Illinois Power Resources Generating, LLC
1500 Eastport Plaza Dr.
Collinsville, IL 62234

June 2, 2025

Illinois Environmental Protection Agency
DWPC – Permits MC #15
Attn: Part 845 Coal Combustion Residual Rule Submittal
2520 W Iles Ave
P.O. Box 19276
Springfield, IL 62794-9276

Re: Edwards Power Plant Ash Pond; IEPA ID # W1438050005-01

Dear Mr. LeCrone:

In accordance with 35 I.A.C. § 845.220(c) Illinois Power Resources Generating, LLC is submitting a corrective action construction permit application for the Edwards Power Plant Ash Pond (IEPA ID # W1438050005-01). One hard copy is provided with this submittal.

The permit application was prepared in accordance with 35 I.A.C. § 845.220 (a) and (c). This submittal includes the completed permit application forms as required by § 845.210.

Sincerely,

Cynthia Vodopivec
SVP, Environmental, Health & Safety

Enclosures

Form CCR 1	Illinois Environmental Protection Agency CCR Surface Impoundment Permit Application Form CCR 1 – General Provisions

Bureau of Water ID Number:
W1438050005

CCR Permit Number:
No Permit Issued

Facility Name:
Edwards Power Plant

For IEPA Use Only

SECTION 1: FACILITY, OPERATOR, AND OWNER INFORMATION (35 Ill. Adm. Code 845.210(b))

Facility, Operator, and Owner Information

1.1	Facility Name		
	Illinois Power Resources Generating, LLC - Edwards Power Plant		
1.2	Illinois EPA CCR Permit Number (if applicable)		
	No Permit Issued		
1.3	Facility Contact Information		
	Name (first and last) Phil Morris	Title Senior Director - Environmental	Phone Number 618-343-7794
	Email address phil.morris@vistracorp.com		
1.4	Facility Mailing Address		
	Street or P.O. box 1500 Eastport Plaza Dr		
	City or town Collinsville	State IL	Zip Code 62234
1.5	Facility Location		
	Street, route number, or other specific identifier 7800 South Cilco Lane		
	County name Peoria	County code (if known)	
	City or town Bartonsville	State IL	Zip Code 61607
1.6	Name of Owner/Operator		
	Illinois Power Resources Generating, LLC		

Facility, Operator, and Owner Info				
	1.7	Owner/Operator Contact Information		
		Name (first and last) Phil Morris	Title Senior Director - Environmental	Phone Number 618-343-7794
		Email address phil.morris@vistracorp.com		
	1.8	Owner/Operator Mailing Address		
		Street or P.O. box 1500 Eastport Plaza Dr		
		City or town Collinsville	State IL	Zip Code 62234

SECTION 2: LEGAL DESCRIPTION (35 Ill. Adm. Code 845.210(c))

Legal Description		
	2.1	Legal Description of the facility boundary
		See Attachment A.

SECTION 3: PUBLICLY ACCESSIBLE INTERNET SITE REQUIREMENTS (35 Ill. Adm. Code 845.810)

Internet Site					
	3.1	Web Address(es) to publicly accessible internet site(s) (CCR website)			
		www.luminant.com/ccr			
	3.2	Is/are the website(s) titled "Illinois CCR Rule Compliance Data and Information"			
		☑	Yes	☐	No

SECTION 4: IMPOUNDMENT IDENTIFICATION

Impoundment Identification				
	4.1	List all the impoundment identification numbers for your facility and check the corresponding box to indicate that you have attached a written description for each impoundment.		
		W1438050005-01 (see Attachment A)	☑	Attached written description
			☐	Attached written description
			☐	Attached written description
			☐	Attached written description
			☐	Attached written description
			☐	Attached written description

			☐	Attached written description
			☐	Attached written description
			☐	Attached written description
			☐	Attached written description

SECTION 5: CHECKLIST AND CERTIFICATION STATEMENT

Checklist and Certification Statement

5.1 In Column 1 below, mark the sections of Form 1 that you have completed and are submitting with your application. For each section, specify in Column 2 any attachments that you are enclosing.

Column 1		Column 2	
Section 1: Facility, Operator, and Owner Information	☑	w/attachments	☐
Section 2: Legal Description	☑	w/attachments	☑
Section 3: Publicly Accessible Internet Site Requirement	☑	w/attachments	☐
Section 4: Impoundment Identification	☑	w/attachments	☑

5.2 **Certification Statement**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name (print or type first and last name) of Owner/Operator	Official Title
Cynthia Vodopivec	SVP - Environmental
Signature: Cynthia S. Vodopivec	Date Signed: 6/2/25

Form CCR 2CA	Illinois Environmental Protection Agency CCR Surface Impoundment Permit Application Form CCR 2CA – Corrective Action Construction

Bureau of Water ID Number:
W1438050005

CCR Permit Number:
No Permit Issued

Facility Name:
Edwards Power Plant

For IEPA Use Only

SECTION 1: DESIGN AND CONSTRUCTION PLANS (35 Ill. Adm. Code 845.220)

Design and Construction Plans

1.1	CCR surface impoundment name.
	Ash Pond
1.2	Identification number of the CCR surface impoundment (if one has been assigned by the Agency).
	W1438050005-01
1.3	Describe the boundaries of the CCR surface impoundment (35 Ill. Adm. Code 845.210 (c)).
	See Attachment A
1.4	State the purpose for which the CCR surface impoundment is being used.
	See Attachment C
1.5	How long has the CCR surface impoundment been in operation?
	See Attachment C
1.6	List the types of CCR that have been placed in the CCR surface impoundment.
	See Attachment D
1.7	List the name of the watershed within which the CCR surface impoundment is located.
	See Attachment F

Design and Construction Plans (Continued)

1.8	What is the size in acres of the watershed within which the CCR surface impoundment is located?	
	See Attachment C	
1.9	Check the corresponding boxes to indicate that you have attached the following:	
	☑	Drawings satisfying the requirements of 35 Ill. Adm. Code 845.220(a)(1)(F).
	☑	A description of the type, purpose, and location of existing instrumentation.
	☑	Area capacity curves for the CCR Impoundment.
	☑	A description of each spillway and diversion design features and capacities and provide the calculations used in their determination.
	☑	The construction specifications and provisions for surveillance, maintenance, and repair of the CCR surface impoundment.
	☑	A description of the physical and engineering properties of the foundation and abutment materials on which the CCR surface impoundment is constructed.
	☑	A statement of the type, size, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR surface impoundment.
	☑	A statement of the method of site preparation and construction of each zone of the CCR impoundment.
	☑	A statement of the approximate dates of construction of each successive stage of construction of the CCR surface impoundment.
1.10.1	Is there any record or knowledge of structural instability of the CCR surface impoundment?	
	☐ Yes	☑ No
1.10.2	If you answered yes to Item 1.10.1, provide detailed explanation of the structural instability.	

SECTION 2: NARRATIVE DESCRIPTION OF THE FACILITY (35 Ill. Adm. Code 845.220)

Narrative Description

2.1	List the types of CCR expected in the CCR surface impoundments.
	See Attachment D

Narrative Description (Cont.)	2.2	Have you attached a chemical analysis of each type of expected CCR?			
		☑	Yes		
	2.3	Estimate of the maximum capacity of the surface impoundment in gallons or cubic yards.			
		See Attachment C			
	2.4	Enter the rate at which CCR and non-CCR waste streams currently enter the CCR impoundment in gallons per day and dry tons.			
		See Attachment C	GPD	See Attachment C	dTn
	2.5	Estimate length of time the CCR surface impoundment will receive CCR and non-CCR waste streams.			
		See Attachment C			
	2.6	Have you attached an on-site transportation plan that includes all existing and planned roads in the facility that will be used during the operation of the CCR surface impoundment?			
		☑	Yes		
SECTION 3: MAPS (35 Ill. Adm. Code 845.220)					
Maps	3.1	Check the corresponding boxes to indicate that you have attached the following maps:			
		☑	A site location map on the most recent United Sates Geological Survey (USGS) quadrangle of the area from the 7 ½ minute series (topographic) or on another map whose scale clearly shows the information required in 35 Ill. Adm. Code 845.220(a)(3).		
		☑	Site plans maps satisfying the requirements of 35 Ill. Adm. Code 845.220(a)(4).		
SECTION 4: ATTACHMENTS					
Attachments	4.1	Check the corresponding boxes to indicate that you have attached the following:			
		☑	A narrative description of the proposed construction of, or modification to, a CCR surface impoundment and any projected changes in the volume or nature of the CCR or non-CCR waste streams.		
		☑	Plans and specifications fully describing the design, nature, function, and interrelationship of each individual component of the facility.		
		☑	The signature and seal of a qualified professional engineer.		
		☑	Certification that the owner or operator of the CCR surface impoundment completed the public notification and public meetings required under 35 Ill. Adm. Code 845.240.		
		☑	A summary of the issues raised by the public during the public notification and public meetings.		
		☑	A summary of any revisions, determinations, or other considerations made in response to those issues raised by the public during the public notification and public meetings.		
		☑	Certification that all contractors, subcontractors, and installers utilized to construct, install, modify, or close a CCR surface impoundment are participants in a training program that is approved by and registered with the U.S. Department of Labor's Employment and Training Administration and that includes instruction in erosion control and environmental remediation.		

		☑	Certification that all contractors, subcontractors, and installers utilized to construct, install, modify, or close a CCR surface impoundment are participants in a training program that is approved by and registered with the U.S. Department of Labor's Employment and Training Administration and that includes instruction in the operation of heavy equipment and excavation.
SECTION 5: GROUNDWATER MONITORING PROGRAM			
Groundwater Monitoring	5.1	Indicate that you have attached the following components of a new groundwater monitoring program or any modifications to an existing groundwater monitoring program by checking the corresponding boxes:	
		☑	A hydrogeologic site investigation meeting the requirements of 35 Ill. Adm. Code 845.620, if applicable.
		☑	Design and construction plans of a groundwater monitoring system meeting the requirements of 35 Ill. Adm. Code 845.630.
		☑	A proposed groundwater sampling and analysis program that includes selection of the statistical procedures to be used for evaluating groundwater monitoring data as required by 35 Ill. Adm. Code 845.640 and 845.650.
SECTION 6: CORRECTIVE ACTION (35 Ill. Adm. Code 845.220(c))			
Corrective Action	6.1	Indicate that you have attached a corrective action plan as specified in 35 Ill. Adm. Code 845.670 by checking the box below:	
		☑	Corrective action plan as specified in 35 Ill. Adm. Code 845.670.
		☑	Corrective action groundwater monitoring program, including identification of revisions to the groundwater system for corrective action.
		☑	Any interim measures necessary to reduce the contaminants leaching from the CCR surface impoundment, and/or potential exposures to human or ecological receptors, including an analysis of the factors specified in 35 Ill. Adm. Code 845.680(a)(3).
SECTION 7: GROUNDWATER MODELING (35 Ill. Adm. Code 845.220(c))			
Groundwater Modeling	7.1	Indicate that you have attached the following by checking the corresponding boxes:	
		☑	The results of groundwater contaminant transport modeling and calculations showing how the corrective action will achieve compliance with the applicable groundwater standards.
		☑	All modeling inputs and assumptions.
		☑	Description of the fate and transport of contaminants with the selected corrective action over time.
		☑	Capture zone modeling, if applicable.
		☑	Any necessary licenses and software needed to review and access both the model and the data contained within the models required by 35 Ill. Adm. Code 845.220(c)(2).

Road Map for Corrective Action
Construction Permit Application
Edwards Power Plant, Ash Pond
Bartonville, IL

CONSTRUCTION PERMIT APPLICATION
Edwards Power Plant – Ash Pond

Appendix A
LEGAL DESCRIPTION
§845.210(c)
Legal description of the facility

Appendix B.1
CORRECTIVE ACTION GROUNDWATER MONITORING PLAN
§845.680(a)(1)
Plan that establishes how data will be collected, documented, and evaluated to assess remedy effectiveness

Appendix B.2
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
§845.620
Hydrogeology, groundwater quality data, conceptual site model

Appendix C
HISTORY OF CONSTRUCTION
§845.220(a)(1)
Construction and operational history of the CCR surface impoundment

Appendix D
TYPES OF CCR AND CHEMICAL CONSTITUENTS
§845.220(a)(2)(A)
Types of CCR expected in the CCR surface impoundment, including chemical analysis of each type

Appendix E & F
SITE PLAN MAP & TRANSPORTATION MAP
§845.220(a)(3) and (a)(4)
Maps showing the facility and existing CCR surface impoundments, site boundaries, groundwater monitoring wells, access roads and transportation corridors

Appendix G
CORRECTIVE ACTION PLAN
§845.670
Identifies the selected remedy based on the results of the Corrective Measures Assessment

Appendix H
GEOTECHNICAL INFORMATION
Geotechnical information and calculations to support permit-level design

Appendix I
PUBLIC NOTIFICATION
§845.220(a)(9)
Certification that public notification and public meeting have been completed required under *§845.240*

Appendix J
CONTRACTOR CERTIFICATION
415 ILCS 5/22.59(b)(4)
Certification that CCR owner/operator will utilize contractors who are participants in an approved training program

Appendix A
CORRECTIVE ACTION ALTERNATIVE ANALYSIS (CAAA)
§845.670(e)
Evaluation of potential viable corrective actions identified in the Corrective Measures Assessment

Appendix B
DRAWINGS AND MATERIAL SPECIFICATIONS
Permit-level design drawings and specifications

Appendix A
HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT
§845.670(f)(4)
Evaluation of potential risks to human and ecological receptors

Appendix B
CAAA SUPPORTING INFORMATION REPORT
§845.670(e)
Information to support preparation of CAAA

Appendix C
CORRECTIVE MEASURES ASSESSMENT
§845.660
Assessment of potential corrective measure technologies to address GWPS exceedances at the CCR surface impoundment

Appendix D
NATURE AND EXTENT REPORT AND ADDENDUM
§845.650(d)(1)
Documents the nature and extent of constituents detected above the GWPS that are attributable to the CCR surface impoundment

Appendix E
GROUNDWATER POLISHING REPORT
§845.220(c)(2)
Presents results of geochemical modeling used to evaluate chemical mechanisms on groundwater polishing under current conditions and after implementation of the corrective measure

Appendix A
FEASIBILITY LEVEL DRAWINGS
Conceptual design drawings showing approximate extents and details of alternatives presented in the CAAA

Appendix B.1
GROUNDWATER MODELING TECHNICAL MEMORANDUM
§845.220(c)(2)
Presents additional groundwater modeling simulations and incorporates data collected since 2022 modeling (Appendix B.2) to support alternatives presented in the CAAA

Appendix B.2
2022 GROUNDWATER MODELING REPORT
§845.220(c)(2)
Presents results of 2022 MODFLOW and MT3DMS groundwater flow and transport models to evaluate potential alternatives

Appendix C
LABOR/MILEAGE ESTIMATES
Detailed material quantity, labor and mileage estimates for alternatives presented in the CAAA

Legend

- New Submittal
- Updated Submittal from Previous Submittal
- Re-submitted from Previous Submittal (No Updates)

Ramboll

Road Map for Corrective Action
Construction Permit Application
Edwards Power Plant, Ash Pond
Bartonville, IL

Section	Rule Text	Location of Information Demonstrating Compliance			Version History			Notes
		Document	Section or Appendix	PDF Page No. & Hyperlink	Submitted Previously	Updated Submittal	New Submittal	
Section 845.220 - Construction Permits								
845.220(a)	All construction permit applications must contain the following information and documents.							
845.220(a)(1)	Design and Construction Plans (Construction History)	CPA	Appendix C	869	x			
845.220(a)(2)	Narrative Description of the Facility. The permit application must contain a written description of the facility with supporting documentation describing the procedures and plans that will be used at the facility to comply with the requirements of this Part. The descriptions must include, but are not limited to, the following information:	CPA	Section 2.2	18		x		
845.220(a)(2)(A)	The types of CCR expected in the CCR surface impoundment, including a chemical analysis of each type of expected CCR;	CPA	Section 2.2	18		x		
845.220(a)(2)(B)	An estimate of the maximum capacity of each surface impoundment in gallons or cubic yards;	CPA	Section 2.2	18		x		
845.220(a)(2)(C)	The rate at which CCR and non-CCR waste streams currently enter the CCR surface impoundment in gallons per day and dry tons;	CPA	Section 2.2	18		x		
845.220(a)(2)(D)	The estimated length of time the CCR surface impoundment will receive CCR and non-CCR waste streams; and	CPA	Section 2.2	18		x		
845.220(a)(2)(E)	An on-site transportation plan that includes all existing and planned roads in the facility that will be used during the operation of the CCR surface impoundment.	CPA	Section 2.2	18		x		
845.220(a)(3)	Site Location Map. All permit applications must contain a site location map on the most recent United States Geological Survey (USGS) quadrangle of the area from the 7½ minute series (topographic), or on another map whose scale clearly shows the following information:	CPA	Appendix F	971		x		
845.220(a)(3)(A)	The facility boundaries and all adjacent property, extending at least 1000 meters (3280 feet) beyond the boundary of the facility;	CPA	Appendix F	971		x		
845.220(a)(3)(B)	All surface waters;	CPA	Appendix F	971		x		
845.220(a)(3)(C)	The prevailing wind direction;	CPA	Appendix F	971		x		
845.220(a)(3)(D)	The limits of all 100-year floodplains;	CPA	Appendix F	971		x		
845.220(a)(3)(E)	All natural areas designated as a Dedicated Illinois Nature Preserve under the Illinois Natural Areas Preservation Act [525 ILCS 30];	CPA	Appendix F	971		x		
845.220(a)(3)(F)	All historic and archaeological sites designated by the National Historic Preservation Act (16 USC 470 et seq.) and the Illinois Historic Sites Advisory Council Act [20 ILCS 3410]; and	CPA	Appendix F	971		x		
845.220(a)(3)(G)	All areas identified as critical habitat under the Endangered Species Act of 1973 (16 USC 1531 et seq.) and the Illinois Endangered Species Protection Act [520 ILCS 10].	CPA	Appendix F	971		x		
845.220(a)(4)	Site Plan Map. The application must contain maps, including cross-sectional maps of the site boundaries, showing the location of the facility. The following information must be shown:	CPA	Appendix E	969		x		
845.220(a)(4)(A)	The entire facility, including any proposed and all existing CCR surface impoundment locations;	CPA	Appendix E	969		x		
845.220(a)(4)(B)	The boundaries, both above and below ground level, of the facility and all CCR surface impoundments or landfills containing CCR included in the facility;	CPA	Appendix E	969		x		
845.220(a)(4)(C)	All existing and proposed groundwater monitoring wells; and	CPA	Appendix E	969		x		
845.220(a)(4)(D)	All main service corridors, transportation routes, and access roads to the facility.	CPA	Appendix E	969		x		
845.220(a)(5)	A narrative description of the proposed construction of, or modification to, a CCR surface impoundment and any projected changes in the volume or nature of the CCR or non-CCR waste streams.	CPA	Section 2.4	20			x	
845.220(a)(6)	Plans and specifications fully describing the design, nature, function and interrelationship of each individual component of the facility.	CPA	Appendix G	973			x	
845.220(a)(7)	A new groundwater monitoring program or any modification to an existing groundwater monitoring program that includes but is not limited to the following information:	CPA	Appendix B.1	34			x	
845.220(a)(7)(A)	A hydrogeologic site investigation meeting the requirements of Section 845.620, if applicable;	CPA	Appendix B.2	136	x			
845.220(a)(7)(B)	Design and construction plans of a groundwater monitoring system meeting the requirements of Section 845.630; and	CPA	Section 2.6	23			x	
845.220(a)(7)(C)	A proposed groundwater sampling and analysis program that includes selection of the statistical procedures to be used for evaluating groundwater monitoring data, (see Sections 845.640 and 845.650).	GMP	Appendix B.1	34			x	
845.220(a)(8)	The signature and seal of a qualified professional engineer.	CPA	Section 2.7	25			x	
845.220(a)(9)	Certification that the owner or operator of the CCR surface impoundment completed the public notification and public meetings required under Section 845.240, a summary of the issues raised by the public, a summary of any revisions, determinations, or other considerations made in response to those issues, and a list of interested persons in attendance who would like to be added to the Agency's listserv for the facility.	CPA	Appendix I	3225			x	
845.220(c)	Corrective Action Construction. In addition to the requirements in subsection (a), all construction permit applications that include any corrective action performed under Subpart F must also contain the following information and documents:							
845.220(c)(1)	Corrective action plan (see Section 845.670);	CPA	Appendix G	973			x	
845.220(c)(2)	Groundwater modeling, including:	CPA	Appendix G	973			x	
845.220(c)(2)(A)	The results of groundwater contaminant transport modeling and calculations showing how the closure will achieve compliance with the applicable groundwater standards;	CPA	Appendix G	973			x	
845.220(c)(2)(B)	All modeling inputs and assumptions;	CPA	Appendix G	973	x			

Road Map for Corrective Action
Construction Permit Application
Edwards Power Plant, Ash Pond
Bartonville, IL

Section	Rule Text	Location of Information Demonstrating Compliance			Version History			Notes
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845.220(c)(2)(C)	Description of the fate and transport of contaminants, with the selected closure over time; and	CPA	Section 2.9	26	x			
845.220(c)(2)(D)	Capture zone modeling, if applicable;	CPA	Section 2.9	26	x			
845.220(c)(3)	Any necessary licenses and software needed to review and access both the models and the data contained within the models required by subsection (c)(2);	CPA	Section 2.9	26	x			
845.220(c)(4)	Corrective action groundwater monitoring program, including identification of revisions to the groundwater monitoring system for corrective action; and	CPA	Appendix B.1	34			x	
845.220(c)(5)	Any interim measures necessary to reduce the contaminants leaching from the CCR surface impoundment, and/or potential exposures to human or ecological receptors, including an analysis of the factors specified in Section 845.680(a)(3).	CPA	Section 2.9	26			x	
Section 845.620 - Hydrogeologic Site Characterization								
845.620(a)	The owner or operator of the CCR surface impoundment must design and implement a hydrogeologic site characterization.	CPA	Appendix B.2	136	x			Additional hydrogeologic site characterization information is also provided in the Nature & Extent Report - location depicted on the visual roadmap above.
Section 845.670 - Corrective Action Plan								
845.670(b)	Within one year after completing the assessment of corrective measures as specified in 35 I.A.C. § 845.660, and after completion of the public meeting in 35 I.A.C. § 845.660(d), the owner or operator of the CCR surface impoundment must submit, in a CPA [or modification to the facility's operating permit] to the IEPA, a CAP that identifies the selected remedy. This requirement applies in addition to, not in place of, any applicable standards under any other State or federal law.	CPA	Appendix G	973			x	
845.670(c)	The CAP must meet the following requirements:							
845.670(c)(1)	Be based on the results of the CMA conducted under 35 I.A.C. § 845.660;	CAAA	Appendix C	1373			x	
845.670(c)(2)	Identify a selected remedy that, at a minimum, meets the standards listed in subsection (d);	CAAA	Section 2	1030			x	
845.670(c)(3)	Contain the corrective action alternatives analysis specified in subsection (e); and	CAAA	Section 2	1030			x	
845.670(c)(4)	Contain proposed schedules for implementation, including an analysis of the factors in subsection (f);	CAP	Table 1	996			x	
845.670(d)	The selected remedy in the CAP must:							
845.670(d)(1)	Be protective of human health and the environment;	CAAA	Section 2.2.1	1038			x	
845.670(d)(2)	Attain the GWPS specified in 35 I.A.C. § 845.600;	GWTM	Section 4	1179			x	
845.670(d)(3)	Control the sources of releases to reduce or eliminate, to the maximum extent feasible, further releases of constituents listed in 35 I.A.C. § 845.600 into the environment;	CAAA	Section 2.2.2	1039			x	
845.670(d)(4)	Remove from the environment as much of the contaminated material that was released from the CCR surface impoundment as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems; and	CAAA	Section 2.5	1056			x	
845.670(d)(5)	Comply with standards for management of wastes as specified in 35 I.A.C. § 845.680(d).	CAAA	Section 2.3.5	1055			x	
845.670(e)	CAAA. In selecting a remedy that meets the standards of subsection (d), the owner or operator of the CCR surface impoundment must consider the following evaluation factors:							
845.670(e)(1)	The long- and short-term effectiveness and protectiveness of each potential remedy, along with the degree of certainty that the remedy will prove successful based on consideration of the following:	CAAA	Section 2.2	1038			x	
845.670(e)(1)(A)	Magnitude of reduction of existing risks;	CAAA	Section 2.2.1	1038			x	
845.670(e)(1)(B)	Magnitude of residual risks in terms of likelihood of further releases due to CCR remaining following implementation of a remedy;	CAAA	Section 2.2.3	1040			x	
845.670(e)(1)(C)	The type and degree of long-term management required, including monitoring, operation, and maintenance;	CAAA	Section 2.2.4	1040			x	
845.670(e)(1)(D)	Short-term risks that might be posed to the community or the environment during implementation of a remedy, including potential threats to human health and the environment associated with excavation, transportation, and re-disposal of contaminants;	CAAA	Section 2.2.5	1041			x	
845.670(e)(1)(E)	Time until GWPS in 35 I.A.C. § 845.600 are achieved;	CAAA	Section 2.2.6	1047			x	
845.670(e)(1)(F)	The potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, re-disposal, containment, or changes in groundwater flow;	CAAA	Section 2.2.7	1049			x	
845.670(e)(1)(G)	The long-term reliability of the engineering and institutional controls, including an analysis of any off-site, nearby destabilizing activities; and	CAAA	Section 2.2.8	1049			x	
845.670(e)(1)(H)	Potential need for replacement of the remedy.	CAAA	Section 2.2.9	1051			x	
845.670(e)(2)	The effectiveness of the remedy in controlling the source to reduce further releases based on consideration of each of the following potential factors:	CAAA	Section 2.2.2	1039			x	
845.670(e)(2)(A)	The extent to which containment practices will reduce further releases; and	CAAA	Section 2.2.2	1039			x	
845.670(e)(2)(B)	The extent to which treatment technologies may be used.	CAAA	Section 2.2.2	1039			x	
845.670(e)(3)	The ease or difficulty of implementing each potential remedy based on consideration of the following types of factors:	CAAA	Section 2.3	1051			x	
845.670(e)(3)(A)	Degree of difficulty associated with constructing the technology;	CAAA	Section 2.3.1	1051			x	
845.670(e)(3)(B)	Expected operational reliability of the technologies;	CAAA	Section 2.3.2	1053			x	

Road Map for Corrective Action
Construction Permit Application
Edwards Power Plant, Ash Pond
Bartonville, IL

Section	Rule Text	Location of Information Demonstrating Compliance			Version History			Notes
		Document	Section or Appendix	PDF Page No. & Hyperlink	Submitted Previously	Updated Submittal	New Submittal	
845.670(e)(3)(C)	Need to coordinate with and obtain necessary approvals and permits from other agencies;	CAAA	Section 2.3.3	1053			x	
845.670(e)(3)(D)	Availability of necessary equipment and specialists; and	CAAA	Section 2.3.4	1054			x	
845.670(e)(3)(E)	Available capacity and location of needed treatment, storage, and disposal services.	CAAA	Section 2.3.5	1055			x	
845.670(e)(4)	The degree to which community concerns are addressed by each potential remedy.	CAAA	Section 2.4	1056			x	
845.670(f)	The owner or operator must specify, as part of the CAP, a schedule for implementing of, and completing, remedial activities. The schedule must require the completion of remedial activities within a reasonable time, taking into consideration the factors in this subsection (f). The owner or operator of the CCR surface impoundment must consider the following factors in determining the schedule of remedial activities:							
845.670(f)(1)	Extent and nature of contamination, as determined by the characterization required under 35 I.A.C. § 845.650(d);	CAP	Section 3.3	988			x	
845.670(f)(2)	Reasonable probabilities of remedial technologies achieving compliance with the GWPS established by 35 I.A.C. § 845.600 and other objectives of the remedy;	CAP	Section 3.3	988			x	
845.670(f)(3)	Availability of treatment or disposal capacity for CCR managed during implementation of the remedy;	CAP	Section 3.3	988			x	
845.670(f)(4)	Potential risks to human health and the environment from exposure to contamination before completion of the remedy;	CAP	Section 3.3	988			x	
845.670(f)(5)	Resource value of the aquifer, including:							
845.670(f)(5)(A)	Current and future uses, including potential residential, agricultural, commercial industrial and ecological uses;	CAP	Section 3.3	988			x	
845.670(f)(5)(B)	Proximity and withdrawal rate of users;	CAP	Section 3.3	988			x	
845.670(f)(5)(C)	Groundwater quantity and quality;	CAP	Section 3.3	988			x	
845.670(f)(5)(D)	The potential impact to the subsurface ecosystem, wildlife, other natural resources, crops, vegetation, and physical structures caused by exposure to CCR constituents;	CAP	Section 3.3	988			x	
845.670(f)(5)(E)	The hydrogeologic characteristic of the facility and surrounding land; and	CAP	Section 3.3	988			x	
845.670(f)(5)(F)	The availability of alternative water supplies; and	CAP	Section 3.3	988			x	
845.670(f)(6)	Other relevant factors.	CAP	Section 3.3	988			x	
Section 845.680 Implementation of the Corrective Action Plan								
845.680(a)	Within 90 days after the Agency's approval of the corrective action plan submitted under Section 845.670, the owner or operator must initiate corrective action. Based on the schedule approved by the Agency for implementation and completion of corrective action, the owner or operator must:							
845.680(a)(1)	Establish and implement a corrective action groundwater monitoring program that:							
845.680(a)(1)(A)	At a minimum, meets the requirements of the monitoring program under Section 845.650;	CA GMP	Section 2.1	44			X	
845.680(a)(1)(B)	Documents the effectiveness of the corrective action remedy; and	CA GMP	Section 3	48			X	
845.680(a)(1)(C)	Demonstrates compliance with the groundwater protection standard under subsection (c).	CA GMP	Section 3	48			X	
845.680(a)(2)	Implement the corrective action remedy approved by the Agency under Section 845.670; and	CAP	Section 1.4	978			X	
845.680(a)(3)	Take any interim measures necessary to reduce the contaminants leaching from the CCR surface impoundment, and/or potential exposures to human or ecological receptors. Interim measures must, to the greatest extent feasible, be consistent with the objectives of, and contribute to the performance of, any remedy that may be required by Section 845.670. The following factors must be considered by an owner or operator in determining whether interim measures are necessary:							
845.680(a)(3)(A)	Time required to develop and implement a final remedy;	CAP	Section 3.4	992			X	
845.680(a)(3)(B)	Actual or potential exposure of nearby populations or environmental receptors to any of the constituents listed in Section 845.600;	CAP	Section 3.4	992			X	
845.680(a)(3)(C)	Actual or potential contamination of sensitive ecosystems or current or potential drinking water supplies;	CAP	Section 3.4	992			X	
845.680(a)(3)(D)	Further degradation of the groundwater that may occur if remedial action is not initiated expeditiously;	CAP	Section 3.4	992			X	
845.680(a)(3)(E)	Weather conditions that may cause any of the constituents listed in Section 845.600 to migrate or be released;	CAP	Section 3.4	992			X	
845.680(a)(3)(F)	Potential for exposure to any of the constituents listed in Section 845.600 as a result of an accident or failure of a container or handling system; and	CAP	Section 3.4	992			X	
845.680(a)(3)(G)	Other situations that may pose threats to human health and the environment.	CAP	Section 3.4	992			X	

Notes:

CA = Corrective Action
CAA = Closure Alternatives Analysis
CAAA = Corrective Action Alternatives Analysis
CAP = corrective action plan
CCR = coal combustion residuals
CMA = Corrective Measures Assessment
CPA = Construction Permit Application
GMP = Groundwater Monitoring Plan
GWPS = groundwater protection standards
GWTM = Groundwater Modeling Technical Memorandum
IEPA = Illinois Environmental Protection Agency

Intended for
Illinois Power Resources Generating, LLC
7800 Cilco Lane
Bartonville, Illinois 61607

Date
June 2, 2025

Project No.
1940110241-003

CONSTRUCTION PERMIT APPLICATION FOR GROUNDWATER CORRECTIVE ACTION

ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS
IEPA ID NO. W1438050005-01

RAMBOLL Bright ideas. Sustainable change.

CONSTRUCTION PERMIT APPLICATION FOR GROUNDWATER CORRECTIVE ACTION EDWARDS POWER PLANT, ASH POND, IEPA ID NO. W1438050005-01

Project name	**Edwards Power Plant Ash Pond**
Project no.	**1940110241-003**
Recipient	**Illinois Power Resources Generating, LLC**
Document type	**Construction Permit Application**
Revision	**FINAL**
Date	**June 2, 2025**
Prepared by	**Rachel A Banoff, EIT**
Checked by	**Beth Richter, PE**
Approved by	**Brian G. Hennings, PG**
Description	**Construction Permit Application for 35 I.A.C. § 845**

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

T 414-837-3607
F 414-837-3608
https://ramboll.com

CONTENTS

1.	**INTRODUCTION**	**2**
1.1	Legal Description	2
1.2	Previous Assessments	2
2.	**CONSTRUCTION PERMIT**	**4**
2.1	History of Construction	4
2.2	Narrative Description of Facility	4
2.3	Site Maps	5
2.4	Narrative Description of Proposed Construction	6
2.4.1	Proposed Corrective Action Construction	7
2.4.1.1	Installation of North Extraction Trench	7
2.4.1.2	Installation of South Extraction Trench	7
2.4.1.3	Mechanical, Electrical, and Piping Installation	8
2.4.1.4	Site Restoration	9
2.4.1.5	System Operation and Waste Streams	9
2.5	Plans and Specifications	9
2.6	Groundwater Monitoring Program	9
2.7	Certification	11
2.8	Public Meeting Information	12
2.9	Corrective Action Construction	12
3.	**ADDITIONAL INFORMATION**	**14**
4.	**REFERENCES**	**15**

TABLES (WITHIN TEXT)

Table 1	CCR Surface Impoundments at Edwards Power Plant

APPENDICES

Appendix A	Legal Description (845.210(c))
Appendix B	Groundwater Information (845.210(d)(1), 845.220(a)(7)(A-C), and 845.220(c)(2-5))
Appendix C	History of Construction Report (845.220(a)(1))
Appendix D	Types of CCR and Chemical Constituents (845.220(a)(2)(A))
Appendix E	Site Plan Map and On-Site Transportation Plan ((845.220(a)(4) and 845.220(a)(2)(E))
Appendix F	Site Location Maps (845.220(a)(3))
Appendix G	Corrective Action Plan and Proposed Schedule (845.670), including the Corrective Action Alternatives Analysis (845.670(e))
Appendix H	Geotechnical Information
Appendix I	Public Notification and Public Meeting Certification (845.220(a)(9))
Appendix J	Contractor Training Certification (45 ILCS 5/22.59(b)(4))

1. INTRODUCTION

Illinois Power Resources Generating, LLC (IPRG) is the owner of the coal-fired Edwards Power Plant (EPP), also referred to as Edwards Power Station (EPS), near Bartonville, Illinois. According to the Illinois Environmental Protection Agency (IEPA), this power plant has one coal combustion residuals (CCR) surface impoundment, as listed in **Table 1** below. This construction permit application is for groundwater corrective action activities at the Ash Pond (AP) only. The EPP was retired from service on December 31, 2022, and is now a closed power plant.

Table 1 – CCR Surface Impoundments at Edwards Power Plant

Impoundment Name	Status	Acronym	IEPA ID Number	Vistra CCR Unit ID	National Inventory of Dams Number
Ash Pond	Inactive	AP	W1438050005-01	301	IL50710

This construction permit application for groundwater corrective action activities (application) was developed in accordance with Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments [1].

1.1 Legal Description

Section 845.210(c): All permit applications must contain a legal description of the facility boundary and a description of the boundaries of all units included in the facility.

A legal description of the facility is provided in **Appendix A**.

1.2 Previous Assessments

Section 845.210(d): Previous Assessments, Investigations Plans, and Programs

The AP is also regulated by Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257, herein referred to as the Federal CCR Rule [2] and subsequently became regulated by 35 I.A.C. § 845 [1]. Several assessments and plans were completed for the AP to satisfy the requirements of both the Federal CCR Rule and 35 I.A.C. § 845; some of which are referred to within and attached to this application.

Section 845.210(d)(1): The Agency may approve the use of any hydrogeologic site investigation or characterization, groundwater monitoring well or system, or groundwater monitoring plan, bearing the seal and signature of an Illinois Licensed Professional Geologist or Licensed Professional Engineer, completed before April 21, 2021 to satisfy the requirements of this Part.

All hydrogeological site investigation reports, monitoring well systems, and plans prepared to support this or other Construction Permit and Operating Permit applications were prepared after April 21, 2021. Therefore, this section is not applicable. Groundwater information that meets the requirements of 845.220(a)(7)(A-C) and 845.220(c)(2-5) is provided in **Appendix B**.

Section 845.210(d)(2): For existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed location restriction demonstration required by Section 845.300 (Placement Above the Uppermost Aquifer), Section 845.310 (Wetlands), Section 845.320 (Fault Areas), Section 845.330 (Seismic Impact Zones), and

Section 845.340 (Unstable Areas) provided that the previously completed assessments meet the applicable requirements of those Sections.

Previous assessments for Placement Above the Uppermost Aquifer, Wetlands, Fault Areas, Seismic Impact Zones, and Unstable Areas were included in the 35 I.A.C. § 845 Initial Operating Permit Application for the AP [3]. The Initial Operating Permit Application was submitted to IEPA on October 25, 2021.

Section 845.210(d)(3): For existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed assessment to serve as the initial assessment required by Section 845.440 (Hazard Potential Classification Assessment), Section 845.450 (Structural Stability Assessment) and Section 845.460 (Safety Factor Assessment) provided that the previously completed assessment: A) Was not completed more than five years ago; and B) Meets the applicable requirements of those Sections.

Previous assessments for the Hazard Potential Classification, Structural Stability, and Safety Factors were included in the 35 I.A.C. § 845 Initial Operating Permit Application for the AP [3]. The Initial Operating Permit Application was submitted to IEPA on October 25, 2021.

Section 845.210(d)(4): For inactive closed CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a post-closure care plan previously approved by the Agency.

No post-closure plan for the AP was previously approved by the Agency. Therefore, this section is not applicable.

2. CONSTRUCTION PERMIT

2.1 History of Construction

Section 845.220(a)(1): Design and Construction Plans (Construction History)

The History of Construction report for the AP and subsequent update prepared in 2021 are provided in **Appendix C**.

2.2 Narrative Description of Facility

Section 845.220(a)(2): Narrative Description of the Facility. The permit application must contain a written description of the facility with supporting documentation describing the procedures and plans that will be used at the facility to comply with the requirements of this Part. The descriptions must include, but are not limited to, the following information:

The Facility Narrative Description details are described in the following sections.

Section 845.220(a)(2)(A): The types of CCR expected in the CCR surface impoundment, including a chemical analysis of each type of expected CCR;

The types of CCR expected in the AP and analysis of the chemical constituents found within the CCR in the AP is provided in **Appendix D**.

Section 845.220(a)(2)(B): An estimate of the maximum capacity of each surface impoundment in gallons or cubic yards;

The AP was estimated to contain approximately 4.1 million cubic yards (MCY) of CCR within the Construction Permit Application [4] prepared for final closure of the AP [5]. The EPP ceased the burning of coal and production of electricity in 2022 and an additional 0.05 MCY of CCR was expected to be placed in the AP since the previous Construction Permit Application [4] was prepared.

As part of final closure activities, the volume of CCR within the AP is expected to increase by approximately 0.2 MCY, resulting in a maximum estimated waste volume of approximately 4.4 MCY of CCR within the AP [4, 5].

Section 845.220(a)(2)(C): The rate at which CCR and non-CCR waste streams currently enter the CCR surface impoundment in gallons per day and dry tons;

There are no waste streams that currently enter the AP or will enter the AP as the EPP ceased the burning of coal and production of electricity in 2022.

Section 845.220(a)(2)(D): The estimated length of time the CCR surface impoundment will receive CCR and non-CCR waste streams; and

There are no CCR or other non-CCR waste streams currently entering the AP or will enter the AP as the EPP ceased the burning of coal and production of electricity in 2022. Additional CCR located within the perimeter dikes of the AP will be relocated to within the AP footprint and consolidated with the current AP CCR as part of closure activities, as discussed in the Final Closure Plan and associated Construction Permit Application prepared for the AP [5, 4].

Section 845.220(a)(2)(E): An on-site transportation plan that includes all existing and planned roads in the facility that will be used during the operation of the CCR surface impoundment.

An On-Site Transportation Plan was developed as required by Section 845.220(a)(2)(E) and is provided for the AP in **Appendix E** that includes all on-site access roads and the surrounding roadways.

2.3 Site Maps

Section 845.220(a)(3): Site Location Map. All permit applications must contain a site location map on the most recent United States Geological Survey (USGS) quadrangle of the area from the 7½ minute series (topographic), or on another map whose scale clearly shows the following information:

A. The facility boundaries and all adjacent property, extending at least 1000 meters (3280 feet) beyond the boundary of the facility;

B. All surface waters;

C. The prevailing wind direction;

D. The limits of all 100-year floodplains;

E. All-natural areas designated as a Dedicated Illinois Nature Preserve under the Illinois Natural Areas Preservation Act [525 ILCS 30];

F. All historic and archaeological sites designated by the National Historic Preservation Act (16 USC 470 et seq.) and the Illinois Historic Sites Advisory Council Act [20 ILCS 3410]; and

G. All areas identified as critical habitat under the Endangered Species Act of 1973 (16 USC 1531 et seq.) and the Illinois Endangered Species Protection Act [520 ILCS 10].

A Site Location Map for the AP showing the information required in Section 845.220(a)(3) is provided in **Appendix F**. The Site Location Map consists of the most recent U.S. Geological Survey (USGS) topographic map (2024) which contains the facility and at least 1,000 meters of the surrounding area. Information included on the Site Location Map meets the requirements for a Flood Hazard Map, Topographic Vicinity Map, Designated Nature Map, Designated Historic and Archeological Site Map, and Identified Critical Habitat Map.

The data in the Site Location Map was collected by performing a comprehensive search of the Illinois Department of Natural Resources (IDNR) natural heritage database [6] for natural and protected areas within 1,000 meters of the AP. Within Peoria County, a total of 20 sites were identified from the Illinois Natural Areas Inventory (INAI) and 12 were identified from the Illinois Nature Preserves Commission (INPC). Within adjacent Tazewell County, a total of 21 sites were identified from the INAI and 16 were identified from the INPC. None of the natural areas or preserves fall within 1,000 meters of the AP.

The IDNR natural heritage database also includes a list of Endangered Species by County [7] and notes that a total of 16 threatened species and 10 endangered species are located within Peoria County. In adjacent Tazewell County, a total of 16 threatened and 16 endangered species are listed. A review of the U.S. Fish and Wildlife Service (USFWS) Threatened & Endangered Species Active Critical Habitat Report [8] identified no critical habitats for threatened or endangered species within Peoria County or adjacent Tazewell County. Therefore, there are no critical habitats within 1,000 meters of the Site.

A search of the IDNR Historic and Architectural Resources Geographic Information System (HARGIS) database [9] for historical sites within 1,000 meters of the Site located no results.

The 100-year floodplain limits were obtained from the EPP Operating Permit Application: Floodplain Compliance for 35 I.A.C. 845.340(c) done by Burns & McDonnell dated October 20, 2021.

Section 845.220(a)(4): Site Plan Map. The application must contain maps, including cross-sectional maps of the site boundaries, showing the location of the facility. The following information must be shown:

A. The entire facility, including any proposed and all existing CCR surface impoundment locations;

B. The boundaries, both above and below ground level, of the facility and all CCR surface impoundments or landfills containing CCR included in the facility;

C. All existing and proposed groundwater monitoring wells; and

D. All main service corridors, transportation routes, and access roads to the facility.

The Site Plan Map for the AP showing the information required in Section 845.220(a)(4) is provided in **Appendix E**. Cross-sectional maps of the AP site boundary is included in the 2023 Supplemental Site Investigation Report [10] in **Appendix G**.

2.4 Narrative Description of Proposed Construction

Section 845.220(a)(5): A narrative description of the proposed construction of, or modification to, a CCR surface impoundment and any projected changes in the volume or nature of the CCR or non-CCR waste streams.

Corrective action will consist of constructing and operating a groundwater extraction (GWE) system, consisting of two groundwater extraction trenches, as outlined in the Corrective Action Plan for the AP (see **Appendix G**). The GWE system when combined with the completed final closure (described in the Final Closure Plan [5]) will serve as groundwater corrective action for the AP.

The GWE system is intended to reduce, to the maximum extent feasible, releases and minimize off-site migration of CCR-derived constituents in groundwater until the groundwater protection standards (GWPS) are achieved. Any liquids collected by the GWE system will be transferred to an appropriate location and treated in accordance with applicable permits that will be obtained after approval of the Corrective Action Plan.

The GWE system remedy includes the construction of two GWE trenches. The trenches will be installed concurrently with closure construction for the AP that is presented in the Final Closure Plan [5] and Closure Construction Permit Application for the AP [4]. Additional coordination with the closure construction final design and construction contractors will be required. Permit-level engineering drawings depicting the proposed remedy and engineering calculations used to support the permit-level design of the remedy are provided in **Appendix G**. Each trench will extend through the potential migration pathway (PMP) and uppermost aquifer (UA) and terminate approximately 1 to 2 feet into the top of bedrock.

2.4.1 Proposed Corrective Action Construction

Corrective action construction will involve multiple components of the GWE system. These will include installation of the north and south groundwater extraction trenches; installation of mechanical, electrical, and piping systems to manage extracted liquids; and site restoration. After the GWE system installation is complete and the final closure of the AP is complete, system operation and maintenance activities will be performed.

Information associated with each of these construction elements of the GWE system are described below.

2.4.1.1 Installation of North Extraction Trench

Roughly 1,600 linear feet of extraction trench will be installed north to south along the northwest side of the AP, generally intersecting groundwater downgradient of the west side of the CCR consolidation area. The extraction trench will include the following characteristics and components:

- Approximate dimensions of up to 2 to 3 feet wide and 21 to 31 feet in depth, extending from post-closure final grades (approximate elevation of 440 feet[1]) and will be keyed approximately 1 to 2 feet into bedrock (approximate elevation range of 411 to 421 feet);
- Materials excavated during trench excavation will be placed within the AP as compacted contouring fill, beneath the ultimate final cover system of the AP;
- Backfill materials consisting of permeable drainage aggregate surrounding a horizontal perforated collection pipe installed near the base of the trench; and,
- Collection sumps will be installed every 300 to 500 feet along the trench (4 total), consisting of a vertical stainless-steel casing connected to the horizontal perforated pipe.

In order to facilitate the installation of the extraction trench and provide equipment access, the work surface will be improved using engineered fill materials to form an access area that is at least 40 feet in width and is level laterally along the trench alignment. The work area will be prepared after CCR has been removed from the closure-by-removal portions of the AP, but prior to the completion of final closure of the AP. Existing site utilities that conflict with the extraction trench alignment will be modified or abandoned, as needed to provide for construction access and remove obstructions along the extraction trench alignment.

2.4.1.2 Installation of South Extraction Trench

Roughly 800 linear feet of extraction trench will be installed north to south along the southwest side of the AP, generally intersecting groundwater downgradient of the west side of the CCR consolidation area. The trench and associated working platform will be constructed from the crest of the existing AP perimeter dike after removal of free water (*i.e.*, standing water) and after removal of the rail line, ballast, and CCR within the perimeter embankments. The extraction trench will include the following characteristics and components:

- Approximate dimensions of up to 2 to 3 feet wide and 50 feet in depth, extending from post-closure final grades (maximum elevation of 450 feet to allow for equipment operational

[1] All elevations in this report are in the North American Vertical Datum of 1988 (NAVD88), unless otherwise noted.

requirements) and will be keyed approximately 1 to 2 feet into bedrock (approximate elevation of 401.5 feet);

- Materials excavated during trench excavation will be placed within the AP as compacted contouring fill, beneath the ultimate final cover system of the AP;
- Backfill materials consisting of permeable drainage aggregate surrounding a horizontal perforated collection pipe installed near the base of the trench; and,
- Collection sumps will be installed every 200 to 500 feet along the trench (3 total), consisting of a vertical stainless-steel casing connected to the horizontal perforated pipe.
- Methane gas is known to be present in the subsurface throughout Illinois, due to both natural and anthropogenic processes (coal mining), and has been encountered at depth during drilling along the AP embankment in the vicinity of the south trench alignment. A detailed health and safety methane monitoring plan will be developed and implemented during on-site construction activities where the potential to encounter methane has been previously identified.

In order to facilitate the installation of the extraction trench and provide equipment access, a working platform will be constructed and centered on the trench alignment. The working platform will be constructed within the existing AP perimeter dike, after free water (*i.e.,* standing water) has been removed from the AP, and thereby is no longer functioning as a dam, but before the final closure has been completed. Removal of the rail line, ballast, and CCR within the perimeter embankments will be removed during closure activities and the surface elevation following these activities will be a maximum of 450 feet to allow for equipment operation requirements. The working platform will be constructed out of engineered fill materials, be at least 40 feet in width, and be level laterally. Existing site utilities that conflict with the extraction trench alignment will be modified or abandoned, as needed to provide for construction access and remove obstructions along the extraction trench alignment.

2.4.1.3 Mechanical, Electrical, and Piping Installation

A mechanical, electrical, and piping system will be installed to support the removal of infiltrated liquids from the GWE trenches. The system will include the following components:

- A single pneumatic pump will be installed in each of the collection sumps along with a discharge pipe that will carry extracted liquids to an equalization (EQ) tank in a nearby compressor shed.
- A GWE system enclosure will be placed within the limits of a central gravel pad. The system enclosure will consist of the following equipment:
  - An air compressor, air receiver tank, EQ tank, and transfer pump to supply compressed air to nearby pneumatic pumps and to transfer liquids from the EQ tank to the water treatment process; and
  - A compressor air manifold consisting of control valves and pulse counters, and a collection sump discharge piping manifold consisting of control valves and flow meters to totalize extracted water from each collection sump will be installed in the compressor shed as well as other miscellaneous electrical controls that allow for continuous automated operation, data collection, and remote telemetry.

- An overhead electrical power drop and buried electrical distribution system will be installed to provided power for the groundwater extraction system.

2.4.1.4 Site Restoration

The GWE system will be constructed during closure construction of the AP and will be completed prior to the closure completion. Therefore, site restoration activities for areas disturbed during construction of the GWE system will be completed in accordance with the Final Closure Plan for the AP [5].

2.4.1.5 System Operation and Waste Streams

Operation of the GWE system is expected to result in the generation of approximately 40 combined gallons per minute (gpm) from both trenches during initial trench operation, with flowrates decreasing to approximately 14 gpm during long-term operations. However, actual flow rates could vary from this estimate. Extracted groundwater will be totalized, treated, and discharged in accordance with applicable permits that will be obtained after approval of this Construction Permit Application.

2.5 Plans and Specifications

Section 845.220(a)(6): Plans and specifications fully describing the design, nature, function and interrelationship of each individual component of the facility.

Permit-level design plans and specifications for key construction materials are included within the Corrective Action Plan for the AP, provided in **Appendix G**. These plans were prepared in accordance with Section 845.670(a)(6) and are consistent with the narrative description provided in **Appendix G**, per Section 845.220(a)(5).

A permit-level evaluation of the stability of the AP perimeter dikes during installation of the GWE system was prepared to support this Construction Permit Application. The stability assessment indicated that installation of the south GWE trench using large construction equipment placed on the working platform on the dike is not expected to result in significant distress to the AP perimeter dikes, and that a safety factor of at least 1.30, in accordance with 845.460(a)(1), is expected to be maintained during GWE system construction. This assessment and supporting geotechnical information are provided in **Appendix H**.

2.6 Groundwater Monitoring Program

Section 845.220(a)(7): A new groundwater monitoring program or any modification to an existing groundwater monitoring program that includes but is not limited to the following information:

A Corrective Action Groundwater Monitoring Plan is included in **Appendix B.1** of this application

Section 845.220(a)(7)(A): A hydrogeologic site investigation meeting the requirements of Section 845.620, if applicable;

Hydrogeologic site investigations for the AP are provided in **Appendix B.2**.

Section 845.220(a)(7)(B): Design and construction plans of a groundwater monitoring system meeting the requirements of Section 845.630; and

Design and construction plans of a GWE system as required by Section 845.630 are provided in the operating and closure permits [3, 4]. The Corrective Action Groundwater Monitoring Plan (**Appendix B.1**) includes content requirements specific to 35 I.A.C. § 845.630 (Groundwater Monitoring System), 35 I.A.C. § 845.640 (Groundwater Sampling and Analysis), 35 I.A.C. § 845.650 (Groundwater Monitoring Program), and 35 I.A.C. § 845.680 (Implementation of the Corrective Action Plan) for the AP.

Section 845.220(a)(7)(C): A proposed groundwater sampling and analysis program that includes selection of the statistical procedures to be used for evaluating groundwater monitoring data (see Sections 845.640 and 845.650).

A groundwater sampling and analysis program that meets the requirements of Section 845.640 and 845.650 is provided in **Appendix B.1.**

2.7 Certification

Section 845.220(a)(8): The signature and seal of a qualified professional engineer

I, Anne Frances Ackerman, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this construction permit application has been prepared in accordance with the accepted practice of engineering.

Anne Frances Ackerman
Printed name



06/02/2025
Signature Date

062.060586 IL 11/30/2025
Registration No. State Exp. Date



Affix Seal

2.8 Public Meeting Information

Section 845.220(a)(9): Certification that the owner or operator of the CCR surface impoundment completed the public notification and public meetings required under Section 845.240, a summary of the issues raised by the public, a summary of any revisions, determinations, or other considerations made in response to those issues, and a list of interested persons in attendance who would like to be added to the Agency's listserv for the facility.

Certification that public notification and public meetings have been completed as required by Section 845.240 is provided in **Appendix I**.

2.9 Corrective Action Construction

Section 845.220(c)(1): Corrective action plan (see Section 845.670);

The Corrective Action Plan is provided in **Appendix G**.

Section 845.220(c)(2): Groundwater modeling, including:

A. *The results of groundwater contaminant transport modeling and calculations showing how the corrective action will achieve compliance with the applicable groundwater standards;*
B. *All modeling inputs and assumptions;*
C. *Description of the fate and transport of contaminants with the selected corrective action over time; and*
D. *Capture zone modeling, if applicable.*

Groundwater modeling as required by Section 845.220(c)(2) is provided within Appendix B of Corrective Action Alternatives Analysis Supporting Information Report, which is included as Appendix B of the Corrective Action Alternatives Analsyis, which is provided as **Appendix G** of this application.

Section 845.220(c)(3): Any necessary licenses and software needed to review and access both the models and the data contained within the models required by subsection (c)(2).

Consistent with previously submitted construction permit applications, electronic copies of the model files are provided within Appendix B of Corrective Action Alternatives Analysis Supporting Information Report, which is included as Appendix B of the Corrective Action Alternatives Analsyis, which is provided as **Appendix G** of this application. Publicly available software can be used to review and access the models and the data, no additional licenses or software are required.

Section 845.220(c)(4): Corrective action groundwater monitoring program, including identification of revisions to the groundwater monitoring system for corrective action.

The corrective action groundwater monitoring program as required by Section 845.220(c)(4) is provided in **Appendix B.1**. The corrective action groundwater monitoring plan establishes how data will be collected, documented, and evaluated to assess remedy effectiveness for all currently documented and potential future releases from the AP. The presence of exceedances at the waste boundary will continue to be evaluated under the Operating Permit Groundwater Monitoring Program previously submitted to IEPA [3].

Section 845.220(c)(5): Any interim measures necessary to reduce the contaminants leaching from the CCR surface impoundment, and/or potential exposures to human or ecological receptors, including an analysis of the factors specified in Section 845.680(a)(3).

No interim measures are necessary or planned ahead of permit approval and completion of the final design. The Corrective Action Plan, provided in **Appendix G**, provides an analysis of the factors specified in Section 845.680(a)(3).

3. ADDITIONAL INFORMATION

Certification that IPRG will utilize contractors, subcontractors, and installers who are participants in an approved training program, in accordance with 415 Illinois Compiled Statutes (ILCS) 5/22.59(b)(4), is provided in **Appendix J**.

4. REFERENCES

[1] Illinois Administrative Code, "Title 35, Subtitle G, Chapter I, Subchapter J, Part 845: Standards for The Disposal Of Coal Combustion Residuals In Surface Impoundments," April 21, 2021.

[2] Code of Federal Regulations, "Title 40, Chapter I, Subchapter I, Part 257, Subpart D, Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," April 17, 2015.

[3] Burns & McDonnell, "Initial Operating Permit, Edwards Power Plant Ash Pond," October 25, 2021. [Online]. Available: https://www.luminant.com/documents/ccr/il-ccr/Edwards/2021/2021%2010%2030%20Edwards%20AP%20Op%20Permit%20App%20W1438050005-01.pdf.

[4] IngenAE, LLC, "Construction Permit Application, Edwards Power Station, Ash Pond, (IEPA ID W1438050005-01), Bartonville, Illinois," June 2022.

[5] IngenAE, LLC, "Final Closure Plan, Edwards Power Plant, Ash Pond, (IEPA ID W1438050005-01), Bartonville, Illinois," June 2022.

[6] Illinois Department of Natural Resources, "IDNR Natural Heritage Database," [Online]. Available: https://naturalheritage.illinois.gov/dataresearch/access-our-data.html. [Accessed 28 March 2025].

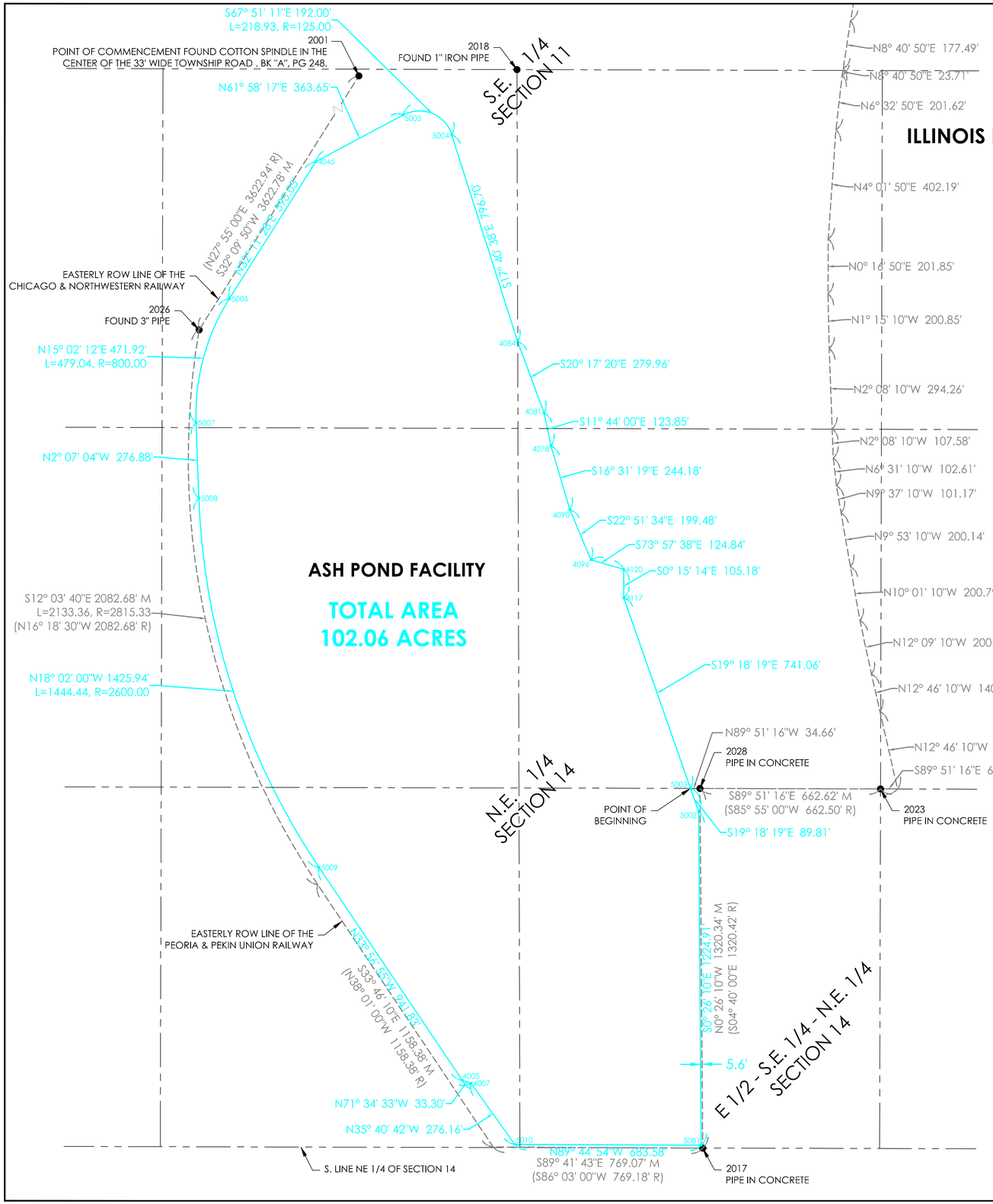
[7] Illinois Department of Natural Resources, "Illinois Threatened and Endangered Species by County," February 2025. [Online]. Available: https://naturalheritage.illinois.gov/content/dam/soi/en/web/naturalheritage/documents/Feb2025_ET_ByCounty.pdf. [Accessed 28 March 2025].

[8] U.S. Fish & Wildlife Service, "USFWS Threatened & Endangered Species Active Critical Habitat," [Online]. Available: https://ecos.fws.gov/ecp/report/table/critical-habitat.html. [Accessed 29 March 2025].

[9] Illinois Department of Natural Resources, "IDNR Historic Preservation Division HARGIS," [Online]. Available: https://dnrhistoric.illinois.gov/preserve/hargis.html. [Accessed 29 March 2025].

[10] Ramboll Americas Engineering Solutions, Inc., "2023 Supplemental Site Investigation Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois," December 1, 2023.

APPENDIX A
LEGAL DESCRIPTION (845.210(c))



ILLINOIS POWER RESOURCES GENERATING, LLC.
EDWARDS POWER PLANT

Land Description of the Edwards Power Plant

Ash Pond Facility

102.06 Acres

Part of the Southeast Quarter of Section 11 and part of the Northeast Quarter of Section 14 in Township 7 North, Range 7 East of the Fourth Principal Meridian, Hollis Township, Peoria County, Illinois being more particularly described as follows:

Commencing at the found Cotton Spindle, in the pavement at the centerline of the 33 feet wide Township Road through the East Half of Section 11 established by an agreement filed for record on November 14, 1891 and recorded in Book "A" on page 248 in the Records of the Town of Hollis, at the intersection of said centerline of the township road with the Easterly Right of Way line of the Chicago and Northwestern Railway; thence South 32 degrees 09 minutes 50 seconds West along the said Right of Way line of the Chicago and Northwestern Railway a distance of 3622.78 to a 3 inch iron pipe on the Easterly Right of Way line of the Peoria and Pekin Union Railway; thence along said Right of Way line being a curve to the left having a radius of 2815.33 feet a curve length of 2133.36 a chord bearing South 12 degrees 03 minutes 40 seconds East a chord distance of 2082.68 feet to the point of tangency; thence South 33 degrees 46 minutes 10 seconds East continuing along said easterly Right of Way line a distance of 1158.38 feet to a point on the South line of the Northeast Quarter of Section 14; thence South 89 degrees 41 minutes 43 seconds East along said South line a distance of 769.07 feet to an iron pipe in concrete at the Southwest corner of the East Half of the Southeast Quarter of the Northeast Quarter of Section 14; thence North 0 degrees 26 minutes 10 seconds West a distance of 1320.34 feet to the iron pipe in concrete at the Northwest corner of the East Half of the Southeast Quarter of the Northeast Quarter of Section 14 from which bears an iron pipe in concrete at the Northeast corner of the East Half of the Southeast Quarter of the Northeast Quarter of Section 14 bearing South 89 degrees 51 minutes 16 seconds East a distance of 662.62 feet; thence from said iron pipe in concrete at the Northwest corner of the East Half of the Southeast Quarter of the northeast Quarter of Section 14 bearing North 89 degrees 51 minutes 16 seconds West a distance of 34.66 feet to the Point of Beginning of the tract described herein; thence South 19 degrees 18 minutes 19 seconds East a distance of 89.81 feet; thence South 0 degrees 26 minutes 10 seconds East a distance of 1224.91 feet; thence North 89 degrees 44 minutes 54 seconds West a distance of 683.58 feet; thence North 35 degrees 40 minutes 42 seconds West a distance of 276.16 feet; thence North 71 degrees 34 minutes 33 seconds West a distance of 33.30 feet; thence North 33 degrees 56 minutes 55 seconds West a distance of 941.83 feet; thence along a curve to the right having a radius of 2600.00 feet a curve length of 1444.44 feet a chord bearing North 18 degrees 02 minutes 00 seconds West a chord distance of 1425.94 feet; thence North 2 degrees 07 minutes 04 seconds West a distance of 276.88 feet; thence along a curve to the right having a radius of 800.00 feet a curve length of 479.04 feet a chord bearing North 15 degrees 02 minutes 12 seconds East a chord distance of 471.92 feet; thence North 32 degrees 11 minutes 28 seconds East a distance of 595.05 feet; thence North 61 degrees 58 minutes 17 seconds East a distance 363.65 feet; thence along a curve to the right having a radius of 125.00 feet a curve length of 218.93 feet a chord bearing South 67 degrees 51 minutes 11 seconds East a chord distance of 192.00 feet; thence South 17 degrees 40 minutes 38 seconds East a distance of 796.70 feet; thence South 20 degrees 17 minutes 20 seconds East a distance of 279.96 feet; thence South 11 degrees 44 minutes 00 seconds East a distance of 123.85 feet; thence South 16 degrees 31 minutes 19 seconds East a distance of 244.18 feet; thence South 22 degrees 51 minutes 34 seconds East a distance of 199.48 feet; thence South 73 degrees 57 minutes 38 seconds East a distance of 124.84 feet; thence South 0 degrees 15 minutes 14 seconds East a distance of 105.18 feet; thence South 19 degrees 18 minutes 19 seconds East a distance of 741.06 feet to the Point of Beginning and containing 102.06 Acres.

LEGEND
- SECTION LINE
- PROPERTY BOUNDARY (BY OTHERS)
- CCR FACILITY BOUNDARY
- FOUND SURVEY MARKER AS NOTED
- M MEASURED DIMENSION
- R RECORD (DEED) DIMENSION

SURVEY NOTE:
THIS DRAWING AND THE INFORMATION SHOWN HERE ON WAS OBTAINED FROM DATA COLLECTED FROM A FIELD SURVEY MADE BY INGENAE, LLC BETWEEN FEBRUARY 12 THROUGH JULY 30, 2021. SURVEY COORDINATES, BEARINGS & DISTANCES ARE REFERENCED TO ILLINOIS WEST 1202 STATE PLANE COORDINATE SYSTEM NAD 1983.

CONTROL MONUMENTATION				
POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION
2001	1434266.26	2436353.57	448.07	COTTON SPINDLE IN ROAD
2017	1428195.82	2436273.01	437.88	PIPE IN CONCRETE
2018	1432154.95	2435591.37	439.92	FOUND 1 IN PIPE
2023	1429514.44	2436925.58	440.94	PIPE IN CONCRETE
2026	1431199.56	2434424.87	435.77	FOUND 3 IN PIPE
2028	1429516.12	2436262.96	438.18	PIPE IN CONCRETE

CCR FACILITY BOUNDARY CORNERS		
POINT NO.	NORTHING	EASTING
4005	1428444.42	2435391.09
4007	1428433.90	2435422.68
4045	1431817.61	2434852.90
4078	1430773.19	2435715.92
4081	1430894.45	2435690.74
4084	1431157.04	2435593.66
4090	1430539.09	2435785.36
4096	1430355.27	2435862.86
4117	1430215.60	2435983.30
4120	1430320.78	2435982.84
5001	1428203.71	2436262.44
5002	1429431.45	2436257.99
5003	1429516.21	2436228.30
5004	1431916.11	2435351.74
5005	1431988.50	2435173.90
5006	1431314.04	2434535.89
5007	1430858.28	2434413.46
5008	1430581.59	2434423.69
5009	1429225.70	2434865.12
5010	1428209.57	2435583.74

SURVEYOR CERTIFICATE:
THIS IS TO CERTIFY THAT WE, INGENAE, LLC, HAVE AT THE REQUEST OF AND FOR THE EXCLUSIVE USE OF THE OWNERS, PERFORMED A SURVEY OF THE TRACT AS SHOWN HEREON AND THAT THIS IS A TRUE REPRESENTATION OF THAT SURVEY. THIS PLAT AND THE SURVEY FROM WHICH IT IS BASED WERE DONE IN ACCORDANCE WITH THE "MINIMUM STANDARDS OF PRACTICE" FOR LAND SURVEYING IN THE STATE OF ILLINOIS.

INGENAE, LLC
PROFESSIONAL DESIGN FIRM
LICENSE NO. 184.007588-0010

STATE OF ILLINOIS · MICHAEL J. GRAMINSKI · 035-2001 · PROFESSIONAL LAND SURVEYOR

MICHAEL J. GRAMINSKI — DATE
I.P.L.S. NO. 035.002901
EXPIRES: 11/30/2022

IngenAE
502 Earth City Plaza, Suite 120
Earth City, MO 63045
www.ingenae.com

Submissions / Revisions: Date:

1		
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10		
11		
12		
13		

Project Name & Location:

EDWARDS
POWER PLANT

7800 S. CILCO LN.
BARTONVILLE, IL 61607

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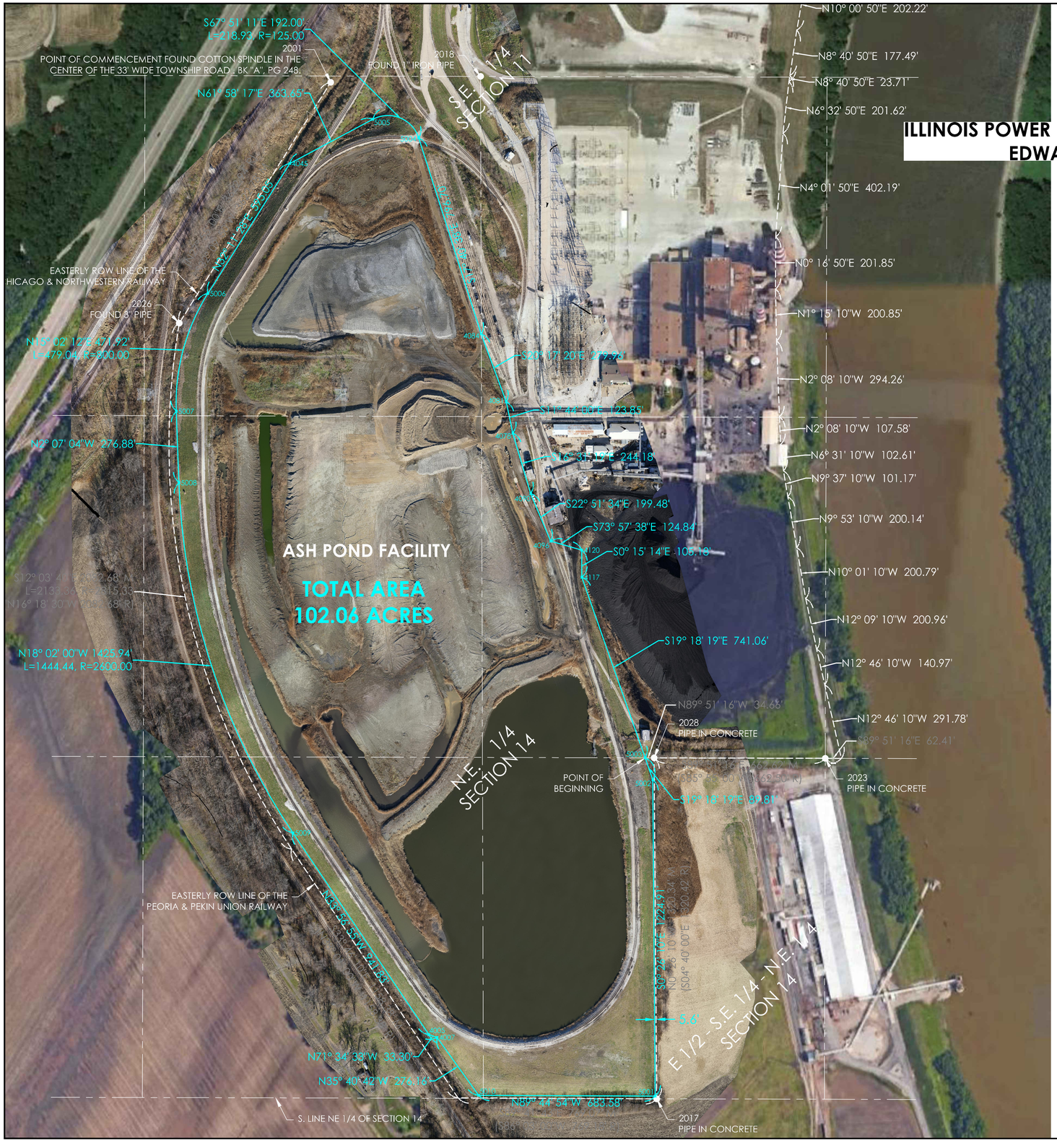
Drawing Name:

CCR FACILITY BOUNDARY EXHIBIT

Date: 9/21/2021	Project No.
Type: SITE	Drawing No. 1
Drawn By: CB	
Approved By: MG	
Scale: AS NOTED	



ILLINOIS POWER RESOURCES GENERATING, LLC.
EDWARDS POWER PLANT

LEGEND
- SECTION LINE
- PROPERTY BOUNDARY (BY OTHERS)
- CCR FACILITY BOUNDARY
- ● FOUND SURVEY MARKER AS NOTED
- M MEASURED DIMENSION
- R RECORD (DEED) DIMENSION

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IngenAE
502 Earth City Plaza, Suite 120
Earth City, MO 63045
www.ingenae.com

Submissions / Revisions:		Date:
1		
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Project Name & Location:

EDWARDS
POWER PLANT

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Drawing Name:

CCR FACILITY BOUNDARY EXHIBIT

Date:	Project No.
9/21/2021	
Type: SITE	Drawing No. 2
Drawn By: CB	
Approved By: BH	
Scale: AS NOTED	

APPENDIX B
GROUNDWATER INFORMATION (845.210(d)(1), 845.220(a)(7)(A-C), 845.220(c)(2-5))

APPENDIX B.1
CORRECTIVE ACTION GROUNDWATER MONITORING PLAN

Intended for
Illinois Power Resources Generating, LLC
7800 Cilco Lane
Bartonville, Illinois, 61607

Date
June 2, 2025

Project No.
1940110241-003

CORRECTIVE ACTION GROUNDWATER MONITORING PLAN

ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS
IEPA ID NO. W1438050005-01

RAMBOLL Bright ideas. Sustainable change.

CORRECTIVE ACTION GROUNDWATER MONITORING PLAN EDWARDS POWER PLANT, ASH POND, IEPA ID NO. W1438050005-01

Project name	**Edwards Power Plant Ash Pond**
Project no.	**1940110241-003**
Recipient	**Illinois Power Resources Generating, LLC**
Document type	**Corrective Action Groundwater Monitoring Plan**
Revision	**FINAL**
Date	**June 2, 2025**
Prepared by	**Rachel Banoff, EIT**
Checked by	**Sung-Woo Lee, PhD**
Approved by	**Brian G. Hennings, PG**
Description	**Corrective Action Groundwater Monitoring Plan**

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

T 414-837-3607
F 414-837-3608
https://ramboll.com



Brian G. Hennings, PG
Project Officer Hydrogeology

CONTENTS

1.	**Introduction**	**4**
1.1	Overview	4
1.2	Site Location and Background	5
1.3	Conceptual Site Model	5
1.4	Groundwater Quality	6
1.5	Supplemental Site Investigation	7
2.	**Corrective Action Groundwater Monitoring Plan**	**8**
2.1	Corrective Action Groundwater Monitoring Program and Parameters	8
2.1.1	35 I.A.C. § 845 Corrective Action Groundwater Monitoring	8
2.2	Sampling Schedule	8
2.3	Groundwater Sample Collection	9
2.4	Methane Monitoring Plan	9
2.5	Laboratory Analysis	9
2.6	Quality Assurance Program	9
2.7	Groundwater Monitoring Well Maintenance Plan	10
2.8	Statistical Analysis	11
2.9	Data Reporting	11
2.10	Compliance with Applicable Groundwater Protection Standards	11
3.	**Effectiveness of the Corrective Action Remedy**	**12**
3.1	Remedy Progress Evaluation	12
3.1.1	Comparison to Groundwater Protection Standard	13
3.1.2	Agreement with Groundwater Model	13
3.1.3	Trend Analysis	14
3.1.4	Adaptive Management Actions	14
3.1.5	Concluding GWE	15
3.2	Stability Evaluation	16
3.3	Attainment Evaluation and Conclusion of Corrective Action Monitoring	16
4.	**References**	**17**

TABLES (ATTACHED)

Table 1-1 35 I.A.C. § 845 Requirements Checklist
Table 2-1 Summary of Monitoring Well Locations and Purpose
Table 2-2 Monitoring Well Locations and Construction Details
Table 2-3 Sampling and Analysis Summary
Table 3-1 Adaptive Site Management Metrics and Trigger Criteria

FIGURES (ATTACHED)

Figure 1-1 Corrective Action Monitoring Outline
Figure 1-2 Site Location Map
Figure 1-3 Site Map
Figure 1-4 Uppermost Aquifer Potentiometric Surface Map, October 28, 2024
Figure 2-1 Proposed 35 I.A.C. § 845 Corrective Action Monitoring Well Location Map
Figure 3-1 Corrective Action Monitoring Timeline
Figure 3-2 Adaptive Site Management Decision-Making Flow Chart

APPENDICES

Appendix A Boring Logs and Well Construction Forms
Appendix B 35 I.A.C. § 845 Multi-Site Statistical Analysis Plan

ACRONYMS AND ABBREVIATIONS

35 I.A.C.	Title 35 of the Illinois Administrative Code
AP	Ash Pond
BCU	bedrock confining unit
CCR	coal combustion residuals
COC	constituent of concern
CSM	conceptual site model
E001	Event 1
E002	Event 2
E003	Event 3
EPP	Edwards Power Plant
GMP	Groundwater Monitoring Plan
GWE	groundwater extraction
GWPS	groundwater protection standard
HCR	Hydrogeologic Site Characterization Report
ID	identification
IEPA	Illinois Environmental Protection Agency
IPRG	Illinois Power Resources Generating, LLC
LEL	lower explosive limit
NID	National Inventory of Dams
No.	Number
PMP	potential migration pathway
QA/QC	quality assurance/quality control
Ramboll	Ramboll Americas Engineering Solutions, Inc.
RL	reporting limit
SI	surface impoundment
StAP	Statistical Analysis Plan
TDS	total dissolved solids
UA	uppermost aquifer
UCF	Upper Cahokia Formation
UCL	upper confidence level
USEPA	United States Environmental Protection Agency

1. INTRODUCTION

1.1 Overview

In accordance with requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845: Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments, Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this Corrective Action Groundwater Monitoring Plan (GMP) on behalf of Edwards Power Plant (EPP), operated by Illinois Power Resources Generating, LLC (IPRG). This GMP will apply specifically to the CCR Unit referred to as the Ash Pond (AP), coal combustion residuals (CCR) identification (ID) number (No.) 301, Illinois Environmental Protection Agency (IEPA) ID No. W1438050005-01, and National Inventory of Dams (NID) No. IL50710. The AP is a 102-acre unlined CCR surface impoundment (SI) formerly used to manage CCR and non-CCR waste streams at the EPP [1]. The AP has a surface area of approximately 91 acres surrounded by berms up to 27 feet higher than the surrounding land surface. This Corrective Action GMP includes 35 I.A.C. § 845 requirements specific to 35 I.A.C. § 845.630 (*Groundwater Monitoring System*), 35 I.A.C. § 845.640 (*Groundwater Sampling and Analysis*), 35 I.A.C. § 845.650 (*Groundwater Monitoring Program*), and 35 I.A.C. § 845.680 (*Implementation of the Corrective Action Plan*) for the AP at the EPP.

The checklist in **Table 1-1** provides references to sections, tables, and figures within this document that meet the specific requirements of 35 I.A.C. § 845.630, 35 I.A.C. § 845.640, 35 I.A.C. § 845.650, and 35 I.A.C. § 845.680.

This Corrective Action GMP will be included as Appendix B.1 to the Construction Permit Application for the EPP AP. The Corrective Action Plan proposes source control (*i.e.*, closure of the AP) followed by groundwater extraction (GWE) as the remedy for the AP. As described in the Corrective Action Plan, the proposed remedy meets the performance standards of 35 I.A.C. § 845.670(d) and addresses all current and potential future releases from the AP. Likewise, this Corrective Action GMP establishes how data will be collected, documented, and evaluated to assess remedy effectiveness for all currently documented and potential future releases from the AP[1] per the process outlined in **Figure 1-1**.

Adaptive site management strategies are an integral part of corrective action groundwater monitoring. The adaptive site management approach consistent with National Research Council, Interstate Technology & Regulatory Council and United States Environmental Protection Agency (USEPA) methodologies will allow timely incorporation of new site information throughout corrective action to ensure the achievement of the groundwater protection standard (GWPS). The adaptive site management approach expedites progress toward meeting the GWPS while acknowledging uncertainties, such as the persistence of current groundwater flow directions and potential related changes in geochemical conditions. The structured decision-making process proposed in this Corrective Action GMP includes specific metrics used to evaluate remedy progress, criteria which would trigger adaptive management evaluation, and options for those management actions.

[1] The presence of exceedances at the waste boundary will continue to be evaluated under the Operating permit GMP previously submitted to IEPA [7].

1.2 Site Location and Background

The EPP is located in Peoria County, Illinois between Mapleton and Bartonville in Section 11, Township 7 North, Range 7 East (**Figure 1-2**). The EPP is located on the floodplain of the Illinois River adjacent to a levee and has one CCR SI, the AP. The AP is located west of the EPP and the EPP property is bordered by a salt processing facility to the north, railroad right-of-way and former Orchard Mines to the west, the Illinois River and a fertilizer production facility to the east, and agricultural land to the south (**Figure 1-3**).

The EPP began power generation in 1960 and the original AP embankments were placed into service at that time. In 2004, modifications to the rail loop surrounding the AP increased the elevations of the embankments and reduced the footprint of the active impoundment [2]. CCR material remains between the rail loop and the berm at the south end of the AP. High power transmission lines bisect the AP and two sub-basins, referred to as the North and South Ponds. The sub-basins are hydraulically connected and CCR placement is continuous throughout the AP.

The AP is a 102-acre unlined CCR SI formerly used to manage CCR and non-CCR waste streams at the EPP [1]. The AP has a surface area of approximately 91 acres surrounded by berms up to 27 feet higher than the surrounding land surface. This pond currently discharges to the Illinois River through Outfall 001 included in the facility National Pollutant Discharge Elimination System permit IL0001970. The primary treatment method for the pond water is settlement via reduced velocity whereby solids settle out in various flow channels and in the main South Pond. The permitted total average daily flow is 5.24 million gallons per day [3].

1.3 Conceptual Site Model

Significant site investigation has been completed at the EPP to characterize the geology, hydrogeology, and groundwater quality. Based on extensive investigation and monitoring, the AP has been well characterized and detailed in the Hydrogeologic Site Characterization Report (HCR) [4] and the Nature and Extent Report [5]. A conceptual site model (CSM) has been developed and is discussed below.

In addition to the CCR, three hydrostratigraphic units have been identified at the AP, based on stratigraphic relationships geologic composition, and common hydrogeologic properties. The units, listed from surface downward, are summarized as follows:

- **Upper Cahokia Formation (UCF)/Potential Migration Pathway (PMP):** Low permeability clays and silts of the UCF are present at the surface. This unit is considered a PMP at elevations similar to the base of the AP, and in places where thin discontinuous sand lenses occur within the Upper Cahokia Formation adjacent to the AP.
- **Uppermost Aquifer (UA):** Thin (generally less than four feet), moderate permeability sand, silty sand, and clayey gravel material within the Lower Cahokia Formation, bedrock, and/or weathered shale bedrock, where present. In locations where higher permeability materials and coarser grained material are absent, the UA is interpreted as the interface between the Lower Cahokia Formation and shale bedrock.
- **Bedrock Confining Unit (BCU):** Thick, very low permeability shales and siltstones of the Carbondale and Modesto Formations. This unit was encountered at elevations ranging from

approximately 400 to 422 feet[2] with higher bedrock elevations occurring beneath the northern portion of the AP.

Groundwater flow in the UA generally flows from east to west in the central portion of the AP towards what is interpreted as a former channel of the Illinois River, and south/southeast at the south end of the AP. In the northernmost portion of the AP there is a minor northwest and northern component of flow in both the UA and PMP that may be attributed to a surface water drainage ditch constructed at an elevation below surrounding groundwater elevations with the stage ranging from 430.07 to 432 feet [6] along the northern and western side of the AP. Groundwater elevations vary seasonally in both the UA and PMP, generally less than 5 feet, although flow directions are consistent. Vertical gradients are generally upward between the UCF/PMP and UA across the EPP, indicate that water within the bedrock periodically migrates vertically upward into the Illinois River. Groundwater elevations and contours for the October 2024 groundwater monitoring event are presented in **Figure 1-4**.

1.4 Groundwater Quality

Groundwater monitoring in accordance with the proposed Operating GMP and sampling methodologies provided in the operating permit application for groundwater compliance at the AP began in the second quarter of 2023 [7]. The proposed compliance monitoring wells yield groundwater samples that represent the quality of downgradient groundwater at the CCR boundary (as required in 35 I.A.C. § 845.630(a)(2)).

The Event 1 (E001) quarterly groundwater monitoring event was completed on June 15, 2023. Supplemental data for monitoring wells APW-01, AW-20, AW-23, and EMW-05 was provided for event E001 as part of on-going nature and extent characterization activities consistent with 35 I.A.C. § 845.650(d)(1) at the EPP AP. In accordance with 35 I.A.C. § 845.610(b)(3)(C) and the statistical analysis plan submitted with the operating permit application (Appendix A of the Groundwater Monitoring Plan), constituent concentrations observed at compliance wells were evaluated for compliance with the GWPSs summarized in 35 I.A.C. § 845.600 to determine exceedances[3] of the GWPS. The statistical determination identified the following GWPS exceedances at compliance groundwater monitoring wells [8]:

- Detected UA Exceedances:
  - Boron in compliance wells AW-19, and AW-21 and supplemental well AW-20[4]
- Detected UCF/PMP Exceedances:
  - Boron at compliance wells AP07S and AW-15S
  - Sulfate at compliance well AW-15S

Subsequent compliance sampling events (following E001) were evaluated for exceedances of the GWPS as described in 35 I.A.C. § 845.600 [9, 10, 11, 12, 13, 14]. Supplemental data for

[2] All elevations in this report are referenced to North American Vertical Datum of 1988 unless otherwise noted.
[3] Throughout this document, "exceedance" or "exceedances" is intended to refer only to potential exceedances of proposed applicable background statistics or GWPSs as described in the proposed groundwater monitoring program, which was submitted to the IEPA on October 25, 2021, as part of IPRG's operating permit application for the EPP AP. That operating permit application, including the proposed groundwater monitoring program, remains under review by the IEPA and therefore IRPG has not identified any actual exceedances.
[4] Supplemental data was provided as part of nature and extent characterization activities consistent with 35 I.A.C. § 845.650(d)(1) at the Edwards AP.

monitoring wells APW-01, AW-20, AW-23, and EMW-05 was provided for the Event 2 (E002) and Event 3 (E003) quarterly groundwater monitoring events as part of on-going nature and extent characterization activities consistent with 35 I.A.C. § 845.650(d)(1) at the EPP AP. Exceedances identified during the subsequent events were consistent with those listed above. In addition to the exceedances listed above, the following exceedances were identified:

- Detected UA Exceedances:
  - Boron in compliance well AW-05
- Detected UCF/PMP Exceedances:
  - Total Dissolved Solids (TDS) at compliance well AW-15S

In accordance with 35 I.A.C. § 845.660, a Corrective Measures Assessment was developed to address current and potential future GWPS exceedances originating from the AP and was submitted to IEPA on June 4, 2024 [15]. The 35 I.A.C. § 845.650 groundwater monitoring requirements will continue to ensure that there will be timely detection of changes in groundwater quality. The selected remedy will meet the performance standards of 35 I.A.C. § 845.670(d) and once implemented and completed, the selected remedy presented in the Corrective Action Plan will attain the GWPSs.

1.5 Supplemental Site Investigation

Additional investigations were conducted in 2021 through 2023 in accordance with 35 I.A.C. § 845.650 to further assess the nature, degree, and extent of elevated boron and sulfate concentrations in groundwater downgradient of the AP.

To delineate to the west of AP, monitoring well AW-23 was installed, sampled, and analyzed for 35 I.A.C. § 845.600 parameters. In addition, two pumping wells (PTW-01 and PTW-02) and two observation wells (OW-01 and OW-02) were installed and aquifer tests performed in 2022 to evaluate hydrogeologic properties of the site and assess potential corrective actions. The results of the above investigations were summarized in the Supplemental Site Investigation Report [16]. As documented in the Nature and Extent Report [5] the nature and extent of GWPS exceedances of boron and sulfate have been described in sufficient detail to support a complete and accurate assessment of the corrective measures necessary to effectively clean up all releases from the AP.

2. CORRECTIVE ACTION GROUNDWATER MONITORING PLAN

This Corrective Action GMP is being provided to propose a groundwater monitoring program specific to the AP that will comply with 35 I.A.C. § 845.680. The Corrective Action GMP will monitor and evaluate groundwater quality specifically to document the effectiveness of the corrective action remedy. The groundwater monitoring program will include sampling and analysis procedures that are consistent and that provide an accurate representation of groundwater quality.

2.1 Corrective Action Groundwater Monitoring Program and Parameters

2.1.1 35 I.A.C. § 845 Corrective Action Groundwater Monitoring

The proposed 35 I.A.C. § 845 corrective action monitoring well network will consist of 12 wells to document the effectiveness of the corrective action remedy and ultimately demonstrate compliance with GWPSs (**Figure 2-1**). The wells included in the corrective action monitoring well network include select compliance monitoring wells from the Operating GMP network (*e.g.*, those with previously reported exceedances of the GWPS) (**Section 1.4**) and monitoring wells installed during the Supplemental Site Investigation (**Section 1.5**).

As appropriate to meet the corrective action monitoring objectives and evaluate the effectiveness of the corrective action remedy (as described in **Section 3**), the corrective action monitoring program involves assigning each well to a monitoring category or purpose (**Table 2-1**). These monitoring categories include:

- **Inside Plume:** monitoring wells with GWPS exceedances.
- **Plume Definition:** wells located along the lateral/vertical boundary of the plume.

A summary of the well locations and associated purpose as it relates to the above categories is presented in **Table 2-1** and **Figure 2-1**. Monitoring well depths and construction details are listed in **Table 2-2**, with boring logs and monitoring well construction forms provided in **Appendix A**. Groundwater samples will be collected and analyzed for the laboratory and field parameters in **Table 2-3**. Laboratory parameters include major ions for evaluating groundwater chemistry and constituents of concern (COCs) (*i.e.*, reported exceedances in accordance with the Operating GMP) the Corrective Action is intended to address. Sampling to evaluate corrective action effectiveness will begin the quarter after the corrective action remedy is implemented and commissioned.

2.2 Sampling Schedule

All wells in the corrective action GMP network, as presented in **Table 2-1**, will be sampled quarterly to provide a complete picture of corrective action effectiveness. Groundwater elevations will be determined at the time of sample collection from each well. Sampling will end in accordance with 35 I.A.C. § 845.680(c), when compliance with the GWPS has been demonstrated "at all points within the plume of contamination that lies beyond the waste boundary […] for a period of three consecutive years" (details in **Section 3.3**).

Consistent with 35 I.A.C. § 845.650(b)(4), quarterly sampling may be reduced to a semiannual frequency with IEPA approval after completion of five years of monitoring. A request for reduced

sampling frequency will include a demonstration that corrective action monitoring effectiveness will not be compromised; sufficient data has been collected to evaluate ongoing remedy effectiveness; and existing data show trends consistent with anticipated remedy performance (details in **Section 3.1**).

2.3 Groundwater Sample Collection

Groundwater sampling procedures have been developed and the collection of groundwater samples is being implemented to meet the requirements of 35 I.A.C. § 845.640. In addition to groundwater well samples, quality assurance samples will be collected as described in **Section 2.5** (**Table 2-3**). Groundwater samples will be collected and analyzed in accordance with the Multi-Site Sampling and Analysis Plan [17].[5]

2.4 Methane Monitoring Plan

Methane, a decomposition product of organic materials, is a colorless, odorless, flammable gas. Methane is known to be present in aquifers throughout Illinois, due to both natural and anthropogenic processes (coal mining). Methane may accumulate in the borehole, well, protective casing or in the general work area near a well or boring. During field activities in 2021 methane was detected above 10% of the lower explosive limit (LEL) at borehole monitoring well locations AW-13, AW-14, AW-15, AW-15C, AW-16, AW-17, AW-22, and P002. Levels quickly dissipated after venting the monitoring wells to the atmosphere. A methane monitoring plan was established for the safe completion of field activities, including groundwater sampling at EPP. Anyone accessing any monitoring well at EPP must follow a methane monitoring plan to manage and mitigate potential hazards associated with the presence of methane gas in groundwater.

2.5 Laboratory Analysis

Laboratory analysis will be performed consistent with the requirements of 35 I.A.C. § 845.640(j) by a state-certified laboratory using methods approved by IEPA and USEPA. Laboratory methods may be modified based on laboratory equipment availability or procedures, but the Reporting Limit (RL) for all parameters analyzed, regardless of method, will be lower than the applicable groundwater quality standard [18]. Concentrations lower than the RL will be reported as less than the RL.

2.6 Quality Assurance Program

Consistent with the requirements of 35 I.A.C. § 845.640(a)(5), the sampling and analysis program includes procedures and techniques for quality assurance/quality control (QA/QC) [18].[5] Additional quality assurance samples to be collected will include the following:

- Field duplicates will be collected at a frequency of one per group of ten or fewer investigative water samples.
- One equipment blank sample will be collected and analyzed for each day of sampling. If dedicated sampling equipment is used, then equipment blank samples will not be collected.
- The duplicate and equipment blank quality assurance samples will be supplemented by the laboratory QA/QC program, which typically includes:

[5] The Multi-Site Sampling and Analysis Plan and Multi-Site Quality Assurance Project plan are living documents which are subject to routine evaluation and updates in accordance with USEPA recommended best practices [25, 26].

- Regular generation of instrument calibration curves to assure instrument reliability
- Laboratory control samples and/or quality control check standards that have been spiked, and analyses to monitor the performance of the analytical method
- Matrix spike/matrix spike duplicate analyses to determine percent recoveries and relative percent differences for each of the parameters detected
- Analysis of replicate samples to check the precision of the instrumentation and/or methodology employed for all analytical methods
- Analysis of method blanks to assure that the system is free of contamination

Water quality meters used to measure pH and turbidity will be calibrated according to manufacturer's specifications. At a minimum, it is recommended that calibration of pH occur daily prior to sampling and checked for accuracy at the end of each day. Unusual or suspect pH measurements during sampling events will be flagged, evaluated, and additional calibration may be performed throughout the sampling events. Turbidity meters will be checked daily, prior to and following sampling. Unusual measurements or erratic meter performance will be flagged and evaluated for overall effects on the data prior to reporting.

2.7 Groundwater Monitoring Well Maintenance Plan

Consistent with the requirements of 35 I.A.C. § 845.630(e)(2), maintenance will be performed according to the Multi-Site Sampling and Analysis Plan [17] as needed to assure that the monitoring wells provide representative groundwater samples. Monitoring wells will be inspected during each groundwater sampling event; inspections will consist of the following:

- Visual inspection, clearing of vegetation, replacement of markers, and painting of protective casings as needed to assure that monitoring wells are clearly marked and accessible
- Visual inspection and repair or replacement of well aprons as needed to assure that they are intact, drain water away from the well, and have not heaved
- Visual inspection and repair or replacement of protective casings as needed to assure that they are undamaged, and that locks are present and functional
- Checks to assure that well caps are intact and vented, unless in flood-prone areas in which case caps will not be vented
- Routine measurement of monitoring well depths to determine the degree of siltation within the wells. Wells will be redeveloped as needed to remove siltation from the screened interval if it impedes flow of water into the well
- Checks to assure that wells are clear of internal obstructions, and flow freely

If wells are damaged or become otherwise inoperable, they will be replaced by wells screened at the same elevation and as close to the original well as possible (ideally within 10 feet) and notification will be provided to IEPA. If a replacement well cannot be installed within approximately 10 feet of the original well location, notification will be sent to the IEPA and a monitoring well will be installed as close as possible to the original monitoring well and given a new well identification number. Any well replacement activities will also be documented in the Annual Groundwater Monitoring and Corrective Action Report.

2.8 Statistical Analysis

A Multi-Site Statistical Analysis Plan (StAP) (**Appendix B**) has been developed to summarize the statistical procedures that will be used to evaluate the groundwater results.

2.9 Data Reporting

Groundwater monitoring and analysis completed in accordance with 35 I.A.C. § 845 under an approved monitoring program will be reported to IEPA annually by January 31 as required by I.A.C. § 845.550, for data collected the preceding year. The Annual Groundwater Monitoring and Corrective Action Report will include the status of the groundwater monitoring and Corrective Action Plan for the AP in addition to other requirements detailed in 35 I.A.C. § 845.610(e).

2.10 Compliance with Applicable Groundwater Protection Standards

As provided in 35 I.A.C. § 845.680(c)(2), corrective action is considered complete when compliance with the GWPS has been achieved by demonstrating that concentration of constituents listed in 35 I.A.C. § 845.600 have not exceeded the GWPSs for a period of three consecutive years, using the statistical procedures and performance standards in 35 I.A.C. § 845.640(f) and (g).

Attainment of GWPSs and conclusion of corrective action monitoring is discussed below in **Section 3.3**.

If a new exceedance is determined during monitoring under the Operating GMP, the Corrective Action groundwater monitoring program will be evaluated for monitoring of additional locations and/or constituents using the adaptive site management methods presented herein.

3. EFFECTIVENESS OF THE CORRECTIVE ACTION REMEDY

The methods for evaluating the effectiveness of the corrective action remedy described in this section are based on the following guidance documents:

- "Methods for Evaluating the Attainment of Cleanup Standards Volume 2: Ground Water," USEPA, Office of Policy, Planning, and Evaluation, 1992. [19]
- "Groundwater Remedy Completion Strategy: Moving Forward with the End in Mind," USEPA, Office of Solid Waste and Emergency Response, 2014. [20]
- "Adaptive Site Management – A Framework for Implementing Adaptive Management at Contaminated Sediment Superfund Sites," USEPA. Office of Superfund Remediation and Technology Innovation, 2022. [21]
- "Environmental Cleanup Best Management Practices: Effective Use of the Project Life Cycle Conceptual Site Model," USEPA, Office of Solid Waste and Emergency Response, 2011. [22]

Evaluation of corrective action remedy effectiveness will occur in three phases (**Figure 3-1**): remedy progress evaluation, stability evaluation, and attainment evaluation [19].

1. Remedy progress evaluation occurs after implementation of corrective actions to assess if the remedy is functioning as anticipated.
2. The stability evaluation, which occurs after treatment has been concluded and a re-equilibration period has elapsed, assesses if a new post-treatment steady state in the groundwater has been reached.
3. Attainment evaluation occurs after a new steady state has been achieved and assesses if COC concentrations are below the GWPS.

COCs are parameters with exceedances of the GWPS to be addressed by the Corrective Action Plan. Corrective action monitoring at EPP AP includes the following COC parameters:

- Boron, sulfate, and TDS

The effectiveness of the remedy at each phase is evaluated using performance metrics designed to assess the goals of that phase. Performance metrics answer questions designed to evaluate multiple aspects of remedy effectiveness with the ultimate goal of holistically guiding management decisions [20]. These metrics may be evaluated using qualitative (subject to expert judgement) or quantitative (numerical outcomes) methods.

This section details the goals and performance metrics of each phase of remedy evaluation. Within each phase, the well groups described in **Section 2.1** have distinct applicable metrics and/or potential management actions consistent with the role of that well group within the corrective action monitoring framework. The remedy evaluation metrics documented here are specific to wells within the Corrective Action monitoring program.

3.1 Remedy Progress Evaluation

The goal of remedy process evaluation is to determine if a groundwater remedy is on track to achieve cleanup standards within the proposed time frame and to inform adaptive management decisions if performance metrics are not achieved. Evaluation of remedy progress includes evaluating the response of COCs in individual monitoring wells and in the plume as a whole.

Remedy progress is evaluated using performance metrics as described below. **Table 3-1** details the questions used to assess remedy progress and metrics which would trigger additional evaluation of adaptive site management options. **Figure 3-2** presents an outline of the decision-making process regarding adaptive management actions (the first step of which is assessing remedy progress per **Table 3-1**).

Documentation of remedy progress metrics will be provided in the Annual Groundwater Monitoring and Corrective Action Report (**Section 2.8**) beginning after the second year of data collection: a minimum of eight data points is required to complete meaningful statistical analysis required for evaluation of the remedy progress metrics, which will be available after two years of quarterly sampling. Per USEPA guidance [20], a thorough review of corrective action progress and remedy effectiveness will be conducted every five years. A Five-Year Annual Groundwater Monitoring and Corrective Action Report will evaluate the comprehensive data set and, if triggered by the results of the remedy progress evaluation metrics (**Table 3-1**), evaluate whether adaptive management actions are needed (**Figure 3-2**). The five-year time frame allows adaptive management decisions to be based on robust data sufficient to complete meaningful statistical analysis while remaining responsive to changing site conditions [20]. The remedy progress evaluation metrics and triggers for additional evaluation are described below.

3.1.1 Comparison to Groundwater Protection Standard

The Inside Plume wells in this monitoring plan were defined based on exceedances of the GWPS. The question posed to evaluate whether exceedances of the GWPS occur, and associated method of evaluation is (**Table 3-1**):

- Are COC concentrations greater than the GWPS? – Compare data points or summary statistics to site-specific GWPS values.

COC concentrations below the GWPS in Inside Plume wells may indicate that remedial actions are approaching completion and that moving to the next phase of remedy effectiveness evaluation may be warranted (see **Section 3.2**). Persistence of COC concentrations above the GWPS in Plume Definition wells may indicate that the plume is no longer properly delineated. Therefore, the trigger criterion for further evaluation is a central tendency measure of the last eight data points exceeding the GWPS.

3.1.2 Agreement with Groundwater Model

A groundwater flow and transport model[6] was used to compare the anticipated time to reach the GWPS for the different corrective actions considered at the AP.

The question posed to evaluate agreement of corrective action remedy progress with the groundwater model results is provided in **Table 3-1** and summarized below:

- Are concentrations of COCs at individual wells consistent with modeling expectations? – Evaluate if the observed results track with the predicted results in general direction and magnitude using expert professional judgement.

Only Inside Plume and Plume Definition wells included in the flow and transport model are evaluated according to this metric. Trigger criteria for additional adaptive site management

[6] The Groundwater Modeling Technical Memorandum is included as an attachment to the Corrective Actions Alternative Analysis presented as part of the Corrective Action Plan.

evaluation include monitoring results failing to follow the general magnitude and direction of groundwater model results at one or more locations. It is acceptable to conclude that no further adaptive site management evaluation is triggered if future observations do not precisely match modeled results on an individual well basis if the direction of remedy progress is adequate.

3.1.3 Trend Analysis

Evaluation of COC trends in wells both within and outside of the plume is a major component of remedy progress evaluations [19, 20]. Decreasing COC concentrations within the groundwater plume provides critical support for remedy effectiveness evaluations. Changing concentrations in wells defining the plume may indicate unanticipated plume migration or a need for better plume definition. Both short-term and long-term trends are important to evaluate remedy performance [19]. All trend analyses are performed in accordance with the Multi-Site StAP (**Appendix B**) and the USEPA Unified Guidance for groundwater statistics [23].

The questions posed to evaluate if COC concentrations are decreasing in Inside Plume and the associated methods for evaluation are provided in **Table 3-1** and summarized as follows:

- Are average plume COC concentrations decreasing? – Evaluate trend based on quarterly average of COC concentrations of Inside Plume wells both for the last eight sampling events and since corrective action was initiated.

The questions posed to evaluate if COC concentrations are changing in Inside Plume wells and Plume Definition wells and the associated methods for evaluation are provided in **Table 3-1** and summarized below:

- Are concentrations of COCs at individual wells changing? – Evaluate trend of COC concentrations, both for the last eight sampling events and since corrective action was initiated.

The goal of the corrective action is to reduce COC concentrations in the groundwater. Therefore, trigger criteria have been established for the three types of corrective action monitoring wells as follows:

- Inside Plume Well triggers for adaptive site management evaluation are based on no decreasing trend in COC concentrations (short-term or long-term).
- Plume Definition well triggers are based on increasing COC concentrations, which may indicate improper delineation of the plume. Therefore, the trigger criterion for adaptive site management evaluation at Plume Definition wells is increasing short- or long-term trend.

3.1.4 Adaptive Management Actions

The goal of adaptive management actions is to understand why performance metrics are not met and, if the remedy is found to be unsuccessful in meeting remediation goals, drive supplemental corrective actions or, in extreme cases, re-evaluation of remedy selection. This section describes in greater detail the steps in the flow chart presented in **Figure 3-2** (adapted from Figure 2 in [20]).

As the remedy progress evaluation metrics are evaluated annually, failure to meet the metrics (as described in **Table 3-1**) leads to further action. If the data available at the time of the Five-Year Review are anticipated to be inadequate for determining the need for adaptive site

management actions, additional data may be collected before the Five-Year Review including collecting samples from additional wells or measuring additional parameters.

If the remedy progress is not found to be adequate during the Five-Year Review, the most critical question is whether or not the remedy is likely to achieve the GWPS in a reasonable time frame. This may be evaluated using methods such as regression analysis or analysis of groundwater flow with respect to operation of the treatment system. If the remedy progress is not judged to be adequate but the remedy is likely to achieve the GWPS in a reasonable time frame, the CSM or the groundwater model may require updating to reflect evolving field conditions[7]. Additional data collected may also suggest ways to optimize the monitoring network or performance metrics [20].

If the remedy does not appear likely to achieve the GWPS in a reasonable time frame, it may be due to changing hydrogeochemical dynamics within the plume or an additional source of COCs not accounted for in the CSM. If available data suggests either occurrence, the Five-Year Review will describe additional activities planned to investigate if the existing remedy is still a viable option for attaining the GWPS. If the technology is still viable, an update to the CSM and groundwater model is likely required [20, 22] and will be conducted after additional investigation is completed.

If the remedy does not appear likely to achieve the GWPS in a reasonable time frame, there is no alternative source of COCs not accounted for in the CSM, and the plume is appropriately delineated; or if the investigation into the hydrogeochemical changes or alternative source of COCs determines that the remedial action is no longer solely viable as a corrective action, an evaluation of additional remedial actions will be initiated.

If the remedy progress evaluation metrics indicate that concentrations across the monitoring network are below the GWPS (and the GWE system has ceased operation; see **Section 3.1.5**), the remedy progress phase may be considered complete, and the monitoring program may move to the Stability Evaluation phase (see **Section 3.2**).

3.1.5 Concluding GWE

Groundwater modeling used to support design of the GWE system (Appendix B of the CAAA-SIR) estimates that the GWPS will be met for all wells within the current monitoring system within 37 years of final closure completion. This estimate will be corroborated according to the remedy progress valuation metric for COC concentrations (**Section 3.1.1**) at wells upgradient of the GWE system. The GWE system is intended to prevent off-site migration of COCs. Therefore, GWE system operation will only be ceased when COC concentrations at on-site wells upgradient of the system do not exceed the GWPS. Additional considerations such as trends in COC concentrations, analysis of groundwater flow, or seasonal variability may also influence the decision of whether to consider cease operating the GWE system.

A period of equilibration and rebound is typical when discontinuing GWE operations and caution should be used when interpreting short-term changes in COC concentrations [19]. The groundwater flow and transport model for the Corrective Action Plan [24] estimated the potential for rebound to occur. A "slack period" of one year (or more, based on modeling results, if

[7] As stated in Section 1.4.1 of the Corrective Action Plan: "Estimated times to reach GWPS will be periodically reviewed and updated based on observed corrective action performance via an adaptive site management strategy."

applicable) will be allowed to elapse after conclusion of GWE operations before stability and GWPS attainment are evaluated.

3.2 Stability Evaluation

Evaluation of groundwater stability reflects the idea that implementation of a remedy will, by necessity, cause changes to the physical and chemical environment of the groundwater. Before assessing if compliance with the GWPS has been attained (**Section 3.3**), any transient effects of treatment on the groundwater (*e.g.*, rebounding concentrations) should be allowed to dissipate [19]. Stability is evaluated to assess if a new stable equilibrium has been reached after GWE has been discontinued. Stability is achieved when groundwater elevations are stable (accounting for seasonal variability); average COC concentrations are stable across all wells; and COC concentrations are stable at each well. If GWE operations have been stopped, a slack period of at least one year is recommended before evaluating stability [19].

Trends in groundwater elevation and COC concentrations at each plume well will be evaluated using the most recent eight data points (*i.e.*, two years of data when sampling quarterly) according to methods presented in the Multi-Site StAP (**Appendix B**). This metric is met for a plume well when there is no statistically significant trend in groundwater elevation or COC concentrations.

Plume COC concentrations will be evaluated for trend using the most recent eight data points, with the average concentration across plume wells per sampling event considered as one data point, according to methods presented in the Multi-Site StAP (**Appendix B**). This metric is met when there is no statistically significant trend in average COC concentrations.

3.3 Attainment Evaluation and Conclusion of Corrective Action Monitoring

The ultimate goal of groundwater corrective action is to attain compliance with the GWPS for each COC in plume wells. After stability has been achieved per the metrics discussed in **Section 3.2**, attainment evaluation will begin. Per 35 I.A.C. § 845.680(c), corrective action is considered complete when compliance with the GWPS has been demonstrated "at all points within the plume of contamination that lies beyond the waste boundary […] for a period of three consecutive years". Attainment of the GWPS will be evaluated in accordance with the Multi-Site StAP (**Appendix B**). Corrective action monitoring is considered complete for the site when COCs in the corrective action monitoring well network do not exceed the GWPS for three years.

4. REFERENCES

[1] IngenAE, LLC, "Final Closure Plan, Edwards Power Plant, Ash Pond, (IEPA ID W1438050005-01), Bartonville, Illinois," June 2022.

[2] AECOM, "History of Construction. USEPA Final CCR Rule 40 C.F.R. Part 257.73(c). Edwards Power Station. Bartonville, Illinois," 2016.

[3] Foth, "Antidegradation Alternative Analysis, Dynegy Midwest Generation, LLC, Edwards Power Station, Bartonville, Illinois," September 8, 2017.

[4] Ramboll Americas Engineering Solutions, Inc., "Hydrogeologic Site Characterization Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois," October 25, 2021.

[5] Ramboll Americas Engineering Solutions, Inc., "Nature and Extent Report, Edwards Power Plant, Ash Pond, IEPA ID No. W1438050005-01," June 4, 2024.

[6] Ramboll Americas Engineering Solutions, Inc., "Groundwater Modeling Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois," June 30, 2022.

[7] Ramboll Americas Engineering Solutions, Inc., "Groundwater Monitoring Plan, Ash Pond, Edwards Power Plant, Bartonville, Illinois," October 25, 2021.

[8] Ramboll Americas Engineering Solutions, Inc., "35 I.A.C. § 845.610(B)(3)(D) Groundwater Monitoring Data and Detected Exceedances 2023 Quarter 2, Ash Pond, Edwards Power Plant, Bartonville, Illinois," October 8, 2023.

[9] Ramboll Americas Engineering Solutions, Inc., "35 I.A.C. § 845.610(B)(3)(D) Groundwater Monitoring Data and Detected Exceedances 2023 Quarter 3, Ash Pond, Edwards Power Plant, Bartonville, Illinois," December 13, 2023.

[10] Ramboll Americas Engineering Solutions, Inc., "35 I.A.C. § 845.610(B)(3)(D) Groundwater Monitoring Data and Detected Exceedances 2023 Quarter 4, Ash Pond, Edwards Power Plant, Bartonville, Illinois," February 12, 2024.

[11] Ramboll Americas Engineering Solutions, Inc., "35 I.A.C. § 845.610(B)(3)(D) Groundwater Monitoring Data and Detected Exceedances 2024 Quarter 1, Ash Pond, Edwards Power Plant, Bartonville, Illinois," May 12, 2024.

[12] Ramboll Americas Engineering Solutions, Inc., "35 I.A.C. § 845.610(B)(3)(D) Groundwater Monitoring Data and Detected Exceedances 2024 Quarter 2, Ash Pond, Edwards Power Plant, Bartonville, Illinois," August 4, 2024.

[13] Ramboll Americas Engineering Solutions, Inc., "35 I.A.C. § 845.610(B)(3)(D) Groundwater Monitoring Data and Detected Exceedances 2024 Quarter 3, Ash Pond, Edwards Power Plant, Bartonville, Illinois," October 12, 2024.

[14] Ramboll Americas Engineering Solutions, Inc., "35 I.A.C. § 845.610(B)(3)(D) Groundwater Monitoring Data and Detected Exceedances 2024 Quarter 4, Ash Pond, Edwards Power Plant, Bartonville, Illinois," February 2, 2025.

[15] Ramboll Americas Engineering Solutions, Inc., 35 I.A.C. § 845 Corrective Measures Assessment, Edwards Power Plant, Ash Pond, IEPA ID: W1438050005-01, June 4, 2024.

[16] Ramboll Americas Engineering Solutions, Inc., "2023 Supplemental Site Investigation Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois," December 1, 2023.

[17] Ramboll Americas Engineering Solutions, Inc., "Multi-Site Sampling and Analysis Plan," December 28, 2022. [Online]. Available: https://www.luminant.com/documents/ccr/il-

ccr/Edwards/2023/Multi-Site%20Sampling%20Analysis%20Plan-Edwards-W1438050005%E2%80%9001.pdf.

[18] Ramboll Americas Engineering Solutions, Inc., "Multi-Site Quality Assurance Project Plan," December 28, 2022. [Online]. Available: https://www.luminant.com/documents/ccr/il-ccr/Edwards/2023/Multi-site%20Quality%20Assurance%20Project%20Plan-Edwards-W1438050005%E2%80%9001.pdf.

[19] United States Environmental Protection Agency, "Methods for Evaluating the Attainment of Cleanup Standards Volume 2: Ground Water," Office of Policy, Planning, and Evaluation, 1992.

[20] United States Environmental Protection Agency, "Groundwater Remedy Completion Strategy: Moving Forward with the End in Mind," Office of Solid Waste and Emergency Response, 2014.

[21] United States Environmental Protection Agency, "Adaptive Site Management - A Framework for Implementing Adaptive Management at Contaminated Sediment Superfund Sites," Office of Superfund Remediation and Technology Innovation, 2022.

[22] United States Environmental Protection Agency, "Environmental Cleanup Best Management Practices: Effective Use of the Project Life Cycle Conceptual Site Model," Office of Solid Waste and Emergency Response, 2011.

[23] United States Environmental Protection Agency, "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance," Office of Resource Conservation and Recovery, 2009.

[24] Ramboll Americas Engineering Solutions, Inc., "Groundwater Modeling Technical Memorandum, Ash Pond, Edwards Power Plant, Bartonville, Illinois," June 2, 2025.

[25] United States Environmental Protection Agency, "Quality Assurance Project Plan Standard," https://www.epa.gov/system/files/documents/2024-04/quality_assurance_project_plan_standard.pdf, 2023.

[26] United States Environmental Protection Agency, "EPA QA Field Activities Procedure," https://www.epa.gov/system/files/documents/2022-09/epa_qa_field_activities_procedure.pdf, 2020.

TABLES

Table 1-1. 35 I.A.C. § 845 Requirements Checklist
Corrective Action Groundwater Monitoring Plan
Edwards Power Plant
Ash Pond
Bartonville, IL

35 I.A.C. § 845 Reference	35 I.A.C. § 845 Components	Location of Information in Corrective Action GMP
845.630	**Groundwater Monitoring Systems**	
845.630(a)(2)	Potential contaminant pathways must be monitored.	NA
845.630(a) 845.630(b) 845.630(c)	At least two upgradient wells and four downgradient wells (min. 1 and 3, but requires additional documentation)	Section 2.1 Figure 1-4
845.630(a) 845.630(b) 845.630(c)	Downgradient Well Density	Figure 2-1
845.630(a)(2)	Downgradient wells at waste boundary	Figure 2-1
845.640	**Groundwater Sampling and Analysis Requirements**	
845.640(a)	Consistent sampling and analysis procedures	Section 2 Tables 2-1 and 2-3
845.640(b)	Methods are appropriate	Section 2 Tables 2-1 and 2-3
845.640(c)	Groundwater elevations must be measured in each well prior to purging, each time groundwater is sampled.	Section 2.2
845.640 (d)(e)(f)(g)(h)	Establishment of background and application of statistical methods	Section 2.8
845.640(i)	Analyze total recoverable metals	Sections 2.1 and Section 2.5
845.640(j)	Analyze groundwater samples using a certified laboratory	Section 2.5
845.650	**Groundwater Monitoring Program**	
845.650(a)	Must include monitoring for all constituents with a groundwater protection standard in Section 845.600(a), calcium, and turbidity	Section 2.1

Table 1-1. 35 I.A.C. § 845 Requirements Checklist
Corrective Action Groundwater Monitoring Plan
Edwards Power Plant
Ash Pond
Bartonville, IL

35 I.A.C. § 845 Reference	35 I.A.C. § 845 Components	Location of Information in Corrective Action GMP
845.650(b)(c)	Groundwater Monitoring Frequency	Sections 2.1
845.650(d)(e)	Exceedances of the groundwater protection standard	Section 3.1.1
NA	Staff gauge/ piezometer to monitor head of neighboring surface water body	Section 1.3 Figure 1-4
845.680	**Implementation of the Corrective Action Plan**	
845.680(a)(1)(a)	Establish and implement a corrective action groundwater monitoring program that meets requirements of 845.650	Sections 2.1 and 3 Tables 2-1 and 3-1 Figure 2-1
845.680(a)(1)(b)	Document the effectiveness of the corrective action remedy	Section 3
845.680(a)(1)(c)	Demonstrate compliance with the groundwater protection standard under Subsection [845.680] (c)	Section 2.10
845.680(c)(1)	Demonstrate compliance with the groundwater protection standards established by 845.600 has been achieved at all points within the plume of contamination that lies beyond the waste boundary	Section 2.10
845.680(c)(2)	Demonstrate that concentrations of constituents listed in 845.600 have not exceeded the groundwater protection standards for a period of three consecutive years using statistical procedures and performance standards in 845.640(f) and (g)	Section 3

[O: RAB 12/03/2024; C: CJC 01/24/2025]

Notes:
GMP = Groundwater Monitoring Plan
NA = Not Applicable

Table 2-1. Summary of Monitoring Well Locations and Purpose
Corrective Action Groundwater Monitoring Plan
Edwards Power Plant
Ash Pond
Bartonville, IL

Well ID	Monitored Unit	Corrective Action Monitoring Well System	
		Inside Plume	Plume Definition
AP07S	PMP	X	
AP07D	BCU		X
APW-01	UA		X
AW-05	UA	X	
AW-06	UA		X
AW-15	UA		X
AW-15S	PMP	X	
AW-19	UA	X	
AW-20	UA	X	
AW-21	UA	X	
EMW-05	UA		X
P002	UCF		X

[O: RAB 12/03/2024; C: CJC 01/24/2025]

Notes:
BCU = bedrock confining unit
PMP = potential migration pathway
UCF = Upper Cahokia Formation
UA = uppermost aquifer

Table 2-2. Monitoring Well Locations and Construction Details
Corrective Action Groundwater Monitoring Plan
Edwards Power Plant
Ash Pond
Bartonville, IL

Location	HSU	Date Constructed	Top of PVC Elevation (ft)	Measuring Point Elevation (ft)	Measuring Point Description	Ground Elevation (ft)	Screen Top Depth (ft bgs)	Screen Bottom Depth (ft bgs)	Screen Top Elevation (ft)	Screen Bottom Elevation (ft)	Well Depth (ft bgs)	Bottom of Boring Elevation (ft)	Screen Length (ft)	Screen Diameter (inches)	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)
AP07S	PMP	12/02/2016	460.87	460.87	Top of PVC	458.54	29.95	34.74	428.59	423.80	35.0	423.54	4.8	2	40.597932	-89.666915
AP07D	BCU	12/08/2016	461.29	461.29	Top of PVC	458.83	55.01	64.59	403.82	394.24	65.0	393.83	9.6	2	40.597946	-89.666924
APW-01	UA	07/27/2010	441.14	441.14	Top of PVC	438.24	7.6	18.0	430.64	420.24	18.0	419.74	10.4	2	40.600127	-89.665120
AW-05	UA	07/22/2015	--	443.37	Top of Disk	440.55	15.9	20.5	424.68	420.08	21.1	419.50	4.6	2	40.598644	-89.666385
AW-06	UA	08/03/2015	--	461.55	Top of Disk	459.51	36.6	41.1	422.91	418.42	41.69	417.26	4.5	2	40.594237	-89.670052
AW-15	UA	01/08/2021	441.55	441.55	Top of PVC	438.74	33.0	38.0	405.74	400.74	38.0	398.74	5	2	40.587957	-89.666822
AW-15S	PMP	01/08/2021	440.76	440.76	Top of PVC	437.79	8.0	18.0	429.79	419.79	18.0	417.79	10	2	40.587947	-89.666841
AW-19	UA	01/09/2021	460.9	460.9	Top of PVC	458.49	35.0	40.0	423.49	418.49	40.0	415.49	5	2	40.595426	-89.669720
AW-20	UA	01/10/2021	461.51	461.51	Top of PVC	459.10	36.5	41.5	422.60	417.60	41.5	416.10	5	2	40.596461	-89.668910
AW-21	UA	01/10/2021	460.79	460.79	Top of PVC	458.25	32.0	37.0	426.25	421.25	37.0	420.25	5	2	40.597287	-89.667734
EMW-05	UA	09/09/2021	458.03	458.03	Top of PVC	455.79	25.7	30.2	430.09	425.59	30.7	421.79	4.5	2	40.598611	-89.667247
P002	UCF	09/04/2015	460.39	460.39	Top of PVC	458.73	24.3	29.0	434.43	429.73	29.4	427.73	4.7	2	40.596227	-89.669084

[O: RAB 01/02/2025; C: CJC 01/25/2025]

Notes:
All elevation data are presented relative to the North American Vertical Datum 1988 (NAVD88), GEOID 12A
-- = data not available
BCU = bedrock confining unit
bgs = below ground surface
ft = foot or feet
HSU = Hydrostratigraphic Unit
PMP = potential migration pathway
PVC = polyvinyl chloride
UCF = Upper Cahokia Formation
UA = uppermost aquifer

Table 2-3. Sampling and Analysis Summary
Corrective Action Groundwater Monitoring Plan
Edwards Power Plant
Ash Pond
Bartonville, IL

Parameter	Analytical Method [1]	Number of Samples	Field Duplicates [2]	Field Blanks [3]	Equipment Blanks [3]	MS/MSD [4]	Total	Container Type	Minimum Volume [5]	Preservation (Cool to 4 °C for all samples)	Sample Hold Time from Collection Date
Corrective Action Parameter(s)[6]											
Boron	6020 [7]	12	2	0	0	1	15	plastic	600 mL	HNO_3 to pH<2	6 months
Sulfate	9036 or EPA 300	12	2	0	0	1	15	plastic	50 mL	Cool to 6 °C	28 days
Total Dissolved Solids	SM 2540 C	12	2	0	0	1	15	plastic	200 mL	Cool to 6 °C	7 days
Inorganic Parameters											
Alkalinity, bicarbonate	SM 2320 B	12	2	0	0	1	15	plastic	500 mL	Cool to 6 °C	14 days
Alkalinity, carbonate	SM 2320 B	12	2	0	0	1	15	plastic	500 mL	Cool to 6 °C	14 days
Calcium	6020 [7]	12	2	0	0	1	15	plastic	600 mL	HNO_3 to pH<2	6 months
Chloride	9251 or EPA 300	12	2	0	0	1	15	plastic	100 mL	Cool to 6 °C	28 days
Fluoride	9214 or EPA 300	12	2	0	0	1	15	plastic	300 mL	Cool to 6 °C	28 days
Magnesium	6020 [7]	12	2	0	0	1	15	plastic	600 mL	HNO_3 to pH<2	6 months
Potassium	6020 [7]	12	2	0	0	1	15	plastic	600 mL	HNO_3 to pH<2	6 months
Sodium	6020 [7]	12	2	0	0	1	15	plastic	600 mL	HNO_3 to pH<2	6 months
Field Parameters											
pH	SM 4500-H+ B	12	NA	NA	NA	NA	12	flow-through cell	NA	none	immediately
Dissolved Oxygen [8]	SM 4500-O/405.1	12	NA	NA	NA	NA	12	flow-through cell	NA	none	immediately
Oxidation/Reduction Potential [8]	SM 2580 B	12	NA	NA	NA	NA	12	flow-through cell	NA	none	immediately
Specific Conductance [8]	SM 2510 B	12	NA	NA	NA	NA	12	flow-through cell	NA	none	immediately
Temperature [8]	SM 2550	12	NA	NA	NA	NA	12	flow-through cell	NA	none	immediately
Turbidity [9]	SM 2130 B	12	NA	NA	NA	NA	12	flow-through cell or hand-held turbidity meter	NA	none	immediately

[O: RAB 01/02/2025; C: CJC 01/25/2025]

Notes:
[1] Analytical method numbers are from SW-846 unless otherwise indicated. Analytical methods may be updated with more recent versions as appropriate.
[2] Field duplicates will be collected at a frequency of one per group of 10 or fewer investigative water samples. Field duplicates will not be collected for radium analysis.
[3] Field blanks will be collected at the discretion of the project manager; Equipment blanks will be collected at a rate of 1 per sampling event if non-dedicated equipment is used.
[4] Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples will be collected at a frequency of one per group of 20 or fewer investigative water samples per CCR unit/multi-unit. Additional volume to be determined by laboratory.
[5] Sample volume is estimated and will be determined by the laboratory.
[6] Determined by reported exceedances under the Operating Groundwater Monitoring Plan
[7] Metals may be analyzed via USEPA methods 6010 or 6020 depending on laboratory instrument availability.
[8] Parameter collected for quality assurance and quality control for field sampling purposes only; not required to be collected or reported under 35 IAC § 845; collection of parameter may be discontinued without notification.
[9] If turbidity exceeds 10 NTU, a duplicate sample filtered through a 0.45 micron filter may be collected for metals analysis in addition to the unfiltered sample. Both samples would be submitted for analysis.
< = less than
°C = degrees Celsius
HNO_3 = nitric acid
mL = milliliter
NA = not applicable
NTU = nephelometric turbidity unit

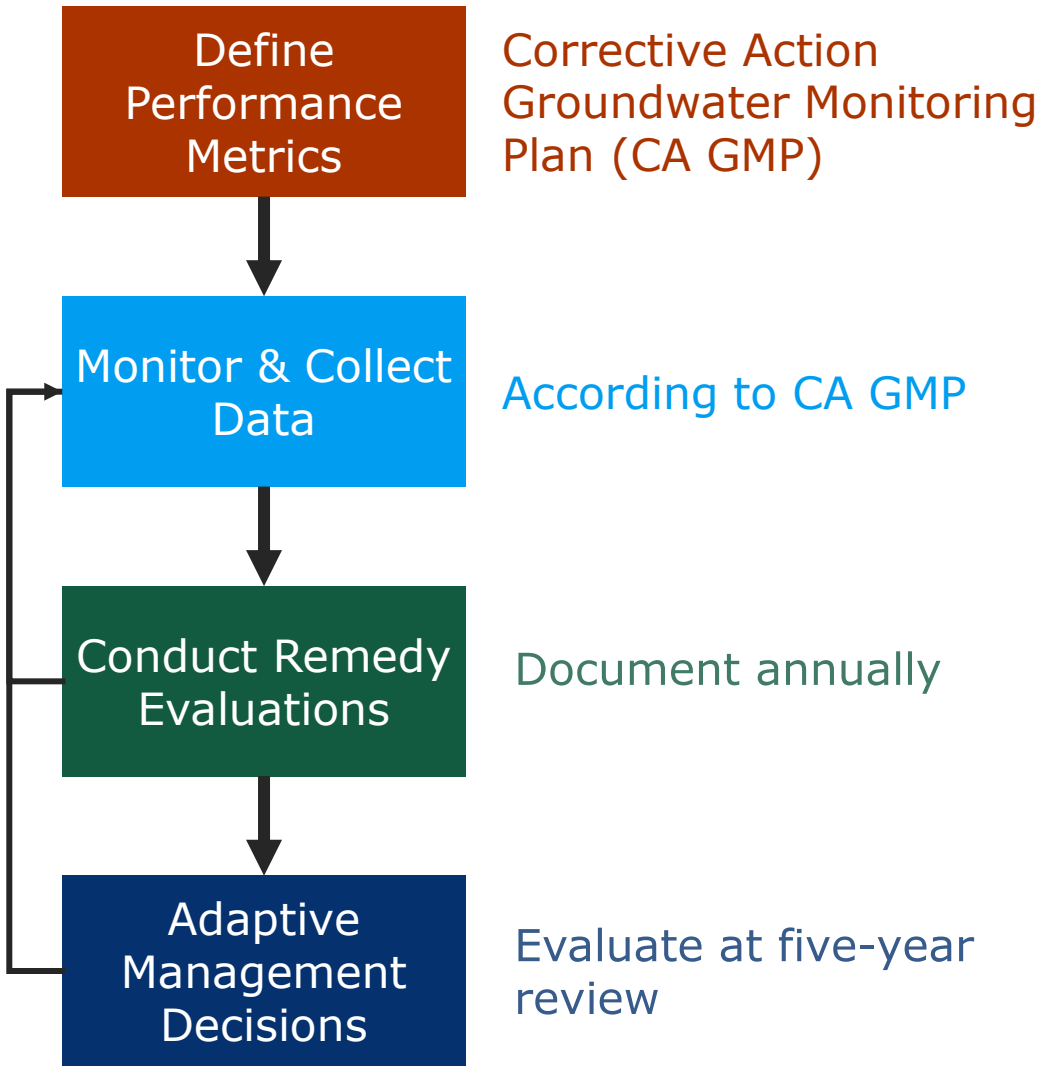
Table 3-1. Adaptive Site Management Metrics and Trigger Criteria
Corrective Action Groundwater Monitoring Plan
Edwards Power Plant
Ash Pond
Bartonville, IL

QUESTION	Are COC concentrations greater than the GWPS?		Are concentrations of COCs at individual wells consistent with modeling expectations?[a]		Are the average COC concentrations decreasing?	Are concentrations of COCs at individual wells changing?	Adaptive Site Management Outcome
EVALUATION[b]	Compare data points or summary statistics to site specific GWPS		Do the observed results track with the predicted results in general direction and magnitude? (Professional judgement)		Evaluate trend on quarterly average of well concentrations, both for last 8 data points and since corrective action initiated or closure completed	Evaluate trend of COCs at each well, both for last 8 data points and since corrective action initiated	
Inside Plume	Central tendency concentration of last eight data points above the GWPS	**AND**	Results inconsistent with model	**AND MORE THAN ONE OF**	Neither trend decreasing	Neither trend decreasing	**Additional Evaluation Triggered (See Figure 3-2)**
Lateral/Vertical Plume Definition	Central tendency concentration of last eight data points above the GWPS		Results inconsistent with model		--	Either trend increasing	

[O: CJC 10/23/2024; C: AOC 10/30/2024]

Notes:
a. Only applies to wells included in the flow and transport model
b. To be documented in Annual Monitoring and Corrective Action Reports
-- = No relevant trigger criteria
COC = constituent of concern
GWPS = groundwater protection standard

FIGURES



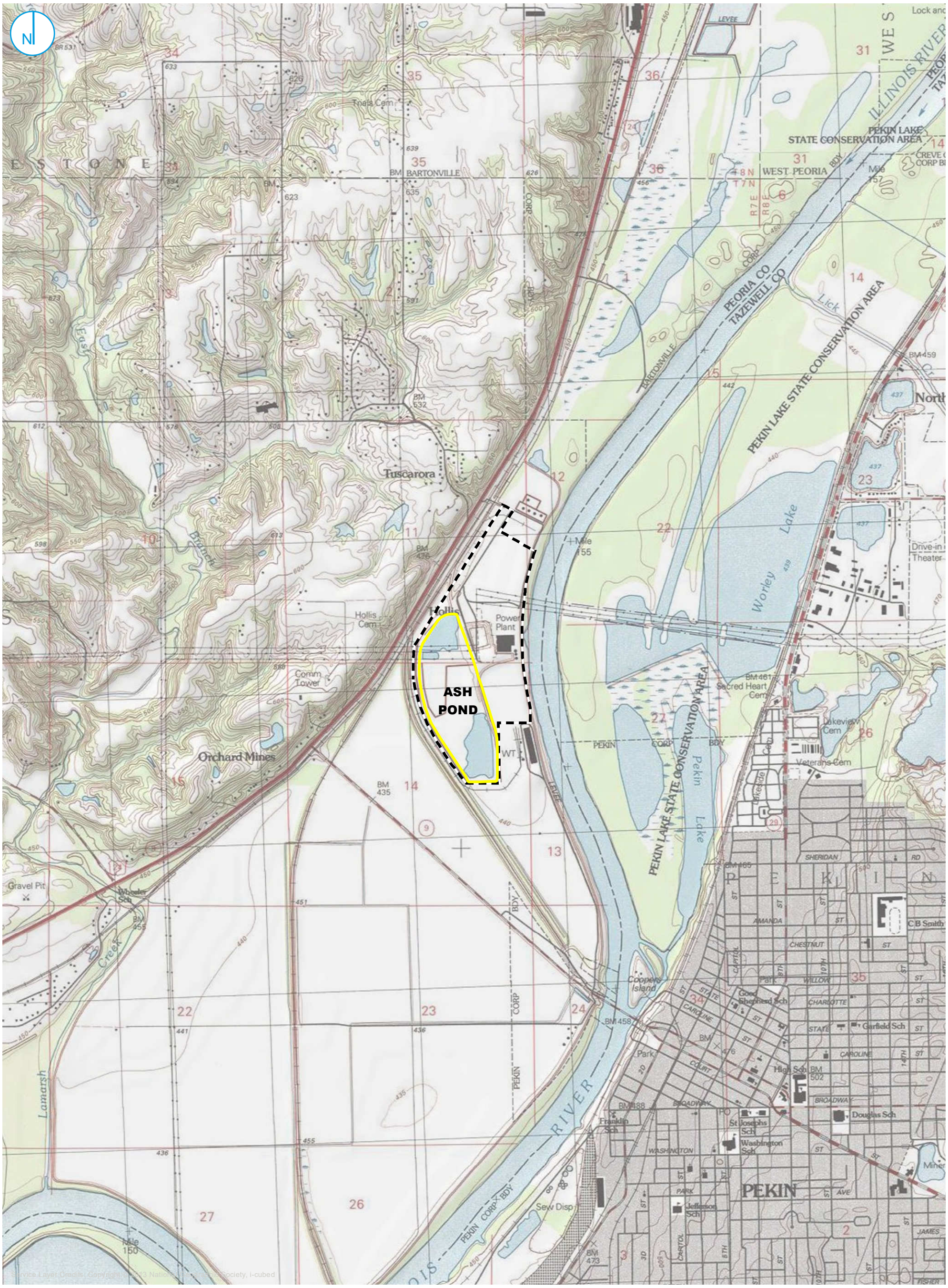
RAMBOLL

DRAFTED BY: AO | 12/3/2024

CORRECTIVE ACTION MONITORING OUTLINE

CORRECTIVE ACTION GROUNDWATER MONITORING PLAN
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Figure 1-1



REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 1,000 2,000 Feet

SITE LOCATION MAP

FIGURE 1-2

CORRECTIVE ACTION
GROUNDWATER MONITORING PLAN
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 2/3/2025 | DESIGNER: GALARNMC

Y:\Mapping\Projects\22\2285\MXD\GMP\Edwards\845_CorrectiveAction\EDW_845CA_GMP.aprx



MONITORING WELL

PORE WATER WELL

REGULATED UNIT (SUBJECT UNIT)

PROPERTY BOUNDARY

0 212.5 425

Feet

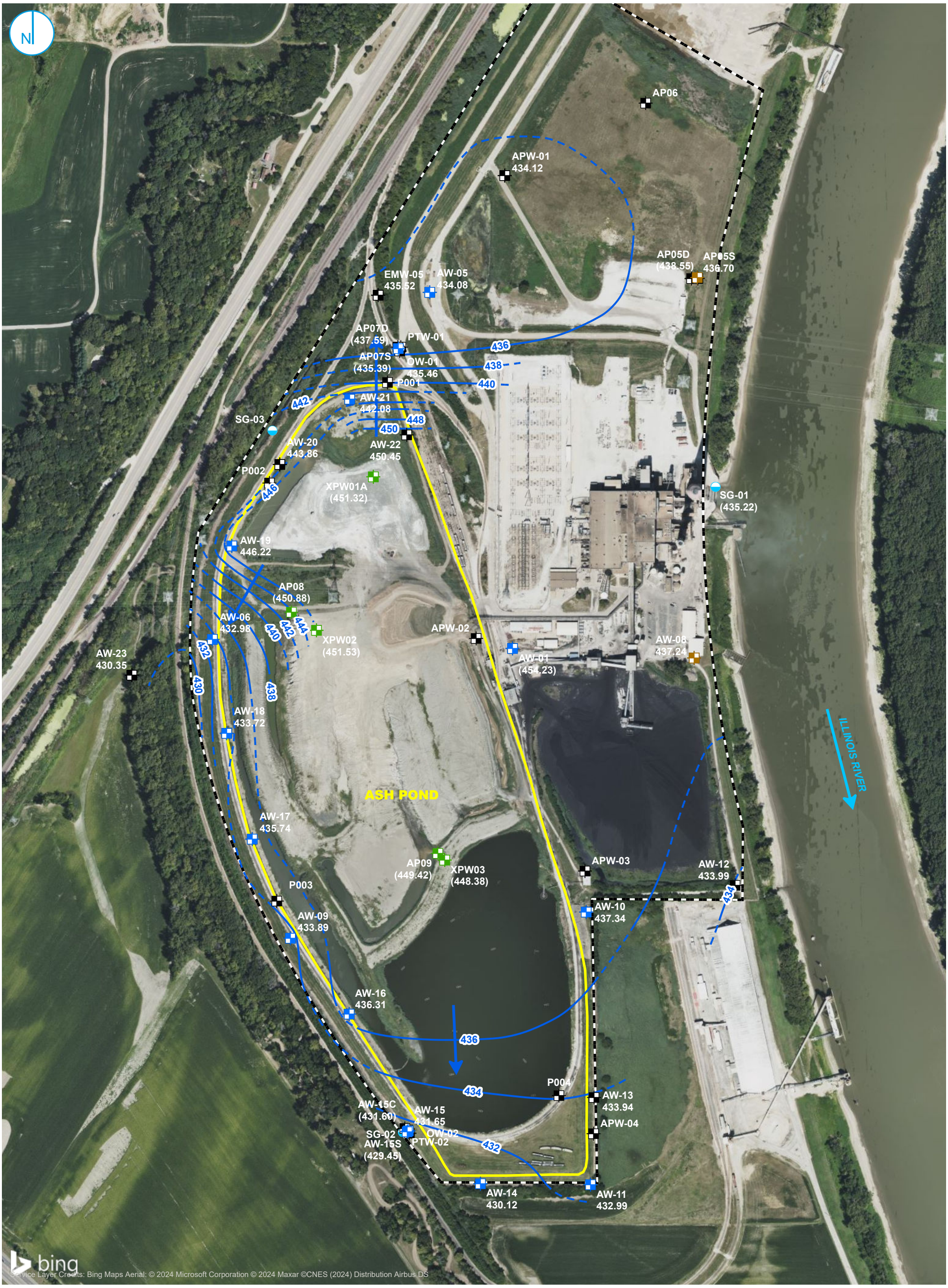
SITE MAP

CORRECTIVE ACTION
GROUNDWATER MONITORING PLAN
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 1-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



- COMPLIANCE MONITORING WELL
- BACKGROUND MONITORING WELL
- PORE WATER WELL
- MONITORING WELL
- STAFF GAGE, RIVER
- GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- REGULATED UNIT (SUBJECT UNIT)
- PROPERTY BOUNDARY

0 212.5 425 Feet

NOTES
1. ELEVATIONS IN PARENTHESES WERE NOT USED FOR CONTOURING.
2. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

UPPERMOST AQUIFER POTENTIOMETRIC SURFACE MAP OCTOBER 28, 2024

CORRECTIVE ACTION GROUNDWATER MONITORING PLAN ASH POND

EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 1-4

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.



MONITORING WELL
REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY
XXX INSIDE PLUME MONITORING WELL
XXX PLUME DEFINITION MONITORING WELL

0 212.5 425
Feet

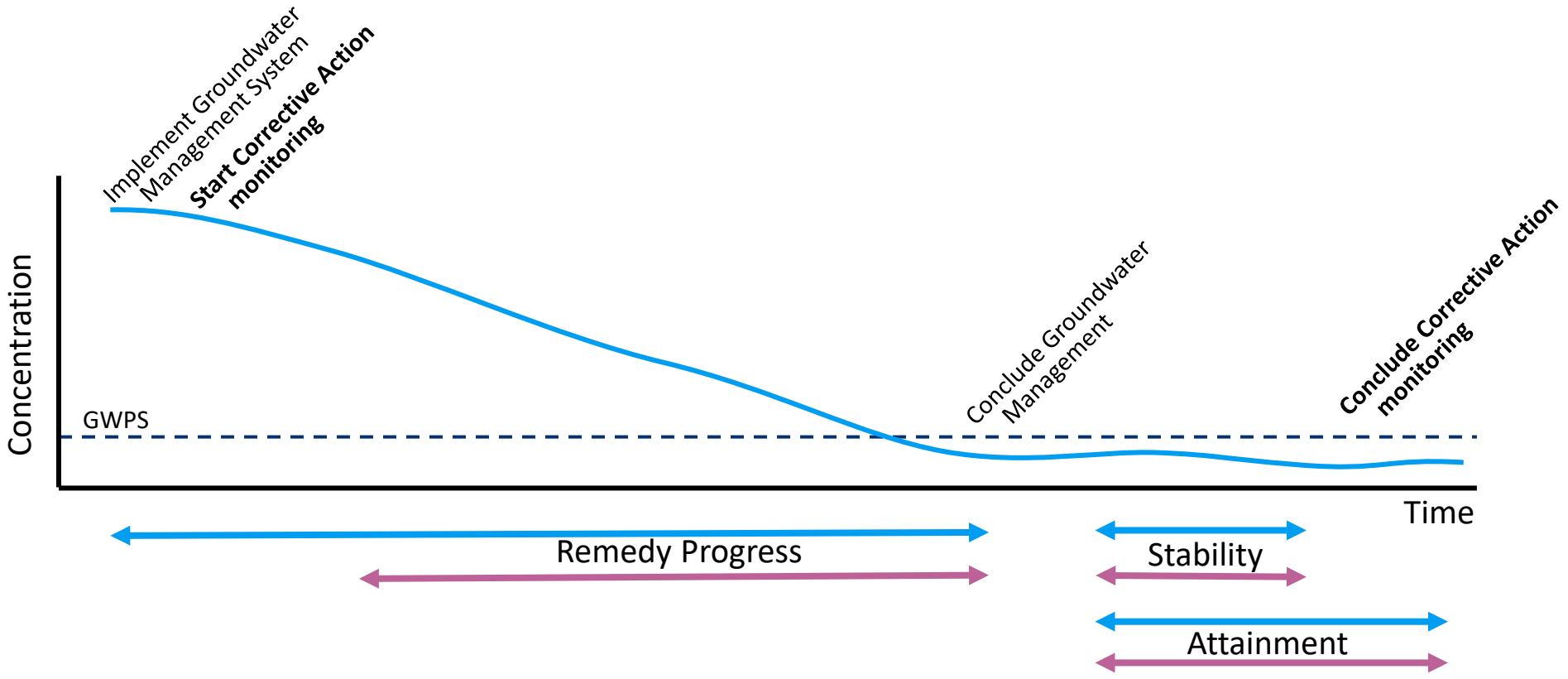
PROPOSED 35 I.A.C. § 845 CORRECTIVE ACTION MONITORING WELL LOCATION MAP

FIGURE 2-1

CORRECTIVE ACTION GROUNDWATER MONITORING PLAN
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL



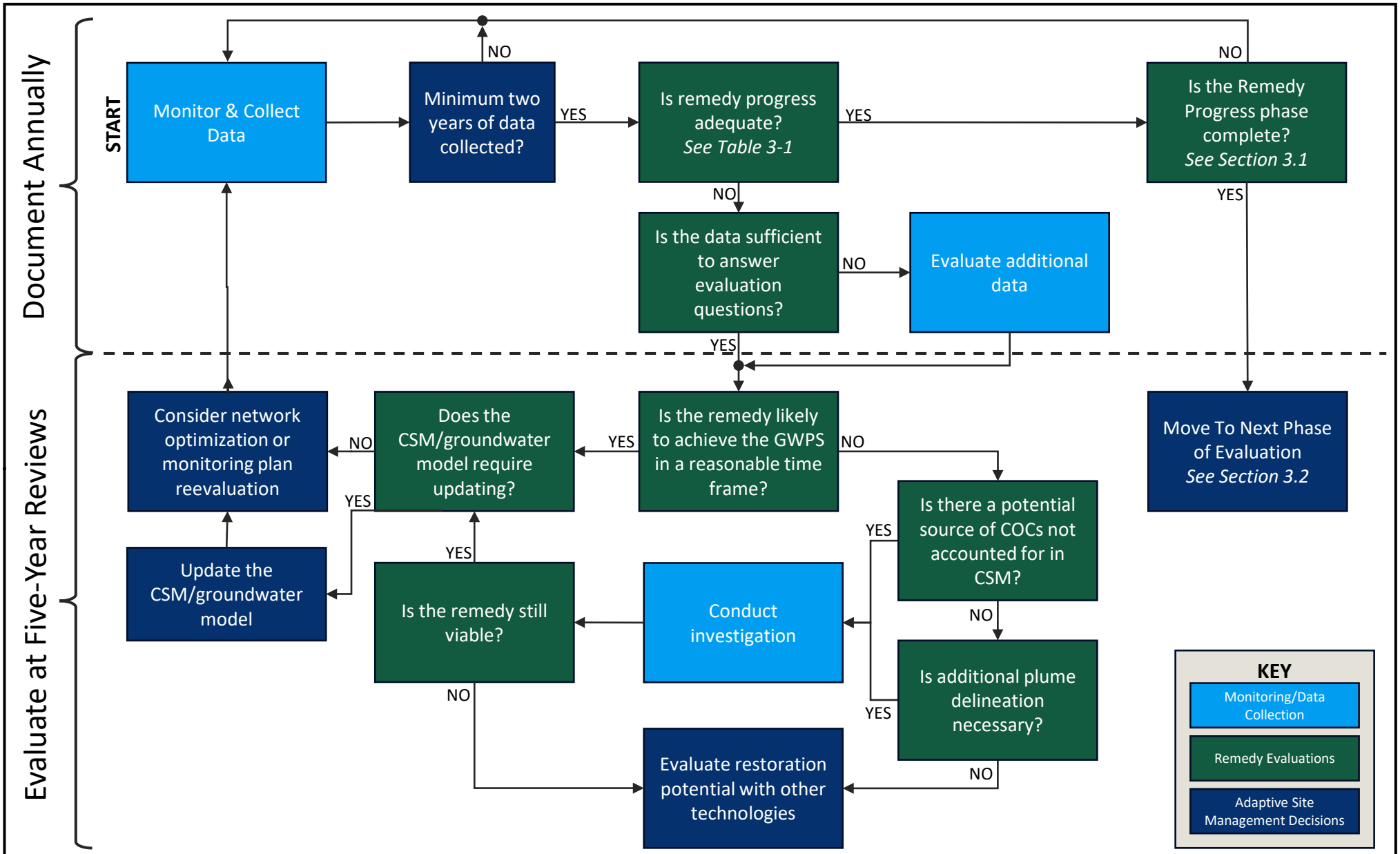
CORRECTIVE ACTION MONITORING TIMELINE

CORRECTIVE ACTION GROUNDWATER MONITORING PLAN
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Figure 3-1

RAMBOLL

DRAFTED BY: AO | 2/3/2025



Adapted from Figure 2 in USEPA (2014) *"Groundwater Remedy Completion Strategy: Moving Forward with the End in Mind,"* Office of Solid Waste and Emergency Response. 9200.2-144. May. https://semspub.epa.gov/work/HQ/100000021.pdf

RAMBOLL

DRAFTED BY: AO | 1/2/2025

ADAPTIVE SITE MANAGEMENT DECISION-MAKING FLOW CHART

CORRECTIVE ACTION GROUNDWATER MONITORING PLAN
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Figure 3-2

APPENDIX A
Boring Logs and Well Construction Forms

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 12/01/2016
Finish: 12/08/2016
WEATHER: Overcast, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger & NX Wireline Rock Core
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: S. Collins

BOREHOLE ID: AP07D
Well ID: AP07D
Surface Elev: 458.42 ft. MSL
Completion: 65.00 ft. BGS
Station: 1,432,082.31N
2,435,355.39E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 26.00 - During drilling
▼ = 52.66 - 01/18/2017
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
1A	13/24 54%	SS	1-4 8-9 N=12	8			0	White (10YR8/1), moist, medium dense, GRAVEL with some medium- to very coarse-grained sand. [FILL]		458	
2A	19/24 79%	SS	5-4 4-4 N=8	22			2	Pale brown (10YR6/3), moist, medium, CLAY with some silt and little very fine-grained sand.		456	
3A	18/24 75%	SS	1-3 4-7 N=7	22			4	Gray (10YR5/1) with 25% yellowish brown (10YR5/4) mottles, moist, soft, CLAY with some silt and trace very fine-grained sand.		454	
4A	7/24 29%	SS	2-3 4-4 N=7	22			6			452	
5A	24/24 100%	SS	1-3 4-4 N=7	27			8			450	
5B				34			10	Dark gray (10YR4/1), moist, soft, CLAY with some silt, trace very fine-grained sand, and trace roots.		448	
6A	24/24 100%	SS	1-2 4-4 N=6	29			12			446	
7A	24/24 100%	SS	woh-3 3-6 N=6	27			14	Gray (10YR5/1) with 30% light yellowish brown (10YR6/4) mottles, moist, soft, CLAY with some silt, trace very fine-grained sand, and trace roots.		444	
8A	24/24 100%	SS	woh-2 2-4 N=4	25			16	Gray (10YR5/1) with 30% dark gray (10YR4/1) mottles, moist, medium, CLAY with some silt, little very fine-grained sand, and trace roots.		442	
9A	23/24 96%	SS	1-3 4-5 N=7	23			18	Gray (10YR5/1) with 30% yellowish brown (10YR5/6) mottles, moist, soft, CLAY with some silt and few very fine-grained sand.		440	
10A	24/24 100%	SS	1-2 3-5 N=5	24			20				

NOTE(S):

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 12/01/2016
Finish: 12/08/2016
WEATHER: Overcast, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger & NX Wireline Rock Core
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: S. Collins

BOREHOLE ID: AP07D
Well ID: AP07D
Surface Elev: 458.42 ft. MSL
Completion: 65.00 ft. BGS
Station: 1,432,082.31N
2,435,355.39E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 26.00 - During drilling
▼ = 52.66 - 01/18/2017
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
11A	24/24 100%	SS	2-4 5-7 N=9	25				Gray (10YR5/1) with 30% yellowish brown (10YR5/6) mottles, moist, soft, CLAY with some silt and few very fine-grained sand. *[Continued from previous page]*		438	
							22	Light gray (10YR6/1) with 20% brownish yellow (10YR6/6) mottles, moist, medium dense, very fine- to medium-grained SAND with little clay.		436	
12A	24/24 100%	SS	2-4 8-8 N=12	26							
12B				22				Dark gray (10YR4/1), moist, stiff, CLAY with some silt, trace sand, trace organic matter.			
							24			434	
13A	24/24 100%	SS	1-2 2-2 N=4	23				Light gray (10YR6/1) with 20% light yellowish brown (10YR6/4) mottles, moist, very soft, CLAY with some silt and little very fine- to fine-grained sand.			
							▼ 26			432	
14A	20/24 83%	SS	1-1 2-2 N=3	19				Light yellowish brown (10YR6/4), wet, very loose, very fine- to medium-grained SAND with few silt and trace clay.			
							28			430	
15A	22/24 92%	SS	woh-woh 1-1	24							
							30	Gray (10YR5/1), wet, very loose, very fine- to very coarse-grained SAND with little silt and trace small gravel.		428	
16A	24/24 100%	SS	woh-1 3-2 N=4	15							
16B				34				Gray (10YR5/1) with 30% brownish yellow (10YR6/6) mottles, moist, soft, CLAY with some silt and trace sand.			
							32			426	
17A	24/24 100%	SS	woh-1 2-2 N=3	28				Gray (10YR5/1) with 30% light yellowish brown (10YR6/4) mottles, moist, soft, CLAY with some silt and trace sand.			
							34			424	
18A	24/24 100%	SS	woh-2 4-6 N=6	30				Gray (10YR5/1), moist, soft, CLAY with some silt, trace sand, and trace organic matter.			
19A				31			36			422	
19B	20/24 83%	SS	1-4 8-26 N=12	17							
							38	Gray (10YR5/1), moist, very stiff, SILT with few clay and trace sand (Weathered SILTSTONE).		420	
20A	10/10 100%	SS	21-50/4"	15							
	0/14 0%	BD						Gray (10YR5/1), dense, hard, SHALE.			
							40				

NOTE(S):

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 12/01/2016
Finish: 12/08/2016
WEATHER: Overcast, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger & NX Wireline Rock Core
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: S. Collins

BOREHOLE ID: AP07D
Well ID: AP07D
Surface Elev: 458.42 ft. MSL
Completion: 65.00 ft. BGS
Station: 1,432,082.31N
2,435,355.39E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 26.00 - During drilling
▼ = 52.66 - 01/18/2017
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
21	48/56 *86%*	RC					42	Gray (10YR5/1), dense, hard, SHALE. *[Continued from previous page]*		418	
							44			416	
							46	Light Gray (10YR6/1), dry, very hard, very fine- to medium-grained SANDSTONE.		414	
22	61/60 *102%*	RC					48	Gray (10YR5/1), dense, hard, SHALE.		412	
							50	Light Gray (10YR6/1), dry, very hard, very fine- to medium-grained SANDSTONE.		410	
23	62/60 *103%*	RC					52 ▼	Gray (10YR5/1), dense, very hard, SILTSTONE.		408	
							54			406	
							56	Gray (10YR5/1), dense, very hard, SILTSTONE with white (N8/1) calcite crystals.		404	Crystals are authigenic.
24	54/60 *90%*	RC					58	Gray (10YR5/1), dense, very hard, SILTSTONE.		402	
							60			400	

NOTE(S):

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 12/01/2016
Finish: 12/08/2016
WEATHER: Overcast, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger & NX Wireline Rock Core
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: S. Collins

BOREHOLE ID: AP07D
Well ID: AP07D
Surface Elev: 458.42 ft. MSL
Completion: 65.00 ft. BGS
Station: 1,432,082.31N
2,435,355.39E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 26.00 - During drilling
▼ = 52.66 - 01/18/2017
▽ =

SAMPLE Number	SAMPLE Recov / Total (in) *% Recovery*	SAMPLE Type	TESTING *Blows / 6 in* N - Value **RQD**	TESTING Moisture (%)	TESTING Dry Den. (lb/ft³)	TESTING *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
25	66/60 *110%*	RC					62	Gray (10YR5/1), dense, very hard, SILTSTONE. *[Continued from previous page]*		398	
										396	
							64	Brown (10YR5/3), moist, very hard, very fine- to medium-grained SANDSTONE. Gray (10YR5/1), dense, very hard, SILTSTONE. Brown (10YR5/3), moist, very hard, very fine- to medium-grained SANDSTONE. Gray (10YR5/1), dense, very hard, SILTSTONE.		394	
	0/4 *0%*	BD						**End of Boring = 65.0 feet**			

NOTE(S):

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Peoria Well #: AP07D

Site Name: Edwards Power Station Borehole #: AP07D

State Plane Coordinate: X 2,435,355.4 Y 1,432,082.3 (or) Latitude: 40° 35' 52.589" Longitude: -89° 40' 0.934"

Surveyed By: Andrew D. Canopy IL Registration #: 035-003391

Drilling Contractor: Bulldog Drilling, Inc. Driller: C. Dutton

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: NX Rock Core Drilling Fluid (Type): Water

Logged By: Scot E. Collins Date Started: 12/1/2016 Date Finished: 12/8/2016

Report Form Completed By: Rhonald W. Hasenyager Date: 1/12/2017

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite

Installation Method: Tremie

Setting Time: +24 hr

Type of Bentonite Seal -- (Granular) Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 60 min.

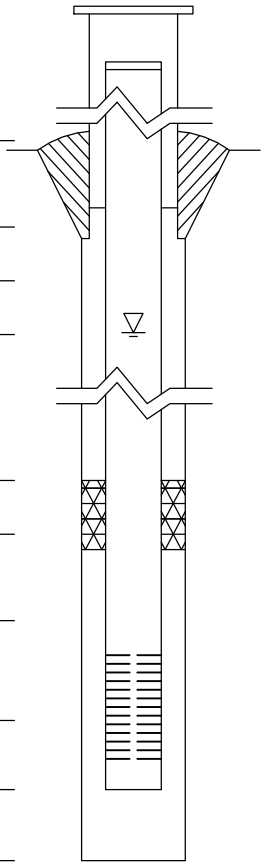
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS) (0.01 ft.)	
461.22	-2.80	Top of Protective Casing
460.89	-2.47	Top of Riser Pipe
458.42	0.00	Ground Surface
458.42	0.00	Top of Annular Sealant
405.76	52.66	Static Water Level (After Completion) 1/18/2017
418.62	39.80	Top of Seal
405.62	52.80	Top of Sand Pack
403.41	55.01	Top of Screen
393.83	64.59	Bottom of Screen
393.42	65.00	Bottom of Well
393.42	65.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	6.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	57.48
Bottom of Screen to End Cap	(feet)	0.41
Screen Length (1st slot to last slot)	(feet)	9.58
Total Length of Casing	(feet)	67.47
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 12/02/2016
Finish: 12/02/2016
WEATHER: Overcast, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: S. Collins

BOREHOLE ID: AP07S
Well ID: AP07S
Surface Elev: 458.31 ft. MSL
Completion: 35.00 ft. BGS
Station: 1,432,078.08N
2,435,357.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 31.80 - During drilling
▼ = 24.57 - 01/18/2017
▽ =

SAMPLE Number	SAMPLE Recov / Total (in) *% Recovery*	SAMPLE Type	TESTING *Blows / 6 in* N - Value **RQD**	TESTING Moisture (%)	TESTING Dry Den. (lb/ft³)	TESTING Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/24 *0%*	BD					0	White (10YR8/1), moist, medium dense, GRAVEL with some medium- to very coarse-grained sand. [FILL]		458	
	0/24 *0%*	BD					2	Pale brown (10YR6/3), moist, medium, CLAY with some silt and little very fine-grained sand.		456	
	0/24 *0%*	BD					4	Gray (10YR5/1) with 25% yellowish brown (10YR5/4) mottles, moist, soft, CLAY with some silt and trace very fine-grained sand.		454	
	0/24 *0%*	BD					6			452	
	0/24 *0%*	BD					8			450	
	0/24 *0%*	BD					10	Dark gray (10YR4/1), moist, soft, CLAY with some silt, trace very fine-grained sand, and trace roots.		448	
	0/24 *0%*	BD					12			446	
	0/24 *0%*	BD					14	Gray (10YR5/1) with 15% light yellowish brown (10YR6/4) mottles, moist, soft, CLAY with some silt, trace very fine-grained sand, and trace roots.		444	
	0/24 *0%*	BD					16	Gray (10YR5/1) with 30% dark gray (10YR4/1) mottles, moist, medium, CLAY with some silt and little very fine-grained sand.		442	
	0/24 *0%*	BD					18	Gray (10YR5/1) with 30% yellowish brown (10YR5.6) mottles, moist, soft, CLAY with some silt and few very fine-grained sand.		440	
							20				

NOTE(S): AP07S drilled approx. 5 ft. west of AP07D.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 12/02/2016
Finish: 12/02/2016
WEATHER: Overcast, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: S. Collins

BOREHOLE ID: AP07S
Well ID: AP07S
Surface Elev: 458.31 ft. MSL
Completion: 35.00 ft. BGS
Station: 1,432,078.08N
2,435,357.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 31.80 - During drilling
▼ = 24.57 - 01/18/2017
▽ =

SAMPLE Number	Recov / Total (in) / % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/24 0%	BD						Gray (10YR5/1) with 30% yellowish brown (10YR5.6) mottles, moist, soft, CLAY with some silt and few very fine-grained sand. *[Continued from previous page]*		438	
	0/24 0%	BD					22	Light gray (10YR6/1) with 20% brownish yellow (10YR6/6) mottles, moist, medium dense, very fine- to medium-grained SAND with little clay.		436	
	0/24 0%	BD						Dark gray (10YR4/1), moist, stiff, CLAY with some silt, trace sand, trace organic matter.			
	0/24 0%	BD					24 ▼	Light gray (10YR6/1) with 20% light yellowish brown (10YR6/4) mottles, moist, very soft, very fine- to medium-grained SAND with few silt and trace clay.		434	
	0/24 0%	BD					26	Light yellowish brown (10YR6/4), wet, very loose, very fine- to medium-grained SAND with few silt and trace clay.		432	
	0/24 0%	BD					28			430	
	0/24 0%	BD					30	Gray (10YR5/1), wet, very loose, very fine- to very coarse-grained SAND with little silt and trace small gravel.		428	
	0/24 0%	BD					32 ▼	Gray (10YR5/1) with 30% brownish yellow (10YR6/6) mottles, moist, soft, very fine- to medium-grained SAND with some silt and trace clay.		426	
	0/24 0%	BD						Gray (10YR5/1) with 30% light yellowish brown (10YR6/4) mottles, moist, soft, CLAY with some silt and trace sand.			
	0/12 0%	BD					34	Gray (10YR5/1), moist, soft, CLAY with some silt, trace sand, and trace organic matter.		424	

End of Boring = 35.0 feet

NOTE(S): AP07S drilled approx. 5 ft. west of AP07D.

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Peoria Well #: AP07S

Site Name: Edwards Power Station Borehole #: AP07S

State Plane Coordinate: X 2,435,357.3 Y 1,432,078.1 (or) Latitude: 40° 35' 52.547" Longitude: -89° 40' 0.909"

Surveyed By: Andrew D. Canopy IL Registration #: 035-003391

Drilling Contractor: Bulldog Drilling, Inc. Driller: C. Dutton

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): _____

Logged By: Scot E. Collins Date Started: 12/2/2016 Date Finished: 12/2/2016

Report Form Completed By: Rhonald W. Hasenyager Date: 1/12/2017

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite

Installation Method: Tremie

Setting Time: +24 hr

Type of Bentonite Seal -- (Granular) Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 33 min.

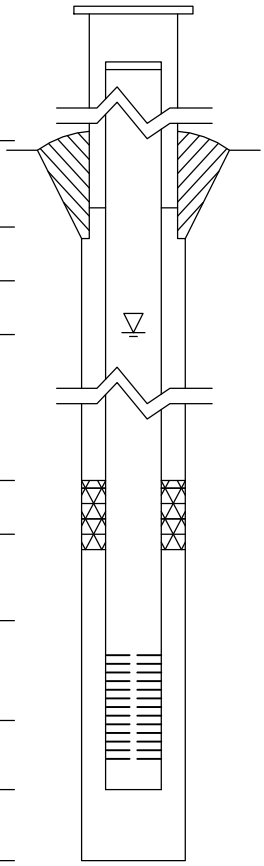
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS) (0.01 ft.)	
461.40	-3.09	Top of Protective Casing
461.08	-2.77	Top of Riser Pipe
458.31	0.00	Ground Surface
458.31	0.00	Top of Annular Sealant
433.74	24.57	Static Water Level (After Completion) 1/18/2017
431.41	26.90	Top of Seal
430.31	28.00	Top of Sand Pack
428.36	29.95	Top of Screen
423.57	34.74	Bottom of Screen
423.31	35.00	Bottom of Well
423.31	35.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	32.72
Bottom of Screen to End Cap	(feet)	0.26
Screen Length (1st slot to last slot)	(feet)	4.79
Total Length of Casing	(feet)	37.77
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

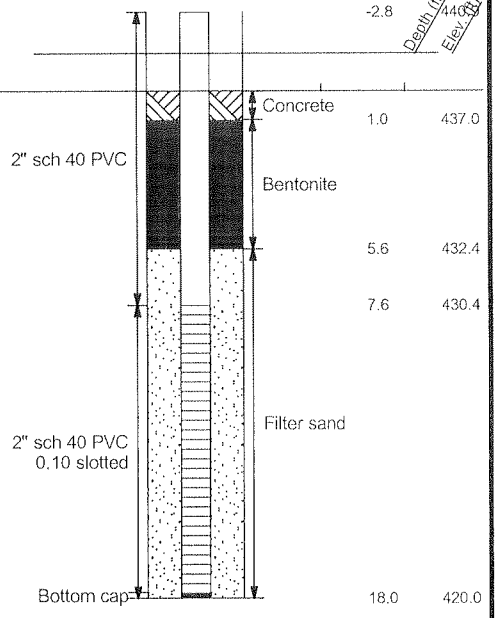
Surface Elevation: 438.02 | Completion Date: 7/27/10

Datum msl | Northing 1432880.82 | Easting 2435852.39

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	FILL			GB1
5				GB2
	Brown, silty CLAY - CL			
10		▽		GB3
15				GB4
	Shaley LIMESTONE		10-0-0	SS5
20	Auger refusal at 18.5 feet.			
25				
30				
35				
40				

WELL DIAGRAM

Stickup
Diameter: 6 inches



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 10 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM
WASHBORING FROM ___ FEET
PH DRILLER JPC LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by: DTK	App'vd. by: RSP
Date: 8/13/10	Date: 9/17/14	Date: 2/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Edwards, Illinois

LOG OF BORING: APW-1

Project No. J017150.01

LOG OF BORING 2002 WL J017150.01 - EDWARDS.GPJ GTINC.0638301.GPJ 12/13/10

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/22/2015
Finish: 7/22/2015
WEATHER: Sunny, warm, mid-70s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: AW-05
Well ID: AW-05
Surface Elev: 440.55 ft. MSL
Completion: 21.10 ft. BGS
Station: 1,432,339.67N
2,435,498.04E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 12.00 - during drilling
▼ = 6.62 - 7/22/15
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
1A	16/24 *67%*	SS	*2-3* *2-7* N=5	20		*2.00*	0	Black (10YR2/1), moist, medium, SILT with few clay and trace very fine- to fine-grained sand, roots.		440	
								FILL - Dark yellowish brown (10YR4/4), moist, stiff, SILT with few clay and trace very fine- to fine-grained sand.			
2A	17/24 *71%*	SS	*5-7* *7-7* N=14	21		*2.00*	2			438	
								FILL - Very dark grayish brown (10YR3/2), moist, stiff, silty CLAY with trace very fine-grained sand.			
3A	18/24 *75%*	SS	*2-2* *2-2* N=4	23		*0.80*	4			436	
								Dark grayish brown (10YR4/2) with 5% dark yellowish brown (10YR4/6) mottles, moist, medium, silty CLAY with trace fine-grained sand.			
4A	16/24 *67%*	SS	*2-2* *2-2* N=4	22		*0.30*	6 ▼			434	
								Brown (10YR5/3) with 5% gray (10YR5/1) mottles, moist, soft, CLAY with very fine- to fine-grained sand.			
5A	18/24 *75%*	SS	*2-1* *3-2* N=4	31		*1.10*	8			432	
								Gray (10YR5/1) with 15% dark yellowish brown (10YR3/4) mottles, moist, stiff, silty CLAY with trace very fine- to fine-grained sand.			
6A	22/24 *92%*	SS	*1-1* *2-2* N=3	31		*0.50*	10			430	
							12 ▼	Gray (10YR5/1) with 15% dark yellowish brown (10YR3/4) mottles, moist, soft, silty CLAY with trace very fine- to fine-grained sand.			
7A	24/24 *100%*	SS	*2-2* *1-1* N=3	52		*0.20*				428	
							14	Gray (10YR5/1) with 10% yellowish brown (10YR5/6) mottles, moist, soft, silty CLAY with trace coarse-grained sand.			
8-1 5-2 8-3 8-4	24/24 *100%*	SH		32		*0.80*				426	
9A	24/24 *100%*	SS	*1-2* *2-4* N=4	32		*0.30*	16			424	
								Dark gray (10YR4/1), moist, medium, silty CLAY with trace very fine-grained sand.			
10A	18/24 *75%*	SS	*1-1* *3-14* N=4	39		*0.30*	18			422	
							20	Dark gray (10YR4/1), moist, hard, weathered SHALE.			

NOTE(S): AW-05 installed in bore hole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/22/2015
Finish: 7/22/2015
WEATHER: Sunny, warm, mid-70s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: AW-05
Well ID: AW-05
Surface Elev: 440.55 ft. MSL
Completion: 21.10 ft. BGS
Station: 1,432,339.67N
2,435,498.04E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 12.00 - during drilling
▼ = 6.62 - 7/22/15
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/5 *0%*	☒ SS	*50/5"*					Dark gray (10YR4/1), moist, hard, weathered SHALE. *[Continued from previous page]*		420	

End of boring = 21.10 feet

NOTE(S): AW-05 installed in bore hole.

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Peoria County Well #: AW-05

Site Name: Edwards Power Station Borehole #: AW-05

State Plane Coordinate: X 2,435,498.0 Y 1,432,339.7 (or) Latitude: _____ Longitude: _____

Surveyed By: Gary C. Rogers IL Registration #: 035-002957

Drilling Contractor: Ramsey Geotechnical Engineering, LLC Driller: B. Williamson

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): None

Logged By: Suzanna L. Keim Date Started: 7/22/2015 Date Finished: 7/22/2015

Report Form Completed By: Suzanna L. Keim Date: 7/24/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- [Granular] Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 30 minutes

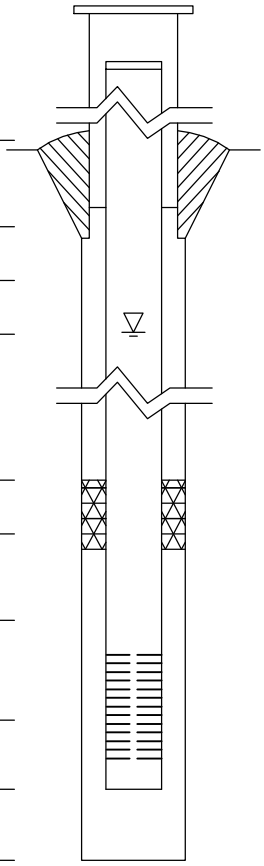
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS) (0.01 ft.)	
443.55	-3.00	Top of Protective Casing
443.37	-2.82	Top of Riser Pipe
440.55	0.00	Ground Surface
438.05	2.50	Top of Annular Sealant
431.39	9.16	Static Water Level (After Completion) 9/23/2015
428.55	12.00	Top of Seal
426.35	14.20	Top of Sand Pack
424.68	15.87	Top of Screen
420.08	20.47	Bottom of Screen
419.45	21.10	Bottom of Well
419.45	21.10	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: [Steel]
Riser Pipe Above W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Screen	SS304	SS316	PTFE	[PVC]	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	18.69
Bottom of Screen to End Cap	(feet)	0.63
Screen Length (1st slot to last slot)	(feet)	4.60
Total Length of Casing	(feet)	23.92
Screen Slot Size **	(inches)	0.010

Well Completion Form (revised 02/06/02)

**Hand-Slotted Well Screens Are Unacceptable

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/29/2015
Finish: 8/3/2015
WEATHER: Sunny, warm, hi-80s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: AW-06
Well ID: AW-06
Surface Elev: 459.19 ft. MSL
Completion: 42.25 ft. BGS
Station: 1,430,727.75N
2,434,495.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 14, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = Dry - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	24/24 100%	BD					0	GRAVEL FILL	458	sample from cuttings
2A	24/24 100%	BD		24			2	FILL - Dark gray (10YR4/1) and brown (10YR4/3), moist, medium, silty CLAY with trace medium- to coarse-grained sand.	456	
3A	14/24 58%	SS	4-6 29-23 N=35	23			4		454	
4A	21/24 88%	SS	14-18 21-26 N=39	29			6	FILL - Very dark gray (10YR3/1), moist, hard, FLY ASH.	452	
5A	20/24 83%	SS	7-7 6-4 N=13	37			8	FILL - Very dark gray (10YR3/1), moist, medium, FLY ASH.	450	
6A	18/24 75%	SS	1-1 3-3 N=4	26			10	FILL - Very dark gray (10YR3/1), moist, soft, FLY ASH.	448	
7A	17/24 71%	SS	2-3 4-5 N=7	22		1.30	12	FILL - Dark gray (10YR4/1), moist, medium, SILT and FLY ASH with few clay and trace coarse-grained sand and small gravel.	446	
8A	14/24 58%	SS	1-1 3-3 N=4	22		0.50	14		444	
9A	17/24 71%	SS	4-6 5-6 N=11	23		0.70	16	Gray (10YR5/1) and brown (10YR5/3), moist, medium, SILT with few clay and trace medium- to coarse-grained sand and roots.	442	
10A	22/24 92%	SS	2-2 3-4 N=5	21		1.30	18		440	
							20	Very dark grayish brown (10YR3/2), moist, stiff, silty CLAY with trace very fine- to fine-grained sand.		

NOTE(S): AW-06 installed in bore hole. Well was constructed using a pre-packed screen.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/29/2015
Finish: 8/3/2015
WEATHER: Sunny, warm, hi-80s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: AW-06
Well ID: AW-06
Surface Elev: 459.19 ft. MSL
Completion: 42.25 ft. BGS
Station: 1,430,727.75N
2,434,495.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 14, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = Dry - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
11-1											
11-2	12/24 *50%*	SH				*0.80*					
11-3											
11-4				20			22	Dark gray (10YR4/1) with 10% dark grayish brown (10YR4/2) mottles, moist, medium, SILT with little clay and trace very fine- to fine-grained sand.		438	
12A	18/24 *75%*	SS	*3-4 6-7* N=10	22		*0.80*					
							24			436	
13A	22/24 *92%*	SS	*3-2 3-3* N=5	24		*0.50*		Dark gray (10YR4/1), moist, medium, SILT with few to little clay and trace fine- to medium-grained sand, woody material and shell fragments.		434	
14-1							26				
14-2	16/24 *67%*	SH				*0.50*				432	
14-3											
14-4				31			28	Dark gray (10YR4/1), moist, medium, SILT with little clay and trace fine- to medium-grained sand and shell fragments.			
15A	20/24 *83%*	SS	*2-3 3-3* N=6	39		*0.80*				430	
	24/24 *100%*	BD					30				
16A										428	
17-1				29			32	Gray (10YR5/1) with 35% yellowish brown (10YR5/6) mottles, moist, stiff, silty CLAY with trace fine-grained sand.			
17-2	24/24 *100%*	SH									
17-3						*1.00*				426	
17-4							34				
18A	16/24 *67%*	SS	*0-3 3-3* N=6	32		*1.20*				424	
19-1							36	Dark gray (10YR4/1), moist, stiff, silty CLAY with trace very fine-grained sand and roots.			
19-2	16/24 *67%*	SH				*0.80*				422	
19-3											
19-4				34			38	Dark gray (10YR4/1) with 5% olive brown (2.5Y4/3) mottles, moist, stiff, silty CLAY with trace fine- to coarse-grained sand and small gravel, trace roots.			
20A	20/24 *83%*	SS	*2-5 6-6* N=11	29						420	
							40	Gray (10YR4/1) with 15% olive brown (2.5Y4/3) mottles,			

NOTE(S): AW-06 installed in bore hole. Well was constructed using a pre-packed screen.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/29/2015
Finish: 8/3/2015
WEATHER: Sunny, warm, hi-80s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: AW-06
Well ID: AW-06
Surface Elev: 459.19 ft. MSL
Completion: 42.25 ft. BGS
Station: 1,430,727.75N
2,434,495.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 14, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = Dry - during drilling
▼ =
▽ =

SAMPLE			TESTING					
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description
21A	4/4 *100%*	☒ SS	*50/4"*	14				moist, stiff, weathered SHALE, slightly laminated.
22A	3/3 *100%*	☒ SS	*50/3"*	13			42	Dark gray (10YR4/1), moist, hard, weathered SHALE.

Borehole Detail: 418

End of boring = 42.25 feet

NOTE(S): AW-06 installed in bore hole. Well was constructed using a pre-packed screen.

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Peoria County Well #: AW-06

Site Name: Edwards Power Station Borehole #: AW-06

State Plane Coordinate: X 2,434,495.3 Y 1,430,727.7 (or) Latitude: _____ Longitude: _____

Surveyed By: Gary C. Rogers IL Registration #: 035-002957

Drilling Contractor: Ramsey Geotechnical Engineering, LLC Driller: B. Williamson

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): None

Logged By: Suzanna L. Keim Date Started: 7/29/2015 Date Finished: 8/3/2015

Report Form Completed By: Suzanna L. Keim Date: 8/5/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- (Granular) Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 1 hour

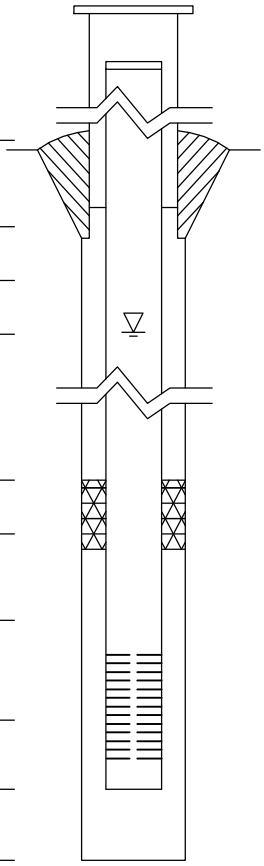
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: Slough (if applicable)

Installation Method: Cave-in



Elevations (MSL)*	Depths (BGS) (0.01 ft.)	
461.79	-2.60	Top of Protective Casing
461.57	-2.38	Top of Riser Pipe
459.19	0.00	Ground Surface
457.19	2.00	Top of Annular Sealant
432.88	26.31	Static Water Level (After Completion) 9/22/2015
426.89	32.30	Top of Seal
424.69	34.50	Top of Sand Pack
422.59	36.60	Top of Screen
418.10	41.09	Bottom of Screen
417.50	41.69	Bottom of Well
416.94	42.25	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	6.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	38.98
Bottom of Screen to End Cap	(feet)	0.60
Screen Length (1st slot to last slot)	(feet)	4.49
Total Length of Casing	(feet)	44.07
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-15

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Gordon Cascade Drilling	1/8/2021	1/8/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
AW-15	Feet (NAVD88)	438.95 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,428,445.04 N, 2,435,405.11 E E/Ⓦ

1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 16.644"

Long -89° 40' 0.557"

Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	240 167		0 1 2 3 4 5 6 7 8 9 10 11 12 13	0 - 0.6' **POORLY-GRADED SAND:** SP, dark grayish brown (10YR 4/2), fine to medium sand, gravel (5-15%), silt (5-15%), roots (0-5%), moist. 0.6 - 13.5' **SILT:** ML, dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/6) to dark brown (7.5YR 3/4) mottling (15-30%), clay (15-30%), sand (5-15%), shells (0-5%), no dilatancy, medium toughness, low plasticity, moist, blocky. 11' dark yellowish brown (10YR 4/6) to dark brown (7.5YR 3/4) mottling (5-15%).	SP ML									CS= Core Sample

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204

Tel: (414) 837-3607
Fax: (414) 837-3608

Boring Number AW-15 Page 2 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			14	13.5 - 14' **LEAN CLAY:** CL, dark gray (10YR 4/1) to (5Y 4/1), silt (15-30%), sand (0-5%), shells (0-5%), no to slow dilatancy, low toughness, medium plasticity, moist.	CL									
			15	14 - 17' **SILTY CLAY:** CL/ML, dark gray (10YR 4/1) to (5Y 4/1), sand (0-5%), shells (0-5%), no to slow dilatancy, low toughness, medium plasticity, wet.	CL/ML									
			16											
			17	17 - 20' **LEAN CLAY:** CL, dark gray (10YR 4/1) to (5Y 4/1), silt (15-30%), sand (0-5%), shells (0-5%), no to slow dilatancy, low toughness, medium plasticity, wet.	CL									
			18											
			19	19.5' moist.										
2 SH	24 24		20	20 - 22' **FAT CLAY:** CH.	CH					27.9	57	38	98	SH= Shelby Tube sample
			21											
3 CS	156 156		22	22 - 35.8' **LEAN CLAY:** CL, dark gray (10YR 4/1) to (5Y 4/1), silt (15-30%), sand (0-5%), shells (0-5%), no to slow dilatancy, low toughness, medium plasticity, moist.	CL									
			23											
			24											
			25											
			26											
			27	26.5' organic material (0-5%).										
			28	28' - 29' organic material (5-15%).										
			29											
			30											
			31											
			32											
			33											
			34	34' piece of wood 1" long.										
			35											
4 CS	60 60		36											

Boring Number AW-15 Page 3 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			37	35.8 - 36.9' **Weathered SHALE Bedrock** BDX (SH), dark gray (10YR 4/1) to gray (10YR 6/1). *(continued)*	BDX (SH)									
			38	36.9 - 40' **SHALE:** BDX (SH), gray (10YR 6/1), dry.	BDX (SH)									
			39											
			40	40' End of Boring.										

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station

Facility License, Permit or Monitoring No.:

Facility ID:

Type of Well: Well Code 72/dp

Distance from Waste/Source: ft.

State: IL

Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat. 40° 35' 16.6" Long. -89° 40' 0.6" or

St. Plane 1,428,445 ft. N, 2,435,405 ft. E. E/Ⓦ

Section Location of Waste/Source: ☒ E ☐ W

____ 1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7

Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known

Gov. Lot Number:

Well Name: AW-15

Date Well Installed: 01/08/2021

Well Installed By: (Person's Name and Firm)

Dave Gordon

Cascade Drilling

A. Protective pipe, top elevation 442.02 ft. (NAVD88)

B. Well casing, top elevation 441.51 ft. (NAVD88)

C. Land surface elevation 439.0 ft. (NAVD88)

D. Surface seal, bottom 437.0 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 411.0 ft. (NAVD88) or 28.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 408.0 ft. (NAVD88) or 31.0 ft.

H. Screen joint, top 406.0 ft. (NAVD88) or 33.0 ft.

I. Well bottom 401.0 ft. (NAVD88) or 38.0 ft.

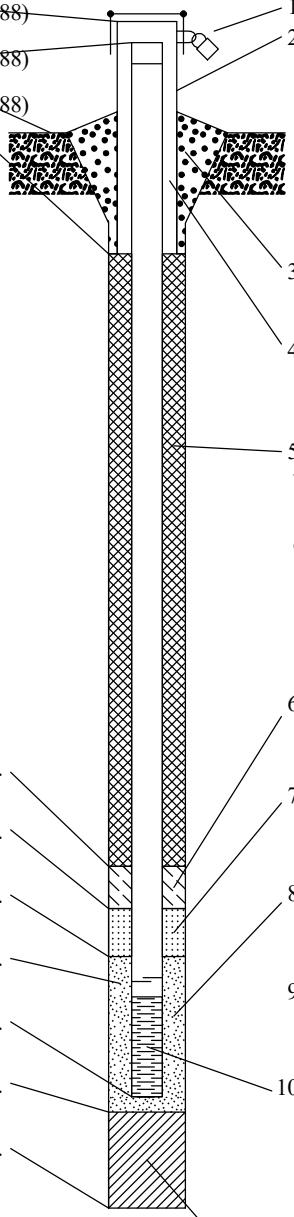
J. Filter pack, bottom 399.0 ft. (NAVD88) or 40.0 ft.

K. Borehole, bottom 399.0 ft. (NAVD88) or 40.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒ Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Bollards

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 4.538 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐

6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. K & E Well Gravel #7
b. Volume added 1.571 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐

10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.

11. Backfill material (below filter pack): None ☐ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 5/19/2021

Signature

Firm: Ramboll
234 W. Florida Street, Milwaukee,WI 53204

Tel: (414) 837-3607
Fax: (414) 837-3608

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-15S

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Gordon Cascade Drilling	1/8/2021	1/8/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
AW-15S	Feet (NAVD88)	437.92 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,428,441.60 N, 2,435,399.83 E E/W
1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 16.61"
Long -89° 40' 0.626"

Local Grid Location
Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	240 200			0 - 12' **SILT:** ML, dark grayish brown (10YR 4/2), brown (10YR 4/3) mottling (5-15%), clay (15-30%), roots (0-5%), wood (0-5%), sand (0-5%), very soft to very stiff, slow to no dilatancy, low toughness, low plasticity, moist.										CS= Core Sample
			1						0.5					
			2											
			3						0.25					
			4											
			5						0.5					
			6		ML									
			7						3					
			8											
			9											
			10	10' dark gray (10YR 4/1), dark grayish brown (10YR 4/2) mottling (30-45%), dark brown (7.5YR 3/3) mottling (0-5%).										
			11	11' dark grayish brown (10YR 4/2), wood (5-15%).					1.5					
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

Boring Number AW-15S

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			12	12 - 20' **LEAN CLAY:** CL, dark gray (10YR 4/1) to (5Y 4/1), shells (0-5%), organic material (0-5%), soft, slow dilatancy, low toughness, medium plasticity, moist to wet.	CL				0.5					
			13											
			14	14' moist.										
			15											
			16											
			17											
			18											
			19											
			20	20' End of Boring.										

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station

Facility License, Permit or Monitoring No.:

Facility ID:

Type of Well: Well Code 71/dw

Distance from Waste/Source: ft. | State: IL

Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat. 40° 35' 16.6" Long. -89° 40' 0.6" or

St. Plane 1,428,442 ft. N, 2,435,400 ft. E. E/Ⓦ

Section Location of Waste/Source: ☒ E ☐ W

____ 1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7

Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known

Gov. Lot Number:

Well Name: AW-15S

Date Well Installed: 01/08/2021

Well Installed By: (Person's Name and Firm): Dave Gordon, Cascade Drilling

A. Protective pipe, top elevation 441.29 ft. (NAVD88)

B. Well casing, top elevation 440.71 ft. (NAVD88)

C. Land surface elevation 437.9 ft. (NAVD88)

D. Surface seal, bottom 436.9 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe

17. Source of water (attach analysis, if required): Potable Water from Site - City of Peoria

E. Bentonite seal, top 436.9 ft. (NAVD88) or 1.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 431.9 ft. (NAVD88) or 6.0 ft.

H. Screen joint, top 429.9 ft. (NAVD88) or 8.0 ft.

I. Well bottom 419.9 ft. (NAVD88) or 18.0 ft.

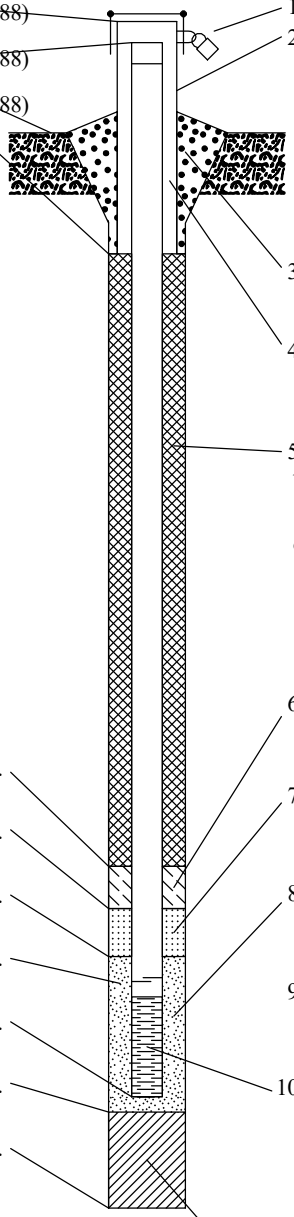
J. Filter pack, bottom 417.9 ft. (NAVD88) or 20.0 ft.

K. Borehole, bottom 417.9 ft. (NAVD88) or 20.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒ Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Bollards

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 0.873 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐

6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. P.W. Gillibrand, Industrial Sand
b. Volume added 2.443 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐

10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☐ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 5/19/2021

Signature

Firm: Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-19

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Adam Jochimsen Cascade Drilling	1/9/2021	1/9/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
AW-19	Feet (NAVD88)	458.53 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,431,161.80 N, 2,434,584.70 E E/Ⓦ

1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 43.536"

Long -89° 40' 10.993"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	120 111		0	0 - 1.8' **FILL, POORLY-GRADED SAND WITH GRAVEL:** (SP)g, brown (10YR 5/3), subrounded to subangular, coarse to medium sand, loose, moist.	(FILL) (SP)g									7-inch override casing set at 10 feet below ground surface
			1											
			2	1.8 - 7.1' ASH, very dark gray (10YR 3/1), silt sized grains, soft, moist to wet.										
			3						0.25					
			4		(FILL) ASH									
			5						0.25					CS= Core Sample
			6											
			7	7.1 - 23.6' **SILTY CLAY:** CL/ML, gray (10YR 5/1), yellowish brown (10YR 5/6) mottling (5-10%), shells (0-5%), organic material (0-5%), very stiff, slow dilatancy, medium toughness, high plasticity, moist.					0.25					
			8											
			9						2.5					
2 CS	60 47		10		CL/ML									
			11						2.25					
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

Boring Number AW-19 Page 2 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	7.1 - 23.6' **SILTY CLAY:** CL/ML, gray (10YR 5/1), yellowish brown (10YR 5/6) mottling (5-10%), shells (0-5%), organic material (0-5%), very stiff, slow dilatancy, medium toughness, high plasticity, moist. *(continued)*					2.5					
			14											
3 CS	60 43		15						2.25					
			16											
			17						2.25					
			18		CL/ML									
			19						2					
4 CS	60 46		20											
			21						2.5					
			22											
			23						2.25					
			24	23.6 - 35' **FAT CLAY:** CH, dark gray (10YR 4/1), very dark gray (10YR 3/1) and yellowish brown (10YR 5/6) mottling (5-10%), organic material (0-5%), shells (0-5%), gravel (0-5%), stiff, slow dilatancy, medium toughness, medium to high plasticity, moist.										
5 CS	60 39		25						2.5					
			26											
			27						2.5					
			28		CH									
			29						2.5					
6 CS	60 41		30											
			31						2.25					
			32											

Boring Number AW-19 Page 3 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	23.6 - 35' **FAT CLAY:** CH, dark gray (10YR 4/1), very dark gray (10YR 3/1) and yellowish brown (10YR 5/6) mottling (5-10%), organic material (0-5%), shells (0-5%), gravel (0-5%), stiff, slow dilatancy, medium toughness, medium to high plasticity, moist. *(continued)*	CH				2.5					
			34											
7 CS	60 60		35	35 - 40.2' **SILTY CLAY:** CL/ML, light brownish gray (10YR 6/2) to grayish brown (10YR 5/2), gravel (0-5%), sand (0-5%), soft, slow dilatancy, low toughness, medium plasticity, moist to wet.					0.5					
			36											
			37		CL/ML				0.5					
			38											
			39						0.25					
			40											
8 CS	36 36		41	40.2 - 41.5' **Weathered SHALE Bedrock** BDX (SH), gray (10YR 6/1) to light yellowish brown (10YR 6/4).	BDX (SH)									
			42	41.5 - 43' **SHALE:** BDX (SH), gray (10YR 6/1).	BDX (SH)									
			43	43' End of Boring.										

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: AW-19
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 43.5" Long. -89° 40' 11.0" or	
Facility ID	St. Plane 1,431,162 ft. N, 2,434,585 ft. E. E/Ⓦ	Date Well Installed: 01/09/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7 ☒ E ☐ W	Well Installed By: (Person's Name and Firm): Adam Jochimsen
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ / Cascade Drilling

A. Protective pipe, top elevation 461.14 ft. (NAVD88)

B. Well casing, top elevation 460.74 ft. (NAVD88)

C. Land surface elevation 458.5 ft. (NAVD88)

D. Surface seal, bottom 456.5 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 427.5 ft. (NAVD88) or 31.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 425.5 ft. (NAVD88) or 33.0 ft.

H. Screen joint, top 423.5 ft. (NAVD88) or 35.0 ft.

I. Well bottom 418.5 ft. (NAVD88) or 40.0 ft.

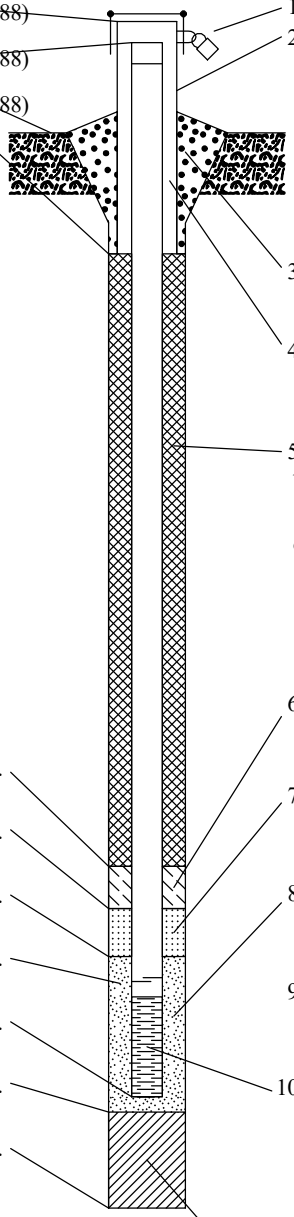
J. Filter pack, bottom 418.5 ft. (NAVD88) or 40.0 ft.

K. Borehole, bottom 415.5 ft. (NAVD88) or 43.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒ Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 5.061 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. P.W. Gillibrand, Industrial Sand
b. Volume added 1.156 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☐ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/19/2021

Signature ____ Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-20

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Adam Jochimsen Cascade Drilling	1/10/2021	1/10/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
AW-20	Feet (NAVD88)	459.08 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,431,539.96 N, 2,434,807.43 E E/Ⓦ

1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 47.26"

Long -89° 40' 8.078"

Local Grid Location: ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 47		0	0 - 0.5' **FILL, POORLY-GRADED SAND WITH GRAVEL:** (SP)g, grayish brown (10YR 5/2), subrounded to subangular, coarse to medium sand, loose, wet.	(FILL) (SP)g									7-inch override casing set at 10 feet below ground surface
			1	0.5 - 6.2' ASH, very dark gray (10YR 3/1), silt sized grains, loose, moist.										
			2											
			3		(FILL) ASH									
			4											
2 CS	60 54		5											CS= Core Sample
			6											
			7	6.2 - 8.9' ASH, very dark gray (10YR 3/1), sand to gravel sized grains, subangular to angular, clinkers (0-5%), slag-like material (0-5%), moist.	(FILL) ASH									
			8											
			9	8.9 - 15' **SILTY CLAY:** CL/ML, dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2), yellowish brown (10YR 5/6) mottling (5-15%), sand (0-5%), gravel (0-5%), stiff, slow to no dilatancy, low to medium toughness, medium to high plasticity, moist.				1.5					
3 CS	60 60		10		CL/ML									
			11					1.25						
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	Tel / Fax
	Ramboll 234 W. Florida Street, Milwaukee,WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

Boring Number AW-20 Page 2 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	8.9 - 15' **SILTY CLAY:** CL/ML, dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2), yellowish brown (10YR 5/6) mottling (5-15%), sand (0-5%), gravel (0-5%), stiff, slow to no dilatancy, low to medium toughness, medium to high plasticity, moist. *(continued)*	CL/ML			1.25						
			14											
4 SH	24 24		15	15 - 17' **LEAN CLAY:** CL.				1.25		35.1	47	29	92.2	SH= Shelby Tube
			16		CL									
5 CS	96 96		17	17 - 19.6' **SILTY CLAY:** CL/ML, dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2), yellowish brown (10YR 5/6) mottling (5-15%), sand (0-5%), gravel (0-5%), stiff, slow to no dilatancy, low to medium toughness, medium to high plasticity, moist.				1.25						
			18		CL/ML									
			19					0.75						
			20	19.6 - 40.8' **SILTY CLAY:** CL/ML, gray (10YR 5/1), shells (0-5%), sand (0-5%), organic material (0-5%), firm to stiff, slow dilatancy, low toughness, medium to high plasticity, moist.										
			21					0.75						
			22											
			23					0.75						
			24	23.8' - 30' dark gray (10YR 4/1), organic material (10-15%), stiff.										
6 CS	60 57		25					2.25						
			26		CL/ML									
			27					2.25						
			28											
			29					0.75						
7 CS	60 60		30											
			31					0.75						
			32											

Boring Number AW-20 Page 3 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	19.6 - 40.8' **SILTY CLAY:** CL/ML, gray (10YR 5/1), shells (0-5%), sand (0-5%), organic material (0-5%), firm to stiff, slow dilatancy, low toughness, medium to high plasticity, moist. *(continued)*				1.25						
			34	33.2' gray (10YR 5/1), brown (7.5YR 4/4) mottling (10-20%), gravel (0-5%), medium toughness, high plasticity.										
8 CS	60 60		35					1						
			36		CL/ML									
			37					0.75						
			38											
			39					0.75						
9 CS	36 36		40	39.7' - 39.9' interbedded sand seams with silt and clay laminations, moist. 40' grayish brown (10YR 5/2).										
			41	40.8 - 43' **Weathered SHALE Bedrock** BDX (SH), gray (10YR 6/1) to yellowish brown (10YR 5/6).	BDX (SH)									
			42											
			43	43' End of Boring.										

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: AW-20
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 47.3" Long. -89° 40' 8.1" or	
Facility ID	St. Plane 1,431,540 ft. N, 2,434,807 ft. E. E/Ⓦ	Date Well Installed: 01/10/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7 ☒ E ☐ W	Well Installed By: (Person's Name and Firm): Adam Jochimsen / Cascade Drilling
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number

A. Protective pipe, top elevation 461.57 ft. (NAVD88)

B. Well casing, top elevation 461.48 ft. (NAVD88)

C. Land surface elevation 459.1 ft. (NAVD88)

D. Surface seal, bottom 457.1 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 427.1 ft. (NAVD88) or 32.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 425.1 ft. (NAVD88) or 34.0 ft.

H. Screen joint, top 422.6 ft. (NAVD88) or 36.5 ft.

I. Well bottom 417.6 ft. (NAVD88) or 41.5 ft.

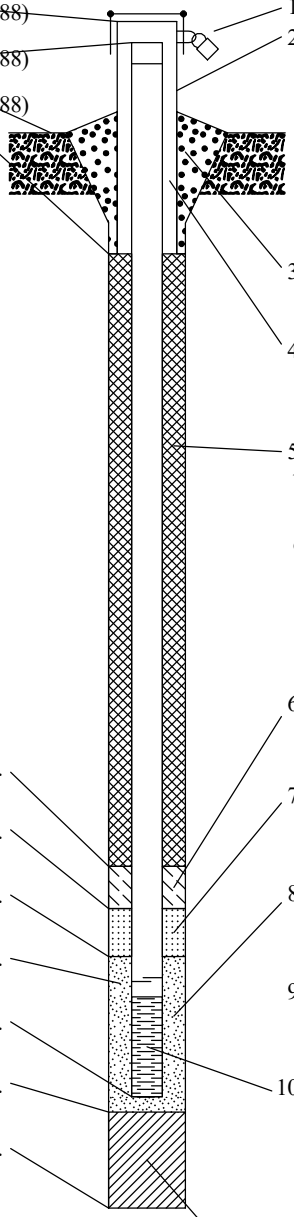
J. Filter pack, bottom 417.6 ft. (NAVD88) or 41.5 ft.

K. Borehole, bottom 416.1 ft. (NAVD88) or 43.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒ Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Bollards

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 5.236 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐

6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. P.W. Gillibrand, Industrial Sand
b. Volume added 1.276 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐

10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.

11. Backfill material (below filter pack): None ☐ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/19/2021

Signature ____ Firm Ramboll, 234 W. Florida Street, Milwaukee,WI 53204 Tel: (414) 837-3607 Fax: (414) 837-3608

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-21

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Adam Jochimsen Cascade Drilling	1/10/2021	1/10/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
AW-21	Feet (NAVD88)	458.28 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,431,842.41 N, 2,435,132.32 E E/Ⓦ

1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 50.23"

Long -89° 40' 3.844"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 / 49		0	0 - 0.5' **FILL, CLAYEY SILT** ML/CL, dark brown (10YR 3/3), loose, moist.	(FILL) ML/CL				0.25					7-inch override casing set at 10 feet below ground surface
			1	0.5 - 9.1' ASH, dark gray (10YR 4/1) to very dark gray (10YR 3/1), silt sized grains, soft, moist.										
			2											
			3						0.25					
			4											
2 CS	60 / 60		5		(FILL) ASH				0.25					CS= Core Sample
			6											
			7						0.25					
			8											
			9						2					
3 CS	60 / 49		10	9.1 - 35.4' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2) to gray (10YR 5/1), brown (7.5YR 4/4) mottling (15-20%), shells (0-5%), sand (0-5%), gravel (0-5%), stiff to very stiff, slow dilatancy, medium to low toughness, medium to high plasticity, moist.										
			11						1.25					
			12		CL/ML									
			13						1.75					
			14											
			15	14.3' - 15' dark gray (10YR 4/1), organic material (5-10%), high plasticity, moist.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204

Tel: (414) 837-3607
Fax: (414) 837-3608

Boring Number AW-21 Page 2 of 2

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
4 CS	60 47		16	9.1 - 35.4' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2) to gray (10YR 5/1), brown (7.5YR 4/4) mottling (15-20%), shells (0-5%), sand (0-5%), gravel (0-5%), stiff to very stiff, slow dilatancy, medium to low toughness, medium to high plasticity, moist. *(continued)*					1.25					
			17						1.75					
			18											
			19						1.25					
5 CS	60 50		20											
			21						0.5					
			22											
			23						2.25					
			24											
6 CS	60 54		25		CL/ML				3					
			26											
			27						1.25					
			28											
			29						1.75					
7 CS	60 60		30	29.8' - 31.5' dark gray (10YR 4/1), organic material (5-10%).										
			31						1.25					
			32	31.5' grayish brown (10YR 5/2), yellowish brown (10YR 5/6) mottling (10-15%).										
			33						0.75					
			34											
8 CS	36 36		35						1					
			36	35.4 - 38' **Weathered SHALE Bedrock** BDX (SH), gray (10YR 6/1) to brownish yellow (10YR 6/6).	BDX (SH)									
			37											
			38	38' End of Boring.										

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: AW-21
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 50.2" Long. -89° 40' 3.8" or	
Facility ID	St. Plane 1,431,842 ft. N, 2,435,132 ft. E. E/Ⓦ	Date Well Installed: 01/10/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7 ☒ E ☐ W	Well Installed By: (Person's Name and Firm): Adam Jochimsen
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ / Cascade Drilling

A. Protective pipe, top elevation 460.84 ft. (NAVD88)

B. Well casing, top elevation 460.61 ft. (NAVD88)

C. Land surface elevation 458.3 ft. (NAVD88)

D. Surface seal, bottom 456.3 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 430.3 ft. (NAVD88) or 28.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 428.3 ft. (NAVD88) or 30.0 ft.

H. Screen joint, top 426.3 ft. (NAVD88) or 32.0 ft.

I. Well bottom 421.3 ft. (NAVD88) or 37.0 ft.

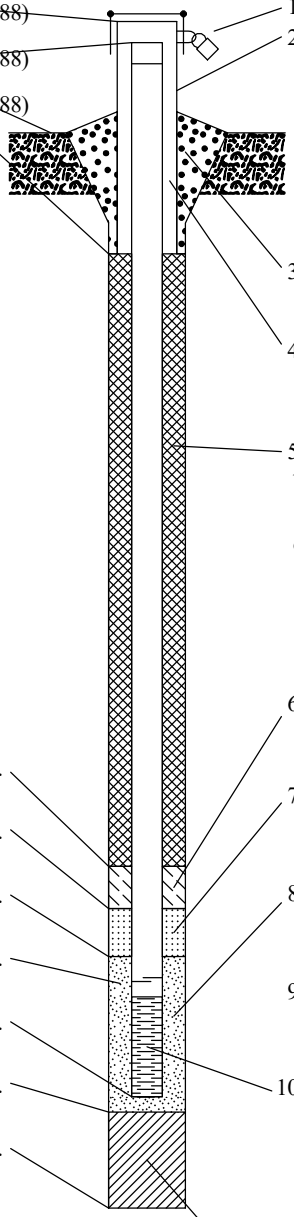
J. Filter pack, bottom 421.3 ft. (NAVD88) or 37.0 ft.

K. Borehole, bottom 420.3 ft. (NAVD88) or 38.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒ Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Bollards

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 4.538 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐

6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. P.W. Gillibrand, Industrial Sand
b. Volume added 1.2 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐

10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.

11. Backfill material (below filter pack): None ☐ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/19/2021

Signature ____ Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

RECORD OF BOREHOLE EMW-05

PROJECT: Part 845 - Edwards Litigation
PROJECT NUMBER: 21454831.0002A
LOCATION: Edwards Power Plant

DRILLING METHOD: 6" Sonic
DRILLING DATE: 9/9/2021
DRILL RIG: Terra Sonic 150CC

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,432,325.51 E: 2,435,264.90

ELEVATION: 455.78
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
0	6" Sonic	(0.0-7.0) NO RECOVERY - Hydrovac cleared to 7 feet below ground surface.				0	VAC	0.0 / 7.0	
					448.8 / 7.0				
		(7.0-18.5) FILL - (SC) CLAYEY SAND, fine sub-rounded poorly-graded sand, low to medium plasticity fines, trace sub-rounded poorly-graded gravel; moderate yellowish brown (10YR 5/4) with dark yellowish brown (10YR 2/2) mottling; non-cohesive, dry, compact.	SC			1	SO	10.9 / 13.0	
					437.3 / 18.5				
		(18.5-19.0) (ML) CLAYEY SILT, non-plastic to low plasticity fines, some fine sub-rounded poorly-graded sand, trace fine sub-rounded gravel; medium dark gray (N4); cohesive, w<PL, firm.	ML						
					436.8 / 19.0				
			SC						
		(19.0-20.0) (SC) CLAYEY SAND, fine sub-rounded poorly-graded sand, non-plastic to low plasticity fines, trace gravel; dark yellowish brown (10YR 4/2); non-cohesive, dry, loose.			435.8 / 20.0				
		(20.0-24.0) (SP&ML) SAND and SILT, fine sub-rounded poorly-graded sand, non-plastic fines, trace sub-rounded gravel; yellowish gray (5Y 7/2); non-cohesive, moist, compact.	SP&ML						▽ Water Level 21.30 ft bgs 9/15/2021
					431.8 / 24.0				
	6" Sonic	(24.0-31.0) (ML) CLAYEY SILT, low to medium plasticity fines, trace fine sub-rounded sand, trace fine sub-rounded gravel; pale brown (5YR 5/2); cohesive, w~PL, soft.	ML			2	SO	14.0 / 14.0	
30		Log continued on next page							

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon

LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

GOLDER

GOLDER STL RECORD OF BOREHOLE MWD EDWARDS.GPJ GLDR_CO.GDT 11/9/21

CONFIDENTIAL ATTORNEY CLIENT PRIVILEGE WORK IN PROGRESS

RECORD OF BOREHOLE EMW-05

PROJECT: Part 845 - Edwards Litigation
PROJECT NUMBER: 21454831.0002A
LOCATION: Edwards Power Plant

DRILLING METHOD: 6" Sonic
DRILLING DATE: 9/9/2021
DRILL RIG: Terra Sonic 150CC

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,432,325.51 E: 2,435,264.90

ELEVATION: 455.78
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
30	6" Sonic		ML		424.8				
		(31.0-32.0) (SC) CLAYEY SAND, fine sub-rounded poorly-graded sand, medium plasticity fines, trace fine sub-rounded gravel; medium light gray (N6); non-cohesive, dry, compact.	SC		31.0 423.8	2	SO	14.0 14.0	
		(32.0-34.0) Moderately weathered (W3), thinly laminated, light gray (N7), very fine grained, moderately porous, very weak (R1), SILTSTONE, [Carbondale Formation] .			32.0 421.8				
		END OF BORING AT 34.0 FEET BELOW GROUND SURFACE.			34.0				
35									
40									
45									
50									
55									
60									

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon

LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

GOLDER

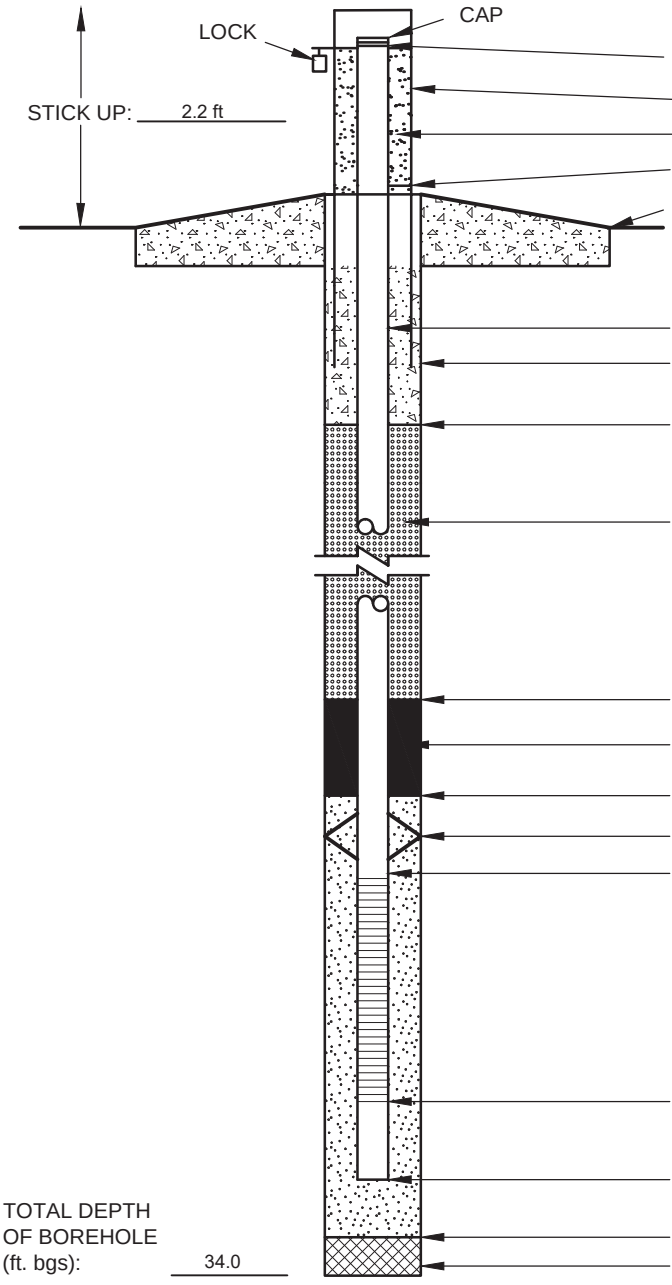
GOLDER STL RECORD OF BOREHOLE MWD EDWARDS.GPJ GLDR_CO.GDT 11/9/21

CONFIDENTIAL ATTORNEY CLIENT PRIVILEGE WORK IN PROGRESS

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG

EMW-05

PROJECT NAME: EDWARDS LITIGATION	PROJECT NUMBER: 21454831.0002B	
SITE NAME: EDWARDS POWER PLANT	LOCATION: EMW-05	
CLIENT: ILLINOIS POWER RESOURCES GENERATING, LLC.	SURFACE ELEVATION: 455.8 FT MSL	
GEOLOGIST: B. TALBERT	NORTHING: 1432325.5	EASTING: 2435264.9
DRILLER: D. GORDON	STATIC WATER LEVEL: 21.30 FT BTOC	COMPLETION DATE: 9/9/2021
DRILLING COMPANY: CASCADE ENVIRONMENTAL	DRILLING METHODS: SONIC	



TOP OF CASING ELEVATION: 457.94 FT MSL

PROTECTIVE CASING (yes) / no): 4" X 5' ALUMINUM

PEA GRAVEL OR SAND

WEEP HOLE

GROUND SURFACE ELEVATION: 455.8 FT MSL

DIAMETER OF RISER PIPE (in.): 2.0

DIAMETER OF BOREHOLE (in.): 6.0

CONCRETE SEAL DEPTH (ft. bgs): 0.3'

TYPE AND AMOUNT OF ANNULAR SEAL: HIGH SOLIDS BENTONITE GROUT

2 BAGS

TOP OF BENTONITE SEAL DEPTH (ft. bgs): 21.7

TYPE AND AMOUNT OF BENTONITE SEAL: 3/8" BENTONITE CHIPS - 1 BAG

TOP OF SAND PACK DEPTH (ft. bgs): 23.7

CENTRALIZER (yes (no) - TYPE: NONE

TOP OF SCREEN DEPTH (ft. bgs): 25.7

TYPE OF SCREEN: 2" x 4.5' SCHEDULE 40 PVC

SCREEN SLOT SIZE (in.): 0.010

SIZE OF SAND PACK: 10/20 SILICA SAND

AMOUNT OF SAND: 2 BAGS

BOTTOM OF SCREEN DEPTH (ft. bgs): 30.2

BOTTOM OF WELL DEPTH (ft. bgs): 30.7

TOTAL DEPTH OF BOREHOLE (ft. bgs): 34.0

BOTTOM OF FILTER PACK (ft. bgs): 30.7

TYPE AND AMOUNT OF BACKFILL: 3.3 FT NATIVE FILL

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL. IN = INCHES. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FEET (2000) ILLINOIS WEST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY INGENAE ON SEPTEMBER 23, 2021. SAND AND BENTONITE BAGS WEIGH 50 POUNDS EACH. CONCRETE SEAL IS AT SURFACE.

CHECKED BY: B. TALBERT

DATE CHECKED: 10/6/2021

PREPARED BY: E. SCHNEIDER

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B010

Date(s) Drilled	09/04/2015 to 09/04/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	45.3 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	459 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
459	0					459.0 / 0.0								
		SS-1	10 6 10	56		458.5 / 0.5 Medium dense, moist, brown, SAND (SP) with gravel and clay.	7.2							
						Medium dense, moist, dark gray, fine to coarse ASH [Fill].	17.4 27.9							
		SS-2	9 8 8	83			20.9 30.7							
455	5	SS-3	3 6 4	100			14.8							
						451.5 / 7.5								
		SS-4	3 3 6	78		Stiff, moist, brown lean CLAY (CL), trace sand and gravel.	22.0							
450	10					449.0 / 10.0								
		SS-5	2 3 4	78		Medium stiff, moist, brown and mottled gray, lean CLAY (CL), trace sand.	24.0							
		SS-6	2 2 3	78			28.0							*12.0 feet: Switch to mud rotary*
445	15	ST-7	250 psi	83			30.5		48	30				*Pushed shelby tube from 15.0 to 17.0 feet*
						440.0 / 19.0								
440	20					Soft, wet, gray, lean CLAY (CL), trace sand and shells.								
		SS-8	1 1 1	83			32.9							
435	25	SS-6	WOH WOH 3	89			21.4							
430	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:48 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

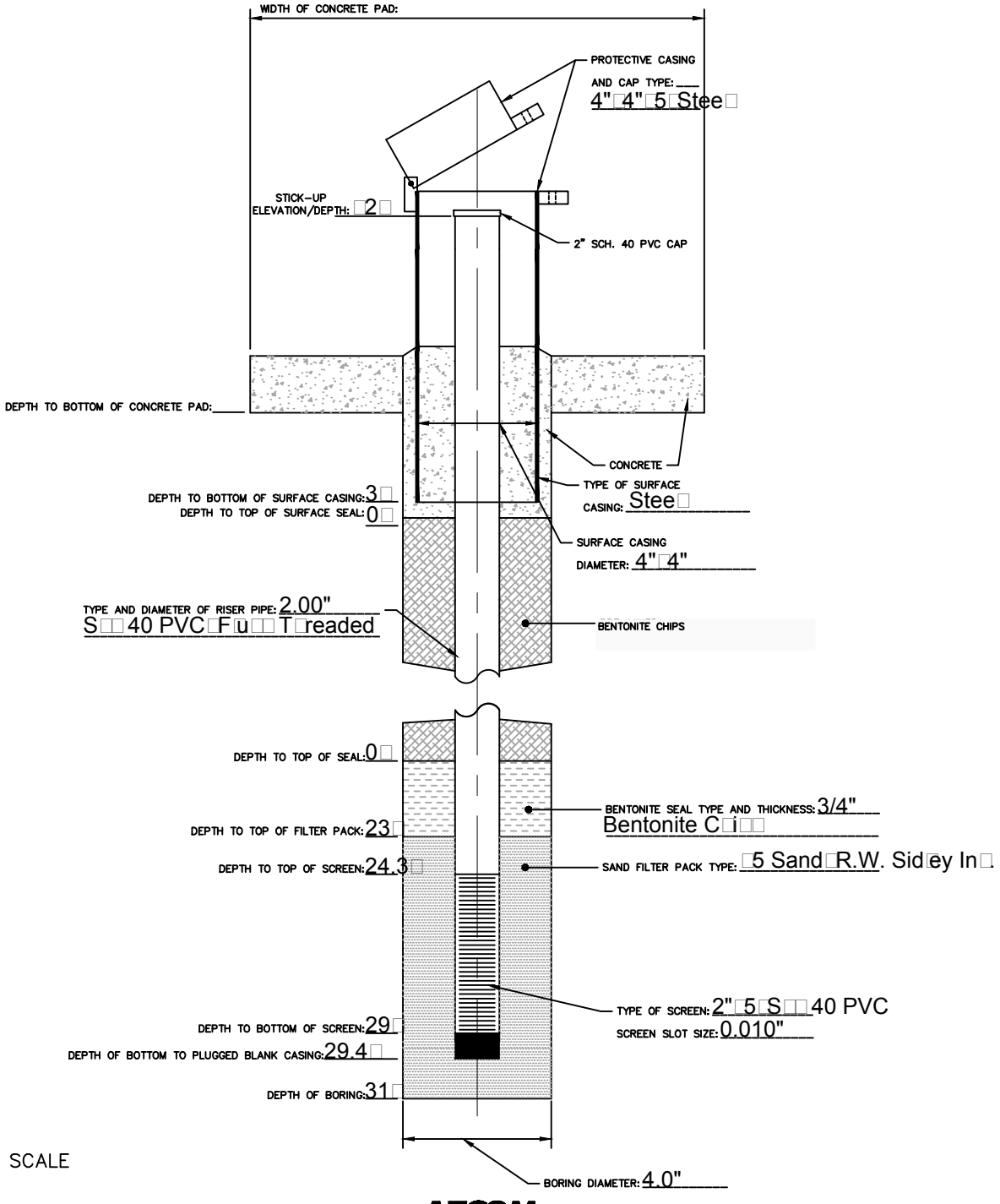
Log of Boring EDW-B010

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30	ST-10		72			30.0	117.6 118.9 118.6	40	25				*Pushed shelby tube from 30.0 to 32.0 feet*
425														
	35	SS-11	1 2 3	94		Becomes medium stiff.	28.2							
420														
	40	SS-12	6 7 50/3.5"	83		419.0 / 40.0 Medium dense, wet, brown, fine to coarse silty SAND (SP) with gravel. 418.0 / 41.0 SHALE: Light gray, weathered.	17.0							*41.0 to 43.0 feet: Hard drilling*
415														
	45	SS-13	50/3"	35		413.8 / 45.3 End of Boring at 45.25 ft	16.4							*Boring backfilled with bentonite and cement fluid*
410														
	50													
405														
	55													
400														
	60													
395														
	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:48 AM

Project: Dynegy Project Location: Pe□in, IL Project Number: 60440202	Log of Piezometer Sheet 1 of 1

Piezometer Location	EDW-P002	Date Installed	09/04/15	Time	11:00-12:00 P.M.
Installed By	S□ott Ko□en	Observed By	N. Sei□er	Total Depth	31□
Method of Installation	4" Po□er Au□er	Drilling Contractor	Strata	Surface Elevation	
Screened Interval	24-29□	Completion Zone			
Remarks		Groundwater Level(s)	29□A□ter Dri□in□		



AECOM

APPENDIX B
35 I.A.C. § 845 Multi-Site Statistical Analysis Plan

Date
April 1, 2025

Project No.
1940110241

35 I.A.C § 845 MULTI-SITE STATISTICAL ANALYSIS PLAN

RAMBOLL Bright ideas. Sustainable change.

35 I.A.C § 845 MULTI-SITE STATISTICAL ANALYSIS PLAN

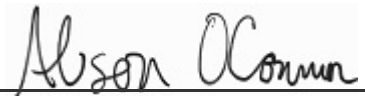
Project no.	**1940110241**
Recipient	**Vistra Corp**
Document type	**Statistical Analysis Plan**
Revision	**FINAL**
Date	**April 1, 2025**
Prepared by	**Rachel Banoff and Alison O'Connor**
Checked by	**Eric J. Tlachac, PE**
Approved by	**Brian G. Hennings, PG**

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

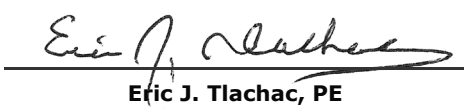
T 414-837-3607
F 414-837-3608
https://ramboll.com



Rachel A. Banoff
Environmental Engineer



Alison O'Connor
Senior Lead Consultant



Eric J. Tlachac, PE
Senior Managing Engineer



Brian G. Hennings, PG
Senior Managing Hydrogeologist

LICENSED PROFESSIONAL CERTIFICATIONS

This certification is based on the description of the statistical methods selected to evaluate groundwater as presented in the following 35 I.A.C. § 845 Multi-Site Statistical Analysis Plan. The procedures described in the plan will be used to establish background conditions and implement compliance and corrective action monitoring as necessary and required by 35 I.A.C. § 845.640, § 845.650, and § 845.680. The 35 I.A.C. § 845 Multi-Site Statistical Analysis Plan was prepared in accordance with the requirements of 35 I.A.C. § 845.640(f), with reference to the acceptable statistical procedures provided in the United States Environmental Protection Agency (USEPA)'s *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (*Unified Guidance,* USEPA 2009), and is intended to provide a logical process and framework for conducting the statistical analysis of the data obtained during groundwater monitoring. In accordance with 35 I.A.C. § 845.640(f)(1), the statistical method chosen for analysis of background groundwater quality is the tolerance interval procedure for each constituent listed in 35 I.A.C. § 845.600(a)(1) at this CCR unit per 35 I.A.C. § 845.640(f)(1)(C). Groundwater Protection Standards (GWPS) will be established in accordance with 35 I.A.C. § 845.600(a) (greater of the background concentration or numerical limit specified in 35 I.A.C. § 845.600(a)(1)). The GWPS will be compared to the appropriate confidence interval for the observed concentrations for each constituent in each compliance well. Consistent with the *Unified Guidance*, the same general statistical method of confidence interval testing against a fixed GWPS is recommended in compliance and corrective action programs. Confidence intervals provide a flexible and statistically accurate method to test how a parameter estimated from a single sample compares to a fixed numerical limit. Confidence intervals explicitly account for variation and uncertainty in the sample data used to construct them.

Description of the statistical methods chosen for analysis of groundwater monitoring data and application of these methods for determining exceedances of the GWPS identified in 35 I.A.C. § 845.600(a) is provided in this 35 I.A.C. § 845 Multi-Site Statistical Analysis Plan.

35 I.A.C. § 845.640 Statistical Analysis (PE)

I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the statistical methods summarized above and described in this document (35 I.A.C. § 845 Multi-Site Statistical Analysis Plan) are appropriate for evaluating the groundwater monitoring data collected as described in the attached document and are in substantial compliance with 35 I.A.C. § 845.640.

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
Date: April 1, 2025



35 I.A.C. § 845.640 Statistical Analysis (PG)

I, Brian G. Hennings, a qualified professional geologist in good standing in the State of Illinois, certify that the statistical methods described in this document (35 I.A.C. § 845 Multi-Site Statistical Analysis Plan) are appropriate for evaluating the groundwater monitoring data collected as described in the attached document and are in substantial compliance with 35 I.A.C. § 845.640.

Brian G. Hennings
Professional Geologist
196.001482
Illinois
Date: April 1, 2025



35 I.A.C. § 845.640 Statistical Analysis

I, Rachel A. Banoff, a qualified professional, certify that the statistical methods described in this document (35 I.A.C. § 845 Multi-Site Statistical Analysis Plan), are appropriate for evaluating the groundwater monitoring data collected as described in the attached document and are in substantial compliance with 35 I.A.C. § 845.640.

Rachel A. Banoff, EIT
Project Statistician
Date: April 1, 2025

DOCUMENT REVISION RECORD

Issue No.	Date	Details of Revisions
Revision 0	April 1, 2025	• Original Document

DOCUMENT APPLICABILITY BY FACILITY OWNER

Table A. Document Applicability by Facility Owner

Facility & Owner	Unit ID	Unit Name
Baldwin Power Plant Dynegy Midwest Generation, LLC	601	Bottom Ash Pond
	605	Fly Ash Pond System
Coffeen Power Plant Illinois Power Generating Company	101	Ash Pond No. 1
	102	Ash Pond No. 2
	103	GMF Gypsum Stack Pond
	104	GMF Recycle Pond
Duck Creek Power Plant Illinois Power Resources Generating, LLC	201/202	Ash Pond No. 1 Ash Pond No. 2
	203	GMF Pond
	205	Bottom Ash Basin
Edwards Power Plant Illinois Power Resources Generating, LLC	301	Ash Pond
Hennepin Power Plant Dynegy Midwest Generation, LLC	802	Ash Pond No. 2
	803	East Ash Pond
	804	Old West Ash Pond
	802/805	Ash Pond No. 2 Ash Pond No. 4
Joppa Power Plant Electric Energy, Inc.	401	East Ash Pond
	403	West Ash Pond
Kincaid Power Plant Kincaid Generation, LLC	141	Ash Pond
Newton Power Plant Illinois Power Generating Company	501	Primary Ash Pond
Vermilion Power Plant Dynegy Midwest Generation, LLC	910	North Ash Pond
	911/912	Old East Ash Pond New East Ash Pond

CONTENTS

Licensed Professional Certifications		**1**
1.	**Introduction**	**7**
1.1	Statistical Analysis Objectives	7
1.2	Statistical Analysis Plan Approach	7
2.	**Groundwater Data Evaluation And Statistical Assumptions**	**9**
2.1	Sample Independence	9
2.2	Non-Detect Data Processing	9
2.3	Testing for Normality	9
2.4	Outlier Evaluation and Management	10
2.5	Trend Analysis	10
2.6	Spatial Variation	11
2.7	Temporal Variation	11
2.8	Updating Background	11
3.	**Compliance Monitoring Program**	**12**
3.1	Monitoring Program Outline	12
3.1.1	Establish Background and GWPS	12
3.1.2	Evaluate Background and GWPS Exceedances	12
3.2	Upper Tolerance Limit	13
3.3	Confidence Intervals	15
3.3.1	Confidence Intervals Around Trending Data	15
3.3.2	Parametric Confidence Intervals around a Mean	17
3.3.3	Non-Parametric Confidence Intervals around a Median	18
4.	**Corrective Action Monitoring Program**	**19**
4.1	Remedy Progress Evaluation	19
4.1.1	Central Tendency	19
4.1.2	Trend of Average Concentration in Individual Wells and in a Plume	20
4.2	Stability Evaluation	20
4.3	Attainment Evaluation	20
5.	**References**	**22**

FIGURES (IN TEXT)

Figure 1	Flow chart illustrating the statistical methods used for calculating background under Compliance Monitoring
Figure 2	Flow chart illustrating the statistical methods used for calculating confidence intervals in Compliance Monitoring

ACRONYMS AND ABBREVIATIONS

%	percent
35 I.A.C.	Title 35 of the Illinois Administrative Code
CCR	coal combustion residuals
CI	confidence interval
DQR	Double Quantification Rule
GMP	Groundwater Monitoring Plan
GWPS	groundwater protection standard
IEPA	Illinois Environmental Protection Agency
LCL	lower confidence limit
LTL	lower tolerance limit
MDL	method detection limit
PQL	practical quantitation limit
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RL	reporting limit
SAP	Sampling and Analysis Plan
SI	surface impoundment
UCL	upper confidence limit
Unified Guidance	Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance (USEPA, 2009)
USEPA	United States Environmental Protection Agency
UTL	upper tolerance limit

1. INTRODUCTION

In April 2021, the Illinois Environmental Protection Agency (IEPA) issued a final rule for the regulation and management of coal combustion residuals (CCR) in surface impoundments (SIs) under the Standards for the Disposal of CCR in Surface Impoundments: Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845. Facilities regulated under 35 I.A.C. § 845 are required to develop and sample a groundwater monitoring well system to evaluate whether impounded CCR materials are impacting groundwater quality. The groundwater quality evaluation must include certification from a qualified professional engineer that the selected statistical method is appropriate for evaluating groundwater monitoring data for the CCR surface impoundment. The procedures described in the evaluation will be used to establish background conditions and implement Compliance and Corrective Action Monitoring as necessary and required by 35 I.A.C. § 845.640, § 845.650, § 845.680, and § 845.780. This Statistical Analysis Plan was prepared in accordance with the requirements of 35 I.A.C. § 845.640(f), with reference to the acceptable statistical procedures provided in United States Environmental Protection Agency's (USEPA's) Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance (Unified Guidance) (USEPA, 2009).[1]

1.1 Statistical Analysis Objectives

This Multi-Site Statistical Analysis Plan provides a framework for conducting the statistical analyses of groundwater data collected during operation, post-closure care, and corrective action monitoring (if required). This Multi-Site Statistical Analysis Plan does not include procedures for groundwater sample collection and analysis conducted in accordance with the Multi-Site Sampling and Analysis Plan (SAP; Ramboll, 2022) or data quality evaluation conducted in accordance with the Multi-Site Quality Assurance Project Plan (QAPP; Ramboll, 2022).[2]

1.2 Statistical Analysis Plan Approach

The analyses described in this document are intended to support monitoring programs described in detail in the CCR unit-specific Operating Permit Groundwater Monitoring Plans (GMPs), Closure Construction Permit GMPs, and Corrective Action GMPs. When necessary and contingent upon equivalent statistical power, an alternative test consistent with the performance standards in 35 I.A.C. § 845.640(g), not included in this Statistical Analysis Plan, may be chosen due to site-specific data requirements.

35 I.A.C. § 845 outlines three phases of groundwater monitoring:

- Baseline Monitoring in accordance with 35 I.A.C. § 845.650(b)(1)
- Compliance Monitoring in accordance with 35 I.A.C. § 845.650 and 35 I.A.C. § 845.780(b)
- Corrective Action Monitoring in accordance with 35 I.A.C. § 845.680(a)

Each phase of the groundwater monitoring program requires specific statistical procedures to accomplish the intended purpose. During the first phase, background groundwater quality will be established, utilizing upgradient and background wells. Compliance Monitoring, which

[1] Despite being currently archived on USEPA's website, the Unified Guidance remains a valid reference for developing a statistical analysis plan (personal communication with Alison O'Connor, February 11, 2025).

[2] The Multi-Site Sampling and Analysis Plan and Multi-Site Quality Assurance Project plan are living documents which are subject to routine evaluation and updates in accordance with USEPA recommended best practices (USEPA 2020; USEPA 2023).

encompasses data collection and statistical evaluation conducted during unit operation and the post-closure care period, will then evaluate whether exceedances occur for 20 required constituents (per 35 I.A.C. § 845.600(a)(1)) relative to the groundwater protection standard (GWPS) established by 35 I.A.C. § 845.600. Corrective Action Monitoring evaluates remedy progress and completion and will be initiated upon implementation of the Corrective Action GMP.

2. GROUNDWATER DATA EVALUATION AND STATISTICAL ASSUMPTIONS

The following subsections outline the statistical tests and procedures utilized to evaluate data collected for consistency with statistical assumptions and evaluate data distribution. These methods may be used in any phase of groundwater monitoring.

2.1 Sample Independence

Independence of sample results is a major assumption for most statistical analyses. To ensure physical independence of groundwater sampling results, the minimum time between sampling events must be longer than the time required for groundwater to move through the monitoring well. Therefore, the minimum time interval between sampling events is a function of the groundwater velocity and well bore volume (diameter of the well and surrounding filter pack). The sampling schedules for Baseline Monitoring, Compliance Monitoring, and Corrective Action Monitoring are specified in 35 I.A.C. § 845 and may conflict with the statistical assumption of independence of sample results.

2.2 Non-Detect Data Processing

Groundwater sample analysis results below the reporting limit (RL), also referred to as the practical quantitation limit (PQL), will not be used in statistical calculations due to the inherent uncertainty in results that are estimated between the method detection limit (MDL) and RL/PQL, and error assumptions inherent to the statistical calculations. Results below the RL/PQL will be considered non-detect data. For statistical characterization evaluations (*e.g.*, distribution testing, and trend analysis), non-detects were replaced with the half of the RL for the analysis. For statistical test procedures that involve the calculation of a mean and standard deviation (as described in **Section 3**):

- If the frequency of non-detect data are less than or equal to 15 percent (%), half of the RL will be substituted for these data.
- If the non-detect frequency is greater than 15% and less than or equal to 50% and the data are normally or log-normally distributed (**Section 2.3**), the Kaplan-Meier method will be used to estimate the mean and standard deviation adjusted for the presence of left-censored values.
- If the non-detect frequency is greater than 50% or data are not normally or log-normally distributed (**Section 2.3**), a non-parametric test or calculation will be used.

2.3 Testing for Normality

In accordance with 35 I.A.C. § 845.640(g)(1), "the statistical method used to evaluate groundwater monitoring data must be appropriate for the distribution of constituents". The Unified Guidance document recommends the Shapiro-Wilk normality test for sample sizes of 50 or less, and the Shapiro-Francia normality test for sample sizes greater than 50. Log-transformation of datasets to achieve normal distributions is preferred to using non-parametric methods. However, if data normality cannot be achieved through log transformation, a non-parametric method is used.

2.4 Outlier Evaluation and Management

Groundwater analytical data may be screened for the existence of outliers using methods described by the Unified Guidance. Outliers are extreme data points that may represent an anomaly or erroneous data point. To test for outliers, one or more of the following outlier tests will be utilized:

- Dixon's test, for well-constituent pairs with less than 25 samples, assumes normally distributed data.
- Rosner's test, for well-constituent pairs with more than 20 samples, assumes normally distributed data.
- Grubb's test for well-constituent pairs with seven or more samples, assumes normally distributed data.

In addition, time series, box-whisker plots, and probability plots will be used to provide visual tools to identify potential outliers, and evaluation of seasonal, spatial, or temporal variability for both normally and non-normally distributed data.

When necessary, a confirmatory sample will be collected to allow the facility to distinguish between an outlier and a true release from the facility (35 I.A.C. § 845.650(d)). If re-sampling is necessary, this sample will be collected within 60 days following outlier identification. Rigorous data validation and review is preferred to formal outlier testing and exclusion to ensure that all data used in statistical evaluations is representative of field conditions. Quality control/quality assurance data are collected and data verification is completed in accordance with the QAPP. Project staff familiar with the site and historical data will review the data generated each quarter and facilitate additional validation as needed. Data quality control, groundwater geochemistry, and sampling procedures will be evaluated as potential sources of error leading to an outlier result. Exclusion of potential outliers without an identified source of error may be considered only for data that could cause extremely elevated background concentrations.

2.5 Trend Analysis

Statistical analyses confirming the lack of trend are a fundamental step to confirm the assumption that groundwater quality values (*i.e.,* constituent means) are stationary or constant over time. These analyses allow for evaluation of variation in the background and compliance data for each constituent over time. A statistically significant increasing trend in the background data could indicate an existing release from the CCR unit or alternative source, requiring further investigation. In addition, statistically significant trending background data can result in increased standard deviation and, therefore, greater prediction or tolerance limits. Consequently, the increased prediction or tolerance limit will have less statistical power or ability to identify a release from a CCR unit.

A linear regression, coupled with a t-test for slope significance at a 95% confidence level (or 0.05 significance level), may be used on datasets for each constituent with few non-detects and a normally distributed variance of the mean to evaluate time trends. The Theil-Sen trend line, coupled with the Mann-Kendall test for slope significance at a 95% confidence level (or 0.05 significance level), may be used for datasets with frequent non-detects or non-normal variance. Similarly, trend analyses could also be used on compliance data to evaluate a possible release from the CCR unit.

2.6 Spatial Variation

Spatial trends and/or variation between background wells could indicate an existing release from a CCR unit. If the spatial variability is not due to an existing release, intrawell comparisons in compliance wells may be used to account for spatial variability and monitor for a future release. However, the CCR units being monitored have been placed into service prior to the start of groundwater monitoring and it is unknown whether a previous release has occurred. Accordingly, intrawell comparisons in compliance wells cannot be used to determine the occurrence of a future release, and interwell comparisons between compliance wells and background wells will be used.

2.7 Temporal Variation

Time series plots can be used to identify temporal dependence. Potentially significant temporal components of variability can be identified by graphing single constituent data from multiple wells together on a time series plot. With temporal dependence, the time series plot has a pattern of parallel traces, in which the individual wells will tend to rise and fall together across the sequence of sampling dates. Time series plots can be helpful by plotting multiple constituents over time for the same well, or averaging values for each constituent across wells on each sampling event and then plotting the averages over time. In either case, the plots can signify whether the general concentration pattern over time is simultaneously observed for different constituents. If so, it may indicate that a group of constituents is highly correlated in groundwater or that the same artifacts of sampling and/or lab analysis impacted the results of several monitoring parameters.

2.8 Updating Background

Updating the background dataset periodically by adding recent results to an existing background dataset can improve the statistical power and accuracy of the statistical analysis, especially for non-parametric prediction intervals. The Unified Guidance recommends updating statistical limits (background) when at least four to eight new measurements (every 2 to 4 years under a semiannual monitoring program or 1 to 2 years under a quarterly monitoring program) are available for comparison to historical data. Methods discussed in **Section 2.4** and professional judgement will be used to evaluate whether any individual data points appear to drive an anomalously high background level. A t-test for equal means (if normal data distribution) or a Mann-Whitney or Wilcoxon test for equal medians (if non-normal data distribution) will be conducted to verify that the two groups of background sample populations are statistically different prior to updating any background datasets. A 0.05 significance level will be utilized when evaluating the two populations, with the null hypothesis that the two populations have equal means or medians. In addition, time series graphs or other trend evaluation statistics (such as a Mann-Kendall test) will be conducted on the new background dataset to verify the absence of a release or changing groundwater quality. If the tests indicate that there are no statistical differences between the two background populations, the new data will be combined with the existing dataset. If the two populations are found to be different, the data will be reviewed to evaluate the cause of the difference. If the differences appear to be caused by a release (*i.e.,* if the new data are significantly higher, or lower for pH), then the previous background dataset may continue to be used. Furthermore, verified outliers will not be added to an existing background dataset. Spatial variability among background wells will also be assessed when background datasets are updated to determine whether pooling data is appropriate.

3. COMPLIANCE MONITORING PROGRAM

Compliance Monitoring encompasses data collection and statistical evaluation conducted during unit operation (35 I.A.C. § 845.640 and 845.650) and the post-closure care period (35 I.A.C. § 845.780). Compliance Monitoring is designed to evaluate whether concentrations of constituents listed in 35 I.A.C. § 845.600(a)(1) in compliance wells exceed GWPS or background in a statistically significant manner.

3.1 Monitoring Program Outline

3.1.1 Establish Background and GWPS

A site-specific GWPS will be established for constituents listed in 35 I.A.C. § 845.600(a)(1) for each CCR unit. The GWPS will be the concentration specified in 35 I.A.C. § 845.600(a)(1), unless the background concentration is greater. For this exception, background concentrations will be used to define the GWPS. Background concentrations will be calculated using a parametric or non-parametric upper tolerance limit (UTL), depending on the data distribution, consistent with 35 I.A.C. § 845.640(f)(1)(C). The procedure for calculating a UTL is outlined in **Figure 1** and described in **Section 3.2**. If only one background result is detected, that value will be used as the UTL.

3.1.2 Evaluate Background and GWPS Exceedances

Per 35 I.A.C. § 845.610(b)(3), groundwater monitoring data from compliance monitoring wells will be evaluated for statistically significant exceedances over background and the site-specific GWPS. In accordance with recommendation in the Unified Guidance for compliance monitoring, exceedances are evaluated by comparing a confidence interval (CI) to a fixed standard. The null hypothesis of this comparison is that compliance well groundwater concentrations do not exceed the standard unless the statistical test indicates otherwise.

GWPS exceedances will be determined by comparing the lower confidence limit (LCL) of the compliance well concentrations to the GWPS, except for pH where the LCL will be compared to the upper end of the GWPS range, and the upper confidence limit (UCL) compared to the low end of the GWPS range. A GWPS exceedance is determined if the LCL is greater than the GWPS, and, for pH, either the LCL is greater than the upper end of the GWPS range or the UCL is less than the low end of the GWPS range. The method of calculating the CI (outlined in **Figure 2** and described in **Section 3.3**) will be determined by sample size, trends in the data, and data normality. The significance level (alpha) for this calculation will be fixed at 0.01 (99% confidence) as recommended by Unified Guidance. If there are too few data points to calculate an LCL (a minimum of four data points is typically required), the most recent data point will be compared to the GWPS.

In the event that statistical analyses identify an exceedance of the GWPS for one or more parameters, the exceedance parameters and wells of concern may be immediately re-sampled. Compliance Monitoring statistics will be updated using the verification resample. If the Compliance Monitoring statistics using the compliance verification resample data result in an exceedance of the GWPS, the exceedance is confirmed.

Comparison of groundwater monitoring data to background is required by 35 I.A.C. § 845.610(3)(B), but these background "exceedances" do not carry any compliance implications.

Background exceedances will be determined by comparing the LCL of the compliance well concentrations to the background UTL, with the exception of pH where the UCL of the compliance well concentrations will also be compared to the background lower tolerance limit (LTL). A background exceedance is determined if the LCL is greater than the background UTL, or, for pH, either the LCL is greater than the UTL or the UCL is less than the LTL. If there are too few data points to calculate an LCL (a minimum of four data points is required), the most recent data point will be compared to the background UTL (and LTL for pH).

Additionally, an exceedance of either background or GWPS will be identified if the constituent monitored was not detected in all previous samples at a compliance well and the two most recent samples have both detections and exceed the GPWS (or are less than the low end of the GWPS range for pH) or background UTL (or are less than the LTL for pH).

3.2 Upper Tolerance Limit

The method for calculating a UTL depends primarily on the proportion of non-detects and the data distribution (**Figure 1**). A parametric UTL will be used to calculate the GWPS when the background data are normally distributed and have a non-detect frequency of 50% or less. The Unified Guidance recommends 95% confidence level and 95% coverage (95/95 tolerance interval). When the non-detect frequency is 15% or less, half the RL will be substituted for non-detects (simple substitution), and the normal mean and standard deviation will be calculated. The Kaplan-Meier method will be used when the detection frequency is between 15% and 50%. The Kaplan-Meier method assesses the linearity of a censored probability plot to determine whether the background sample can be approximately normalized. If so, then the Kaplan-Meier method will be used to compute estimates of the mean and standard deviation adjusted for the presence of left-censored values. The Kaplan-Meier estimate of the mean and standard deviation will be substituted for the sample mean and standard deviation.

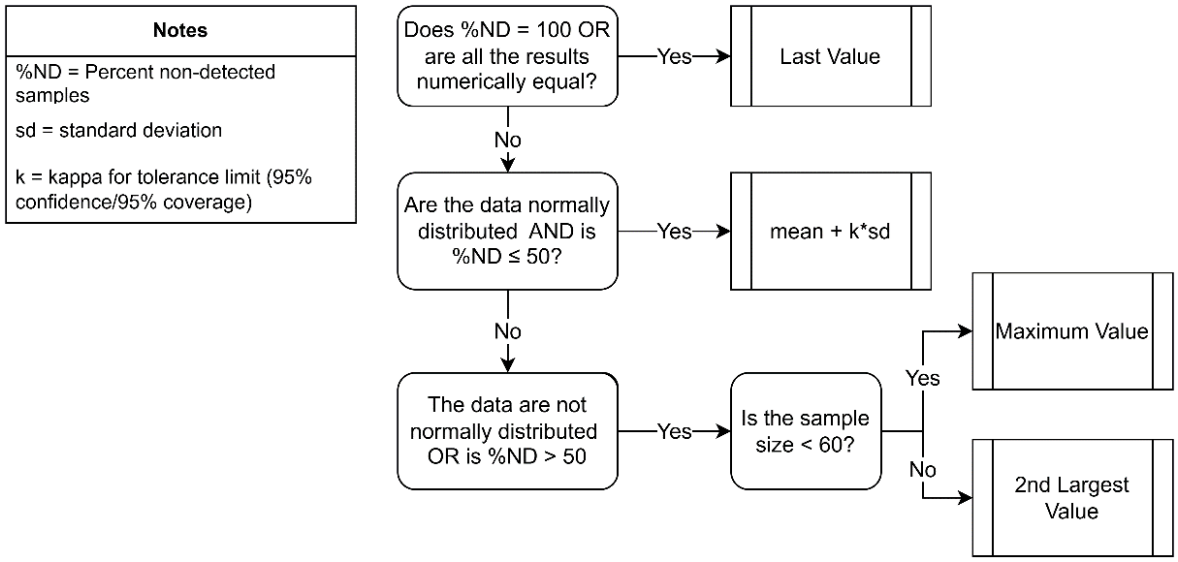


Figure 1. Flow chart illustrating the statistical methods used for calculating background under Compliance Monitoring.

The parametric UTL on a future mean will be calculated from the background dataset as follows:

$$UTL = \overline{x} + \kappa\,(n, \gamma, \alpha - 1) \cdot s$$

$\overline{x}$ = background sample mean

s = background sample standard deviation

$\kappa\,(n, \gamma, \alpha - 1)$ = one-sided normal tolerance factor based on the chosen coverage (γ) and confidence level (α -1) and the size of the background dataset (n). Values may be calculated per Millard (2013) or looked up in Table 17-3 in Appendix D of the Unified Guidance.

If the UTL is constructed on the logarithms of original observations to achieve normality, where $\overline{y}$ and s_y are the log-mean and log-standard deviation, the limit will be exponentiated for back-transformation to the concentration scale as follows:

$$TL = \exp\left[\overline{y} + \kappa\,(n, \gamma, \alpha - 1) \cdot s_y\right]$$

$\overline{y}$ = background sample log-mean

s_y = background sample log-standard deviation

If the background data set is non-parametric or has a non-detect frequency greater than 50%, a non-parametric UTL is used. The maximum concentration is used as the non-parametric UTL for sample sizes less than 60 and the second largest concentration is used as the non-parametric UTL for sample sizes greater than or equal to 60. As described in the Unified Guidance, the advantages include the resulting UTL reflecting actual concentration magnitudes, and the UTL more likely representing a detected concentration (unless all the data were non-detect).

3.3 Confidence Intervals

The method for calculating a CI depends on whether or not there is a trend in the data, the proportion of non-detects, and the data distribution (**Figure 2**). The following sections describe the procedure for calculating the CI in each case.

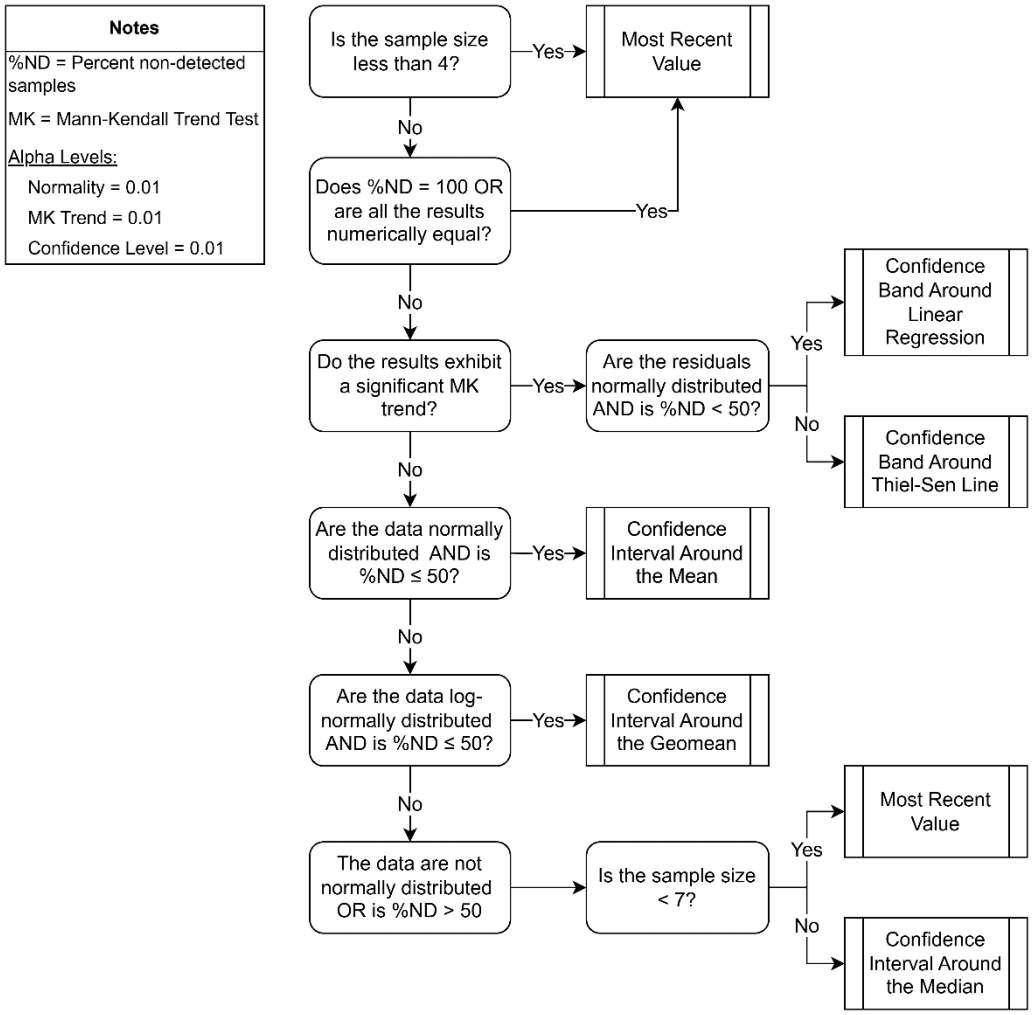


Figure 2. Flow chart illustrating the statistical methods used for calculating confidence intervals in Compliance Monitoring.

3.3.1 Confidence Intervals Around Trending Data

If compliance data exhibit a statistically significant trend based on results from a Mann-Kendall trend test and consists of a sufficient sample size (see below), CIs accounting for trends will be constructed to account for the trend-induced variation. If this is not accounted for, a wider CI will inevitably be calculated for a given confidence level and sample size (n). A wider CI will result in less statistical power, or ability to demonstrate an exceedance or return to compliance. When a linear trend line has been estimated, a series of CIs is estimated at each point along the trend. This creates a simultaneous confidence band that follows the trend line. As the underlying population mean increases or decreases, the confidence band also increases to reflect this change at that point in time.

Linear regression will be used when the compliance data set consists of at least eight samples, the frequency of non-detects is below 50%, and residuals around the trend line are normally distributed. The linear regression of concentration against sampling date (time) will be computed as follows:

$$\hat{b} = \sum_{i=1}^{n} (t_i - \overline{t}) \cdot x_i / (n-1) \cdot s_t^2$$

x_i = i^{th} concentration value and

t_i = i^{th} sampling date

$\overline{t}$ = sampling mean date

s_t^2 = variance of the sampling dates

This estimate leads to the following regression equation:

$$\hat{x} = \overline{x} + \hat{b} \cdot (t - \overline{t})$$

$\overline{x}$ = mean concentration level

$\hat{x}$ = estimated mean concentration at time t

The regression residuals will also be computed at each sampling event to ensure uniformity and lack of significant skewness. Regression residuals will be computed at each sampling event as follows:

$$r_i = x_i - \hat{x}_i$$

The estimated variance around the regression line, or mean squared error, will be computed as follows:

$$s_e^2 = \frac{1}{n-2} \sum_{i=1}^{n} r_i^2$$

The CI around a linear regression trend line given confidence level (1-α) and a point in time (t_0), will be computed as follows:

$$LCL_{1-\alpha} = \hat{x}_0 - \sqrt{2s_e^2 \cdot F_{1-2\alpha,2,n-1} \cdot \left[\frac{1}{n} + \frac{(t_0 - \overline{t})^2}{(n-1) \cdot s_t^2}\right]}$$

$$UCL_{1-\alpha} = \hat{x}_0 - \sqrt{2s_e^2 \cdot F_{1-2\alpha,2,n-2} \cdot \left[\frac{1}{n} + \frac{(t_0 - \overline{t})^2}{(n-1) \cdot s_t^2}\right]}$$

$\hat{x}_0$ = estimated mean concentration from the regression equation at time t_0

$F_{1-2\alpha,2,n-2}$ = upper (1-2α)th percentage point from an *F*-distribution with 2 and (*n*-2) degrees of freedom

If the compliance data set consists of at least seven samples but has a non-detect frequency greater than 50% or the residuals are not normally distributed, the Thiel-Sen trend line will be used as a non-parametric alternative to linear regression for calculation of the CI. The Thiel-Sen trend line estimates the median concentration over time by combining the median pairwise slope with the median concentration value and the median sample date. To compute the Thiel-Sen line,

the data will first be ordered by sampling event x_1, x_2, x_n. All possible distinct pairs of measurements (x_i, x_j) for $j > i$ will be considered and the simple pairwise slope estimate will be computed for each pair as follows:

$$m_{ij} = (x_j - x_i)/(j - i)$$

With a sample size of n, there will be a total of $N = n(n\text{-}1)/2$ pairwise estimates m_{ij}. If a given observation is a non-detect, half the RL will be substituted. The N pairwise slope estimates (m_{ij}) will be ordered from least to greatest (renamed $m_{(1)}$, $m_{(2)}$,..$m_{(N)}$). The Thiel-Sen estimate of slope (Q) will be calculated as the median value of the list depending on whether N is even or odd as follows:

$$Q = \begin{cases} m_{([N+1]/2)} \; if \; N \; is \; odd \\ (m_{(N/2)} + m_{([N+2]/2)})/2 \; if \; N \; is \; even \end{cases}$$

The sample concentration magnitude will be ordered from least to greatest, $x_{(1)}$, $x_{(2)}$, to $x_{(n)}$ and the median concentration will be calculated as follows:

$$\tilde{x} = \begin{cases} x_{([n+1]/2)} \; if \; n \; is \; odd \\ (x_{(n/2)} + x_{([n+2]/2)})/2 \; if \; n \; is \; even \end{cases}$$

The median sampling date ($\tilde{t}$) with ordered times ($t_{(1)}$, $t_{(2)}$, to $t_{(n)}$) will also be determined in this way. The Thiel-Sen trend line will then be computed for an estimate at any time (t) of the expected median concentration (x) as follows:

$$x = \tilde{x} + Q \cdot (\mathrm{t} - \tilde{t}) = (\tilde{x} - Q \cdot \tilde{t}) + Q \cdot \mathrm{t}$$

To construct a confidence band around the Thiel-Sen line, sample pairs (t_i, x_i) will be formed with a sample date (t_i) and the concentration measurement from that date (x_i). Bootstrap samples (B) will be formed by repeatedly sampling n pairs at random with replacement from the original sample pairs. This will be repeated 500 times. For each bootstrap sample, a Thiel-Sen trend line will be constructed using the equation above. A series of equally spaced t_j values will be identified along the range of sampling dates represented in the original sample, j=1 to m. The Thiel-Sen trend line associated with each bootstrap replicate will be used to compute an estimated concentration ($\hat{x}_j^B$). A CI will be constructed for the lower αth percentile $\hat{x}_j^{[\alpha]}$from the distribution of estimated concentrations at each time point (t_j). For a UCL, compute the upper (1-α)th percentile, $\hat{x}_j^{[1-\alpha]}$ at each t_j; for an LCL, compute the lower αth percentile, $\hat{x}_j^{[\alpha]}$ at each t_j.

3.3.2 Parametric Confidence Intervals around a Mean

If compliance data do not show a trend and are normal or log-normal, one-sided parametric CIs around a sample mean will be constructed for each constituent and well pair. The LCL will be calculated as:

$$LCL_{1-\alpha} = \overline{x} - t_{1-\alpha,n-1} \cdot \frac{s}{\sqrt{n}}$$

The UCL will be calculated as:

$$UCL_{1-\alpha} = \overline{x} + t_{1-\alpha,n-1} \cdot \frac{s}{\sqrt{n}}$$

$\overline{x}$ = compliance sample mean

s = compliance sample standard deviation

n = compliance sample size

$t_{1-\alpha,n-1}$ = obtained from a Student's t-table with (n–1) degrees of freedom at the chosen alpha level (0.01) (Table 16-1 in Appendix D of the Unified Guidance)

If compliance data are distributed lognormally, the LCL will be computed around the lognormal geometric mean as:

$$LCL_{1-\alpha} = \exp\left(\overline{y} - t_{1-\alpha,n-1} \cdot \frac{s_y}{\sqrt{n}}\right)$$

The UCL will be computed around the lognormal geometric mean as:

$$UCL_{1-\alpha} = \exp\left(\overline{y} + t_{1-\alpha,n-1} \cdot \frac{s_y}{\sqrt{n}}\right)$$

$\overline{y}$ = compliance sample log-mean

s_y = compliance sample log-standard deviation

3.3.3 Non-Parametric Confidence Intervals around a Median

Non-parametric confidence intervals around the median will be computed if the compliance data do not show a trend and contain greater than 50% non-detects or are non-normally distributed. The mathematical algorithm used to construct non-parametric CIs is based on the probability p that any randomly-selected measurement in a sample of n concentration measurements will be less than an unknown p x 100th percentile of interest (where P is between 0 and 1). Then the probability that the measurement will exceed the p x 100th percentile is (1–p). The number of sample values falling below the p x 100th percentile out of a set of n should follow a binomial distribution with parameters n and success probability p, where 'success' is defined as the event that a sample measurement is below the p x 100th percentile. The probability that the interval formed by a given pair of order statistics will contain the percentile of interest will then be determined by a cumulative binomial distribution *Bin(x;n,p)*, representing the probability of x or fewer successes occurring in n trials with success probability p. P will be set to 0.50 for an interval around the median. In accordance with the Unified Guidance, a confidence interval around the median will only be calculated if at least seven data points are available.

The sample size n will be ordered from least to greatest. Given p = 0.50, candidate interval endpoints will be chosen by ordered data values with ranks rounded upward to the next higher integers. The ranks of the endpoint will be denoted L^* and U* and are calculated using the following equations (Conover, 1999, p. 144):

$$L^* = np - Z_{1-\alpha}\sqrt{np(1-p)}$$

$$U^* = np + Z_{1-\alpha}\sqrt{np(1-p)}$$

4. CORRECTIVE ACTION MONITORING PROGRAM

Corrective Action Monitoring is performed after a corrective action remedy has been selected and implemented. 35 I.A.C. § 845.680(a)(1) specifies that the corrective action groundwater monitoring program must meet the requirements listed in 35 I.A.C. § 845.650 (*i.e.*, Compliance Monitoring), document the effectiveness of the selected remedy, and demonstrate compliance with the GWPS. Post-Closure Care monitoring as described in **Section 3** will operate concurrently with Corrective Action Monitoring, fulfilling the requirements of 35 I.A.C. § 845.650. This document describes the statistical methods used to document the progress of the selected remedy and demonstrate compliance with the GWPS.

Evaluation of corrective action remedy effectiveness will occur in three phases: remedy progress evaluation, stability evaluation, and attainment evaluation (USEPA, 1992).

1. Remedy progress evaluation occurs after implementation of corrective actions to assess if the remedy is functioning as anticipated.
2. The stability evaluation, which occurs after treatment has been concluded and a re-equilibration period has elapsed, assesses if a new post-treatment steady state in the groundwater has been reached.
3. Attainment evaluation occurs after a new steady state has been achieved and assesses if COC concentrations are below the GWPS.

In accordance with the Unified Guidance, these evaluations only apply to constituents which have previous exceedances of the GWPS. Constituents without previous GWPS exceedances continue to be evaluated according to Compliance Monitoring (per **Section 3**). The Corrective Action GMP for each unit describes the detailed approach to remedy effectiveness evaluation and reporting. Statistical evaluations used in each of these three phases are described below.

4.1 Remedy Progress Evaluation

The goal of remedy progress evaluation is to determine if a groundwater remedy is on track to achieve cleanup standards within the proposed time frame and to inform adaptive management decisions if performance metrics are not achieved. Evaluations of remedy effectiveness include:

- Comparison of the central tendency (*i.e.*, mean or median) of data from corrective action monitoring wells to the GWPS
- Trend analysis of average concentrations in individual wells and in a plume

Unlike Compliance Monitoring, remedy progress evaluation does not result in the determination of exceedances. Instead, the results from these analyses are used to evaluate performance metrics described in the site-specific Corrective Action GMP.

4.1.1 Central Tendency

The two most common central tendency measures of a data set are the sample mean and sample median. The sample mean best represents the central tendency of normally-distributed data; therefore, the mean will be used to represent the tendency if the data are approximately normally distributed and the frequency of non-detects is below 50%. The sample mean is given by the arithmetic average of each value in the sample:

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

$\bar{x}$ = sample mean

n = sample count

x_i = i^{th} observation of x

The sample median is the 50th percentile of values in a sample and represents the midpoint of the ordered list of values. Because it is based on rank-order, the sample median is insensitive to data distribution; therefore, the median will be used if the data are not normally distributed or the frequency of non-detects is 50% or greater. The sample median is determined by arranging all values in order and selecting the middle value (or, if an even number of values exists, the mean of the two middle values).

4.1.2 Trend of Average Concentration in Individual Wells and in a Plume

Insight into remedy progress can be gained by evaluating changes in concentration at both the individual well and plume levels.

Trends at the individual well level are evaluated according to **Section 2.5**. To evaluate trends at the plume level, the trend on quarterly average concentrations is evaluated (per **Section 4.1.1**). Quarterly average concentrations in the plume are generated by calculating the mean or median as appropriate based on distribution (**Section 4.1.1**) of concentrations collected during a single sample event. Trend is then evaluated as described in **Section 2.5**. The magnitude of the trend (*i.e.*, slope) may be evaluated according to methods in **Section 3.3.1**.

4.2 Stability Evaluation

In order to evaluate ultimate effectiveness of the remedy, it is critical to evaluate if a new stable equilibrium has been reached after the implementation of corrective action (e.g., completion of source control or conclusion of groundwater extraction). Stability evaluation will be completed using trend analysis as described in **Section 2.5**.

4.3 Attainment Evaluation

Per 35 I.A.C. § 845.680(c), corrective action is considered complete when compliance with the GWPS has been demonstrated "at all points within the plume of contamination that lies beyond the waste boundary […] for a period of three consecutive years". Accordingly, attainment of the GWPS will be evaluated for well-constituent pairs previously determined to exceed the GWPS. This evaluation will include data collected after groundwater conditions have stabilized (**Section 4.2**).

The Unified Guidance recommends comparing a CI to the fixed GWPS to evaluate attainment of corrective action. The null hypothesis of this test is the reverse of that in Compliance Monitoring: corrective action well groundwater concentrations are assumed to exceed the GWPS unless the statistical test indicates otherwise. The CI will be calculated according to methods presented in **Section 3.3**. For pH, the only parameter with an upper and lower background and GWPS, the GWPS will be attained (*i.e.*, the null hypothesis rejected) when the CI falls within the range of the GWPS (*i.e.*, if the LCL of the CI is above the lower limit and the UCL is below the upper limit). For all other parameters, the GWPS will be attained when the UCL is below the GWPS. Once this

statistical evaluation indicates that GWPS has been met for three years (*i.e.*, that the null hypothesis is rejected), corrective action will be concluded.

5. REFERENCES

Conover, W. J., 1999. Practical Nonparametric Statistics (3rd ed.). John Wiley & Sons, Inc.

Illinois Administrative Code, Title 35, Subtitle G, Chapter I, Subchapter J, Part 845: Standards for The Disposal Of Coal Combustion Residuals In Surface Impoundments, effective April 21, 2021.

Millard S. P., 2013. EnvStats: An R Package for Environmental Statistics. Springer. ISBN 978-1-4614-8455-4

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2022. *Multi-Site Sampling and Analysis Plan*. https://www.luminant.com/documents/ccr/il-ccr/Newton/2023/Multi-Site%20Sampling%20Analysis%20Plan-Newton-W0798070001%E2%80%9001.pdf. December 28.

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2022. *Multi-Site Quality Assurance Project Plan.* https://www.luminant.com/documents/ccr/il-ccr/Newton/2023/Multi-site%20Quality%20Assurance%20Project%20Plan-Newton-W0798070001%E2%80%9001.pdf. December 28.

United States Environmental Protection Agency (USEPA), 1992. Methods for Evaluating the Attainment of Cleanup Standards Volume 2: Groundwater. EPA 230-R-92-014. Office of Policy, Planning, and Evaluation. July.

United States Environmental Protection Agency (USEPA), 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance. EPA 530-R-09-007. March.

United States Environmental Protection Agency (USEPA), 2020. EPA QA Field Activities Procedure. IT/IM Directive Procedure. https://www.epa.gov/system/files/documents/2022-09/epa_qa_field_activities_procedure.pdf. June 9.

United States Environmental Protection Agency (USEPA), 2023. Quality Assurance Project Plan Standard. IT/IM Directive Procedure. https://www.epa.gov/system/files/documents/2024-04/quality_assurance_project_plan_standard.pdf. August 21.

APPENDIX B.2
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

Intended for
Illinois Power Resources Generating, LLC

Date
October 25, 2021

Project No.
1940100806-004

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

ASH POND

EDWARDS POWER PLANT

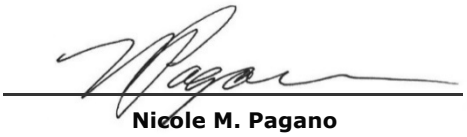
BARTONVILLE, ILLINOIS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT ASH POND

Project Name	**Edwards Power Plant Ash Pond**
Project No.	**1940100806-004**
Recipient	**Illinois Power Resources Generating, LLC**
Document Type	**Hydrogeologic Site Characterization Report**
Revision	**FINAL**
Date	**October 25, 2021**

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

T 414-837-3607
F 414-837-3608
https://ramboll.com



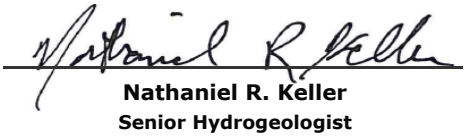
Nicole M. Pagano
Senior Managing Engineer



Brian G. Hennings, PG
Senior Managing Hydrogeologist



Scott S. Woods
Hydrogeologist



Nathaniel R. Keller
Senior Hydrogeologist

CONTENTS

Executive Summary		**6**
1.	**Introduction**	**12**
1.1	Overview	12
1.2	Part 845 Description	12
1.3	Previous Investigations and Reports	12
1.4	Site Location and Background	13
1.5	Site History and Unit Description	13
2.	**Regional and Site Geology**	**15**
2.1	Topography	15
2.2	Regional Geomorphology	15
2.3	Soils	15
2.4	Regional Geology	15
2.4.1	Regional Unlithified Geology	15
2.4.2	Regional Bedrock Geology	16
2.4.3	Structure	16
2.4.4	Seismic Setting	17
2.4.5	Mining Activities	17
2.5	Site Geology	18
2.5.1	Site Specific Unlithified Geology	18
2.5.1.1	Fill and CCR	18
2.5.1.2	Upper Cahokia Formation	19
2.5.1.3	Lower Cahokia Formation	20
2.5.2	Bedrock	20
3.	**Regional and Local Hydrogeology**	**21**
3.1	Regional Hydrogeology	21
3.2	Site Hydrogeology	21
3.2.1	Hydrostratigraphic Units	21
3.2.2	Uppermost Aquifer	22
3.2.3	Potential Migration Pathways	22
3.2.4	Water Table Elevation and Groundwater Flow	22
3.2.4.1	Vertical Hydraulic Gradients	23
3.2.4.2	Impact of River Stage on Groundwater Flow	23
3.2.5	Hydraulic Conductivity	24
3.2.5.1	Field Hydraulic Conductivities	24
3.2.5.2	Laboratory Hydraulic Conductivities	24
3.2.6	Horizontal Groundwater Gradients and Groundwater Flow Velocity	25
3.2.7	Groundwater Classification	26
3.2.8	Methane Observed in Groundwater	26
3.3	Surface Water Hydrology	26
3.3.1	Climate	26
3.3.2	Surface Waters	27
4.	**Groundwater Quality**	**29**
4.1	Summary of Groundwater Monitoring Activities	29
4.1.1	40 C.F.R. § 257 Program Monitoring and Well Network	29
4.1.2	Part 845 Well Installation and Groundwater Monitoring	30

4.2	Groundwater Monitoring Results and Analysis	30
4.2.1	Arsenic	31
4.2.2	Barium	31
4.2.3	Beryllium	31
4.2.4	Boron	32
4.2.5	Chloride	32
4.2.6	Chromium	32
4.2.7	Cobalt	33
4.2.8	Fluoride	33
4.2.9	Lead	33
4.2.10	Lithium	33
4.2.11	pH	34
4.2.12	Radium 226 and 228 Combined	34
4.2.13	Sulfate	34
4.2.14	Thallium	34
4.2.15	Total Dissolved Solids	35
5.	**Evaluation of Potential Receptors**	**36**
5.1	Water Well Survey	36
5.2	Surface Water	36
5.3	Nature Preserves, Historic Sites, Endangered/Threatened Species	37
6.	**Conclusions**	**38**
7.	**References**	**40**

TABLES (WITHIN TEXT)

Table A	Average Monthly Temperature Extremes and Precipitation for Peoria, Illinois
Table B	40 C.F.R. § 257 Groundwater Monitoring Program Parameters
Table C	Part 845 Groundwater Monitoring Program Parameters

TABLES (ATTACHED)

Table ES-1	Part 845 Requirements Checklist
Table 2-1	Geotechnical Results
Table 2-2	Ash Analytical Results
Table 2-3	Porewater Analytical Results
Table 2-4	Soil Analytical Results
Table 3-1	Monitoring Well Locations and Construction Details
Table 3-2	Vertical Hydraulic Gradients
Table 3-3	Field Hydraulic Conductivities
Table 3-4	Horizontal Hydraulic Gradients and Groundwater Flow Velocities
Table 4-1	Groundwater Analytical Results
Table 4-2	Groundwater Field Parameters

FIGURES (IN TEXT)

Figure A	Daily Gage Height, January 1, 2018 to March 18, 2021 for USGS Gaging Station 05568500 at the Illinois River at Kingston Mines, Illinois.

FIGURES (ATTACHED)

Figure 1-1	Site Location Map
Figure 1-2	Site Map
Figure 2-1	Site Topographic Map
Figure 2-2	Soil Survey Map
Figure 2-3	Surficial Geologic Deposits
Figure 2-4	Major Structural Features of Illinois
Figure 2-5	Field Investigation Location Map
Figure 2-6	Geologic Cross-Sections A-A’
Figure 2-7	Geologic Cross-Sections B-B’
Figure 2-8	Geologic Cross Section C-C’
Figure 2-9	Bottom of Ash
Figure 2-10	Top of Bedrock
Figure 3-1	Monitoring Well Location Map
Figure 3-2	Top of Uppermost Aquifer
Figure 3-3	Uppermost Aquifer Groundwater Elevation Contours, February 9, 2021
Figure 3-4	Uppermost Aquifer Groundwater Elevation Contours, March 22, 2021

APPENDICES

Appendix A	Historic Topographic Map (1957)
Appendix B	Information Pertinent to 35 I.A.C. § 845.220(a)(3)
Appendix C	Boring Logs and Well Construction Logs
Appendix D	Geotechnical Laboratory Reports
Appendix E	Groundwater Elevations and Contour Maps
Appendix F	Hydraulic Conductivity Test Data
Appendix G	Floodplain Map

ACRONYMS AND ABBREVIATIONS

§	Section
°F	degrees Fahrenheit
35 I.A.C.	Title 35 of the Illinois Administrative Code
40 C.F.R.	Title 40 of the Code of Federal Regulations
bgs	below ground surface
CCR	coal combustion residuals
cm/s	centimeters per second
CPT	cone penetrometer test
CSM	Conceptual Site Model
EPP	Edwards Power Plant
ESRI	Environmental Systems Research Institute
Federal CCR Rule	40 C.F.R. § 257 Subpart D
FEMA	Federal Emergency Management Agency
ft/day	feet per day
ft/ft	feet per feet
g	horizontal acceleration
GMP	Groundwater Monitoring Plan
gpm	gallons per minute
GWPS	Groundwater Protection Standard
HCR	Hydrogeologic Site Characterization Report
HUC	Hydrologic Unit Code
ID	identification
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
ILWATER	Illinois Water and Related Wells
IPRG	Illinois Power Resources Generating, LLC
ISGS	Illinois State Geological Survey
ISWS	Illinois State Water Survey
LEL	lower explosive limit
MGD	million gallons per day
mg/L	milligrams per liter
NAVD88	North American Vertical Datum of 1988
NID	National Inventory of Dams
No.	Number
NGVD29	National Geodetic Vertical Datum of 1929
NPDES	National Pollutant Discharge Elimination System
NRT	Natural Resource Technology, Inc.
NRT/OBG	Natural Resource Technology, Inc., an OBG Company
Part 845	Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845
pCi/L	picoCuries per liter
pcf	Pound per cubic foot
PMP	Potential Migration Pathway
Ramboll	Ramboll Americas Engineering Solutions, Inc.
Rapps	Rapps Engineering & Applied Science
SI	Surface Impoundment

SU	standard units
SSURGO	Soil Survey Geographic
TDS	total dissolved solids
USCS	Unified Soil Classification System
USFWS	United States Fish and Wildfire Service
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

EXECUTIVE SUMMARY

This Hydrogeologic Site Characterization Report (HCR) for the Ash Pond at Edwards Power Plant (EPP) has been assembled to satisfy the information and analysis requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) Section (§) 845.620 as summarized in **Table ES-1**. The Conceptual Site Model (CSM) includes hydrogeologic and groundwater quality data specific to the Ash Pond, which has been collected between 2015 and 2021. The Ash Pond is located at the Former EPP which is located in Bartonville, Illinois (**Figure 1-1**).

The EPP property is situated in an agricultural/industrial area. The EPP is bound by a salt processing facility to the north, a fertilizer processing plant and the Illinois River to the east, agricultural fields to the south, and railroad tracks and Highway 42 to the west. The Ash Pond is the only coal combustion residuals (CCR) Unit present on the EPP (Vistra identification [ID] number [No.] 301, Illinois Environmental Protection Agency [IEPA] ID No. W1438050005-01, and National Inventory of Dams [NID] No. IL50710).

Four hydrogeologic units are present at the EPP and described as follows from the surface downward:

- **CCR:** Saturated CCR consisting primarily of fly ash within the Ash Pond. CCR is present at thicknesses up to 46.5 feet and at elevations as low as 413.9 feet North American Vertical Datum of 1988 (NAVD88) in the central and northern portion of the Ash Pond**.**
- **Upper Cahokia Formation/Potential Migration Pathway (PMP):** Low permeability clays and silts of the Upper Cahokia Formation are present at the surface. This unit is considered a PMP at elevations similar to the base of the Ash Pond, and in places where thin discontinuous sand lenses occur within the Upper Cahokia Formation adjacent to the Ash Pond.
- **Uppermost Aquifer:** Thin (generally less than 4 feet), moderate permeability sand, silty sand, and clayey gravel material within the Lower Cahokia Formation, bedrock, and/or weathered shale bedrock, where present. In locations where higher permeability materials and coarser grained material are absent, the uppermost aquifer is interpreted as the interface between the Lower Cahokia Formation and shale bedrock.
- **Bedrock Confining Unit:** Thick, very low permeability shales and siltstones of the Carbondale and Modesto Formations. This unit was encountered at elevations ranging from approximately 400 to 422 feet NAVD88 with higher bedrock elevations occurring beneath the northern portion of the Ash Pond.

In general, the Upper Cahokia Formation consists of low permeability clays and silts, with limited occurrences of thin discontinuous sand lenses. In several locations, generally near the southern and western portions of the unit, coarser grained materials are present at the base of the Lower Cahokia Formation and/or the top of the bedrock is weathered resulting in relatively higher hydraulic conductivities. Because the interface is laterally continuous, and has relatively higher conductivity, the unlithified/lithified contact was designated as the uppermost aquifer.

Occasional sand lenses within the Upper Cahokia Formation, and clay intervals downgradient at elevations similar to the base of ash in the Ash Pond were identified as PMPs. The underlying bedrock is interpreted as the lower confining unit and has hydraulic conductivities generally an order of magnitude less than those measured in the uppermost aquifer.

Groundwater occurs within both the unlithified materials and bedrock and consistently flows east to west/southwest towards what is interpreted as a former channel of the Illinois River. Based on calculations in this HCR, horizontal gradients range from 0.0014 to 0.0041 feet per feet (ft/ft) and groundwater velocity in the uppermost aquifer ranges from 1.7×10^{-4} to 2.7×10^{-1} feet per day (ft/day) in the north-central and southern portions of the unit, respectively. Calculation of vertical gradients indicate variable results with groundwater migrating from the lower bedrock confining unit into the uppermost aquifer during the winter season (as observed in February). Upward gradients measured in February 2021 were larger in well nests nearer to the Illinois River, indicating the Illinois River may be a regional discharge zone for the bedrock near the Ash Pond.

Part 845 parameters were monitored in uppermost aquifer and PMP monitoring wells as part of groundwater quality evaluations for the 40 C.F.R. § 257 monitoring program performed between 2015 and present. These data were supplemented with installation and sampling of additional locations in 2021. The results indicate that the following parameters were detected at concentrations greater than the applicable 35 I.A.C. § 845.600(a)(1) groundwater protection standards (GWPSs) and are considered potential exceedances:

- Arsenic – at downgradient uppermost aquifer wells AW-05, AW-06, AW-09, AW-10, AW-11, AW-13, AW-14, AW-19 and AW-20; upgradient uppermost aquifer wells AP05S and AW-08; PMP monitoring wells APW-01 and APW-04; and downgradient bedrock wells AP07D and AW-15C.
- Barium – at downgradient uppermost aquifer wells AW-10, AW-11, and AW-15; and bedrock monitoring wells AW-15C and AP07D.
- Beryllium – at downgradient uppermost aquifer wells AW-08, AW-09, AW-10, and AW-11; and bedrock monitoring well AP07D.
- Boron - at downgradient uppermost aquifer wells AW-05, AW-18, AW-19, AW-20, and AW-21; and PMP wells AP07S and AW-15S.
- Chloride – at downgradient uppermost aquifer well AW-05; PMP monitoring wells APW-01 and APW-04; and at bedrock monitoring wells AP05D and AP07D.
- Cobalt - at downgradient uppermost aquifer wells AW-05, AW-06, AW-09, AW-10, AW-11, AW-14, and AW-17; PMP monitoring wells APW-01 and AW-15S; downgradient bedrock well AP07D; and upgradient well AP05S.
- Lead – at downgradient uppermost aquifer wells AW-05, AW-06, AW-09, AW-10, AW-11, and AW-22; upgradient uppermost aquifer well AP05S; PMP monitoring wells APW-01 and AW-15S; and downgradient bedrock well AP07D.
- Lithium - at downgradient uppermost aquifer wells AW-05, AW-06, AW-09, AW-10, AW-11, AW-15, AW-16, AW-17, and AW-18; upgradient uppermost aquifer well AP05S; downgradient bedrock wells AP07D and AW-15C; and upgradient bedrock well AP05D.
- Radium 226 and 228 combined – at downgradient uppermost aquifer wells AW-09, AW-10, AW-11, AW-15 and AW-16; upgradient uppermost aquifer well AP05S; and downgradient bedrock wells AP07D and AW-15C.
- Sulfate – at downgradient uppermost aquifer well AW-05, and downgradient PMP wells AP07S and AW-15S.

- Total Dissolved Solids (TDS) - at downgradient uppermost aquifer well AW-05; downgradient PMP wells AP07S and AW-15S, and bedrock monitoring wells AP05D, AP07D, and AW-15C.
- Chromium, fluoride, pH, and thallium were also detected at concentrations and/or measured (for pH) outside of their respective GWPSs at one or more locations during monitoring. However, the occurrences were infrequent and/or isolated and individual locations are not listed.

Concentration results for the above parameters were compared directly to 35 I.A.C. § 845.600(a)(1) GWPS to determine potential exceedances. Potential exceedances include results reported during the background groundwater monitoring or prior period that are greater than the GWPS. The results are considered potential exceedances because the results were compared directly to the standard and did not include an evaluation of background groundwater quality, the statistical methodologies proposed in the groundwater monitoring plan (GMP) provided in the Operating Permit application, or alternative source demonstrations. Exceedances will be determined following IEPA approval of the GMP.

TABLE ES-1. PART 845 REQUIREMENTS CHECKLIST
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Part 845 Reference	Individual Part 845 Components Reviewed for Completeness	Location of Information in HCR
845.620(b)	**The hydrogeologic site characterization shall include but not be limited to the following:**	--
845.620(b)(1)	Geologic well logs/boring logs;	Table 3-1 Figure 3-1 Appendix C
845.620(b)(2)	Climatic aspects of the site, including seasonal and temporal fluctuations in groundwater flow;	Sections 3.2.4 & 3.3.1 Tables 3-2, 3-3 & 4-2 Figures 3-3 & 3-4
845.620(b)(3)	Identification of nearby surface water bodies and drinking water intakes;	Sections 3.3.2 & 5.2 Appendix B
845.620(b)(4)	Identification of nearby pumping wells and associated uses of the groundwater;	Section 5.1 Appendix B
845.620(b)(5)	Identification of nearby dedicated nature preserves;	Section 5.3 Appendix B
845.620(b)(6)	Geologic setting;	Section 2.4 & 2.5 Figure 2-3
845.620(b)(7)	Structural characteristics;	Section 2.4.3 Figure 2-4
845.620(b)(8)	Geologic cross-sections;	Figures 2-6 to 2-8
845.620(b)(9)	Soil characteristics;	Section 2.3 Figure 2-2
845.620(b)(10)	Identification of confining layers;	Section 3.2.1

TABLE ES-1. PART 845 REQUIREMENTS CHECKLIST
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Part 845 Reference	Individual Part 845 Components Reviewed for Completeness	Location of Information in HCR
845.620(b)(11)	Identification of potential migration pathways;	Sections 3.2.1 & 3.2.3
845.620(b)(12)	Groundwater quality data;	Section 4.2 Table 4-1 & Table 4-2
845.620(b)(13)	Vertical and horizontal extent of the geologic layers to a minimum depth of 100 feet below land surface, including lithology and stratigraphy;	Section 2.5 Figures 2-6 to 2-8 Appendix C
845.620(b)(14)	A map displaying any known underground mines beneath a CCR surface impoundment;	Section 2.4.5 Appendix B
845.620(b)(15)	Chemical and physical properties of the geologic layers to a minimum depth of 100 feet below land surface;	Section 2.5.1 & 3.2.5 Table 3-4 Appendix D
845.620(b)(16)	Hydraulic characteristics of the geologic layers identified as migration pathways and geologic layers that limit migration, including:	Section 3.2 Tables 3-2 to 3-4 Appendices D & F
845.620(b)(16)(A)	water table depth;	Section 3.2.4 Figures 3-3 to 3-4 Appendix E
845.620(b)(16)(B)	hydraulic conductivities;	Section 3.2.5 Table 3-3 Appendices D & F
845.620(b)(16)(C)	effective and total porosities;	Section 2.5.1 Table 2-1
845.620(b)(16)(D)	direction and velocity of groundwater flow; and	Sections 3.2.4, 3.2.5, & 3.2.6 Tables 3-2, 3-3, & 3-4 Figures 3-3 & 3-4

TABLE ES-1. PART 845 REQUIREMENTS CHECKLIST
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Part 845 Reference	Individual Part 845 Components Reviewed for Completeness	Location of Information in HCR
845.620(b)(16)(E)	map of the potentiometric surface;	Figures 3-3 & 3-4
845.620(b)(17)	Groundwater classification pursuant to 35 I.A.C. § 620; and	Section 3.2.7

Notes:

[O:SSW 7/13/21, U:CJC 08/16/21; C:SSW 08/16/21]

-- = reference to main regulation
35 I.A.C. § 620 = Title 35 of the Illinois Administrative Code, Part 620
HCR = Hydrogeologic Site Characterization Report

1. INTRODUCTION

1.1 Overview

In accordance with requirements of the Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (SIs): 35 I.A.C. § 845 (Part 845) (IEPA, April 15, 2021), Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this HCR on behalf of EPP (**Figure 1-1**), operated by Illinois Power Resources Generating, LLC (IPRG). This report will apply specifically to the CCR Unit referred to as the Ash Pond. The Ash Pond is a 91-acre unlined CCR SI used to manage CCR and non-CCR waste streams at the EPP. This HCR includes Part 845 content requirements specific to 35 I.A.C. § 845.620(b) (Hydrogeologic Site Characterization) for the Ash Pond at EPP.

1.2 Part 845 Description

Part 845 contains comprehensive rules for the design, construction, operation, corrective action, closure, and post closure care of SIs containing CCR. CCR is commonly referred to as coal ash, and CCR SIs are commonly referred to as coal ash ponds. This rule includes GWPSs applicable to each CCR SI at the waste boundary and requires each owner or operator to monitor groundwater. IEPA's rule includes a permitting program as well as all federal standards for CCR SIs promulgated by the United States Environmental Protection Agency (USEPA). In addition, the rules include procedures for public participation, closure alternatives analyses, and closure prioritization, and provides access to records via public website. The rule also includes financial assurance requirements for CCR SIs.

A checklist which identifies the specific requirements of 35 I.A.C. § 845.620 is included in **Table ES-1**. The table provides references to sections, tables, and figures included in this document to locate the information that meets specific requirements of 35 I.A.C. § 845.620.

1.3 Previous Investigations and Reports

Numerous hydrogeologic investigations have been performed concerning the CCR Unit located at the EPP. The information presented in this HCR includes data collected in support of the monitoring well network established for development of the GMP and supplements comprehensive data collection and evaluations from prior hydrogeologic investigation reports (recent to oldest), including, but not limited to, the following:

- ***Natural Resource Technology, Inc., an OBG Company (NRT/OBG), October 17, 2017. Hydrogeologic Monitoring Plan – Edwards Ash Pond.*** A summary of data collected since the submittal of the *Site Characterization and Groundwater Monitoring Plan for CCP Impoundment (Rapps Engineering & Applied Science [Rapps], 2009)* including site geology and hydrogeology, aquifer properties, and monitoring network placement and rationale.
- ***Foth, September 8, 2017. Antidegradation Alternative Analysis, Dynegy Midwest Generation, LLC, Edwards Power Station, Bartonville, Illinois.*** An assessment to determine if unwatering and dewatering activities in preparation for installation of a final cover system will cause an impairment to the Illinois River.
- ***AECOM, January 12, 2016. 30% Design Data Report for Edwards Ash Pond Coal Combustion Residuals units at the E.D. Edwards Power Station.*** A geotechnical

program consisting of installation of auger borings, cone penetrometer test (CPT) soundings and piezometers to obtain information for compliance with requirements of Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257 Subpart D (Federal CCR Rule), design basis, and summary, in addition to preliminary construction costs and schedule.

- ***Natural Resource Technology, Inc. (NRT), March 19, 2013. Phase I Hydrogeological Assessment Report, Coal Combustion Product Impoundment, E.D. Edwards Energy Center, Peoria County IL.*** An investigation and assessment of groundwater quality from the unlined SI at the EPP. Summarizes hydrogeologic information pertinent to the site, evaluates groundwater quality data to determine whether or not operation of the impoundment had adversely affected groundwater, and determined the potential for off-site migration and whether or not there are potential groundwater receptors in the event of a release.
- ***Rapps, December 11, 2009. Site Characterization and Groundwater Monitoring Plan for CCP Impoundment, Ameren Energy Resources Generating, E.D. Edwards Plant, Peoria County, IL.*** A summary assessing the potential for constituent migration from the impoundment. Includes an assessment of subsurface hydrogeologic conditions at the site, identification of private, potable water wells, and oil and gas wells within 2,500 feet of the facility, public water supply wells within 10 miles of the facility, and plans for a groundwater monitoring network.

A GMP is being prepared for the Ash Pond in conjunction with this report and is included in the Operating Permit to which this Report is attached.

1.4 Site Location and Background

The EPP is located in Peoria County between Mapleton and Bartonville in Section 11, Township 7 North, Range 7 East (**Figure 1-1**). The EPP is located near the Illinois River adjacent to a levee and has one CCR SI, the Ash Pond, covering approximately 91 surface acres.

The EPP is situated in a predominantly agricultural area with industrial parcels bordering the property. Historically several coal mines were operated at depths of 100 to 160 feet below ground surface (bgs) in the vicinity of the EPP. The EPP property is bordered by a salt processing facility to the north, railroad right-of-way and former Orchard Mines to the west, the Illinois River and fertilizer production facility to the east, and agricultural land to the south (**Figure 1-2**).

The Ash Pond was investigated in 2013, as requested by IEPA. Results of the investigation (NRT, 2013) indicated that CCR constituents had not impacted groundwater in the vicinity of the Ash Pond. However, exceedances of Class I Groundwater Standards were reported for pH, chloride, iron, manganese, TDS, and sulfate. Additional wells were installed in 2015 to comply with the Federal CCR Rule, and again in 2021 to collect additional data to meet the requirements of 35 I.A.C. § 845.620.

1.5 Site History and Unit Description

The EPP began power generation in 1960 and the original Ash Pond embankments were placed into service at that time. In 2004, modifications to the rail loop surrounding the Ash Pond increased the elevations of the embankments and reduced the footprint of the active impoundment (AECOM, 2016b). CCR material remains between the rail loop and the berm at the south end of the Ash Pond. High power transmission lines bisect the Ash Pond and two

sub-basins, referred to as the North and South Ponds, were established. The sub-basins are hydraulically connected and CCR placement is continuous throughout the Ash Pond.

The Ash Pond has a surface area of approximately 91 acres with berms up to 27 feet higher than the surrounding land surface. This pond currently discharges to the Illinois River through Outfall 001 included in the facility National Pollutant Discharge Elimination System (NPDES) permit, IL0001970. The primary treatment method for the pond water is settlement via reduced velocity whereby solids settle out in various flow channels and in the main South Pond. The permitted total average daily flow is 5.24 million gallons per day (MGD) (Foth, 2017).

2. REGIONAL AND SITE GEOLOGY

2.1 Topography

The EPP and embankments surrounding the Ash Pond are located at an elevation of approximately 460 feet NAVD88 (**Figure 2-1**). Topographic maps drawn prior to construction indicate the areas of the Ash Pond were generally between 435 and 440 feet National Geodetic Vertical Datum (NGVD29), except for a historic drainage feature or former river channel located in the western portion of the Ash Pond, which has an elevation of approximately 430 feet NGVD29 (**Appendix A**). The areas surrounding the EPP are generally at an elevation of around 435 to 440 feet NVGD29. West of the Ash Pond (across Highway 24), the elevation increases to approximately 600 feet NGVD29, where bedrock outcrops or is present near the surface at the edge of the former historic Illinois River valley.

2.2 Regional Geomorphology

The Ash Pond lies at the eastern edge of the Galesburg Plain of the Till Plains section, the largest physiographic division in Illinois, covering approximately four-fifths of the state. It is characterized by level to undulatory till plains with a few morainic ridges in a late youthful stage of erosion. The Galesburg Plain includes the western portion of the Illinoian drift sheet in western Illinois, with most streams flowing from a central upland region westward into the Mississippi River and eastward and southward into the Illinois River. Drainage systems are well developed, and the larger valleys tend to be steep walled, alluviated, and terraced (Rapps, 2009; NRT, 2013).

2.3 Soils

Surficial soils at the Ash Pond are shown on **Figure 2-2** and based on Peoria County soil survey data available in the Soil Survey Geographic (SSURGO) by the United States Department of Agriculture's Natural Resources Conservation Service provided by Environmental Systems Research Institute (ESRI) web hosted layer. Soils surrounding the Ash Pond, not including the Urban Land (#533) within the limits of the EPP, are identified as: Orthents (loamy, hilly/undulating) along the entire Ash Pond boundary; Beaucoup silty clay loam (0 to 2 percent slopes, rarely flooded) and Titus silty clay (0 to 2 percent slopes, rarely flooded) north and south of the Ash Pond within agricultural land; Lawson silt loam (0 to 2 percent slopes, frequently flooded) east of the Illinois River; Sarpy loamy fine sand (0 to 2 percent slopes, frequently flooded, long duration) east of the Ash Pond and adjacent to the Illinois River.

2.4 Regional Geology

2.4.1 Regional Unlithified Geology

The Ash Pond is located in the Illinois Valley where the general sequence of unlithified Quaternary deposits consists of poorly sorted sand, silt, and clay of the Cahokia Formation. The upper part of the Cahokia Formation consists of overbank silts and clays, while the coarser-textured lower portion is mainly sandy channel and lateral accretion deposits. The Cahokia Formation is present along all Illinois streams, although locally absent where active stream erosion is occurring. In major valleys, it commonly overlies the well-sorted deposits of the Henry Formation (Willman and Frye, 1970). The Cahokia Formation is generally greater than 20 feet thick in the study area (NRT, 2017). Regional surficial deposits, which were mapped on a

regional scale, shown on **Figure 2-3** indicate Radnor Till may be present near the topographic bluffs discussed in Section 2.1.

Underlying the Cahokia Formation is glacial outwash belonging to the Henry and Banner Formations. The sands of the Henry and Banner Formations fill the deepest parts of the Illinois Valley, and are generally 75 to 150 feet thick in the area. The Sankoty Sand Member of the Banner Formation rests directly on bedrock and fills the deepest part of the Illinois Valley in the area. Its thickness varies from about 50 to 150 feet due to erosion and irregularities on the bedrock surface (Burch and Kelly, 1993). The Sankoty Sand is the most extensive aquifer in the region and is characterized by coarse- to medium-grained sand with an abundance of quartz grains, of which 25 percent or more are pink, rounded, and polished. Gravel is present in some beds but is not common (Willman and Frye, 1970).

2.4.2 Regional Bedrock Geology

The unlithified deposits are underlain by Pennsylvanian age bedrock, much of which is shale, of the Carbondale and Modesto Formations (Kolata, 2005; Willman et al., 1967). The Carbondale Formation, named for Carbondale, Jackson County, near the outcrop belt of the formation, includes all strata from the base of the Colchester (No. 2) Coal Member to the top of the Danville (No. 7) Coal Member. It overlies the Spoon Formation and varies in thickness from less than 150 feet in western and northeastern Illinois to more than 400 feet in southern Illinois. The Carbondale Formation consists of sandstones, shales, limestones, and coals. The sandstones occur in elongate, channel facies up to about 100 feet thick, are typically subgraywackes, and are more argillaceous than older Pennsylvanian sandstones in Illinois. Gray shales make up the greatest part of the formation, with the thicker gray shales representing delta front or prodelta deposits. Gray to dark-gray, argillaceous limestones are widespread and normally fossiliferous. The coals include the principal economic coals of Illinois, the Danville (No. 7), the Herrin (No. 6), the Springfield-Harrisburg (No. 5), and the Colchester (No. 2).

The Modesto Formation, named for Modesto, Macoupin County, near the type locality, overlies the Carbondale Formation and includes all strata from the top of Danville (No. 7) Coal to the base of the Shoal Creek Limestone Member or the LaSalle Limestone Member. Its thickness varies from less than 125 feet along the LaSalle Anticlinal Belt in east-central Illinois to over 450 feet in southern Illinois, averaging approximately 350 feet. The Modesto Formation consists of sediments similar to those found in the underlying Carbondale Formation, but the coals are thinner and less extensive, the limestones tend to be thicker and less argillaceous, and several red claystones and shales are associated with the open-marine limestones. Gray shales constitute a major part of the Modesto Formation and individual beds tend to be extremely thick.

The elevation of the bedrock surface in the study area ranges from approximately 400 to 450 feet above mean sea level (Herzog et al., 1994). Well logs indicate that the depth to bedrock ranges from more than 50 feet in the Illinois Valley to less than 20 feet in the adjacent uplands, and the lithology of the uppermost bedrock is mainly shale.

2.4.3 Structure

The major geologic structural features around Illinois are shown on **Figure 2-4**. The Ash Pond is located within a stable region of the continent within the north-central portion of the Illinois Basin. In accordance with 40 C.F.R. § 257.62(a), an analysis was completed to identify fault areas. The results indicate the following: "The nearest known mapped faults are four unnamed

faults associated with the Troy Grove Dome, which are located approximately 63 miles northeast and the timeframe of the most recent activity on the fault is not known. Based on the available published geologic data and information reviewed, there are no active faults or fault damage zones that have had displacement in Holocene time reported or indicated within 200 feet of the Site" (Haley & Aldrich, Inc., 2018).

2.4.4 Seismic Setting

As required in 35 I.A.C. § 845.330, existing and new CCR SIs and lateral expansions of existing landfills must not be located in seismic impact areas, unless owners or operators demonstrate that the unit is designed to resist the maximum horizontal acceleration (g) in lithified earth material. The definition of a seismic impact zone per 40 C.F.R. § 257.63 is "areas having a 10 percent or greater probability that the maximum expected horizontal acceleration in hard rock, expressed as a percentage of the earth's gravitational pull, will exceed 0.10 g in 50 years." Based on the data illustrated on the 2014 United States Geological Survey (USGS) Hazard Map, the vicinity of the EPP exhibits a potential horizontal acceleration of 0.06 g with a 98 percent probability of not being exceeded in 50 years. The Ash Pond is therefore not within a seismic impact area, as currently defined in 35 I.A.C. § 845.330. This assessment was completed during evaluation of the Ash Pond with respect to 40 C.F.R. § 257.63 (Haley & Aldrich, Inc., 2018).

2.4.5 Mining Activities

A survey to identify historic mining activities was conducted for a 1,000-meter radius around the Ash Pond and is provided in **Appendix B**. Based on the directory of coal mines for Putnam County (Illinois State Geological Survey [ISGS], 2019), the nearest coal mines in the vicinity of the Ash Pond are immediately adjacent to the western berm of the Ash Pond. These subsurface mines, identified as #828 (located adjacent to western property boundary), #6673 (located approximately 0.1 miles northwest of the Ash Pond), and #3021 (located approximately 0.6 miles north of the Ash Pond), are abandoned underground shaft mines that used the longwall method of mining, essentially removing all of the coal. Orchard Mine (#828), was owned and operated by the Third Vein Coal Company between 1890 and 1909. The coal seam at this location ranged from 32 to 42 inches in thickness, and was mined at depths of approximately 100 to 160 feet bgs. The lateral extent of the mine (with uncertainty limits) extends to the western edge of the Ash Pond (**Figure 1-2** and **Appendix B**). The Petri Mine (#6673) was owned and operated by George Petri Coal Company between 1919 and 1933. The coal seam at this location was on average 4.67 feet thick and located at a depth of approximately 112 feet. The Hollis Mine (#3021) was owned and operated by Robert Rogers between 1933 and 1940. The coal seam at this location was on average 3 feet thick. The source map for this mine indicated some type of fault was present (perhaps a channel) that separated the east and west portions of the mine.

The primary coal mined in this region was the Springfield Coal Seam. The Springfield Coal Seam is located within the central portion of the Carbondale Formation. The Springfield Coal Seam crops out along the margins of the Illinois Basin and reaches a maximum depth in Illinois of about 1,300 feet bgs.

An oil and gas well survey was also conducted in 2021 for a 1,000-meter radius around the Ash Pond. Based on records obtained from ISGS, there are no oil or gas wells located within a 1,000-meter radius of the EPP property. A gas storage field with multiple abandoned and active storage wells is located approximately six miles west of the Ash Pond. Additionally, two wells of unknown

status and one stratigraphic test well are located outside of the 1,000-meter radius to the southeast of the Ash Pond.

2.5 Site Geology

A field investigation was performed in 2021 to collect additional data for the discussion of vertical and horizontal lithology, stratigraphy, chemical properties, and physical properties of geologic layers to a minimum of 100 feet bgs as specified in 35 I.A.C. § 845.620(b). Field investigation locations are shown on **Figure 2-5**.

2.5.1 Site Specific Unlithified Geology

The stratigraphy within and immediately surrounding the Ash Pond consists of fill material and CCR underlain by unlithified river alluvium of the Cahokia Formation. The Cahokia Formation (consisting of clay/silt and sandy or gravelly materials in contact with the bedrock) has been separated into two units for this discussion: the upper unit, consisting of predominantly clay/silt, and the lower unit, consisting of sandy and/or gravelly material observed near the top of bedrock. Boring logs, monitoring well and piezometer construction forms obtained from investigations at the Ash Pond are provided in **Appendix C**.

Cross-sections illustrating the subsurface materials encountered at the Ash Pond are included in **Figures 2-6** through **2-8**.

2.5.1.1 Fill and CCR

Fill, predominantly coal ash (fly ash, bottom ash, and slag) within the Ash Pond, and materials within constructed berms and railroad embankments, are present around the Ash Pond. Ash is present within the Ash Pond at thicknesses up to approximately 46.5 feet as measured in XPW02, and ash is generally between 30.5 and 43 feet thick as observed in XPW01, XPW01A, XPW03, EDW-B002, EDW-B003 and EDW-B014 (**Figure 2-9** and **Appendix C**). The Ash Pond overlies the Upper Cahokia Formation, and the lowest base of ash elevation of 413.9 feet NAVD88 was observed in the center of the Ash Pond while the highest base of ash elevation was observed along the berms around 450 feet NAVD88 (**Figure 2-9** and **Appendix C)**.

Geotechnical analysis results from six samples collected from ash at soil borings XPW01, XPW01A and XPW02, yielded Unified Soil Classification System (USCS) soil classifications of silt, elastic silt, and silty sand. Previous geotechnical analyses of samples collected from within the ash at the Ash Pond did not provide USCS soil classifications, however, the percent composition of gravel, sand, and fines (silt and clay) were consistent with the most recent samples collected. Sample locations are shown on **Figure 2-5** and the geotechnical results of ash samples collected in 2021 are summarized in **Table 2-1** and the geotechnical laboratory report is provided in **Appendix D**. Geotechnical results from XPW01, XPW01A and XPW02 indicated the following:

- The average moisture content was 40.5 percent and ranged from 33.4 to 45.1 percent.
- The average total porosity (calculated) was 52 percent and ranged from 47 to 55 percent.
- The average dry density was 71.3 pounds per cubic foot (pcf) and ranged from 67.5 to 77.1 pcf.
- The average specific gravity was 2.38 and ranged from 2.335 to 2.414.
- The average grain size distribution was 0.2 percent gravel, 29.9 percent sand, and 69.9 percent fines (silt and clay).

Solid samples were collected from XPW01, XPW01A, XPW02 and XPW03 in 2021. The results of chemical analysis of solid samples collected from ash within the Ash Pond are summarized in **Table 2-2**.

Leachate wells were installed near the base of ash at locations XPW01A, XPW02 and XPW03 in 2021, and porewater samples were collected. The analytical results of porewater samples collected from within the Ash Pond are summarized in **Table 2-3**.

2.5.1.2 Upper Cahokia Formation

The Upper Cahokia Formation located in the vicinity of the Ash Pond is generally classified as lean or fat clay with traces of sand and gravel, although the unit is siltier in the southern portion of the Ash Pond as observed in boring locations AW-08, AW-09, AW-10, and AW-11 (**Figure 2-9** and **Figure 2-10**). Thickness of the Upper Cahokia Formation ranged from 5 feet (as observed in EDW-B014, located in the northern portion of the Ash Pond) to approximately 40 feet (as measured in AW-08). Beneath the Ash Pond, the thickness of the Upper Cahokia Formation is variable. A minimum of five feet of clay was observed between the base of ash and the top of bedrock at EDW-B014 and clay is approximately 10 feet thick in other centrally located borings as observed in EDW-B002, EDW-B003, EDW-B005, and XPW01 (**Figure 2-9** and **Figure 2-10**). Near the berms where the fill deposits are thinner, the Upper Cahokia can exceed 40 feet in thickness as observed at EDW-B012 (**Appendix C**).

Discontinuous sandy lenses have been observed within the Upper Cahokia as indicated by a sand/silty sand lens encountered in EDW-B001 (**Figure 2-10**) and AP07S/D, with a thickness of up to 5 feet, but was not observed in any surrounding borings, indicating it is not laterally continuous. A clayey sand lens was observed in AW-22, with a thickness of 1.6 feet, but was not observed in any surrounding borings, indicating it is not laterally continuous. Portions of the Upper Cahokia Formation may have been removed from within the footprint of the Ash Pond either through erosion or during construction of the berms surrounding the pond as indicated by bottom of ash elevations that are lower than preconstruction topography; however, this unit has been encountered in all borings installed below the footprint of the Ash Pond.

Sample locations are shown on **Figure 2-5** and the geotechnical results collected from the Upper Cahokia Formation in 2021 are summarized in **Table 2-1** and the geotechnical laboratory report is provided in **Appendix D**. Geotechnical results from the Upper Cahokia Formation are consistent with the results from previous investigations (Haley & Aldrich, Inc., 2018; and AECOM, 2016a, **Appendix D**), with the exception of grain size as detailed below.

- Moisture content of the samples ranged from 23.2 to 35.1 percent, with an average of 27.9 percent. These observations are at the lower end of the range observed during previous investigations (Haley & Aldrich, Inc., 2018) that indicate a range of 33.1 to 57.9 percent, with an average of 42.1 percent.
- The average total porosity (calculated) was 45 percent, with a range between 42 and 50 percent.
- The average dry density was 91.9 pcf and ranged from 83.9 to 101.3 pcf. These observations are consistent with previous investigations (Haley & Aldrich, Inc., 2018) which indicated an average dry density of 84.45 pcf and range between 67.4 and 101.7 pcf.
- The average specific gravity was 2.69 with a range of 2.661 to 2.700.

- The average grain size distribution was 0 percent gravel, 24.4 percent sand, and 75.6 percent silt and clay. Previous investigations identified the following grain size distribution: 0 percent gravel, 1.75 percent sand, and 98.25 percent silt and clay. The difference in grain size distribution is attributed to sandy intervals that were sampled in 2021 which included a clayey sand, and shallow clay with a higher sand percentage.

Soil samples obtained from the Upper Cahokia Formation were also analyzed for chemical parameters. The results of soil samples collected from the Upper Cahokia Formation are summarized in **Table 2-4**.

2.5.1.3 Lower Cahokia Formation

Several borings encountered thin sandy or gravelly units overlying the bedrock (*i.e.,* EDW-B009 [4 feet], EDW-B010 [1 foot], AW-11 [1 foot] and AW-12 [3 feet]; **Appendix C**), which for this discussion is referred to as the Lower Cahokia Formation. Borings with greater thicknesses (>1 foot) are generally located in the south portion of the Ash Pond. Based on these observations, the coarser grained material of Lower Cahokia Formation is limited in extent and generally only present outside the center of a bedrock valley (discussed in the next section).

The composition of the Lower Cahokia Formation varies across the Ash Pond and was classified as well-graded gravel, clayey gravel, silty sand, and poorly graded sand. Boring locations identified for collection of geotechnical and chemical parameters in 2021 were not able to collect samples due to the size of the gravel, or did not encounter the coarser grained materials of the Lower Cahokia Formation and no samples were collected. Therefore, no geotechnical or chemical results are available for the Lower Cahokia Formation.

2.5.2 Bedrock

The unlithified deposits are underlain by Pennsylvanian age bedrock, much of which is shale, of the Carbondale and Modesto Formations. The elevation of the top of bedrock (**Figure 2-10**) is highest north of the Ash Pond at AW-21 (422.88 feet NAVD88) and declines in elevation to the east toward AW08 (404.5 feet NAVD88) and south toward AW-16 (400.92 feet NAVD88). The top of rock was described as shale, siltstone, and shaley limestone based on borings which were advanced to bedrock. Deep borings AP07D and AP05D, installed in 2017, encountered thin layers of sandstone within the shale and siltstone (**Appendix C**).

The cross-sections (**Figures 2-6** through **2-8**) indicate the presence of a bedrock valley/depression in the west and southwest portion of the pond. Based on the distribution of coarser grained materials of the Lower Cahokia Formation, it appears that the materials are likely present in limited areas on the southern side of the bedrock valley. No geotechnical or solid samples were collected within the bedrock. Boring locations are shown on **Figure 2-5.**

3. REGIONAL AND LOCAL HYDROGEOLOGY

3.1 Regional Hydrogeology

Berg, Kempton, and Cartwright (1984) classified the area as AX (alluvium, a mixture of gravel, sand, silt, and clay along streams, variable in composition and thickness). Aquifers in the Illinois Valley generally fall into two broad categories: (1) unlithified sediments that are glacial or alluvial in origin and contain mostly sand and gravel deposits interbedded with clay and silt, and (2) bedrock aquifers like sandstone and fractured limestone, which vary widely in permeability. The principal aquifer in the area is the sand and gravel outwash deposits of the Banner and Henry Formations in the Illinois Valley. Well logs indicate that high-capacity wells with yields up to 1,000 gallons per minute (gpm) have been developed in this aquifer. These high yield formations have not been observed with any continuity in the vicinity of the Ash Pond. Groundwater wells in the adjacent uplands are either shallow wells in thin sand and gravel lenses which occur within the Glasford Formation diamicton or drilled into the underlying bedrock.

The general pattern of groundwater movement is generally toward the Illinois River, which represents a discharge boundary and receives ground water from both sides. Consequently, the ground-water system plays a role in maintaining baseflow in the Illinois River. Smaller flow systems exist, but the main impetus of flow-direction is toward the river (Burch and Kelley, 1993).

3.2 Site Hydrogeology

Prior to 2015, there were four monitoring wells (APW-01 through APW-04) located around the Ash Pond for monitoring groundwater. In 2015 and 2017, additional wells and piezometers were installed within and around the Ash Pond to meet requirements of 40 C.F.R. § 257. In 2021, additional wells were installed to provide information to meet the requirements of Part 845. A summary of monitoring well locations and construction details are included in **Table 3-1** and depicted on **Figure 3-1**.

3.2.1 Hydrostratigraphic Units

Four distinct water-bearing layers have been identified at the Ash Pond based on stratigraphic relationships and common hydrogeologic properties which are summarized below and discussed in subsequent sections.

- **CCR:** CCR consisting primarily of fly ash within the Ash Pond. CCR is present from the surface (approximately 450 to 460 feet) to a minimum elevation of approximately 414 feet. Water elevations measured in piezometers screened within the Ash Pond indicate the phreatic surface ranges from approximately 450 to 455 feet which is higher than surrounding monitoring wells (**Appendix E**).
- **Upper Cahokia Formation/PMP:** Low permeability clays and silts of the Upper Cahokia Formation. This unit also includes discontinuous lenses of sand, sandy clay to clayey sand, and sandy silt where they occur within the clay and silt. Isolated sand lenses of limited thickness were encountered in three borings located in the northern portion of the site. The saturated and unconfined sandy lenses within the Upper Cahokia Formation and clay and silt screened near the adjacent base of ash in the southern portion of the property (where bedrock is at a lower elevation) have been identified as PMPs.

- **Uppermost Aquifer:** Thin (generally less than 4 feet), moderate permeability sand, silty sand, and clayey gravel units which includes the unconfined clays and silts of the Upper Cahokia Formation, where saturated, and the thin, moderate permeability sands and gravels of the Lower Cahokia Formation, which at some locations also includes the bedrock interface. More permeable materials are generally located in the southern portion of the site. The top of the uppermost aquifer is presented in **Figure 3-2**.
- **Bedrock Confining Unit:** Thick, very low permeability shales and siltstones of the Carbondale and Modesto Formations that are the base of the uppermost aquifer. The bedrock elevation varies between approximately 422 and 400 feet on site, with varying degrees of weathering observed during drilling.

3.2.2 Uppermost Aquifer

The uppermost aquifer includes saturated portions of the Cahokia Formation (both upper and lower) in the vicinity of the Site. Higher permeability materials are generally present at the interface between the unlithified materials and the underlying bedrock. Groundwater monitoring for the uppermost aquifer is focused on this zone because it is continuous, moderate permeability, and likely to indicate potential impacts from the Ash Pond. The top of uppermost aquifer (**Figure 3-2**) was evaluated with respect to the location restrictions in 2018 (Haley & Aldrich, Inc., 2018).

3.2.3 Potential Migration Pathways

The Upper Cahokia Formation consists of low permeability clays and silts, with limited occurrences of thin discontinuous sand lenses. Isolated sand lenses of limited extent within the Upper Cahokia Formation, and clay intervals downgradient of the Ash Pond at elevations similar to the base of ash and above the unlithified/lithified interface, were identified as PMPs. Monitoring wells AP-06, APW-02 through APW-04, P002, AW-15S (clay and silts of the upper Cahokia Formation) and AP07S (discontinuous sand lens) are considered to be screened within PMPs and utilized for this discussion.

3.2.4 Water Table Elevation and Groundwater Flow

Groundwater in the uppermost aquifer generally flows from east to west in the central portion of the Ash Pond towards what is interpreted as a former channel of the Illinois River, and south/southeast at the south end of the Ash Pond (**Figures 3-3** and **3-4**). In the northernmost portion of the Ash Pond there is a minor northwest and northern component of flow in both the uppermost aquifer and PMP. Groundwater elevations vary seasonally, generally less than 5 feet, while across the site they range between approximately 430 and 450 feet, although flow directions are generally consistent. Groundwater contour maps are located in **Appendix E**.

Groundwater elevations in PMP wells range from approximately 455 feet NAVD88 (APW-02) to 430 feet NAVD88 (AW-15S) with flow generally from the east to the south and northwest (**Figures 3-3** and **3-4**) similar to that observed in the uppermost aquifer. Groundwater elevations measured at APW02 are similar to CCR piezometers and the location of the well (within the berm of the unit) may be affected by water elevations in the active Ash Pond. Given the elevations of groundwater detected in these unconfined wells and the lowest elevation of ash (414 feet NAVD88), portions of the Ash Pond are likely in contact with groundwater.

Groundwater elevations within the bedrock were not contoured because the wells are screened at different elevations and within different lithologic materials in this confining unit. However, comparison of elevations in bedrock wells shows flow directions may be consistent with shallower flow systems.

3.2.4.1 Vertical Hydraulic Gradients

Vertical hydraulic gradients were calculated using available groundwater elevation data from February to July 2021 at nested well locations within the Upper Cahokia Formation/PMPs, uppermost aquifer, and bedrock. Vertical hydraulic gradients are presented in **Table 3-2**. The results of the vertical hydraulic gradient calculations for these hydrostratigraphic units are summarized below:

- Within CCR unit:
  - Gradients calculated between AP08 (CCR) and XPW02 (CCR) in the northern portion of the Ash Pond were upward for all events in February through July 2021.
  - Gradients calculated between AP09 (CCR) and XPW03 (CCR) in the central portion of the Ash Pond were downward for all events in February through July 2021.
- Bedrock confining unit to uppermost aquifer:
  - Gradients calculated between AW-15 (uppermost aquifer) and AW-15C (bedrock) indicate variable directions, with upward gradients measured during four events and flat to slightly downward gradients measured in four events.
  - In monitoring wells AP-05S (uppermost aquifer) and AP-05D (bedrock), gradients were upward in February 2021, and downward in March through July 2021. The Illinois River was measured at an elevated level during April and May and measured gradients are likely a result of the river elevation.
- Uppermost aquifer to Upper Cahokia Formation/PMPs:
  - Gradients between AW-15 (uppermost aquifer) and AW-15S (PMP) were upward for all events in February through July 2021.
  - Gradients between APW-03 (PMP) and AW-10 (uppermost aquifer) were upward for all events in March through July 2021.
  - Gradients between APW-04 (PMP) and AW-13 (uppermost aquifer) were upward for all events in February through July 2021.

Although gradients were downward at times between the uppermost aquifer and bedrock surface and the deep bedrock wells, it is expected that groundwater within the bedrock aquifer discharges to the Illinois River during time periods with lower river elevations or in locations south of the site, which is consistent with flow directions in the uppermost aquifer.

3.2.4.2 Impact of River Stage on Groundwater Flow

Based on groundwater elevations and flow maps it does not appear groundwater from the uppermost aquifer consistently flows into the Illinois River adjacent to the EPP property (**Figures 3-3** and **3-4**). However, the River is likely a regional discharge area for the unlithified materials and bedrock although not along the section of the EPP property. Vertical gradients observed in 2021, indicate that water within the bedrock periodically migrates vertically into the Illinois River.

3.2.5 Hydraulic Conductivity

3.2.5.1 Field Hydraulic Conductivities

Field hydraulic conductivity tests were performed in monitoring wells screened within all hydrostratigraphic units in 2021. The test analyses and results are summarized in **Table 3-3**, and analyses are included in **Appendix F**.

Field hydraulic conductivity tests from wells screened within the ash (XPW01A, XPW02 and XPW03) resulted in a geometric mean horizontal hydraulic conductivity of 6.8×10^{-4} cm/s. Previous field hydraulic conductivity tests performed in 2017 (NRT/OBG, 2017) from wells screened within the ash (AP08 and AP09) resulted in a geometric mean of 2.7×10^{-3} cm/s (AP08) and 1.44×10^{-3} cm/s (AP09). Overall, the geometric mean horizontal hydraulic conductivity of the CCR material is 1.4×10^{-3} cm/s.

In the uppermost aquifer wells (AW-12, AW-15, AW-16, AW-17, AW-18, AW-19, AW-20, AW-21, and AW-22) analysis of hydraulic conductivity tests resulted in a geometric mean horizontal conductivity of 1.6×10^{-4} cm/s. Previous field hydraulic conductivity tests (NRT/OBG, 2017) in wells screened within the uppermost aquifer (APW-01, AP05S, AW-05, AW-06, AW-08, AW-09, AW-10 and AW-11) resulted in a geometric mean horizontal hydraulic conductivity of 2.1×10^{-4} cm/s (**Appendix F**). Overall, the geometric mean horizontal hydraulic conductivity for all uppermost aquifer wells is 1.7×10^{-4} cm/s.

Field hydraulic conductivity tests performed in Upper Cahokia monitoring well AW-15S in 2021 resulted in a hydraulic conductivity of 3.2×10^{-3} cm/s, which is an order of magnitude higher than previous results (AP06 and AP07S; NRT/OBG 2017) of approximately 5×10^{-4} cm/s (**Appendix F**). Overall, the geometric mean horizontal hydraulic conductivity for the PMP wells is 9.2×10^{-4} cm/s.

Previous field hydraulic conductivity tests (NRT/OBG, 2017) performed in bedrock wells AP07D and AP05D resulted in horizontal hydraulic conductivities that ranged 1.1×10^{-7} to 3.49×10^{-7} cm/s. A field hydraulic conductivity test from bedrock well AW-15C resulted in a horizontal hydraulic conductivity of 8.2×10^{-4} cm/s. AW-15C is located in the southern portion of the Site within the top 15 feet of shale bedrock. The hydraulic conductivity measured at this location indicates that the surficial bedrock is likely weathered at this location while it is more competent in the northern portions of the Site and at greater depths. The overall geometric mean hydraulic conductivity calculated from AP05D, AP07D, and AW-15C results in a horizontal hydraulic conductivity of 3.2×10^{-6} cm/s which is likely more representative of the bedrock underlying the Site.

3.2.5.2 Laboratory Hydraulic Conductivities

Ten samples were collected for laboratory vertical hydraulic conductivity analysis (ASTM D 5084) during the 2021 field investigation from the hydrostratigraphic units described in Section 3.2.1.1 of this HCR. The results of the 2021 analyses are tabulated in **Table 2-1**, sample locations are shown on **Figure 2-5**, and laboratory reports are provided in **Appendix D**. The results of the 2021 vertical hydraulic conductivity analysis, as well as data available from previous investigations, for these hydrostratigraphic units are summarized below:

- **CCR:** Six samples collected in 2021 from ash borings XPW01, XPW01A, XPW02, and XPW03. Vertical permeability test results in the ash indicated a geometric mean vertical hydraulic

conductivity of 9.3 x 10^{-6} cm/s. Historical results from two samples collected by AECOM (2016a) from ash borings EDW-B002 and EDW-B003 indicated a geometric mean vertical hydraulic conductivity of 7.9 x 10^{-5} cm/s (NRT, 2017).

- **Upper Cahokia Formation/PMP:** Four samples were collected in 2021 from soil borings AW-13A, AW-15, AW-20, and AW-22 for geotechnical testing. Falling head permeability tests results in the Upper Cahokia Formation from these locations indicated a geometric mean vertical hydraulic conductivity of 6.4 x 10^{-8} cm/s. This result is consistent with results of historical samples collected by Haley & Aldrich, Inc. (2018) and AECOM (2016a) which indicated a geometric mean vertical hydraulic conductivity of 7.3 x 10^{-8} cm/s.
- **Lower Cahokia Formation and Bedrock:** Samples were either unable to be collected or analyzed due to their composition.

3.2.6 Horizontal Groundwater Gradients and Groundwater Flow Velocity

Groundwater in the uppermost aquifer generally flows from east to west in the central portion of the Ash Pond towards what is interpreted as a former channel of the Illinois River, and south/southeast at the south end of the Ash Pond. In the northernmost portion of the Ash Pond there is a minor northwest and northern component of flow in both the uppermost aquifer and PMP. Groundwater elevations and flow directions near the Ash Pond are illustrated in 2021 contour maps (**Figures 3-3** and **3-4**). There is little seasonal variation in groundwater flow direction in the unlithified materials regardless of the river elevation as illustrated in **Figures 3-3** and **3-4** (additional contour maps are included in **Appendix E**). Groundwater elevation contours begin to turn toward the river in the southern portion of the site indicating that the uppermost aquifer may discharge to the river south of the site. Horizontal hydraulic gradients were calculated for the uppermost aquifer and PMP, and are summarized in **Table 3-4**.

Horizontal hydraulic gradients calculated for the uppermost aquifer between February and July 2021 range from 0.001 to 0.004 ft/ft. The horizontal hydraulic gradient for the uppermost aquifer is slightly steeper as it nears the sand and gravel in the southwest portion of the Ash Pond, with an average horizontal hydraulic gradient of 0.004 ft/ft (between wells AW-10 and AW-15), in comparison to the central portion of the Ash Pond with an average horizontal hydraulic gradient of 0.002 ft/ft (**Table 3-4**). The steepening gradient towards the southwest portion of the Ash Pond are consistent with previously the reported gradient trends (NRT/OBG, 2017).

Horizontal hydraulic gradients calculated for the PMP between February and July 2021 between wells APW-03 and APW-04 range from 0.003 to 0.004 ft/ft, with an average horizontal hydraulic gradient of 0.003 ft/ft (**Table 3-4**).

The average of hydraulic gradients between wells and an average effective porosity as derived from geotechnical test data obtained from soil borings completed in 2021 were used to calculate uppermost aquifer and PMP groundwater velocities.

Groundwater velocities in the uppermost aquifer determined in the center portion of the Ash Pond (between AW-08 and AW-06) ranged from approximately 1.7 x 10^{-4} to 4.0 x 10^{-4} ft/day in 2021 with an average of 2.5 x 10^{-4} ft/day. Groundwater velocities determined in the southern portion of the Ash Pond between AW-10 and AW-15 were consistent, ranging from 0.25 to 0.27 ft/day, with an average of 0.26 ft/day (**Table 3-4**). The higher velocities observed in the southern portion of the Ash Pond are a result of coarse-grained materials present there.

Groundwater velocities in the PMP determined in the southeastern portion of the Ash Pond (between APW-03 and APW-04) ranged from 0.35 to 0.53 ft/day, with an average of 0.43 ft/ day (**Table 3-4**).

3.2.7 Groundwater Classification

Per 35 I.A.C. § 620.210, groundwater within the uppermost aquifer at the Ash Pond meets the definition of a Class I – Potable Resource Groundwater based on the following criteria:

- Groundwater in the uppermost aquifer extends 10 feet or more below the land surface.
- Hydraulic conductivity exceeds the 1 x 10^{-4} cm/s criterion (**Table 3-3**).

Field hydraulic conductivity tests performed on the unlithified geologic materials that include moderate permeability sand, silty sand, and clayey gravel units which includes the Lower Cahokia Formation and the bedrock interface) and lithified materials (shales and siltstones of the Carbondale and Modesto Formations) at the EPP had geometric mean hydraulic conductivities exceeding 1 x 10^{-4} cm/s. Based on this information groundwater is classified as Class I – Potable Resource Groundwater.

3.2.8 Methane Observed in Groundwater

Methane, a decomposition product of organic materials, is a colorless, odorless, flammable gas. Methane is known to be present in aquifers throughout Illinois, due to both natural and anthropogenic processes (coal mining). Methane may accumulate in the borehole, well, protective casing or in the general work area near a well or boring. During field activities in 2021, methane was detected above 10 percent of the lower explosive limit (LEL) at borehole monitoring well locations AW-13, AW-14, AW-15, AW-15C, AW-16, AW-17, AW-22, and P002. Levels quickly dissipated after venting the monitoring wells to the atmosphere. A methane monitoring plan was established for the safe completion of field activities, including groundwater sampling at EPP. Anyone completing soil borings or approaching any monitoring well at EPP must follow a methane monitoring plan to manage and mitigate potential hazards associated with the presence of methane gas in groundwater.

3.3 Surface Water Hydrology

3.3.1 Climate

The climate in Bartonville is humid and annual precipitation generally exceeds evapotranspiration. Illinois State Water Survey (ISWS) records from 1989 through 2020 at Peoria, Illinois, which is located northeast of the EPP, indicates precipitation averages 35.3 inches per year. Monthly precipitation averages higher than 3 inches from April through August, and 1 to 3 inches in September through March. On average 16 inches of precipitation occur as snowfall.

As shown below in **Table A** below, ISWS temperature records show average maximum daily temperatures for 1989 to 2020 ranging from above 70 degrees Fahrenheit (°F) in May through September and minimum average daily temperatures that are below freezing December through March.

Table A. Average Monthly Temperature Extremes and Precipitation for Peoria, Illinois.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Maximum Temperature (ºF)	33.3	37.6	49.9	62.5	72.6	81.3	84.4	82.5	76.9	64.5	50.1	37.2	61.2
Minimum Temperature (ºF)	18.3	21.5	31.6	41.8	52.2	61.7	65.4	63.2	55.4	44.1	33.3	22.7	42.7
Precipitation (inches)	1.71	1.60	2.08	3.42	3.93	3.18	3.02	3.10	2.97	2.64	2.35	1.84	35.3
https://www.isws.illinois.edu/warm/stationmeta.asp?site=ICC&from=wx													

3.3.2 Surface Waters

The predominant surface water body in the region is the Illinois River and associated lowland backwater lakes. The Illinois River is located directly adjacent to and upgradient from the Ash Pond. A USGS stream gage (#05568500) for the Illinois River at Kingston Mines, Illinois is located 8.7 miles south and west (downstream) of the EPP. The gage datum elevation is 428 feet NGVD29. Daily gage heights for the period of January 1, 2018 to March 18, 2021 are shown in **Figure A** below. The gage height of 3 feet, representing approximate baseflow, occurs at an elevation of about 431 feet NGVD29. Bordering the east perimeter of the Ash Pond, the river has a normal baseflow elevation of about 431 feet NGVD29.

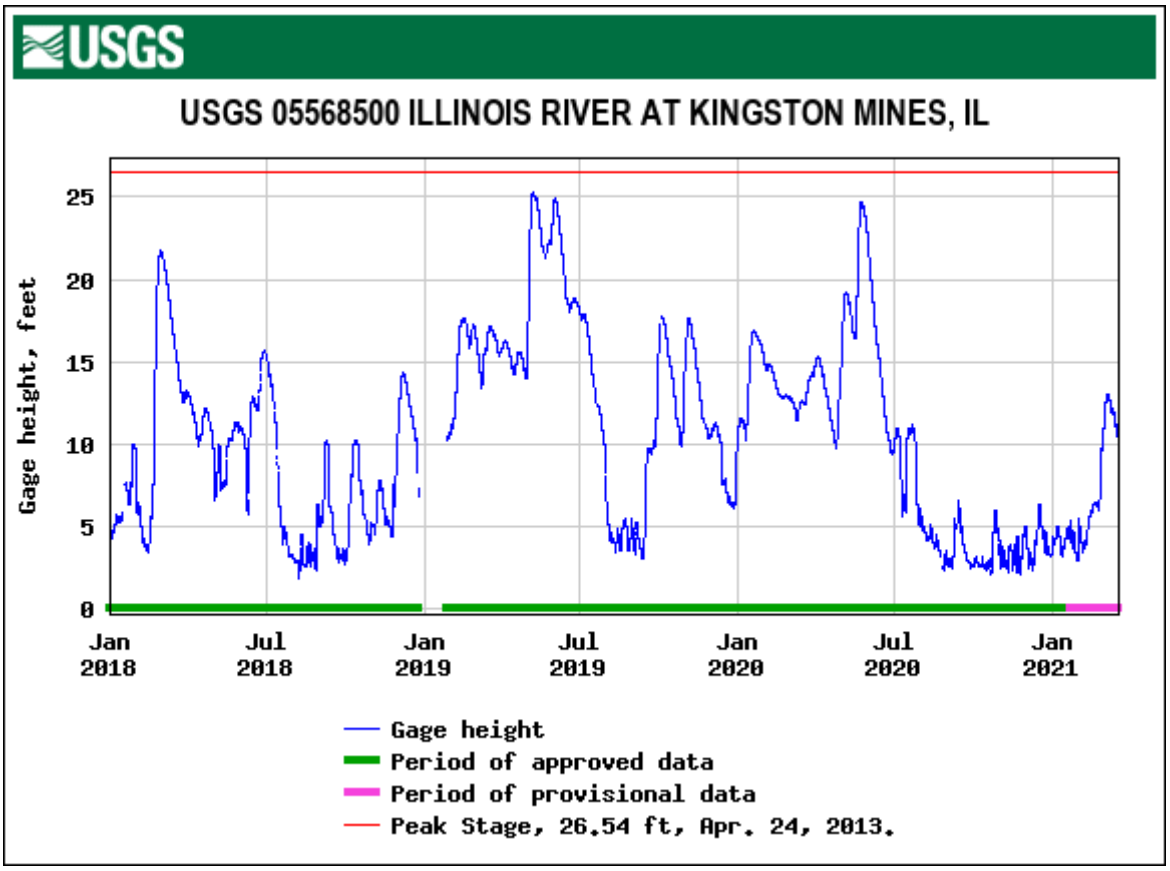


Figure A. Daily Gage Height, January 1, 2018 to March 18, 2021 for USGS Gaging Station 05568500 at the Illinois River at Kingston Mines, Illinois.

A map of surface waters in the vicinity of the Ash Pond is presented in **Appendix B**. The headwaters for the East Branch of Lamarsh Creek are located approximately 0.45 miles northwest of the Ash Pond. The East Branch of the Lamarsh Creek flows southwest to the Lamarsh Creek and ultimately to the Illinois River. Other surface waters in the vicinity include Worley Lake and Pekin Lake, both of which are located across the Illinois River at approximately 0.5 miles from the Ash Pond.

A Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map is not available for Peoria County. A historic (1983) floodplain map indicates that the Ash Pond is located within a Zone C floodplain, and the area surrounding the Ash Pond is within a Zone A13 floodplain (**Appendix G**). Additional information is provided in **Section 5.2**.

4. GROUNDWATER QUALITY

4.1 Summary of Groundwater Monitoring Activities

Between 2010 and 2012, groundwater samples were collected from a subset of wells (APW-01 through APW-04) to assess groundwater quality in the vicinity of the Ash Pond. That assessment included collection of groundwater samples, dissolved analyses of potential indicators of CCR impacts, and comparison to 35 I.A.C. § 620 Groundwater Quality Standards. Results from that assessment indicated no impacts were present from the Ash Pond and the information was reported to IEPA in the *Phase I Hydrogeological Assessment Report* (NRT, 2013). The 2010 to 2012 results are not included in this report.

In 2015 and 2016, additional well installation and groundwater sampling was initiated to meet the requirements of 40 C.F.R. § 257. Groundwater samples were collected, and totals analyses were completed for Appendix III and Appendix IV parameters. In 2021, additional wells were installed to comply with Part 845; wells were sampled for the parameters listed in 35 I.A. C. § 845.600. A review and summary of data from both the 40 C.F.R. § 257 and proposed Part 845 monitoring programs is included in the evaluation of groundwater quality at the Ash Pond.

4.1.1 40 C.F.R. § 257 Program Monitoring and Well Network

The 40 C.F.R. § 257 monitoring well network consists of six monitoring wells screened in the uppermost aquifer, including two background monitoring wells (AP05S and AW-08) and six compliance wells (AW-06, AW-09, AW-10, and AW-11). The boring logs, well construction forms, and other related monitoring well forms for the monitoring well network are included in **Appendix C** of this HCR. The CCR Monitoring Well Network locations are shown on **Figure 3-1**.

Assessment monitoring of these wells was established on April 9, 2018. Details on the procedures and techniques used to fulfill the groundwater sampling and analysis program requirements are found in the Sampling and Analysis Plan for the Ash Pond. Results are discussed in **Section 4.2**.

Groundwater samples are collected and analyzed for the field and laboratory parameters from Appendix III and Appendix IV of 40 C.F.R. § 257 as summarized in **Table B** below.

Table B. 40 C.F.R. § 257 Groundwater Monitoring Program Parameters

Field Parameters[1]			
Groundwater Elevation	pH		
Appendix III Parameters (Total, except TDS)			
Boron	Chloride	Sulfate	
Calcium	Fluoride	TDS	
Appendix IV Parameters (Total)			
Antimony	Cadmium	Lead	Selenium
Arsenic	Chromium	Lithium	Thallium
Barium	Cobalt	Molybdenum	Radium 226 and 228 combined
Beryllium			

[1]Dissolved oxygen, temperature, specific conductance, oxidation/reduction potential, and turbidity are recorded during sample collection

4.1.2 Part 845 Well Installation and Groundwater Monitoring

In 2021, 23 additional monitoring wells (AP05D, AP05S, AP07D, AP07S, APW-02, APW-03, APW-04, AW-05, AW-08, AW-12, AW-13, AW-14, AW-15, AW-15C, AW-15S, AW-16, AW-17, AW-18, AW-19, AW-20, AW-21, AW-22, P002) were installed along the perimeter of the Ash Pond to assess the vertical and horizontal lithology, stratigraphy, chemical properties, and physical properties of geologic layers to a minimum of 100 feet bgs as specified in 35 I.A.C. § 845.620(b). Additionally, three leachate monitoring wells (XPW01A, XPW02, and XPW03) were installed within the Ash Pond to characterize CCR materials and leachate. These locations and samples were discussed in **Section 2.5.1**. The boring logs, well construction forms, and related monitoring well forms for the well network are included in **Appendix C** of this HCR. The well locations are shown on **Figure 3-1**.

Prospective monitoring wells sampled for eight rounds between February and August 2021 and the test results were used to develop this HCR and assess well locations for inclusion in the Part 845 monitoring well network.

Groundwater samples were analyzed for 35 I.A.C. § 845.600 parameters summarized in **Table C** below. Part 845 groundwater monitoring results are included below in **Section 4.2**. A summary of groundwater analytical results is presented in **Table 4-1**.

Table C. Part 845 Groundwater Monitoring Program Parameters

Field Parameters[1]			
pH	Turbidity	Groundwater Elevation	
Metals (Total)			
Antimony	Boron	Cobalt	Molybdenum
Arsenic	Cadmium	Lead	Selenium
Barium	Calcium	Lithium	Thallium
Beryllium	Chromium	Mercury	
Inorganics (Total)			
Fluoride	Sulfate	Chloride	TDS
Other (Total)			
Radium 226 and 228 combined			

[1]Dissolved oxygen, temperature, specific conductance, and oxidation/reduction potential were recorded during sample collection.

4.2 Groundwater Monitoring Results and Analysis

Groundwater data collected from the 40 C.F.R. § 257 network monitoring wells between 2015 and 2021 and from the wells installed in 2021 were evaluated with respect to standards included in 35 I.A.C. § 845.600(a)(1). The groundwater analytical results are summarized in **Table 4-1** and discussed in the subsections below and groundwater field parameters are included in **Table**

4-2. Results indicate that the parameters discussed in the following sections were greater than the applicable 35 I.A.C. § 845.600(a)(1) standards and are considered potential exceedances[1].

4.2.1 Arsenic

Arsenic was detected at concentrations greater than the GWPS (0.010 milligrams per liter [mg/L]) in eleven uppermost aquifer wells: downgradient wells AW-05, AW-06, AW-09, AW-10, AW-11, AW-13, AW-14, AW-19 and AW-20 and upgradient wells AP05S and AW-08. Concentrations ranged from non-detect (at a reporting limit of 0.001 mg/L) to 0.097 mg/L and have shown temporal variability with concentrations greater than and less than the GWPS at all wells. The median concentration of arsenic in these uppermost aquifer wells was 0.01 mg/L.

PMP wells APW-01 and APW-04 had arsenic concentrations greater than the GWPS during sampling events in 2021. Concentrations of arsenic in these wells range from 0.0054 to 0.025 mg/L with a median concentration of 0.0127 mg/L.

Bedrock well AP07D had arsenic concentrations greater than the GWPS during three of six events in 2021. The concentrations at AP07D ranged from 0.0044 to 0.057 mg/L and results are consistent with variability seen in other parameters. The median concentration of arsenic in bedrock well AP07D was 0.0209 mg/L. Bedrock well AW-15C had arsenic concentrations greater than the GWPS during one event in 2021 at 0.011 mg/L.

4.2.2 Barium

Barium was detected at concentrations greater than the GWPS (2.0 mg/L) in three uppermost aquifer wells (AW-10, AW-11, and AW-15). These wells are located around the southern portion of the Ash Pond, in the locations where the bedrock is at lower elevation and concentrations are variable. AW-10 and AW-11 have not exceeded the standard since 2018, and AW-15 only exceeded the standard once in 2021 shortly after installation of the well. Barium concentrations have declined at AW-15 following the initial sampling.

No PMP wells had barium concentrations greater than the GWPS.

Bedrock well AW-15C had barium concentrations greater than the GWPS during all events sampled in 2021 with a median barium concentration of 3.3 mg/L. Bedrock well AP07D had concentrations greater than the GWPS during 50 percent of events sampled in 2021 and fluctuated significantly, ranging from 0.31 to 8.6 mg/L between sampling events. The median barium concentration in bedrock well AP07D was 1.95 mg/L.

4.2.3 Beryllium

Beryllium was detected at concentrations greater than the GWPS (0.004 mg/L) in four uppermost aquifer wells (AW-08, AW-09, AW-10, and AW-11). Three of the uppermost aquifer wells (AW-08, AW-09, and AW-10) have not had beryllium concentrations greater than the GWPS since 2016, and AW-11 has not had beryllium concentrations greater than the GWPS since 2018.

[1] Potential exceedances include results reported during the eight rounds of baseline groundwater monitoring that are greater than the applicable 35 I.A.C. § 845.600(a)(1) standards. The results are considered potential exceedances because they were compared directly to the standard and did not include an evaluation of background groundwater quality or apply the statistical methodologies proposed in the Groundwater Monitoring Plan (GMP). For simplicity, "GWPS" will be used hereafter in discussing potential exceedances. Exceedances will be determined following IEPA approval of the GMP.

No PMP wells have had beryllium concentrations greater than the GWPS.

Bedrock well AP07D had beryllium concentrations greater than the GWPS during three events in 2021. The beryllium concentrations at AP07D ranged from non-detect (at a reporting limit of 0.001 mg/L) to 0.017 mg/L with a median concentration of 0.0057 mg/L.

4.2.4 Boron

Boron is a primary indicator parameter for CCR leachate impacts on groundwater quality. Boron was detected at concentrations greater than the GWPS (2 mg/L) in five uppermost aquifer wells (AW-05, AW-18, AW-19, AW-20 and AW-21). At AW-18, concentrations of boron are variable with results both greater than and less than the GWPS, with the most recent results generally less than the GWPS. Uppermost aquifer wells AW-05, AW-19, AW-20, and AW-21 have consistently had concentrations greater than the GWPS during all sampling events in 2021. These wells are located on the west-northwest and north side of the Ash Pond. Concentrations in these wells range from 0.41 to 12 mg/L, with the most elevated boron concentrations occurring in AW-21.

Two PMP wells located north and southwest of the Ash Pond (AP07S screened in a sand lens and AW-15S screened in clay near the base of the Ash Pond), reported boron concentrations greater than the GWPS during all sampling events in 2021. Concentrations of boron in these wells range from 5.4 to 12 mg/L. Based on the eight rounds collected in 2021, boron concentrations in AW-15S and AP07S appear to be consistently within this range. No other wells screened within PMPs have had boron concentrations greater than the GWPS.

Concentrations of boron in bedrock wells (AP05D, AP07D, and AW-15C) range from 0.6 to 1.8 mg/L which are consistent with concentrations detected in the Peoria region (Burch and Kelley, 1993).

4.2.5 Chloride

Chloride was detected at concentrations greater than the GWPS (200 mg/L) in one uppermost aquifer well (AW-05). Concentrations of chloride in this well have declined, similar to boron and sulfate, and groundwater from AW-05 has not exceeded the standard since 2017.

In samples from PMP well APW-04, three of five samples collected in 2021 had concentrations greater than the GWPS with concentrations increasing between sampling events. The median concentration of chloride in APW-04 was 220 mg/L. This well is located near the southeast corner of the unit. One sample collected 2021 from PMP well APW-01, located northeast and upgradient of the unit, had a concentration greater than the GWPS.

Bedrock wells AP05D (background) and AP07D have consistently reported chloride concentrations above the standard in all sampling events in 2021. Concentrations in these wells range from 230 to 830 mg/L, which are generally greater than those measured in the Ash Pond. Concentrations are similar to those detected in groundwater in the Peoria region (Burch and Kelley, 1993).

4.2.6 Chromium

Chromium was detected at concentrations greater than the GWPS (0.1 mg/L) in three uppermost aquifer wells (AW-09, AW-10, and AW-11). The three uppermost aquifer wells have only had chromium concentrations greater than the GWPS once each with the last occurrence in 2018 (AW-11).

No PMP wells have had chromium concentrations greater than the GWPS.

Bedrock well AP07D has had chromium concentrations greater than the GWPS during three events in 2021. The concentrations ranged from non-detect (at a reporting limit of 0.004 mg/L) to 0.59 mg/L and the median concentration of chromium in bedrock well AP07D was 0.175 mg/L. The variability of chromium is consistent with other parameters at this location.

4.2.7 Cobalt

Cobalt was detected at concentrations greater than the GWPS (0.006 mg/L) in seven downgradient uppermost aquifer wells (AW-05, AW-06, AW-09, AW-10, AW-11, AW-14 and AW-17). Cobalt was also detected at concentrations greater than the GWPS in upgradient uppermost aquifer well AP05S. In general, the frequency of cobalt concentrations greater than the GWPS has declined in these wells.

Cobalt was detected at concentrations greater than the GWPS in PMP well APW-01 during two sampling events in 2021. PMP well AW-15S reported cobalt concentrations greater than the GWPS only during the initial event following installation in 2021.

Bedrock well AP07D had cobalt concentrations greater than the GWPS during five of six sampling events in 2021. The concentrations ranged from non-detect (at a reporting limit of 0.002 mg/L) to 0.290 mg/L, with similar variability to other parameters. The median concentration of cobalt at bedrock well AP07D was 0.104 mg/L.

4.2.8 Fluoride

Fluoride was detected at concentrations greater than the GWPS (4.0 mg/L) during two of eight sampling events in 2021 at downgradient uppermost aquifer well AW-18.

No PMP wells had fluoride concentrations greater than the GWPS.

No bedrock wells had fluoride concentrations greater than the GWPS.

4.2.9 Lead

Lead was detected at concentrations greater than the GWPS (0.0075 mg/L) in six uppermost aquifer wells (AW-05, AW-06, AW-09, AW-10, AW-11, and AW-22). Lead was also detected at concentrations greater than the GWPS in upgradient uppermost aquifer well AP05S.

Lead was detected at concentrations greater than the GWPS in PMP well APW-01 during one sampling event in 2021. PMP well AW-15S had lead concentrations greater than the GWPS during the initial event following installation in 2021.

Bedrock well AP07D has had lead concentrations greater than the GWPS during five events in 2021. The concentrations ranged from non-detect (with a reporting limit of 0.001 mg/L) to 0.270 mg/L; the median concentration of lead in bedrock well AP07D was 0.09 mg/L. The variability of lead concentrations is consistent with other parameters at this location.

4.2.10 Lithium

Lithium was detected at concentrations greater than the GWPS (0.04 mg/L) in nine downgradient uppermost aquifer wells (AW05, AW-06, AW-09, AW-10, AW-11, AW-15, AW-16, AW-17, and AW-18). Lithium was also detected greater than the GWPS in upgradient uppermost aquifer AP05S.

No PMP wells have had lithium concentrations greater than the GWPS.

Bedrock wells AP05D, AP07D, and AW-15C have consistently reported lithium concentrations greater than the GWPS in all sampling events in 2021. Lithium concentrations ranged from 0.045 to 0.72 mg/L with a median concentration of 0.065 mg/L.

4.2.11 pH

pH was measured below the lower GWPS of 6.5 standard units (SU) in upgradient uppermost aquifer well AP05S and seven downgradient uppermost aquifer wells (AW-08, AW-12, AW-16, AW-17, AW-18, AW-19, and AW-20), during one sampling event in 2021.

pH was also measured below the lower GWPS in PMP wells AP07S, APW-03, and P002 during the same sampling event.

No bedrock wells had pH measurements outside of the range between the lower and upper (9.0 SU) GWPS.

4.2.12 Radium 226 and 228 Combined

Radium 226 and 228 combined was detected at concentrations greater than the GWPS (5 picoCuries per liter [pCi/L]) in five uppermost aquifer wells (AW-09, AW-10, AW-11, AW-15, and AW-16). Uppermost aquifer wells AW-09, AW-10, and AW-11 have not had radium 226 and 228 combined concentrations greater than the GWPS since 2018. Uppermost aquifer well AW-15 has had radium 226 and 228 combined concentrations greater than the GWPS during two events in 2021 with a median concentration of 4.14 pCi/L. Uppermost aquifer well AW-16 had radium 226 and 228 combined concentrations greater than the GWPS five times in 2021 with a median concentration of 5.63 pCi/L. Upgradient uppermost aquifer well AP05S had radium 226 and 228 combined concentrations greater than the GWPS three times in 2021 with a median concentration of 2.68 pCi/L.

No PMP wells have had radium 226 and 228 combined concentrations greater than the GWPS.

Bedrock wells AP07D and AW-15C have had radium 226 and 228 combined concentrations greater than the GWPS during three events in 2021. The concentrations ranged from 0.268 to 23 pCi/L with median concentrations of 8.22 pCi/L (AP07D) and 5.09 pCi/L (AW-15C).

4.2.13 Sulfate

Sulfate is also a primary indicator parameter of CCR leachate impacts on groundwater quality. Sulfate was detected at concentrations greater than the GWPS (400 mg/L) in uppermost aquifer well AW-05 during one event in July 2017.

PMP wells AP07S and AW-15S have had sulfate concentrations greater than the GWPS during multiple events in 2021. The concentrations ranged from 150 to 570 mg/L with a median concentration of 480 mg/L.

No bedrock wells had sulfate concentrations greater than the GWPS.

4.2.14 Thallium

Thallium was detected at concentrations greater than the GWPS (0.002 mg/L) at uppermost aquifer well AW-10 during one sampling event in 2016.

No PMP wells have had thallium concentrations greater than the GWPS.

Thallium was detected at concentrations greater than the GWPS in bedrock well AP07D during one sampling event in 2021.

4.2.15 Total Dissolved Solids

Total Dissolved Solids (TDS) was detected at concentrations greater than the GWPS (1,200 mg/L) at uppermost aquifer well AW-05 during four sampling events from 2016 to 2017 with a median concentration of 1,100 mg/L.

TDS was detected at similar concentrations greater than the GWPS in PMP wells AP07S and AW-15S during multiple sampling events in 2021.

TDS was detected at concentrations greater than the GWPS in bedrock wells AP05D, AP07D, and AW-15C. Concentrations ranged from 820 mg/L to 2,600 mg/L with a median concentration of 1,200 mg/L.

5. EVALUATION OF POTENTIAL RECEPTORS

5.1 Water Well Survey

A potable water well inventory was completed in 2021 utilizing federal and state databases to assess nearby pumping wells, drinking water receptors, and other uses of water in the vicinity of the Ash Pond. The following sources of information were queried to identify well locations, drinking water receptors, and other uses of water within 1,000 meters of the Ash Pond boundary:

- ISGS Illinois Water and Related Wells (ILWATER) Map[1]

Based on records obtained from the ISGS ILWATER, there are 14 wells located outside of the EPP property within 1,000 meters of the Ash Pond (**Appendix B**). These included seven engineering test wells, three industrial-commercial wells, three farm/domestic wells, and one monitoring well. Three of the 14 identified offsite water wells are downgradient of the Ash Pond, two of which are identified as water wells, and one is identified as plugged and abandoned. No potable wells were identified downgradient of the Ash Pond. Primary uses are industrial applications, monitoring, and engineering test wells.

5.2 Surface Water

A search was performed utilizing the United States Fish and Wildlife Service (USFWS) Wetlands Mapper[2] and the USGS National Map [3] for surface water bodies within 1,000 meters of the Ash Pond (**Appendix B**). The predominant surface water body in the region is the Illinois River and associated lowland backwater lakes. The Illinois River is located approximately 900 feet to the east and upgradient from the Ash Pond. As discussed in **Section 3.3.2**, a USGS stream gage (#05568500) for the Illinois River at Kingston Mines, Illinois is located 8.7 miles south and west (downstream) of the EPP. The gage datum elevation is 428 feet NGVD29. Daily gage heights for the period of January 1, 2018 to March 18, 2021 are shown on **Figure A** in **Section 3.3.2**. The gage height of 3 feet, representing approximate baseflow, occurs at an elevation of about 431 feet NGVD29.

The headwaters for the East Branch of Lamarsh Creek are located approximately 0.45 miles northwest of the Ash Pond. The East Branch of the Lamarsh Creek flows southwest to the Lamarsh Creek and ultimately to the Illinois River. Other surface waters in the vicinity include Worley Lake and Pekin Lake, both of which are located across the Illinois River at a distance of approximately 0.5 miles from the Ash Pond.

Additional surface waters indicated in the USFWS Wetland Mapper and USGS National Map include several freshwater forested/shrub wetlands located generally to the north, west and southeast of the EPP, several freshwater ponds ranging in size from 0.2 acres to approximately 3.7 acres and located generally to the north and west of the Ash Pond, and two freshwater emergent wetlands located to the northeast of the EPP. A map of wetlands and surface waters in the vicinity of the Ash Pond is presented in **Appendix B**.

[1] ISGS ILWATER Map: https://prairieresearch.maps.arcgis.com/apps/webappviewer/index.html?id=e06b64ae0c814ef3a4e43a191cb57f87
[2] USFWS Wetlands Mapper: https://www.fws.gov/wetlands/data/mapper.html
[3] USGS National Map: https://apps.nationalmap.gov/viewer/

The USGS National Map places the EPP within the Pekin Lake-Illinois River subwatershed (Hydrologic Unit Code [HUC] 071300030304), which is part of the Lamarsh Creek-Illinois River watershed (HUC 0713000303) and located within the larger Lower Illinois-Lake Chautauqua subbasin (HUC 07130003).

A FEMA Flood Insurance Rate Map is not available for Peoria County. A historic (1983) floodplain map indicates that the Ash Pond is located within a Zone C floodplain, and the area surrounding the Ash Pond is within a Zone A13 floodplain (**Appendix G**). The map shows that the area immediately surrounding the Ash Pond is defined as Zone A, indicating a 100-year flood boundary, that has a 1 percent chance of being equaled or exceeded in any given year.

5.3 Nature Preserves, Historic Sites, Endangered/Threatened Species

A search of the Illinois Department of Natural Resources (IDNR) Natural Heritage Database[4] for natural areas and protected areas within 1,000 meters of the Ash Pond was performed. No natural or protected areas were identified within 1,000 meters of the Ash Pond (**Appendix B**).

The IDNR Natural Heritage Database Threatened and Endangered Species by County[5] lists 24 threatened and endangered species as located within Peoria County, including nine endangered and 15 threatened species. Habitats for endangered or threatened species are identified at the county level only (**Appendix B**).

Additionally, a search of the IDNR Historic Preservation Division[6] database for historic sites in the vicinity of the Ash Pond yielded no results within 1,000 meters of the Ash Pond (**Appendix B**). The Illinois State Archaeological Survey (ISAS)[7] databases that do not require credentials to access were also searched and yielded no results within 1,000 meters of the Ash Pond.

[4] IDNR Natural Heritage Database: https://www2.illinois.gov/dnr/conservation/NaturalHeritage/Pages/NaturalHeritageDatabase.aspx
[5] Illinois Threatened and Endangered Species by County: https://www2.illinois.gov/dnr/ESPB/Documents/ET_by_County.pdf
[6] IDNR Historic Preservation Division: https://www2.illinois.gov/dnrhistoric/Pages/default.aspx
[7] ISAS: https://www.isas.illinois.edu/

6. CONCLUSIONS

Hydrogeologic characterization of the EPP was originally developed as part of the Site Characterization and Groundwater Monitoring Plan for Coal Combustion Product (CCP) Impoundment, Ameren Energy Resources Generating, E.D. Edwards Plant, Peoria County, IL (Rapps, 2009) and most recently updated for this HCR. Results of these hydrogeologic studies were reintroduced in this HCR and updated to include geologic, hydrogeologic, and groundwater quality data collected with a focus on the Ash Pond (Part 845 regulated CCR Unit and subject of this HCR).

The data were summarized and evaluated for changes in groundwater conditions since the previous investigations; available groundwater quality data for the Ash Pond was compared to the Part 845 Standards.

The results of the hydrogeologic and groundwater quality evaluation are:

- There are three principal types of unlithified materials above the bedrock in the vicinity of the Ash Pond, these include the following in descending order: Fill, predominantly coal ash (fly ash, bottom ash, and slag) within the Ash Pond, and materials within constructed berms and railroad embankments, are present around the Ash Pond; Upper Cahokia Formation (fine-grained deposits of the Cahokia Formation ranging in thickness at the Ash Pond from 5 to 40 feet); and Lower Cahokia Formation (course-grained deposits of the Cahokia Formation consisting of sands and gravels ranging in thickness at the Ash Pond from 1 to 4 feet). Depth to bedrock at the Ash Pond ranges from approximately 20 feet at AW-05 in the north to 58 feet at AW-16 in the southwest.
- Four distinct water bearing layers have been identified at the Ash Pond based on stratigraphic relationships and common hydrogeologic characteristics, these include the following in descending order: Ash Unit (saturated CCR consisting primarily of fly ash within the ash pond, and having a geometric mean horizontal hydraulic conductivity of 1.4×10^{-3} cm/s); Upper Cahokia Formation/PMP (low permeability clays and silts of the Upper Cahokia Formation and discontinuous lenses of sand that have been identified as PMPs); uppermost aquifer (thin, generally less than 4 feet thick sand, silty sand, and clayey gravel units which includes the Lower Cahokia Formation and the bedrock interface with a geometric mean horizontal hydraulic conductivity of 1.7×10^{-4} cm/s); Bedrock Confining Unit (generally low permeability shales and siltstones with interbedded sandstone) with a geometric mean horizontal hydraulic conductivity of 3.2×10^{-6} cm/s.
- Groundwater within the uppermost aquifer flows predominantly to the west and south, with a minor component to the north. Groundwater flow occurs primarily in the more permeable zones within the Lower Cahokia Formation.
- Groundwater velocities in the uppermost aquifer determined in the center portion of the Ash Pond (between AW-08 and AW-06) ranged from approximately 1.7×10^{-4} to 4.0×10^{-4} ft/day in 2021 with an average of 2.5×10^{-4} ft/day. Groundwater velocities determined in the southern portion of the Ash Pond between AW-10 and AW-15 were consistent with an average of 0.26 ft/day. The higher velocities observed in the southern portion of the Ash Pond are a result of coarse-grained materials present there.

- As determined by the detailed geologic information provided, and the hydrogeologic and groundwater quality data, groundwater within the uppermost aquifer at the Ash Pond is classified as Class I – Potable Resource Groundwater.
- Potential exceedances of 35 I.A.C. § 845.600 GWPSs were detected in monitoring wells at the Ash Pond are summarized as follows:
  - Arsenic – at downgradient uppermost aquifer wells AW-05, AW-06, AW-09, AW-10, AW-11, AW-13, AW-14, AW-19 and AW-20; upgradient uppermost aquifer wells AP05S and AW-08; PMP monitoring wells APW-01 and APW-04; and downgradient bedrock wells AP07D and AW-15C.
  - Barium – at downgradient uppermost aquifer wells AW-10, AW-11, and AW-15; and bedrock monitoring wells AW-15C and AP07D.
  - Beryllium – at downgradient uppermost aquifer wells AW-08, AW-09, AW-10, and AW-11; and bedrock monitoring well AP07D.
  - Boron - at downgradient uppermost aquifer wells AW-05, AW-18, AW-19, AW-20, and AW-21; and PMP wells AP07S and AW-15S.
  - Chloride – at downgradient uppermost aquifer well AW-05; PMP monitoring wells APW-01 and APW-04; and at bedrock monitoring wells AP05D and AP07D.
  - Cobalt - at downgradient uppermost aquifer wells AW-05, AW-06, AW-09, AW-10, AW-11, AW-14, and AW-17; PMP monitoring wells APW-01 and AW-15S; downgradient bedrock well AP07D; and upgradient well AP05S.
  - Lead – at downgradient uppermost aquifer wells AW-05, AW-06, AW-09, AW-10, AW-11, and AW-22; upgradient uppermost aquifer well AP05S; PMP monitoring wells APW-01 and AW-15S; and downgradient bedrock well AP07D.
  - Lithium - at downgradient uppermost aquifer wells AW-05, AW-06, AW-09, AW-10, AW-11, AW-15, AW-16, AW-17, and AW-18; upgradient uppermost aquifer well AP05S; downgradient bedrock wells AP07D and AW-15C; and upgradient bedrock well AP05D.
  - Radium 226 and 228 combined – at downgradient uppermost aquifer wells AW-09, AW-10, AW-11, AW-15 and AW-16; upgradient uppermost aquifer well AP05S; and downgradient bedrock wells AP07D and AW-15C.
  - Sulfate – at downgradient uppermost aquifer well AW-05, and downgradient PMP wells AP07S and AW-15S.
  - TDS - at downgradient uppermost aquifer well AW-05; downgradient PMP wells AP07S and AW-15S, and bedrock monitoring wells AP05D, AP07D, and AW-15C.
  - Chromium, fluoride, pH, and thallium were also detected at concentrations and/or measured (for pH) outside of their respective GWPSs at one or more locations during monitoring. However, the occurrences were infrequent and/or isolated and individual locations are not listed.

This HCR satisfies Part 845 content requirements specific to 35 I.A.C. § 845.620(b) (Hydrogeologic Site Characterization) for the Ash Pond at the EPP.

7. REFERENCES

AECOM, 2016a. *Geotechnical Data Report for Dynegy Edwards Power Station.*

AECOM, 2016b. *History of Construction. USEPA Final CCR Rule 40 C.F.R. Part 257.73(c). Edwards Power Station. Bartonville, IL*. Accessed at https://www.luminant.com/ccr/ on June 7, 2021.

Berg, R.C., and J.P. Kempton, 1987. Stack-Unit Mapping of Geologic Materials in Illinois to a Depth of 15 Meters: Illinois State Geological Survey, Circular 542, 23 p.

Berg, R.C., J.P. Kempton, and K. Cartwright, 1984. *Potential for Contamination of Shallow Aquifers in Illinois: Illinois State Geological Survey, Circular 532, 30 p.*

Burch Stephen L., and Douglas J. Kelley, 1993. *Peoria-Pekin Regional Ground-Water Quality Assessment. Illinois State Water Survey, Champaign, Research Report 124, 1993.*

Foth, September 8, 2017. *Antidegradation Alternative Analysis, Dynegy Midwest Generation, LLC, Edwards Power station, Bartonville, Illinois.*

Haley & Aldrich, Inc., February 12, 2018*. Memorandum: Ash Pond – Underlying Clay and Depth of CCR Evaluation, Edwards Station, Bartonville, IL. File No. 129319-003*

Haley & Aldrich, Inc., October 16, 2018*. Memorandum: Location Restriction Demonstration - Placement Above the Uppermost Aquifer, Ash Pond, Edwards Power Station, Bartonville, IL. File No. 129788.*

Herzog, B.L., B.J. Stiff, C.A. Chenoweth, K.L. Warner, J.B. Sieverling, and C. Avery, 1994. *Buried Bedrock Surface of Illinois: Illinois State Geological Survey map, scale 1:500,000*

Illinois Department of Natural Resources (IDNR), 2021. Illinois Threatened and Endangered Species by County: https://www2.illinois.gov/dnr/ESPB/Documents/ET_by_County.pdf

Illinois Department of Natural Resources (IDNR), 2021. *Nature Preserve Directory*. Accessed from https://www2.illinois.gov/dnr/INPC/Pages/NaturePreserveDirectory.aspx

Illinois Environmental Protection Agency (IEPA), 2015b. *Modified NPDES Permit IL0001970*. *Approved August 28, 2015.*

Illinois Environmental Protection Agency (IEPA), 2020b. *Coal Combustion Residual Surface Impoundments* website, accessed from https://www2.illinois.gov/epa/topics/water-quality/watershed-management/ccr-surface-impoundments/Pages/default.aspx.

Illinois Natural Heritage Database, 2020. *Illinois Threatened and Endangered Species by County as of December 2020*. Accessed from https://www2.illinois.gov/dnr/ESPB/Documents/ET%20List%20Review%20and%20Revision/Illinois%20Threatened%20and%20Endangered%20Species%20by%20County.pdf

Illinois State Geological Survey (ISGS), 2019. *Directory of Coal Mines in Illinois, Peoria County*. Accessed from https://isgs.illinois.edu/research/coal/maps/county/peoria

Illinois State Geological Survey (ISGS), 2021. *Illinois Water & Related Wells Map (ILWATER)*. Accessed from https://prairie-

research.maps.arcgis.com/apps/webappviewer/index.html?id=e06b64ae0c814ef3a4e43a191cb57f87

Illinois State Water Survey (ISWS), 2021. *Official Climate Normals from 1989-2020, Peoria, Illinois*. Accessed from https://www.isws.illinois.edu/warm/stationmeta.asp?site=ICC&from=wx

Kolata, D.R., 2005. *Bedrock Geology of Illinois: Illinois State Geological Survey map, scale 1:500,000.*

Natural Resource Technology, Inc. (NRT), March 19, 2013*. Phase I Hydrogeological Assessment Report, Coal Combustion Product Impoundment, E.D. Edwards Energy Center, Peoria County IL.*

Natural Resources Technology, Inc. (NRT), October 2017. Sampling and Analysis Plan, Final, Edwards Ash Pond, Edwards Power Station, Bartonville, Illinois, Project No. 2285, Revision 0.

Natural Resource Technology Inc., an OBG Company (NRT/OBG), October 17, 2017. *Hydrogeologic Monitoring Plan – Edwards Ash Pond.*

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2021. *Groundwater Monitoring Plan. Edwards Ash Pond*. Edwards Power Plant. Bartonville, Illinois.

Rapps Engineering & Applied Science, December 11, 2009. Site Characterization and Groundwater Monitoring Plan for CCP Impoundment, Ameren Energy Resources Generating, E.D. Edwards Plant, Peoria County, IL.

USGS, 2021. Daily Gage Height, January 1, 2018 to March 18, 2021 for USGS Gaging Station 05568500 at the Illinois River at Kingston Mines, Illinois. Accessed 10 May 2021 at URL: https://waterdata.usgs.gov/il/nwis/uv/?05568500

Willman, H.B., and J.C. Frye, 1970. Pleistocene Stratigraphy of Illinois: Illinois State Geological Survey, Bulletin 94, 204 p.

Willman, H.B., J.C. Frye, J.A. Simon, K.E. Clegg, D.H. Swann, E. Atherton, C. Collinson, J.A. Lineback, T.C. Buschbach, and H.B. Willman, 1967. Geologic Map of Illinois: Illinois State Geological Survey map, scale 1:500,000.

TABLES

TABLE 2-1. GEOTECHNICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Field Location ID	Top of Sample (ft bgs)	Bottom of Sample (ft bgs)	Moisture Content (%)	Dry Density (pcf)	Specific Gravity	Total Porosity [1]	Vertical Hydraulic Conductivity (cm/s)	LL	PL	PI	Laboratory USCS	Gravel (%)	Sand (%)	Fines (%)
CCR															
XPW01 (20-22)	XPW01	20	22	43.7	69.8	2.381	53%	1.18E-05	51	53	NP	SM	0	68.9	31.1
XPW01A (41-41.5)	XPW01A	41	41.5	35.1	71.7	2.378	52%	6.77E-06	60	43	17	MH	0	13.7	86.3
XPW02 (10-12)	XPW02	10	12	45.1	67.5	2.414	55%	1.20E-05	52	47	5	MH	0.5	28.1	71.4
XPW02 (22-24)	XPW02	22	24	33.4	77.1	2.335	47%	2.08E-06	38	30	8	ML	0	4.1	95.9
XPW02 (45.5-46.5)	XPW02	45.5	46.5	41.7	73.5	2.397	51%	1.00E-05	39	33	6	ML	0.1	37.4	62.5
XPW03 (10-12)	XPW03	10	12	43.8	68	2.388	54%	3.29E-05	36	29	7	ML	0.4	27.2	72.4
Upper Cahokia Formation															
AW-13A (5-7)	AW-13A	5	7	25.2	96.5	2.661	42%	4.72E-08	30	14	16	CL	0	30.3	69.7
AW-15 (20-22)	AW-15	20	22	27.9	85.8	2.694	49%	2.87E-08	57	19	38	CH	0	2.0	98
AW-20 (15-17)	AW-20	15	17	35.1	83.9	2.690	50%	7.23E-08	47	18	29	CL	0	7.8	92.2
AW-22 (30-32)	AW-22	30	32	23.2	101.3	2.700	40%	1.74E-07	22	13	9	SC	0	57.4	42.6

[O:LTA 7/13/21, U: SSW 08/13/21; C:CJC 08/16/21; U: LDC 09/16/21; C: SSW 09/16/21]

Notes:

[1] Porosity calculated as relationship of bulk density to particle density ($n = 100[1- (p_b/p_d)]$)
bgs = below ground surface
% = Percent
CCR = coal combustion residuals
cm/s = centimeters per second
ft = foot/feet
LL = Liquid limit
NP = Non Plastic
pcf = pounds per cubic foot
PI = Plasticity Index
PL = Plastic Limit

USCS = Unified Soil Classification System
CH = Fat Clay
CL = Lean Clay
MH = Elastic Silt
ML = Silt
SC = Clayey Sand
SM = Silty Sand
SP = Poorly Graded-Sand

TABLE 2-2. ASH ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Depth (ft BGS)	Sample Date	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Boron (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Lead (mg/kg)	Lithium (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Selenium (mg/kg)	Thallium (mg/kg)
XPW01	17-19	01/08/2021	<6.6	24	840	4	170	7.5	67	11	90	47	<0.44	25	4.9	<2.2
XPW01A	40.5-42.5	01/08/2021	<7	22	190	4.7	700	11	37	4.7	93	<12	<0.46	11	4	<2.3
XPW02	24-25	01/09/2021	20	72	160	6.8	400	2.3	60	19	76	20	<0.32	7	5.5	<1.6
XPW02	43-45	01/09/2021	8.9	42	94	8.3	840	8.5	84	19	140	<91	<0.36	14	6.5	2.1
XPW03	13-15	01/09/2021	<5.5	8	1300	2.2	500	<1.8	27	6.1	14	33	<0.37	3.2	2.2	<1.8
XPW03	35-37	01/09/2021	<7	37	600	5.8	970	20	65	8	130	20	<0.47	11	3.6	<2.3

Notes:
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method.
BGS = below ground surface
ft = feet
mg/kg = milligrams per kilogram

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TABLE 2-3. POREWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)
XPW01A	02/11/2021	0.0032	0.069	0.04	<0.001	18	0.0023	39	93	<0.004	<0.002	<0.25	0.0087	0.64	<0.0002	4	12.0	0.256	0.014	210	<0.001
XPW01A	03/04/2021	<0.003	0.082	0.031	<0.001	15	0.0017	39	83	<0.004	<0.002	<0.25	<0.001	0.57	<0.0002	5	11.4	0.275	0.01	210	<0.001
XPW01A	03/23/2021	<0.003	0.072	0.028	<0.001	15	0.0015	36	91	<0.004	<0.002	<0.25	<0.001	0.61	<0.0002	4.6	11.2	0.261	0.0089	210	<0.001
XPW01A	04/12/2021	<0.003	0.088	0.029	<0.001	16	0.0014	38	93	<0.004	<0.002	<0.25	0.0011	0.64	<0.0002	4.3	11.9	0.233	0.011	220	<0.001
XPW01A	05/04/2021	0.0042	0.079	0.034	<0.001	17	0.0011	51	47	<0.004	<0.002	<0.25	<0.001	0.67	<0.0002	3.8	11.9	0.425	0.011	210	<0.001
XPW01A	07/21/2021	<0.003	0.096	0.032	<0.001	19	0.0012	52	96	<0.004	<0.002	<0.25	<0.001	0.72	<0.0002	3.3	11.8	0.604	0.0095	230	<0.001
XPW02	02/11/2021	<0.003	0.13	0.022	<0.001	15	0.0013	40	110	<0.004	<0.002	0.3	0.0043	0.34	0.00021	2.9	12.2	0.548	0.13	800	<0.001
XPW02	03/03/2021	<0.003	0.16	0.017	<0.001	14	0.0011	37	110	<0.004	<0.002	0.294	<0.001	0.33	0.00022	3.2	11.9	0.179	0.14	840	<0.001
XPW02	03/23/2021	<0.003	0.15	0.017	<0.001	16	<0.001	37	120	<0.004	<0.002	0.313	<0.001	0.32	<0.0002	2.8	11.6	0.101	0.14	890	<0.001
XPW02	04/12/2021	<0.003	0.18	0.015	<0.001	13	<0.001	27	110	<0.004	<0.002	0.324	<0.001	0.34	0.00021	2.9	12.2	0.464	0.15	880	<0.001
XPW02	05/04/2021	<0.003	0.18	0.022	<0.001	15	<0.001	29	120	<0.004	<0.002	0.361	<0.001	0.3	<0.0002	3.3	12.2	0.133	0.15	950	<0.001
XPW02	07/22/2021	<0.003	0.2	0.018	<0.001	14	0.001	28	130	<0.004	<0.002	0.412	<0.001	0.32	<0.0002	3	12.1	0.427	0.17	970	<0.001
XPW03	02/11/2021	<0.003	0.026	0.071	<0.001	5.4	0.0013	50	96	<0.004	<0.002	0.265	<0.001	0.18	<0.0002	3.1	11.9	0.194	0.024	270	<0.001
XPW03	03/03/2021	<0.003	0.028	0.066	<0.001	4.9	0.0012	53	91	<0.004	<0.002	0.27	<0.001	0.16	<0.0002	3.6	11.7	0.349	0.024	280	<0.001
XPW03	03/23/2021	<0.003	0.027	0.063	<0.001	5.3	0.0011	49	250	<0.004	<0.002	0.275	<0.001	0.18	<0.0002	3.1	11.2	0.065	0.024	300	<0.001
XPW03	04/12/2021	<0.003	0.027	0.067	<0.001	5	0.0011	51	93	<0.004	<0.002	<0.25	<0.001	0.17	<0.0002	3.6	12.0	0.208	0.023	290	<0.001
XPW03	05/04/2021	<0.003	0.027	0.07	<0.001	5.5	0.0012	52	86	<0.004	<0.002	<0.25	<0.001	0.16	<0.0002	3.8	12.0	0.213	0.023	280	<0.001
XPW03	07/22/2021	<0.003	0.025	0.065	<0.001	7	0.0011	52	94	<0.004	<0.002	0.284	<0.001	0.17	<0.0002	3.3	11.7	0.211	0.021	270	<0.001

Notes:
Field readings are reported with as many significant figures as provided by analytical laboratory.
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method.
mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = standard units

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RAMBOLL

TABLE 2-4. SOIL ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Geologic Unit	Sample Depth (ft BGS)	Sample Date	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Boron (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Lead (mg/kg)	Lithium (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Selenium (mg/kg)	Thallium (mg/kg)
AW-15	Upper Cahokia Formation	33-35	01/08/2021	<4.7	4.9	170	<1.6	22	<1.6	31	12	15	37	<0.31	<1.6	<1.6	<1.6
AW-20	Upper Cahokia Formation	17-19	01/10/2021	<3.9	3.2	150	<1.3	16	<1.3	21	11	14	22	<0.26	1.5	1.4	<1.3
AW-22	Upper Cahokia Formation	32-34	01/08/2021	<3.7	4	83	<1.2	21	<1.2	28	10	12	25	<0.25	<1.2	<1.2	<1.2
AW-22	Upper Cahokia Formation	45-47	01/08/2021	<4.6	7.2	230	<1.5	39	<1.5	42	14	18	36	<0.31	<1.5	<3.1	<1.5

Notes:
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method.
BGS = below ground surface
ft = foot or feet
mg/kg = milligrams per kilogram

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TABLE 3-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Well Number	HSU	Date Constructed	Top of PVC Elevation (ft)	Measuring Point Elevation (ft)	Measuring Point Description	Ground Elevation (ft)	Screen Top Depth (ft BGS)	Screen Bottom Depth (ft BGS)	Screen Top Elevation (ft)	Screen Bottom Elevation (ft)	Well Depth (ft BGS)	Bottom of Boring Elevation (ft)	Screen Length (ft)	Screen Diameter (inches)	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)
AP05S	UA	11/29/2016	443.53	443.53	Top of PVC	441.13	32.87	37.64	408.26	403.49	38.06	403.10	4.8	2	40.598807	-89.66191
AP05D	BCU	12/05/2016	443.45	443.45	Top of PVC	441.23	47.09	56.69	394.14	384.54	57.17	382.90	9.6	2	40.598796	-89.661901
AP06	UCF	11/30/2016	442.17	442.17	Top of PVC	439.53	19.93	24.72	419.60	414.81	25.00	414.50	4.8	2	40.601038	-89.662759
AP07S	UCF	12/02/2016	461.08	461.08	Top of PVC	458.31	29.95	34.74	428.36	423.57	35.00	423.30	4.8	2	40.59793	-89.666919
AP07D	BCU	12/08/2016	460.89	460.89	Top of PVC	458.42	55.01	64.59	403.41	393.83	65.00	393.40	9.6	2	40.597941	-89.666926
AP08	CCR	12/06/2016	460.60	460.60	Top of PVC	458.10	9.99	19.58	448.11	438.52	19.98	438.10	9.6	2	40.594578	-89.668728
AP09	CCR	12/07/2016	460.22	460.22	Top of PVC	457.24	9.79	19.39	447.45	437.85	19.80	437.40	9.6	2	40.59149	-89.666303
APW-01	UCF	07/27/2010	441.07	441.07	Top of PVC	437.83	7.60	18.00	430.23	419.83	18.00	419.30	10.4	2	40.600127	-89.66512
APW-02	UCF	07/20/2010	464.92	464.92	Top of PVC	461.72	39.60	50.00	422.12	411.72	50.00	411.70	10.4	2	40.594228	-89.665642
APW-03	UCF	07/19/2010	444.37	444.37	Top of PVC	441.22	19.60	30.00	421.62	411.22	30.00	411.20	10.4	2	40.591259	-89.663843
APW-04	UCF	07/27/2010	439.66	439.66	Top of PVC	437.19	9.60	20.00	427.59	417.19	20.00	417.20	10.4	2	40.587909	-89.663726
AW-01[1]	PMP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AW-05	UA	07/22/2015	--	443.37	Top of Disk	440.55	15.87	20.47	424.68	420.08	21.10	419.50	4.6	2	40.598645	-89.666407
AW-06	UA	08/03/2015	--	461.57	Top of Disk	459.19	36.60	41.09	422.59	418.10	41.69	416.90	4.5	2	40.594237	-89.670051
AW-08	UA	07/21/2015	--	462.54	Top of Disk	460.66	47.55	57.19	413.11	403.47	57.70	403.00	9.6	2	40.593964	-89.661996
AW-09	UA	08/03/2015	--	461.45	Top of Disk	458.32	47.14	51.62	411.18	406.70	52.23	406.10	4.5	2	40.590422	-89.668777
AW-10	UA	07/23/2015	--	439.93	Top of Disk	437.64	27.62	32.23	410.02	405.41	32.74	404.90	4.6	2	40.590733	-89.663826
AW-11	UA	07/28/2015	--	439.87	Top of Disk	437.16	24.21	28.81	412.95	408.35	29.31	407.20	4.6	2	40.587261	-89.663781
AW-12	UA	01/07/2021	443.80	443.80	Top of PVC	441.16	26.00	31.00	415.16	410.16	31.00	406.20	5	2	40.591071	-89.661333
AW-13	UA	01/09/2021	441.26	441.26	Top of PVC	438.67	25.00	30.00	413.67	408.67	30.00	408.70	5	2	40.588378	-89.663714
AW-14	UA	01/08/2021	439.40	439.40	Top of PVC	436.83	24.00	29.00	412.83	407.83	29.00	401.80	5	2	40.58729	-89.665621
AW-15	UA	01/08/2021	441.51	441.51	Top of PVC	438.95	33.00	38.00	405.95	400.95	38.00	399.00	5	2	40.587964	-89.666822
AW-15C	BCU	01/08/2021	440.02	440.02	Top of PVC	437.62	43.00	48.00	394.62	389.62	48.00	337.60	5	2	40.588	-89.666882

TABLE 3-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Well Number	HSU	Date Constructed	Top of PVC Elevation (ft)	Measuring Point Elevation (ft)	Measuring Point Description	Ground Elevation (ft)	Screen Top Depth (ft BGS)	Screen Bottom Depth (ft BGS)	Screen Top Elevation (ft)	Screen Bottom Elevation (ft)	Well Depth (ft BGS)	Bottom of Boring Elevation (ft)	Screen Length (ft)	Screen Diameter (inches)	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)
AW-15S	UCF	01/08/2021	440.71	440.71	Top of PVC	437.92	8.00	18.00	429.92	419.92	18.00	417.90	10	2	40.587955	-89.666841
AW-16	UA	01/08/2021	461.79	461.79	Top of PVC	459.45	55.00	60.00	404.45	399.45	60.00	396.50	5	2	40.589457	-89.667799
AW-17	UA	01/08/2021	462.10	462.10	Top of PVC	459.69	51.00	56.00	408.69	403.69	56.00	402.70	5	2	40.591698	-89.669404
AW-18	UA	01/09/2021	462.65	462.65	Top of PVC	460.28	46.00	51.00	414.28	409.28	51.00	405.30	5	2	40.593044	-89.669822
AW-19	UA	01/09/2021	460.74	460.74	Top of PVC	458.53	35.00	40.00	423.53	418.53	40.00	415.50	5	2	40.595434	-89.66972
AW-20	UA	01/10/2021	461.48	461.48	Top of PVC	459.08	36.50	41.50	422.58	417.58	41.50	416.10	5	2	40.596469	-89.66891
AW-21	UA	01/10/2021	460.61	460.61	Top of PVC	458.28	32.00	37.00	426.28	421.28	37.00	420.30	5	2	40.597294	-89.667734
AW-22	UA	01/08/2021	463.19	463.19	Top of PVC	460.30	44.00	49.00	416.30	411.30	49.00	410.30	5	2	40.596836	-89.666783
P002	UCF	--	460.39	460.39	Top of PVC	458.70	30.60	35.60	--	--	35.90	--	5	2	40.596235	-89.669084
XPW01A	CCR	01/09/2021	464.16	464.16	Top of PVC	460.99	33.00	43.00	427.99	417.99	43.00	418.00	10	2	40.596306	-89.667345
XPW02	CCR	01/09/2021	473.79	473.79	Top of PVC	471.16	36.00	46.00	435.16	425.16	46.00	424.20	10	2	40.594351	-89.668312
XPW03	CCR	01/10/2021	466.04	466.04	Top of PVC	462.62	27.00	37.00	435.62	425.62	37.00	422.60	10	2	40.591416	-89.666188
SG-01	SW	--	--	--	--	--	--	--	--	--	--	--	--	--	40.596075	-89.661625

Notes:
1 Well location is planned, well construction details not available.
All elevation data are presented relative to the North American Vertical Datum 1988 (NAVD88), GEOID 12A
-- = data not available
BCU = bedrock confining unit
BGS = below ground surface
CCR = Coal Combustion Residual
ft = foot or feet
HSU = Hydrostratigraphic Unit
PMP = potential migration pathway
PVC = polyvinyl chloride
SW = surface water
UA = uppermost aquifer
UCF = Upper Cahokia Formation

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TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Date	AP08 Groundwater Elevation (ft NAVD88) CCR-shallow	XPW02 Groundwater Elevation (ft NAVD88) CCR-deep	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
2/9/2021	452.60	452.97	-0.37	13.16	-0.03	up
3/2/2021	452.85	453.17	-0.32	13.16	-0.02	up
3/22/2021	453.59	454.08	-0.49	13.16	-0.04	up
4/12/2021	453.16	453.73	-0.57	13.16	-0.04	up
5/4/2021	452.70	453.23	-0.53	13.16	-0.04	up
6/15/2021	452.40	452.90	-0.50	13.16	-0.04	up
6/28/2021	452.92	453.47	-0.55	13.16	-0.04	up
7/21/2021	452.97	453.67	-0.70	13.16	-0.05	up
			Middle of screen elevation AP08			443.32
			Middle of screen elevation XPW02			430.16

Date	AP09 Groundwater Elevation (ft NAVD88) CCR-shallow	XPW03 Groundwater Elevation (ft NAVD88) CCR-deep	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
2/9/2021	451.96	450.74	1.22	12.03	0.10	down
3/2/2021	451.95	450.72	1.23	12.03	0.10	down
3/22/2021	451.95	450.77	1.18	12.03	0.10	down
4/12/2021	451.86	450.62	1.24	12.03	0.10	down
5/4/2021	452.12	450.84	1.28	12.03	0.11	down
6/15/2021	451.61	450.38	1.23	12.03	0.10	down
6/28/2021	452.09	450.86	1.23	12.03	0.10	down
7/21/2021	452.19	451.03	1.16	12.03	0.10	down
			Middle of screen elevation AP09			442.65
			Middle of screen elevation XPW03			430.62

TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Date	AW-15 Groundwater Elevation (ft NAVD88)	AW-15C Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UA	BCU				
2/9/2021	433.03	433.32	-0.29	11.33	-0.03	up
3/2/2021	433.50	433.50	0.00	11.33	0.00	flat
3/22/2021	433.68	433.66	0.02	11.33	0.00	down
4/12/2021	433.76	433.80	-0.04	11.33	0.00	up
5/4/2021	433.69	433.71	-0.02	11.33	0.00	up
6/15/2021	433.65	433.63	0.02	11.33	0.00	down
6/28/2021	433.59	433.58	0.01	11.33	0.00	flat
7/21/2021	433.65	433.67	-0.02	11.33	0.00	up
			Middle of screen elevation AW-15			403.45
			Middle of screen elevation AW-15C			392.12

Date	AW-15S Groundwater Elevation (ft NAVD88)	AW-15 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UCF/PMP	UA				
2/9/2021	431.91	433.03	-1.12	21.47	-0.05	up
3/2/2021	431.19	433.50	-2.31	21.47	-0.11	up
3/22/2021	431.33	433.68	-2.35	21.47	-0.11	up
4/12/2021	431.13	433.76	-2.63	21.47	-0.12	up
5/4/2021	429.82	433.69	-3.87	26.37	-0.15	up
6/15/2021	431.00	433.65	-2.65	21.47	-0.12	up
6/28/2021	429.86	433.59	-3.73	26.41	-0.14	up
7/21/2021	431.25	433.65	-2.40	21.47	-0.11	up
			Middle of screen elevation AW-15S			424.92
			Middle of screen elevation AW-15			403.45

TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Date	AP05S Groundwater Elevation (ft NAVD88)	AP05D Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UA	BCU				
2/9/2021	437.61	439.14	-1.53	16.54	-0.09	up
3/2/2021	437.93	435.81	2.12	16.54	0.13	down
3/22/2021	438.43	433.33	5.10	16.54	0.31	down
4/12/2021	438.59	431.96	6.63	16.54	0.40	down
5/4/2021	438.43	432.29	6.14	16.54	0.37	down
6/15/2021	438.30	435.02	3.28	16.54	0.20	down
6/28/2021	438.24	433.14	5.10	16.54	0.31	down
7/21/2021	438.67	437.15	1.52	16.54	0.09	down
			Middle of screen elevation AP-05S			405.88
			Middle of screen elevation AP-05D			389.34

Date	APW-03 Groundwater Elevation (ft NAVD88)	AW-10 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UCF/PMP	UA				
2/9/2021	436.78	- - -	- - -	- - -	- - -	- - -
3/2/2021	436.47	438.84	-2.37	8.70	-0.27	up
3/22/2021	436.75	438.84	-2.09	8.70	-0.24	up
4/12/2021	436.25	438.85	-2.60	8.70	-0.30	up
5/4/2021	436.06	438.80	-2.74	8.70	-0.31	up
6/15/2021	435.64	438.62	-2.98	8.70	-0.34	up
6/28/2021	436.22	438.61	-2.39	8.70	-0.27	up
7/21/2021	436.13	438.60	-2.47	8.70	-0.28	up
			Middle of screen elevation APW-03			416.42
			Middle of screen elevation AW-10			407.72

TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Date	APW-04 Groundwater Elevation (ft NAVD88)	AW-13 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UCF/PMP	UA				
2/9/2021	432.44	435.52	-3.08	11.22	-0.27	up
3/2/2021	432.74	435.84	-3.10	11.22	-0.28	up
3/22/2021	432.75	435.86	-3.11	11.22	-0.28	up
4/12/2021	432.91	435.92	-3.01	11.22	-0.27	up
5/4/2021	432.40	435.83	-3.43	11.22	-0.31	up
6/15/2021	431.79	435.56	-3.77	11.22	-0.34	up
6/28/2021	431.21	435.40	-4.19	11.22	-0.37	up
7/21/2021	432.13	435.98	-3.85	11.22	-0.34	up
			Middle of screen elevation APW-04			422.39
			Middle of screen elevation AW-13			411.17

[O:SSW 7/13/21, U: SSW 08/13/21; C:CJC 08/16/21; U:SSW 9/22/21]

Notes:
[1] Distance change was calculated using the midpoint of the piezometer screen and water table surface. If the water table surface was above the top of the monitoring well screen, then distance change was calculated using the midpoint of both screens.
[2] Vertical gradients between ±0.0015 are considered flat, and typically have less than 0.02 foot difference in groundwater elevation between wells.
- - - = no data collected on date / no vertical gradient calculated
BCU = bedrock confining unit
dh = head change
dl = distance change
ft = foot/feet
NAVD88 = North American Vertical Datum of 1988
UCF/PMP = Upper Cahokia Formation/potential migration pathway
UA = uppermost aquifer

TABLE 3-3. FIELD HYDRAULIC CONDUCTIVITIES
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Well ID	Gradient Position	Bottom of Screen Elevation (ft NAVD88)	Screen Length [1] (ft)	Field Identified Screened Material	Slug Type	Analysis Method	Number of Field Tests	Test Analyzed [3]	Hydraulic Conductivity (cm/s)	Minimum Hydraulic Conductivity (cm/s)	Maximum Hydraulic Conductivity (cm/s)	Hydraulic Conductivity Geometric Mean (cm/s)
Uppermost Aquifer												
AW-12	U	410.16	5	(GW)s	Solid	Bouwer-Rice	6	RH-2	1.5E-02	4.7E-07	1.5E-02	1.6E-04
AW-15	D	400.95	5	CL/BR [2]	Solid	Cooper-Bredehoeft-Papadopulos	6	RH-3	7.5E-03			
AW-16	D	399.45	5	CL/ML/BR [2]	Solid	Cooper-Bredehoeft-Papadopulos	4	RH-1	7.7E-04			
AW-17	D	403.69	5	CL/ML/BR	Solid	Bouwer-Rice	1	FH-1	4.7E-07			
AW-18	D	409.28	5	CL/ML/BR	Solid	Bouwer-Rice	1	RH-1	7.3E-07			
AW-19	D	418.53	5	CL/ML	Solid	Cooper-Bredehoeft-Papadopulos	1	RH-1	4.1E-05			
AW-20	D	417.58	5	CL/ML/BR [2]	Solid	Cooper-Bredehoeft-Papadopulos	1	RH-1	2.5E-03			
AW-21	D	421.28	5	CL/ML/BR [2]	Solid	Cooper-Bredehoeft-Papadopulos	2	RH-2	2.5E-04			
AW-22	D	411.30	5	CL/BR [2]	Solid	Cooper-Bredehoeft-Papadopulos	2	RH-2	1.1E-04			
Potential Migration Pathway												
AW-15S	D	419.92	10	ML/CL	Solid	Bouwer-Rice	3	RH-1	3.2E-03	3.2E-03	3.2E-03	3.2E-03
Bedrock												
AW-15C	D	389.62	5	BR	Solid	Cooper-Bredehoeft-Papadopulos	6	RH-2	8.2E-04	8.2E-04	8.2E-04	8.2E-04
Ash Pond												
XPW01A	CCR	417.99	10	s(ML)	Solid	Cooper-Bredehoeft-Papadopulos	4	FH-1	3.2E-04	3.2E-04	1.8E-03	6.8E-04
XPW02	CCR	425.16	10	s(ML)	Solid	Kansas Geological Survey	5	RH-2	1.8E-03			
XPW03	CCR	425.62	10	(SP-SM)g	Solid	Cooper-Bredehoeft-Papadopulos	4	RH-1	5.5E-04			

[O:SSW 7/13/21, U: SSW 08/13/21; C:CJC 08/16/21; U:CJC 08/16/21]

Notes:

[1] All wells are constructed from 2 inch PVC with 0.01 inch slotted screens.
[2] Boring log indicates well is screened in weathered shale bedrock.
[3] Test response data (elapsed time and corresponding changes in water levels) were plotted as normalized displacement to evaluate similarity among repeat test data within each well. A single test was selected for analysis at each well based on the quality of the test data (*i.e.,* smooth recovery curve) and coincidence of repeat test data.

cm/s = centimeters per second
BR = bedrock
CCR = coal combustion residuals
CL - lean clay
D = downgradient
FH-1 = Falling Head 1 Test
ft = foot/feet
ML = silt
NA = Not Applicable
NAVD88 = North American Vertical Datum of 1988
RH-1 = Rising Head 1 Test
RH-2 = Rising Head 2 Test
RH-3 = Rising Head 3 Test
SP-SM = poorly graded silty sand

RAMBOLL

TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

$V = K i / n_e$ V = Groundwater Velocity
K = Hydraulic Conductivity [1]
i = hydraulic gradient
n_e = Effective Porosity [2]

Central Portion of CCR Unit (AW-08 to AW-06): Uppermost Aquifer

Distance between Wells (ft): 2213
Hydraulic Conductivity (ft/day): 0.02
Effective Porosity (%): 13 Assumes: silt/clay

Date	AW-08 Elevation (ft NAVD88)	AW-06 Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/day)
2/9/2021	438.28	434.40	3.88	0.002	2.1E-04
3/2/2021	437.77	434.62	3.15	0.001	1.7E-04
3/22/2021	439.27	434.70	4.57	0.002	2.5E-04
4/12/2021	440.09	434.85	5.24	0.002	2.9E-04
5/4/2021	439.47	434.48	4.99	0.002	2.7E-04
6/15/2021	440.14	434.26	5.88	0.003	3.2E-04
6/28/2021	439.41	434.60	4.81	0.002	2.6E-04
7/21/2021	441.74	434.40	7.34	0.003	4.0E-04
			Average	0.002	2.5E-04

Southern Portion of CCR Unit (AW-10 to AW-15): Uppermost Aquifer

Distance between Wells (ft): 1300
Hydraulic Conductivity (ft/day): 10.7
Effective Porosity (%): 16 Assumes: gravel/ clay

Date	AW-10 Elevation (ft NAVD88)	AW-15 Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/day)
2/9/2021	--	433.03	--	--	--
3/2/2021	438.84	433.50	5.34	0.004	0.27
3/22/2021	438.84	433.68	5.16	0.004	0.27
4/12/2021	438.85	433.76	5.09	0.004	0.26
5/4/2021	438.80	433.69	5.11	0.004	0.26
6/15/2021	438.62	433.65	4.97	0.004	0.26
6/28/2021	438.61	433.59	5.02	0.004	0.26
7/21/2021	438.60	433.65	4.95	0.004	0.25
			Average	0.004	0.26

TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

EDWARDS POWER PLANT

ASH POND

BARTONVILLE, ILLINOIS

Southeastern Portion of CCR Unit (APW-03 to APW-04): Potential Migration Pathway

Distance between Wells (ft): 1220

Hydraulic Conductivity (ft/day): 9.1

Effective Porosity (%): 7 Assumes: clay

Date	APW-03 Elevation (ft NAVD88)	APW-04 Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/day)
2/9/2021	436.78	432.44	4.34	0.004	0.46
3/2/2021	436.47	432.74	3.73	0.003	0.40
3/22/2021	436.75	432.75	4.00	0.003	0.42
4/12/2021	436.25	432.91	3.34	0.003	0.35
5/4/2021	436.06	432.40	3.66	0.003	0.39
6/15/2021	435.64	431.79	3.85	0.003	0.41
6/28/2021	436.22	431.21	5.01	0.004	0.53
7/21/2021	436.13	432.13	4.00	0.003	0.42
			Average	0.003	0.43

[O:SSW 7/13/21, U: CJC 08/13/21; NRK 8/16/21; C:CJC 08/17/21]

Notes:

[1] Hydraulic conductivity values used above are average of the individual wells or average of the hydrostratigraphic unit as derived from slug tests completed in March and April 2021 by Ramboll and published in the 2017 Hydrogeologic Monitoring Plan - Edwards Ash Pond (OBG/NRT, 2017).

[2]Effective porosity used in these calculations was derived from an average between estimated values of 0.20 for silt material, 0.267 for gravel, 0.07 for clay, and 0.28 for sand from *Morris, D.A. and A.I. Johnson, 1967. Summary of hydrologic and physical properties of rock and soil materials as analyzed by the Hydrologic Laboratoryof the U.S. Geological Survey, U.S. Geological Survey Water-Supply Paper 1839-D, 42p. and Heath, R.C., 1983. Basicground-water hydrology, U.S. Geological Survey Water-Supply Paper 2220, 86p*. Effective porosity may be as high as maximum total porosity (50%) calculated in Table 2-1

-- = data not available

% = percent

ft = foot/feet

ft/day = feet per day

ft/ft = feet per foot

NAVD88 = North American Vertical Datum of 1988

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
AP05S	01/18/2017	0.0041	0.003	0.54	<0.001	0.36	<0.001	110	44	<0.004	0.0025	<0.25	0.001	0.04	<0.0002	0.019	6.9	1.05	<0.001	38	<0.001	860
AP05S	05/10/2017	<0.003	0.0041	0.54	<0.001	0.34	<0.001	110	42	<0.004	<0.002	<0.25	<0.001	0.038	<0.0002	0.015	7.1	1.32	<0.001	32	<0.001	810
AP05S	06/07/2017	<0.003	0.0055	0.59	<0.001	0.34	<0.001	110	42	<0.004	<0.002	<0.25	<0.001	0.034	<0.0002	0.015	6.8	1.43	<0.001	29	<0.001	500
AP05S	06/22/2017	<0.003	0.0063	0.65	<0.001	0.32	<0.001	110	42	<0.004	<0.002	<0.25	<0.001	0.036	<0.0002	0.015	7.2	1.89	<0.001	26	<0.001	880
AP05S	07/21/2017	<0.003	0.0077	0.69	<0.001	0.27	<0.001	120	41	<0.004	<0.002	<0.25	<0.001	0.035	<0.0002	0.014	6.9	1.75	<0.001	23	<0.001	840
AP05S	07/31/2017	<0.003	0.0074	0.77	<0.001	0.29	<0.001	130	44	<0.004	<0.002	<0.25	<0.001	0.038	<0.0002	0.012	7.0	1.38	<0.001	19	<0.001	750
AP05S	08/07/2017	<0.003	0.0077	0.77	<0.001	0.3	<0.001	120	41	<0.004	<0.002	<0.25	<0.001	0.035	<0.0002	0.011	7.0	2.2	<0.001	17	<0.001	840
AP05S	08/23/2017	<0.003	0.0072	0.79	<0.001	0.31	<0.001	98	43	<0.004	<0.002	<0.25	<0.001	0.044	<0.0002	0.0076	6.9	2.63	<0.001	12	<0.001	820
AP05S	11/02/2017	--	--	--	--	0.37	--	100	39	--	--	<0.25	--	--	--	--	7.2	--	--	10	--	820
AP05S	05/07/2018	<0.003	0.0028	0.46	<0.001	0.29	<0.001	94	42	<0.004	<0.002	<0.25	<0.001	0.032	<0.0002	0.0038	7.2	--	<0.001	8.1	<0.001	860
AP05S	05/29/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.68	--	--	--	--
AP05S	07/27/2018	--	0.0047	0.7	<0.001	0.33	--	110	41	<0.004	<0.002	<0.25	<0.001	0.025	--	0.0029	7.1	3.19	<0.001	6.2	--	940
AP05S	08/27/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.0	--	--	--	--	--
AP05S	02/27/2019	<0.003	0.0046	0.87	<0.001	0.29	<0.001	91	40	<0.004	<0.002	<0.25	<0.001	0.02	<0.0002	0.0014	7.1	2.3	<0.001	4	<0.001	880
AP05S	08/06/2019	--	0.0067	1.1	<0.001	0.24	--	110	37	<0.004	<0.002	<0.25	<0.001	0.031	--	<0.001	7.1	3	<0.001	<1	--	900
AP05S	02/27/2020	<0.003	0.0088	1.4	<0.001	0.31	<0.001	170	40	0.028	0.013	<0.25	0.0099	0.059	<0.0002	0.0026	6.7	2.85	0.0016	<1	<0.001	840
AP05S	09/01/2020	--	0.003	1.2	<0.001	0.38	--	110	41	0.0076	0.004	<0.25	0.0033	0.036	--	<0.001	6.9	3.16	<0.001	<1	--	760
AP05S	02/10/2021	<0.003	0.0016	0.56	<0.001	0.26	<0.00089	110	38	<0.004	<0.002	<0.25	<0.001	0.028	<0.0002	<0.001	6.9	0.773	<0.001	1.2	<0.001	790
AP05S	02/23/2021	<0.003	0.0059	1.3	<0.001	0.39	<0.001	120	47	0.02	0.0083	<0.25	0.0091	0.044	<0.0002	0.002	6.8	2.9	<0.001	<1	<0.001	530
AP05S	03/08/2021	<0.003	0.0022	1.1	<0.001	0.39	<0.001	110	45	0.0043	0.0028	<0.25	0.0016	0.039	<0.0002	0.004	6.8	2.7	<0.001	<1	<0.001	670
AP05S	03/24/2021	<0.003	0.0024	1	<0.001	0.31	<0.001	110	45	0.0045	0.0029	<0.25	0.0018	0.033	<0.0002	<0.001	6.3	4.48	<0.001	2.2	<0.001	850
AP05S	04/13/2021	<0.003	0.0026	1.2	<0.001	0.34	<0.001	99	42	0.007	0.0041	<0.25	0.0027	0.04	<0.0002	<0.001	7.0	2.66	<0.001	5	<0.001	830

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
AP05S	05/07/2021	<0.003	0.0044	1.2	<0.001	0.36	<0.001	120	43	0.019	0.0071	<0.25	0.0074	0.037	<0.0002	0.0013	6.8	3.38	<0.001	2.7	<0.001	950
AP05S	06/16/2021	<0.003	0.01	1.7	0.0014	0.35	0.0011	170	47	0.043	0.024	<0.25	0.03	0.068	<0.0002	0.0029	6.9	9.64	0.003	1.8	<0.001	620
AP05S	06/29/2021	<0.003	0.0066	1.3	<0.001	0.36	<0.001	120	56	0.021	0.013	<0.25	0.015	0.065	<0.0002	0.002	6.9	8.25	<0.001	1.6	<0.001	550
AP05S	07/22/2021	<0.003	0.012	1.4	0.0019	0.42	0.0011	160	44	0.048	0.028	<0.25	0.033	0.071	<0.0002	0.0034	7.0	6.09	0.0032	2.5	<0.001	950
AP05D	02/10/2021	<0.003	<0.001	0.44	<0.001	1.1	<0.00089	22	230	<0.004	<0.002	0.562	<0.001	0.065	0.0014	0.017	7.7	1.21	<0.001	40	<0.001	1100
AP05D	03/08/2021	<0.003	0.0017	0.82	<0.001	1.3	<0.001	28	260	<0.004	<0.002	0.415	<0.001	0.073	<0.0002	0.017	7.2	1.19	<0.001	32	<0.001	1200
AP05D	03/24/2021	<0.003	0.0012	0.43	<0.001	1	<0.001	21	240	<0.004	<0.002	<0.25	<0.001	0.063	<0.0002	0.016	7.6	0.997	<0.001	43	<0.001	1000
AP05D	04/15/2021	<0.003	0.0018	1.6	<0.001	1.7	<0.001	33	410	<0.004	<0.002	0.557	<0.001	0.13	<0.0002	0.0029	7.4	2.75	<0.001	1.6	<0.001	2600
AP05D	05/07/2021	<0.003	0.0035	1.3	<0.001	1.6	<0.001	30	510	0.02	0.0028	0.683	0.0024	0.077	<0.0002	0.0057	7.7	3.75	<0.001	1.3	<0.001	1900
AP07S	02/10/2021	<0.003	<0.001	0.064	<0.001	5.8	<0.00089	120	80	<0.004	0.003	0.524	<0.001	<0.02	0.00021	<0.001	6.8	0.123	<0.001	160	<0.001	610
AP07S	03/04/2021	<0.003	<0.001	0.08	<0.001	6.2	<0.001	130	74	0.0054	0.0045	0.347	0.002	<0.01	<0.0002	0.0017	6.7	1.22	<0.001	150	<0.001	620
AP07S	03/24/2021	<0.003	<0.001	0.065	<0.001	5.8	<0.001	120	79	<0.004	0.0027	0.39	<0.001	<0.02	<0.0002	<0.001	6.2	0.207	<0.001	160	<0.001	770
AP07S	04/13/2021	<0.003	<0.001	0.14	<0.001	7.3	<0.001	230	190	<0.004	0.0027	<0.25	0.0011	<0.02	<0.0002	0.001	6.8	0.336	<0.001	430	<0.001	1200
AP07S	05/05/2021	<0.003	<0.001	0.15	<0.001	8.3	<0.001	260	110	0.096	0.0036	<0.25	0.0018	<0.02	<0.0002	0.0023	6.6	1.2	<0.001	420	<0.001	1400
AP07S	06/16/2021	<0.003	<0.001	0.12	<0.001	7.4	<0.001	280	120	<0.004	0.002	<0.25	<0.001	<0.02	<0.0002	<0.001	6.6	1.82	<0.001	440	<0.001	1400
AP07S	06/28/2021	<0.003	<0.001	0.12	<0.001	10	<0.001	280	130	<0.004	0.0021	<0.25	<0.001	<0.02	<0.0002	<0.001	6.8	1.85	<0.001	410	<0.001	1500
AP07S	07/22/2021	<0.003	<0.001	0.13	<0.001	12	<0.001	260	130	<0.004	0.0023	<0.25	<0.001	<0.02	<0.0002	<0.001	6.6	1.4	<0.001	480	<0.001	1600
AP07D	02/10/2021	<0.003	0.0049	0.31	<0.001	1.3	<0.00089	16	500	<0.004	<0.002	1	<0.001	0.053	<0.0002	0.011	8.2	0.268	<0.001	130	<0.001	1400
AP07D	03/08/2021	<0.003	0.036	2.6	0.0096	1.4	0.0025	90	550	0.29	0.18	1.07	0.15	0.41	0.00033	0.01	7.8	12.2	0.012	96	<0.001	1500
AP07D	03/24/2021	<0.003	0.033	4.1	0.01	1.2	0.0023	78	830	0.34	0.22	1.21	0.17	0.49	0.00029	0.0092	7.5	19.4	0.014	51	0.0012	850
AP07D	04/13/2021	<0.003	0.0088	1.3	0.0018	1.3	<0.001	18	710	0.059	0.028	1.27	0.03	0.15	<0.0002	0.015	7.8	4.24	0.0018	54	<0.001	2000
AP07D	05/05/2021	<0.003	0.057	8.6	0.017	1.4	0.004	58	820	0.59	0.29	1.32	0.27	0.72	0.00054	0.015	7.9	23	0.019	47	0.0026	820

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
AP07D	07/22/2021	<0.003	0.0044	1.2	0.0012	1.8	<0.001	18	700	0.034	0.018	0.984	0.014	0.12	<0.0002	0.0087	7.5	1.68	0.0098	100	<0.001	2300
APW-01	06/17/2021	<0.003	0.025	0.12	<0.001	0.69	<0.001	190	210	0.012	0.0053	0.294	0.0063	0.028	<0.0002	0.0025	6.9	1.62	<0.001	300	<0.001	1000
APW-01	06/29/2021	<0.003	0.023	0.19	<0.001	0.71	0.0014	180	160	0.024	0.013	0.322	0.019	0.032	<0.0002	0.0023	6.8	4.15	0.0017	280	<0.001	780
APW-01	07/22/2021	<0.003	0.018	0.13	<0.001	0.84	<0.001	180	160	0.013	0.0065	<0.25	0.0075	<0.02	<0.0002	0.0024	6.9	1.73	0.0011	300	<0.001	1100
APW-02	02/10/2021	<0.003	<0.001	0.15	<0.001	0.047	<0.001	100	12	<0.004	<0.002	0.36	<0.001	<0.02	<0.0002	<0.001	7.0	0.207	<0.001	1.4	<0.001	400
APW-02	03/03/2021	<0.003	<0.001	0.17	<0.001	0.074	<0.001	120	10	<0.004	<0.002	0.277	<0.001	<0.02	<0.0002	<0.001	7.0	0.836	<0.001	1.4	<0.001	510
APW-02	03/24/2021	<0.003	<0.001	0.17	<0.001	0.048	<0.001	120	12	<0.004	<0.002	0.3	<0.001	<0.02	<0.0002	<0.001	6.5	0.578	<0.001	5.7	<0.001	480
APW-02	04/13/2021	<0.003	0.0012	0.19	<0.001	0.11	<0.001	130	9.7	0.0068	0.0043	<0.25	0.0012	<0.02	<0.0002	<0.001	6.9	0.0707	<0.001	11	0.0019	440
APW-02	05/06/2021	<0.003	<0.001	0.16	<0.001	0.13	<0.001	120	13	0.023	<0.002	<0.25	<0.001	<0.02	<0.0002	<0.001	6.8	0.365	<0.001	10	<0.001	580
APW-03	02/10/2021	<0.003	<0.001	0.26	<0.001	0.15	<0.001	160	27	<0.004	<0.002	0.34	<0.001	<0.02	<0.0002	<0.001	6.8	0.37	<0.001	<1	<0.001	720
APW-03	03/04/2021	<0.003	<0.001	0.3	<0.001	0.13	<0.001	180	28	<0.004	<0.002	<0.25	<0.001	0.018	<0.0002	<0.001	6.6	1.1	<0.001	2	<0.001	850
APW-03	03/24/2021	<0.003	<0.001	0.3	<0.001	0.13	<0.001	170	28	<0.004	<0.002	<0.25	<0.001	<0.02	<0.0002	<0.001	6.4	0.756	<0.001	3.5	<0.001	880
APW-03	04/13/2021	<0.003	0.0011	0.35	<0.001	0.14	<0.001	200	28	<0.004	<0.002	<0.25	0.0015	<0.02	<0.0002	<0.001	6.8	0.547	<0.001	7.1	<0.001	860
APW-03	05/07/2021	<0.003	0.0011	0.34	<0.001	0.14	<0.001	200	33	0.0082	<0.002	<0.25	0.0012	<0.02	<0.0002	<0.001	6.8	1.38	<0.001	8.7	<0.001	950
APW-04	02/10/2021	<0.003	0.0089	0.34	<0.001	0.56	<0.001	160	170	<0.004	<0.002	0.422	<0.001	<0.02	<0.0002	0.0034	6.9	0.551	<0.001	20	<0.001	740
APW-04	03/04/2021	<0.003	0.0094	0.38	<0.001	0.6	<0.001	180	180	<0.004	<0.002	0.256	<0.001	0.012	<0.0002	0.0046	6.8	1.18	<0.001	32	<0.001	630
APW-04	03/22/2021	<0.003	0.0064	0.33	<0.001	0.63	<0.001	180	230	0.0044	<0.002	<0.25	<0.001	<0.02	<0.0002	0.0015	6.9	0.748	<0.001	42	<0.001	850
APW-04	04/13/2021	<0.003	0.016	0.5	<0.001	0.54	<0.001	180	220	0.012	0.0035	<0.25	0.0037	<0.02	<0.0002	0.0049	6.8	3.85	<0.001	43	<0.001	860
APW-04	05/07/2021	<0.003	0.0054	0.33	<0.001	0.69	<0.001	200	350	0.0072	<0.002	0.252	<0.001	<0.02	<0.0002	0.0014	6.8	0.553	<0.001	58	<0.001	1100
AW-05	11/09/2015	<0.003	0.0053	0.19	<0.001	1.8	<0.001	180	280	0.0099	0.0047	<0.25	0.0024	0.03	<0.0002	0.0023	6.7	0.35	0.0012	290	<0.001	1100
AW-05	02/17/2016	<0.003	0.013	0.28	<0.001	1.7	<0.001	180	180	0.026	0.013	0.326	0.011	0.046	<0.0002	0.0028	6.8	3.51	0.0013	280	<0.001	1000
AW-05	05/17/2016	<0.003	0.028	0.41	<0.001	1.6	<0.001	210	290	0.03	0.019	0.325	0.018	0.047	<0.0002	0.0035	6.7	0.602	0.0014	270	<0.001	1100

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
AW-05	07/21/2016	<0.003	0.007	0.26	<0.0005	2.7	<0.001	190	570	0.017	0.0091	0.427	0.0069	0.038	<0.0002	0.0023	6.9	1.31	0.0011	380	<0.001	1700
AW-05	11/10/2016	<0.003	0.0035	0.14	<0.001	2.8	<0.001	200	300	<0.004	0.0022	0.278	<0.001	0.021	<0.0002	0.0012	7.1	1.01	<0.001	330	<0.001	1300
AW-05	01/17/2017	<0.003	0.0025	0.13	<0.001	1.5	<0.001	160	130	<0.004	<0.002	<0.25	<0.001	0.018	<0.0002	0.0021	7.1	2.06	<0.001	270	<0.001	1000
AW-05	05/08/2017	0.003	0.013	0.39	0.0016	1.4	0.0015	180	140	0.04	0.029	<0.25	0.023	0.07	<0.0002	0.0038	7.2	2.13	0.0037	280	<0.001	1100
AW-05	07/19/2017	<0.003	0.029	0.63	0.003	5.9	0.0023	260	420	0.088	0.054	<0.25	0.046	0.12	<0.0002	0.0041	7.1	1.07	0.004	470	<0.001	1300
AW-05	11/01/2017	--	--	--	--	7.6	--	260	650	--	--	<0.25	--	--	--	--	7.2	--	--	370	--	1600
AW-05	02/27/2020	<0.003	0.032	0.4	0.001	1.8	<0.001	170	81	0.04	0.018	0.284	0.014	0.053	<0.0002	0.004	7.0	0.809	0.0017	270	<0.001	910
AW-05	06/17/2021	<0.003	0.0039	0.12	<0.001	2.6	<0.001	160	110	<0.004	0.0025	0.371	<0.001	0.024	<0.0002	0.0022	7.0	0.801	<0.001	330	<0.001	970
AW-05	06/28/2021	<0.003	0.0035	0.11	<0.001	3.1	<0.001	170	69	<0.004	<0.002	0.308	<0.001	<0.02	<0.0002	0.0018	7.0	0.14	<0.001	290	<0.001	910
AW-05	07/22/2021	<0.003	0.0032	0.11	<0.001	2.9	<0.001	150	67	<0.004	<0.002	0.272	<0.001	<0.02	<0.0002	0.002	7.1	3.77	<0.001	300	<0.001	1100
AW-06	11/10/2015	<0.003	0.0034	0.29	<0.001	0.31	<0.001	110	61	0.014	0.006	<0.25	0.006	0.035	<0.0002	0.0034	7.0	2.54	0.001	36	<0.001	560
AW-06	02/17/2016	<0.003	0.0018	0.2	<0.001	0.29	<0.001	72	75	0.0071	0.0024	0.441	0.0023	0.029	<0.0002	0.0038	7.2	2.62	<0.001	40	<0.001	650
AW-06	05/18/2016	<0.003	0.0014	0.18	<0.001	0.17	<0.001	110	43	<0.004	<0.002	0.465	<0.001	0.017	<0.0002	0.0044	7.2	1.21	<0.001	41	<0.001	490
AW-06	07/22/2016	<0.003	0.0082	0.32	0.00085	0.21	<0.001	120	50	0.026	0.014	0.414	0.014	0.042	0.0018	0.0052	7.1	2.08	0.0022	42	<0.001	540
AW-06	11/11/2016	<0.003	0.0045	0.25	<0.001	0.16	<0.001	110	45	0.024	0.0068	0.429	0.0064	0.03	<0.0002	0.0064	7.2	0.498	<0.001	39	<0.001	530
AW-06	01/17/2017	<0.003	0.0036	0.19	<0.001	0.17	<0.001	100	39	0.0084	0.0028	0.351	0.0063	0.02	<0.0002	0.0066	7.2	0.372	<0.001	39	<0.001	540
AW-06	05/09/2017	<0.003	0.0014	0.16	<0.001	0.18	<0.001	110	37	<0.004	<0.002	0.415	0.0012	0.018	<0.0002	0.0095	7.2	0.399	<0.001	38	<0.001	560
AW-06	07/20/2017	<0.003	0.032	0.46	0.0011	0.19	<0.001	140	34	0.033	0.019	0.314	0.019	0.049	<0.0002	0.0086	7.3	0.813	0.0023	34	<0.001	480
AW-06	11/02/2017	--	--	--	--	0.18	--	100	32	--	--	0.405	--	--	--	--	7.1	--	--	32	--	500
AW-06	05/05/2018	<0.003	0.037	0.45	0.0014	0.17	<0.001	120	37	0.034	0.018	0.286	0.019	0.048	<0.0002	0.008	7.2	--	0.0028	29	<0.001	430
AW-06	05/29/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.09	--	--	--	--
AW-06	08/24/2018	--	0.0048	0.18	<0.001	0.14	--	110	35	<0.004	<0.002	0.366	0.0018	<0.01	--	0.0057	7.9	1.98	<0.001	31	--	540

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
AW-06	02/27/2019	<0.003	0.0046	0.18	<0.001	0.13	<0.001	110	35	<0.004	<0.002	0.28	0.0013	<0.01	<0.0002	0.0051	7.3	0.357	<0.001	29	<0.001	580
AW-06	08/06/2019	--	0.02	0.35	<0.001	0.093	--	120	33	0.024	0.01	0.393	0.011	0.035	--	0.0055	7.2	1.82	0.002	29	--	580
AW-06	02/27/2020	<0.003	0.0053	0.21	<0.001	0.12	<0.001	110	33	0.0068	<0.002	0.413	0.0016	0.02	<0.0002	0.0049	7.0	0.242	<0.001	23	<0.001	500
AW-06	08/31/2020	--	0.0024	0.15	<0.001	0.12	--	100	34	<0.004	<0.002	0.372	<0.001	<0.02	--	0.0046	7.3	0.945	<0.001	25	--	540
AW-06	02/23/2021	<0.003	0.026	0.4	<0.001	0.13	<0.001	130	36	0.026	0.014	0.355	0.014	0.033	<0.0002	0.0063	7.1	1.97	0.0014	27	<0.001	390
AW-08	11/09/2015	<0.003	0.0011	0.15	<0.001	0.16	<0.001	140	19	<0.004	0.0038	<0.25	<0.001	0.025	<0.0002	0.0028	6.6	1.12	0.0012	80	<0.001	740
AW-08	02/17/2016	<0.003	0.0014	0.16	<0.001	0.17	<0.001	150	20	<0.004	0.0034	0.324	<0.001	0.025	<0.0002	0.0027	6.8	1.27	<0.001	61	<0.001	660
AW-08	05/17/2016	<0.003	0.0056	0.19	0.014	0.21	<0.001	160	18	<0.004	0.0053	0.376	<0.001	0.019	<0.0002	0.0044	6.8	0.454	<0.001	59	<0.001	680
AW-08	07/21/2016	<0.003	0.0018	0.13	<0.0005	0.14	<0.001	100	23	<0.004	0.002	0.34	<0.001	0.019	<0.0002	0.004	7.0	0.357	<0.001	55	<0.001	680
AW-08	11/10/2016	<0.003	0.011	0.2	<0.001	0.15	<0.001	160	20	<0.004	0.0034	0.346	<0.001	0.016	<0.0002	0.0085	7.1	0.433	<0.001	46	<0.001	710
AW-08	01/17/2017	<0.003	0.0012	0.15	<0.001	0.13	<0.001	110	20	<0.004	0.003	<0.25	<0.001	0.02	<0.0002	0.0032	7.2	0.408	<0.001	64	<0.001	640
AW-08	05/08/2017	<0.003	0.017	0.21	<0.001	0.11	<0.001	160	16	<0.004	<0.002	0.331	<0.001	0.014	<0.0002	0.0072	7.1	0.975	<0.001	23	<0.001	780
AW-08	07/19/2017	<0.003	0.016	0.22	<0.001	0.085	<0.001	160	16	<0.004	<0.002	<0.25	<0.001	0.014	<0.0002	0.0062	7.3	0.394	<0.001	19	<0.001	640
AW-08	11/01/2017	--	--	--	--	0.14	--	150	16	--	--	0.334	--	--	--	--	7.1	--	--	11	--	680
AW-08	05/05/2018	<0.003	0.027	0.24	<0.001	0.096	<0.001	130	18	<0.004	<0.002	0.338	<0.001	0.014	<0.0002	0.0044	7.1	--	<0.001	7.5	<0.001	640
AW-08	05/29/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.422	--	--	--	--
AW-08	07/27/2018	--	0.02	0.19	<0.001	0.13	--	130	17	<0.004	<0.002	0.313	<0.001	<0.01	--	0.0043	7.2	0.807	<0.001	6	--	600
AW-08	08/27/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.1	--	--	--	--	--
AW-08	02/27/2019	<0.003	0.019	0.22	<0.001	0.12	<0.001	140	17	<0.004	<0.002	0.27	<0.001	<0.01	<0.0002	0.0049	7.1	0.402	<0.001	9.6	<0.001	670
AW-08	08/06/2019	--	0.0074	0.18	<0.001	0.1	--	130	19	<0.004	<0.002	0.287	<0.001	0.017	--	0.0037	7.3	3.95	<0.001	20	--	700
AW-08	02/27/2020	<0.003	0.019	0.23	<0.001	0.11	<0.001	140	16	<0.004	<0.002	0.3	<0.001	<0.02	<0.0002	0.0051	6.9	0.933	<0.001	<1	<0.001	680
AW-08	09/01/2020	--	0.0086	0.17	<0.001	0.17	--	130	16	<0.004	<0.002	0.278	<0.001	<0.02	--	0.0023	7.1	0.124	<0.001	2.3	--	660

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
AW-08	02/10/2021	<0.003	0.0081	0.16	<0.001	0.12	<0.001	130	17	<0.004	<0.002	0.291	<0.001	<0.02	<0.0002	0.0015	7.1	0.158	<0.001	<1	<0.001	550
AW-08	02/23/2021	<0.003	0.018	0.28	<0.001	0.12	<0.001	150	5.2	0.0095	0.0041	0.318	0.0044	<0.02	<0.0002	0.0033	6.9	1.82	<0.001	<1	<0.001	410
AW-08	03/05/2021	<0.003	0.0065	0.18	<0.001	0.17	<0.001	140	16	<0.004	<0.002	0.263	<0.001	<0.02	<0.0002	0.0051	6.9	0.291	<0.001	3.2	<0.001	670
AW-08	03/24/2021	<0.003	0.0063	0.16	<0.001	0.099	<0.001	130	20	<0.004	<0.002	0.34	<0.001	<0.02	<0.0002	0.0056	6.3	0.251	<0.001	3.9	<0.001	620
AW-08	04/13/2021	<0.003	0.024	0.33	<0.001	0.19	<0.001	150	14	0.008	0.0025	<0.25	0.0024	<0.02	<0.0002	0.0027	6.8	0.416	<0.001	<1	<0.001	680
AW-08	05/07/2021	<0.003	0.014	0.24	<0.001	0.12	<0.001	150	14	<0.004	<0.002	0.297	<0.001	<0.02	<0.0002	0.0025	7.0	0.0155	<0.001	1.5	<0.001	680
AW-08	06/16/2021	<0.003	0.024	0.27	<0.001	0.18	<0.001	150	15	<0.004	<0.002	0.269	<0.001	<0.02	<0.0002	0.0041	7.0	0.139	<0.001	<1	<0.001	640
AW-08	06/28/2021	<0.003	0.018	0.24	<0.001	0.13	<0.001	150	17	<0.004	<0.002	0.396	<0.001	<0.02	<0.0002	0.0017	7.0	0.568	<0.001	1.5	<0.001	480
AW-08	07/21/2021	<0.003	0.02	0.26	<0.001	0.11	<0.001	140	14	<0.004	<0.002	<0.25	<0.001	<0.02	<0.0002	0.0014	6.9	0.589	<0.001	<1	<0.001	730
AW-09	11/10/2015	<0.003	0.018	0.62	0.0029	0.79	<0.001	170	31	0.075	0.04	<0.25	0.038	0.11	<0.0002	0.014	6.8	7.71	0.0067	28	<0.001	700
AW-09	02/17/2016	<0.003	0.046	1.1	0.007	0.86	0.0028	210	31	0.2	0.093	0.313	0.11	0.26	0.00026	0.02	6.6	5.97	0.0091	23	0.0016	700
AW-09	05/17/2016	<0.003	<0.001	0.15	<0.001	1.3	<0.001	120	32	<0.004	0.0023	0.338	<0.001	0.022	<0.0002	0.015	6.5	0.464	<0.001	37	<0.001	640
AW-09	07/22/2016	<0.003	0.025	0.57	0.0025	0.51	0.0012	180	32	0.073	0.043	0.342	0.036	0.11	<0.0002	0.024	6.6	3.46	0.0036	19	<0.001	660
AW-09	11/11/2016	<0.003	0.02	0.39	<0.001	0.38	<0.001	140	29	0.03	0.017	0.334	0.0097	0.04	<0.0002	0.026	6.7	2.23	0.0013	8.6	<0.001	790
AW-09	01/17/2017	<0.003	<0.001	0.18	<0.001	0.84	<0.001	120	32	<0.004	0.0029	<0.25	<0.001	0.022	<0.0002	0.012	6.9	0.729	<0.001	28	<0.001	710
AW-09	05/09/2017	<0.003	0.0049	0.22	<0.001	0.49	<0.001	140	28	<0.004	0.0051	0.281	<0.001	0.022	<0.0002	0.02	7.1	0	<0.001	13	<0.001	760
AW-09	07/20/2017	<0.003	0.031	0.57	0.0013	0.31	<0.001	160	28	0.039	0.024	<0.25	0.024	0.06	<0.0002	0.028	6.9	1.86	0.002	1.6	<0.001	700
AW-09	11/02/2017	--	--	--	--	0.9	--	110	32	--	--	0.279	--	--	--	--	7.0	--	--	29	--	690
AW-09	05/05/2018	<0.003	0.036	0.37	<0.001	0.29	<0.001	130	26	0.015	0.01	0.294	0.0076	0.029	<0.0002	0.037	7.0	--	0.0015	<1	<0.001	670
AW-09	05/29/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.633	--	--	--	--
AW-09	08/24/2018	--	<0.001	0.18	<0.001	0.72	--	120	36	<0.004	0.0034	0.334	<0.001	0.011	--	0.015	7.0	0.466	<0.001	26	--	720
AW-09	02/27/2019	<0.003	0.0019	0.22	<0.001	0.52	<0.001	120	29	<0.004	0.0036	0.25	<0.001	0.013	<0.0002	0.016	7.0	0.771	<0.001	12	<0.001	780

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
AW-09	08/06/2019	--	0.026	0.54	<0.001	0.2	--	140	27	0.017	0.011	<0.25	0.011	0.036	--	0.015	7.2	1.94	0.0012	<1	--	770
AW-09	02/27/2020	<0.003	0.017	0.46	<0.001	0.24	<0.001	130	24	0.0092	0.0051	<0.25	0.0035	0.023	<0.0002	0.012	6.9	1.51	<0.001	<1	<0.001	740
AW-09	08/31/2020	--	0.02	0.46	<0.001	0.26	--	120	26	0.0089	0.0059	<0.25	0.0044	0.022	--	0.016	6.9	1.43	<0.001	<1	--	760
AW-09	02/23/2021	<0.003	0.017	0.46	<0.001	0.28	<0.001	140	8.1	0.022	0.013	<0.25	0.013	0.034	<0.0002	0.018	6.9	1.01	0.0011	<1	<0.001	470
AW-10	11/09/2015	<0.003	0.01	0.98	<0.001	0.42	<0.001	140	94	0.015	0.0083	<0.25	0.0054	0.073	<0.0002	0.0017	6.6	3.83	0.0013	2.8	<0.001	1100
AW-10	02/18/2016	<0.003	0.097	6.3	0.015	0.56	0.0031	280	99	0.45	0.25	<0.25	0.27	0.85	0.00033	0.0094	7.0	7.06	0.016	1.2	0.0023	1200
AW-10	05/18/2016	<0.003	0.04	3.4	0.0011	0.53	<0.001	170	83	0.056	0.034	0.324	0.035	0.11	<0.0002	0.0028	7.1	5.73	0.0021	<1	<0.001	1100
AW-10	07/21/2016	<0.003	0.01	1	<0.0005	0.46	<0.001	130	100	0.015	0.0097	<0.25	0.0074	0.08	<0.0002	0.0016	7.1	6.07	0.001	<1	<0.001	1100
AW-10	11/11/2016	<0.003	0.018	1.4	0.0012	0.44	<0.001	140	92	0.038	0.026	<0.25	0.022	0.12	<0.0002	0.0029	7.1	3.57	0.0025	<1	<0.001	1100
AW-10	01/17/2017	<0.003	0.0023	0.58	<0.001	0.44	<0.001	110	85	<0.004	0.0022	<0.25	<0.001	0.056	<0.0002	0.0023	7.1	1.23	<0.001	1.8	<0.001	1100
AW-10	05/10/2017	<0.003	0.0032	0.66	<0.001	0.49	<0.001	120	89	<0.004	0.0027	<0.25	<0.001	0.057	<0.0002	0.0032	6.9	1.12	<0.001	4.1	<0.001	1200
AW-10	07/20/2017	<0.003	0.0052	0.67	<0.001	0.43	<0.001	130	84	0.0042	0.0033	<0.25	0.0018	0.052	<0.0002	0.0043	7.0	0.875	<0.001	<1	<0.001	980
AW-10	11/02/2017	--	--	--	--	0.54	--	100	85	--	--	<0.25	--	--	--	--	7.2	--	--	2.8	--	1000
AW-10	05/07/2018	<0.003	0.0089	0.88	<0.001	0.42	<0.001	110	85	<0.004	0.0031	<0.25	0.001	0.042	<0.0002	0.002	7.3	--	<0.001	<1	<0.001	1000
AW-10	05/29/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.4	--	--	--	--
AW-10	07/27/2018	--	0.018	1.4	0.0022	0.48	--	170	88	0.063	0.036	<0.25	0.035	0.11	--	0.003	7.2	8.03	0.0035	<1	--	1100
AW-10	08/27/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.1	--	--	--	--	--
AW-10	02/27/2019	<0.003	0.012	0.93	<0.001	0.47	<0.001	130	85	<0.004	0.0037	<0.25	0.0024	0.04	<0.0002	0.028	7.2	1.79	<0.001	<1	<0.001	1100
AW-10	08/06/2019	--	0.019	1.5	0.0014	0.5	--	160	100	0.05	0.026	<0.25	0.026	0.12	--	0.0022	7.3	4.08	0.0033	<1	--	1200
AW-10	02/27/2020	<0.003	0.011	1.2	<0.001	0.46	<0.001	140	83	0.023	0.0098	<0.25	0.0092	0.065	<0.0002	0.0012	6.8	2.19	0.0012	<1	<0.001	1200
AW-10	08/31/2020	--	0.014	1.3	<0.001	0.54	--	140	88	0.0095	0.0062	<0.25	0.0051	0.051	--	<0.001	6.8	3.43	<0.001	<1	--	1200
AW-10	02/23/2021	<0.003	0.01	1	<0.001	0.55	<0.001	130	110	0.0051	0.0037	<0.25	0.0024	0.047	<0.0002	<0.001	6.9	3.1	<0.001	<1	<0.001	680

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
AW-10	03/23/2021	<0.003	0.0095	0.98	<0.001	0.5	<0.001	130	96	<0.004	0.0022	<0.25	0.0011	0.04	<0.0002	<0.001	6.8	1.77	<0.001	<1	<0.001	1100
AW-11	11/09/2015	<0.003	0.011	1.2	<0.001	0.23	<0.001	170	33	0.029	0.011	<0.25	0.0099	0.067	<0.0002	0.0043	6.5	2.78	0.0019	1.4	<0.001	870
AW-11	02/18/2016	<0.003	0.014	1.6	0.0013	0.24	<0.001	210	36	0.044	0.023	0.29	0.026	0.078	<0.0002	0.0066	6.9	3.2	0.0021	2	<0.001	900
AW-11	05/18/2016	<0.003	0.0053	0.83	<0.001	0.25	<0.001	170	31	0.0095	0.0067	0.38	0.0049	0.033	<0.0002	0.0065	7.0	0.558	<0.001	1.8	<0.001	860
AW-11	07/22/2016	<0.003	0.0054	0.84	<0.0005	0.22	<0.001	160	36	0.0042	0.0034	<0.25	0.0019	0.033	<0.0002	0.0037	7.0	2.69	<0.001	1.9	<0.001	880
AW-11	11/11/2016	<0.003	0.021	2	0.0027	0.25	0.0014	220	33	0.095	0.044	<0.25	0.049	0.14	<0.0002	0.0088	7.1	2.69	0.0061	<1	<0.001	880
AW-11	01/17/2017	<0.003	0.0042	0.56	<0.001	0.22	0.0015	150	35	0.0063	0.0038	<0.25	0.0015	0.031	<0.0002	0.01	7.2	0.394	0.0012	2.2	<0.001	920
AW-11	05/09/2017	<0.003	0.014	1.4	0.0012	0.23	<0.001	210	34	0.031	0.023	<0.25	0.024	0.08	<0.0002	0.0073	7.0	5.75	0.003	4.9	<0.001	940
AW-11	07/20/2017	<0.003	0.025	2.5	0.0028	0.23	0.0017	240	30	0.091	0.046	<0.25	0.05	0.14	<0.0002	0.0077	7.2	4.47	0.0042	<1	<0.001	920
AW-11	11/02/2017	--	--	--	--	0.23	--	140	33	--	--	<0.25	--	--	--	--	7.2	--	--	3.2	--	920
AW-11	05/07/2018	<0.003	0.011	0.73	<0.001	0.21	<0.001	140	30	<0.004	0.0029	<0.25	<0.001	0.021	<0.0002	0.0064	7.2	--	<0.001	<1	<0.001	880
AW-11	05/29/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.75	--	--	--	--
AW-11	08/27/2018	--	0.029	3	0.0046	0.3	--	290	31	0.15	0.07	0.27	0.08	0.16	--	0.0099	7.2	7.6	0.0083	1.1	--	980
AW-11	02/27/2019	<0.003	0.013	0.76	<0.001	0.22	<0.001	160	30	<0.004	0.0031	<0.25	0.0012	0.017	<0.0002	0.0053	7.2	2.33	<0.001	<1	<0.001	970
AW-11	08/06/2019	--	0.018	0.88	<0.001	0.18	--	160	30	<0.004	0.0023	<0.25	<0.001	0.031	--	0.0046	7.2	1.69	<0.001	<1	--	980
AW-11	02/27/2020	<0.003	0.013	1.3	<0.001	0.22	<0.001	170	30	0.0081	0.0041	<0.25	0.0033	0.029	<0.0002	0.0028	6.7	3.68	<0.001	<1	<0.001	970
AW-11	08/31/2020	--	0.011	0.77	<0.001	0.21	--	150	29	<0.004	0.0024	<0.25	<0.001	0.025	--	0.0021	6.9	1.52	<0.001	<1	--	970
AW-11	02/23/2021	<0.003	0.011	0.98	<0.001	0.25	<0.001	160	33	<0.004	0.0023	<0.25	0.0011	0.024	<0.0002	0.0016	7.0	2.46	<0.001	<1	<0.001	510
AW-12	02/11/2021	<0.003	0.0021	1.4	<0.001	0.27	<0.001	130	43	<0.004	<0.002	0.37	<0.001	0.036	<0.0002	0.023	6.8	1.62	0.0013	2.8	<0.001	770
AW-12	03/04/2021	<0.003	0.0026	1.5	<0.001	0.24	<0.001	120	41	<0.004	<0.002	<0.25	<0.001	0.028	<0.0002	0.0048	6.8	0.828	<0.001	<1	<0.001	780
AW-12	03/24/2021	<0.003	0.0025	1.4	<0.001	0.21	<0.001	120	45	<0.004	<0.002	2.14	<0.001	0.026	<0.0002	0.0037	6.4	0.846	<0.001	<1	<0.001	830
AW-12	04/12/2021	<0.003	0.0068	1.5	<0.001	0.23	<0.001	130	39	<0.004	<0.002	2.78	0.0012	0.031	<0.0002	0.0048	7.0	1.87	<0.001	1.2	<0.001	810

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
AW-12	05/07/2021	<0.003	0.0038	1.5	<0.001	0.26	<0.001	140	34	0.0072	<0.002	1.62	<0.001	0.025	<0.0002	0.004	7.0	1.24	<0.001	<1	<0.001	840
AW-13	02/11/2021	<0.003	0.013	1.5	<0.001	0.3	<0.001	140	80	0.0046	0.0041	<0.25	0.0034	0.033	<0.0002	0.0028	6.9	3.05	<0.001	3.2	<0.001	920
AW-13	03/04/2021	<0.003	0.0098	1.2	<0.001	0.29	<0.001	140	74	0.0077	0.0024	<0.25	0.0013	0.03	<0.0002	0.0015	6.7	3.02	<0.001	2	<0.001	1000
AW-13	03/23/2021	<0.003	0.012	1.3	<0.001	0.28	<0.001	140	89	<0.004	0.002	<0.25	0.0012	0.029	<0.0002	<0.001	6.7	2.98	<0.001	1.4	<0.001	1000
AW-13	04/12/2021	<0.003	0.014	1.3	<0.001	0.27	<0.001	140	81	<0.004	0.0021	<0.25	<0.001	0.036	<0.0002	0.0014	6.8	1.39	<0.001	<1	<0.001	1000
AW-13	05/07/2021	<0.003	0.014	1.4	<0.001	0.3	<0.001	150	86	<0.004	<0.002	<0.25	<0.001	0.03	<0.0002	<0.001	6.8	3.14	<0.001	<1	<0.001	1100
AW-14	02/11/2021	<0.003	0.0064	0.63	<0.001	0.21	<0.001	170	28	0.009	0.011	<0.25	0.0061	0.027	<0.0002	0.046	7.0	2.69	0.0016	54	<0.001	950
AW-14	03/04/2021	<0.003	0.011	0.59	<0.001	0.19	<0.001	170	26	<0.004	0.0058	<0.25	<0.001	0.023	<0.0002	0.022	6.9	2.67	<0.001	26	<0.001	960
AW-14	03/22/2021	<0.003	0.011	0.63	<0.001	0.18	<0.001	170	37	<0.004	0.0043	<0.25	<0.001	0.02	<0.0002	0.0044	6.9	2.38	<0.001	10	<0.001	1000
AW-14	04/12/2021	0.0045	0.01	0.7	<0.001	0.17	<0.001	170	24	<0.004	0.0041	<0.25	0.0022	0.025	<0.0002	0.0037	6.8	2.36	<0.001	3	<0.001	1100
AW-14	05/06/2021	<0.003	0.0096	0.75	<0.001	0.19	<0.001	180	25	<0.004	0.0029	1.21	<0.001	<0.02	<0.0002	<0.001	6.8	1.99	<0.001	<1	<0.001	1000
AW-14	06/28/2021	<0.003	0.009	0.76	<0.001	0.17	<0.001	180	26	<0.004	0.0029	1.37	<0.001	0.029	<0.0002	<0.001	6.8	3.66	<0.001	1.7	<0.001	760
AW-14	07/21/2021	<0.003	0.0085	0.75	<0.001	0.17	<0.001	170	25	<0.004	0.0025	<0.25	<0.001	<0.02	<0.0002	<0.001	6.7	1.94	<0.001	<1	<0.001	1100
AW-15	02/12/2021	<0.003	0.0023	2.1	<0.001	0.57	<0.001	130	49	<0.004	<0.002	<0.25	<0.001	0.049	<0.0002	0.001	6.8	2.96	<0.001	1	<0.001	1100
AW-15	03/05/2021	<0.003	0.0037	2	<0.001	0.43	<0.001	140	43	<0.004	0.0023	<0.25	<0.001	0.041	<0.0002	<0.001	6.7	5.14	<0.001	<1	<0.001	980
AW-15	03/22/2021	<0.003	0.0041	1.7	<0.001	0.47	<0.001	140	51	<0.004	<0.002	<0.25	<0.001	0.039	<0.0002	<0.001	6.8	6.89	<0.001	<1	<0.001	990
AW-15	05/06/2021	<0.003	0.0058	1.8	<0.001	0.43	<0.001	140	41	<0.004	<0.002	0.881	<0.001	0.033	<0.0002	<0.001	6.6	4.14	<0.001	<1	<0.001	1000
AW-15	06/17/2021	<0.003	0.0063	1.4	<0.001	0.3	<0.001	140	38	<0.004	<0.002	0.706	<0.001	0.041	<0.0002	0.0031	--	1.49	<0.001	<1	<0.001	780
AW-15C	02/12/2021	<0.003	0.0059	3.1	<0.001	0.81	<0.001	99	92	0.0048	0.0032	<0.25	0.0026	0.06	<0.0002	0.0088	7.0	4.84	<0.001	3.1	<0.001	1200
AW-15C	03/04/2021	<0.003	0.0038	3.6	<0.001	0.73	<0.001	110	55	<0.004	0.0025	<0.25	0.0011	0.058	<0.0002	0.0082	6.8	7.49	<0.001	<1	<0.001	1700
AW-15C	03/22/2021	<0.003	0.0035	3.2	<0.001	0.6	<0.001	110	59	<0.004	0.0021	<0.25	0.0012	0.056	<0.0002	0.0014	6.7	7.52	<0.001	<1	<0.001	1100
AW-15C	04/13/2021	0.0033	0.011	2.9	<0.001	0.68	<0.001	92	110	0.0044	0.0026	<0.25	0.0029	0.062	<0.0002	0.0059	7.0	5.25	<0.001	1.9	<0.001	1200

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
AW-15C	05/06/2021	<0.003	0.0056	3.4	<0.001	0.63	<0.001	110	63	<0.004	<0.002	1.55	<0.001	0.047	<0.0002	0.0016	6.8	4.68	<0.001	<1	<0.001	1000
AW-15C	07/21/2021	<0.003	0.0064	3.6	<0.001	0.69	<0.001	99	72	<0.004	<0.002	0.407	<0.001	0.045	<0.0002	0.0011	6.8	4.92	<0.001	<1	<0.001	1100
AW-15S	02/12/2021	<0.003	0.0043	0.22	0.0011	5.5	<0.001	250	50	0.022	0.011	0.302	0.014	0.032	<0.0002	0.0042	7.0	0.74	0.0024	480	<0.001	1300
AW-15S	03/04/2021	<0.003	0.001	0.11	<0.001	5.4	<0.001	270	47	<0.004	<0.002	0.27	<0.001	<0.02	<0.0002	0.0043	7.1	1.08	0.0013	510	<0.001	1200
AW-15S	03/22/2021	<0.003	0.001	0.1	<0.001	6.2	<0.001	260	42	<0.004	<0.002	0.25	0.0014	<0.02	<0.0002	0.0033	6.9	0.236	0.0015	520	<0.001	1300
AW-15S	04/26/2021	<0.003	<0.001	0.1	<0.001	5.4	<0.001	270	41	<0.004	<0.002	<0.25	<0.001	<0.02	<0.0002	0.0034	7.0	--	0.0013	550	<0.001	1400
AW-15S	05/06/2021	<0.003	<0.001	0.098	<0.001	5.8	<0.001	270	40	<0.004	<0.002	<0.25	<0.001	<0.02	<0.0002	0.0034	6.7	0.532	0.0012	540	<0.001	1300
AW-15S	06/17/2021	<0.003	<0.001	0.093	<0.001	5.7	<0.001	270	37	<0.004	<0.002	0.336	<0.001	0.021	<0.0002	0.0031	6.7	0.229	<0.001	550	<0.001	1300
AW-15S	06/29/2021	<0.003	<0.001	0.097	<0.001	5.4	<0.001	260	39	<0.004	<0.002	0.255	<0.001	<0.02	<0.0002	0.0033	6.9	0.582	<0.001	560	<0.001	1200
AW-15S	07/21/2021	<0.003	0.0015	0.11	<0.001	6.1	<0.001	260	38	<0.004	<0.002	<0.25	<0.001	<0.02	<0.0002	0.003	6.6	1.09	<0.001	570	<0.001	1400
AW-16	02/11/2021	<0.003	0.0013	1.4	<0.001	0.52	<0.001	130	59	<0.004	<0.002	<0.25	<0.001	0.045	<0.0002	<0.001	6.8	5.73	<0.001	<1	<0.001	1100
AW-16	03/03/2021	<0.003	0.0015	1.4	<0.001	0.54	<0.001	140	53	<0.004	<0.002	<0.25	<0.001	0.045	<0.0002	<0.001	6.8	7.02	<0.001	<1	<0.001	1100
AW-16	03/24/2021	<0.003	<0.001	1.3	<0.001	0.49	<0.001	130	53	<0.004	<0.002	<0.25	<0.001	0.046	<0.0002	<0.001	6.4	7.46	<0.001	<1	<0.001	1000
AW-16	04/23/2021	<0.003	0.0016	1.2	<0.001	0.45	<0.001	140	55	<0.004	<0.002	<0.25	<0.001	0.036	<0.0002	<0.001	6.8	4.69	<0.001	<1	<0.001	1000
AW-16	05/05/2021	<0.003	0.0016	1.3	<0.001	0.5	<0.001	140	53	<0.004	<0.002	<0.25	<0.001	0.039	<0.0002	<0.001	6.7	5.52	<0.001	<1	<0.001	1200
AW-16	06/24/2021	<0.003	0.0018	1.2	<0.001	0.54	<0.001	150	49	<0.004	<0.002	<0.25	<0.001	0.1	<0.0002	<0.001	6.6	4.41	<0.001	<1	<0.001	1200
AW-16	06/29/2021	<0.003	0.002	1.1	<0.001	0.51	<0.001	140	54	<0.004	<0.002	<0.25	<0.001	0.043	<0.0002	<0.001	6.8	5.84	<0.001	<1	<0.001	1100
AW-16	07/21/2021	<0.003	0.002	1.2	<0.001	0.56	<0.001	130	56	<0.004	<0.002	<0.25	<0.001	0.036	<0.0002	<0.001	6.8	4.77	<0.001	<1	<0.001	1200
AW-17	02/11/2021	<0.003	0.0064	1.2	<0.001	0.48	<0.001	100	56	0.0053	0.0046	<0.25	0.0031	0.071	<0.0002	0.0024	7.0	2.91	<0.001	<1	<0.001	850
AW-17	03/03/2021	<0.003	0.0079	1.2	<0.001	0.44	<0.001	120	52	0.0094	0.0065	<0.25	0.0048	0.057	<0.0002	0.003	6.8	3.57	<0.001	<1	<0.001	970
AW-17	03/23/2021	<0.003	0.0052	1.1	<0.001	0.43	<0.001	100	60	<0.004	0.0022	0.787	<0.001	0.043	<0.0002	0.0014	6.2	2.41	<0.001	<1	<0.001	950
AW-17	04/23/2021	<0.003	0.0054	1	<0.001	0.4	<0.001	110	57	<0.004	0.0024	<0.25	<0.001	0.041	<0.0002	0.0017	6.9	2.33	<0.001	<1	<0.001	700

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
AW-17	05/05/2021	<0.003	0.0053	1.1	<0.001	0.44	<0.001	110	55	<0.004	0.0021	<0.25	<0.001	0.04	<0.0002	0.0012	6.8	3.1	<0.001	<1	<0.001	860
AW-17	06/24/2021	<0.003	0.0052	1	<0.001	0.46	<0.001	110	59	<0.004	0.0023	<0.25	<0.001	0.094	<0.0002	<0.001	6.6	2.85	<0.001	<1	<0.001	950
AW-17	06/29/2021	<0.003	0.0058	1.1	<0.001	0.44	<0.001	110	55	0.0053	0.0049	<0.25	0.0039	0.064	<0.0002	0.0015	6.9	2.8	<0.001	<1	<0.001	720
AW-17	07/21/2021	<0.003	0.0051	1.2	<0.001	0.48	<0.001	100	56	<0.004	0.0023	<0.25	<0.001	0.039	<0.0002	0.0016	7.0	2.98	<0.001	<1	<0.001	1000
AW-18	02/11/2021	<0.003	0.0037	0.6	<0.001	2.7	<0.001	110	69	<0.004	0.0028	0.345	<0.001	0.11	<0.0002	0.022	7.0	2.68	<0.001	23	<0.001	740
AW-18	03/03/2021	<0.003	0.0095	1	<0.001	1	<0.001	140	75	<0.004	0.0024	2.88	<0.001	0.13	<0.0002	0.022	7.0	4.7	<0.001	6.5	<0.001	900
AW-18	03/23/2021	<0.003	0.0059	0.59	<0.001	3	<0.001	110	64	<0.004	<0.002	4.04	<0.001	0.062	<0.0002	0.027	6.4	2.82	<0.001	28	<0.001	750
AW-18	04/13/2021	<0.003	0.005	0.85	<0.001	1.6	<0.001	110	80	<0.004	<0.002	3.41	<0.001	0.067	<0.0002	0.011	6.9	1.29	<0.001	12	<0.001	860
AW-18	05/05/2021	<0.003	0.0055	0.97	<0.001	0.96	<0.001	140	81	<0.004	<0.002	10.2	<0.001	0.055	<0.0002	0.0071	6.9	2.23	<0.001	4	<0.001	910
AW-18	06/23/2021	<0.003	0.0051	1	<0.001	1.2	<0.001	140	88	<0.004	<0.002	<0.25	<0.001	0.093	<0.0002	0.0044	6.9	2.86	0.0037	3.2	<0.001	870
AW-18	06/29/2021	<0.003	0.0031	1.4	<0.001	0.41	<0.001	130	74	<0.004	<0.002	<0.25	<0.001	0.07	<0.0002	0.0051	6.9	3.42	<0.001	12	<0.001	710
AW-18	07/21/2021	<0.003	0.0033	1.1	<0.001	1.3	<0.001	120	85	<0.004	<0.002	0.251	<0.001	0.039	<0.0002	0.0033	7.0	2.34	<0.001	4.6	<0.001	930
AW-19	02/11/2021	<0.003	0.016	0.23	<0.001	2.9	<0.001	110	81	0.0073	0.0038	0.455	0.0047	0.033	<0.0002	0.0097	7.0	0.483	<0.001	28	<0.001	510
AW-19	03/03/2021	<0.003	0.02	0.24	<0.001	2.7	<0.001	120	80	0.0076	0.0039	0.329	0.0036	0.025	<0.0002	0.0052	7.1	0.795	<0.001	26	<0.001	650
AW-19	03/23/2021	<0.003	0.014	0.2	<0.001	2.6	<0.001	110	88	<0.004	<0.002	0.346	0.0016	<0.02	<0.0002	0.0034	6.4	0.129	<0.001	29	<0.001	590
AW-19	04/12/2021	<0.003	0.016	0.18	<0.001	2.5	<0.001	110	77	<0.004	<0.002	0.318	0.0013	<0.02	<0.0002	0.004	6.9	0.492	<0.001	29	<0.001	570
AW-19	05/05/2021	<0.003	0.015	0.18	<0.001	2.6	<0.001	120	86	<0.004	<0.002	0.414	<0.001	<0.02	<0.0002	0.0043	7.1	0.882	<0.001	33	<0.001	530
AW-19	06/23/2021	<0.003	0.016	0.18	<0.001	2.5	<0.001	120	88	<0.004	<0.002	0.289	<0.001	0.023	<0.0002	0.0036	7.0	0.658	<0.001	37	<0.001	580
AW-19	06/29/2021	<0.003	0.0075	0.19	<0.001	2.6	<0.001	110	80	<0.004	<0.002	0.276	<0.001	0.021	<0.0002	0.0035	7.1	2.15	<0.001	36	<0.001	550
AW-19	07/21/2021	<0.003	0.0092	0.18	<0.001	2.8	<0.001	110	86	<0.004	<0.002	0.342	<0.001	<0.02	<0.0002	0.0033	7.2	0.458	<0.001	38	<0.001	670
AW-20	02/11/2021	<0.003	0.012	0.15	<0.001	2.3	<0.001	150	90	0.0055	0.0034	0.394	0.0042	0.027	<0.0002	0.0028	6.8	0.606	<0.001	48	<0.001	790
AW-20	03/03/2021	<0.003	0.013	0.13	<0.001	2.2	<0.001	170	89	<0.004	0.002	0.286	<0.001	<0.02	<0.0002	0.0028	6.9	0.515	<0.001	45	<0.001	830

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
AW-20	03/23/2021	<0.003	0.011	0.13	<0.001	2.3	<0.001	160	89	<0.004	<0.002	0.275	<0.001	<0.02	<0.0002	0.0025	6.4	1.38	<0.001	43	<0.001	800
AW-20	04/12/2021	<0.003	0.012	0.13	<0.001	2.1	<0.001	160	87	<0.004	<0.002	0.321	<0.001	0.021	<0.0002	0.0022	6.9	1.17	<0.001	39	<0.001	730
AW-20	05/05/2021	<0.003	0.012	0.14	<0.001	2.2	<0.001	160	93	<0.004	<0.002	0.313	<0.001	<0.02	<0.0002	0.0026	6.9	0.448	<0.001	41	<0.001	730
AW-21	02/11/2021	<0.003	<0.001	0.079	<0.001	12	<0.001	110	100	<0.004	<0.002	0.646	<0.001	<0.02	<0.0002	0.019	7.2	0.645	<0.001	250	<0.001	650
AW-21	03/03/2021	<0.003	0.0011	0.063	<0.001	11	<0.001	120	96	<0.004	<0.002	0.474	<0.001	<0.02	<0.0002	0.024	7.2	0.493	<0.001	240	<0.001	710
AW-21	03/23/2021	<0.003	0.0011	0.08	<0.001	12	<0.001	110	99	<0.004	<0.002	0.399	<0.001	<0.02	<0.0002	0.018	6.7	0.223	<0.001	250	<0.001	650
AW-21	04/12/2021	<0.003	0.0016	0.085	<0.001	11	<0.001	110	100	<0.004	<0.002	0.416	0.0012	<0.02	<0.0002	0.021	7.2	0.83	<0.001	41	<0.001	630
AW-21	05/05/2021	<0.003	0.0011	0.067	<0.001	11	<0.001	120	96	<0.004	<0.002	0.526	<0.001	<0.02	<0.0002	0.02	7.2	0.237	<0.001	230	<0.001	710
AW-21	06/23/2021	<0.003	0.0022	0.062	<0.001	12	<0.001	120	93	<0.004	<0.002	0.372	<0.001	<0.02	<0.0002	0.015	7.2	1.08	<0.001	250	<0.001	700
AW-21	06/29/2021	<0.003	0.0013	0.075	<0.001	11	<0.001	110	95	<0.004	<0.002	0.409	<0.001	<0.02	<0.0002	0.016	7.2	0.645	<0.001	250	<0.001	640
AW-21	07/21/2021	<0.003	0.0015	0.075	<0.001	12	<0.001	110	100	<0.004	<0.002	0.275	<0.001	<0.02	<0.0002	0.016	7.3	1	<0.001	260	<0.001	800
AW-22	02/12/2021	<0.003	0.0043	0.76	<0.001	0.32	<0.001	78	40	<0.004	<0.002	<0.25	<0.001	0.023	<0.0002	0.0015	7.0	1.55	<0.001	<1	<0.001	540
AW-22	03/03/2021	<0.003	0.0029	0.8	<0.001	0.23	<0.001	82	39	<0.004	<0.002	<0.25	<0.001	0.022	<0.0002	0.0013	6.9	1	<0.001	<1	<0.001	570
AW-22	03/23/2021	<0.003	0.0016	0.73	<0.001	0.23	<0.001	77	39	<0.004	<0.002	0.374	<0.001	0.022	<0.0002	0.0017	6.5	1.12	<0.001	<1	<0.001	540
AW-22	04/23/2021	<0.003	0.0032	0.99	<0.001	0.33	<0.001	110	42	0.0041	<0.002	<0.25	0.0081	<0.02	<0.0002	0.0021	6.9	2.37	0.0011	<1	<0.001	500
AW-22	05/05/2021	<0.003	0.0017	0.8	<0.001	0.38	<0.001	80	40	<0.004	<0.002	<0.25	<0.001	<0.02	<0.0002	<0.001	6.9	2.13	<0.001	<1	<0.001	530
P002	02/12/2021	<0.003	0.0046	0.11	<0.001	1.4	<0.001	170	78	<0.004	0.0042	0.344	<0.001	<0.02	<0.0002	0.0016	6.6	0.166	<0.001	1.1	<0.001	730
P002	03/03/2021	<0.003	0.0071	0.1	<0.001	1.1	<0.001	180	70	<0.004	0.0042	0.297	<0.001	<0.02	<0.0002	0.0017	6.8	0.4	<0.001	1.2	<0.001	810
P002	03/23/2021	<0.003	0.0062	0.096	<0.001	1.2	<0.001	170	71	<0.004	0.0041	0.363	<0.001	<0.02	<0.0002	0.0017	6.3	0.195	<0.001	1.2	<0.001	830
P002	04/13/2021	<0.003	0.0084	0.097	<0.001	1.2	<0.001	170	74	<0.004	0.0044	0.337	<0.001	<0.02	<0.0002	0.0017	6.8	0.124	<0.001	<1	<0.001	790
P002	05/04/2021	<0.003	0.0079	0.1	<0.001	1.2	<0.001	180	69	<0.004	0.0045	0.335	<0.001	<0.02	<0.0002	0.002	6.8	0.0443	<0.001	<1	<0.001	860

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200

Notes:
Detected at concentration greater than the GWPS
-- = data not available
GWPS = Groundwater Protection Standard
mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = standard units
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method. Estimated concentrations below the reporting limit and associated qualifiers are not provided since they are not utilized in statistics to determine exceedances above Part 845 standards.
35 I.A.C. 845.600 = Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
AP05D	02/10/2021	0.33	126	7.7	2032	8.4	3.9
AP05D	03/08/2021	0.20	-67.3	7.2	2821	14.9	27.5
AP05D	03/24/2021	6.13	-54	7.6	1882	13.7	0
AP05D	04/15/2021	0.43	-97.9	7.4	3148	10.1	36.6
AP05D	05/07/2021	1.50	-106	7.7	3722	17.4	323
AP05S	01/18/2017	0	95	6.9	1095	12.1	96
AP05S	05/10/2017	0	105	7.1	1035	14.6	73.9
AP05S	06/07/2017	0	103	6.8	989	15.4	63.9
AP05S	06/22/2017	0	105	7.2	1017	18.3	68.7
AP05S	07/21/2017	0	89	6.9	1030	19.8	61.8
AP05S	07/31/2017	0	70	7.0	1011	15.6	94
AP05S	08/07/2017	0	95	7.0	1040	15.4	82.8
AP05S	08/23/2017	0	96	6.9	1002	15.7	98.1
AP05S	11/02/2017	0	79	7.2	1120	12.8	95.8
AP05S	05/07/2018	0	94	7.2	1040	13.7	85.4
AP05S	07/27/2018	0	79	7.1	1010	15.1	95.3
AP05S	08/27/2018	0	95	7.0	1112	15.3	99.1
AP05S	02/27/2019	0	89	7.1	1270	11.9	99
AP05S	08/06/2019	0	80	7.1	1010	16.9	1000
AP05S	02/27/2020	0.20	-102	6.7	1711	8.6	518
AP05S	09/01/2020	0.14	-118	6.9	1664	18.6	466
AP05S	02/10/2021	0.19	8.3	6.9	1648	6.5	15
AP05S	02/23/2021	0.50	-120	6.8	1499	15.1	1410
AP05S	03/08/2021	0.11	-85.9	6.8	1821	13.9	447
AP05S	03/24/2021	0.17	-26.3	6.3	1561	12.5	276
AP05S	04/13/2021	0.06	-138	7.0	1496	13.9	380
AP05S	05/07/2021	0.72	-112	6.8	1651	15.1	271
AP05S	06/16/2021	0.12	-201	6.9	1753	27.2	2780
AP05S	06/29/2021	0.30	-152	6.9	1736	20.7	2500
AP05S	07/22/2021	0.20	-122	7.0	1721	26.6	1450
AP07D	02/10/2021	6.63	128	8.2	3028	8.8	21.1
AP07D	03/08/2021	7.44	30.9	7.8	3453	16.4	6830
AP07D	03/24/2021	5.54	9.5	7.5	3509	14.3	13900
AP07D	04/13/2021	0.26	-129	7.8	3621	19.0	1620
AP07D	05/05/2021	0	-168	7.9	3209	22.8	635
AP07D	07/22/2021	3.60	47.4	7.5	3002	17.8	1930
AP07S	02/10/2021	0.76	80.3	6.8	1193	9.2	16.2
AP07S	03/04/2021	0.69	79.5	6.7	1118	12.1	12
AP07S	03/24/2021	0.43	26.4	6.2	1084	13.6	0
AP07S	04/13/2021	0.60	29.9	6.8	1792	15.4	146
AP07S	05/05/2021	0.61	20.9	6.6	1875	17.9	1240
AP07S	06/16/2021	1.60	21.8	6.5	1986	36.0	27.5
AP07S	06/28/2021	2.20	55.8	6.8	2034	16.7	34.3
AP07S	07/22/2021	1.20	16.5	6.6	2473	17.7	591

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
APW-01	06/17/2021	0.63	-103	6.9	1450	37.3	2000
APW-01	06/29/2021	24.00	-95.6	6.8	10540	19.9	3560
APW-01	07/22/2021	0.09	-135	6.9	1648	16.6	3280
APW-02	02/10/2021	0.22	-104	7.0	1042	9.0	1.24
APW-02	03/03/2021	0.17	-76.8	7.0	1046	14.0	34.3
APW-02	03/24/2021	0.30	-41.6	6.5	992.8	12.8	249
APW-02	04/13/2021	1.50	-93.7	6.9	989	12.6	123
APW-02	05/06/2021	0.67	-118	6.8	943	16.5	71.1
APW-03	02/10/2021	0.14	-111	6.8	1574	10.9	106
APW-03	03/04/2021	0.19	-52.9	6.6	1637	12.5	67.3
APW-03	03/24/2021	0.23	-51.7	6.4	1628	13.4	0
APW-03	04/13/2021	0.23	-128	6.8	1696	21.7	732
APW-03	05/07/2021	0.98	-106	6.8	1641	27.2	595
APW-04	02/10/2021	0.18	-89.8	6.9	1636	7.5	141
APW-04	03/04/2021	0.21	-55	6.8	1596	10.2	131
APW-04	03/22/2021	0.21	-50.9	6.9	1458	11.3	514
APW-04	04/13/2021	0.26	-123	6.8	1706	18.7	1300
APW-04	05/07/2021	0.19	-125	6.8	1805	21.5	114
AW-05	11/09/2015	0	-9	6.7	2210	15.8	268
AW-05	02/17/2016	0	-17	6.8	1980	12.5	286
AW-05	05/17/2016	0	-30	6.7	1736	13.7	238
AW-05	07/21/2016	0	-54	6.9	1662	18.3	237
AW-05	11/10/2016	0	-48	7.1	1340	13.9	190
AW-05	01/17/2017	0	-56	7.1	1288	14.2	190
AW-05	05/08/2017	0	-63	7.2	1229	14.8	164
AW-05	07/19/2017	0	-74	7.1	1230	19.9	217
AW-05	11/01/2017	0	-50	7.2	1250	13.4	206
AW-05	02/27/2020	3.80	51.4	7.0	1273	9.7	922
AW-05	06/17/2021	0.64	-42.2	7.0	1433	17.4	186
AW-05	06/28/2021	0.80	6.8	7.0	1430	19.5	39.2
AW-05	07/22/2021	0.73	-35.6	7.1	1351	19.5	19
AW-06	11/10/2015	0	78	7.0	1140	14.0	1000
AW-06	02/17/2016	0	80	7.2	1110	11.8	1000
AW-06	05/18/2016	0	108	7.2	1024	12.7	1000
AW-06	07/22/2016	0	95	7.1	1035	15.0	1000
AW-06	11/11/2016	0	83	7.2	995	14.0	1000
AW-06	01/17/2017	0	95	7.2	1030	14.6	1000
AW-06	05/09/2017	0	80	7.2	963	14.5	1000
AW-06	07/20/2017	0	89	7.3	1080	18.8	1000
AW-06	11/02/2017	0	111	7.1	1100	13.4	1000
AW-06	05/05/2018	0	74	7.2	1010	14.0	1000
AW-06	08/24/2018	0	96	7.9	1049	15.1	98.1
AW-06	02/27/2019	0	65	7.3	860	11.5	91.4
AW-06	08/06/2019	0	111	7.2	1031	17.2	1000

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
AW-06	02/27/2020	2.40	16.2	7.0	985	12.4	119
AW-06	08/31/2020	5.40	-42.6	7.3	924	19.2	36
AW-06	02/23/2021	2.00	-30.1	7.1	1008	12.0	1650
AW-08	11/09/2015	0	21	6.6	1380	16.8	0
AW-08	02/17/2016	0	67	6.8	1290	12.3	104
AW-08	05/17/2016	0	48	6.8	1244	13.3	112
AW-08	07/21/2016	0	78	7.0	1275	15.7	102
AW-08	11/10/2016	0	74	7.1	1149	14.2	78
AW-08	01/17/2017	0	67	7.2	1105	15.3	75
AW-08	05/08/2017	0	74	7.1	1002	15.4	78.4
AW-08	07/19/2017	0	68	7.3	1010	21.4	76.5
AW-08	11/01/2017	0	74	7.1	1120	13.0	80.4
AW-08	05/05/2018	0	65	7.1	1080	13.7	93.1
AW-08	07/27/2018	0	72	7.2	1120	15.0	75.6
AW-08	08/27/2018	0	70	7.1	1088	15.3	81.6
AW-08	02/27/2019	0	73	7.1	1162	12.0	99.2
AW-08	08/06/2019	0	73	7.3	1160	17.2	88.7
AW-08	02/27/2020	0.23	-140	6.9	1303	12.1	33.5
AW-08	09/01/2020	0.07	-149	7.1	1280	19.3	3.3
AW-08	02/10/2021	0.26	-104	7.1	1328	11.8	2.51
AW-08	02/23/2021	0.46	-144	6.9	1405	15.2	1310
AW-08	03/05/2021	0.33	-64	6.9	1253	14.2	3.75
AW-08	03/24/2021	0.28	-83.6	6.3	1320	15.8	1.32
AW-08	04/13/2021	0.64	-154	6.8	1453	17.5	500
AW-08	05/07/2021	1.70	-156	7.0	1372	17.6	59.8
AW-08	06/16/2021	3.50	-152	7.0	1386	23.1	87.9
AW-08	06/28/2021	7.90	-98.8	7.0	1246	23.8	133
AW-08	07/21/2021	0	-126	6.9	764	23.2	16.9
AW-09	11/10/2015	0.67	87	6.8	1280	13.6	1000
AW-09	02/17/2016	0	115	6.6	1240	12.0	1000
AW-09	05/17/2016	0	82	6.5	1268	13.2	1000
AW-09	07/22/2016	0	67	6.6	1242	15.4	1000
AW-09	11/11/2016	0	39	6.7	1148	14.4	1000
AW-09	01/17/2017	0	57	6.9	1162	14.2	1000
AW-09	05/09/2017	0	68	7.1	1046	15.0	1000
AW-09	07/20/2017	0	64	6.9	1150	19.5	1000
AW-09	11/02/2017	0	59	7.0	1060	13.1	1000
AW-09	05/05/2018	0	55	7.0	1100	13.9	1000
AW-09	08/24/2018	0	59	7.0	1128	14.6	95
AW-09	02/27/2019	0	55	7.0	1055	11.8	1000
AW-09	08/06/2019	0	73	7.2	1324	16.9	1000
AW-09	02/27/2020	1.00	-114	6.9	1490	12.3	135
AW-09	08/31/2020	1.80	-115	6.9	1477	19.2	352
AW-09	02/23/2021	1.10	-123	6.9	1515	12.5	485

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
AW-10	11/09/2015	4.47	-38	6.6	2240	14.5	583
AW-10	02/18/2016	0.17	-24	7.0	2020	11.2	1000
AW-10	05/18/2016	0	-20	7.1	2230	13.6	1000
AW-10	07/21/2016	0	-56	7.1	1985	14.9	1000
AW-10	11/11/2016	0	-65	7.1	1784	13.8	1000
AW-10	01/17/2017	0	-67	7.1	1682	14.7	1000
AW-10	05/10/2017	0	-65	6.9	1607	15.0	1000
AW-10	07/20/2017	0	-78	7.0	1740	18.0	1000
AW-10	11/02/2017	0	-70	7.2	1560	13.7	1000
AW-10	05/07/2018	0	-62	7.3	1740	12.7	1000
AW-10	07/27/2018	0	-71	7.2	1460	15.1	1000
AW-10	08/27/2018	0	-57	7.1	1603	15.1	1000
AW-10	02/27/2019	0	-67	7.2	1624	11.9	1000
AW-10	08/06/2019	0	-72	7.3	1420	17.1	1000
AW-10	02/27/2020	0.04	-127	6.8	2169	8.3	863
AW-10	08/31/2020	0.05	-135	6.8	2167	21.3	375
AW-10	02/23/2021	0	-138	6.9	2234	10.3	740
AW-10	03/23/2021	0.13	-55.7	6.8	2222	10.8	1610
AW-11	11/09/2015	5.27	-12	6.5	1900	13.2	844
AW-11	02/18/2016	0	61	6.9	1860	11.9	1000
AW-11	05/18/2016	0	40	7.0	1625	13.4	1000
AW-11	07/22/2016	0	55	7.0	1534	15.3	1000
AW-11	11/11/2016	0	64	7.1	1441	14.3	1000
AW-11	01/17/2017	0	66	7.2	1539	15.1	1000
AW-11	05/09/2017	0	61	7.0	1625	14.6	1000
AW-11	07/20/2017	0	58	7.2	1530	21.8	1000
AW-11	11/02/2017	0	72	7.2	1390	12.8	1000
AW-11	05/07/2018	0	71	7.2	1540	14.1	1000
AW-11	08/27/2018	0	71	7.2	1460	15.1	1000
AW-11	02/27/2019	0	72	7.2	1240	12.0	1000
AW-11	08/06/2019	0	74	7.2	1307	17.0	1000
AW-11	02/27/2020	0	-152	6.7	1780	7.8	2400
AW-11	08/31/2020	0.01	-163	6.9	1805	23.7	170
AW-11	02/23/2021	0	-140	7.0	1799	9.7	582
AW-12	02/11/2021	0.10	-114	6.8	1592	12.9	531
AW-12	03/04/2021	0.07	-65.1	6.8	1487	13.7	6.58
AW-12	03/24/2021	0.09	-57.8	6.4	1469	13.6	48.1
AW-12	04/12/2021	0.09	-89.6	7.0	1476	15.4	139
AW-12	05/07/2021	0.91	-128	7.0	1154	17.0	3.07
AW-13	02/11/2021	0.15	-90.2	6.9	2016	8.7	134
AW-13	03/04/2021	0.05	-28.8	6.7	1891	10.4	46.9
AW-13	03/23/2021	0.09	-48.2	6.7	1778	10.4	112
AW-13	04/12/2021	0.14	-86	6.8	1897	12.0	1200
AW-13	05/07/2021	0.08	-96.5	6.8	1700	15.1	30.1

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
AW-14	02/11/2021	0.21	-85.8	7.0	2138	10.0	473
AW-14	03/04/2021	0.08	-80.7	6.9	1895	11.2	85.8
AW-14	03/22/2021	0.08	-79.4	6.9	1841	11.8	88.8
AW-14	04/12/2021	0.10	-127	6.8	1874	13.3	67.7
AW-14	05/06/2021	0.83	-146	6.8	1891	14.2	67
AW-14	06/28/2021	0.06	-150	6.8	1851	17.0	30.6
AW-14	07/21/2021	0	-131	6.6	1940	25.5	40.4
AW-15	02/12/2021	0.20	-81.8	6.8	1824	11.0	24.4
AW-15	03/05/2021	0.16	-47.7	6.7	1756	12.6	78.3
AW-15	03/22/2021	0.60	-51.5	6.8	27.6	14.4	383
AW-15	05/06/2021	0.53	-118	6.6	1936	14.4	30.6
AW-15C	02/12/2021	0.16	-84.2	7.0	1495	7.9	155
AW-15C	03/04/2021	0.10	-76.4	6.8	1281	12.3	111
AW-15C	03/22/2021	0.08	-36.5	6.7	1216	13.0	782
AW-15C	04/13/2021	0.01	-53.6	7.0	2127	13.9	0.67
AW-15C	05/06/2021	0.72	-99.3	6.8	1824	13.4	33.2
AW-15C	07/21/2021	0	-85	6.8	2360	23.0	30.1
AW-15S	02/12/2021	1.79	62.9	7.0	1609	7.7	702
AW-15S	03/04/2021	0.67	-3.5	7.1	1707	10.0	24.8
AW-15S	03/22/2021	0.52	50.1	6.9	1773	12.6	73.1
AW-15S	04/26/2021	1.10	7.1	7.0	1966	13.2	0.89
AW-15S	05/06/2021	0.89	64.5	6.7	1801	12.8	38.4
AW-15S	06/17/2021	0.47	-47.1	6.6	1812	15.7	32.1
AW-15S	06/29/2021	0.24	117	6.9	1795	18.5	23.3
AW-15S	07/21/2021	0	-5	6.6	1960	20.2	326
AW-16	02/11/2021	0.28	-69.5	6.8	2465	12.8	0
AW-16	03/03/2021	0.13	-63.7	6.8	455.1	13.6	146
AW-16	03/24/2021	0.14	-40.7	6.4	140.3	13.8	0
AW-16	04/23/2021	0.52	-99.4	6.8	1574	14.1	3.19
AW-16	05/05/2021	0.08	-107	6.7	1638	15.8	312
AW-16	06/24/2021	2.00	-100	6.6	2040	17.2	0
AW-16	06/29/2021	0.01	-108	6.8	2242	19.0	18.8
AW-16	07/21/2021	0.16	-136	6.8	1949	16.8	38.9
AW-17	02/11/2021	0.25	-104	7.0	2079	11.1	182
AW-17	03/03/2021	0.20	-86.3	6.8	1922	12.7	462
AW-17	03/23/2021	0.18	-35.6	6.2	1476	13.4	11.3
AW-17	04/23/2021	0.23	-136	6.9	1778	13.6	110
AW-17	05/05/2021	0.13	-133	6.8	1723	14.8	79.6
AW-17	06/24/2021	2.60	-96	6.6	1960	17.0	44.1
AW-17	06/29/2021	0.03	-130	6.9	1825	18.4	751
AW-17	07/21/2021	0.40	-157	7.0	1795	17.0	245
AW-18	02/11/2021	0.36	-70.8	7.0	1684	9.3	101
AW-18	03/03/2021	0.25	-113	7.0	1996	13.2	217
AW-18	03/23/2021	0.15	-69.4	6.4	1466	13.4	330

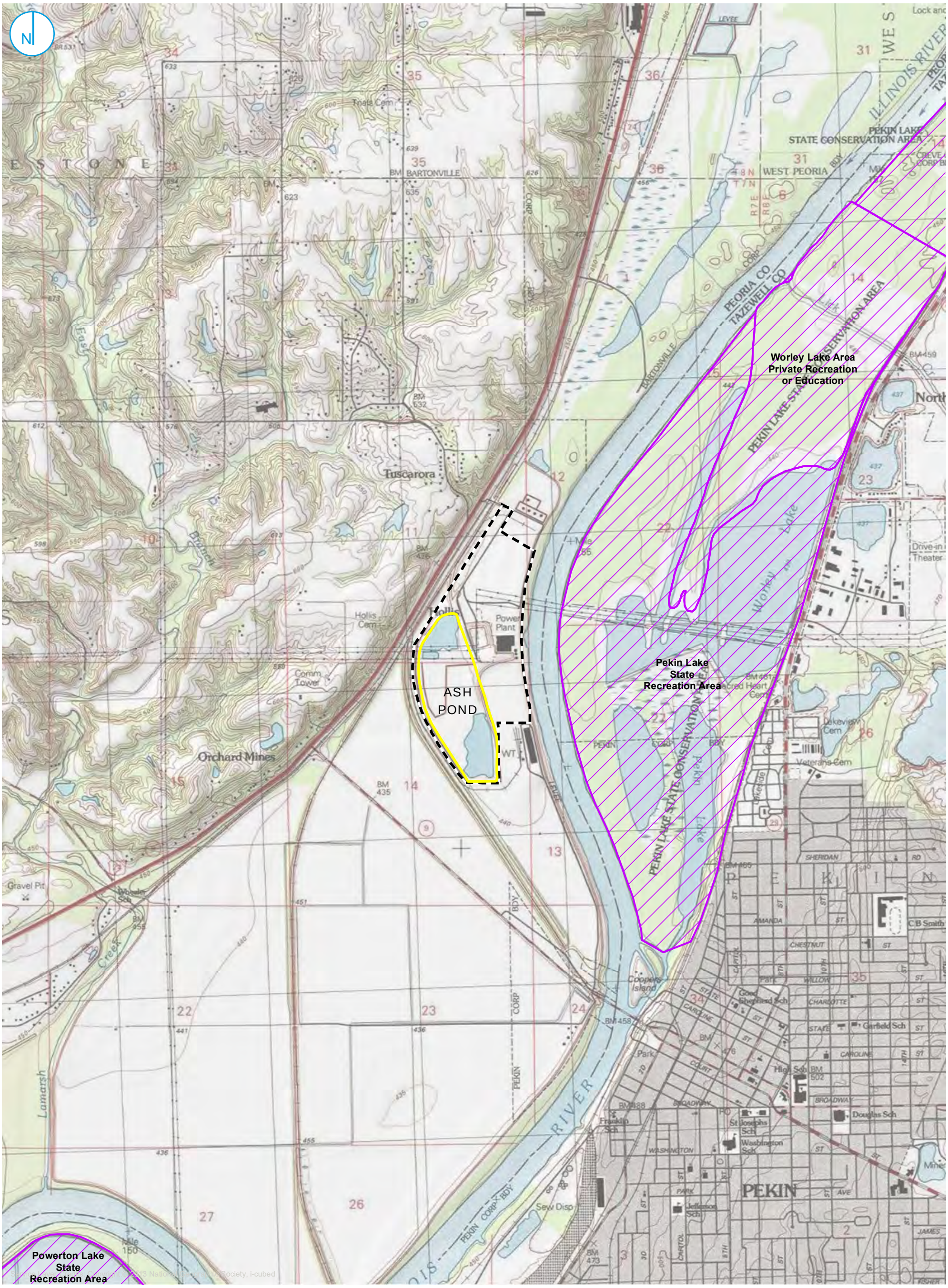
TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
AW-18	04/13/2021	0.32	-136	6.9	1884	14.9	81.4
AW-18	05/05/2021	0.11	-164	6.9	1830	15.5	48.4
AW-18	06/23/2021	0.12	-142	6.9	1815	17.2	8.23
AW-18	06/29/2021	0.14	-144	6.9	1887	20.6	20.1
AW-18	07/21/2021	0.02	-149	7.0	1870	17.3	60
AW-19	02/11/2021	0.34	-55.5	7.0	1220	11.0	397
AW-19	03/03/2021	0.52	-37.9	7.1	827.2	13.7	445
AW-19	03/23/2021	0.26	9.6	6.4	1125	13.7	97.7
AW-19	04/12/2021	1.40	-59.5	6.9	985	16.5	20.7
AW-19	05/05/2021	0.91	-90.4	7.1	1038	15.5	111
AW-19	06/23/2021	0.87	-61.9	7.0	206	17.8	0.95
AW-19	06/29/2021	0.85	-79.1	7.1	1131	17.8	14.7
AW-19	07/21/2021	0.44	-111	7.2	1119	16.6	18.9
AW-20	02/11/2021	0.25	-52.9	6.8	1570	12.4	144
AW-20	03/03/2021	0.12	-41.5	6.9	1390	14.3	51.9
AW-20	03/23/2021	0.19	-1.2	6.4	1420	14.1	21.9
AW-20	04/12/2021	1.30	-62.2	6.9	1334	16.1	4.52
AW-20	05/05/2021	0.70	-93.2	6.9	1369	16.5	37.8
AW-21	02/11/2021	1.09	-92.6	7.2	1133	10.2	17.8
AW-21	03/03/2021	0.28	-38.5	7.2	1134	14.0	0
AW-21	03/23/2021	0.30	1.6	6.7	1068	13.7	11.1
AW-21	04/12/2021	1.90	-18.3	7.2	1003	16.1	17.4
AW-21	05/05/2021	0.55	-40.6	7.2	1052	15.7	37.7
AW-21	06/23/2021	0.93	-26.5	7.2	1068	16.0	33.7
AW-21	06/29/2021	0.85	-36.9	7.2	1053	16.7	14.9
AW-21	07/21/2021	1.90	9.5	7.3	1081	20.8	39.9
AW-22	02/12/2021	1.00	-73.7	7.0	1048	2.9	47.3
AW-22	03/03/2021	0.09	-89.6	6.9	248.4	14.1	5950
AW-22	03/23/2021	0.08	-51.3	6.5	778.3	13.4	0
AW-22	04/23/2021	0.59	-99.3	6.9	1108	13.4	4.17
AW-22	05/05/2021	0.19	-122	6.9	916	15.6	292
P002	02/12/2021	0.64	-30.8	6.6	1384	8.8	25.8
P002	03/03/2021	0.25	-4.6	6.8	1348	14.5	19.9
P002	03/23/2021	0.39	21.5	6.3	1504	13.6	6.77
P002	04/13/2021	0.86	-50.1	6.8	1509	14.1	18.1
P002	05/04/2021	0.89	-55.7	6.8	1141	14.3	20.7

Notes:
Field readings are reported with as many significant figures as provided by analytical laboratory.
cm = centimeter
deg. C = degrees Celsius
mg/L = milligrams per liter
mV = millivolts
NTU = nephelometric turbidity units
SU = standard units

generated 10/05/2021, 3:57:37 PM CDT

FIGURES



PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY
PROTECTED AREA

SITE LOCATION MAP

FIGURE 1-1

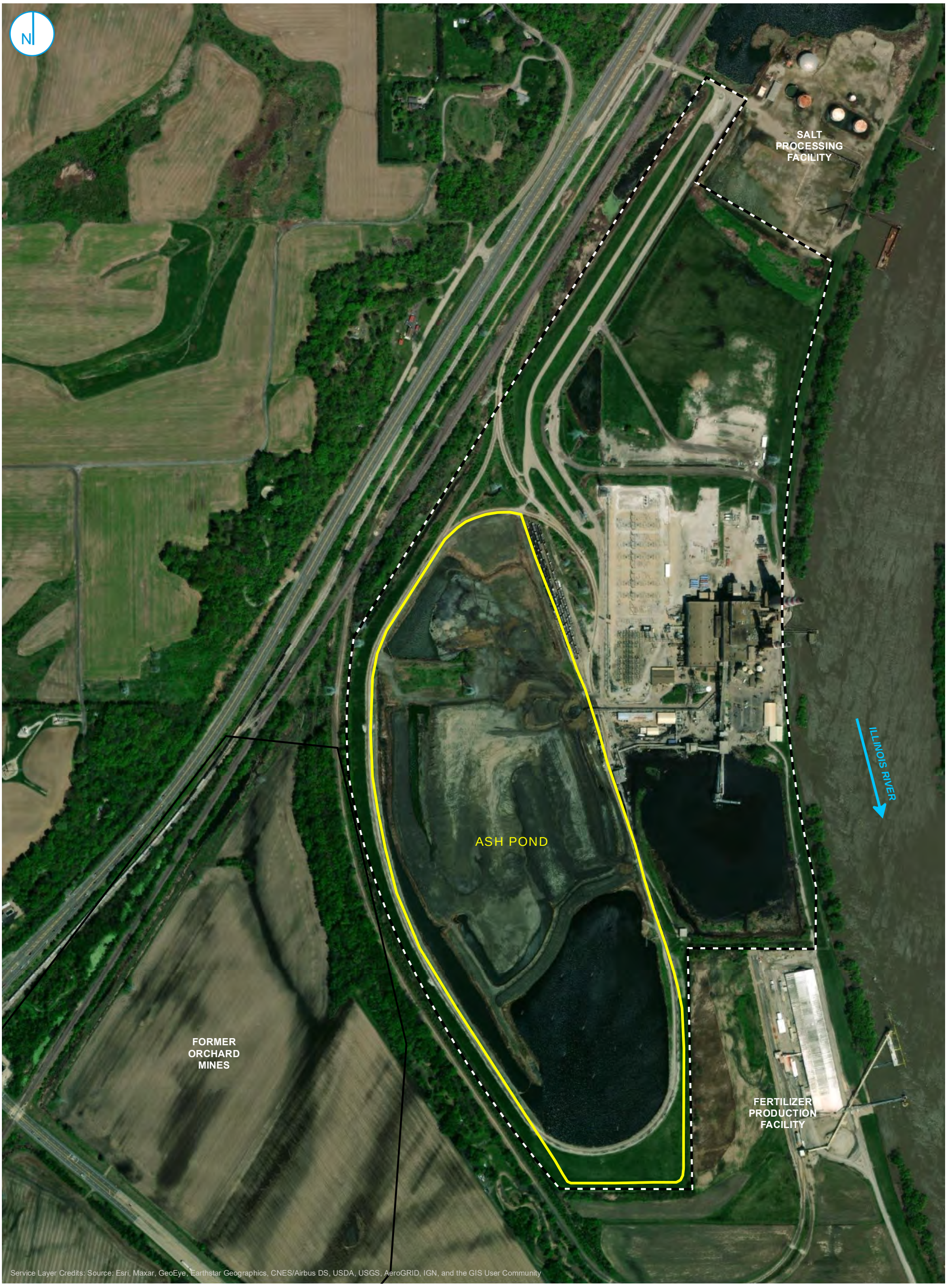
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 8/12/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Edwards\Figure 1-2_Site Map.mxd



PART 845 REGULATED UNIT (SUBJECT UNIT)
FORMER ORCHARD MINES AREA
PROPERTY BOUNDARY

0 250 500 Feet

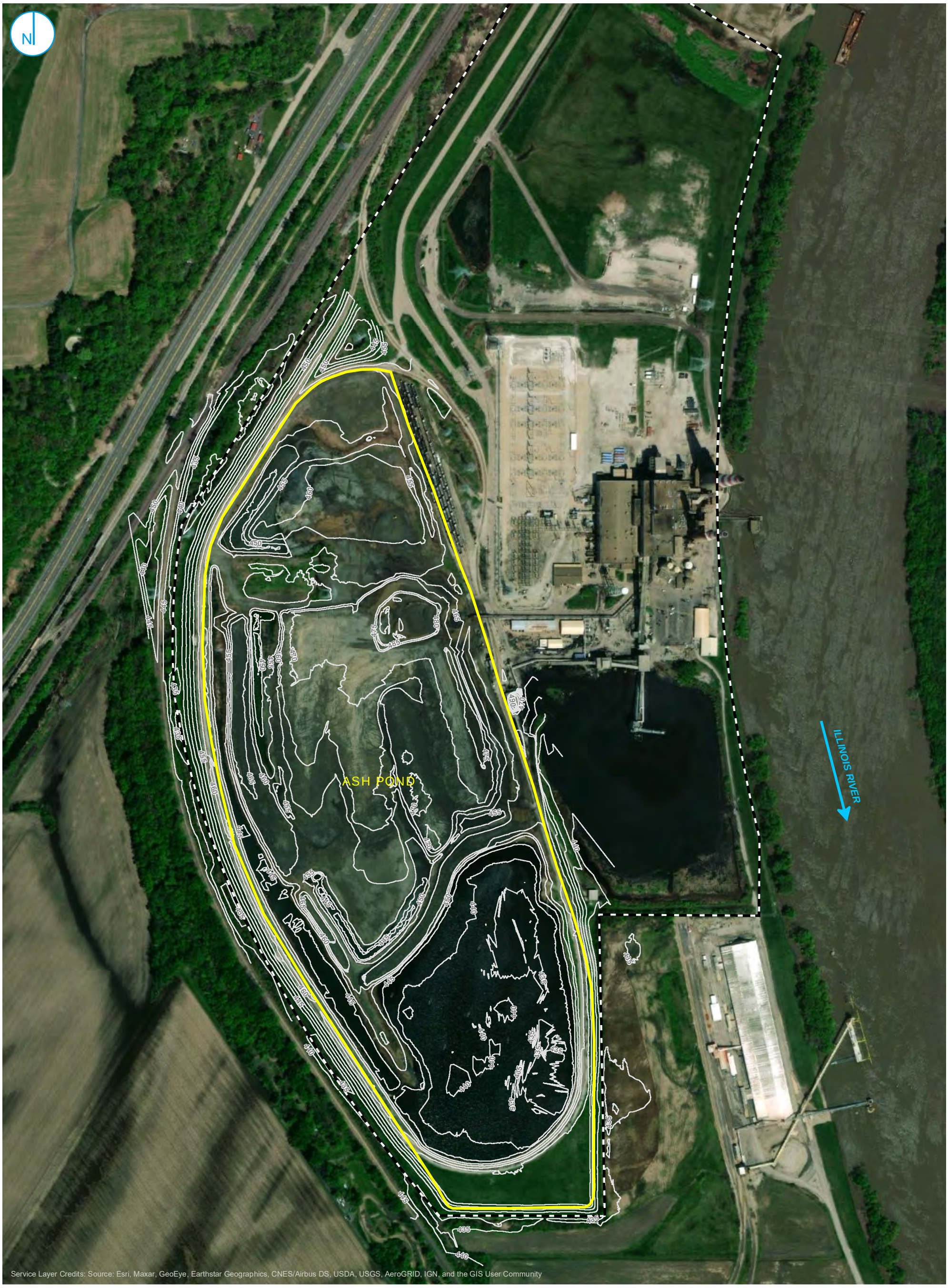
SITE MAP

FIGURE 1-2

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



5FT TOPOGRAPHIC CONTOUR
PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 200 400 Feet

SOURCE
INGENAE SURVEY, 2021

SITE TOPOGRAPHIC MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

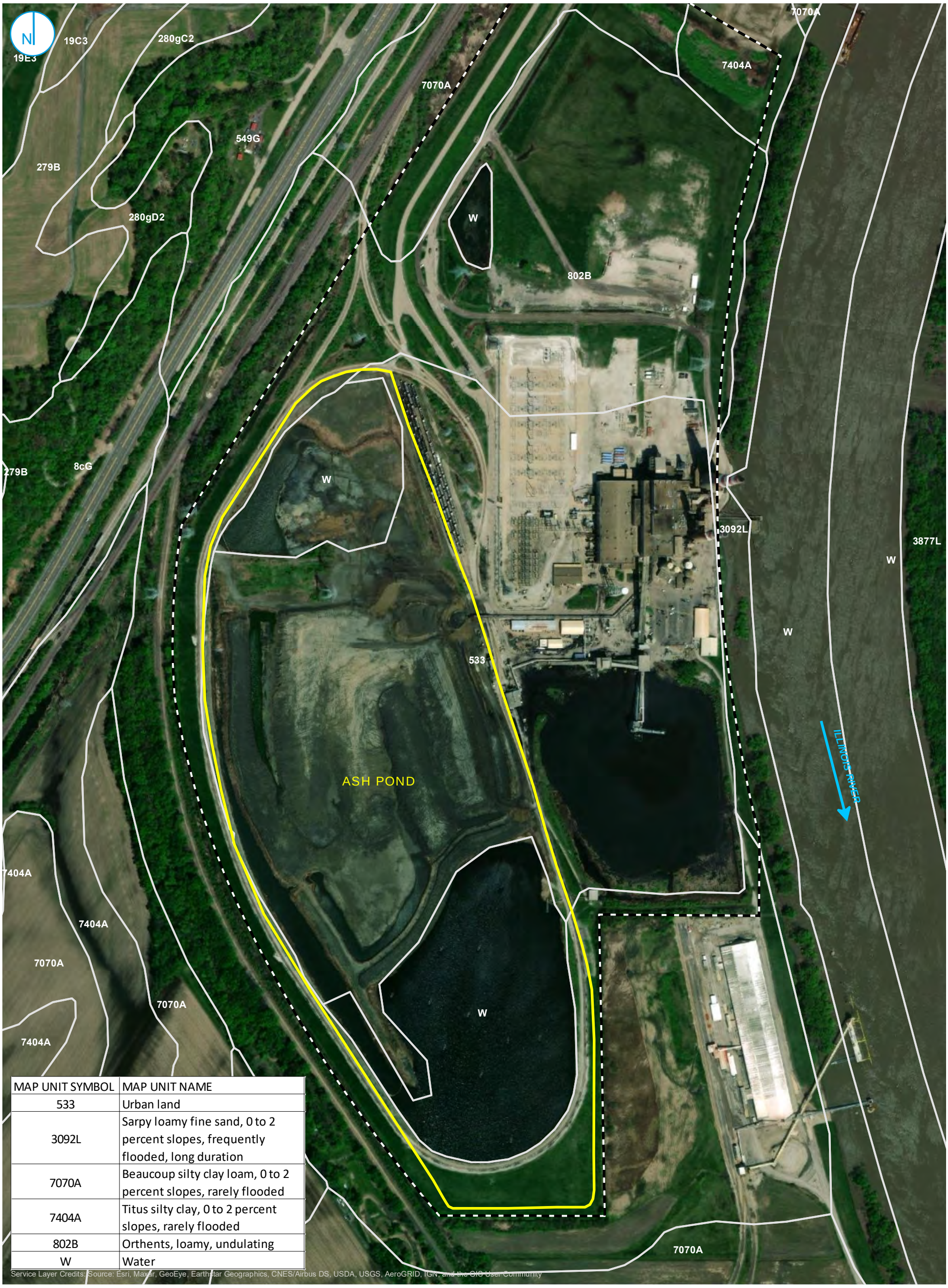
FIGURE 2-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 8/12/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Edwards\Figure 2-2_Soil Survey.mxd



MAP UNIT SYMBOL	MAP UNIT NAME
533	Urban land
3092L	Sarpy loamy fine sand, 0 to 2 percent slopes, frequently flooded, long duration
7070A	Beaucoup silty clay loam, 0 to 2 percent slopes, rarely flooded
7404A	Titus silty clay, 0 to 2 percent slopes, rarely flooded
802B	Orthents, loamy, undulating
W	Water

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

NRCS SOIL SURVEY MAP UNIT BOUNDARY

PART 845 REGULATED UNIT (SUBJECT UNIT)

PROPERTY BOUNDARY

0 200 400 Feet

SOURCE
NATURAL RESOURCES CONSERVATION SERVICE (NRCS)

SOIL SURVEY MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

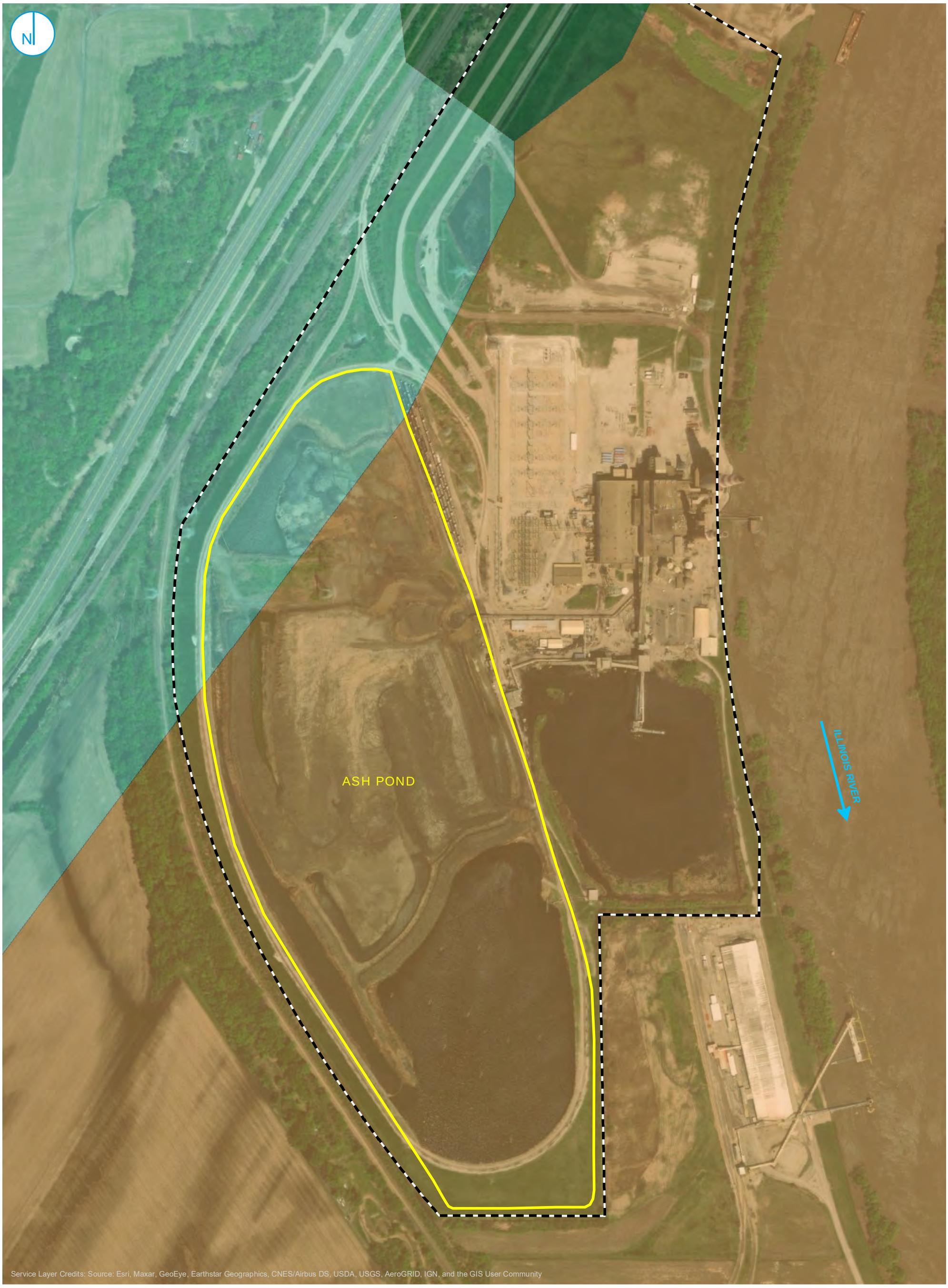
FIGURE 2-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 8/12/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Edwards\Figure 2-3_Surficial Geologic Deposits.mxd



PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY
CAHOKIA ALLUVIUM (INCLUDES ALLUVIAL FAN FACIES)
NOT A QUATERNARY DEPOSIT
RADNOR TILL MEMBER

0 200 400 Feet

SOURCE:
ILLINOIS STATE GEOLOGICAL SURVEY (ISGS)

SURFICIAL GEOLOGIC DEPOSITS

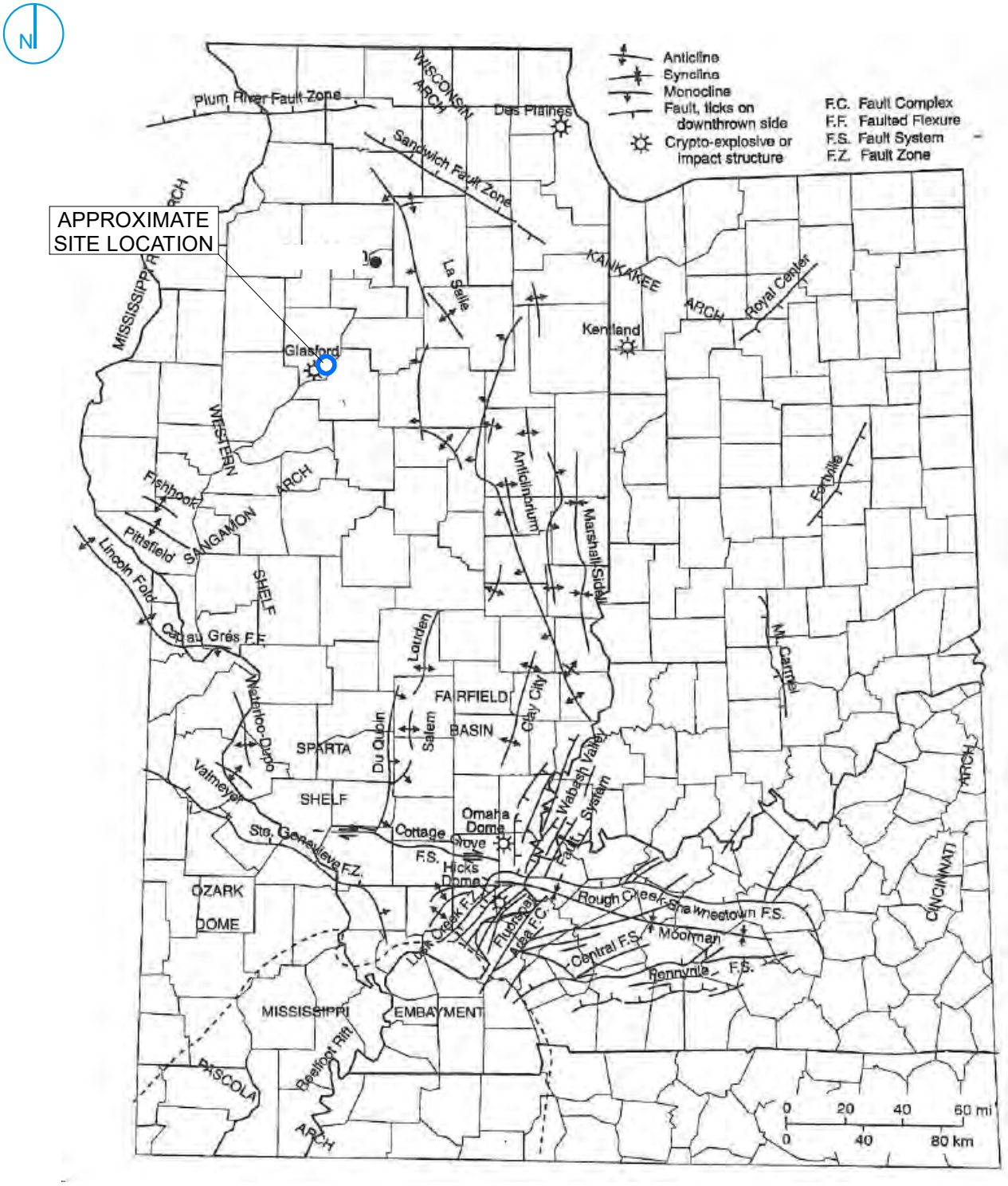
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 2-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22285\MXD\845_Operating_Permit\Edwards\Figure 2-4_Major Structural Features of Illinois.mxd
PROJECT: 169000XXXX | DATED: 8/12/2021 | DESIGNER: STOLZSD



SOURCE NOTE: MODIFIED FROM "NELSON, W.J. 1995, STRUCTURAL FEATURES IN ILLINOIS, ILLINOIS STATE GEOLOGICAL SURVEY, BULLETIN 100, CHAMPAIGN, ILLINOIS."

Service Layer Credits:

MAJOR STRUCTURAL FEATURES OF ILLINOIS

FIGURE 2-4

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE
PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 200 400 Feet

FIELD INVESTIGATION LOCATIONS

FIGURE 2-5

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

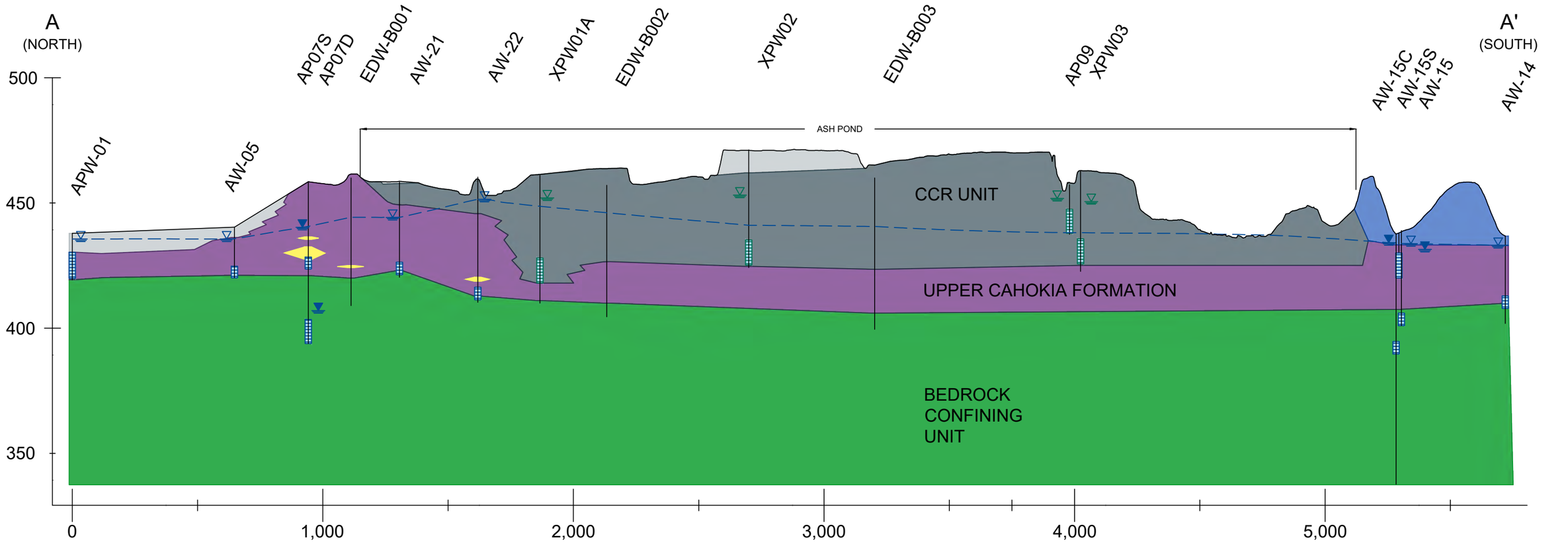
RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



NOTES

1. This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.
2. Scale is approximate.
3. Vertical scale is exaggerated 10X.
4. Vertical Datum: NAVD88
5. Groundwater elevations measured on April 12, 2021.



LEGEND

- COAL COMBUSTION RESIDUALS, CCRs
- FILL
- CLAY (CL/CH)
- SILT (ML)
- SAND (SP/SM/SW)
- BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, V. LITTLE SS)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPER AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- BEDROCK GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)

40' 0 400'

GEOLOGIC CROSS SECTION A-A'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 2-6

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

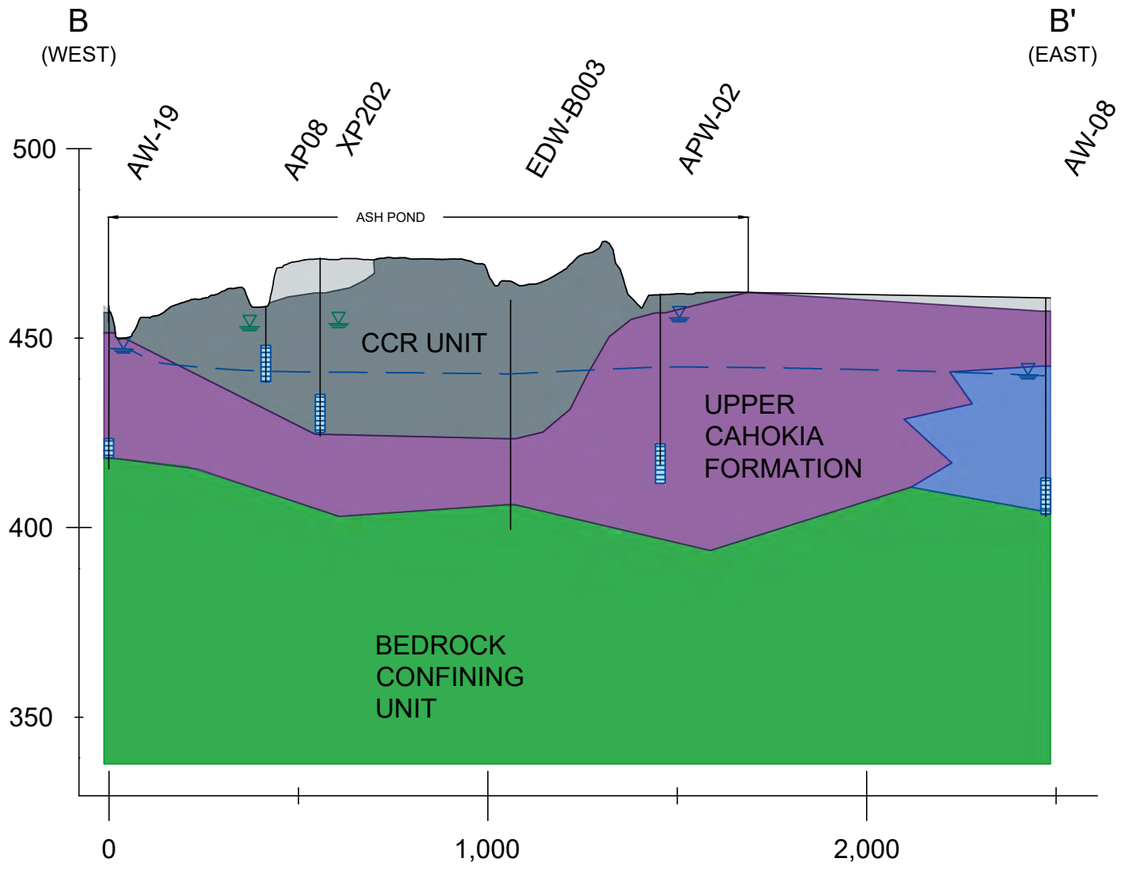
RAMBOLL

PROJECT: 1kyrm006 | DATE PLOTTED: 6/7/2021 | Dan Wilson | C:\Users\dwilson\Documents\~CCR GW\Deliverables\Part 845 Operating Permits\Sites\Edwards\Hydrogeo\Figures\Working Files\CAD\Cross Sections\Edwards Cross Sections.dwg



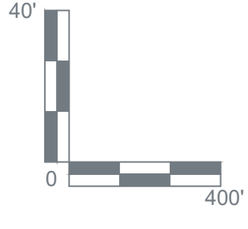
NOTES

1. This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.
2. Scale is approximate.
3. Vertical scale is exaggerated 10X.
4. Vertical Datum: NAVD88
5. Groundwater elevations measured on April 12, 2021.



LEGEND

- COAL COMBUSTION RESIDUALS, CCRs
- FILL
- CLAY (CL/CH)
- SILT (ML)
- SAND (SP/SM/SW)
- BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, V. LITTLE SS)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPER AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- BEDROCK GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)



GEOLOGIC CROSS SECTION B-B'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 2-7

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

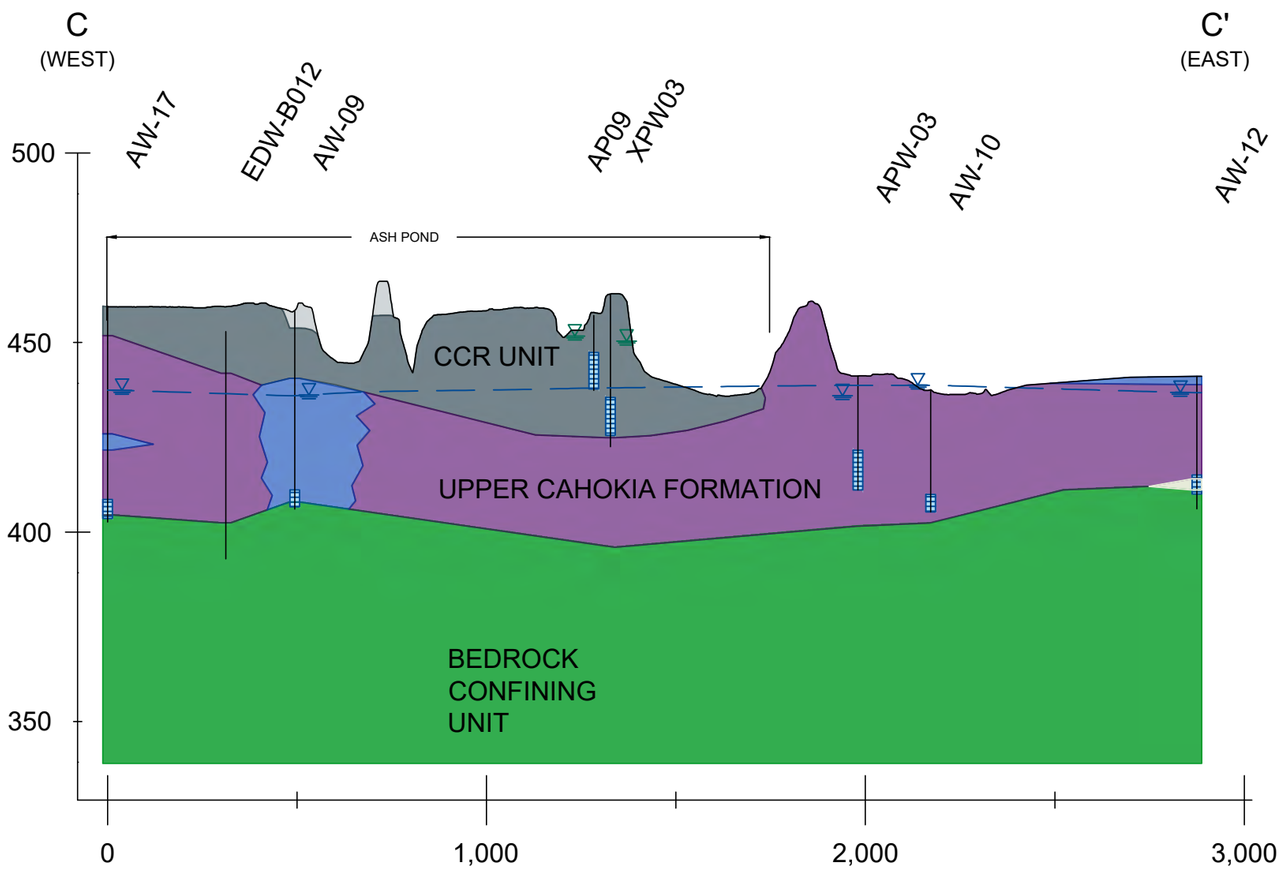
RAMBOLL

PROJECT: 1...\Documents\-CCR GW\Deliverables\Part 845 Operating Permits\Sites\Edwards\Hydrogeo\Figures\Working Files\CAD\Cross Sections\Edwards Cross Sections.dwg



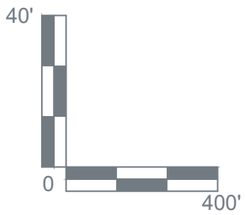
NOTES

1. This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.
2. Scale is approximate.
3. Vertical scale is exaggerated 10X.
4. Vertical Datum: NAVD88
5. Groundwater elevations measured on April 12, 2021.



LEGEND

- COAL COMBUSTION RESIDUALS, CCRs
- FILL
- CLAY (CL/CH)
- SILT (ML)
- GRAVEL (GP/GW)
- BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, V. LITTLE SS)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPER AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- BEDROCK GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)



GEOLOGIC CROSS SECTION C-C'

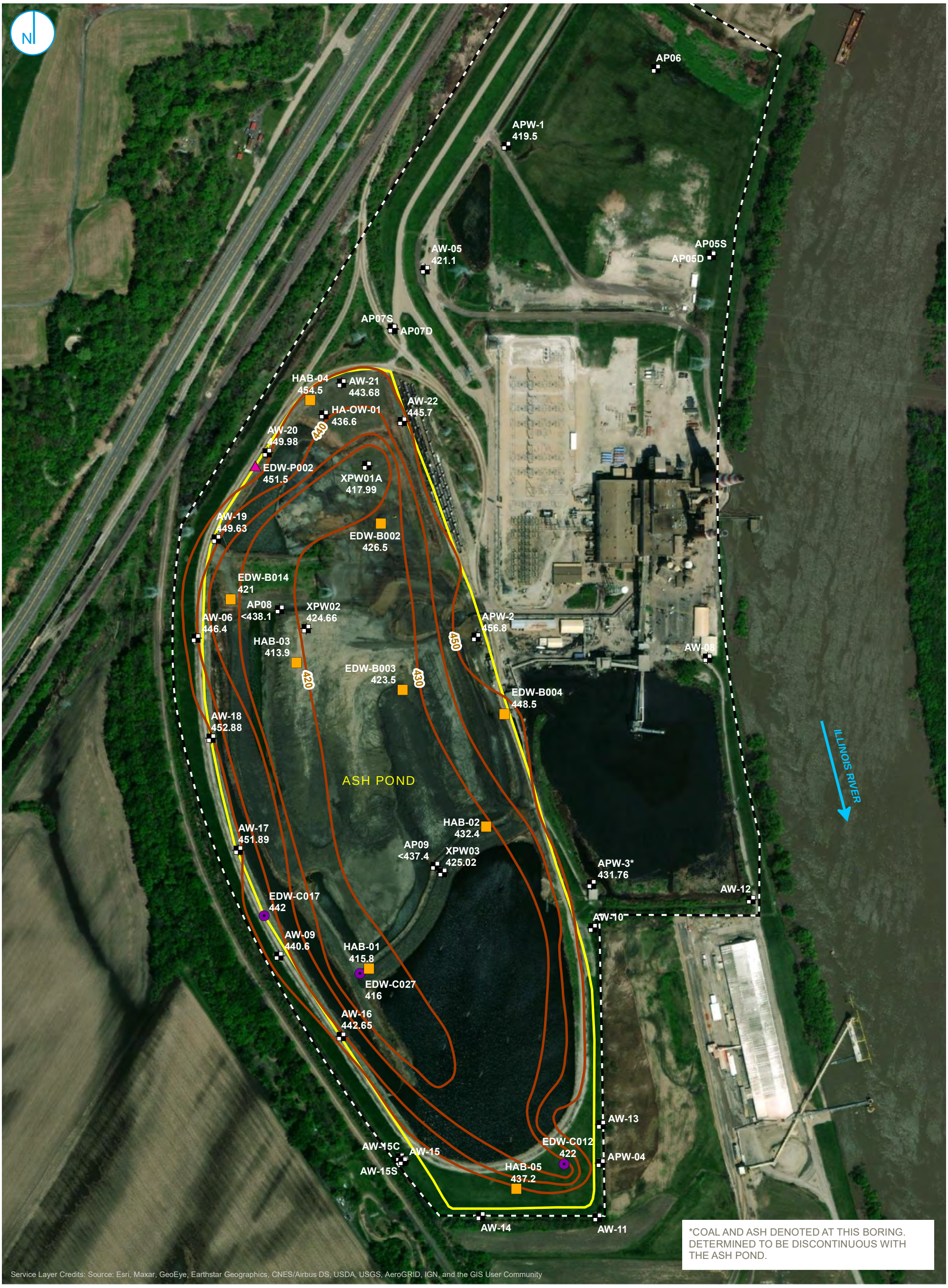
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 2-8

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 1300006 | DATE: 6/29/2021 | DRAWN BY: BCarlson | CHECKED BY: KMcLaughlin
C:\Users\bcarlson\Ramboll\Americas Documents\CCR GW\Deliverables\Part 845 Operating Permits\Sites\Edwards\Hydrogeo\Figures\Working Files\CAD\Cross Sections\Edwards Cross Sections.dwg



BORING
MONITORING WELL LOCATION
CPT
PIEZOMETER
BOTTOM OF ASH ELEVATION CONTOUR
PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 200 400 Feet

NOTE:
ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

BOTTOM OF ASH

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 2-9

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

N

AP06
<414.5

APW-1
419.6

AW-05
421.1

AP05D
404.2

AP07D
419.6

EDW-B001
420

HAB-04
<441.8

AW-21
422.88

AW-22
412.80

HA-OW-01
<421.1

AW-20
418.28

XPW01A
410.99

EDW-B002
410

AW-19
418.33

EDW-B014
415.5

XPW02
<424.16

AW-06
419.7

HAB-03
406.9

APW-2
<411.8

AW-08
404.5

EDW-B004
405

AW-18
410.48

ASH POND

HAB-02
<419.9

AW-17
404.59

XPW03
<422.62

APW-3
<411.2

AW-12
411.16

AW-10
406.9

AW-09
406

HAB-01
399

AW-16
400.95

AW-13
409.67

AW-15C
407.42

APW-4
<453.3

HAB-05
<417.7

AW-14
409.83

AW-11
408.3

420
416
412
408
406
404
410

ILLINOIS RIVER

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

BORINGS
MONITORING WELL
BEDROCK ELEVATION CONTOUR (1-FT INTERVAL)
PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 200 400
Feet

NOTE:
ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

TOP OF BEDROCK

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

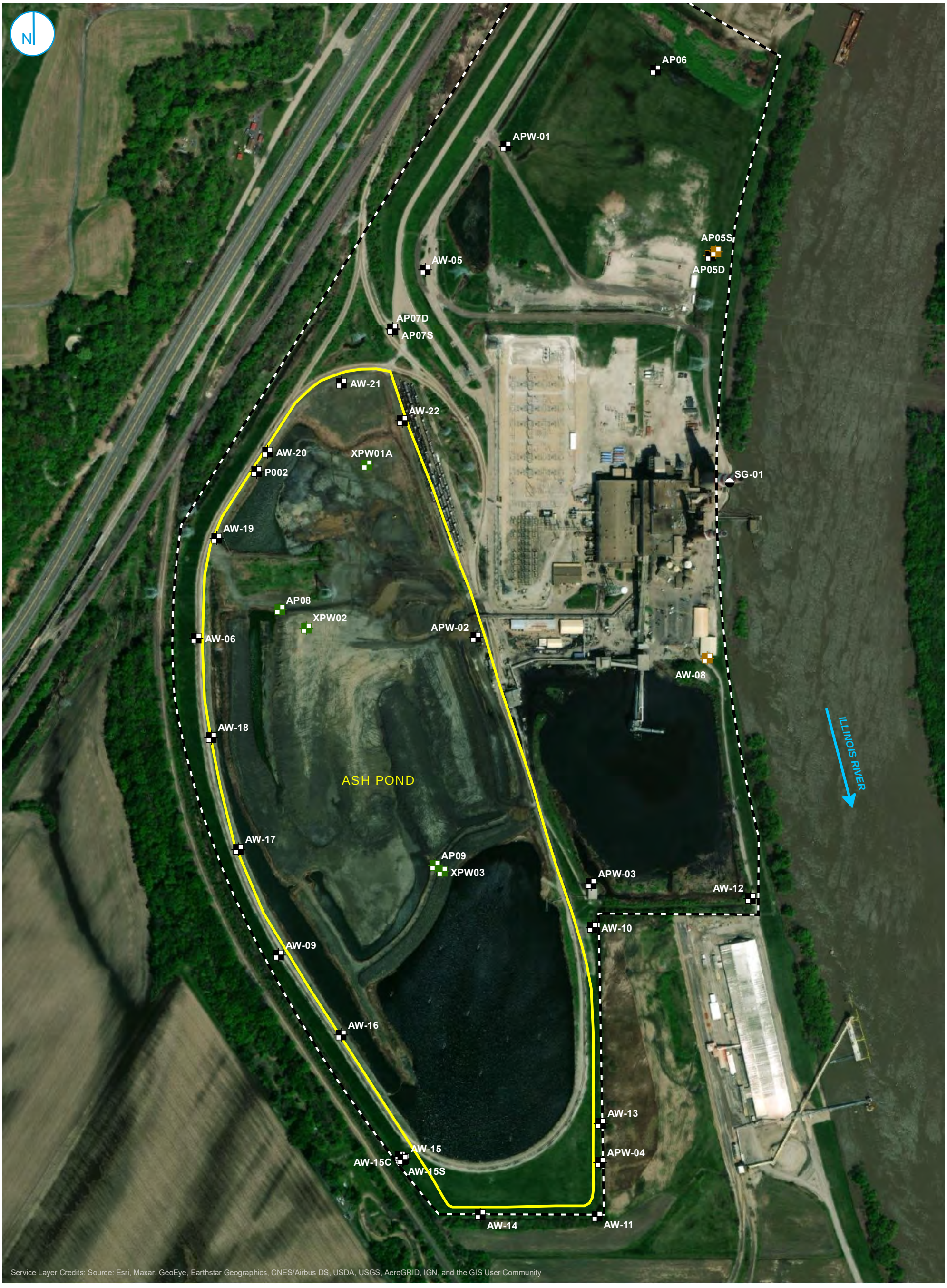
FIGURE 2-10

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 9/28/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Edwards\Figure 3-1_Monitoring Well Location Map.mxd



BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE
PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 200 400 Feet

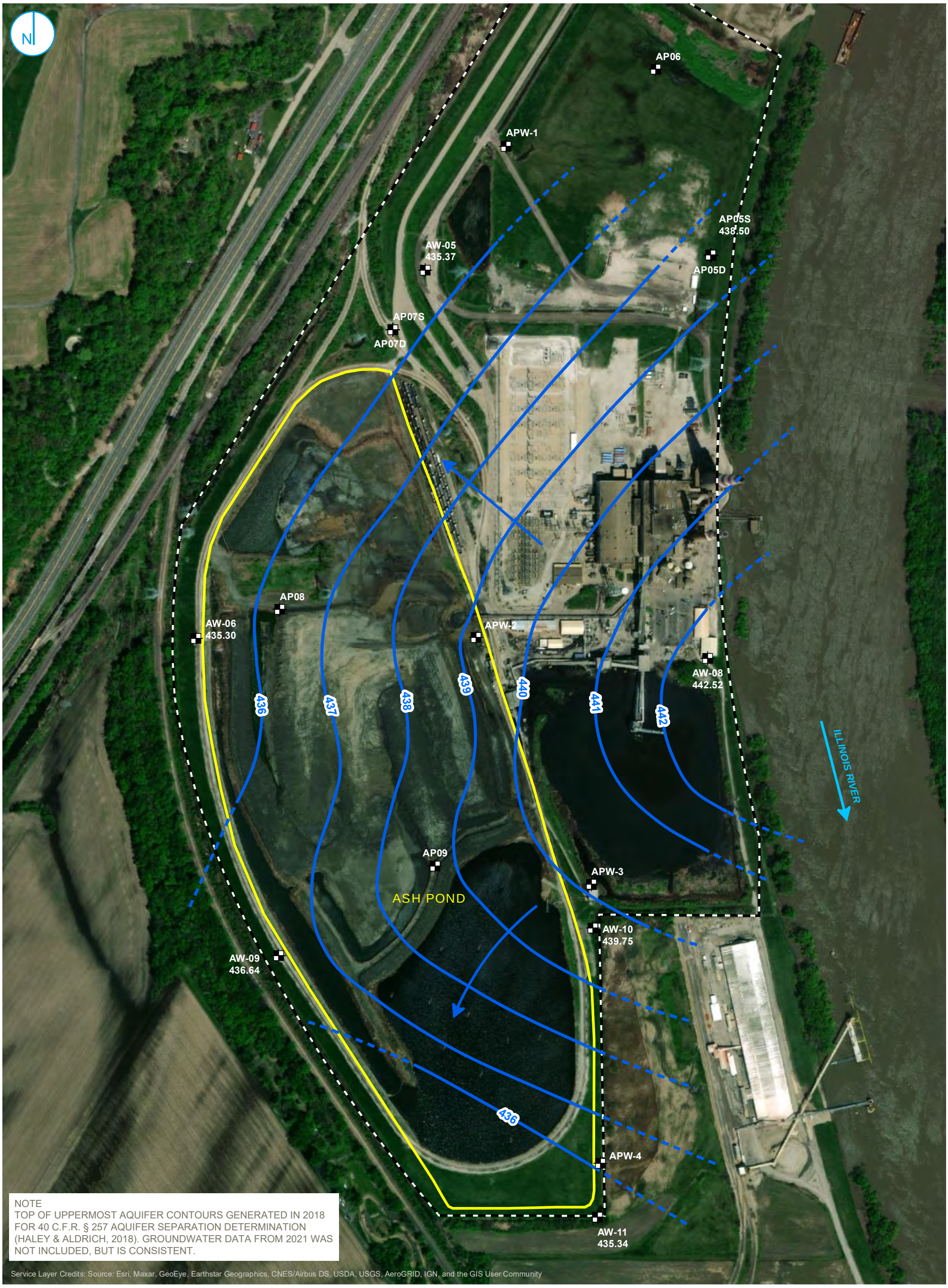
MONITORING WELL LOCATION MAP

FIGURE 3-1

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



MONITORING WELL
INTERPRETED TOP OF UPPERMOST AQUIFER (95TH PERCENTILE GROUNDWATER ELEVATION CONTOURS, 2017)
INFERRED TOP OF UPPERMOST AQUIFER CONTOUR
GROUNDWATER FLOW DIRECTION
PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 200 400 Feet

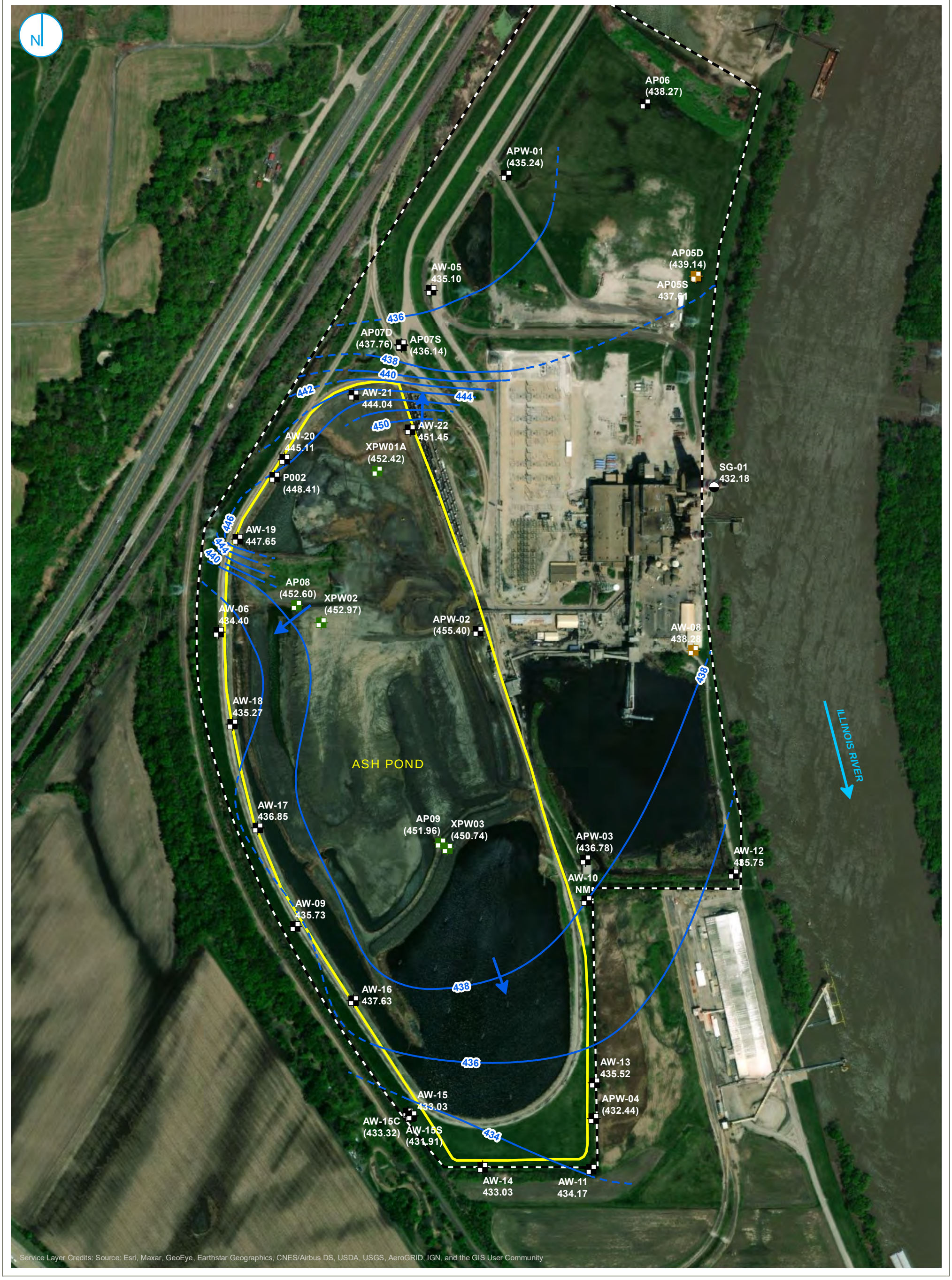
TOP OF UPPERMOST AQUIFER

FIGURE 3-2

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE
PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION

0 212.5 425 Feet

NOTES
1. PARENTHESIS INDICATES WELL NOT USED FOR CONTOURING
2. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988

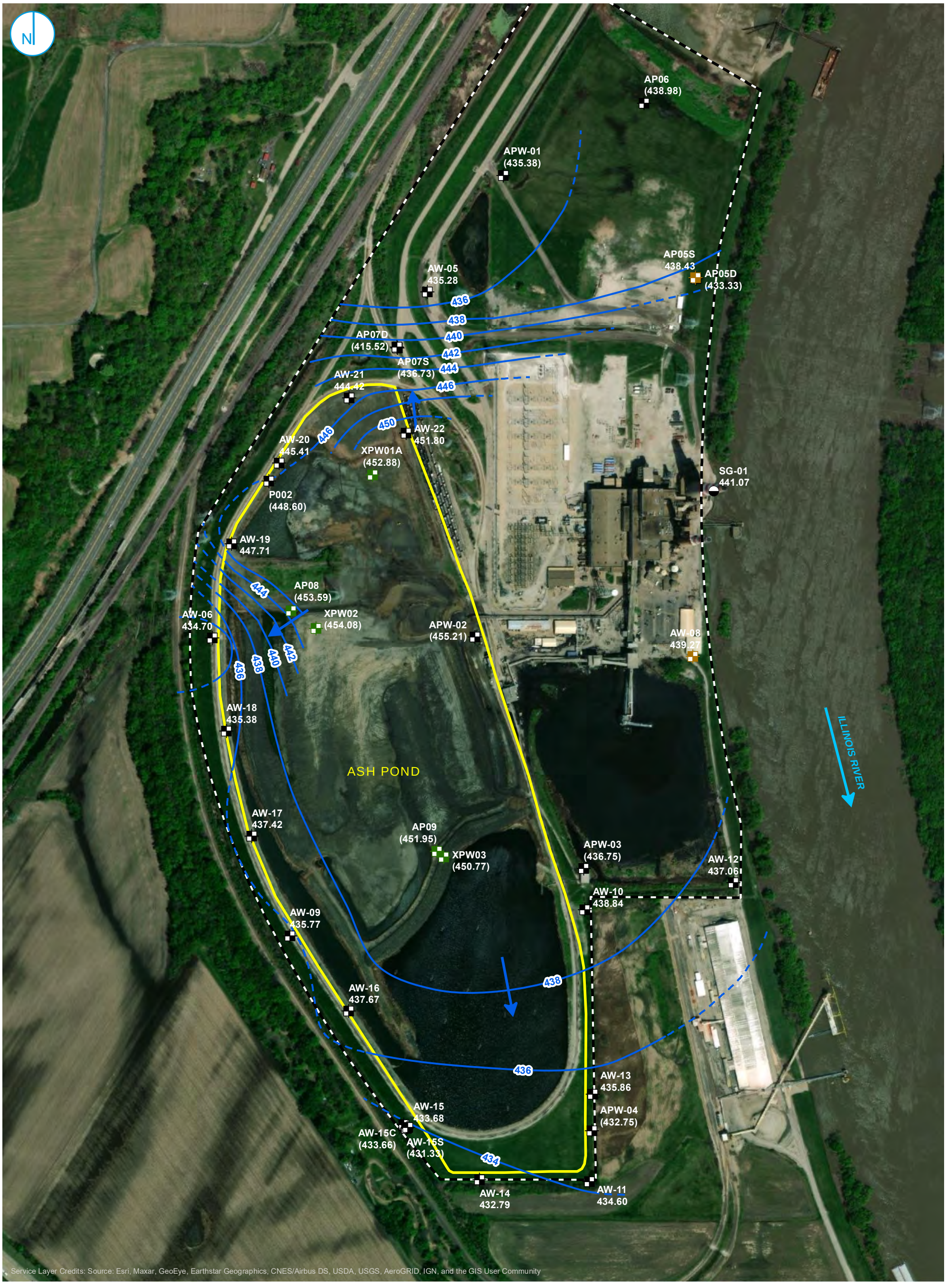
UPPERMOST AQUIFER GROUNDWATER ELEVATION CONTOURS FEBRUARY 9, 2021

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 3-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE
PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION

0 212.5 425 Feet

NOTES
1. PARENTHESIS INDICATES WELL NOT USED FOR CONTOURING
2. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

UPPERMOST AQUIFER GROUNDWATER ELEVATION CONTOURS MARCH 22, 2021

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

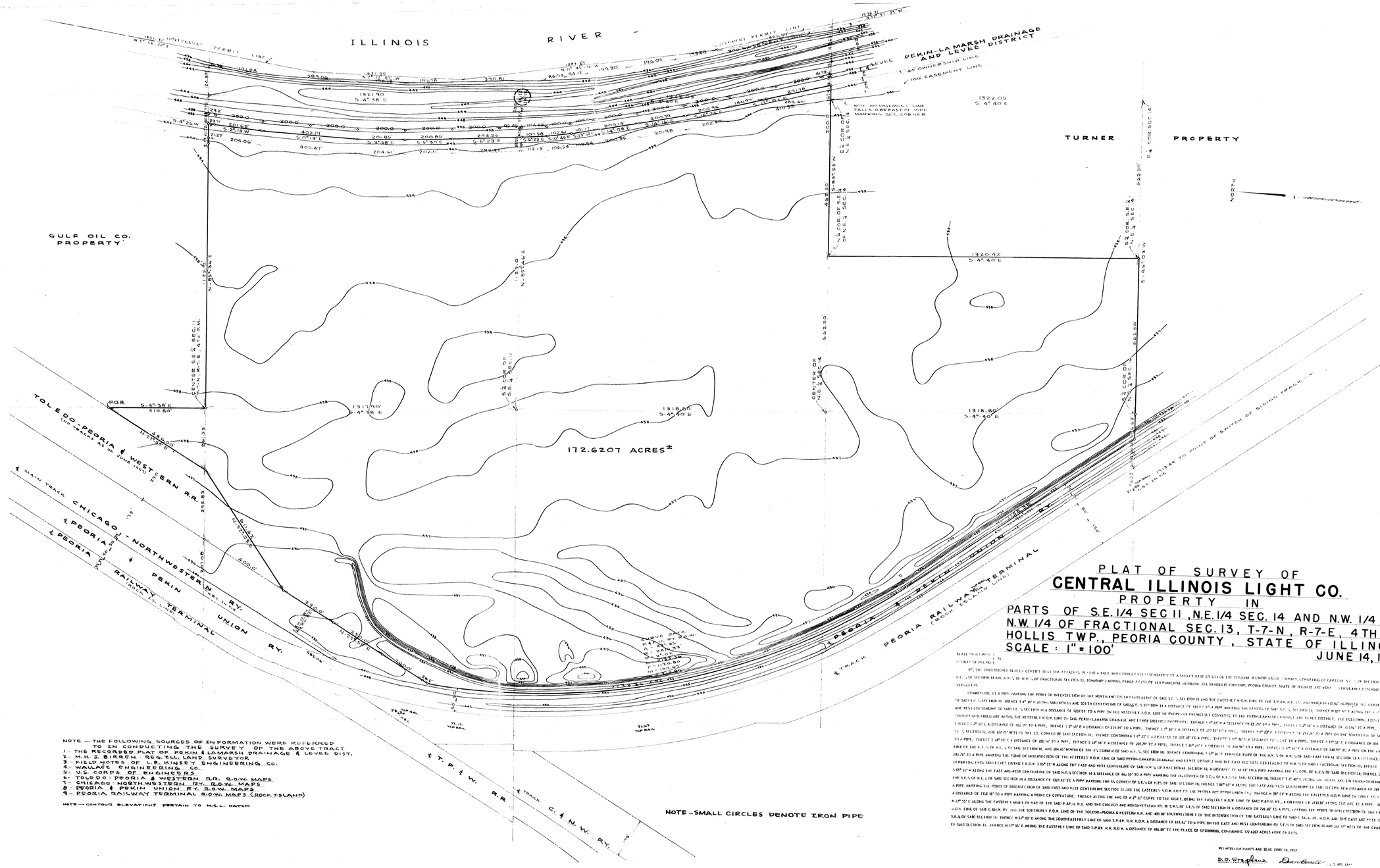
FIGURE 3-4

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

APPENDICES

APPENDIX A
HISTORIC TOPOGRAPHIC MAP (1957)



NOTE — THE FOLLOWING SOURCES OF INFORMATION WERE REFERRED TO IN CONDUCTING THE SURVEY OF THE ABOVE TRACT.
1 - THE RECORDED PLAT OF PEKIN & LAMARSH DRAINAGE & LEVEE DIST.
2 - M.H. J. BIRREN REG. ILL. LAND SURVEYOR
3 - FIELD NOTES OF L.B. KINSEY ENGINEERING CO.
4 - WALLACE ENGINEERING CO.
5 - U.S. CORPS OF ENGINEERS
6 - TOLEDO - PEORIA & WESTERN R.R. R.O.W. MAPS
7 - CHICAGO - NORTH WESTERN RY. R.O.W. MAPS
8 - PEORIA & PEKIN UNION RY. R.O.W. MAPS
9 - PEORIA RAILWAY TERMINAL R.O.W. MAPS (ROCK ISLAND)

NOTE — CONTOUR ELEVATIONS PERTAIN TO M.S.L. DATUM

NOTE - SMALL CIRCLES DENOTE IRON PIPE

PLAT OF SURVEY OF
CENTRAL ILLINOIS LIGHT CO.
PROPERTY IN
PARTS OF S.E.1/4 SEC 11, N.E.1/4 SEC. 14 AND N.W. 1/4 OF N.W. 1/4 OF FRACTIONAL SEC. 13, T-7-N, R-7-E, 4TH P.M. HOLLIS TWP., PEORIA COUNTY, STATE OF ILLINOIS
SCALE : 1" = 100'
JUNE 14, 1957

STATE OF ILLINOIS }
COUNTY OF PEORIA } SS

WE, THE UNDERSIGNED, HEREBY CERTIFY THAT THE ATTACHED PLAT IS A TRUE AND CORRECT REPRESENTATIVE OF A SURVEY MADE BY US FOR THE CENTRAL ILLINOIS LIGHT COMPANY, CONSISTING OF PARTS OF S.E.1/4 OF SECTION 11, N.E.1/4 OF SEC. 14 AND N.W.1/4 OF N.W.1/4 OF FRACTIONAL SECTION 13, TOWNSHIP 7 NORTH, RANGE 7 EAST OF 4TH PRINCIPAL MERIDIAN, HELL BERGER'S TOWNSHIP, PEORIA COUNTY, STATE OF ILLINOIS AND THAT THE PLAT CORRECTLY DESCRIBES SAID PREMISES AS FOLLOWS.

COMMENCING AT A PIPE MARKING THE POINT OF INTERSECTION OF THE NORTH AND SOUTH CENTERLINE OF SAID SEC. 11 AND THE EASTERLY R.O.W. LINE OF THE T.P.&W. R.R. AND WHICH IS 410.80' NORTH OF THE CENTER OF SAID S.E.1/4 SECTION 11; THENCE S 4° 38' E ALONG SAID NORTH AND SOUTH CENTERLINE OF SAID SEC. 11 A DISTANCE OF 410.80' TO A PIPE MARKING THE CENTER OF SAID SEC. 11 AND WEST CENTERLINE OF SAID SEC. 14 SECTION 14 A DISTANCE OF 1317.90' TO A PIPE ON THE WESTERLY R.O.W. LINE OF PROPERTY PREVIOUSLY CONVEYED TO THE PEKIN-LAMARSH DRAINAGE AND LEVEE DISTRICT; THE FOLLOWING COURSES AND DISTANCES ARE ALONG THE WESTERLY R.O.W. LINE OF SAID PEKIN-LAMARSH DRAINAGE AND LEVEE DISTRICT PROPERTY: THENCE S 4° 38' E A DISTANCE OF 852.39' TO A PIPE; THENCE S 3° 30' E A DISTANCE OF 2135.85' TO A PIPE; THENCE S 5° 30' E A DISTANCE OF 1170.80' TO A PIPE; THENCE S 4° 38' E A DISTANCE OF 1318.85' TO A PIPE ON THE SOUTH LINE OF SAID SEC. 11, SAID POINT BEING 1322.05' WEST OF THE S.E. CORNER OF SAID SECTION 11; THENCE CONTINUING S 4° 38' E A DISTANCE OF 1322.05' TO A PIPE; THENCE S 5° 30' E A DISTANCE OF 1170.80' TO A PIPE; THENCE S 3° 30' E A DISTANCE OF 2135.85' TO A PIPE; THENCE S 4° 38' E A DISTANCE OF 852.39' TO A PIPE; THENCE S 4° 58' E A DISTANCE OF 200.39' TO A PIPE; THENCE S 5° 18' E A DISTANCE OF 200.74' TO A PIPE; THENCE S 5° 39' E A DISTANCE OF 200.96' TO A PIPE; THENCE S 5° 52' E A DISTANCE OF 200.39' TO A PIPE; THENCE S 6° 08' E A DISTANCE OF 200.20' TO A PIPE; THENCE S 6° 26' E A DISTANCE OF 200.39' TO A PIPE; THENCE S 6° 39' E A DISTANCE OF 200.59' TO A PIPE; THENCE S 6° 51' E A DISTANCE OF 200.79' TO A PIPE; THENCE S 7° 05' E A DISTANCE OF 200.98' TO A PIPE; THENCE S 7° 18' E A DISTANCE OF 201.18' TO A PIPE; THENCE S 7° 32' E A DISTANCE OF 201.37' TO A PIPE; THENCE S 7° 45' E A DISTANCE OF 201.57' TO A PIPE; THENCE S 7° 58' E A DISTANCE OF 201.76' TO A PIPE; THENCE S 8° 12' E A DISTANCE OF 201.96' TO A PIPE; THENCE S 8° 25' E A DISTANCE OF 202.15' TO A PIPE; THENCE S 8° 38' E A DISTANCE OF 202.35' TO A PIPE; THENCE S 8° 52' E A DISTANCE OF 202.54' TO A PIPE; THENCE S 9° 05' E A DISTANCE OF 202.74' TO A PIPE; THENCE S 9° 19' E A DISTANCE OF 202.93' TO A PIPE; THENCE S 9° 32' E A DISTANCE OF 203.13' TO A PIPE; THENCE S 9° 46' E A DISTANCE OF 203.32' TO A PIPE; THENCE S 10° 00' E A DISTANCE OF 203.52' TO A PIPE; THENCE S 10° 13' E A DISTANCE OF 203.71' TO A PIPE; THENCE S 10° 27' E A DISTANCE OF 203.91' TO A PIPE; THENCE S 10° 40' E A DISTANCE OF 204.10' TO A PIPE; THENCE S 10° 54' E A DISTANCE OF 204.30' TO A PIPE; THENCE S 11° 07' E A DISTANCE OF 204.49' TO A PIPE; THENCE S 11° 21' E A DISTANCE OF 204.69' TO A PIPE; THENCE S 11° 34' E A DISTANCE OF 204.88' TO A PIPE; THENCE S 11° 48' E A DISTANCE OF 205.08' TO A PIPE; THENCE S 12° 01' E A DISTANCE OF 205.27' TO A PIPE; THENCE S 12° 15' E A DISTANCE OF 205.47' TO A PIPE; THENCE S 12° 28' E A DISTANCE OF 205.66' TO A PIPE; THENCE S 12° 42' E A DISTANCE OF 205.86' TO A PIPE; THENCE S 12° 55' E A DISTANCE OF 206.05' TO A PIPE; THENCE S 13° 09' E A DISTANCE OF 206.25' TO A PIPE; THENCE S 13° 22' E A DISTANCE OF 206.44' TO A PIPE; THENCE S 13° 36' E A DISTANCE OF 206.64' TO A PIPE; THENCE S 13° 49' E A DISTANCE OF 206.83' TO A PIPE; THENCE S 14° 03' E A DISTANCE OF 207.03' TO A PIPE; THENCE S 14° 16' E A DISTANCE OF 207.22' TO A PIPE; THENCE S 14° 30' E A DISTANCE OF 207.42' TO A PIPE; THENCE S 14° 43' E A DISTANCE OF 207.61' TO A PIPE; THENCE S 14° 57' E A DISTANCE OF 207.81' TO A PIPE; THENCE S 15° 10' E A DISTANCE OF 208.00' TO A PIPE; THENCE S 15° 24' E A DISTANCE OF 208.20' TO A PIPE; THENCE S 15° 37' E A DISTANCE OF 208.39' TO A PIPE; THENCE S 15° 51' E A DISTANCE OF 208.59' TO A PIPE; THENCE S 16° 04' E A DISTANCE OF 208.78' TO A PIPE; THENCE S 16° 18' E A DISTANCE OF 208.98' TO A PIPE; THENCE S 16° 31' E A DISTANCE OF 209.17' TO A PIPE; THENCE S 16° 45' E A DISTANCE OF 209.37' TO A PIPE; THENCE S 16° 58' E A DISTANCE OF 209.56' TO A PIPE; THENCE S 17° 12' E A DISTANCE OF 209.76' TO A PIPE; THENCE S 17° 25' E A DISTANCE OF 209.95' TO A PIPE; 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THENCE S 76° 09' E A DISTANCE OF 260.85' TO A PIPE; THENCE S 76° 22' E A DISTANCE OF 261.04' TO A PIPE; THENCE S 76° 36' E A DISTANCE OF 261.24' TO A PIPE; THENCE S 76° 49' E A DISTANCE OF 261.43' TO A PIPE; THENCE S 77° 03' E A DISTANCE OF 261.63' TO A PIPE; THENCE S 77° 16' E A DISTANCE OF 261.82' TO A PIPE; THENCE S 77° 30' E A DISTANCE OF 262.02' TO A PIPE; THENCE S 77° 43' E A DISTANCE OF 262.21' TO A PIPE; THENCE S 77° 57' E A DISTANCE OF 262.41' TO A PIPE; THENCE S 78° 10' E A DISTANCE OF 262.60' TO A PIPE; THENCE S 78° 24' E A DISTANCE OF 262.80' TO A PIPE; THENCE S 78° 37' E A DISTANCE OF 262.99' TO A PIPE; THENCE S 78° 51' E A DISTANCE OF 263.19' TO A PIPE; THENCE S 79° 04' E A DISTANCE OF 263.38' TO A PIPE; THENCE S 79° 18' E A DISTANCE OF 263.58' TO A PIPE; THENCE S 79° 31' E A DISTANCE OF 263.77' TO A PIPE; THENCE S 79° 45' E A DISTANCE OF 263.97' TO A PIPE; THENCE S 79° 58' E A DISTANCE OF 264.16' TO A PIPE; THENCE S 80° 12' E A DISTANCE OF 264.36' TO A PIPE; THENCE S 80° 25' E A DISTANCE OF 264.55' TO A PIPE; THENCE S 80° 39' E A DISTANCE OF 264.75' TO A PIPE; THENCE S 80° 52' E A DISTANCE OF 264.94' TO A PIPE; THENCE S 81° 06' E A DISTANCE OF 265.14' TO A PIPE; THENCE S 81° 19' E A DISTANCE OF 265.33' TO A PIPE; THENCE S 81° 33' E A DISTANCE OF 265.53' TO A PIPE; THENCE S 81° 46' E A DISTANCE OF 265.72' TO A PIPE; THENCE S 82° 00' E A DISTANCE OF 265.92' TO A PIPE; THENCE S 82° 13' E A DISTANCE OF 266.11' TO A PIPE; THENCE S 82° 27' E A DISTANCE OF 266.31' TO A PIPE; THENCE S 82° 40' E A DISTANCE OF 266.50' TO A PIPE; THENCE S 82° 54' E A DISTANCE OF 266.70' TO A PIPE; THENCE S 83° 07' E A DISTANCE OF 266.89' TO A PIPE; THENCE S 83° 21' E A DISTANCE OF 267.09' TO A PIPE; THENCE S 83° 34' E A DISTANCE OF 267.28' TO A PIPE; THENCE S 83° 48' E A DISTANCE OF 267.48' TO A PIPE; THENCE S 84° 01' E A DISTANCE OF 267.67' TO A PIPE; THENCE S 84° 15' E A DISTANCE OF 267.87' TO A PIPE; THENCE S 84° 28' E A DISTANCE OF 268.06' TO A PIPE; THENCE S 84° 42' E A DISTANCE OF 268.26' TO A PIPE; THENCE S 84° 55' E A DISTANCE OF 268.45' TO A PIPE; THENCE S 85° 09' E A DISTANCE OF 268.65' TO A PIPE; THENCE S 85° 22' E A DISTANCE OF 268.84' TO A PIPE; THENCE S 85° 36' E A DISTANCE OF 269.04' TO A PIPE; THENCE S 85° 49' E A DISTANCE OF 269.23' TO A PIPE; THENCE S 86° 03' E A DISTANCE OF 269.43' TO A PIPE; THENCE S 86° 16' E A DISTANCE OF 269.62' TO A PIPE; THENCE S 86° 30' E A DISTANCE OF 269.82' TO A PIPE; THENCE S 86° 43' E A DISTANCE OF 270.01' TO A PIPE; THENCE S 86° 57' E A DISTANCE OF 270.21' TO A PIPE; THENCE S 87° 10' E A DISTANCE OF 270.40' TO A PIPE; THENCE S 87° 24' E A DISTANCE OF 270.60' TO A PIPE; THENCE S 87° 37' E A DISTANCE OF 270.79' TO A PIPE; THENCE S 87° 51' E A DISTANCE OF 270.99' TO A PIPE; THENCE S 88° 04' E A DISTANCE OF 271.18' TO A PIPE; THENCE S 88° 18' E A DISTANCE OF 271.38' TO A PIPE; THENCE S 88° 31' E A DISTANCE OF 271.57' TO A PIPE; THENCE S 88° 45' E A DISTANCE OF 271.77' TO A PIPE; THENCE S 88° 58' E A DISTANCE OF 271.96' TO A PIPE; THENCE S 89° 12' E A DISTANCE OF 272.16' TO A PIPE; THENCE S 89° 25' E A DISTANCE OF 272.35' TO A PIPE; THENCE S 89° 39' E A DISTANCE OF 272.55' TO A PIPE; THENCE S 89° 52' E A DISTANCE OF 272.74' TO A PIPE; THENCE S 90° 06' E A DISTANCE OF 272.94' TO A PIPE; THENCE S 90° 19' E A DISTANCE OF 273.13' TO A PIPE; THENCE S 90° 33' E A DISTANCE OF 273.33' TO A PIPE; THENCE S 90° 46' E A DISTANCE OF 273.52' TO A PIPE; THENCE S 91° 00' E A DISTANCE OF 273.72' TO A PIPE; THENCE S 91° 13' E A DISTANCE OF 273.91' TO A PIPE; THENCE S 91° 27' E A DISTANCE OF 274.11' TO A PIPE; THENCE S 91° 40' E A DISTANCE OF 274.30' TO A PIPE; THENCE S 91° 54' E A DISTANCE OF 274.50' TO A PIPE; THENCE S 92° 07' E A DISTANCE OF 274.69' TO A PIPE; THENCE S 92° 21' E A DISTANCE OF 274.89' TO A PIPE; THENCE S 92° 34' E A DISTANCE OF 275.08' TO A PIPE; THENCE S 92° 48' E A DISTANCE OF 275.28' TO A PIPE; THENCE S 93° 01' E A DISTANCE OF 275.47' TO A PIPE; THENCE S 93° 15' E A DISTANCE OF 275.67' TO A PIPE; THENCE S 93° 28' E A DISTANCE OF 275.86' TO A PIPE; THENCE S 93° 42' E A DISTANCE OF 276.06' TO A PIPE; THENCE S 93° 55' E A DISTANCE OF 276.25' TO A PIPE; THENCE S 94° 09' E A DISTANCE OF 276.45' TO A PIPE; THENCE S 94° 22' E A DISTANCE OF 276.64' TO A PIPE; THENCE S 94° 36' E A DISTANCE OF 276.84' TO A PIPE; THENCE S 94° 49' E A DISTANCE OF 277.03' TO A PIPE; THENCE S 95° 03' E A DISTANCE OF 277.23' TO A PIPE; THENCE S 95° 16' E A DISTANCE OF 277.42' TO A PIPE; THENCE S 95° 30' E A

APPENDIX B
INFORMATION PERTINENT TO 35 I.A.C. § 845.220(a)(3)

SUMMARY OF POTENTIAL RECEPTORS WITHIN 1,000 METERS

DESKTOP STUDY

EDWARDS POWER PLANT

ASH POND

BARTONVILLE, IL

Category	Number of Receptors Identified Within 1,000 Meters	Number of Receptors Identified Downgradient of Unit	Notes
Mines	3	0	
Wells	14	3	No potable wells identified downgradient. Primary uses are industrial applications, monitoring and engineering test wells.
Surface Water Features	21	17	
Historic Sites	0	---	
Natural Sites	0	---	
Threatened or Endangered Species	24	---	Data provided only at a county level.
Oil Fields	0	3	Two wells of unknown status and one stratigraphic test well upgradient from unit.

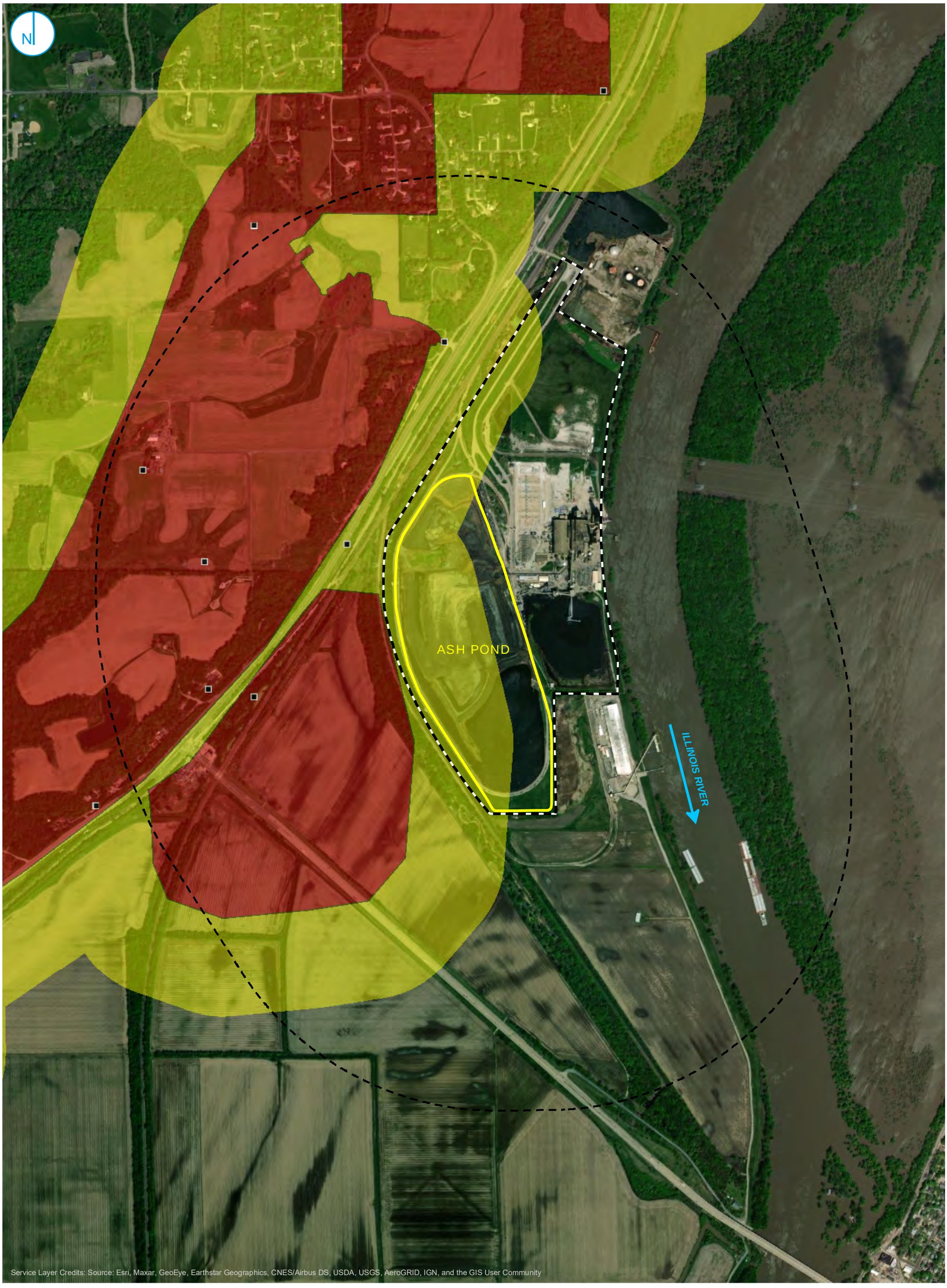
[O: CJC 03/26/21; C: LDC 09/16/21]

Notes:

--- = none

RAMBOLL

MINING ACTIVITIES



- COAL MINE SHAFT
- UNDERGROUND COAL MINE
- UNDERGROUND MINE BUFFER REGION
- PART 845 REGULATED UNIT (SUBJECT UNIT)
- 1000 METER UNIT BUFFER
- PROPERTY BOUNDARY

0 500 1,000 Feet

SOURCES: ISGS - ILMINES

ACTIVE AND ABANDONED COAL MINES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE B-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

MINES WITHIN 1,000 METERS

DESKTOP STUDY

EDWARDS POWER PLANT

ASH POND

BARTONVILLE, IL

Mine ID	Mine Name	Distance from Unit (meters)	Physical Orientation to Unit	Hydraulic Orientation to Unit	Range of Active Dates	Mine Type	Coal Unit Mined	Mine Depth Top (ft BGS)	Mine Depth Bottom (ft BGS)	Final Extent Map Available	Notes
828	Third Vein Coal Co., Orchard Mine	0	U	Downgradient	1890-1909	Underground/Longwall	Springfield/Colchester	100	165	Y	Gas noted from roof of Colchester coal.
6673	George Petri Coal Co., Petri Mine	161	NW	Downgradient	1919-1933	Underground	Springfield	112	--	Y	None
3021	Robert Rogers, Hollis Mine	966	N	Downgradient	1933-1940	Main Slope	Springfield	--	--	Y	Fault noted (possible channel)

[O: CJC 03/26/21; C: LDC 09/16/21]

Notes:

BGS = below ground surface
ft = feet
ID = identification number
N = north
NW = northwest
U = underlying

WATER WELL SURVEY



- DRY
- ENGINEERING
- WATER
- N/A
- PART 845 REGULATED UNIT (SUBJECT UNIT)
- 1000 METER UNIT BUFFER
- PROPERTY BOUNDARY

0 500 1,000 Feet

SOURCE
IL WELLS

DRINKING WATER INTAKES, PUMPS, AND OTHER WATER USES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE B-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

WELLS WITHIN 1,000 METERS
DESKTOP STUDY
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, IL

Well Number	Date Constructed	Ground Elevation (ft NAVD88)	Screen Top Depth (FT BGS)	Screen Bottom Depth (ft BGS)	Screen Length (ft)	Screen Diameter (inches)	Well Depth (ft BGS)	Total Boring Depth (ft BGS)	Latitude (DD)	Longitude (DD)	Hydraulic Position Designation (B/Sd/U/D)	Notes
121792344300	11/19/1998	450	108	118	10	2	118	118	40.58296	-89.655159	U	
121433424000	8/16/2001	---	---	---	---	---	---	20	40.588081	-89.664793	U	
121432480200	9/30/1971	454	---	---	---	---	---	95	40.588073	-89.660552	U	
121432356000	---	---	---	---	---	---	---	60	40.605076	-89.661192	Sd	
121432525900	9/29/1971	---	---	---	---	---	---	51	40.587184	-89.659272	U	
121432526000	9/30/1971	445	---	---	---	---	---	96	40.587184	-89.659272	U	
121432526100	10/31/1971	436	---	---	---	---	---	96	40.587184	-89.659272	U	
121432526200	10/31/1971	437	---	---	---	---	---	92	40.587184	-89.659272	U	
121432526300	10/31/1971	437	---	---	---	---	---	92	40.587184	-89.659272	U	
121432526400	10/31/1971	436	---	---	---	---	---	35	40.587184	-89.659272	U	
121430133300	4/4/1968	---	---	---	---	---	---	30	40.590234	-89.662127	U	
121432221000	8/18/1978	570	---	---	---	---	---	65	40.600805	-89.667324	D	
121433566000	12/11/2017	---	---	---	---	---	---	98	40.586327	-89.679076	D	
121433566500	12/13/2017	---	80	300	220	4	300	300	40.586327	-89.679076	D	

[O: CJC 03/26/21; C: LDC 09/16/21]

Notes:
--- = no data
B = background
BGS = below ground surface
D = downgradient
DD = decimal degrees
ft = foot/feet
LCU = lower confining unit
NAVD88 = North American Vertical Datum of 1988, GEOID 12A
Sd= sidegradient
U = upgradient

ILLINOIS STATE GEOLOGICAL SURVEY

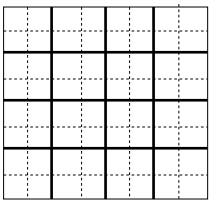
Water Well	Top	Bottom
s.s. #55311	0	0
black dirt	0	10
grit gravel yellowish	10	12
dark tough clay black	12	30
Total Depth		**30**

Casing: 24" CONCRETE(TOP/BOTTOM) from 0' to 0'
Water from Gilbert gravel at 0' to 0'.

Remarks: tracing done by Dept. of Pub. Health
Driller's Log filed
Sample set # 55311 (1' - 25')
Owner Address: P.O. Box 876 Pekin, IL
Location source: Location from the driller

Permit Date: January 1, 1968 **Permit #:** NF3700

COMPANY Hampton, E. T.
FARM Cargo Carriers
DATE DRILLED April 5, 1968 **NO.**
ELEVATION 0 **COUNTY NO.** 01333
LOCATION 200'S 250'W NE/c SE NE
LATITUDE 40.590234 **LONGITUDE** -89.662127
COUNTY **Peoria** **API 121430133300** **14 - 7N - 7E**



ILLINOIS STATE GEOLOGICAL SURVEY

Water Well	Top	Bottom
clay	0	30
rock	30	65
Total Depth		**65**

Casing: 24" ID CEMENT from 11' to 51'

Water from rock at 37' to 38'.

Static level 37' below casing top which is 1' above GL

Driller's Log filed

Owner Address: 911 Chestnut St. Pekin, IL

Location source: Location from permit

Permit Date: August 8, 1978 **Permit #:** 77945

COMPANY Shaver, D.

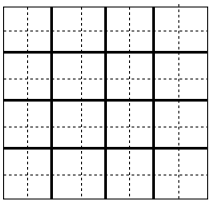
FARM Frazier, Sam

DATE DRILLED August 19, 1978 **NO.**

ELEVATION 570GL **COUNTY NO.** 22210

LOCATION NE NW SE

LATITUDE 40.600805 **LONGITUDE** -89.667324



COUNTY **Peoria** **API 121432221000** **11 - 7N - 7E**

ILLINOIS STATE GEOLOGICAL SURVEY

Industrial Water Well	Top	Bottom
clay,sand & gravel	0	3
clay-sticky,black	3	10
clay-softer	10	15
clay-dark	15	29
sandstone-gray,soft	29	35
limestone	35	36
shale-gray	36	37
limestone-shale	37	43
shale-softer	43	60
Total Depth		**60**

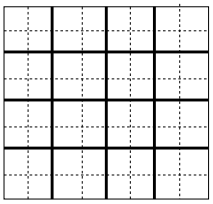
Size hole below casing: 0"

Remarks: no water

Owner Address: 7022 S. Cilco Lane Bartonville, IL
Location source: Location from permit

Permit Date: September 17, 1987 **Permit #:** 135221

COMPANY Sauder, Steven E.
FARM Clark Oil & Refining
DATE DRILLED **NO.**
ELEVATION 0 **COUNTY NO.** 23560
LOCATION 100'N line, 50'W line of NW SW NW
LATITUDE 40.605076 **LONGITUDE** -89.661192
COUNTY **Peoria** **API** **121432356000** **12 - 7N - 7E**



ILLINOIS STATE GEOLOGICAL SURVEY

Engineering Test	Top	Bottom
C #9411 (Spls. 1-11)	0	0
Total Depth		**95**

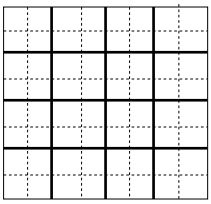
Remarks: Rec'd. 3/73

Core #C 9411 (0' - 0') Received: March 1, 1973

Owner Address: ,
Add'l loc. info: FALSE
Elev updated - ABL

Permit Date: **Permit #:**

COMPANY owner
FARM Bridge FA R25&75,Il.River
DATE DRILLED October 1, 1971 **NO.** 6-prelim
ELEVATION 454GL **COUNTY NO.** 24802
LOCATION SE SW NW
LATITUDE 40.588073 **LONGITUDE** -89.660552
COUNTY **Peoria** **API 121432480200** **13 - 7N - 7E**



ILLINOIS STATE GEOLOGICAL SURVEY

Engineering Test	Top	Bottom
Total Depth		51

Permit Date: **Permit #:**

COMPANY IL Dept. of Transportation

FARM Bridge over Illinois River at Pekin

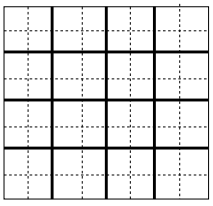
DATE DRILLED September 30, 1971 **NO.** 4-prelim

ELEVATION 450GL **COUNTY NO.** 25259

LOCATION

LATITUDE 40.587184 **LONGITUDE** -89.659272

COUNTY **Peoria** **API** **121432525900** **13 - 7N - 7E**



ILLINOIS STATE GEOLOGICAL SURVEY

Engineering Test	Top	Bottom
Total Depth		96

Permit Date: **Permit #:**

COMPANY IL Dept. of Transportation

FARM Bridge over Illinois River @ Pekin

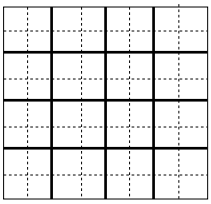
DATE DRILLED October 1, 1971 **NO.** 5-prelim

ELEVATION 445GL **COUNTY NO.** 25260

LOCATION

LATITUDE 40.587184 **LONGITUDE** -89.659272

COUNTY **Peoria** **API** **121432526000** **13 - 7N - 7E**



ILLINOIS STATE GEOLOGICAL SURVEY

Engineering Test	Top	Bottom
Total Depth		96

Permit Date: **Permit #:**

COMPANY IL Dept. of Transportation

FARM Bridge over Illinois River @ Pekin

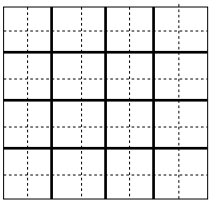
DATE DRILLED November 1, 1971 **NO.** 7-prelim

ELEVATION 436GL **COUNTY NO.** 25261

LOCATION

LATITUDE 40.587184 **LONGITUDE** -89.659272

COUNTY **Peoria** **API** **121432526100** **13 - 7N - 7E**



ILLINOIS STATE GEOLOGICAL SURVEY

Engineering Test	Top	Bottom
Total Depth		92

Permit Date: **Permit #:**

COMPANY IL Dept. of Transportation

FARM Bridge over Illinois River @ Pekin

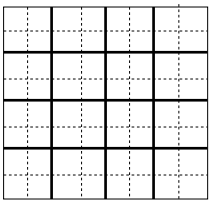
DATE DRILLED November 1, 1971 **NO.** 8-prelim

ELEVATION 437GL **COUNTY NO.** 25262

LOCATION

LATITUDE 40.587184 **LONGITUDE** -89.659272

COUNTY **Peoria** **API** **121432526200** **13 - 7N - 7E**



ILLINOIS STATE GEOLOGICAL SURVEY

Engineering Test	Top	Bottom
Total Depth		92

Permit Date: **Permit #:**

COMPANY IL Dept. of Transportation

FARM Bridge over Illinois River @ Pekin

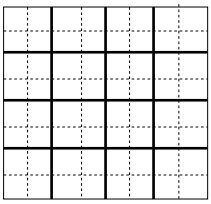
DATE DRILLED November 1, 1971 **NO.** 9-prelim

ELEVATION 437GL **COUNTY NO.** 25263

LOCATION

LATITUDE 40.587184 **LONGITUDE** -89.659272

COUNTY **Peoria** **API** **121432526300** **13 - 7N - 7E**



ILLINOIS STATE GEOLOGICAL SURVEY

Engineering Test	Top	Bottom
Total Depth		35

Permit Date: **Permit #:**

COMPANY IL Dept. of Transportation

FARM Bridge over Illinois River @ Pekin

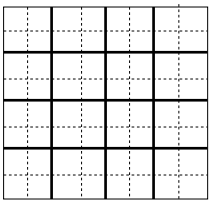
DATE DRILLED November 1, 1971 **NO.** STH-1

ELEVATION 436GL **COUNTY NO.** 25264

LOCATION

LATITUDE 40.587184 **LONGITUDE** -89.659272

COUNTY **Peoria** **API** **121432526400** **13 - 7N - 7E**



ILLINOIS STATE GEOLOGICAL SURVEY

Semi-Private Water Well	Top	Bottom
clay	0	20
Total Depth		**20**

Casing: 6" SDR 21 from -1' to 11'
36" CONCRETE WELL TILE from 11' to 20'

Grout: HOLE PLUG from 10 to 11.

Grout: PEA GRAVEL from 11 to 20.

Water from clay at 4' to 20'.

Owner Address: 8710 S. Cargill Rd. Pekin, IL

Address of well: same as above

Location source: Location from permit

Permit Date: July 2, 2001 **Permit #:**

COMPANY Greenfield, Edward K.

FARM Cargill Fertilizer

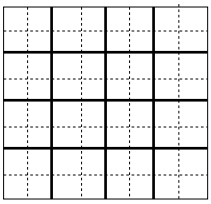
DATE DRILLED August 17, 2001 **NO.**

ELEVATION 0 **COUNTY NO.** 34240

LOCATION SW SE NE

LATITUDE 40.588081 **LONGITUDE** -89.664793

COUNTY **Peoria** **API 121433424000** **14 - 7N - 7E**



ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	Top	Bottom
topsoil	0	2
brown clay	2	9
tan clay	9	14
gray clay	14	34
gravel	34	35
light gray shale	35	79
dark gray shale	79	98
Total Depth		**98**

Grout: BENTONITE from 0 to 98.

Water from DRY HOLE at ' to '.

Owner Address: PO Box 876 Pekin, IL

Address of well: 8710 S. Cargill Rd.
Peoria, IL

Location source: Location from permit

Permit Date: October 2, 2017 **Permit #:** 143-025

COMPANY Layten, James

FARM The Mosaic Company

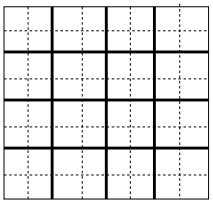
DATE DRILLED December 12, 2017 **NO.** -1

ELEVATION **COUNTY NO.** 35660

LOCATION NW NW SW

LATITUDE 40.586327 **LONGITUDE** -89.679076

COUNTY **Peoria** **API** **121433566000** **14 - 7N - 7E**



ILLINOIS STATE GEOLOGICAL SURVEY

Water Well for Commercial Operation	Top	Bottom
topsoil	0	2
brown clay	2	7
tan clay	7	16
gray clay	16	38
gravel	38	39
light gray shale	39	76
dark gray shale	76	88
hard gray shale	88	149
white shale	149	209
black shale	209	229
sandstone	229	246
light gray shale	246	265
shale w/ seams of sandstone	265	300
Total Depth		**300**

Casing: 6" SDR 21 from -3' to 88'
4" SCH 40 SLOTTED from 80' to 300'

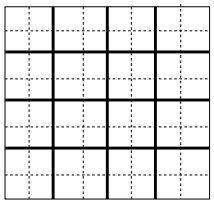
Grout: BENSEAL from 6 to 300.

Water from sandstone & shale at 80' to 300'.
Static level 5' below casing top which is 3' above GL
Pumping level 105' when pumping at 5 gpm for hours
Permanent pump installed at 140'
on February 12, 2018, with a capacity of 5 gpm
Remarks: Driller's Estimated Well Yield 5 gpm

Owner Address: PO Box 876 Pekin, IL
Address of well: 8710 S. Cargill Rd.
Peoria, IL 61607
Location source: Location from permit

Permit Date: October 2, 2017 **Permit #:** 143-025

COMPANY Layten, James
FARM The Mosaic Company
DATE DRILLED December 14, 2017 **NO.** 2
ELEVATION **COUNTY NO.** 35665
LOCATION NW NW SW
LATITUDE 40.586327 **LONGITUDE** -89.679076
COUNTY **Peoria** **API** **121433566500** **14 - 7N - 7E**



ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	Top	Bottom
silty clayey fine sand	0	14
lake clay with sand stringers	14	23
sand & gravel (coarsens downward)	23	118
Total Depth		**118**

Casing: 2" PVC from 0' to 108'
2" PVC SCREEN from 108' to 118'
Screen: 10' of 2" diameter .01 slot
Grout: NEAT CEMENT from 0 to 19.

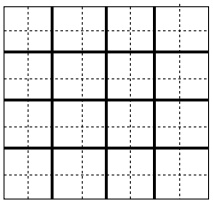
Water from at 22' to '.
Static level 22' below casing top which is 0' above GL

Remarks: bedrock not encountered

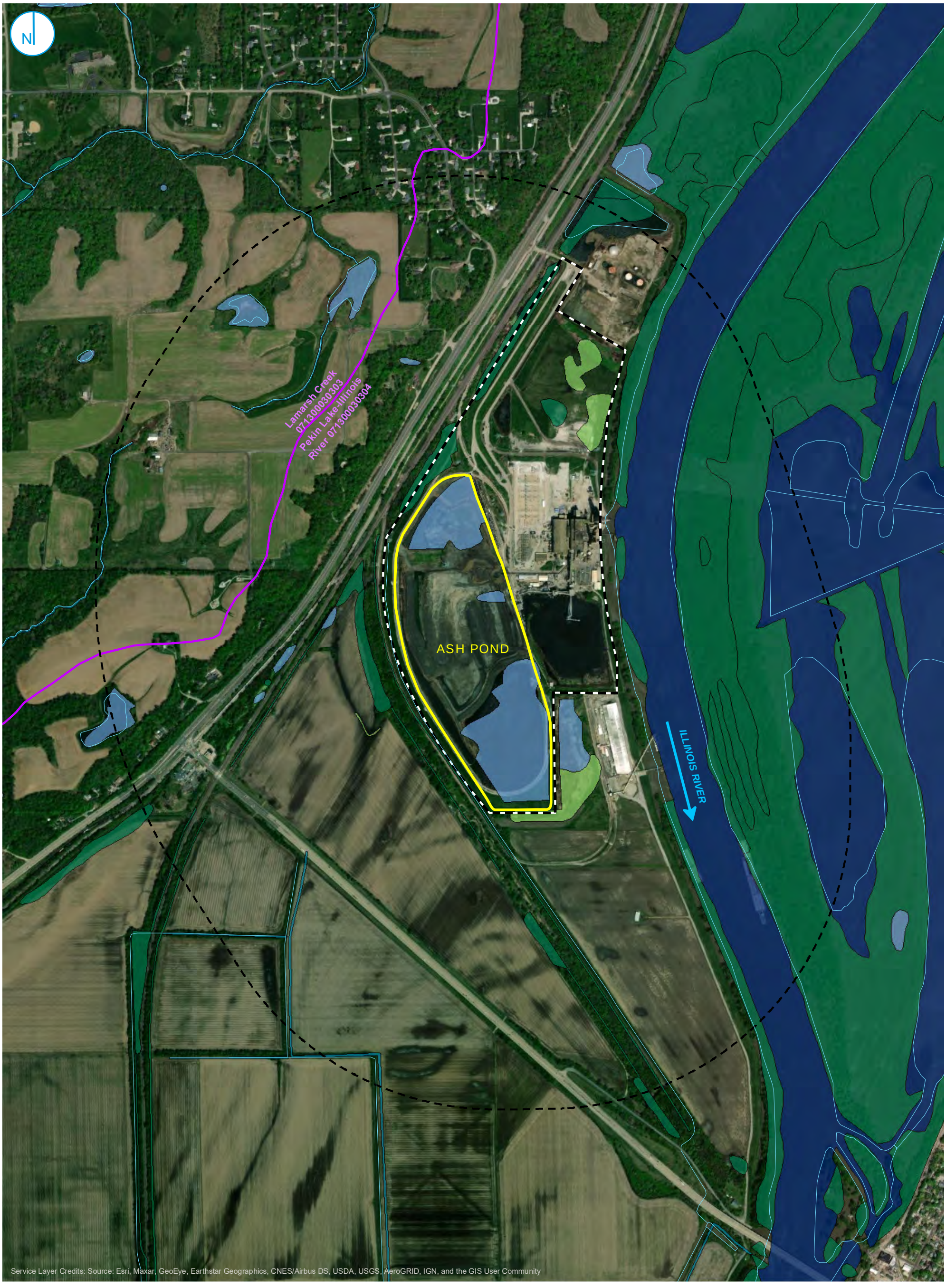
Owner Address: ,
Address of well: Conservation Rd.
Add'l loc. info: FALSE
Tim Soldwedel Lake
Location source: Location from the driller

Permit Date: **Permit #:** none

COMPANY Wright's Drilling
FARM State of Illinois
DATE DRILLED November 20, 1998 **NO.** TH-3
ELEVATION 450 **COUNTY NO.** 23443
LOCATION SW SW SW
LATITUDE 40.58296 **LONGITUDE** -89.655159
COUNTY **Tazewell** **API** **121792344300** **27 - 25N - 5W**



SURFACE WATERS



SURFACE WATERBODY
WATERSHED BOUNDARY (HUC 12)
PART 845 REGULATED UNIT (SUBJECT UNIT)
1000 METER UNIT BUFFER
PROPERTY BOUNDARY

0 500 1,000 Feet

NATIONAL WETLANDS INVENTORY
FRESHWATER EMERGENT WETLAND
FRESHWATER FORESTED/SHRUB WETLAND
FRESHWATER POND
LAKE
OTHER
RIVERINE

SOURCES: USGS, USFWS

SURFACE WATERBODIES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE B-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

SURFACE WATER FEATURES WITHIN 1,000 METERS
DESKTOP STUDY
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, IL

HUC	Surface Water ID	Distance from Unit (meters)	Physical Orientation to Unit	Hydraulic Orientation to Unit	Classification Code	Size (acres)	Notes
--	Freshwater Emergent Wetland 2	381	NE	Downgradient	PEM1C	3.02	--
--	Freshwater Emergent Wetland 3	442	NE	Downgradient	PEM1C	3.24	--
--	Freshwater Forested/Shrub Wetland 1	43	NW	Downgradient	PFO1A	4.35	--
--	Freshwater Forested/Shrub Wetland 10	817	N	Downgradient	PFO1C	5.81	--
--	Freshwater Forested/Shrub Wetland 2	64	W	Downgradient	PFO1Ax	3.42	--
--	Freshwater Forested/Shrub Wetland 3	244	N	Downgradient	PFO1C	4.60	--
--	Freshwater Forested/Shrub Wetland 4	128	W	Downgradient	PFO1A	1.29	--
--	Freshwater Forested/Shrub Wetland 5	104	W	Downgradient	PFO1C	3.86	--
--	Freshwater Forested/Shrub Wetland 6	485	W	Downgradient	PFO1C	0.09	--
--	Freshwater Forested/Shrub Wetland 7	314	SE	Upgradient	PFO1C	1.68	--
--	Freshwater Forested/Shrub Wetland 8	320	NE	Downgradient	PFO1C	1.31	--
--	Freshwater Forested/Shrub Wetland 9	272	N	Downgradient	PFO1C	4.61	--
--	Freshwater Pond	201	W	Downgradient	PUBFx	0.4	--
--	Freshwater Pond	351	W	Downgradient	PUBGx	0.61	--
--	Freshwater Pond	534	W	Downgradient	PUBGx	0.22	--
--	Freshwater Pond	631	N	Downgradient	PUBGh	3.72	--
--	Freshwater Pond	799	NW	Downgradient	PUBGh	3.18	--
--	Freshwater Pond	966	W	Downgradient	PUBGh	3.51	--
07130003	Lake (Illinois River)	335	E	Upgradient	--	16,202.80	Staff gauge installed 8.7 river miles downstream of site. USGS 05568500 ILLINOIS RIVER AT KINGSTON MINES, IL
--	Pekin Lake	805	E	Upgradient	--	64.00	--
--	Worley Lake	805	E	Upgradient	--	64.00	--

[O: CJC 03/26/21; C: LDC 09/16/21]

Notes:
-- = not applicable
E = east
HUC = Hydrologic Unit Code
N = north
NE = northeast
NW = northwest
SE = southeast
USGS = United States Geological Survey
W = west

ENDANGERED / THREATENED SPECIES

PEORIA COUNTY THREATENED AND ENDANGERED SPECIES

DESKTOP STUDY

EDWARDS POWER PLANT

ASH POND

BARTONVILLE, IL

Scientific Name	Common Name	Status	Number of Occurances	Last Observed
Acipenser fulvescens	Lake Sturgeon	LE	3	6/22/2016
Agalinis skinneriana	Pale False Foxglove	LT	1	7/13/2011
Apalone mutica	Smooth Softshell	LT	2	9/18/2007
Boltonia decurrens	Decurrent False Aster	LT	5	9/13/2019
Bombus affinis	Rusty Patched Bumble Bee	LE	6	7/19/2016
Corallorhiza maculata	Spotted Coral-root Orchid	LE	1	6/1/2007
Cypripedium parviflorum	Small Yellow Lady's Slipper	LE	1	4/28/2012
Elliptio crassidens	Elephant-ear	LE	1	8/19/2012
Filipendula rubra	Queen-of-the-prairie	LT	1	8/5/2011
Fundulus dispar	Starhead Topminnow	LT	1	7/5/1989
Ixobrychus exilis	Least Bittern	LT	1	6/19/2004
Lanius ludovicianus	Loggerhead Shrike	LE	1	7/27/2006
Lepomis miniatus	Redspotted Sunfish	LT	1	10/28/2010
Lepomis symmetricus	Bantam Sunfish	LT	1	10/14/1998
Monarda clinopodia	White Bergamot	LT	1	7/13/1964
Myotis septentrionalis	Northern Long-eared Myotis	LT	2	6/7/2016
Myotis sodalis	Indiana Bat	LE	1	8/9/2017
Pandion haliaetus	Osprey	LT	4	5/1/2020
Poliocitellus franklinii	Franklin's Ground Squirrel	LT	1	7/19/2017
Quadrula metanevra	Monkeyface	LT	2	6/26/2012
Rallus elegans	King Rail	LE	1	5/26/1988
Reginaia ebenus	Ebonyshell	LE	1	8/4/2012
Speyeria idalia	Regal Fritillary	LT	1	7/14/1961
Viburnum molle	Arrowwood	LT	2	7/1/2017

[O: CJC 03/26/21; C: LDC 09/16/21]

Notes:

-- = not provided/cannot be determined

LE = listed endangered

LT = listed threatened

RAMBOLL

APPENDIX C
BORING LOGS AND WELL CONSTRUCTION LOGS

2021 RAMBOLL BORING LOGS

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-12

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Russ Gordon Cascade Drilling	1/7/2021	1/7/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
AW-12	Feet (NAVD88)	441.16 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,429,585.53 N, 2,436,922.88 E E/Ⓦ

1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 27.828"

Long -89° 39' 40.8"

Local Grid Location

Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	72 72		0	0 - 2.2' **SILT:** ML, very dark grayish brown (10YR 3/2), roots (5-10%), clay (0-5%), sand (0-5%), gravel (0-5%), moist.	ML									CS= Core Sample
			2											
			3	2.2 - 6.2' **SILTY CLAY:** CL/ML, very dark grayish brown (10YR 3/2), sand (0-5%), stiff, medium plasticity, moist.	CL/ML				1.5					
			4						1					
			5						1					
2 CS	48 48		6	6' - 6.2' layer of gravelly clay, wet.					0.75					
			7	6.2 - 10.4' **SILTY CLAY:** CL/ML, dark gray (10YR 4/1), sand (0-5%), gravel (0-5%), organic material (0-5%), firm to stiff, medium plasticity, moist to wet.	CL/ML				0.75					
			8						1					
			9						1					
3 CS	120 84		10											
			11	10.4 - 18.4' **LEAN CLAY:** CL, dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/4) mottling (0-5%), sand (0-5%), gravel (0-5%), stiff, medium plasticity, moist.	CL				1					
			12											
			13						1					
			14	14' dark yellowish brown (10YR 4/4) mottling (30-45%).					1					
			15											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature SH Wb

Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

Boring Number AW-12 Page 2 of 2

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
4 CS	120 120		16	10.4 - 18.4' **LEAN CLAY:** CL, dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/4) mottling (0-5%), sand (0-5%), gravel (0-5%), stiff, medium plasticity, moist. *(continued)*	CL				1					
			17						1					
			18											
			19	18.4 - 23.8' **SILTY CLAY:** CL/ML, dark gray (10YR 4/1), sand (0-5%), organic material (0-5%), gravel (0-5%), very soft to soft, medium plasticity, moist.										
5 CS	120 120		20						0.25					
			21		CL/ML									
			22						0.25					
			23						0.5					
			24	23.8 - 27' **SILTY CLAY:** CL/ML, gray (10YR 6/1), sand (0-5%), shells (0-5%), firm to stiff, medium plasticity, moist.					1					
			25		CL/ML				1					
			26						1					
			27	27 - 30' **WELL-GRADED GRAVEL WITH SAND:** (GW)s, dark gray (10YR 4/1), fine to coarse gravel, wet.					0.5					
			28		(GW)s									
			29											
6 CS	60 60		30	30 - 35' **Weathered SHALE Bedrock** BDX (SH), gray (10YR 5/1).										
			31											
			32		BDX (SH)									
			33											
			34											
			35	35' End of Boring.										

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-13

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Gordon Cascade Drilling	1/9/2021	1/9/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
AW-13	Feet (NAVD88)	438.67 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,428,600.70 N, 2,436,267.19 E E/Ⓦ

1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 18.134"

Long -89° 39' 49.372"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	240 135		1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	0 - 0.9' **FILL, SILT WITH GRAVEL:** (ML)g, brown (10YR 4/3), clay (5-15%), sand (5-15%), no dilatancy, low toughness, non-plastic, wet. 0.9 - 2.6' **SILT:** ML, dark brown (10YR 3/3) to dark olive brown (2.5Y 3/3), clay (15-30%), sand (5-15%), yellowish brown (10YR 5/4) sand seams, no dilatancy, medium toughness, low plasticity. 2.6 - 5.5' **LEAN CLAY WITH SAND:** (CL)s, yellowish brown (10YR 5/4), dark gray (10YR 4/1) mottling (5-15%), silt (5-15%), no to slow dilatancy, low toughness, low to medium plasticity. 5.5 - 20' **LEAN CLAY:** CL, dark gray (10YR 4/1), yellowish brown (10YR 5/4) mottling (0-5%), silt (15-30%), no dilatancy, low toughness, medium plasticity. 7.8' wet.	(FILL) (ML)g ML (CL)s CL									CS= Core Sample

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	Tel / Fax
	Ramboll 234 W. Florida Street, Milwaukee,WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

Boring Number AW-13 Page 2 of 2

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			16	5.5 - 20' **LEAN CLAY:** CL, dark gray (10YR 4/1), yellowish brown (10YR 5/4) mottling (0-5%), silt (15-30%), no dilatancy, low toughness, medium plasticity. *(continued)*	CL									
			17											
			18											
			19	19' very dark gray (5Y 3/1), shells (0-5%), organic material (0-5%).										
2 CS	60 60		20	20 - 23.6' **SILTY CLAY:** CL/ML, dark gray (10YR 4/1), yellowish brown (10YR 5/4) mottling (0-5%), shells (0-5%), organic material (0-5%), no dilatancy, low toughness, low plasticity.	CL/ML									
			21											
			22											
			23											
			24	23.6 - 27.3' **SILT:** ML, dark gray (10YR 4/1), clay (15-30%), no dilatancy, low toughness, low plasticity.	ML									
3 CS	60 60		25											
			26											
			27											
			28	27.3 - 29' **Weathered SHALE Bedrock** BDX (SH), gray (5Y 6/1) to greenish gray (GLEY 1 6/1).	BDX (SH)									
			29	29 - 30' **SHALE:** BDX (SH), gray (5Y 6/1).	BDX (SH)									
			30	30' End of Boring.										

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-13A

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Gordon Cascade Drilling	1/9/2021	1/9/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
	Feet (NAVD88)	Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane N, E E/W
1/4 of 1/4 of Section , T 7 N, R 7 E
Lat ° ' "
Long ° ' "
Local Grid Location Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 51		0.5 1.0 1.5	0 - 1.9' **FILL, SILT WITH GRAVEL:** (ML)g, brown (10YR 4/3), clay (5-15%), sand (5-15%), no dilatancy, low toughness, non-plastic, moist.	(FILL) (ML)g									CS= Core Sample
			2.0 2.5	1.9 - 2.7' **FILL, POORLY-GRADED GRAVEL:** GP, dark olive brown (2.5Y 3/3), fine gravel, sand (5-15%), silt (0-5%), dry.	(FILL) GP									
			3.0 3.5 4.0 4.5	2.7 - 5' **SILT:** ML, dark brown (10YR 3/3) to dark olive brown (2.5Y 3/3), clay (15-30%), sand (5-15%), yellowish brown (10YR 5/4) sand seams, no dilatancy, medium toughness, low plasticity, moist.	ML									
2 SH	24 24		5.0 5.5 6.0 6.5	5 - 7' **LEAN CLAY:** CL.	CL					25.2	30	16	69.7	SH= Shelby Tube sample
			7.0	7' End of Boring.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-14

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Gordon Cascade Drilling	1/8/2021	1/8/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
AW-14	Feet (NAVD88)	436.83 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,428,201.15 N, 2,435,739.93 E E/W

1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 14.215"

Long -89° 39' 56.236"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	120 120		1	0 - 2.2' **SILT WITH SAND:** (ML)s, very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2), gravel (5-15%), roots (0-5%), no dilatancy, low toughness, non-plastic, moist to wet.	(ML)s									CS= Core Sample
			2											
			3	2.2 - 3.7' **SILT:** ML, dark grayish brown (10YR 4/2), very dark grayish brown (10YR 3/2) mottling (15-30%), yellowish brown (10YR 5/6) mottling (0-5%), clay (15-30%), sand (0-5%), stiff, no dilatancy, low toughness, low plasticity, moist.	ML				1.5					
			4											
			5	3.7 - 27' **LEAN CLAY:** CL, dark gray (10YR 4/1), silt (5-30%), shells (0-5%), organic material (0-5%).					0.25					
			6											
			7						0.25					
			8											
			9											
			10		CL									
2 CS	120 101		11											
			12											
			13											
			14											
			15											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204

Tel: (414) 837-3607
Fax: (414) 837-3608

Boring Number AW-14 Page 2 of 2

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			16	3.7 - 27' **LEAN CLAY:** CL, dark gray (10YR 4/1), silt (5-30%), shells (0-5%), organic material (0-5%). *(continued)*										
			17											
			18	18' organic material (5-15%).										
			19											
3 CS	60 60		20	20' slow dilatancy.										
			21		CL									
			22											
			23											
			24											
4 CS	120 84		25											
			26											
			27	27 - 28' **Weathered SHALE Bedrock** BDX (SH), dark grayish brown (10YR 4/2), clay (15-30%), shells (0-5%), gravel (0-5%).	BDX (SH)									
			28	28 - 35' **SHALE:** BDX (SH), dark gray (10YR 4/1) to gray (10YR 6/1), dry.										
			29											
			30											
			31		BDX (SH)									
			32											
			33											
			34											
			35	35' End of Boring.										

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-15

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Gordon Cascade Drilling	1/8/2021	1/8/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
AW-15	Feet (NAVD88)	438.95 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,428,445.04 N, 2,435,405.11 E E/Ⓦ

1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 16.644"

Long -89° 40' 0.557"

Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	240 167		0 1 2 3 4 5 6 7 8 9 10 11 12 13	0 - 0.6' **POORLY-GRADED SAND:** SP, dark grayish brown (10YR 4/2), fine to medium sand, gravel (5-15%), silt (5-15%), roots (0-5%), moist. 0.6 - 13.5' **SILT:** ML, dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/6) to dark brown (7.5YR 3/4) mottling (15-30%), clay (15-30%), sand (5-15%), shells (0-5%), no dilatancy, medium toughness, low plasticity, moist, blocky. 11' dark yellowish brown (10YR 4/6) to dark brown (7.5YR 3/4) mottling (5-15%).	SP ML									CS= Core Sample

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204

Tel: (414) 837-3607
Fax: (414) 837-3608

Boring Number AW-15 Page 2 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			14	13.5 - 14' **LEAN CLAY:** CL, dark gray (10YR 4/1) to (5Y 4/1), silt (15-30%), sand (0-5%), shells (0-5%), no to slow dilatancy, low toughness, medium plasticity, moist.	CL									
			15	14 - 17' **SILTY CLAY:** CL/ML, dark gray (10YR 4/1) to (5Y 4/1), sand (0-5%), shells (0-5%), no to slow dilatancy, low toughness, medium plasticity, wet.	CL/ML									
			16											
			17	17 - 20' **LEAN CLAY:** CL, dark gray (10YR 4/1) to (5Y 4/1), silt (15-30%), sand (0-5%), shells (0-5%), no to slow dilatancy, low toughness, medium plasticity, wet.	CL									
			18											
			19	19.5' moist.										
2 SH	24 24		20	20 - 22' **FAT CLAY:** CH.	CH					27.9	57	38	98	SH= Shelby Tube sample
			21											
3 CS	156 156		22	22 - 35.8' **LEAN CLAY:** CL, dark gray (10YR 4/1) to (5Y 4/1), silt (15-30%), sand (0-5%), shells (0-5%), no to slow dilatancy, low toughness, medium plasticity, moist.	CL									
			23											
			24											
			25											
			26											
			27	26.5' organic material (0-5%).										
			28	28' - 29' organic material (5-15%).										
			29											
			30											
			31											
			32											
			33											
			34	34' piece of wood 1" long.										
			35											
4 CS	60 60		36											

Boring Number AW-15 Page 3 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			37	35.8 - 36.9' **Weathered SHALE Bedrock** BDX (SH), dark gray (10YR 4/1) to gray (10YR 6/1). *(continued)*	BDX (SH)									
			38	36.9 - 40' **SHALE:** BDX (SH), gray (10YR 6/1), dry.	BDX (SH)									
			39											
			40	40' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-15C

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Gordon Cascade Drilling	1/7/2021	1/8/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
AW-15C	Feet (NAVD88)	437.62 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,428,458.08 N, 2,435,388.24 E E/Ⓦ

1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 16.774"

Long -89° 40' 0.775"

Local Grid Location: Feet ☐N ☐S ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	120 120		0	0 - 4.4' **CLAYEY SILT** ML/CL, grayish brown (10YR 5/2), brown (10YR 4/3) mottling (0-5%), roots (0-5%), gravel (0-5%), stiff, no to slow dilatancy, low toughness, low plasticity, moist.					1.5					CS= Core Sample
			1											
			2	1.8' brown (10YR 4/3) mottling (15-20%), strong brown (7.5YR 5/6) mottling (0-5%).	ML/CL									
			3						1.5					
			4											
			5	4.4 - 8' **LEAN CLAY:** CL, dark grayish brown (10YR 4/2), grayish brown (10YR 5/2) mottling (0-15%), dark yellowish brown (10YR 4/6) mottling (0-5%), no to slow dilatancy, low toughness, medium plasticity, moist, light gray (7.5YR 7/1) sand seams (0-5%) with strong brown (7.5YR 4/6) mottling, 1/16" thick light gray (7.5YR 7/1) sand seams (0-5%), strong brown (7.5YR 4/6) mottling, 1/16" diameter.	CL				1.5					
			6											
			7	7.5' organic material (0-15%), shells (0-5%).					2.5					
			8	8 - 30.2' **SILTY CLAY:** CL/ML, dark grayish brown (10YR 4/2), dark gray (10YR 4/1) (5-15%), yellowish brown (10YR 5/8) mottling (5-15%), sand (5-15%), organic material (0-15%), shells (0-5%).										
			9	9.5' no sand, gray (10YR 4/1) mottling (0-5%).					0.75					
2 CS	120 120		10		CL/ML									
			11						0.5					
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204

Tel: (414) 837-3607
Fax: (414) 837-3608

Boring Number AW-15C

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	8 - 30.2' **SILTY CLAY:** CL/ML, dark grayish brown (10YR 4/2), dark gray (10YR 4/1) (5-15%), yellowish brown (10YR 5/8) mottling (5-15%), sand (5-15%), organic material (0-15%), shells (0-5%). *(continued)*					0.25					
			14											
			15						0.25					
			16											
			17	17.2' - 19' organic material (5-15%).					0.25					
			18											
			19						0.25					
3 CS	120 116		20	20' organic material (0-5%), no mottling.										
			21		CL/ML				0.25					
			22	21.4' light brownish gray (10YR 6/2) mottling (0-5%), silt seams <1/16".										
			23						0.25					
			24											
			25						0.25					
			26											
			27						0.25					
			28											
			29						0.25					
4 CS	120 113		30	30.2 - 40' **Weathered SHALE Bedrock** BDX (SH), gray (2.5Y 5/1), highly decomposed, dry.										
			31		BDX (SH)									
			32											

Boring Number AW-15C

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	30.2 - 40' **Weathered SHALE Bedrock** BDX (SH), gray (2.5Y 5/1), highly decomposed, dry. *(continued)*										
			34											
			35											
			36		BDX (SH)									
			37	36.6' dark grayish brown (10YR 4/2) to gray (5Y 6/1).										
			38											
			39											
5 CS	60 46		40	40 - 100' **SHALE:** BDX (SH), dark grayish brown (10YR 4/2) to gray (5Y 6/1).										
			41											
			42											
			43											
			44											
6 CS	84 84		45											
			46		BDX (SH)									
			47											
			48											
			49											
			50											
			51											
			52											

Boring Number AW-15C

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
7 CS	240 211		53	40 - 100' **SHALE:** BDX (SH), dark grayish brown (10YR 4/2) to gray (5Y 6/1). *(continued)* 52' greenish gray (GLEY 1 5/1) to gray (5Y 6/1) laminations.										
			54											
			55											
			56											
			57											
			58	57.2 - 57.3' light brownish gray (10YR 6/2) concretion.										
			59											
			60											
			61											
			62		BDX (SH)									
			63											
			64											
			65											
			66											
			67											
			68											
			69											
			70	69.5 - 69.6' light brownish gray (10YR 6/2) concretion.										
			71											
			72											

Boring Number AW-15C

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
8 CS	240 48		73	40 - 100' **SHALE:** BDX (SH), dark grayish brown (10YR 4/2) to gray (5Y 6/1). *(continued)*										
			74											
			75											
			76											
			77											
			78											
			79											
			80											
			81											
			82	82' dark greenish gray (GLEY 1 4/1).	BDX (SH)									
			83											
			84											
			85											
			86											
			87											
			88											
			89											
			90											
			91											
			92											

Boring Number AW-15C

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
9 CS	96 46		93	40 - 100' **SHALE:** BDX (SH), dark grayish brown (10YR 4/2) to gray (5Y 6/1). *(continued)*	BDX (SH)									
			94											
			95											
			96											
			97											
			98											
			99											
			100	100' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-15S

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Gordon Cascade Drilling	1/8/2021	1/8/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
AW-15S	Feet (NAVD88)	437.92 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,428,441.60 N, 2,435,399.83 E E/W
1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 16.61"
Long -89° 40' 0.626"

Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	240 200			0 - 12' **SILT:** ML, dark grayish brown (10YR 4/2), brown (10YR 4/3) mottling (5-15%), clay (15-30%), roots (0-5%), wood (0-5%), sand (0-5%), very soft to very stiff, slow to no dilatancy, low toughness, low plasticity, moist.										CS= Core Sample
			1						0.5					
			2											
			3						0.25					
			4											
			5						0.5					
			6		ML									
			7						3					
			8											
			9											
			10	10' dark gray (10YR 4/1), dark grayish brown (10YR 4/2) mottling (30-45%), dark brown (7.5YR 3/3) mottling (0-5%).										
			11	11' dark grayish brown (10YR 4/2), wood (5-15%).					1.5					
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature [signature]

Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

Boring Number AW-15S

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			12	12 - 20' **LEAN CLAY:** CL, dark gray (10YR 4/1) to (5Y 4/1), shells (0-5%), organic material (0-5%), soft, slow dilatancy, low toughness, medium plasticity, moist to wet.	CL				0.5					
			13											
			14	14' moist.										
			15											
			16											
			17											
			18											
			19											
			20	20' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-16

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Adam Jochimsen Cascade Drilling	1/7/2021	1/8/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
AW-16	Feet (NAVD88)	459.45 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,428,987.30 N, 2,435,130.53 E E/Ⓦ

1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 22.018"

Long -89° 40' 4.077"

Local Grid Location: ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 / 57		0 - 1 - 2 - 3 - 4 - 5	0 - 5' **FILL, SILT WITH SAND:** (ML)s, grayish brown (10YR 5/2), ash (5-10%), gravel (0-5%), stiff, slow dilatancy, low toughness, non-plastic, moist to dry.	(FILL) (ML)s				1.25					7-inch override casing set at 20 feet below ground surface
2 CS	60 / 60		5 - 6 - 7 - 8 - 9 - 10	5 - 16.8' ASH, very dark gray (10YR 3/1), silt to sand sized grains, slag-like material (0-5%), subangular to subrounded, loose, dry to moist.	(FILL) ASH									CS= Core Sample
3 CS	120 / 92		10 - 11 - 12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	Tel / Fax
	Ramboll 234 W. Florida Street, Milwaukee,WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

Boring Number AW-16 Page 2 of 4

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	5 - 16.8' ASH, very dark gray (10YR 3/1), silt to sand sized grains, slag-like material (0-5%), subangular to subrounded, loose, dry to moist. *(continued)*	(FILL) ASH									
			14											
			15											
			16											
			17	16.8 - 58.5' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), brown (7.5YR 4/4) mottling (15-20%), shells (0-5%), sand (0-5%), gravel (0-5%), stiff to firm, slow dilatancy, low to medium toughness, medium plasticity, moist.					1.25					
			18											
			19						2.25					
4 CS	120 88		20											
			21						0.75					
			22	22.1' dark gray (10YR 4/1), organic material (0-5%).										
			23						0.75					
			24		CL/ML									
			25						2					
			26											
			27						1.75					
			28											
			29						2.5					
5 CS	60 40		30											
			31						1.5					
			32											

Boring Number AW-16 Page 3 of 4

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	16.8 - 58.5' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), brown (7.5YR 4/4) mottling (15-20%), shells (0-5%), sand (0-5%), gravel (0-5%), stiff to firm, slow dilatancy, low to medium toughness, medium plasticity, moist. *(continued)*					1.5					
			34	34' brown (7.5YR 4/4) mottling, stiff.										
6 CS	60 60		35						1.75					
			36											
			37						1.5					
			38	38' dark grayish green (5GY 4/2), no mottling.										
			39						1.25					
7 CS	60 60		40											
			41						1.25					
			42		CL/ML									
			43						1.5					
			44											
8 CS	60 60		45	45' organic material (5-10%).					1.25					
			46											
			47						1					
			48											
			49						1					
9 CS	60 58		50											
			51						0.75					
			52											

Boring Number AW-16 Page 4 of 4

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			53	16.8 - 58.5' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), brown (7.5YR 4/4) mottling (15-20%), shells (0-5%), sand (0-5%), gravel (0-5%), stiff to firm, slow dilatancy, low to medium toughness, medium plasticity, moist. *(continued)*					0.75					
			54											
10 CS	60 60		55		CL/ML				0.75					
			56											
			57						0.75					
			58											
			59	58.5 - 60' **Weathered SHALE Bedrock** BDX (SH), gray (10YR 5/1).	BDX (SH)				0.5					
11 CS	36 36		60	60 - 63' **SHALE:** BDX (SH), black (10YR 2/1).										
			61		BDX (SH)									
			62											
			63	63' End of Boring.										

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-17

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Adam Jochimsen Cascade Drilling	1/8/2021	1/8/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
AW-17	Feet (NAVD88)	459.69 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,429,801.14 N, 2,434,680.17 E E/Ⓦ

1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 30.085"

Long -89° 40' 9.855"

Local Grid Location: Feet ☐N ☐S ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 60		0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5	0 - 4.7' ASH, grayish brown (10YR 5/2), sand to gravel sized grains, subangular to subrounded medium to fine-grained sand, silt (5-10%), loose, moist.	(FILL) ASH									7-inch override casing set at 20 feet below ground surface
2 CS	120 65		5.0 5.5 6.0	4.7 - 6.3' **FILL, SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), sand (5-10%), very soft, rapid dilatancy, low toughness, medium to low plasticity, moist to wet.	(FILL) CL/ML				0.25					CS= Core Sample
			6.5 7.0 7.5	6.3 - 7.8' ASH, grayish brown (10YR 5/2), sand to gravel sized grains, subangular to subrounded medium to coarse-grained sand, loose moist.	(FILL) ASH				2.25					
			8.0 8.5 9.0 9.5 10.0	7.8 - 33.7' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), brown (7.5YR 4/4) mottling (25-30%), organic material (0-10%), shells (0-5%), sand (0-5%), stiff to very stiff, slow dilatancy, low toughness, medium plasticity, moist.	CL/ML				2.5					

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

Boring Number AW-17 Page 2 of 4

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			10.5	7.8 - 33.7' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), brown (7.5YR 4/4) mottling (25-30%), organic material (0-10%), shells (0-5%), sand (0-5%), stiff to very stiff, slow dilatancy, low toughness, medium plasticity, moist. *(continued)*										
			11.0						2					
			11.5											
			12.0											
			12.5	12.2' -12.3 strong brown (7.5YR 4/6) layer of oxidation.										
			13.0						2.25					
			13.5											
			14.0											
			14.5											
3 CS	120 114		15.0	14.7' gray (10YR 5/1), no mottling, silt seams <1/16" thick (0-5%), firm, moist.					1.5					
			15.5											
			16.0											
			16.5											
			17.0						1.5					
			17.5											
			18.0											
			18.5		CL/ML									
			19.0						1					
			19.5											
			20.0	20' brown (7.5YR 4/4) mottling (10-15%).										
			20.5											
			21.0						0.75					
			21.5											
			22.0											
			22.5											
			23.0						0.75					
			23.5											
			24.0											
			24.5											
4 CS	60 60		25.0						0.75					
			25.5											
			26.0											
			26.5											

Boring Number AW-17 Page 3 of 4

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			27.0	7.8 - 33.7' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), brown (7.5YR 4/4) mottling (25-30%), organic material (0-10%), shells (0-5%), sand (0-5%), stiff to very stiff, slow dilatancy, low toughness, medium plasticity, moist. *(continued)* 26.8' - 27.6' dark gray (10YR 4/1), organic material (10-15%), very stiff.					3.25					
			27.5											
			28.0											
			28.5											
			29.0						2.5					
			29.5											
5 CS	60 60		30.0		CL/ML									
			30.5											
			31.0						1.25					
			31.5											
			32.0											
			32.5											
			33.0						1.25					
			33.5											
			34.0	33.7 - 38' **CLAYEY SILT** ML/CL, yellowish brown (10YR 5/4), gray (10YR 6/1) mottling (5-15%), organic material (5-10%), sand (0-5%), firm, slow dilatancy, low toughness, low plasticity, moist.										
			34.5											
			35.0						0.75					
6 CS	60 58		35.5											
			36.0		ML/CL									
			36.5											
			37.0						0.75					
			37.5											
			38.0	38 - 55.1' **SILTY CLAY:** CL/ML, dark gray (10YR 4/1) to gray (10YR 5/1), shells (0-5%), organic material (0-5%), firm, slow dilatancy, low toughness, medium plasticity, moist.										
			38.5											
			39.0						0.75					
			39.5											
			40.0											
7 CS	120 109		40.5		CL/ML									
			41.0						0.75					
			41.5											
			42.0											
			42.5											
			43.0						0.75					

Boring Number AW-17

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			43.5	38 - 55.1' **SILTY CLAY:** CL/ML, dark gray (10YR 4/1) to gray (10YR 5/1), shells (0-5%), organic material (0-5%), firm, slow dilatancy, low toughness, medium plasticity, moist. *(continued)*										
			44.0											
			44.5											
			45.0						0.75					
			45.5											
			46.0											
			46.5											
			47.0						0.75					
			47.5											
			48.0											
			48.5	48.2' organic material (5-10%).										
			49.0		CL/ML				0.75					
			49.5											
8 CS	84 70		50.0											
			50.5											
			51.0						0.75					
			51.5											
			52.0											
			52.5											
			53.0						0.75					
			53.5											
			54.0						0.75					
			54.5											
			55.0	54.7' - 55.1' gravel (0-5%).										
			55.5	55.1 - 57' **SHALE:** BDX (SH), gray (10YR 6/1), dry.	BDX (SH)									
			56.0											
			56.5											
			57.0	57' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-18

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Adam Jochimsen Cascade Drilling	1/8/2021	1/9/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
AW-18	Feet (NAVD88)	460.28 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,430,290.97 N, 2,434,561.45 E E/Ⓦ

1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 34.932"

Long -89° 40' 11.358"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 56		0	0 - 1.4' **FILL, POORLY-GRADED SAND WITH GRAVEL:** (SP)g, brown (10YR 4/3), subrounded to rounded, medium sand, loose, moist.	(FILL) (SP)g									7-inch override casing set at 10 feet below ground surface
			1											
			2	1.4 - 7.4' ASH, very dark gray (10YR 3/1), silt sized grains, moist to wet.										
			3											
			4		(FILL) ASH									
2 CS	60 56		5											CS= Core Sample
			6											
			7	6.8' sand and gravel (10-15%).					2.5					
			8	7.4 - 34.2' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), brown (7.5YR 4/4) mottling, (10-20%), shells (0-5%), organic material (0-5%), firm to very stiff, slow dilatancy, low toughness, medium plasticity, moist.									
			9						2.25					
3 CS	120 73		10		CL/ML									
			11						1.75					
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204

Tel: (414) 837-3607
Fax: (414) 837-3608

Boring Number AW-18 Page 2 of 4

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	7.4 - 34.2' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), brown (7.5YR 4/4) mottling, (10-20%), shells (0-5%), organic material (0-5%), firm to very stiff, slow dilatancy, low toughness, medium plasticity, moist. *(continued)*					1.75					
			14											
			15						1.75					
			16											
			17						1.5					
			18											
			19						1.75					
4 CS	120 77		20											
			21						0.75					
			22		CL/ML									
			23						0.75					
			24											
			25						0.75					
			26											
			27						0.75					
			28											
			29						0.5					
5 CS	60 51		30											
			31						0.75					
			32	31.4' organic material (5-10%).										

Boring Number AW-18 Page 3 of 4

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	7.4 - 34.2' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), brown (7.5YR 4/4) mottling, (10-20%), shells (0-5%), organic material (0-5%), firm to very stiff, slow dilatancy, low toughness, medium plasticity, moist. *(continued)*	CL/ML				2.5					
			34											
6 CS	60 46		35	34.2 - 39.4' **CLAYEY SILT** ML/CL, gray (10YR 5/1), brown (7.5YR 4/4) mottling (15-20%), shells (0-5%), firm to very stiff, slow dilatancy, low toughness, low plasticity, moist.					2.5					
			36											
			37		ML/CL				1.25					
			38											
			39						0.75					
7 CS	60 58		40	39.4 - 49.8' **SILTY CLAY:** CL/ML, dark gray (10YR 4/1), organic material (5-10%), shells (0-5%), firm, slow dilatancy, low toughness, medium plasticity, moist.										
			41						0.75					
			42											
			43						0.75					
			44											
8 CS	60 60		45		CL/ML				0.75					
			46											
			47						0.75					
			48											
			49						0.75					
9 CS	60 60		50	49.8 - 55' **SHALE:** BDX (SH), gray (10YR 6/1), dry.										
			51		BDX (SH)									
			52											

Boring Number AW-18 Page 4 of 4

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			53	49.8 - 55' **SHALE:** BDX (SH), gray (10YR 6/1), dry. *(continued)*	BDX (SH)									
			54											
			55	55' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-19

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Adam Jochimsen Cascade Drilling	1/9/2021	1/9/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
AW-19	Feet (NAVD88)	458.53 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,431,161.80 N, 2,434,584.70 E E/Ⓦ

1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 43.536"

Long -89° 40' 10.993"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	120 111		0	0 - 1.8' **FILL, POORLY-GRADED SAND WITH GRAVEL:** (SP)g, brown (10YR 5/3), subrounded to subangular, coarse to medium sand, loose, moist.	(FILL) (SP)g									7-inch override casing set at 10 feet below ground surface
			1											
			2	1.8 - 7.1' ASH, very dark gray (10YR 3/1), silt sized grains, soft, moist to wet.										
			3						0.25					
			4		(FILL) ASH									
			5						0.25					CS= Core Sample
			6											
			7	7.1 - 23.6' **SILTY CLAY:** CL/ML, gray (10YR 5/1), yellowish brown (10YR 5/6) mottling (5-10%), shells (0-5%), organic material (0-5%), very stiff, slow dilatancy, medium toughness, high plasticity, moist.					0.25					
			8											
			9						2.5					
2 CS	60 47		10		CL/ML									
			11						2.25					
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

Boring Number AW-19 Page 2 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	7.1 - 23.6' **SILTY CLAY:** CL/ML, gray (10YR 5/1), yellowish brown (10YR 5/6) mottling (5-10%), shells (0-5%), organic material (0-5%), very stiff, slow dilatancy, medium toughness, high plasticity, moist. *(continued)*					2.5					
			14											
3 CS	60 43		15						2.25					
			16											
			17						2.25					
			18		CL/ML									
			19						2					
4 CS	60 46		20											
			21						2.5					
			22											
			23						2.25					
			24	23.6 - 35' **FAT CLAY:** CH, dark gray (10YR 4/1), very dark gray (10YR 3/1) and yellowish brown (10YR 5/6) mottling (5-10%), organic material (0-5%), shells (0-5%), gravel (0-5%), stiff, slow dilatancy, medium toughness, medium to high plasticity, moist.										
5 CS	60 39		25						2.5					
			26											
			27						2.5					
			28		CH									
			29						2.5					
6 CS	60 41		30											
			31						2.25					
			32											

Boring Number AW-19 Page 3 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	23.6 - 35' **FAT CLAY:** CH, dark gray (10YR 4/1), very dark gray (10YR 3/1) and yellowish brown (10YR 5/6) mottling (5-10%), organic material (0-5%), shells (0-5%), gravel (0-5%), stiff, slow dilatancy, medium toughness, medium to high plasticity, moist. *(continued)*	CH				2.5					
			34											
7 CS	60 60		35	35 - 40.2' **SILTY CLAY:** CL/ML, light brownish gray (10YR 6/2) to grayish brown (10YR 5/2), gravel (0-5%), sand (0-5%), soft, slow dilatancy, low toughness, medium plasticity, moist to wet.					0.5					
			36											
			37		CL/ML				0.5					
			38											
			39						0.25					
			40											
8 CS	36 36		41	40.2 - 41.5' **Weathered SHALE Bedrock** BDX (SH), gray (10YR 6/1) to light yellowish brown (10YR 6/4).	BDX (SH)									
			42	41.5 - 43' **SHALE:** BDX (SH), gray (10YR 6/1).	BDX (SH)									
			43	43' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-20

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Adam Jochimsen Cascade Drilling	1/10/2021	1/10/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
AW-20	Feet (NAVD88)	459.08 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,431,539.96 N, 2,434,807.43 E E/Ⓦ

1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 47.26"

Long -89° 40' 8.078"

Local Grid Location: ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 47		0	0 - 0.5' **FILL, POORLY-GRADED SAND WITH GRAVEL:** (SP)g, grayish brown (10YR 5/2), subrounded to subangular, coarse to medium sand, loose, wet.	(FILL) (SP)g									7-inch override casing set at 10 feet below ground surface
			1	0.5 - 6.2' ASH, very dark gray (10YR 3/1), silt sized grains, loose, moist.										
			2											
			3		(FILL) ASH									
			4											
2 CS	60 54		5											CS= Core Sample
			6											
			7	6.2 - 8.9' ASH, very dark gray (10YR 3/1), sand to gravel sized grains, subangular to angular, clinkers (0-5%), slag-like material (0-5%), moist.	(FILL) ASH									
			8											
			9	8.9 - 15' **SILTY CLAY:** CL/ML, dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2), yellowish brown (10YR 5/6) mottling (5-15%), sand (0-5%), gravel (0-5%), stiff, slow to no dilatancy, low to medium toughness, medium to high plasticity, moist.				1.5					
3 CS	60 60		10		CL/ML									
			11					1.25						
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	Tel / Fax
	Ramboll 234 W. Florida Street, Milwaukee,WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

Boring Number AW-20 Page 2 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	8.9 - 15' **SILTY CLAY:** CL/ML, dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2), yellowish brown (10YR 5/6) mottling (5-15%), sand (0-5%), gravel (0-5%), stiff, slow to no dilatancy, low to medium toughness, medium to high plasticity, moist. *(continued)*	CL/ML			1.25						
			14											
4 SH	24 24		15	15 - 17' **LEAN CLAY:** CL.				1.25		35.1	47	29	92.2	SH= Shelby Tube
			16		CL									
5 CS	96 96		17	17 - 19.6' **SILTY CLAY:** CL/ML, dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2), yellowish brown (10YR 5/6) mottling (5-15%), sand (0-5%), gravel (0-5%), stiff, slow to no dilatancy, low to medium toughness, medium to high plasticity, moist.				1.25						
			18		CL/ML									
			19					0.75						
			20	19.6 - 40.8' **SILTY CLAY:** CL/ML, gray (10YR 5/1), shells (0-5%), sand (0-5%), organic material (0-5%), firm to stiff, slow dilatancy, low toughness, medium to high plasticity, moist.										
			21					0.75						
			22											
			23					0.75						
			24	23.8' - 30' dark gray (10YR 4/1), organic material (10-15%), stiff.										
6 CS	60 57		25					2.25						
			26		CL/ML									
			27					2.25						
			28											
			29					0.75						
7 CS	60 60		30											
			31					0.75						
			32											

Boring Number AW-20 Page 3 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	19.6 - 40.8' **SILTY CLAY:** CL/ML, gray (10YR 5/1), shells (0-5%), sand (0-5%), organic material (0-5%), firm to stiff, slow dilatancy, low toughness, medium to high plasticity, moist. *(continued)*				1.25						
			34	33.2' gray (10YR 5/1), brown (7.5YR 4/4) mottling (10-20%), gravel (0-5%), medium toughness, high plasticity.										
8 CS	60 60		35					1						
			36		CL/ML									
			37					0.75						
			38											
			39					0.75						
9 CS	36 36		40	39.7' - 39.9' interbedded sand seams with silt and clay laminations, moist. 40' grayish brown (10YR 5/2).										
			41	40.8 - 43' **Weathered SHALE Bedrock** BDX (SH), gray (10YR 6/1) to yellowish brown (10YR 5/6).	BDX (SH)									
			42											
			43	43' End of Boring.										

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-21

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Adam Jochimsen Cascade Drilling	1/10/2021	1/10/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
AW-21	Feet (NAVD88)	458.28 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,431,842.41 N, 2,435,132.32 E E/Ⓦ

1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 50.23"

Long -89° 40' 3.844"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 / 49		0	0 - 0.5' **FILL, CLAYEY SILT** ML/CL, dark brown (10YR 3/3), loose, moist.	(FILL) ML/CL				0.25					7-inch override casing set at 10 feet below ground surface
			1	0.5 - 9.1' ASH, dark gray (10YR 4/1) to very dark gray (10YR 3/1), silt sized grains, soft, moist.										
			2											
			3						0.25					
			4											
2 CS	60 / 60		5		(FILL) ASH				0.25					CS= Core Sample
			6											
			7						0.25					
			8											
			9						2					
3 CS	60 / 49		10	9.1 - 35.4' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2) to gray (10YR 5/1), brown (7.5YR 4/4) mottling (15-20%), shells (0-5%), sand (0-5%), gravel (0-5%), stiff to very stiff, slow dilatancy, medium to low toughness, medium to high plasticity, moist.										
			11						1.25					
			12		CL/ML									
			13						1.75					
			14											
			15	14.3' - 15' dark gray (10YR 4/1), organic material (5-10%), high plasticity, moist.										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204

Tel: (414) 837-3607
Fax: (414) 837-3608

Boring Number AW-21 Page 2 of 2

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
4 CS	60 47		16	9.1 - 35.4' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2) to gray (10YR 5/1), brown (7.5YR 4/4) mottling (15-20%), shells (0-5%), sand (0-5%), gravel (0-5%), stiff to very stiff, slow dilatancy, medium to low toughness, medium to high plasticity, moist. *(continued)*					1.25					
			17						1.75					
			18											
			19						1.25					
5 CS	60 50		20											
			21						0.5					
			22											
			23						2.25					
			24											
6 CS	60 54		25		CL/ML				3					
			26											
			27						1.25					
			28											
			29						1.75					
7 CS	60 60		30	29.8' - 31.5' dark gray (10YR 4/1), organic material (5-10%).										
			31						1.25					
			32	31.5' grayish brown (10YR 5/2), yellowish brown (10YR 5/6) mottling (10-15%).										
			33						0.75					
			34											
8 CS	36 36		35						1					
			36	35.4 - 38' **Weathered SHALE Bedrock** BDX (SH), gray (10YR 6/1) to brownish yellow (10YR 6/6).	BDX (SH)									
			37											
			38	38' End of Boring.										

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-22

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Russ Gordon Cascade Drilling	1/7/2021	1/8/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
AW-22	Feet (NAVD88)	460.30 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,431,677.07 N, 2,435,397.38 E E/W

1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 48.582"

Long -89° 40' 0.42"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 60		0	0 - 1.6' **FILL, SILTY CLAY:** CL/ML, dark grayish brown (10YR 4/2), gravel (0-5%), sand (0-5%), stiff to very stiff, low plasticity, moist.	(FILL) CL/ML				2.5					7-inch override casing set at 20 feet below ground surface
			2	1.6 - 14.6' ASH, dark gray (10YR 4/1), silt sized grians, sand (0-5%), moist to wet.					1.5					
2 CS	60 28		5	5.5' brown (10YR 5/3), gravel (15-25%).	(FILL) ASH									CS= Core Sample
3 CS	120 84		10	10' very dark gray (10YR 3/1), sand (0-5%) wet.										
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

Boring Number AW-22 Page 2 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	1.6 - 14.6' ASH, dark gray (10YR 4/1), silt sized grians, sand (0-5%), moist to wet. *(continued)*	(FILL) ASH									
			14											
			15	14.6 - 30' **LEAN CLAY:** CL, dark grayish brown (10YR 4/2), gravel (0-5%), stiff to very stiff, low to medium plasticity, moist.					2.5					
			16						3					
			17						3					
			18											
			19											
4 CS	120 120		20											
			21						1					
			22		CL				1					
			23						1.5					
			24	24' yellowish brown (10YR 5/4), stiff, medium plasticity, moist.					1.5					
			25											
			26						1					
			27						1					
			28						1.5					
			29						1					
5 SH	24 24		30	30 - 32' **CLAYEY SAND:** SC.						23.2	22	9	42.6	SH= Shelby Tube sample
			31		SC									
			32											

Boring Number AW-22 Page 3 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
6 CS	96 96		33	32 - 34' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), yellowish brown mottling (0-5%), sand (0-5%), organic material (0-5%), very soft, medium to high plasticity, moist.	CL/ML				0.25					
			34	34 - 40' **SILTY CLAY:** to **LEAN CLAY:** CL/ML, dark gray (10YR 4/1), sand (0-5%), very soft to soft, medium plasticity, moist.					0.25					
			35	34.8' - 35' layer of silt, wet.					0.5					
			36						0.5					
			37	36.8' - 37.2' layer of silt, wet.	CL/ML				1					
			38	38' - 38.4' layer of fine sand, wet.					0.5					
			39	39.1' - 39.5 layer of fine sand, wet.					0.5					
7 CS	60 60		40	40 - 41.6' **CLAYEY SAND:** SC, dark gray (10YR 4/1), fine sand, shells (5-10%), wet.	SC				0.25					
			41											
			42	41.6 - 45' **LEAN CLAY:** CL, dark gray (10YR 4/1), shells (0-5%), soft, medium plasticity, moist.					0.5					
			43		CL				0.5					
			44						0.5					
8 CS	60 60		45	45 - 47.5' **LEAN CLAY:** CL, very dark grayish brown (10YR 3/2), sand (0-5%), shells (0-5%), stiff, medium plasticity, moist.					1.5					
			46		CL				1					
			47											
			48	47.5 - 50' **Weathered SHALE Bedrock** BDX (SH), gray (10YR 5/1).										
			49		BDX (SH)									
			50	50' End of Boring.										

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		XPW01

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Russ Gordon Cascade Drilling	1/8/2021	1/8/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
	Feet (NAVD88)	Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane N, E E/W
1/4 of 1/4 of Section , T 7 N, R 7 E
Lat ° ' "
Long ° ' "
Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 60		0	0 - 7.8' ASH, dark gray (10YR 4/1), silt to sand and gravel sized grains, moist.										CS= Core Sample
			3	3' grayish brown (10YR 5/2).	(FILL) ASH									
2 CS	60 60		5	5.8' dark gray (10YR 4/1).										
			8	7.8 - 10' **FILL, LEAN CLAY WITH GRAVEL:** (CL)g, brown (10YR 5/3), brick (0-5%), sand (0-5%), low plasticity, moist.	(FILL) (CL)g				2					
3 CS	60 60		10	10 - 12.8' ASH, dark gray (10YR 4/1), silt to sand and gravel sized grains, brick (15-25%), moist to wet.	(FILL) ASH									
			13	12.8 - 15' ASH, dark gray (10YR 4/1), silt to sand sized grains, wet.	(FILL) ASH									
			15											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature SH WL

Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

Boring Number XPW01 Page 2 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
4 SH	24 0		15	15 - 17' ASH, No Recovery.	(FILL) ASH									SH= Shelby Tube sample
			16											
5 CS	36 36		17	17 - 19' ASH, dark gray (10YR 4/1), silt sized grains, sand (0-5%), wet.	(FILL) ASH									
			18											
			19	19 - 20' ASH, dark gray (10YR 4/1), silt to sand sized grains, gravel (0-5%), wet.	(FILL) ASH									
6 SH	24 24		20	20 - 22' ASH, sand to silt sized grains.	(FILL) ASH					43.7	51		31.1	
			21											
7 CS	36 36		22	22 - 25' ASH, very dark gray (10YR 3/1) to black (10YR 2/1), silt to sand sized grains, slag-like material (15-25%).	(FILL) ASH									
			23											
			24											
8 CS	60 0		25	25 - 30' ASH, No Recovery.	(FILL) ASH									
			26											
			27											
			28											
			29											
9 CS	60 0		30	30 - 35' ASH, No Recovery.	(FILL) ASH									
			31											
			32											
			33											
			34											
10 CS	60 0		35	35 - 40' ASH, No Recovery.	(FILL) ASH									
			36											
			37											
			38											
			39											
			40											

Boring Number XPW01 Page 3 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
11 CS	60 60		41	40 - 43' ASH, dark gray (10YR 4/1) to black (10YR 2/1), silt to sand sized grains, wet.	(FILL) ASH									
			42											
			43	43 - 50' **FAT CLAY:** CH, dark grayish brown (10YR 4/2), organic material (0-5%), sand (0-5%), soft to stiff, high plasticity, moist.					0.5					
			44						0.5					
12 CS	72 72		45											
			46						0.5					
			47		CH				0.5					
			48						0.5					
			49						0.5					
			50	50 - 51' **Weathered SHALE Bedrock** BDX (SH).	BDX (SH)				0.5					
			51	51' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		XPW01A

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Russ Gordon Cascade Drilling	1/8/2021	1/9/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
XPW01A	Feet (NAVD88)	460.99 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,431,483.28 N, 2,435,242.39 E E/Ⓦ

1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 46.676"

Long -89° 40' 2.443"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1	0 - 7.8' ASH, Blind drill to 35 feet below ground surface (ft bgs). See XPW01 boring log for detailed lithologies.	(FILL) ASH									
			2											
			3											
			4											
			5											
			6											
			7											
			8	7.8 - 10' **FILL, LEAN CLAY WITH GRAVEL:** (CL)g.	(FILL) (CL)g									
			9											
			10	10 - 12.8' ASH.	(FILL) ASH									
			11											
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature SH WL

Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

Boring Number XPW01A

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13	10 - 12.8' ASH. *(continued)*	(FILL) ASH									
			14	12.8 - 15' ASH.	(FILL) ASH									
			15	15 - 17' ASH.	(FILL) ASH									
			16	17 - 19' ASH.	(FILL) ASH									
			17	19 - 20' ASH.	(FILL) ASH									
			18	20 - 22' ASH.	(FILL) ASH									
			19	22 - 25' ASH.	(FILL) ASH									
			20	25 - 30' ASH.	(FILL) ASH									
			21	30 - 35' ASH.	(FILL) ASH									
			22											
			23											
			24											
			25											
			26											
			27											
			28											
			29											
			30											
			31											
			32											

Boring Number XPW01A

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			30	30 - 35' ASH. *(continued)*	(FILL) ASH									
			33											
			34											
1 NR	60 0		35	35 - 40' ASH, No Recovery.	(FILL) ASH									NR= No Recovery
			36											
			37											
			38											
			39											
2 MC	24 24		40	40 - 42' ASH, silt sized grains.	(FILL) ASH					35.1	60	17	86.3	MC= Modified California sample
			41											
			42	42 - 43' s(ML), Blind drill to 43 ft bgs. See XPW01 boring log for detailed lithologies.	(FILL) s(ML)									
			43	43' End of Boring.										

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		XPW02

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Russ Gordon Cascade Drilling	1/9/2021	1/9/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
XPW02	Feet (NAVD88)	471.16 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,430,769.44 N, 2,434,978.01 E E/Ⓦ

1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 39.636"

Long -89° 40' 5.923"

Local Grid Location: Feet ☐N ☐S ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 60		0	0 - 9.2' **FILL, SANDY SILT WITH GRAVEL:** s(ML)g, grayish brown (10YR 5/2), moist.	(FILL) s(ML)g									CS= Core Sample
2 CS	60 60		5											
			9	9.2 - 10' ASH, very dark gray (10YR 3/1), silt sized grains, sand (0-5%), slag-like material (0-5%), moist.	(FILL) ASH									
3 SH	24 24		10	10 - 12' ASH, silt sized grains.	(FILL) ASH					45.1	52	5	71.4	SH= Shelby Tube sample
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	Tel / Fax
SH WL	Ramboll 234 W. Florida Street, Milwaukee,WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

Boring Number XPW02 Page 2 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
4 CS	36 36		12	12 - 12.8' **FILL, SANDY SILT WITH GRAVEL:** s(ML)g, grayish brown (10YR 5/2), moist.	(FILL) s(ML)g									
			13	12.8 - 20' ASH, very dark gray (10YR 3/1), silt sized grains, sand (0-5%), slag-like material (0-5%), moist.										
			14											
5 CS	60 60		15											
			16		(FILL) ASH									
			17											
			18											
			19											
6 SH	24 0		20	20 - 22' ASH, No Recovery.										
			21		(FILL) ASH									
7 MC	24 24		22	22 - 35' ASH, very dark gray (10YR 3/1), silt sized grains, sand (0-5%), slag-like material (0-5%), wet.						33.4	38	8	95.9	MC= Modified California sample
			23											
8 CS	72 72		24											
			25											
			26											
			27		(FILL) ASH									
			28											
			29											
9 CS	60 60		30											
			31											
			32											

Boring Number XPW02 Page 3 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	22 - 35' ASH, very dark gray (10YR 3/1), silt sized grains, sand (0-5%), slag-like material (0-5%), wet. *(continued)*	(FILL) ASH									
			34											
10 MC	24 0		35	35 - 37' ASH, No Recovery.	(FILL) ASH									
			36											
11 MC	24 0		37	37 - 39' ASH, No Recovery.	(FILL) ASH									
			38											
12 CS	12 0		39	39 - 40' ASH, No Recovery.	(FILL) ASH									
13 CS	60 60		40	40 - 46.5' ASH, very dark gray (10YR 3/1), silt to sand sized grains, wet.										
			41											
			42											
			43		(FILL) ASH									
			44											
14 MC	24 18		45							41.7	39	6	62.5	Clay encountered in last 6 inches of sample liner.
			46											
			47	46.5 - 47' **LEAN CLAY:** CL.	CL									
				47' End of Boring.										

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		XPW03

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Russ Gordon Cascade Drilling	1/9/2021	1/10/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
XPW03	Feet (NAVD88)	462.62 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,429,703.68 N, 2,435,574.02 E E/W

1/4 of 1/4 of Section , T 7 N, R 7 E

Lat 40° 35' 29.072" Long -89° 39' 58.275"

Local Grid Location: Feet ☐N ☐S ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 60		0	0 - 10' ASH, dark gray (10YR 4/1), silt to sand sized grains, gravel (0-5%), moist.										CS= Core Sample
			1											
			2											
			3											
			4											
2 CS	60 60		5	4.7' very dark gray (10YR 3/1).	(FILL) ASH									
			6											
			7											
			8											
			9											
3 MC	24 24		10	10 - 12' ASH, silt sized grains.						43.8	36	7	72.4	MC= Modified California sample
			11		(FILL) ASH									
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature SH WL

Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

Boring Number XPW03 Page 2 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
4 CS	36 36		12	12 - 15' ASH, very dark gray (10YR 3/1), silt to sand sized grains, gravel (0-5%), loose, wet.	(FILL) ASH									
5 CS	60 60		15	15 - 28' ASH, dark gray (10YR 4/1), sand to silt sized grians, loose, wet.	(FILL) ASH									
6 CS	60 60		20											
7 CS	60 60		25											
8 CS	60 34		28	28 - 37.6' ASH, dark gray (10YR 4/1), sand to silt and gravel sized grains, coal (15-25%), loose, wet.	(FILL) ASH									
			30											
			32											

Boring Number XPW03 Page 3 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
9 CS	60 60		33 34 35 36 37	28 - 37.6' ASH, dark gray (10YR 4/1), sand to silt and gravel sized grains, coal (15-25%), loose, wet. *(continued)*	(FILL) ASH									
			38 39 40	37.6 - 40' **FAT CLAY:** CH, dark gray (10YR 4/1), soft, high plasticity, moist.	CH				0.5					
				40' End of Boring.										

2021 RAMBOLL WELL CONSTRUCTION LOGS

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: AW-12
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 27.8" Long. -89° 39' 40.8" or	
Facility ID	St. Plane 1,429,586 ft. N, 2,436,923 ft. E. E/Ⓦ	Date Well Installed: 01/07/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7 ☒ E ☐ W	Well Installed By: (Person's Name and Firm): Russ Gordon / Cascade Drilling
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number

A. Protective pipe, top elevation 444.31 ft. (NAVD88)

B. Well casing, top elevation 443.80 ft. (NAVD88)

C. Land surface elevation 441.2 ft. (NAVD88)

D. Surface seal, bottom 439.2 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☒ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 419.2 ft. (NAVD88) or 22.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 417.2 ft. (NAVD88) or 24.0 ft.

H. Screen joint, top 415.2 ft. (NAVD88) or 26.0 ft.

I. Well bottom 410.2 ft. (NAVD88) or 31.0 ft.

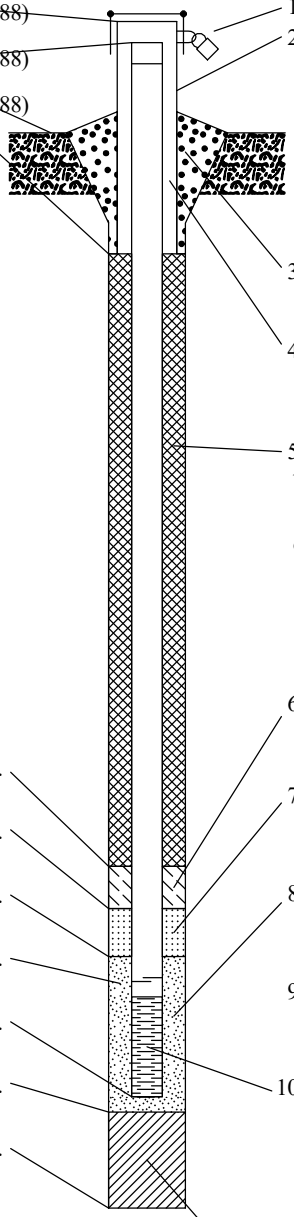
J. Filter pack, bottom 409.7 ft. (NAVD88) or 31.5 ft.

K. Borehole, bottom 406.2 ft. (NAVD88) or 35.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒ Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 3.491 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. P.W. Gillibrand, Industrial Sand
b. Volume added 1.233 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☐ Formation Materials Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/19/2021

Signature: SA WL

Firm: Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name Edwards Power Station	Local Grid Location of Well _____ft. ☐ N. ☐ S. _____ft. ☐ E. ☐ W.	Well Name AW-13
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 18.1" Long. -89° 39' 49.4" or	
Facility ID	St. Plane 1,428,601 ft. N, 2,436,267 ft. E. E / (W)	Date Well Installed 01/09/2021
Type of Well Well Code 72/dp	Section Location of Waste/Source ____1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7 ☒ E ☐ W	Well Installed By: (Person's Name and Firm) Dave Gordon Cascade Drilling
Distance from Waste/ Source ft. / State IL	Location of Well Relative to Waste/Source u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number

A. Protective pipe, top elevation 441.67 ft. (NAVD88)

B. Well casing, top elevation 441.26 ft. (NAVD88)

C. Land surface elevation 438.7 ft. (NAVD88)

D. Surface seal, bottom 436.7 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☐ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐
Hollow Stem Auger ☐
Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe _____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 418.7 ft. (NAVD88) or 20.0 ft.

F. Fine sand, top _____ ft. (NAVD88) or _____ ft.

G. Filter pack, top 415.7 ft. (NAVD88) or 23.0 ft.

H. Screen joint, top 413.7 ft. (NAVD88) or 25.0 ft.

I. Well bottom 408.7 ft. (NAVD88) or 30.0 ft.

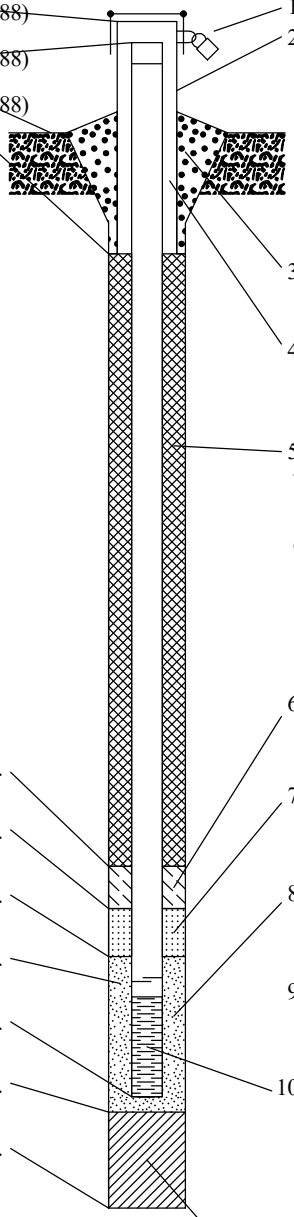
J. Filter pack, bottom 408.7 ft. (NAVD88) or 30.0 ft.

K. Borehole, bottom 408.7 ft. (NAVD88) or 30.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
   d. ____% Bentonite . . . Bentonite-cement grout ☐
   e. 3.142 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. _____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. Not Applicable
   b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. P.W. Gillibrand, Industrial Sand
   b. Volume added 1.222 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 5/19/2021

Signature [signature]	Firm Ramboll 234 W. Florida Street, Milwaukee,WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station

Facility License, Permit or Monitoring No.:

Facility ID:

Type of Well: Well Code 72/dp

Distance from Waste/Source: ft.

State: IL

Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat. 40° 35' 14.2" Long. -89° 39' 56.2" or

St. Plane 1,428,201 ft. N, 2,435,740 ft. E. E/Ⓦ

Section Location of Waste/Source: ☒ E ☐ W

____ 1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7

Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known

Gov. Lot Number:

Well Name: AW-14

Date Well Installed: 01/08/2021

Well Installed By: (Person's Name and Firm)

Dave Gordon

Cascade Drilling

A. Protective pipe, top elevation 439.99 ft. (NAVD88)

B. Well casing, top elevation 439.40 ft. (NAVD88)

C. Land surface elevation 436.8 ft. (NAVD88)

D. Surface seal, bottom 434.8 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 418.8 ft. (NAVD88) or 18.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 415.3 ft. (NAVD88) or 21.5 ft.

H. Screen joint, top 412.8 ft. (NAVD88) or 24.0 ft.

I. Well bottom 407.8 ft. (NAVD88) or 29.0 ft.

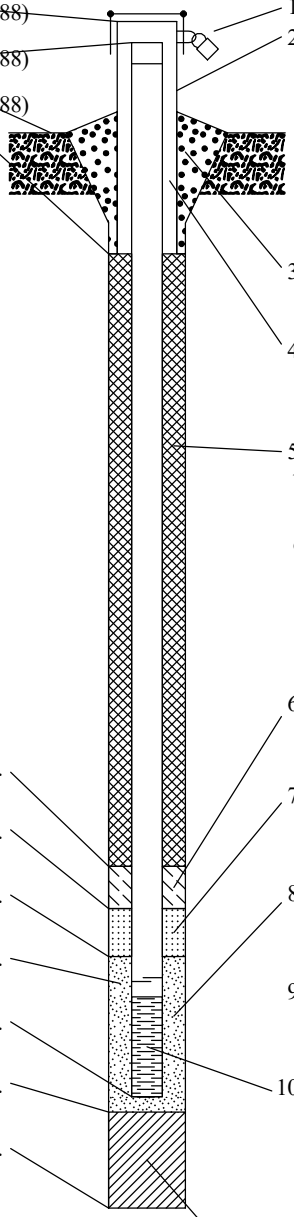
J. Filter pack, bottom 405.8 ft. (NAVD88) or 31.0 ft.

K. Borehole, bottom 401.8 ft. (NAVD88) or 35.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒ Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Bollards

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 2.793 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐

6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. P.W. Gillibrand, Industrial Sand
b. Volume added 1.571 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐

10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.

11. Backfill material (below filter pack): None ☐ Bentonite Chips Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 5/19/2021

Signature

Firm: Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station

Facility License, Permit or Monitoring No.:

Facility ID:

Type of Well: Well Code 72/dp

Distance from Waste/Source: ft.

State: IL

Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat. 40° 35' 16.6" Long. -89° 40' 0.6" or

St. Plane 1,428,445 ft. N, 2,435,405 ft. E. E/Ⓦ

Section Location of Waste/Source: ☒ E ☐ W

____ 1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7

Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known

Gov. Lot Number:

Well Name: AW-15

Date Well Installed: 01/08/2021

Well Installed By: (Person's Name and Firm)

Dave Gordon

Cascade Drilling

A. Protective pipe, top elevation 442.02 ft. (NAVD88)

B. Well casing, top elevation 441.51 ft. (NAVD88)

C. Land surface elevation 439.0 ft. (NAVD88)

D. Surface seal, bottom 437.0 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 411.0 ft. (NAVD88) or 28.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 408.0 ft. (NAVD88) or 31.0 ft.

H. Screen joint, top 406.0 ft. (NAVD88) or 33.0 ft.

I. Well bottom 401.0 ft. (NAVD88) or 38.0 ft.

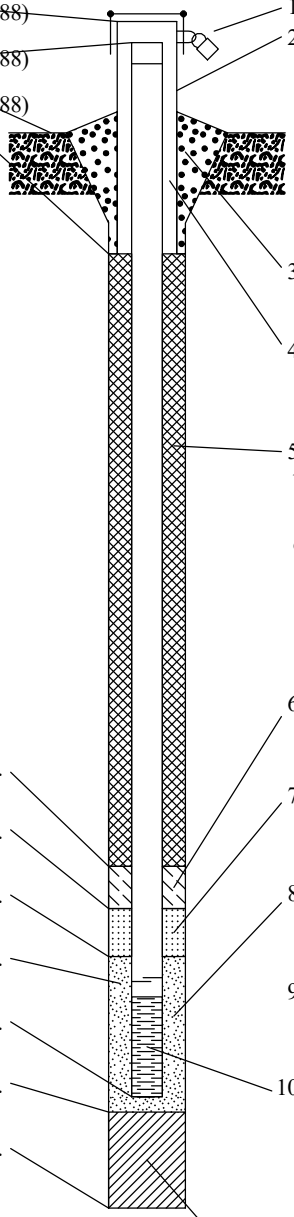
J. Filter pack, bottom 399.0 ft. (NAVD88) or 40.0 ft.

K. Borehole, bottom 399.0 ft. (NAVD88) or 40.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒ Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Bollards

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 4.538 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐

6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. K & E Well Gravel #7
b. Volume added 1.571 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐

10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.

11. Backfill material (below filter pack): None ☐ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 5/19/2021

Signature

Firm: Ramboll
234 W. Florida Street, Milwaukee,WI 53204

Tel: (414) 837-3607
Fax: (414) 837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: AW-15C
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 16.8" Long. -89° 40' 0.8" or	
Facility ID	St. Plane 1,428,458 ft. N, 2,435,388 ft. E. E/Ⓦ	Date Well Installed: 01/08/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7 ☒ E ☐ W	Well Installed By: (Person's Name and Firm): Dave Gordon
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ Cascade Drilling

A. Protective pipe, top elevation 440.67 ft. (NAVD88)

B. Well casing, top elevation 440.02 ft. (NAVD88)

C. Land surface elevation 437.6 ft. (NAVD88)

D. Surface seal, bottom 435.6 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐
Hollow Stem Auger ☐
Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 400.6 ft. (NAVD88) or 37.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 396.6 ft. (NAVD88) or 41.0 ft.

H. Screen joint, top 394.6 ft. (NAVD88) or 43.0 ft.

I. Well bottom 389.6 ft. (NAVD88) or 48.0 ft.

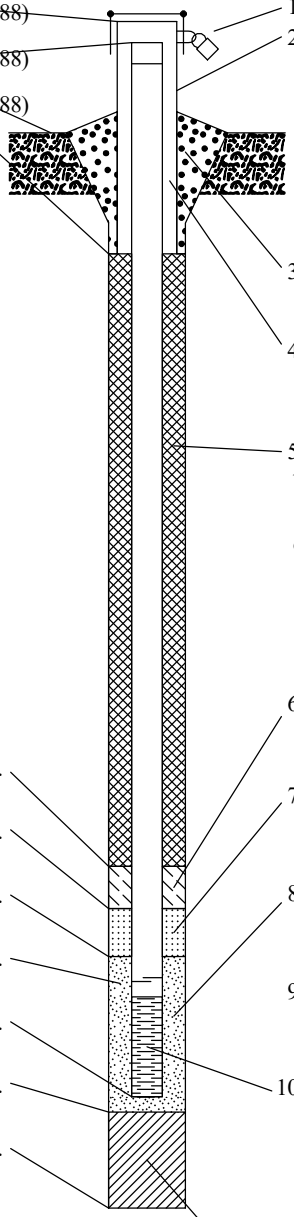
J. Filter pack, bottom 385.6 ft. (NAVD88) or 52.0 ft.

K. Borehole, bottom 337.6 ft. (NAVD88) or 100.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒
Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Bollards
3. Surface seal: Bentonite ☐
Concrete ☒
Other ☐
4. Material between well casing and protective pipe:
Bentonite ☐
Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 6.109 Ft^3 volume added for any of the above
f. How installed: Tremie ☐
Tremie pumped ☒
Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. K & E Well Gravel #7
b. Volume added 0.873 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒
Flush threaded PVC schedule 80 ☐
Other ☐
10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒
Continuous slot ☐
Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☐
Bentonite Grout Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/19/2021

Signature ____ Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station

Facility License, Permit or Monitoring No.:

Facility ID:

Type of Well: Well Code 71/dw

Distance from Waste/Source: ft. | State: IL

Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat. 40° 35' 16.6" Long. -89° 40' 0.6" or

St. Plane 1,428,442 ft. N, 2,435,400 ft. E. E/Ⓦ

Section Location of Waste/Source: ☒ E ☐ W

____ 1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7

Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known

Gov. Lot Number:

Well Name: AW-15S

Date Well Installed: 01/08/2021

Well Installed By: (Person's Name and Firm): Dave Gordon, Cascade Drilling

A. Protective pipe, top elevation 441.29 ft. (NAVD88)

B. Well casing, top elevation 440.71 ft. (NAVD88)

C. Land surface elevation 437.9 ft. (NAVD88)

D. Surface seal, bottom 436.9 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe

17. Source of water (attach analysis, if required): Potable Water from Site - City of Peoria

E. Bentonite seal, top 436.9 ft. (NAVD88) or 1.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 431.9 ft. (NAVD88) or 6.0 ft.

H. Screen joint, top 429.9 ft. (NAVD88) or 8.0 ft.

I. Well bottom 419.9 ft. (NAVD88) or 18.0 ft.

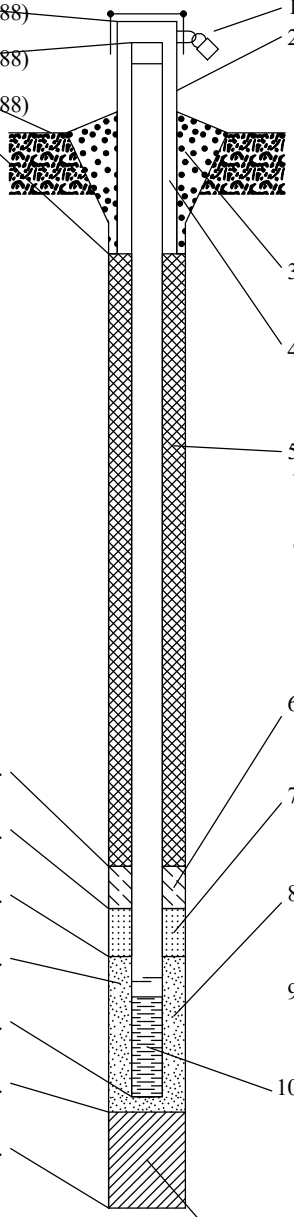
J. Filter pack, bottom 417.9 ft. (NAVD88) or 20.0 ft.

K. Borehole, bottom 417.9 ft. (NAVD88) or 20.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒ Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Bollards

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 0.873 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐

6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. P.W. Gillibrand, Industrial Sand
b. Volume added 2.443 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐

10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☐ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 5/19/2021

Signature

Firm: Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: AW-16
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 22.0" Long. -89° 40' 4.1" or	
Facility ID	St. Plane 1,428,987 ft. N, 2,435,131 ft. E. E/Ⓦ	Date Well Installed: 01/07/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7 ☒ E ☐ W	Well Installed By: (Person's Name and Firm): Adam Jochimsen
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ Cascade Drilling

A. Protective pipe, top elevation 462.46 ft. (NAVD88)

B. Well casing, top elevation 461.79 ft. (NAVD88)

C. Land surface elevation 459.5 ft. (NAVD88)

D. Surface seal, bottom 457.5 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 409.5 ft. (NAVD88) or 50.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 407.0 ft. (NAVD88) or 52.5 ft.

H. Screen joint, top 404.5 ft. (NAVD88) or 55.0 ft.

I. Well bottom 399.5 ft. (NAVD88) or 60.0 ft.

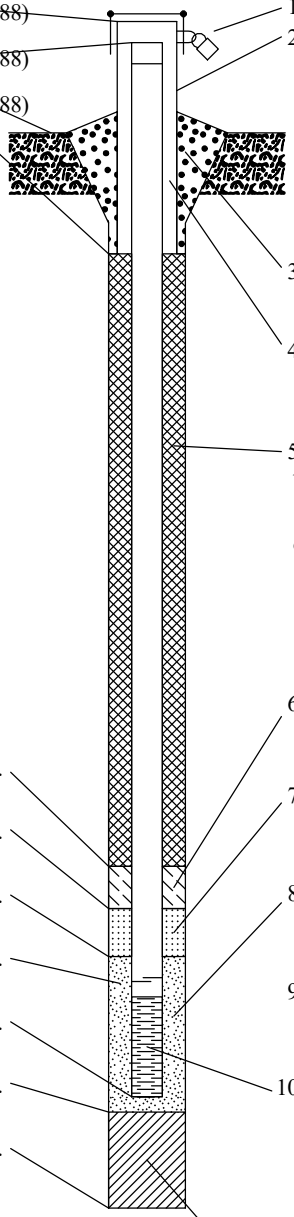
J. Filter pack, bottom 396.5 ft. (NAVD88) or 63.0 ft.

K. Borehole, bottom 396.5 ft. (NAVD88) or 63.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒ Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Bollards

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 8.378 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐

6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. K & E Well Gravel #7
b. Volume added 1.833 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐

10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.

11. Backfill material (below filter pack): None ☐ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/19/2021

Signature ____ Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: AW-17
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 30.1" Long. -89° 40' 9.9" or	
Facility ID	St. Plane 1,429,801 ft. N, 2,434,680 ft. E. E/Ⓦ	Date Well Installed: 01/08/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7 ☒ E ☐ W	Well Installed By: (Person's Name and Firm): Adam Jochimsen
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ / Cascade Drilling

A. Protective pipe, top elevation 462.76 ft. (NAVD88)

B. Well casing, top elevation 462.10 ft. (NAVD88)

C. Land surface elevation 459.7 ft. (NAVD88)

D. Surface seal, bottom 457.7 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 412.7 ft. (NAVD88) or 47.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 410.7 ft. (NAVD88) or 49.0 ft.

H. Screen joint, top 408.7 ft. (NAVD88) or 51.0 ft.

I. Well bottom 403.7 ft. (NAVD88) or 56.0 ft.

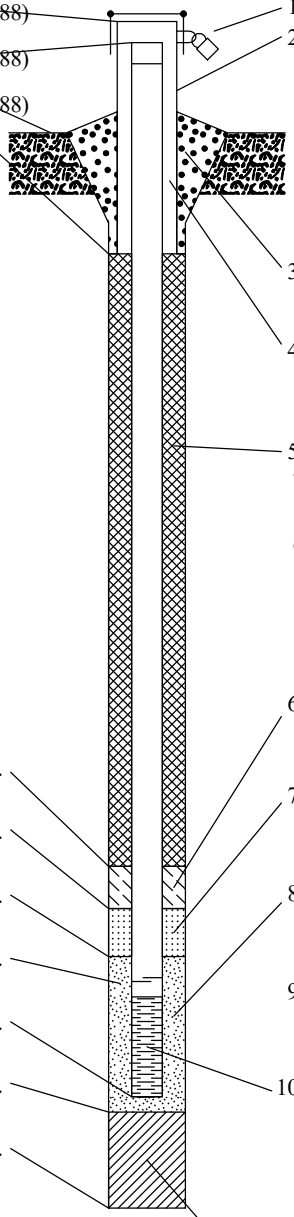
J. Filter pack, bottom 403.7 ft. (NAVD88) or 56.0 ft.

K. Borehole, bottom 402.7 ft. (NAVD88) or 57.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒ Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 7.854 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. K & E Well Gravel #7
b. Volume added 1.2 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☐ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/19/2021

Signature ____ Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: AW-18
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 34.9" Long. -89° 40' 11.4" or	
Facility ID	St. Plane 1,430,291 ft. N, 2,434,561 ft. E. E/Ⓦ	Date Well Installed: 01/09/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7 ☒ E ☐ W	Well Installed By: (Person's Name and Firm): Adam Jochimsen / Cascade Drilling
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number

A. Protective pipe, top elevation 463.32 ft. (NAVD88)

B. Well casing, top elevation 462.65 ft. (NAVD88)

C. Land surface elevation 460.3 ft. (NAVD88)

D. Surface seal, bottom 458.3 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 418.3 ft. (NAVD88) or 42.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 416.3 ft. (NAVD88) or 44.0 ft.

H. Screen joint, top 414.3 ft. (NAVD88) or 46.0 ft.

I. Well bottom 409.3 ft. (NAVD88) or 51.0 ft.

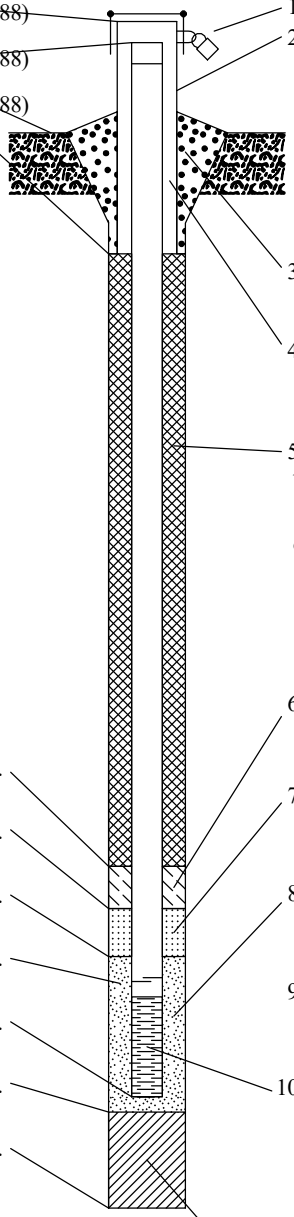
J. Filter pack, bottom 409.3 ft. (NAVD88) or 51.0 ft.

K. Borehole, bottom 405.3 ft. (NAVD88) or 55.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒ Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 6.981 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. P.W. Gillibrand, Industrial Sand
b. Volume added 1.134 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☐ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/19/2021

Signature ____ Firm Ramboll, 234 W. Florida Street, Milwaukee,WI 53204 Tel: (414) 837-3607 Fax: (414) 837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: AW-19
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 43.5" Long. -89° 40' 11.0" or	
Facility ID	St. Plane 1,431,162 ft. N, 2,434,585 ft. E. E/Ⓦ	Date Well Installed: 01/09/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7 ☒ E ☐ W	Well Installed By: (Person's Name and Firm): Adam Jochimsen
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ / Cascade Drilling

A. Protective pipe, top elevation 461.14 ft. (NAVD88)

B. Well casing, top elevation 460.74 ft. (NAVD88)

C. Land surface elevation 458.5 ft. (NAVD88)

D. Surface seal, bottom 456.5 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 427.5 ft. (NAVD88) or 31.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 425.5 ft. (NAVD88) or 33.0 ft.

H. Screen joint, top 423.5 ft. (NAVD88) or 35.0 ft.

I. Well bottom 418.5 ft. (NAVD88) or 40.0 ft.

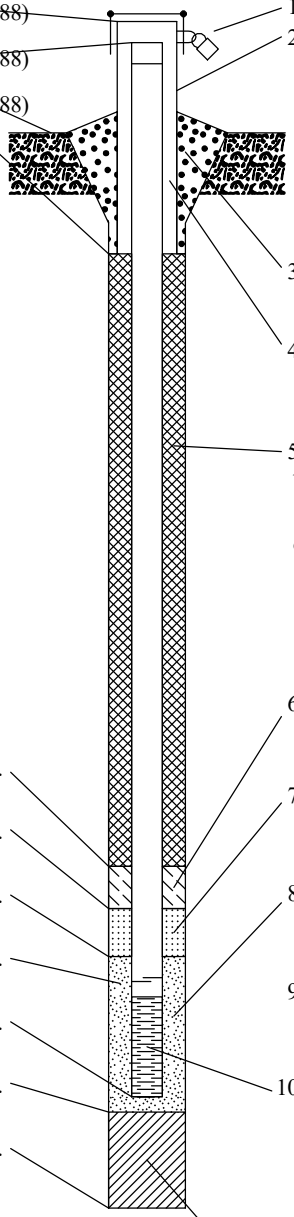
J. Filter pack, bottom 418.5 ft. (NAVD88) or 40.0 ft.

K. Borehole, bottom 415.5 ft. (NAVD88) or 43.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒ Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 5.061 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. P.W. Gillibrand, Industrial Sand
b. Volume added 1.156 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☐ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/19/2021

Signature ____ Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: AW-20
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 47.3" Long. -89° 40' 8.1" or	
Facility ID	St. Plane 1,431,540 ft. N, 2,434,807 ft. E. E/Ⓦ	Date Well Installed: 01/10/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7 ☒ E ☐ W	Well Installed By: (Person's Name and Firm): Adam Jochimsen / Cascade Drilling
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number

A. Protective pipe, top elevation 461.57 ft. (NAVD88)

B. Well casing, top elevation 461.48 ft. (NAVD88)

C. Land surface elevation 459.1 ft. (NAVD88)

D. Surface seal, bottom 457.1 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 427.1 ft. (NAVD88) or 32.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 425.1 ft. (NAVD88) or 34.0 ft.

H. Screen joint, top 422.6 ft. (NAVD88) or 36.5 ft.

I. Well bottom 417.6 ft. (NAVD88) or 41.5 ft.

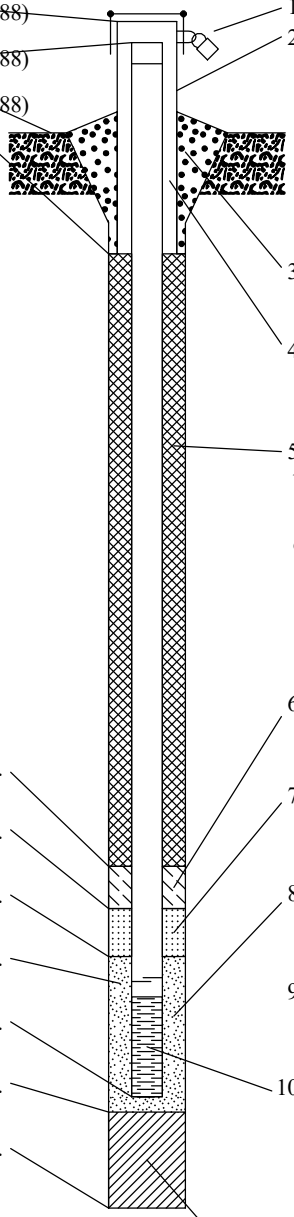
J. Filter pack, bottom 417.6 ft. (NAVD88) or 41.5 ft.

K. Borehole, bottom 416.1 ft. (NAVD88) or 43.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒ Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Bollards

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 5.236 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐

6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. P.W. Gillibrand, Industrial Sand
b. Volume added 1.276 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐

10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.

11. Backfill material (below filter pack): None ☐ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/19/2021

Signature ____ Firm Ramboll, 234 W. Florida Street, Milwaukee,WI 53204 Tel: (414) 837-3607 Fax: (414) 837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: AW-21
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 50.2" Long. -89° 40' 3.8" or	
Facility ID	St. Plane 1,431,842 ft. N, 2,435,132 ft. E. E/Ⓦ	Date Well Installed: 01/10/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7 ☒ E ☐ W	Well Installed By: (Person's Name and Firm): Adam Jochimsen
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ / Cascade Drilling

A. Protective pipe, top elevation 460.84 ft. (NAVD88)

B. Well casing, top elevation 460.61 ft. (NAVD88)

C. Land surface elevation 458.3 ft. (NAVD88)

D. Surface seal, bottom 456.3 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 430.3 ft. (NAVD88) or 28.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 428.3 ft. (NAVD88) or 30.0 ft.

H. Screen joint, top 426.3 ft. (NAVD88) or 32.0 ft.

I. Well bottom 421.3 ft. (NAVD88) or 37.0 ft.

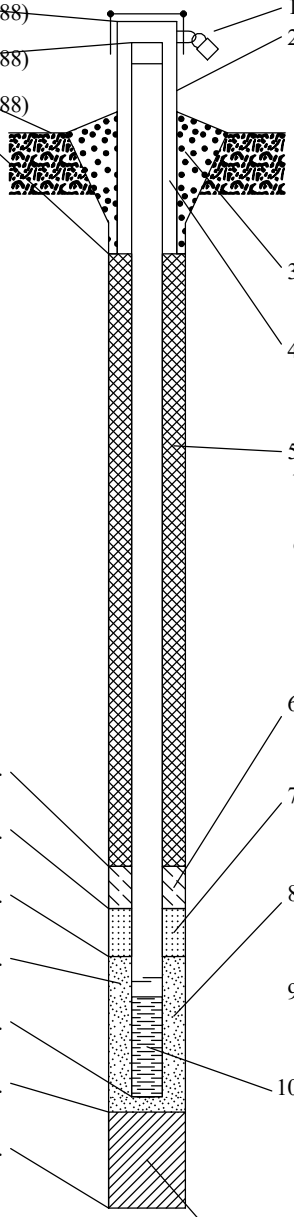
J. Filter pack, bottom 421.3 ft. (NAVD88) or 37.0 ft.

K. Borehole, bottom 420.3 ft. (NAVD88) or 38.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒ Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Bollards

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 4.538 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐

6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. P.W. Gillibrand, Industrial Sand
b. Volume added 1.2 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐

10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.

11. Backfill material (below filter pack): None ☐ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/19/2021

Signature ____ Firm Ramboll
234 W. Florida Street, Milwaukee,WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name Edwards Power Station	Local Grid Location of Well _____ ft. ☐ N. ☐ S. _____ ft. ☐ E. ☐ W.	Well Name AW-22
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 48.6" Long. -89° 40' 0.4" or	
Facility ID	St. Plane 1,431,677 ft. N, 2,435,397 ft. E. E / (W)	Date Well Installed 01/08/2021
Type of Well Well Code 72/dp	Section Location of Waste/Source ____ 1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7 ☒ E ☐ W	Well Installed By: (Person's Name and Firm) Russ Gordon Cascade Drilling
Distance from Waste/ Source ft. / State IL	Location of Well Relative to Waste/Source u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number

A. Protective pipe, top elevation 463.90 ft. (NAVD88)

B. Well casing, top elevation 463.19 ft. (NAVD88)

C. Land surface elevation 460.3 ft. (NAVD88)

D. Surface seal, bottom 458.3 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☒ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐
Hollow Stem Auger ☐
Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe _____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 420.3 ft. (NAVD88) or 40.0 ft.

F. Fine sand, top _____ ft. (NAVD88) or _____ ft.

G. Filter pack, top 418.3 ft. (NAVD88) or 42.0 ft.

H. Screen joint, top 416.3 ft. (NAVD88) or 44.0 ft.

I. Well bottom 411.3 ft. (NAVD88) or 49.0 ft.

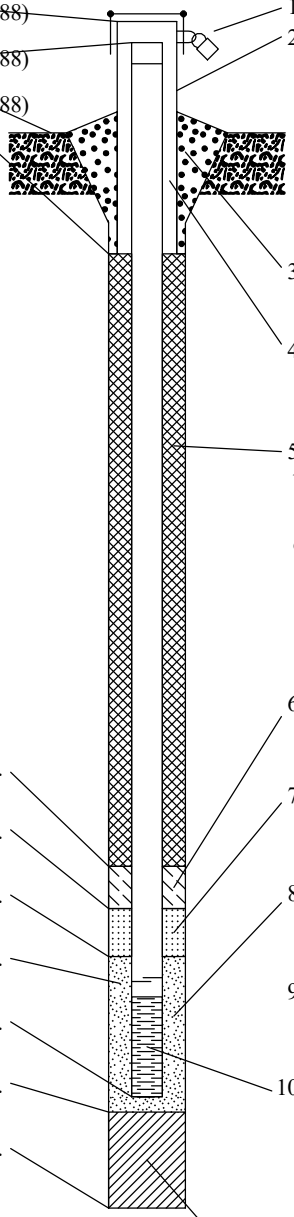
J. Filter pack, bottom 411.3 ft. (NAVD88) or 49.0 ft.

K. Borehole, bottom 410.3 ft. (NAVD88) or 50.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 6.632 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. _____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. Not Applicable
   b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. P.W. Gillibrand, Industrial Sand
   b. Volume added 1.2 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☐ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 5/19/2021

Signature [signature]	Firm Ramboll 234 W. Florida Street, Milwaukee, WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name Edwards Power Station	Local Grid Location of Well _____ft. ☐ N. ☐ S. _____ft. ☐ E. ☐ W.	Well Name XPW01A
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 46.7" Long. -89° 40' 2.4" or	
Facility ID	St. Plane 1,431,483 ft. N, 2,435,242 ft. E. E / (W)	Date Well Installed 01/09/2021
Type of Well Well Code 72/dp	Section Location of Waste/Source ____1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7 ☒ E ☐ W	Well Installed By: (Person's Name and Firm) Russ Gordon Cascade Drilling
Distance from Waste/ Source ft. / State IL	Location of Well Relative to Waste/Source u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number

A. Protective pipe, top elevation 464.42 ft. (NAVD88)

B. Well casing, top elevation 464.16 ft. (NAVD88)

C. Land surface elevation 461.0 ft. (NAVD88)

D. Surface seal, bottom 459.0 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☒
SM ☐ SC ☐ ML ☒ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐
Hollow Stem Auger ☐
Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe _____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 432.0 ft. (NAVD88) or 29.0 ft.

F. Fine sand, top _____ ft. (NAVD88) or _____ ft.

G. Filter pack, top 430.0 ft. (NAVD88) or 31.0 ft.

H. Screen joint, top 428.0 ft. (NAVD88) or 33.0 ft.

I. Well bottom 418.0 ft. (NAVD88) or 43.0 ft.

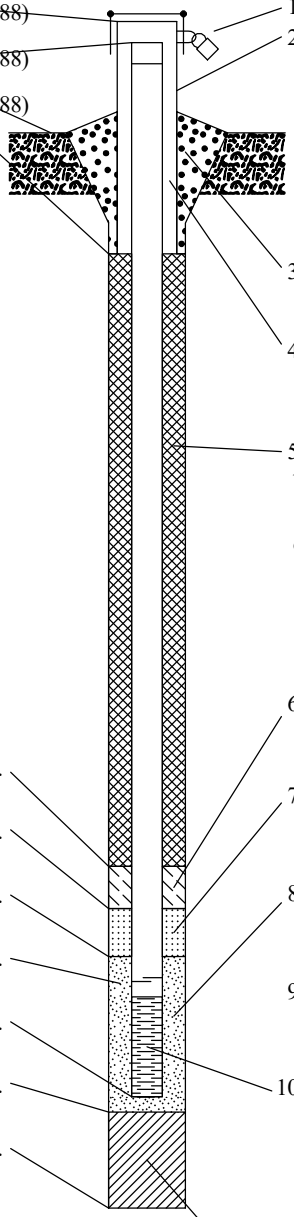
J. Filter pack, bottom 418.0 ft. (NAVD88) or 43.0 ft.

K. Borehole, bottom 418.0 ft. (NAVD88) or 43.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
   d. ____% Bentonite . . . Bentonite-cement grout ☐
   e. 4.712 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. _____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. Not Applicable
   b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. P.W. Gillibrand, Industrial Sand
   b. Volume added 2.094 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 5/19/2021

Signature [signature]	Firm Ramboll 234 W. Florida Street, Milwaukee,WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name Edwards Power Station	Local Grid Location of Well _____ft. ☐ N. ☐ S. _____ft. ☐ E. ☐ W.	Well Name XPW02
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 39.6" Long. -89° 40' 5.9" or	
Facility ID	St. Plane 1,430,769 ft. N, 2,434,978 ft. E. E / (W)	Date Well Installed 01/09/2021
Type of Well Well Code 72/dp	Section Location of Waste/Source ____1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7 ☒ E ☐ W	Well Installed By: (Person's Name and Firm) Russ Gordon Cascade Drilling
Distance from Waste/ Source ft. / State IL	Location of Well Relative to Waste/Source u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number

A. Protective pipe, top elevation 474.46 ft. (NAVD88)

B. Well casing, top elevation 473.79 ft. (NAVD88)

C. Land surface elevation 471.2 ft. (NAVD88)

D. Surface seal, bottom 469.2 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☒
SM ☐ SC ☐ ML ☒ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐
Hollow Stem Auger ☐
Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe _____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 439.2 ft. (NAVD88) or 32.0 ft.

F. Fine sand, top _____ ft. (NAVD88) or _____ ft.

G. Filter pack, top 437.2 ft. (NAVD88) or 34.0 ft.

H. Screen joint, top 435.2 ft. (NAVD88) or 36.0 ft.

I. Well bottom 425.2 ft. (NAVD88) or 46.0 ft.

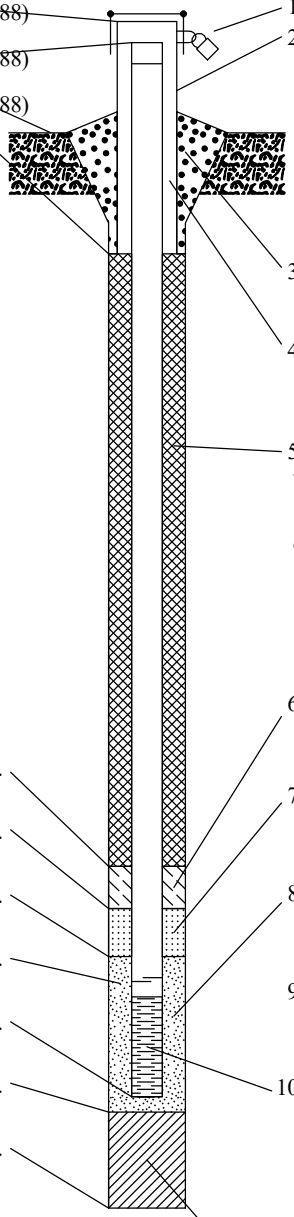
J. Filter pack, bottom 425.2 ft. (NAVD88) or 46.0 ft.

K. Borehole, bottom 424.2 ft. (NAVD88) or 47.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
   d. ____% Bentonite . . . Bentonite-cement grout ☐
   e. 5.236 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. _____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. Not Applicable
   b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. P.W. Gillibrand, Industrial Sand
   b. Volume added 2.073 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Date Modified: 5/19/2021

Signature [signature]	Firm Ramboll 234 W. Florida Street, Milwaukee, WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station

Facility License, Permit or Monitoring No.:

Facility ID:

Type of Well: Well Code 72/dp

Distance from Waste/Source: ft.

State: IL

Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat. 40° 35' 29.1" Long. -89° 39' 58.3" or

St. Plane 1,429,704 ft. N, 2,435,574 ft. E. E/Ⓦ

Section Location of Waste/Source: ☒ E ☐ W

____ 1/4 of ____ 1/4 of Sec. ____, T. 7 N, R. 7

Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known

Gov. Lot Number:

Well Name: XPW03

Date Well Installed: 01/10/2021

Well Installed By: (Person's Name and Firm)

Russ Gordon

Cascade Drilling

A. Protective pipe, top elevation 466.56 ft. (NAVD88)

B. Well casing, top elevation 466.04 ft. (NAVD88)

C. Land surface elevation 462.6 ft. (NAVD88)

D. Surface seal, bottom 460.6 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☒
SM ☐ SC ☐ ML ☒ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☐ No

14. Drilling method used: Rotary ☐
Hollow Stem Auger ☐
Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 439.6 ft. (NAVD88) or 23.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 437.6 ft. (NAVD88) or 25.0 ft.

H. Screen joint, top 435.6 ft. (NAVD88) or 27.0 ft.

I. Well bottom 425.6 ft. (NAVD88) or 37.0 ft.

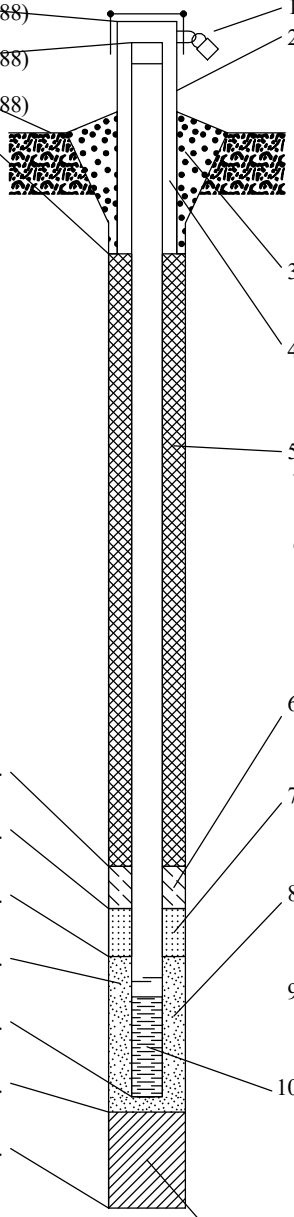
J. Filter pack, bottom 425.6 ft. (NAVD88) or 37.0 ft.

K. Borehole, bottom 422.6 ft. (NAVD88) or 40.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒
Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Bollards

3. Surface seal: Bentonite ☐
Concrete ☒
Other ☐

4. Material between well casing and protective pipe:
Bentonite ☐
Sand Other ☒

5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.6 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 3.665 Ft^3 volume added for any of the above
f. How installed: Tremie ☐
Tremie pumped ☒
Gravity ☐

6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. P.W. Gillibrand, Industrial Sand
b. Volume added 2.029 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒
Flush threaded PVC schedule 80 ☐
Other ☐

10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒
Continuous slot ☐
Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☐
Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

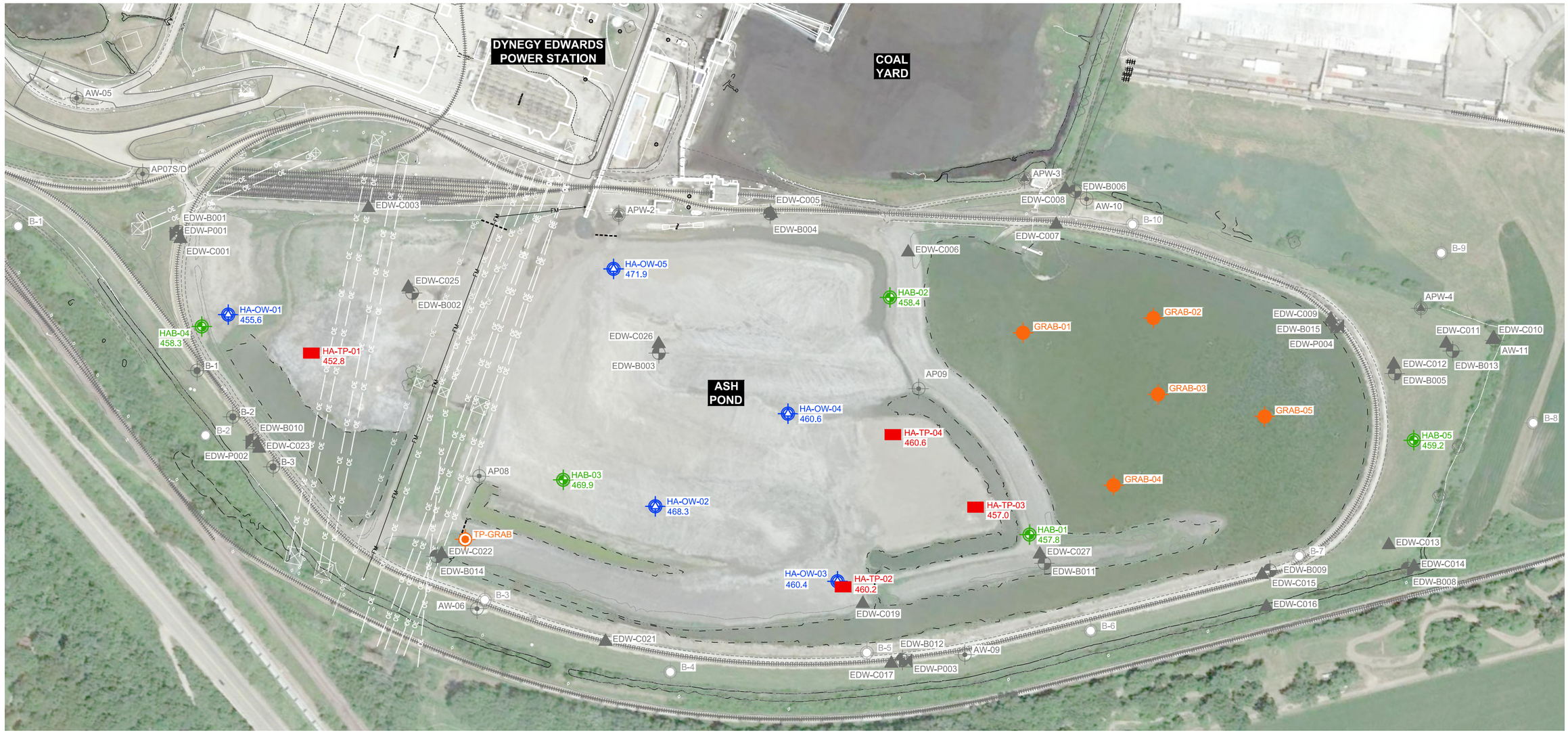
Date Modified: 5/19/2021

Signature

Firm: Ramboll
234 W. Florida Street, Milwaukee,WI 53204

Tel: (414) 837-3607
Fax: (414) 837-3608

PRE-2021 BORING LOGS



LEGEND

- HAB-04 458.3 — DESIGNATION, LOCATION, AND GROUND SURFACE ELEVATION OF TEST BORINGS PERFORMED BY STRATA EARTH SERVICES, LLC. OF PALATINE, ILLINOIS DURING THE PERIOD 27 NOVEMBER 2017 TO 8 DECEMBER 2018.
- HA-OW-01 455.6 — DESIGNATION, LOCATION, AND GROUND SURFACE ELEVATION OF OBSERVATION WELLS INSTALLED BY STRATA EARTH SERVICES, LLC. OF PALATINE, ILLINOIS DURING THE PERIOD 7 DECEMBER 2017 TO 8 DECEMBER 2018.
- GRAB-04 — DESIGNATION AND APPROXIMATE LOCATION OF OF GRAB SAMPLES COLLECTED BY STRATA EARTH SERVICES, LLC. OF PALATINE, ILLINOIS ON 4 DECEMBER 2017.
- TP-GRAB — DESIGNATION AND APPROXIMATE LOCATION OF TEST PIT GRAB SAMPLES COLLECTED BY HALEY & ALDRICH ON 19 JANUARY 2018.
- HA-TP-01 452.8 — DESIGNATION, LOCATION, AND GROUND SURFACE ELEVATION OF TEST PITS PERFORMED AND GRAB SAMPLES COLLECTED BY HEADWATERS, INC. OF SOUTH JORDAN, UTAH DURING THE PERIOD 12 DECEMBER 2017 TO 13 DECEMBER 2017.
- EDW-B014 — DESIGNATION AND APPROXIMATE LOCATIONOF TEST BORINGS PERFORMED BY STRATA EARTH SERVICES, INC. OF PALATINE, ILLINOIS FOR AECOM DURING THE PERIOD 3 TO 13 SEPTEMBER AND 5 NOVEMBER 2015.
- EDW-C021 — DESIGNATION AND APPROXIMATE LOCATION OF CONE PENETROMETERS SOUNDING PERFORMED BY CONETEC, INC. OF NEW BERLIN, NEW JERSEY DURING THE PERIOD 19 TO 29 AUGUST 2015.
- EDW-P002 — DESIGNATION AND APPROXIMATE LOCATIONOF PIEZOMETERS INSTALLED BY STRATA EARTH SERVICES, INC. OF PALATINE, ILLINOIS FOR AECOM DURING THE PERIOD 4 SEPTEMBER AND 4 TO 5 NOVEMBER 2015.
- B-3 — DESIGNATION AND APPROXIMATE LOCATION OF TEST BORINGS PERFORMED BY GEOTECHNOLOGY, INC. OF COLLINSVILLE, ILLINOIS ON 19 JULY 2010.
- APW-2 — EXISTING GEOTECHNOLOGY 2010 MONITORING WELL.
- AW-06 — EXISTING HANSON 2015 MONITORING WELL.
- B-4 — DESIGNATION AND APPROXIMATE LOCATION OF HISTORIC TEST BORINGS PERFORMED BY REITZ & JENS IN 2003.

NOTES

1. BACKGROUND IMAGE PROVIDED BY GOOGLE EARTH PRO, DATED 16 JUNE 2016.
2. ELEVATIONS INDICATED IN THIS DRAWING ARE IN FEET AND REFER TO NAVD88 DATUM. HORIZONTAL DATUM IS NAD83 ILLINOIS STATE PLANE WEST ZONE, US FOOT.
3. TECHNICAL MONITORING OF SUBSURFACE EXPLORATIONS SHOWN IN GREEN, BLUE, RED, AND ORANGE WAS PERFORMED BY HALEY & ALDRICH DURING THE PERIOD 27 NOVEMBER TO 13 DECEMBER 2017.
4. AS-DRILLED LOCATIONS AND GROUND SURFACE ELEVATIONS OF EXPLORATIONS WERE DETERMINED IN THE FIELD BY OPTICAL SURVEY BY MAURER-STUTZ, INC. OF PEORIA, ILLINOIS.

N

0 300 600
SCALE IN FEET

HALEY ALDRICH

DYNEGY EDWARDS POWER STATION
7800 SOUTH CILCO LANE
BARTONVILLE, ILLINOIS

DRAFT

SUBSURFACE EXPLORATION LOCATIONS PLAN

SCALE: AS SHOWN
FEBRUARY 2018

FIGURE 2

VARI, KATALIN Printed: 2/8/2018 12:00 PM Layout: ...
G:\129319-DYNEGY POND CLOSURES\CAD\FIGURES\GEOTEC\129319_003_FIG-2_EXPL LOC.DWG

HALEY ALDRICH

TEST BORING REPORT DRAFT

Boring No. HAB-01

Project: Edwards Power Station, Bartonville, Illinois
Client: Dynegy
Contractor: Strata Earth Services, LLC

File No. 129319-003
Sheet No. 1 of 3
Start 30 November 2017
Finish 30 November 2017
Driller K. Diehl
H&A Rep. C. Giusti

Elevation 457.8
Datum NGVD 88
Location N 1,429,282.52 E 2,435,251.74

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	-	Rig Make & Model: Detrich D-120 ATV
Inside Diameter (in.)	4	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: Augers to 17 ft
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0																
	8 8 8	S1 10	3.5 5.0		ML	Medium dense gray to black SILT (ML), no structure, moist, PP=0.5 tons/ft^2						100				
5						-FLY ASH-										
	1 WOH 1 WOH	S2, S3 24	7.5 9.5		ML	Similar to S1, except very loose, wet, and tan bedding						100				
					ML	Very loose tan SILT (ML), no structure, wet, PP=0.5 tons/ft^2						100				
10	P U S H	U1 10	10.0 12.0		ML	Similar to S3						100				
	2 1 2	S4 20	13.5 15.0		ML	Very loose gray to black SILT with sand (ML), some gray/sandy bedding, wet, becoming silt at bottom 8.0 in.					15	85				
15	P U S H	U2 17.5	15.0 17.0		ML	Similar to S4						100				
						Note: Switched to rotary drilling with water at 17.0 ft.										
	WOH WOH WOH	S5, S6 24	18.5 20.5		ML	Very loose gray to black SILT (ML), 1.0 in. bed tan silt at 19.5 ft, wet, PP=0 tons/ft^2, tan from 19.8 ft to 20.5 ft						100				
20																

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
11/30/17		0	7.5	9.5	5.5

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	58.8
Rock Cored (ft)	-
Samples	14S, 5U

Boring No. HAB-01

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 129319TB_HA-LIB09.GLB HA-TB+CORE+WELL-07-1.GDT \\HALEYALDRICH.COM\SHAREWAS_COMMON\PROJECTS\129319-DYNEGY POND CLOSURES\003\FIELDWORK\SUBSURFACE EXPLORATION LOGS\GINT\129319-0037B.GPJ 12 Feb 18

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	WOH															
	WOR WOR WOH	S7 24	23.5 25.0		ML	Very loose gray to black SILT (ML), no structure, wet, PP=0 tons/ft ^{2}						100				
						-FLY ASH-										
25	P U S H	U3 24	25.0 27.0		ML	Similar to S7					1	99				
	WOH WOH 1 WOH	S8 24	28.5 30.5		ML	Similar to S7, except contains sandy pockets					5	95				
30																
	1 WOH WOH WOH	S9 24	33.5 35.5		ML	Very loose gray to black SILT (ML), no structure, wet, PP=0 tons/ft ^{2}						100				
35																
	WOR WOR WOR	S10 24	38.5 40.0		ML	Similar to S9, except with some light gray to tan bedding						100				
40				415.8 42.0		Note: Driller estimated strata change at 42.0 ft.										
	WOR WOH WOH 1	S11 24	43.5 45.5		OH	Very soft olive-brown organic SILT (OH), varved, moist to wet, trace organic material and shell fragments						100		M	H	H
45	P U S H	U4 24	45.5 47.5		OH	Similar to S11				1	3	96				
						-ALLUVIAL DEPOSITS-										
	WOH 2 2 2	S12 24	47.5 49.5		OH	Similar to S11, except soft						100				

H&A-TEST BORING-07-1 129319TB_HA-LIB09.GLB HA-TB+CORE+WELL-07-1.GDT \\HALEYALDRICH.COM\SHAREWAS_COMMON\PROJECTS\129319-DYNEGY POND CLOSURES\003\FIELDWORK\SUBSURFACE EXPLORATION LOGS\GINT\129319-0037B.GPJ 12 Feb 18

HALEY ALDRICH

TEST BORING REPORT

DRAFT

Boring No. HAB-01
File No. 129319-003
Sheet No. 3 of 3

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
50	WOR WOH WOH 3	S13 24	49.5 51.5		OH	Similar to S11 -ALLUVIAL DEPOSITS-						100				
				406.3 51.5												
	P U S H	U5 24	51.5 53.5		CH	Olive-brown fat CLAY (CH), wet					1	99				
55																
				400.8 57.0												
	68/3.5	S14 2.5	58.5 58.8	399.0 58.8	CL	Hard gray lean CLAY (CL), laminated, dry to moist -WEATHERED BEDROCK- BOTTOM OF EXPLORATION AT 58.8 FT Note: PP=Pocket Penetrometer.						100		H	M	L

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HAB-01

H&A-TEST BORING-07-1 129319TB_HA-LIB09.GLB HA-TB+CORE+WELL-07-1.GDT \\HALEYALDRICH.COM\SHAREWAS_COMMON\PROJECTS\129319-DYNEGY POND CLOSURES\003\FIELDWORK\SUBSURFACE EXPLORATION LOGS\GINT\129319-0037B.GPJ 12 Feb 18

HALEY ALDRICH

TEST BORING REPORT DRAFT

Boring No. HAB-02

Project	Edwards Power Station, Bartonville, Illinois
Client	Dynegy
Contractor	Strata Earth Services, LLC

File No. 129319-003
Sheet No. 1 of 2
Start 30 November 2017
Finish 01 December 2017
Driller K. Diehl
H&A Rep. C. Giusti

Elevation 458.4
Datum NGVD 88
Location
N 1,429,903.58
E 2,435,764.03

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	-	Rig Make & Model: Detrich D-120 ATV
Inside Diameter (in.)	4	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: Augers to 17 ft
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0																
	3 2 3	S1 16	3.5 5.0		ML	Loose gray to black SILT (ML), no structure, moist, PP=0.5 tons/ft ^{2}						100				
5						-FLY ASH-										
	2 1 1	S2 18	8.5 10.0		ML	Similar to S1, except very loose and wet, PP=0 tons/ft ^{2}						100				
10						Note: Final hammer blow caused sampler to penetrate 18.0 in.										
	P U S H	U1 0	11.0 13.0			No recovery, shelby tube.										
	1 WOH WOH	S3 4	13.5 15.0		ML	Similar to S1, except very loose and wet with cinders and traces of sand				5	5	90				
15	P U S H	U2 0	15.0 17.0			No recovery, shelby tube.										
						Note: Switch to rotary drilling with water at 17.0 ft.										
	1 WOH WOH	S4 24	18.5 20.5		ML	Very loose gray SILT (ML), 1.0 in. tan bed at 19.5 ft, wet, trace sand pockets, PP=0 tons/ft ^{2}					5	95				
20																

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
11/30/17		0	8.5	10.0	5.0

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	38.5
Rock Cored (ft)	-
Samples	8S, 5U

Boring No. HAB-02

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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HALEY ALDRICH

TEST BORING REPORT

DRAFT

Boring No. HAB-02
File No. 129319-003
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	WOH															
	P U S H	U3 24	20.5 22.5		ML	Similar to S4 -FLY ASH-					5	95				
	1 WOH WOH WOH	S5 14	23.5 25.5		ML	Similar to S4						100				
25				432.4 26.0		Note: Driller noted change in drilling at 26.0 ft. -ALLUVIAL DEPOSITS-										
	WOH WOH WOH 2	S6 24	28.5 30.5		CH	Very soft olive-gray to gray-brown fat CLAY (CH), varved, moist to wet, trace organics and shell fragments						100		M	H	H
30	P U S H	U4 18	30.5 32.5		CH	Similar to S6						100				
	WOH 2 2 3	S7 24	32.5 34.5		CH	Soft olive-gray to gray-brown fat CLAY (CH), varved, some red-brown mottling, moist to wet, trace organics and shell fragments, PP=0.25 tons/ft ^{2}						100		M	H	H
	WOH WOH 3 2	S8 24	34.5 36.5		CH	Similar to S7						100				
35	P U S H	U5 24	36.5 38.5		CH	Similar to S7						100				
				419.9 38.5		BOTTOM OF EXPLORATION AT 38.5 FT Note: PP=Pocket Penetrometer.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HAB-02

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HALEY ALDRICH

TEST BORING REPORT DRAFT

Boring No. HAB-03

Project	Edwards Power Station, Bartonville, Illinois
Client	Dynegy
Contractor	Strata Earth Services, LLC

File No. 129319-003
Sheet No. 1 of 5
Start 27 November 2017
Finish 29 November 2017
Driller K. Diehl
H&A Rep. C. Giusti

Elevation 469.9
Datum NGVD 88

Location
N 1,430,619.71
E 2,434,935.46

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	-	Rig Make & Model: Detrich D-120 ATV
Inside Diameter (in.)	4	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: Augers to 17.5 ft
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0																
	1 1 2	S1 18	3.5 5.0		ML	Very loose light brown SILT with sand (ML), moist					20	80				
5						-FLY ASH-										
10	1 WOH 1	S2 18	10.5 12.0		ML	Similar to S1, except contains tan to light brown mottling, PP=0.5 tons/ft ^{2}					20	80				
	P U S H	U1 15	12.0		ML	Very loose light brown SILT with sand (ML), moist, contains tan to light brown mottling					20	80				
15	12 16 17	S3 16	14.0 15.5		ML	Dense dark brown and black SILT (ML), dry, PP=3 tons/ft ^{2}					5	95				
	P U S H	U2 24	15.5 17.5		ML	Similar to S3					5	95				
						Note: Switched to rotary drilling with water at 17.5 ft.										
20																

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
11/27/17		0	41	43	40
11/30/17			0		15

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	118.0
Rock Cored (ft)	-
Samples	3S, 4U

Boring No. HAB-03

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 129319TB_HA-LIB09.GLB HA-TB+CORE+WELL-07-1.GDT \\HALEYALDRICH.COM\SHAREWAS_COMMON\PROJECTS\129319-DYNEGY POND CLOSURES\003\FIELDWORK\SUBSURFACE EXPLORATION LOGS\GINT\129319-0037B.GPJ 12 Feb 18

HALEY ALDRICH

TEST BORING REPORT

DRAFT

Boring No. HAB-03
File No. 129319-003
Sheet No. 2 of 5

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20																
	1 WOH WOH 2	S4 24	23.0 25.0		ML	Very loose gray to black SILT (ML) -FLY ASH-					5	95				
25	1 WOH 5 7	S5 24	25.0 27.0		ML	Similar to S4, except loose					5	95				
	2 4 4 4	S6 13	27.0 29.0	443.4 26.5	SP- SM	Loose gray to black poorly graded SAND with silt (SP-SM), mps 4 mm -BOTTOM ASH-		10	10	10	60	10				
30	1 1 2 2	S7, S8 17	29.0 31.0	440.9 29.0	SP- SM	Very loose gray to black poorly graded SAND with silt (SP-SM), mps 4 mm, contains cinders, contains 12.0 in. thick layer of fly ash from 30.0 ft to 31.0 ft			60	20	10	10				
	1 1 3 6	S9 17	31.0 33.0	438.9 31.0	SP	Very loose to loose gray to black poorly graded SAND (SP), mps 5 mm		5	60	15	15	5				
	2 2 4 5	S0 23	33.0 35.0		SP	Loose gray to black poorly graded SAND (SP), mps 3 mm		15	75	5	5					
35	2 4 6 18	S11 18	35.0 37.0		SP	Loose gray to black poorly graded SAND (SP), some cementation, contains cinders			20	60	20					
	26 26 19 36	S12 15	37.0 39.0		SP	Dense gray to black poorly graded SAND (SP), mps 3 mm Note: Drilling fluid additive added at 37.0 ft.			5	5	75	5				
40	19 17 40 35	S13 18	39.0 41.0		SP	Similar to S12, except hard with greater cinder content and some cementation, PP=3 tons/ft ^{2}			5	5	75	5				
	10 6 6 4	S14 18	41.0 43.0	427.9 42.0	SP	Similar to S12, except medium dense			5	5	75	5				
	WOH WOH WOH WOH	S15 11	43.0 45.0		ML ML	Medium dense gray-brown SILT (ML), at 42.0 ft -FLY ASH- Very loose gray-brown SILT (ML), PP=0 tons/ft ^{2}					5 5	95 95				
45	WOR WOR 1 2	S16 21	45.0 47.0		ML	Similar to S15					10	90				
	1 WOH 1 2	S17 23	47.0 49.0		ML	Similar to S15, except with interbedded black poorly graded medium SAND					5	95				
	1	S18	49.0		ML	Similar to S15, except with interbedded black poorly graded SAND and					5	95				

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

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Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
50	WOH WOH 2	24	51.0			contains cinders, mps 10 mm										
	1 1 2 3	S19 23	51.0 53.0		ML	Very loose gray-brown SILT with sand (ML), contains cinders -FLY ASH-					20	80				
	WOH 1 WOH WOH	S20 24	53.0 55.0		ML	Similar to S19					20	80				
55	P U S H	U3 24	55.0 57.0		ML	Top 1.0 ft similar to S19					20	80				
				413.9 56.0	CH	Bottom 1.0 ft gray fat CLAY (CH), wet					1	99				
	WOH 4 4 4	S21 24	57.0 59.0		CH	Medium stiff gray fat CLAY (CH), varved, tan to brown mottling, moist to wet, trace organics, PP=0.75 tons/ft ^{2} -ALLUVIAL DEPOSITS-						100				
	12 6 8 16	S22 24	59.0 61.0		CH	Similar to S21, except stiff						100				
60				409.4 60.5												
	P U S H	U4 16	61.0 62.5		CL	Olive-gray lean CLAY with gravel (CL), mps 25 mm, moist, PP=1.5 tons/ft ^{2}	12	13	4	5	6	60		H	M	H
				406.9 63.0												
	53 75/2"	S23 8	63.0 64.1		CH	Hard olive-gray fat CLAY (CH), laminated, moist to dry, PP=>4.5 tons/ft ^{2} -DECOMPOSED ROCK-						100		H	M	H
65																
	12 26 74	S24 10	68.5 70.0		CL	Similar to S23						100				
70																
	75/3"	S25 3	73.5 73.8		CL	Hard olive gray lean CLAY (CL), laminated, moist to dry, PP=>4.5 tons/ft ^{2}						100		H	M	H
75																
	75/3"	S26 3	78.5		CL	Similar to S25						100				

H&A-TEST BORING-07-1 129319TB_HA-LIB09.GLB HA-TB+CORE+WELL-07-1.GDT \\HALEYALDRICH.COM\SHAREWAS_COMMON\PROJECTS\129319-DYNEGY POND CLOSURES\003\FIELDWORK\SUBSURFACE EXPLORATION LOGS\GINT\129319-0037B.GPJ 12 Feb 18

HALEY ALDRICH

TEST BORING REPORT

DRAFT

Boring No. HAB-03
File No. 129319-003
Sheet No. 4 of 5

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
			78.8													
80																
	60/3.5"	S27 3.5	83.5 83.8		CL	Similar to S25						100				
85						-DECOMPOSED ROCK-										
	60/3.5"	S28 3	88.5 88.8		CL	Similar to S25						100				
90																
	60/3.5"	S29 3	93.5 93.8		CL	Similar to S25						100				
95																
	68/4"	S30 10	98.5 99.3		CL	Similar to S25						100				
100																
	60/4"	S31 3	103.5 103.8		CL	Similar to S25						100				
105																
	70/4"	S32	108.5									100				

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HAB-03

H&A-TEST BORING-07-1 129319TB_HA-LIB09.GLB HA-TB+CORE+WELL-07-1.GDT \\HALEYALDRICH.COM\SHAREWAS_COMMON\PROJECTS\129319-DYNEGY POND CLOSURES\003\FIELDWORK\SUBSURFACE EXPLORATION LOGS\GINT\129319-003TB.GPJ 12 Feb 18

HALEY ALDRICH

TEST BORING REPORT

DRAFT

Boring No. HAB-03
File No. 129319-003
Sheet No. 5 of 5

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
		3	108.8		CL	Similar to S25										
110						-DECOMPOSED ROCK-										
						Note: Driller notes hard drilling at 112.0 ft										
	100/1"	S33 0	113.5 113.6			No recovery. Note: Spoon refusal at depth 113.6 ft.										
115																
				351.9 118.0		BOTTOM OF EXPLORATION AT 118.0 ft Note: PP=Pocket Penetrometer.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HAB-03

H&A-TEST BORING-07-1 129319TB_HA-LIB09.GLB HA-TB+CORE+WELL-07-1.GDT \\HALEYALDRICH.COM\SHAREWAS_COMMON\PROJECTS\129319-DYNEGY POND CLOSURES\003\FIELDWORK\SUBSURFACE EXPLORATION LOGS\GINT\129319-0037B.GPJ 12 Feb 18

HALEY ALDRICH

TEST BORING REPORT DRAFT

Boring No. HAB-04

Project: Edwards Power Station, Bartonville, Illinois
Client: Dynegy
Contractor: Strata Earth Services, LLC

File No. 129319-003
Sheet No. 1 of 1
Start 05 December 2017
Finish 05 December 2017
Driller K. Diehl
H&A Rep. C. Giusti

Elevation 458.3
Datum NGVD 88
Location N 1,431,767.36 E 2,434,995.09

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	-	Rig Make & Model: Detrich D-120 ATV
Inside Diameter (in.)	4	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: Auger
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0						-FLY ASH-										
	10 9 7 7	S1, S2 24	2.0 4.0	454.5 3.8	ML	Medium dense gray to black SILT (ML), no structure, moist, PP=3.5 tons/ft ^{2}						100				
5	P U S H	U1 21	4.0 6.0		CH	Stiff brown fat CLAY (CH), varved, some red-brown mottling, moist, PP=2.5 tons/ft ^{2}				1	2	97		M	H	H
						-ALLUVIAL DEPOSITS-										
10	1 3 3 3	S3 20	8.5 10.5		CH	Medium stiff olive-gray fat CLAY (CH), varved, red-brown mottling, moist, PP=0.75 tons/ft ^{2}						100		M	H	H
	1 2 2 3	S4 24	10.5 12.5		CH	Soft olive-gray fat CLAY (CH), varved, brown mottling, moist, trace organics and shell pockets, sand at 12.4 ft, PP=0.5 tons/ft ^{2}					5	95		M	H	H
	P U S H	U2 24	12.5 14.5		CH	Similar to S4					5	95				
15	3 5 7 4	S5 24	14.5 16.5		CH	Stiff olive-brown to olive-gray fat CLAY (CH), varved, moist, trace organics, PP=1.0 tons/ft ^{2}						100		H	H	H
				441.8 16.5		BOTTOM OF EXPLORATION AT 16.5 FT Note: PP=Pocket Penetrometer.										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
12/5/17		0	14.5	16.5	DRY

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	16.5
Rock Cored (ft)	-
Samples	5S, 2U

Boring No. HAB-04

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 129319TB_HA-LIB09.GLB HA-TB+CORE+WELL-07-1.GDT \\HALEYALDRICH.COM\SHAREWAS_COMMON\PROJECTS\129319-DYNEGY POND CLOSURES\003\FIELDWORK\SUBSURFACE EXPLORATION LOGS\GINT\129319-0037B.GPJ 12 Feb 18

TEST BORING REPORT DRAFT

Boring No. HAB-05

Project	Edwards Power Station, Bartonville, Illinois
Client	Dynegy
Contractor	Strata Earth Services, LLC

File No. 129319-003
Sheet No. 1 of 2
Start 04 December 2017
Finish 06 December 2017
Driller K. Diehl
H&A Rep. C. Giusti

Elevation 459.2
Datum NGVD 88
Location N 1,428,320.25 E 2,435,895.55

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	-	Rig Make & Model: Detrich D-120 ATV
Inside Diameter (in.)	4	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: Auger
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0	3 5 7 11	S1 22	0.0 2.0		ML	Medium dense brown SILT with sand (ML), mps 5 mm, no structure, moist, contains roots and organics, PP=1.0 tons/ft ^{2}					10	90				
						-FILL-										
	5 17 56	S2 18	3.5 5.0	455.0 4.2	ML	Similar to S1, except very dense					10	90				
					ML	Very dense gray to black SILT (ML), PP=3.0 tons/ft ^{2}					10	90				
5	3 34 45	S3, S4 18	5.0 6.5	453.2 6.0	ML	Very dense to hard brown SILT with sand (ML), no structure, moist					10	90				
	13 15 20 16	S5 *	6.5 8.5		ML	Dense to very dense gray to black SILT (ML), no structure, dry to moist, PP=2.0 tons/ft ^{2}					5	95				
						-FLY ASH-										
	P U S H	U1 14	8.5 10.5		ML	Similar to S4					5	95				
10	P U S H	U2 15	10.5 12.5		ML	Similar to S4					5	95				
				447.7 11.5	SP- SM	Gray to black poorly graded SAND with silt (SP-SM), mps 5 mm, no structure, wet, PP=0.0 tons/ft ^{2}			10	10	70	10				
						-BOTTOM ASH-										
	1 1 1 1 1	S6 12	13.5 15.5		SP- SM	Very loose gray to black poorly graded SAND with silt (SP-SM), mps 5 mm, no structure, wet, PP=0.0 tons/ft ^{2}			10	10	70	10				
15																
				440.7 18.5	SP	Very loose gray to black poorly graded SAND (SP) mps 6 mm, no structure, wet, PP=0.0 tons/ft ^{2}			10	20	70					
	1 1 WOH	S7 20	18.5 20.5													
20																

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
12/4/17		0	13.5	15.5	15

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	41.5
Rock Cored (ft)	-
Samples	15S, 4U

Boring No. HAB-05

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 129319TB_HA-LIB09.GLB HA-TB+CORE+WELL-07-1.GDT \\HALEYALDRICH.COM\SHAREWAS_COMMON\PROJECTS\129319-DYNEGY POND CLOSURES\003\FIELDWORK\SUBSURFACE EXPLORATION LOGS\GINT\129319-0037B.GPJ 12 Feb 18

HALEY ALDRICH

TEST BORING REPORT

DRAFT

Boring No. HAB-05
File No. 129319-003
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20	1															
				437.2 22.0		Note: Driller noted resistance change at 22.0 ft										
						-FILL-										
	5 9 12 13	S8 12	23.5 25.5		CH	Very stiff olive-brown to gray-brown fat CLAY (CH), no structure, moist, PP=1.5-2.0 tons/ft ^{2}						100		H	H	H
25	1 1 2 3	S9 6	25.5 27.5		CH	Similar to S8, except soft and light brown, PP=1.0 tons/ft ^{2}						100				
	2 3 4 5	S10 6	27.5 29.5		CH	Similar to S8, except medium stiff and light brown with gray mottling						100				
30	2 2 2 3	S11 20	29.5 31.5		CH	Very soft to soft light brown fat CLAY (CH), gray-brown mottling, moist, PP=0.5 tons/ft ^{2}						100		M	H	H
	1 2 3 3	S12, S13 24	31.5 33.5	427.2 32.0	CH	Similar to S11, except medium stiff						100				
					CH	Medium stiff olive-gray fat CLAY (CH), varved, moist, trace organics, PP=1.25 tons/ft ^{2}						100				
						-ALLUVIAL DEPOSITS-										
35	1 2 2 3	S14 22	33.5 35.5		CH	Soft olive-gray fat CLAY (CH), varved, moist, trace organics						100		M	H	H
	P U S H	U3 24	35.5 37.5		CH	Similar to S14					1	99				
	2 2 3 3	S15 22	37.5 39.5		CH	Similar to S14, except medium stiff with shell fragments, PP=1.0 tons/ft ^{2}						100				
40	P U S H	U4 24	39.5 41.5		CH	Similar to S14						100				
				417.7 41.5		BOTTOM OF EXPLORATION AT 41.5 FT										
						Note: PP=Pocket Penetrometer.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HAB-05

H&A-TEST BORING-07-1 129319TB_HA-LIB09.GLB HA-TB+CORE+WELL-07-1.GDT \\HALEYALDRICH.COM\SHAREWAS_COMMON\PROJECTS\129319-DYNEGY POND CLOSURES\003\FIELDWORK\SUBSURFACE EXPLORATION LOGS\GINT\129319-0037B.GPJ 12 Feb 18

HALEY ALDRICH

TEST BORING REPORT DRAFT

Boring No. HA-OW-01

Project	Edwards Power Station, Bartonville, Illinois
Client	Dynegy
Contractor	Strata Earth Services, LLC

File No. 129319-003
Sheet No. 1 of 2
Start 07 December 2017
Finish 08 December 2017
Driller K. Diehl
H&A Rep. C. Giusti

Elevation 455.6
Datum NGVD 88

Location
N 1,431,706.38
E 2,435,045.27

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type	HSA	S	-	Rig Make & Model: Detrich D-120 ATV
Inside Diameter (in.)	4	1 3/8	-	Bit Type: Roller Bit
Hammer Weight (lb)	-	140	-	Drill Mud: None
Hammer Fall (in.)	-	30	-	Casing: Auger to 30.5 ft
				Hoist/Hammer: Winch Automatic Hammer
				PID Make & Model:

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Well Diagram	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0																	
	2 3 3 3	S1 22	3.5 5.5			ML	Loose light brown to black SILT with sand (ML), no structure, moist, PP=1.5 tons/ft^2 -FILL-					20	80				
5																	
	WOH WOH WOH WOH	S2 24	8.5 10.5			ML	Very loose gray to black SILT (ML), no structure, wet, contains fine sand pockets, PP=0.0 tons/ft^2					5	95				
10																	
	WOH WOH WOH WOH	S3 24	10.5 12.5			ML	Similar to S2						100				
	WOH WOH 4 2	S4 24	12.5 14.5		442.1 13.5	SM	Loose gray to black silty SAND (SM), no structure, moist to wet, PP=1.0 tons/ft^2				10	70	20				
					441.1 14.5	ML	-BOTTOM ASH- Very loose gray to black SILT (ML), no structure, wet, contains fine sand pockets, PP=0.0 tons/ft^2					5	95				
15	1 1 2 2	S5 13	14.5 16.5				-FLY ASH-										
	3 1 WOH 2	S6 6	16.5 18.5			ML	Similar to S5					10	90				
	3 7 8 11	S7 12	18.5 20.5		436.6 19.0	CH	Stiff dark brown to gray fat CLAY (CH), varved, moist, contains organics, PP=3.25 tons/ft^2 -ALLUVIAL DEPOSITS-						100		H	H	H
20																	

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water
12/7/17		0	8.5	8.5	6
12/11/17	8:00	96	18.0	18.0	4.79

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	34.5
Rock Cored (ft)	-
Samples	10S, 4U

Boring No. HA-OW-01

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Plasticity**: N - Nonplastic L - Low M - Medium H - High
Toughness: L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

H&A-TEST BORING-07-1 129319TB_HA-LIB09.GLB HA-TB+CORE+WELL-07-1.GDT \\HALEYALDRICH.COM\SHAREWAS_COMMON\PROJECTS\129319-DYNEGY POND CLOSURES\003\FIELDWORK\SUBSURFACE EXPLORATION LOGS\GINT\129319-0037B.GPJ 12 Feb 18

HALEY ALDRICH

TEST BORING REPORT

DRAFT

Boring No. HA-OW-01
File No. 129319-003
Sheet No. 2 of 2

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	Well Diagram	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
20																	
	2 4 5 6	S8 11	20.5 22.5			CH	Stiff dark brown to gray fat CLAY (CH), varved, some light brown mottling, moist, contains organics, PP=1.0 tons/ft^2						100		H	H	H
							-ALLUVIAL DEPOSITS-										
	P U S H	U1 16	22.5 24.5			CH	Similar to S8						100				
					431.1												
25	2 2 3 3	S9 12	24.5 26.5		24.5	CL	Medium stiff olive-gray and yellow-brown lean CLAY (CL), mottled, moist, contains organics, PP=1.0 tons/ft^2						100		M	H	H
	P U S H	U2 10	26.5 28.5				Note: Shelby tube discarded due to low recovery.				2	2	96				
	P U S H	U3 15	28.5 30.5			CL	Similar to S9						100				
30							Note: Switched to rotary drilling with water at 30.5 ft.										
					425.1												
	WOH 2 2 4	S10 23	30.5 32.5		30.5	CH	Soft gray fat CLAY (CH), varved, moist, contains organic and shell fragments, PP=1.25 tons/ft^2						100		M	H	H
					423.1												
	P U S H	U4 23	32.5 34.5		32.5	ML	Light brown to tan sandy SILT with gravel (ML), moist		20	10	10	10	50				
					421.1												
					34.5		BOTTOM OF EXPLORATION 34.5 FT Note: PP=Pocket Penetrometer. Installed observation well in completed borehole.										

NOTE: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

Boring No. HA-OW-01

H&A-TEST BORING-07-1 129319TB_HA-LIB09.GLB HA-TB+CORE+WELL-07-1.GDT \\HALEYALDRICH.COM\SHAREWAS_COMMON\PROJECTS\129319-DYNEGY POND CLOSURES\003\FIELDWORK\SUBSURFACE EXPLORATION LOGS\GINT\129319-0037B.GPJ 12 Feb 18

File: \\URSSTLOUIS\STLOUIS\PROJECTS\GEOTECH\DYNEGY - BALDWIN 2014\CCR\047ASKS\00 PROGRAM TASKS\1.0 TASK 1 INITIAL UNIT ASSESSMENT\CCR FACT SHEETS\SITE MAPS\FIGURE 2 BORING LOCATION PLAN (EDWARDS ASH POND)_AJW_EDITS.DWG Last edited: AUG. 05, 15 @ 4:03 p.m. by: eric_glazier

EDW-C020
EDW-B007
EDW-C018
EDW-C021
EDW-B012
EDW-C017
EDW-P003
EDW-B014
EDW-C022
EDW-C024
EDW-C023
EDW-B010
EDW-P002
EDW-C019
EDWARDS
ASH POND
EDW-C001
EDW-B001
EDW-P001
EDW-C016
EDW-C027
EDW-B011
EDW-B002
EDW-C025
EDW-C002
EDW-C015
EDW-B009
EDW-C026
EDW-B003
EDW-C014
EDW-B008
EDW-C003
EDW-C013
EDW-C005
EDW-B004
EDW-C004
EDW-C012
EDW-B005
EDW-C006
EDW-C009
EDW-B015
EDW-P004
EDW-C011
EDW-B013
EDW-C007
EDW-C010
EDW-C008
EDW-B006

EXPLORATION METHOD (B=BORING, C=CPT, P=PIEZOMETER)
XXX–X###
ID NUMBER
STATION ABBREVIATION

LEGEND

- PROPOSED BORING LOCATION
- PROPOSED CPT LOCATION
- PROPOSED PIEZOMETER LOCATION
- PROPOSED CROSS SECTION LOCATION
- CCR UNIT BERM ALIGNMENT

SOURCE:
MAP PROVIDED BY GOOGLE EARTH PRO 2015

Ø 400
APPROXIMATE SCALE FEET

DYNEGY, INC	PROJECT NO. 60440202
AECOM	
DRN. BY: djd July 2015 DSGN. BY: eg CHKD. BY: eg	Edwards Ash Pond Field Investigation Plan
	FIG. NO. 1

PRIVILEGED & CONFIDENTIAL - ATTORNEY CLIENT PRIVILEGED

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B001

Date(s) Drilled	11/05/2015 to 11/05/2015	Logged By	Robert Weseljak	Checked By	AJW
Drilling Method	Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	51.0 ft
Drill Rig Type	Mobile B-57 Truck Mounted	Drilling Contractor	Strata Earth Services	Surface Elevation	460 ft
Borehole Backfill	Portland Cement and Bentonite	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
460	0	SS-1	2 6 8	61		Elevation (feet) 460.0 / Depth (feet) 0.0 Stiff, dry, gray mottled with brown, lean CLAY (CL).					3.0			
						457.5 / 2.5								
		SS-2	3 4 5	94		Stiff, moist, brown mottled with gray and black, lean CLAY (CL), trace shell fragments.					3.0			
455	5	SS-3	3 3 3	75		Becomes medium stiff.					1.0			
		ST-4	200 psi	100										*Pushed shelby tube from 7.0 to 9.0 feet*
450	10	SS-5	3 3 6	83		450.0 / 10.0 Stiff, moist, grayish black, lean CLAY (CL), trace organics.					1.0 1.5			
445	15	SS-6	1 3 5	78							1.25			
440	20	SS-7	1 6 7	100		440.0 / 20.0 Stiff, moist, very dark gray to grayish black with some brown, lean CLAY (CL).					1.5 2.5			
435	25	SS-8	WOH WOH 2	100		435.0 / 25.0 Very soft, wet, brown mottled with gray, sandy lean CLAY (CL).					1.0 0.5			
430	30					430.0 / 30.0								

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:32:54 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B001

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
430	30	ST-9	150 psi	100		Soft, wet, gray, silty lean CLAY (CL-ML).					1.25			*Pushed shelby tube from 30.0 to 32.0 feet*
425	35	SS-10	2 2 4	100		425.0 / 35.0 Loose, wet, gray, silty SAND (SM), trace wood fragments. 424.2 / 35.8 Medium stiff, moist, gray, lean CLAY (CL).					0.5 1.0			
420	40	SS-11	50/3"	100		420.0 / 40.0 CLAYSTONE: Brown and gray, weathered, hard.								
415	45	SS-12	50/2"			414.0 / 46.0 SILTSTONE: Thin to medium bedding, fresh, argillaceous.								*Run 1 - Start 13:46, End 14:00*
		Run 1	16.7	36.7										
410	50					409.0 / 51.0 End of Boring at 51 ft								*Boring backfilled with Portland Cement and bentonite*
405	55													
400	60													
395	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:32:54 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B002

Date(s) Drilled	09/03/2015 to 09/03/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	52.5 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	457 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	7.5 ft on 9/3/2015		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0	SS-1	7 6 8	89		457.0 / 0.0 Medium dense, moist, dark brown, FLY ASH [Fill].	38.4							
455						454.5 / 2.5								
		SS-1	3 2 2	100		Loose, moist, dark gray, FLY ASH [Fill].	62.4							
	5	ST-3	150 psi	62.5			66.6		65	29				*Pushed shelby tube from 5.0 to 7.0 feet*
450						449.5 / ▽ 7.5								
		SS-4	WOR	100		Very loose, wet, black, FLY ASH [Fill].	79.0							
	10	ST-5		55			76.9	90.8 94.3 91.2	17	NP				*10.0 feet switch to mud rotary* *Pushed shelby tube from 10.0 to 12.0 feet*
445						Becomes dark gray.								
						Hard layer at tip of tube.								
	15	SS-6	1 2 3	100		Becomes loose.	52.5							
440														
	20	SS-7	12 17 2	37		437.0 / 20.0 Medium dense, wet, dark gray, FLY ASH [Fill], with cementous layers.	67.8							
435														
	25	SS-8	1 WOH WOH	100		432.0 / 25.0 Very loose, wet, dark gray, FLY ASH [Fill].	63.9							
430														
	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:01 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B002

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30	SS-9	WOR WOH WOH	100		426.5 With clay. / 30.5 Very soft, wet, brown, lean CLAY (CL), with sand.	126.1 31.1				0.5			
425														
	35	ST-10	100 psi	100		422.0 / 35.0 Very soft, gray, lean CLAY (CL), with sand, trace shells.	31.6		36	18	0.25			
420														
	40	SS-11	WOH WOH WOH	100			42.9				0.75			
415														
	45	SS-12	WOH WOH 2	100		Grades with trace organics.	57.7				0.25			
410						410.0 / 47.0 SHALE: Light gray, silt sized.								
	50	SS-13	50/3"	100			11.1							
405						404.5 / 52.5 End of Boring at 52.5 ft								*Boring backfilled with bentonite and cement fluid*
	55													
400														
	60													
395														
	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:01 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B003

Date(s) Drilled	09/03/2015 to 09/03/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	60.5 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	460 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	7 ft on 9/3/2015		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
460	0	SS-1	7 7 7	83		460.0 / 0.0 Medium dense, moist, dark gray, FLY ASH [Fill].	44.4							
		SS-2	3 2 2	100		Becomes loose.	27.3							
455	5	SS-3	1 WOH 2			455.0 / 5.0 Very soft, moist, lean CLAY (CL) with ash, sand, and organics.	37.2							
						▽ 452.5 / 7.5								
		ST-4	<100 psi	100		Ash, dark gray [Fill].	55.5							*Pushed shelby tube from 7.5 to 9.5 feet*
450	10	SS-5	WOR WOR WOR	67			50.6							*10.0 feet: Switch to mud rotary*
						447.0 / 13.0 Very dense, dark gray, moist, fine to coarse ASH with sand and gravel, slightly cemented [Fill].								*13.0 feet: Hard drilling*
445	15	SS-6	26 37 29	100			29.7							
						Becomes very loose, dark gray, fine.								
440	20	SS-7	1 1 1	100			42.1							
435	25	ST-8	100 psi	100		Grades with sand.	54.9							*Pushed shelby tube from 25.0 to 27.0 feet*
430	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:06 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B003

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
430	30	ST-9	100 psi	100		Varved FLY ASH.	71.7	91.2 92.9 92.0						*Pushed shelby tube from 30.0 to 32.0 feet*
425	35	SS-10	WOR WOR WOR	100		423.5 / 36.5	51.9 43.0							
						Very soft, moist, brown to gray, silty CLAY (CL), trace sand, shells, and organics.								
420	40	SS-11	WOH WOH WOR	100			31.6				.75			
415	45	ST-12	100 psi	100		415.0 / 45.0 Soft, moist, dark gray, fat CLAY (CH) with sand.	46.0				1.0			*Pushed shelby tube from 45.0 to 47.0 feet*
410	50	SS-13	1 2 3	100		410.0 / 50.0 Medium stiff, moist, brownish to greenish, gray, lean CLAY (CL), with sand.	55.4				1.0			
						406.0 / 54.0 SHALE, gray, weathered, silt sized.								
405	55	SS-14	11 50/5"	100			23.3 9.8							
400	60	SS-15	50/3"	100		399.5 / 60.5 End of Boring at 60.5 ft	7.1							*Boring backfilled with bentonite and cement fluid*
395	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:06 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B003A

Sheet 1 of 1

Date(s) Drilled	09/03/2015 to 09/03/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	9.5 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
Boring Location	5' East of EDW-B003 (ft NAD83)	Groundwater Level(s)	7 ft on 9/3/2015		

Depth (feet)	SAMPLES Type Number	SAMPLES Sampling Resist. OR Core RQD (%)	SAMPLES Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION Elevation (feet)	MATERIAL DESCRIPTION Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0					Offset boring to attempt shelby tube at 7.5 feet	0.0								
5														
	ST-1		0											*Pushed shelby tube from 7.5 to 9.5 feet*
						9.5								
10					End of Boring at 9.5 ft									*Boring backfilled with bentonite and cement fluid*
15														
20														
25														
30														

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:12 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B004

Date(s) Drilled	09/11/2015 to 09/11/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	60.3 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0							0.0								
	SS	1	16 12 15	83		6" stone at surface.	0.5	18.9							
						Medium dense, moist, dark gray, ASH [Fill].									
	SS	2	3 2 2	100			3.5	28.5 20.1							
						Becomes dark gray to dark brown, trace silty clay, sand and gravel.									
5	SS	3	2 2 4	77								1.25			
	SS	4	2 3 4	100				21.6				2.0			
10	SS	5	2 2 2	67				21.5				2.0			*10.0 feet: Switch to mud rotary*
							12.5								
	SS	6	2 2 2	100		Soft, wet, brown mottled, silty CLAY (CL), trace sand and gravel.		25.4				1.25			
15	SS	7	2 3 3	77				25.8				1.25			
20	SS	8	WOH 2 3	89		Grades brown, with sand.		31.3				.75			
25	SS	9	2 2 3	89			26.0	23.0 19.5							
						Medium stiff, wet, brown, clayey SAND (SC).	26.5								
						Medium stiff, wet, dark gray to gray, silty CLAY (CL), trace sand.									
30							30.0								

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B004

Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30	SS-10	2 7 6	89		Stiff, gray, wet, lean CLAY (CL), with sand, and organics.	19.7				4.0			
35					35.0 Stiff, wet, gray mottled, lean CLAY (CL) with sand.								
	ST-11		100			20.1				1.25			*Pushed shelby tube from 36.0 to 38.0 feet*
40	SS-12	2 3 3	89		40.0 Stiff, wet, brown mottled, lean CLAY (CL), trace sand.	30.0				1.75			
45	SS-13	2 3 5	83		45.0 Medium stiff, wet, dark gray, lean CLAY (CL).	39.5 35.1				1.25			
50	SS-14	2 2 3	100		50.0 Medium, stiff, wet, gray, lean CLAY (CL) with sand, trace shells and organics.	65.2				1.25			
55	SS-15	3 8 23				33.4 13.2							
					56.0 SHALE: Light gray, weathered.								*56.5 to 60.0 feet: Solid drilling*
60	SS-16	50/3"	100		60.0 End of Boring at 60.3 ft	8.8							*Boring backfilled with bentonite and cement fluid*
65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:15 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B005

Date(s) Drilled	09/10/2015 to 09/10/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	53.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	8 ft on 9/10/2015		

Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0	SS	SS-1	4 4 5	95		Medium, stiff, moist, brown, clayey SAND (SC), trace gravel, topsoil, roots and fill.	0.0	45.8				2.0			
							2.5								
	SS	SS-2	9 15 11	100		Medium dense, moist, brown, sandy SILT (ML) with gravel.		26.0							
5	SS	SS-3	2 2 2	100		Loose, moist, brown, sandy elastic SILT (MH) with clay.	5.0	50.9				1.8			
							▽ 8.0								
	SS	SS-4		100		Loose, wet, brown, sandy SILT (ML) with gravel.		37.4							
10	SS	SS-5	1 2 5	100		Medium stiff, wet, light brown and gray, clayey SAND (SC) with gravel.	10.0	44.3							*10.0 feet: Switch to mud rotary*
15	SS	SS-6	2 8 10	100		Very stiff, wet, brown, sand SILT (ML) with gravel.	15.0	41.4							
20	SS	SS-7	1 1 1	100		Soft, wet, brown, gravelly CLAY (CL), trace sand.	20.0	51.1							
25	SS	SS-8	2"	100				55.3							
						Very loose, wet, dark brown ASH [Fill].	26.5	47.6							
30	SS	SS-9		100				69.3							

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:20 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B005

Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30	SS-9		100			69.3							
35	SS-10	WOR WOH WOH	67		35.0 Very loose, wet, black, ASH, with organic clay [Fill].	37.3							
40	ST-11	150 psi	100		38.0 Soft, wet, gray, fat CLAY (CH), trace sand, shells, and organics.	44.8		57	35				*Pushed shelby tube from 41.0 to 43.0 feet*
45	SS-12	WOH 2 2	100		45.0 Soft, wet, dark gray and greenish gray, lean CLAY (CL), with sand, organics and shale.	88.7							
50	SS-13	11 18 44	89		49.5 SHALE: light gray, weathered.	15.9 12.8							
55					53.0 End of Boring at 53 ft								*Boring backfilled with bentonite and cement fluid*
60													
65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:21 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B006

Date(s) Drilled	09/08/2015 to 09/08/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	37.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION Elevation (feet) / Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0	SS	SS-1	3 4 6	94		Stiff, moist, dark brown, lean CLAY (CL) with sand and glass.	26.4				3.0			
2.5	SS	SS-2	3 3 3	67		Medium stiff, brown to dark brown lean CLAY (CL), trace sand.	30.1				1.25			
5.0	SS	SS-3	2 3 4	100		Medium stiff, moist, gray and mottled brown, lean CLAY (CL), trace sand.	24.8		48	29	2.0			
	SS	SS-4	3 4 4	100			26.0				1.5			
10	SS	SS-5	1 2 1	100		Becomes soft.	34.2				1.0			*10.0 feet: Switch to mud rotary*
13.0	ST	ST-6		100		Soft, moist, gray fat CLAY (CH) with sand and shells.	31.1		62	42	1.25			*Pushed shelby tube from 12.0 to 14.0 feet*
15.0	SS	SS-7	1 1 1	100		Soft, moist, brownish gray, lean CLAY (CL).	40.8				1.0			
20	SS	SS-8	WOH WOH 1	100		Becomes very soft, brown and gray, with sand.	43.4				0.75			
26.0	ST	ST-9		100		Very soft, moist, dark gray, organic SILT (OH).	76.0		72	35	0.75			*Pushed shelby tube from 26.0 to 28.0 feet*
30						30.0								

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:26 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B006

Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30	SS-10		89		Very soft, moist, gray lean CLAY (CL) with sand, pockets of organics. 31.0	43.4 19.6				0.75			
					Very soft, moist, grayish brown, lean CLAY (CL) with sand, silt, and organics.								
					33.0 SHALE: light gray, weathered.								
35	SS-11		84			14.2							
					37.0 End of Boring at 37 ft								*Boring backfilled with bentonite and cement fluid*
40													
45													
50													
55													
60													
65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:26 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B008

Date(s) Drilled	09/13/2015 to 09/13/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	42.5 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0					0.0								
	SS-1	3 4 4	100		Stiff, moist, brown, lean CLAY (CL) with sand and gravel, trace roots.	13.2				4.0			
	SS-2	3 4 6	100			19.5		42	20	4.25			
5	SS-3	2 3 5	67		Becomes medium stiff.	42.3				2.0			
					7.5								
	SS-4	1 3 2	89		Medium stiff, moist, gray and mottled brown, lean CLAY (CL), trace sand.	22.8				2.5			
10					11.0								*10.0 feet: Switch to mud rotary*
	ST-5	150 psi	85		Medium stiff, moist, brown and gray fat CLAY (CH), trace sand.	33.6		52	33	0.75			
15					15.0								
	SS-6	WOH 1 1	100		Soft, moist, dark brown, lean CLAY (CL), trace shells.	64.6				0.75			
20	SS-7	WOH WOH WOH	100		Becomes very soft.	44.4				0.75			
					24.0								
25	ST-8	150 psi			Very soft, moist, dark gray, fat CLAY (CL), trace organics.	68.9		67	36	1.0			
30					30.0								

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:32 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B008

Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30	SS-9	WOH WOH WOH	100		Very soft, moist, gray and brownish gray, lean CLAY (CL), trace sand.	71.4				0.5			
35	SS-10	WOH WOH WOH	100		Trace wood, organics, and shells.	56.9				0.75			
					39.0 SHALE: Light gray, slightly weathered.								
40	SS-11	66/4"	100			12.6							*40.0 to 42.5 feet: Solid drilling*
					42.5 End of Boring at 42.5 ft								*Boring backfilled with bentonite and cement fluid*
45													
50													
55													
60													
65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:32 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B009

Date(s) Drilled	11/05/2015 to 11/05/2015	Logged By	Robert Weseljak	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	66.5 ft
Drill Rig Type	Mobile B-57 Truck Mounted	Drilling Contractor	Strata Earth Services	Surface Elevation	446 ft
Borehole Backfill	Portland Cement and Bentonite	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0					446.0 / 0.0								
445		SS-1	11 13 15	100		445.5 / 0.5 Medium dense, moist, brown silty SAND (SM).					1.0 1.25			
						Very stiff, moist, gray and brown, sandy SILT (ML).								
						443.5 / 2.5								
		SS-2	2 1 1	67		Soft, dry, gray and brown sandy SILT (ML)					0.25			
						441.5 / 4.5								
	5					Concrete from 4.5 to 5.5.								
440		SS-3	5 2 5	11		440.5 / 5.5 Light brown, well graded GRAVEL (GW).								*5.5 feet: Limestone cobbles*
						438.5 / 7.5								
		SS-4	5 4 4	89		437.5 / 8.5 Stiff, dry, brownish gray, silty SAND with GRAVEL (SM).					1.0			
						Medium dense, moist, black, sandy SILT (ML).								
	10													
435						435.0 / 11.0								
		ST-5	250 psi	75		Medium stiff, moist, brownish gray, lean CLAY (CL).					1.5			*Pushed shelby tube from 11.0 to 13.0 feet* *Trace gravel in top of tube*
	15					431.0 / 15.0								
430		SS-6	1 5 5	89		Medium dense, moist, brown mottled with reddish brown, lean CLAY (CL).					2.0			
	20					426.0 / 20.0								
425		SS-7	WOH 2 4	94		Very soft to medium dense, moist to wet, gray, lean CLAY (CL) with shell and wood fragments.					1.0			
	25					421.0 / 25.0								
420		SS-8	WOH WOH 3	100		Very soft to soft, wet, gray, lean CLAY (CL) with shell fragments.					0.5 1.0			
	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:38 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B009

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
415	30	SS-9	WOH 7 7	100		415.5 / 30.5 Stiff, dry, black, lean CLAY (CL), low plasticity.					1.0 1.25			
410	35	ST-10	125 psi	100		Becomes gray.					1.0			*Pushed shelby tube from 35.0 to 37.0 feet*
405	40	SS-11	WOH WOH 4	100		406.0 / 40.0 Soft, moist to wet, gray, lean CLAY (CL) with shell fragments, low to medium plasticity.					0.5			
400	45	SS-12	WOH 1 4	100							1.0			
395	50	SS-13	WOH WOH WOH	100		396.0 / 50.0 Very soft, wet, gray, SILT (ML) with shell fragments, low plasticity.					1.0			
390	55	SS-14	WOH WOH 17	100		390.0 / 56.0 Medium dense, wet, gray, fine to coarse clayey GRAVEL (GC), trace fine to coarse sand, reddish brown gravel.					3.0			
385	60	SS-15	50/3"	17		386.0 / 60.0 CLAYSTONE: Gray.								
	65	Run 1	0	0										*61.5 feet: Run 1 - Start 7:57, End 8:10*

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:39 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B009

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
380		Run 1	0	0		Elevation (feet) 379.5 / Depth (feet) 66.5								
						End of Boring at 66.5 ft								
	70													
375														
	75													
370														
	80													
365														
	85													
360														
	90													
355														
	95													
350														
	100													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:39 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B010

Date(s) Drilled	09/04/2015 to 09/04/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	45.3 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	459 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
459	0					459.0 / 0.0								
		SS-1	10 6 10	56		458.5 / 0.5 Medium dense, moist, brown, SAND (SP) with gravel and clay.	7.2							
						Medium dense, moist, dark gray, fine to coarse ASH [Fill].	17.4 27.9							
		SS-2	9 8 8	83			20.9 30.7							
455	5	SS-3	3 6 4	100			14.8							
						451.5 / 7.5								
		SS-4	3 3 6	78		Stiff, moist, brown lean CLAY (CL), trace sand and gravel.	22.0							
450	10					449.0 / 10.0								
		SS-5	2 3 4	78		Medium stiff, moist, brown and mottled gray, lean CLAY (CL), trace sand.	24.0							
		SS-6	2 2 3	78			28.0							*12.0 feet: Switch to mud rotary*
445	15	ST-7	250 psi	83			30.5		48	30				*Pushed shelby tube from 15.0 to 17.0 feet*
						440.0 / 19.0								
440	20					Soft, wet, gray, lean CLAY (CL), trace sand and shells.								
		SS-8	1 1 1	83			32.9							
435	25	SS-6	WOH WOH 3	89			21.4							
430	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:48 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B010

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30	ST-10		72			30.0	117.6 118.9 118.6	40	25				*Pushed shelby tube from 30.0 to 32.0 feet*
425														
	35	SS-11	1 2 3	94		Becomes medium stiff.	28.2							
420														
	40	SS-12	6 7 50/3.5"	83		419.0 / 40.0 Medium dense, wet, brown, fine to coarse silty SAND (SP) with gravel. 418.0 / 41.0 SHALE: Light gray, weathered.	17.0							*41.0 to 43.0 feet: Hard drilling*
415														
	45	SS-13	50/3"	35		413.8 / 45.3 End of Boring at 45.25 ft	16.4							*Boring backfilled with bentonite and cement fluid*
410														
	50													
405														
	55													
400														
	60													
395														
	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:48 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B011

Date(s) Drilled	09/12/2015 to 09/12/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	62.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	456 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	7.5 ft on 9/12/2015		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
						Elevation (feet) 456.0 / Depth (feet) 0.0								
455	0	SS-1	9 12 12	89		Medium dense, moist, dark gray, ASH [Fill].	27.7							
		SS-2	8 9 14	100			16.3							
450	5	SS-3	6 9 9	94			29.4							
		SS-4	2 1 1	100		Becomes loose, wet. ▽	45.3							
445	10	SS-5		84			70.0							*10.0 feet: Switch to mud rotary*
440	15	SS-6	WOR WOR WOR WOR	100		Becomes very loose.	63.2							
435	20	SS-7		56			84.9							
430	25	SS-8	WOR WOR WOR WOR	89			74.7							
	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:53 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B011

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
425	30	SS-9	WOR WOR WOR WOR	100			73.7							
420	35	SS-10	WOR WOR WOR WOR	84			93.9							
415	40	SS-11	WOH 1 2	100		416.0 / 40.0 Soft, wet, gray, silty CLAY (CL), trace sand, shells, and organics.	47.9							
410	45	SS-12	WOR WOR WOH	94		411.0 / 45.0 Very soft, wet, gray, fat CLAY (CH), trace sand, shells, and wood.	63.3		63	42				
405	50	SS-13	WOR WOR WOH	89		406.0 / 50.0 Very soft, wet, dark gray and grayish brown, lean CLAY (CL).	62.5							
400	55	SS-14	WOR WOR WOH	100		Grades gray.	52.9							
395	60	SS-15	50/3"	100		398.0 / 58.0 SHALE: Light gray, soft.	9.1							*58.0 to 62.0 feet: Solid drilling*
	65					394.0 / 62.0 End of Boring at 62 ft								*Boring backfilled with bentonite and cement fluid*

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:53 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B012

Date(s) Drilled	09/09/2015 to 09/09/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	60.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	453 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
						Elevation (feet) / Depth (feet)								
	0					453.0 / 0.0								
		SS-1	6 6 4	94		452.6 / 0.4 Limestone gravel.	23.0							
						Stiff, moist, brown sandy SILT (ML), trace clay, gravel, and topsoil.								
						450.5 / 2.5								
450		SS-2	5 4 3	78		Loose, moist, dark brown ASH [Fill].	23.8		28	2				
	5	SS-3	3 4 11	56			26.5							
445		SS-4	10 10 7	89			26.5							
	10	SS-5	2 3 4	89		With clay.	24.7 24.9							
						442.0 / 11.0 Stiff, moist, brown to gray, silty CLAY (CL), trace sand, shells, and roots.								
440		SS-6	3 3 6	94			22.0							
	15	SS-7	2 3 4	61		Becomes medium stiff.	24.3		48	29				*15.0 feet: Switch to mud rotary*
435														
	20	ST-8	100 psi	75			23.8							*Pushed shelby tube from 20.0 to 22.0 feet*
430														
	25	SS-9	3 3 3	100			23.2							
425														
	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:59 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B012

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30	SS-10	2 2 4	61			24.8							
420														
	35	SS-11	2 2 2	100		Becomes soft, trace sand.	28.3							
415														
	40	SS-12	WOH 2 2	100		Becomes soft, trace sand, shells, and organics.	32.2							
410														
	45	SS-13	1 2 3	100			50.2							
						406.0 / 47.0								
405		ST-14		100		Medium stiff, moist, dark gray, fat CLAY (CL).	50.8	104.4 104.9 104.0	54	34				*Pushed shelby tube from 47.0 to 49.0 feet*
						404.0 / 49.0								
	50	SS-15	3 2 4	100		Medium stiff, moist, gray and brownish gray, lean CLAY (CL), trace sand.	67.4							
400														
	55	SS-16	11 21 23	100		397.5 / 55.5 Gray broken rock, weathered.	50.5 15.3							
						396.0 / 57.0 Light gray rock, weathered.								
395														
	60	SS-17	50/2.5"	75		392.8 / 60.2 End of Boring at 60 ft	17.9							*Boring backfilled with bentonite and cement fluid*
390														
	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:59 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B013

Date(s) Drilled	09/11/2015 to 09/11/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	53.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0							0.0								
	SS	1	4 4 7	44		Medium stiff, moist, dark gray to brown, CLAY (CL) with ASH [Fill].		13.6							
							2.5								
	SS	2	1 3 4	83		Medium stiff, moist, brown, silty CLAY (CL), trace sand, gravel, and roots.		17.4				2.0			
5															
	SS	3		46				24.3 20.0		49	28				
							8.0								
	SS	4	3 4 6	72		Stiff, moist, dark gray, silty CLAY (CL), trace sand.		24.3				2.0			
10	SS	5	2 4 7	83				25.4				2.0			*10.0 feet: Switch to mud rotary*
						Gray and mottled brown silty CLAY (CL), trace sand.									
15	SS	6	2 2 4	100		Becomes medium stiff, gray and mottled brown.		25.5		41	29	1.0			
20	SS	7	2 3 3	67				23.5				1.0			
25	SS	8	3 3 4	67		Becomes gray, trace organics.		27.7				1.25			
30							30.0								

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:34:04 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B013

Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30	SS-9	1 2 2	94		Medium stiff, moist, brown mottled gray, sandy CLAY (CL), trace silt and shells.	20.2				1.5			
					32.0								
	ST-10		100		Medium stiff, moist, gray and brown lean CLAY (CL) with sand.	33.3		42	19	1.25			*Pushed shelby tube from 32.0 to 34.0 feet*
35	SS-11	2 2 2	89		Becomes dark gray, trace organics.	58.0				1.0			
40	SS-12	2 2 3	100			54.5				1.25			
45	SS-13	2 2 4	100		Grades with calcium carbonate seams and shells.	66.2				1.75			
					Gravel layer 47.5 feet to 49.0 feet								
50					53.0								
					End of Boring at 53 ft								*Boring backfilled with bentonite and cement fluid*
55													
60													
65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:34:05 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B014

Date(s) Drilled	09/12/2015 to 09/12/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	45.5 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	456 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	5 ft on 9/12/2015		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0					Elevation (feet) 456.0 / Depth (feet) 0.0								
455		SS-1	1 4 10	89		Medium dense, moist, dark gray, ASH [Fill].	28.2							
		SS-2	7 2 1	100		Becomes wet, gray.	40.8							
	5					▽								
450		ST-3		35										*Pushed shelby tube from 5.0 to 7.0 feet*
		SS-4	1 1 1	100		Becomes light gray.	60.2							
	10					Becomes dark gray.								*10.0 feet: Switch to mud rotary*
445		SS-5		100			78.7							*Pushed shelby tube from 10.0 to 12.0 feet*
	15					Becomes light gray.								
440		ST-6	1/12" 1/12"	100			86.5							
	20													
435		SS-7	1/12" 1/12"	100			73.1							
	25													
430		SS-8	WOR WOR WOR	100			48.7							
	30					426.0 / 30.0								

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:34:10 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B014

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
425	30	SS-9	WOR WOR WOR	67		Very loose, wet, black to gray, ASH with clay [Fill].	31.6							
	35					421.0 / 35.0								
420		SS-10	WOH 1 2	100		Soft, wet, gray, silty CLAY (CL), trace shells and wood.								
	40					415.5 / 40.5								
415		SS-11	2 18 34	100		SHALE: Light gray, weathered.	27.3 19.6 10.2							*42.0 to 45.0 feet: Solid drilling*
	45	SS-12	56	100		410.5 / 45.5	14.2							
410						End of Boring at 45.5 ft								*Boring backfilled with bentonite and cement fluid*
	50													
405														
	55													
400														
	60													
395														
	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:34:10 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B015

Date(s) Drilled	09/10/2015 to 09/10/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	57.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	444 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0	SS-1	5 4 1	72		Elevation (feet) 444.0 / Depth (feet) 0.0 443.6 / 0.4 Brown gravel. Medium stiff, moist, gray to brown, sandy CLAY (CL), trace silt.	54.7							
440		SS-2	5 9 13	50		441.5 / 2.5 Medium dense, moist, light brown to white, fine to coarse GRAVEL (GP) with sand, trace silt and limestone.	4.5							
	5	SS-3	6 10 13	39			5.4							
		SS-4	6 9 7	39			7.2							
435														
	10	SS-5	4 5 6	39			6.5							*10.0 feet: Switch to mud rotary; borehole collapsed*
		SS-6	10 3 2	11			3.6							
430														
	15	SS-7	4 4 4	39		Some coarse limestone.	8.2							
425														
	20	SS-8	10 7 9	39			7.8							
420														*23.0 to 25.0 feet: Drove casing with hammer* *23.0 to 29.0 feet: Hard drilling*
	25	SS-9	7 4 11	33			8.1							
415														
	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:34:16 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B015

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30					413.0 / 31.0								
		ST-10	300 psi	100		Medium stiff, wet, gray, sandy CLAY (CL), trace silt, shells, and organics.	20.2	122.2 121.0 119.8	24	11	2.5			*Pushed shelby tube from 31.0 to 33.0 feet*
410														
	35					409.0 / 35.0								
		SS-11	WOH 2 3	94		Medium stiff, wet, gray and dark gray lean CLAY (CL)	33.8				1.25			
						407.0 / 37.0								
		ST-12	175 psi			Soft, wet, dark gray, fat CLAY (CH).	41.0		66	43	1.0			*Pushed shelby tube from 37.0 to 39.0 feet*
405						405.0 / 39.0								
	40	SS-13	WOH 2 2	100		Soft, wet, brown and gray, lean CLAY (CL).	36.2				1.0			
400														
	45	SS-14	WOH 2 2	83		Grades with sand.	49.4				1.0			
395														
	50	SS-15	3 5 14	22		Grades without sand.	30.9				0.5			
						392.0 / 52.0								
						SHALE: Light gray, silt sized, weathered.								*52.0 feet: Solid drilling*
390														
	55	SS-16	71/6"	oK			11.0							
						387.0 / 57.0								
						End of Boring at 57 ft								*Boring backfilled with bentonite and cement fluid*
385														
	60													
380														
	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:34:16 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B015A

Sheet 1 of 1

Date(s) Drilled	09/10/2015 to 09/10/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	30.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
Boring Location	5' SW of EDW-B015 (ft NAD83)	Groundwater Level(s)	ft on		

Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0					0.0 Blank power auger to 30.0 feet to confirm 29.0 feet of gravel.								*Offset 5.0 feet west of EDW-B015*
5													*5.0 to 30.0 feet: No cuttings*
													7.0 feet: Borehole collapsed; created a 14" diameter hole with no cuttings
10													
15													
20													*20.0 feet: Groundwater encountered*
25													*Auger hole collapsed and auger removed. No clay on auger.*
30					30.0 End of Boring at 30 ft								

AECOM

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:34:21 AM

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 11/28/2016
Finish: 12/05/2016
WEATHER: Sunny, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger & NX Wireline Rock Core
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: R. Hasenyager

BOREHOLE ID: AP05D
Well ID: AP05D
Surface Elev: 441.23 ft. MSL
Completion: 58.30 ft. BGS
Station: 1,432,401.77N
2,436,749.16E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 6.25 - During drilling
▼ = 13.34 - 01/18/2017
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
1A	13/24 54%	SS	1-4 5-5 N=9	27			0	Black (10YR3/1), moist, soft, CLAY with some silt, trace sand, and trace gravel.		440	
2A	20/24 83%	SS	3-3 4-4 N=7	109			2	Black (10YR2/1), moist, soft, SILT with few clay, trace sand, and trace gravel.		438	
3A	20/24 83%	SS	2-3 4-4 N=7	29			4	Dark yellowish brown (10YR4/4), moist, medium, CLAY with some silt and trace sand.		436	
4A	14/24 58%	SS	1-3 2-3 N=5	33			6 ▼	Gray (10YR5/1), moist, soft, CLAY with some silt and trace sand.		434	
5A	20/24 83%	SS	woh-2 2-2 N=4	40			8			432	
6A	20/24 83%	SS	1-2 2-3 N=4	33			10	Gray (10YR5/1) with 20% yellowish brown (10YR5/6) mottles, moist, soft, CLAY with some silt and trace sand.		430	
7A	18/24 75%	SS	1-2 2-3 N=4	35			12 ▼	Yellowish brown (10YR5/6) with 25% Gray (10YR5/1) mottles, moist, soft, CLAY with some silt and trace sand.		428	
8A	24/24 100%	SS	woh-1 2-2 N=3	27			14	Dark yellowish brown (10YR4/4) with 10% yellowish brown (10YR5/6) mottles, moist, very soft, CLAY with some silt and trace sand.		426	
9A	22/24 92%	SS	1-1 1-2 N=2	26			16			424	
10A	24/24 100%	SS	woh-woh 1-2	28			18	Gray (10YR5/1) with 15% yellowish brown (10YR5/6) mottles, moist, very soft, SILT with few clay, trace sand, and trace shell fragments.		422	
							20				

NOTE(S):

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 11/28/2016
Finish: 12/05/2016
WEATHER: Sunny, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger & NX Wireline Rock Core
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: R. Hasenyager

BOREHOLE ID: AP05D
Well ID: AP05D
Surface Elev: 441.23 ft. MSL
Completion: 58.30 ft. BGS
Station: 1,432,401.77N
2,436,749.16E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 6.25 - During drilling
▼ = 13.34 - 01/18/2017
▽ =

SAMPLE Number	Recov / Total (in) / % Recovery	Type	TESTING Blows / 6 in / N - Value / RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
11A	24/24 *100%*	ss	*woh-woh* *2-2*	28						420	
12A	24/24 *100%*	ss	*woh-woh* *2-2*	34			22				
13A	24/24 *100%*	ss	*woh-woh* *1-2*	35						418	
14A	24/24 *100%*	ss	*woh-1* *2-2* N=3	47			24				
15A	23/24 *96%*	ss	*woh-woh* *1-2*	73						416	
16A	24/24 *100%*	ss	*woh-woh* *2-2*	68			26				
17A	24/24 *100%*	ss	*woh-woh* *woh-woh*	64						414	
18A	24/24 *100%*	ss	*woh-woh* *2-2*	50			28	Gray (10YR5/1), moist, very soft, CLAY with some silt, trace sand, and trace shell fragments.			
19A	15/24 *63%*	ss	*woh-1* *18-23* N=19	46						412	
19B				5			30				
										410	
							32				
										408	
							34				
										406	
							36				
										404	
							38	Medium light gray (N6/1), dry, hard, SILTSTONE with little very fine-grained sand.			
										402	
							40				

NOTE(S):

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 11/28/2016
Finish: 12/05/2016
WEATHER: Sunny, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger & NX Wireline Rock Core
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: R. Hasenyager

BOREHOLE ID: AP05D
Well ID: AP05D
Surface Elev: 441.23 ft. MSL
Completion: 58.30 ft. BGS
Station: 1,432,401.77N
2,436,749.16E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 6.25 - During drilling
▼ = 13.34 - 01/18/2017
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
20	48/53 *91%*	RC		12			42	Medium light gray (N6/1), dry, hard, SILTSTONE with little very fine-grained sand. *[Continued from previous page]*		400	
							44			398	
21	56/60 *93%*	RC						Grayish brown (10YR5/2), dry, hard, very fine- to medium-grained SANDSTONE.		396	
							46			394	
							48	Medium light gray (N6/1), dry, hard, SILTSTONE with little very fine-grained sand.		392	
22	62/60 *103%*	RC					50			390	
							52	Grayish brown (10YR5/2), dry, hard, very fine- to medium-grained SANDSTONE.		388	
							54				
23	54/57 *95%*	RC						Medium light gray (N6/1), dry, hard, SILTSTONE with little very fine-grained sand.		386	
							56	Grayish brown (10YR5/2), dry, hard, very fine- to medium-grained SANDSTONE.			
	0/14 *0%*	BD						Medium light gray (N6/1), dry, hard, SILTSTONE with little very fine-grained sand.		384	
							58				

End of Boring = 57.1 ft. BGS

NOTE(S):

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 11/28/2016
Finish: 11/29/2016
WEATHER: Sunny, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: R. Hasenyager

BOREHOLE ID: AP05S
Well ID: AP05S
Surface Elev: 441.13 ft. MSL
Completion: 38.06 ft. BGS
Station: 1,432,405.64N
2,436,746.64E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 6.25 - During drilling
▼ = 5.23 - 01/18/2017
▽ =

SAMPLE Number	SAMPLE Recov / Total (in) *% Recovery*	SAMPLE Type	TESTING *Blows / 6 in* N - Value **RQD**	TESTING Moisture (%)	TESTING Dry Den. (lb/ft³)	TESTING Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/24 *0%*	BD					0	Black (10YR3/1), moist, soft, CLAY with some silt, trace sand, and trace gravel.		440	
	0/24 *0%*	BD					2	Black (10YR2/1), moist, soft, SILT with few clay, trace sand, and trace gravel.		438	
	0/24 *0%*	BD					4	Dark yellowish brown (10YR4/4), moist, medium, CLAY with some silt and trace sand.		436	
	0/24 *0%*	BD					6	Gray (10YR5/1), moist, soft, CLAY with some silt and trace sand.		434	
	0/24 *0%*	BD					8			432	
	0/24 *0%*	BD					10	Gray (10YR5/1) with 20% yellowish brown (10YR5/6) mottles, moist, soft, CLAY with some silt and trace sand.		430	
	0/24 *0%*	BD					12	Yellowish brown (10YR5/6) with 25% Gray (10YR5/1) mottles, moist, soft, CLAY with some silt and trace sand.		428	
	0/24 *0%*	BD					14	Dark yellowish brown (10YR4/4) with 10% yellowish brown (10YR5/6) mottles, moist, very soft, CLAY with some silt and trace sand.		426	
	0/24 *0%*	BD					16			424	
	0/24 *0%*	BD					18	Gray (10YR5/1) with 15% yellowish brown (10YR5/6) mottles, moist, very soft, SILT with few clay, trace sand, and trace shell fragments.		422	
							20				

NOTE(S): AP05S drilled approx. 5 ft. north of AP05D.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 11/28/2016
Finish: 11/29/2016
WEATHER: Sunny, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: R. Hasenyager

BOREHOLE ID: AP05S
Well ID: AP05S
Surface Elev: 441.13 ft. MSL
Completion: 38.06 ft. BGS
Station: 1,432,405.64N
2,436,746.64E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 6.25 - During drilling
▼ = 5.23 - 01/18/2017
▽ =

SAMPLE Number	SAMPLE Recov / Total (in) *% Recovery*	SAMPLE Type	TESTING *Blows / 6 in* N - Value **RQD**	TESTING Moisture (%)	TESTING Dry Den. (lb/ft³)	TESTING Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/24 *0%*	BD									
	0/24 *0%*	BD					22			420	
	0/24 *0%*	BD									
	0/24 *0%*	BD					24			418	
	0/24 *0%*	BD									
	0/24 *0%*	BD					26			416	
	0/24 *0%*	BD									
	0/24 *0%*	BD					28	Gray (10YR5/1), moist, very soft, CLAY with some silt, trace sand, and trace shell fragments.		414	
	0/24 *0%*	BD									
	0/24 *0%*	BD					30			412	
	0/24 *0%*	BD									
	0/24 *0%*	BD					32			410	
	0/24 *0%*	BD									
	0/24 *0%*	BD					34			408	
	0/24 *0%*	BD									
	0/24 *0%*	BD					36			406	
	0/24 *0%*	BD									
	0/24 *0%*	BD						Medium light gray (N6/1), dry, hard, SILTSTONE with little very fine-grained sand.		404	
							38				

End of Boring = 38.06 ft. BGS

NOTE(S): AP05S drilled approx. 5 ft. north of AP05D.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 11/30/2016
Finish: 11/30/2016
WEATHER: Overcast, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: S. Collins

BOREHOLE ID: AP06
Well ID: AP06
Surface Elev: 439.53 ft. MSL
Completion: 25.00 ft. BGS
Station: 1,433,216.94N
2,436,506.21E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 2.50 - During drilling
▼ = 4.95 - 01/18/2017
▽ =

SAMPLE Number	Recov / Total (in) / % Recovery	Type	TESTING Blows / 6 in / N - Value / RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
1A	21/24 *88%*	SS	*woh-2* *4-5* N=6	25			0	Light yellowish brown (10YR6/4), moist, medium, CLAY with some silt, trace sand and trace roots/grass.		438	
2A	20/24 *83%*	SS	*3-3* *5-6* N=8	29			2	Dark gray (10YR4/1), moist, medium, CLAY with some silt, trace sand and trace roots/grass.		436	
3A	21/24 *88%*	SS	*2-2* *3-4* N=5	28			4	Gray (10YR5/1), moist, soft, CLAY with some silt, trace sand and trace gravel.		434	
4A	21/24 *88%*	SS	*2-2* *2-3* N=4	24			6			432	
5A	22/24 *92%*	SS	*woh-1* *2-3* N=3	35			8	Gray (10YR6/1) with 20% yellowish brown (10YR5/6) mottles, moist, very soft, CLAY with some silt and trace sand.		430	
6A	22/24 *92%*	SS	*woh-1* *2-2* N=3	39			10			428	
7A	22/24 *92%*	SS	*woh-woh* *1-2*	31			12			426	
8A	18/24 *75%*	SS	*1-1* *2-1* N=3	30			14	Gray (10YR6/1), moist, very soft, CLAY with some silt, trace sand and trace shell fragments.		424	
9A	24/24 *100%*	SS	*woh-woh* *1-2*	31			16			422	
10A	21/24 *88%*	SS	*woh-woh* *woh-1*	32			18			420	
							20				

NOTE(S):

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 11/30/2016
Finish: 11/30/2016
WEATHER: Overcast, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: S. Collins

BOREHOLE ID: AP06
Well ID: AP06
Surface Elev: 439.53 ft. MSL
Completion: 25.00 ft. BGS
Station: 1,433,216.94N
2,436,506.21E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 2.50 - During drilling
▼ = 4.95 - 01/18/2017
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
11A	24/24 *100%*	SS	*woh-woh woh-2*	34							
							22	Gray (10YR6/1), moist, very soft, CLAY with some silt, trace sand and trace shell fragments. *[Continued from previous page]*		418	
12A	18/24 *75%*	SS	*wor-wor wor-wor*	39						416	
13A	12/12 *100%*	SS	*woh-woh*	42			24				

End of Boring = 25.0 ft. BGS

NOTE(S):

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 12/01/2016
Finish: 12/08/2016
WEATHER: Overcast, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger & NX Wireline Rock Core
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: S. Collins

BOREHOLE ID: AP07D
Well ID: AP07D
Surface Elev: 458.42 ft. MSL
Completion: 65.00 ft. BGS
Station: 1,432,082.31N
2,435,355.39E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 26.00 - During drilling
▼ = 52.66 - 01/18/2017
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
1A	13/24 54%	SS	1-4 8-9 N=12	8			0	White (10YR8/1), moist, medium dense, GRAVEL with some medium- to very coarse-grained sand. [FILL]		458	
2A	19/24 79%	SS	5-4 4-4 N=8	22			2	Pale brown (10YR6/3), moist, medium, CLAY with some silt and little very fine-grained sand.		456	
3A	18/24 75%	SS	1-3 4-7 N=7	22			4	Gray (10YR5/1) with 25% yellowish brown (10YR5/4) mottles, moist, soft, CLAY with some silt and trace very fine-grained sand.		454	
4A	7/24 29%	SS	2-3 4-4 N=7	22			6			452	
5A	24/24 100%	SS	1-3 4-4 N=7	27			8			450	
5B				34			10	Dark gray (10YR4/1), moist, soft, CLAY with some silt, trace very fine-grained sand, and trace roots.		448	
6A	24/24 100%	SS	1-2 4-4 N=6	29			12			446	
7A	24/24 100%	SS	woh-3 3-6 N=6	27			14	Gray (10YR5/1) with 30% light yellowish brown (10YR6/4) mottles, moist, soft, CLAY with some silt, trace very fine-grained sand, and trace roots.		444	
8A	24/24 100%	SS	woh-2 2-4 N=4	25			16	Gray (10YR5/1) with 30% dark gray (10YR4/1) mottles, moist, medium, CLAY with some silt, little very fine-grained sand, and trace roots.		442	
9A	23/24 96%	SS	1-3 4-5 N=7	23			18	Gray (10YR5/1) with 30% yellowish brown (10YR5/6) mottles, moist, soft, CLAY with some silt and few very fine-grained sand.		440	
10A	24/24 100%	SS	1-2 3-5 N=5	24			20				

NOTE(S):

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 12/01/2016
Finish: 12/08/2016
WEATHER: Overcast, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger & NX Wireline Rock Core
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: S. Collins

BOREHOLE ID: AP07D
Well ID: AP07D
Surface Elev: 458.42 ft. MSL
Completion: 65.00 ft. BGS
Station: 1,432,082.31N
2,435,355.39E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 26.00 - During drilling
▼ = 52.66 - 01/18/2017
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
11A	24/24 100%	SS	2-4 5-7 N=9	25				Gray (10YR5/1) with 30% yellowish brown (10YR5/6) mottles, moist, soft, CLAY with some silt and few very fine-grained sand. *[Continued from previous page]*		438	
							22	Light gray (10YR6/1) with 20% brownish yellow (10YR6/6) mottles, moist, medium dense, very fine- to medium-grained SAND with little clay.		436	
12A	24/24 100%	SS	2-4 8-8 N=12	26							
12B				22				Dark gray (10YR4/1), moist, stiff, CLAY with some silt, trace sand, trace organic matter.			
							24			434	
13A	24/24 100%	SS	1-2 2-2 N=4	23				Light gray (10YR6/1) with 20% light yellowish brown (10YR6/4) mottles, moist, very soft, CLAY with some silt and little very fine- to fine-grained sand.			
							▼ 26			432	
14A	20/24 83%	SS	1-1 2-2 N=3	19				Light yellowish brown (10YR6/4), wet, very loose, very fine- to medium-grained SAND with few silt and trace clay.			
							28			430	
15A	22/24 92%	SS	woh-woh 1-1	24							
							30	Gray (10YR5/1), wet, very loose, very fine- to very coarse-grained SAND with little silt and trace small gravel.		428	
16A	24/24 100%	SS	woh-1 3-2 N=4	15							
16B				34				Gray (10YR5/1) with 30% brownish yellow (10YR6/6) mottles, moist, soft, CLAY with some silt and trace sand.			
							32			426	
17A	24/24 100%	SS	woh-1 2-2 N=3	28				Gray (10YR5/1) with 30% light yellowish brown (10YR6/4) mottles, moist, soft, CLAY with some silt and trace sand.			
							34			424	
18A	24/24 100%	SS	woh-2 4-6 N=6	30				Gray (10YR5/1), moist, soft, CLAY with some silt, trace sand, and trace organic matter.			
19A				31			36			422	
19B	20/24 83%	SS	1-4 8-26 N=12	17							
							38	Gray (10YR5/1), moist, very stiff, SILT with few clay and trace sand (Weathered SILTSTONE).		420	
20A	10/10 100%	SS	21-50/4"	15							
	0/14 0%	BD						Gray (10YR5/1), dense, hard, SHALE.			
							40				

NOTE(S):

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 12/01/2016
Finish: 12/08/2016
WEATHER: Overcast, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger & NX Wireline Rock Core
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: S. Collins

BOREHOLE ID: AP07D
Well ID: AP07D
Surface Elev: 458.42 ft. MSL
Completion: 65.00 ft. BGS
Station: 1,432,082.31N
2,435,355.39E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 26.00 - During drilling
▼ = 52.66 - 01/18/2017
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
21	48/56 *86%*	RC					42	Gray (10YR5/1), dense, hard, SHALE. *[Continued from previous page]*		418	
							44			416	
							46	Light Gray (10YR6/1), dry, very hard, very fine- to medium-grained SANDSTONE.		414	
22	61/60 *102%*	RC					48	Gray (10YR5/1), dense, hard, SHALE.		412	
							50	Light Gray (10YR6/1), dry, very hard, very fine- to medium-grained SANDSTONE.		410	
23	62/60 *103%*	RC					52 ▼	Gray (10YR5/1), dense, very hard, SILTSTONE.		408	
							54			406	
							56	Gray (10YR5/1), dense, very hard, SILTSTONE with white (N8/1) calcite crystals.		404	Crystals are authigenic.
24	54/60 *90%*	RC					58	Gray (10YR5/1), dense, very hard, SILTSTONE.		402	
							60			400	

NOTE(S):

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 12/01/2016
Finish: 12/08/2016
WEATHER: Overcast, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger & NX Wireline Rock Core
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: S. Collins

BOREHOLE ID: AP07D
Well ID: AP07D
Surface Elev: 458.42 ft. MSL
Completion: 65.00 ft. BGS
Station: 1,432,082.31N
2,435,355.39E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 26.00 - During drilling
▼ = 52.66 - 01/18/2017
▽ =

SAMPLE Number	SAMPLE Recov / Total (in) *% Recovery*	SAMPLE Type	TESTING *Blows / 6 in* N - Value **RQD**	TESTING Moisture (%)	TESTING Dry Den. (lb/ft³)	TESTING *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
25	66/60 *110%*	RC					62	Gray (10YR5/1), dense, very hard, SILTSTONE. *[Continued from previous page]*		398	
										396	
							64	Brown (10YR5/3), moist, very hard, very fine- to medium-grained SANDSTONE. Gray (10YR5/1), dense, very hard, SILTSTONE. Brown (10YR5/3), moist, very hard, very fine- to medium-grained SANDSTONE. Gray (10YR5/1), dense, very hard, SILTSTONE.		394	
	0/4 *0%*	BD						**End of Boring = 65.0 feet**			

NOTE(S):

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 12/02/2016
Finish: 12/02/2016
WEATHER: Overcast, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: S. Collins

BOREHOLE ID: AP07S
Well ID: AP07S
Surface Elev: 458.31 ft. MSL
Completion: 35.00 ft. BGS
Station: 1,432,078.08N
2,435,357.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 31.80 - During drilling
▼ = 24.57 - 01/18/2017
▽ =

SAMPLE Number	SAMPLE Recov / Total (in) *% Recovery*	SAMPLE Type	TESTING *Blows / 6 in* N - Value **RQD**	TESTING Moisture (%)	TESTING Dry Den. (lb/ft³)	TESTING Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/24 *0%*	BD					0	White (10YR8/1), moist, medium dense, GRAVEL with some medium- to very coarse-grained sand. [FILL]		458	
	0/24 *0%*	BD					2	Pale brown (10YR6/3), moist, medium, CLAY with some silt and little very fine-grained sand.		456	
	0/24 *0%*	BD					4	Gray (10YR5/1) with 25% yellowish brown (10YR5/4) mottles, moist, soft, CLAY with some silt and trace very fine-grained sand.		454	
	0/24 *0%*	BD					6			452	
	0/24 *0%*	BD					8			450	
	0/24 *0%*	BD					10	Dark gray (10YR4/1), moist, soft, CLAY with some silt, trace very fine-grained sand, and trace roots.		448	
	0/24 *0%*	BD					12			446	
	0/24 *0%*	BD					14	Gray (10YR5/1) with 15% light yellowish brown (10YR6/4) mottles, moist, soft, CLAY with some silt, trace very fine-grained sand, and trace roots.		444	
	0/24 *0%*	BD					16	Gray (10YR5/1) with 30% dark gray (10YR4/1) mottles, moist, medium, CLAY with some silt and little very fine-grained sand.		442	
	0/24 *0%*	BD					18	Gray (10YR5/1) with 30% yellowish brown (10YR5.6) mottles, moist, soft, CLAY with some silt and few very fine-grained sand.		440	
							20				

NOTE(S): AP07S drilled approx. 5 ft. west of AP07D.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 12/02/2016
Finish: 12/02/2016
WEATHER: Overcast, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: S. Collins

BOREHOLE ID: AP07S
Well ID: AP07S
Surface Elev: 458.31 ft. MSL
Completion: 35.00 ft. BGS
Station: 1,432,078.08N
2,435,357.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 31.80 - During drilling
▼ = 24.57 - 01/18/2017
▽ =

SAMPLE Number	Recov / Total (in) / % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/24 0%	BD						Gray (10YR5/1) with 30% yellowish brown (10YR5.6) mottles, moist, soft, CLAY with some silt and few very fine-grained sand. *[Continued from previous page]*		438	
	0/24 0%	BD					22	Light gray (10YR6/1) with 20% brownish yellow (10YR6/6) mottles, moist, medium dense, very fine- to medium-grained SAND with little clay.		436	
	0/24 0%	BD						Dark gray (10YR4/1), moist, stiff, CLAY with some silt, trace sand, trace organic matter.			
	0/24 0%	BD					24 ▼	Light gray (10YR6/1) with 20% light yellowish brown (10YR6/4) mottles, moist, very soft, very fine- to medium-grained SAND with few silt and trace clay.		434	
	0/24 0%	BD					26	Light yellowish brown (10YR6/4), wet, very loose, very fine- to medium-grained SAND with few silt and trace clay.		432	
	0/24 0%	BD					28			430	
	0/24 0%	BD					30	Gray (10YR5/1), wet, very loose, very fine- to very coarse-grained SAND with little silt and trace small gravel.		428	
	0/24 0%	BD					32 ▼	Gray (10YR5/1) with 30% brownish yellow (10YR6/6) mottles, moist, soft, very fine- to medium-grained SAND with some silt and trace clay.		426	
	0/24 0%	BD						Gray (10YR5/1) with 30% light yellowish brown (10YR6/4) mottles, moist, soft, CLAY with some silt and trace sand.			
	0/12 0%	BD					34	Gray (10YR5/1), moist, soft, CLAY with some silt, trace sand, and trace organic matter.		424	

End of Boring = 35.0 feet

NOTE(S): AP07S drilled approx. 5 ft. west of AP07D.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 12/06/2016
Finish: 12/06/2016
WEATHER: Overcast, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger
FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: S. Collins

BOREHOLE ID: AP08
Well ID: AP08
Surface Elev: 458.10 ft. MSL
Completion: 19.98 ft. BGS
Station: 1,430,854.31N
2,434,861.98E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 6.00 - During drilling
▼ = 8.88 - 01/18/2017
▽ =

SAMPLE Number	SAMPLE Recov / Total (in) *% Recovery*	SAMPLE Type	TESTING *Blows / 6 in* N - Value **RQD**	TESTING Moisture (%)	TESTING Dry Den. (lb/ft³)	TESTING *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/60 *0%*	BD					2	Light yellowish brown (10YR6/4), moist to wet, medium, FLY ASH.		456	
							4			454	
							6 ▼			452	
	0/60 *0%*	BD					8			450	
							▼				
							10			448	
							12			446	
	0/60 *0%*	BD					14			444	
							16			442	
	0/60 *0%*	BD					18			440	

End of Boring = 20.0 ft. BGS

NOTE(S): AP08 blind drilled in fly ash.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: 7800 S Cilco Ln, Bartonville, Illinois
Project: 16E0433
DATES: **Start:** 12/06/2016
Finish: 12/07/2016
WEATHER: Overcast, cool (hi-30s)

CONTRACTOR: Bulldog Drilling, Inc.
Rig mfg/model: CME-550X ATV Drill
Drilling Method: 4¼" Hollow Stem Auger

FIELD STAFF: **Driller:** C. Dutton
Helper: M. Baetje
Eng/Geo: S. Collins

BOREHOLE ID: AP09
Well ID: AP09
Surface Elev: 457.24 ft. MSL
Completion: 19.80 ft. BGS
Station: 1,429,733.15N
2,435,541.77E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin
Township: Hollis
Section 14, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 6.00 - During drilling
▼ = 8.20 - 01/18/2017
▽ =

SAMPLE Number	SAMPLE Recov / Total (in) *% Recovery*	SAMPLE Type	TESTING *Blows / 6 in* N - Value **RQD**	TESTING Moisture (%)	TESTING Dry Den. (lb/ft³)	TESTING *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/60 *0%*	BD					2	Light yellowish brown (10YR6/4), moist to wet, medium, FLY ASH.		456	
							4			454	
							6 ▼			452	
	0/60 *0%*	BD					8 ▼			450	
							10			448	
	0/60 *0%*	BD					12			446	
							14			444	
							16			442	
	0/60 *0%*	BD					18			440	
										438	

End of Boring = 19.8 ft. BGS

NOTE(S): AP09 blind drilled in fly ash.

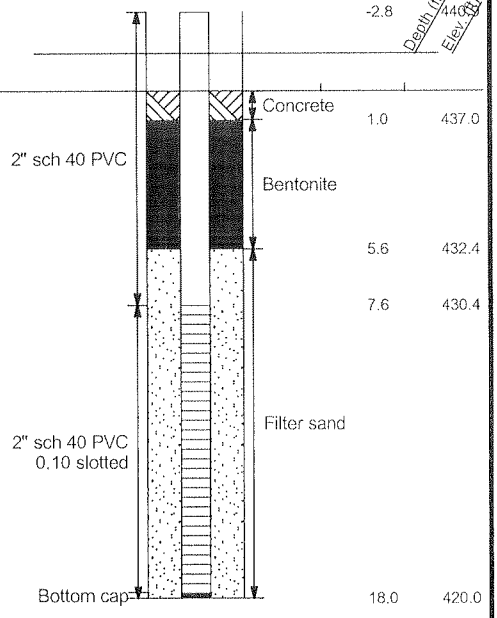
Surface Elevation: 438.02 | Completion Date: 7/27/10

Datum msl | Northing 1432880.82 | Easting 2435852.39

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	FILL			GB1
5				GB2
	Brown, silty CLAY - CL			
10		▽		GB3
15				GB4
	Shaley LIMESTONE		10-0-0	SS5
20	Auger refusal at 18.5 feet.			
25				
30				
35				
40				

WELL DIAGRAM

Stickup
Diameter: 6 inches



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 10 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM
WASHBORING FROM ___ FEET
PH DRILLER JPC LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by: DTK	App'vd. by: RSP
Date: 8/13/10	Date: 9/17/14	Date: 2/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Edwards, Illinois

LOG OF BORING: APW-1

Project No. J017150.01

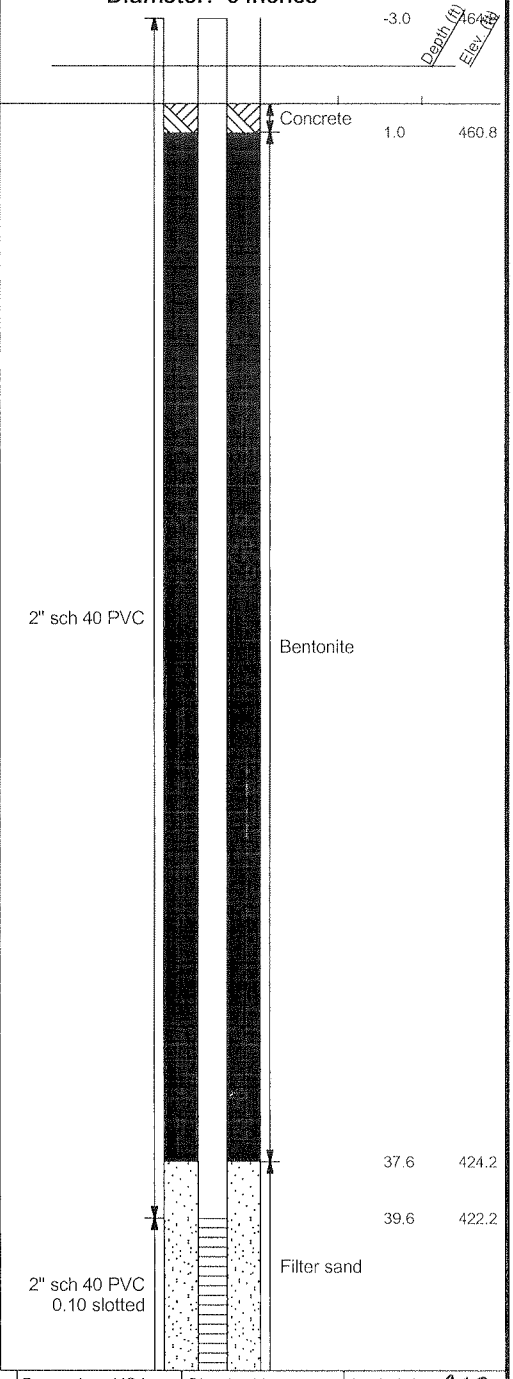
LOG OF BORING 2002 WL J017150.01 - EDWARDS.GPJ GTINC.0638301.GPJ 12/13/10

Surface Elevation: 461.80
Datum msl

Completion Date: 7/20/10
Northing: 1430732.11
Easting: 243579.28

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	FILL: ash			GB1
5	Black, silty CLAY - CL			GB2
10				GB3
15				GB4
20				GB5
25	Gray, silty CLAY - CL			GB6
30				GB7
35				GB8
40				GB9

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 38 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM
WASHBORING FROM ___ FEET
PH DRILLER JPC LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by: DTK	App'vd. by: RSP
Date: 8/13/10	Date: 2/17/11	Date: 2/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Edwards, Illinois

LOG OF BORING: APW-2

Project No. J017150.01

LOG OF BORING 2002 WL J0171150.01 - EDWARDS.GPJ GTINC 0638301.GPJ 12/13/10

Surface Elevation: 461.80
Datum msl

Completion Date: 7/20/10
Northing: 1430732.11
Easting: 243579.28

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	WELL DIAGRAM
	Gray, silty CLAY - CL *(continued)*			GB10	Stickup Diameter: 6 inches 2" sch 40 PVC 0.10 slotted Filter sand Bottom cap 50.0 411.8
50	Boring terminated at 50 feet.				
55					
60					
65					
70					
75					
80					
85					

GROUNDWATER DATA

ENCOUNTERED AT 38 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM
WASHBORING FROM ___ FEET
PH DRILLER JPC LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by: DTC	App'vd. by: RSF
Date: 8/13/10	Date: 2/17/11	Date: 2/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Edwards, Illinois

CONTINUATION OF
LOG OF BORING: APW-2

Project No. J017150.01

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01 - EDWARDS.GPJ GTINC 0638301.GPJ 12/13/10

Surface Elevation: 444.26

Datum msl

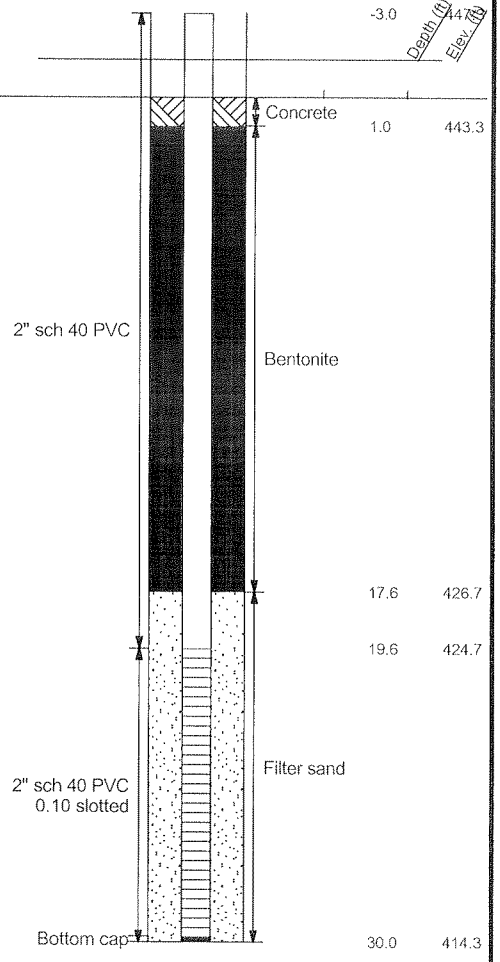
Completion Date: 7/19/10

Northing 1429652.72

Easting 2436225.53

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Black COAL and ash			GB1
5				
				GB2
10				
				GB3
	Gray and brown, silty CLAY - CL			
15				GB4
20				
				GB5
25				
				GB6
30	Boring terminated at 30 feet.			
35				
40				

WELL DIAGRAM



GROUNDWATER DATA

ENCOUNTERED AT 17 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

PH DRILLER JPC LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by: SAK	App'vd. by: RSI
Date: 8/13/10	Date: 8/17/11	Date: 8/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Edwards, Illinois

LOG OF BORING: APW-3

Project No. J017150.01

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01 - EDWARDS.GPJ GTINC 0638301.GPJ 12/13/10

Surface Elevation: 473.30

Datum msl

Completion Date: 7/27/10

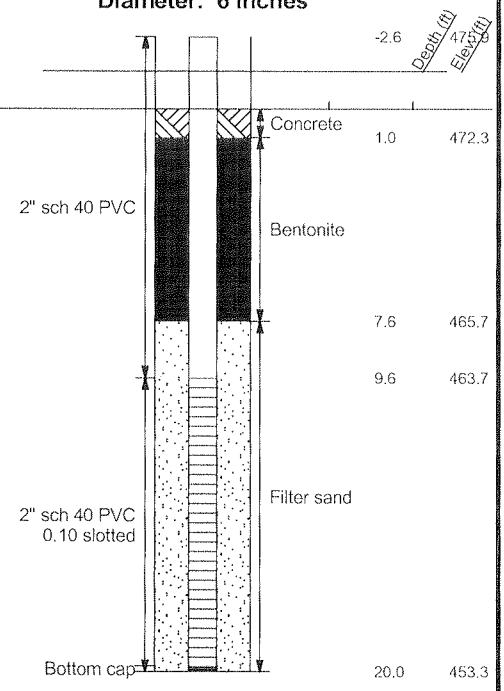
Northing 1428432.43

Easting 2436265.52

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	FILL			GB1
	GRAVEL			GB2
5				
	Brown, silty CLAY, trace gravel - CL			GB3
10				GB4
15				GB5
20	Boring terminated at 20 feet.			
25				
30				
35				
40				

WELL DIAGRAM

Stickup
Diameter: 6 inches



GROUNDWATER DATA

ENCOUNTERED AT 7.5 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

PH DRILLER JPC LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by: DTK	App'vd. by: RSP
Date: 8/13/10	Date: 8/17/11	Date: 8/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Edwards, Illinois

LOG OF BORING: APW-4

Project No. J017150.01

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01 - EDWARDS.GPJ GTINC 0638301.GPJ 12/13/10

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/22/2015
Finish: 7/22/2015
WEATHER: Sunny, warm, mid-70s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: AW-05
Well ID: AW-05
Surface Elev: 440.55 ft. MSL
Completion: 21.10 ft. BGS
Station: 1,432,339.67N
2,435,498.04E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 12.00 - during drilling
▼ = 6.62 - 7/22/15
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
1A	16/24 *67%*	SS	*2-3* *2-7* N=5	20		*2.00*	0	Black (10YR2/1), moist, medium, SILT with few clay and trace very fine- to fine-grained sand, roots.		440	
								FILL - Dark yellowish brown (10YR4/4), moist, stiff, SILT with few clay and trace very fine- to fine-grained sand.			
2A	17/24 *71%*	SS	*5-7* *7-7* N=14	21		*2.00*	2			438	
								FILL - Very dark grayish brown (10YR3/2), moist, stiff, silty CLAY with trace very fine-grained sand.			
3A	18/24 *75%*	SS	*2-2* *2-2* N=4	23		*0.80*	4			436	
								Dark grayish brown (10YR4/2) with 5% dark yellowish brown (10YR4/6) mottles, moist, medium, silty CLAY with trace fine-grained sand.			
4A	16/24 *67%*	SS	*2-2* *2-2* N=4	22		*0.30*	6 ▼			434	
								Brown (10YR5/3) with 5% gray (10YR5/1) mottles, moist, soft, CLAY with very fine- to fine-grained sand.			
5A	18/24 *75%*	SS	*2-1* *3-2* N=4	31		*1.10*	8			432	
								Gray (10YR5/1) with 15% dark yellowish brown (10YR3/4) mottles, moist, stiff, silty CLAY with trace very fine- to fine-grained sand.			
6A	22/24 *92%*	SS	*1-1* *2-2* N=3	31		*0.50*	10			430	
							12 ▼	Gray (10YR5/1) with 15% dark yellowish brown (10YR3/4) mottles, moist, soft, silty CLAY with trace very fine- to fine-grained sand.			
7A	24/24 *100%*	SS	*2-2* *1-1* N=3	52		*0.20*				428	
							14	Gray (10YR5/1) with 10% yellowish brown (10YR5/6) mottles, moist, soft, silty CLAY with trace coarse-grained sand.			
8-1 5-2 8-3 8-4	24/24 *100%*	SH		32		*0.80*				426	
9A	24/24 *100%*	SS	*1-2* *2-4* N=4	32		*0.30*	16			424	
								Dark gray (10YR4/1), moist, medium, silty CLAY with trace very fine-grained sand.			
10A	18/24 *75%*	SS	*1-1* *3-14* N=4	39		*0.30*	18			422	
							20	Dark gray (10YR4/1), moist, hard, weathered SHALE.			

NOTE(S): AW-05 installed in bore hole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/22/2015
Finish: 7/22/2015
WEATHER: Sunny, warm, mid-70s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: AW-05
Well ID: AW-05
Surface Elev: 440.55 ft. MSL
Completion: 21.10 ft. BGS
Station: 1,432,339.67N
2,435,498.04E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 11, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 12.00 - during drilling
▼ = 6.62 - 7/22/15
▽ =

SAMPLE			TESTING						
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
	0/5 *0%*	☒ SS	*50/5"*					Dark gray (10YR4/1), moist, hard, weathered SHALE. *[Continued from previous page]*		420	

End of boring = 21.10 feet

NOTE(S): AW-05 installed in bore hole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/29/2015
Finish: 8/3/2015
WEATHER: Sunny, warm, hi-80s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: AW-06
Well ID: AW-06
Surface Elev: 459.19 ft. MSL
Completion: 42.25 ft. BGS
Station: 1,430,727.75N
2,434,495.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 14, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = Dry - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	24/24 100%	BD					0	GRAVEL FILL	458	sample from cuttings
2A	24/24 100%	BD		24			2	FILL - Dark gray (10YR4/1) and brown (10YR4/3), moist, medium, silty CLAY with trace medium- to coarse-grained sand.	456	
3A	14/24 58%	SS	4-6 29-23 N=35	23			4		454	
4A	21/24 88%	SS	14-18 21-26 N=39	29			6	FILL - Very dark gray (10YR3/1), moist, hard, FLY ASH.	452	
5A	20/24 83%	SS	7-7 6-4 N=13	37			8	FILL - Very dark gray (10YR3/1), moist, medium, FLY ASH.	450	
6A	18/24 75%	SS	1-1 3-3 N=4	26			10	FILL - Very dark gray (10YR3/1), moist, soft, FLY ASH.	448	
7A	17/24 71%	SS	2-3 4-5 N=7	22		1.30	12	FILL - Dark gray (10YR4/1), moist, medium, SILT and FLY ASH with few clay and trace coarse-grained sand and small gravel.	446	
8A	14/24 58%	SS	1-1 3-3 N=4	22		0.50	14		444	
9A	17/24 71%	SS	4-6 5-6 N=11	23		0.70	16	Gray (10YR5/1) and brown (10YR5/3), moist, medium, SILT with few clay and trace medium- to coarse-grained sand and roots.	442	
10A	22/24 92%	SS	2-2 3-4 N=5	21		1.30	18		440	
							20	Very dark grayish brown (10YR3/2), moist, stiff, silty CLAY with trace very fine- to fine-grained sand.		

NOTE(S): AW-06 installed in bore hole. Well was constructed using a pre-packed screen.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/29/2015
Finish: 8/3/2015
WEATHER: Sunny, warm, hi-80s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: AW-06
Well ID: AW-06
Surface Elev: 459.19 ft. MSL
Completion: 42.25 ft. BGS
Station: 1,430,727.75N
2,434,495.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 14, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = Dry - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
11-1											
11-2	12/24 *50%*	SH				*0.80*					
11-3											
11-4				20			22	Dark gray (10YR4/1) with 10% dark grayish brown (10YR4/2) mottles, moist, medium, SILT with little clay and trace very fine- to fine-grained sand.		438	
12A	18/24 *75%*	SS	*3-4 6-7* N=10	22		*0.80*					
							24			436	
13A	22/24 *92%*	SS	*3-2 3-3* N=5	24		*0.50*		Dark gray (10YR4/1), moist, medium, SILT with few to little clay and trace fine- to medium-grained sand, woody material and shell fragments.		434	
14-1							26				
14-2	16/24 *67%*	SH				*0.50*				432	
14-3											
14-4				31			28	Dark gray (10YR4/1), moist, medium, SILT with little clay and trace fine- to medium-grained sand and shell fragments.			
15A	20/24 *83%*	SS	*2-3 3-3* N=6	39		*0.80*				430	
	24/24 *100%*	BD					30				
16A										428	
17-1				29			32	Gray (10YR5/1) with 35% yellowish brown (10YR5/6) mottles, moist, stiff, silty CLAY with trace fine-grained sand.			
17-2	24/24 *100%*	SH									
17-3						*1.00*				426	
17-4							34				
18A	16/24 *67%*	SS	*0-3 3-3* N=6	32		*1.20*				424	
19-1							36	Dark gray (10YR4/1), moist, stiff, silty CLAY with trace very fine-grained sand and roots.			
19-2	16/24 *67%*	SH				*0.80*				422	
19-3											
19-4				34			38	Dark gray (10YR4/1) with 5% olive brown (2.5Y4/3) mottles, moist, stiff, silty CLAY with trace fine- to coarse-grained sand and small gravel, trace roots.			
20A	20/24 *83%*	SS	*2-5 6-6* N=11	29						420	
							40	Gray (10YR4/1) with 15% olive brown (2.5Y4/3) mottles,			

NOTE(S): AW-06 installed in bore hole. Well was constructed using a pre-packed screen.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/29/2015
Finish: 8/3/2015
WEATHER: Sunny, warm, hi-80s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: AW-06
Well ID: AW-06
Surface Elev: 459.19 ft. MSL
Completion: 42.25 ft. BGS
Station: 1,430,727.75N
2,434,495.33E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 14, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = Dry - during drilling
▼ =
▽ =

SAMPLE			TESTING					
Number	Recov / Total (in) *% Recovery*	Type	*Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description
21A	4/4 *100%*	☒ SS	*50/4"*	14				moist, stiff, weathered SHALE, slightly laminated.
22A	3/3 *100%*	☒ SS	*50/3"*	13			42	Dark gray (10YR4/1), moist, hard, weathered SHALE.

Borehole Detail: 418

End of boring = 42.25 feet

NOTE(S): AW-06 installed in bore hole. Well was constructed using a pre-packed screen.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/20/2015
Finish: 7/21/2015
WEATHER: Sunny, warm, hi-70s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: AW-08
Well ID: AW-08
Surface Elev: 460.66 ft. MSL
Completion: 57.67 ft. BGS
Station: 1,430,641.18N
2,436,732.68E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 14, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 30.00 - during drilling
▼ = 10.58 - 7/21/15
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL
1A	16/24 67%	SS	4-3 5-7 N=8	15		3.30	0	FILL - Very dark grayish brown (10YR3/2), moist, medium, clayey SILT with trace fine- to coarse-grained sand, trace small gravel.	460
2A	16/24 67%	SS	4-3 3-4 N=6	25		3.00	2	FILL - Gray (10YR5/1), moist, medium, SILT with little clay, trace fine- to coarse-grained sand, trace small gravel.	458
3A	17/24 71%	SS	1-2 1-2 N=3	16		2.50	4	Very dark gray (10YR3/1), moist, soft, silty CLAY with trace fine-grained sand.	456
4A	19/24 79%	SS	5-6 6-6 N=12	22		1.30	6	Gray (10YR5/1) with 30% dark yellowish brown (10YR4/6) mottles, moist, stiff, silty CLAY with trace fine-grained sand.	454
5A	21/24 88%	SS	1-2 2-2 N=4	28		2.30	8		452
6A	24/24 100%	SS	1-2 2-3 N=4	37		0.80	10 ▼	Dark gray (10YR4/1) with 15% dark brown (10YR3/3) mottles, moist, soft, silty CLAY with trace fine-grained sand.	450
7A	21/24 88%	SS	3-3 4-4 N=7	27		0.80	12		448
8-1 8-2 8-3	8/24 33%	SH					14	Dark gray (10YR4/1) with 5% dark yellowish brown (10YR4/6) mottles, moist, medium, very fine- to fine-grained sandy CLAY.	446
8-4				24		0.80	16		
9A	22/24 92%	SS	2-2 3-4 N=5	30		0.80	18	Dark gray (10YR4/1) with 5% dark yellowish brown (10YR4/6) mottles, moist, medium, very fine- to fine-grained sandy CLAY with trace very fine- to fine-grained sand seams (wet).	444
10A	22/24 92%	SS	2-1 2-1 N=3	42		0.30	20	Dark gray (N4/0), moist, soft, SILT with few clay and slight trace shell fragments.	442

NOTE(S): AW-08 installed in bore hole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/20/2015
Finish: 7/21/2015
WEATHER: Sunny, warm, hi-70s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: AW-08
Well ID: AW-08
Surface Elev: 460.66 ft. MSL
Completion: 57.67 ft. BGS
Station: 1,430,641.18N
2,436,732.68E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 14, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 30.00 - during drilling
▼ = 10.58 - 7/21/15
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
11-1											
11-2	18/24 75%	SH						Dark gray (10YR4/1), moist, stiff, SILT with trace clay and trace shell fragments.		440	
11-3											
11-4				25		1.30	22				
12A	24/24 100%	SS	5-7 14-15 N=21	18		3.30		Dark gray (10YR4/1), moist, very stiff, SILT with few clay, trace medium- to coarse-grained sand, slight trace shell fragments.		438	
13A	24/24 100%	SS	2-3 4-4 N=7	32		1.50	24	Dark gray (10YR4/1), moist, stiff, SILT with few clay and slight trace very fine- to fine-grained sand.		436	
14A	24/24 100%	SS	6-7 7-8 N=14	28		1.20	26			434	
15A	22/24 92%	SS	1-2 3-3 N=5	27		1.30	28			432	
16A	24/24 100%	SS	1-2 2-2 N=4	29		1.20	▼ 30	Dark gray (10YR4/1) with 5% yellowish brown (10YR5/4) mottles, moist, stiff, SILT with few clay and trace fine- to medium-grained sand.		430	
17A	24/24 100%	SS	3-4 6-7 N=10	29		1.60	32			428	
18A	24/24 100%	SS	2-2 2-4 N=4	32		0.80	34			426	
19A	24/24 100%	SS	4-4 5-6 N=9	28		1.00	36	Gray (10YR5/1) with 35% dark yellowish brown (10YR4/4) mottles, moist, medium, SILT with few clay and trace very fine- to fine-grained sand.		424	
20A	24/24 100%	SS	1-1 1-2 N=2	30		0.70	38			422	
							40	Grayish brown (10YR5/2) with 25% yellowish brown (10YR5/4) mottles, moist, medium, SILT with few clay and trace very fine-grained sand.			

NOTE(S): AW-08 installed in bore hole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/20/2015
Finish: 7/21/2015
WEATHER: Sunny, warm, hi-70s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: AW-08
Well ID: AW-08
Surface Elev: 460.66 ft. MSL
Completion: 57.67 ft. BGS
Station: 1,430,641.18N
2,436,732.68E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 14, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 30.00 - during drilling
▼ = 10.58 - 7/21/15
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
21A	24/24 100%	ss	0-0 2-2 N=2	28		0.30	42	Dark gray (10YR4/1) and dark yellowish brown (10YR4/4), moist, soft, SILT with few clay and trace very fine-grained sand.		420	
22A	24/24 100%	ss	3-2 3-3 N=5	27		0.20	44			418	
23A	24/24 100%	ss	3-3 4-4 N=7	41		0.50	46			416	
24A	24/24 100%	ss	4-5 4-4 N=9	41		0.30	48	Dark gray (10YR4/1), moist, very soft to medium, SILT with few clay and trace very fine-grained sand and shell fragments.		414	
25A	24/24 100%	ss	0-0 3-3 N=3	48		0.20	50			412	
26A	24/24 100%	ss	2-2 3-3 N=5	43		0.30	52			410	
27A	24/24 100%	ss	3-3 4-5 N=7	60		0.50	54			408	
28A	24/24 100%	ss	2-4 8-10 N=12	29		1.00	56	Gray (10YR5/1), moist, stiff, very fine-grained sandy SILT, little clay.		406	
29A	11/24 46%	ss	23-50/5"	20				Gray (10YR5/1), moist, hard, weathered SHALE.		404	

End of boring = 57.67 feet

NOTE(S): AW-08 installed in bore hole.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/29/2015
Finish: 8/3/2015
WEATHER: Sunny, warm, lo-80s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: AW-09
Well ID: AW-09
Surface Elev: 458.32 ft. MSL
Completion: 52.23 ft. BGS
Station: 1,429,340.11N
2,434,856.97E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 14, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = Dry - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
	24/24 100%	BD					0	GRAVEL FILL	458	
							2			Sample from cuttings
2A	24/24 100%	BD		23				FILL - Dark gray (10YR4/1), very moist, SILT with few clay and gravel.	456	
							4	FILL - Yellowish brown (10YR5/4), moist, medium, silty CLAY with trace fine- to coarse-grained sand.	454	
3A	21/24 88%	SS	1-3 6-9 N=9	29		0.50		FILL - Very dark gray (10YR3/1), moist, stiff, FLY ASH.		
							6		452	
4A	19/24 79%	SS	10-13 14-15 N=27	28						
							8		450	
5A	22/24 92%	SS	5-5 5-5 N=10	36						
							10		448	
6A	18/24 75%	SS	2-3 3-2 N=6	36						
							12	FILL - Very dark gray (10YR3/1), moist, medium, FLY ASH.	446	
7A	20/24 83%	SS	3-4 7-9 N=11	32						
							14		444	
8A	21/24 88%	SS	2-3 4-4 N=7	37						
							16		442	
9A	22/24 92%	SS	3-5 4-3 N=9	38						
							18	Very dark gray (10YR3/1), moist, medium, SILT with few clay and trace very fine - to fine-grained sand.	440	
10A	15/24 63%	SS	2-2 4-4 N=6	26		1.50		Dark gray (10YR4/1) with 35% yellowish brown (10YR5/6) mottles, moist, medium, SILT with few clay, trace very fine- to fine-grained sand and organics.		
							20			

NOTE(S): AW-09 installed in bore hole. Well was constructed using a pre-packed screen.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/29/2015
Finish: 8/3/2015
WEATHER: Sunny, warm, lo-80s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: AW-09
Well ID: AW-09
Surface Elev: 458.32 ft. MSL
Completion: 52.23 ft. BGS
Station: 1,429,340.11N
2,434,856.97E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 14, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = Dry - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Elevation ft. MSL	Remarks
11A	16/24 67%	SS	1-2 4-5 N=6	24		2.30	0	Grayish brown (10YR5/2), moist, medium, SILT with little clay, trace coarse-grained sand and roots.	438	
12A	18/24 75%	SS	7-9 9-9 N=18	26		1.80	22	Gray (10YR5/1) with 25% yellowish brown (10YR5/6) mottles, moist, stiff, silty CLAY with trace fine-grained sand.	436	
13-1						1.80	24		434	
13-2	21/24 88%	SH						Very dark gray (10YR3/1), moist, stiff, SILT with few clay and trace very fine- to fine-grained sand.		
13-3						1.80				
13-4				28			26		432	
14A	19/24 79%	SS	6-6 5-6 N=11	28		0.50		Dark gray (10YR4/1) with 20% very dark grayish brown (10YR3/2) mottles, moist, medium, SILT with few clay and trace very fine- to fine-grained sand.		
15A	22/24 92%	SS	1-3 3-4 N=6	25		1.30	28		430	
16-1								Gray (10YR5/1) with 30% dark yellowish brown (10YR4/4) mottles, moist, stiff, SILT with few clay and trace very fine- to fine-grained sand, woody material and shell fragments.		
16-2	18/24 75%	SH				1.30				
16-3										
16-4				40			32		428	
17A	24/24 100%	SS	1-1 3-4 N=4	31		0.80		Gray (10YR5/1) with 30% dark yellowish brown (10YR4/4) mottles, moist, medium, SILT with few clay and trace very fine- to fine-grained sand and woody material.		
18-1						0.80	34		426	
18-2	24/24 100%	SH				0.80				
18-3						0.80				
18-4				32			36	Dark gray (10YR4/1), moist, medium, SILT with little clay and trace very fine-grained sand.	424	
19A	24/24 100%	SS	1-2 3-3 N=5	36		0.70				
20A	13/24 54%	SS	3-3 3-3 N=6	34		0.50	38	Dark gray (10YR4/1), moist, medium to stiff, SILT with little clay and trace very fine-grained sand and shell fragments.	422	
							40		420	

NOTE(S): AW-09 installed in bore hole. Well was constructed using a pre-packed screen.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/29/2015
Finish: 8/3/2015
WEATHER: Sunny, warm, lo-80s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: AW-09
Well ID: AW-09
Surface Elev: 458.32 ft. MSL
Completion: 52.23 ft. BGS
Station: 1,429,340.11N
2,434,856.97E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 14, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = Dry - during drilling
▼ =
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
21-1											
21-2	16/24 *67%*	SH				*1.30*					
21-3											
21-4				40			42			418	
22A	20/24 *83%*	SS	*3-4* 5-5 N=9	52		*0.80*				416	
	24/24 *100%*	SS	*2-3* *3-4* N=6				44	Dark gray (10YR4/1), moist, medium to stiff, SILT with little clay and trace very fine-grained sand and shell fragments. *[Continued from previous page]*		414	
23A				81		*0.80*					
24-1							46			412	
24-2	24/24 *100%*	SH									
24-3						*1.00*					
24-4				77			48			410	
	24/24 *100%*	SS	*1-3* *3-5* N=6								
25A				41		*0.80*					
26-1	11/12 *92%*	SH				*0.50*	50			408	
26-2				13				Dark gray (10YR4/1), moist, hard, weathered SHALE.			
26A	9/12 *75%*	SS	*50-50/3"*								
27A	2/2 *100%*	SS	*50/2"*	14			52				

End of boring = 52.23 feet

NOTE(S): AW-09 installed in bore hole. Well was constructed using a pre-packed screen.

FIELD BORING LOG

HANSON

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/23/2015
Finish: 7/23/2015
WEATHER: Sunny, warm, calm, mid-70s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: AW-10
Well ID: AW-10
Surface Elev: 437.64 ft. MSL
Completion: 32.74 ft. BGS
Station: 1,429,461.05N
2,436,231.40E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 14, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 7.00 - during drilling
▼ = 6.68 - 7/23/15
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
1A	16/24 67%	ss	6-5 5-5 N=10	25			0	Very dark grayish brown (10YR3/2), moist, very stiff, SILT with few clay and trace very fine- to fine-grained sand and roots.		436	
2A	20/24 83%	ss	2-2 2-3 N=4	30		1.50	2				
3A	15/24 63%	ss	1-1 3-3 N=4	25		2.30	4	Very dark gray (10YR3/1) with 3% dark yellowish brown (10YR4/4) mottles, moist, stiff , silty CLAY with trace very fine- to fine-grained sand.		434	
4A	16/24 67%	ss	4-3 4-3 N=7	29		1.00	6			432	
5A	19/24 79%	ss	1-1 2-2 N=3	29		0.80	8	Gray (10YR5/1) with 5% dark gray (10YR4/1) and 5% dark yellowish brown (10YR4/4) mottles, moist, medium, silty CLAY with trace fine-grained sand.		430	
6A	24/24 100%	ss	1-1 1-2 N=2	45		0.80	10			428	
7A	24/24 100%	ss	2-2 2-3 N=4	43		0.30	12	Dark gray (10YR4/1) with 5% dark yellowish brown (10YR4/4) mottles, moist, medium, SILT with few clay and trace very fine- to fine-grained sand.		426	
8A	24/24 100%	ss	1-1 1-1 N=2	55		0.30	14	Dark gray (10YR4/1), moist, soft, SILT with few clay and trace very fine-grained sand and shell fragments.		424	
9A	24/24 100%	ss	2-2 2-3 N=4	41		0.50	16			422	
10A	24/24 100%	ss	1-1 1-1 N=2	34		0.30	18	Dark gray (10YR4/1), moist, soft, SILT with few clay and trace very fine-grained sand, shell fragments, and woody fragments.		420	
							20			418	

NOTE(S): AW-10 installed in bore hole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/23/2015
Finish: 7/23/2015
WEATHER: Sunny, warm, calm, mid-70s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: S. Keim

BOREHOLE ID: AW-10
Well ID: AW-10
Surface Elev: 437.64 ft. MSL
Completion: 32.74 ft. BGS
Station: 1,429,461.05N
2,436,231.40E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 14, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 7.00 - during drilling
▼ = 6.68 - 7/23/15
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
11A	24/24 100%	SS	0-0 1-1 N=1	57		0.30					
12A	24/24 100%	SS	2-1 1-2 N=2	58		0.30	22			416	
13-1							24			414	
13-2	24/24 100%	SH						Dark gray (10YR4/1), moist, soft, SILT with few clay and trace very fine-grained sand, shell fragments, and woody fragments. *[Continued from previous page]*			
13-3											
13-4				89		0.80	26			412	
14A	24/24 100%	SS	1-1 2-2 N=3	100		0.30				410	
15A	24/24 100%	SS	0-1 2-1 N=3	56		0.50	28			408	
16A	24/24 100%	SS	0-6 6-9 N=12	26		1.80	30				
17A	9/9 100%	SS	33-50/6"	18			32	Gray (10YR5/1), moist, hard, weathered SHALE.		406	

End of boring = 32.74 feet

NOTE(S): AW-10 installed in bore hole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/24/2015
Finish: 7/28/2015
WEATHER: Sunny, warm, mid-70s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: AW-11
Well ID: AW-11
Surface Elev: 437.16 ft. MSL
Completion: 30.00 ft. BGS
Station: 1,428,196.31N
2,436,251.05E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 14, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 9.00 - during drilling
▼ = 5.77 - 7/27/15
▽ =

SAMPLE Number	Recov / Total (in) % Recovery	Type	TESTING Blows / 6 in N - Value RQD	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) Qp (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
1	10/24 *42%*	SS	*3-4 4-5* N=8	23		*2.80*		FILL - Black (10YR2/1), moist, medium, CLAY with some silt and trace sand and small gravel.		436	
2	13/24 *54%*	SS	*2-2 2-2* N=4	26		*0.80*	2	Very dark gray (10YR3/1) with 20% dark yellowish brown (10YR4/6) mottles, moist, soft, CLAY with some silt and trace sand.		434	
3	10/24 *42%*	SS	*1-1 2-1* N=3	25		*1.30*	4	Gray (10YR5/1) with 30% yellowish brown (10YR5/6) mottles, moist, soft, CLAY swith some silt and trace very fine-grained sand.		432	
4	14/24 *58%*	SS	*1-2 2-1* N=4	28		*0.50*	6 ▼	Very dark gray (10YR3/1), wet, very soft, SILT with few clay and trace very fine-grained sand.		430	
5-1							8				
5-2	24/24 *100%*	SH					▼			428	
5-3						*0.80*					
5-4				40			10	Gray (10YR5/1) with 10% yellowish brown (10YR5/6) mottles, moist, soft, SILT with few clay and trace very fine-grained sand.			
6	20/24 *83%*	SS	*1-1 1-1* N=2	53		*0.30*				426	
7	24/24 *100%*	SS	*2-2 2-2* N=4	66		*0.30*	12	Gray (10YR5/1), moist, soft, SILT with few clay and trace very fine-grained sand.		424	
8	24/24 *100%*	SS	*1-1 1-1* N=2	50		*0.30*	14			422	
9	24/24 *100%*	SS	*1-1 1-1* N=2	56		*0.00*	16	Gray (10YR5/1), moist, soft, SILT with few clay and trace very fine-grained sand, shell fragments and woody fragments.		420	
10	24/24 *100%*	SS	*woh-1 1-1* N=2	61		*0.50*	18			418	
							20				

NOTE(S): AW-11 installed in bore hole.

FIELD BORING LOG

CLIENT: Natural Resource Technology, Inc.
Site: Edwards Power Station
Location: Bartonville, Illinois
Project: 15E0030
DATES: **Start:** 7/24/2015
Finish: 7/28/2015
WEATHER: Sunny, warm, mid-70s

CONTRACTOR: Ramsey Geotechnical Engineering, LLC
Rig mfg/model: Diedrich D-50
Drilling Method: 4 ¼" HSA, split spoon sampler
FIELD STAFF: **Driller:** B. Williamson
Helper: D. Crump
Eng/Geo: R. Hasenyager

BOREHOLE ID: AW-11
Well ID: AW-11
Surface Elev: 437.16 ft. MSL
Completion: 30.00 ft. BGS
Station: 1,428,196.31N
2,436,251.05E

TOPOGRAPHIC MAP INFORMATION:
Quadrangle: Pekin Quadrangle (7½' series)
Township: Hollis Township
Section 14, **Tier** 7N; **Range** 7E

WATER LEVEL INFORMATION:
▼ = 9.00 - during drilling
▼ = 5.77 - 7/27/15
▽ =

SAMPLE Number	Recov / Total (in) *% Recovery*	Type	TESTING *Blows / 6 in* N - Value **RQD**	Moisture (%)	Dry Den. (lb/ft³)	Qu (tsf) *Qp* (tsf) Failure Type	Depth ft. BGS	Lithologic Description	Borehole Detail	Elevation ft. MSL	Remarks
11	22/24 *92%*	ss	*woh-woh* *1-1*	61		*0.20*	22			416	
12	24/24 *100%*	ss	*1-1* *1-1* N=2	86		*0.50*	24	Gray (10YR5/1), moist, soft, SILT with few clay and trace very fine-grained sand, shell fragments and woody fragments. *[Continued from previous page]*		414	
13	24/24 *100%*	ss	*1-1* *2-1* N=3	84		*0.50*	26			412	
14A	22/24 *92%*	ss	*2-3* *5-11* N=8	36		*0.50*				410	
14B				11			28	Gray (10YR5/1), wet, loose, very fine- to very coarse-grained SAND with some small to medium gravel.			
15A				83				Gray (10YR5/1), moist, soft, SILT with few clay and trace very fine-grained sand, shell fragments and woody fragments.		408	
15B	24/24 *100%*	ss	*3-39* *27-62* N=66	16				Gray (10YR5/1), wet, loose, medium- to very coarse-grained SAND.			
							30	Gray (10YR5/1), moist, hard, weathered SHALE.			

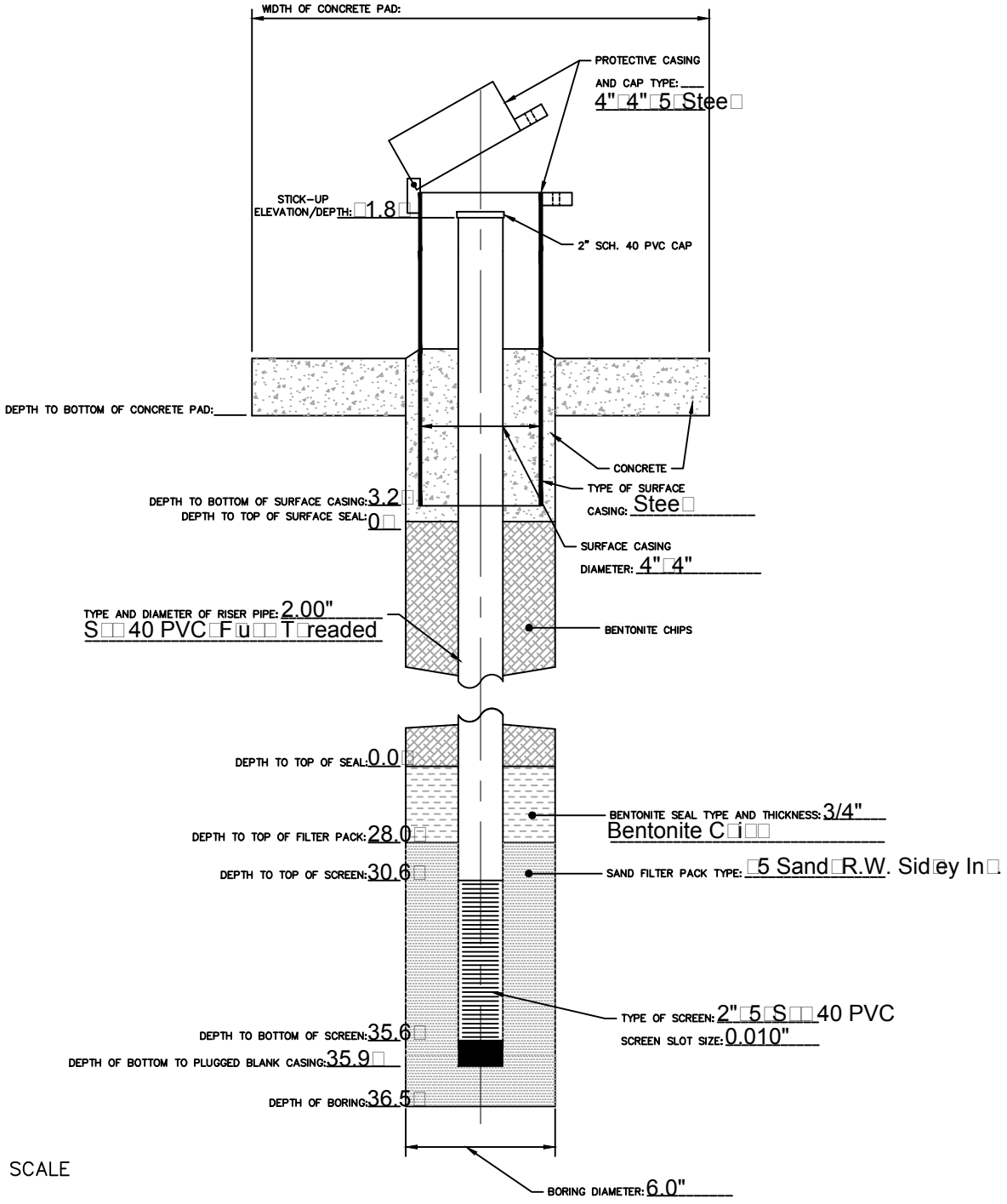
End of boring = 30.00 feet

NOTE(S): AW-11 installed in bore hole.

PRE-2021 PIEZOMETER AND WELL CONSTRUCTION LOGS

Project: Dynegy Project Location: Pe□in, IL Project Number: 60440202	Log of Piezometer Sheet 1 of 1

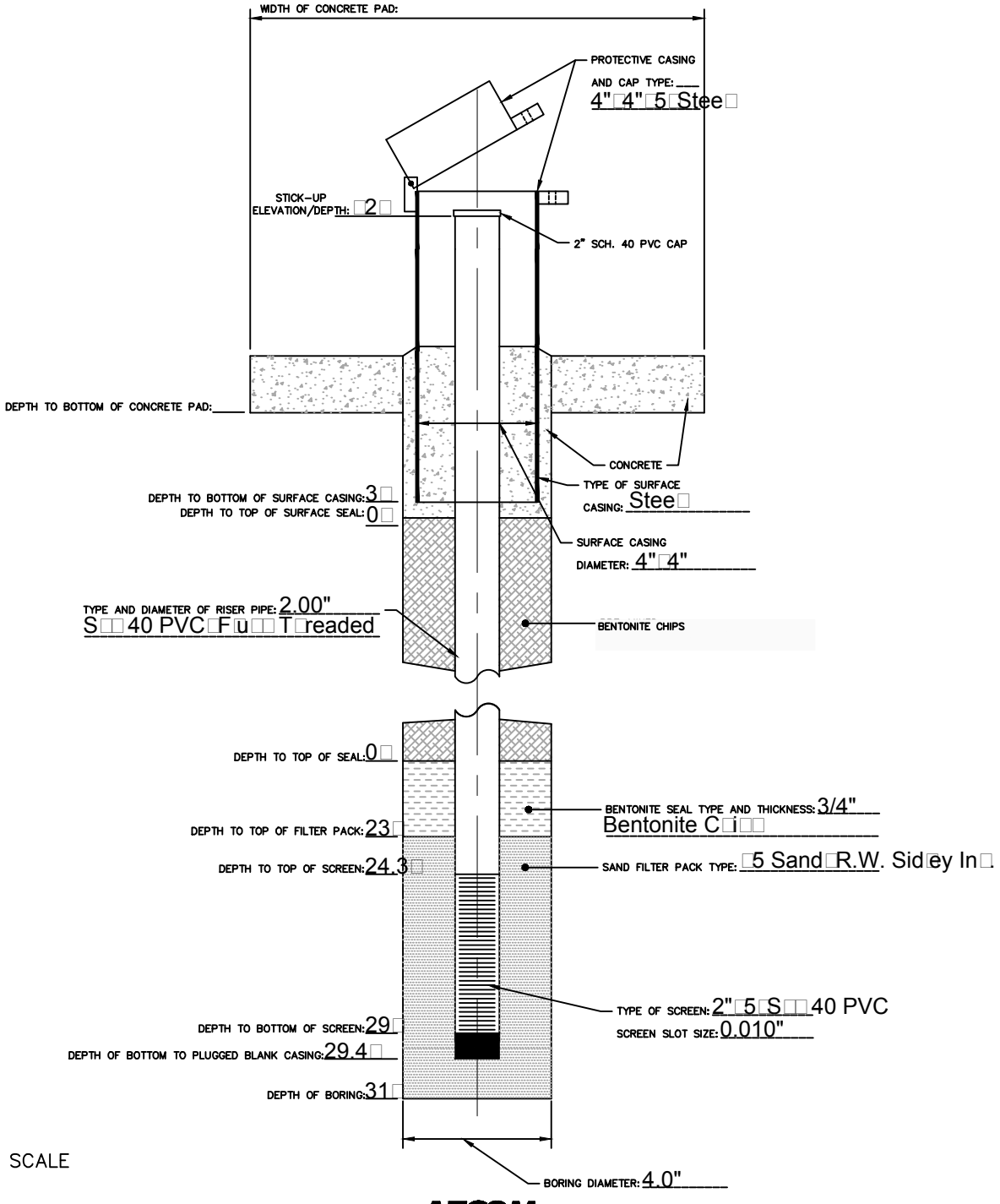
Piezometer Location	EDW-P001	Date Installed	11/05/15	Time	5:30 P.M.
Installed By	Jo□□ Ko□n	Observed By	R. We□e□a□	Total Depth	36.5□
Method of Installation	6" Mud Rotary	Drilling Contractor	Strata	Surface Elevation	
Screened Interval	30.6-35.6□	Completion Zone			
Remarks		Groundwater Level(s)	24.64□ro□ to□o□□a□in□		



AECOM

Project: Dynegy Project Location: Pe□in, IL Project Number: 60440202	Log of Piezometer Sheet 1 of 1

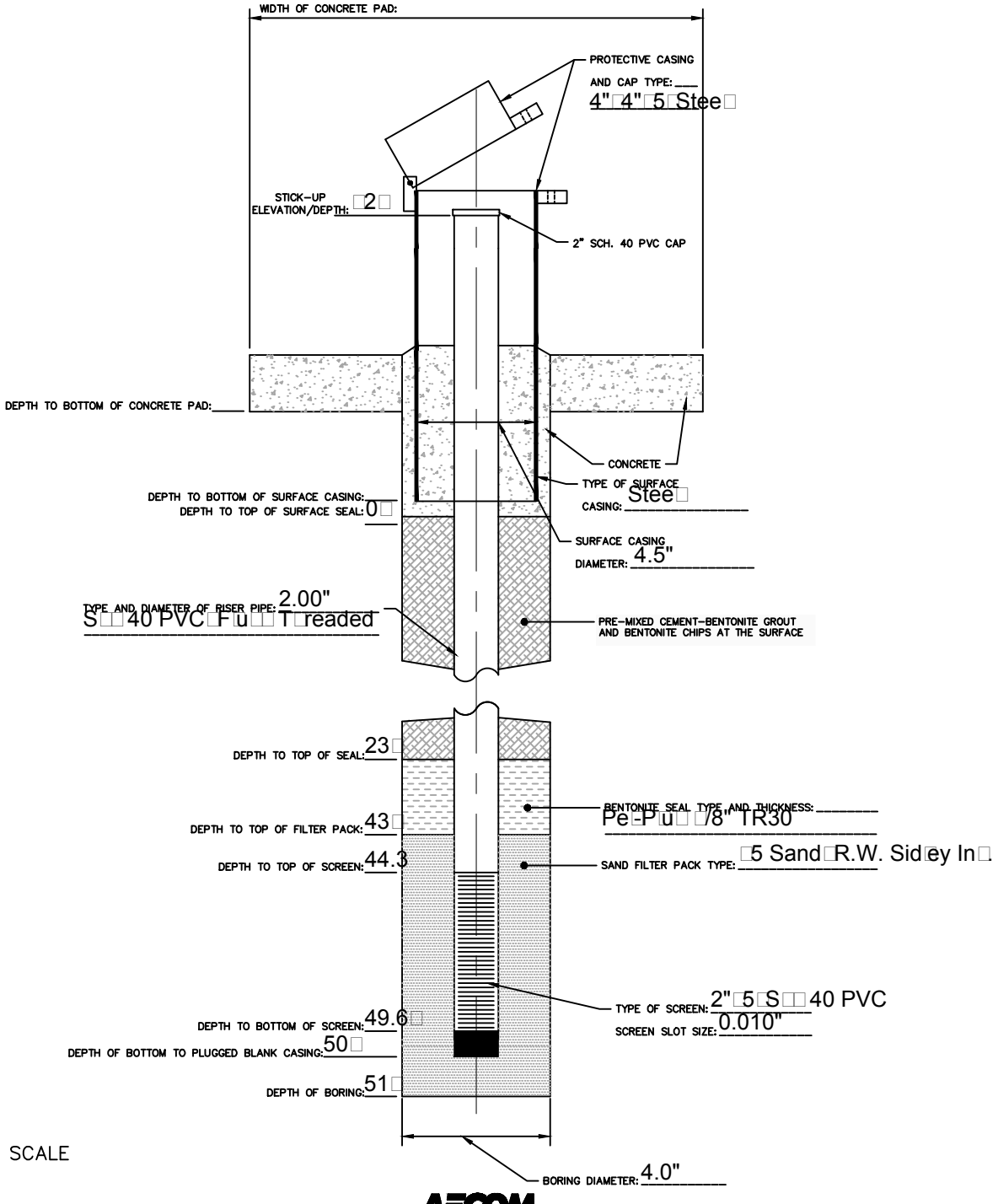
Piezometer Location	EDW-P002	Date Installed	09/04/15	Time	11:00-12:00 P.M.
Installed By	S□ott Ko□en	Observed By	N. Sei□er	Total Depth	31□
Method of Installation	4" Po□er Au□er	Drilling Contractor	Strata	Surface Elevation	
Screened Interval	24-29□	Completion Zone			
Remarks		Groundwater Level(s)	29□A□ter Dri□in□		



AECOM

Project: Dynegy Project Location: Pe□in, IL Project Number: 60440202	Log of Piezometer Sheet 1 of 1

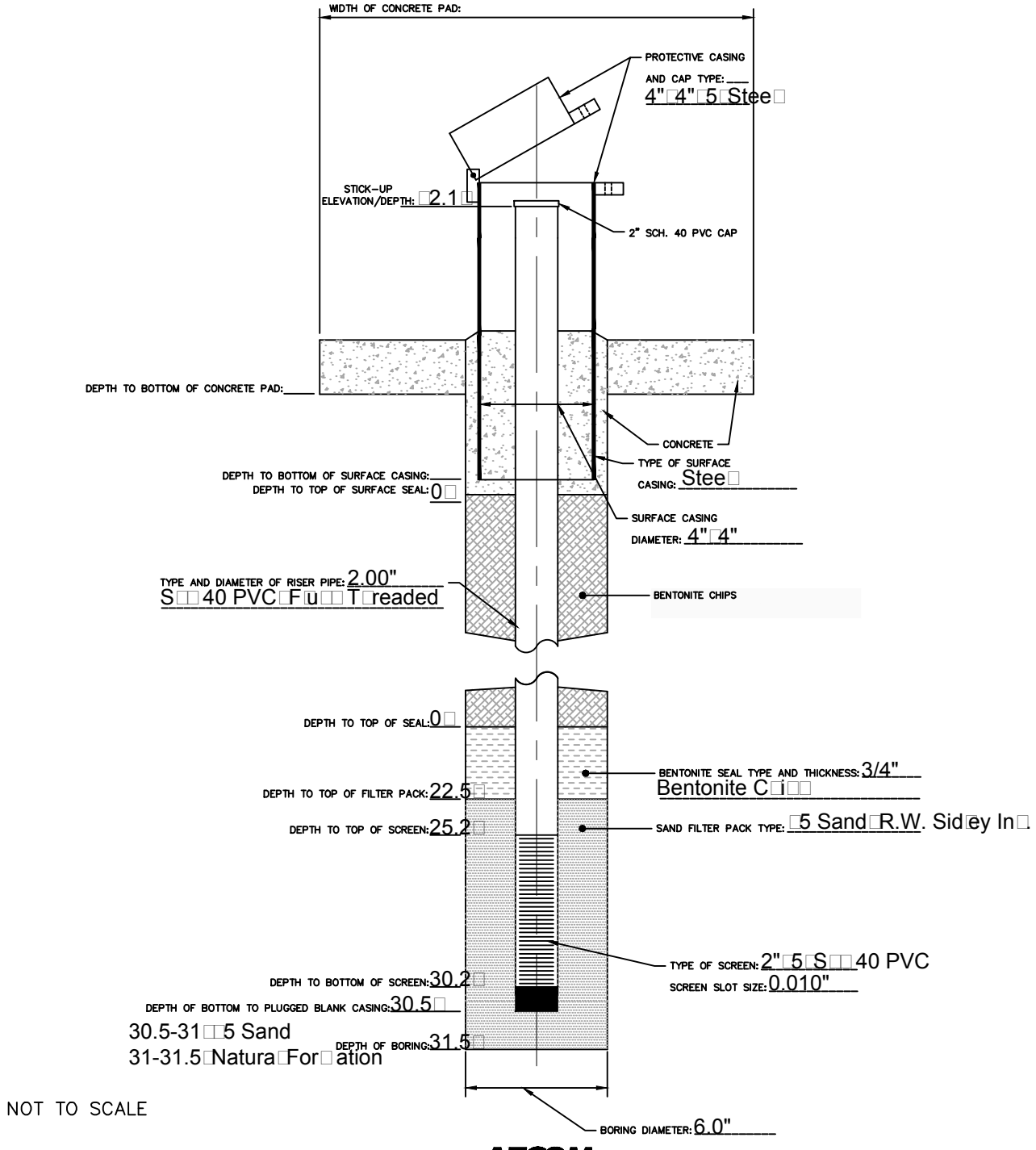
Piezometer Location	EDW-P003	Date Installed	09/04/15	Time	3:30-6:00 P.M.
Installed By	S□ott Ko□en	Observed By	N. Sei□er	Total Depth	51□
Method of Installation	3 7/8" Ro□□ Bit	Drilling Contractor	Strata	Surface Elevation	
Screened Interval	44.3-49.6□	Completion Zone			
Remarks		Groundwater Level(s)			



AECOM

Project: Dynegy Project Location: Pe□in, IL Project Number: 60440202	Log of Piezometer Sheet 1 of 1

Piezometer Location	EDW-P004	Date Installed	11/04/15	Time	12:00
Installed By	Jo□□ Ko□n	Observed By	R. We□e□a□	Total Depth	31.5□
Method of Installation	6" Mud Rotary	Drilling Contractor	Strata	Surface Elevation	
Screened Interval	25.2-30.2□	Completion Zone			
Remarks		Groundwater Level(s)	14.85 Fro□ To□o□Ca□in□		



AECOM

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Peoria Well #: AP05D

Site Name: Edwards Power Station Borehole #: AP05D

State Plane Coordinate: X 2,436,749.2 Y 1,432,401.8 (or) Latitude: 40° 35' 55.667" Longitude: -89° 39' 42.842"

Surveyed By: Andrew D. Canopy IL Registration #: 035-003391

Drilling Contractor: Bulldog Drilling, Inc. Driller: C. Dutton

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: NX Rock Core Drilling Fluid (Type): Water

Logged By: Rhonald W. Hasenyager Date Started: 11/28/2016 Date Finished: 12/5/2016

Report Form Completed By: Rhonald W. Hasenyager Date: 1/12/2017

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite

Installation Method: Tremie

Setting Time: +24 hr

Type of Bentonite Seal -- (Granular) Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 15.5 hrs.

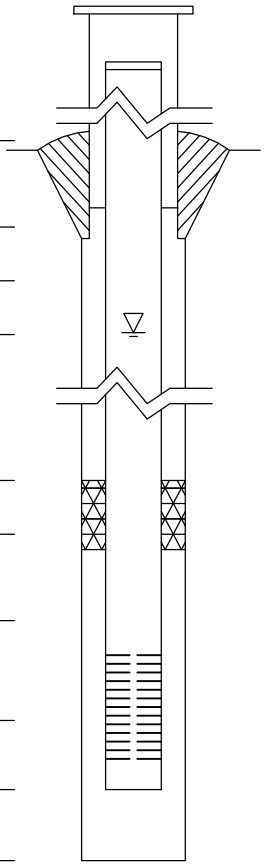
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: Filter sand (if applicable)

Installation Method: Gravity



Elevations (MSL)*	Depths (BGS) (0.01 ft.)	
443.85	-2.62	Top of Protective Casing
443.45	-2.22	Top of Riser Pipe
441.23	0.00	Ground Surface
441.23	0.00	Top of Annular Sealant
427.89	13.34	Static Water Level (After Completion) 1/18/2017
398.03	43.20	Top of Seal
395.83	45.40	Top of Sand Pack
394.14	47.09	Top of Screen
384.54	56.69	Bottom of Screen
384.06	57.17	Bottom of Well
382.93	58.30	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	6.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	49.32
Bottom of Screen to End Cap	(feet)	0.47
Screen Length (1st slot to last slot)	(feet)	9.60
Total Length of Casing	(feet)	59.39
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Peoria Well #: AP05S

Site Name: Edwards Power Station Borehole #: AP05S

State Plane Coordinate: X 2,436,746.6 Y 1,432,405.6 (or) Latitude: 40° 35' 55.705" Longitude: -89° 39' 42.875"

Surveyed By: Andrew D. Canopy IL Registration #: 035-003391

Drilling Contractor: Bulldog Drilling, Inc. Driller: C. Dutton

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): _____

Logged By: Rhonald W. Hasenyager Date Started: 11/28/2016 Date Finished: 11/29/2016

Report Form Completed By: Rhonald W. Hasenyager Date: 1/12/2017

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite

Installation Method: Tremie

Setting Time: +24 hr

Type of Bentonite Seal -- (Granular) Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 55 min.

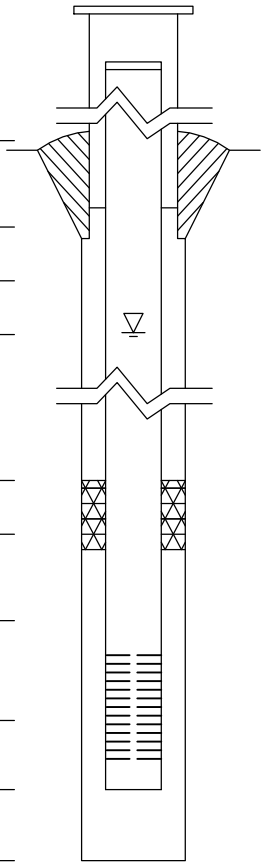
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS) (0.01 ft.)	
443.92	-2.79	Top of Protective Casing
443.53	-2.40	Top of Riser Pipe
441.13	0.00	Ground Surface
441.13	0.00	Top of Annular Sealant
435.90	5.23	Static Water Level (After Completion) 1/18/2017
411.02	30.11	Top of Seal
409.98	31.15	Top of Sand Pack
408.26	32.87	Top of Screen
403.49	37.64	Bottom of Screen
403.07	38.06	Bottom of Well
403.07	38.06	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	35.26
Bottom of Screen to End Cap	(feet)	0.42
Screen Length (1st slot to last slot)	(feet)	4.78
Total Length of Casing	(feet)	40.46
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Peoria Well #: AP06

Site Name: Edwards Power Station Borehole #: AP06

State Plane Coordinate: X 2,436,506.2 Y 1,433,216.9 (or) Latitude: 40° 36' 3.736" Longitude: -89° 39' 45.931"

Surveyed By: Andrew D. Canopy IL Registration #: 035-003391

Drilling Contractor: Bulldog Drilling, Inc. Driller: C. Dutton

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): _____

Logged By: Scot E. Collins Date Started: 11/30/2016 Date Finished: 11/30/2016

Report Form Completed By: Rhonald W. Hasenyager Date: 1/12/2017

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite

Installation Method: Tremie

Setting Time: +24 hr

Type of Bentonite Seal -- (Granular) Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 30 min

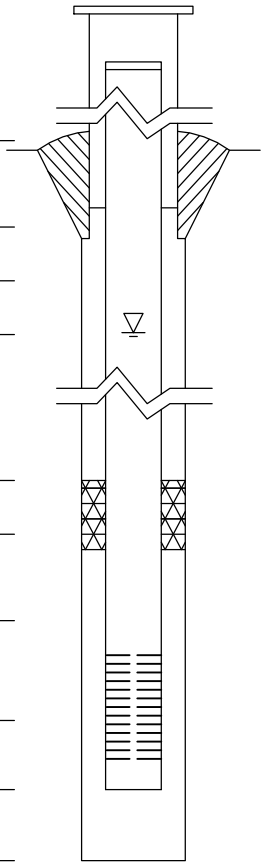
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS) (0.01 ft.)	
442.35	-2.82	Top of Protective Casing
442.17	-2.64	Top of Riser Pipe
439.53	0.00	Ground Surface
439.53	0.00	Top of Annular Sealant
434.58	4.95	Static Water Level (After Completion) 1/18/2017
422.63	16.90	Top of Seal
421.63	17.90	Top of Sand Pack
419.60	19.93	Top of Screen
414.81	24.72	Bottom of Screen
414.53	25.00	Bottom of Well
414.53	25.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	22.57
Bottom of Screen to End Cap	(feet)	0.28
Screen Length (1st slot to last slot)	(feet)	4.79
Total Length of Casing	(feet)	27.64
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Peoria Well #: AP07D

Site Name: Edwards Power Station Borehole #: AP07D

State Plane Coordinate: X 2,435,355.4 Y 1,432,082.3 (or) Latitude: 40° 35' 52.589" Longitude: -89° 40' 0.934"

Surveyed By: Andrew D. Canopy IL Registration #: 035-003391

Drilling Contractor: Bulldog Drilling, Inc. Driller: C. Dutton

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: NX Rock Core Drilling Fluid (Type): Water

Logged By: Scot E. Collins Date Started: 12/1/2016 Date Finished: 12/8/2016

Report Form Completed By: Rhonald W. Hasenyager Date: 1/12/2017

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite

Installation Method: Tremie

Setting Time: +24 hr

Type of Bentonite Seal -- (Granular) Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 60 min.

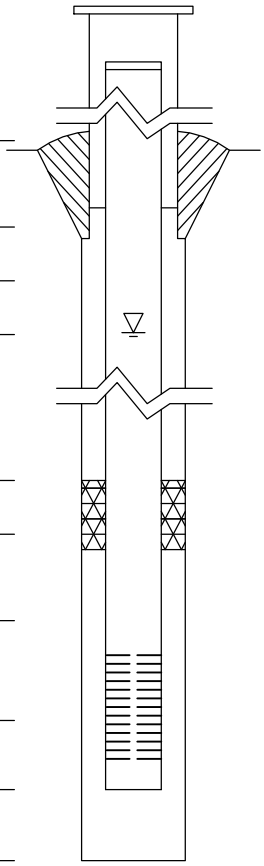
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS) (0.01 ft.)	
461.22	-2.80	Top of Protective Casing
460.89	-2.47	Top of Riser Pipe
458.42	0.00	Ground Surface
458.42	0.00	Top of Annular Sealant
405.76	52.66	Static Water Level (After Completion) 1/18/2017
418.62	39.80	Top of Seal
405.62	52.80	Top of Sand Pack
403.41	55.01	Top of Screen
393.83	64.59	Bottom of Screen
393.42	65.00	Bottom of Well
393.42	65.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	6.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	57.48
Bottom of Screen to End Cap	(feet)	0.41
Screen Length (1st slot to last slot)	(feet)	9.58
Total Length of Casing	(feet)	67.47
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Peoria Well #: AP07S

Site Name: Edwards Power Station Borehole #: AP07S

State Plane Coordinate: X 2,435,357.3 Y 1,432,078.1 (or) Latitude: 40° 35' 52.547" Longitude: -89° 40' 0.909"

Surveyed By: Andrew D. Canopy IL Registration #: 035-003391

Drilling Contractor: Bulldog Drilling, Inc. Driller: C. Dutton

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): _____

Logged By: Scot E. Collins Date Started: 12/2/2016 Date Finished: 12/2/2016

Report Form Completed By: Rhonald W. Hasenyager Date: 1/12/2017

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite

Installation Method: Tremie

Setting Time: +24 hr

Type of Bentonite Seal -- (Granular) Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 33 min.

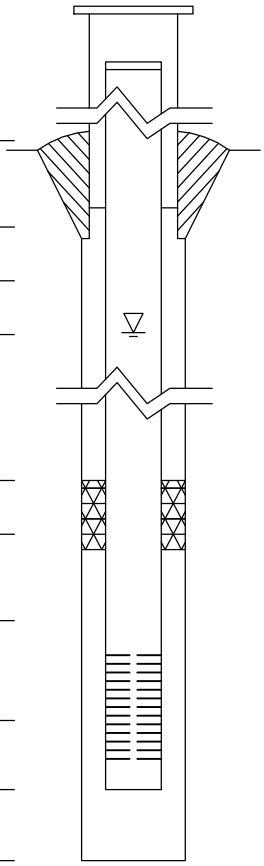
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS) (0.01 ft.)	
461.40	-3.09	Top of Protective Casing
461.08	-2.77	Top of Riser Pipe
458.31	0.00	Ground Surface
458.31	0.00	Top of Annular Sealant
433.74	24.57	Static Water Level (After Completion) 1/18/2017
431.41	26.90	Top of Seal
430.31	28.00	Top of Sand Pack
428.36	29.95	Top of Screen
423.57	34.74	Bottom of Screen
423.31	35.00	Bottom of Well
423.31	35.00	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	32.72
Bottom of Screen to End Cap	(feet)	0.26
Screen Length (1st slot to last slot)	(feet)	4.79
Total Length of Casing	(feet)	37.77
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Peoria Well #: AP08

Site Name: Edwards Power Station Borehole #: AP08

State Plane Coordinate: X 2,434,862.0 Y 1,430,854.3 (or) Latitude: 40° 35' 40.492" Longitude: -89° 40' 7.421"

Surveyed By: Andrew D. Canopy IL Registration #: 035-003391

Drilling Contractor: Bulldog Drilling, Inc. Driller: C. Dutton

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): _____

Logged By: Scot E. Collins Date Started: 12/6/2016 Date Finished: 12/6/2016

Report Form Completed By: Rhonald W. Hasenyager Date: 1/12/2017

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite chips

Installation Method: Gravity

Setting Time: +24 hr

Type of Bentonite Seal -- Granular Pellet Slurry (choose one)

Installation Method: _____

Setting Time: _____

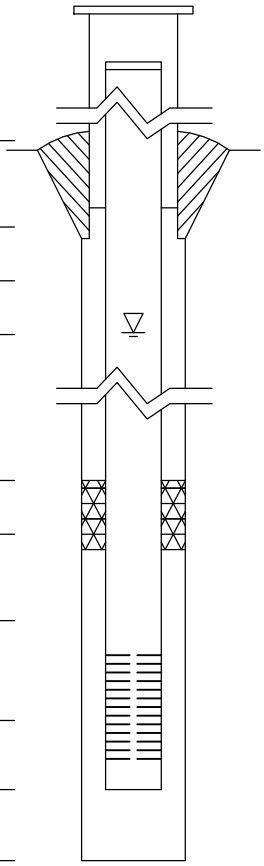
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS) (0.01 ft.)	
460.97	-2.87	Top of Protective Casing
460.60	-2.50	Top of Riser Pipe
458.10	0.00	Ground Surface
458.10	0.00	Top of Annular Sealant
449.22	8.88	Static Water Level (After Completion) 1/18/2017
n/a	n/a	Top of Seal
450.70	7.40	Top of Sand Pack
448.11	9.99	Top of Screen
438.52	19.58	Bottom of Screen
438.12	19.98	Bottom of Well
438.12	19.98	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: Steel
Riser Pipe Above W.T.	SS304	SS316	PTFE	PVC	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	PVC	OTHER:
Screen	SS304	SS316	PTFE	PVC	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	12.49
Bottom of Screen to End Cap	(feet)	0.40
Screen Length (1st slot to last slot)	(feet)	9.59
Total Length of Casing	(feet)	22.48
Screen Slot Size **	(inches)	0.010

Well Completion Form (revised 02/06/02)

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Peoria Well #: AP09

Site Name: Edwards Power Station Borehole #: AP09

State Plane Coordinate: X 2,435,541.8 Y 1,429,733.2 (or) Latitude: 40° 35' 27.365" Longitude: -89° 39' 58.691"

Surveyed By: Andrew D. Canopy IL Registration #: 035-003391

Drilling Contractor: Bulldog Drilling, Inc. Driller: C. Dutton

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): _____

Logged By: Scot E. Collins Date Started: 12/6/2016 Date Finished: 12/7/2016

Report Form Completed By: Rhonald W. Hasenyager Date: 1/12/2017

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite chips

Installation Method: Tremie

Setting Time: +24 hr

Type of Bentonite Seal -- Granular Pellet Slurry (choose one)

Installation Method: _____

Setting Time: _____

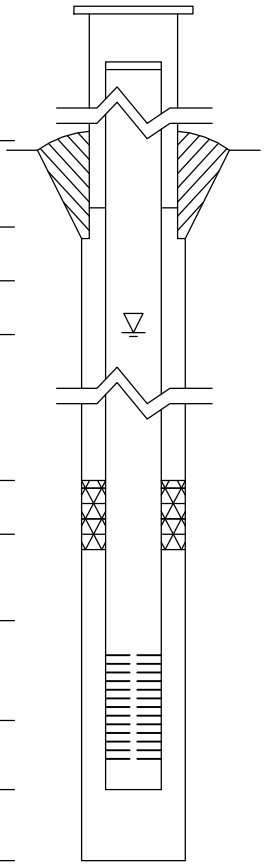
Type of Sand Pack: Quartz sand

Grain Size: 10/20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS) (0.01 ft.)	
460.58	-3.34	Top of Protective Casing
460.22	-2.98	Top of Riser Pipe
457.24	0.00	Ground Surface
457.24	0.00	Top of Annular Sealant
449.04	8.20	Static Water Level (After Completion) 1/18/2017
n/a	n/a	Top of Seal
450.14	7.10	Top of Sand Pack
447.45	9.79	Top of Screen
437.85	19.39	Bottom of Screen
437.44	19.80	Bottom of Well
437.44	19.80	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: Steel
Riser Pipe Above W.T.	SS304	SS316	PTFE	PVC	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	PVC	OTHER:
Screen	SS304	SS316	PTFE	PVC	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	12.77
Bottom of Screen to End Cap	(feet)	0.41
Screen Length (1st slot to last slot)	(feet)	9.60
Total Length of Casing	(feet)	22.78
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

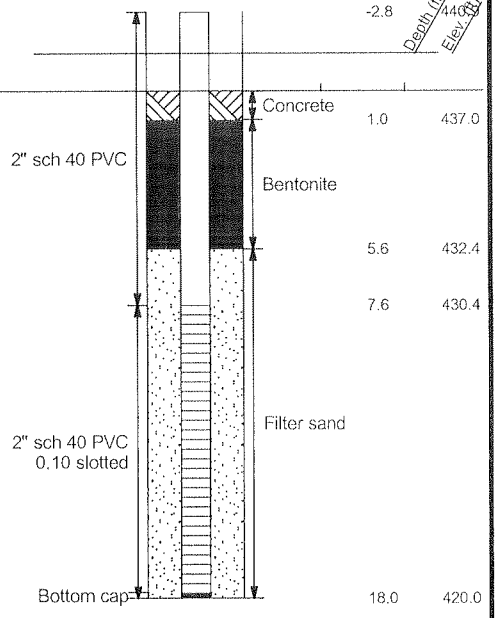
Surface Elevation: 438.02 | Completion Date: 7/27/10

Datum msl | Northing 1432880.82 | Easting 2435852.39

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	FILL			GB1
5				GB2
	Brown, silty CLAY - CL			
10		▽		GB3
15				GB4
	Shaley LIMESTONE		10-0-0	SS5
20	Auger refusal at 18.5 feet.			
25				
30				
35				
40				

WELL DIAGRAM

Stickup
Diameter: 6 inches



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 10 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM
WASHBORING FROM ___ FEET
PH DRILLER JPC LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by: DTK	App'vd. by: RSP
Date: 8/13/10	Date: 9/17/14	Date: 2/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Edwards, Illinois

LOG OF BORING: APW-1

Project No. J017150.01

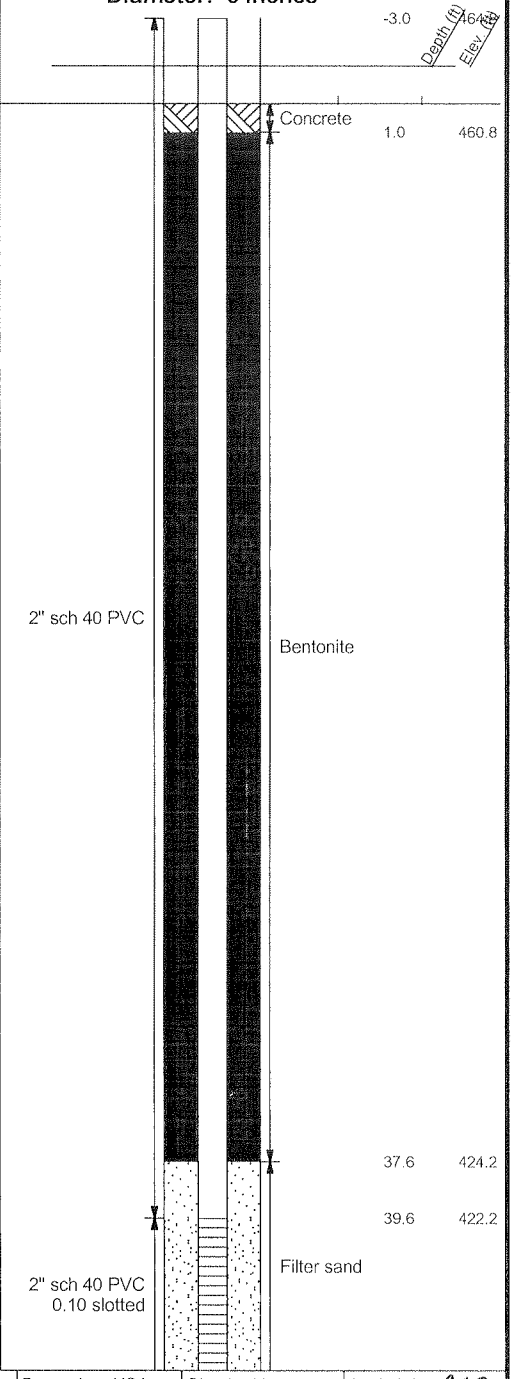
LOG OF BORING 2002 WL J017150.01 - EDWARDS.GPJ GTINC.0638301.GPJ 12/13/10

Surface Elevation: 461.80
Datum msl

Completion Date: 7/20/10
Northing: 1430732.11
Easting: 243579.28

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	FILL: ash			GB1
5	Black, silty CLAY - CL			GB2
10				GB3
15				GB4
20				GB5
25	Gray, silty CLAY - CL			GB6
30				GB7
35				GB8
40				GB9

WELL DIAGRAM



NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

GROUNDWATER DATA

ENCOUNTERED AT 38 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM
WASHBORING FROM ___ FEET
PH DRILLER JPC LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by: DTK	App'vd. by: RSP
Date: 8/13/10	Date: 2/17/11	Date: 2/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Edwards, Illinois

LOG OF BORING: APW-2

Project No. J017150.01

LOG OF BORING 2002 WL J0171150.01 - EDWARDS.GPJ GTINC 0638301.GPJ 12/13/10

Surface Elevation: 461.80
Datum msl

Completion Date: 7/20/10
Northing: 1430732.11
Easting: 243579.28

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES	WELL DIAGRAM
	Gray, silty CLAY - CL *(continued)*			GB10	Stickup Diameter: 6 inches 2" sch 40 PVC 0.10 slotted Filter sand Bottom cap 50.0 411.8
50	Boring terminated at 50 feet.				
55					
60					
65					
70					
75					
80					
85					

GROUNDWATER DATA

ENCOUNTERED AT 38 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM
WASHBORING FROM ___ FEET
PH DRILLER JPC LOGGER
CME 550X DRILL RIG
HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by: DTC	App'vd. by: RSF
Date: 8/13/10	Date: 2/17/11	Date: 2/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Edwards, Illinois

CONTINUATION OF
LOG OF BORING: APW-2

Project No. J017150.01

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01 - EDWARDS.GPJ GTINC 0638301.GPJ 12/13/10

Surface Elevation: 444.26

Datum msl

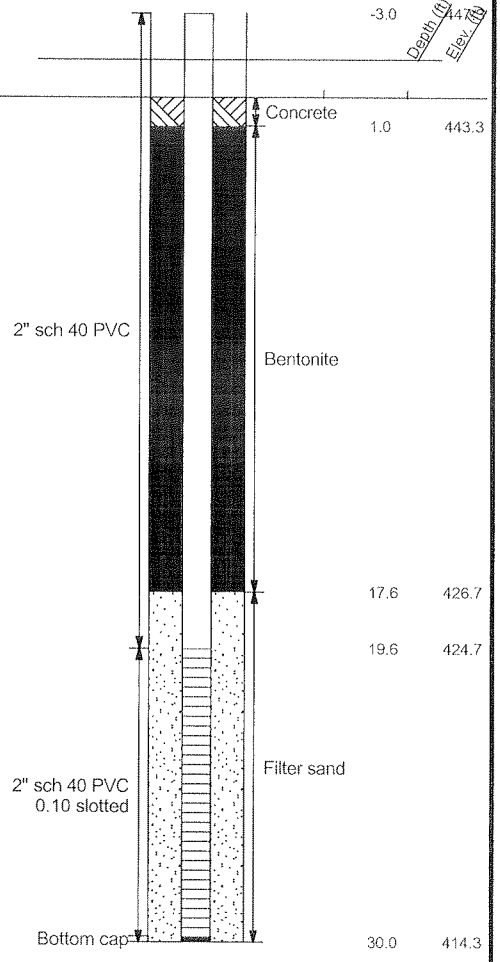
Completion Date: 7/19/10

Northing 1429652.72

Easting 2436225.53

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	Black COAL and ash			GB1
5				
				GB2
10				
				GB3
	Gray and brown, silty CLAY - CL			
15				GB4
20				
				GB5
25				
				GB6
30	Boring terminated at 30 feet.			
35				
40				

WELL DIAGRAM



GROUNDWATER DATA

ENCOUNTERED AT 17 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

PH DRILLER JPC LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by: SAK	App'vd. by: RSI
Date: 8/13/10	Date: 8/17/11	Date: 8/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Edwards, Illinois

LOG OF BORING: APW-3

Project No. J017150.01

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01 - EDWARDS.GPJ GTINC 0638301.GPJ 12/13/10

Surface Elevation: 473.30

Datum msl

Completion Date: 7/27/10

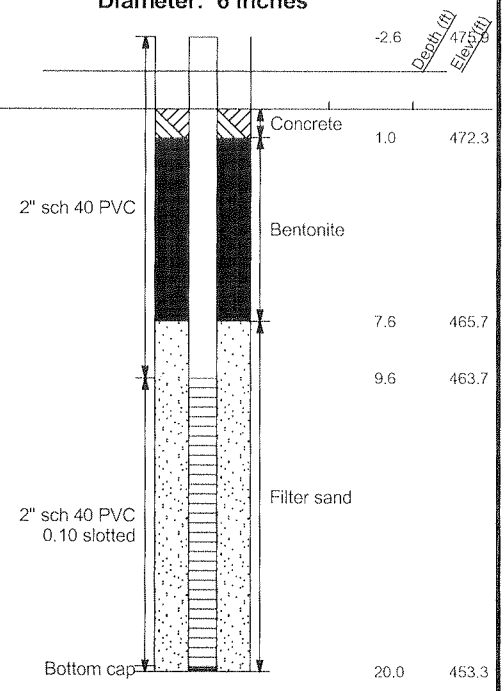
Northing 1428432.43

Easting 2436265.52

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GRAPHIC LOG	DRY UNIT WEIGHT (pcf) SPT BLOW COUNTS CORE RECOVERY/RQD	SAMPLES
	FILL			GB1
	GRAVEL			GB2
5				
	Brown, silty CLAY, trace gravel - CL			GB3
10				GB4
15				GB5
20	Boring terminated at 20 feet.			
25				
30				
35				
40				

WELL DIAGRAM

Stickup
Diameter: 6 inches



GROUNDWATER DATA

ENCOUNTERED AT 7.5 FEET ▽

DRILLING DATA

___ AUGER 3 3/4" HOLLOW STEM

WASHBORING FROM ___ FEET

PH DRILLER JPC LOGGER

CME 550X DRILL RIG

HAMMER TYPE Auto

REMARKS:

Drawn by: KSA	Checked by: DTK	App'vd. by: RSP
Date: 8/13/10	Date: 8/17/11	Date: 8/17/11

GEOTECHNOLOGY INC
FROM THE GROUND UP

Ameren Power Plant
Edwards, Illinois

LOG OF BORING: APW-4

Project No. J017150.01

NOTE: STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN SOIL TYPES AND THE TRANSITION MAY BE GRADUAL. GRAPHIC LOG FOR ILLUSTRATION PURPOSES ONLY.

LOG OF BORING 2002 WL J017150.01 - EDWARDS.GPJ GTINC 0638301.GPJ 12/13/10

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Peoria County Well #: AW-05

Site Name: Edwards Power Station Borehole #: AW-05

State Plane Coordinate: X 2,435,498.0 Y 1,432,339.7 (or) Latitude: _____ Longitude: _____

Surveyed By: Gary C. Rogers IL Registration #: 035-002957

Drilling Contractor: Ramsey Geotechnical Engineering, LLC Driller: B. Williamson

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): None

Logged By: Suzanna L. Keim Date Started: 7/22/2015 Date Finished: 7/22/2015

Report Form Completed By: Suzanna L. Keim Date: 7/24/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- [Granular] Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 30 minutes

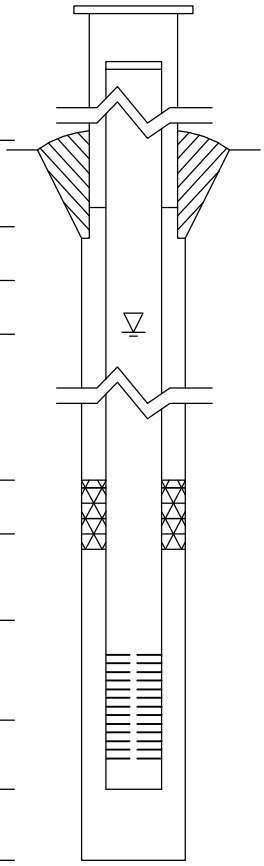
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS) (0.01 ft.)	
443.55	-3.00	Top of Protective Casing
443.37	-2.82	Top of Riser Pipe
440.55	0.00	Ground Surface
438.05	2.50	Top of Annular Sealant
431.39	9.16	Static Water Level (After Completion) 9/23/2015
428.55	12.00	Top of Seal
426.35	14.20	Top of Sand Pack
424.68	15.87	Top of Screen
420.08	20.47	Bottom of Screen
419.45	21.10	Bottom of Well
419.45	21.10	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: [Steel]
Riser Pipe Above W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Screen	SS304	SS316	PTFE	[PVC]	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	18.69
Bottom of Screen to End Cap	(feet)	0.63
Screen Length (1st slot to last slot)	(feet)	4.60
Total Length of Casing	(feet)	23.92
Screen Slot Size **	(inches)	0.010

Well Completion Form (revised 02/06/02)

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Peoria County Well #: AW-06

Site Name: Edwards Power Station Borehole #: AW-06

State Plane Coordinate: X 2,434,495.3 Y 1,430,727.7 (or) Latitude: _____ Longitude: _____

Surveyed By: Gary C. Rogers IL Registration #: 035-002957

Drilling Contractor: Ramsey Geotechnical Engineering, LLC Driller: B. Williamson

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): None

Logged By: Suzanna L. Keim Date Started: 7/29/2015 Date Finished: 8/3/2015

Report Form Completed By: Suzanna L. Keim Date: 8/5/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- (Granular) Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 1 hour

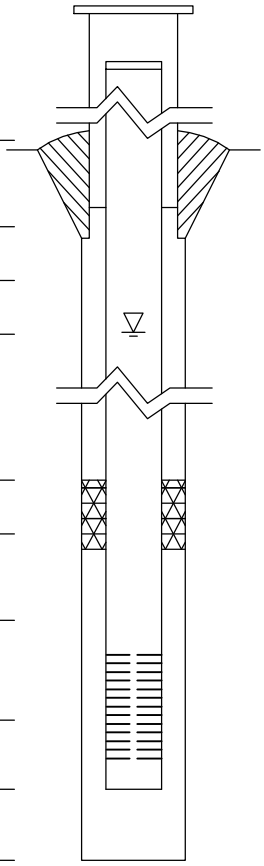
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: Slough (if applicable)

Installation Method: Cave-in



Elevations (MSL)*	Depths (BGS) (0.01 ft.)	
461.79	-2.60	Top of Protective Casing
461.57	-2.38	Top of Riser Pipe
459.19	0.00	Ground Surface
457.19	2.00	Top of Annular Sealant
432.88	26.31	Static Water Level (After Completion) 9/22/2015
426.89	32.30	Top of Seal
424.69	34.50	Top of Sand Pack
422.59	36.60	Top of Screen
418.10	41.09	Bottom of Screen
417.50	41.69	Bottom of Well
416.94	42.25	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: (Steel)
Riser Pipe Above W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	(PVC)	OTHER:
Screen	SS304	SS316	PTFE	(PVC)	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	6.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	38.98
Bottom of Screen to End Cap	(feet)	0.60
Screen Length (1st slot to last slot)	(feet)	4.49
Total Length of Casing	(feet)	44.07
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Peoria County Well #: AW-08

Site Name: Edwards Power Station Borehole #: AW-08

State Plane Coordinate: X 2,436,732.7 Y 1,430,641.2 (or) Latitude: _____ Longitude: _____

Surveyed By: Gary C. Rogers IL Registration #: 035-002957

Drilling Contractor: Ramsey Geotechnical Engineering, LLC Driller: B. Williamson

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): None

Logged By: Suzanna L. Keim Date Started: 7/20/2015 Date Finished: 7/21/2015

Report Form Completed By: Suzanna L. Keim Date: 7/24/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- [Granular] Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 30 minutes

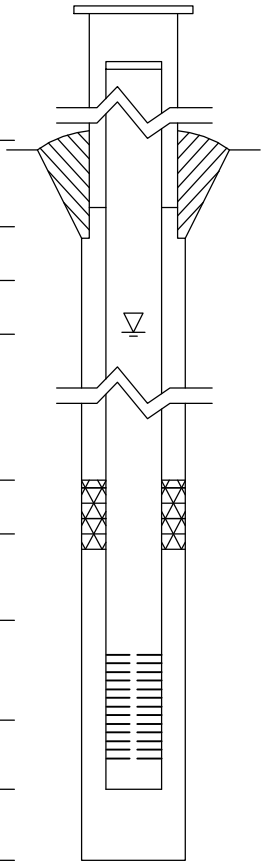
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS)	(0.01 ft.)
462.72	-2.06	Top of Protective Casing
462.54	-1.88	Top of Riser Pipe
460.66	0.00	Ground Surface
458.66	2.00	Top of Annular Sealant
441.09	19.57	Static Water Level (After Completion) 9/21/2015
416.16	44.50	Top of Seal
415.16	45.50	Top of Sand Pack
413.11	47.55	Top of Screen
403.47	57.19	Bottom of Screen
402.99	57.67	Bottom of Well
402.99	57.67	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: [Steel]
Riser Pipe Above W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Screen	SS304	SS316	PTFE	[PVC]	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	49.43
Bottom of Screen to End Cap	(feet)	0.48
Screen Length (1st slot to last slot)	(feet)	9.64
Total Length of Casing	(feet)	59.55
Screen Slot Size **	(inches)	0.010

Well Completion Form (revised 02/06/02)

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Peoria County Well #: AW-09

Site Name: Edwards Power Station Borehole #: AW-09

State Plane Coordinate: X 2,434,857.0 Y 1,429,340.1 (or) Latitude: _____ Longitude: _____

Surveyed By: Gary C. Rogers IL Registration #: 035-002957

Drilling Contractor: Ramsey Geotechnical Engineering, LLC Driller: B. Williamson

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): None

Logged By: Suzanna L. Keim Date Started: 7/29/2015 Date Finished: 8/3/2015

Report Form Completed By: Suzanna L. Keim Date: 8/7/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >24 hours

Type of Bentonite Seal -- [Granular] Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 30 minutes

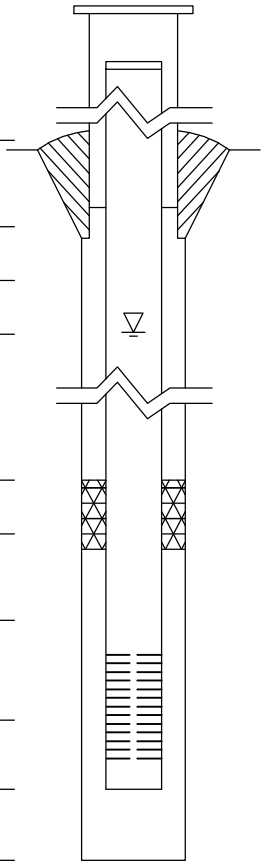
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



	Elevations (MSL)*	Depths (BGS) (0.01 ft.)
Top of Protective Casing	461.65	-3.33
Top of Riser Pipe	461.45	-3.13
Ground Surface	458.32	0.00
Top of Annular Sealant	455.82	2.50
Static Water Level (After Completion) 9/23/2015	432.22	26.10
Top of Seal	415.12	43.20
Top of Sand Pack	413.22	45.10
Top of Screen	411.18	47.14
Bottom of Screen	406.70	51.62
Bottom of Well	406.09	52.23
Bottom of Borehole	406.09	52.23

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: Steel
Riser Pipe Above W.T.	SS304	SS316	PTFE	PVC	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	PVC	OTHER:
Screen	SS304	SS316	PTFE	PVC	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	6.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	50.27
Bottom of Screen to End Cap	(feet)	0.61
Screen Length (1st slot to last slot)	(feet)	4.48
Total Length of Casing	(feet)	55.36
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Peoria County Well #: AW-10

Site Name: Edwards Power Station Borehole #: AW-10

State Plane Coordinate: X 2,436,231.4 Y 1,429,461.1 (or) Latitude: _____ Longitude: _____

Surveyed By: Gary C. Rogers IL Registration #: 035-002957

Drilling Contractor: Ramsey Geotechnical Engineering, LLC Driller: B. Williamson

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): None

Logged By: Suzanna L. Keim Date Started: 7/23/2015 Date Finished: 7/23/2015

Report Form Completed By: Suzanna L. Keim Date: 7/24/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- [Granular] Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 30 minutes

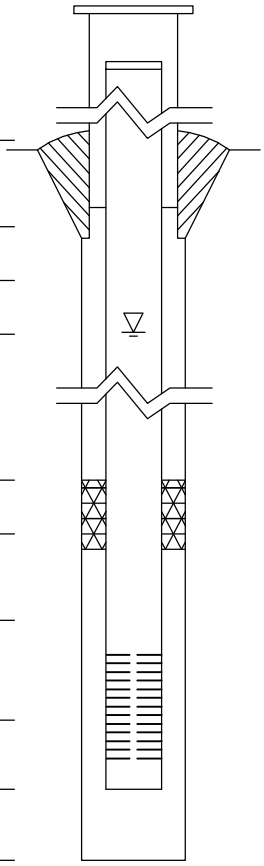
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: n/a (if applicable)

Installation Method: _____



Elevations (MSL)*	Depths (BGS) (0.01 ft.)	
440.16	-2.52	Top of Protective Casing
439.93	-2.29	Top of Riser Pipe
437.64	0.00	Ground Surface
434.64	3.00	Top of Annular Sealant
436.64	1.00	Static Water Level (After Completion) 9/22/2015
412.14	25.50	Top of Seal
411.49	26.15	Top of Sand Pack
410.02	27.62	Top of Screen
405.41	32.23	Bottom of Screen
404.90	32.74	Bottom of Well
404.90	32.74	Bottom of Borehole

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: [Steel]
Riser Pipe Above W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Screen	SS304	SS316	PTFE	[PVC]	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	29.91
Bottom of Screen to End Cap	(feet)	0.51
Screen Length (1st slot to last slot)	(feet)	4.61
Total Length of Casing	(feet)	35.03
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

Illinois Environmental Protection Agency — Well Completion Report

Site #: _____ County: Peoria County Well #: AW-11

Site Name: Edwards Power Station Borehole #: AW-11

State Plane Coordinate: X 2,436,251.1 Y 1,428,196.3 (or) Latitude: _____ Longitude: _____

Surveyed By: Gary C. Rogers IL Registration #: 035-002957

Drilling Contractor: Ramsey Geotechnical Engineering, LLC Driller: B. Williamson

Consulting Firm: Hanson Professional Services Inc. Geologist: Rhonald W. Hasenyager, LPG #196-000246

Drilling Method: Hollow Stem Auger Drilling Fluid (Type): None

Logged By: Rhonald W. Hasenyager Date Started: 7/24/2015 Date Finished: 7/28/2015

Report Form Completed By: Suzanna L. Keim Date: 7/28/2015

ANNULAR SPACE DETAILS

Type of Surface Seal: Concrete

Type of Annular Sealant: High-solids bentonite

Installation Method: Tremie

Setting Time: >48 hours

Type of Bentonite Seal -- [Granular] Pellet Slurry (choose one)

Installation Method: Gravity

Setting Time: 30 minutes

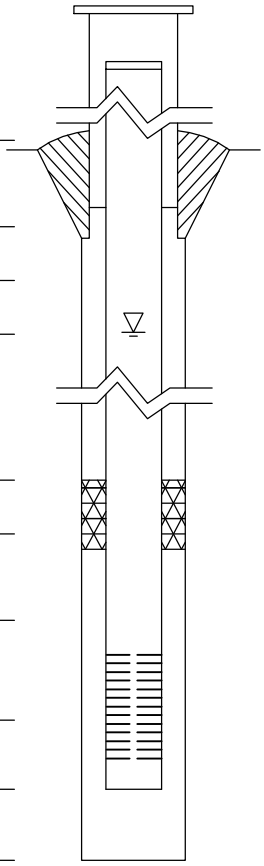
Type of Sand Pack: Quartz Sand

Grain Size: 10-20 (sieve size)

Installation Method: Gravity

Type of Backfill Material: Quartz sand (if applicable)

Installation Method: Gravity



	Elevations (MSL)*	Depths (BGS) (0.01 ft.)
Top of Protective Casing	440.08	-2.92
Top of Riser Pipe	439.87	-2.71
Ground Surface	437.16	0.00
Top of Annular Sealant	435.16	2.00
Static Water Level (After Completion) 9/21/2015	404.91	32.25
Top of Seal	416.56	20.60
Top of Sand Pack	414.81	22.35
Top of Screen	412.95	24.21
Bottom of Screen	408.35	28.81
Bottom of Well	407.85	29.31
Bottom of Borehole	407.16	30.00

* Referenced to a National Geodetic Datum

WELL CONSTRUCTION MATERIALS

(Choose one type of material for each area)

Protective Casing	SS304	SS316	PTFE	PVC	OTHER: Steel
Riser Pipe Above W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Riser Pipe Below W.T.	SS304	SS316	PTFE	[PVC]	OTHER:
Screen	SS304	SS316	PTFE	[PVC]	OTHER:

CASING MEASUREMENTS

Diameter of Borehole	(inches)	8.0
ID of Riser Pipe	(inches)	2.0
Protective Casing Length	(feet)	5.0
Riser Pipe Length	(feet)	26.92
Bottom of Screen to End Cap	(feet)	0.50
Screen Length (1st slot to last slot)	(feet)	4.60
Total Length of Casing	(feet)	32.02
Screen Slot Size **	(inches)	0.010

**Hand-Slotted Well Screens Are Unacceptable

APPENDIX D
GEOTECHNICAL LABORATORY REPORTS

TERRACON GEOTECHNICAL LABORATORY REPORTS

March 5, 2021
Revised: May 10, 2021

Mr. Scott Woods
Ramboll Environ U.S. Corporation
333 West Wacker Drive, Ste 2700
Chicago, IL 60606-2872

RE: Laboratory Testing Program for the Edwards Power Station Project – Terracon Project No. 11215017

Dear Mr. Woods,

We are pleased to submit our report pertaining to geotechnical laboratory testing of soil samples in reference to the Edwards Power Station Project. As instructed, Terracon performed the following tests on samples selected by Ramboll:

- Specific Gravity of Soils – ASTM D854
- Water Content of Soil and Rock – ASTM D2216
- Liquid Limit, Plastic Limit and Plasticity Index of Soils – ASTM D4318
- Hydraulic Conductivity of Saturated Porous Materials Using a Flexible-Wall Permeameter – ASTM D5084
- Laboratory Determination of Density (Unit Weight) of Soil Specimens – ASTM D7263
- Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis – ASTM D6913
- Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis – ASTM D7928

The test data included in this report, only represent the samples tested and may not reflect actual site materials and/or conditions. The scope of services provided by Terracon did not include interpretation of the laboratory test data, and therefore, we are not liable for any interpretation performed by others. If you wish us to provide you with this service, we would be happy to discuss this matter with you at your convenience. Any reproduction of this report must be done in its entirety.

We are pleased to have the opportunity to provide you with our testing services. Should you have any questions, or require additional assistance, please feel free to contact us at any time.

Sincerely,
Terracon Consultants, Inc.



William P. Quinn
Department Manager – Laboratory Services

LABORATORY TESTING SUMMARY

PROJECT NAME: Edwards Power Station

PROJECT NUMBER: 11215017

CLIENT: Confidential

Boring Number	Sample Number	Depth	Description	USCS	WC %	Dry Density (pcf)	% Gravel	% Sand	% Silt	% Clay	LL	PL	PI	Permeability k (cm/sec)	Specific Gravity
AW-13A	0850	5.0'-7.0'	LIGHT BROWN AND GRAY SANDY LEAN CLAY	CL	25.2	96.5	0.0	30.3	42.4	27.3	30	14	16	4.72E-08	2.661
AW-15	1025	20.0'-22.0'	GRAY FAT CLAY	CH	27.9	85.8	0.0	2.0	43.8	54.2	57	19	38	2.87E-08	2.694
AW-20	0810	15.0'-17.0'	GRAY AND DARK GRAY LEAN CLAY - SAND POCKETS NOTED	CL	35.1	83.9	0.0	7.8	41.3	50.9	47	18	29	7.23E-08	2.690
AW-22	0745	30.0'-32.0'	GRAY, LIGHT GRAY AND LIGHT BROWN CLAYEY SAND	SC	23.2	101.3	0.0	57.4	27.3	15.3	22	13	9	1.74E-07	2.700
XPW-01	1210	20.0'-22.0'	DARK GRAY SILTY SAND	SM	43.7	69.8	0.0	68.9	27.2	3.9	51	53	NP	1.18E-05	2.381
XPW-01A	1530	41.0'-41.5'	DARK GRAY ELASTIC SILT	MH	35.1	71.7	0.0	13.7	64.4	21.9	60	43	17	6.77E-06	2.378
XPW-02	0845	10.0'-12.0'	DARK GRAY AND GRAYISH BROWN ELASTIC SILT WITH SAND	MH	45.1	67.5	0.5	28.1	54.6	16.8	52	47	5	1.20E-05	2.414
XPW-02	0950	22.0'-24.0'	DARK GRAY SILT	ML	33.4	77.1	0.0	4.1	84.0	11.9	38	30	8	2.08E-06	2.335
XPW-02	1245	45.0'-47.0'	GRAYISH BROWN SANDY SILT	ML	41.7	73.5	0.1	37.4	49.7	12.8	39	33	6	1.00E-05	2.397
XPW-03	1500	10.0'-12.0'	DARK GRAY SILT WITH SAND - ROOTS NOTED	ML	43.8	68.0	0.4	27.2	51.3	21.1	36	29	7	3.29E-05	2.388

Specific Gravity of Soils
ASTM D854

Terracon
Consulting Engineers & Scientists

SPECIFIC GRAVITY OF SOIL SOLIDS

ASTM D-854

AASHTO T 100

Laboratory Services Group **192 Exchange Blvd.** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

Project Number: 11215017
Project Name: Edwards Power Station
Test Date: 3/1/2021

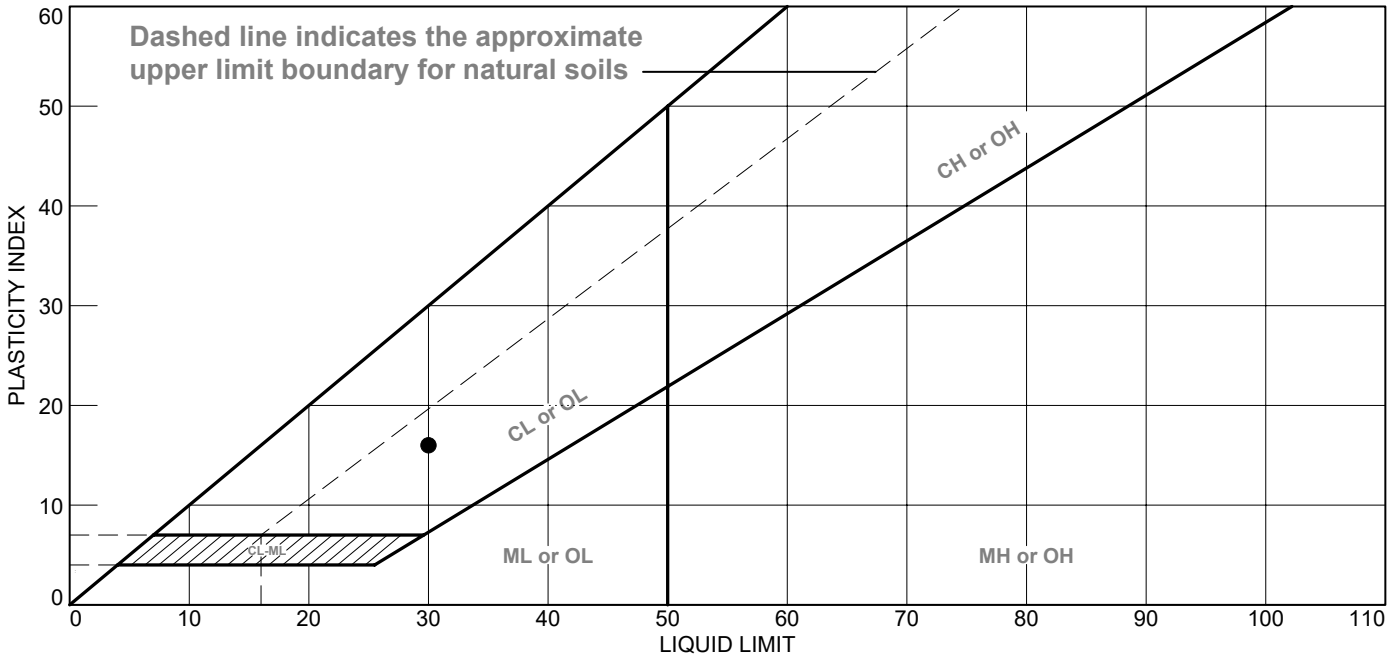
Results Summary

Boring / Sample	Sample Number	Depth (ft)		Specific Gravity (Gs)
AW-13A	0850	5.0'-7.0'		2.661
AW-15	1025	20.0'-22.0'		2.694
AW-20	0810	15.0'-17.0'		2.690
AW-22	0745	30.0'-32.0'		2.700
XPW-01	1210	20.0'-22.0'		2.381
XPW-01A	1530	41.0'-41.5'		2.378
XPW-02	0845	10.0'-12.0'		2.414
XPW-02	0950	22.0'-24.0'		2.335
XPW-02	1245	45.0'-47.0'		2.397
XPW-03	1500	10.0'-12.0'		2.388

Tested By: SJH Checked By: WPQ

Liquid Limit, Plastic Limit and Plasticity Index of Soils
ASTM D4318

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	LIGHT BROWN AND GRAY SANDY LEAN CLAY	30	14	16	99.3	69.7	CL

Project No. 11215017 **Client:** CONFIDENTIAL

Project: EDWARDS POWER STATION

Source of Sample: AW-13A **Depth:** 5.0'-7.0'
Sample Number: 0850

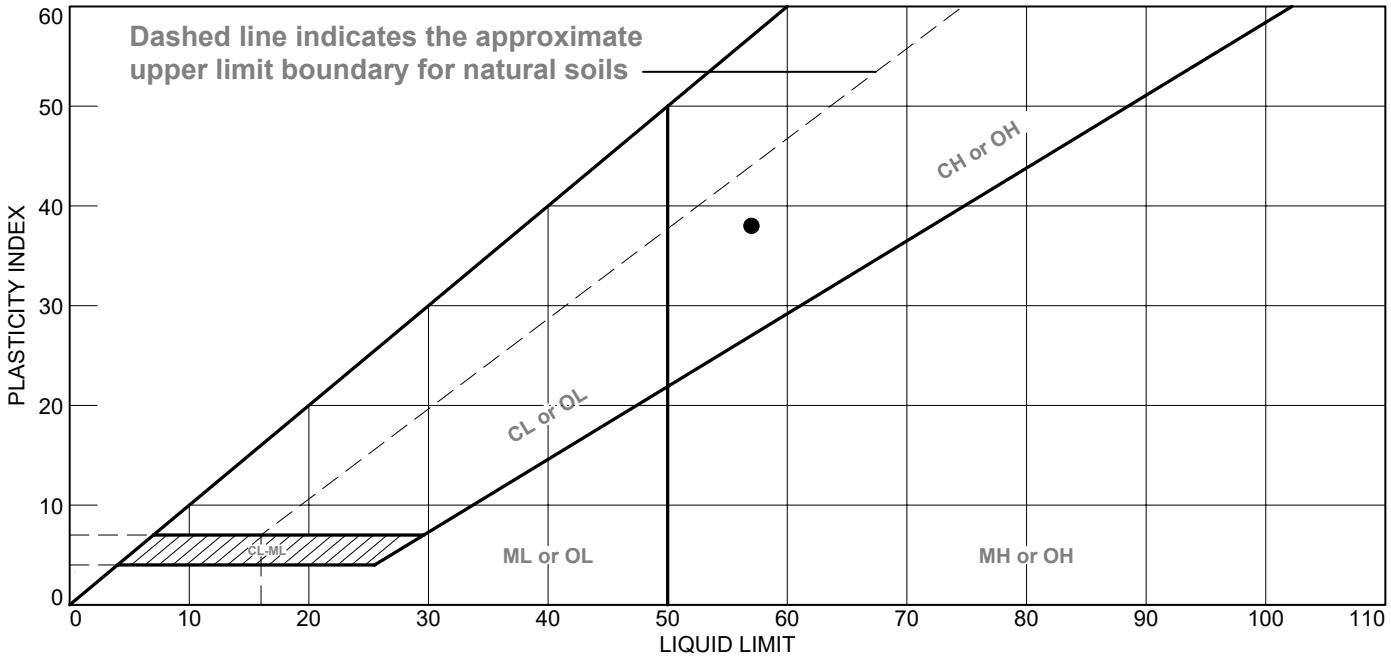
Remarks:

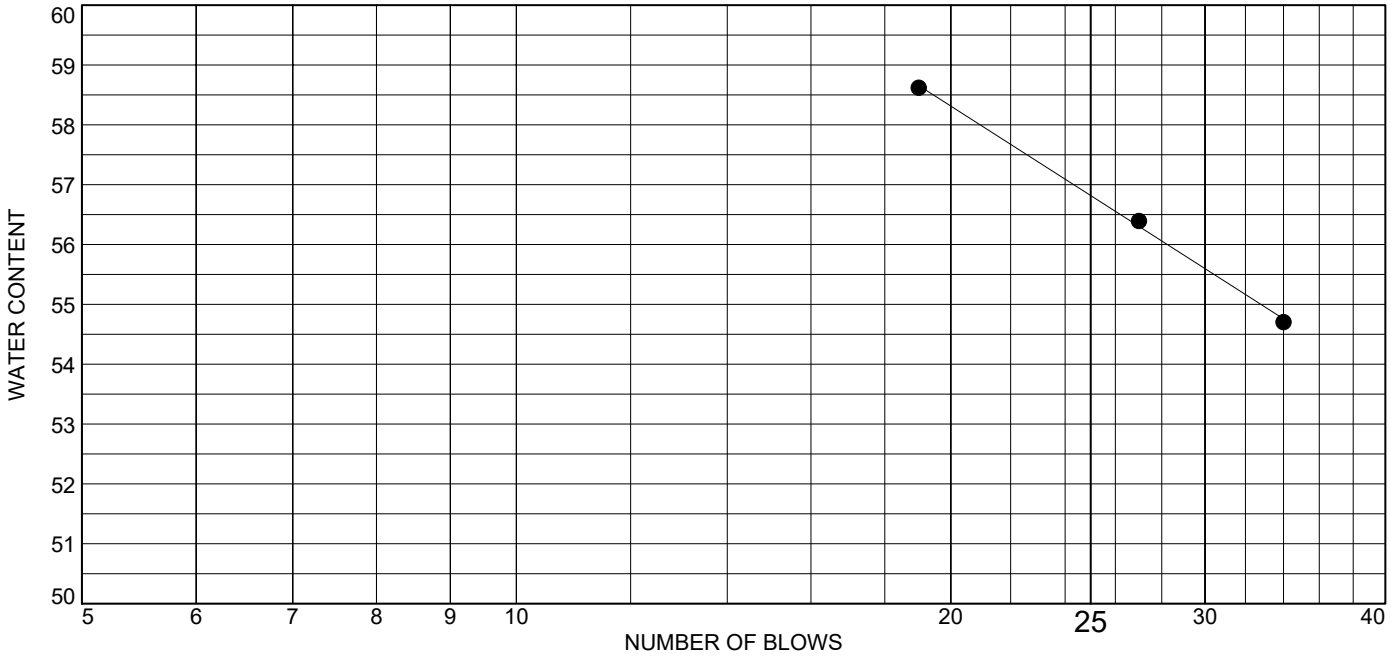
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY FAT CLAY	57	19	38	99.5	98.0	CH

Project No. 11215017 **Client:** CONFIDENTIAL

Project: EDWARDS POWER STATION

Source of Sample: AW-15 **Depth:** 20.0'-22.0'
Sample Number: 1025

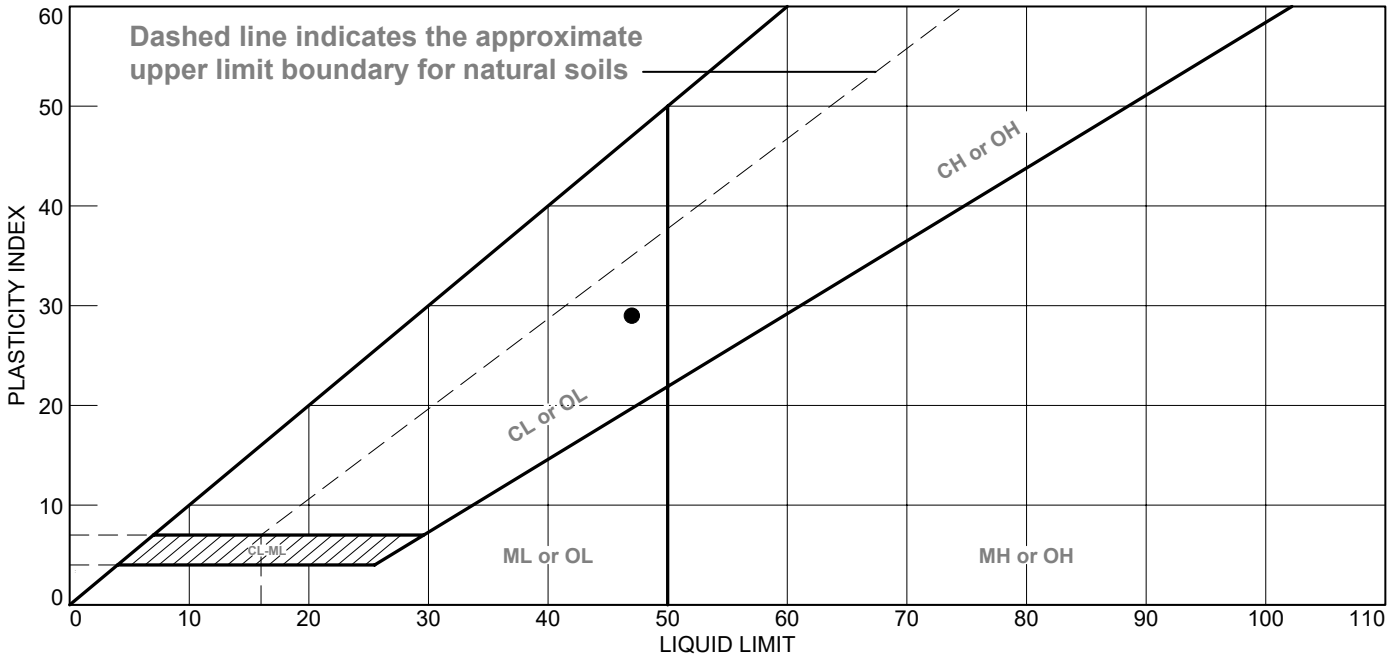
Remarks:

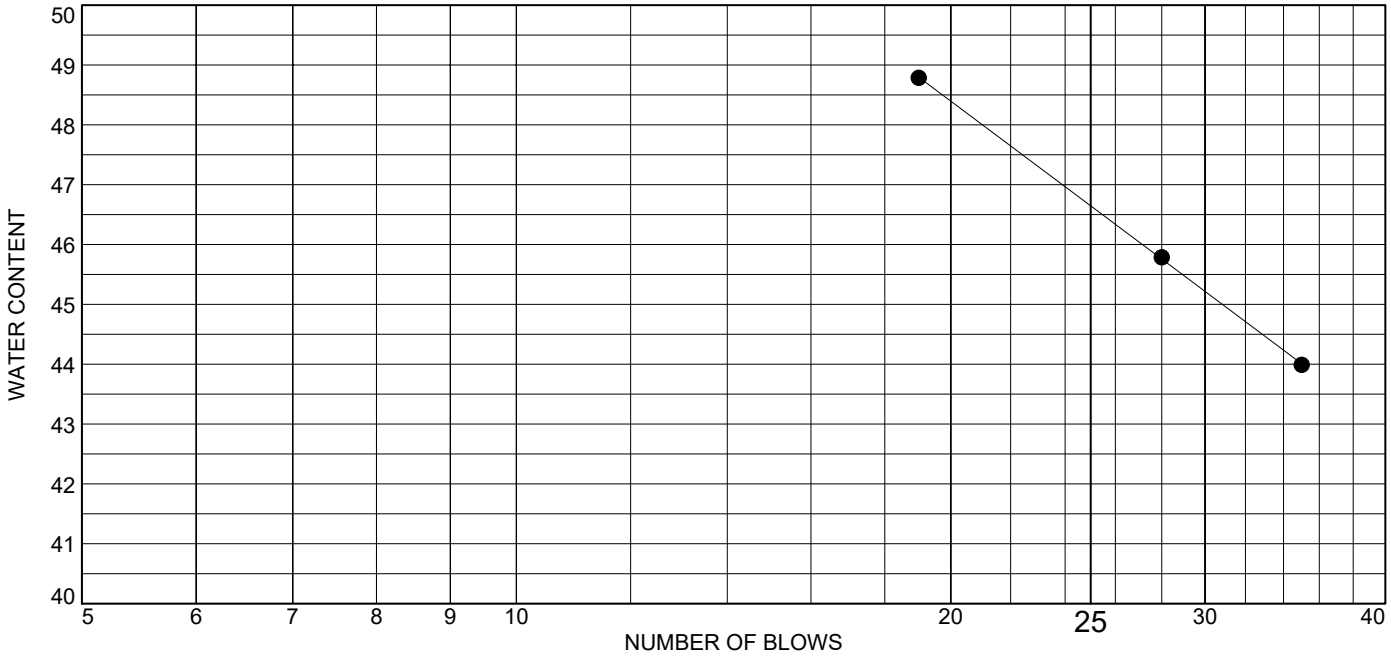
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY AND DARK GRAY LEAN CLAY - SAND POCKETS NOTED	47	18	29	96.9	92.2	CL

Project No. 11215017 **Client:** CONFIDENTIAL

Project: EDWARDS POWER STATION

Source of Sample: AW-20 **Depth:** 15.0'-17.0'
Sample Number: 0810

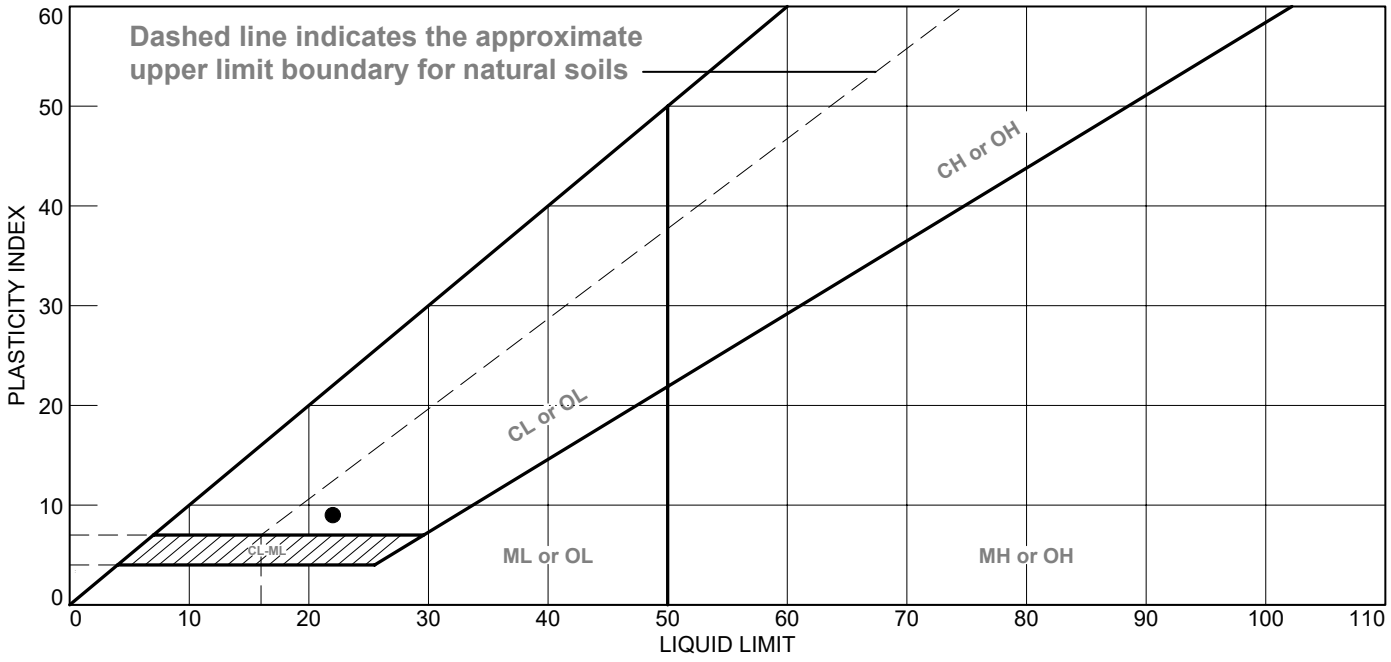
Remarks:

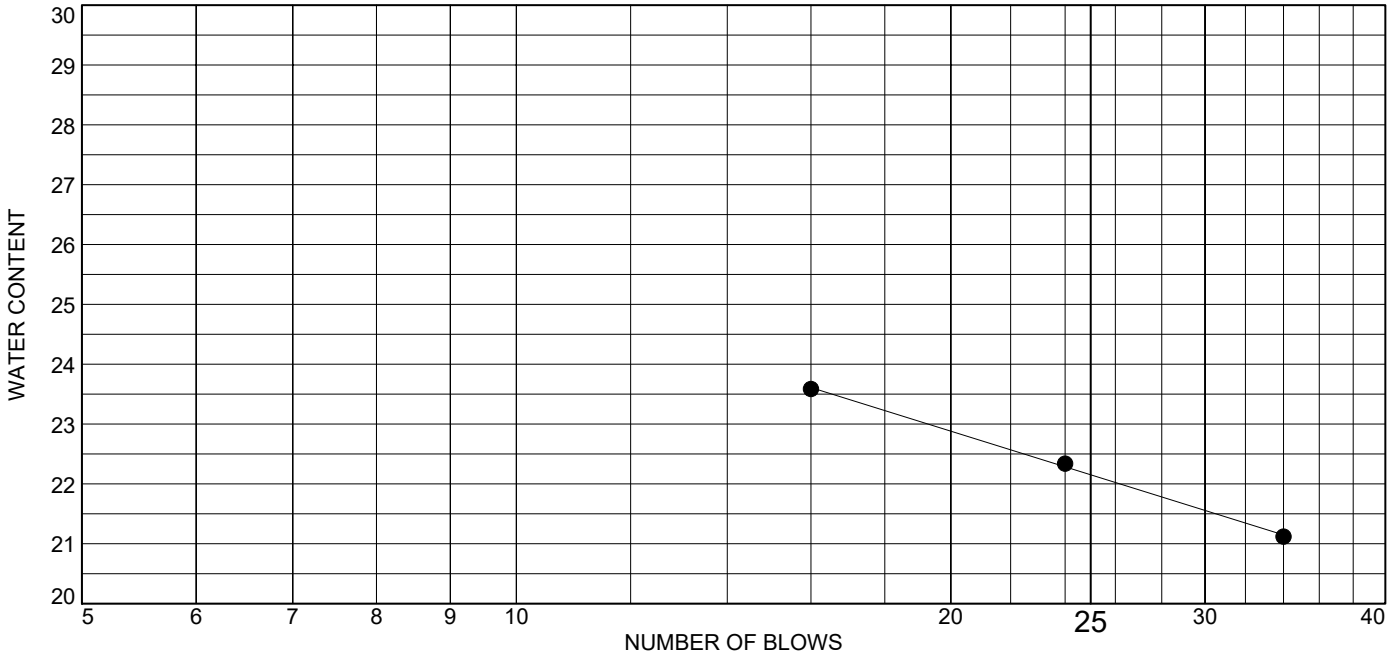
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY, LIGHT GRAY AND LIGHT BROWN CLAYEY SAND	22	13	9	98.3	42.6	SC

Project No. 11215017 **Client:** CONFIDENTIAL

Project: EDWARDS POWER STATION

Source of Sample: AW-22 **Depth:** 30.0'-32.0'
Sample Number: 0745

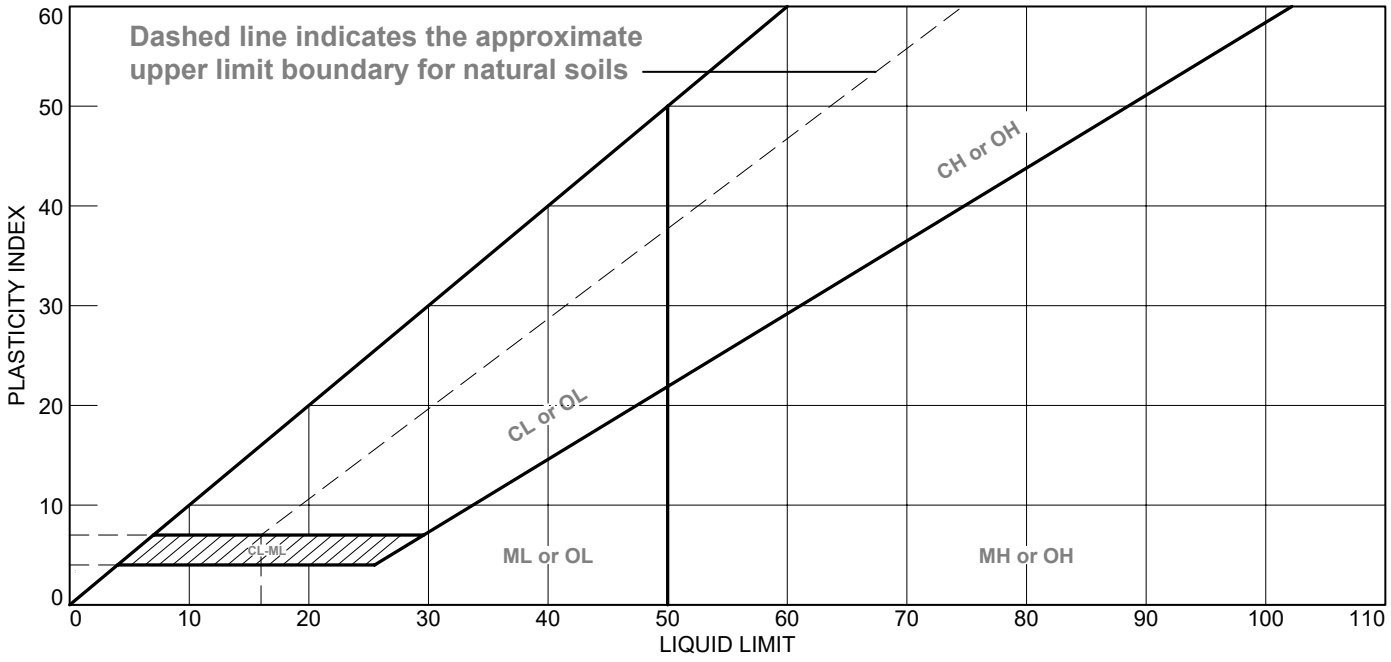
Remarks:

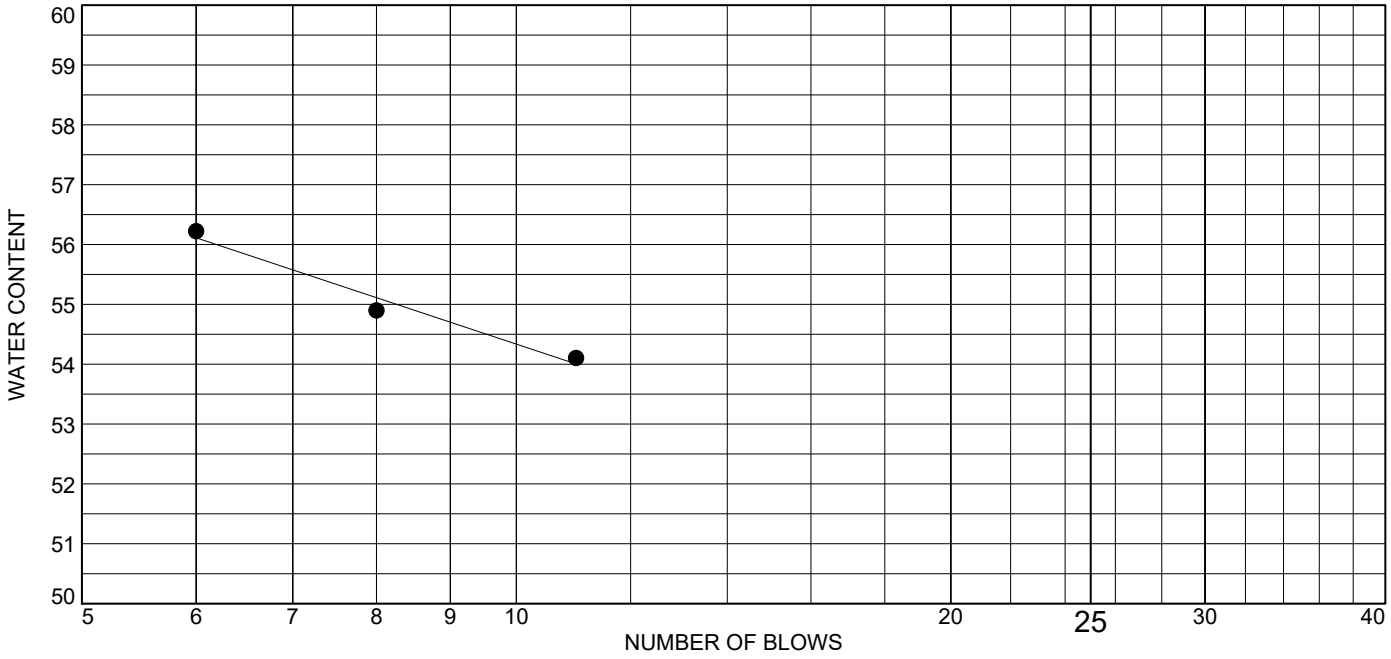
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY SILTY SAND	51	53	NP	62.1	31.1	SM

Project No. 11215017 **Client:** CONFIDENTIAL

Project: EDWARDS POWER STATION

Source of Sample: XPW-01 **Depth:** 20.0'-22.0'
Sample Number: 1210

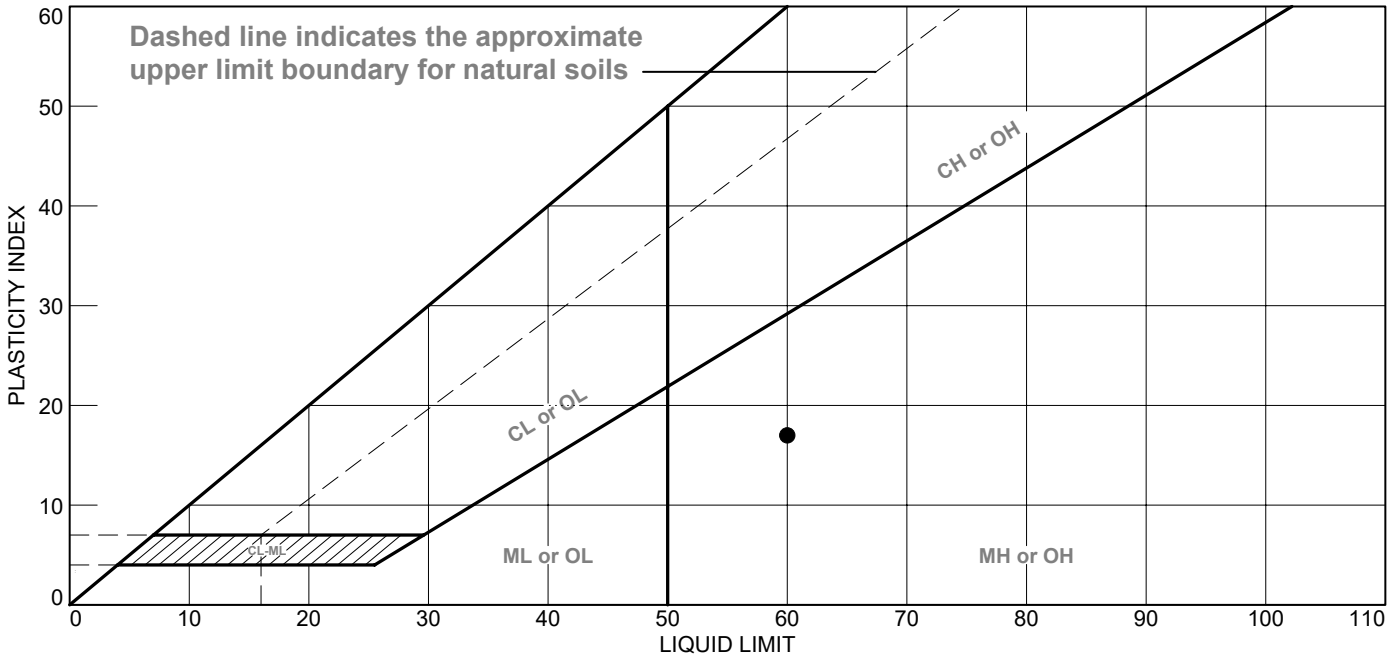
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY ELASTIC SILT	60	43	17	98.6	86.3	MH

Project No. 11215017 **Client:** CONFIDENTIAL

Project: EDWARDS POWER STATION

Source of Sample: XPW-01A **Depth:** 41.0'-41.5'
Sample Number: 1530

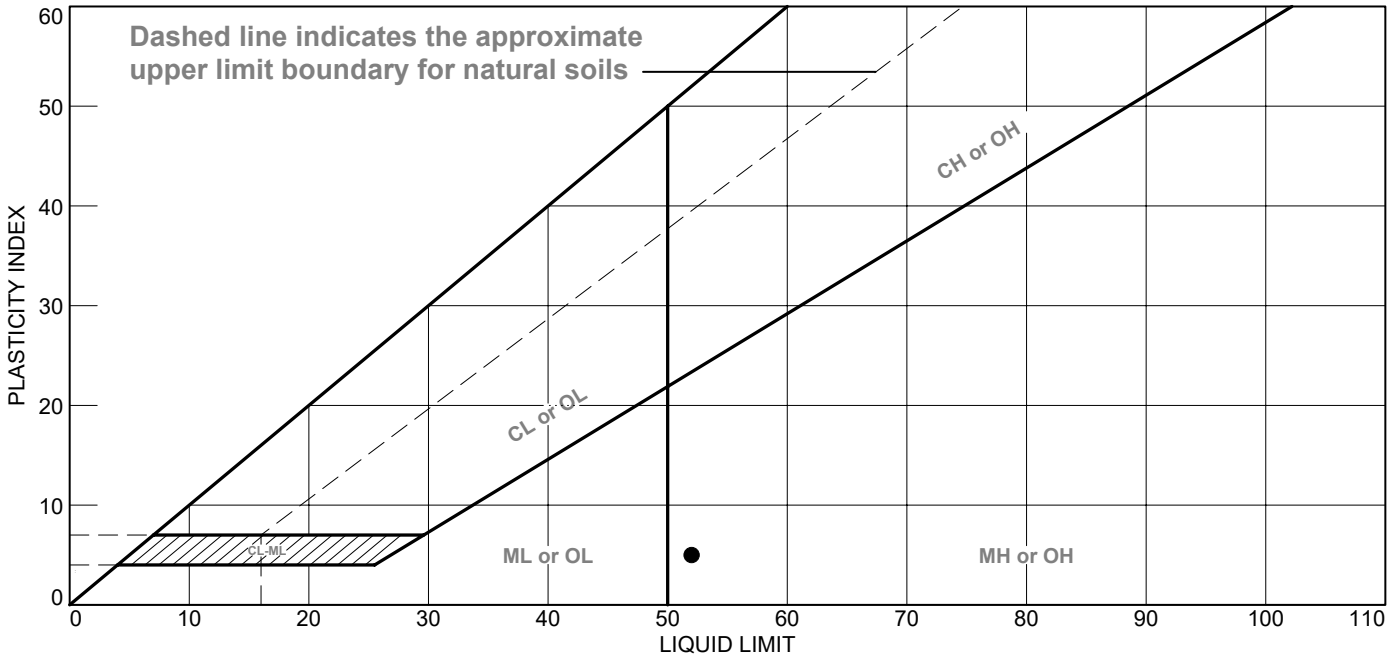
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY AND GRAYISH BROWN ELASTIC SILT WITH SAND	52	47	5	92.2	71.4	MH

Project No. 11215017 **Client:** CONFIDENTIAL

Project: EDWARDS POWER STATION

Source of Sample: XPW-02 **Depth:** 10.0'-12.0'
Sample Number: 0845

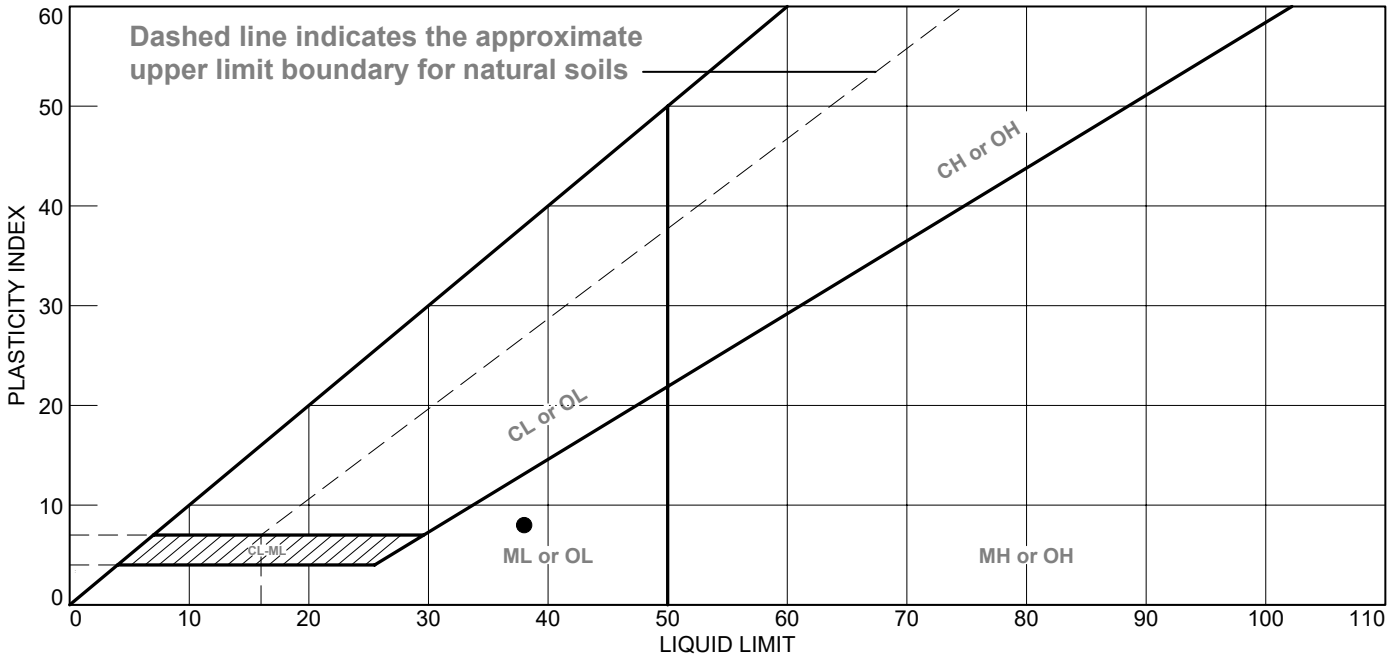
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY SILT	38	30	8	99.8	95.9	ML

Project No. 11215017 **Client:** CONFIDENTIAL

Project: EDWARDS POWER STATION

Source of Sample: XPW-02 **Depth:** 22.0'-24.0'
Sample Number: 0950

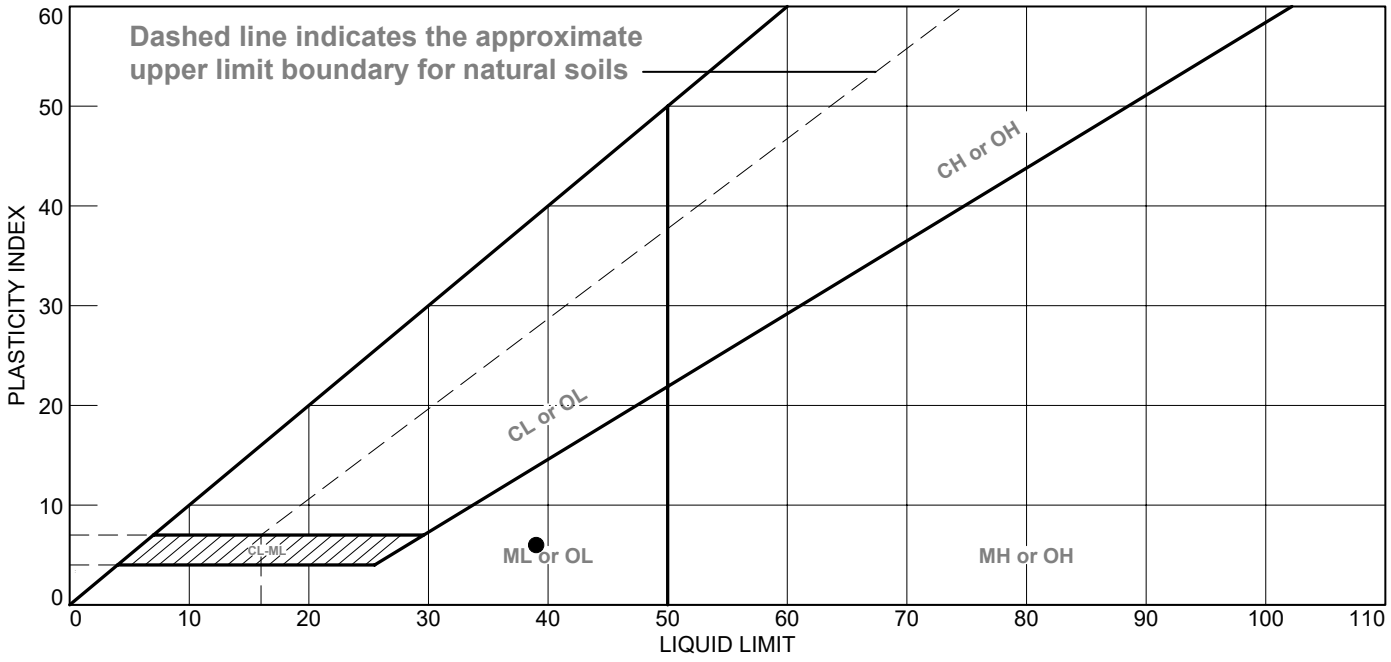
Remarks:

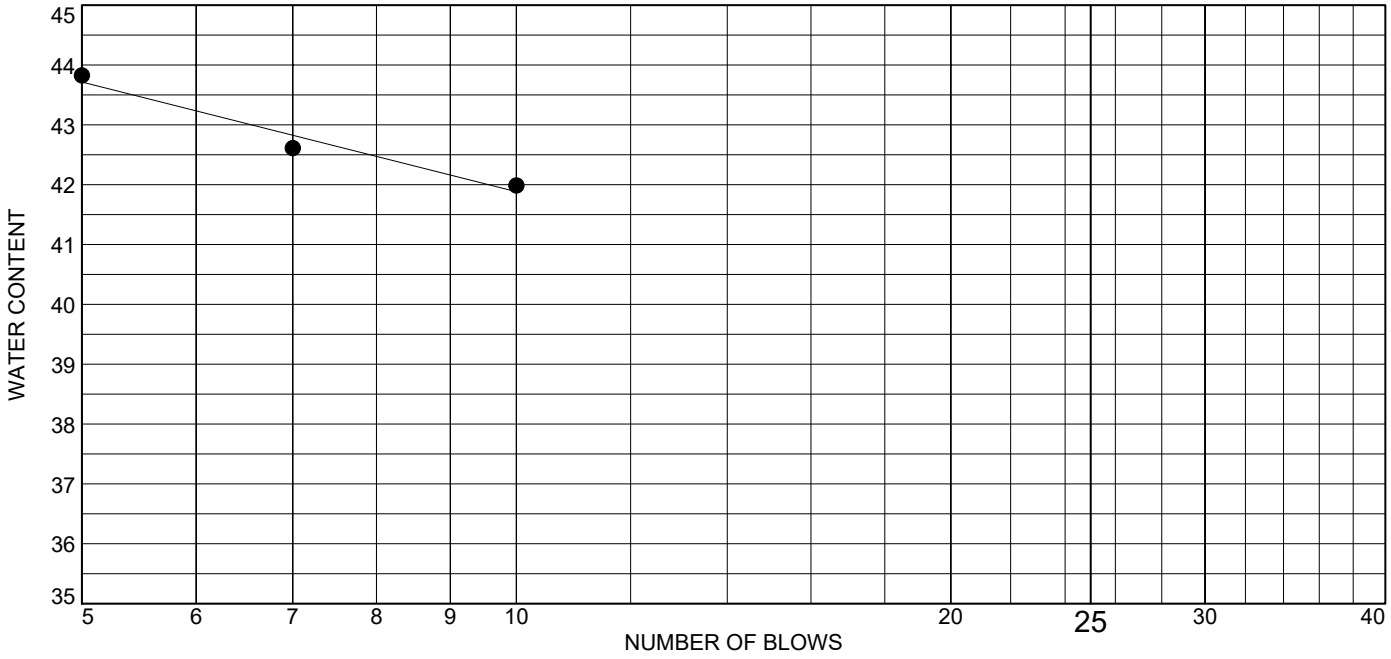
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAYISH BROWN SANDY SILT	39	33	6	90.7	62.5	ML

Project No. 11215017 **Client:** CONFIDENTIAL

Project: EDWARDS POWER STATION

Source of Sample: XPW-02 **Depth:** 45.0'-47.0'
Sample Number: 1245

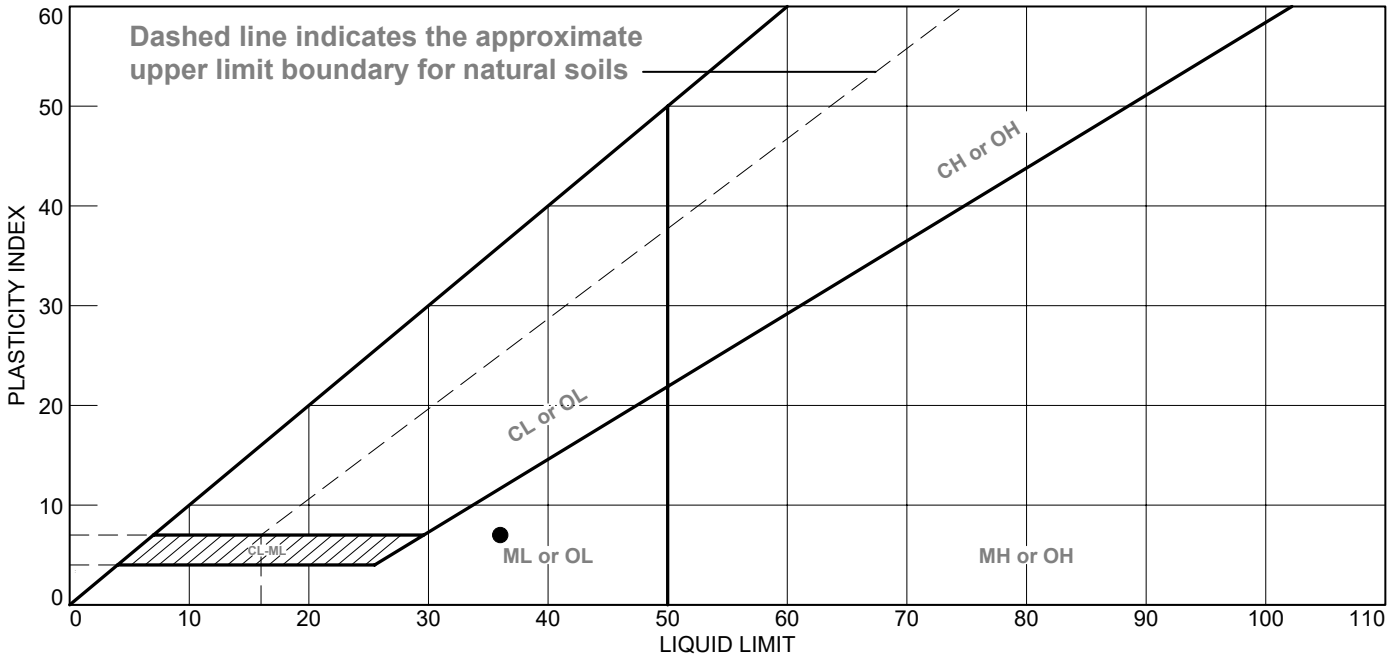
Remarks:

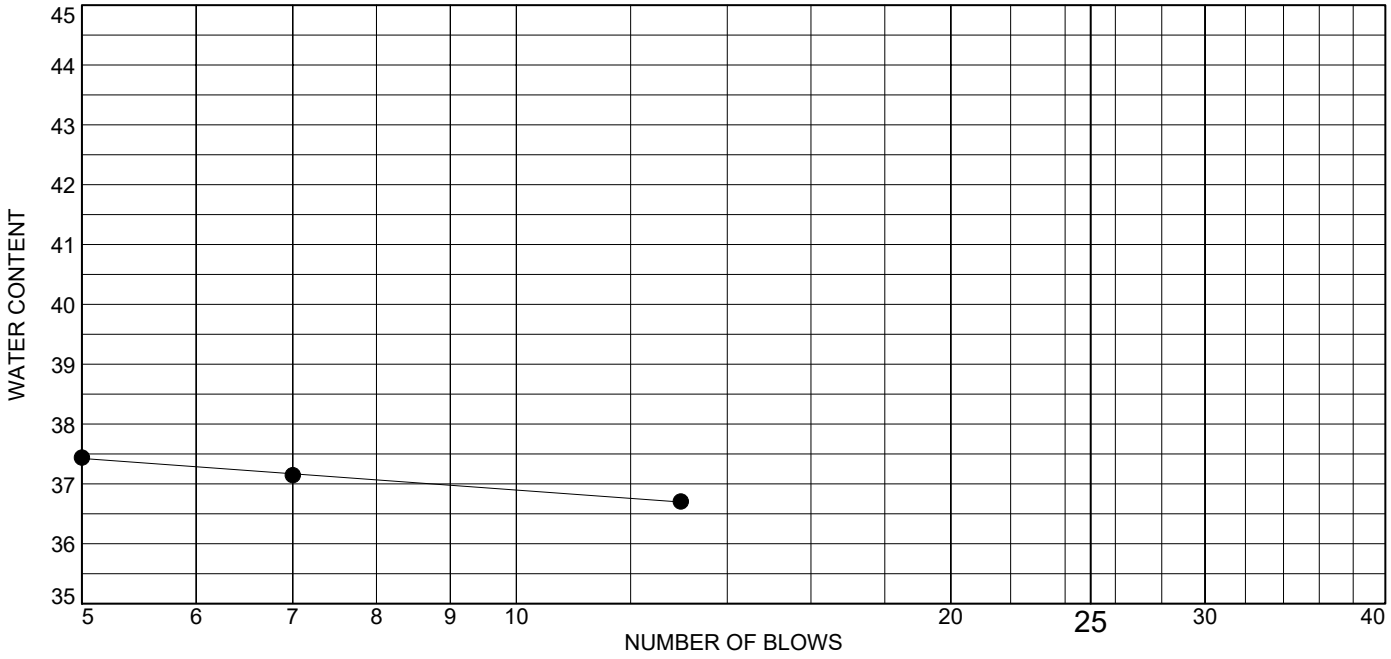
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY SILT WITH SAND - ROOTS NOTED	36	29	7	89.7	72.4	ML

Project No. 11215017 **Client:** CONFIDENTIAL

Project: EDWARDS POWER STATION

Source of Sample: XPW-03 **Depth:** 10.0'-12.0'
Sample Number: 1500

Remarks:

Terracon

Figure

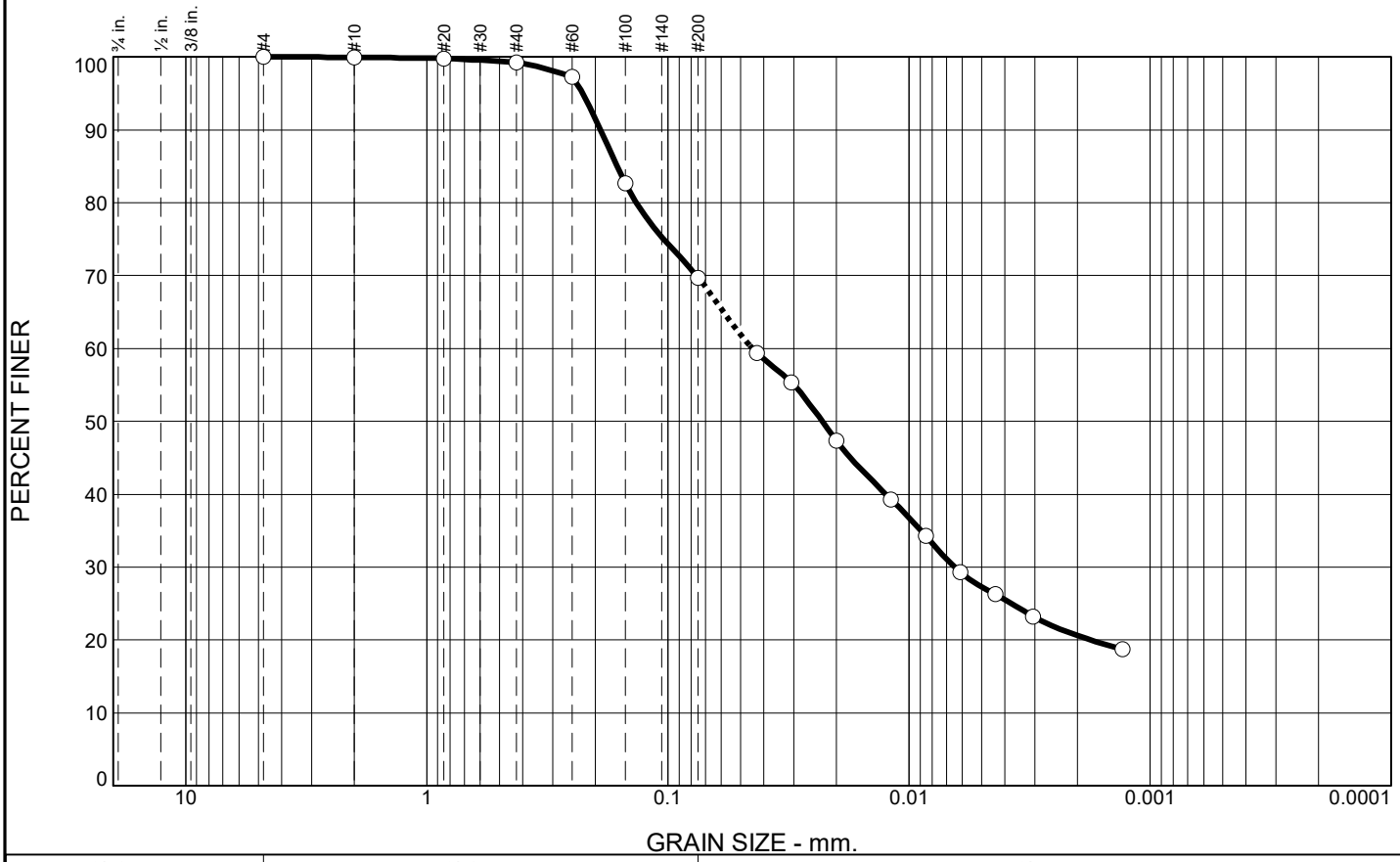
Tested By: DT **Checked By:** WPQ

Terracon

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
ASTM D6913

Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis
ASTM D7928

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.7	29.6	42.4	27.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	99.8		
#40	99.3		
#60	97.3		
#100	82.6		
#200	69.7		
0.0427 mm.	59.4		
0.0307 mm.	55.4		
0.0200 mm.	47.3		
0.0119 mm.	39.3		
0.0085 mm.	34.3		
0.0061 mm.	29.3		
0.0044 mm.	26.3		
0.0031 mm.	23.2		
0.0013 mm.	18.7		

* (no specification provided)

Soil Description

LIGHT BROWN AND GRAY SANDY LEAN CLAY

Atterberg Limits

PL= 14 LL= 30 PI= 16

Coefficients

D_{90}= 0.1902 D_{85}= 0.1626 D_{60}= 0.0446
D_{50}= 0.0229 D_{30}= 0.0065 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(9)

Remarks

F.M.=0.20

Source of Sample: AW-13A **Depth:** 5.0'-7.0'
Sample Number: 0850

Date: 1-29-21

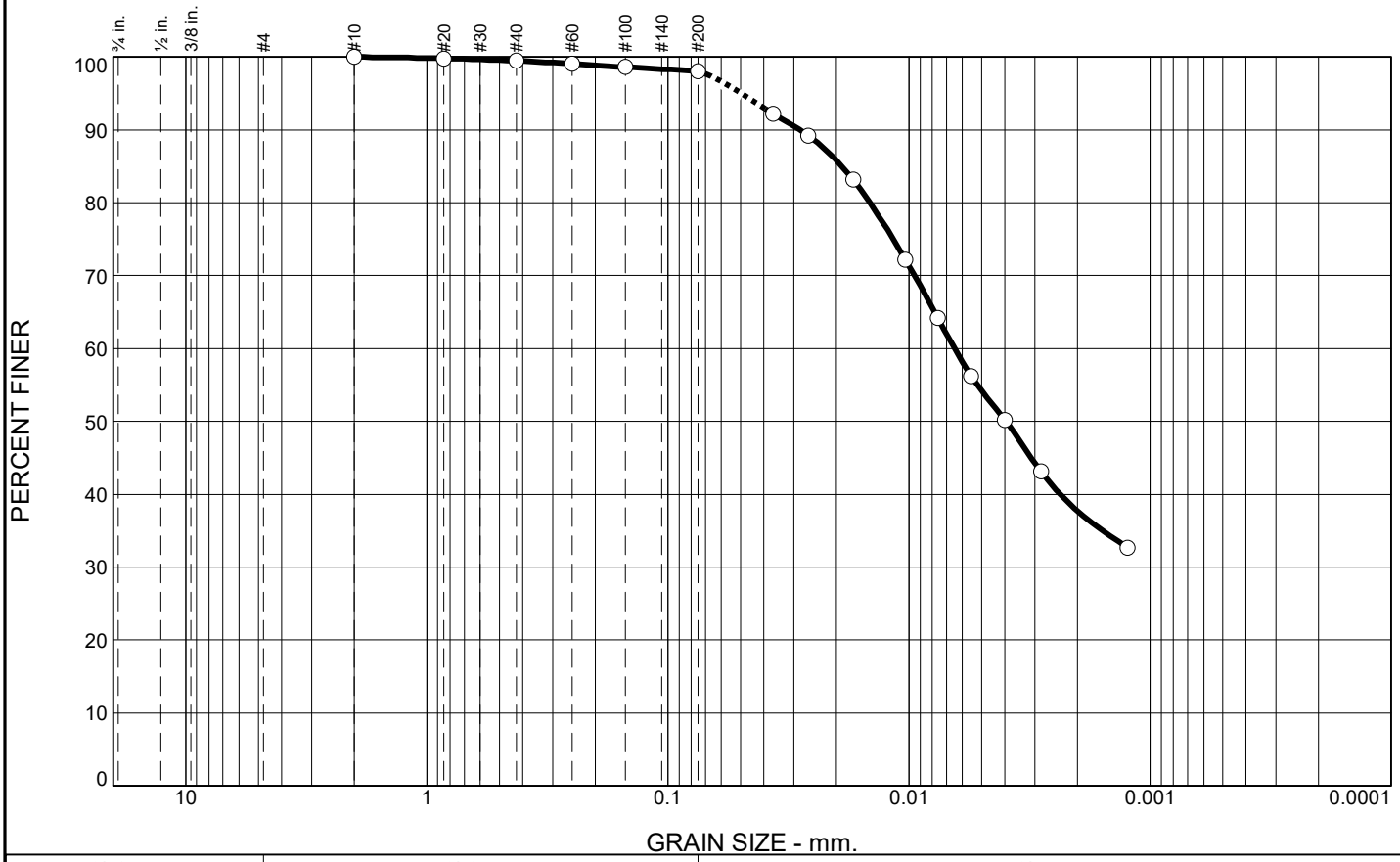
Terracon

Client: CONFIDENTIAL
Project: EDWARDS POWER STATION

Project No: 11215017 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.5	1.5	43.8	54.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.8		
#40	99.5		
#60	99.1		
#100	98.6		
#200	98.0		
0.0365 mm.	92.2		
0.0262 mm.	89.2		
0.0171 mm.	83.2		
0.0104 mm.	72.2		
0.0076 mm.	64.2		
0.0055 mm.	56.2		
0.0040 mm.	50.2		
0.0028 mm.	43.2		
0.0012 mm.	32.7		

* (no specification provided)

Soil Description

GRAY FAT CLAY

Atterberg Limits

PL= 19 LL= 57 PI= 38

Coefficients

D_{90}= 0.0285 D_{85}= 0.0190 D_{60}= 0.0065
D_{50}= 0.0040 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(41)

Remarks

F.M.=0.03

Source of Sample: AW-15 **Depth:** 20.0'-22.0'
Sample Number: 1025 **Date:** 1-29-21

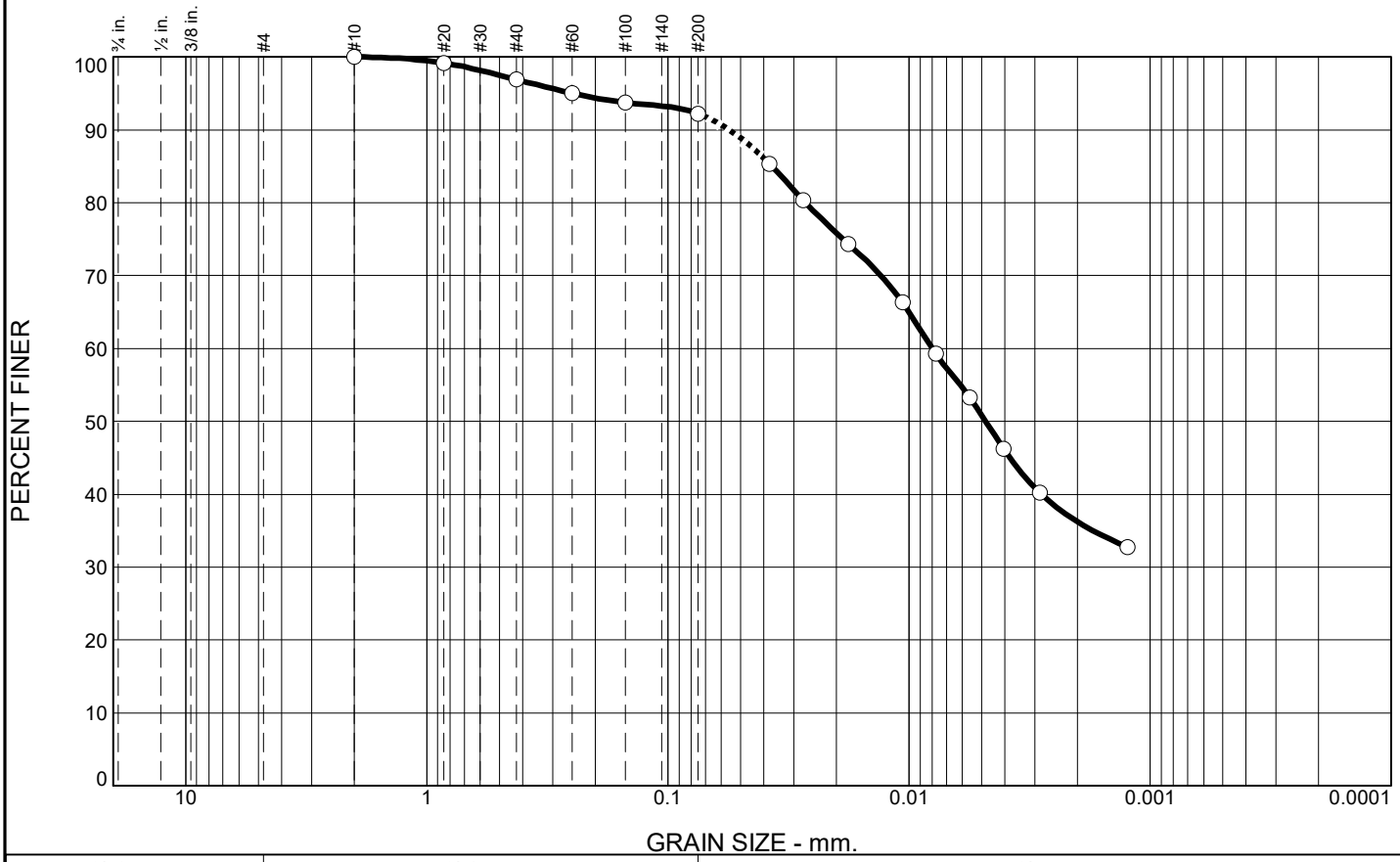
Terracon

Client: CONFIDENTIAL
Project: EDWARDS POWER STATION

Project No: 11215017 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	3.1	4.7	41.3	50.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.2		
#40	96.9		
#60	95.1		
#100	93.7		
#200	92.2		
0.0379 mm.	85.3		
0.0274 mm.	80.3		
0.0178 mm.	74.3		
0.0106 mm.	66.3		
0.0077 mm.	59.3		
0.0056 mm.	53.3		
0.0041 mm.	46.3		
0.0029 mm.	40.2		
0.0012 mm.	32.7		

* (no specification provided)

Soil Description

GRAY AND DARK GRAY LEAN CLAY - SAND POCKETS NOTED

Atterberg Limits

PL= 18 LL= 47 PI= 29

Coefficients

D_{90}= 0.0556 D_{85}= 0.0370 D_{60}= 0.0080
D_{50}= 0.0048 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(28)

Remarks

F.M.=0.13

Source of Sample: AW-20 **Depth:** 15.0'-17.0'
Sample Number: 0810 **Date:** 1-29-21

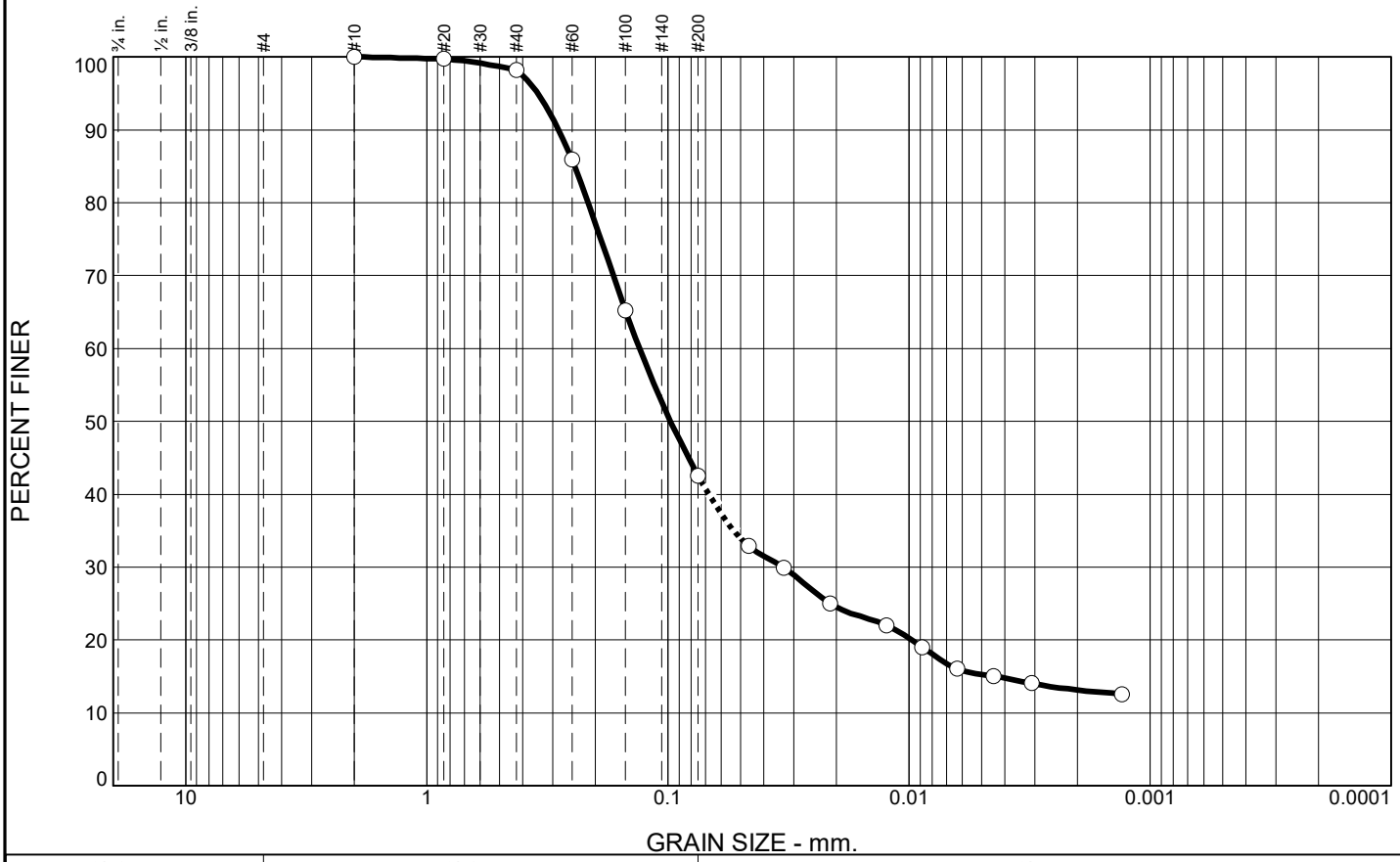
Terracon

Client: CONFIDENTIAL
Project: EDWARDS POWER STATION

Project No: 11215017 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.7	55.7	27.3	15.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.7		
#40	98.3		
#60	85.9		
#100	65.2		
#200	42.6		
0.0463 mm.	32.9		
0.0331 mm.	29.9		
0.0212 mm.	25.0		
0.0124 mm.	22.0		
0.0088 mm.	19.0		
0.0063 mm.	16.0		
0.0045 mm.	15.1		
0.0031 mm.	14.1		
0.0013 mm.	12.6		

* (no specification provided)

Soil Description

GRAY, LIGHT GRAY AND LIGHT BROWN CLAYEY SAND

Atterberg Limits

PL= 13 LL= 22 PI= 9

Coefficients

D_{90}= 0.2838 D_{85}= 0.2437 D_{60}= 0.1311
D_{50}= 0.0975 D_{30}= 0.0333 D_{15}= 0.0044
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-4(1)

Remarks

F.M.=0.44

Source of Sample: AW-22 **Depth:** 30.0'-32.0'
Sample Number: 0745

Date: 1-29-21

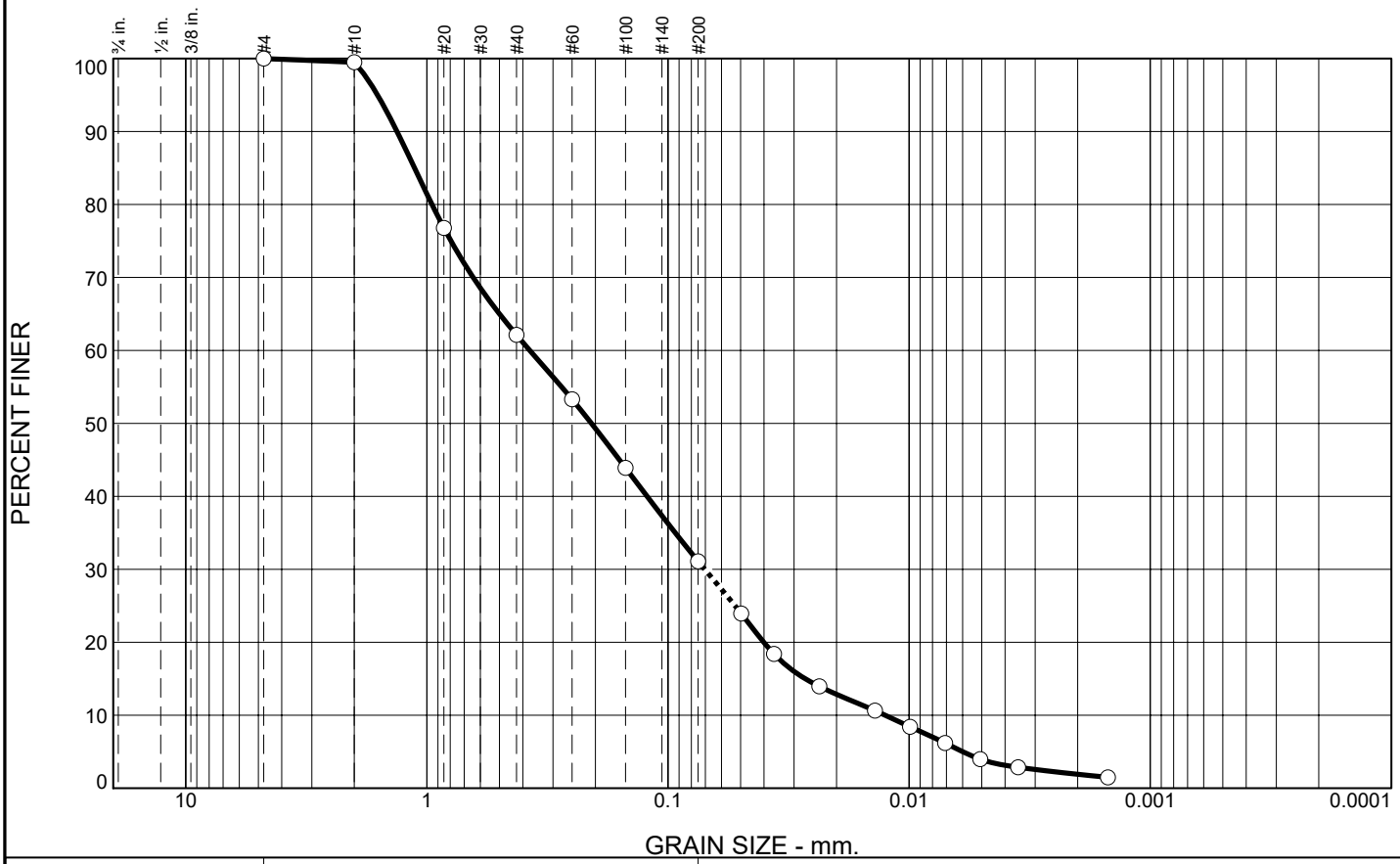
Terracon

Client: CONFIDENTIAL
Project: EDWARDS POWER STATION

Project No: 11215017 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.5	37.4	31.0	27.2	3.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.5		
#20	76.8		
#40	62.1		
#60	53.3		
#100	43.9		
#200	31.1		
0.0497 mm.	23.9		
0.0363 mm.	18.4		
0.0236 mm.	14.0		
0.0139 mm.	10.6		
0.0099 mm.	8.4		
0.0071 mm.	6.2		
0.0051 mm.	4.0		
0.0035 mm.	2.9		
0.0015 mm.	1.5		

* (no specification provided)

Soil Description

DARK GRAY SILTY SAND

Atterberg Limits

PL= 53 LL= 51 PI= NP

Coefficients

D_{90}= 1.3306 D_{85}= 1.1250 D_{60}= 0.3744
D_{50}= 0.2077 D_{30}= 0.0704 D_{15}= 0.0270
D_{10}= 0.0126 C_u= 29.78 C_c= 1.05

Classification

USCS= SM AASHTO= A-2-5(0)

Remarks

F.M.=1.45

Source of Sample: XPW-01 **Depth:** 20.0'-22.0'
Sample Number: 1210 **Date:** 1-29-21

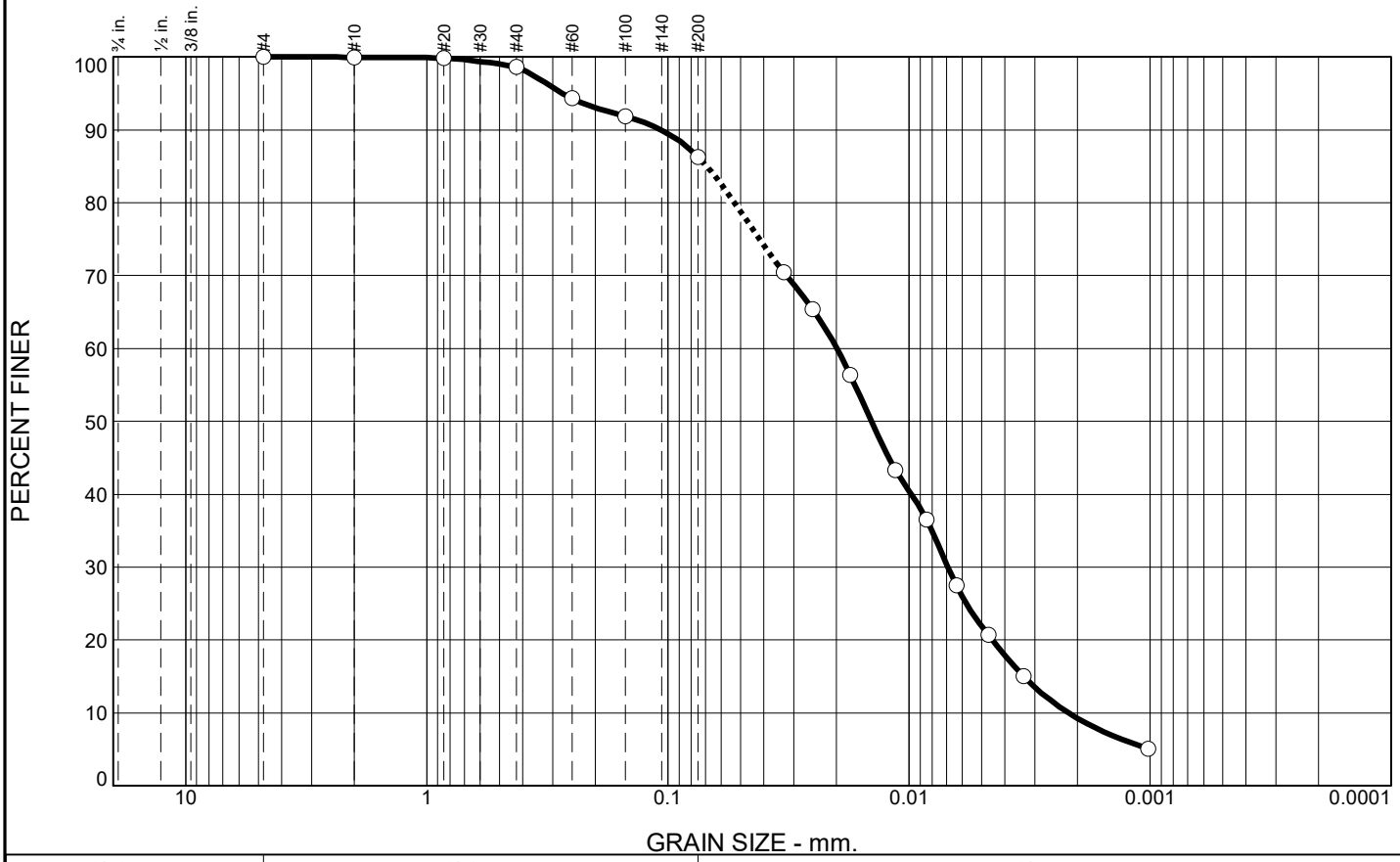
Terracon

Client: CONFIDENTIAL
Project: EDWARDS POWER STATION

Project No: 11215017 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	1.4	12.3	64.4	21.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	99.9		
#40	98.6		
#60	94.3		
#100	91.9		
#200	86.3		
0.0332 mm.	70.5		
0.0251 mm.	65.4		
0.0175 mm.	56.3		
0.0114 mm.	43.3		
0.0085 mm.	36.6		
0.0064 mm.	27.5		
0.0047 mm.	20.7		
0.0034 mm.	15.1		
0.0010 mm.	5.0		

* (no specification provided)

Soil Description

DARK GRAY ELASTIC SILT

Atterberg Limits

PL= 43 LL= 60 PI= 17

Coefficients

D_{90}= 0.1066 D_{85}= 0.0691 D_{60}= 0.0199
D_{50}= 0.0143 D_{30}= 0.0069 D_{15}= 0.0033
D_{10}= 0.0022 C_u= 9.15 C_c= 1.09

Classification

USCS= MH AASHTO= A-7-5(20)

Remarks

F.M.=0.13

Source of Sample: XPW-01A **Depth:** 41.0'-41.5'
Sample Number: 1530

Date: 2-18-21

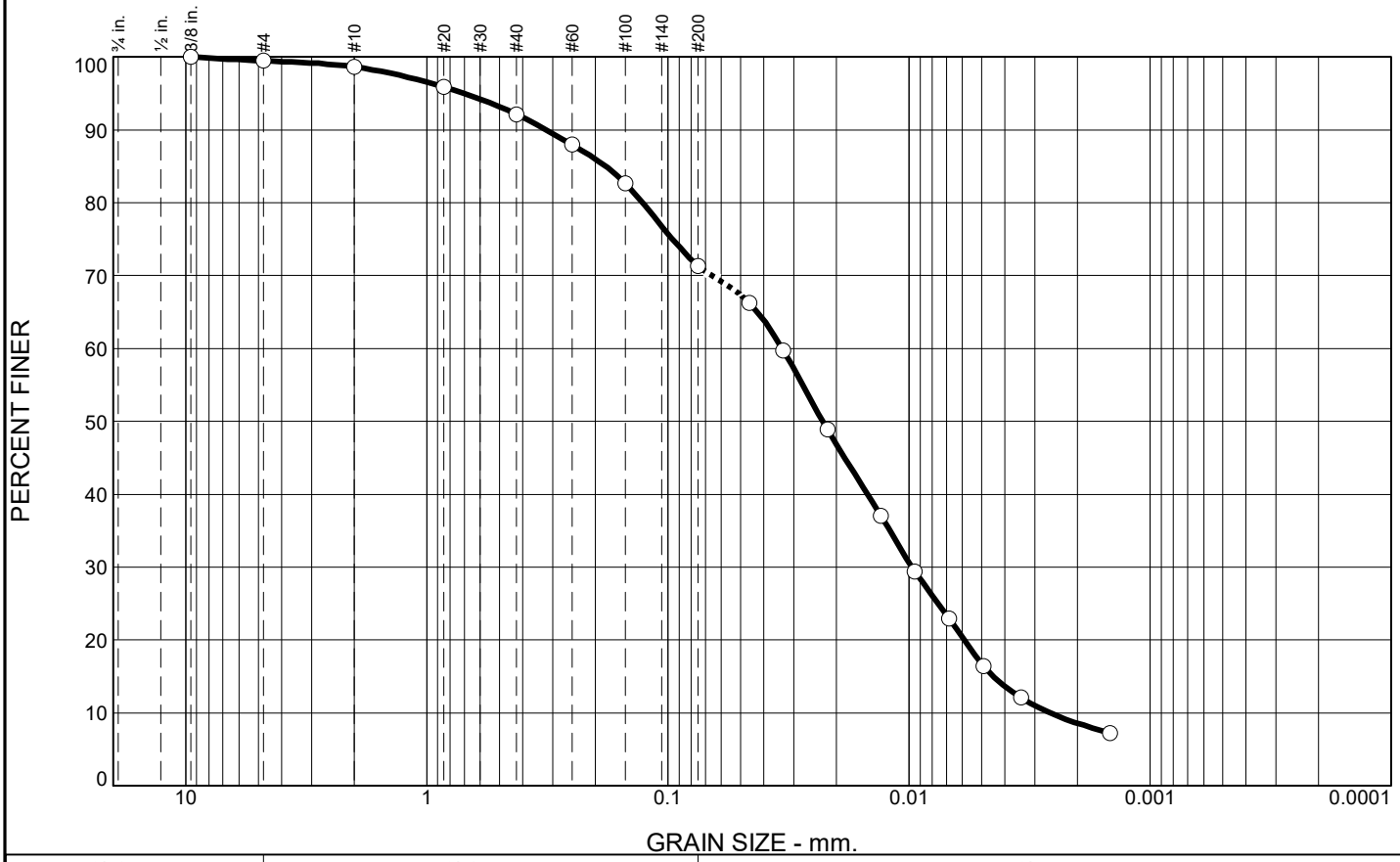
Terracon

Client: CONFIDENTIAL
Project: EDWARDS POWER STATION

Project No: 11215017 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.5	0.9	6.4	20.8	54.6	16.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.5		
#10	98.6		
#20	95.9		
#40	92.2		
#60	88.0		
#100	82.6		
#200	71.4		
0.0460 mm.	66.2		
0.0333 mm.	59.7		
0.0218 mm.	48.9		
0.0131 mm.	37.0		
0.0095 mm.	29.4		
0.0068 mm.	22.9		
0.0049 mm.	16.4		
0.0034 mm.	12.1		
0.0015 mm.	7.2		

* (no specification provided)

Soil Description

DARK GRAY AND GRAYISH BROWN ELASTIC SILT WITH SAND

Atterberg Limits

PL= 47 LL= 52 PI= 5

Coefficients

D_{90}= 0.3194 D_{85}= 0.1815 D_{60}= 0.0336
D_{50}= 0.0228 D_{30}= 0.0097 D_{15}= 0.0045
D_{10}= 0.0026 C_u= 12.95 C_c= 1.08

Classification

USCS= MH AASHTO= A-5(7)

Remarks

F.M.=0.38

Source of Sample: XPW-02 **Depth:** 10.0'-12.0'
Sample Number: 0845 **Date:** 1-29-21

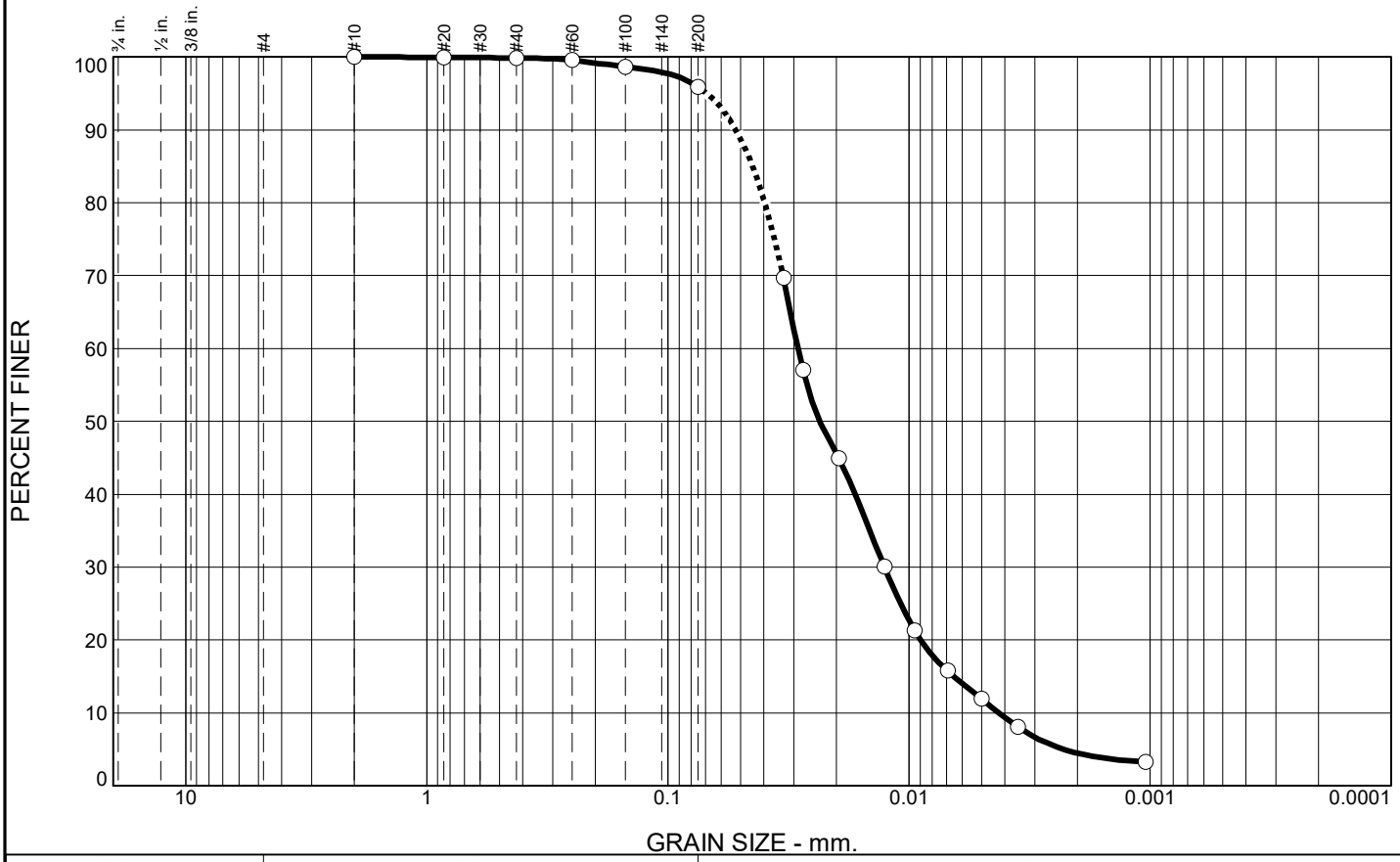
Terracon

Client: CONFIDENTIAL
Project: EDWARDS POWER STATION

Project No: 11215017 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.2	3.9	84.0	11.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.9		
#40	99.8		
#60	99.5		
#100	98.6		
#200	95.9		
0.0331 mm.	69.7		
0.0275 mm.	57.0		
0.0196 mm.	44.9		
0.0127 mm.	30.1		
0.0095 mm.	21.3		
0.0069 mm.	15.8		
0.0050 mm.	11.9		
0.0035 mm.	8.1		
0.0010 mm.	3.2		

* (no specification provided)

Soil Description

DARK GRAY SILT

Atterberg Limits

PL= 30 LL= 38 PI= 8

Coefficients

D_{90}= 0.0522 D_{85}= 0.0446 D_{60}= 0.0289
D_{50}= 0.0234 D_{30}= 0.0126 D_{15}= 0.0065
D_{10}= 0.0042 C_u= 6.82 C_c= 1.30

Classification

USCS= ML AASHTO= A-4(10)

Remarks

F.M.=0.02

Source of Sample: XPW-02 **Depth:** 22.0'-24.0'
Sample Number: 0950 **Date:** 2-18-21

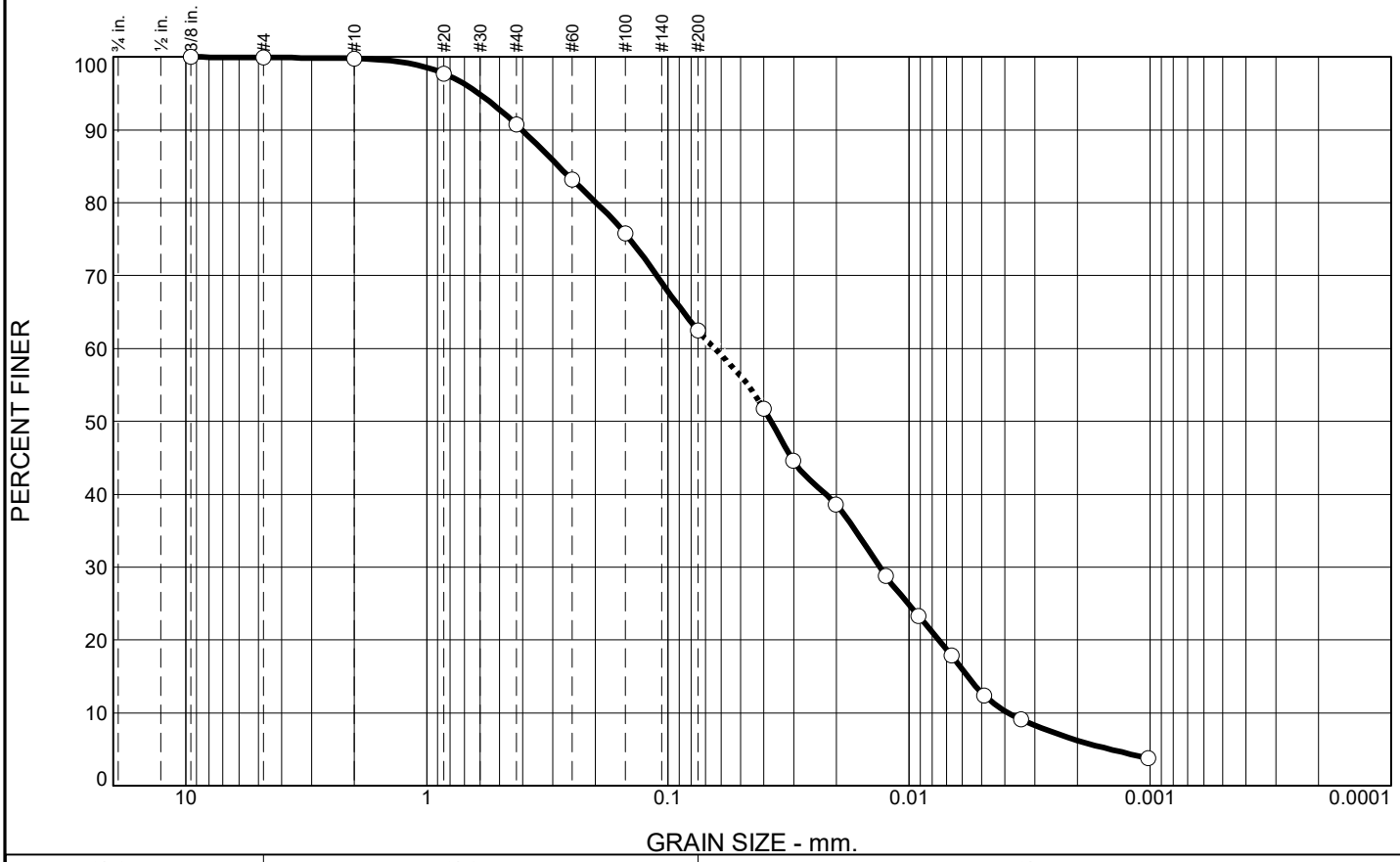
Terracon

Client: CONFIDENTIAL
Project: EDWARDS POWER STATION

Project No: 11215017 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.1	0.1	9.1	28.2	49.7	12.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.9		
#10	99.8		
#20	97.7		
#40	90.7		
#60	83.2		
#100	75.8		
#200	62.5		
0.0400 mm.	51.7		
0.0302 mm.	44.6		
0.0201 mm.	38.6		
0.0125 mm.	28.8		
0.0091 mm.	23.3		
0.0067 mm.	17.9		
0.0049 mm.	12.4		
0.0034 mm.	9.1		
0.0010 mm.	3.8		

* (no specification provided)

Soil Description

GRAYISH BROWN SANDY SILT

Atterberg Limits

PL= 33 LL= 39 PI= 6

Coefficients

D_{90}= 0.4022 D_{85}= 0.2838 D_{60}= 0.0640
D_{50}= 0.0374 D_{30}= 0.0132 D_{15}= 0.0057
D_{10}= 0.0039 C_u= 16.47 C_c= 0.70

Classification

USCS= ML AASHTO= A-4(3)

Remarks

F.M.=0.45

Source of Sample: XPW-02 **Depth:** 45.0'-47.0'
Sample Number: 1245 **Date:** 2-18-21

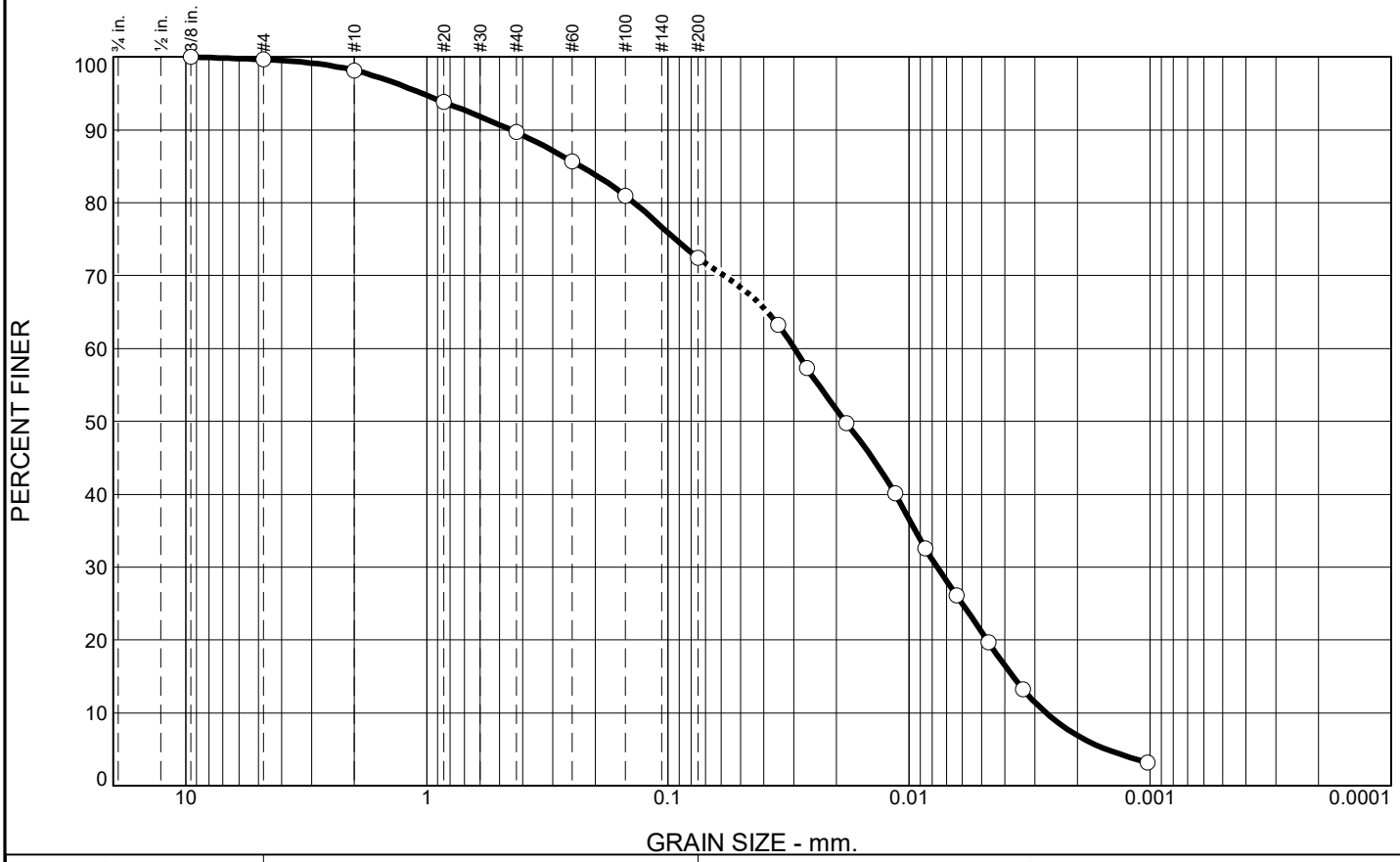
Terracon

Client: CONFIDENTIAL
Project: EDWARDS POWER STATION

Project No: 11215017 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.4	1.4	8.5	17.3	51.3	21.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.6		
#10	98.2		
#20	93.8		
#40	89.7		
#60	85.7		
#100	81.0		
#200	72.4		
0.0348 mm.	63.2		
0.0265 mm.	57.3		
0.0182 mm.	49.8		
0.0114 mm.	40.1		
0.0086 mm.	32.6		
0.0063 mm.	26.1		
0.0047 mm.	19.7		
0.0034 mm.	13.3		
0.0010 mm.	3.2		

* (no specification provided)

Soil Description

DARK GRAY SILT WITH SAND - ROOTS NOTED

Atterberg Limits

PL= 29 LL= 36 PI= 7

Coefficients

D_{90}= 0.4460 D_{85}= 0.2296 D_{60}= 0.0299
D_{50}= 0.0184 D_{30}= 0.0076 D_{15}= 0.0037
D_{10}= 0.0027 C_u= 11.07 C_c= 0.72

Classification

USCS= ML AASHTO= A-4(5)

Remarks

F.M.=0.46

Source of Sample: XPW-03 **Depth:** 10.0'-12.0'
Sample Number: 1500 **Date:** 2-18-21

Terracon

Client: CONFIDENTIAL
Project: EDWARDS POWER STATION

Project No: 11215017 **Figure**

Tested By: SJH **Checked By:** WPQ

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible-Wall Permeameter ASTM D5084

Terracon
Consulting Engineers & Scientists

Laboratory Services Group 192 Exchange Blvd Glendale Heights, Illinois 60139 Ph. (630) 717-4263

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO.: **11215017** **3/5/2021**
PROJECT NAME: **EDWARDS POWER STATION**
CLIENT: **CONFIDENTIAL**
LOCATION : **CONFIDENTIAL**

SUMMARY OF TEST RESULTS

BORING NO. AW13A

TIME SAMPLED: 8:50

DEPTH: 5..0'-7.0'

CLASSIFICATION LIGHT BROWN AND GRAY SANDY LEAN CLAY (CL)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	96.5	97.7
WATER CONTENT (%)	25.2	25.8
DIAMETER (cm)	7.150	7.153
LENGTH (cm)	9.159	9.038
B VALUE PARAMETER:	0.95	
HYDRAULIC GRADIENT (MAXIMUM)	21.81	
PERCENT SATURATION	98.5	

SPECIMEN PHOTO



(Percent saturation calculation is based on final measurements and a measured specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec): 4.72E-08

Deaired water was used as the liquid permeant.

Terracon
Consulting Engineers & Scientists

Laboratory Services Group 192 Exchange Blvd Glendale Heights, Illinois 60139 Ph. (630) 717-4263

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO.: **15205262** **3/5/2021**
PROJECT NAME: **EDWARDS POWER STATION**
CLIENT: **CONFIDENTIAL**
LOCATION : **CONFIDENTIAL**

SUMMARY OF TEST RESULTS

BORING NO. AW15A

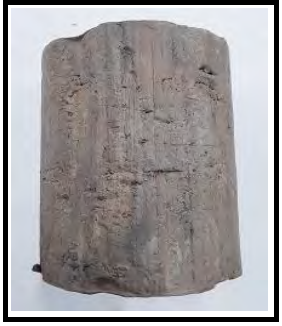
TIME SAMPLED: 10:25

DEPTH: 20.0'-22.0'

CLASSIFICATION GRAY FAT CLAY (CH)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	85.8	86.3
WATER CONTENT (%)	27.9	34.5
DIAMETER (cm)	7.218	7.169
LENGTH (cm)	8.961	9.038
B VALUE PARAMETER:	0.97	
HYDRAULIC GRADIENT (MAXIMUM)	22.29	
PERCENT SATURATION	98.3	

SPECIMEN PHOTO



(Percent saturation calculation is based on final measurements and a measured specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec): 2.87E-08

Deaired water was used as the liquid permeant.

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO.: **15205262** **3/5/2021**
PROJECT NAME: **EDWARDS POWER STATION**
CLIENT: **CONFIDENTIAL**
LOCATION : **CONFIDENTIAL**

SUMMARY OF TEST RESULTS

BORING NO.	AW20
TIME SAMPLED:	N/A
DEPTH:	15.0'-17.0'
CLASSIFICATION	GRAY AND DARK GRAY LEAN CLAY - SAND POCKETS NOTED

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	83.9	86.6
WATER CONTENT (%)	35.1	34.6
DIAMETER (cm)	7.143	7.212
LENGTH (cm)	9.300	8.830
B VALUE PARAMETER:	0.96	
HYDRAULIC GRADIENT (MAXIMUM)	21.48	
PERCENT SATURATION	99.6	

SPECIMEN PHOTO



(Percent saturation calculation is based on final measurements and a measured specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec): 7.23E-08

Deaired water was used as the liquid permeant.

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO.: **11215017** **3/5/2021**
PROJECT NAME: **EDWARDS POWER STATION**
CLIENT: **CONFIDENTIAL**
LOCATION : **CONFIDENTIAL**

SUMMARY OF TEST RESULTS

BORING NO. AW22

TIME SAMPLED: 7:45

DEPTH: 5..0'-7.0'

CLASSIFICATION GRAY, LIGHT GRAY AND LIGHT BROWN CLAYEY SAND (SC)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	101.3	101.9
WATER CONTENT (%)	23.2	23.9
DIAMETER (cm)	7.141	7.204
LENGTH (cm)	8.463	8.273
B VALUE PARAMETER:	0.99	
HYDRAULIC GRADIENT (MAXIMUM)	23.60	
PERCENT SATURATION	99.0	

SPECIMEN PHOTO



(Percent saturation calculation is based on final measurements and a measured specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec): 1.74E-07

Deaired water was used as the liquid permeant.

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO.: **11215017** **5/4/2021**
PROJECT NAME: **EDWARDS POWER STATION**
CLIENT: **CONFIDENTIAL**
LOCATION : **CONFIDENTIAL**

SUMMARY OF TEST RESULTS

BORING NO.	XPW-01
TIME SAMPLED:	12:10
DEPTH:	20.0'-22.0'
CLASSIFICATION	DARK GRAY SILTY SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	69.8	55.7
WATER CONTENT (%)	43.7	69.2
DIAMETER (cm)	7.272	7.183
LENGTH (cm)	6.449	8.273
B VALUE PARAMETER:	0.99	
HYDRAULIC GRADIENT (MAXIMUM)	9.17	
PERCENT SATURATION	99.3	

SPECIMEN PHOTO



(Percent saturation calculation is based on final measurements and a measured specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec): 1.18E-05

Deaired water was used as the liquid permeant.

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO.: **11215017** **5/4/2021**
PROJECT NAME: **EDWARDS POWER STATION**
CLIENT: **CONFIDENTIAL**
LOCATION : **CONFIDENTIAL**

SUMMARY OF TEST RESULTS

BORING NO.	XPW-01A
TIME SAMPLED:	15:30
DEPTH:	40.0'-42.0'
CLASSIFICATION	DARK GRAY ELASTIC SILT

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	71.7	73.1
WATER CONTENT (%)	35.1	42.7
DIAMETER (cm)	6.082	6.072
LENGTH (cm)	10.387	10.221
B VALUE PARAMETER:	0.99	
HYDRAULIC GRADIENT (MAXIMUM)	9.08	
PERCENT SATURATION	99.0	

SPECIMEN PHOTO



(Percent saturation calculation is based on final measurements and a measured specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec): **6.77E-06**

Deaired water was used as the liquid permeant.

Terracon
Consulting Engineers & Scientists

Laboratory Services Group 192 Exchange Blvd Glendale Heights, Illinois 60139 Ph. (630) 717-4263

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO.: **11215017** **5/4/2021**
PROJECT NAME: **EDWARDS POWER STATION**
CLIENT: **CONFIDENTIAL**
LOCATION : **CONFIDENTIAL**

SUMMARY OF TEST RESULTS

BORING NO. XPW-02

TIME SAMPLED: 8:45

DEPTH: 10.0'-12.0'

CLASSIFICATION DARK GRAY AND GRAYISH BROWN ELASTIC SILT WITH SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	67.5	70.1
WATER CONTENT (%)	45.1	47.2
DIAMETER (cm)	7.220	7.150
LENGTH (cm)	8.112	7.973
B VALUE PARAMETER:	0.97	
HYDRAULIC GRADIENT (MAXIMUM)	11.62	
PERCENT SATURATION	99.5	

SPECIMEN PHOTO



(Percent saturation calculation is based on final measurements and a measured specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec): 1.20E-05

Deaired water was used as the liquid permeant.

Terracon
Consulting Engineers & Scientists

Laboratory Services Group 192 Exchange Blvd Glendale Heights, Illinois 60139 Ph. (630) 717-4263

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO.: **11215017** **5/4/2021**
PROJECT NAME: **EDWARDS POWER STATION**
CLIENT: **CONFIDENTIAL**
LOCATION : **CONFIDENTIAL**

SUMMARY OF TEST RESULTS

BORING NO. XPW-02

TIME SAMPLED: 9:50

DEPTH: 22.0'-24.0'

CLASSIFICATION DARK GRAY SILT

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	77.1	79.6
WATER CONTENT (%)	33.4	35.1
DIAMETER (cm)	6.067	6.076
LENGTH (cm)	11.969	11.556
B VALUE PARAMETER:	0.95	
HYDRAULIC GRADIENT (MAXIMUM)	7.88	
PERCENT SATURATION	99.2	

SPECIMEN PHOTO



(Percent saturation calculation is based on final measurements and a measured specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec): 2.08E-06

Deaired water was used as the liquid permeant.

Terracon
Consulting Engineers & Scientists

Laboratory Services Group 192 Exchange Blvd Glendale Heights, Illinois 60139 Ph. (630) 717-4263

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO.: **11215017** **5/4/2021**
PROJECT NAME: **EDWARDS POWER STATION**
CLIENT: **CONFIDENTIAL**
LOCATION : **CONFIDENTIAL**

SUMMARY OF TEST RESULTS

BORING NO. XPW-02

TIME SAMPLED: 12:45

DEPTH: 45.0'-47.0'

CLASSIFICATION GRAYISH BROWN SANDY SILT

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	73.5	78.9
WATER CONTENT (%)	41.7	36.8
DIAMETER (cm)	6.073	5.993
LENGTH (cm)	9.127	8.731
B VALUE PARAMETER:	0.95	
HYDRAULIC GRADIENT (MAXIMUM)	10.33	
PERCENT SATURATION	98.9	

SPECIMEN PHOTO



(Percent saturation calculation is based on final measurements and a measured specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec): 1.00E-05

Deaired water was used as the liquid permeant.

Terracon
Consulting Engineers & Scientists

Laboratory Services Group 192 Exchange Blvd Glendale Heights, Illinois 60139 Ph. (630) 717-4263

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO.: **11215017** **5/4/2021**
PROJECT NAME: **EDWARDS POWER STATION**
CLIENT: **CONFIDENTIAL**
LOCATION : **CONFIDENTIAL**

SUMMARY OF TEST RESULTS

BORING NO.	XPW-03
TIME SAMPLED:	15:00
DEPTH:	10.0'-12.0'
CLASSIFICATION	DARK GRAY SILT WITH SAND - ROOTS NOTED

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	68.0	70.7
WATER CONTENT (%)	43.8	46.0
DIAMETER (cm)	6.111	6.085
LENGTH (cm)	12.259	11.894
B VALUE PARAMETER:	0.98	
HYDRAULIC GRADIENT (MAXIMUM)	7.69	
PERCENT SATURATION	99.6	

SPECIMEN PHOTO



(Percent saturation calculation is based on final measurements and a measured specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec): **3.29E-05**

Deaired water was used as the liquid permeant.

AECOM
GEOTECHNICAL REPORTS

January 12, 2016

Mr. Matt Ballance, PE
Senior Project Engineer
Dynegy Inc.
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

RE: Geotechnical Data Report for Dynegy Edwards Station; Edwards Ash Pond

Dear Mr. Ballance:

AECOM is pleased to provide this 30% Design Data Package for Edwards Ash Pond Coal Combustion Residuals (CCR) units at the E.D. Edwards Power Station (Bartonsville, IL). The Data Package includes summary tables, field exploration plan, and laboratory data.

At Edwards, the geotechnical exploratory program included the following:

- 14 auger borings
- 22 CPT soundings
- 4 standpipe piezometers

AECOM looks forward to providing continued support to Dynegy and working together on this important program. Please do not hesitate to call the undersigned, if you have any questions or comments on this 30% Design Data Package.

Sincerely,

AECOM

Jeremy M. Thomas, P.E.
Project Manager
jeremy.thomas@aecom.com

Attachments:
Tables
Table 1-1 Exploration Location Table
Table 1-2 Water Level Measurements – Piezometers

Figures
D-01 Exploration Locations
D-02 Cross Section Locations
D-03 Piezometer Locations

x

Appendices

Appendix A Boring Logs
Appendix B Piezometer Installation Logs
Appendix C CPT Sounding Logs
Appendix D Laboratory Test Results

TABLES

E. D. Edwards Station

Tabel 1-1 Exploration Location Table

Boring	Depth	Longitude	Latitude	Elevation
EDW-B001	51.0	-89.6671	40.5975	460
EDW-B002	52.5	-89.6671	40.5956	457
EDW-B003	60.5	-89.6668	40.5936	460
EDW-B004	60.3	-89.6652	40.5933	461
EDW-B005	53.0	-89.6643	40.5879	460
EDW-B006	37.0	-89.6638	40.5904	440
EDW-B008	42.5	-89.6662	40.5873	439
EDW-B009	66.5	-89.6667	40.5881	446
EDW-B010	45.3	-89.6691	40.5963	459
EDW-B011	62.0	-89.6675	40.5902	456
EDW-B012	60.0	-89.669	40.5909	453
EDW-B013	53.0	-89.664	40.5875	458
EDW-B014	45.5	-89.6695	40.5947	456
EDW-B015	57.0	-89.6643	40.5884	444
Piezometers	Depth	Longitude	Latitude	Elevation
EDW-P001	36.5	-89.6671	40.5975	460
EDW-P002	31.0	-89.6691	40.5963	459
EDW-P003	51.0	-89.669	40.5909	453
EDW-P004	31.5	-89.6643	40.5884	444
CPT	Depth	Longitude	Latitude	Elevation
EDW-C001	38.9	40.5975	-89.6671	460
EDW-C003	54.6	40.5960	-89.6663	461
EDW-C005	40.0	40.5933	-89.6652	461
EDW-C006	40.0	40.5920	-89.665	473
EDW-C007	54.8	40.5907	-89.6642	461
EDW-C008	33.6	40.5904	-89.6638	441
EDW-C009	52.2	40.5884	-89.6643	444
EDW-C010	30.0	40.5873	-89.6638	442
EDW-C011	47.1	40.5875	-89.664	358
EDW-C012	50.2	40.5879	-89.6643	460
EDW-C013	56.3	40.5875	-89.666	458
EDW-C014	38.2	40.5873	-89.6662	443
EDW-C015	40.0	40.5881	-89.6667	446
EDW-C016	36.9	40.5880	-89.6669	449
EDW-C017	55.9	40.5909	-89.669	453
EDW-C019	53.3	40.5914	-89.6685	462
EDW-C021	49.4	40.5934	-89.6699	452
EDW-C022	20.0	40.5947	-89.6695	456
EDW-C023	40.7	40.5963	-89.6691	459
EDW-C025	20.0	40.5956	-89.6671	457
EDW-C026	14.6	40.5936	-89.6668	460
EDW-C027	40.0	40.5902	-89.6675	456

E. D. Edwards Station

Table 1-2 Water Level Measurements - Piezometers

Piezometer	Ground Surface Elevation (ft)	Screen Depth Interval (ft)		Water Surface Elevation (ft)		
		Top	Bottom	10/28/2015	11/24/2015	12/17/2015
EDW-P001	461.0	30.0	35.0		436.7	438.9
EDW-P002	459.0	24.3	29.0	449.7	449.8	450.2
EDW-P003	459.6	44.3	49.6	437.3	438.7	439.1
EDW-P004	455.6	25.2	30.2		442.8	442.9

FIGURES

File: \\URSSTLOUIS\STLOUIS\PROJECTS\GEOTECH\DYNEGY - BALDWIN 2014\CCR\04TASKS\00 PROGRAM TASKS\1.0 TASK 1 INITIAL UNIT ASSESSMENT\CCR FACT SHEETS\SITE MAPS\FIGURE 2 BORING LOCATION PLAN (EDWARDS ASH POND)_AJW_EDITS.DWG Last edited: AUG. 05, 15 @ 4:03 p.m. by: eric_glazier

EDW-C020
EDW-B007
EDW-C018
EDW-C021
EDW-B012
EDW-C017
EDW-P003
EDW-B014
EDW-C022
EDW-C024
EDW-C023
EDW-B010
EDW-P002
EDW-C019
EDWARDS
ASH POND
EDW-C001
EDW-B001
EDW-P001
EDW-C016
EDW-C027
EDW-B011
EDW-B002
EDW-C025
EDW-C002
EDW-C015
EDW-B009
EDW-C026
EDW-B003
EDW-C014
EDW-B008
EDW-C003
EDW-C013
EDW-C005
EDW-B004
EDW-C004
EDW-C012
EDW-B005
EDW-C006
EDW-C009
EDW-B015
EDW-P004
EDW-C011
EDW-B013
EDW-C007
EDW-C010
EDW-C008
EDW-B006

EXPLORATION METHOD (B=BORING, C=CPT, P=PIEZOMETER)
XXX–X###
ID NUMBER
STATION ABBREVIATION

LEGEND

- PROPOSED BORING LOCATION
- PROPOSED CPT LOCATION
- PROPOSED PIEZOMETER LOCATION
- PROPOSED CROSS SECTION LOCATION
- CCR UNIT BERM ALIGNMENT

SOURCE:
MAP PROVIDED BY GOOGLE EARTH PRO 2015

Ø 400
APPROXIMATE SCALE FEET

DYNEGY, INC	PROJECT NO. 60440202
AECOM	
DRN. BY: djd July 2015 DSGN. BY: eg CHKD. BY: eg	Edwards Ash Pond Field Investigation Plan
	FIG. NO. 1

PRIVILEGED & CONFIDENTIAL - ATTORNEY CLIENT PRIVILEGED

APPENDIX A

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B001

Date(s) Drilled	11/05/2015 to 11/05/2015	Logged By	Robert Weseljak	Checked By	AJW
Drilling Method	Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	51.0 ft
Drill Rig Type	Mobile B-57 Truck Mounted	Drilling Contractor	Strata Earth Services	Surface Elevation	460 ft
Borehole Backfill	Portland Cement and Bentonite	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
460	0	SS-1	2 6 8	61		Stiff, dry, gray mottled with brown, lean CLAY (CL).					3.0			
						457.5 / 2.5								
		SS-2	3 4 5	94		Stiff, moist, brown mottled with gray and black, lean CLAY (CL), trace shell fragments.					3.0			
455	5	SS-3	3 3 3	75		Becomes medium stiff.					1.0			
		ST-4	200 psi	100										*Pushed shelby tube from 7.0 to 9.0 feet*
450	10	SS-5	3 3 6	83		450.0 / 10.0 Stiff, moist, grayish black, lean CLAY (CL), trace organics.					1.0 1.5			
445	15	SS-6	1 3 5	78							1.25			
440	20	SS-7	1 6 7	100		440.0 / 20.0 Stiff, moist, very dark gray to grayish black with some brown, lean CLAY (CL).					1.5 2.5			
435	25	SS-8	WOH WOH 2	100		435.0 / 25.0 Very soft, wet, brown mottled with gray, sandy lean CLAY (CL).					1.0 0.5			
430	30					430.0 / 30.0								

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:32:54 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B001

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
430	30	ST-9	150 psi	100		Soft, wet, gray, silty lean CLAY (CL-ML).					1.25			*Pushed shelby tube from 30.0 to 32.0 feet*
425	35	SS-10	2 2 4	100		425.0 / 35.0 Loose, wet, gray, silty SAND (SM), trace wood fragments. 424.2 / 35.8 Medium stiff, moist, gray, lean CLAY (CL).					0.5 1.0			
420	40	SS-11	50/3"	100		420.0 / 40.0 CLAYSTONE: Brown and gray, weathered, hard.								
415	45	SS-12	50/2"			414.0 / 46.0 SILTSTONE: Thin to medium bedding, fresh, argillaceous.								*Run 1 - Start 13:46, End 14:00*
		Run 1	16.7	36.7										
410	50					409.0 / 51.0 End of Boring at 51 ft								*Boring backfilled with Portland Cement and bentonite*
405	55													
400	60													
395	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:32:54 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B002

Date(s) Drilled	09/03/2015 to 09/03/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	52.5 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	457 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	7.5 ft on 9/3/2015		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0	SS-1	7 6 8	89		457.0 / 0.0 Medium dense, moist, dark brown, FLY ASH [Fill].	38.4							
455						454.5 / 2.5								
		SS-1	3 2 2	100		Loose, moist, dark gray, FLY ASH [Fill].	62.4							
	5	ST-3	150 psi	62.5			66.6		65	29				*Pushed shelby tube from 5.0 to 7.0 feet*
450						449.5 / ▽ 7.5								
		SS-4	WOR	100		Very loose, wet, black, FLY ASH [Fill].	79.0							
	10	ST-5		55			76.9	90.8 94.3 91.2	17	NP				*10.0 feet switch to mud rotary* *Pushed shelby tube from 10.0 to 12.0 feet*
445						Becomes dark gray.								
						Hard layer at tip of tube.								
	15	SS-6	1 2 3	100		Becomes loose.	52.5							
440														
	20	SS-7	12 17 2	37		437.0 / 20.0 Medium dense, wet, dark gray, FLY ASH [Fill], with cementous layers.	67.8							
435														
	25	SS-8	1 WOH WOH	100		432.0 / 25.0 Very loose, wet, dark gray, FLY ASH [Fill].	63.9							
430														
	30													

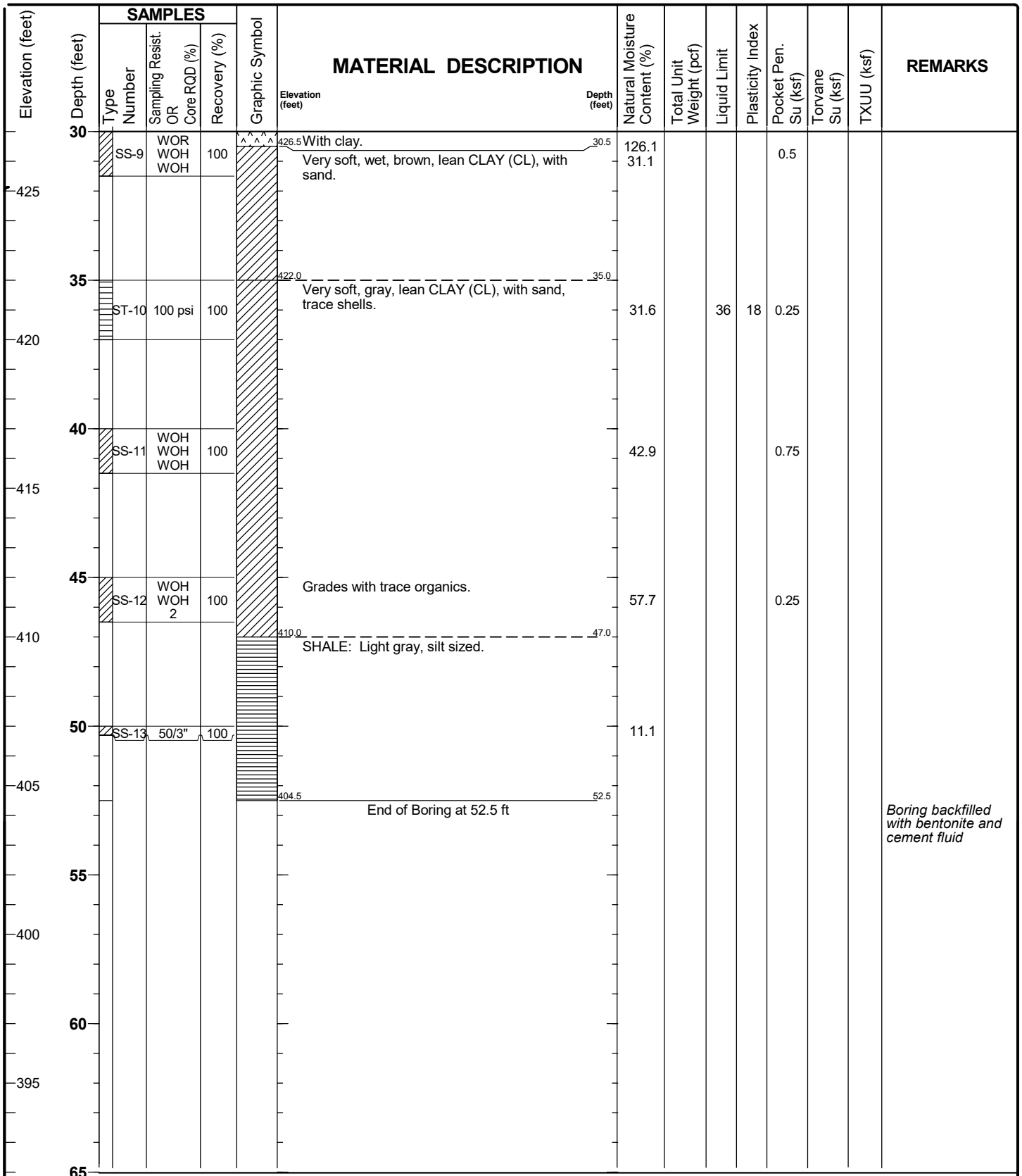
Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:01 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B002



Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:01 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B003

Date(s) Drilled	09/03/2015 to 09/03/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	60.5 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	460 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	7 ft on 9/3/2015		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
460	0	SS-1	7 7 7	83		460.0 / 0.0 Medium dense, moist, dark gray, FLY ASH [Fill].	44.4							
		SS-2	3 2 2	100		Becomes loose.	27.3							
455	5	SS-3	1 WOH 2			455.0 / 5.0 Very soft, moist, lean CLAY (CL) with ash, sand, and organics.	37.2							
						▽ 452.5 / 7.5								
		ST-4	<100 psi	100		Ash, dark gray [Fill].	55.5							*Pushed shelby tube from 7.5 to 9.5 feet*
450	10	SS-5	WOR WOR WOR	67			50.6							*10.0 feet: Switch to mud rotary*
						447.0 / 13.0 Very dense, dark gray, moist, fine to coarse ASH with sand and gravel, slightly cemented [Fill].								*13.0 feet: Hard drilling*
445	15	SS-6	26 37 29	100			29.7							
						Becomes very loose, dark gray, fine.								
440	20	SS-7	1 1 1	100			42.1							
435	25	ST-8	100 psi	100		Grades with sand.	54.9							*Pushed shelby tube from 25.0 to 27.0 feet*
430	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:06 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B003

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
430	30	ST-9	100 psi	100		Varved FLY ASH.	71.7	91.2 92.9 92.0						*Pushed shelby tube from 30.0 to 32.0 feet*
425	35	SS-10	WOR WOR WOR	100		423.5 / 36.5	51.9 43.0							
						Very soft, moist, brown to gray, silty CLAY (CL), trace sand, shells, and organics.								
420	40	SS-11	WOH WOH WOR	100			31.6				.75			
415	45	ST-12	100 psi	100		415.0 / 45.0 Soft, moist, dark gray, fat CLAY (CH) with sand.	46.0				1.0			*Pushed shelby tube from 45.0 to 47.0 feet*
410	50	SS-13	1 2 3	100		410.0 / 50.0 Medium stiff, moist, brownish to greenish, gray, lean CLAY (CL), with sand.	55.4				1.0			
						406.0 / 54.0 SHALE, gray, weathered, silt sized.								
405	55	SS-14	11 50/5"	100			23.3 9.8							
400	60	SS-15	50/3"	100		399.5 / 60.5 End of Boring at 60.5 ft	7.1							*Boring backfilled with bentonite and cement fluid*
395	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:06 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B003A

Sheet 1 of 1

Date(s) Drilled	09/03/2015 to 09/03/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	9.5 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
Boring Location	5' East of EDW-B003 (ft NAD83)	Groundwater Level(s)	7 ft on 9/3/2015		

Depth (feet)	SAMPLES Type Number	SAMPLES Sampling Resist. OR Core RQD (%)	SAMPLES Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION Elevation (feet)	MATERIAL DESCRIPTION Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0					Offset boring to attempt shelby tube at 7.5 feet	0.0								
5														
	ST-1		0											*Pushed shelby tube from 7.5 to 9.5 feet*
						9.5								
10					End of Boring at 9.5 ft									*Boring backfilled with bentonite and cement fluid*
15														
20														
25														
30														

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:12 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B004

Date(s) Drilled	09/11/2015 to 09/11/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	60.3 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0							0.0								
	SS	1	16 12 15	83		6" stone at surface.	0.5	18.9							
						Medium dense, moist, dark gray, ASH [Fill].									
	SS	2	3 2 2	100			3.5	28.5 20.1							
						Becomes dark gray to dark brown, trace silty clay, sand and gravel.									
5	SS	3	2 2 4	77								1.25			
	SS	4	2 3 4	100				21.6				2.0			
10	SS	5	2 2 2	67				21.5				2.0			*10.0 feet: Switch to mud rotary*
							12.5								
	SS	6	2 2 2	100		Soft, wet, brown mottled, silty CLAY (CL), trace sand and gravel.		25.4				1.25			
15	SS	7	2 3 3	77				25.8				1.25			
20	SS	8	WOH 2 3	89		Grades brown, with sand.		31.3				.75			
25	SS	9	2 2 3	89			26.0	23.0 19.5							
						Medium stiff, wet, brown, clayey SAND (SC).	26.5								
						Medium stiff, wet, dark gray to gray, silty CLAY (CL), trace sand.									
30							30.0								

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:15 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B004

Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION Elevation (feet) / Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30	SS	10	2 7 6	89		Stiff, gray, wet, lean CLAY (CL), with sand, and organics.	19.7				4.0			
35						35.0								
	ST	11		100		Stiff, wet, gray mottled, lean CLAY (CL) with sand.	20.1				1.25			*Pushed shelby tube from 36.0 to 38.0 feet*
40	SS	12	2 3 3	89		40.0 Stiff, wet, brown mottled, lean CLAY (CL), trace sand.	30.0				1.75			
45	SS	13	2 3 5	83		45.0 Medium stiff, wet, dark gray, lean CLAY (CL).	39.5 35.1				1.25			
50	SS	14	2 2 3	100		50.0 Medium, stiff, wet, gray, lean CLAY (CL) with sand, trace shells and organics.	65.2				1.25			
55	SS	15	3 8 23			56.0 SHALE: Light gray, weathered.	33.4 13.2							*56.5 to 60.0 feet: Solid drilling*
60	SS	16	50/3"	100		60.0 End of Boring at 60.3 ft	8.8							*Boring backfilled with bentonite and cement fluid*
65														

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:15 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B005

Date(s) Drilled	09/10/2015 to 09/10/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	53.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	8 ft on 9/10/2015		

Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0	SS	SS-1	4 4 5	95		Medium, stiff, moist, brown, clayey SAND (SC), trace gravel, topsoil, roots and fill.	0.0	45.8				2.0			
							2.5								
	SS	SS-2	9 15 11	100		Medium dense, moist, brown, sandy SILT (ML) with gravel.		26.0							
5	SS	SS-3	2 2 2	100		Loose, moist, brown, sandy elastic SILT (MH) with clay.	5.0	50.9				1.8			
							▽ 8.0								
	SS	SS-4		100		Loose, wet, brown, sandy SILT (ML) with gravel.		37.4							
10	SS	SS-5	1 2 5	100		Medium stiff, wet, light brown and gray, clayey SAND (SC) with gravel.	10.0	44.3							*10.0 feet: Switch to mud rotary*
15	SS	SS-6	2 8 10	100		Very stiff, wet, brown, sand SILT (ML) with gravel.	15.0	41.4							
20	SS	SS-7	1 1 1	100		Soft, wet, brown, gravelly CLAY (CL), trace sand.	20.0	51.1							
25	SS	SS-8	2"	100				55.3							
						Very loose, wet, dark brown ASH [Fill].	26.5	47.6							
30	SS	SS-9		100				69.3							

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:20 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B005

Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30	SS-9		100			69.3							
35	SS-10	WOR WOH WOH	67		35.0 Very loose, wet, black, ASH, with organic clay [Fill].	37.3							
40	ST-11	150 psi	100		38.0 Soft, wet, gray, fat CLAY (CH), trace sand, shells, and organics.	44.8		57	35				*Pushed shelby tube from 41.0 to 43.0 feet*
45	SS-12	WOH 2 2	100		45.0 Soft, wet, dark gray and greenish gray, lean CLAY (CL), with sand, organics and shale.	88.7							
50	SS-13	11 18 44	89		49.5 SHALE: light gray, weathered.	15.9 12.8							
55					53.0 End of Boring at 53 ft								*Boring backfilled with bentonite and cement fluid*
60													
65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:21 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B006

Date(s) Drilled	09/08/2015 to 09/08/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	37.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION Elevation (feet) / Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0	SS	SS-1	3 4 6	94		Stiff, moist, dark brown, lean CLAY (CL) with sand and glass.	26.4				3.0			
2.5	SS	SS-2	3 3 3	67		Medium stiff, brown to dark brown lean CLAY (CL), trace sand.	30.1				1.25			
5	SS	SS-3	2 3 4	100		Medium stiff, moist, gray and mottled brown, lean CLAY (CL), trace sand.	24.8		48	29	2.0			
	SS	SS-4	3 4 4	100			26.0				1.5			
10	SS	SS-5	1 2 1	100		Becomes soft.	34.2				1.0			*10.0 feet: Switch to mud rotary*
13.0	ST	ST-6		100		Soft, moist, gray fat CLAY (CH) with sand and shells.	31.1		62	42	1.25			*Pushed shelby tube from 12.0 to 14.0 feet*
15	SS	SS-7	1 1 1	100		Soft, moist, brownish gray, lean CLAY (CL).	40.8				1.0			
20	SS	SS-8	WOH WOH 1	100		Becomes very soft, brown and gray, with sand.	43.4				0.75			
25														
26.0	ST	ST-9		100		Very soft, moist, dark gray, organic SILT (OH).	76.0		72	35	0.75			*Pushed shelby tube from 26.0 to 28.0 feet*
30						30.0								

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:26 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B006

Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30	SS-10		89		Very soft, moist, gray lean CLAY (CL) with sand, pockets of organics. — 31.0	43.4 19.6				0.75			
					Very soft, moist, grayish brown, lean CLAY (CL) with sand, silt, and organics.								
					— 33.0								
					SHALE: light gray, weathered.								
35	SS-11		84			14.2							
					— 37.0								
					End of Boring at 37 ft								*Boring backfilled with bentonite and cement fluid*
40													
45													
50													
55													
60													
65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:26 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B008

Date(s) Drilled	09/13/2015 to 09/13/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	42.5 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION Elevation (feet) / Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0					0.0								
	SS-1	3 4 4	100		Stiff, moist, brown, lean CLAY (CL) with sand and gravel, trace roots.	13.2				4.0			
	SS-2	3 4 6	100			19.5		42	20	4.25			
5	SS-3	2 3 5	67		Becomes medium stiff.	42.3				2.0			
					7.5								
	SS-4	1 3 2	89		Medium stiff, moist, gray and mottled brown, lean CLAY (CL), trace sand.	22.8				2.5			
10					11.0								*10.0 feet: Switch to mud rotary*
	ST-5	150 psi	85		Medium stiff, moist, brown and gray fat CLAY (CH), trace sand.	33.6		52	33	0.75			
15					15.0								
	SS-6	WOH 1 1	100		Soft, moist, dark brown, lean CLAY (CL), trace shells.	64.6				0.75			
20	SS-7	WOH WOH WOH	100		Becomes very soft.	44.4				0.75			
					24.0								
25	ST-8	150 psi			Very soft, moist, dark gray, fat CLAY (CL), trace organics.	68.9		67	36	1.0			
30					30.0								

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:32 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B008

Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30	SS-9	WOH WOH WOH	100		Very soft, moist, gray and brownish gray, lean CLAY (CL), trace sand.	71.4				0.5			
35	SS-10	WOH WOH WOH	100		Trace wood, organics, and shells.	56.9				0.75			
					39.0 SHALE: Light gray, slightly weathered.								
40	SS-11	66/4"	100			12.6							*40.0 to 42.5 feet: Solid drilling*
					42.5 End of Boring at 42.5 ft								*Boring backfilled with bentonite and cement fluid*
45													
50													
55													
60													
65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:32 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B009

Date(s) Drilled	11/05/2015 to 11/05/2015	Logged By	Robert Weseljak	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	66.5 ft
Drill Rig Type	Mobile B-57 Truck Mounted	Drilling Contractor	Strata Earth Services	Surface Elevation	446 ft
Borehole Backfill	Portland Cement and Bentonite	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0					446.0 / 0.0								
445		SS-1	11 13 15	100		445.5 / 0.5 Medium dense, moist, brown silty SAND (SM).					1.0 1.25			
						Very stiff, moist, gray and brown, sandy SILT (ML).								
						443.5 / 2.5								
		SS-2	2 1 1	67		Soft, dry, gray and brown sandy SILT (ML)					0.25			
	5					441.5 / 4.5 Concrete from 4.5 to 5.5.								
440		SS-3	5 2 5	11		440.5 / 5.5 Light brown, well graded GRAVEL (GW).								*5.5 feet: Limestone cobbles*
						438.5 / 7.5								
		SS-4	5 4 4	89		437.5 / 8.5 Stiff, dry, brownish gray, silty SAND with GRAVEL (SM).					1.0			
	10					Medium dense, moist, black, sandy SILT (ML).								
435						435.0 / 11.0								
		ST-5	250 psi	75		Medium stiff, moist, brownish gray, lean CLAY (CL).					1.5			*Pushed shelby tube from 11.0 to 13.0 feet* *Trace gravel in top of tube*
	15					431.0 / 15.0								
430		SS-6	1 5 5	89		Medium dense, moist, brown mottled with reddish brown, lean CLAY (CL).					2.0			
	20					426.0 / 20.0								
425		SS-7	WOH 2 4	94		Very soft to medium dense, moist to wet, gray, lean CLAY (CL) with shell and wood fragments.					1.0			
	25					421.0 / 25.0								
420		SS-8	WOH WOH 3	100		Very soft to soft, wet, gray, lean CLAY (CL) with shell fragments.					0.5 1.0			
	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:38 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B009

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
415	30	SS-9	WOH 7 7	100		415.5 / 30.5 Stiff, dry, black, lean CLAY (CL), low plasticity.					1.0 1.25			
410	35	ST-10	125 psi	100		Becomes gray.					1.0			*Pushed shelby tube from 35.0 to 37.0 feet*
405	40	SS-11	WOH WOH 4	100		406.0 / 40.0 Soft, moist to wet, gray, lean CLAY (CL) with shell fragments, low to medium plasticity.					0.5			
400	45	SS-12	WOH 1 4	100							1.0			
395	50	SS-13	WOH WOH WOH	100		396.0 / 50.0 Very soft, wet, gray, SILT (ML) with shell fragments, low plasticity.					1.0			
390	55	SS-14	WOH WOH 17	100		390.0 / 56.0 Medium dense, wet, gray, fine to coarse clayey GRAVEL (GC), trace fine to coarse sand, reddish brown gravel.					3.0			
385	60	SS-15	50/3"	17		386.0 / 60.0 CLAYSTONE: Gray.								
	65	Run 1	0	0										*61.5 feet: Run 1 - Start 7:57, End 8:10*

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:39 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B009

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
380		Run 1	0	0		Elevation (feet) 379.5 / Depth (feet) 66.5								
						End of Boring at 66.5 ft								
	70													
375														
	75													
370														
	80													
365														
	85													
360														
	90													
355														
	95													
350														
	100													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:39 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B010

Date(s) Drilled	09/04/2015 to 09/04/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	45.3 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	459 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
459	0					459.0 / 0.0								
		SS-1	10 6 10	56		458.5 / 0.5 Medium dense, moist, brown, SAND (SP) with gravel and clay.	7.2							
						Medium dense, moist, dark gray, fine to coarse ASH [Fill].	17.4 27.9							
		SS-2	9 8 8	83			20.9 30.7							
455	5	SS-3	3 6 4	100			14.8							
						451.5 / 7.5								
		SS-4	3 3 6	78		Stiff, moist, brown lean CLAY (CL), trace sand and gravel.	22.0							
450	10					449.0 / 10.0								
		SS-5	2 3 4	78		Medium stiff, moist, brown and mottled gray, lean CLAY (CL), trace sand.	24.0							
		SS-6	2 2 3	78			28.0							*12.0 feet: Switch to mud rotary*
445	15	ST-7	250 psi	83			30.5		48	30				*Pushed shelby tube from 15.0 to 17.0 feet*
						440.0 / 19.0								
440	20					Soft, wet, gray, lean CLAY (CL), trace sand and shells.								
		SS-8	1 1 1	83			32.9							
435	25	SS-6	WOH WOH 3	89			21.4							
430	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:48 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B010

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30	ST-10		72			30.0	117.6 118.9 118.6	40	25				*Pushed shelby tube from 30.0 to 32.0 feet*
425														
	35	SS-11	1 2 3	94		Becomes medium stiff.	28.2							
420														
	40	SS-12	6 7 50/3.5"	83		419.0 / 40.0 Medium dense, wet, brown, fine to coarse silty SAND (SP) with gravel. 418.0 / 41.0 SHALE: Light gray, weathered.	17.0							*41.0 to 43.0 feet: Hard drilling*
415														
	45	SS-13	50/3"	35		413.8 / 45.3 End of Boring at 45.25 ft	16.4							*Boring backfilled with bentonite and cement fluid*
410														
	50													
405														
	55													
400														
	60													
395														
	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:48 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B011

Date(s) Drilled	09/12/2015 to 09/12/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	62.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	456 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	7.5 ft on 9/12/2015		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
						Elevation (feet) 456.0 / Depth (feet) 0.0								
455	0	SS-1	9 12 12	89		Medium dense, moist, dark gray, ASH [Fill].	27.7							
		SS-2	8 9 14	100			16.3							
450	5	SS-3	6 9 9	94			29.4							
		SS-4	2 1 1	100		Becomes loose, wet. ▽	45.3							
445	10	SS-5		84			70.0							*10.0 feet: Switch to mud rotary*
440	15	SS-6	WOR WOR WOR WOR	100		Becomes very loose.	63.2							
435	20	SS-7		56			84.9							
430	25	SS-8	WOR WOR WOR WOR	89			74.7							
	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:53 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B011

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
425	30	SS-9	WOR WOR WOR WOR	100			73.7							
420	35	SS-10	WOR WOR WOR WOR	84			93.9							
415	40	SS-11	WOH 1 2	100		416.0 / 40.0 Soft, wet, gray, silty CLAY (CL), trace sand, shells, and organics.	47.9							
410	45	SS-12	WOR WOR WOH	94		411.0 / 45.0 Very soft, wet, gray, fat CLAY (CH), trace sand, shells, and wood.	63.3		63	42				
405	50	SS-13	WOR WOR WOH	89		406.0 / 50.0 Very soft, wet, dark gray and grayish brown, lean CLAY (CL).	62.5							
400	55	SS-14	WOR WOR WOH	100		Grades gray.	52.9							
						398.0 / 58.0 SHALE: Light gray, soft.								*58.0 to 62.0 feet: Solid drilling*
395	60	SS-15	50/3"	100		394.0 / 62.0 End of Boring at 62 ft	9.1							*Boring backfilled with bentonite and cement fluid*
	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:53 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B012

Sheet 1 of 2

Date(s) Drilled	09/09/2015 to 09/09/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	60.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	453 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
						Elevation (feet) / Depth (feet)								
	0					453.0 / 0.0								
		SS-1	6 6 4	94		452.6 / 0.4 Limestone gravel.	23.0							
						Stiff, moist, brown sandy SILT (ML), trace clay, gravel, and topsoil.								
						450.5 / 2.5								
450		SS-2	5 4 3	78		Loose, moist, dark brown ASH [Fill].	23.8		28	2				
	5	SS-3	3 4 11	56			26.5							
445		SS-4	10 10 7	89			26.5							
	10	SS-5	2 3 4	89		With clay.	24.7 24.9							
						442.0 / 11.0 Stiff, moist, brown to gray, silty CLAY (CL), trace sand, shells, and roots.								
440		SS-6	3 3 6	94			22.0							
	15	SS-7	2 3 4	61		Becomes medium stiff.	24.3		48	29				*15.0 feet: Switch to mud rotary*
435														
	20	ST-8	100 psi	75			23.8							*Pushed shelby tube from 20.0 to 22.0 feet*
430														
	25	SS-9	3 3 3	100			23.2							
425														
	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:59 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B012

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30	SS-10	2 2 4	61			24.8							
420														
	35	SS-11	2 2 2	100		Becomes soft, trace sand.	28.3							
415														
	40	SS-12	WOH 2 2	100		Becomes soft, trace sand, shells, and organics.	32.2							
410														
	45	SS-13	1 2 3	100			50.2							
						406.0 / 47.0								
405		ST-14		100		Medium stiff, moist, dark gray, fat CLAY (CL).	50.8	104.4 104.9 104.0	54	34				*Pushed shelby tube from 47.0 to 49.0 feet*
						404.0 / 49.0								
	50	SS-15	3 2 4	100		Medium stiff, moist, gray and brownish gray, lean CLAY (CL), trace sand.	67.4							
400														
	55	SS-16	11 21 23	100		397.5 / 55.5 Gray broken rock, weathered.	50.5 15.3							
						396.0 / 57.0 Light gray rock, weathered.								
395														
	60	SS-17	50/2.5"	75		392.8 / 60.2 End of Boring at 60 ft	17.9							*Boring backfilled with bentonite and cement fluid*
390														
	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:33:59 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B013

Date(s) Drilled	09/11/2015 to 09/11/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	53.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0	SS	SS-1	4 4 7	44		Medium stiff, moist, dark gray to brown, CLAY (CL) with ASH [Fill].	0.0	13.6							
							2.5								
	SS	SS-2	1 3 4	83		Medium stiff, moist, brown, silty CLAY (CL), trace sand, gravel, and roots.		17.4				2.0			
5	SS	SS-3		46				24.3 20.0		49	28				
							8.0								
	SS	SS-4	3 4 6	72		Stiff, moist, dark gray, silty CLAY (CL), trace sand.		24.3				2.0			
10	SS	SS-5	2 4 7	83				25.4				2.0			*10.0 feet: Switch to mud rotary*
						Gray and mottled brown silty CLAY (CL), trace sand.									
15	SS	SS-6	2 2 4	100		Becomes medium stiff, gray and mottled brown.		25.5		41	29	1.0			
20	SS	SS-7	2 3 3	67				23.5				1.0			
25	SS	SS-8	3 3 4	67		Becomes gray, trace organics.		27.7				1.25			
30							30.0								

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:34:04 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B013

Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
30	SS-9	1 2 2	94		Medium stiff, moist, brown mottled gray, sandy CLAY (CL), trace silt and shells.	20.2				1.5			
					32.0								
	ST-10		100		Medium stiff, moist, gray and brown lean CLAY (CL) with sand.	33.3		42	19	1.25			*Pushed shelby tube from 32.0 to 34.0 feet*
35	SS-11	2 2 2	89		Becomes dark gray, trace organics.	58.0				1.0			
40	SS-12	2 2 3	100			54.5				1.25			
45	SS-13	2 2 4	100		Grades with calcium carbonate seams and shells.	66.2				1.75			
					Gravel layer 47.5 feet to 49.0 feet								
50					53.0								
					End of Boring at 53 ft								*Boring backfilled with bentonite and cement fluid*
55													
60													
65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:34:05 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B014

Date(s) Drilled	09/12/2015 to 09/12/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	45.5 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	456 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	5 ft on 9/12/2015		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0					Elevation (feet) 456.0 / Depth (feet) 0.0								
455		SS-1	1 4 10	89		Medium dense, moist, dark gray, ASH [Fill].	28.2							
		SS-2	7 2 1	100		Becomes wet, gray.	40.8							
	5					▽								
450		ST-3		35										*Pushed shelby tube from 5.0 to 7.0 feet*
		SS-4	1 1 1	100		Becomes light gray.	60.2							
	10					Becomes dark gray.								*10.0 feet: Switch to mud rotary*
445		SS-5		100			78.7							*Pushed shelby tube from 10.0 to 12.0 feet*
	15					Becomes light gray.								
440		ST-6	1/12" 1/12"	100			86.5							
	20													
435		SS-7	1/12" 1/12"	100			73.1							
	25													
430		SS-8	WOR WOR WOR	100			48.7							
	30					426.0 / 30.0								

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:34:10 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B014

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
425	30	SS-9	WOR WOR WOR	67		Very loose, wet, black to gray, ASH with clay [Fill].	31.6							
	35	SS-10	WOH 1 2	100		421.0 / 35.0 Soft, wet, gray, silty CLAY (CL), trace shells and wood.								
420	40	SS-11	2 18 34	100		415.5 / 40.5 SHALE: Light gray, weathered.	27.3 19.6 10.2							*42.0 to 45.0 feet: Solid drilling*
415	45	SS-12	56	100		410.5 / 45.5 End of Boring at 45.5 ft	14.2							*Boring backfilled with bentonite and cement fluid*
410	50													
405	55													
400	60													
395	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:34:10 AM

AECOM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B015

Date(s) Drilled	09/10/2015 to 09/10/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	57.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	444 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
						Elevation (feet) / Depth (feet)								
	0					444.0 / 0.0								
		SS-1	5 4 1	72		443.6 / 0.4 Brown gravel.	54.7							
						Medium stiff, moist, gray to brown, sandy CLAY (CL), trace silt.								
						441.5 / 2.5								
440		SS-2	5 9 13	50		Medium dense, moist, light brown to white, fine to coarse GRAVEL (GP) with sand, trace silt and limestone.	4.5							
	5	SS-3	6 10 13	39			5.4							
		SS-4	6 9 7	39			7.2							
435														
	10	SS-5	4 5 6	39			6.5							*10.0 feet: Switch to mud rotary; borehole collapsed*
		SS-6	10 3 2	11			3.6							
430	15	SS-7	4 4 4	39		Some coarse limestone.	8.2							
425														
	20	SS-8	10 7 9	39			7.8							
420														*23.0 to 25.0 feet: Drove casing with hammer* *23.0 to 29.0 feet: Hard drilling*
	25	SS-9	7 4 11	33			8.1							
415	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:34:16 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B015

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30					413.0 / 31.0								
		ST-10	300 psi	100		Medium stiff, wet, gray, sandy CLAY (CL), trace silt, shells, and organics.	20.2	122.2 121.0 119.8	24	11	2.5			*Pushed shelby tube from 31.0 to 33.0 feet*
410														
	35					409.0 / 35.0								
		SS-11	WOH 2 3	94		Medium stiff, wet, gray and dark gray lean CLAY (CL)	33.8				1.25			
						407.0 / 37.0								
		ST-12	175 psi			Soft, wet, dark gray, fat CLAY (CH).	41.0		66	43	1.0			*Pushed shelby tube from 37.0 to 39.0 feet*
405						405.0 / 39.0								
	40	SS-13	WOH 2 2	100		Soft, wet, brown and gray, lean CLAY (CL).	36.2				1.0			
400														
	45	SS-14	WOH 2 2	83		Grades with sand.	49.4				1.0			
395														
	50	SS-15	3 5 14	22		Grades without sand.	30.9				0.5			
						392.0 / 52.0								
						SHALE: Light gray, silt sized, weathered.								*52.0 feet: Solid drilling*
390														
	55	SS-16	71/6"	oK			11.0							
						387.0 / 57.0								
						End of Boring at 57 ft								*Boring backfilled with bentonite and cement fluid*
385														
	60													
380														
	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:34:16 AM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B015A

Sheet 1 of 1

Date(s) Drilled	09/10/2015 to 09/10/2015	Logged By	Norm Seiler	Checked By	AJW
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	30.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
Boring Location	5' SW of EDW-B015 (ft NAD83)	Groundwater Level(s)	ft on		

Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
0					0.0 Blank power auger to 30.0 feet to confirm 29.0 feet of gravel.								*Offset 5.0 feet west of EDW-B015*
5													*5.0 to 30.0 feet: No cuttings*
													7.0 feet: Borehole collapsed; created a 14" diameter hole with no cuttings
10													
15													
20													*20.0 feet: Groundwater encountered*
25													*Auger hole collapsed and auger removed. No clay on auger.*
30					30.0 End of Boring at 30 ft								

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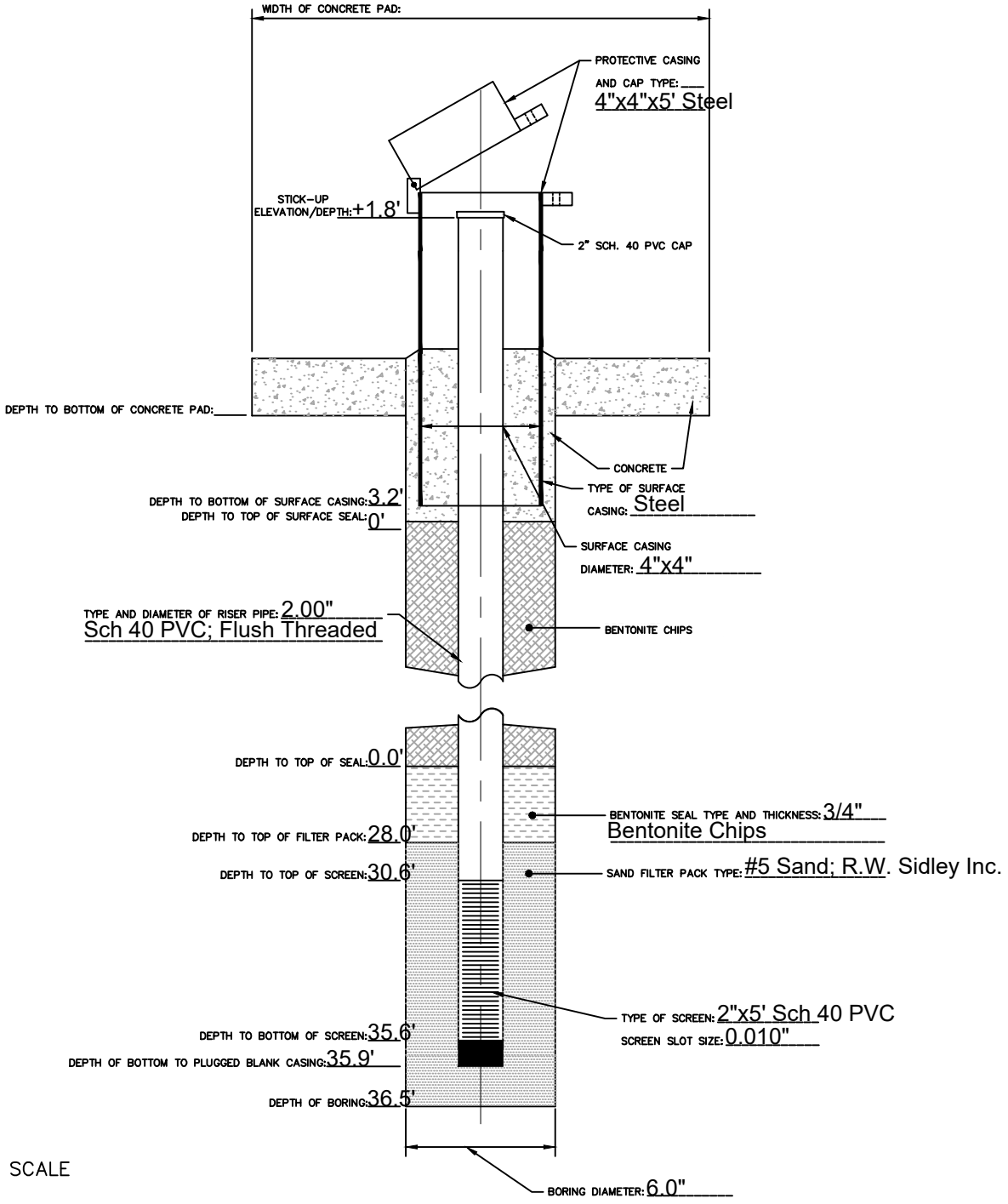
Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 12/18/2015 9:34:21 AM

APPENDIX B

Project: Dynegy Project Location: Pekin, IL Project Number: 60440202	Log of Piezometer Sheet 1 of 1

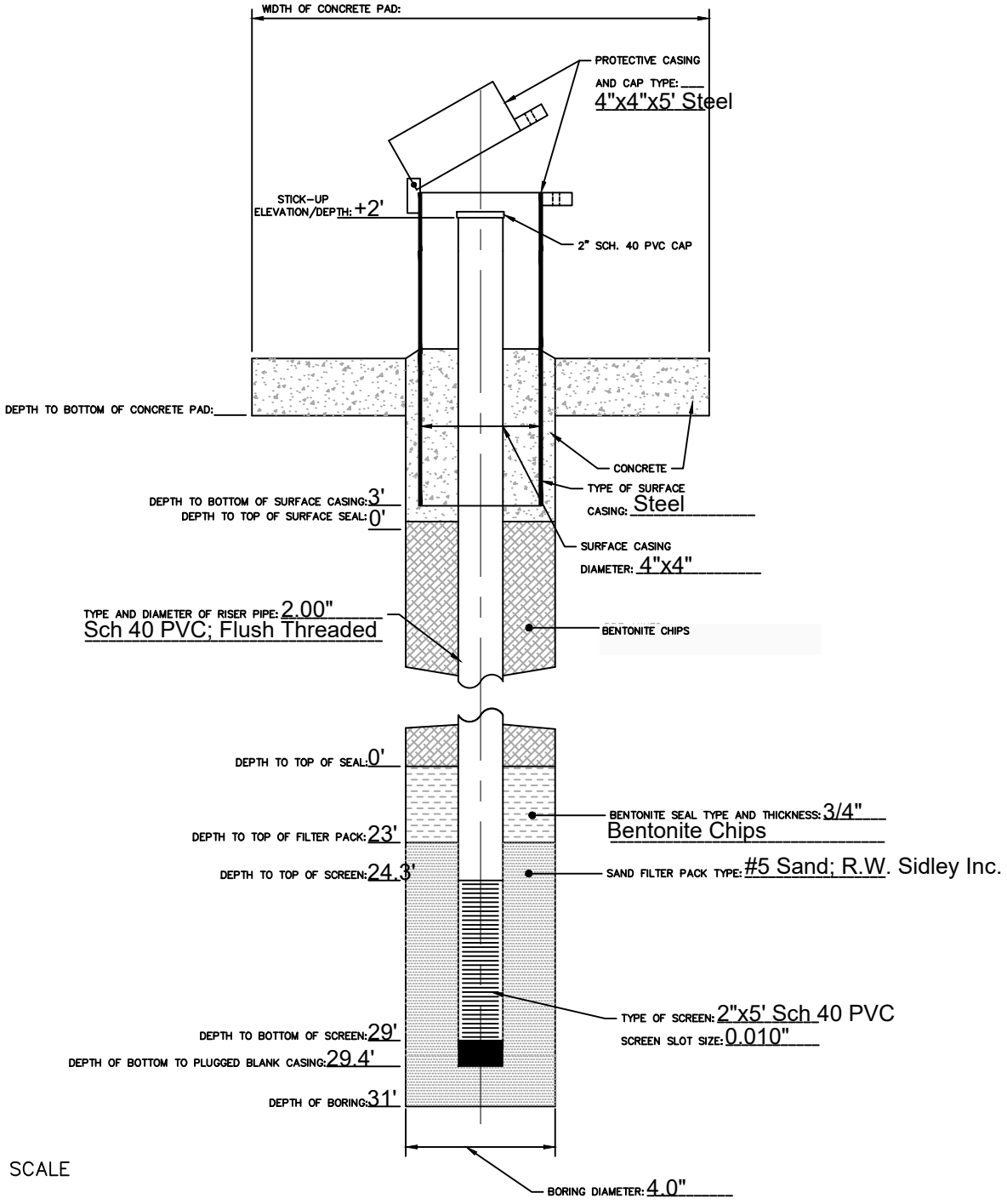
Piezometer Location	EDW-P001	Date Installed	11/05/15	Time	5:30 P.M.
Installed By	Josh Kohn	Observed By	R. Weseljak	Total Depth	36.5'
Method of Installation	6" Mud Rotary	Drilling Contractor	Strata	Surface Elevation	
Screened Interval	30.6-35.6'	Completion Zone			
Remarks		Groundwater Level(s)	24.64' from top of casing		



AECOM

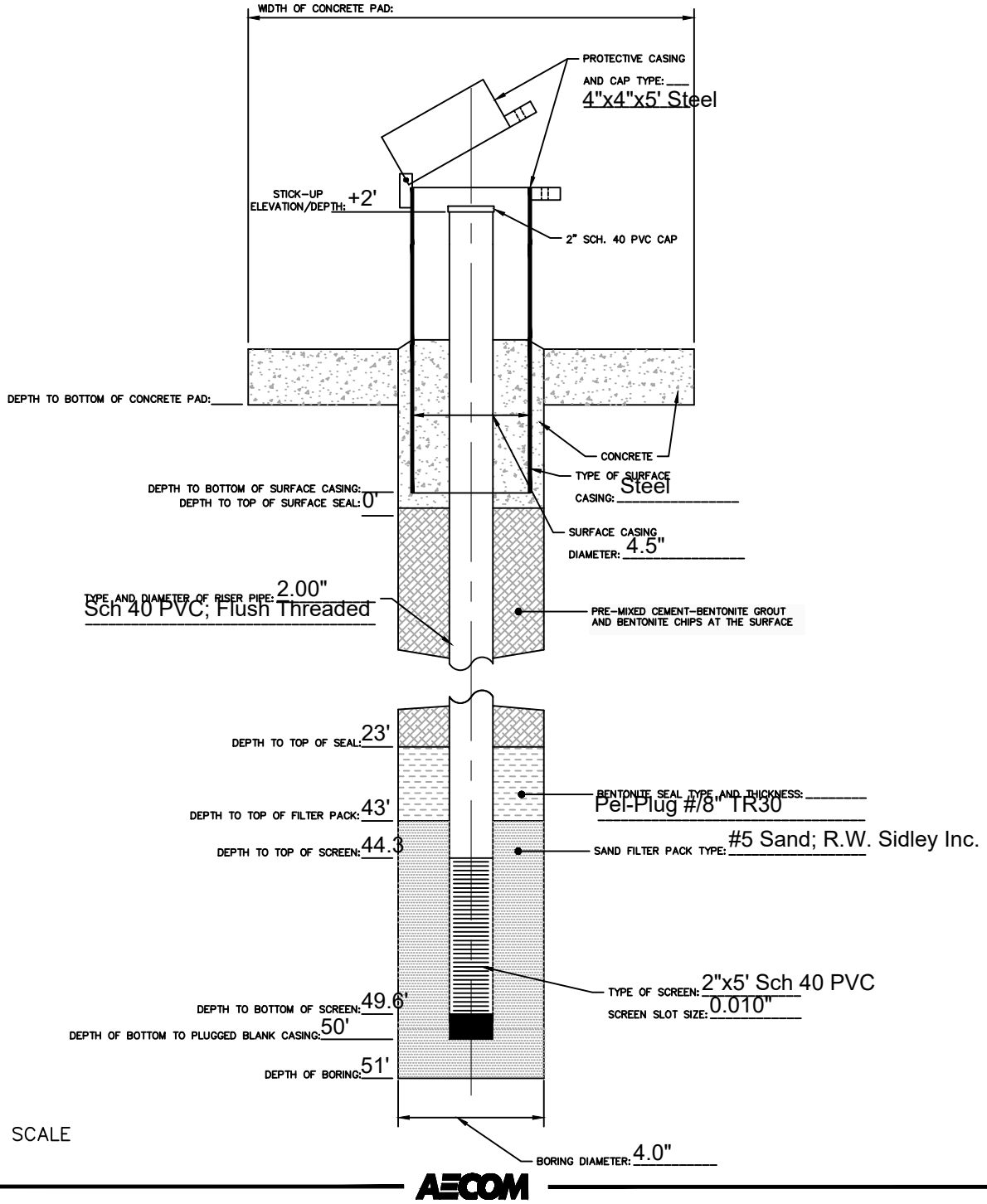
Project: Dynegy Project Location: Pekin, IL Project Number: 60440202	Log of Piezometer Sheet 1 of 1

Piezometer Location	EDW-P002	Date Installed	09/04/15	Time	11:00-12:00 P.M.
Installed By	Scott Komen	Observed By	N. Seiler	Total Depth	31'
Method of Installation	4" Power Auger	Drilling Contractor	Strata	Surface Elevation	
Screened Interval	24-29'	Completion Zone			
Remarks		Groundwater Level(s)	29' After Drilling		



Project: Dynegy Project Location: Pekin, IL Project Number: 60440202	Log of Piezometer Sheet 1 of 1

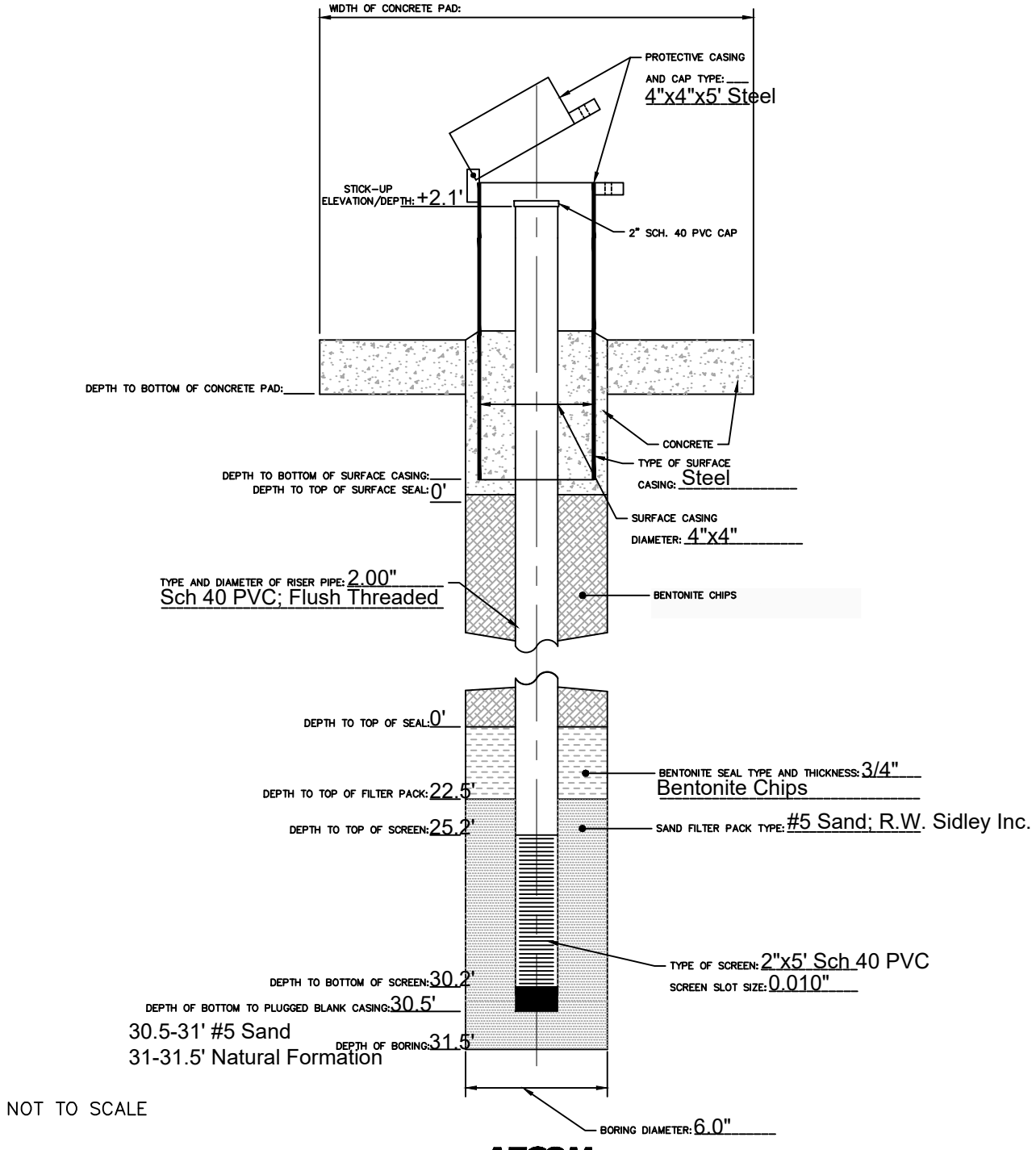
Piezometer Location	EDW-P003	Date Installed	09/04/15	Time	3:30-6:00 P.M.
Installed By	Scott Komen	Observed By	N. Seiler	Total Depth	51'
Method of Installation	3 7/8" Rock Bit	Drilling Contractor	Strata	Surface Elevation	
Screened Interval	44.3-49.6'	Completion Zone			
Remarks		Groundwater Level(s)			



AECOM

Project: Dynegy Project Location: Pekin, IL Project Number: 60440202	Log of Piezometer Sheet 1 of 1

Piezometer Location	EDW-P004	Date Installed	11/04/15	Time	12:00
Installed By	Josh Kohn	Observed By	R. Weseljak	Total Depth	31.5'
Method of Installation	6" Mud Rotary	Drilling Contractor	Strata	Surface Elevation	
Screened Interval	25.2-30.2'	Completion Zone			
Remarks		Groundwater Level(s)	14.85 From Top of Casing		



AECOM

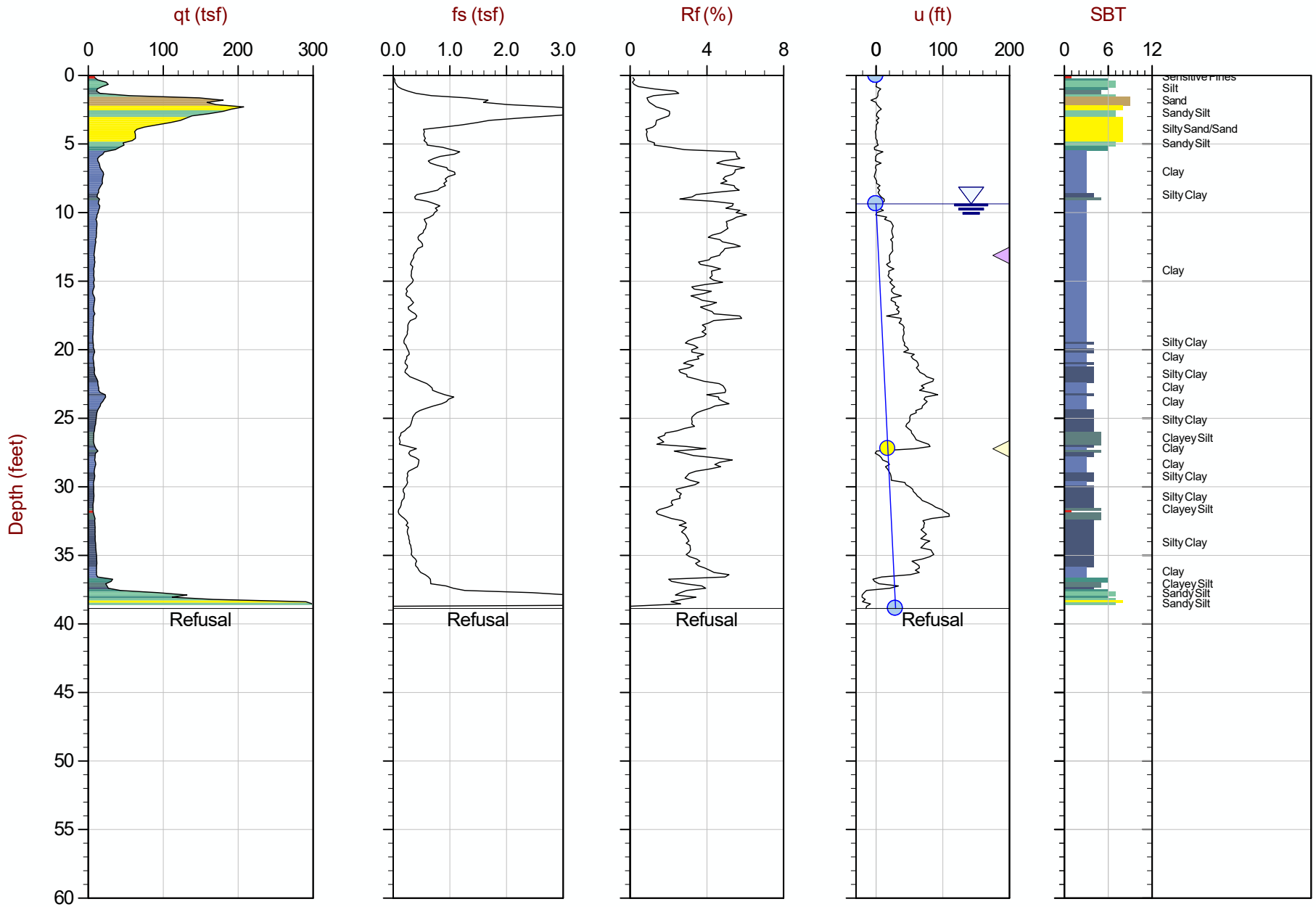
APPENDIX C

CONETEC

AECOM

Job No: 15-53073
Date: 08:19:15 13:46
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C001
Cone: 374:T1500F15U500



Max Depth: 11.850 m / 38.88 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP01.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497502m E: 274312m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

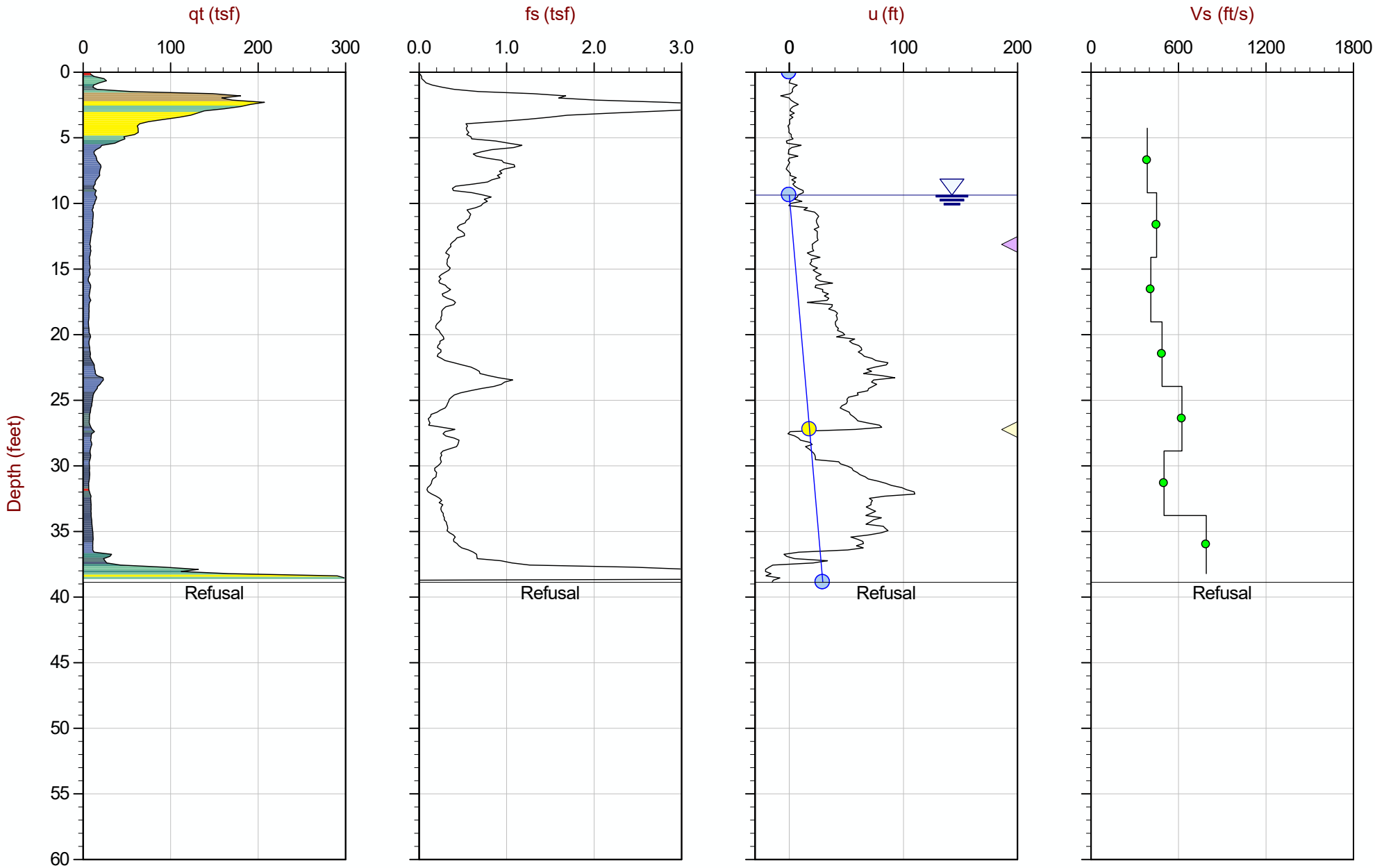
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:19:15 13:46
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C001
Cone: 374:T1500F15U500



Max Depth: 11.850 m / 38.88 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP01.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497502m E: 274312m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

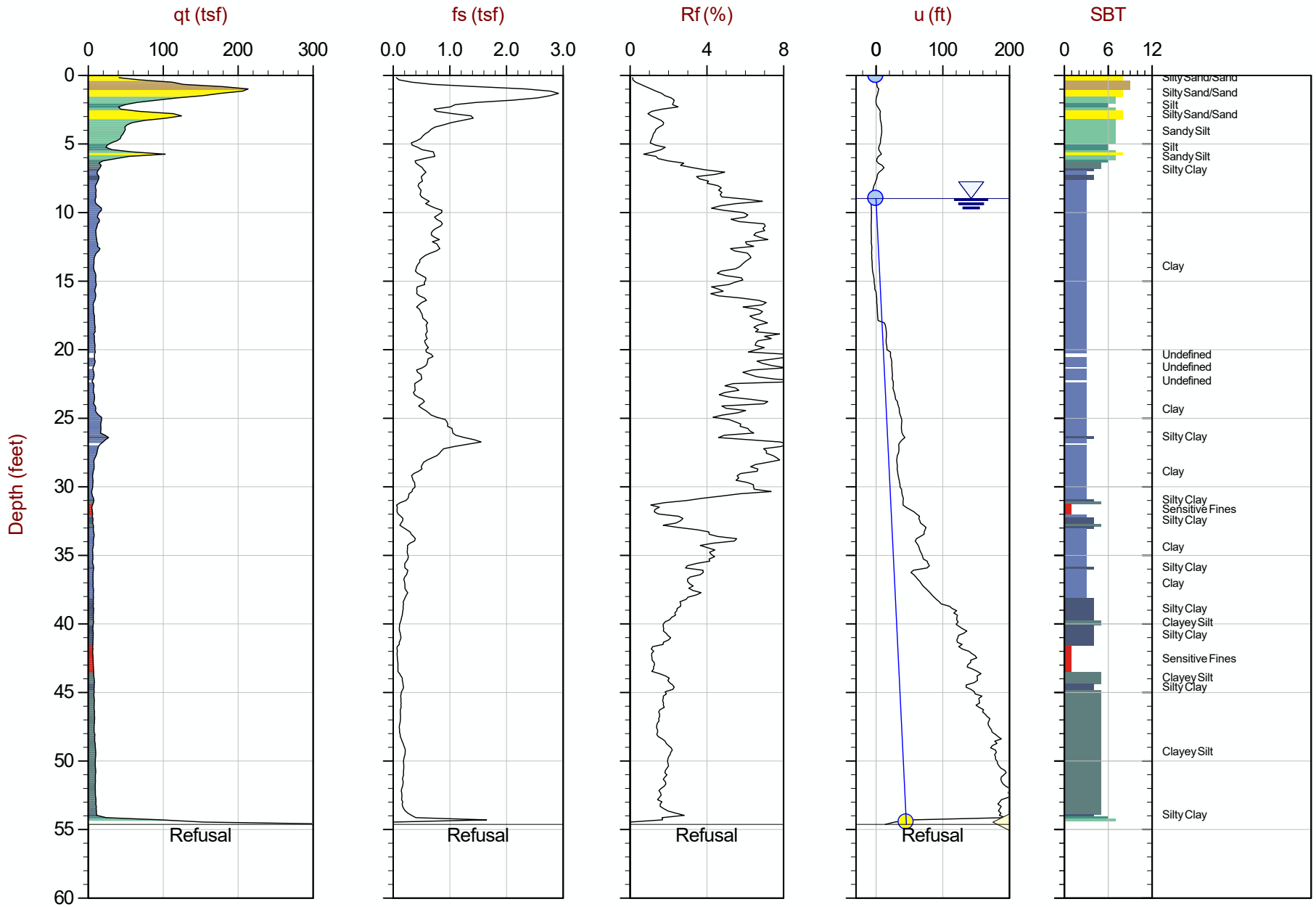
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 15:22
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C003
Cone: 340:T1500F15U500



Max Depth: 16.650 m / 54.63 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP03.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497325m E: 274377m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

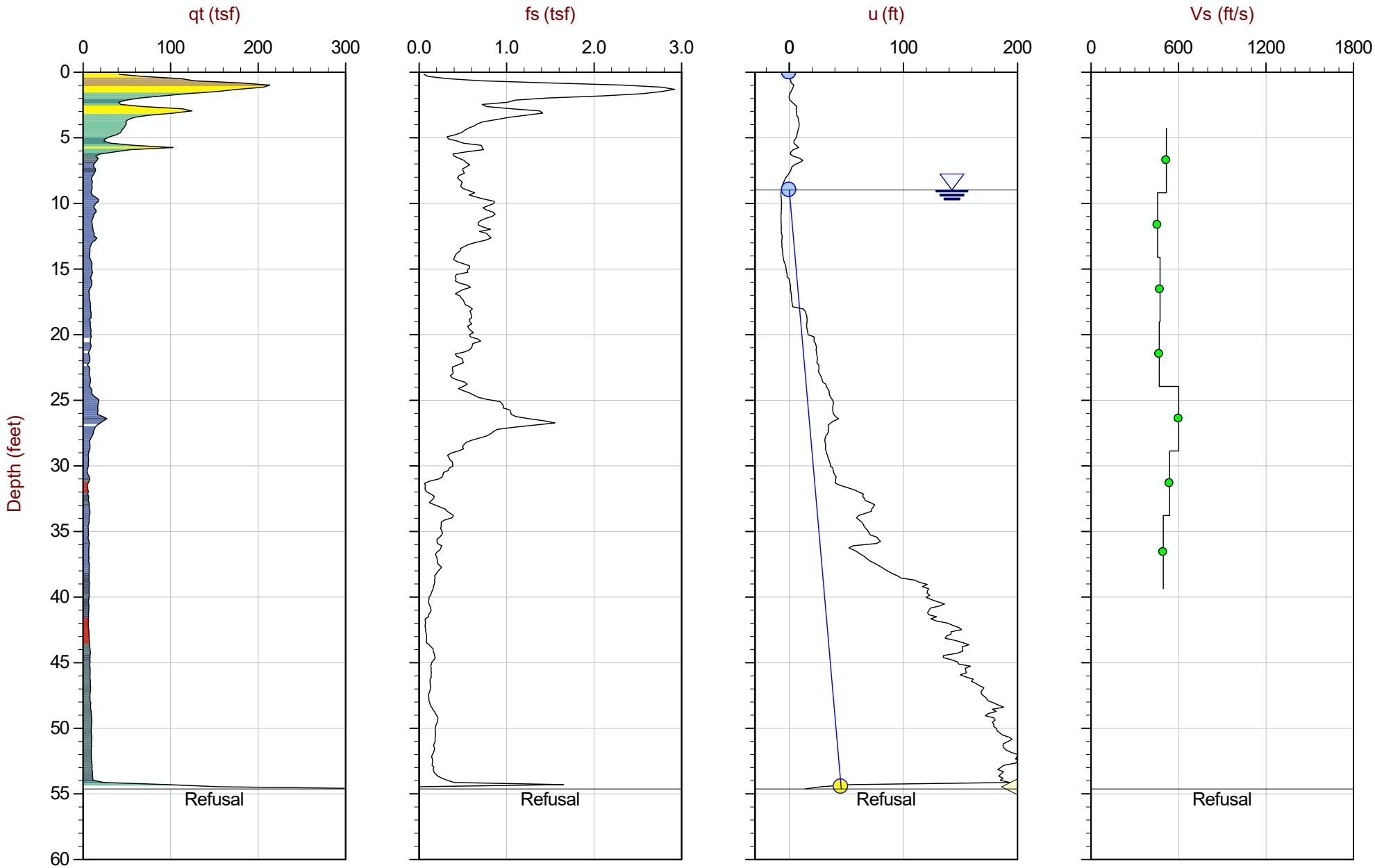
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 15:22
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C003
Cone: 340:T1500F15U500



Max Depth: 16.650 m / 54.63 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP03.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497325m E: 274377m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

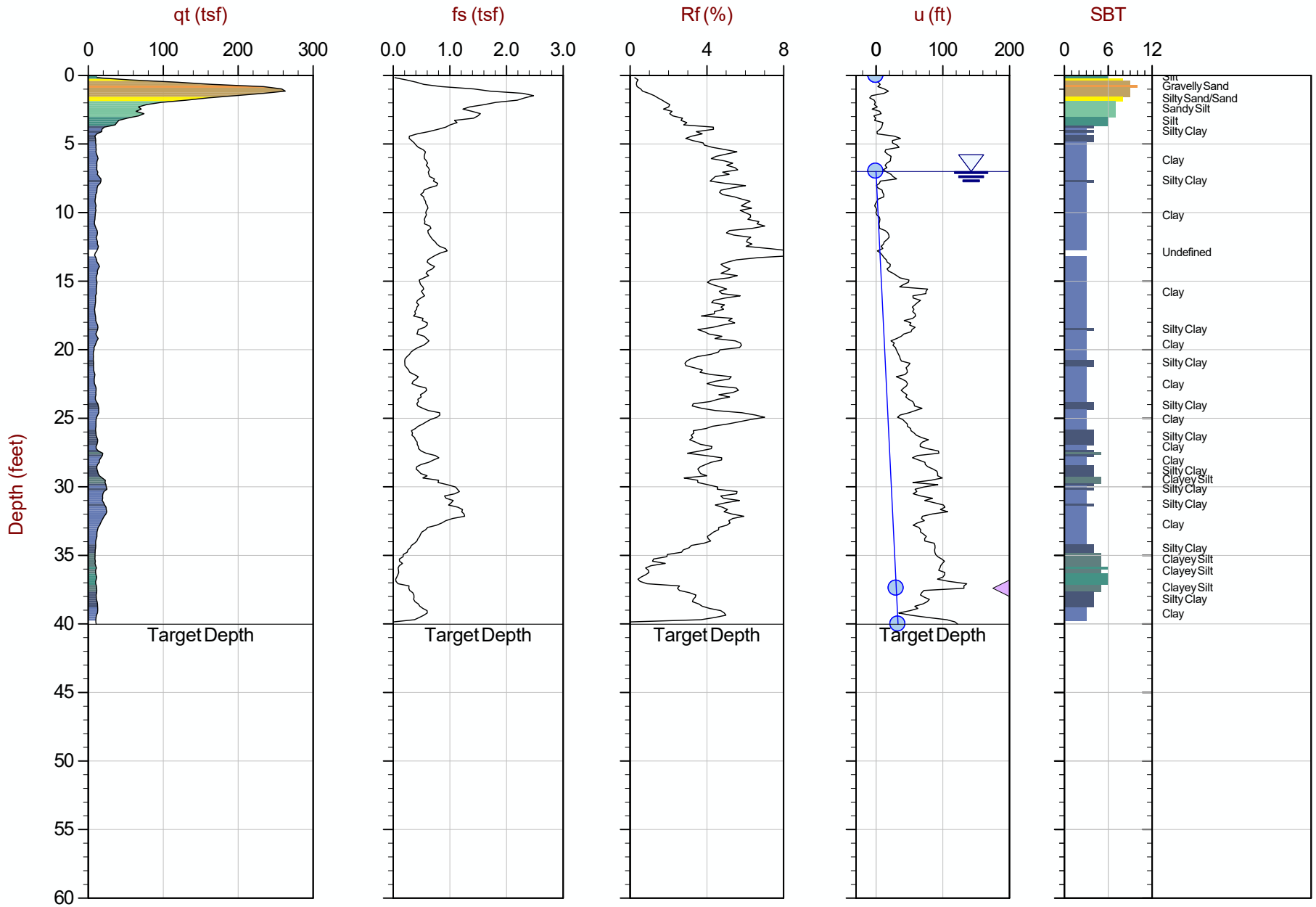
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:26:15 15:05
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C005
Cone: 374:T1500F15U500



Max Depth: 12.200 m / 40.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP05.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497026m E: 274468m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

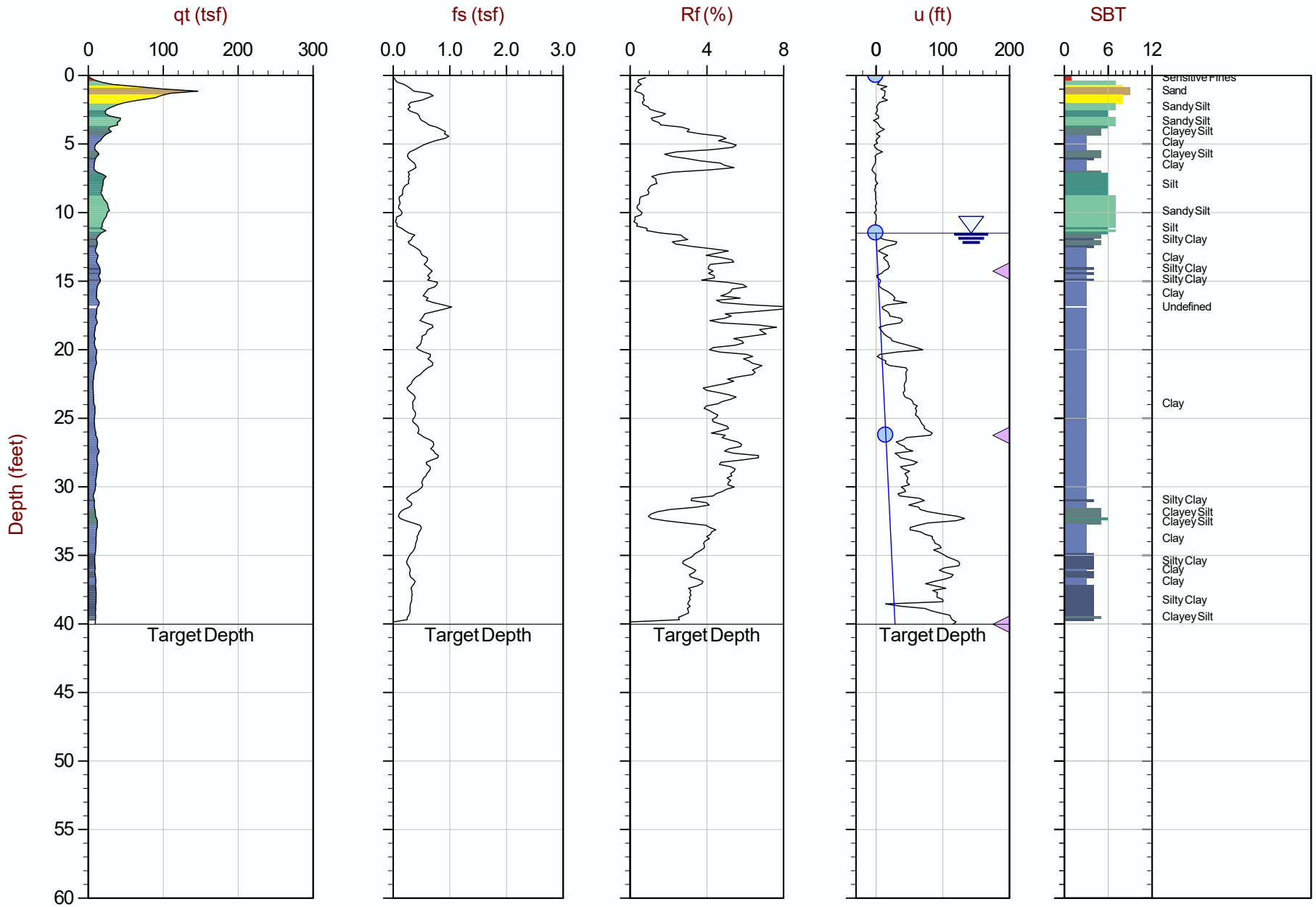
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:25:15 15:52
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C006
Cone: 374:T1500F15U500



Max Depth: 12.200 m / 40.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP06.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496880m E: 274500m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

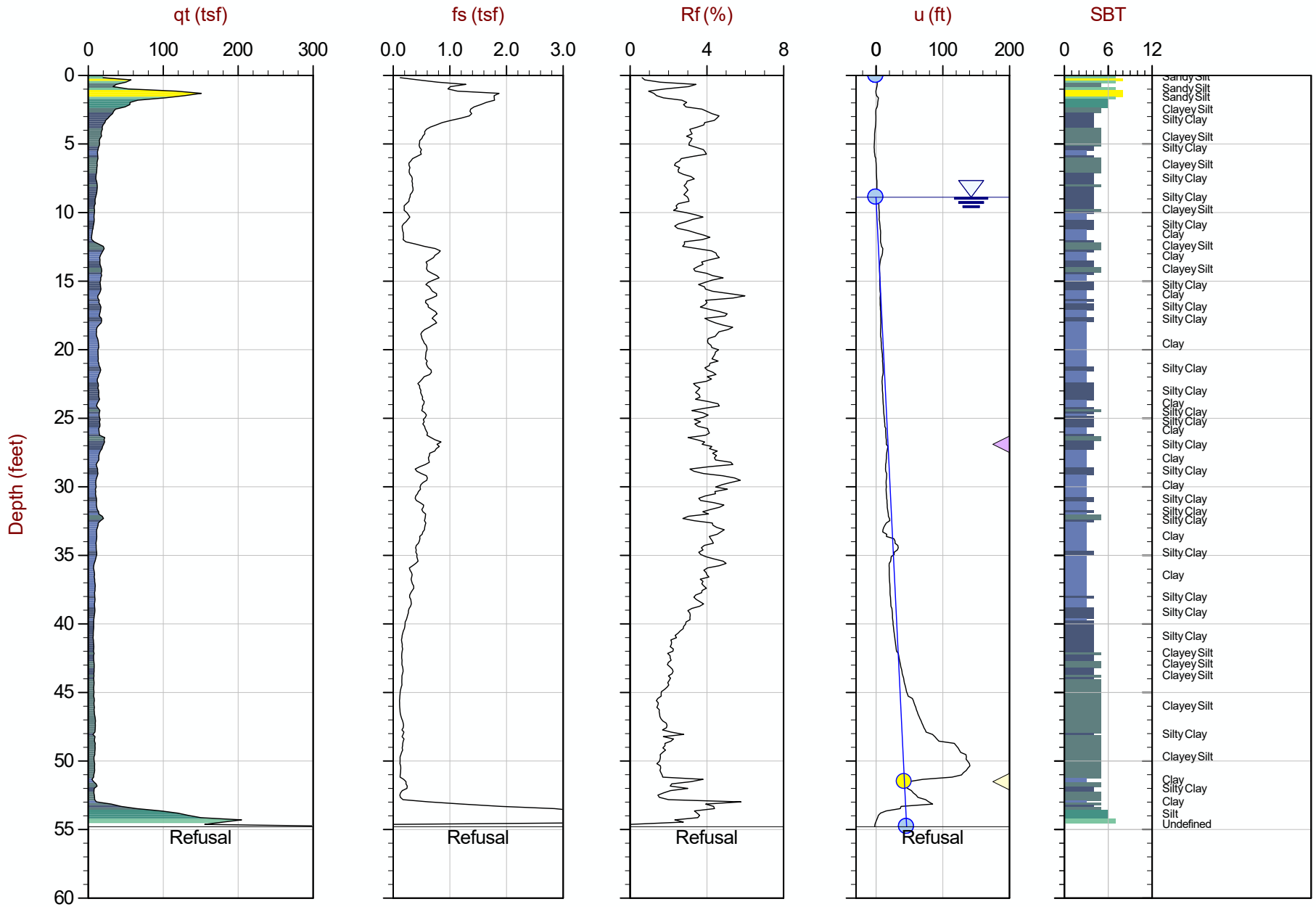
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:29:15 09:19
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C007
Cone: 340:T1500F15U500



Max Depth: 16.700 m / 54.79 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP07.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496736m E: 274551m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

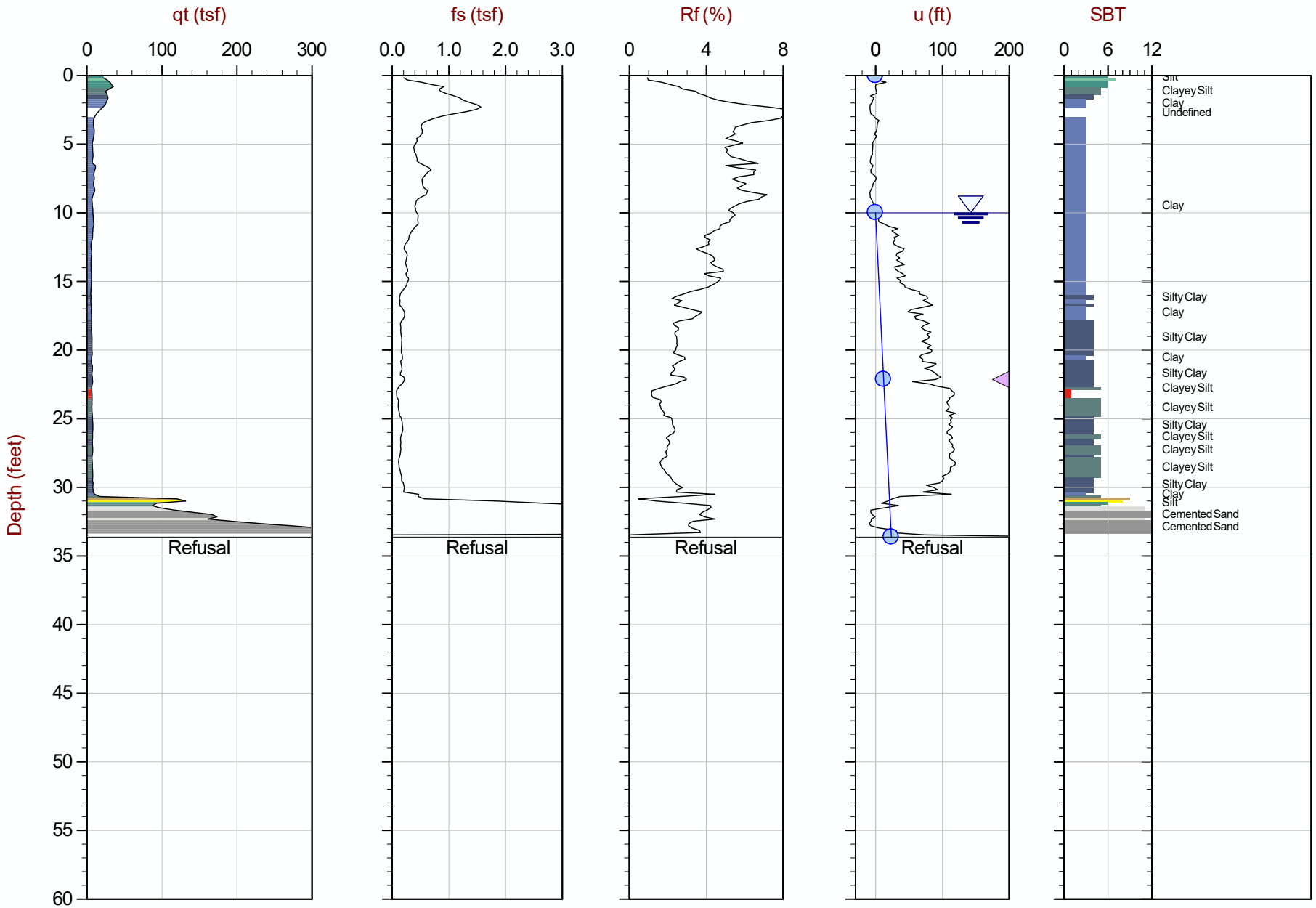
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 08:50
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C008
Cone: 374:T1500F15U500



Max Depth: 10.250 m / 33.63 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP08.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496731m E: 274576m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

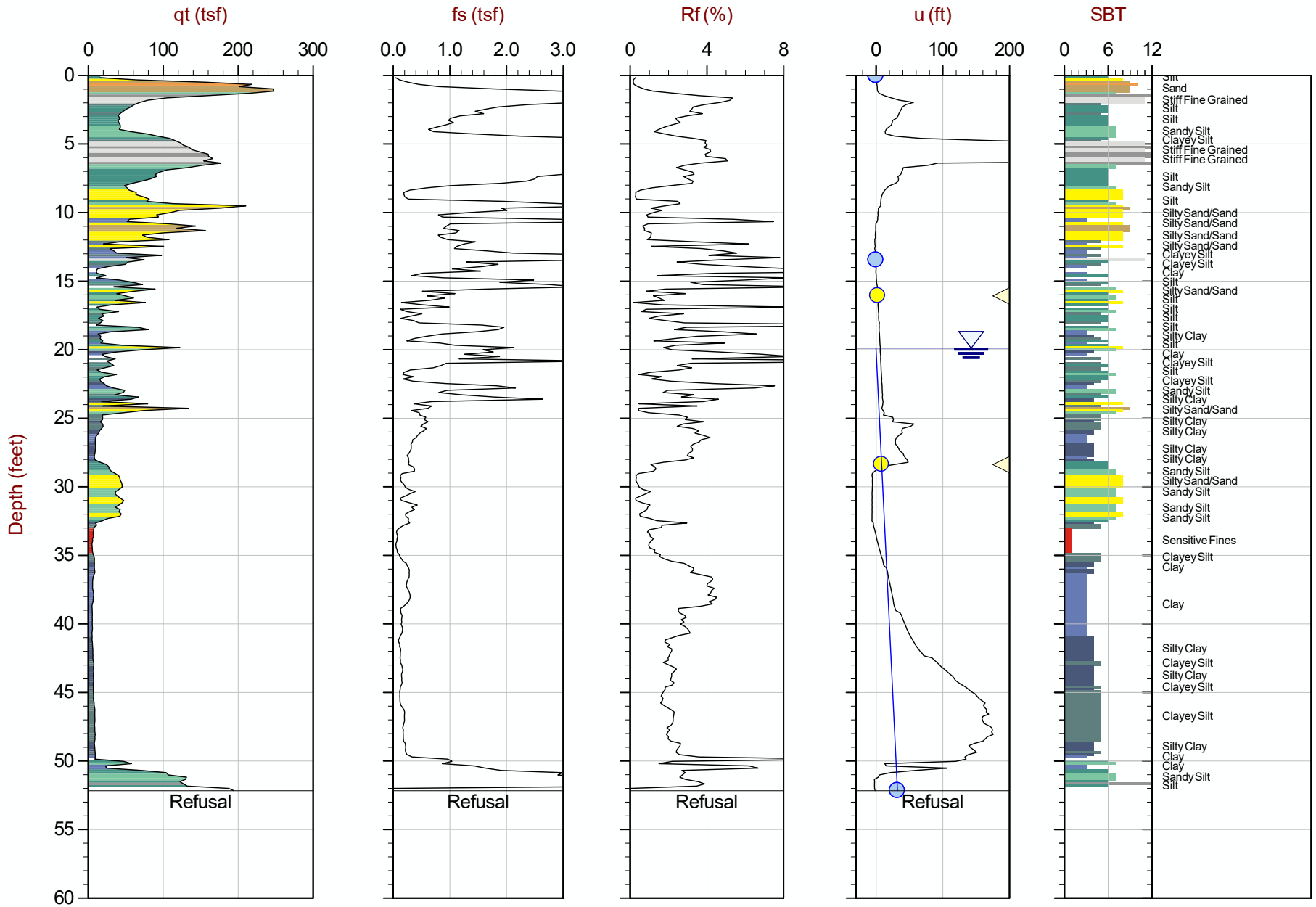
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:28:15 16:08
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C009
Cone: 340:T1500F15U500



Max Depth: 15.900 m / 52.16 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP09.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496476m E: 274538m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

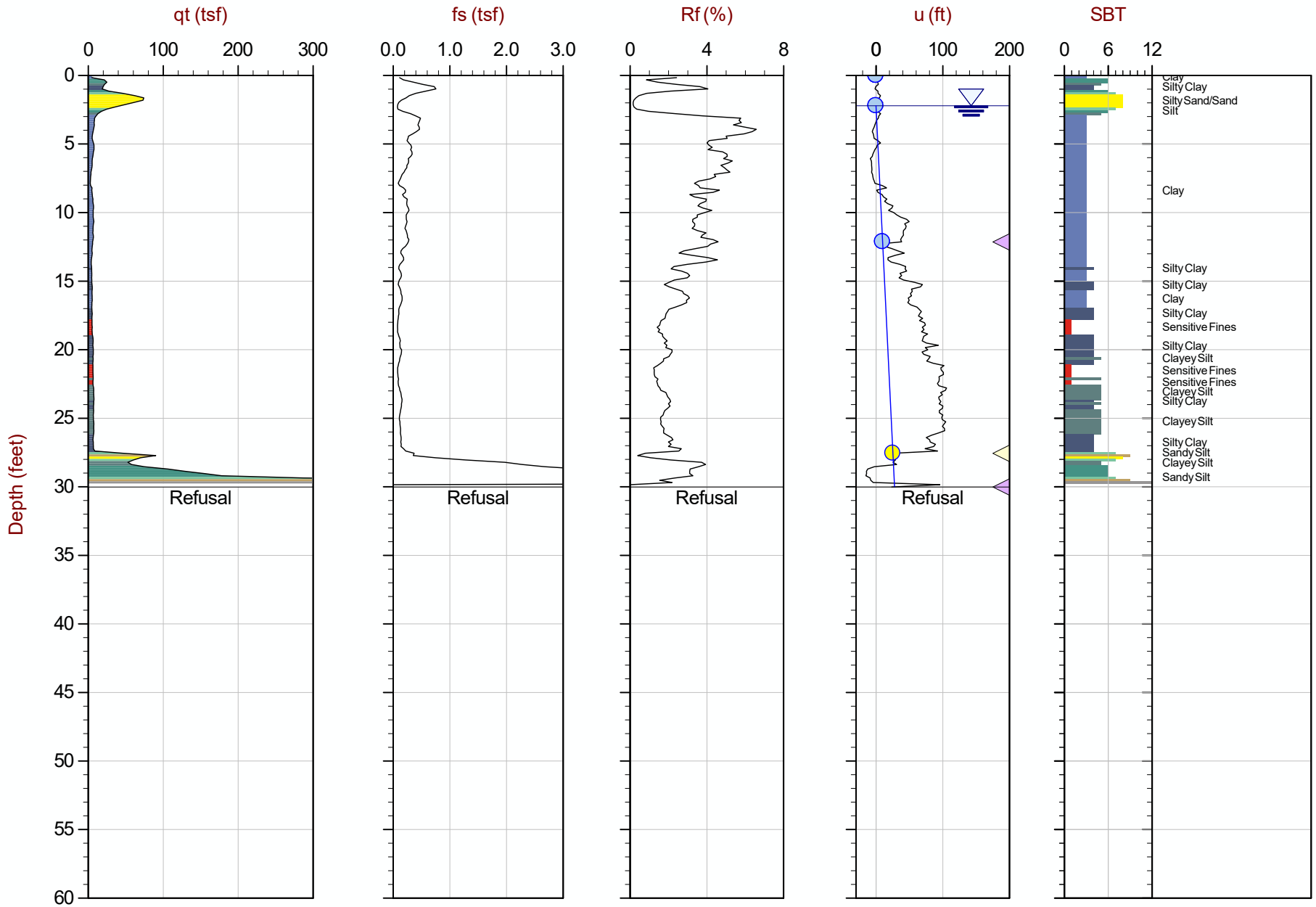
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 12:10
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C010
Cone: 374:T1500F15U500



Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP10.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496351m E: 274562m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

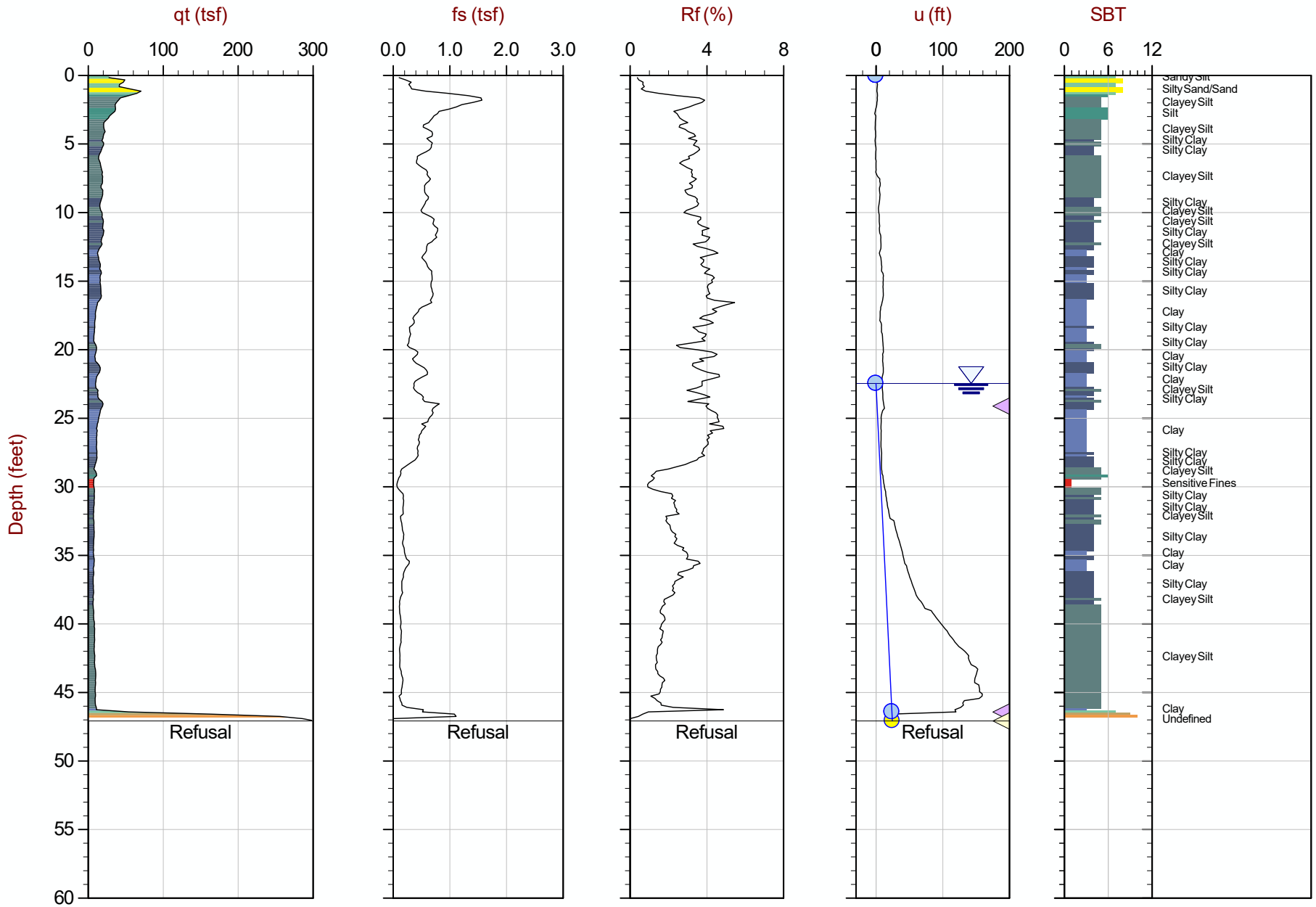
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:28:15 10:19
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C011
Cone: 340:T1500F15U500



Max Depth: 14.350 m / 47.08 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP11.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496372m E: 274553m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

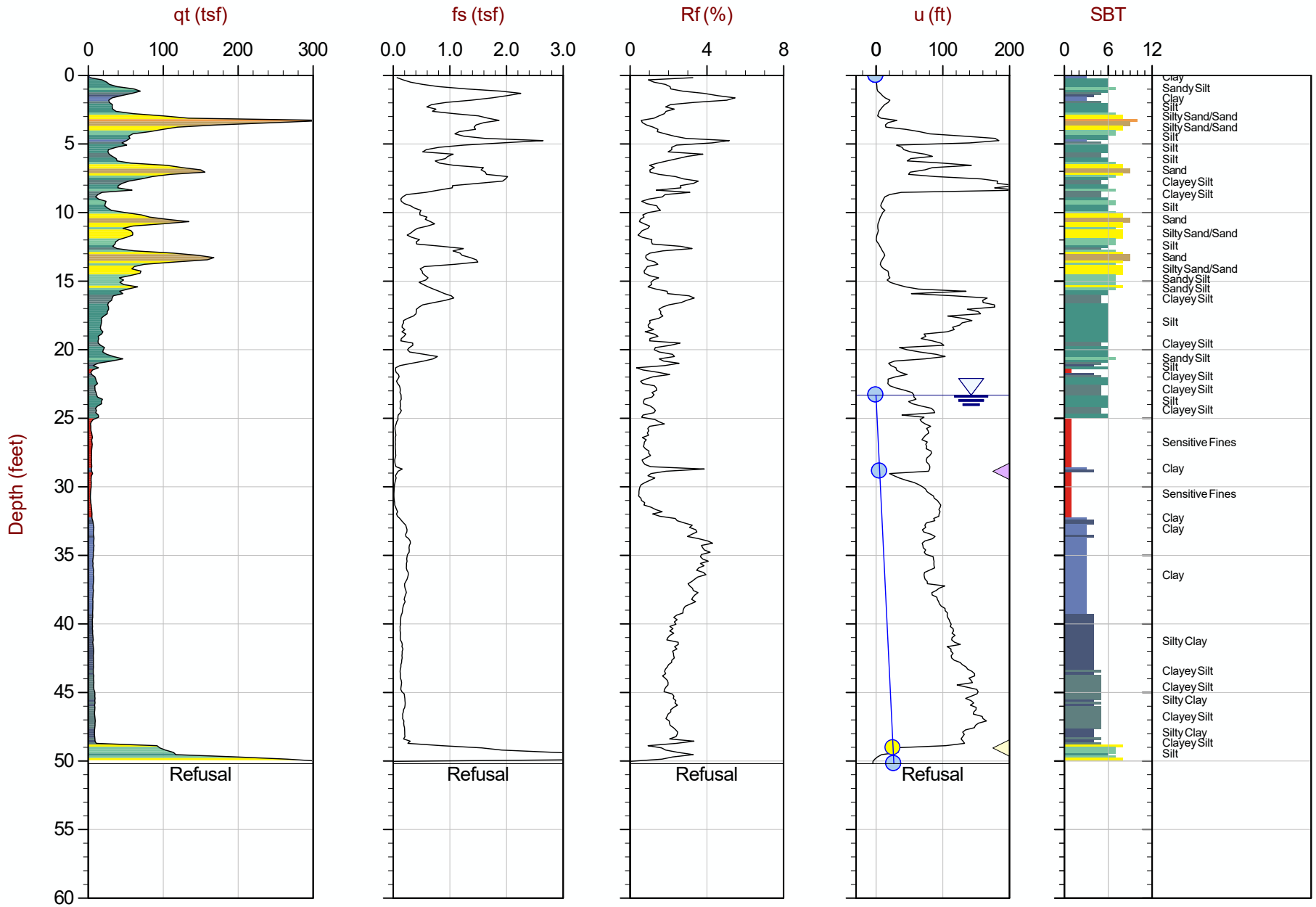
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:28:15 14:27
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C012
Cone: 340:T1500F15U500



Max Depth: 15.300 m / 50.20 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP12.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496424m E: 274524m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

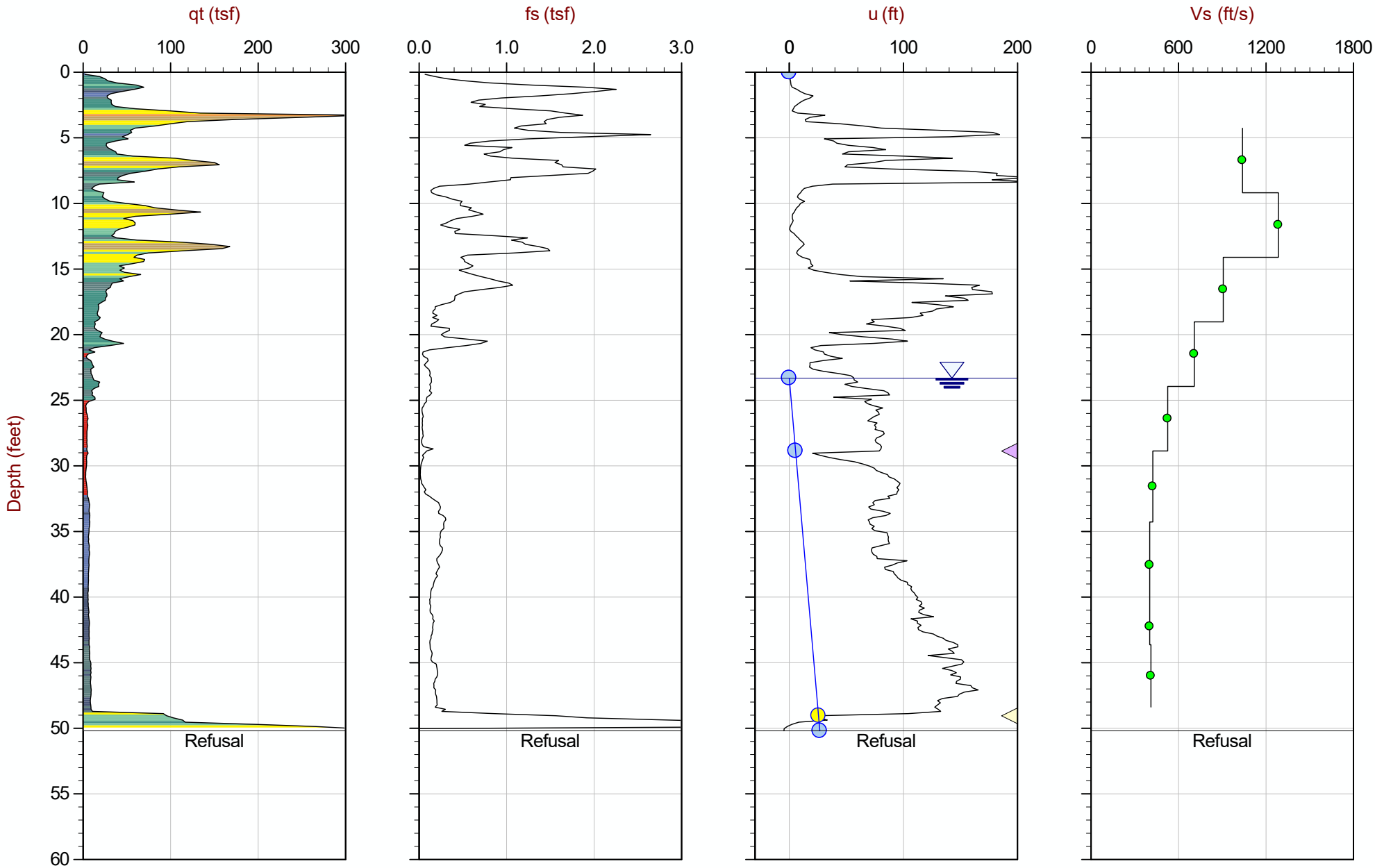
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:28:15 14:27
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C012
Cone: 340:T1500F15U500



Max Depth: 15.300 m / 50.20 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP12.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496424m E: 274524m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

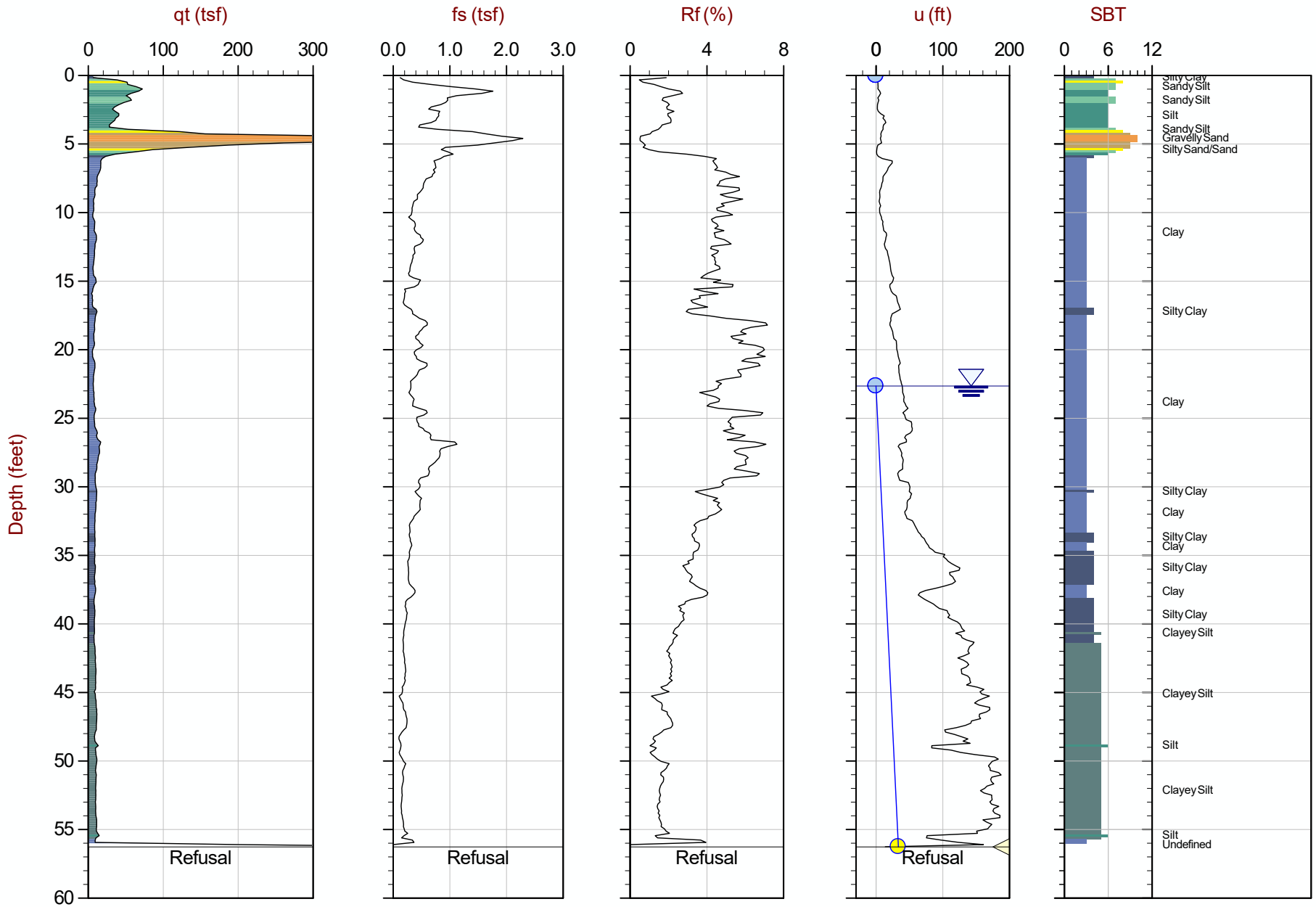
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:28:15 08:45
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C013
Cone: 340:T1500F15U500



Max Depth: 17.150 m / 56.27 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP13.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496386m E: 274376m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

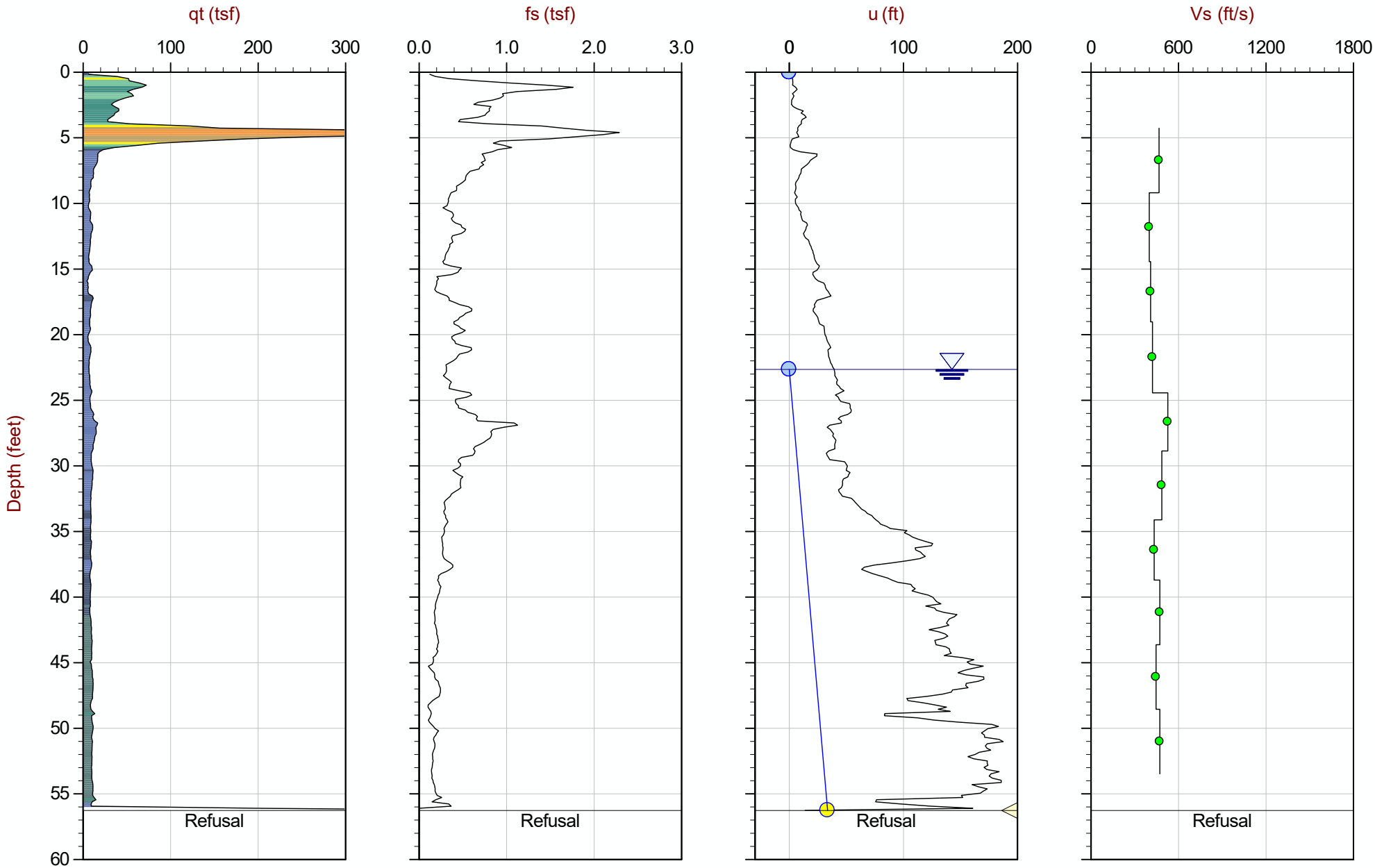
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:28:15 08:45
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C013
Cone: 340:T1500F15U500



Max Depth: 17.150 m / 56.27 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP13.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496386m E: 274376m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

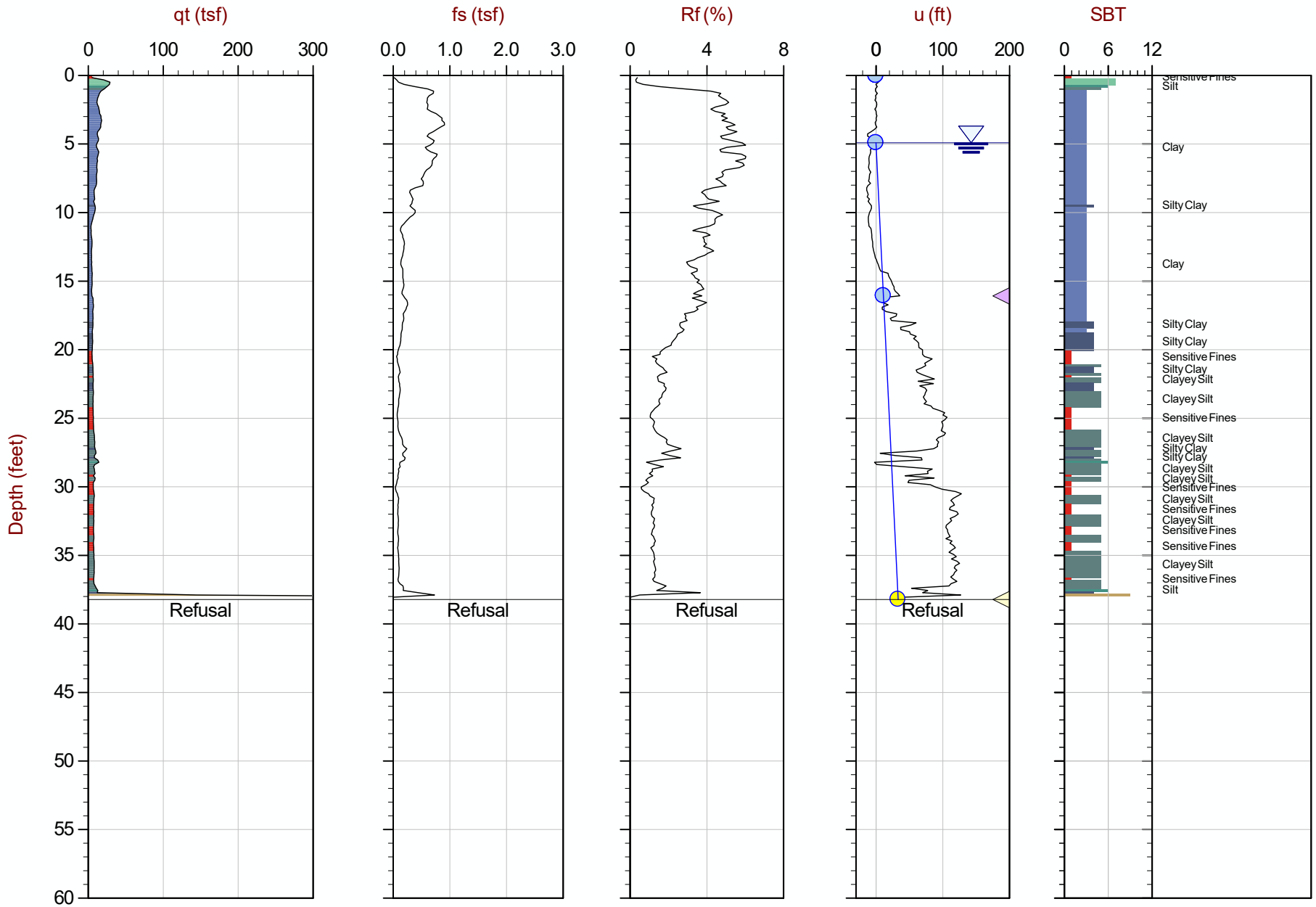
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 14:29
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C014
Cone: 374:T1500F15U500



Max Depth: 11.650 m / 38.22 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP14.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496366m E: 274362m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

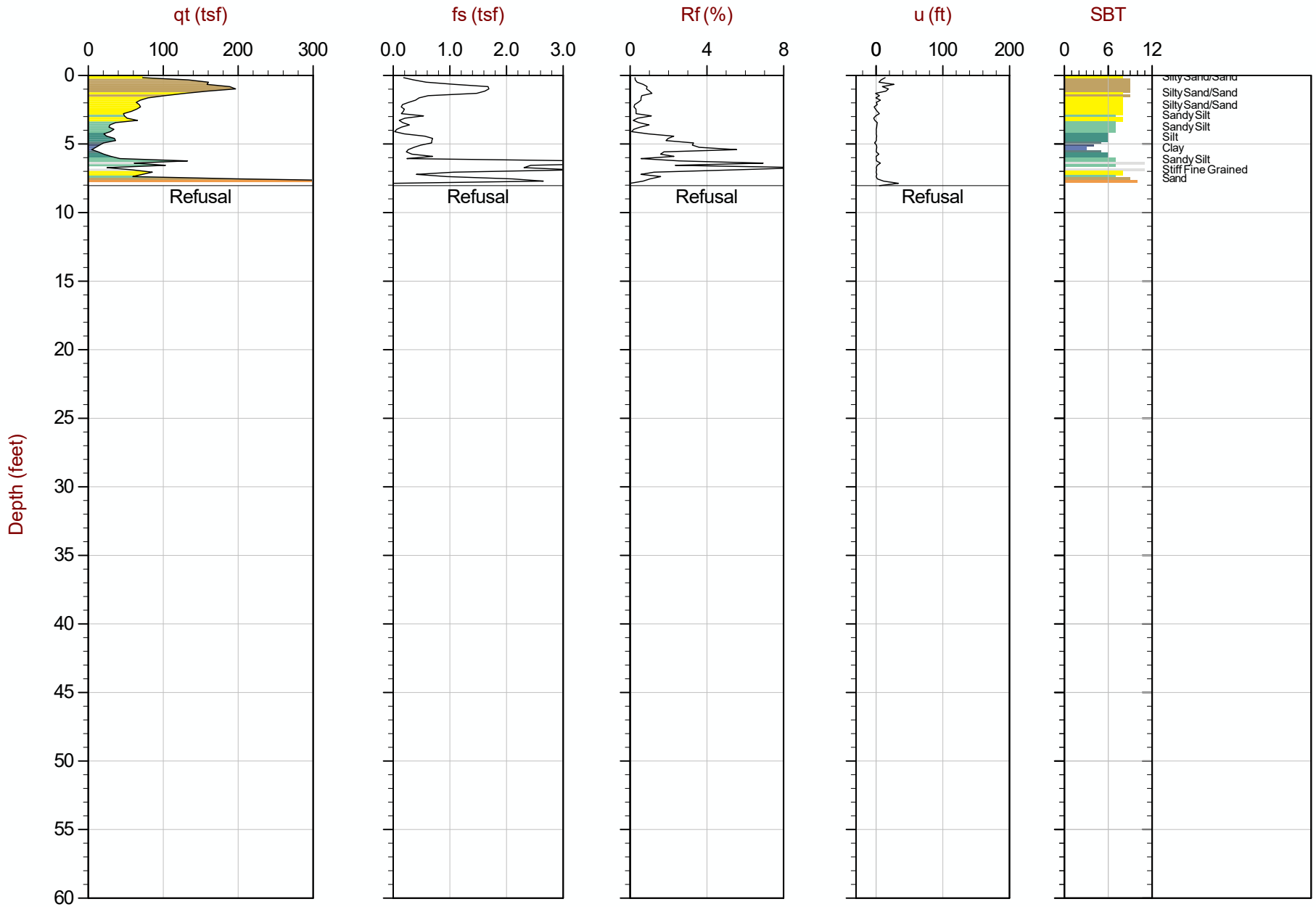
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:19:15 13:31
Site: Edwards Power Station

Sounding: EDW-C015
Cone: 335:T1500F15U500



Max Depth: 2.450 m / 8.04 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP15.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496447m E: 274334m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

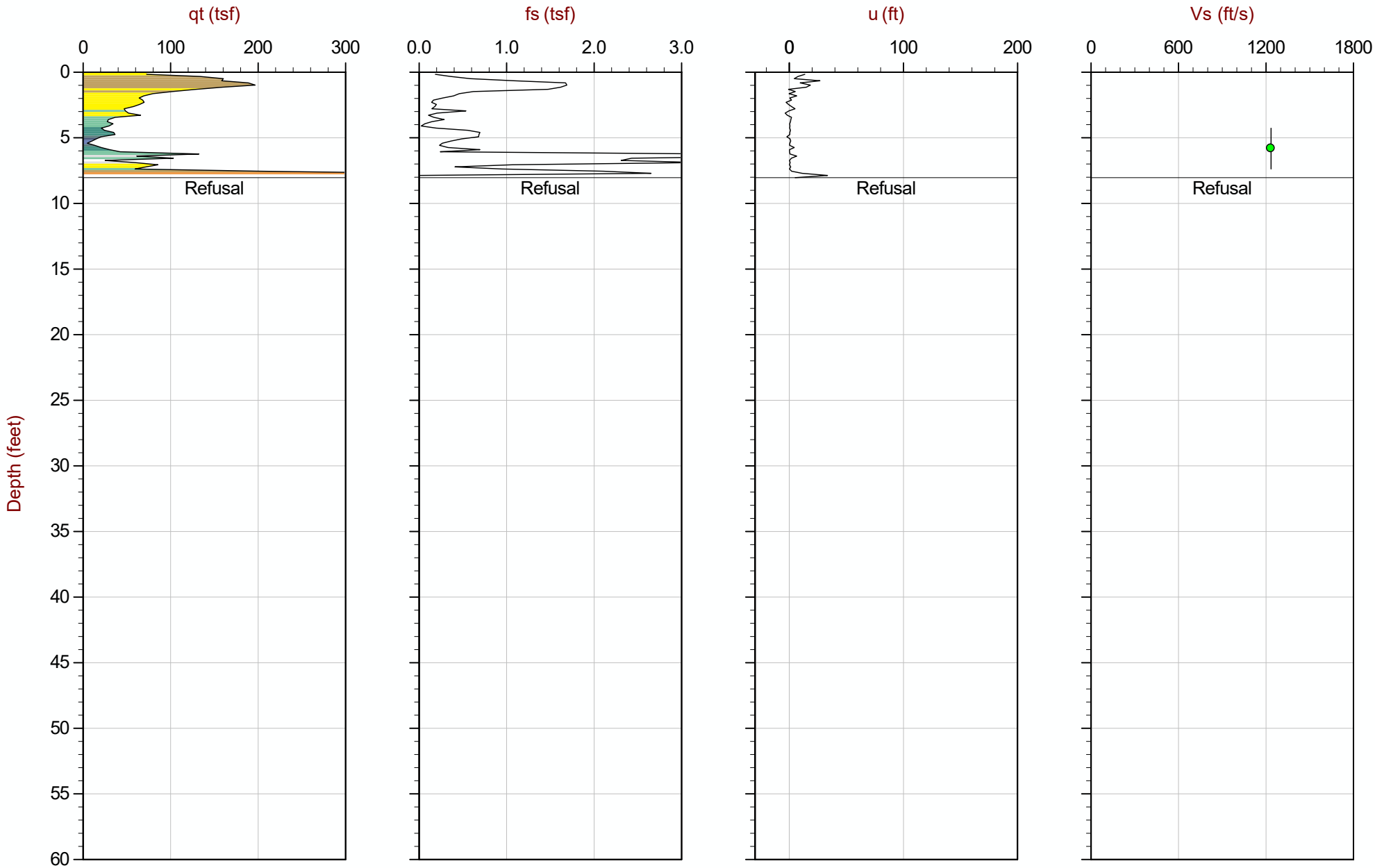
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:19:15 13:31
Site: Edwards Power Station

Sounding: EDW-C015
Cone: 335:T1500F15U500



Max Depth: 2.450 m / 8.04 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP15.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496447m E: 274334m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

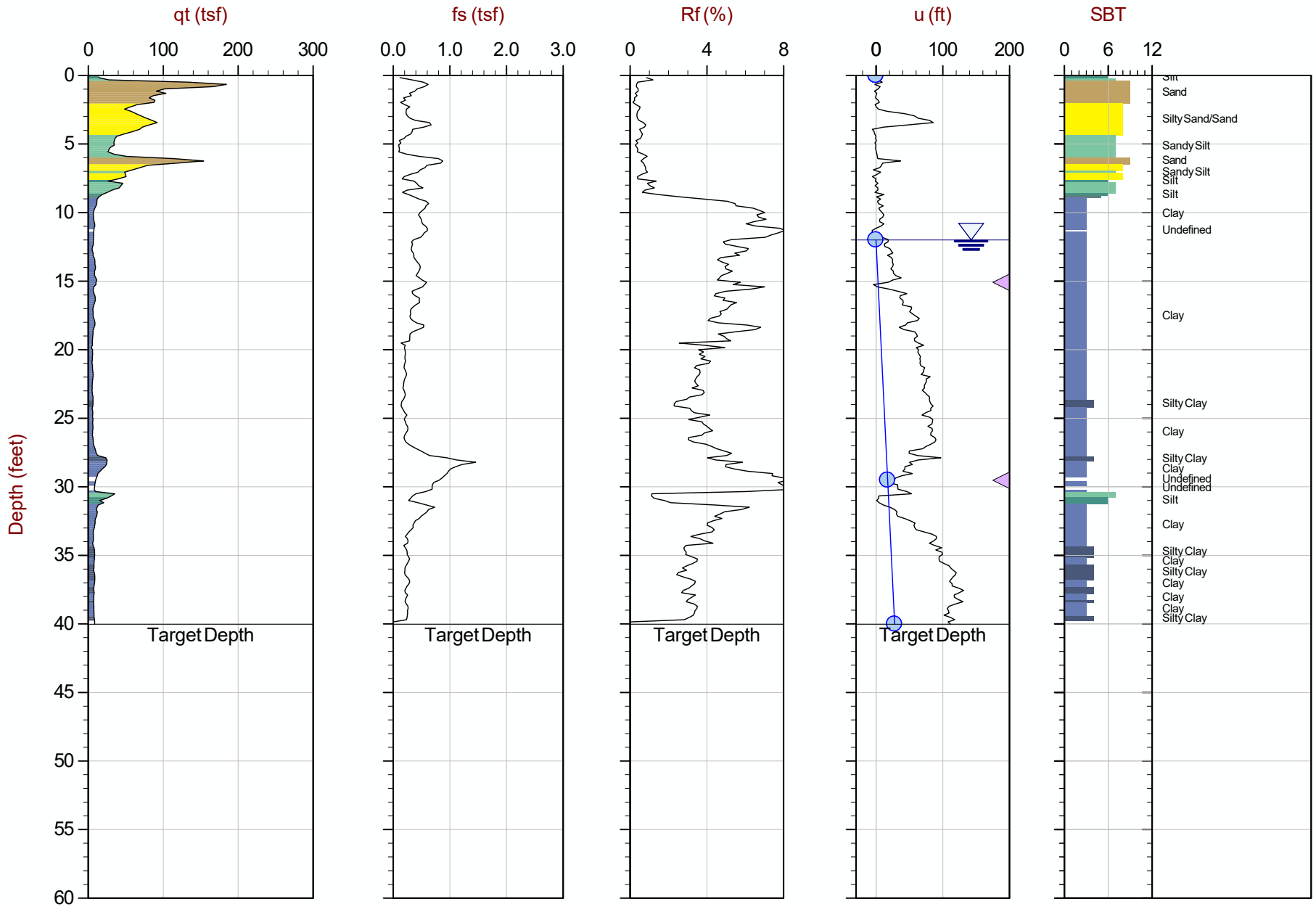
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:19:15 14:12
Site: Edwards Power Station

Sounding: EDW-C015A
Cone: 335:T1500F15U500



Max Depth: 12.200 m / 40.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP15A.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496435m E: 274342m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

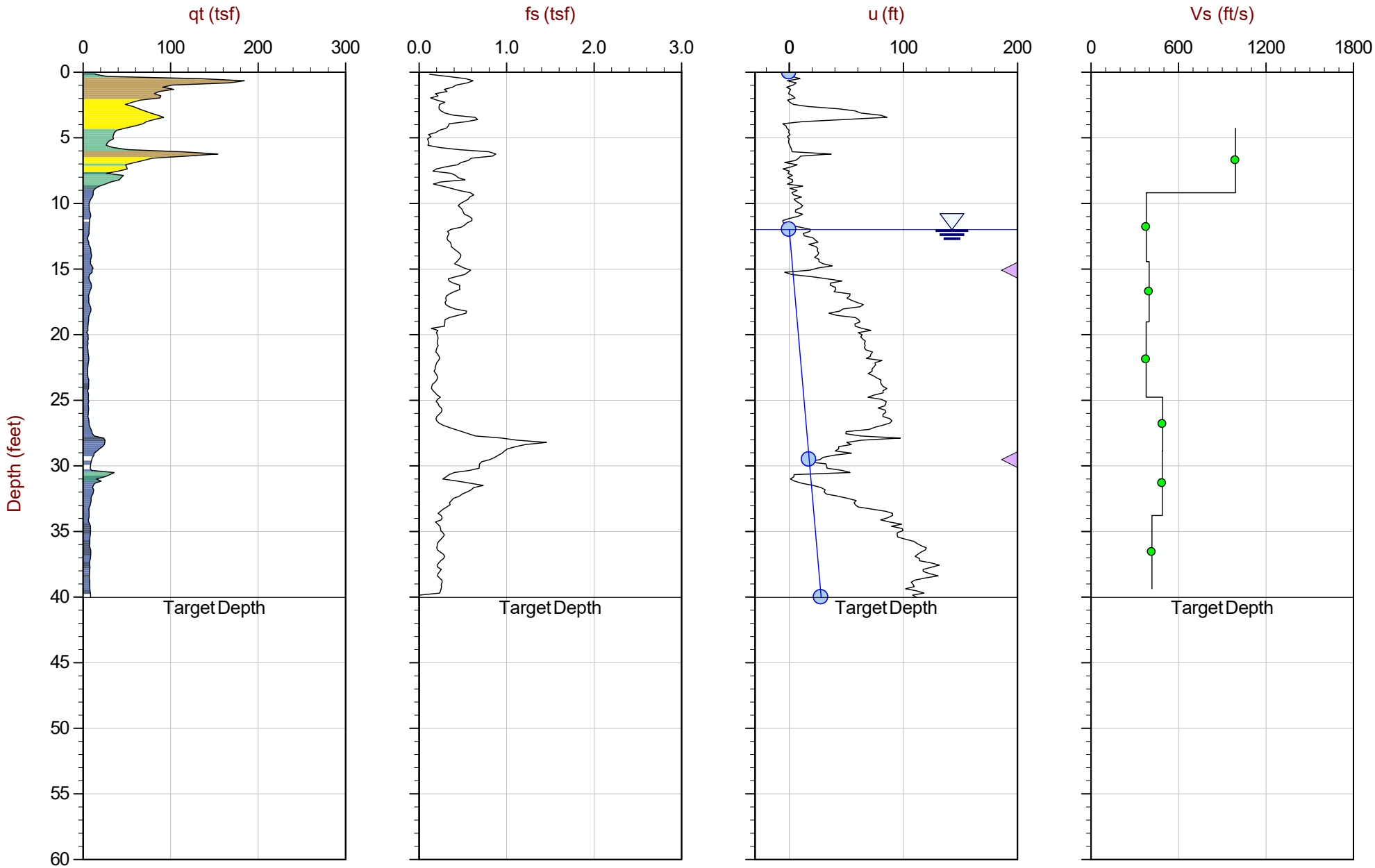
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:19:15 14:12
Site: Edwards Power Station

Sounding: EDW-C015A
Cone: 335:T1500F15U500



Max Depth: 12.200 m / 40.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP15A.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496435m E: 274342m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

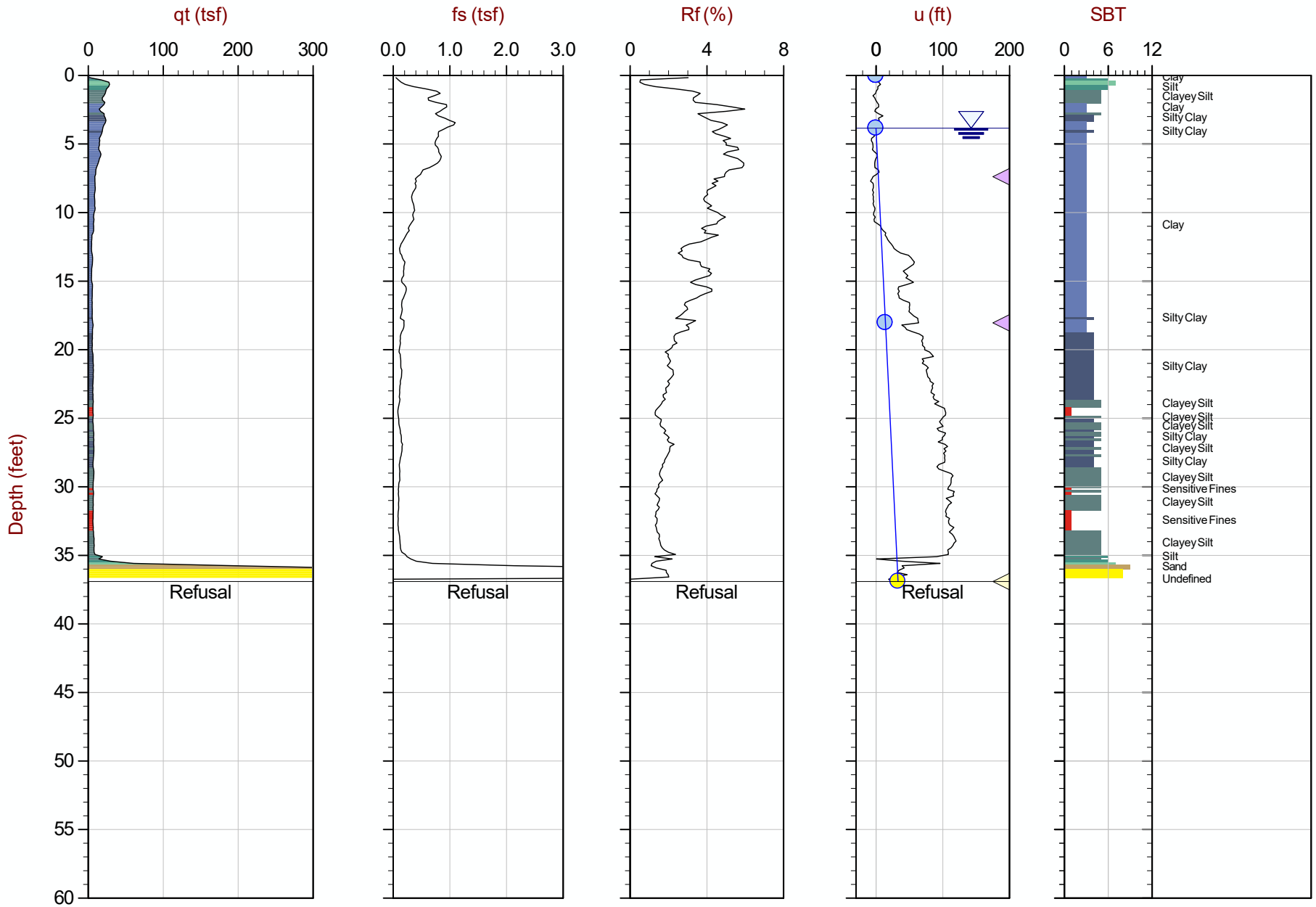
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:28:15 08:46
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C016
Cone: 374:T1500F15U500



Max Depth: 11.250 m / 36.91 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP16.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496442m E: 274308m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

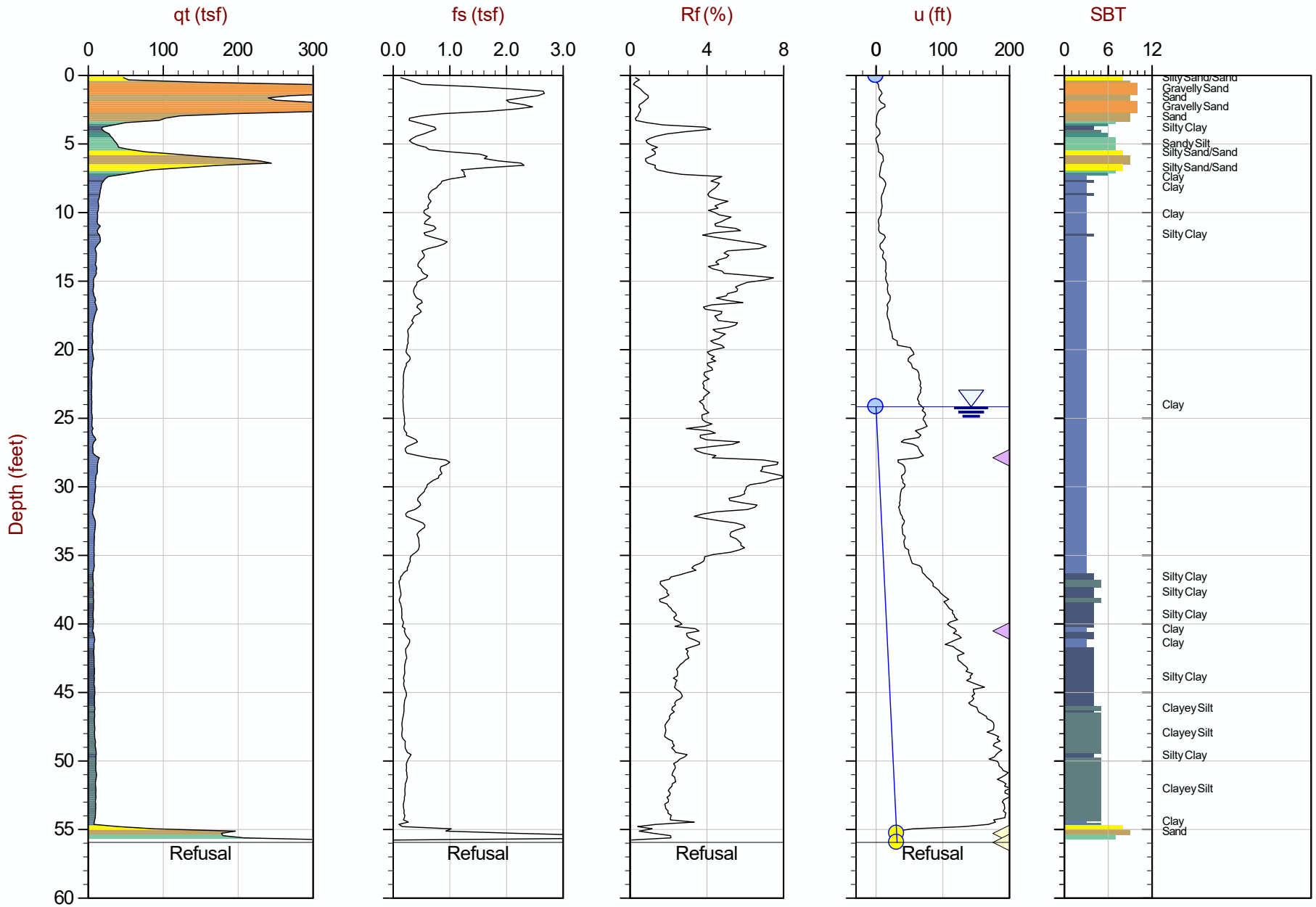
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 11:13
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C017
Cone: 340:T1500F15U500



Max Depth: 17.050 m / 55.94 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP17.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496775m E: 274137m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

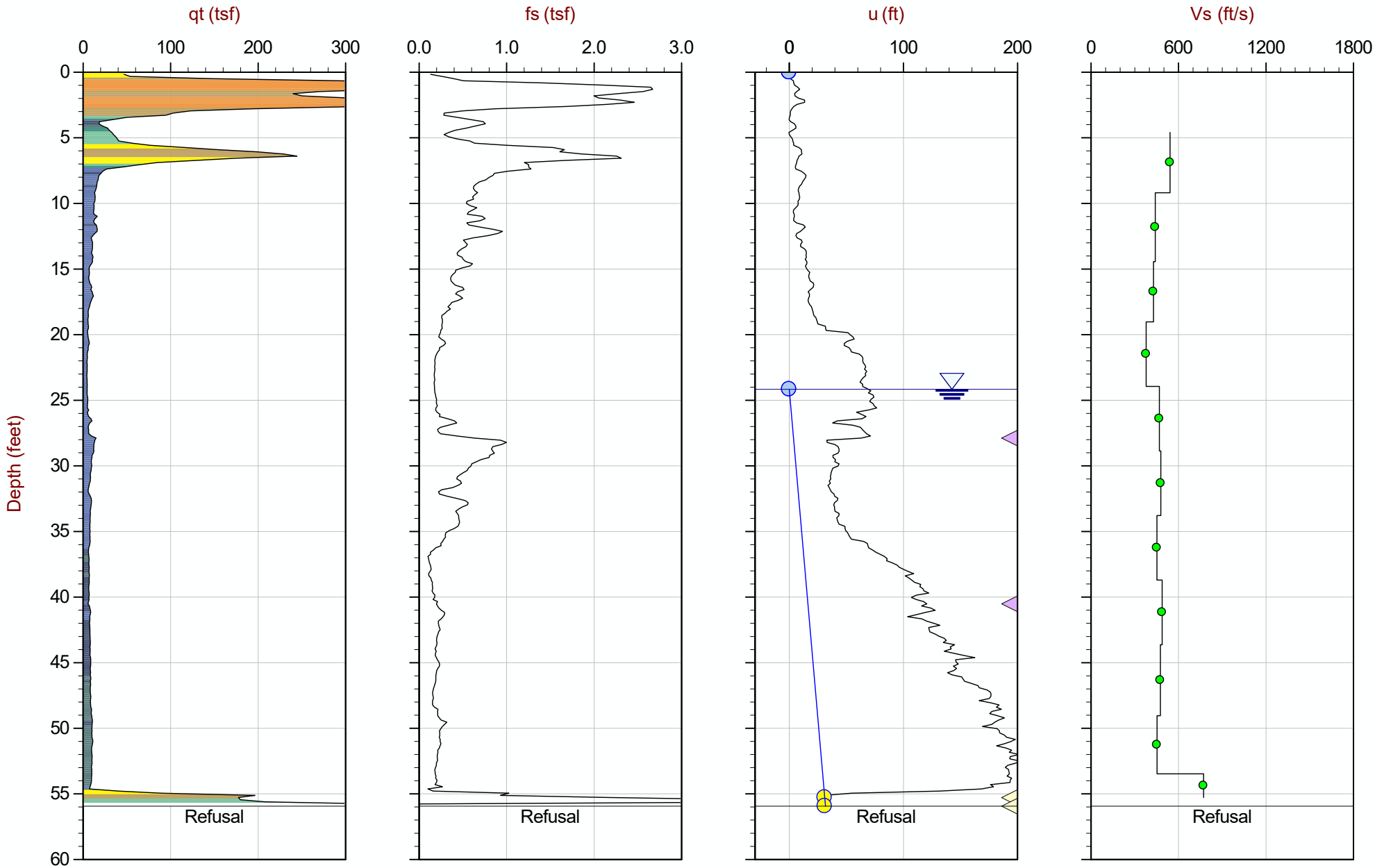
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 11:13
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C017
Cone: 340:T1500F15U500



Max Depth: 17.050 m / 55.94 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP17.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496775m E: 274137m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

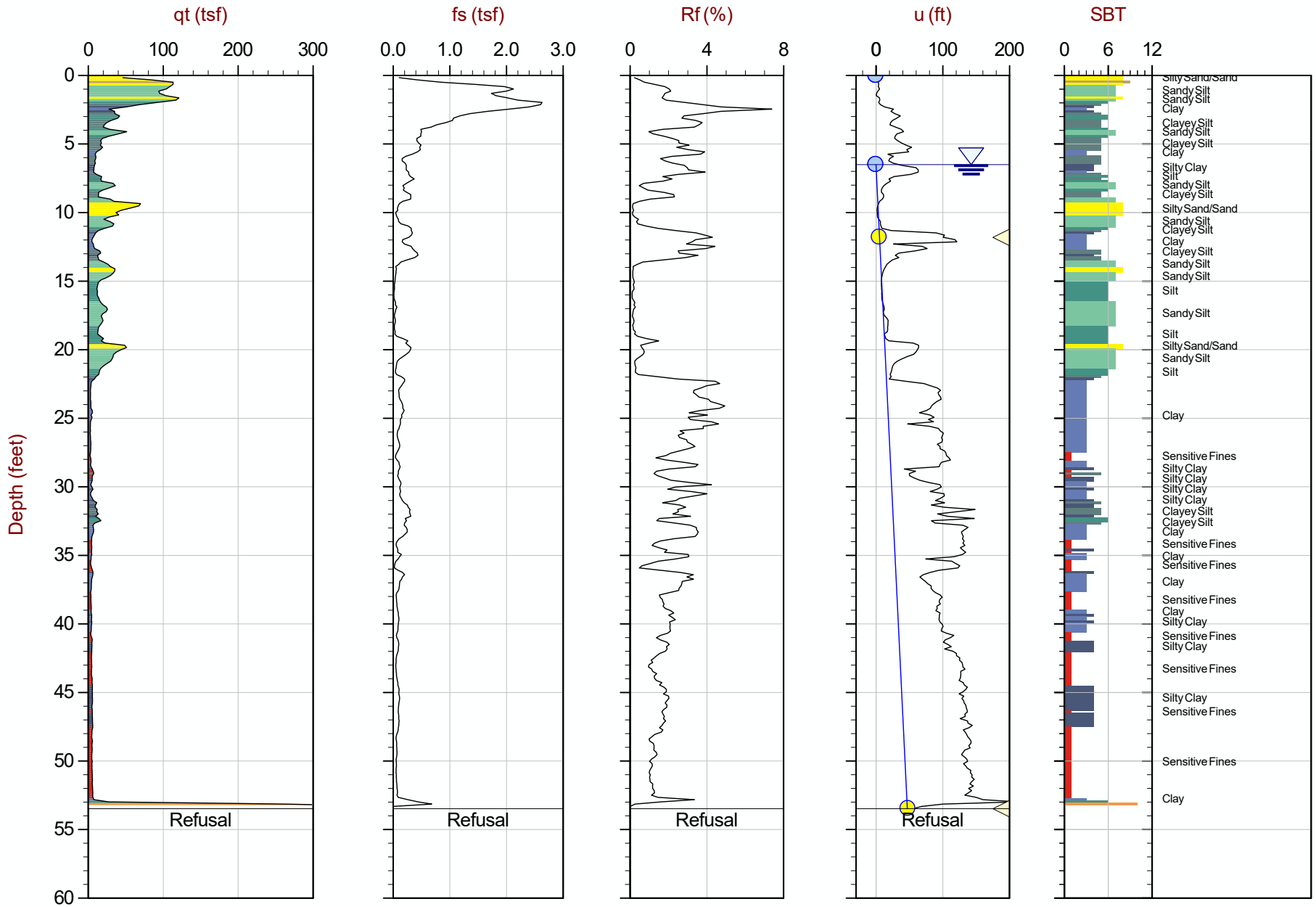
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 15:23
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C019
Cone: 340:T1500F15U500



Max Depth: 16.300 m / 53.48 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP19.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496825m E: 274184m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

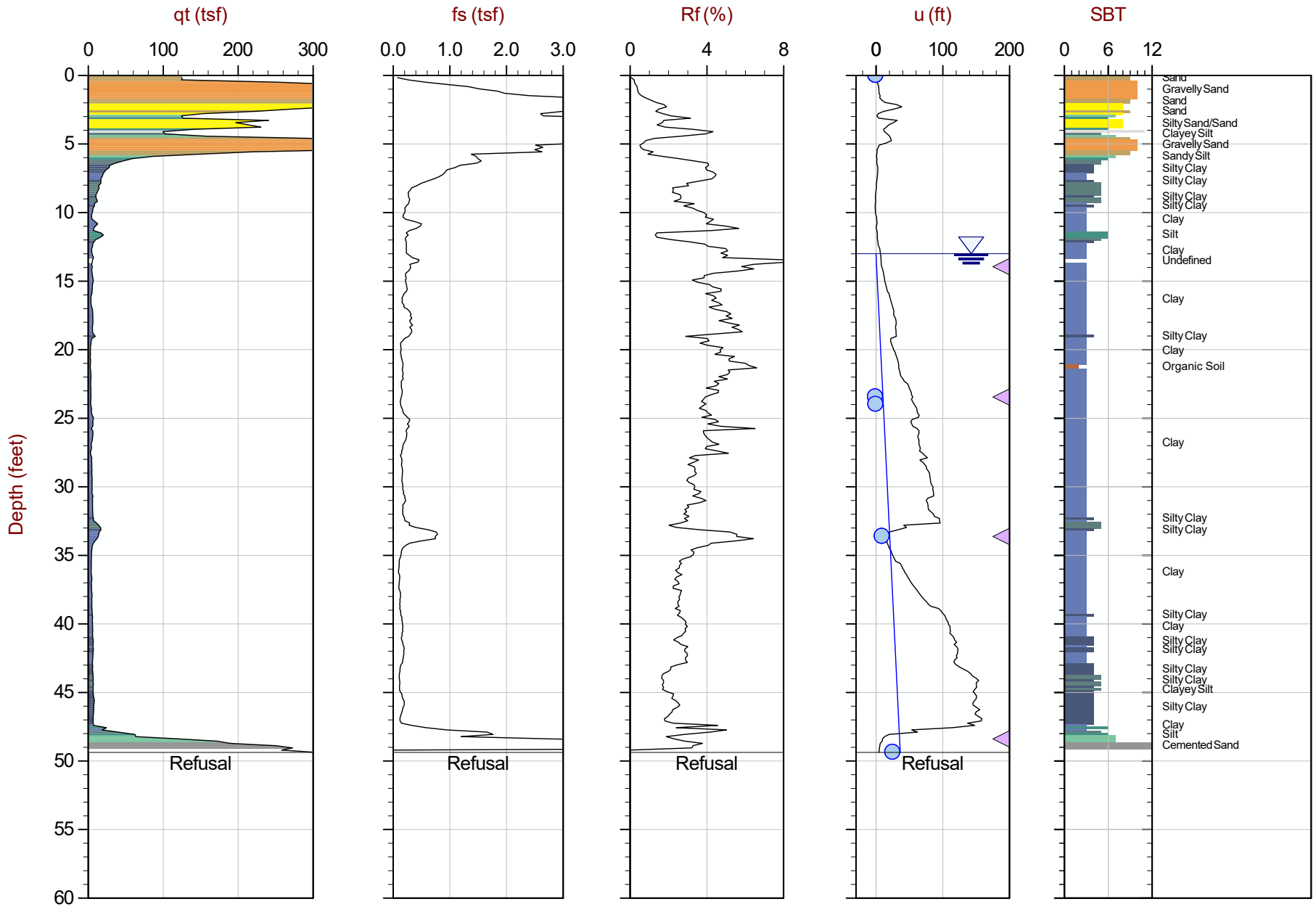
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 13:27
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C021
Cone: 340:T1500F15U500



Max Depth: 15.050 m / 49.38 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP21.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497046m E: 274071m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

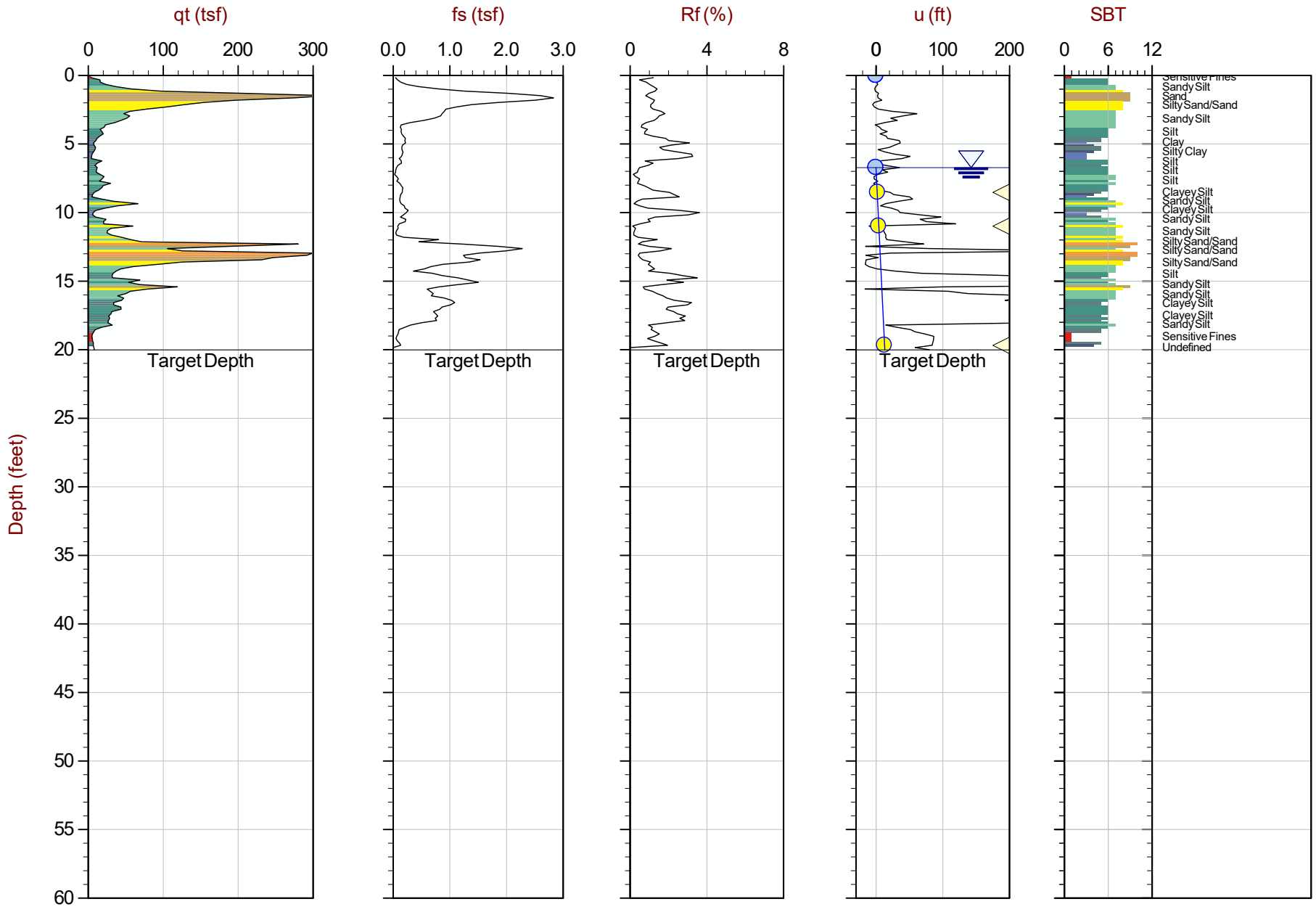
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:26:15 10:35
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C022
Cone: 374:T1500F15U500



Max Depth: 6.100 m / 20.01 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP22.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497185m E: 274108m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

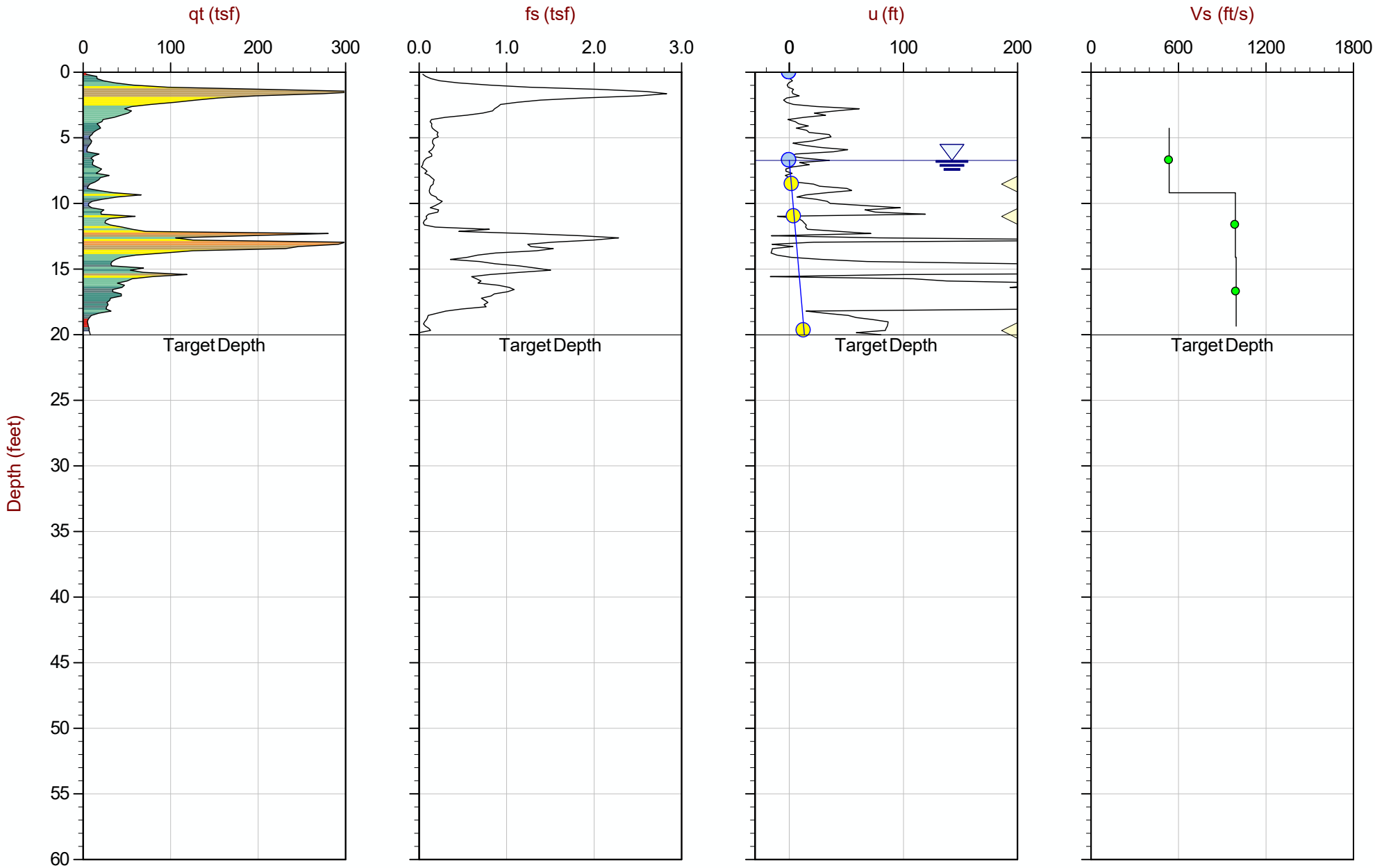
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:26:15 10:35
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C022
Cone: 374:T1500F15U500



Max Depth: 6.100 m / 20.01 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP22.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497185m E: 274108m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

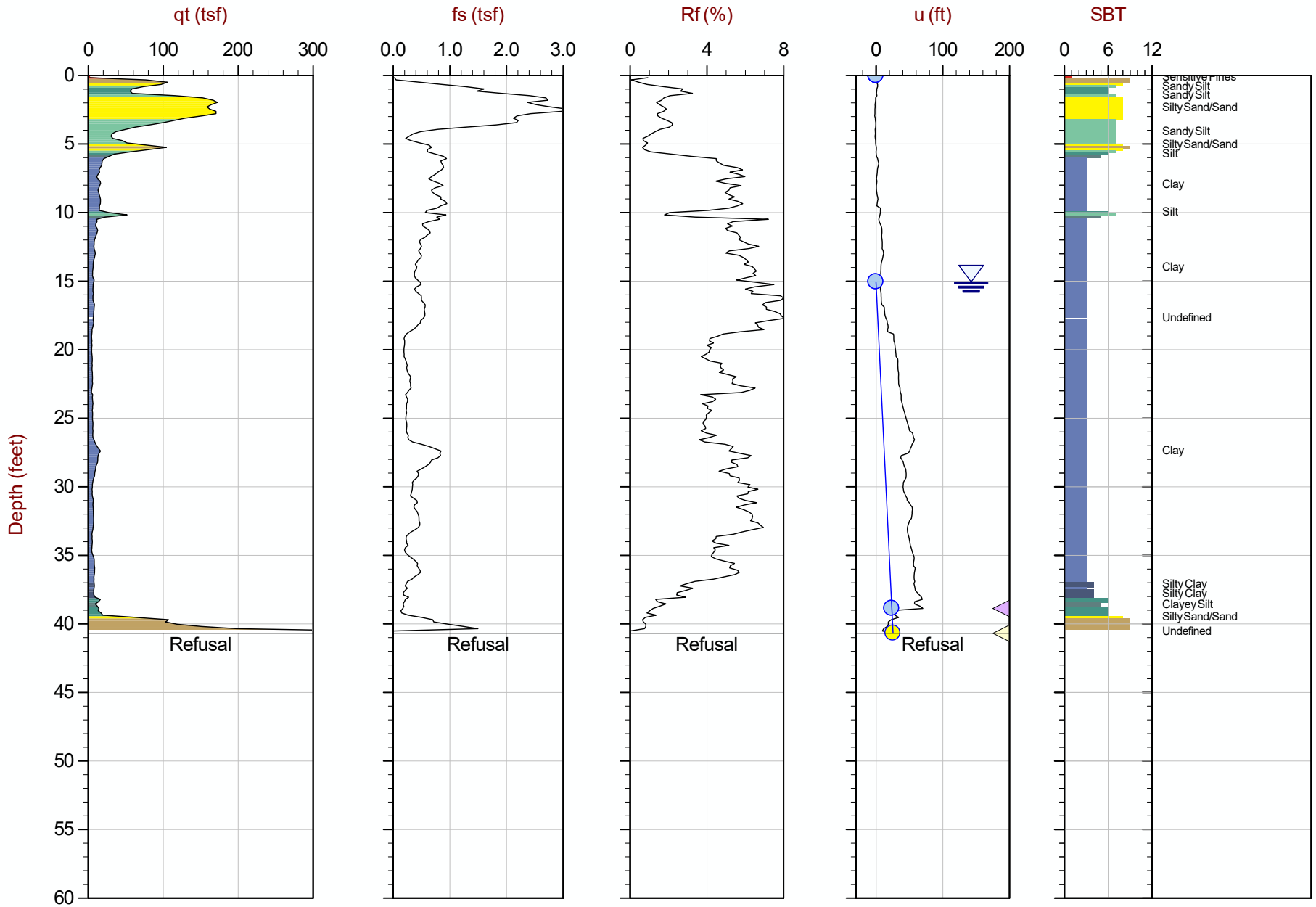
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 08:52
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C023
Cone: 340:T1500F15U500



Max Depth: 12.400 m / 40.68 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP23.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497364m E: 274147m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

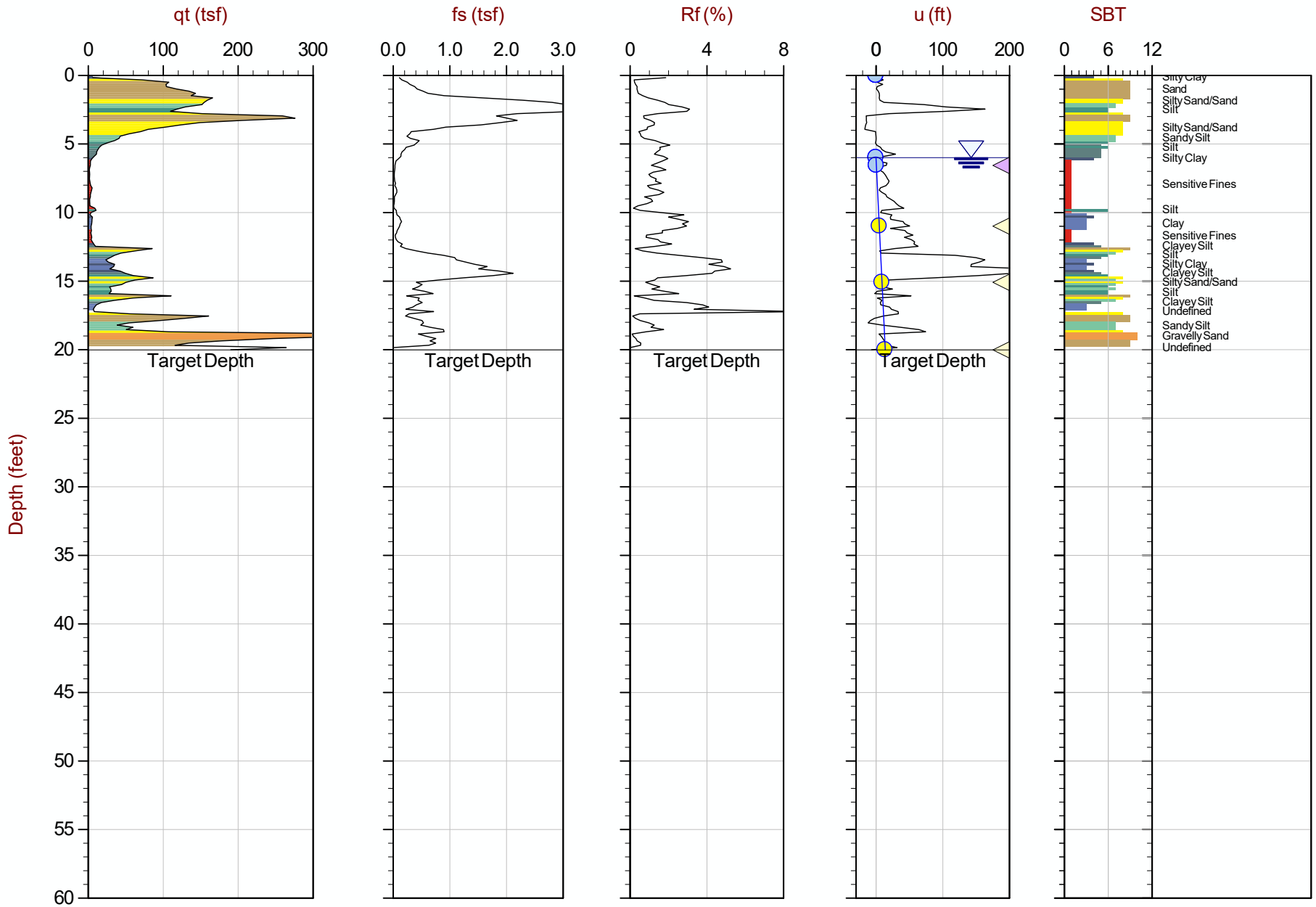
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:25:15 13:44
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C025
Cone: 374:T1500F15U500



Max Depth: 6.100 m / 20.01 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP25.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497285m E: 274315m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

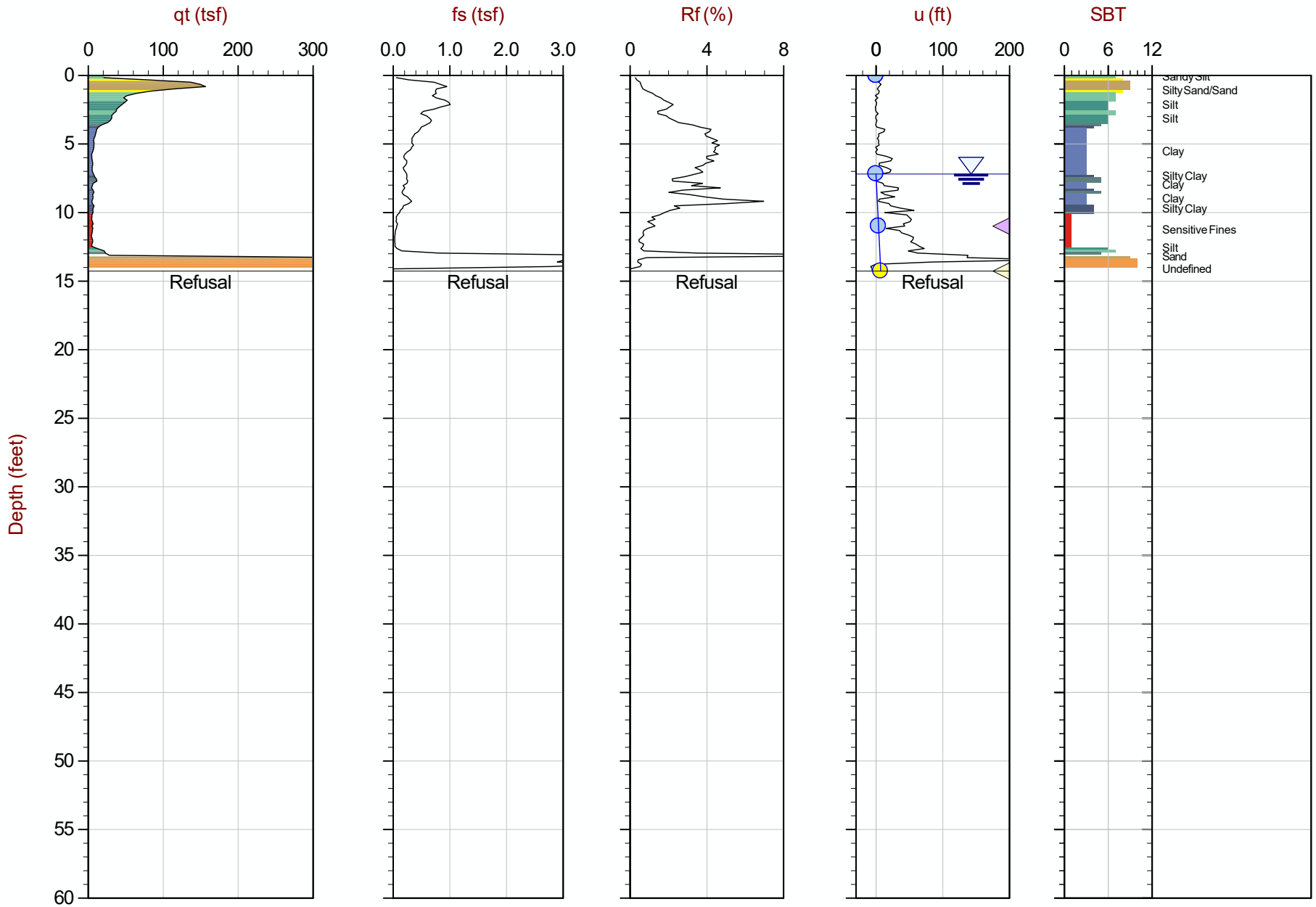
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:26:15 12:20
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C026
Cone: 374:T1500F15U500



Max Depth: 4.350 m / 14.27 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP26.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497062m E: 274334m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

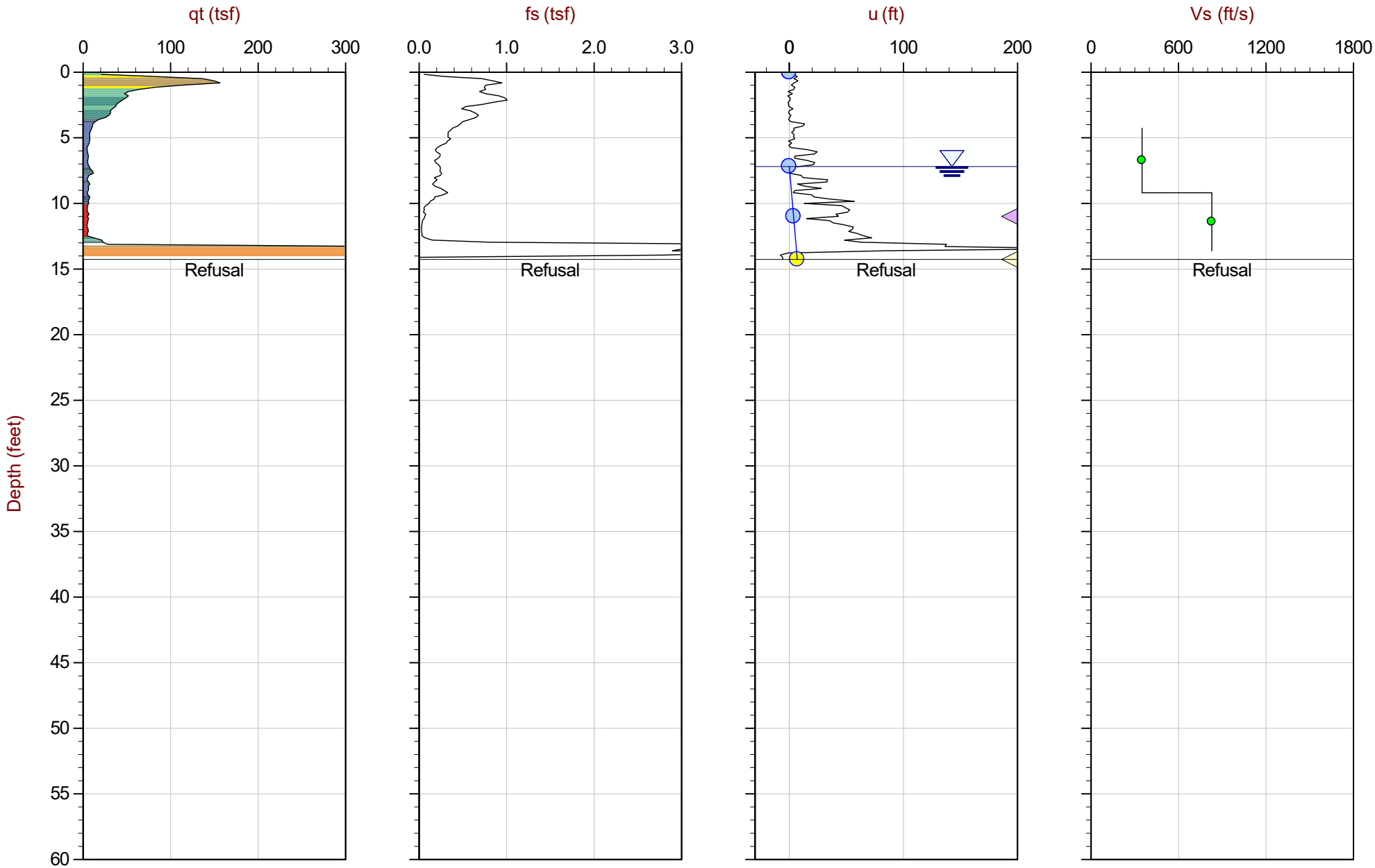
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:26:15 12:20
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C026
Cone: 374:T1500F15U500



Max Depth: 4.350 m / 14.27 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP26.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497062m E: 274334m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

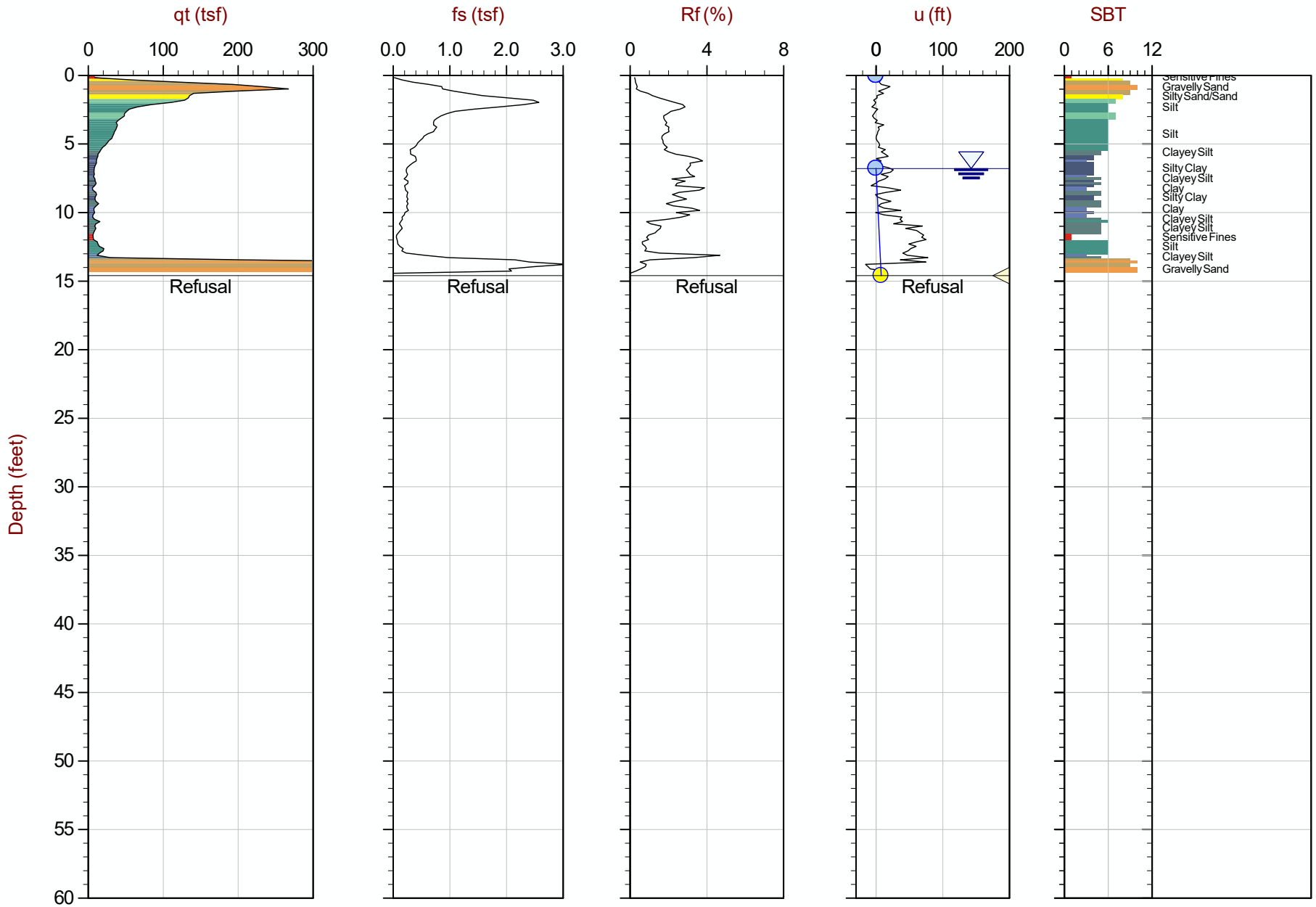
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:26:15 14:00
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C026B
Cone: 374:T1500F15U500



Max Depth: 4.450 m / 14.60 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP26B.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497064m E: 274335m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

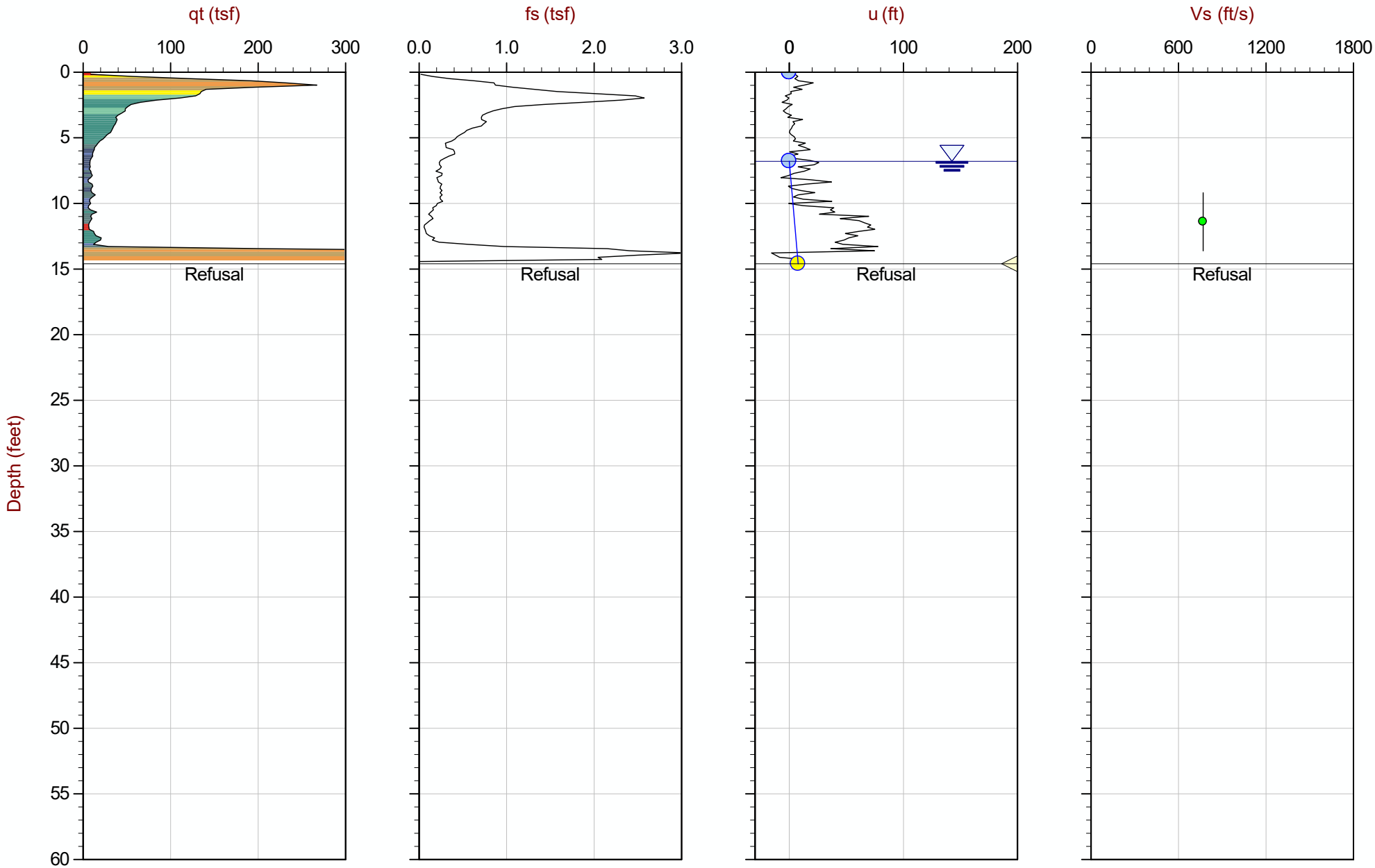
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:26:15 14:00
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C026B
Cone: 374:T1500F15U500



Max Depth: 4.450 m / 14.60 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP26B.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497064m E: 274335m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

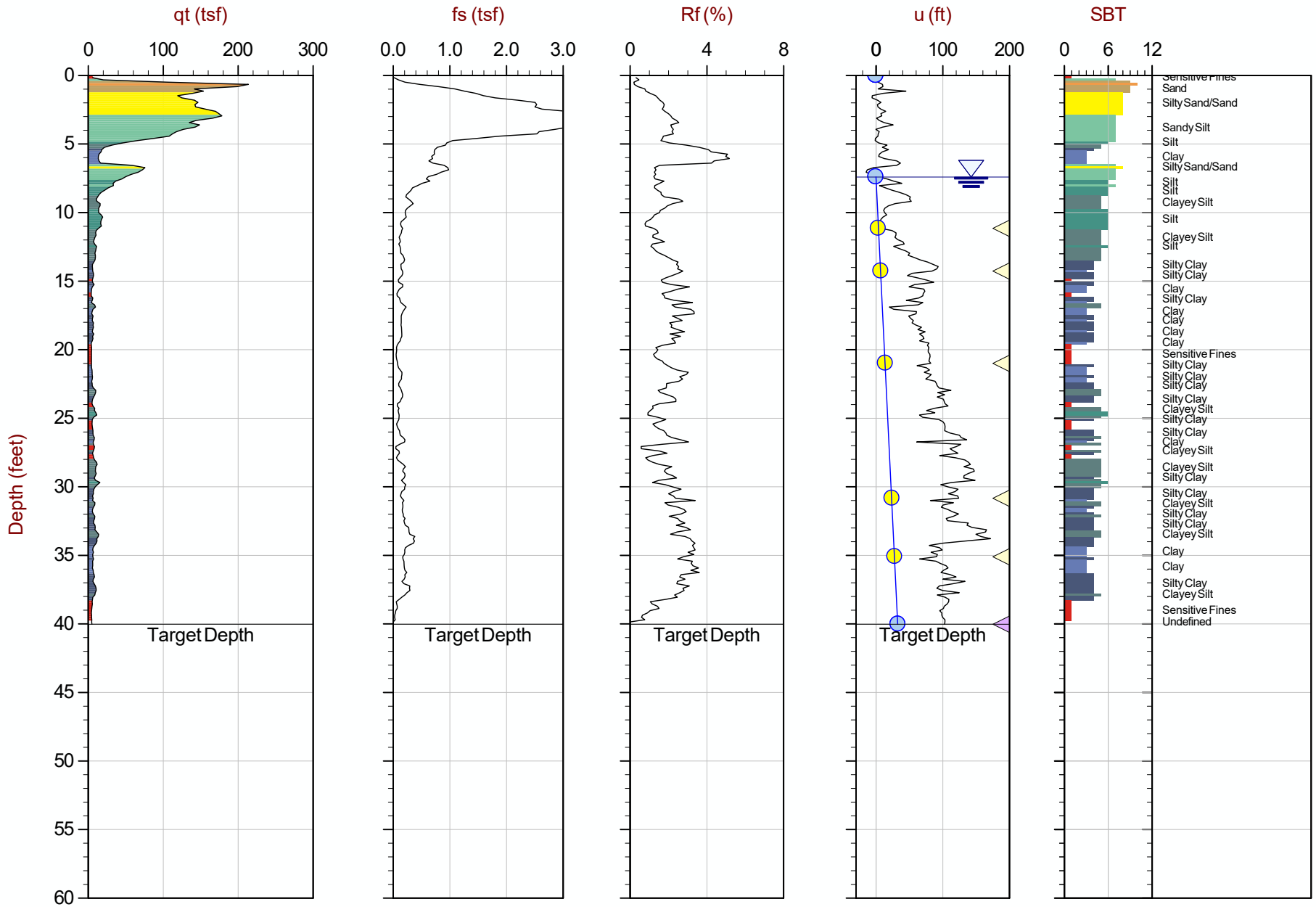
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:25:15 11:00
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C027
Cone: 374:T1500F15U500



Max Depth: 12.200 m / 40.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP27.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496687m E: 274266m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

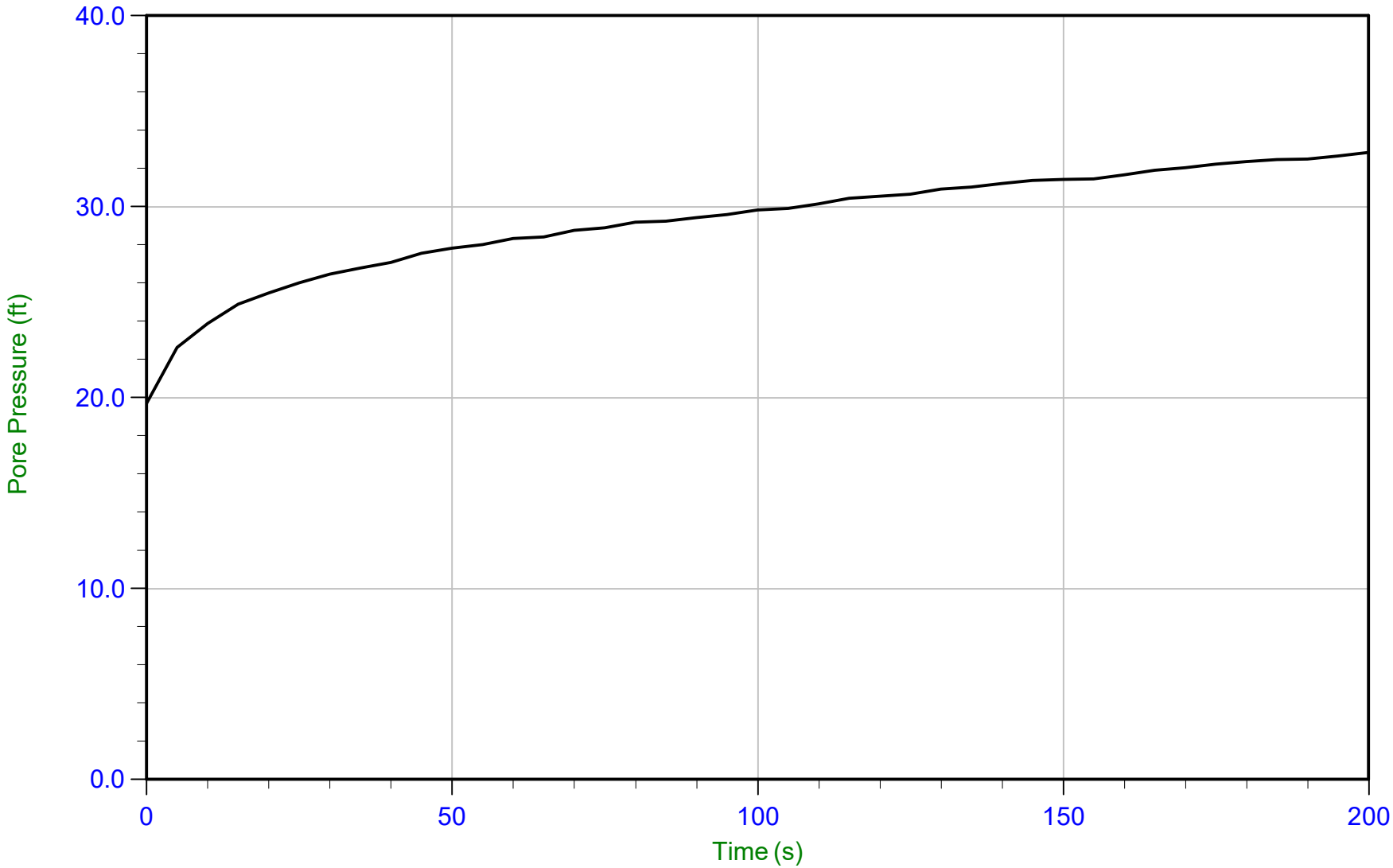
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 19-Aug-2015 13:46:01
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C001
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP01.PPD
Depth: 4.000 m / 13.123 ft
Duration: 200.0 s

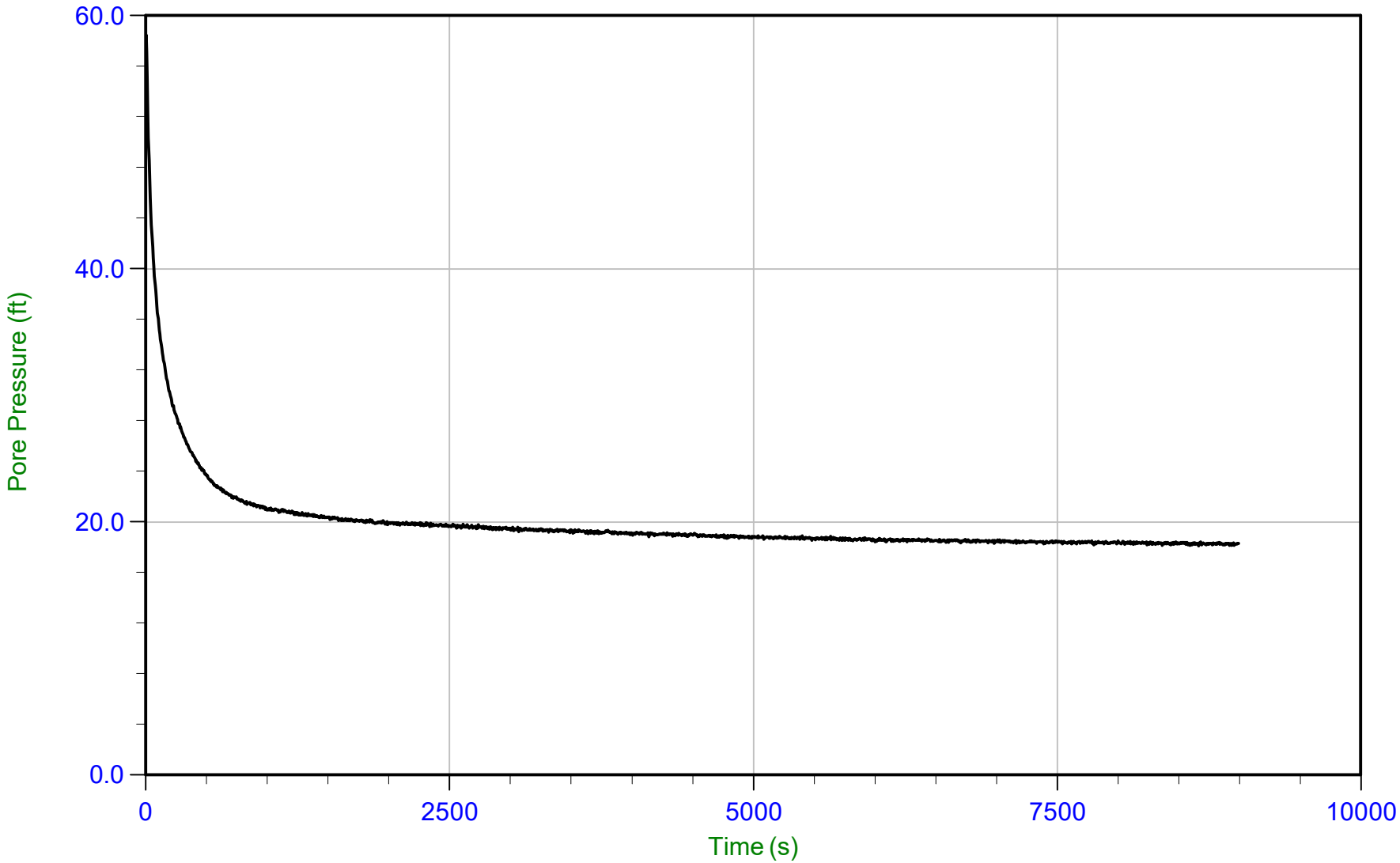
U Min: 19.7 ft
U Max: 32.8 ft

CONETEC

AECOM

Job No: 15-53073
Date: 19-Aug-2015 13:46:01
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C001
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP01.PPD
Depth: 8.300 m / 27.231 ft
Duration: 9000.0 s

U Min: 18.1 ft
U Max: 58.5 ft

WT: 2.855 m / 9.367 ft
Ueq: 17.9 ft
U(50): 38.16 ft

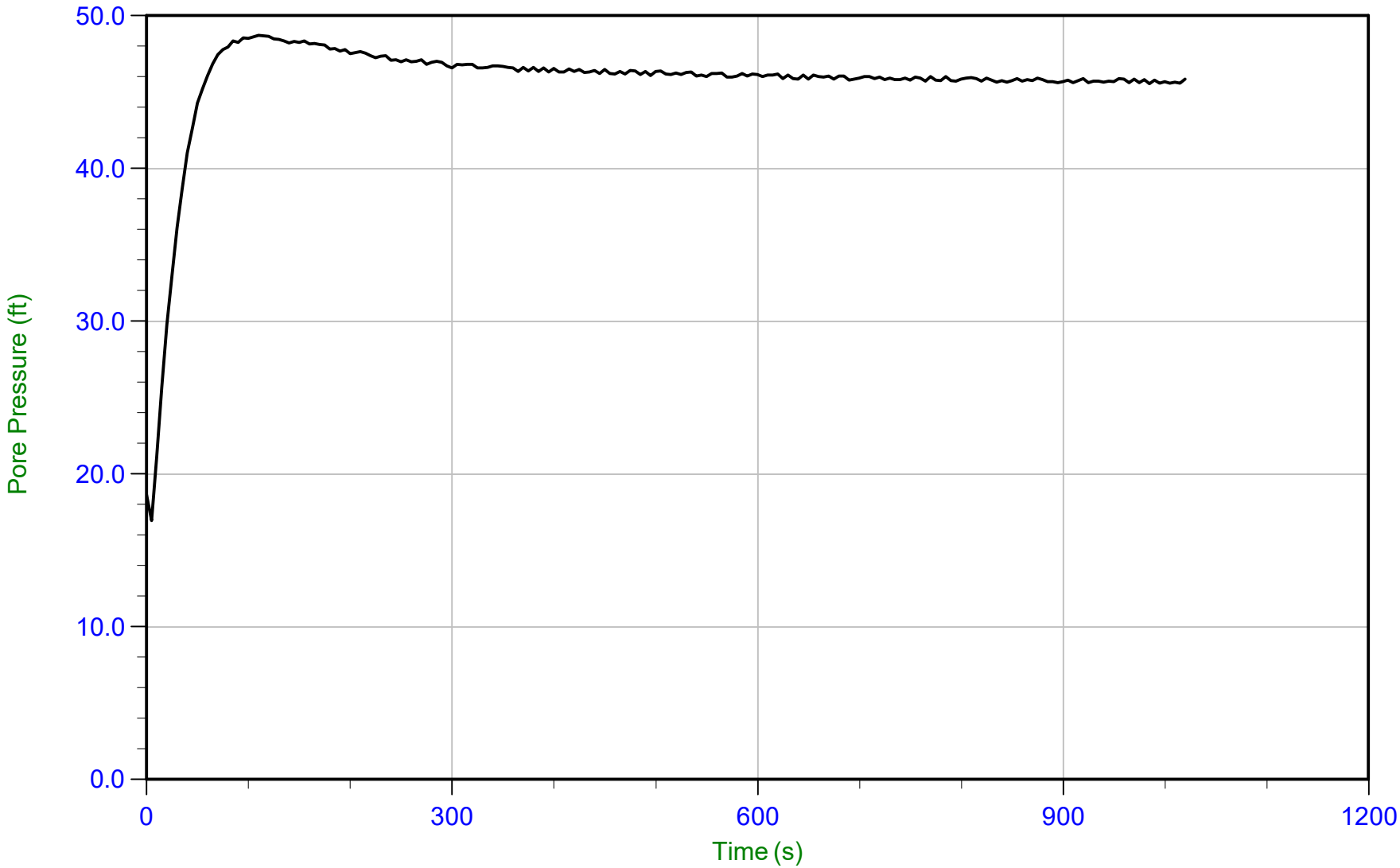
T(50): 80.8 s
Ir: 100
Ch: 8.7 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 14:27:54
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C003
Cone: AD419
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP03.PPD
Depth: 16.600 m / 54.461 ft
Duration: 1020.0 s

U Min: 16.9 ft
U Max: 48.7 ft

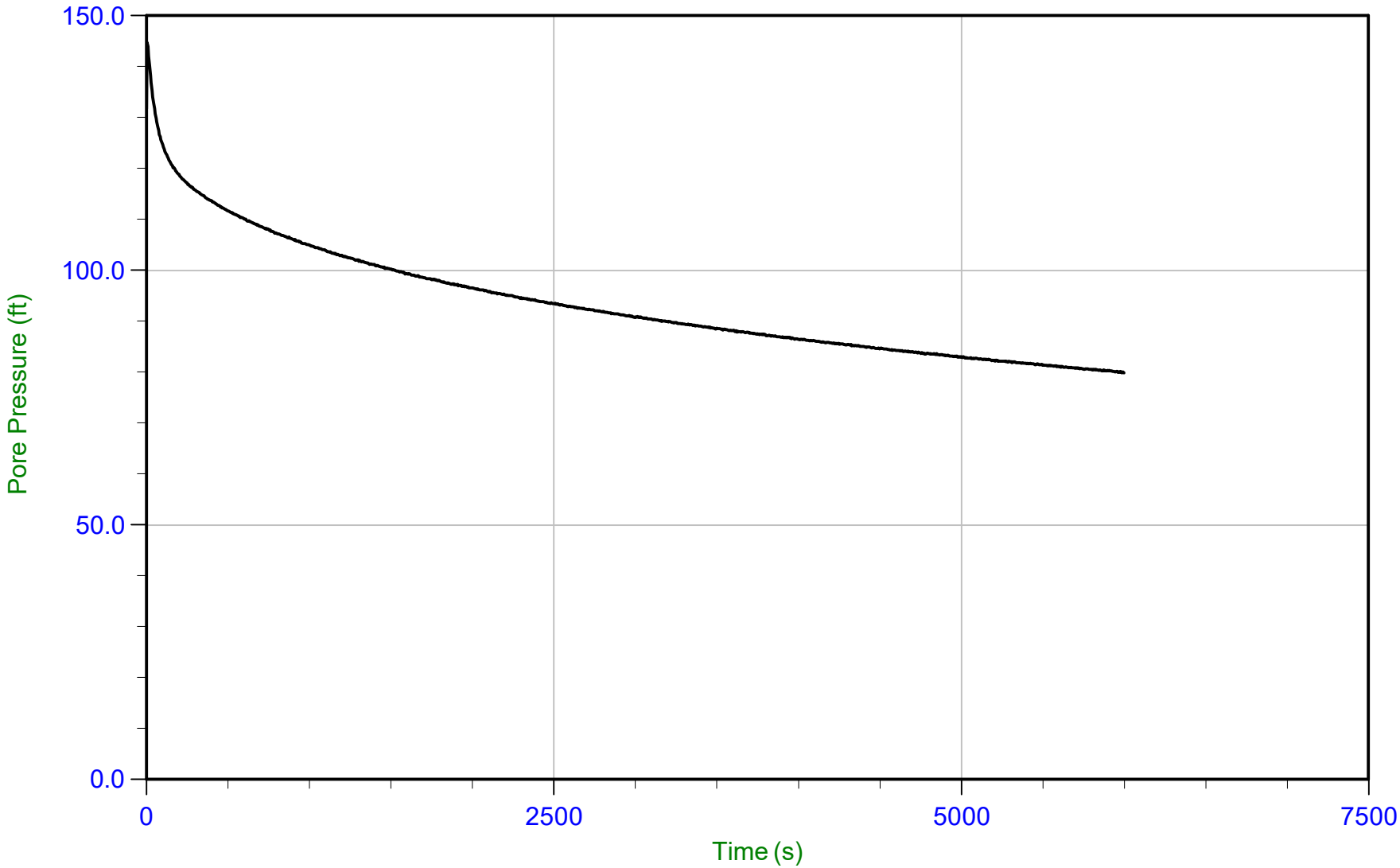
WT: 2.736 m / 8.976 ft
Ueq: 45.5 ft

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 15:05:24
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C005
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP05.PPD
Depth: 11.400 m / 37.401 ft
Duration: 6000.0 s

U Min: 79.9 ft
U Max: 144.8 ft

WT: 2.134 m / 7.001 ft
Ueq: 30.4 ft
U(50): 87.59 ft

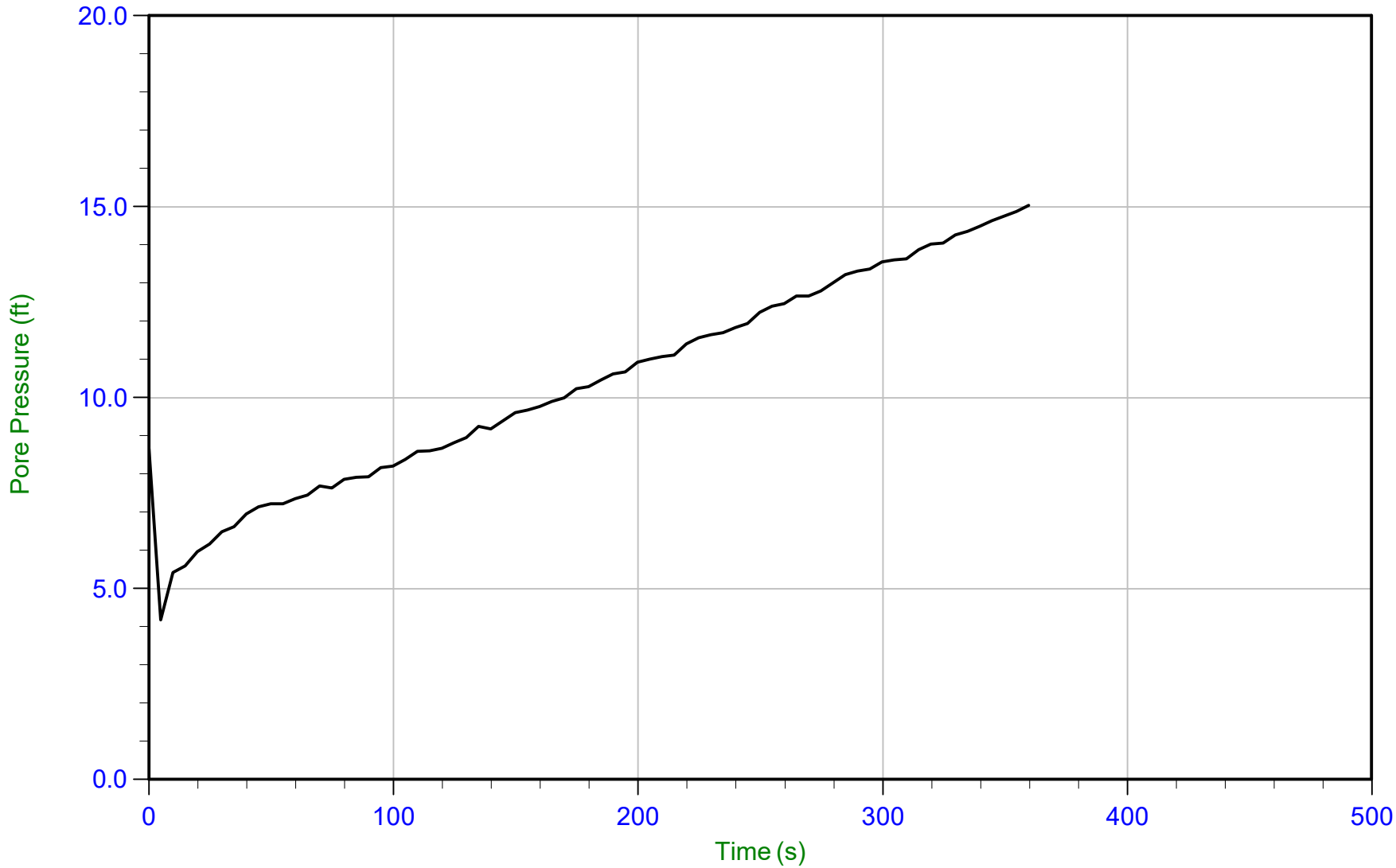
T(50): 3717.5 s
Ir: 100
Ch: 0.2 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 15:52:43
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C006
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP06.PPD
Depth: 4.350 m / 14.271 ft
Duration: 360.0 s

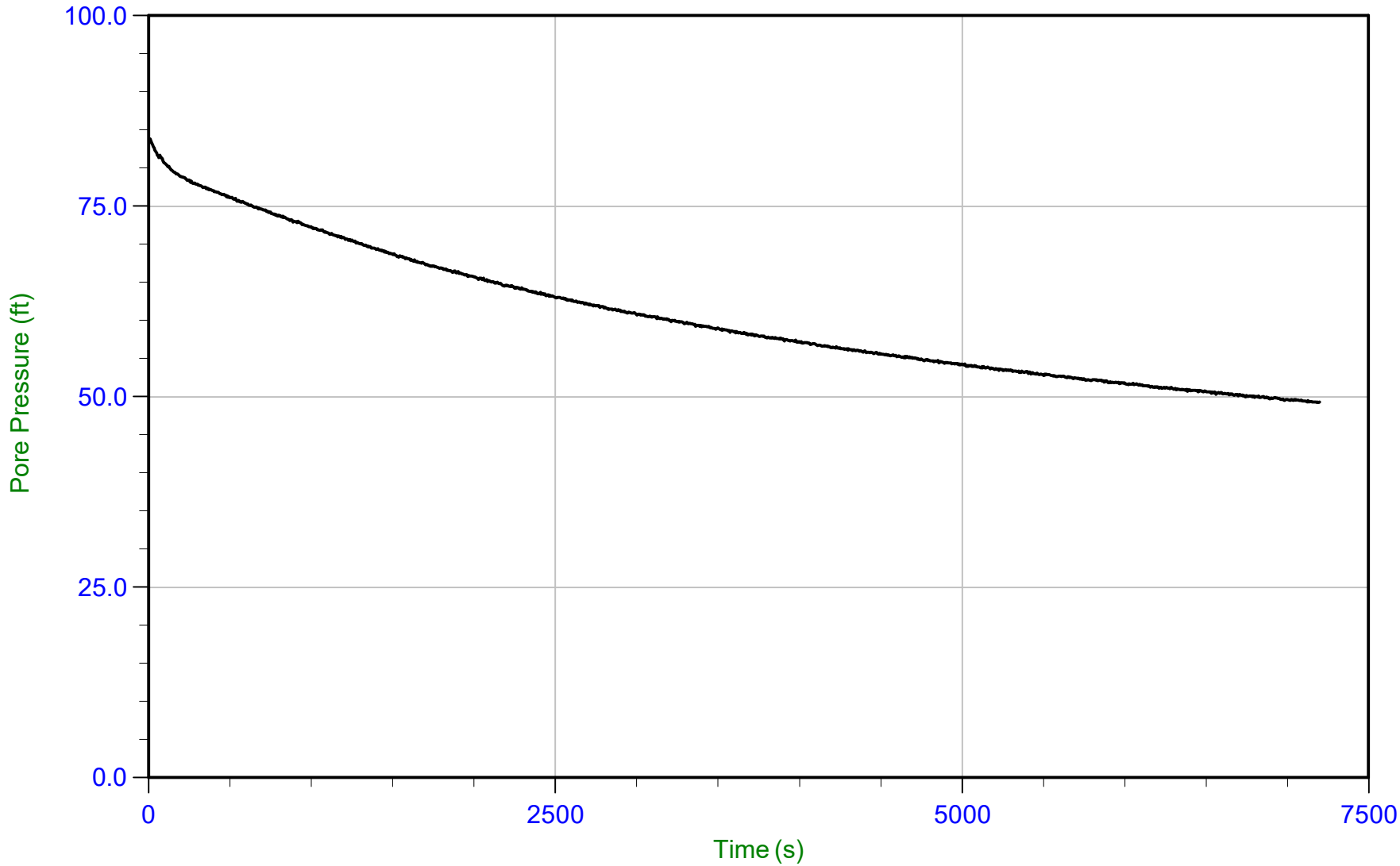
U Min: 4.2 ft
U Max: 15.0 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 15:52:43
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C006
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP06.PPD
Depth: 8.000 m / 26.246 ft
Duration: 7200.0 s

U Min: 49.2 ft
U Max: 83.8 ft

WT: 3.505 m / 11.499 ft
Ueq: 14.7 ft
U(50): 49.29 ft

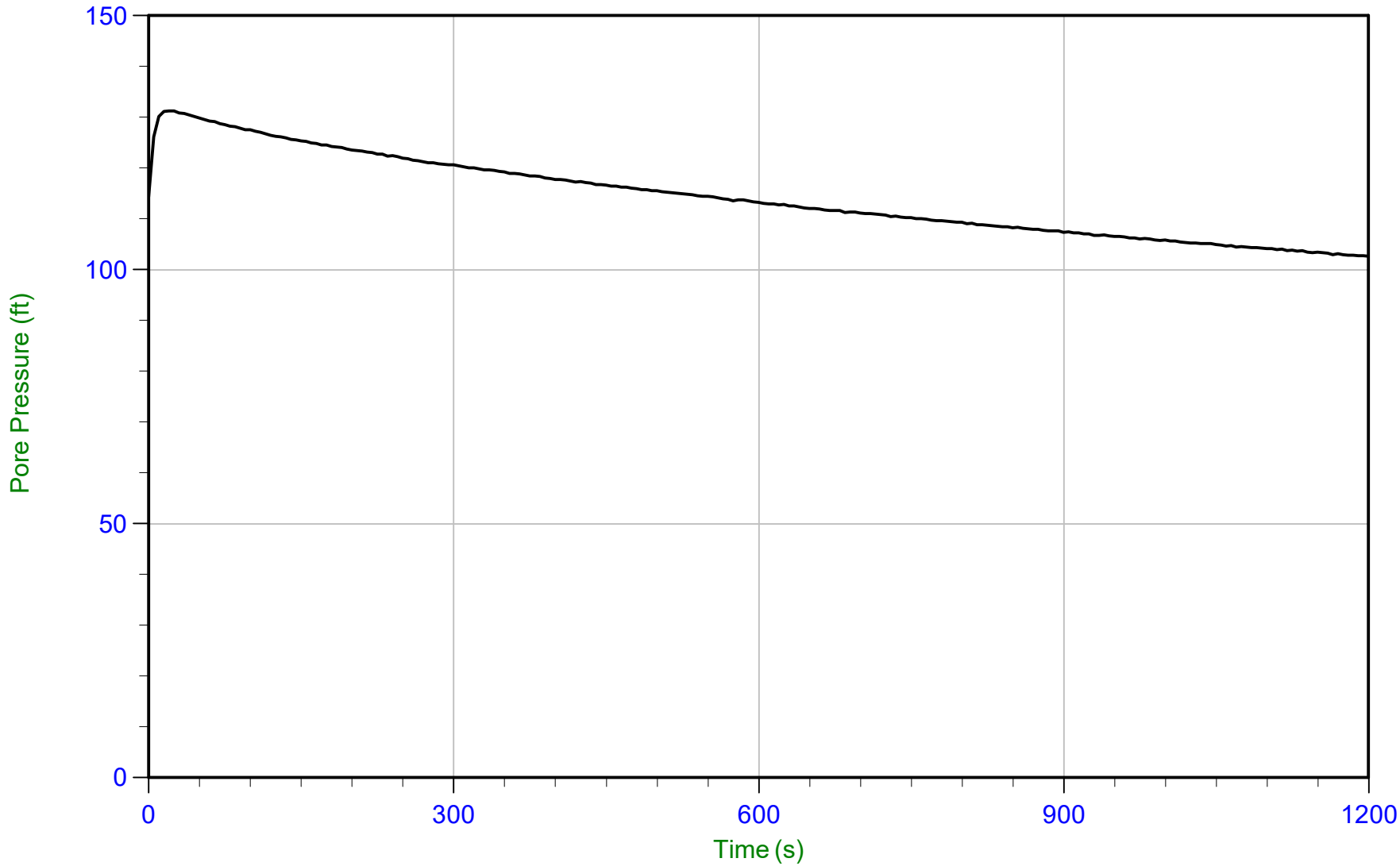
T(50): 7113.9 s
Ir: 100
Ch: 0.1 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 15:52:43
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C006
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP06.PPD
Depth: 12.200 m / 40.026 ft
Duration: 1200.0 s

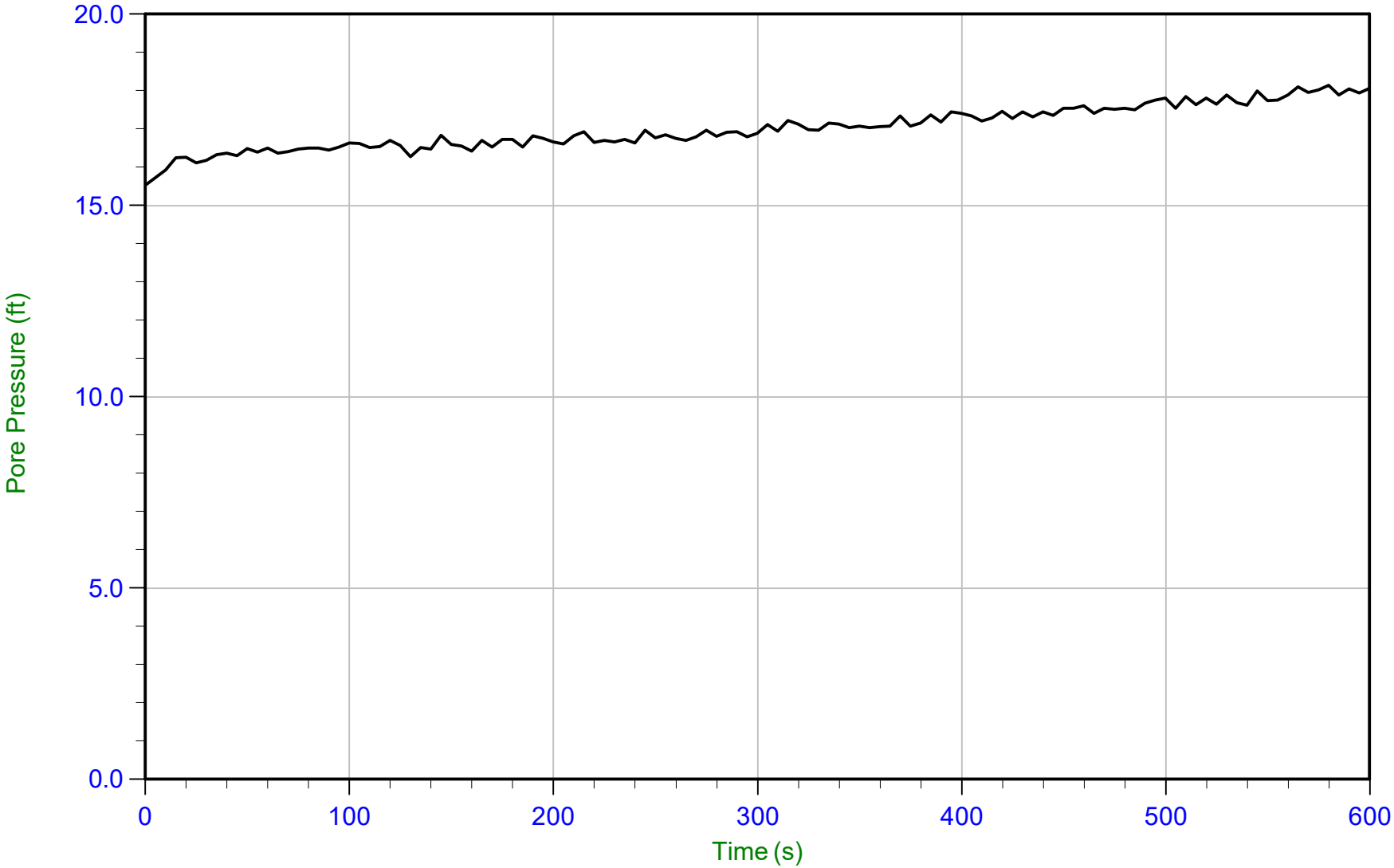
U Min: 102.7 ft
U Max: 131.3 ft

CONETEC

AECOM

Job No: 15-53073
Date: 29-Aug-2015 09:19:17
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C007
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP07.PPD
Depth: 8.200 m / 26.903 ft
Duration: 600.0 s

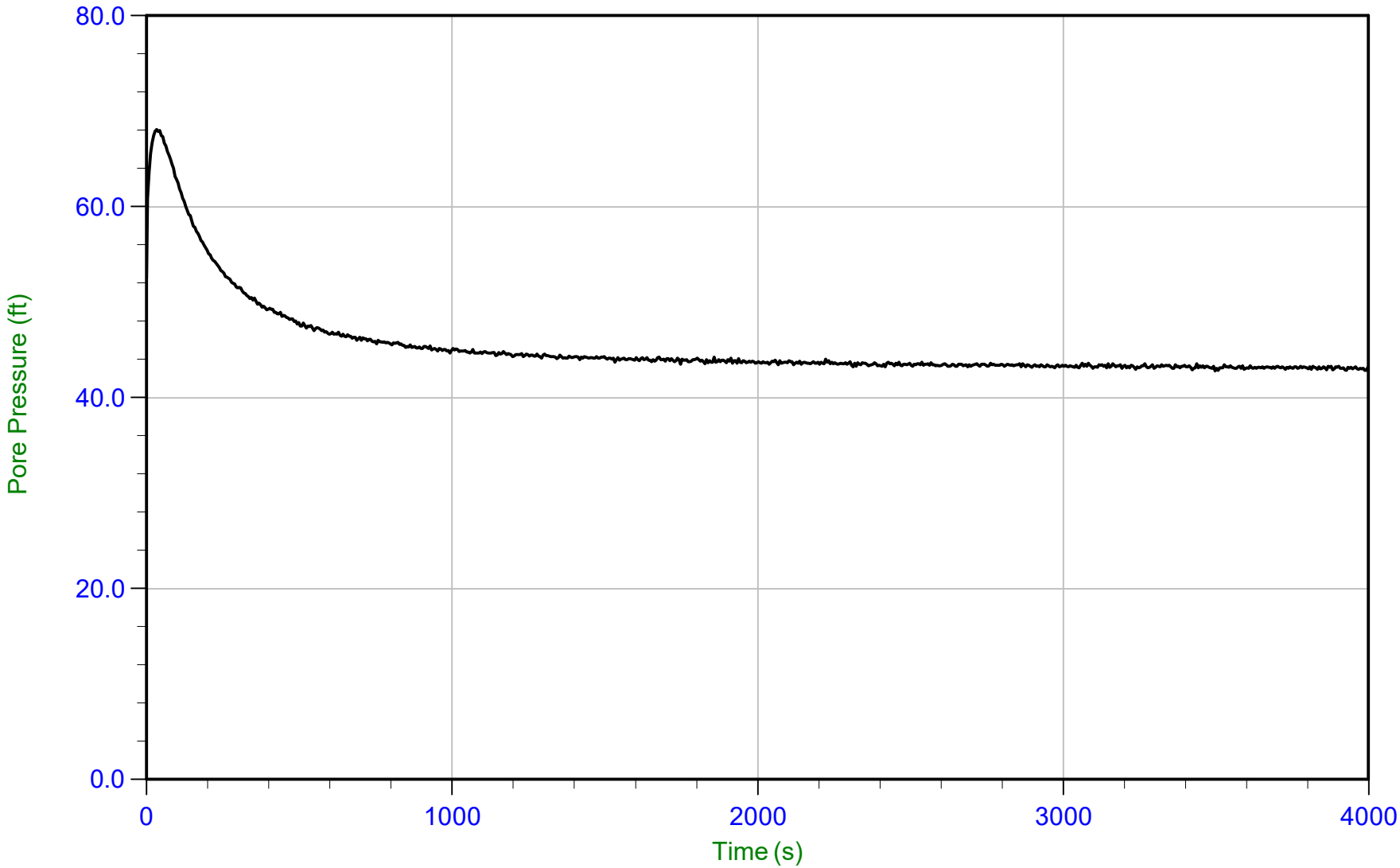
U Min: 15.5 ft
U Max: 18.1 ft

CONETEC

AECOM

Job No: 15-53073
Date: 29-Aug-2015 09:19:17
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C007
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP07.PPD
Depth: 15.700 m / 51.509 ft
Duration: 4000.0 s

U Min: 42.8 ft
U Max: 68.1 ft

WT: 2.709 m / 8.888 ft
Ueq: 42.6 ft
U(50): 55.34 ft

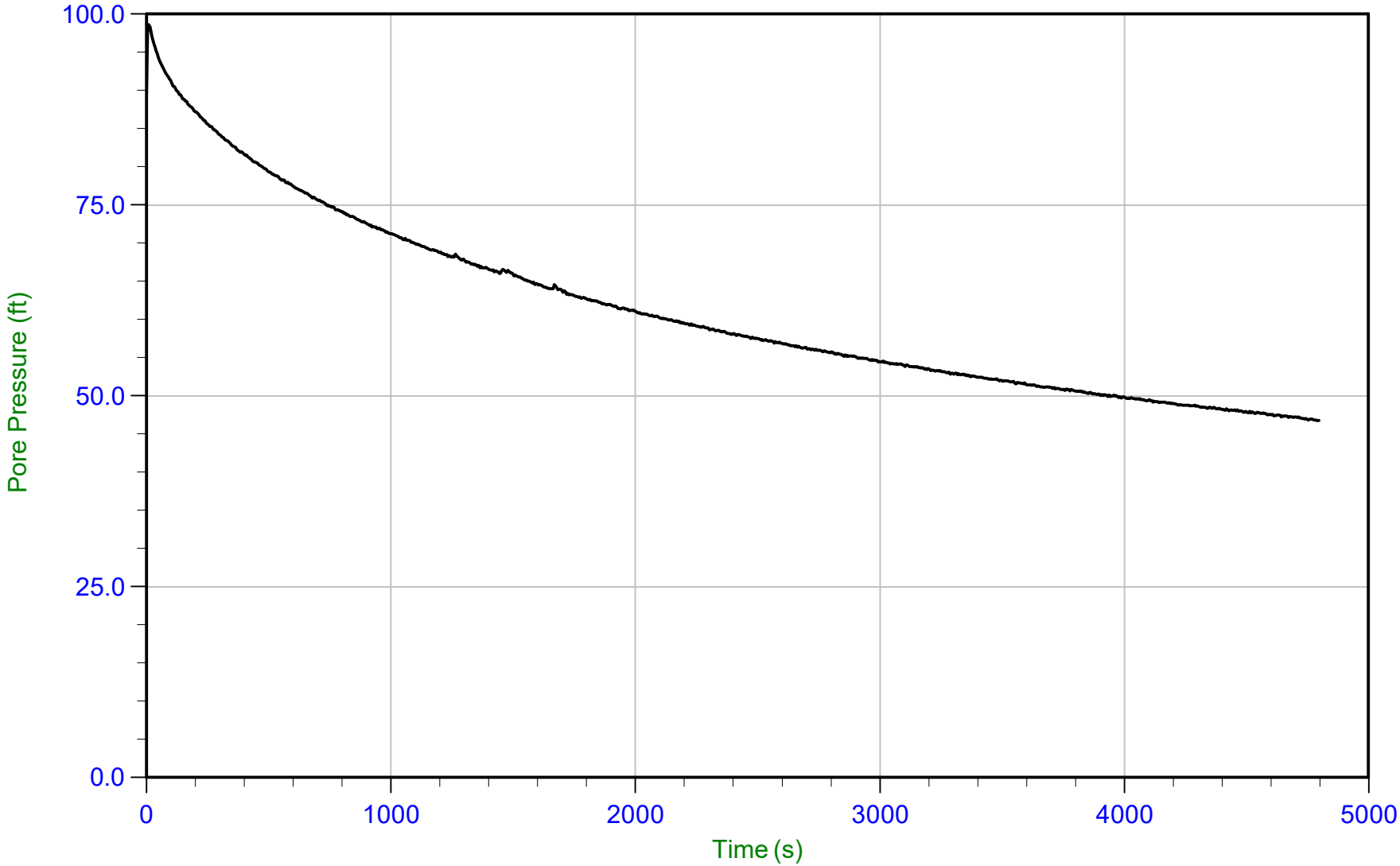
T(50): 166.2 s
Ir: 100
Ch: 4.2 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 08:50:17
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C008
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP08.PPD
Depth: 6.750 m / 22.145 ft
Duration: 4800.0 s

U Min: 46.8 ft
U Max: 98.7 ft

WT: 3.048 m / 10.000 ft
Ueq: 12.1 ft
U(50): 55.40 ft

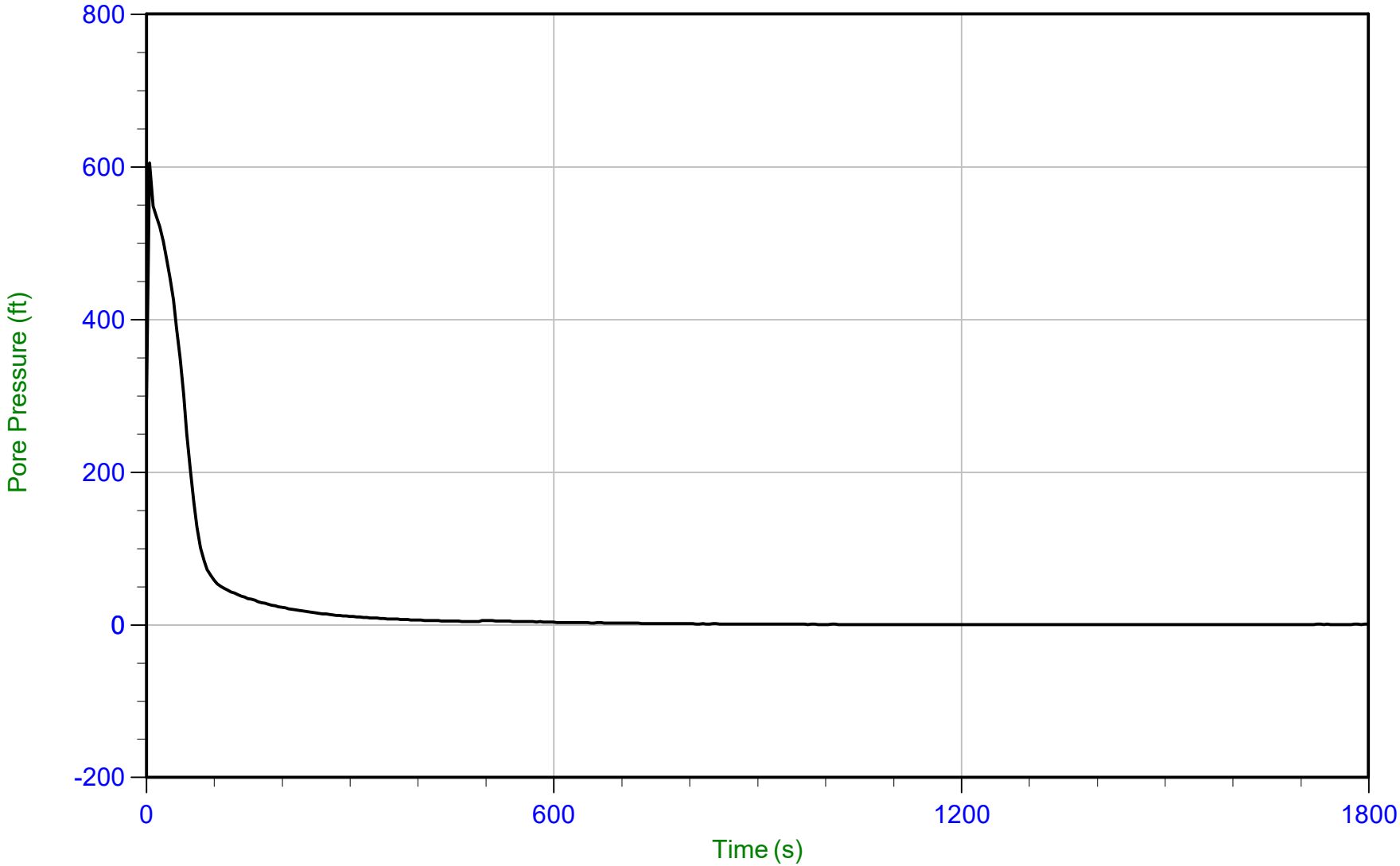
T(50): 2835.5 s
Ir: 100
Ch: 0.2 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 08:50:17
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C008
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP08.PPD
Depth: 10.250 m / 33.628 ft
Duration: 1800.0 s

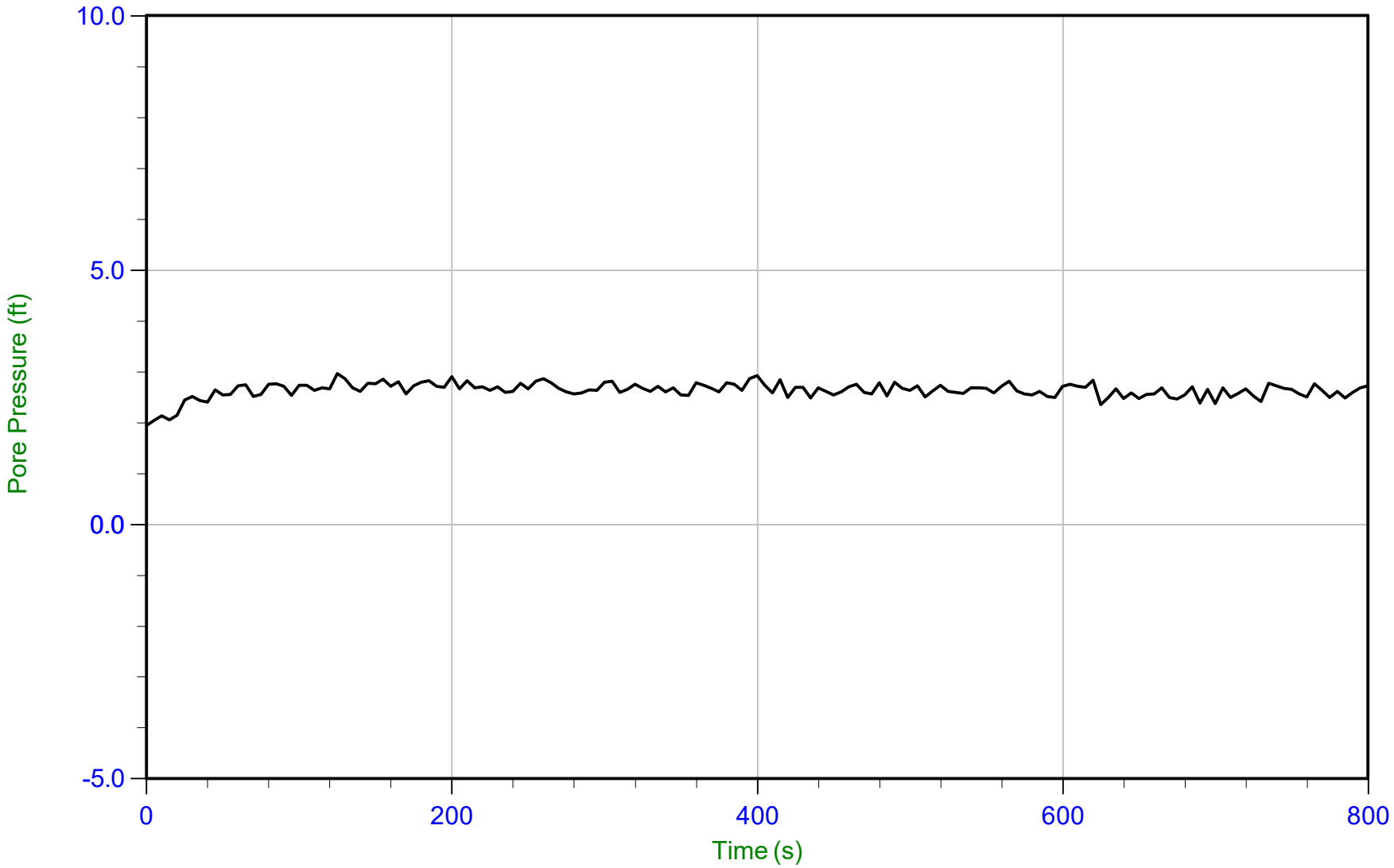
U Min: 0.1 ft
U Max: 605.2 ft

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 16:08:12
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C009
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP09.PPD
Depth: 4.900 m / 16.076 ft
Duration: 800.0 s

U Min: 1.9 ft
U Max: 3.0 ft

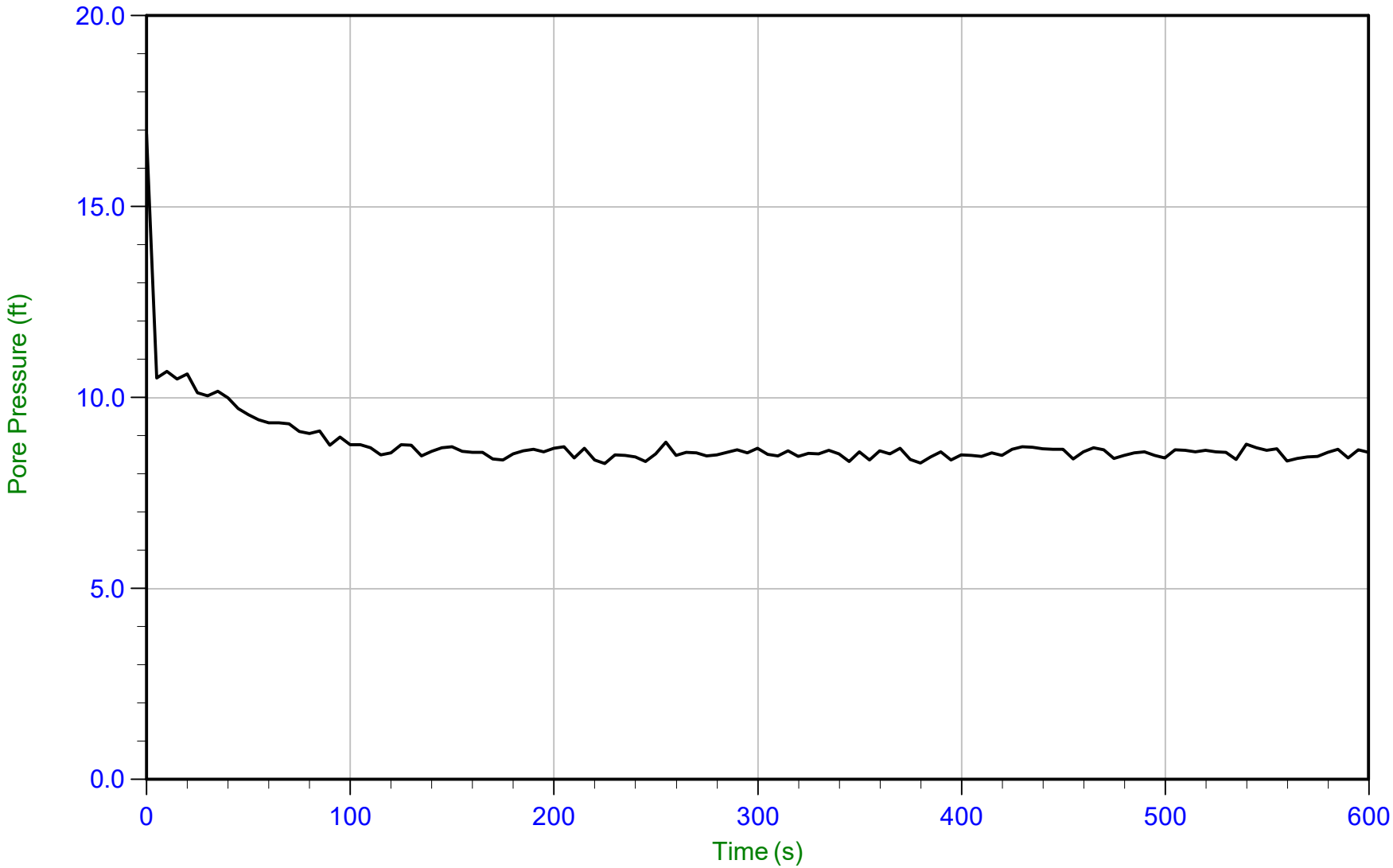
WT: 4.104 m / 13.464 ft
Ueq: 2.6 ft

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 16:08:12
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C009
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP09.PPD
Depth: 8.650 m / 28.379 ft
Duration: 600.0 s

U Min: 8.3 ft
U Max: 16.9 ft

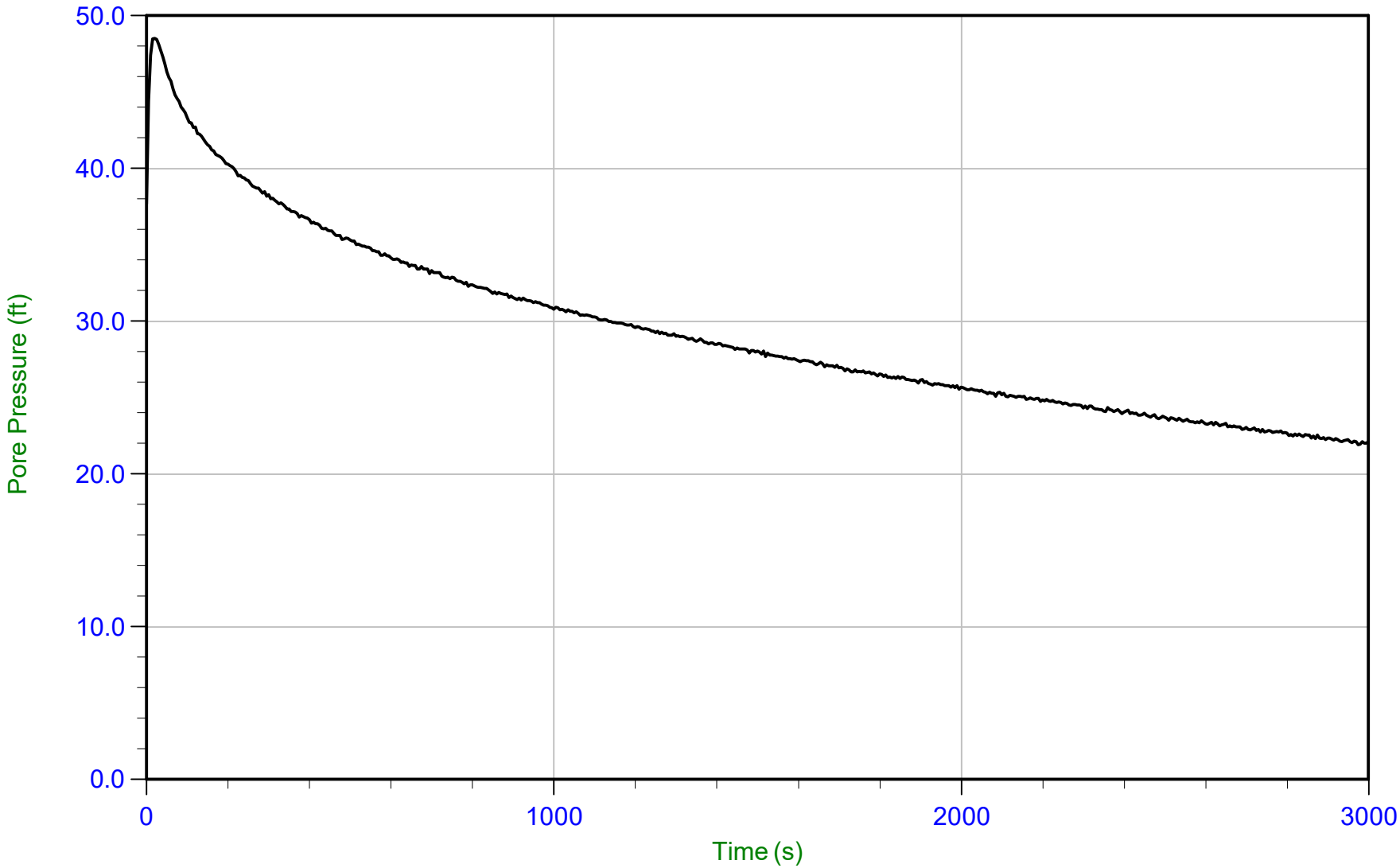
WT: 6.062 m / 19.888 ft
Ueq: 8.5 ft

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 12:10:38
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C010
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP10.PPD
Depth: 3.700 m / 12.139 ft
Duration: 3000.0 s

U Min: 21.9 ft
U Max: 48.5 ft

WT: 0.674 m / 2.211 ft
Ueq: 9.9 ft
U(50): 29.22 ft

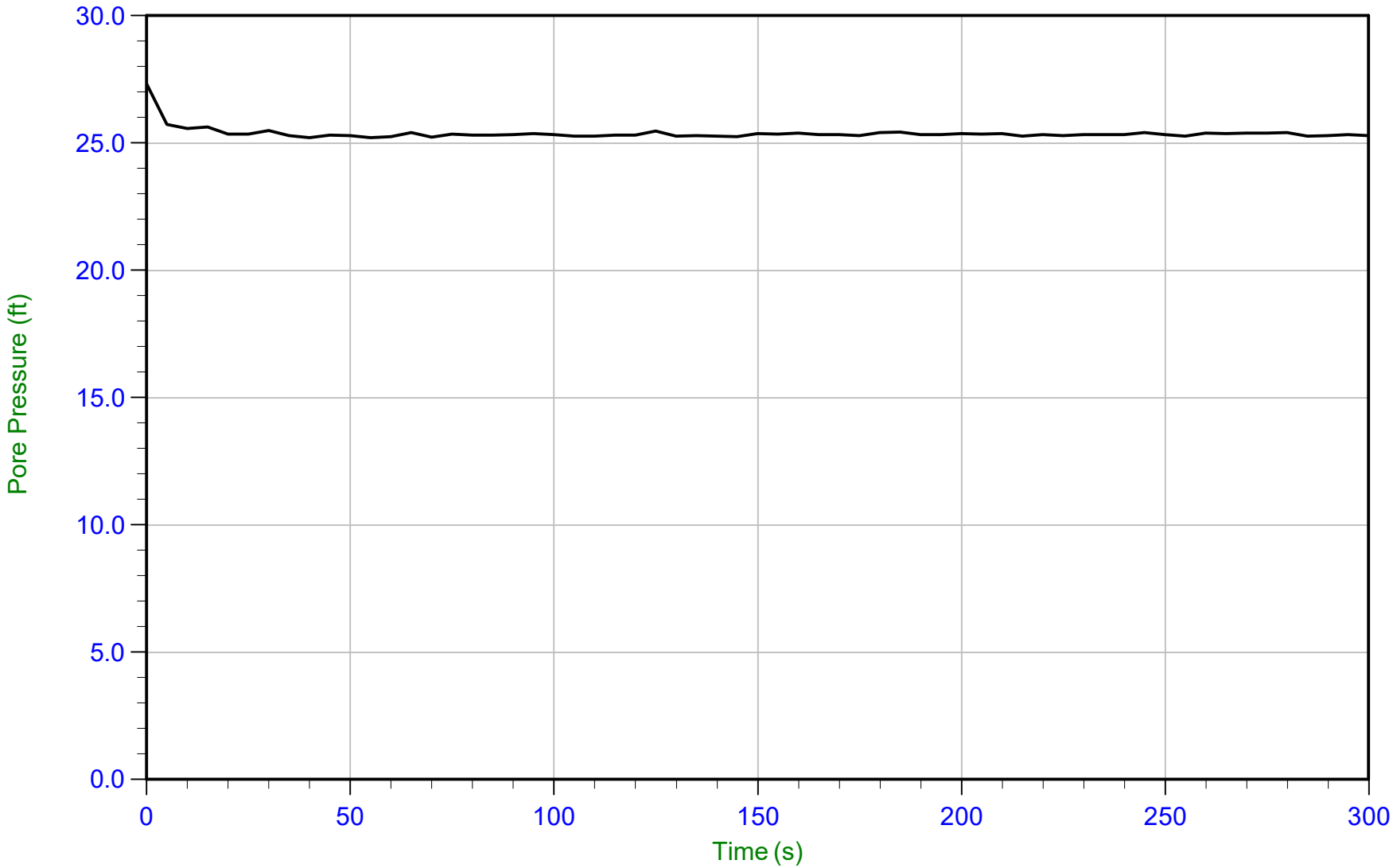
T(50): 1239.4 s
Ir: 100
Ch: 0.6 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 12:10:38
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C010
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP10.PPD
Depth: 8.400 m / 27.559 ft
Duration: 300.0 s

U Min: 25.2 ft
U Max: 27.3 ft

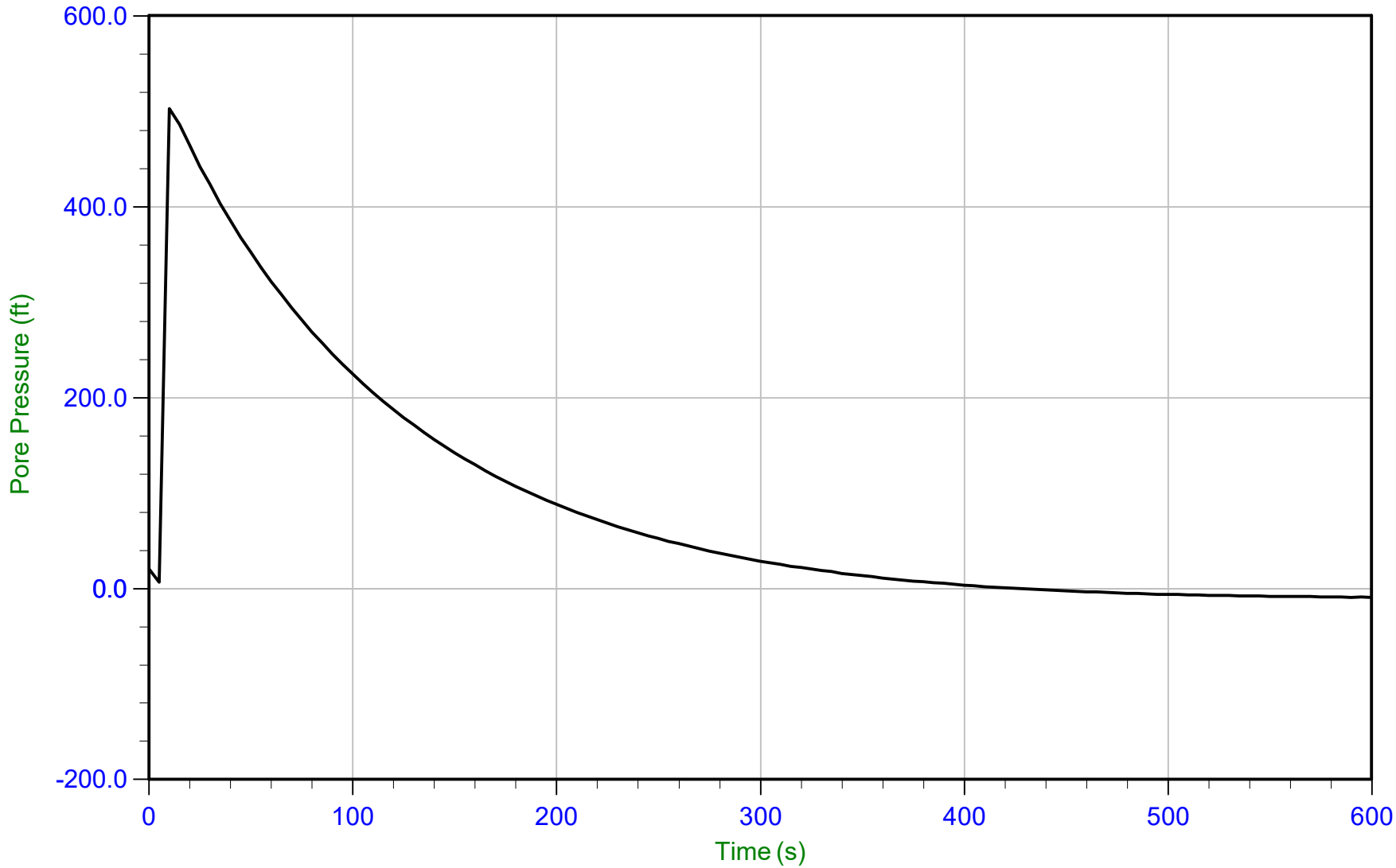
WT: 0.674 m / 2.211 ft
Ueq: 25.3 ft

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 12:10:38
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C010
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP10.PPD
Depth: 9.150 m / 30.019 ft
Duration: 600.0 s

U Min: -9.2 ft
U Max: 502.6 ft

WT: 9.150 m / 30.019 ft
Ueq: 0.0 ft
U(50): 251.28 ft

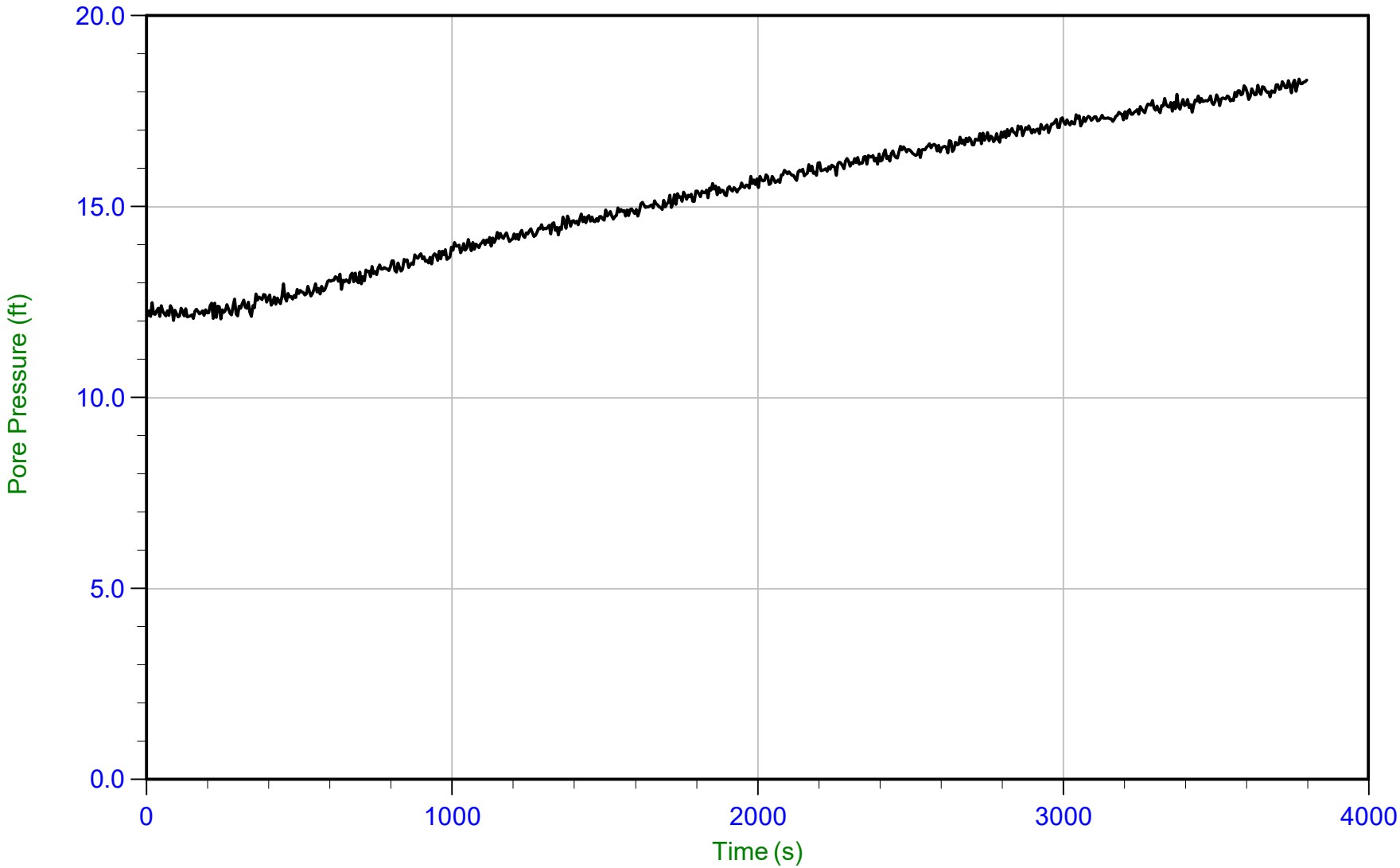
T(50): 77.5 s
Ir: 100
Ch: 9.1 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 10:19:26
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C011
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP11.PPD
Depth: 7.350 m / 24.114 ft
Duration: 3800.0 s

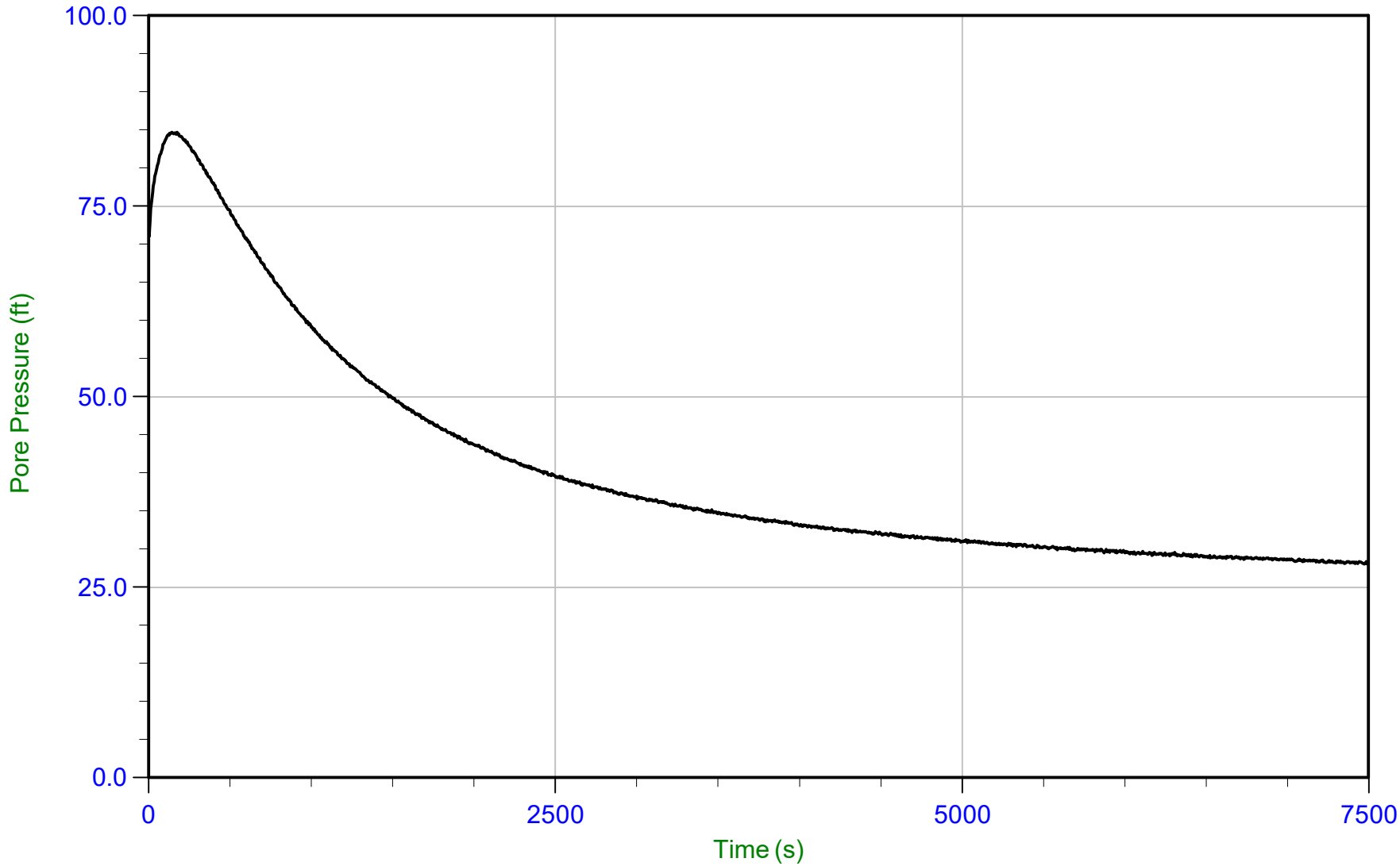
U Min: 12.0 ft
U Max: 18.3 ft

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 10:19:26
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C011
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP11.PPD
Depth: 14.150 m / 46.423 ft
Duration: 7500.0 s

U Min: 28.0 ft
U Max: 84.7 ft

WT: 6.848 m / 22.467 ft
Ueq: 24.0 ft
U(50): 54.34 ft

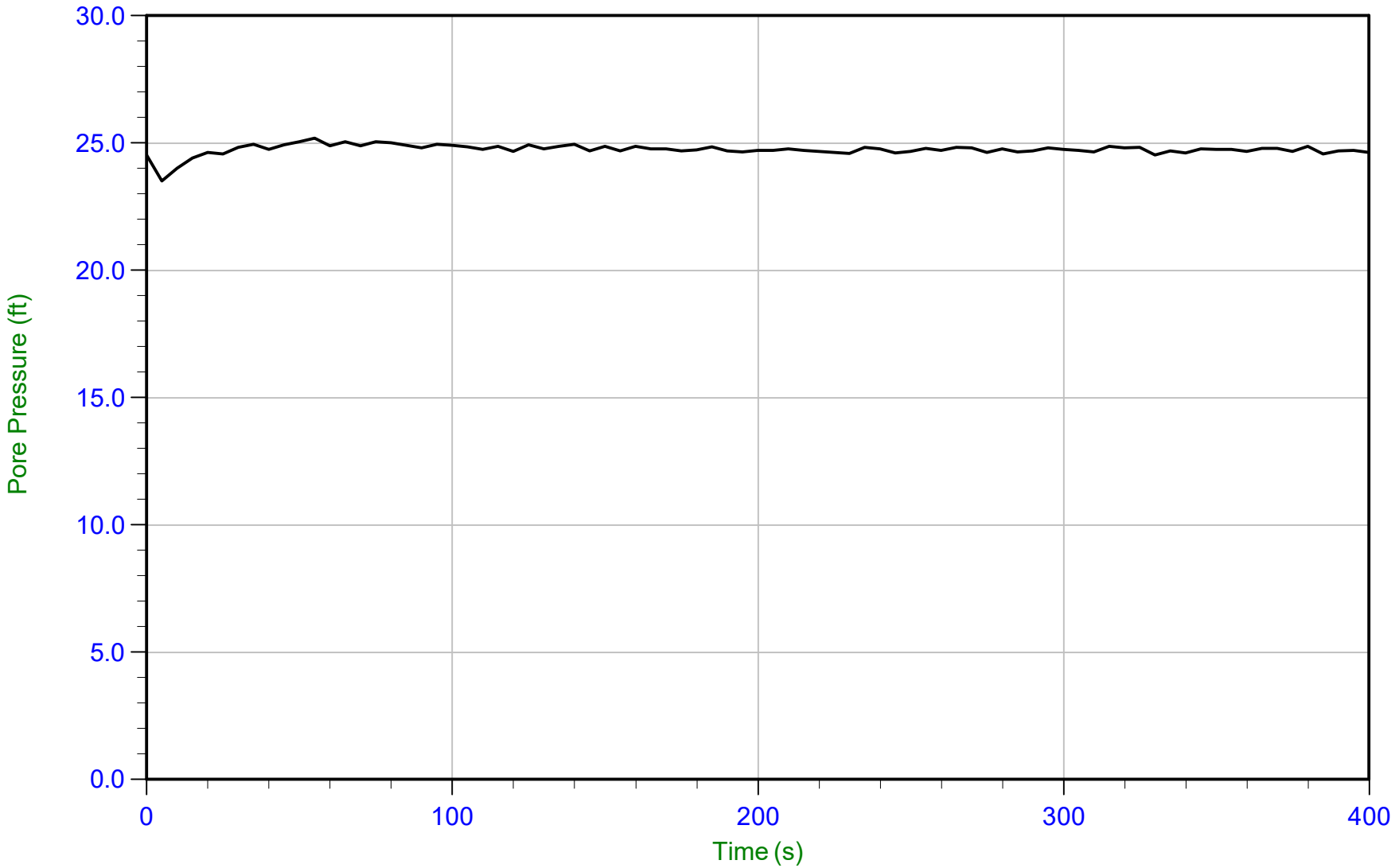
T(50): 1082.1 s
Ir: 100
Ch: 0.6 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 10:19:26
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C011
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP11.PPD
Depth: 14.350 m / 47.079 ft
Duration: 400.0 s

U Min: 23.5 ft
U Max: 25.2 ft

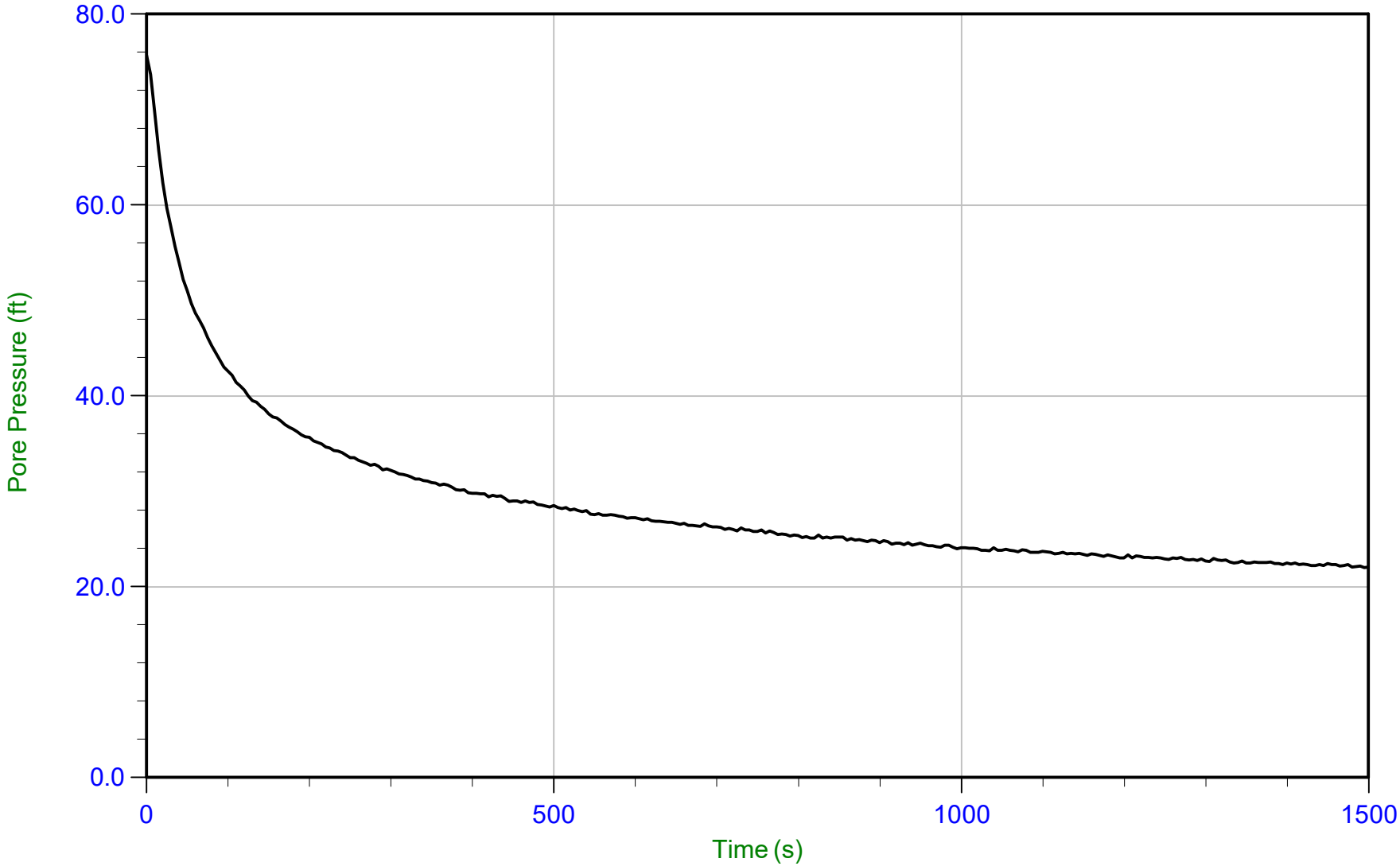
WT: 6.848 m / 22.467 ft
Ueq: 24.6 ft

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 14:27:24
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C012
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP12.PPD
Depth: 8.800 m / 28.871 ft
Duration: 1500.0 s

U Min: 22.0 ft
U Max: 75.7 ft

WT: 7.108 m / 23.320 ft
Ueq: 5.6 ft
U(50): 40.63 ft

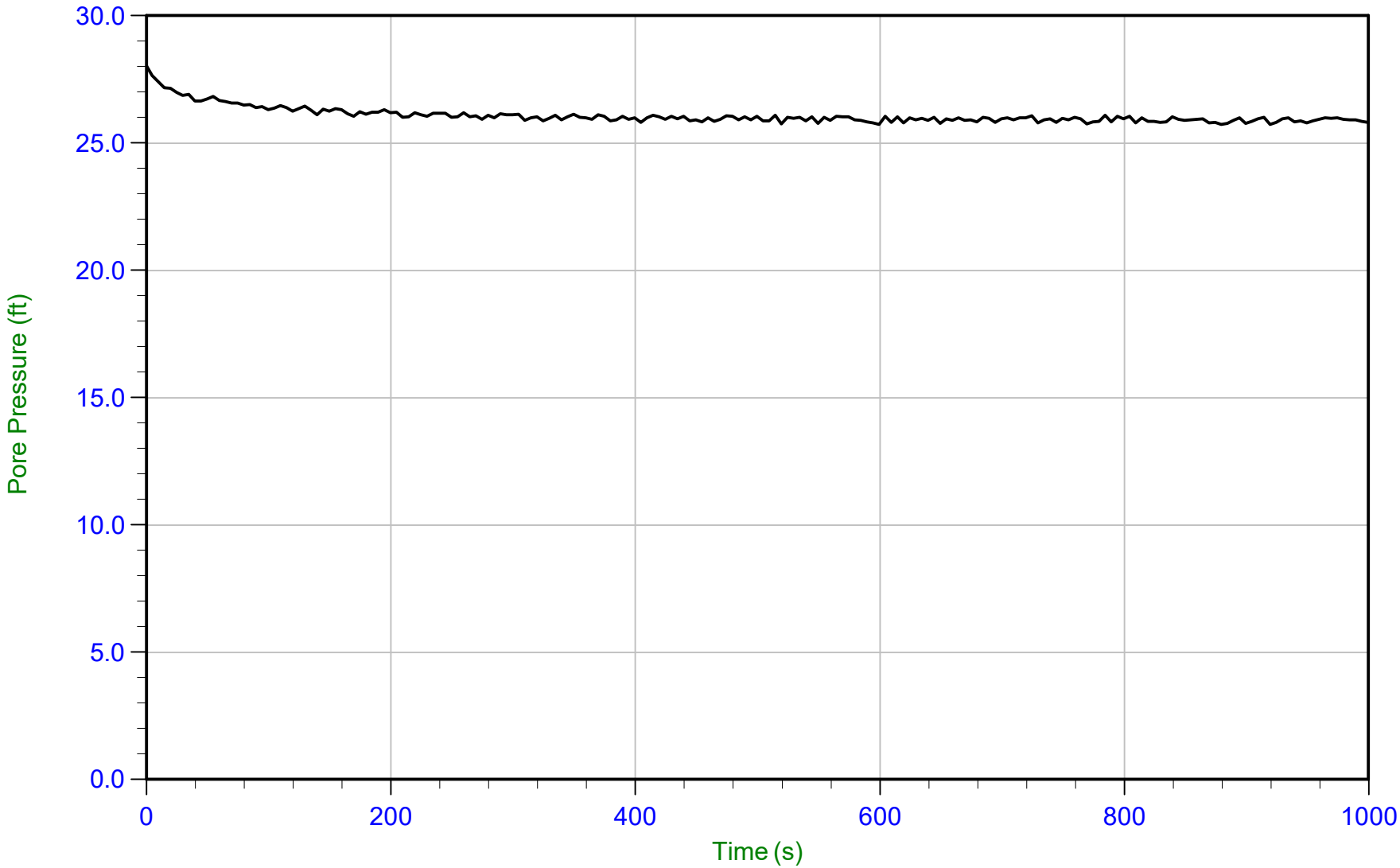
T(50): 119.8 s
Ir: 100
Ch: 5.9 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 14:27:24
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C012
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP12.PPD
Depth: 14.950 m / 49.048 ft
Duration: 1000.0 s

U Min: 25.7 ft
U Max: 28.0 ft

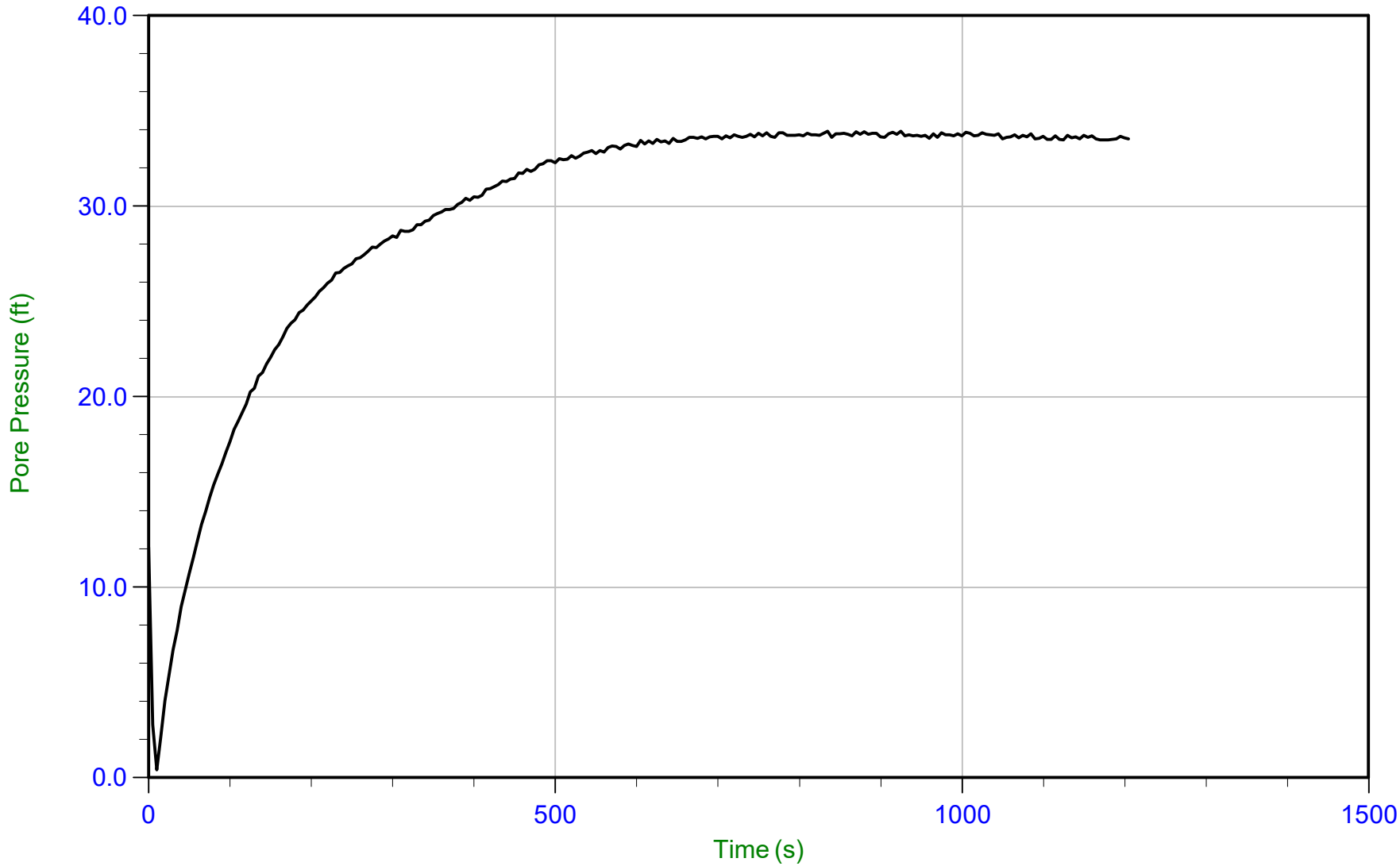
WT: 7.108 m / 23.320 ft
Ueq: 25.7 ft

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 08:45:02
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C013
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP13.PPD
Depth: 17.150 m / 56.266 ft
Duration: 1205.0 s

U Min: 0.4 ft
U Max: 33.9 ft

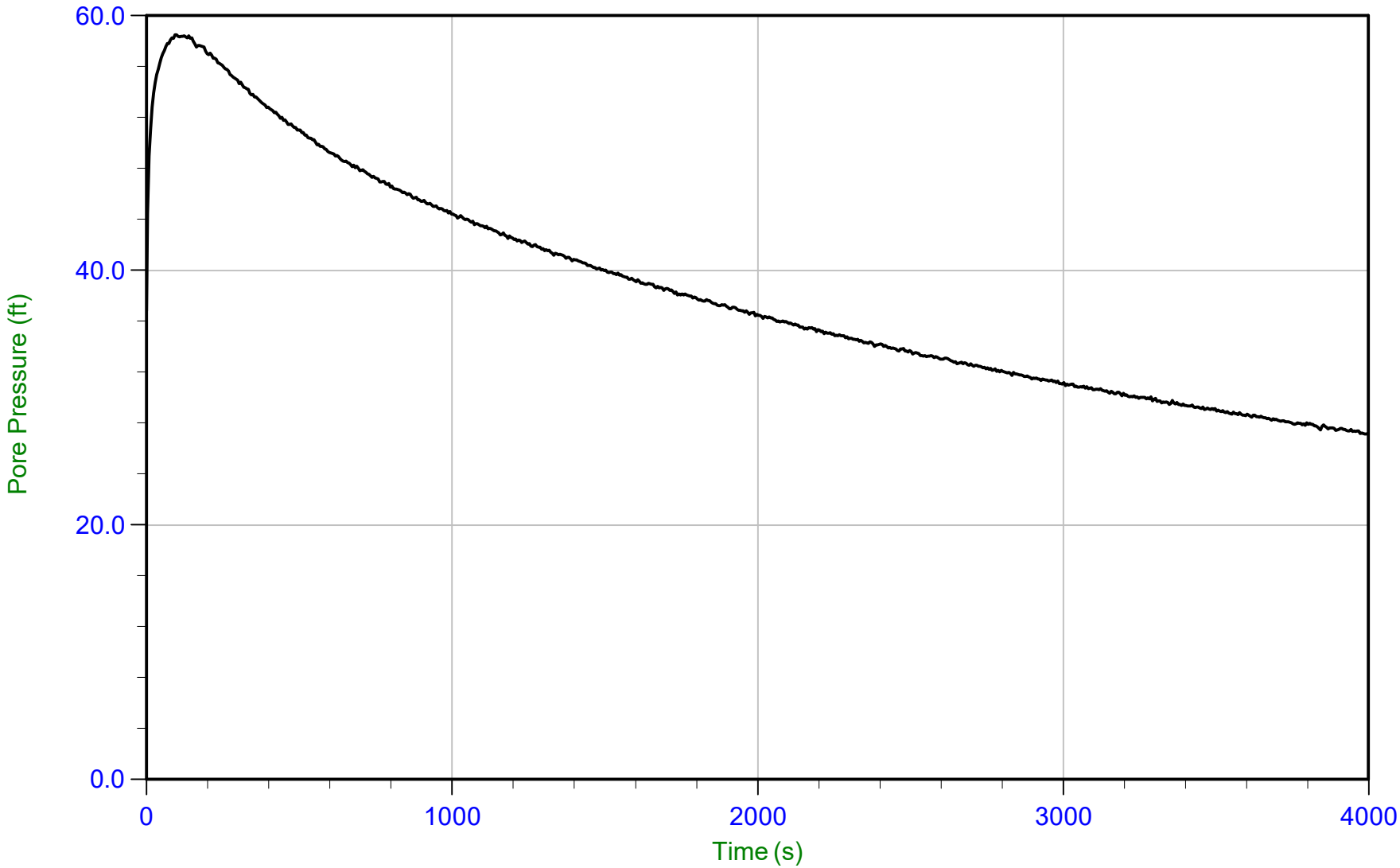
WT: 6.905 m / 22.654 ft
Ueq: 33.6 ft

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 14:29:59
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C014
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP14.PPD
Depth: 4.900 m / 16.076 ft
Duration: 4000.0 s

U Min: 27.1 ft
U Max: 58.5 ft

WT: 1.498 m / 4.915 ft
Ueq: 11.2 ft
U(50): 34.84 ft

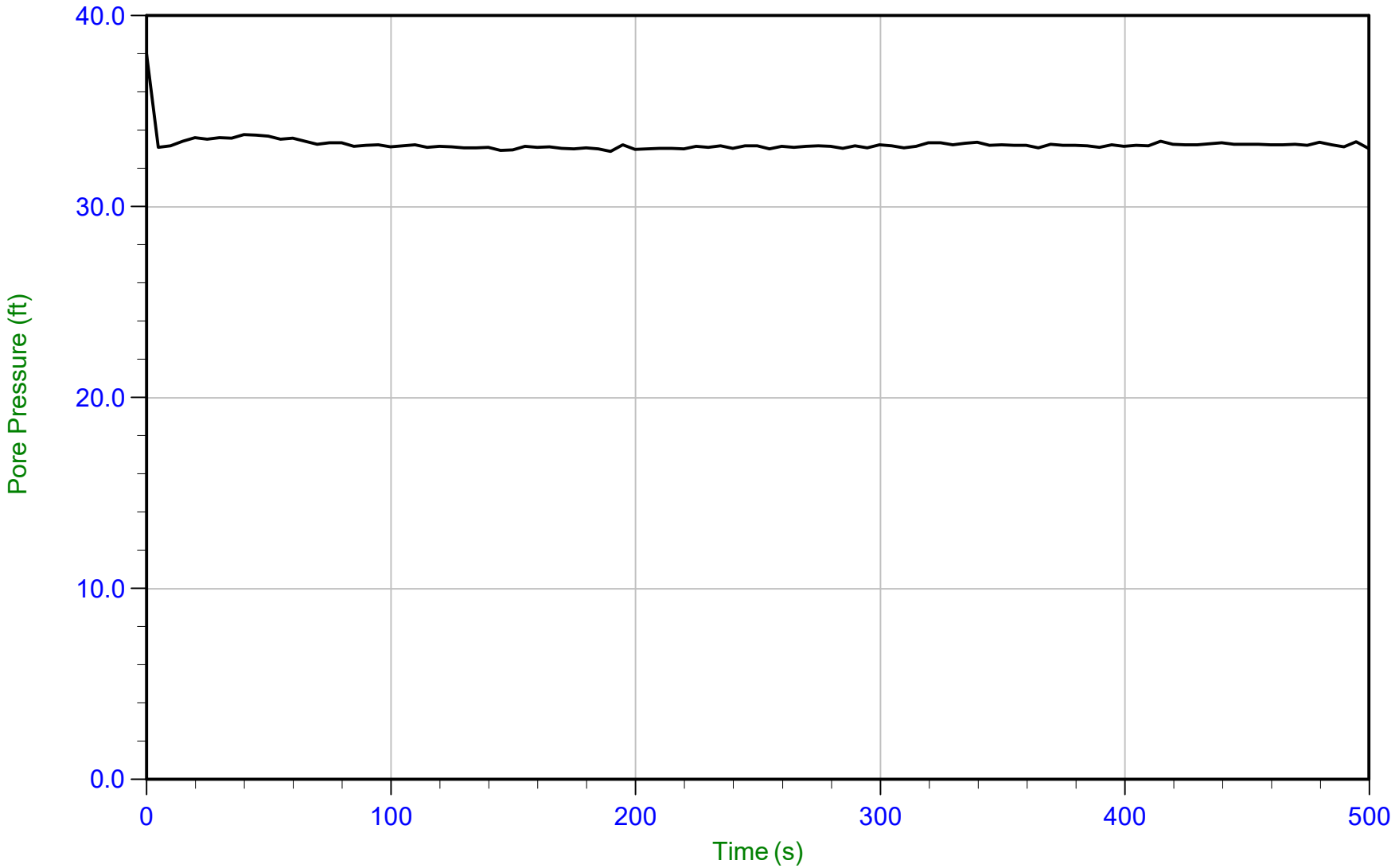
T(50): 2190.4 s
Ir: 100
Ch: 0.3 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 14:29:59
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C014
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP14.PPD
Depth: 11.650 m / 38.221 ft
Duration: 500.0 s

U Min: 32.9 ft
U Max: 38.0 ft

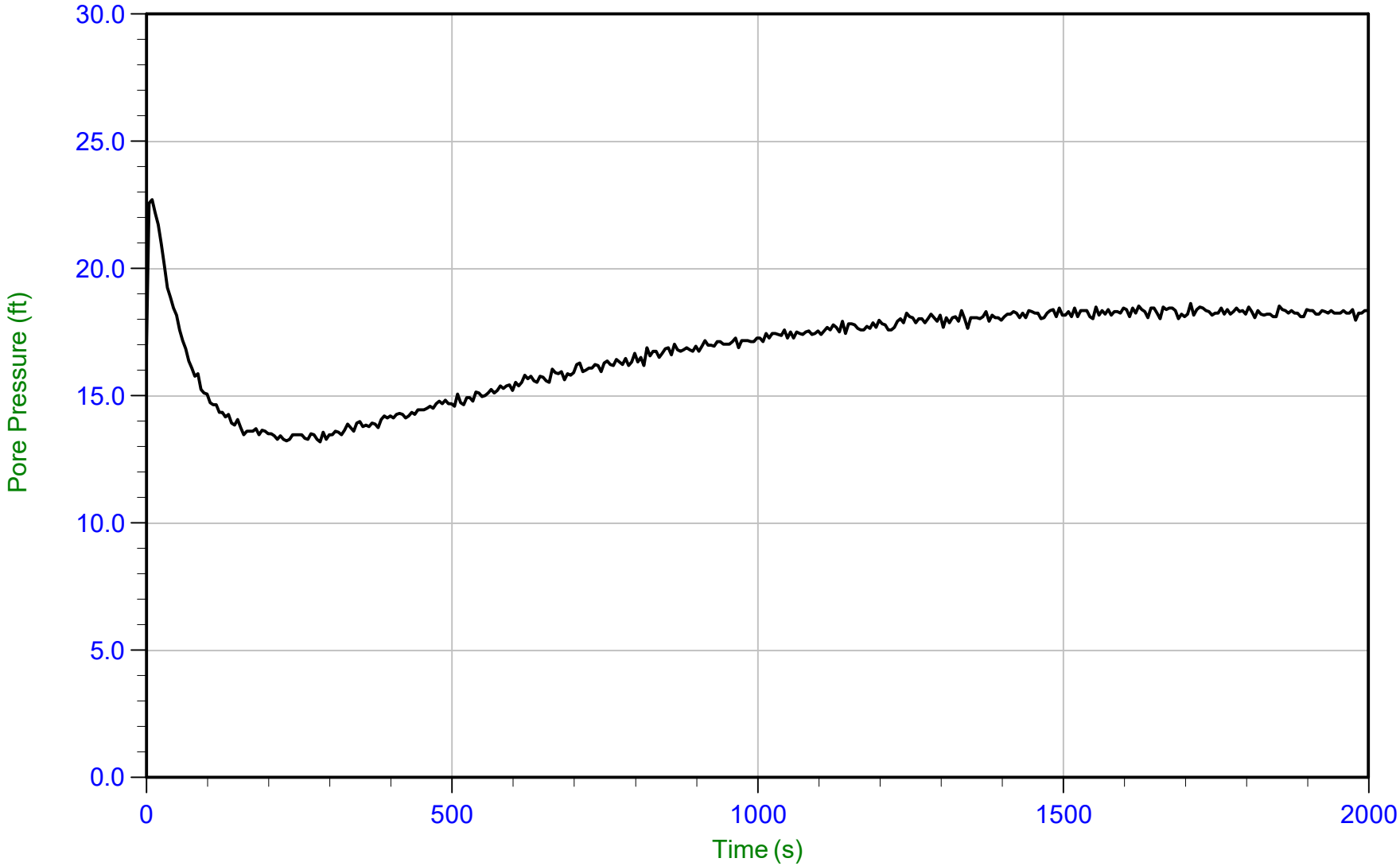
WT: 1.498 m / 4.915 ft
Ueq: 33.3 ft

CONETEC

AECOM

Job No: 15-53073
Date: 19-Aug-2015 14:12:51
Site: Edwards Power Station

Sounding: EDW-C015A
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP15A.PPD
Depth: 4.600 m / 15.092 ft
Duration: 2000.0 s

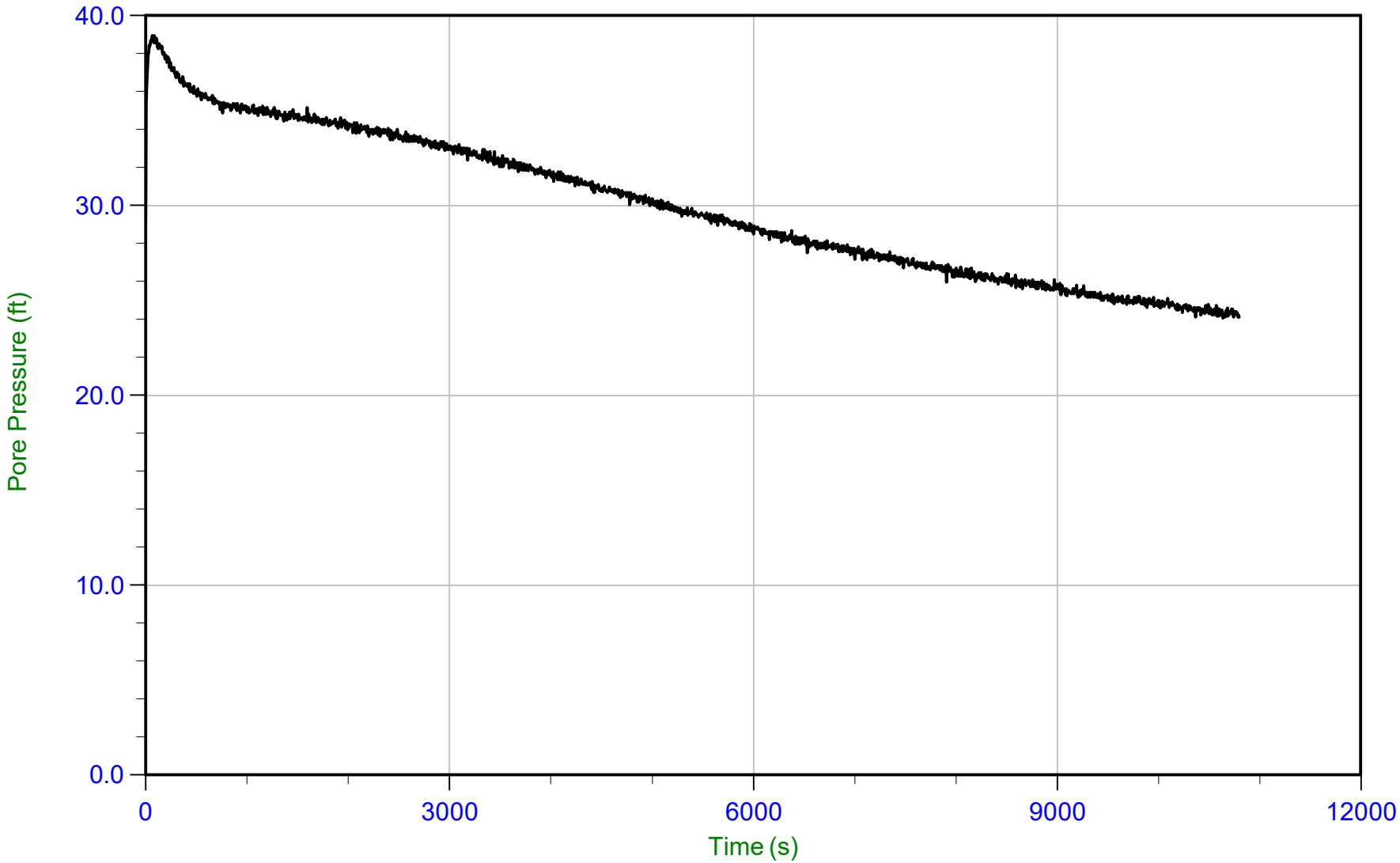
U Min: 13.2 ft
U Max: 22.7 ft

CONETEC

AECOM

Job No: 15-53073
Date: 19-Aug-2015 14:12:51
Site: Edwards Power Station

Sounding: EDW-C015A
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP15A.PPD
Depth: 9.000 m / 29.527 ft
Duration: 10800.0 s

U Min: 24.1 ft
U Max: 39.0 ft

WT: 3.658 m / 12.001 ft
Ueq: 17.5 ft
U(50): 28.24 ft

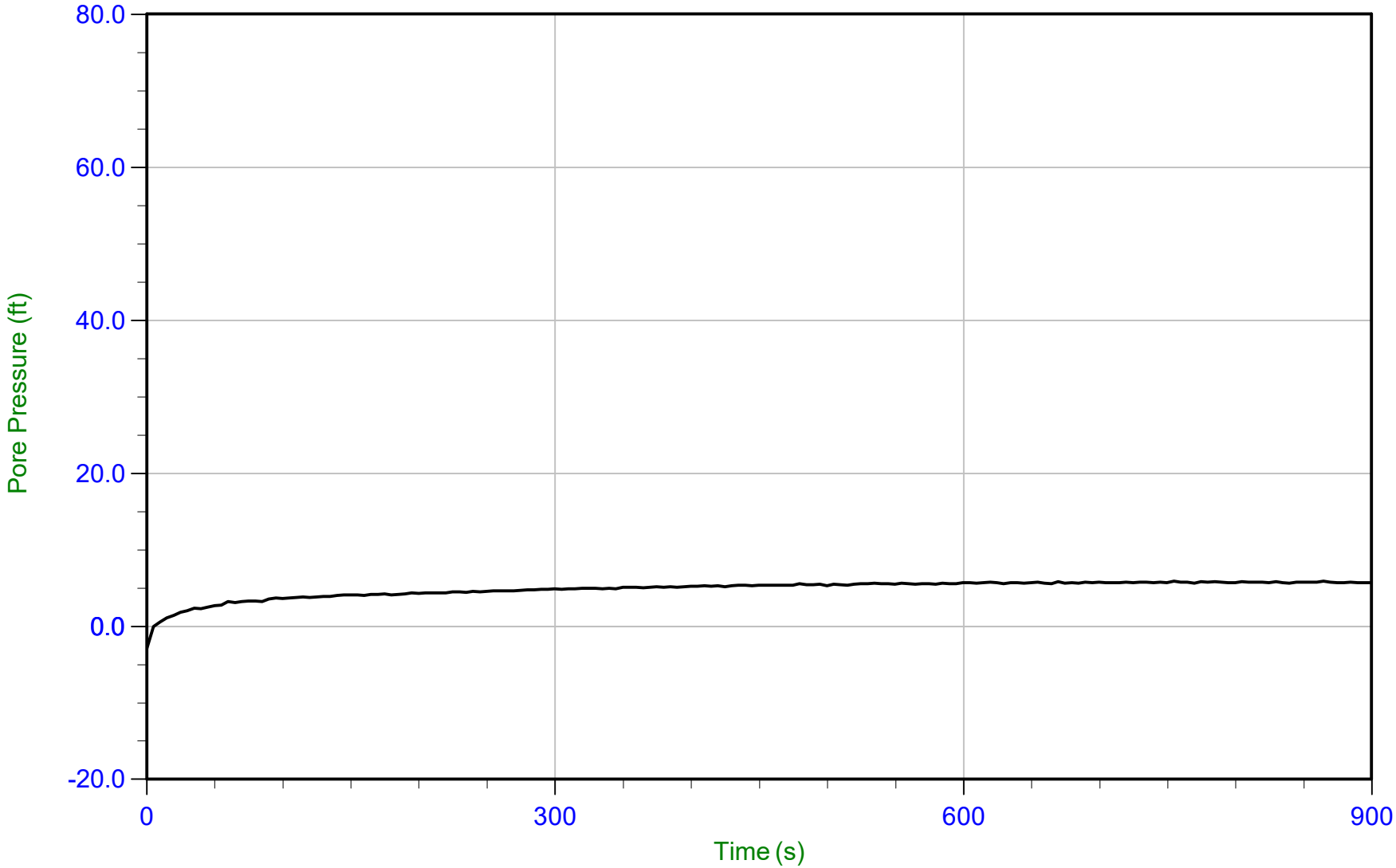
T(50): 6094.6 s
Ir: 100
Ch: 0.1 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 08:46:01
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C016
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP16.PPD
Depth: 2.250 m / 7.382 ft
Duration: 900.0 s

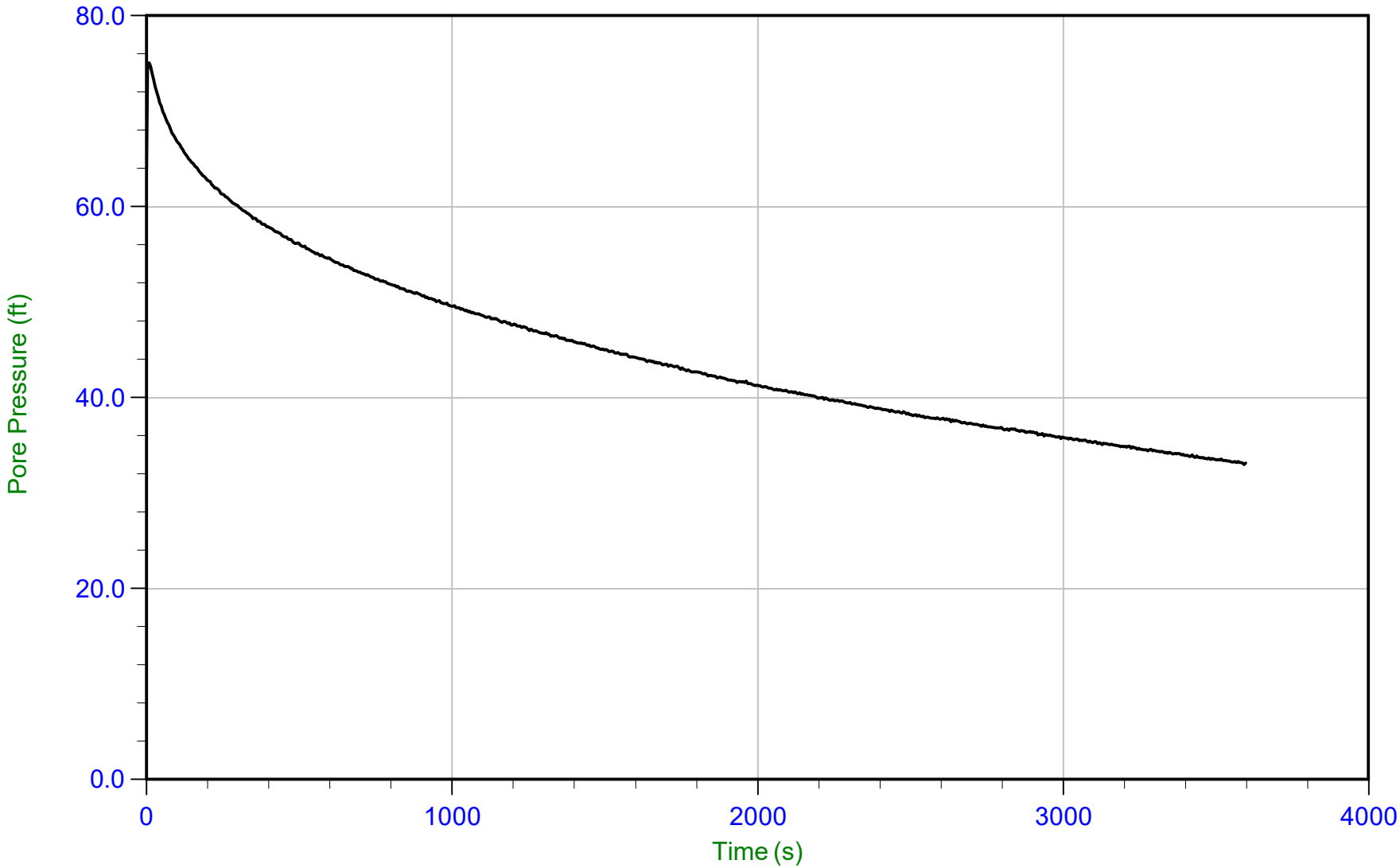
U Min: -2.9 ft
U Max: 5.9 ft

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 08:46:01
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C016
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP16.PPD
Depth: 5.500 m / 18.044 ft
Duration: 3600.0 s

U Min: 33.0 ft
U Max: 75.1 ft

WT: 1.173 m / 3.848 ft
Ueq: 14.2 ft
U(50): 44.64 ft

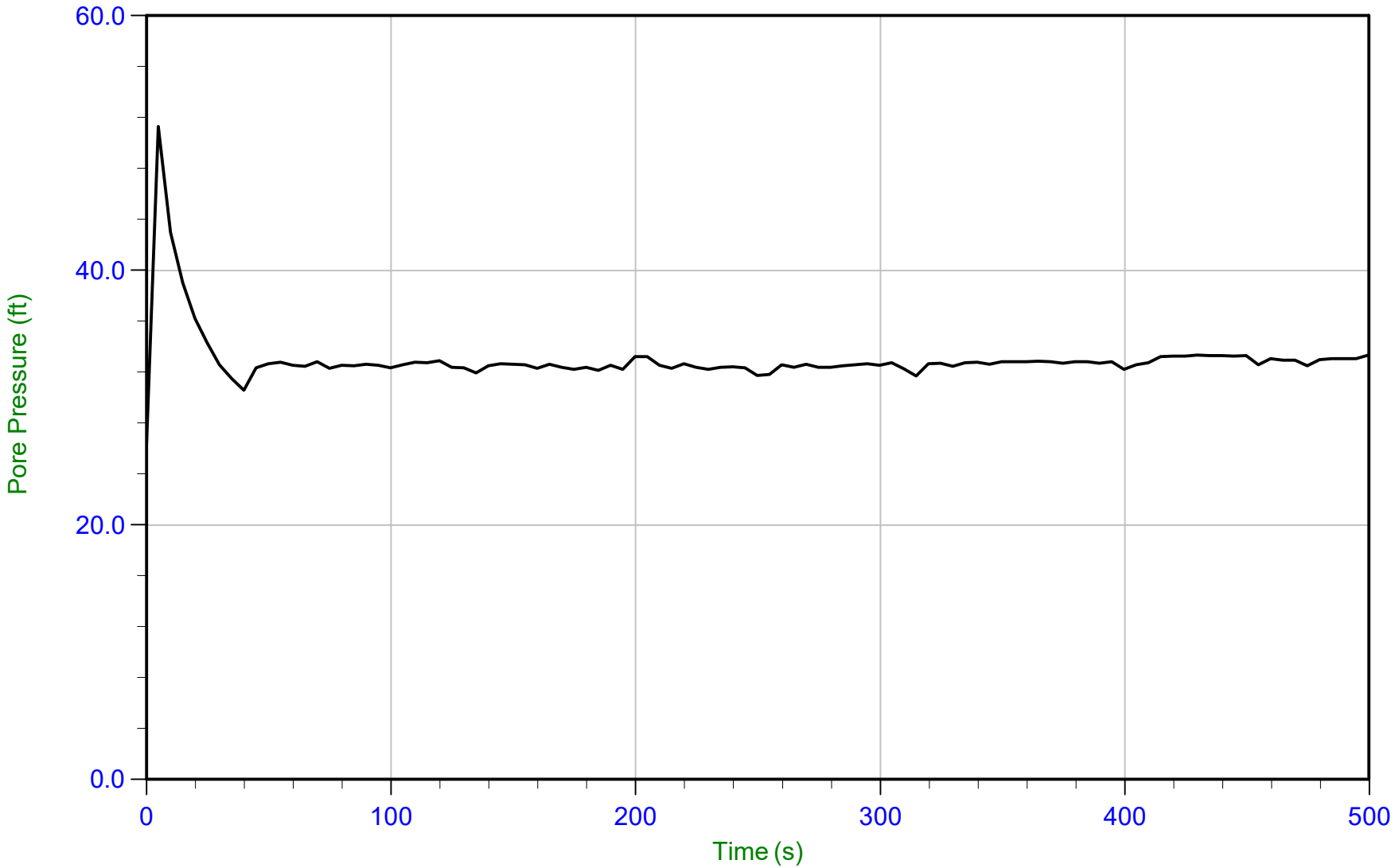
T(50): 1538.2 s
Ir: 100
Ch: 0.5 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 08:46:01
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C016
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP16.PPD
Depth: 11.250 m / 36.909 ft
Duration: 500.0 s

U Min: 26.4 ft
U Max: 51.3 ft

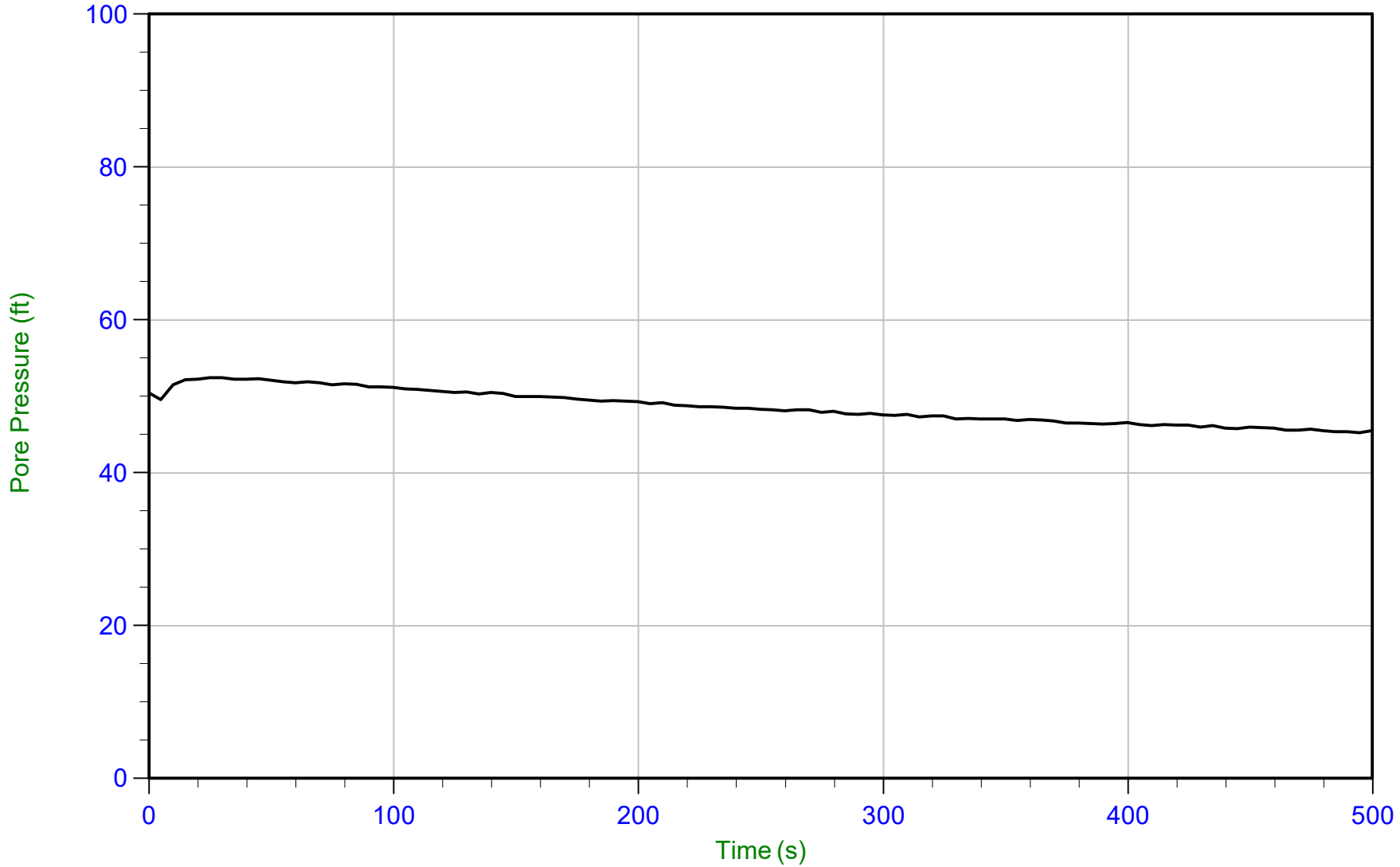
WT: 1.173 m / 3.848 ft
Ueq: 33.1 ft

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 11:13:32
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C017
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP17.PPD
Depth: 8.500 m / 27.887 ft
Duration: 500.0 s

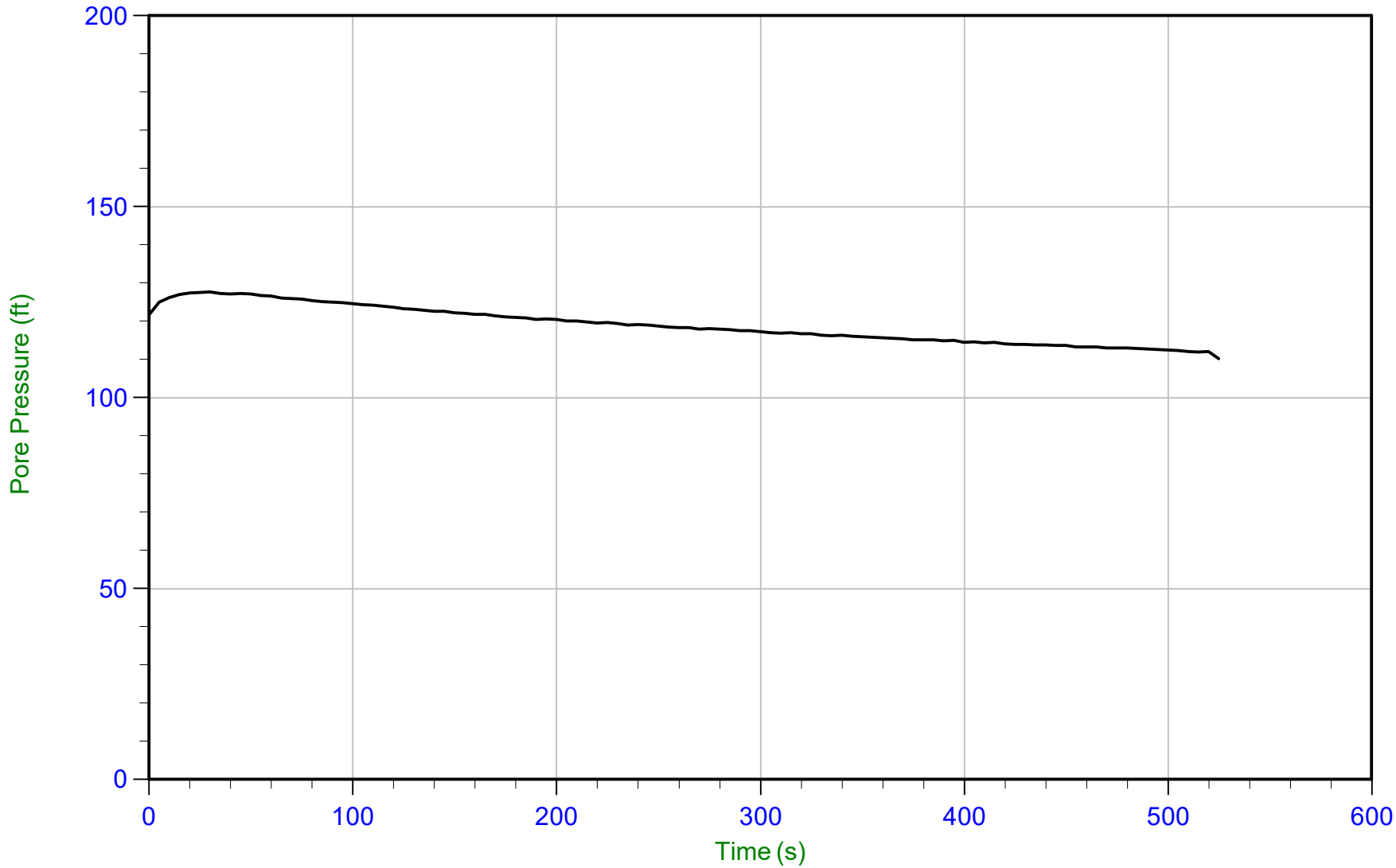
U Min: 45.3 ft
U Max: 52.5 ft

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 11:13:32
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C017
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP17.PPD
Depth: 12.350 m / 40.518 ft
Duration: 525.0 s

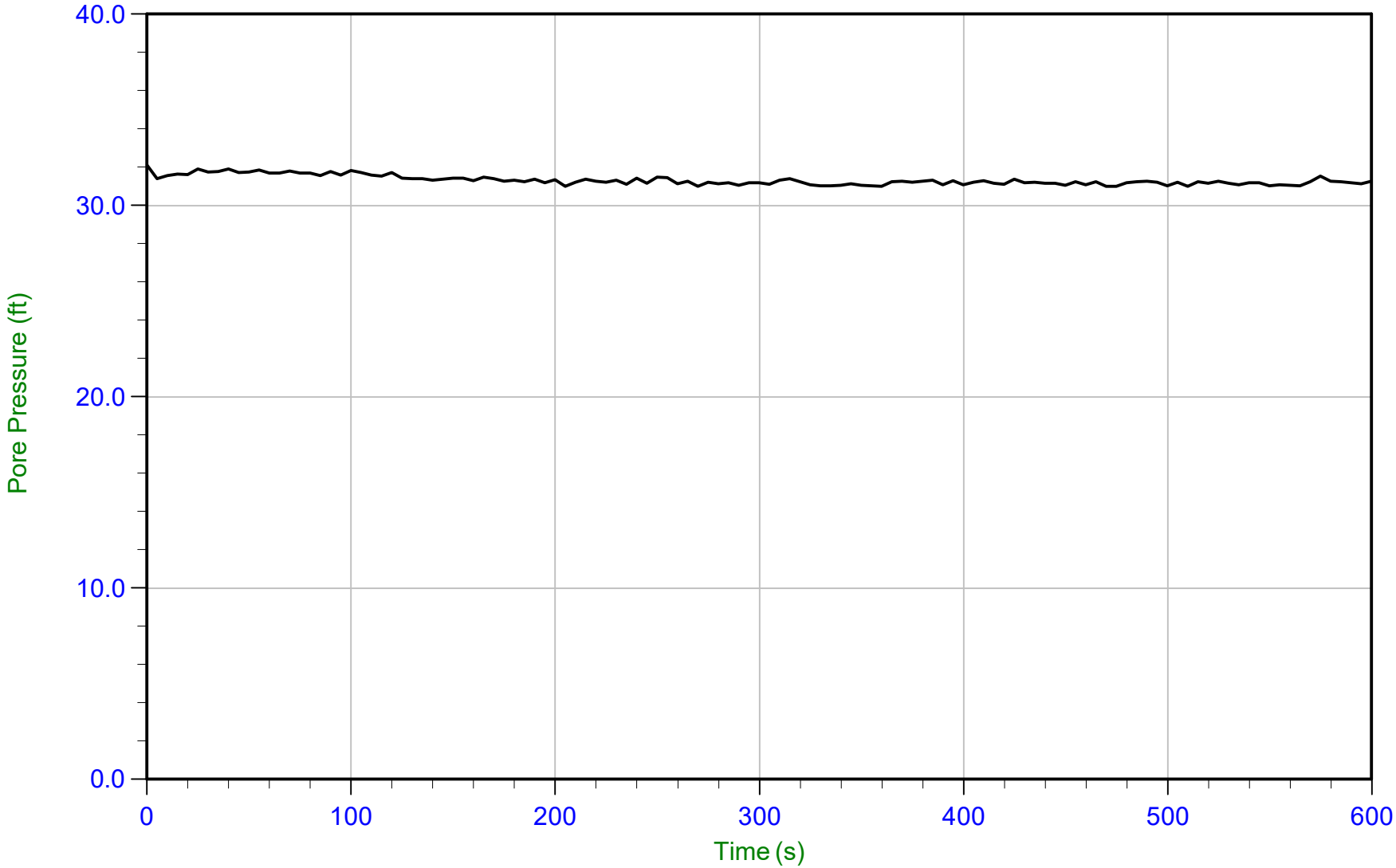
U Min: 110.3 ft
U Max: 127.7 ft

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 11:13:32
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C017
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP17.PPD
Depth: 16.850 m / 55.281 ft
Duration: 600.0 s

U Min: 31.0 ft
U Max: 32.1 ft

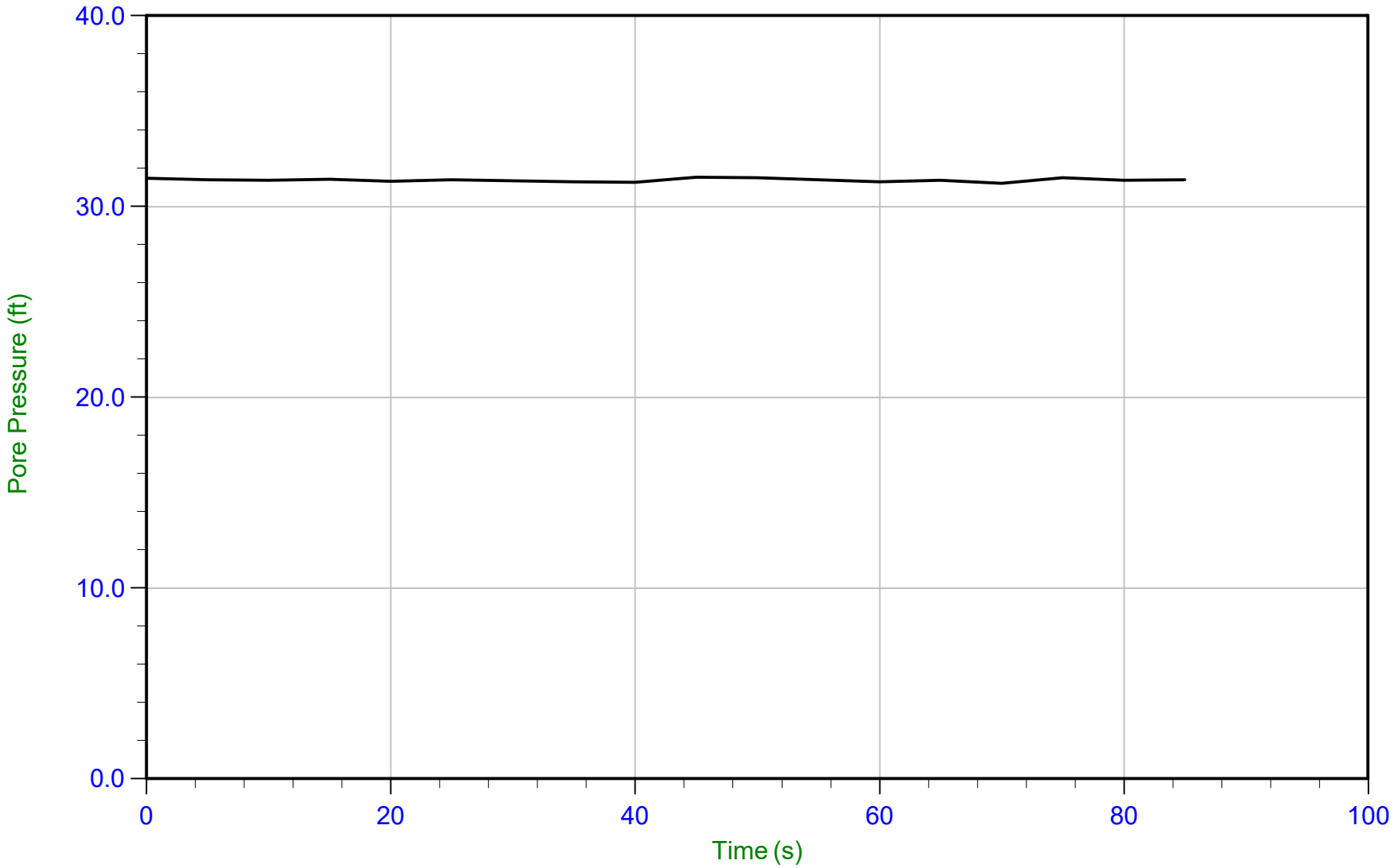
WT: 7.367 m / 24.170 ft
Ueq: 31.1 ft

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 11:13:32
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C017
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP17.PPD
Depth: 17.050 m / 55.938 ft
Duration: 85.0 s

U Min: 31.2 ft
U Max: 31.5 ft

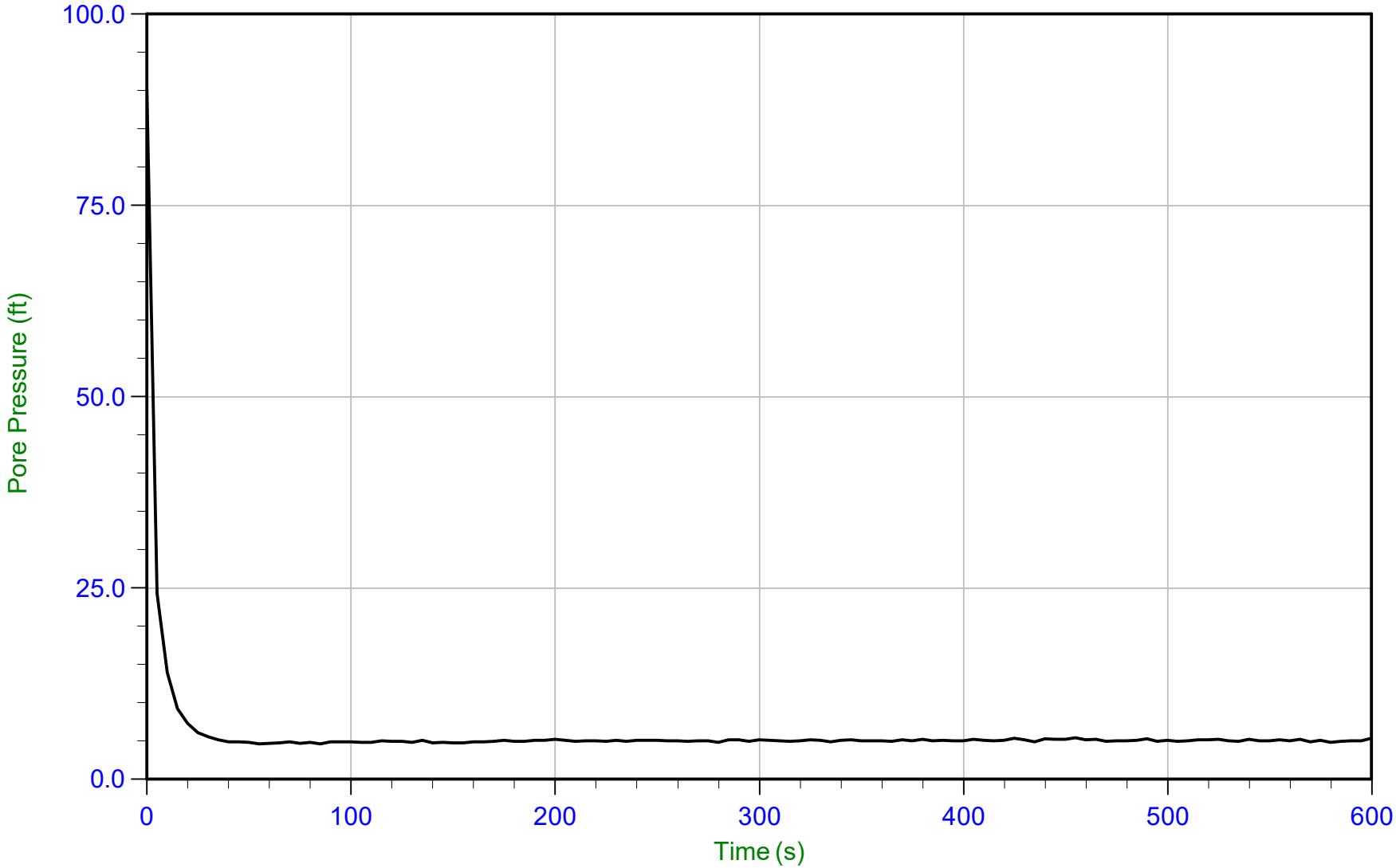
WT: 7.525 m / 24.688 ft
Ueq: 31.2 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 11:13:53
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C019
Cone: AD419
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP19.PPD
Depth: 3.600 m / 11.811 ft
Duration: 600.0 s

U Min: 4.7 ft
U Max: 90.3 ft

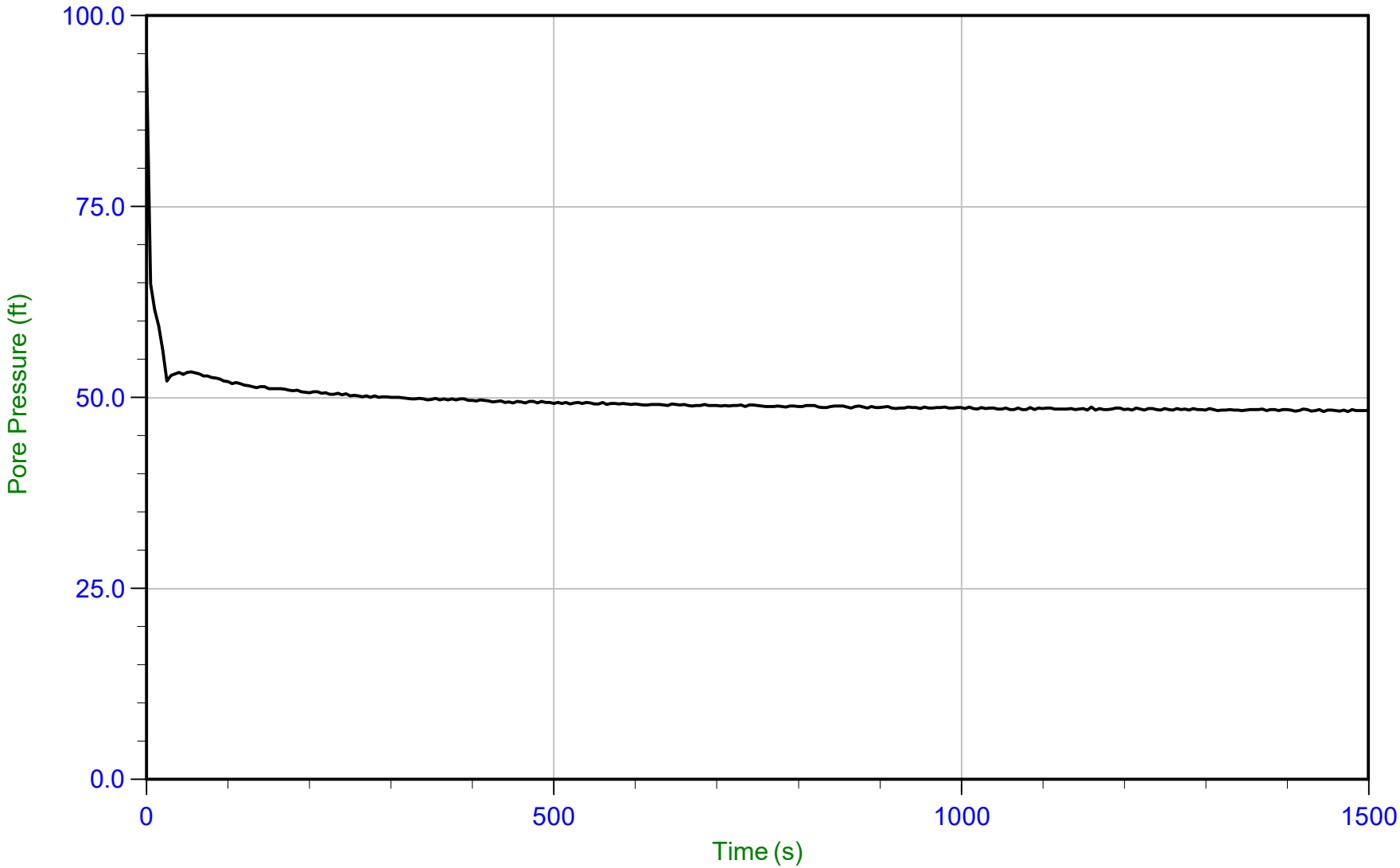
WT: 1.983 m / 6.506 ft
Ueq: 5.3 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 11:13:53
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C019
Cone: AD419
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP19.PPD
Depth: 16.300 m / 53.477 ft
Duration: 1500.0 s

U Min: 48.2 ft
U Max: 94.2 ft

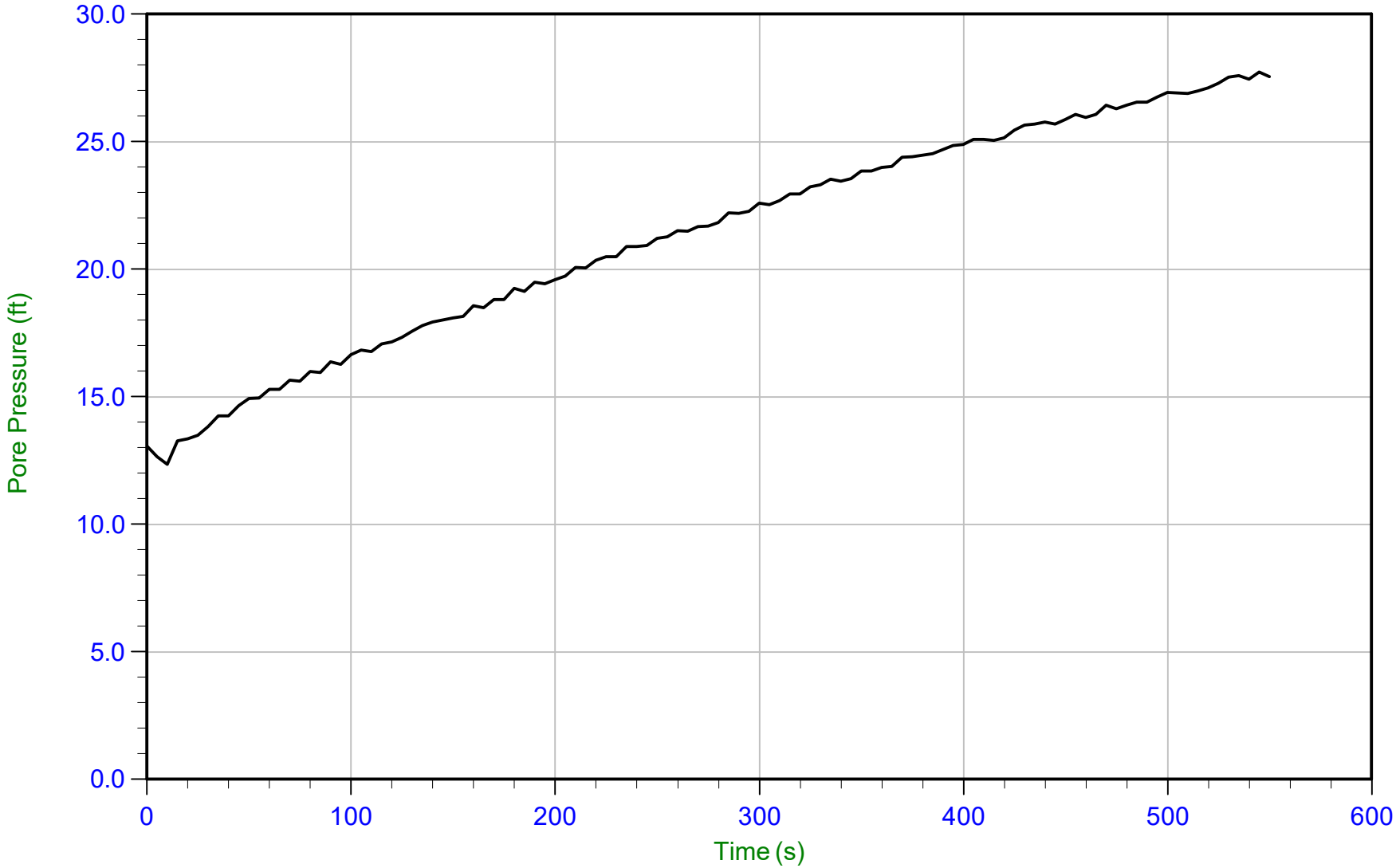
WT: 1.620 m / 5.315 ft
Ueq: 48.2 ft

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 10:21:35
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C021
Cone: AD419
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP21.PPD
Depth: 4.250 m / 13.943 ft
Duration: 550.0 s

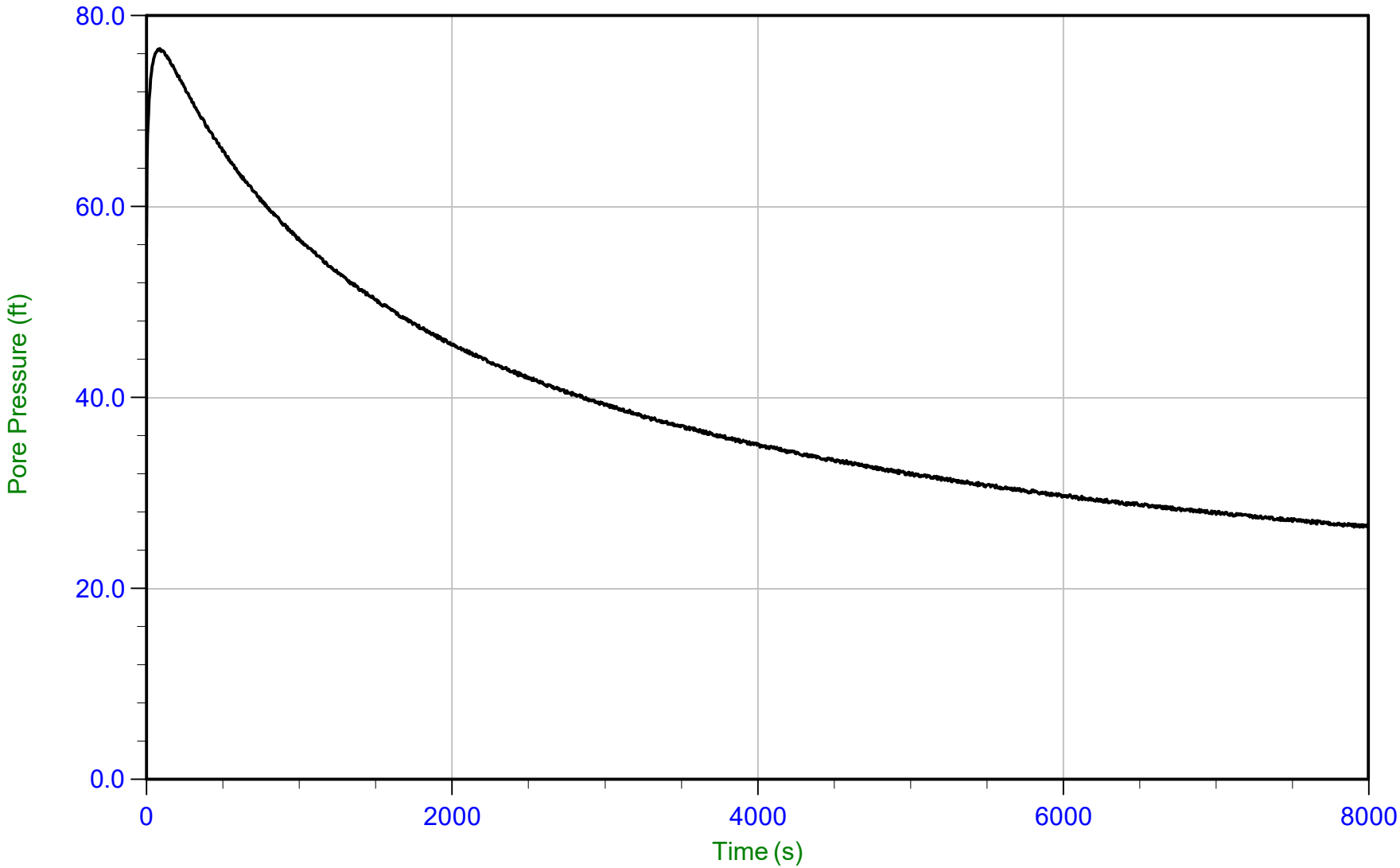
U Min: 12.4 ft
U Max: 27.7 ft

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 10:21:35
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C021
Cone: AD419
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP21.PPD
Depth: 7.150 m / 23.458 ft
Duration: 8000.0 s

U Min: 26.4 ft
U Max: 76.5 ft

WT: 3.962 m / 13.000 ft
Ueq: 10.5 ft
U(50): 43.50 ft

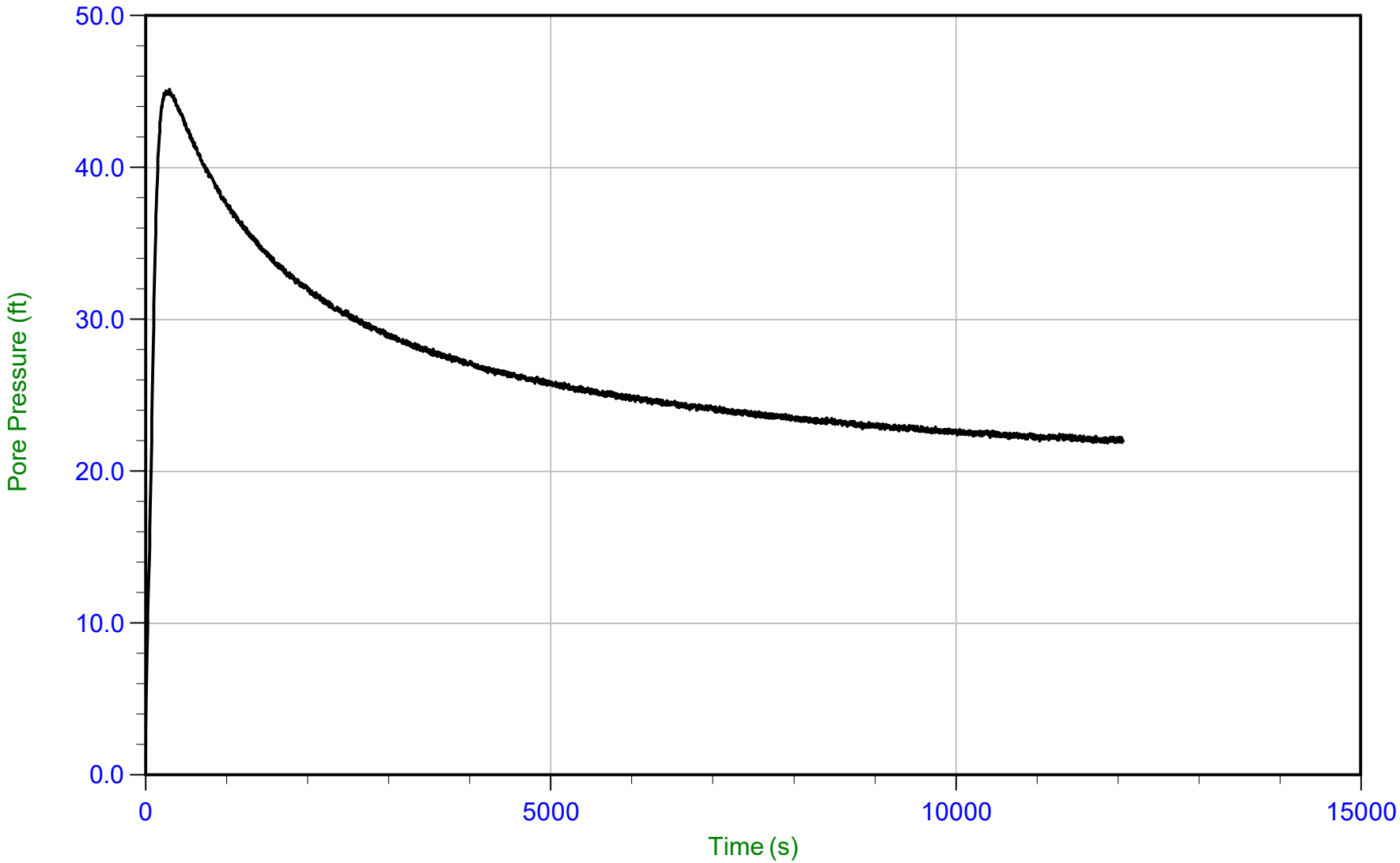
T(50): 2190.1 s
Ir: 100
Ch: 0.3 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 10:21:35
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C021
Cone: AD419
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP21.PPD
Depth: 10.250 m / 33.628 ft
Duration: 12070.0 s

U Min: 2.0 ft
U Max: 45.1 ft

WT: 3.962 m / 13.000 ft
Ueq: 20.6 ft
U(50): 32.88 ft

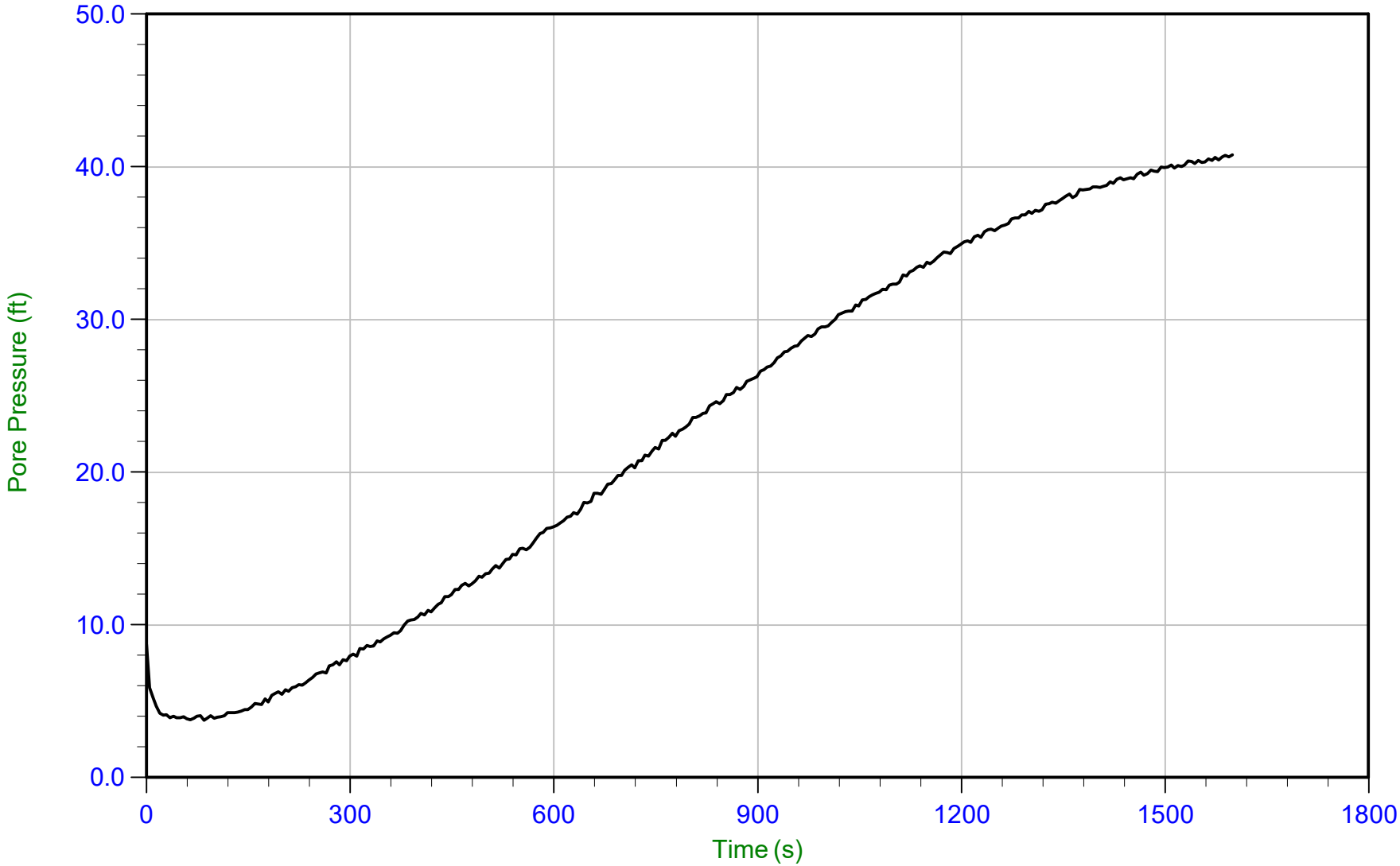
T(50): 1449.3 s
Ir: 100
Ch: 0.5 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 10:21:35
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C021
Cone: AD419
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP21.PPD
Depth: 14.750 m / 48.392 ft
Duration: 1600.0 s

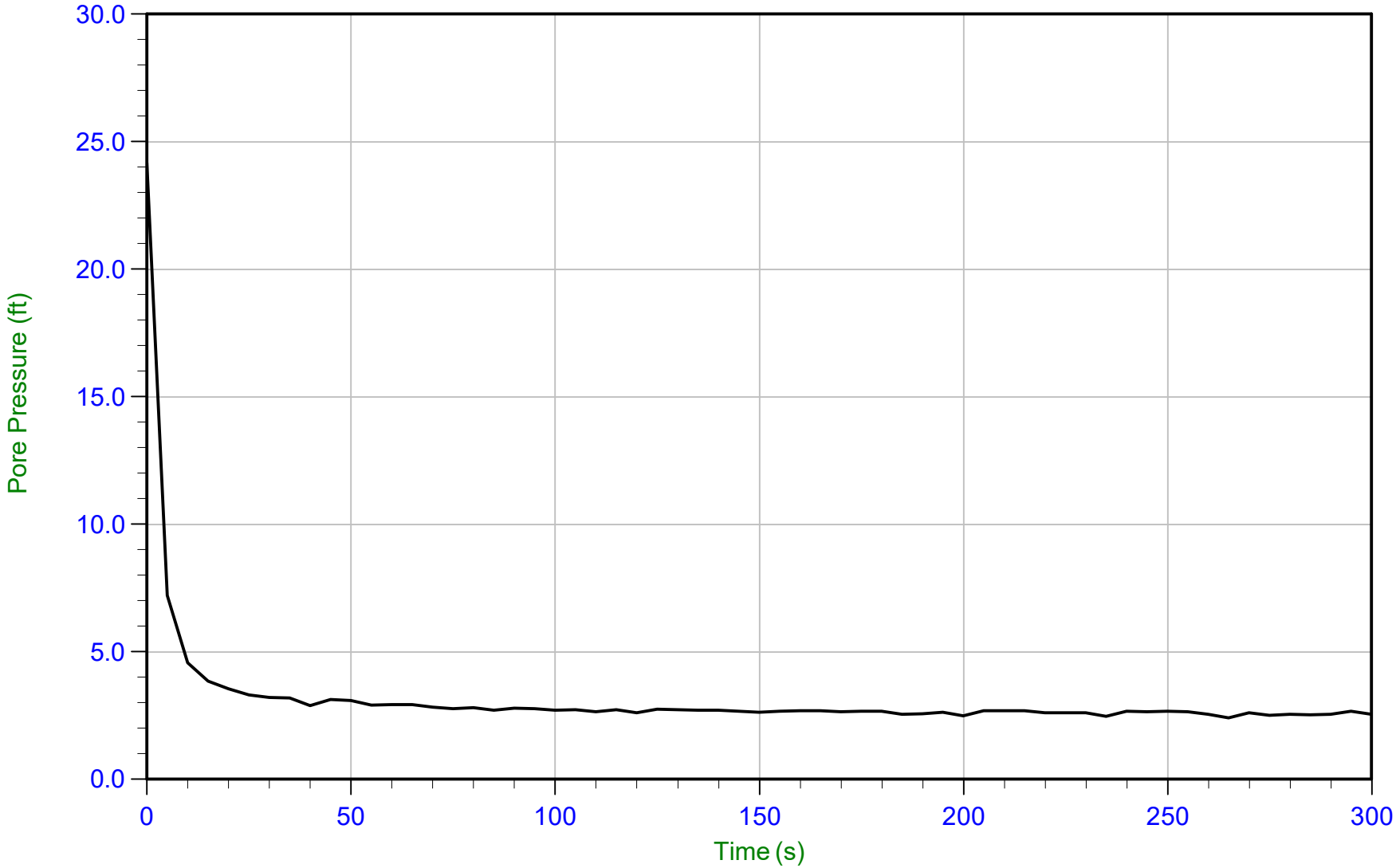
U Min: 3.8 ft
U Max: 40.8 ft

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 10:35:11
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C022
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP22.PPD
Depth: 2.600 m / 8.530 ft
Duration: 300.0 s

U Min: 2.4 ft
U Max: 24.2 ft

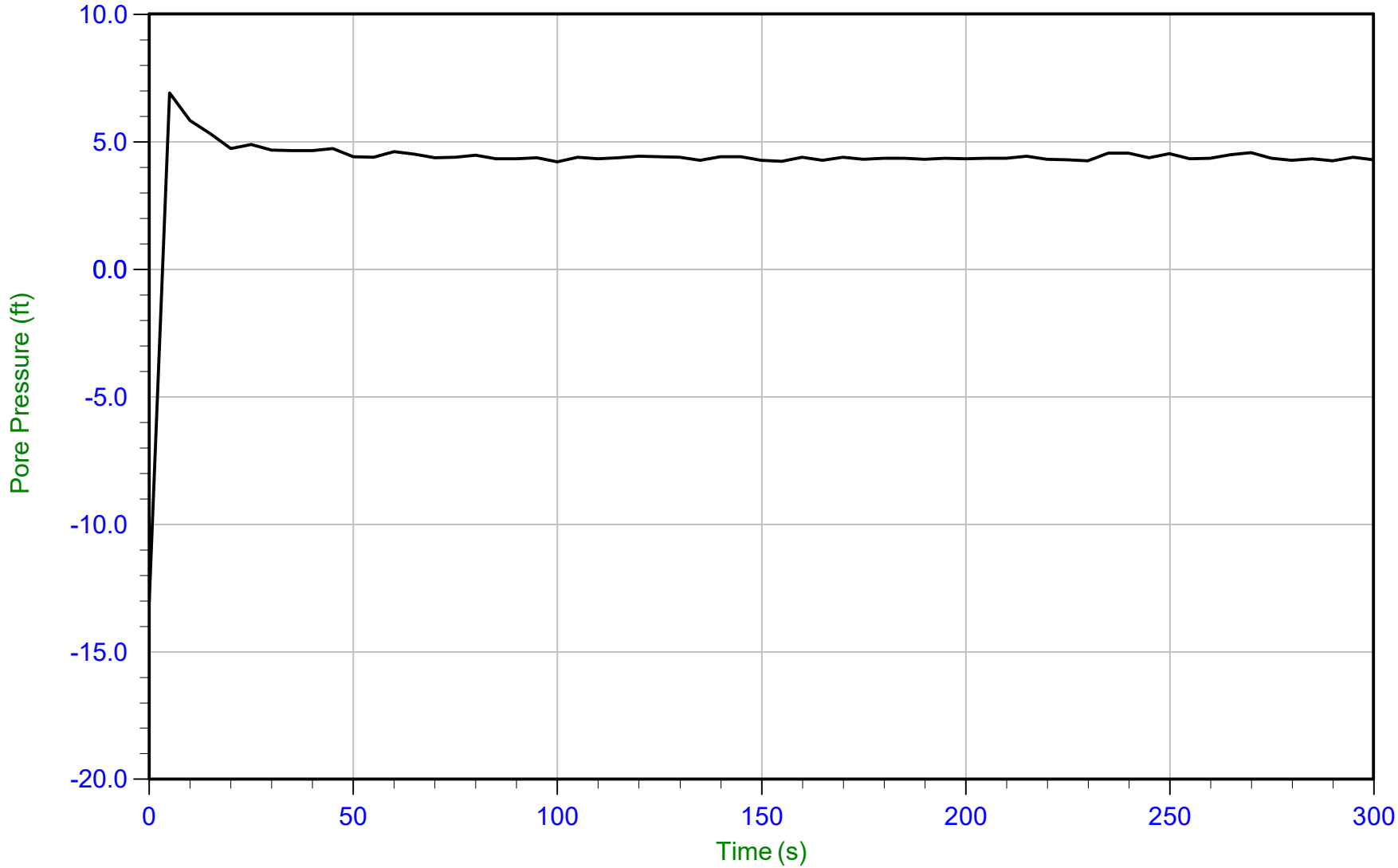
WT: 1.870 m / 6.135 ft
Ueq: 2.4 ft

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 10:35:11
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C022
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP22.PPD
Depth: 3.350 m / 10.991 ft
Duration: 300.0 s

U Min: -13.1 ft
U Max: 6.9 ft

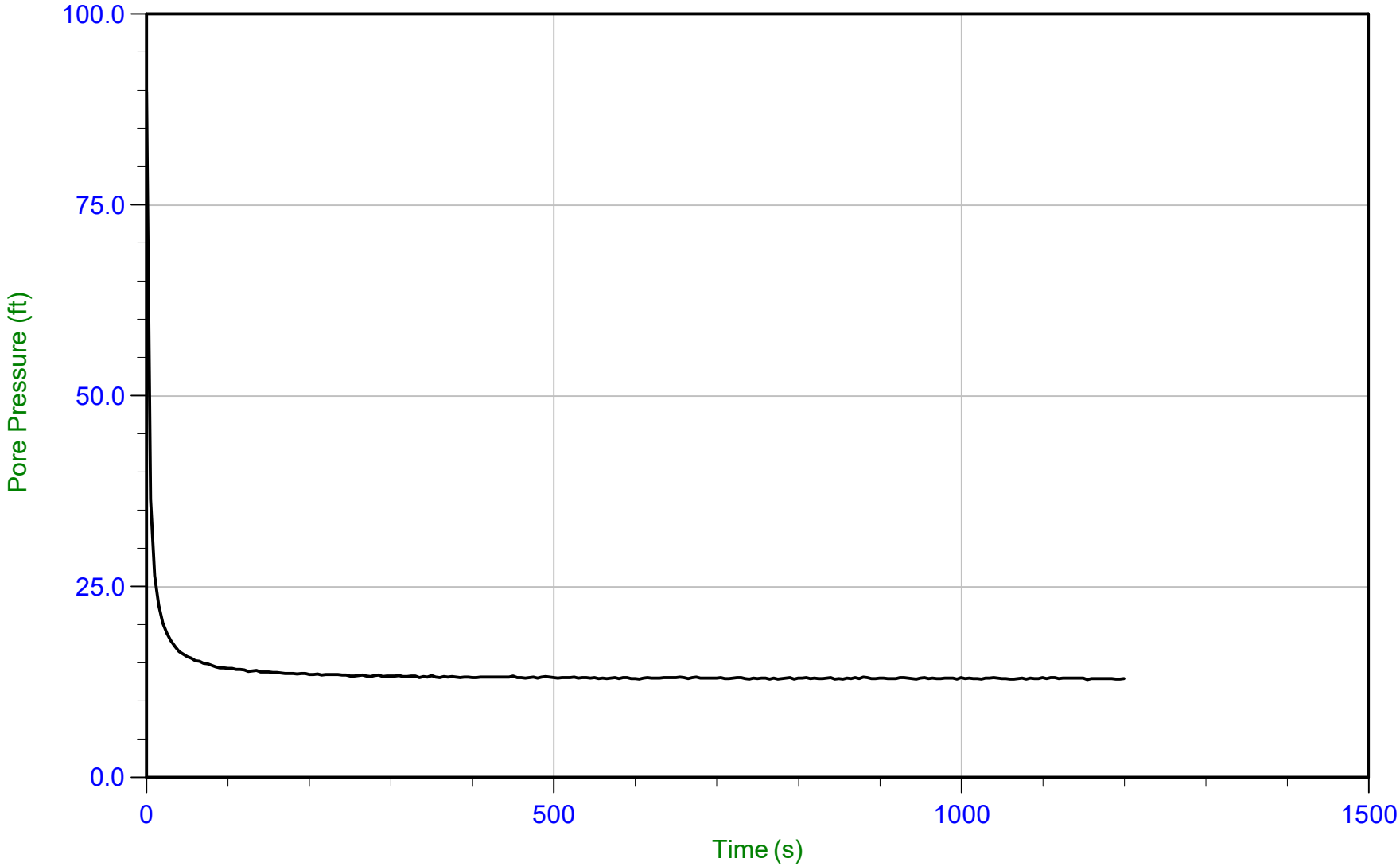
WT: 2.048 m / 6.719 ft
Ueq: 4.3 ft

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 10:35:11
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C022
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP22.PPD
Depth: 6.000 m / 19.685 ft
Duration: 1200.0 s

U Min: 12.8 ft
U Max: 89.8 ft

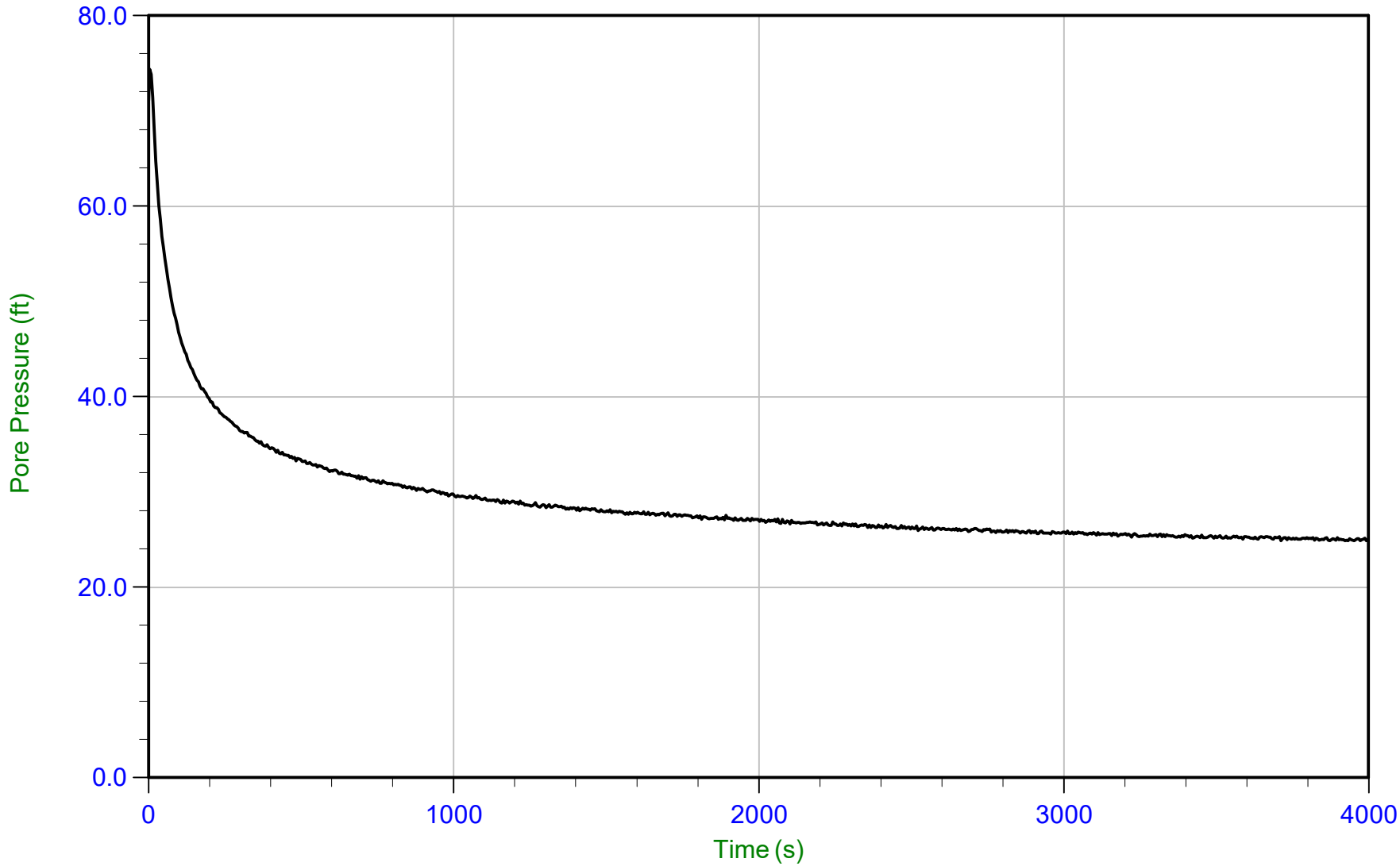
WT: 2.084 m / 6.837 ft
Ueq: 12.8 ft

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 08:52:49
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C023
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP23.PPD
Depth: 11.850 m / 38.877 ft
Duration: 4000.0 s

U Min: 24.9 ft
U Max: 74.4 ft

WT: 4.589 m / 15.056 ft
Ueq: 23.8 ft
U(50): 49.09 ft

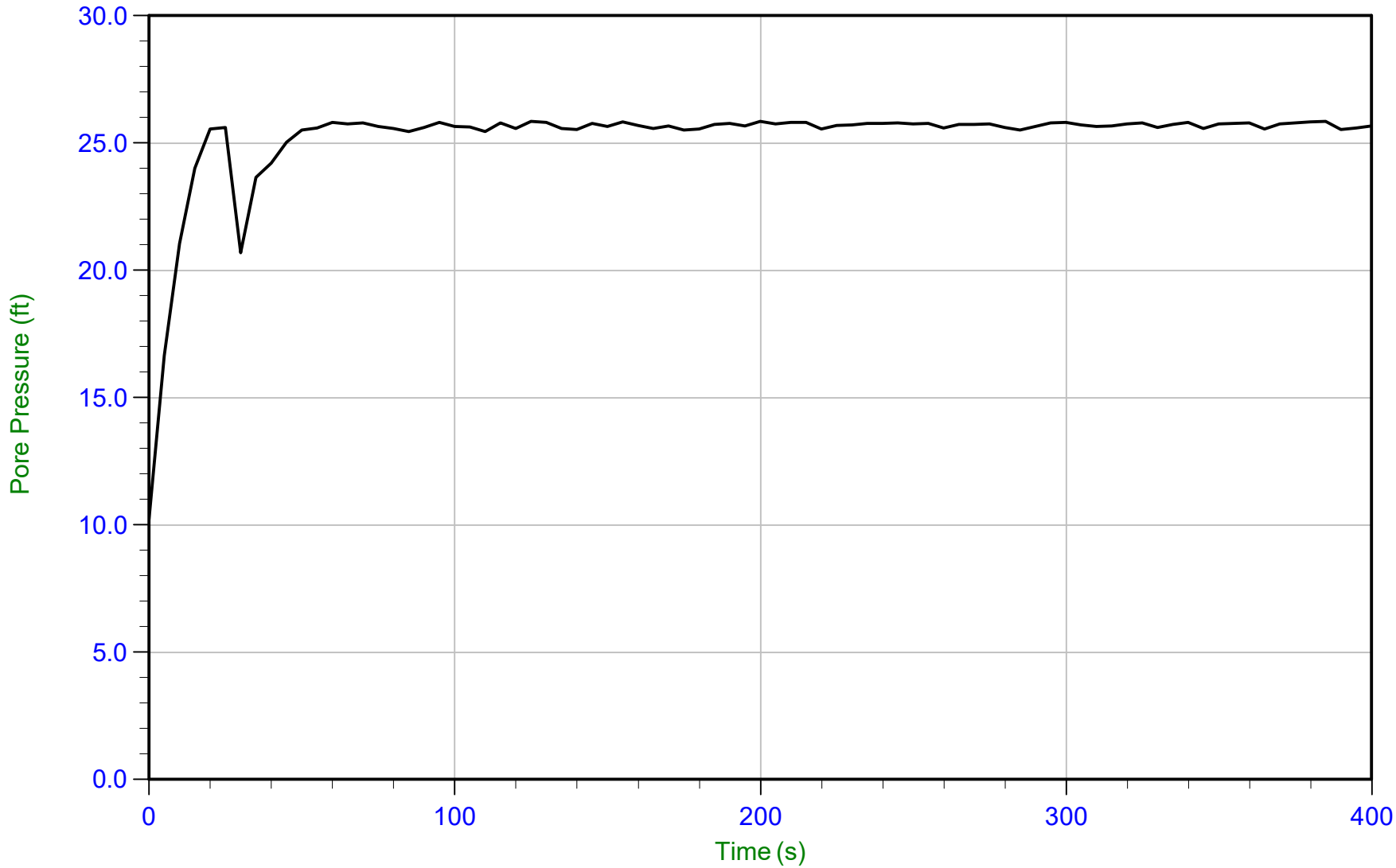
T(50): 77.9 s
Ir: 100
Ch: 9.0 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 08:52:49
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C023
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP23.PPD
Depth: 12.400 m / 40.682 ft
Duration: 400.0 s

U Min: 10.2 ft
U Max: 25.9 ft

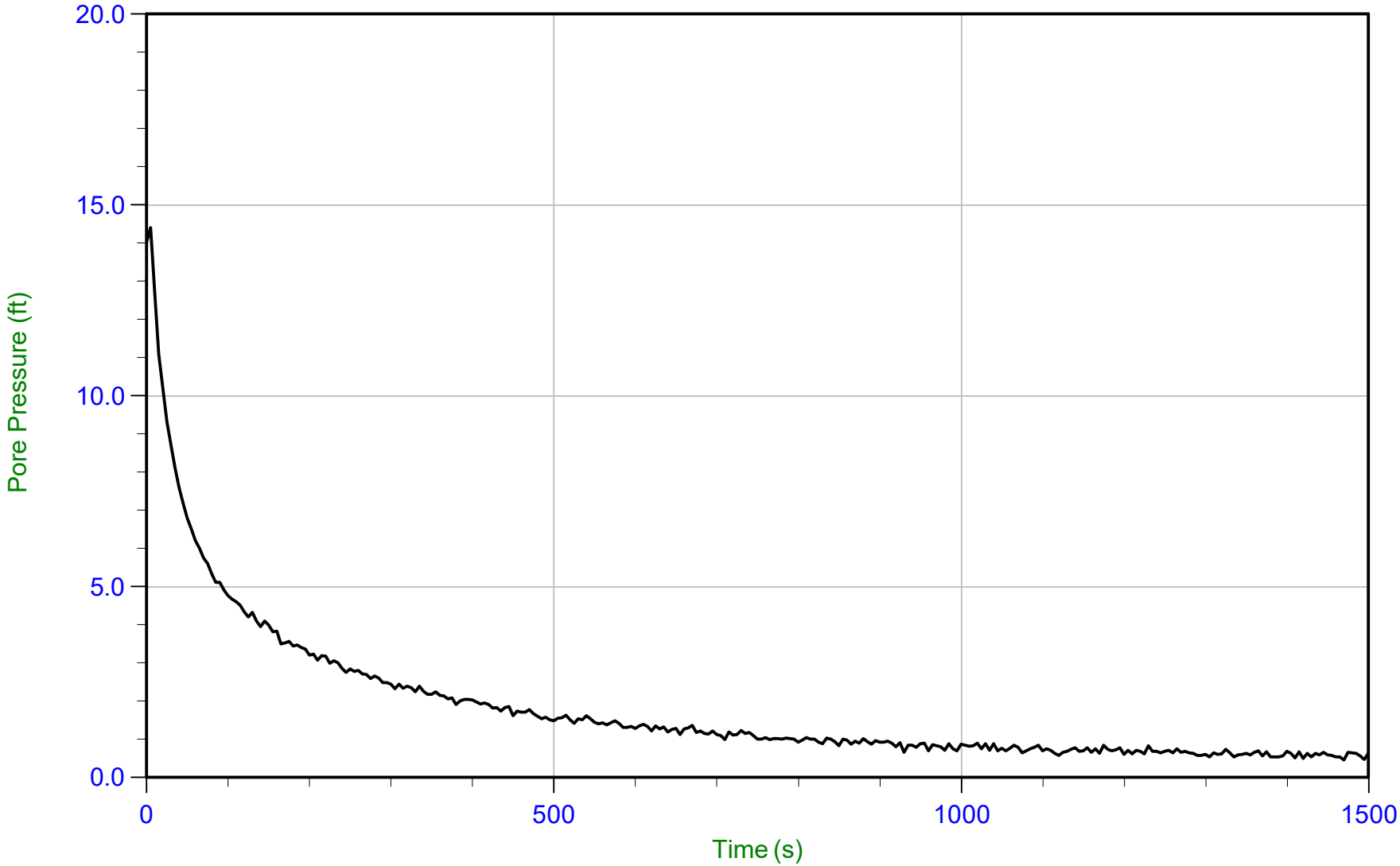
WT: 4.589 m / 15.056 ft
Ueq: 25.6 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 13:44:56
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C025
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP25.PPD
Depth: 2.000 m / 6.562 ft
Duration: 1500.0 s

U Min: 0.5 ft
U Max: 14.4 ft

WT: 1.826 m / 5.991 ft
Ueq: 0.6 ft
U(50): 7.49 ft

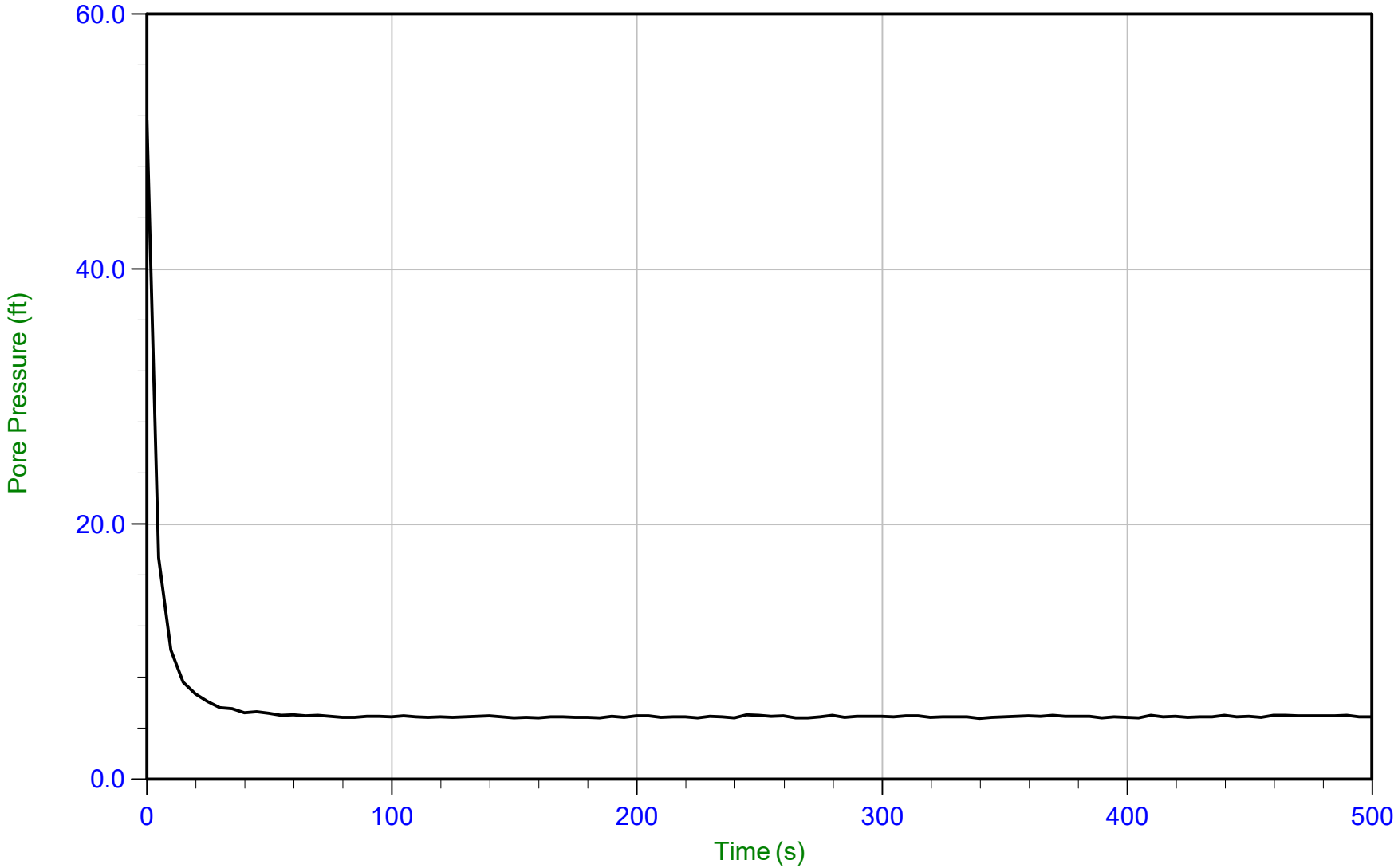
T(50): 36.3 s
Ir: 100
Ch: 19.3 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 13:44:56
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C025
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP25.PPD
Depth: 3.350 m / 10.991 ft
Duration: 500.0 s

U Min: 4.8 ft
U Max: 51.7 ft

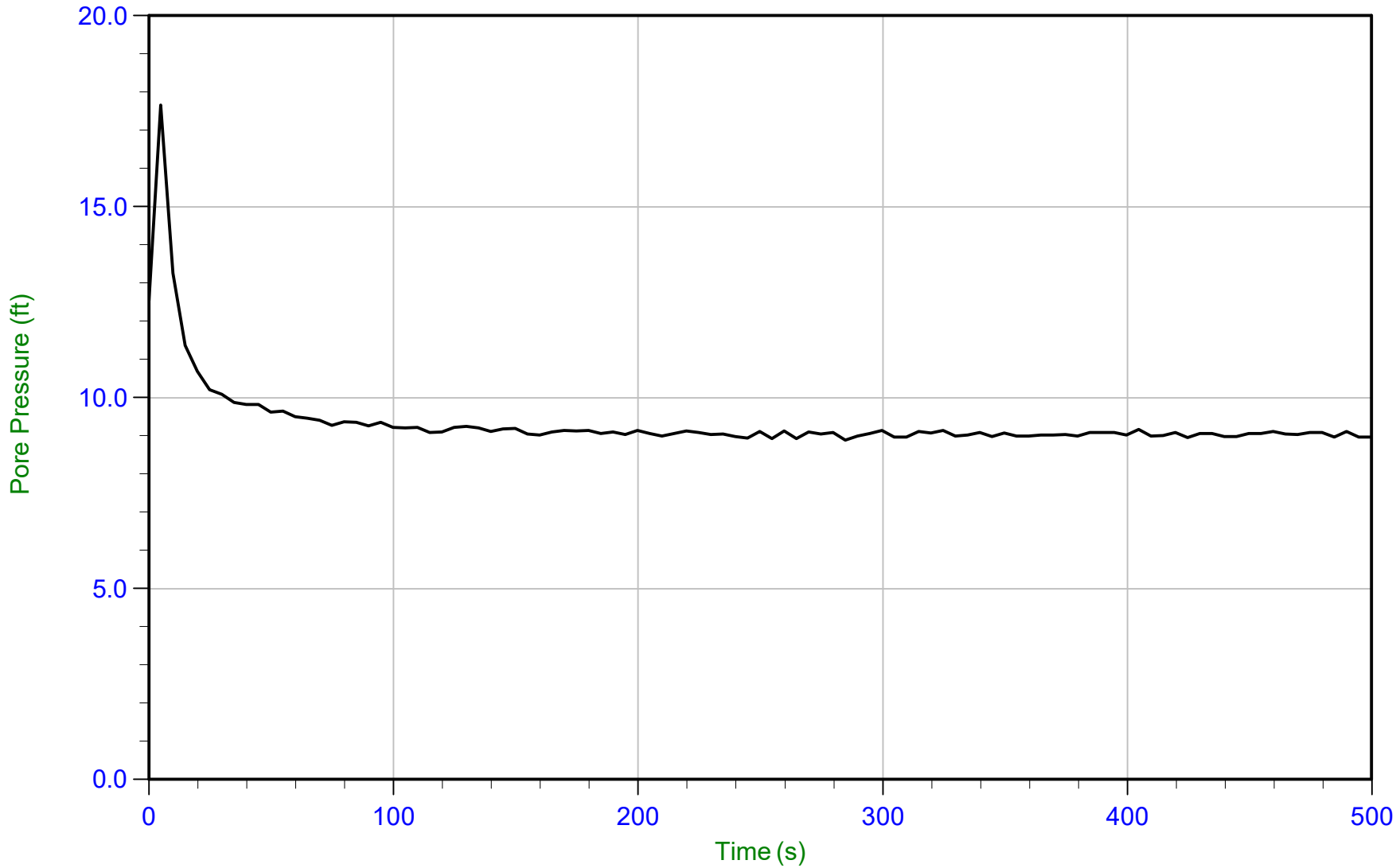
WT: 1.826 m / 5.991 ft
Ueq: 5.0 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 13:44:56
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C025
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP25.PPD
Depth: 4.600 m / 15.092 ft
Duration: 500.0 s

U Min: 8.9 ft
U Max: 17.7 ft

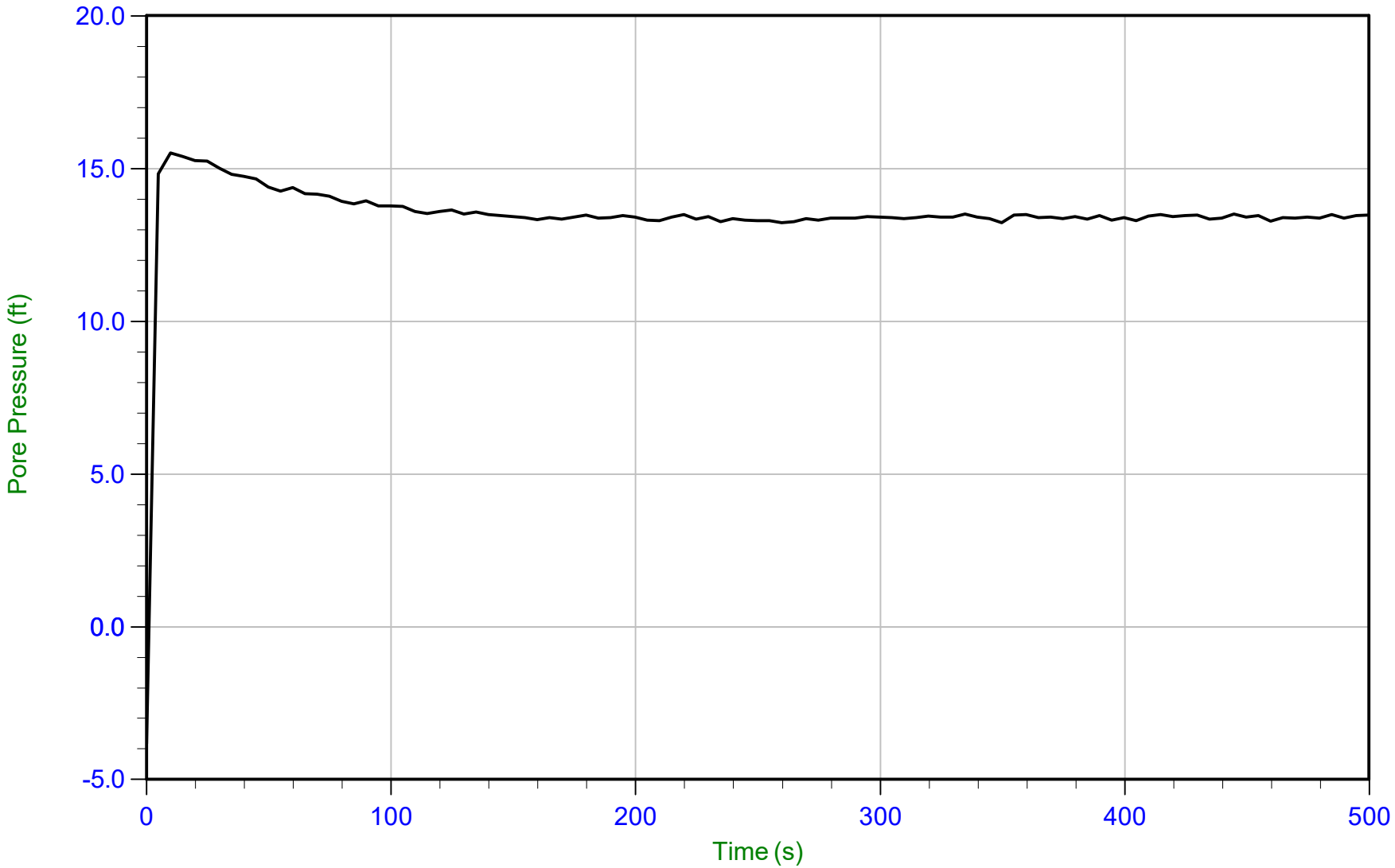
WT: 1.848 m / 6.063 ft
Ueq: 9.0 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 13:44:56
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C025
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP25.PPD
Depth: 6.100 m / 20.013 ft
Duration: 500.0 s

U Min: -3.8 ft
U Max: 15.5 ft

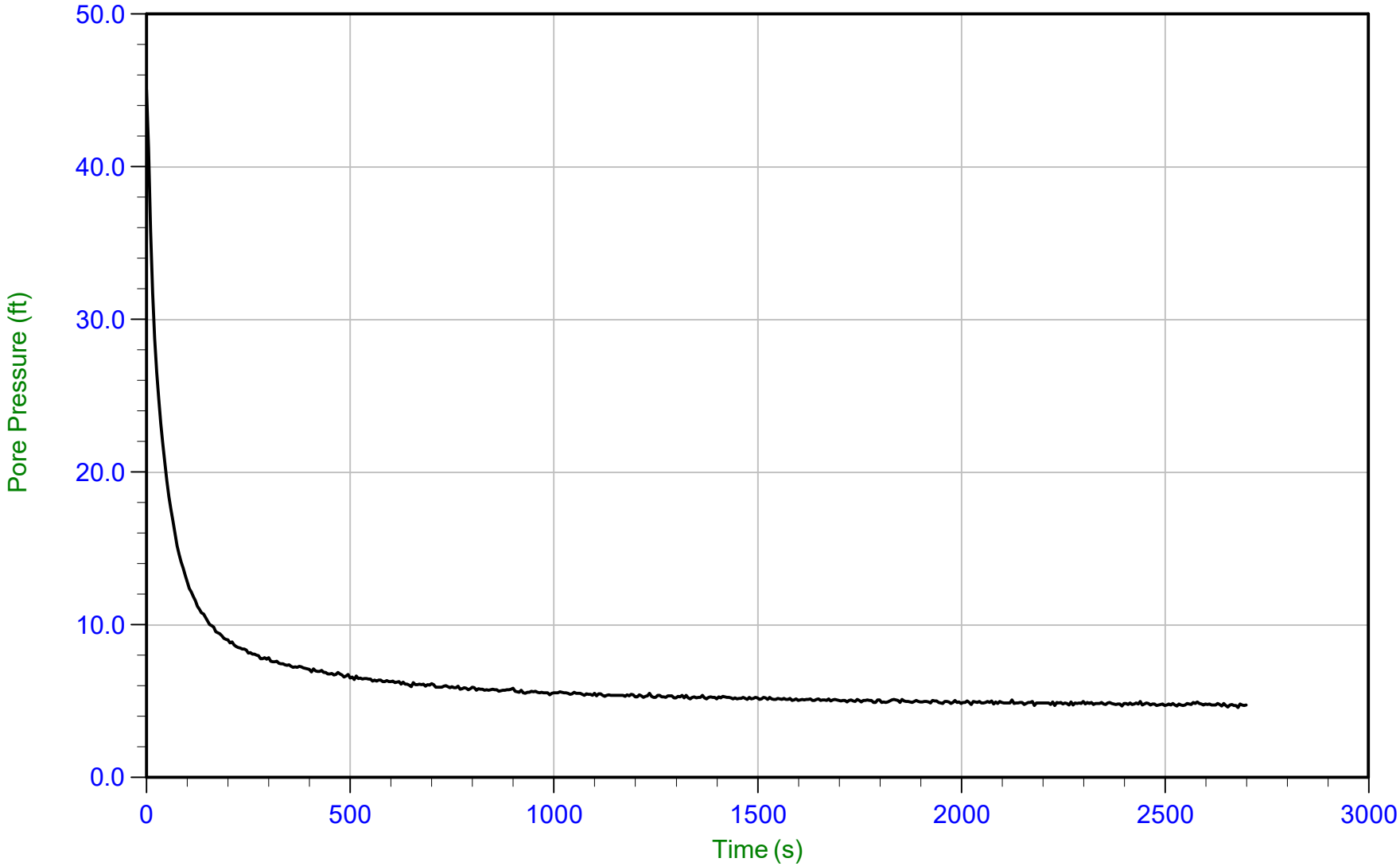
WT: 1.962 m / 6.437 ft
Ueq: 13.6 ft

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 12:20:07
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C026
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP26.PPD
Depth: 3.350 m / 10.991 ft
Duration: 2700.0 s

U Min: 4.6 ft
U Max: 45.1 ft

WT: 2.191 m / 7.188 ft
Ueq: 3.8 ft
U(50): 24.43 ft

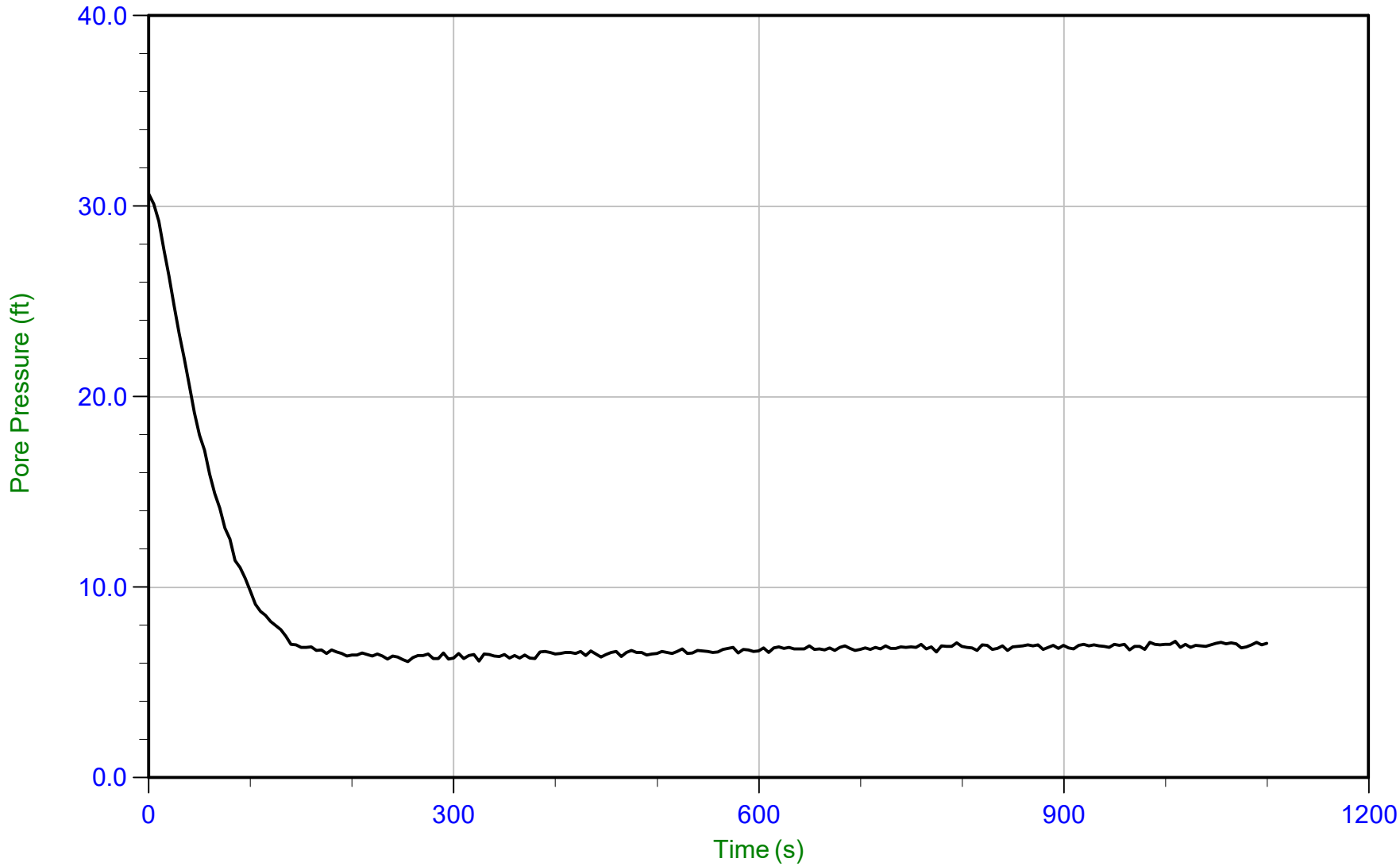
T(50): 31.2 s
Ir: 100
Ch: 22.5 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 12:20:07
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C026
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP26.PPD
Depth: 4.350 m / 14.271 ft
Duration: 1100.0 s

U Min: 6.1 ft
U Max: 30.7 ft

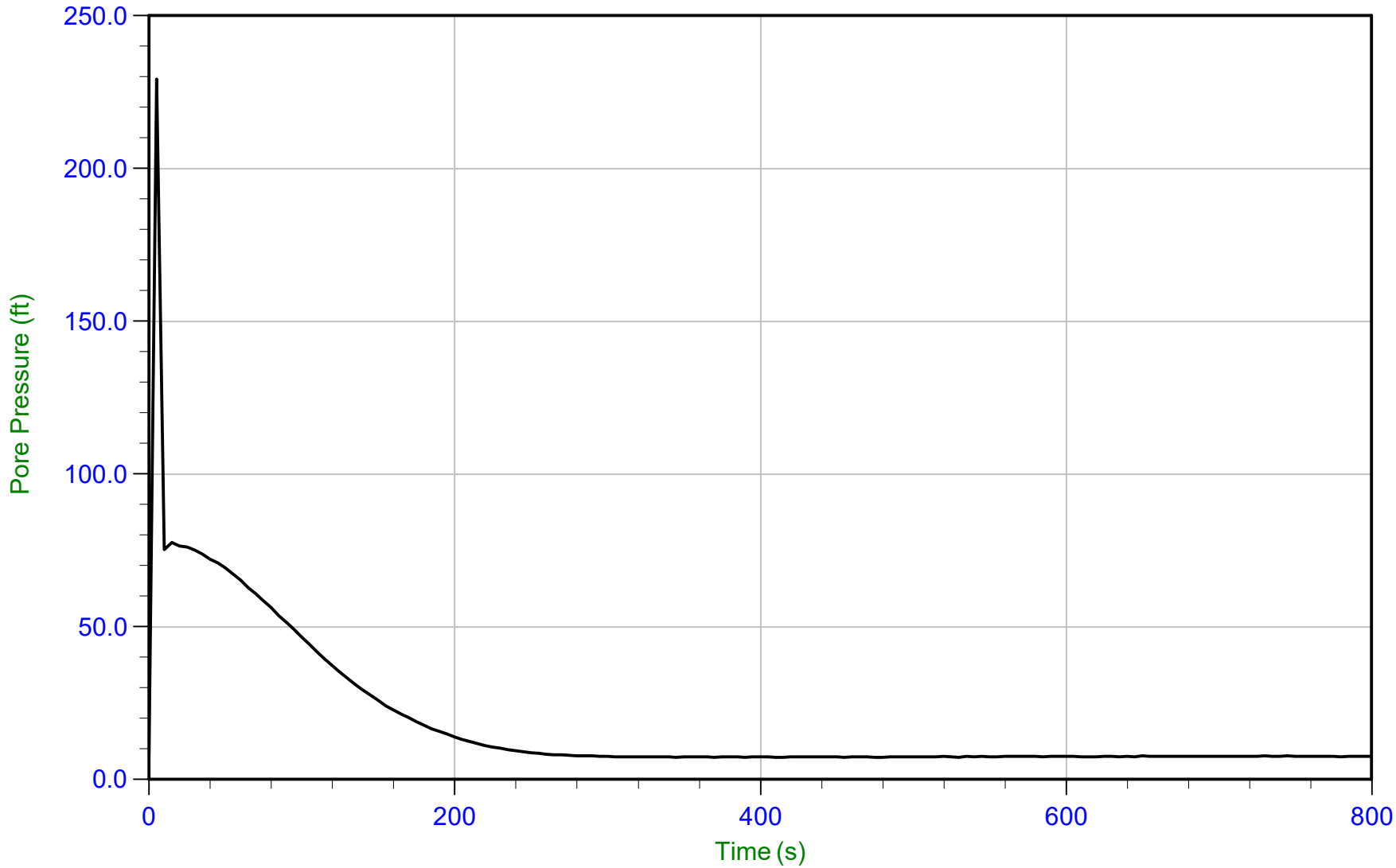
WT: 2.191 m / 7.188 ft
Ueq: 7.1 ft

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 14:00:29
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C026B
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP26B.PPD
Depth: 4.450 m / 14.600 ft
Duration: 800.0 s

U Min: 7.3 ft
U Max: 229.3 ft

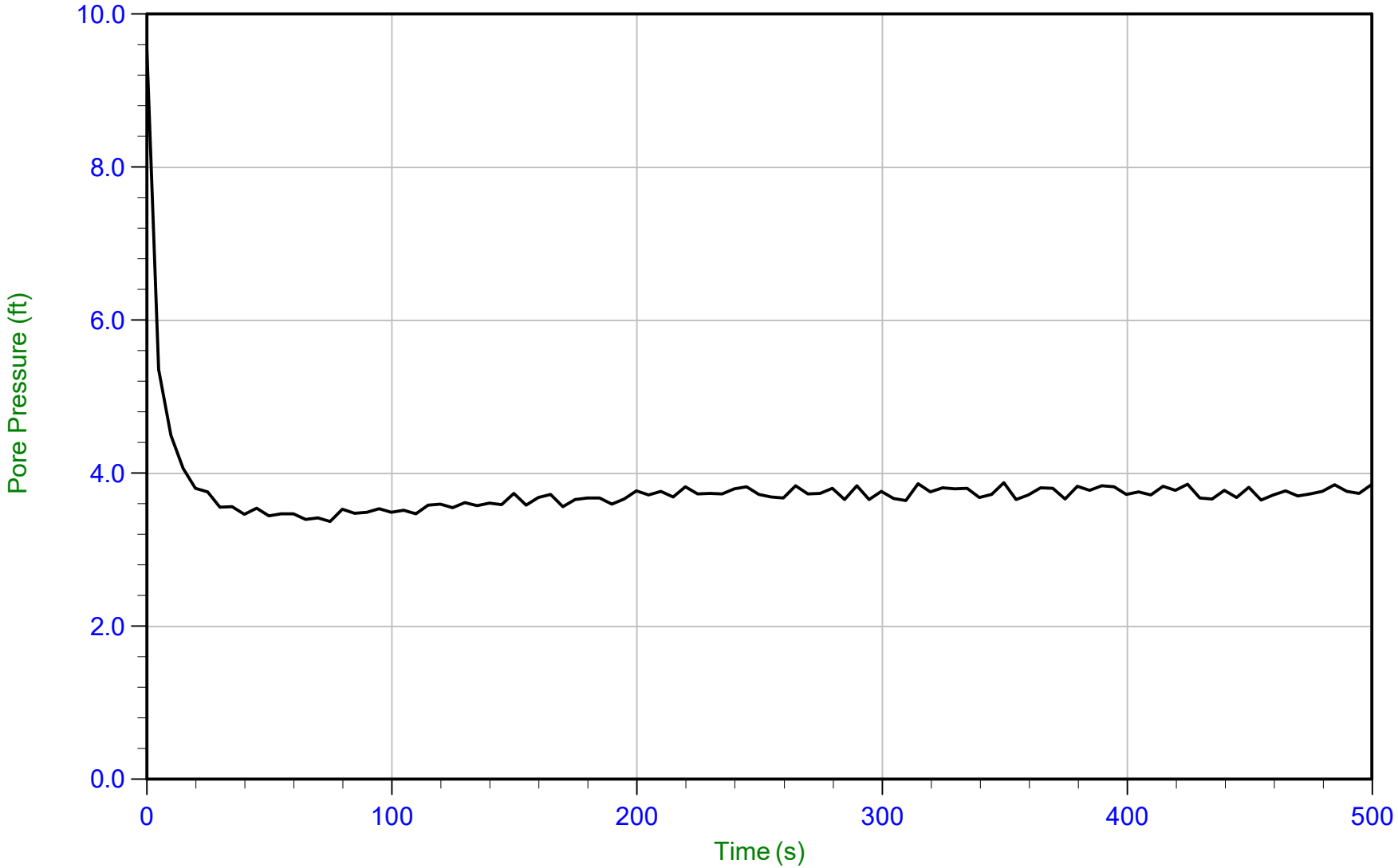
WT: 2.069 m / 6.788 ft
Ueq: 7.8 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 11:00:21
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C027
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP27.PPD
Depth: 3.400 m / 11.155 ft
Duration: 500.0 s

U Min: 3.4 ft
U Max: 9.5 ft

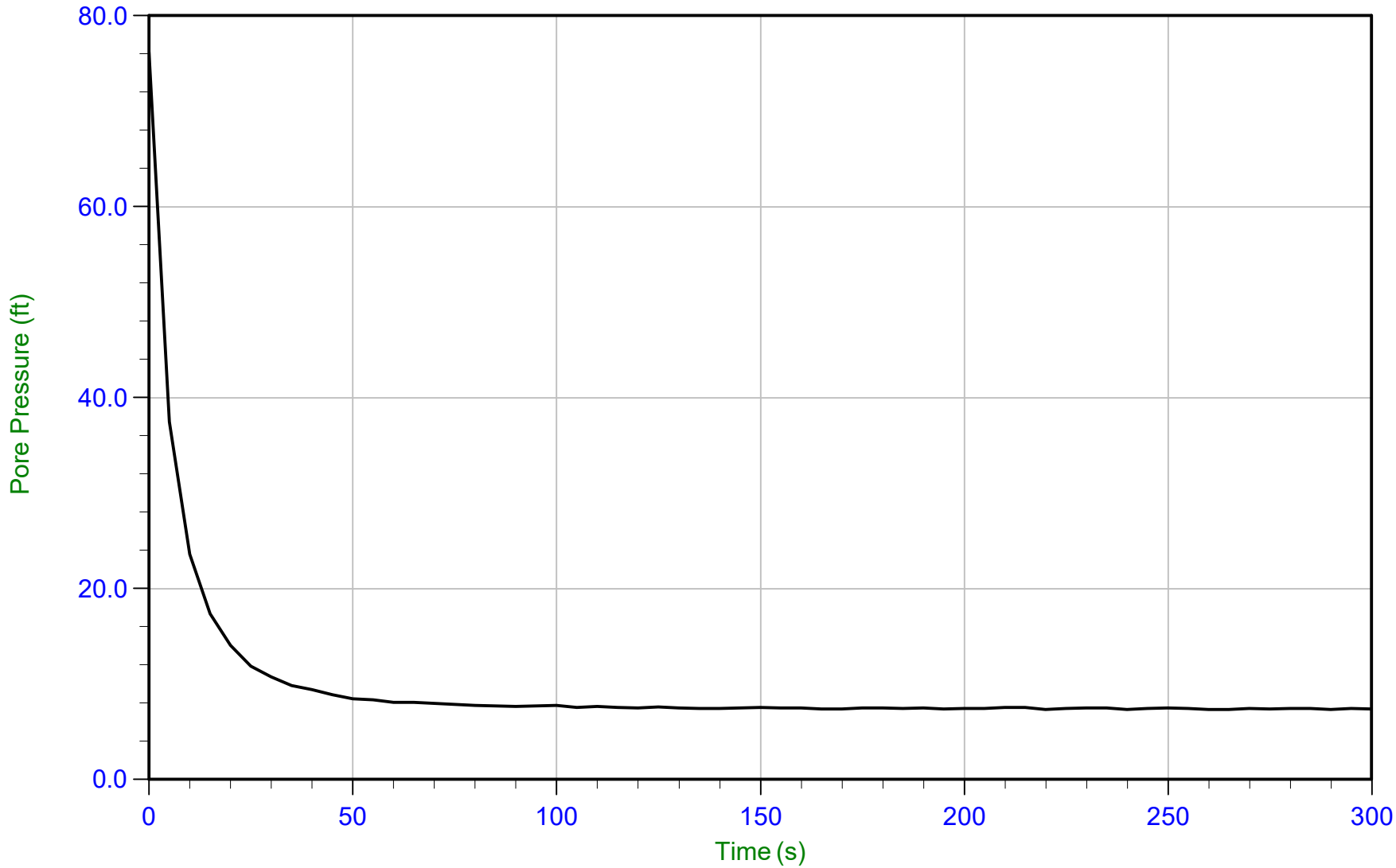
WT: 2.257 m / 7.405 ft
Ueq: 3.7 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 11:00:21
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C027
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP27.PPD
Depth: 4.350 m / 14.271 ft
Duration: 300.0 s

U Min: 7.3 ft
U Max: 76.2 ft

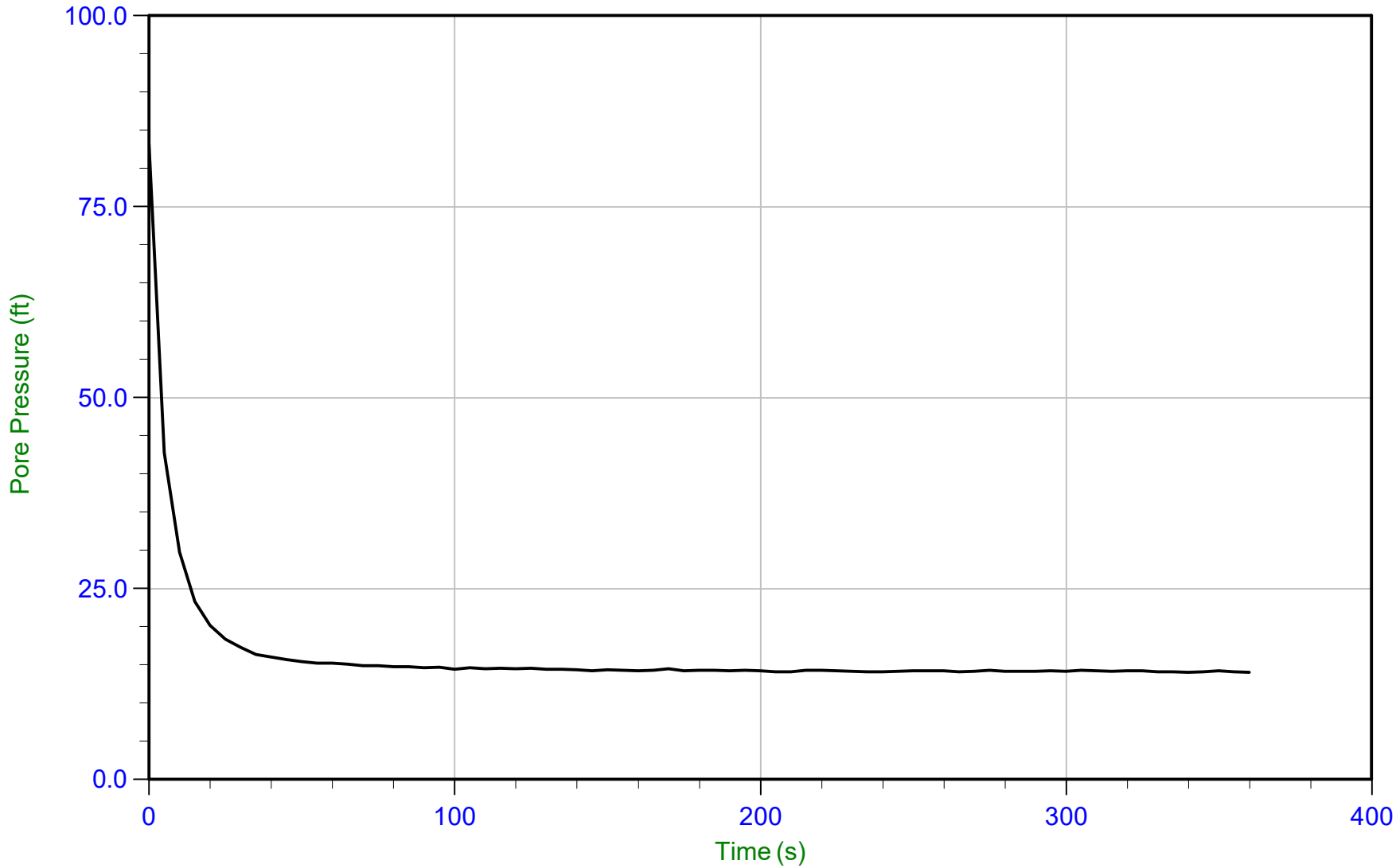
WT: 2.064 m / 6.772 ft
Ueq: 7.5 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 11:00:21
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C027
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP27.PPD
Depth: 6.400 m / 20.997 ft
Duration: 360.0 s

U Min: 14.0 ft
U Max: 83.3 ft

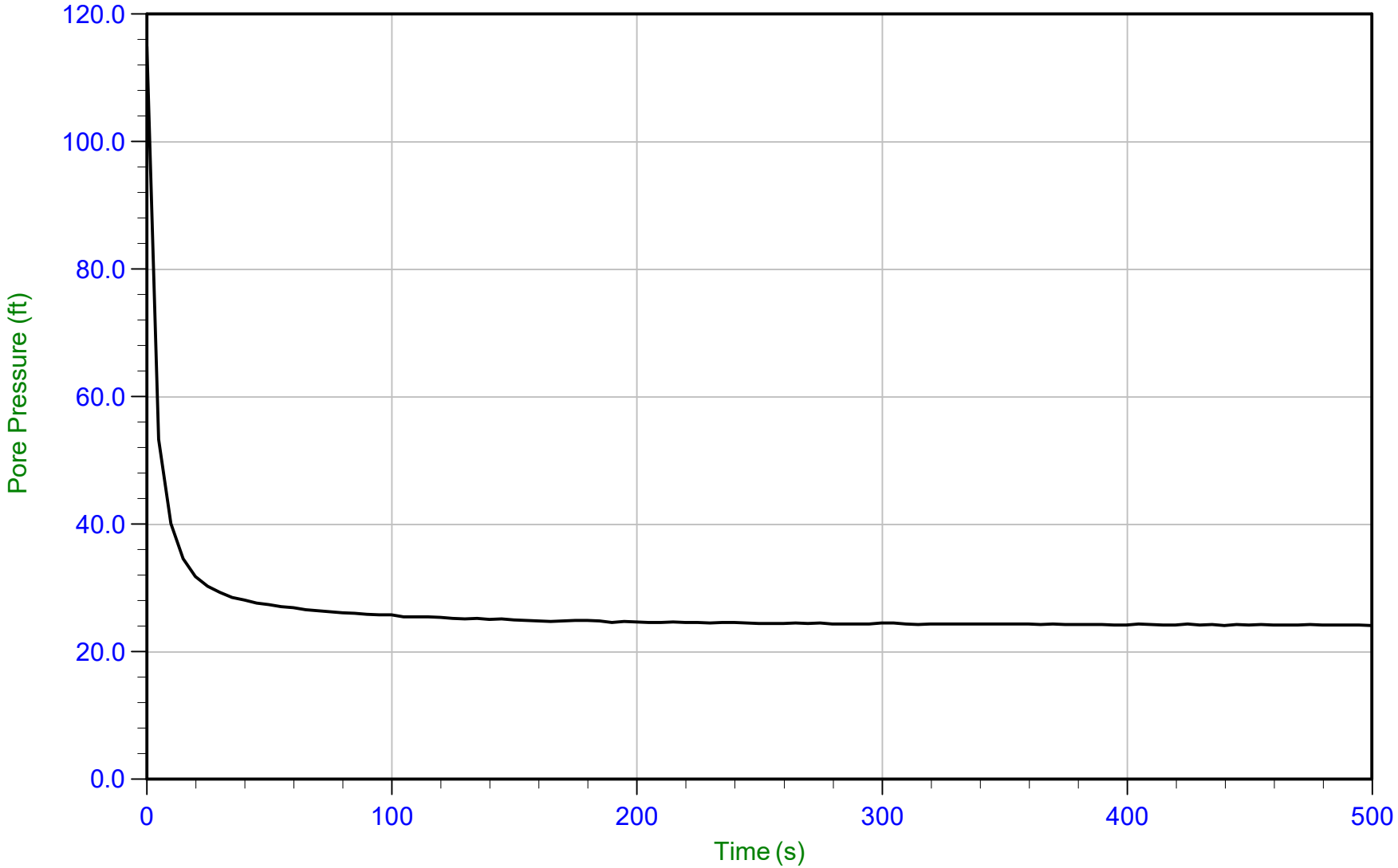
WT: 2.061 m / 6.762 ft
Ueq: 14.2 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 11:00:21
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C027
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP27.PPD
Depth: 9.400 m / 30.840 ft
Duration: 500.0 s

U Min: 24.1 ft
U Max: 114.9 ft

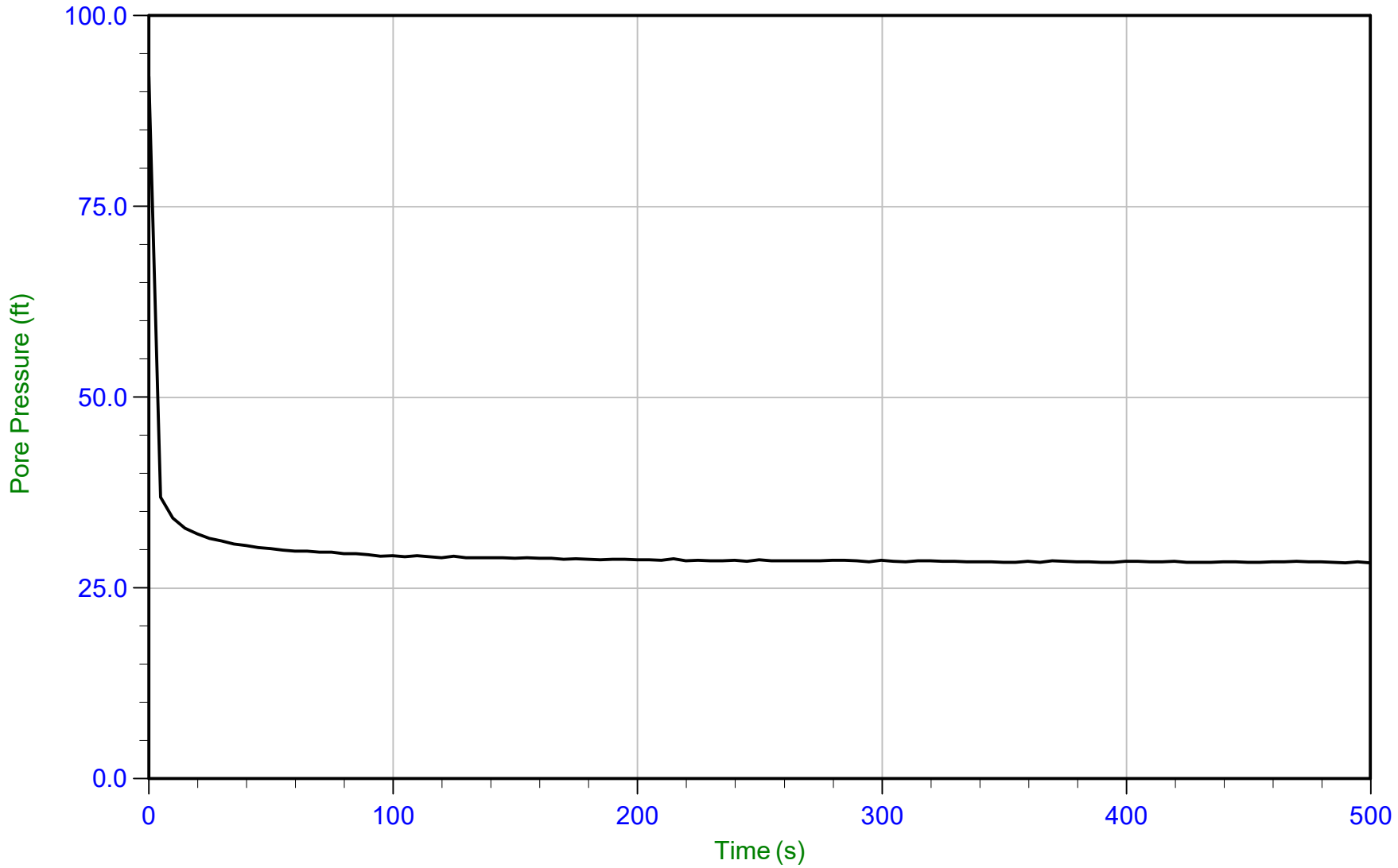
WT: 2.034 m / 6.673 ft
Ueq: 24.2 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 11:00:21
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C027
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP27.PPD
Depth: 10.700 m / 35.105 ft
Duration: 500.0 s

U Min: 28.3 ft
U Max: 92.0 ft

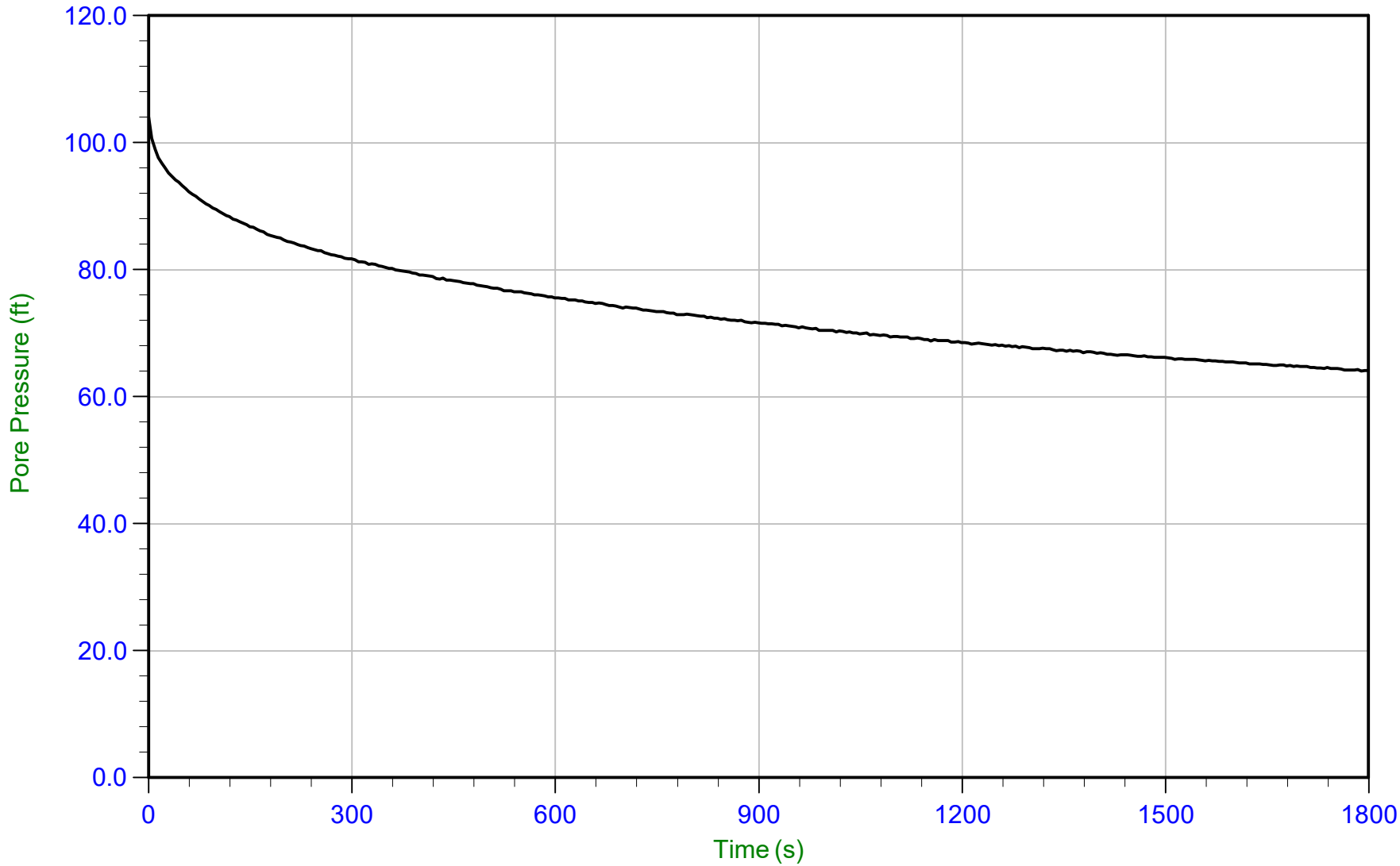
WT: 2.022 m / 6.634 ft
Ueq: 28.5 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 11:00:21
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C027
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP27.PPD
Depth: 12.200 m / 40.026 ft
Duration: 1800.0 s

U Min: 64.1 ft
U Max: 104.0 ft

WT: 2.064 m / 6.772 ft
Ueq: 33.3 ft
U(50): 68.65 ft

T(50): 1184.7 s
Ir: 100
Ch: 0.6 sq cm/min

APPENDIX D

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynergy - Edwards Site

PROJECT NUMBER: MR155218

CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	LL	PL	PI	Specific Gravity
EDW-B002	S-1	0.0'-1.5'	FILL: OLIVE BROWN TRACE BROWN SILTY SAND WITH GRAVEL	SM	38.4	4.50+								
EDW-B002	S-2	2.5'-4.0'	GRAY SANDY SILT	ML	62.4	3.50								
EDW-B002	S-3	5.0'-7.0'	GREENISH GRAY SANDY SILT	MH	66.6						65	36	29	
EDW-B002	S-4	7.5'-10.0'	DARK GRAY FLY ASH		79.0		0.0	7.4	73.1	19.5				
EDW-B002	S-5	10.0'-12.0'	GRAY TO DARK GRAY VARVED FLY ASH		76.9						17	27	NP	
EDW-B002	S-6	15.0'-16.5'	DARK GRAY FLY ASH		52.5									
EDW-B002	S-7	20.0'-21.5'	DARK GRAY FLY ASH WITH SAND AND GRAVEL		67.8									
EDW-B002	S-8	25.0'-27.0'	DARK GRAY FLY ASH		63.9									2.471
EDW-B002	S-9	30.0'-30.5'	LIGHT GRAY LEAN CLAY WITH ORGANIC POCKETS	CL	126.1	<.25								
EDW-B002	S-9A	30.5'-31.5'	BROWN TO RUST BROWN LEAN CLAY WITH SAND	CL	31.1	0.50								
EDW-B002	S-10	35.0'-37.0'	GRAY LEAN CLAY WITH SAND	CL	31.6						36	18	18	
EDW-B002	S-11	40.0'-41.5'	GRAY LEAN CLAY	CL	42.9	1.00								2.592
EDW-B002	S-12	45.0'-46.5'	GRAY TO DARK GRAY LEAN CLAY WITH SAND	CL	57.7	0.75								
EDW-B002	S-13	50.0'-50.25'	GRAY SILT WITH SAND	ML	11.1	4.50+								
EDW-B003	S-1	0.0'-1.5'	FILL: DARK GRAY FLY ASH WITH SAND		44.4									2.469
EDW-B003	S-2	2.5'-4.0'	FILL: DARK GRAY FLY ASH WITH SAND		27.3	2.00								
EDW-B003	S-3	5.0'-6.5'	FILL: BROWN AND BLACK LEAN CLAY WITH SAND AND ORGANICS	OL	37.2	1.00								
EDW-B003	S-4	7.5'-9.5'	FILL: DARK GRAY FLY ASH		55.5									
EDW-B003	S-5	10.0'-11.5'	FILL: DARK GRAY FLY ASH		50.6		2.3	19.8	56.3	21.6				
EDW-B003	S-6	15.0'-16.5'	FILL: DARK GRAY FLY ASH WITH SAND AND GRAVEL		29.7									2.772
EDW-B003	S-7	20.0'-21.5'	FILL: DARK GRAY FLY ASH WITH SAND AND GRAVEL		42.1									
EDW-B003	S-8	25.0'-27.0'	FILL: DARK GRAY FLY ASH WITH SAND		54.9									
EDW-B003	S-9	30.0'-32.0'	FILL: VERY DARK GRAY VARVED FLY ASH		71.7		0.0	20.6	66.4	13.0				
EDW-B003	S-10	35.0'-36.5'	FILL: DARK GRAY FLY ASH WITH SAND		51.9									
EDW-B003	S-10A	36.5'-37.0'	GRAY LEAN CLAY WITH ORGANIC POCKETS	CL	43.0	2.25								
EDW-B003	S-11	40.0'-41.5'	GRAY TO BROWNISH GRAY LEAN CLAY WITH SAND	CL	31.6	1.25								
EDW-B003	S-12	45.0'-47.0'	DARK GRAY FAT CLAY WITH SAND	CH	46.0						51	17	34	
EDW-B003	S-13	50.0'-51.5'	BROWNISH GRAY TO GREENISH GRAY LEAN CLAY WITH SAND	CL	55.4	0.50								
EDW-B003	S-14	55.0'-55.5'	BLUISH GRAY CLAYEY SILT	ML	23.3	3.50								
EDW-B003	S-14A	55.5'-55.92'	BLUISH GRAY SILT	ML	9.8									
EDW-B003	S-15	60.0'-60.25'	BLUISH GRAY SILT	ML	7.1									

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynergy - Edwards Site | PROJECT NUMBER: MR155218 | CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	LL	PL	PI	Specific Gravity
EDW-B004	S-1	0.0'-1.5'	FILL: DARK GRAY FLY ASH		18.9	4.50+								
EDW-B004	S-2	2.5'-3.5'	FILL: DARK GRAY FLY ASH WITH SAND		28.5	4.00								
EDW-B004	S-2A	3.5'-4.0'	BROWN TO GRAY LEAN CLAY WITH SAND - FLY ASH NOTED	CL	20.1	3.25								
EDW-B004	S-3	5.0'-6.5'	BROWN AND GRAY LEAN CLAY	CL	21.6	1.75								
EDW-B004	S-4	7.5'-9.0'	GRAY AND DARK GRAY LEAN CLAY WITH ORGANICS	CL	23.4	4.00	0.0	9.3	43.3	47.4	37	16	21	
EDW-B004	S-5	10.0'-11.5'	BROWN AND DARK GRAY LEAN CLAY	CL	21.5	2.25								
EDW-B004	S-6	12.5'-14.0'	BROWN AND GRAY LEAN CLAY WITH SAND	CL	25.4	1.25								
EDW-B004	S-7	15.0'-16.5'	DARK GRAY LEAN CLAY	CL	25.8	2.50								
EDW-B004	S-8	20.0'-21.5'	BROWN AND GRAY LEAN CLAY WITH SAND	CL	31.3	1.00								
EDW-B004	S-9	25.0'-26.0'	BROWN AND GRAY LEAN CLAY WITH SAND AND SAND POCKETS	CL	23.0	1.25								
EDW-B004	S-9A	26.0'-26.5'	GRAY AND BROWN CLAYEY SAND	SC	19.5	0.75								
EDW-B004	S-10	30.0'-31.5'	GRAYISH BROWN AND DARK GRAY LEAN CLAY WITH SAND - ORGANIC	CL	19.7	3.75								
EDW-B004	S-11	36.0'-38.0'	BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND	CL	20.1						35	17	18	
EDW-B004	S-12	40.0'-41.5'	BROWN, RUST BROWN AND GRAY LEAN CLAY	CL	30.0	1.25								
EDW-B004	S-13	45.0'-46.0'	GRAY LEAN CLAY	CL	39.5	1.00								
EDW-B004	S-13A	46.0'-46.5'	BROWNISH GRAY LEAN CLAY WITH SAND	CL	35.1									
EDW-B004	S-14	50.0'-51.5'	GRAY LEAN CLAY WITH SAND	CL	65.2	1.75								2.617
EDW-B004	S-15	55.0'-56.5'	BROWN AND BLUISH GRAY LEAN CLAY WITH SAND	CL	33.4	1.25								
EDW-B004	S-15A	56.0'-56.5'	BLUISH GRAY SILT	ML	13.2									
EDW-B004	S-16	60.0'-60.25'	BLUISH GRAY SOFT SHALE		8.8									
EDW-B005	S-1	0.0'-1.5'	FILL: BROWN AND DARK BROWN CLAYEY SAND WITH GRAVEL AND SILT	SC	45.8	4.50								
EDW-B005	S-2	2.5'-4.0'	FILL: BROWN SANDY SILT WITH GRAVEL	ML	26.0									
EDW-B005	S-3	5.0'-6.5'	FILL: BROWN SANDY SILT WITH CLAY CHUNKS	MH	50.9	3.25					61	54	7	
EDW-B005	S-4	8.5'-10.0'	FILL: BROWN SANDY SILT WITH GRAVEL	ML	37.4	4.50+								
EDW-B005	S-5	10.0'-11.5'	FILL: LIGHT BROWN AND GRAY CLAYEY SAND WITH GRAVEL	SC	44.3									
EDW-B005	S-6	15.0'-16.5'	FILL: BROWN SANDY SILT WITH GRAVEL	ML	41.4									
EDW-B005	S-7	20.0'-21.5'	FILL: GRAY FLY ASH		51.1	1.75	3.1	21.3	51.7	23.9				
EDW-B005	S-8	25.0'-26.0'	FILL: BROWNISH GRAY CLAYEY SILT WITH SAND AND GRAVEL	ML	55.3									
EDW-B005	S-8A	26.0'-27.0'	FILL: GRAY AND BLACK ORGANIC SILT	OL	47.6						44	29	15	
EDW-B005	S-9	29.0'-31.0'	FILL: DARK GRAY FLY ASH		69.3									
EDW-B005	S-10	35.0'-36.5'	GRAY AND GRAYISH BLACK LEAN CLAY WITH SAND AND ORGANICS	CL	37.3	1.00								
EDW-B005	S-11	41.0'-43.0'	GRAY FAT CLAY SHELL - ORGANICS NOTED	CH	44.8						57	22	35	
EDW-B005	S-12	45.0'-46.5'	DARK GRAY AND GREENISH GRAY LEAN CLAY WITH SAND - ORGANICS AND SHALE NOTED	CL	88.7	1.00								2.521
EDW-B005	S-13	50.0'-51.0'	BLUISH GRAY CLAYEY SILT	CL-ML	15.9	4.50+								
EDW-B005	S-14	51.0'-51.5'	BLUISH GRAY SOFT SHALE		12.8									

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynergy - Edwards Site

PROJECT NUMBER: MR155218

CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	LL	PL	PI	Specific Gravity
EDW-B006	S-1	0.0'-1.5'	FILL: DARK BROWN AND DARK GRAY LEAN CLAY WITH SAND AND BRICK	CL	26.4	2.25								
EDW-B006	S-2	2.5'-5.0'	RUST BROWN AND GRAY MOTTLED LEAN CLAY	CL	30.1	1.25								
EDW-B006	S-3	5.0'-6.5'	GRAY AND DARK GRAY LEAN CLAY TRACE SAND	CL	24.8	2.25					48	19	29	
EDW-B006	S-4	7.5'-10.0'	GRAY AND RUST BROWN MOTTLED LEAN CLAY	CL	26.0	2.50								
EDW-B006	S-5	10.0'-11.5'	BROWNISH GRAY LEAN CLAY	CL	34.2	1.25								
EDW-B006	S-6	13.0'-15.0'	GRAY FAT CLAY WITH SAND	CH	31.1						62	20	42	
EDW-B006	S-7	15.0'-16.5'	BROWNISH GRAY LEAN CLAY	CL	40.8	1.00								
EDW-B006	S-8	20.0'-21.5'	BROWN AND GRAY LEAN CLAY WITH SAND	CL	43.4	0.75								
EDW-B006	S-9	26.0'-28.0'	DARK GRAY ORGANIC SILT	OH	76.0						72	37	35	
EDW-B006	S-10	30.0'-31.0'	GRAY LEAN CLAY WITH SAND - ORGANIC POCKETS NOTED	CL	43.4	0.50								
EDW-B006	S-10A	31.0'-31.5'	BLUISH GRAY LEAN CLAY WITH SAND AND SILT	CL	19.6									
EDW-B006	S-11	35.0'-35.42'	BLUISH GRAY SILT WITH SAND	ML	14.2	3.50								
EDW-B008	S-1	0.0'-1.5'	BROWN LEAN CLAY WITH SAND AND GRAVEL	CL	13.2	4.50+								
EDW-B008	S-2	2.5'-4.0'	DARK BROWN LEAN CLAY WITH SAND	CL	19.5	3.75					42	22	20	
EDW-B008	S-3	5.0'-6.5'	DARK GRAY AND RUST BROWN MOTTLED LEAN CLAY WITH SAND	CL	42.3	2.00								
EDW-B008	S-4	7.5'-9.0'	BROWN AND LIGHT GRAY LEAN CLAY WITH SAND	CL	22.8	2.00								
EDW-B008	S-5	11.0'-13.0'	BROWN AND GRAY FAT CLAY WITH SAND	CH	33.6						52	19	33	
EDW-B008	S-6	15.0'-16.5'	GRAY LEAN CLAY WITH SAND	CL	64.6	0.50								
EDW-B008	S-7	20.0'-21.5'	BROWN AND GRAY LEAN CLAY - SHELL NOTED	CL	44.4	0.50								
EDW-B008	S-8	24.0'-26.5'	DARK GRAY FAT CLAY SHELL - ORGANICS NOTED	CH	68.9						67	31	36	
EDW-B008	S-9	30.0'-31.5'	GRAY AND BROWNISH GRAY LEAN CLAY WITH SAND	CL	71.4	0.50								
EDW-B008	S-10	35.0'-36.5'	GRAY LEAN CLAY WITH SAND - WOODCHIPS, ORGANICS AND SHELL NOTED	CL	56.9	0.25								
EDW-B008	S-11	40.0'-40.33'	BLUISH GRAY SILT WITH SOFT SHALE	ML	12.6	3.00								

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynergy - Edwards Site | PROJECT NUMBER: MR155218 | CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	LL	PL	PI	Specific Gravity
EDW-B010	S-1 TOP	0.0'-0.5'	FILL: BROWN SAND WITH GRAVEL	SP	7.2									
EDW-B010	BOTTOM	0.0'-0.5'	FILL: BROWN LEAN CLAY WITH SAND AND GRAVEL	CL	17.4	4.50+								
EDW-B010	S-1A	0.5'-1.5'	FILL: DARK GRAY FLY ASH		27.9									
EDW-B010	S-2	2.5'-3.0'	FILL: DARK GRAY FLY ASH		20.9									
EDW-B010	S-2A	3.0'-4.0'	FILL: DARK GRAY FLY ASH		30.7	4.50								
EDW-B010	S-3	5.0'-6.5'	FILL: DARK BROWN AND DARK GRAY SAND WITH GRAVEL - FLY ASH NOTED	SP	14.8		12.6	54.8	26.0	6.6				
EDW-B010	S-4	7.5'-9.0'	BROWN WITH RUST BROWN STAINS LEAN CLAY WITH SAND	CL	22.0	3.75								
EDW-B010	S-5	10.0'-11.5'	BROWN AND RUST BROWN LEAN CLAY WITH SAND	CL	24.0	2.00								
EDW-B010	S-6	12.5'-14.0'	BROWN LEAN CLAY	CL	28.0	1.25								
EDW-B010	S-7	15.0'-17.0'	BROWN AND GRAY MOTTLED LEAN CLAY	CL	30.5						48	18	30	
EDW-B010	S-8	20.0'-21.5'	GRAY LEAN CLAY	CL	32.9	0.75								
EDW-B010	S-9	25.0'-26.5'	GRAY LEAN CLAY WITH SAND	CL	21.4	0.50								
EDW-B010	S-10	30.0'-32.0'	BLUISH GRAY LEAN CLAY	CL	30.0						40	15	25	
EDW-B010	S-11	35.0'-36.5'	BROWNISH GRAY LEAN CLAY	CL	28.2	1.50								
EDW-B010	S-12	40.0'-41.0'	BROWN, RUST BROWN AND GRAY SILTY SAND WITH GRAVEL	SM	17.0									
EDW-B010	S-13	45.0'-45.25'	BLUISH GRAY CLAYEY SILT - SHALE NOTED	CL-ML	16.4	4.50								
EDW-B011	S-1	0.0'-1.5'	FILL: DARK GRAY FLY ASH		27.7	4.50+								
EDW-B011	S-2	2.5'-4.0'	FILL: DARK GRAY AND BLACK FLY ASH - ASPHALT NOTED		16.3	4.50+								
EDW-B011	S-3	5.0'-6.5'	FILL: GRAY FLY ASH		29.4	4.50+								
EDW-B011	S-4	7.5'-9.0'	FILL: DARK GRAY FLY ASH		45.3	3.00								
EDW-B011	S-5	9.0'-11.0'	FILL: VERY DARK GRAY FLY ASH		70.0		15.5	21.3	46.0	17.2				
EDW-B011	S-6	15.0'-17.0'	FILL: DARK GRAY FLY ASH		63.2									
EDW-B011	S-7	19.5'-21.5'	FILL: GRAY FLY ASH		84.9		0.2	16.7	58.0	25.1				
EDW-B011	S-8	25.0'-27.0'	FILL: DARK GRAY FLY ASH - CLAY NOTED		74.7									2.691
EDW-B011	S-9	30.0'-32.0'	FILL: DARK GRAY FLY ASH		73.7									
EDW-B011	S-10	35.0'-37.0'	FILL: DARK GRAY FLY ASH		93.9									
EDW-B011	S-13	40.0'-41.5'	BROWN AND GRAY LEAN CLAY	CL	47.9	1.00								
EDW-B011	S-14	45.0'-46.5'	GRAYISH BROWN FAT CLAY WITH SAND	CH	63.3	0.50					63	21	42	
EDW-B011	S-15	50.0'-51.5'	DARK GRAY AND GRAYISH BROWN LEAN CLAY	CL	62.5	0.50								
EDW-B011	S-16	55.0'-56.5'	GRAY LEAN CLAY	CL	52.9	0.75								
EDW-B011	S-17	60.0'-60.25'	BLUISH GRAY SOFT SHALE		9.1									

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynergy - Edwards Site | PROJECT NUMBER: MR155218 | CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	LL	PL	PI	Specific Gravity
EDW-B012	S-1	0.0'-1.5'	FILL: BROWN SANDY SILT WITH GRAVEL	ML	23.0									
EDW-B012	S-2	2.5'-4.0'	FILL: DARK GRAY FLY ASH		23.8	4.50+					28	26	2	
EDW-B012	S-3	5.0'-6.5'	FILL: DARK GRAY FLY ASH		26.5		0.0	9.6	73.7	16.7				
EDW-B012	S-4	7.5'-9.0'	FILL: DARK GRAY FLY ASH		26.5	4.50								
EDW-B012	S-5	10.0'-11.0'	FILL: DARK BROWN LEAN CLAY WITH SAND - FLY ASH NOTED	CL	24.7	3.75								
EDW-B012	S-5A	11.0'-11.5'	BROWN AND GRAYISH BROWN LEAN CLAY	CL	24.9	2.00								
EDW-B012	S-6	12.5'-14.0'	BROWN LEAN CLAY	CL	22.0	3.50								
EDW-B012	S-7	15.0'-16.5'	BROWN AND RUST BROWN MOTTLED LEAN CLAY	CL	24.3	3.25					48	19	29	
EDW-B012	S-8	20.0'-22.0'	BROWNISH GRAY MOTTHED LEAN CLAY WITH SAND	CL	23.8									
EDW-B012	S-9	25.0'-26.5'	BROWNISH GRAY LEAN CLAY WITH SAND	CL	23.2	1.25								
EDW-B012	S-10	30.0'-31.5'	BROWN AND GRAY LEAN CLAY	CL	24.8	1.50								
EDW-B012	S-11	35.0'-36.5'	RUST BROWN AND GRAY LEAN CLAY WITH SAND	CL	28.3	1.50								
EDW-B012	S-12	40.0'-41.5'	BLUISH GRAY AND BROWNISH GRAY LEAN CLAY	CL	32.2	1.00								
EDW-B012	S-13	45.0'-46.5'	BROWNISH GRAY LEAN CLAY	CL	50.2	1.25								
EDW-B012	S-14	47.0'-49.0'	DARK GRAY FAT CLAY	CH	50.8						54	20	34	
EDW-B012	S-15	49.0'-50.5'	GRAY AND BROWNISH GRAY LEAN CLAY WITH SAND	CL	67.4	1.00								
EDW-B012	S-16	55.0'-55.5'	GRAY LEAN CLAY WITH SAND	CL	50.5	1.75								
EDW-B012	S-16A	55.5'-56.5'	BLUISH GRAY CLAYEY SILT	CL-ML	15.3	4.50								
EDW-B012	S-17	60.0'-60.21'	BLUISH GRAY CLAYEY SILT	CL-ML	17.9	1.50								
EDW-B013	S-1	0.0'-1.5'	FILL: BROWN AND DARK BROWN LEAN CLAY WITH SAND AND GRAVEL	CL	13.6	4.50+								
EDW-B013	S-2	2.5'-4.0'	BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND	CL	17.4	4.50+								
EDW-B013	S-3	6.0'-8.0'	BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL	CL	24.3						49	21	28	
EDW-B013	S-4	8.0'-9.5'	DARK GRAY AND RUST BROWN MOTTLED LEAN CLAY	CL	24.3	3.00								
EDW-B013	S-5	10.0'-11.5'	DARK GRAY LEAN CLAY	CL	25.4	2.25								
EDW-B013	S-6	15.0'-16.5'	DARK GRAY AND BROWNISH GRAY LEAN CLAY	CL	25.5	1.50					41	17	24	
EDW-B013	S-7	20.0'-21.5'	BROWN AND DARK GRAY LEAN CLAY	CL	23.5	1.75								
EDW-B013	S-8	25.0'-26.5'	DARK BROWNISH GRAY LEAN CLAY	CL	27.7									
EDW-B013	S-9	30.0'-31.5'	GRAY AND RUST BROWN MOTTLED SANDY LEAN CLAY	CL	20.2	0.50								
EDW-B013	S-10	32.0'-34.0'	GRAY AND BROWN LEAN CLAY WITH SAND	CL	33.3						42	23	19	
EDW-B013	S-11	34.0'-35.5'	DARK GRAY LEAN CLAY	CL	58.0	0.50								
EDW-B013	S-12	40.0'-41.5'	GRAY LEAN CLAY WITH SAND	CL	54.5	1.75								
EDW-B013	S-13	45.0'-46.5'	GRAY LEAN CLAY - CALCIUM CABONATE SEAMS AND SHELL NOTED	CL	66.2	1.25								
EDW-B013	S-3	6.0'-8.0'	BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL	CL	20.0									

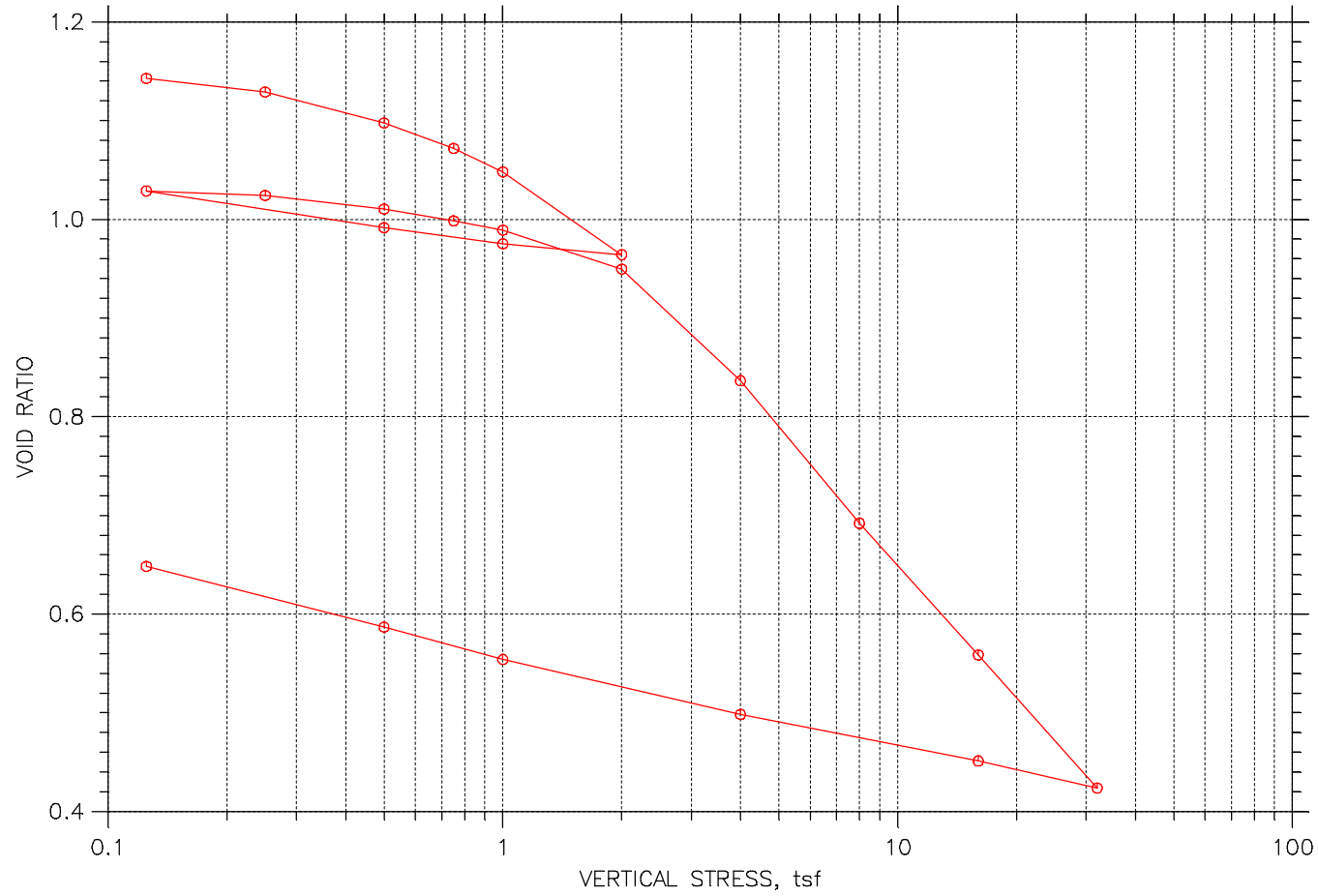
LABORATORY TESTING SUMMARY

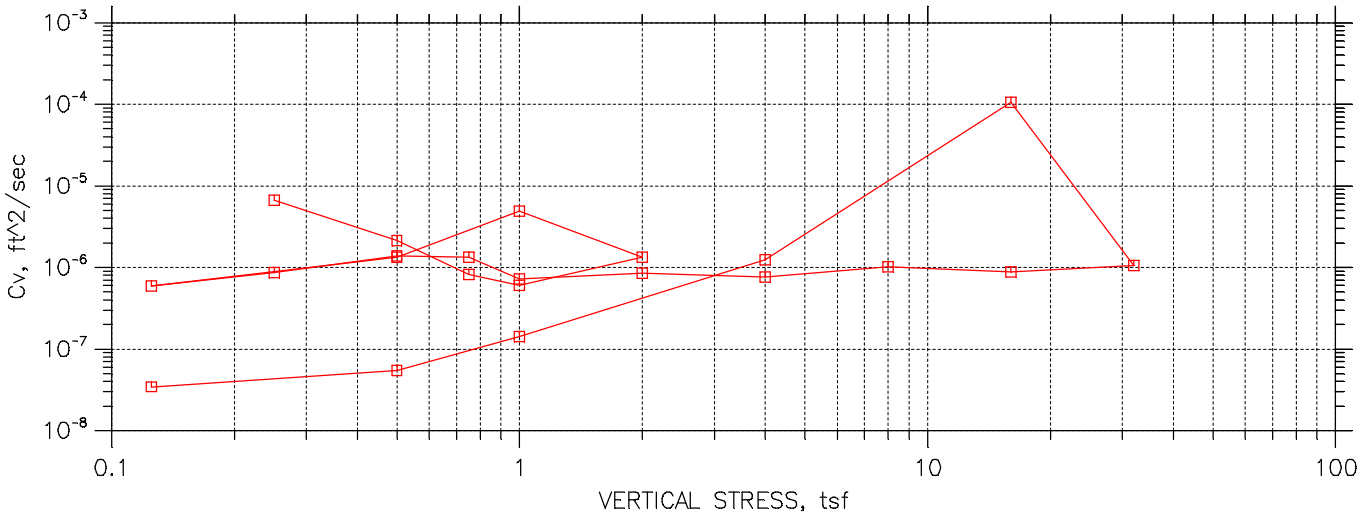
PROJECT NAME: Dynergy - Edwards Site | PROJECT NUMBER: MR155218 | CLIENT: AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	LL	PL	PI	Specific Gravity
EDW-B014	S-1	0.0'-1.5'	FILL: DARK GRAY FLY ASH		28.2	4.00								
EDW-B014	S-2	2.5'-3.5'	FILL: DARK GRAY CLAYEY SILT - FLY ASH NOTED	CL-ML	40.8	1.50								
EDW-B014	S-2A	3.5'-4.0'	FILL: GRAY CLAYEY SILT WITH SAND - FLY ASH NOTED	CL-ML	50.0									
EDW-B014	S-4	7.0'-8.5'	FILL: GRAY SILTY SAND WITH GRAVEL - FLY ASH NOTED	SM	60.2		0.0	35.1	45.4	19.5				
EDW-B014	S-6	15.0'-17.0'	FILL: GRAY AND DARK GRAY FLY ASH		78.7	3.50								
EDW-B014	S-7	20.0'-22.5'	FILL: DARK GRAY FLY ASH		86.5	1.50								2.524
EDW-B014	S-8	25.0'-26.7'	FILL: DARK GRAY FLY ASH - CLAY NOTED		73.1									
EDW-B014	S-9	30.0'-31.5'	GRAY AND DARK GRAY LEAN CLAY - ORGANIC POCKETS NOTED	CL	48.7									
EDW-B014	S-10	35.0'-36.7'	GRAY LEAN CLAY	CL	31.6	0.75								
EDW-B014	S-11	40.0'-40.5'	BLUISH GRAY LEAN CLAY WITH SAND AND GRAVEL	CL	27.3	4.00								2.719
EDW-B014	S-11A	40.5'-41.0'	BLUISH GRAY AND GREENISH GRAY SILT WITH SOFT SHALE	ML	19.6	4.50+								
EDW-B014	S-11B	41.0'-41.5'	GRAY SOFT SHALE		10.2									
EDW-B014	S-12	45.0'-45.5'	GRAY SILT WITH SAND	ML	14.5	4.50								
EDW-B015	S-1	0.0'-1.5'	FILL: GRAYISH BROWN SANDY SILT	ML	54.7									
EDW-B015	S-2	2.5'-4.0'	BROWN SAND WITH GRAVEL	SP	4.5									
EDW-B015	S-3	5.0'-6.5'	BROWN SAND WITH GRAVEL	SP	5.4									
EDW-B015	S-4	7.5'-9.0'	BROWN SAND WITH GRAVEL	SP	7.2									
EDW-B015	S-5	10.0'-11.5'	BROWN SAND WITH GRAVEL	SP	6.5									
EDW-B015	S-6	13.0'-14.25'	BROWN AND GRAY GRAVEL	GP	3.6									
EDW-B015	S-7	15.0'-16.5'	LIGHT GRAY GRAVEL WITH SAND - LIMESTONE FRAGMENTS NOTED	GP	8.2									
EDW-B015	S-8	20.0'-21.5'	GRAY GRAVEL WITH SAND	GP	7.8									
EDW-B015	S-9	25.0'-26.5'	LIGHT GRAY GRAVEL WITH SAND AND SILT	GP	8.1									
EDW-B015	S-10	31.0'-33.0'	BROWN AND GRAY MOTTLED SANDY LEAN CLAY WITH GRAVEL	CL	20.2						24	13	11	
EDW-B015	S-11	35.0'-36.5'	GRAY AND DARK GRAY LEAN CLAY	CL	33.8	1.50								
EDW-B015	S-12	37.0'-39.0'	DARK GRAY FAT CLAY	CH	41.0						66	23	43	
EDW-B015	S-13	39.0'-40.5'	BROWN AND GRAY LEAN CLAY	CL	36.2	0.50								
EDW-B015	S-14	45.0'-46.5'	BROWN AND GRAY LEAN CLAY WITH SAND	CL	49.4	1.00								
EDW-B015	S-15	50.0'-51.0'	GRAY LEAN CLAY	CL	30.9	1.50								
EDW-B015	S-16	55.0'-55.5'	BLUISH GRAY SILT - SHALE NOTED	ML	11.0	4.25								

CONSOLIDATION TEST DATA

SUMMARY REPORT





Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

CONSOLIDATION TEST DATA

Project: DYNERGY EDWARDS | Location: BARTONVILLE, IL | Project No.: MR155218
Boring No.: EDW-B003 | Tested By: HP | Checked By: BCM
Sample No.: S-12 | Test Date: 10/26/15 | Depth: 45.0'-47.0'
Test No.: EDW003S12 | Sample Type: 3.0" ST | Elevation: ----

Soil Description: DARK GRAY FAT CLAY WITH SAND CH
Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435

Estimated Specific Gravity: 2.72 | Liquid Limit: 51 | Initial Height: 1.00 in
Initial Void Ratio: 1.15 | Plastic Limit: 24 | Specimen Diameter: 2.50 in
Final Void Ratio: 0.65 | Plasticity Index: 27

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	X-14	RING	RING	X-19
Wt. Container + Wet Soil, gm	165.03	249.08	236.35	164.81
Wt. Container + Dry Soil, gm	127.13	213.35	213.35	142.68
Wt. Container, gm	44.81	111.54	111.54	44.72
Wt. Dry Soil, gm	82.32	101.81	101.81	97.96
Water Content, %	46.04	35.09	22.59	22.59
Void Ratio	---	1.15	0.65	---
Degree of Saturation, %	---	83.18	94.86	---
Dry Unit Weight, pcf	---	79.069	103.05	---

CONSOLIDATION TEST DATA

Project: DYNERGY EDWARDS
Boring No.: EDW-B003
Sample No.: S-12
Test No.: EDW003S12

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 10/26/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 45.0'-47.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: DARK GRAY FAT CLAY WITH SAND CH
Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435

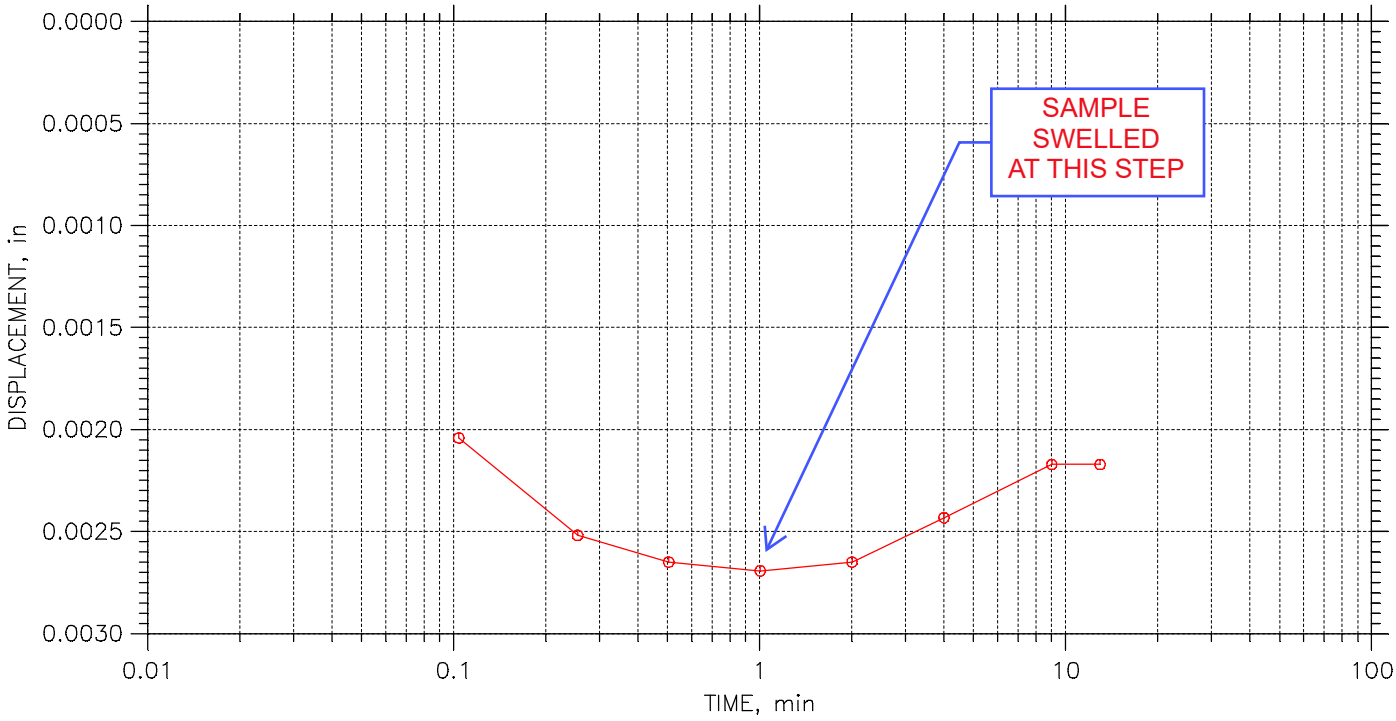
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	T50 Fitting Sq.Rt. min	T50 Fitting Log min	Coefficient of Consolidation Sq.Rt. ft^2/sec	Coefficient of Consolidation Log ft^2/sec	Coefficient of Consolidation Ave. ft^2/sec
1	0.125	0.002172	1.143	0.22	0.0	0.0	0.00e+000	0.00e+000	0.00e+000
2	0.25	0.008644	1.129	0.87	1.0	0.6	5.41e-006	8.79e-006	6.69e-006
3	0.5	0.02315	1.098	2.32	3.9	1.2	1.42e-006	4.45e-006	2.15e-006
4	0.75	0.03518	1.072	3.53	6.5	4.7	8.27e-007	1.15e-006	9.61e-007
5	1	0.04617	1.048	4.63	8.6	0.0	6.06e-007	0.00e+000	6.06e-007
6	2	0.08522	0.964	8.54	3.7	0.0	1.33e-006	0.00e+000	1.33e-006
7	1	0.08005	0.975	8.02	1.0	0.0	4.94e-006	0.00e+000	4.94e-006
8	0.5	0.07245	0.992	7.26	3.7	0.0	1.33e-006	0.00e+000	1.33e-006
9	0.125	0.05516	1.029	5.53	8.4	0.0	5.93e-007	0.00e+000	5.93e-007
10	0.25	0.05733	1.024	5.74	5.8	0.0	8.68e-007	0.00e+000	8.68e-007
11	0.5	0.06376	1.010	6.39	3.6	0.0	1.38e-006	0.00e+000	1.38e-006
12	0.75	0.06924	0.999	6.94	3.7	0.0	1.33e-006	0.00e+000	1.33e-006
13	1	0.07358	0.989	7.37	11.4	2.0	4.29e-007	2.42e-006	7.28e-007
14	2	0.09195	0.950	9.21	8.7	2.5	5.48e-007	1.92e-006	8.53e-007
15	4	0.1446	0.836	14.49	5.8	5.7	7.57e-007	7.69e-007	7.63e-007
16	8	0.2117	0.692	21.21	3.8	3.7	1.02e-006	1.04e-006	1.03e-006
17	16	0.2736	0.559	27.42	3.8	3.6	8.62e-007	9.02e-007	8.81e-007
18	32	0.3363	0.424	33.70	2.1	3.1	1.30e-006	8.96e-007	1.06e-006
19	16	0.3237	0.451	32.43	0.0	0.0	1.05e-004	0.00e+000	1.05e-004
20	4	0.3017	0.498	30.23	2.1	0.0	1.25e-006	0.00e+000	1.25e-006
21	1	0.2758	0.554	27.64	20.3	0.0	1.42e-007	0.00e+000	1.42e-007
22	0.5	0.2611	0.586	26.16	78.7	39.4	3.86e-008	7.70e-008	5.14e-008
23	0.125	0.2322	0.648	23.27	93.5	0.0	3.45e-008	0.00e+000	3.45e-008

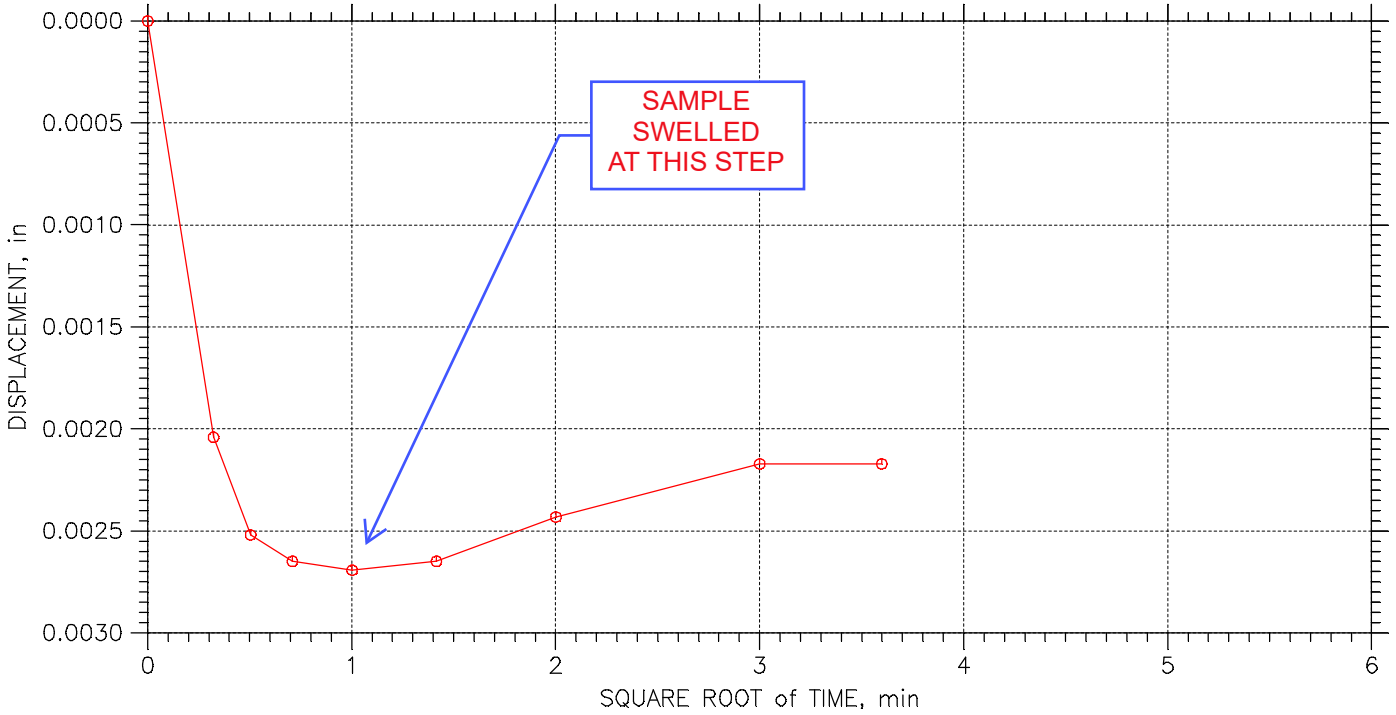
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 1 of 23

Stress: 0.125 tsf





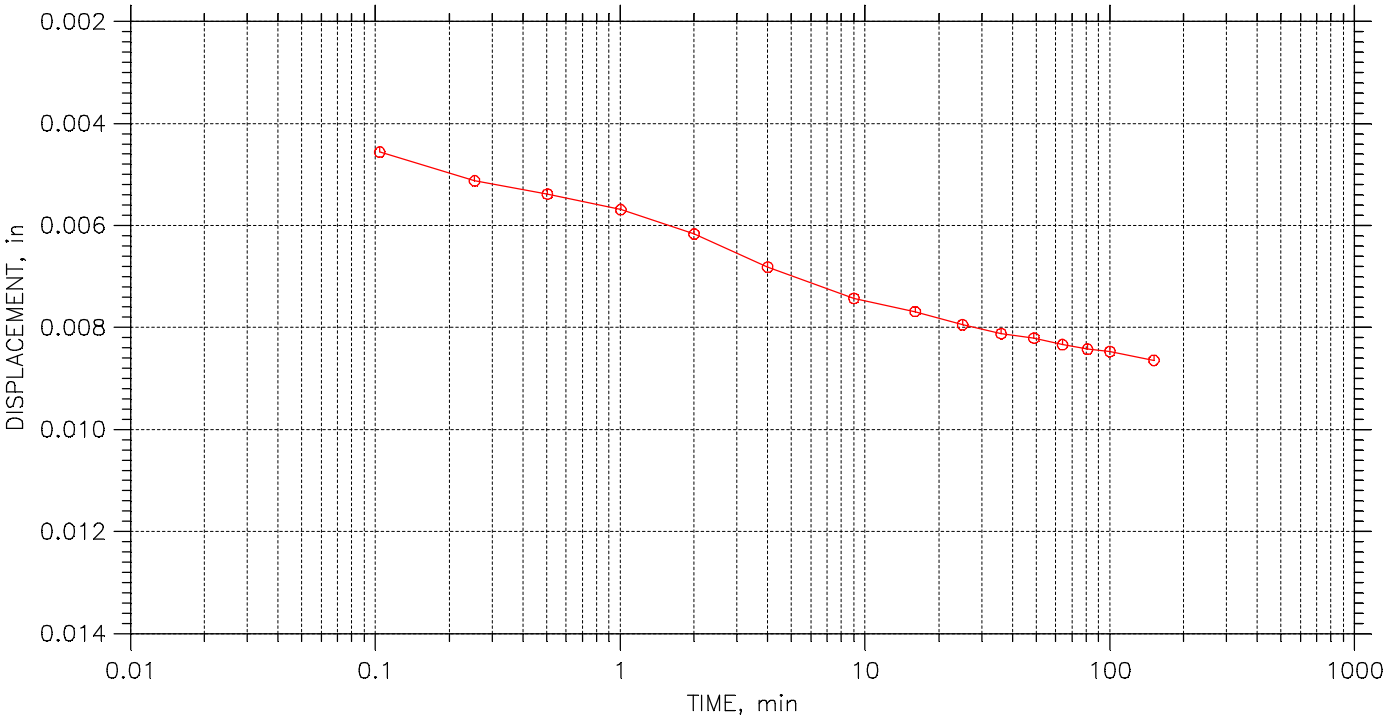
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

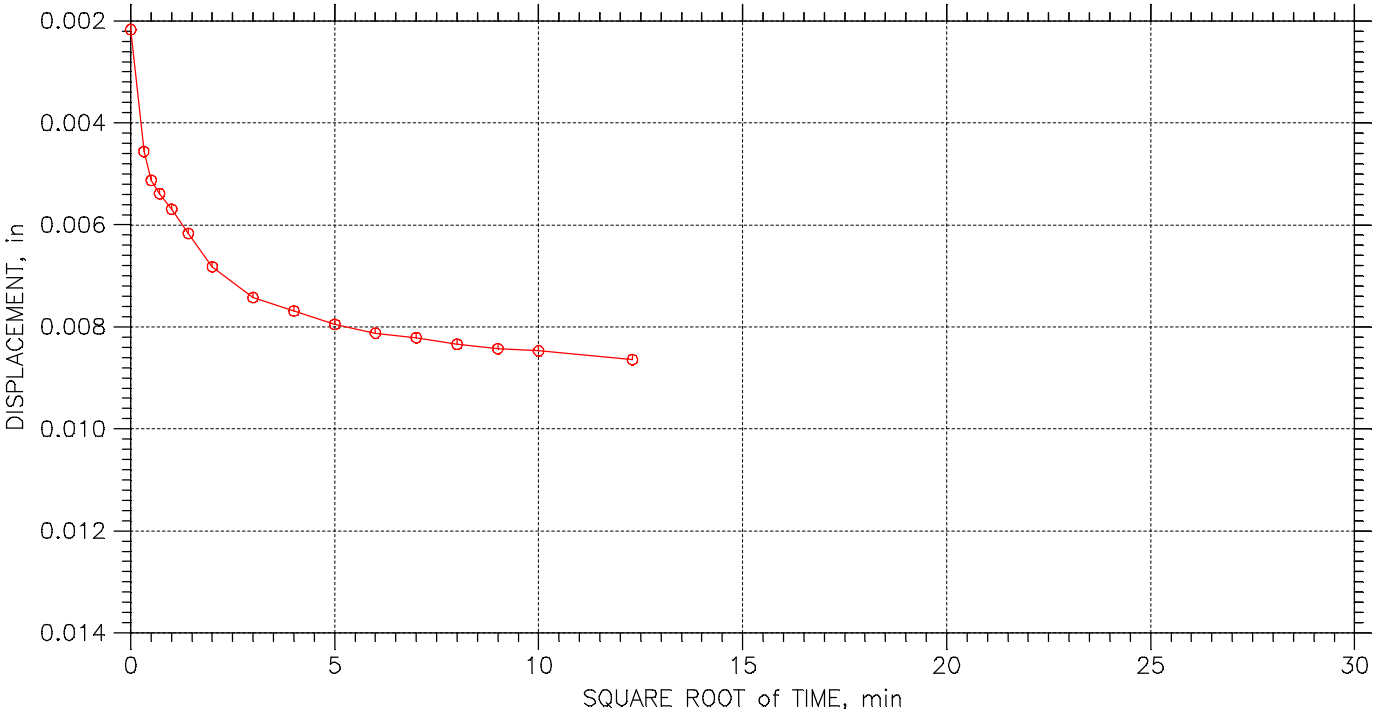
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 2 of 23

Stress: 0.25 tsf





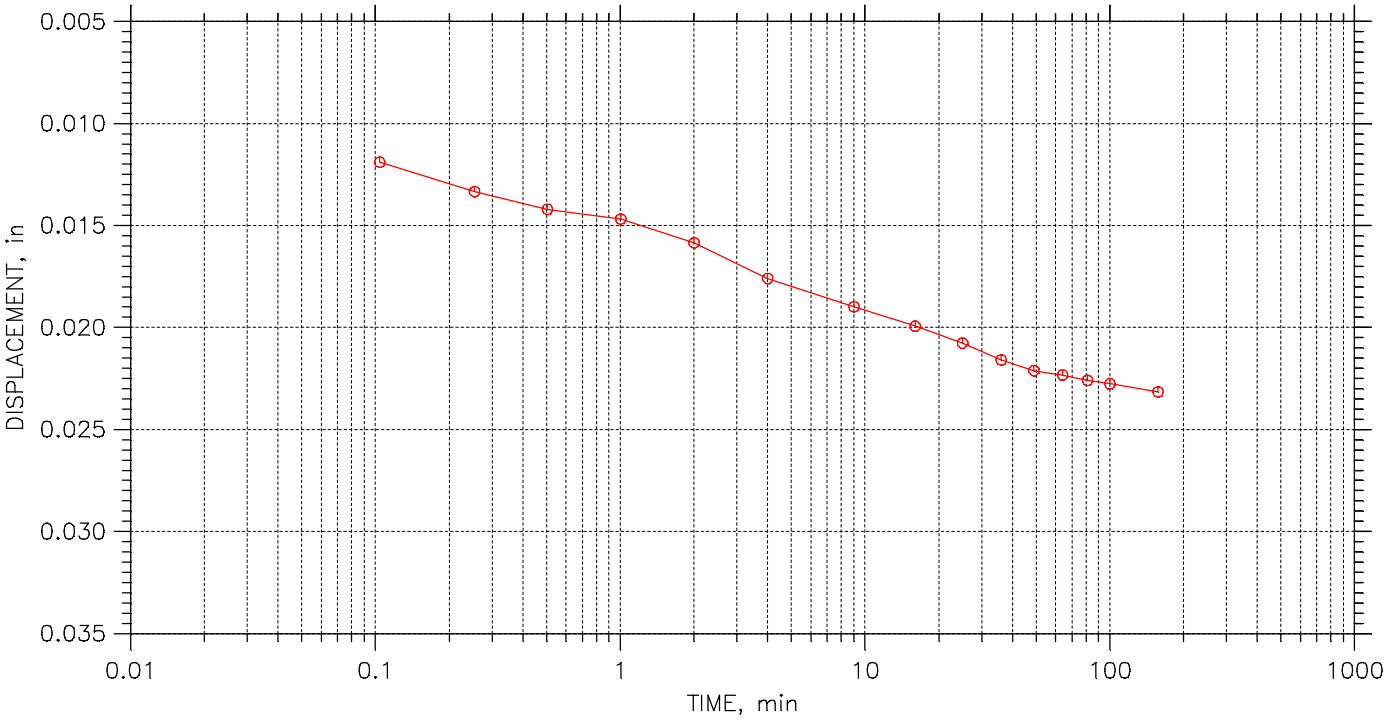
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

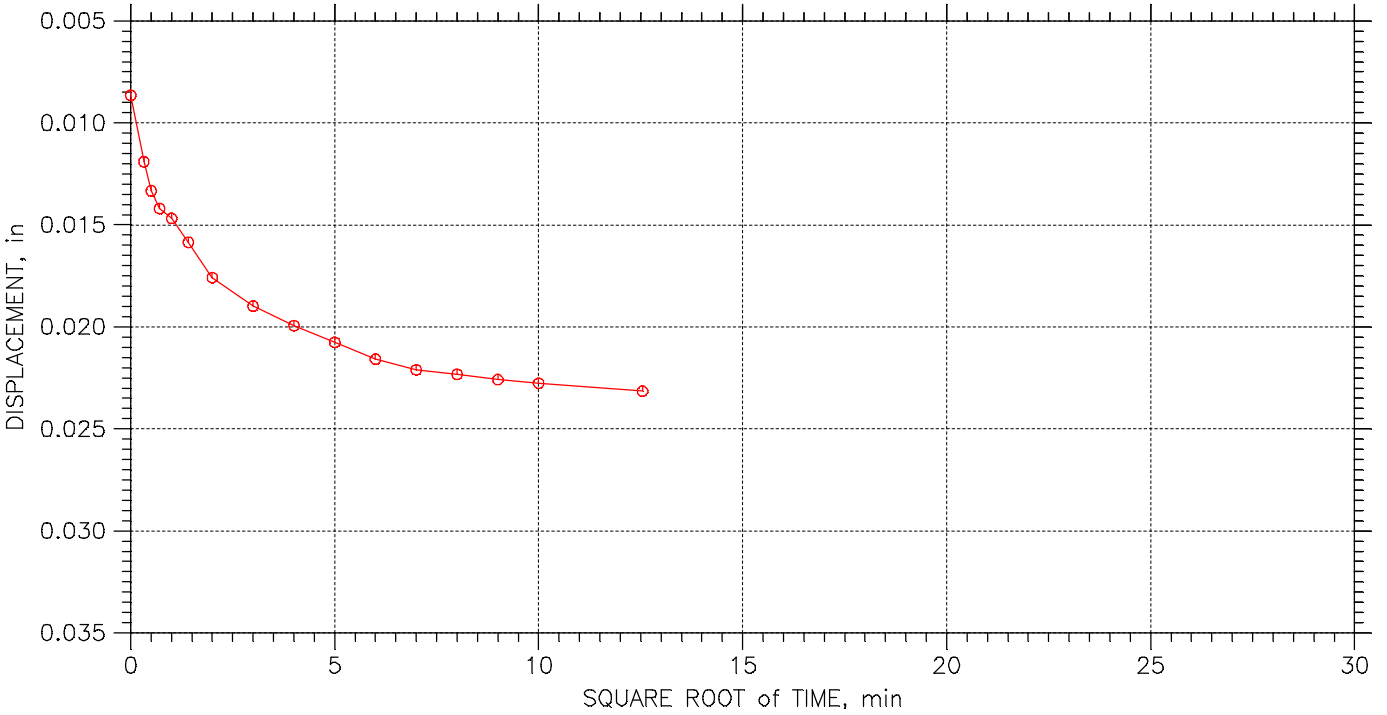
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 3 of 23

Stress: 0.5 tsf





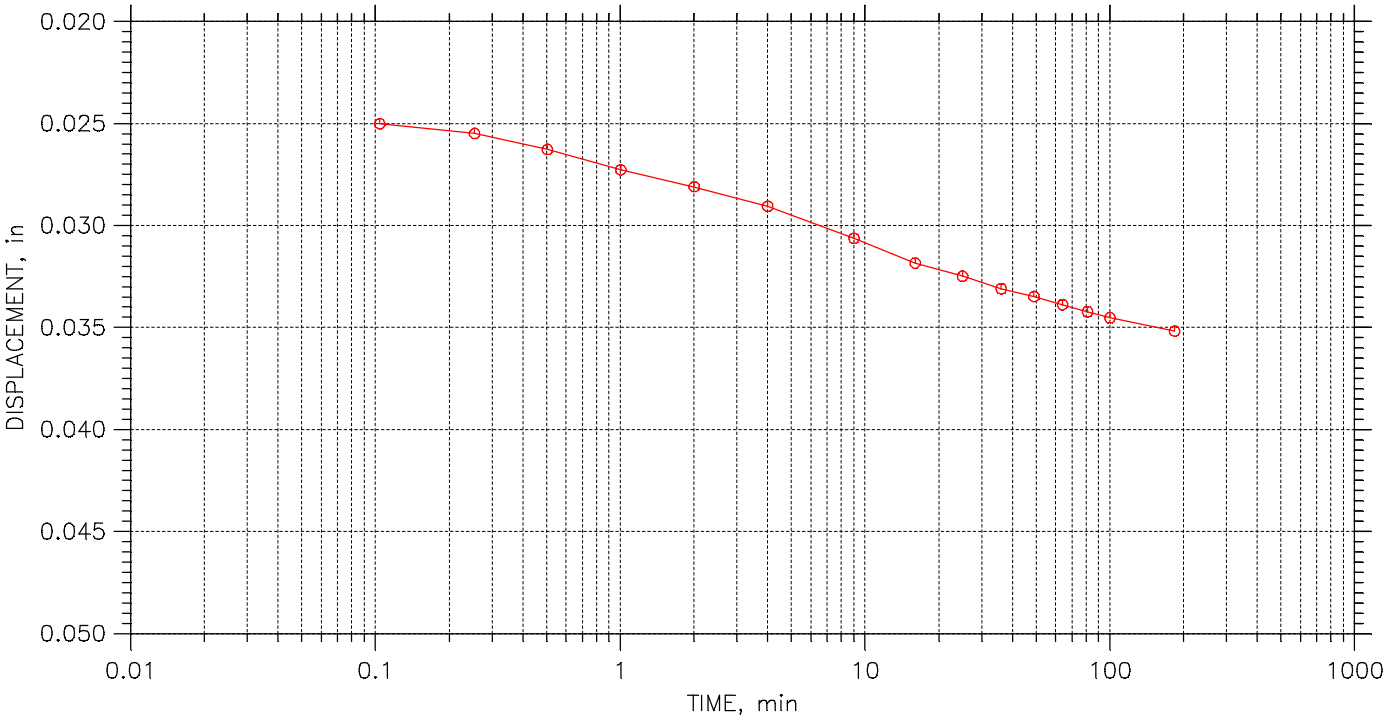
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

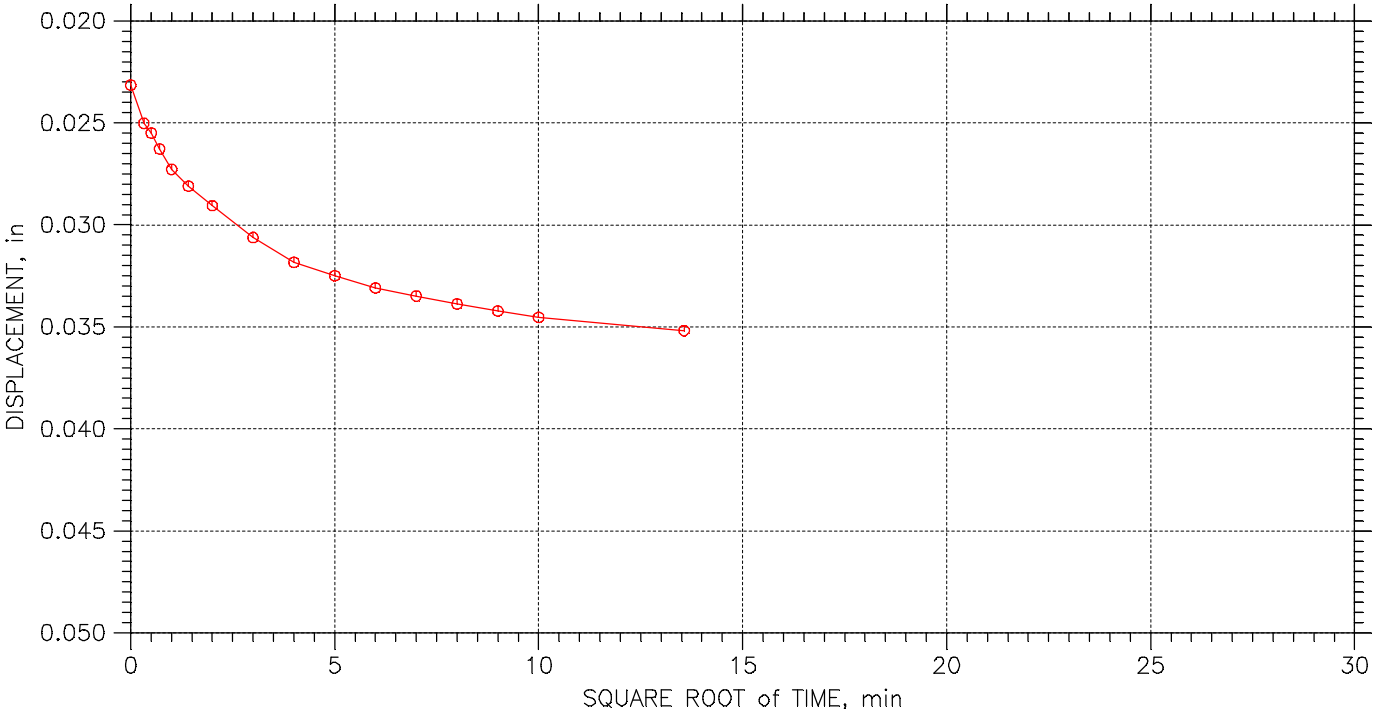
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 4 of 23

Stress: 0.75 tsf





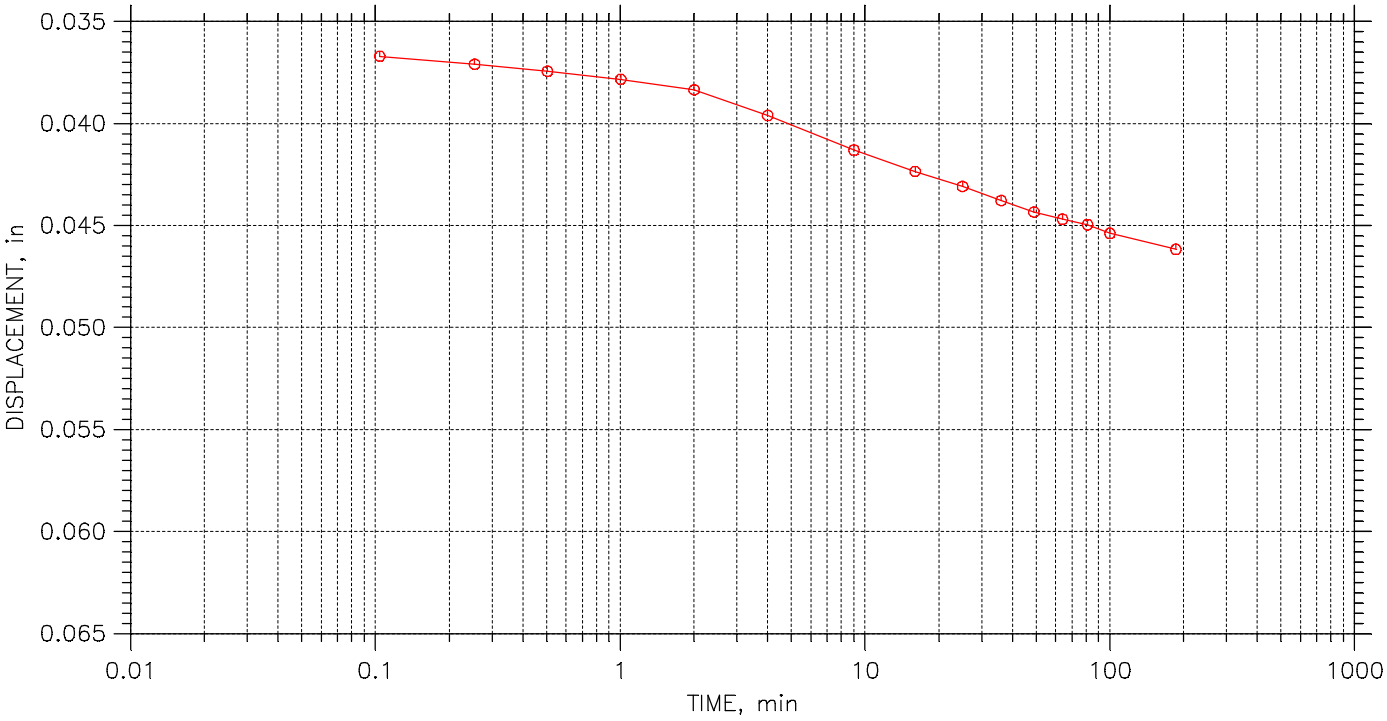
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

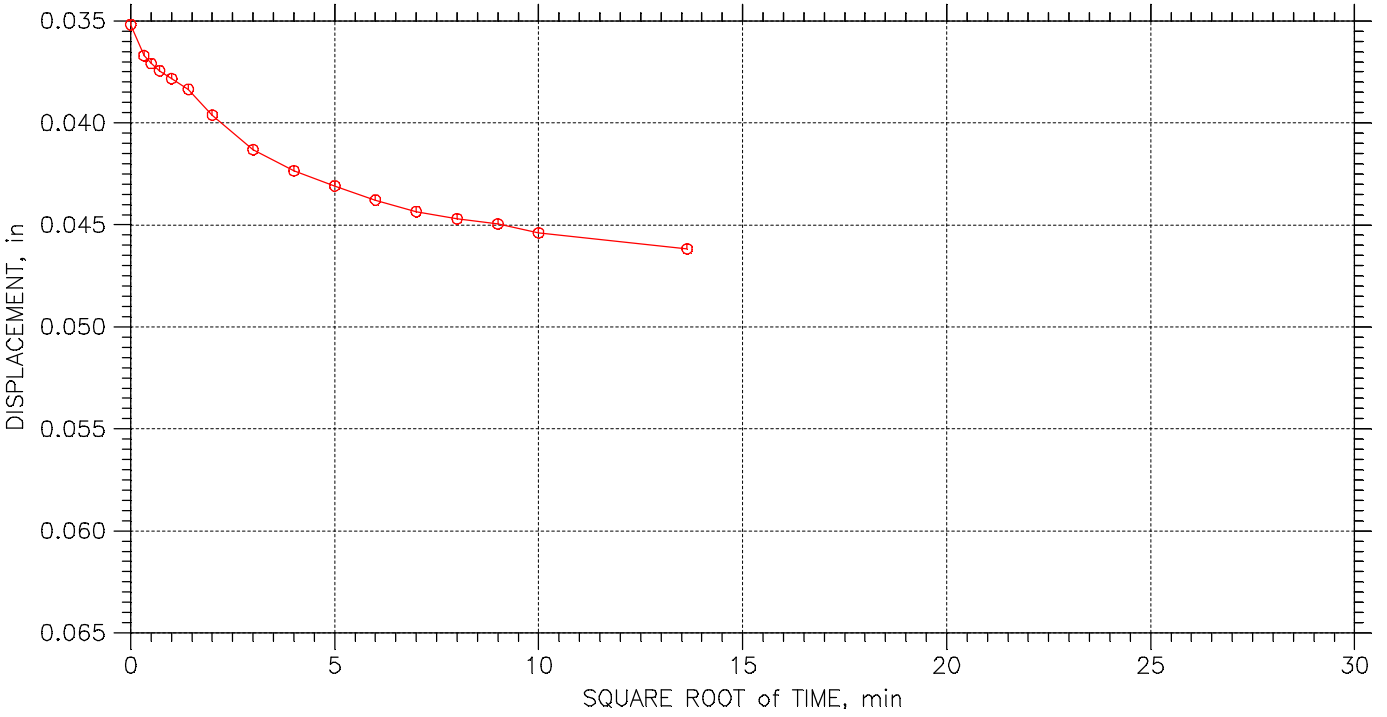
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 5 of 23

Stress: 1. tsf





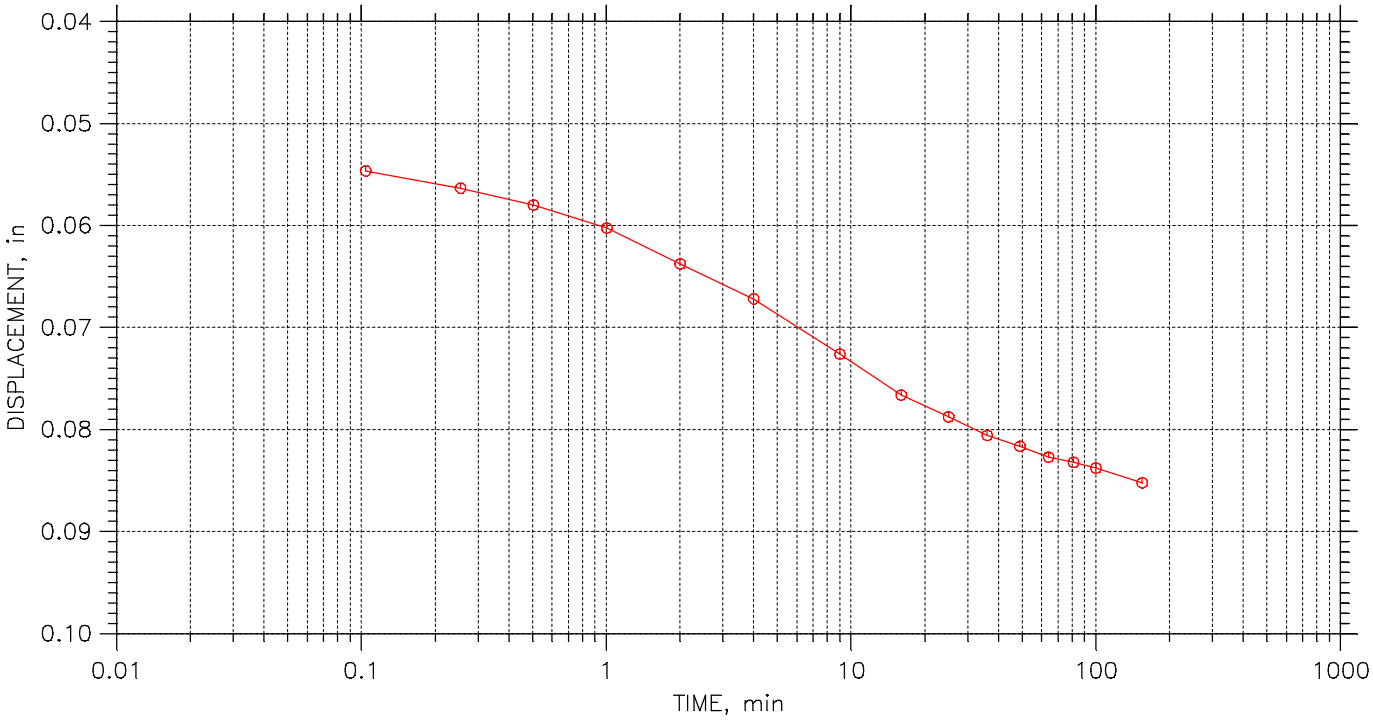
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

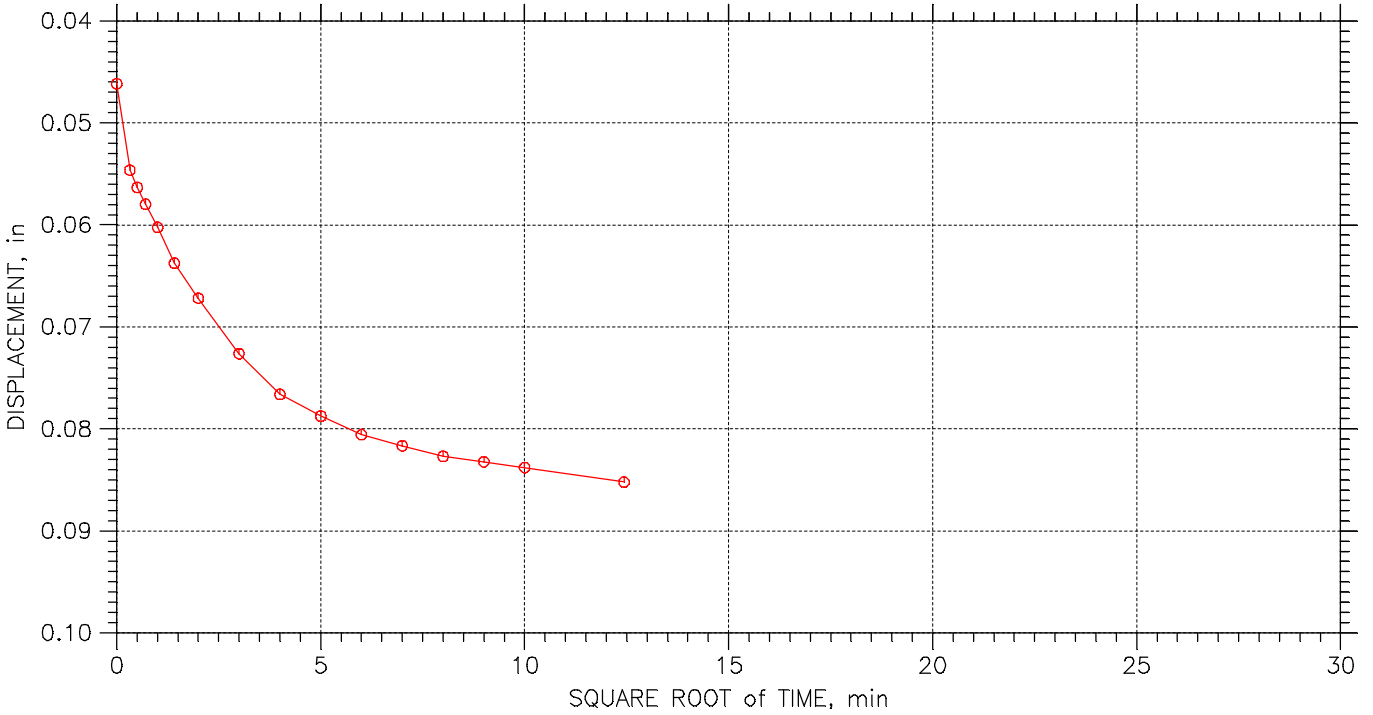
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 6 of 23

Stress: 2. tsf





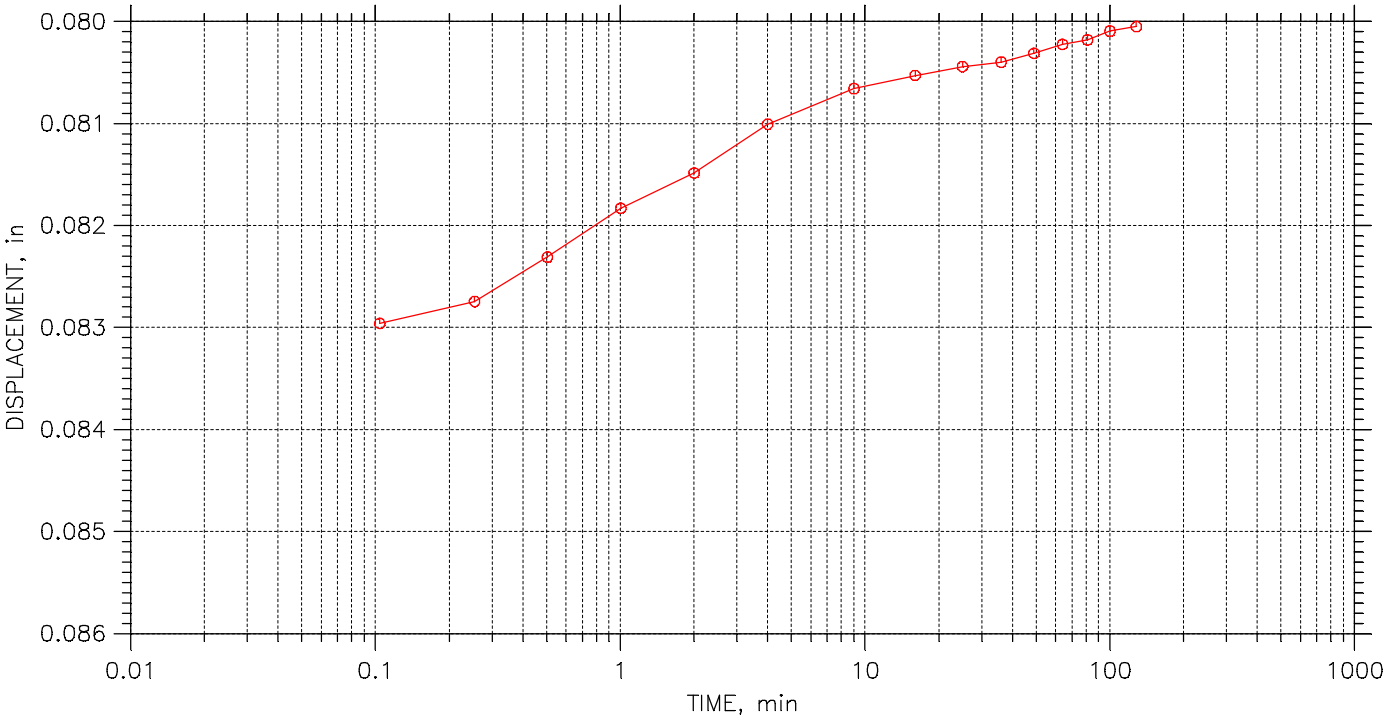
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

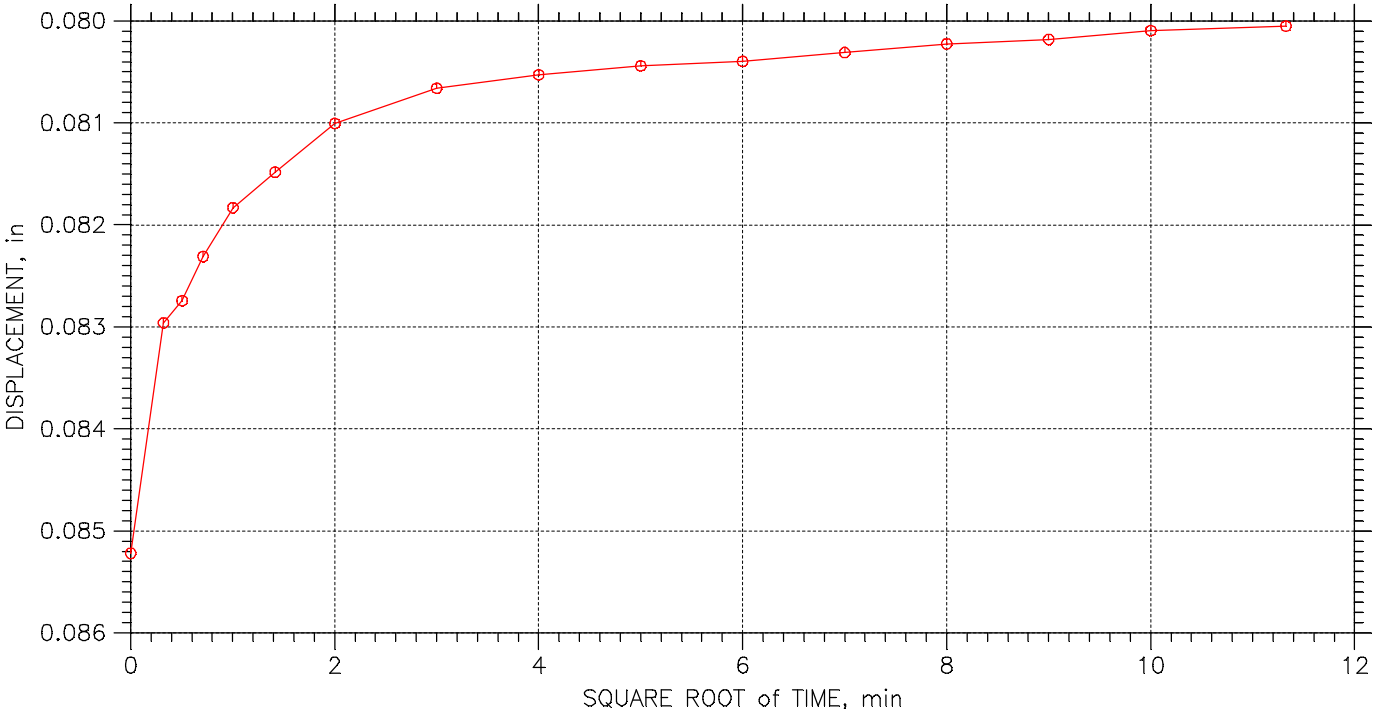
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 7 of 23

Stress: 1. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

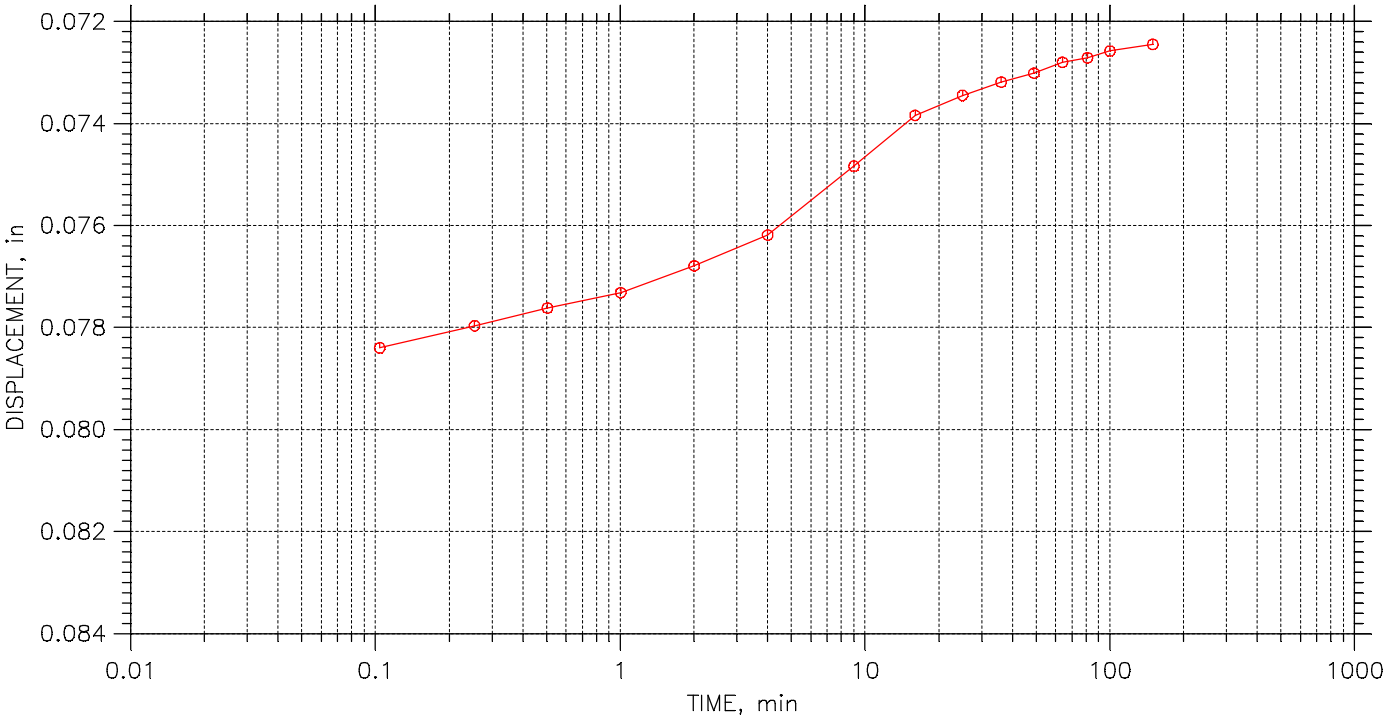
Mon, 16-NOV-2015 17:10:57

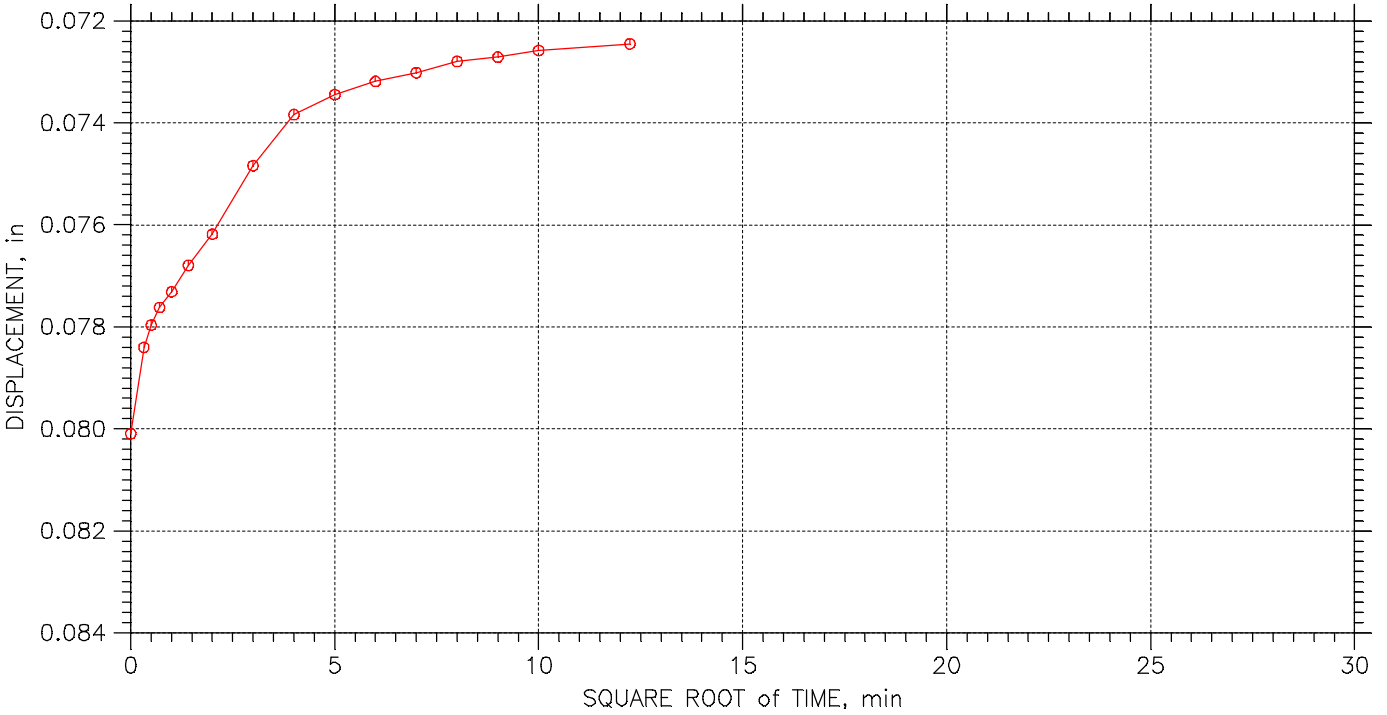
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 8 of 23

Stress: 0.5 tsf





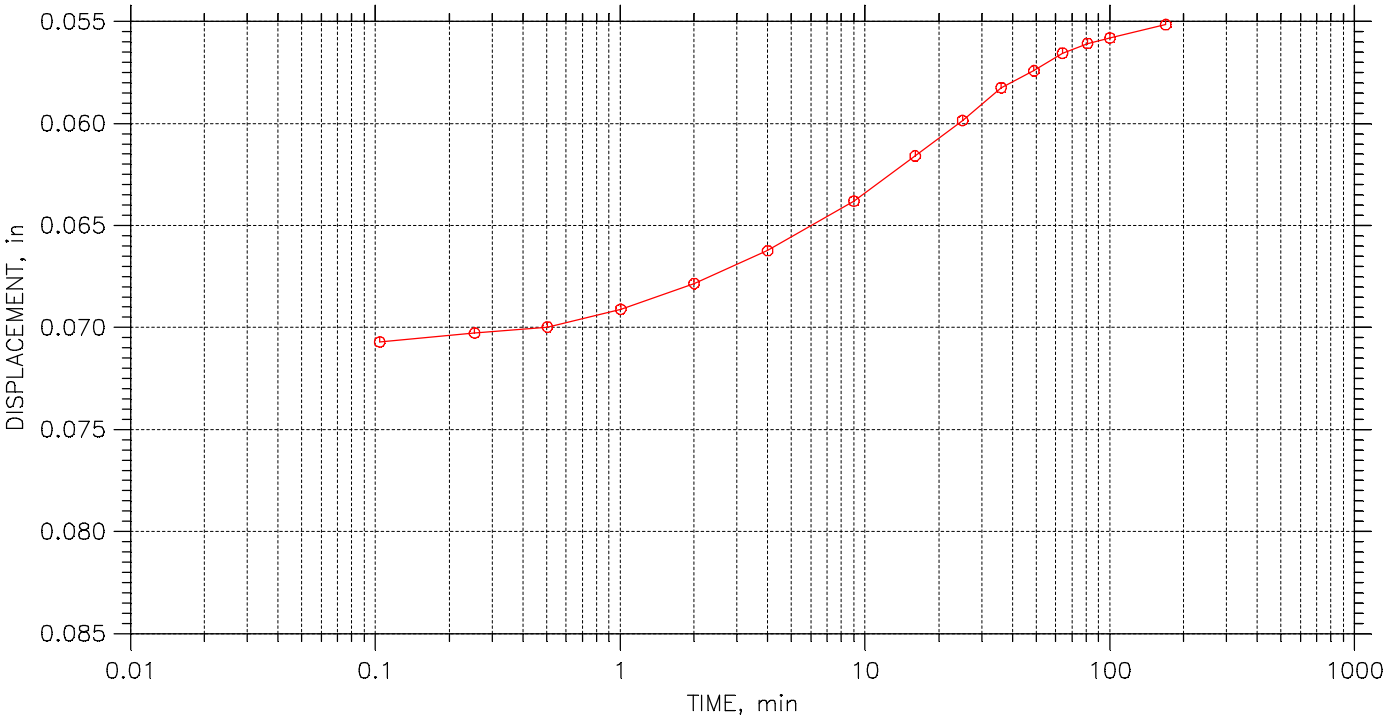
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

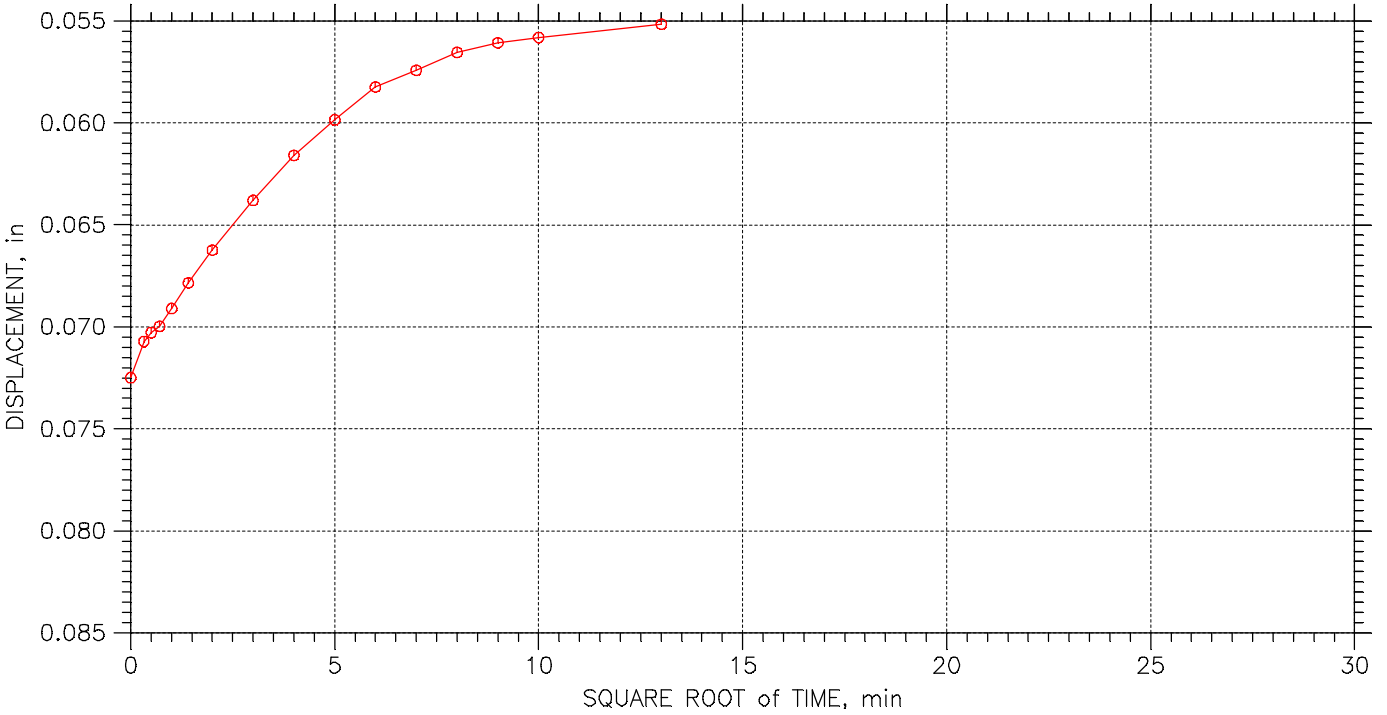
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 9 of 23

Stress: 0.125 tsf





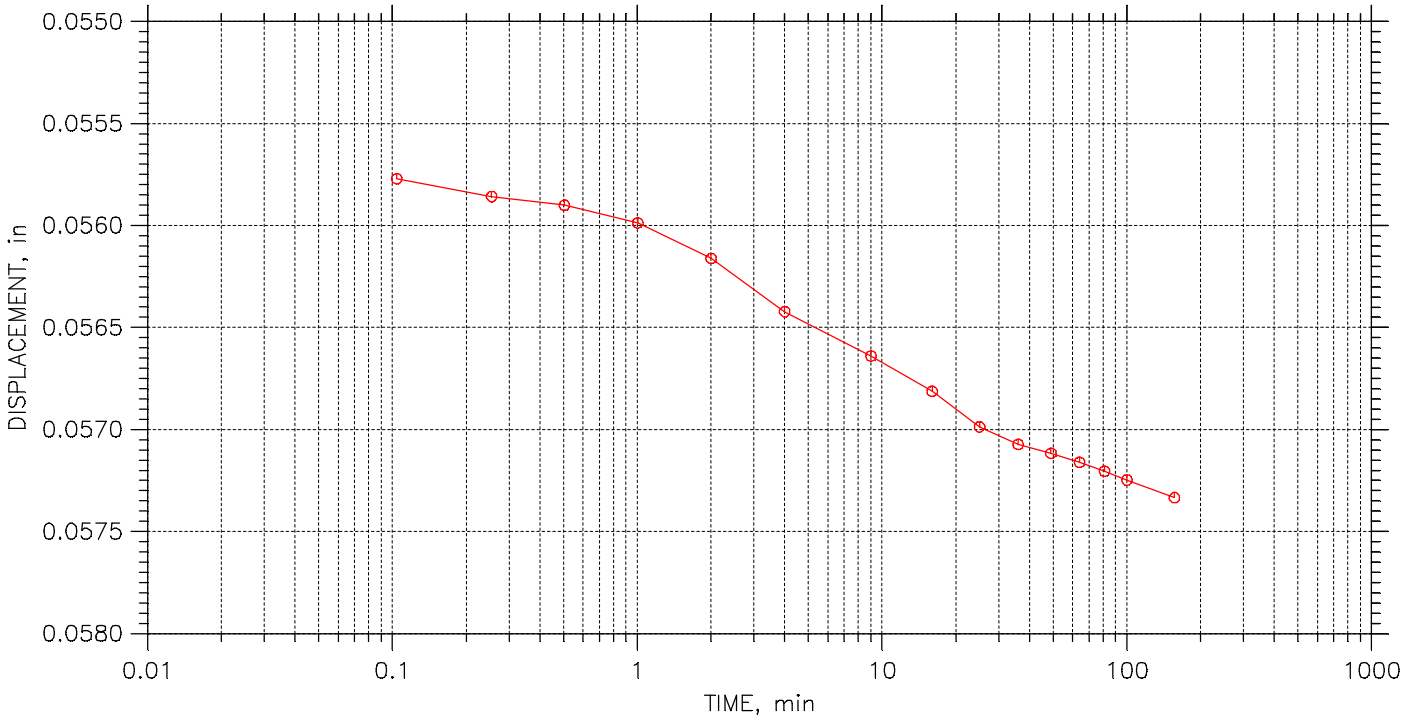
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

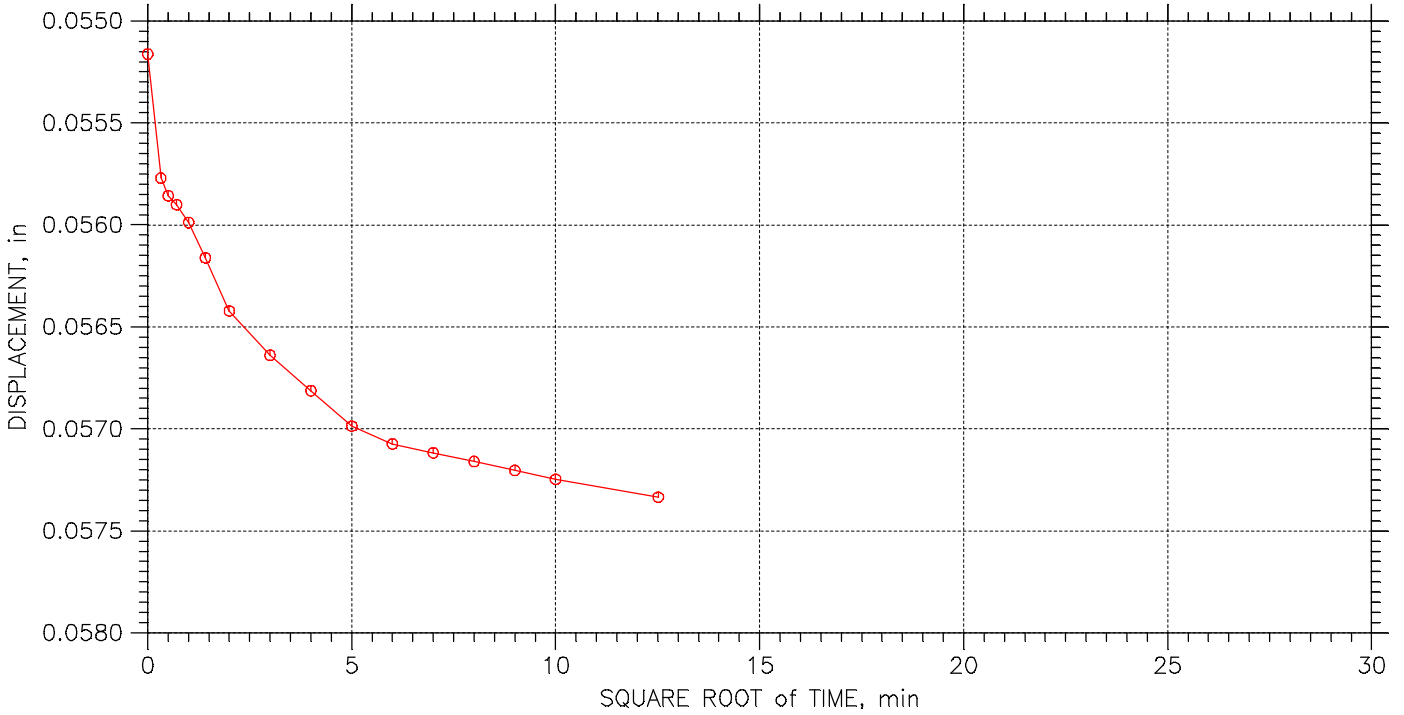
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 10 of 23

Stress: 0.25 tsf





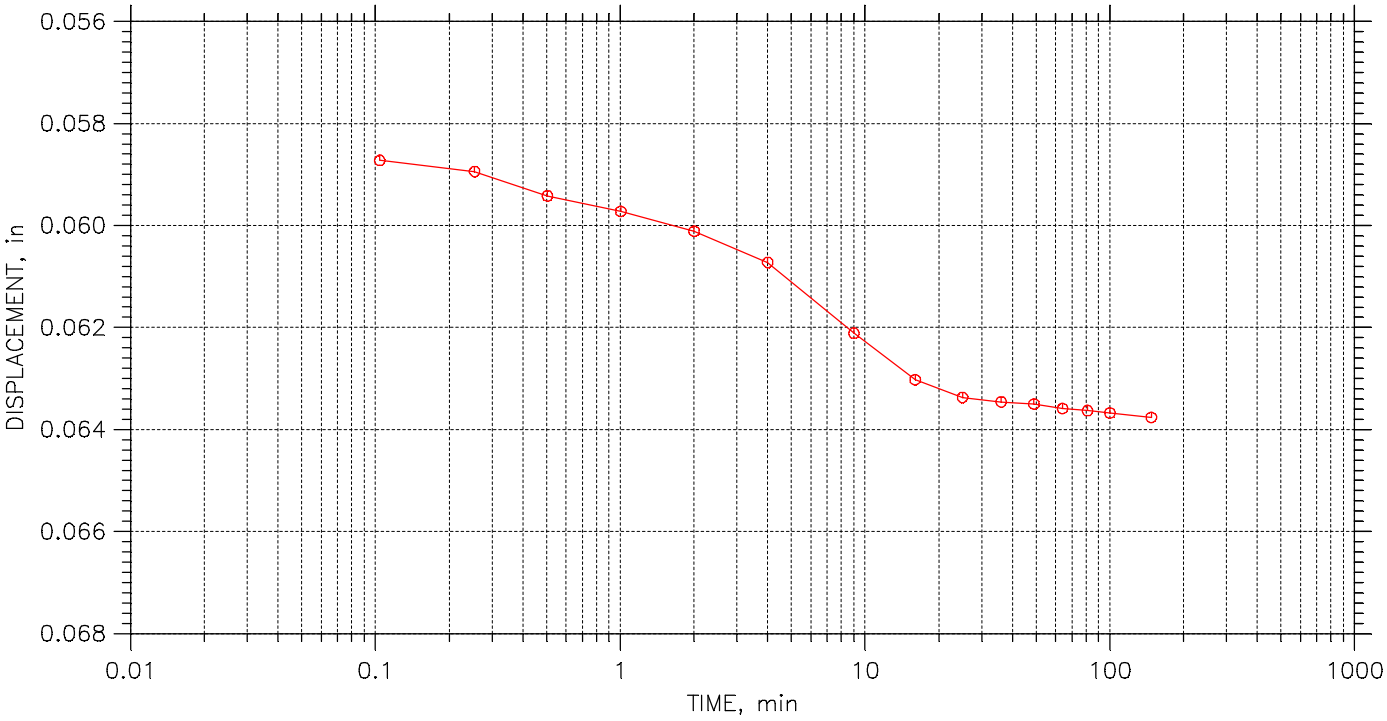
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

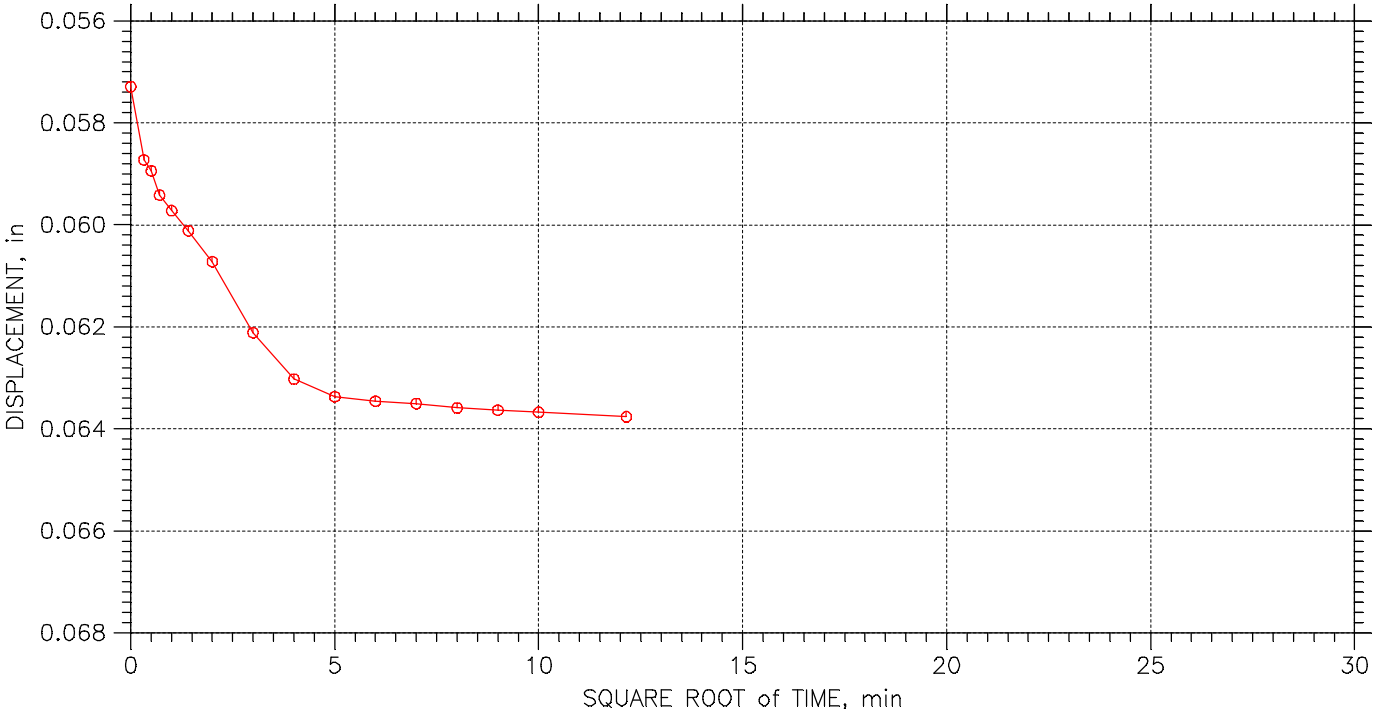
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 11 of 23

Stress: 0.5 tsf





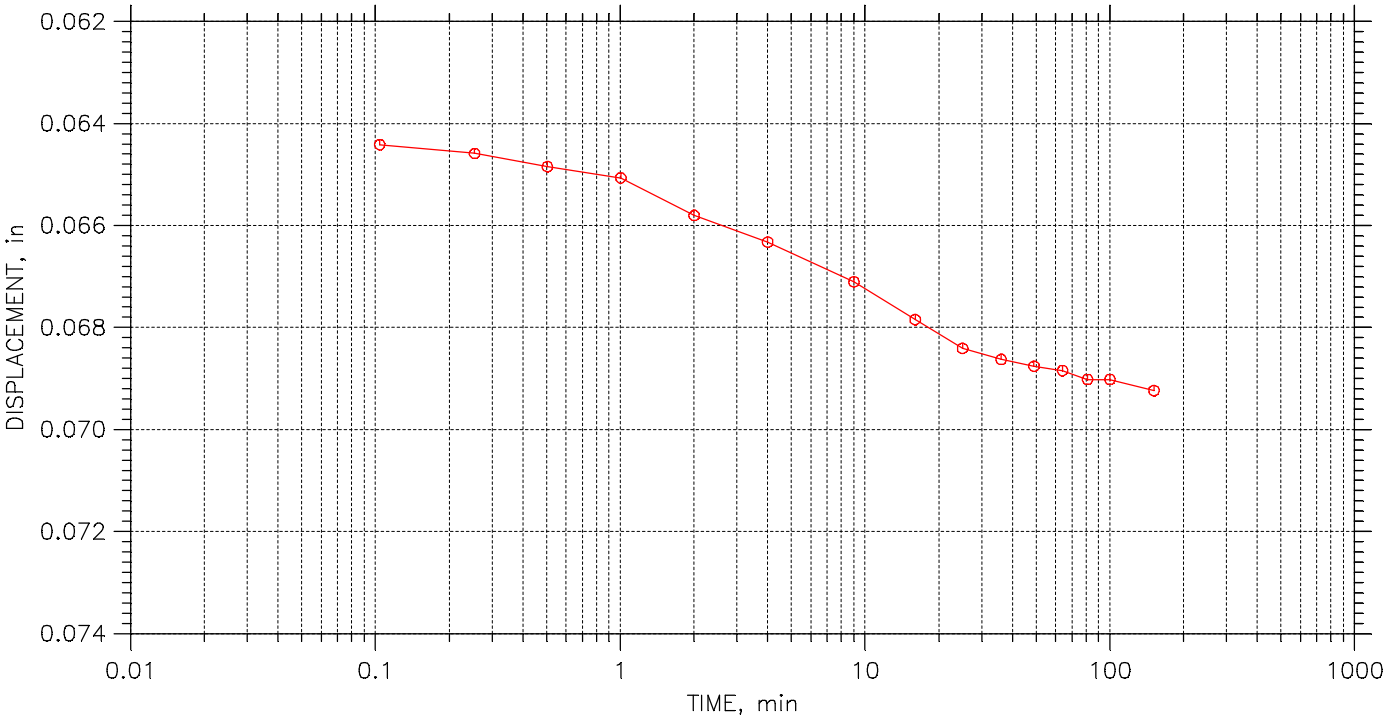
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

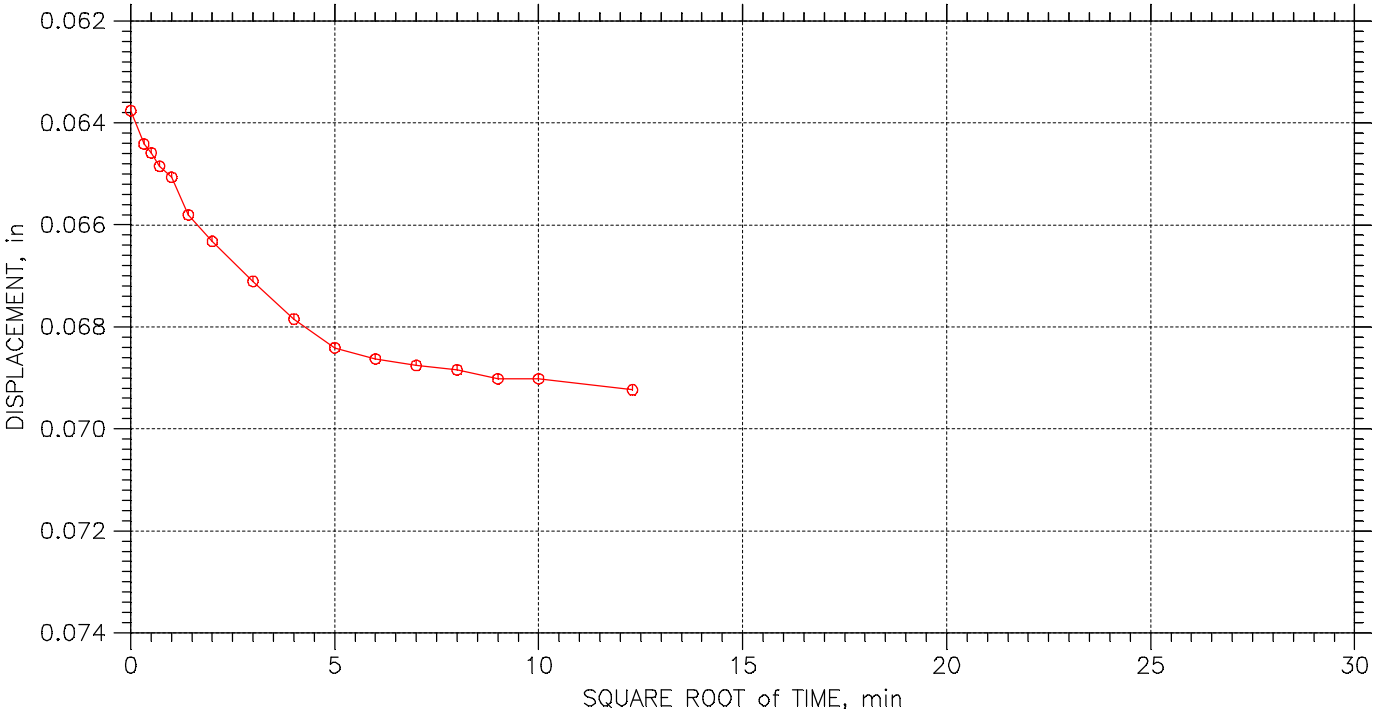
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 12 of 23

Stress: 0.75 tsf





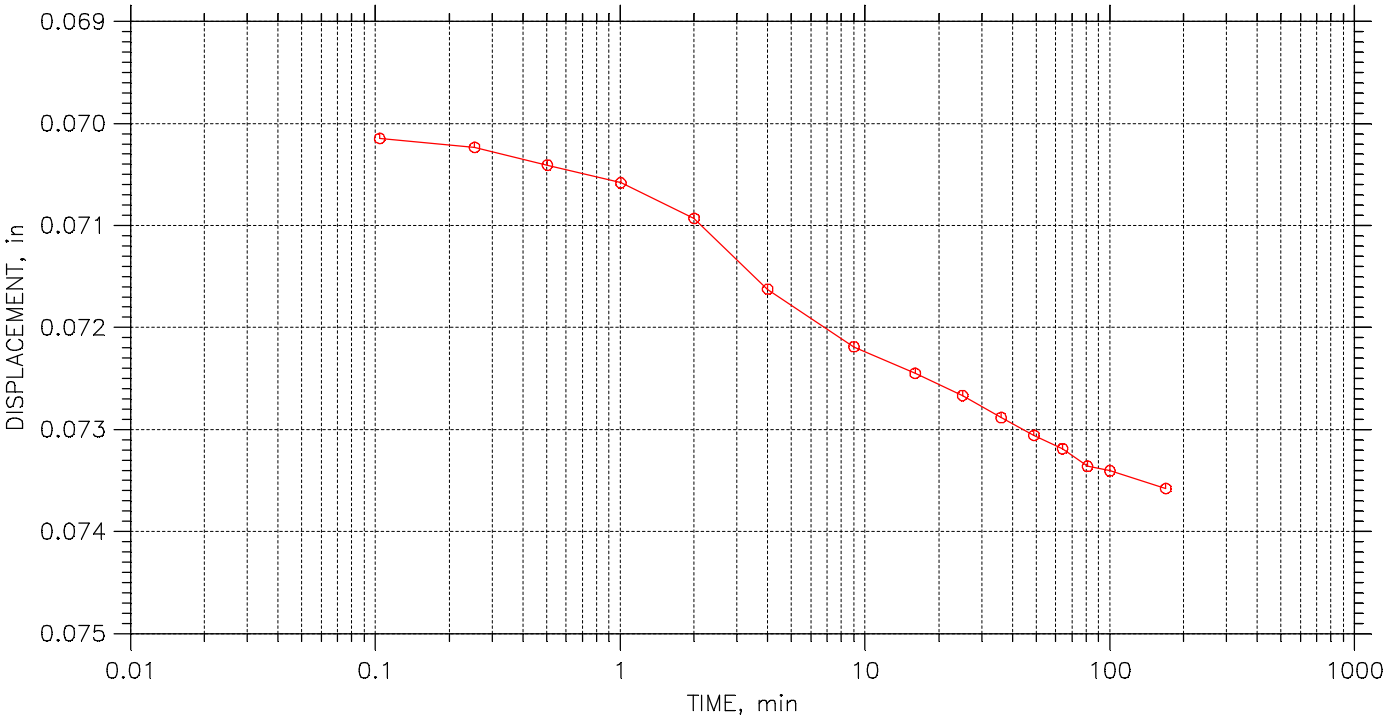
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

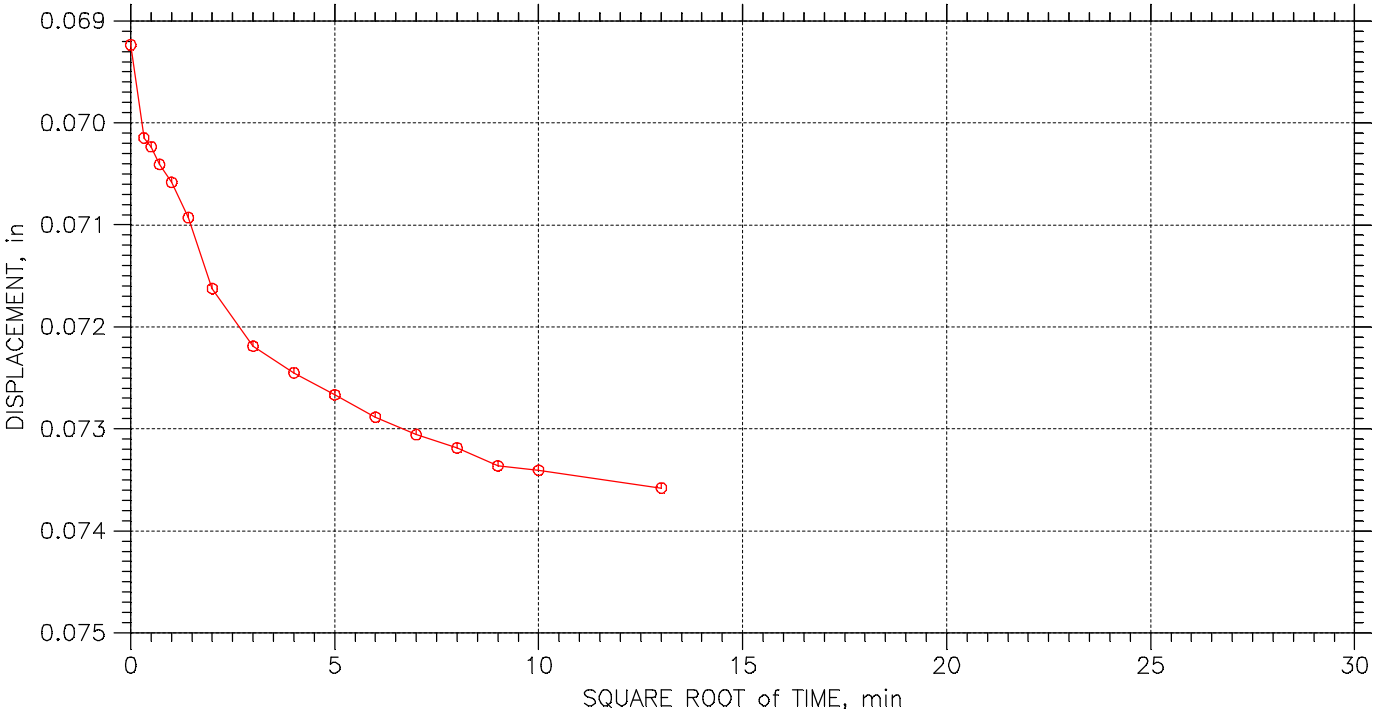
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 13 of 23

Stress: 1. tsf





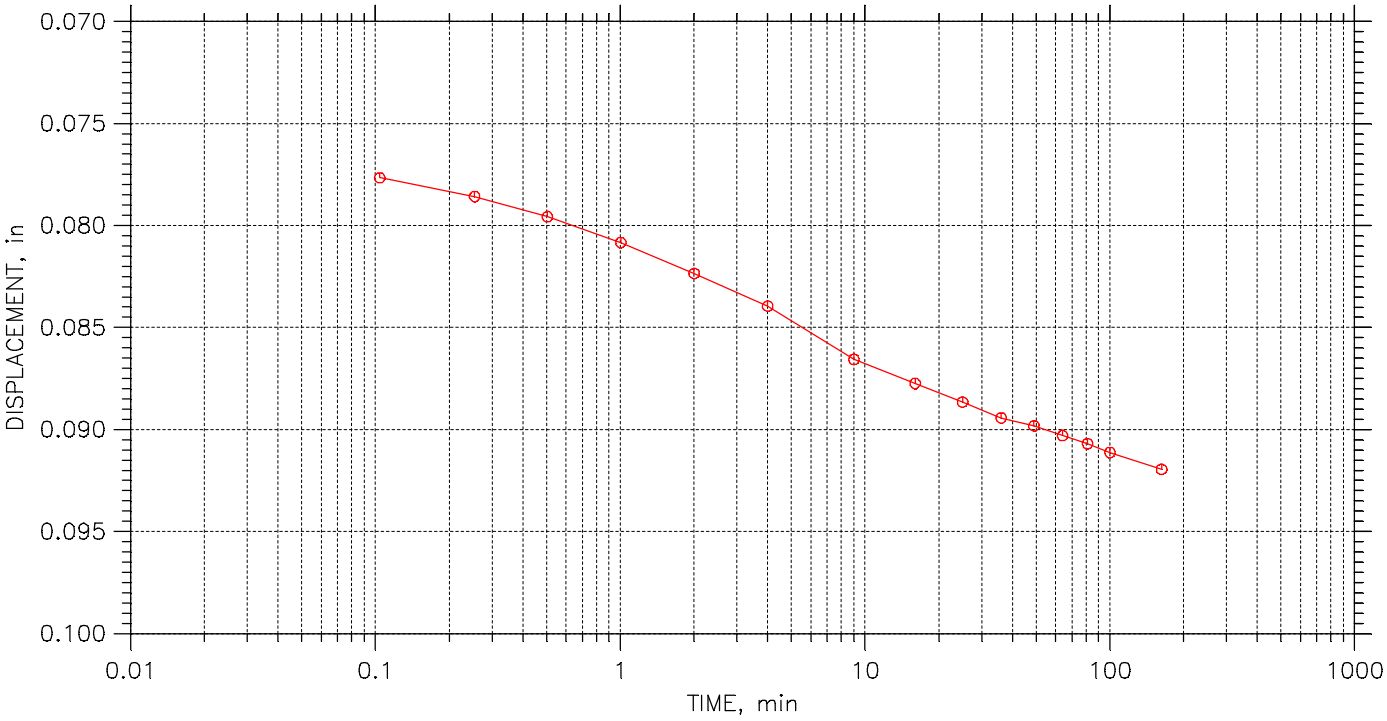
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

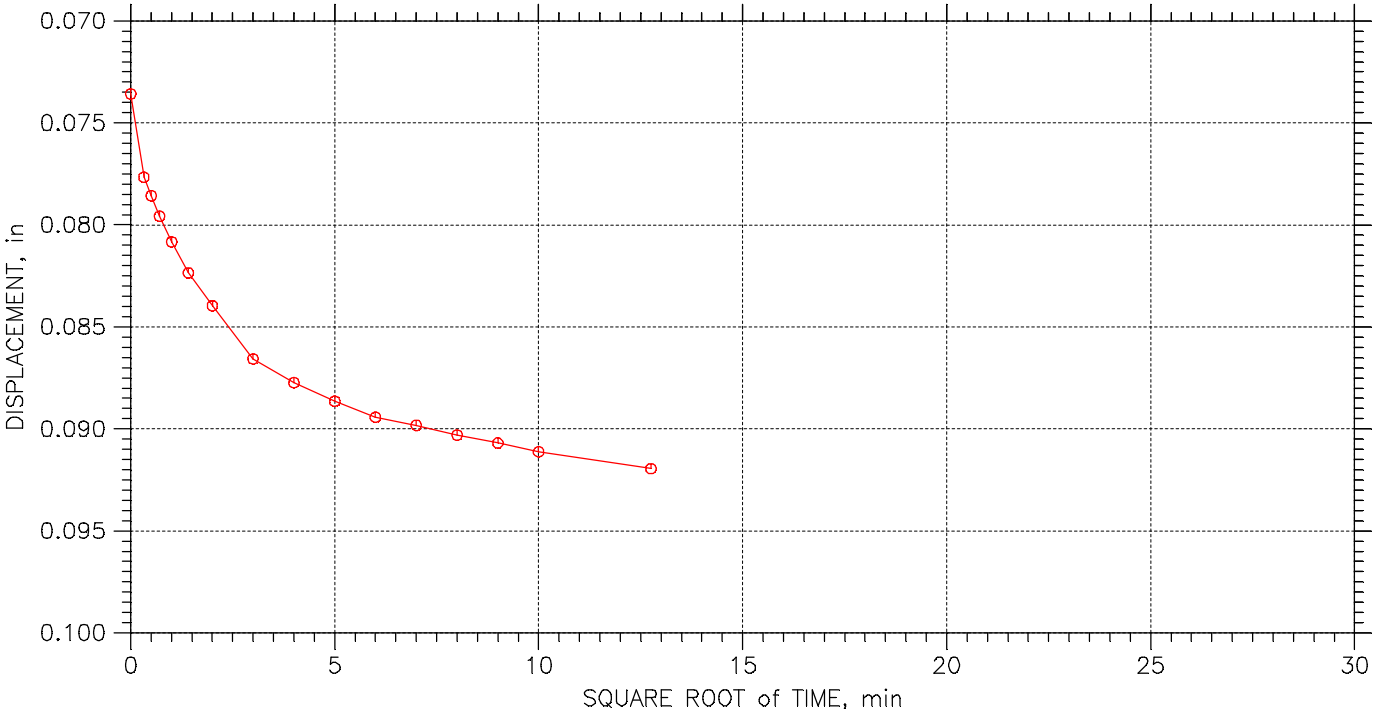
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 14 of 23

Stress: 2. tsf





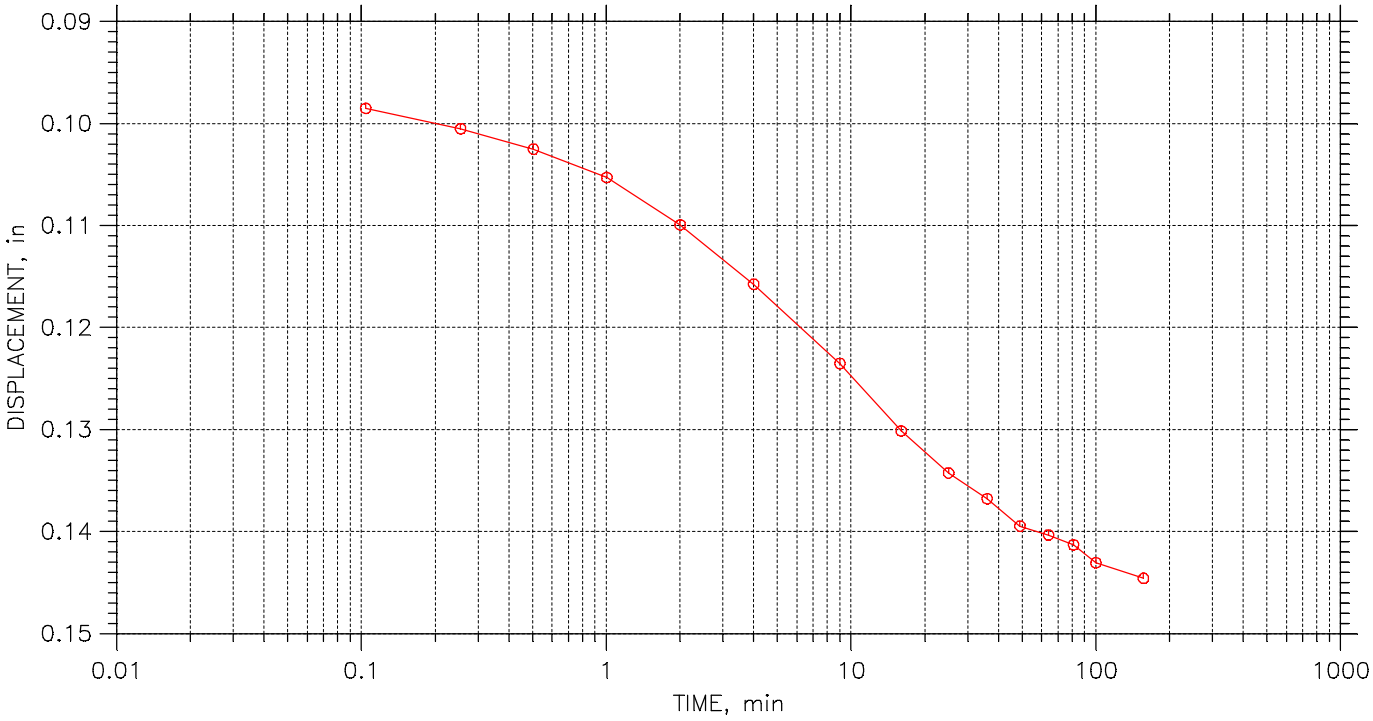
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

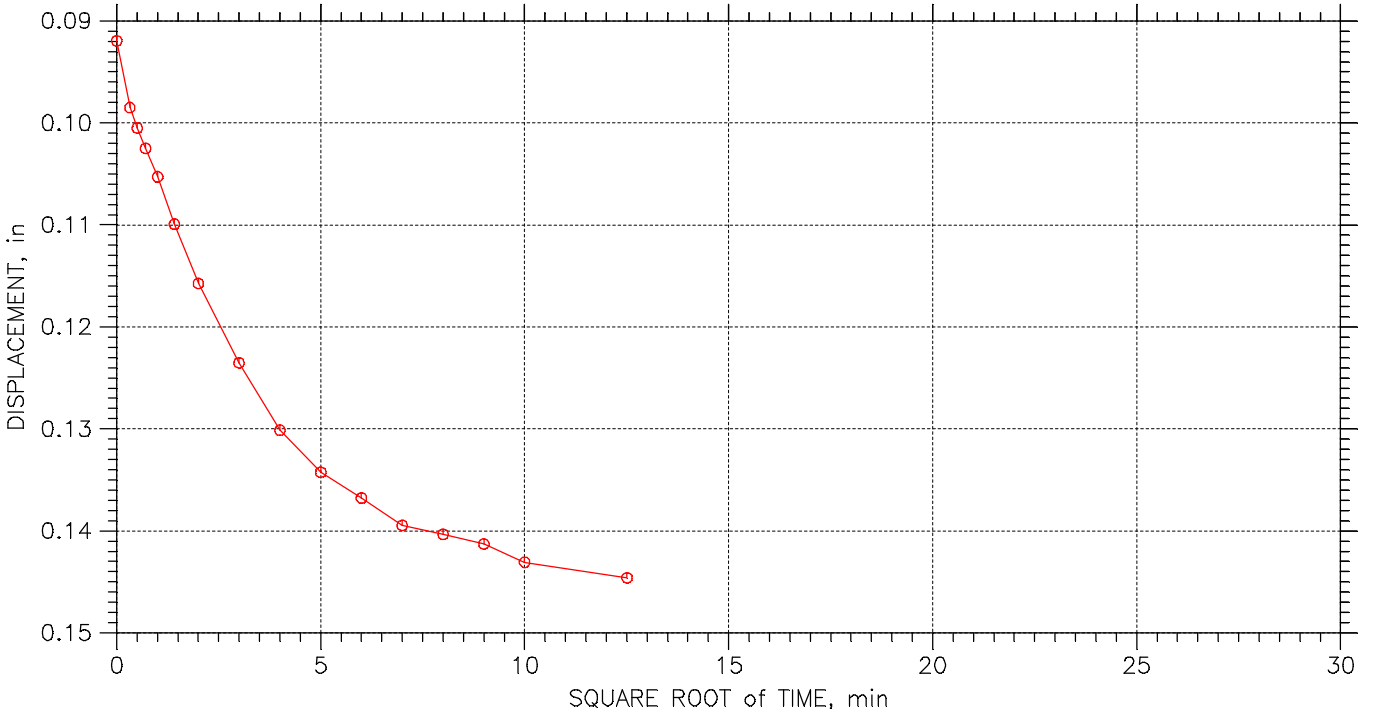
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 15 of 23

Stress: 4. tsf





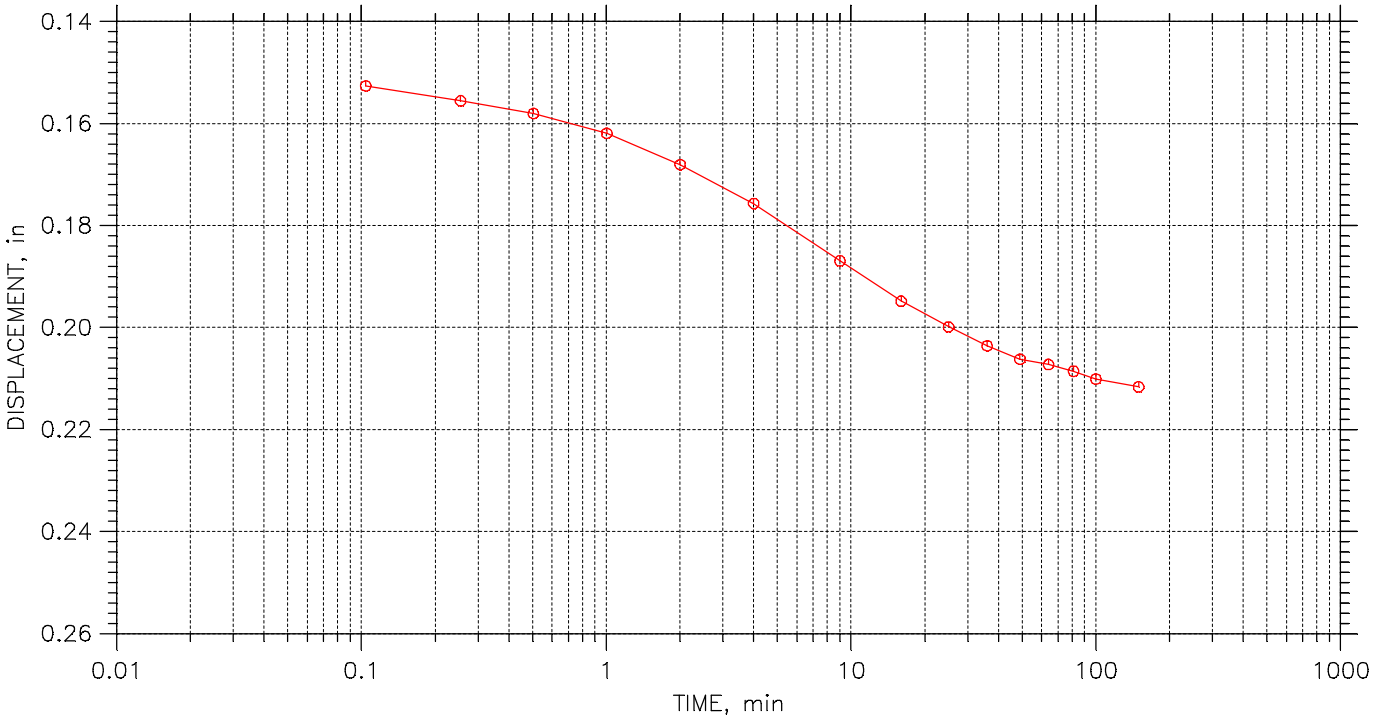
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

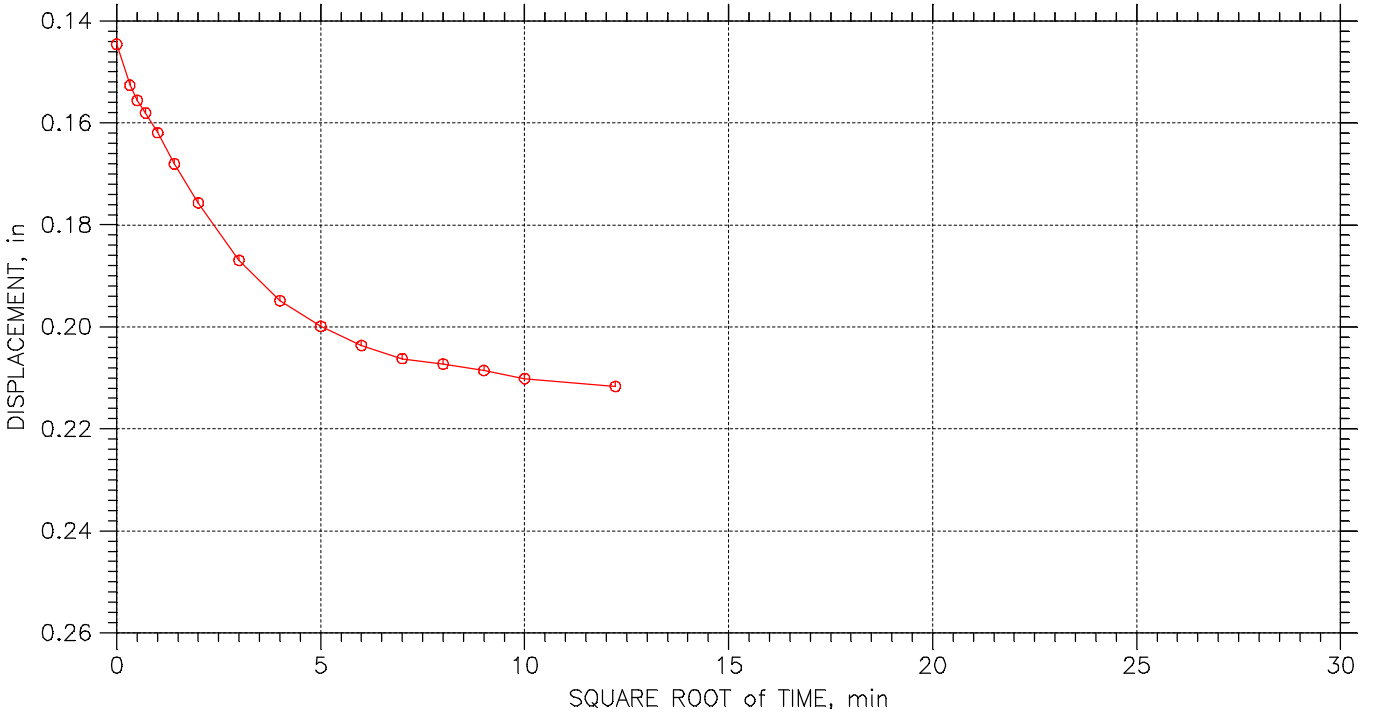
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 16 of 23

Stress: 8. tsf





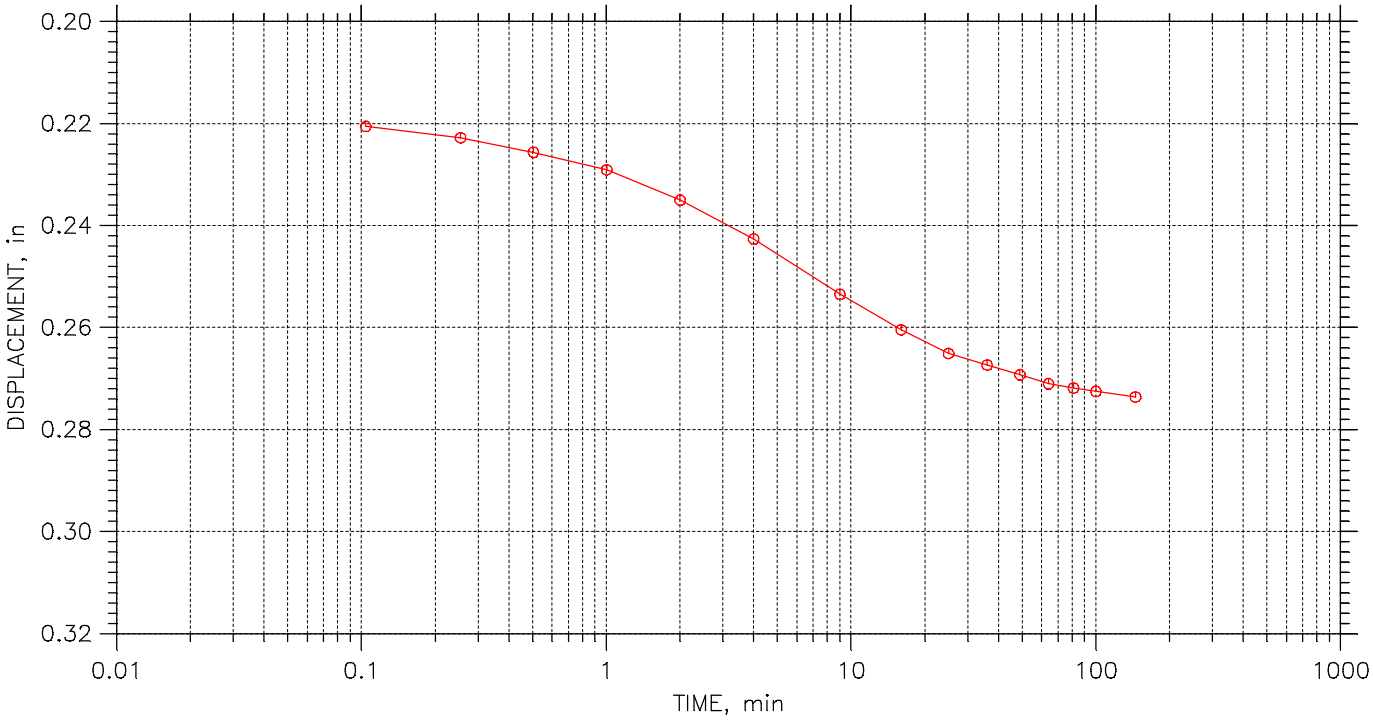
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

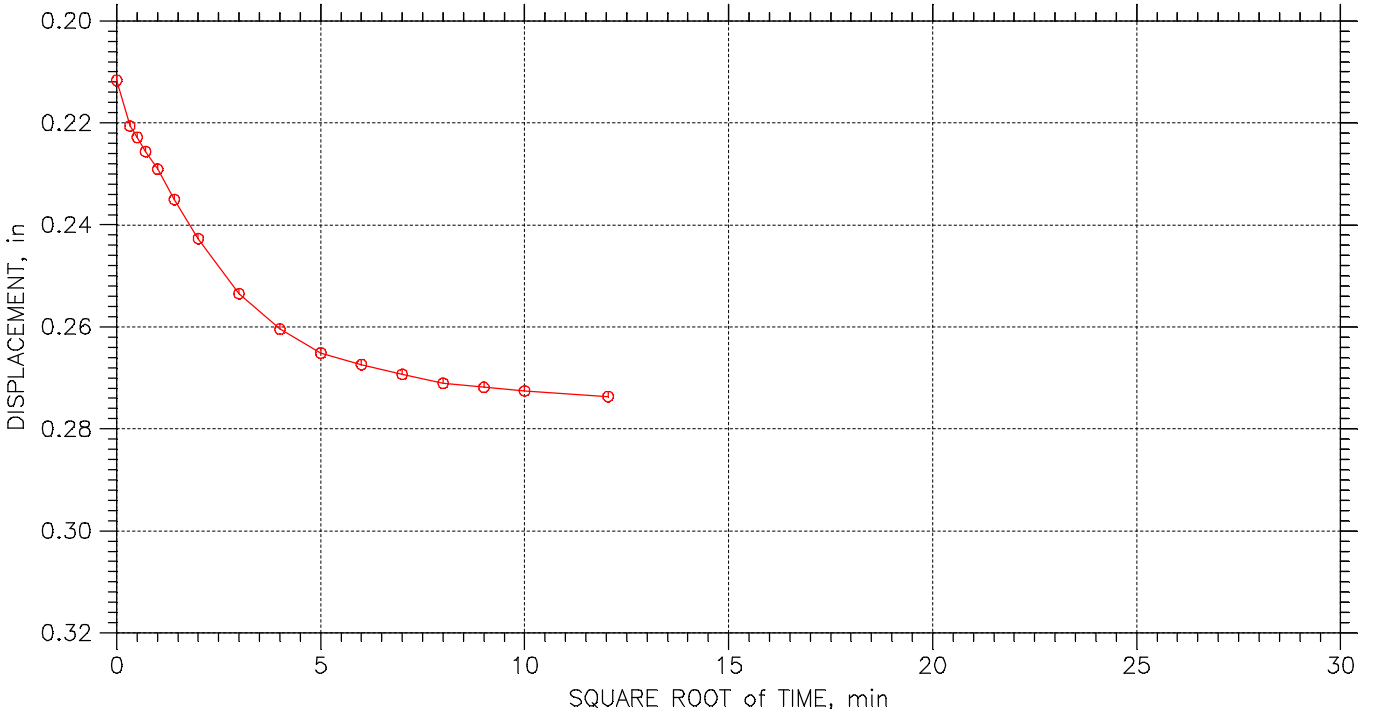
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 17 of 23

Stress: 16. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

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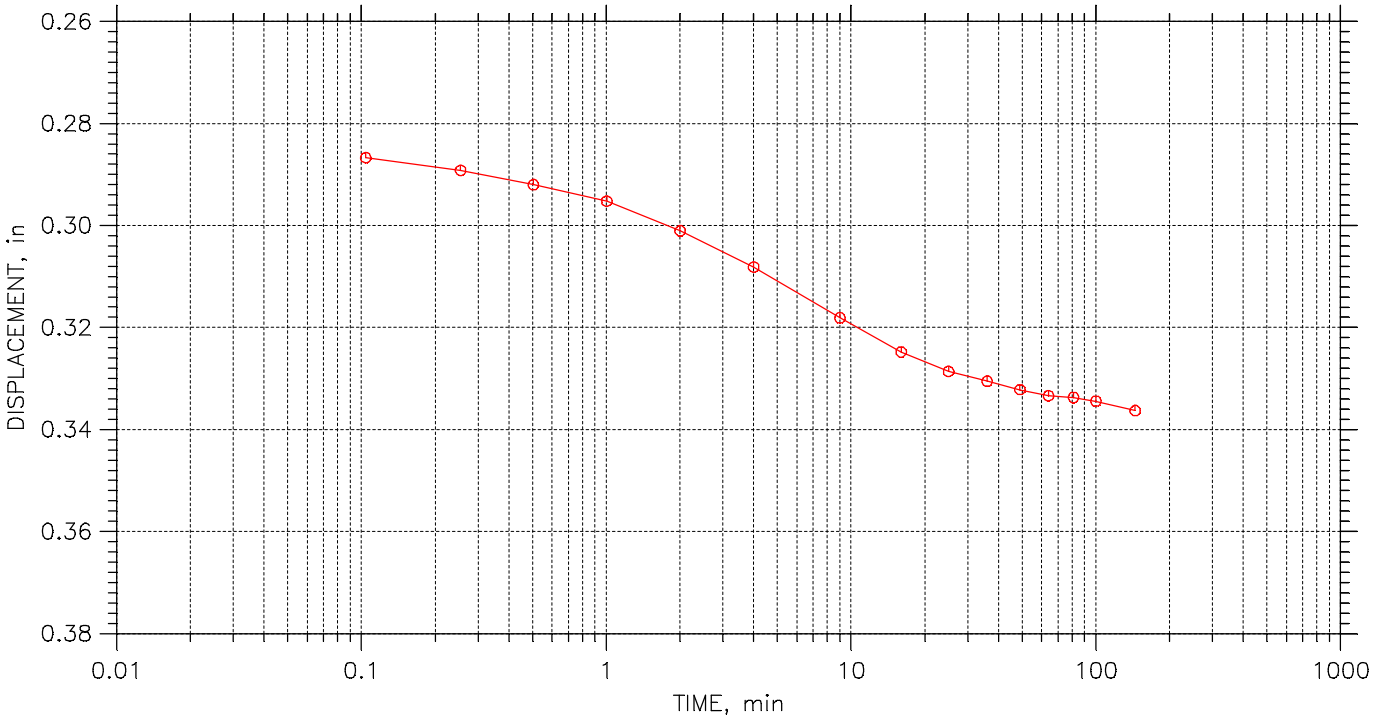
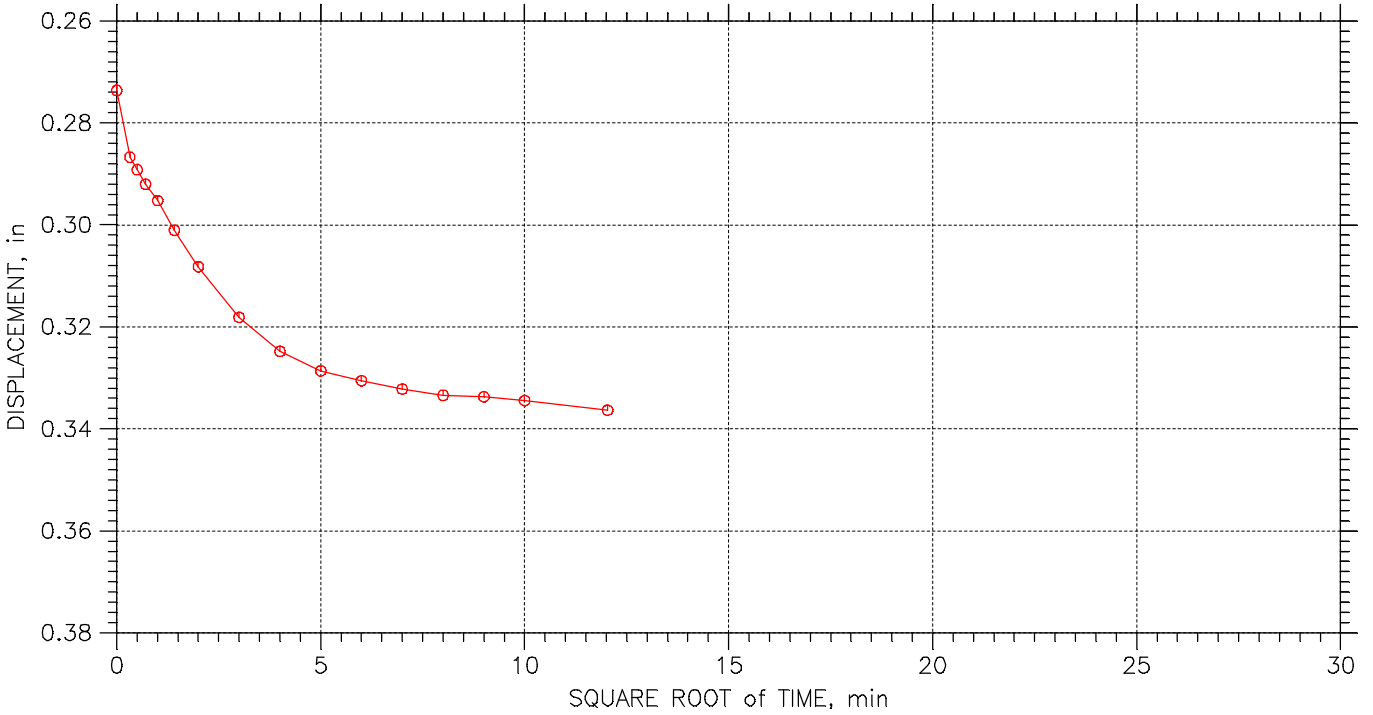
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 18 of 23

Stress: 32. tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

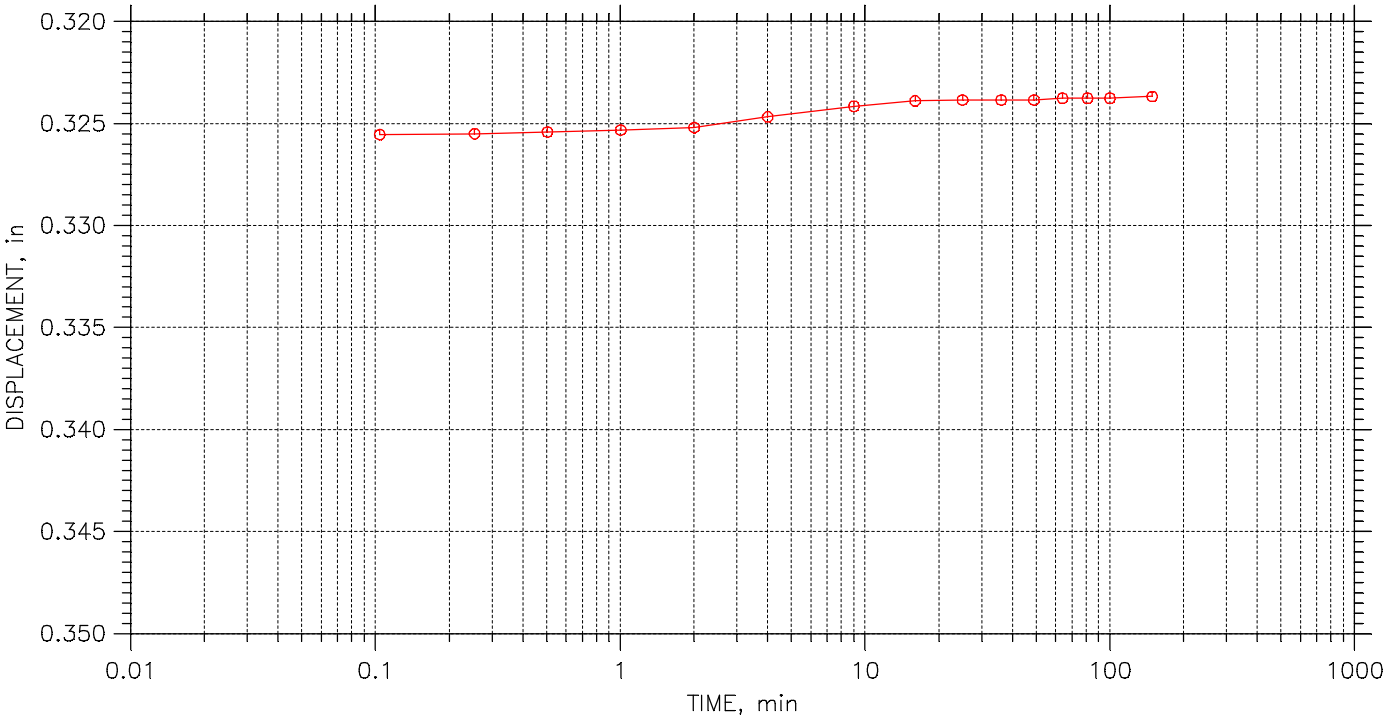
Mon, 16-NOV-2015 17:11:12

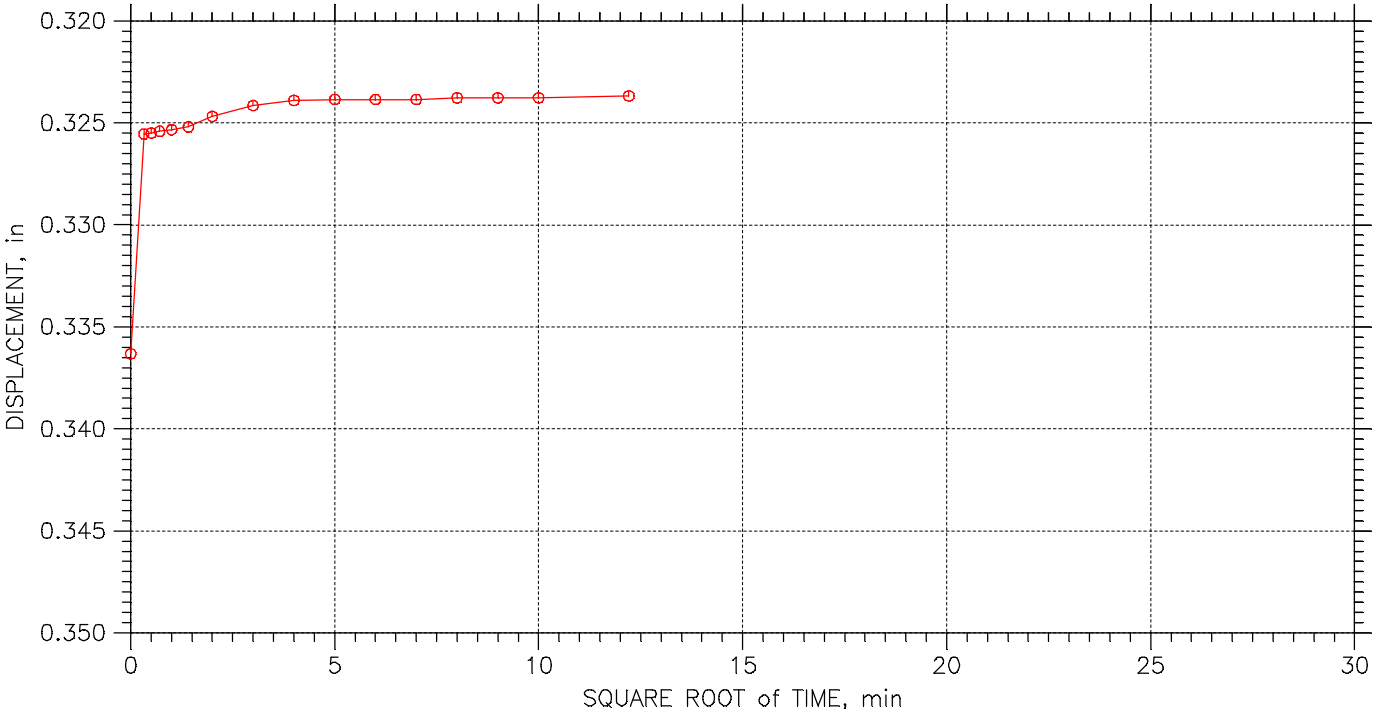
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 19 of 23

Stress: 16. tsf





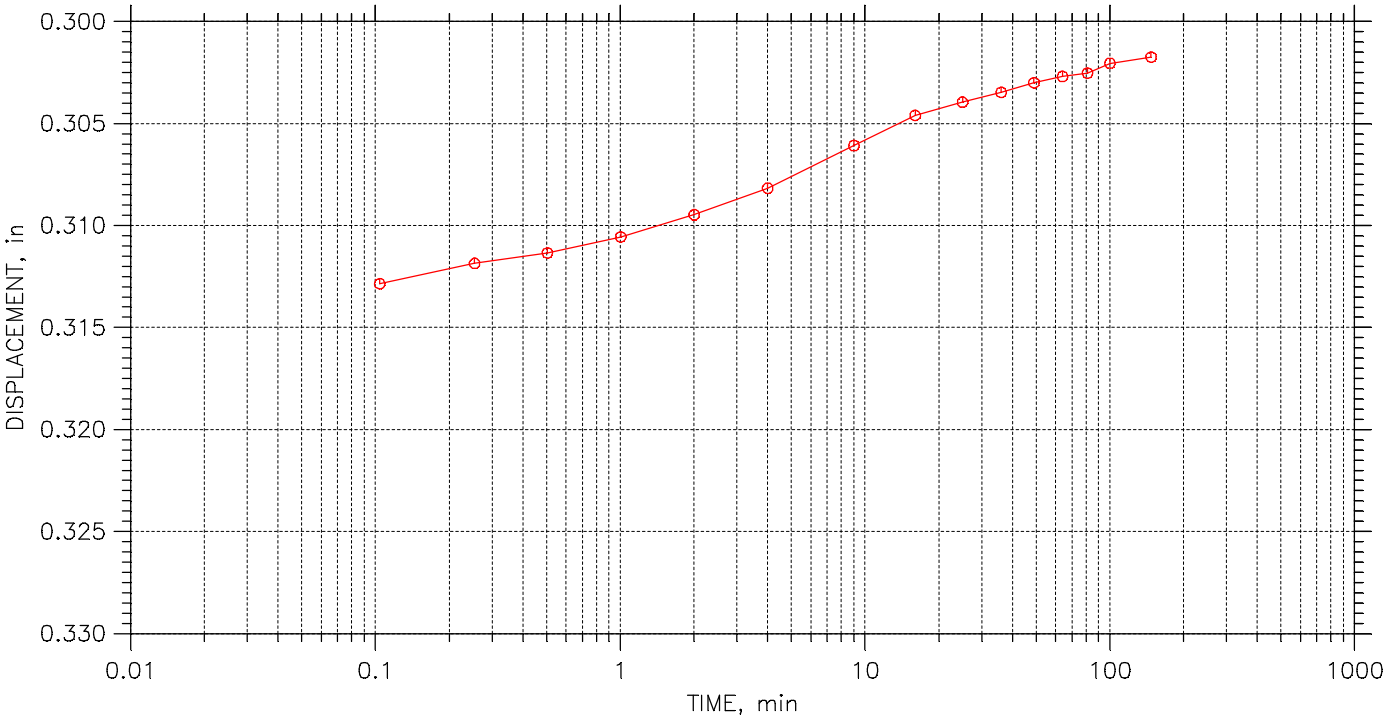
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

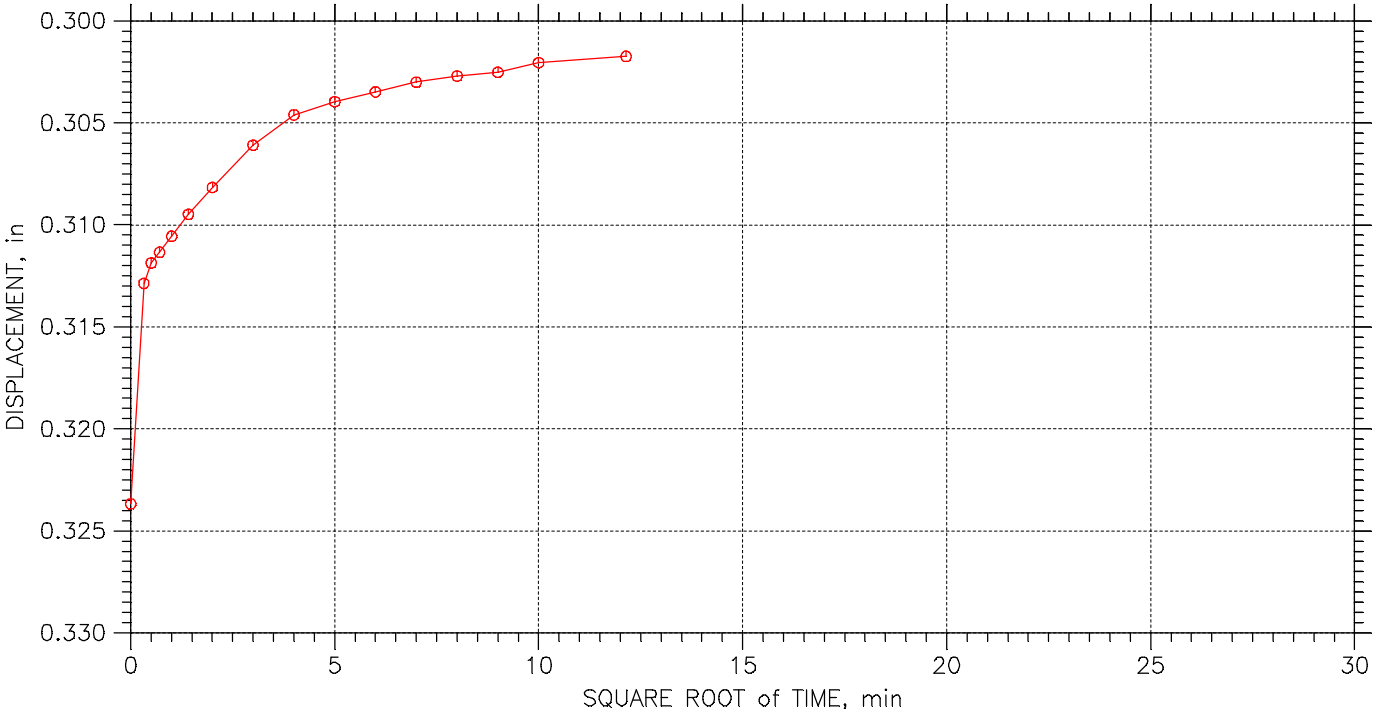
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 20 of 23

Stress: 4. tsf





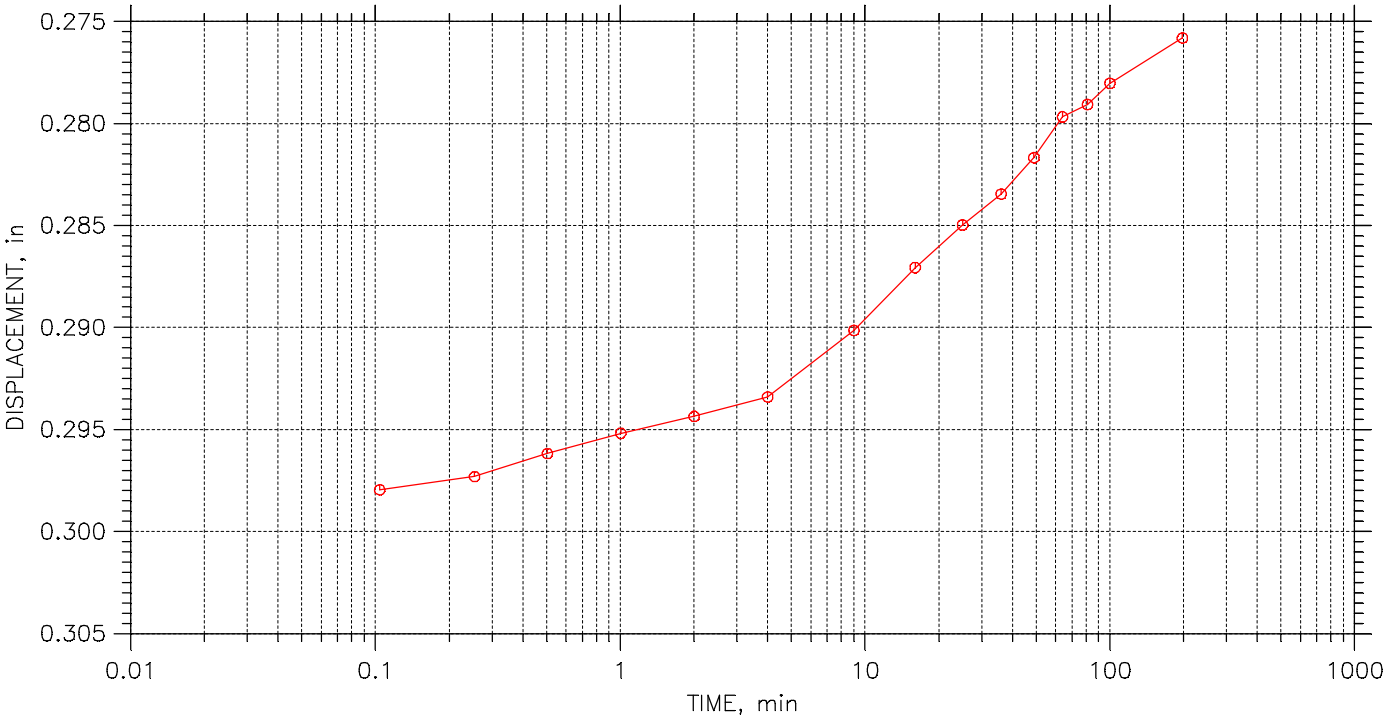
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

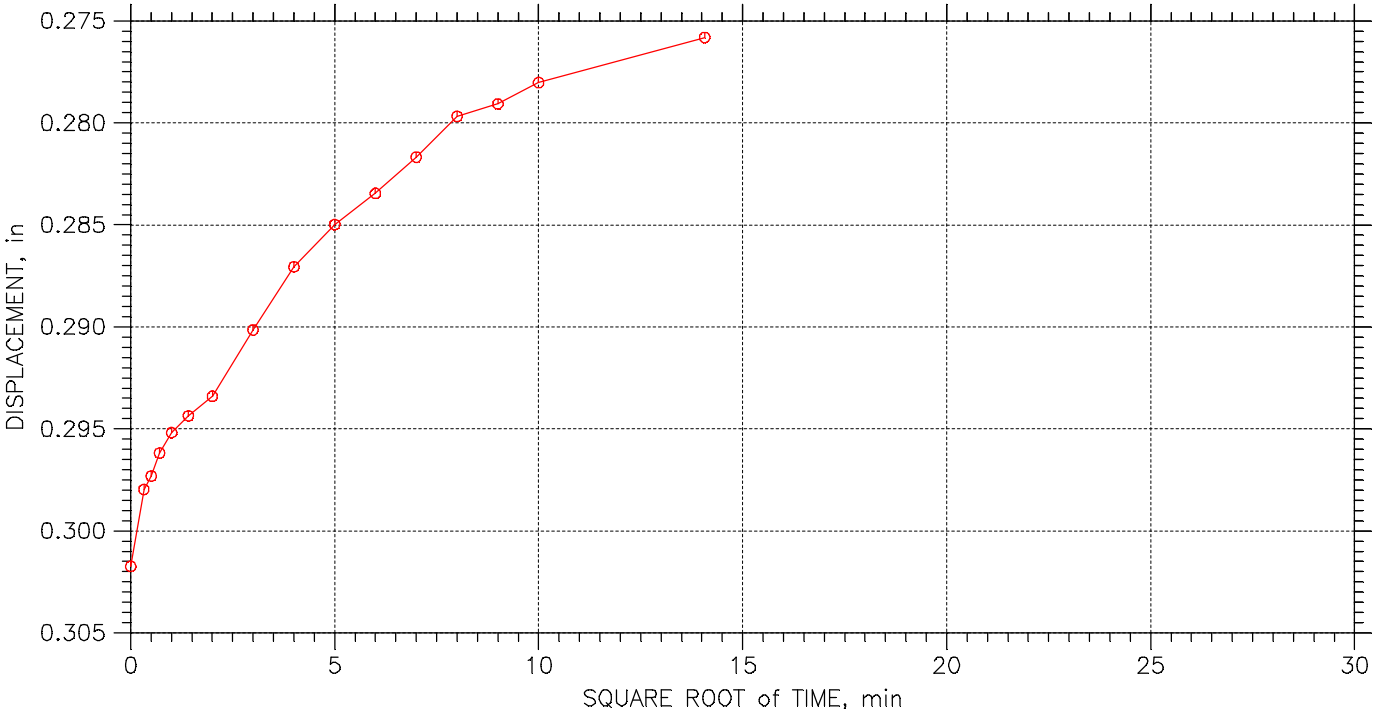
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 21 of 23

Stress: 1. tsf





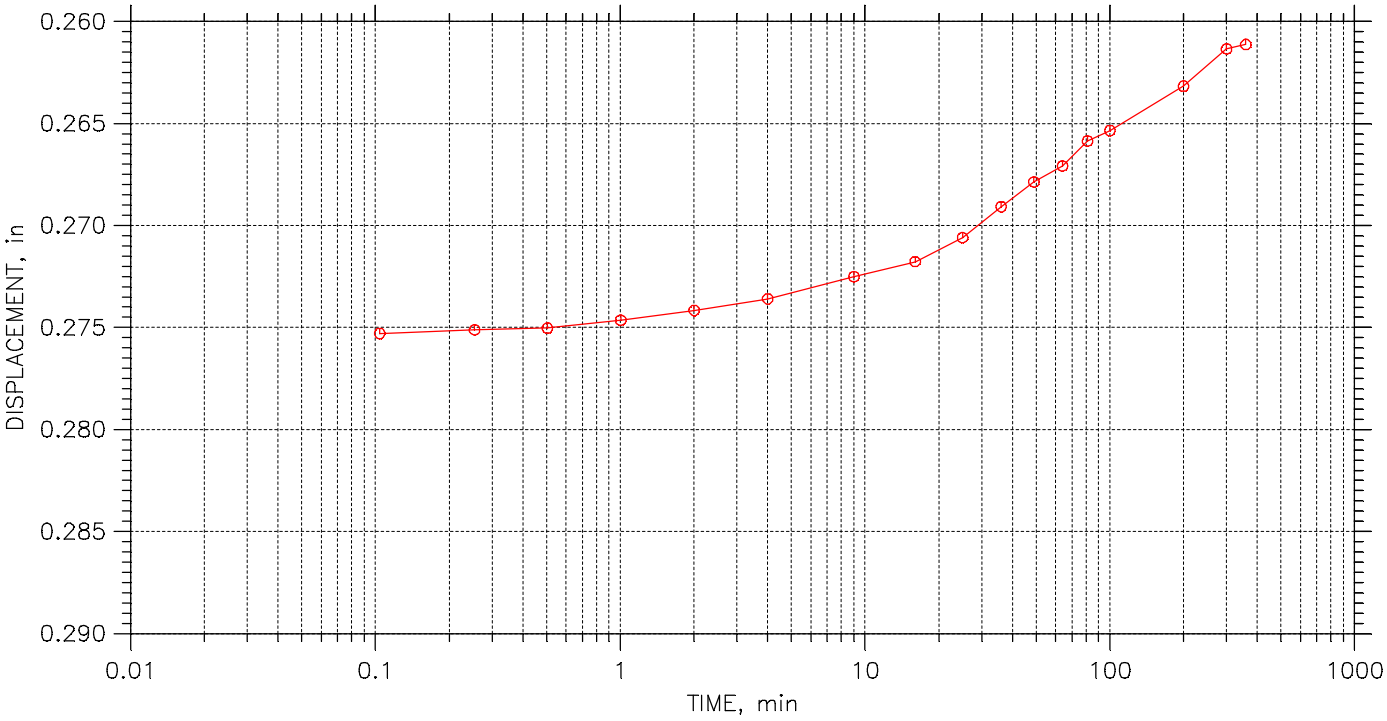
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

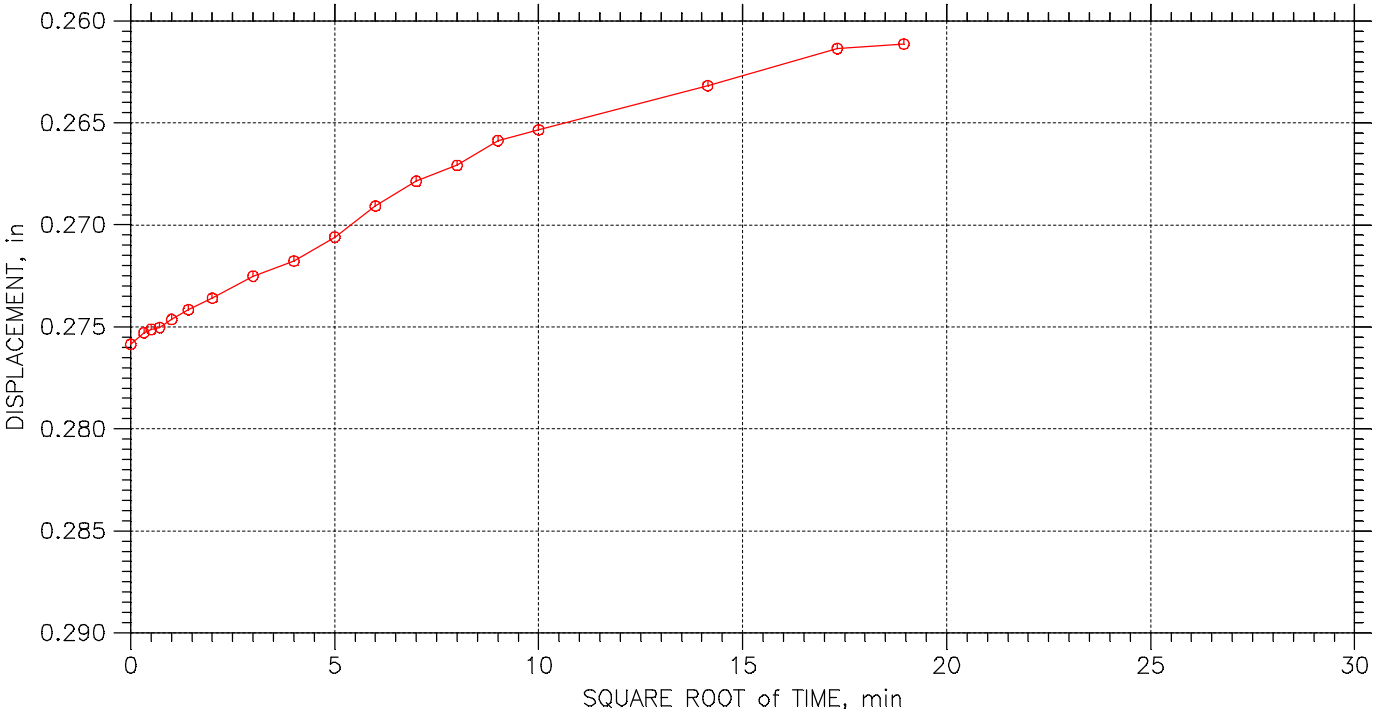
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 22 of 23

Stress: 0.5 tsf





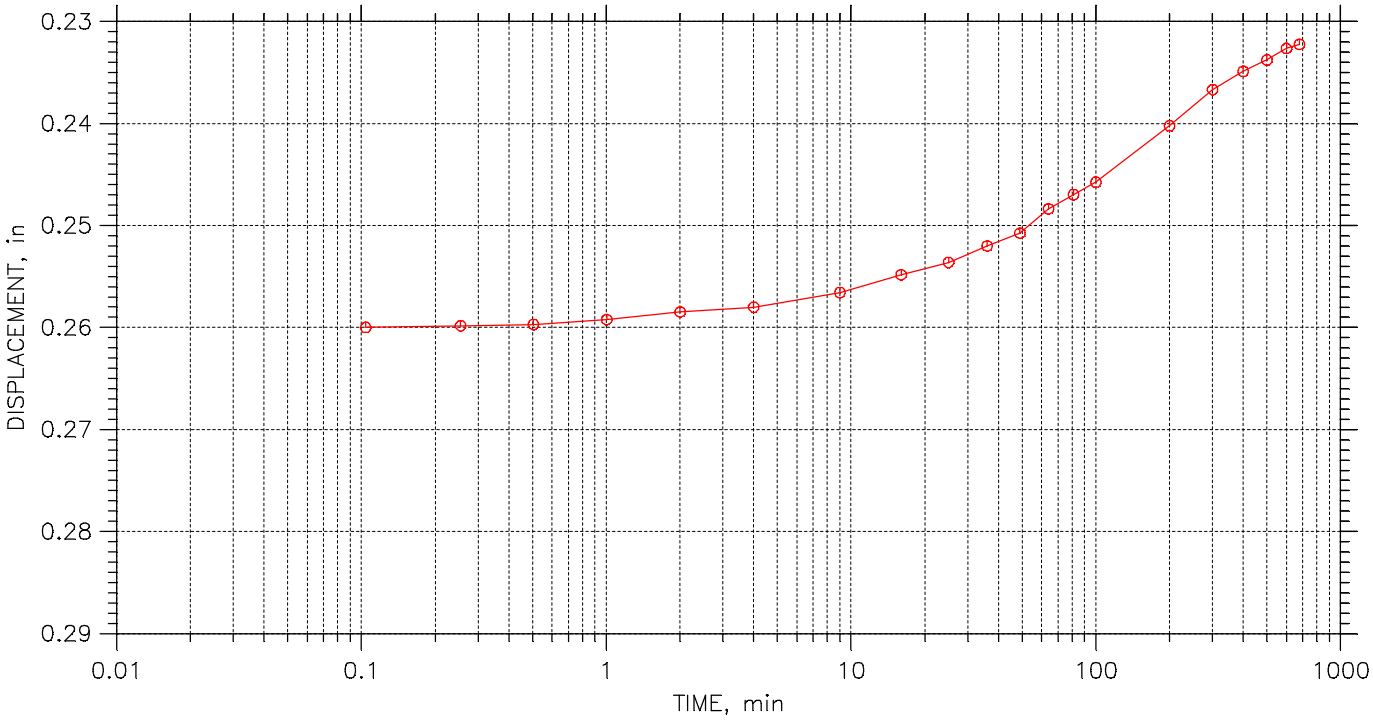
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

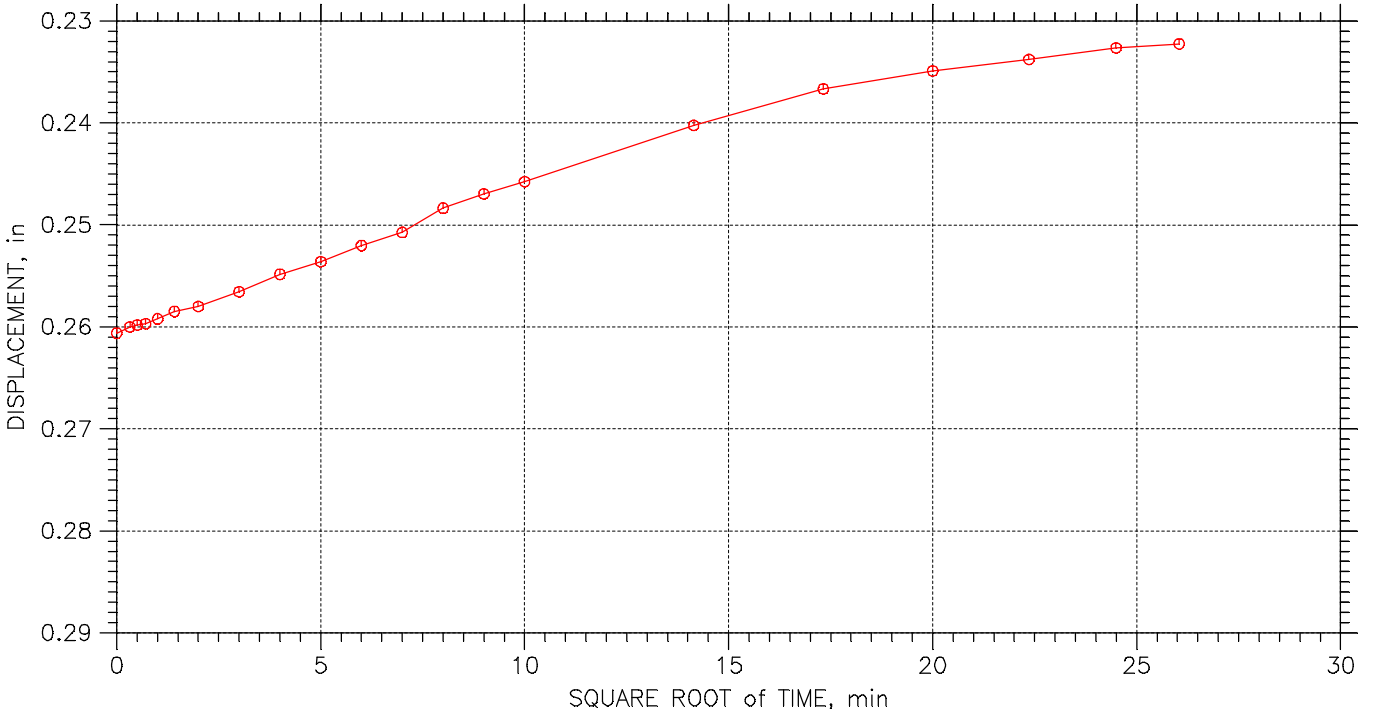
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 23 of 23

Stress: 0.125 tsf





Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

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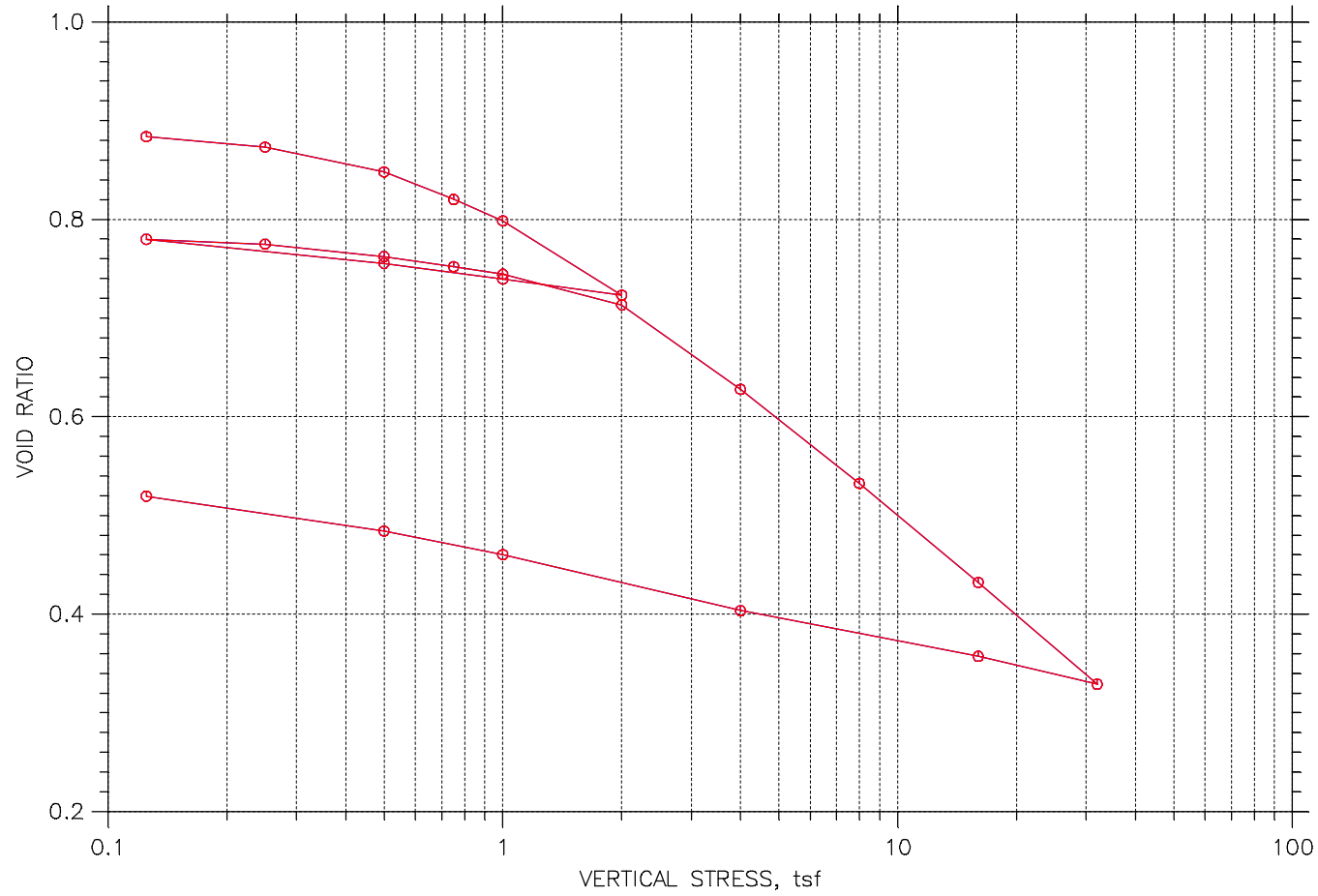
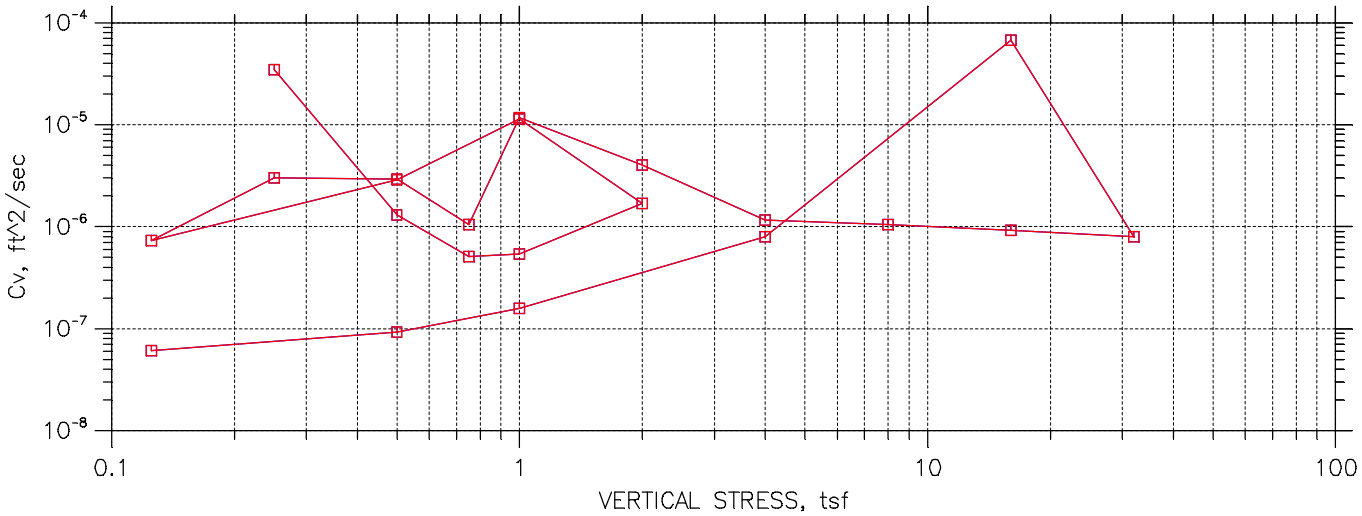
CONSOLIDATION TEST DATA

SUMMARY REPORT





Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

CONSOLIDATION TEST DATA

Project: DYNERGY EDWARDS
Boring No.: EDW-B008 S5
Sample No.: S-5
Test No.: EDWB008S5

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 10/26/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 11.0'-13.0'
Elevation: -----

Soil Description: BROWN AND GRAY FAT CLAY WITH SAND CH
Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435

Estimated Specific Gravity: 2.72
Initial Void Ratio: 0.91
Final Void Ratio: 0.52

Liquid Limit: 52
Plastic Limit: 19
Plasticity Index: 33

Initial Height: 0.75 in
Specimen Diameter: 2.49 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	X19	RING	RING	A-8
Wt. Container + Wet Soil, gm	194.52	185.3	175.79	131.94
Wt. Container + Dry Soil, gm	156.81	159.5	159.5	115.76
Wt. Container, gm	44.78	74.3	74.3	31.14
Wt. Dry Soil, gm	112.03	85.199	85.199	84.62
Water Content, %	33.66	30.28	19.12	19.12
Void Ratio	---	0.91	0.52	---
Degree of Saturation, %	---	90.87	100.68	---
Dry Unit Weight, pcf	---	89.066	111.96	---

CONSOLIDATION TEST DATA

Project: DYNERGY EDWARDS
Boring No.: EDW-B008 S5
Sample No.: S-5
Test No.: EDWB008S5

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 10/26/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 11.0'-13.0'
Elevation: -----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWN AND GRAY FAT CLAY WITH SAND CH
Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435

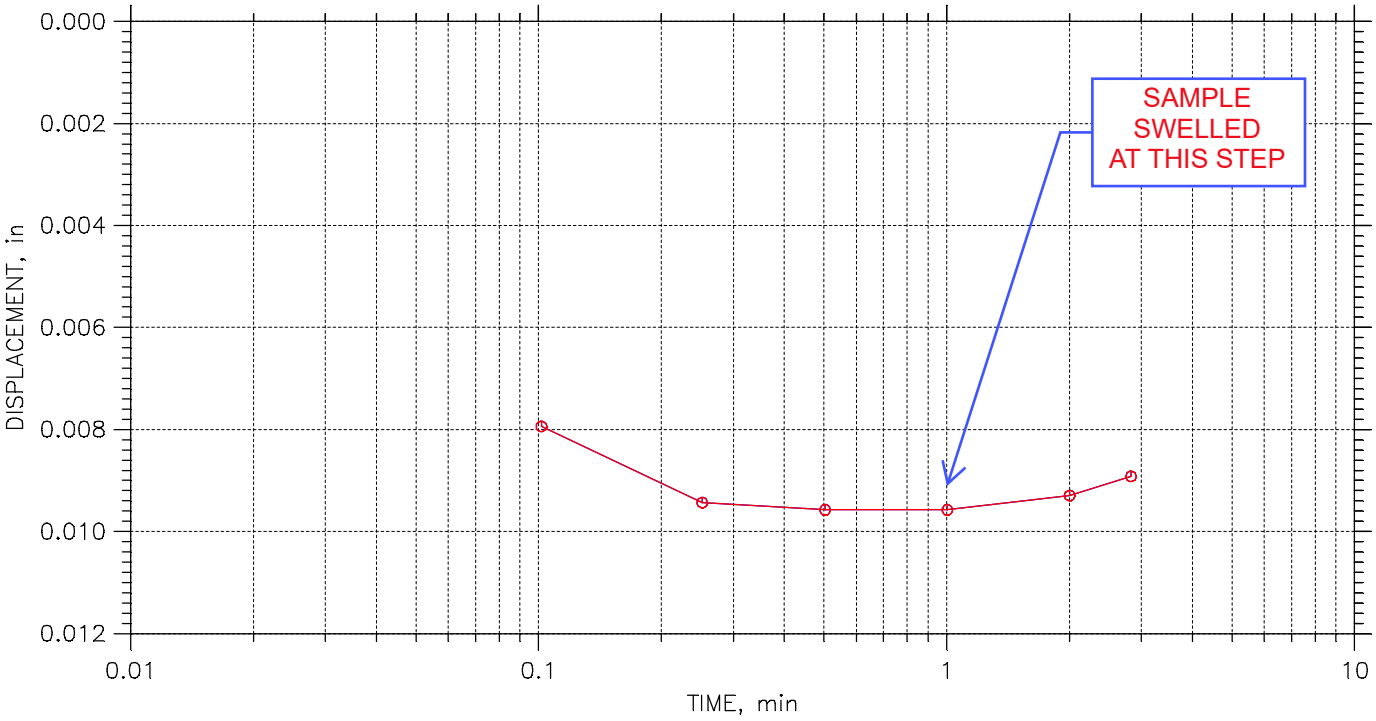
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	T50 Fitting Sq.Rt. min	T50 Fitting Log min	Coefficient of Consolidation Sq.Rt. ft^2/sec	Coefficient of Consolidation Log ft^2/sec	Coefficient of Consolidation Ave. ft^2/sec
1	0.125	0.008922	0.884	1.19	0.0	0.0	0.00e+000	0.00e+000	0.00e+000
2	0.25	0.01289	0.874	1.72	0.1	0.0	3.48e-005	0.00e+000	3.48e-005
3	0.5	0.02294	0.848	3.07	1.5	0.5	2.05e-006	5.95e-006	3.05e-006
4	0.75	0.03373	0.821	4.51	5.8	0.0	5.07e-007	0.00e+000	5.07e-007
5	1	0.04241	0.798	5.67	3.8	3.2	7.58e-007	8.96e-007	8.21e-007
6	2	0.07189	0.723	9.61	2.1	1.1	1.30e-006	2.41e-006	1.69e-006
7	1	0.06554	0.739	8.76	0.2	0.0	1.15e-005	0.00e+000	1.15e-005
8	0.5	0.05914	0.756	7.91	0.9	0.0	2.88e-006	0.00e+000	2.88e-006
9	0.125	0.0497	0.780	6.64	3.7	0.0	7.35e-007	0.00e+000	7.35e-007
10	0.25	0.05157	0.775	6.89	0.9	0.0	3.01e-006	0.00e+000	3.01e-006
11	0.5	0.05657	0.762	7.56	0.9	0.0	2.94e-006	0.00e+000	2.94e-006
12	0.75	0.06059	0.752	8.10	3.9	1.3	6.94e-007	2.10e-006	1.04e-006
13	1	0.06357	0.744	8.50	0.2	0.0	1.18e-005	0.00e+000	1.18e-005
14	2	0.07577	0.713	10.13	0.9	0.4	2.80e-006	7.14e-006	4.02e-006
15	4	0.1094	0.628	14.62	2.1	0.0	1.17e-006	0.00e+000	1.17e-006
16	8	0.1468	0.532	19.63	2.1	0.0	1.04e-006	0.00e+000	1.04e-006
17	16	0.1861	0.432	24.88	2.1	0.0	9.17e-007	0.00e+000	9.17e-007
18	32	0.2266	0.329	30.29	2.1	0.0	7.97e-007	0.00e+000	7.97e-007
19	16	0.2155	0.357	28.81	0.0	0.0	6.68e-005	0.00e+000	6.68e-005
20	4	0.1974	0.403	26.38	2.1	0.0	7.97e-007	0.00e+000	7.97e-007
21	1	0.1751	0.460	23.40	11.4	0.0	1.58e-007	0.00e+000	1.58e-007
22	0.5	0.1661	0.483	22.21	8.8	0.0	2.16e-007	0.00e+000	2.16e-007
23	0.125	0.153	0.517	20.45	32.0	0.0	6.18e-008	0.00e+000	6.18e-008

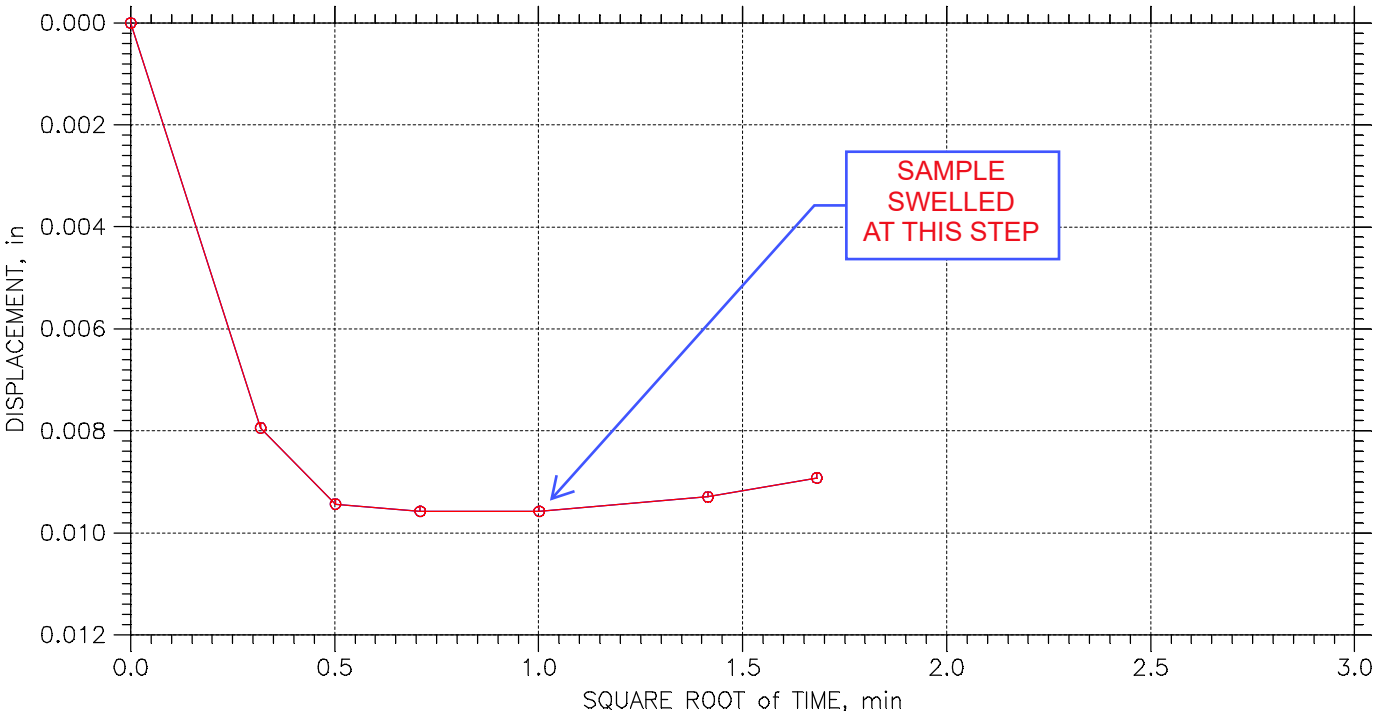
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 1 of 23

Stress: 0.125 tsf





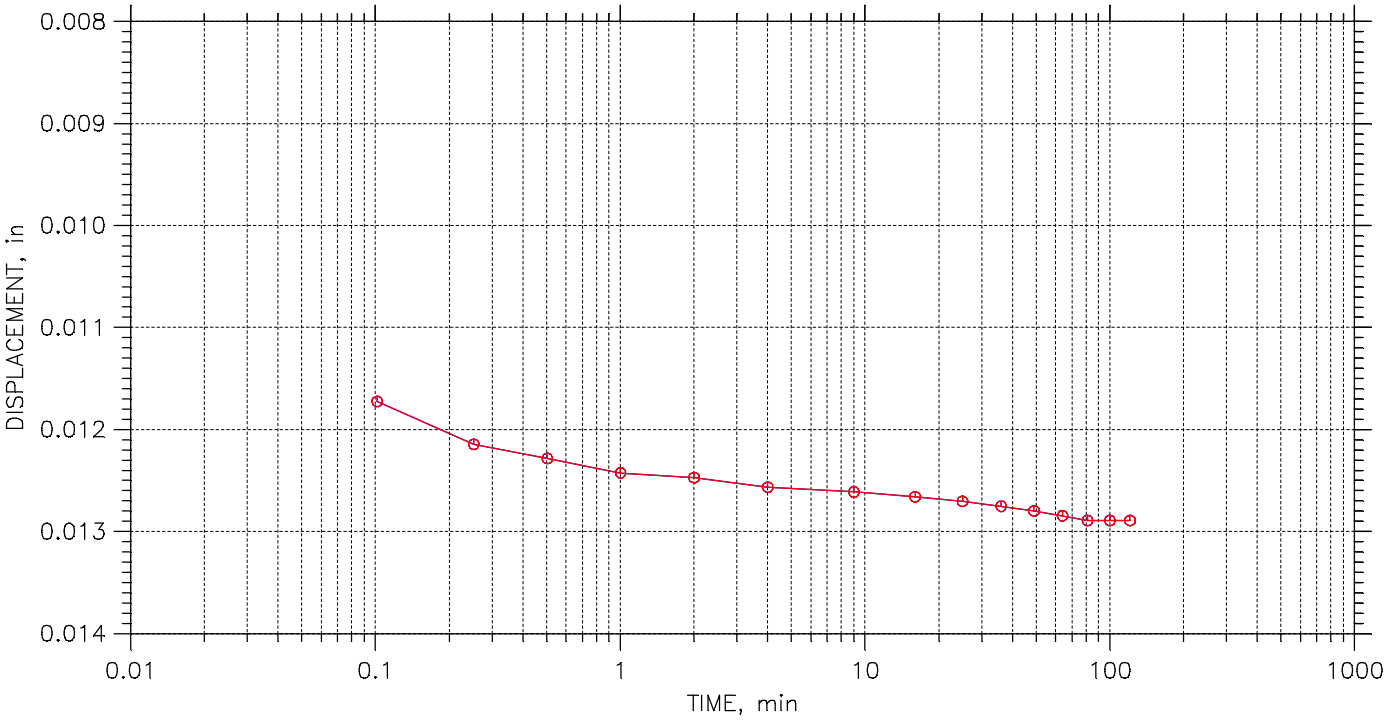
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

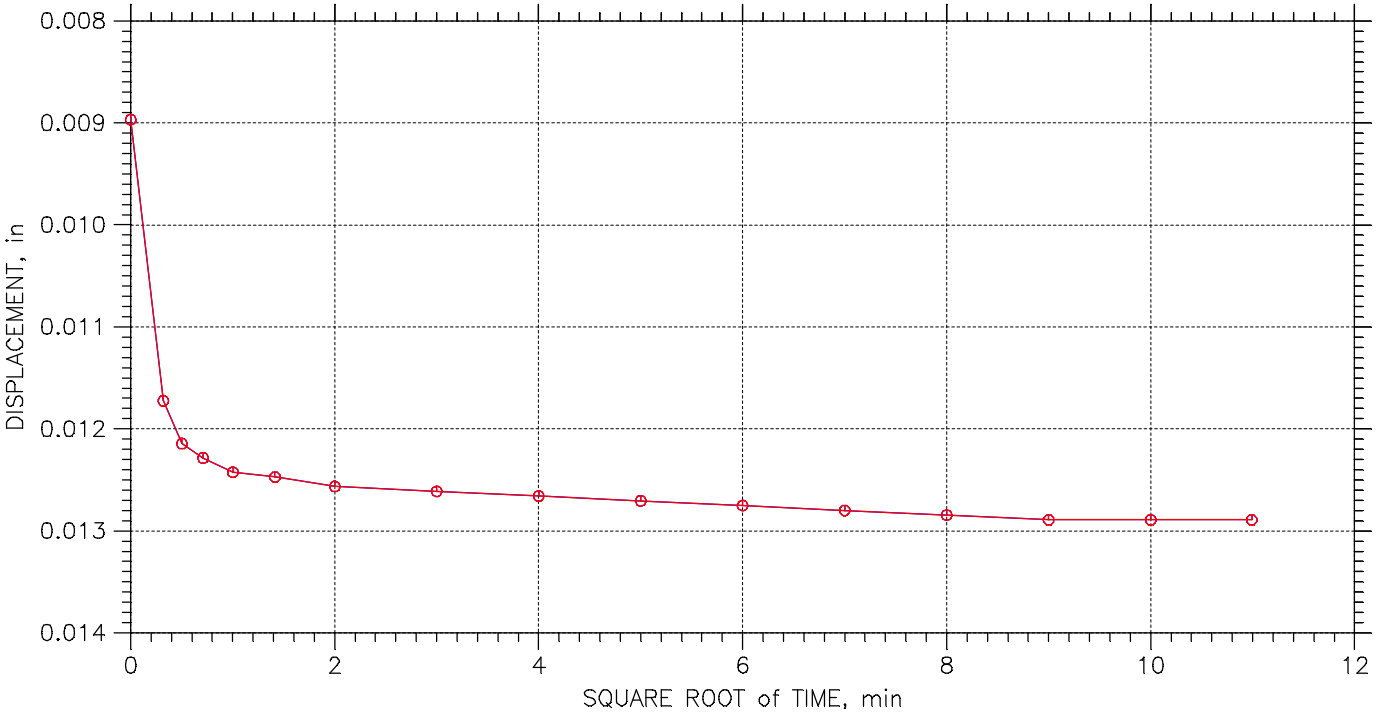
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 2 of 23

Stress: 0.25 tsf





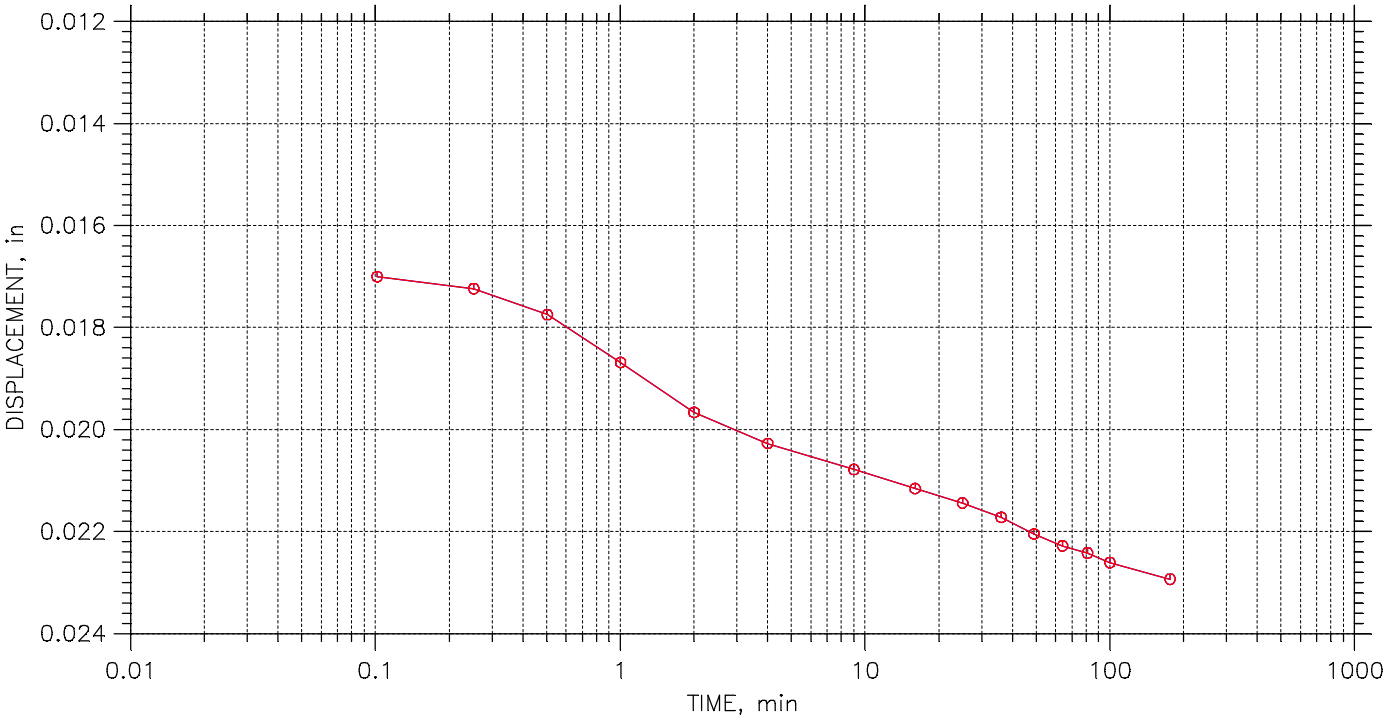
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

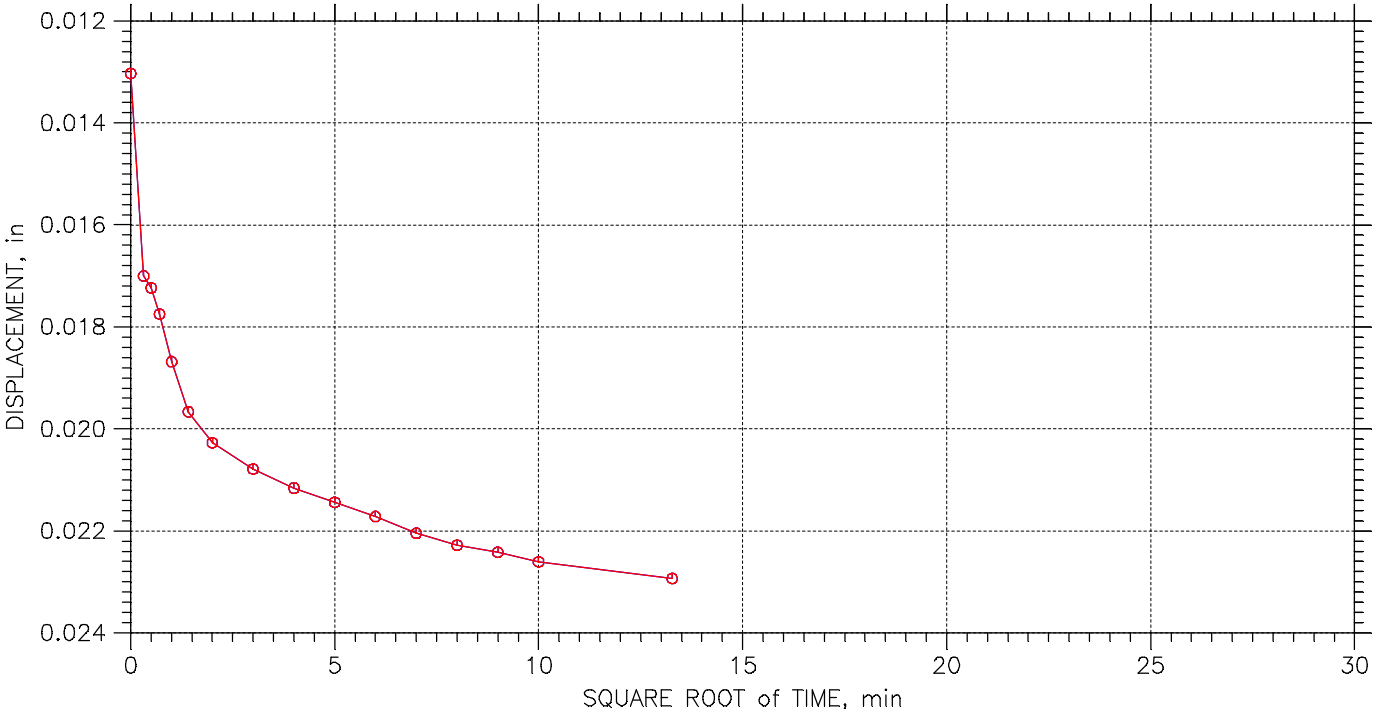
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 3 of 23

Stress: 0.5 tsf





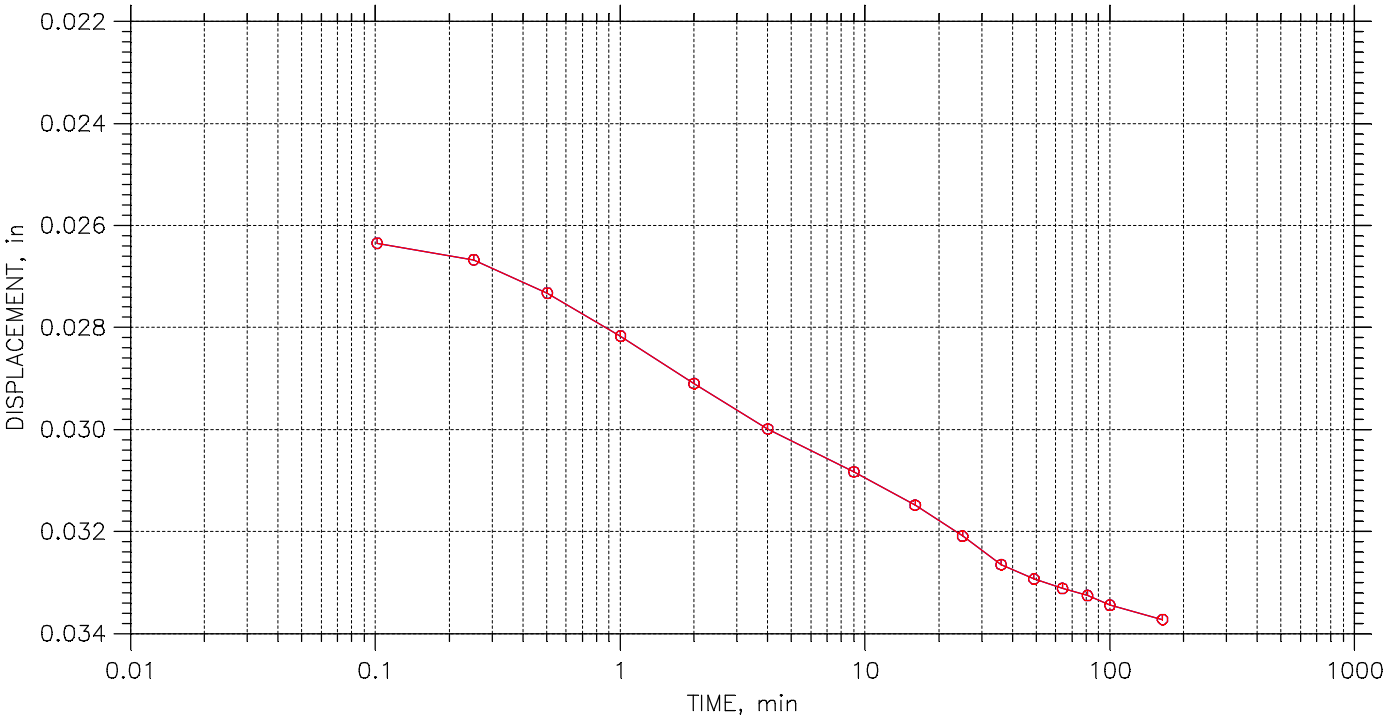
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

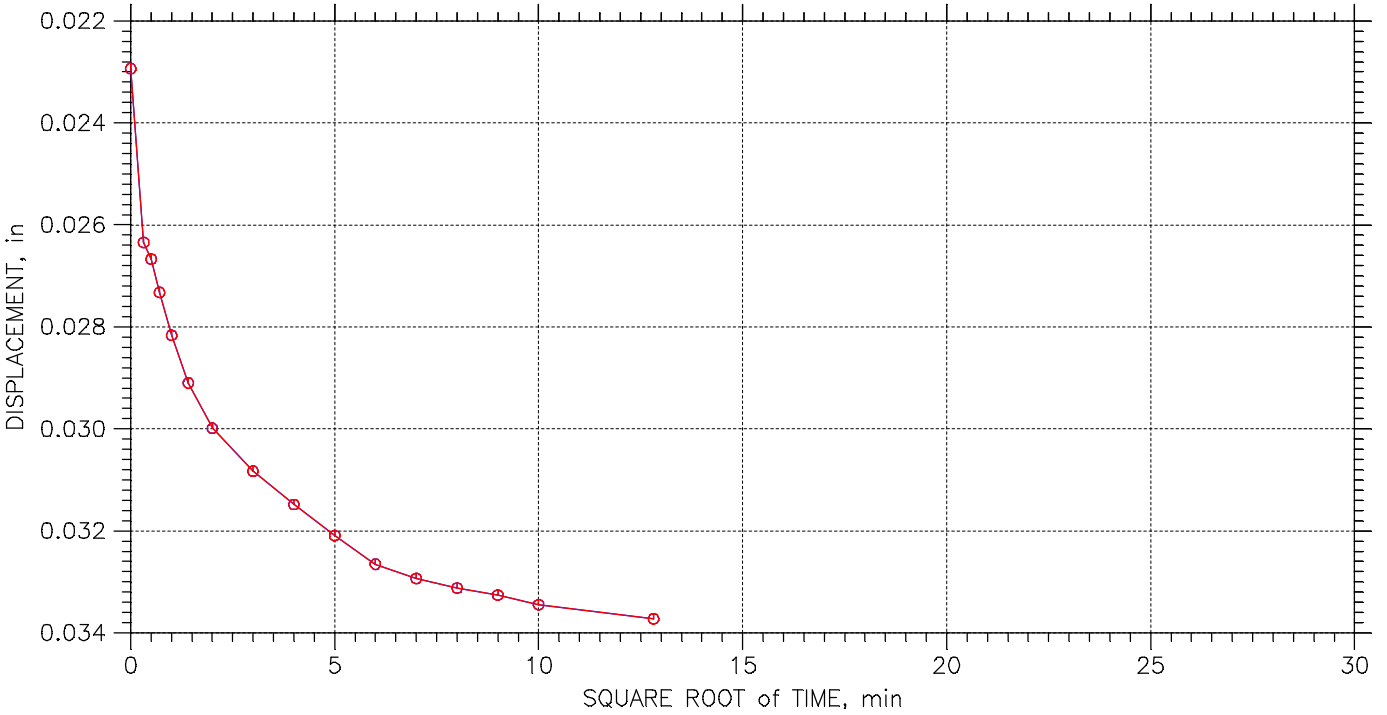
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 4 of 23

Stress: 0.75 tsf





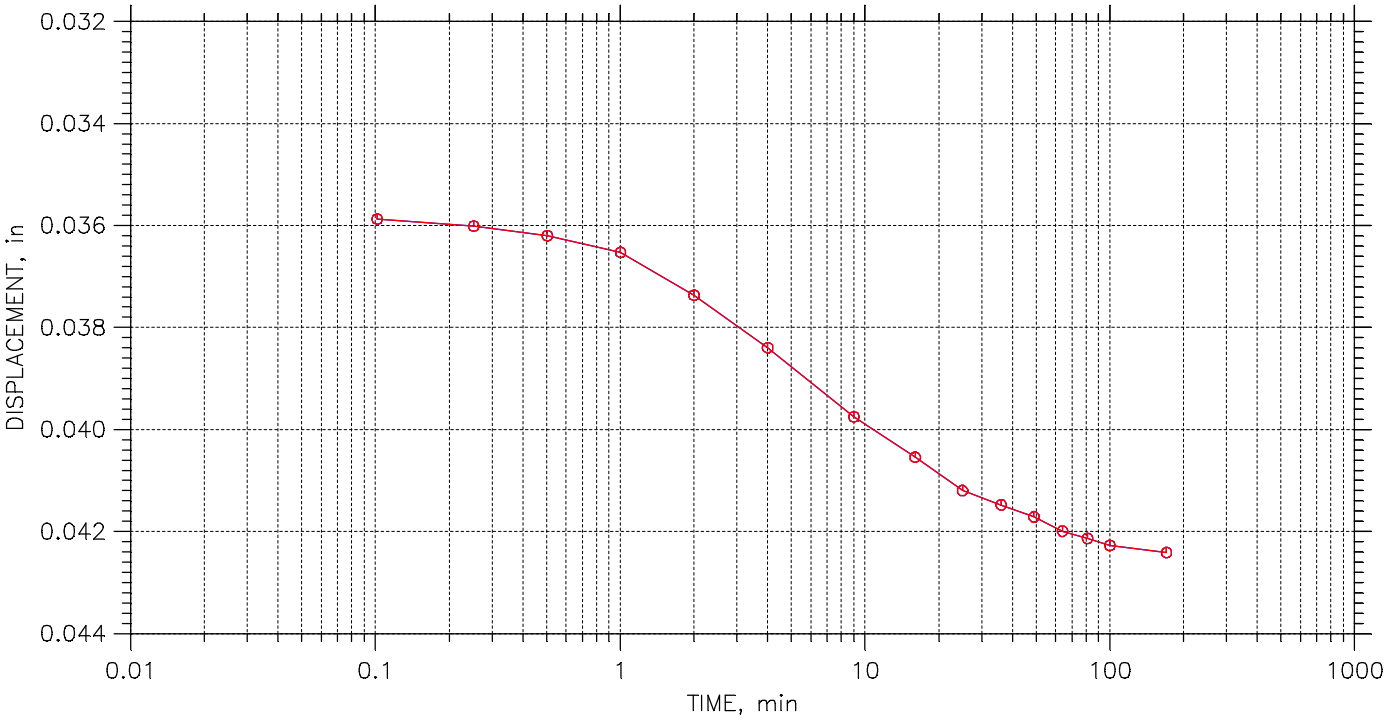
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

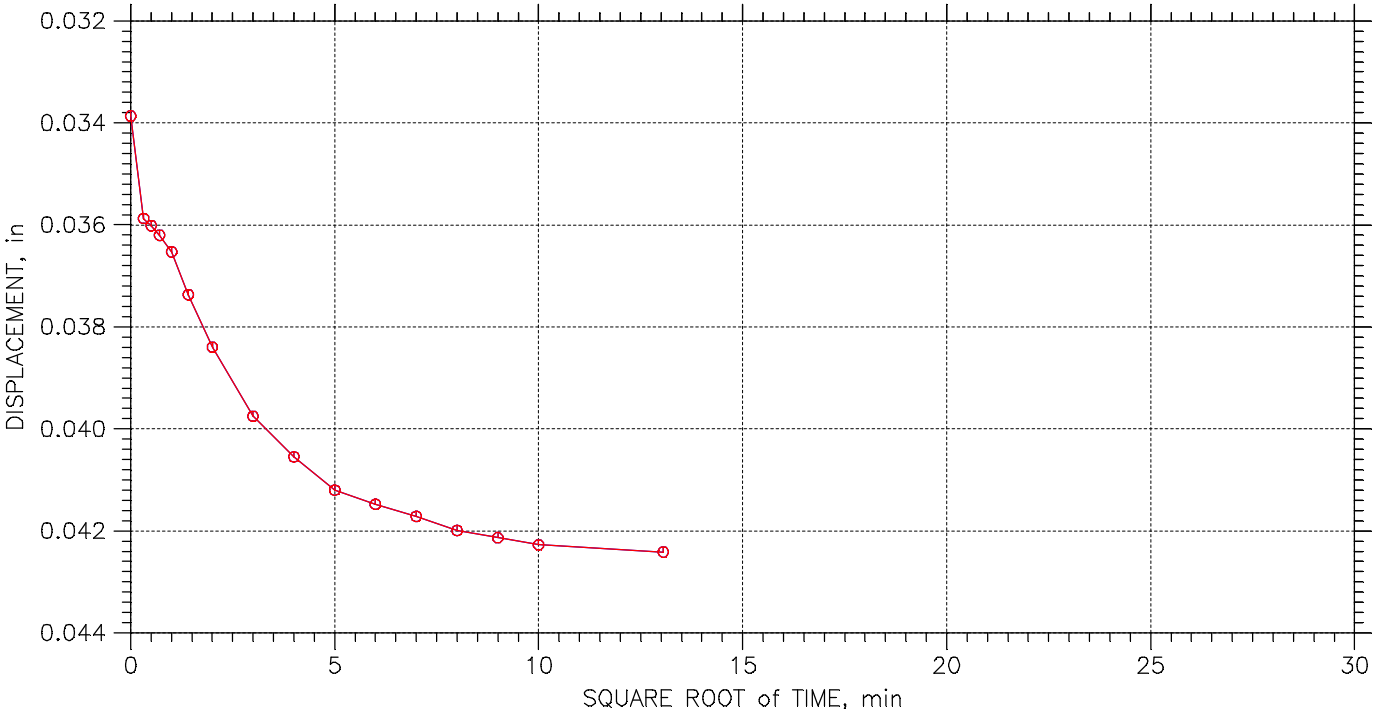
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 5 of 23

Stress: 1. tsf





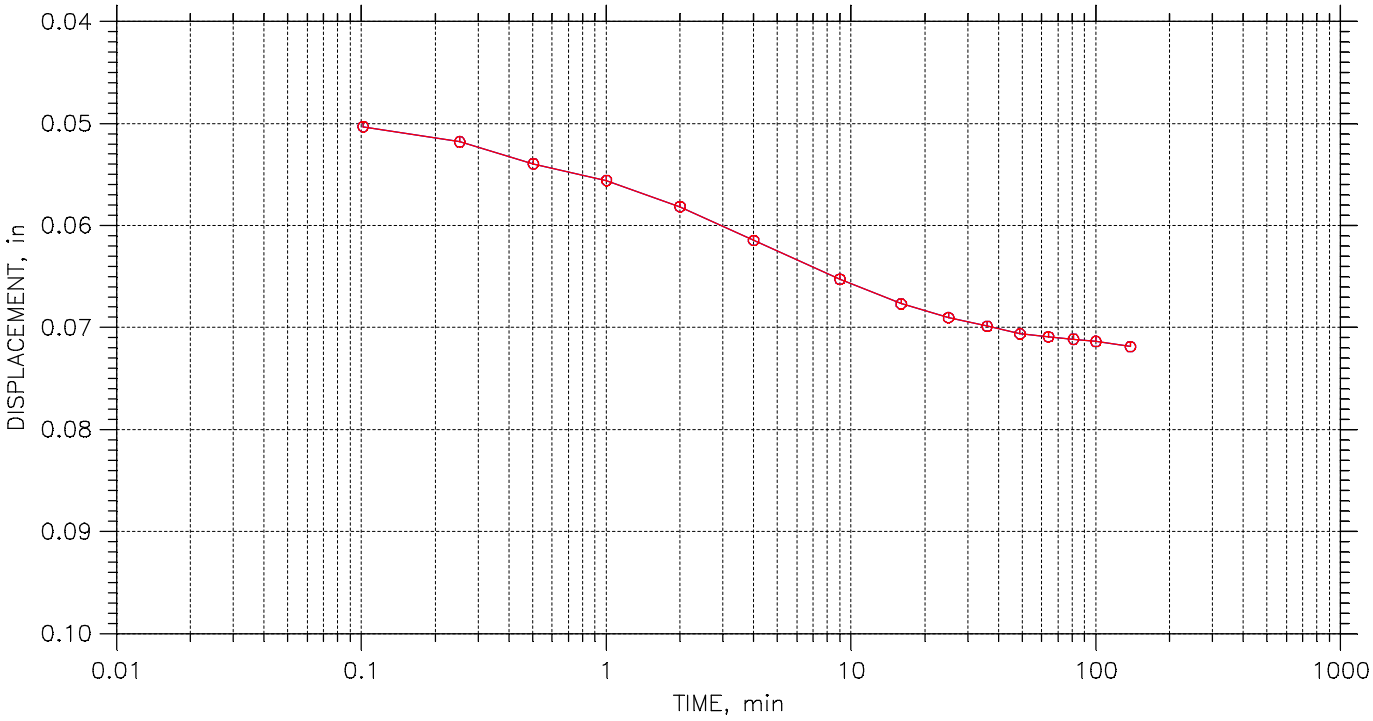
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

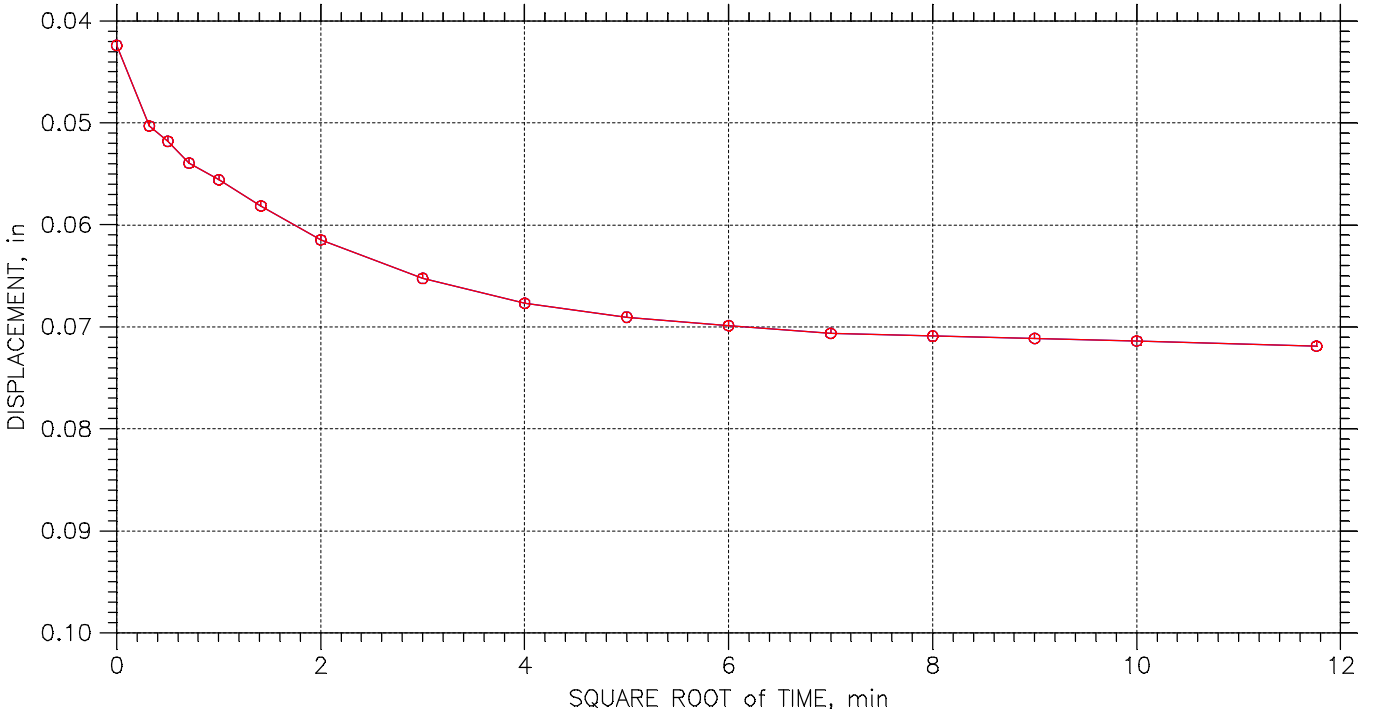
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 6 of 23

Stress: 2. tsf





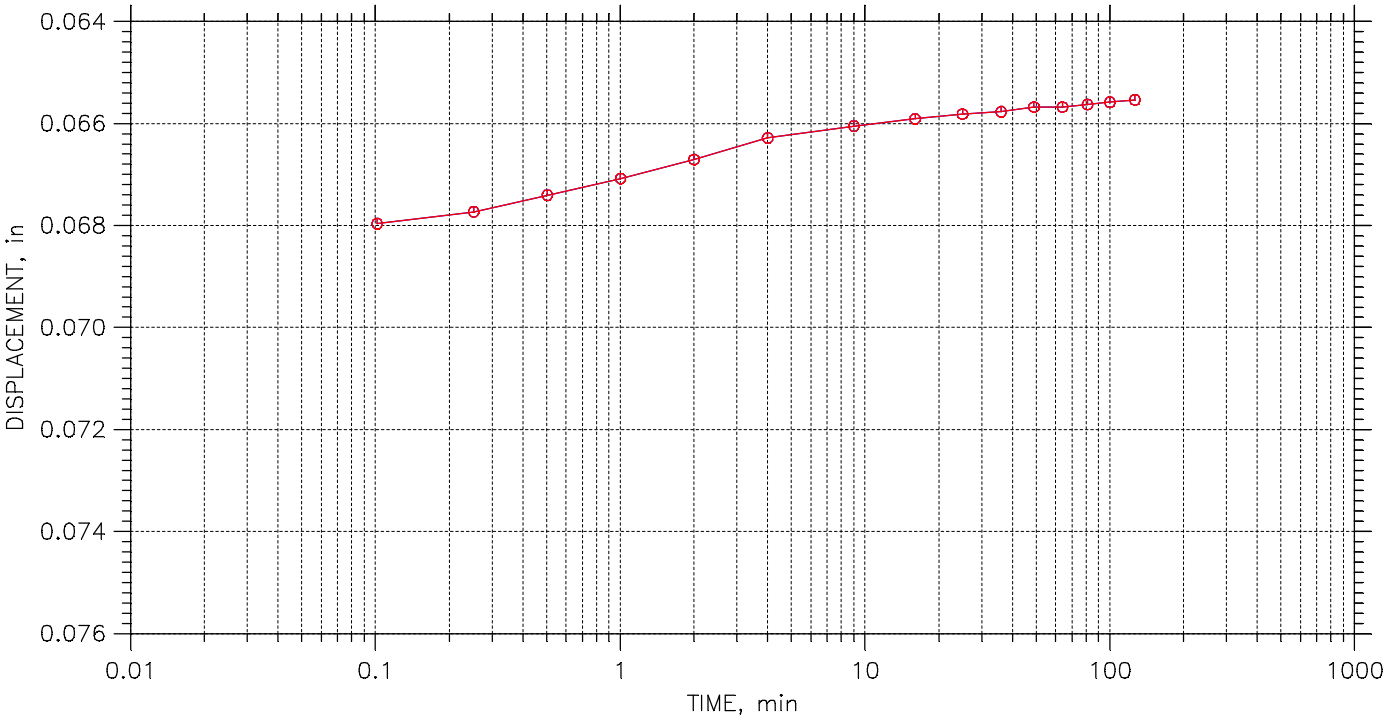
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

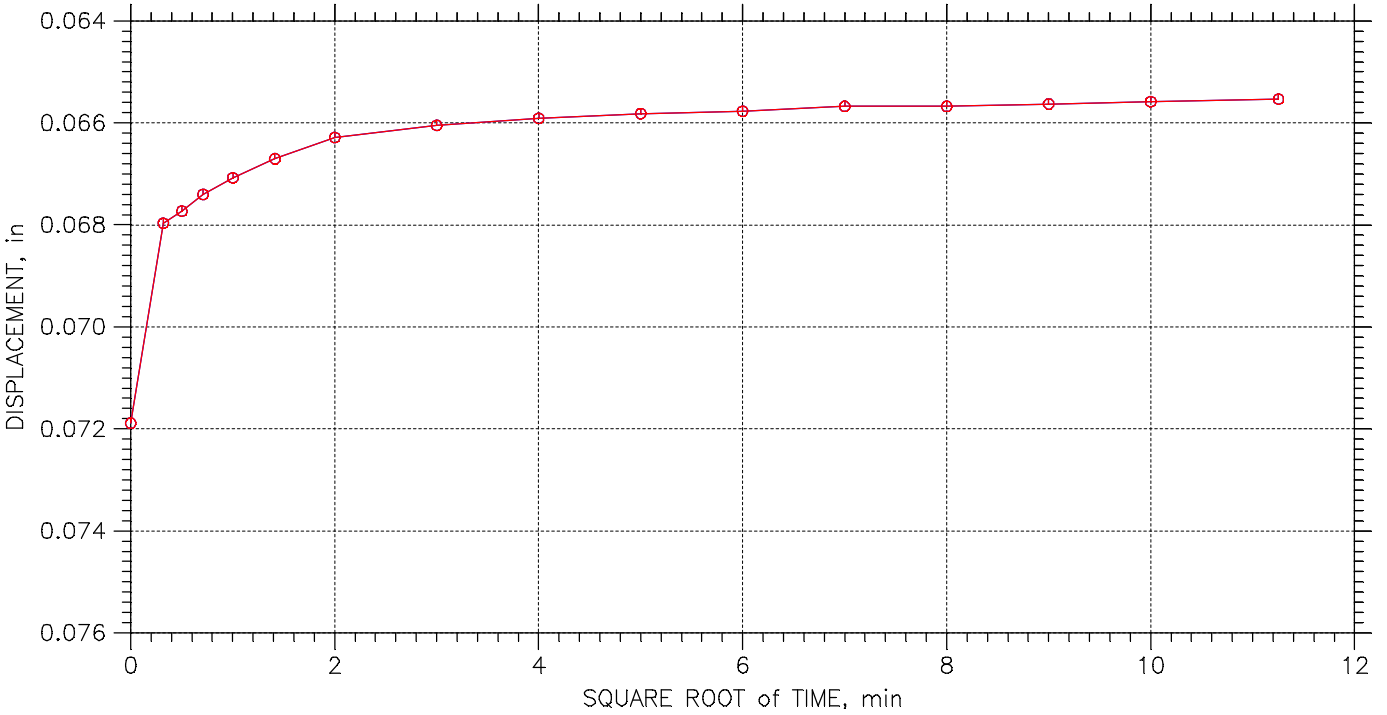
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 7 of 23

Stress: 1. tsf





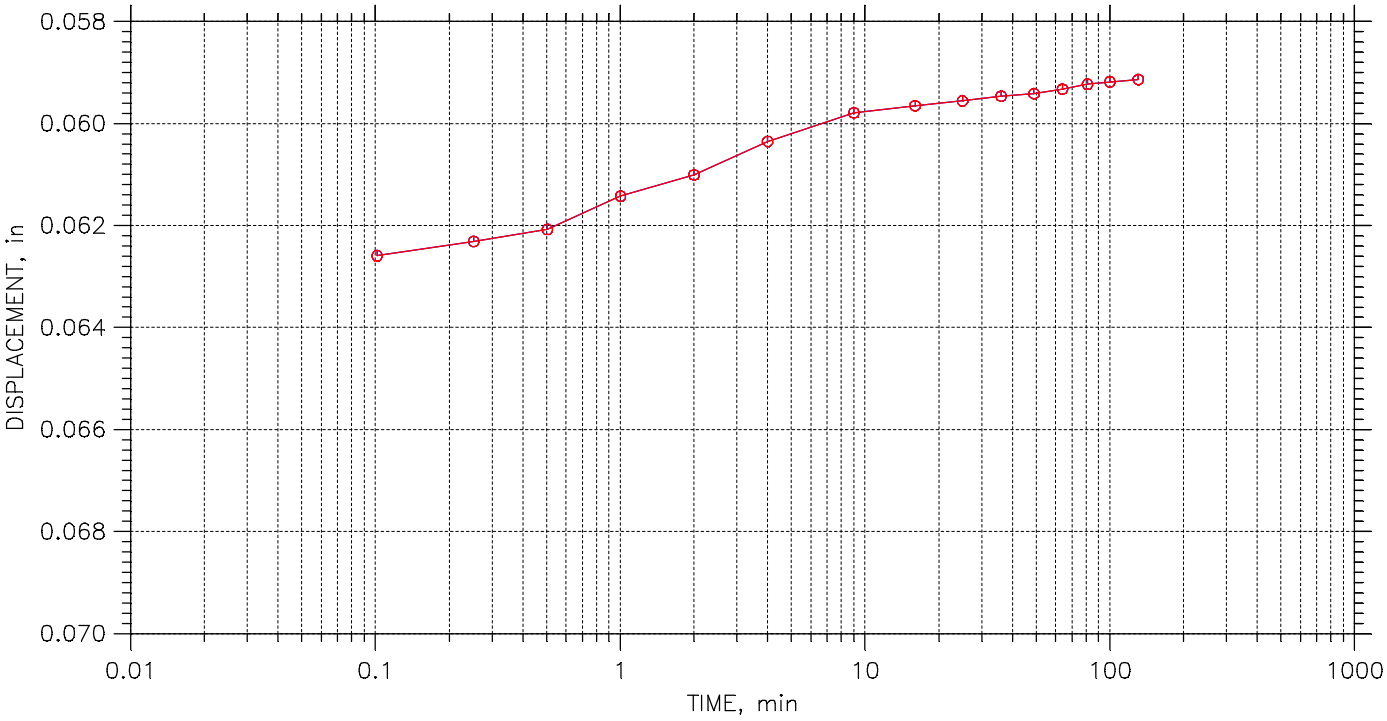
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

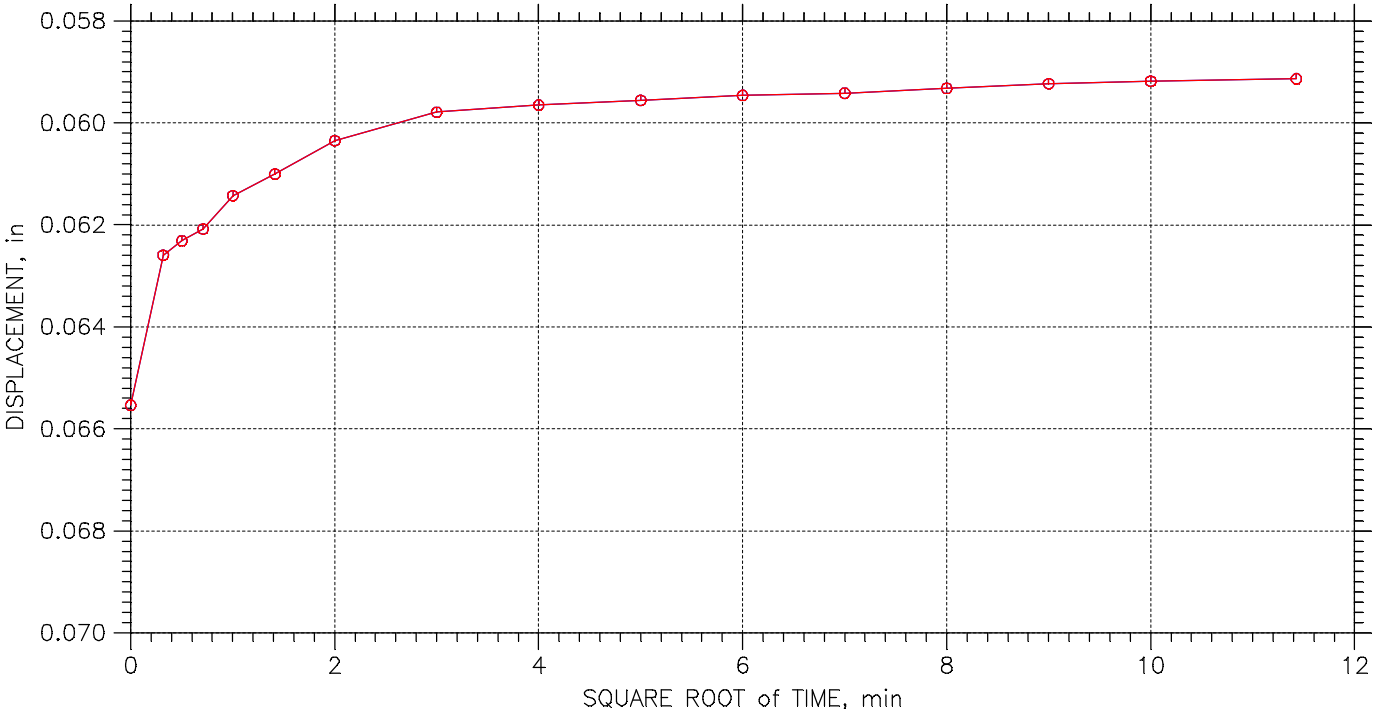
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 8 of 23

Stress: 0.5 tsf





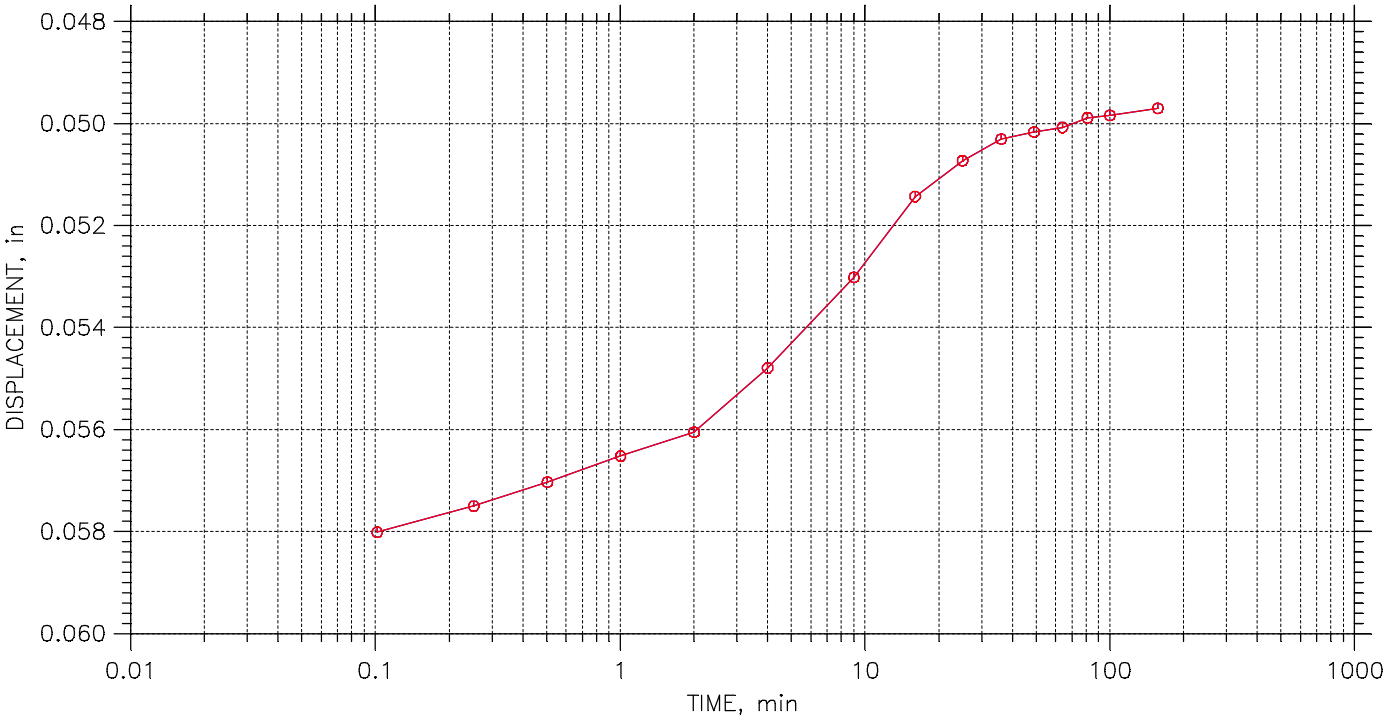
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

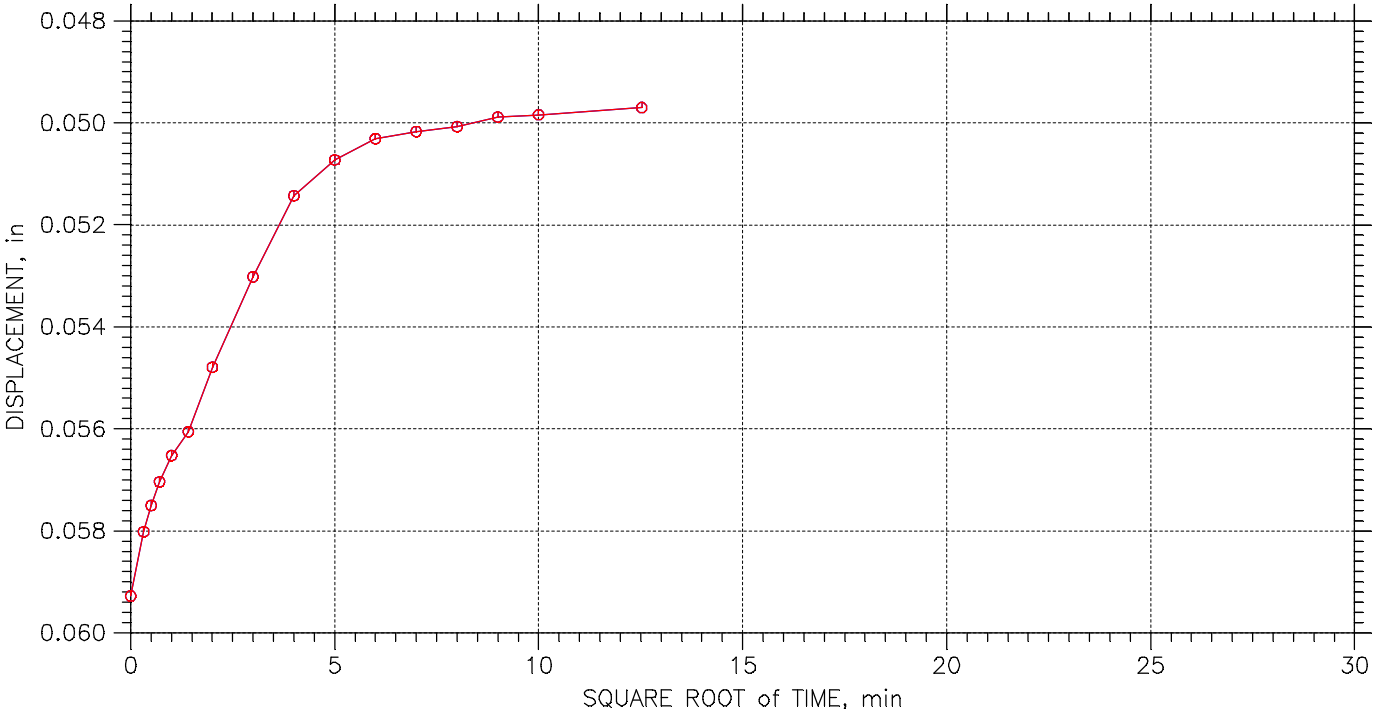
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 9 of 23

Stress: 0.125 tsf





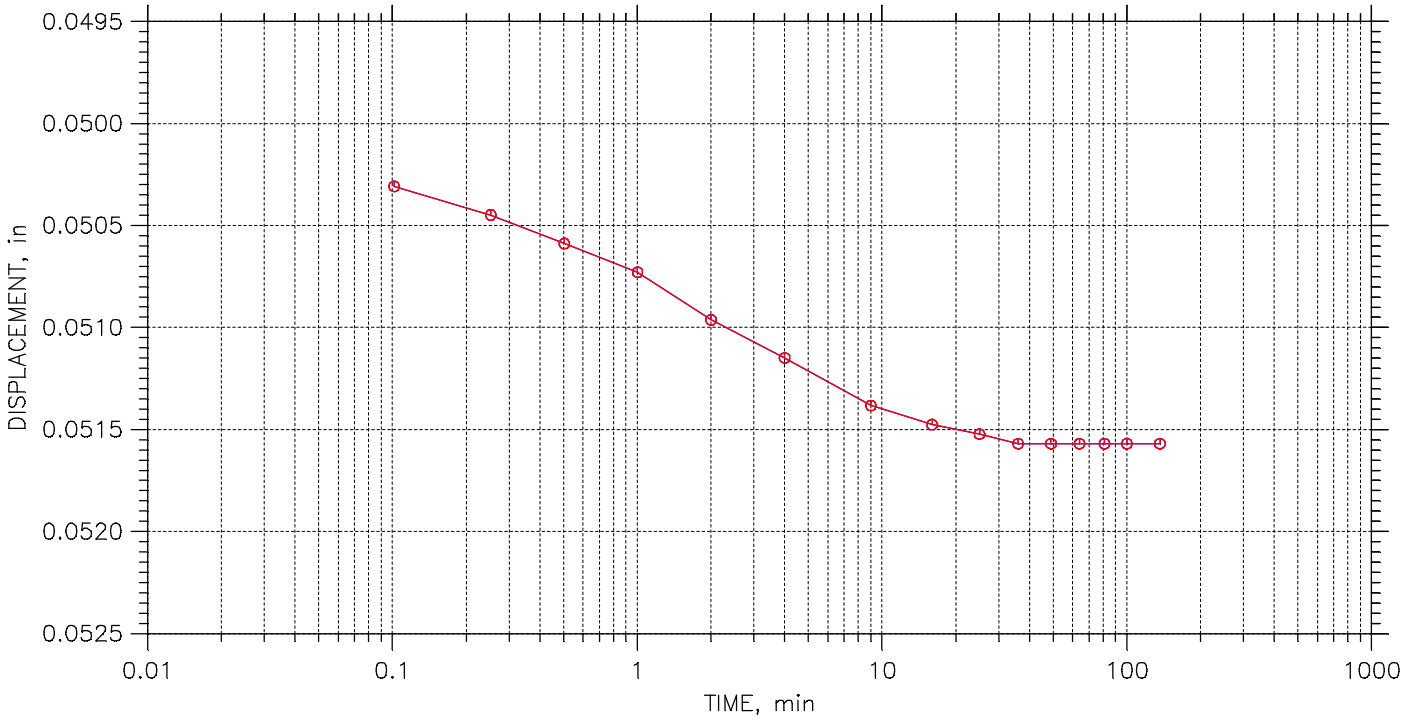
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

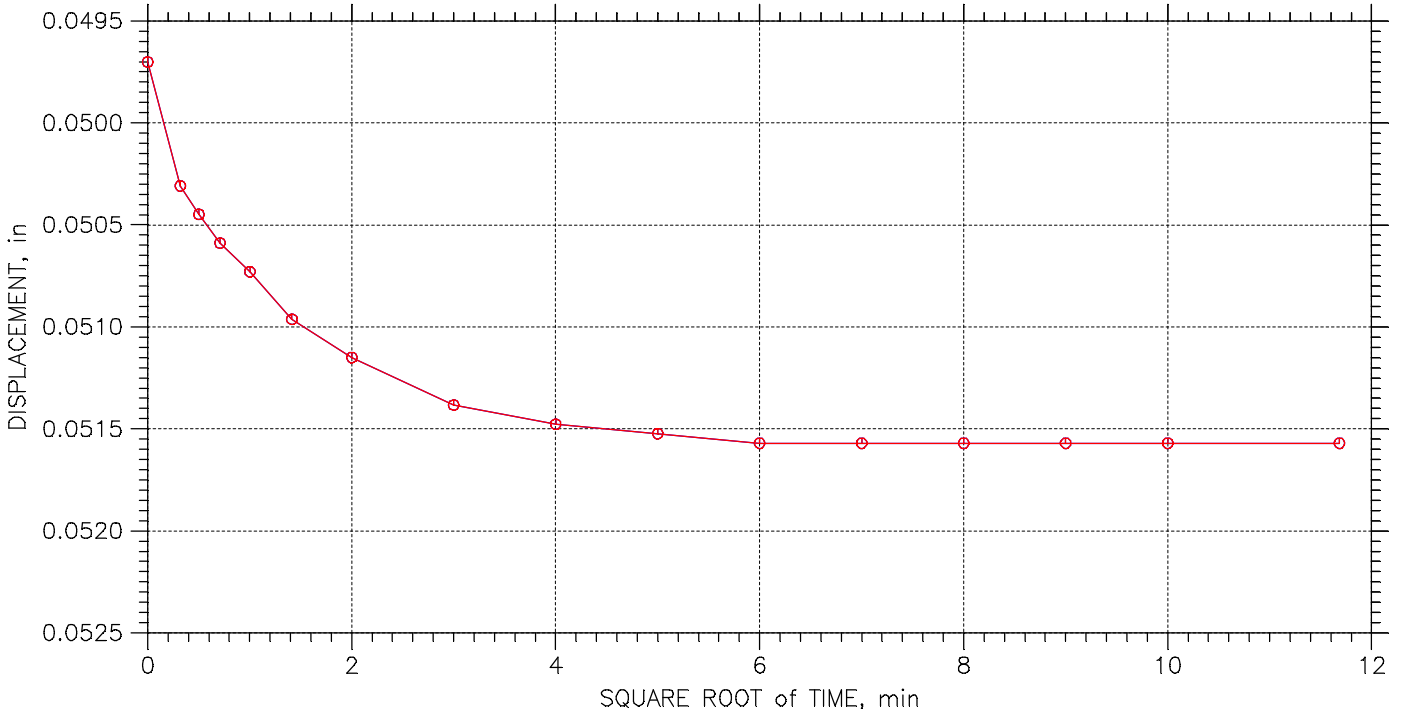
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 10 of 23

Stress: 0.25 tsf





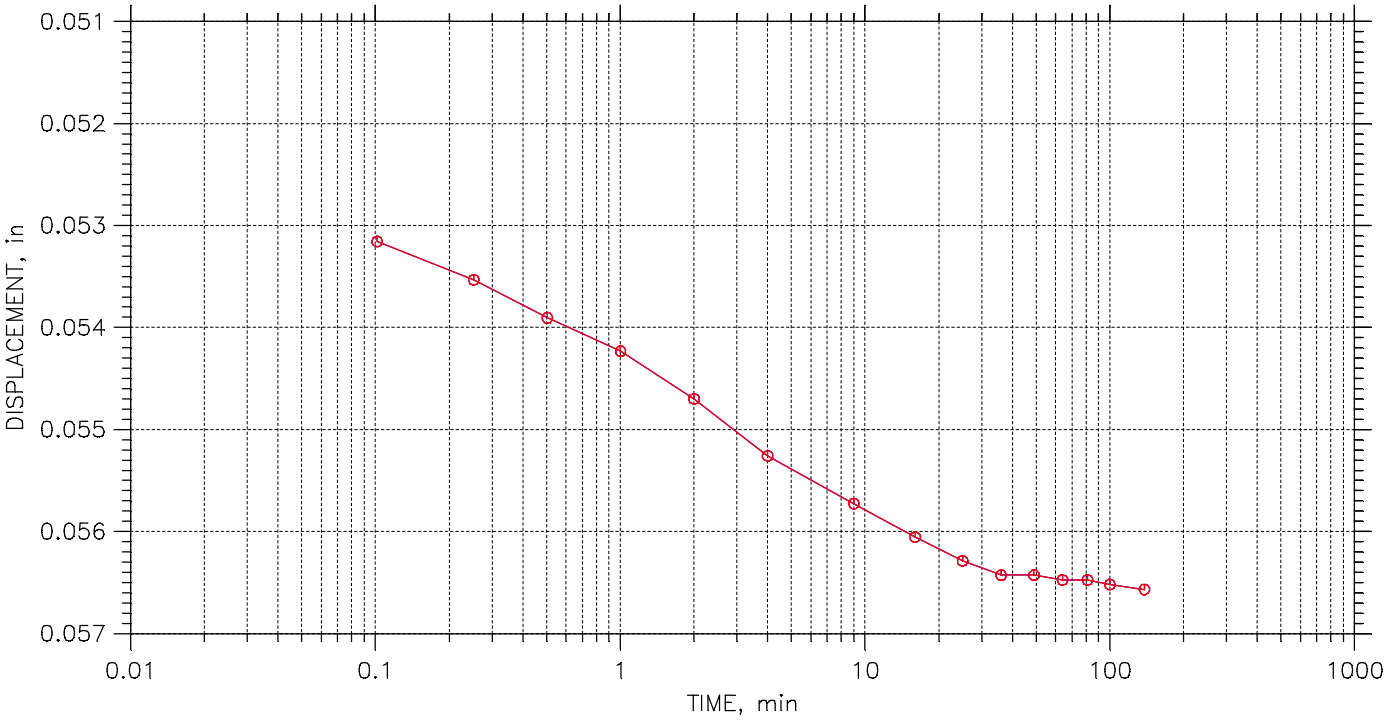
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

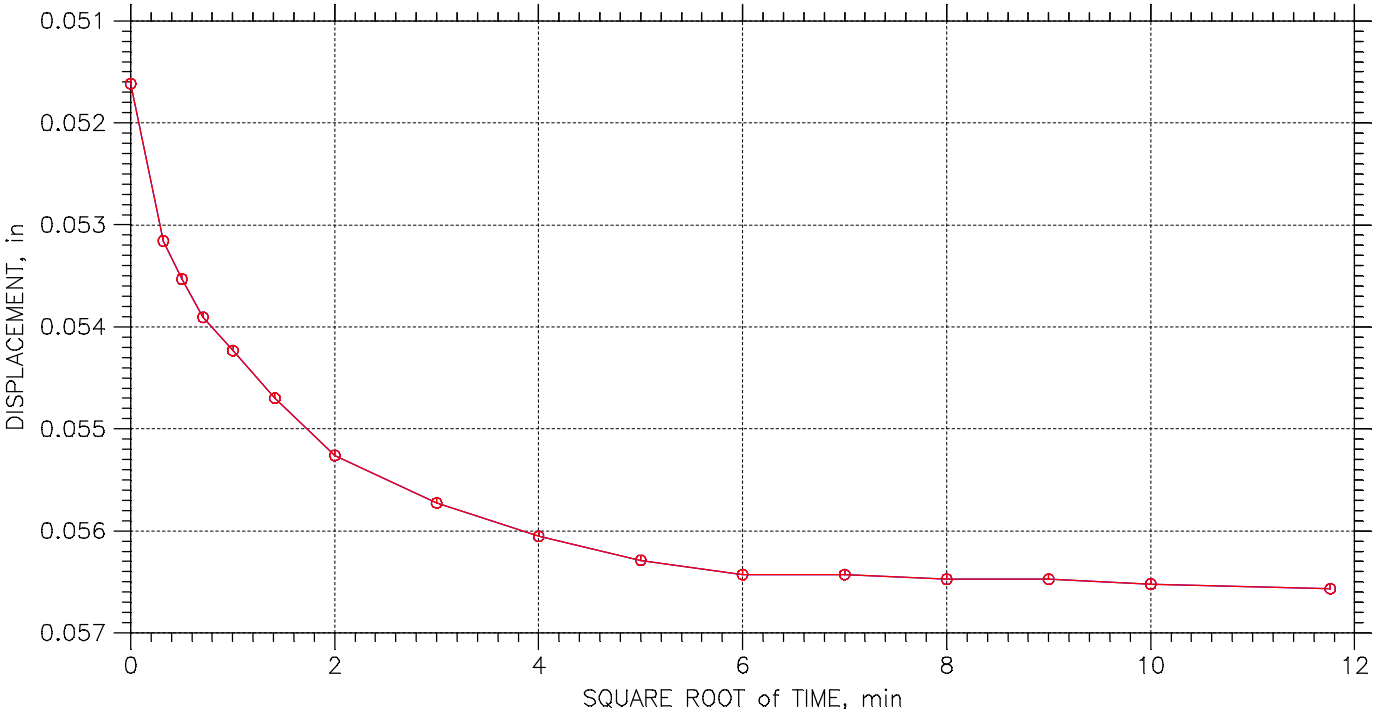
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 11 of 23

Stress: 0.5 tsf





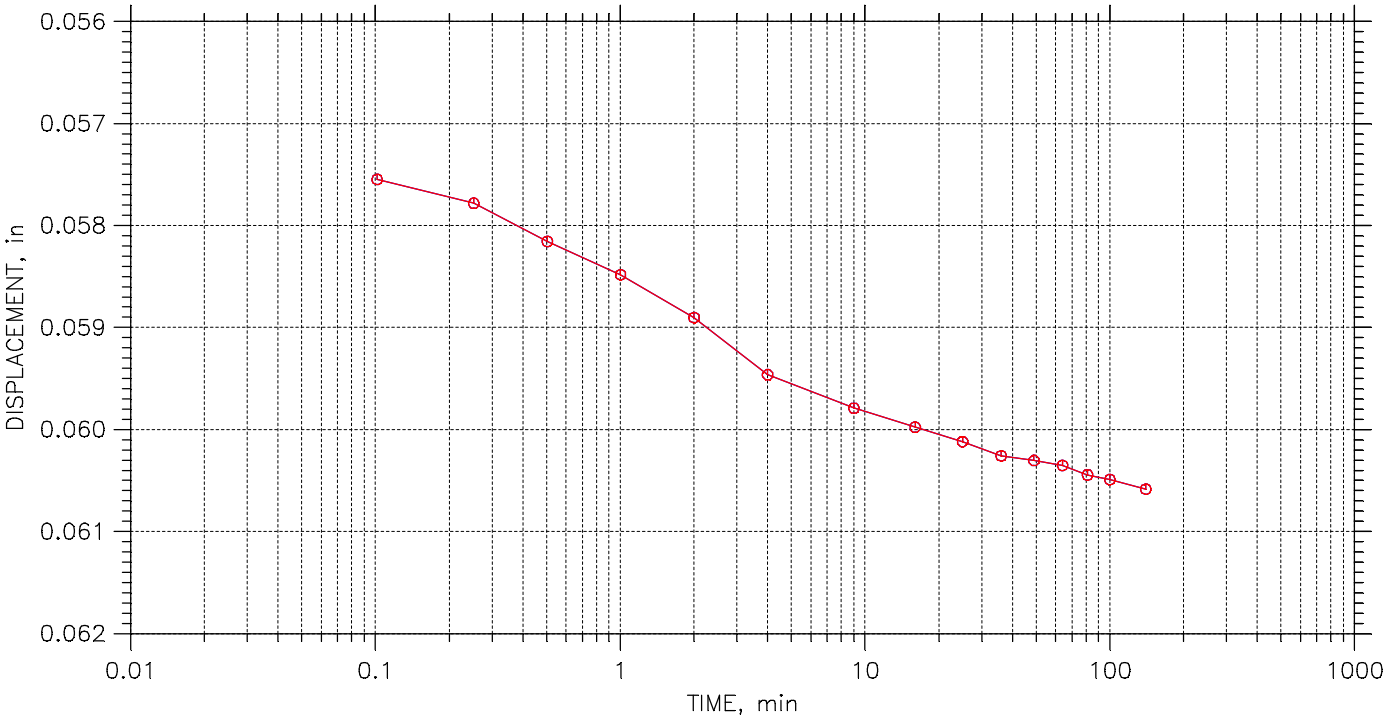
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

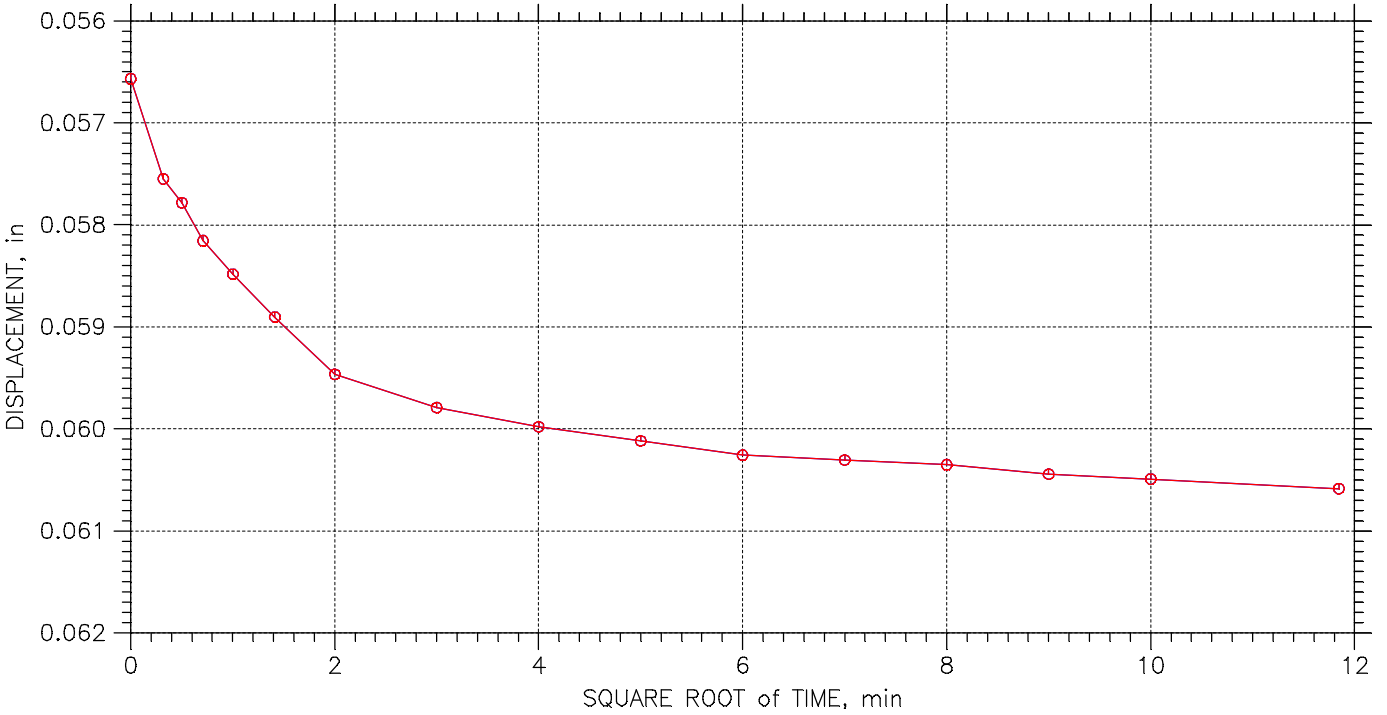
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 12 of 23

Stress: 0.75 tsf





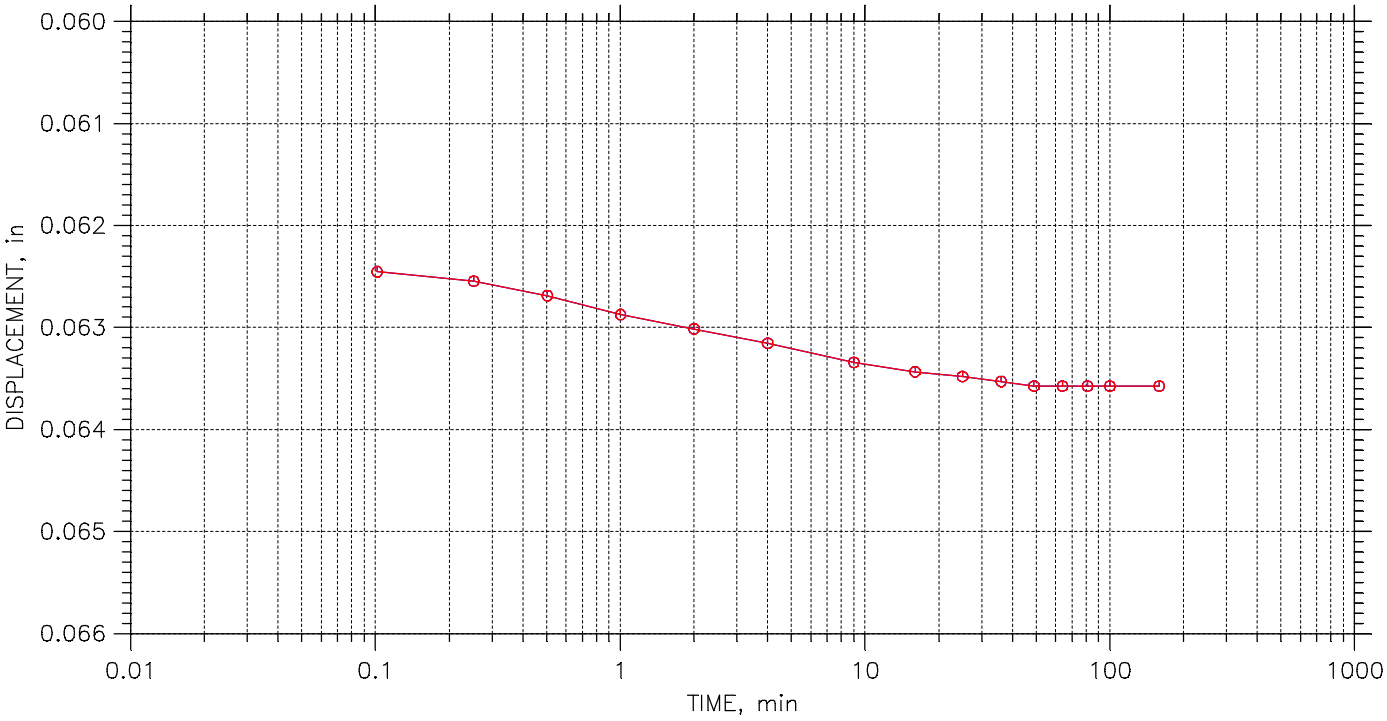
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

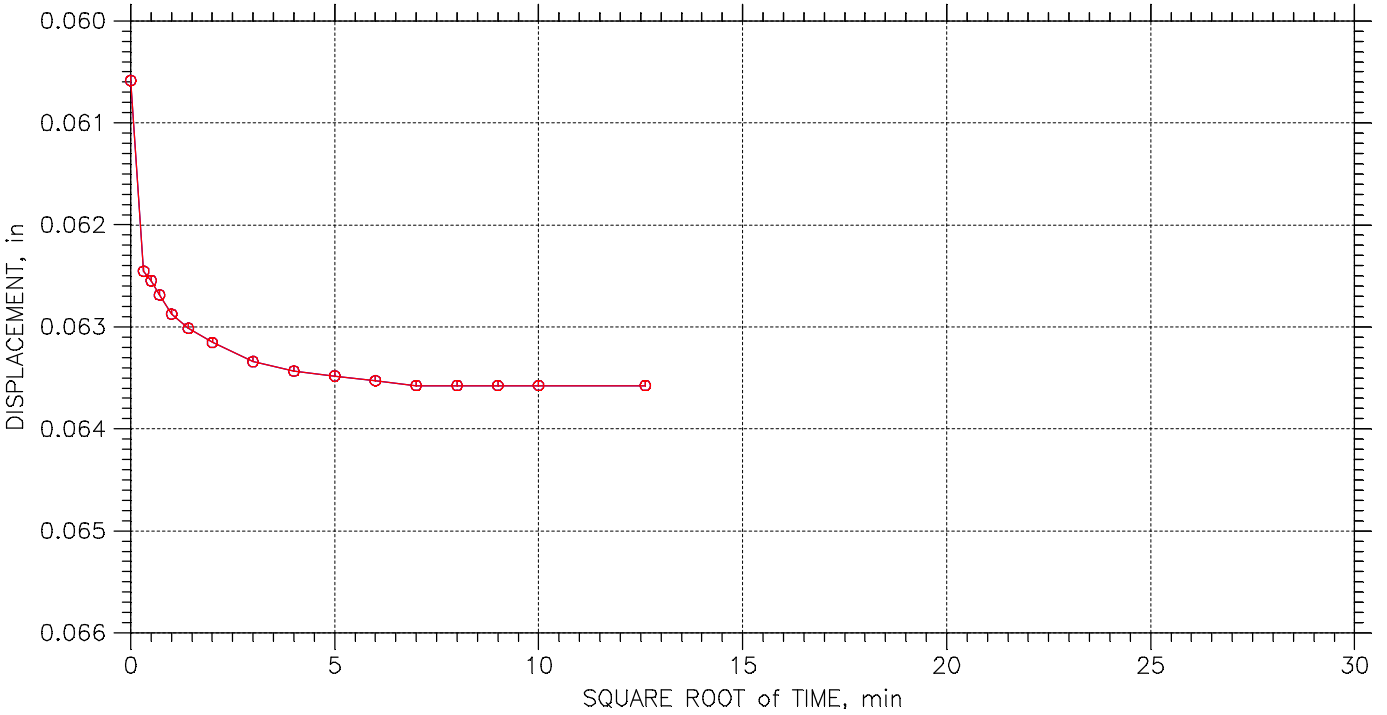
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 13 of 23

Stress: 1. tsf





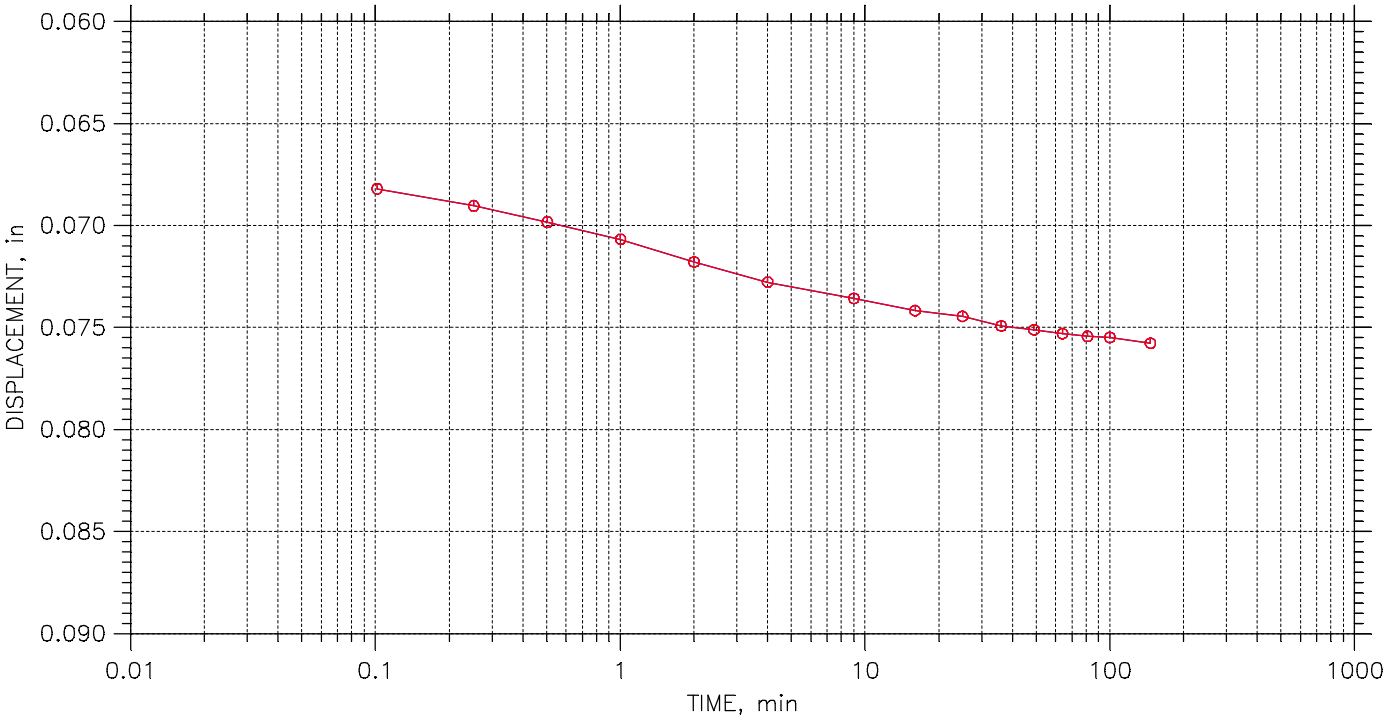
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

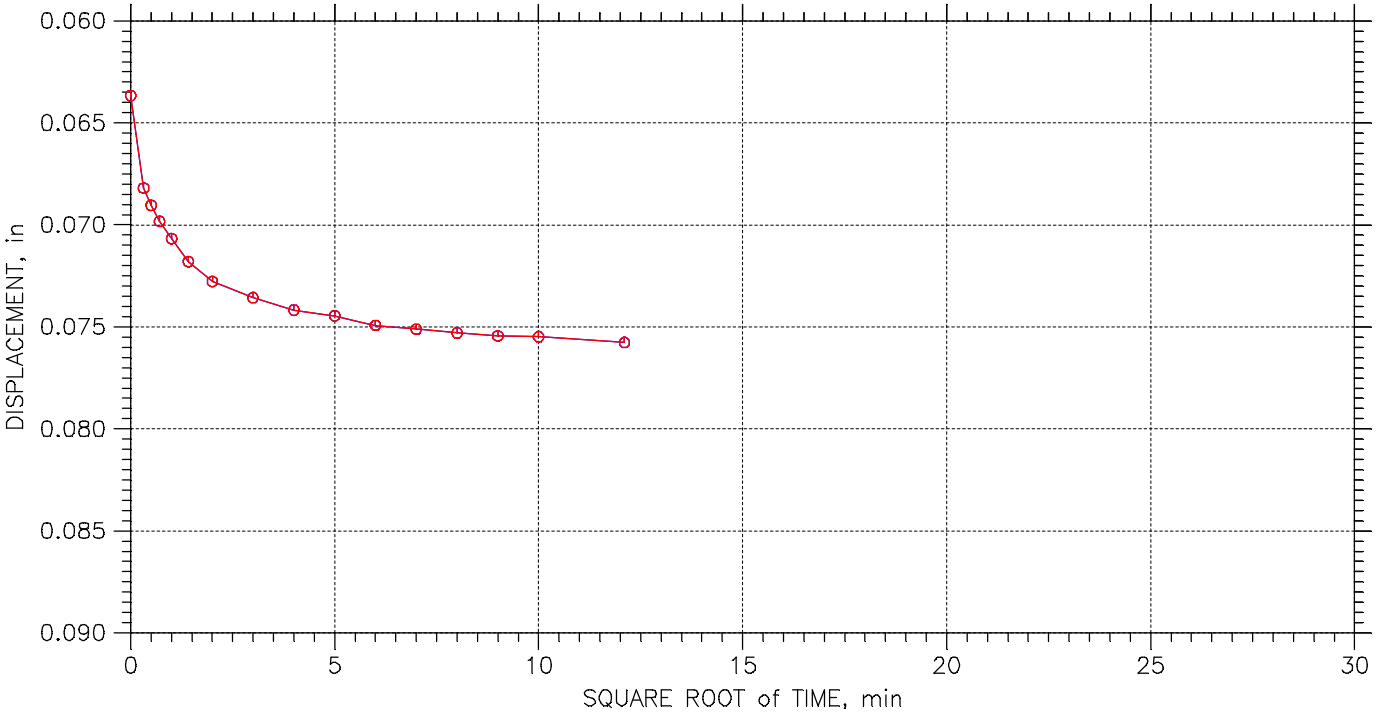
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 14 of 23

Stress: 2. tsf





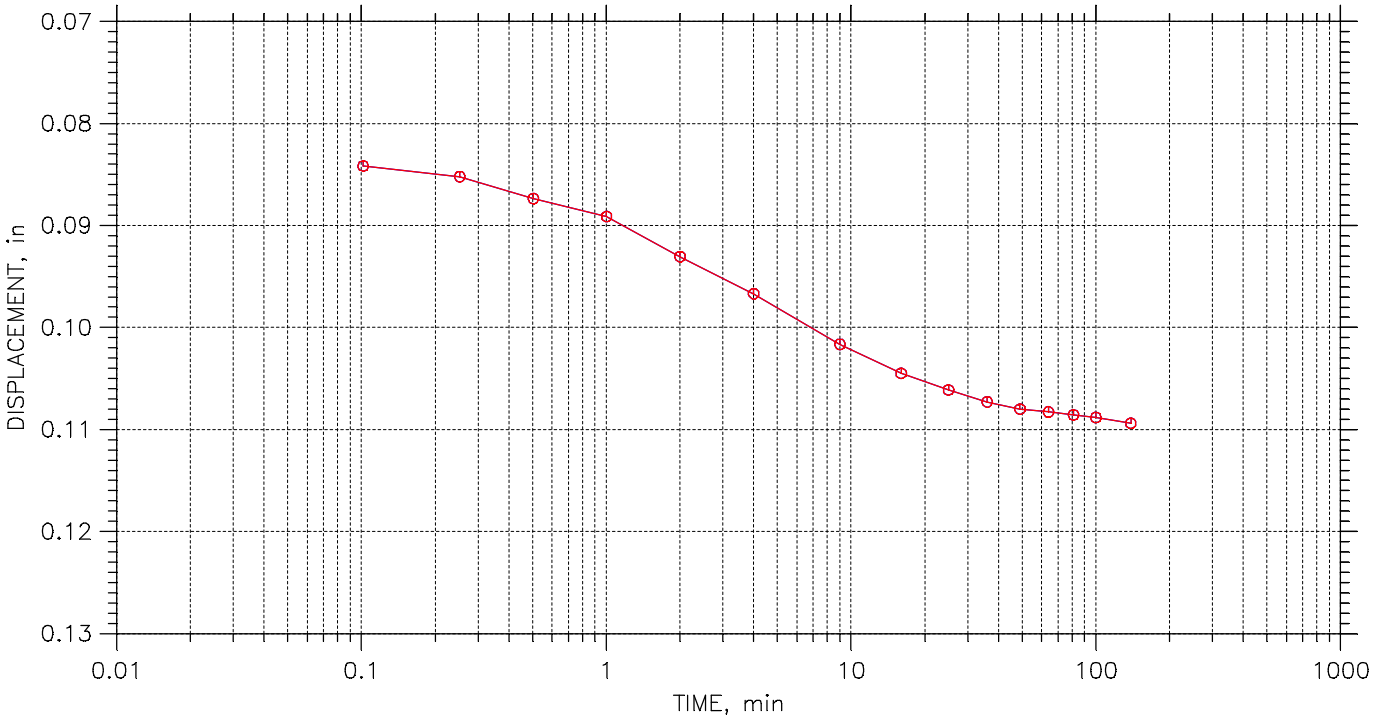
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

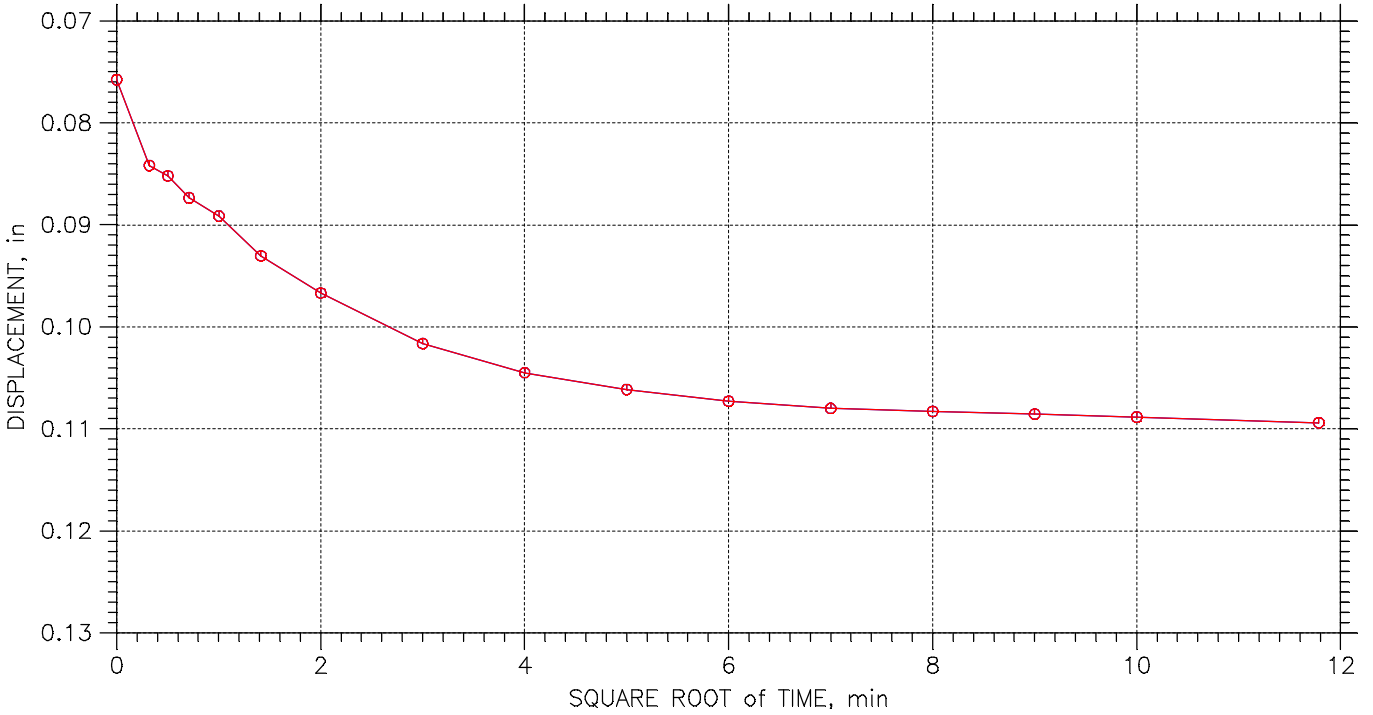
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 15 of 23

Stress: 4. tsf





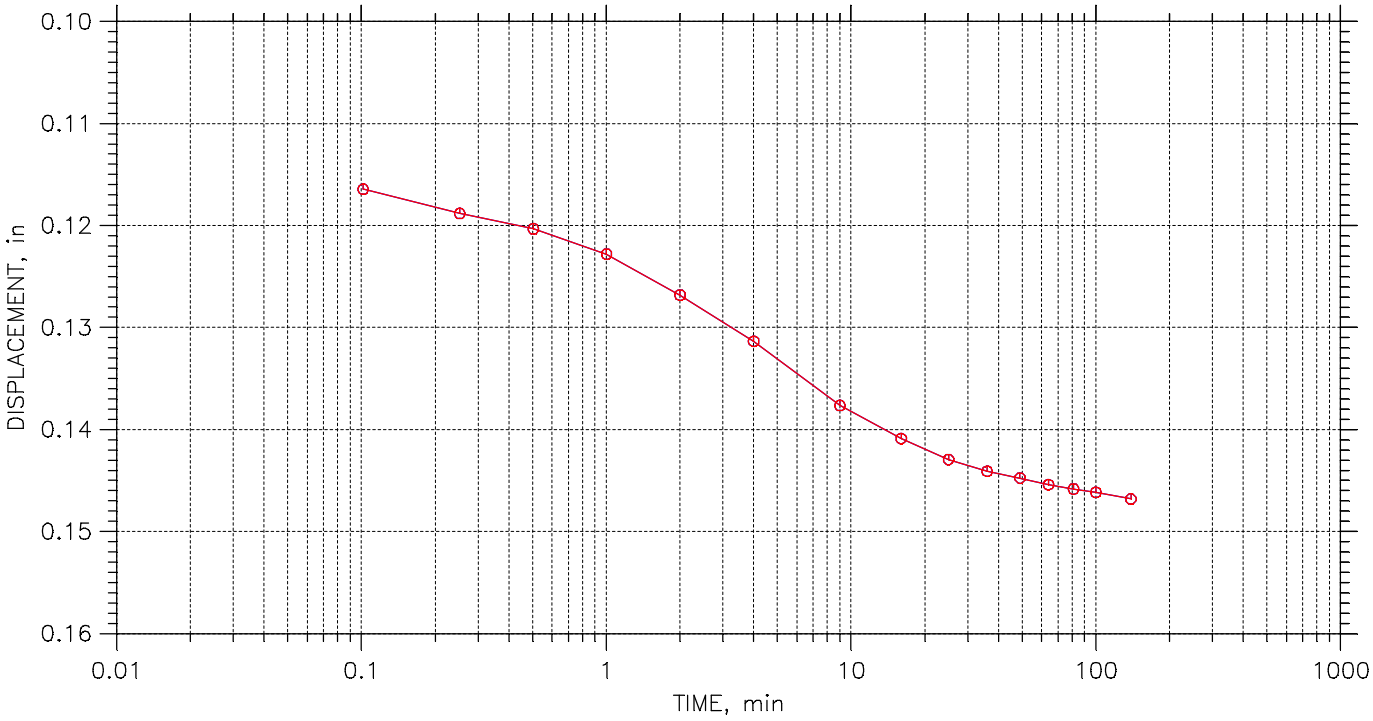
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

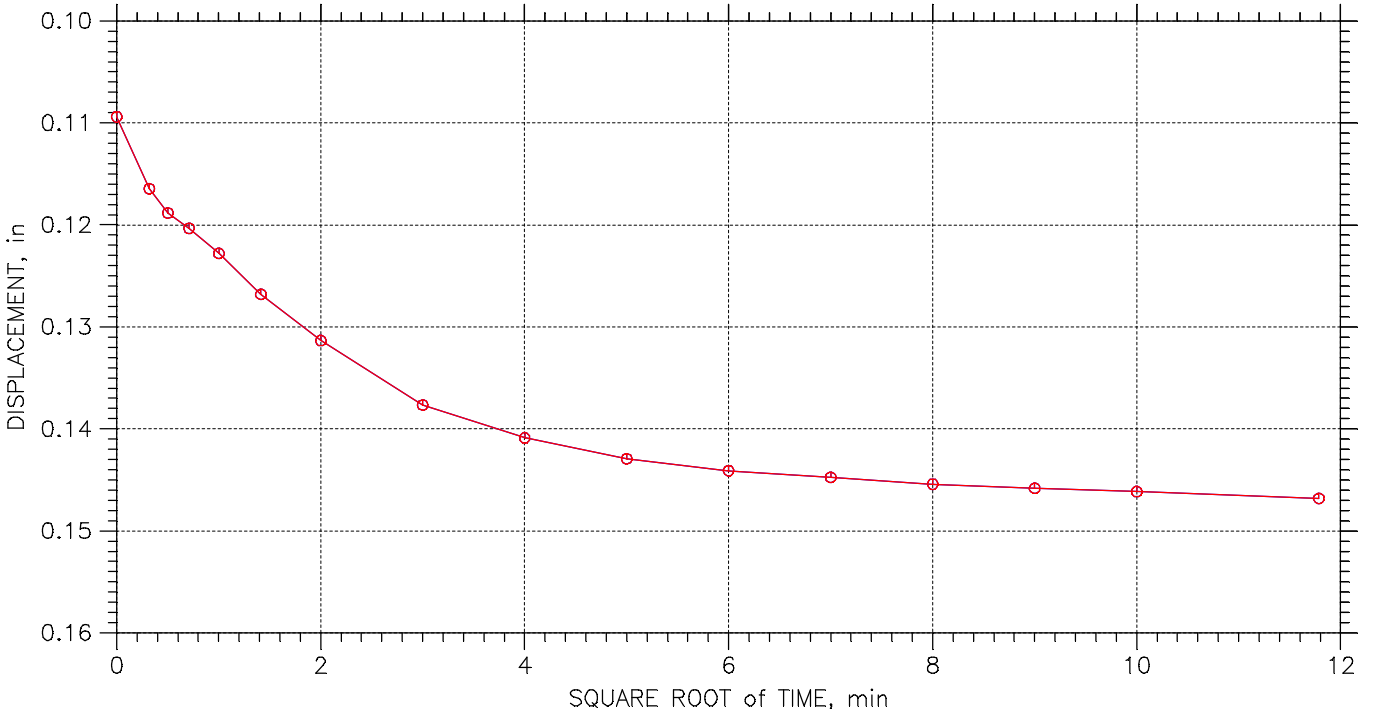
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 16 of 23

Stress: 8. tsf





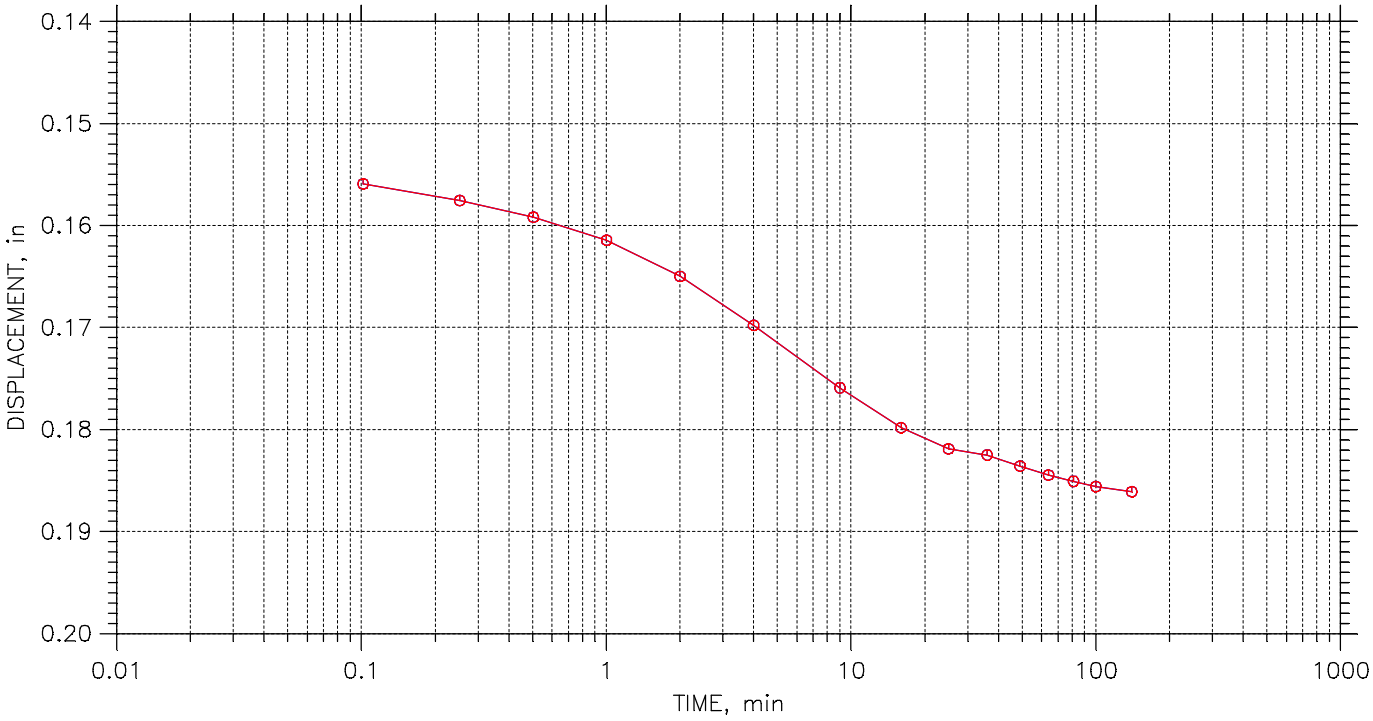
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

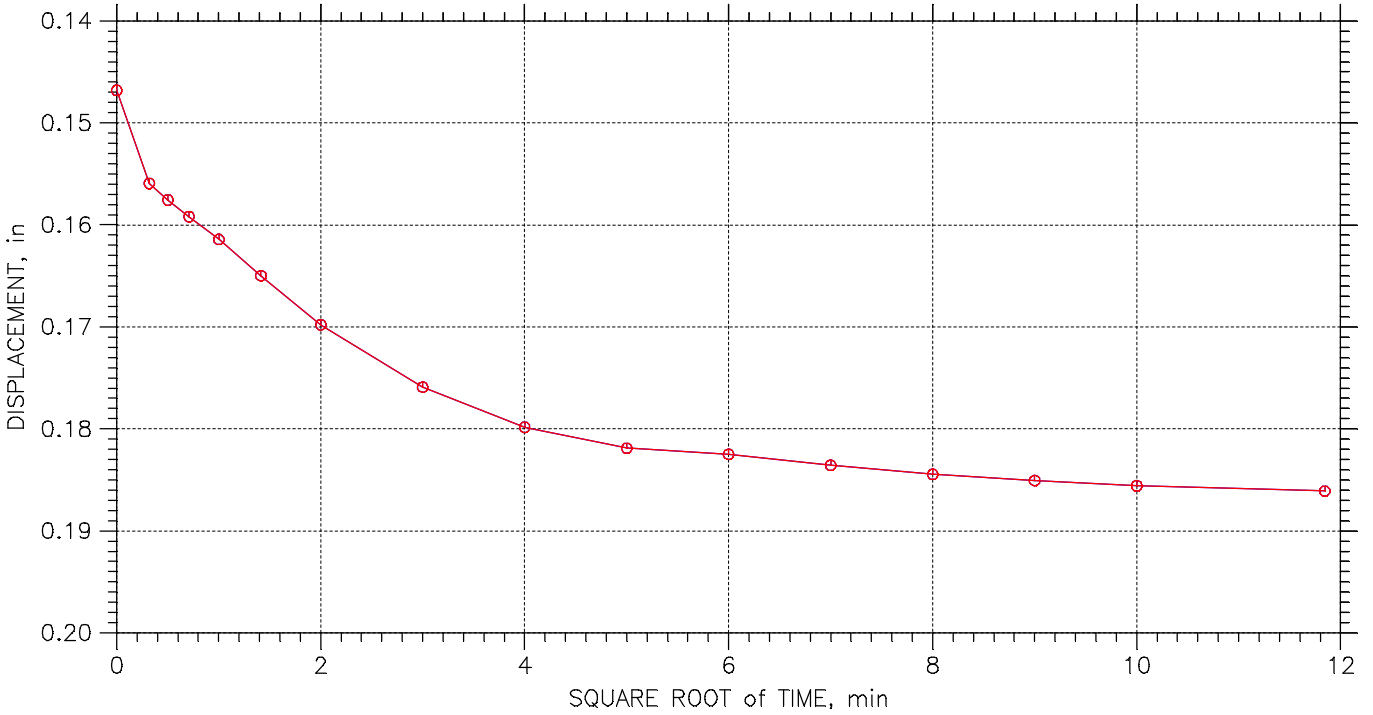
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 17 of 23

Stress: 16. tsf





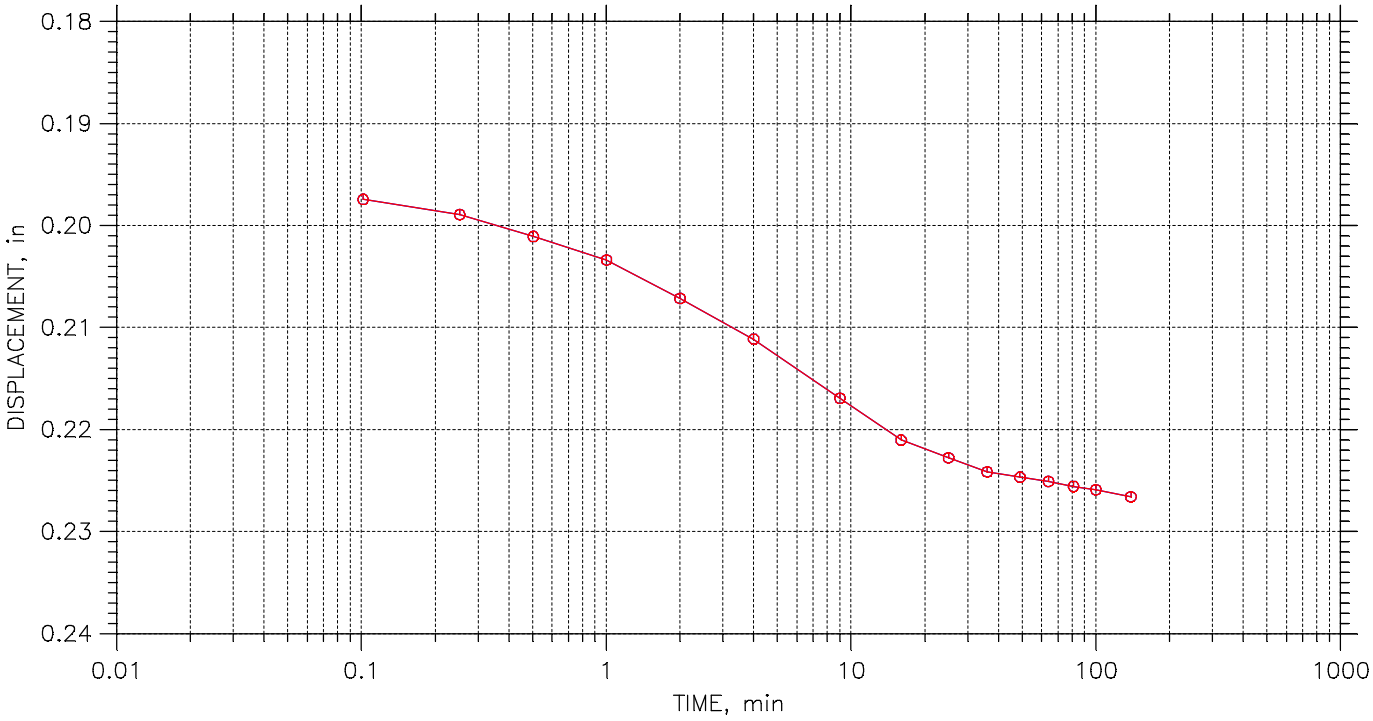
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

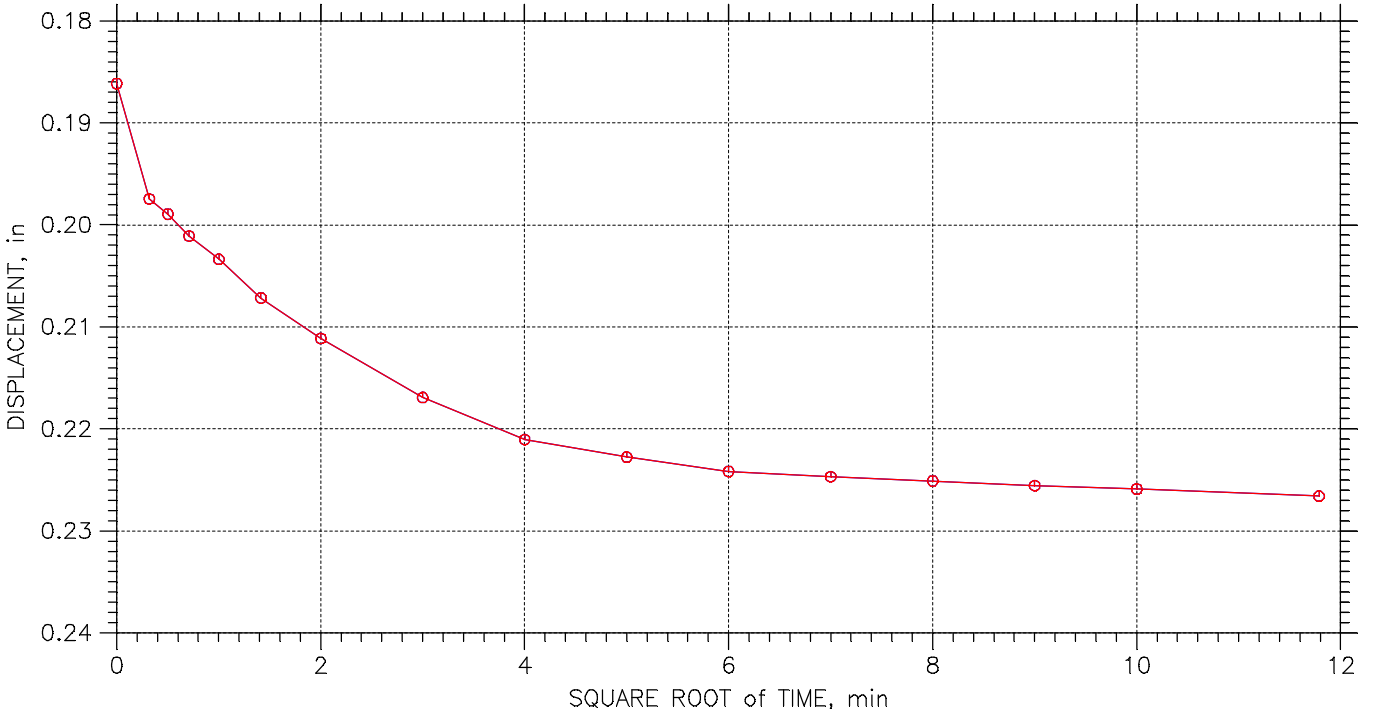
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 18 of 23

Stress: 32. tsf





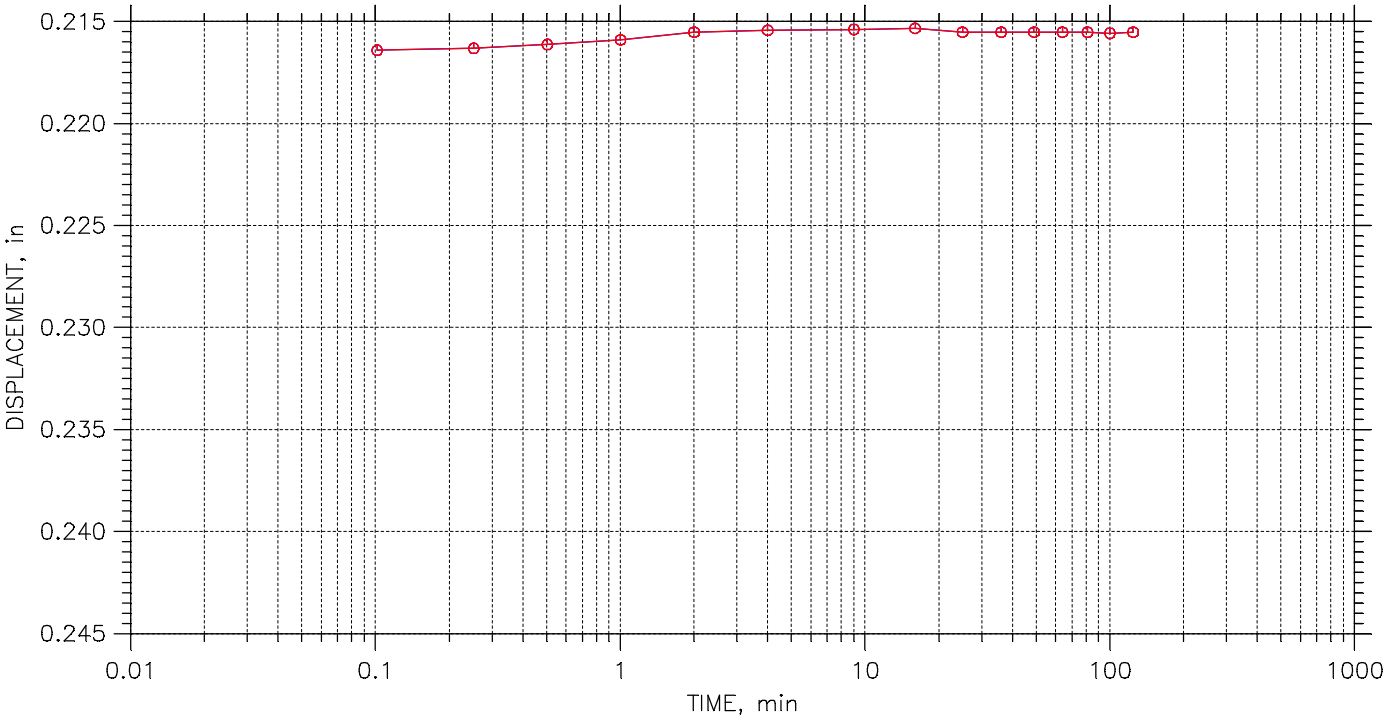
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

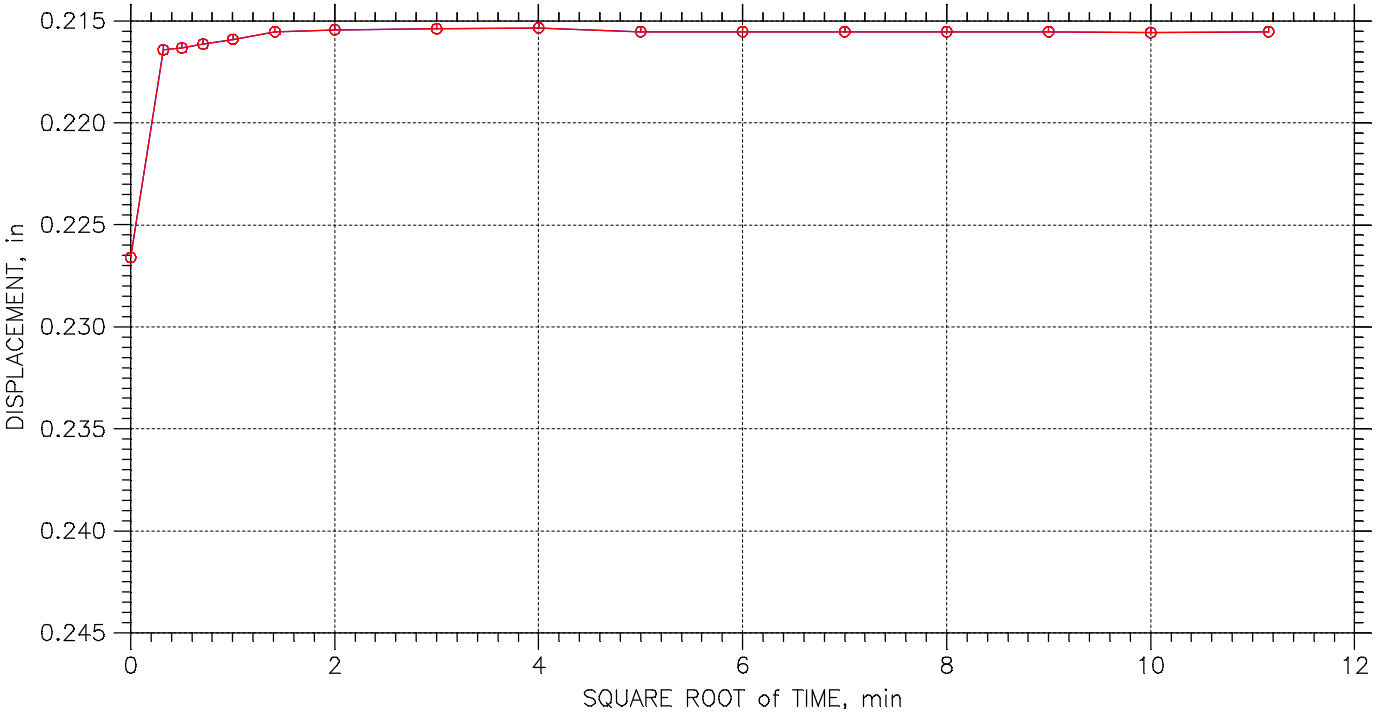
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 19 of 23

Stress: 16. tsf





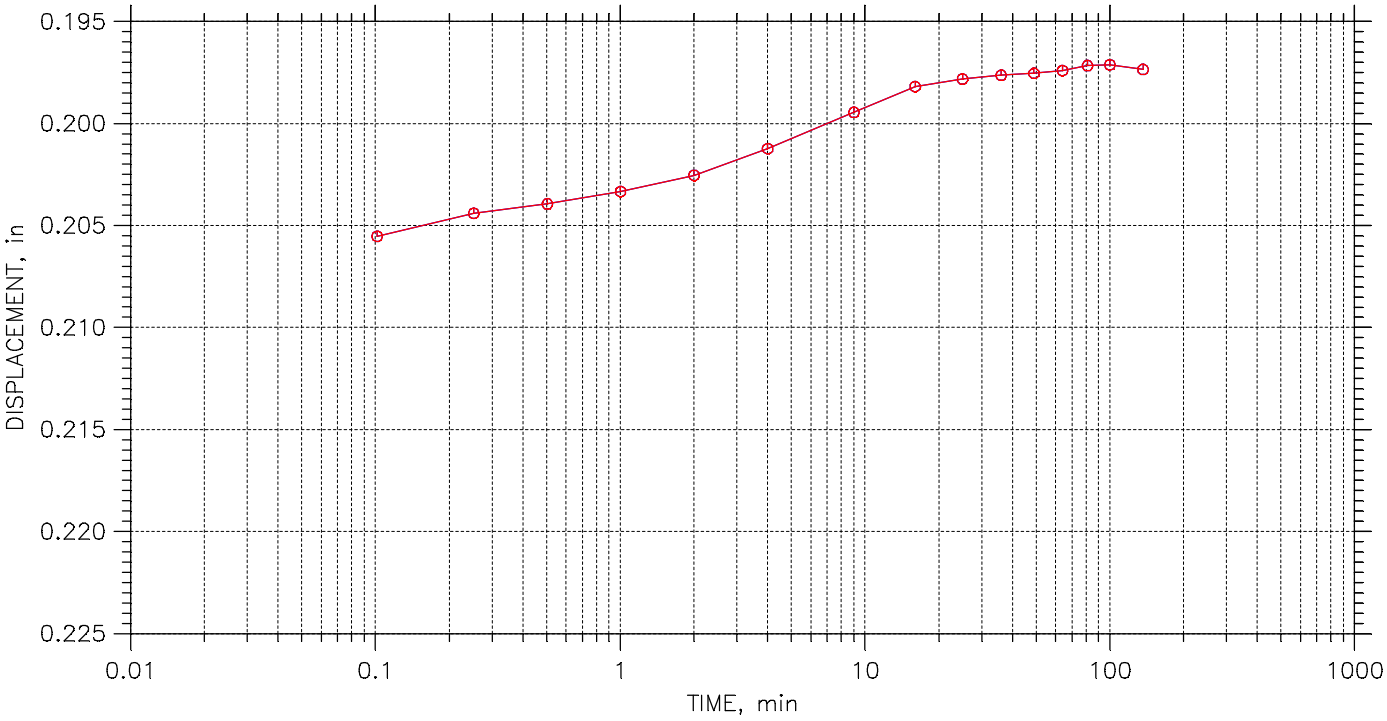
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

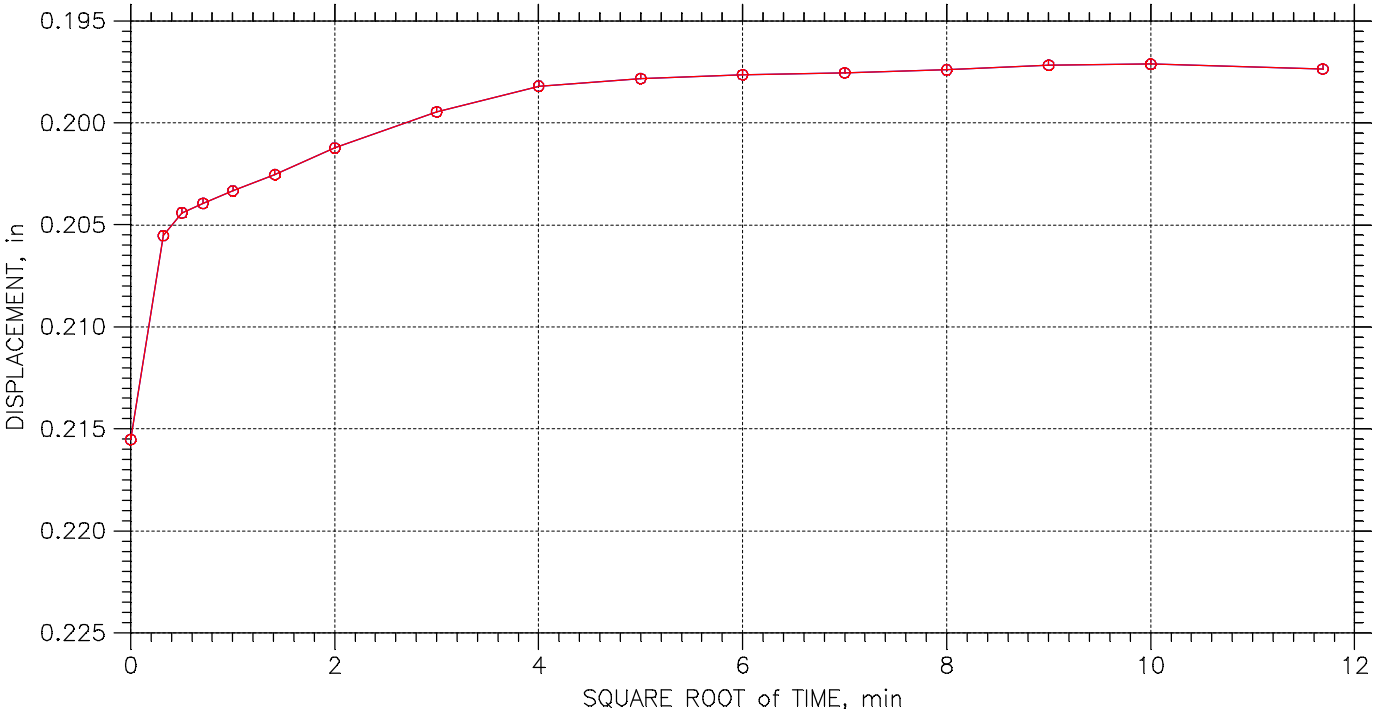
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 20 of 23

Stress: 4. tsf





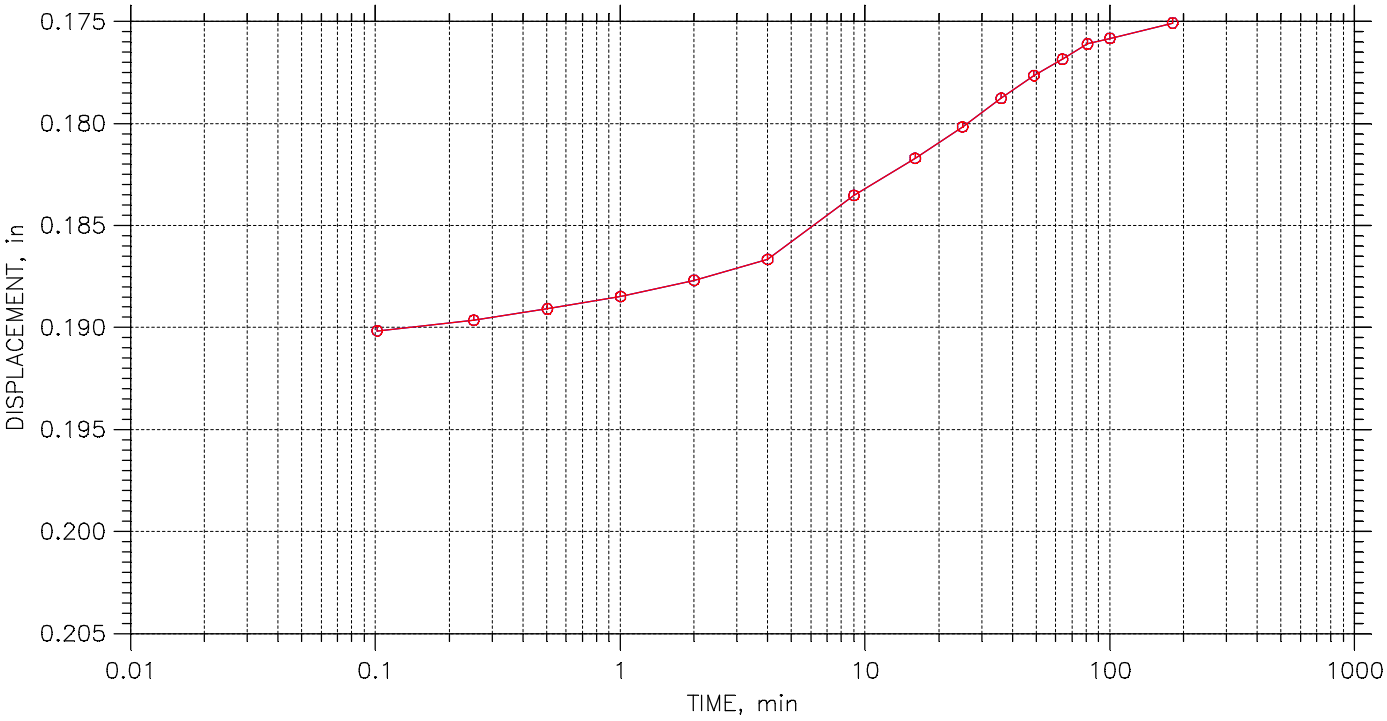
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

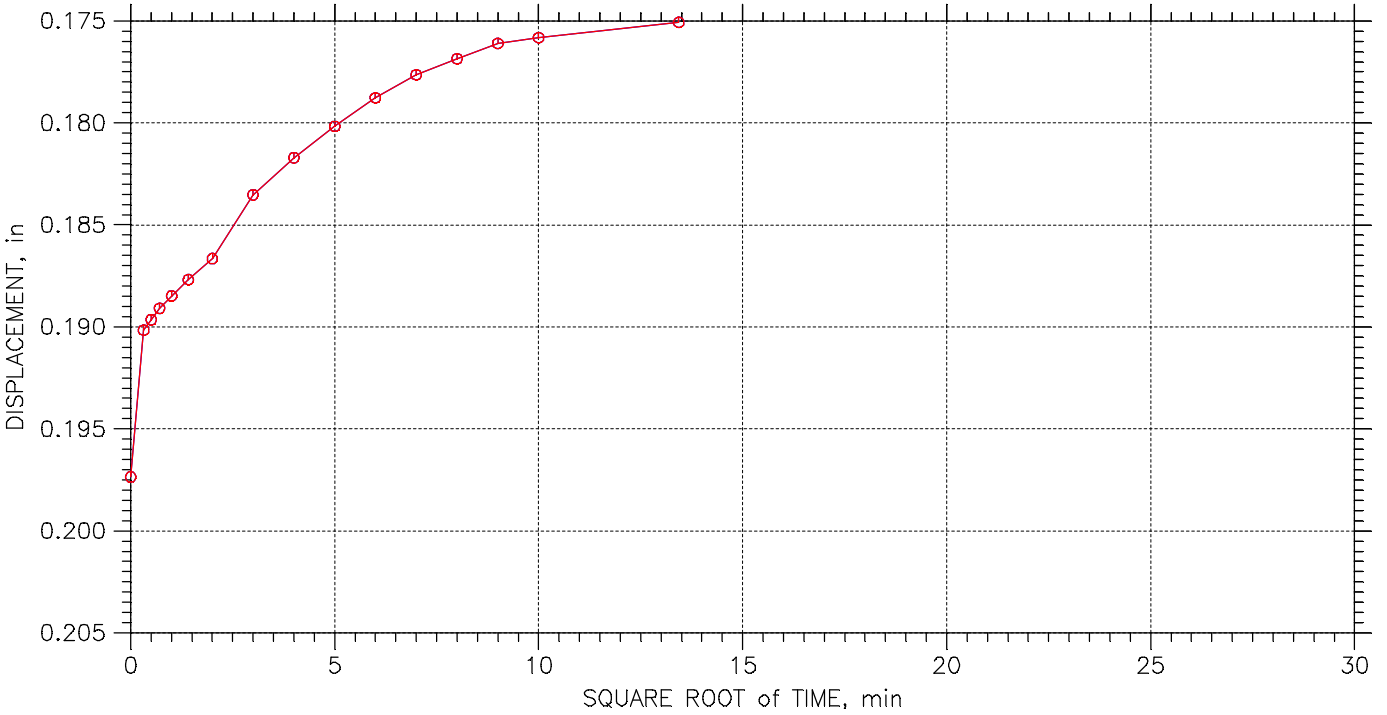
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 21 of 23

Stress: 1. tsf





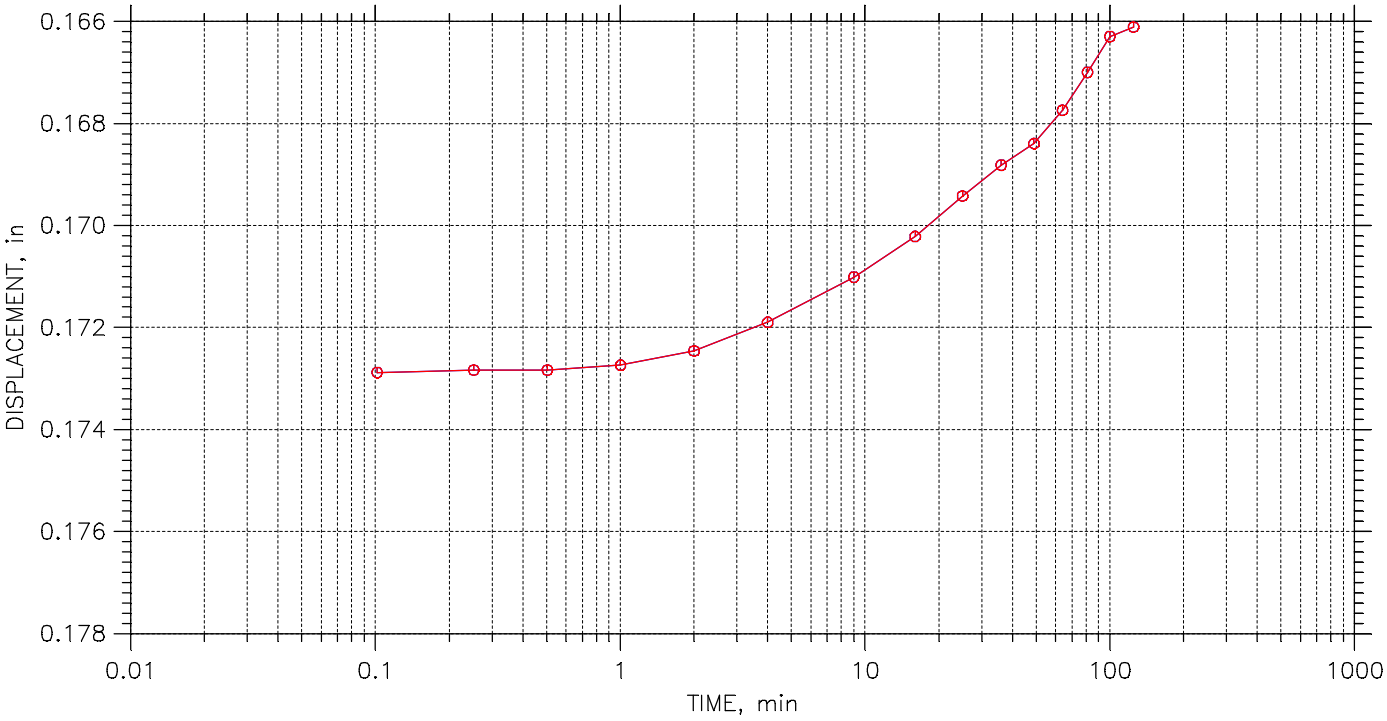
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

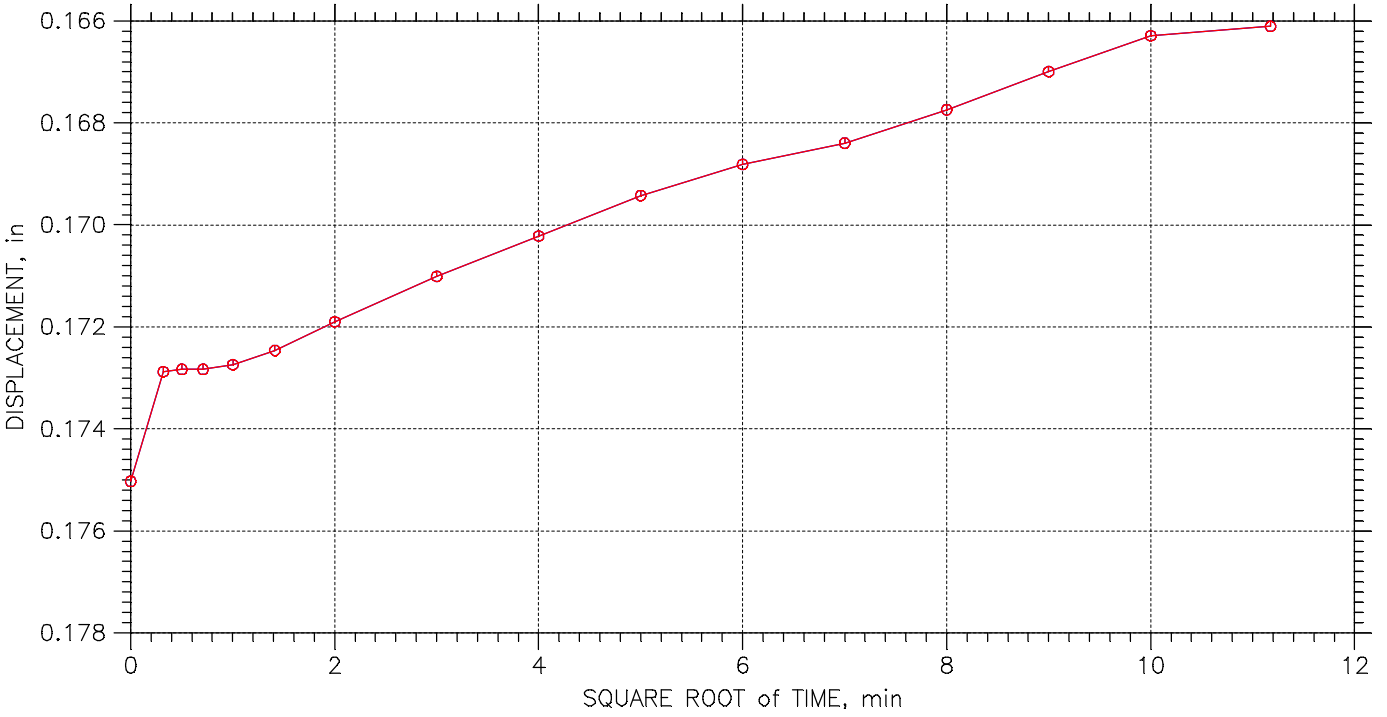
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 22 of 23

Stress: 0.5 tsf





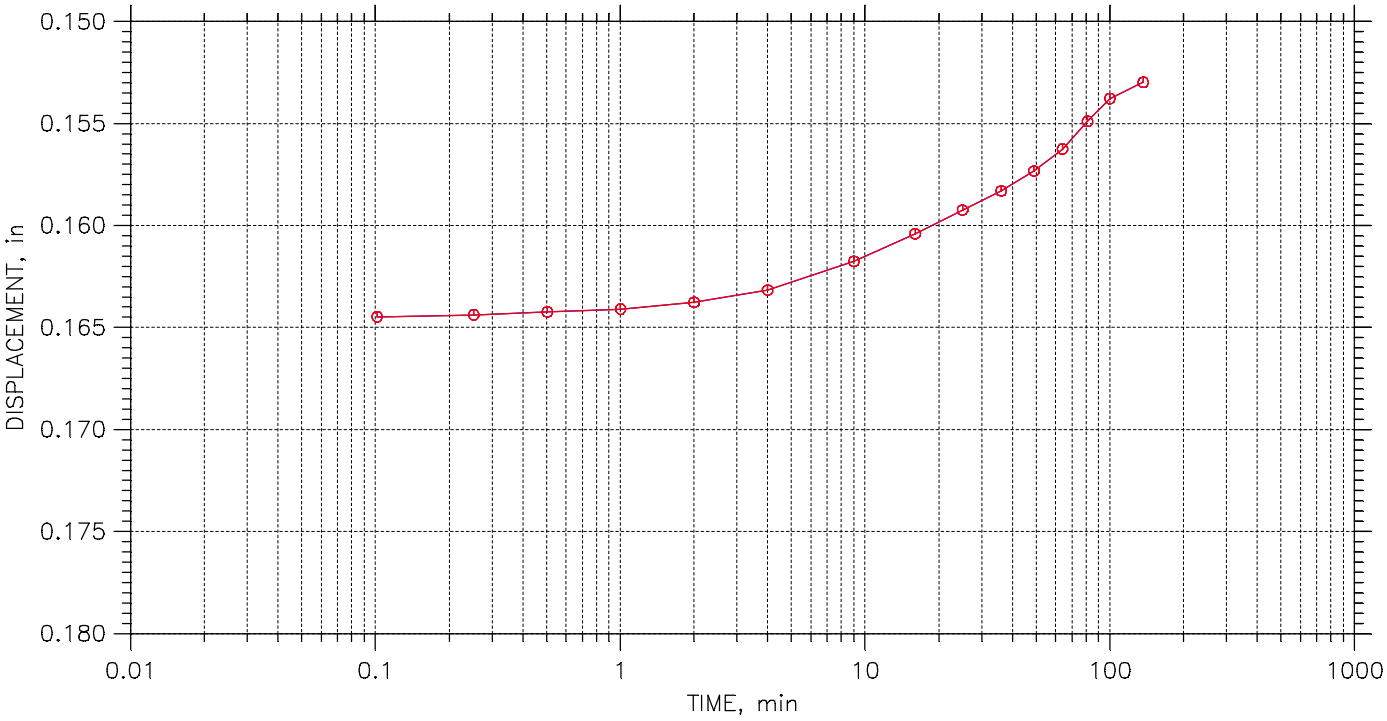
Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

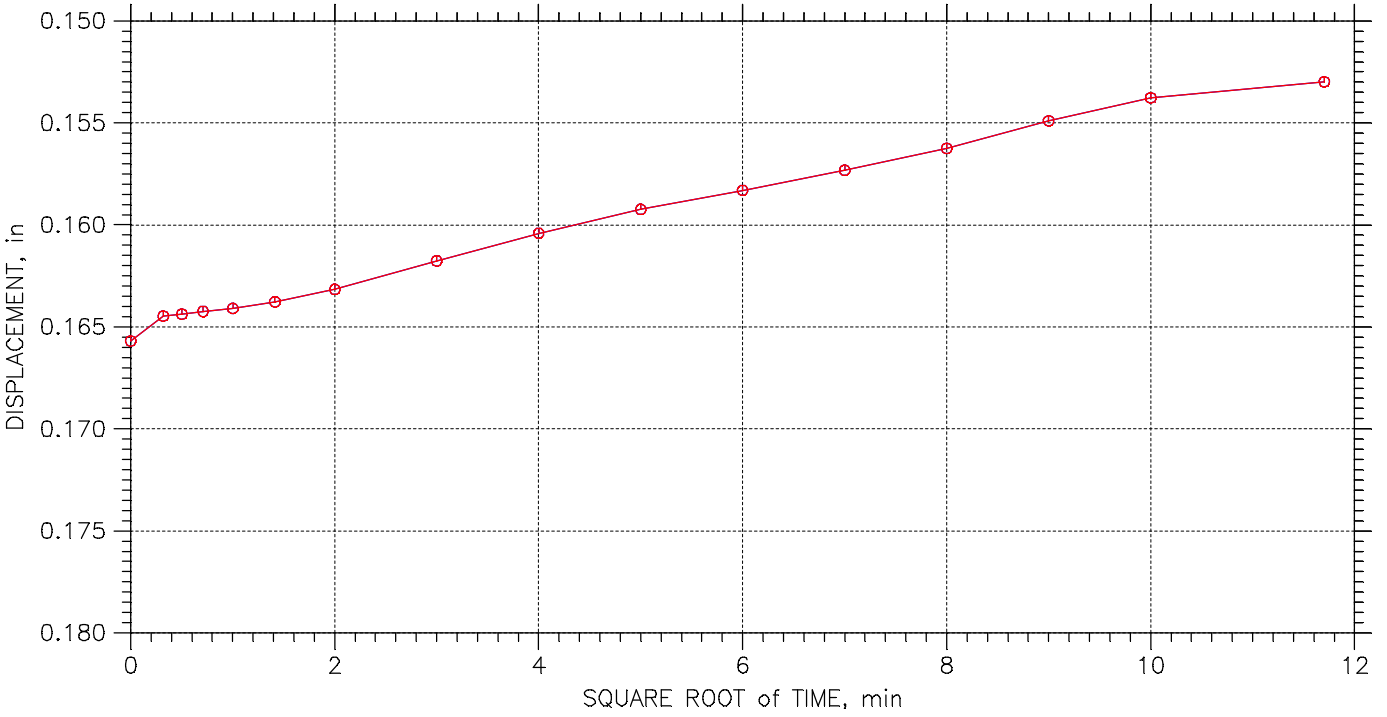
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 23 of 23

Stress: 0.125 tsf

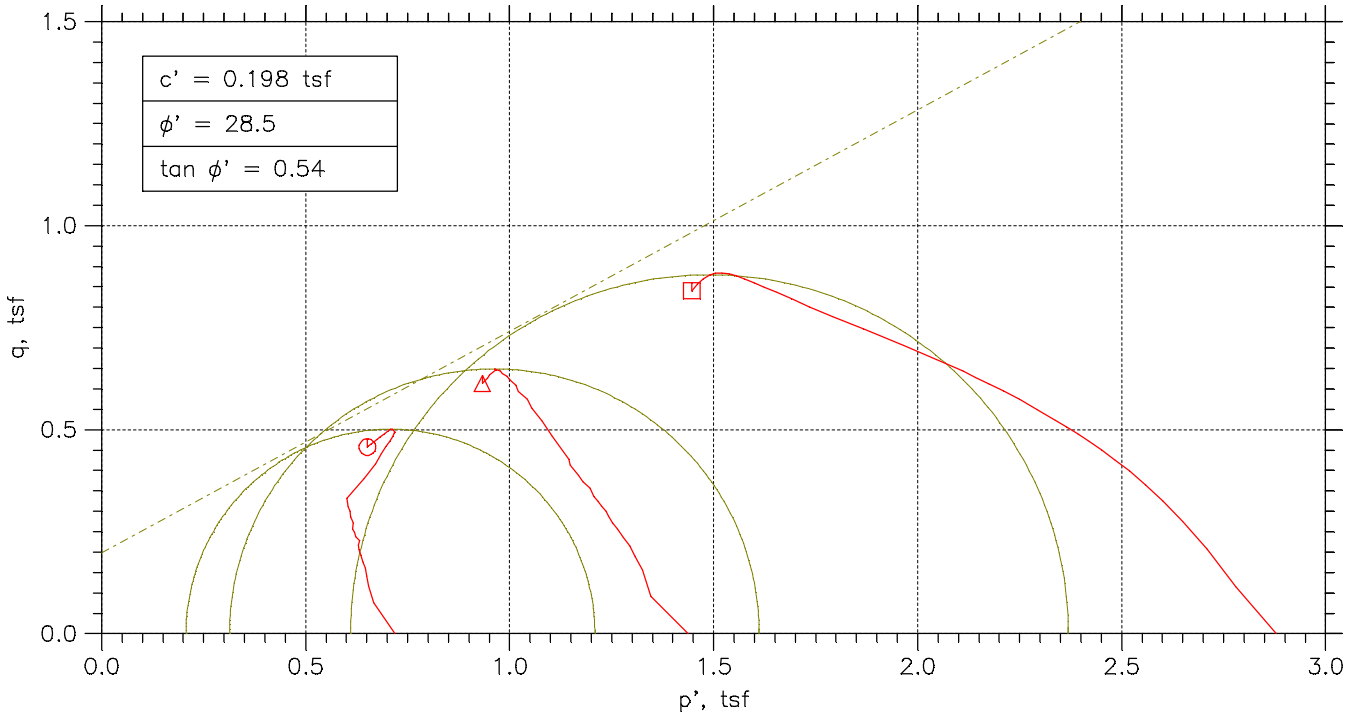


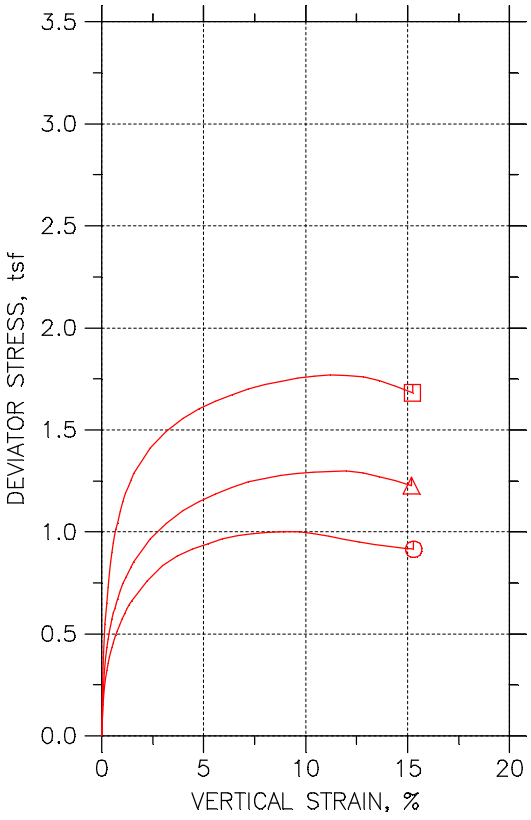


Terracon Consulting Engineers & Scientists	Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

Terracon
Consulting Engineers & Scientists





Symbol		⏲	△	⊡	
Test No.		10.0 PSI	20.0 PSI	40.0 PSI	
Initial	Diameter, in	2.8213	2.8323	2.8173	
	Height, in	6.3035	6.2161	6.1913	
	Water Content, %	75.11	79.41	77.79	
	Dry Density, pcf	54.95	52.86	53.58	
	Saturation, %	99.96	99.73	99.68	
	Void Ratio	1.9536	2.0704	2.0291	
Before Shear	Water Content, %	68.95	65.19	53.75	
	Dry Density, pcf	58.12	60.23	67.7	
	Saturation, %	100.00	100.00	100.00	
	Void Ratio	1.7926	1.6948	1.3974	
	Back Press., tsf	5.0417	5.0434	5.0421	
Minor Prin. Stress, tsf		0.71831	1.4366	2.8779	
Max. Dev. Stress, tsf		1.0023	1.2984	1.7688	
Time to Failure, min		780	900	840	
Strain Rate, %/min		0.02	0.02	0.02	
B-Value		0.96	0.99	0.95	
Estimated Specific Gravity		2.60	2.60	2.60	
Liquid Limit		72	72	72	
Plastic Limit		37	37	37	
Plasticity Index		35	35	35	

Project: DYNERGY EDWARDS

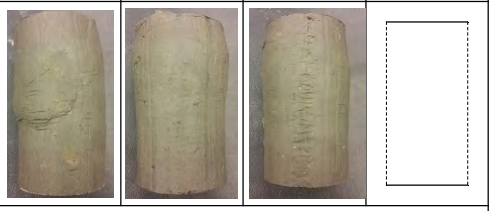
Location: BARTONVILLE, IL

Project No.: MR155218

Boring No.: EDW006 S9

Sample Type: 3.0" ST

Failure Sketch



Description: DARK GRAY ORGANIC SILT OH SHELL NOTED

Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

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CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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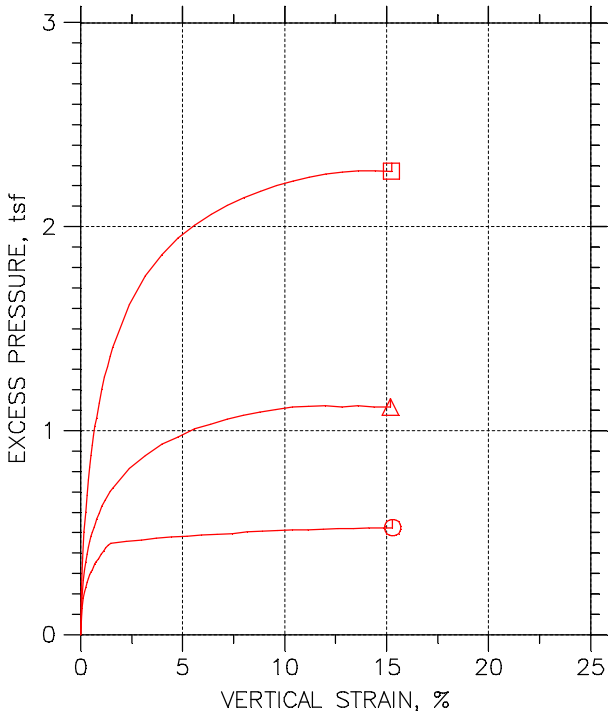

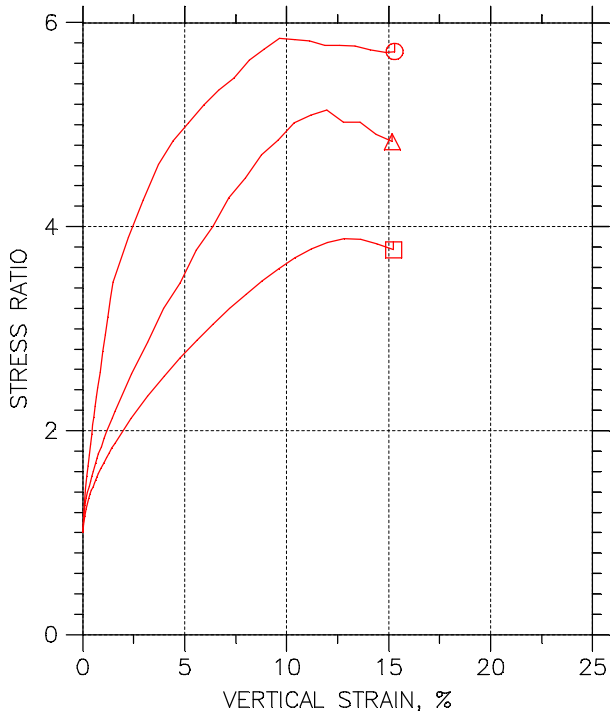

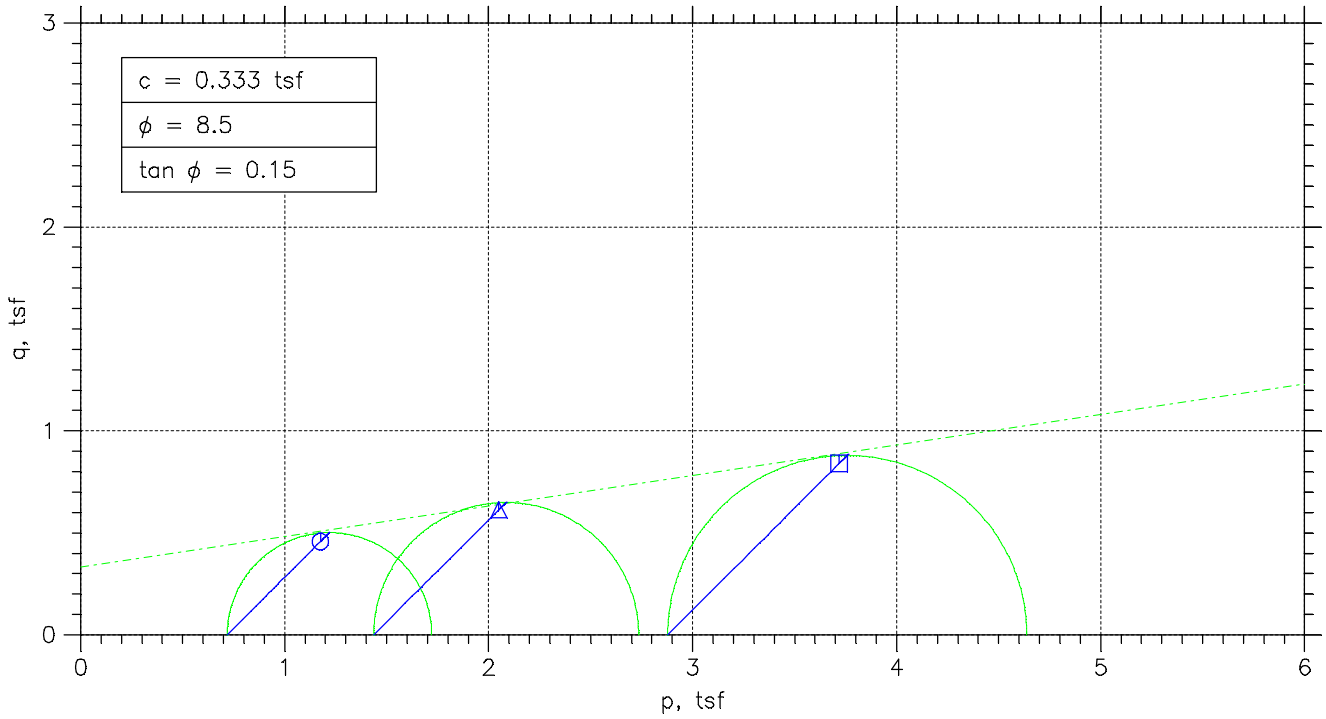

Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
Boring No.: EDW006 S9	Tested By: BCM	Checked By: WPQ
Sample No.: S-9	Test Date: 10/29/15	Depth: 26.0'-28.0'
Test No.: EDW006 S9	Sample Type: 3.0" ST	Elevation: ----
Description: DARK GRAY ORGANIC SILT OH SHELL NOTED		
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.		

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW006 S9
Sample No.: S-9
Test No.: 10.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

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Soil Description: DARK GRAY ORGANIC SILT OH SHELL NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.30 in
Specimen Area: 6.25 in^2
Specimen Volume: 39.41 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 72

Plastic Limit: 37

Estimated Specific Gravity: 2.60

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.2514	0	0	5.0417	5.76	5.76
2	5.0001	0.062925	6.2553	13.244	0.15244	5.17	5.76	5.9124
3	10	0.12448	6.2592	20.256	0.233	5.2217	5.76	5.993
4	15	0.18877	6.2632	24.54	0.28211	5.2513	5.76	6.0421
5	20	0.2517	6.2672	27.823	0.31965	5.2728	5.76	6.0796
6	25	0.31326	6.271	30.773	0.35331	5.2966	5.76	6.1133
7	30	0.37618	6.275	33.555	0.38502	5.3169	5.76	6.145
8	35	0.43911	6.279	35.892	0.41157	5.3355	5.76	6.1716
9	40	0.4993	6.2828	37.896	0.43428	5.3483	5.76	6.1943
10	45	0.56085	6.2866	39.843	0.45632	5.3564	5.76	6.2163
11	50	0.62241	6.2905	41.568	0.47578	5.375	5.76	6.2358
12	55	0.68534	6.2945	43.405	0.49649	5.3878	5.76	6.2565
13	60	0.74689	6.2984	44.74	0.51144	5.4	5.76	6.2714
14	70	0.87137	6.3063	47.578	0.5432	5.4145	5.76	6.3032
15	80.001	0.99586	6.3143	50.305	0.57361	5.4371	5.76	6.3336
16	90.001	1.119	6.3221	52.698	0.60015	5.4511	5.76	6.3602
17	100	1.2393	6.3298	54.645	0.62158	5.4662	5.76	6.3816
18	110	1.3625	6.3377	56.704	0.64419	5.4795	5.76	6.4042
19	120	1.4856	6.3457	58.429	0.66296	5.49	5.76	6.423
20	180	2.2256	6.3937	67.5	0.76012	5.4975	5.76	6.5201
21	240	2.9766	6.4432	74.567	0.83326	5.5045	5.76	6.5933
22	300	3.7112	6.4923	79.52	0.88187	5.5155	5.76	6.6419
23	360	4.4485	6.5424	83.304	0.91676	5.5214	5.76	6.6768
24	420	5.2009	6.5943	86.308	0.94235	5.5254	5.76	6.7024
25	480	5.9368	6.6459	89.202	0.96639	5.5295	5.76	6.7264
26	540	6.6769	6.6986	91.372	0.98211	5.5335	5.76	6.7421
27	600	7.4293	6.7531	92.93	0.99081	5.5376	5.76	6.7508
28	660	8.1638	6.8071	94.322	0.99766	5.5446	5.76	6.7577
29	720	8.9039	6.8624	95.435	1.0013	5.5486	5.76	6.7613
30	780	9.6562	6.9196	96.325	1.0023	5.5533	5.76	6.7623
31	840	10.394	6.9765	96.047	0.99124	5.555	5.76	6.7512
32	900	11.131	7.0344	95.768	0.98023	5.5568	5.76	6.7402
33	960	11.883	7.0944	94.878	0.9629	5.5585	5.76	6.7229
34	1020	12.607	7.1532	94.489	0.95107	5.5608	5.76	6.7111
35	1080	13.351	7.2146	94.043	0.93853	5.5632	5.76	6.6985
36	1140	14.11	7.2784	93.876	0.92866	5.5637	5.76	6.6887
37	1200	14.841	7.3408	93.71	0.91912	5.5649	5.76	6.6791
38	1236.6	15.291	7.3798	93.765	0.91481	5.5661	5.76	6.6748

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW006 S9
Sample No.: S-9
Test No.: 10.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

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Consulting Engineers & Scientists

Soil Description: DARK GRAY ORGANIC SILT OH SHELL NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.30 in
Specimen Area: 6.25 in^2
Specimen Volume: 39.41 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 72

Plastic Limit: 37

Estimated Specific Gravity: 2.60

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	5.76	5.76	0	0.000	0.71831	0.71831	1.000	0.71831	0
2	0.06	5.9124	5.76	0.12834	0.842	0.74242	0.58998	1.258	0.6662	0.07622
3	0.12	5.993	5.76	0.18002	0.773	0.77129	0.53829	1.433	0.65479	0.1165
4	0.19	6.0421	5.76	0.20963	0.743	0.79079	0.50868	1.555	0.64973	0.14105
5	0.25	6.0796	5.76	0.23112	0.723	0.80684	0.48719	1.656	0.64702	0.15982
6	0.31	6.1133	5.76	0.25493	0.722	0.8167	0.46338	1.762	0.64004	0.17666
7	0.38	6.145	5.76	0.27525	0.715	0.82807	0.44306	1.869	0.63556	0.19251
8	0.44	6.1716	5.76	0.29384	0.714	0.83605	0.42447	1.970	0.63026	0.20579
9	0.50	6.1943	5.76	0.30661	0.706	0.84598	0.4117	2.055	0.62884	0.21714
10	0.56	6.2163	5.76	0.31474	0.690	0.85989	0.40357	2.131	0.63173	0.22816
11	0.62	6.2358	5.76	0.33333	0.701	0.86077	0.38499	2.236	0.62288	0.23789
12	0.69	6.2565	5.76	0.3461	0.697	0.8687	0.37221	2.334	0.62045	0.24824
13	0.75	6.2714	5.76	0.3583	0.701	0.87146	0.36002	2.421	0.61574	0.25572
14	0.87	6.3032	5.76	0.37281	0.686	0.8887	0.3455	2.572	0.6171	0.2716
15	1.00	6.3336	5.76	0.39546	0.689	0.89647	0.32285	2.777	0.60966	0.28681
16	1.12	6.3602	5.76	0.4094	0.682	0.90907	0.30891	2.943	0.60899	0.30008
17	1.24	6.3816	5.76	0.4245	0.683	0.91539	0.29382	3.116	0.6046	0.31079
18	1.36	6.4042	5.76	0.43785	0.680	0.92465	0.28046	3.297	0.60255	0.3221
19	1.49	6.423	5.76	0.4483	0.676	0.93297	0.27001	3.455	0.60149	0.33148
20	2.23	6.5201	5.76	0.45585	0.600	1.0226	0.26246	3.896	0.64252	0.38006
21	2.98	6.5933	5.76	0.46282	0.555	1.0887	0.25549	4.261	0.67212	0.41663
22	3.71	6.6419	5.76	0.47386	0.537	1.1263	0.24446	4.608	0.68539	0.44094
23	4.45	6.6768	5.76	0.47966	0.523	1.1554	0.23865	4.841	0.69703	0.45838
24	5.20	6.7024	5.76	0.48373	0.513	1.1769	0.23458	5.017	0.70576	0.47118
25	5.94	6.7264	5.76	0.48779	0.505	1.1969	0.23052	5.192	0.71371	0.48319
26	6.68	6.7421	5.76	0.49186	0.501	1.2086	0.22645	5.337	0.71751	0.49106
27	7.43	6.7508	5.76	0.49592	0.501	1.2132	0.22239	5.455	0.71779	0.4954
28	8.16	6.7577	5.76	0.50289	0.504	1.2131	0.21542	5.631	0.71425	0.49883
29	8.90	6.7613	5.76	0.50696	0.506	1.2127	0.21136	5.738	0.712	0.50065
30	9.66	6.7623	5.76	0.5116	0.510	1.209	0.20671	5.849	0.70785	0.50114
31	10.39	6.7512	5.76	0.51334	0.518	1.1962	0.20497	5.836	0.70059	0.49562
32	11.13	6.7402	5.76	0.51509	0.525	1.1835	0.20323	5.823	0.69334	0.49012
33	11.88	6.7229	5.76	0.51683	0.537	1.1644	0.20148	5.779	0.68293	0.48145
34	12.61	6.7111	5.76	0.51915	0.546	1.1502	0.19916	5.775	0.6747	0.47554
35	13.35	6.6985	5.76	0.52147	0.556	1.1354	0.19684	5.768	0.6661	0.46927
36	14.11	6.6887	5.76	0.52205	0.562	1.1249	0.19626	5.732	0.66058	0.46433
37	14.84	6.6791	5.76	0.52322	0.569	1.1142	0.1951	5.711	0.65466	0.45956
38	15.29	6.6748	5.76	0.52438	0.573	1.1087	0.19393	5.717	0.65134	0.4574

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW006 S9
Sample No.: S-9
Test No.: 20.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

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Soil Description: DARK GRAY ORGANIC SILT OH SHELL NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.22 in
Specimen Area: 6.30 in^2
Specimen Volume: 39.16 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 72

Plastic Limit: 37

Estimated Specific Gravity: 2.60

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.3003	0	0	5.0434	6.48	6.48
2	5.0002	0.053874	6.3037	16.056	0.18339	5.2253	6.48	6.6634
3	10	0.11698	6.3077	27.272	0.3113	5.3105	6.48	6.7913
4	15	0.18163	6.3118	33.307	0.37994	5.363	6.48	6.8599
5	20	0.24782	6.316	37.862	0.43162	5.4014	6.48	6.9116
6	25	0.31247	6.3201	41.506	0.47285	5.4382	6.48	6.9528
7	30	0.3802	6.3244	44.922	0.51142	5.4714	6.48	6.9914
8	35	0.44639	6.3286	47.826	0.54411	5.5006	6.48	7.0241
9	40	0.51412	6.3329	50.502	0.57417	5.5245	6.48	7.0542
10	45	0.57876	6.337	52.95	0.60161	5.5449	6.48	7.0816
11	50	0.64649	6.3413	55.228	0.62706	5.5682	6.48	7.1071
12	55	0.71268	6.3456	57.391	0.65119	5.5898	6.48	7.1312
13	60	0.77887	6.3498	59.327	0.67271	5.6102	6.48	7.1527
14	70	0.91279	6.3584	62.857	0.71177	5.6382	6.48	7.1918
15	80.001	1.0467	6.367	65.988	0.74622	5.6732	6.48	7.2262
16	90.001	1.1791	6.3755	68.778	0.77673	5.7	6.48	7.2567
17	110	1.4485	6.3929	73.504	0.82783	5.7449	6.48	7.3078
18	120	1.5824	6.4016	75.895	0.8536	5.7619	6.48	7.3336
19	180	2.3828	6.4541	86.713	0.96734	5.8598	6.48	7.4473
20	240	3.1817	6.5074	94.171	1.0419	5.9216	6.48	7.5219
21	300	3.9805	6.5615	100.66	1.1046	5.9782	6.48	7.5846
22	360	4.7763	6.6164	105.5	1.1481	6.0115	6.48	7.6281
23	420	5.5721	6.6721	109.89	1.1858	6.0517	6.48	7.6658
24	480	6.371	6.729	113.87	1.2184	6.0739	6.48	7.6984
25	540	7.1745	6.7873	117.29	1.2442	6.1013	6.48	7.7242
26	600	7.978	6.8465	119.96	1.2616	6.1176	6.48	7.7416
27	660	8.7738	6.9063	122.35	1.2756	6.1357	6.48	7.7556
28	720	9.5758	6.9675	124.58	1.2873	6.1456	6.48	7.7673
29	780	10.378	7.0299	126.17	1.2922	6.1584	6.48	7.7722
30	840	11.177	7.0931	127.76	1.2969	6.1631	6.48	7.7769
31	900	11.976	7.1575	129.07	1.2984	6.1666	6.48	7.7784
32	960	12.787	7.224	129.36	1.2893	6.1596	6.48	7.7693
33	1020	13.584	7.2907	128.62	1.2702	6.1643	6.48	7.7502
34	1080	14.381	7.3586	127.93	1.2518	6.1596	6.48	7.7318
35	1140	15.18	7.4279	126.51	1.2263	6.1602	6.48	7.7063

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW006 S9
Sample No.: S-9
Test No.: 20.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

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Soil Description: DARK GRAY ORGANIC SILT OH SHELL NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.22 in
Specimen Area: 6.30 in^2
Specimen Volume: 39.16 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 72

Plastic Limit: 37

Estimated Specific Gravity: 2.60

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	6.48	6.48	0	0.000	1.4366	1.4366	1.000	1.4366	0
2	0.05	6.6634	6.48	0.18195	0.992	1.4381	1.2547	1.146	1.3464	0.091693
3	0.12	6.7913	6.48	0.2671	0.858	1.4808	1.1695	1.266	1.3252	0.15565
4	0.18	6.8599	6.48	0.31958	0.841	1.497	1.117	1.340	1.307	0.18997
5	0.25	6.9116	6.48	0.35807	0.830	1.5102	1.0786	1.400	1.2944	0.21581
6	0.31	6.9528	6.48	0.39482	0.835	1.5147	1.0418	1.454	1.2782	0.23642
7	0.38	6.9914	6.48	0.42806	0.837	1.52	1.0086	1.507	1.2643	0.25571
8	0.45	7.0241	6.48	0.45722	0.840	1.5235	0.97941	1.556	1.2515	0.27206
9	0.51	7.0542	6.48	0.48113	0.838	1.5297	0.9555	1.601	1.2426	0.28708
10	0.58	7.0816	6.48	0.50154	0.834	1.5367	0.93509	1.643	1.2359	0.30081
11	0.65	7.1071	6.48	0.52487	0.837	1.5388	0.91176	1.688	1.2253	0.31353
12	0.71	7.1312	6.48	0.54644	0.839	1.5414	0.89018	1.732	1.2158	0.32559
13	0.78	7.1527	6.48	0.56685	0.843	1.5425	0.86977	1.773	1.2061	0.33635
14	0.91	7.1918	6.48	0.59485	0.836	1.5535	0.84178	1.846	1.1977	0.35589
15	1.05	7.2262	6.48	0.62984	0.844	1.553	0.80679	1.925	1.1799	0.37311
16	1.18	7.2567	6.48	0.65666	0.845	1.5567	0.77996	1.996	1.1683	0.38836
17	1.45	7.3078	6.48	0.70157	0.847	1.5629	0.73506	2.126	1.149	0.41392
18	1.58	7.3336	6.48	0.71848	0.842	1.5717	0.71814	2.189	1.1449	0.4268
19	2.38	7.4473	6.48	0.81646	0.844	1.5875	0.62017	2.560	1.1038	0.48367
20	3.18	7.5219	6.48	0.87827	0.843	1.6003	0.55835	2.866	1.0793	0.52097
21	3.98	7.5846	6.48	0.93484	0.846	1.6064	0.50178	3.201	1.0541	0.55229
22	4.78	7.6281	6.48	0.96809	0.843	1.6166	0.46854	3.450	1.0426	0.57404
23	5.57	7.6658	6.48	1.0083	0.850	1.6141	0.4283	3.769	1.0212	0.5929
24	6.37	7.6984	6.48	1.0305	0.846	1.6246	0.40614	4.000	1.0153	0.6092
25	7.17	7.7242	6.48	1.0579	0.850	1.6229	0.37873	4.285	1.0008	0.6221
26	7.98	7.7416	6.48	1.0742	0.852	1.624	0.3624	4.481	0.99318	0.63078
27	8.77	7.7556	6.48	1.0923	0.856	1.6199	0.34432	4.705	0.98212	0.63779
28	9.58	7.7673	6.48	1.1022	0.856	1.6217	0.33441	4.850	0.97807	0.64366
29	10.38	7.7722	6.48	1.115	0.863	1.6138	0.32158	5.018	0.96769	0.64611
30	11.18	7.7769	6.48	1.1197	0.863	1.6138	0.31691	5.092	0.96536	0.64845
31	11.98	7.7784	6.48	1.1232	0.865	1.6118	0.31341	5.143	0.96261	0.6492
32	12.79	7.7693	6.48	1.1162	0.866	1.6097	0.32041	5.024	0.96505	0.64464
33	13.58	7.7502	6.48	1.1209	0.882	1.5859	0.31575	5.023	0.95083	0.63509
34	14.38	7.7318	6.48	1.1162	0.892	1.5722	0.32041	4.907	0.9463	0.62588
35	15.18	7.7063	6.48	1.1168	0.911	1.5461	0.31983	4.834	0.93298	0.61315

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-006 S9
Sample No.: S-9
Test No.: 40.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Terracon
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Soil Description: DARK GRAY ORGANIC SILT OH SHELL NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767.

Specimen Height: 6.19 in
Specimen Area: 6.23 in^2
Specimen Volume: 38.60 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 72

Plastic Limit: 37

Estimated Specific Gravity: 2.60

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.2339	0	0	5.0421	7.92	7.92
2	5.0041	0.048386	6.237	20.074	0.23173	5.2556	7.92	8.1517
3	10.004	0.10997	6.2408	35.922	0.41443	5.4179	7.92	8.3344
4	15	0.17448	6.2448	47.727	0.55027	5.5452	7.92	8.4703
5	20	0.239	6.2489	56.501	0.65101	5.6441	7.92	8.571
6	25	0.30498	6.253	63.345	0.72938	5.7261	7.92	8.6494
7	30	0.37096	6.2572	69.271	0.79709	5.7994	7.92	8.7171
8	35	0.43547	6.2612	74.094	0.85204	5.8628	7.92	8.772
9	40	0.50292	6.2655	78.366	0.90055	5.9192	7.92	8.8206
10	45	0.57036	6.2697	82.179	0.94372	5.971	7.92	8.8637
11	50	0.63781	6.274	85.44	0.98051	6.0187	7.92	8.9005
12	55	0.70379	6.2781	88.426	1.0141	6.0629	7.92	8.9341
13	60	0.77124	6.2824	91.274	1.0461	6.1059	7.92	8.9661
14	70	0.90613	6.291	96.097	1.0998	6.1781	7.92	9.0198
15	80	1.0381	6.2993	100.51	1.1488	6.2449	7.92	9.0688
16	90	1.173	6.3079	104.27	1.1902	6.3054	7.92	9.1102
17	100	1.3079	6.3166	107.4	1.2242	6.3572	7.92	9.1442
18	110	1.4398	6.325	110.34	1.256	6.4072	7.92	9.176
19	120	1.5747	6.3337	113.19	1.2867	6.4514	7.92	9.2067
20	180	2.3709	6.3853	125.22	1.412	6.6602	7.92	9.332
21	240	3.1832	6.4389	133.67	1.4947	6.801	7.92	9.4147
22	300	3.9838	6.4926	140.24	1.5552	6.9063	7.92	9.4752
23	360	4.7858	6.5473	145.66	1.6018	6.9854	7.92	9.5218
24	420	5.5951	6.6034	150.49	1.6408	7.0493	7.92	9.5608
25	480	6.3957	6.6599	154.71	1.6726	7.1017	7.92	9.5926
26	540	7.1948	6.7172	158.57	1.6997	7.1459	7.92	9.6197
27	600	8.0027	6.7762	162.01	1.7215	7.1825	7.92	9.6415
28	660	8.8047	6.8358	165.09	1.7389	7.2151	7.92	9.6589
29	720	9.6009	6.896	167.99	1.7539	7.2424	7.92	9.6739
30	780	10.406	6.958	170.42	1.7635	7.2651	7.92	9.6835
31	840	11.211	7.0211	172.49	1.7688	7.2843	7.92	9.6888
32	900	12.013	7.0851	173.91	1.7673	7.2989	7.92	9.6873
33	960	12.824	7.151	174.74	1.7594	7.3099	7.92	9.6794
34	1020	13.618	7.2167	174.37	1.7397	7.3151	7.92	9.6597
35	1080	14.419	7.2843	173.27	1.7126	7.3157	7.92	9.6326
36	1140	15.24	7.3548	171.71	1.6809	7.314	7.92	9.6009

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-006 S9
Sample No.: S-9
Test No.: 40.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: DARK GRAY ORGANIC SILT OH SHELL NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767.

Specimen Height: 6.19 in
Specimen Area: 6.23 in^2
Specimen Volume: 38.60 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 72

Plastic Limit: 37

Estimated Specific Gravity: 2.60

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	7.92	7.92	0	0.000	2.8779	2.8779	1.000	2.8779	0
2	0.05	8.1517	7.92	0.21346	0.921	2.8961	2.6644	1.087	2.7803	0.11587
3	0.11	8.3344	7.92	0.37573	0.907	2.9166	2.5021	1.166	2.7093	0.20721
4	0.17	8.4703	7.92	0.50311	0.914	2.925	2.3748	1.232	2.6499	0.27514
5	0.24	8.571	7.92	0.60199	0.925	2.9269	2.2759	1.286	2.6014	0.3255
6	0.30	8.6494	7.92	0.68399	0.938	2.9233	2.1939	1.332	2.5586	0.36469
7	0.37	8.7171	7.92	0.75728	0.950	2.9177	2.1206	1.376	2.5191	0.39854
8	0.44	8.772	7.92	0.82068	0.963	2.9092	2.0572	1.414	2.4832	0.42602
9	0.50	8.8206	7.92	0.8771	0.974	2.9013	2.0008	1.450	2.451	0.45028
10	0.57	8.8637	7.92	0.92886	0.984	2.8927	1.949	1.484	2.4209	0.47186
11	0.64	8.9005	7.92	0.97655	0.996	2.8818	1.9013	1.516	2.3916	0.49026
12	0.70	8.9341	7.92	1.0208	1.007	2.8712	1.8571	1.546	2.3642	0.50705
13	0.77	8.9661	7.92	1.0638	1.017	2.8601	1.8141	1.577	2.3371	0.52303
14	0.91	9.0198	7.92	1.1359	1.033	2.8418	1.7419	1.631	2.2919	0.54992
15	1.04	9.0688	7.92	1.2028	1.047	2.8238	1.6751	1.686	2.2494	0.57439
16	1.17	9.1102	7.92	1.2633	1.061	2.8048	1.6146	1.737	2.2097	0.5951
17	1.31	9.1442	7.92	1.3151	1.074	2.787	1.5628	1.783	2.1749	0.61209
18	1.44	9.176	7.92	1.3651	1.087	2.7688	1.5128	1.830	2.1408	0.62801
19	1.57	9.2067	7.92	1.4093	1.095	2.7552	1.4686	1.876	2.1119	0.64333
20	2.37	9.332	7.92	1.6181	1.146	2.6717	1.2598	2.121	1.9658	0.70598
21	3.18	9.4147	7.92	1.7588	1.177	2.6137	1.119	2.336	1.8664	0.74736
22	3.98	9.4752	7.92	1.8641	1.199	2.569	1.0137	2.534	1.7914	0.77761
23	4.79	9.5218	7.92	1.9432	1.213	2.5365	0.93464	2.714	1.7356	0.80092
24	5.60	9.5608	7.92	2.0072	1.223	2.5115	0.87066	2.885	1.6911	0.8204
25	6.40	9.5926	7.92	2.0595	1.231	2.4909	0.81832	3.044	1.6546	0.83629
26	7.19	9.6197	7.92	2.1037	1.238	2.4738	0.77411	3.196	1.6239	0.84983
27	8.00	9.6415	7.92	2.1404	1.243	2.4589	0.73747	3.334	1.5982	0.86073
28	8.80	9.6589	7.92	2.173	1.250	2.4438	0.7049	3.467	1.5743	0.86944
29	9.60	9.6739	7.92	2.2003	1.255	2.4315	0.67756	3.589	1.5545	0.87696
30	10.41	9.6835	7.92	2.223	1.261	2.4184	0.65488	3.693	1.5366	0.88174
31	11.21	9.6888	7.92	2.2422	1.268	2.4045	0.63569	3.783	1.5201	0.88442
32	12.01	9.6873	7.92	2.2567	1.277	2.3885	0.62115	3.845	1.5048	0.88367
33	12.82	9.6794	7.92	2.2678	1.289	2.3695	0.61009	3.884	1.4898	0.87969
34	13.62	9.6597	7.92	2.273	1.307	2.3445	0.60486	3.876	1.4747	0.86983
35	14.42	9.6326	7.92	2.2736	1.328	2.3169	0.60428	3.834	1.4606	0.85632
36	15.24	9.6009	7.92	2.2718	1.352	2.287	0.60602	3.774	1.4465	0.84046

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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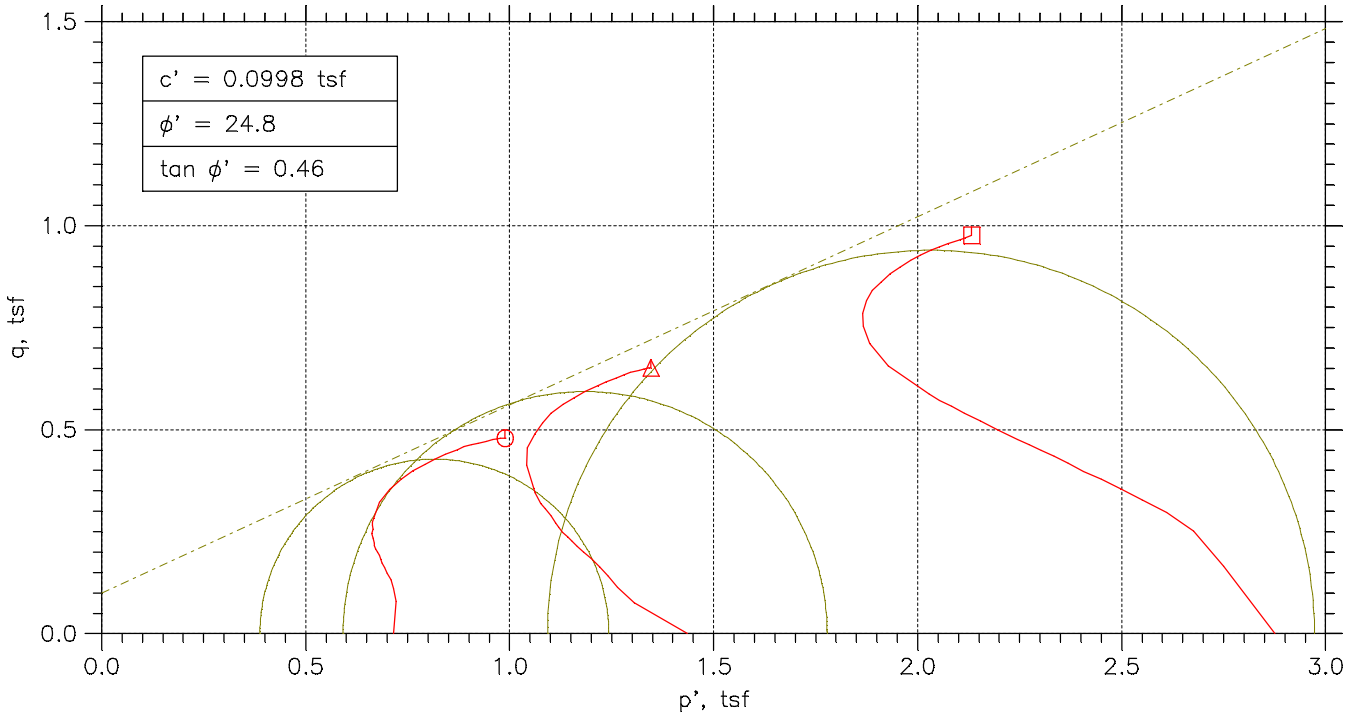

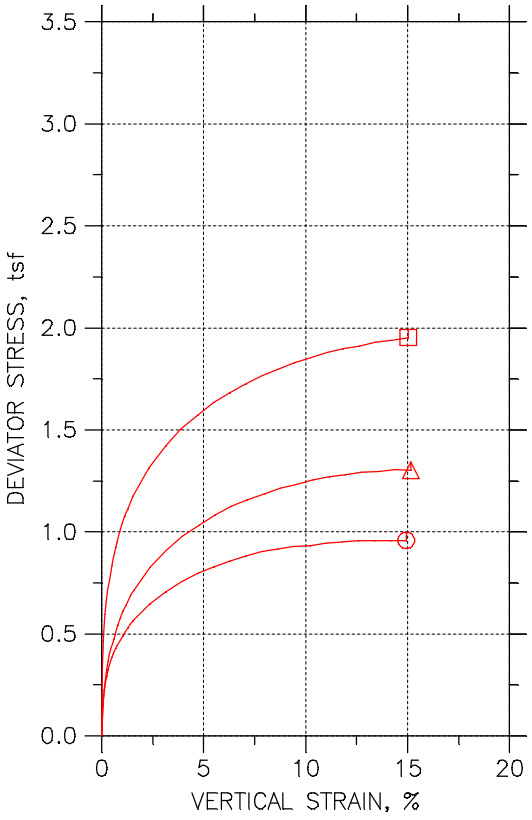

Symbol		⏲	△	⊡	
Test No.		10.0 PSI	20.0 PSI	40.0 PSI	
Initial	Diameter, in	2.8094	2.8291	2.8406	
	Height, in	5.9575	6.2256	6.276	
	Water Content, %	27.95	28.58	25.69	
	Dry Density, pcf	95.83	93.77	96.62	
	Saturation, %	98.51	95.87	92.26	
	Void Ratio	0.77188	0.81092	0.75748	
Before Shear	Water Content, %	27.39	26.71	23.87	
	Dry Density, pcf	97.31	98.35	103.	
	Saturation, %	100.00	100.00	100.00	
	Void Ratio	0.74495	0.72649	0.64936	
	Back Press., tsf	5.0452	5.044	5.045	
Minor Prin. Stress, tsf		0.71483	1.436	2.875	
Max. Dev. Stress, tsf		0.95795	1.304	1.9522	
Time to Failure, min		1140	1080	1140	
Strain Rate, %/min		0.02	0.02	0.02	
B-Value		0.95	0.97	0.95	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		48	48	48	
Plastic Limit		18	18	18	
Plasticity Index		30	30	30	

Project: DYNERGY EDWARDS

Location: BARTONVILLE, IL

Project No.: MR155218

Boring No.: EDW010 S-7

Sample Type: 3.0" ST

Failure Sketch



Description: BROWN AND GRAY MOTTLED LEAN CLAY CL

Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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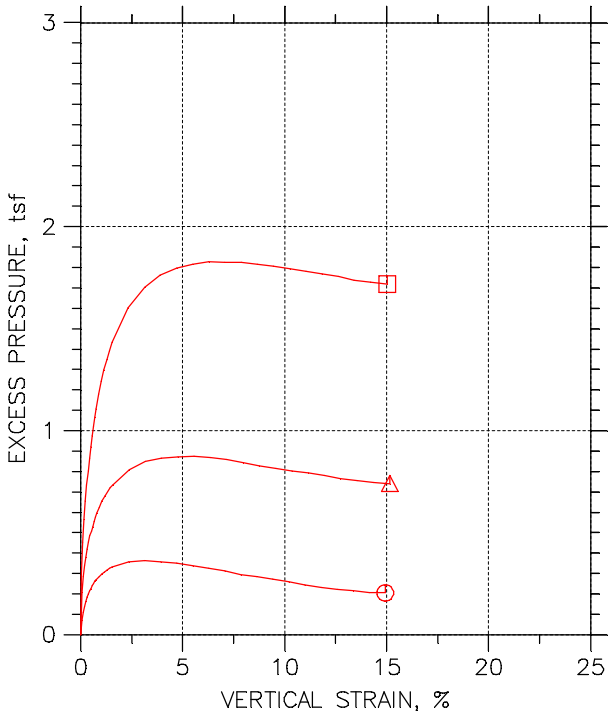

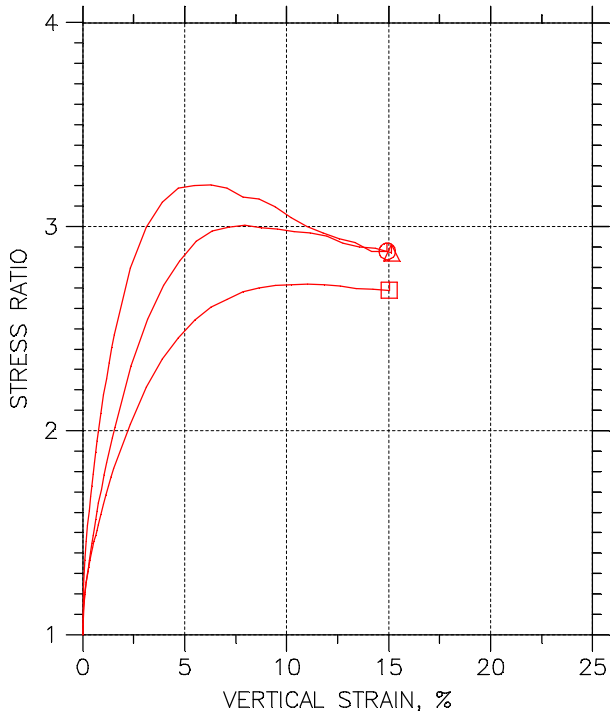

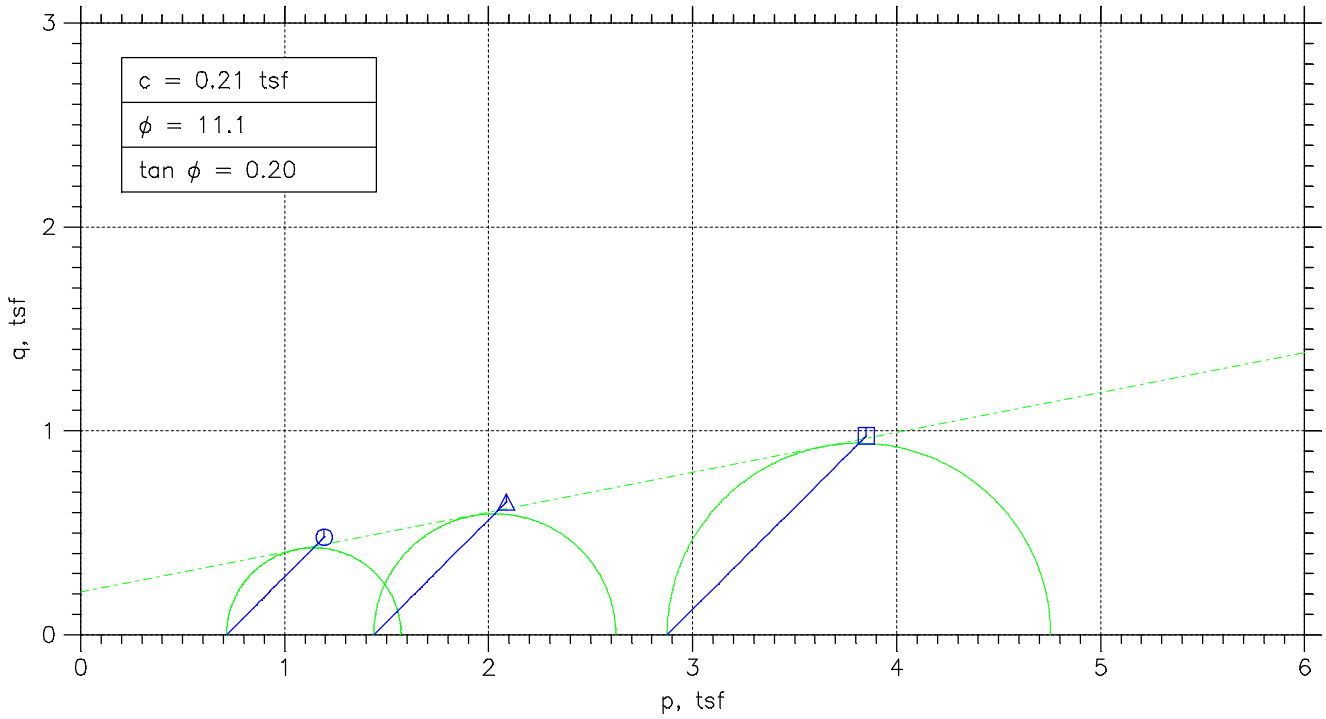

Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
Boring No.: EDW-010 S-7	Tested By: BCM	Checked By: WPQ
Sample No.: S-7	Test Date: 10/29/15	Depth: 15.0'-17.0'
Test No.: EDW-010 S-7	Sample Type: 3.0" ST	Elevation: ----
Description: BROWN AND GRAY MOTTLED LEAN CLAY CL		
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.		

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-010 S-7
Sample No.: S-7
Test No.: 10.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-17.0'
Elevation: ----

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Soil Description: BROWN AND GRAY MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 5.96 in
Specimen Area: 6.20 in^2
Specimen Volume: 36.93 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 18

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.1991	0	0	5.0452	5.76	5.76
2	5.0041	0.056448	6.2027	13.621	0.15811	5.1172	5.76	5.9181
3	10.004	0.12013	6.2066	19.07	0.22122	5.1549	5.76	5.9812
4	15.004	0.18382	6.2106	22.767	0.26394	5.1834	5.76	6.0239
5	20	0.24895	6.2146	25.54	0.29589	5.2078	5.76	6.0559
6	25	0.31408	6.2187	27.923	0.3233	5.2287	5.76	6.0833
7	30	0.37922	6.2227	29.967	0.34673	5.2467	5.76	6.1067
8	35	0.4429	6.2267	31.669	0.36619	5.2595	5.76	6.1262
9	40	0.50948	6.2309	33.275	0.3845	5.2716	5.76	6.1445
10	45	0.57462	6.235	34.734	0.4011	5.285	5.76	6.1611
11	50	0.63975	6.2391	36.047	0.41599	5.296	5.76	6.176
12	55	0.70488	6.2432	37.312	0.43031	5.3065	5.76	6.1903
13	60	0.77001	6.2473	38.48	0.44348	5.314	5.76	6.2035
14	70	0.90028	6.2555	40.669	0.4681	5.3286	5.76	6.2281
15	80	1.032	6.2638	42.663	0.4904	5.3431	5.76	6.2504
16	90	1.1608	6.272	44.609	0.5121	5.3512	5.76	6.2721
17	100	1.2925	6.2803	46.263	0.53038	5.3622	5.76	6.2904
18	110	1.4213	6.2885	47.869	0.54807	5.3704	5.76	6.3081
19	120	1.5516	6.2969	49.377	0.56459	5.3762	5.76	6.3246
20	180	2.3404	6.3477	56.868	0.64504	5.4011	5.76	6.405
21	240	3.1249	6.3991	62.706	0.70554	5.407	5.76	6.4655
22	300	3.908	6.4513	67.717	0.75576	5.4035	5.76	6.5158
23	360	4.7026	6.5051	72.046	0.79743	5.3959	5.76	6.5574
24	420	5.4871	6.5591	75.549	0.82931	5.3831	5.76	6.5893
25	480	6.2774	6.6144	78.565	0.85521	5.3721	5.76	6.6152
26	540	7.0676	6.6706	81.63	0.88108	5.3576	5.76	6.6411
27	600	7.8492	6.7272	84.305	0.90231	5.3396	5.76	6.6623
28	660	8.6337	6.7849	86.446	0.91734	5.3303	5.76	6.6773
29	720	9.424	6.8441	88.197	0.92783	5.3175	5.76	6.6878
30	780	10.213	6.9043	89.462	0.93294	5.3036	5.76	6.6929
31	840	10.997	6.9651	91.213	0.94289	5.2891	5.76	6.7029
32	900	11.786	7.0274	92.818	0.95098	5.2769	5.76	6.711
33	960	12.572	7.0906	94.083	0.95535	5.2682	5.76	6.7154
34	1020	13.361	7.1551	95.105	0.95701	5.2618	5.76	6.717
35	1080	14.148	7.2208	95.981	0.95705	5.2502	5.76	6.717
36	1140	14.93	7.2871	96.953	0.95795	5.2502	5.76	6.7179

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-010 S-7
Sample No.: S-7
Test No.: 10.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-17.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWN AND GRAY MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 5.96 in
Specimen Area: 6.20 in^2
Specimen Volume: 36.93 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 18

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	5.76	5.76	0	0.000	0.71483	0.71483	1.000	0.71483	0
2	0.06	5.9181	5.76	0.072008	0.455	0.80093	0.64282	1.246	0.72188	0.079057
3	0.12	5.9812	5.76	0.10975	0.496	0.82629	0.60507	1.366	0.71568	0.11061
4	0.18	6.0239	5.76	0.13821	0.524	0.84056	0.57662	1.458	0.70859	0.13197
5	0.25	6.0559	5.76	0.1626	0.550	0.84812	0.55223	1.536	0.70018	0.14795
6	0.31	6.0833	5.76	0.1835	0.568	0.85462	0.53132	1.608	0.69297	0.16165
7	0.38	6.1067	5.76	0.2015	0.581	0.86005	0.51332	1.675	0.68669	0.17336
8	0.44	6.1262	5.76	0.21428	0.585	0.86674	0.50055	1.732	0.68364	0.1831
9	0.51	6.1445	5.76	0.22648	0.589	0.87285	0.48835	1.787	0.6806	0.19225
10	0.57	6.1611	5.76	0.23983	0.598	0.87609	0.475	1.844	0.67555	0.20055
11	0.64	6.176	5.76	0.25086	0.603	0.87996	0.46396	1.897	0.67196	0.208
12	0.70	6.1903	5.76	0.26132	0.607	0.88382	0.45351	1.949	0.66866	0.21515
13	0.77	6.2035	5.76	0.26887	0.606	0.88944	0.44596	1.994	0.6677	0.22174
14	0.90	6.2281	5.76	0.28338	0.605	0.89954	0.43144	2.085	0.66549	0.23405
15	1.03	6.2504	5.76	0.2979	0.607	0.90733	0.41693	2.176	0.66213	0.2452
16	1.16	6.2721	5.76	0.30603	0.598	0.9209	0.4088	2.253	0.66485	0.25605
17	1.29	6.2904	5.76	0.31707	0.598	0.92814	0.39776	2.333	0.66295	0.26519
18	1.42	6.3081	5.76	0.3252	0.593	0.9377	0.38963	2.407	0.66367	0.27403
19	1.55	6.3246	5.76	0.331	0.586	0.94841	0.38382	2.471	0.66612	0.28229
20	2.34	6.405	5.76	0.35597	0.552	1.0039	0.35885	2.797	0.68137	0.32252
21	3.12	6.4655	5.76	0.36178	0.513	1.0586	0.35305	2.998	0.70582	0.35277
22	3.91	6.5158	5.76	0.3583	0.474	1.1123	0.35653	3.120	0.73441	0.37788
23	4.70	6.5574	5.76	0.35075	0.440	1.1615	0.36408	3.190	0.7628	0.39872
24	5.49	6.5893	5.76	0.33797	0.408	1.2062	0.37686	3.201	0.79151	0.41466
25	6.28	6.6152	5.76	0.32694	0.382	1.2431	0.38789	3.205	0.8155	0.42761
26	7.07	6.6411	5.76	0.31242	0.355	1.2835	0.40241	3.190	0.84295	0.44054
27	7.85	6.6623	5.76	0.29442	0.326	1.3227	0.42041	3.146	0.87156	0.45115
28	8.63	6.6773	5.76	0.28513	0.311	1.347	0.4297	3.135	0.88837	0.45867
29	9.42	6.6878	5.76	0.27235	0.294	1.3703	0.44248	3.097	0.90639	0.46391
30	10.21	6.6929	5.76	0.25841	0.277	1.3894	0.45641	3.044	0.92288	0.46647
31	11.00	6.7029	5.76	0.2439	0.259	1.4138	0.47093	3.002	0.94238	0.47144
32	11.79	6.711	5.76	0.2317	0.244	1.4341	0.48313	2.968	0.95862	0.47549
33	12.57	6.7154	5.76	0.22299	0.233	1.4472	0.49184	2.942	0.96951	0.47768
34	13.36	6.717	5.76	0.2166	0.226	1.4552	0.49822	2.921	0.97673	0.47851
35	14.15	6.717	5.76	0.20499	0.214	1.4669	0.50984	2.877	0.98836	0.47852
36	14.93	6.7179	5.76	0.20499	0.214	1.4678	0.50984	2.879	0.98881	0.47897

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW010 S-7
Sample No.: S-7
Test No.: 20.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-17.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWN AND GRAY MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.23 in
Specimen Area: 6.29 in^2
Specimen Volume: 39.14 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 18

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.2863	0	0	5.044	6.48	6.48
2	5.0041	0.05533	6.2898	13.126	0.15025	5.2498	6.48	6.6303
3	10.004	0.11988	6.2939	19.719	0.22558	5.328	6.48	6.7056
4	15.004	0.18597	6.298	24.693	0.2823	5.381	6.48	6.7623
5	20.004	0.25206	6.3022	28.769	0.32867	5.4242	6.48	6.8087
6	25.004	0.31968	6.3065	32.245	0.36814	5.4644	6.48	6.8481
7	30.004	0.38731	6.3108	35.122	0.40071	5.4988	6.48	6.8807
8	35.004	0.45339	6.315	37.46	0.4271	5.5286	6.48	6.9071
9	40.004	0.52256	6.3193	39.617	0.45138	5.5525	6.48	6.9314
10	45.004	0.58557	6.3234	41.595	0.47362	5.5747	6.48	6.9536
11	50.004	0.65166	6.3276	43.633	0.49649	5.5991	6.48	6.9765
12	55.004	0.71775	6.3318	45.791	0.5207	5.6207	6.48	7.0007
13	60.004	0.7823	6.3359	47.769	0.54284	5.6394	6.48	7.0228
14	70.004	0.91601	6.3444	50.885	0.57747	5.6668	6.48	7.0575
15	80	1.0497	6.353	54.002	0.61202	5.6983	6.48	7.092
16	90	1.1834	6.3616	56.459	0.639	5.7228	6.48	7.119
17	110	1.4493	6.3788	61.314	0.69208	5.7642	6.48	7.1721
18	120	1.583	6.3874	63.292	0.71343	5.7776	6.48	7.1934
19	180	2.3746	6.4392	73.961	0.82699	5.8522	6.48	7.307
20	240	3.1676	6.492	82.052	0.91001	5.8919	6.48	7.39
21	300	3.9653	6.5459	89.124	0.9803	5.9077	6.48	7.4603
22	360	4.766	6.6009	94.698	1.0329	5.9158	6.48	7.5129
23	420	5.5652	6.6568	100.03	1.082	5.9193	6.48	7.562
24	480	6.366	6.7137	104.89	1.1248	5.9117	6.48	7.6048
25	540	7.1682	6.7717	108.78	1.1566	5.9012	6.48	7.6366
26	600	7.9582	6.8299	112.56	1.1866	5.8884	6.48	7.6666
27	660	8.7559	6.8896	116.22	1.2145	5.8709	6.48	7.6945
28	720	9.5582	6.9507	119.03	1.233	5.8598	6.48	7.713
29	780	10.356	7.0125	122.09	1.2535	5.8453	6.48	7.7335
30	840	11.16	7.076	124.79	1.2697	5.8353	6.48	7.7497
31	900	11.954	7.1398	127	1.2807	5.8248	6.48	7.7607
32	960	12.753	7.2052	129.22	1.2913	5.8073	6.48	7.7713
33	1020	13.56	7.2725	130.84	1.2954	5.7986	6.48	7.7754
34	1080	14.358	7.3402	132.94	1.304	5.791	6.48	7.784
35	1140	15.15	7.4087	134.02	1.3024	5.7846	6.48	7.7824

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW010 S-7
Sample No.: S-7
Test No.: 20.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-17.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWN AND GRAY MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.23 in
Specimen Area: 6.29 in^2
Specimen Volume: 39.14 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 18

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	6.48	6.48	0	0.000	1.436	1.436	1.000	1.436	0
2	0.06	6.6303	6.48	0.20586	1.370	1.3804	1.2302	1.122	1.3053	0.075127
3	0.12	6.7056	6.48	0.28401	1.259	1.3776	1.152	1.196	1.2648	0.11279
4	0.19	6.7623	6.48	0.33708	1.194	1.3813	1.099	1.257	1.2401	0.14115
5	0.25	6.8087	6.48	0.38024	1.157	1.3845	1.0558	1.311	1.2201	0.16434
6	0.32	6.8481	6.48	0.42048	1.142	1.3837	1.0156	1.362	1.1996	0.18407
7	0.39	6.8807	6.48	0.45488	1.135	1.3819	0.98116	1.408	1.1815	0.20036
8	0.45	6.9071	6.48	0.48463	1.135	1.3785	0.95142	1.449	1.165	0.21355
9	0.52	6.9314	6.48	0.50854	1.127	1.3789	0.92751	1.487	1.1532	0.22569
10	0.59	6.9536	6.48	0.5307	1.121	1.379	0.90535	1.523	1.1422	0.23681
11	0.65	6.9765	6.48	0.55519	1.118	1.3773	0.88085	1.564	1.1291	0.24825
12	0.72	7.0007	6.48	0.57677	1.108	1.38	0.85927	1.606	1.1196	0.26035
13	0.78	7.0228	6.48	0.59543	1.097	1.3834	0.84061	1.646	1.112	0.27142
14	0.92	7.0575	6.48	0.62284	1.079	1.3907	0.8132	1.710	1.1019	0.28874
15	1.05	7.092	6.48	0.65433	1.069	1.3937	0.78171	1.783	1.0877	0.30601
16	1.18	7.119	6.48	0.67883	1.062	1.3962	0.75722	1.844	1.0767	0.3195
17	1.45	7.1721	6.48	0.72023	1.041	1.4079	0.71581	1.967	1.0619	0.34604
18	1.58	7.1934	6.48	0.73365	1.028	1.4158	0.7024	2.016	1.0591	0.35672
19	2.37	7.307	6.48	0.80829	0.977	1.4547	0.62775	2.317	1.0412	0.41349
20	3.17	7.39	6.48	0.84795	0.932	1.4981	0.58809	2.547	1.0431	0.455
21	3.97	7.4603	6.48	0.8637	0.881	1.5526	0.57235	2.713	1.0625	0.49015
22	4.77	7.5129	6.48	0.87186	0.844	1.5971	0.56418	2.831	1.0806	0.51646
23	5.57	7.562	6.48	0.87536	0.809	1.6426	0.56068	2.930	1.1017	0.54098
24	6.37	7.6048	6.48	0.86778	0.771	1.6931	0.56827	2.979	1.1307	0.56242
25	7.17	7.6366	6.48	0.85728	0.741	1.7354	0.57876	2.998	1.1571	0.57831
26	7.96	7.6666	6.48	0.84445	0.712	1.7782	0.59159	3.006	1.1849	0.5933
27	8.76	7.6945	6.48	0.82695	0.681	1.8236	0.60909	2.994	1.2163	0.60726
28	9.56	7.713	6.48	0.81587	0.662	1.8532	0.62017	2.988	1.2367	0.61651
29	10.36	7.7335	6.48	0.80129	0.639	1.8883	0.63475	2.975	1.2615	0.62676
30	11.16	7.7497	6.48	0.79138	0.623	1.9144	0.64466	2.970	1.2795	0.63487
31	11.95	7.7607	6.48	0.78088	0.610	1.9359	0.65516	2.955	1.2955	0.64037
32	12.75	7.7713	6.48	0.76339	0.591	1.9639	0.67266	2.920	1.3183	0.64564
33	13.56	7.7754	6.48	0.75464	0.583	1.9768	0.6814	2.901	1.3291	0.64768
34	14.36	7.784	6.48	0.74706	0.573	1.993	0.68899	2.893	1.341	0.65199
35	15.15	7.7824	6.48	0.74064	0.569	1.9978	0.6954	2.873	1.3466	0.6512

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-010 S7
Sample No.: S-7
Test No.: 40.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-17.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWN AND GRAY MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.28 in
Specimen Area: 6.34 in^2
Specimen Volume: 39.77 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 18

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.3372	0	0	5.045	7.92	7.92
2	5.0034	0.036161	6.3395	29.009	0.32946	5.3353	7.92	8.2495
3	10.003	0.10125	6.3436	44.36	0.50349	5.4952	7.92	8.4235
4	15.003	0.16634	6.3477	52.512	0.59563	5.6081	7.92	8.5156
5	20.003	0.23288	6.352	58.07	0.65823	5.6994	7.92	8.5782
6	25.003	0.29942	6.3562	62.835	0.71176	5.7779	7.92	8.6318
7	30.003	0.36451	6.3604	66.964	0.75804	5.8489	7.92	8.678
8	35.003	0.43104	6.3646	70.351	0.79586	5.9111	7.92	8.7159
9	40.003	0.49758	6.3689	73.792	0.83422	5.9681	7.92	8.7542
10	45.003	0.56122	6.3729	76.915	0.86897	6.0199	7.92	8.789
11	50.003	0.62632	6.3771	79.509	0.89769	6.0658	7.92	8.8177
12	55.003	0.69141	6.3813	82.103	0.92637	6.11	7.92	8.8464
13	60.003	0.7565	6.3855	84.432	0.95202	6.1513	7.92	8.872
14	70.003	0.88523	6.3938	88.826	1.0003	6.2246	7.92	8.9203
15	80.003	1.0154	6.4022	92.637	1.0418	6.2874	7.92	8.9618
16	90.003	1.1441	6.4105	96.078	1.0791	6.3444	7.92	8.9991
17	100	1.2743	6.419	99.307	1.1139	6.3944	7.92	9.0339
18	110	1.4031	6.4273	102.17	1.1445	6.4386	7.92	9.0645
19	120	1.5318	6.4357	105.08	1.1756	6.4788	7.92	9.0956
20	180	2.3245	6.488	118.31	1.313	6.648	7.92	9.233
21	240	3.1243	6.5415	129.11	1.4211	6.7475	7.92	9.3411
22	300	3.8982	6.5942	137.9	1.5057	6.8062	7.92	9.4257
23	360	4.6923	6.6492	145.04	1.5706	6.8405	7.92	9.4906
24	420	5.4951	6.7056	152.14	1.6335	6.8615	7.92	9.5535
25	480	6.2791	6.7617	157.91	1.6814	6.8719	7.92	9.6014
26	540	7.0746	6.8196	163.31	1.7241	6.8714	7.92	9.6441
27	600	7.8702	6.8785	168.65	1.7654	6.8702	7.92	9.6854
28	660	8.6498	6.9372	173.1	1.7966	6.8621	7.92	9.7166
29	720	9.454	6.9988	177.86	1.8298	6.8516	7.92	9.7498
30	780	10.257	7.0614	181.83	1.854	6.8399	7.92	9.774
31	840	11.038	7.1234	185.96	1.8796	6.8272	7.92	9.7996
32	900	11.839	7.1882	189.4	1.8971	6.8149	7.92	9.8171
33	960	12.632	7.2534	192.47	1.9106	6.8021	7.92	9.8306
34	1020	13.412	7.3187	196.23	1.9305	6.7824	7.92	9.8505
35	1080	14.223	7.388	199.09	1.9403	6.7742	7.92	9.8603
36	1140	15.029	7.458	202.21	1.9522	6.7638	7.92	9.8722

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-010 S7
Sample No.: S-7
Test No.: 40.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-17.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWN AND GRAY MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.28 in
Specimen Area: 6.34 in^2
Specimen Volume: 39.77 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 18

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	7.92	7.92	0	0.000	2.875	2.875	1.000	2.875	0
2	0.04	8.2495	7.92	0.29023	0.881	2.9142	2.5847	1.127	2.7495	0.16473
3	0.10	8.4235	7.92	0.45018	0.894	2.9283	2.4248	1.208	2.6765	0.25174
4	0.17	8.5156	7.92	0.56302	0.945	2.9076	2.3119	1.258	2.6098	0.29781
5	0.23	8.5782	7.92	0.65433	0.994	2.8789	2.2206	1.296	2.5497	0.32912
6	0.30	8.6318	7.92	0.73285	1.030	2.8539	2.1421	1.332	2.498	0.35588
7	0.36	8.678	7.92	0.80381	1.060	2.8292	2.0711	1.366	2.4502	0.37902
8	0.43	8.7159	7.92	0.86604	1.088	2.8048	2.0089	1.396	2.4068	0.39793
9	0.50	8.7542	7.92	0.92304	1.106	2.7861	1.9519	1.427	2.369	0.41711
10	0.56	8.789	7.92	0.97481	1.122	2.7691	1.9001	1.457	2.3346	0.43449
11	0.63	8.8177	7.92	1.0208	1.137	2.7519	1.8542	1.484	2.303	0.44885
12	0.69	8.8464	7.92	1.065	1.150	2.7364	1.81	1.512	2.2732	0.46318
13	0.76	8.872	7.92	1.1063	1.162	2.7207	1.7687	1.538	2.2447	0.47601
14	0.89	8.9203	7.92	1.1795	1.179	2.6957	1.6954	1.590	2.1955	0.50013
15	1.02	8.9618	7.92	1.2424	1.192	2.6744	1.6326	1.638	2.1535	0.52091
16	1.14	8.9991	7.92	1.2994	1.204	2.6547	1.5756	1.685	2.1152	0.53955
17	1.27	9.0339	7.92	1.3494	1.211	2.6395	1.5256	1.730	2.0825	0.55695
18	1.40	9.0645	7.92	1.3936	1.218	2.6258	1.4814	1.773	2.0536	0.57224
19	1.53	9.0956	7.92	1.4337	1.220	2.6168	1.4412	1.816	2.029	0.58778
20	2.32	9.233	7.92	1.603	1.221	2.5849	1.272	2.032	1.9285	0.65648
21	3.12	9.3411	7.92	1.7024	1.198	2.5936	1.1725	2.212	1.8831	0.71053
22	3.90	9.4257	7.92	1.7612	1.170	2.6194	1.1138	2.352	1.8666	0.75283
23	4.69	9.4906	7.92	1.7955	1.143	2.6501	1.0795	2.455	1.8648	0.7853
24	5.50	9.5535	7.92	1.8164	1.112	2.6921	1.0585	2.543	1.8753	0.81676
25	6.28	9.6014	7.92	1.8269	1.087	2.7295	1.0481	2.604	1.8888	0.84071
26	7.07	9.6441	7.92	1.8263	1.059	2.7728	1.0486	2.644	1.9107	0.86207
27	7.87	9.6854	7.92	1.8251	1.034	2.8152	1.0498	2.682	1.9325	0.88268
28	8.65	9.7166	7.92	1.817	1.011	2.8545	1.0579	2.698	1.9562	0.89828
29	9.45	9.7498	7.92	1.8065	0.987	2.8982	1.0684	2.713	1.9833	0.91488
30	10.26	9.774	7.92	1.7949	0.968	2.9341	1.0801	2.717	2.0071	0.92701
31	11.04	9.7996	7.92	1.7821	0.948	2.9725	1.0928	2.720	2.0327	0.93981
32	11.84	9.8171	7.92	1.7699	0.933	3.0022	1.1051	2.717	2.0536	0.94857
33	12.63	9.8306	7.92	1.7571	0.920	3.0284	1.1179	2.709	2.0731	0.95528
34	13.41	9.8505	7.92	1.7373	0.900	3.0681	1.1376	2.697	2.1029	0.96525
35	14.22	9.8603	7.92	1.7292	0.891	3.086	1.1458	2.693	2.1159	0.97013
36	15.03	9.8722	7.92	1.7187	0.880	3.1084	1.1562	2.688	2.1323	0.97609

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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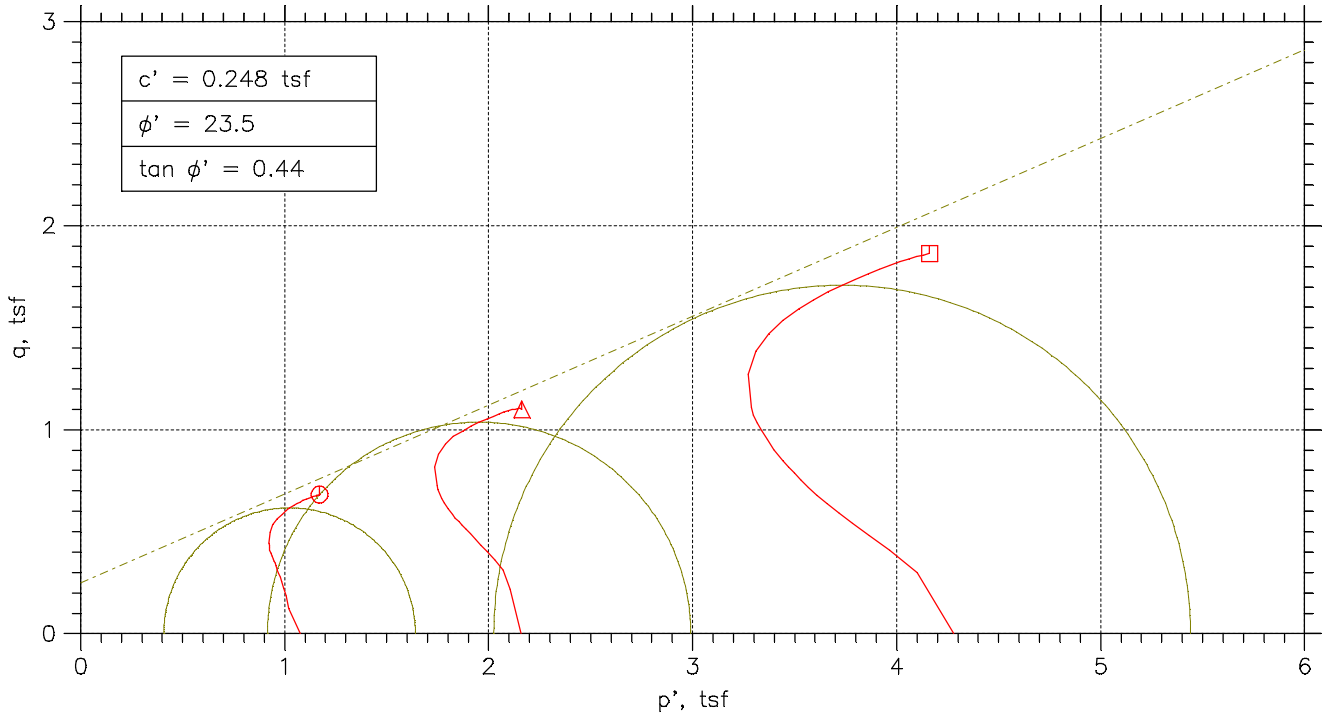

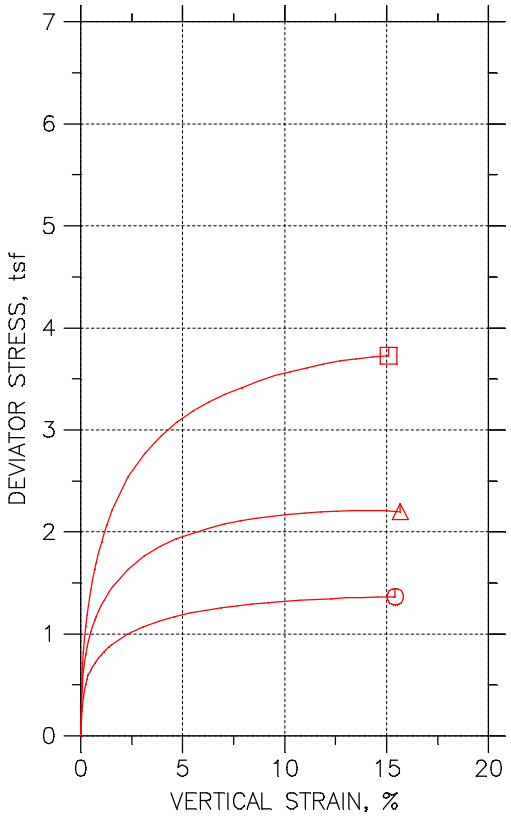

Symbol		⏲	△	⊡	
Test No.		15.0 PSI	30.0 PSI	60.0 PSI	
Initial	Diameter, in	2.8382	2.8134	2.8295	
	Height, in	6.3996	6.3425	6.2551	
	Water Content, %	31.54	29.27	28.87	
	Dry Density, pcf	87.92	91.94	94.81	
	Saturation, %	92.13	94.02	99.28	
	Void Ratio	0.93126	0.84681	0.791	
Before Shear	Water Content, %	31.86	27.59	24.62	
	Dry Density, pcf	90.97	97.01	101.7	
	Saturation, %	100.00	100.00	100.00	
	Void Ratio	0.86663	0.75044	0.66973	
	Back Press., tsf	5.0434	5.0422	5.0794	
Minor Prin. Stress, tsf		1.0766	2.1578	4.2806	
Max. Dev. Stress, tsf		1.3642	2.2082	3.7265	
Time to Failure, min		1205.9	1080	1140	
Strain Rate, %/min		0.02	0.02	0.02	
B-Value		0.97	0.98	0.96	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		48	48	48	
Plastic Limit		19	19	19	
Plasticity Index		29	29	29	

Project: DYNERGY EDWARDS

Location: BARTONVILLE, IL

Project No.: MR155218

Boring No.: EDW-012 S-7

Sample Type: 3.0" ST

Failure Sketch



Description: BROWN AND RUST BROWN MOTTLED LEAN CLAY CL

Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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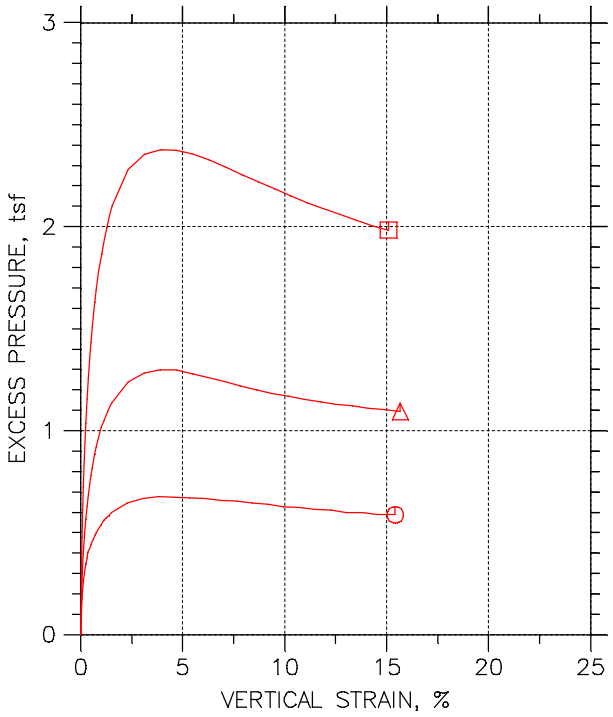

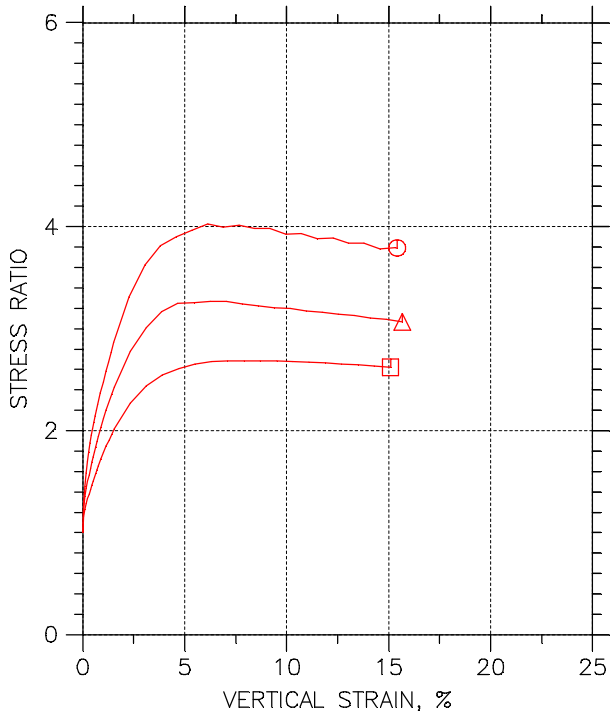

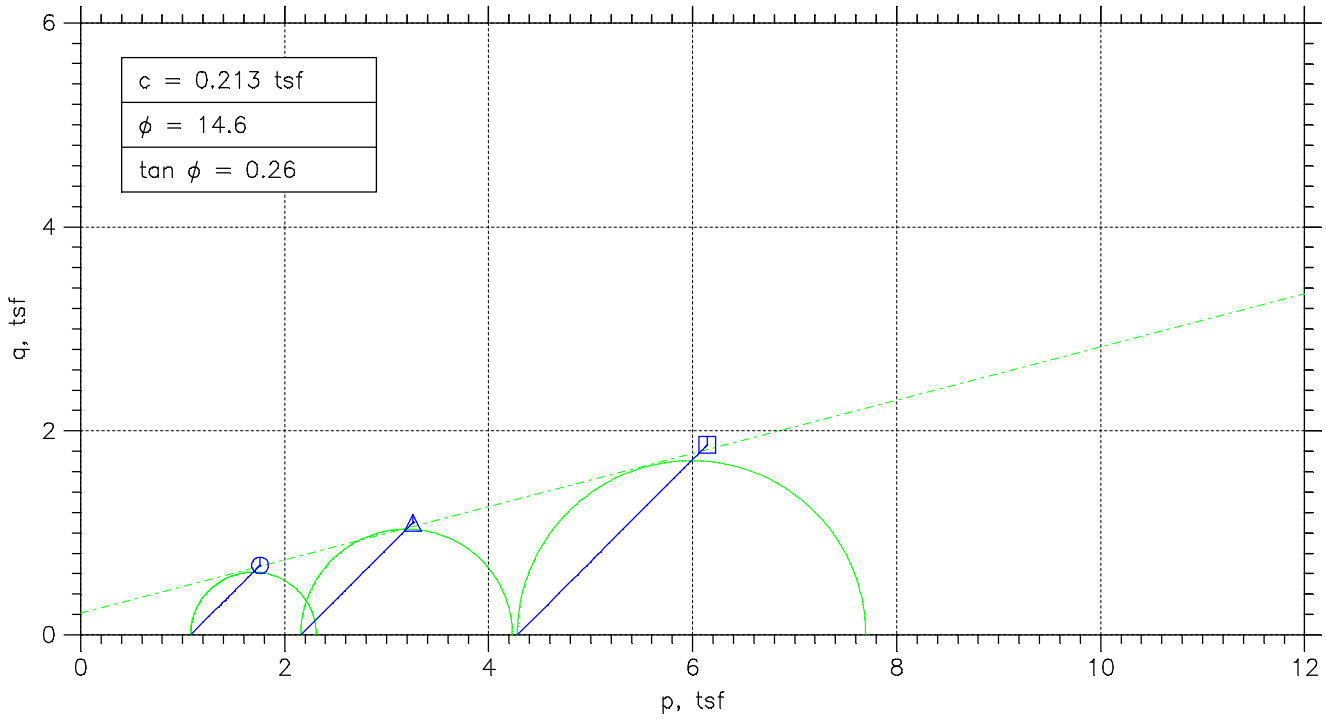

Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
Boring No.: EDW-012 S-7	Tested By: BCM	Checked By: WPQ
Sample No.: S-7	Test Date: 11/5/15	Depth: 15.0'-17.0'
Test No.: EDW-012 S-7	Sample Type: 3.0" ST	Elevation: ----
Description: BROWN AND RUST BROWN MOTTLED LEAN CLAY CL		
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.		

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-012 S-7
Sample No.: S-7
Test No.: 15.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/5/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-17.0'
Elevation: ----

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Soil Description: BROWN AND RUST BROWN MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.40 in
Specimen Area: 6.33 in^2
Specimen Volume: 40.49 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 19

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.3266	0	0	5.0434	6.12	6.12
2	5.0003	0.05234	6.3299	21.743	0.24732	5.2234	6.12	6.3673
3	10	0.11458	6.3339	32.694	0.37164	5.2995	6.12	6.4916
4	15	0.17541	6.3377	39.538	0.44917	5.3506	6.12	6.5692
5	20	0.23765	6.3417	44.908	0.50986	5.3907	6.12	6.6299
6	25	0.30131	6.3458	49.067	0.55672	5.4203	6.12	6.6767
7	30	0.36214	6.3496	52.331	0.5934	5.4476	6.12	6.7134
8	35	0.42579	6.3537	54.963	0.62285	5.4673	6.12	6.7428
9	40	0.48945	6.3577	57.122	0.64689	5.4848	6.12	6.7669
10	45	0.55452	6.3619	59.175	0.66971	5.4993	6.12	6.7897
11	50.001	0.61818	6.366	61.228	0.6925	5.5132	6.12	6.8125
12	55.001	0.68183	6.3701	62.966	0.71169	5.5283	6.12	6.8317
13	60.001	0.74549	6.3741	64.545	0.72908	5.5399	6.12	6.8491
14	70.001	0.87563	6.3825	67.599	0.76257	5.5632	6.12	6.8826
15	80.001	1.0029	6.3907	70.284	0.79184	5.5829	6.12	6.9118
16	90.001	1.1303	6.399	72.863	0.81985	5.6032	6.12	6.9398
17	100	1.259	6.4073	75.18	0.84481	5.6154	6.12	6.9648
18	110	1.3863	6.4156	77.444	0.86913	5.6276	6.12	6.9891
19	120	1.5136	6.4239	79.392	0.88984	5.6427	6.12	7.0098
20	180	2.2832	6.4745	89.553	0.99588	5.6886	6.12	7.1159
21	240	3.0499	6.5257	96.923	1.0694	5.7124	6.12	7.1894
22	300	3.8194	6.5779	102.87	1.126	5.7194	6.12	7.246
23	360	4.5847	6.6306	107.72	1.1697	5.7165	6.12	7.2897
24	420	5.35	6.6842	111.77	1.2039	5.7141	6.12	7.3239
25	480	6.1238	6.7393	115.4	1.2329	5.7124	6.12	7.3529
26	540	6.8848	6.7944	118.4	1.2547	5.7014	6.12	7.3747
27	600	7.6572	6.8512	121.14	1.2731	5.6973	6.12	7.3931
28	660	8.4239	6.9086	123.83	1.2905	5.6874	6.12	7.4105
29	720	9.1878	6.9667	126.25	1.3047	5.6822	6.12	7.4247
30	780	9.9587	7.0264	128.56	1.3174	5.67	6.12	7.4374
31	840	10.721	7.0864	130.72	1.3282	5.6671	6.12	7.4482
32	900	11.496	7.1484	132.83	1.3379	5.6561	6.12	7.4579
33	960	12.266	7.2111	134.78	1.3457	5.6538	6.12	7.4657
34	1020	13.031	7.2746	136.78	1.3537	5.6433	6.12	7.4737
35	1080	13.799	7.3394	138.3	1.3568	5.6416	6.12	7.4768
36	1140	14.57	7.4057	139.88	1.36	5.6317	6.12	7.48
37	1200	15.338	7.4728	141.57	1.364	5.6317	6.12	7.484
38	1205.9	15.418	7.4798	141.73	1.3642	5.6311	6.12	7.4842

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-012 S-7
Sample No.: S-7
Test No.: 15.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/5/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-17.0'
Elevation: ----

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Soil Description: BROWN AND RUST BROWN MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.40 in
Specimen Area: 6.33 in^2
Specimen Volume: 40.49 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 19

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	6.12	6.12	0	0.000	1.0766	1.0766	1.000	1.0766	0
2	0.05	6.3673	6.12	0.18002	0.728	1.1439	0.89655	1.276	1.0202	0.12366
3	0.11	6.4916	6.12	0.25609	0.689	1.1921	0.82048	1.453	1.0063	0.18582
4	0.18	6.5692	6.12	0.30719	0.684	1.2185	0.76938	1.584	0.99396	0.22459
5	0.24	6.6299	6.12	0.34726	0.681	1.2392	0.72931	1.699	0.98424	0.25493
6	0.30	6.6767	6.12	0.37688	0.677	1.2564	0.69969	1.796	0.97805	0.27836
7	0.36	6.7134	6.12	0.40417	0.681	1.2658	0.6724	1.883	0.9691	0.2967
8	0.43	6.7428	6.12	0.42392	0.681	1.2755	0.65265	1.954	0.96408	0.31142
9	0.49	6.7669	6.12	0.44134	0.682	1.2821	0.63523	2.018	0.95868	0.32345
10	0.55	6.7897	6.12	0.45585	0.681	1.2904	0.62072	2.079	0.95557	0.33485
11	0.62	6.8125	6.12	0.46979	0.678	1.2993	0.60678	2.141	0.95303	0.34625
12	0.68	6.8317	6.12	0.48489	0.681	1.3034	0.59168	2.203	0.94753	0.35585
13	0.75	6.8491	6.12	0.4965	0.681	1.3091	0.58007	2.257	0.94461	0.36454
14	0.88	6.8826	6.12	0.51973	0.682	1.3194	0.55684	2.369	0.93812	0.38128
15	1.00	6.9118	6.12	0.53948	0.681	1.3289	0.53709	2.474	0.93301	0.39592
16	1.13	6.9398	6.12	0.5598	0.683	1.3366	0.51677	2.586	0.92669	0.40992
17	1.26	6.9648	6.12	0.572	0.677	1.3494	0.50457	2.674	0.92698	0.42241
18	1.39	6.9891	6.12	0.58419	0.672	1.3615	0.49238	2.765	0.92694	0.43456
19	1.51	7.0098	6.12	0.59929	0.673	1.3671	0.47728	2.864	0.9222	0.44492
20	2.28	7.1159	6.12	0.64516	0.648	1.4273	0.43141	3.308	0.92935	0.49794
21	3.05	7.1894	6.12	0.66897	0.626	1.477	0.4076	3.624	0.94229	0.53469
22	3.82	7.246	6.12	0.67594	0.600	1.5266	0.40063	3.811	0.96364	0.56301
23	4.58	7.2897	6.12	0.67304	0.575	1.5732	0.40353	3.899	0.98836	0.58483
24	5.35	7.3239	6.12	0.67072	0.557	1.6098	0.40585	3.966	1.0078	0.60197
25	6.12	7.3529	6.12	0.66897	0.543	1.6405	0.4076	4.025	1.024	0.61645
26	6.88	7.3747	6.12	0.65794	0.524	1.6733	0.41863	3.997	1.046	0.62736
27	7.66	7.3931	6.12	0.65387	0.514	1.6958	0.42269	4.012	1.0592	0.63654
28	8.42	7.4105	6.12	0.644	0.499	1.7231	0.43257	3.983	1.0778	0.64524
29	9.19	7.4247	6.12	0.63878	0.490	1.7425	0.43779	3.980	1.0902	0.65237
30	9.96	7.4374	6.12	0.62658	0.476	1.7674	0.44999	3.928	1.1087	0.6587
31	10.72	7.4482	6.12	0.62368	0.470	1.7811	0.45289	3.933	1.117	0.66409
32	11.50	7.4579	6.12	0.61264	0.458	1.8018	0.46392	3.884	1.1329	0.66893
33	12.27	7.4657	6.12	0.61032	0.454	1.8119	0.46625	3.886	1.1391	0.67284
34	13.03	7.4737	6.12	0.59987	0.443	1.8304	0.4767	3.840	1.1536	0.67687
35	13.80	7.4768	6.12	0.59813	0.441	1.8352	0.47844	3.836	1.1568	0.67838
36	14.57	7.48	6.12	0.58826	0.433	1.8483	0.48831	3.785	1.1683	0.67999
37	15.34	7.484	6.12	0.58826	0.431	1.8523	0.48831	3.793	1.1703	0.68199
38	15.42	7.4842	6.12	0.58767	0.431	1.8531	0.48889	3.790	1.171	0.68212

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-012 S-7
Sample No.: S-7
Test No.: 30.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/5/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-16.5'
Elevation: ----

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Soil Description: BROWN AND RUST BROWN MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.34 in
Specimen Area: 6.22 in^2
Specimen Volume: 39.43 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 19

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.2165	0	0	5.0422	7.2	7.2
2	5	0.057327	6.2201	37.373	0.4326	5.3099	7.2	7.6326
3	10	0.11918	6.224	53.994	0.62462	5.4417	7.2	7.8246
4	15	0.18405	6.228	62.676	0.72458	5.5332	7.2	7.9246
5	20	0.24892	6.232	69.557	0.80361	5.6096	7.2	8.0036
6	25	0.31228	6.236	75.327	0.86972	5.6726	7.2	8.0697
7	30	0.37564	6.24	80.356	0.92719	5.728	7.2	8.1272
8	35	0.44202	6.2441	85.068	0.9809	5.7788	7.2	8.1809
9	40	0.50689	6.2482	88.985	1.0254	5.8225	7.2	8.2254
10	45	0.57025	6.2522	92.478	1.065	5.8616	7.2	8.265
11	50	0.6321	6.2561	95.602	1.1003	5.8972	7.2	8.3003
12	55	0.69697	6.2602	98.513	1.133	5.9298	7.2	8.333
13	60	0.76033	6.2642	101.53	1.167	5.9607	7.2	8.367
14	70	0.88856	6.2723	106.72	1.225	6.0115	7.2	8.425
15	80	1.0198	6.2806	111.69	1.2804	6.0569	7.2	8.4804
16	90	1.1496	6.2888	115.93	1.3273	6.0949	7.2	8.5273
17	110	1.412	6.3056	123.92	1.415	6.1573	7.2	8.615
18	120	1.5403	6.3138	127.47	1.4536	6.1806	7.2	8.6536
19	180	2.3247	6.3645	144.14	1.6307	6.2815	7.2	8.8307
20	240	3.1062	6.4158	156.9	1.7608	6.3252	7.2	8.9608
21	300	3.8877	6.468	167.01	1.8591	6.3415	7.2	9.0591
22	360	4.6691	6.521	175.01	1.9323	6.3398	7.2	9.1323
23	420	5.4611	6.5756	181.3	1.9852	6.32	7.2	9.1852
24	480	6.2516	6.6311	187.18	2.0324	6.3025	7.2	9.2324
25	540	7.0361	6.687	192.69	2.0747	6.2844	7.2	9.2747
26	600	7.8221	6.7441	197.24	2.1057	6.2616	7.2	9.3057
27	660	8.6005	6.8015	201.31	2.1311	6.2418	7.2	9.3311
28	720	9.391	6.8608	205.13	2.1527	6.2237	7.2	9.3527
29	780	10.177	6.9209	208.78	2.172	6.2109	7.2	9.372
30	840	10.96	6.9817	211.85	2.1847	6.1957	7.2	9.3847
31	900	11.752	7.0444	214.97	2.1972	6.1841	7.2	9.3972
32	960	12.536	7.1076	217.25	2.2007	6.1713	7.2	9.4007
33	1020	13.315	7.1714	219.79	2.2067	6.1631	7.2	9.4067
34	1080	14.104	7.2373	221.96	2.2082	6.1514	7.2	9.4082
35	1140	14.884	7.3036	223.76	2.2059	6.145	7.2	9.4059
36	1200	15.665	7.3713	225.14	2.199	6.1363	7.2	9.399

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-012 S-7
Sample No.: S-7
Test No.: 30.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/5/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-16.5'
Elevation: ----

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Soil Description: BROWN AND RUST BROWN MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.34 in
Specimen Area: 6.22 in^2
Specimen Volume: 39.43 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 19

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	7.2	7.2	0	0.000	2.1578	2.1578	1.000	2.1578	0
2	0.06	7.6326	7.2	0.26768	0.619	2.3227	1.8901	1.229	2.1064	0.2163
3	0.12	7.8246	7.2	0.39948	0.640	2.3829	1.7583	1.355	2.0706	0.31231
4	0.18	7.9246	7.2	0.49104	0.678	2.3913	1.6668	1.435	2.029	0.36229
5	0.25	8.0036	7.2	0.56744	0.706	2.394	1.5904	1.505	1.9922	0.4018
6	0.31	8.0697	7.2	0.63042	0.725	2.3971	1.5274	1.569	1.9622	0.43486
7	0.38	8.1272	7.2	0.68582	0.740	2.3992	1.472	1.630	1.9356	0.4636
8	0.44	8.1809	7.2	0.73656	0.751	2.4021	1.4212	1.690	1.9117	0.49045
9	0.51	8.2254	7.2	0.7803	0.761	2.4029	1.3775	1.744	1.8902	0.5127
10	0.57	8.265	7.2	0.81937	0.769	2.4034	1.3384	1.796	1.8709	0.53249
11	0.63	8.3003	7.2	0.85495	0.777	2.4031	1.3028	1.845	1.853	0.55013
12	0.70	8.333	7.2	0.88761	0.783	2.4032	1.2702	1.892	1.8367	0.56651
13	0.76	8.367	7.2	0.91851	0.787	2.4063	1.2393	1.942	1.8228	0.58349
14	0.89	8.425	7.2	0.96925	0.791	2.4136	1.1885	2.031	1.8011	0.61251
15	1.02	8.4804	7.2	1.0147	0.792	2.4235	1.1431	2.120	1.7833	0.64022
16	1.15	8.5273	7.2	1.0526	0.793	2.4324	1.1051	2.201	1.7688	0.66363
17	1.41	8.615	7.2	1.115	0.788	2.4577	1.0427	2.357	1.7502	0.7075
18	1.54	8.6536	7.2	1.1384	0.783	2.473	1.0194	2.426	1.7462	0.7268
19	2.32	8.8307	7.2	1.2393	0.760	2.5492	0.91853	2.775	1.7339	0.81533
20	3.11	8.9608	7.2	1.283	0.729	2.6356	0.87479	3.013	1.7552	0.88039
21	3.89	9.0591	7.2	1.2993	0.699	2.7176	0.85846	3.166	1.788	0.92957
22	4.67	9.1323	7.2	1.2976	0.672	2.7925	0.86021	3.246	1.8263	0.96614
23	5.46	9.1852	7.2	1.2778	0.644	2.8652	0.88004	3.256	1.8726	0.9926
24	6.25	9.2324	7.2	1.2603	0.620	2.9299	0.89753	3.264	1.9137	1.0162
25	7.04	9.2747	7.2	1.2422	0.599	2.9903	0.91561	3.266	1.9529	1.0373
26	7.82	9.3057	7.2	1.2194	0.579	3.0441	0.93836	3.244	1.9912	1.0529
27	8.60	9.3311	7.2	1.1996	0.563	3.0893	0.95818	3.224	2.0237	1.0655
28	9.39	9.3527	7.2	1.1815	0.549	3.1289	0.97626	3.205	2.0526	1.0763
29	10.18	9.372	7.2	1.1687	0.538	3.1611	0.98909	3.196	2.0751	1.086
30	10.96	9.3847	7.2	1.1535	0.528	3.189	1.0043	3.175	2.0966	1.0924
31	11.75	9.3972	7.2	1.1419	0.520	3.2131	1.0159	3.163	2.1145	1.0986
32	12.54	9.4007	7.2	1.129	0.513	3.2295	1.0287	3.139	2.1291	1.1004
33	13.31	9.4067	7.2	1.1209	0.508	3.2436	1.0369	3.128	2.1402	1.1033
34	14.10	9.4082	7.2	1.1092	0.502	3.2567	1.0486	3.106	2.1527	1.1041
35	14.88	9.4059	7.2	1.1028	0.500	3.2608	1.055	3.091	2.1579	1.1029
36	15.67	9.399	7.2	1.0941	0.498	3.2628	1.0637	3.067	2.1633	1.0995

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-012 S-7
Sample No.: S-7
Test No.: 60.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/5/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-16.5'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWN AND RUST BROWN MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767.

Specimen Height: 6.26 in
Specimen Area: 6.29 in^2
Specimen Volume: 39.33 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 19

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.2881	0	0	5.0794	9.36	9.36
2	5	0.055149	6.2915	52.036	0.59549	5.5563	9.36	9.9555
3	10	0.11755	6.2955	71.569	0.81852	5.8035	9.36	10.179
4	15	0.18141	6.2995	84.326	0.96381	5.9774	9.36	10.324
5	20	0.24672	6.3036	94.702	1.0817	6.1181	9.36	10.442
6	25	0.31203	6.3078	103.75	1.1843	6.2356	9.36	10.544
7	30	0.37733	6.3119	111.85	1.2759	6.3392	9.36	10.636
8	35	0.44119	6.3159	119.26	1.3596	6.4305	9.36	10.72
9	40	0.5065	6.3201	125.99	1.4353	6.5113	9.36	10.795
10	45	0.5718	6.3242	132.6	1.5097	6.5858	9.36	10.87
11	50	0.63566	6.3283	138.48	1.5755	6.6503	9.36	10.936
12	55	0.70097	6.3325	143.88	1.6359	6.7091	9.36	10.996
13	60	0.76628	6.3366	149.33	1.6968	6.7667	9.36	11.057
14	70	0.89544	6.3449	158.97	1.8039	6.8626	9.36	11.164
15	80	1.0261	6.3533	167.86	1.9023	6.9446	9.36	11.262
16	90	1.1567	6.3617	176.06	1.9927	7.0185	9.36	11.353
17	100	1.2873	6.3701	183	2.0684	7.0773	9.36	11.428
18	110	1.4165	6.3784	189.56	2.1398	7.1325	9.36	11.5
19	120	1.5471	6.3869	196.55	2.2157	7.1802	9.36	11.576
20	180	2.3351	6.4384	227.25	2.5413	7.3582	9.36	11.901
21	240	3.1261	6.491	249.54	2.768	7.4332	9.36	12.128
22	300	3.9156	6.5443	267.01	2.9376	7.4565	9.36	12.298
23	360	4.7123	6.599	281.56	3.0721	7.453	9.36	12.432
24	420	5.5149	6.6551	294.48	3.1859	7.4338	9.36	12.546
25	480	6.3087	6.7115	305.17	3.2739	7.4059	9.36	12.634
26	540	7.1069	6.7692	315.07	3.3513	7.3716	9.36	12.711
27	600	7.9066	6.8279	323.91	3.4156	7.3349	9.36	12.776
28	660	8.699	6.8872	332.28	3.4737	7.2994	9.36	12.834
29	720	9.5044	6.9485	340.75	3.5308	7.2645	9.36	12.891
30	780	10.304	7.0104	347.84	3.5725	7.2302	9.36	12.932
31	840	11.102	7.0734	354.51	3.6086	7.1977	9.36	12.969
32	900	11.898	7.1372	361.34	3.6452	7.1668	9.36	13.005
33	960	12.697	7.2026	367.64	3.675	7.1383	9.36	13.035
34	1020	13.49	7.2686	373.2	3.6967	7.1104	9.36	13.057
35	1080	14.297	7.337	378.28	3.7121	7.0837	9.36	13.072
36	1140	15.095	7.406	383.31	3.7265	7.0621	9.36	13.086

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-012 S-7
Sample No.: S-7
Test No.: 60.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/5/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-16.5'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWN AND RUST BROWN MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767.

Specimen Height: 6.26 in
Specimen Area: 6.29 in^2
Specimen Volume: 39.33 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 19

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	9.36	9.36	0	0.000	4.2806	4.2806	1.000	4.2806	0
2	0.06	9.9555	9.36	0.47694	0.801	4.3992	3.8037	1.157	4.1015	0.29775
3	0.12	10.179	9.36	0.72413	0.885	4.375	3.5565	1.230	3.9658	0.40926
4	0.18	10.324	9.36	0.89803	0.932	4.3464	3.3826	1.285	3.8645	0.4819
5	0.25	10.442	9.36	1.0388	0.960	4.3235	3.2419	1.334	3.7827	0.54084
6	0.31	10.544	9.36	1.1563	0.976	4.3087	3.1244	1.379	3.7165	0.59215
7	0.38	10.636	9.36	1.2598	0.987	4.2967	3.0208	1.422	3.6588	0.63796
8	0.44	10.72	9.36	1.3511	0.994	4.2891	2.9295	1.464	3.6093	0.67979
9	0.51	10.795	9.36	1.432	0.998	4.2839	2.8487	1.504	3.5663	0.71764
10	0.57	10.87	9.36	1.5064	0.998	4.2839	2.7742	1.544	3.5291	0.75483
11	0.64	10.936	9.36	1.571	0.997	4.2852	2.7097	1.581	3.4974	0.78777
12	0.70	10.996	9.36	1.6297	0.996	4.2868	2.6509	1.617	3.4689	0.81795
13	0.77	11.057	9.36	1.6873	0.994	4.2901	2.5933	1.654	3.4417	0.84839
14	0.90	11.164	9.36	1.7833	0.989	4.3013	2.4974	1.722	3.3993	0.90195
15	1.03	11.262	9.36	1.8653	0.981	4.3177	2.4154	1.788	3.3665	0.95115
16	1.16	11.353	9.36	1.9391	0.973	4.3341	2.3415	1.851	3.3378	0.99633
17	1.29	11.428	9.36	1.9979	0.966	4.3511	2.2827	1.906	3.3169	1.0342
18	1.42	11.5	9.36	2.0531	0.960	4.3673	2.2275	1.961	3.2974	1.0699
19	1.55	11.576	9.36	2.1008	0.948	4.3955	2.1798	2.016	3.2877	1.1079
20	2.34	11.901	9.36	2.2788	0.897	4.5432	2.0018	2.270	3.2725	1.2707
21	3.13	12.128	9.36	2.3539	0.850	4.6947	1.9268	2.437	3.3108	1.384
22	3.92	12.298	9.36	2.3771	0.809	4.8411	1.9035	2.543	3.3723	1.4688
23	4.71	12.432	9.36	2.3736	0.773	4.9791	1.907	2.611	3.443	1.536
24	5.51	12.546	9.36	2.3544	0.739	5.1121	1.9262	2.654	3.5192	1.593
25	6.31	12.634	9.36	2.3265	0.711	5.228	1.9541	2.675	3.5911	1.6369
26	7.11	12.711	9.36	2.2922	0.684	5.3397	1.9884	2.685	3.6641	1.6756
27	7.91	12.776	9.36	2.2556	0.660	5.4407	2.0251	2.687	3.7329	1.7078
28	8.70	12.834	9.36	2.2201	0.639	5.5342	2.0606	2.686	3.7974	1.7368
29	9.50	12.891	9.36	2.1852	0.619	5.6263	2.0955	2.685	3.8609	1.7654
30	10.30	12.932	9.36	2.1509	0.602	5.7022	2.1298	2.677	3.916	1.7862
31	11.10	12.969	9.36	2.1183	0.587	5.7709	2.1623	2.669	3.9666	1.8043
32	11.90	13.005	9.36	2.0875	0.573	5.8383	2.1932	2.662	4.0158	1.8226
33	12.70	13.035	9.36	2.059	0.560	5.8967	2.2217	2.654	4.0592	1.8375
34	13.49	13.057	9.36	2.031	0.549	5.9463	2.2496	2.643	4.098	1.8484
35	14.30	13.072	9.36	2.0043	0.540	5.9885	2.2763	2.631	4.1324	1.8561
36	15.09	13.086	9.36	1.9828	0.532	6.0243	2.2979	2.622	4.1611	1.8632

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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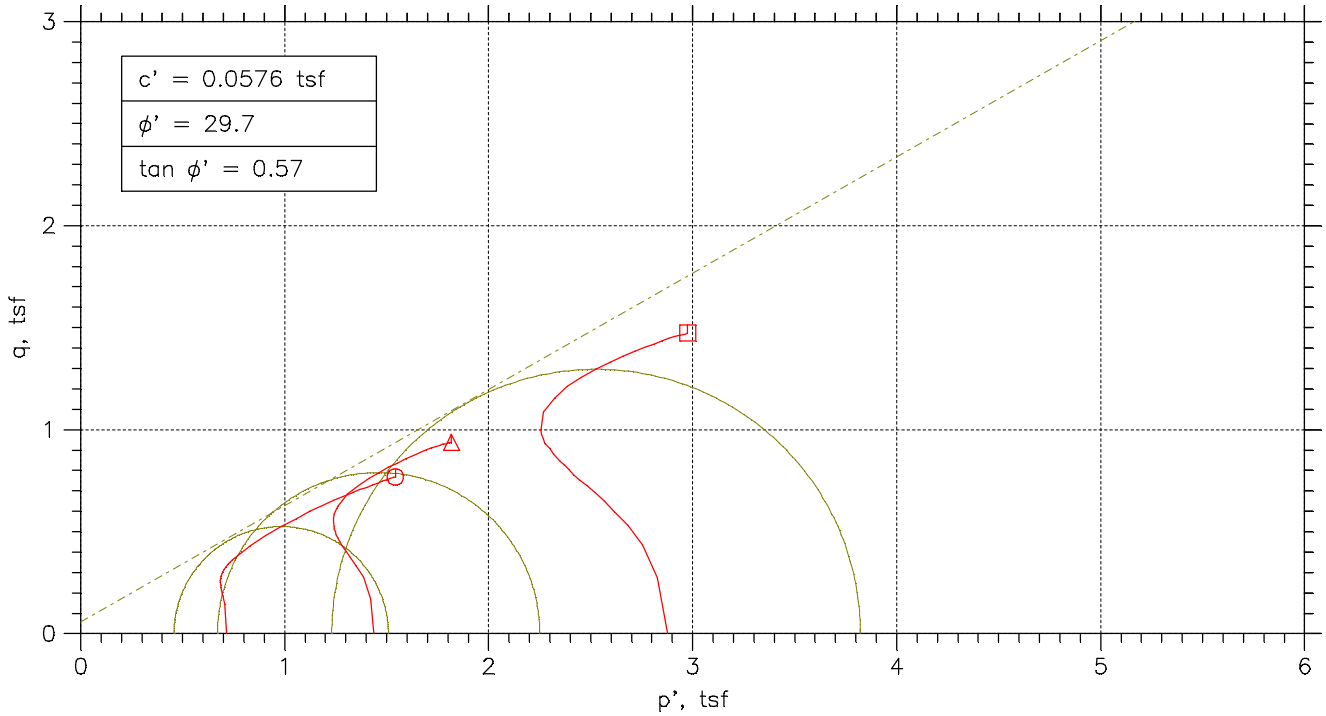

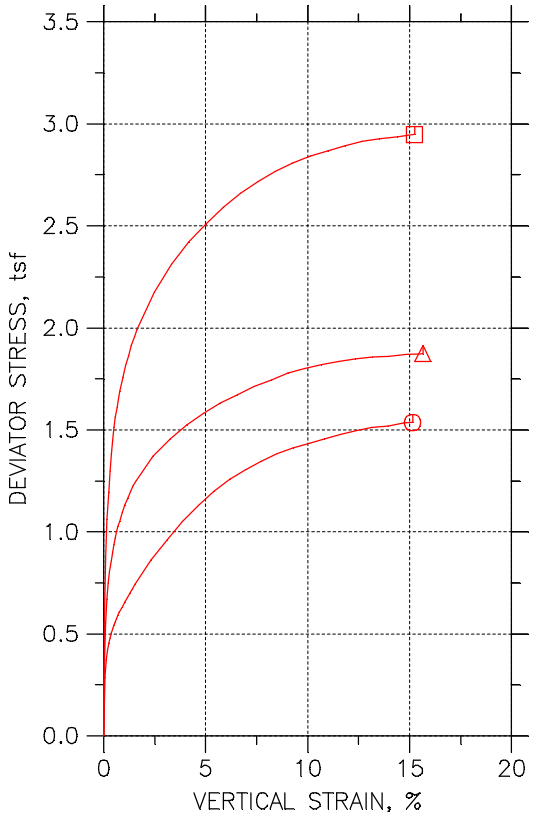

Symbol		○	△	□	
Test No.		10.0 PSI	20.0 PSI	40.0 PSI	
Initial	Diameter, in	2.8386	2.8571	2.8543	
	Height, in	6.0421	6.0181	5.878	
	Water Content, %	19.07	19.02	18.95	
	Dry Density, pcf	111.5	111.3	111.5	
	Saturation, %	99.28	98.47	98.47	
	Void Ratio	0.52245	0.52554	0.52343	
Before Shear	Water Content, %	18.80	18.40	16.50	
	Dry Density, pcf	112.4	113.2	117.2	
	Saturation, %	100.00	100.00	100.00	
	Void Ratio	0.51129	0.50044	0.4489	
	Back Press., tsf	5.0445	5.044	5.0432	
Minor Prin. Stress, tsf		0.71549	1.436	2.8768	
Max. Dev. Stress, tsf		1.536	1.8745	2.9478	
Time to Failure, min		1174.7	1140	1080	
Strain Rate, %/min		0.02	0.02	0.02	
B-Value		0.95	0.97	0.97	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		49	49	49	
Plastic Limit		21	21	21	
Plasticity Index		28	28	28	

Project: DYNERGY EDWARDS

Location: BARTONVILLE, IL

Project No.: MR155218

Boring No.: EDW-013 S3

Sample Type: 3.0" ST

Failure Sketch



Description: BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL CL

Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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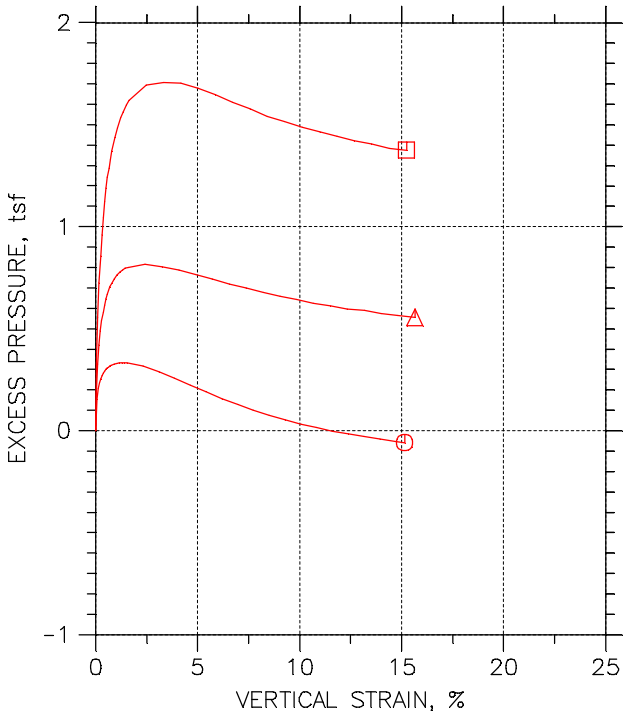

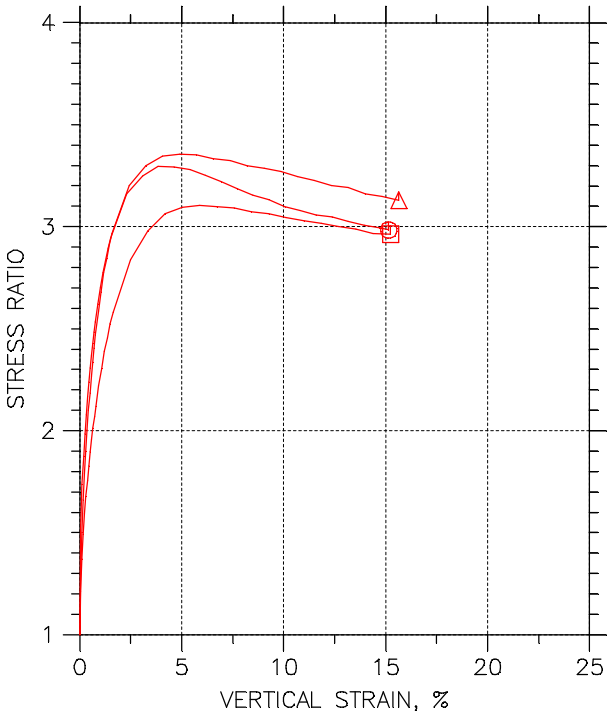

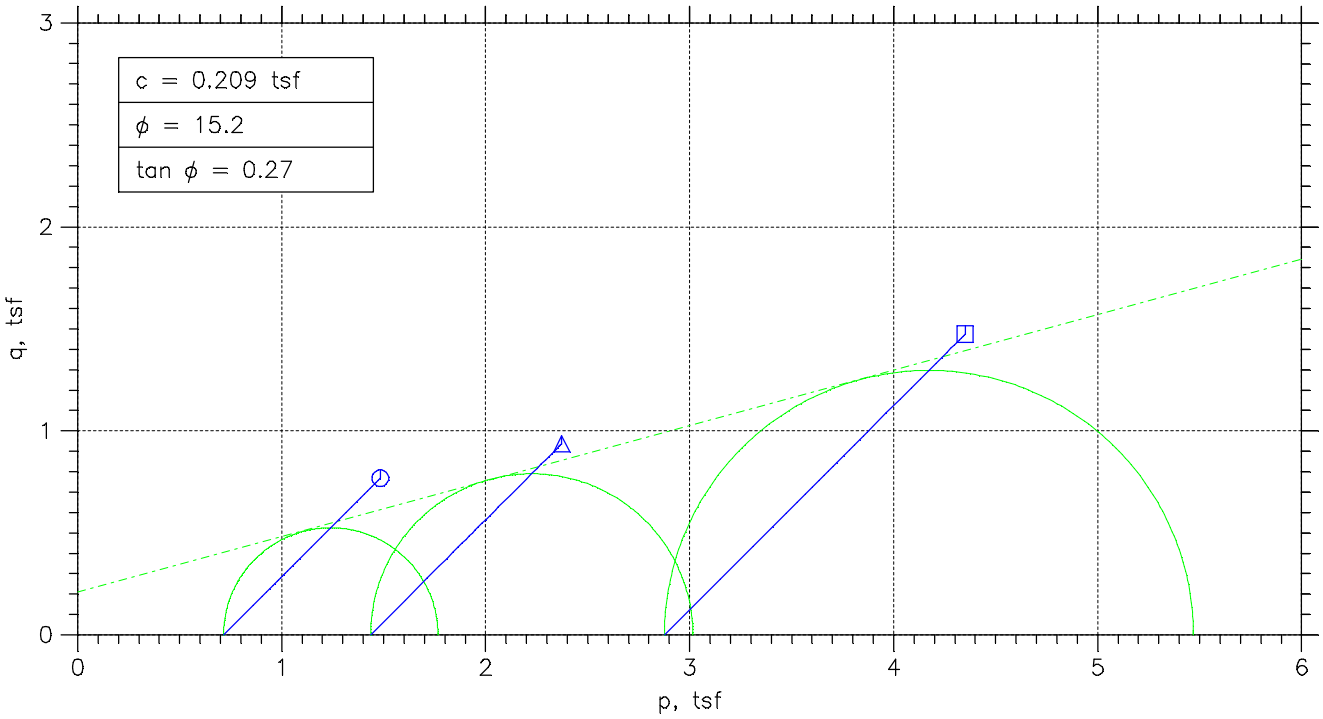

Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
Boring No.: EDW-013 S3	Tested By: BCM	Checked By: WPQ
Sample No.: S-3	Test Date: 11/4/15	Depth: 6.0'-8.0'
Test No.: EDW-013 S3	Sample Type: 3.0" ST	Elevation: -----
Description: BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL CL		
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767		

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-013 S3
Sample No.: S-3
Test No.: 10.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/4/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 6.0'-8.0'
Elevation: -----

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Soil Description: BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.04 in
Specimen Area: 6.33 in^2
Specimen Volume: 38.24 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 49

Plastic Limit: 21

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.3284	0	0	5.0445	5.76	5.76
2	5.0002	0.058512	6.3321	25.429	0.28914	5.1976	5.76	6.0491
3	10	0.12273	6.3362	32.957	0.3745	5.2511	5.76	6.1345
4	15	0.18695	6.3402	36.958	0.4197	5.2802	5.76	6.1797
5	20	0.25117	6.3443	39.959	0.45348	5.3	5.76	6.2135
6	25	0.31682	6.3485	42.381	0.48065	5.3139	5.76	6.2407
7	30	0.38104	6.3526	44.539	0.50481	5.3273	5.76	6.2648
8	35	0.44526	6.3567	46.277	0.52416	5.3372	5.76	6.2842
9	40	0.50948	6.3608	47.909	0.5423	5.3454	5.76	6.3023
10	45	0.5737	6.3649	49.488	0.55981	5.3512	5.76	6.3198
11	50	0.63935	6.3691	50.91	0.57551	5.3564	5.76	6.3355
12	55	0.70357	6.3732	52.278	0.5906	5.3617	5.76	6.3506
13	60	0.76922	6.3774	53.542	0.60448	5.3657	5.76	6.3645
14	70.001	0.89623	6.3856	55.911	0.63042	5.371	5.76	6.3904
15	80.001	1.0232	6.3938	58.175	0.6551	5.375	5.76	6.4151
16	90.001	1.1503	6.402	60.386	0.67913	5.3774	5.76	6.4391
17	100	1.2787	6.4104	62.387	0.70072	5.3779	5.76	6.4607
18	110	1.4043	6.4185	64.387	0.72227	5.3785	5.76	6.4823
19	120	1.5342	6.427	66.493	0.74491	5.3768	5.76	6.5049
20	180	2.3134	6.4783	77.602	0.86247	5.3611	5.76	6.6225
21	240	3.0926	6.5303	87.078	0.96008	5.3331	5.76	6.7201
22	300	3.8561	6.5822	96.028	1.0504	5.3023	5.76	6.8104
23	360	4.6339	6.6359	103.98	1.1282	5.268	5.76	6.8882
24	420	5.4102	6.6903	111.3	1.1977	5.2348	5.76	6.9577
25	480	6.1766	6.745	117.72	1.2566	5.2016	5.76	7.0166
26	540	6.9544	6.8014	123.3	1.3053	5.172	5.76	7.0653
27	600	7.7321	6.8587	128.09	1.3446	5.1446	5.76	7.1046
28	660	8.4985	6.9162	132.78	1.3822	5.1184	5.76	7.1422
29	720	9.2777	6.9756	136.88	1.4129	5.0975	5.76	7.1729
30	780	10.057	7.036	140.2	1.4347	5.0759	5.76	7.1947
31	840	10.819	7.0961	143.62	1.4572	5.0591	5.76	7.2172
32	900	11.602	7.159	146.99	1.4783	5.0416	5.76	7.2383
33	960	12.382	7.2227	150.1	1.4963	5.0288	5.76	7.2563
34	1020	13.151	7.2866	152.89	1.5107	5.0148	5.76	7.2707
35	1080	13.932	7.3527	155.15	1.5193	5.0032	5.76	7.2793
36	1140	14.706	7.4195	157.94	1.5327	4.9921	5.76	7.2927
37	1174.7	15.146	7.458	159.1	1.536	4.9857	5.76	7.296

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-013 S3
Sample No.: S-3
Test No.: 10.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/4/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 6.0'-8.0'
Elevation: -----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.04 in
Specimen Area: 6.33 in^2
Specimen Volume: 38.24 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 49

Plastic Limit: 21

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	5.76	5.76	0	0.000	0.71549	0.71549	1.000	0.71549	0
2	0.06	6.0491	5.76	0.15304	0.529	0.85158	0.56245	1.514	0.70701	0.14457
3	0.12	6.1345	5.76	0.20658	0.552	0.88341	0.50891	1.736	0.69616	0.18725
4	0.19	6.1797	5.76	0.23567	0.562	0.89951	0.47981	1.875	0.68966	0.20985
5	0.25	6.2135	5.76	0.25546	0.563	0.91352	0.46003	1.986	0.68677	0.22674
6	0.32	6.2407	5.76	0.26942	0.561	0.92672	0.44606	2.078	0.68639	0.24033
7	0.38	6.2648	5.76	0.2828	0.560	0.93749	0.43268	2.167	0.68508	0.2524
8	0.45	6.2842	5.76	0.2927	0.558	0.94695	0.42279	2.240	0.68487	0.26208
9	0.51	6.3023	5.76	0.30084	0.555	0.95694	0.41464	2.308	0.68579	0.27115
10	0.57	6.3198	5.76	0.30666	0.548	0.96863	0.40882	2.369	0.68873	0.27991
11	0.64	6.3355	5.76	0.3119	0.542	0.9791	0.40359	2.426	0.69134	0.28776
12	0.70	6.3506	5.76	0.31714	0.537	0.98895	0.39835	2.483	0.69365	0.2953
13	0.77	6.3645	5.76	0.32121	0.531	0.99875	0.39428	2.533	0.69651	0.30224
14	0.90	6.3904	5.76	0.32645	0.518	1.0195	0.38904	2.620	0.70425	0.31521
15	1.02	6.4151	5.76	0.33052	0.505	1.0401	0.38496	2.702	0.71252	0.32755
16	1.15	6.4391	5.76	0.33285	0.490	1.0618	0.38264	2.775	0.7222	0.33956
17	1.28	6.4607	5.76	0.33343	0.476	1.0828	0.38206	2.834	0.73241	0.35036
18	1.40	6.4823	5.76	0.33401	0.462	1.1037	0.38147	2.893	0.74261	0.36113
19	1.53	6.5049	5.76	0.33227	0.446	1.1281	0.38322	2.944	0.75567	0.37245
20	2.31	6.6225	5.76	0.31656	0.367	1.2614	0.39893	3.162	0.83017	0.43124
21	3.09	6.7201	5.76	0.28862	0.301	1.3869	0.42686	3.249	0.9069	0.48004
22	3.86	6.8104	5.76	0.25778	0.245	1.5081	0.4577	3.295	0.98291	0.52521
23	4.63	6.8882	5.76	0.22345	0.198	1.6202	0.49203	3.293	1.0561	0.56408
24	5.41	6.9577	5.76	0.19028	0.159	1.7229	0.5252	3.281	1.1241	0.59887
25	6.18	7.0166	5.76	0.15711	0.125	1.815	0.55837	3.250	1.1867	0.6283
26	6.95	7.0653	5.76	0.12744	0.098	1.8933	0.58805	3.220	1.2407	0.65263
27	7.73	7.1046	5.76	0.10009	0.074	1.96	0.6154	3.185	1.2877	0.67232
28	8.50	7.1422	5.76	0.073902	0.053	2.0238	0.64158	3.154	1.3327	0.69112
29	9.28	7.1729	5.76	0.052953	0.037	2.0754	0.66253	3.133	1.369	0.70643
30	10.06	7.1947	5.76	0.031423	0.022	2.1187	0.68406	3.097	1.4014	0.71734
31	10.82	7.2172	5.76	0.014548	0.010	2.1582	0.70094	3.079	1.4296	0.72862
32	11.60	7.2383	5.76	-0.0029095	-0.002	2.1967	0.7184	3.058	1.4576	0.73916
33	12.38	7.2563	5.76	-0.015711	-0.011	2.2275	0.7312	3.046	1.4793	0.74813
34	13.15	7.2707	5.76	-0.029677	-0.020	2.2559	0.74516	3.027	1.5005	0.75534
35	13.93	7.2793	5.76	-0.041315	-0.027	2.2761	0.7568	3.008	1.5164	0.75964
36	14.71	7.2927	5.76	-0.052371	-0.034	2.3005	0.76786	2.996	1.5342	0.76634
37	15.15	7.296	5.76	-0.058772	-0.038	2.3102	0.77426	2.984	1.5422	0.76798

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-013 S3
Sample No.: ----
Test No.: 20.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/4/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 6.0'-8.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.02 in
Specimen Area: 6.41 in^2
Specimen Volume: 38.58 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 49

Plastic Limit: 21

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.4112	0	0	5.044	6.48	6.48
2	5.0001	0.036568	6.4135	30.226	0.33933	5.2282	6.48	6.8193
3	10	0.095395	6.4173	49.495	0.55532	5.3711	6.48	7.0353
4	15	0.16217	6.4216	59.764	0.67009	5.4644	6.48	7.1501
5	20	0.22895	6.4259	66.858	0.74912	5.5321	6.48	7.2291
6	25	0.29572	6.4302	72.098	0.8073	5.5828	6.48	7.2873
7	30	0.36409	6.4346	76.704	0.85828	5.6254	6.48	7.3383
8	35	0.43405	6.4391	80.568	0.90088	5.6604	6.48	7.3809
9	40	0.50082	6.4434	83.903	0.93755	5.689	6.48	7.4175
10	45	0.57078	6.448	86.92	0.97058	5.7129	6.48	7.4506
11	50	0.63756	6.4523	89.62	1.0001	5.7309	6.48	7.4801
12	55	0.70433	6.4566	92.002	1.0259	5.7496	6.48	7.5059
13	60	0.77429	6.4612	94.384	1.0518	5.7642	6.48	7.5318
14	70	0.91261	6.4702	98.513	1.0962	5.7881	6.48	7.5762
15	80.001	1.0478	6.479	101.9	1.1324	5.8068	6.48	7.6124
16	90.001	1.1861	6.4881	105.29	1.1684	5.8219	6.48	7.6484
17	100	1.3212	6.497	108.15	1.1985	5.8301	6.48	7.6785
18	110	1.4595	6.5061	110.79	1.2261	5.8394	6.48	7.7061
19	120	1.5947	6.5151	113.28	1.2519	5.8435	6.48	7.7319
20	180	2.423	6.5704	125.03	1.3702	5.8581	6.48	7.8502
21	240	3.2498	6.6265	133.87	1.4546	5.847	6.48	7.9346
22	300	4.0702	6.6832	141.44	1.5238	5.8307	6.48	8.0038
23	360	4.8969	6.7413	147.9	1.5797	5.8091	6.48	8.0597
24	420	5.7253	6.8005	154.2	1.6326	5.7863	6.48	8.1126
25	480	6.5521	6.8607	159.44	1.6733	5.763	6.48	8.1533
26	540	7.3804	6.922	164.79	1.7141	5.742	6.48	8.1941
27	600	8.2072	6.9844	169.34	1.7457	5.7204	6.48	8.2257
28	660	9.0339	7.0479	174.05	1.7781	5.7024	6.48	8.2581
29	720	9.8591	7.1124	177.97	1.8016	5.686	6.48	8.2816
30	780	10.684	7.1781	181.41	1.8196	5.6697	6.48	8.2996
31	840	11.508	7.2449	184.64	1.835	5.6563	6.48	8.315
32	900	12.335	7.3132	187.76	1.8486	5.6406	6.48	8.3286
33	960	13.166	7.3832	190.52	1.8579	5.633	6.48	8.3379
34	1020	13.991	7.4541	192.74	1.8617	5.619	6.48	8.3417
35	1080	14.821	7.5267	195.44	1.8695	5.6096	6.48	8.3495
36	1140	15.646	7.6003	197.87	1.8745	5.5997	6.48	8.3545

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-013 S3
Sample No.: ----
Test No.: 20.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/4/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 6.0'-8.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.02 in
Specimen Area: 6.41 in^2
Specimen Volume: 38.58 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 49

Plastic Limit: 21

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	6.48	6.48	0	0.000	1.436	1.436	1.000	1.436	0
2	0.04	6.8193	6.48	0.18429	0.543	1.5911	1.2518	1.271	1.4214	0.16966
3	0.10	7.0353	6.48	0.32717	0.589	1.6642	1.1089	1.501	1.3865	0.27766
4	0.16	7.1501	6.48	0.42048	0.627	1.6857	1.0156	1.660	1.3506	0.33504
5	0.23	7.2291	6.48	0.48812	0.652	1.697	0.94792	1.790	1.3225	0.37456
6	0.30	7.2873	6.48	0.53886	0.667	1.7045	0.89718	1.900	1.3008	0.40365
7	0.36	7.3383	6.48	0.58143	0.677	1.7129	0.85461	2.004	1.2837	0.42914
8	0.43	7.3809	6.48	0.61643	0.684	1.7205	0.81962	2.099	1.2701	0.45044
9	0.50	7.4175	6.48	0.645	0.688	1.7286	0.79104	2.185	1.2598	0.46877
10	0.57	7.4506	6.48	0.66891	0.689	1.7377	0.76713	2.265	1.2524	0.48529
11	0.64	7.4801	6.48	0.68699	0.687	1.7491	0.74905	2.335	1.2491	0.50003
12	0.70	7.5059	6.48	0.70565	0.688	1.7563	0.73039	2.405	1.2434	0.51297
13	0.77	7.5318	6.48	0.72023	0.685	1.7676	0.71581	2.469	1.2417	0.52588
14	0.91	7.5762	6.48	0.74414	0.679	1.7881	0.6919	2.584	1.24	0.54812
15	1.05	7.6124	6.48	0.7628	0.674	1.8056	0.67324	2.682	1.2394	0.5662
16	1.19	7.6484	6.48	0.77797	0.666	1.8265	0.65808	2.775	1.2423	0.58421
17	1.32	7.6785	6.48	0.78613	0.656	1.8484	0.64991	2.844	1.2492	0.59925
18	1.46	7.7061	6.48	0.79546	0.649	1.8667	0.64058	2.914	1.2536	0.61305
19	1.59	7.7319	6.48	0.79954	0.639	1.8884	0.6365	2.967	1.2625	0.62596
20	2.42	7.8502	6.48	0.81412	0.594	1.9921	0.62192	3.203	1.307	0.68508
21	3.25	7.9346	6.48	0.80304	0.552	2.0876	0.633	3.298	1.3603	0.7273
22	4.07	8.0038	6.48	0.78671	0.516	2.1731	0.64933	3.347	1.4112	0.76191
23	4.90	8.0597	6.48	0.76514	0.484	2.2506	0.67091	3.355	1.4607	0.78983
24	5.73	8.1126	6.48	0.74239	0.455	2.3262	0.69365	3.354	1.5099	0.8163
25	6.55	8.1533	6.48	0.71907	0.430	2.3903	0.71698	3.334	1.5536	0.83664
26	7.38	8.1941	6.48	0.69807	0.407	2.452	0.73797	3.323	1.595	0.85703
27	8.21	8.2257	6.48	0.67649	0.388	2.5052	0.75955	3.298	1.6324	0.87284
28	9.03	8.2581	6.48	0.65841	0.370	2.5557	0.77763	3.287	1.6667	0.88905
29	9.86	8.2816	6.48	0.64209	0.356	2.5956	0.79396	3.269	1.6948	0.90081
30	10.68	8.2996	6.48	0.62576	0.344	2.6299	0.81029	3.246	1.7201	0.90982
31	11.51	8.315	6.48	0.61234	0.334	2.6587	0.8237	3.228	1.7412	0.91748
32	12.33	8.3286	6.48	0.5966	0.323	2.688	0.83945	3.202	1.7637	0.92428
33	13.17	8.3379	6.48	0.58902	0.317	2.7049	0.84703	3.193	1.776	0.92893
34	13.99	8.3417	6.48	0.57502	0.309	2.7227	0.86102	3.162	1.7919	0.93084
35	14.82	8.3495	6.48	0.56569	0.303	2.7399	0.87036	3.148	1.8051	0.93477
36	15.65	8.3545	6.48	0.55577	0.296	2.7548	0.88027	3.129	1.8175	0.93725

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-013 S3
Sample No.: S-3
Test No.: 40.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/4/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 6.0'-8.0'
Elevation: ----

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Soil Description: BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 5.88 in
Specimen Area: 6.40 in^2
Specimen Volume: 37.61 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 49

Plastic Limit: 21

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.3988	0	0	5.0432	7.92	7.92
2	5.0041	0.048179	6.4019	48.62	0.54682	5.3658	7.92	8.4668
3	10.004	0.10879	6.4058	77.205	0.86778	5.6	7.92	8.7878
4	15.004	0.17407	6.41	94.356	1.0599	5.7689	7.92	8.9799
5	20.004	0.23934	6.4142	106.47	1.1952	5.9005	7.92	9.1152
6	25.004	0.30772	6.4186	115.76	1.2985	6.0036	7.92	9.2185
7	30	0.37611	6.423	123.2	1.3811	6.0892	7.92	9.3011
8	35	0.44449	6.4274	129.5	1.4506	6.1649	7.92	9.3706
9	40	0.51287	6.4318	135	1.5113	6.2313	7.92	9.4313
10	45	0.58125	6.4362	139.57	1.5613	6.2855	7.92	9.4813
11	50	0.65119	6.4407	143.87	1.6083	6.3309	7.92	9.5283
12	55	0.72113	6.4453	147.8	1.6511	6.3746	7.92	9.5711
13	60	0.78951	6.4497	151.16	1.6874	6.413	7.92	9.6074
14	70	0.93094	6.4589	157.56	1.7563	6.4788	7.92	9.6763
15	80	1.0724	6.4682	162.96	1.814	6.5278	7.92	9.734
16	90	1.2138	6.4774	167.78	1.865	6.5767	7.92	9.785
17	100	1.3568	6.4868	172.3	1.9124	6.607	7.92	9.8324
18	110	1.4982	6.4961	176.23	1.9532	6.639	7.92	9.8732
19	120	1.6381	6.5054	179.9	1.9911	6.6605	7.92	9.9111
20	180	2.4804	6.5616	198.15	2.1743	6.7374	7.92	10.094
21	240	3.3274	6.619	212.42	2.3106	6.7514	7.92	10.231
22	300	4.176	6.6777	224.69	2.4227	6.7467	7.92	10.343
23	360	5.0277	6.7375	234.87	2.5099	6.7217	7.92	10.43
24	420	5.8747	6.7982	244.73	2.5919	6.6891	7.92	10.512
25	480	6.7264	6.8602	253.49	2.6604	6.6512	7.92	10.58
26	540	7.5718	6.923	261.25	2.717	6.6209	7.92	10.637
27	600	8.4204	6.9871	268.49	2.7667	6.5848	7.92	10.687
28	660	9.2674	7.0524	275.04	2.808	6.5598	7.92	10.728
29	720	10.122	7.1194	280.92	2.841	6.5301	7.92	10.761
30	780	10.979	7.1879	286.37	2.8685	6.5068	7.92	10.789
31	840	11.838	7.258	291.67	2.8934	6.4858	7.92	10.813
32	900	12.685	7.3284	296.55	2.9135	6.4643	7.92	10.834
33	960	13.532	7.4002	300.74	2.9261	6.4474	7.92	10.846
34	1020	14.391	7.4745	304.73	2.9354	6.4276	7.92	10.855
35	1080	15.24	7.5493	309.08	2.9478	6.4183	7.92	10.868

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-013 S3
Sample No.: S-3
Test No.: 40.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/4/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 6.0'-8.0'
Elevation: ----

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Soil Description: BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 5.88 in
Specimen Area: 6.40 in^2
Specimen Volume: 37.61 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 49

Plastic Limit: 21

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	7.92	7.92	0	0.000	2.8768	2.8768	1.000	2.8768	0
2	0.05	8.4668	7.92	0.32266	0.590	3.101	2.5542	1.214	2.8276	0.27341
3	0.11	8.7878	7.92	0.55679	0.642	3.1878	2.32	1.374	2.7539	0.43389
4	0.17	8.9799	7.92	0.72569	0.685	3.211	2.1511	1.493	2.6811	0.52993
5	0.24	9.1152	7.92	0.85732	0.717	3.2147	2.0195	1.592	2.6171	0.59758
6	0.31	9.2185	7.92	0.96041	0.740	3.2149	1.9164	1.678	2.5657	0.64924
7	0.38	9.3011	7.92	1.046	0.757	3.2119	1.8308	1.754	2.5213	0.69054
8	0.44	9.3706	7.92	1.1217	0.773	3.2057	1.7551	1.827	2.4804	0.72532
9	0.51	9.4313	7.92	1.1881	0.786	3.2	1.6887	1.895	2.4443	0.75564
10	0.58	9.4813	7.92	1.2423	0.796	3.1958	1.6345	1.955	2.4152	0.78065
11	0.65	9.5283	7.92	1.2877	0.801	3.1974	1.5891	2.012	2.3932	0.80414
12	0.72	9.5711	7.92	1.3314	0.806	3.1965	1.5454	2.068	2.371	0.82554
13	0.79	9.6074	7.92	1.3698	0.812	3.1944	1.507	2.120	2.3507	0.84371
14	0.93	9.6763	7.92	1.4357	0.817	3.1975	1.4412	2.219	2.3193	0.87817
15	1.07	9.734	7.92	1.4846	0.818	3.2062	1.3922	2.303	2.2992	0.90699
16	1.21	9.785	7.92	1.5335	0.822	3.2083	1.3433	2.388	2.2758	0.93251
17	1.36	9.8324	7.92	1.5638	0.818	3.2254	1.313	2.456	2.2692	0.95619
18	1.50	9.8732	7.92	1.5958	0.817	3.2342	1.281	2.525	2.2576	0.97662
19	1.64	9.9111	7.92	1.6174	0.812	3.2506	1.2595	2.581	2.255	0.99555
20	2.48	10.094	7.92	1.6943	0.779	3.3569	1.1826	2.839	2.2697	1.0872
21	3.33	10.231	7.92	1.7082	0.739	3.4792	1.1686	2.977	2.3239	1.1553
22	4.18	10.343	7.92	1.7036	0.703	3.5959	1.1733	3.065	2.3846	1.2113
23	5.03	10.43	7.92	1.6785	0.669	3.7082	1.1983	3.095	2.4532	1.2549
24	5.87	10.512	7.92	1.6459	0.635	3.8228	1.2309	3.106	2.5269	1.296
25	6.73	10.58	7.92	1.6081	0.604	3.9292	1.2688	3.097	2.599	1.3302
26	7.57	10.637	7.92	1.5778	0.581	4.0161	1.2991	3.092	2.6576	1.3585
27	8.42	10.687	7.92	1.5417	0.557	4.1018	1.3352	3.072	2.7185	1.3833
28	9.27	10.728	7.92	1.5166	0.540	4.1682	1.3602	3.064	2.7642	1.404
29	10.12	10.761	7.92	1.4869	0.523	4.2309	1.3899	3.044	2.8104	1.4205
30	10.98	10.789	7.92	1.4636	0.510	4.2817	1.4132	3.030	2.8475	1.4343
31	11.84	10.813	7.92	1.4427	0.499	4.3276	1.4342	3.017	2.8809	1.4467
32	12.69	10.834	7.92	1.4211	0.488	4.3692	1.4557	3.001	2.9125	1.4568
33	13.53	10.846	7.92	1.4042	0.480	4.3987	1.4726	2.987	2.9357	1.463
34	14.39	10.855	7.92	1.3844	0.472	4.4278	1.4924	2.967	2.9601	1.4677
35	15.24	10.868	7.92	1.3751	0.466	4.4495	1.5017	2.963	2.9756	1.4739

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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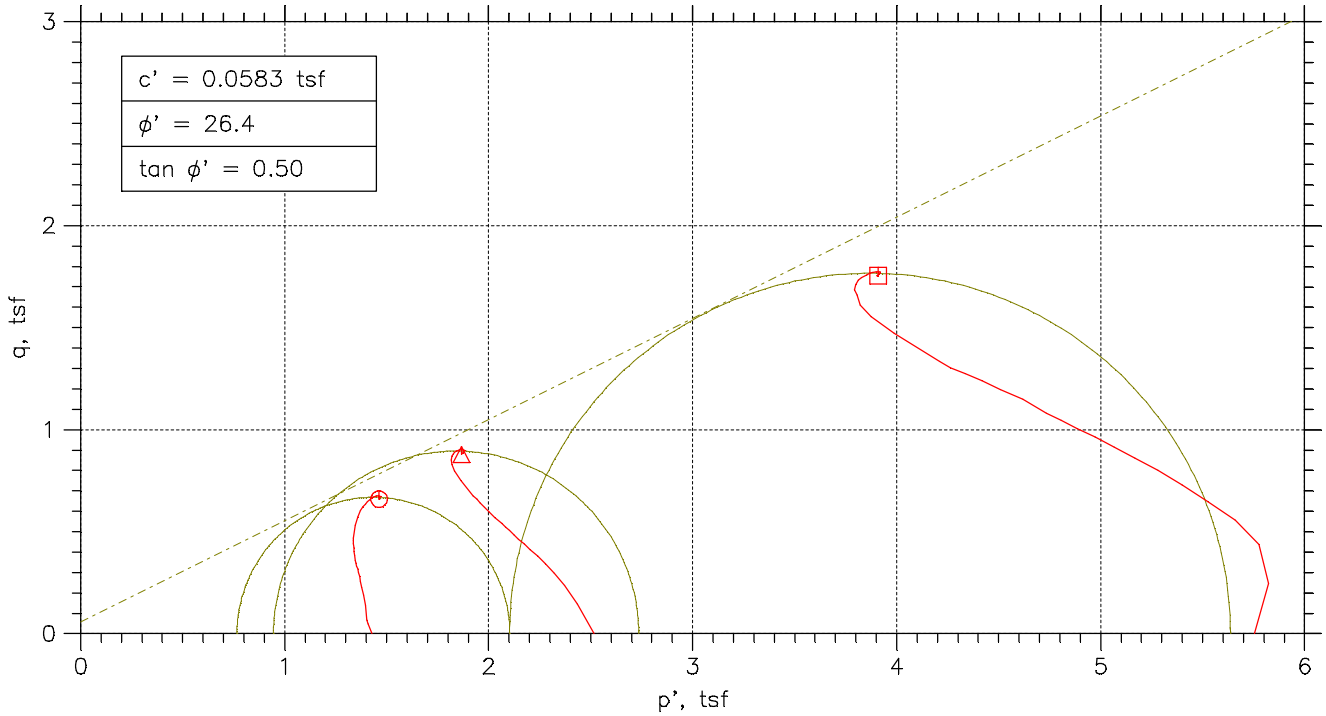

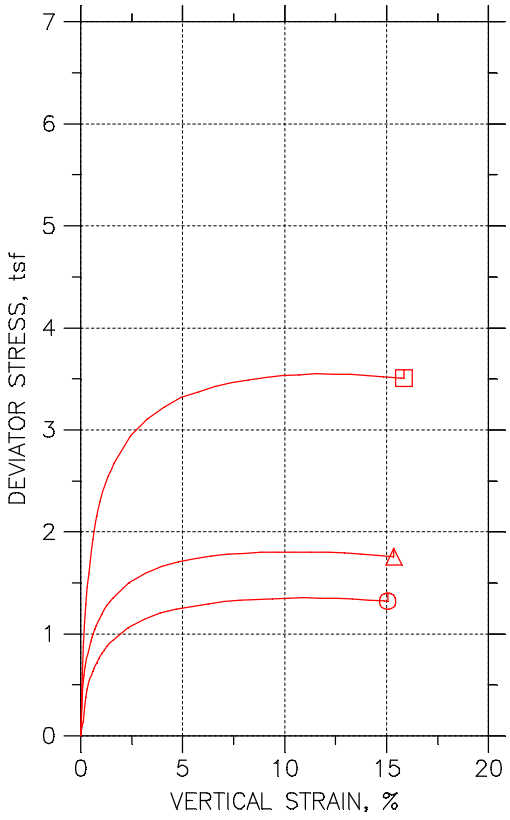

Symbol		⏲	△	◫	
Test No.		20.0 PSI	40.0 PSI	80.0 PSI	
Initial	Diameter, in	2.8323	2.8394	2.8232	
	Height, in	5.9835	6.1287	6.0461	
	Water Content, %	35.45	32.69	30.23	
	Dry Density, pcf	84.39	88.44	92.32	
	Saturation, %	95.27	96.65	97.97	
	Void Ratio	1.0122	0.91997	0.83931	
Before Shear	Water Content, %	27.91	28.32	23.10	
	Dry Density, pcf	96.52	95.92	104.3	
	Saturation, %	100.00	100.00	100.00	
	Void Ratio	0.75927	0.7702	0.62821	
	Back Press., tsf	5.0509	5.0422	1.4473	
Minor Prin. Stress, tsf		1.4291	2.5178	5.7527	
Max. Dev. Stress, tsf		1.3524	1.8029	3.5485	
Time to Failure, min		840	780	840	
Strain Rate, %/min		0.02	0.02	0.02	
B-Value		0.98	0.99	0.96	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		42	42	42	
Plastic Limit		23	23	23	
Plasticity Index		19	19	19	

Project: DYNERGY EDWARDS

Location: BARTONVILLE, IL

Project No.: MR155218

Boring No.: EDW-013 S10

Sample Type: 3.0" ST

Failure Sketch



Description: GRAY AND BROWN LEAN CLAY WITH SAND CL

Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

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CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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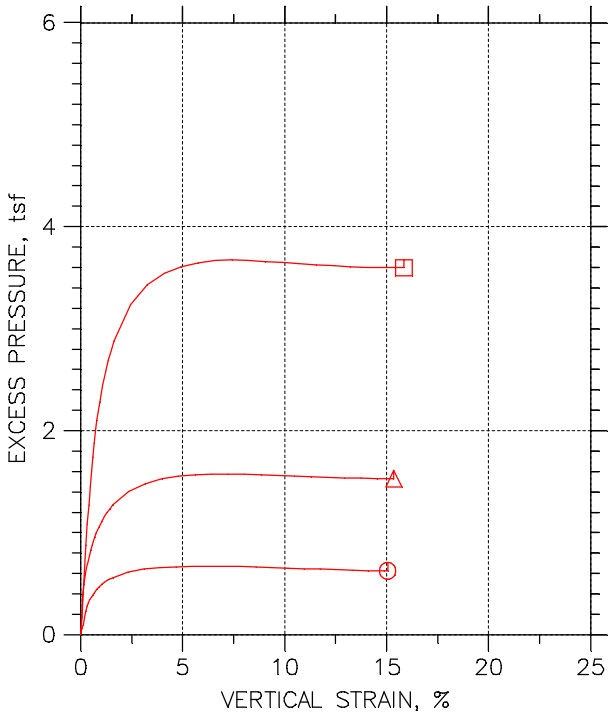

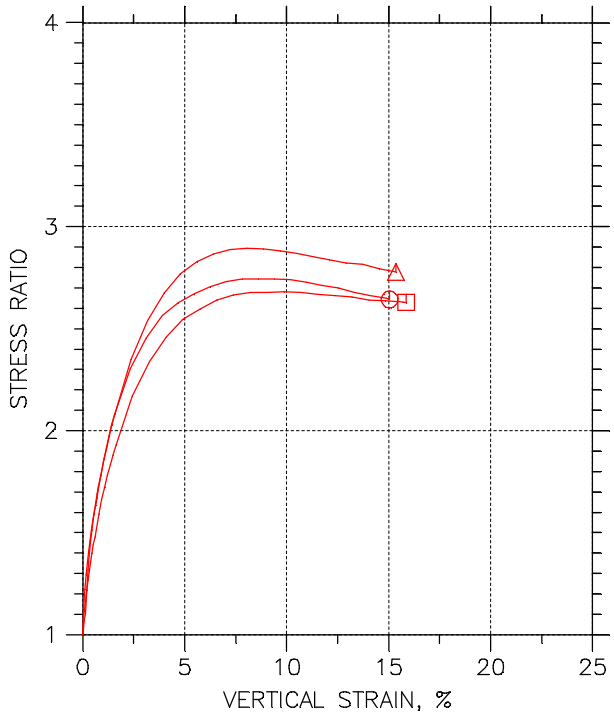

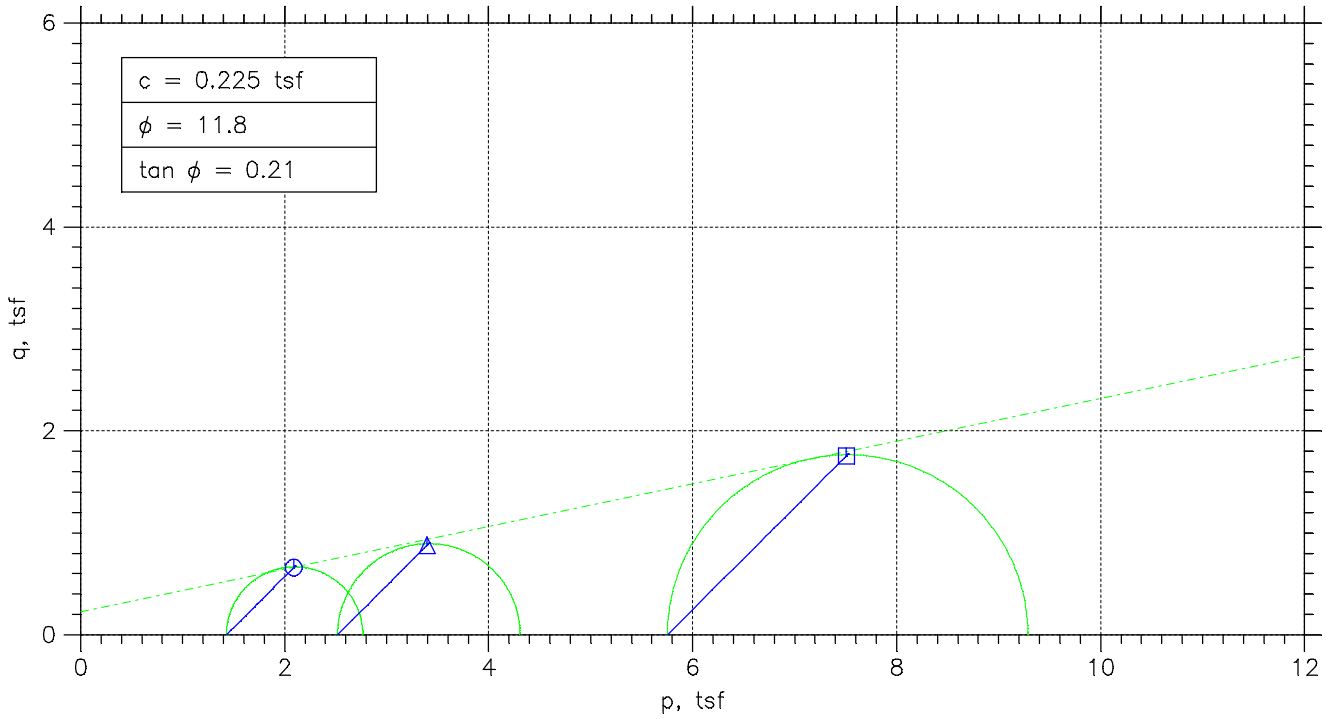

Project: DYNERGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
Boring No.: EDW-013 S10	Tested By: BCM	Checked By: WPQ
Sample No.: S-10	Test Date: 10/29/15	Depth: 32.0'-34.0'
Test No.: EDW-013 S10	Sample Type: 3.0" ST	Elevation: -----
Description: GRAY AND BROWN LEAN CLAY WITH SAND CL		
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767		

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-013 S10
Sample No.: S-10
Test No.: 20.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 32.0'-34.0'
Elevation: -----

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Soil Description: GRAY AND BROWN LEAN CLAY WITH SAND CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.98 in
Specimen Area: 6.30 in^2
Specimen Volume: 37.70 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.3003	0	0	5.0509	6.48	6.48
2	5.0003	0.070614	6.3048	8.4452	0.096443	5.1202	6.48	6.5764
3	10	0.13546	6.3089	11.964	0.13654	5.1458	6.48	6.6165
4	15	0.19743	6.3128	24.163	0.27558	5.2208	6.48	6.7556
5	20	0.26228	6.3169	33.487	0.38169	5.2837	6.48	6.8617
6	25	0.32713	6.321	40.115	0.45693	5.3296	6.48	6.9369
7	30	0.39054	6.325	45.041	0.51272	5.364	6.48	6.9927
8	35	0.45539	6.3292	49.088	0.55842	5.3925	6.48	7.0384
9	40	0.52024	6.3333	52.665	0.59872	5.4169	6.48	7.0787
10	45	0.58653	6.3375	55.773	0.63364	5.4396	6.48	7.1136
11	50	0.6485	6.3415	58.412	0.66321	5.4594	6.48	7.1432
12	55	0.71335	6.3456	61.052	0.69272	5.4775	6.48	7.1727
13	60.001	0.7782	6.3497	63.339	0.7182	5.4932	6.48	7.1982
14	70.001	0.9079	6.3581	67.62	0.76574	5.5199	6.48	7.2457
15	80.001	1.039	6.3665	71.315	0.80652	5.5438	6.48	7.2865
16	90.001	1.1687	6.3748	74.716	0.84388	5.5636	6.48	7.3239
17	100	1.297	6.3831	77.825	0.87784	5.5816	6.48	7.3578
18	110	1.4281	6.3916	80.698	0.90905	5.5979	6.48	7.389
19	120	1.5593	6.4001	83.161	0.93555	5.6095	6.48	7.4155
20	180	2.3332	6.4508	95.243	1.063	5.6642	6.48	7.543
21	240	3.1229	6.5034	103.34	1.144	5.6945	6.48	7.624
22	300	3.904	6.5563	109.67	1.2044	5.7102	6.48	7.6844
23	360	4.6807	6.6097	114.07	1.2426	5.7172	6.48	7.7226
24	420	5.469	6.6648	117.59	1.2703	5.7201	6.48	7.7503
25	480	6.2544	6.7207	120.81	1.2943	5.7218	6.48	7.7743
26	540	7.0312	6.7768	123.8	1.3153	5.7207	6.48	7.7953
27	600	7.8223	6.835	126.21	1.3295	5.7178	6.48	7.8095
28	660	8.6063	6.8936	128.03	1.3372	5.7137	6.48	7.8172
29	720	9.3787	6.9524	129.79	1.3441	5.709	6.48	7.8241
30	780	10.17	7.0136	131.6	1.351	5.7044	6.48	7.831
31	840	10.952	7.0752	132.89	1.3524	5.6974	6.48	7.8324
32	900	11.731	7.1376	133.72	1.3488	5.6928	6.48	7.8288
33	960	12.525	7.2024	134.83	1.3478	5.6875	6.48	7.8278
34	1020	13.309	7.2675	135.53	1.3427	5.68	6.48	7.8227
35	1080	14.091	7.3337	135.65	1.3318	5.6794	6.48	7.8118
36	1140	14.882	7.4019	135.94	1.3224	5.6776	6.48	7.8024
37	1152.3	15.045	7.4161	135.89	1.3193	5.677	6.48	7.7993

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-013 S10
Sample No.: S-10
Test No.: 20.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 32.0'-34.0'
Elevation: -----

Terracon Consulting Engineers & Scientists

Soil Description: GRAY AND BROWN LEAN CLAY WITH SAND CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.98 in
Specimen Area: 6.30 in^2
Specimen Volume: 37.70 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	6.48	6.48	0	0.000	1.4291	1.4291	1.000	1.4291	0
2	0.07	6.5764	6.48	0.069246	0.718	1.4563	1.3598	1.071	1.4081	0.048221
3	0.14	6.6165	6.48	0.09485	0.695	1.4708	1.3342	1.102	1.4025	0.068269
4	0.20	6.7556	6.48	0.16992	0.617	1.5348	1.2592	1.219	1.397	0.13779
5	0.26	6.8617	6.48	0.23276	0.610	1.578	1.1963	1.319	1.3872	0.19084
6	0.33	6.9369	6.48	0.27873	0.610	1.6073	1.1504	1.397	1.3788	0.22846
7	0.39	6.9927	6.48	0.31306	0.611	1.6287	1.116	1.459	1.3724	0.25636
8	0.46	7.0384	6.48	0.34158	0.612	1.6459	1.0875	1.513	1.3667	0.27921
9	0.52	7.0787	6.48	0.36602	0.611	1.6618	1.0631	1.563	1.3624	0.29936
10	0.59	7.1136	6.48	0.38871	0.613	1.674	1.0404	1.609	1.3572	0.31682
11	0.65	7.1432	6.48	0.4085	0.616	1.6838	1.0206	1.650	1.3522	0.3316
12	0.71	7.1727	6.48	0.42653	0.616	1.6953	1.0025	1.691	1.3489	0.34636
13	0.78	7.1982	6.48	0.44225	0.616	1.705	0.98684	1.728	1.3459	0.3591
14	0.91	7.2457	6.48	0.46901	0.612	1.7258	0.96007	1.798	1.3429	0.38287
15	1.04	7.2865	6.48	0.49287	0.611	1.7427	0.93621	1.861	1.3395	0.40326
16	1.17	7.3239	6.48	0.51266	0.608	1.7603	0.91643	1.921	1.3384	0.42194
17	1.30	7.3578	6.48	0.5307	0.605	1.7762	0.89839	1.977	1.3373	0.43892
18	1.43	7.389	6.48	0.54699	0.602	1.7911	0.8821	2.031	1.3366	0.45452
19	1.56	7.4155	6.48	0.55863	0.597	1.806	0.87046	2.075	1.3382	0.46777
20	2.33	7.543	6.48	0.61333	0.577	1.8788	0.81576	2.303	1.3473	0.53152
21	3.12	7.624	6.48	0.64358	0.563	1.9295	0.7855	2.456	1.3575	0.57202
22	3.90	7.6844	6.48	0.6593	0.547	1.9742	0.76979	2.565	1.372	0.60219
23	4.68	7.7226	6.48	0.66628	0.536	2.0054	0.76281	2.629	1.3841	0.62128
24	5.47	7.7503	6.48	0.66919	0.527	2.0302	0.7599	2.672	1.395	0.63515
25	6.25	7.7743	6.48	0.67093	0.518	2.0524	0.75815	2.707	1.4053	0.64715
26	7.03	7.7953	6.48	0.66977	0.509	2.0747	0.75931	2.732	1.417	0.65767
27	7.82	7.8095	6.48	0.66686	0.502	2.0917	0.76222	2.744	1.427	0.66474
28	8.61	7.8172	6.48	0.66279	0.496	2.1035	0.7663	2.745	1.4349	0.66858
29	9.38	7.8241	6.48	0.65813	0.490	2.115	0.77095	2.743	1.443	0.67204
30	10.17	7.831	6.48	0.65348	0.484	2.1266	0.77561	2.742	1.4511	0.67551
31	10.95	7.8324	6.48	0.64649	0.478	2.135	0.78259	2.728	1.4588	0.67619
32	11.73	7.8288	6.48	0.64184	0.476	2.1361	0.78725	2.713	1.4617	0.67442
33	12.52	7.8278	6.48	0.6366	0.472	2.1403	0.79248	2.701	1.4664	0.67392
34	13.31	7.8227	6.48	0.62904	0.468	2.1428	0.80005	2.678	1.4714	0.67137
35	14.09	7.8118	6.48	0.62845	0.472	2.1324	0.80063	2.663	1.4665	0.66588
36	14.88	7.8024	6.48	0.62671	0.474	2.1247	0.80238	2.648	1.4636	0.66118
37	15.05	7.7993	6.48	0.62613	0.475	2.1222	0.80296	2.643	1.4626	0.65963

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-013 S10
Sample No.: S-10
Test No.: 40.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 32.0'-34.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: GRAY AND BROWN LEAN CLAY WITH SAND CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.13 in
Specimen Area: 6.33 in^2
Specimen Volume: 38.81 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.3319	0	0	5.0422	7.56	7.56
2	5.0001	0.049959	6.3351	25.547	0.29035	5.2708	7.56	7.8503
3	10.004	0.10929	6.3388	41.648	0.47306	5.4236	7.56	8.0331
4	15.004	0.17017	6.3427	52.381	0.59462	5.5356	7.56	8.1546
5	20.004	0.23262	6.3467	60.539	0.68679	5.6242	7.56	8.2468
6	25.004	0.29975	6.3509	67.151	0.76129	5.7006	7.56	8.3213
7	30.004	0.36533	6.3551	72.647	0.82305	5.7683	7.56	8.3831
8	35.004	0.4309	6.3593	77.585	0.87841	5.8248	7.56	8.4384
9	40.004	0.49803	6.3636	81.878	0.9264	5.8756	7.56	8.4864
10	45.004	0.56204	6.3677	85.914	0.97144	5.9211	7.56	8.5314
11	50.004	0.62761	6.3719	89.435	1.0106	5.9619	7.56	8.5706
12	55.004	0.6963	6.3763	92.698	1.0467	6.001	7.56	8.6067
13	60.004	0.76187	6.3805	95.875	1.0819	6.0371	7.56	8.6419
14	70.004	0.89614	6.3892	101.2	1.1404	6.1001	7.56	8.7004
15	80.004	1.0304	6.3978	105.97	1.1925	6.1538	7.56	8.7525
16	90.004	1.1631	6.4064	110.34	1.2401	6.201	7.56	8.8001
17	100	1.3005	6.4153	114.08	1.2803	6.2412	7.56	8.8403
18	110	1.4332	6.424	117.56	1.3176	6.2774	7.56	8.8776
19	120	1.569	6.4328	120.69	1.3509	6.3118	7.56	8.9109
20	180	2.3684	6.4855	135.2	1.501	6.4477	7.56	9.061
21	240	3.1786	6.5398	144.78	1.594	6.5241	7.56	9.154
22	300	3.9889	6.595	152.03	1.6598	6.569	7.56	9.2198
23	360	4.7976	6.651	157.53	1.7053	6.5952	7.56	9.2653
24	420	5.6095	6.7082	162	1.7387	6.6086	7.56	9.2987
25	480	6.4166	6.766	165.6	1.7622	6.6151	7.56	9.3222
26	540	7.2316	6.8255	168.65	1.779	6.6174	7.56	9.339
27	600	8.0434	6.8857	171.18	1.79	6.6145	7.56	9.35
28	660	8.8506	6.9467	173.55	1.7987	6.6092	7.56	9.3587
29	720	9.6608	7.009	175.35	1.8013	6.6022	7.56	9.3613
30	780	10.477	7.073	177.11	1.8029	6.5958	7.56	9.3629
31	840	11.286	7.1374	178.61	1.8018	6.5882	7.56	9.3618
32	900	12.099	7.2035	180.03	1.7994	6.5812	7.56	9.3594
33	960	12.914	7.2709	181.32	1.7955	6.5748	7.56	9.3555
34	1020	13.732	7.3398	181.88	1.7841	6.5766	7.56	9.3441
35	1080	14.54	7.4092	182.18	1.7703	6.5725	7.56	9.3303
36	1140	15.353	7.4804	182.61	1.7576	6.5719	7.56	9.3176

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-013 S10
Sample No.: S-10
Test No.: 40.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 32.0'-34.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: GRAY AND BROWN LEAN CLAY WITH SAND CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.13 in
Specimen Area: 6.33 in^2
Specimen Volume: 38.81 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	7.56	7.56	0	0.000	2.5178	2.5178	1.000	2.5178	0
2	0.05	7.8503	7.56	0.22861	0.787	2.5795	2.2892	1.127	2.4344	0.14517
3	0.11	8.0331	7.56	0.3814	0.806	2.6094	2.1364	1.221	2.3729	0.23653
4	0.17	8.1546	7.56	0.49337	0.830	2.619	2.0244	1.294	2.3217	0.29731
5	0.23	8.2468	7.56	0.58202	0.847	2.6226	1.9358	1.355	2.2792	0.34339
6	0.30	8.3213	7.56	0.65841	0.865	2.6207	1.8594	1.409	2.24	0.38064
7	0.37	8.3831	7.56	0.72606	0.882	2.6148	1.7917	1.459	2.2033	0.41153
8	0.43	8.4384	7.56	0.78263	0.891	2.6136	1.7352	1.506	2.1744	0.43921
9	0.50	8.4864	7.56	0.83337	0.900	2.6108	1.6844	1.550	2.1476	0.4632
10	0.56	8.5314	7.56	0.87886	0.905	2.6104	1.6389	1.593	2.1247	0.48572
11	0.63	8.5706	7.56	0.91968	0.910	2.6087	1.5981	1.632	2.1034	0.50529
12	0.70	8.6067	7.56	0.95875	0.916	2.6058	1.559	1.671	2.0824	0.52336
13	0.76	8.6419	7.56	0.99491	0.920	2.6048	1.5229	1.710	2.0638	0.54095
14	0.90	8.7004	7.56	1.0579	0.928	2.6003	1.4599	1.781	2.0301	0.57021
15	1.03	8.7525	7.56	1.1115	0.932	2.5988	1.4062	1.848	2.0025	0.59626
16	1.16	8.8001	7.56	1.1588	0.934	2.5991	1.359	1.913	1.9791	0.62007
17	1.30	8.8403	7.56	1.199	0.936	2.5991	1.3188	1.971	1.9589	0.64017
18	1.43	8.8776	7.56	1.2352	0.937	2.6002	1.2826	2.027	1.9414	0.65879
19	1.57	8.9109	7.56	1.2696	0.940	2.5991	1.2482	2.082	1.9236	0.67543
20	2.37	9.061	7.56	1.4055	0.936	2.6133	1.1123	2.349	1.8628	0.7505
21	3.18	9.154	7.56	1.4819	0.930	2.6299	1.0359	2.539	1.8329	0.79698
22	3.99	9.2198	7.56	1.5268	0.920	2.6508	0.99102	2.675	1.8209	0.82991
23	4.80	9.2653	7.56	1.553	0.911	2.6701	0.96477	2.768	1.8174	0.85267
24	5.61	9.2987	7.56	1.5664	0.901	2.6901	0.95136	2.828	1.8207	0.86936
25	6.42	9.3222	7.56	1.5728	0.893	2.7072	0.94495	2.865	1.8261	0.88112
26	7.23	9.339	7.56	1.5752	0.885	2.7217	0.94261	2.887	1.8321	0.88952
27	8.04	9.35	7.56	1.5723	0.878	2.7355	0.94553	2.893	1.8405	0.89498
28	8.85	9.3587	7.56	1.567	0.871	2.7495	0.95078	2.892	1.8501	0.89937
29	9.66	9.3613	7.56	1.56	0.866	2.759	0.95778	2.881	1.8584	0.90063
30	10.48	9.3629	7.56	1.5536	0.862	2.7671	0.96419	2.870	1.8656	0.90145
31	11.29	9.3618	7.56	1.546	0.858	2.7736	0.97177	2.854	1.8727	0.90089
32	12.10	9.3594	7.56	1.539	0.855	2.7782	0.97877	2.838	1.8785	0.89971
33	12.91	9.3555	7.56	1.5326	0.854	2.7807	0.98519	2.822	1.8829	0.89775
34	13.73	9.3441	7.56	1.5344	0.860	2.7675	0.98344	2.814	1.8755	0.89205
35	14.54	9.3303	7.56	1.5303	0.864	2.7578	0.98752	2.793	1.8727	0.88516
36	15.35	9.3176	7.56	1.5297	0.870	2.7457	0.9881	2.779	1.8669	0.87881

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-013 S10
Sample No.: S-10
Test No.: 80.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 32.0'-34.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: GRAY AND BROWN LEAN CLAY WITH SAND CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.05 in
Specimen Area: 6.26 in^2
Specimen Volume: 37.85 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.2601	0	0	1.4473	7.2	7.2
2	5.0002	0.057416	6.2637	42.956	0.49377	1.6232	7.2	7.6938
3	10	0.12843	6.2682	75.999	0.87297	1.8591	7.2	8.073
4	15	0.19491	6.2723	96.821	1.1114	2.0973	7.2	8.3114
5	20	0.26139	6.2765	112.87	1.2948	2.3215	7.2	8.4948
6	25	0.32939	6.2808	127.24	1.4586	2.53	7.2	8.6586
7	30	0.39436	6.2849	139.93	1.6031	2.7199	7.2	8.8031
8	35	0.46084	6.2891	150.32	1.7209	2.8923	7.2	8.9209
9	40	0.52581	6.2932	159.97	1.8302	3.0478	7.2	9.0302
10	45	0.59531	6.2976	168.57	1.9273	3.1905	7.2	9.1273
11	50	0.6633	6.3019	175.7	2.0074	3.3198	7.2	9.2074
12	55	0.7313	6.3062	183.2	2.0917	3.438	7.2	9.2917
13	60	0.79929	6.3105	189.45	2.1615	3.5452	7.2	9.3615
14	70	0.9383	6.3194	201.61	2.2971	3.7298	7.2	9.4971
15	80	1.0758	6.3282	210.37	2.3936	3.8876	7.2	9.5936
16	90.001	1.2163	6.3372	218.14	2.4784	4.0228	7.2	9.6784
17	100	1.3538	6.346	224.69	2.5493	4.1375	7.2	9.7493
18	110	1.4928	6.355	230.15	2.6075	4.2388	7.2	9.8075
19	120	1.6303	6.3639	236.18	2.6721	4.3262	7.2	9.8721
20	180	2.4432	6.4169	262.25	2.9425	4.685	7.2	10.142
21	240	3.2787	6.4723	279.34	3.1075	4.8801	7.2	10.308
22	300	4.1067	6.5282	292.25	3.2232	4.9907	7.2	10.423
23	360	4.9136	6.5836	303.47	3.3188	5.0548	7.2	10.519
24	420	5.7506	6.6421	310.87	3.3698	5.0903	7.2	10.57
25	480	6.5802	6.701	318.68	3.4241	5.1136	7.2	10.624
26	540	7.4006	6.7604	325.24	3.4638	5.1206	7.2	10.664
27	600	8.2346	6.8219	330.8	3.4913	5.1171	7.2	10.691
28	660	9.0626	6.884	336.15	3.5158	5.1061	7.2	10.716
29	720	9.877	6.9462	340.92	3.5338	5.0973	7.2	10.734
30	780	10.714	7.0113	344.8	3.5408	5.088	7.2	10.741
31	840	11.542	7.0769	348.79	3.5485	5.0746	7.2	10.749
32	900	12.361	7.1431	351.99	3.5479	5.0647	7.2	10.748
33	960	13.204	7.2124	355.4	3.5478	5.0566	7.2	10.748
34	1020	14.025	7.2813	357.18	3.5319	5.0478	7.2	10.732
35	1080	14.848	7.3517	359.59	3.5217	5.0496	7.2	10.722
36	1140	15.696	7.4256	361.69	3.507	5.049	7.2	10.707
37	1151.2	15.853	7.4395	362.53	3.5086	5.0455	7.2	10.709

TRIAXIAL TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-013 S10
Sample No.: S-10
Test No.: 80.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 32.0'-34.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: GRAY AND BROWN LEAN CLAY WITH SAND CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.05 in
Specimen Area: 6.26 in^2
Specimen Volume: 37.85 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	7.2	7.2	0	0.000	5.7527	5.7527	1.000	5.7527	0
2	0.06	7.6938	7.2	0.17589	0.356	6.0706	5.5768	1.089	5.8237	0.24688
3	0.13	8.073	7.2	0.41177	0.472	6.2139	5.3409	1.163	5.7774	0.43648
4	0.19	8.3114	7.2	0.64998	0.585	6.2141	5.1027	1.218	5.6584	0.5557
5	0.26	8.4948	7.2	0.87421	0.675	6.1733	4.8785	1.265	5.5259	0.64739
6	0.33	8.6586	7.2	1.0827	0.742	6.1286	4.67	1.312	5.3993	0.72932
7	0.39	8.8031	7.2	1.2726	0.794	6.0832	4.4801	1.358	5.2816	0.80155
8	0.46	8.9209	7.2	1.445	0.840	6.0286	4.3077	1.399	5.1682	0.86046
9	0.53	9.0302	7.2	1.6005	0.874	5.9824	4.1522	1.441	5.0673	0.9151
10	0.60	9.1273	7.2	1.7432	0.904	5.9368	4.0095	1.481	4.9731	0.96363
11	0.66	9.2074	7.2	1.8725	0.933	5.8877	3.8802	1.517	4.8839	1.0037
12	0.73	9.2917	7.2	1.9907	0.952	5.8537	3.762	1.556	4.8078	1.0459
13	0.80	9.3615	7.2	2.0979	0.971	5.8163	3.6548	1.591	4.7356	1.0807
14	0.94	9.4971	7.2	2.2825	0.994	5.7673	3.4702	1.662	4.6187	1.1485
15	1.08	9.5936	7.2	2.4403	1.020	5.7059	3.3124	1.723	4.5091	1.1968
16	1.22	9.6784	7.2	2.5755	1.039	5.6556	3.1772	1.780	4.4164	1.2392
17	1.35	9.7493	7.2	2.6902	1.055	5.6118	3.0625	1.832	4.3371	1.2746
18	1.49	9.8075	7.2	2.7915	1.071	5.5686	2.9612	1.881	4.2649	1.3037
19	1.63	9.8721	7.2	2.8789	1.077	5.5459	2.8738	1.930	4.2098	1.336
20	2.44	10.142	7.2	3.2377	1.100	5.4575	2.515	2.170	3.9863	1.4712
21	3.28	10.308	7.2	3.4328	1.105	5.4274	2.3199	2.339	3.8737	1.5538
22	4.11	10.423	7.2	3.5434	1.099	5.4325	2.2093	2.459	3.8209	1.6116
23	4.91	10.519	7.2	3.6075	1.087	5.464	2.1452	2.547	3.8046	1.6594
24	5.75	10.57	7.2	3.643	1.081	5.4794	2.1097	2.597	3.7945	1.6849
25	6.58	10.624	7.2	3.6663	1.071	5.5105	2.0864	2.641	3.7984	1.712
26	7.40	10.664	7.2	3.6733	1.060	5.5432	2.0794	2.666	3.8113	1.7319
27	8.23	10.691	7.2	3.6698	1.051	5.5742	2.0829	2.676	3.8285	1.7457
28	9.06	10.716	7.2	3.6588	1.041	5.6097	2.0939	2.679	3.8518	1.7579
29	9.88	10.734	7.2	3.65	1.033	5.6364	2.1027	2.681	3.8695	1.7669
30	10.71	10.741	7.2	3.6407	1.028	5.6528	2.112	2.677	3.8824	1.7704
31	11.54	10.749	7.2	3.6273	1.022	5.6739	2.1254	2.670	3.8996	1.7743
32	12.36	10.748	7.2	3.6174	1.020	5.6832	2.1353	2.662	3.9092	1.774
33	13.20	10.748	7.2	3.6093	1.017	5.6913	2.1434	2.655	3.9173	1.7739
34	14.02	10.732	7.2	3.6005	1.019	5.6841	2.1522	2.641	3.9181	1.766
35	14.85	10.722	7.2	3.6023	1.023	5.6721	2.1504	2.638	3.9113	1.7609
36	15.70	10.707	7.2	3.6017	1.027	5.658	2.151	2.630	3.9045	1.7535
37	15.85	10.709	7.2	3.5982	1.026	5.6631	2.1545	2.628	3.9088	1.7543

DIRECT SHEAR TEST REPORT

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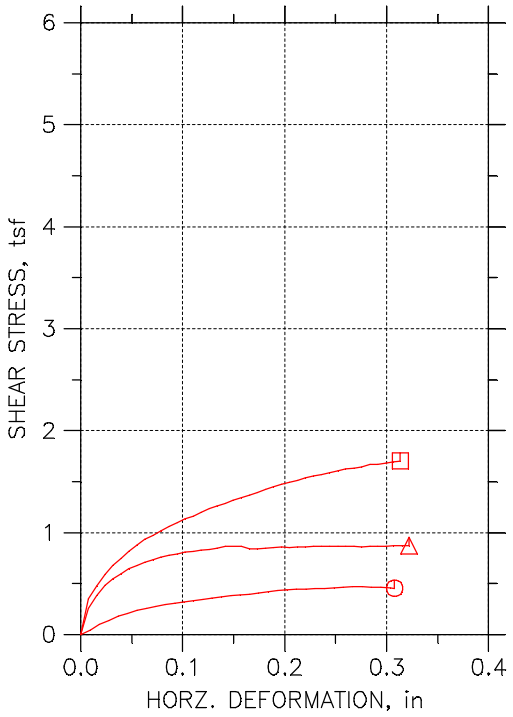

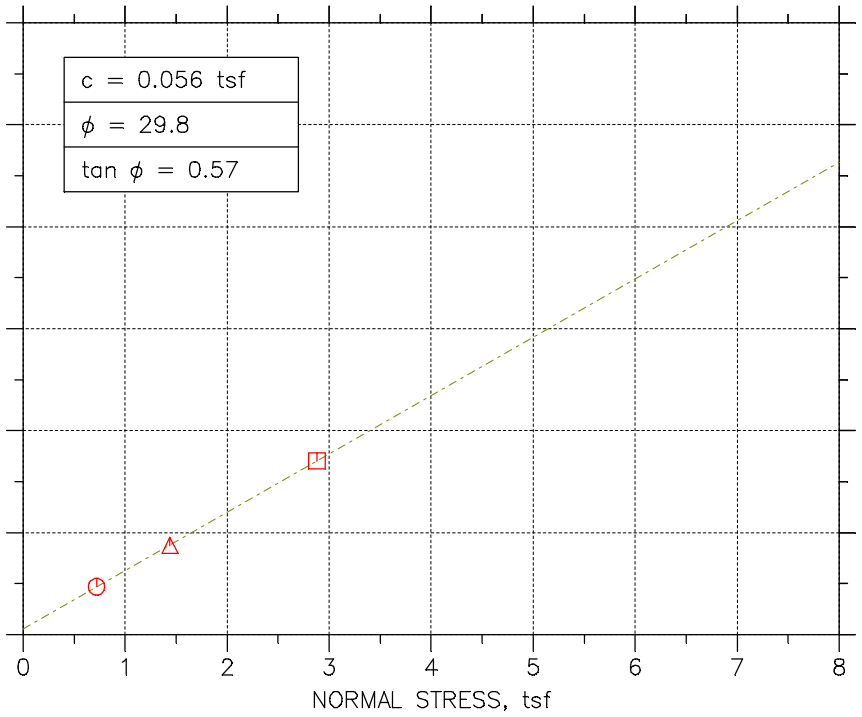

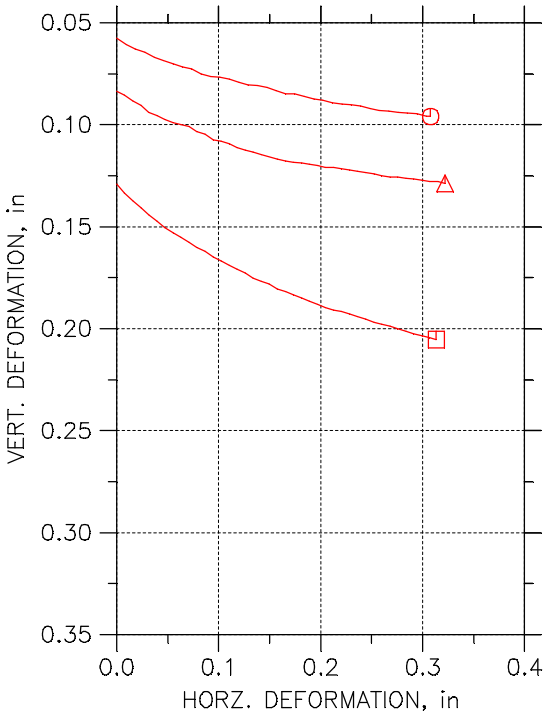

Symbol		⏲	△	⊡	
Test No.		10 PSI	20 PSI	40 PSI	
Sample No.		S-5	S-5	S-5	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.502	2.5016	2.5035	
	Area, in^2	4.9165	4.9149	4.9227	
	Height, in	1.0098	1.0087	1.0067	
	Water Content, %	75.08	66.70	67.21	
	Dry Density, pcf	51.869	56.572	54.543	
	Saturation, %	97.66	99.74	94.70	
	Void Ratio	1.7682	1.5381	1.6325	
Consol. Height, in		0.955	0.93155	0.88124	
Consol. Void Ratio		1.6179	1.344	1.3044	
Final	Water Content, %	64.90	53.10	47.20	
	Dry Density, pcf	57.319	64.848	68.523	
	Saturation, %	99.18	100.59	99.10	
	Void Ratio	1.505	1.2142	1.0954	
Normal Stress, tsf		0.71991	1.4387	2.88	
Max. Shear Stress, tsf		0.47008	0.87498	1.7039	
Ult. Shear Stress, tsf		0.45479	0.87367	1.7039	
Time to Failure, min		3678.3	1181.7	1190.6	
Disp. Rate, in/min		6.49e-005	0.000267	0.000267	
Estimated Specific Gravity		2.30	2.30	2.30	
Liquid Limit		NP	NP	NP	
Plastic Limit		NP	NP	NP	
Plasticity Index		NP	NP	NP	

Project: DYNERGY EDWARDS	
Location: BARTONVILLE, IL	
Project No.: MR155218	
Boring No.: EDW-B002 S5	
Sample Type: 3.0" ST	
Description: GRAY TO DARK GRAY VARVED FLY ASH	
Remarks: TEST PERFORMED AS PER ASTM D3080.	

DIRECT SHEAR TEST DATA

Project: DYNERGY EDWARDS
Boring No.: EDW-B002 S5
Sample No.: S-5
Test No.: 10 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/23/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 10.0'-12.0'
Elevation: ----

Soil Description: GRAY TO DARK GRAY VARVED FLY ASH
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	0.7191	0.05749	0	0
2	156.95	0.7199	0.06058	0.04248	0.009199
3	277.29	0.7199	0.06298	0.1019	0.0184
4	393.34	0.7199	0.06449	0.1405	0.0276
5	521.67	0.7199	0.06689	0.1795	0.03679
6	638.11	0.7191	0.06852	0.2096	0.04599
7	753.57	0.7199	0.07016	0.2362	0.05519
8	865.04	0.7199	0.07168	0.2577	0.06439
9	981.73	0.7199	0.07275	0.2764	0.07359
10	1096.66	0.7199	0.07502	0.2939	0.08279
11	1214.45	0.7199	0.07628	0.3104	0.09199
12	1328.38	0.7199	0.07678	0.3228	0.1012
13	1454.83	0.7199	0.07767	0.3353	0.1104
14	1573.59	0.7199	0.0793	0.3472	0.1196
15	1688.63	0.7199	0.08044	0.3596	0.1288
16	1817.30	0.7199	0.08094	0.3721	0.138
17	1955.96	0.7199	0.08183	0.3817	0.1472
18	2070.95	0.7199	0.08321	0.3902	0.1564
19	2203.51	0.7199	0.08473	0.3965	0.1656
20	2323.62	0.7199	0.08485	0.4072	0.1748
21	2452.80	0.7199	0.08599	0.4191	0.184
22	2580.16	0.7199	0.08731	0.431	0.1932
23	2700.75	0.7199	0.08813	0.4401	0.2024
24	2823.89	0.7199	0.08933	0.4463	0.2116
25	2950.56	0.7199	0.09002	0.4486	0.2208
26	3070.17	0.7199	0.09027	0.4491	0.23
27	3194.72	0.7199	0.09078	0.4514	0.2392
28	3328.14	0.7199	0.09217	0.4588	0.2483
29	3443.95	0.7191	0.09292	0.4655	0.2575
30	3554.17	0.7191	0.09343	0.4695	0.2667
31	3678.32	0.7199	0.09393	0.4701	0.2759
32	3812.79	0.7199	0.09443	0.4678	0.2851
33	3932.15	0.7199	0.09475	0.4633	0.2943
34	4054.51	0.7199	0.09576	0.4571	0.3035
35	4102.88	0.7199	0.09601	0.4548	0.3078

DIRECT SHEAR TEST DATA

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Project: DYNERGY EDWARDS
Boring No.: EDW-B002 S5
Sample No.: S-5
Test No.: 20 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/23/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 10.0'-12.0'
Elevation: ----

Soil Description: GRAY TO DARK GRAY VARVED FLY ASH
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	1.438	0.08377	0	0
2	33.66	1.439	0.08551	0.2598	0.007876
3	62.53	1.439	0.08828	0.3842	0.01575
4	94.03	1.439	0.09063	0.4817	0.02363
5	123.61	1.439	0.09391	0.5451	0.0315
6	153.40	1.439	0.09565	0.5982	0.03938
7	184.06	1.439	0.09749	0.644	0.04725
8	213.02	1.439	0.09903	0.6793	0.05513
9	241.92	1.439	0.09985	0.7094	0.06301
10	271.68	1.439	0.101	0.7362	0.07088
11	302.17	1.439	0.1033	0.7611	0.07876
12	330.34	1.439	0.1047	0.7781	0.08663
13	360.65	1.439	0.1073	0.7886	0.09451
14	392.06	1.439	0.1082	0.8089	0.1024
15	421.40	1.439	0.1095	0.818	0.1103
16	448.87	1.439	0.1113	0.8259	0.1181
17	477.79	1.439	0.1125	0.8351	0.126
18	506.84	1.439	0.1134	0.8495	0.1339
19	537.40	1.439	0.1148	0.8632	0.1418
20	593.97	1.439	0.1167	0.8652	0.1575
21	623.57	1.439	0.1179	0.8429	0.1654
22	655.08	1.439	0.1184	0.8423	0.1733
23	684.47	1.439	0.1188	0.8481	0.1811
24	712.80	1.439	0.1195	0.8521	0.189
25	740.02	1.439	0.1199	0.8573	0.1969
26	771.65	1.439	0.1208	0.8567	0.2048
27	801.16	1.439	0.121	0.858	0.2126
28	830.38	1.439	0.1215	0.8625	0.2205
29	861.82	1.439	0.1222	0.8645	0.2284
30	891.86	1.439	0.1228	0.8665	0.2362
31	920.33	1.439	0.1234	0.8678	0.2441
32	947.61	1.439	0.124	0.8645	0.252
33	978.79	1.439	0.1249	0.8645	0.2599
34	1008.02	1.439	0.1256	0.8645	0.2677
35	1036.49	1.439	0.1257	0.8625	0.2756
36	1067.92	1.439	0.1262	0.8652	0.2835
37	1095.86	1.439	0.1267	0.8652	0.2914
38	1124.42	1.439	0.1273	0.8691	0.2992
39	1152.92	1.439	0.1277	0.8704	0.3071
40	1181.69	1.439	0.128	0.875	0.315
41	1207.99	1.439	0.1287	0.8737	0.322

DIRECT SHEAR TEST DATA

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Consulting Engineers & Scientists

Project: DYNERGY EDWARDS
Boring No.: EDW-B002 S5
Sample No.: S-5
Test No.: 40 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/23/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 10.0'-12.0'
Elevation: ----

Soil Description: GRAY TO DARK GRAY VARVED FLY ASH
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	2.879	0.1292	0	0
2	34.66	2.879	0.1336	0.3516	0.007876
3	65.95	2.879	0.1374	0.4772	0.01575
4	98.49	2.879	0.1406	0.5912	0.02363
5	128.04	2.879	0.1442	0.6779	0.0315
6	157.00	2.879	0.1474	0.7496	0.03938
7	188.14	2.88	0.1504	0.8151	0.04725
8	217.44	2.88	0.1529	0.8772	0.05513
9	247.88	2.879	0.1551	0.9339	0.06301
10	276.45	2.879	0.1577	0.9701	0.07088
11	306.20	2.879	0.1601	1.017	0.07876
12	336.36	2.879	0.162	1.06	0.08663
13	366.50	2.879	0.1648	1.096	0.09451
14	397.75	2.879	0.1667	1.135	0.1024
15	427.67	2.88	0.169	1.161	0.1103
16	455.53	2.88	0.171	1.197	0.1181
17	485.04	2.879	0.1726	1.234	0.126
18	515.15	2.879	0.1753	1.262	0.1339
19	546.34	2.879	0.1769	1.285	0.1418
20	576.29	2.879	0.1782	1.317	0.1496
21	605.44	2.879	0.1806	1.346	0.1575
22	631.71	2.879	0.1819	1.367	0.1654
23	663.92	2.879	0.1834	1.395	0.1733
24	693.09	2.879	0.1851	1.423	0.1811
25	722.31	2.879	0.1865	1.447	0.189
26	753.49	2.88	0.1881	1.472	0.1969
27	783.68	2.879	0.1898	1.494	0.2048
28	812.56	2.879	0.1911	1.515	0.2126
29	840.21	2.879	0.1916	1.537	0.2205
30	873.07	2.879	0.1927	1.556	0.2284
31	901.78	2.88	0.194	1.57	0.2362
32	929.62	2.88	0.1952	1.589	0.2441
33	960.88	2.88	0.1967	1.608	0.252
34	990.19	2.88	0.1979	1.625	0.2599
35	1019.61	2.88	0.1986	1.632	0.2677
36	1048.80	2.879	0.1999	1.647	0.2756
37	1076.60	2.88	0.2013	1.668	0.2835
38	1109.68	2.88	0.2026	1.67	0.2914
39	1138.55	2.88	0.2036	1.681	0.2992
40	1167.91	2.879	0.2044	1.694	0.3071
41	1190.59	2.88	0.2054	1.704	0.3133

DIRECT SHEAR TEST REPORT

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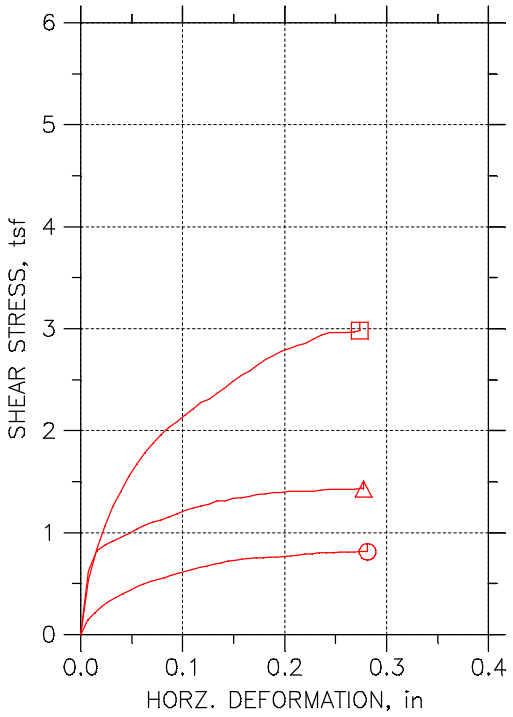

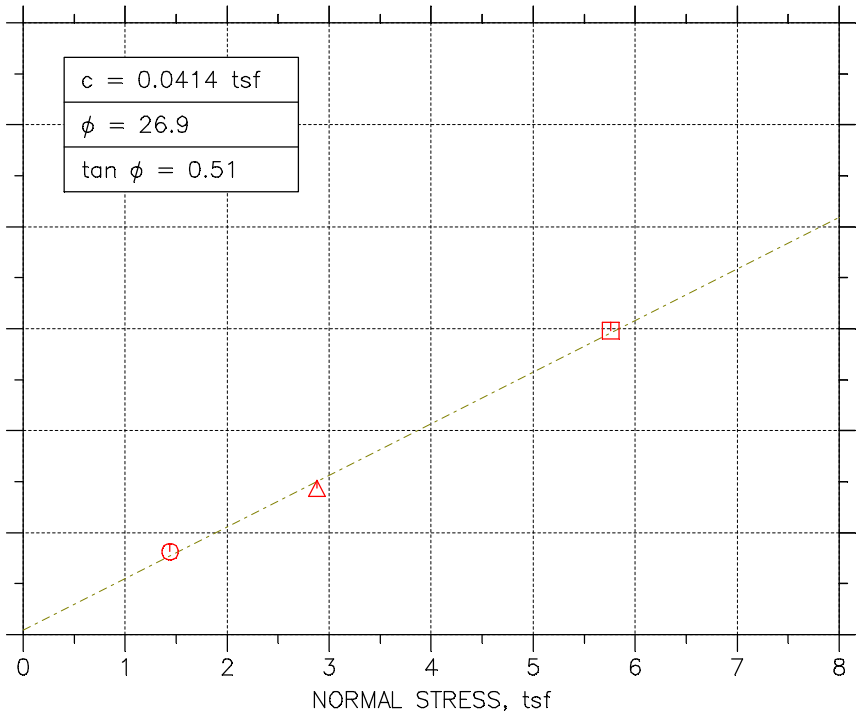

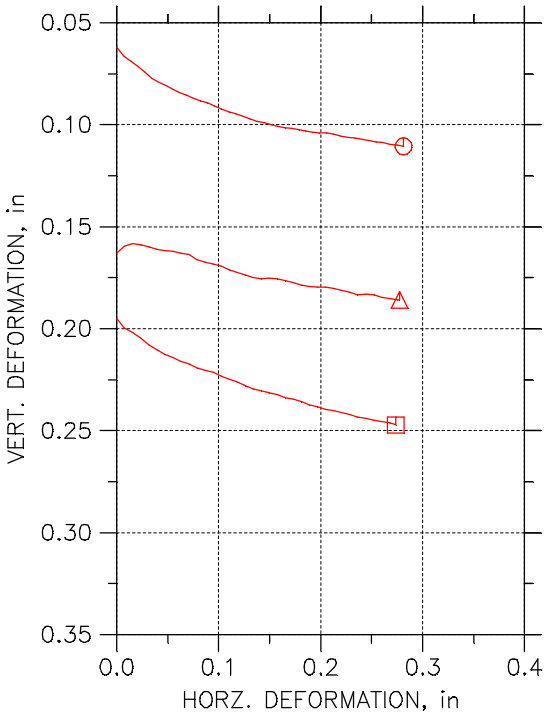

Symbol		○	△	□	
Test No.		20 PSI	40 PSI	80 PSI	
Sample No.		S-9	S-9	S-9	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.5035	2.4988	2.4921	
	Area, in^2	4.9227	4.9041	4.8779	
	Height, in	1.0067	0.98937	0.99213	
	Water Content, %	71.70	70.21	69.53	
	Dry Density, pcf	53.119	54.563	54.248	
	Saturation, %	96.83	98.97	97.11	
	Void Ratio	1.7031	1.6315	1.6468	
Consol. Height, in		0.95172	0.83719	0.8042	
Consol. Void Ratio		1.5555	1.2268	1.1454	
Final	Water Content, %	60.80	49.80	42.70	
	Dry Density, pcf	59.677	67.193	72.249	
	Saturation, %	99.46	100.75	99.47	
	Void Ratio	1.406	1.1369	0.98736	
Normal Stress, tsf		1.4396	2.8798	5.7593	
Max. Shear Stress, tsf		0.81396	1.4353	2.9807	
Ult. Shear Stress, tsf		0.81396	1.4289	2.9807	
Time to Failure, min		1202.3	4163.3	1353.2	
Disp. Rate, in/min		0.000267	6.69e-005	0.000207	
Estimated Specific Gravity		2.30	2.30	2.30	
Liquid Limit		NP	NP	NP	
Plastic Limit		NP	NP	NP	
Plasticity Index		NP	NP	NP	

Project: DYNERGY EDWARDS
Location: BARTONVILLE, IL
Project No.: MR155218
Boring No.: EDW-B003 S9
Sample Type: 3.0" ST

Description: VERY DARK GRAY VARVED FLY ASH

Remarks: TEST PERFORMED AS PER ASTM D3080

DIRECT SHEAR TEST DATA

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Project: DYNERGY EDWARDS
Boring No.: EDW-B003 S9
Sample No.: S-9
Test No.: 20 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/23/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 30.0'-32.0'
Elevation: ----

Soil Description: VERY DARK GRAY VARVED FLY ASH
Remarks: TEST PERFORMED AS PER ASTM D3080



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	1.438	0.06197	0	0
2	29.97	1.439	0.06626	0.1471	0.006868
3	57.78	1.439	0.06903	0.2144	0.01374
4	88.56	1.439	0.07142	0.2734	0.0206
5	120.00	1.439	0.0742	0.3261	0.02747
6	147.42	1.439	0.07741	0.3658	0.03434
7	177.07	1.44	0.07918	0.4002	0.04121
8	208.08	1.439	0.08094	0.4362	0.04807
9	237.87	1.439	0.08258	0.468	0.05494
10	268.15	1.44	0.08422	0.4952	0.06181
11	297.24	1.44	0.08555	0.5181	0.06868
12	327.37	1.439	0.08693	0.5374	0.07555
13	354.52	1.44	0.08832	0.5599	0.08241
14	388.81	1.439	0.08933	0.5859	0.08928
15	414.34	1.439	0.0909	0.6053	0.09615
16	443.05	1.44	0.09235	0.6214	0.103
17	475.44	1.44	0.09362	0.6428	0.1099
18	503.04	1.439	0.09456	0.6569	0.1168
19	531.73	1.44	0.09576	0.672	0.1236
20	563.76	1.44	0.09708	0.6908	0.1305
21	590.20	1.44	0.09841	0.7049	0.1374
22	620.48	1.439	0.09897	0.719	0.1442
23	648.48	1.44	0.09992	0.7268	0.1511
24	679.58	1.44	0.1007	0.7399	0.158
25	707.75	1.44	0.1014	0.7493	0.1648
26	736.66	1.44	0.1019	0.7503	0.1717
27	766.24	1.44	0.1026	0.754	0.1786
28	796.15	1.44	0.1031	0.7592	0.1854
29	823.23	1.439	0.1038	0.7618	0.1923
30	851.40	1.44	0.104	0.767	0.1991
31	883.03	1.44	0.1041	0.7727	0.206
32	911.21	1.44	0.1047	0.7764	0.2129
33	944.16	1.44	0.1056	0.7879	0.2197
34	971.55	1.44	0.1061	0.7936	0.2266
35	1000.34	1.44	0.1065	0.802	0.2335
36	1031.20	1.44	0.1073	0.803	0.2403
37	1059.90	1.439	0.1079	0.8067	0.2472
38	1088.96	1.44	0.1084	0.8113	0.2541
39	1119.26	1.44	0.1087	0.8108	0.2609
40	1145.99	1.44	0.1097	0.8098	0.2678
41	1177.16	1.44	0.1101	0.814	0.2747
42	1202.27	1.44	0.1106	0.814	0.2812

DIRECT SHEAR TEST DATA

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Project: DYNERGY EDWARDS
Boring No.: EDW-B003 S9
Sample No.: S-9
Test No.: 40 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/23/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 30.0'-32.0'
Elevation: ----

Soil Description: VERY DARK GRAY VARVED FLY ASH
Remarks: TEST PERFORMED AS PER ASTM D3080



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	4.541	0.1631	0	0
2	165.26	2.88	0.1594	0.623	0.007876
3	285.62	2.88	0.1584	0.8242	0.01575
4	408.00	2.88	0.1589	0.8772	0.02363
5	528.28	2.88	0.1597	0.9172	0.0315
6	644.59	2.88	0.161	0.9573	0.03938
7	763.78	2.88	0.1618	0.994	0.04725
8	884.32	2.88	0.1622	1.033	0.05513
9	993.76	2.88	0.163	1.072	0.06301
10	1117.20	2.88	0.1637	1.102	0.07088
11	1235.24	2.88	0.166	1.124	0.07876
12	1344.93	2.88	0.1672	1.154	0.08663
13	1464.24	2.88	0.1684	1.183	0.09451
14	1587.75	2.88	0.1694	1.219	0.1024
15	1704.16	2.879	0.171	1.241	0.1103
16	1806.00	2.879	0.1724	1.26	0.1181
17	1919.53	2.88	0.1737	1.281	0.126
18	2040.50	2.88	0.1748	1.31	0.1339
19	2161.06	2.88	0.1757	1.312	0.1418
20	2270.85	2.88	0.1753	1.338	0.1496
21	2391.12	2.88	0.1755	1.346	0.1575
22	2509.07	2.88	0.1764	1.356	0.1654
23	2633.81	2.88	0.1773	1.373	0.1733
24	2755.77	2.88	0.1787	1.382	0.1811
25	2871.20	2.88	0.1792	1.392	0.189
26	2977.15	2.88	0.1795	1.392	0.1969
27	3107.25	2.88	0.1796	1.405	0.2048
28	3223.67	2.88	0.1804	1.408	0.2126
29	3336.47	2.88	0.1812	1.406	0.2205
30	3458.59	2.88	0.1821	1.403	0.2284
31	3580.72	2.88	0.1833	1.418	0.2362
32	3695.22	2.879	0.1829	1.425	0.2441
33	3803.01	2.88	0.1834	1.426	0.252
34	3924.20	2.88	0.1847	1.426	0.2599
35	4048.11	2.88	0.1853	1.428	0.2677
36	4163.33	2.88	0.1858	1.435	0.2756
37	4182.96	2.88	0.186	1.429	0.2775

DIRECT SHEAR TEST DATA

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Project: DYNERGY EDWARDS
Boring No.: EDW-B003 S9
Sample No.: S-9
Test No.: 80 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/23/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 30.0'-32.0'
Elevation: ----

Soil Description: VERY DARK GRAY VARVED FLY ASH
Remarks: TEST PERFORMED AS PER ASTM D3080



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	5.757	0.195	0	0
2	58.95	5.759	0.1996	0.5335	0.007876
3	100.20	5.759	0.2019	0.8357	0.01575
4	140.38	5.759	0.2048	1.069	0.02363
5	178.98	5.759	0.2079	1.257	0.0315
6	214.75	5.759	0.2102	1.405	0.03938
7	256.36	5.759	0.2126	1.554	0.04725
8	295.19	5.759	0.2142	1.68	0.05513
9	332.54	5.759	0.216	1.784	0.06301
10	373.08	5.759	0.2174	1.879	0.07088
11	411.52	5.759	0.219	1.962	0.07876
12	450.22	5.759	0.2203	2.034	0.08663
13	487.04	5.759	0.2214	2.089	0.09451
14	524.30	5.759	0.2232	2.152	0.1024
15	562.81	5.759	0.2247	2.215	0.1103
16	600.83	5.759	0.2262	2.277	0.1181
17	638.96	5.759	0.2278	2.314	0.126
18	681.52	5.759	0.2295	2.365	0.1339
19	716.24	5.759	0.2303	2.426	0.1418
20	755.33	5.76	0.2315	2.489	0.1496
21	791.66	5.759	0.2324	2.542	0.1575
22	830.85	5.759	0.2338	2.587	0.1654
23	870.20	5.759	0.2346	2.643	0.1733
24	908.45	5.759	0.2356	2.697	0.1811
25	944.85	5.759	0.2372	2.738	0.189
26	983.52	5.759	0.2383	2.779	0.1969
27	1022.76	5.759	0.2395	2.809	0.2048
28	1059.45	5.759	0.2401	2.838	0.2126
29	1096.13	5.759	0.2411	2.858	0.2205
30	1136.62	5.759	0.2421	2.903	0.2284
31	1174.43	5.759	0.2433	2.936	0.2362
32	1210.69	5.759	0.244	2.961	0.2441
33	1248.49	5.759	0.2448	2.964	0.252
34	1288.45	5.759	0.2456	2.966	0.2599
35	1323.77	5.759	0.2462	2.967	0.2677
36	1353.20	5.759	0.2472	2.982	0.2737

DIRECT SHEAR TEST REPORT

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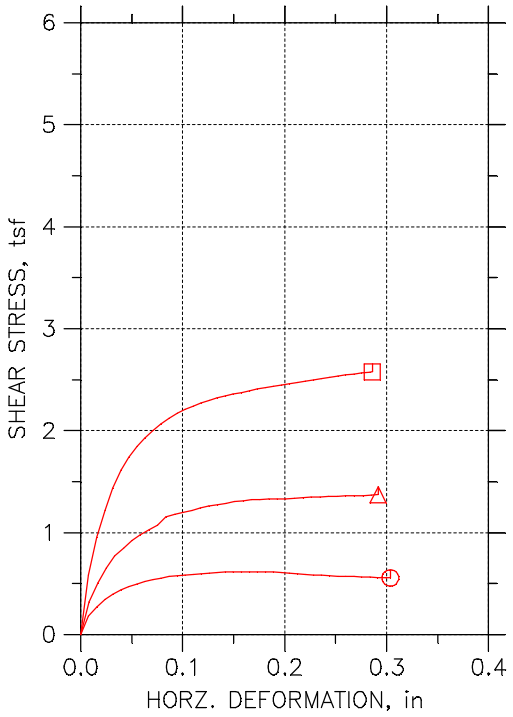

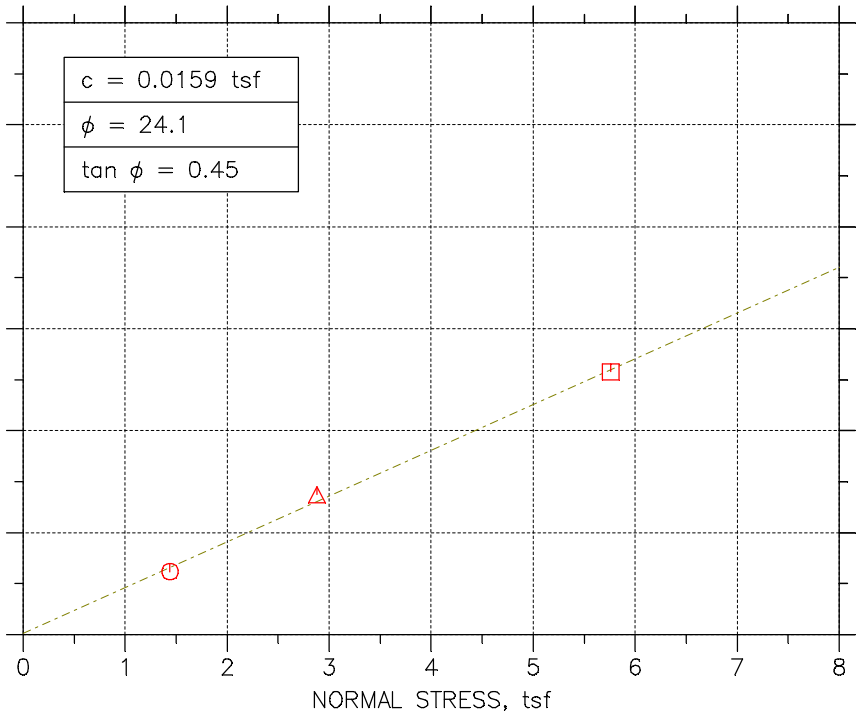

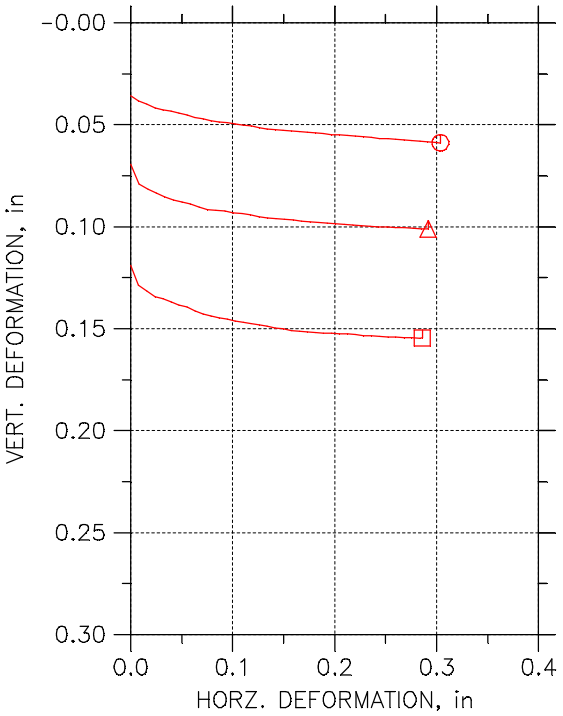

Symbol		⏲	△	⊡	
Test No.		20 PSI	40 PSI	80 PSI	
Sample No.		S-10	S-10	S-10	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.4921	2.4996	2.4976	
	Area, in^2	4.8779	4.9072	4.8995	
	Height, in	0.99606	0.98583	0.98858	
	Water Content, %	29.91	28.99	29.10	
	Dry Density, pcf	90.515	92.188	91.834	
	Saturation, %	92.88	93.65	93.21	
	Void Ratio	0.87597	0.84192	0.84903	
Consol. Height, in		0.96227	0.91945	0.88312	
Consol. Void Ratio		0.81233	0.71789	0.65176	
Final	Water Content, %	28.10	23.40	19.70	
	Dry Density, pcf	96.208	102.73	108.85	
	Saturation, %	99.92	97.47	95.68	
	Void Ratio	0.76496	0.653	0.56003	
Normal Stress, tsf		1.4392	2.8795	5.7594	
Max. Shear Stress, tsf		0.61821	1.3715	2.5767	
Ult. Shear Stress, tsf		0.55697	1.3715	2.5767	
Time to Failure, min		793.54	1341	1400	
Disp. Rate, in/min		0.000207	0.000207	0.000207	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		40	40	40	
Plastic Limit		15	15	15	
Plasticity Index		25	25	25	

Project: DYNERGY EDWARDS	
Location: BARTONVILLE, IL	
Project No.: MR155218	
Boring No.: EDW010 S10	
Sample Type: 3.0" ST	
Description: BLUISH GRAY LEAN CLAY CL	
Remarks: TEST PERFORMED AS PER ASTM D3080	

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DIRECT SHEAR TEST DATA

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Project: DYNERGY EDWARDS
Boring No.: EDW010 S10
Sample No.: S-10
Test No.: 20 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/4/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 30.0'-32.0'
Elevation: ----

Soil Description: BLUISH GRAY LEAN CLAY CL
Remarks: TEST PERFORMED AS PER ASTM D3080



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	1.438	0.03587	0	0
2	39.39	1.439	0.03845	0.185	0.007876
3	76.42	1.439	0.0399	0.2733	0.01575
4	116.70	1.439	0.04167	0.343	0.02363
5	155.57	1.439	0.04274	0.3971	0.0315
6	194.59	1.439	0.04325	0.439	0.03938
7	231.17	1.439	0.04419	0.4699	0.04725
8	266.54	1.439	0.04514	0.4951	0.05513
9	305.27	1.439	0.0464	0.5183	0.06301
10	340.94	1.439	0.04709	0.537	0.07088
11	379.25	1.439	0.04797	0.555	0.07876
12	423.04	1.439	0.04873	0.5699	0.08663
13	457.67	1.439	0.04905	0.5782	0.09451
14	495.80	1.439	0.04968	0.586	0.1024
15	531.98	1.439	0.05012	0.5924	0.1103
16	571.20	1.439	0.05068	0.5989	0.1181
17	608.83	1.439	0.0515	0.604	0.126
18	647.29	1.439	0.05207	0.6079	0.1339
19	683.43	1.438	0.05239	0.6124	0.1418
20	721.04	1.438	0.0527	0.615	0.1496
21	758.83	1.439	0.05295	0.6169	0.1575
22	793.54	1.439	0.05327	0.6182	0.1654
23	830.97	1.439	0.05365	0.6176	0.1733
24	869.12	1.439	0.05396	0.615	0.1811
25	906.41	1.439	0.0544	0.6124	0.189
26	945.26	1.439	0.05491	0.6073	0.1969
27	982.69	1.439	0.0551	0.6021	0.2048
28	1020.06	1.439	0.05529	0.5957	0.2126
29	1059.90	1.439	0.0556	0.5905	0.2205
30	1095.28	1.439	0.05585	0.586	0.2284
31	1131.23	1.439	0.05617	0.5821	0.2362
32	1169.64	1.439	0.05674	0.5776	0.2441
33	1209.10	1.439	0.05699	0.5731	0.252
34	1244.59	1.439	0.0573	0.5718	0.2599
35	1283.36	1.439	0.05762	0.5705	0.2677
36	1319.90	1.439	0.05775	0.5679	0.2756
37	1357.90	1.439	0.05806	0.5641	0.2835
38	1393.69	1.438	0.05838	0.5615	0.2914
39	1434.20	1.44	0.05875	0.5589	0.2992
40	1455.26	1.439	0.05894	0.557	0.3036

DIRECT SHEAR TEST DATA

Terracon Consulting Engineers & Scientists

Project: DYNERGY EDWARDS
Boring No.: EDW010 S10
Sample No.: S-10
Test No.: 40 PSI

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 11/4/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 30.0'-32.0'
Elevation: ----

Soil Description: BLUISH GRAY LEAN CLAY CL
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	2.879	0.06953	0	0
2	66.92	2.879	0.07899	0.3222	0.00838
3	104.04	2.88	0.0817	0.5099	0.01676
4	142.82	2.879	0.08347	0.6542	0.02514
5	185.18	2.88	0.08542	0.7741	0.03352
6	219.73	2.88	0.08681	0.8505	0.0419
7	257.69	2.88	0.08794	0.9202	0.05028
8	298.10	2.88	0.08882	0.982	0.05866
9	333.83	2.88	0.09046	1.029	0.06704
10	369.75	2.88	0.0916	1.072	0.07542
11	413.04	2.88	0.09204	1.152	0.0838
12	445.97	2.88	0.09229	1.18	0.09218
13	485.62	2.88	0.09317	1.197	0.1006
14	521.13	2.88	0.09368	1.22	0.1089
15	559.14	2.88	0.09418	1.241	0.1173
16	595.57	2.879	0.095	1.261	0.1257
17	634.46	2.88	0.09563	1.272	0.1341
18	671.61	2.88	0.0962	1.289	0.1425
19	707.68	2.88	0.09645	1.303	0.1508
20	746.34	2.88	0.0967	1.312	0.1592
21	785.27	2.879	0.09727	1.321	0.1676
22	821.12	2.88	0.09778	1.327	0.176
23	858.67	2.88	0.09796	1.33	0.1844
24	895.38	2.88	0.09834	1.334	0.1927
25	934.75	2.88	0.09866	1.333	0.2011
26	971.24	2.88	0.09891	1.337	0.2095
27	1007.72	2.88	0.09916	1.342	0.2179
28	1045.96	2.88	0.09941	1.346	0.2262
29	1084.53	2.88	0.09992	1.351	0.2346
30	1120.37	2.88	0.1001	1.354	0.243
31	1156.63	2.88	0.1002	1.357	0.2513
32	1197.77	2.88	0.1003	1.36	0.2597
33	1233.68	2.88	0.1004	1.362	0.2681
34	1272.09	2.88	0.1006	1.364	0.2765
35	1311.64	2.88	0.1009	1.369	0.2849
36	1340.99	2.88	0.1011	1.371	0.2916

DIRECT SHEAR TEST DATA

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Project: DYNERGY EDWARDS
Boring No.: EDW010 S10
Sample No.: S-10
Test No.: 80 PSI

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 11/5/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 30.0'-32.0'
Elevation: ----

Soil Description: BLUISH GRAY LEAN CLAY CL
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	5.757	0.1189	0	0
2	53.81	5.759	0.1286	0.586	0.007876
3	93.90	5.759	0.1315	0.9544	0.01575
4	132.06	5.759	0.1342	1.218	0.02363
5	171.21	5.759	0.1354	1.435	0.0315
6	211.15	5.759	0.1367	1.61	0.03938
7	250.46	5.759	0.1385	1.74	0.04725
8	288.21	5.759	0.1395	1.844	0.05513
9	324.71	5.759	0.1411	1.926	0.06301
10	364.16	5.759	0.1428	2.004	0.07088
11	401.96	5.759	0.1437	2.067	0.07876
12	438.83	5.759	0.1446	2.119	0.08663
13	478.24	5.759	0.1452	2.171	0.09451
14	515.94	5.759	0.1461	2.207	0.1024
15	554.42	5.759	0.1469	2.242	0.1103
16	590.30	5.759	0.1476	2.272	0.1181
17	626.52	5.759	0.1482	2.294	0.126
18	663.24	5.759	0.1488	2.321	0.1339
19	700.05	5.759	0.1496	2.34	0.1418
20	741.31	5.759	0.15	2.362	0.1496
21	780.69	5.759	0.1509	2.374	0.1575
22	817.38	5.759	0.1512	2.393	0.1654
23	854.69	5.759	0.1515	2.407	0.1733
24	892.50	5.759	0.1519	2.423	0.1811
25	930.62	5.759	0.1523	2.434	0.189
26	969.48	5.759	0.1523	2.444	0.1969
27	1008.12	5.759	0.1525	2.457	0.2048
28	1045.34	5.759	0.1527	2.471	0.2126
29	1083.92	5.759	0.1529	2.484	0.2205
30	1123.76	5.759	0.1533	2.499	0.2284
31	1160.12	5.759	0.1535	2.512	0.2362
32	1197.88	5.759	0.1537	2.526	0.2441
33	1240.24	5.759	0.1541	2.536	0.252
34	1277.15	5.759	0.1541	2.545	0.2599
35	1312.34	5.759	0.1543	2.556	0.2677
36	1351.46	5.759	0.1543	2.566	0.2756
37	1391.74	5.759	0.1546	2.576	0.2835
38	1399.98	5.759	0.1545	2.577	0.2859

DIRECT SHEAR TEST REPORT

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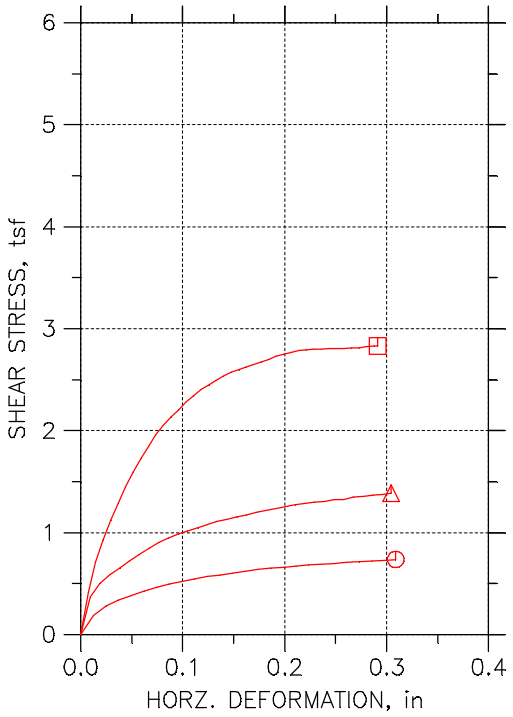

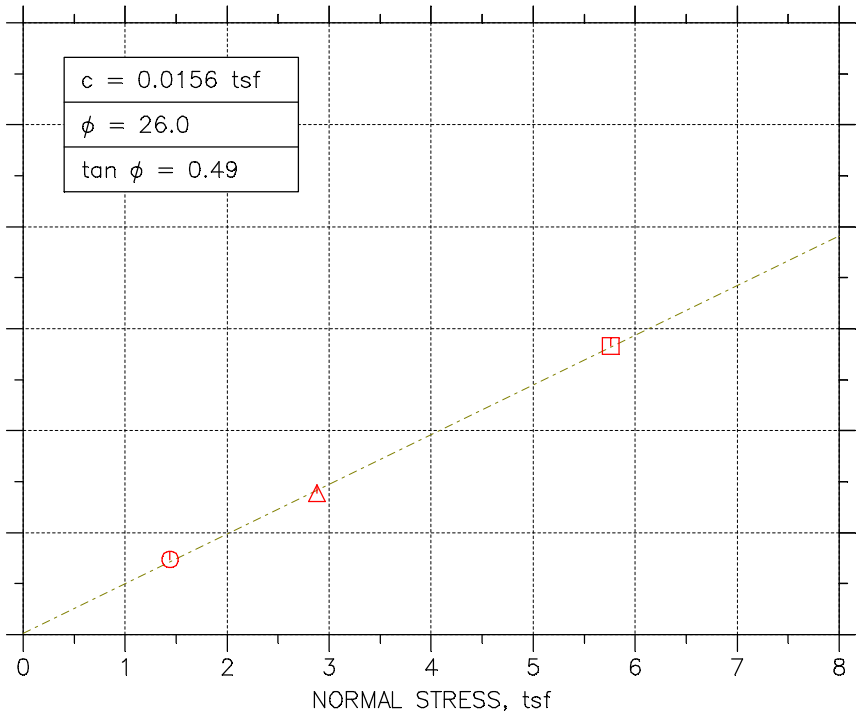

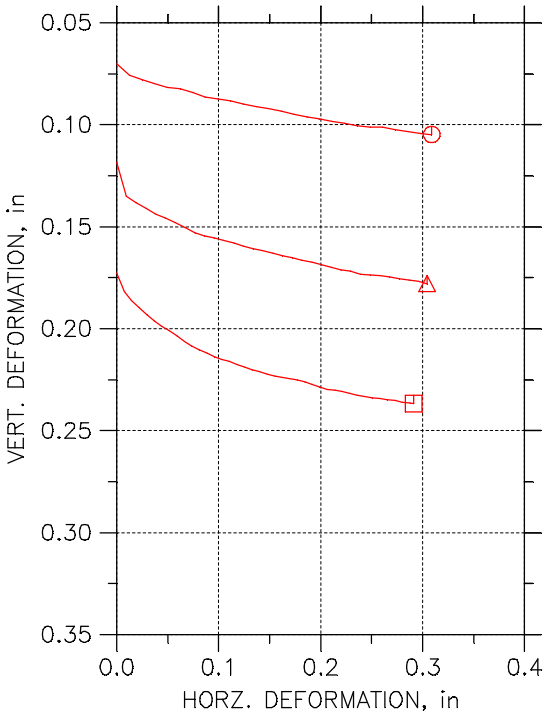

Symbol		⏲	△	⊡	
Test No.		20 PSI	40 PSI	80 PSI	
Sample No.		S-14	S-14	S-14	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.5087	2.5067	2.502	
	Area, in^2	4.9428	4.9351	4.9165	
	Height, in	0.99961	1.0098	0.99646	
	Water Content, %	50.80	50.19	50.11	
	Dry Density, pcf	69.233	69.813	69.282	
	Saturation, %	95.13	95.32	93.94	
	Void Ratio	1.4527	1.4323	1.4509	
Consol. Height, in		0.93203	0.8987	0.83564	
Consol. Void Ratio		1.2868	1.1646	1.0554	
Final	Water Content, %	44.10	36.30	31.60	
	Dry Density, pcf	77.344	84.748	90.862	
	Saturation, %	100.34	98.38	98.93	
	Void Ratio	1.1954	1.0036	0.86882	
Normal Stress, tsf		1.4393	2.8799	5.7593	
Max. Shear Stress, tsf		0.73733	1.3874	2.8312	
Ult. Shear Stress, tsf		0.73733	1.3874	2.8312	
Time to Failure, min		961	3164.9	1365.2	
Disp. Rate, in/min		0.000207	8.85e-005	0.000232	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		54	54	54	
Plastic Limit		20	20	20	
Plasticity Index		34	34	34	

Project: DYNERGY EDWARDS	
Location: BARTONVILLE, IL	
Project No.: MR155218	
Boring No.: EDW012 S14	
Sample Type: 3.0" ST	
Description: DARK GRAY FAT CLAY CH SHELL NOTED	
Remarks: TEST PERFORMED AS PER ASTM D3080.	

DIRECT SHEAR TEST DATA

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Project: DYNERGY EDWARDS
Boring No.: EDW012 S14
Sample No.: S-14
Test No.: 20 PSI

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 11/5/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 47.0'-49.0'
Elevation: ----

Soil Description: DARK GRAY FAT CLAY CH SHELL NOTED
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	1.438	0.07004	0	0
2	47.30	1.438	0.0759	0.1909	0.01241
3	86.02	1.439	0.07811	0.2818	0.02482
4	124.31	1.439	0.07994	0.3416	0.03724
5	160.06	1.438	0.08176	0.3855	0.04965
6	200.31	1.439	0.08246	0.4281	0.06206
7	238.78	1.438	0.08441	0.4644	0.07447
8	275.86	1.439	0.08649	0.4949	0.08688
9	314.97	1.439	0.08737	0.5229	0.09929
10	355.17	1.439	0.08832	0.5477	0.1117
11	393.92	1.439	0.08977	0.5706	0.1241
12	429.38	1.439	0.09128	0.5859	0.1365
13	468.43	1.439	0.09223	0.6056	0.1489
14	506.02	1.439	0.09336	0.6215	0.1614
15	542.62	1.439	0.09481	0.6381	0.1738
16	586.75	1.439	0.09614	0.6521	0.1862
17	618.29	1.439	0.09721	0.6616	0.1986
18	656.28	1.438	0.09828	0.6718	0.211
19	696.76	1.439	0.09935	0.682	0.2234
20	732.98	1.439	0.1005	0.6915	0.2358
21	769.67	1.439	0.1012	0.6998	0.2482
22	812.59	1.439	0.1013	0.7093	0.2606
23	848.00	1.439	0.1026	0.7151	0.2731
24	887.83	1.438	0.1033	0.724	0.2855
25	924.52	1.438	0.1043	0.731	0.2979
26	961.00	1.439	0.1048	0.7373	0.3088

DIRECT SHEAR TEST DATA

Terracon
Consulting Engineers & Scientists

Project: DYNERGY EDWARDS
Boring No.: EDW012 S14
Sample No.: S-14
Test No.: 40 PSI

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 11/7/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 47.0'-49.0'
Elevation: ----

Soil Description: DARK GRAY FAT CLAY CH SHELL NOTED
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	2.879	0.1185	0	0
2	372.53	2.88	0.1351	0.3735	0.009556
3	468.99	2.88	0.1381	0.5003	0.01911
4	564.01	2.88	0.141	0.5902	0.02867
5	651.75	2.88	0.144	0.656	0.03822
6	744.20	2.88	0.1459	0.7228	0.04778
7	835.68	2.879	0.1481	0.7865	0.05733
8	925.97	2.88	0.1505	0.8454	0.06689
9	1018.05	2.88	0.1529	0.9026	0.07645
10	1104.25	2.88	0.1545	0.9476	0.086
11	1195.15	2.88	0.1556	0.9882	0.09556
12	1289.11	2.88	0.1568	1.019	0.1051
13	1376.20	2.88	0.158	1.049	0.1147
14	1467.76	2.88	0.1596	1.082	0.1242
15	1560.82	2.88	0.1608	1.11	0.1338
16	1648.67	2.88	0.1618	1.132	0.1433
17	1734.35	2.88	0.1631	1.153	0.1529
18	1827.14	2.88	0.1642	1.177	0.1624
19	1925.93	2.88	0.1651	1.202	0.172
20	2006.92	2.88	0.1663	1.219	0.1816
21	2105.98	2.88	0.1673	1.236	0.1911
22	2191.37	2.88	0.1688	1.253	0.2007
23	2278.65	2.88	0.1698	1.274	0.2102
24	2368.36	2.88	0.1711	1.289	0.2198
25	2452.94	2.88	0.1719	1.301	0.2293
26	2544.63	2.88	0.1735	1.308	0.2389
27	2629.18	2.88	0.1737	1.323	0.2485
28	2720.25	2.88	0.1741	1.327	0.2579
29	2813.74	2.88	0.1747	1.347	0.2675
30	2902.90	2.88	0.1755	1.353	0.2771
31	2995.72	2.88	0.1763	1.367	0.2866
32	3085.70	2.879	0.177	1.376	0.2962
33	3164.86	2.88	0.178	1.387	0.3043

DIRECT SHEAR TEST DATA

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Project: DYNERGY EDWARDS
Boring No.: EDW012 S14
Sample No.: S-14
Test No.: 80 PSI

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 11/9/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 47.0'-49.0'
Elevation: ----

Soil Description: DARK GRAY FAT CLAY CH SHELL NOTED
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	5.758	0.1729	0	0
2	39.55	5.758	0.1819	0.4139	0.007372
3	77.10	5.759	0.1863	0.7122	0.01474
4	112.99	5.759	0.1897	0.9304	0.02212
5	148.81	5.759	0.193	1.122	0.02949
6	184.76	5.759	0.1961	1.293	0.03686
7	219.25	5.759	0.1988	1.448	0.04423
8	256.03	5.759	0.2008	1.596	0.0516
9	290.21	5.759	0.2034	1.726	0.05897
10	325.35	5.759	0.2062	1.846	0.06635
11	362.78	5.759	0.2083	1.96	0.07372
12	397.12	5.759	0.2103	2.054	0.08109
13	429.34	5.759	0.2121	2.132	0.08846
14	462.52	5.759	0.2137	2.205	0.09583
15	499.06	5.759	0.215	2.279	0.1032
16	532.30	5.759	0.2162	2.34	0.1106
17	569.81	5.76	0.2177	2.403	0.1179
18	598.74	5.759	0.2187	2.447	0.1253
19	633.77	5.759	0.2199	2.494	0.1327
20	670.11	5.759	0.2209	2.537	0.1401
21	703.89	5.759	0.2224	2.574	0.1474
22	737.17	5.759	0.2233	2.6	0.1548
23	771.57	5.759	0.2238	2.622	0.1622
24	805.68	5.759	0.2246	2.647	0.1696
25	841.96	5.759	0.2251	2.675	0.1769
26	874.04	5.759	0.226	2.7	0.1843
27	910.30	5.759	0.2273	2.727	0.1917
28	942.84	5.759	0.2287	2.746	0.199
29	977.11	5.759	0.2297	2.769	0.2064
30	1011.86	5.759	0.2302	2.785	0.2137
31	1046.27	5.759	0.2307	2.794	0.2211
32	1078.57	5.759	0.2316	2.801	0.2285
33	1111.99	5.759	0.2326	2.8	0.2359
34	1147.40	5.759	0.2332	2.803	0.2432
35	1179.32	5.759	0.2338	2.804	0.2506
36	1216.60	5.759	0.2341	2.806	0.258
37	1246.79	5.759	0.2347	2.809	0.2653
38	1278.72	5.759	0.2353	2.814	0.2727
39	1316.44	5.759	0.236	2.823	0.2801
40	1349.92	5.759	0.2364	2.829	0.2875
41	1365.24	5.759	0.2367	2.831	0.2913

DIRECT SHEAR TEST REPORT

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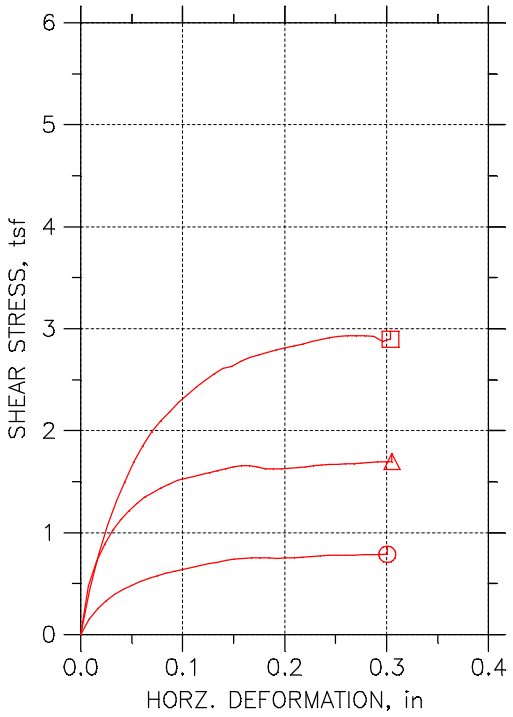

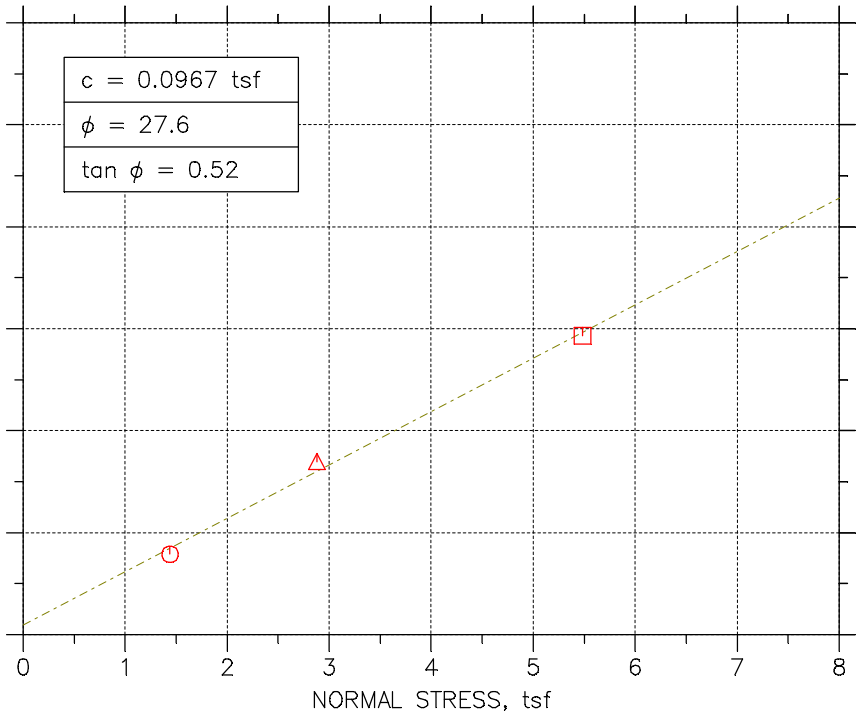

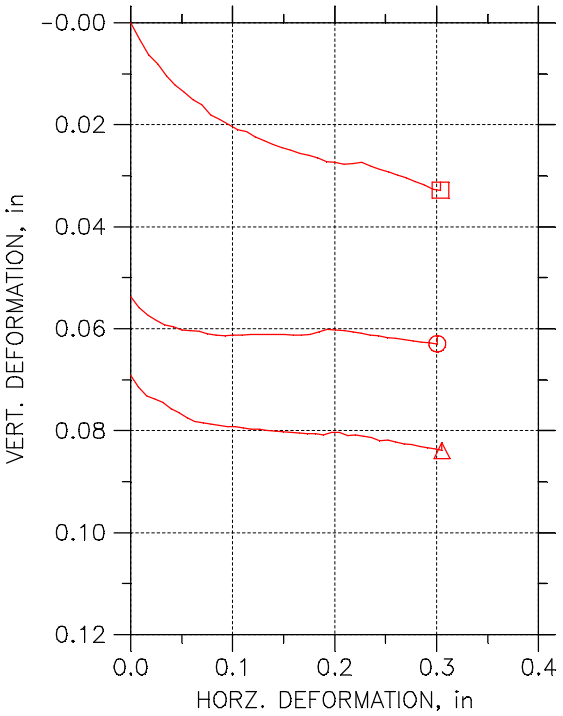

Symbol		⏲	△	⊡	
Test No.		20 PSI	40 PSI	80 PSI	
Sample No.		S-10	S-10	S-10	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.498	2.5	2.5087	
	Area, in^2	4.901	4.9087	4.9431	
	Height, in	0.98898	0.99252	0.99606	
	Water Content, %	20.30	20.20	20.70	
	Dry Density, pcf	101.54	100.62	99.218	
	Saturation, %	85.50	83.10	82.20	
	Void Ratio	0.62921	0.64421	0.66738	
Consol. Height, in		0.94144	0.9279	0.99606	
Consol. Void Ratio		0.5509	0.53717	0.66738	
Final	Water Content, %	19.10	18.60	22.80	
	Dry Density, pcf	108.45	109.91	102.6	
	Saturation, %	96.32	97.56	98.66	
	Void Ratio	0.52546	0.50521	0.61241	
Normal Stress, tsf		1.4396	2.8794	5.4854	
Max. Shear Stress, tsf		0.78821	1.6963	2.9302	
Ult. Shear Stress, tsf		0.78821	1.6963	2.8965	
Time to Failure, min		1242.6	1357.2	1031.5	
Disp. Rate, in/min		0.000232	0.000232	0.000232	
Estimated Specific Gravity		2.65	2.65	2.65	
Liquid Limit		24	24	24	
Plastic Limit		13	13	13	
Plasticity Index		11	11	11	

Project: DYNERGY EDWARDS
Location: BARTONVILLE, IL
Project No.: MR155218
Boring No.: EDW015 S10
Sample Type: 3.0" ST
Description: BROWN AND GRAY MOTTLED SANDY LEAN CLAY WITH GRAVEL CL
Remarks: TEST PERFORMED AS PER ASTM D3080.

DIRECT SHEAR TEST DATA

Project: DYNERGY EDWARDS
Boring No.: EDW015 S10
Sample No.: S-10
Test No.: 20 PSI

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 11/10/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 31.0'-33.0'
Elevation: ----

Soil Description: BROWN AND GRAY MOTTLED SANDY LEAN CLAY WITH GRAVEL CL
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	1.439	0.05371	0	0
2	53.95	1.44	0.05592	0.1498	0.00838
3	89.12	1.439	0.05743	0.2586	0.01676
4	121.56	1.439	0.05838	0.3313	0.02514
5	157.67	1.44	0.05919	0.3949	0.03352
6	194.41	1.44	0.05957	0.4472	0.0419
7	229.85	1.44	0.0602	0.4865	0.05028
8	262.66	1.44	0.06033	0.5204	0.05866
9	296.74	1.44	0.06052	0.5501	0.06704
10	331.66	1.44	0.06102	0.577	0.07542
11	364.35	1.44	0.06128	0.6007	0.0838
12	395.09	1.44	0.06134	0.6201	0.09218
13	431.13	1.44	0.06121	0.6417	0.1006
14	466.24	1.44	0.06121	0.6611	0.1089
15	499.12	1.44	0.06109	0.6772	0.1173
16	531.39	1.44	0.06109	0.6939	0.1257
17	565.38	1.44	0.06115	0.7106	0.1341
18	600.22	1.44	0.06115	0.7257	0.1425
19	633.76	1.44	0.06115	0.7381	0.1508
20	668.19	1.44	0.06121	0.7478	0.1592
21	702.22	1.44	0.06121	0.7543	0.1676
22	736.72	1.44	0.06115	0.7553	0.176
23	772.13	1.439	0.06058	0.7521	0.1844
24	804.93	1.44	0.06008	0.7494	0.1927
25	838.10	1.44	0.06027	0.751	0.2011
26	873.29	1.44	0.06033	0.7548	0.2095
27	907.96	1.44	0.06058	0.7613	0.2179
28	940.97	1.44	0.06083	0.7661	0.2262
29	974.96	1.44	0.06121	0.771	0.2346
30	1009.21	1.44	0.0614	0.7758	0.243
31	1042.51	1.44	0.06178	0.7769	0.2513
32	1073.94	1.439	0.06191	0.778	0.2597
33	1112.13	1.44	0.06216	0.7801	0.2681
34	1143.69	1.44	0.06241	0.7823	0.2765
35	1177.31	1.44	0.0626	0.785	0.2849
36	1213.76	1.44	0.06273	0.7861	0.2932
37	1242.60	1.44	0.06298	0.7882	0.3006

DIRECT SHEAR TEST DATA

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Project: DYNERGY EDWARDS
Boring No.: EDW015 S10
Sample No.: S-10
Test No.: 40 PSI

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 11/10/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 31.0'-33.0'
Elevation: ----

Soil Description: BROWN AND GRAY MOTTLED SANDY LEAN CLAY WITH GRAVEL CL
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	2.887	0.06916	0	0
2	81.09	2.879	0.07142	0.4785	0.007876
3	117.60	2.879	0.07313	0.7219	0.01575
4	151.97	2.879	0.07376	0.8898	0.02363
5	186.66	2.879	0.07439	1.023	0.0315
6	221.15	2.879	0.07571	1.129	0.03938
7	253.83	2.879	0.07647	1.211	0.04725
8	289.37	2.879	0.07741	1.288	0.05513
9	323.30	2.879	0.07823	1.347	0.06301
10	356.53	2.879	0.07849	1.394	0.07088
11	391.02	2.879	0.07867	1.439	0.07876
12	424.56	2.879	0.07893	1.477	0.08663
13	459.98	2.879	0.07918	1.51	0.09451
14	492.86	2.879	0.07924	1.534	0.1024
15	523.80	2.879	0.07943	1.552	0.1103
16	556.72	2.879	0.07968	1.571	0.1181
17	588.93	2.879	0.07975	1.588	0.126
18	622.51	2.879	0.08	1.607	0.1339
19	657.43	2.879	0.08006	1.626	0.1418
20	692.69	2.879	0.08025	1.644	0.1496
21	724.45	2.879	0.08031	1.655	0.1575
22	759.66	2.879	0.08044	1.658	0.1654
23	791.34	2.88	0.08057	1.646	0.1733
24	825.40	2.879	0.08063	1.628	0.1811
25	858.43	2.879	0.08082	1.623	0.189
26	892.73	2.879	0.08031	1.623	0.1969
27	926.40	2.879	0.08038	1.63	0.2048
28	958.76	2.879	0.08101	1.635	0.2126
29	993.58	2.879	0.08088	1.643	0.2205
30	1027.07	2.879	0.08113	1.655	0.2284
31	1059.32	2.88	0.08132	1.662	0.2362
32	1094.50	2.879	0.08195	1.667	0.2441
33	1128.29	2.879	0.08189	1.671	0.252
34	1161.15	2.879	0.08227	1.676	0.2599
35	1194.98	2.879	0.08258	1.676	0.2677
36	1230.64	2.879	0.08271	1.684	0.2756
37	1263.56	2.879	0.08315	1.688	0.2835
38	1294.95	2.879	0.0834	1.693	0.2914
39	1331.25	2.879	0.08365	1.694	0.2992
40	1357.24	2.879	0.08391	1.696	0.3052

DIRECT SHEAR TEST DATA

Terracon Consulting Engineers & Scientists

Project: DYNERGY EDWARDS
Boring No.: EDW015 S10
Sample No.: S-10
Test No.: 80 PSI

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 11/12/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 31.0'-33.0'
Elevation: ----

Soil Description: BROWN AND GRAY MOTTLED SANDY LEAN CLAY WITH GRAVEL CL
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	5.485	0	0	0
2	36.40	5.485	0.003256	0.437	0.008716
3	71.32	5.485	0.006327	0.7826	0.01743
4	106.78	5.485	0.008001	1.076	0.02615
5	141.55	5.485	0.01042	1.313	0.03486
6	173.06	5.485	0.01219	1.499	0.04358
7	209.72	5.485	0.01358	1.693	0.05229
8	245.51	5.485	0.01507	1.854	0.06101
9	279.22	5.485	0.0161	1.987	0.06973
10	314.35	5.485	0.01805	2.098	0.07844
11	349.53	5.485	0.01898	2.187	0.08716
12	383.30	5.485	0.02	2.276	0.09587
13	415.59	5.485	0.02093	2.352	0.1046
14	449.70	5.485	0.0214	2.428	0.1133
15	485.17	5.485	0.02242	2.494	0.122
16	517.51	5.485	0.02317	2.551	0.1307
17	556.85	5.485	0.02382	2.612	0.1395
18	584.89	5.485	0.02447	2.627	0.1482
19	618.32	5.485	0.02503	2.678	0.1569
20	654.74	5.485	0.02568	2.719	0.1656
21	687.22	5.485	0.02596	2.742	0.1743
22	720.44	5.485	0.02652	2.766	0.183
23	755.56	5.485	0.02726	2.793	0.1917
24	788.89	5.485	0.02735	2.81	0.2005
25	823.96	5.485	0.02782	2.83	0.2092
26	856.37	5.485	0.02763	2.851	0.2179
27	893.08	5.485	0.02735	2.874	0.2266
28	925.58	5.485	0.02819	2.893	0.2353
29	960.00	5.485	0.02875	2.911	0.244
30	995.06	5.485	0.02931	2.924	0.2527
31	1031.53	5.485	0.02987	2.93	0.2614
32	1062.43	5.485	0.03042	2.929	0.2701
33	1097.75	5.486	0.03117	2.929	0.2789
34	1131.93	5.485	0.03182	2.926	0.2876
35	1165.06	5.485	0.03266	2.877	0.2963
36	1194.80	5.485	0.03284	2.897	0.3037

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO.: **MR155218** **11/17/2015**
PROJECT NAME: **DYNERGY - EDWARDS SITE**
CLIENT: **AECOM**
LOCATION : **BARTONVILLE, IL**

SUMMARY OF TEST RESULTS

BORING NO. EDW-B002

SAMPLE NO. S-5

DEPTH: 10.0'-12.0'

CLASSIFICATION GRAY TO DARK GRAY VARVED FLY ASH

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	55.9	59.7
WATER CONTENT (%)	66.4	60.8
DIAMETER (cm)	7.218	7.030
LENGTH (cm)	8.678	8.558
HYDRAULIC GRADIENT (MAXIMUM)	10.87	
PERCENT SATURATION	100.0	

SAMPLE PHOTO



(Percent saturation calculation is based on final measurements and an estimated specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec): 9.19E-05

Deaired water was used as the liquid permeant.

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO.: **MR155218** **11/17/2015**
PROJECT NAME: **DYNERGY - EDWARDS SITE**
CLIENT: **AECOM**
LOCATION : **BARTONVILLE, IL**

SUMMARY OF TEST RESULTS

BORING NO.	EDW-B003
SAMPLE NO.	S-9
DEPTH:	30.0'-32.0'
CLASSIFICATION	VERY DARK GRAY VARVED FLY ASH

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	53.2	59.3
WATER CONTENT (%)	71.2	61.7
DIAMETER (cm)	7.206	6.968
LENGTH (cm)	8.429	8.091
HYDRAULIC GRADIENT (MAXIMUM)	11.19	
PERCENT SATURATION	100.2	(Percent saturation calculation is based on final measurements and an estimated specific gravity.)
HYDRAULIC CONDUCTIVITY k (cm/sec)	6.79E-05	

SAMPLE PHOTO



Deaired water was used as the liquid permeant.

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO.: **MR155218** **11/17/2015**
PROJECT NAME: **DYNERGY - EDWARDS SITE**
CLIENT: **AECOM**
LOCATION : **BARTONVILLE, IL**

SUMMARY OF TEST RESULTS

BORING NO.	EDW-B004
SAMPLE NO.	S-11
DEPTH:	36.0'-38.0'
CLASSIFICATION	BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND CL

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	111.1	113.9
WATER CONTENT (%)	19.3	18.0
DIAMETER (cm)	7.117	7.074
LENGTH (cm)	8.145	8.042

SAMPLE PHOTO



HYDRAULIC GRADIENT (MAXIMUM)	20.21	
PERCENT SATURATION	100.5	(Percent saturation calculation is based on final measurements and an estimated specific gravity.)
HYDRAULIC CONDUCTIVITY k (cm/sec)	7.20E-07	

Deaired water was used as the liquid permeant.

UNCONFINED COMPRESSION TEST REPORT

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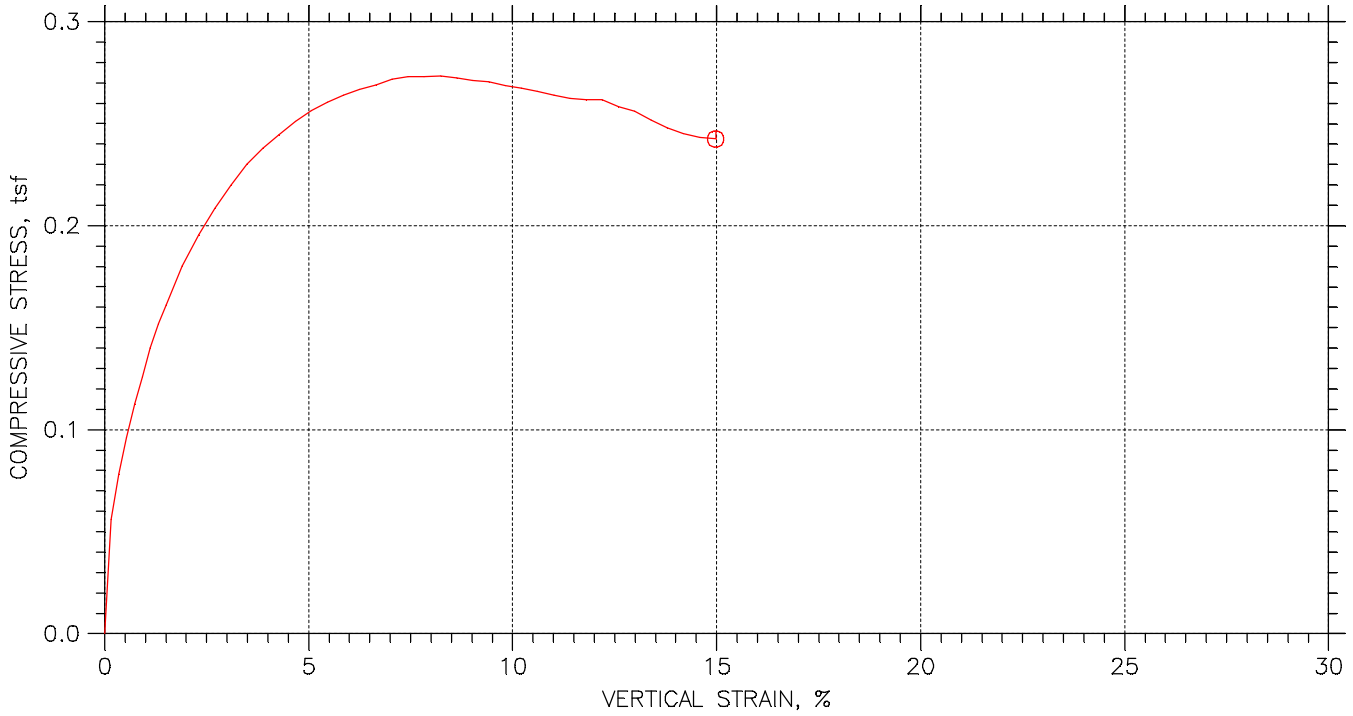

Symbol		⏲			
Test No.		EDW-002 S10			
Initial	Diameter, in	2.8118			
	Height, in	5.9587			
	Water Content, %	29.48			
	Dry Density, pcf	93.81			
	Saturation, %	98.98			
	Void Ratio	0.81002			
Unconfined Compressive Strength, tsf		0.27347			
Undrained Shear Strength, tsf		0.13673			
Time to Failure, min		10.5			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		36			
Plastic Limit		18			
Plasticity Index		18			
Failure Sketch					

Project: DYNERGY EDWARDS
Location: BARTONVILLE, IL
Project No.: MR155199
Boring No.: EDW-002 S10
Sample Type: 3.0" ST
Description: GRAY LEAN CLAY WITH SAND CL
Remarks: TEST PERFORMED AS PER ASTM D 2166.

UNCONFINED COMPRESSION TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-002 S10
Sample No.: S-10
Test No.: EDW-002 S10

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/17/15
Sample Type: 3.0" ST

Project No.: MR155199
Checked By: WPQ
Depth: 35.0'-37.0'
Elevation: -----

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Soil Description: GRAY LEAN CLAY WITH SAND CL
Remarks: TEST PERFORMED AS PER ASTM D 2166.

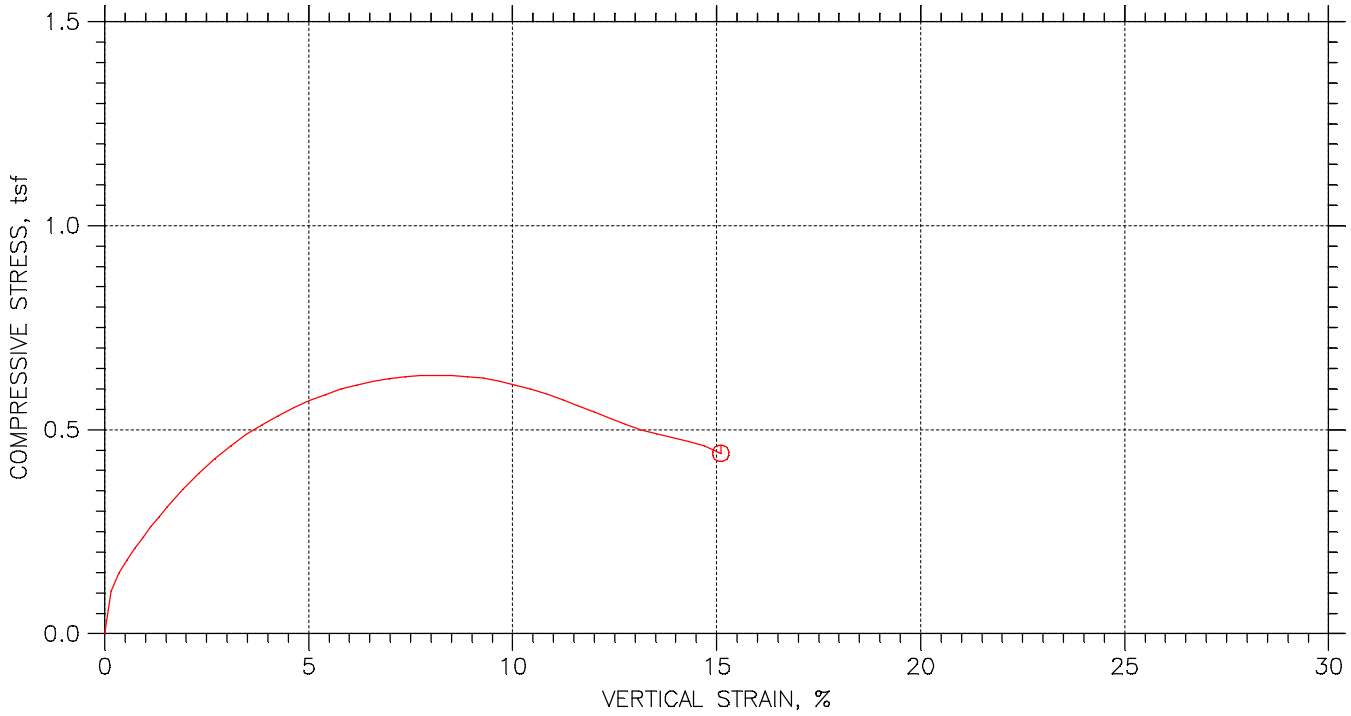
Specimen Height: 5.96 in
Specimen Area: 6.21 in^2
Specimen Volume: 37.00 in^3

Liquid Limit: 36
Plastic Limit: 18
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.2096	0	0
2	0.25007	0.0091325	0.15326	4.8253	6.2191	0.055864	0.027932
3	0.50007	0.020663	0.34678	6.7659	6.2312	0.078179	0.039089
4	0.75007	0.032286	0.54184	8.3394	6.2434	0.096171	0.048086
5	1.0001	0.043725	0.73381	9.808	6.2555	0.11289	0.056444
6	1.2501	0.055348	0.92887	10.962	6.2678	0.12592	0.062961
7	1.5001	0.066879	1.1224	12.221	6.2801	0.14011	0.070054
8	1.7501	0.078318	1.3144	13.27	6.2923	0.15184	0.075919
9	2.0001	0.089941	1.5094	14.109	6.3047	0.16112	0.080561
10	2.5001	0.11346	1.9042	15.84	6.3301	0.18016	0.090082
11	3.0001	0.13708	2.3005	17.256	6.3558	0.19548	0.097739
12	3.5001	0.1606	2.6953	18.462	6.3816	0.2083	0.10415
13	4.0001	0.18413	3.09	19.564	6.4076	0.21983	0.10991
14	4.5001	0.20756	3.4833	20.56	6.4337	0.23009	0.11504
15	5.0001	0.23108	3.878	21.347	6.4601	0.23792	0.11896
16	5.5001	0.2546	4.2728	22.029	6.4867	0.24451	0.12225
17	6.0001	0.27822	4.6691	22.71	6.5137	0.25103	0.12552
18	6.5001	0.30183	5.0654	23.287	6.5409	0.25634	0.12817
19	7.0001	0.32536	5.4602	23.759	6.5682	0.26045	0.13022
20	7.5001	0.34897	5.8565	24.179	6.5959	0.26394	0.13197
21	8.0001	0.37249	6.2513	24.546	6.6236	0.26682	0.13341
22	8.5001	0.39602	6.6461	24.861	6.6517	0.2691	0.13455
23	9.0001	0.41972	7.0439	25.228	6.6801	0.27191	0.13596
24	9.5001	0.44343	7.4418	25.438	6.7088	0.273	0.1365
25	10	0.46686	7.835	25.543	6.7375	0.27296	0.13648
26	10.5	0.49039	8.2298	25.7	6.7664	0.27347	0.13673
27	11	0.51372	8.6215	25.7	6.7954	0.2723	0.13615
28	11.5	0.53734	9.0178	25.7	6.825	0.27112	0.13556
29	12	0.56114	9.4172	25.753	6.8551	0.27048	0.13524
30	12.5	0.58503	9.8182	25.7	6.8856	0.26873	0.13437
31	13	0.60874	10.216	25.7	6.9161	0.26755	0.13377
32	13.5	0.63235	10.612	25.648	6.9468	0.26582	0.13291
33	14	0.65588	11.007	25.595	6.9776	0.26411	0.13205
34	14.5	0.67912	11.397	25.543	7.0083	0.26241	0.13121
35	15	0.70274	11.794	25.595	7.0398	0.26178	0.13089
36	15.5	0.72654	12.193	25.7	7.0718	0.26166	0.13083
37	16	0.75043	12.594	25.49	7.1043	0.25834	0.12917
38	16.5	0.77414	12.992	25.385	7.1368	0.2561	0.12805
39	17	0.79784	13.39	25.071	7.1696	0.25177	0.12589
40	17.5	0.82155	13.788	24.808	7.2026	0.24799	0.124
41	18	0.84517	14.184	24.651	7.2359	0.24529	0.12264
42	18.5	0.86887	14.582	24.546	7.2696	0.24311	0.12156
43	19	0.8924	14.976	24.599	7.3034	0.2425	0.12125

UNCONFINED COMPRESSION TEST REPORT



Symbol		⏲			
Test No.		EDWB003S12			
Initial	Diameter, in	2.8343			
	Height, in	6.0811			
	Water Content, %	41.57			
	Dry Density, pcf	79.31			
	Saturation, %	99.09			
	Void Ratio	1.141			
Unconfined Compressive Strength, tsf		0.63249			
Undrained Shear Strength, tsf		0.31624			
Time to Failure, min		10.504			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		51			
Plastic Limit		17			
Plasticity Index		34			
Failure Sketch					

Project: DYNERGY EDWARDS
Location: BARTONVILLE, IL
Project No.: MR155218
Boring No.: EDW-003 S12
Sample Type: 3.0" ST
Description: DARK GRAY FAT CLAY WITH SAND CH
Remarks: TEST PERFORMED AS PER ASTM D2166.

UNCONFINED COMPRESSION TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-003 S12
Sample No.: S-12
Test No.: EDWB003S12

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/13/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 45.0'-47.0'
Elevation: -----

Soil Description: DARK GRAY FAT CLAY WITH SAND CH
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 6.08 in
Specimen Area: 6.31 in^2
Specimen Volume: 38.37 in^3

Liquid Limit: 51
Plastic Limit: 17
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.3091	0	0
2	0.25402	0.0096859	0.15928	9.0737	6.3192	0.10339	0.051693
3	0.50402	0.021401	0.35193	13.007	6.3314	0.14792	0.07396
4	0.75402	0.033117	0.54458	15.945	6.3436	0.18097	0.090485
5	1.004	0.044924	0.73875	18.515	6.356	0.20973	0.10486
6	1.254	0.056824	0.93444	20.927	6.3686	0.23659	0.1183
7	1.504	0.068816	1.1316	23.235	6.3813	0.26216	0.13108
8	1.754	0.080808	1.3288	25.385	6.3941	0.28585	0.14293
9	2.004	0.092893	1.5276	27.536	6.407	0.30944	0.15472
10	2.504	0.11678	1.9205	31.522	6.4326	0.35282	0.17641
11	3.004	0.14058	2.3118	35.246	6.4584	0.39293	0.19646
12	3.504	0.1642	2.7002	38.55	6.4842	0.42806	0.21403
13	4.004	0.18754	3.084	41.592	6.5099	0.46002	0.23001
14	4.504	0.21115	3.4723	44.319	6.536	0.48822	0.24411
15	5.004	0.23505	3.8652	46.732	6.5628	0.5127	0.25635
16	5.504	0.25885	4.2565	48.935	6.5896	0.53468	0.26734
17	6.004	0.28246	4.6449	50.981	6.6164	0.55477	0.27739
18	6.504	0.30571	5.0272	52.764	6.643	0.57188	0.28594
19	7.004	0.32905	5.4109	54.285	6.67	0.58598	0.29299
20	7.504	0.35248	5.7962	55.753	6.6973	0.59938	0.29969
21	8.0041	0.37637	6.1891	56.96	6.7253	0.6098	0.3049
22	8.5041	0.40026	6.582	58.061	6.7536	0.61899	0.30949
23	9.0041	0.42388	6.9704	58.848	6.7818	0.62477	0.31238
24	9.5041	0.44721	7.3542	59.53	6.8099	0.6294	0.3147
25	10.004	0.47018	7.7319	60.054	6.8378	0.63235	0.31618
26	10.504	0.49343	8.1141	60.316	6.8662	0.63249	0.31624
27	11.004	0.51723	8.5055	60.526	6.8956	0.63198	0.31599
28	11.504	0.54121	8.8999	60.631	6.9255	0.63035	0.31517
29	12.004	0.56511	9.2928	60.474	6.9554	0.626	0.313
30	12.504	0.58835	9.6751	60.002	6.9849	0.6185	0.30925
31	13.004	0.61151	10.056	59.372	7.0145	0.60943	0.30471
32	13.504	0.63484	10.44	58.691	7.0445	0.59986	0.29993
33	14.004	0.65874	10.833	57.746	7.0756	0.58762	0.29381
34	14.504	0.68281	11.228	56.593	7.1071	0.57332	0.28666
35	15.004	0.70689	11.624	55.334	7.1389	0.55807	0.27904
36	15.504	0.73023	12.008	54.127	7.1701	0.54353	0.27177
37	16.004	0.7532	12.386	52.816	7.201	0.52809	0.26404
38	16.504	0.77598	12.761	51.505	7.2319	0.51278	0.25639
39	17.004	0.79904	13.14	50.456	7.2635	0.50015	0.25007
40	17.504	0.82266	13.528	49.669	7.2961	0.49015	0.24507
41	18.004	0.84637	13.918	48.987	7.3292	0.48124	0.24062
42	18.504	0.86998	14.306	48.201	7.3624	0.47138	0.23569
43	19.004	0.89341	14.692	47.257	7.3956	0.46007	0.23003
44	19.504	0.91666	15.074	45.736	7.4289	0.44326	0.22163
45	19.538	0.91823	15.1	45.631	7.4312	0.44211	0.22106

UNCONFINED COMPRESSION TEST REPORT

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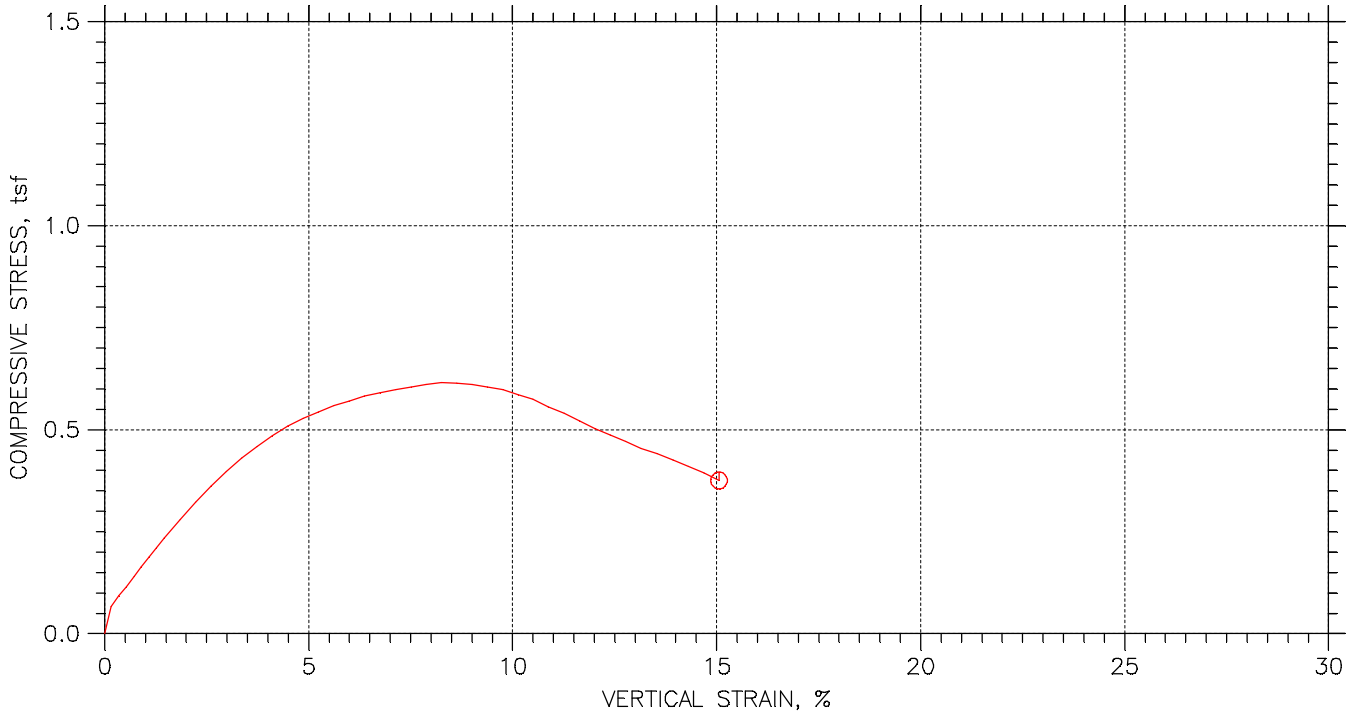

Symbol		⏲			
Test No.		EDWB004S11			
Initial	Diameter, in	2.8217			
	Height, in	6.2535			
	Water Content, %	19.25			
	Dry Density, pcf	111.4			
	Saturation, %	99.83			
	Void Ratio	0.52451			
Unconfined Compressive Strength, tsf		0.61504			
Undrained Shear Strength, tsf		0.30752			
Time to Failure, min		11.004			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		35			
Plastic Limit		17			
Plasticity Index		18			
Failure Sketch					

Project: DYNERGY EDWARDS
Location: BARTONVILLE, IL
Project No.: MR155218
Boring No.: EDW-004 S11
Sample Type: 3.0" ST
Description: BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND CL
Remarks: TEST PERFORMED AS PER ASTM D 2166.

UNCONFINED COMPRESSION TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-004 S11
Sample No.: S-11
Test No.: EDWB004S11

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/13/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 36.0'-38.0'
Elevation: -----

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Soil Description: BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND CL
Remarks: TEST PERFORMED AS PER ASTM D 2166.

Specimen Height: 6.25 in
Specimen Area: 6.25 in^2
Specimen Volume: 39.10 in^3

Liquid Limit: 35
Plastic Limit: 17
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.2531	0	0
2	0.25398	0.0096859	0.15489	5.717	6.2628	0.065724	0.032862
3	0.50398	0.021494	0.3437	8.0772	6.2747	0.092683	0.046341
4	0.75398	0.033117	0.52957	10.07	6.2864	0.11534	0.057668
5	1.004	0.04474	0.71543	12.221	6.2982	0.1397	0.069852
6	1.254	0.056363	0.9013	14.319	6.31	0.16338	0.081691
7	1.504	0.068078	1.0886	16.469	6.322	0.18756	0.093782
8	1.754	0.079701	1.2745	18.567	6.3339	0.21106	0.10553
9	2.004	0.091601	1.4648	20.665	6.3461	0.23446	0.11723
10	2.504	0.1154	1.8454	24.808	6.3707	0.28038	0.14019
11	3.004	0.13929	2.2274	28.637	6.3956	0.32239	0.1612
12	3.504	0.16291	2.6051	32.256	6.4204	0.36173	0.18087
13	4.004	0.18652	2.9827	35.56	6.4454	0.39724	0.19862
14	4.504	0.20977	3.3544	38.707	6.4702	0.43074	0.21537
15	5.004	0.2332	3.7291	41.382	6.4953	0.45872	0.22936
16	5.504	0.257	4.1097	43.952	6.5211	0.48528	0.24264
17	6.004	0.2808	4.4903	46.313	6.5471	0.50931	0.25465
18	6.504	0.30442	4.8679	48.201	6.5731	0.52798	0.26399
19	7.004	0.32794	5.244	49.827	6.5992	0.54363	0.27182
20	7.504	0.35128	5.6172	51.4	6.6253	0.55859	0.27929
21	8.004	0.37462	5.9904	52.606	6.6516	0.56944	0.28472
22	8.504	0.39832	6.3696	53.97	6.6785	0.58184	0.29092
23	9.004	0.42221	6.7516	55.019	6.7059	0.59073	0.29537
24	9.504	0.44601	7.1322	55.911	6.7334	0.59785	0.29893
25	10.004	0.46945	7.5069	56.802	6.7606	0.60494	0.30247
26	10.504	0.4926	7.8771	57.537	6.7878	0.61031	0.30515
27	11.004	0.51594	8.2503	58.219	6.8154	0.61504	0.30752
28	11.504	0.53928	8.6235	58.323	6.8433	0.61364	0.30682
29	12.004	0.56298	9.0026	58.323	6.8718	0.61109	0.30555
30	12.504	0.58678	9.3832	58.009	6.9006	0.60525	0.30263
31	13.004	0.6104	9.7608	57.537	6.9295	0.59783	0.29891
32	13.504	0.63355	10.131	56.593	6.9581	0.5856	0.2928
33	14.004	0.65671	10.501	55.701	6.9868	0.574	0.287
34	14.504	0.68014	10.876	54.18	7.0162	0.55599	0.278
35	15.004	0.70394	11.257	52.869	7.0463	0.54022	0.27011
36	15.504	0.72783	11.639	51.295	7.0768	0.52188	0.26094
37	16.004	0.75163	12.019	49.669	7.1074	0.50317	0.25158
38	16.504	0.77515	12.395	48.306	7.1379	0.48726	0.24363
39	17.004	0.79867	12.772	46.889	7.1687	0.47094	0.23547
40	17.504	0.82229	13.149	45.368	7.1998	0.45369	0.22685
41	18.004	0.84655	13.537	44.319	7.2322	0.44122	0.22061
42	18.504	0.87081	13.925	43.008	7.2648	0.42625	0.21312
43	19.004	0.89489	14.31	41.592	7.2974	0.41037	0.20519
44	19.504	0.91832	14.685	40.071	7.3294	0.39363	0.19682
45	20.004	0.94157	15.057	38.393	7.3615	0.3755	0.18775

UNCONFINED COMPRESSION TEST REPORT

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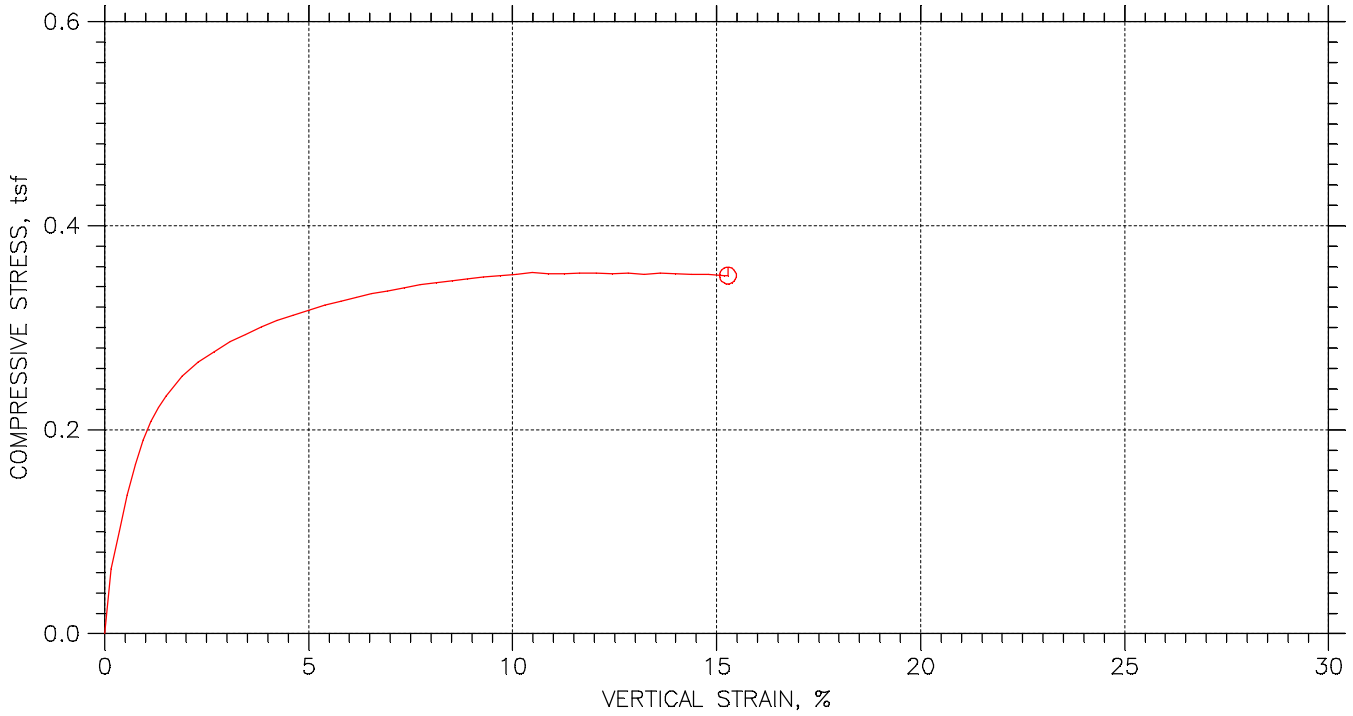

Symbol		⏲			
Test No.		EDWB008S5			
Initial	Diameter, in	2.8047			
	Height, in	6.0665			
	Water Content, %	33.59			
	Dry Density, pcf	88.9			
	Saturation, %	100.40			
	Void Ratio	0.91009			
Unconfined Compressive Strength, tsf		0.35399			
Undrained Shear Strength, tsf		0.177			
Time to Failure, min		13.504			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		52			
Plastic Limit		19			
Plasticity Index		33			
Failure Sketch					

Project: DYNERGY EDWARDS
Location: BARTONVILLE, IL
Project No.: MR155218
Boring No.: EDW-008 S5
Sample Type: 3.0" ST
Description: BROWN AND GRAY FAT CLAY WITH SAND CH
Remarks: TEST PERFORMED AS PER ASTM D2166.

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UNCONFINED COMPRESSION TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-008 S5
Sample No.: S-5
Test No.: EDWB008S5

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/13/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 11.0'-13.0'
Elevation: -----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWN AND GRAY FAT CLAY WITH SAND CH
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 6.07 in
Specimen Area: 6.18 in^2
Specimen Volume: 37.48 in^3

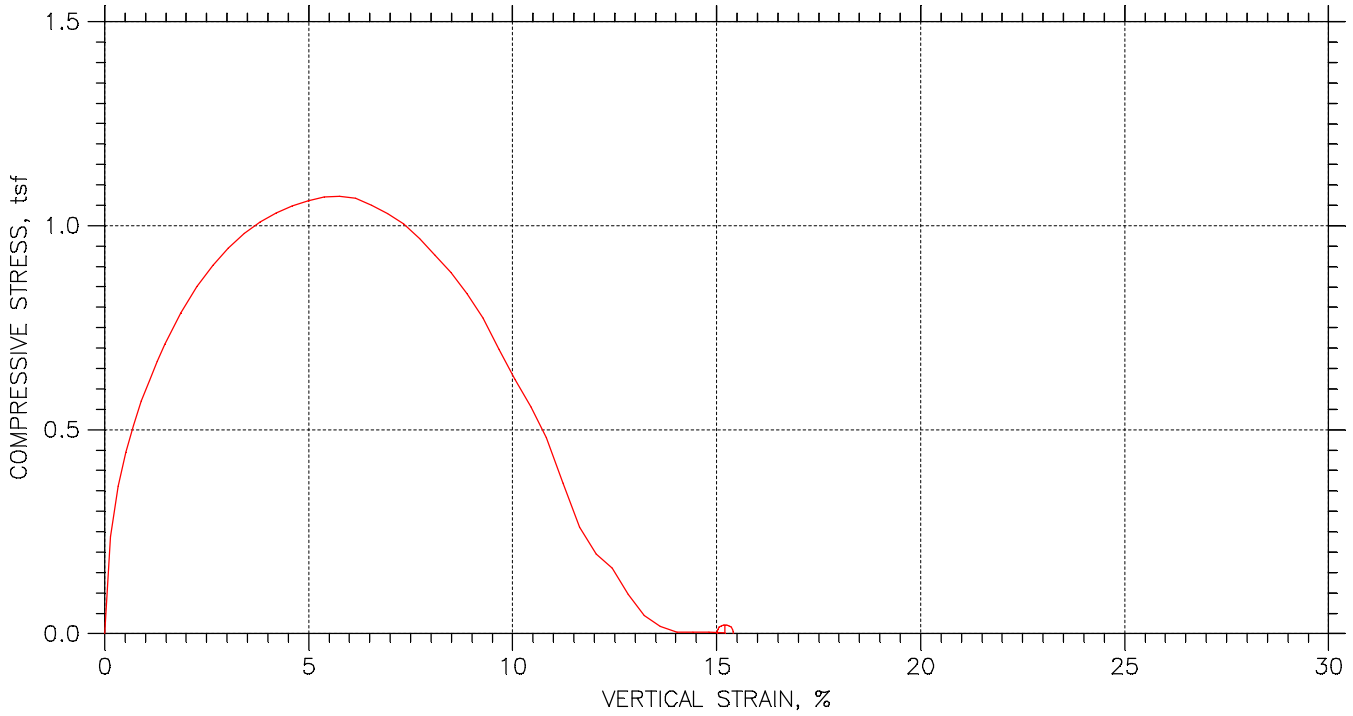
Liquid Limit: 52
Plastic Limit: 19
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.1783	0	0
2	0.254	0.0097782	0.16118	5.4547	6.1883	0.063465	0.031732
3	0.504	0.021678	0.35734	8.6541	6.2005	0.10049	0.050246
4	0.754	0.033578	0.55349	11.696	6.2127	0.13555	0.067774
5	1.004	0.045293	0.74661	14.319	6.2248	0.16562	0.082809
6	1.254	0.057009	0.93972	16.417	6.2369	0.18952	0.094758
7	1.504	0.068632	1.1313	18.042	6.249	0.20788	0.10394
8	1.754	0.080255	1.3229	19.301	6.2611	0.22195	0.11098
9	2.004	0.091878	1.5145	20.298	6.2733	0.23296	0.11648
10	2.504	0.11512	1.8977	22.081	6.2978	0.25244	0.12622
11	3.004	0.13865	2.2854	23.392	6.3228	0.26638	0.13319
12	3.504	0.16245	2.6778	24.389	6.3483	0.27661	0.1383
13	4.004	0.18615	3.0685	25.333	6.3739	0.28616	0.14308
14	4.504	0.20949	3.4533	26.067	6.3993	0.29329	0.14664
15	5.004	0.23274	3.8364	26.854	6.4248	0.30094	0.15047
16	5.504	0.25608	4.2212	27.483	6.4506	0.30676	0.15338
17	6.004	0.27969	4.6104	28.06	6.4769	0.31193	0.15596
18	6.504	0.30368	5.0058	28.637	6.5039	0.31702	0.15851
19	7.004	0.32748	5.3981	29.214	6.5309	0.32207	0.16104
20	7.504	0.35091	5.7843	29.686	6.5576	0.32594	0.16297
21	8.004	0.37406	6.166	30.158	6.5843	0.32978	0.16489
22	8.504	0.39731	6.5492	30.63	6.6113	0.33358	0.16679
23	9.004	0.42092	6.9384	30.997	6.639	0.33617	0.16808
24	9.504	0.445	7.3353	31.417	6.6674	0.33927	0.16963
25	10.004	0.46917	7.7337	31.837	6.6962	0.34232	0.17116
26	10.504	0.49315	8.1291	32.151	6.725	0.34422	0.17211
27	11.004	0.51658	8.5153	32.466	6.7534	0.34613	0.17307
28	11.504	0.53992	8.9	32.781	6.7819	0.34802	0.17401
29	12.004	0.56363	9.2908	33.095	6.8111	0.34985	0.17492
30	12.504	0.5878	9.6892	33.358	6.8412	0.35107	0.17554
31	13.004	0.61206	10.089	33.62	6.8716	0.35227	0.17613
32	13.504	0.63614	10.486	33.935	6.9021	0.35399	0.177
33	14.004	0.65966	10.874	33.987	6.9321	0.35301	0.1765
34	14.504	0.68309	11.26	34.092	6.9623	0.35256	0.17628
35	15.004	0.70661	11.648	34.354	6.9928	0.35372	0.17686
36	15.504	0.7305	12.042	34.459	7.0241	0.35322	0.17661
37	16.004	0.75467	12.44	34.564	7.0561	0.35269	0.17634
38	16.504	0.77875	12.837	34.774	7.0882	0.35322	0.17661
39	17.004	0.80255	13.229	34.826	7.1203	0.35216	0.17608
40	17.504	0.8258	13.612	35.088	7.1518	0.35325	0.17662
41	18.004	0.84923	13.999	35.193	7.184	0.35272	0.17636
42	18.504	0.87293	14.389	35.298	7.2168	0.35216	0.17608
43	19.004	0.89719	14.789	35.456	7.2506	0.35208	0.17604
44	19.504	0.92127	15.186	35.508	7.2846	0.35096	0.17548
45	19.621	0.92671	15.276	35.56	7.2923	0.35111	0.17555

UNCONFINED COMPRESSION TEST REPORT

Terracon
Consulting Engineers & Scientists



Symbol		⏲			
Test No.		EDWB015S12			
Initial	Diameter, in	2.8217			
	Height, in	6.061			
	Water Content, %	41.01			
	Dry Density, pcf	79.76			
	Saturation, %	98.82			
	Void Ratio	1.1289			
Unconfined Compressive Strength, tsf		1.0722			
Undrained Shear Strength, tsf		0.53609			
Time to Failure, min		7.5002			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		66			
Plastic Limit		23			
Plasticity Index		43			
Failure Sketch					

Project: DYNERGY EDWARDS
Location: BARTONVILLE, IL
Project No.: MR155218
Boring No.: EDW-015 S12
Sample Type: 3.0" ST
Description: DARK GRAY FAT CLAY CH
Remarks: TEST PERFORMED AS PER ASTM D 2166.

Mon, 16-NOV-2015 22:13:27

UNCONFINED COMPRESSION TEST

Project: DYNERGY EDWARDS
Boring No.: EDW-015 S12
Sample No.: S-12
Test No.: EDWB015S12

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/13/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 37.0'-39.0'
Elevation: -----

Terracon
Consulting Engineers & Scientists

Soil Description: DARK GRAY FAT CLAY CH
Remarks: TEST PERFORMED AS PER ASTM D 2166.

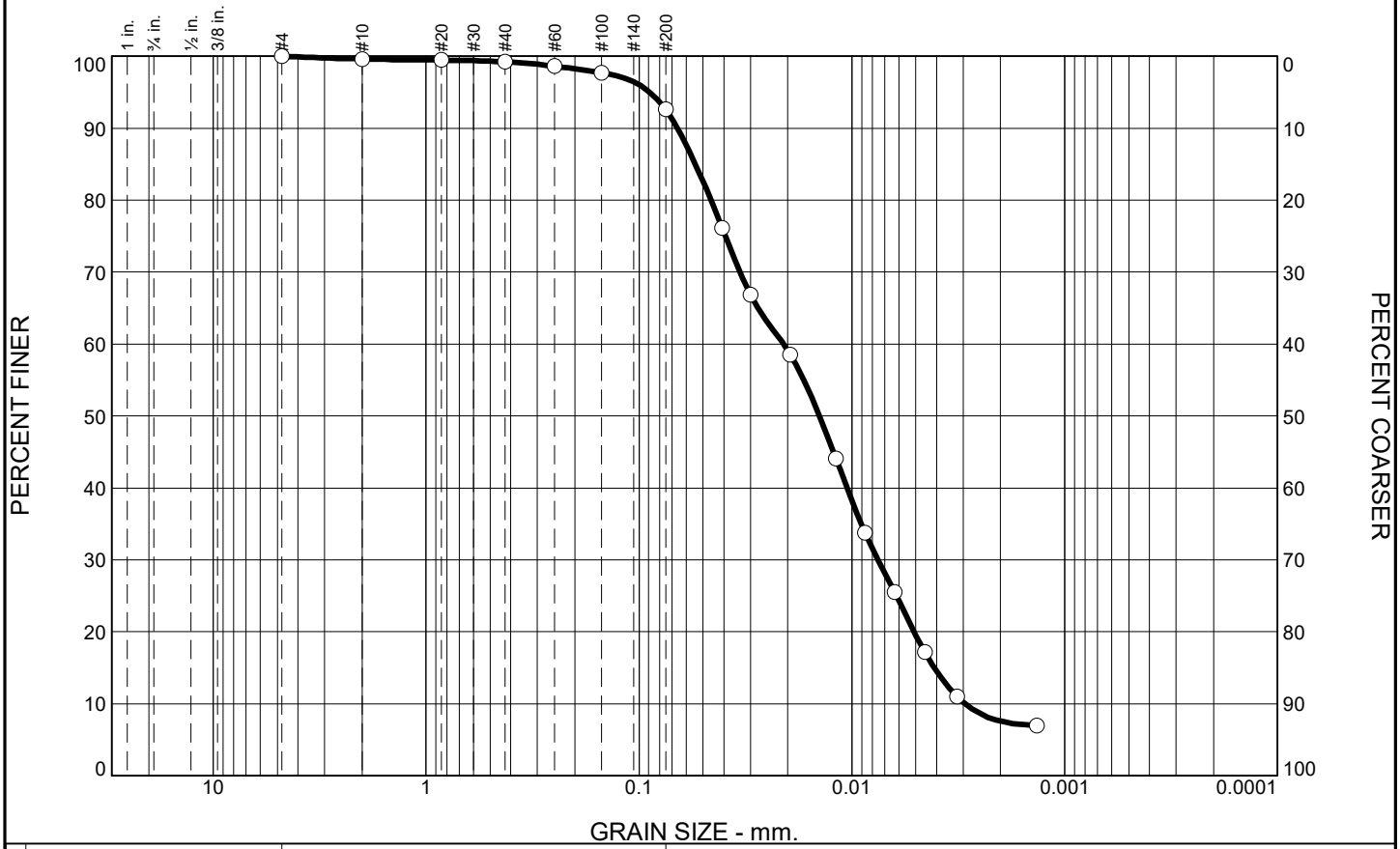
Specimen Height: 6.06 in
Specimen Area: 6.25 in^2
Specimen Volume: 37.90 in^3

Liquid Limit: 66
Plastic Limit: 23
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.2531	0	0
2	0.25015	0.0088557	0.14611	20.683	6.2623	0.2378	0.1189
3	0.50015	0.02011	0.33179	31.44	6.2739	0.3608	0.1804
4	0.75015	0.031548	0.52051	38.87	6.2858	0.44523	0.22261
5	1.0002	0.042987	0.70924	44.692	6.2978	0.51094	0.25547
6	1.2502	0.05461	0.90101	49.96	6.31	0.57006	0.28503
7	1.5002	0.066141	1.0913	54.506	6.3221	0.62075	0.31038
8	1.7502	0.077949	1.2861	58.665	6.3346	0.6668	0.3334
9	2.0002	0.089664	1.4794	62.547	6.347	0.70952	0.35476
10	2.5002	0.11346	1.872	69.644	6.3724	0.78689	0.39344
11	3.0002	0.13726	2.2647	75.633	6.398	0.85113	0.42556
12	3.5002	0.16069	2.6513	80.512	6.4234	0.90246	0.45123
13	4.0002	0.18385	3.0333	84.615	6.4487	0.94473	0.47236
14	4.5002	0.20728	3.4199	88.164	6.4745	0.98043	0.49021
15	5.0002	0.23089	3.8095	91.158	6.5008	1.0096	0.50482
16	5.5002	0.25497	4.2067	93.543	6.5277	1.0318	0.51588
17	6.0002	0.27905	4.604	95.428	6.5549	1.0482	0.5241
18	6.5002	0.30266	4.9936	96.98	6.5818	1.0609	0.53045
19	7.0002	0.32582	5.3756	98.2	6.6084	1.0699	0.53496
20	7.5002	0.34915	5.7607	98.81	6.6354	1.0722	0.53609
21	8.0002	0.37277	6.1503	98.755	6.6629	1.0672	0.53358
22	8.5002	0.39685	6.5475	97.535	6.6912	1.0495	0.52475
23	9.0002	0.42074	6.9417	96.149	6.7196	1.0302	0.51511
24	9.5002	0.44445	7.3329	94.097	6.7479	1.004	0.502
25	10	0.46769	7.7164	91.214	6.776	0.96922	0.48461
26	10.5	0.49085	8.0984	87.72	6.8042	0.92824	0.46412
27	11	0.51428	8.485	84.061	6.8329	0.88577	0.44289
28	11.5	0.53798	8.8761	79.514	6.8622	0.83428	0.41714
29	12	0.56215	9.2749	74.135	6.8924	0.77444	0.38722
30	12.5	0.58614	9.6706	67.093	6.9226	0.69782	0.34891
31	13	0.60966	10.059	60.162	6.9525	0.62304	0.31152
32	13.5	0.63291	10.442	53.897	6.9822	0.55578	0.27789
33	14	0.65652	10.832	46.854	7.0127	0.48106	0.24053
34	14.5	0.6806	11.229	36.153	7.0441	0.36953	0.18476
35	15	0.70532	11.637	25.617	7.0766	0.26064	0.13032
36	15.5	0.72986	12.042	19.296	7.1092	0.19543	0.097714
37	16	0.75366	12.435	15.969	7.1411	0.16101	0.080505
38	16.5	0.77773	12.832	9.5372	7.1736	0.095723	0.047862
39	17	0.80181	13.229	4.3805	7.2065	0.043765	0.021883
40	17.5	0.82543	13.619	1.7744	7.239	0.017648	0.0088241
41	18	0.8496	14.017	0.44359	7.2725	0.0043917	0.0021958
42	18.5	0.87404	14.421	0.38814	7.3068	0.0038247	0.0019123
43	19	0.89802	14.816	0.33269	7.3408	0.0032632	0.0016316
44	19.5	0.92164	15.206	0.16635	7.3745	0.0016241	0.00081206

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.4	0.4	6.6	73.1	19.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.6		
#20	99.5		
#40	99.2		
#60	98.6		
#100	97.7		
#200	92.6		

* (no specification provided)

DARK GRAY FLY ASH

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0659 D_{85}= 0.0543 D_{60}= 0.0210
D_{50}= 0.0142 D_{30}= 0.0075 D_{15}= 0.0041
D_{10}= 0.0029 C_u= 7.16 C_c= 0.92

Classification

USCS= AASHTO=

Remarks

F.M.=0.05

Source of Sample: EDW-B002 **Depth:** 7.5'-10.0'
Sample Number: S-4 **Date:** 11-5-15

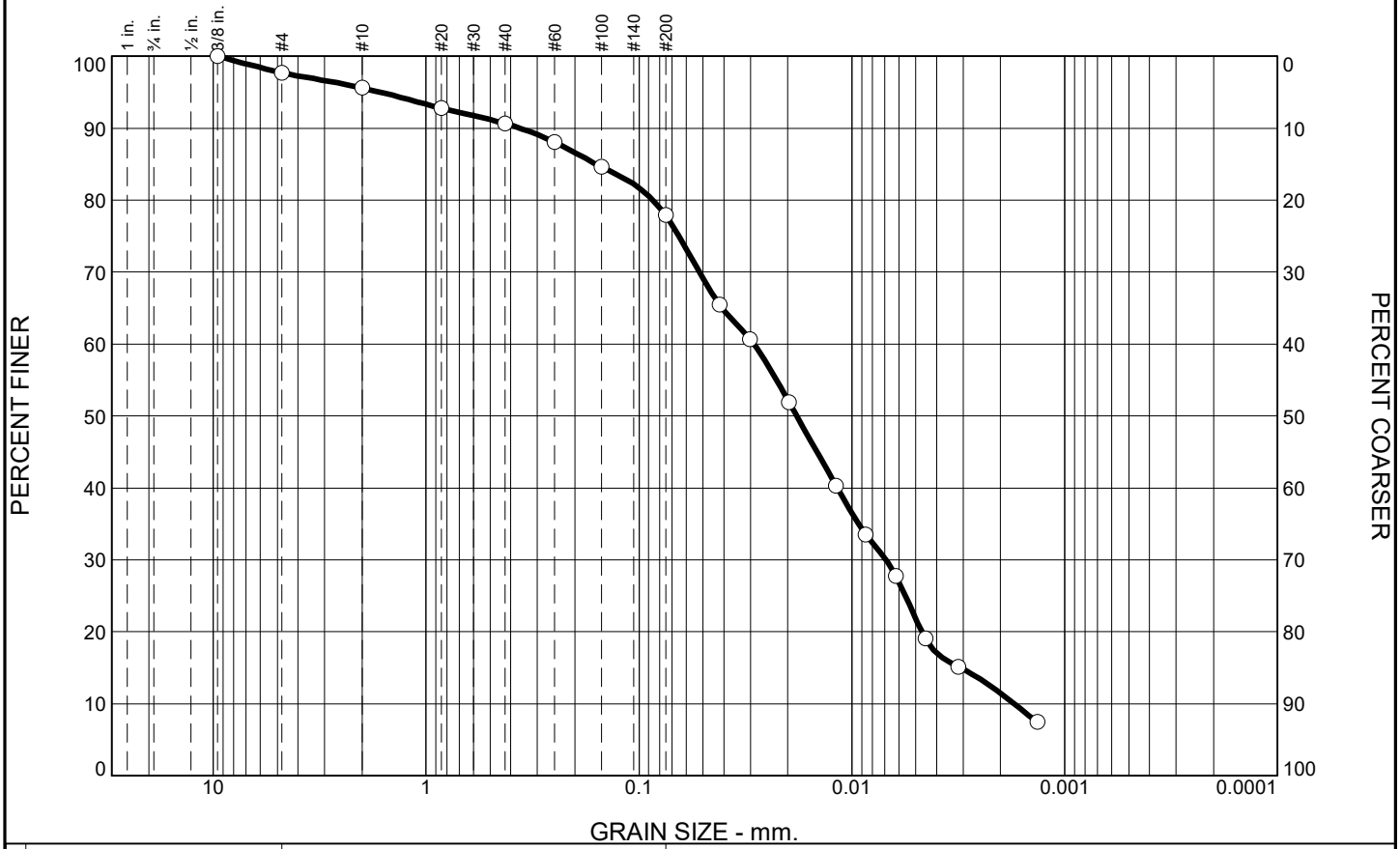
Terracon

Client: DYNERGY
Project: DYNERGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.3	2.1	5.0	12.7	56.3	21.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	97.7		
#10	95.6		
#20	92.8		
#40	90.6		
#60	88.1		
#100	84.6		
#200	77.9		

* (no specification provided)

FILL: DARK GRAY FLY ASH

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3632 D_{85}= 0.1593 D_{60}= 0.0290
D_{50}= 0.0181 D_{30}= 0.0069 D_{15}= 0.0031
D_{10}= 0.0017 C_u= 16.81 C_c= 0.96

Classification

USCS= AASHTO=

Remarks

F.M.=0.47

Source of Sample: EDW-B003 **Depth:** 10.0'-11.5'
Sample Number: S-5 **Date:** 11-5-15

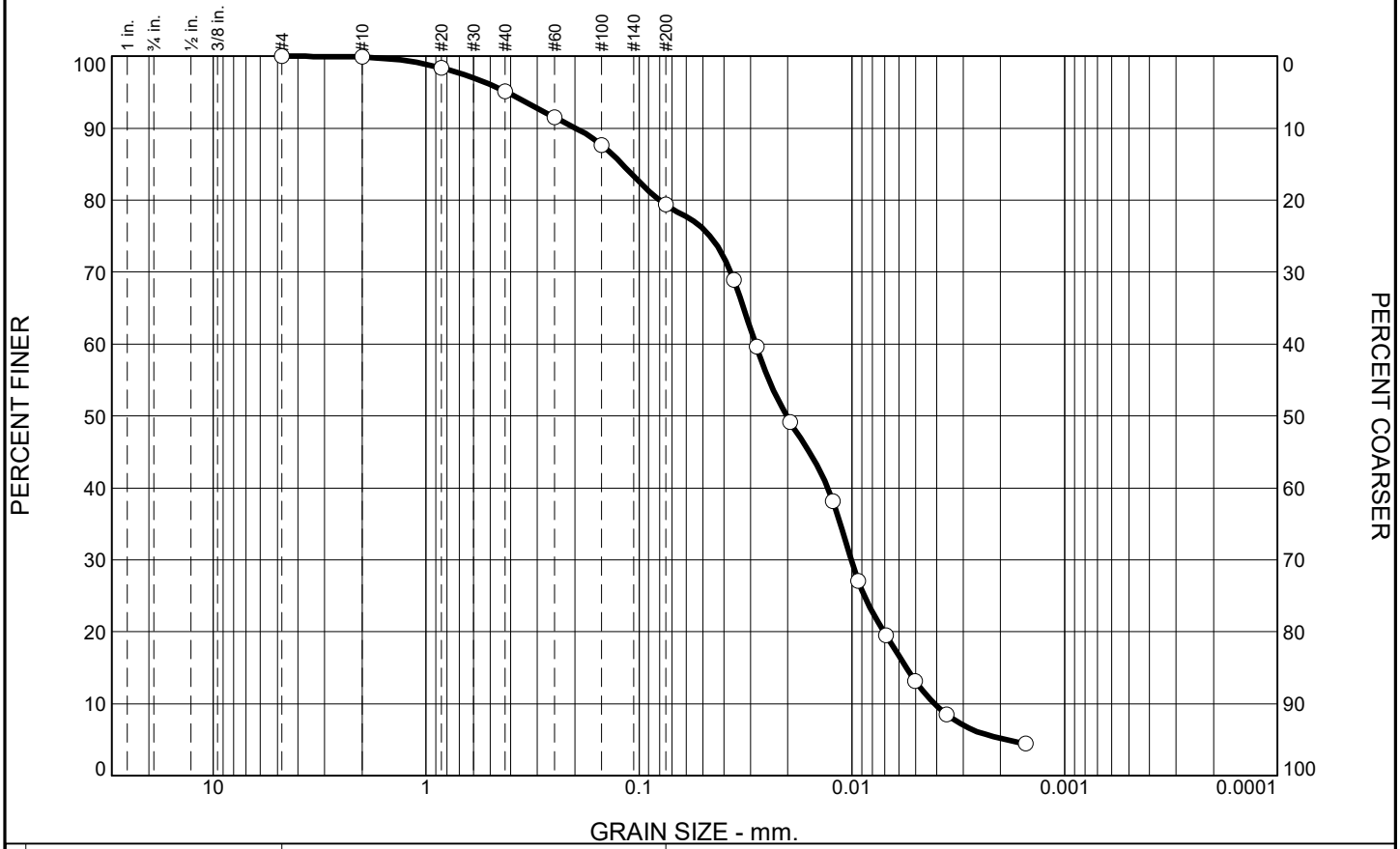
Terracon

Client: DYNERGY
Project: DYNERGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	4.8	15.7	66.4	13.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	98.4		
#40	95.1		
#60	91.5		
#100	87.6		
#200	79.4		

* (no specification provided)

FILL: VERY DARK GRAY VARVED FLY ASH

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1981 D_{85}= 0.1202 D_{60}= 0.0284
D_{50}= 0.0203 D_{30}= 0.0101 D_{15}= 0.0056
D_{10}= 0.0041 C_u= 6.92 C_c= 0.87

Classification

USCS= AASHTO=

Remarks

F.M.=0.23

Source of Sample: EDW-B003 **Depth:** 30.0'-32.0'
Sample Number: S-9 **Date:** 11-5-15

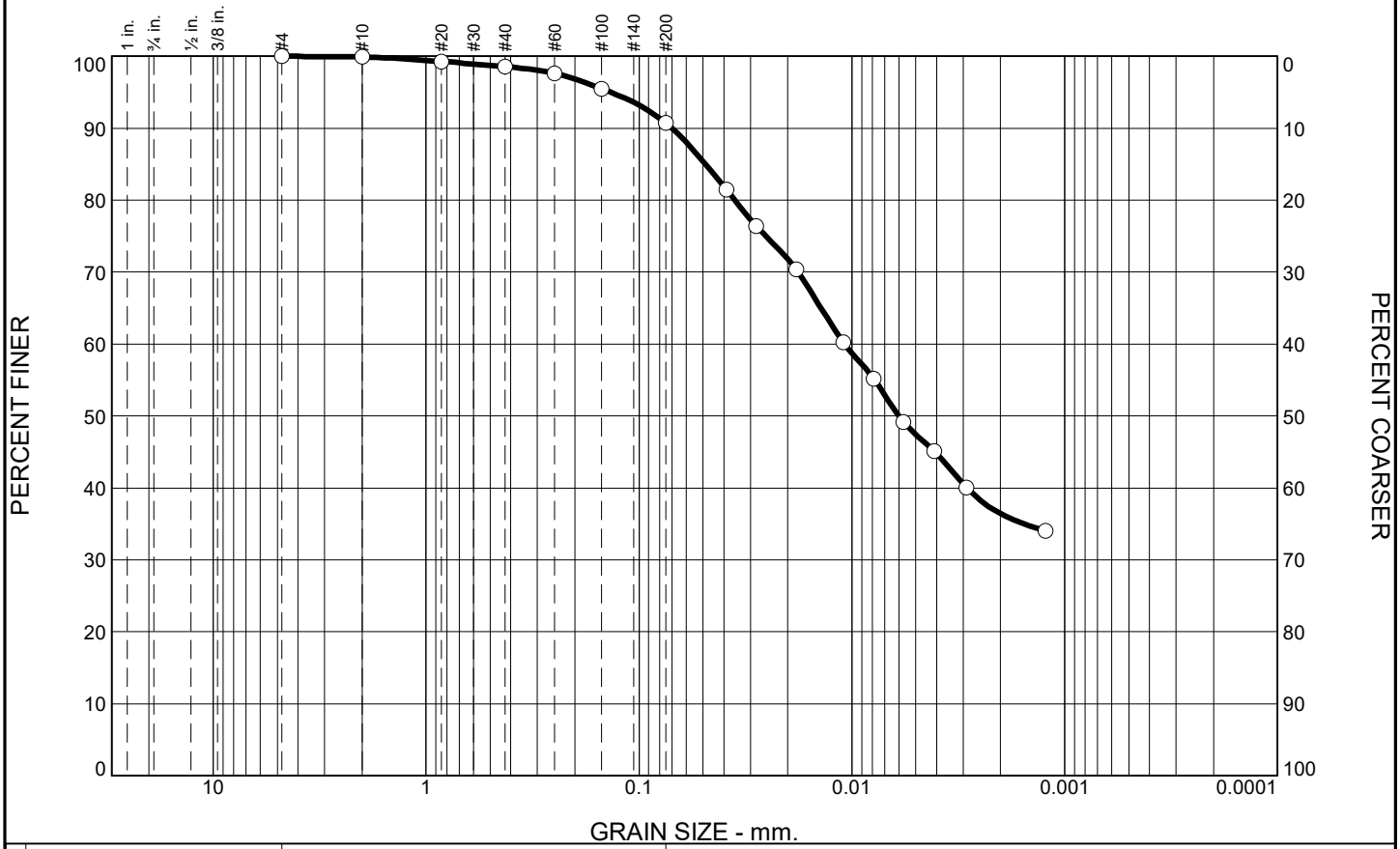
Terracon

Client: DYNERGY
Project: DYNERGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	1.4	7.8	43.3	47.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	99.3		
#40	98.5		
#60	97.6		
#100	95.5		
#200	90.7		

* (no specification provided)

GRAY AND DARK GRAY LEAN CLAY WITH ORGANICS

Atterberg Limits

PL= 16 LL= 37 PI= 21

Coefficients

D_{90}= 0.0702 D_{85}= 0.0486 D_{60}= 0.0108
D_{50}= 0.0060 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(19)

Remarks

F.M.=0.08

Source of Sample: EDW-B004 **Depth:** 7.5'-9.0'
Sample Number: S-4 **Date:** 11-5-15

Terracon

Client: DYNERGY
Project: DYNERGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.1	1.6	5.6	14.1	51.7	23.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	96.9		
#10	95.3		
#20	92.5		
#40	89.7		
#60	86.7		
#100	82.6		
#200	75.6		

* (no specification provided)

FILL: GRAY FLY ASH

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4580 D_{85}= 0.1999 D_{60}= 0.0244
D_{50}= 0.0136 D_{30}= 0.0065 D_{15}= 0.0028
D_{10}= 0.0019 C_u= 12.93 C_c= 0.91

Classification

USCS= AASHTO=

Remarks

F.M.=0.52

Source of Sample: EDW-B005 **Depth:** 20.0'-21.5'
Sample Number: S-7 **Date:** 11-13-15

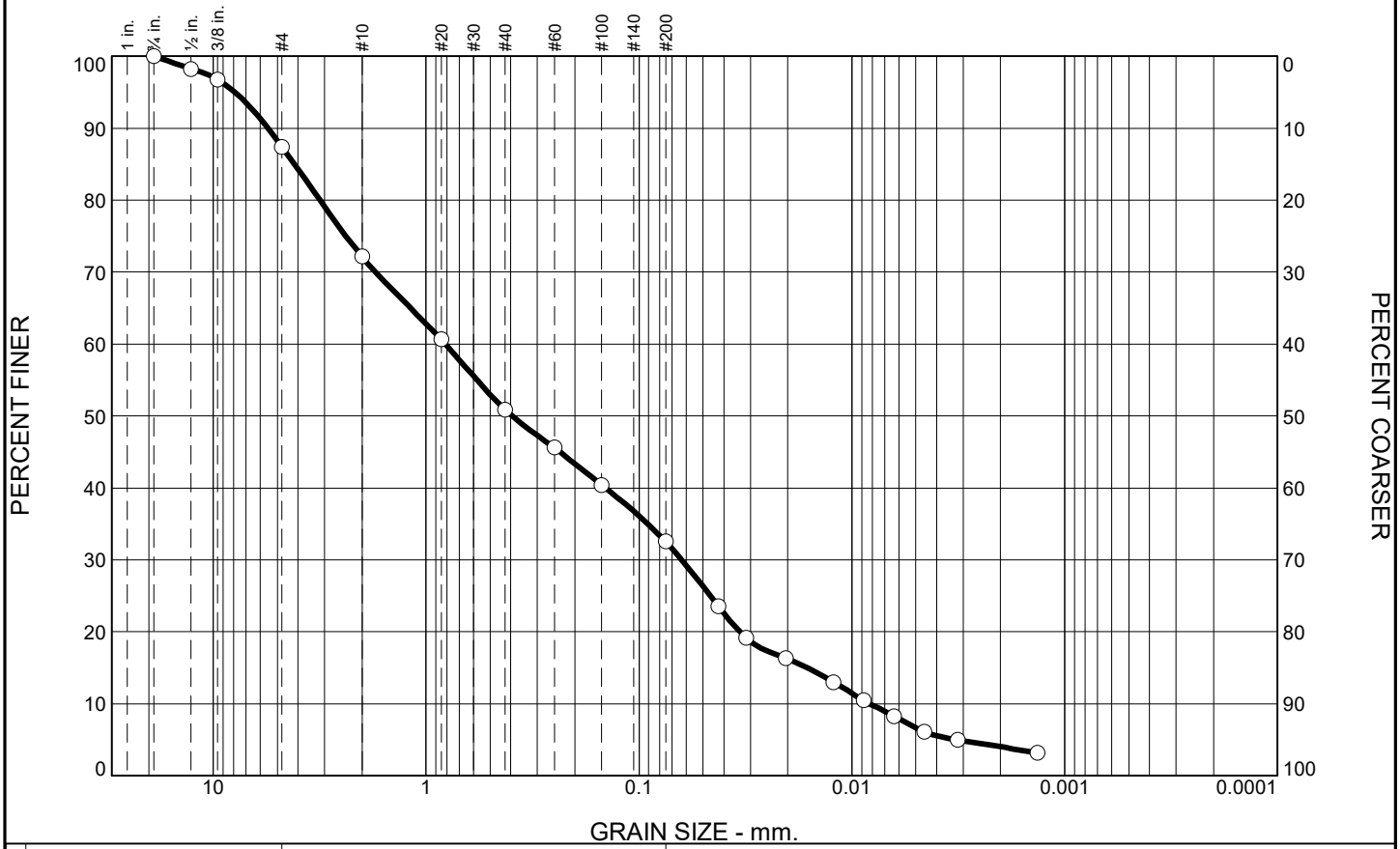
Terracon

Client: DYNERGY
Project: DYNERGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	12.6	15.3	21.2	18.3	26.0	6.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	98.2		
.375	96.7		
#4	87.4		
#10	72.1		
#20	60.6		
#40	50.9		
#60	45.6		
#100	40.4		
#200	32.6		

* (no specification provided)

FILL: DARK BROWN AND DARK GRAY SAND WITH GRAVEL - FLY ASH NOTED

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 5.5350 D_{85}= 4.1471 D_{60}= 0.8124
D_{50}= 0.3943 D_{30}= 0.0630 D_{15}= 0.0162
D_{10}= 0.0082 C_u= 98.50 C_c= 0.59

Classification

USCS= SP AASHTO=

Remarks

F.M.=2.33

Source of Sample: EDW-B010 **Depth:** 5.0'-6.5'
Sample Number: S-3 **Date:** 11-5-15

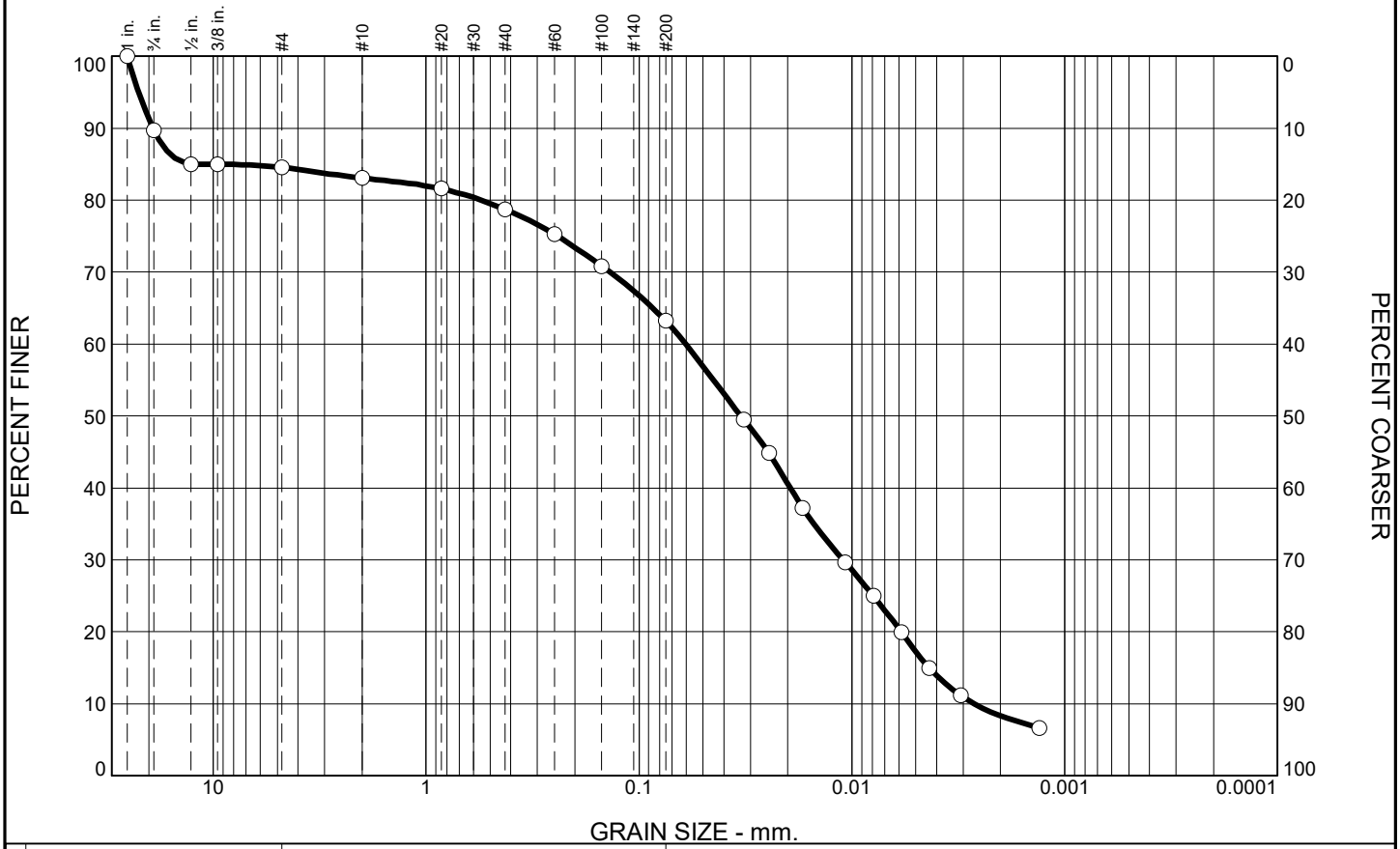
Terracon

Client: DYNERGY
Project: DYNERGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.3	5.2	1.4	4.4	15.5	46.0	17.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	89.7		
.5	85.0		
.375	85.0		
#4	84.5		
#10	83.1		
#20	81.6		
#40	78.7		
#60	75.3		
#100	70.8		
#200	63.2		

* (no specification provided)

FILL: VERY DARK GRAY FLY ASH

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 19.2789 D_{85}= 8.9744 D_{60}= 0.0604
D_{50}= 0.0333 D_{30}= 0.0110 D_{15}= 0.0043
D_{10}= 0.0027 C_u= 22.70 C_c= 0.75

Classification

USCS= AASHTO=

Remarks

F.M.=1.47

Source of Sample: EDW-B011 **Depth:** 9.0'-11.0'
Sample Number: S-5 **Date:** 11-12-15

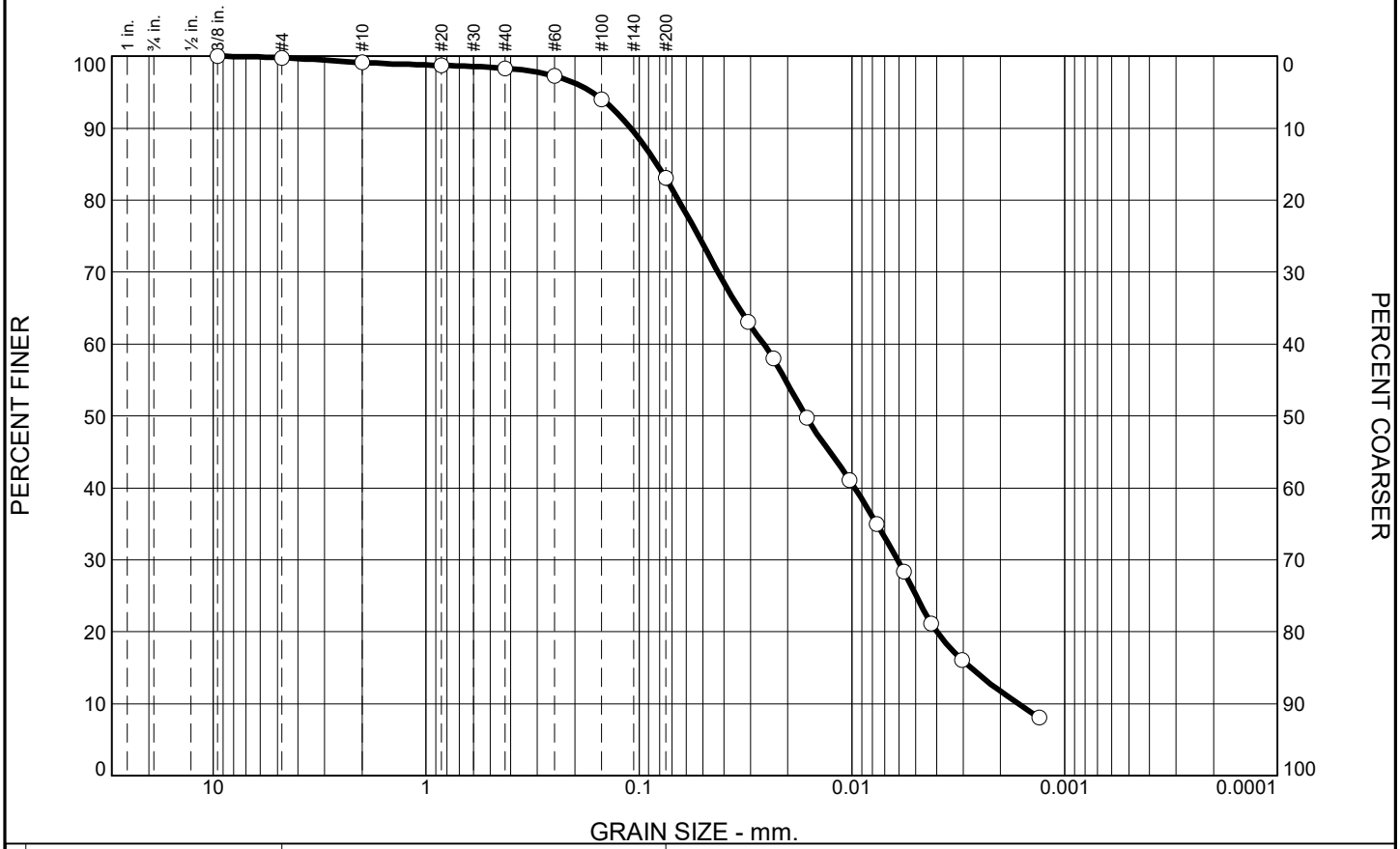
Terracon

Client: DYNERGY
Project: DYNERGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.2	0.7	0.8	15.2	58.0	25.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.8		
#10	99.1		
#20	98.7		
#40	98.3		
#60	97.3		
#100	94.0		
#200	83.1		

* (no specification provided)

FILL: GRAY FLY ASH

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1094 D_{85}= 0.0823 D_{60}= 0.0260
D_{50}= 0.0165 D_{30}= 0.0061 D_{15}= 0.0028
D_{10}= 0.0017 C_u= 15.75 C_c= 0.87

Classification

USCS= AASHTO=

Remarks

F.M.=0.12

Source of Sample: EDW-B011 **Depth:** 19.5'-21.5'
Sample Number: S-7 **Date:** 11-11-15

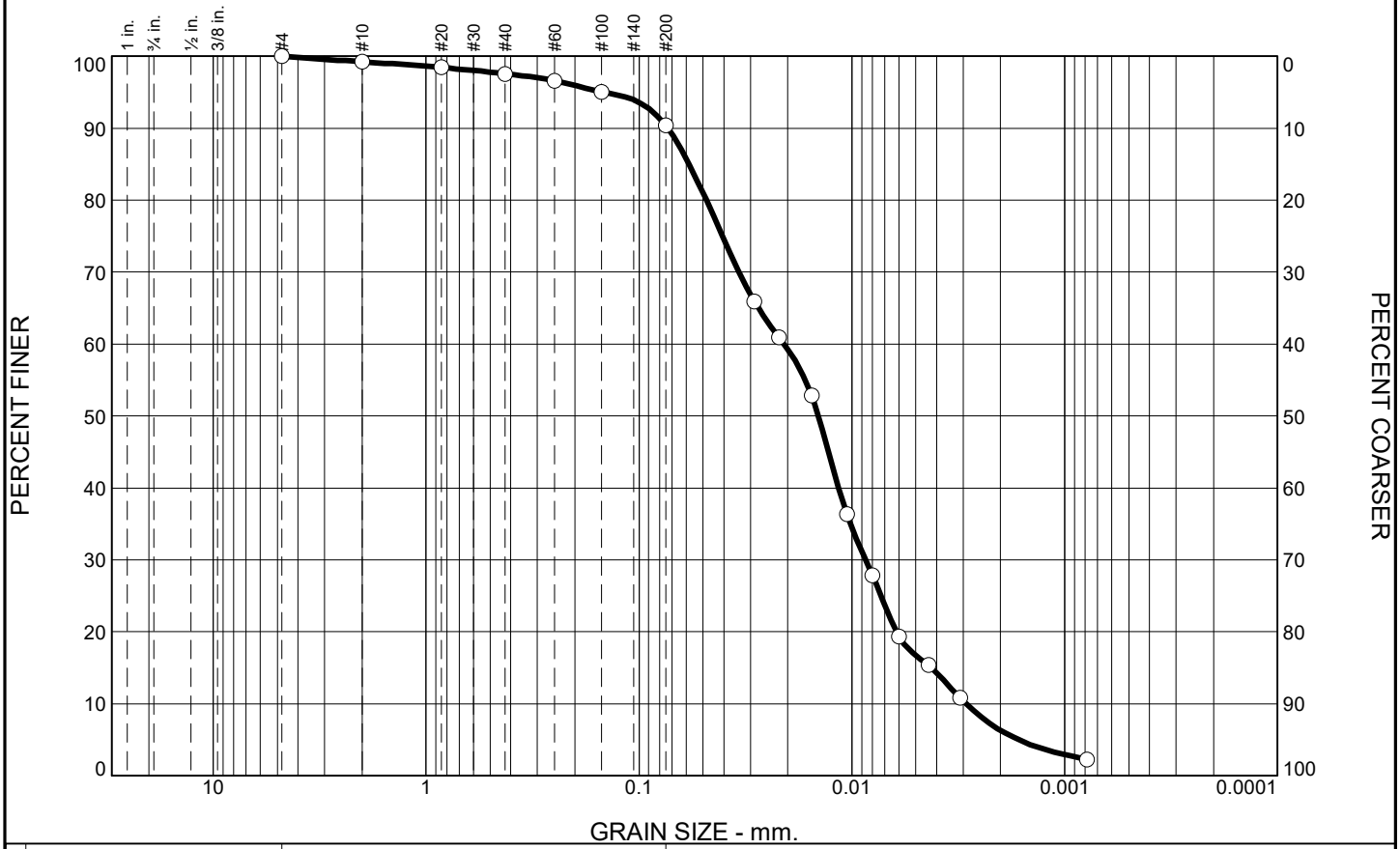
Terracon

Client: DYNERGY
Project: DYNERGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.8	1.6	7.2	73.7	16.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.2		
#20	98.4		
#40	97.6		
#60	96.6		
#100	95.1		
#200	90.4		

* (no specification provided)

FILL: DARK GRAY FLY ASH

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0732 D_{85}= 0.0581 D_{60}= 0.0208
D_{50}= 0.0144 D_{30}= 0.0086 D_{15}= 0.0042
D_{10}= 0.0029 C_u= 7.17 C_c= 1.22

Classification

USCS= AASHTO=

Remarks

F.M.=0.12

Source of Sample: EDW-B012 **Depth:** 5.0'-6.5'
Sample Number: S-3 **Date:** 11-13-15

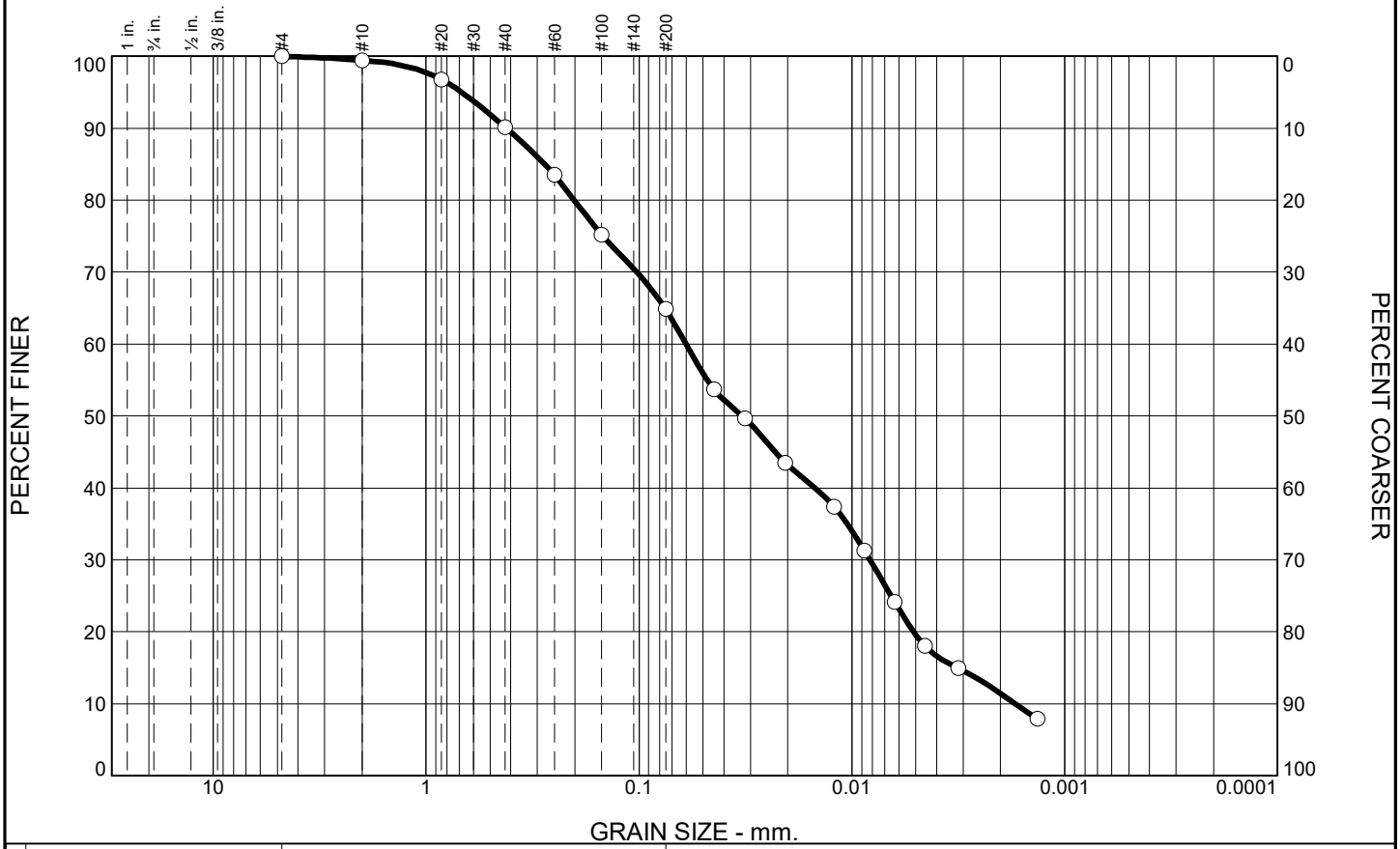
Terracon

Client: DYNERGY
Project: DYNERGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.6	9.3	25.2	45.4	19.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.4		
#20	96.8		
#40	90.1		
#60	83.5		
#100	75.2		
#200	64.9		

* (no specification provided)

FILL: GRAY SILTY SAND WITH GRAVEL - FLY ASH NOTED

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4213 D_{85}= 0.2775 D_{60}= 0.0602
D_{50}= 0.0328 D_{30}= 0.0082 D_{15}= 0.0032
D_{10}= 0.0017 C_u= 35.34 C_c= 0.66

Classification

USCS= SM AASHTO=

Remarks

F.M.=0.47

Source of Sample: EDW-B014 **Depth:** 7.0'-8.5'
Sample Number: S-4 **Date:** 11-5-15

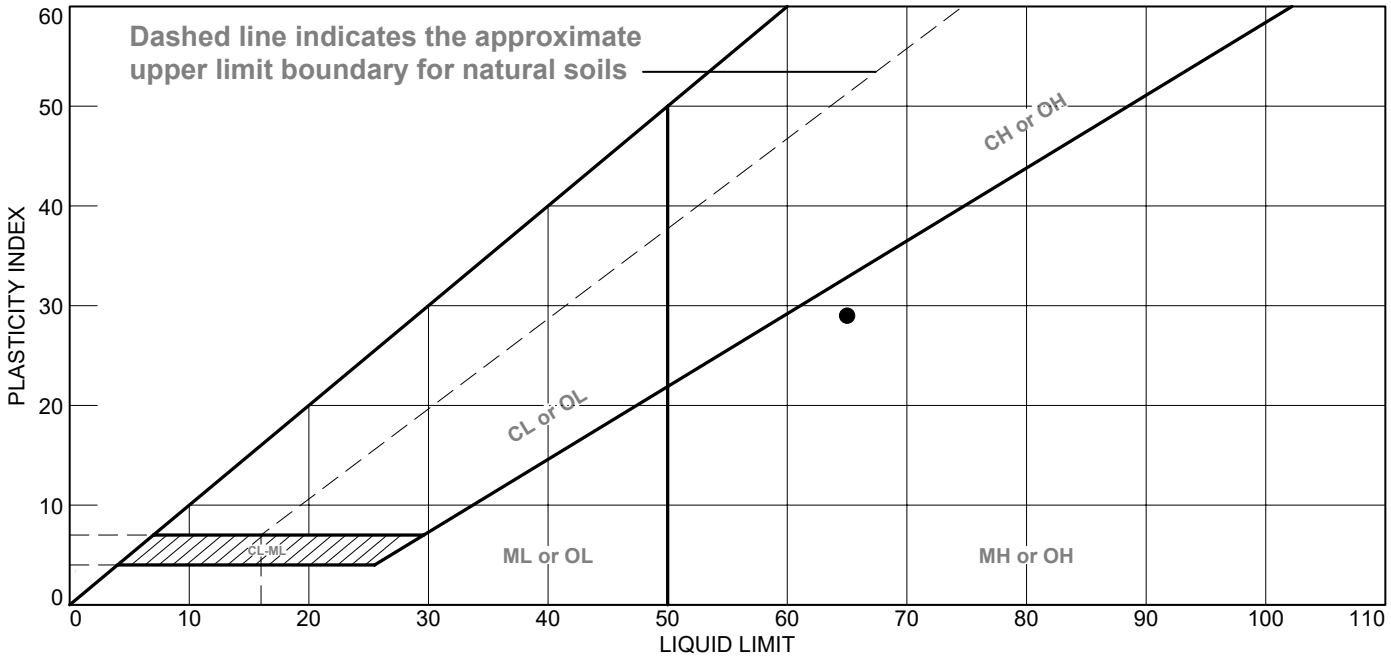
Terracon

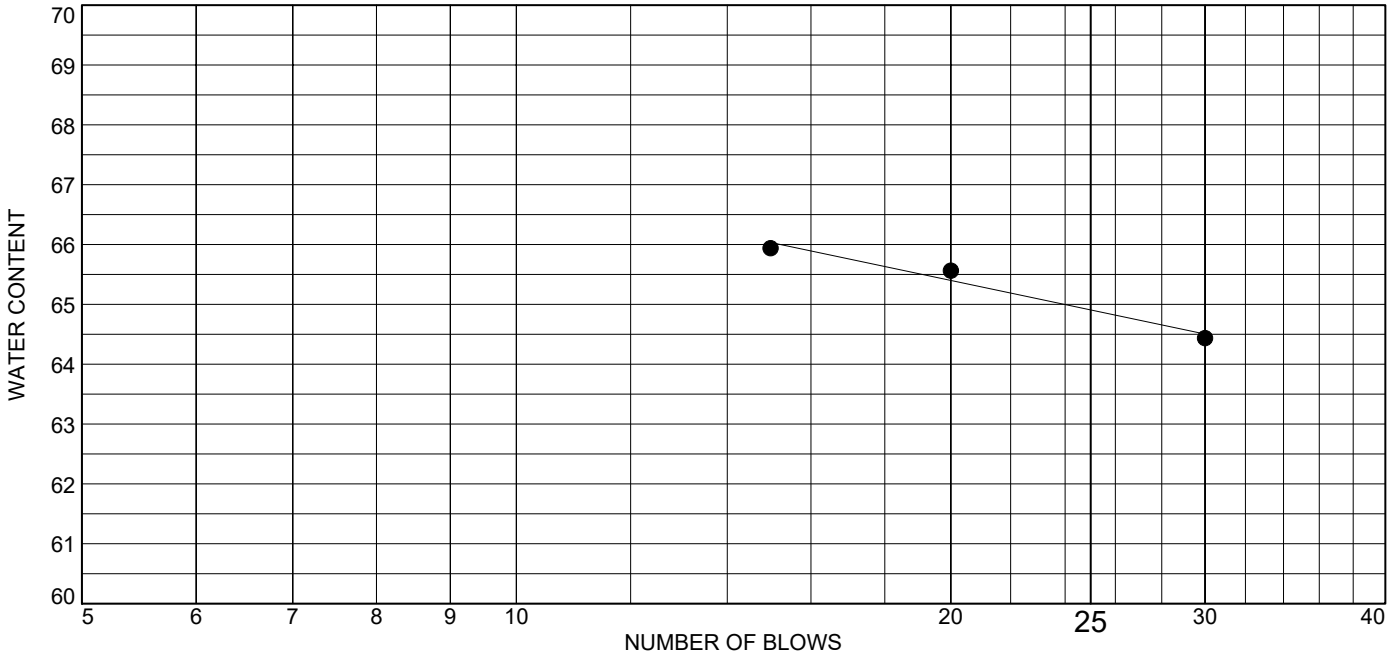
Client: DYNERGY
Project: DYNERGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GREENISH GRAY SANDY SILT	65	36	29			MH

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

Source of Sample: EDW-B002 **Depth:** 5.0'-7.0'
Sample Number: S-3

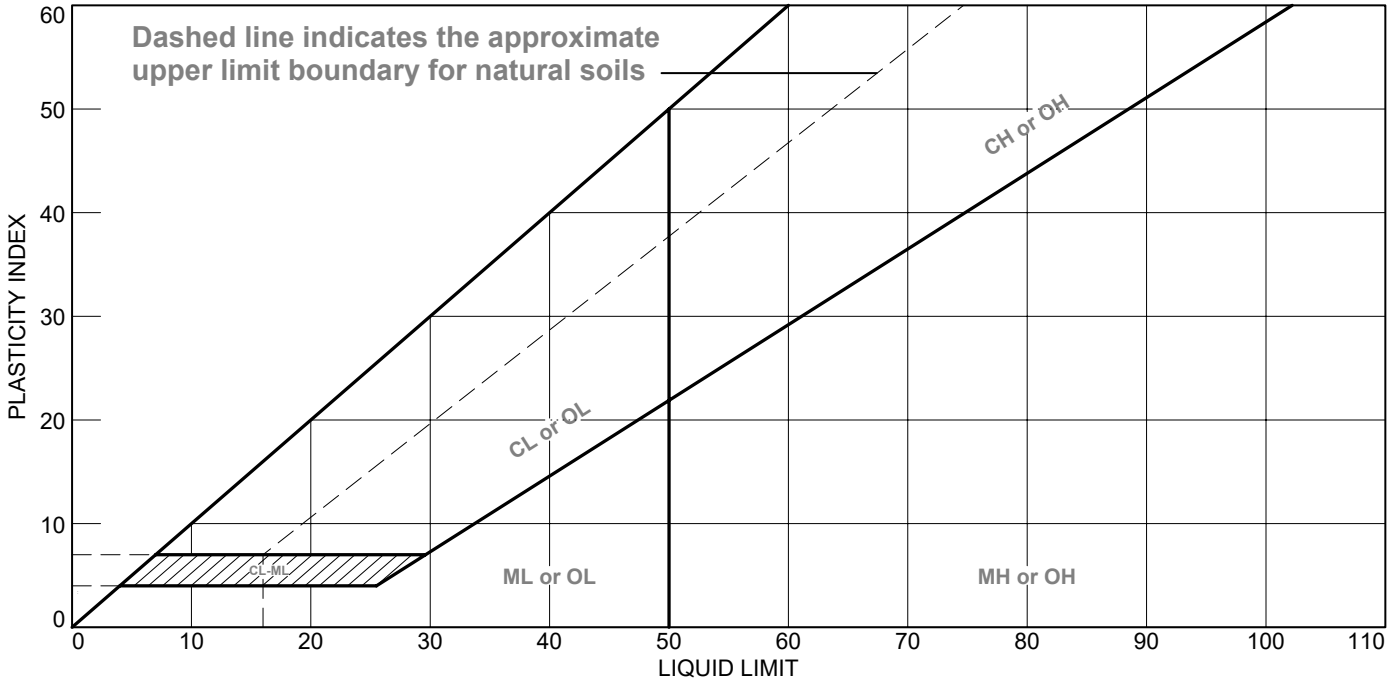
Terracon

Remarks:
● SHELL NOTED

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY TO DARK GRAY FLY ASH	17	27	NP			

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

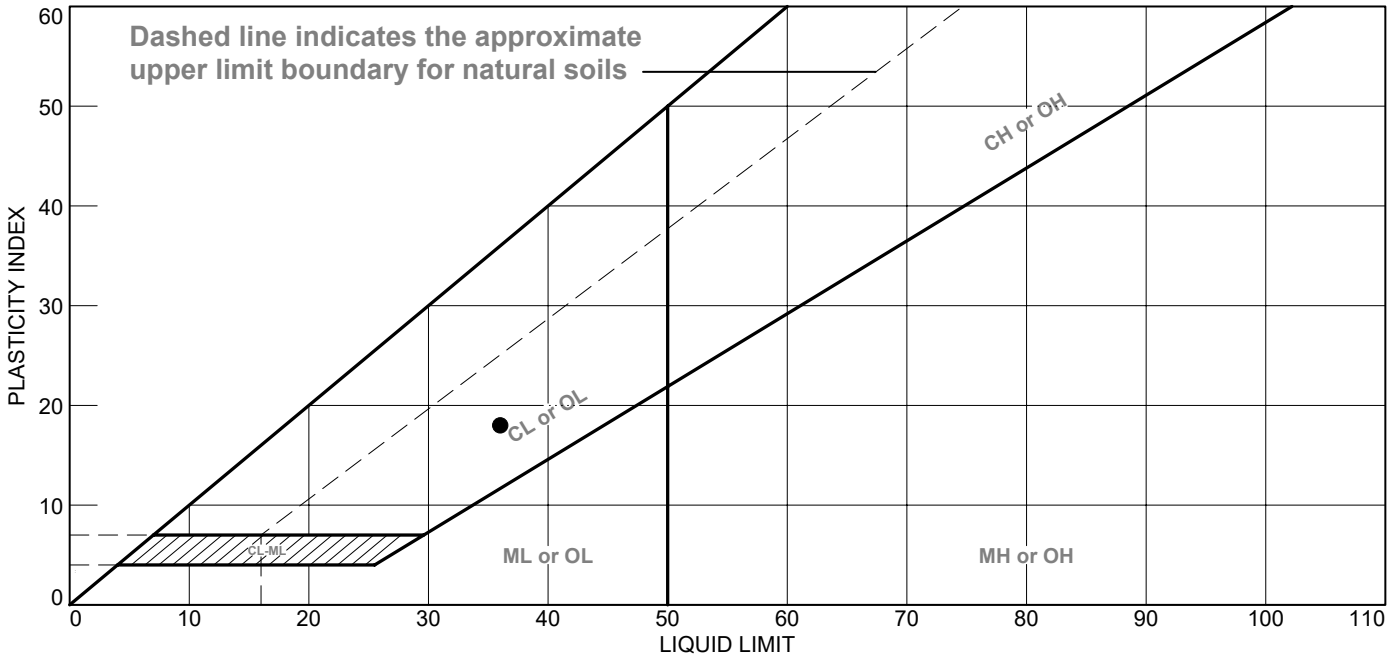
Source of Sample: EDW-B002 **Depth:** 10.0'-12.0'
Sample Number: S-5

Remarks:

Terracon

Figure

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY LEAN CLAY WITH SAND	36	18	18			CL

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

Source of Sample: EDW-B002 **Depth:** 35.0'-37.0'
Sample Number: S-10

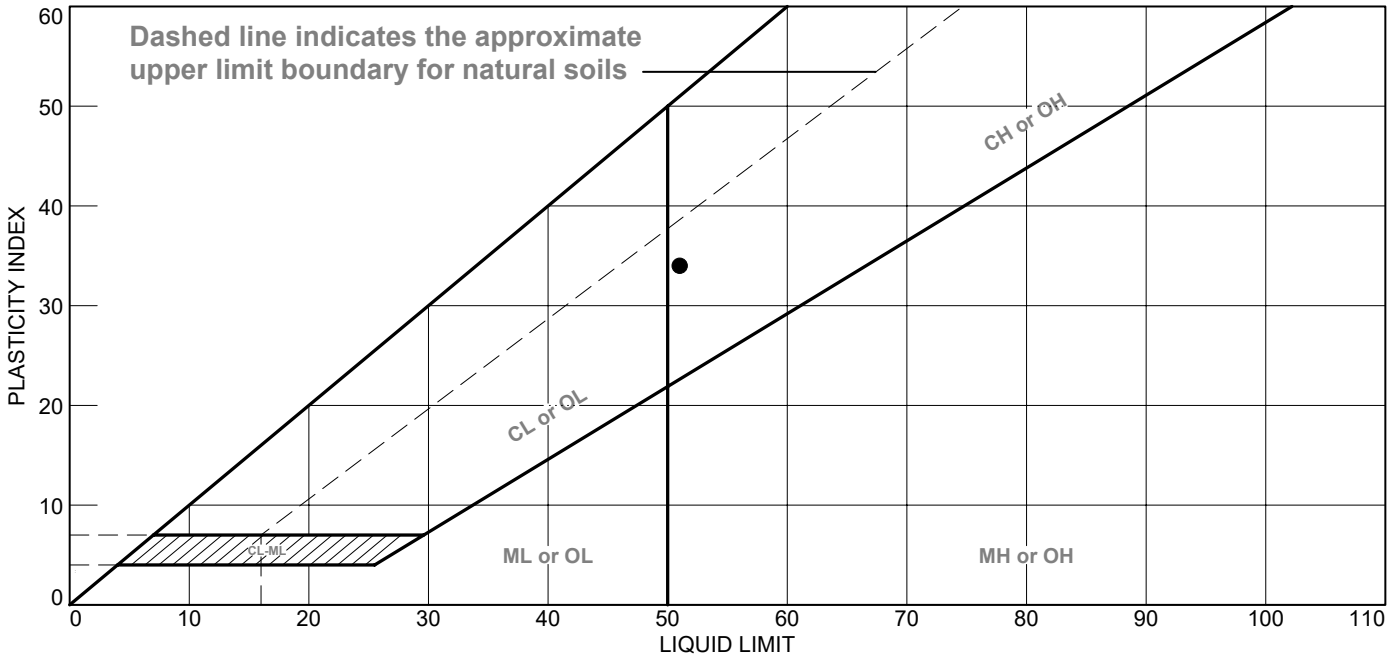
Remarks:

Terracon

Figure

Tested By: SJH **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY FAT CLAY WITH SAND	51	17	34			CH

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

Source of Sample: EDW-B003 **Depth:** 45.0'-47.0'
Sample Number: S-12

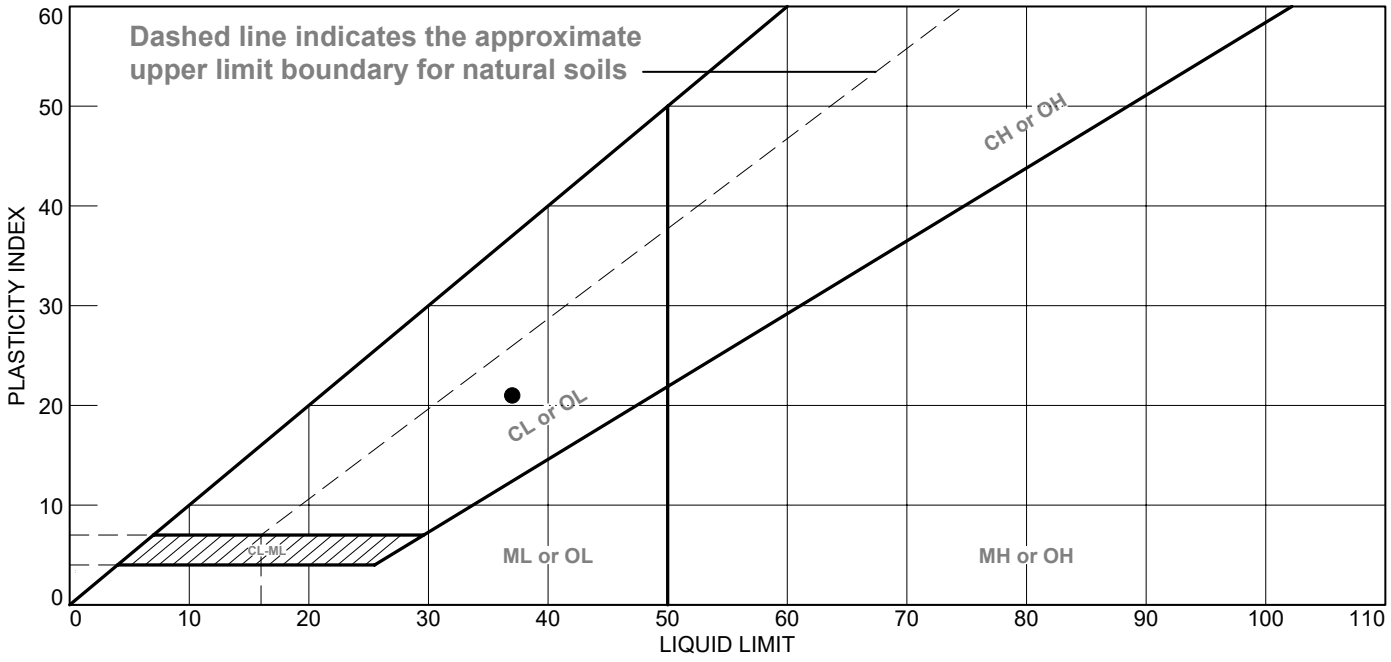
Terracon

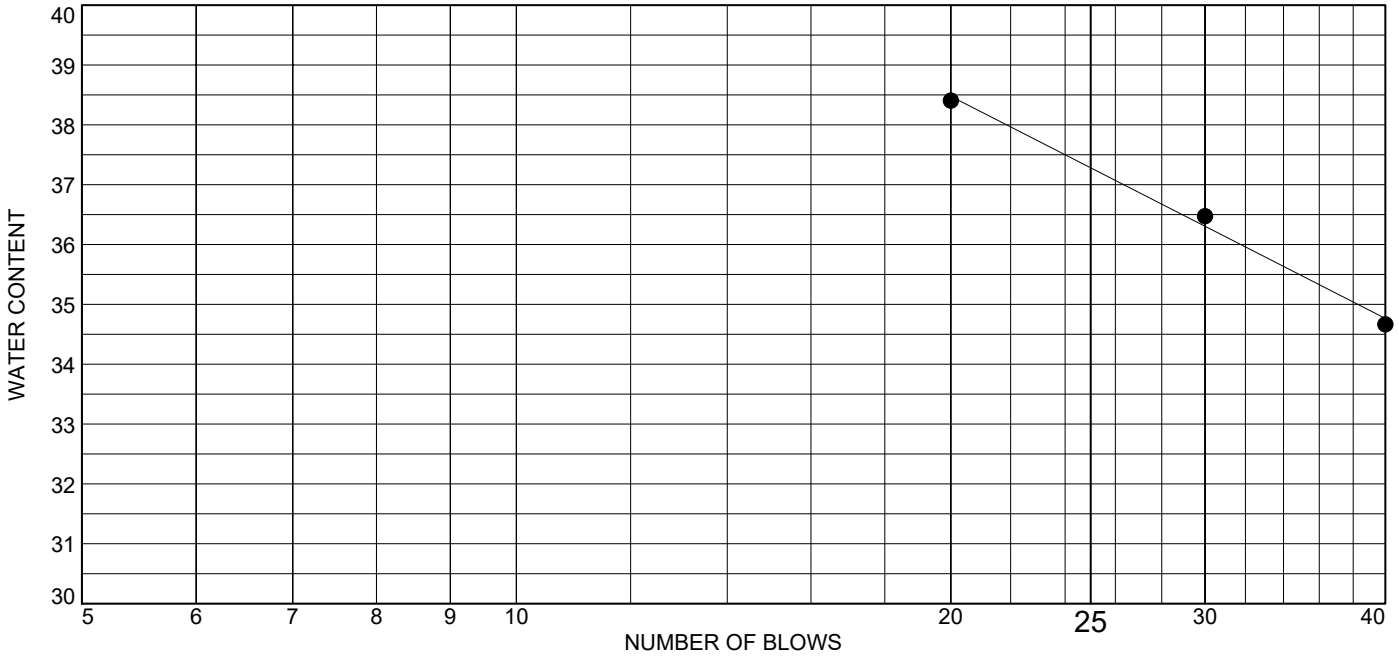
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY AND DARK GRAY LEAN CLAY WITH ORGANICS	37	16	21	98.5	90.7	CL

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

Source of Sample: EDW-B004 **Depth:** 7.5'-9.0'
Sample Number: S-4

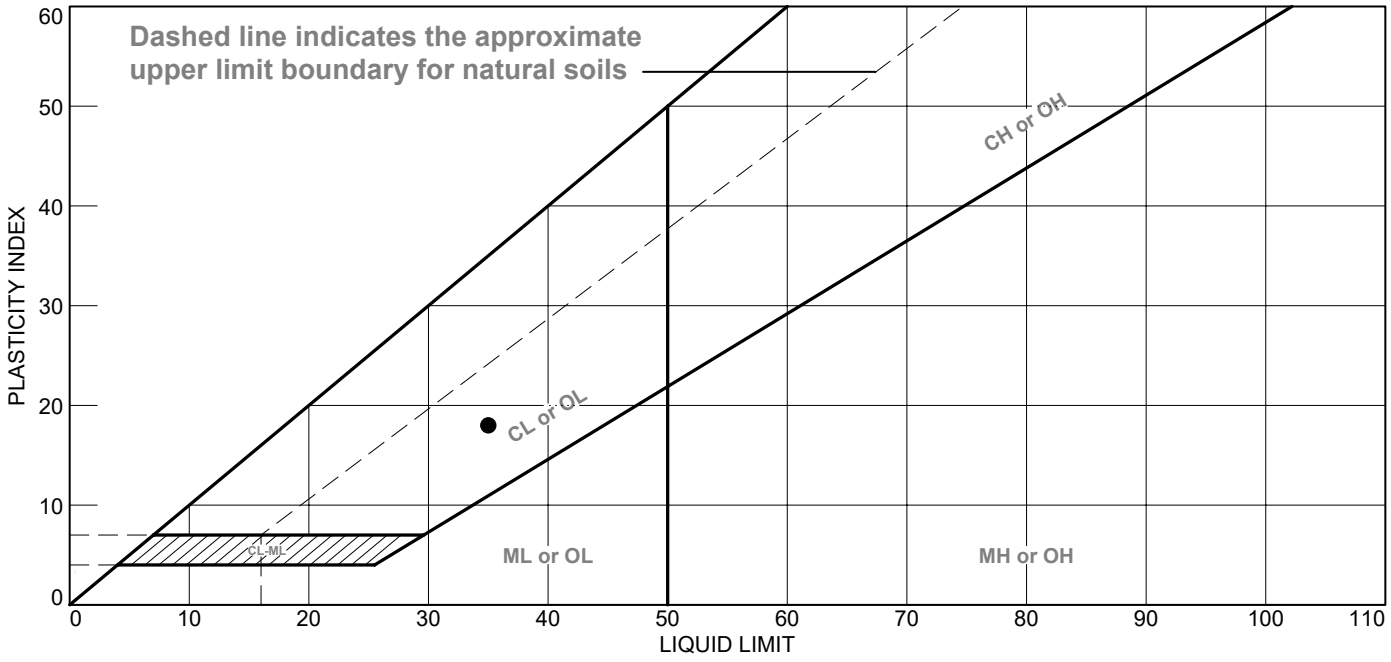
Remarks:

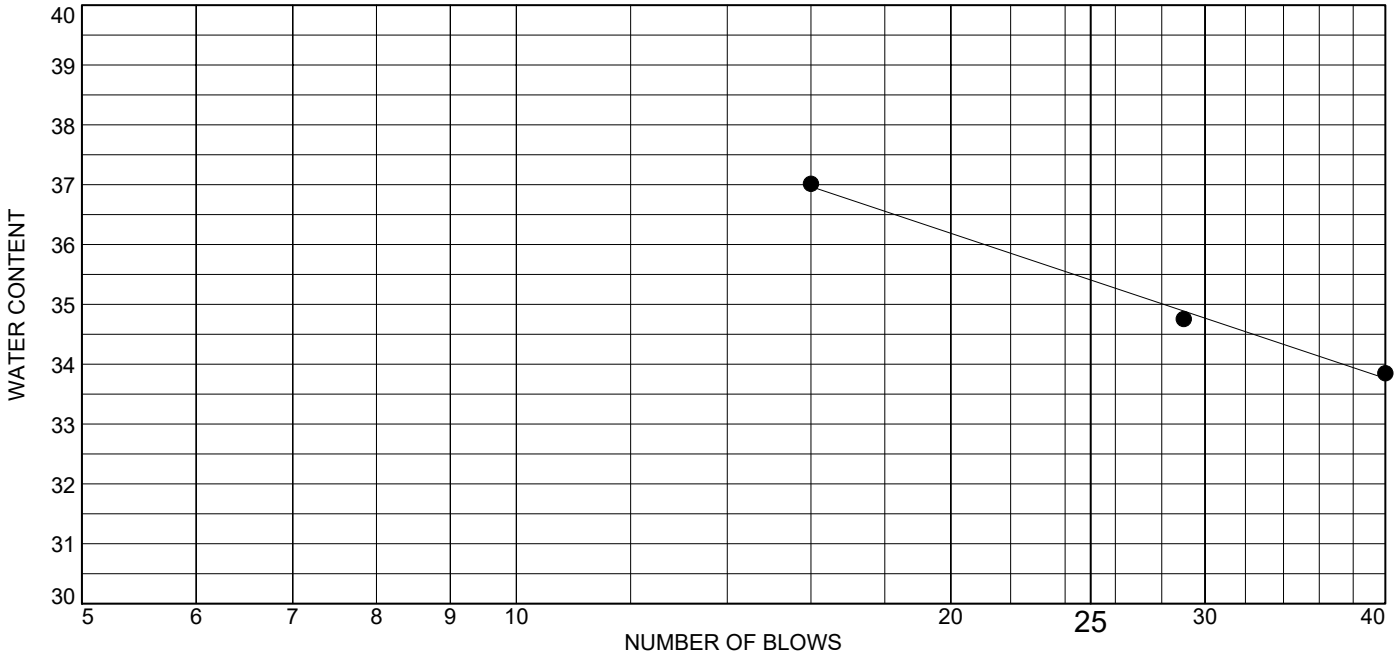
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND	35	17	18			CL

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

Source of Sample: EDW-B004 **Depth:** 36.0'-38.0'
Sample Number: S-11

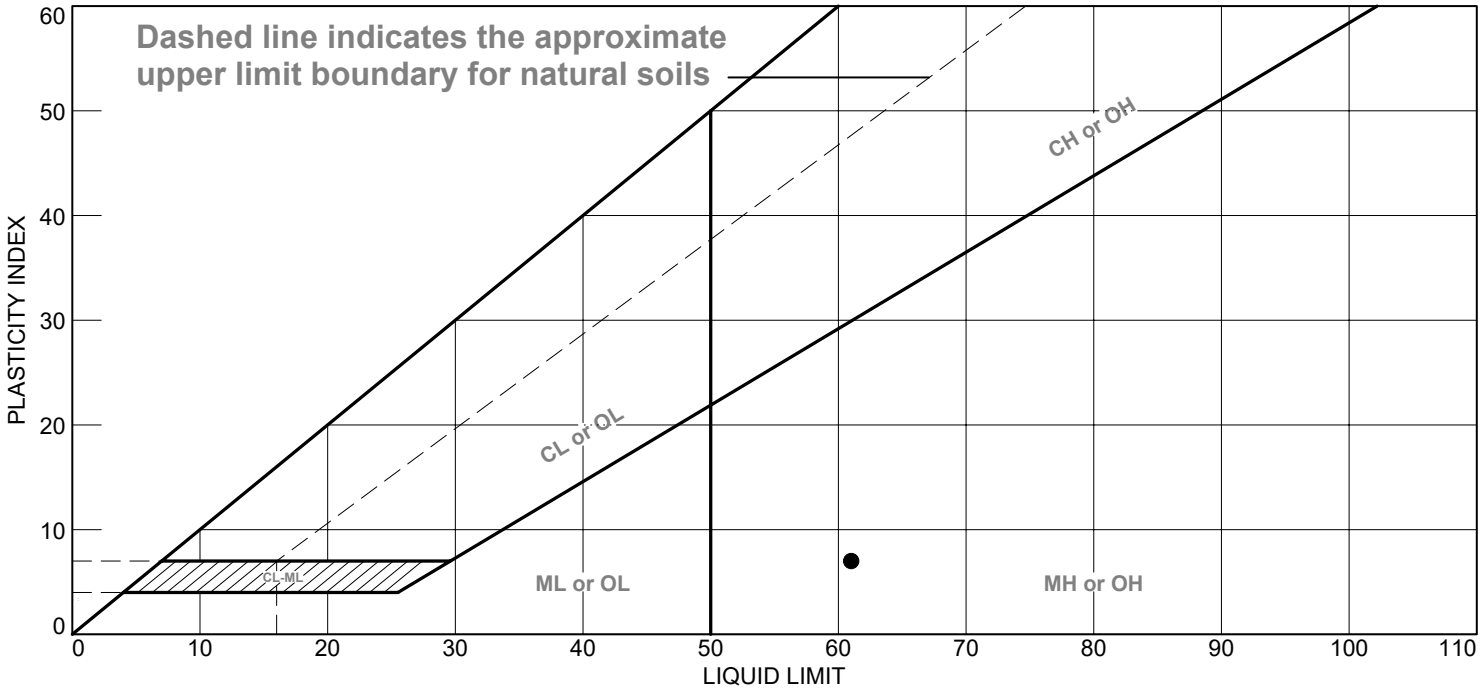
Remarks:

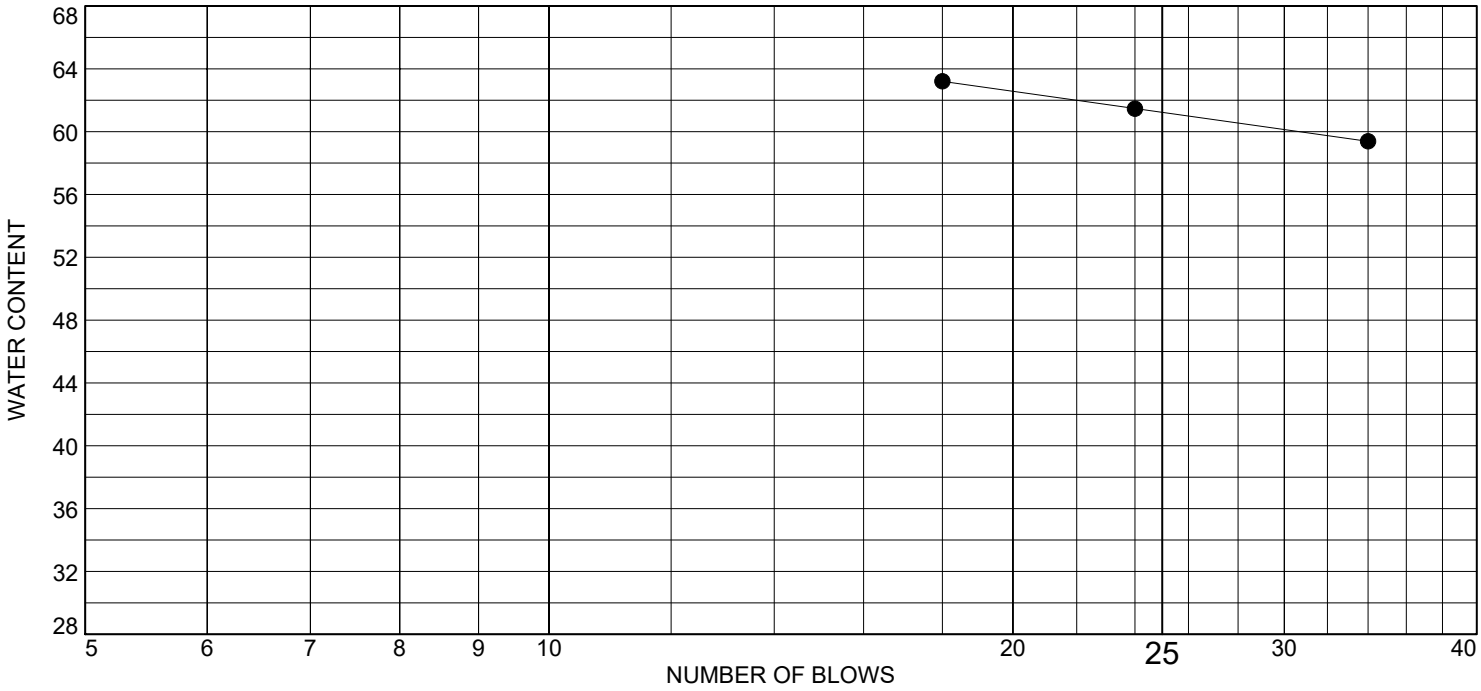
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	FILL: BROWN SANDY SILT WITH CLAY CHUNKS	61	54	7			MH

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

Source of Sample: EDW-B005 **Depth:** 5.0'-6.5'

Sample Number: S-3

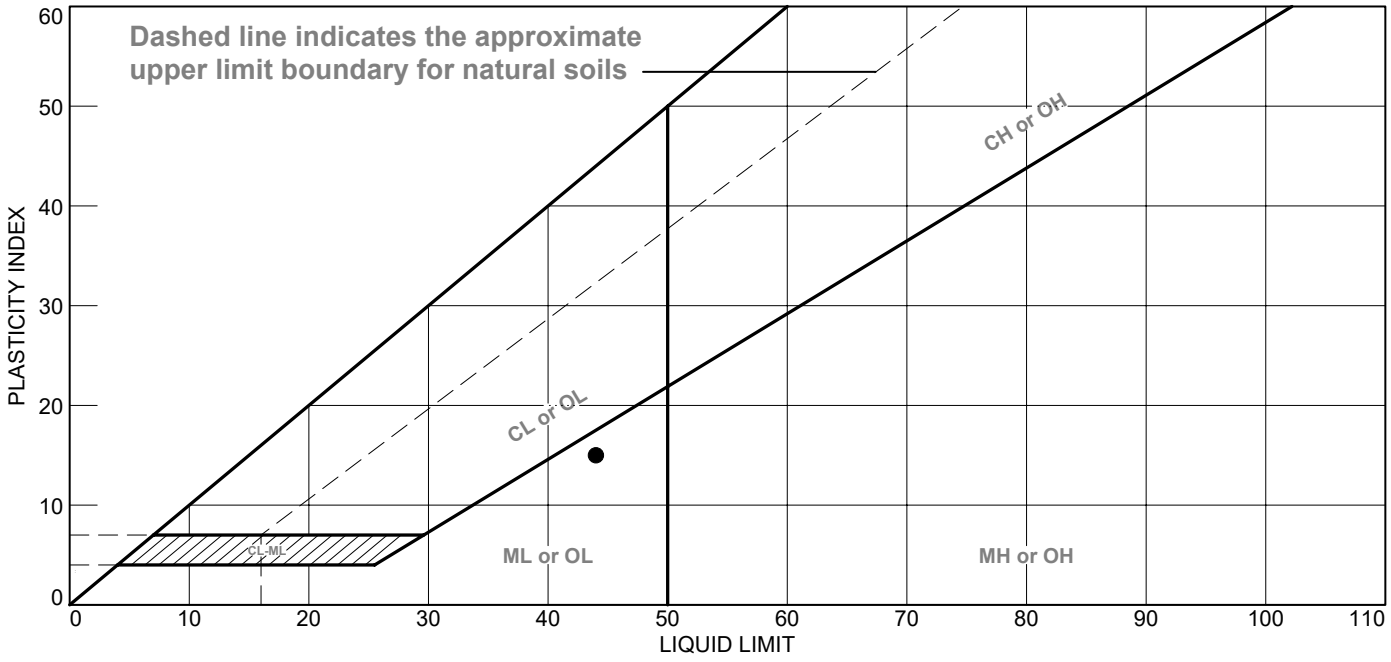
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	FILL: GRAY AND BLACK ORGANIC SILT	44	29	15			OL

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

Source of Sample: EDW-B005 **Depth:** 26.0'-27.0'
Sample Number: S-8A

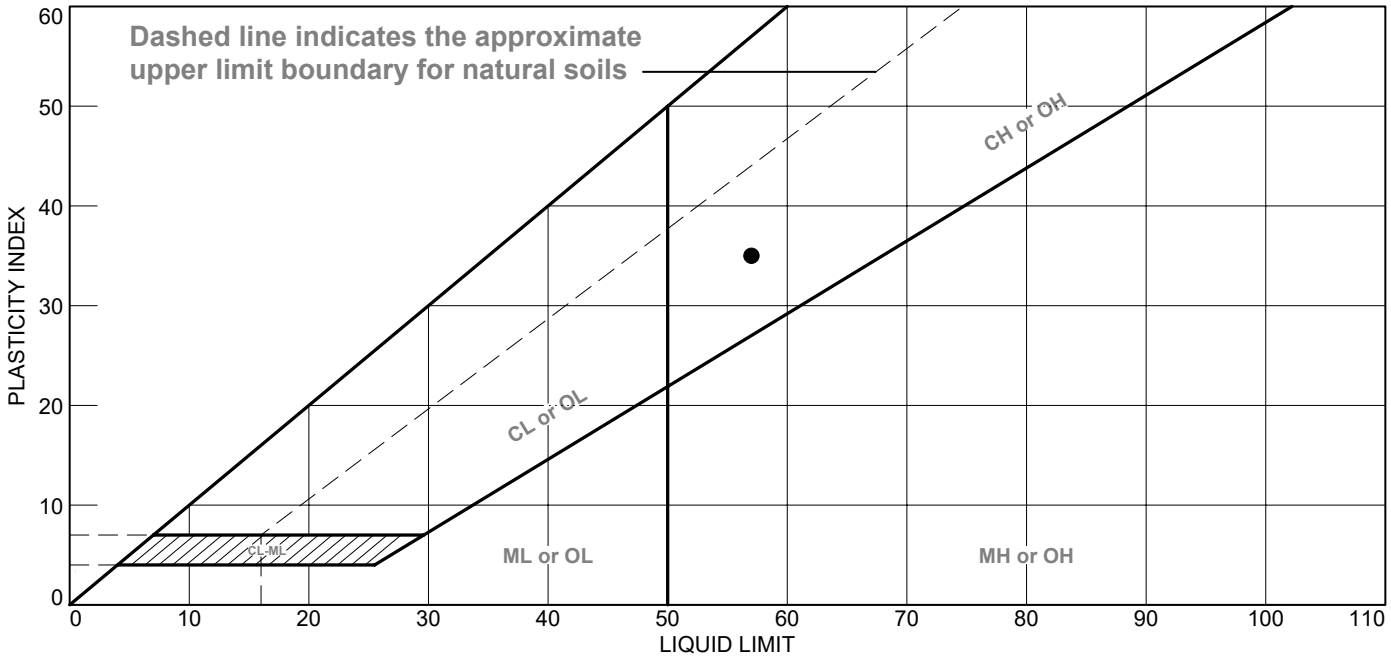
Terracon

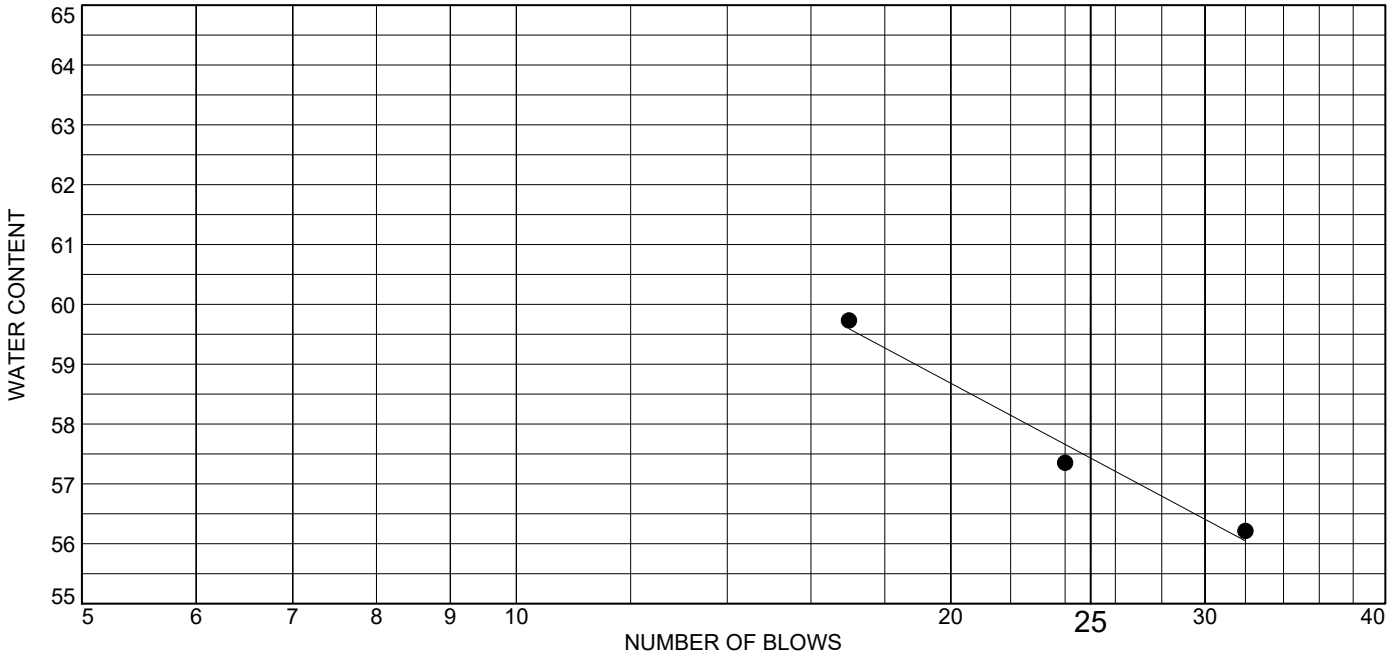
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY FAT CLAY SHELL - ORGANICS NOTED	57	22	35			CH

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

Source of Sample: EDW-B005 **Depth:** 41.0'-43.0'
Sample Number: S-11

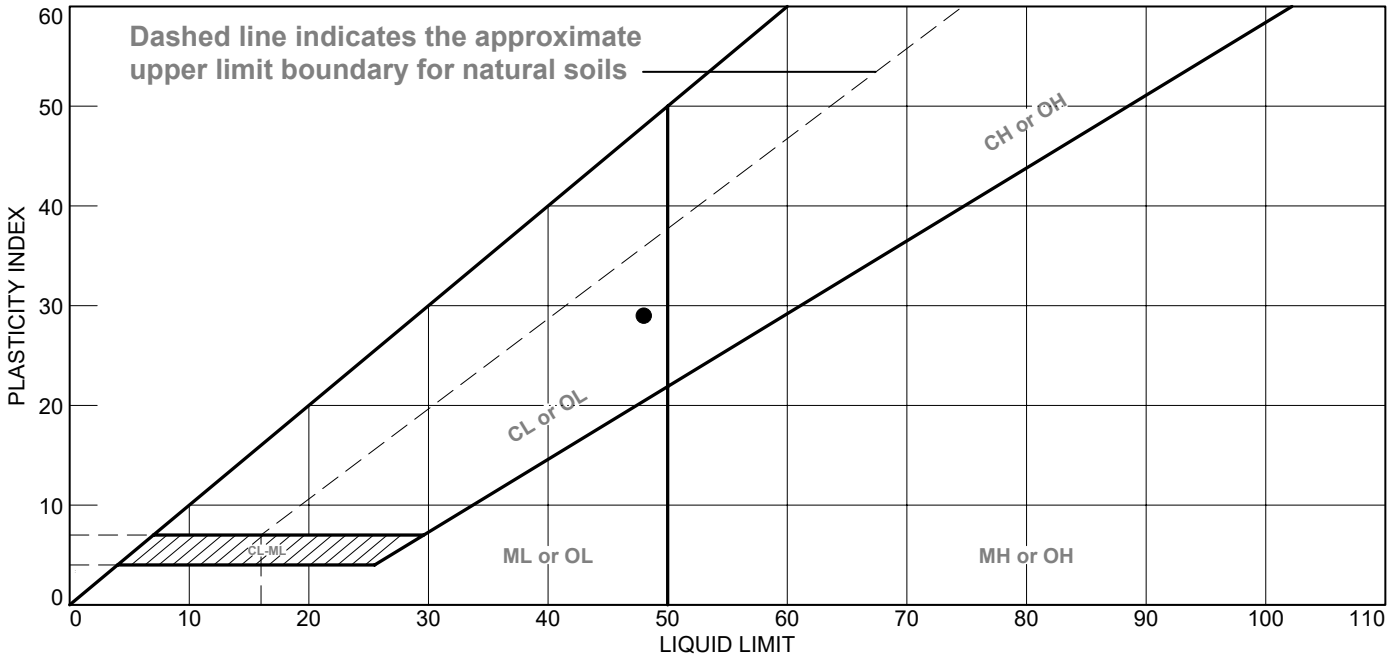
Remarks:

Terracon

Figure

Tested By: SJH **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY AND DARK GRAY LEAN CLAY TRACE SAND	48	19	29			CL

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

Source of Sample: EDW-B006 **Depth:** 5.0'-6.5'
Sample Number: S-3

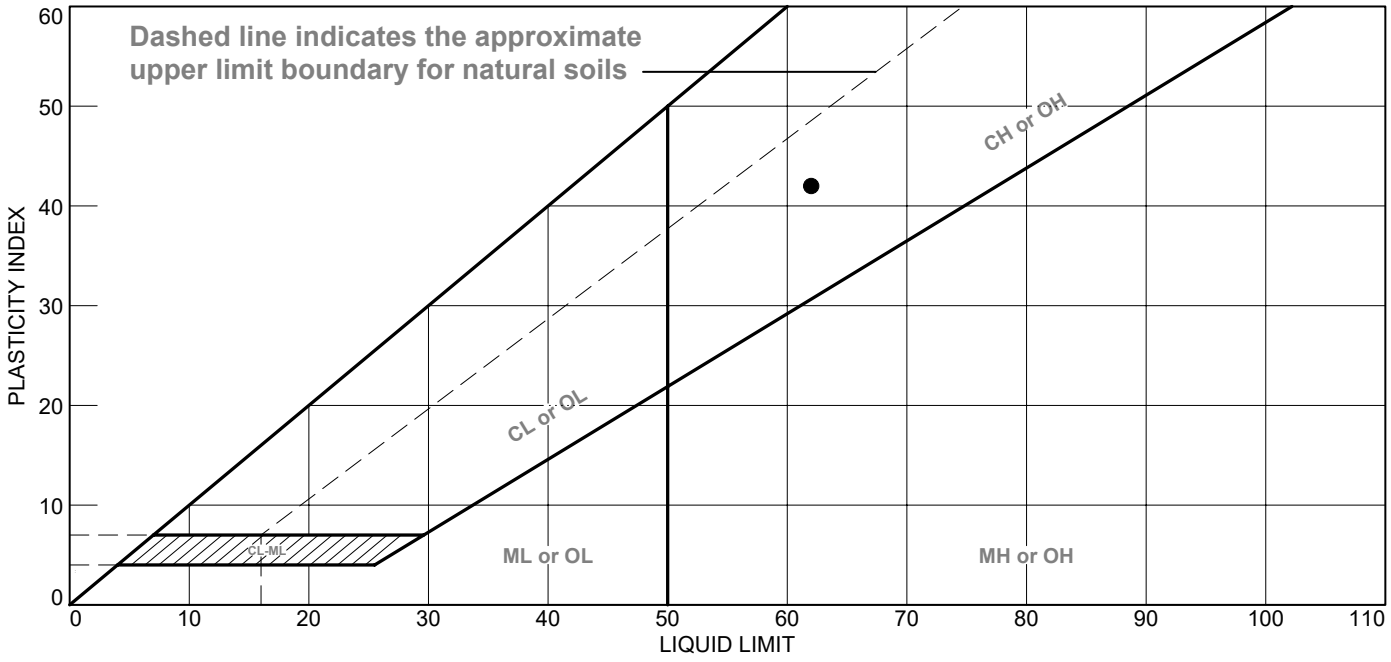
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY FAT CLAY WITH SAND	62	20	42			CH

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

Source of Sample: EDW-B006 **Depth:** 13.0'-15.0'
Sample Number: S-6

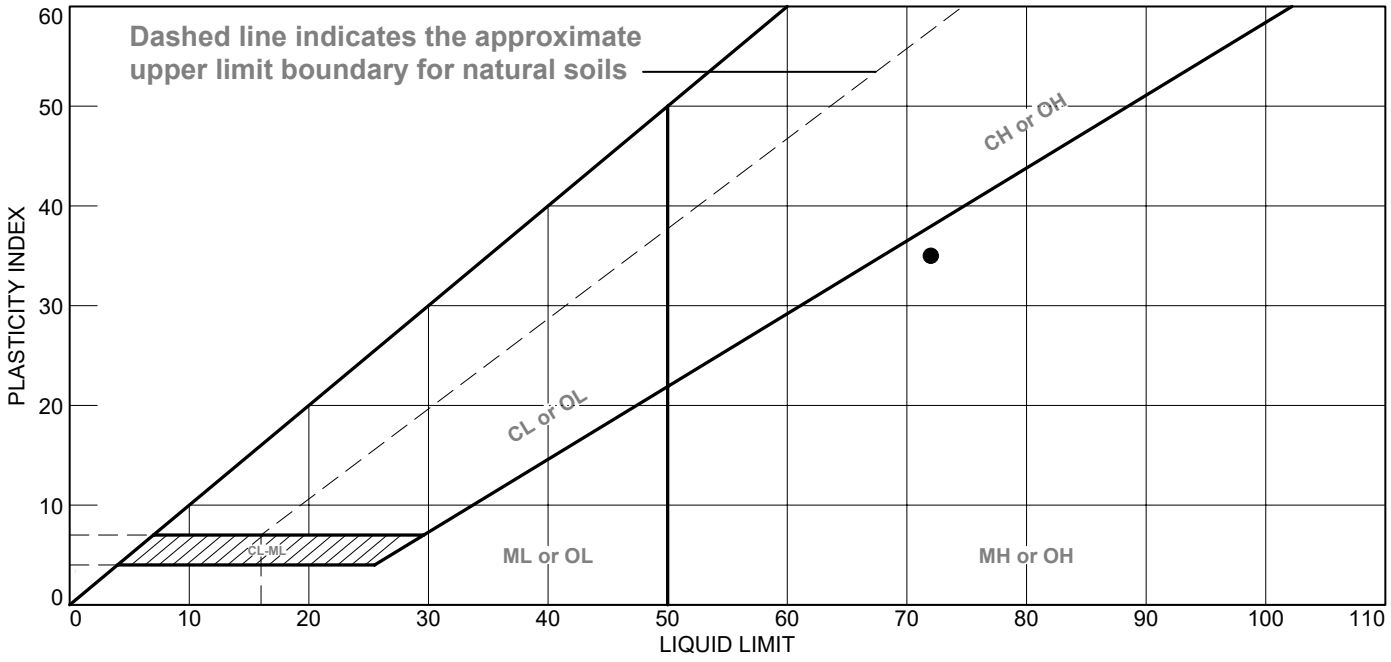
Remarks:

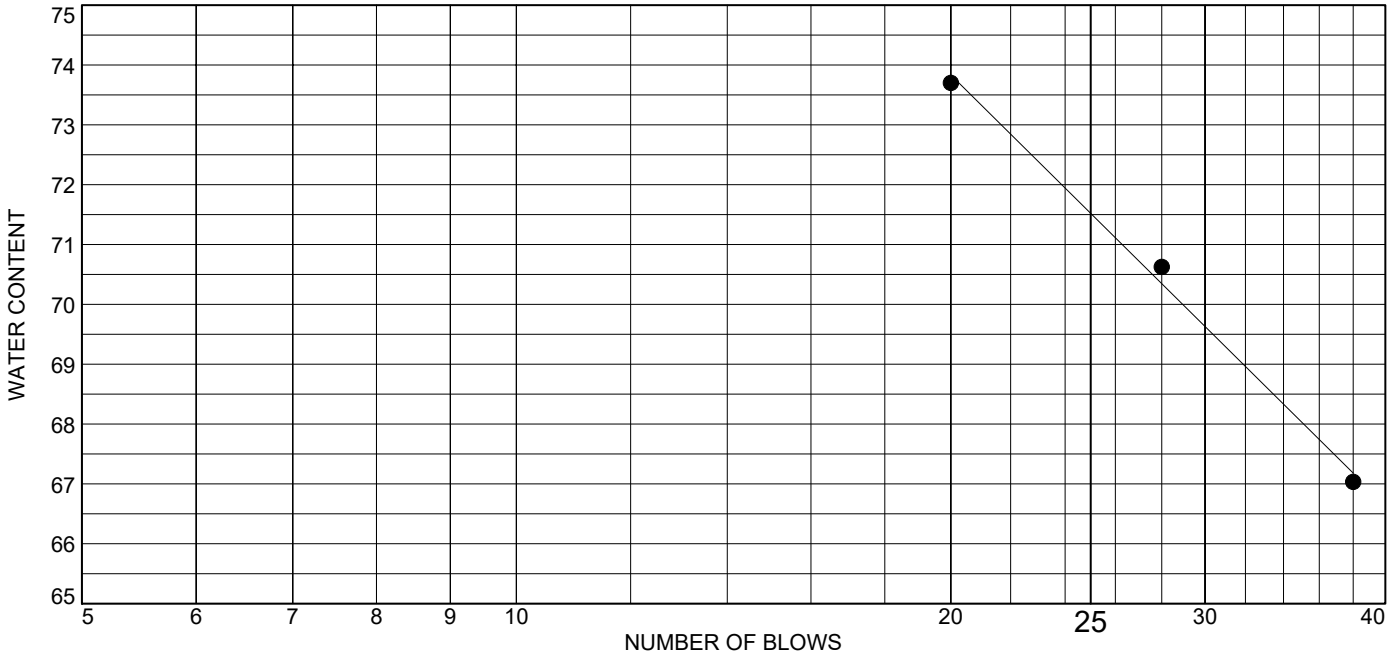
Terracon

Figure

Tested By: SJH **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY ORGANIC SILT	72	37	35			OH

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

Source of Sample: EDW-B006 **Depth:** 26.0'-28.0'
Sample Number: S-9

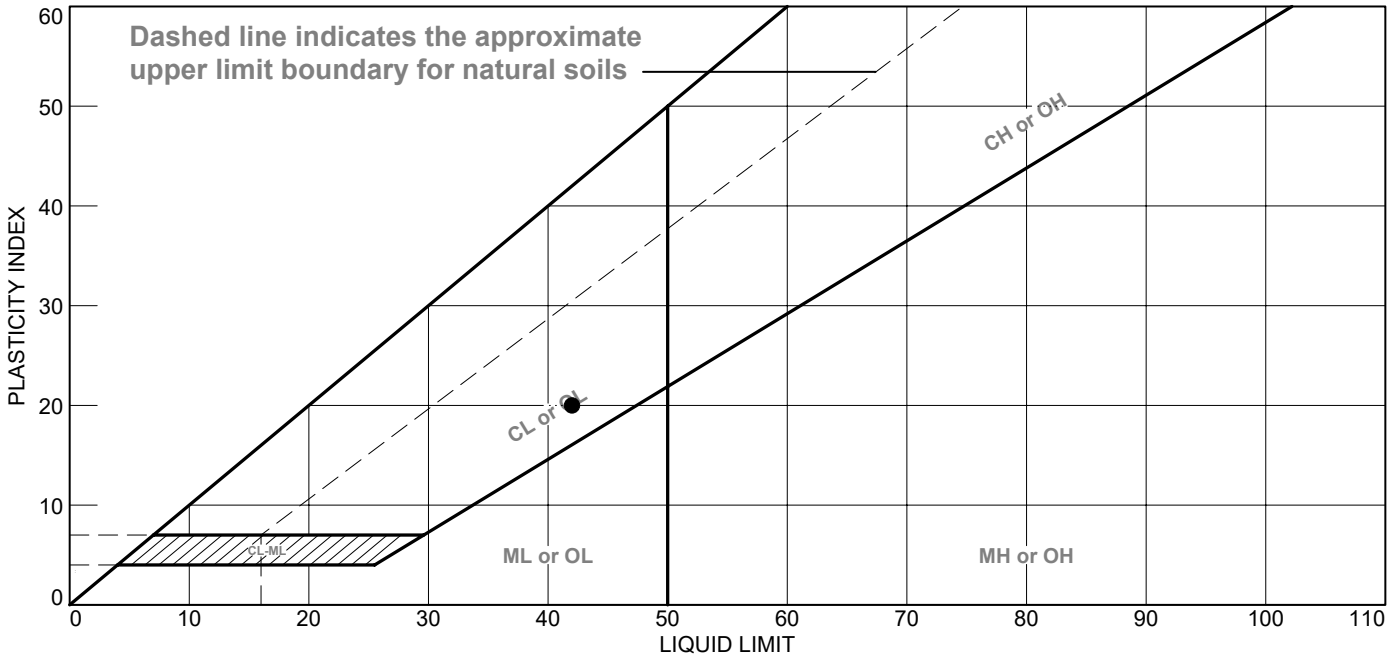
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK BROWN LEAN CLAY WITH SAND	42	22	20			CL

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

Source of Sample: EDW-B008 **Depth:** 2.5'-4.0'
Sample Number: S-2

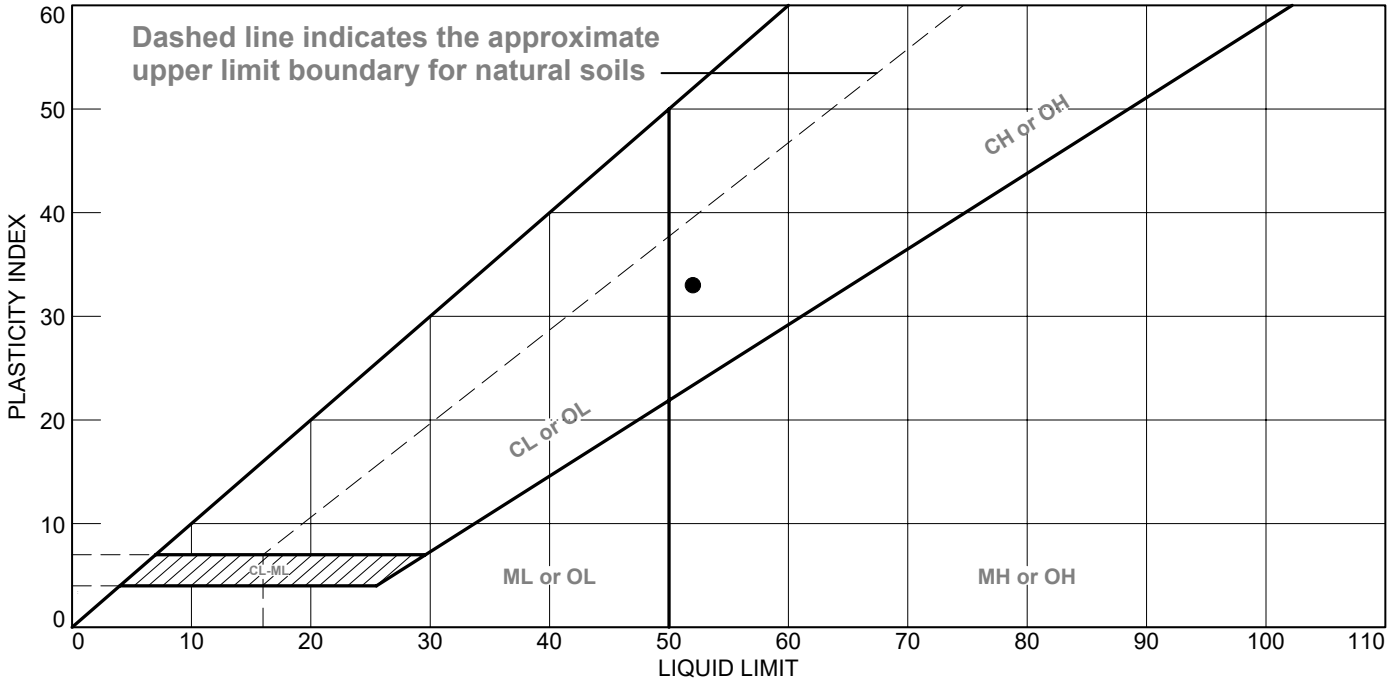
Remarks:

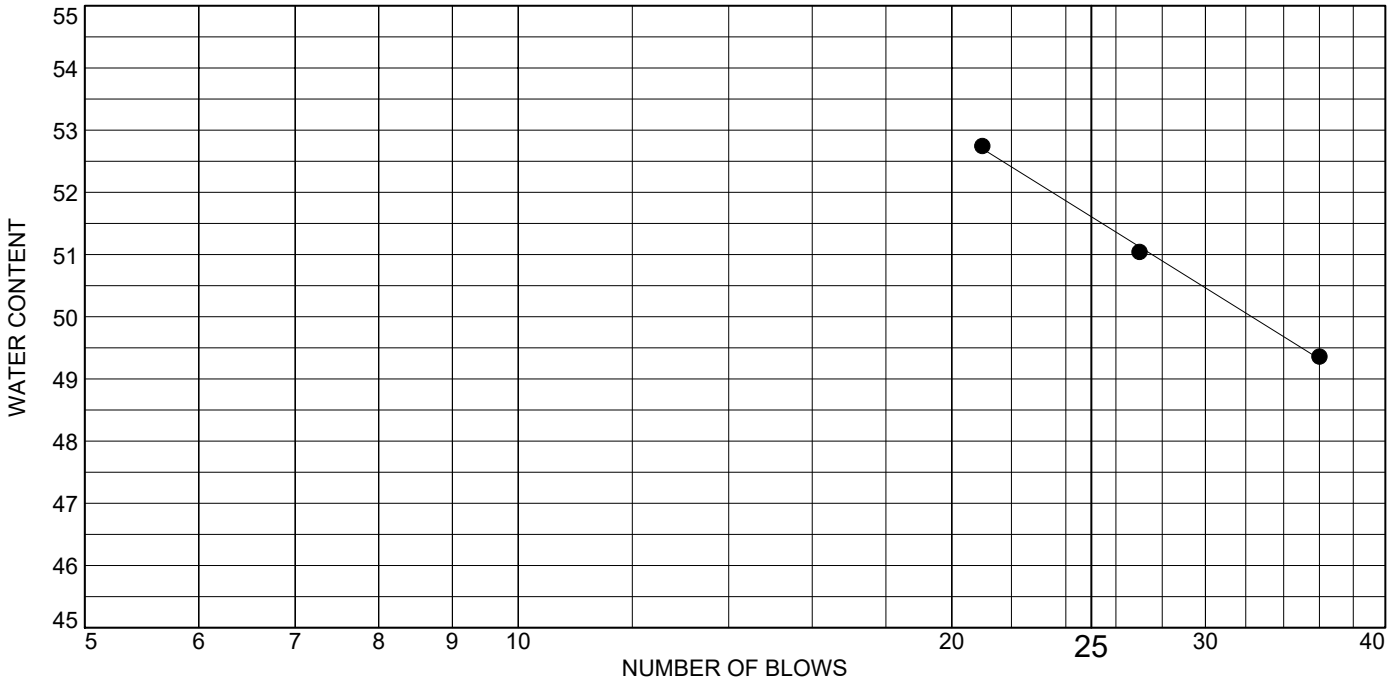
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAY FAT CLAY WITH SAND	52	19	33			CH

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

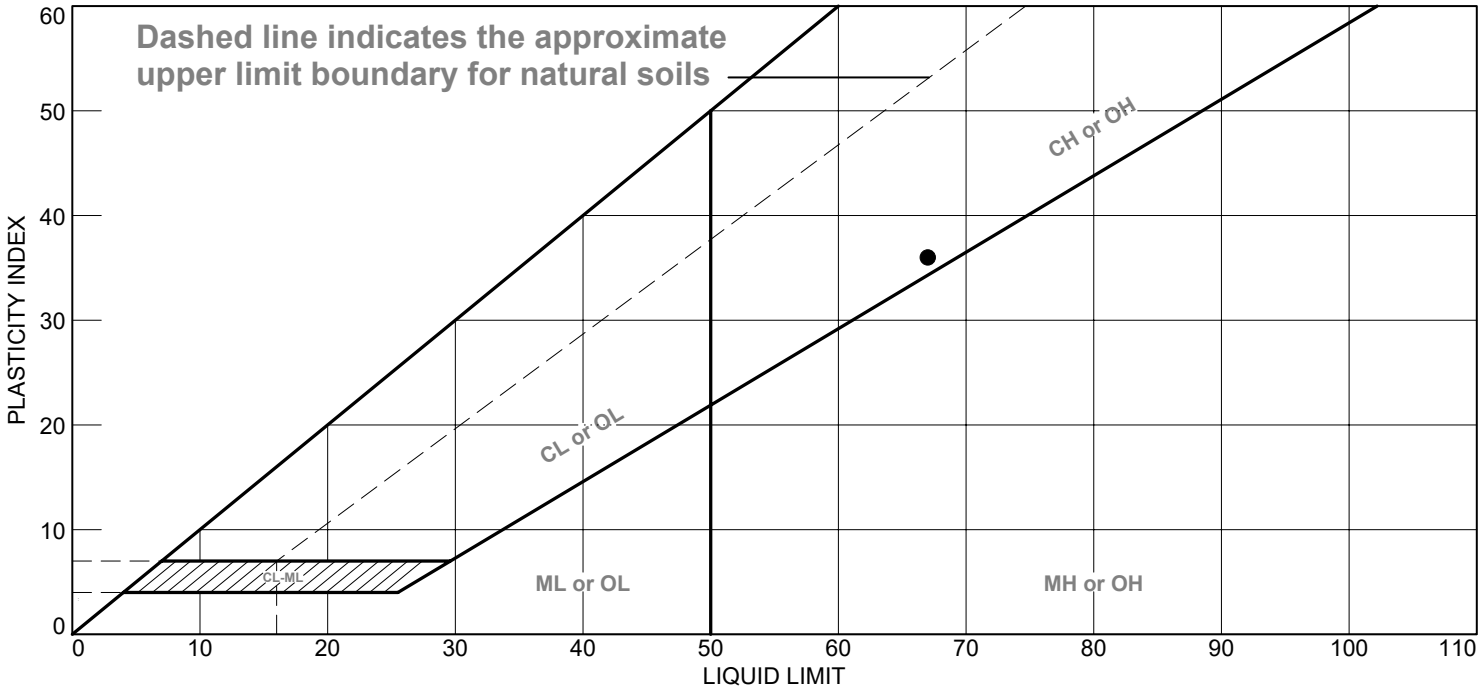
Source of Sample: EDW-B008 **Depth:** 11.0'-13.0'
Sample Number: S-5

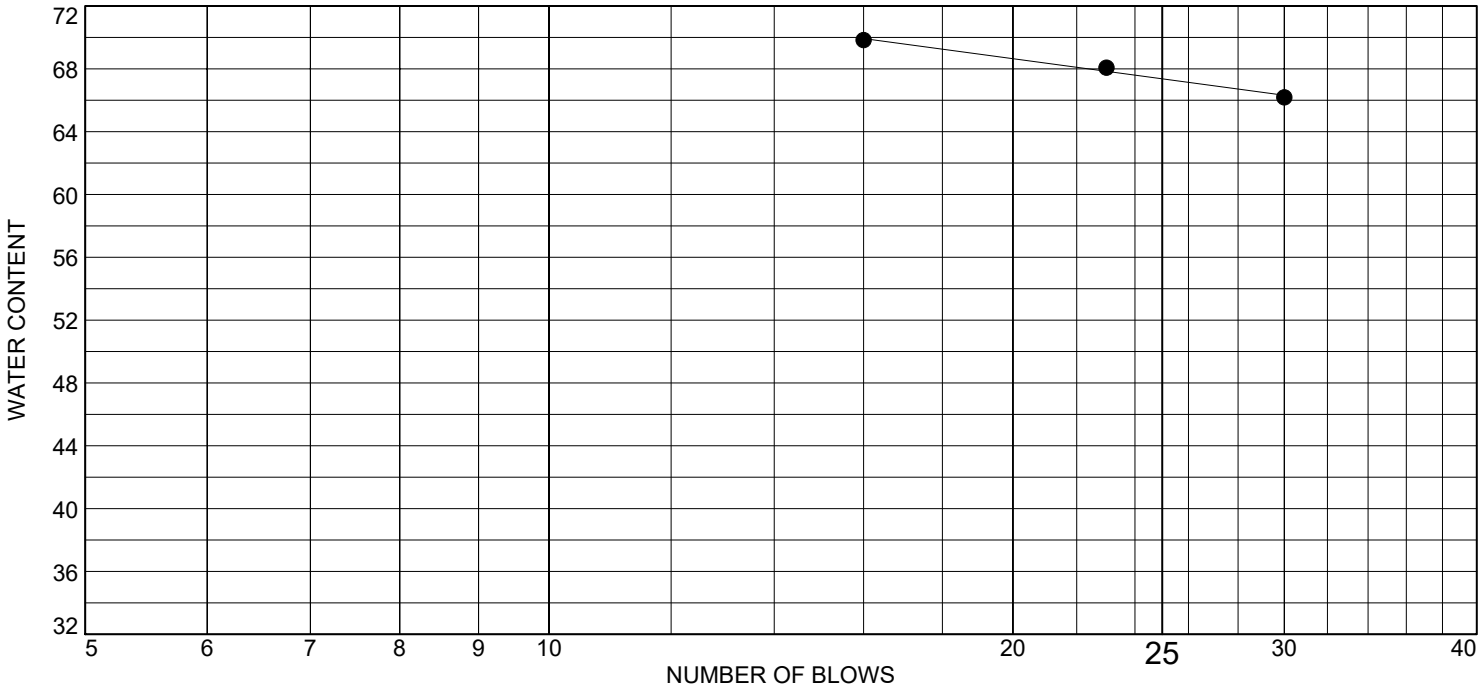
Remarks:

Terracon

Figure

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY FAT CLAY SHELL - ORGANICS NOTED	67	31	36			CH

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

Source of Sample: EDW-B008 **Depth:** 24.0'-26.5'

Sample Number: S-8

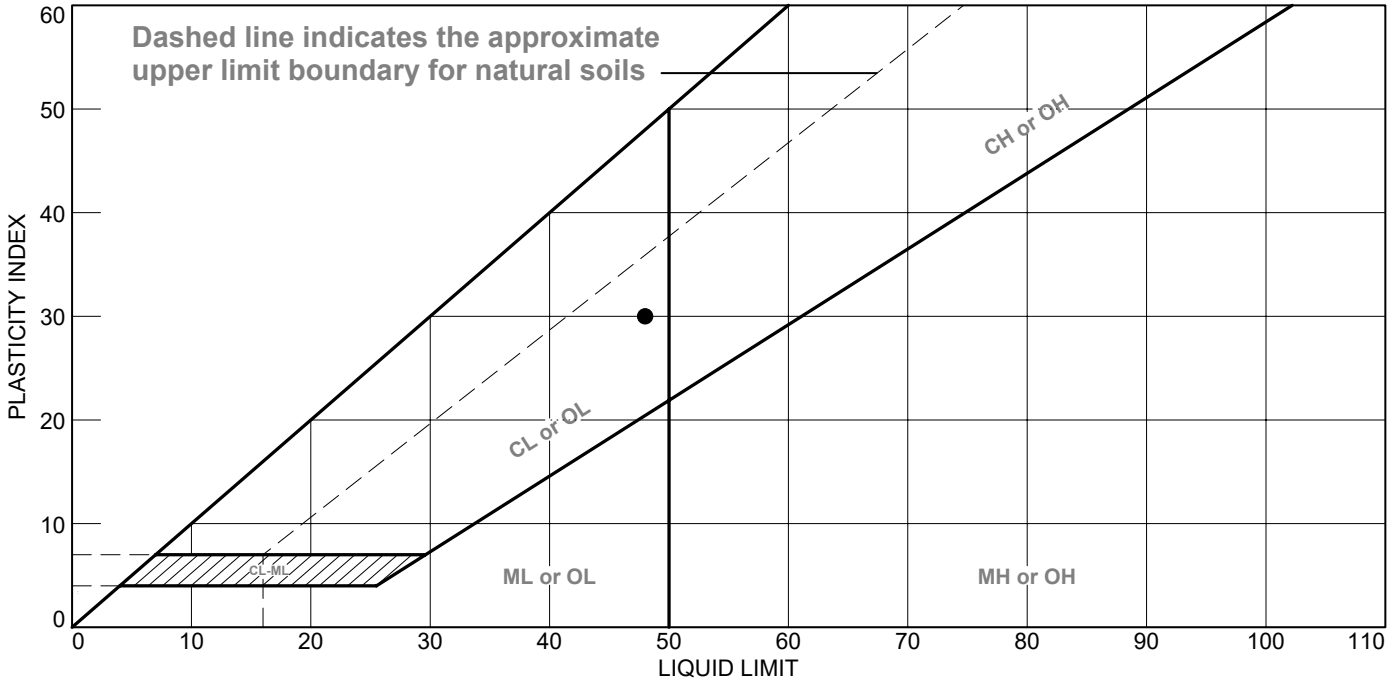
Remarks:

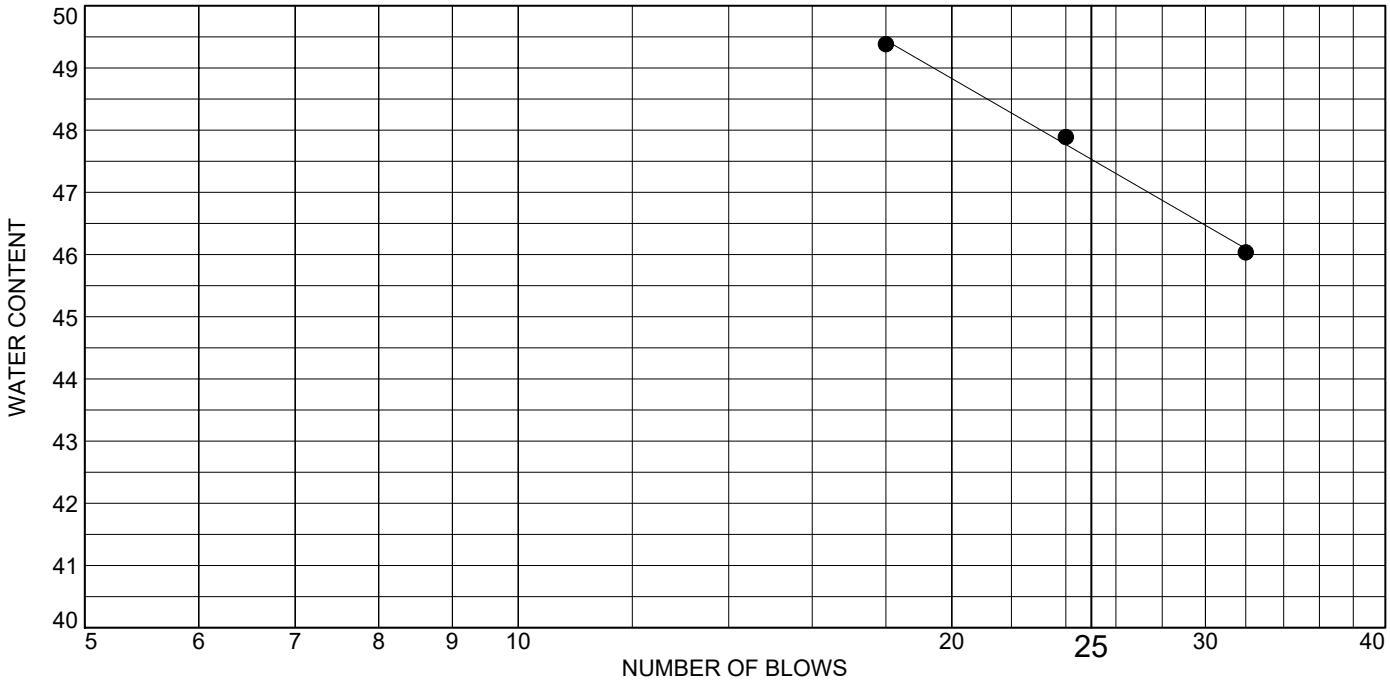
Terracon

Figure

Tested By: SJH **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAY MOTTLED LEAN CLAY	48	18	30			CL

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

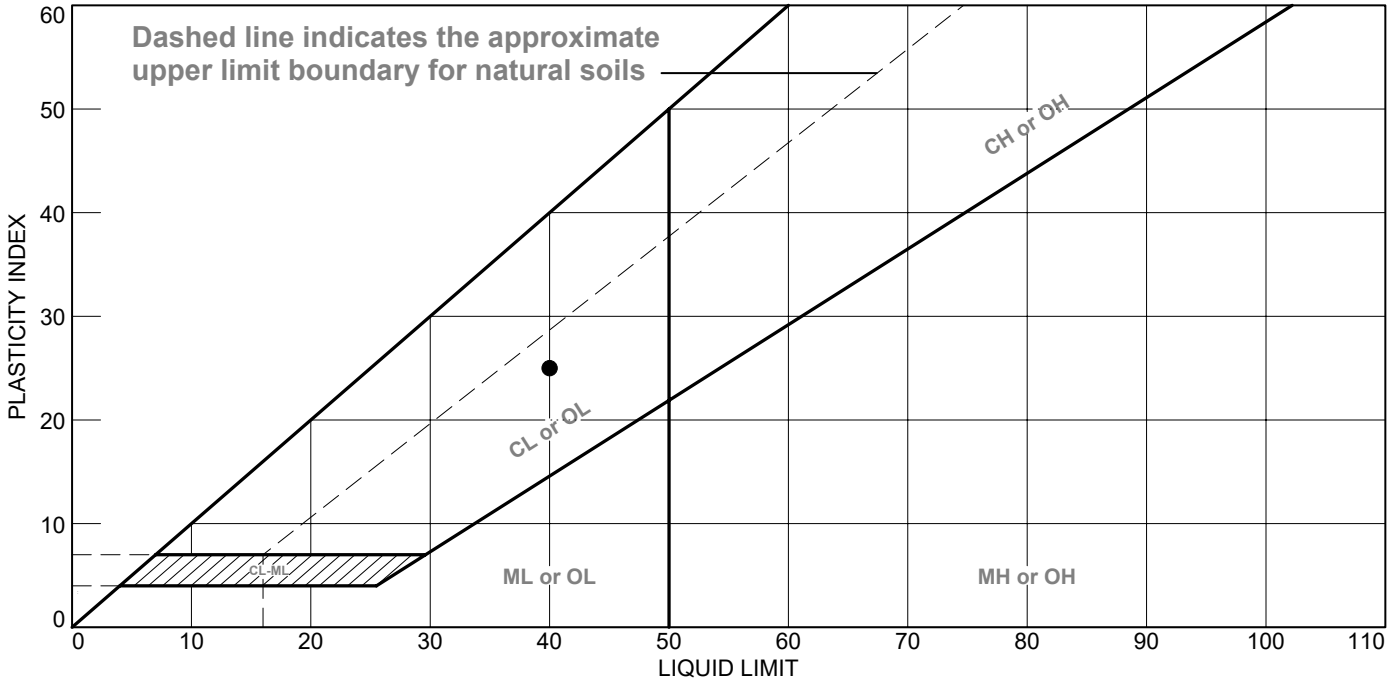
Source of Sample: EDW-B010 **Depth:** 15.0'-17.0'
Sample Number: S-7

Remarks:

Terracon

Figure

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BLUISH GRAY LEAN CLAY	40	15	25			CL

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

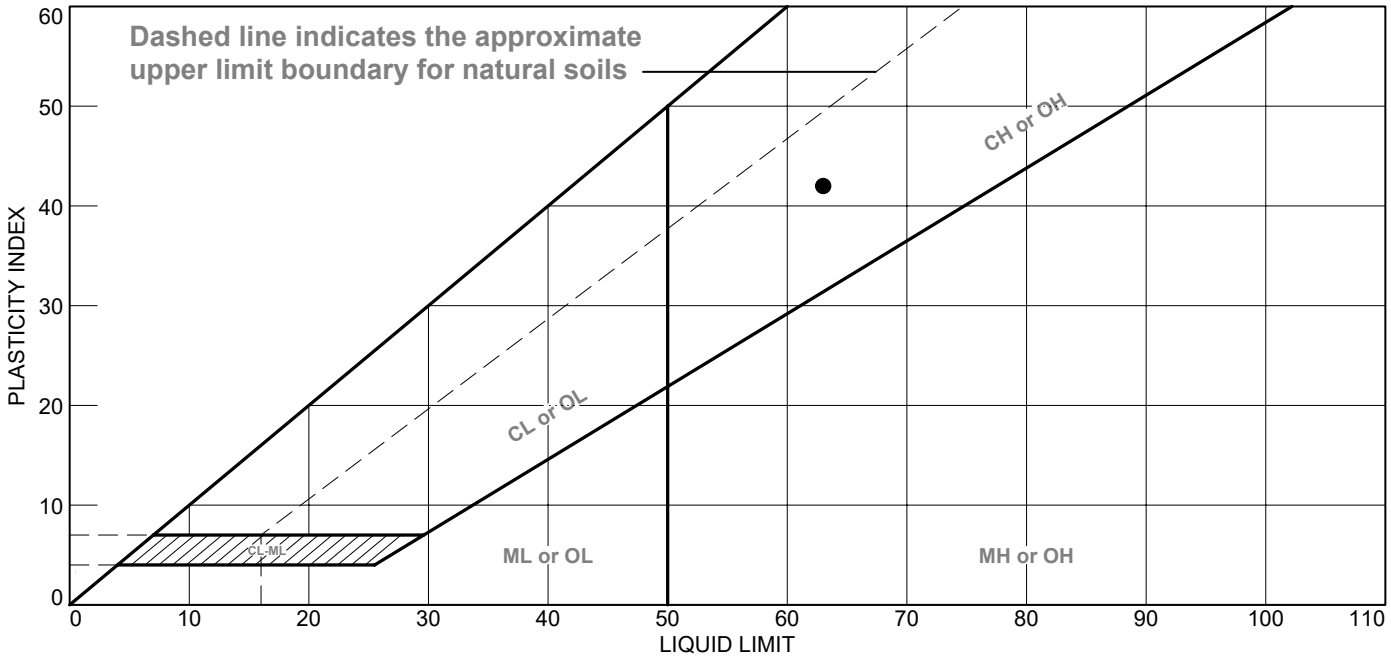
Source of Sample: EDW-B010 **Depth:** 30.0'-32.0'
Sample Number: S-10

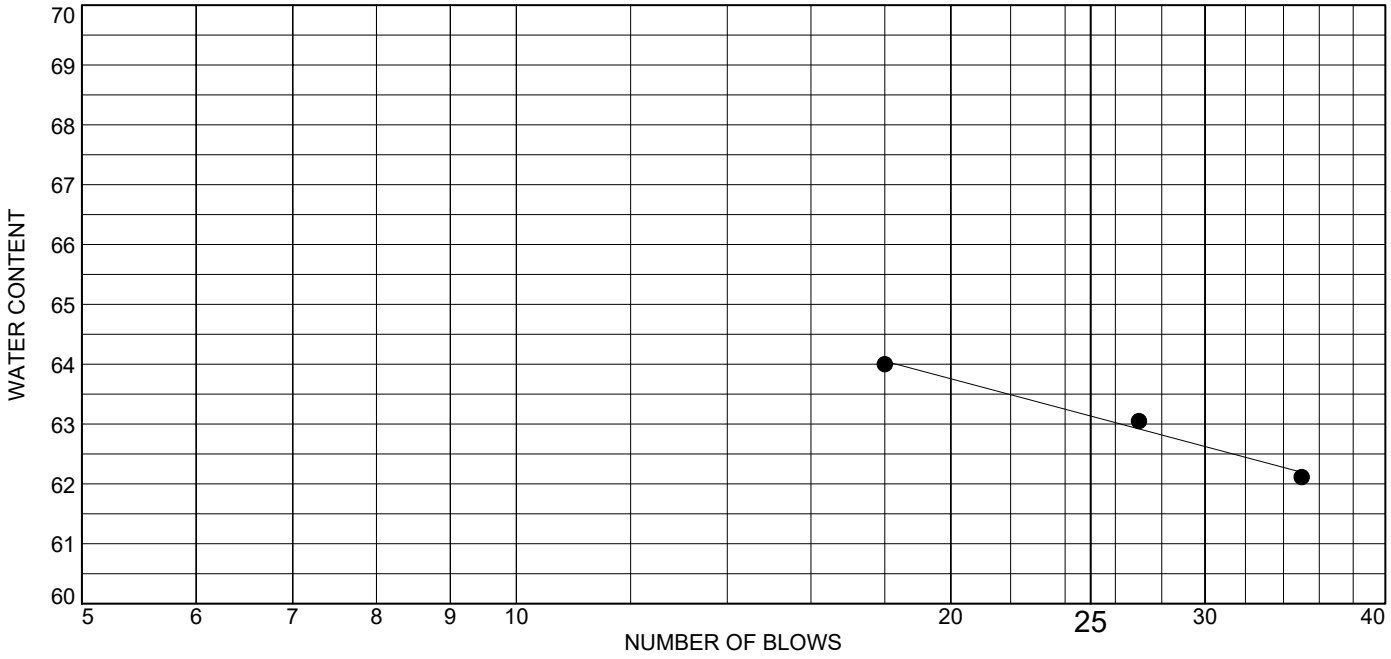
Remarks:

Terracon

Figure

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAYISH BROWN FAT CLAY WITH SAND	63	21	42			CH

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

Source of Sample: EDW-B011 **Depth:** 45.0'-46.5'
Sample Number: S-14

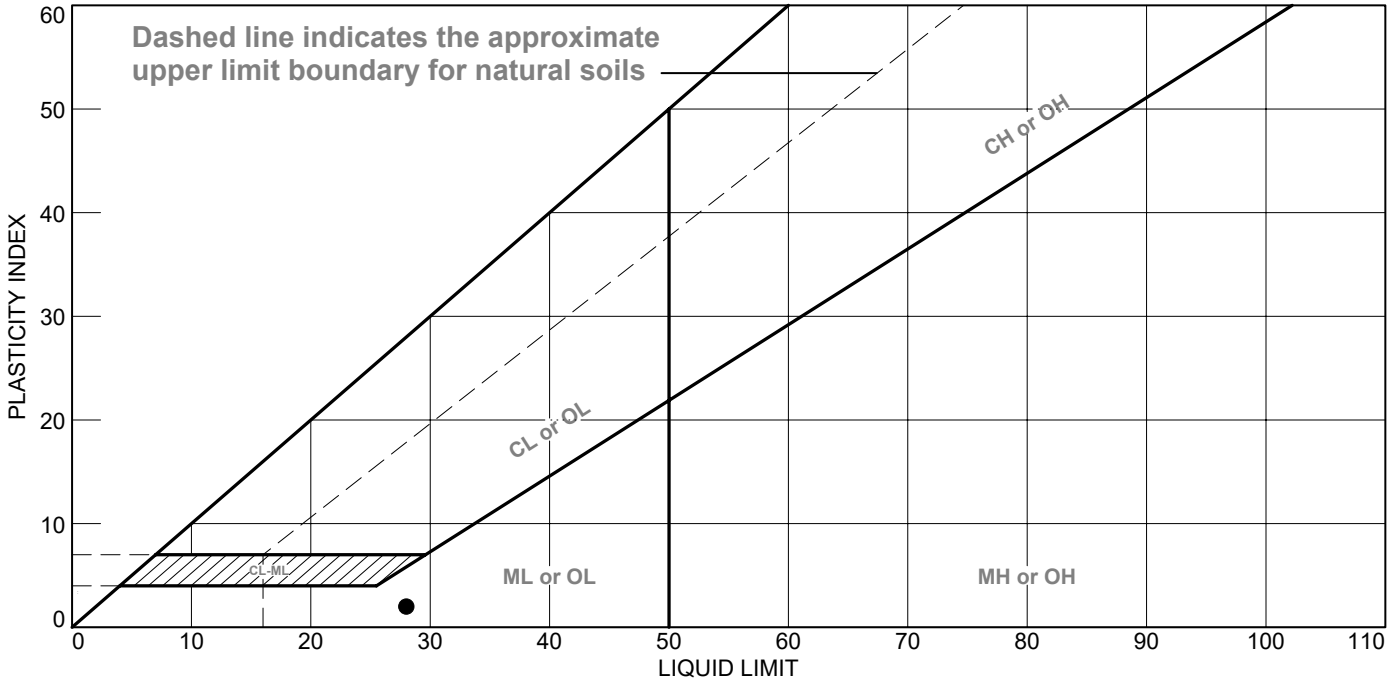
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	FILL: DARK GRAY FLY ASH	28	26	2			

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

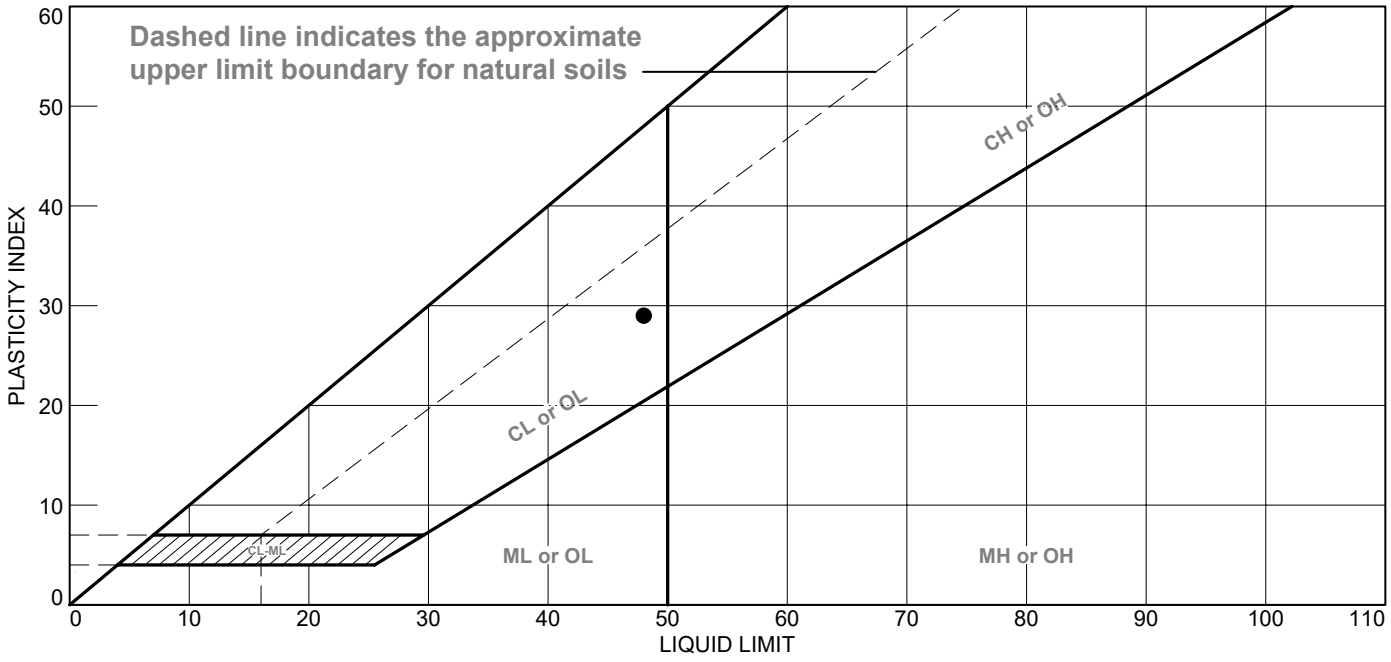
Source of Sample: EDW-B012 **Depth:** 2.5'-4.0'
Sample Number: S-2

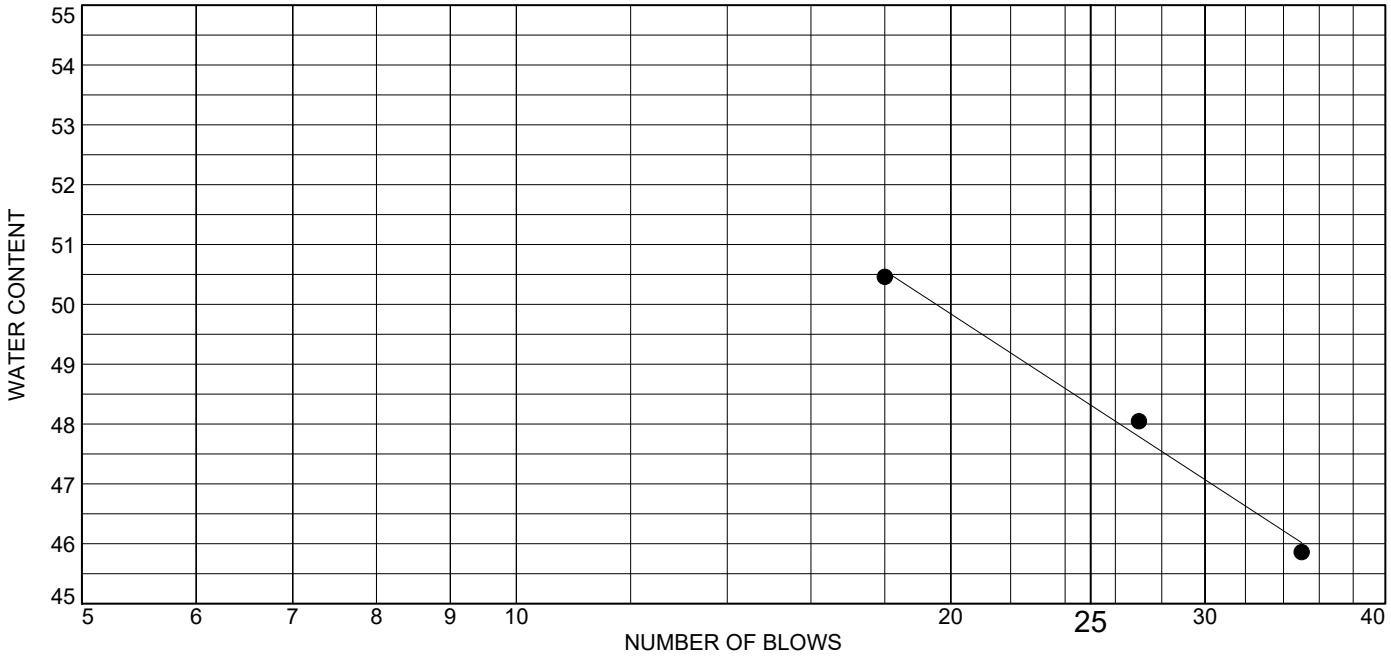
Remarks:

Terracon

Figure

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND RUST BROWN MOTTLED LEAN CLAY	48	19	29			CL

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

Source of Sample: EDW-B012 **Depth:** 15.0'-16.5'
Sample Number: S-7

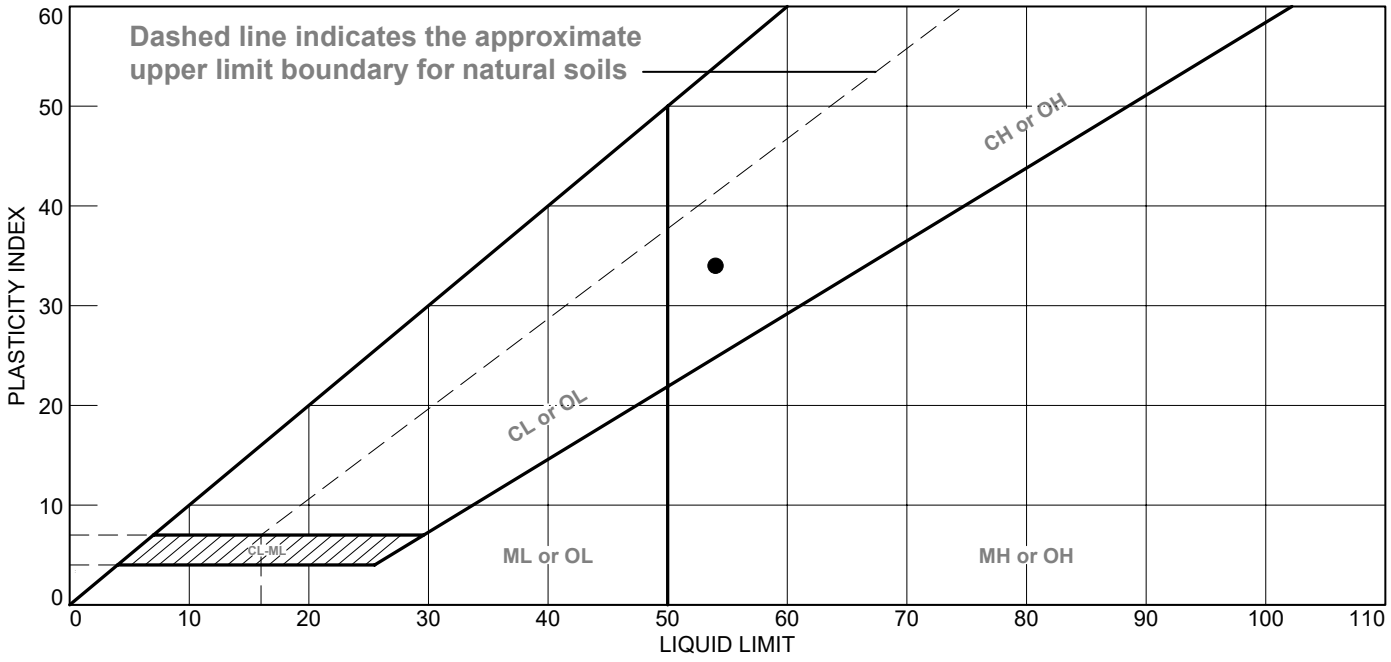
Remarks:

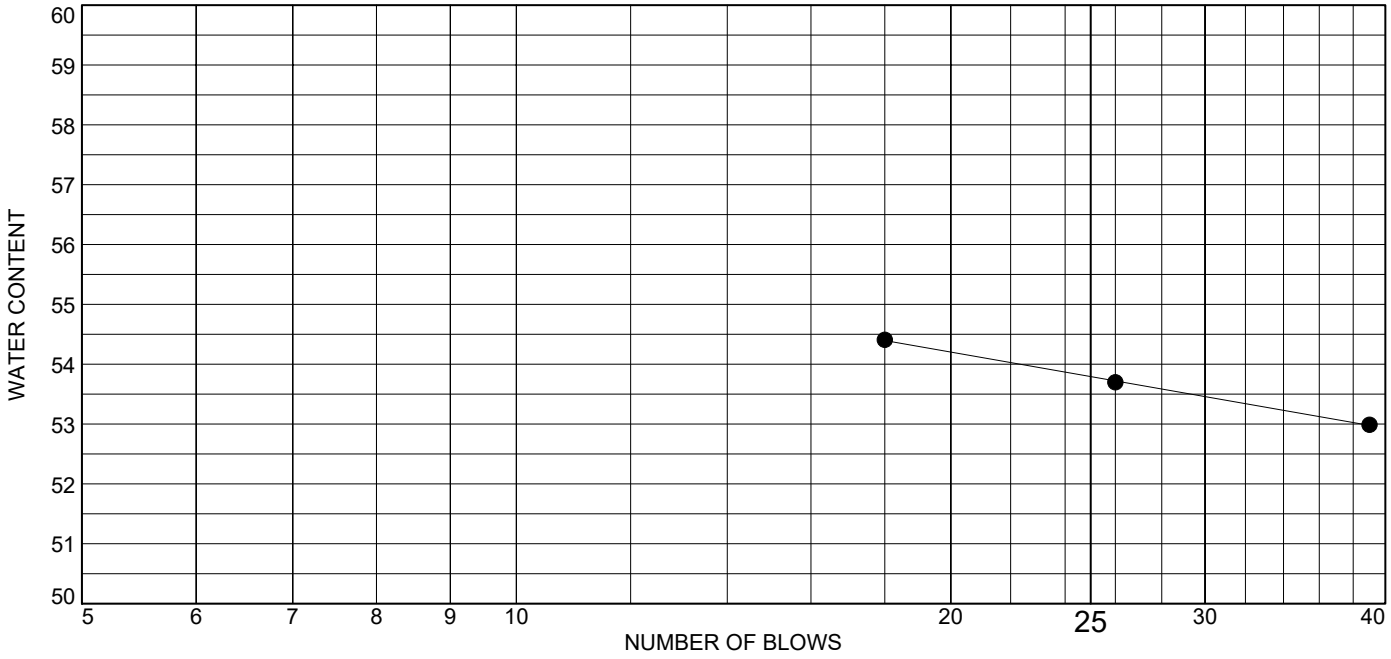
Terracon

Figure

Tested By: SJH **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY FAT CLAY	54	20	34			CH

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

Source of Sample: EDW-B012 **Depth:** 47.0'-49.0'
Sample Number: S-14

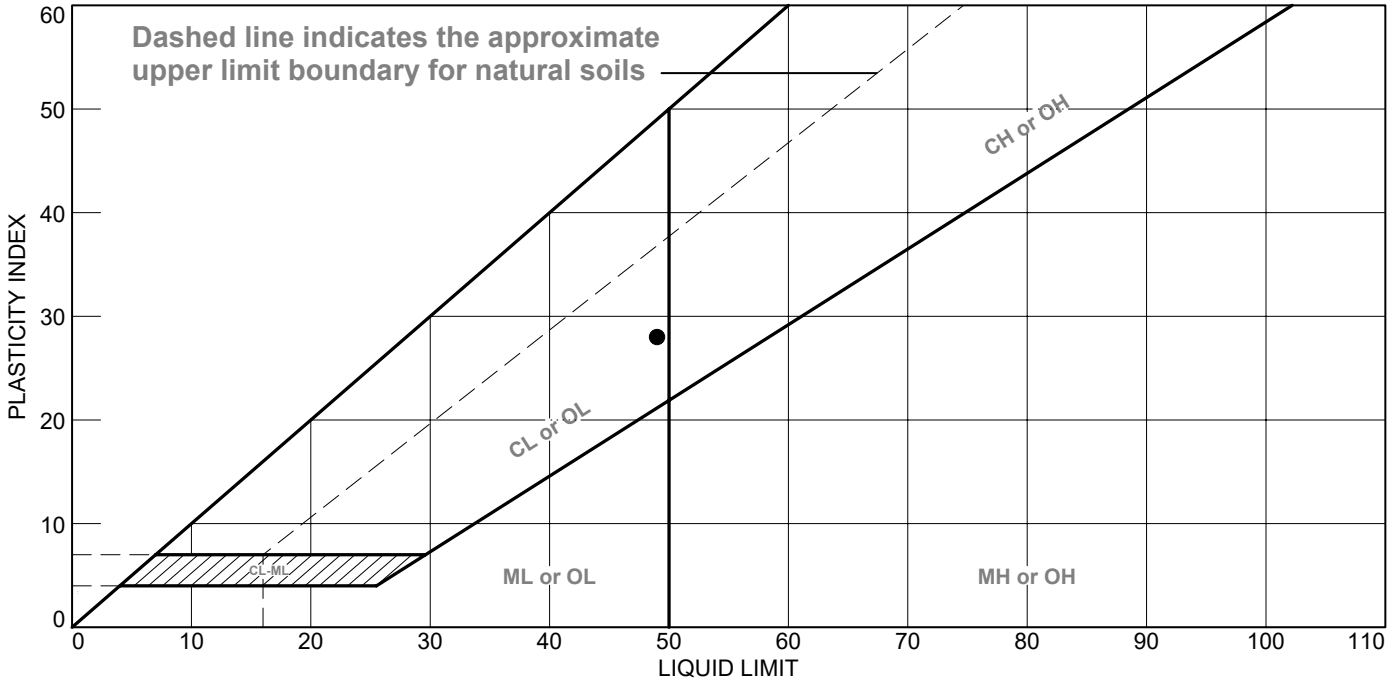
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL	49	21	28			CL

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

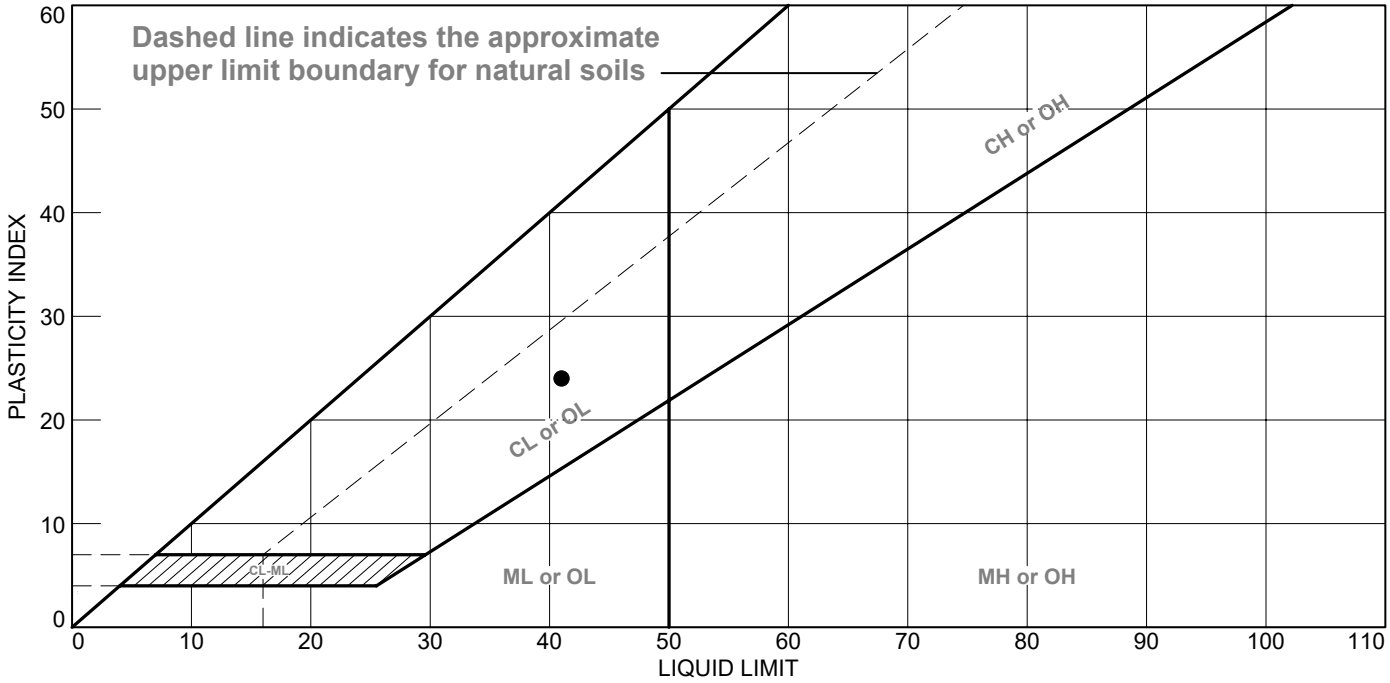
Source of Sample: EDW-B013 **Depth:** 6.0'-8.0'
Sample Number: S-3

Remarks:

Terracon

Figure

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY AND BROWNISH GRAY LEAN CLAY	41	17	24			CL

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

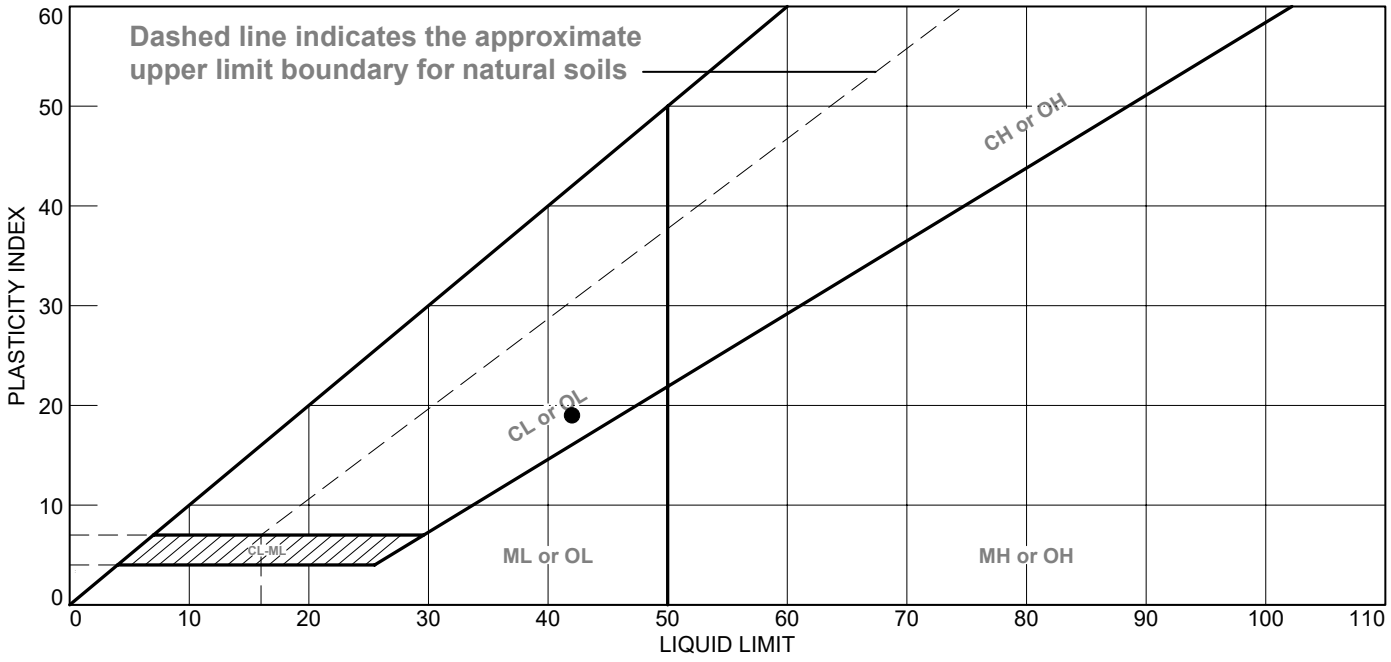
Source of Sample: EDW-B013 **Depth:** 15.0'-16.5'
Sample Number: S-6

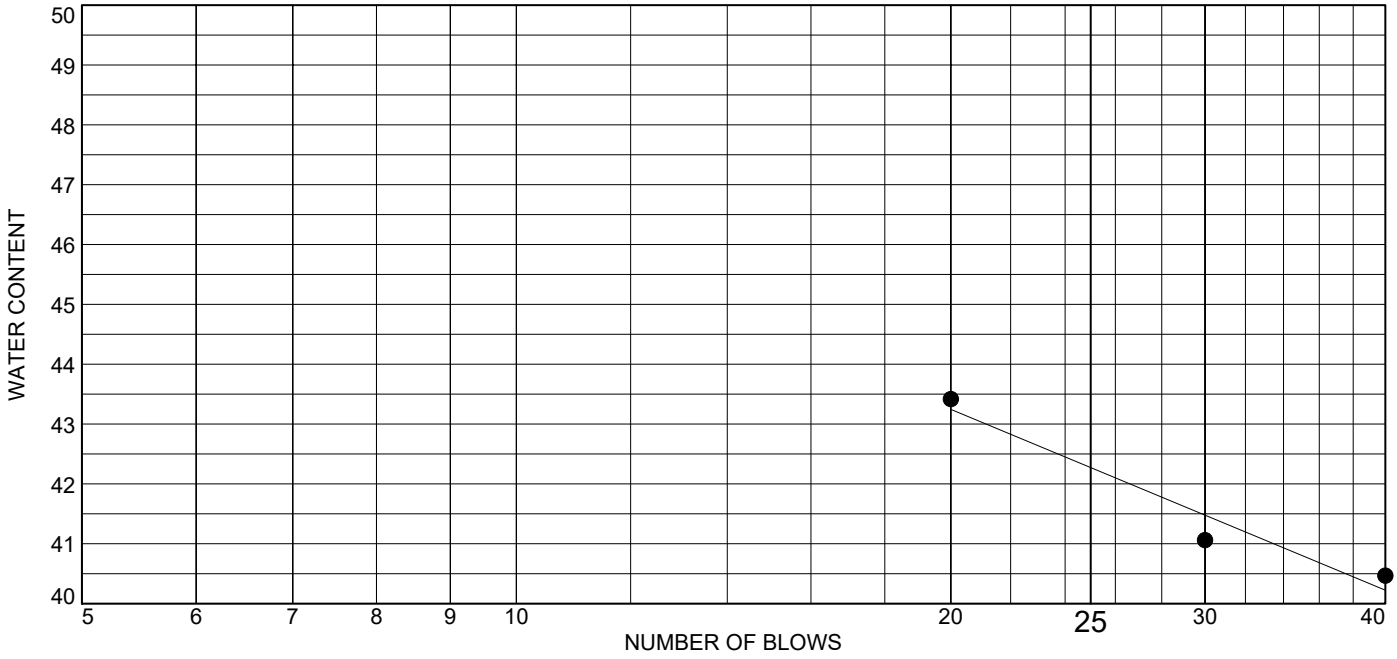
Remarks:

Terracon

Figure

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY AND BROWN LEAN CLAY WITH SAND	42	23	19			CL

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

Source of Sample: EDW-B013 **Depth:** 32.0'-34.0'
Sample Number: S-10

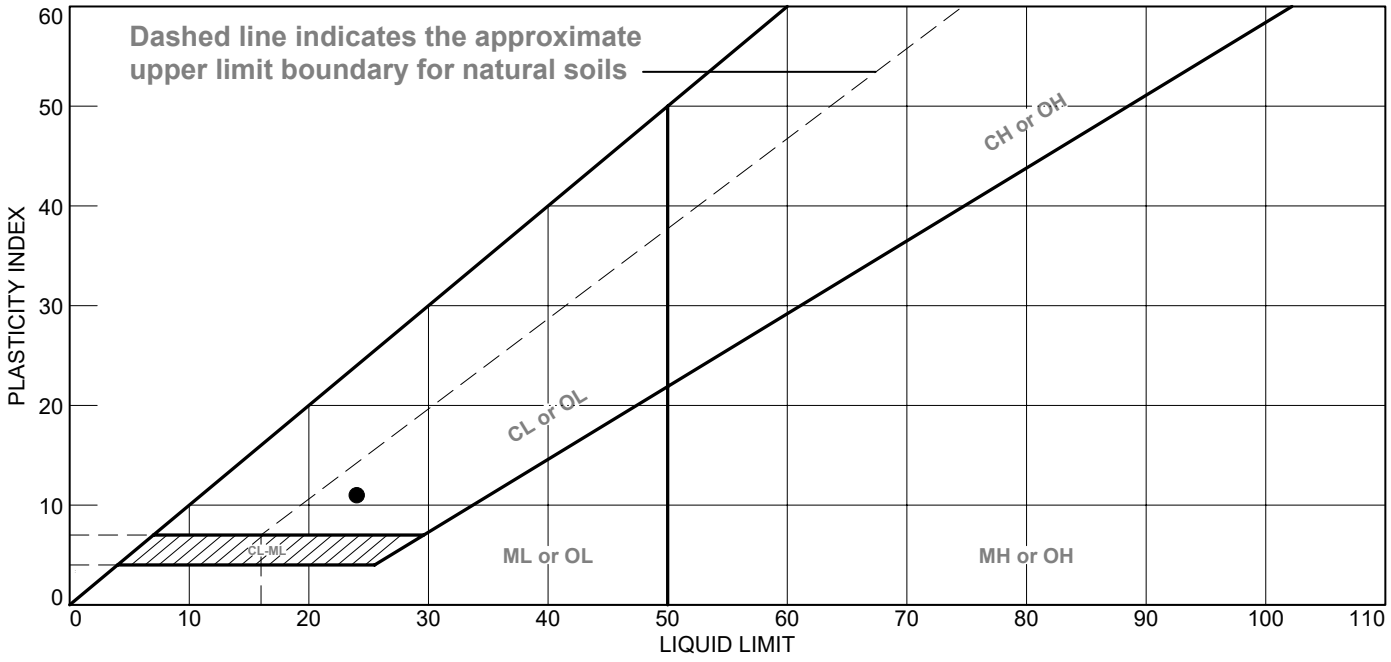
Remarks:

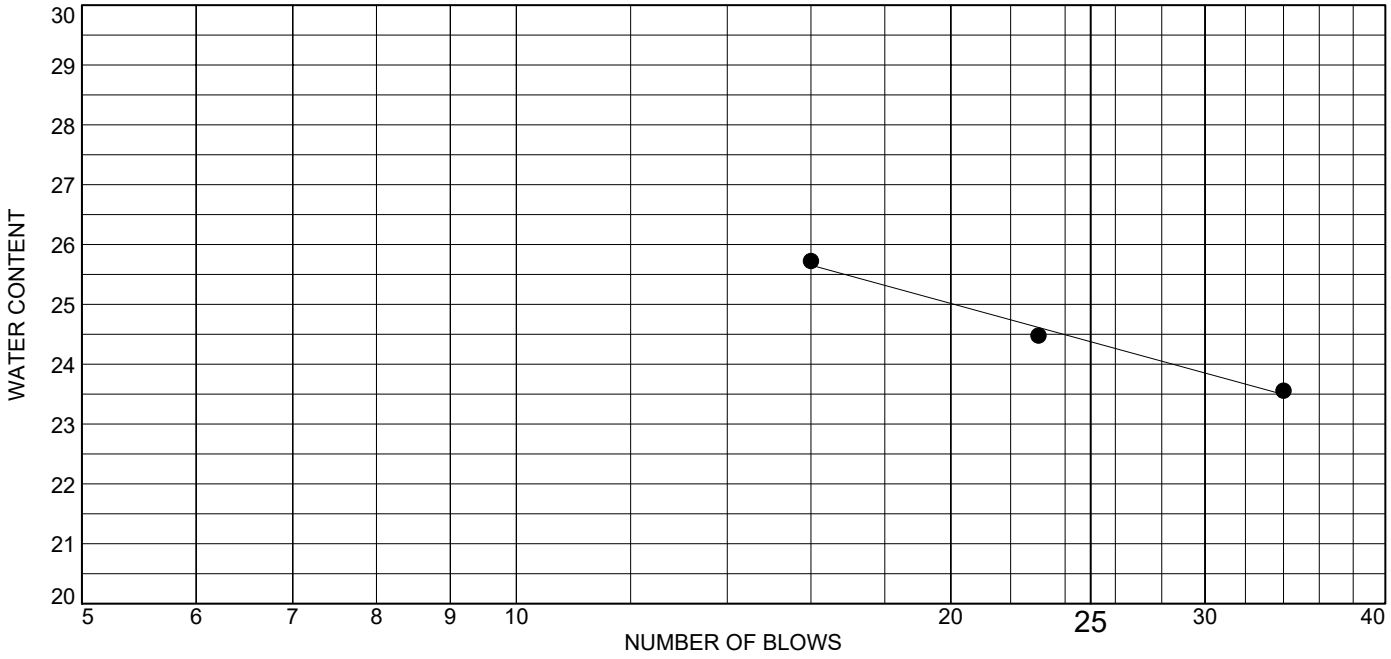
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAY MOTTLED SANDY LEAN CLAY WITH GRAVEL	24	13	11			CL

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

Source of Sample: EDW-B015 **Depth:** 31.0'-33.0'
Sample Number: S-10

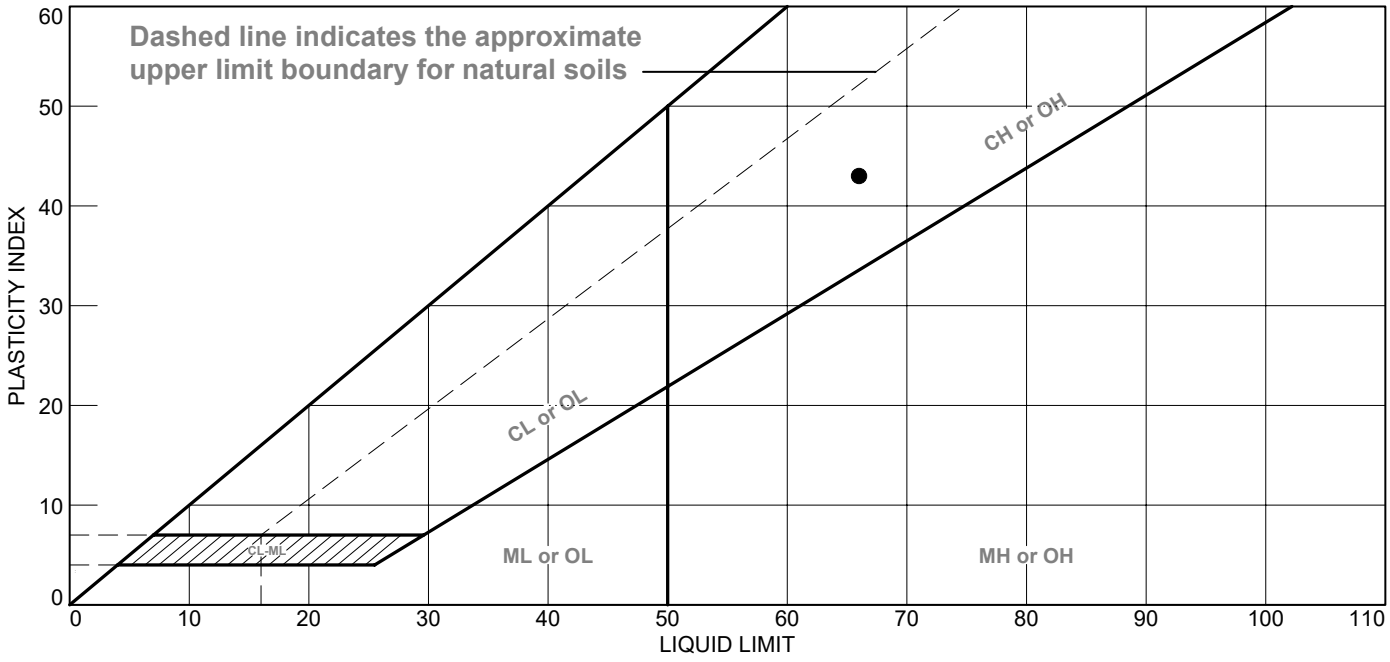
Remarks:

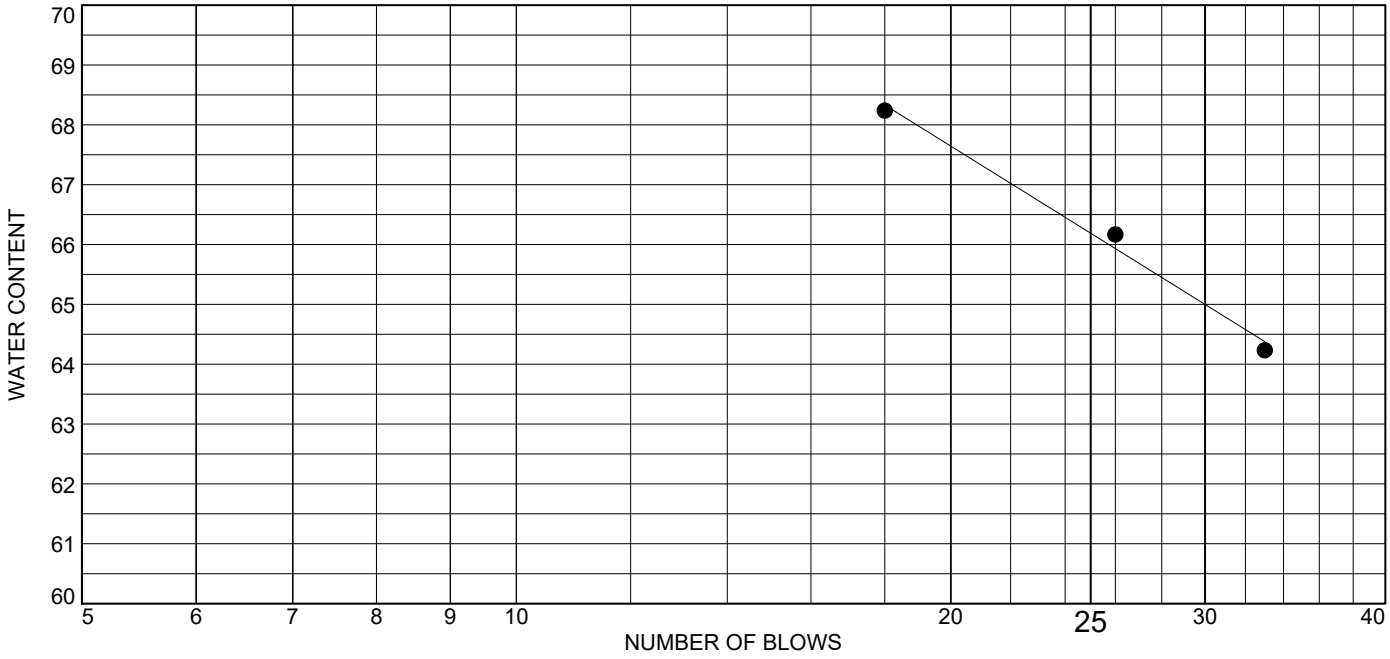
Terracon

Figure

Tested By: SJH **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY FAT CLAY	66	23	43			CH

Project No. MR155218 **Client:** DYNERGY

Project: DYNERGY - EDWARDS SITE

Source of Sample: EDW-B015 **Depth:** 37.0'-39.0'
Sample Number: S-12

Remarks:

Terracon

Figure

Tested By: SJH **Checked By:** WPQ

Terracon
Consulting Engineers & Scientists

SPECIFIC GRAVITY OF SOIL SOLIDS
ASTM D-854

Project Number: MR155218
Project Name: Dynergy Edwards
Test Date: 11/10/2015

Results Summary

Boring / Sample	Sample Description	USCS	Sample Number	Depth (ft)	Passing #4	Specific Gravity (Gs)
EDW-B002	DARK GRAY FLY ASH		S-8	25.0'-27.0'	100.00%	2.471
EDW-B002	GRAY LEAN CLAY	CL	S-11	40.0'-41.5'	100.00%	2.592
EDW-B003	FILL: DARK GRAY FLY ASH WITH SAND		S-1	0.0'-1.5'	100.00%	2.469
EDW-B003	FILL: DARK GRAY FLY ASH WITH SAND AND GRAVEL		S-6	15.0'-16.5'	100.00%	2.772
EDW-B004	GRAY LEAN CLAY WITH SAND	CL	S-14	50.0'-51.5'	100.00%	2.617
EDW-B005	DARK GRAY AND GREENISH GRAY LEAN CLAY WITH SAND - ORGANICS AND SHALE NOTED	CL	S-12	45.0'-46.5'	100.00%	2.521
EDW-B011	FILL: DARK GRAY FLY ASH - CLAY NOTED		S-8	25.0'-29.0'	100.00%	2.691
EDW-B014	FILL: DARK GRAY FLY ASH		S-7	20.0'-22.5'	100.00%	2.524
EDW-B014	BLUISH GRAY LEAN CLAY WITH SAND AND GRAVEL	CL	S-11	40.0'-40.5'	100.00%	2.719

Terracon
Consulting Engineers & Scientists

Laboratory Services Group | 750 Corporate Woods Parkway | Vernon Hills, Illinois 60061 | Ph. (224)352-7000 | Fax (224)352-7024

Soil Resistivity	**AASHTO T 288/ ASTM G 57**
Soil pH	**AASHTO T 289/ ASTM G 51**
Soil REDOX	**DIPRA**
Soil Sulfides	**DIPRA**
Water Content	**AASHTO T 93/ ASTM D 2216**

Soil Corrosivity Indication Series

Project No.: MR155218
Project Name: DYNERGY EDWARDS

Client Name: AECOM
Test Date: 5/11/13/15

Summary of Test Results

Boring / Sample No.	Resistivity Natural Miller Soil Box(ohms)	Resistivity Saturated Miller Soil Box(ohms)	pH Soil Water Slurry	REDOX (mV)Soil Water Slurry	Sulfides Reaction	As Received WC%	Saturated WC%	Total Points
EDW-B002 S6	**1,720**	**1,550**	**9.77**	**65**	**NEG**	**52.3**	**77.4**	**14.5**
Points	0	8	3	3.5	0			
Description:	DARK GRAY FLY ASH							
EDW-B004 S3	**3,380**	**3,070**	**8.97**	**140**	**NEG**	**21.4**	**36.9**	**3.0**
Points	0	0	3	0	0			
Description:	BROWN AND GRAY LEAN CLAY							
EDW-B005 S12	**1,120**	**960**	**8.38**	**195**	**NEG**	**88.7**	**99.4**	**10.0**
Points	0	10	0	0	0			
Description:	DARK GRAY AND GREENISH GRAY LEAN CLAY WITH SAND							
EDW- B011 S6	**1,760**	**1,600**	**9.85**	**60**	**NEG**	**63.6**	**82.3**	**14.5**
Points	0	8	3	3.5	0			
Description:	DARK GRAY FLY ASH							
EDW-B0014 S7	**1,995**	**1,810**	**10.89**	**35**	**4**	**86.5**	**98.6**	**15.0**
Points	0	8	3	4	0			
Description:	DARK GRAY FLY ASH							

Resistivity:	Points:	pH:	Points:	Redox:	Points:	Sulfides:	Points:	†
<1500 ohms	10	0.0-2.0	5	Negative	5	Positive	3.5	
1500-1800	8	2.0-4.0	3	0 - 50mV	4	Trace	2	
1800-2100	5	4.0-6.5	0	50 - 100mV	3.5	Negative	0	
2100-2500	2	6.5-7.5	0*	100mV+	0			
2500-3000	1	7.5-8.5	0					
3000+	0	8.5 +	3					

*- If Sulfides are present and a low or neg. ReDox, add 3 points

† - THIS SYSTEM IS BASED ON A 25.5 POINT CORROSIVITY RATING SYSTEM DEVELOPED BY THE AMERICAN NATIONAL STANDARDS FOR POLYETHYLENE ENCASEMENT AND DUCTILE-IRON PIPE SYSTEMS. IT SHOULD BE NOTED THAT THESE TEST RESULTS ARE AN INDICATION OF SOIL CHEMISTRY AND SHOULD BE USED AS A INDICATION OF POSSIBLE CORROSIVE CONDITIONS. TERRACON IS NOT LIABLE FOR ANY REMEDIAL MEASURES TAKEN ON THE BASIS OF THESE RESULTS.

Tested by: BCM

Checked By: WPQ

Terracon
Consulting Engineers & Scientists

ORGANIC CONTENT TEST
ASTM D-2974
Method C

Laboratory Services Group *750 Corporate Woods Parkway, Vernon Hills, Illinois 60061* *Phone: (224) 352-7000 Fax:(224)352-7*

Project No.: MR155218
Project Name: DYNERGY - EDWARDS SITE
Client: AECOM
Date Tested: 11/13/2015

Sample Information

Boring / Source:	EDW-B005
Sample No.:	S-12
Depth (ft.):	45.0-46.5'
Description:	CL

Organic Content Test Data

Tare No.:	C
Tare Wt. (gm):	20.04
Wet Wt. + Tare (gm):	49.66
Dry Wt. + Tare (gm):	36.05
Moisture Content (%):	**85.01**
Wt. of Ash + Tare (gm):	34.63
Percent Ash:	91.13
Organic Content (%):	**8.87**

** Note: Test performed by heating the sample to 440 degrees Centigrade until constant weight of ash is attained.

HALEY & ALDRICH, INC.
GEOTECHNICAL LABORATORY REPORTS

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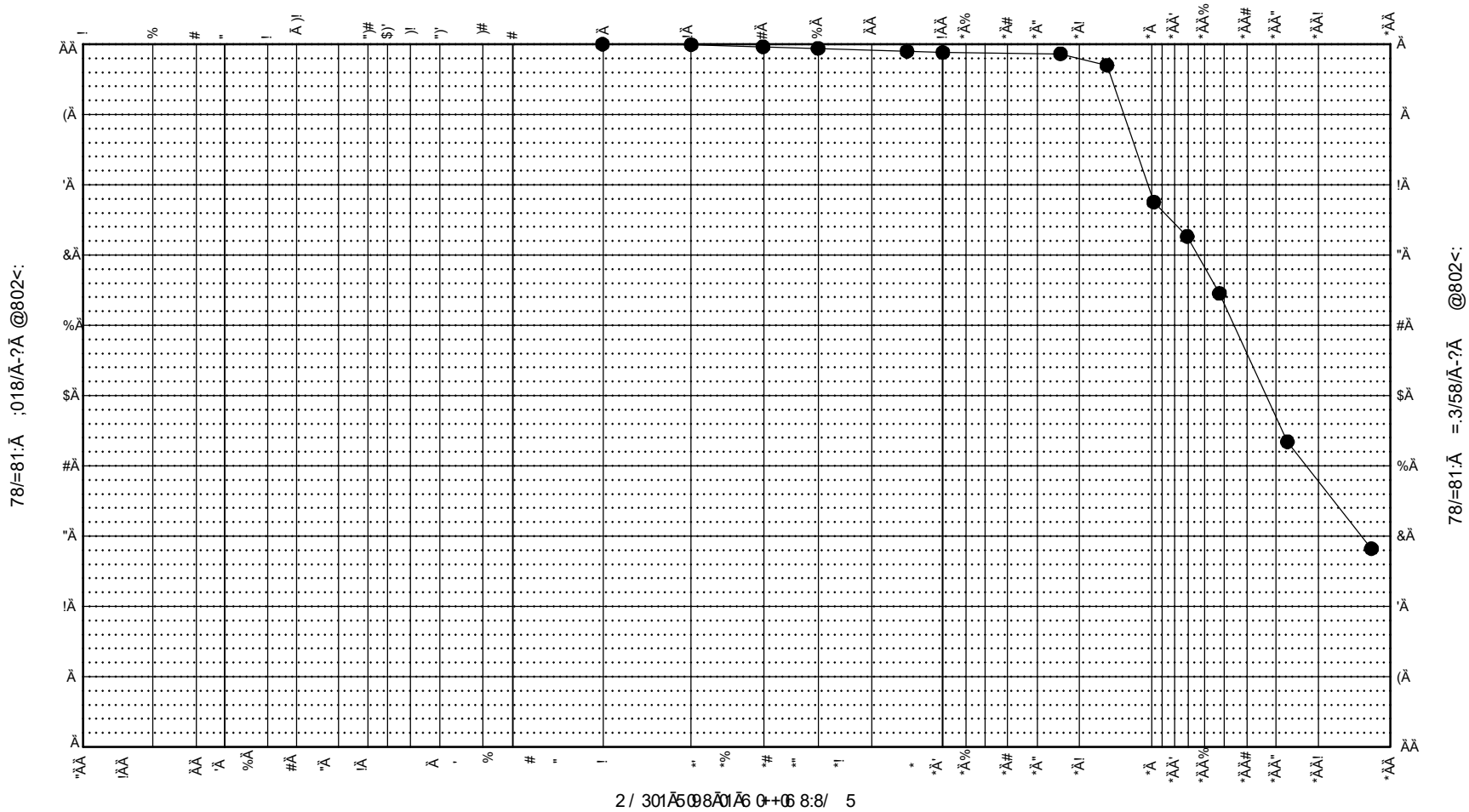

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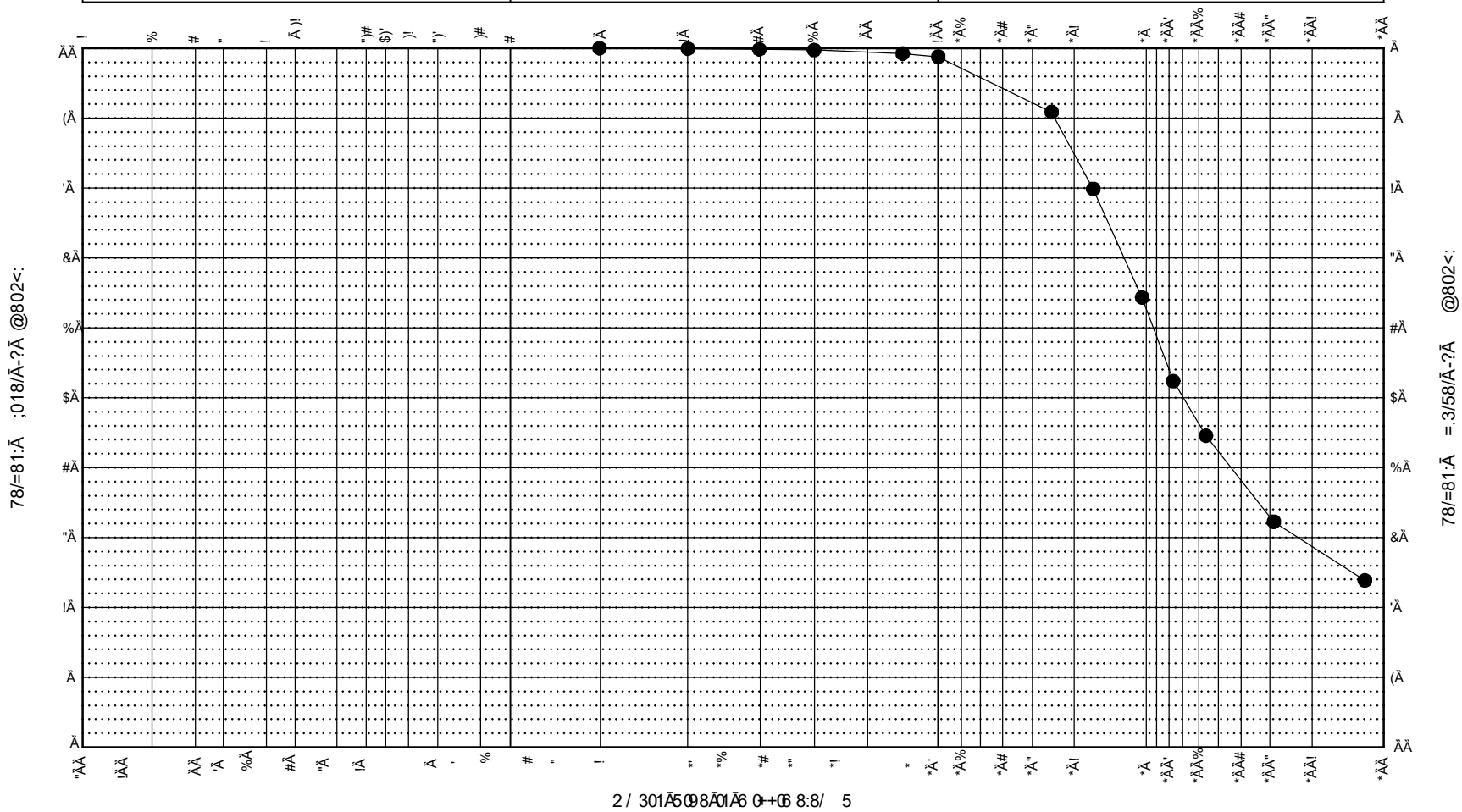

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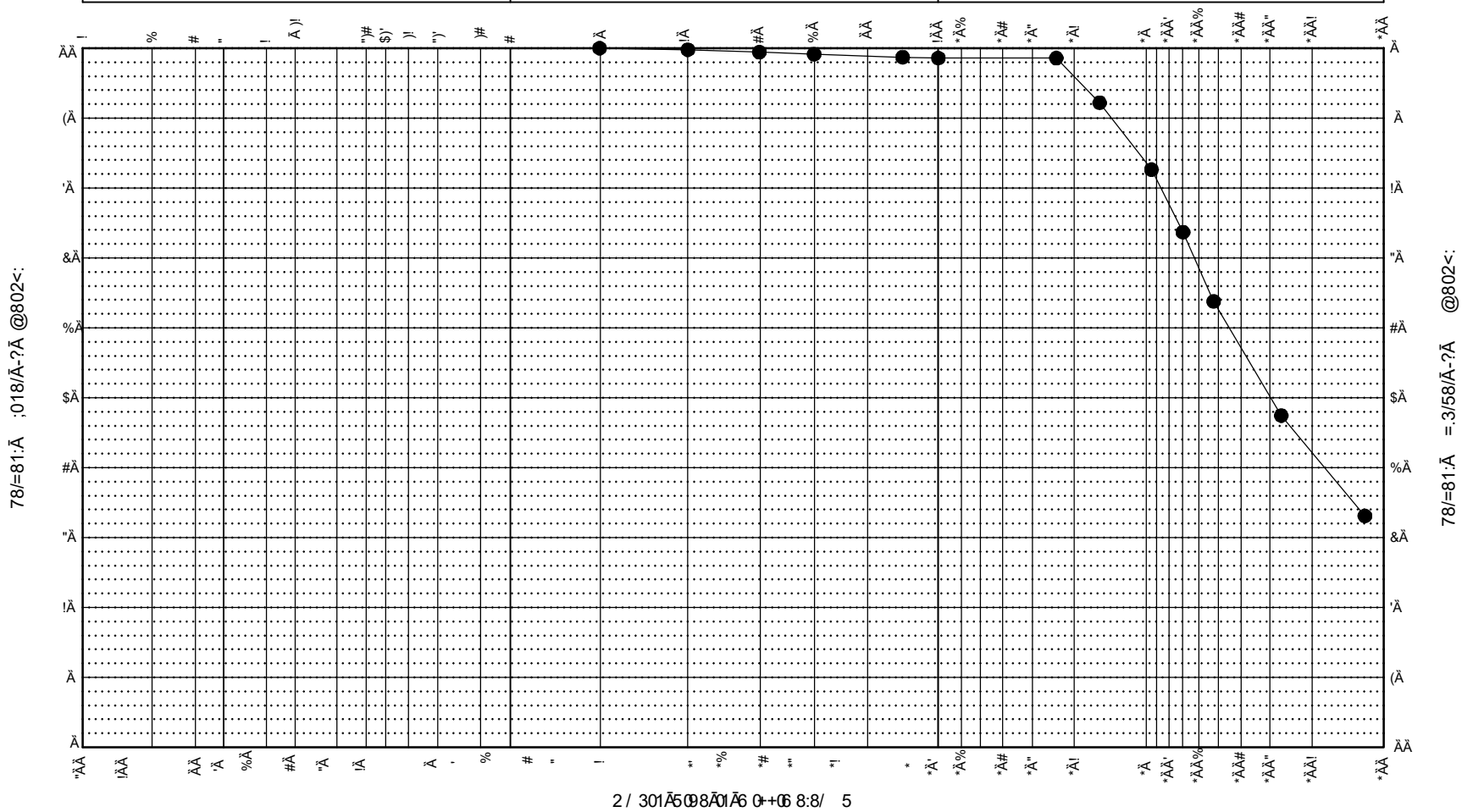

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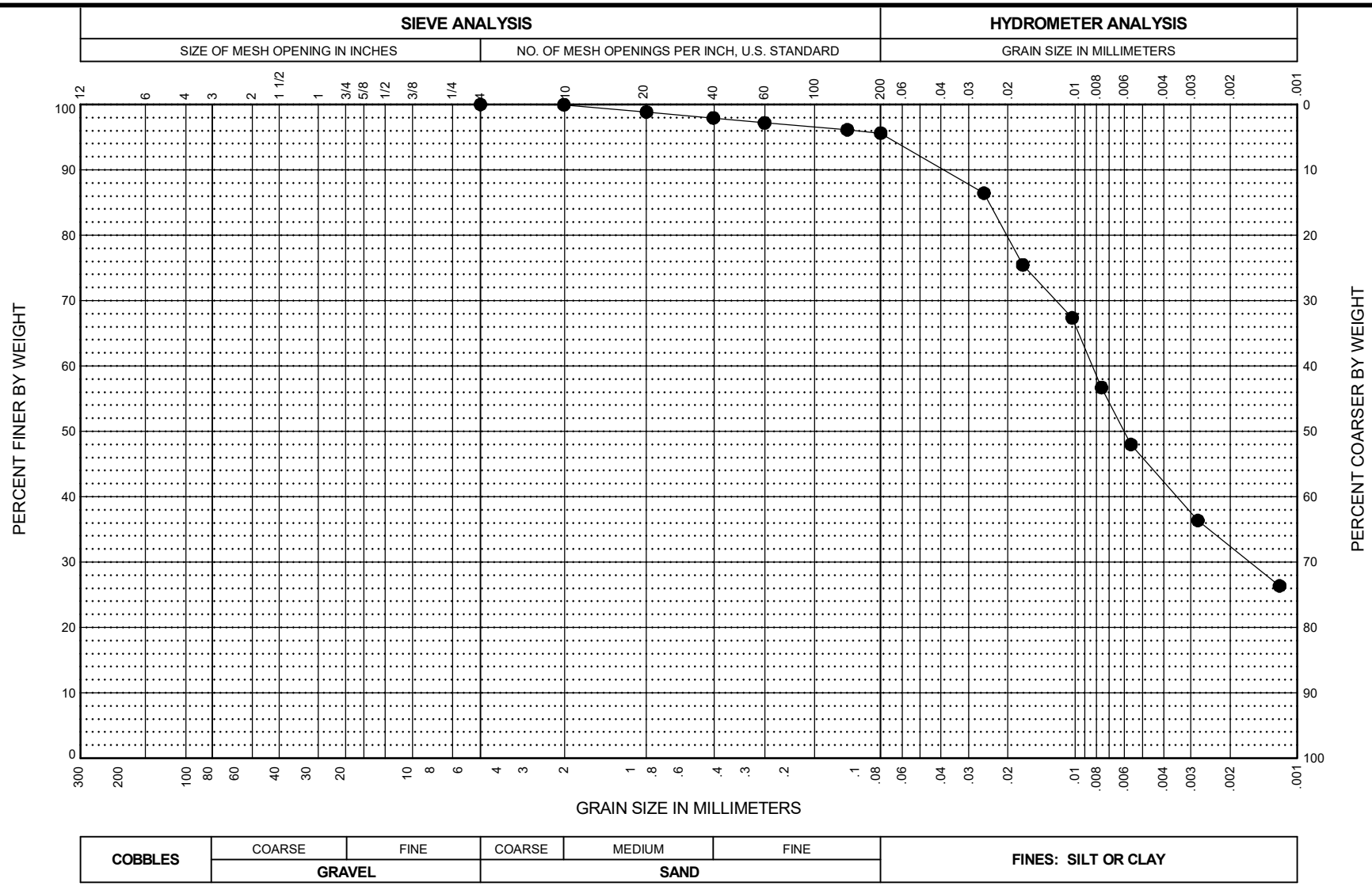


BORING AND SAMPLE NO.	DEPTH (feet)	U.S.C.S. SYMBOL	SAMPLE DESCRIPTION	FINES %	NAT. W.C. %	LL %	PL %	PI %
● HA-OW-01, U3	28.5 - 30.5	CL	Gray and brown, Lean Clay.	95.6	33.1	48	19	29

Edwards Power Station Ash Pond
Bartonville, Illinois

GRAIN SIZE DISTRIBUTION

January 2018 41-1-37849-001

SHANNON & WILSON, INC.
Geotechnical and Environmental Consultants

FIG.

GSA- WITH SAMPLE INTERVALS 41-1-37849-001 LAB DATA.GPJ SHAN_WIL.GDT 2/1/18

HYDRAULIC CONDUCTIVITY

Project	Edwards Power Station Ash Pond
Location	Bartonville, Illinois
Job No.	41-1-37849-001
Boring	HAB-1
Sample	U5
Depth (ft)	52.7
Description	Gray, Fat Clay (CH).

		Date
Tested By	CMB	1/23/18
Calculated By	CMB	1/31/18
Checked By	DPM	1/31/18
File	41-1-37849-001 HAB-1 U5 D5084	
Procedure	ASTM D5084	
Permeant	Deaired Water	

Permeameter No. 14

Standpipe Vol (cm^3/cm) Inflow: 1.242 Outflow: 1.239

	Before Test	After Test
Sample Diameter (in)	2.827	2.817
Sample Length (in)	2.114	2.095
Sample Area (cm^2)	40.50	40.21
Sample Volume (cm^3)	217.44	213.97
Sample Wt. (g)	360.63	360.22
Wet Density (pcf)	103.5	105.1
Dry Density (pcf)	67.4	67.4
Saturation (%)	96.9	101.0
Consolidation (psi)	8 min	9 max

	Before Test	After Test
Tare No.	1-5	8
Tare Wt. (g)	2.50	99.87
Wet Soil + Tare (g)	84.76	459.62
Dry Soil + Tare (g)	56.06	330.77
Water Content (%)	53.6	55.8
Porosity	0.597	
Pore Volume (CC)	129.83	
Starting B.P. Saturation (%)	97	

Specific Gravity 2.68 (estimated)

Read Time day	hr	min	P_{cell} psi	P_{in} psi	P_{out} psi	Readings (cm) h_{in}	h_{out}	Water Temp. °C	Inflow PV	Outflow PV	Storage PV	Total PV	i	K @ 20°C cm/s
24	8	37	99.0	91.0	90.0	81.10	30.40	23.2	---	---	---	---	---	---
24	10	15	99.0	91.0	90.0	80.95	30.65	23.2	0.00	0.00	0.00	0.00	22.5	4.3E-08
24	11	55	99.0	91.0	90.0	80.80	30.85	23.4	0.00	0.00	0.00	0.00	22.4	3.7E-08
24	14	1	99.0	91.0	90.0	80.60	31.00	23.4	0.00	0.00	0.00	0.01	22.3	2.9E-08
24	15	46	99.0	91.0	90.0	80.40	31.20	23.3	0.00	0.00	0.00	0.01	22.3	4.0E-08
25	9	21	99.0	91.0	90.0	78.65	33.00	22.8	-0.02	0.02	0.00	0.02	21.6	3.6E-08
25	11	48	99.0	91.0	90.0	78.40	33.20	23.1	0.00	0.00	0.00	0.03	21.5	3.4E-08
29	7	57	99.0	91.0	90.0	70.25	40.80	22.6	-0.08	0.07	0.00	0.10	18.6	3.4E-08
29	10	35	99.0	91.0	90.0	70.05	41.00	22.6	0.00	0.00	0.00	0.10	18.5	3.3E-08
29	12	55	99.0	91.0	90.0	69.85	41.20	22.7	0.00	0.00	0.00	0.10	18.4	3.7E-08
29	15	42	99.0	91.0	90.0	69.60	41.40	22.7	0.00	0.00	0.00	0.10	18.4	3.5E-08
30	7	39	99.0	91.0	90.0	68.35	42.55	22.8	-0.01	0.01	0.00	0.12	17.9	3.3E-08

Average Hydraulic Conductivity at Completion @ 20°C (m/s)	3.4E-10
Average Hydraulic Conductivity at Completion @ 20°C (cm/s)	3.4E-08

Shannon & Wilson, Inc.
2043 Westport Center Drive
St. Louis, MO 63146

HYDRAULIC CONDUCTIVITY

Project	Edwards Power Station Ash Pond
Location	Bartonville, Illinois
Job No.	41-1-37849-001
Boring	HAB-3
Sample	U3
Depth (ft)	56.6
Description	Gray-brown, Fat Clay (CH).

		Date
Tested By	CMB	1/23/18
Calculated By	CMB	1/31/18
Checked By	DPM	1/31/18
File	41-1-37849-001 HAB-3 U3 D5084	
Procedure	ASTM D5084	
Permeant	Deaired Water	

Permeameter No. 16

Standpipe Vol (cm^3/cm) Inflow: 1.247 Outflow: 1.240

	Before Test	After Test
Sample Diameter (in)	2.837	2.837
Sample Length (in)	2.186	2.162
Sample Area (cm^2)	40.78	40.78
Sample Volume (cm^3)	226.44	223.96
Sample Wt. (g)	457.85	458.25
Wet Density (pcf)	126.2	127.7
Dry Density (pcf)	101.7	102.6
Saturation (%)	100.0	104.1
Consolidation (psi)	7 min	8 max

	Before Test	After Test
Tare No.	3-3	12
Tare Wt. (g)	2.54	102.09
Wet Soil + Tare (g)	107.24	559.53
Dry Soil + Tare (g)	86.95	469.51
Water Content (%)	24.0	24.5
Porosity	0.392	
Pore Volume (CC)	88.71	
Starting B.P. Saturation (%)	95	

Specific Gravity 2.68 (estimated)

Read Time day hr min	P_{cell} psi	P_{in} psi	P_{out} psi	Readings (cm) h_{in}	Readings (cm) h_{out}	Water Temp. °C	Inflow PV	Outflow PV	Storage PV	Total PV	i	K @ 20°C cm/s
24 8 38	98.0	91.0	90.0	92.75	30.60	23.0	---	---	---	---	---	---
24 10 16	98.0	91.0	90.0	92.75	31.40	23.1		0.01	0.01	0.01	23.7	8.1E-08
24 11 56	98.0	91.0	90.0	92.45	31.75	23.2	0.00	0.00	0.00	0.02	23.6	6.5E-08
24 14 2	98.0	91.0	90.0	92.10	32.15	23.4	0.00	0.01	0.00	0.02	23.5	5.9E-08
24 15 47	98.0	91.0	90.0	91.80	32.40	23.4	0.00	0.00	0.00	0.03	23.4	5.2E-08
25 9 22	98.0	91.0	90.0	89.30	34.80	22.9	-0.04	0.03	0.00	0.06	22.5	4.8E-08
25 11 49	98.0	91.0	90.0	89.00	35.10	23.1	0.00	0.00	0.00	0.06	22.4	4.3E-08
29 11 37	98.0	91.0	90.0	62.60	44.85	22.8	---	---	---	---	15.9	---
29 12 56	98.0	91.0	90.0	62.45	44.95	22.9	0.00	0.00	0.00	0.06	15.8	4.7E-08
29 15 43	98.0	91.0	90.0	61.95	45.05	22.8	-0.01	0.00	0.00	0.07	15.7	5.4E-08
30 7 40	98.0	91.0	90.0	60.30	46.70	22.7	-0.02	0.02	0.00	0.09	15.1	5.3E-08

Average Hydraulic Conductivity at Completion @ 20°C (m/s)	4.9E-10
Average Hydraulic Conductivity at Completion @ 20°C (cm/s)	4.9E-08

Shannon & Wilson, Inc.
2043 Westport Center Drive
St. Louis, MO 63146

HYDRAULIC CONDUCTIVITY

Project	Edwards Power Station Ash Pond
Location	Bartonville, Illinois
Job No.	41-1-37849-001
Boring	HAB-5
Sample	U3
Depth (ft)	36.3
Description	Gray-brown, Fat Clay (CH).

		Date
Tested By	CMB	1/23/18
Calculated By	CMB	1/31/18
Checked By	DPM	1/31/18
File	41-1-37849-001 HAB-5 U3 D5084	
Procedure	ASTM D5084	
Permeant	Deaired Water	

Permeameter No. 17

Standpipe Vol (cm^3/cm) Inflow: 1.240 Outflow: 1.240

	Before Test	After Test
Sample Diameter (in)	2.816	2.815
Sample Length (in)	2.132	2.130
Sample Area (cm^2)	40.18	40.15
Sample Volume (cm^3)	217.59	217.23
Sample Wt. (g)	384.42	388.30
Wet Density (pcf)	110.2	111.5
Dry Density (pcf)	78.6	77.8
Saturation (%)	95.8	101.1
Consolidation (psi)	14 min	15 max

	Before Test	After Test
Tare No.	5-3	29
Tare Wt. (g)	2.53	165.59
Wet Soil + Tare (g)	84.89	553.20
Dry Soil + Tare (g)	61.22	436.05
Water Content (%)	40.3	43.3
Porosity	0.530	
Pore Volume (CC)	115.38	
Starting B.P. Saturation (%)	95	

Specific Gravity 2.68 (estimated)

Read Time day	hr	min	P_{cell} psi	P_{in} psi	P_{out} psi	Readings (cm) h_{in}	h_{out}	Water Temp. °C	Inflow PV	Outflow PV	Storage PV	Total PV	i	K @ 20°C cm/s
24	8	39	105.0	91.0	90.0	88.35	32.35	23.2	---	---	---	---	---	---
24	10	17	105.0	91.0	90.0	88.55	34.40	23.2					23.0	
24	11	57	105.0	91.0	90.0	88.00	35.00	23.4	-0.01	0.01	0.00	0.01	22.8	1.2E-07
24	14	3	105.0	91.0	90.0	87.40	35.70	23.4	-0.01	0.01	0.00	0.01	22.5	1.1E-07
24	15	48	105.0	91.0	90.0	86.90	36.20	23.3	-0.01	0.01	0.00	0.02	22.4	1.0E-07
25	9	23	105.0	91.0	90.0	82.50	40.40	22.9	-0.05	0.05	0.00	0.06	20.8	9.0E-08
25	11	50	105.0	91.0	90.0	82.00	40.95	23.1	-0.01	0.01	0.00	0.07	20.6	8.3E-08
29	7	59	105.0	91.0	90.0	64.95	56.80	22.7	-0.18	0.17	-0.01	0.24	14.5	8.2E-08
29	10	36	105.0	91.0	90.0	64.50	57.20	22.7	0.00	0.00	0.00	0.25	14.3	9.1E-08
29	12	57	105.0	91.0	90.0	64.15	57.60	22.9	0.00	0.00	0.00	0.25	14.2	9.0E-08
29	15	44	105.0	91.0	90.0	63.65	58.00	22.9	-0.01	0.00	0.00	0.25	14.0	9.2E-08
30	7	41	105.0	91.0	90.0	61.25	60.20	22.7	-0.03	0.02	0.00	0.28	13.2	8.5E-08

Average Hydraulic Conductivity at Completion @ 20°C (m/s)	8.9E-10
Average Hydraulic Conductivity at Completion @ 20°C (cm/s)	8.9E-08

Shannon & Wilson, Inc.
2043 Westport Center Drive
St. Louis, MO 63146

HYDRAULIC CONDUCTIVITY

Project	Edwards Power Station Ash Pond
Location	Bartonville, Illinois
Job No.	41-1-37849-001
Boring	HA-OW-01
Sample	U3
Depth (ft)	29.3
Description	Gray-brown, Lean Clay (CL).

		Date
Tested By	CMB	1/31/18
Calculated By	CMB	2/7/18
Checked By	DPM	2/7/18
File	41-1-37849-001 HA-OW-01 U3 D5084	
Procedure	ASTM D5084	
Permeant	Deaired Water	

Permeameter No. 17

Standpipe Vol (cm^3/cm) Inflow: 1.240 Outflow: 1.240

	Before Test	After Test
Sample Diameter (in)	2.821	2.800
Sample Length (in)	1.928	1.875
Sample Area (cm^2)	40.32	39.73
Sample Volume (cm^3)	197.47	189.19
Sample Wt. (g)	376.66	370.79
Wet Density (pcf)	119.0	122.3
Dry Density (pcf)	90.1	93.1
Saturation (%)	100.6	105.5
Consolidation (psi)	11 min	12 max

	Before Test	After Test
Tare No.	1-3	25
Tare Wt. (g)	2.53	161.25
Wet Soil + Tare (g)	77.63	531.39
Dry Soil + Tare (g)	59.36	443.03
Water Content (%)	32.1	31.4
Porosity	0.461	
Pore Volume (CC)	91.12	
Starting B.P. Saturation (%)	96	

Specific Gravity 2.68 (estimated)

Read Time day	hr	min	P_{cell} psi	P_{in} psi	P_{out} psi	Readings (cm) h_{in}	h_{out}	Water Temp. °C	Inflow PV	Outflow PV	Storage PV	Total PV	i	K @ 20°C cm/s
1	12	7	102.0	91.0	90.0	89.85	37.25	22.6	---	---	---	---	---	---
1	15	39	102.0	91.0	90.0	89.75	37.70	22.6	0.00	0.01	0.00	0.01	25.0	2.5E-08
2	7	34	102.0	91.0	90.0	88.65	38.75	22.4	-0.01	0.01	0.00	0.02	24.6	2.2E-08
2	10	26	102.0	91.0	90.0	88.45	38.95	22.4	0.00	0.00	0.00	0.02	24.5	2.3E-08
2	13	18	102.0	91.0	90.0	88.30	39.16	22.5	0.00	0.00	0.00	0.03	24.4	2.0E-08
5	7	34	102.0	91.0	90.0	83.85	43.00	22.4	-0.06	0.05	0.00	0.08	22.7	2.1E-08
5	10	1	102.0	91.0	90.0	83.70	43.10	22.5	0.00	0.00	0.00	0.08	22.7	1.8E-08
5	13	14	102.0	91.0	90.0	83.50	43.30	22.5	0.00	0.00	0.00	0.08	22.6	2.2E-08
5	16	4	102.0	91.0	90.0	83.35	43.45	22.4	0.00	0.00	0.00	0.08	22.5	1.9E-08
6	7	35	102.0	91.0	90.0	82.40	44.30	22.3	-0.01	0.01	0.00	0.10	22.1	2.1E-08

Average Hydraulic Conductivity at Completion @ 20°C (m/s)	2.0E-10
Average Hydraulic Conductivity at Completion @ 20°C (cm/s)	2.0E-08

Shannon & Wilson, Inc.
2043 Westport Center Drive
St. Louis, MO 63146

TABLE I

SUMMARY OF CURRENT SUBSURFACE EXPLORATIONS
DYNEGY
EDWARDS POWER STATION
BARTONVILLE, ILLINOIS

Exploration Designation[1]	Ground Surface El.[2] (ft)	Northing[2]	Easting[2]	Total Exploration Depth (ft)	Water[3]	
					Depth Below Ground Surface (ft)	Elevation (ft)
HAB-01	457.8	1,429,282.52	2,435,251.74	58.8	5.5	452.3
HAB-02	458.4	1,429,903.58	2,435,764.03	38.5	5.0	453.4
HAB-03	469.9	1,430,619.71	2,434,935.46	118.0	15.0	454.9
HAB-04	458.3	1,431,767.36	2,434,995.09	16.5	DRY	DRY
HAB-05	459.2	1,428,320.25	2,435,895.55	41.5	15.0	444.2
HA-OW-01	455.6	1,431,706.38	2,435,054.27	34.5	4.8	450.8

Notes:

1) Technical monitoring of explorations completed during the period 27 November 2017 through 8 December 2017 was performed by Haley & Aldrich, Inc.

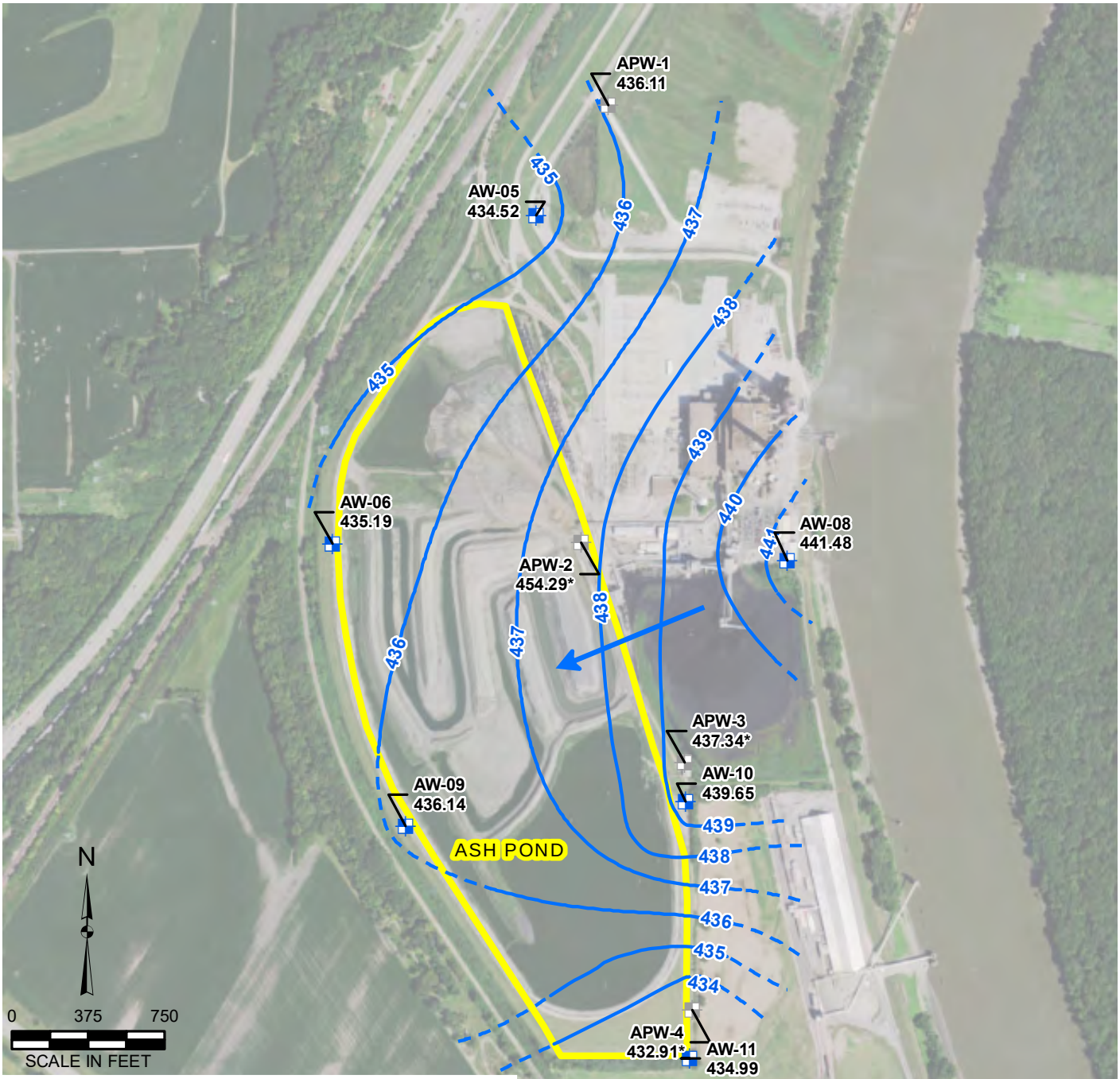
2) As drilled locations and ground surface elevations of test borings were determined in the field by Maurer-Stutz, Inc. of Peoria, IL by optical survey. Coordinates are shown in Illinois State Plane West Zone NAD83. Elevations are in units of feet, relative to NAVD88.

3) Water level readings represent the highest water level observed either during drilling, after completion of the boring, or as indicated by subsurface exploration instruments. Refer to the subsurface exploration logs for additional water level data. Water level readings have been made in the subsurface explorations at times and under conditions discussed herein. However, it must be noted that fluctuations in the level of the water may occur due to variations in season, rainfall, temperature, plant operations, and other factors not evident at the time measurements were made and reported.

TABLE II
SUMMARY OF LABORATORY TEST RESULTS
DYNEGY
EDWARDS POWER STATION
BARTONVILLE, ILLINOIS

Exploration Designation	Sample Number	Sample Type	Sample Depth (ft)	USCS Symbol	Material Type	Moisture Content (%)	LL	PL	PI	% Gravel	% Sand	% Fines	Hydraulic Conductivity		
													Dry Density (pcf)	k (cm/sec)	Confining Pressure (psi)
HAB-1	U5	Shelby Tube	51.5-53.5	CH	Alluvial Deposits	57.9	68	29	39	0	1	99	67.4	3.4E-08	8
HAB-3	U3	Shelby Tube	56.0-57.0	CH	Alluvial Deposits	40.3	57	23	34	0	1	99	101.7	4.9E-08	7
HAB-5	U3	Shelby Tube	35.5-37.5	CH	Alluvial Deposits	39.0	64	24	39	0	1	99	78.6	8.9E-08	14
HA-OW-01	U3	Shelby Tube	28.5-30.5	CL	Alluvial Deposits	33.1	48	19	29	0	4	96	90.1	2.0E-08	11

APPENDIX E
GROUNDWATER CONTOUR MAPS AND ELEVATIONS



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ANS 1/25/17
APPROVED BY/DATE:
JJW 2/7/17

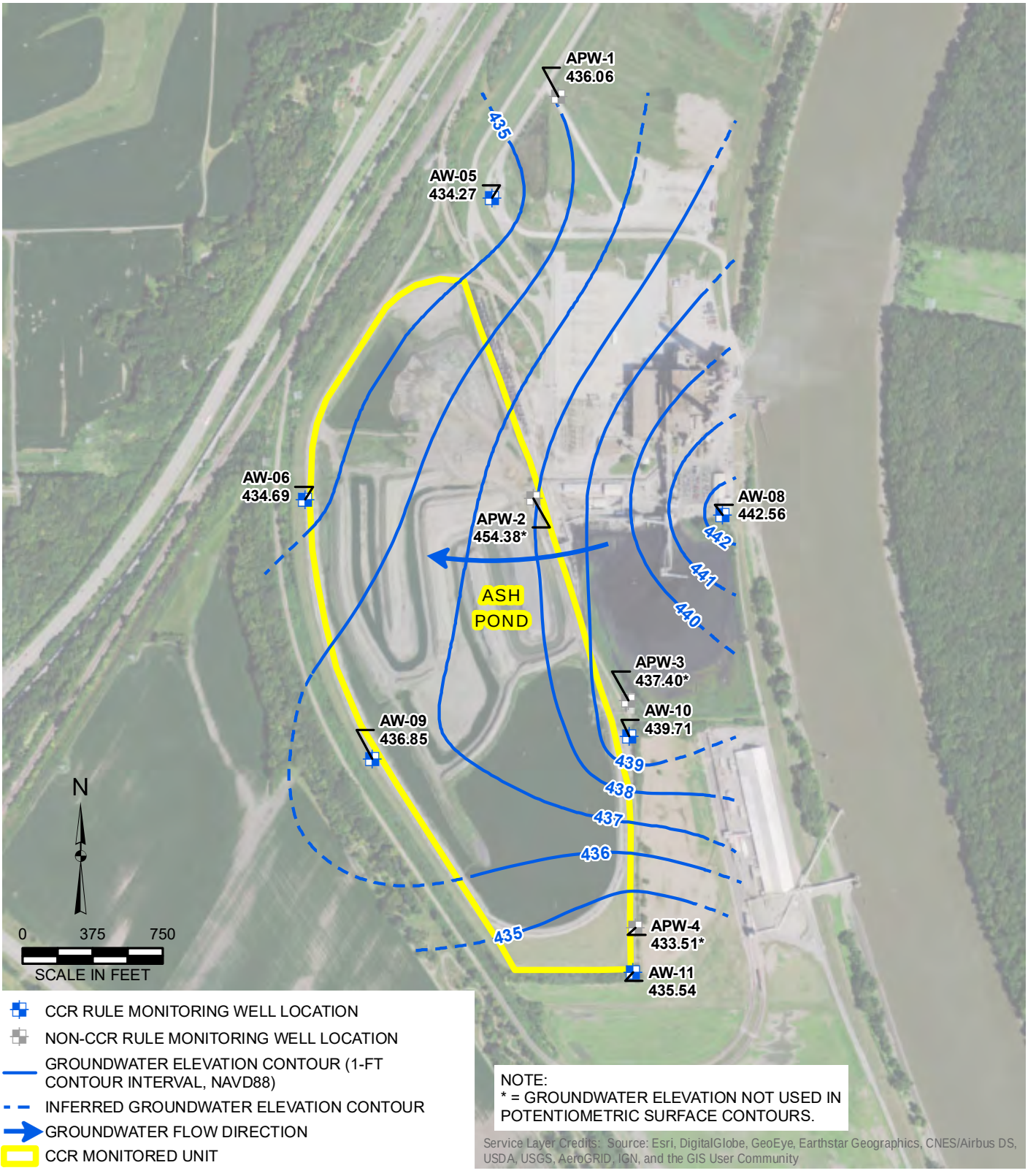
EDWARDS ASH POND (UNIT ID: 301)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 1: DECEMBER 21, 2015

DYNEGY CCR RULE GROUNDWATER MONITORING
EDWARDS POWER STATION
BARTONSVILLE, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



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REVIEWED BY/DATE:
ANS 1/25/17
APPROVED BY/DATE:
JJW 2/8/17

EDWARDS ASH POND (UNIT ID: 301)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 2: FEBRUARY 17, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
EDWARDS POWER STATION
BARTONSVILLE, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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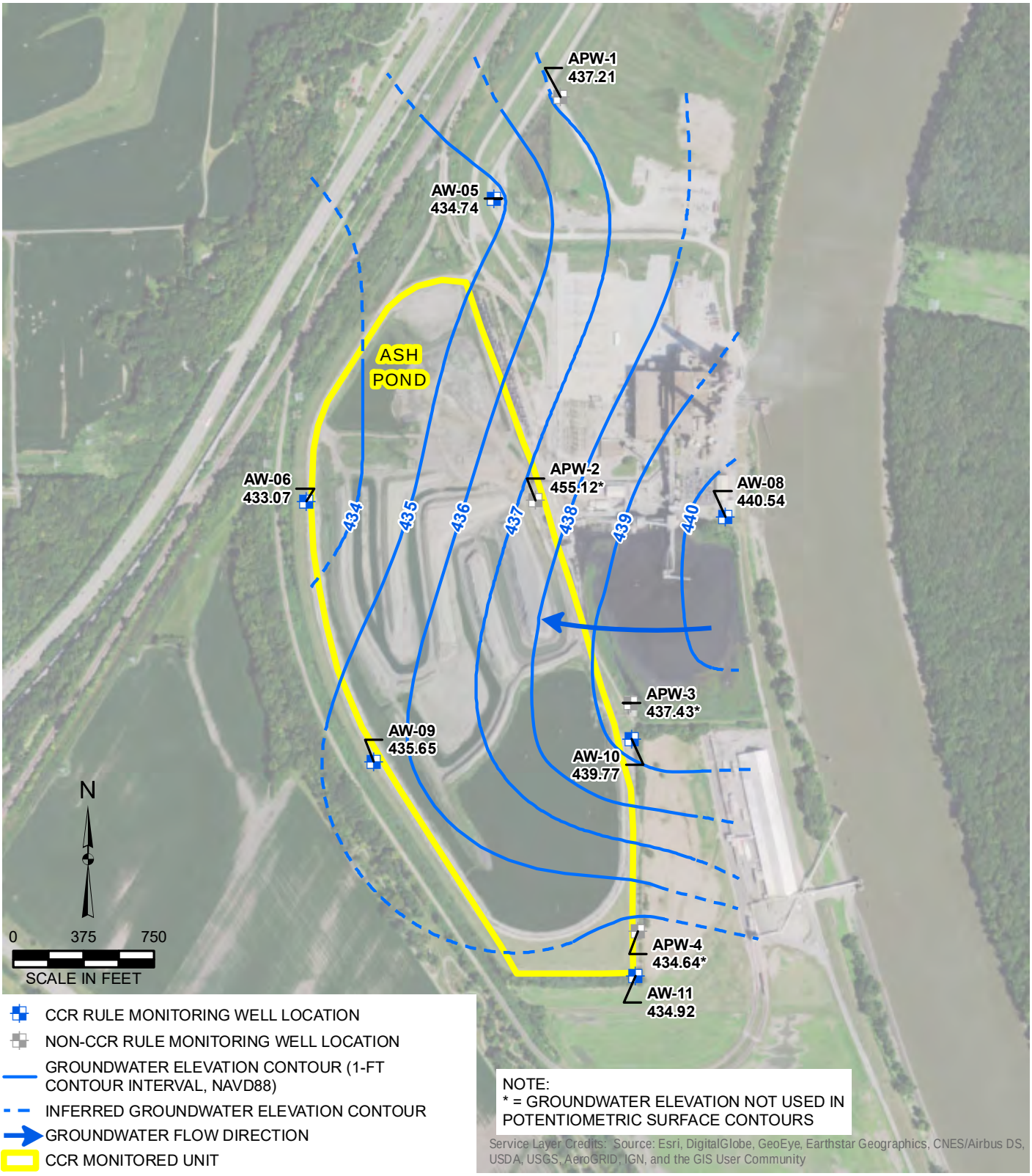

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ANS 1/25/17
APPROVED BY/DATE:
JJW 2/8/17

EDWARDS ASH POND (UNIT ID: 301)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 3: MAY 17, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
EDWARDS POWER STATION
BARTONSVILLE, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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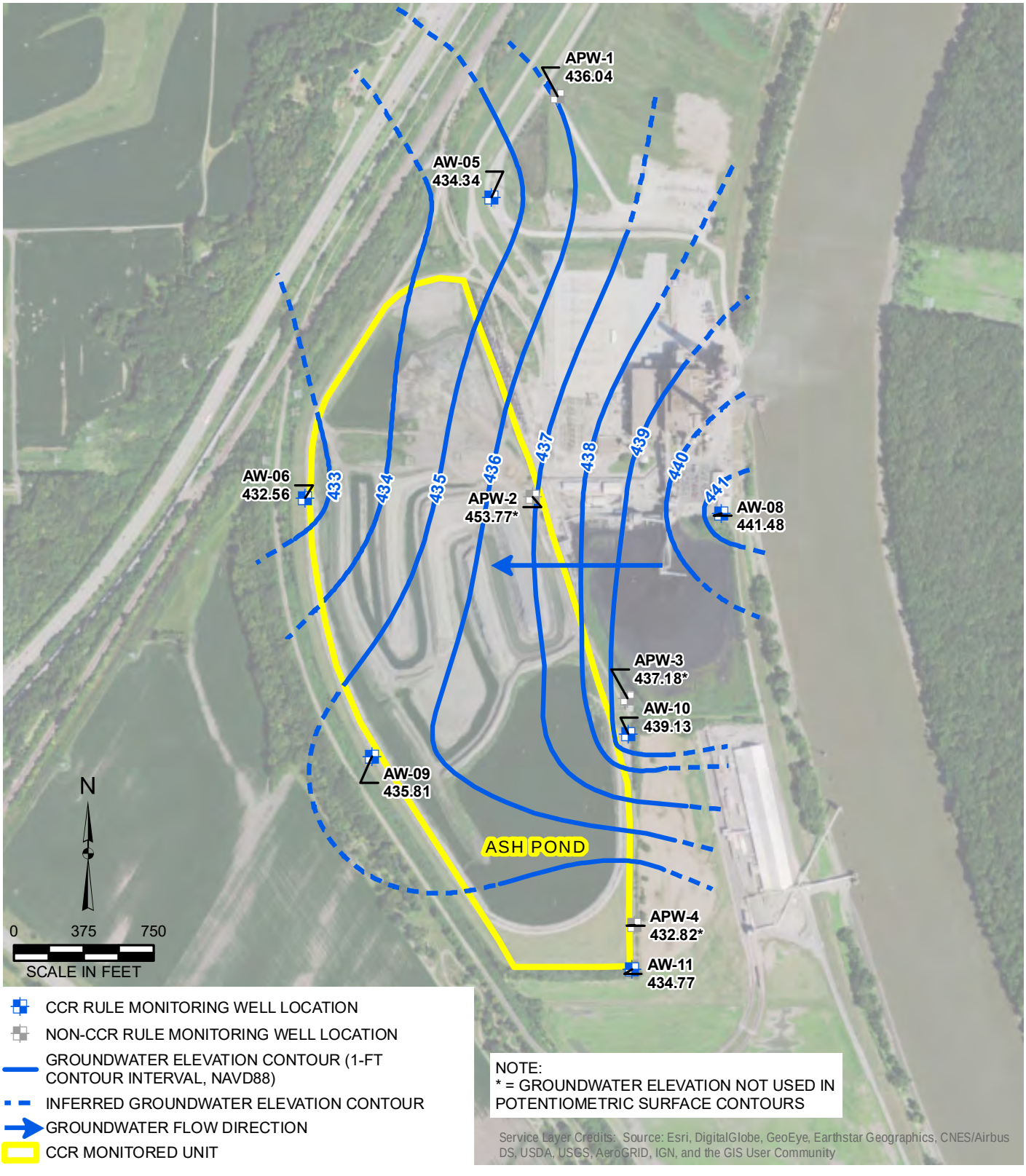

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APPROVED BY/DATE:
JJW 2/8/17

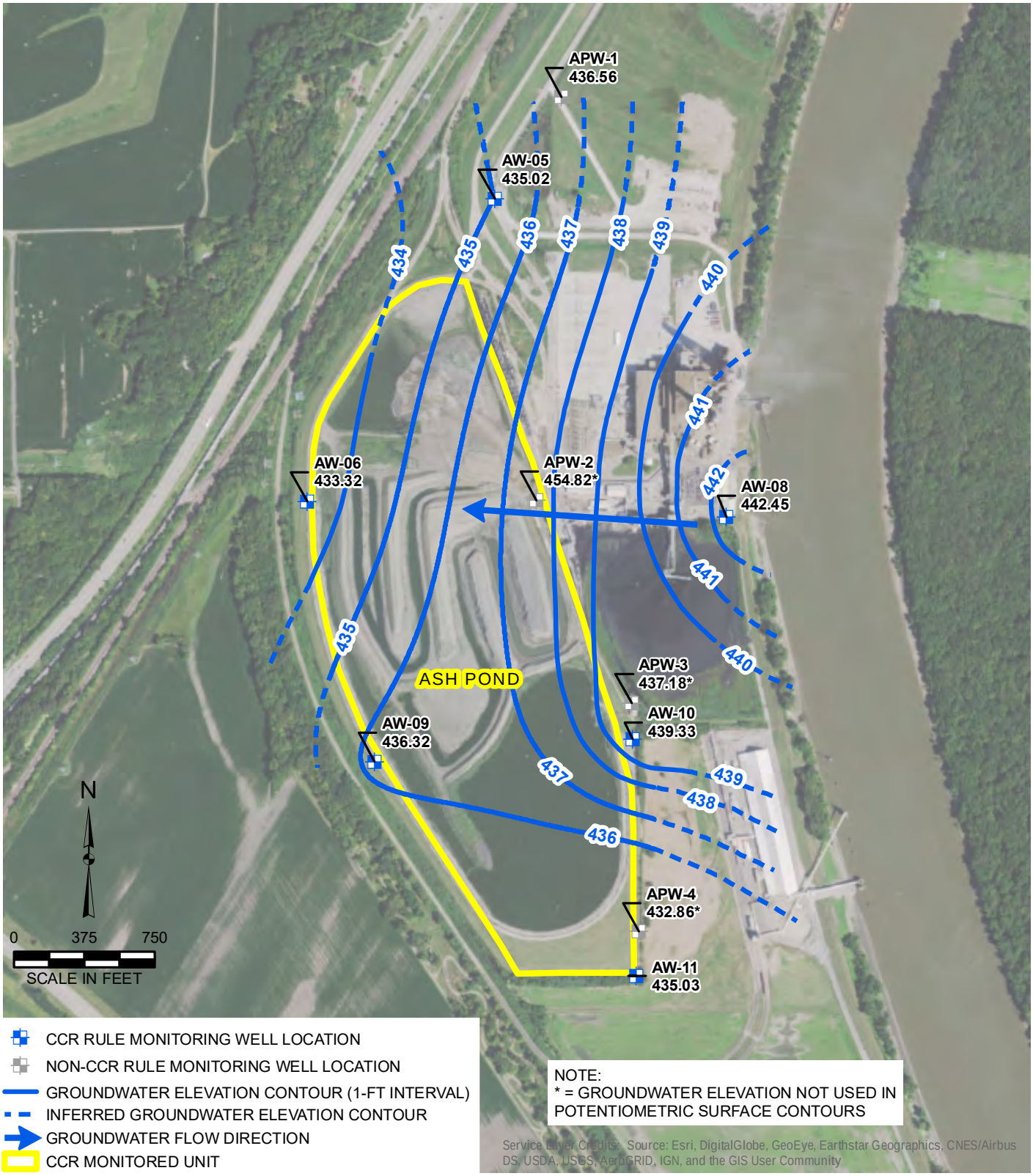
EDWARDS ASH POND (UNIT ID: 301)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 4: JULY 21, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
EDWARDS POWER STATION
BARTONSVILLE, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



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APPROVED BY/DATE:
JJW 9/1/17

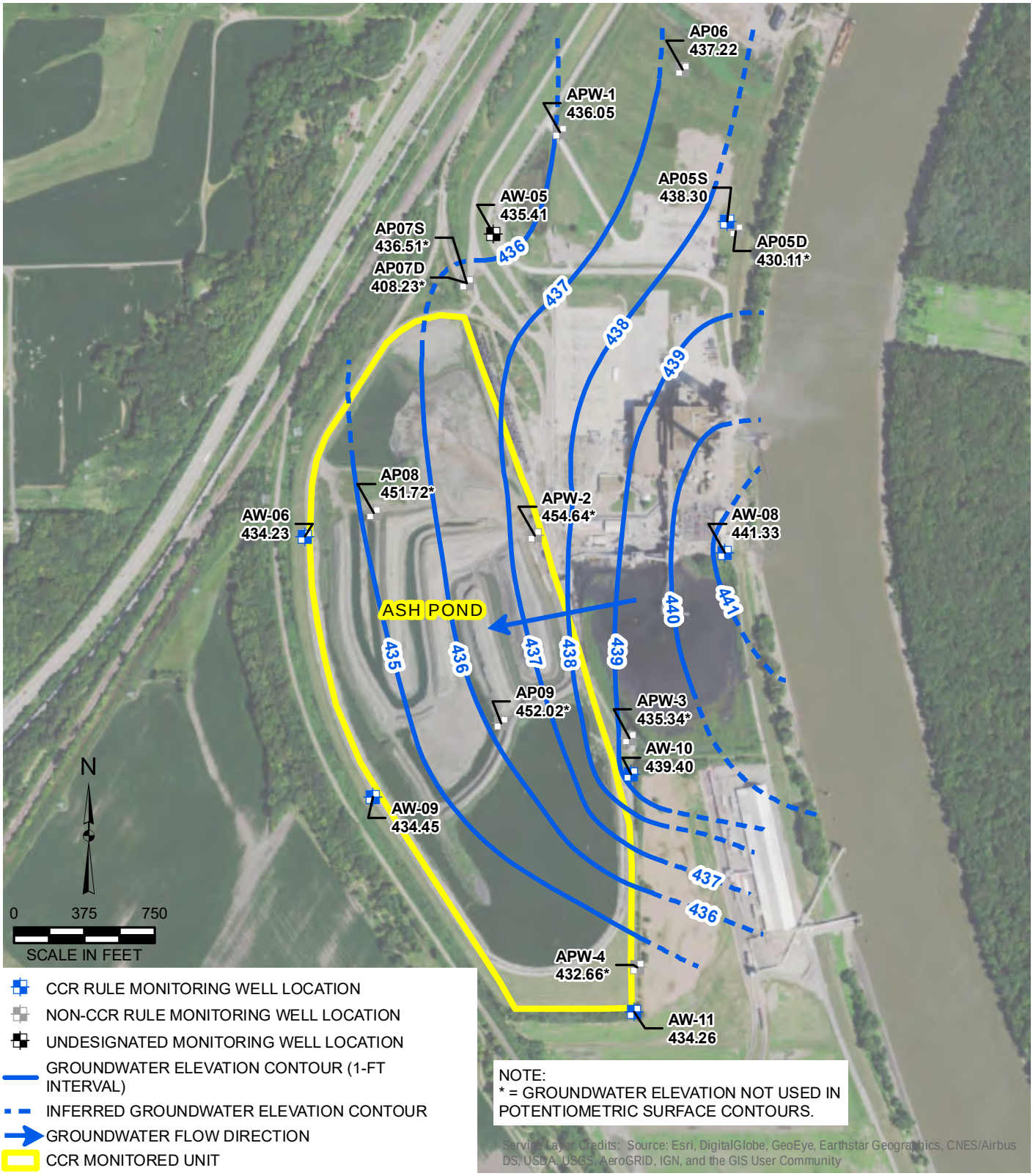
EDWARDS ASH POND (UNIT ID: 301)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 5: NOVEMBER 10, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
EDWARDS POWER STATION
BARTONSVILLE, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



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ANS 3/6/17
APPROVED BY/DATE:
JJW 9/1/17

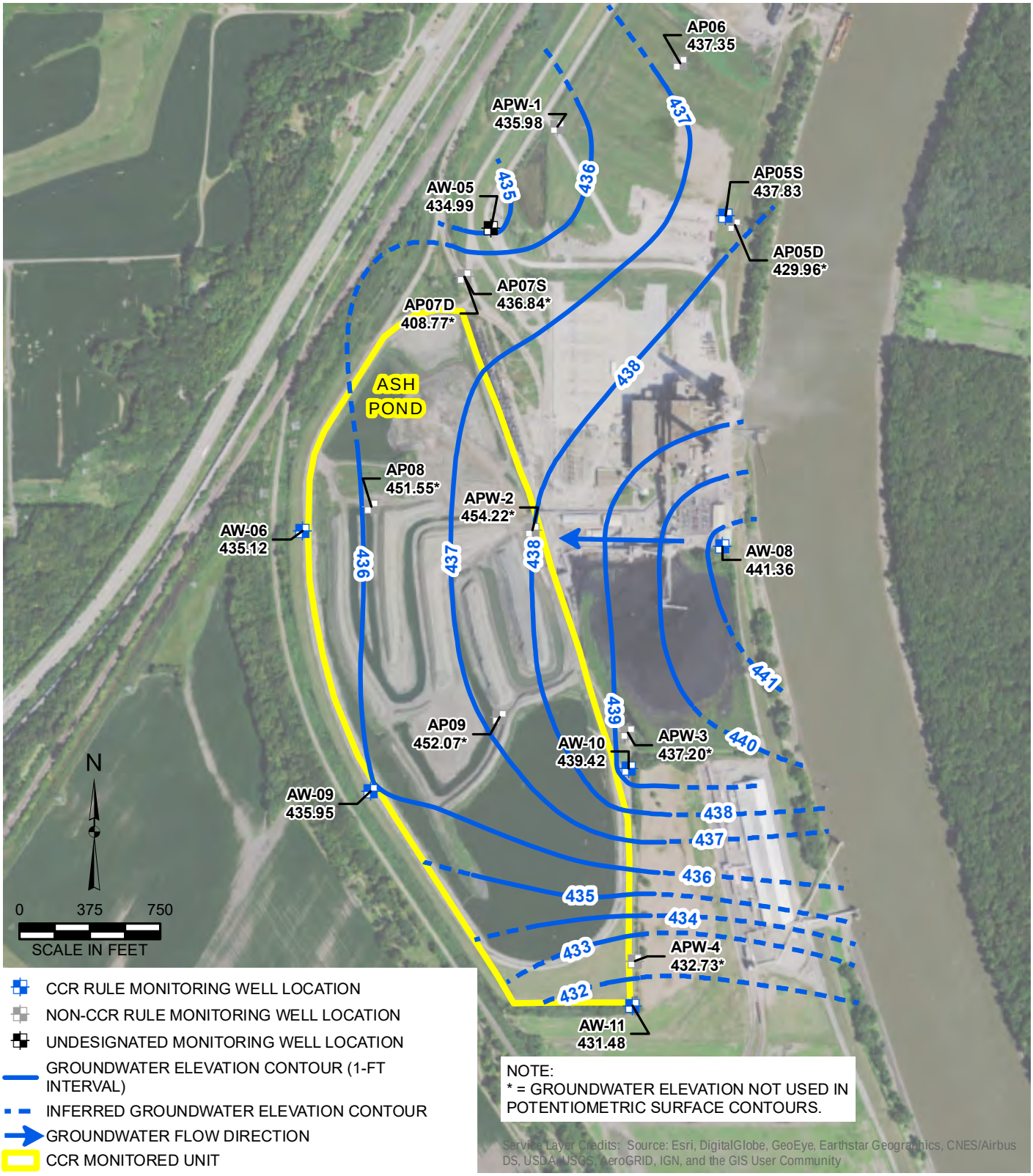
EDWARDS ASH POND (UNIT ID: 301)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 6: JANUARY 16, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
EDWARDS POWER STATION
BARTONSVILLE, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



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JJW 9/1/17

EDWARDS ASH POND (UNIT ID: 301)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 7: MAY 8, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
EDWARDS POWER STATION
BARTONSVILLE, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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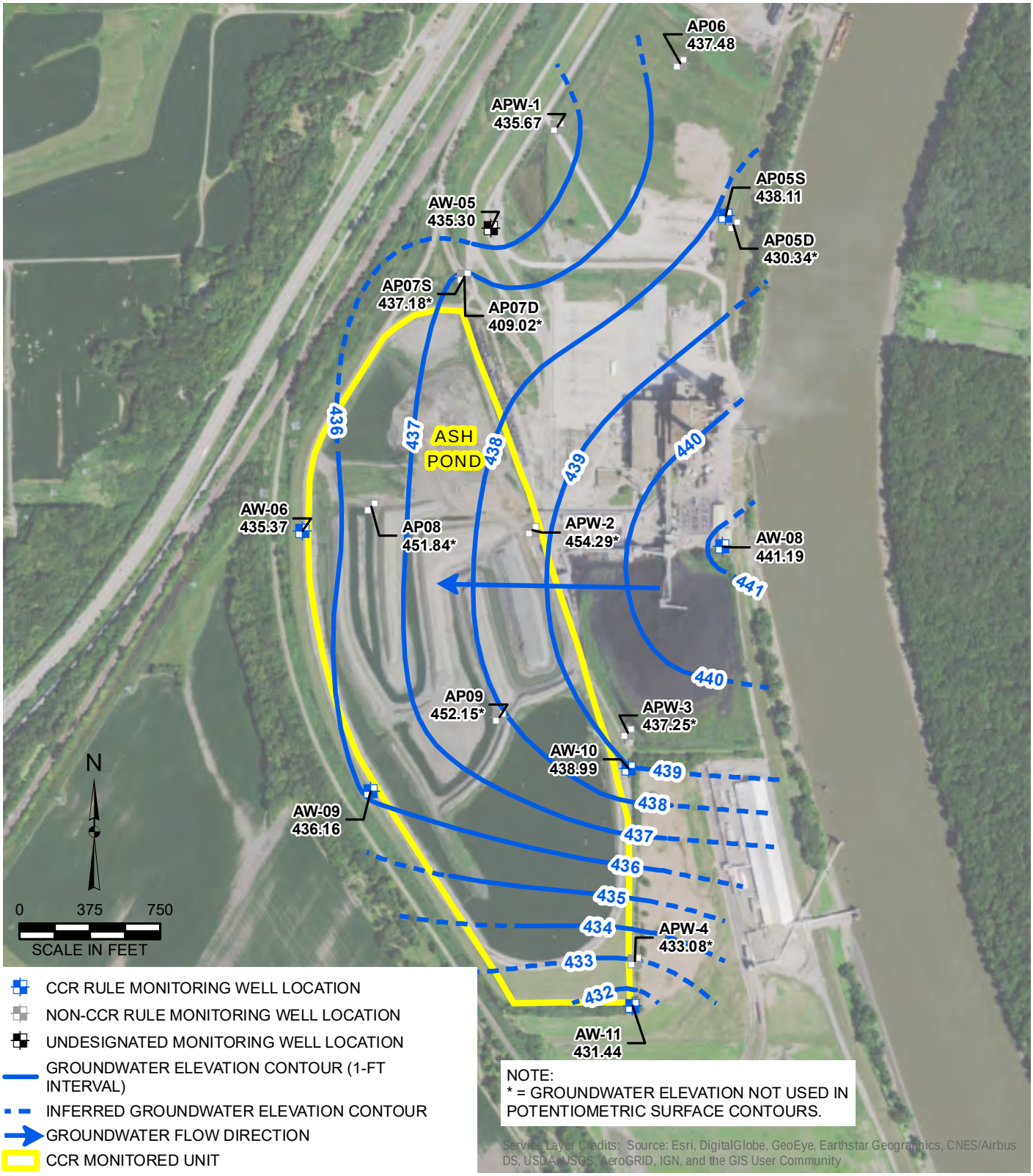

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ANS 7/29/17
APPROVED BY/DATE:
JJW 9/1/17

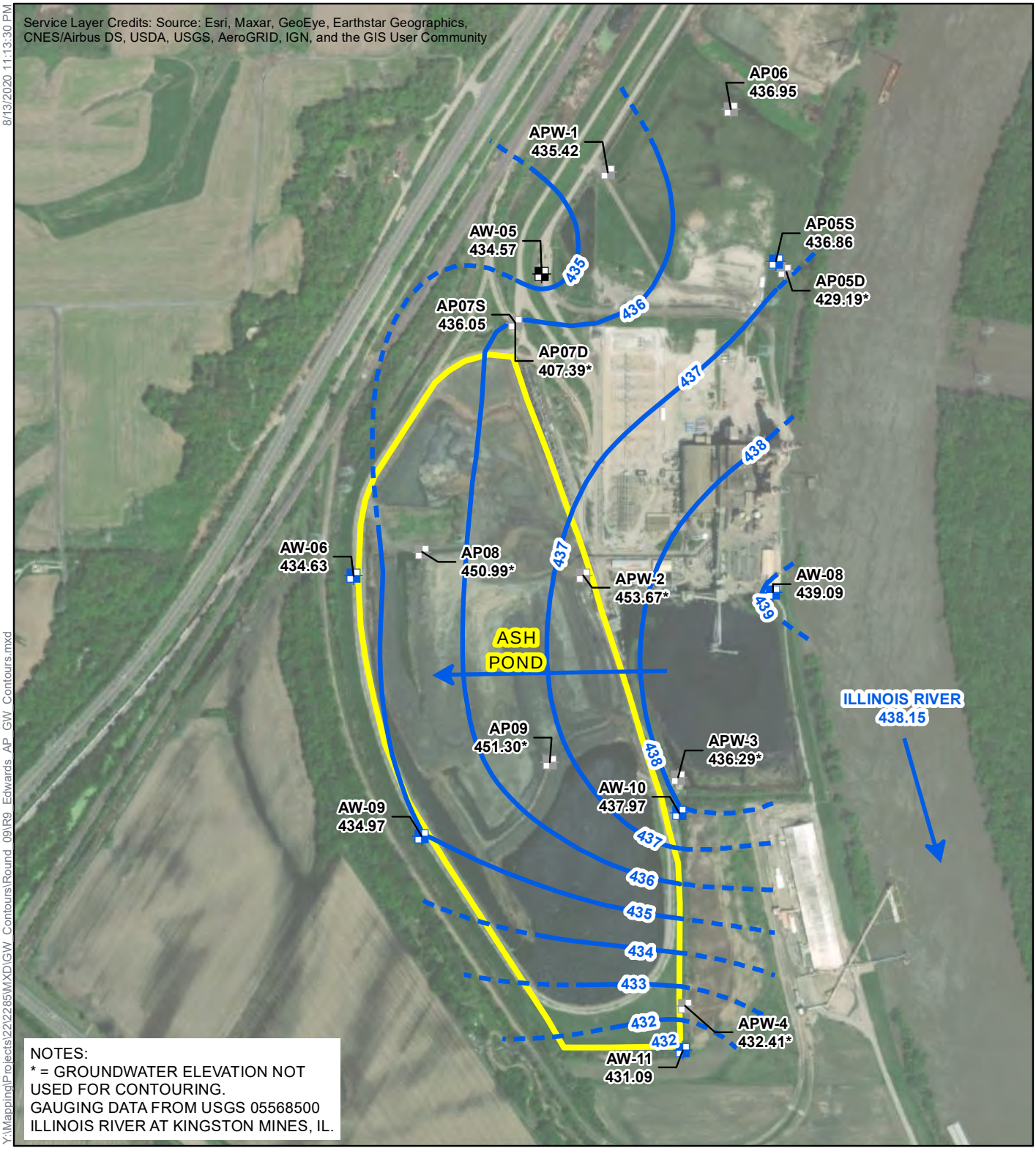
EDWARDS ASH POND (UNIT ID: 301)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 8: JULY 19, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
EDWARDS POWER STATION
BARTONSVILLE, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



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NOTES:
* = GROUNDWATER ELEVATION NOT USED FOR CONTOURING.
GAUGING DATA FROM USGS 05568500 ILLINOIS RIVER AT KINGSTON MINES, IL.

- CCR RULE MONITORING WELL LOCATION
- NON-CCR RULE MONITORING WELL LOCATION
- UNDESIGNATED MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (1-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- CCR MONITORED UNIT

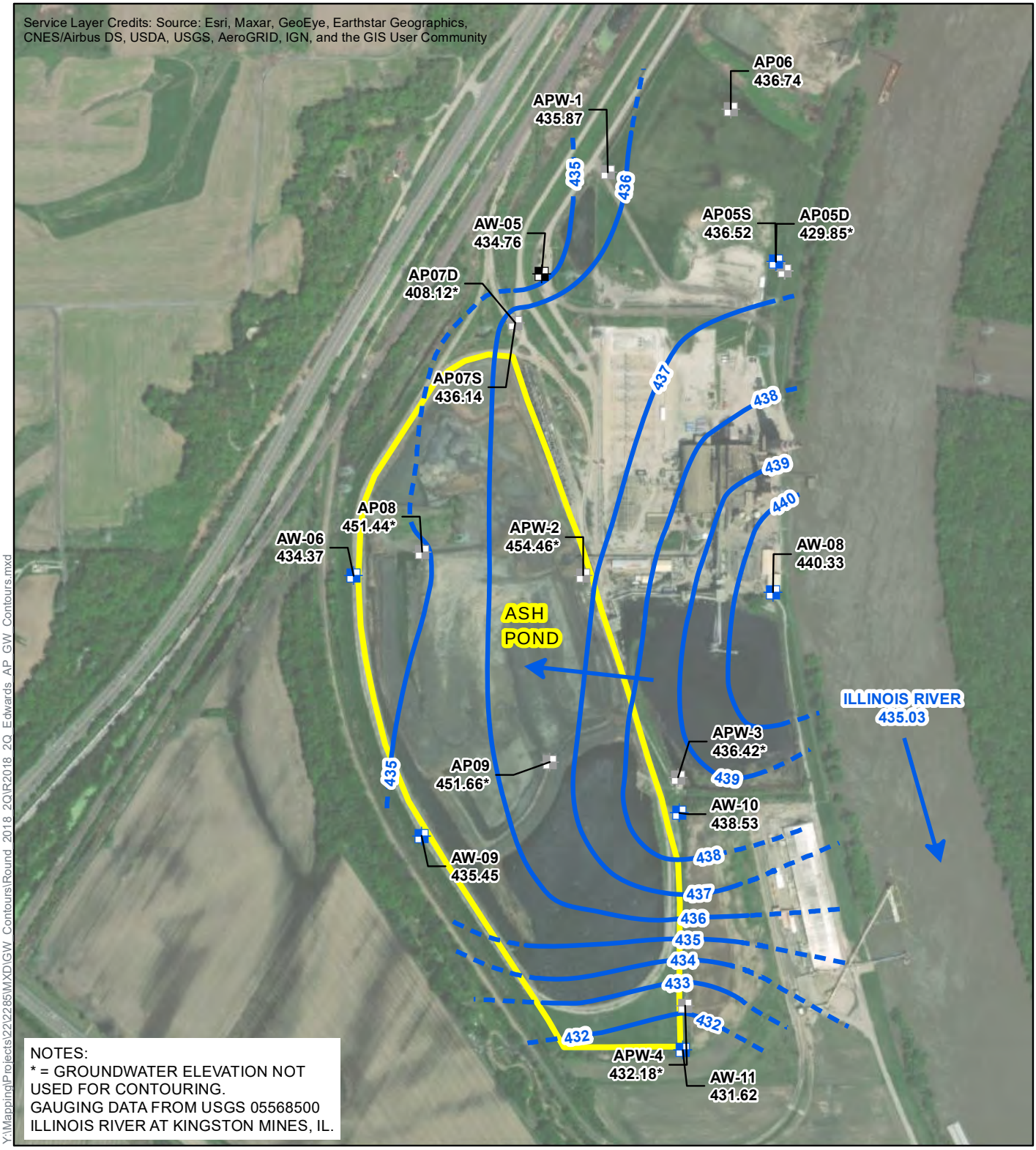
EDWARDS ASH POND (UNIT ID: 301)
GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 1, 2017

CCR RULE GROUNDWATER MONITORING
EDWARDS POWER STATION
BARTONVILLE, ILLINOIS

0 187.5 375 750
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



CCR RULE MONITORING WELL LOCATION
NON-CCR RULE MONITORING WELL LOCATION
UNDESIGNATED MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR (1-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
CCR MONITORED UNIT

EDWARDS ASH POND (UNIT ID: 301)
GROUNDWATER ELEVATION CONTOUR MAP
MAY 4, 2018

CCR RULE GROUNDWATER MONITORING
EDWARDS POWER STATION
BARTONVILLE, ILLINOIS

0 187.5 375 750
Feet

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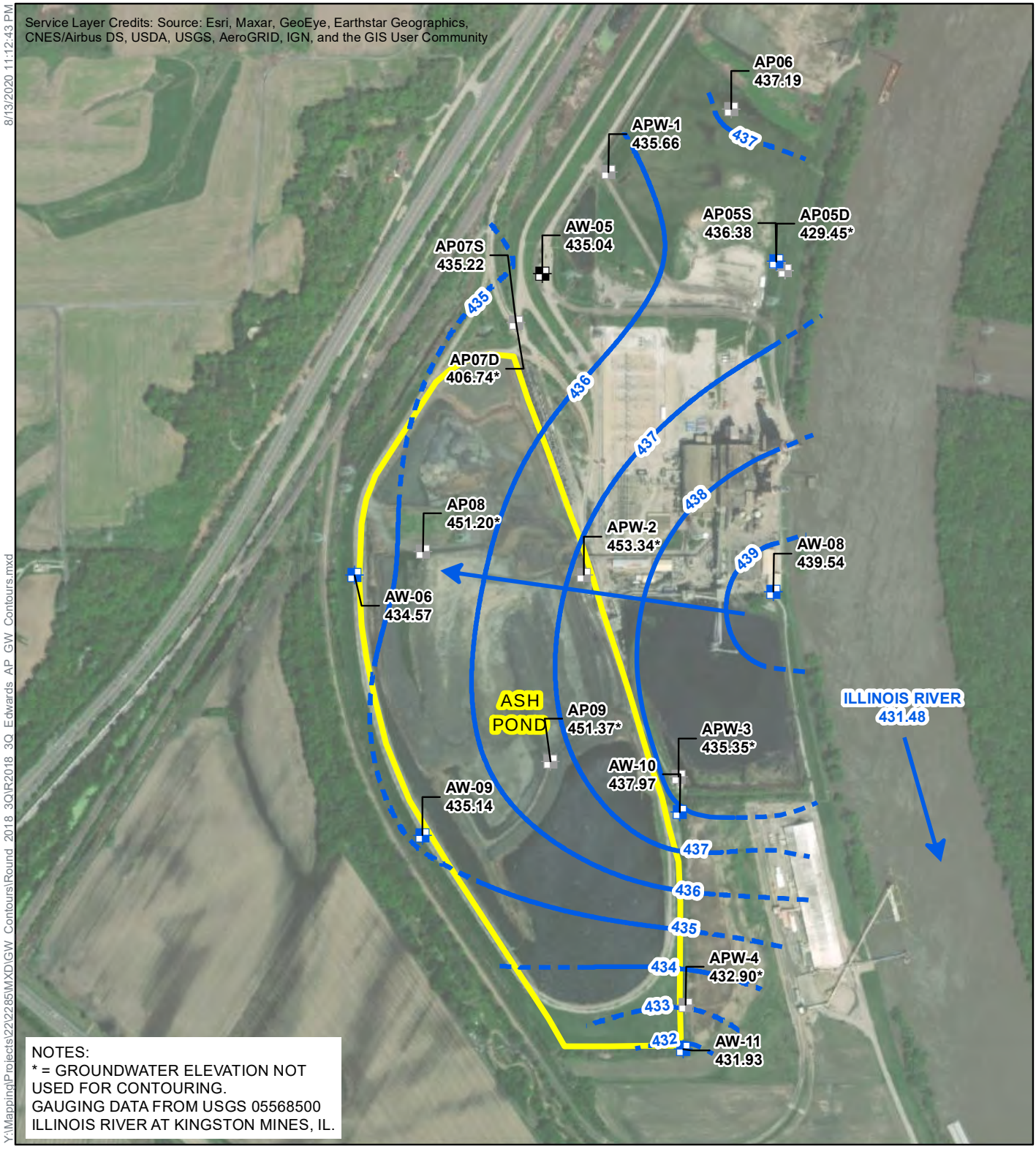
O'BRIEN & GERE ENGINEERS, INC.



NOTES:
* = GROUNDWATER ELEVATION NOT USED FOR CONTOURING.
GAUGING DATA FROM USGS 05568500 ILLINOIS RIVER AT KINGSTON MINES, IL.

- CCR RULE MONITORING WELL LOCATION
- NON-CCR RULE MONITORING WELL LOCATION
- UNDESIGNATED MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (1-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- CCR MONITORED UNIT

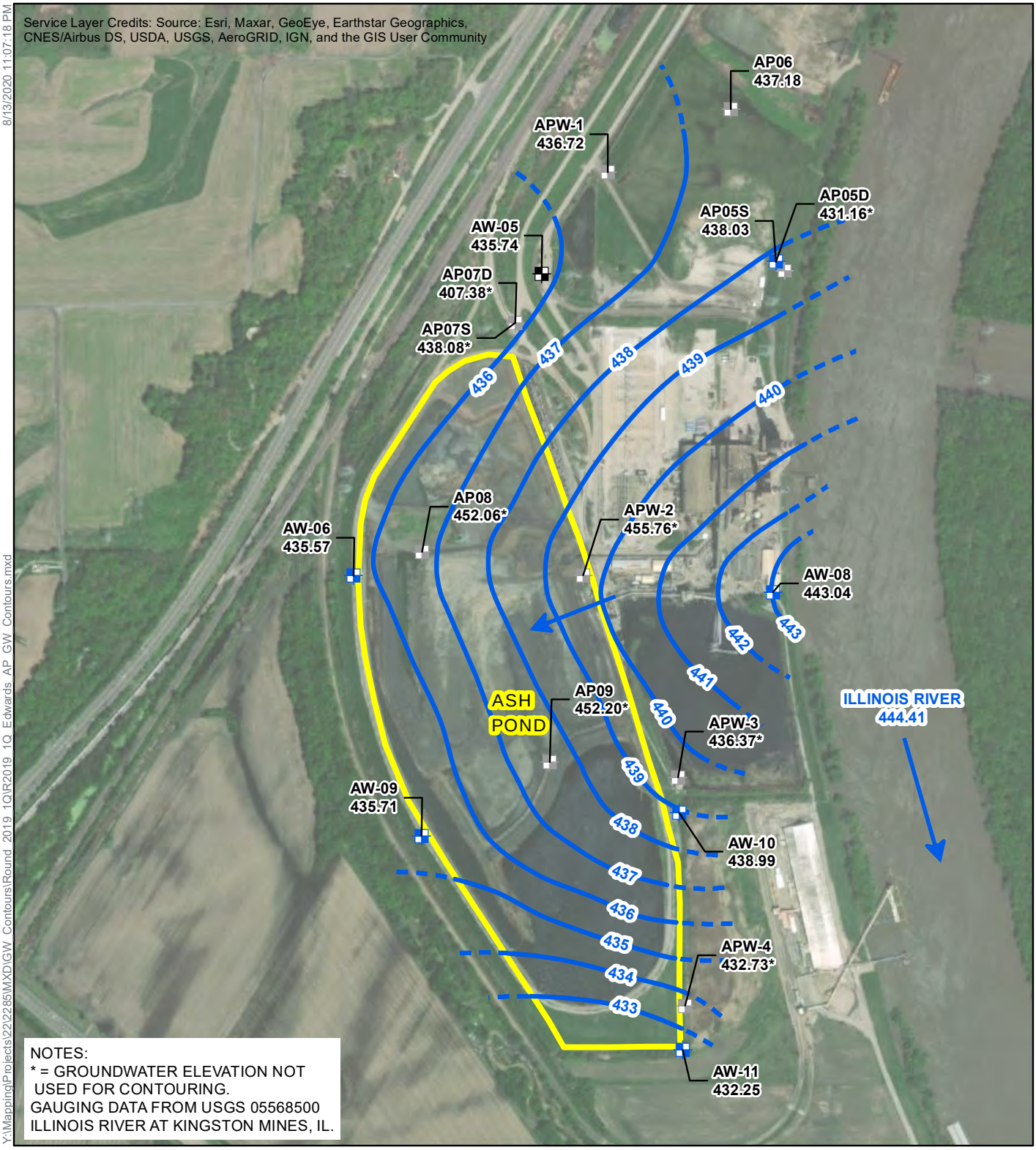
EDWARDS ASH POND (UNIT ID: 301)
GROUNDWATER ELEVATION CONTOUR MAP
JULY 26, 2018

CCR RULE GROUNDWATER MONITORING
EDWARDS POWER STATION
BARTONVILLE, ILLINOIS

0 187.5 375 750
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



CCR RULE MONITORING WELL LOCATION
NON-CCR RULE MONITORING WELL LOCATION
UNDESIGNATED MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR (1-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
CCR MONITORED UNIT

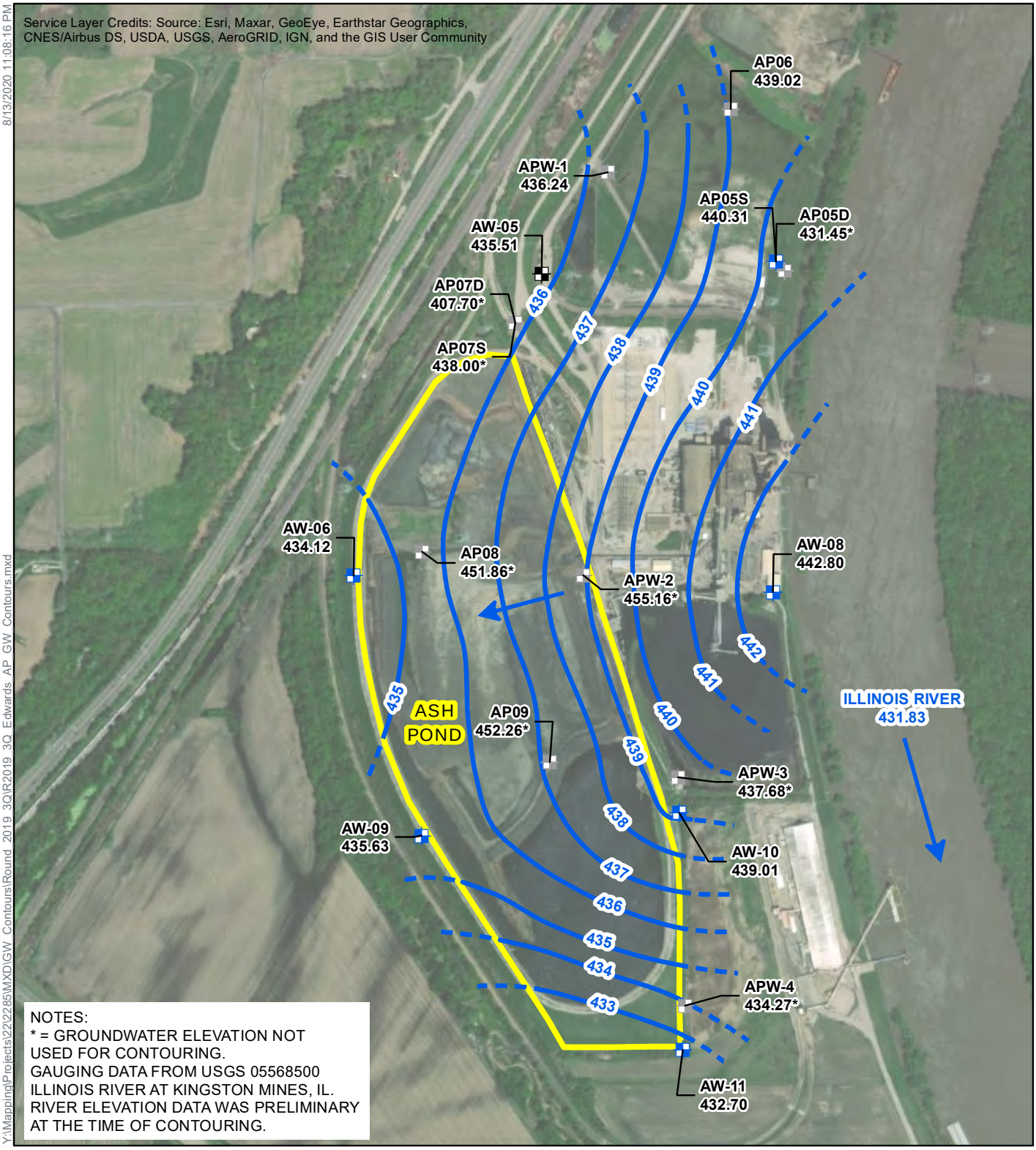
EDWARDS ASH POND (UNIT ID: 301)
GROUNDWATER ELEVATION CONTOUR MAP
FEBRUARY 25, 2019

CCR RULE GROUNDWATER MONITORING
EDWARDS POWER STATION
BARTONVILLE, ILLINOIS

0 187.5 375 750
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



CCR RULE MONITORING WELL LOCATION
NON-CCR RULE MONITORING WELL LOCATION
UNDESIGNATED MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR (1-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
CCR MONITORED UNIT

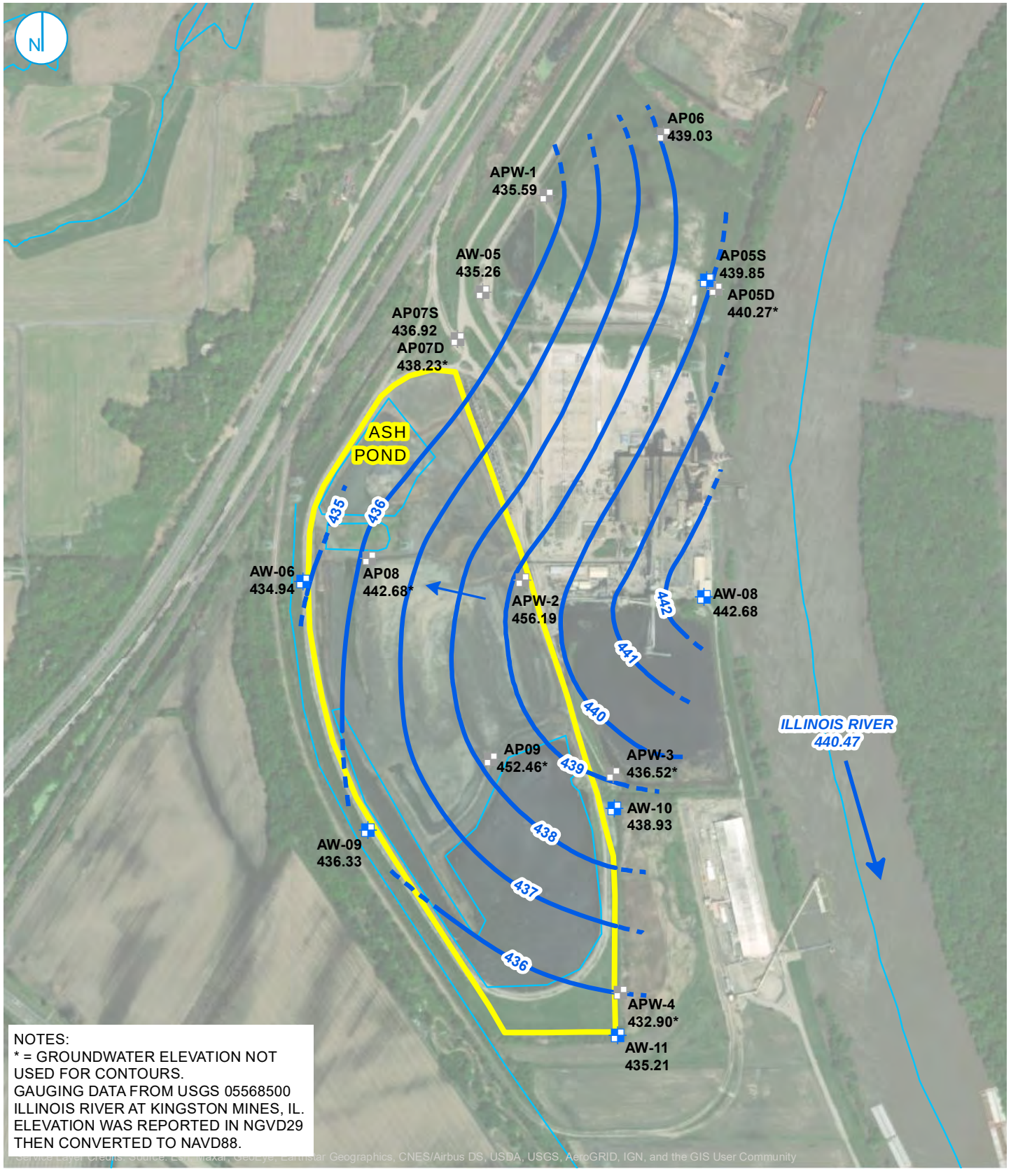
EDWARDS ASH POND (UNIT ID: 301)
GROUNDWATER ELEVATION CONTOUR MAP
AUGUST 6, 2019

CCR RULE GROUNDWATER MONITORING
EDWARDS POWER STATION
BARTONVILLE, ILLINOIS

0 187.5 375 750
Feet

N

O'BRIEN & GERE ENGINEERS, INC.



NOTES:
* = GROUNDWATER ELEVATION NOT USED FOR CONTOURS.
GAUGING DATA FROM USGS 05568500 ILLINOIS RIVER AT KINGSTON MINES, IL. ELEVATION WAS REPORTED IN NGVD29 THEN CONVERTED TO NAVD88.

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Y:\Mapping\Projects\222885\MXD\GW_Contours\Round_2020_1Q\R2020_1Q_Edwards_AP_GW_Contours.mxd

PROJECT: 169000XXXX | DATED: 8/14/2020 | DESIGNER: STOLZSD

- CCR RULE MONITORING WELL
- NON-CCR RULE MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR (1-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- CCR MONITORED UNIT
- SURFACE WATER FEATURE

0 450 900 Feet

GROUNDWATER ELEVATION CONTOUR MAP
FEBRUARY 27, 2020

EDWARDS ASH POND (UNIT ID: 301)
VISTRA ENERGY
EDWARDS POWER STATION
BARTONVILLE, ILLINOIS

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

TABLE E-1. GROUNDWATER ELEVATION RESULTS

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
AP05S	01/16/2017	438.30
AP05S	05/08/2017	437.83
AP05S	06/07/2017	438.37
AP05S	06/22/2017	438.08
AP05S	07/19/2017	438.11
AP05S	07/31/2017	438.35
AP05S	08/07/2017	438.44
AP05S	08/23/2017	438.53
AP05S	11/01/2017	436.86
AP05S	05/04/2018	436.52
AP05S	07/26/2018	436.38
AP05S	08/27/2018	436.59
AP05S	02/25/2019	438.03
AP05S	08/06/2019	440.31
AP05S	02/27/2020	439.85
AP05S	08/31/2020	438.32
AP05S	09/01/2020	438.19
AP05S	02/09/2021	437.61
AP05S	02/10/2021	437.61
AP05S	02/11/2021	437.95
AP05S	02/23/2021	437.84
AP05S	03/02/2021	437.93
AP05S	03/08/2021	437.93
AP05S	03/22/2021	438.43
AP05S	03/24/2021	438.43
AP05S	04/12/2021	438.59
AP05S	04/13/2021	438.41
AP05S	05/04/2021	438.43
AP05S	05/07/2021	438.41
AP05S	06/15/2021	438.30
AP05S	06/16/2021	438.25
AP05S	06/28/2021	438.24
AP05S	06/29/2021	438.27
AP05S	07/21/2021	438.67
AP05S	07/22/2021	438.68
AP05S	08/30/2021	438.13
AP05D	01/16/2017	430.11
AP05D	05/08/2017	429.96
AP05D	07/19/2017	430.34
AP05D	11/01/2017	429.19
AP05D	05/04/2018	429.85
AP05D	07/26/2018	429.45
AP05D	02/25/2019	431.16
AP05D	08/06/2019	431.45
AP05D	02/27/2020	440.27

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
AP05D	08/31/2020	440.23
AP05D	02/09/2021	439.14
AP05D	02/10/2021	439.14
AP05D	02/11/2021	430.80
AP05D	03/02/2021	435.81
AP05D	03/08/2021	435.81
AP05D	03/22/2021	433.33
AP05D	03/24/2021	433.33
AP05D	04/12/2021	431.96
AP05D	04/15/2021	432.63
AP05D	05/04/2021	432.29
AP05D	05/07/2021	433.08
AP05D	06/15/2021	435.02
AP05D	06/28/2021	433.14
AP05D	07/21/2021	437.15
AP05D	08/30/2021	438.36
AP06	01/16/2017	437.22
AP06	05/08/2017	437.35
AP06	07/19/2017	437.48
AP06	11/01/2017	436.95
AP06	05/04/2018	436.74
AP06	07/26/2018	437.19
AP06	02/25/2019	437.18
AP06	08/06/2019	439.02
AP06	02/27/2020	439.03
AP06	08/31/2020	436.24
AP06	02/09/2021	438.27
AP06	02/11/2021	437.92
AP06	03/02/2021	438.67
AP06	03/22/2021	438.98
AP06	04/12/2021	438.77
AP06	05/04/2021	438.02
AP06	06/15/2021	436.60
AP06	06/28/2021	437.92
AP06	07/21/2021	438.04
AP06	08/30/2021	436.85
AP07S	01/16/2017	436.51
AP07S	05/08/2017	436.84
AP07S	07/19/2017	437.18
AP07S	11/01/2017	436.05
AP07S	05/04/2018	436.14
AP07S	07/26/2018	435.22
AP07S	02/25/2019	438.08
AP07S	08/06/2019	438.00
AP07S	02/27/2020	436.92

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
AP07S	08/31/2020	435.45
AP07S	02/09/2021	436.14
AP07S	02/10/2021	436.14
AP07S	02/11/2021	436.12
AP07S	03/02/2021	436.50
AP07S	03/04/2021	436.50
AP07S	03/22/2021	436.73
AP07S	03/24/2021	436.73
AP07S	04/12/2021	436.61
AP07S	04/13/2021	436.50
AP07S	05/04/2021	436.23
AP07S	05/05/2021	436.13
AP07S	06/15/2021	435.97
AP07S	06/16/2021	436.30
AP07S	06/28/2021	436.37
AP07S	07/21/2021	436.26
AP07S	07/22/2021	436.21
AP07S	08/30/2021	435.75
AP07D	01/16/2017	408.23
AP07D	05/08/2017	408.77
AP07D	07/19/2017	409.02
AP07D	11/01/2017	407.39
AP07D	05/04/2018	408.12
AP07D	07/26/2018	406.74
AP07D	02/25/2019	407.38
AP07D	08/06/2019	407.70
AP07D	02/27/2020	438.23
AP07D	08/31/2020	437.77
AP07D	02/09/2021	437.76
AP07D	02/10/2021	437.76
AP07D	02/11/2021	429.88
AP07D	03/02/2021	431.15
AP07D	03/08/2021	431.15
AP07D	03/22/2021	415.52
AP07D	03/24/2021	415.52
AP07D	04/12/2021	407.02
AP07D	04/13/2021	407.18
AP07D	05/04/2021	402.41
AP07D	05/05/2021	402.50
AP07D	06/15/2021	399.23
AP07D	06/28/2021	397.79
AP07D	07/21/2021	399.78
AP07D	07/22/2021	399.87
AP07D	08/30/2021	400.21
AP08	01/16/2017	451.72

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
AP08	01/18/2017	451.72
AP08	05/08/2017	451.55
AP08	07/19/2017	451.84
AP08	11/01/2017	450.99
AP08	05/04/2018	451.44
AP08	07/26/2018	451.20
AP08	02/25/2019	452.06
AP08	08/06/2019	451.86
AP08	02/27/2020	453.97
AP08	08/31/2020	451.28
AP08	02/09/2021	452.60
AP08	02/11/2021	452.58
AP08	03/02/2021	452.85
AP08	03/22/2021	453.59
AP08	04/12/2021	453.16
AP08	05/04/2021	452.70
AP08	06/15/2021	452.40
AP08	06/28/2021	452.92
AP08	07/21/2021	452.97
AP08	08/30/2021	451.89
AP09	01/17/2017	452.02
AP09	01/18/2017	452.02
AP09	05/08/2017	452.07
AP09	07/19/2017	452.15
AP09	11/01/2017	451.30
AP09	05/04/2018	451.66
AP09	07/26/2018	451.37
AP09	02/25/2019	452.20
AP09	08/06/2019	452.26
AP09	02/27/2020	452.46
AP09	08/31/2020	451.49
AP09	02/09/2021	451.96
AP09	02/11/2021	451.84
AP09	03/02/2021	451.95
AP09	03/22/2021	451.95
AP09	04/12/2021	451.86
AP09	05/04/2021	452.12
AP09	06/15/2021	451.61
AP09	06/28/2021	452.09
AP09	07/21/2021	452.19
AP09	08/30/2021	451.96
APW-01	12/21/2015	436.11
APW-01	02/17/2016	436.06
APW-01	05/17/2016	437.21
APW-01	07/21/2016	436.04

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
APW-01	11/10/2016	436.56
APW-01	01/16/2017	436.05
APW-01	05/08/2017	435.98
APW-01	07/19/2017	435.67
APW-01	11/01/2017	435.42
APW-01	05/04/2018	435.87
APW-01	07/26/2018	435.66
APW-01	02/25/2019	436.72
APW-01	08/06/2019	436.24
APW-01	02/27/2020	435.59
APW-01	08/31/2020	434.34
APW-01	02/09/2021	435.24
APW-01	02/11/2021	435.14
APW-01	03/02/2021	435.42
APW-01	03/22/2021	435.38
APW-01	04/12/2021	435.56
APW-01	05/04/2021	435.19
APW-01	06/15/2021	433.62
APW-01	06/17/2021	434.54
APW-01	06/28/2021	435.32
APW-01	06/29/2021	435.57
APW-01	07/21/2021	435.05
APW-01	07/22/2021	435.00
APW-01	08/30/2021	434.98
APW-02	12/21/2015	454.29
APW-02	02/17/2016	454.38
APW-02	05/17/2016	455.12
APW-02	07/21/2016	453.77
APW-02	11/10/2016	454.82
APW-02	01/16/2017	454.64
APW-02	05/08/2017	454.22
APW-02	07/19/2017	454.29
APW-02	11/01/2017	453.67
APW-02	05/04/2018	454.46
APW-02	07/26/2018	453.34
APW-02	02/25/2019	455.76
APW-02	08/06/2019	455.16
APW-02	02/27/2020	456.19
APW-02	08/31/2020	455.43
APW-02	02/09/2021	455.40
APW-02	02/10/2021	450.37
APW-02	02/11/2021	450.37
APW-02	03/02/2021	455.31
APW-02	03/03/2021	455.31
APW-02	03/22/2021	455.21

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
APW-02	03/24/2021	455.21
APW-02	04/12/2021	455.43
APW-02	04/13/2021	455.44
APW-02	05/04/2021	455.43
APW-02	05/06/2021	455.46
APW-02	06/15/2021	455.70
APW-02	06/28/2021	455.63
APW-02	07/21/2021	455.69
APW-02	08/30/2021	455.55
APW-03	12/21/2015	437.34
APW-03	02/17/2016	437.40
APW-03	05/17/2016	437.43
APW-03	07/21/2016	437.18
APW-03	11/10/2016	437.18
APW-03	01/16/2017	435.34
APW-03	05/08/2017	437.20
APW-03	07/19/2017	437.25
APW-03	11/01/2017	436.29
APW-03	05/04/2018	436.42
APW-03	07/26/2018	435.35
APW-03	02/25/2019	436.37
APW-03	08/06/2019	437.68
APW-03	02/27/2020	436.52
APW-03	08/31/2020	435.69
APW-03	02/09/2021	436.78
APW-03	02/10/2021	429.81
APW-03	02/11/2021	429.81
APW-03	03/02/2021	436.47
APW-03	03/04/2021	436.47
APW-03	03/22/2021	436.75
APW-03	03/24/2021	436.75
APW-03	04/12/2021	436.25
APW-03	04/13/2021	436.10
APW-03	05/04/2021	436.06
APW-03	05/07/2021	435.94
APW-03	06/15/2021	435.64
APW-03	06/28/2021	436.22
APW-03	07/21/2021	436.13
APW-03	08/30/2021	435.57
APW-04	12/21/2015	432.91
APW-04	02/17/2016	433.51
APW-04	05/17/2016	434.64
APW-04	07/21/2016	432.82
APW-04	11/10/2016	432.86
APW-04	01/16/2017	432.66

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
APW-04	05/08/2017	432.73
APW-04	07/19/2017	433.08
APW-04	11/01/2017	432.41
APW-04	05/04/2018	432.18
APW-04	07/26/2018	432.90
APW-04	02/25/2019	432.73
APW-04	08/06/2019	434.27
APW-04	02/27/2020	432.90
APW-04	08/31/2020	431.05
APW-04	02/09/2021	432.44
APW-04	02/10/2021	432.30
APW-04	02/11/2021	432.30
APW-04	03/02/2021	432.74
APW-04	03/04/2021	432.74
APW-04	03/22/2021	432.75
APW-04	04/12/2021	432.91
APW-04	04/13/2021	432.84
APW-04	05/04/2021	432.40
APW-04	05/07/2021	432.31
APW-04	06/15/2021	431.79
APW-04	06/28/2021	431.21
APW-04	07/21/2021	432.13
APW-04	08/30/2021	431.98
AW-05	11/09/2015	434.06
AW-05	12/21/2015	434.52
AW-05	02/17/2016	434.27
AW-05	05/17/2016	434.74
AW-05	07/21/2016	434.34
AW-05	11/10/2016	435.02
AW-05	01/16/2017	435.41
AW-05	05/08/2017	434.99
AW-05	07/19/2017	435.30
AW-05	11/01/2017	434.57
AW-05	05/04/2018	434.76
AW-05	07/26/2018	435.04
AW-05	02/25/2019	435.74
AW-05	08/06/2019	435.51
AW-05	02/27/2020	435.26
AW-05	08/31/2020	434.16
AW-05	02/09/2021	435.10
AW-05	02/11/2021	435.03
AW-05	03/02/2021	435.17
AW-05	03/22/2021	435.28
AW-05	04/12/2021	435.55
AW-05	05/04/2021	435.16

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
AW-05	06/15/2021	434.68
AW-05	06/17/2021	434.27
AW-05	06/28/2021	435.12
AW-05	07/21/2021	434.91
AW-05	07/22/2021	434.79
AW-05	08/30/2021	434.44
AW-06	11/09/2015	434.65
AW-06	12/21/2015	435.19
AW-06	02/17/2016	434.69
AW-06	05/17/2016	433.07
AW-06	07/21/2016	432.56
AW-06	11/10/2016	433.32
AW-06	01/16/2017	434.23
AW-06	05/08/2017	435.12
AW-06	07/19/2017	435.37
AW-06	11/01/2017	434.63
AW-06	05/04/2018	434.37
AW-06	07/26/2018	434.57
AW-06	02/25/2019	435.57
AW-06	08/06/2019	434.12
AW-06	02/27/2020	434.94
AW-06	08/31/2020	433.60
AW-06	02/09/2021	434.40
AW-06	02/11/2021	434.50
AW-06	02/23/2021	434.81
AW-06	03/02/2021	434.62
AW-06	03/22/2021	434.70
AW-06	04/12/2021	434.85
AW-06	05/04/2021	434.48
AW-06	06/15/2021	434.26
AW-06	06/28/2021	434.60
AW-06	07/21/2021	434.40
AW-06	08/30/2021	436.01
AW-08	11/09/2015	439.28
AW-08	12/21/2015	441.48
AW-08	02/17/2016	442.56
AW-08	05/17/2016	440.54
AW-08	07/21/2016	441.48
AW-08	11/10/2016	442.45
AW-08	01/16/2017	441.33
AW-08	05/08/2017	441.36
AW-08	07/19/2017	441.19
AW-08	11/01/2017	439.09
AW-08	05/04/2018	440.33
AW-08	07/26/2018	439.54

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
AW-08	08/27/2018	439.63
AW-08	02/25/2019	443.04
AW-08	08/06/2019	442.80
AW-08	02/27/2020	442.68
AW-08	08/31/2020	440.09
AW-08	09/01/2020	440.07
AW-08	02/09/2021	438.28
AW-08	02/10/2021	434.16
AW-08	02/11/2021	434.16
AW-08	02/23/2021	438.16
AW-08	03/02/2021	437.77
AW-08	03/05/2021	437.77
AW-08	03/22/2021	439.27
AW-08	03/24/2021	439.27
AW-08	04/12/2021	440.09
AW-08	04/13/2021	440.01
AW-08	05/04/2021	439.47
AW-08	05/07/2021	439.38
AW-08	06/15/2021	440.14
AW-08	06/16/2021	440.16
AW-08	06/28/2021	439.41
AW-08	07/21/2021	441.74
AW-08	08/30/2021	439.49
AW-09	11/09/2015	435.03
AW-09	12/21/2015	436.14
AW-09	02/17/2016	436.85
AW-09	05/17/2016	435.65
AW-09	07/21/2016	435.81
AW-09	11/10/2016	436.32
AW-09	01/16/2017	434.45
AW-09	05/08/2017	435.95
AW-09	07/19/2017	436.16
AW-09	11/01/2017	434.97
AW-09	05/04/2018	435.45
AW-09	07/26/2018	435.14
AW-09	02/25/2019	435.71
AW-09	08/06/2019	435.63
AW-09	02/27/2020	436.33
AW-09	08/31/2020	435.29
AW-09	02/09/2021	435.73
AW-09	02/11/2021	435.67
AW-09	02/23/2021	435.76
AW-09	03/02/2021	434.63
AW-09	03/22/2021	435.77
AW-09	04/12/2021	435.96

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
AW-09	05/04/2021	435.63
AW-09	06/15/2021	435.64
AW-09	06/28/2021	436.51
AW-09	07/21/2021	435.90
AW-09	08/30/2021	435.35
AW-10	11/09/2015	438.64
AW-10	12/21/2015	439.65
AW-10	02/17/2016	439.71
AW-10	05/17/2016	439.77
AW-10	07/21/2016	439.13
AW-10	11/10/2016	439.33
AW-10	01/16/2017	439.40
AW-10	05/08/2017	439.42
AW-10	07/19/2017	438.99
AW-10	11/01/2017	437.97
AW-10	05/04/2018	438.53
AW-10	07/26/2018	437.97
AW-10	08/27/2018	438.62
AW-10	02/25/2019	438.99
AW-10	08/06/2019	439.01
AW-10	02/27/2020	438.93
AW-10	08/31/2020	438.84
AW-10	02/23/2021	438.84
AW-10	03/02/2021	438.84
AW-10	03/22/2021	438.84
AW-10	03/23/2021	438.84
AW-10	04/12/2021	438.85
AW-10	05/04/2021	438.80
AW-10	06/15/2021	438.62
AW-10	06/28/2021	438.61
AW-10	07/21/2021	438.60
AW-10	08/30/2021	437.93
AW-11	11/09/2015	434.19
AW-11	12/21/2015	434.99
AW-11	02/17/2016	435.54
AW-11	05/17/2016	434.92
AW-11	07/21/2016	434.77
AW-11	11/10/2016	435.03
AW-11	01/16/2017	434.26
AW-11	05/08/2017	431.48
AW-11	07/19/2017	431.44
AW-11	11/01/2017	431.09
AW-11	05/04/2018	431.62
AW-11	07/26/2018	431.93
AW-11	02/25/2019	432.25

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
AW-11	08/06/2019	432.70
AW-11	02/27/2020	435.21
AW-11	08/31/2020	434.18
AW-11	02/09/2021	434.17
AW-11	02/11/2021	434.13
AW-11	02/23/2021	434.63
AW-11	03/02/2021	434.51
AW-11	03/22/2021	434.60
AW-11	04/12/2021	434.65
AW-11	05/04/2021	434.56
AW-11	06/15/2021	433.40
AW-11	06/28/2021	434.38
AW-11	07/21/2021	434.56
AW-11	08/30/2021	434.05
AW-12	02/09/2021	435.75
AW-12	03/02/2021	436.97
AW-12	03/04/2021	436.97
AW-12	03/22/2021	437.06
AW-12	03/24/2021	437.06
AW-12	04/12/2021	436.81
AW-12	05/04/2021	436.66
AW-12	05/07/2021	436.29
AW-12	06/15/2021	435.14
AW-12	06/28/2021	436.75
AW-12	07/21/2021	438.01
AW-12	08/30/2021	435.86
AW-13	02/09/2021	435.52
AW-13	03/02/2021	435.84
AW-13	03/04/2021	435.84
AW-13	03/22/2021	435.86
AW-13	03/23/2021	435.86
AW-13	04/12/2021	435.92
AW-13	05/04/2021	435.83
AW-13	05/07/2021	435.77
AW-13	06/15/2021	435.56
AW-13	06/28/2021	435.40
AW-13	07/21/2021	435.98
AW-13	08/30/2021	435.28
AW-14	02/09/2021	433.03
AW-14	03/02/2021	432.94
AW-14	03/04/2021	432.94
AW-14	03/22/2021	432.79
AW-14	04/12/2021	432.95
AW-14	05/04/2021	432.99
AW-14	05/06/2021	432.41

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
AW-14	06/15/2021	372.50
AW-14	06/28/2021	432.87
AW-14	07/21/2021	433.04
AW-14	08/30/2021	432.21
AW-15	02/09/2021	433.03
AW-15	02/12/2021	433.03
AW-15	03/02/2021	433.50
AW-15	03/05/2021	433.50
AW-15	03/22/2021	433.68
AW-15	04/12/2021	433.76
AW-15	05/04/2021	433.69
AW-15	05/06/2021	433.60
AW-15	06/15/2021	433.65
AW-15	06/28/2021	433.59
AW-15	07/21/2021	433.65
AW-15	08/30/2021	434.43
AW-15C	02/09/2021	433.32
AW-15C	02/12/2021	431.22
AW-15C	03/02/2021	433.50
AW-15C	03/04/2021	433.50
AW-15C	03/22/2021	433.66
AW-15C	04/12/2021	433.80
AW-15C	04/13/2021	433.64
AW-15C	05/04/2021	433.71
AW-15C	05/06/2021	433.61
AW-15C	06/15/2021	433.63
AW-15C	06/28/2021	433.58
AW-15C	07/21/2021	433.67
AW-15C	08/30/2021	431.51
AW-15S	02/09/2021	431.91
AW-15S	02/12/2021	434.01
AW-15S	03/02/2021	431.19
AW-15S	03/04/2021	431.19
AW-15S	03/22/2021	431.33
AW-15S	04/12/2021	431.13
AW-15S	04/26/2021	431.15
AW-15S	05/04/2021	429.82
AW-15S	05/06/2021	430.14
AW-15S	06/15/2021	431.00
AW-15S	06/17/2021	430.24
AW-15S	06/28/2021	429.86
AW-15S	06/29/2021	429.06
AW-15S	07/21/2021	431.25
AW-15S	08/30/2021	430.87
AW-16	02/09/2021	437.63

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
AW-16	03/02/2021	437.61
AW-16	03/03/2021	437.61
AW-16	03/22/2021	437.67
AW-16	03/24/2021	437.67
AW-16	04/12/2021	437.79
AW-16	04/23/2021	437.78
AW-16	05/04/2021	437.74
AW-16	05/05/2021	437.68
AW-16	06/15/2021	437.77
AW-16	06/24/2021	437.89
AW-16	06/28/2021	437.79
AW-16	06/29/2021	437.81
AW-16	07/21/2021	437.74
AW-16	08/30/2021	437.41
AW-17	02/09/2021	436.85
AW-17	03/02/2021	437.20
AW-17	03/03/2021	437.20
AW-17	03/22/2021	437.42
AW-17	03/23/2021	437.42
AW-17	04/12/2021	437.58
AW-17	04/23/2021	437.48
AW-17	05/04/2021	437.40
AW-17	05/05/2021	437.20
AW-17	06/15/2021	437.34
AW-17	06/24/2021	437.30
AW-17	06/28/2021	437.24
AW-17	06/29/2021	437.30
AW-17	07/21/2021	437.70
AW-17	08/30/2021	437.03
AW-18	02/09/2021	435.27
AW-18	03/02/2021	435.17
AW-18	03/03/2021	435.17
AW-18	03/22/2021	435.38
AW-18	03/23/2021	435.38
AW-18	04/12/2021	435.37
AW-18	04/13/2021	435.25
AW-18	05/04/2021	435.04
AW-18	05/05/2021	434.97
AW-18	06/15/2021	434.98
AW-18	06/23/2021	435.03
AW-18	06/28/2021	435.23
AW-18	06/29/2021	435.34
AW-18	07/21/2021	435.25
AW-18	08/30/2021	434.68
AW-19	02/09/2021	447.65

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
AW-19	03/02/2021	447.64
AW-19	03/03/2021	447.64
AW-19	03/22/2021	447.71
AW-19	03/23/2021	447.71
AW-19	04/12/2021	447.55
AW-19	05/04/2021	447.36
AW-19	05/05/2021	447.33
AW-19	06/15/2021	447.09
AW-19	06/23/2021	447.15
AW-19	06/28/2021	447.40
AW-19	06/29/2021	447.42
AW-19	07/21/2021	447.22
AW-19	08/30/2021	446.88
AW-20	02/09/2021	445.11
AW-20	03/02/2021	445.23
AW-20	03/03/2021	445.23
AW-20	03/22/2021	445.41
AW-20	03/23/2021	445.41
AW-20	04/12/2021	445.29
AW-20	05/04/2021	445.08
AW-20	05/05/2021	445.07
AW-20	06/15/2021	444.55
AW-20	06/28/2021	445.08
AW-20	07/21/2021	445.24
AW-20	08/30/2021	444.25
AW-21	02/09/2021	444.04
AW-21	03/02/2021	444.20
AW-21	03/03/2021	444.20
AW-21	03/22/2021	444.42
AW-21	03/23/2021	444.42
AW-21	04/12/2021	444.17
AW-21	05/04/2021	443.74
AW-21	05/05/2021	443.72
AW-21	06/15/2021	442.83
AW-21	06/23/2021	443.13
AW-21	06/28/2021	443.79
AW-21	06/29/2021	443.82
AW-21	07/21/2021	443.46
AW-21	08/30/2021	442.68
AW-22	02/09/2021	451.45
AW-22	02/12/2021	451.45
AW-22	03/02/2021	451.64
AW-22	03/03/2021	451.64
AW-22	03/22/2021	451.80
AW-22	03/23/2021	451.80

TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
AW-22	04/12/2021	451.55
AW-22	04/23/2021	451.53
AW-22	05/04/2021	451.46
AW-22	05/05/2021	451.29
AW-22	06/15/2021	451.30
AW-22	06/28/2021	451.44
AW-22	07/21/2021	451.54
AW-22	08/30/2021	452.04
P002	02/09/2021	448.41
P002	02/12/2021	448.41
P002	03/02/2021	448.50
P002	03/03/2021	448.50
P002	03/22/2021	448.60
P002	03/23/2021	448.60
P002	04/12/2021	448.42
P002	04/13/2021	448.33
P002	05/04/2021	448.31
P002	06/15/2021	448.19
P002	06/28/2021	448.33
XPW01A	02/09/2021	452.42
XPW01A	03/02/2021	452.72
XPW01A	03/04/2021	452.72
XPW01A	03/22/2021	452.88
XPW01A	03/23/2021	452.88
XPW01A	04/12/2021	452.65
XPW01A	05/04/2021	452.41
XPW01A	06/15/2021	452.13
XPW01A	06/28/2021	452.98
XPW01A	07/21/2021	452.63
XPW01A	08/30/2021	452.32
XPW02	02/09/2021	452.97
XPW02	03/02/2021	453.17
XPW02	03/03/2021	453.17
XPW02	03/22/2021	454.08
XPW02	03/23/2021	454.08
XPW02	04/12/2021	453.73
XPW02	05/04/2021	453.23
XPW02	06/15/2021	452.90
XPW02	06/28/2021	453.47
XPW02	07/21/2021	453.67
XPW02	07/22/2021	453.55
XPW02	08/30/2021	452.36
XPW03	02/09/2021	450.74
XPW03	03/02/2021	450.72
XPW03	03/03/2021	450.72

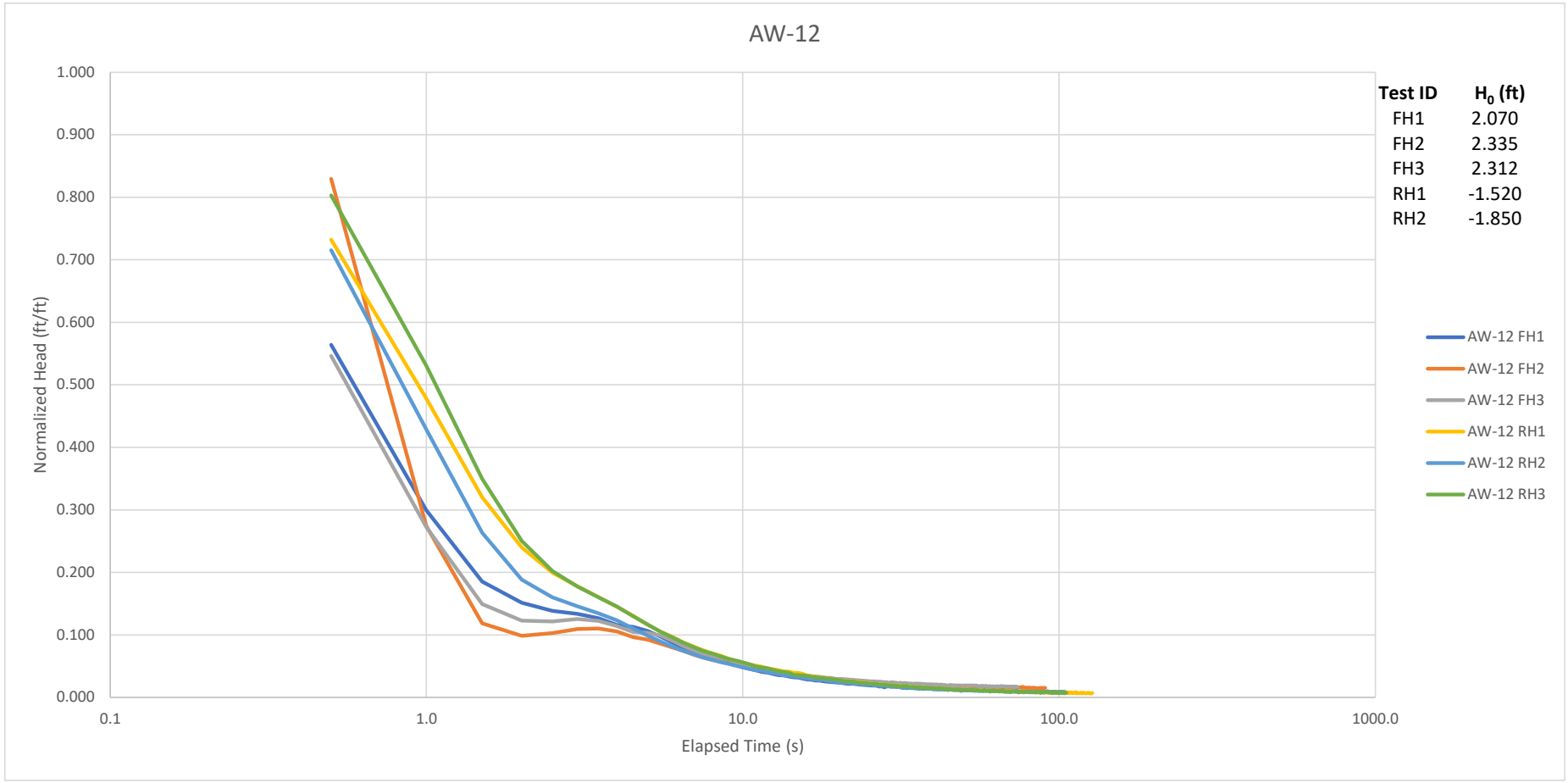
TABLE E-1. GROUNDWATER ELEVATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

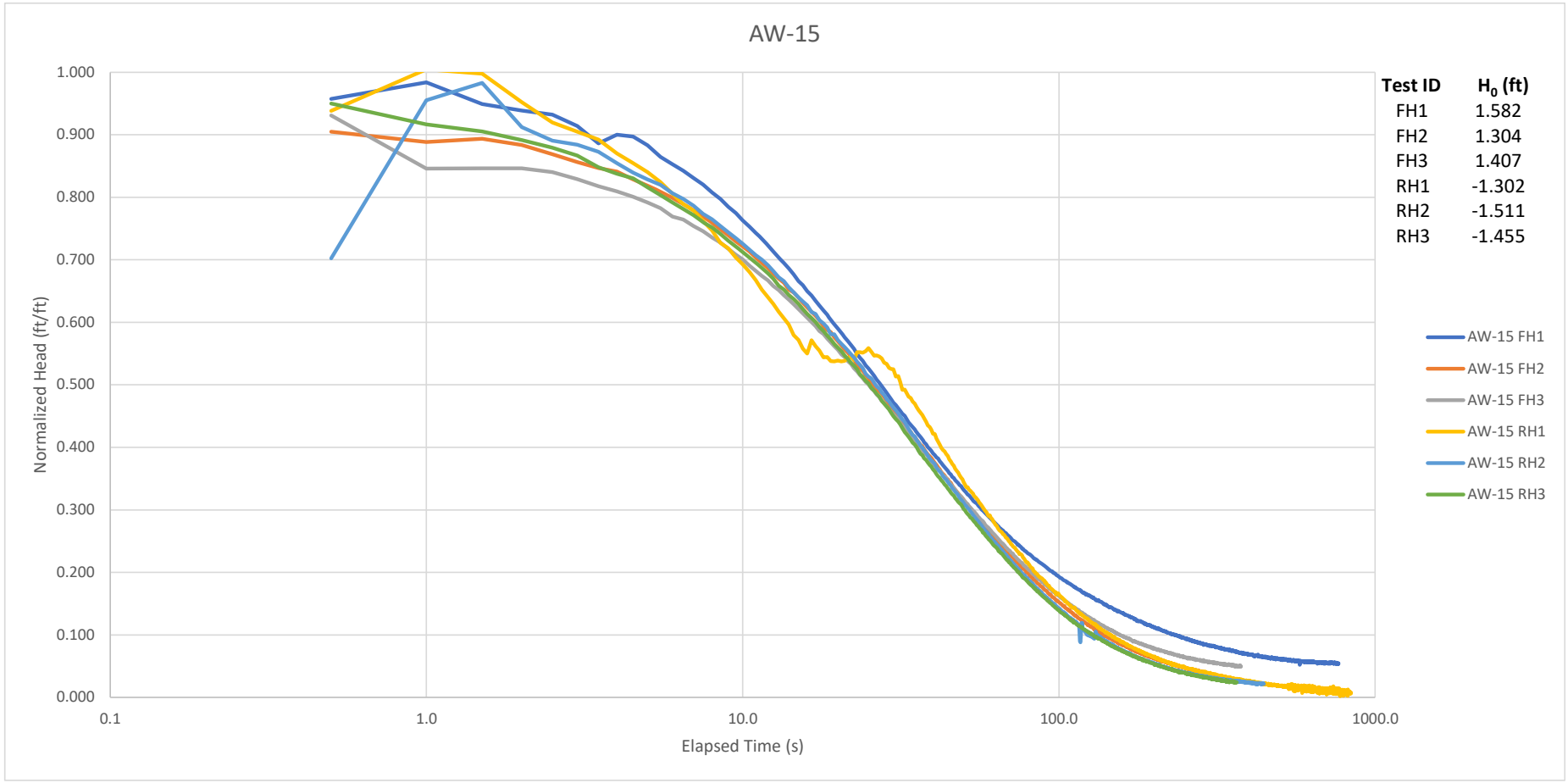
Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
XPW03	03/22/2021	450.77
XPW03	03/23/2021	450.77
XPW03	04/12/2021	450.62
XPW03	05/04/2021	450.84
XPW03	06/15/2021	450.38
XPW03	06/28/2021	450.86
XPW03	07/21/2021	451.03
XPW03	07/22/2021	450.86
XPW03	08/30/2021	450.76
SG-01	06/15/2021	625.21

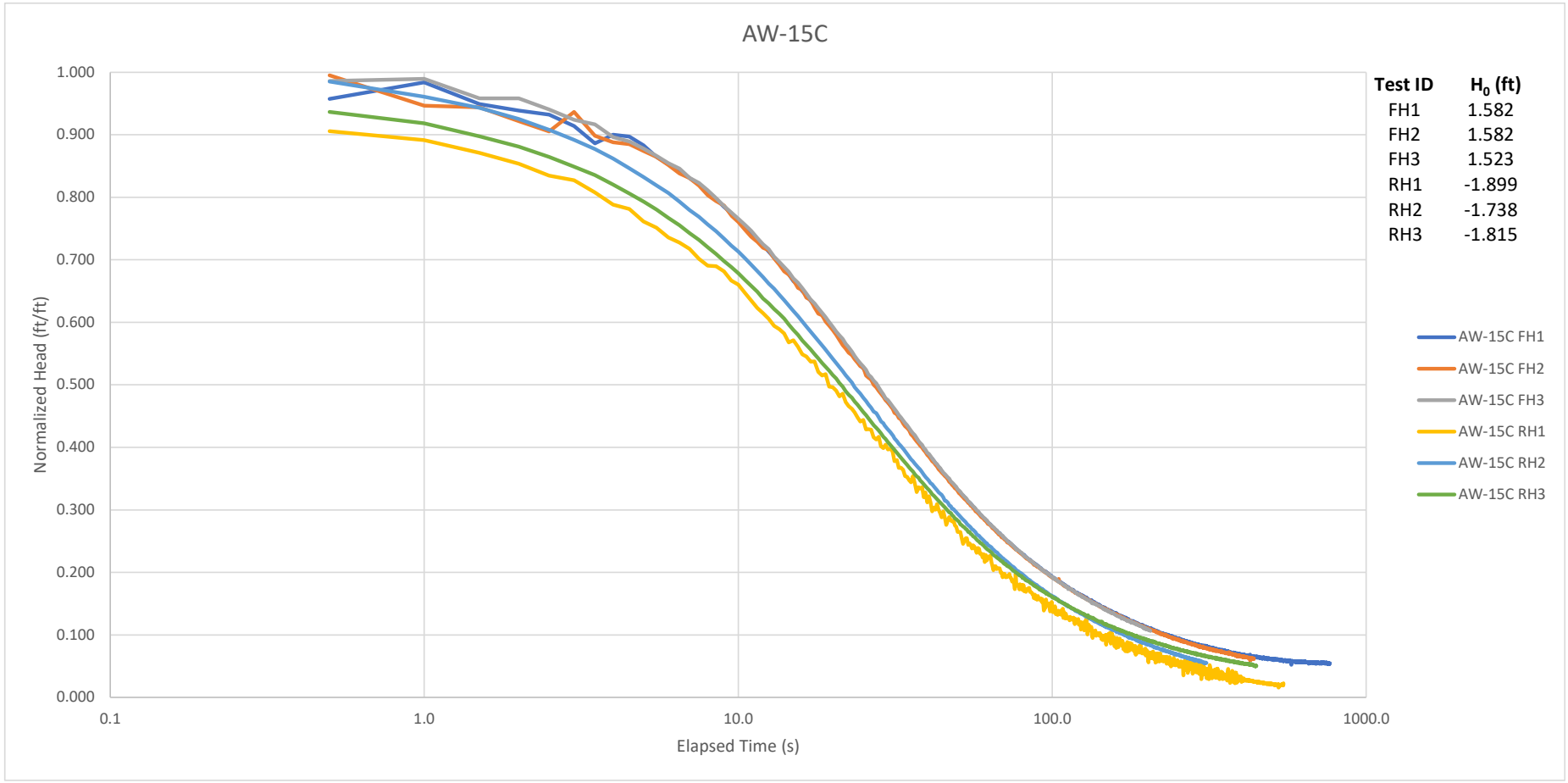
Notes:
ft NAVD88 = feet relative to the North American Vertical Datum 1988, GEOID 12A

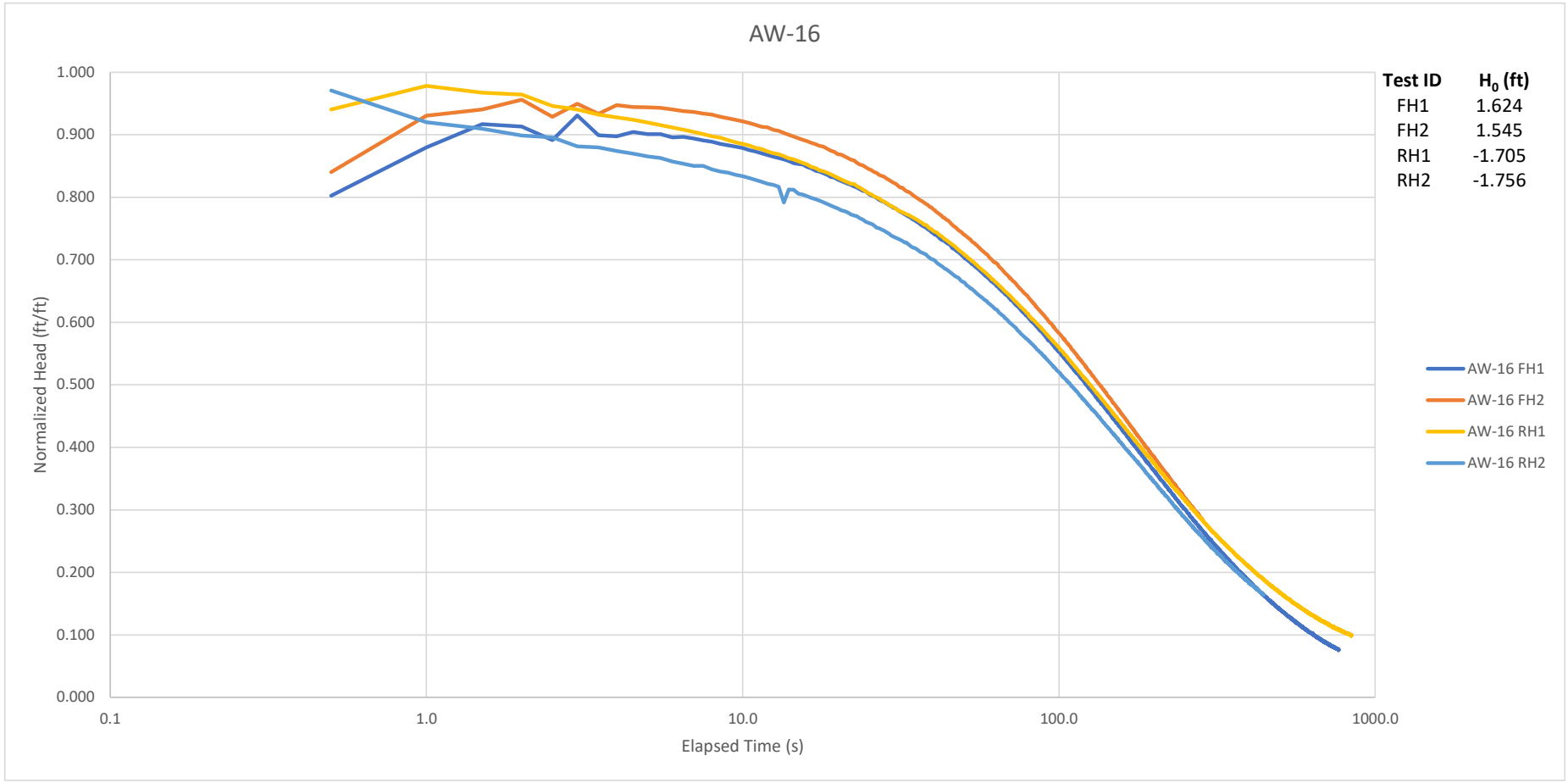
generated 10/05/2021, 4:08:22 PM CDT

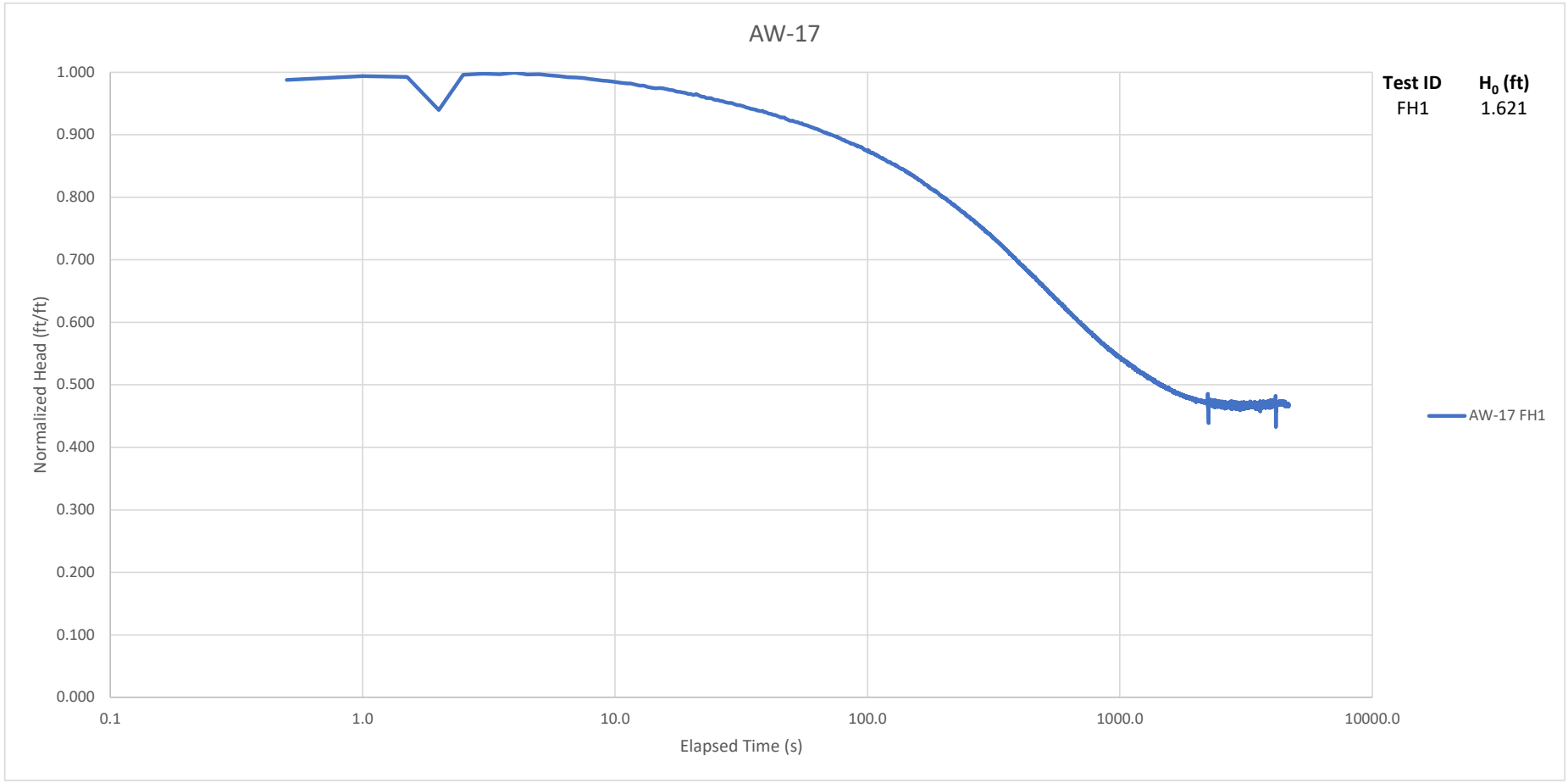
APPENDIX F
HYDRAULIC CONDUCTIVITY TEST DATA

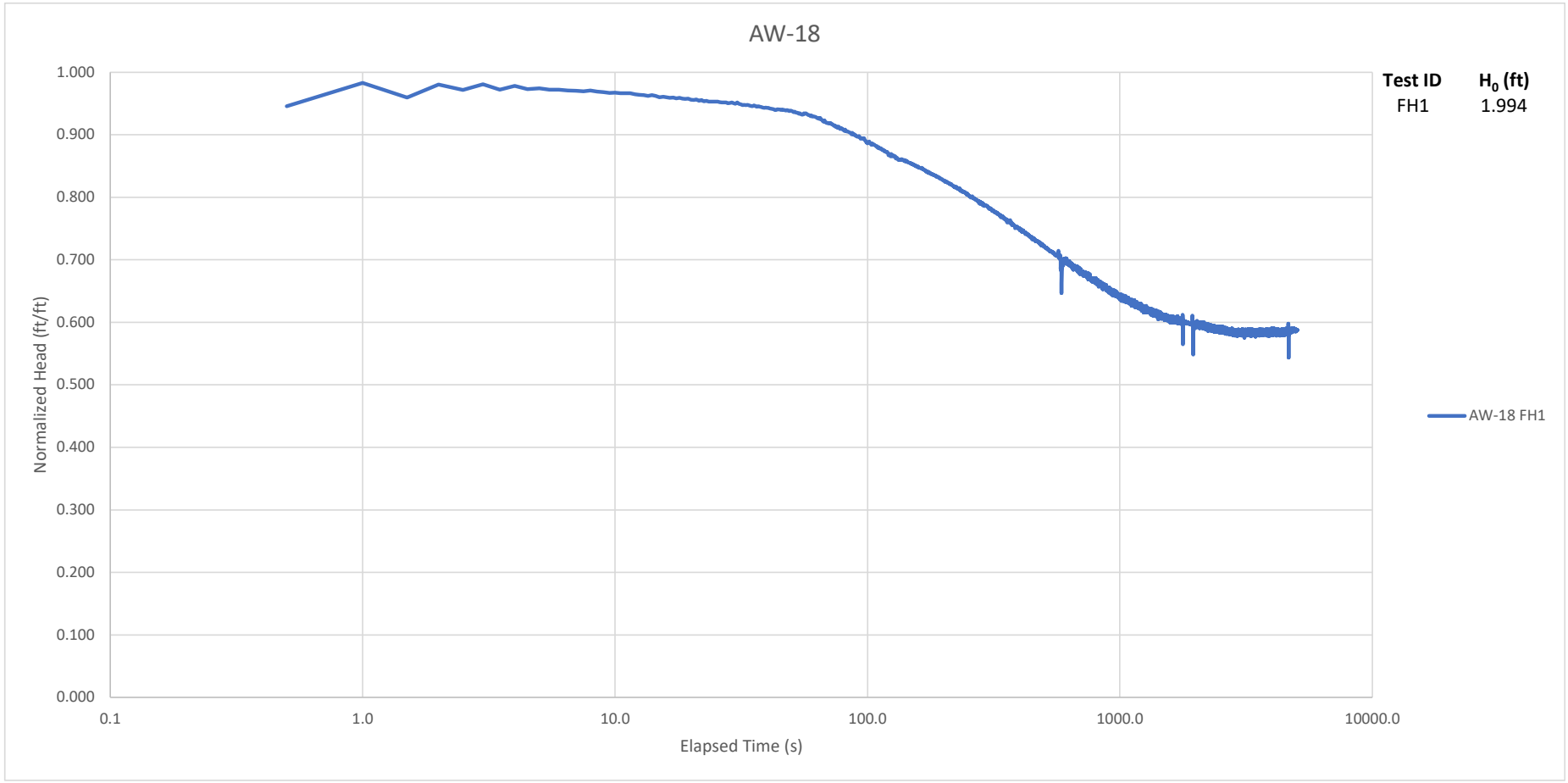

AW-12
Normalized Head (ft/ft)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.1
1.0
10.0
100.0
1000.0
Elapsed Time (s)
Test ID
H_0 (ft)
FH1 2.070
FH2 2.335
FH3 2.312
RH1 -1.520
RH2 -1.850
AW-12 FH1
AW-12 FH2
AW-12 FH3
AW-12 RH1
AW-12 RH2
AW-12 RH3

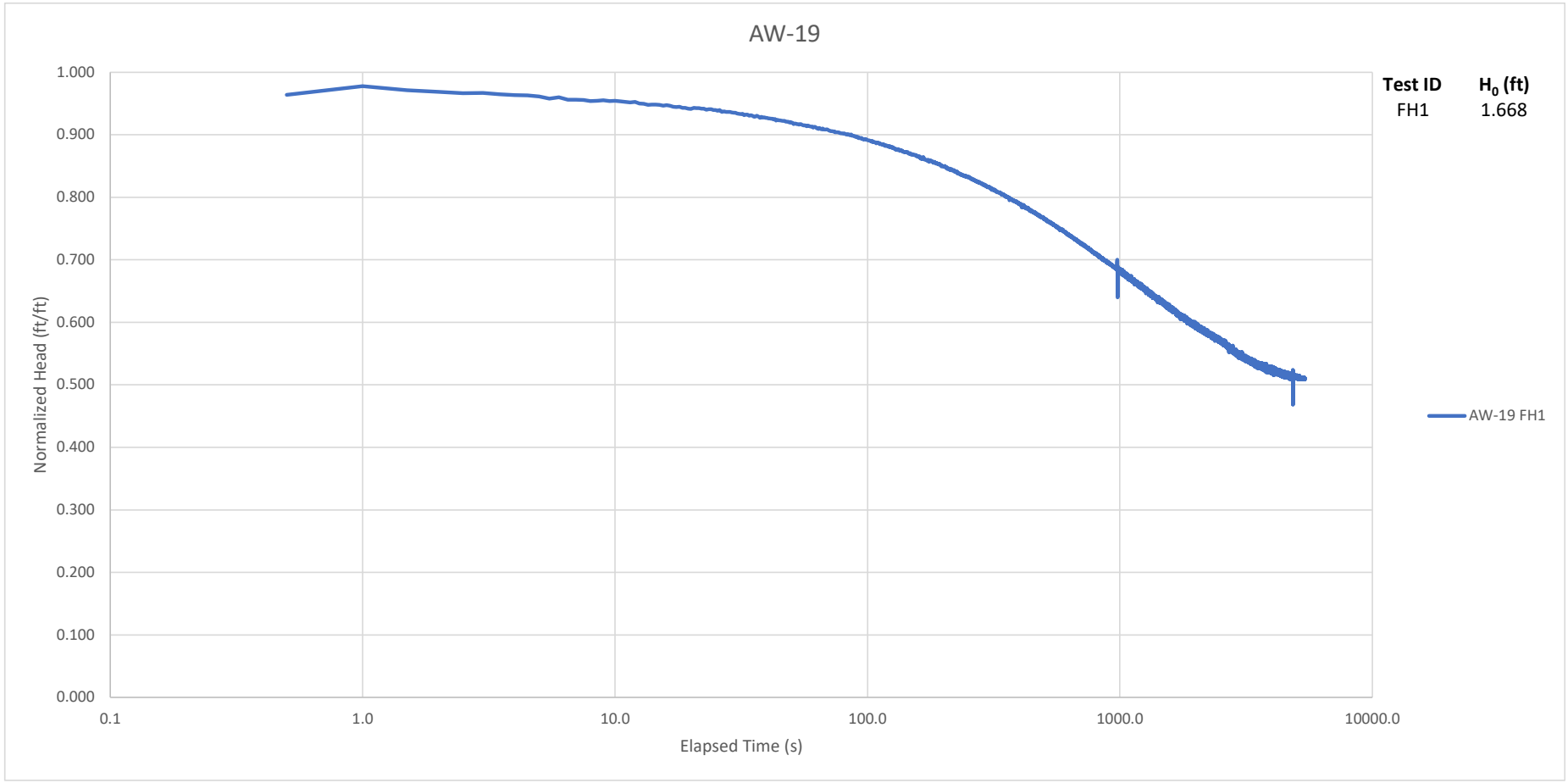

AW-15
Normalized Head (ft/ft)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.1
1.0
10.0
100.0
1000.0
Elapsed Time (s)
Test ID
H_0 (ft)
FH1 1.582
FH2 1.304
FH3 1.407
RH1 -1.302
RH2 -1.511
RH3 -1.455
AW-15 FH1
AW-15 FH2
AW-15 FH3
AW-15 RH1
AW-15 RH2
AW-15 RH3

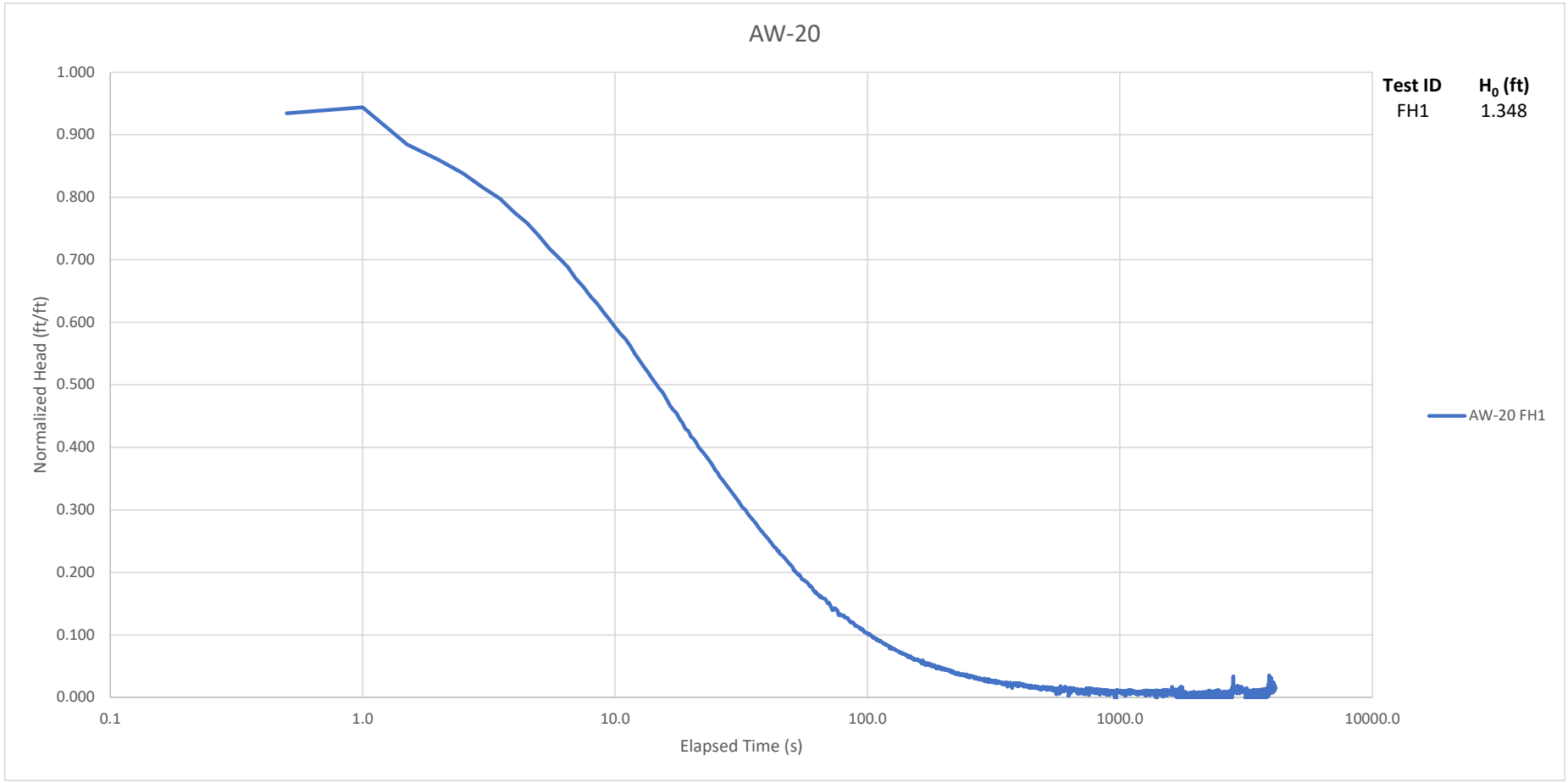

AW-15C
Normalized Head (ft/ft)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.1
1.0
10.0
100.0
1000.0
Elapsed Time (s)
Test ID
H_0 (ft)
FH1 1.582
FH2 1.582
FH3 1.523
RH1 -1.899
RH2 -1.738
RH3 -1.815
AW-15C FH1
AW-15C FH2
AW-15C FH3
AW-15C RH1
AW-15C RH2
AW-15C RH3

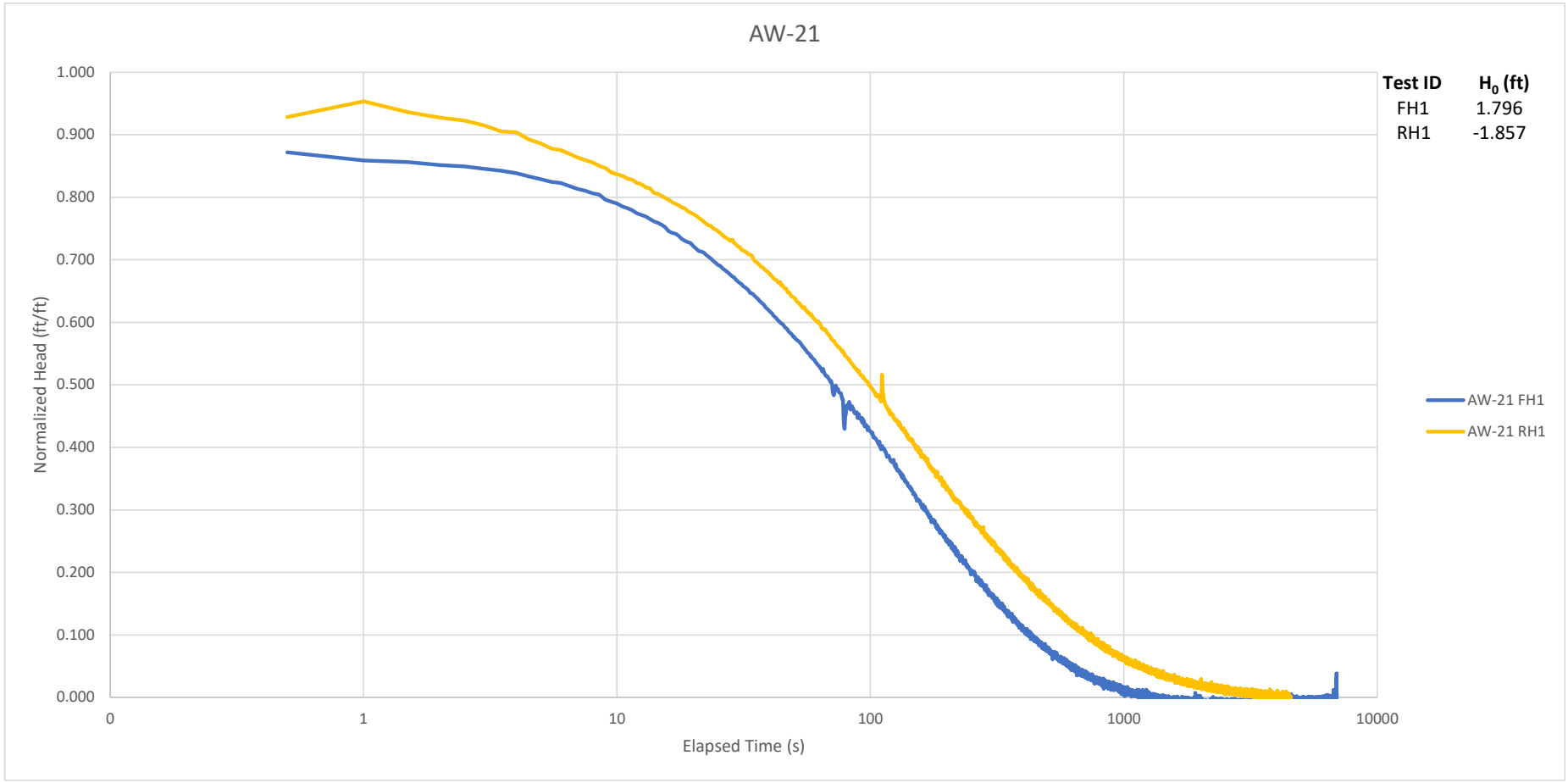

AW-16
Normalized Head (ft/ft)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.1
1.0
10.0
100.0
1000.0
Elapsed Time (s)
Test ID
H_0 (ft)
FH1 1.624
FH2 1.545
RH1 -1.705
RH2 -1.756
AW-16 FH1
AW-16 FH2
AW-16 RH1
AW-16 RH2

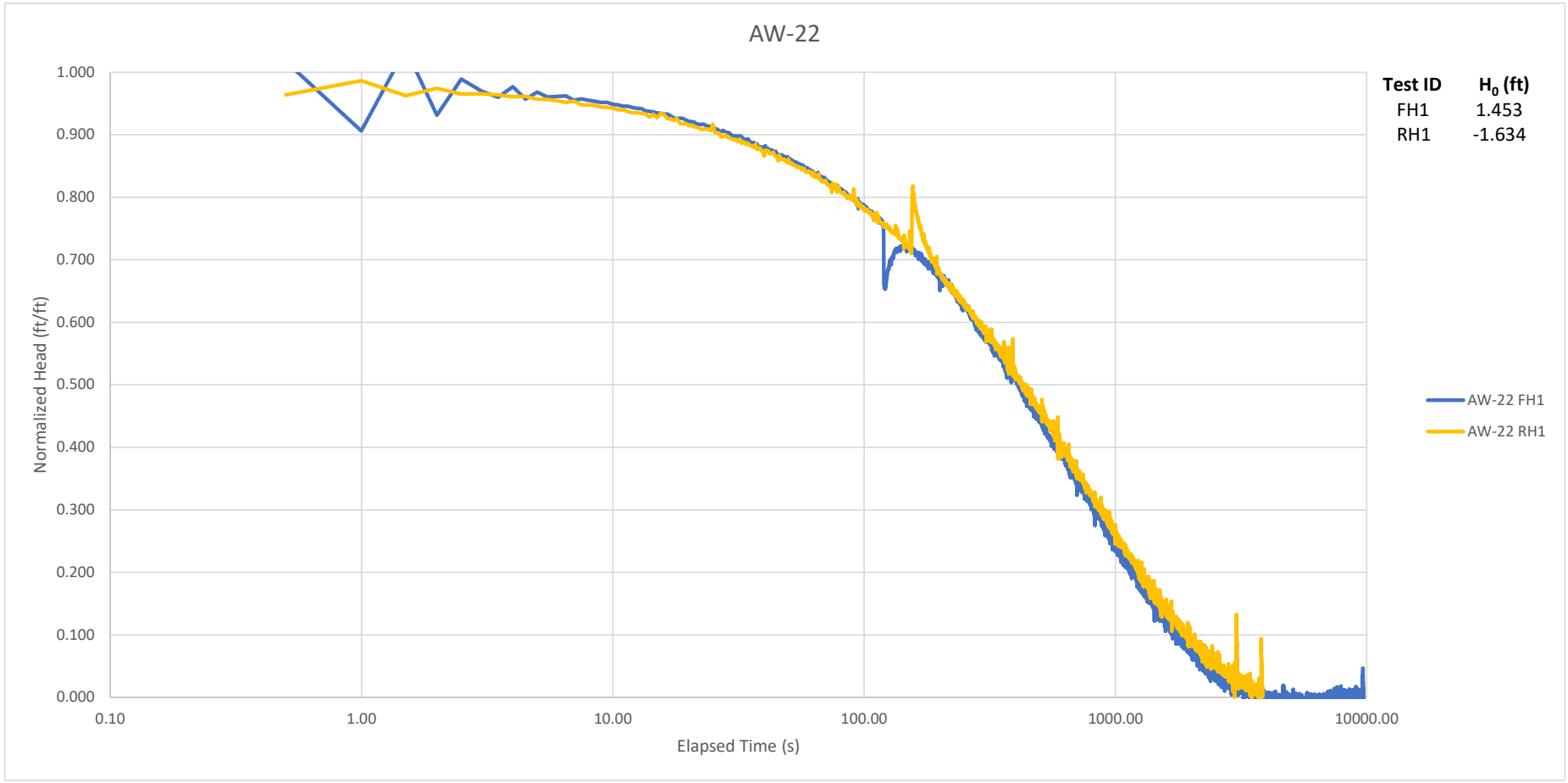

AW-17
Normalized Head (ft/ft)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.1
1.0
10.0
100.0
1000.0
10000.0
Elapsed Time (s)
Test ID
FH1
H0 (ft)
1.621
AW-17 FH1

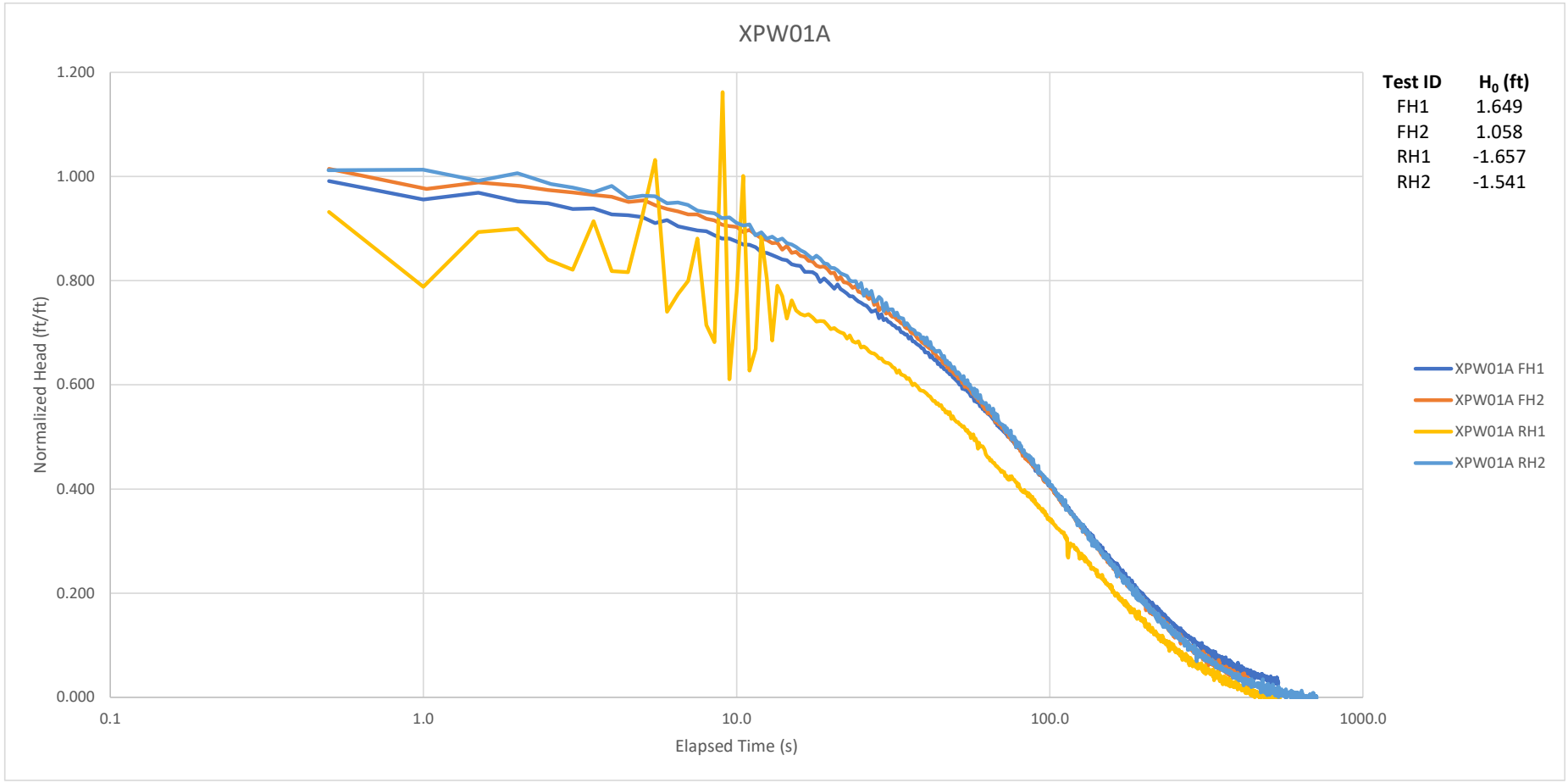

AW-18
Normalized Head (ft/ft)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.1
1.0
10.0
100.0
1000.0
10000.0
Elapsed Time (s)
Test ID
H0 (ft)
FH1
1.994
AW-18 FH1

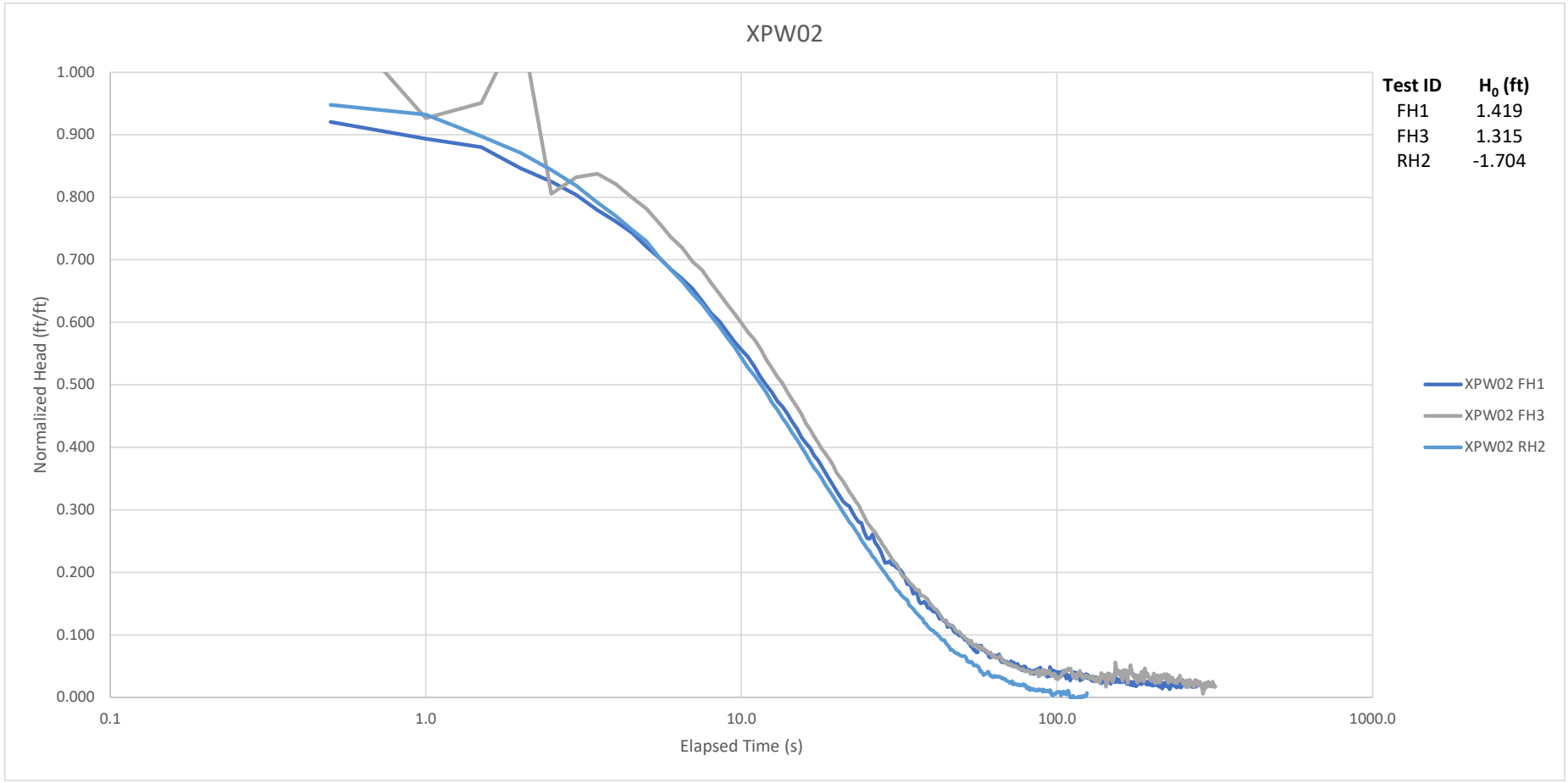

AW-19
Normalized Head (ft/ft)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.1
1.0
10.0
100.0
1000.0
10000.0
Elapsed Time (s)
Test ID
FH1
H0 (ft)
1.668
AW-19 FH1

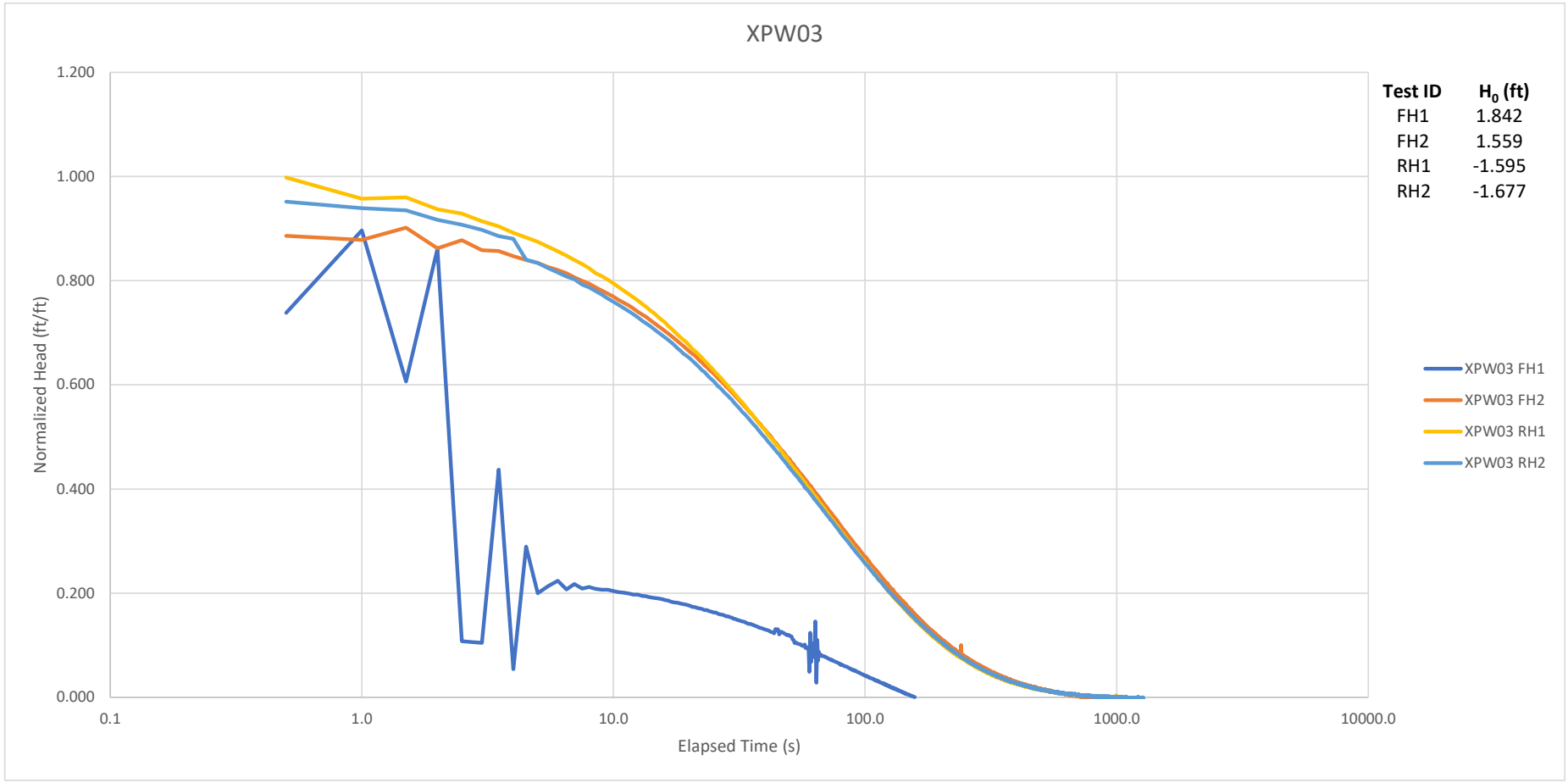

AW-20
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Normalized Head (ft/ft)
0.1
1.0
10.0
100.0
1000.0
10000.0
Elapsed Time (s)
Test ID
FH1
H_0 (ft)
1.348
AW-20 FH1

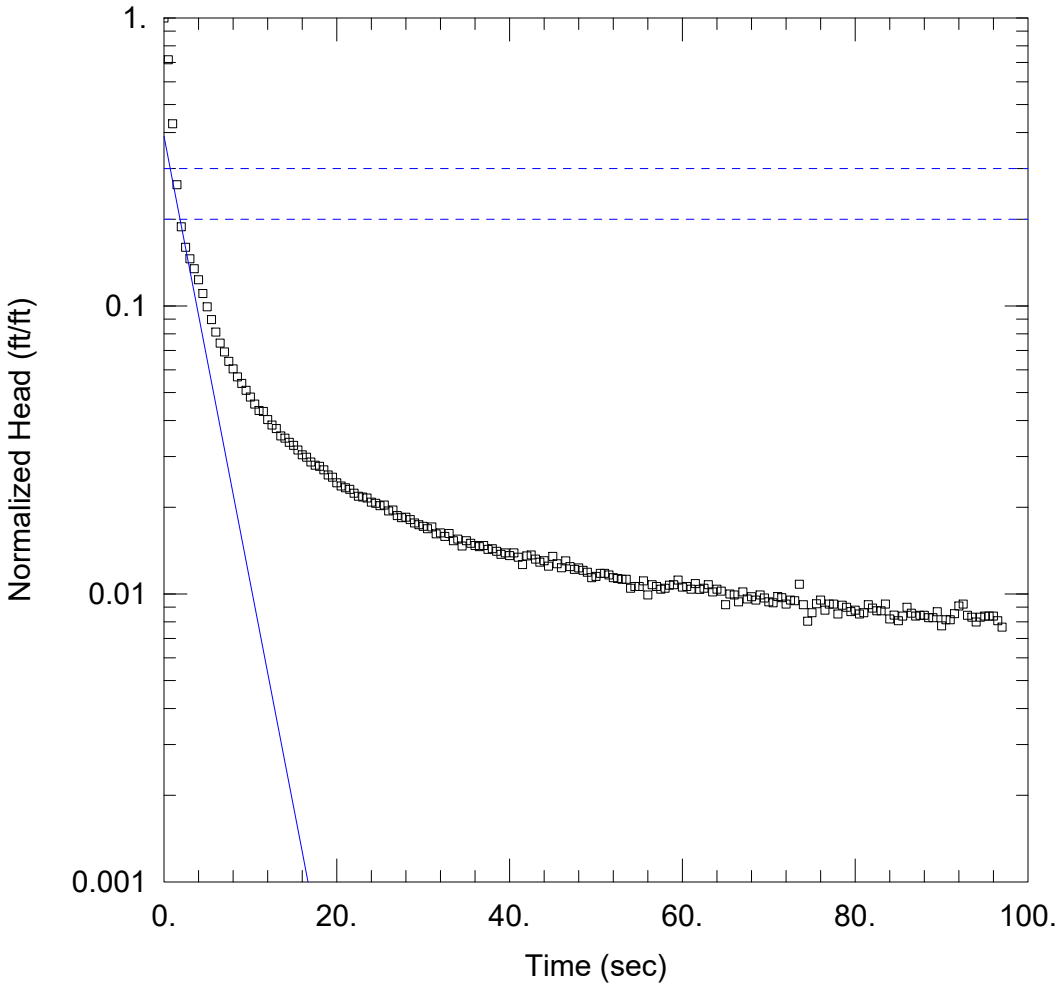

AW-21
Test ID
H_0 (ft)
FH1
1.796
RH1
-1.857
Normalized Head (ft/ft)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0
1
10
100
1000
10000
Elapsed Time (s)
AW-21 FH1
AW-21 RH1


AW-22
Normalized Head (ft/ft)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.10
1.00
10.00
100.00
1000.00
10000.00
Elapsed Time (s)
Test ID
H0 (ft)
FH1
1.453
RH1
-1.634
AW-22 FH1
AW-22 RH1


XPW01A
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Normalized Head (ft/ft)
0.1
1.0
10.0
100.0
1000.0
Elapsed Time (s)
Test ID
H_0 (ft)
FH1 1.649
FH2 1.058
RH1 -1.657
RH2 -1.541
XPW01A FH1
XPW01A FH2
XPW01A RH1
XPW01A RH2


XPW02
Test ID
H_0 (ft)
FH1
1.419
FH3
1.315
RH2
-1.704
Normalized Head (ft/ft)
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
0.1
1.0
10.0
100.0
1000.0
Elapsed Time (s)
XPW02 FH1
XPW02 FH3
XPW02 RH2


XPW03
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Normalized Head (ft/ft)
0.1
1.0
10.0
100.0
1000.0
10000.0
Elapsed Time (s)
Test ID
H_0 (ft)
FH1
1.842
FH2
1.559
RH1
-1.595
RH2
-1.677
XPW03 FH1
XPW03 FH2
XPW03 RH1
XPW03 RH2



AW-12 RH2

PROJECT INFORMATION

Company: Ramboll
Client: IPRG
Project: 1940100457-001
Location: Bartonville, IL
Test Well: AW-12
Test Date: 3/26/21

AQUIFER DATA

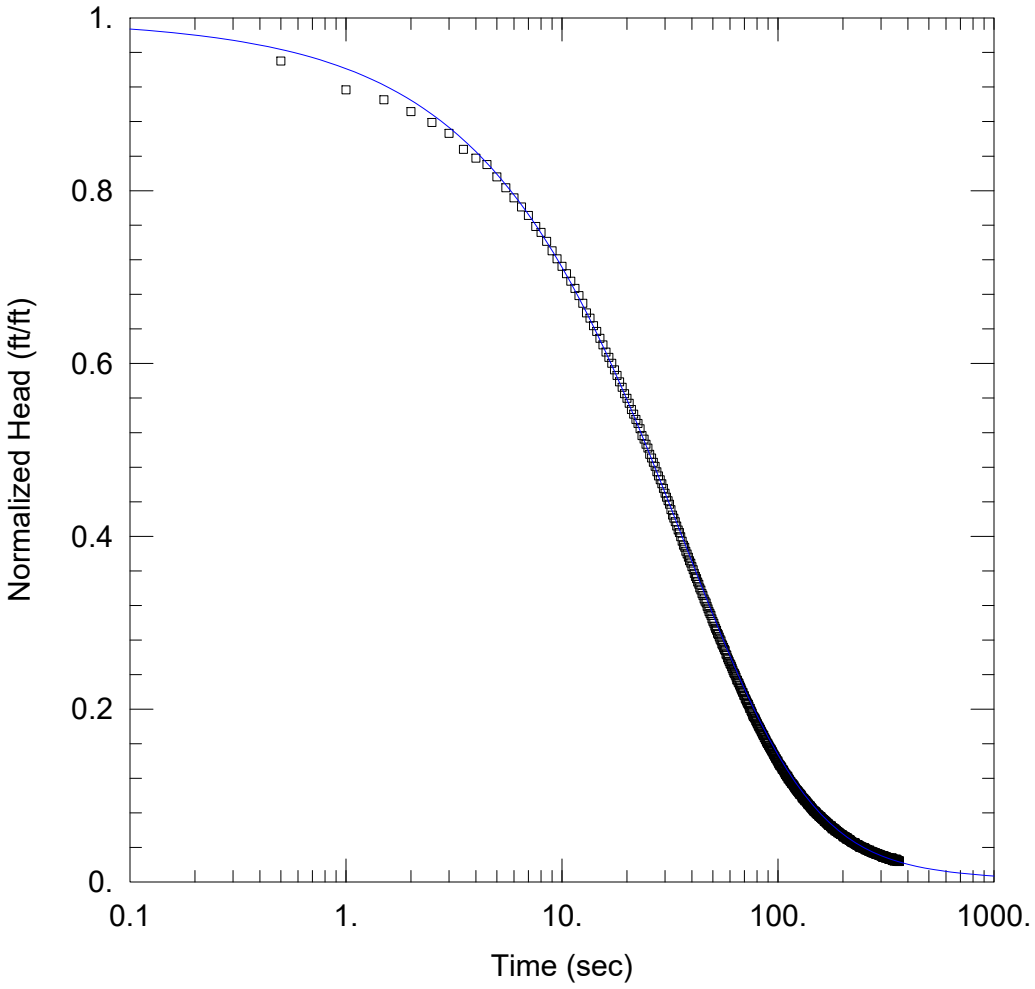
Saturated Thickness: 8. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AW-12)

Initial Displacement: -1.85 ft
Total Well Penetration Depth: 4. ft
Casing Radius: 0.08625 ft
Static Water Column Height: 26.87 ft
Screen Length: 4. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
K = 0.01541 cm/sec
Solution Method: Bouwer-Rice
y0 = -0.7181 ft



AW-15 RH3

PROJECT INFORMATION

Company: Ramboll
Client: IPRG
Project: 1940100457-001
Location: Bartonville, IL
Test Well: AW-15
Test Date: 3/26/21

AQUIFER DATA

Saturated Thickness: 1.1 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AW-15)

Initial Displacement: -1.455 ft
Total Well Penetration Depth: 1.1 ft
Casing Radius: 0.08625 ft
Static Water Column Height: 32.64 ft
Screen Length: 1.1 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.2498 cm^2/sec
S = 0.0004365

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
170.5	-0.09726	358.	-0.03627
171.	-0.09813	358.5	-0.03592
171.5	-0.09536	359.	-0.03433
172.	-0.097	359.5	-0.03553
172.5	-0.0949	360.	-0.03482
173.	-0.09536	360.5	-0.03584
173.5	-0.09506	361.	-0.03465
174.	-0.09481	361.5	-0.03491
174.5	-0.09536	362.	-0.03449
175.	-0.0934	362.5	-0.03449
175.5	-0.09326	363.	-0.03592
176.	-0.09269	363.5	-0.03543
176.5	-0.09258	364.	-0.03522
177.	-0.09444	364.5	-0.03506
177.5	-0.09229	365.	-0.03476
178.	-0.08948	365.5	-0.03491

SOLUTION

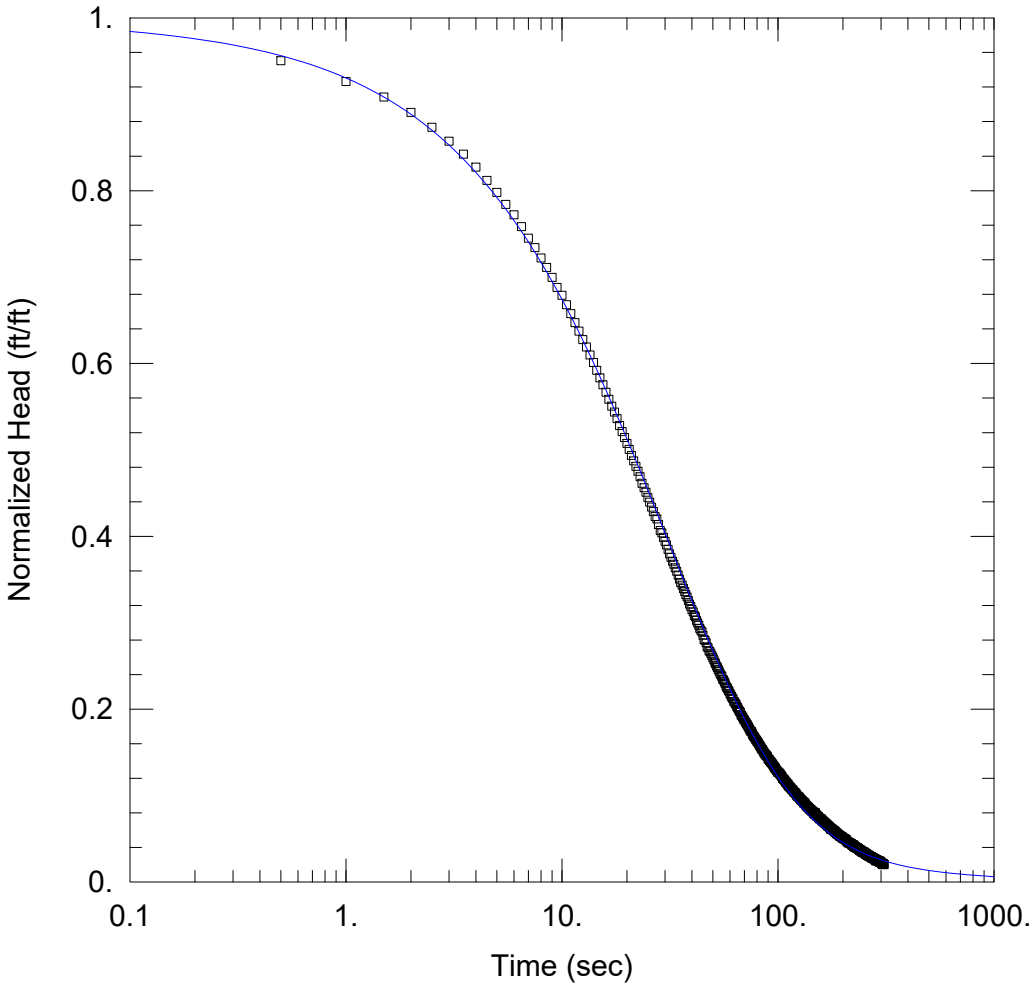
Slug Test
Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.2498	cm^2/sec
S	0.0004365	

K = T/b = 0.007449 cm/sec
Ss = S/b = 0.0003968 1/ft



AW-15C RH2

PROJECT INFORMATION

Company: Ramboll
Client: IPRG
Project: 1940100457-001
Location: Bartonville, IL
Test Well: AW-15C
Test Date: 3/25/21

AQUIFER DATA

Saturated Thickness: 11. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AW-15C)

Initial Displacement: -1.738 ft
Total Well Penetration Depth: 11. ft
Casing Radius: 0.08625 ft
Static Water Column Height: 44.27 ft
Screen Length: 11. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.2765 cm^2/sec
S = 0.000631

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
142.5	-0.143	300.	-0.039
143.	-0.144	300.5	-0.038
143.5	-0.144	301.	-0.038
144.	-0.142	301.5	-0.039
144.5	-0.141	302.	-0.039
145.	-0.142	302.5	-0.038
145.5	-0.141	303.	-0.037
146.	-0.139	303.5	-0.037
146.5	-0.138	304.	-0.036
147.	-0.14	304.5	-0.035
147.5	-0.137	305.	-0.036
148.	-0.139	305.5	-0.036
148.5	-0.135	306.	-0.035
149.	-0.14	306.5	-0.036
149.5	-0.137	307.	-0.036
150.	-0.136	307.5	-0.036
150.5	-0.135	308.	-0.037
151.	-0.133	308.5	-0.035
151.5	-0.132	309.	-0.035
152.	-0.132	309.5	-0.035
152.5	-0.132	310.	-0.036
153.	-0.132		

SOLUTION

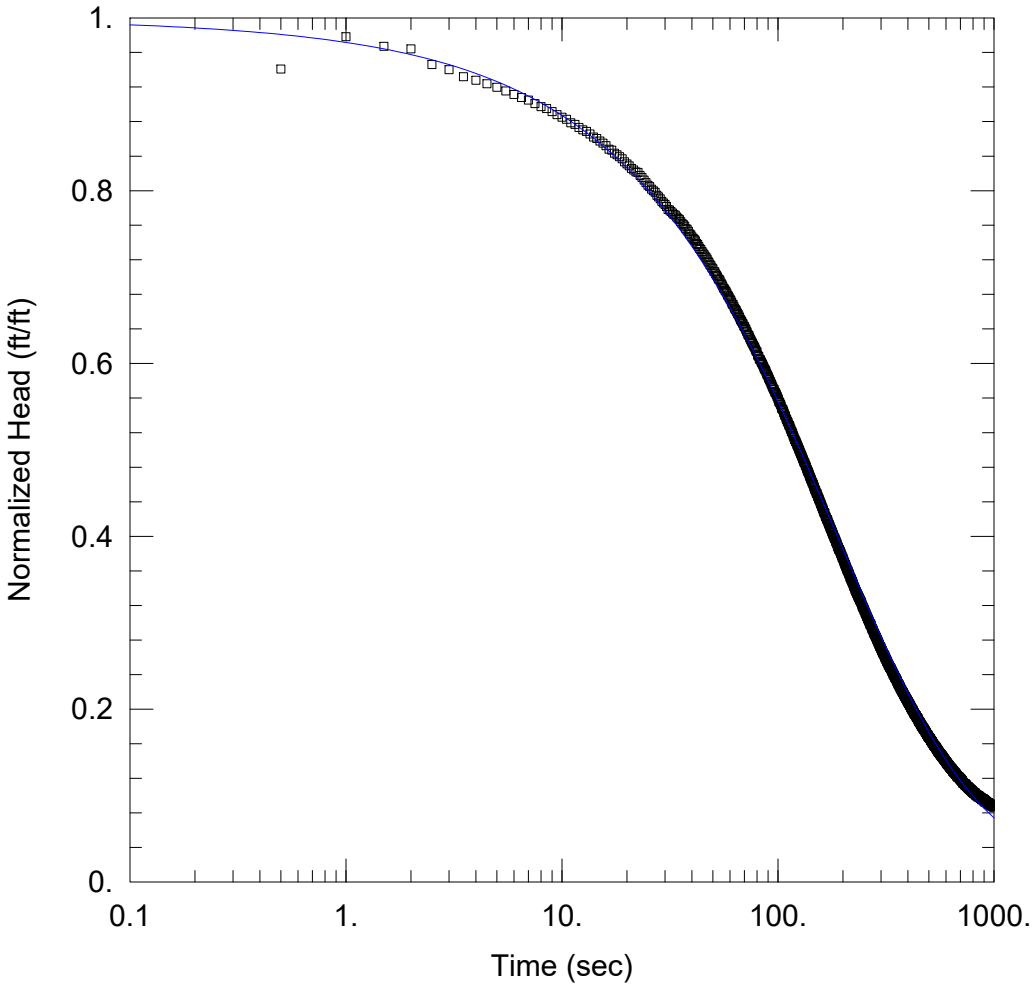
Slug Test
Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.2765	cm^2/sec
S	0.000631	

K = T/b = 0.0008246 cm/sec
Ss = S/b = 5.736E-5 1/ft



AW-16 RH1

PROJECT INFORMATION

Company: Ramboll
Client: IPRG
Project: 1940100457-001
Location: Bartonville, IL
Test Well: AW-16
Test Date: 3/25/21

AQUIFER DATA

Saturated Thickness: 1.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AW-16)

Initial Displacement: -1.705 ft
Total Well Penetration Depth: 5. ft
Casing Radius: 0.08625 ft
Static Water Column Height: 38.27 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.035 cm^2/sec
S = 0.001995

SOLUTION

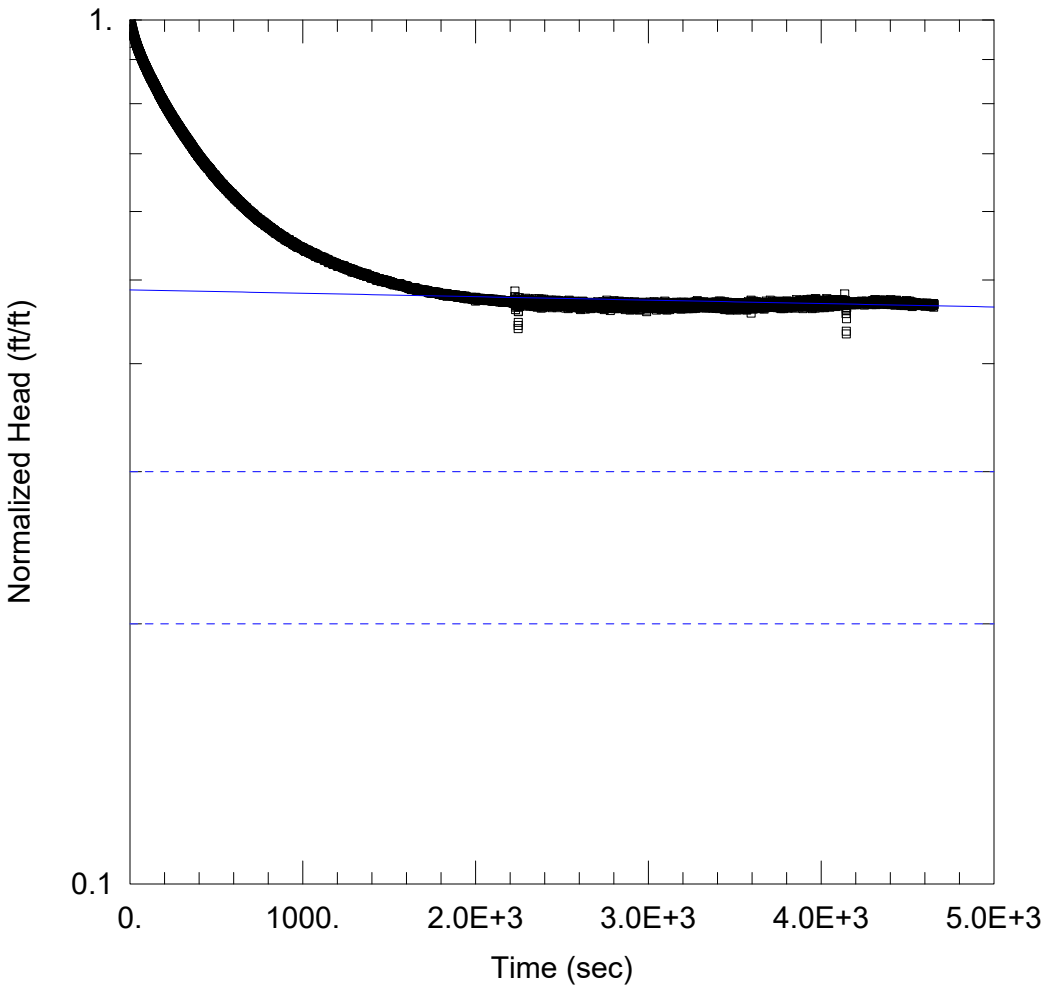
Slug Test
Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.035	cm^2/sec
S	0.001995	

K = T/b = 0.0007656 cm/sec
Ss = S/b = 0.00133 1/ft



AW-17 FH1

PROJECT INFORMATION

Company: Ramboll
Client: IPRG
Project: 1940100457-001
Location: Bartonville, IL
Test Well: AW-17
Test Date: 3/25/21

AQUIFER DATA

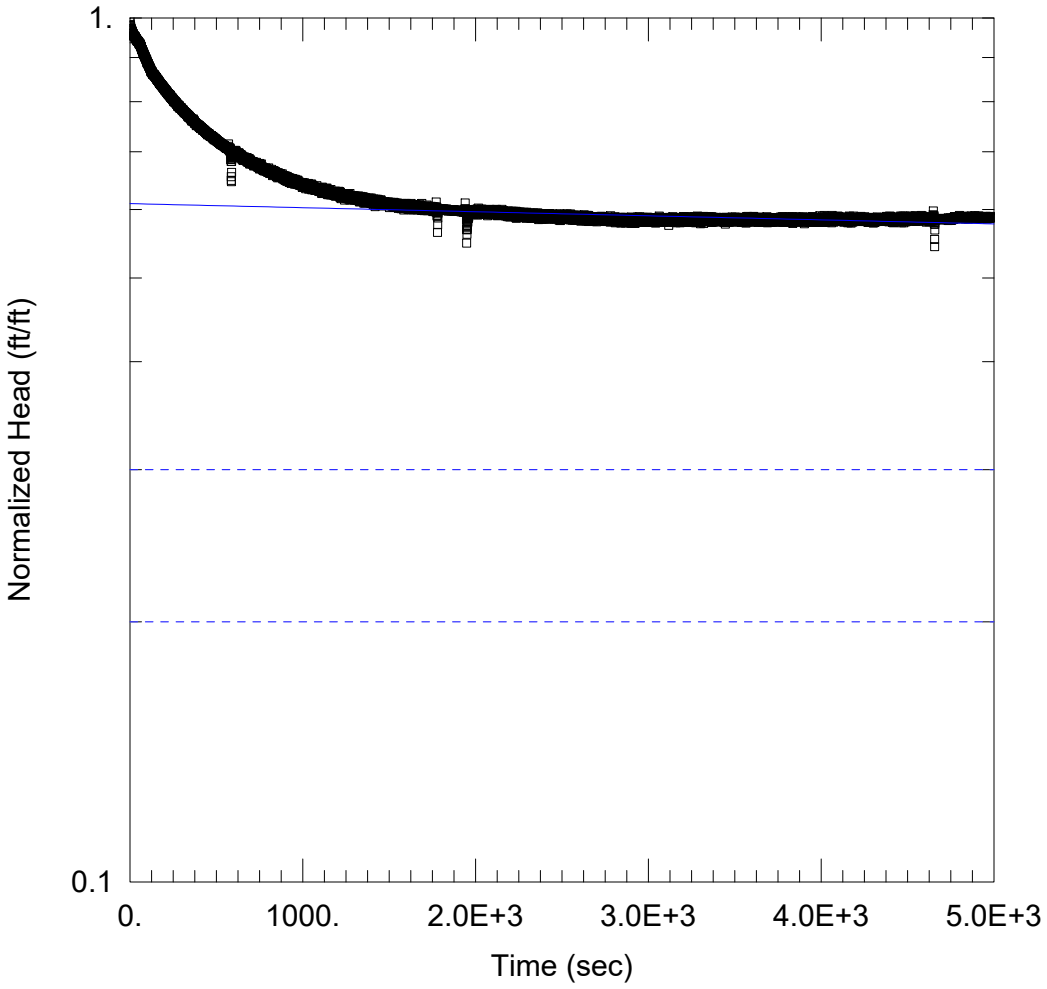
Saturated Thickness: 3.9 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AW-17)

Initial Displacement: 1.621 ft
Total Well Penetration Depth: 3.9 ft
Casing Radius: 0.08625 ft
Static Water Column Height: 33.31 ft
Screen Length: 3.9 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
K = 4.687E-7 cm/sec
Solution Method: Bouwer-Rice
y0 = 0.7895 ft



AW-18 FH1

PROJECT INFORMATION

Company: Ramboll
Client: IPRG
Project: 1940100457-001
Location: Bartonville, IL
Test Well: AW-18
Test Date: 3/25/21

AQUIFER DATA

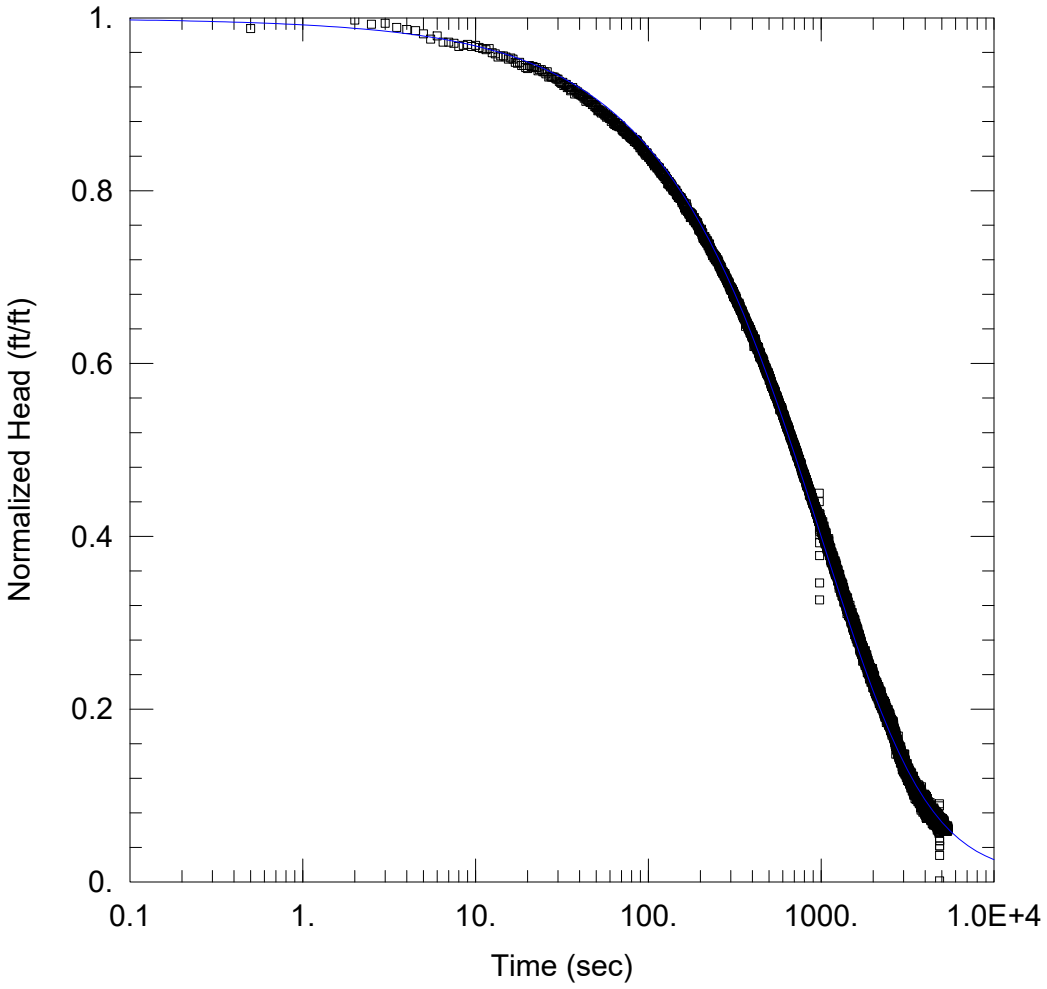
Saturated Thickness: 7.2 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AW-18)

Initial Displacement: 1.994 ft
Total Well Penetration Depth: 1.2 ft
Casing Radius: 0.08625 ft
Static Water Column Height: 24.97 ft
Screen Length: 1.2 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
K = 7.343E-7 cm/sec
Solution Method: Bouwer-Rice
y0 = 1.216 ft



AW-19 FH1

PROJECT INFORMATION

Company: Ramboll
Client: IPRG
Project: 1940100457-001
Location: Bartonville, IL
Test Well: AW-19
Test Date: 3/25/21

AQUIFER DATA

Saturated Thickness: 6.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AW-19)

Initial Displacement: 0.818 ft
Total Well Penetration Depth: 5. ft
Casing Radius: 0.08625 ft
Static Water Column Height: 28.39 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.008186 cm^2/sec
S = 0.000721

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
2681.	0.14	5387.	0.051
2681.5	0.13	5387.5	0.051
2682.	0.135	5388.	0.05
2682.5	0.134	5388.5	0.05
2683.	0.135	5389.	0.05
2683.5	0.135	5389.5	0.051
2684.	0.136	5390.	0.05
2684.5	0.136	5390.5	0.052
2685.	0.133	5391.	0.051
2685.5	0.138	5391.5	0.05
2686.	0.137	5392.	0.051
2686.5	0.136	5392.5	0.05
2687.	0.137	5393.	0.051
2687.5	0.137	5393.5	0.05
2688.	0.134	5394.	0.05
2688.5	0.143	5394.5	0.051
2689.	0.133	5395.	0.053
2689.5	0.134	5395.5	0.052
2690.	0.132	5396.	0.049
2690.5	0.129	5396.5	0.05
2691.	0.139	5397.	0.051
2691.5	0.138	5397.5	0.052
2692.	0.137	5398.	0.052
2692.5	0.134	5398.5	0.053
2693.	0.134	5399.	0.05
2693.5	0.13	5399.5	0.049
2694.	0.137	5400.	0.05
2694.5	0.136	5400.5	0.05
2695.	0.137	5401.	0.049
2695.5	0.134	5401.5	0.05
2696.	0.132	5402.	0.049
2696.5	0.133	5402.5	0.05
2697.	0.134	5403.	0.049
2697.5	0.142	5403.5	0.051
2698.	0.134	5404.	0.05
2698.5	0.135	5404.5	0.05
2699.	0.134		

SOLUTION

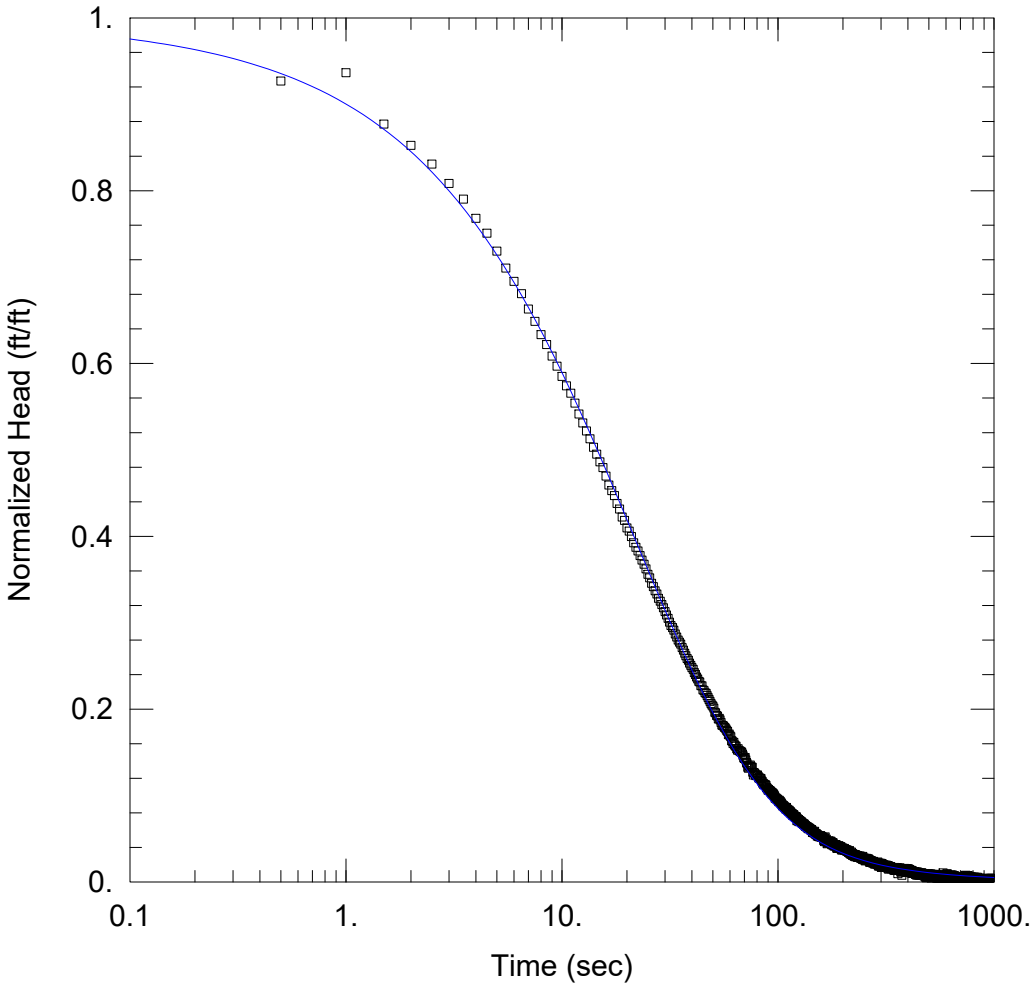
Slug Test
Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.008186	cm^2/sec
S	0.000721	

K = T/b = 4.132E-5 cm/sec
Ss = S/b = 0.0001109 1/ft



AW-20 FH1

PROJECT INFORMATION

Company: Ramboll
Client: IPRG
Project: 1940100457-001
Location: Bartonville, IL
Test Well: AW-20
Test Date: 4/26/21

AQUIFER DATA

Saturated Thickness: 4.2 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AW-20)

Initial Displacement: 1.348 ft
Total Well Penetration Depth: 0.7 ft
Casing Radius: 0.08625 ft
Static Water Column Height: 27.43 ft
Screen Length: 0.7 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.3262 cm^2/sec
S = 0.001523

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
2051.5	-0.01633	4117.5	0.01078
2052.	-0.01155	4118.	0.00906
2052.5	-0.0067	4118.5	0.01181
2053.	-0.00585	4119.	0.01042
2053.5	-0.00294	4119.5	0.01162
2054.	-0.00769	4120.	0.01006
2054.5	-0.00864	4120.5	0.01078
2055.	-0.00811	4121.	0.011
2055.5	-0.0063	4121.5	0.01
2056.	-0.0128	4122.	0.01146
2056.5	-0.00571		

SOLUTION

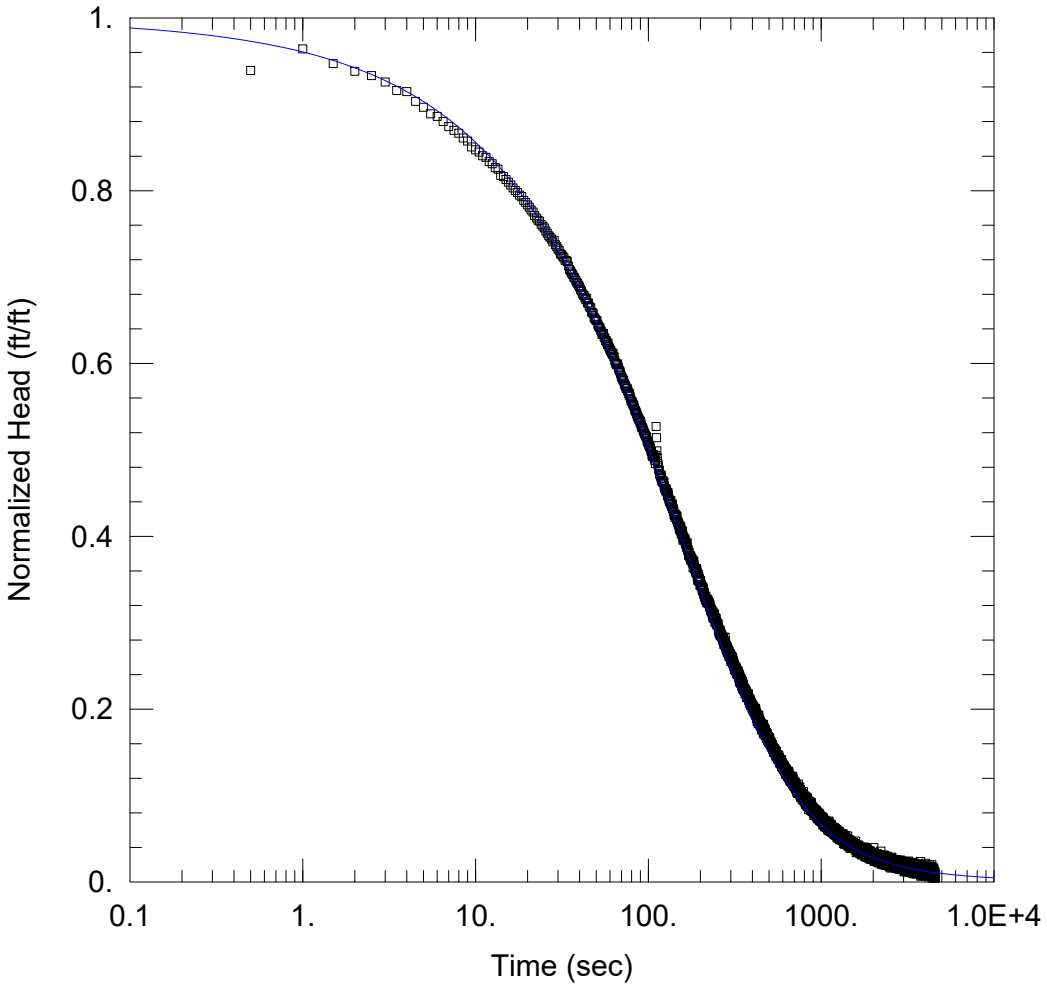
Slug Test
Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.3262	cm^2/sec
S	0.001523	

K = T/b = 0.002548 cm/sec
Ss = S/b = 0.0003626 1/ft



AW-21 RH1

PROJECT INFORMATION

Company: Ramboll
Client: IPRG
Project: 1940100457-001
Location: Bartonville, IL
Test Well: AW-21
Test Date: 4/26/21

AQUIFER DATA

Saturated Thickness: 4.6 ft
Anisotropy Ratio (Kz/Kr): 1.

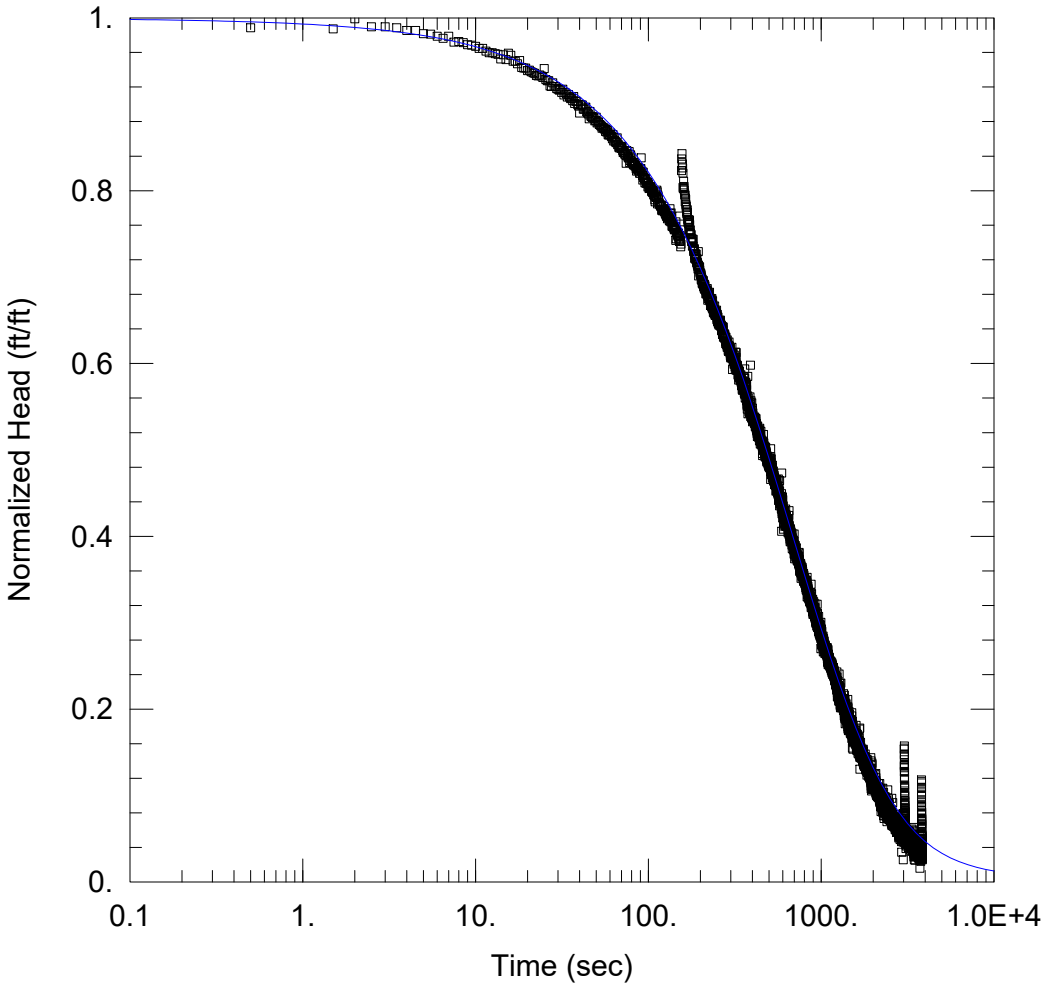
WELL DATA (AW-21)

Initial Displacement: -1.857 ft
Total Well Penetration Depth: 1.6 ft
Casing Radius: 0.08625 ft
Static Water Column Height: 22.48 ft
Screen Length: 1.6 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.03465 cm^2/sec
S = 0.004463

K = T/b = 0.0002471 cm/sec
Ss = S/b = 0.0009703 1/ft



AW-22 RH1

PROJECT INFORMATION

Company: Ramboll
Client: IPRG
Project: 1940100457-001
Location: Bartonville, IL
Test Well: AW-22
Test Date: 4/26/21

AQUIFER DATA

Saturated Thickness: 4.5 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (AW-22)

Initial Displacement: -1.634 ft
Total Well Penetration Depth: 1.5 ft
Casing Radius: 0.08625 ft
Static Water Column Height: 40.37 ft
Screen Length: 1.5 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.01475 cm^2/sec
S = 0.000209

Time (sec)	Displacement (ft)	Time (sec)	Displacement (ft)
1916.5	-0.198	3849.5	-0.055
1917.	-0.204	3850.	-0.049
1917.5	-0.199	3850.5	-0.056
1918.	-0.2	3851.	-0.057
1918.5	-0.206	3851.5	-0.052
1919.	-0.199	3852.	-0.053
1919.5	-0.208	3852.5	-0.056
1920.	-0.205	3853.	-0.044
1920.5	-0.197		

SOLUTION

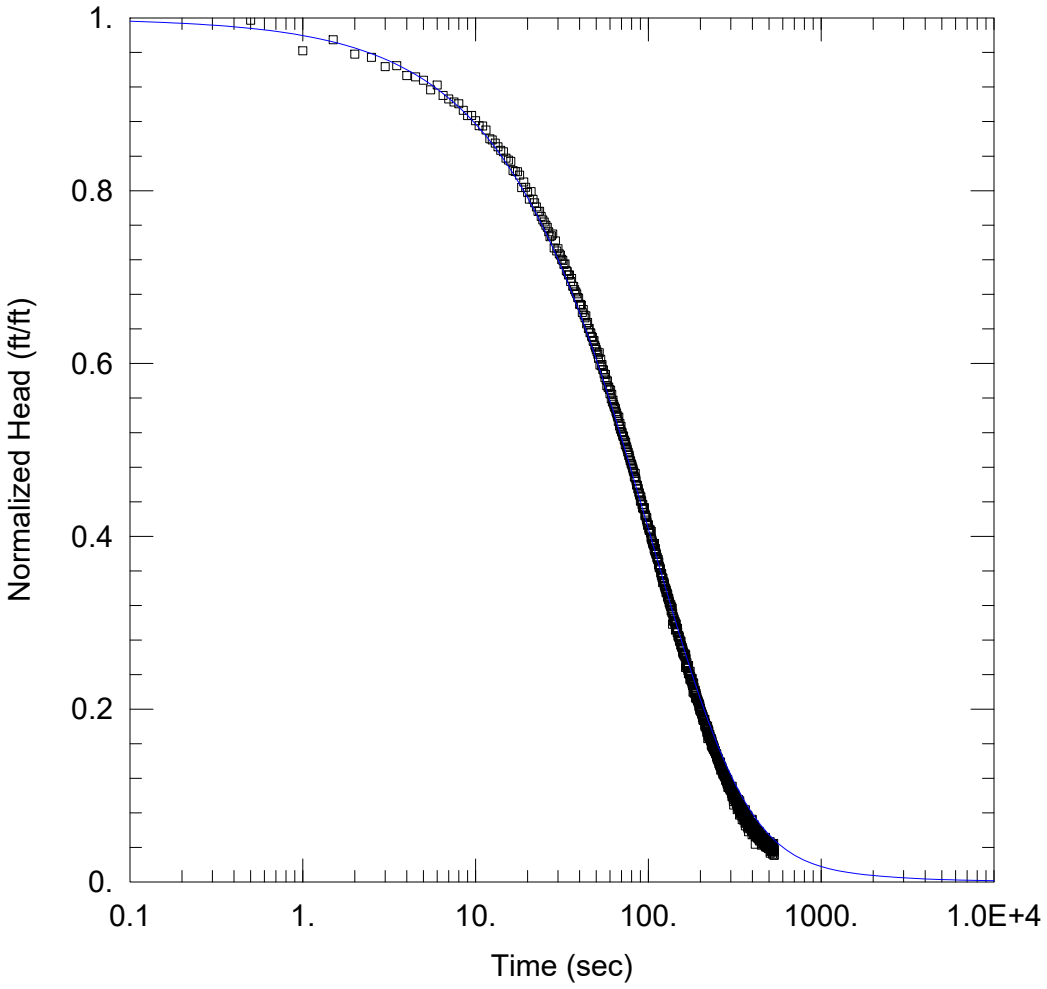
Slug Test
Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.01475	cm^2/sec
S	0.000209	

K = T/b = 0.0001075 cm/sec
Ss = S/b = 4.644E-5 1/ft



XPW01A FH1

PROJECT INFORMATION

Company: Ramboll
Client: IPRG
Project: 1940100457-001
Location: Bartonville, IL
Test Well: XPW01A
Test Date: 4/26/21

AQUIFER DATA

Saturated Thickness: 12. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (XPW01A)

Initial Displacement: 1.649 ft
Total Well Penetration Depth: 12. ft
Casing Radius: 0.08625 ft
Static Water Column Height: 34.39 ft
Screen Length: 12. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.1187 cm^2/sec
S = 5.41E-5

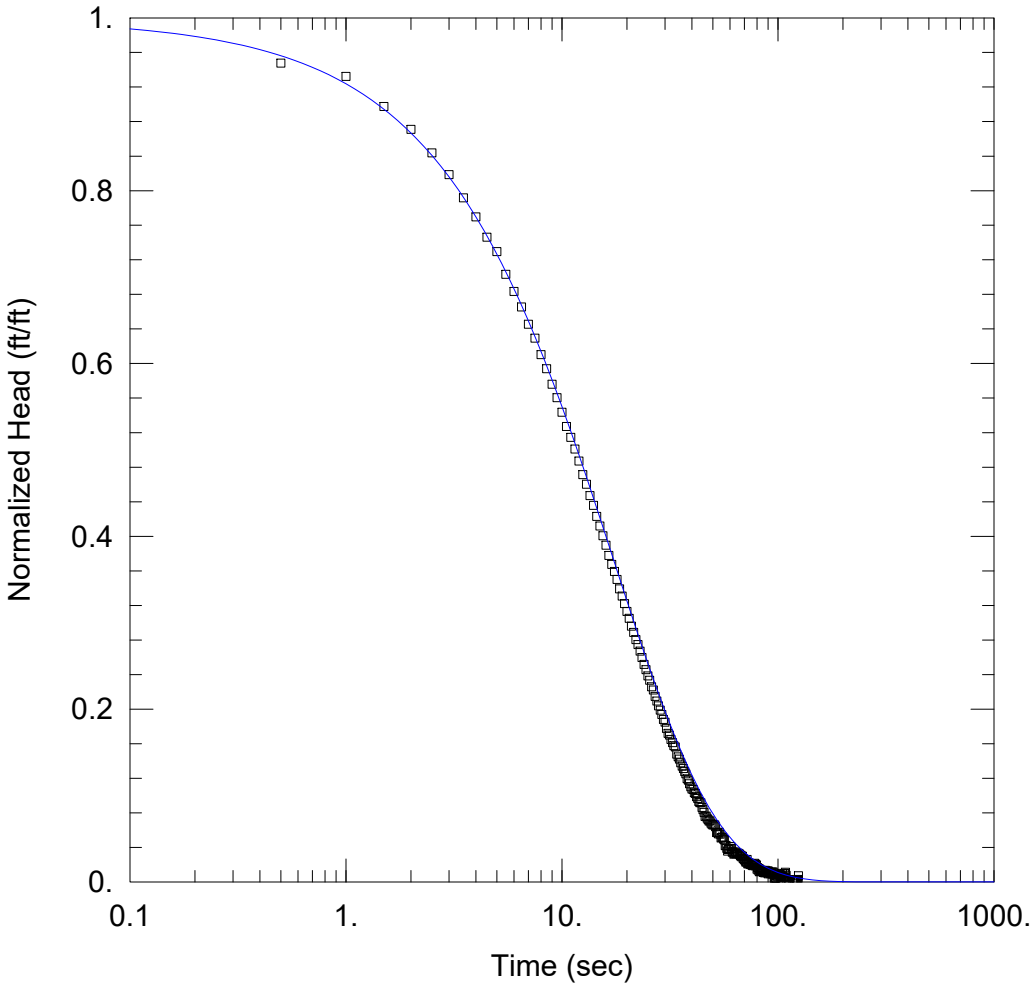
Slug Test
Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	0.1187	cm^2/sec
S	5.41E-5	

K = T/b = 0.0003245 cm/sec
Ss = S/b = 4.509E-6 1/ft



XPW02 RH2

PROJECT INFORMATION

Company: Ramboll
Client: IPRG
Project: 1940100457-001
Location: Bartonville, IL
Test Well: XPW02
Test Date: 4/26/21

AQUIFER DATA

Saturated Thickness: 42.4 ft

WELL DATA (XPW02)

Initial Displacement: -1.704 ft
Total Well Penetration Depth: 28.45 ft
Casing Radius: 0.08625 ft

Static Water Column Height: 28.45 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

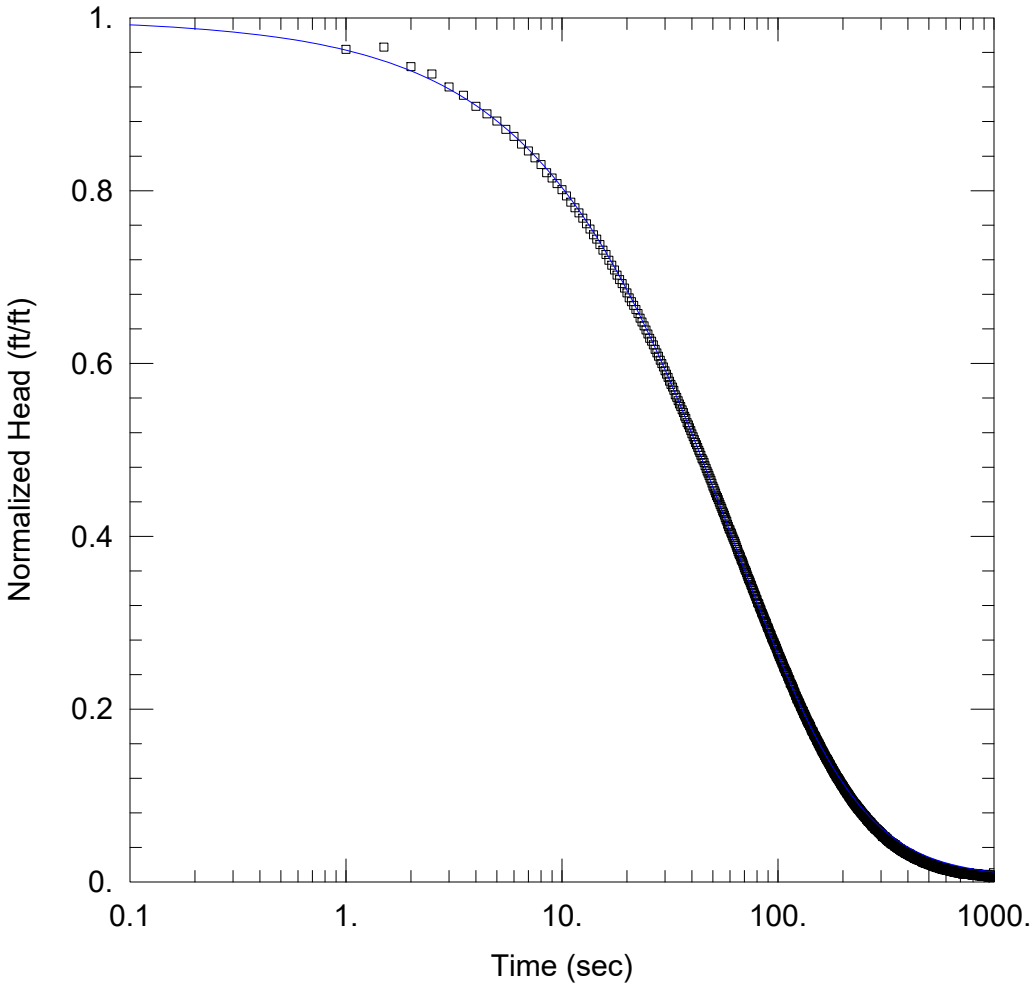
SOLUTION

Aquifer Model: Unconfined

Kr = 0.001787 cm/sec
Kz/Kr = 1.

Solution Method: KGS Model

Ss = 7.211E-6 ft^{-1}



XPW03 RH1

PROJECT INFORMATION

Company: Ramboll
Client: IPRG
Project: 1940100457-001
Location: Bartonville, IL
Test Well: XPW03
Test Date: 4/27/21

AQUIFER DATA

Saturated Thickness: 9.6 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (XPW03)

Initial Displacement: -1.595 ft
Total Well Penetration Depth: 9.6 ft
Casing Radius: 0.08625 ft
Static Water Column Height: 25.21 ft
Screen Length: 9.6 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.1608 cm^2/sec
S = 0.0002548

Parameter	Estimate	
T	0.1608	cm^2/sec
S	0.0002548	

K = T/b = 0.0005494 cm/sec
Ss = S/b = 2.654E-5 1/ft

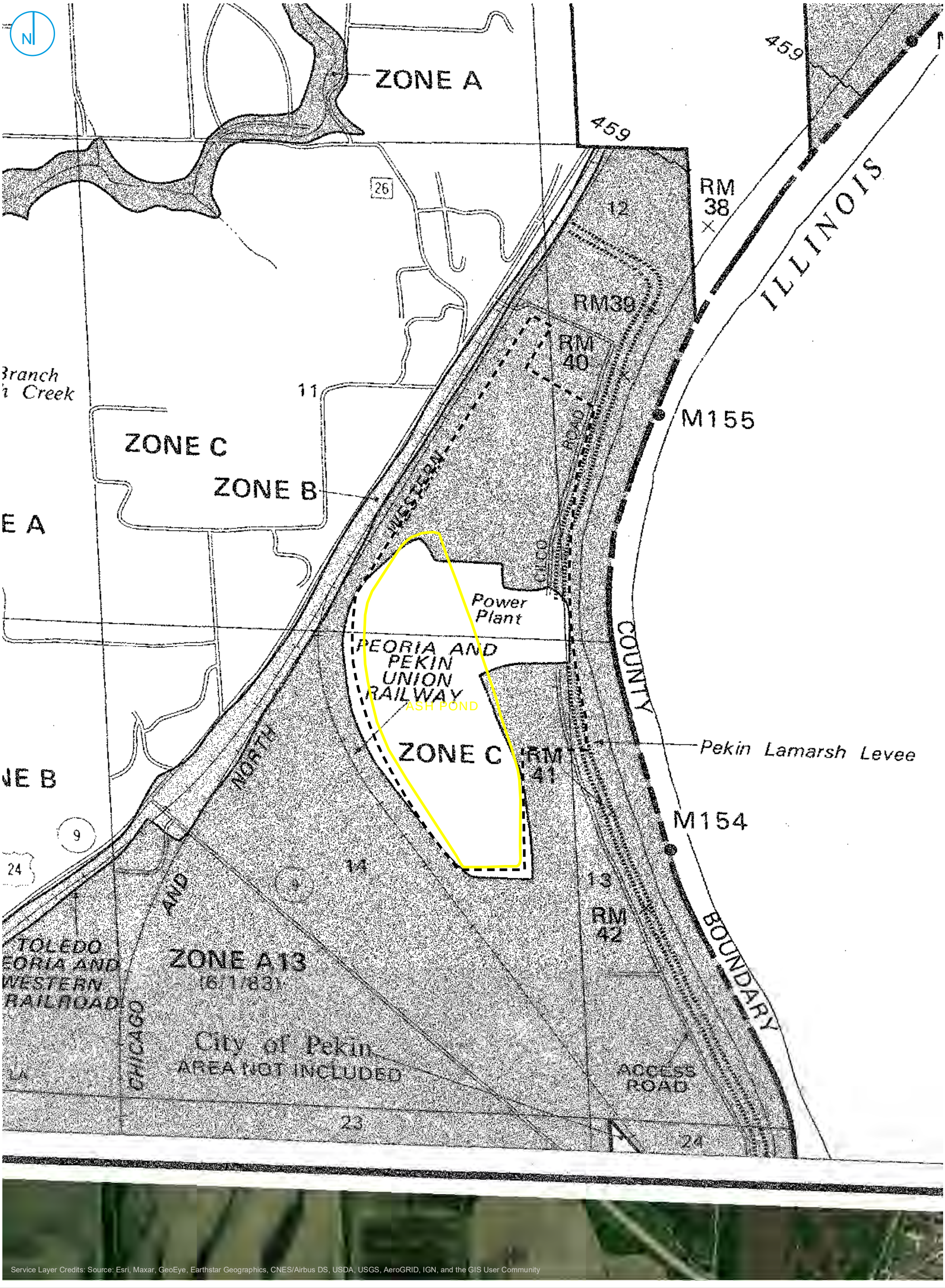
NRT HYDRAULIC CONDUCTIVITY TEST DATA

Table 2
Summary of Field and Laboratory Hydraulic Conductivity Tests
Hydrogeologic Monitoring Plan
Edwards Power Station

Field Tests						
Well ID	Analysis Method	Hydraulic Conductivity (cm/sec, falling head test)	Hydraulic Conductivity (cm/sec, rising head test)	Well Geometric Mean (cm/sec)	Approximate Screened Elevation (ft)	Interpreted Unit
Uppermost Aquifer						
APW1	KGS	2.60E-03	2.70E-03	2.65E-03	430.4-420.4	Clay-Shale Contact
AP05S	KGS	2.40E-03	2.60E-03	2.50E-03	408.5-403.5	Clay-Siltstone Contact
AP06	Hvorslev	3.30E-04	5.40E-04	4.22E-04	419.6-414.8	Clay
AP07S	KGS	6.00E-04	5.70E-04	5.85E-04	428.4-423.6	Sand/ Silty Sand
AW05	KGS	1.00E-03	1.30E-03	1.14E-03	424.7-420.1	Clay-Shale Contact
AW06	KGS	7.20E-06	4.00E-06	5.37E-06	422.6-418.1	Clay-Shale Contact
AW08	B&R	3.50E-06	9.50E-06	5.77E-06	413.1-403.5	Silt-Shale Contact
AW09	B&R	1.00E-05	4.50E-05	2.12E-05	411.2-406.7	Silt-Shale Contact
AW10	KGS	3.50E-05	4.10E-05	3.79E-05	410.0-405.4	Silt-Shale Contact
AW11	KGS	3.10E-03	3.40E-03	3.25E-03	413.0-408.4	Thin Sand, Clay-Shale Contact
Additional Monitored Units						
AP05D	KGS	4.50E-08	2.70E-06	3.49E-07	394-384	Siltstone (w/ thin sandstone)
AP07D	KGS	1.50E-07	8.00E-08	1.10E-07	403.3-393.8	Siltstone (w/ thin sandstone)
AP08	KGS	2.80E-03	2.60E-03	2.70E-03	448.1-438.5	CCR
AP09	KGS	1.30E-03	1.60E-03	1.44E-03	447.5-437.9	CCR

Laboratory Tests			
Well/ Soil Boring ID	Approximate Sample Elevation (ft)	Hydraulic Conductivity (cm/sec)	Interpreted Unit
EDW-B002	447.0	9.2E-05	CCR Unit
EDW-B003	430.0	6.8E-05	
Geometric Mean		**7.9E-05**	
EDW-B004	425.0	7.2E-07	Clay

APPENDIX G
FEMA FLOOD HAZARD MAP



PART 845 REGULATED UNIT (SUBJECT UNIT)

PROPERTY BOUNDARY

500-Year Flood Boundary
100-Year Flood Boundary
Zone Designations*
100-Year Flood Boundary
500-Year Flood Boundary

ZONE B
ZONE A1
ZONE A5
ZONE B

0 500 1,000 Feet

NOTE

GIS DATA OF THE NATIONAL FLOOD HAZARD LAYER NOT AVAILABLE FOR PEORIA COUNTY.

FLOODPLAIN MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND

EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

APPENDIX G

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

APPENDIX C
HISTORY OF CONSTRUCTION REPORT (845.220(a)(1))

Geosyntec consultants

1 McBride and Son Center Drive, Suite 202
Chesterfield, MO 63005
PH 636-812-0800
www.geosyntec.com

October 11, 2021

Illinois Power Resources Generation, LLC
7800 South Cilco Lane
Bartonville, Illinois 61607

Subject: Periodic History of Construction Report Update Letter
USEPA Final CCR Rule, 40 CFR §257.73(c)
Edwards Power Plant
Bartonville, Illinois

Geosyntec Consultants (Geosyntec) has prepared this Letter at the request of Illinois Power Resources Generation (IPRG) to document updates to the Initial History of Construction (HoC) report for the Edwards Power Plant (EPP), also known as the Edwards Power Station (EPS). The Initial HoC report was prepared by AECOM in October of 2016 [1] in accordance with 40 Code of Federal Regulations (CFR) §257.73(c) of the United States Environmental Protection Agency (USEPA) Coal Combustion Residuals Rule, known as the CCR Rule [2]. This letter also includes information required by Section 845.220(a)(1)(B) (Design and Construction Plans) of the state-specific Illinois Environmental Protection Agency (IEPA) Part 845 CCR Rule [3] that is not expressly required by §257.73(c).

BACKGROUND

The CCR Rule required that, by October 17, 2016, Initial HoC reports to be compiled for existing CCR surface impoundments with: (1) a height of five feet or more and a storage volume of 20 acre-feet or more, or (2) a height of 20 feet or more. The Initial HoC report was required to contain, to the extent feasible, the information specified in 40 CFR §257.73(c)(1)(i)-(xii). The Initial HoC report for EPP, which included the existing CCR surface impoundment, the Ash Pond (AP), was prepared and subsequently posted to IPRG's CCR Website prior to October 17, 2016.

The CCR Rule requires that Initial HoC to be updated if there is a significant change to any information complied in the Initial HoC report, as listed below:

§ 257.73(c)(2): If there is a significant change to any information complied under paragraph (c)(1) of this section, the owner or operator of the CCR unit must update the relevant information and place it in the facility's operating record as required by § 257.105(f)(9).

IRPG retained Geosyntec to review the Initial HoC report, review reasonably and readily available information for the AP generated since the Initial HoC report was prepared, and perform a site visit to EPP to evaluate if significant changes may have occurred since the Initial HoC report was prepared. This Letter contains the results of Geosyntec's evaluation and documents significant changes that have occurred at the AP and EPP, as they pertain the requirements of §257.73(c)(1)(i)-(xii)

UPDATES TO HISTORY OF CONSTRUCTION REPORT

Geosyntec's evaluation for the EPP AP determined that no known significant changes requiring updates to the information in the Initial HoC report pertaining to pertaining to §257.73(c)(1)(ii-viii) of the CCR Rule had occurred since the Initial HoC report had been developed.

However, Geosyntec's evaluation determined that significant changes at the EPP AP pertaining to §257.73(c)(1) (i),(ix)-(x) of the CCR Rule had occurred since the Initial HoC report had been developed. Additionally, information how long the CCR surface impoundments have been operating and the types of CCR in the surface impoundments, as required by Section 845.220(a)(1)(B) of the Part 845 Rule were not included in the Initial HoC report, as this information is not required by the CCR Rule. Each change and the subsequent updates to the Initial HoC report is described within this section.

Section 845.220(a)(1)(B): A statement of … how long the CCR surface impoundment has been in operation, and the types of CCR that have been placed in the surface impoundment.

Ash Pond

The AP is in operation since 1960. As of the date of this report, the AP has been present for approximately 61 years.

CCR placed in the AP has been used to store and dispose sluiced bottom ash and fly ash and to clarify water, including non-CCR station process wastewaters, prior to discharge in accordance with the station's NPDES permit [1].

§ 257.73(c)(1)(i): The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.

The state identification number (ID) for the AP have been assigned by the Illinois Environmental Protection Agency (IEPA). The ID is listed in **Table 1**.

Table 1 – IEPA ID Numbers

CCR Surface Impoundment	State ID
Ash Pond	W1438050005-01

§ 257.73(c)(1)(ix): Area-capacity curves for the CCR unit.

Updated area-capacity curves were prepared for the Process Water Pond and the Clarification Pond for the AP in 2021. These curves are provided in **Figures 1** and **2**.

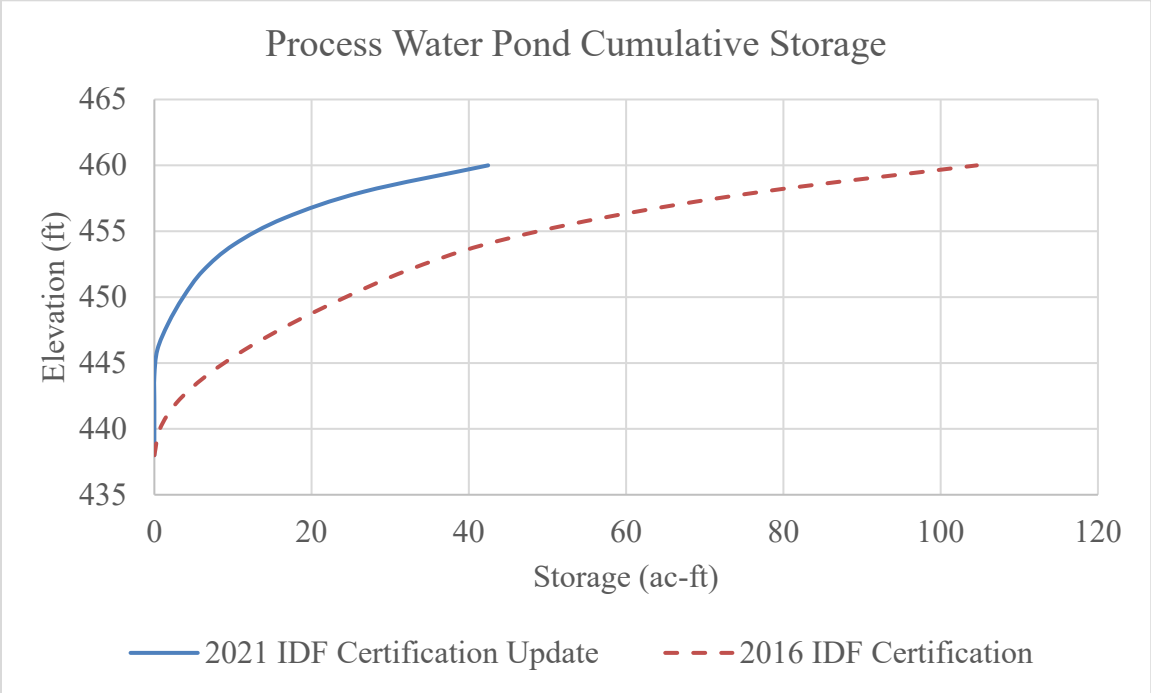


Figure 1 – Area-Capacity Curve for Ash Pond – Process Water Pond

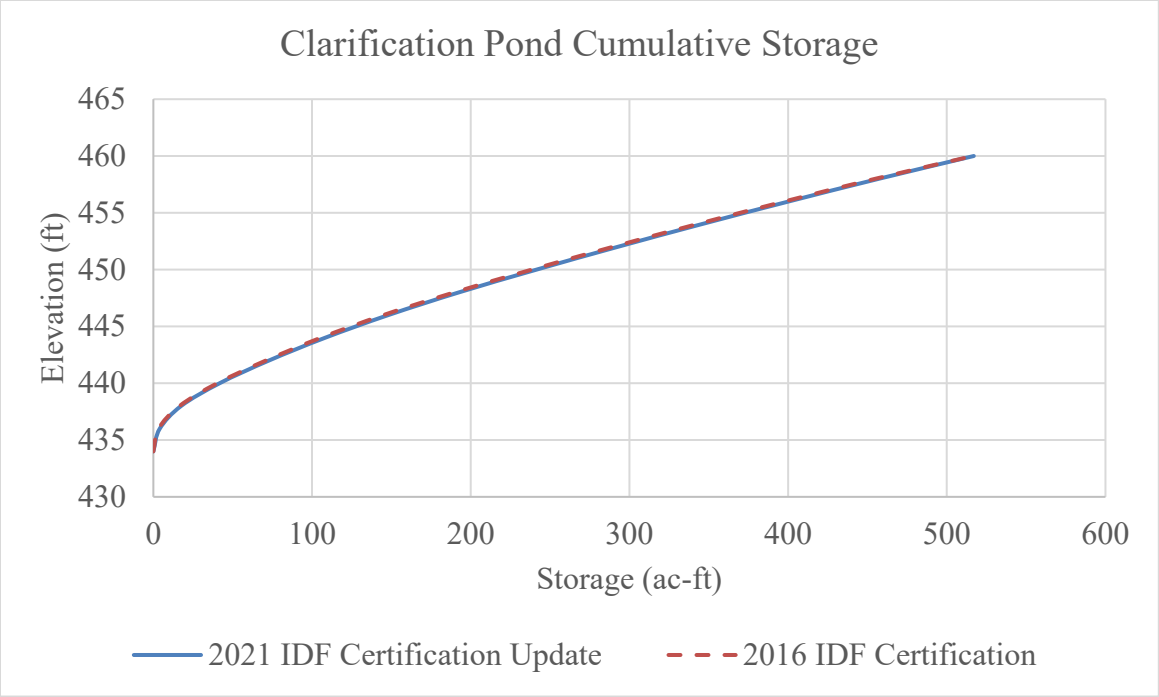


Figure 2 – Area-Capacity Curve for Ash Pond – Clarification Pond

§ 257.73(c)(1)(x): A description of each spillway and diversion design features and capacities and calculations used in their determination.

Updated discharge capacity calculations for the existing spillways were prepared in 2021 using HydroCAD 10 modeling software. The calculations indicate that the AP has sufficient storage capacity and will not overtop the embankments during the 1,000 year 24-hour rainfall event. The results of the calculations are provided in **Table 2**.

Table 2 – Results of Updated Discharge Capacity Calculations

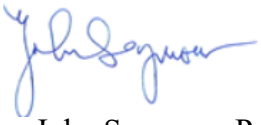
	Process Water Pond	Clarification Pond
Approximate Berm Minimum Elevation[1], ft	458.8	459.6
Approximate Emergency Spillway Elevation[1], ft	Not Applicable	Not Applicable
Starting Water Surface Elevation[1] (SWSE), ft	450.4	447.3
Peak Water Surface Elevation[1] (PWSE), ft	458.6	457.5
Time to Peak, hr	9.3	24.6
Surface Area[2], ac	7.3	29.2
Storage[3], ac-ft	27.2	265.3
Notes:		

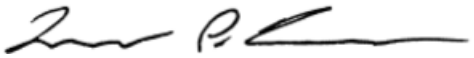
[1]Elevations are based on the NAVD88 datum
[2]Surface area is defined as the water surface area at the PWSE
[2]Storage is defined as the volume between the SWSE and PWSE

CLOSING

This letter has been prepared to document Geosyntec's evaluation of changes that have occurred at the AP at the EPP since the Initial HoC was developed, based on reasonably and readily available information provided by IPRG, observed by Geosyntec during the site visit, or generated by Geosyntec as part of subsequent calculations.

Sincerely,





John Seymour, P.E.
Senior Principal

Lucas P. Carr, P.E.
Senior Engineer

REFERENCES

[1] AECOM, "History of Construction, USEPA 40 CFR § 257.73(c), Edwards Power Station, Bartonville, IL," October 2016.

[2] United Stated Environmental Protection Agency, "40 CFR Parts 257 and 261, Hazardous and Solid Waste Management System, Disposal of Coal Combustion Residuals from Electric Utilities, Final Rule, 2015," 2015.

[3] Illinois Environmental Protection Agency, "35 Ill. Adm. Code Part 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments," Springfield, IL, 2021.

AECOM

October 2016

Illinois Power Resources Generating, LLC
7800 South Cilco Lane
Bartonville, IL 61607

RE: History of Construction
USEPA Final CCR Rule, 40 CFR § 257.73(c)
Edwards Power Station
Bartonville, Illinois

On behalf of Illinois Power Resources Generating, LLC, AECOM has prepared the following history of construction for the Ash Pond at the Edwards Power Station in accordance with 40 CFR § 257.73(c).

BACKGROUND

40 CFR § 257.73(c)(1) requires the owner or operator of an existing coal combustion residual (CCR) surface impoundment that either (1) has a height of five feet or more and a storage volume of 20 acre-feet or more, or (2) has a height of 20 feet or more to compile a history of construction by October 17, 2016 that contains, to the extent feasible, the information specified in 40 CFR § 257.73(c)(1)(i)–(xii).

The history of construction presented herein was compiled based on existing documentation, to the extent that it is reasonably and readily available (see 80 Fed. Reg. 21302, 21380 [April 17, 2015]), and AECOM's site experience. AECOM's document review included record drawings, geotechnical investigations, operation and maintenance information, etc. for Ash Pond at the Edwards Power Station.

AECOM

HISTORY OF CONSTRUCTION

§ 257.73(c)(1)(i): The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.

Owner: Illinois Power Resources Generating, LLC

Address: 1500 Eastport Plaza Drive
Collinsville, IL 62234

CCR Units: Ash Pond

The Ash Pond does not have a state assigned identification number.

§ 257.73(c)(1)(ii): The location of the CCR unit identified on the most recent USGS $7^1/_2$ or 15 minute topographic quadrangle map or a topographic map of equivalent scale if a USGS map is not available.

The location of the Ash Pond has been identified on an USGS 7-1/2 minute topographic quadrangle map in **Appendix A**.

§ 257.73(c)(1)(iii): A statement of the purpose for which the CCR unit is being used.

The Ash Pond is being used to store and dispose of sluiced bottom ash and fly ash and to clarify water, including non-CCR station process wastewaters, prior to discharge in accordance with the station's NPDES permit.

§ 257.73(c)(1)(iv): The name and size in acres of the watershed where the CCR unit is located.

The Ash Pond and the Edwards Power Station are located in the Illinois River Watershed with a 12-digit Hydrologic Unit Code (HUC) of 071300030304 and a drainage area of 8,3821 acres (USGS, 2016).

§ 257.73(c)(1)(v): A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed.

The foundation materials consist of native alluvial clay underlain by bedrock. The physical properties of the native alluvial clay are described as lean clay with zones of fat clay. The consistency of the clay varies from soft to stiff. The bedrock is classified as weathered to slightly weathered shale. An available summary of the engineering properties of the foundation and abutment materials is presented in **Table 1** below. The engineering properties are based on previous geotechnical explorations and laboratory testing.

Table 1. Summary of Foundation and Abutment Material Engineering Properties

Material	Unit Weight (pcf)	Effective (drained) Shear Strength Parameters		Total (undrained) Shear Strength Parameters	
		c' (psf)	Φ' (°)	c (psf)	Φ (°)
Native Clay Crust	120	200	27.5	1250	0
Native Clay 1	117	100	26	650	0
Native Clay 2	105	200	26	700	0
Native Clay 3	105	200	26	900	0
Bedrock - Shale	140	1000	36	1000	36

The Ash Pond is an enclosed impoundment with embankments and does not have abutments.

§ 257.73(c)(1)(vi): A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; the method of site preparation and construction of each zone of the CCR unit; and the approximate dates of construction of each successive stage of construction of the CCR unit.

The Ash Pond original embankments were constructed with soils excavated from within the limits of the proposed pond. Physical properties for the original embankment construction are described as lean clay with trace sand and shells. The consistency of the original embankment material varies from soft to stiff, with a general consistency of stiff. The original embankment was later modified for construction of a new rail loop. The modifications were constructed by adding new material to widen the downstream side of the embankment and occasionally raising the crest elevation of the embankment by as much as 12 feet. Physical characteristics for the new embankment material are described as fly ash, classified as silt to poorly-graded silty sand with gravel. The consistency of the new embankment material varies from soft to very stiff, with a general consistency of stiff to very stiff. Construction of the new rail loop also cut off the southern portion of the pond by the construction of a new dike across the interior of the pond. The new dike material consists of medium dense, fine to coarse, crushed stone gravel with sand, classified as poorly graded gravel. The cut off area to the south was filled in with ash and capped by topsoil. An available summary of the engineering properties of the construction materials is presented in **Table 2** below. The engineering properties are based on previous geotechnical explorations and laboratory testing.

Table 2. Summary of Construction Material Engineering Properties

Material	Unit Weight (pcf)	Effective (drained) Shear Strength Parameters		Total (undrained) Shear Strength Parameters	
		c' (psf)	Φ' (°)	c (psf)	Φ (°)
Old Embankment 1	125	200	28	2500	0
Old Embankment 2	125	100	29	1250	0
New Embankment	115	200	30	2500	0
New Embankment (Crushed Stone - Sandy Gravel)	120	0	32	0	32

The method of site preparation of the Ash Pond is not reasonably and readily available.

The approximate dates of construction of each successive stage of construction of the Ash Pond are provided in **Table 3** below.

Table 3. Approximate dates of construction of each successive stage of construction.

Date	Event
1960	Construction of the original embankments
2004	Construction of the rail loop that modified the original embankments and cut-off the southern portion of the Ash Pond

§ 257.73(c)(1)(vii): At a scale that details engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the normal operating pool surface elevation and the maximum pool surface elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment, and any identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation.

Drawings that contain items pertaining to the requested information for the Ash Pond are listed in **Table 4** below. Items marked as "Not Available" are items not found during a review of the reasonably and readily available record documentation.

Table 4. List of drawings containing items pertaining to the information requested in § 257.73(c)(1)(vii).

	Ash Pond
Dimensional plan view (all zones)	C175-G1906-3 to 4 03057-PL, 03057-1
Dimensional cross sections	C175-G1906-4, 03057-1X
Foundation Improvements	Not Applicable
Drainage Provisions	Not Applicable
Spillways and Outlets	C175-G1921-1 to 3
Diversion Ditches	Not Found
Instrument Locations	Plate 2, Figure 2A
Slope Protection	Not Available
Normal Operating Pool Elevation	Not Available
Maximum Pool Elevation	Not Available
Approximate Maximum Depth of CCR in 2016	71 feet

All drawings referenced in **Table 4** above can be found in **Appendix B and Appendix C**.

A 6-inch diameter sanitary sewer force main was also identified and is buried at a shallow depth within the Ash Pond. Drawings of the sanitary sewer force main are presented in **Appendix B**.

Based on the review of the drawings listed above, no natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation were identified.

§ 257.73(c)(1)(viii): A description of the type, purpose, and location of existing instrumentation.

Existing instrumentation at the Ash Pond consist of open-standpipe piezometers. The purpose of the piezometers is to measure the pore water pressures within the embankment. One (1) open-standpipe piezometer (B-2) was installed in 2010 and the location is presented on Plate 2 in **Appendix C**. Four (4) open-standpipe piezometers (EDW-P001 to P004) were installed in 2015 and the locations are presented on Figure 2A in **Appendix C**.

§ 257.73(c)(1)(ix): Area-capacity curves for the CCR unit.

Area-capacity curves for the Ash Pond are not reasonably and readily available.

§ 257.73(c)(1)(x): A description of each spillway and diversion design features and capacities and calculations used in their determination.

The spillway system for the Ash Pond includes a morning glory spillway structure that consists of vertically stacked 36-inch diameter (dia.) pipe sections seated on a concrete drop inlet structure and pad. The spillway structure discharges clarified plant process water and CCR contact stormwater through a 36-inch dia. corrugated metal pipe (CMP) and into the Illinois River in accordance with the station's NPDES permit. In 2016, the Ash Pond's discharge capability was evaluated using HydroCAD 10 software modeling a 1,000-year, 24-hour rainfall event. The results of the HydroCAD analysis are presented below in **Table 5**.

There are three separate sub-basins within the Ash Pond: the Process Water Pond, the Fly Ash Pond, and the Clarification Pond. The first sub-basin is the Process Water Pond and is located at the northwestern end of the Ash Pond. The second sub-basin is the Fly Ash Pond. The third sub-basin is the Clarification Pond, which is located furthest downstream at the southern end of the Ash Pond. During normal plant operations, bottom ash is sluiced into the Ash Pond. The settling channels located within the Fly Ash Pond discharge into the Clarification Pond through internal culvert pipes. However, during the design storm, rainfall discharge through these channels exceed the capacity of the culvert pipes, and will likely overtop or wash out the small interior splitter dikes and discharge directly into the Clarification Pond. Therefore, the storage potential of the Fly Ash Pond was considered insignificant and rainfall that would normally be collected within the Fly Ash Pond was modeled to discharge directly into the Clarification Pond.

Table 5. Results of HydroCAD 10 analyses

	Ash Pond - Process Water Pond	Ash Pond - Clarification Pond
Approximate Minimum Berm Elevation[1] (ft)	458.8	459.6
Approximate Emergency Spillway Elevation1 (ft)	N/A	N/A
Starting Pool Elevation[1] (ft)	449.5	447.2
Peak Elevation[1] (ft)	457.8	457.4
Time to Peak (hr)	14.4	48.0
Surface Area (ac)	11.4	28.9
Storage [2] (ac-ft)	52.6	265.0

Note: 1. Elevations are based on NAVD88 datum.
2. Storage given is from Starting Pool Elevation to Peak Elevation.

§ 257.73(c)(1)(xi): The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.

The construction specifications for the Ash Pond are not reasonably and readily available.

The provisions for surveillance, maintenance, and repair of the Ash Pond are located in *Edwards Power Station; Operation and Maintenance Manual for Ash Ponds and Levees* (presented in **Appendix D**). The operations and maintenance plan for the Ash Pond is currently being revised by Illinois Power Resources Generating, LLC.

§ 257.73(c)(1)(xii): Any record or knowledge of structural instability of the CCR unit.

In early 2009, a minor surficial movement was observed along the northern end of the downstream slope of the west embankment. After the slide was repaired, a second surficial movement occurred in the same area in late 2009. In early 2010, the second movement was repaired with covered stone and the water level in the Process Water Pond area was lowered by approximately 3.5 feet. Annual inspections since 2011 have not identified an issue in the repaired areas. Photos of the 2009 surficial movement area are presented in **Appendix E**.

There is no record or knowledge of any other structural instability of the Ash Pond at Edwards Power Station.

AECOM

LIMITATIONS

The signature of AECOM's authorized representative on this document represents that to the best of AECOM's knowledge, information and belief in the exercise of its professional judgment, it is AECOM's professional opinion that the aforementioned information is accurate as of the date of such signature. Any recommendation, opinion or decisions by AECOM are made on the basis of AECOM's experience, qualifications and professional judgment and are not to be construed as warranties or guaranties. In addition, opinions relating to environmental, geologic, and geotechnical conditions or other estimates are based on available data and that actual conditions may vary from those encountered at the times and locations where data are obtained, despite the use of due care.

Sincerely,

Claudia Prado
Project Manager

Victor Modeer, P.E., D.GE
Senior Project Manager

REFERENCES

United States Environmental Protection Agency (USEPA). (2015). *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities; Final Rule.* 40 CFR Parts 257 and 261, 80 Fed. Reg. 21302, 21380 April 17, 2015.

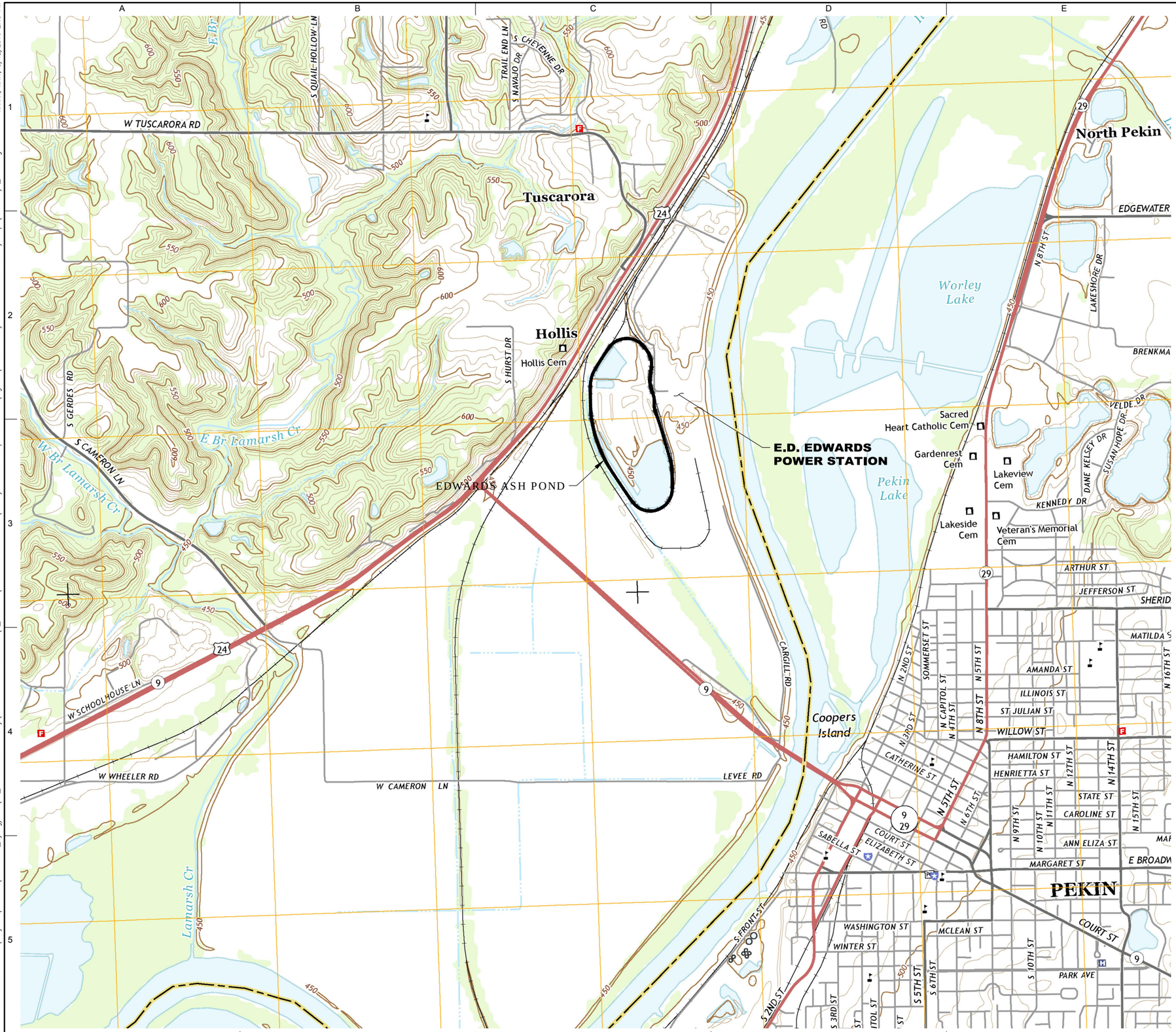
United States Geological Survey (USGS). (2016). The National Map Viewer. http://viewer.nationalmap.gov/viewer/. USGS data first accessed in March of 2016.

APPENDICES

Appendix A: History of Construction Vicinity Map
Appendix B: Edwards Power Station Drawings
Appendix C: Edwards Power Station Piezometer Locations
Appendix D: Operation and Maintenance Manual for Ash Ponds and Levees
Appendix E: Photos of 2009 Surficial Movement

AECOM

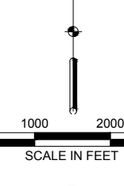
Appendix A: History of Construction Vicinity Map



LEGEND

CCR UNITS

SOURCE:
MAP PROVIDED FROM ELECTRONIC USGS DIGITAL RASTER GRAPHIC 7.5 MINUTE TOPOGRAPHIC MAP OF PEKIN ILLINOIS, REVISED 2015.



QUADRANGLE LOCATION

N

0 1000 2000 3000

SCALE IN FEET

AECOM
1001 Hi□□and□Pa□a Dri□e, Suite 300
St. Loui□, Mo. 63110
314 429-0100 □□one□
314-429-0462 □a□□

ILLINOIS POWER RESOURCES, GENERATING, L.L.C.

7800 Sout□Ci□o Ln.,
Barton□i□e, I□inoi□

HISTORY OF CONSTRUCTION

EDWARDS POWER STATION
BARTONVILLE, ILLINOIS

ISSUED FOR BIDDING	DATE BY
ISSUED FOR CONSTRUCTION	DATE BY

REVISIONS

NO.	DESCRIPTION	DATE
△		
△		
△		
△		
△		

AECOM PROJECT NO:	60489731
DRAWN BY:	DJD
DESIGNED BY:	DJD
CHECKED BY:	MN
DATE CREATED:	2016-04-13
PLOT DATE:	
SCALE:	1" □ 1000□
ACAD VER:	2014

SHEET TITLE

HISTORY OF CONSTRUCTION VICINITY MAP

01

DRAWING PATH: P:\Projects\Geotech\60428794_DynegyCCR\13_Construction History\04 Technical Production\7_Edwards\Reference Documents\Vicinity Location Map References\Figures\C-01 History of Construction Vicinity Map (Edwards) _MJN.dwg NANAK, MATT, 8/12/2016 2:43 PM

Appendix B: Edwards Power Station Drawings

1. “Plant Site Fill, Stage 3 – Final Arrgt.”, Drawing No. C175-G1906-3, Revision F, 1 July, 1960, Commonwealth Associates Inc.
2. “Plant Site Fill, Stage 1 Continuation – Final Arrgt.”, Drawing No. C175-G1906-4, Revision C, 4 March, 1958, Commonwealth Associates Inc.
3. “Construction Thru Levee, Ash Pond Drainage Duct”, Drawing No. C175-G1921-1, Revision C, 26 March, 1975, Commonwealth Associates Inc.
4. “Construction Thru Levee, Ash Pond Drainage Duct Details”, Drawing No. C175-G1921-2, Revision D, 15 February, 1960, Commonwealth Associates Inc.
5. “Construction Thru Levee, Ash Pond Drainage Duct, Cofferdam & Other Details.”, Drawing No. C175-G1921-3, Revision B, 15 June, 1959, Commonwealth Associates Inc.
6. “Proposed 150 Car Loop Track, General Plan”, Drawing No. 03057-PL, Revision 1, 20 November, 2003, Design Nine, Inc.
7. “Proposed 150 Car Loop Track, Plan/Profile - Loop/Wye Track Loop Sta. 0+00 to Sta. 29+00”, Drawing No. 03057-1 (Sheet 6), Revision 2, 3 December, 2003, Design Nine, Inc.
8. “Proposed 150 Car Loop Track, Plan/Profile - Loop Track Sta. 29+00 to Sta. 60+00”, Drawing No. 03057-1 (Sheet 7), Revision 1, 20 November, 2003, Design Nine, Inc.
9. “Proposed 150 Car Loop Track, Plan/Profile - Loop Track Sta. 60+00 to Sta. 91+00”, Drawing No. 03057-1 (Sheet 8), Revision 2, 3 December, 2003, Design Nine, Inc.
10. “Proposed 150 Car Loop Track, Plan/Profile - Loop Track Sta. 91+00 to Sta. 101+22.23”, Drawing No. 03057-1 (Sheet 9), Revision 2, 3 December, 2003, Design Nine, Inc.
11. “Proposed 150 Car Loop Track, Detail of Merchants Track Area”, Drawing No. 03057-1 (Sheet 10), Revision 2, 3 December, 2003, Design Nine, Inc.
12. “Proposed 150 Car Loop Track, Cross Sections - Loop Track Sta. 0+00 to Sta. 7+20.79”, Drawing No. 03057-1X (Sheet 11), Revision 2, 3 December, 2003, Design Nine, Inc.
13. “Proposed 150 Car Loop Track, Cross Sections - Loop Track Sta. 8+00 to Sta. 13+00”, Drawing No. 03057-1X (Sheet 12), Revision 1, 20 November, 2003, Design Nine, Inc.
14. “Proposed 150 Car Loop Track, Cross Sections - Loop Track Sta. 14+00 to Sta. 20+00”, Drawing No. 03057-1X (Sheet 13), Revision 2, 3 December, 2003, Design Nine, Inc.
15. “Proposed 150 Car Loop Track, Cross Sections - Loop Track Sta. 21+03.74 to Sta. 27+00”, Drawing No. 03057-1X (Sheet 14), Revision 2, 3 December, 2003, Design Nine, Inc.
16. “Proposed 150 Car Loop Track, Cross Sections - Loop Track Sta. 27+52 to Sta. 34+00”, Drawing No. 03057-1X (Sheet 15), Revision 2, 3 December, 2003, Design Nine, Inc.
17. “Proposed 150 Car Loop Track, Cross Sections - Loop Track Sta. 35+00 to Sta. 42+00”, Drawing No. 03057-1X (Sheet 16), Revision 1, 20 November, 2003, Design Nine, Inc.
18. “Proposed 150 Car Loop Track, Cross Sections - Loop Track Sta. 42+95.47 to Sta. 50+00”, Drawing No. 03057-1X (Sheet 17), Revision 1, 20 November, 2003, Design Nine, Inc.
19. “Proposed 150 Car Loop Track, Cross Sections - Loop Track Sta. 50+42.36 to Sta. 57+00”, Drawing No. 03057-1X (Sheet 18), Revision 2, 3 December, 2003, Design Nine, Inc.
20. “Proposed 150 Car Loop Track, Cross Sections - Loop Track Sta. 58+00 to Sta. 64+49.7”, Drawing No. 03057-1X (Sheet 19), Revision 2, 3 December, 2003, Design Nine, Inc.

Appendix B: Edwards Power Station Drawings (continued)

21. “Proposed 150 Car Loop Track, Cross Sections - Loop Track Sta. 65+00 to Sta. 70+00”, Drawing No. 03057-1X (Sheet 20), Revision 2, 3 December, 2003, Design Nine, Inc.
22. “Proposed 150 Car Loop Track, Cross Sections - Loop Track Sta. 80+79.67 to Sta. 87+37.4”, Drawing No. 03057-1X (Sheet 21), Revision 1, 20 November, 2003, Design Nine, Inc.
23. “Proposed 150 Car Loop Track, Cross Sections - Loop Track Sta. 87+77.4 to Sta. 94+00”, Drawing No. 03057-1X (Sheet 22), Revision 2, 3 December, 2003, Design Nine, Inc.
24. “Proposed 150 Car Loop Track, Cross Sections - Loop Track Sta. 94+65.41 to Sta. 99+00”, Drawing No. 03057-1X (Sheet 23), Revision 2, 3 December, 2003, Design Nine, Inc.
25. “Proposed 150 Car Loop Track, Cross Sections - Wye Track Sta. 94+00 to Sta. 99+00”, Drawing No. 03057-1X (Sheet 24), Revision 2, 3 December, 2003, Design Nine, Inc.
26. “Proposed 150 Car Loop Track, Cross Sections - Runaround Track Sta. 1+23.8 to Sta. 6+86.72”, Drawing No. 03057-1X (Sheet 25), Revision 2, 3 December, 2003, Design Nine, Inc.

NOTE
ABANDON EXISTING DITCH
REROUTE NEW DITCH

DRAINAGE DITCH

BORROW PIT AREA

6 TANDEM TOWERS. SEE CHF 223

EL. 482.0±

6 TOWERS

SECTION LINE

1/8 LINE

STARTING POINT

DRAIN

SEE SHEET #1

SEE G-1913 SH. 2

COAL RECEIVING HOPPER

ASH STORAGE FOR APPROX. 1.7 YEARS. (166,500± CU. YDS.)

516'-0

97'-6

550'-0

SUBSTATION

FUTURE

BASE LINE E.S.W.

475'-0

625'-0

296'-0

166'-0

BASE LINE N.I.S.

H.S. TANK 1

BOILER HOUSE

TURBINE HOUSE

STACK

STAGE 3

163'-0

215'-0

220'-0

Sec. 14 Sec. 11
Sec. 13 Sec. 12

SECTION LINE

CHANNEL LINE

PERMIT LINE

100' EASEMENT

200' EASEMENT

CREST OF LEVEE

PROPERTY LINE

Proposed Route for Gulf Oil Co. Sewer Lines. To Connect into Drain at Outlet End of C.I.L.Co. Culvert.

culvert

D:12"

D:24"

W.L.

435 436 437 438 439 440

NOTES

ALL SLOPES INDICATED ARE TO THE RATIO OF:
"1" HORIZONTAL TO "1" VERTICAL FOR EXCAVATIONS.
"2" HORIZONTAL TO "1" VERTICAL FOR FILLS - PERMANENT SLOPES.
"1" (APPROX.) HORIZONTAL TO "1" VERTICAL FOR FILLS - TEMPORARY SLOPES.
TEMPORARY SLOPES NOTED.

FILL REQ'D. * 137,200 C.Y.
EL. 438' TO EL. 462'

* EXCLUDING ASH STORAGE DIKES AND ROADWAY ENTRANCE AT THE N.W. COR. OF PROPERTY.

UNIT 1

REV.	DATE	DESCRIPTION	BY	APPROVED
F	7/1/60	Roadway Entrance Changed at N. West Cor. N. Property added.	H.S.F.	H.S.F.
E	8/19/59	ADDED FILL AT TRANSMISSION TOWER	W.E.R.	H.S.F.
D	11/15/58	Pile Reqmts & Necessary, 165'-0 (10'-0 Dia. Added) - Ash Storage Levee Relocated) - Fill Around Boiler House Revised.	R.G.D.	H.S.F.
C	12/2/58	Relocated Fill @ N.E. Corner / Added 100'-0 Min. Dimension	R.G.D.	H.S.F.
B	12/2/58	Added Additional Ash Storage Ash Storage Drain - Removed Roadway By Levee - Revised Coal Handling Area.	R.G.D.	H.S.F.
A	7/14/58	Added Ash Retaining Dike - Relocated Fill @ N.E. Corner	R.G.D.	H.S.F.

DESIGN AND DRAWING APPROVED — DATE 8-27-57
H.S.F. — DATE 10-2-57
H.S. Fenwick, Reg. P.E. — DATE 10-2-57
APPROVED A.R.S. Schulweis — DATE 5-6-58

OWNER AND LOCATION
E.D. EDWARDS STATION
CENTRAL ILLINOIS LIGHT CO.
PEORIA, ILLINOIS

PREPARED UNDER RESPONSIBLE SUPERVISION OF
H. S. FENWICK
MICHIGAN PROFESSIONAL REGISTRATION NO. 2954
ILLINOIS STRUCTURAL REGISTRATION NO. 81-2416
AT OFFICES OF
COMMONWEALTH ASSOCIATES INC.
209 E. WASHINGTON AVE., JACKSON, MICH.

TITLE
PLANT SITE FILL
STAGE 3 — FINAL ARR'G'T.

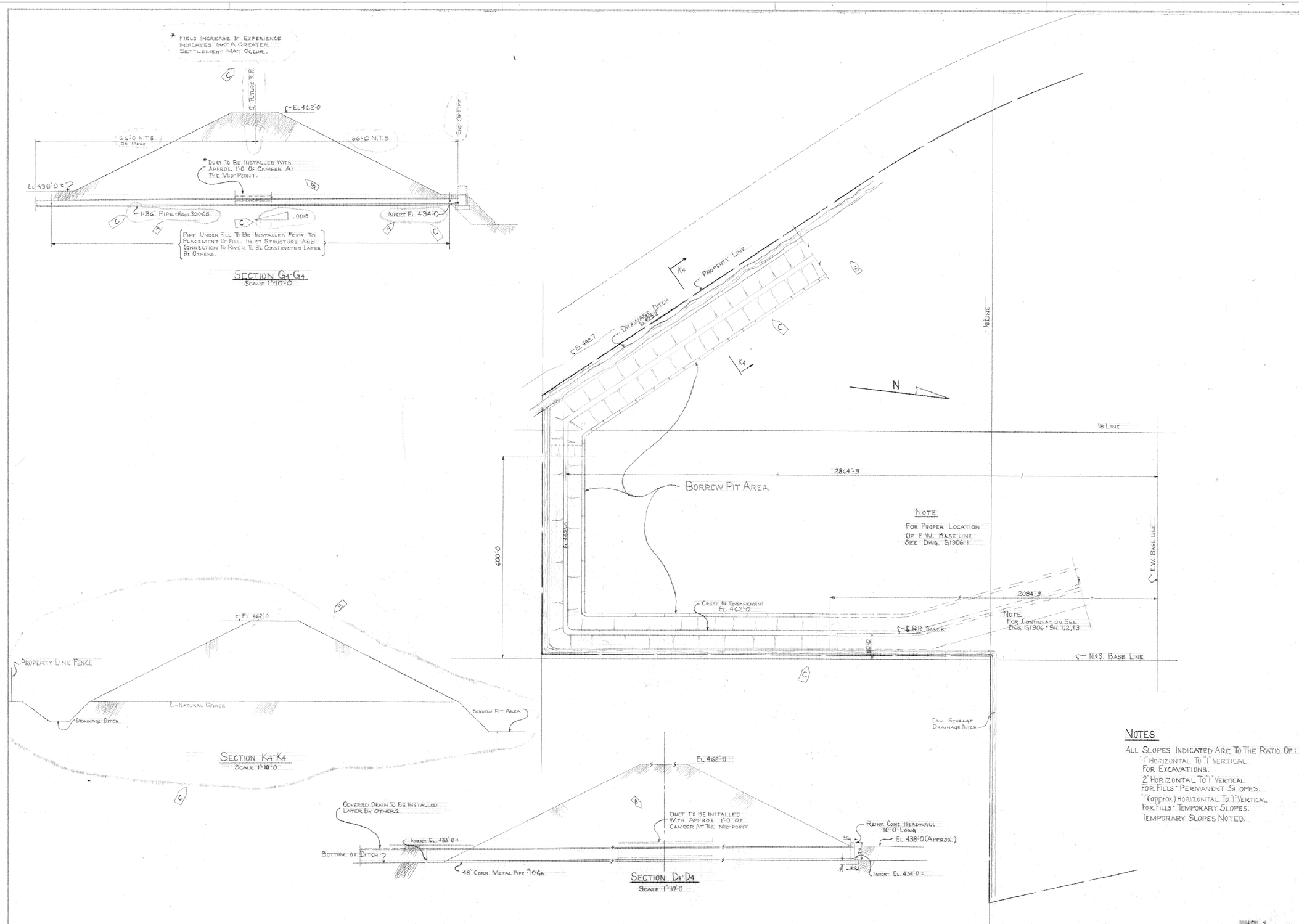
SCALE 1"=100'-0 — DRAWING NO. C175-G1906 — REV. F — SHEET 3

2-20-118-1

PRINTS SENT — AP — 10-27-59

O.K. TO FILE

Cargill & Bolton, Chicago



Notes

All Slopes Indicated Are To The Ratio Of:
- "1" Horizontal To "1" Vertical For Excavations.
- "2" Horizontal To "1" Vertical For Fills - Permanent Slopes.
- "1" (approx.) Horizontal To "1" Vertical For Fills - Temporary Slopes.
- Temporary Slopes Noted.

UNIT 1

REV.	DATE	DESCRIPTION	BY	APPROVED
C	3-4-58	Revised Section K4-K4 & G4-G4. Revised Ash Pipe on Plan Added Coal Storage Drainage Ditch	R.G. Dunn	H.S.F.
B	10-31-57	Revised Section K4-K4 - Added Camber Notes - Revised Plan #K4-K4	R.G. Dunn	H.S.F.
A	10-2-57	Added Invert El. @ Sec. G4-G4 - Changed Pipe Mat.	R.G. Dunn	H.S.F.

Design and Drafting: R.G. Dunn, Date 9-25-57; H.S.F., Date 10-2-57; H.S. Fenwick, Sec. P.E., Date 10-2-57; Approved: H.B. Schuiling, Date 5-6-58

Prepared Under Responsible Supervision Of: H. S. FENWICK, Michigan Professional Registration No. 3934, Illinois Structural Registration No. 81-2416, At Offices Of: Commonwealth Associates Inc., 2200 E. Washington Ave., Jackson, Mich.

Owner and Location: E.D. EDWARDS STATION, CENTRAL ILLINOIS LIGHT CO., PEORIA, ILLINOIS

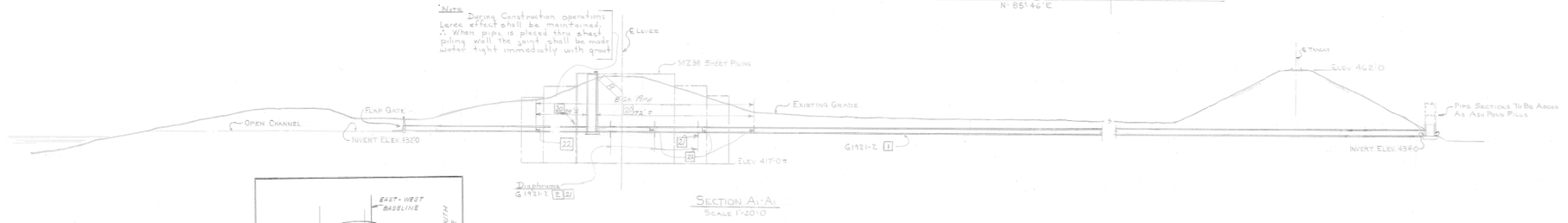
Title: Plant Site Fill, Stage #1 Continuation

Scale: 1"=100'-0; 2-20-118-1; Drawing No. C175-G1906; Rev. C; Sheet 4

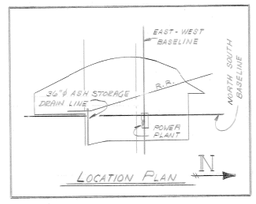
C:\Documents and Settings\ps2622\Local Settings\Temp\60038860-68AD-450E-A34C-B6CB31EF1A09\1175-g1921.sht1.dwg

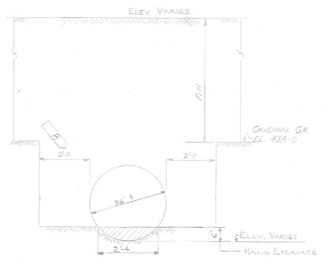


NOTE: During Construction operations Levee effect shall be maintained. ∴ When pipe is placed thru sheet piling wall the joint shall be made water tight immediately with grout

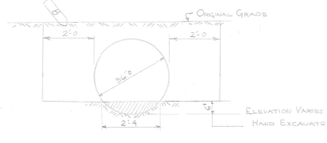


SECTION A1-A1
SCALE 1"=20'-0"





SECTION B1-B1
SCALE ½"=1'-0



SECTION C1-C1
SCALE ½"=1'-0

PIPE MATERIALS & HANDLING

1. DRAIN PIPE SHALL BE 36"ø 16GA. (CORRUGATED PIPE CULVERT CONFORMING TO FEDERAL SPECIFICATIONS QQ-C-806 FOR CULVERTS; IRON OR STEEL, ZINC COATED, TYPE I, OF PURE IRON, COPPER BEARING PURE IRON, COPPER IRON, OR COPPER MOLYBDENUM IRON; AND THE PIPE SHALL BE COATED AS FOLLOWS:

   THE PIPE SHALL BE COATED ON THE INSIDE & OUTSIDE WITH ASBESTOS FIBERS & A BITUMINOUS MATERIAL SIMILAR AND EQUAL TO THAT USED ON "FREE FLOW" DRAINAGE PIPE MANUFACTURED BY REPUBLIC STEEL CO., YOUNGSTOWN, OHIO OR TO THAT USED ON ARMCO "SMOOTH FLO" ASBESTOS BONDED DRAINAGE PIPE MANUFACTURED BY AMERICAN ROLLING MILL CO. MIDDLETOWN, OHIO.

2. THE PIPE SHALL BE LAID ON ORIGINAL EARTH HAND EXCAVATED THE LAST 6" OF DEPTH TO FIT THE CONTOUR OF THE PIPE - TO THE ESTABLISHED GRADIENT AND ALIGNMENT, WITH HORIZONTAL SEAMS OR JOINING SECTIONS AT QUARTER POINTS; PIPE SHALL BE FULL CIRCLED, FREE FROM DENTS AND OTHER DEFECTS; AND SHALL BE CLEANED AND LOWERED INTO THE TRENCH IN SUCH MANNER AS TO AVOID UNNECESSARY HANDLING AND INJURY TO THE PIPE. CONNECTIONS BETWEEN SECTIONS OF PIPE SHALL BE CAREFULLY ADJUSTED AND CONNECTING BANDS SHALL LAP EQUAL DISTANCES ON THE SECTIONS CONNECTED. IMMEDIATELY PRIOR TO CONNECTING, THE LAPPED PORTIONS OF PIPE AND THE CONNECTING BAND SHALL BE GIVEN A 1/16-INCH COATING OF APPROVED BITUMINOUS MATERIAL SIMILAR TO THAT USED FOR COATING THE PIPE. THE BAND SHALL BE DRAWN UP TIGHT TO INSURE A WATER-TIGHT JOINT UNDER AN INTERNAL PRESSURE HEAD OF 24.5 FT. (10.63#/in²)

3. AFTER CONNECTIONS HAVE BEEN COMPLETED AND BACKFILL TAMPED INTO PLACE, ALL JOINTS SHALL BE CAULKED ON THE INSIDE WITH APPROVED BITUMINOUS MATERIAL SIMILAR TO THAT USED FOR COATING THE PIPE, SO MELTED AND APPLIED AS TO FILL THE GAP BETWEEN SECTIONS OF PIPE COMPLETELY AND SEAL THE JOINT EFFECTIVELY. AT ANY PLACE WHERE THE BITUMINOUS COATING HAS BECOME BROKEN SUFFICIENTLY TO EXPOSE THE METAL, PRIOR TO ACCEPTANCE, SUCH DEFECT SHALL BE REMEDIED BY THE APPLICATION OF A NEW COATING.

4. EACH PIPE CULVERT SHALL BE PROVIDED WITH THREE METAL DIAPHRAGMS, LOCATED SYMMETRICALLY ABOUT CENTERLINE OF PIPE AND SPACED 20 FEET ON CENTERS, TRUTHLY AND SECURELY JOINED TO THE PIPE IN SUCH MANNER AS TO PREVENT ANY SEEPAGE BETWEEN PIPE AND DIAPHRAGM. DIAPHRAGMS SHALL BE 8 FEET BY 8 FEET IN SIZE AND MADE FROM 12 GAUGE SHEETS CONFORMING TO FEDERAL SPECIFICATION: QQ-I-716 FOR "IRON AND STEEL; SHEET, BLACK AND ZINC-COATED (GALVANIZED)," TYPE III WITH CLASS C ZINC COATING; AND BASE METAL SHALL BE PURE IRON, COPPER BEARING IRON, COPPER IRON, OR COPPER MOLYBDENUM IRON, AND MADE BY THE OPEN-HEARTH PROCESS. ALL DIAPHRAGM FITTINGS SHALL BE ZINC-COATED. DIAPHRAGMS SHALL BE COATED WITH AN APPROVED BITUMINOUS MATERIAL, NOT LESS THAN 0.03 INCH IN THICKNESS, SIMILAR TO THAT USED FOR COATING THE CULVERT PIPE, AND AFTER PLACING, ALL SEAMS AND JOINTS SHALL BE THOROUGHLY CAULKED WITH SUCH MATERIAL.

5. A 36-INCH CIRCULAR CAST-IRON AUTOMATIC DRAINAGE GATE SIMILAR AND EQUAL TO CALCO MODEL NO. 5CC OF THE ARMCO CULVERT MANUFACTURERS' ASSOCIATION, OR TYTON SLUICE GATE OF THE TOLEDAN CULVERT MANUFACTURERS' ASSOCIATION, SHALL BE PROPERLY CONNECTED TO THE OUTSIDE-DISTRICT END OF EACH CULVERT PIPE. THE SECTION OF PIPE TO WHICH THE GATE IS CONNECTED SHALL BE NOT LESS THAN 20 FEET IN LENGTH. AFTER PLACING, ALL SEAMS AND JOINTS SHALL BE THOROUGHLY CAULKED WITH APPROVED BITUMINOUS MATERIAL SIMILAR TO THAT USED FOR COATING THE PIPE.

6. A 36" CAST IRON SLIDE GATE SIMILAR & EQUAL TO ARMCO DRAINAGE & METAL CO. MODEL 30-05C

EXCAVATION & BACKFILL

1. EXCAVATION OF THE LAST 6" OF MATERIAL SHALL BE HAND EXCAVATED TO FIT THE PERIPHERY OF THE PIPE.

2. BACKFILL THRU LEVEE SHALL BE AN IMPERVIOUS FILL MATERIAL COMPACTED TO A MINIMUM OF 90% STANDARD PROCTOR AT 4% ABOVE & 2% BELOW OPTIMUM MOISTURE CONTENT.

UNIT 1

REV.	DATE	DESCRIPTION	BY	APPROVED
C	5-26-78	ADDED EITENSION TO EXISTING ASH POND DRAINAGE SYSTEM PER R. SCHNEER SKETCH.	D. ALEXANDER	
B	9/14/76	ADD BCA PIPE AND TERMINUS CHANGE, INCREASE TRENCH WIDTH	L.G. MILLER	H.S.F.
A	6/7/58	ISSUED FOR CONSTRUCTION	L.G. MILLER	

DESIGNED J. WILSON; DRAWN R.G. DUNN DATE 5-7-58
TRACED L.G. MILLER DATE 6-7-58
CHECKED H.S.F. DATE 6-10-58
APPROVED DATE 6-17-58

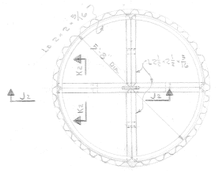
PREPARED UNDER RESPONSIBLE SUPERVISION OF H.S. FENWICK
MICHIGAN PROFESSIONAL REGISTRATION NO. 3896
ILLINOIS STRUCTURAL REGISTRATION NO. 81-2410
AT OFFICES OF COMMONWEALTH ASSOCIATES INC. 209 E. WASHINGTON AVE., JACKSON, MICH.

OWNER AND LOCATION
E.D. EDWARDS STATION
CENTRAL ILLINOIS LIGHT CO.
PEORIA, ILLINOIS

TITLE
CONSTRUCTION THRU LEVEE
ASH POND
DRAINAGE DUCT

DRAWING AS NOTED 220-118-1
DRAWING NO. C175-G1921 REV. C SHEET 1

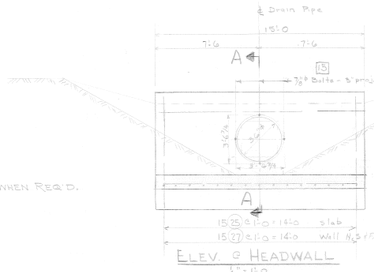
INPUT BY ... PLOT BY ... CHECKED BY ... Info Const Copy



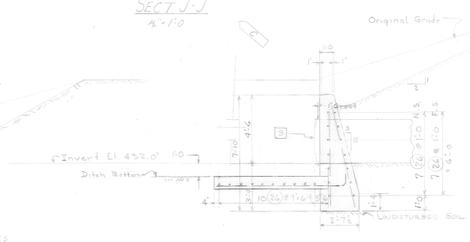
PLAN - Mk 14

NOTE
FIELD FURNISH WHEN REQ'D.

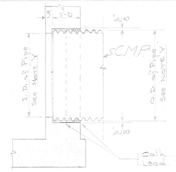
DEBRIS SKIMMER
Frame to be Heavily Galvanized.
Scale ½"=1'-0"



ELEV. ℄ HEADWALL
½"=1'-0

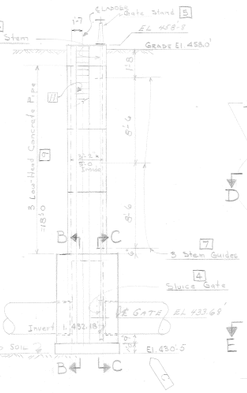


SECT A-A
½"=1'-0

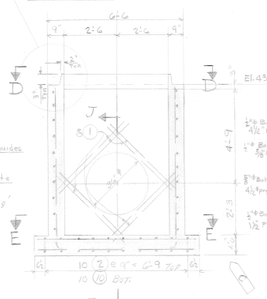


SECT J-J
½"=1'-0

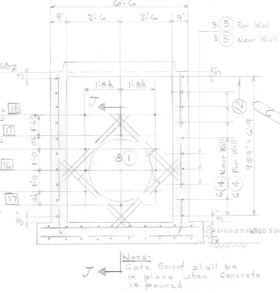
NOTE Y
Field check I.D. & O.D. of pipe before recess is formed.



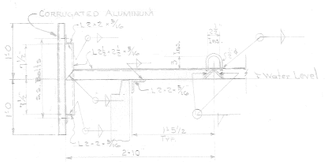
ELEV. OF SLUICE GATE PIT
LOOKING SOUTH



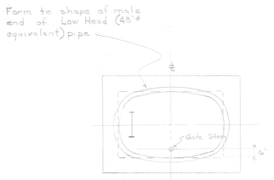
SECT B-B
½"=1'-0



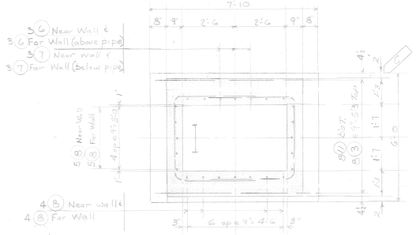
SECT CC
½"=1'-0



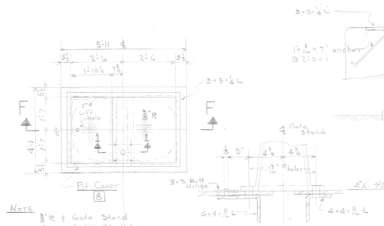
SECTION J2-J2
SCALE 1"=1'-0



SECT D-D
½"=1'-0



SECT E-E
½"=1'-0

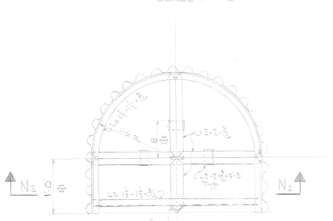


PLAN & TOP OF GATE PIT
½"=1'-0

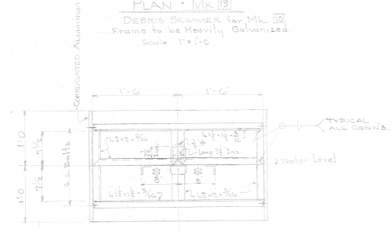
SECT 1-1

SECT F-F
½"=1'-0

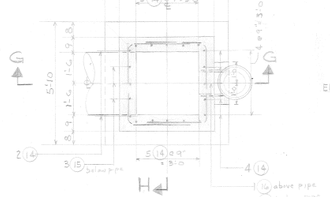
BAR SUMMARY			
SIZE	STR	BENT	WEIGHT
7	409	891	1290
5	576	94	670
4	88	178	266
TOTAL	1073	1163	2226



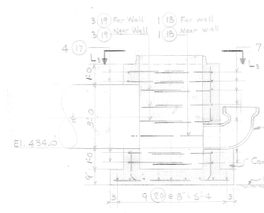
PLAN - Mk 19
DEBRIS SKIMMER for Mk. 10
Frame to be Heavily Galvanized.
Scale 1"=1'-0



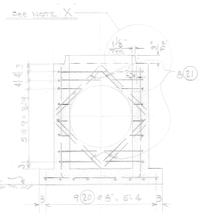
SECTION N2-N2
SCALE 1"=1'-0



PLAN
INLET BASIN
½"=1'-0

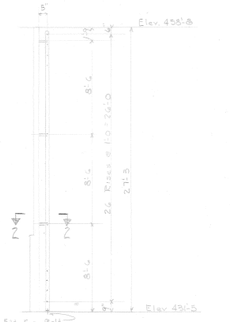


SECT G-G
½"=1'-0

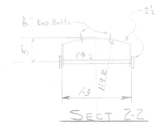


SECT H-H
½"=1'-0

NOTE X
Field check with pipe before forming.



ELEV. OF LADDER



SECT 7-7

MISC. STR. STEEL ITEMS		
ITEM	DESCRIPTION	WT.
8	P.T. FRAME & COVER	445#
11	LADDER	278#

BILL OF MISCELLANEOUS MATL.

Location	Item No.	Quan.	Description	Purch. Local	Req'n No.
G 1921-1	G1921-2	1088'	36"ø Corr. Metal Pipe Asphalt & Asbestos Lined		30065
"	2	2	80 sq. ft. Gal. Diaphrams		30065
G 1921-2	3	1	36"ø Flap Gate Armco Model 30c or Equal (Mfr. to submit Shop Dwg. for approval)		30104
"	4	1	Sluice Gate - 36"ø Armco Model 30-05c or Equal with C.I. Seating Surfaces & Spigot Back		
"	5	1	Sluice Gate Stand Armco Model "CPE-2" or Equal		
"	6	1	Sluice Gate Stem 1½"ø Hot Rolled Steel Cl 36 with splice @ mid length		
"	7	3	Sluice Gate Stem Guides Armco Type "I" 2" Pipe Item		30104
"	8	1	Sluice Gate P.T. Frame & Cover		30088
"	9	3	60° Sections of 48"ø Equivalent Lo-head Concrete pipe (ASTM C76 Class B)		30087
"	10	1	12"ø Conc. Bell & Spig. Elbow		30087
"	11	1	Ladder As Detailed		30088
G1921-3	12	LOT	Sheet Piling		30080
"	13	LOT	Wales & Bracing See List on G1921-2		30090
G1921-2	14	1	Debris Skimmer		Field Furn.
"	15	4	⅞ x 12" Bolts for Anchor Bolts w/ Nuts		30104
"	16	6	⅞ x 12½ Anchor Bolts		30104
"	17	2	½" x 3" Anchor Bolts		30104
"	18	2	⅝ x 12" Anchor Bolts		30104
"	12	1	Debris Skimmer (Ext.)		Field Furn.
G1921-1	G1921-2	25	36" Dia. Conc. Metal Pipe		30386
"	G1921-2	21	Rip Asphalt & Asbestos Lined		30386
"	"	22	4 @ 8'-2" x 2'-6" Galv. Diaphragm		30386
"	"	23	4 Asphaltic Zinc Clad Armco Crimped 36" Dia. Pipe Bands 2'-9" Lg. w/ Armco Rods & Nuts w/ Asphaltic Sealing Compound Per Spec. (QQ-C-326).		30386
G1921-2	13	Lot	Oakum - Tarred & Oiled		Field Furn.
"	24	Lot	Lead Wool		"

BAR LIST (Reinforcing Bars)

LOCATION	MARK	NO. REQ'D	SIZE	SHAPE	LGTH	WT.	BEND. DIAG.
Gate Pit	1	16	7	Str.	4'-9	155	4'-0
" "	2	10	"	"	5'-6	112	4'-0
" "	3	8	"	"	6'-4	109	
" "	4	12	"	Bent	11'-10	214	
" "	5	6	"	"	6'-4	78	
" "	6	6	"	Str.	5'-0	57	
" "	7	6	"	Bent	5'-3	40	
" "	8	18	"	"	9'-9	235	
" "	9	6	"	"	13'-6	165	
" "	10	10	7	Str.	6'-6	112	Field Furnish
" "	11	8	7	Str.	7'-6	182	
" "	12	2	7	Bent	11'-10	58	
Inlet Basin	14	16	4	Bent	7'-3	78	3'-10
" "	15	4	"	"	3'-3	9	6'-4
" "	16	1	"	Str.	2'-9	2	
" "	17	21	"	Bent	9'-8	71	
" "	18	2	"	"	5'-6	7	
" "	19	6	"	"	3'-4	13	
" "	20	18	"	Str.	5'-10	70	
" "	21	8	"	"	3'-0	16	
Headwall	25	16	5	Bent	6'-0	94	3'-10
"	26	24	5	Str.	14'-4	856	3'-10
"	27	30	5	Str.	7'-0	220	

NOTES:
BARS SHALL BE TAGGED WITH DRAWING No. & MK. No. - EXAMPLE;
G-1921-1 - (1)
DRAWING NO. — MARK

All concrete shall attain a compression strength of 3000 #/in² after 28 days

UNIT 1

REV.	DATE	DESCRIPTION	BY	APPROVED
C	8/29/58	ADD 20, 21, 22; ADD 23, 24, 25 & 26 AND INCREASE THICKNESS OF P.T. SLAB TO 12", ADD SECT J-J	L.G.M.	H.S.F.
B	9/14/58	ITEMS 14 THRU 18 ADDED - SECTIONS L-L & M-M ADDED	R.G.D.	H.S.F.
A	4/16/58	ITEMS ADDED TO 8/M	J.I. BROWN	H.S.F.
D	3/3/60	Debris Skimmers Mk. 14 & Mk. 19 released.	H.S.F.	H.S.F.

DRAWN BY John W. Wilcox DATE 5-22-58
CHECKED BY L.G. Minner DATE 6-7-58
H. S. Fenwick NO. P.E. DATE 6-10-58
APPROVED BY H.D. Schilling DATE 6-17-58

(SEAL)

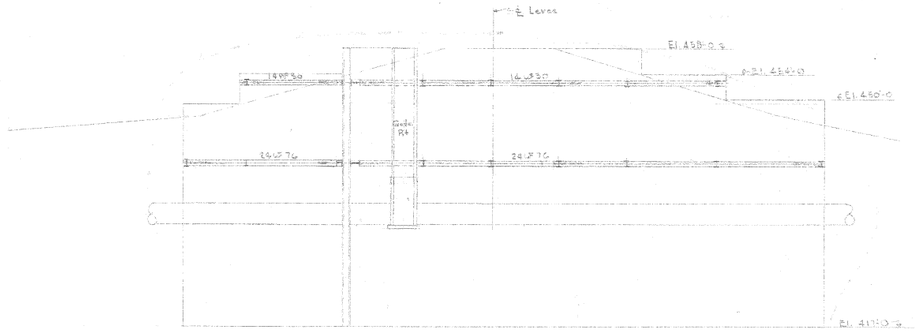
PREPARED UNDER RESPONSIBLE SUPERVISION OF
H. S. FENWICK
MICHIGAN PROFESSIONAL REGISTRATION NO. 3954
ILLINOIS STRUCTURAL REGISTRATION NO. 81-2416
AT OFFICE OF
COMMONWEALTH ASSOCIATES INC.
208 E. WASHINGTON AVE. JACKSON, MICH.

OWNER AND LOCATION
E.D. EDWARDS STATION
CENTRAL ILLINOIS LIGHT CO.
PEORIA, ILLINOIS

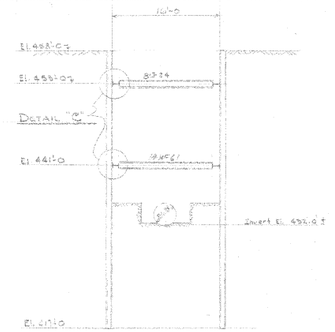
CONSTRUCTION THRU LEVER
ASH POND
DRAINAGE DUST DETAILS

SCALE 3-30-118-1
DRAWING NO. C 175-G1921
REV. D
SHEET 2

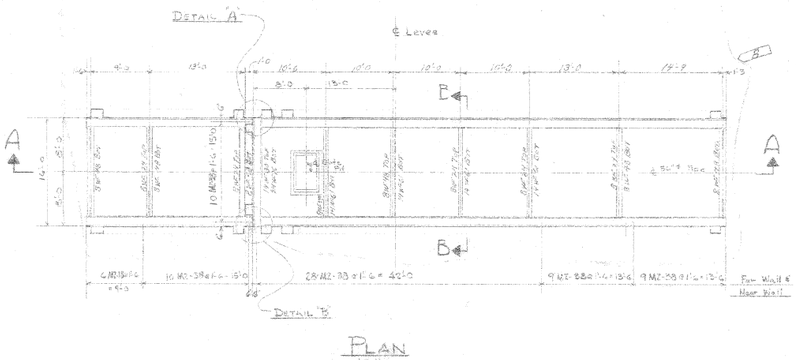
OK TO FILE



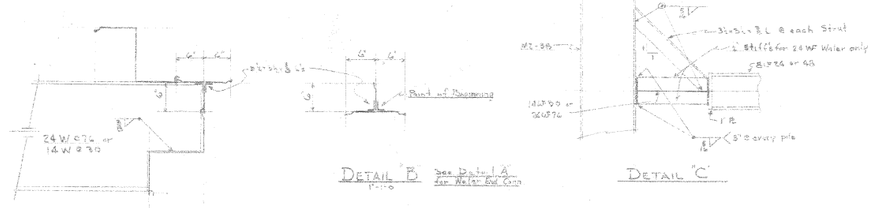
SECT A-A
1/8"=1'-0



SECT B-B
1/8"=1'-0



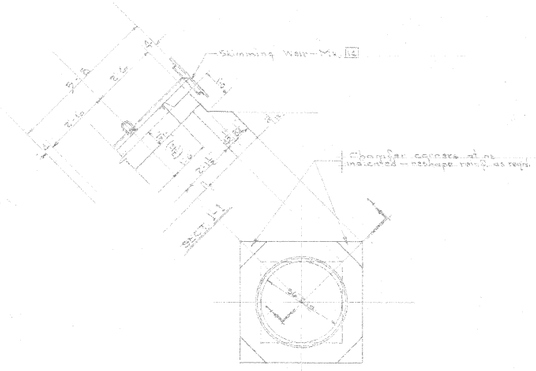
PLAN
1/8"=1'-0



DETAIL "A"
1"=1'-0

DETAIL "B" See Detail "A" for Water End Conn.

DETAIL "C"



VIEW 1-1
Scale 1/2"=1'-0

MATERIALS LIST
BRACES AND WALES

1	5 PCS. 8WF24 BRACES	13'-9"	LONG
2	7 PCS. 8WF48 "	12'-1"	"
3	1 PC. 24 WF 76 WALE	16'-0"	"
4	4 PCS. 24 WF 76 "	34'-0"	"
5	2 PCS. 24 WF 76 "	24'-9"	"
6	1 PC. 14 WF 30 "	16'-0"	"
7	2 PCS. 14 WF 30 "	15'-0"	"
8	2 PCS. 14 WF 30 "	22'-0"	"
9	2 PCS. 14 WF 30 "	34'-0"	"
10	24 PCS. 3½"x3½"x3/8" BRACES	2'-0"	"
	APPROX. WT. 13 TONS		
11	4 PCS. 14 WF 61 WALE	12'-1	LONG (SALVAGE FROM SC. 9 SH. COFFERDAM)
			SEE DWG C1923-1 ITEM 16

SEE ITEM 13 B/M C1921-2

UNIT 1

REV.	DATE	DESCRIPTION	BY	APPROVED
B	4/19/59	REVISE STRUT SPACING, ADD MIDDLE STRUTS	L.G.M.	H.S.F.
A	6/19/58	ISSUED FOR CONSTRUCTION	L.G. MILLER	[signature]

DESIGN AND DRAWING: John W. Wilcox DATE 5-28-58; CHKD L.G. MILLER DATE 6-9-58; H.S. Fenwick, P.E. DATE 6-10-58; APPROVED H.B. Schuiling DATE 6-17-58

SEAL

REGISTERED UNDER ILLINOIS LIGHT COMPANY
H. S. FENWICK
MICHIGAN PROFESSIONAL REGISTRATION NO. 3954
ILLINOIS STRUCTURAL REGISTRATION NO. 81-5416
AT OFFICE OF
COMMONWEALTH ASSOCIATES, INC.
209 E. WASHINGTON AVE. JACKSON, MICH.

OWNER AND LOCATION
E.D. EDWARDS STATION
CENTRAL ILLINOIS LIGHT CO
PEORIA, ILLINOIS

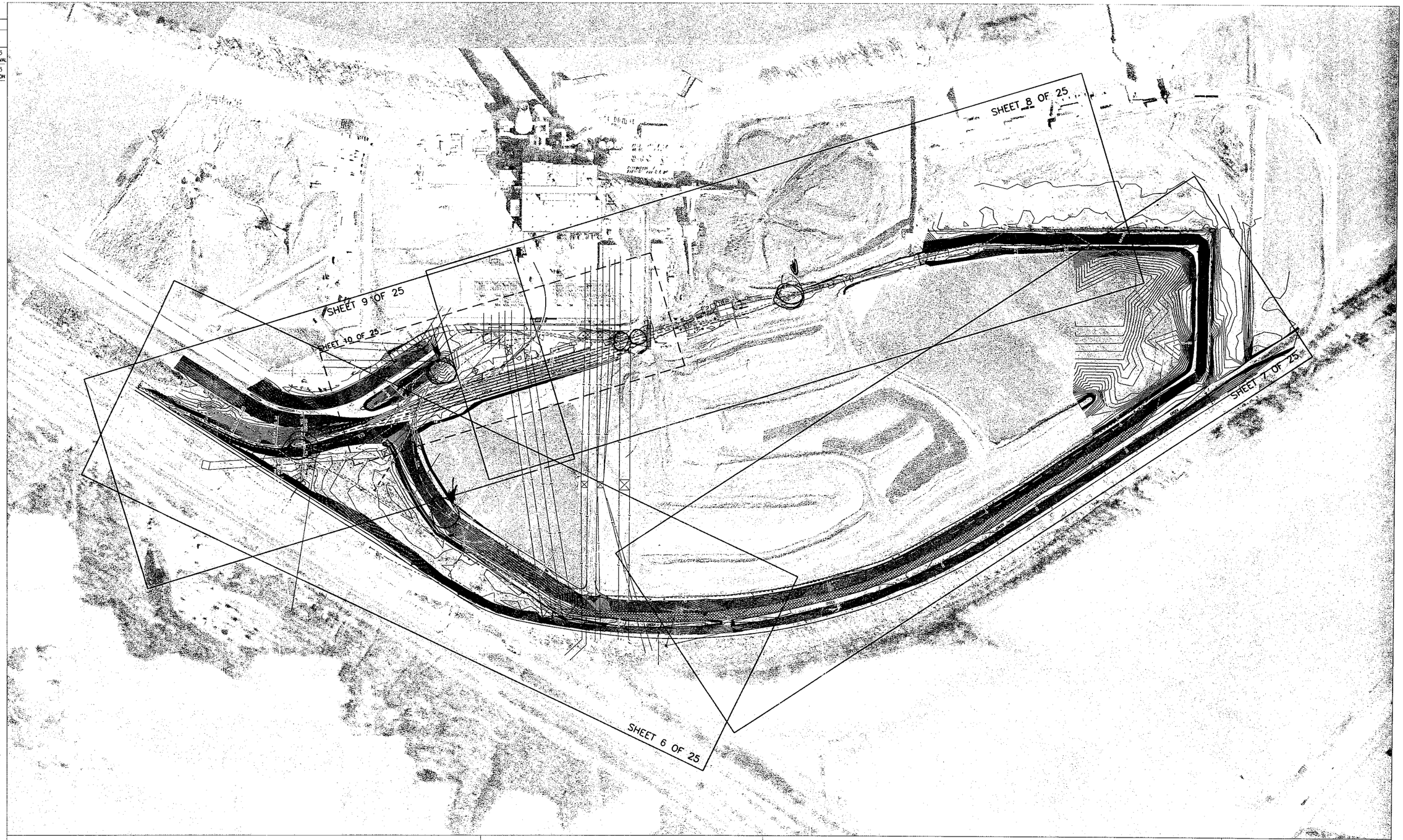
TITLE
CONSTRUCTION THRU LEVEE
ASH POND DRAINAGE DUCT
COFFERDAM & OTHER DETAILS

SCALE: AS NOTED
2-20-58-1
DRAWING NO. C-175-G1921
REV. B
SHEET 3

PRINT DIST.

REVISIONS		
REV.	W.O.	
0		11/05/03 PRELIMINARY FOR APPROVAL
1		11/20/03 ISSUED FOR CONSTRUCTION

T:\2003\AmerenIEdwards\Design-off ROW & pond\03057-1.dwg, General Plan, 12/5/2003 12:18:27 PM, SPH



LEGEND:

- EXISTING GROUND CONTOURS
- CL EXISTING TRACK
- EXISTING OVERHEAD POWER LINE
- CL EXISTING TRACK TO BE REMOVED
- EXISITING POINT OF SWITCH (P.SW.)
- CL PROPOSED TRACK
- PROPOSED GRADING LIMITS
- PROPOSED POINT OF SWITCH (P.SW.)

0 100 200 400
SCALE 1"=200'

ISSUED FOR CONSTRUCTION

NOTICE OF LIMITED RESPONSIBILITY

THE RESPONSIBILITY OF THE UNDERSIGNED ENGINEER IS LIMITED TO THE DESIGN WORK SHOWN ON PROJECT DRAWINGS AND DOCUMENTS BEARING HIS/HER SEAL, SIGNATURE OR INITIALS. HE/SHE DOES NOT HAVE AUTHORITY OVER THE PROJECT AS A WHOLE. THE UNDERSIGNED DISCLAIMS ANY RESPONSIBILITY FOR WORK DONE UNDER SUBSEQUENT REVISIONS AND ANY OTHER DOCUMENTS ASSOCIATED WITH THE PROJECT WHICH DO NOT BEAR HIS/HER SEAL, SIGNATURE OR INITIALS

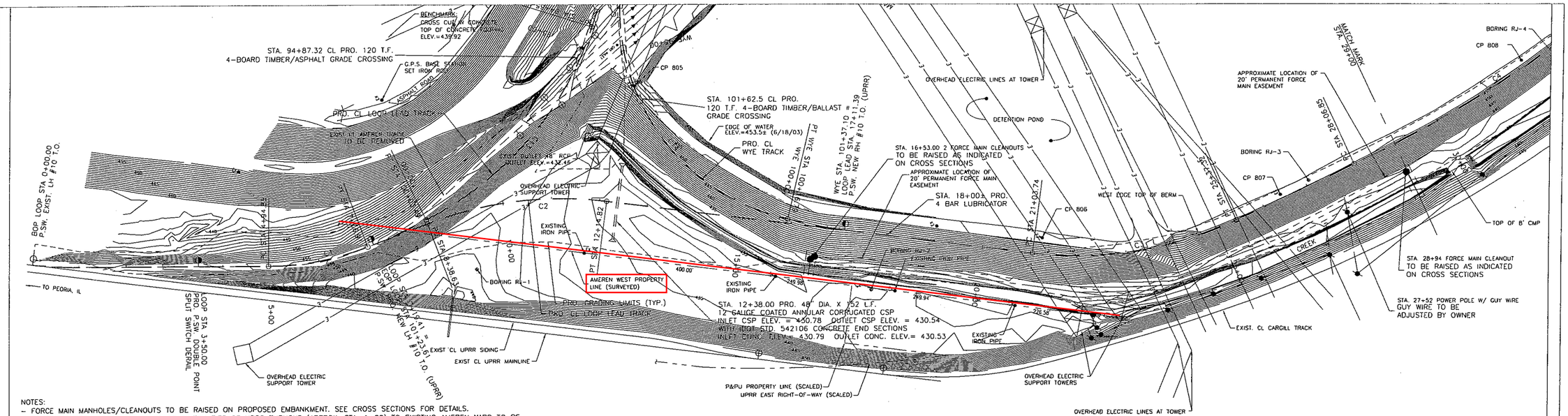
DESIGN NINE, INC.
ENGINEERING SERVICES FOR RAILROADS AND INDUSTRY
ST. LOUIS, MO.

PREPARED FOR AmerenCILCO

DRAWN	SPH	PROPOSED 150 CAR LOOP TRACK FOR EDWARDS POWER PLANT BARTONVILLE, ILLINOIS		
CHKD	GTH			
SUPV.				
APPD		LOCATION		CLASS
		GENERAL PLAN		
AmerenCILCO	ST. LOUIS, MISSOURI	DRAWING NO	SHEET NO	REV.
		03057-PL	5 OF 25	1

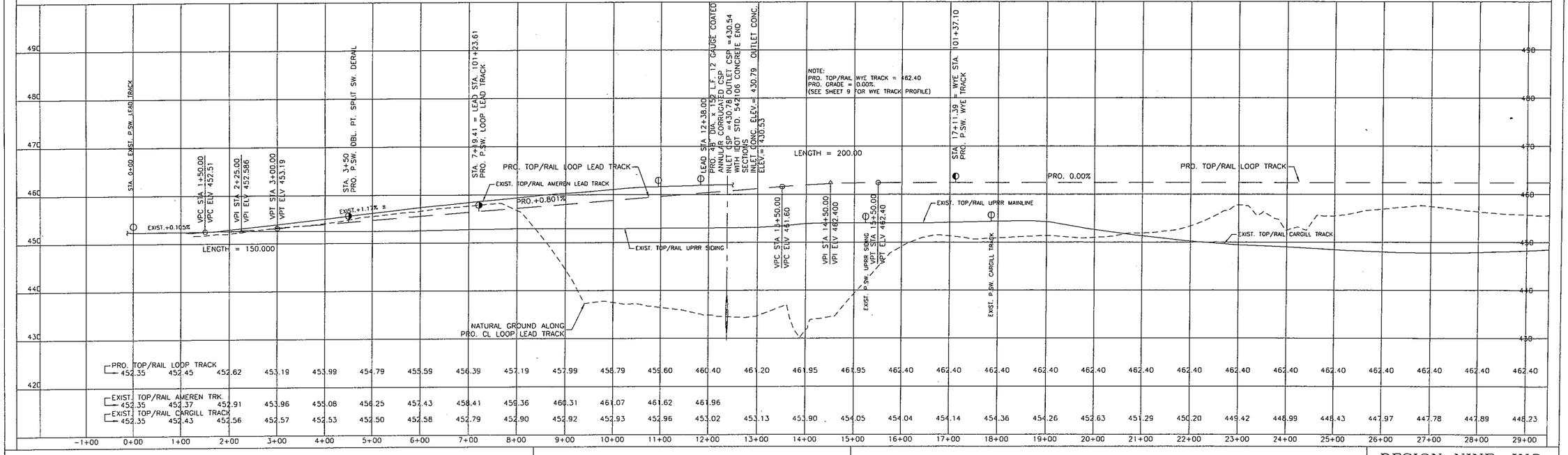
PRINT DIST.

REVISIONS		
REV.	W.O.	
0		11/05/03 PRELIMINARY FOR APPROVAL
1		11/20/03 ISSUED FOR CONSTRUCTION
2		12/03/03 ISSUED FOR CONSTRUCTION



NOTES:
- FORCE MAIN MANHOLES/CLEANOUTS TO BE RAISED ON PROPOSED EMBANKMENT. SEE CROSS SECTIONS FOR DETAILS.
- EXISTING AMEREN TRACK FROM END OF SWITCH TIES OF UPRR TURNOUT (APPROX. STA. 1+20) TO EXISTING AMEREN YARD TO BE REMOVED. GRADING PERFORMED & SUBBALLAST PLACED (SEE CROSS SECTIONS) DURING DUMP HOUSE WORK OUTAGE.
- EXISTING YARD LEAD TURNOUTS TO BE REMOVED, REHABILITATED AS REQUIRED AND REINSTALLED AT PROPOSED LOCATIONS. EXTRA TURNOUTS TO BE DISMANTLED WITH SALVAGEABLE MATERIALS STOCKPILED ON SITE AS DESIGNATED BY OWNER. SCRAP MATERIALS TO BE REMOVED AND PROPERLY DISPOSED OF OFF SITE.
- EXISTING LEAD TRACK AND YARD TRACK TO BE REMOVED TO THE LIMITS REQUIRED BY THE PROPOSED WORK. SALVAGEABLE MATERIALS TO BE STOCKPILED ON SITE AS DESIGNATED BY OWNER. SCRAP MATERIALS TO BE REMOVED AND PROPERLY DISPOSED OF OFF SITE.
- EMBANKMENT CONSTRUCTION DETAILED ON CROSS SECTIONS PURSUANT TO REITZ & JENS, INC.
- DESIGN TOP/RAIL TO DESIGN TOP/SUBBALLAST IS 2.21' WITH 136# RAIL.

LEAD C1	LEAD C2	LEAD C3	LEAD C4	LEAD C13	WYE C14
D = 10°00'00"	D = 7°30'00"	D = 7°30'00"	D = 2°15'00"	D = 8°30'00"	D = 12°45'00"
R = 573.69'	R = 764.49'	R = 764.49'	R = 2546.64'	R = 674.69'	R = 450.31'
Δ = 21°10'44"	Δ = 28°11'38"	Δ = 32°29'45"	Δ = 33°29'31"	Δ = 45°41'42"	Δ = 102°31'42"
T = 107.25'	T = 191.98'	T = 222.80'	T = 766.25'	T = 284.27'	T = 561.36'
Lc = 211.79'	Lc = 375.92'	L = 433.28'	Lc = 1488.53'	Lc = 537.59'	Lc = 804.14'
Lo = 212.06'	Lo = 376.19'	Lo = 433.56'	Lo = 1488.62'	Lo = 538.08'	Lo = 805.81'
E = 9.94'	E = 23.74'	E = 31.80'	E = 112.78'	E = 57.44'	E = 269.34'



LEGEND:
- EXISTING GROUND CONTOURS
- CL EXISTING TRACK
- EXISTING OVERHEAD POWER LINE
- EXISTING PROPERTY LINE
- CL EXISTING TRACK TO BE REMOVED
- EXISITING POINT OF SWITCH (P.SW.)
- CL PROPOSED TRACK
- PROPOSED GRADING LIMITS
- PROPOSED POINT OF SWITCH (P.SW.)

0 50 100 200
SCALE: 1"=100'

ISSUED FOR CONSTRUCTION

NOTICE OF LIMITED RESPONSIBILITY
THE RESPONSIBILITY OF THE UNDERSIGNED ENGINEER IS LIMITED TO THE DESIGN WORK SHOWN ON PROJECT DRAWINGS AND DOCUMENTS BEARING HIS/HER SEAL, SIGNATURE OR INITIALS. HE/SHE DOES NOT HAVE AUTHORITY OVER THE PROJECT AS A WHOLE. THE UNDERSIGNED DISCLAIMS ANY RESPONSIBILITY FOR WORK DONE UNDER SUBSEQUENT REVISIONS AND ANY OTHER DOCUMENTS ASSOCIATED WITH THE PROJECT WHICH DO NOT BEAR HIS/HER SEAL, SIGNATURE OR INITIALS.

DESIGN NINE, INC.
ENGINEERING SERVICES FOR RAILROADS AND INDUSTRY
ST. LOUIS, MO.

PREPARED FOR AmerenCILCO

DRAWN	SPH
CHKD.	GTH
SUPV.	
APPD.	

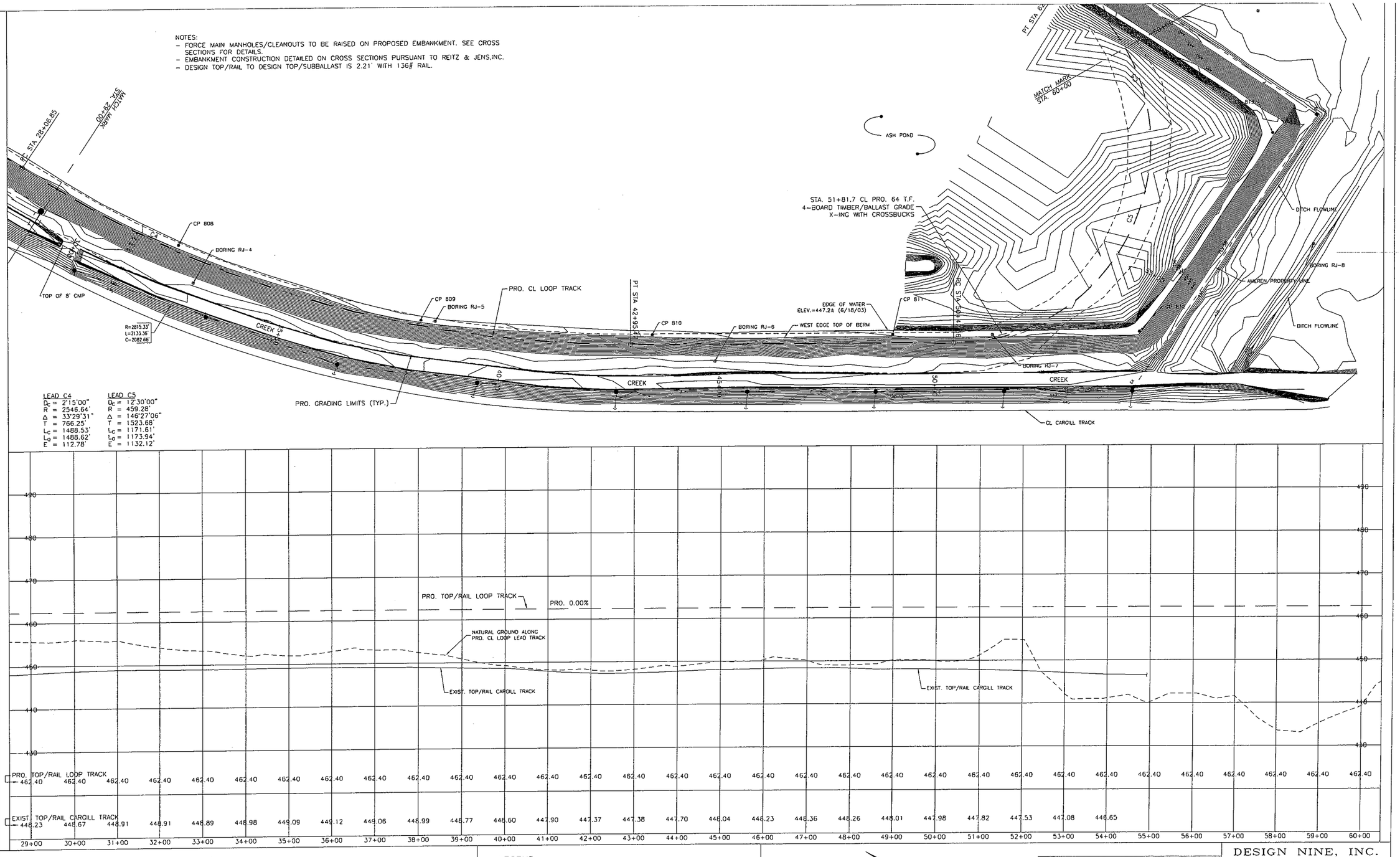
PROPOSED 150 CAR LOOP TRACK FOR EDWARDS POWER PLANT BARTONVILLE, ILLINOIS

LOCATION	PLAN/PROFILE - LOOP/WYE TRACK LOOP STA. 0+00 TO STA. 29+00	CLASS
ST. LOUIS, MISSOURI AmerenCILCO	DRAWING NO. 03057-1	SHEET NO. 6 OF 25	REV. 2

T:\2003\AmerenEdwards\Design-off ROW & pond\03057-1.dwg, Plan-Prof 100' (1), 12/5/2003 1:27:10 PM, SPH

PRINT DIST.	
REVISIONS	
REV.	W.O.
0	11/05/03
PRELIMINARY FOR APPROVAL	
1	11/20/03
ISSUED FOR CONSTRUCTION	

NOTES:
- FORCE MAIN MANHOLES/CLEANOUTS TO BE RAISED ON PROPOSED EMBANKMENT. SEE CROSS SECTIONS FOR DETAILS.
- EMBANKMENT CONSTRUCTION DETAILED ON CROSS SECTIONS PURSUANT TO REITZ & JENS,INC.
- DESIGN TOP/RAIL TO DESIGN TOP/SUBBALLAST IS 2.21' WITH 136# RAIL.



LEAD C4
D_C = 2°15'00"
R = 2546.64'
Δ = 33°29'31"
T = 766.25'
L_C = 1488.53'
L_d = 1488.62'
E = 112.78'

LEAD C5
D_C = 12°30'00"
R = 459.28'
Δ = 146°27'06"
T = 1523.68'
L_C = 1171.61'
L_d = 1173.94'
E = 1132.12'

LEGEND:
- EXISTING GROUND CONTOURS
- CL EXISTING TRACK
- EXISTING OVERHEAD POWER LINE
- EXISTING PROPERTY LINE
- CL EXISTING TRACK TO BE REMOVED
- EXISISTING POINT OF SWITCH (P.SW.)
- CL PROPOSED TRACK
- PROPOSED GRADING LIMITS
- PROPOSED POINT OF SWITCH (P.SW.)

0 50 100 200
SCALE: 1"=100'

ISSUED FOR CONSTRUCTION

NOTICE OF LIMITED RESPONSIBILITY
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DESIGN NINE, INC.
ENGINEERING SERVICES FOR RAILROADS AND INDUSTRY
ST. LOUIS, MO.

PREPARED FOR AmerenCILCO

DRAWN	SPH	PROPOSED 150 CAR LOOP TRACK FOR EDWARDS POWER PLANT BARTONVILLE, ILLINOIS	
CHKD.	GTH		
SUPV.			
APPD.		LOCATION	PLAN/PROFILE - LOOP TRACK STA. 29+00 TO STA. 60+00
		ST. LOUIS, MISSOURI	CLASS
AmerenCILCO		DRAWING NO. 03057-1	SHEET NO. 7 OF 25
			REV. 1

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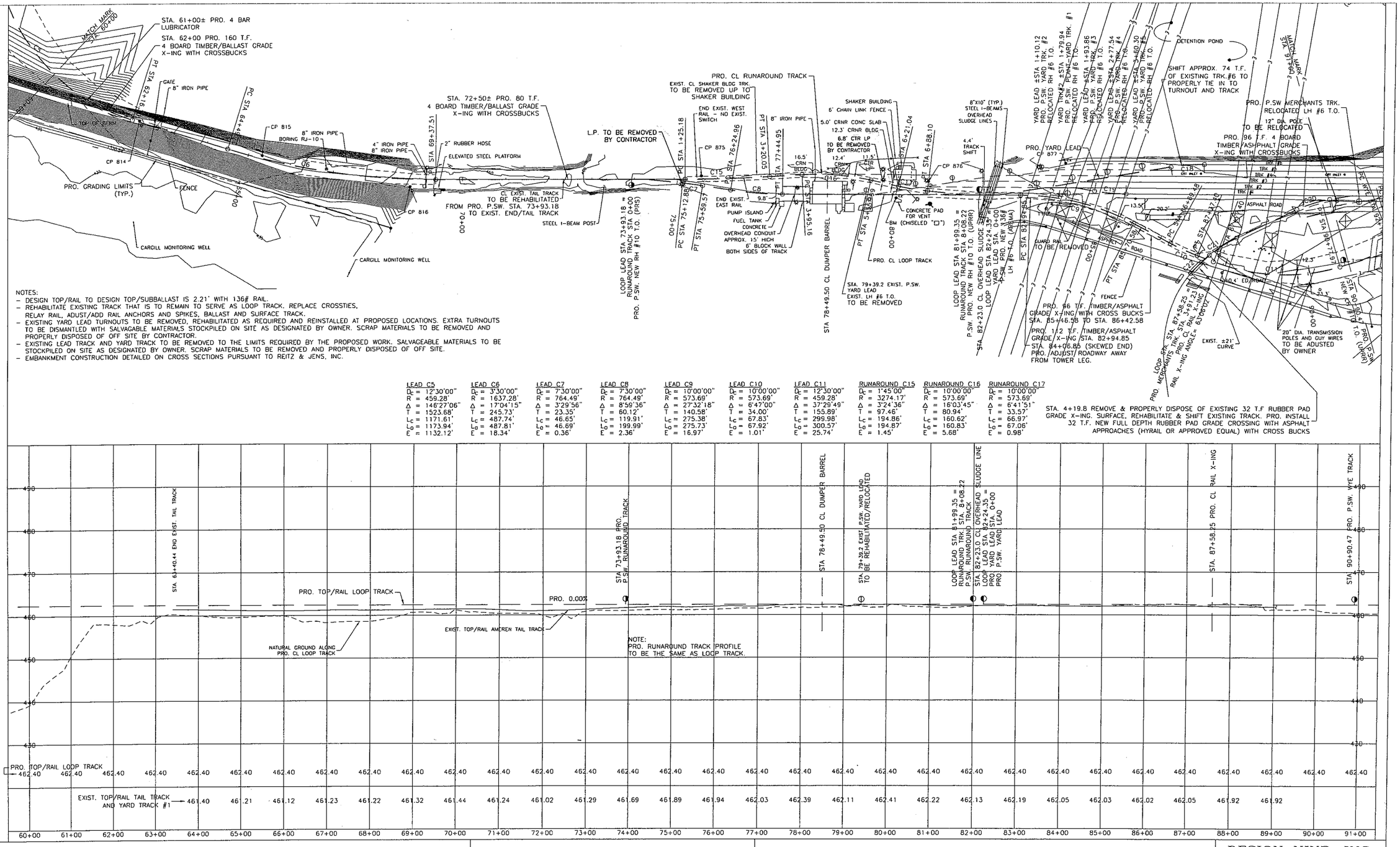
PRINT DIST.		
REVISIONS		
REV.	W.O.	
0 PRELIMINARY FOR APPROVAL	11/05/03	
1 ISSUED FOR CONSTRUCTION	11/20/03	
2 ISSUED FOR CONSTRUCTION	12/03/03	



NOTES:
- DESIGN TOP/RAIL TO DESIGN TOP/SUBBALLAST IS 2.21' WITH 136# RAIL.
- REHABILITATE EXISTING TRACK THAT IS TO REMAIN TO SERVE AS LOOP TRACK. REPLACE CROSSTIES, RELAY RAIL, ADJUST/ADD RAIL ANCHORS AND SPIKES, BALLAST AND SURFACE TRACK.
- EXISTING YARD LEAD TURNOUTS TO BE REMOVED, REHABILITATED AS REQUIRED AND REINSTALLED AT PROPOSED LOCATIONS. EXTRA TURNOUTS TO BE DISMANTLED WITH SALVAGABLE MATERIALS STOCKPILED ON SITE AS DESIGNATED BY OWNER. SCRAP MATERIALS TO BE REMOVED AND PROPERLY DISPOSED OF OFF SITE BY CONTRACTOR.
- EXISTING LEAD TRACK AND YARD TRACK TO BE REMOVED TO THE LIMITS REQUIRED BY THE PROPOSED WORK. SALVAGEABLE MATERIALS TO BE STOCKPILED ON SITE AS DESIGNATED BY OWNER. SCRAP MATERIALS TO BE REMOVED AND PROPERLY DISPOSED OF OFF SITE.
- EMBANKMENT CONSTRUCTION DETAILED ON CROSS SECTIONS PURSUANT TO REITZ & JENS, INC.

LEAD C5	LEAD C6	LEAD C7	LEAD C8	LEAD C9	LEAD C10	LEAD C11	RUNAROUND C15	RUNAROUND C16	RUNAROUND C17
D_C = 12°30'00"	D_C = 3°30'00"	D_C = 7°30'00"	D_C = 7°30'00"	D_C = 10°00'00"	D_C = 10°00'00"	D_C = 12°30'00"	D_C = 14°00'00"	D_C = 10°00'00"	D_C = 10°00'00"
R = 459.28'	R = 1637.28'	R = 764.49'	R = 764.49'	R = 573.69'	R = 573.69'	R = 459.28'	R = 3274.17'	R = 573.69'	R = 573.69'
Δ = 146°27'06"	Δ = 17°04'15"	Δ = 3°29'56"	Δ = 8°59'36"	Δ = 27°32'18"	Δ = 6°47'00"	Δ = 37°29'49"	Δ = 3°24'36"	Δ = 16°03'45"	Δ = 6°41'51"
T = 1523.68'	T = 245.73'	T = 23.35'	T = 60.12'	T = 140.58'	T = 34.00'	T = 155.89'	T = 97.46'	T = 80.94'	T = 33.57'
L_C = 1171.61'	L_C = 487.74'	L_C = 46.65'	L_C = 119.91'	L_C = 275.38'	L_C = 67.83'	L_C = 299.98'	L_C = 194.86'	L_C = 160.62'	L_C = 66.97'
L_O = 1173.94'	L_O = 487.81'	L_O = 46.69'	L_O = 199.99'	L_O = 275.73'	L_O = 67.92'	L_O = 300.57'	L_O = 194.87'	L_O = 160.83'	L_O = 67.06'
E' = 1132.12'	E' = 18.34'	E' = 0.36'	E' = 2.36'	E' = 16.97'	E' = 1.01'	E' = 25.74'	E' = 1.45'	E' = 5.68'	E' = 0.98'

LEGEND:
- EXISTING GROUND CONTOURS
- CL EXISTING TRACK
- EXISTING OVERHEAD POWER LINE
- EXISTING PROPERTY LINE
- CL EXISTING TRACK TO BE REMOVED
- EXISITING POINT OF SWITCH (P.S.W.)
- CL PROPOSED TRACK
- PROPOSED GRADING LIMITS
- PROPOSED POINT OF SWITCH (P.S.W.)

0 50 100 200
SCALE: 1"=100'

ISSUED FOR CONSTRUCTION

NOTICE OF LIMITED RESPONSIBILITY
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DESIGN NINE, INC.
ENGINEERING SERVICES FOR RAILROADS AND INDUSTRY
ST. LOUIS, MO.

PREPARED FOR AmerenCILCO

DRAWN	SPH
CHKD.	GTH
SUPV.	-
APPD.	-

PROPOSED 150 CAR LOOP TRACK
FOR EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

LOCATION	PLAN/PROFILE - LOOP TRACK STA. 60+00 TO STA. 91+00	CLASS
ST. LOUIS, MISSOURI	DRAWING NO. 03057-1	SHEET NO. 8 OF 25
AmerenCILCO		REV. 2

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REVISIONS		
REV.	W.O.	
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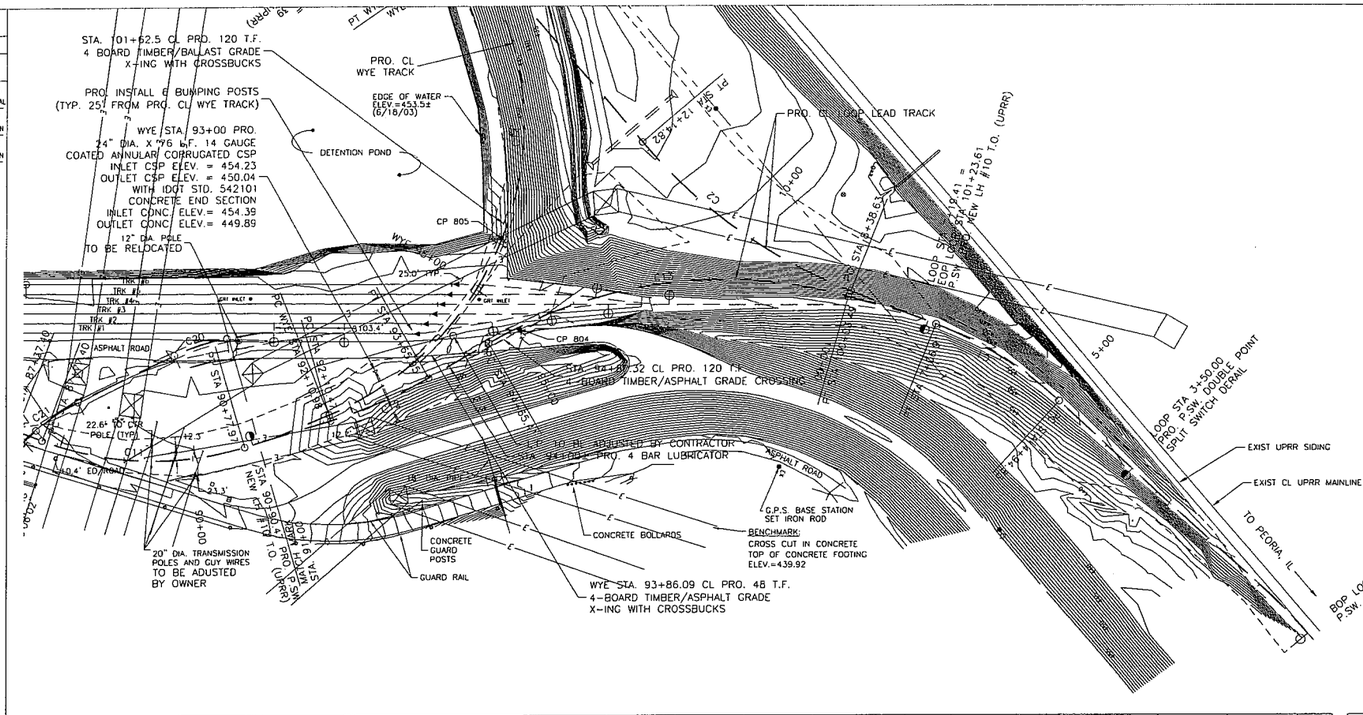
1		11/20/03 ISSUED FOR CONSTRUCTION
2		12/03/03 ISSUED FOR CONSTRUCTION



NOTES:
- EXISTING AMEREN TRACK FROM END OF SWITCH TIES OF UPRR TURNOUT (APPROX. STA. 1+20) TO EXISTING AMEREN YARD TO BE REMOVED, GRADING PERFORMED & SUBBALLAST PLACED (SEE CROSS SECTIONS) DURING DUMP HOUSE WORK OUTAGE.
- EXISTING YARD LEAD TURNOUTS TO BE REMOVED, REHABILITATED AS REQUIRED AND REINSTALLED AT PROPOSED LOCATIONS. EXTRA TURNOUTS TO BE DISMANTLED WITH SALVAGEABLE MATERIALS STOCKPILED ON SITE AS DESIGNATED BY OWNER. SCRAP MATERIALS TO BE REMOVED AND PROPERLY DISPOSED OF OFF SITE.
- EXISTING LEAD TRACK AND YARD TRACK TO BE REMOVED TO THE LIMITS REQUIRED BY THE PROPOSED WORK. SALVAGEABLE MATERIALS TO BE STOCKPILED ON SITE AS DESIGNATED BY OWNER. SCRAP MATERIALS TO BE REMOVED AND PROPERLY DISPOSED OF OFF SITE.
- EMBANKMENT & CONSTRUCTION DETAILED ON CROSS SECTIONS PURSUANT TO RENTZ & JENS, INC.
- DESIGN TOP/RAIL TO DESIGN TOP/SUBBALLAST IS 2.21' WITH 136# RAIL.

LEAD C1
D_C = 10°00'00"
R = 573.69'
Δ = 21°10'44"
T = 107.25'
L_C = 211.79'
L_O = 212.06'
E = 9.94'

LEAD C2
D_C = 7°30'00"
R = 764.49'
Δ = 28°11'38"
T = 191.98'
L_C = 375.92'
L_O = 376.19'
E = 23.74'

LEAD C9
D_C = 10°00'00"
R = 573.69'
Δ = 27°32'18"
T = 140.58'
L_C = 275.38'
L_O = 275.73'
E = 16.97'

LEAD C10
D_C = 10°00'00"
R = 573.69'
Δ = 6°47'00"
T = 34.00'
L_C = 67.83'
L_O = 67.92'
E = 1.01'

LEAD C11
D_C = 12°30'00"
R = 459.28'
Δ = 37°29'49"
T = 155.89'
L_C = 299.98'
L_O = 300.57'
E = 25.74'

LEAD C12
D_C = 8°45'00"
R = 655.45'
Δ = 13°35'29"
T = 78.11'
L_C = 155.33'
L_O = 155.48'
E = 4.64'

LEAD C13
D_C = 8°30'00"
R = 674.69'
Δ = 45°41'42"
T = 284.27'
L_C = 537.59'
L_O = 538.08'
E = 57.44'

WYE C14
D_C = 12°45'00"
R = 450.31'
Δ = 102°31'42"
T = 561.36'
L_C = 804.14'
L_O = 805.81'
E = 269.34'

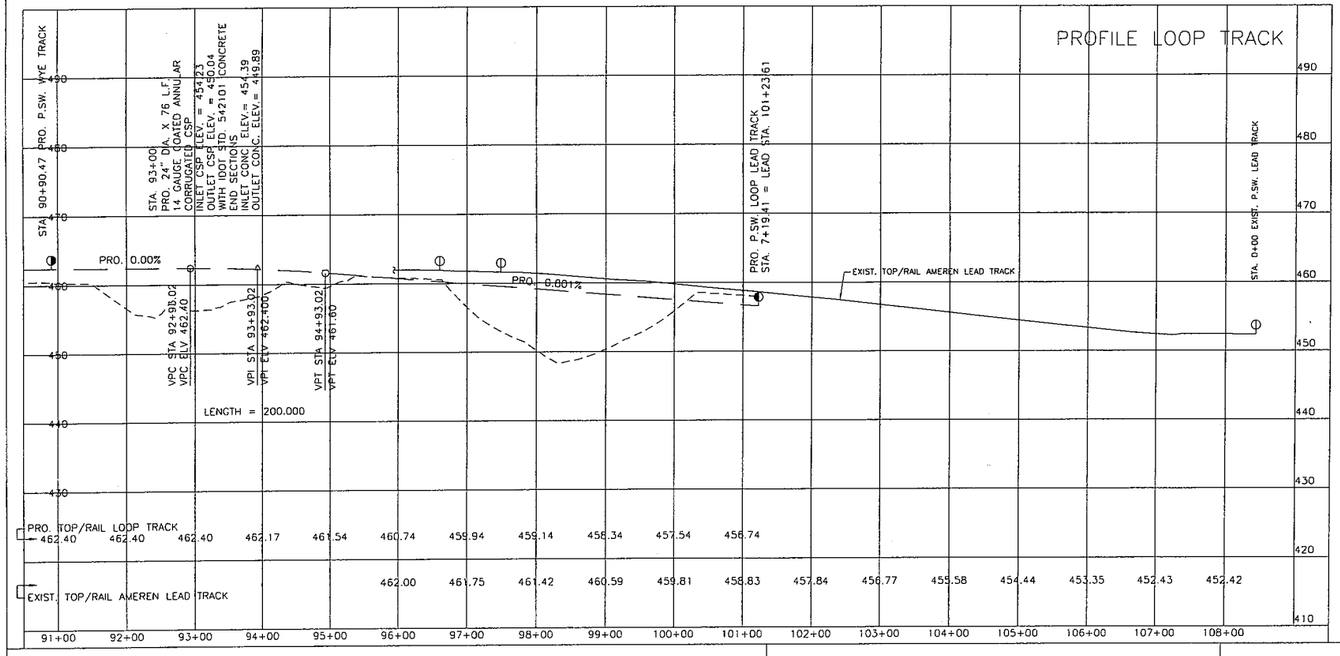
YARD C18
D_C = 12°30'00"
R = 459.28'
Δ = 9°39'05"
T = 38.77'
L_C = 77.21'
L_O = 77.37'
E = 1.63'

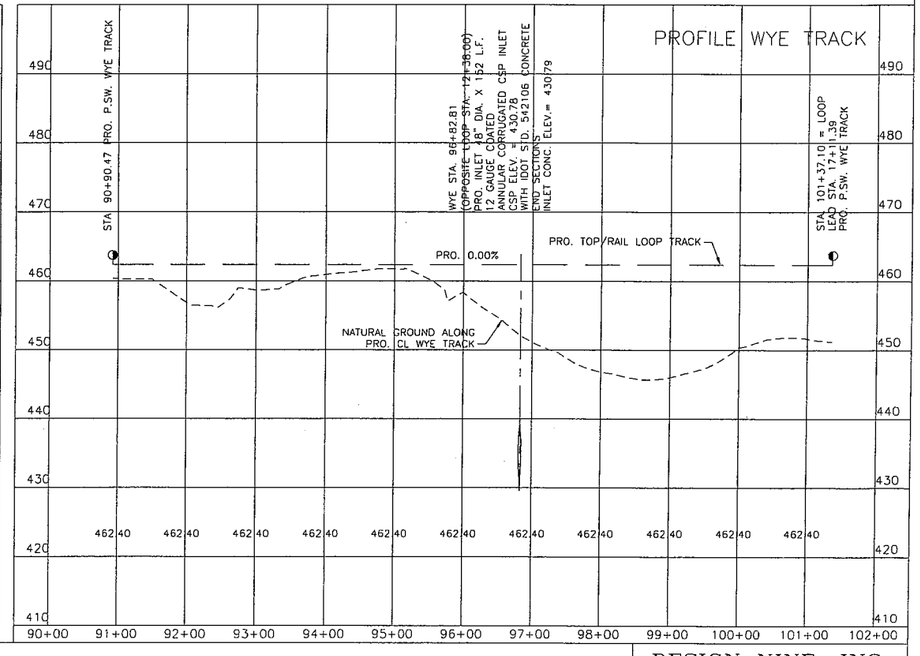
YARD C19
D_C = 12°30'00"
R = 459.28'
Δ = 9°21'00"
T = 37.56'
L_C = 74.80'
L_O = 74.95'
E = 1.53'

PLANT C20
D_C = 20°00'00"
R = 287.94'
Δ = 16°08'24"
T = 40.83'
L_C = 80.70'
L_O = 81.11'
E = 2.88'

PLANT C21
D_C = 23°00'00"
R = 250.79'
Δ = 16°46'12"
T = 36.97'
L_C = 72.91'
L_O = 73.41'
E = 2.71'

PLANT C22
D_C = 22°59'47"
R = 250.83'
Δ = 8°10'55"
T = 17.94'
L_C = 35.58'
L_O = 35.82'
E = 0.64'





LEGEND:
- EXISTING GROUND CONTOURS
- CL EXISTING TRACK
- EXISTING OVERHEAD POWER LINE
- EXISTING PROPERTY LINE
- CL EXISTING TRACK TO BE REMOVED
- EXISITING POINT OF SWITCH (P.SW.)
- CL PROPOSED TRACK
- PROPOSED GRADING LIMITS
- PROPOSED POINT OF SWITCH (P.SW.)

0 50 100 200
SCALE: 1"=100'

ISSUED FOR CONSTRUCTION

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DESIGN NINE, INC.
ENGINEERING SERVICES FOR RAILROADS AND INDUSTRY
ST. LOUIS, MO.

PREPARED FOR AmerenCILCO

DRAWN	SPH
CHKD.	GTH
SUPV.	
APPD.	

PROPOSED 150 CAR LOOP TRACK
FOR EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

LOCATION	PLAN/PROFILE - LOOP/WYE TRACK LOOP STA. 91+00 TO STA. 101+22.23	CLASS
ST. LOUIS, MISSOURI	DRAWING NO. 03057-1	SHEET NO. 9 OF 25
AmerenCILCO		REV. 2

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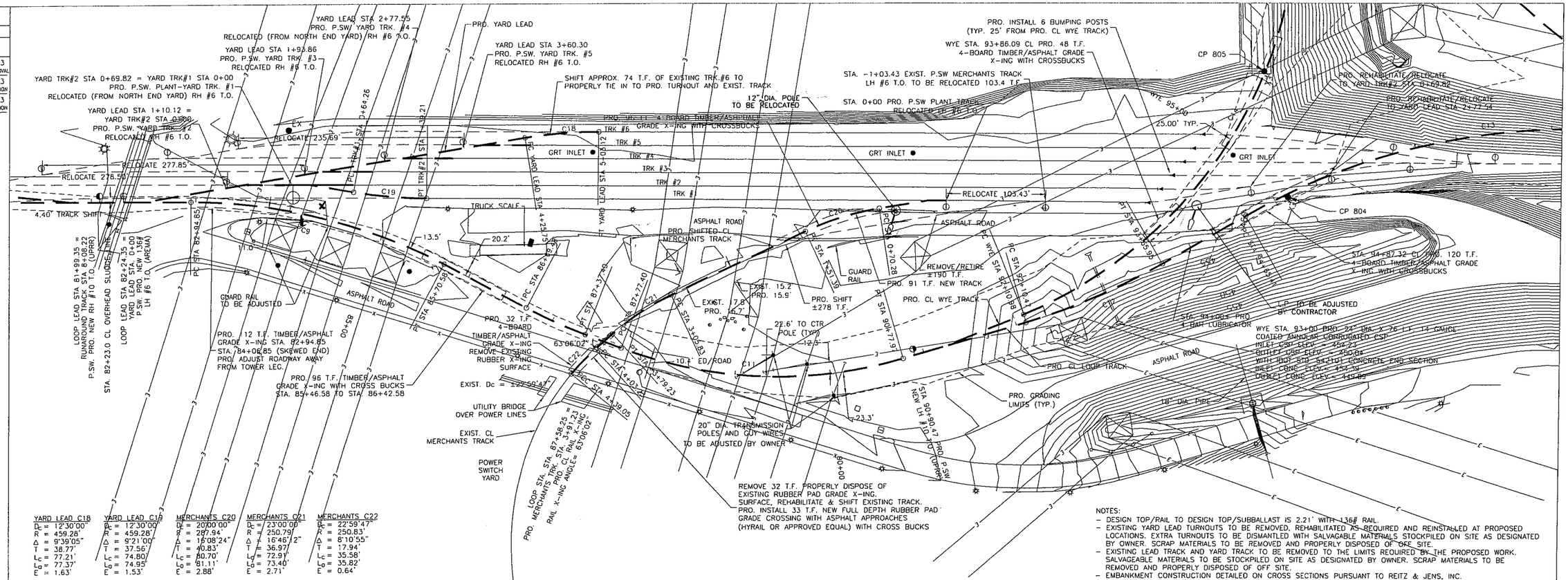

MERCHANTS TRACK PROFILE

YARD LEAD C18	YARD LEAD C19	MERCHANTS C20	MERCHANTS C21	MERCHANTS C22
D_C = 12°30'00"	D_C = 12°30'00"	D_C = 20°00'00"	D_C = 23°00'00"	D_C = 22°59'47"
R = 459.26'	R = 459.28'	R = 287.94'	R = 250.79'	R = 250.83'
Δ = 9°39'05"	Δ = 9°21'00"	Δ = 15°08'24"	Δ = 16°45'12"	Δ = 8°10'55"
T = 38.77'	T = 37.56'	T = 40.83'	T = 36.97'	T = 17.94'
L_C = 77.21'	L_C = 74.80'	L_C = 80.70'	L_C = 72.91'	L_C = 35.58'
L_O = 77.37'	L_O = 74.95'	L_O = 81.11'	L_O = 73.40'	L_O = 35.82'
E = 1.63'	E = 1.53'	E = 2.88'	E = 2.71'	E = 0.64'

NOTES:
- DESIGN TOP/RAIL TO DESIGN TOP/SUBBALLAST IS 2.21' WITH 136# RAIL.
- EXISTING YARD LEAD TURNOUTS TO BE REMOVED, REHABILITATED AS REQUIRED AND REINSTALLED AT PROPOSED LOCATIONS. EXTRA TURNOUTS TO BE DISMANTLED WITH SALVAGABLE MATERIALS STOCKPILED ON SITE AS DESIGNATED BY OWNER. SCRAP MATERIALS TO BE REMOVED AND PROPERLY DISPOSED OF OFF SITE.
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- EMBANKMENT CONSTRUCTION DETAILED ON CROSS SECTIONS PURSUANT TO REITZ & JENS, INC.

LEGEND:

- EXISTING GROUND CONTOURS
- CL EXISTING TRACK
- EXISTING OVERHEAD POWER LINE
- EXISTING PROPERTY LINE
- CL EXISTING TRACK TO BE REMOVED
- EXISITING POINT OF SWITCH (P.SW.)
- CL PROPOSED TRACK
- PROPOSED GRADING LIMITS
- PROPOSED POINT OF SWITCH (P.SW.)

0 25 50 100
SCALE: 1"=50'

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DESIGN NINE, INC.
ENGINEERING SERVICES FOR RAILROADS AND INDUSTRY
ST. LOUIS, MO.

PREPARED FOR AmerenCILCO

DRAWN	SPH
CHKD.	GTH
SUPV.	
APPD.	

PROPOSED 150 CAR LOOP TRACK FOR EDWARDS POWER PLANT BARTONVILLE, ILLINOIS

LOCATION	DETAIL OF MERCHANTS TRACK AREA	CLASS
ST. LOUIS, MISSOURI	DRAWING NO. 03057-1	SHEET NO. 10 OF 25
AmerenCILCO		REV. 2

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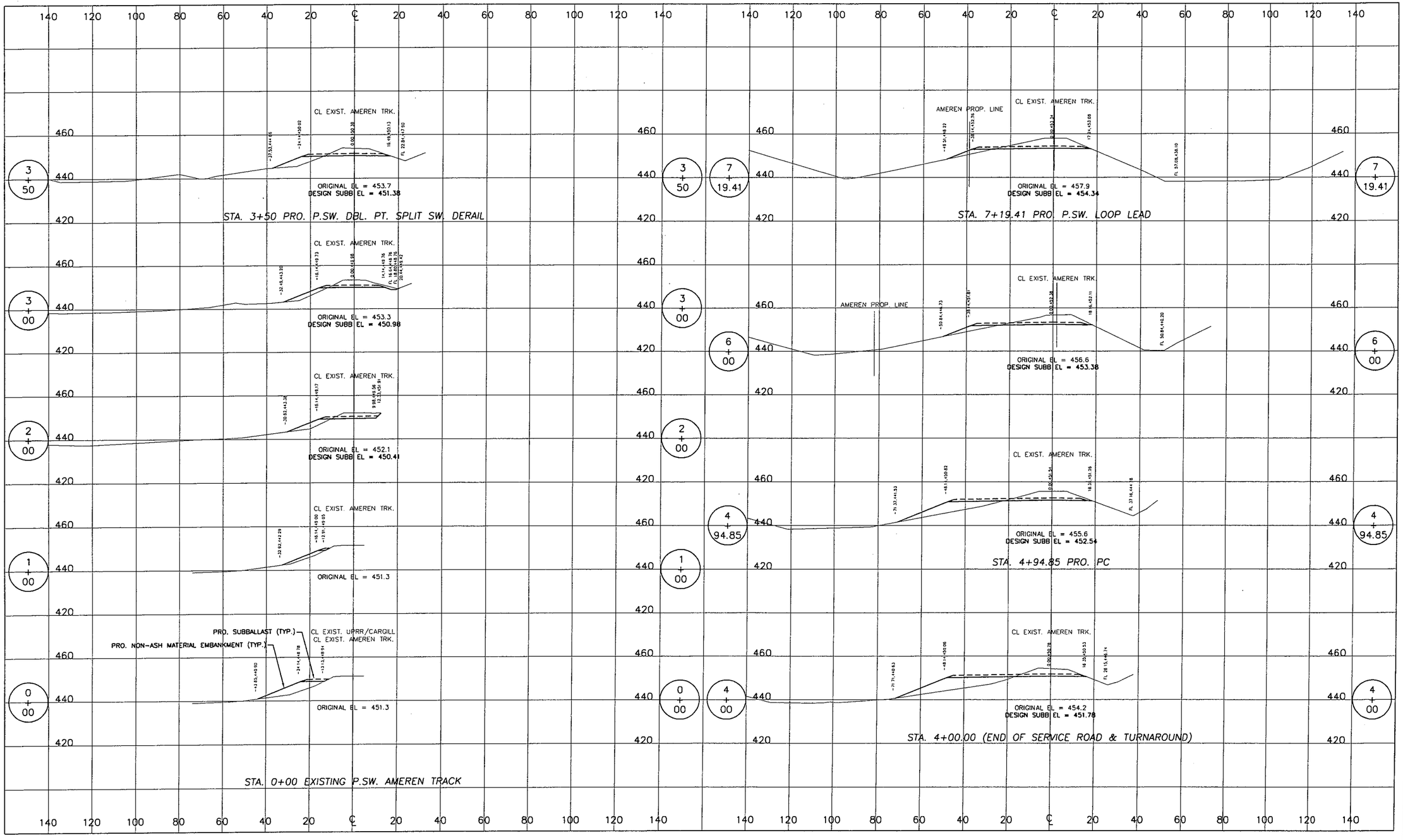

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ENGINEERING SERVICES FOR RAILROADS AND INDUSTRY
ST. LOUIS, MO.

PREPARED FOR AmerenCILCO

DRAWN	SPH
CHKD.	GTH
SUPV.	
APPD.	

PROPOSED 150 CAR LOOP TRACK
FOR EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

LOCATION	CROSS SECTIONS - LOOP TRACK STA. 0+00 TO STA. 7+20.79	CLASS
ST. LOUIS, MISSOURI	DRAWING NO. 03057-1X	SHEET NO. 11 OF 25
AmerenCILCO		REV. 2

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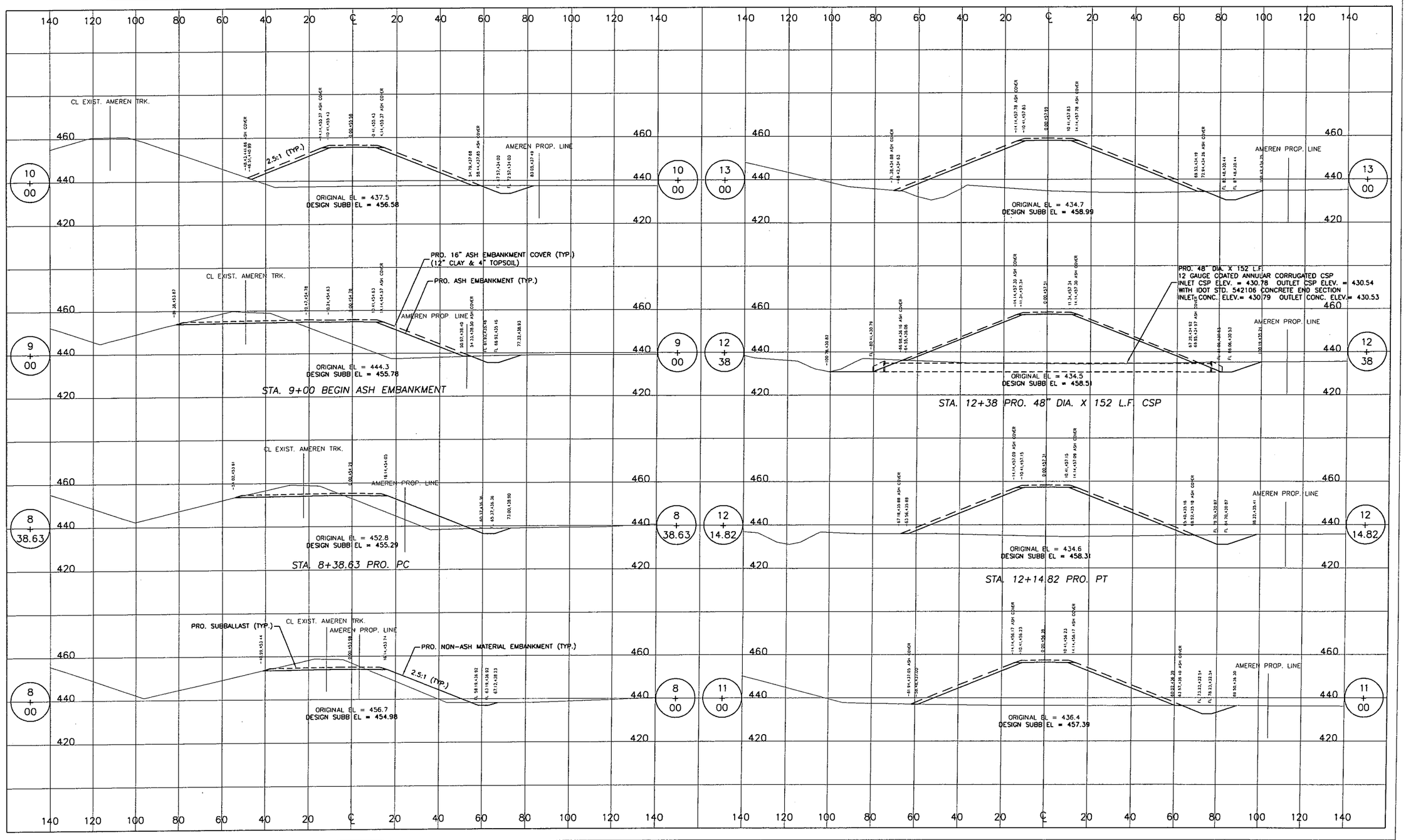

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ST. LOUIS, MO.

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CHKD.	GTH
SUPV.	
APPD.	

PROPOSED 150 CAR LOOP TRACK
FOR EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

LOCATION	CROSS SECTIONS - LOOP TRACK STA. 8+00 TO STA. 13+00	CLASS
ST. LOUIS, MISSOURI AmerenCILCO	DRAWING NO. 03057-1X	SHEET NO. 12 OF 25
		REV. 1

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1 11/20/03 ISSUED FOR CONSTRUCTION
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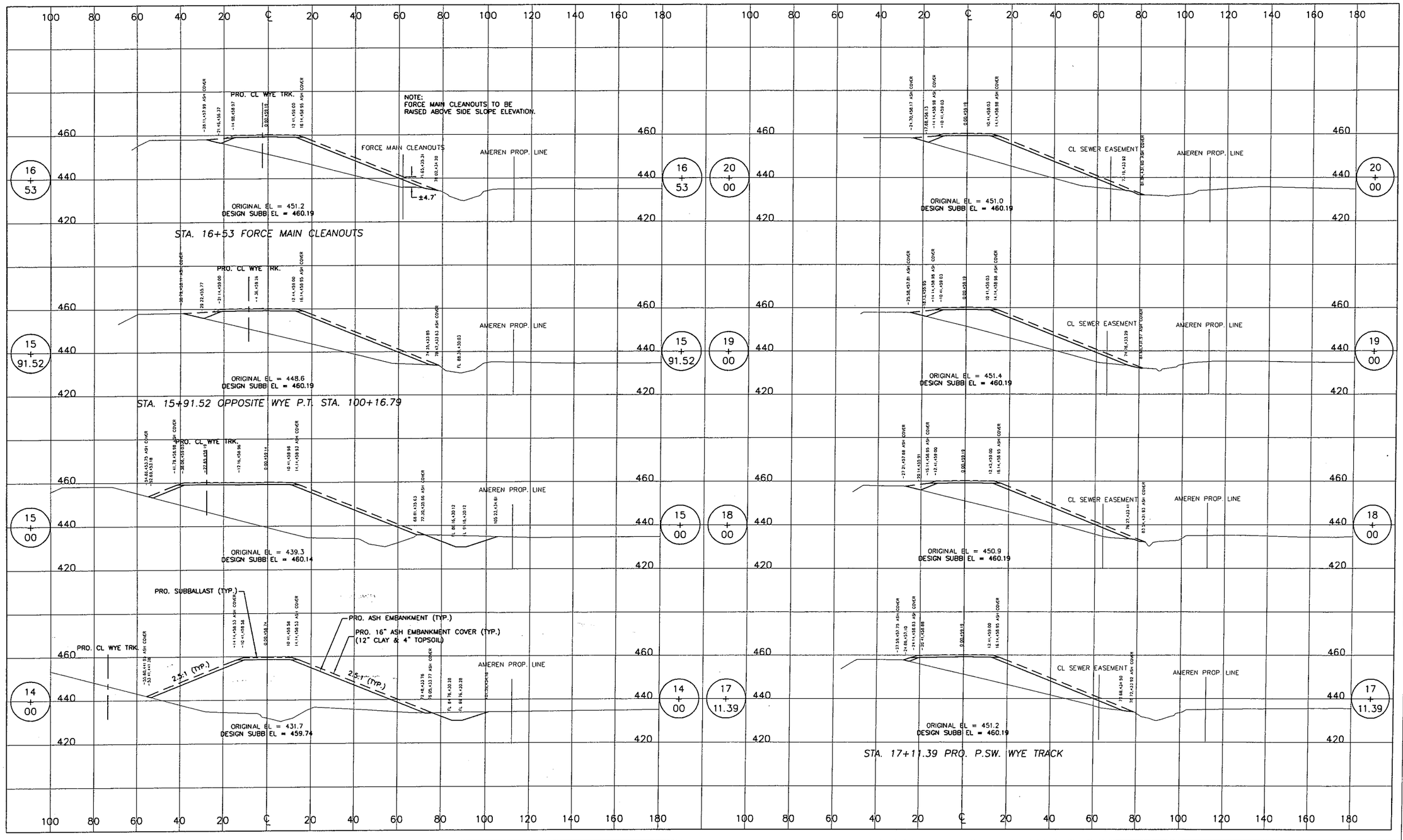

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PROPOSED 150 CAR LOOP TRACK
FOR EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

LOCATION	CROSS SECTIONS – LOOP TRACK STA. 14+00 TO STA. 20+00	CLASS
ST. LOUIS, MISSOURI	DRAWING NO. 03057-1X	SHEET NO. 13 OF 25
AmerenCILCO		REV. 2

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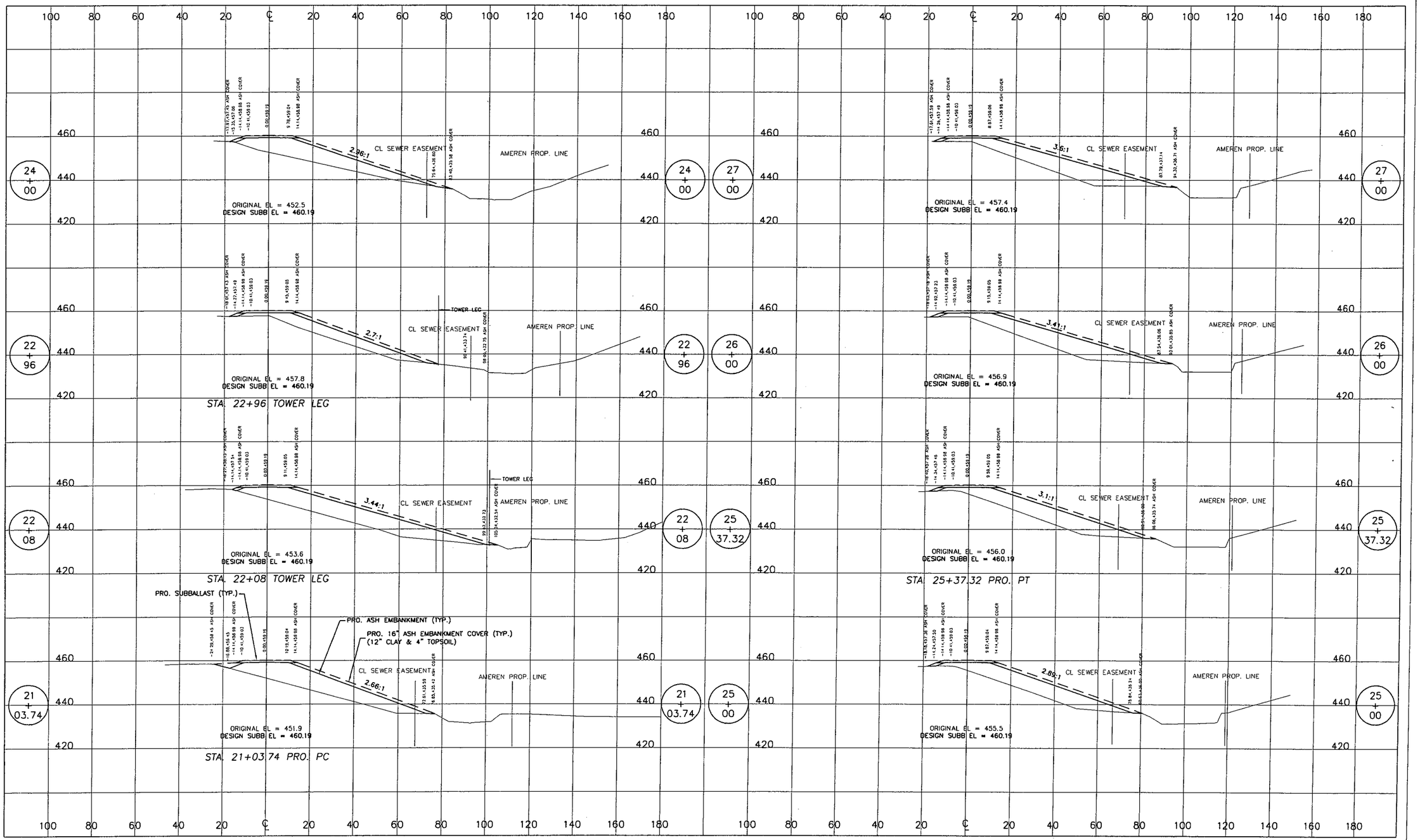

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CHKD.	GTH
SUPV.	-
APPD.	-

PROPOSED 150 CAR LOOP TRACK
FOR EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

LOCATION	CROSS SECTIONS - LOOP TRACK STA. 21+03.74 TO STA. 27+00	CLASS
ST. LOUIS, MISSOURI	DRAWING NO. 03057-1X	SHEET NO. 14 OF 25
AmerenCILCO		REV. 2

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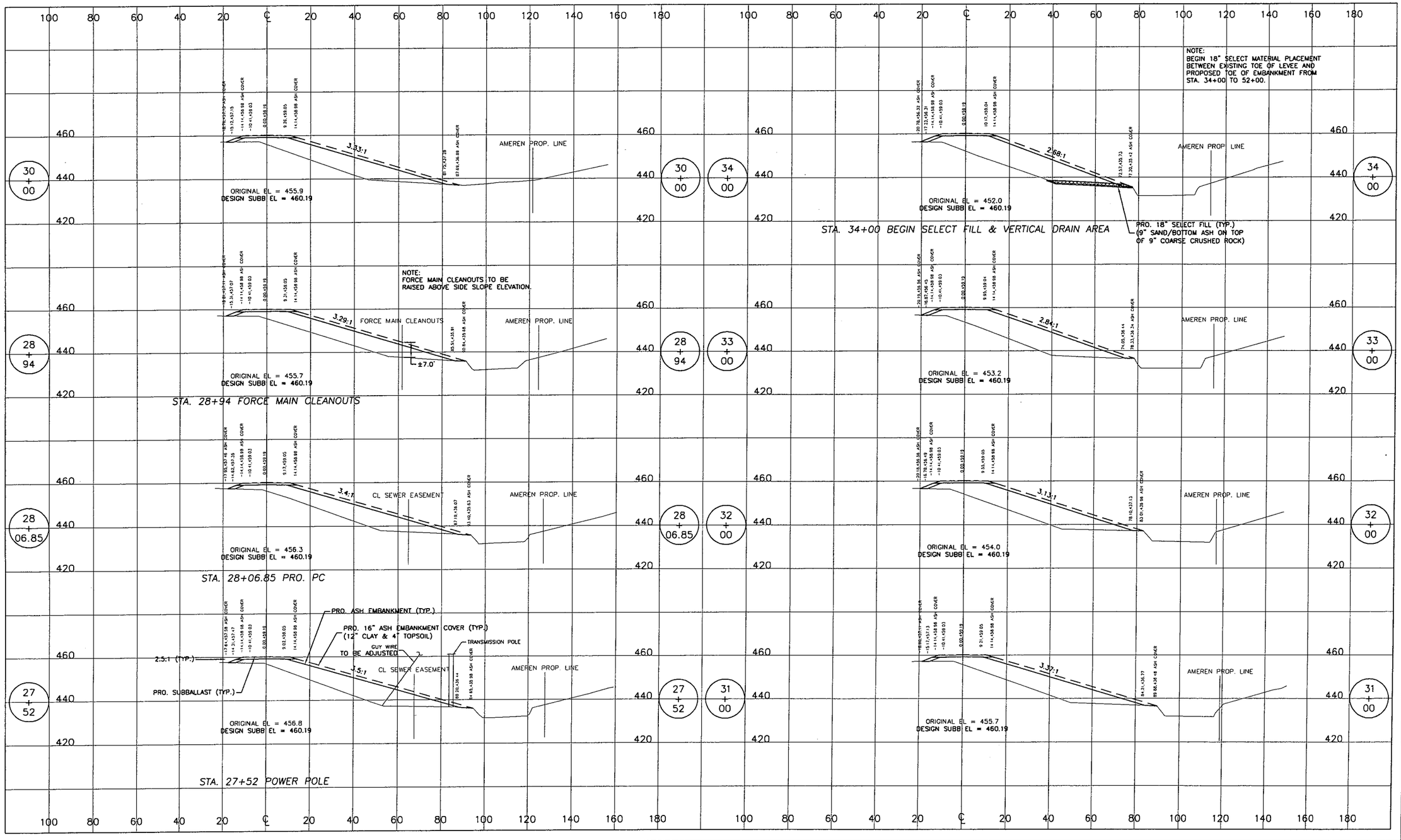

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ST. LOUIS, MO.

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CHKD.	GTH
SUPV.	
APPD.	

PROPOSED 150 CAR LOOP TRACK
FOR EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

LOCATION	CROSS SECTIONS - LOOP TRACK STA. 27+52 TO STA. 34+00	CLASS
ST. LOUIS, MISSOURI	DRAWING NO. 03057-1X	SHEET NO. 15 OF 25
AmerenCILCO		REV. 2

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REVISIONS		
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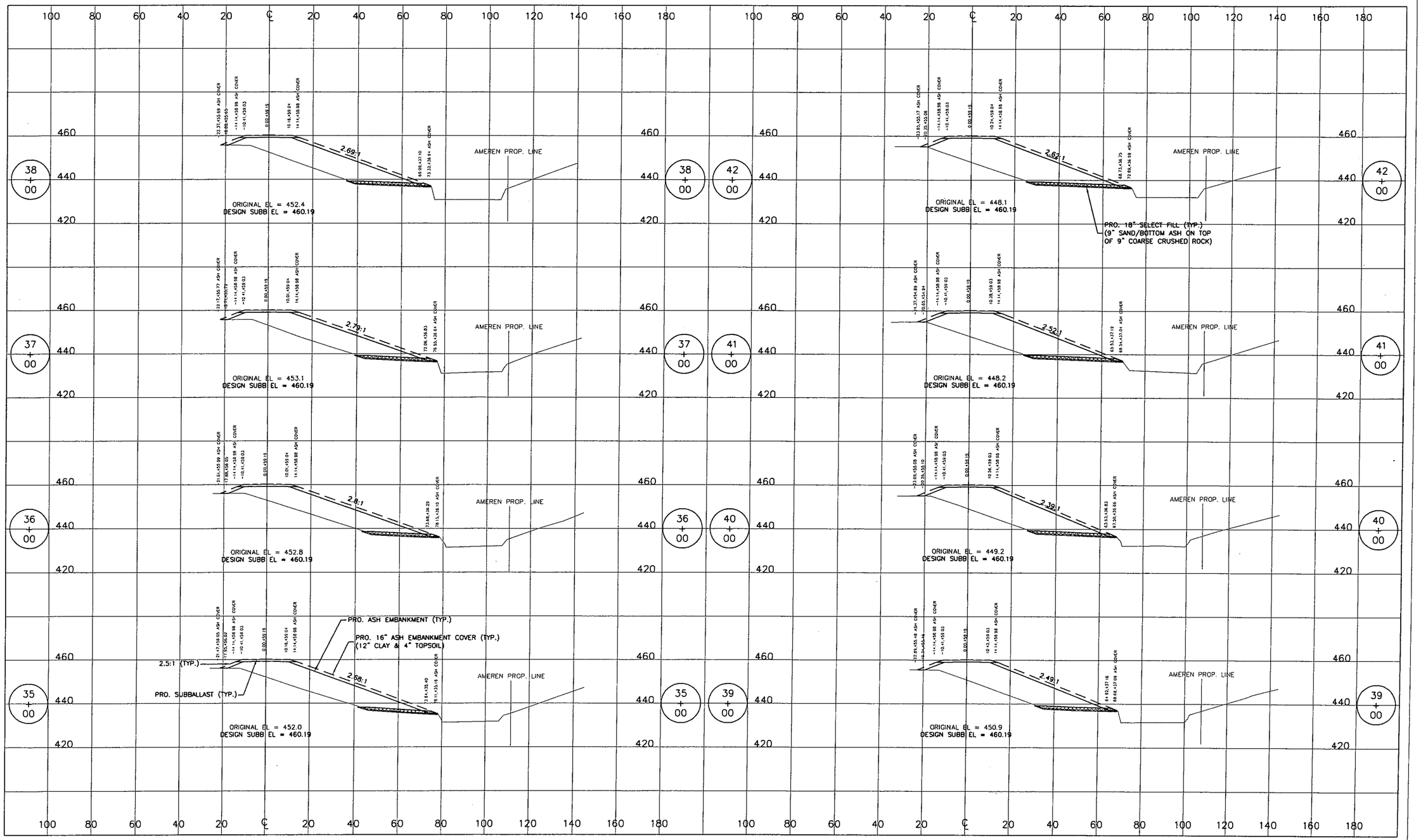

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APPD.	

PROPOSED 150 CAR LOOP TRACK
FOR EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

LOCATION	CROSS SECTIONS – LOOP TRACK STA. 35+00 TO STA. 42+00	CLASS
ST. LOUIS, MISSOURI	DRAWING NO. 03057-1X	SHEET NO. 16 OF 25
AmerenCILCO		REV. 1

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REV.	W.O.	
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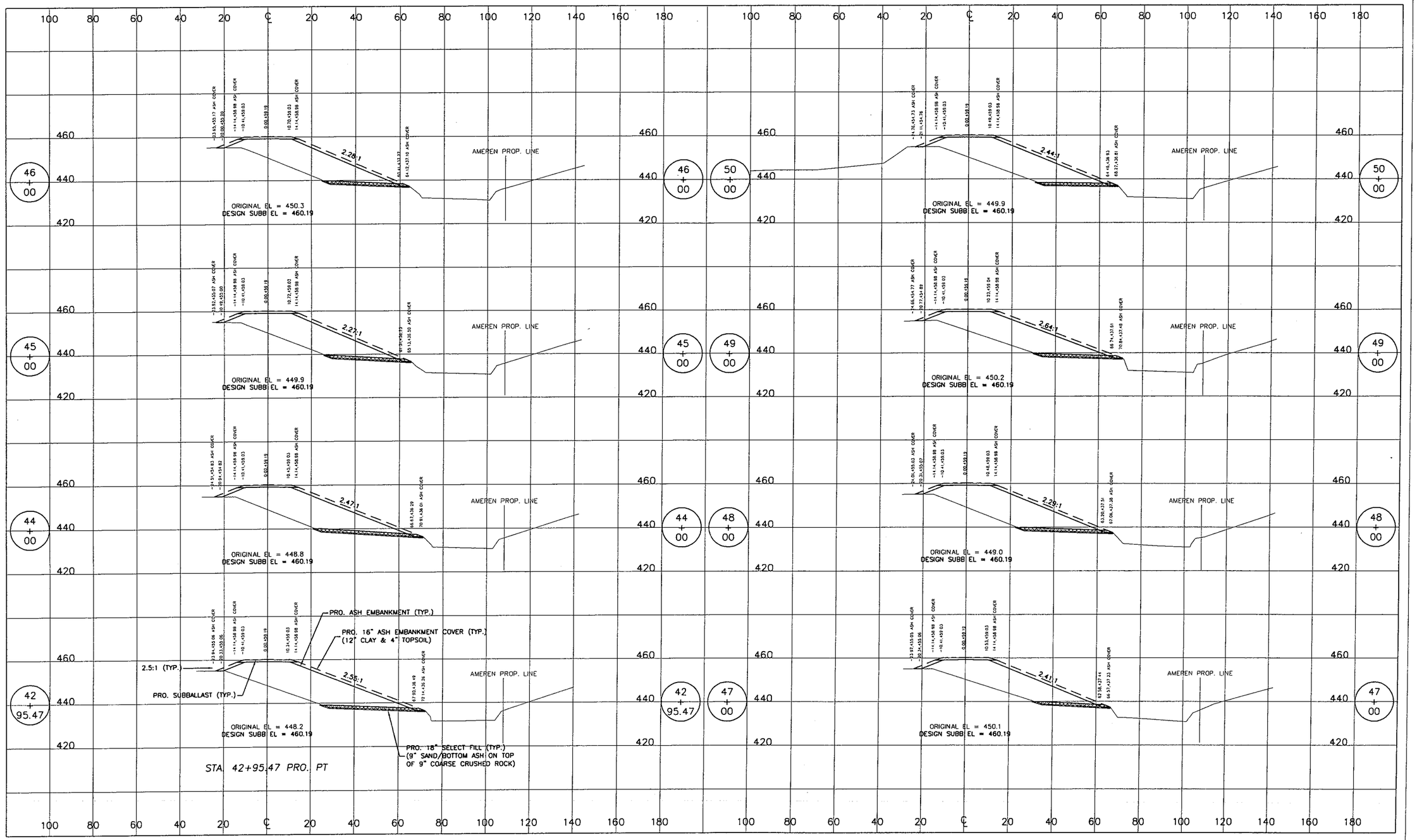

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ENGINEERING SERVICES FOR RAILROADS AND INDUSTRY
ST. LOUIS, MO.

PREPARED FOR AmerenCILCO

DRAWN	SPH
CHKD.	GTH
SUPV.	
APPD.	

PROPOSED 150 CAR LOOP TRACK
FOR EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

LOCATION	CROSS SECTIONS - LOOP TRACK STA. 42+95.47 TO STA. 50+00	CLASS
ST. LOUIS, MISSOURI AmerenCILCO	DRAWING NO. 03057-1X	SHEET NO. 17 OF 25
		REV. 1

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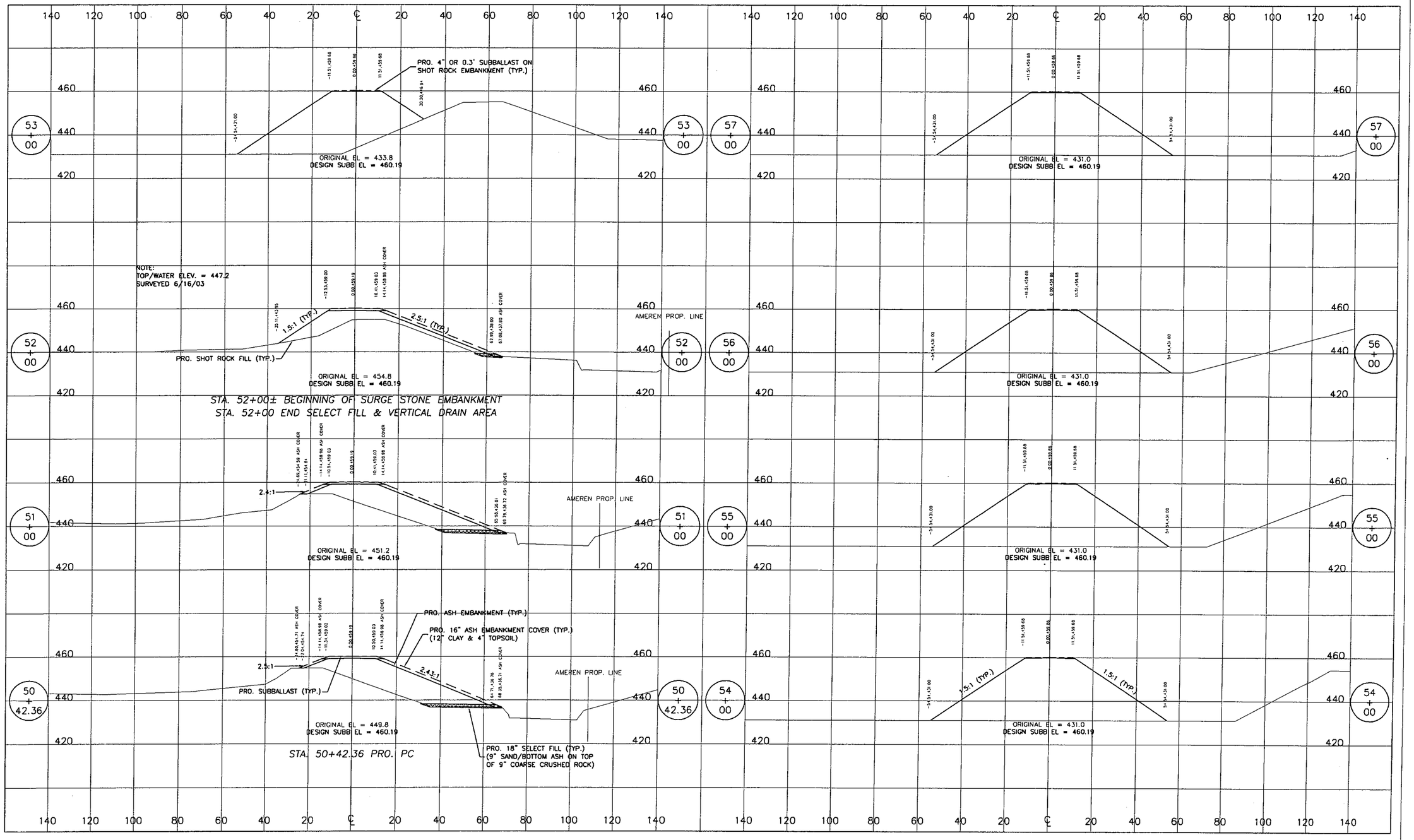

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DESIGN NINE, INC.
ENGINEERING SERVICES FOR RAILROADS AND INDUSTRY
ST. LOUIS, MO.

PREPARED FOR AmerenCILCO

DRAWN	SPH
CHKD.	GTH
SUPV.	-
APPD.	-

PROPOSED 150 CAR LOOP TRACK
FOR EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

LOCATION	CROSS SECTIONS - LOOP TRACK STA. 50+42.36 TO STA. 57+00	CLASS
ST. LOUIS, MISSOURI AmerenCILCO	DRAWING NO. 03057-1X	SHEET NO. 18 OF 25
		REV. 2

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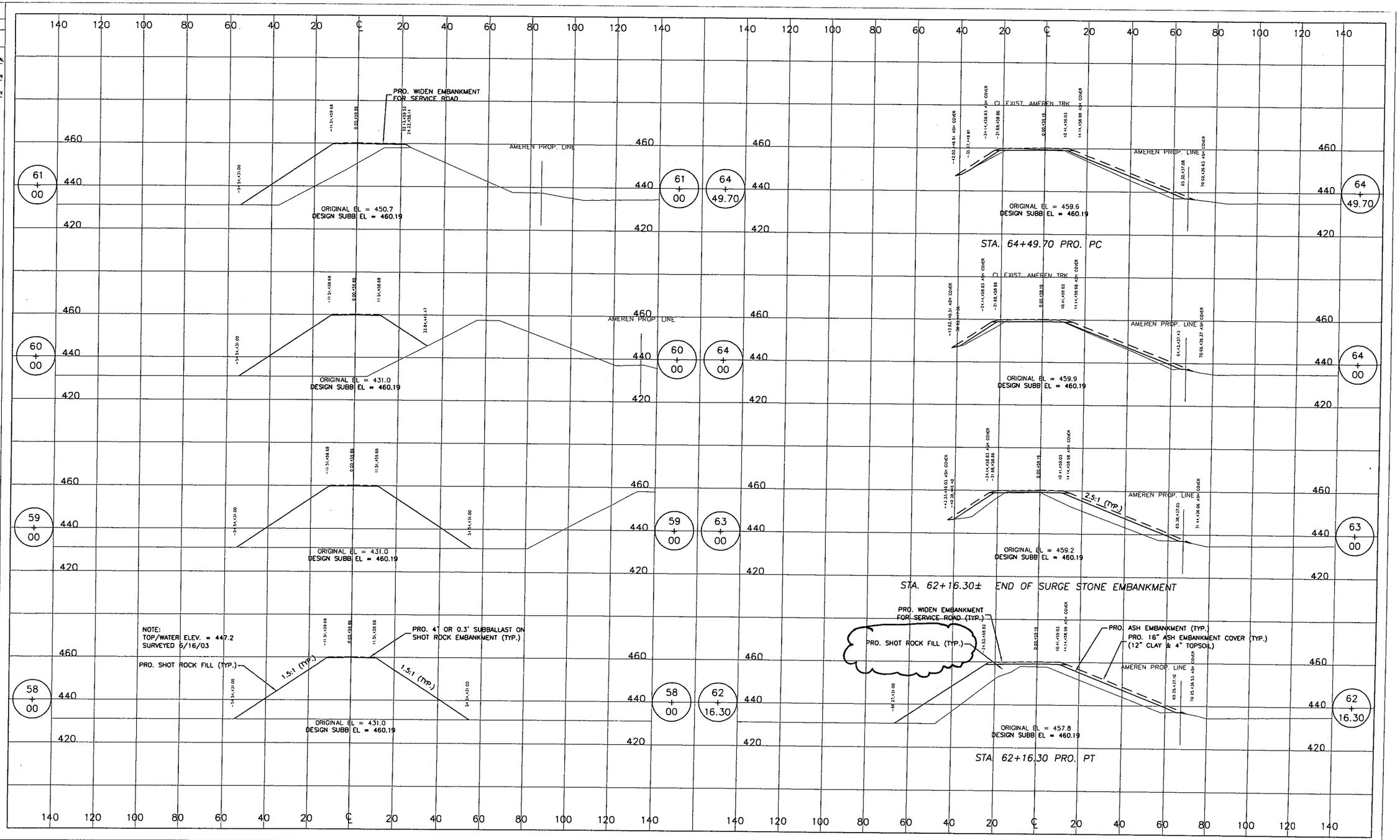

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ST. LOUIS, MO.

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CHKD.	GTH
SUPV.	
APPD.	

PROPOSED 150 CAR LOOP TRACK
FOR EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

LOCATION	CROSS SECTIONS – LOOP TRACK STA. 58+00 TO STA. 64+49.7	CLASS
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AmerenCILCO		REV. 2

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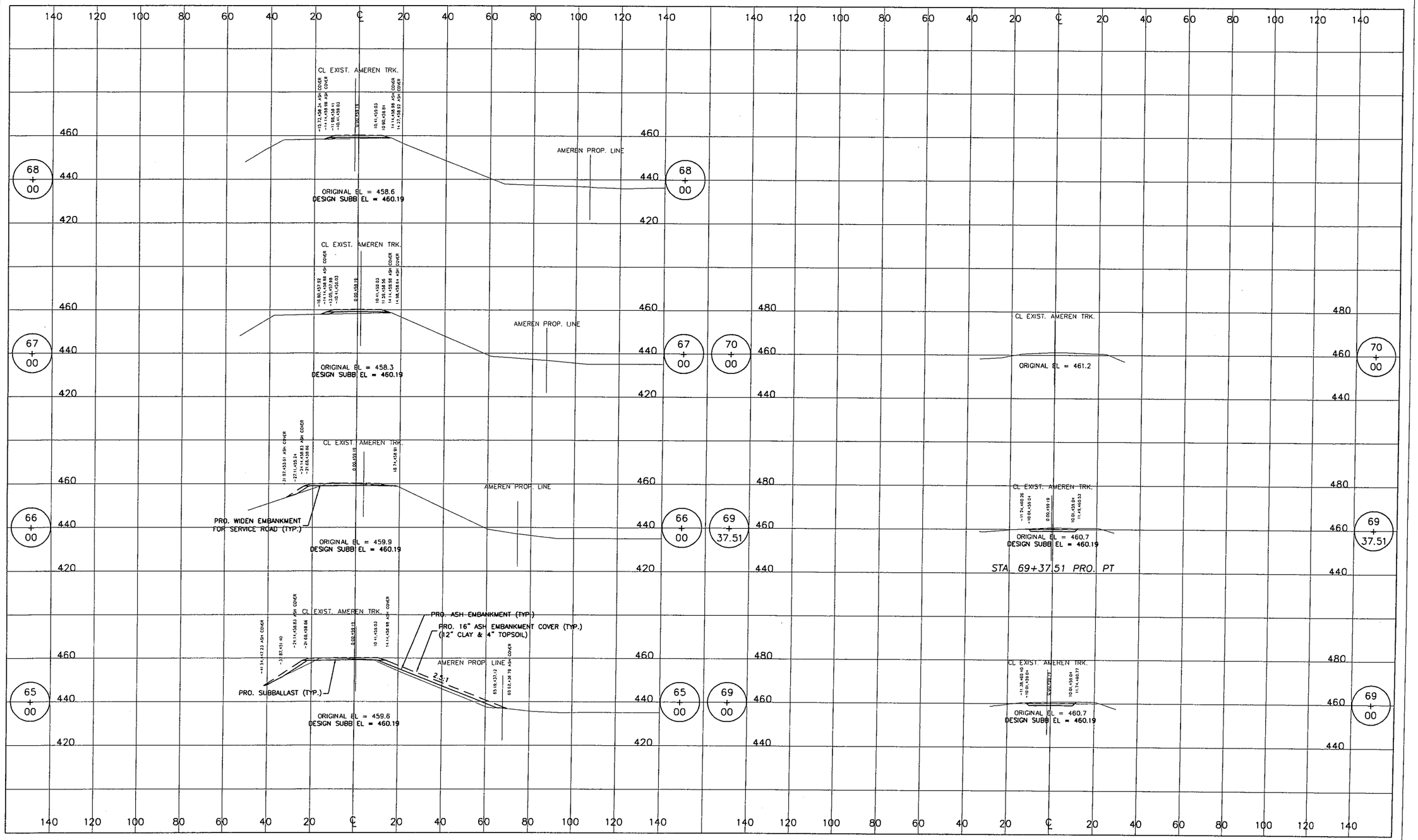

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DESIGN NINE, INC.
ENGINEERING SERVICES FOR RAILROADS AND INDUSTRY
ST. LOUIS, MO.

PREPARED FOR AmerenCILCO

DRAWN	SPH	PROPOSED 150 CAR LOOP TRACK FOR EDWARDS POWER PLANT BARTONVILLE, ILLINOIS		
CHKD.	GTH			
SUPV.				
APPD.		LOCATION: CROSS SECTIONS - LOOP TRACK STA. 65+00 TO STA. 70+00		CLASS
AmerenCILCO ST. LOUIS, MISSOURI		DRAWING NO. 03057-1X	SHEET NO. 20 OF 25	REV. 2

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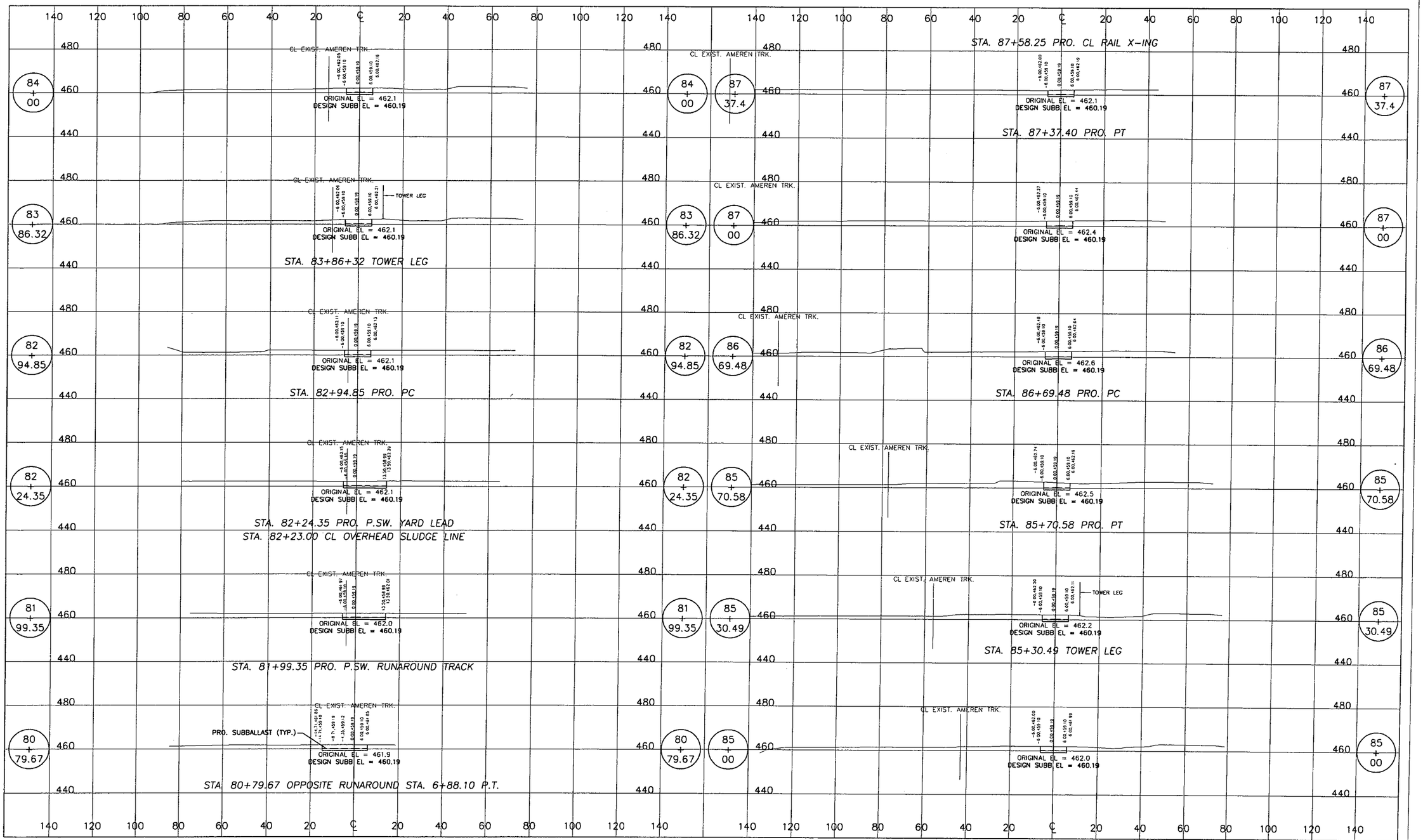

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ENGINEERING SERVICES FOR RAILROADS AND INDUSTRY
ST. LOUIS, MO.

PREPARED FOR AmerenCILCO

DRAWN	SPH
CHKD.	GTH
SUPV.	.
APPD.	.

PROPOSED 150 CAR LOOP TRACK
FOR EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

LOCATION	CROSS SECTIONS - LOOP TRACK STA. 80+79.67 TO STA. 87+37.4	CLASS
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AmerenCILCO		REV. 1

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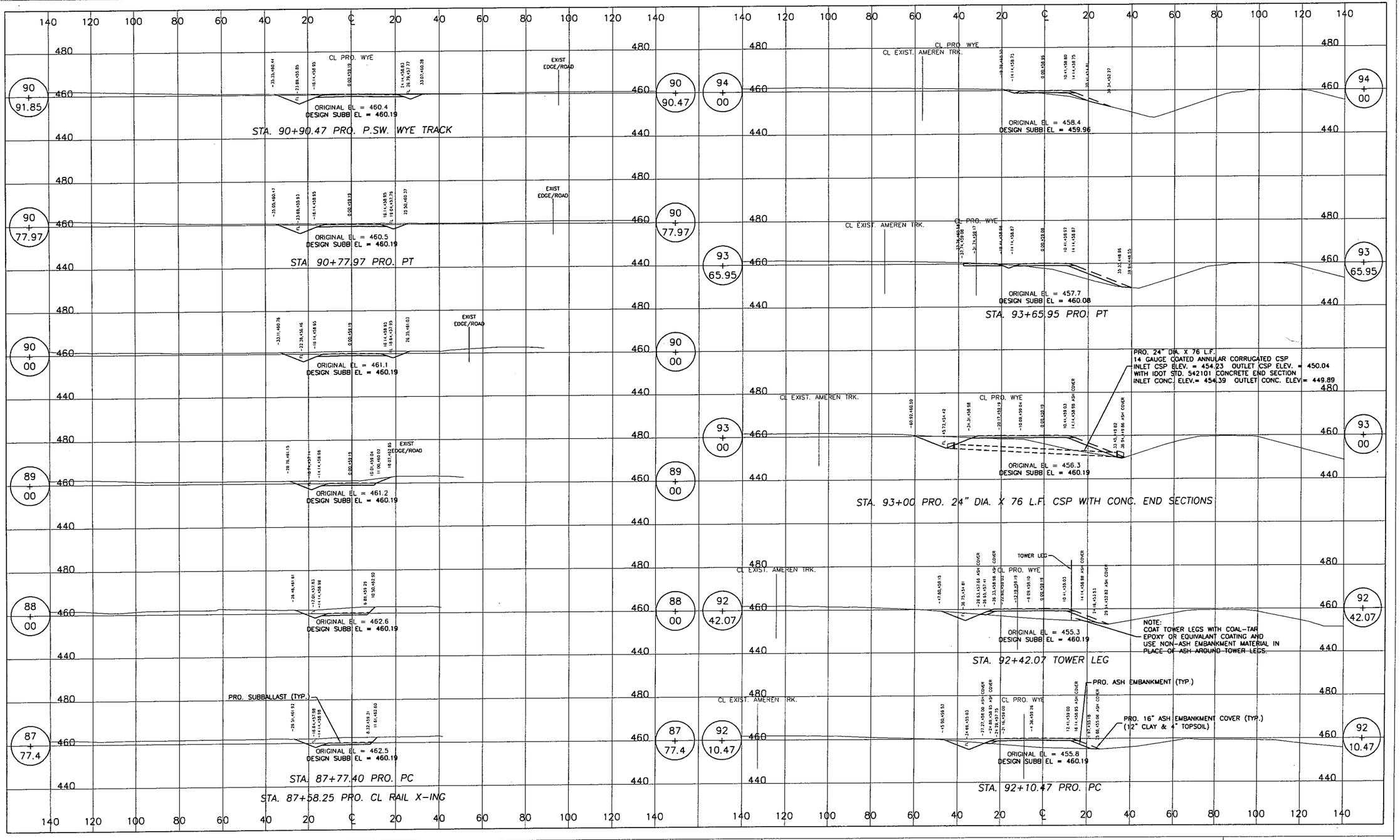

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ENGINEERING SERVICES FOR RAILROADS AND INDUSTRY
ST. LOUIS, MO.

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APPD.	

PROPOSED 150 CAR LOOP TRACK
FOR EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

LOCATION	CROSS SECTIONS - LOOP TRACK STA. 87+77.4 TO STA. 94+00	CLASS
ST. LOUIS, MISSOURI	DRAWING NO. 03057-1X	SHEET NO. 22 OF 25	REV. 2

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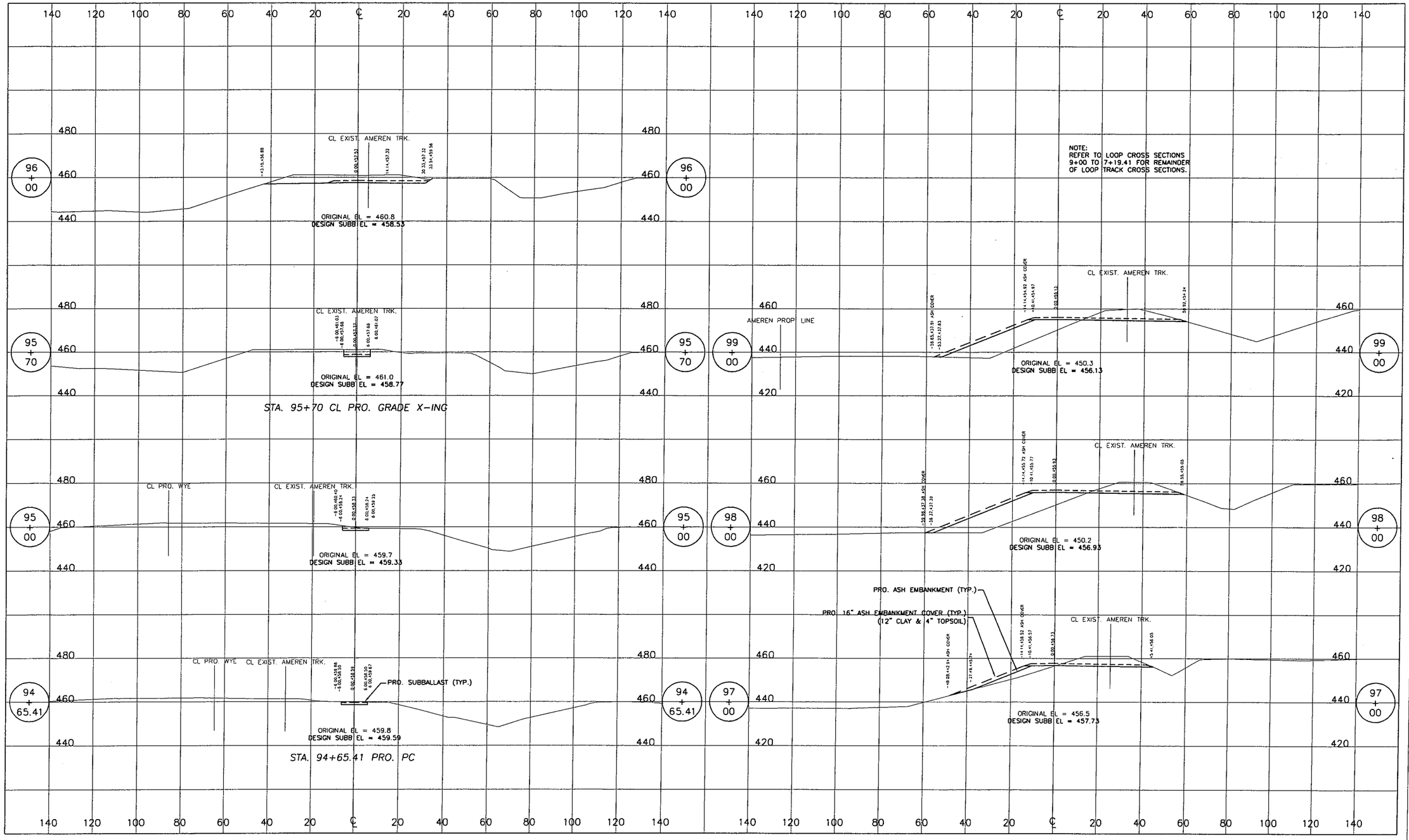

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ST. LOUIS, MO.

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CHKD.	GTH
SUPV.	
APPD.	

PROPOSED 150 CAR LOOP TRACK
FOR EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

LOCATION	CROSS SECTIONS - LOOP TRACK STA. 94+65.41 TO STA. 99+00	CLASS
ST. LOUIS, MISSOURI	DRAWING NO. 03057-1X	SHEET NO. 23 OF 25	REV. 2

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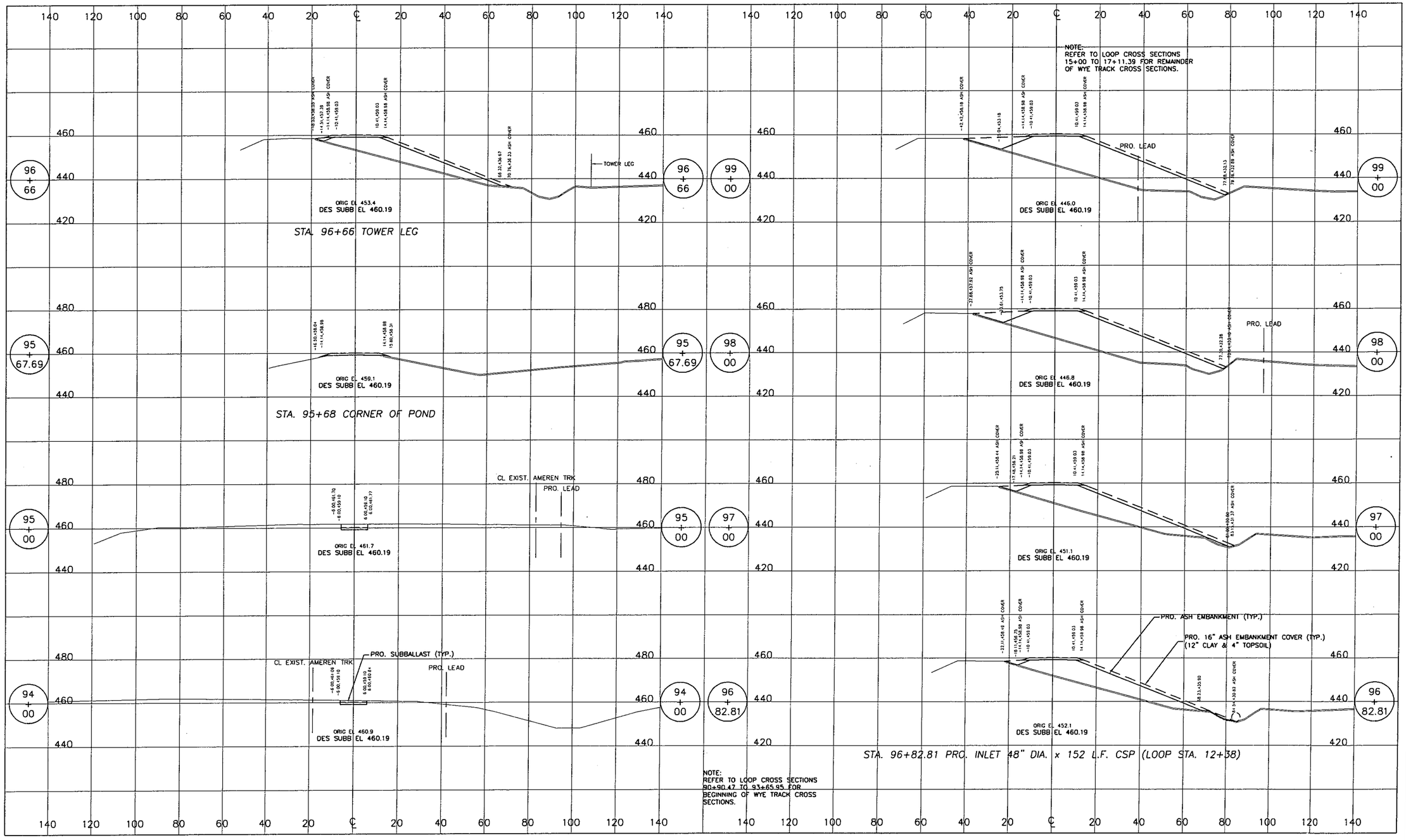

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ENGINEERING SERVICES FOR RAILROADS AND INDUSTRY
ST. LOUIS, MO.

PREPARED FOR AmerenCILCO

DRAWN	SPH
CHKD.	GTH
SUPV.	-
APPD.	-

PROPOSED 150 CAR LOOP TRACK
FOR EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

LOCATION	CROSS SECTIONS - WYE TRACK STA. 94+00 TO STA. 99+00	CLASS
ST. LOUIS, MISSOURI AmerenCILCO	DRAWING NO. 03057-1X	SHEET NO. 24 OF 25
		REV. 2

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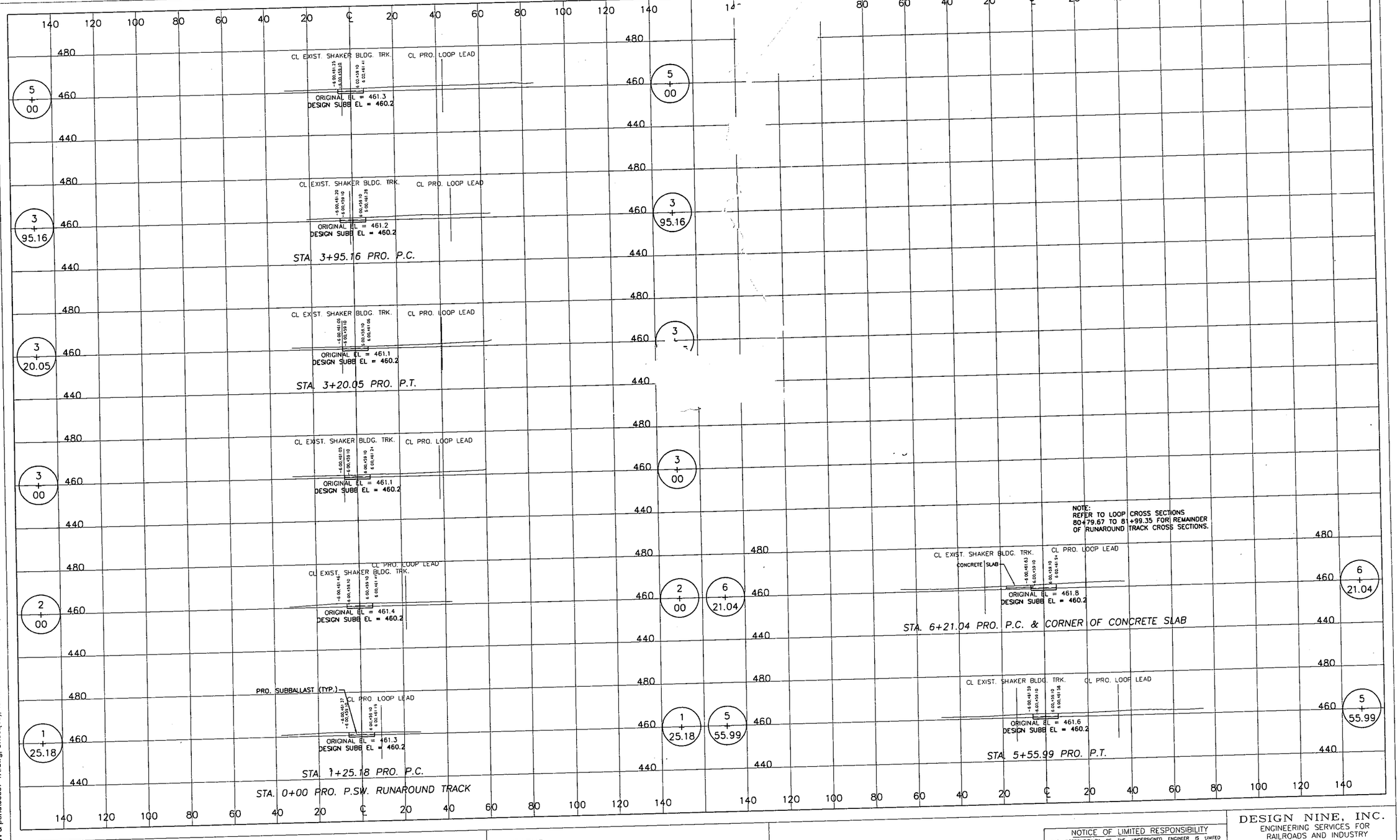

NOTE:
REFER TO LOOP CROSS SECTIONS 80+79.67 TO 81+99.35 FOR REMAINDER OF RUNAROUND TRACK CROSS SECTIONS.

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ST. LOUIS, MO.

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SUPV.	
APPD.	

PROPOSED 150 CAR LOOP TRACK
FOR EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

LOCATION	CROSS SECTIONS -- RUNAROUND TRACK STA. 1+23.8 TO STA. 6+86.72	CLASS
ST. LOUIS, MISSOURI AmerenCILCO	DRAWING NO. 03057-1X	SHEET NO. 25 OF 25	REV. 2

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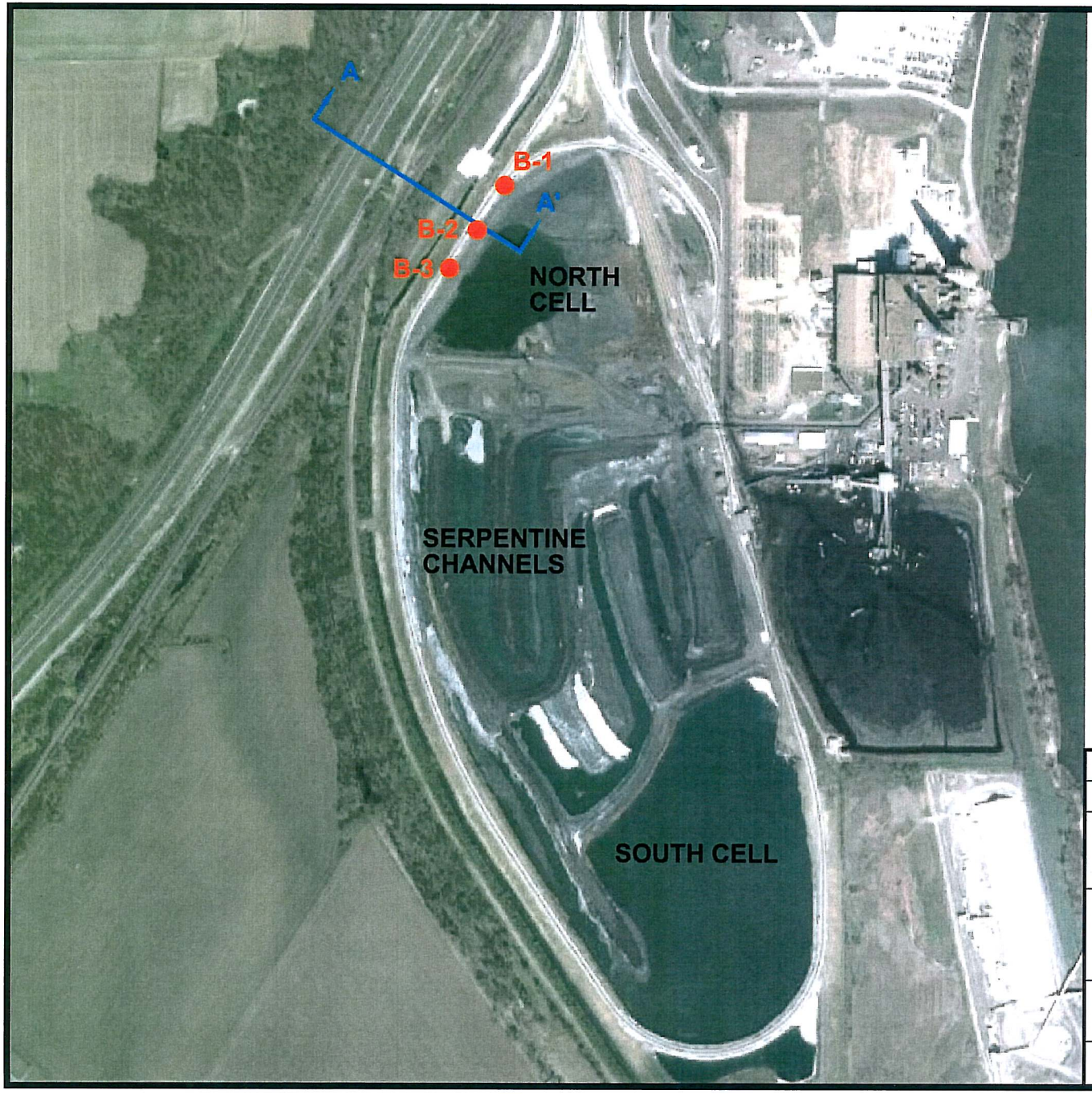
AECOM

Appendix C: Edwards Power Station Piezometer Locations



NOTES

1. Plan adapted from an aerial drawing courtesy of Google Earth, dated May 14, 2004.

LEGEND

- Boring Location
- Slope Stability Cross Section

N

0 1000 2000

SCALE IN FEET

Drawn By: SLC	Ck'd By: SA	App'vd By: DJW
Date: 11-09-10	Date: 12/2/10	Date: 1/4/11

GEOTECHNOLOGY INC.
ENGINEERING AND ENVIRONMENTAL SERVICES
ST. LOUIS • COLLINSVILLE • KANSAS CITY

E. D. Edwards Power Station
Bartonville, Illinois

AERIAL PHOTOGRAPH OF SITE AND BORING LOCATIONS

Project Number J017150.01	PLATE 2



EXPLORATION METHOD (B=BORING, C=CPT, P=PIEZOMETER)

XXX-X###

ID NUMBER

STATION ABBREVIATION

SOURCE:
MAP PROVIDED BY GOOGLE EARTH PRO 2015

LEGEND

PIEZOMETER LOCATION

CCR UNIT BERM ALIGNMENT

N

0 400

APPROXIMATE SCALE FEET

Illinois Power Resources Generating, LLC

PROJECT NO. 60440202

AECOM

DRN. BY: djd October 2015
DSGN. BY: eg
CHKD. BY: eg

Edwards Ash Pond Piezometer Locations

FIG. NO. 2A

File: P:\PROJECTS\GEOTECH\60428794_DYNEGYCCR\Q4TASKS\00 PROGRAM TASKS\1.0 TASK 1 INITIAL UNIT ASSESSMENT\CCR FACT SHEETS\SITE MAPS\FIGURE 2A PIEZOMETER LOCATION PLAN (EDWARDS ASH POND).DWG Last edited: NOV. 04, 15 @ 09:32 a.m. by: david_deguire

AECOM

Appendix D: Operation and Maintenance Manual for Ash Ponds and Levees

Edwards Power Station

Operational Procedure

x-xxx-xxxx--xxx

Operation & Maintenance Manual for Ash Ponds and Levees

Effective Date: xx/xx/xxxx

Reason for Change: New Procedure

Approved By: *x* Date: xx/xx/xxxx

x
Greg Russell

Responsible Department: Edwards Power Station, Technical Services Department

- ☐ This entire document shall be in the field during procedure performance.
- ☐ The following portions of this procedure shall be in the field during procedure performance: _____
- ☐ _____ from this procedure shall be in the field during procedure performance.
- ☐ No part of this procedure is required to be in the field during procedure performance.

Table of Contents

Section		Page Number
1.0	Purpose	1
2.0	Scope	1
3.0	Responsibilities	1
4.0	Historical Information	1
5.0	Flow Regulating Structures	2
6.0	Operations Requirements	4
7.0	Maintenance Requirements	4
8.0	Maintenance Logs	5
9.0	Contact Numbers	6
10.0	References	6
11.0	Records	7

1.0 Purpose

1.1 This procedure is intended to ensure the safe and environmentally responsible operation and use of all water impoundment and levee structures at Edwards Power Station facility. The primary purpose of the Edwards Fly Ash Pond is for the storage of fly ash and treatment of fly ash sluice water to meet NPDES Permit Conditions. The primary purpose of the Pekin-Lamarsh Levee is flood prevention. This procedure then assures:

1.1.1 The embankment structures and flow regulating structures are properly operated and maintained.

1.1.2 Inspections of these structures are conducted.

1.1.3 A maintenance program will be performed.

1.1.4 Communication takes place with the Dam Safety Staff regarding the structures' condition and operation.

2.0 Scope

2.1 This procedure applies to all onsite personnel and the Dam Safety Group staff.

3.0 Responsibilities

3.1 On-site Technical Services – Conducts ash pond and levee embankment and structure observations and completes the inspections, reporting any undesirable conditions to the Supervising Engineer, Dam Safety.

3.2 On-site personnel – Operates the facilities as described in this Operational Procedure. Reports any conditions noted during routine activities to the shift supervisor. Coordinates scheduling of maintenance as required to maintain proper operations of the ash pond facility.

3.3 Shift Supervisor (SS) - Calls Technical Service personnel when structure concerns are reported. Make entries into the shift log book indicating the concern and actions taken.

3.4 Supervising Engineer, Dam Safety - Conducts annual detailed dam safety inspections and provides a report with findings and recommendations.

4.0 Historical Information

4.1 Plant construction started in 1959. The original ash pond was located north of Unit 1 in the area of the current switch yard. In the 1960's, the current

ash pond was opened. Original plans show the top of berm elevation to be constructed at 462'. Site surveys and geotechnical borings show the height of the berm to be 455± and the clay core at 452±. In 2004, the top berm was raised and outer embankment thickened to allow for construction of a railroad loop for coal train unloading. The south end of the pond was cut-off by the rail loop embankment and was subsequently filled in with ash, then covered with a topsoil cap. Specifications for the construction of the original ash pond berm are not available.

4.2 The Pekin-Lamarsh Levee was constructed by the Pekin & Lamarsh Drainage and Levee District. The U.S. Army Corps of Engineers inspects the levee annually and sends the reports to the levee district. The levee district requested that the ash pond outlet pipe be inspected after the Corps inspection in 2008. Due to high water in the Illinois River, the inspection was not completed until December, 2009. The inspection report is on file in the Dam Safety office. Plans of the outlet pipe construction are on file as listed in the table below.

5.0 Flow Regulating Structures

5.1 Embankments

- North Levee (Pekin-Lamarsh Levee District)
  The North Levee is approximately 1300' long with a top elevation of 458'±. This levee was built prior to construction of the plant. There are no known levee penetrations in this portion of levee. Construction of the power plant broke the continuous section of levee into two parts. At the plant, the landside area has been filled to the top of levee. Nature of the fill is not known.

- South Levee (Pekin-Lamarsh Levee District)
  The South levee is approximately 2200' long with a top elevation of 458'±. The levee was constructed prior to construction of the plant. Penetrations thru the south levee include the ash pond drainage pipe and slide gate, cooling water intake, and cooling water discharge piping. Plans for construction of the ash pond drainage pipe, cooling water discharge duct, and cooling water intake pipe/screen house are on file. We currently do not have copies of the original levee drawings on file.

- Ash Pond (Bottom Ash / Fly Ash)
  Top of ash pond berm elevation was originally designed at Elevation 462.00, but the berm was not constructed to this elevation. See attached design plans (1960) and site surveys (2003). From boring logs done in 2003, the top of clay core is approximately 452±. This top of clay elevation

varies around the embankment. In 2004, the east and south berms were modified to accommodate the rail loop. Currently, the top of rail is at elevation 462.40 with top of subgrade being 2.2' below top of rail, or 460.20.

The ash pond is divided into several components: 1.) Fly ash settling basin on the south; 2.) Serpentine channels in the center; and 3.) Bottom ash/Process water basin on the north. The basins are separated by interior dikes constructed of ash. Elevations of the interior dikes are slightly above the exterior embankments at the serpentine channels. Water level in the pond should always be kept 2 feet below the level of the clay core (452.00) in the embankment. Therefore, normal high pool elevation is 450.00. This allows for 2.9 feet of storage depth over the top of the ash pond outlet structure; or approximately 116 acre-ft storage or 37,850,000 gallons (45% of 89 acres times 2.9' deep).

5.2 Structures

- Ash Pond Outlet Structure - The water level in the pond is regulated by the pond outlet structure on the east side of the pond. Plans showing the outlet structure and walkway are on file. The pond outlet structure shall be checked regularly (at least weekly or more often if there are excessive rain events) to ensure proper pond discharge. Elevation of the top of the structure is 447.1'446.1. Elevation of the walkway is 456.4'455.4. Normal depth of flow over the drop structure is 3 to 4 inches during non-rainfall discharge. A 36-inch diameter CMP exits the outlet structure.
- Outlet Pipe Slide Gate – A 36-inch diameter cast iron slide gate regulates flow from the ash pond to the Illinois River. In flood conditions, this gate is closed to prevent flood water from backing up into the pond. The gate is located on the south end of the Pekin-Lamarsh Levee. It is a positively seating gate (flood condition). The gate is actuated by a manual wheel operator at the top of the structure. Depth of the gate is approximately 25'. Plans showing the construction details of the slide gate structure are on file.
- Outlet Pipe Flap Gate – A 36-inch diameter circular cast-iron automatic drainage flap gate is located at the end of the ash pond outlet pipe, 90 feet downstream of the slide gate. This is a general purpose flap gate to keep debris and flow from entering the outlet pipe. The flap gate is 36" diameter. Plans showing notes relating to the flap gate construction are on file.
- Bottom Ash/Process Water Culvert Pipe – This culvert regulates the level of water in north basin of the Ash Pond. This pipe is located in a berm

constructed from ash. Flowline elevations of the pipe are 449.38' inlet and 448.30' outlet.

- Fly Ash Culvert Pipes – Two culvert pipes are located near the sluice pipe outlet to deliver flow into either of two serpentine channels. Each serpentine channel is constructed of ash and used to settle-out the majority of ash prior to the flow entering the south basin. The two serpentine channels are alternated as the ash accumulates and is excavated or dredged from the channel.

6.0 Operations Requirements

Normal Operation - Plant personnel shall monitor the level of all ash pond basins within the perimeter ash pond berm on a daily basis. If levels within any of the basins exceed the prescribed maximum levels, action shall be taken immediately to remedy the situation.

Normal Operating Levels	
Ash Pond Outlet Structure	447.1'
South Pond Water Level	447.3'
North Pond Process Water Culvert Pipe	449.38
North Basin Water Level	449.5'

Illinois River Flood Stage – Plant personnel shall monitor the Illinois River level when approaching and exceeding flood stage on a daily basis. When river level equals the ash pond water level and the river is rising, the slide gate at the Pekin-LaMarsh levee should be closed. Ash pond water levels and river levels should then be monitored on a daily basis to determine when the slide gate should be opened to allow flow from the pond to the river. At no time should water from the river be allowed to flow into the pond.

Emergency Conditions – If a condition arises where there is a possibility of an embankment failure, then the following procedures will be followed:

1. Notify the Supervising Engineer Dam Safety immediately.
2. The pond level will be lowered by portable pumps. Monitor the embankment for changed conditions.

7.0 Maintenance Requirements

7.1 Maintenance Program - The plant's impoundment and flood prevention structures shall be inspected and maintained in a manner to ensure safe and environmentally responsible operations. A regular maintenance program shall be performed and shall consist of the following inspection items:

1. Earth embankments: Walk the crest, side slopes, and downstream toe of the dam concentrating on surface erosion, seepage, cracks,

settlement, slumps, slides, and animal burrows. Frequency of inspection: Quarterly.

2. Vegetation: Grass should be a thick vigorous growth to stabilize the earth embankment soils and prevent erosion form occurring. Note the height of the grass; if greater than one foot a mowing of the area should be scheduled before the next inspection. There should be NO trees on the earth embankment and none within a minimum of 20 feet of the embankment toe or other structures. Frequency of inspection: Quarterly.
3. Pond Outlet Structure: Check for any debris or other obstructions around the concrete inlet which may block or restrict the flow of water. Check for the development of any rusty areas on the concrete, and seepage, cracking, breaking, or spalling of concrete. Check for settlement or cracking in the walkway structure. Frequency of inspection: Quarterly.
4. Outlet Pipe Slide Gate: Check the structure for development of any rusty areas on the concrete, and seepage, cracking, breaking, or spalling of concrete. Check the slide gate stem, grease the stem, and operate the slide gate through its full range of motion to ensure proper operation. Check for buildup of debris in the manhole. Frequency of inspection: Quarterly.
5. Pond/Levee Perimeter: Check the perimeter of the embankment and levee for a distance of at least 100 feet from the toe for signs of seepage or boils. Inspection frequency for levee will be determined by Dam Safety Engineer during flood events. Frequency of ash pond embankment inspection: Quarterly for ash pond embankment.
6. Special Inspections – Special inspections of the levees and ash pond berms shall be performed after earthquakes, floods, water level exceedance in the ponds, or heavy rainfall events. Inspection and report shall be equal to an annual inspection level of detail. Water level in the pond should be noted after a heavy rainfall. Dam Safety staff shall accompany plant personnel on special inspections. Frequency: As required.

8.0 Maintenance Logs

8.1 Plant personnel shall maintain an up-to-date log of operations (water levels, gate adjustments, inlet and outlet flows, serpentine channels, etc.), visual observations, unusual occurrences, and maintenance performed. The log book shall be reviewed during the Annual Engineering Inspection. Logs shall be kept for the life of the plant.

9.0 Contact Numbers

Plant Environmental Supervisor: Mark Davis / 309-633-2861
Plant Operations Office: 309-633-2409
Plant Control Room: 309-633-2428 / 309-633-2425
Supervising Engineer Dam Safety: Steve Bluemner / 314-554-6298
Dam Safety Staff Contact: Mike Wagstaff / 314-554-6296

10.0 References

10.1 AER - DSP-004, "Dam Safety Program for Non-Illinois Department of Natural Resources (non-IDNR) Regulated Facilities"

10.2 Drawings

Drawing Number	Sheet Name	Date
C175-G1915 Rev 2 Sheet A	Corps Permit Applications (Pekin-Lamarsh Levee Penetrations)	6-30-1960
C175-G3902 Rev. Sheet 3	Edwards Plant Site Layout	2-21-1986
C175-G3903 Rev. W Sheet 1	Plant Yard Layout	7-1-1969
C175-G3902 Rev. 0 Sheet 1	Plant Site Survey and Layout	8-7-1967
C175-G1913 Rev. C Sheet 2	Yard Drainage Details	7-31-1958
C175-G1913 Rev. Sheet 3	Yard Drainage Details – Catch Basins and Manholes	4-22-1958
C175-G1906 Rev. A Sheet 5	Plant Site Fill – Depressions Infill for Yard Foundations	5-14-1958
CSK-010 Rev. 0 Sheet	Sanitary Sewer Force Main Plan	2-19-2007
03057-	Proposed 150 Car Loop Track	12-3-2003
C175-G1906 Rev. D Sheet 1	Plant Site Fill – Phase #1	5-6-1958
C175-G1906 Rev. C Sheet 4	Plant Site Fill – Phase #1	5-6-1958
C175-G1906 Rev. B Sheet 2	Plant Site Fill – Phase #2	5-6-1958
C175-G1906 Rev. F Sheet 3	Plant Site Fill – Phase #3	5-6-1958
C175-G1921 Rev. D Sheet 2	Construction Thru Levee / Ash Pond Drainage Duct Detail	6-17-1958
201032 S-1 Rev 1	Overflow Pipe Area Site Plan / Ash Pond Floating Boom Replacement	7-23-2004
201032 S-2 Rev 1	Access Bridge Steel Framing / Ash Pond Floating Boom Replacement	7-23-2004
201032 S-3 Rev 1	Ash Pond Floating Boom Replacement / Hardboom and Stiff Arm Details	7-23-2004
C175-G3077 Rev. C Sheet 2	Site Equipment & Piping Layout	9-10-1976

10.3 Easements: Executed Easement Agreement dated 7 August 1957, between Pekin & Lamarsh Drainage and Levee District and Central Illinois Light

Company, for an easement in perpetuity for the maintenance of the levee. A copy of this document resides in the Dam Safety files.

11.0 Records

	Record Type	Responsible Person	Retention Period	Location
11.1	Copies of weekly inspections	Plant Technical Services	Life of plant	Onsite Environmental Supervisor and Dam Safety Department office
11.2	Copies of Quarterly inspections	Plant Technical Services	Life of plant	Onsite Environmental Supervisor and Dam Safety Department office
11.3	Log Book	Plant Technical Services	Life of plant	Onsite Environmental Supervisor office

AECOM

Appendix E: Photos of 2009 Surficial Movement



Figure E.1: Photo of 2009 Surficial Movement



Figure E.2: Photo of 2009 Surficial Movement



Figure E.3: Photo of Surficial Movement Area after Repairs



Figure E.4: Photo of Surficial Movement Area after Repairs

APPENDIX D
TYPES OF CCR AND CHEMICAL CONSTITUENTS (845.220(a)(2)(A)

Edwards Power Plant -- Ash Pond's Chemical Constituents

In accordance with 35 I.A.C. 845.230(d)(2)(C), IPRG is submitting available/existing analyses of "the chemical constituents of all waste streams, chemical additives and sorbent materials entering or contained in" the CCR impoundment, Ash Pond.

A list of the chemical constituents' analyses contained in the IPRG surface impoundment can be found in Appendices A and B. Appendix A contains chemical constituents found in the surface free liquid and the subsurface free liquids as determined through antidegradation studies.

Table 1 in Appendix B contains results for chemical constituents found in the solid CCR material. Three locations for solid CCR material collection were selected by evaluating the extent of ash through time on aerial photographs (Figure 1 in Appendix B), identifying visible differences (color) in surficial materials, and capturing a representative spatial distribution (both vertically and horizontally). Sample locations were also selected based on ability to access safely (Figure 2 in Appendix B). Samples from one or two depth intervals were collected at each of the three sampling locations.

IPRG is also including a list of chemical additives, sorbent materials and waste streams that were submitted in the facility's NPDES permit applications to IEPA within the past ten years at a minimum and/or listed in the current NPDES permit (IL0001970) in Appendix C.

Appendix A: Aqueous Chemical Constituents Contained in the Ash Pond

Pollutant	Units	Surface Free Liquids Average Concentration	Subsurface Free Liquids Average Concentration
Ammonia	mg/L	< 0.275	1.71
Arsenic	mg/L	0.002	0.023
Arsenic, Dissolved	mg/L	< 0.00007	< 0.0004
Barium	mg/L	0.166	0.161
Boron	mg/L	0.332	15.5
Cadmium	mg/L	0.0002	0.0005
Cadmium, Dissolved	mg/L	0.0001	< 0.0001
Chloride	mg/L	103	100
Chromium	mg/L	0.002	0.011
Chromium (hexavalent)	mg/L	< 0.009	< 0.007
Chromium, Trivalent	mg/L	< 0.0002	< 0.0002
Copper	mg/L	0.005	0.011
Copper, Dissolved	mg/L	0.004	0.002
Cyanide	mg/L	< 0.002	< 0.002
Fluoride	mg/L	0.265	< 0.550
Fluoride, Dissolved	mg/L	0.270	< 0.340
Iron	mg/L	0.635	2.42
Iron, Dissolved	mg/L	0.016	< 0.025
Lead	mg/L	0.001	0.012
Lead, Dissolved	mg/L	0.0001	< 0.0001
Manganese	mg/L	0.021	0.026
Mercury	mg/L	0.0000045	0.0000127
Mercury, Dissolved	mg/L	< 0.0001	< 0.0001
Nickel	mg/L	0.002	0.014
Nickel, Dissolved	mg/L	0.002	0.004
Nitrate - Nitrite	mg/L	4.30	1.00
Nitrogen	mg/L	5.00	3.10
Nitrogen, Total Kjeldahl	mg/L	0.690	2.10
Oil and Grease	mg/L	< 1.20	< 1.08
pH*	SU	7.98	9.71
Phenols	mg/L	< 0.003	< 0.005
Selenium	mg/L	0.001	0.048
Silver	mg/L	< 0.00002	< 0.00005
Sulfate	mg/L	78.1	919
TDS	mg/L	517	1567
Total Hardness by 2340B	mg/L	329	501
TSS	mg/L	14.7	89.8
Zinc	mg/L	0.007	0.040
Zinc, Dissolved	mg/L	< 0.003	< 0.003

*Used https://calstormcompliance.com/ph-averaging-tool

Appendix B Table 1: Solid CCR Chemical Constituents Contained in the Ash Pond

EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Depth (ft BGS)	Sample Date	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Boron (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Lead (mg/kg)	Lithium (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Selenium (mg/kg)	Thallium (mg/kg)
XPW01	17-19	01/08/2021	<6.6	24	840	4	170	7.5	67	11	90	47	<0.44	25	4.9	<2.2
XPW01A	40.5-42.5	01/08/2021	<7	22	190	4.7	700	11	37	4.7	93	<12	<0.46	11	4	<2.3
XPW02	24-25	01/09/2021	20	72	160	6.8	400	2.3	60	19	76	20	<0.32	7	5.5	<1.6
XPW02	43-45	01/09/2021	8.9	42	94	8.3	840	8.5	84	19	140	<91	<0.36	14	6.5	2.1
XPW03	13-15	01/09/2021	<5.5	8	1300	2.2	500	<1.8	27	6.1	14	33	<0.37	3.2	2.2	<1.8
XPW03	35-37	01/09/2021	<7	37	600	5.8	970	20	65	8	130	20	<0.47	11	3.6	<2.3

Notes:
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method.
BGS = below ground surface
ft = feet
mg/kg = milligrams per kilogram

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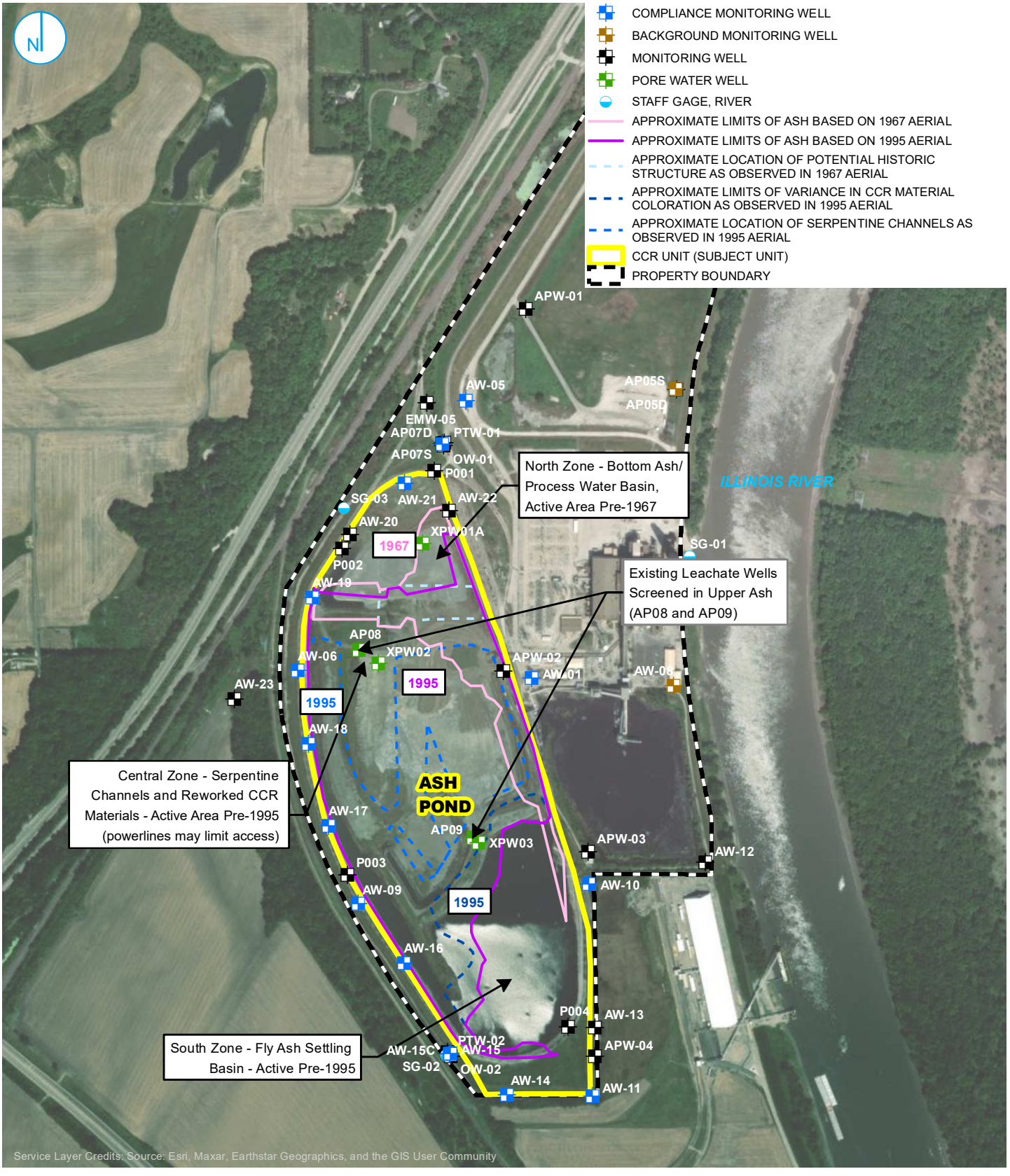


Y:\Mapping\Projects\22\22885\MXD\845\Edwards\ResponseIEPA_2024\Figure 1. Edwards_CCR Characterization.mxd

PROJECT: 169000XXXX | DATED: 3/11/2024 | DESIGNER: GALARNMC

0 400 800 Feet

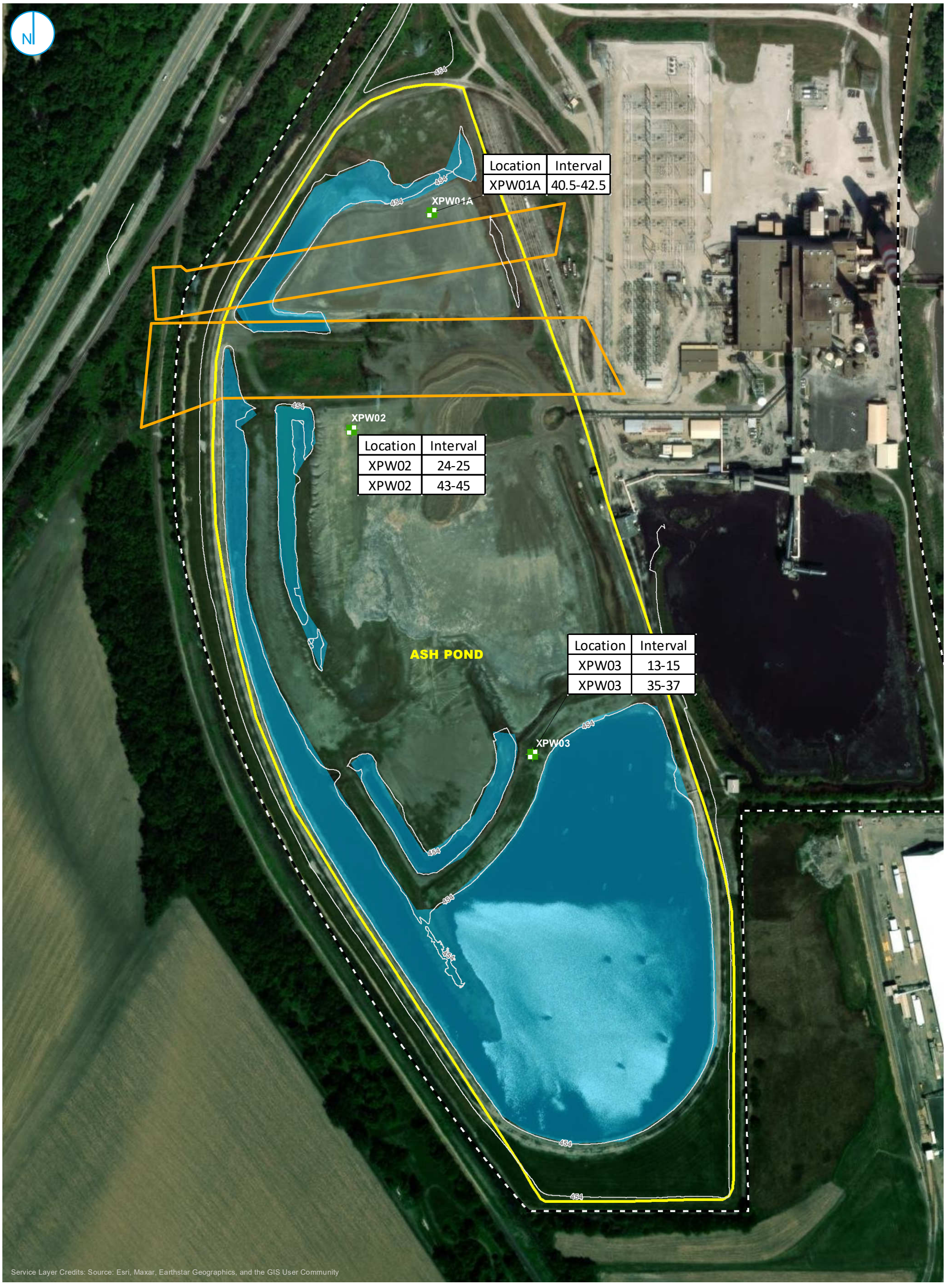
CCR CHARACTERIZATION MAP

EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

APPENDIX B
FIGURE 1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



CCR COLLECTION LOCATION
454 ELEVATION CONTOUR
POWERLINES ABOVE
ELEVATION BELOW 454
REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 150 300 Feet

2022 CONDITIONS

ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

APPENDIX B
FIGURE 2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Appendix C: List of Chemical Additives, Waste Streams and Sorbent Materials

Chemical Additives
Aqueous Ammonia
Bulab 5532 (polymer)
Bulab 8808 (antiscale)
Bulab 8862 (biocide)
Bulab 6057 (biocide)
Calcium Bromide (52%)*
Carbon Dioxide
Ferric Chloride (35%)
Hawkins Aqua Hawk 9937 (polymer)
Hydrated Lime
Hydrochloric Acid (cleaning only)
Molten Sulfur
Sodium Hydroxide (50%)
Sodium Hypochlorite
Sodium Metabisulfate
Strong Acid Cation Resin
Strong Base Anion Resin
Sulfuric Acid (93%)
Kochkleen L-11 (high pH cleaner)

* Only a very small percentage of these chemicals would enter the ash pond. A high majority of the product would be consumed in the combustion process.

Waste Streams and Sorbent Materials*
Fly Ash and Fly Ash Sluice Water
Bottom Ash, Economizer Ash pyrites sluice water
Non-chemical metal cleaning wastewater
Boiler and Turbine Room Sumps
Coal Pile Runoff
Yard Substation and Track Drains
Water treatment wastewater

*No sorbent materials

DYNEGY

Safety Data Sheet

Section 1
Identification of the Substance and of the Supplier

1.1 Product Identifier

Product Name/Identification:	ASTM Class C Fly Ash
Synonyms:	Coal Fly Ash, Pozzolan
Formula:	UVCB Substance

1.2 Relevant Identified Uses of the Substance or Mixture and Uses Advices Against

Relevant Identified Uses:	Component of wallboard, concrete, roofing material, bricks, cement kiln feed.
Uses Advised Against:	None known.

1.3 Details of the Supplier of the SDS

Manufacturer/Supplier:	Dynegy, Inc.
Street Address:	601 Travis Street, Suite 1400
City, State and Zip Code:	Houston, TX 77002
Customer Service Telephone:	800-633-4704

Section 2
Hazards Identification

2.1 Classification of the Substance

GHS Classification(s) according to OSHA Hazard Communication Standard (29 CFR 1910.1200):

- Eye Irritant, Category 2A
- STOT-SE, Category 3 (Respiratory Irritation)
- Carcinogen, Category 1A
- STOT-RE, Category 1 (Lungs)
- Toxic to Reproduction, Category 2

2.2 Label Elements

Labelling according to 29 CFR 1910.1200 Appendices A, B and C*	
Hazard Pictogram(s):	
Signal word:	**DANGER**
Hazard Statement(s):	*Causes serious eye irritation.* *May cause damage to lungs after repeated/prolonged exposure via inhalation.* *May cause respiratory irritation.* *May cause cancer of the lung.* *Suspected of damaging fertility or the unborn child.*
Precautionary Statement(s):	*Obtain special instructions before use.* *Do not handle until all safety precautions have been read and understood.* *Avoid breathing dust.* *Wear protective gloves/protective clothing/eye protection/face protection.* *Wash thoroughly after handling.* *Do not eat drink or smoke when using this product.* *Use outdoors or in a well-ventilated area.* *If exposed or concerned: Get medical advice/attention.* *Store in a secure area.* *Dispose of product in accordance with local/national regulations.*

** Fly ash and other coal combustion products (CCPs) are UVCB substances (unknown or variable composition or biological). Various CCPs, noted as ashes/ash residuals; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Waste solids, ashes under TSCA are defined as: "The residuum from the burning of a combination of carbonaceous materials. The following elements may be present as oxides: aluminum, calcium, iron, magnesium, nickel, phosphorus, potassium, silicon, sulfur, titanium, and vanadium." Ashes including fly ash and fluidized bed combustion ash are identified by CAS number 68131-74-8. The exact composition of the ash is dependent on the fuel source and flue additives composed of many constituents. The*

classification of the final substance is dependent on the presence of specific identified oxides as well as other trace elements.

2.3 Other Hazards

Listed Carcinogens:

-Respirable Crystalline Silica

IARC: [Yes] **NTP:** [Yes] **OSHA:** [Yes] **Other:** **(ACGIH)** [Yes]

Section 3
Composition/Information on Ingredients

Substance	***CAS No.***	***Percentage (%)***	***GHS Classification***
Crystalline Silica	*14808-60-7*	*30 - 60%*	*Repeat Dose STOT, Category 1* *Carcinogen, Category 1A*
Silica, crystalline respirable (RCS)	*14808-60-7*	***See Footnote 1***	*Repeat Dose STOT, Category 1* *Carcinogen, Category 1A*
Aluminosilicates	*71243-67-9* *1327-36-2*	*30 - 60%*	*Single Exposure STOT, Category 3*
Iron oxide	*1309-37-1*	*1 - 10%*	*Not Classified*
Calcium oxide (CaO)	*1305-78-8*	*20 - 30%*	*Skin Irritant, Category 2* *Eye Irritant, Category 1* *Single Exposure STOT, Category 3*
Magnesium oxide	*1309-48-4*	*2 - 10%*	*Not Classified*
Phosphorus pentoxide (P_2O_5)	*1314-56-3*	*≤2%*	*Skin Irritant, Category 2* *Eye Irritant, Category 2B*
Sodium oxide	*1313-59-3*	*1-8%*	*Not Classified*
Potassium oxide (K_2O)	*12136-45-7*	*≤1%*	*Skin Irritant, Category 2* *Eye Irritant, Category 2B*
Titanium dioxide (TiO_2)	*13463-67-7*	*<3%*	*Not Classified*
Bromide salt (calcium)	*7789-41-5*	*See Footnote 2*	*Toxic to Reproduction, Category 2*

Footnote 1: *The percentage of respirable crystalline silica has not been determined. Therefore, a GHS classification of Carcinogen, Category 1A has been assigned.*

Footnote 2: *Analytical data are not available to demonstrate that the concentration of bromide salt is <0.1%; therefore, a GHS classification of Toxic to Reproduction, Category 2 has been assigned.*

Section 4
First Aid Measures

4.1 Description of First Aid Measures

Inhalation:	If product is inhaled and irritation of the nose or coughing occurs, remove person to fresh air. Get medical advice/attention if respiratory symptoms persist.
Skin Contact:	If skin exposure occurs, wash with soap and water.
Eye Contact:	If product gets into the eye, rinse copiously with water for several minutes. Remove contact lenses, if present and easy to do. Seek medical attention/advice if irritation occurs or persists.
Ingestion:	No specific first aid measures are required.

4.2 Most Important Health Effects, Both Acute and Delayed

Acute Effects: Direct exposure may cause respiratory irritation, eye irritation and skin irritation. The product dust can dry and irritate the skin and cause dermatitis and can irritate eyes and skin through mechanical abrasion.

Chronic Effects: Chronic exposure may cause lung damage from repeated exposure. Prolonged inhalation of respirable crystalline silica above certain concentrations may cause lung diseases, including silicosis and lung cancer. Repeated exposure to dusts containing inorganic bromide salts may affect fertility and/or result in effects to the unborn child.

4.3 Indication of Any Immediate Medical Attention and Special Treatment Needed

Seek first aid or call a doctor or Poison Control Center if contact with eyes occurs and irritation remains after rinsing. Get medical advice if inhalation occurs and respiratory symptoms persist.

Section 5
Firefighting Measures

5.1 Extinguishing Media

Suitable Extinguishing Media:	Product is not flammable. Use extinguishing media appropriate for surrounding fire.
Unsuitable Extinguishing Media:	Not applicable, the product is not flammable.

5.2 Special Hazards Arising from the Substance or Mixture

Hazardous Combustion Products:	None known.

5.3 Advice for Firefighters

Special Protective Equipment and Precautions for Firefighters:	As with any fire, wear self-contained breathing apparatus (NIOSH approved or equivalent) and full protective gear.

Section 6
Accidental Release Measures

6.1 Personal Precautions, Protective Equipment and Emergency Procedures

Personal precautions/Protective Equipment:	See Section 8.2.2 Individual Protective Measures. For concentrations exceeding Occupational Exposure Levels (OELs), use a self-contained breathing apparatus (SCBA).
Emergency procedures:	Use scooping, water spraying/flushing/misting or ventilated vacuum cleaning systems to clean up spills. Do not use pressurized air.

6.2 Environmental Precautions

Environmental precautions:	Prevent contamination of drains or waterways and dispose according to local and national regulations.

6.3 Methods and Material for Containment and Cleaning Up

Methods and materials for containment and cleaning up:	Do not use brooms or compressed air to clean surfaces. Use dust collection vacuum and extraction systems. Large spills of dry product should be removed by a vacuum system. Dampened material should be removed by mechanical means and recycled or disposed of according to local and national regulations.

See Sections 8 and 13 for additional information on exposure controls and disposal.

Section 7
Handling and Storage

7.1 Precautions for Safe Handling

Practice good housekeeping. Use adequate exhaust ventilation, dust collection and/or water mist to maintain airborne dust concentrations below permissible exposure limits (note: respirable crystalline silica dust may be in the air without a visible dust cloud).

Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain and test ventilation and dust collection equipment. In cases of insufficient ventilation, wear a NIOSH approved respirator for silica dust when handling or disposing dust from this product. Avoid contact with skin and eyes. Wash or vacuum clothing that has become dusty. Avoid eating, smoking, or drinking while handling the material.

7.2 Conditions for Safe Storage, Including any Incompatibilities

Minimize dust produced during loading and unloading.

Section 8
Exposure Controls/Personal Protection

8.1 Control Parameters

OCCUPATIONAL EXPOSURE LIMITS					
SUBSTANCE		**OSHA PEL TWA (mg/m^3)**	**NIOSH REL TWA (mg/m^3)**	**ACGIH TLV TWA (mg/m^3)**	**CA - OSHA PEL (mg/m^3)**
Calcium oxide		5	2	2	2
Particulates Not Otherwise Regulated	Total	15	15	10	10
	Respirable	5	5	3	5
Respirable Crystalline Silica	Respirable Crystalline Silica	0.05	0.05	0.025	0.05
Titanium dioxide	Total	15	2.4 (fine) 0.3 (ultrafine)	10	10
Manganese dioxide (as manganese compounds)	Total	5 (Ceiling)	1 3 (STEL)	0.1	0.2
	Respirable	-	-	0.02	-

8.2 Exposure Controls

8.2.1 Engineering Controls

Provide ventilation to maintain the ambient workplace atmosphere below the occupational exposure limit(s). Use general and local exhaust ventilation and dust collection systems as necessary to minimize exposure.

8.2.2 Personal Protective Equipment (PPE)

Respiratory protection:	Wear a NIOSH approved particulate respirator if exposure to airborne particulates is unavoidable and where occupational exposure limits may be exceeded. If airborne exposures are anticipated to exceed applicable PELs or TLVs, a self-contained breathing apparatus or airline respirator is recommended.
Eye and face protection:	If eye contact is possible, wear protective glasses with side shields. Avoid contact lenses.
Hand and skin protection:	Wear gloves and protective clothing. Wash hands with soap and water after contact with material.

Section 9
Physical and Chemical Properties

9.1 Information on Basic Physical and Chemical Properties

Property: Value	Property: Value
Appearance (physical state, color, etc.): Fine tan/ gray particulate	**Upper/lower flammability or explosive limits:** Not applicable
Odor: Odorless[1]	**Vapor Pressure (Pa):** Not applicable
Odor threshold: Not applicable	**Vapor Density:** Not applicable
pH (25 °C) (in water): Not Determined	**Specific gravity or relative density:** 2.2 – 2.9
Melting point/freezing point (°C): Not applicable	**Water Solubility:** Slight
Initial boiling point/boiling range (°C): NA	**Partition coefficient: n-octane/water:** NA
Flash point (°C): Not determined	**Auto ignition temperature (°C):** Not applicable
Evaporation rate: Not applicable	**Decomposition temperature (°C):** Not determined
Flammability (solid, gas): Not combustible	**Viscosity:** Not applicable

[1] The use of urea or aqueous ammonia injected into the flue gas to reduce nitrogen oxides (NOx) emissions may result in the presence of ammonium sulfate or ammonium bisulfate in the ash at less than 0.1%. When ash containing these substances becomes wet under high pH (>9), free ammonia gas may be released resulting in objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces.

Section 10
Stability and Reactivity

10.1 Reactivity:	The material is an inert, inorganic material primarily composed of elemental oxides.
10.2 Chemical stability:	The material is stable under normal use conditions.
10.3 Possibility of hazardous reactions:	The material is a relatively stable, inert material; however, when ash containing ammonia becomes wet under high pH (>9), free ammonia gas may be released resulting in an objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces. Polymerization will not occur.
10.4 Conditions to avoid:	Product can become airborne in moderate winds. Dry material should be stored in silos. Materials stored out of doors should be covered or maintained in a damp condition.
10.5 Incompatible materials:	None known.
10. 6 Hazardous decomposition products:	None known.

Section 11
Toxicological Information

11.1 Information on Toxicological Effects

Endpoint	Data
Acute oral toxicity	LD50 > 2000 mg/kg
Acute dermal toxicity	LD50 > 2000 mg/kg
Acute inhalation toxicity	LD50 > 5.0 mg/L
Skin corrosion/irritation	Does not meet the classification criteria but may cause slight skin irritation. Product dust can dry the skin which can result in irritation.
Eye damage/irritation	Causes serious eye irritation. Positive scores for conjunctiva irritation and chemosis in 2/3 animals based on average of 24, 48 and 72-hour scores with irritation clearing within 21 days; No corneal or iritis effects observed.
Respiratory/skin sensitization	Not a respiratory or dermal sensitizer.
Germ cell mutagenicity	Not mutagenic in in-vitro and in-vivo assays with or without metabolic activation.
Carcinogenicity	Not available. Respirable crystalline silica has been identified as a carcinogen by OSHA, NTP, ACGIH and IARC.
Reproductive toxicity	No developmental toxicity was observed in available animal studies. Reproductive studies on CCPs showed either no reproductive effects, or some effects on male and female reproductive organs and parameters but without a clear dose response. Inorganic bromide salts have been shown to have adverse effects on reproductive parameters in some animal studies.
STOT-SE	CCPs when present as a nuisance dust may result in respiratory irritation.
STOT-RE	In a 180-day inhalation study with fly ash dust, no effects were observed at the highest dose tested. NOEC = 4.2 mg/m^3; it is not possible to assess the level at which toxicologically significant effects may occur. Repeated inhalation exposures to high levels of respirable crystalline silica may result in lung damage (i.e., silicosis).
Aspiration Hazard	Not applicable based product form.

Section 12
Ecological Information

12.1 Toxicity

Fly Ash C (CAS# 68131-74-8)	
Toxicity to Fish	LC50 > 100 mg/L
Toxicity to Aquatic Invertebrates	Data indicates that the test substance is not toxic to *Daphnia magna* (EC50 undetermined).
Toxicity to Aquatic Algae and Plants	EC50 = 10 mg/L

Calcium oxide CAS# 1305-78-8	
Toxicity to Fish	LC50 = 50.6 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Invertebrates	EC50 = 49.1 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Algae and Plants	NOEC =48 mg/L @ 72 hours based on $Ca(OH)_2$ The initial pH of the test medium was not directly related to the biologically relevant effects. The formation of precipitates is likely the result of the reaction between CO_2 dissolved in the medium.

12.2 Persistence and Degradability

Not relevant for inorganic materials.

12.3 Bioaccumulative Potential

This material does not contain any compounds that would bioaccumulate up the food chain.

12.4 Mobility in Soil

No data available.

12.5 Results of PBT and vPvB Assessment

This material does not contain any compounds classified as “persistent, bioaccumulative or toxic” nor as “very persistent/very bioaccumulative”.

12.6 Other Adverse Effects

None known.

Section 13

Disposal Considerations

See Sections 7 and 8 above for safe handling and use, including appropriate industrial hygiene practices.

Dispose of all waste product and containers in accordance with federal, state and local regulations.

Section 14
Transport Information

Regulatory entity: U.S. DOT	Shipping Name:	Not Regulated
	Hazard Class:	Not Regulated
	ID Number:	Not Regulated
	Packing Group:	Not Regulated

Section 15
Regulatory Information

15.1 Safety, Health and Environmental Regulations/Legislation Specific for the Mixture

- TSCA Inventory Status

  All components are listed on the TSCA Inventory.

- California Proposition 65.

  The following substances are known to the State of California to be carcinogens and/or reproductive toxicants:

  - Respirable crystalline silica

- State Right-to-Know (RTK)

Component	CAS	MA[1,2]	NJ[3,4]	PA[5]	RI[6]
Ammonium bisulfate	7803-63-6	No	Yes	No	No
Ammonium sulfate	7783-20-2	Yes	No	Yes	No
Calcium oxide	1305-78-8	Yes	Yes	Yes	No
Iron oxide	1309-37-1	Yes	Yes	Yes	No
Magnesium oxide	1309-48-4	No	Yes	No	No
Manganese oxide-as manganese compounds	1313-13-9; Various	No	No	Yes	Yes
Phosphorus pentoxide (or phosphorus oxide)	1314-56-3	Yes	Yes	Yes	No
Potassium oxide	12136-45-7	No	Yes	No	No
Silica-crystalline (SiO2), quartz	14808-60-7	Yes	Yes	Yes	No
Sodium oxide	1313-59-3	No	Yes	No	No
Titanium dioxide	13463-67-7	Yes	Yes	Yes	Yes

[1] Massachusetts Department of Public Health, no date
[2] 189th General Court of The Commonwealth of Massachusetts, no date
[3] New Jersey Department of Health and Senior Services, 2010a
[4] New Jersey Department of Health, 2010b
[5] Pennsylvania Code, 1986
[6] Rhode Island Department of Labor and Training, no date

Section 16
Other Information, Including Date of Preparation or Last Revision

16.1 Indication of Changes

Date of preparation or last revision: February 23, 2018

16.2 Abbreviations and Acronyms

- ACGIH: American Conference of Industrial Hygienists
- CA: California
- CAS: Chemical Abstract Services
- CCP: Coal Combustion Product
- CFR: Code of Federal Regulations
- EPA: Environmental Protection Agency

- GHS: Globally Harmonized System of Classification and Labelling
- IARC: International Agency for Research on Cancer
- LC50: Concentration resulting in the mortality of 50 % of an animal population
- LD50: Dose resulting in the mortality of 50 % of an animal population
- MA: Massachusetts
- NA: Not Applicable
- NJ: New Jersey
- NOEC: No observed effect concentration
- NIOSH: National Institute of Occupational Safety and Health
- NOx: Nitrogen oxides
- NTP: US National Toxicology Program
- OEL: Occupational Exposure Limit
- OSHA: Occupational Safety and Health Administration
- PA: Pennsylvania
- PBT: Persistent, Toxic and Bioaccumulative
- PEL: Permissible exposure limit
- PPE: Personal Protective Equipment
- REL: Recommended exposure limit
- RI: Rhode Island
- RCS: Respirable Crystalline Silica
- RTK: Right-to-Know
- SCBA: Self-contained breathing apparatus
- SDS: Safety Data Sheet
- STEL: Short-term exposure limit
- STOT-RE: Specific target organ toxicity-repeated exposure
- STOT-SE: Specific target organ toxicity-single exposure
- TLV: Threshold limit value
- TSCA: Toxic Substances Control Act
- TWA: Time-weighted average
- UEL: Upper explosive limit
- UVCB: Unknown or Variable Composition/Biological
- U.S.: United States
- U.S. DOT: United States of Department of Transportation

16.3 Other Hazards

Hazardous Materials Identification System (HMIS) Degree of hazard (0= low, 4 = extreme)							
Health:	2*	**Flammability:**	0	**Physical Hazards:**	0	**Personal protection:****	

** Chronic Health Effects*
*** Appropriate personal protection is defined by the activity to be performed.*
See Section 8 for additional information.

DISCLAIMER:

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Safety Data Sheet

Section 1
Identification of the Substance and of the Supplier

1.1 Product Identifier

Product Name/Identification:	ASTM Bottom Ash
Synonyms:	Ash; Ashes; Ash residues; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Coal Fly Ash; Pozzolan; Waste solids.
Formula:	UVCB Substance

1.2 Relevant Identified Uses of the Substance or Mixture and Uses Advices Against

Relevant Identified Uses:	Component of wallboard, concrete, roofing material, bricks, cement kiln feed.
Uses Advised Against:	None known.

1.3 Details of the Supplier of the SDS

Manufacturer/Supplier:	Dynegy, Inc.
Street Address:	601 Travis Street, Suite 1400
City, State and Zip Code:	Houston, TX 77002
Customer Service Telephone:	800-633-4704

Section 2
Hazards Identification

2.1 Classification of the Substance

GHS Classification(s) according to OSHA Hazard Communication Standard (29 CFR 1910.1200):

- Eye Irritant, Category 2A
- STOT-SE, Category 3 (Respiratory Irritation)
- Carcinogen, Category 1A
- STOT-RE, Category 1 (Lungs)
- Toxic to Reproduction, Category 2

2.2 Label Elements

Labelling according to 29 CFR 1910.1200 Appendices A, B and C*	
Hazard Pictogram(s):	
Signal word:	**DANGER**
Hazard Statement(s):	*Causes serious eye irritation.* *May cause respiratory irritation.* *May cause damage to lungs after repeated/prolonged exposure via inhalation.* *May cause cancer of the lung.* *Suspected of damaging fertility or the unborn child.*
Precautionary Statement(s):	*Obtain special instructions before use.* *Do not handle until all safety precautions have been read and understood.* *Avoid breathing dust.* *Wash thoroughly after handling.* *Do not eat drink or smoke when using this product.* *Wear protective gloves/protective clothing/eye protection/face protection.* *Use outdoors or in a well-ventilated area.* *If exposed or concerned: Get medical advice/attention.* *Store in a secure area.* *Dispose of product in accordance with local/national regulations.*

** Fly ash and other coal combustion products (CCPs) are UVCB substances (unknown or variable composition or biological). Various CCPs, noted as ashes/ash residuals; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Waste solids, ashes under TSCA are defined as: "The residuum from the burning of a combination of carbonaceous materials. The following elements may be present as oxides: aluminum, calcium, iron, magnesium, nickel, phosphorus, potassium, silicon, sulfur, titanium, and vanadium." Ashes including fly ash and fluidized bed combustion ash are identified by CAS number 68131-74-8. The exact composition of the ash is dependent on the fuel source and flue additives composed of many constituents. The classification of the final substance is dependent on the presence of specific identified oxides as well as other trace elements.*

2.3 Other Hazards

Listed Carcinogens:

-Respirable Crystalline Silica

IARC: [Yes] **NTP:** [Yes] **OSHA:** [Yes] **Other:** **(ACGIH)** [Yes]

Section 3
Composition/Information on Ingredients

Substance	*CAS No.*	*Percentage (%)*	*GHS Classification*
Crystalline Silica	*14808-60-7*	*20 - 40%*	*Repeat Dose STOT, Category 1* *Carcinogen, Category 1A*
Silica, crystalline respirable (RCS)	*14808-60-7*	*See Footnote 1*	*Repeat Dose STOT, Category 1* *Carcinogen. Category 1A*
Aluminosilicates[2]	*Various, see Footnote 2*	*10 - 60%*	*Single Exposure STOT, Category 3*
Calcium oxide (CaO)	*1305-78-8*	*10 - 30%*	*Skin Irritant, Category 2* *Eye Irritant, Category 1* *Single Exposure STOT, Category 3*
Iron oxide	*1309-37-1*	*1 - 10%*	*Not Classified*
Manganese dioxide (MnO_2)	*1313-13-9*	*<2%*	*Skin Irritant, Category 2* *Eye Irritant, Category 2B*
Magnesium oxide	*1309-48-4*	*2 - 10%*	*Not Classified*
Phosphorus pentoxide (P_2O_5)	*1314-56-3*	*≤2%*	*Skin Irritant, Category 2* *Eye Irritant, Category 2B*
Sodium oxide	*1313-59-3*	*1 - 10%*	*Not Classified*
Potassium oxide (K_2O)	*12136-45-7*	*≤1%*	*Skin Irritant Category 2* *Eye Irritant Category 2B*
Titanium dioxide (TiO_2)	*13463-67-7*	*<3%*	*Not Classified*

[1]The percentage of respirable crystalline silica has not been determined. Therefore, a GHS classification of Carcinogen 1A has been assigned.

[2]Aluminosilicates (CAS# 1327-36-2) may be in the form of mullite (CAS# 1302-93-8); aluminosilicate glass; pozzolans (CAS# 71243-67-9); or calcium aluminosilicates such as tricalcium aluminate (C3A), or calcium sulfoaluminate (C4A3S). The form is dependent on the source of the coal and or the process used to create the CCP. Pulverized coal combustion would be more likely to create high levels of pozzolans. Aluminosilicates may have inclusions of calcium, titanium, iron, potassium, phosphorus, magnesium and other metal oxides.

Section 4
First Aid Measures

4.1 Description of First Aid Measures

Inhalation:	If product is inhaled and irritation of the nose or coughing occurs, remove person to fresh air. Get medical advice/attention if respiratory symptoms persist.
Skin Contact:	If skin exposure occurs, wash with soap and water.
Eye Contact:	If product gets into the eye, rinse copiously with water for several minutes. Remove contact lenses, if present and easy to do. Seek medical attention/advice if irritation occurs or persists.
Ingestion:	No specific first aid measures are required.

4.2 Most Important Health Effects, Both Acute and Delayed

Acute Effects: Direct exposure may cause respiratory irritation, eye irritation and skin irritation. The product dust can dry and irritate the skin and cause dermatitis and can irritate eyes and skin through mechanical abrasion.

Chronic Effects: Chronic exposure may cause lung damage from repeated exposure. Prolonged inhalation of respirable crystalline silica above certain concentrations may cause lung diseases, including silicosis and lung cancer.

4.3 Indication of Any Immediate Medical Attention and Special Treatment Needed

Seek first aid or call a doctor or Poison Control Center if contact with eyes occurs and irritation remains after rinsing. Get medical advice if inhalation occurs and respiratory symptoms persist.

Section 5
Firefighting Measures

5.1 Extinguishing Media

Suitable Extinguishing Media:	Product is not flammable. Use extinguishing media appropriate for surrounding fire.
Unsuitable Extinguishing Media:	Not applicable, the product is not flammable.

5.2 Special Hazards Arising from the Substance or Mixture

Hazardous Combustion Products:	None known.

5.3 Advice for Firefighters

Special Protective Equipment and Precautions for Firefighters:	As with any fire, wear self-contained breathing apparatus (NIOSH approved or equivalent) and full protective gear.

Section 6
Accidental Release Measures

6.1 Personal Precautions, Protective Equipment and Emergency Procedures

Personal precautions/Protective Equipment:	See Section 8.2.2 Individual Protective Measures. For concentrations exceeding Occupational Exposure Levels (OELs), use a self-contained breathing apparatus (SCBA).
Emergency procedures:	Use scooping, water spraying/flushing/misting or ventilated vacuum cleaning systems to clean up spills. Do not use pressurized air.

6.2 Environmental Precautions

Environmental precautions:	Prevent contamination of drains or waterways and dispose according to local and national regulations.

6.3 Methods and Material for Containment and Cleaning Up

Methods and materials for containment and cleaning up:	Do not use brooms or compressed air to clean surfaces. Use dust collection vacuum and extraction systems. Large spills of dry product should be removed by a vacuum system. Dampened material should be removed by mechanical means and recycled or disposed of according to local and national regulations.

See Sections 8 and 13 for additional information on exposure controls and disposal.

Section 7
Handling and Storage

7.1 Precautions for Safe Handling

Practice good housekeeping. Use adequate exhaust ventilation, dust collection and/or water mist to maintain airborne dust concentrations below permissible exposure limits (note: respirable crystalline silica dust may be in the air without a visible dust cloud).

Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain and test ventilation and dust collection equipment. In cases of insufficient ventilation, wear a NIOSH approved respirator for silica dust when handling or disposing dust from this product. Avoid contact with skin and eyes. Wash or vacuum clothing that has become dusty. Avoid eating, smoking, or drinking while handling the material.

7.2 Conditions for Safe Storage, Including any Incompatibilities

Minimize dust produced during loading and unloading.

Section 8
Exposure Controls/Personal Protection

8.1 Control Parameters

OCCUPATIONAL EXPOSURE LIMITS					
SUBSTANCE		**OSHA PEL TWA (mg/m^3)**	**NIOSH REL TWA (mg/m^3)**	**ACGIH TLV TWA (mg/m^3)**	**CA - OSHA PEL (mg/m^3)**
Calcium oxide		5	2	2	2
Particulates Not Otherwise Regulated	Total	15	15	10	10
	Respirable	5	5	3	5
Respirable Crystalline Silica	Respirable	0.05	0.05	0.025	0.05
Manganese dioxide (as manganese compounds)	Total	5 (Ceiling)	1 3 (STEL)	0.1	0.2
	Respirable	-	-	0.02	-

8.2 Exposure Controls

8.2.1 Engineering Controls

Provide ventilation to maintain the ambient workplace atmosphere below the occupational exposure limit(s). Use general and local exhaust ventilation and dust collection systems as necessary to minimize exposure.

8.2.2 Personal Protective Equipment (PPE)

Respiratory protection:	Wear a NIOSH approved particulate respirator if exposure to airborne particulates is unavoidable and where occupational exposure limits may be exceeded. If airborne exposures are anticipated to exceed applicable PELs or TLVs, a self-contained breathing apparatus or airline respirator is recommended.
Eye and face protection:	If eye contact is possible, wear protective glasses with side shields. Avoid contact lenses.
Hand and skin protection:	Wear gloves and protective clothing. Wash hands with soap and water after contact with material.

Section 9
Physical and Chemical Properties

9.1 Information on Basic Physical and Chemical Properties

Property: Value	Property: Value
Appearance (physical state, color, etc.): Fine tan/ gray particulate	**Upper/lower flammability or explosive limits:** Not applicable
Odor: Odorless[1]	**Vapor Pressure (Pa):** Not applicable
Odor threshold: Not applicable	**Vapor Density:** Not applicable
pH (25 °C) (in water): 8 - 11	**Specific gravity or relative density:** 2.2 – 2.9
Melting point/freezing point (°C): Not applicable	**Water Solubility:** Slight
Initial boiling point and boiling range (°C): Not applicable	**Partition coefficient: n-octane/water:** Not determined
Flash point (°C): Not determined	**Auto ignition temperature (°C):** Not applicable
Evaporation rate: Not applicable	**Decomposition temperature (°C):** Not determined
Flammability (solid, gas): Not combustible	**Viscosity:** Not applicable

[1] The use of urea or aqueous ammonia injected into the flue gas to reduce nitrogen oxides (NOx) emissions may result in the presence of ammonium sulfate or ammonium bisulfate in the ash at less than 0.1%. When ash containing these substances becomes wet under high pH (>9), free ammonia gas may be released resulting in objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces.

Section 10
Stability and Reactivity

10.1 Reactivity:	The material is an inert, inorganic material primarily composed of elemental oxides.
10.2 Chemical stability:	The material is stable under normal use conditions.
10.3 Possibility of hazardous reactions:	The material is a relatively stable, inert material; however, when ash containing ammonia becomes wet under high pH (>9), free ammonia gas may be released resulting in an objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces. Polymerization will not occur.
10.4 Conditions to avoid:	Product can become airborne in moderate winds. Dry material should be stored in silos. Materials stored out of doors should be covered or maintained in a damp condition.
10.5 Incompatible materials:	None known.
10. 6 Hazardous decomposition products:	None known.

Section 11
Toxicological Information

11.1 Information on Toxicological Effects

Endpoint	Data
Acute oral toxicity	LD50 > 2000 mg/kg
Acute dermal toxicity	LD50 > 2000 mg/kg
Acute inhalation toxicity	LD50 > 5.0 mg/L
Skin corrosion/irritation	Does not meet the classification criteria but may cause slight skin irritation. Product dust can dry the skin which can result in irritation.
Eye damage/irritation	Causes serious eye irritation. Positive scores for conjunctiva irritation and chemosis in 2/3 animals based on average of 24, 48 and 72-hour scores with irritation clearing within 21 days; no corneal or iritis effects observed.
Respiratory/skin sensitization	Not a respiratory or dermal sensitizer.
Germ cell mutagenicity	Not mutagenic in in-vitro and in-vivo assays with or without metabolic activation.
Carcinogenicity	Not available. Respirable crystalline silica has been identified as a carcinogen by OSHA, NTP, ACGIH and IARC.
Reproductive toxicity	No developmental toxicity was observed in available animal studies. Reproductive studies on CCPs showed either no reproductive effects, or some effects on male and female reproductive organs and parameters but without a clear dose response.
STOT-SE	CCPs when present as a nuisance dust may result in respiratory irritation.
STOT-RE	In a 180-day inhalation study with fly ash dust, no effects were observed at the highest dose tested. NOEC = 4.2 mg/m^3; it is not possible to assess the level at which toxicologically significant effects may occur. Repeated inhalation exposures to high levels of respirable crystalline silica may result in lung damage (i.e., silicosis).
Aspiration Hazard	Not applicable based product form.

Section 12
Ecological Information

12.1 Toxicity

Fly Ash (CAS# 68131-74-8)	
Toxicity to Fish	LC50 > 100 mg/L
Toxicity to Aquatic Invertebrates	Data indicates that the test substance is not toxic to *Daphnia magna* (EC50 undetermined)
Toxicity to Aquatic Algae and Plants	EC50 = 10 mg/L
Calcium oxide CAS# 1305-78-8	
Toxicity to Fish	LC50 = 50.6 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Invertebrates	EC50 = 49.1 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Algae and Plants	NOEC =48 mg/L @ 72 hours based on $Ca(OH)_2$ The initial pH of the test medium was not directly related to the biologically relevant effects. The formation of precipitates is likely the result of the reaction between CO_2 dissolved in the medium.

12.2 Persistence and Degradability

Not relevant for inorganic materials.

12.3 Bioaccumulative Potential

This material does not contain any compounds that would bioaccumulate up the food chain.

12.4 Mobility in Soil

No data available.

12.5 Results of PBT and vPvB Assessment

This material does not contain any compounds classified as “persistent, bioaccumulative or toxic” nor as “very persistent/very bioaccumulative”.

12.6 Other Adverse Effects

None known.

Section 13
Disposal Considerations

See Sections 7 and 8 above for safe handling and use, including appropriate industrial hygiene practices.

Dispose of all waste product and containers in accordance with federal, state and local regulations.

Section 14
Transport Information

Regulatory entity: U.S. DOT	Shipping Name:	Not Regulated
	Hazard Class:	Not Regulated
	ID Number:	Not Regulated
	Packing Group:	Not Regulated

Section 15
Regulatory Information

15.1 Safety, Health and Environmental Regulations/Legislation Specific for the Mixture

- TSCA Inventory Status

  All components are listed on the TSCA Inventory.

- California Proposition 65

  The following substances are known to the State of California to be carcinogens and/or reproductive toxicants:

  - Respirable crystalline silica
  - Titanium dioxide

- State Right-to-Know (RTK)

Component	CAS	MA[1,2]	NJ[3,4]	PA[5]	RI[6]
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[1] Massachusetts Department of Public Health, no date
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- U.S.: United States
- U.S. DOT: United States of Department of Transportation

16.3 Other Hazards

Hazardous Materials Identification System (HMIS) Degree of hazard (0= low, 4 = extreme)							
Health:	2*	**Flammability:**	0	**Physical Hazards:**	0	**Personal protection:****	

** Chronic Health Effects*
******* *Appropriate personal protection is defined by the activity to be performed.*
See Section 8 for additional information.

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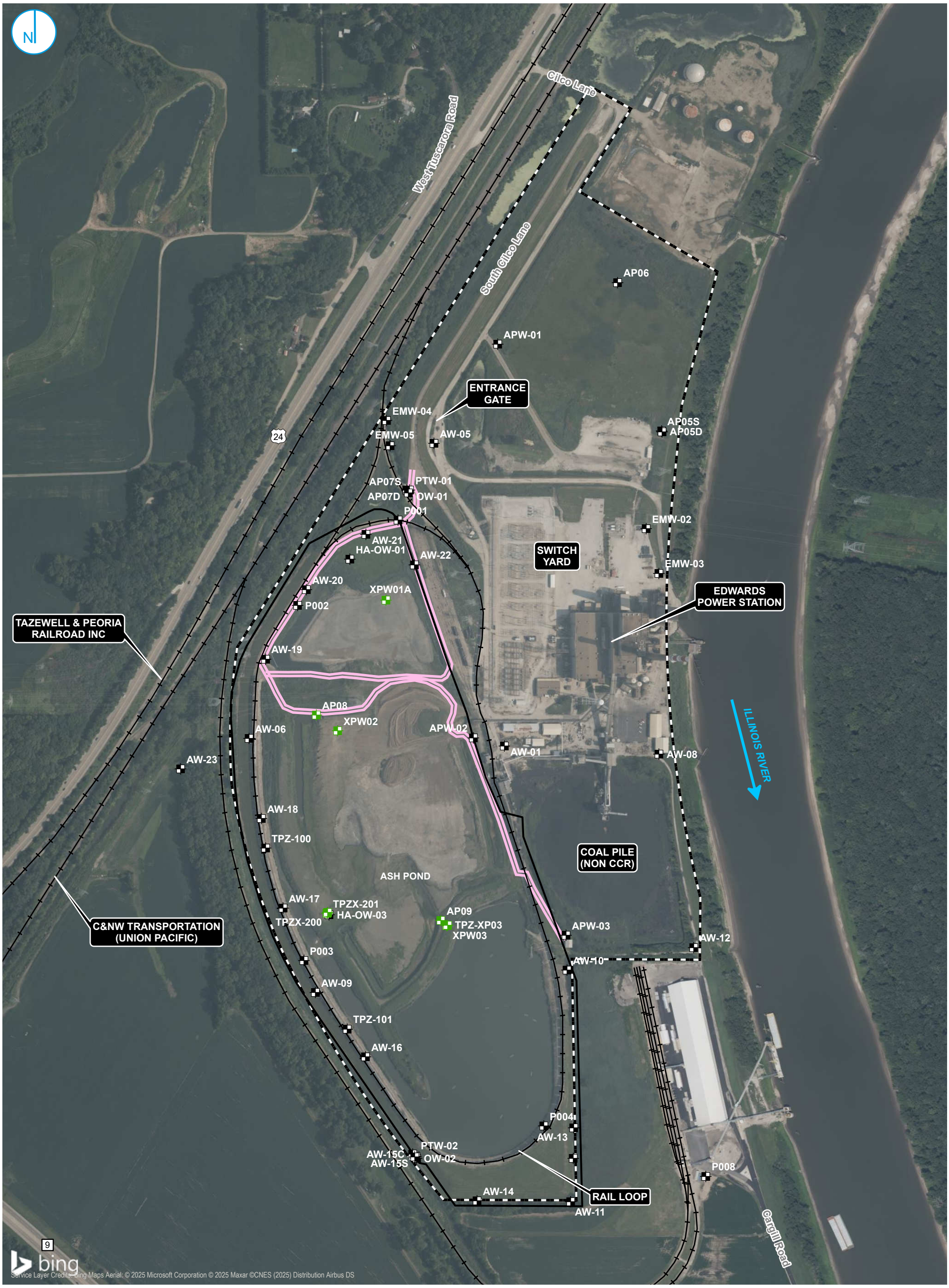
APPENDIX E
SITE PLAN MAP AND ON-SITE TRANSPORTATION PLAN ((845.220(a)(4) AND 845.220(a)(2)(E))



MONITORING WELL
PORE WATER WELL
ONSITE TRANSPORTATION ROUTE FOR CLOSURE
RAILROAD
SITE FEATURE
PROPERTY BOUNDARY

0 250 500 Feet

SITE PLAN MAP AND TRANSPORTATION PLAN

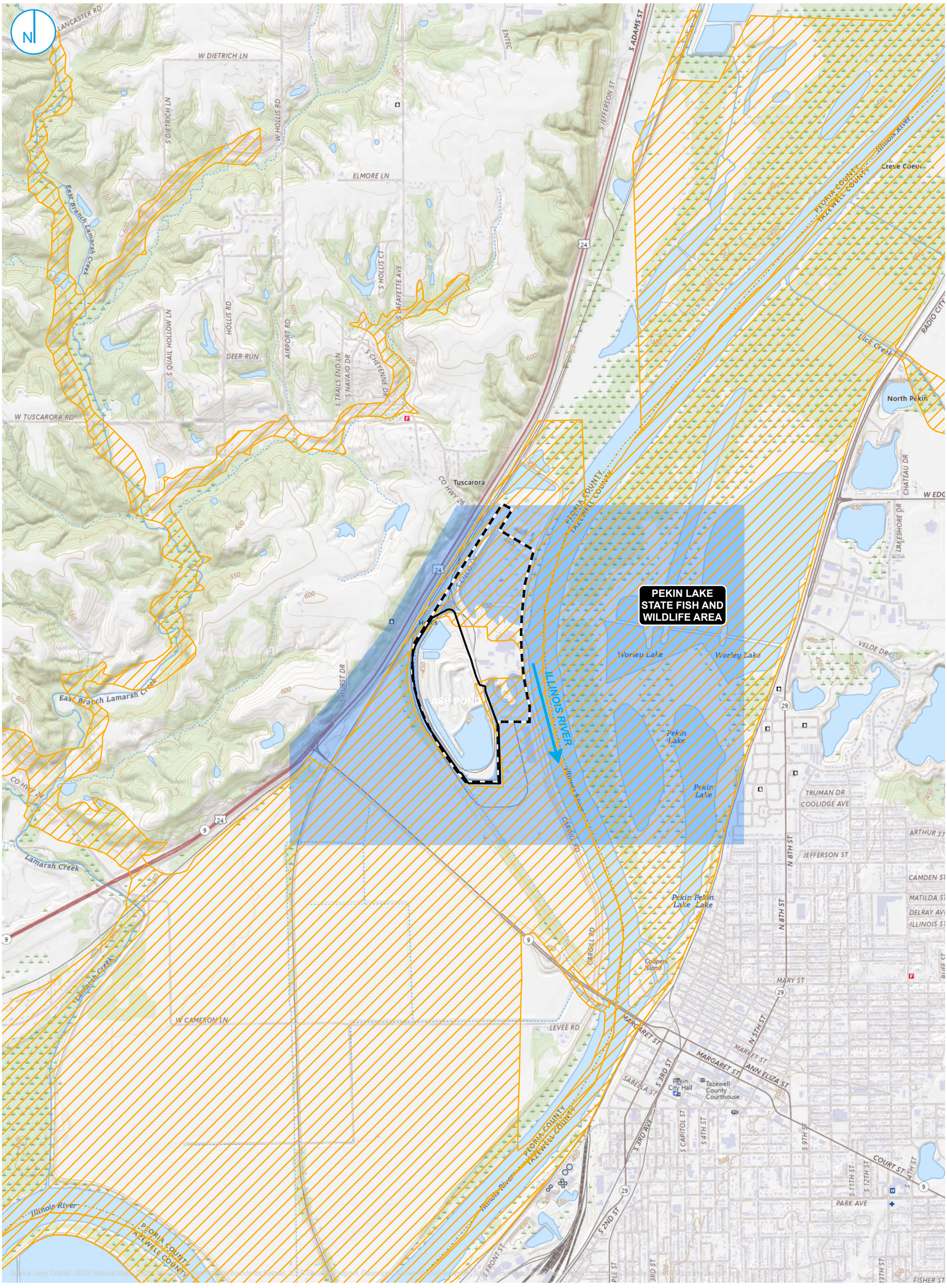
CONSTRUCTION PERMIT APPLICATION
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

APPENDIX E

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

APPENDIX F
SITE LOCATION MAPS (845.220(a)(3))



FEMA 100-YEAR FLOOD ZONE

CORRECTED MODEL INUNDATION EXTENTS OF BFE (BURNS AND MCDONNELL, 2022)

SITE FEATURE

PROPERTY BOUNDARY

PREVAILING WIND

0 1,000 2,000 Feet

NOTES:

1. THE BASEMAP FOR THIS FIGURE INCLUDES THE 2024 USGS US 7.5-MINUTE SERIES QUADRANGLE MAP FOR PEKIN, IL.
2. NO DEDICATED ILLINOIS NATURE PRESERVES OR DESIGNATED HISTORIC AND ARCHAEOLOGICAL SITES PER THE ILLINOIS NATIONAL HISTORIC PRESERVATION ACT WERE LISTED WITHIN 1,000 METERS OF THE SITE.
3. THE IDNR NATURAL HERITAGE DATABASE THREATENED AND ENDANGERED SPECIES BY COUNTY LIST 16 STATE THREATENED AND 10 ENDANGERED SPECIES IN PEORIA COUNTY AND 16 THREATENED AND 16 ENDANGERED SPECIES IN TAZEWELL COUNTY.

SITE LOCATION MAP

CONSTRUCTION PERMIT APPLICATION
ASH POND

EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

APPENDIX F

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

APPENDIX G
CORRECTIVE ACTION PLAN AND PROPOSED SCHEDULE (845.670), INCLUDING THE CORRECTIVE ACTION ALTERNATIVES ANALYSIS (845.670(e))

Intended for
Illinois Power Resources Generating, LLC
7800 Cilco Lane
Bartonville, Illinois, 61607

Date
June 2, 2025

Project No.
1940110241-003

CORRECTIVE ACTION PLAN

ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS
IEPA ID NO. W1438050005-01

RAMBOLL Bright ideas. Sustainable change.

CORRECTIVE ACTION PLAN
EDWARDS POWER PLANT, ASH POND, IEPA ID NO. W1438050005-01

Project name	**Edwards Power Plant Ash Pond**
Project no.	**1940110241-003**
Recipient	**Illinois Power Resources Generating, LLC**
Document type	**Corrective Action Plan**
Revision	**FINAL**
Date	**June 2, 2025**
Prepared by	**Elizabeth (Richter) Rotstein, PE**
Checked by	**Lucas Carr, PE**
Approved by	**Brian G. Hennings, PG**
Description	**Corrective Action Plan for 35 I.A.C. § 845**

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

T 414-837-3607
F 414-837-3608
https://ramboll.com

Elizabeth C. Rotstein

Elizabeth (Richter) Rotstein, PE
Qualified Professional Engineer

Brian G. Hennings, PG
Project Officer, Hydrogeology

CONTENTS

1.	**Introduction**	**3**
1.1	Plant and Site Information	3
1.2	Organization of the Corrective Action Plan	3
1.3	Permit Status	3
1.4	Selected Corrective Action Remedy	3
1.4.1	Narrative Description of Selected Corrective Action Remedy	4
1.4.1.1	Narrative Discussion of Remedy Design and Function	5
1.4.2	Narrative Description of Proposed Remedy Operations	7
1.4.3	Narrative Description of Proposed Groundwater Monitoring	8
2.	**Corrective Action Overview**	**10**
2.1	Integration of Corrective Action with Source Control (Final Closure)	10
2.2	Corrective Measures Assessment	10
2.3	Analysis of Corrective Action Alternatives	11
2.3.1	Corrective Action Alternatives Analysis Supporting Information Report	11
2.3.2	Corrective Action Alternatives Analysis	11
3.	**Corrective Action Plan**	**12**
3.1	General Requirements	12
3.2	Remedy Selection	12
3.3	Schedule for Implementation	13
3.3.1	Other Relevant Factors	17
3.4	Necessity of Interim Measures	17
4.	**References**	**19**

TABLES (WITHIN TEXT)

Table A	Estimated Timeframes to Attain GWPS in Groundwater Monitoring Wells

TABLES

Table 1	Proposed Milestone Schedule for Implementing Corrective Action Remedy (Groundwater Extraction)

APPENDICES

Appendix A	Corrective Action Alternatives Analysis (845.670(e)), including Corrective Measures Assessment (845.660)
Appendix B	Drawings and Material Specifications for Selected Remedy

ACRONYMS AND ABBREVIATIONS

%	percent
35 I.A.C.	Title 35 of the Illinois Administrative Code
40 C.F.R.	Title 40 of the Code of Federal Regulations
amp	amperage
AP	Ash Pond, also referred to as Site
BCU	bedrock confining unit
CA	Corrective Action
CA GMP	Corrective Action Groundwater Monitoring Plan
CAAA	Corrective Action Alternatives Analysis
CAAA-SIR	Corrective Action Alternatives Analysis Supporting Information Report
CAP	Corrective Action Plan
CBR	closure-by-removal
CCR	coal combustion residuals
CIP	closure-in-place
CMA	Corrective Measures Assessment
COC	constituent of concern
COI	constituent of interest
CP	Construction Permit
CY	cubic yards
EPP	Edwards Power Plant
EQ	equalization
gpm	gallons per minute
Gradient	Gradient Corporation
GWE	Groundwater Extraction
GWP	Groundwater Polishing
GWPS	groundwater protection standards
HCR	Hydrogeologic Site Characterization Report
ID	identification
IEPA	Illinois Environmental Protection Agency
IPRG	Illinois Power Resources Generating, LLC
ISGS	Illinois State Geological Survey
NAVD88	North American Vertical Datum of 1988
NID	National Inventory of Dams
No.	number
OMM	Operations, Maintenance, and Monitoring
OP	Operating Permit
PMP	potential migration pathway
psf	Pound per square foot
psi	Pound per square inch
Ramboll	Ramboll Americas Engineering Solutions, Inc.
SFA	Safety Factor Assessment
TDS	total dissolved solids
UA	uppermost aquifer
UCF	Upper Cahokia Formation
USEPA	United States Environmental Protection Agency
VAC	volt alternating current

1. INTRODUCTION

1.1 Plant and Site Information

Illinois Power Resources Generating, LLC (IPRG) is the owner of the inactive coal-fired Edwards Power Plant (EPP), also referred to as the Edwards Power Station, in Bartonville, Peoria County, Illinois. IGPC intends to complete groundwater corrective action (CA) at the coal combustion residuals (CCR) surface impoundment (SI) Ash Pond (AP), which is identified by Illinois Environmental Protection Agency (IEPA) identification (ID) number (No.) W1438050005-01, CCR Unit ID No. 301, and National Inventory of Dams (NID) No. IL50710. This Corrective Action Plan (CAP) has been prepared for the AP at the EPP under the requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments [1].

1.2 Organization of the Corrective Action Plan

This CAP is organized in the following manner:

- **Section 1** includes an introduction to the AP, lists the status of other 35 I.A.C. § 845 permit applications submitted to IEPA, identifies the selected remedy, and provides a narrative of remedy construction;
- **Section 2** includes an overview of the CA process, including the results of the Corrective Measures Assessment (CMA) and Corrective Action Alternatives Analysis (CAAA);
- **Section 3** provides the CAP requirements, the selected remedy, an evaluation of effectiveness and an implementation schedule, as required by 35 I.A.C. § 845.670; and
- **Section 4** includes reference documents used in the development of this CAP.

This CAP was prepared as an attachment to the Construction Permit application for the AP as required by 35 I.A.C. § 845.220(a) and (c).

1.3 Permit Status

In addition to the Construction Permit (CP) application for CA, to which this CAP is an appendix, the following 35 I.A.C. § 845 permit applications have previously been submitted to IEPA by IPRG for the AP:

- An OP application, as required by 35 I.A.C. § 845.230, was submitted on October 25, 2021 [2].
- A CP application for closure of the AP [3], as required by 35 I.A.C. § 845.220, including a CCR Surface Impoundment Final Closure Plan, as required by 35 I.A.C. § 845.720, was submitted on June 29, 2022 [4].
  - The Final Closure Plan selected hybrid closure-in-place (CIP) with consolidation as the most appropriate closure method for the AP.

As of the date of this CAP, IPRG's OP and CP applications for the AP are pending with IEPA.

1.4 Selected Corrective Action Remedy

Groundwater Extraction (GWE), combined with the source control presented within the Final Closure Plan [4], has been identified as the most appropriate remedy for the AP, based on the Corrective Action Alternatives Analysis (CAAA) provided in **Appendix A**. Potential remedies

evaluated in the CAAA included Source Control with Groundwater Polishing (GWP), Source Control with GWE, and Source Control with Phytoremediation.

The CAAA, which was prepared by Gradient Corporation (Gradient), was based on a CAAA Supporting Information Report (CAAA-SIR) that was prepared by Ramboll Americas Engineering Solutions, Inc. (Ramboll) and is attached to the CAAA. The CAAA-SIR includes the results of groundwater modeling and feasibility-level design information for each remedy.

A Groundwater Polishing Evaluation Report [5] is also attached to the CAAA. This report presents results from geochemical modeling of exceedance[1] parameters addressed at AP by the CAP. Geochemical modeling evaluated GWP as a component of the proposed CA. The results of the GWP evaluation also contextualized estimates of the modeled times to meet groundwater protection standards (GWPS) by evaluating potential changes in constituent of concern (COC) attenuation as groundwater quality returns to background conditions.

1.4.1 Narrative Description of Selected Corrective Action Remedy

CA will consist of the source control, as outlined in the Final Closure Plan for the AP [4], and the operation of a GWE system, which will be located at the downgradient boundary of the AP and will intercept CCR-impacted groundwater from native soil units, prior to it flowing offsite. This will control the source to reduce, to the maximum extent feasible, further releases of constituents listed in 845.600 in accordance with 845.670(d)(3).

The proposed source control portion of the remedy (*e.g.,* closure) exceeds the minimum Closure Performance Standards listed in 35 I.A.C. § 845.750. The closure will control infiltration in accordance with the performance standard in 35 I.A.C. § 845, thus removing the hydraulic head that can force leachate into subsurface soils and is the mechanism that can drive risk (United States Environmental Protection Agency [USEPA], 2015a, p. 21342):

> *EPA's risk assessment shows that the highest risks are associated with CCR surface impoundments due to the hydraulic head imposed by impounded water. Dewatered CCR surface impoundments will no longer be subjected to hydraulic head so the risk of releases, including the risk that the unit will leach into the groundwater, would be no greater than those from CCR landfills.*

The AP will be closed using a hybrid consolidate-and-cap approach. This will include completely removing approximately 1,130,000 cubic yards (CY) of CCR [3] from the closure-by-removal (CBR) area and relocating the waste material to the south end and other low areas of the SI (the CIP area). Additionally, approximately 210,000 CY of CCR will be relocated from the rail loop embankment into the CIP footprint. The excavation and consolidation will reduce the total CCR footprint from approximately 102 acres to approximately 69 acres, providing a 33 acre, or approximately 32 percent (%), reduction in the consolidated and closed final footprint of the AP. Additional closure activities will include construction of an earthen separation berm at the perimeter of the relocation area of the AP to contain the relocated ash, installing a system to address residual saturation, and installing an engineered low permeability geomembrane cover system.

[1] Throughout this document, "exceedance" or "exceedances" is intended to refer only to potential exceedances of proposed applicable background statistics or GWPSs as described in the proposed groundwater monitoring program, which was submitted to the IEPA on October 25, 2021 as part of IPRG's operating permit application for the EPP AP. That operating permit application, including the proposed groundwater monitoring program, remains under review by the IEPA and, therefore, IPRG has not identified any actual exceedances.

The consolidated CCR will be covered with an alternate geomembrane final cover system having performance that exceeds the 35 I.A.C. § 845.750(c)(2) minimum final cover requirements. The proposed source control is predicted to reduce water flux out of the AP by 94% relative to pre-closure conditions (**Appendix A**).

The GWE system will be installed concurrent with closure construction and will consist of two groundwater extraction trenches. The groundwater extraction trenches will collect CCR-impacted groundwater from the potential migration pathway (PMP) and Upper Aquifer (UA).

The system will be continuously operated during the CA period, outside of routine shutdowns for system maintenance and/or power outages. Groundwater CA performance will be monitored in accordance with the Corrective Action Groundwater Monitoring Plan (CA GMP). The system operation will cease when concentrations in monitoring wells upgradient of the GWE do not exceed the GWPS and a determination has been made that COCs will not rebound above the GWPS after the system is removed from operation. Monitoring and adaptive site management practices presented in the corrective action groundwater monitoring plan describe how stability in groundwater data will be evaluated before assessing if compliance with the GWPS has been attained to allow any transient effects of treatment on the groundwater (e.g., rebounding concentrations) to dissipate.

Estimated timelines for GWE system operations and times to reach the GWPS will be periodically reviewed and updated based on observed CA performance via an adaptive site management strategy. These periodic, updated estimates will be communicated to IEPA and the public within annual CA monitoring reports, in accordance with the CA GMP.

CA will be considered complete when a demonstration that GWPS compliance beyond the waste boundary has been achieved for at least three years after remedy operations have ceased and a CA Completion Report and Certification have been submitted to IEPA in accordance with 35 I.A.C. § 845.680(e).

1.4.1.1 Narrative Discussion of Remedy Design and Function

The GWE system remedy includes the construction of two GWE trenches. Permit-level engineering drawings depicting the proposed remedy are provided in **Appendix B**. Each trench is described below:

North Trench:

- The north trench will be approximately 1,600-feet long and up to 2 to 3 feet wide and will run north to south along the northwest side of the AP, generally intersecting groundwater downgradient of the west side of the CCR consolidation area.
- The north trench will extend from the post-construction surface grade (approximate elevation of 440 feet[2]) through the PMP and UA, and terminate approximately 1 to 2 feet below the top of bedrock (bedrock expected to be at an approximate elevation range of 411 to 421 feet). The depth of the north trench ranges from approximately 21 to 31 feet deep (to bottom of key).

[2] All elevations in this report are in the North American Vertical Datum of 1988 (NAVD88), unless otherwise noted.

South Trench:

- The south trench will be approximately 800-feet long and up to 2 to 3 wide and will run north to south along the southwest side of the AP generally intersecting groundwater down gradient of the southwest side of the CCR consolidation area.
- The south trench will extend from the post-construction crest elevation after removal of the rail line, ballast, and CCR embankment section (approximately elevation 450 feet) through the PMP and UA and terminate approximately 1 to 2 feet below the top of bedrock (expected to be at an approximate elevation of 401.5 feet). The depth of the south trench will be approximately 50 feet deep.

Construction of the selected remedy will include the following tasks:

- A Pre-Design Investigation (PDI) along the trench alignments will be required to verify the bedrock elevation and trench depth. The results of the PDI will be incorporated into the final trench design documents.
- Site utilities will be modified and/or abandoned, as necessary to provide construction access.

Specific construction activities for the north trench are described below.

- Groundwater fate and transport modeling estimates an initial extraction flow rate of approximately 20 gallons per minute (gpm), which decreases to 6 gpm as operation of the GWE trench captures groundwater downgradient of the CCR unit.
- Perforated groundwater collection pipe will be laid in the trench base at an approximate 0.5 to 2% grade to slope towards the collection sumps.
- A total of four collection sumps are anticipated to be installed at 300 to 500 foot centers along the north trench alignment. Sumps will consist of a pit to hold extracted water, a pneumatic pump, and a discharge pipe that will carry extracted water to an equalization (EQ) tank into a nearby compressor shed.
- Site utilities will be modified and/or abandoned, as necessary to provide construction access. This may require raising existing high-voltage power lines that cross the northern trench alignment, in order to provide a safe working distance between the energized lines and construction equipment. Additionally, previously abandoned portions of a sewer force main within the trench alignment may need to be removed to allow for trench construction.

Specific construction activities for the south trench are described below.

- The contractor will establish a 40-foot-wide level work platform at an elevation of 450 feet along the crest of the AP embankment at the south trench alignment to allow construction of the trench by the specialty trench contractor.
- Groundwater fate and transport modeling estimates an initial extraction flow rate of approximately 19 gpm, which decreases to 8 gpm as operation of the GWE trench captures groundwater downgradient of the CCR unit.
- Geotechnical monitoring will be performed during construction of the work platform and south trench to evaluate the AP embankment for signs of distress during construction. A geotechnical monitoring plan will be incorporated into the final design documents.

- Methane is known to be present in aquifers throughout Illinois, due to both natural and anthropogenic processes (coal mining), and has been encountered at depth during drilling along the AP embankment in the vicinity of the south trench alignment [6]. A detailed methane monitoring plan will be developed and implemented during onsite construction activities where the potential to encounter methane has been previously identified.
- Perforated groundwater collection pipe will be laid in the trench base at an approximate 0.5 to 2% grade to slope towards the collection sumps.
- A total of three collection sumps are anticipated to be installed at 200 to 500 foot centers along the south trench alignment. Sumps will consist of a pit to hold extracted water, a pneumatic pump and a discharge pipe that will carry extracted water to an EQ tank into a nearby compressor shed.

Electrical infrastructure to support the GWE system will be installed prior to delivery and placement of the GWE system. System infrastructure will include:

- Electrical infrastructure to support the GWE system will include a 480-volt alternating current (VAC), 400-amperage (amp) power service, including supporting transformers and other infrastructure to power each compressor shed.

A groundwater extraction system enclosure will be placed within the limits of a central gravel pad. The system enclosure will consist of the following equipment:

- An air compressor, air receiver tank, EQ tank, and transfer pump to supply compressed air to nearby pneumatic pumps and to transfer liquids from the EQ tank to the water treatment process; and
- A compressor air manifold consisting of control valves and pulse counters, and a collection sump discharge piping manifold consisting of control valves and flow meters to totalize extracted water from each collection sump will be installed in the compressor shed as well as other miscellaneous electrical controls that allow for continuous automated operation, data collection, and remote telemetry.

Additionally, preliminary geotechnical assessments performed to confirm that installation of the south trench is not expected to adversely impact the structural integrity of the AP perimeter dikes.

1.4.2 Narrative Description of Proposed Remedy Operations

- The GWE system will be operated in accordance with this CAP, and other applicable permits and regulations. Operations, monitoring, and maintenance (OMM) will be conducted on the GWE system on a routine basis. OMM will consist of system wide data collection to track groundwater recovery and discharge rates, sediment removal (as needed), and to optimize trench extraction rates as needed under an adaptive site management strategy. Waste streams associated with the GWE system and their management include: accumulated sediment/solids that collect at the bottom of the EQ tanks, which will be intermittently removed, dried, and disposed of at a non-hazardous landfill, as needed based on accumulation rates.
- The conveyance piping will be flushed on an as-needed basis if solids accumulation is observed on the inner wall of the conveyance pipe during routine OMM inspections. Flush water will be managed in accordance with applicable permits that will be obtained at a later date.

Routine equipment maintenance will be conducted per recommendations provided by manufacturers of the various components of the GWE system. Additionally, faulty equipment will be replaced as needed to keep the GWE system operating within design specifications. Equipment maintenance and/or replacements may require temporary shutdown of the GWE system.

1.4.3 Narrative Description of Proposed Groundwater Monitoring

CA groundwater monitoring will be conducted in accordance with the CA GMP during remedy operation to evaluate the effectiveness of the CA remedy and whether groundwater concentrations are achieving the GWPS as predicted by the groundwater model. Groundwater data collected as part of the monitoring program will be analyzed to determine if the remedy is on track to meet GWPS and to inform adaptive management decisions if performance metrics are not achieved. Information associated with each of these activities is described below.

- Regular groundwater monitoring will be conducted utilizing a CA groundwater monitoring network designed in accordance with 35 I.A.C. § 845.680(a)(1).
- Laboratory parameters include major ions for evaluating groundwater chemistry and COCs (*i.e.*, reported exceedances in accordance with the Operating GMP) the CA is intended to address. Sampling to evaluate CA effectiveness will begin the quarter after the CA remedy is implemented and commissioned. Samples will be collected on a quarterly basis initially and potentially reduced to a semiannual basis once five years of monitoring have occurred, in accordance with 35 I.A.C. § 845.650(b)(4). Monitoring results will be submitted to IEPA for each monitoring event, in addition to an Annual Groundwater Monitoring and CA Report, in accordance with 35 I.A.C. § 845.610(e).
- Routine maintenance of the monitoring well network will include inspecting the wells, making repairs to the wells (as needed) and rehabilitating and/or replacing wells to improve performance (as needed).
- Adaptive site management strategies will be employed as an integral part of ongoing CA at the AP. The adaptive site management approach will allow timely incorporation of new site information to ensure the achievement of the GWPS. The effectiveness of the remedy at each phase is evaluated using performance metrics designed to assess the goals of that phase. Performance metrics answer questions designed to evaluate multiple aspects of remedy effectiveness with the ultimate goal of holistically guiding management decisions [7]. The goals and performance metrics of each phase of remedy evaluation are presented in Section 3 of the CA GMP included in the CP application.
- Documentation of remedy progress metrics will be provided in the Annual Groundwater Monitoring and CA Report beginning after the second year of data collection: a minimum of eight data points is required to complete meaningful statistical analysis required for evaluation of the remedy progress metrics, which will be available after two years of quarterly sampling. Per USEPA guidance [7], a thorough review of CA progress and remedy effectiveness will be conducted every five years. A Five-Year Annual Groundwater Monitoring and CA Report will evaluate the comprehensive data set and, if triggered by the results of the remedy progress evaluation metrics, evaluate whether adaptive management actions are needed. The five-year time frame allows adaptive management decisions to be based on a robust data sufficient to complete meaningful statistical analysis while remaining responsive to changing site conditions [7].

- CA Confirmation Monitoring and Completion
  - Per 35 I.A.C. § 845.680(c), CA is considered complete when compliance with the GWPS has been demonstrated "at all points within the plume of contamination that lies beyond the waste boundary […] for a period of three consecutive years". At that time, an attainment evaluation will be implemented. This will include monitoring each well for three additional years to confirm that GWPS have been achieved, in accordance 35 I.A.C. § 845.680(c).
  - After completion of the CA confirmation monitoring period, a CA Completion Report and Certification will be prepared and submitted to IEPA, in accordance with 35 I.A.C. § 845.680(e).

2. CORRECTIVE ACTION OVERVIEW

This CAP is based on the tiered assessment and analysis of alternative remedial technologies and remedies that was completed via the CMA and CAAA (**Appendix A**). The objective of these assessments were to determine the optimal alternative for the AP that, when coupled within the source control proposed in the Final Closure Plan [4], would remediate groundwater and provide compliance with the GWPS specified under 35 I.A.C. § 845.600.

2.1 Integration of Corrective Action with Source Control (Final Closure)

All documents, assessments, and analyses performed as part of this CAP assume that the source control presented in the Final Closure Plan [4] for the AP will also be implemented. Final design and construction of the proposed GWE trenches and associated appurtenant structures and infrastructure will be closely coordinated with the AP closure construction. It is expected that CA construction will occur concurrently with closure construction. Construction will be sequenced such that: a) CCR and any underlying comingled soils are removed from the CCR relocation area, and backfilling and regrading the area is completed prior to initiating construction of the north GWE trench; and b) the existing rail loop, ballast and CCR embankment are removed prior to initiating construction of the south GWE trench. It is anticipated that construction of the trenches will occur prior to installation of the final cover system. This sequencing is necessary to facilitate construction of the trenches without adversely impacting the closure construction, and vice versa, and to allow placement of trench spoils beneath the cover system.

Source control alone, without other supplemental corrective action, has been estimated via groundwater modeling to reduce the hydraulic flux out of the AP by 94%, relative to pre-closure conditions. Groundwater modeling performed to support the Final Closure Plan estimates that source control activities are expected to result in GWPS being achieved in greater than 100 years after closure completion, without implementing other forms of CA [4].

The remedy presented in this CAP is supplemental to a system to address residual saturation, completion of source control via closure, and placing the CCR above the groundwater table and UA, which when combined are the primary remedial action that will be performed at the site.

2.2 Corrective Measures Assessment

The CMA [8] was performed for the AP and submitted to the IEPA on June 6, 2024, after the exceedances of the GWPSs were identified. The CMA considered a total of five corrective measures for the AP, including:

- Source Control with GWP
- Source Control with GWE
- Source Control with Groundwater Cutoff Wall
- Source Control with In-Situ Chemical Treatment
- Source Control with Phytoremediation

Based on the CMA, three corrective measures, including Source Control-GWP, Source Control-GWE, and Source Control-Phytoremediation, were identified as potentially viable corrective measures for the AP and were included for further evaluation, design advancement, and

comparative assessment within the CAAA for the AP. The other corrective measures were determined by the CMA to be unlikely to be viable for the AP and were not evaluated further within the CAAA.

2.3 Analysis of Corrective Action Alternatives

2.3.1 Corrective Action Alternatives Analysis Supporting Information Report

The CAAA for the AP was prepared by Gradient based on a Corrective Action Alternatives Analysis Supporting Information Report (CAAA-SIR) prepared by Ramboll. The CAAA-SIR included additional evaluation, design advancement, and comparative assessment of the Source Control-GWP, Source Control-GWE, and Source Control-Phytoremediation corrective measures identified as potentially viable for the AP by the CMA. The evaluation included the completion of feasibility-level design activities for each alternative; this incorporated the following tasks:

- Performing predictive groundwater modeling to evaluate the scope (*i.e.*, location and extents) of each alternative and the corresponding estimated time to achieve the GWPS;
- Developing feasibility-level design drawings showing the extents in plan and elevation view of each engineered remedy;
- Estimating the time required to design, construct, and implement each remedy, in addition to ongoing operational and maintenance requirements;
- Developing conceptual plans for the storage, treatment, and discharge of extracted groundwater for applicable remedies;
- Identifying future tasks required to implement each alternative, including permitting, investigation, and design efforts; and
- Estimating relevant material quantities, labor hours, delivery miles, equipment miles, and daily commuting miles associated with constructing each remedy.

2.3.2 Corrective Action Alternatives Analysis

The CAAA (**Appendix A**) included a detailed analysis of each of the corrective action alternatives presented in the CAAA-SIR, including an evaluation of:

- Long and short-term effectiveness and protectiveness;
- Ease or difficulty of implementation;
- Degree to which community concerns are addressed; and,
- Relative amount of contamination removed from the environment.

Based on the CAAA, Source Control-GWE was identified as the most appropriate CA for the AP and was selected for further design development as part of this CAP.

It should be noted that the permit-level engineering assessments, groundwater modeling, and other information contained within this CAP were developed to a higher level of design and detail than those assessments performed in the CAAA; therefore, information on items such as permitting, remedy scope, estimated time to reach GWPS, implementation schedule, etc. may differ between this CAP and the included CAAA-SIR and CAAA. Information for the Source Control-GWE contained within the CAP should be considered to supersede information contained within the CAAA and CAAA-SIR.

3. CORRECTIVE ACTION PLAN

The 35 I.A.C. § 845 requirements for the CAP and corresponding demonstrations that the proposed corrective measures meet these requirements are discussed individually in this section. Many of the CAP requirements are disused within the CMA and CAAA documents that have been prepared to support the CAP. Therefore, the demonstrations will also refer to those documents.

3.1 General Requirements

35 I.A.C. § 845.670(c): The corrective action plan must meet the following requirements:

(1) Be based on the results of the corrective measures assessment conducted under 35 I.A.C. § 845.660;

(2) Identify a selected remedy that at a minimum, meets the standards listed in subsection (d);

(3) Contain the corrective action alternatives analysis specified in subsection (e); and

(4) Contain proposed schedules for implementation, including an analysis of the factors in subsection (f).

This CAP is based on the results of the CMA and CAAA, which are included within **Appendix A**. The proposed schedule for implementing source control with GWE is provided in **Table 1**.

3.2 Remedy Selection

Section 845.670(d): The selected remedy in the corrective action plan must:

(1) Be protective of human health and the environment;

Current conditions at the AP pose no risk to human health or the environment (**Appendix A**). Concentrations of CCR-derived constituents are anticipated to decline once the AP is closed and the GWE remedy is in place as presented in the CAAA [9] (**Appendix A**). The GWE system will provide hydraulic control and intercept migration of groundwater as CCR-derived constituent concentrations decline below the GWPS.

(2) Attain the groundwater protection standards specified in 35 I.A.C. § 845.600;

Groundwater modeling indicates source control with GWE (Appendix B of the CAAA-SIR which is attached in **Appendix A**), which is selected as the remedy of this CAP, will result in attainment of the GWPS within the current monitoring system within 37 years of final closure completion.

(3) Control the sources of releases to reduce or eliminate, to the maximum extent feasible, further releases of constituents listed in 35 I.A.C. § 845.600 into the environment;

The AP will be closed using a hybrid consolidate and CIP approach which will act as the main source control mechanism to prevent further releases of CCR-derived constituents. The GWE system will intercept potential off-site migration of CCR-derived constituents in groundwater until the GWPS are achieved.

The main source of CCR-derived constituent release occurred as a result of surface water infiltration. The GWE system was designed to intercept CCR-impacted groundwater from native soil units prior to it flowing offsite. If the remedy is found to be unsuccessful in meeting

remediation goals, adaptive site management actions will be taken as described within the CA GMP (**Appendix B**).

(4) Remove from the environment as much of the contaminated material that was released from the CCR surface impoundment as is feasible, taking into account factors such as avoiding inappropriate disturbance of sensitive ecosystems; and

No known releases of CCR due to a structural integrity issue have occurred at the AP.

(5) Comply with standards for management of wastes as specified in 35 I.A.C. § 845.680(d).

The CCR managed as part of the closure will be done in accordance with all 35 I.A.C. § 845 requirements and the Final Closure Plan [4].

3.3 Schedule for Implementation

GWE is effective as an engineered corrective action as it intercepts downgradient groundwater, supports attainment of the GWPS, and has been demonstrated as a reliable and applicable ex-situ remedial technology by the USEPA **[10]**. GWE will be implemented as the final CA. GWE will continue to operate as the CA following source control until (1) GWPS have been met and (2) it has been determined that potential rebound above GWPS is not expected after operation of the GWE system is ceased. Monitoring and adaptive site management practices presented in the corrective action groundwater monitoring plan will be used to determine when operation of the GWE will cease after the GWPS has been met. The corrective action groundwater monitoring plan describes how stability in groundwater data will be evaluated before assessing if compliance with the GWPS has been attained to allow any transient effects of treatment on the groundwater (e.g., rebounding concentrations) to dissipate.

The GWE remedy was evaluated to determine if it can be successfully implemented to achieve GWPS compliance in a timely manner. Timeframes to attain GWPS in the CA monitoring network wells are estimated in **Table A**:

Table A. Estimated Timeframes to Attain GWPS in Groundwater Monitoring Wells

Description	2 years**	5 years**	10 years**	20 years**	37 years**
Percentage of wells predicted to attain GWPS*	20%	20%	60%	80%	100 %

*: 10 wells were used for this estimate as presented in the 2025 Groundwater Modeling Technical Memorandum.
**: Years counted starting from completion of CA.

35 I.A.C. § 845.670(f): The owner or operator must specify, as part of the corrective action plan, a schedule for implementing, of and completing, remedial activities. The schedule must require the completion of remedial activities within a reasonable time, taking into consideration the factors in this subsection (f). The owner or operator of the CCR surface impoundment must consider the following factors in determining the schedule of remedial activities:

The schedule implementing and completing the Source Control-GWE remedy at the AP is included in **Table 1**. The schedule will result in completion of remedial activities within a reasonable timeframe considering the factors specified by 35 I.A.C. §§ 845.670(f)(1) through (5), as summarized below.

35 I.A.C. § 845.670(f)(1): Extent and nature of contamination, as determined by the characterization required under 35 I.A.C. § 845.650(d);

The Nature and Extent Report [11], which was submitted to the IEPA on June 4, 2024 and is included with relevant updates as Appendix D to the CAAA report (**Appendix A**), details exceedances of the GWPS. Groundwater modeling and geochemical analysis were performed by Ramboll as part of the CAAA-SIR to design the remedy, and the modeling considered the nature and extent of contamination.

35 I.A.C. § 845.670(f)(2): Reasonable probabilities of remedial technologies achieving compliance with the GWPS established by 35 I.A.C. § 845.600 and other objectives of the remedy;

Several remedies were evaluated in the CAAA and it was determined that the selected remedy (Source Control–GWE) is expected to achieve compliance with 35 I.A.C. § 845.600. Groundwater modeling was performed to evaluate future groundwater quality in the vicinity of the AP impoundment. The results of the modeling indicate that groundwater will attain the GWPS for all constituents within approximately 37 years after closure.

As discussed in the CMA, source control via consolidate-and-cap approach and GWE are proven methods for addressing groundwater contamination [8]. The proposed consolidate-and-cap approach is consistent with the requirements of Title 40 of the Code of Federal Regulations (40 C.F.R.) Section 257 and 35 I.A.C. § 845. The proposed cover has been demonstrated to be compliant by equivalency in the Final Closure Plan [4].

35 I.A.C. § 845.670(f)(3): Availability of treatment or disposal capacity for CCR managed during implementation of the remedy;

The selected remedy includes CIP and GWE. The CCR will be managed within the footprint of the existing CCR Unit as proposed in the Final Closure Plan [4]. The GWE system is not expected to result in the management of CCR. Therefore, the treatment and disposal capacity of CCR is not an applicable consideration for the selected remedy.

35 I.A.C. § 845.670(f)(4): Potential risks to human health and the environment from exposure to contamination before completion of the remedy;

A Human Health and Ecological Risk Assessment was completed and included as an attachment to the CAAA [9] (**Appendix A**). The overall conclusion is that groundwater from the AP impoundment and potential groundwater contributions to surface water pose no unacceptable risks to human health or the environment. Groundwater data collected from 2015 to 2021 were used to estimate exposures, and data from the one available surface water sample was also evaluated. For groundwater constituents retained as constituents of interest (COIs), surface water and sediment concentrations were modeled using the maximum detected groundwater concentration. This conclusion was reached using methodology consistent with applicable USEPA risk assessment principles. The assessment relied on conservative assumptions meant to overestimate possible exposures and risks and provide an additional level of certainty in the conclusions.

35 I.A.C. § 845.670(f)(5): Resource value of the aquifer, including:

The resource value of the aquifer is discussed in the Hydrogeologic Site Characterization Report (HCR) [12], which is included as Attachment B.3 in the CP application [3]. The principal aquifer in

the region is the sand and gravel outwash deposits of the Banner and Henry Formations in the Illinois Valley. Well logs indicate that high-capacity wells with yields up to 1,000 gpm have been developed in this aquifer. These high yield formations have not been observed in the vicinity of the Ash Pond. Groundwater wells in the adjacent uplands are either shallow wells in thin sand and gravel lenses which occur within the Glasford Formation diamicton or drilled into the underlying bedrock. The aquifer in the vicinity of the Ash Pond is limited to thin (generally less than four feet), moderate permeability sand, silty sand, and clayey gravel material within the Lower Cahokia Formation, bedrock, and/or weathered shale bedrock, where present. In locations where higher permeability materials and coarser grained material are absent, the aquifer is interpreted as the interface between the Lower Cahokia Formation and shale bedrock. Paragraphs (A) through (F) from 35 I.A.C. § 845.670(f)(5) are further addressed, as summarized below.

35 I.A.C. § 845.670(f)(5)(A): Current and future uses, including potential residential, agricultural, commercial industrial and ecological uses; and

Current uses and users of the groundwater are discussed in the HCR Section 5.1 and attachments and, were considered in the CAAA as part of the Human Health and Ecological Risk Assessment which concluded that groundwater from the AP impoundment and potential groundwater contributions to surface water pose no unacceptable risks to human health or the environment. No changes in future residential, commercial, or ecological use are expected. In the absence of changes to current and future uses there is no applicable scheduling consideration.

35 I.A.C. § 845.670(f)(5)(B): Proximity and withdrawal rate of users;

A water well inventory was completed in 2021 utilizing federal and state databases to assess nearby pumping wells, drinking water receptors, and other uses of water in the vicinity of the AP. Based on records obtained from the Illinois State Geological Survey (ISGS) ILWATER Map [13], there are 14 wells located outside of the EPP property within 1,000 meters of the AP. These included seven engineering test wells, three industrial-commercial wells, three farm/domestic wells, and one monitoring well. Three of the 14 identified offsite water wells are downgradient of the AP, two of which are identified as water wells, and one is identified as plugged and abandoned. No potable wells were identified downgradient of the AP. Primary uses are industrial applications, monitoring, and engineering test wells.

Additional evaluation of these receptors was completed as part of a supplemental site investigation [14] to determine the status and use of wells at locations identified in the most recent survey. The evaluation resulted in confirmation of seven potential water wells within 1,000 meters of the AP boundary. Based on the analysis only 3 wells are present within 1,000-meters of the AP, two are non-potable supplies and the third well is located upgradient of the AP and will not be impacted by a potential release from the AP.

35 I.A.C. § 845.670(f)(5)(C): Groundwater quantity and quality;

Per 35 I.A.C. § 620.210, groundwater within the UA at the AP meets the definition of Class I – Potable Resource Groundwater [12]. The Human Health and Ecological Risk Assessment [9] concluded that groundwater from the AP impoundment and potential groundwater contributions to surface water pose no unacceptable risks to human health or the environment.

35 I.A.C. § 845.670(f)(5)(D): The potential impact to the subsurface ecosystem, wildlife, other natural resources, crops, vegetation, and physical structures caused by exposure to CCR constituents;

Potential surface receptors are discussed in HCR Sections 5.2 and 5.3. A survey to identify surface water features, nature preserves, and historic sites was conducted for a 1,000-meter radius around the AP. Section 3.5 of the Human Health and Ecological Risk Assessment [9] included as Appendix A of the CAAA indicated there are no current unacceptable risks to ecological receptors at the AP.

- Ecological receptors exposed to surface water include aquatic plants, amphibians, reptiles, and fish. The risk evaluation showed that none of the COIs in surface water exceeded protective screening benchmarks.
- Ecological receptors exposed to sediment include benthic invertebrates. The modeled sediment COIs did not exceed the conservative screening benchmarks, therefore, none of the COIs evaluated in sediment are expected to pose an unacceptable risk to ecological receptors.
- Ecological receptors were also evaluated for exposure to bioaccumulative COIs. This evaluation considered higher trophic-level wildlife with direct exposure to surface water and sediment and secondary exposure through the consumption of dietary items (*e.g.*, plants, invertebrates, small mammals, fish). Based on US EPA Region 4 Ecological Risk Assessment Supplemental Guidance (March 2018 Update) [15], only mercury was identified as a bioaccumulative COI. However, the modeled concentrations did not exceed benchmarks protective of bioaccumulative effects. Therefore, mercury is not considered to pose an ecological risk via bioaccumulation. Overall, this evaluation demonstrated that none of the COCs evaluated are expected to pose an unacceptable risk to ecological receptors.

Overall, this evaluation demonstrated that none of the COIs evaluated are expected to pose an unacceptable risk to ecological receptors. In the absence of unacceptable risks to ecological receptors there is no applicable scheduling consideration.

35 I.A.C. § 845.670(f)(5)(E): The hydrogeologic characteristic of the facility and surrounding land; and

In addition to the CCR present at AP, there are three principal layers of unlithified material present above the bedrock, which are categorized into the hydrostratigraphic units described below (from surface downward) based on stratigraphic relationships and common hydrogeologic characteristics:

- Upper Cahokia Formation (UCF)/PMP: Low permeability clays and silts of the UCF are present at the surface. This unit is considered a PMP at elevations similar to the base of the AP, and in places where thin discontinuous sand lenses occur within the UCF adjacent to the AP.
- UA: Thin (generally less than 4 feet), moderate permeability sand, silty sand, and clayey gravel material within the Lower Cahokia Formation, bedrock, and/or weathered shale bedrock, where present. In locations where higher permeability materials and coarser grained material are absent, the UA is interpreted as the interface between the Lower Cahokia Formation and shale bedrock.
- Bedrock Confining Unit (BCU): Thick, very low permeability shales and siltstones of the Carbondale and Modesto Formations. This unit was encountered at elevations ranging from

approximately 400 to 422 feet[3] with higher bedrock elevations occurring beneath the northern portion of the AP.

The effects of nature and extent of contamination on schedule were considered by incorporating the geometry, hydraulic, and geochemical properties of these units into the groundwater modeling and groundwater polishing reports, attached to the CAAA-SIR and CAAA respectively included in **Attachment A**, which estimate the time to reach the GWPS for remedial alternatives.

The GWE remedy will intercept groundwater migrating through the UA and PMP and reduce off-site migration.

35 I.A.C. § 845.670(f)(5)(F): The availability of alternative water supplies.

As discussed in subsection 670(f)(5)(B) above, there are 3 water wells within 1,000 meters of the AP [14]. There is currently no need for an alternative water supply well as there are no current unacceptable risks to human or ecological receptors at the site and the GWE remedy will reduce off-site migration of AP CCR-derived constituents.

3.3.1 Other Relevant Factors

35 I.A.C. § 845.670(f)(6): Other relevant factors.

No additional factors were identified for consideration.

3.4 Necessity of Interim Measures

35 I.A.C § 845.680(a)(3) states the owner or operator must take any interim measures necessary to reduce the constituents leaching from the CCR surface impoundment, and/or potential exposures to human or ecological receptors. As indicated in the HHERA and discussed above, there are no currently unacceptable risks to human or ecological receptors. Due to the low permeability clay in the Cahokia Formation foundation soils surrounding the AP, migration of porewater and movement of groundwater outside the AP are limited. Therefore, no interim measures are required. Further, all subsections of this requirement are discussed as follows.

35 I.A.C. § 845.680(a)(3)(A): Time required to develop and implement a final remedy.

As described in the CAAA-SIR, remedy construction is estimated to be complete within 6 years of approval of the CP, which is relatively short compared to the estimated time to reach the GWPS.

35 I.A.C. § 845.680(a)(3)(B): Actual or potential exposure of nearby populations or environmental receptors to any of the constituents listed in 35 I.A.C. § 845.600.

There are no current unacceptable risks to human or ecological receptors at the site (**Appendix A**). Because there are no receptors within the footprint of impacted groundwater, the resource value of the UA is limited in the vicinity of the Ash Pond, and it is not a source of drinking water near the Ash Pond [12, 14]. Additionally, the Illinois River surface water is not used as a source of drinking water in the area.

[3] All elevations in this report are referenced to North American Vertical Datum of 1988 unless otherwise noted.

35 I.A.C. § 845.680(a)(3)(C): Actual or potential contamination of sensitive ecosystems or current or potential drinking water supplies.

The nature and extent of exceedances have been evaluated in the Nature and Extent Report [11]. Although there are exceedances of GWPS, there are no impacts to current or potential drinking water supplies. As stated above, there are no current unacceptable risks to human or ecological receptors at the site. The Illinois River surface water adjacent to the AP is not used as a source of drinking water in the area. Additionally, an ecological risk assessment was completed [9] and no unacceptable risks were identified for ecological receptors exposed to surface water and sediment.

35 I.A.C. § 845.680(a)(3)(D): Further degradation of the groundwater that may occur if remedial action is not initiated expeditiously.

No interim measure is expected to prevent further degradation of the groundwater more expeditiously than implementation of the selected remedy.

35 I.A.C. § 845.680(a)(3)(E): Weather conditions that may cause any of the constituents listed in 35 I.A.C. § 845.600 to migrate or be released.

There are no unacceptable risks presented by the AP under current conditions from weather-related phenomena.

35 I.A.C. § 845.680(a)(3)(F): Potential for exposure to any of the constituents listed in 35 I.A.C. § 845.600 as a result of accident or failure of a container or handling system.

There are no container or handling systems that pose a risk to receptors in the interim.

35 I.A.C. § 845.680(a)(3)(G): *Other situations that may pose threats to human health and the environment.*

No other situations have been identified where AP CCR leachate poses threats to human health and the environment.

4. REFERENCES

[1] "35 Ill. Admn. Code Part 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments," Illinois Environmental Protection Agency, Springfield, IL, 2021.

[2] Burns & McDonnell, "Initial Operating Permit, Edwards Power Plant Ash Pond," October 25, 2021.

[3] IngenAE, LLC, "Construction Permit Application, Edwards Power Station, Ash Pond, (IEPA ID W1438050005-01), Bartonville, Illinois," June 29, 2022.

[4] IngenAE, LLC, "Final Closure Plan, Edwards Power Plant, Ash Pond, (IEPA ID W1438050005-01), Bartonville, Illinois," June 2022.

[5] Life Cycle Geo, LLC, Groundwater Polishing Evaluation Report, 2025.

[6] Natural Resource Technology, Inc., "Hydrogeologic Site Characterization Report, Hennepin West Ash Pond System, Hennepin, Illinois," December 20, 2017.

[7] United States Environmental Protection Agency, "Groundwater Remedy Completion Strategy: Moving Forward with the End in Mind," Office of Solid Waste and Emergency Response, 2014.

[8] Ramboll Americas Engineering Solutions, Inc., "35 I.A.C. § 845 Corrective Measures Assessment, Edwards Power Plant, Ash Pond, IEPA ID No. W1438050005-01," Bartonville, IL, June 4, 2024.

[9] Gradient, "Human Health and Ecological Risk Assessment, Ash Pond, Edwards Power Plant, Bartonville, Illinois," Bartonville, Illinois, June 30, 2022.

[10] USEPA, "Federal Remediation Technologies Roundtable, Technology Screening Matrix - Groundwater Pump and Treat," [Online]. Available: https://www.frtr.gov/matrix/Groundwater-Pump-and-Treat/. [Accessed 3 December 2024].

[11] Ramboll Americas Engineering Solutions, Inc., "Nature and Extent Report, Edwards Power Plant, Ash Pond, IEPA ID No. W1438050005-01," Ramboll Americas Engineering Solutions, Inc., Bartonville, Illinois, June 4, 2024.

[12] Ramboll Americas Engineering Solutions, Inc., "Hydrogeologic Site Characterization Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois," October 25, 2021.

[13] Illinois State Geological Survey (ISGS), "Illinois Water & Related Wells Map (ILWATER)," [Online]. Available: https://prairie-research.maps.arcgis.com/apps/webappviewer/index.html?id=e06b64ae0c814ef3a4e43a191cb57f87. [Accessed 2021].

[14] Ramboll Americas Engineering Solutions, Inc., "2023 Supplemental Site Investigation Report, Ash Pond, Edwards Power Plant," Ramboll Americas Engineering Solutions, Inc., Bartonville, Illinois, December 1, 2023.

[15] USEPA, "Region 4 Ecological Risk Assessment Supplemental Guidance," 2018.

TABLES

Table 1. Proposed Milestone Schedule for Implementing Corrective Action Remedy (Source Control with Groundwater Extraction)

Implementation Phase	Implementation Task	Timeframe (Preliminary Estimates)
1: Pre-Construction	Agency Coordination, Approvals, and Permitting	18 to 24 months
	Final Design and Bid Process	24 to 36 months
	Timeframe to Complete Corrective Action Pre-Construction Activities	42 to 60 months
2: Corrective Action Construction	Corrective Action Construction	9 to 18 months
	Timeframe to Complete Corrective Action Construction	9 to 18 months
3: Corrective Action O&M and Closure	Corrective Action Monitoring and O&M	444 months (37 years)
	Corrective Action Groundwater Compliance Monitoring	36 months
	Corrective Action Completion	6 months
	Timeframe to Complete Corrective Action O&M and Closure	486 months (40.5 years)
Total Timeline to Complete Corrective Action (after approval of Corrective Action Plan)		537 to 564 months (45 to 47 years)

[1]All timeframes are preliminary and may change as the project develops. Timeframes may also be affected by regulatory review and/or permit approval processes, for both 35 I.A.C. § 845 and non-35 I.A.C. § 845 permits.

APPENDIX A
CORRECTIVE ACTION ALTERNATIVES ANALYSIS (845.670(E)), INCLUDING CORRECTIVE MEASURES ASSESSMENT (845.660)

Corrective Action Alternatives Analysis for the Ash Pond at the Edwards Power Plant, Bartonville, Illinois

June 2, 2025

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Table of Contents

Page

Summary of Findings S-1

1 Introduction 1
1.1 Site Description and History 1
1.1.1 Site Location and History 1
1.1.2 CCR Impoundment 1
1.1.3 Surface Water Hydrology 2
1.1.4 Hydrogeology 3
1.1.5 Site Vicinity 3
1.2 Part 845 Regulatory Review and Requirements 4

2 Corrective Action Alternatives Analysis 5
2.1 Corrective Action Alternative Descriptions 5
2.1.1 Alternative 1: Source Control-GWP 7
2.1.2 Alternative 2: Source Control-GWE 8
2.1.3 Alternative 3: Source Control-Phytoremediation 11
2.2 Long- and Short-Term Effectiveness and Protectiveness of Corrective Action Alternative (IAC Section 845.670(e)(1)) 13
2.2.1 Magnitude of Reduction of Existing Risks/Be Protective of Human Health and the Environment (IAC Section 845.670(e)(1)(A)/IAC Section 845.670(d)(1)) 13
2.2.2 Effectiveness of the Remedy in Controlling the Source (IAC Section 845.670(e)(2)/IAC Section 845.670(d)(3)) 14
2.2.3 Likelihood of Future Releases of CCR (IAC Section 845.670(e)(1)(B)) 15
2.2.4 Type and Degree of Long-Term Management, Including Monitoring, Operation, and Maintenance (IAC Section 845.670(e)(1)(C)) 15
2.2.5 Short-Term Risks to the Community or the Environment During Implementation of Remedy (IAC Section 845.670(e)(1)(D)) 16
2.2.5.1 Safety Impacts 16
2.2.5.2 Cross-Media Impacts to Air 19
2.2.5.3 Cross-Media Impacts to Surface Water and Sediments 19
2.2.5.4 Control of Exposure to Any Residual Contamination During Implementation of the Remedy 20
2.2.5.5 Other Identified Impacts 21
2.2.6 Time Until Groundwater Protection Standards Are Achieved/Attain the Groundwater Protection Standards Specified in Section 845.600 (IAC Section 845.670(e)(1)(E)/IAC Section 845.680(d)(2)) 22

2.2.7 Potential for Exposure of Humans and Environmental Receptors to Remaining Wastes, Considering the Potential Threat to Human Health and the Environment Associated with Excavation, Transportation, Re-disposal, Containment, or Changes in Groundwater Flow (IAC Section 845.670(e)(1)(F)) 24
2.2.8 Long-Term Reliability of the Engineering and Institutional Controls (IAC Section 845.670(e)(1)(G)) 24
2.2.9 Potential Need for Replacement of the Remedy (IAC Section 845.670(e)(1)(H)) 26
2.3 The Ease or Difficulty of Implementing a Remedy (IAC Section 845.670 (e)(3)) .. 26
2.3.1 Degree of Difficulty Associated with Constructing the Remedy (IAC Section 845.670(e)(3)(A)) 26
2.3.2 Expected Operational Reliability of the Remedy (IAC Section 845.670(e)(3)(B)) 28
2.3.3 Need to Coordinate with and Obtain Necessary Approvals and Permits from Other Agencies (IAC Section 845.670(e)(3)(C)) 28
2.3.4 Availability of Necessary Equipment and Specialists (IAC Sections 845.670(e)(3)(D) and 845.660(c)(1), "Ease of Implementation") 29
2.3.5 Available Capacity and Location of Needed Treatment, Storage, and Disposal Services/Comply with Standards for Management of Wastes as Specified in Section 845.680(d) (IAC Section 845.670(e)(3)(E)/IAC Section 845.670(d)(5)) 30
2.4 The Degree to Which Community Concerns Are Addressed by the Remedy (IAC Section 845.670(e)(4)) 31
2.5 Remove from the Environment as Much of the Contaminated Material that Was Released from the CCR Surface Impoundment as Is Feasible, Taking into Account Factors such as Avoiding Inappropriate Disturbance of Sensitive Ecosystems (IAC Section 845.670(d)(4)) 31
2.6 Summary 33

References 34

Appendix A Human Health and Ecological Risk Assessment
Appendix B Corrective Action Alternatives Analysis – Supporting Information Report
Appendix C Corrective Measures Assessment
Appendix D Nature and Extent Report
Appendix E Groundwater Polishing Evaluation Report

List of Tables

Table S.1 Comparison of Proposed Corrective Action Alternatives with Respect to Factors Specified in IAC Section 845.670(d) and IAC Section 845.670(e)

Table 2.1 Key Parameters for the Source Control-GWE Corrective Action Alternative

Table 2.2 Key Parameters for the Source Control-Phytoremediation Corrective Action Alternative

Table 2.3 Expected Number of On-Site Worker Accidents Under Each Corrective Action Alternative

Table 2.4 Expected Number of Off-Site Worker Accidents Related to Off-Site Car and Truck Use Under Each Corrective Action Alternative

Table 2.5 Expected Number of Community Accidents Under Each Corrective Action Alternative

Table 2.6 Estimated Timeline and Implementation Schedule Under Each Corrective Action Alternative

List of Figures

Figure 1.1 Site Location Map

Abbreviations

AP	Ash Pond
BMP	Best Management Practice
BCU	Bedrock Confining Unit
bgs	Below Ground Surface
CAA	Closure Alternatives Analysis
CAAA	Corrective Action Alternatives Analysis
CBR	Closure-by-Removal
CCR	Coal Combustion Residual
CIP	Closure-in-Place
CMA	Corrective Measures Assessment
EPP	Edwards Power Plant
GHG	Greenhouse Gas
GWE	Groundwater Extraction
GWP	Groundwater Polishing
GWPS	Groundwater Protection Standard
HUC	Hydrologic Unit Code
IAC	Illinois Administrative Code
ID No.	Identification Number
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
IPRG	Illinois Power Resources Generating, LLC
LCF	Lower Cahokia Formation
LLDPE	Linear Low-density Polyethylene
msl	Mean Sea Level
NAVD88	North American Vertical Datum of 1988
NID	National Inventory of Dams
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
PMP	Potential Migration Pathway
SFWA	State Fish and Wildlife Area
Source Control-GWP	Source Control with Groundwater Polishing
Source Control-GWE	Source Control with Groundwater Extraction
Source Control-Phytoremediation	Source Control with Phytoremediation
UA	Uppermost Aquifer
UCF	Upper Cahokia Formation
US DOT	United States Department of Transportation
US EPA	United States Environmental Protection Agency

Summary of Findings

Title 35, Part 845 of the Illinois Administrative Code (IAC) (IEPA, 2021) requires that a Corrective Action Alternatives Analysis (CAAA) be performed as part of the remedy selection, prior to undertaking any corrective actions at certain coal combustion residual (CCR)-containing impoundments, where exceedances of groundwater protection standards (GWPSs) have been identified. This report presents a CAAA for the Ash Pond (AP) at the Edwards Power Plant (EPP) pursuant to the requirements under IAC Section 845.670. The goal of performing a CAAA is to holistically evaluate the potentially viable corrective actions identified in the Corrective Measures Assessment (CMA) (Appendix C; Ramboll, 2024a) in order to remediate groundwater and achieve compliance with the groundwater protection standards (GWPSs) specified under IAC Section 845.600 (IEPA, 2021). These analyses assess potentially viable corrective action alternatives based on a wide range of factors, including the efficiency, reliability, and ease of implementation of a corrective action; its potential positive and negative short- and long-term impacts on human health and the environment; and its ability to address concerns raised by the community (IEPA, 2021).

It is important to note that many CCR sites are complex groundwater environments where remedial actions would inherently take many years to complete. While no formal definition of a complex groundwater environment exists, most would agree that there are a number of common characteristics at complex groundwater sites, including the following (NRC, 2013):

- Highly heterogeneous subsurface environments;
- Large source zones;
- Multiple, recalcitrant constituents; and
- Long timeframes over which releases occurred.

Each of these characteristics are common at CCR sites. Surface impoundments are often tens to hundreds of acres in size and many have operated for decades, leading to large source zones and prolonged releases. Furthermore, CCR impoundments are often located in alluvial geologic settings where sands are interbedded with silts and clays. This results in a heterogeneous environment where constituent mass may persist for many years in low-permeability deposits. Finally, the constituents that are most common at CCR sites include metals and inorganics that do not naturally biodegrade. The combination of these factors results in a complex groundwater environment where remediation, even under the best of circumstances, may take many years to achieve GWPSs. It is for these reasons that the United States Environmental Protection Agency (US EPA) refused to specify what is a reasonable *versus* an unreasonable timeframe for groundwater corrective actions at CCR sites, stating that it "was truly unable to establish an outer limit on the necessary timeframes – including even a presumptive outer bound" (US EPA, 2015a).

In this CAAA, all corrective actions that have been evaluated consist of source control with residual plume management. Source control is generally considered to be one of the more effective remedial action approaches. Source control involves removing the hydraulic head from an impoundment (*i.e.*, unwatering and dewatering) and preventing further downward migration of constituents. US EPA has found that "releases from surface impoundments [to groundwater] drop dramatically after closure" (US EPA, 2014). US EPA has also stated that source control is the most effective means of ensuring the timely attainment of remediation objectives (US EPA, 2015b). As a result, the implementation of source control often has a substantial and immediate effect on groundwater quality improvements.

The specific source control method that is the central component of all the corrective action alternatives evaluated in this CAAA is closure-in-place (CIP) using a consolidate-and-cap approach. Specifically, this approach includes the removal of free liquids, excavation of CCR from the high points and northwestern sections of the AP and consolidation into the southern portion and other low areas of the AP, and the installation of a low-permeability final geomembrane cover system. The excavation and consolidation would decrease the total CCR footprint from approximately 102 acres to 69 acres, a reduction of about 32%, in the final consolidated and closed footprint of the AP. The final cover system consisting of a 40-milliliter (mil) linear low-density polyethylene (LLDPE) geomembrane layer, a geocomposite drainage layer, and 24 inches (in) of protective soil cover would be installed over the closed portion of the AP. These activities are designed to control, minimize, or eliminate, post-closure infiltration of liquids into the impounded CCR. An earthen separation berm would be constructed at the perimeter of the consolidated AP to contain the relocated CCRs. As demonstrated by the groundwater modeling in support of the Closure Alternatives Analysis (CAA) (Gradient, 2022), this source control approach would result in a reduction of the migration of water into the AP by 97% compared to pre-closure conditions. Additionally, source control would result in a reduction of hydraulic flux out of the AP by 94% compared to pre-closure conditions (Ramboll, 2022), demonstrating that source control will control, minimize, or eliminate post-closure releases of leachate.

Three potential corrective actions are evaluated in this CAAA: Source Control with Groundwater Polishing (Source Control-GWP), Source Control with Groundwater Extraction (Source Control-GWE) and Source Control with Phytoremediation (Source Control-Phytoremediation). All alternatives consist of source control and residual plume management, and all alternatives were identified as a viable approach in the CMA (Appendix C; Ramboll, 2024a). The residual plume management portions of these corrective action alternatives include groundwater polishing (GWP), groundwater extraction (GWE), and phytoremediation.

Under the Source Control-GWP alternative, constituent concentrations in groundwater would be actively monitored to ensure the improvement of downgradient groundwater quality resulting from physical and geochemical attenuation mechanisms. Site-specific evaluations demonstrated that GWP is appropriate at the AP because Site conditions are favorable for natural attenuation of inorganic contaminants *via* adsorption (Appendix E; Life Cycle Geo, LLC, 2025). Under the Source Control-GWE alternative, two groundwater extraction trenches (GWE) would be constructed within the footprint of the AP to remove impacted groundwater in the Upper Cahokia Formation (UCF)/Potential Migration Pathway (PMP) and Uppermost Aquifer (UA) and prevent off-Site migration of CCR constituents. One extraction trench (*i.e.,* North Trench) would be 1,700 feet (ft) long and 3 ft wide; the other (*i.e*., South Trench) would be 800 ft long and 3 ft wide. Perforated collection pipes would be installed along the trenches. The trenches would be backfilled with clean granular fill and capped with compacted clay to reduce surface water infiltration. The collection pipes would drain to sumps spaced throughout the trenches to extract groundwater. Extracted groundwater would be collected and sent to a new on-Site lined settling pond constructed within the excavated area of the AP and discharged from either a new or existing outfall managed under the National Pollutant Discharge Elimination System (NPDES) permit for the Site. Under the Source Control-Phytoremediation, two tree segments along the west side of the AP would be planted to prevent the westerly off-Site groundwater migration from the AP. Each tree segment would consist of a grid of tree plantings, and each planting would contain one tree and a well system to passively draw groundwater upward to the root zone and allow phytoremediation to occur. Each tree structure would consist of a borehole advanced into the UA and backfilled with tree cuttings and porous material to allow groundwater from the UA and PMP to rise to the potentiometric surface elevation. A surface liner would be installed to reduce precipitation infiltration to facilitate downward root growth for groundwater intake. As part of all three corrective action alternatives, an adaptive site management plan would be implemented in order to optimize the selected remedy based on real-time data that are collected.

Table S.1 evaluates all corrective actions alternatives (Source Control-GWP, Source Control-GWE, and Source Control-Phytoremediation) with regard to each of the factors specified under IAC Section 845.670(d) and IAC Section 845.670(e) (IEPA, 2021). Based on this evaluation and the details provided in Section 2 of this report, the most appropriate corrective action for this Site is Source Control-GWE. The expected time to meet GWPS in all monitoring wells is expected to be shorter under the Source Control-GWE alternative (approximately 37 years) than under the Source Control-GWP alternative (over 100 years) and the Source Control-Phytoremediation alternative (approximately 48 to 77 years), assuming all corrective action alternatives start after completion of source control. In addition, Source Control-GWE has higher operational reliability over the long-term than the Source Control-Phytoremediation alternative. Thus, Source Control-GWE is the most appropriate corrective action alternative for the AP.

Table S.1 Comparison of Proposed Corrective Action Alternatives with Respect to Factors Specified in IAC Section 845.670(d) and IAC Section 845.670(e)

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
Magnitude of Reduction of Existing Risks/Be Protective of Human Health and the Environment (Section 2.2.1; IAC Section 845.670(e)(1)(A)/ IAC Section 845.670(d)(1))	Because current conditions do not present a risk to human health or the environment at the AP, there will be no unacceptable risks to human health or the environment for future conditions when the unit has been closed and source control/residual plume management has been implemented. Concentrations of CCR-related constituents will decline over time and, consequently, potential exposures to CCR-related constituents in the environment will also decline. The magnitude of the reduction of existing risks is the same for all three potential corrective action alternatives, and each corrective action alternative is equally protective of human health and the environment.	Because current conditions do not present a risk to human health or the environment at the AP, there will be no unacceptable risks to human health or the environment for future conditions when the unit has been closed and source control/residual plume management has been implemented. Concentrations of CCR-related constituents will decline over time and, consequently, potential exposures to CCR-related constituents in the environment will also decline. The magnitude of the reduction of existing risks is the same for all three potential corrective action alternatives, and each corrective action alternative is equally protective of human health and the environment.	Because current conditions do not present a risk to human health or the environment at the AP, there will be no unacceptable risks to human health or the environment for future conditions when the unit has been closed and source control/residual plume management has been implemented. Concentrations of CCR-related constituents will decline over time and, consequently, potential exposures to CCR-related constituents in the environment will also decline. The magnitude of the reduction of existing risks is the same for all three potential corrective action alternatives, and each corrective action alternative is equally protective of human health and the environment.
Effectiveness of the Remedy in Controlling the Source (Section 2.2.2; IAC Section 845.670(e)(2))			
Extent to Which Containment Practices Will Reduce Further Releases/Control the Sources of Releases to Reduce or Eliminate, to the Maximum Extent Feasible (IAC Section 845.670(e)(2)(A)/ IAC Section 845.670(d)(3))	All three alternatives include source control (which is the primary remedial measure) and residual plume management. Modeling results (see the CAA; Gradient, 2022; Ramboll, 2022) indicate that source control would result in a reduction of hydraulic flux into AP by 97%, and	All three alternatives include source control (which is the primary remedial measure), and residual plume management. Modeling results (see the CAA; Gradient, 2022; Ramboll, 2022) indicate that source control would result in a reduction of hydraulic flux into AP by 97%, and	All three alternatives include source control (which is the primary remedial measure), and residual plume management. Modeling results (see the CAA; Gradient, 2022; Ramboll, 2022) indicate that source control would result in a reduction of hydraulic flux into AP by 97%, and

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
	flux out of the AP by 94% compared to pre-closure conditions. Source control is thus effective at controlling releases. Under the residual plume management for Source Control-GWP alternative, physical and geochemical attenuation mechanisms would mitigate impacts to downgradient groundwater quality and control the residual plume. If necessary, remedy optimizations would be implemented under the adaptive site management program.	flux out of the AP by 94% compared to pre-closure conditions. Source control is thus effective at controlling releases. Under the residual plume management for Source Control-GWE alternative, groundwater extraction trenches would remove impacted groundwater and control off-Site migration of impacted groundwater. If necessary, remedy optimizations would be implemented under the adaptive site management program.	flux out of the AP by 94% compared to pre-closure conditions. Source control is thus effective at controlling releases. Under the residual plume management for Source Control-Phytoremediation alternative, tree wells would remove impacted groundwater and control the westerly off-Site migration. If necessary, remedy optimizations would be implemented under the adaptive site management program.
Extent to Which Treatment Technologies May Be Used (IAC Section 845.670(e)(2)(B))	Source Control-GWP would rely on physical and geochemical attenuation processes. If necessary, remedy optimizations would be implemented under the adaptive site management program.	For the Source Control-GWE alternative, it would require construction of a new on-Site settling pond to treat extracted groundwater prior to discharge *via* an NPDES permitted outfall. If necessary, remedy optimizations would be implemented under the adaptive site management program.	For the Source Control-Phytoremediation alternative, trees would passively treat groundwater by uptaking impacted groundwater. If necessary, remedy optimizations would be implemented under the adaptive site management program.
Likelihood of Future Releases of CCR (Section 2.2.3; IAC Section 845.670(e)(1)(B))	All three corrective action alternatives include source control using CIP with a consolidate-and-cap approach. Free liquids would be removed; a new cover system would be installed over the AP, which would include a 40-mil LLDPE geomembrane layer, a geocomposite drainage layer, 24 in of protective soil cover, as well as new stormwater	All three corrective action alternatives include source control using CIP with a consolidate-and-cap approach. Free liquids would be removed; a new cover system would be installed over the AP, which would include a 40-mil LLDPE geomembrane layer, a geocomposite drainage layer, 24 in of protective soil cover, as well as new stormwater	All three corrective action alternatives include source control using CIP with a consolidate-and-cap approach. Free liquids would be removed; a new cover system would be installed over the AP, which would include a 40-mil LLDPE geomembrane layer, a geocomposite drainage layer, 24 in of protective soil cover, as well as new stormwater

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
	control structures. Relative to current conditions, this cover system would provide increased protection against berm and surface erosion, precipitation infiltration, and other adverse effects that could potentially trigger a release of CCR (Appendix B; Ramboll, 2025a). There would be minimal risk of accidental CCR releases occurring post-closure for all of the corrective action alternatives.	control structures. Relative to current conditions, this cover system would provide increased protection against berm and surface erosion, precipitation infiltration, and other adverse effects that could potentially trigger a release of CCR (Appendix B; Ramboll, 2025a). There would be minimal risk of accidental CCR releases occurring post-closure for all of the corrective action alternatives.	control structures. Relative to current conditions, this cover system would provide increased protection against berm and surface erosion, precipitation infiltration, and other adverse effects that could potentially trigger a release of CCR (Appendix B; Ramboll, 2025a). There would be minimal risk of accidental CCR releases occurring post-closure for all of the corrective action alternatives.
Type and Degree of Long-Term Management, Including Monitoring, Operation, and Maintenance (Section 2.2.4; IAC Section 845.670(e)(1)(C))	Minimal long-term O&M efforts would be required under Source Control-GWP because it would not require the installation, operation, or maintenance of any engineered systems or structures other than maintenance of the monitoring well network. Post-closure care groundwater monitoring would continue for a minimum of 30 years as required by IAC Section 845.780(c). Additionally, corrective action groundwater monitoring would continue for 3 years after GWPS have been achieved. Based on the adaptive site management approach, remedy optimizations may be implemented to ensure achievement of the GWPSs.	Long-term O&M efforts required under Source Control-GWE would include the maintenance of the groundwater collection trench system and discharge of extracted groundwater. Extracted groundwater would be managed and treated by a newly-constructed on-Site settling pond before discharge *via* an NPDES permitted outfall. Post-closure care groundwater monitoring would continue for a minimum of 30 years as required by IAC Section 845.780(c). Additionally, corrective action groundwater monitoring would continue for 3 years after GWPS have been achieved. Based on the adaptive site management approach, remedy optimizations may be implemented to ensure achievement of the GWPSs.	Long-term O&M efforts required under Source Control-Phytoremediation would include regular inspection and maintenance of the phytoremediation system, including inspections and maintenance of water delivery systems, maintenance to irrigation systems, maintenance and pruning of the trees, mowing and clearing other vegetation around the tress, collection of tree tissue samples, harvesting tree waste, and maintenance of phytoremediation installation components, *etc.* Post-closure care groundwater monitoring would continue for a minimum of 30 years as required by IAC Section 845.780(c). Additionally, corrective action groundwater monitoring would continue for 3 years after GWPS have been achieved. Based on the adaptive site

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
			management approach, remedy optimizations may be implemented to ensure achievement of the GWPSs.
Short-Term Risks to the Community or the Environment During Implementation of Remedy (Section 2.2.5; IAC Section 845.670(e)(1)(D))			
Safety Impacts	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all potential corrective action alternatives. While appropriate controls would be established to prevent accidents and injuries from occurring, the risks of accidents and injuries occurring during source control would be the same for all corrective action alternatives. These source control risks were evaluated in the CAA (Gradient, 2022). Overall, no worker accidents or injuries would be expected under the Source Control-GWP alternative because no installation, operation, and maintenance of engineered systems or structures would be required. Similarly, no off-Site impacts on nearby residents would be expected under the Source Control-GWP alternative.	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all potential corrective action alternatives. While appropriate controls would be established to prevent accidents and injuries from occurring, the risks of accidents and injuries occurring during source control would be the same for all corrective action alternatives. These source control risks were evaluated in the CAA (Gradient, 2022). Overall, considering worker accidents occurring during residual plume management both on- and off-Site, 0.71 worker injuries and 1.1×10^{-2} worker fatalities would be expected to occur under the Source Control-GWE alternative, which is the highest among the three alternatives. In total, an estimated 0.18 injuries and 2.5×10^{-3} fatalities would be expected to occur among community	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all potential corrective action alternatives. While appropriate controls would be established to prevent accidents and injuries from occurring, the risks of accidents and injuries occurring during source control would be the same for all corrective action alternatives. These source control risks were evaluated in the CAA (Gradient, 2022). Overall, considering worker accidents occurring during residual plume management both on- and off-Site, 0.50 worker injuries and 7.7×10^{-3} worker fatalities would be expected to occur under the Source Control-Phytoremediation alternative. In total, an estimated 0.13 injuries and 1.8×10^{-3} fatalities would be expected to occur among community members due to off-Site activities

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
		members due to off-Site activities under the Source Control-GWE alternative, which is the highest among the three alternatives.	under the Source Control-Phytoremediation alternative.
Cross-Media Impacts to Air	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all three potential corrective action alternatives. Air impacts occurring during source control would be the same for all three corrective action alternatives. These source control risks were evaluated in the CAA (Gradient, 2022). Cross-media impacts to air can include air pollutants and GHG emissions, which are proportional to the potential impact of each alternative on other emissions from construction vehicles and equipment. Residual plume management for the Source Control-GWP alternative would be expected to have minimal air impacts because it would not require the construction of any engineered systems or structures.	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all three potential corrective action alternatives. Air impacts occurring during source control would be the same for all three corrective action alternatives. These source control risks were evaluated in the CAA (Gradient, 2022). Cross-media impacts to air can include air pollutants and GHG emissions, which are proportional to the potential impact of each alternative on other emissions from construction vehicles and equipment. Residual plume management for the Source Control-GWE alternative would have the greatest air impacts among all three alternatives due to the highest vehicle and equipment miles required for construction, operation, and maintenance of the extraction trench system.	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all three potential corrective action alternatives. Air impacts occurring during source control would be the same for all three corrective action alternatives. These source control risks were evaluated in the CAA (Gradient, 2022). Cross-media impacts to air can include air pollutants and GHG emissions, which are proportional to the potential impact of each alternative on other emissions from construction vehicles and equipment. Residual plume management for the Source Control-Phytoremediation alternative would have greater air impacts than the Source Control-GWP due to the installation of the tree segments.
Cross-Media Impacts to Surface Water and Sediments	Groundwater modeling performed in support of the CAA (Gradient, 2022) predicted that source control (*i.e.*, CIP using a consolidate-and-cap approach) would result in a	Groundwater modeling performed in support of the CAA (Gradient, 2022) predicted that source control (*i.e.*, CIP using a consolidate-and-cap approach) would result in a	Groundwater modeling performed in support of the CAA (Gradient, 2022) predicted that source control (*i.e.*, CIP using a consolidate-and-cap approach) would result in a

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
	reduction of hydraulic flux in and out of the AP by 97% and 94%, respectively, compared to pre-closure conditions (Ramboll, 2022). Under residual plume management for the Source Control-GWP alternative, minimal surface water and sediment impacts would be expected, because it would not require the construction of any engineered systems or structures.	reduction of hydraulic flux in and out of the AP by 97% and 94%, respectively, compared to pre-closure conditions (Ramboll, 2022). Under residual plume management for the Source Control-GWE alternative, extracted groundwater would be treated at the on-Site settling pond and discharged *via* an NPDES-permitted outfall. Surface water and sediment impacts associated with residual plume management would be higher than the those of Source Control-GWP alternative due to the construction of the extraction trench system and the settling pond. Erosion and sediment runoff may occur due to the close proximity to the wetlands and surface water bodies during construction activities.	reduction of hydraulic flux in and out of the AP by 97% and 94%, respectively, compared to pre-closure conditions (Ramboll, 2022). Under residual plume management for the Source Control-Phytoremediation alternative, limited construction activities would be required to install the tree well systems, including staging of a work platform and equipment, hollow stem auger drilling for the tree well system, and other installation items. Surface water and sediment impacts associated with residual plume management would be higher than the those of the Source Control-GWP alternative. Erosion and sediment runoff may occur due to the close proximity to the wetlands and surface water bodies during construction activities.
Control of Exposure to Any Residual Contamination During Implementation of the Remedy	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all three potential corrective action alternatives. While appropriate controls would be established to prevent exposures of CCR during source control, the risks of CCR exposure during source control activities would be the same for all corrective action alternatives.	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all three potential corrective action alternatives. While appropriate controls would be established to prevent exposures of CCR during source control, the risks of CCR exposure during source control activities would be the same for all corrective action alternatives.	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all three potential corrective action alternatives. While appropriate controls would be established to prevent exposures of CCR during source control, the risks of CCR exposure during source control activities would be the same for all corrective action alternatives.

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
	Risks to workers arising from potential contact with residual contamination during construction activities associated with residual plume management would be minimal under the Source Control-GWP alternative, which would not involve exposure to any soil or groundwater waste streams.	Risks to workers arising from potential contact with residual contamination during construction, operation, and maintenance activities associated with residual plume management would be higher for the Source Control-GWE alternative than under the Source Control-GWP and Source Control-Phytoremediation alternatives; Source Control-GWE would involve the production, management, and treatment of extracted groundwater, as well as on-Site disposal of excavated spoils generated during extraction trench construction.	Risks to workers arising from potential contact with residual contamination during construction, operation, and maintenance activities associated with residual plume management would be higher for the Source Control-Phytoremediation alternative than under the Source Control-GWP alternative, but lower than Source Control-GWE alternative; Source Control-Phytoremediation would only involve disposal of spoils generated during construction, but not involve the management of impacted groundwater.
Other Identified Impacts	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all potential corrective action alternatives. Thus, impacts during source control would be the same for all of the corrective action alternatives (see the CAA; Gradient, 2022). The energy demands of construction equipment and vehicles associated with residual plume management under the Source Control-GWP would be minimal because this alternative would not require any significant construction activity.	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all potential corrective action alternatives. Thus, impacts during source control would be the same for all of the corrective action alternatives (see the CAA; Gradient, 2022). The energy demands of construction equipment and vehicles associated with residual plume management would be greatest under the Source Control/GWE alternative due to the activities that would be required to construct the GWE system.	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all potential corrective action alternatives. Thus, impacts during source control would be the same for all of the corrective action alternatives (see the CAA; Gradient, 2022). The energy demands of construction equipment and vehicles associated with residual plume management under the Source Control-Phytoremediation would be less compared to the Source Control-GWE alternative, but greater than the Source Control-GWP alternative.

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
	Similarly, traffic and noise impacts associated with residual plume management would be expected to be lower for the Source Control-GWP alternative compared to Source Control-GWE and Source Control-Phytoremediation since no significant construction activities would be required. There would be no impacts to natural resources and habitats under the Source Control-GWP alternative because no additional construction activities would occur after implementation of the source control.	Similarly, traffic and noise impacts associated with residual plume management would be expected to be higher under the Source Control-GWE alternative than the Source Control-GWP alternative, due to the construction activities required to construct the extraction trench system and settling pond under the Source Control-GWE alternative. Under the Source Control-GWE alternative, there would be some negative impacts to natural resources and habitats, including disturbances of some existing habitats atop portions of the construction areas and potential impacts to aquatic and wetland species in the discontinuous wetland areas in the immediate vicinity of the AP due to potential sediment runoff during construction.	Similarly, traffic and noise impacts associated with residual plume management would be expected to be higher under the Source Control-Phytoremediation alternative than the Source Control-GWP alternative, due to the construction activities related to installation of tree segments under the Source Control-Phytoremediation alternative. Under the Source Control-Phytoremediation alternative, there would be some negative impacts to natural resources and habitats, including disturbances of some existing habitats atop portions of the construction areas and potential impacts to aquatic and wetland species in the discontinuous wetland areas in the immediate vicinity of the AP due to potential sediment runoff during construction.
Time Until Groundwater Protection Standards Are Achieved/Attain the Groundwater Protection Standards Specified in Section 845.600 (Section 2.2.6; IAC Section 845.670(e)(1)(E); IAC Section 845.670(d)(2))	Groundwater modeling performed in support of the CAA (Gradient, 2022) predicted that source control (*i.e.*, CIP using a consolidate-and-cap approach) would result in a reduction of hydraulic flux in and out of the AP by 97% and 94%, respectively, compared to pre-closure conditions (Ramboll, 2022). Additional modeling was conducted to evaluate future groundwater	Groundwater modeling performed in support of the CAA (Gradient, 2022) predicted that source control (*i.e.*, CIP using a consolidate-and-cap approach) would result in a reduction of hydraulic flux in and out of the AP by 97% and 94%, respectively, compared to pre-closure conditions (Ramboll, 2022). Additional modeling was conducted to evaluate future groundwater	Groundwater modeling performed in support of the CAA (Gradient, 2022) predicted that source control (*i.e.*, CIP using a consolidate-and-cap approach) would result in a reduction of hydraulic flux in and out of the AP by 97% and 94%, respectively, compared to pre-closure conditions (Ramboll, 2022). Additional modeling was conducted to evaluate future groundwater

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
	quality in the vicinity of the AP under each of the proposed corrective action alternatives. The results indicate that groundwater would attain the GWPSs for all constituents identified as having potential exceedances in the monitoring well network within over 100 years under the Source Control-GWP alternative (Ramboll, 2025b).	quality in the vicinity of the AP under each of the proposed corrective action alternatives. The results indicate that groundwater would attain the GWPSs for all constituents identified as having potential exceedances in the monitoring well network within approximately 37 years after source control has been completed under the Source Control-GWE alternative. Current modeling indicates that an additional 13 years of system operation may be required to prevent concentrations from rebounding above the GWPSs, thus the total corrective action operation and maintenance (O&M) period would likely be 50 years for the Source Control-GWE alternative (Ramboll, 2025b). However, additional modeling would be performed, and additional data would be collected as part of the Corrective Action Groundwater Monitoring Plan to determine the exact required duration of additional system operation.	quality in the vicinity of the AP under each of the proposed corrective action alternatives. The results indicate that groundwater would attain the GWPSs for all constituents identified as having potential exceedances in the monitoring well network within approximately 48 to 77 years after source control has been completed under the Source Control-Phytoremediation alternative. Current modeling indicates that an additional 22 to 73 years of system operation may be required to prevent concentrations from rebounding above the GWPSs, thus the total corrective action O&M period would likely be 70 to 150 years for the Source Control-Phytoremediation alternative (Ramboll, 2025b). However, additional modeling would be performed, and additional data would be collected as part of the Corrective Action Groundwater Monitoring Plan to determine the exact required duration of additional system operation.
Potential for Exposure of Humans and Environmental Receptors to Remaining Wastes, Considering the Potential Threat to Human Health and the Environment Associated with Excavation, Transportation,	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all potential corrective action alternatives, thus, potential exposures to CCR remaining in AP	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all potential corrective action alternatives, thus, potential exposures to CCR remaining in AP	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all potential corrective action alternatives, thus, potential exposures to CCR remaining in AP

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
Re-disposal, Containment, or Changes in Groundwater Flow (Section 2.2.7; IAC Section 845.670(e)(1)(F))	would be the same under all alternatives. Once source control activities have been completed, this corrective action alternative is expected to limit exposure of humans and environmental receptors to CCR remaining in AP. Furthermore, as a result of the source control, there would be minimal risks of CCR releases post-closure. The Source Control-GWP alternative would not involve exposure to the soil or groundwater waste streams and, thus, there is no potential for exposure of humans and environmental receptors to wastes.	would be the same under all alternatives. Once source control activities have been completed, this corrective action alternative is expected to limit exposure of humans and environmental receptors to CCR remaining in AP. Furthermore, as a result of the source control, there would be minimal risks of CCR releases post-closure. Potential risks to workers that come in contact with residual contamination of CCR-related constituents during groundwater extraction and treatment, as well as on-Site disposal of construction spoils would be managed through the use of rigorous safety protocols and personal protective equipment. Some changes in groundwater flow (*i.e.*, potential controlled discharge into Illinois River) may occur under the Source Control-GWE alternative, due to the operation of the GWE system. Hydrogeological changes would also be expected under this alternative, such as lowering groundwater table in the vicinity of the extraction trenches, altering flow patterns in the UA, and causing changes in hydraulic gradients. However, changes to groundwater	would be the same under all alternatives. Once source control activities have been completed, this corrective action alternative is expected to limit exposure of humans and environmental receptors to CCR remaining in AP. Furthermore, as a result of the source control, there would be minimal risks of CCR releases post-closure. Potential risks to workers in contact with residual contamination during disposal of spoils generated from tree well/boring installation would be managed through the use of rigorous safety protocols and personal protective equipment. Local hydraulic gradients and groundwater flow direction may change under the residual plume managed for the Source Control-Phytoremediation alternative, because tree installations west of the AP would uptake groundwater in the UA/PMP and work as pumps. However, changes to groundwater flow would not be expected to have an effect on the potential for the exposure of humans and environmental receptors to remaining wastes.

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
		flow would not be expected to have an effect on the potential for the exposure of humans and environmental receptors to remaining wastes.	
Long-Term Reliability of the Engineering and Institutional Controls (Section 2.2.8; IAC Section 845.670(e)(1)(G))	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all potential corrective action alternatives. Thus, long-term reliability during source control would be the same for all corrective action alternatives (see the CAA; Gradient, 2022). Residual plume management under the Source Control-GWP alternative would be reliable because it is a proven process that would rely on physical and geochemical attenuation processes and active monitoring. Site specific evaluations have shown that chemical attenuation is feasible, and remobilization is unlikely to impact the time to achieve GWPSs as groundwater returns to background conditions (Appendix E; Life Cycle Geo, LLC, 2025). If necessary, remedy optimizations would be implemented under the adaptive site management program.	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all potential corrective action alternatives. Thus, long-term reliability during source control would be the same for all corrective action alternatives (see the CAA; Gradient, 2022). Residual plume management under the Source Control-GWE alternative would be reliable, as long as the extraction trench and pumps are maintained and operated appropriately, because it is a proven remedy that has been implemented at many sites. Routine and non-routine maintenance of the GWE system is required to ensure reliable operation of the extraction trench and pumps, as well as other system components. If necessary, remedy optimizations would be implemented under the adaptive site management program.	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all potential corrective action alternatives. Thus, long-term reliability during source control would be the same for all corrective action alternatives (see the CAA; Gradient, 2022). Residual plume management under the Source Control-Phytoremediation alternative would be reliable provided it is constructed in accordance with standard design and specifications. The effectiveness of the phytoremediation installations would depend on the trees' ability to grow under Site conditions. Significant variability exists in the time needed to reach GWPSs (48 to 77 years) and the total remedy O&M duration (70 to 150 years) that would potentially be required to prevent concentrations from rebounding above the GWPSs, which suggests the uncertainty in the system's overall operational reliability. In addition, the lack of large-scale case studies for boron or other CCR-

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
			constituents adds extra uncertainty to its long-term reliability (Appendix B; Ramboll, 2025a). As a combination of mechanical and biological systems, routine and ongoing maintenance would be required to ensure reliable operation over the long-term.
Potential Need for Replacement of the Remedy (Section 2.2.9; IAC Section 845.670(e)(1)(H))	Replacement of the residual plume management remedy under the Source Control-GWP alternative would likely be unnecessary, because the alternative would not require the installation, operation, and maintenance of engineered systems or structures. Adaptive site management strategies would be used to implement remedy optimizations, if necessary, to ensure that remedial goals are achieved.	Replacement of the residual plume management remedy under the Source Control-GWE alternative would likely be unnecessary as long as the extraction trench and treatment system are maintained appropriately. Adaptive site management strategies would be used to implement remedy optimizations, if necessary, to ensure that remedial goals are achieved.	Tree replacement is expected during the time horizon of the residual plume management under the Source Control-Phytoremediation alternative. Depending on the performance and lifespan of the trees, it is estimated that trees may be replaced one to five times, assuming a 30- to 50-year tree lifespan. An annual tree replacement rate is estimated to be 10% (approximately 60 trees) during the first 5 years, and then 5% afterwards. Ongoing maintenance and inspections would be required to monitor tree performance.
Degree of Difficulty Associated with Constructing the Remedy (Section 2.3.1; IAC Section 845.670 (e)(3)(A))	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all potential corrective action alternatives. Thus, construction difficulties would be the same for all corrective action alternatives. Difficulties associated with implementing CIP using a consolidate-and-cap approach were	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all potential corrective action alternatives. Thus, construction difficulties would be the same for all corrective action alternatives. Difficulties associated with implementing CIP using a consolidate-and-cap approach were	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all potential corrective action alternatives. Thus, construction difficulties would be the same for all corrective action alternatives. Difficulties associated with implementing CIP using a consolidate-and-cap approach were

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
	evaluated in the CAA (see the CAA; Gradient, 2022). Residual plume management under the Source Control-GWP alternative would rely on physical and geochemical attenuation processes and therefore would not pose any significant construction challenges.	evaluated in the CAA (see the CAA; Gradient, 2022). Residual plume management under the Source Control-GWE would involve the construction of two extraction trenches, a settling pond, and a conveyance system to extract and treat impacted groundwater. It may have the following challenges during construction of the extraction trenches (Appendix B; Ramboll, 2025): ▪ Shallow groundwater trenches are commonly constructed at similar depths using specialized and conventional equipment. ▪ Constructing the South Trench would necessitate significant modifications to the AP embankment to create a suitable working platform for construction equipment. This would require the use of excavation shoring and/or other approach to ensure dike stability during construction. Geotechnical design involving three-dimensional analysis would be utilized for the construction. The modifications would likely require a geotechnical monitoring program to assess the	evaluated in the CAA (see the CAA; Gradient, 2022). Residual plume management under the Source Control-Phytoremediation would utilize a tree well system to uptake and control impacted groundwater. It may have the following challenges during installation of the tree segments (Appendix B; Ramboll, 2025): ▪ This approach would require a hollow stem auger drill rig for installing the tree well systems, along with general construction equipment to install a working pad for the southern tree segment. Local Site geology is not expected to pose significant challenges during any earthwork or tree well borings. ▪ Constructing the southern tree segment would necessitate significant modifications to the AP embankment to create a suitable working platform for construction equipment. This would require the use of excavation shoring and/or other approaches to ensure dike stability during construction because the modifications would be intrusive and may

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
		embankment for any signs of distress during construction. If distress is detected, construction may need to be temporarily paused to evaluate and address the issue. ▪ High-voltage power lines crossing the North Trench alignment may need to be raised to ensure a safe working distance from construction equipment. ▪ Additionally, naturally occurring methane at the Site necessitates a methane monitoring and response plan, which may lead to periodic safety shutdowns during construction to allow methane levels to decrease to safe levels.	temporarily increase the risk of dike instability relative to current conditions. Geotechnical designs involving three-dimensional analysis would be utilized for the construction. The modifications would likely require a geotechnical monitoring program to assess the embankment for any signs of distress during construction. If distress is detected, construction may need to be temporarily paused to evaluate and address the issue. ▪ High-voltage power lines crossing the North Trench alignment may need to be raised to ensure a safe working distance from construction equipment. ▪ Additionally, naturally occurring methane at the Site necessitates a methane monitoring and response plan, which may lead to periodic safety shutdowns during construction to allow methane levels to decrease to safe levels.
Expected Operational Reliability of the Remedy (Section 2.3.2;	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
IAC Section 845.670 (e)(3)(B))	potential corrective action alternatives. Thus, the operational reliability of the remedy would be the same for all corrective action alternatives. The reliability associated with implementing CIP using a consolidate-and-cap approach was evaluated in the CAA (see the CAA; Gradient, 2022). Residual plume management under the Source Control-GWP alternative would have high operational reliability because this alternative would rely on natural processes and active monitoring. Adaptive site management strategies would be used to implement remedy optimizations, if necessary.	potential corrective action alternatives. Thus, the operational reliability of the remedy would be the same for all corrective action alternatives. The reliability associated with implementing CIP using a consolidate-and-cap approach was evaluated in the CAA (see the CAA; Gradient, 2022). Residual plume management under the Source Control-GWE alternative would have high operational reliability because it is an established technology, as long as the extraction trench and treatment system are maintained and operated appropriately. Adaptive site management strategies would be used to implement remedy optimizations, if necessary.	potential corrective action alternatives. Thus, the operational reliability of the remedy would be the same for all corrective action alternatives. The reliability associated with implementing CIP using a consolidate-and-cap approach was evaluated in the CAA (see the CAA; Gradient, 2022). Residual plume management under the Source Control-Phytoremediation alternative would also have high operational reliability, as long as the phytoremediation installations are constructed in accordance with the design and specifications. The effectiveness of the phytoremediation installations would depend on the trees' ability to grow under Site conditions. Significant variability exists in the time needed to reach GWPSs (48 to 77 years) and the total remedy O&M duration (70 to 150 years) that would potentially be required to prevent concentrations from rebounding above the GWPSs, which suggests the uncertainty in the system's overall operational reliability. In addition, the lack of large-scale case studies for boron or other CCR-constituents adds extra uncertainty to its long-term reliability (Appendix B; Ramboll, 2025a). As a

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
			combination of mechanical and biological systems, routine and ongoing maintenance would be required to ensure reliable operation over the long-term.
Need to Coordinate with and Obtain Necessary Approvals and Permits from Other Agencies (Section 2.3.3; IAC Section 845.670 (e)(3)(C))	Specific permits and approvals associated with source control using a consolidate-and-cap approach was evaluated in the CAA (Gradient, 2022). Residual plume management for Source Control-GWP would require regulatory approval, but no additional permits would be needed.	Specific permits and approvals associated with source control using a consolidate-and-cap approach was evaluated in the CAA (Gradient, 2022). Residual plume management for the Source Control-GWE alternative would require regulatory approval. Groundwater extracted from the extraction trench would require a modified NPDES permit, which would likely require renewals depending on the timeline of corrective action implementation. Permits from the IEPA for construction stormwater controls and BMPs, a joint water pollution control, placement of excavated spoils beneath the AP final cover system *via* an amendment to the AP Closure Plan and Construction Permit Application, and operation would be required. An Illinois Department of Natural Resources (IDNR) Dam Safety modification permit would be obtained for modifications of the embankment.	Specific permits and approvals associated with source control using a consolidate-and-cap approach was evaluated in the CAA (Gradient, 2022). Residual plume management for the Source Control-Phytoremediation alternative would require regulatory approval. A general stormwater permit through IEPA would be required for construction activities, including construction stormwater controls and other BMPs such as installation of silt fences and other measures. An IDNR Dam Safety Modification Permit would be required for modification of the embankment. These permits and plans typically take 18-24 months to obtain, although some may already be obtained during the AP final closure.
Availability of Necessary Equipment and Specialists (Section 2.3.4;	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all	Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
IAC Section 845.670 (e)(3)(D))	potential corrective action alternatives. Thus, equipment and specialist needs would be the same for all corrective action alternatives. An assessment of necessary equipment and specialists associated with implementing CIP using a consolidate-and-cap approach was evaluated in the CAA (see the CAA; Gradient, 2022). Residual plume management under the Source Control-GWP alternative would require standard environmental monitoring equipment and groundwater professionals. Specialists such as geologists, hydrogeologists, statisticians (*i.e.*, statistical analysis), and geochemists would be available to collect and evaluate the data.	potential corrective action alternatives. Thus, equipment and specialist needs would be the same for all corrective action alternatives. An assessment of necessary equipment and specialists associated with implementing CIP using a consolidate-and-cap approach was evaluated in the CAA (see the CAA; Gradient, 2022). Residual plume management under the Source Control-GWE alternative would require specialists to manage the GWE system throughout its construction and operational period. 1. Construction of the groundwater extraction system (*i.e.*, the trenches and settling pond) on the Site would require a specialized contractor, and specialized and often custom-built equipment including one-pass construction equipment. Additionally, geotechnical specialists would be needed to design the working platform and monitor the AP embankment for signs of distress during the trench installation. The availability of contractors with such equipment may be limited. Specialists including design engineers, construction	potential corrective action alternatives. Thus, equipment and specialist needs would be the same for all corrective action alternatives. An assessment of necessary equipment and specialists associated with implementing CIP using a consolidate-and-cap approach was evaluated in the CAA (see the CAA; Gradient, 2022). Residual plume management under the Source Control-Phytoremediation alternative would require specialists to construct and manage the phytoremediation installations throughout its construction and operational period. 1. Specialists in phytoremediation design would be needed during the design and construction of the remedy. The construction of the tree well systems would require a widely available hollow stem auger drill rig, and the drilling crew would not need specialized skills beyond typical capabilities. Additionally, geotechnical specialists would be required for the design and construction of the working platform and to monitor the embankment for signs of distress during construction. These types

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
		managers and contractor staff experienced in trench construction and similar geologic environments would be required as well. In addition, specialists and equipment may have backlogs from similar specialty ground improvement projects in the area. 2. This alternative would necessitate the use of equipment and the expertise of specialists for tasks such as field data collection, groundwater sampling, analysis, and periodic corrective action groundwater monitoring and reporting. Similar to those in the Source Control-GWP alternative, these activities are already being conducted as part of routine groundwater monitoring.	of equipment and specialists have been utilized in the past for other similar types of phytoremediation design and construction projects. 2. This alternative would necessitate the use of equipment and the expertise of specialists for tasks such as field data collection, groundwater sampling, analysis, and periodic corrective action groundwater monitoring and reporting. Similar to those in the Source Control-GWP alternative, these activities are already being conducted as part of routine groundwater monitoring.
Available Capacity and Location of Needed Treatment, Storage, and Disposal Services/Comply with Standards for Management of Wastes as Specified in Section 845.680(d) (Section 2.3.5; IAC Section 845.670 (e)(3)(E)/ IAC section 845.670(d)(5))	No treatment, storage, or disposal services would be required with the residual plume management under the Source Control-GWP alternative, as GWP would not generate any significant volume of waste or wastewater.	Residual plume management for the Source Control-GWE alternative would require the construction of the extraction trench system, which would generate spoils during the construction phase, and the waste materials would be used as subgrade fill beneath the AP final cover system. Extracted groundwater would be treated at an on-Site settling pond.	Residual plume management for the Source Control-GWE alternative would generate spoils during the tree well/boring installations, which would be disposed of on-Site in the AP during closure construction. Organic waste would be produced annually throughout the phytoremediation process, including replaced trees and seasonal debris. Periodic sampling of the waste would determine whether it can be chipped

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
		Discharge from the settling pond would be conveyed to an NPDES permitted outfall.	for on-Site mulch/compost or may need off-Site disposal. Waste Management Peoria City, a nearby landfill 18 miles away, would handle off-Site disposal, if necessary.
The Degree to Which Community Concerns Are Addressed by the Remedy (Section 2.4; IAC Section 845.670(e)(4))	The combination of source control (*i.e.*, CIP using a consolidate-and-cap approach) with residual plume management would cause groundwater concentrations to decline over time under all of the corrective action alternatives, as suggested by the groundwater modeling (Ramboll, 2025b). A public meeting was held on April 30, 2025, pursuant to requirements under IAC Section 845.710(e). Questions raised by attendees were addressed at the meeting; a written summary of the questions and responses were prepared.	The combination of source control (*i.e.*, CIP using a consolidate-and-cap approach) with residual plume management would cause groundwater concentrations to decline over time under all of the corrective action alternatives, as suggested by the groundwater modeling (Ramboll, 2025b). A public meeting was held on April 30, 2025, pursuant to requirements under IAC Section 845.710(e). Questions raised by attendees were addressed at the meeting; a written summary of the questions and responses were prepared.	The combination of source control (*i.e.*, CIP using a consolidate-and-cap approach) with residual plume management would cause groundwater concentrations to decline over time under all of the corrective action alternatives, as suggested by the groundwater modeling (Ramboll, 2025b). A public meeting was held on April 30, 2025, pursuant to requirements under IAC Section 845.710(e). Questions raised by attendees were addressed at the meeting; a written summary of the questions and responses were prepared.
Remove from the Environment as Much of the Contaminated Material That Was Released from the CCR Surface Impoundment as Is Feasible, taking into Account Factors Such as Avoiding Inappropriate Disturbance of Sensitive Ecosystems (Section 2.5; IAC Section 845.670(d)(4))	There have been no known releases of CCR at the AP. All potential corrective action alternatives would have source control with residual plume management efforts. The source control would include a consolidate-and-cap approach with free liquids removal to limit the infiltration of precipitation into the impounded CCR. Additionally, residual plume management under the Source	There have been no known releases of CCR at the AP. All potential corrective action alternatives would have source control with residual plume management efforts. The source control would include a consolidate-and-cap approach with free liquids removal to limit the infiltration of precipitation into the impounded CCR. Additionally, residual plume management under the Source	There have been no known releases of CCR at the AP. All potential corrective action alternatives would have source control with residual plume management efforts. The source control would include a consolidate-and-cap approach with free liquids removal to limit the infiltration of precipitation into the impounded CCR. Additionally, residual plume management under the Source

Evaluation Factor (Report Section; Part 845 Section)	Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
	Control-GWP alternative would address impacted groundwater by relying on physical and geochemical attenuation processes to reduce the residual concentrations of CCR-related constituents in groundwater. Attenuation via sorption onto mineral surfaces should remain stable under post-closure conditions, and remobilization is unlikely to impact the time to achieve GWPS (Appendix E; Life Cycle Geo, LLC, 2025). No ecosystems would be disturbed because no construction activities are expected under the Source Control-GWP alternative.	Control-GWE alternative would rely on the GWE trenches to reduce or prevent migration of impacted groundwater off-Site. The construction activities would likely result in some negative impacts to the ecosystem, including disturbances of some existing habitats near the construction areas. Short-term impacts could also occur to sensitive aquatic and wetland species in the discontinuous wetland areas in the immediate vicinity of the AP.	Control-Phytoremediation alternative would remove the CCR-constituents in groundwater and control off-Site migration through the phytoremediation installations (*i.e.*, approximately 550 tree well systems). The construction activities would likely result in some negative impacts to the ecosystem, including disturbances of some existing habitats near the construction areas. Short-term impacts could also occur to sensitive aquatic and wetland species in the discontinuous wetland areas in the immediate vicinity of the AP.

Notes:

AP = Ash Pond; BMP = Best Management Practice; CAA = Closure Alternatives Analysis; CCR = Coal Combustion Residual; CIP = Closure-in-Place; GHG = Greenhouse Gas; GWE = Groundwater Extraction Trench; GWP = Groundwater Polishing; GWPS = Groundwater Protection Standard; LLDPE = Linear Low Density Polyethylene; IAC = Illinois Administrative Code; IEPA = Illinois Environmental Protection Agency; NPDES = National Pollutant Discharge Elimination System; PMP = Potential Migration Pathway; Source Control-GWE = Source Control with Groundwater Extraction Trench; Source Control-GWP = Source Control with Groundwater Polishing; Source Control-Phytoremediation = Source Control with Phytoremediation; UA = Uppermost Aquifer.

1 Introduction

1.1 Site Description and History

1.1.1 Site Location and History

Edwards Power Plant (EPP) is an electric power generating facility owned by Illinois Power Resources Generating, LLC (IPRG). The facility is located between Mapleton and Bartonville in Peoria County and is situated along the Illinois River (Ramboll, 2021). The facility began operating in 1960 and was retired in 2022 (Ramboll, 2021; Vistra Corp, 2021).

1.1.2 CCR Impoundment

A part of its operations, Edwards Power Plant produced and stored CCRs. The Edwards Ash Pond ("the Ash Pond," AP) (Vistra identification number [ID No.] CCR Unit 301, Illinois Environmental Protection Agency [IEPA] ID No. W1438050005-01, and National Inventory of Dams [NID] ID No. IL50710), which is the only CCR-containing impoundment at this Site, is the subject of this report.

The AP (Figure 1.1) is a 102-acre[1] unlined surface impoundment that was constructed in 1960 for the management of sluiced bottom ash, fly ash, and other non-CCR wastes generated historically by the facility (Ramboll, 2025c; AECOM, 2016; Ramboll, 2021). The AP has been in continuous operation since 1960 and after retirement in 2022, the AP no longer receives sluice ash (Gradient, 2022).

There are three sub-basins that are hydraulically connected within the AP: the Process Water Pond (the "North Cell"), the Fly Ash Pond, and the Clarification Pond (the "South Cell"; AECOM, 2016; Figure 1.1). The Process Water Pond and the Fly Ash Pond received CCR and other waste streams from the facility. Serpentine channels located within the Fly Ash Pond were used to settle out the majority of the CCR prior to discharging decanted water into the Clarification Pond, which serves as the settling basin for the unit. The Clarification Pond discharged to the Illinois River *via* a National Pollutant Discharge Elimination System (NPDES)-permitted outfall (AECOM, 2016; Ramboll, 2021).

In 2004, a rail loop was constructed to the south of the Clarification Pond which included installation of embankments for the rail loop with ash, as a permissible beneficial use. The footprint of the AP was reduced at that time, and the CCR material located south of the rail loop was capped with soil (AECOM, 2016).

[1] Previous reports have noted that the pond was approximately 91 acres (AECOM, 2016; Ramboll, 2021), although the official surveyed size is 102 acres (Ramboll, 2025c).

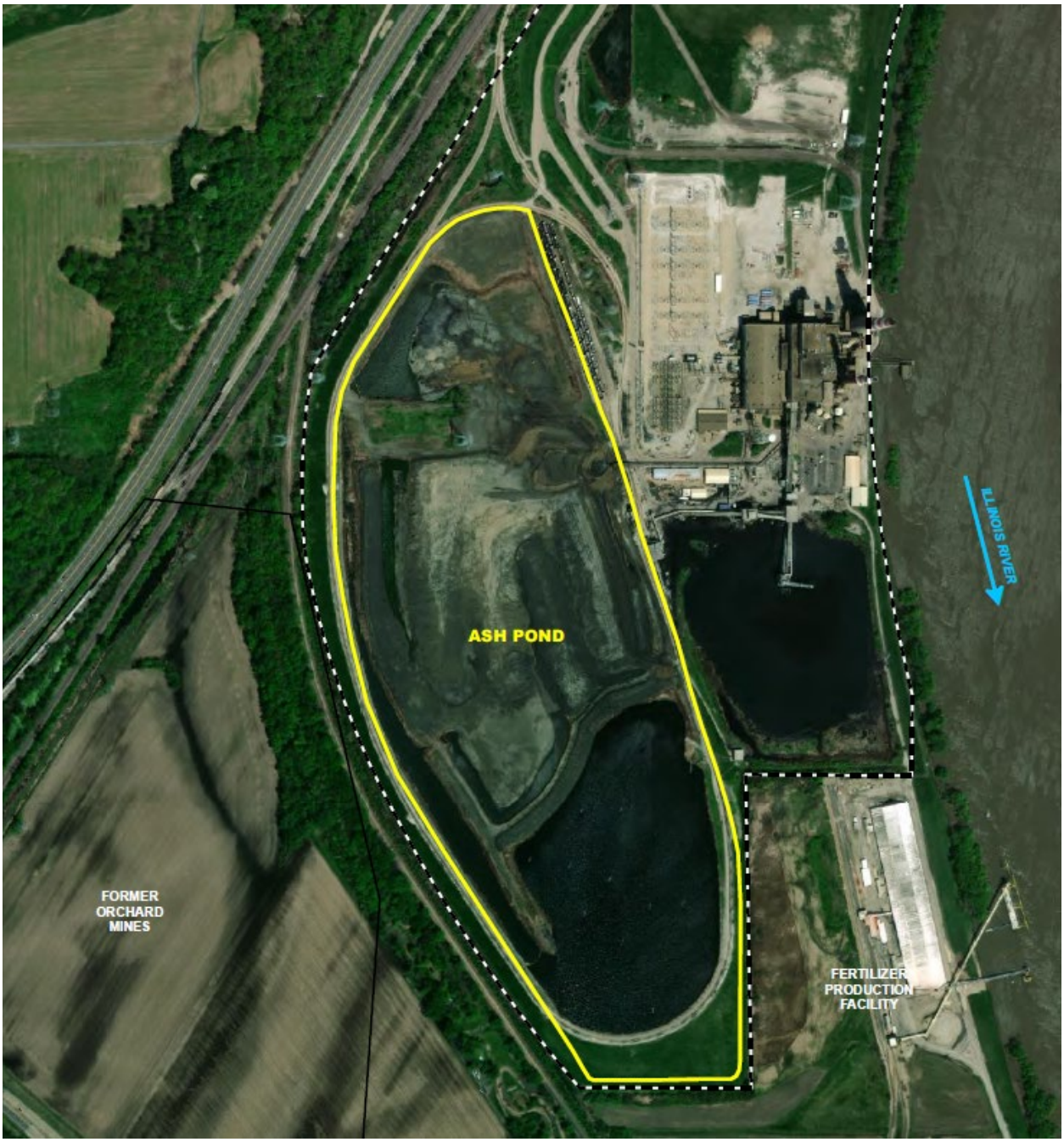

Figure 1.1 Site Location Map. Source: Ramboll (2021).

1.1.3 Surface Water Hydrology

The Clarification Pond associated with the AP (Figure 1.1) discharged decanted water to the Illinois River *via* an NPDES-permitted outfall. The Illinois River is located approximately more than 800 ft east of the outer border of the AP within the Pekin Lake-Illinois River sub watershed (Hydrologic Unit Code [HUC] 071300030304; Ramboll, 2021). The segment of the Illinois River adjacent to the Site (Section IL_D-05) is listed on the 2018 Illinois Section 303(d) List as being impaired for fish consumption due to mercury and

polychlorinated biphenyls (IEPA, 2016, 2019). Two lakes, Pekin Lake and Worley Lake, are located about 0.5 miles east of the AP on the opposite side of the Illinois River (Ramboll, 2021).

1.1.4 Hydrogeology

The geology underlying the Site in the vicinity of the AP consists of several distinct hydrostratigraphic units (Ramboll, 2021):

- **Upper Cahokia Formation (UCF)/Potential Migration Pathway (PMP):** Low permeability clays and silts consist of the Upper Cahokia Formation. This unit also includes discontinuous lenses of sand, sandy clay to clayey sand, and sandy silt. The saturated and unconfined sandy lenses within the UCF have been identified as PMP. The thickness of the UCF ranges between 5 and 40 ft in the vicinity of the AP.
- **Uppermost Aquifer (UA):** The UA contains thin layers (generally less than 4 ft) of moderately permeable sand, silty sand, and clayey gravel within the Lower Cahokia Formation (LCF) and saturated portions of the UCF. More permeable materials are generally located in the southern portion of the Site. The bottom of the UA (*i.e.*, LCF) overlies the shale bedrock.
- **Bedrock Confining Unit (BCU):** This confining layer consists of thick and low permeability shales and siltstones of the Carbondale and Modesto Formations.

Groundwater within the UA flows predominantly to the west in the central portion of the AP towards a former channel of the Illinois River, and to the south/southeast in the southern end of the AP. There is a minor component in the northernmost portion of the AP where groundwater in the UA and PMP flows to the north and northwest (Ramboll, 2021). Groundwater flow occurs primarily in the more permeable zones within the LCF in the UA (Ramboll, 2021).

During groundwater interaction with surface water, CCR-related constituents may partition between sediments and the surface water column. It should be noted that many CCR-related constituents occur naturally in sediments and surface water (and can also arise from other industrial sources). As a result, their presence in the sediments and/or surface water of the Illinois River does not necessarily signify contributions from the AP. There is little seasonal variation in groundwater flow direction in the UA regardless of surface water levels of the Illinois River (Ramboll, 2021).

1.1.5 Site Vicinity

The Edwards Power Plant Site is bordered by a salt processing facility to the north, a railroad right-of-way and Highway 42 to the west, agricultural fields to the south, and the Illinois River and a fertilizer production facility to the east (Ramboll, 2021; Figure 1.1). Coal mining operations occurred in the vicinity of the Site from 1890 until 1940. The mine located closest to the AP was the Orchard Mine (Mine ID No. 828), which operated from 1890 until 1909 and extended laterally (within uncertainty bounds) to the western edge of the AP. The Petri Mine (Mine ID No. 6673) operated from 1919 until 1933 and was located approximately 0.1 miles northwest of the AP. The Hollis Mine (Mine ID No. 3021) operated from 1933 until 1940 and was located approximately 0.6 miles north of the AP (Ramboll, 2021).

Although the area surrounding the Site is predominantly agricultural and industrial, there are a few scenic and recreational areas located within a few miles of the Site. These include the Illinois River, Worley Lake, the Pekin Lake State Fish and Wildlife Area (SFWA), and the Powerton Lake SFWA. Pekin Lake SFWA is located east of the Site on the opposite bank of the Illinois River. Powerton Lake SFWA is located

approximately 3 miles downstream of the Site on the opposite bank of the Illinois River. There are some small, discontinuous wetland areas in the immediate vicinity of the AP (US FWS, 2021). Based on a review of the Illinois Department of Natural Resources (IDNR) Historic Preservation Division database and the Illinois State Archaeological Survey database, there are no historic sites located within 1,000 meters of the AP (Ramboll, 2021).

1.2 Part 845 Regulatory Review and Requirements

Title 35, Part 845 of the Illinois Administrative Code (IAC) (IEPA, 2021) requires that a Corrective Action Alternatives Analysis (CAAA) be performed as part of the remedy selection, prior to undertaking any corrective actions at certain CCR-containing impoundments where exceedances of groundwater protection standard (GWPSs) have been identified. Because exceedances[2] of GWPSs in groundwater associated with the AP have been identified for boron and sulfate (Appendix D; Ramboll, 2024a), this report presents a CAAA for the AP pursuant to the requirements under IAC Section 845.670. The goal of a CAAA is to holistically evaluate a range of factors for the various corrective actions being considered at an impoundment, including the efficiency, reliability, and ease of implementation of the corrective action; its potential positive and negative short- and long-term impacts on human health and the environment; and its ability to address concerns raised by the community (IEPA, 2021). A CAAA is a decision-making tool that is designed to aid in the selection of a corrective action alternative.

[2] Throughout this document, "exceedance" or "exceedances" is intended to refer only to potential exceedances of proposed applicable background statistics or Groundwater Protection Standards (GWPS) as described in the proposed groundwater monitoring program, which was submitted to IEPA on October 25, 2021 as part of IPRG's operating permit application for the AP (Burns & McDonnell, 2022). That operating permit application, including the proposed groundwater monitoring program, remains under review by IEPA and therefore IPRG has not identified any actual exceedances.

2 Corrective Action Alternatives Analysis

This section presents the CAAA pursuant to requirements under IAC Section 845.670 (IEPA, 2021). The goal of a CAAA is to fully evaluate proposed viable corrective measures that were identified in the CMA. The CAAA evaluates potential corrective actions with respect to a wide range of factors, including the performance, reliability, and ease of implementation of the corrective action; its potential impacts on human health and the environment; and its ability to address concerns raised by the community (IEPA, 2021).

Per IAC Section 845.670(d) (IEPA, 2021), any corrective actions selected under a Corrective Action Plan must:

1. Be protective of human health and the environment;
2. Attain the groundwater protection standards specified in Section 845.600;
3. Control the sources of releases to reduce or eliminate, to the maximum extent feasible, further releases of constituents listed in Section 845.600 into the environment;
4. Remove from the environment as much of the contaminated material that was released from the CCR surface impoundment as is feasible, considering factors such as avoiding inappropriate disturbance of sensitive ecosystems; and
5. Comply with standards for management of wastes as specified in Section 845.680(d).

At the AP, a CAAA is required because groundwater monitoring associated with the AP identified exceedances of the GWPSs. Groundwater monitoring was conducted in accordance with the proposed groundwater monitoring plan between 2015 and 2023 (Appendix D; Ramboll, 2024b). The groundwater samples collected from groundwater compliance monitoring wells were used to evaluate compliance with the groundwater quality standards listed in IAC Section 845.600(a). As of the date of this report, boron and sulfate were identified as constituents/parameters with exceedances of their corresponding GWPSs (Appendix D; Ramboll, 2024b).

Three potentially viable corrective actions for the AP were selected in the CMA for further consideration in this CAAA. Each of these corrective action alternatives include source control (closure-in-place [CIP] using a consolidate-and-cap approach). The corrective actions alternatives that are considered in this CAAA are Source Control with Groundwater Polishing (Source Control-GWP), Source Control with Groundwater Extraction (Source Control-GWE), and Source Control with Phytoremediation (Source Control-Phytoremediation). The corrective actions are described below in Section 2.1.

2.1 Corrective Action Alternative Descriptions

For all three corrective actions evaluated in this CAAA, source control is the primary remedy. US EPA has stated that source control is the most effective means of ensuring the timely attainment of remediation objectives (US EPA, 2015b). The source control for the AP consists of CIP using a consolidate-and-cap approach. Specific elements of this approach include:

- Free liquids would be removed from the AP *via* unwatering and dewatering, as described above, and managed in accordance with the NPDES permit for the facility (845.750(b)(1) and

845.750(b)(2)). The methods by which free liquids will be removed may include drilled sumps, engineered trenches, and/or horizontal wells. Collected flows would be pumped to a temporary storage system and discharged to an outfall in accordance with the NPDES permit for the Site;

- Excavation of approximately 1.13 million cubic yards of CCRs from the high points and northwestern area of the AP and consolidation into a 69-acre CIP area in the south end and other low areas of the AP. All CCR and up to 1 ft of underlying soils would be removed from the designated closure-by-removal (CBR) area;
- Removal of approximately 210,000 cubic yards of soils and other existing structures from the rail loop embankment located on the perimeter berm of the AP for placement into the CIP footprint;
- Construction of a new earthen containment berm to separate the 33-acre excavated portion of the AP from the consolidate-and-cap portion of the AP;
- Contouring and grading of the northwestern portion to manage stormwater;
- Installation of stormwater control infrastructure. Stormwater would be managed using an existing drainage ditch on the western side of the CCR surface impoundment, which discharges to the Illinois River *via* the EPP's NPDES permit; and
- Construction of a final cover system consisting of a 40-mil linear low-density polyethylene (LLDPE) geomembrane layer, a geocomposite drainage layer, and 24 in of protective soil cover suitable for supporting vegetative growth. A possible future solar redevelopment has been planned atop the cover system.

These source control activities include removal of free liquids, excavation and consolidation of CCR , and a reduction of the final impoundment footprint from 102 acres to approximately 69 acres (IngenAE, LLC, 2022a). A low-permeability final geomembrane cover system consisting of a 40-mil linear low-density polyethylene (LLDPE) geomembrane layer, a geocomposite drainage layer, and 24 in of protective soil cover would be installed over the closed portion of the AP. These measures (installation of a geosynthetic cap and consolidation of CCR) will control to the maximum extent feasible the migration of CCR constituents to groundwater, thus facilitating the achievement of the GWPSs in accordance with IAC Section 845.600. As demonstrated by the groundwater modeling in support of the Closure Alternatives Analysis (CAA; Gradient, 2022), this source control approach would result in a reduction of the migration of water into the AP by 97% compared to pre-closure conditions. Additionally, source control would result in a reduction of hydraulic flux out of the AP by 94% compared to pre-closure conditions. Due to the reduction in the hydraulic flux out of the AP, the mass flux out of the AP will also be controlled or minimized as much as feasible as a result of CIP (Ramboll, 2022), demonstrating that source control will control, minimize, or eliminate post-closure release of leachate.

In addition to source control, the corrective actions evaluated in this CAAA include residual plume management. Three potential corrective actions, identified as viable in the CMA, are evaluated in this CAAA for the AP:

- **Alternative 1:** Source Control with Groundwater Polishing (Source Control-GWP);
- **Alternative 2:** Source Control with Groundwater Extraction (Source Control-GWE);
- **Alternative 3:** Source Control with Phytoremediation (Source Control-Phytoremediation).

For all three potential corrective action alternatives, adaptive site management strategies would be integrated into residual plume management. This approach ensures the timely incorporation of new Site information throughout the corrective action process in order to optimize the remediation and expedite

achievement of the GWPSs. As part of the adaptive site management approach, system performance and residual plume conditions would be monitored throughout the implementation of the selected corrective action. If groundwater concentrations do not respond as expected to the corrective action, the adaptive site management approach would enable prompt adjustments, optimizations, or replacement of the remedy to ensure overall effectiveness.

2.1.1 Alternative 1: Source Control-GWP

The first corrective action alternative is Source Control-GWP. This remedy includes source control (CIP using a consolidate-and-cap approach) combined with residual plume management based on natural physical and geochemical processes that would reduce groundwater concentrations downgradient of the AP. GWP mechanisms were evaluated using geochemical speciation and reaction models. The primary objective of the geochemical model was to support the evaluation of GWP as a potential remedy for the Site. The model focused on evaluating the dominant geochemical reactions that may occur at time scales relevant to groundwater flow, including adsorption and mineral dissolution/precipitation reactions (*i.e.*, iron and aluminum hydroxides, carbonates, and some sulfates) (Appendix E; Life Cycle Geo, LLC, 2025). Model inputs included geochemically reactive solid mineral phases, downgradient groundwater composition, and background groundwater composition derived from Site-specific data. Speciation models analyzed the distribution of chemical constituents between solid and aqueous phases, while reaction models assessed how these distributions may shift in response to changing Site conditions (US EPA, 2015).

Components of residual plume management for the Source Control-GWP alternative include:

- Groundwater concentrations would be reduced in the downgradient plume as a result of physical and geochemical attenuation processes. Site-specific evaluations have shown that GWP would reduce the groundwater concentrations and mobility of inorganic contaminants, especially after the implementation of source control. Specifically, chemical attenuation of contaminants is feasible *via* sorption to aquifer solids, particularly iron and aluminum oxides under current conditions. Attenuation *via* sorption onto mineral surfaces should remain stable under post-closure conditions, and remobilization is unlikely to impact the time to achieve GWPS as groundwater returns to background conditions (Appendix E; Life Cycle Geo, LLC, 2025).
- Corrective action groundwater monitoring using a groundwater monitoring system designed in accordance IAC Section 845.680(c), which would be installed within the plume that lies beyond the facility boundary.
- Adaptive site management strategies for this alternative would include geochemical modeling. Groundwater monitoring results would be evaluated and compared to the model-predicted concentrations. In situations in which observed groundwater concentrations deviate significantly from modeled conditions, alternative methods or techniques would be evaluated, and if viable, incorporated as per IAC Section 845.680(b).
- Corrective action confirmation groundwater sampling would be performed for 3 years after GWPSs have been achieved.
- Following the completion of the corrective action confirmation monitoring period, a report and certification for Corrective Action Completion would be prepared and submitted to IEPA as per IAC Section 845.680(e).

The overall corrective action implementation duration for this alternative is over 100 years after completion of source control has been completed (Appendix B; Ramboll, 2025a), including:

- Over 100 years of corrective action monitoring (*i.e.*, time to meet GWPSs),
- At least 3 years (36 months) of corrective action confirmation monitoring,[3] and
- Approximately 6 months associated with post-closure reporting.

Although source control (*i.e.*, closure-in-place [CIP]) is a primary component of the corrective action, the labor time, equipment usage, and mileage linked to source control were previously estimated in the Closure Alternative Analysis (CAA) (Gradient, 2022) and are not repeated in this analysis. There is no labor and mileage incurred with the residual plume management under the Source Control and GWP alternative, because no construction would be required under this alternative. Mileage and labor associated with corrective action monitoring was not included in this analysis (Appendix B; Ramboll, 2025a).

2.1.2 Alternative 2: Source Control-GWE

The second corrective action alternative is Source Control-GWE. This remedy includes source control (*i.e.*, CIP using a consolidate-and-cap approach) with groundwater extraction trenches as the residual plume management approach. The residual plume management approach would include the construction of two extraction trenches, the North and the South Trenches, to capture impacted groundwater from the UCF/PMP and UA and control westerly off-Site migration of impacted groundwater. The North Trench would be located along the inboard CCR excavation slope. It would be 1,700 ft long, 3 ft wide, and would extend to an elevation of 411 to 416 ft above mean sea level (msl) or about 24 to 29 ft below ground surface (bgs).[4] The South Trench would be located on the crest of the existing embankment after removal of the rail line, ballast, and CCR. It would be 800 ft long, 3 ft wide, and would extend to an elevation of 401.5 ft above msl or about 39 ft below bgs. Perforated collection pipes would be installed along the trenches. The trenches would be backfilled with clean granular fill and capped with compacted clay to reduce surface water infiltration. Groundwater that is captured would be pumped to a new on-Site lined settling pond located within the excavated area of the AP before discharge to either the Illinois River or the drainage channel adjacent to the AP *via* a new or existing outfall, and would be managed in accordance with the NPDES permits for the Site.

Implementation of residual plume management for Source Control-GWE is expected to include various tasks across three major phases: pre-construction activities (Phase 1); corrective action construction (Phase 2); and corrective action operations, maintenance, and closeout (Phase 3). The activities associated with each of these phases are summarized below:

- **Phase 1:** Pre-construction activities including obtaining permits from agencies and completing Site investigations and engineering designs.
- **Phase 2:** Construction of the extraction trenches, settling pond, and minor Site restoration of disturbed areas.
    - Mobilization of equipment and materials to the Site, and preparation for Site construction including stormwater best management practices (BMPs), modification for Site utilities, and specialty geotechnical techniques for trenching activities. A detailed methane monitoring plan

[3] It should be noted that post-closure care groundwater monitoring will continue for a minimum of 30 years as required by IAC Section. 845.780(c).
[4] All elevations in this report are in the North American Vertical Datum of 1988 (NAVD88), unless otherwise noted.

would be developed and implemented during the on-Site construction to address the presence of methane in aquifers at the AP;

- The extraction trenches would be constructed using specialized trenching equipment due to the relatively deep depth. This method utilizes a specialized one-pass trencher to excavate subgrade soils, install collection piping and sumps, and backfill the trench with granular material, all in a single operation. Alternative construction methods may be evaluated in later design phases. The trenches would be backfilled with clean granular material and capped with low-permeability clay and topsoil;
- Excavated spoils would be placed at the AP to use as subgrade fill beneath the final cover system;
- The 1-acre, geomembrane-lined collection pond would be constructed to manage extracted groundwater using conventional construction equipment. An additional transfer pump may be necessary for discharge of extracted groundwater to the collection pond; and,
- Site restoration would be completed following the construction of the GWE system and settling pond.

- **Phase 3:** Operations, Maintenance (O&M), and Closeout of the GWE system. Details pertaining to each of these activities are outlined below.
  - Operation of the GWE system;
  - Corrective Action O&M would involve routine maintenance of extraction pumps, air compressor, flow totalizers, and other system components; non-routine maintenance would include repair or replacement of the system components, flushing or jetting of water conveyance lines to remove accumulated organic or inorganic solids from the interior walls;
  - Monitoring of extracted groundwater under the appropriate modified NPDES permit;
  - Adaptive site management strategies would be employed to track remediation progress and incorporate new Site information to assure the achievement of the GWPSs;
  - Corrective action monitoring would be performed using a corrective action groundwater monitoring network designed in accordance with IAC Section 845.680(c), which would be installed within the plume that lies beyond the facility boundary;
  - GWPSs are expected to be achieved in approximately 37 years after source control is completed. Current modeling indicates that the GWE trenches may be required to continue operating for an additional 13 years to prevent concentrations from rebounding above the GWPSs; however, additional modeling would be performed and additional data would be collected as part of the Corrective Action Groundwater Monitoring Plan to evaluate and assess the exact required duration of additional system operation. Therefore, the total operational time period for the horizontal GWE system may be about 50 years under current estimates. Corrective action monitoring would continue during this time and include a 3-year corrective action confirmation monitoring period; and
  - Following the completion of the corrective action confirmation monitoring period, a report and certification for Corrective Action Completion would be prepared and submitted to IEPA as per IAC Section 845.680(e).

The overall corrective action implementation duration is approximately 58 to 60 years (693 to 720 months), including (Appendix B; Ramboll, 2025a):

- Approximately 4 to 5 years (42 to 60 months) of pre-construction activities (Phase 1; assumed to occur concurrently with source control);
- Approximately 9 to 18 months of corrective action construction (Phase 2; assumed to occur concurrently with source control); and
- Approximately 53.5 years (642 months) of O&M and closeout (Phase 3; assumed to start after the completion of source control):
    - Phase 3 is estimated to include 37 years (444 months) of corrective action monitoring (*i.e.*, time to meet GWPSs), 13 years (156 months) of additional operation to prevent groundwater concentrations from rebounding above the GWPSs,[5] at least 3 years (36 months) of corrective action confirmation monitoring,[6] and 6 months associated with post-closure reporting.

Key parameters for the Source Control-GWE corrective action alternative are shown in Table 2.1, below.

Table 2.1 Key Parameters for the Source Control-GWE Corrective Action Alternative[a]

Parameter[b]	Value[c]
Labor Hours	
Total On-Site Labor	32,600 hours
Total Off-Site Labor	0 hours
40% Contingency	13,000 hours
Total Labor Hours:	45,600 hours
Vehicle and Equipment Travel Miles	
Vehicles On-Site	89,100 miles
On-Site Haul Trucks (Unloaded + Loaded)	968 miles
Labor Mobilization	560,000 miles
Equipment Mobilization (Unloaded + Loaded)	27,200 miles
Off-Site Haul Trucks (Unloaded + Loaded)	125,000 miles
Material Deliveries (Unloaded + Loaded)	24,000 miles
Total On-Site Vehicle and Equipment Travel Miles:	90,100 miles
Total Off-Site Vehicle and Equipment Travel Miles:	736,000 miles
Total Vehicle and Equipment Travel Miles:	826,000 miles

Notes:
Source Control-GWE = Source Control with Groundwater Extraction.
(a) Although source control (*i.e.*, closure-in-place [CIP]) is a primary component of the corrective action, the labor time, equipment usage, and mileage linked to source control were previously estimated in the Closure Alternative Analysis (CAA) and are not repeated in this analysis.
(b) Site activities are expected to occur during the corrective action construction and O&M phases for this alternative.
(c) Values reported in this table were rounded to reflect 3 significant figures.
Source: Appendix B; Ramboll, 2025a.

[5] Current modeling indicates that an additional 13 years of system operation may be required to prevent concentrations from rebounding above the GWPSs; however, additional modeling would be performed, and additional data would be collected as part of the Corrective Action Groundwater Monitoring Plan to evaluate and assess the exact required duration of additional system operation.
[6] It should be noted that post-closure care groundwater monitoring would continue for a minimum of 30 years or until such time as GWPSs are achieved, whichever is longer, as required by IAC Section 845.780(c).

2.1.3 Alternative 3: Source Control-Phytoremediation

The third corrective action alternative is Source Control-Phytoremediation. This remedy includes source control (*i.e.*, CIP using a consolidate-and-cap approach) combined with phytoremediation as the residual plume management approach. This residual plume management approach would include the installation of two segments of trees on the west side of the AP to control off-Site migration of impacted groundwater. Each tree segment would consist of a grid of tree plantings, and each planting would contain one tree and a well system to passively draw groundwater upward to the root zone and allow phytoremediation to occur. Each tree structure would consist of a borehole advanced into the UA and backfilled with tree cuttings and porous material to allow groundwater from the UA and PMP to rise to the potentiometric surface elevation. A surface liner would be installed to reduce precipitation inflow to facilitate downward root growth for groundwater intake. The two separate tree segments would address exceedances in the northern and southern areas of the AP, respectively. The northern tree segment would be located along the berm within the excavation area and would be 1,700 ft long. The southern tree segment would be along the exterior toe of the former perimeter dike of the AP and would be 1,900 ft long. The two segments would include a total of about 550 trees, with 200 trees in the northern section and 350 trees in the southern section.

Implementation of residual plume management for Source Control-Phytoremediation is expected to include various tasks across three major phases: pre-construction activities (Phase 1); corrective action construction (Phase 2); and corrective action operations, maintenance, and closeout (Phase 3). The activities associated with each of these phases are summarized below:

- **Phase 1:** Pre-construction activities including obtaining permits from agencies, and completing Site investigations and engineering designs.
- **Phase 2:** Construction of the phytoremediation system (tree well systems), and Site restoration of disturbed areas.
    - Mobilization of equipment and materials to the Site and preparation for Site construction, which would include implementing stormwater BMPs around the construction area, modification of Site utilities, and the construction of a work platform;
    - Geotechnical monitoring would be performed to evaluate the AP embankment for signs of distress during construction;
    - The phytoremediation system would be constructed using a hollow stem auger drill rig to allow enough space for a tree cutting, appropriate backfill, and additional items associated with the installation. The upper portion of each borehole, located above the groundwater table, would be backfilled with mixture of porous material, organic moisture-wicking material, and nutrient amendments;
    - A detailed methane monitoring plan would be developed and implemented to account for methane presence in aquifers at the AP; and
    - Site restoration would be completed following the phytoremediation installations.
- **Phase 3:** Operations, Maintenance, and Closeout of the phytoremediation system. Details pertaining to each of these activities are outlined below.
    - Corrective Action O&M would involve routine and non-routine maintenance of the phytoremediation system including inspections and maintenance of water delivery systems and/or the delivery of irrigation water, maintenance to irrigation systems, maintenance and pruning of the trees, mowing and clearing other vegetation around the tress, collection of tree

tissue samples, harvesting tree waste, and maintenance of phytoremediation installation components;

- Adaptive site management strategies would be employed to track remediation progress and incorporate new Site information to assure the achievement of the GWPSs;
- Corrective action monitoring would be performed using a corrective action groundwater monitoring network designed in accordance with IAC Section 845.680(c), which would be installed within the plume that lies beyond the facility boundary;
- GWPSs are expected to be achieved in 48 to 77 years after source control is completed. Current modeling indicates that operation of the phytoremediation system may be required for an additional 22 to 73 years to prevent concentrations from rebounding above the GWPS; however, additional modeling would be performed, and additional data would be collected as part of the Corrective Action Groundwater Monitoring Plan to evaluate and assess the exact required duration of additional system operation. Therefore, the total operational time period for the phytoremediation system may range from 70 years with ideal tree performance to 150 years with sub-optimal performance. Corrective action monitoring would continue during this time and would include an additional 3 years of corrective action confirmation after corrective action operation has ceased; and
- Following the completion of the corrective action confirmation monitoring period, a report and certification for Corrective Action Completion would be prepared and submitted to IEPA as per IAC Section 845.680(e).

The overall corrective action implementation duration is approximately 78 to 161 years (939 to 1,932 months), including:

- Approximately 4 to 6 years (48 to 72 months) of pre-construction activities (Phase 1; assumed to occur concurrently with source control),
- Approximately 9 to 18 months of corrective action construction (Phase 2; assumed to occur concurrently with source control), and
- Approximately 74 to 154 years (882 to 1,842 months) of corrective action O&M and closeout (Phase 3).
    - Phase 3 is estimated to include 48 to 77 years (576 to 924 months) of corrective action O&M (*i.e.*, time to meet GWPSs), 22 to 73 years (156 to 876 months) of additional operation to prevent concentrations from rebounding above the GWPSs,[7] at least 3 years (36 months) of corrective action confirmation monitoring, [8] and 6 months associated with post-closure reporting (Appendix B).

[7] Current modeling indicates that an additional 22 to 73 years of system operation may be required to prevent concentrations from rebounding above the GWPSs; however, additional modeling would be performed, and additional data would be collected as part of the Corrective Action Groundwater Monitoring Plan to evaluate and assess the exact required duration of additional system operation.

[8] It should be noted that post-closure care groundwater monitoring would continue for a minimum of 30 years or until such time as GWPSs are achieved, whichever is longer, as required by IAC Section 845.780(c).

Key parameters for the Source Control-GWE corrective action alternative are shown in Table 2.2, below.

Table 2.2 Key Parameters for the Source Control-Phytoremediation Corrective Action Alternative[a]

Parameter[b]	Value[c]
Labor Hours	
Total On-Site Labor	22,800 hours
Total Off-Site Labor	0 hours
40% Contingency	9,130 hours
Total Labor Hours:	32,000 hours
Vehicle and Equipment Travel Miles	
Vehicles On-Site	68,600 miles
On-Site Haul Trucks (Unloaded + Loaded)	1,510 miles
Labor Mobilization	402,000 miles
Equipment Mobilization (Unloaded + Loaded)	66,200 miles
Off-Site Haul Trucks (Unloaded + Loaded)	34,300 miles
Material Deliveries (Unloaded + Loaded)	17,300 miles
Total On-Site Vehicle and Equipment Travel Miles:	70,100 miles
Total Off-Site Vehicle and Equipment Travel Miles:	520,000 miles
Total Vehicle and Equipment Travel Miles:	590,000 miles

Notes:
Source Control-Phytoremediation = Source Control with Phytoremediation.
(a) Although source control (*i.e.*, closure-in-place [CIP]) is a primary component of the corrective action, the labor time, equipment usage, and mileage linked to source control were previously estimated in the Closure Alternative Analysis (CAA) and are not repeated in this analysis.
(b) Site activities are expected to occur during the corrective action construction and O&M phases for this alternative.
(c) Values reported in this table were rounded to reflect 3 significant figures.
Source: Appendix B; Ramboll, 2025a.

2.2 Long- and Short-Term Effectiveness and Protectiveness of Corrective Action Alternative (IAC Section 845.670(e)(1))

2.2.1 Magnitude of Reduction of Existing Risks/Be Protective of Human Health and the Environment (IAC Section 845.670(e)(1)(A)/IAC Section 845.670(d)(1))

There are no current unacceptable risks to human or ecological receptors at this Site associated with the AP (Appendix A; Gradient, 2022). Because current conditions do not present a risk to human health or the environment at the AP, there will be no unacceptable risk to human health or the environment for future conditions when the unit has been closed and source control/residual plume management has been implemented. Concentrations of CCR-related constituents will decline over time and, consequently, potential exposures to CCR-related constituents in the environment will also decline. As a result of this, the magnitude of the reduction of existing risks is the same for all corrective action alternatives (IAC Section 845.670(e)(1)(A)), and all corrective action alternatives are equally protective of human health and the environment (IAC Section 84.670(d)(1)).

2.2.2 Effectiveness of the Remedy in Controlling the Source (IAC Section 845.670(e)(2)/IAC Section 845.670(d)(3))

Extent to Which Containment Practices Will Reduce Further Releases/Control the Sources of Releases to Reduce or Eliminate, to the Maximum Extent Feasible (IAC Section 845.670(e)(2)(A)/IAC Section 845.670(d)(3))

Source control (*i.e.*, CIP using a consolidate-and-cap approach) which includes the removal of free liquids, excavation of CCR in the northern portions of the AP and consolidation into the southern portion of the AP, and the installation of a low-permeability final cover system designed to limit the infiltration of precipitation into the impounded CCR, would be implemented for all corrective action alternatives. As demonstrated by the groundwater modeling in support of the Closure Alternatives Analysis (CAA; Gradient, 2022), this source control approach would result in a reduction of the migration of water into the AP by 97% compared to pre-closure conditions. Additionally, source control would result in a reduction of hydraulic flux out of the AP by 94% compared to pre-closure conditions (Ramboll, 2022). Because source control would be undertaken at the Site prior to the implementation of any residual plume management, all three corrective action alternatives would remove the potential for CCR within the impoundment to impact groundwater. All three corrective action alternatives would be equally and fully protective with regard to source control. The effectiveness of residual plume management for each of the corrective action alternatives with respect to residual source control is summarized below.

- Under the Source Control-GWP alternative, the attenuation of dissolved constituent concentrations remaining after source control would be achieved through natural physical and geochemical processes. Site-specific evaluations have shown that GWP would reduce the groundwater concentrations and mobility of inorganic contaminants, especially after the implementation of source control. Specifically, chemical attenuation of contaminants is feasible *via* sorption to aquifer solids, particularly iron and aluminum oxides under current conditions. Attenuation *via* sorption onto mineral surfaces should remain stable under post-closure conditions, and remobilization is unlikely to impact the time to achieve GWPS as groundwater returns to background conditions (Appendix E; Life Cycle Geo, LLC, 2025). In cases in which observed groundwater concentrations deviate significantly from modeled conditions, alternative methods or techniques would be evaluated under the adaptive site management, and if viable, incorporated as per IAC Section 845.680(b).
- Under the Source Control-GWE alternative, residual source control would be achieved by extracting impacted groundwater and preventing off-Site migration through installation of two extraction trenches along the western side of the AP. GWE is a widely used corrective measure that has been effectively implemented at many sites to contain and capture dissolved-phase groundwater plumes. In cases in which observed groundwater concentrations deviate significantly from modeled conditions, alternative methods or techniques to achieve the GWPSs would be evaluated under the adaptive site management plan, and if viable, incorporated as per IAC Section 845.680(b).
- Under the Source Control-Phytoremediation alternative, residual source control would be achieved by removing impacted groundwater and controlling the westerly off-Site migration through the installation of two tree segments on the west side of the AP. Phytoremediation is a commonly used corrective measure that has been effectively implemented at many sites to remove constituents from groundwater. In cases in which observed groundwater concentrations deviate significantly from modeled conditions, alternative methods or techniques to achieve the GWPSs would be evaluated under the adaptive site management plan, and if viable, incorporated as per IAC Section 845.680(b).

Because all three corrective action alternatives include source control, and residual plume management, each potential corrective action alternatives would be equally effective at reducing releases from both primary and residual sources (IAC Section 845.670(e)(2)(A)/IAC Section 845.670(d)(3)).

Extent to Which Treatment Technologies May Be Used (IAC Section 845.670(e)(2)(B))

Because Source Control-GWP would rely on physical and geochemical processes, no additional treatment technologies would be required under this alternative. For the Source Control-GWE alternative, extracted groundwater would be managed and treated by a newly constructed on-Site settling pond, although other methods for treated extracted groundwater may be evaluated at later phases of design (Appendix B; Ramboll, 2025a). For the Source Control-Phytoremediation alternative, tree plantings would passively treat groundwater by uptaking impacted groundwater. No additional treatment technologies are planned for this alternative. For all corrective action alternatives, remedy optimizations would be implemented, if necessary, under the adaptive site management program.

2.2.3 Likelihood of Future Releases of CCR (IAC Section 845.670(e)(1)(B))

All three corrective action alternatives include source control using CIP with a consolidate-and-cap approach. Free liquids would be removed; a new cover system would be installed over the AP, which would include a 40-mil LLDPE geomembrane layer, a geocomposite drainage layer, 24 in of protective soil cover, and new stormwater control structures. Relative to current conditions, this cover system would provide increased protection against berm and surface erosion, precipitation infiltration, and other adverse effects that could potentially trigger a release of CCR. There would be minimal risk of accidental CCR releases occurring post-closure for all of the corrective action alternatives.

2.2.4 Type and Degree of Long-Term Management, Including Monitoring, Operation, and Maintenance (IAC Section 845.670(e)(1)(C))

The type and degree of long-term residual groundwater plume management associated with each corrective action alternative is summarized below.

- Residual plume management for the Source Control-GWP alternative would not require the installation, operation, or maintenance of any engineered systems or structures, other than maintenance of the monitoring well network. The only long-term management activity required under this alternative would be corrective action groundwater monitoring and routine maintenance of the monitoring wells, which would continue for at least 3 years after GWPSs have been achieved for all wells, in accordance with IAC Section 845.680(c)(2). Post-closure care groundwater monitoring would continue for a minimum of 30 years as required by IAC Section 845.780(c). Based on the adaptive site management approach, remedy optimization (additional methods or techniques) may be implemented to ensure the achievement of the GWPSs.
- Residual plume management for the Source Control-GWE would require the construction of two groundwater extraction trenches. Multiple tasks would be completed over three phases: pre-construction activities (Phase 1), corrective action construction (Phase 2), and corrective action O&M, and closeout (Phase 3). Once pre-construction activities are completed, construction of the extraction trenches would occur concurrently with AP closure activities. This approach would allow for the spoils generated from the extraction trenches to be disposed beneath the final cover system of the AP. Corrective action O&M would require regular inspection and maintenance of the extraction trench system. Extracted groundwater would be managed and treated by a newly-constructed on-Site collection pond before discharge *via* an NPDES outfall to the Illinois River.

Additionally, corrective action groundwater sampling and routine maintenance of the monitoring well network would continue for at least 3 years after GWPSs have been achieved at all wells, in accordance with IAC Section 845.680(c)(2). Post-closure care groundwater monitoring would continue for a minimum of 30 years as required by IAC Section 845.780(c). Based on the adaptive site management approach, remedy optimization (additional methods or techniques) may be implemented to ensure the achievement of the GWPSs.

- Residual plume management for the Source Control-Phytoremediation would require the construction of two tree segments. Multiple tasks would be completed over three phases: pre-construction activities (Phase 1), corrective action construction (Phase 2), corrective action O&M, and closeout (Phase 3). Once pre-construction activities are completed, the installation of tree segments would occur concurrently with AP closure activities to allow spoils generated from boring of tree wells to be disposed beneath the final cover system of the AP. Corrective action O&M would require regular inspection and maintenance of the phytoremediation system, including inspections and maintenance of water delivery systems and/or the delivery of irrigation water, maintenance to irrigation systems, maintenance and pruning of the trees, mowing and clearing other vegetation around the trees, collection of tree tissue samples, harvesting tree waste, and maintenance of phytoremediation installation components, *etc.* Additionally, corrective action groundwater sampling and routine maintenance of the monitoring well network would continue for at least 3 years after GWPSs have been achieved at all wells, in accordance with IAC Section 845.680(c)(2). Post-closure care groundwater monitoring would continue for a minimum of 30 years as required by IAC Section 845.780(c). Based on the adaptive site management approach, remedy optimization (additional methods or techniques) may be implemented to ensure the achievement of the GWPSs.

2.2.5 Short-Term Risks to the Community or the Environment During Implementation of Remedy (IAC Section 845.670(e)(1)(D))

2.2.5.1 Safety Impacts

Best practices would be employed during construction in order to ensure worker safety and comply with all relevant regulations, permit requirements, and safety plans. However, it is impossible to completely eliminate risks to workers during construction and/or other corrective action activities. For example, injuries and fatalities can occur due to truck accidents or equipment malfunctions. Truck accidents that occur off-Site can also result in injuries or fatalities to community members. The safety impacts associated with source control (*i.e.*, CIP using a consolidate-and-cap approach), which were evaluated in the CAA (Gradient, 2022), are the same for all corrective action alternatives. The safety impacts associated with residual plume management (*i.e.*, construction and O&M) for each corrective action alternative are described below.

- The Source Control-GWP alternative would not require the construction and maintenance of any engineered systems or structures, and therefore no safety impacts are expected.
- The Source Control-GWE alternative would include the construction of two groundwater extraction trenches and a settling pond to collect, extract and treat CCR-impacted groundwater. Potential safety concerns would be related to construction and O&M of the extraction trenches and settling pond.
- The Source Control-Phytoremediation alternative would include the installation of two tree segments to extract impacted groundwater and control off-Site migration of CCR-impacted

groundwater. Potential safety concerns would be related to the installation and O&M of the tree segments.

Worker Risks

On-Site accidents include injuries and deaths arising from the use of heavy equipment and/or earthmoving operations during Site activities. Off-Site accidents include injuries and deaths due to vehicle accidents during labor and equipment mobilization/demobilization, as well as materials/supplies hauling and deliveries.

As discussed in section 2.1.1, there are no construction activities or operational requirements associated with residual plume management for the Source Control-GWP alternative. As shown in Tables 2.1-2.2, Ramboll estimates that residual plume management for the Source Control-GWE corrective action alternative would require 32,600 on-Site labor hours, and residual plume management for the Source Control-Phytoremediation corrective action alternative would require 22,800 on-Site labor hours (Appendix B; Ramboll, 2025a). The US Bureau of Labor Statistics (US DOL, 2020a,b) provides an estimate of the hourly fatality and injury rates for construction workers. Based on the accident rates reported by the US Bureau of Labor Statistics and the on-Site labor hours reported in Appendix B, approximately 0.34 worker injuries and 3.0×10^{-3} worker fatalities would occur on-Site under the Source Control-GWE corrective action alternative; and approximately 0.24 worker injuries and 2.1×10^{-3} worker fatalities would occur on-Site under the Source Control-Phytoremediation corrective action alternative (Table 2.3). No worker accidents would be expected under the Source Control-GWP alternative. The number of on-Site worker accidents is therefore expected to be highest under the Source Control-GWE alternative and lowest under the Source Control-GWP alternative.

Table 2.3 Expected Number of On-Site Worker Accidents Under Each Corrective Action Alternative[a,b]

Corrective Action Alternative	Injuries	Fatalities
Source Control-GWP	0	0
Source Control-GWE	0.34	3.0×10^{-3}
Source Control-Phytoremediation	0.24	2.1×10^{-3}

Notes:
Source Control-GWE = Source Control with Groundwater Extraction; Source Control-GWP = Source Control with Groundwater Polishing; Source Control-Phytoremediation = Source Control with Phytoremediation.
(a) Although source control (*i.e.*, closure-in-place [CIP]) is a primary component of the corrective action, the worker accidents associated with source control were previously estimated in the Closure Alternative Analysis (CAA) and are not repeated in this analysis.
(b) Worker accidents associated with groundwater sampling and monitoring are not included in this analysis for any of the alternatives.
Source: Appendix B; Ramboll, 2025a.

Off-Site, a greater number of haul truck miles, labor and equipment mobilization/demobilization miles, and material delivery miles would be required under the Source Control-GWE alternative compared to the Source Control-Phytoremediation alternative (Tables 2.1-2.2). For residual plume management under the Source Control-GWE corrective action alternative, 736,000 total off-Site vehicle and equipment travel miles would be required. In contrast, residual plume management under the Source Control-Phytoremediation alternative, 520,000 total off-Site vehicle and equipment travel miles would be required and no off-Site travel miles would be expected under the Source Control and GWP alternative (Appendix B; Ramboll, 2025a). The United States Department of Transportation (US DOT) provides estimates of the expected number of fatalities and injuries "per vehicle mile driven" for drivers and passengers of large

trucks and passenger vehicles (US DOT, 2023a). Table 2.4 shows the expected number of off-Site accidents under each corrective action alternative due to all categories of off-Site vehicle usage. For these calculations, it was assumed that labor mobilization/demobilization would rely upon passenger vehicles (cars or light trucks, including pickups, vans, and sport utility vehicles) and that hauling, equipment mobilization/demobilization, and material deliveries would rely upon large trucks. Based on US DOT's accident statistics and the mileage estimates in Appendix B, an estimated 0.37 worker injuries and 8.1×10^{-3} worker fatalities would be expected to occur due to off-Site activities under the Source Control-GWE alternative; and an estimated 0.26 worker injuries and 5.7×10^{-3} worker fatalities would be expected to occur due to off-Site activities under the Source Control-Phytoremediation alternative. No worker accidents would be expected under the Source Control-GWP alternative.

Table 2.4 Expected Number of Off-Site Worker Accidents Related to Off-Site Car and Truck Use Under Each Corrective Action Alternative[a]

Off-Site Vehicle Use Category	Source Control-GWP		Source Control-GWE		Source Control-Phytoremediation	
	Injuries	Fatalities	Injuries	Fatalities	Injuries	Fatalities
Hauling	0	0	0.026	2.0×10^{-3}	7.2×10^{-3}	5.4×10^{-4}
Labor Mobilization/Demobilization	0	0	0.33	5.3×10^{-3}	0.24	3.8×10^{-3}
Equipment Mobilization/Demobilization	0	0	5.7×10^{-3}	4.3×10^{-4}	0.014	1.0×10^{-3}
Material Deliveries	0	0	5.1×10^{-3}	3.8×10^{-4}	3.6×10^{-3}	2.7×10^{-4}
Total:	0	0	0.37	8.1×10^{-3}	0.26	5.7×10^{-3}

Notes:
Source Control-GWE = Source Control with Groundwater Extraction Trench; Source Control-GWP = Source Control with Groundwater Polishing; Source Control-Phytoremediation = Source Control with Phytoremediation.
(a) Although source control (*i.e.*, closure-in-place [CIP]) is a primary component of the corrective action, the worker accidents associated with source control were previously estimated in the Closure Alternative Analysis (CAA) and are not repeated in this analysis.

Overall, considering accidents occurring both on- and off-Site, no worker injuries and worker fatalities would be expected to occur for residual plume management under the Source Control and GWP alternative; 0.71 worker injuries and 0.011 worker fatalities would be expected to under the Source Control-GWE alternative; and 0.50 worker injuries and 7.7×10^{-3} worker fatalities would be expected to occur under the Source Control-Phytoremediation alternative. Thus, overall risks to workers would be highest under the Source Control-GWE.

Community Risks

Vehicle accidents that occur off-Site can result in injuries or fatalities among community members as well as workers. Based on the accident statistics reported by US DOT (2023b) and the off-Site travel mileages reported in Appendix B (and summarized in Tables 2.1-2.2), off-Site vehicle accidents could result in an estimated 1.8×10^{-2} injuries and 2.5×10^{-3} fatalities among community members (*e.g.*, people involved in haul truck accidents that are neither haul truck drivers nor passengers, including pedestrians, drivers of other vehicles) under the Source Control-GWE alternative (Table 2.5). Under the Source Control-Phytoremediation alternative, off-Site vehicle accidents could result in an estimated 0.13 community injuries and 1.8×10^{-3} community fatalities. No community risks are expected under the Source Control-GWP alternative. Therefore, off-Site impacts on nearby residents, including injuries or fatalities, would be the highest under the Source Control-GWE alternative, and lowest under the Source Control-GWP alternative.

Table 2.5 Expected Number of Community Accidents Under Each Corrective Action Alternative[a]

Off-Site Vehicle Use Category	Source Control-GWP		Source Control-GWE		Source Control-Phytoremediation	
	Injuries	Fatalities	Injuries	Fatalities	Injuries	Fatalities
Hauling	0	0	3.3×10^{-2}	2.4×10^{-4}	9.0×10^{-3}	6.6×10^{-5}
Labor Mobilization/Demobilization	0	0	0.14	2.2×10^{-3}	9.7×10^{-2}	1.6×10^{-3}
Equipment Mobilization/Demobilization	0	0	7.2×10^{-3}	5.3×10^{-5}	1.7×10^{-2}	1.3×10^{-5}
Material Deliveries	0	0	6.3×10^{-3}	4.6×10^{-5}	4.5×10^{-3}	3.3×10^{-5}
Total:	0	0	0.18	2.5×10^{-3}	0.13	1.8×10^{-3}

Notes:
Source Control-GWE = Source Control with Groundwater Extraction Trench; Source Control-GWP = Source Control with Groundwater Polishing; Source Control-Phytoremediation = Source Control with Phytoremediation.
(a) Although source control (*i.e.,* closure-in-place [CIP]) is a primary component of the corrective action, the worker accidents associated with source control were previously estimated in the Closure Alternative Analysis (CAA) and are not repeated in this analysis.

2.2.5.2 Cross-Media Impacts to Air

Air pollution can occur both on-Site (*e.g*., construction activities) and off-Site (*e.g*., along transportation routes), potentially impacting workers as well as community members. Diesel emissions are a major source of air pollutants and greenhouse gas (GHG) emissions at construction sites. Diesel exhaust contains air pollutants, including nitrogen oxides (NO_x), particulate matter (PM), carbon monoxide (CO), and volatile organic compounds (VOCs) (Hesterberg *et al*., 2009; Mauderly and Garshick, 2009). Construction equipment also emits GHGs, including carbon dioxide (CO_2) and possibly nitrous oxide (N_2O). The potential impact of each corrective action alternative on GHG emissions is proportional to the potential impact of each alternative on other emissions from construction vehicles and equipment.

Source control (*i.e*., CIP using a consolidate-and-cap approach) would be implemented for all three potential corrective action alternatives. Air impacts occurring during source control would be the same for all corrective action alternatives. Impacts associated with CIP using a consolidate-and-cap approach were evaluated in the CAA (Gradient, 2022). On-Site emissions would be highest under the Source Control-GWE alternative due to the greatest amount of on-Site vehicle travel miles required under this corrective action alternative (90,100 total on-Site travel miles under the Source Control-GWE alternative *versus* 70,100 total on-Site travel miles under the Source Control-Phytoremediation alternative and no on-Site travel miles under the source Control-GWP alternative; Section 2.1.1; Tables 2.1-2.2). Off-Site emissions would similarly be highest under the Source Control-GWE alternative due to the greatest amount of off-Site vehicle and equipment travel miles required under this alternative (736,000 total off-Site travel miles under the Source Control-GWE alternative *versus* 520,000 total off-Site travel miles under the Source Control-Phytoremediation alternative and no off-Site travel miles under the Source Control-GWP alternative). In summary, air impacts would be highest for the Source Control-GWE alternative due to greatest vehicle travel miles, and lowest for the Source Control-GWP alternative, because no construction activities would be expected under this alternative.

2.2.5.3 Cross-Media Impacts to Surface Water and Sediments

Under all three corrective action alternatives, the constituent mass flux from groundwater into surface water would decline over time after source control has been completed (Ramboll, 2022). Source control would include removal of free liquids, consolidation of CCR in the AP and the installation of a low-permeability geomembrane final cover system to limit the precipitation infiltration into the CCR unit. This approach would minimize the amount of water retained within the impoundment, which further reduces the hydraulic flux through the CCR. As demonstrated by the groundwater modeling in support of the Closure

Alternatives Analysis (CAA; Gradient, 2022), this source control approach would result in a reduction of the migration of water into the AP by 97% compared to pre-closure conditions. Additionally, source control would result in a reduction of hydraulic flux out of the AP by 94% compared to pre-closure conditions. Due to the reduction in the hydraulic flux out of the AP, the mass flux out of the AP will also be controlled or minimized as much as feasible as a result of CIP (Ramboll, 2022).

Under the Source Control-GWP alternative, minimal surface water and sediment impacts would be expected associated with residual plume management because it would not require the construction of any engineered systems or structures (other than utilizing monitoring wells).

Under the Source Control-GWE alternative, surface water and sediment impacts associated with residual plume management would be higher than the those of Source Control-GWP alternative due to the construction of the extraction trenches and the settling pond. Construction can have short-term negative impacts on surface water and sediment quality immediately adjacent to a site due to erosion and sediment runoff. Extracted groundwater would be discharged to either the Illinois River or the drainage channel adjacent to the AP *via* a new or existing outfall. Any associated impacts would be addressed through BMPs in accordance with Site land disturbance permits.

Under the Source Control-Phytoremediation alternative, surface water and sediment impacts associated with residual plume management would be higher than the those of Source Control-GWP alternative, because it would require some construction, which is limited to staging of a work platform and equipment, hollow stem auger drilling for the tree well system, and other installation items related to the phytoremediation system. Construction can have short-term negative impacts on surface water and sediment quality immediately adjacent to a site due to erosion and sediment runoff. Any associated impacts would be addressed through BMPs in accordance with Site land disturbance permits.

2.2.5.4 Control of Exposure to Any Residual Contamination During Implementation of the Remedy

Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all three corrective action alternatives. While appropriate controls would be established to prevent exposures of CCR during source control, the risks of CCR exposure during source control would be the same for all corrective action alternatives. For each of the other corrective action components for the three potential alternatives, no residual CCR exposures would be expected to occur. However, impacted soils and groundwater can be a source of CCR-related constituent exposure for workers. Risks to workers arising from potential contact with residual contamination during construction, operation, and maintenance activities associated with residual plume management would be higher for the Source Control-GWE alternative than for the Source Control-GWP and Source Control-Phytoremediation alternatives because the Source Control-GWE would involve both the production, management, and treatment of extracted groundwater, as well as on-Site disposal of excavated spoils generated during extraction trench construction. The Source Control-Phytoremediation alternative would not involve the management of impacted groundwater; exposure would be limited to disposal of spoils generated during phytoremediation installations. The Source Control-GWP alternative would not involve exposure to either of these soil or groundwater waste streams associated with residual plume management. Any potential CCR-exposures during the Source Control-GWE or the Source Control-Phytoremediation alternatives would be managed through the use of rigorous safety protocols and personal protective equipment.

2.2.5.5 Other Identified Impacts

Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all three corrective action alternatives. Thus, impacts during source control would be the same for all of the corrective action alternatives (see the CAA; Gradient, 2022).

In addition to safety impacts, cross-media impacts, and the potential for workers to be exposed to residual contamination, construction activities and remedial operations can have significant energy demands and can cause nuisance impacts such as traffic and noise. Energy consumption at a construction site is synonymous with fossil fuel consumption, because the energy to power construction vehicles and equipment comes from the burning of fossil fuels. Fossil fuel demands considered here include the burning of diesel fuel during construction equipment and vehicle travel miles. Because GHG emission impacts and energy consumption impacts both arise from the same sources at construction sites, the trends discussed in Section 2.2.5.2 with respect to GHG emissions also apply to the evaluation of energy demands. Specifically, the energy demands of construction equipment and vehicles associated with residual plume management would be greater under the Source Control-GWE alternative, while the energy demands under the Source Control-GWP and Source Control-Phytoremediation alternatives associated with residual plume management are expected to be lower. The Source Control-GWP would not require any significant construction activity and the Source Control-Phytoremediation is expected to require relatively limited construction activity. In addition, energy would be required for the O&M of the extraction trench system under the Source Control-GWE and the tree wells under Source Control-Phytoremediation alternatives; there is no operational energy required under the Source Control-GWP alternative because the Source Control-GWP alternative would rely on natural physical and geochemical processes.

Traffic and noise impacts associated with residual plume management are also expected to be higher under the Source Control-GWE and Source Control-Phytoremediation alternatives than the Source Control-GWP alternative; construction activities would be required to construct the extraction trench system and settling pond under the Source Control-GWE alternative and to install tree segments under the Source Control-Phytoremediation alternative. Traffic may increase temporarily around the Site under the Source Control-GWE and Source Control-Phytoremediation alternatives due to the daily arrival and departure of the workforce, equipment mobilization/demobilization, and material deliveries. However, these impacts would be expected to largely occur at the beginning and end of each workday (for the arrival/departure of the work force), at the beginning and end of the construction period (for equipment mobilization/ demobilization), and at specific times throughout the construction period (for material deliveries). Traffic and noise impacts associated with residual plume management from the Source Control-GWP alternative is expected to be significantly less than those associated with the Source Control-GWE and Source Control-Phytoremediation alternatives.

Construction activities can negatively impact natural resources and habitats near the Site, as well as scenic and recreational value. According to the IDNR Natural Heritage, Historic Preservation Division, and the Illinois State Archaeological Survey databases, no natural areas, protected areas, or historic sites were identified 1,000 meters from the AP (Ramboll, 2021). There would be no impacts associated with residual plume management under the Source Control-GWP alternative because no additional construction activities are expected to occur. The Source Control-GWE alternative would require construction of two extraction trenches and an on-Site settling pond and the Source Control-Phytoremediation would involve installation of tree well systems, both of which would occur during the later phase of the AP closure construction. The AP is separated spatially from the Illinois River; construction activities at the AP are unlikely to have a significant negative impact on aquatic species found in the Illinois River (due to, *e.g.*, erosion and sediment runoff). However, construction activities could cause disturbance of some existing habitats atop portions of the construction areas, and habitats in the immediate vicinity of these locations by causing alarm and

escape behavior in nearby wildlife (*e.g.*, due to noise disturbances). In addition, it is also possible that limited negative short-term impacts could occur to sensitive aquatic and wetland species in the discontinuous wetland areas in the immediate vicinity of the AP due to potential sediment runoff during construction (see Section 1.1.3).

2.2.6 Time Until Groundwater Protection Standards Are Achieved/Attain the Groundwater Protection Standards Specified in Section 845.600 (IAC Section 845.670(e)(1)(E)/IAC Section 845.680(d)(2))

This section of the report evaluates the time required to achieve GWPSs, pursuant to requirements under IAC Section 845.670(e)(1)(E) (IEPA, 2021) and under IAC Section 845.680(d)(2).

Groundwater within the UA flows predominantly to the west in the central portion of the AP towards a former channel of the Illinois River, and to the south/southeast in the southern end of the AP. There is a minor component in the northernmost portion of the AP where groundwater in the UA and PMP flows to the north and northwest (Ramboll, 2021). Groundwater flow occurs primarily in the more permeable zones within the LCF in the UA (Ramboll, 2021).

Groundwater modeling was performed in support of the CAA (Gradient, 2022). The modeling predicted that source control would result in a reduction of the migration of water into AP by 97% compared to pre-closure conditions. Additionally, source control would result in a reduction of hydraulic flux out of AP by 94% compared to pre-closure conditions (Ramboll, 2022). Additional modeling was conducted for each of the corrective action alternatives to evaluate future groundwater quality in the vicinity of the AP as a result of residual plume management (Appendix B; Ramboll, 2025b), and the results of the modeling indicate that it would take more than 100 years to achieve the GWPSs for all of the constituents[9] identified as having potential groundwater exceedances in AP groundwater monitoring wells under the Source Control-GWP once source control has been completed. Under the Source Control-GWE alternative, approximately 37 years would be required to achieve GWPSs once source control is completed. Current modeling indicates that an additional 13 years of system operation may be required to prevent concentrations from rebounding above the GWPSs (Appendix B; Ramboll, 2025a); however, additional modeling would be performed, and additional data would be collected as part of the Corrective Action Groundwater Monitoring Plan to evaluate and assess the exact required duration of additional system operation for the Source Control-GWE alternative. Under the Source Control-Phytoremediation alternative, approximately 48 to 77 years would be required to achieve GWPSs once source control is completed. Current modeling indicates that an additional 22 to 73 years of system operation may be required to prevent concentrations from rebounding above the GWPSs (Appendix B; Ramboll, 2025a); however, additional modeling would be performed, and additional data would be collected as part of the Corrective Action Groundwater Monitoring Plan to evaluate and assess the exact required duration of additional system operation for the Source Control-Phytoremediation alternative. The timeframe for achieving GWPS under the Source Control-GWE is predicted to be shorter than the timeframe for achieving the GWPS under the Source Control-GWP and Source Control-Phytoremediation alternatives.

[9] Boron was selected as a surrogate for the contaminant fate and transport simulations to evaluate the effectiveness of each of the corrective action alternatives. Boron has similar groundwater transport characteristics as the other constituents that have been detected with potential GWPS exceedances (*i.e.*, sulfate). Therefore, subsurface transport during closure conditions would be similar for all these constituents. Boron has been detected in AP groundwater at the highest concentrations relative to its GWPS and it will likely take the longest time to meet the GWPS. It is not necessary to model all constituents that show GWPS exceedances or have been detected at lower concentrations relative to their GWPSs, because those constituents will likely achieve their GWPSs more quickly (Appendix B; Ramboll, 2025b).

Table 2.6 Estimated Timeline and Implementation Schedule Under Each Corrective Action Alternative

Implementation Phase	Implementation Task	Timeframe		
		Source Control-GWP	Source Control-GWE	Source Control-Phytoremediation
1: Pre-Construction Activities[a] (Concurrent with Source Control)	Agency Coordination, Approvals, and Permitting	NA	18 to 24 months	18 to 24 months
	Pilot Study		NA	6 to 12 months
	Final Design and Bid Process		24 to 36 months	24 to 36 months
	Total Timeframe to Complete Pre-Construction Activities		42 to 60 months	48 to 72 months
2: Corrective Action Construction[a] (Concurrent with Source Control)	Corrective Action Construction	NA	9 to 18 months	9 to 18 months
	Total Timeframe to Complete Corrective Action Construction Activities		9 to 18 months	9 to 18 months
3: Corrective Action O&M and Closeout[b] (After Completion of Source Control)	Corrective Action Monitoring (Time to Meet GWPS)	Over 100 years	444 months (37 years)	576 to 924 months (48 to 77 years)
	Potential Additional Corrective Action Operation (After GWPS Have Been Achieved)[c]	NA	156 (13 years)	264 to 876 months (22 to 73 years)
	Corrective Action Confirmation Monitoring	36 months	36 months	36 months
	Corrective Action Completion Reporting	6 months	6 months	6 months
	Total Timeframe to Complete Corrective Action O&M and Closeout	Over 100 years	642 months (53.5 years)	882 to 1,842 months (74 to 154 years)
Total Timeline to Complete Corrective Action (All Phases)		Over 100 years	693 to 720 months (58 to 60 years)	939 to 1,932 months (78 to 161 years)

Notes:
O&M = Operations and Maintenance; Source Control-GWE = Source Control with Groundwater Extraction; Source Control-GWP = Source Control with Groundwater Polishing; Source Control-Phytoremediation= Source Control with Phytoremediation.
(a) Pre-construction Activities (Phase 1) and Corrective Action Construction (Phase 2) are assumed to occur concurrently with the source control (*i.e.*, closure-in-place or CIP) activities, to allow waste materials to be placed underneath the Ash Pond (AP) final cover system under the Source Control-GWE and Source Control-Phytoremediation alternatives.
(b) Corrective Action O&M and Closeout (Phase 3) is assumed to start after the source control (*i.e.*, closure-in-place or CIP) is complete.
(c) For Source Control-GWE and Source Control-Phytoremediation alternatives, current modeling indicates that additional system operation may be required to prevent concentrations from rebounding above the GWPSs (Appendix B; Ramboll, 2025a); additional modeling would be performed and data would be collected as part of the Corrective Action Groundwater Monitoring Plan to evaluate and assess the exact required duration of additional system operation.
Source: Appendix B; Ramboll, 2025a.

2.2.7 Potential for Exposure of Humans and Environmental Receptors to Remaining Wastes, Considering the Potential Threat to Human Health and the Environment Associated with Excavation, Transportation, Re-disposal, Containment, or Changes in Groundwater Flow (IAC Section 845.670(e)(1)(F))

Section 2.2.1 describes the magnitude of reduction of existing risks under each corrective action alternative. Section 2.2.2 describes the effectiveness of the remedy in controlling the source, including the extent to which containment practices would reduce further releases. Section 2.2.3 describes the likelihood of future releases of CCR occurring under each corrective action alternative, and Section 2.2.5 describes the short-term risks to workers, the community, and the environment during implementation of the remedy, including safety impacts and control of exposure to any residual contamination. In summary, source control measures (*i.e.*, CIP using a consolidate-and-cap approach) would be undertaken at the Site. Thus, potential exposures to CCR remaining in the AP would be the same under all three alternatives. Similarly, due to the source control common to all of the corrective action alternatives, a new geomembrane cover system would be placed over the AP, and no residual CCR exposures would be expected to occur during the implementation of any of the alternatives. All corrective action alternatives would therefore be equally and fully protective with regard to exposure to residual CCR. There are no current or future risks to any human or ecological receptors at the Site, and there would be no risk of CCR releases post-closure.

For construction workers, risks arising from potential contact with residual contamination during construction, operation, and maintenance activities associated with residual plume management would be higher for the Source Control-GWE alternative than for the Source Control-GWP and Source Control-Phytoremediation alternatives because the Source Control-GWE would involve the production, management, and potential treatment of extracted groundwater, as well as on-Site disposal of excavated spoils generated during extraction trench construction. The Source Control-Phytoremediation alternative would involve management of spoils generated by tree well/boring installation. The Source Control-GWP alternative would not involve exposure to either of these soil or groundwater waste streams. Any potential CCR exposures occurring under Source Control-GWE during groundwater extraction and treatment would be managed through the use of rigorous safety protocols, personal protective equipment, and appropriate disposal practice.

Some changes in groundwater flow (*i.e.*, potential controlled discharge of extracted groundwater) may occur under the Source Control-GWE alternative, due to the operation of the GWE system. Hydrogeological changes would be expected under the Source Control-GWE alternative, such as lowering groundwater table in the vicinity of the extraction trenches, altering flow patterns in the UA, and causing changes in hydraulic gradients. Under the Source Control-Phytoremediation alternative, tree installations west of the AP would be designed to uptake groundwater in the UA/PMP and work as pumps, which would change local hydraulic gradients and groundwater flow direction. However, changes to groundwater flow would not be expected to have an effect on the potential for the exposure of humans and environmental receptors to remaining wastes.

2.2.8 Long-Term Reliability of the Engineering and Institutional Controls (IAC Section 845.670(e)(1)(G))

Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all potential corrective action alternatives. Thus, the long-term reliability during source control would be the same for each corrective action alternative (Gradient, 2022). The long-term reliability of the engineering and

institutional controls associated with residual plume management of all corrective alternatives are summarized below.

- Residual plume management under the Source Control-GWP alternative would be reliable, because it would rely on natural physical and geochemical processes, rather than the installation, operation, and maintenance of engineered systems or structures. Site specific evaluations have shown that chemical attenuation is feasible, and remobilization is unlikely to impact the time to achieve GWPS as groundwater returns to background conditions (Appendix E; Life Cycle Geo, LLC, 2025). Under this alternative, engineering failure would not occur, and no O&M activities would be required to ensure the success of the alternative (other than those required for groundwater monitoring). Active groundwater monitoring would be in place to track the remediation progress. Should the predicted decrease in groundwater concentrations not occur, the adaptive site management approach would enable prompt adjustments or enhancements to the corrective action in accordance with IAC Section 845.680(b). This strategy would allow continuous improvement of the AP groundwater remediation in response to new Site information and/or the performance of the corrective action alternative.
- GWE is a proven remedy that has been implemented at many sites. Thus, residual plume management under the Source Control-GWE alternative would be expected to be reliable, provided it is constructed in accordance with standard design and specifications. Under this alternative, the extraction trenches and settling pond would require engineering design and installation for groundwater extraction and treatment. Routine and non-routine maintenance of the GWE system is required to ensure reliable operation of the extraction trench and pumps, as well as other system components. GWPSs are expected to be achieved in approximately 37 years after source control is completed. Current modeling indicates that the GWE trenches may be required to operate for an additional 13 years to prevent concentrations from rebounding above the GWPSs.[10] Active groundwater monitoring would be in place, similar to those required under the Source Control-GWP alternative.
- Residual plume management under the Source Control-Phytoremediation alternative would be expected to be reliable, provided it is constructed in accordance with standard design and specifications. The effectiveness of the phytoremediation installations would depend on the trees' ability to grow under Site conditions and would require the root systems to achieve target uptake rates of approximately 40 gallons per day per tree. Sensitivity analyses show significant variability in the time needed to reach GWPSs (48 to 77 years) and the total remedy duration (70 to 150 years) to prevent concentrations from rebounding above the GWPSs.[11] This suggests that the overall operational reliability of this remedy is uncertain. In addition, although phytoremediation can address low concentrations of boron and other inorganics, the lack of large-scale case studies for boron or other CCR-constituents adds extra uncertainty to its long-term reliability (Appendix B; Ramboll, 2025a). As a combination of mechanical and biological systems, routine and ongoing maintenance would be required to ensure reliable operation over the long-term.
- For all corrective action alternatives, remedy optimizations would be implemented if necessary under the adaptive site management program.

[10] Current modeling indicates that an additional 13 years of system operation may be required to prevent concentrations from rebounding above the GWPSs under the Source Control-GWE alternative; however, additional modeling would be performed, and additional data would be collected as part of the Corrective Action Groundwater Monitoring Plan to evaluate and assess the exact required duration of additional system operation.

[11] Current modeling indicates that an additional 22 to 73 years of system operation may be required to prevent concentrations from rebounding above the GWPSs under the Source Control-Phytoremediation alternative; however, additional modeling would be performed, and additional data would be collected as part of the Corrective Action Groundwater Monitoring Plan to evaluate and assess the exact required duration of additional system operation.

2.2.9 Potential Need for Replacement of the Remedy (IAC Section 845.670(e)(1)(H))

The potential need for the eventual replacement of the residual plume management remedy under each corrective action alternative is summarized as follows:

- Source Control-GWP would rely on natural physical geochemical processes to achieve reductions in groundwater concentrations to below the GWPSs. Because no installation, operation, and maintenance of engineered systems or structures would be required, it would be unlikely that the residual plume management remedy under the Source Control-GWP alternative would need to be replaced. Adaptive site management strategies would be used to implement remedy optimizations or replacement, as necessary based on data that are collected, to ensure that remedial goals are achieved.
- Source Control-GWE would utilize two extraction trenches and a settling pond to extract and treat impacted groundwater to achieve reductions in groundwater concentrations to below GWPSs. While the GWE system would need ongoing maintenance and potential replacement of system components over time, it is unlikely that the residual plume management remedy under the Source Control-GWE alternative would need to be replaced. Adaptive site management strategies would be used to implement remedy optimizations or replacement, as necessary based on data that are collected, to ensure that remedial goals are achieved.
- Source Control-Phytoremediation would utilize tree well system installations to control migration of CCR-constituents in groundwater. Tree replacement is expected during the time horizon of the remedy. Depending on the performance and lifespan of the trees, it is estimated that trees may be replaced one to five times, assuming a 30- to 50-year tree lifespan. An annual tree replacement rate is estimated to be 10% (approximately 60 trees) during the first 5 years, and then 5% afterwards. Ongoing maintenance and inspections would be required to monitor tree performance. Adaptive site management strategies would be used to implement remedy optimizations or replacement, as necessary based on data that are collected, to ensure that remedial goals are achieved.

2.3 The Ease or Difficulty of Implementing a Remedy (IAC Section 845.670 (e)(3))

2.3.1 Degree of Difficulty Associated with Constructing the Remedy (IAC Section 845.670(e)(3)(A))

Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all three corrective action alternatives. Thus, construction difficulties regarding source control would be the same for all corrective action alternatives. Difficulties associated with implementing CIP using a consolidate-and-cap approach were evaluated in the CAA (Gradient, 2022). The expected degree of difficulty associated with residual plume management for each of the corrective action alternatives is summarized below.

- Residual plume management under the Source Control-GWP alternative would rely on physical and geochemical attenuation processes and therefore would not pose any significant construction challenges. This alternative would only require the construction and use of monitoring wells designed in accordance with IAC Section 845.680(c). Therefore, there would be minimal difficulty in constructing the Source Control-GWP remedy.

- Residual plume management under the Source Control-GWE alternative would involve the construction of two extraction trenches, a settling pond and conveyance system to extract and treat impacted groundwater. It may have the following challenges during construction of the extraction trenches (Appendix B; Ramboll, 2025a):
    - The construction of the groundwater trenches required by this alternative is commonly constructed at similar depths and would be performed using specialized and conventional construction equipment.
    - Constructing the South Trench would necessitate significant modifications to the AP embankment to create a suitable working platform for construction equipment. This would require the use of excavation shoring and/or other approaches to ensure dike stability during construction because the modifications would be intrusive and may temporarily increase the risk of dike instability relative to current conditions. Geotechnical designs involving three-dimensional analysis would be utilized for the construction. The modifications would likely require a geotechnical monitoring program to assess the embankment for any signs of distress during construction. If distress is detected, construction may need to be temporarily paused to evaluate and address the issue.
    - High-voltage power lines crossing the North Trench alignment may need to be raised to ensure a safe working distance from construction equipment.
    - Additionally, naturally occurring methane at the Site necessitates a methane monitoring and response plan, which may lead to periodic safety shutdowns during construction to allow methane levels to decrease to safe levels.
    - Groundwater monitoring would be conducted using a groundwater monitoring network designed in accordance with IAC Section 845.680(c).
- Residual plume management under the Source Control-Phytoremediation alternative would utilize a tree well system to uptake and control impacted groundwater. It may have the following challenges during construction of the tree segments (Appendix B; Ramboll, 2025a):
    - This approach would require a hollow stem auger drill rig for installing the tree well systems, along with general construction equipment such as excavation and grading machinery, to install a working pad for the southern tree segment. Local Site geology is not expected to pose significant challenges during any earthwork or tree well borings.
    - Constructing the southern tree segment would necessitate significant modifications to the AP embankment to create a suitable working platform for construction equipment. This would require the use of excavation shoring and/or other approaches to ensure dike stability during construction because the modifications would be intrusive and may temporarily increase the risk of dike instability relative to current conditions. Geotechnical designs involving three-dimensional analysis would be utilized for the construction. The modifications would likely require a geotechnical monitoring program to assess the embankment for any signs of distress during construction. If distress is detected, construction may need to be temporarily paused to evaluate and address the issue.
    - High-voltage power lines crossing the northern tree segment may need to be raised to ensure a safe working distance from construction equipment.
    - Additionally, naturally occurring methane at the Site necessitates a methane monitoring and response plan, which may lead to periodic safety shutdowns during construction to allow methane levels to decrease to safe levels.

- Groundwater monitoring would be conducted using a groundwater monitoring network designed in accordance with IAC Section 845.680(c).

2.3.2 Expected Operational Reliability of the Remedy (IAC Section 845.670(e)(3)(B))

Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all three corrective action alternatives. Thus, the operational reliability of the remedy would be the same for all corrective action alternatives. The reliability associated with implementing CIP using a consolidate-and-cap approach was evaluated in the CAA (Gradient, 2022). All three corrective action alternatives would likely be highly reliable with respect to operational controls associated with residual plume management; specific details for each corrective action alternative are discussed below.

- Residual plume management under the Source Control-GWP alternative would have high operational reliability because it would rely on natural processes and active monitoring, rather than the installation, operation, and maintenance of engineered systems or structures (other than monitoring wells). Under the Source Control-GWP alternative, engineering failure would not occur and no O&M activities would be required to ensure the success of the alternative.
- Residual plume management under the Source Control-GWE alternative would also have high operational reliability because it is an established and commonly used remedial technique, as long as the extraction trench system is constructed in accordance with the design and specifications. The remedy would operate as a mechanical system and would require routine and non-routine maintenance of the GWE system to ensure reliable operation (in addition to those required for groundwater monitoring); and
- Residual plume management under the Source Control-Phytoremediation alternative would also have high operational reliability as long as the phytoremediation installations are constructed in accordance with the design and specifications. The effectiveness of the phytoremediation installations would depend on the trees' ability to grow under Site conditions, and would require the root systems to achieve target uptake rates of approximately 40 gallons per day per tree. Sensitivity analyses show significant variability in the time needed to reach GWPSs (48 to 77 years) and the total remedy duration (70 to 150 years) to prevent concentrations from rebounding above the GWPSs. This suggests that the overall operational reliability of this remedy is uncertain. In addition, although phytoremediation can address low concentrations of boron and other inorganics, the lack of large-scale case studies for boron or other CCR-constituents adds extra uncertainty to its long-term reliability (Appendix B; Ramboll, 2025a). As a combination of mechanical and biological systems, routine and ongoing maintenance would be required to ensure reliable operation over the long-term.

2.3.3 Need to Coordinate with and Obtain Necessary Approvals and Permits from Other Agencies (IAC Section 845.670(e)(3)(C))

All three corrective action alternatives would require regulatory approvals. Specific permits and approvals associated with source control (*i.e.*, CIP using a consolidate-and-cap-approach) are the same for all corrective action alternatives and are discussed in the CAA (Gradient, 2022). The specific approvals and permits associated with residual plume management for all corrective action alternatives are discussed below.

- The Source Control-GWP alternative would not need additional permits from other agencies, other than the permits issued by IEPA for source control (*i.e.*, Closure Plan and Construction Permit Application) and approval of the eventual Corrective Action Plan.
- The Source Control-GWE alternative would require approvals and permits and Site-specific NPDES permits. Groundwater extracted from the GWE trenches would require a modified NPDES permit. The NPDES permit would likely require renewals depending on the timeline of corrective action implementation. In addition, permits from the IEPA for construction of stormwater controls and BMPs, a joint water pollution control, an amendment to the AP Closure Plan and Construction Permit Application for placement of excavated spoils beneath the AP final cover system, and an IDNR Dam Safety Modification Permit for modification of the embankment would be required. These permits and plans typically take 18-24 months to obtain, although some may already be obtained during the AP final closure.
- The Source Control-Phytoremediation alternative would require a general stormwater permit through IEPA for construction activities, including construction stormwater controls and other BMPs such as installation of silt fences and other measures. An IDNR Dam Safety Modification Permit would be required for modification of the embankment. These permits and plans typically take 18-24 months to obtain, although some may already be obtained during the AP final closure.

2.3.4 Availability of Necessary Equipment and Specialists (IAC Sections 845.670(e)(3)(D) and 845.660(c)(1), "Ease of Implementation")

Source control (*i.e.*, CIP using a consolidate-and-cap approach) would be implemented for all three corrective action alternatives. Thus, equipment and specialist needs would be the same for all corrective action alternatives. An assessment of necessary equipment and specialists associated with implementing CIP using a consolidate-and-cap approach was evaluated in the CAA (see the CAA; Gradient, 2022). Specialized equipment and personnel are essential for field data collection and groundwater sampling for residual plume management under each potential corrective action alternative. Additionally, the assessment of groundwater concentrations for Site constituents would necessitate laboratory equipment and specialists for each alternative. The availability of equipment and specialists associated with residual plume management for each corrective action alternative is summarized below.

- Residual plume management under the Source Control-GWP alternative would require groundwater professionals, such as geologists, hydrogeologists, statisticians (*i.e.*, statistical analysis), and geochemists to evaluate all monitoring data, ensuring that physical and geochemical processes function as anticipated for this alternative. The equipment and specialists needed for Site groundwater monitoring and analysis are currently engaged in these tasks as part of the routine groundwater monitoring program outlined in accordance with IAC Section 845.220(c)(4).
- Residual plume management under the Source Control-GWE alternative would require specialists to manage the GWE system throughout its construction and operational period.
    - Construction of the groundwater extraction system (*i.e.*, the trenches and settling pond) on the Site would require a specialized contractor. The contractor would most likely need specialized and often custom-built equipment including one-pass construction equipment. Additionally, geotechnical specialists would be needed to design the working platform and monitor the AP embankment for signs of distress during the trench installation. The availability of contractors with such equipment may be limited. Specialists including design engineers, construction managers, and contractor staff experienced in trench construction and similar geologic environments would be required as well. In addition, specialists and equipment may have

backlogs from similar specialty ground improvement projects in the area, such as electric utility, dam/levee, and other market sectors.

- This alternative would necessitate the use of equipment and the expertise of specialists for tasks such as field data collection, groundwater sampling, analysis, and periodic corrective action groundwater monitoring and reporting. Similar to those in the Source Control-GWP alternative, these activities are already being conducted as part of routine groundwater monitoring in accordance with IAC Section 845.220(c)(4).

- Residual plume management under the Source Control-Phytoremediation alternative would require specialists to construct and manage the phytoremediation installations throughout its construction and operational period.
  - Specialists in phytoremediation design would be needed during the design and construction of the remedy. The construction of the tree well systems would require a widely available hollow stem auger drill rig, and the drilling crew would not need specialized skills beyond typical capabilities. Additionally, geotechnical specialists would be required for the design and construction of the working platform and to monitor the embankment for signs of distress during construction. These types of equipment and specialists have been utilized in the past for other similar types of phytoremediation design and construction projects (Appendix B)
  - This alternative would necessitate the use of equipment and the expertise of specialists for tasks such as field data collection, groundwater sampling, analysis, and periodic corrective action groundwater monitoring and reporting. Similar to those in the Source Control-GWP alternative, these activities are already being conducted as part of routine groundwater monitoring in accordance with IAC Section 845.220(c)(4).

2.3.5 Available Capacity and Location of Needed Treatment, Storage, and Disposal Services/Comply with Standards for Management of Wastes as Specified in Section 845.680(d) (IAC Section 845.670(e)(3)(E)/IAC Section 845.670(d)(5))

The available capacity and location of needed treatment, storage, and disposal services associated with residual plume management under each corrective action alternative is summarized below. All the practices employed in each alternative would comply with standards for the management of wastes as specified in IAC Section 845.670(e)(3)(E) and IAC Section 845.680(d)(5).

- Residual plume management for the Source Control-GWP remedy would not require any treatment, storage, or disposal services, because GWP is not anticipated to produce a substantial amount of waste or wastewater, aside from minor purge water volumes generated during routine groundwater sampling activities for residual plume management. This could be managed by a standard waste management contractor.
- Residual plume management for the Source Control-GWE alternative would require the construction of the extraction trench system and a new settling pond on-Site:
  - The construction of the extraction trenches would generate spoils, and the waste materials would be used as subgrade fill beneath the AP final cover system during the closure construction. Completing the extraction trench construction at the same time as the AP closure would provide sufficient on-Site capacity for the disposal of generated spoils.
  - The extraction trench system would send extracted groundwater to an on-Site settling pond, which collects solids removed during groundwater recovery *via* the pneumatic extraction

pumps and transfer piping. The settling pond would need to be sited, designed, constructed and maintained properly. The siting of the settling pond would need to consider limiting impacts to existing Site infrastructure, nearby solar redevelopment, wetlands, and floodplains.

- Discharge from the settling pond would be conveyed to an NPDES permitted outfall. Renewal of the NPDES permits may be necessary to continue operations, depending on the timeline of the corrective action implementation in relation to the source control completion.

- Residual plume management for the Source Control-GWE alternative would generate spoils during the tree well/boring installations, which would be disposed of on-Site in the AP during closure construction. Simultaneously completing the phytoremediation installations with the AP closure would ensure sufficient on-Site capacity for disposing of generated spoils. Organic waste would be produced annually throughout the phytoremediation process, including replaced trees and seasonal debris. Periodic sampling of the waste would determine whether it can be chipped for on-Site mulch/compost or may need off-Site disposal. Waste Management Peoria City, a nearby landfill located 18 miles away, would have sufficient capacity to handle off-Site disposal, if necessary.

2.4 The Degree to Which Community Concerns Are Addressed by the Remedy (IAC Section 845.670(e)(4))

Several nonprofits raised concerns regarding the potential impacts of the AP on groundwater and surface water quality including Earthjustice, the Prairie Rivers Network, the League of Women Voters, and the Sierra Club (Earthjustice *et al*., 2018; LWVGP, 2021; Sierra Club, 2014; Sierra Club and CIHCA, 2014; UCS, 2018). The combination of source control (*i.e*., CIP using a consolidate-and-cap approach) with residual plume management would cause groundwater concentrations to decline over time under all of the corrective action alternatives, as suggested by the groundwater modeling (Ramboll, 2022), thus addressing community concerns.

A public meeting was held on April 30, 2025, pursuant to requirements under IAC Section 845.710(e). Questions raised by attendees were addressed at the meeting; a written summary of the questions and responses were prepared.

2.5 Remove from the Environment as Much of the Contaminated Material that Was Released from the CCR Surface Impoundment as Is Feasible, Taking into Account Factors such as Avoiding Inappropriate Disturbance of Sensitive Ecosystems (IAC Section 845.670(d)(4))

There have been no documented releases of CCR from the unit (Ramboll, 2025c). All three potential corrective action alternatives include source control (*i.e.*, CIP using a consolidate-and-cap approach) and residual plume management efforts. Source Control for AP would include excavation of CCR from the high points and northwestern section area, consolidation into the southern end and low areas of the AP, and the installation of a low-permeability final geomembrane cover system designed to limit the infiltration of precipitation into the impounded CCR. Groundwater modeling was performed in support of the Closure Plan (IngenAE, LLC, 2022b), and concluded that this source control approach would result in a reduction of the migration of water into the AP by 97% compared to pre-closure conditions. Additionally, source control would result in a reduction of hydraulic flux out of the AP by 94% compared to pre-closure conditions (Ramboll, 2022). Therefore, source control will prevent further releases of CCR constituents from AP into the environment.

Moreover, residual plume management under each corrective action alternative will further result in the removal of contaminated material from the environment and/or the improvement of downgradient groundwater quality. Groundwater modeling predicted that it would take more than 100 years after source control has been completed to achieve the GWPSs in all monitoring wells under the Source Control-GWP alternative. Under the Source Control-GWE alternative, GWPSs would be achieved in approximately 37 years after source control has been completed. Under the Source Control-Phytoremediation alternative, GWPSs would be achieved in approximately 48 to 77 years after source control has been completed (see Section 2.2.6; Appendix B; Ramboll, 2025b). Current modeling indicates that an additional 13 years may be required to prevent concentrations from rebounding above the GWPSs under the Source Control-GWE alternative and 22 to 73 years of system operation may be required to prevent concentrations from rebounding above the GWPSs under the Source Control-Phytoremediation alternative (see Section 2.2.6; Appendix B; Ramboll, 2025b). However, additional modeling would be performed, and additional data would be collected as part of the Corrective Action Groundwater Monitoring Plan to evaluate and assess the exact required duration of additional system operation. Specific considerations for residual plume management for each alternative are provided below.

- Residual plume management under the Source Control-GWP alternative would address impacted groundwater by relying on physical and geochemical attenuation processes to reduce the residual concentrations of CCR. Site-specific evaluation demonstrated conditions are favorable for the attenuation of inorganic contaminants *via* adsorption. Attenuation *via* sorption onto mineral surfaces should remain stable under post-closure conditions, and remobilization is unlikely to impact the time to achieve GWPS. Contaminant levels in groundwater are anticipated to drop below the GWPS at all compliance monitoring wells following the migration of background groundwater during the post-closure phase (Appendix E; Life Cycle Geo, LLC, 2025). In cases in which observed groundwater concentrations deviate significantly from modeled conditions, alternative methods or techniques would be evaluated under the adaptive site management program, and if viable, incorporated as per IAC Section 845.680(b). No ecosystems would be disturbed because no construction activities would be expected under the Source Control-GWP alternative.
- Residual plume management under the Source Control-GWE alternative would rely on the GWE trenches to reduce or prevent migration of impacted groundwater off-Site. Groundwater quality would also be improved as a result of physical and geochemical attenuation processes. The construction activities could cause disturbances of some existing habitats atop portions of the construction areas, and habitats in the immediate vicinity of these locations by causing alarm and escape behavior in nearby wildlife (*e.g.*, due to noise disturbances). In addition, it is also possible that limited negative short-term impacts could occur to sensitive aquatic and wetland species in the discontinuous wetland areas in the immediate vicinity of the AP (see Section 1.1.3).
- Residual plume management under the Source Control-Phytoremediation alternative would rely on the phytoremediation installations (*i.e.*, approximately 550 trees) to remove the CCR-constituents in groundwater and control off-Site migration through the. Groundwater quality would also be improved as a result of physical and geochemical attenuation processes. The construction activities could cause disturbances of some existing habitats atop portions of the construction areas, and habitats in the immediate vicinity of these locations by causing alarm and escape behavior in nearby wildlife (*e.g.*, due to noise disturbances). In addition, it is also possible that limited negative short-term impacts could occur to sensitive aquatic and wetland species in the discontinuous wetland areas in the immediate vicinity of the AP (see Section 1.1.3).

2.6 Summary

This CAAA evaluates all corrective action alternatives identified as potentially viable in the CMA with regard to each of the factors specified in IAC Section 845.670(d) and 845.670(e) (IEPA, 2021). Based on this evaluation, the most appropriate corrective action for this Site is Source Control-GWE. The expected time to meet GWPS in all monitoring wells is expected to be shorter under the Source Control-GWE alternative (approximately 37 years) than under the Source Control-GWP alternative (more than 100 years) and the Source Control-Phytoremediation alternative (approximately 48 to 77 years). In addition, Source Control-GWE has higher operational reliability over the long-term than the Source Control-Phytoremediation alternative. Thus, Source Control-GWE is the most appropriate corrective action alternative for the AP.

References

AECOM. 2016. Letter Report re: History of Construction, USEPA Final CCR Rule, 40 CFR § 257.73(c), Edwards Power Station, Bartonville, Illinois. Report to Illinois Power Resources Generating, LLC, Bartonville, IL. 55p., October.

Burns & McDonnell. 2021. "Initial Operating Permit, Edwards Power Plant Ash Pond." Report to Illinois Power Resources Generating, LLC, Collinsville, IL. Submitted to Illinois Environmental Protection Agency (IEPA). 1278p., October 25.

Earthjustice; Prairie Rivers Network; Environmental Integrity Project (EIP); Sierra Club. 2018. "Cap and Run: Toxic Coal Ash Left Behind by Big Polluters Threatens Illinois Water." 45p.

Gradient. 2022. "Closure Alternatives Analysis and Preliminary Corrective Measures Assessment for the Ash Pond at the Edwards Power Plant, Bartonville, Illinois." 122p., June 30.

Hesterberg, TW; Valberg, PA; Long, CM; Bunn, WB III; Lapin, C. 2009. "Laboratory studies of diesel exhaust health effects: Implications for near-roadway exposures." *EM Mag*. (August):12-16. Accessed at http://pubs.awma.org/gsearch/em/2009/8/hesterberg.pdf.

Illinois Environmental Protection Agency (IEPA). 2016. "Appendix A-5. 303(d) Listed Waters Maps." In "Illinois Integrated Water Quality Report and Section 303(d) List - Volume I: Surface Water - 2016 (Final as submitted to US EPA Region V on July 11, 2016)." 34p. Accessed at https://www2.illinois.gov/epa/Documents/iepa/water-quality/watershed-management/tmdls/2016/303-d-list/appendix-a5.pdf.

Illinois Environmental Protection Agency (IEPA). 2019. "Appendix A-1. Illinois' 2018 303(d) List and Prioritization." In "Illinois Integrated Water Quality Report and Section 303(d) List, 2018 (Final as submitted to US EPA Region V on February 22, 2021)." 40p., May 20. Accessed at https://www2.illinois.gov/epa/topics/water-quality/watershed-management/tmdls/Documents/Appendix%20A-1_303d_by_priority_FINAL_5-20-19.pdf.

Illinois Environmental Protection Agency (IEPA). 2021. "Standards for the disposal of coal combustion residuals in surface impoundments." Accessed at https://www.ilga.gov/commission/jcar/admincode/035/03500845sections.html.

IngenAE, LLC. 2022a. "Closure Plan: Edwards Power Station Ash Pond, Peoria County, Illinois (IEPA ID W1438050005-01) (Final Draft)." Report to Illinois Power Resources Generating, LLC, Collinsville, IL. 18p.

IngenAE, LLC. 2022b. "Final Closure Plan: Edwards Power Station Ash Pond, Bartonville, Illinois (IEPA ID W1438050005-01) (Draft)." Report to Illinois Power Resources Generating, LLC, Collinsville, IL. 783p., April.

League of Women Voters of Greater Peoria (LWVGP). 2021. "Edwards Coal Ash Pond public meeting." October 13. Accessed at https://www.lwvgp.org/observer-reports/category/environmental-issues.

Life Cycle Geo, LLC. 2025. "Groundwater Polishing Evaluation Report, Edwards Ash Pond." Report to Ramboll, Milwaukee, WI.

Mauderly, JL; Garshick, E. 2009. "Diesel exhaust." In *Environmental Toxicants: Human Exposures and Their Health Effects (Third Edition)*. Ed.: Lippmann, M, John Wiley & Sons, Inc., Hoboken, NJ. p551-631.

National Research Council (NRC). 2013. "Alternatives for Managing the Nation's Complex Contaminated Groundwater Sites." Division of Earth and Life Sciences, Water Science and Technology Board, Committee on Future Options for Management in the Nation's Subsurface Remediation Effort. National Academies Press, Washington, DC. 422p. Accessed at http://www.nap.edu/catalog.php?record_id=14668.

Ramboll. 2021. "Hydrogeologic Site Characterization Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois." Report to Illinois Power Resources Generating, LLC. 733p., October 25.

Ramboll. 2022. "Groundwater Modeling Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois (Final)." Report to Illinois Power Resources Generating, LLC. 164p., June 30.

Ramboll. 2024b. "Nature and Extent Report, Edwards Power Plant, Ash Pond, IEPA ID No. W1438050005-01." Report to Illinois Power Resources Generating, LLC, Bartonville, IL. 25p.

Ramboll. 2025a. "Corrective Action Alternatives Analysis Supporting Information Report: Ash Pond Edwards Power Plant, Bartonville, Illinois, IEPA ID No. W1438050005-01 (Final)." Report to Illinois Power Resources Generating, LLC, Bartonville, IL.

Ramboll. 2025b. "Groundwater Modeling Technical Memorandum, Ash Pond, Edwards Power Plant, Bartonville, Illinois, IEPA ID No. W1438050005-01 (Final)." Report to Illinois Power Resources Generating, LLC, Bartonville, IL.

Ramboll. 2025c. "Corrective Action Plan, Ash Pond, Edwards Power Plant, Bartonville, Illinois, IEPA ID No. W1438050005-01 (Final)." Report to Illinois Power Resources Generating, LLC, Bartonville, IL. 27p..

Sierra Club. 2014. "Dangerous Waters: America's Coal Ash Crisis." 43p.

Sierra Club; Central Illinois Healthy Community Alliance (CIHCA). 2014. "Dynegy's Toxic Assets: Legacy Coal Pollution in the Heartland." 17p.

Union of Concerned Scientists (UCS). 2018. "Soot to Solar: E.D. Edwards Power Station, Bartonville, IL." 2p., October.

US Dept. of Labor (US DOL). 2020a. "Fatal occupational injuries, total hours worked, and rates of fatal occupational injuries by selected worker characteristics, occupations, and industries, civilian workers, 2019." Bureau of Labor Statistics. December. Accessed at https://www.bls.gov/iif/oshwc/cfoi/cfoi_rates_2019hb.xlsx.

US Dept. of Labor (US DOL). 2020b. "Table R100. Incidence rates for nonfatal occupational injuries and illnesses involving days away from work per 10,000 full-time workers by occupation and selected events or exposures leading to injury or illness, private industry, 2019." Bureau of Labor Statistics. October. Accessed at https://www.bls.gov/iif/oshwc/osh/case/cd_r100_2019.xlsx.

US Dept. of Transportation (US DOT). 2023a. "Traffic Safety Facts 2021: A Compilation of Motor Vehicle Crash Data." National Highway Traffic Safety Administration (NHTSA), National Center for Statistics and Analysis (NCSA). DOT HS 813 527. 225p., December. Accessed at https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813527.

US Dept. of Transportation (US DOT). 2023b. "Large Truck and Bus Crash Facts 2021." Federal Motor Carrier Safety Administration, Analysis Division, FMCSA-RRA-23-002, 118p., November.

US EPA. 2014. "Human and Ecological Risk Assessment of Coal Combustion Residuals (Final)." Office of Solid Waste and Emergency Response (OSWER), Office of Resource Conservation and Recovery. Submitted to US EPA Docket. EPA-HQ-OLEM-2020-0107-0885. 1237p., December. Accessed at http://www.regulations.gov/#!documentDetail;D=EPA-HQ-RCRA-2009-0640-11993.

US EPA. 2015a. "Hazardous and solid waste management system; Disposal of coal combustion residuals from electric utilities (Final rule)." Fed. Reg. 80(74):21302-21501. 40 CFR 257, 40 CFR 261. April 17.

US EPA. 2015b. "Use of Monitored Natural Attenuation for Inorganic Contaminants in Groundwater at Superfund Sites." Office of Solid Waste and Emergency Response (OSWER). OSWER Directive 9283.1-36. 83p., August.

US Fish & Wildlife Service (US FWS). 2021. "Wetlands Mapper." National Wetlands Inventory. November 30. Accessed at https://www.fws.gov/wetlands/data/mapper.html.

Vistra Corp. 2021. "Ash Pond Closure at the Edwards Power Plant." 14p., October 11.

Appendix A

Human Health and Ecological Risk Assessment

Human Health and Ecological Risk Assessment
Ash Pond
Edwards Power Plant
Bartonville, Illinois

June 30, 2022

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www.gradientcorp.com
One Beacon Street, 17th Floor
Boston, MA 02108
617-395-5000

Table of Contents

Page

1 Introduction 1

2 Site Overview 3
- 2.1 Site Description 3
- 2.2 Geology/Hydrogeology 5
- 2.3 Conceptual Site Model 6
- 2.4 Groundwater Monitoring 9
- 2.5 Surface Water Sampling 11

3 Risk Evaluation 14
- 3.1 Risk Evaluation Process 14
- 3.2 Human and Ecological Conceptual Exposure Models 15
  - 3.2.1 Human Conceptual Exposure Model 16
    - 3.2.1.1 Groundwater or Surface Water as a Drinking Water/Irrigation Source 17
    - 3.2.1.2 Recreational Exposures 18
  - 3.2.2 Ecological Conceptual Exposure Model 19
- 3.3 Identification of Constituents of Interest 20
  - 3.3.1 Human Health Constituents of Interest 20
  - 3.3.2 Ecological Constituents of Interest 21
  - 3.3.3 Surface Water and Sediment Modeling 24
- 3.4 Human Health Risk Evaluation 27
  - 3.4.1 Recreators Exposed to Surface Water 27
  - 3.4.2 Recreators Exposed to Sediment 29
- 3.5 Ecological Risk Evaluation 30
  - 3.5.1 Ecological Receptors Exposed to Surface Water 31
  - 3.5.2 Ecological Receptors Exposed to Sediment 33
  - 3.5.3 Ecological Receptors Exposed to Bioaccumulative Constituents of Interest 34
- 3.6 Uncertainties and Conservatisms 35

4 Summary and Conclusions 37

References 39

Appendix A Surface Water and Sediment Modeling
Appendix B Screening Benchmarks

List of Tables

Table 2.1 Groundwater Monitoring Wells Related to Edwards Ash Pond

Table 2.2 Groundwater Data Summary

Table 2.3 Surface Water Data Summary

Table 3.1 Human Health Constituents of Interest

Table 3.2 Ecological Constituents of Interest

Table 3.3 Groundwater and Surface Water Properties Used in Modeling

Table 3.4 Sediment Properties Used in Modeling

Table 3.5 Surface Water and Sediment Modeling Results

Table 3.6 Risk Evaluation for Recreators Exposed to Surface Water

Table 3.7 Risk Evaluation for Recreators Exposed to Sediment

Table 3.8 Risk Evaluation of Ecological Receptors Exposed to Surface Water

Table 3.9 Risk Evaluation of Ecological Receptors Exposed to Sediment

List of Figures

Figure 2.1 Site Location Map

Figure 2.2 Groundwater Elevation in Uppermost Aquifer – February 2021

Figure 2.3 Modeled and Observed Extent of Boron in Groundwater and Water Wells Identified in Receptor Survey

Figure 2.4 Monitoring Well Locations

Figure 2.5 Surface Water Sampling Location

Figure 3.1 Overview of Risk Evaluation Methodology

Figure 3.2 Human Conceptual Exposure Model

Figure 3.3 Ecological Conceptual Exposure Model

Abbreviations

ADI	Acceptable Daily Intake
AP	Ash Pond
BCF	Bioconcentration Factor
BCG	Biota Concentration Guide
BCU	Bedrock Confining Unit
CAA	Closure Alternatives Assessment
CCR	Coal Combustion Residual
CEM	Conceptual Exposure Model
COI	Constituent of Interest
COPC	Constituent of Potential Concern
CSF	Cancer Slope Factor
CSM	Conceptual Site Model
EPP	Edwards Power Plant
ESV	Ecological Screening Value
GWPS	Groundwater Protection Standard
GWQS	Groundwater Quality Standards
HTC	Human Threshold Criteria
IAC	Illinois Administrative Code
IEPA	Illinois Environmental Protection Agency
ILWATER	Illinois Water and Related Wells
IPRG	Illinois Power Resources Generating, LLC
ISGS	Illinois State Geological Survey
MCL	Maximum Contaminant Level
NOEC	No Observed Effect Concentration
NPDES	National Pollutant Discharge Elimination System
NRWQC	National Recommended Water Quality Criteria
ORNL RAIS	Oak Ridge National Laboratory's Risk Assessment Information System
PMP	Potential Migration Pathway
PRG	Preliminary Remediation Goal
RfD	Reference Dose
RME	Reasonable Maximum Exposure
RSL	Regional Screening Level
SWQS	Surface Water Quality Standards
TEC	Threshold Effect Concentration
UA	Uppermost Aquifer
UCF	Upper Cahokia Formation
US DOE	United States Department of Energy
US EPA	United States Environmental Protection Agency
USGS	United States Geological Survey

1 Introduction

The Edwards Power Plant (EPP or "the Site") is an electric power-generating facility with coal-fired units located in Peoria County, Illinois, between Mapleton and Bartonville. The facility is owned by Illinois Power Resources Generating, LLC (IPRG), and began operations in 1960. The EPP has one surface impoundment for storage of coal combustion residuals (CCR) known as the Ash Pond (AP), which covers approximately 91 acres (Ramboll, 2021). The EPP Ash Pond (Illinois Environmental Protection Agency [IEPA] ID No. W1438050005-01) is planned to commence closure by the end of 2022 and is the subject of this report.

This report presents the results of an evaluation that characterizes potential risk to human and ecological receptors that may be exposed to CCR constituents in environmental media potentially impacted by the AP. This risk evaluation was performed to support the Closure Alternatives Assessment (CAA) for the AP in accordance with requirements in Title 35 Part 845 of the Illinois Administrative Code (IAC) (IEPA, 2021a). Human and ecological risks were evaluated for Site-specific constituents of interest (COIs). The conceptual site model (CSM) assumed that Site-related COIs in groundwater may migrate to the Illinois River and affect surface water and sediment in the vicinity of the Site.

Consistent with United States Environmental Protection Agency (US EPA) guidance (US EPA, 1989), this report used a tiered approach to evaluate potential risks, which included the following steps:

1. Identify complete exposure pathways and develop a conceptual exposure model (CEM).
2. Identify Site-related COIs: Constituents detected in groundwater were considered COIs if their maximum detected concentration over the period from 2015 to 2021 exceeded a groundwater protection standard (GWPS), identified in Part 845.600 (IEPA, 2021a), or relevant surface water quality standards (SWQS) (IEPA, 2019; US EPA Region IV, 2018).
3. Perform screening-level risk analysis: Compare maximum measured or modeled COI concentrations in surface water and sediment to conservative, health-protective benchmarks to determine constituents of potential concern (COPCs).
4. Perform refined risk analysis: If COPCs are identified, perform a refined analysis to evaluate potential risks associated with the COPCs.
5. Formulate risk conclusions and discuss any associated uncertainties.

This assessment relies on a conservative (*i.e.*, health-protective) approach and is consistent with the risk approaches outlined in US EPA guidance. Specifically, Gradient considered evaluation criteria detailed in IEPA guidance documents (*e.g.*, IEPA, 2013, 2019), incorporating principles and assumptions consistent with the Federal CCR Rule (US EPA, 2015a) and US EPA's "Human and Ecological Risk Assessment of Coal Combustion Residuals" (US EPA, 2014).

US EPA has established acceptable risk metrics. Risks above these US EPA-defined metrics are termed potentially "unacceptable risks." Based on the evaluation presented in this report, no unacceptable risks to human and ecological receptors resulting from CCR exposures associated with the AP were identified. This means that the risks from the Site are likely indistinguishable from normal background risks. Specific risk assessment results include the following:

- No completed exposure pathways were identified for any groundwater receptors; consequently, no risks were identified relating to the use of groundwater.
- No unacceptable risks were identified for recreators swimming or boating in the Illinois River adjacent to the Site.
- No unacceptable risks were identified for recreators exposed to sediment in the Illinois River adjacent to the Site.
- No unacceptable risks were identified for anglers consuming locally caught fish.
- No unacceptable risks were identified for ecological receptors exposed to surface water or sediment.
- No bioaccumulative ecological risks were identified.

It should be noted that this evaluation incorporates a number of conservative assumptions that tend to overestimate exposure and risk. Moreover, it should be noted that because current conditions do not present a risk to human health or the environment, there will also be no unacceptable risk to human health or the environment for future conditions when the AP is closed. For all future closure scenarios, potential releases of CCR-related constituents will decline over time and, consequently, potential exposures to CCR-related constituents in the environment will also decline.

2 Site Overview

2.1 Site Description

The EPP is located in Peoria County, Illinois, between Mapleton and Bartonville, in a predominantly agricultural area. The EPP is bordered by a salt processing facility to the north, railroad right-of-way and former Orchard Mines to the west, the Illinois River and fertilizer production facility to the east, and agricultural land to the south (Figure 2.1) (Ramboll, 2021). The Illinois River flows adjacent to the facility from north to south (Figure 2.1). The AP discharges to the Illinois River under a National Pollutant Discharge Elimination System (NPDES) permit (Ramboll, 2021).

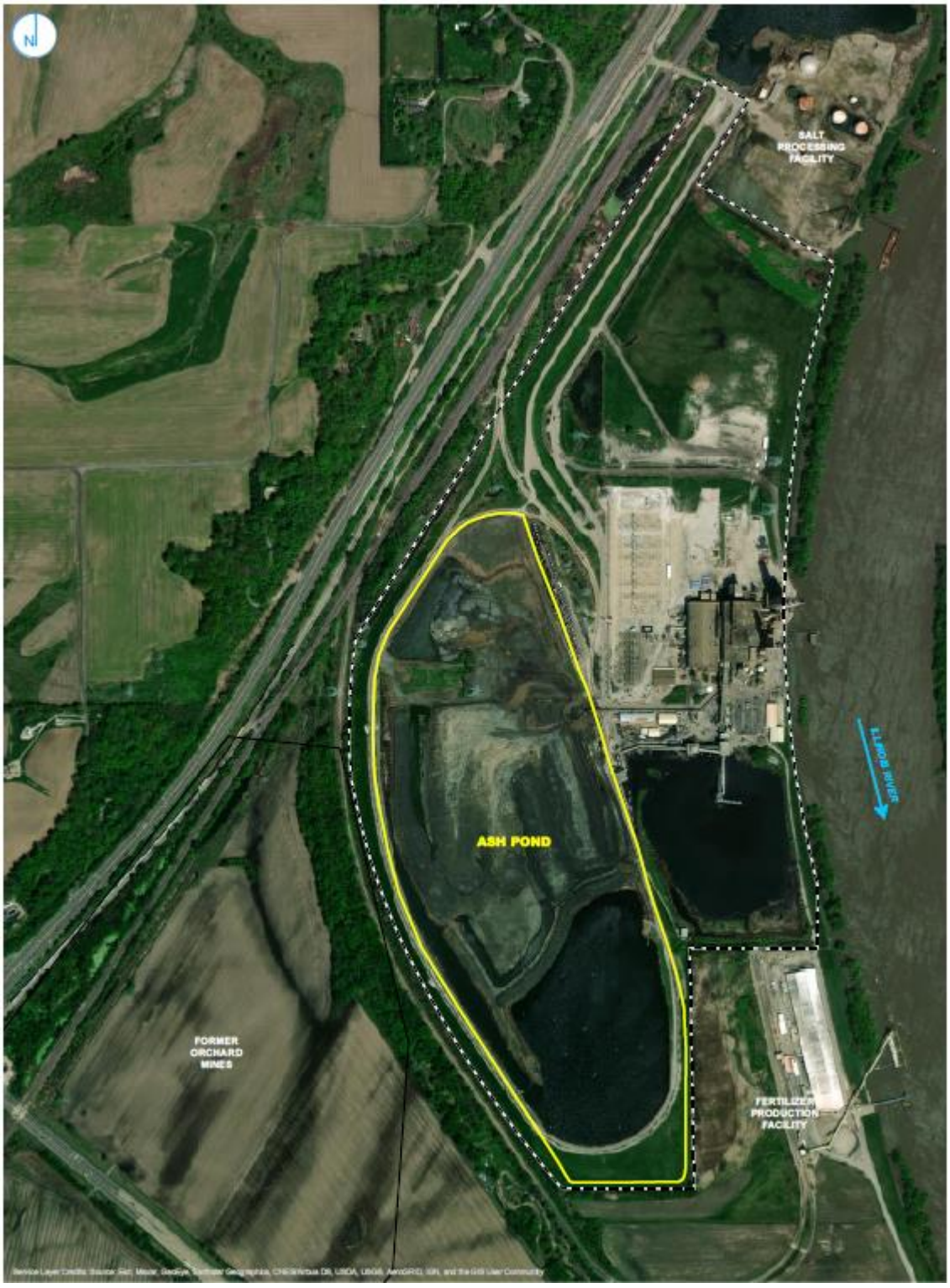


Figure 2.1 Site Location Map. Source: Ramboll (2021).

2.2 Geology/Hydrogeology

The geology underlying the Site in the vicinity of the AP primarily consists of unlithified deposits of the Cahokia Formation, underlain by a thick shale bedrock (Ramboll, 2021). The uppermost aquifer (UA) has been identified as the Lower Cahokia Formation (LCF) and saturated portions of the Upper Cahokia Formation (UCF) (Ramboll, 2021). The underlying shale has been identified as a bedrock confining unit (BCU) (Ramboll, 2021).

The UCF consists of low-permeability clays and silts, as well as discontinuous lenses of sand, sandy clay to clayey sand, and sandy silt. The saturated and unconfined sandy lenses within the UCF have been identified as Potential Migration Pathways. The thickness of the UCF ranges between 5 and 40 feet (ft) in the vicinity of the AP (Ramboll, 2021). The LCF consists of coarse materials of sand and gravel directly overlying the bedrock. The UA includes the LCF and, where saturated, portions of the UCF (Ramboll, 2021). The UA is primarily composed of moderately permeable sands and clayey gravels with a geometric mean horizontal hydraulic conductivity of 1.6×10^{-4} centimeters per second (cm/s) (Ramboll, 2021). Horizontal hydraulic gradients calculated for the UA range from 0.001 to 0.004 ft/ft (Ramboll, 2021). The bottom of the UA (*i.e.*, LCF) overlies the shale BCU. This confining layer consists of very low-permeability shales and siltstones with interbedded sandstone. The BCU has a geometric mean horizontal hydraulic conductivity of 3.2×10^{-6} cm/s (Ramboll, 2021), approximately two orders of magnitude lower than the overlying UA.

The alluvial soils of the UA are limited to areas immediately adjacent to and underlying the Illinois River and are located in north-south orientation parallel to the river (Ramboll, 2022a). In the area immediately underlying the AP, a thick layer of low-permeability clays associated with the UCF has been observed (Ramboll, 2022a). This clay layer restricts the migration of groundwater from the saturated deposits underlying the AP into the surrounding areas. West of the AP, the elevation of the ground surface increases and, correspondingly, the elevation of the shale BCU also increases. Based on regional information, alluvial soils are not expected to occur in the areas west of US Highway 24 (Ramboll, 2022a).

Groundwater flow within the UA occurs in both a northward and southward direction along the orientation of the UA, parallel to the river (Figure 2.2). The Illinois River recharges groundwater (*i.e.*, surface water flows into groundwater) throughout much of the area surrounding the EPP. Due to the hydraulic influence of the AP, a groundwater mound (*i.e.*, piezometric maximum) is located underneath the AP. This mound facilitates groundwater flow in both a northward and southward direction (Figure 2.2). Moreover, the groundwater mound associated with the AP may have resulted in a localized area in which groundwater flows in an easterly direction to the Illinois River. This easterly groundwater flow component and potential groundwater interaction with surface water in the Illinois River is expected to be eliminated after pond closure when the hydraulic head in the AP is removed. Because the shale BCU is elevated in the areas west of the AP and alluvial soils are not expected to occur west of the AP past US Highway 24, there is expected to be only a limited groundwater flow component from areas underlying the AP toward the west.



Figure 2.2 Groundwater Elevation in Uppermost Aquifer – February 2021. Source: Ramboll (2021).

2.3 Conceptual Site Model

A CSM describes sources of contamination, the hydrogeological units, and the physical processes that control the transport of water and solutes. In this case, the CSM describes how groundwater underlying the AP migrates and potentially interacts with surface water and sediment in the adjacent Illinois River. The CSM was developed using available hydrogeologic data specific to the AP (Ramboll, 2021), including information on groundwater flow and surface water characteristics.

CCR-related constituents from the AP may migrate vertically downward and into groundwater. Once in groundwater, these constituents may migrate northward and southward consistent with the primary groundwater flow directions. Based on groundwater modeling and groundwater monitoring conducted at the Site, and because of the low-permeability clays underlying the AP, no CCR-related constituents from

the AP have migrated off of the EPP property to the north or the south in excess of their GWPS (Figure 2.3). Some CCR-constituents may migrate eastward to the Illinois River, as a result of the groundwater mound caused by the AP. As a result, dissolved constituents in groundwater may partition between river sediments and Illinois River surface water.

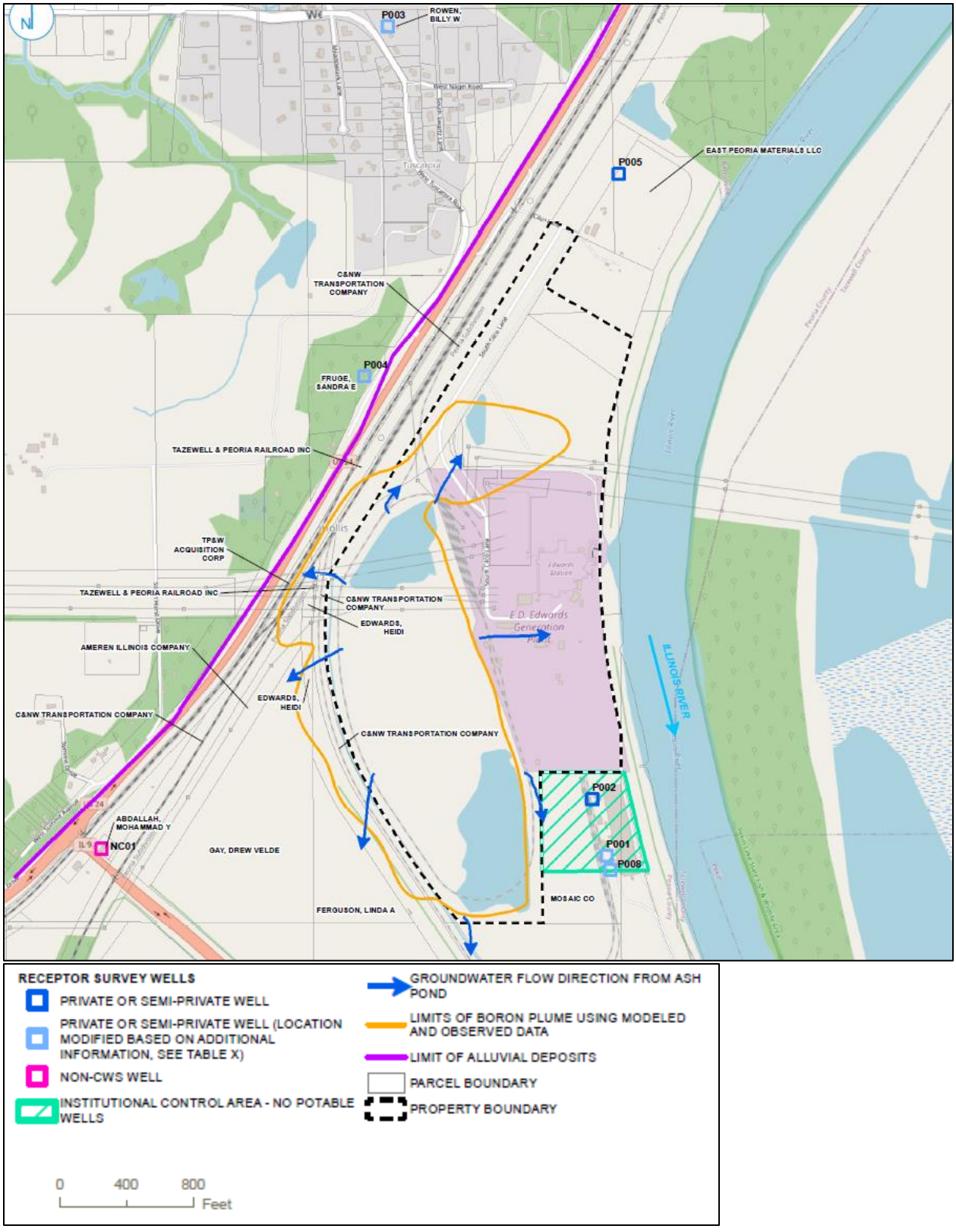


Figure 2.3 Modeled and Observed Extent of Boron in Groundwater and Water Wells Identified in Receptor Survey. Source: Ramboll (2022b).

2.4 Groundwater Monitoring

A total of 28 wells have been used to monitor the groundwater quality near and downgradient of the AP. Of these, 18 wells are screened in the UA, 8 are screened in the UCF, and 3 are screened in the BCU (Table 2.1) (Ramboll, 2021). The analyses presented in this report relied on all available data from the 28 wells collected between 2015 and 2021, which is the period subsequent to the promulgation of the Federal CCR Rule. Groundwater samples were analyzed for a suite of total metals, specified in Illinois CCR Rule Part 845.600 (IEPA, 2021a).[1] A summary of the groundwater data used in this risk evaluation is presented in Table 2.2. The AP well locations are shown in Figure 2.4. Note that there are additional wells located within the boundary of the AP and screened in pore water, that were not used in this risk analysis because they are not reflective of groundwater. The use of groundwater data in this risk evaluation does not imply that any detected constituents are associated with the AP or that they have been identified as potential groundwater exceedances.

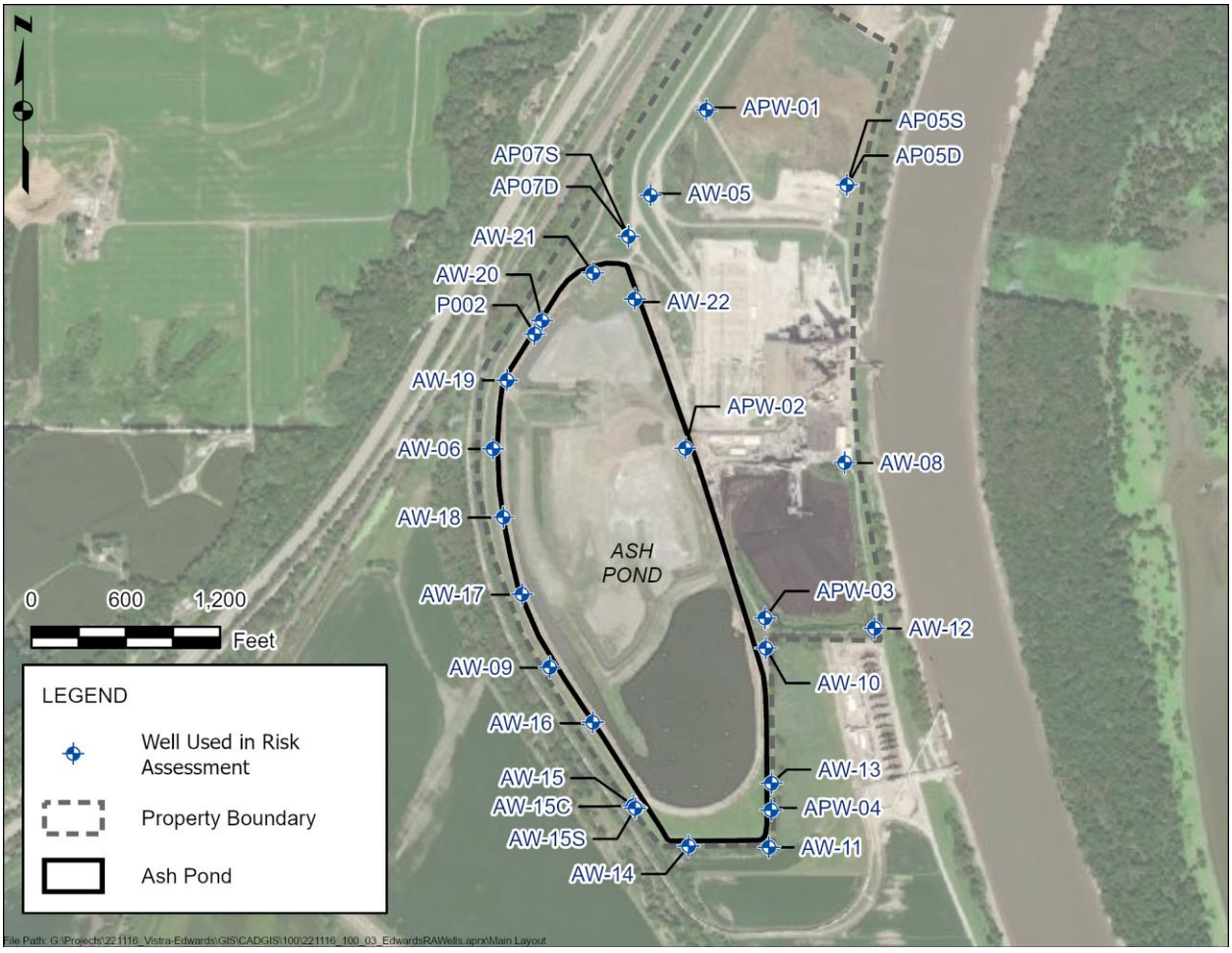


Figure 2.4 Monitoring Well Locations. Source: Ramboll (2021).

[1] Samples were analyzed for a longer list of inorganic constituents and general water quality parameters (chloride, fluoride, sulfate, and total dissolved solids), but these constituents were not evaluated in the risk evaluation.

Table 2.1 Groundwater Monitoring Wells Related to Edwards Ash Pond

Well	Hydrogeologic Unit	Date Constructed	Screen Top Depth (ft bgs)	Screen Bottom Depth (ft bgs)	Well Depth (ft bgs)
AP05S	UA	11/29/2016	32.87	37.64	38.06
AP05D	BCU	12/05/2016	47.09	56.69	57.17
AP06[a]	UCF	11/30/2016	19.93	24.72	25.00
AP07S	UCF	12/02/2016	29.95	34.74	35.00
AP07D	BCU	12/08/2016	55.01	64.59	65.00
APW-01	UCF	07/27/2010	7.60	18.00	18.00
APW-02	UCF	07/20/2010	39.60	50.00	50.00
APW-03	UCF	07/19/2010	19.60	30.00	30.00
APW-04	UCF	07/27/2010	9.60	20.00	20.00
AW-05	UA	07/22/2015	15.87	20.47	21.10
AW-06	UA	08/03/2015	36.60	41.09	41.69
AW-08	UA	07/21/2015	47.55	57.19	57.70
AW-09	UA	08/03/2015	47.14	51.62	52.23
AW-10	UA	07/23/2015	27.62	32.23	32.74
AW-11	UA	07/28/2015	24.21	28.81	29.31
AW-12	UA	01/07/2021	26.00	31.00	31.00
AW-13	UA	01/09/2021	25.00	30.00	30.00
AW-14	UA	01/08/2021	24.00	29.00	29.00
AW-15	UA	01/08/2021	33.00	38.00	38.00
AW-15C	BCU	01/08/2021	43.00	48.00	48.00
AW-15S	UCF	01/08/2021	8.00	18.00	18.00
AW-16	UA	01/08/2021	55.00	60.00	60.00
AW-17	UA	01/08/2021	51.00	56.00	56.00
AW-18	UA	01/09/2021	46.00	51.00	51.00
AW-19	UA	01/09/2021	35.00	40.00	40.00
AW-20	UA	01/10/2021	36.50	41.50	41.50
AW-21	UA	01/10/2021	32.00	37.00	37.00
AW-22	UA	01/08/2021	44.00	49.00	49.00
P002	UCF	--	30.60	35.60	35.90

Notes:
Source: Ramboll (2021).
-- = Data Unavailable; BCU = Bedrock Confining Unit; bgs = Below Ground Surface; ft = Feet; UA = Uppermost Aquifer; UCF = Upper Cahokia Formation.

Table 2.2 Groundwater Data Summary

Constituent	Samples with Constituent Detected	Samples Analyzed	Minimum Detected Value	Maximum Detected Value	Maximum Detection Limit
Total Metals (mg/L)					
Antimony	4	229	0.003	0.0045	0.003
Arsenic	228	253	0.001	0.097	0.02
Barium	253	253	0.062	8.6	0.02
Beryllium	29	253	0.00085	0.017	0.001
Boron	260	260	0.047	12	0.4
Cadmium	14	229	0.0011	0.004	0.001
Chromium	93	253	0.004	0.59	0.004
Cobalt	141	253	0.002	0.29	0.002
Lead	109	253	0.001	0.27	0.001
Lithium	179	253	0.011	0.85	0.02
Mercury	8	229	0.00021	0.0018	0.0002
Molybdenum	211	253	0.001	0.046	0.002
Selenium	57	253	0.001	0.019	0.004
Thallium	5	229	0.0012	0.0026	0.001
Radionuclides (pCi/L)					
Radium-226+228	252	252	0	23	1.93
Other (mg/L)					
Chloride	260	260	5.2	830	250
Fluoride	128	260	0.25	10.2	2.5
Sulfate	181	260	1	570	250
Total Dissolved Solids	260	260	390	2,600	34

Notes:
Source: Ramboll (2021).
pCi/L = PicoCuries Per Liter.

2.5 Surface Water Sampling

One surface water sample was collected from the Illinois River in 2017, as part of the Antidegradation Alternatives Analysis (Foth Infrastructure & Environment, LLC, 2017). The sample was collected from the "River Inlet," located approximately 1,000 feet north (upstream) of the AP outfall to the river (Figure 2.5, Table 2.3) (Foth Infrastructure & Environment, LLC, 2017). It should be noted that although this sample location is due east of the northern end of the AP, it was not collected specifically to examine the potential impact of the AP on the Illinois River. Data from this sample are included in this report for completeness; however, due to the lack of upstream and downstream samples, results from this sample are insufficient to evaluate the potential impact of the AP on the surface water quality conditions in the Illinois River. Instead, the potential impact of groundwater flowing from the UA to the Illinois River was modeled to predict potential surface water effects resulting from the AP (Section 3.3.3). These model-predicted surface water concentrations were used in this evaluation to assess potential risk to surface water receptors.



Figure 2.5 Surface Water Sampling Location. Source: Foth Infrastructure & Environment, LLC (2017, Figure 1).

Table 2.3 Surface Water Data Summary

Constituent	Detected Concentration (mg/L)
Total Metals	
Arsenic	0.0025
Barium	0.080
Boron	0.097
Cadmium	0.00023
Chromium	0.0073
Copper	0.0063
Iron	4.2
Lead	0.0049
Manganese	0.11
Mercury	0.000015
Nickel	0.0060
Selenium	0.0012
Silver	0.000028
Zinc	0.033
Other	
Chloride	100
Fluoride	0.23
Sulfate	65
Total Dissolved Solids	534

Notes:
Source: Foth Infrastructure & Environment, LLC (2017).
Sample collected from the River Inlet location on February 13, 2017.

3 Risk Evaluation

3.1 Risk Evaluation Process

A risk evaluation was conducted to determine whether constituents present in groundwater underlying and downgradient of the AP have the potential to pose adverse health effects to human and ecological receptors. The risk evaluation is consistent with the principles of risk assessment established by US EPA and has considered evaluation criteria detailed in Illinois guidance documents (*e.g.*, IEPA, 2013, 2019).

The general risk evaluation approach is summarized in Figure 3.1 and discussed below.

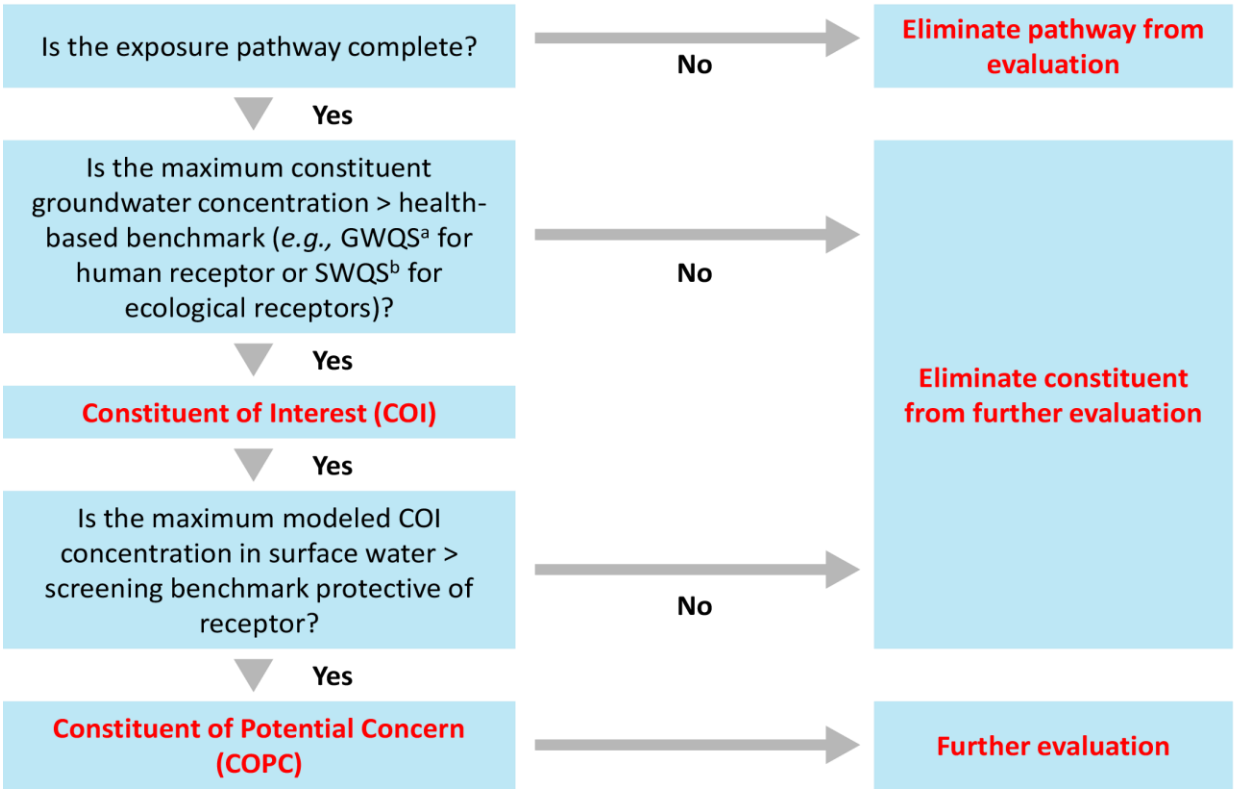


Figure 3.1 Overview of Risk Evaluation Methodology. GWQS = Groundwater Quality Standard; IEPA = Illinois Environmental Protection Agency; SWQS = Surface Water Quality Standard.
(a) The IEPA Part 845 GWPS were used to identify COIs.
(b) IEPA SWQS protective of chronic exposures to aquatic organisms were used to identify ecological COIs. In the absence of SWQS, US EPA Region IV Ecological Screening Values (ESV) were used.

The first step in the risk evaluation was to develop the CEMs and identify complete exposure pathways. All potential receptors and exposure pathways based on groundwater use and surface water use in the vicinity of the Site were considered. Exposure pathways that are incomplete were excluded from the evaluation.

Groundwater data were used to identify COIs. COIs were identified as constituents with maximum concentrations in groundwater in excess of groundwater quality standards (GWQS)[2] for human receptors and SWQS for ecological receptors. Based on the CSM (Section 2.2), groundwater flows in both a northward and southward direction along the orientation of the LCF/UA, parallel to the river. In the area immediately underlying the AP, a thick layer of low-permeability clays associated with the UCF has been observed (Ramboll, 2022a). This clay layer restricts groundwater migration from the saturated deposits underlying the AP to the surrounding areas. A groundwater mound associated with operation of the AP may cause a localized zone where groundwater flows in an easterly direction into the Illinois River. This easterly groundwater flow component and potential groundwater interaction with surface water in the Illinois River is expected to be eliminated after pond closure when the hydraulic head in the AP is removed. There is expected to be only a limited groundwater flow component from areas underlying the AP toward the west.

One surface water sample was collected from the Illinois River adjacent to the Site; however, sediment samples have not been collected from the river. Gradient modeled the potential migration of COIs from groundwater to surface water and sediment to evaluate potential risks to receptors (see Section 3.3.3).

Gradient modeled the COI concentrations in surface water and sediment based on the groundwater data from the AP-related wells. The measured and modeled COI concentrations in surface water and sediment were compared to conservative, generic risk-based screening benchmarks for human health and ecological receptors. These generic screening benchmarks rely on default assumptions with limited consideration of site-specific characteristics. Human health benchmarks are receptor-specific values calculated for each pathway and environmental medium that are designed to be protective of human health. Ecological benchmarks are medium-specific values designed to be protective of all potential ecological receptors exposed to surface water. Ecological and human health screening benchmarks are inherently conservative because they are intended to screen out chemicals that are of no concern with a high level of confidence. Therefore, a measured or modeled COI concentration exceeding a screening benchmark does not indicate an unacceptable risk; it only indicates that further risk evaluation is warranted. COIs with maximum concentrations exceeding a conservative screening benchmark are identified as COPCs requiring further evaluation.

As described in more detail below, this evaluation relied on the screening assessment to demonstrate that constituents present in groundwater underlying the AP do not pose an unacceptable human health or ecological risk. That is, after the screening step, no COPCs were identified and further assessment was not warranted.

3.2 Human and Ecological Conceptual Exposure Models

A CEM provides an overview of the receptors and exposure pathways requiring risk evaluation. The CEM describes the source of the contamination, the mechanism that may lead to a release of contamination, the environmental media to which a receptor may be exposed, the route of exposure (exposure pathway), and the types of receptors that may be exposed to these environmental media.

[2] As discussed further in Section 3.3.2, groundwater quality standards are protective of human health and not necessarily of ecological receptors. While ecological receptors are not exposed to groundwater, groundwater can potentially enter into the adjacent surface water and impact ecological receptors. Therefore, two sets of COIs were identified: one for humans and another for ecological receptors.

3.2.1 Human Conceptual Exposure Model

The human CEM for the Site depicts the relationships between the off-site environmental media potentially impacted by constituents in groundwater and the human receptors that could be exposed to these media. Figure 3.2 presents a human CEM for the Site. It considers a human receptor who could be exposed to COIs hypothetically released from the AP into groundwater, surface water, sediment, and fish. The following human receptors and exposure pathways were evaluated for inclusion in the Site-specific CEM:

- Residents – exposure to groundwater/surface water as drinking water
- Residents – exposure to groundwater/surface water used for irrigation
- Recreators in the river near the Site:
  - Boaters – exposure to surface water and sediment while boating
  - Swimmers – exposure to surface water and sediment while swimming
  - Anglers – exposure to surface water and sediment and consumption of locally caught fish

All of these exposure pathways were considered to be complete except for residential exposure to groundwater or surface water used for drinking water or irrigation. Section 3.2.1.1 explains why the residential drinking water and irrigation pathways are incomplete, and Section 3.2.1.2 provides additional description of the recreational exposures.

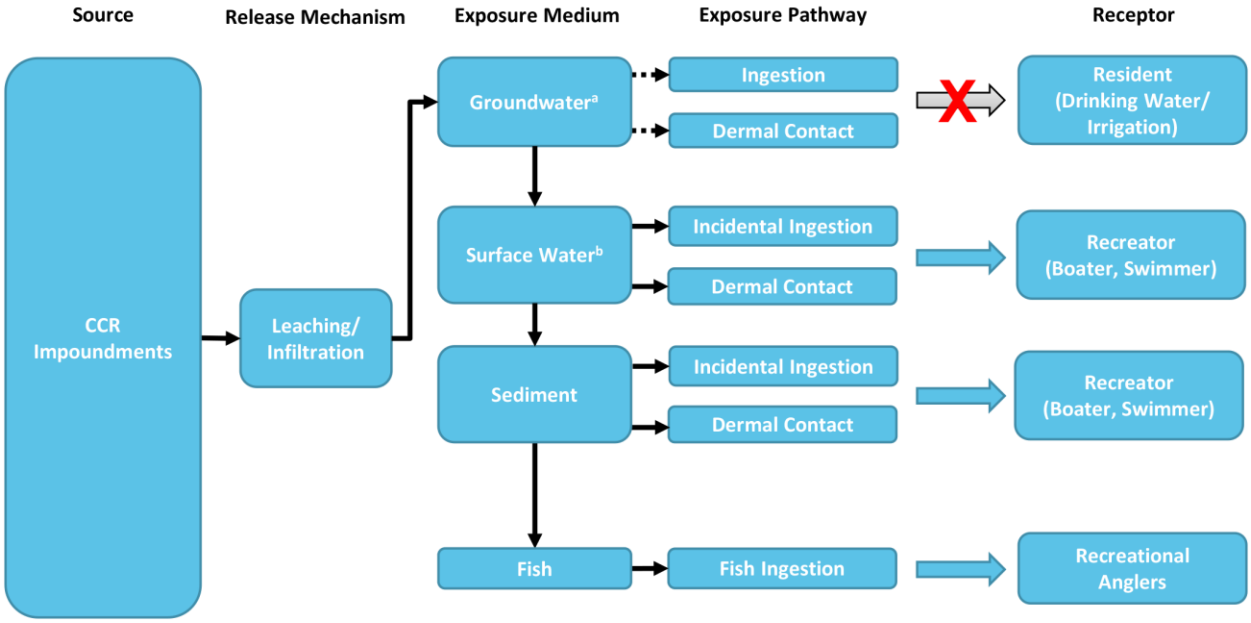


Figure 3.2 Human Conceptual Exposure Model. CCR = Coal Combustion Residual. Dashed line/Red X = Incomplete or Insignificant Exposure Pathway.
(a) Groundwater in the vicinity of the Site is not used as a drinking water or irrigation source.
(b) Surface water is not used as a drinking water source.

3.2.1.1 Groundwater or Surface Water as a Drinking Water/Irrigation Source

Groundwater as a source of drinking water and/or irrigation water is not a complete exposure pathway for CCR-related constituents originating from the AP. Based on groundwater modeling and groundwater monitoring conducted at the Site, and because of the low-permeability clays underlying the AP, no CCR-related constituents from the AP have migrated off of the EPP property to the north or the south in excess of their GWPS (Figure 2.3). Additionally, a summary of the evidence, presented below, supports the conclusion that there are no residential uses of groundwater that could be impacted as a result of the AP. Furthermore, Illinois River surface water is not used as a source of drinking water in the area.

- **There are no groundwater users near the EPP in areas where groundwater could be impacted due to the AP.** Relying on federal and state databases, Ramboll completed a potable water well survey in 2021 (Ramboll, 2021). A total of 7 wells were identified proximate to the EPP during a comprehensive search of the Illinois State Geological Survey's (ISGS) Illinois Water and Related Wells (ILWATER) Map (ISGS, 2020; Ramboll, 2021) (Figure 2.3). All of these wells are either in areas where groundwater is not expected to be impacted by the AP or are industrial wells that are not used for domestic purposes (Ramboll, 2021). Specific information pertaining to each well identified in the receptor survey is provided below.

    - Well P004: This is a residential well located on the bluff above the Illinois River, north of the AP. The well is 65 feet deep and screened in the shale bedrock (ISGS, 1978). The shale bedrock is a hydrostratigraphic unit that has a limited hydraulic connection to the UCF and LCF soil deposits located on the EPP property. Based on topographic maps, the ground surface elevation at the well is approximately 480 ft msl (based on NAVD88)[3] (USGS, 2017). Thus, the bottom of P004 is located at an elevation of approximately 415 ft msl (570 ft minus 65 ft). The well log indicates that the bedrock was encountered at a depth of 30 feet (ISGS, 1978), which is at an elevation of 450 ft msl (480 ft minus 30 ft). Additionally, the well log indicates that groundwater was encountered at a depth of 37 feet below the top casing (which is 36 feet below ground surface [ft bgs]; ISGS, 1978). Thus, the groundwater elevation at P004 is 444 ft msl (480 ft minus 36 ft). Because the groundwater elevation is below the depth of the bedrock, the unlithified soils at P004 are unsaturated (*i.e.*, there is no alluvial aquifer at P004). Additionally, the measured groundwater elevation at P004 (444 ft msl) is higher than the measured groundwater elevations at AW-05 and APW-01 (approximately 435 ft msl; Figure 2.2), which are the closest monitoring wells to P004, and are screened in unlithified soils of the UCF and LCF. Thus, it is impossible for any groundwater impacts associated with the AP to impact groundwater quality at well P004.

    - Well P003: This is a residential well located to the north of the EPP. The well is 43 feet deep and screened in clay (ISGS, 1969). Based on topographic maps, the ground surface elevation at the well is approximately 570 ft msl (based on NAVD88) (USGS, 2017); thus, the bottom of P003 is located at an elevation of approximately 527 ft msl (570 ft minus 43 ft). Because groundwater underlying the AP is located at an elevation of approximately 430 to 440 ft msl (Figure 2.2; *i.e.*, 87 to 97 ft lower than P003), it is impossible for any groundwater impacts associated with the AP to impact groundwater quality at P003.

    - Well P005: This is a well located on an industrial property, owned by East Peoria Materials LLC, north of the EPP. The well was installed to a depth of 60 ft bgs into bedrock (ISGS, 1987). After the well was drilled, the driller's notes indicated that it did not yield sufficient

[3] NAVD88 is the North American Vertical Datum of 1988.

water ("no water"; ISGS, 1987); thus, Gradient believes this well is not likely to be active, if it even still exists.

- Well P001: This is an industrial well located on the Mosaic Company property, formerly owned by Cargill Marine and Terminal and Cargo Carriers. The well was installed to a depth of 20 ft bgs into clay (ISGS, 2001). As a result of prior recognized environmental conditions on the property, land-use restrictions have been implemented that prevent anyone from installing, operating, or maintaining a potable water supply well (Eastep, 2003). Thus, it is not expected that this well is used for domestic purposes.
- Well P002: This is an industrial well located on the Mosaic Company property, formerly owned by Cargill Marine and Terminal and Cargo Carriers. The well was installed to a depth of 30 ft bgs into clay (ISGS, 1968). As a result of prior recognized environmental conditions on the property, land-use restrictions have been implemented that prevent anyone from installing, operating, or maintaining a potable water supply well (Eastep, 2003). Thus, it is not expected that this well is used for domestic purposes.
- Well P008: This is an industrial well located on the Mosaic Company property, formerly owned by Cargill Marine and Terminal and Cargo Carriers. The well was installed to a depth of 300 ft bgs into shale bedrock (ISGS, 2017). As a result of prior recognized environmental conditions on the property, land-use restrictions have been implemented that prevent anyone from installing, operating, or maintaining a potable water supply well (Eastep, 2003). Thus, it is not expected that this well is used for domestic purposes.
- NC-01: This is a non-community water source well associated with the Freedom Gas Station (Hahn, 2020). Peoria County Health Department indicated that the well is not a potable well (Hahn, 2020). Moreover, the well is side-gradient from the AP and unlikely to be affected by any AP-related impacts.

- **The Illinois River is not used as a public water supply adjacent to the Site.** The Illinois River is classified as a "General Use Water." IEPA supports the use of the Illinois River for aquatic life and primary contact recreation, but it is not designated for public and food processing water supplies (IEPA, 2018). The Illinois River is used as a public water supply in the city of Peoria, IL; however, this location is approximately 9 miles upstream of the Site (ISWS, 2022). The segment of the Illinois River adjacent to the Site (Assessment Unit ID: IL D-05) is listed on the 2018 Illinois Section 303(d) List as being impaired for fish consumption, due to mercury and polychlorinated biphenyls (US EPA, 2018; IEPA, 2021b). Therefore, surface water adjacent to the Site is not used as a source of drinking water, and this exposure pathway was not evaluated further.
- **The AP has a limited hydraulic connection to underlying bedrock groundwater resources**. The shale bedrock aquitard underlying the UA forms a hydraulic barrier between the AP and deeper groundwater resources. Due to very low hydraulic conductivity of the shale bedrock aquitard, downward migration of shallow groundwater to the underlying aquifers is expected to be limited. Therefore, the likelihood of AP-related impacts to the deep groundwater resources is minimal.

3.2.1.2 Recreational Exposures

The Illinois River flows from north to south past the Site. Recreational exposure to surface water and sediment may occur during activities such as swimming, boating, or fishing in the river. Exposure estimates for swimmers provide a health-protective means to evaluate exposure during other recreational activities. Recreational anglers may also consume locally caught fish from the Illinois River.

3.2.2 Ecological Conceptual Exposure Model

The ecological CEM for the Site depicts the relationships between off-site environmental media (surface water and sediment) potentially impacted by COIs in groundwater and ecological receptors that may be exposed to these media. The ecological risk evaluation considered both direct toxicity as well as secondary toxicity *via* bioaccumulation. Figure 3.3 presents the ecological CEM for the Site. The following ecological receptor groups and exposure pathways were considered:

- **Ecological Receptors Exposed to Surface Water:**

  Aquatic plants, amphibians, reptiles, and fish

- **Ecological Receptors Exposed to Sediment:**

  Benthic invertebrates (*e.g.*, insects, crayfish, mussels)

- **Ecological Receptors Exposed to Bioaccumulative COIs:**

  Higher trophic-level wildlife (avian and mammalian) *via* direct exposures (surface water and sediment exposure) and secondary exposures through the consumption of prey (*e.g.*, plants, invertebrates, small mammals, fish)

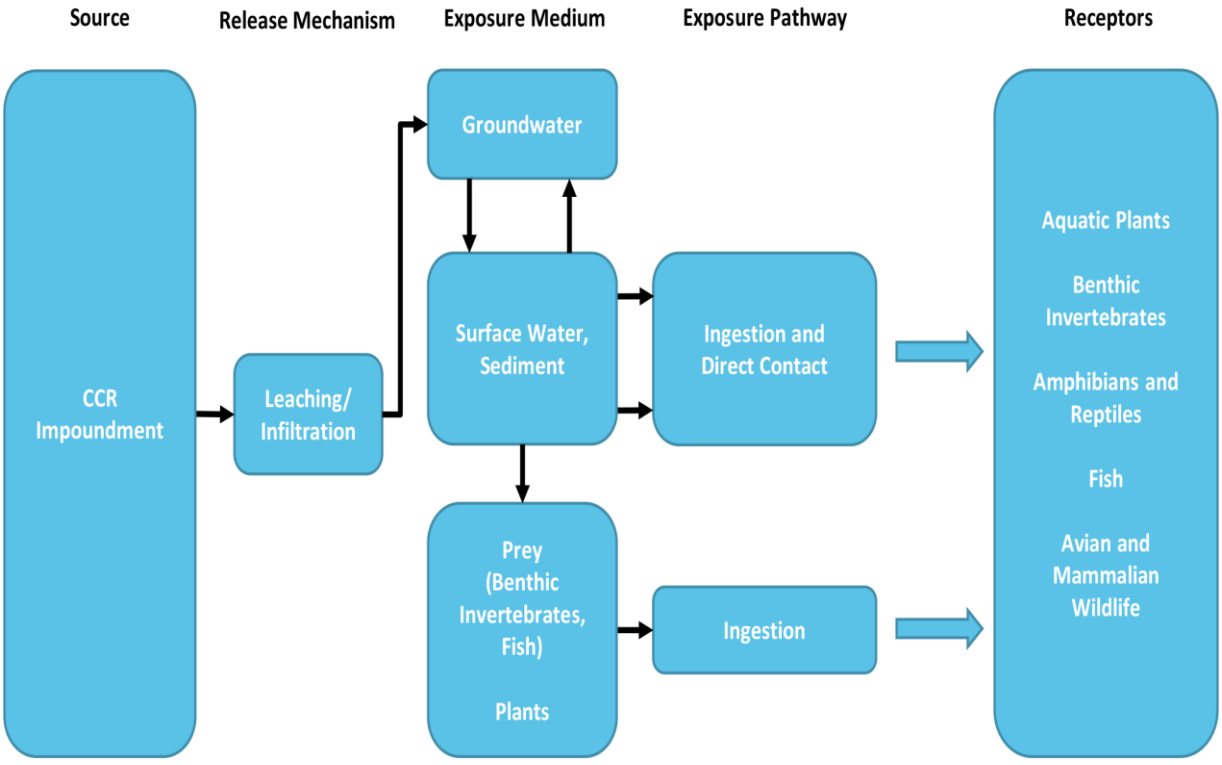


Figure 3.3 Ecological Conceptual Exposure Model. CCR = Coal Combustion Residual.

3.3 Identification of Constituents of Interest

Risks were evaluated for COIs. A constituent was considered a COI if the maximum detected constituent concentration in groundwater exceeded a health-based benchmark. According to US EPA risk assessment guidance (US EPA, 1989), this screening step is designed to reduce the number of constituents carried through the risk evaluation that are anticipated to have a minimal contribution to the overall risk. Identified COIs are the constituents that are most likely to pose a risk concern in the surface water adjacent to the Site.

3.3.1 Human Health Constituents of Interest

For the human health risk evaluation, COIs were conservatively identified as constituents with maximum concentrations in groundwater above the GWPS listed in the Illinois CCR Rule Part 845.600 (IEPA, 2021a). Gradient used the maximum detected concentrations from groundwater samples collected from all of the AP-associated wells, regardless of hydrostratigraphic unit. The use of groundwater data in this risk evaluation does not imply that detected constituents are associated with the AP or that they have been identified as potential groundwater exceedances. Using this approach, 11 COIs (arsenic, barium, beryllium, boron, chromium, cobalt, lead, lithium, thallium, radium-226+228, and fluoride) were identified for the human health risk evaluation *via* the surface water pathway (Table 3.1).

The water quality parameters that exceeded the GWPS included chloride, sulfate, and total dissolved solids; however, these constituents were not included in the risk evaluation because the GWPS are based on aesthetic quality. The US EPA secondary maximum contaminant levels (MCLs) for chloride, sulfate, and total dissolved solids are based on aesthetic quality. The secondary MCLs for chloride and sulfate (250 mg/L) are based on salty taste (US EPA, 2021a). The secondary MCL for total dissolved solids (500 mg/L) is based on hardness, deposits, colored water, staining, and salty taste (US EPA, 2021a). Given that these parameters are not likely to pose a human health risk concern in the event of exposure, they were not considered to be human health COIs.

Table 3.1 Human Health Constituents of Interest

Constituent[a]	Maximum Concentration	GWPS[b]	Human Health COI[c]
Total Metals (mg/L)			
Antimony	0.0045	0.006	No
Arsenic	0.097	0.01	Yes
Barium	8.6	2	Yes
Beryllium	0.017	0.004	Yes
Boron	12	2	Yes
Cadmium	0.004	0.005	No
Chromium	0.59	0.1	Yes
Cobalt	0.29	0.006	Yes
Lead	0.27	0.0075	Yes
Lithium	0.85	0.04	Yes
Mercury	0.0018	0.002	No
Molybdenum	0.046	0.1	No
Selenium	0.019	0.05	No
Thallium	0.0026	0.002	Yes
Radionuclides (pCi/L)			
Radium-226+228	23	5	Yes
Other (mg/L, unless otherwise noted)			
Chloride	830	200	No[d]
Fluoride	10.2	4	Yes
Sulfate	570	400	No[d]
Total Dissolved Solids	2,600	1,200	No[e]

Notes:
COI = Constituent of Interest; GWPS = Groundwater Protection Standard; MCL = Maximum Contaminant Level; pCi/L = PicoCuries Per Liter.
Shaded = Compound identified as a COI.
(a) The constituents are those listed in the IL Part 845.600 GWPS (IEPA, 2021a).
(b) The IL Part 845.600 GWPS (IEPA, 2021a) were used to identify COIs.
(c) COIs are constituents for which the maximum concentration exceeds the groundwater standard.
(d) This constituent is not likely to pose a human health risk concern due to the absence of studies regarding toxicity to human health. Therefore, this constituent is not considered a COI.
(e) Total dissolved solids are not considered a COI because the MCL is based on aesthetic quality.

3.3.2 Ecological Constituents of Interest

The Illinois GWPS, as defined in IEPA's guidance, were developed to protect human health but not necessarily ecological receptors. While ecological receptors are not exposed to groundwater, groundwater can potentially migrate into the adjacent surface water and impact ecological receptors. Therefore, to identify ecological COIs, the maximum concentrations of constituents detected in groundwater were compared to ecological surface water benchmarks protective of aquatic life.

The surface water screening benchmarks for freshwater organisms were obtained from the following hierarchy of sources:

- IEPA (2019) SWQS. IEPA SWQS are health-protective benchmarks for aquatic life exposed to surface water on a long-term basis (*i.e.*, chronic exposure). The SWQS for several metals are hardness dependent (cadmium, chromium, copper, lead, manganese, nickel, and zinc). Screening benchmarks for these constituents were calculated assuming US EPA's default hardness of 100 mg/L (US EPA, 2022).[4]
- US EPA Region IV (2018) surface water Ecological Screening Values (ESVs) for hazardous waste sites.

Benchmarks from a United States Department of Energy (US DOE) guidance document ("A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota") were used for radium (US DOE, 2019). US DOE presents benchmarks for radium-226 and radium-228 (4 and 3 picoCuries per liter [pCi/L], respectively). Given that radium concentrations are expressed as total radium (radium-226+228, *i.e.*, the sum of radium-226 and radium-228), Gradient used the lower of the two benchmarks (3 pCi/L for radium-228) to evaluate total radium concentrations.

Consistent with the human health risk evaluation, Gradient used the maximum detected concentrations from groundwater samples collected from all of the AP-associated wells, (regardless of hydrostratigraphic unit) without considering spatial or temporal representativeness for ecological receptor exposures. The use of the maximum constituent concentrations in this evaluation is designed to conservatively identify COIs that warrant further investigation. Barium, boron, cadmium, chromium, cobalt, lead, lithium, mercury, radium-226+228, chloride, and fluoride were identified as COIs for ecological receptors (Table 3.2).

[4] Hardness data are not available for the Illinois River adjacent to the Site; therefore, the US EPA (2022) default hardness of 100 mg/L was used. Use of a higher hardness value would result in less stringent screening values, thus, use of the US EPA default hardness is conservative.

Table 3.2 Ecological Constituents of Interest

Constituent[a]	Maximum Groundwater Concentration	Ecological Benchmark[b]	Basis	Ecological COI[c]
Total Metals (mg/L)				
Antimony	0.0045	0.19	US EPA R4 ESV	No
Arsenic	0.097	0.19	IEPA SWQC	No
Barium	8.6	5	IEPA SWQC	Yes
Beryllium	0.017	0.064	US EPA R4 ESV	No
Boron	12	7.6	IEPA SWQC	Yes
Cadmium	0.004	0.0011	IEPA SWQC	Yes
Chromium	0.59	0.21	IEPA SWQC	Yes
Cobalt	0.29	0.019	US EPA R4 ESV	Yes
Lead	0.27	0.020	IEPA SWQC	Yes
Lithium	0.85	0.44	US EPA R4 ESV	Yes
Mercury	0.0018	0.0011	IEPA SWQC	Yes
Molybdenum	0.046	7.2	US EPA R4 ESV	No
Selenium	0.019	1	IEPA SWQC	No
Thallium	0.0026	0.006	US EPA R4 ESV	No
Radionuclides (pCi/L)				
Radium-226+228	23	3	US DOE	Yes
Other (mg/L, unless otherwise noted)				
Chloride	830	500	IEPA SWQC	Yes
Fluoride	10.2	4	IEPA SWQC	Yes
Sulfate	570	NA	NA	No
Total Dissolved Solids	2,600	NA	NA	No

Notes:
AP = Ash Pond; COI = Constituent of Interest; ESV = Ecological Screening Value; GWPS = Groundwater Protection Standard; IEPA = Illinois Environmental Protection Agency; NA = Not Available; pCi/L = PicoCuries Per Liter; SWQC = Surface Water Quality Criteria; US DOE = United States Department of Energy; US EPA R4 = US Environmental Protection Agency Region IV.
Shaded = Compound identified as a COI.
(a) The constituents are those listed in the IL Part 845.600 GWPS (IEPA, 2021a) that were detected in at least one groundwater sample from the 28 wells related to the Edwards AP.
(b) Ecological benchmarks are from the hierarchy of sources discussed in Section 3.3.2: IEPA SWQC (IEPA, 2019); US EPA R4 "Ecological Risk Assessment Supplemental Guidance" (US EPA Region IV, 2018); and US DOE's guidance document "A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota" (US DOE, 2019).
(c) Constituents with maximum detected concentrations exceeding a benchmark protective of surface water exposure are considered ecological COIs.

3.3.3 Surface Water and Sediment Modeling

One surface water sample was collected from the Illinois River adjacent to the Site; however, as discussed in Section 2.5, this sample is insufficient to evaluate the potential impact of the AP on the Illinois River. Therefore, to estimate the potential contribution to surface water (and sediment) from groundwater specifically associated with the AP, Gradient modeled concentrations in the Illinois River surface water and sediment from groundwater that may flow to the Illinois River for the detected human and ecological COIs (arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, lead, lithium, mercury, thallium, radium-226+228, chloride, and fluoride). The constituents detected in groundwater above a ecological or health-based benchmark are most likely to pose a risk concern in the adjacent surface water. Gradient modeled human health and ecological COI concentrations in the surface water and sediment using a mass balance calculation based on the surface water and groundwater mixing. The model assumes a well-mixed groundwater-surface water location.

The maximum detected concentrations in groundwater (regardless of well location) from 2015 to 2021 were conservatively used to model COI concentrations in surface water and sediment. The groundwater data were measured as total metals. Use of the total metal concentration for these COIs may overestimate surface water concentrations because dissolved concentrations, which are lower than total concentrations, represent the mobile fractions of constituents that could likely flow to and mix with surface water.

The modeling approach does not account for geochemical transformations that may occur during groundwater mixing with surface water. Gradient assumed that predicted surface water concentrations were influenced only by the physical mixing of groundwater as it enters the surface water and were not further influenced by the geochemical reactions in the water and sediment, such as precipitation. In addition, the model only predicts surface water and sediment concentrations as a result of the potential migration of COI concentrations in AP-related groundwater and does not account for background concentrations in surface water or sediment.

For this evaluation, Gradient adapted a simplified and conservative form of US EPA's indirect exposure assessment methodology (US EPA, 1998) that was used in US EPA's coal combustion waste risk assessment (US EPA, 2014). The model is a mass-balance calculation based on surface water and groundwater mixing and the concept that the dissolved and sorbed concentrations can be related through an equilibrium partition coefficient (K_d). The model assumes a well-mixed groundwater-surface water location, with partitioning among total suspended solids, dissolved water column, sediment pore water, and solid sediments.

Sorption to soil and sediment is highly dependent on the surrounding geochemical conditions. To be conservative, Gradient ignored the natural attenuation capacity of soil and sediment and estimated the surface water concentration based only on the physical mixing of groundwater and surface water (*i.e.*, dilution).

The aquifer and surface water properties used to estimate the volume of groundwater flowing to the Illinois River and surface water concentrations are presented in Table 3.3. The COI concentrations in sediment were modeled using the COI-specific sediment-to-water partitioning coefficients and the sediment properties presented in Table 3.4. In the absence of Site-specific information for the Illinois River, Gradient used default assumptions (*e.g.*, depth of the upper benthic layer and bed sediment porosity) to model sediment concentrations. The modeled surface water and sediment concentrations are presented in Table 3.5. These modeled concentrations reflect conservative contributions from groundwater. A description of the modeling and the detailed results are presented in Appendix A.

Table 3.3 Groundwater and Surface Water Properties Used in Modeling

Parameter	Unit	Value	Notes/Source
Groundwater			
COI Concentration	mg/L	Constituent specific	Maximum detected concentration in groundwater.
Cross Section Area for the UA[a]	m^2	1,277	The length of the groundwater discharge zone was assumed to be equal to the length of the AP (*i.e.*, approximately 1,047 m). The thickness of the discharge zone was assumed to be equal to the maximum thickness of the UA (1.22 m) (Ramboll, 2021).
Hydraulic Gradient	m/m	0.004	Maximum average horizontal hydraulic gradient determined for the UA (Ramboll, 2021).
Hydraulic Conductivity of the UA	cm/s	0.00017	Geometric mean horizontal hydraulic conductivity for all UA wells (Ramboll, 2021).
Surface Water			
Surface Water Flow Rate	L/yr	5.3×10^{12}	Representative low flow (10th percentile) discharge rate for the Illinois River at USGS Kingston Mines, Illinois, gauging station (USGS 05568500) (USGS, 2022).
Total Suspended Solids (TSS)	mg/L	105	TSS data from Illinois River inlet (Foth Infrastructure & Environment, LLC, 2017).
Depth of the Water Column	m	2.74	Illinois River bathymetry data (Bist LLC, 2022).
Suspended Sediment to Water Partition Coefficient	mg/L	Constituent specific	Values based on US EPA (2014).

Notes:
AP = Ash Pond; COI = Constituent of Interest; L/yr = Liter Per Year; UA = Uppermost Aquifer; US EPA = United States Environmental Protection Agency; USGS = United States Geological Survey.
(a) The cross-sectional area represents the area through which groundwater flows from the UA to the Illinois River.

Table 3.4 Sediment Properties Used in Modeling

Parameter	Unit	Value	Notes/Source
Sediment			
Depth of Upper Benthic Layer	m	0.03	Default (US EPA, 2014).
Depth of Water Body	m	2.77	Depth of water column (2.74 m, as indicated by Illinois River bathymetry data (Bist LLC, 2022) plus depth of upper benthic layer (0.03 m) (US EPA, 2014).
Bed Sediment Particle Concentration	g/cm^3	1	Default (US EPA, 2014).
Bed Sediment Porosity	-	0.6	Default (US EPA, 2014).
TSS Mass per Unit Area	kg/m^2	0.29	Depth of water column × TSS × conversion factors (10^{-6} kg/mg and 1,000 L/m^3).
Sediment Mass per Unit Area	kg/m^2	30	Depth of upper benthic layer × bed sediment particulate concentration × conversion factors (0.001 kg/g, 10^6 cm^3/m^3).
Sediment to Water Partitioning Coefficients	mg/L	Constituent specific	Values based on US EPA (2014).

Notes:
TSS = Total Suspended Solids; US EPA = United States Environmental Protection Agency.

Table 3.5 Surface Water and Sediment Modeling Results

COI	Groundwater Concentration (mg/L or pCi/L)	Mass Discharge Rate (mg/year or pCi/year)	Total Water Column Concentration (mg/L or pCi/L)	Concentration Sorbed to Bottom Sediments (mg/kg or pCi/kg)
Total Metals				
Arsenic	0.097	2.7E+04	5.1E-09	6.9E-07
Barium	8.6	2.4E+06	4.5E-07	6.9E-05
Beryllium	0.017	4.7E+03	8.9E-10	2.1E-07
Boron	12	3.3E+06	6.3E-07	2.2E-06
Cadmium	0.0040	1.1E+03	2.1E-10	4.5E-08
Chromium	0.59	1.6E+05	3.1E-08	1.7E-04
Cobalt	0.29	7.9E+04	1.5E-08	2.5E-06
Lead	0.27	7.4E+04	1.4E-08	1.0E-05
Lithium	0.85	2.3E+05	4.4E-08	(a)
Mercury	0.0018	4.9E+02	9.4E-11	3.4E-07
Thallium	0.0026	7.1E+02	1.4E-10	1.2E-09
Radionuclides				
Radium-226+228	23	6.3E+06	1.2E-06	5.0E-03
Other				
Chloride	830	2.3E+08	4.3E-05	(a)
Fluoride	10.2	2.8E+06	5.3E-07	8.3E-05
Sulfate	570	1.6E+08	3.0E-05	(a)

Notes:
COI = Constituent of Concern; K_d = Equilibrium Partition Coefficient; pCi/L = PicoCuries Per Liter; pCi/kg = PicoCuries Per Kilogram.
(a) Lithium, chloride, and sulfate do not readily sorb to soil or sediment particles; a K_d value of 0 was used for the modeling.

3.4 Human Health Risk Evaluation

The section below presents the results of the human health risk evaluation for recreators (boaters, swimmers and anglers) along the Illinois River adjacent to the Site. Risks were assessed using the maximum measured or modeled COIs in surface water.

3.4.1 Recreators Exposed to Surface Water

Screening Exposures: Recreators could be exposed to surface water *via* incidental ingestion and dermal contact while swimming or boating. In addition, anglers could consume fish caught in the Illinois River. The maximum measured or modeled COI concentrations in surface water were used as conservative upper-end estimates of the COI concentrations to which a recreator might be exposed directly (incidental ingestion of COIs in surface water while swimming) and indirectly (consumption of locally caught fish exposed to COIs in surface water).

Screening Benchmarks: Illinois surface water criteria (IEPA, 2019), known as human threshold criteria (HTC), are based on incidental exposure through contact or ingestion of small volumes of water while swimming or during other recreational activities, as well as the consumption of fish. The HTC values were calculated from the following equation (IEPA, 2019):

$$\mathrm{HTC} = \frac{\mathrm{ADI}}{\mathrm{W} + (\mathrm{F} \times \mathrm{BCF})}$$

where:

HTC = Human health protection criterion in milligrams per liter (mg/L)
ADI = Acceptable daily intake (mg/day)
W = Water consumption rate (L/day)
F = Fish consumption rate (kg/day)
BCF = Bioconcentration factor (L/kg-tissue)

Illinois defines the acceptable daily intake (ADI) as the "maximum amount of a substance which, if ingested daily for a lifetime, results in no adverse effects to humans" (IEPA, 2019). US EPA defines its chronic reference dose (RfD) as an "estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure for a chronic duration (up to a lifetime) to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime" (US EPA, 2011a). Illinois lists methods to derive an ADI from the primary literature (IEPA, 2019). In accordance with Illinois guidance, Gradient derived an ADI by multiplying the MCL by the default water ingestion rate of 2 L/day (IEPA, 2019). In the absence of an MCL, Gradient applied the RfD used by US EPA to derive its Regional Screening Levels (RSLs) (US EPA, 2021c) as a conservative estimate of the ADI. The RfDs are given in mg/kg-day, while the ADIs are given in mg/day; thus, Gradient multiplied the RfD by a standard body weight of 70 kg to obtain the ADI in mg/day. The calculation of the HTC values is shown in Appendix B, Table B.1.

Gradient used bioconcentration factors (BCFs) from a hierarchy of sources. The primary BCFs were those that US EPA used to calculate the National Recommended Water Quality Criteria (NRWQC) for human health (US EPA, 2002). Other sources included BCFs used in the US EPA coal combustion ash risk assessment (US EPA, 2014) and BCFs reported by Oak Ridge National Laboratory's Risk Assessment

Information System (ORNL RAIS) (ORNL, 2020).[5] Lithium did not have a BCF value available from any authoritative source; therefore, the water quality criterion for lithium was calculated assuming a BCF of 1. This is a conservative assumption, as lithium does not readily bioaccumulate in the aquatic environment (ECHA, 2020a,b; ATSDR, 2010).

Illinois recommends a fish consumption rate of 0.020 kg/day (20 g/day) for an adult weighing 70 kg (IEPA, 2019). Illinois recommends a water consumption rate of 0.01 L/day for "incidental exposure through contact or ingestion of small volumes of water while swimming or during other recreational activities" (IEPA, 2019). Appendix B, Table B.1 presents the calculated HTC for fish and water and for fish consumption only.

The HTC for fish consumption for radium-226+228 was calculated as follows:

$$\mathrm{HTC} = \frac{\mathrm{TCR}}{(\mathrm{SF} \times \mathrm{BAF} \times \mathrm{F})}$$

where:

HTC = Human health protection criterion in picoCuries per liter (pCi/L)
TCR = Target cancer risk ($1x10^{-5}$)
SF = Food ingestion slope factor (risk/pCi)
BAF = Bioaccumulation factor (L/kg-tissue)
F = Fish consumption rate (kg/day)

The food ingestion slope factor (lifetime excess total cancer risk per unit exposure, in risk/pCi) used to calculate the HTC was the highest value of those for radium-226 (Ra-226), radium-228 (Ra-228), and "Ra-228+D" (US EPA, 2001). According to US EPA (2001), "+D" indicates that "the risks from associated short-lived radioactive decay products (*i.e.,* those decay products with radioactive half-lives less than or equal to 6 months) are also included."

Screening Risk Evaluation: The maximum modeled and measured COI concentrations in surface water were compared to the calculated Illinois HTC values (Table 3.6). All surface water concentrations were below their respective benchmarks. The HTC values are protective of recreational exposure *via* water and/or fish ingestion and do not account for dermal exposures to COIs in surface water while swimming. However, given that the measured and modeled COI surface water concentrations are orders of magnitude below HTC protective of water and/or fish ingestion, dermal exposures to COIs are not expected to be a risk concern. Moreover, the dermal uptake of metals is considered to be minimal and only a small proportion of ingestion exposures. Thus, none of the COIs evaluated would be expected to pose an unacceptable risk to recreators exposed to surface water while swimming and anglers consuming fish caught in the Illinois River.

[5] Although recommended by US EPA (2015c), US EPA EpiSuite 4.1 (US EPA, 2019) was not used as a source of BCFs because inorganic compounds are outside the estimation domain of the program.

Table 3.6 Risk Evaluation for Recreators Exposed to Surface Water

COI	Maximum Surface Water Concentration		HTC for Water and Fish	HTC for Water Only	HTC for Fish Only	COPC	
	Modeled	Measured[a]				Based on Modeled Concentrations	Based on Measured Concentrations
Total Metals (mg/L)							
Arsenic	5.1E-09	2.5E-03	0.022	2.0	0.023	No	No
Barium	4.5E-07	8.0E-02	1.5	400	1.5	No	No
Beryllium	8.9E-10	NR	0.021	0.80	0.021	No	NA
Boron	6.3E-07	9.7E-02	467	1,400	700	No	No
Cadmium	2.1E-10	2.3E-04	0.0018	1.0	0.0019	No	No
Chromium	3.1E-08	7.3E-03	0.61	20	0.63	No	No
Cobalt	1.5E-08	NR	0.0035	2.1	0.0035	No	NA
Lead	1.4E-08	4.9E-03	0.015	0.015	0.015	No	No
Lithium	4.4E-08	NR	4.7	14	7.0	No	NA
Mercury	9.4E-11	1.5E-05	0.000053	0.40	0.000053	No	No
Thallium	1.4E-10	NR	0.0017	0.40	0.0017	No	NA
Radionuclides (pCi/L)							
Radium-226+228	1.2E-06	NR	1,000	1,000	87,413	No	NA
Other (mg/L)							
Chloride	4.3E-05	1.0E+02	NA	NA	NA	NA	NA
Fluoride	5.3E-07	2.3E-01	143	800	174	No	No
Sulfate	3.0E-05	6.5E+01	NA	NA	NA	NA	NA

Notes:

COI = Constituent of Interest; COPC = Constituent of Potential Concern; HTC = Human Threshold Criteria; NA = Not Analyzed or Not Applicable; NR = Not Reported; pCi/L = PicoCuries Per Liter.

(a) Measured concentrations are shown only for COIs. Measured surface water concentrations may be different from modeled concentrations because measured data include the effects of background and other industrial sources. Modeled concentrations only represent the potential effect on surface water quality resulting from the measured groundwater concentrations.

3.4.2 Recreators Exposed to Sediment

Recreational exposure to sediment may occur during boating and swimming activity along the Illinois River; exposure to sediment may occur through incidental ingestion and dermal contact.

Screening Exposures: COIs in impacted groundwater flowing into the river can sorb to sediments. In the absence of sediment data, sediment concentrations were modeled using maximum detected groundwater concentrations.

Screening Benchmarks: There are no established recreator RSLs that are protective of recreational exposures to sediment (US EPA, 2021b). Therefore, benchmarks that are protective of recreational exposures to sediment *via* incidental ingestion and dermal contact were calculated using US EPA's RSL guidance (US EPA, 2021b). These benchmarks were calculated using the recommended assumptions (*i.e.*, oral bioavailability, body weights, averaging time) and toxicity reference values (*i.e.*, RfD and cancer slope factor [CSF]), with the following changes: Recreators were assumed to be exposed to sediment while recreating 60 days a year (or two weekend days per week for 30 weeks a year, from April to October). The exposure duration was assumed for a child 6 years of age and an adult 20 years of age, per US EPA guidance (Stalcup, 2014). The daily recommended residential soil ingestion rates of 200 mg/day for a child and 100 mg/day for an adult are based on an all-day exposure to residential soils (Stalcup, 2014; US EPA,

2011b). Since recreational exposures to sediment are assumed to occur for less than four hours per day, one-third of the daily residential soil ingestion (67 mg/day for a child and 33 mg/day for an adult) was used as a conservative assumption. For dermal exposures, recreators were assumed to be exposed to sediment on their lower legs and feet (1,026 cm^2 for the child and 3,026 cm^2 for the adult, based on the age-weighted surface areas reported in US EPA, 2011b). While other body parts may be exposed to sediment, the contact time will likely be very short, as the sediment would wash off in the surface water. Gradient used US EPA's recommended adherence factor of 0.2 mg/cm^2 based on child exposure to wet soil (US EPA, 2004; Stalcup, 2014), which was used in the US EPA RSL User's Guide for a child recreator exposed to soil or sediment (US EPA, 2021b). The sediment screening benchmarks were calculated based on a target hazard quotient of 1, or a target cancer risk of $1x10^{-5}$. Appendix B, Table B.2 presents the calculation of screening benchmarks protective of recreational exposures to sediment. A recreator sediment screening benchmark for radium-226+228 was based on soil Preliminary Remediation Goals (PRGs) calculated for radium-226 and radium-228 using US EPA's PRG calculator (US EPA, 2020). The lower of the two values was used as the recreator sediment screening benchmark for radium-226+228 (Appendix B, Table B.3).

Screening Risk Evaluation: The modeled sediment concentrations were well below the recreational sediment screening benchmarks (Table 3.7). Therefore, exposure to sediment is not expected to pose an unacceptable risk to recreators while swimming or boating.

Table 3.7 Risk Evaluation for Recreators Exposed to Sediment

COI[a]	Modeled Sediment Concentration (mg/kg)	Recreator Sediment Screening Benchmark (mg/kg)	COPC
Total Metals (mg/kg)			
Arsenic	6.9E-07	6.8E+01	No
Barium	6.9E-05	2.7E+05	No
Beryllium	2.1E-07	2.7E+03	No
Boron	2.2E-06	2.7E+05	No
Chromium	1.7E-04	2.1E+06	No
Cobalt	2.5E-06	4.1E+02	No
Lead	1.0E-05	4.0E+02	No
Lithium	(a)	2.7E+03	NA
Thallium	1.2E-09	1.4E+01	No
Radionuclides (pCi/kg)			
Radium-226+228	5.0E-03	7.9E+03	No
Other (mg/kg)			
Fluoride	8.3E-05	5.5E+04	No

Notes:
COI = Constituent of Interest; COPC = Constituent of Potential Concern; K_d = Equilibrium Partition Coefficient; NA = Not Applicable; pCi/kg = PicoCuries Per Kilogram.
(a) Lithium does not readily sorb to soil or sediment particles; a K_d value of 0 was used for the modeling.

3.5 Ecological Risk Evaluation

Based on the ecological CEM (Figure 3.3), ecological receptors could be exposed to surface water and dietary items (*i.e.*, prey and plants) potentially impacted by identified COIs (barium, boron, cadmium, chromium, cobalt, lead, lithium, mercury, radium-226+228, chloride, and fluoride).

3.5.1 Ecological Receptors Exposed to Surface Water

Screening Exposures: The ecological evaluation considered aquatic communities in the Illinois River potentially impacted by identified ecological COIs. Measured and modeled surface water concentrations were compared to risk-based ecological screening benchmarks.

Screening Benchmarks: Surface water screening benchmarks protective of aquatic life were obtained from the following hierarchy of sources:

- IEPA SWQS (IEPA, 2019), regulatory standards that are intended to protect aquatic life exposed to surface water on a long-term basis (*i.e.*, chronic exposure). For cadmium, the surface water benchmark is hardness dependent and calculated using a default hardness of 100 mg/L (US EPA, 2022).[6]
- US EPA Region IV (2018) surface water ESVs for hazardous waste sites.
- US DOE benchmarks from the guidance document, "A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota" (US DOE, 2019).

Risk Evaluation: The maximum measured or modeled COI concentrations in surface water were compared to the benchmarks protective of aquatic life (Table 3.8). The modeled surface water concentrations were below their respective benchmarks. In the measured data, iron, nickel, and zinc were slightly above their respective benchmarks (Table 3.8); however, they were not retained as COPCs. The measured concentrations for these three constituents are likely reflective of background concentrations in the Illinois River, as opposed to the AP, because they are all naturally occurring constituents that are not commonly associated with CCR (*i.e.*, none of the three constituents are listed in Appendix IV of the Federal CCR Rule [US EPA, 2015a]). Furthermore, the exceedance ratios (measured concentration divided by the benchmark) were very low for nickel (1.2) and zinc (1.03), thus, they are not expected to present an ecological risk. Iron was detected at 4.2 mg/L, *versus* an ecological benchmark of 1 mg/L; however, iron is ubiquitous in the environment and is not characteristic of impacts from CCR impoundments. Thus, none of the COIs evaluated are expected to pose an unacceptable risk to aquatic life in the Illinois River.

[6] Conservatisms associated with using a default hardness value are discussed in Section 3.6.

Table 3.8 Risk Evaluation of Ecological Receptors Exposed to Surface Water

COI	Maximum Surface Water Concentration		Ecological Freshwater Benchmark	Basis	COPC	
	Modeled	Measured			Based on Modeled Concentrations	Based on Measured Concentrations
Total Metals (mg/L)						
Barium	4.5E-07	8.0E-02	5.0	IEPA (2019)	No	No
Boron	6.3E-07	9.7E-02	7.6	IEPA (2019)	No	No
Cadmium	2.1E-10	2.3E-04	0.00093	IEPA (2019)	No	No
Chromium	3.1E-08	7.3E-03	0.18	IEPA (2019)	No	No
Cobalt	1.5E-08	NA	0.019	US EPA R4 (2018)	No	NA
Lead	1.4E-08	4.9E-03	0.016	IEPA (2019)	No	No
Lithium	4.4E-08	NA	0.44	US EPA R4 (2018)	No	NA
Mercury	9.4E-11	1.5E-05	0.0011	IEPA (2019)	No	No
Thallium	1.4E-10	NA	0.0060	US EPA R4 (2018)	No	NA
Radionuclides (pCi/L)						
Radium-226+228	1.2E-06	NA	3.4	US DOE (2019)	No	NA
Other (mg/L)						
Chloride	4.3E-05	1.0E+02	230	US EPA R4 (2018)	No	No
Fluoride	5.3E-07	2.3E-01	2.7	US EPA R4 (2018)	No	No

Notes:
COI = Constituent of Interest; COPC = Constituent of Potential Concern; IEPA = Illinois Environmental Protection Agency; NA =Not Analyzed or Not Applicable; pCi/L = PicoCuries Per Liter; US DOE = United States Department of Energy; US EPA R4 = United States Environmental Protection Agency Region IV.

3.5.2 Ecological Receptors Exposed to Sediment

Screening Exposures: COIs in impacted groundwater flowing to the Illinois River can sorb to sediments *via* chemical partitioning. In the absence of sediment data, sediment concentrations were modeled using maximum detected groundwater concentrations. Therefore, the modeled COI sediment concentrations reflect the potential maximum Site-related sediment concentration from groundwater.

Screening Benchmarks: Sediment screening benchmarks were obtained from US EPA Region IV (2018). The majority of the sediment ESVs are based on threshold effect concentrations (TECs) from MacDonald *et al.* (2000), which provide consensus values that identify concentrations below which harmful effects on sediment-dwelling organisms are unlikely to be observed. In the absence of an ESV for radium-226+228, a sediment screening value of 90,000 pCi/kg was used, based on the biota concentration guide (BCG) for radium-228 (US DOE, 2019).[7] The no observed effect concentration (NOEC) of 38 mg/kg was used as a conservative benchmark for boron in the absence of an ESV (ECHA, 2019). Lithium, chloride, and fluoride are not expected to sorb to sediment; therefore, risk to ecological receptors exposed to sediment was not evaluated for these constituents. The benchmarks used in this evaluation are listed in Table 3.9.

Screening Risk Results: The maximum modeled COI sediment concentrations were below their respective sediment screening benchmarks (Table 3.9). The modeled sediment concentrations attributed to potential contributions from Site groundwater for all COIs were less than 1% of the sediment screening benchmark. Therefore, the modeled sediment concentrations attributed to potential contributions from Site groundwater are not expected to significantly contribute to ecological exposures in the Illinois River adjacent to the Site.

[7] The biota concentration guide (BCG) for sediment is 90 pCi/g for Ra-228 and 100 pCi/g for Ra-226; the lower of the two values was used for Ra-226+228 and converted to pCi/kg (US DOE, 2019).

Table 3.9 Risk Evaluation of Ecological Receptors Exposed to Sediment

COI	Modeled Sediment Concentration	ESV[a]	COPC	% of Benchmark
Total Metals (mg/kg)				
Barium	6.9E-05	20	No	0.00035%
Boron	2.2E-06	38[b]	No	0.000006%
Cadmium	4.5E-08	0.99	No	0.000005%
Chromium	1.7E-04	43	No	0.0004%
Cobalt	2.5E-06	50	No	0.000005%
Lead	1.0E-05	35.8	No	0.00003%
Lithium	-	-	-	-
Mercury	3.4E-07	0.18	No	0.0002%
Radionuclides (pCi/kg)				
Radium-226+228	5.0E-03	90,000[c]	No	0.0000056%
Other (mg/kg)				
Chloride	-	-	-	-
Fluoride	8.3E-05	NA	No	-

Notes:
COI = Constituent of Interest; COPC = Constituent of Potential Concern; ESV = Ecological Screening Value; NA = Not Available; NOEC = No Observed Effect Concentration; pCi/kg = PicoCuries Per Kilogram; US DOE = United States Department of Energy; US EPA = United States Environmental Protection Agency.
(a) ESV from US EPA Region IV (2018).
(b) NOEC of 38 mg/kg was used as a conservative benchmark for boron in the absence of an ESV (ECHA, 2019).
(c) ESV from US DOE (2019); value converted from 90 pCi/g to 90,000 pCi/kg.

3.5.3 Ecological Receptors Exposed to Bioaccumulative Constituents of Interest

Screening Exposures: COIs with bioaccumulative properties can impact higher-trophic-level wildlife exposed to these COIs *via* direct exposures (surface water and sediment exposure) and secondary exposures through the consumption of dietary items (*e.g.*, plants, invertebrates, small mammals, and fish).

Screening Benchmark: US EPA Region IV (2018) guidance and IEPA's SWQS (IEPA, 2019) guidance were used to identify constituents with potential bioaccumulative effects.

Risk Evaluation: With the exception of mercury, the ecological COIs (barium, boron, cadmium, chromium, cobalt, lead, lithium, radium-226+228, chloride, and fluoride) were not identified as having potential bioaccumulative effects. Therefore, these COIs are not considered to pose an ecological risk *via* bioaccumulation. IEPA (2019) identifies mercury as the only metal with bioaccumulative properties. US EPA Region IV (2018) also identifies mercury (including methyl mercury) as having potential bioaccumulative effects.[8]

The modeled mercury concentration in surface water (9.4×10^{-11} mg/L) was below the mercury surface water ESV for wildlife (1.3×10^{-6} mg/L), and the modeled mercury concentration in sediment (3.4×10^{-7} mg/kg) was below the sediment ESV for wildlife (0.18 mg/kg) (US EPA Region IV, 2018). Both the modeled surface water and sediment concentrations were below benchmarks protective of receptors

[8] US EPA Region IV (2018) identifies selenium as having potential bioaccumulative effects. Although selenium was detected in groundwater, it was not considered an ecological COI.

accounting for bioaccumulative properties. Therefore, in addition to not posing an ecological risk from direct toxicity, mercury does not pose a risk from bioaccumulation exposures.

3.6 Uncertainties and Conservatisms

A number of uncertainties and their potential impact on the risk evaluation are discussed below. Wherever possible, conservative assumptions were used in an effort to minimize uncertainties and overestimate rather than underestimate risks.

Exposure Estimates:

- The risk evaluation included the IL Part 845.600 constituents detected in groundwater samples collected from wells associated with the AP. However, it is possible that not all of the detected constituents are related specifically to the AP.
- The human health and ecological risk characterizations were based on the maximum measured or modeled COI concentrations, rather than on averages. Thus, the variability in exposure concentrations was not considered. Assuming continuous exposure to the maximum concentration overestimates human and ecological exposures, given that receptors are mobile and concentrations change over time. For example, US EPA guidance states that risks should be estimated using average exposure concentrations as represented by the 95% upper confidence limit on the mean (US EPA, 1992). Given that exposure estimates based on the maximum concentrations did not exceed risk benchmarks, Gradient has greater confidence that there is no risk concern.
- Only constituents detected in groundwater were used to identify COIs and model COI concentrations in surface water and sediment. For the constituents that were not detected in the AP groundwater, the detection limits were below the IL Part 845.600 GWPS and, thus, do not require further evaluation.
- COI concentrations in surface water were modeled using the maximum detected total COI concentrations in groundwater. Modeling surface water concentrations using total metal concentrations may overestimate surface water concentrations because dissolved concentrations, which are lower than total concentrations, represent the mobile fractions of constituents that could likely flow to and mix with surface water.
- The COIs identified in this evaluation also occur naturally in the environment. Contributions to exposure from natural or other non-AP-related sources were not considered in the evaluation of modeled concentrations; only exposure contributions potentially attributable to Site groundwater mixing with surface water were evaluated. While not quantified, exposures from potential AP-related groundwater contributions are likely to represent only a small fraction of the overall human and ecological exposure to COIs that also have natural or non-AP-related sources.
- Screening benchmarks for human health were developed using exposure inputs based on US EPA's recommended values for reasonable maximum exposure (RME) assessments (Stalcup, 2014). RME is defined as "the highest exposure that is reasonably expected to occur at a site but that is still within the range of possible exposures" (US EPA, 2004). US EPA states the "intent of the RME is to estimate a conservative exposure case (*i.e.*, well above the average case) that is still within the range of possible exposures" (US EPA, 1989). US EPA also notes that this high-end exposure "is the highest dose estimated to be experienced by some individuals, commonly stated as approximately equal to the 90th percentile exposure category for individuals" (US EPA, 2015b). Thus, most individuals will have lower exposures than those presented in this risk assessment.

Toxicity Benchmarks:

- Screening-level ecological benchmarks were compiled from IEPA and US EPA guidance and designed to be protective of the majority of Site conditions, leaving the option for Site-specific refinement. In some cases, these benchmarks may not be representative of the Site-specific conditions or receptors found at the Site, or may not accurately reflect concentration-response relationships encountered at the Site. For example, the ecological benchmark for cadmium is hardness dependent. Gradient relied on US EPA's default hardness of 100 mg/L due to the lack of hardness data from the Illinois River adjacent to the Site. However, United States Geological Survey (USGS) data from Hennepin, Illinois, (approximately 55 miles upstream of the Site) reported hardness ranging from 200 to 370 mg/L, with a mean of 288 mg/L, based on samples collected in 1980-1997 (USGS, 2021). Increasing the hardness from 100 to 288 mg/L would increase the cadmium SWQS because benchmarks increase (become less stringent) with higher levels of hardness. Regardless of the hardness, the maximum modeled cadmium concentration is orders of magnitude below the SWQS.
- In addition, for the ecological evaluation, Gradient conservatively assumed all constituents to be 100% bioavailable. Modeled COI concentrations in surface water are considered total COI concentrations. US EPA recommends using dissolved metals as a measure of exposure to ecological receptors because it represents the bioavailable fraction of metal in water (US EPA, 1993). Therefore, the modeled surface water COI concentrations may be an overestimation of exposure concentrations to ecological receptors.
- In general, it is important to appreciate that the human health toxicity factors used in this risk evaluation are developed to account for uncertainties, such that safe exposure levels used as benchmarks are often many times lower (even orders of magnitude lower) than the levels that cause effects that have been observed in human or animal studies. For example, toxicity factors incorporate a 10-fold safety factor to protect sensitive subpopulations. This means that a risk exceedance does not necessarily equate to actual harm.

4 Summary and Conclusions

A screening-level risk evaluation was performed for Site-related constituents in groundwater at the EPP in Peoria County, Illinois, between Mapleton and Bartonville. The CSM developed for the Site indicates that groundwater beneath the AP flows into the Illinois River adjacent to the Site and may potentially impact surface water and sediment.

CEMs were developed for human and ecological receptors. The complete exposure pathways for humans include recreators in the Illinois River who are exposed to surface water and sediment (boaters and swimmers) and anglers who consume locally caught fish. Based on the local hydrogeology, residential exposure to groundwater used for drinking water or irrigation is not a complete pathway and was not evaluated. The complete exposure pathways for ecological receptors include aquatic life (including aquatic and marsh plants, amphibians, reptiles, and fish) exposed to surface water; benthic invertebrates exposed to sediment; and avian and mammalian wildlife exposed to bioaccumulative COIs in surface water, sediment, and dietary items.

Groundwater data collected from 2015 to 2021 were used to estimate exposures, and data from the one available surface water sample was also evaluated. For groundwater constituents retained as COIs, surface water and sediment concentrations were modeled using the maximum detected groundwater concentration. Surface water and sediment exposure estimates were screened against benchmarks protective of human health and ecological receptors for this risk evaluation.

US EPA has established acceptable risk metrics. Risks above these US EPA-defined metrics are termed potentially "unacceptable risks." Based on the evaluation presented in this report, no unacceptable risks to human and ecological receptors resulting from CCR exposures associated with the AP were identified. This means that the risks from the Site are likely indistinguishable from normal background risks. Specific risk assessment results include the following:

- For recreators (boaters and swimmers) exposed to surface water, all COIs were below the conservative risk-based screening benchmarks. Therefore, none of the COIs evaluated in surface water are expected to pose an unacceptable risk to recreators boating or swimming in the Illinois River adjacent to the Site.
- For recreators exposed to sediment *via* incidental ingestion and dermal contact, the modeled sediment concentrations were below health-protective sediment benchmarks. Therefore, the modeled sediment concentration are not expected to pose an unacceptable risk to recreators exposed to sediment in the Illinois River adjacent to the Site.
- For anglers consuming locally caught fish, the modeled concentrations of all COIs in surface water (as well as the measured data) were below conservative benchmarks protective of fish consumption. Therefore, none of the COIs evaluated are expected to pose an unacceptable risk to recreators consuming fish caught in the Illinois River.
- Ecological receptors exposed to surface water include aquatic and marsh plants, amphibians, reptiles, and fish. The risk evaluation showed that none of the modeled or measured COIs in surface water exceeded protective screening benchmarks. Ecological receptors exposed to sediment include benthic invertebrates. The modeled sediment COIs did not exceed the conservative

screening benchmarks; therefore, none of the COIs evaluated in sediment are expected to pose an unacceptable risk to ecological receptors.

- Ecological receptors were also evaluated for exposure to bioaccumulative COIs. This evaluation considered higher-trophic-level wildlife with direct exposure to surface water and sediment and secondary exposure through the consumption of dietary items (*e.g.*, plants, invertebrates, small mammals, fish). Mercury was the only ecological COI identified as having potential bioaccumulative effects. However, the modeled concentrations did not exceed benchmarks protective of bioaccumulative effects. Therefore, mercury is not considered to pose an ecological risk *via* bioaccumulation. Overall, this evaluation demonstrated that none of the COIs evaluated are expected to pose an unacceptable risk to ecological receptors.

It should be noted that this evaluation incorporates a number of conservative assumptions that tend to overestimate exposure and risk. The risk evaluation was based on the maximum detected COI concentration; however, US EPA guidance states that risks should be based on a representative average concentration such as the 95% upper confidence limit on the mean; thus, using the maximum concentration tends to overestimate exposure. Although the COIs identified in this evaluation also occur naturally in the environment, the contributions to exposure from natural background sources and nearby industry were not considered; thus, CCR-related exposures were likely overestimated. Exposure estimates assumed 100% metal bioavailability, which likely results in overestimates of exposure and risks. Exposure estimates were based on inputs to evaluate the "reasonable maximum exposure"; thus, most individuals will have lower exposures than those estimated in this risk assessment.

Finally, it should be noted that because current conditions do not present a risk to human health or the environment, there will also be no unacceptable risk to human health or the environment for future conditions when the AP is closed. For all future closure scenarios, potential releases of CCR-related constituents will decline over time and, consequently, potential exposures to CCR-related constituents in the environment will also decline.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2010. "Toxicological Profile for Boron." November. Accessed at http://www.atsdr.cdc.gov/ToxProfiles/tp26.pdf.

Bist LLC. 2022. "Illinois River bathymetry map." Accessed at https://fishing-app.gpsnauticalcharts.com/i-boating-fishing-web-app/fishing-marine-charts-navigation.html#15.68/40.5926/-89.6608.

Burns McDonnell. 2021. "Initial Operating Permit, Edwards Power Plant Ash Pond." Report to Illinois Power Resources Generating, LLC (Collinsville, IL) Submitted to Illinois Environmental Protection Agency (IEPA). 1278p. October 25.

Eastep, LW. [Illinois Environmental Protection Agency (IEPA)]. 2003. "Letter to G. Brown and D. Klein (Cargill Marine and Terminal, Inc./Pekin) [re: No Further Remediation Determination for Cargill Fertilizer, Inc. Remediation Site, Bartonville, IL]." Submitted to Illinois, Peoria County. 8p. August 12.

European Chemicals Agency (ECHA). 2019. "Ecotoxicological information: Sediment toxicity: 001 Weight of evidence." In REACH dossier for Boron (CAS No. 7740-42-8). Accessed at https://echa.europa.eu/registration-dossier/-/registered-dossier/14776/6/3.

European Chemicals Agency (ECHA). 2020a. "REACH dossier for boron (CAS No. 7440-42-8)." Accessed at https://echa.europa.eu/registration-dossier/-/registered-dossier/14776.

European Chemicals Agency (ECHA). 2020b. "REACH dossier for lithium (CAS No. 7439-93-2)." Accessed at https://echa.europa.eu/registration-dossier/-/registered-dossier/14178.

Foth Infrastructure & Environment, LLC (Peoria, IL). 2017. "Antidegradation Alternatives Analysis, Dynegy Midwest Generation, LLC Edwards Power Station, Bartonville, Illinois (NPDES Permit IL0001970) (Draft)." Report to Dynegy Midwest Generation, LLC (Collinsville, IL) 60p. May.

Google, LLC. 2022. "Google Earth Pro." Accessed at https://www.google.com/earth/versions/#earth-pro.

Hahn, M. 2020. Prefiled Responses of Dr. Melinda Hahn. In the Matter of Standards For The Disposal Of Coal Combustion Residuals In Surface Impoundments: Proposed New 35 Ill. Adm. Code 845. September 24.

Hanson Professional Services, Inc. 2019. "Antidegradation Assessment for Management of Waters from Closure and Post-Closure Care of Ash Ponds, Vermilion Site, Dynegy Midwest Generation, LLC, NPDES Permit No. IL0004057." Report to Dynegy Midwest Generation, LLC (Collinsville, IL). June 1.

Illinois Environmental Protection Agency (IEPA). 2013. "Title 35: Environmental Protection, Subtitle F: Public Water Supplies, Chapter I: Pollution Control Board, Part 620: Ground Water Quality." Accessed at https://www.ilga.gov/commission/jcar/admincode/035/035006200D04200R.html.

Illinois Environmental Protection Agency (IEPA). 2018. "Illinois Integrated Water Quality Report and Section 303(d) List, 2018 (Draft)." November 14.

Illinois Environmental Protection Agency (IEPA). 2019. "Title 35: Environmental Protection, Subtitle C: Water Pollution, Chapter I: Pollution Control Board, Part 302: Water Quality Standards." Accessed at https://www.epa.gov/sites/production/files/2019-11/documents/ilwqs-title35-part302.pdf.

Illinois Environmental Protection Agency (IEPA). 2021a. "Standards for the disposal of coal combustion residuals in surface impoundments." Accessed at https://www.ilga.gov/commission/jcar/admincode/035/03500845sections.html.

Illinois Environmental Protection Agency (IEPA), Bureau of Water. 2021b. "Illinois Integrated Water Quality Report and Section 303(d) List, 2018 (Final)." 83p. February. Accessed at https://www2.illinois.gov/epa/topics/water-quality/watershed-management/tmdls/Pages/303d-list.aspx.

Illinois State Geological Survey (ISGS). 1968. Water Well Driller's Log. Permit Date: January 1, 1968. Permit No. NF3700. Accessed at https://isgs-oas.isgs.illinois.edu/reports/rwservlet?watersummary&121430133300.

Illinois State Geological Survey (ISGS). 1969. Water Well Driller's Log. Permit Date: December 9, 1969. Permit No. NF7549. Accessed at https://isgs-oas.isgs.illinois.edu/reports/rwservlet?watersummary&121430151500.

Illinois State Geological Survey (ISGS). 1978. Water Well Driller's Log. Permit Date: August 8, 1978. Permit No. 77945. Accessed at https://isgs-oas.isgs.illinois.edu/reports/rwservlet?watersummary&121432221000.

Illinois State Geological Survey (ISGS). 1987. Water Well Driller's Log. Permit Date: September 17, 1987. Permit No. 135221. Accessed at https://isgs-oas.isgs.illinois.edu/reports/rwservlet?watersummary&121432356000.

Illinois State Geological Survey (ISGS). 2001. Water Well Driller's Log. Permit Date: July 2, 2001. Accessed at https://isgs-oas.isgs.illinois.edu/reports/rwservlet?watersummary&121433424000.

Illinois State Geological Survey (ISGS). 2017. Water Well for Commercial Operation, Driller's Log. Permit Date: October 2, 2017. Permit No. 143-025.

Illinois State Geological Survey (ISGS). 2020. "Illinois Water Well (ILWATER) Interactive Map." December 31. Accessed at https://prairie-research.maps.arcgis.com/apps/webappviewer/index.html?id=e06b64ae0c814ef3a4e43a191cb57f87.

Illinois State Water Survey (ISWS). 2022. "Illinois water supply planning: Middle Illinois region." Accessed at https://www.isws.illinois.edu/illinois-water-supply-planning/middle-illinois-basin.

MacDonald, DD; Ingersoll, CG; Berger, TA. 2000. "Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems." *Arch. Environ. Contam. Toxicol.* 39:20-31. doi: 10.1007/s002440010075.

Oak Ridge National Laboratory (ORNL). 2018. "Risk Assessment Information System (RAIS) Toxicity Values and Chemical Parameters: Chemical Toxicity Values." Accessed at https://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chem.

Oak Ridge National Laboratory (ORNL) (Oak Ridge, TN). 2020. "Risk Assessment Information System (RAIS) Toxicity Values and Physical Parameters Search." Accessed at https://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chem.

Ramboll. 2021. "Hydrogeologic Site Characterization Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois." Report to Illinois Power Resources Generating, LLC. 733p. October 25.

Ramboll. 2022a. "Groundwater Modeling Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois (Final)." Report to Illinois Power Resources Generating, LLC.

Ramboll. 2022b. "Well Survey Results, Ash Pond, Edward Power Plant, Bartonville, Illinois (Draft)." 1p. March 28.

Stalcup, D. 2014. Memorandum to Superfund National Policy Managers, Regions 1-10 re: Human Health Evaluation Manual, Supplemental Guidance: Update of standard default exposure factors. US EPA, Office of Solid Waste and Emergency Response (OSWER), OSWER Directive 9200.1-120, February 6. Accessed at https://www.epa.gov/sites/production/files/2015-11/documents/oswer_directive_9200.1-120_exposurefactors_corrected2.pdf.

US Dept. of Energy (US DOE). 2019. "A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota." DOE-STD-1153-2019. Accessed at https://www.standards.doe.gov/standards-documents/1100/1153-astd-2019/@@images/file.

US EPA. 1989. "Risk Assessment Guidance for Superfund (RAGS). Volume I: Human Health Evaluation Manual (Part A) (Interim final)." Office of Emergency and Remedial Response, NTIS PB90-155581, EPA-540/1-89-002, December.

US EPA. 1992. "Risk Assessment Guidance for Superfund: Supplemental Guidance to RAGS: Calculating the Concentration Term." Office of Emergency and Remedial Response, OSWER Directive 9285.7-08I, NTIS PB92-963373, May.

US EPA. 1993. Memorandum to US EPA Directors and Regions re: Office of Water policy and technical guidance on interpretation and implementation of aquatic life metals criteria. Office of Water, EPA-822-F93-009, October 1.

US EPA. 1998. "Methodology for assessing health risks associated with multiple pathways of exposure to combustor emissions." National Center for Environmental Assessment (NCEA) (Cincinnati, OH), EPA 600/R-98/137., December. Accessed at http://www.epa.gov/nceawww1/combust.htm.

US EPA. 2001. "Radionuclide Table: Radionuclide Carcinogenicity – Slope Factors (Federal Guidance Report No. 13 Morbidity Risk Coefficients, in Units of Picocuries)." Health Effects Assessment Summary Tables (HEAST) 72p. Accessed at https://www.epa.gov/radiation/radionuclide-table-radionuclide-carcinogenicity-slope-factors.

US EPA. 2002. "National Recommended Water Quality Criteria (NRWQC): 2002. Human Health Criteria Calculation Matrix." Office of Water, EPA-822-R-02-012, November.

US EPA. 2004. "Risk Assessment Guidance for Superfund (RAGS). Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) (Final)." Office of Superfund Remediation and Technology Innovation, EPA/540/R/99/005, OSWER 9285.7-02EP; PB99-963312, July. Accessed at http://www.epa.gov/oswer/riskassessment/ragse/pdf/part_e_final_revision_10-03-07.pdf.

US EPA. 2011a. "IRIS Glossary." August 31. Accessed at https://ofmpub.epa.gov/sor_internet/registry/termreg/searchandretrieve/glossariesandkeywordlists/search.do?details=&glossaryName=IRIS%20Glossary#formTop.

US EPA. 2011b. "Exposure Factors Handbook: 2011 Edition." Office of Research and Development, US EPA, National Center for Environmental Assessment (NCEA) EPA/600/R-090/052F. September. Accessed at https://www.epa.gov/expobox/about-exposure-factors-handbook.

US EPA. 2014. "Human and Ecological Risk Assessment of Coal Combustion Residuals (Final)." Office of Solid Waste and Emergency Response (OSWER), Office of Resource Conservation and Recovery, December. Accessed at http://www.regulations.gov/#!documentDetail;D=EPA-HQ-RCRA-2009-0640-11993.

US EPA. 2015a. "Hazardous and solid waste management system; Disposal of coal combustion residuals from electric utilities (Final rule)." *Fed. Reg.* 80(74):21302-21501, 40 CFR 257, 40 CFR 261, April 17.

US EPA. 2015b. "Conducting a Human Health Risk Assessment." October 14. Accessed at http://www2.epa.gov/risk/conducting-human-health-risk-assessment#tab-4.

US EPA. 2015c. "Human Health Ambient Water Quality Criteria: 2015 Update." Office of Water, EPA 820-F-15-001. June.

US EPA. 2018. "Waterbody Report: Illinois River (Assessment Unit ID: IL_D-05)." Accessed at https://mywaterway.epa.gov/waterbody-report/IL_EPA/IL_D-05/2018.

US EPA. 2019. "EPI Suite™ - Estimation Program Interface." March 12. Accessed at https://www.epa.gov/tsca-screening-tools/epi-suitetm-estimation-program-interface.

US EPA. 2020. "Preliminary Remediation Goals for Radionuclides (PRG): PRG Calculator." Accessed at https://epa-prgs.ornl.gov/cgi-bin/radionuclides/rprg_search. July 24.

US EPA. 2021a. "Secondary drinking water standards: Guidance for nuisance chemicals." January 7. Accessed at https://www.epa.gov/sdwa/secondary-drinking-water-standards-guidance-nuisance-chemicals.

US EPA. 2021b. "Regional Screening Levels (RSLs) - User's Guide." 82p. November. Accessed at https://www.epa.gov/risk/regional-screening-levels-rsls-users-guide.

US EPA. 2021c. "Regional Screening Level (RSL) Summary Table (TR=1E-06, HQ=1)." 11p. November. Accessed at https://semspub.epa.gov/work/HQ/401635.pdf.

US EPA. 2022. "National Recommended Water Quality Criteria [NRWQC] - Aquatic Life Criteria Table." Accessed at https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table. January 6.

US EPA Region IV. 2018. "Region 4 Ecological Risk Assessment Supplemental Guidance (March 2018 Update)." Superfund Division, Scientific Support Section. March. Accessed at https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf.

US Geological Survey (USGS). 2017. USGS Topographic Basemap. December 15. Accessed at https://www.arcgis.com/home/item.html?id=2b01e4b6aaa84f439ebe62c830f39780

US Geological Survey (USGS). 2021. "Streamgage data for Illinois River at Hennepin, IL [USGS 05556200] [Summary of all available data]." Accessed at https://waterdata.usgs.gov/il/nwis/inventory/?site_no=05556200&

US Geological Survey (USGS). 2022. "Discharge data for Illinois River at Kingston Mines, IL (2015-2022) [USGS 05568500] [Daily data]." In National Water Information System Web Interface. Accessed at https://waterdata.usgs.gov/usa/nwis/uv?site_no=05568500.

Appendix A

Surface Water and Sediment Modeling

Gradient modeled concentrations in river surface water and sediment based on available groundwater data. First, we estimated the flow rate of constituents of interest (COIs) discharged to the Illinois River *via* groundwater. Then, we adapted United States Environmental Protection Agency (US EPA) indirect exposure assessment methodology (US EPA, 1998) in order to model surface water and sediment water concentrations in the Illinois River.

Model Overview

The groundwater flow to the river is represented by a one-dimensional, steady-state model. In this model, the groundwater plume migrates horizontally in the Uppermost Aquifer (UA) prior to flowing to the Illinois River. The groundwater flow entering the river is the flow going through a cross-sectional area that has a length equal to the Edwards Ash Pond (AP) and a width equal to the maximum saturated thickness of the UA. It was assumed that all the groundwater flowing through the UA would ultimately discharge to the Illinois River. The length of groundwater discharge zone was estimated using Google Earth Pro (Google, LLC, 2022).

The groundwater flow to the Illinois River mixes with the surface water in the river. The COIs entering the river *via* groundwater can dissolve into the water column, sorb to suspended sediments, or sorb to benthic sediments. Using US EPA's indirect exposure assessment methodology (US EPA, 1998), the model evaluates the surface water and sediment concentrations at a location downstream of the groundwater discharge, assuming a well-mixed water column.

Groundwater Discharge Rate

The groundwater discharge rate was evaluated using conservative assumptions. Gradient conservatively assumed that the groundwater concentrations were uniformly equal to the maximum detected concentration for each individual COI. Further, Gradient ignored adsorption by subsurface soil and assumed that all the groundwater flowing through the UA was discharged into the river.

For each groundwater unit, the groundwater flow rate into the river was derived using Darcy's Law:

$$Q = K \times i \times A$$

where:

Q = Groundwater flow rate (m^3/s)
K = Hydraulic conductivity (m/s)
i = Hydraulic gradient (m/m)
A = Cross-sectional area (m^2)

For each COI, the mass discharge rate into the river was then calculated by:

$$m_c = C_c \times Q \times CF$$

where:

m_c = Mass discharge rate of the COI (mg/year)
C_c = Maximum groundwater concentration of the COI in milligrams per liter (mg/L)
Q = Groundwater flow rate (m^3/s)
CF = Conversion factors: 1,000 L/m^3; 31,557,600 s/year

The values of the aquifer parameters used for these calculations are provided in Table A.1. The calculated mass discharge rates were then used as inputs for the surface water and sediment partitioning model.

The cross-sectional area for the UA was 1,277 m^2. The length of the discharge zone was estimated to be equal to the length of the AP (*i.e.*, approximately 1,047 m). The height of the discharge zone was assumed to be the maximum thickness of the UA (1.22 m) (Burns McDonnell, 2021). The hydraulic gradient was 0.004 m/m, based on the maximum average horizontal hydraulic gradient determined for the UA (Burns McDonnell, 2021). The hydraulic conductivity of the UA was 0.00017 cm/s, based on the geometric mean horizontal hydraulic conductivity for all UA wells (Burns McDonnell, 2021).

Surface Water and Sediment Concentration

Groundwater discharged into the river will be diluted in the surface water flow. Constituents transported by groundwater into the surface water migrate into the water column and the bed sediments. The surface water model we used to estimate the surface water and sediment concentrations is a steady-state model described in US EPA's indirect exposure assessment methodology (US EPA, 1998) and also used in US EPA's "Human and Ecological Risk Assessment of Coal Combustion Residuals [CCR]" (US EPA, 2014). This model describes the partitioning of constituents between surface water, suspended sediments, and benthic sediments based on equilibrium partition coefficients (K_d). It estimates the concentrations of constituents in surface water, suspended sediments, and benthic sediments at steady-state equilibrium at a theoretical location downstream of the discharge point after complete mixing of the water column. In our analysis, Gradient used the partitioning coefficients given in Table J-1 of the US EPA CCR Risk Assessment for all COIs (US EPA, 2014). These coefficients are presented in Table A.2.

To be conservative, Gradient assumed that the constituents were not affected by dissipation or degradation once they entered the water body. The total water body concentration of the COI was calculated as (US EPA, 1998):

$$C_{wtot} = \frac{m_c}{V_f \times f_{water}}$$

where:

C_{wtot} = Total water body concentration of the constituent (mg/L)
m_c = Mass discharge rate of the COI (mg/year)
V_f = Water body annual flow (L/year)
f_{water} = Fraction of COI in the water column (unitless)

For the Illinois River annual flow rate, Gradient conservatively used the low flow (10th percentile) discharge rate of about 5,946 cubic feet per second (cfs) or 5.3 x 10^{12} L/yr based on the daily mean discharge rates measured at United States Geological Survey (USGS) station at Kingston Mines, IL (USGS 05568500) between 2017 and 2021 (USGS, 2022). The surface water parameters are presented in Table A.3.

The fraction of COIs in the water column was calculated for each COI using the sediment/water and suspended solids/water partition coefficients (US EPA, 2014, Table J-1). The fraction of COIs in the water column is defined as (US EPA, 2014):

$$f_{water} = \frac{(1 + [K_{dsw} \times TSS \times 0.000001]) \times \frac{d_w}{d_z}}{\left([1 + (K_{dsw} \times TSS \times 0.000001)] \times \frac{d_w}{d_z}\right) + ([bsp + K_{dbs} \times bsc] \times \frac{d_b}{d_z})}$$

where:

K_{dsw}	=	Suspended sediment-water partition coefficient (mL/g)
K_{dbs}	=	Sediment-water partition coefficient (mL/g)
TSS	=	Total suspended solids in the surface water body (mg/L), set equal to 105 mg/L measured at the Illinois River inlet (Foth Infrastructure & Environment, LLC, 2017)
0.000001	=	Units conversion factor
d_w	=	Depth of the water column (m). The depth of the water column was estimated as 2.74 m, based on bathymetry data for the Illinois River (Bist LLC, 2022).
d_b	=	Depth of the upper benthic layer (m), set equal to 0.03 m (US EPA, 2014)
$d_z = d_w + d_b$	=	Depth of the water body (m)
bsp	=	Bed sediment porosity (unitless), set equal to 0.6 (US EPA, 2014)
bsc	=	Bed sediment particle concentration (g/cm^3), set equal to 1.0 g/cm^3 (US EPA, 2014)

The fraction of COIs dissolved in the water column (f_d) is calculated as (US EPA 2014):

$$f_d = \frac{1}{1 + K_{dsw} \times TSS \times 0.000001}$$

The values of the fraction of COIs in the water column and other calculated parameters are presented in Table A.4.

The total water column concentration (C_{wcTot}) of the COIs, comprising both the dissolved and suspended sediment phases, is then calculated as (US EPA, 2014):

$$C_{wcTot} = C_{wtot} \times f_{water} \times \frac{d_z}{d_w}$$

Finally, the dissolved water column concentration (C_{dw}) for the COIs is calculated as (US EPA, 2014):

$$C_{dw} = f_d \times C_{wcTot}$$

The dissolved water column concentration was then used to calculate the concentration of COIs sorbed to suspended solids in the water column (US EPA, 1998):

$$C_{sw} = C_{dw} \times K_{dsw}$$

where:

C_{sw}	=	Concentration sorbed to suspended solids (mg/kg)
C_{dw}	=	Concentration dissolved in the water column (mg/L)
K_{dsw}	=	Suspended solids/water partition coefficient (mL/g)

In the same way, using the total water body concentration and the fraction of COIs in the benthic sediments, the model derives the total concentration in benthic sediments (US EPA, 2014, Table J-1-12):

$$C_{bstot} = f_{benth} \times C_{wtot} \times \frac{d_z}{d_b}$$

where:

C_{bstot}	=	Total concentration in bed sediment (mg/L or g/m^3)
C_{wtot}	=	Total water body concentration of the constituent (mg/L)
f_{benth}	=	Fraction of contaminant in benthic sediments (unitless)
d_b	=	Depth of the upper benthic layer (m)
$d_z = d_w + d_b$	=	Depth of the water body (m)

This value can be used to calculate dry weight sediment concentration as follows:

$$C_{sed-dw} = \frac{C_{bstot}}{bsc}$$

where:

C_{sed-dw}	=	Dry weight sediment concentration (mg/kg)
C_{bstot}	=	Total sediment concentration (mg/L)
bsc	=	Bed sediment bulk density (used the default value of 1 g/cm^3 from US EPA, 2014)

The total sediment concentration is composed of the concentration dissolved in the bed sediment pore water (equal to the concentration dissolved in the water column) and the concentration sorbed to benthic sediments (US EPA, 1998).

The concentration sorbed to benthic sediments was calculated from (US EPA, 1998):

$$C_{sb} = C_{dbs} \times K_{dbs}$$

where:

C_{sb}	=	Concentration sorbed to bottom sediments (mg/kg)
C_{dbs}	=	Concentration dissolved in the sediment pore water (mg/L)
K_{dbs}	=	Sediments/water partition coefficient (mL/kg)

For each COI, the modeled total water column concentration, the modeled dry weight sediment concentration, and the modeled concentration sorbed to sediment are presented in Table A.5.

Table A.1 Parameters Used to Estimate Groundwater Discharge to Surface Water

Groundwater Unit	Parameter	Name	Value	Unit
UA	A	Cross-Sectional Area	1,277	m^2
UA	i	Hydraulic Gradient	0.004	m/m
UA	K	Hydraulic Conductivity	0.00017	cm/s

Notes:
Source: Hydraulic gradient and hydraulic conductivity values from Burns McDonnell (2021).
Cross-sectional area was estimated from Burns McDonnell (2021).
UA = Uppermost Aquifer.

Table A.2 Partition Coefficients

Constituent	Sediment-Water, Mean, K_{dbs}		Suspended Sediment-Water, Mean, K_{dsw}	
	Value (log_{10}) (mL/g)	Value (mL/g)	Value (log_{10}) (mL/g)	Value (mL/g)
Metals				
Arsenic	2.4	2.51E+02	3.9	7.94E+03
Barium	2.5	3.16E+02	4	1.00E+04
Beryllium	2.8	6.31E+02	4.2	1.58E+04
Boron	0.8	6.31E+00	3.9	7.94E+03
Cadmium	3.3	2.00E+03	4.9	7.94E+04
Chromium	4.9	7.94E+04	5.1	1.26E+05
Cobalt	3.1	1.26E+03	4.8	6.31E+04
Lead	4.6	3.98E+04	5.7	5.01E+05
Lithium	-	-	-	-
Mercury	4.9	7.94E+04	5.3	2.00E+05
Thallium	1.3	2.00E+01	4.1	1.26E+04
Radionuclides				
Radium-226+228	-	7.40E+03	-	7.40E+03
Other				
Chloride	-	-	-	-
Fluoride	2.2	1.58E+02	2.2	1.58E+02
Sulfate	-	-	-	-

Notes:
Source: US EPA (2014).
Lithium, chloride, and sulfate do not readily sorb to soils and sediments. Consequently, sediment concentrations were not modeled for these constituents (K_d was assumed to be 0).

Table A.3 Surface Water Parameters

Parameter	Name	Value	Unit
TSS	Total Suspended Solids	105	mg/L
V_{fx}	Surface Water Flow Rate	5.3×10^{12}	L/yr
d_b	Depth of Upper Benthic Layer (default)	0.03	m
d_w	Depth of Water Column	2.74	m
d_z	Depth of Water Body	2.77	m
bsc	Bed Sediment Bulk Density (default)	1	g/cm^3
bsp	Bed Sediment Porosity (default)	0.6	-
M_{TSS}	TSS Mass per Unit Area[a]	0.29	kg/m^2
M_S	Sediment Mass per Unit Area[b]	30	kg/m^2

Notes:
Source of default values: US EPA (2014).
Source of TSS data: Foth Infrastructure & Environment, LLC (2017).
(a) Determined by multiplying total suspended solids, TSS, by the depth of water column, d_w.
(b) Determined by multiplying depth of upper benthic layer, d_b, by the sediment bed particle concentration of 1 g/cm^3.

Table A.4 Calculated Parameters

COI	Fraction of Constituent in the Water Column f_{water}	Fraction of Constituent in the Benthic Sediments $f_{benthic}$	Fraction of Constituent Dissolved in the Water Column $f_{dissolved}$
Arsenic	0.400	0.600	0.545
Barium	0.372	0.628	0.488
Beryllium	0.278	0.722	0.375
Boron	0.960	0.040	0.545
Cadmium	0.300	0.700	0.107
Chromium	0.016	0.984	0.070
Cobalt	0.356	0.644	0.131
Lead	0.110	0.890	0.019
Lithium	0.993	0.007	
Mercury	0.025	0.975	0.046
Thallium	0.912	0.088	0.431
Radionuclides			
Radium-226+228	0.021	0.979	0.563
Other			
Fluoride	0.369	0.631	0.984

Notes:
COI = Constituent of Concern.

Table A.5 Surface Water and Sediment Modeling Results

COI	Groundwater Concentration (mg/L or pCi/L)	Mass Discharge Rate (mg/year or pCi/year)	Total Water Column Concentration (mg/L or pCi/L)	Concentration Sorbed to Bottom Sediments (mg/kg or pCi/kg)
Total Metals				
Arsenic	0.097	2.7E+04	5.1E-09	6.9E-07
Barium	8.6	2.4E+06	4.5E-07	6.9E-05
Beryllium	0.017	4.7E+03	8.9E-10	2.1E-07
Boron	12	3.3E+06	6.3E-07	2.2E-06
Cadmium	0.0040	1.1E+03	2.1E-10	4.5E-08
Chromium	0.59	1.6E+05	3.1E-08	1.7E-04
Cobalt	0.29	7.9E+04	1.5E-08	2.5E-06
Lead	0.27	7.4E+04	1.4E-08	1.0E-05
Lithium	0.85	2.3E+05	4.4E-08	(a)
Mercury	0.0018	4.9E+02	9.4E-11	3.4E-07
Thallium	0.0026	7.1E+02	1.4E-10	1.2E-09
Radionuclides				
Radium-226+228	23	6.3E+06	1.2E-06	5.0E-03
Other				
Chloride	830	2.3E+08	4.3E-05	(a)
Fluoride	10.2	2.8E+06	5.3E-07	8.3E-05
Sulfate	570	1.6E+08	3.0E-05	(a)

Notes:

COI = Constituent of Concern; pCi/kg = PicoCuries Per Kilogram; pCi/L = PicoCuries Per Liter.

(a) Lithium, chloride, and sulfate do not readily sorb to soil or sediment particles; a K_d value of 0 was used for the modeling.

Appendix B

Screening Benchmarks

Table B.1 Calculated Water Quality Standards Protective of Incidental Ingestion and Fish Consumption

Human Health COI	BCF[a] (L/kg-tissue)	Basis	MCL (mg/L)	RfD (mg/kg-day)	ADI[b] (mg/day)	Human Threshold Criteria		
						Water & Fish (mg/L)	Water Only (mg/L)	Fish Only (mg/L)
Arsenic	44	NRWQC (2002)	0.010	0.00030	0.020	0.022	2.0	0.023
Barium	130	US EPA (2014)	2.0	0.20	4.0	1.5	400	1.5
Beryllium	19	NRWQC (2002)	0.0040	0.0020	0.0080	0.021	0.80	0.021
Boron	1	(c)	NC	0.20	14	467	1,400	700
Chromium	16	NRWQC (2002)	0.10	1.5	0.20	0.61	20	0.63
Cobalt	300	ORNL (2020)	NC	0.00030	0.021	0.0035	2.1	0.0035
Fluoride	2.3	US EPA (2014)	4.0	0.040	8.0	143	800	174
Lead	46	US EPA (2014)	0.015	NC	0.030	0.015	0.015	0.015
Lithium	1	(c)	NC	0.002	0.14	4.7	14	7.0
Thallium	116	NRWQC (2002)	0.0020	0.000010	0.0040	0.0017	0.40	0.0017

Human Health COI	BAF (L/kg-tissue)		MCL (pCi/L)	ADI (pCi/day)	Food Ingestion Slope Factor[d] (risk/pCi)	Human Threshold Criteria		
	SW-Fish	Basis				Water & Fish (pCi/L)	Water Only (pCi/L)	Fish Only (pCi/L)
Radium-226+228	4.0	ORNL (2020)	5	10	1.43E-09	1,000	1,000	87,413

Notes:

ADI = Acceptable Daily Intake; BAF = Bioaccumulation Factor; BCF = Bioconcentration Factor; MCL = Maximum Contaminant Level; NC = No Criterion Available; NRWQC = National Recommended Water Quality Criteria; ORNL = Oak Ridge National Laboratory; pCi = PicoCurie; Ra = Radium; RAIS = Risk Assessment Information System; RfD = Reference Dose; US EPA = United States Environmental Protection Agency.

(a) BCFs from the following hierarchy of sources:

NRWQC (US EPA, 2002). National Recommended Water Quality Criteria: 2002. Human Health Criteria Calculation Matrix.

US EPA (2014). Human and Ecological Risk Assessment of Coal Combustion Residuals.

ORNL RAIS (ORNL, 2020). Risk Assessment Information System (RAIS) Toxicity Values and Chemical Parameters.

(b) ADI based on the MCL is calculated as the MCL (mg/L) multiplied by a water ingestion rate of 2 L/day. In the absence of an MCL, the ADI was calculated as the RfD (mg/kg-day) multiplied by the body weight (70 kg).

(c) BCF of 1 was used as a conservative assumption, due to lack of published BCF.

(d) Food ingestion slope factors for Ra-226+D and Ra-228+D were compared and the higher factor (Ra-228+D) was selected. The "+D" indicates that the risks from "associated short-lived radioactive decay products are also included" (US EPA, 2001).

Equations from IEPA (2019):

Consumption of Water and Fish

$$HTC = \frac{ADI}{W + (F \times BCF)}$$

Incidental Consumption of Water Only

$$HTC = \frac{ADI}{W}$$

Consumption of Fish Only

$$HTC = \frac{ADI}{F \times BCF}$$

Where:

Human Threshold Criteria (HTC)	Chemical-specific	mg/L
Acceptable Daily Intake (ADI)	Chemical-specific	mg/day
Fish Consumption Rate (F)	0.02	kg/day
Bioconcentration Factor (BCF)/ Bioaccumulation Factor (BAF)	Chemical-specific	L/kg-tissue
Water Consumption Rate (W)	0.01	L/day
Body Weight	70	kg
Target Cancer Risk (TCR)	1.0E-05	

Radium-226+228

$$HTC = \frac{TCR}{(SF \times BAF \times F)}$$

Table B.2 Recreator Exposure to Sediment

COI	Relative Bioavailability (unitless)	Dermal Absorption Fraction (unitless)	Cancer				Cancer SL (mg/kg)	Non-Cancer								Recreator RSL Sediment (mg/kg)	Basis[a]
			TRV		Child + Adult			TRV		Child		Adult		Child	Adult		
			CSF (mg/kg-day)$^{-1}$	Dermal CSF (mg/kg-day)$^{-1}$	Incidental Ingestion SL (mg/kg)	Dermal Contact SL (mg/kg)		RfD (mg/kg-day)	Dermal RfD (mg/kg-day)	Incidental Ingestion SL (mg/kg)	Dermal Contact SL (mg/kg)	Incidental Ingestion SL (mg/kg)	Dermal Contact SL (mg/kg)	Non-Cancer SL (mg/kg)			
Total Metals																	
Arsenic	1	3.0E-02	1.5E+00	1.5E+00	8.1E+01	4.1E+02	6.8E+01	3.0E-04	3.0E-04	4.1E+02	4.4E+03	4.4E+03	8.0E+03	3.8E+02	2.8E+03	6.8E+01	c
Barium	1	NA	NC	NC	NC	NC	NC	2.0E-01	1.4E-02	2.7E+05	NA	2.9E+06	NA	2.7E+05	2.9E+06	2.7E+05	nc
Beryllium	1	NA	NC	NC	NC	NC	NC	2.0E-03	1.4E-05	2.7E+03	NA	2.9E+04	NA	2.7E+03	2.9E+04	2.7E+03	nc
Boron	1	NA	NC	NC	NC	NC	NC	2.0E-01	2.0E-01	2.7E+05	NA	2.9E+06	NA	2.7E+05	2.9E+06	2.7E+05	nc
Chromium	1	NA	NC	NC	NC	NC	NC	1.5E+00	2.0E-02	2.1E+06	NA	2.2E+07	NA	2.1E+06	2.2E+07	2.1E+06	nc
Cobalt	1	NA	NC	NC	NC	NC	NC	3.0E-04	3.0E-04	4.1E+02	NA	4.4E+03	NA	4.1E+02	4.4E+03	4.1E+02	nc
Lead	1	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	4.0E+02	L
Lithium	1	NA	NC	NC	NC	NC	NC	2.0E-03	2.0E-03	2.7E+03	NA	2.9E+04	NA	2.7E+03	2.9E+04	2.7E+03	nc
Thallium	1	NA	NC	NC	NC	NC	NC	1.0E-05	1.0E-05	1.4E+01	NA	1.5E+02	NA	1.4E+01	1.5E+02	1.4E+01	nc
Other																	
Fluoride	1	NA	NC	NC	NC	NC	NC	4.0E-02	4.0E-02	5.5E+04	NA	5.8E+05	NA	5.5E+04	5.8E+05	5.5E+04	nc
Radionuclides																**Total Soil PRG (pCi/kg)**	
Radium-226+228																7.9E+03	

Notes:

ABS = Dermal Absorption Fraction; COI = Constituent of Interest; CSF = Cancer Slope Factor; NC = No Criterion Available; pCi = PicoCurie; PRG = Preliminary Remediation Goal; RfD = Reference Dose; RSL = Regional Screening Level; SL = Screening Level; TRV = Toxicity Reference Value; US EPA = United States Environmental Protection Agency.

(a) Screening benchmark defined as the lower of the Screening Levels for cancer and non-cancer. The basis of the benchmark presented as c = based on cancer endpoint, nc = based on non-cancer endpoint, or L = based on blood lead levels.

Equations for Screening Benchmark and Screening Levels:

$$\text{Screening Benchmark} = \frac{1}{\frac{1}{SL_{ing}} + \frac{1}{SL_{derm}}}$$

$$\text{Non-cancer } SL_{ing} = \frac{THQ * RfD}{Intake} \qquad \text{Cancer } SL_{ing} = \frac{TR}{Intake * CSF}$$

$$\text{Non-cancer } SL_{derm} = \frac{THQ * RfD}{Intake * ABS} \qquad \text{Cancer } SL_{derm} = \frac{TR}{Intake * ABS * CSF}$$

Where:

Target Risk (TR)	1E-05	
Target Hazard Quotient (THQ)	1	
Reference Dose (RfD)	Chemical-specific	mg/kg-day
Dermal Absorption Fraction (ABS)	Chemical-specific	
Cancer Slope Factor (CSF)	Chemical-specific	mg/kg
Incidental Ingestions Screening Level (SL_{ing})	Chemical-specific	mg/kg
Dermal Contact Screening Level (SL_{derm})	Chemical-specific	mg/kg

Sediment – Ingestion (Chemical)

$$\text{Intake Factor (IF)} = \frac{IR \times EF \times ED \times CF}{BW \times AT} =$$

			Non-Cancer		Cancer		
			7.3E-07 Child	6.8E-08 Adult	6.3E-08 Child	2.0E-08 Adult	Basis
	IR	Ingestion Rate (mg/day)	67	33	67	33	One-third of US EPA residential soil ingestion rate (Professional Judgment)
	EF	Sediment Exposure Frequency (days/year)	60	60	60	60	2 days/week between April and October when air temperature > 70°F (Professional Judgment)
	ED	Exposure Duration (years)	6	20	6	20	Default value for Resident (US EPA, 2021b)
	CF	Conversion Factor (kg/mg)	0.000001	0.000001	0.000001	0.000001	
	BW	Body Weight (kg)	15	80	15	80	Default value for Resident (US EPA, 2021b)
	AT	Averaging Time (days)	2,190	7,300	25,550	25,550	Default value for Resident (US EPA, 2021b)

Sediment – Dermal Contact (Chemical)

$$\text{Intake Factor (IF)} = \frac{SA \times AF \times EF \times ED \times CF}{BW \times AT} =$$

			Non-Cancer		Cancer		
			2.2E-06 Child	1.2E-06 Adult	1.9E-07 Child	3.6E-07 Adult	Basis
	SA	Surface Area Exposed to Sediment (cm^2/day)	1,026	3,026	1,026	3,026	Age weighted SA for lower legs and feet (US EPA, 2011b)
	AF	Sediment Skin Adherence Factor (mg/cm^2)	0.2	0.2	0.2	0.2	Age weighted AF for children exposed to sediment (US EPA, 2011b)
	EF	Sediment Exposure Frequency (days/year)	60	60	60	60	2 days/week between April and October when air temperature > 70°F (Professional Judgment)
	ED	Exposure Duration (years)	6	20	6	20	Default value for Resident (US EPA, 2021b)
	CF	Conversion Factor (kg/mg)	0.000001	0.000001	0.000001	0.000001	
	BW	Body Weight (kg)	15	80	15	80	Default value for Resident (US EPA, 2021b)
	AT	Averaging Time (days)	2,190	7,300	25,550	25,550	Default value for Resident (US EPA, 2021b)

Table B.3.1 Recreator PRGs for Soil, Input Values

Variable	Recreator Soil Default Value	Form-input Value
A (PEF Dispersion Constant)	16.2302	16.8653
B (PEF Dispersion Constant)	18.7762	18.7848
City (Climate Zone)	Default	Chicago, IL (7)
C (PEF Dispersion Constant)	216.108	215.0624
Cover layer thickness for GSF (gamma shielding factor) cm	0 cm	0 cm
$CF_{rec\text{-}fowl}$ (fowl contaminated fraction) unitless	1	1
$CF_{rec\text{-}game}$ (game contaminated fraction) unitless	1	1
ED_{rec} (exposure duration - recreator) yr		26
EF_{rec} (exposure frequency - recreator) day/yr		60
$f_{p\text{-}fowl}$ (fowl on-site fraction) unitless	1	1
$f_{p\text{-}game}$ (land game on-site fraction) unitless	1	1
$f_{s\text{-}fowl}$ (fraction of year fowl is on site) unitless	1	1
$f_{s\text{-}game}$ (fraction of year land game is on site) unitless	1	1
$MLF_{pasture}$ (pasture plant mass loading factor) unitless	0.25	0.25
t_{rec} (time - recreator) yr		26
TR (target risk) unitless	0.000001	0.000001
F(x) (function dependent on U_m/U_t) unitless	0.194	0.182
PEF (particulate emission factor) m^3/kg	1,359,344,438	1,560,521,177
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	98.431
A_s (acres)	0.5	0.5
Site area for ACF (area correction factor) m^2	1,000,000 m^2	1,000 m^2
ED_{rec} (exposure duration - recreator) yr		26
$ED_{rec\text{-}a}$ (exposure duration - recreator adult) yr		20
$ED_{resc\text{-}c}$ (exposure duration - recreator child) yr		6
EF_{rec} (exposure frequency - recreator) day/yr		60
$EF_{rec\text{-}a}$ (exposure frequency - recreator adult) day/yr		60
$EF_{rec\text{-}c}$ (exposure frequency - recreator child) day/yr		60
ET_{rec} (exposure time - recreator) hr/day		8
$ET_{rec\text{-}a}$ (exposure time - recreator) hr/day		8
$ET_{rec\text{-}c}$ (exposure time - recreator) hr/day		8
$IFA_{rec\text{-}adj}$ (age-adjusted inhalation rate - recreator) m^3		9,200
$IFS_{rec\text{-}adj}$ (age-adjusted soil intake rate - recreator) mg		63,720
$IRA_{rec\text{-}a}$ (inhalation rate - recreator adult) m^3/day	20	20
$IRA_{rec\text{-}c}$ (inhalation rate - recreator child) m^3/day	10	10
$IRS_{rec\text{-}a}$ (soil intake rate - recreator adult) mg/day	100	33
$IRS_{rec\text{-}c}$ (soil intake rate - recreator child) mg/day	200	67
t_{rec} (time - recreator) yr		26
TR (target risk) unitless	0.000001	0.000001
U_m (mean annual wind speed) m/s	4.69	4.65
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Notes:

IL = Illinois; PRG = Preliminary Remediation Goal

Table B.3.2 Recreator PRGs for Soil, Ra-226

Isotope	ICRP Lung Absorption Type	Soil Ingestion Slope Factor (risk/pCi)	Inhalation Slope Factor (risk/pCi)	External Exposure Slope Factor (risk/yr per pCi/g)	Food Ingestion Slope Factor (risk/pCi)	Lambda (1/yr)	Half-life (yr)	1,000 m^2 Soil Volume Area Correction Factor	0 cm Soil Volume Gamma Shielding Factor	Particulate Emission Factor (m^3/kg)	Dry Soil-to-plant transfer factor (pCi/g-fresh plant per pCi/g-dry soil)	Beef Transfer Factor (pCi/kg per pCi/d)	Poultry Transfer Factor (pCi/kg per pCi/d)	Ingestion PRG TR=1.0E-06 (pCi/g)	Inhalation PRG TR=1.0E-06 (pCi/g)	External Exposure PRG TR=1.0E-06 (pCi/g)	Total PRG TR=1.0E-06 (pCi/g)	Total PRG TR=1.0E-06 (mg/kg)	Total PRG TR=1.0E-06 (pCi/kg)
Ra-226	S	6.77E-10	2.82E-08	2.50E-08	5.14E-10	4.33E-04	1.60E+03	6.85E-01	1.00E+00	1.56E+09	1.95E-02	1.70E-03	-	2.32E+01	6.02E+03	4.10E+01	1.48E+01	1.50E-05	1.48E+04

Notes:
d = Day; ICRP = International Commission on Radiological Protection; Ra = Radium; S = Slow; pCi = PicoCurie; PRG = Preliminary Remediation Goal; TR = Target Risk; yr = Year.

Table B.3.3 Recreator PRGs for Soil, Ra-228

Isotope	ICRP Lung Absorption Type	Soil Ingestion Slope Factor (risk/pCi)	Inhalation Slope Factor (risk/pCi)	External Exposure Slope Factor (risk/yr per pCi/g)	Food Ingestion Slope Factor (risk/pCi)	Lambda (1/yr)	Half-life (yr)	1,000 m^2 Soil Volume Area Correction Factor	0 cm Soil Volume Gamma Shielding Factor	Particulate Emission Factor (m^3/kg)	Dry Soil-to-plant transfer factor (pCi/g-fresh plant per pCi/g-dry soil)	Beef Transfer Factor (pCi/kg per pCi/d)	Poultry Transfer Factor (pCi/kg per pCi/d)	Ingestion PRG TR=1.0E-06 (pCi/g)	Inhalation PRG TR=1.0E-06 (pCi/g)	External Exposure PRG TR=1.0E-06 (pCi/g)	Total PRG TR=1.0E-06 (pCi/g)	Total PRG TR=1.0E-06 (mg/kg)	Total PRG TR=1.0E-06 (pCi/kg)
Ra-228	S	1.98E-09	4.37E-08	3.43E-11	1.42E-09	1.21E-01	5.75E+00	1.00E+00	1.00E+00	1.56E+09	1.95E-02	1.70E-03	-	7.93E+00	3.89E+03	2.04E+04	7.91E+00	2.90E-08	7.91E+03

Notes:

d = Day; ICRP = International Commission on Radiological Protection; Ra= Radium; S = Slow; pCi = PicoCurie; PRG = Preliminary Remediation Goal; TR = Target Risk; yr = Year.

Appendix B

Corrective Action Alternatives Analysis – Supporting Information Report

Intended for
Illinois Power Resources Generating, LLC
7800 Cilco Lane
Bartonville, Illinois 61607

Date
June 2, 2025

Project No.
1940110241-003

CORRECTIVE ACTION ALTERNATIVES ANALYSIS SUPPORTING INFORMATION REPORT

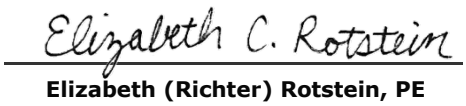
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

IEPA ID NO. W1438050005-01

RAMBOLL Bright ideas. Sustainable change.

CORRECTIVE ACTION ALTERNATIVES ANALYSIS SUPPORTING INFORMATION REPORT EDWARDS POWER PLANT, ASH POND, IEPA ID NO. W1438050005-01

Project name	**Edwards Power Plant Ash Pond**
Project no.	**1940110241-003**
Recipient	**Illinois Power Resources Generating, LLC**
Document type	**Corrective Action Plan**
Revision	**FINAL**
Date	**June 2, 2025**
Prepared by	**Rachel A. Banoff, EIT**
Checked by	**Elizabeth (Richter) Rotstein, PE**
Approved by	**Brian G. Hennings, PG**
Description	**Corrective Action Alternatives Analysis Supporting Information Report**



Elizabeth (Richter) Rotstein, PE
Qualified Professional Engineer



Brian G. Hennings, PG
Project Officer, Hydrogeology

CONTENTS

1.	**Introduction and Background**	**5**
1.1	Plant and Site Information	5
1.2	CAAA-SIR Background and Scope	5
1.2.1	Identified Corrective Action Alternatives	5
1.2.2	Scope of CAAA-SIR	6
1.2.3	Criterion for Estimating Time to Achieve GWPS	6
1.3	Report Contents	7
2.	**Alternative 1 Remedy: Source Control with Groundwater Polishing**	**8**
2.1	Supporting Groundwater Modeling and Time to Reach GWPS	8
2.2	Remedy Implementation	8
2.2.1	Remedy Implementation Schedule	9
2.2.2	Management of Extracted Groundwater	10
2.2.3	35 I.A.C. § 845.670(e)(1)(H) and 35 I.A.C. § 845.670(e)(3) Information	10
3.	**Alternative 2 Remedy: Source Control with Groundwater Extraction**	**12**
3.1	Remedy Scoping and Groundwater Modeling Results	12
3.2	Remedy Implementation	13
3.2.1	Phase 1: Pre-Construction Activities	13
3.2.2	Phase 2: Corrective Action Construction	14
3.2.3	Phase 3: Corrective Action Operations, Maintenance, and Closure	17
3.2.4	Remedy Implementation Schedule	18
3.2.5	Management of Extracted Groundwater	19
3.2.6	35 I.A.C. § 845.670(e)(1)(H) and 35 I.A.C. § 845.670(e)(3) Information	20
4.	**Alternative 3 Remedy: Source Control with Phytoremediation**	**23**
4.1	Remedy Scoping and Groundwater Modeling Results	23
4.2	Remedy Implementation	24
4.2.1	Phase 1: Pre-Construction Activities	25
4.2.2	Phase 2: Corrective Action Construction	25
4.2.3	Phase 3: Corrective Action Operations, Maintenance, and Closure	27
4.2.4	Remedy Implementation Schedule	28
4.2.5	Management of Extracted Groundwater	29
4.2.6	35 I.A.C. § 845.670(e)(1)(H) and 35 I.A.C. § 845.670(e)(3) Information	29
5.	**Material Quantity, Labor, and Mileage Estimates**	**33**
6.	**References**	**34**

TABLES

Table A Feasibility-Level Implementation Schedule – Alternative 1: Source Control with Groundwater Polishing
Table B Feasibility-Level Implementation Schedule – Alternative 2: Source Control with Groundwater Extraction
Table C Feasibility-Level Implementation Schedule – Alternative 3: Source Control with Phytoremediation

APPENDICES

Appendix A Feasibility-Level Design Drawings for Alternatives 2 and 3 Remedies
Appendix B1 Groundwater Modeling Technical Memorandum
Appendix B2 Groundwater Modeling Report
Appendix C Material Quantity, Labor, and Mileage Estimates for Alternative 2 and Alternative 3 Remedies

ACRONYMS AND ABBREVIATIONS

%	percent
35 I.A.C.	Title 35 of the Illinois Administrative Code
40 C.F.R.	Title 40 of the Code of Federal Regulations
AP	Ash Pond
BMP	best management practice
CAAA	Corrective Action Alternatives Analysis
CAAA-SIR	Corrective Action Alternatives Analysis Supporting Information Report
CAP	Corrective Action Plan
CBR	closure-by-removal
CCR	coal combustion residuals
CCR Rule	40 C.F.R. § 257 Subpart D
CIP	closure-in-place
CMA	Corrective Measures Assessment
COC	constituent of concern
EDW	Edwards Power Station
EPP	Edwards Power Plant
gpm	gallons per minute
Gradient	Gradient Corporation
GWE	groundwater extraction
GWP	groundwater polishing
GWPS	groundwater protection standard(s)
HDPE	high-density polyethylene
ID	identification
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
IPRG	Illinois Power Resources Generating, LLC
Kd	soil adsorption coefficient
LEL	lower explosive limit
mg/L	milligrams per liter
mL/g	milliliters per gram
NAVD88	North American Vertical Datum of 1988
NID	National Inventory of Dams
No.	Number
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance
PMP	potential migration pathway
Ramboll	Ramboll Americas Engineering Solutions, Inc.
RS Means	RS Means Heavy Construction Cost Data
SI	surface impoundment
UA	uppermost aquifer
USEPA	United States Environmental Protection Agency

1. INTRODUCTION AND BACKGROUND

1.1 Plant and Site Information

Illinois Power Resources Generating, LLC (IPRG) is the owner of the inactive coal-fired Edwards Power Plant (EPP), also referred to as the Edwards Power Station (EDW), in Bartonville, Illinois (the "site"). IPRG intends to complete groundwater corrective action at the coal combustion residuals (CCR) surface impoundment (SI) known as the Ash Pond (AP), which has an Illinois Environmental Protection Agency (IEPA) identification (ID) number (No.) of W1438050005-01, a CCR Unit ID of 301, and a National Inventory of Dams (NID) No. IL50710. Groundwater corrective action for the EPP AP will be performed under the requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments [1] and the requirements of Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257, herein referred to as the Federal CCR Rule [2].

1.2 CAAA-SIR Background and Scope

35 I.A.C. § 845 requires a Corrective Action Alternatives Analysis (CAAA) to be completed as part of remedy selection, pursuant to the requirements of 35 I.A.C. § 845.670(e). The CAAA for the EPP AP was prepared by Gradient Corporation (Gradient). Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this Corrective Action Alternatives Analysis Supporting Information Report (CAAA-SIR) to provide information requested by Gradient to support the CAAA for the EPP AP.

This CAAA-SIR is a feasibility-level assessment utilized to evaluate multiple groundwater corrective action alternatives. The remedy that is ultimately selected within the CAAA, to which this CAAA-SIR is attached, was then further developed into a permit-level design within the Corrective Action Plan (CAP), to which the CAAA is attached. Therefore, there may be minor differences in information presented for the selected remedy between this CAAA-SIR and the CAP. Information that may be different includes, but is not limited to, groundwater quality data, groundwater modeling inputs and results, implementation schedules, time to reach groundwater protection standards (GWPS), physical dimensions and scope of the remedy, engineering design parameters, and number and location of wells included in the monitoring system. These differences are due to the further refinement of the remedial design that is inherent with advancing the selected remedy into the permit-level remedial design that is included within the CAP.

1.2.1 Identified Corrective Action Alternatives

Corrective action remedies selected for additional evaluation within this CAAA-SIR were identified as potentially feasible for the AP in the Corrective Measures Assessment (CMA) [3], performed by Ramboll and attached to the CAAA prepared by Gradient. The remedies identified as potentially feasible included:

- Alternative 1: Source control with groundwater polishing (GWP);
- Alternative 2: Source control with groundwater extraction (GWE); and
- Alternative 3: Source control with phytoremediation.

Other remedies, including source control with a cutoff wall and source control with permeable reactive barrier, were determined to be infeasible for the site during the CMA process.

1.2.2 Scope of CAAA-SIR

Ramboll completed the following tasks and documented the tasks within this CAAA-SIR, for each of the corrective action alternative remedies listed in **Section 1.2.1**:

- Feasibility-level design drawings (**Appendix A**) were developed to show the approximate extents and typical sections/details of the Alternative 2 remedy (source control with GWE) and the Alternative 3 remedy (source control with phytoremediation). Drawings were not prepared for the Alternative 1 remedy as it does not involve construction at the site.
- Narratives describing the implementation of each remedy were developed, including the pre-design, design, construction, operations and maintenance (O&M), and closure phases.
- Feasibility-level schedules providing the estimated time to implement each remedy were developed, including design, permitting, construction, and post-construction O&M.
- Feasibility-level plans for the management of extracted groundwater were developed for alternatives where groundwater extraction is a component of the potential corrective action.
- Information required to evaluate specific portions of 35 I.A.C. § 845.670(e) requirements were prepared, as requested by Gradient, including 35 I.A.C. § 845.670(e)(1)(H) and 35 I.A.C. § 845.670(e)(3).
- Estimates of implementation-based equipment mileage, vehicle delivery mileage, labor hour, and labor commuting mileage, were developed for each remedy alternative where physical construction and/or O&M activities are expected to occur.

All remedies presented within this CAAA-SIR assume that the source control presented in the Final Closure Plan [4] for the EPP AP will also be implemented. The AP will be closed using a hybrid consolidation and closure-in-place (CIP) method. This will include completely removing approximately 1,130,000 cubic yards of CCR from the closure-by-removal (CBR) area (high points and northwestern sections of the SI) and relocating the waste material to the south end and other low areas of the SI (the CIP area). Additionally, approximately 210,000 cubic yards will be relocated from the rail loop embankment into the CIP footprint. The excavation and consolidation will reduce the total CCR footprint from approximately 102 acres to approximately 69 acres, providing a 33-acre, or approximately 32 percent (%), reduction in the consolidated and closed final footprint of the AP. Additional closure activities will include construction of an earthen separation berm at the perimeter of the relocation area of the AP to contain the relocated ash, and installation of an engineered low permeability geomembrane cover system.

Updated groundwater modeling (**Appendix B**) estimates that source control alone will result in GWPS being achieved approximately 800 years after closure completion without implementing other forms of corrective action. The potential remedies evaluated in this CAAA-SIR are intended to work in conjunction with the primary remedy, which is source control.

1.2.3 Criterion for Estimating Time to Achieve GWPS

Times to achieve GWPS for each of the remedial alternative remedies were estimated using the groundwater flow and transport model as provided in **Appendix B**. This approach was utilized to provide a consistent comparison of the time to reach GWPS for each remedy, as required by 35 I.A.C. § 845.670(e)(f).

1.3 Report Contents

The following information is included within this report:

- **Section 1** includes the introduction and background;
- **Section 2** includes information for the Alternative 1 remedy: source control with GWP;
- **Section 3** includes information for the Alternative 2 remedy: source control with GWE;
- **Section 4** includes information for the Alternative 3 remedy: source control with phytoremediation;
- **Section 5** includes information used to develop estimates of material quantities, labor hours, and mileage; and
- **Section 6** includes reference documents used in the development of this CAAA-SIR.

2. ALTERNATIVE 1 REMEDY: SOURCE CONTROL WITH GROUNDWATER POLISHING

The Alternative 1 remedy, source control with GWP, includes a consolidate-and-cap approach for source control, after which GWP would be implemented. GWP is a remedial alternative that relies on natural geochemical processes and can be an appropriate remedy, as recognized by the United States Environmental Protection Agency (USEPA) in a final policy directive [5] for groundwater remediation.

2.1 Supporting Groundwater Modeling and Time to Reach GWPS

The constituents of concern (COCs) exceeding the GWPS at compliance groundwater monitoring wells as of the 2024 Annual Report [6] are boron, sulfate, and total dissolved solids. Boron was selected for modeling source control presented in the Final Closure Plan and was identified as a surrogate for the exceedance[1] of sulfate, as described in the Groundwater Modeling Report [7] (included in **Appendix B2**). For modeling purposes, it was assumed that boron would not significantly sorb or chemically react with aquifer solids (soil adsorption coefficient [Kd] was set to 0 milliliters per gram [mL/g]) which is a conservative estimate for predicting contaminant transport times in the model. Boron transport is likely to be affected by both chemical and physical attenuation mechanisms (*i.e.,* adsorption and/or precipitation reactions as well as dilution and dispersion) [7]. Physical attenuation (dilution and dispersion) of contaminants in groundwater is simulated in the groundwater computer models. Chemical attenuation mechanisms and their effect on modeled times for exceedances to reach the GWPS are discussed in the Groundwater Polishing Evaluation Report [8].

Groundwater modeling for the Alternative 1 remedy, performed to support the Closure Plan for the AP and further refined in 2024 (**Appendix B1**), estimated that GWPS would be met in approximately 800 years after the implementation of source control for all wells within the existing AP monitoring network.

2.2 Remedy Implementation

Implementation of this remedy would be initiated after source control (*e.g.,* final closure of the AP) is completed. Implementation would include performing corrective action groundwater monitoring, enacting an adaptive management strategy, and, after GWPS have been met, performing corrective action closure and completion activities. Information associated with each of these activities is described below.

- Corrective Action Groundwater Monitoring
  - Regular corrective action groundwater monitoring would be conducted utilizing a corrective action groundwater monitoring well network designed in accordance with 35 I.A.C. § 845.680(c), which specifies that wells must be installed in the plume of contamination that lies beyond the waste boundary.

[1] Throughout this document, "exceedance" or "exceedances" is intended to refer only to potential exceedances of proposed applicable background statistics or GWPS as described in the proposed groundwater monitoring program, which was submitted to the IEPA on October 25, 2021 as part of IPRG's operating permit application for the EPP AP. That operating permit application, including the proposed groundwater monitoring program, remains under review by the IEPA and, therefore, IPRG has not identified any actual exceedances.

    - Samples would be collected for major ions for evaluating groundwater chemistry and COCs. Samples would be collected on a quarterly basis initially and potentially reduced to a semiannual basis once five years of monitoring have occurred, in accordance with 35 I.A.C. § 845.650(b)(4).
    - Monitoring results would be submitted to IEPA for each monitoring event, in addition to an annual groundwater monitoring and corrective action report, in accordance with 35 I.A.C. § 845.610(e).
    - Routine maintenance of the monitoring well network would occur during the monitoring period. This would include inspecting the wells, making repairs to the wells (as and if needed), and rehabilitating and/or replacing wells to improve performance (as and if needed).

- Adaptive Management during Monitoring
  - Groundwater monitoring results would be evaluated and documented in the monitoring reports submitted to IEPA, in accordance with 35 I.A.C. § 845.610(e).
  - Remedy progress evaluation as part of adaptive site management may include additional investigation to inform updates to the conceptual site model, groundwater, and geochemical models.
  - If remedy progress does not correspond with expectations, additional methods or techniques to achieve compliance with GWPS would be evaluated and, if feasible, implemented in accordance with 35 I.A.C. § 845.680(b).
- Corrective Action Confirmation Monitoring and Completion
  - After GWPS have been met for all corrective action monitoring wells, corrective action confirmation groundwater monitoring would be implemented. This would include monitoring each well for three additional years to confirm that GWPS have been achieved, in accordance 35 I.A.C. § 845.680(c).
    - It should be noted that post-closure care groundwater monitoring required for a 30-year period by 35 I.A.C. § 845.780(c) would continue to occur after corrective action groundwater monitoring is expected to be completed.
  - After completion of the corrective action confirmation monitoring period, a Corrective Action Completion Report and Certification would be prepared and submitted to IEPA, in accordance with 35 I.A.C. § 845.680(e).

2.2.1 Remedy Implementation Schedule

A feasibility-level implementation schedule for the Alternative 1 source control with GWP remedy is provided in **Table A** below.

Table A. Feasibility-Level Implementation Schedule – Alternative 1: Source Control with Groundwater Polishing

Implementation Phase	Implementation Task	Timeframe* (Preliminary Estimates)
Corrective Action Implementation	Corrective Action Monitoring (Time to Meet GWPS)	9,600 months
	Corrective Action Confirmation Monitoring	36 months
	Corrective Action Completion	6 months
	Timeframe to Complete Corrective Action Implementation	Approximately 800 years
	Total Timeline to Complete Corrective Action (after completion of Source Control)	Approximately 800 years

*All timeframes are assumed to start after source control (*e.g.,* final closure of the SI) is complete.

2.2.2 Management of Extracted Groundwater

No groundwater extraction would occur under this remedy.

2.2.3 35 I.A.C. § 845.670(e)(1)(H) and 35 I.A.C. § 845.670(e)(3) Information

As requested by Gradient, the following information required by 35 I.A.C. § 845.670(e)(1)(H) and 35 I.A.C. § 845.670(e)(3) has been developed for the remedy. The information was developed based on preliminary-level information contained within the CMA for the EPP AP and then refined based on additional feasibility-level design activities performed as part of the development of this CAAA-SIR.

- Potential Need for Replacement of the Remedy – 35 I.A.C. § 845.670(e)(1)(H)
  - No replacement of the remedy would be required for source control with GWP, as a physical remedy would not be constructed.
- Degree of Difficulty Associated with Constructing the Remedy – 35 I.A.C. § 845.670(e)(3)(A)
  - No construction would be required with the source control with GWP remedy; therefore, there is no construction difficulty for the remedy.
- Expected Operational Reliability of the Remedy - 35 I.A.C. § 845.670(e)(3)(B)
  - A report detailing the GWP process [8] has been developed and evaluates the reliability and the potential for reversibility of the chemical attenuation mechanisms. This report is attached to the Gradient CAAA.
  - GWP would begin once source control has been completed without delays and continuously function during the corrective action period.
- Need to Coordinate with and Obtain Necessary Approvals and Permits from Other Agencies - 35 I.A.C. § 845.670(e)(3)(C)
  - No permits from other agencies would be required outside of permits issued by IEPA for source control (Closure Plan and Construction Permit Application, submitted to IEPA in 2022 [9]).

- Availability of Necessary Equipment and Specialists - 35 I.A.C. § 845.670(e)(3)(D)
  - Equipment and specialists for field data collection and groundwater sampling are required for the GWP alternative. Laboratory equipment and specialists would also be required to assess groundwater concentrations of site constituents. Groundwater professionals (*i.e.,* geologists, hydrogeologists, statisticians, geochemists) would be required to perform statistical analysis and other assessments to confirm that GWP is progressing as intended and to prepare corrective-action-related groundwater monitoring and progress reports.
  - The equipment and specialists required for site groundwater monitoring and analysis are currently performing this work as part of the routine groundwater monitoring program in accordance with 35 I.A.C. § 845.220(c)(4). Therefore, no new equipment or specialists are required for groundwater monitoring for this alternative.
- Available Capacity and Location of Needed Treatment, Storage, and Disposal Services – 35 I.A.C. § 845.670(e)(3)(E)
  - No treatment, storage, or disposal services would be required with the source control with GWP remedy, as GWP would not generate an appreciable volume of waste or wastewater.

3. ALTERNATIVE 2 REMEDY: SOURCE CONTROL WITH GROUNDWATER EXTRACTION

The Alternative 2 remedy, source control with GWE, includes the construction of two GWE trenches that would be constructed in conjunction with source control (*e.g.*, final closure) implementation. Each trench is described below.

- North Trench
  - Approximately 1,700-foot-long north trench extending along the inboard CCR removal area excavation slope.
  - The north trench is proposed to be installed to the bottom of the uppermost aquifer (UA) which is at an elevation of approximately 411 to 421 feet[2]..
- South Trench
  - Approximately 800-foot-long south trench on the crest of the existing embankment after removal of the rail line, ballast and CCR embankment section.
  - The south trench would extend from the post-construction crest elevation (approximate elevation 450 feet) to the bottom of the UA and would require construction of a work platform into the existing dike. The work platform is anticipated to be at an approximate elevation of 440 feet. The trench would extend from the platform grade to an approximate elevation of 401.5 feet.

The preliminary depth and extents of both trenches were based on available groundwater and other site data and may be adjusted during future phases of design. The trenches would be on the order of 3 feet wide, installed into the UA and Upper Cahokia Formation/potential migration pathway (PMP) to capture CCR constituents in both units, and backfilled with highly permeable aggregate surrounding a perforated collection pipe. Collection sumps would be located approximately every 500 feet along the trench alignments. Groundwater would be pumped from each of the sumps and routed to a collection pond constructed within the CBR area of the AP. After settling, the groundwater would be discharged to either the Illinois River or the drainage channel adjacent to the AP via a new or existing National Pollutant Discharge Elimination System (NPDES) outfall, and in accordance with site-specific permit requirements.

Drawings showing the location of the GWE remedy are provided as Figures 1 and 2 in **Appendix A.**

3.1 Remedy Scoping and Groundwater Modeling Results

The size and scope of the remedy (*e.g.,* number and location of trenches, trench depths, expected discharge rates) were selected using iterative, three-dimensional groundwater fate and transport modeling. Initial locations where trenches could feasibly be constructed were evaluated by reviewing physical constraints around the AP and designating locations on IPRG property where the trenches could feasibly be constructed with limited impacts to other site features. In particular, the trench alignments were selected to avoid, to the extent possible, the existing sewer force main which crosses the northern portion of the pond, while avoiding sensitive areas

[2] All elevations in this report are referenced to North American Vertical Datum of 1988 (NAVD88), unless otherwise noted.

such as wetlands and regulatory floodplains [10, 11]. Additionally, the trench alignments are located outside of the AP, where they would provide minimal impacts to the source control construction (*e.g.,* closure activities). However, limited right-of-way for the southern trench would necessitate modification to the existing AP dikes in order to allow for the trench to be installed.

The depths of the trenches were selected using iterative, three-dimensional groundwater fate and transport modeling. Various depth intervals and configurations were evaluated during groundwater modeling simulations to identify optimal depths to achieve reduction in the time to reach GWPS while also retaining feasibility to construct and operate. During these groundwater modeling simulations, a single continuous trench was determined not to be beneficial and did not result in additional reduction in the time to reach GWPS. Thus, two separate trenches were selected to address exceedances in the northern and southern areas of the AP, respectively.

The resulting GWE trench remedy includes two separate trenches located along the western side of the AP. This two-trench configuration would capture CCR constituents in both the PMP and the UA and reduce the potential for off-site migration of groundwater containing CCR constituents. Additionally, the selected two-trench remedy would reduce, to the extent feasible, portions of the AP dikes, which require intrusive modifications to allow the trenches to be constructed.

Groundwater flow and transport modeling indicated that the GWPS would be met in approximately 37 years. The mean time to meet the GWPS for wells that were evaluated is approximately 5 years; however, GWPS would be achieved at certain wells within the first year of remedy operation. The two GWE trenches are expected to require that extraction continue for a total of 50 years (*i.e.*, 13 years after GWPS have been met) to reduce the potential for concentrations to rebound above the GWPS after pumping from the trenches ceases. The estimated discharge rate from the north trench would initially be on the order of 20 gallons per minute (gpm) and would stabilize to below 10 gpm after approximately 7 years; the discharge rate from the south trench would initially be on the order of 20 gpm and would stabilize to below 10 gpm after approximately 12 years. This results in a total estimated extraction rate ranging from 40 gpm to a long-term rate of approximately 20 gpm or less.

A Groundwater Modeling Technical Memorandum providing additional information on the groundwater modeling used to support the CAAA-SIR evaluation of this remedy is provided in **Appendix B**. This memorandum also includes estimated times to meet GWPS at each well.

3.2 Remedy Implementation

Implementation of the Alternative 2 source control with GWE remedy is expected to include multiple tasks spread out over three phases, including pre-construction activities (Phase 1), corrective action construction (Phase 2), and corrective action operations, maintenance, and closure (Phase 3). Information for each phase is described in this section.

3.2.1 Phase 1: Pre-Construction Activities

Pre-construction activities would include further pre-design investigation, obtaining permits from other agencies, completing the final design of the remedy, and selecting a remedy implementation contractor via a bidding process. Information associated with each of these activities is described below.

- Completing pre-design investigation, final design and bid activities, including:

  - Completion of additional subsurface investigations and groundwater monitoring to further refine the necessary extents and design of both the north and south trenches.
  - Collection of geotechnical data to support the design of dike modifications to allow the trench to be constructed.
  - Additional data collection and analyses may be required to characterize the potential impact of known naturally occurring sources of subsurface methane on construction and to design an extraction system.
  - Completion of engineering calculations, design drawings, specifications, and a construction quality assurance plan.
  - Bidding and selection of the GWE construction contractor.
- Obtaining permits or modifications from other agencies including:
  - A general stormwater permit for construction site activities though IEPA, including construction of stormwater controls and implementation of other best management practices (BMPs) such as silt fences and other measures.
  - An Illinois Department of Natural Resources (IDNR) Office of Water Resources, Dam Safety modification permit would be obtained for modification of the AP embankment.
  - A NPDES permit modification would be obtained to accept discharge of extracted groundwater for the operational lifetime of the GWE trenches.
  - An amendment to the submitted AP Final Closure Plan and Construction Permit Application would be completed to allow for the disposal of trench spoils beneath the AP final cover system.

3.2.2 Phase 2: Corrective Action Construction

Corrective action construction would be initiated after pre-construction activities are complete. It would include mobilizing construction equipment to the site, preparing the site for construction activities, constructing a work platform for the south trench, constructing the north and south trenches (which would include replacement of existing subgrade soils with permeable trench materials), constructing the extracted groundwater management system, and performing post-construction and site restoration activities.

GWE trench construction is assumed to occur concurrently within the latter phases of AP closure construction. This would allow all spoils generated during trench construction to be placed beneath the final cover system within the AP, in addition to reducing the risk of intrusive trench construction activities from negatively impacting the stability of the AP dikes. This would likely mean that the trenches would be constructed after the AP has been dewatered; after CCR has been removed from the CBR portions of the AP; and after the existing sewer force main has been abandoned, but before the final cover system has been completed. It was assumed that a construction contractor, separate from the closure construction contractor, would complete installation of the trenches.

Information associated with each of these activities is described below.

- Site Preparation
  - The contractor would mobilize equipment, construction facilities, and materials to the site; implement stormwater BMPs around the construction area; construct a staging and laydown area; and construct temporary access roads leading from the southern trench alignment to the existing site access road.
  - Site utilities would be modified and/or abandoned, as necessary, to provide construction access. This may require raising existing high-voltage power lines that cross the northern trench alignment to provide a safe working distance between the energized lines and construction equipment. Additionally, previously abandoned portions of a sewer force main within the trench alignment may need to be removed to allow for trench construction.
  - A 30-foot wide, level work platform would be constructed into the existing dike in the vicinity of the southern trench. The work platform is required due to the lack of right-of-way between the existing AP perimeter dike and the adjacent stormwater drainage channel and property boundary. The excavation would require substantial physical modification to the AP dike and may require the use of temporary or permanent shoring to supplement embankment grading to construct the work platform and reduce the risk of instability and other negative impacts to the AP dike during trench construction.
  - Geotechnical monitoring would be performed during construction of the work platform and south trench to evaluate the AP perimeter dikes for signs of distress during construction.
  - Methane is known to be present in aquifers throughout Illinois, due to both natural and anthropogenic processes (coal mining), and has been encountered at the AP [12]. A detailed methane monitoring plan would be developed and implemented during on-site construction activities where the potential to encounter methane has been identified.
- Trench Installation
  - The north and south trenches are assumed to be constructed using specialized trenching equipment (*i.e.*, one-pass trenching methods) due to the relatively deep trench depths (up to approximately 40 feet). This method uses a specialized one-pass trencher to excavate subgrade soils, place collection piping and sumps, and backfill the trench with granular fill in a single operation. Other construction methods may be considered during later phases of design.
  - The north trench would be excavated along the design alignment near the inboard CCR removal area excavation slope. Excavation would be conducted to the base of the UA. The south trench would be excavated along the design alignment to a depth of approximately 39 feet from the platform grade, terminating within the UA. Both trenches are expected to be on the order of 3 feet wide. Perforated groundwater collection pipe would be laid in the trench bases at an approximate 0.5 to 2% grade to slope towards collection sumps.
    - Excavated soils (*e.g.*, spoils) would be placed into off-road dump trucks and hauled to the AP for use as contouring (*i.e.*, subgrade) fill beneath the final cover system. The material would be moisture-conditioned by spreading it in thin lifts and compacting in accordance with the subgrade fill specifications for the AP final closure.
  - Collection sumps would be installed along the trenches. Sumps would consist of a pit to hold extracted water, a discharge line, a pneumatic pump to pump water to the discharge

line, and an air compressor. Collection sumps would be located every 500 feet along the length of each collection trench.

  - The trenches would be backfilled with imported clean granular material and capped with low-permeability clay and topsoil at the surface, or a more erosion-resistant material (*i.e.*, a turf-reinforced mat or gravel), if needed to prevent stormwater erosion and infiltration of the trench.
  - Underground trenches would be excavated to allow placement of high-density polyethylene (HDPE) piping to convey extracted groundwater from the trenches to the settling pond and from the settling pond to either an existing or a new NDPES outfall.

- Mechanical, Electrical, and Piping Installation
  - Electrical power drops would be installed in the northern and southern trench areas and the settling pond area, to provide power for the trench pumping and water management systems.
  - Equalization tanks and transfer pumps would be placed at the surface adjacent to each trench due to the extended distance required for conveyance of extracted groundwater to the settling pond.
- Discharge Management Installation
  - An approximately 1-acre settling pond for management of extracted groundwater was assumed to be constructed using conventional construction equipment. However, other groundwater treatment and management technologies may be evaluated during a later phase of design.
    - The location of the settling pond would be sited to limit adverse impacts or conflicts with the AP final closure construction and future solar redevelopment. The precise location of the pond would be evaluated during later phases of design and in conjunction with final closure design updates. For the purpose of this CAAA-SIR, the pond was assumed to be located within the CBR area of the AP final closure.
    - The settling pond was assumed to be approximately 1 acre in size and 5 feet deep. Soils from the settling pond excavation and/or from the construction of the southern trench working platform would be used to create 10-foot-wide berms around the perimeter of the settling pond to contain extracted groundwater. Excavated soils from the settling pond would be managed within the settling pond footprint. A geomembrane liner system would be installed in the settling pond to reduce the potential for releases of extracted groundwater.
  - An additional transfer pump may be required for discharge of extracted groundwater to the settling pond.
- Site Restoration
  - Following completion of the installation of the trenches, the work platform for the south trench area would be restabilized. This would include the replacement of excavated materials as backfill to the original dike grades and potentially the removal of any excavation shoring.

- Site restoration would be completed following the installation of the trenches. This would include repairing site infrastructure that was relocated or damaged during construction and minor regrading and seeding of disturbed areas.
- Temporary BMPs would also be installed during the site restoration period. The BMPs would be removed once vegetation is established.

3.2.3 Phase 3: Corrective Action Operations, Maintenance, and Closure

Corrective action operations, maintenance, and closure would be initiated after corrective action construction is completed. It would include operating and maintaining the remedy, performing corrective action groundwater compliance monitoring, and, after GWPS have been met, performing corrective action closure and completion activities. Information associated with each of these activities is described below.

- Corrective Action O&M
  - Continued operation of the trench systems would require routine, scheduled inspections and associated maintenance including, but not limited to, totalizer data collection, and maintenance of extraction pumps as well as other system components.
  - Non-routine maintenance that may occur during extended operation of the trenches may include tasks such as repair or replacement of the extraction pumps, repair or replacement of a system air compressor, and flushing or jetting of water conveyance lines in the event organic or inorganic solids accumulate on the interior walls.
  - Routine monitoring and compliance activities associated with the treatment and discharge of extracted water via the site's NPDES permit and either existing or new outfall would also be completed during this phase.
  - Groundwater modeling provided in **Appendix B** indicates that ongoing operation and associated O&M activities of the two GWE trenches may need to continue for a total of 50 years (*i.e.*, 13 years after GWPS have been met) to prevent concentrations from rebounding above the GWPS. Therefore, it was assumed that O&M will occur over a period of 50 years, after which the trenches will be shut off and O&M will cease.
- Corrective Action Groundwater Monitoring
  - Regular corrective action groundwater monitoring would be conducted using a corrective action groundwater monitoring system designed in accordance with 35 I.A.C. § 845.680(c), which specified that wells must be installed within the plume of contamination that lies beyond the waste boundary.
    - Samples would be collected for each constituent required by 35 I.A.C. § 845.600(a)(1). Samples would be collected on a quarterly basis initially and potentially reduced to a semiannual basis once five years of monitoring have occurred, in accordance with 35 I.A.C. § 845.650(b)(4).
    - Monitoring results would be submitted to IEPA after each monitoring event, in addition to an annual groundwater monitoring and corrective action report, in accordance with 35 I.A.C. § 845.640(e). The annual corrective action report would include an evaluation of the actual performance of the remedy relative to the remedy's expected performance.

    - Routine maintenance of the monitoring system would be conducted during the monitoring period. This would include inspection of the wells, making repairs to the wells (as and if needed), and rehabilitation and/or replacing the wells to improve performance (as and if needed).
  - If the remedy does not achieve its expected performance, additional methods or techniques to achieve compliance with GWPS would be evaluated and, if feasible, implemented in accordance with 35 I.A.C. § 845.680(b).
- Adaptive Management during Monitoring
  - Groundwater monitoring results will be evaluated and documented in the monitoring reports submitted to IEPA, in accordance with 35 I.A.C. § 845.610(e)
  - Remedy progress evaluation as part of adaptive site management may include additional investigation to inform updates to the conceptual site, groundwater, and geochemical models.
  - If remedy progress does not correspond with expectations, additional methods or techniques to achieve compliance with GWPS will be evaluated and, if feasible, implemented in accordance with 35 I.A.C. § 845.680(b).
- Corrective Action Completion
  - After GWPS have been met for all compliance wells for a period of three years after pumping of the trenches has ceased, corrective action would be considered complete, per 35 I.A.C. § 845.680(c).
  - After completion of the corrective action confirmation monitoring period, a Corrective Action Completion Report and Certification would then be submitted to IEPA, in accordance with 35 I.A.C. § 845.680(e).

3.2.4 Remedy Implementation Schedule

A feasibility-level implementation schedule for the Alternative 2 source control with GWE remedy is provided in **Table B** below.

Table B. Feasibility-Level Implementation Schedule – Alternative 2: Source Control with Groundwater Extraction

Implementation Phase	Implementation Task	Timeframe (Preliminary Estimates)
1: Pre-Construction	Agency Coordination, Approvals, and Permitting	18 to 24 months
	Final Design and Bid Process	24 to 36 months
	Timeframe to Complete Corrective Action Pre-Construction Activities	42 to 60 months
2: Corrective Action Construction	Corrective Action Construction	9 to 18 months
	Timeframe to Complete Corrective Action Construction	9 to 18 months
3: Corrective Action O&M and Closure*	Corrective Action Monitoring and O&M	600 months (50 years)
	Corrective Action Groundwater Compliance Monitoring	36 months
	Corrective Action Completion	6 months
	Timeframe to Complete Corrective Action O&M and Closure	642 months (53.5 years)
	Total Timeline to Complete Corrective Action	693 to 720 months (58 to 60 years)

*Denotes a timeframe that is assumed to start after source control (*e.g.,* final closure of the SI) is complete.

It should be noted that Phases 1 and 2 were assumed to occur concurrently with closure construction to allow spoils to be disposed of beneath the AP final cover system. Therefore, the start of Phase 3 (Corrective Action O&M and Closure) is assumed to begin at the completion of source control (final closure of the AP). In the event that Phases 1 and 2 could not be completed concurrently with source control due to a delay in receiving permits or construction-related conflicts, the total schedule would likely increase.

3.2.5 Management of Extracted Groundwater

Extracted groundwater was assumed to be managed and treated by the GWE system and a newly constructed settling pond, to be located on-site. However, other forms of groundwater management and/or treatment may be evaluated during future phases of design.

The settling pond would need to be sited to not conflict with site infrastructure and planned solar development and may be incorporated into the footprint of the CBR portion of the AP, where a stormwater detention basin is currently proposed. A settling pond of approximately 1 acre in size was assumed to be sufficient to allow sediments to settle from extracted groundwater prior to discharge. Groundwater collected from the trenches would be sent to the settling pond via the pneumatic extraction pumps and transfer piping. Treated water would discharge via an existing or new NPDES outfall. Groundwater would be discharged in accordance with site-specific NPDES permit requirements.

3.2.6 35 I.A.C. § 845.670(e)(1)(H) and 35 I.A.C. § 845.670(e)(3) Information

As requested by Gradient, the following information required by 35 I.A.C. § 845.670(e)(1)(H) and 35 I.A.C. § 845.670(e)(3) has been developed for the remedy. The information was developed based on preliminary-level information contained within the CMA for the AP and then refined based on additional feasibility-level design activities performed as part of the development of this CAAA-SIR.

- Potential Need for Replacement of the Remedy – 35 I.A.C. § 845.670(e)(1)(H)
  - No replacement of the remedy is expected to be required during the design life of the remedy, although the remedy would require ongoing monitoring and maintenance to retain its effectiveness.
- Degree of Difficulty Associated with Constructing the Remedy – 35 I.A.C. § 845.670(e)(3)(A)
  - The remedy would require use of specialized contractors and equipment (*i.e.*, one-pass trenching contractor and equipment) for the installation of the trenches, in addition to general construction equipment (*i.e.*, excavation and grading equipment).
  - While trenches are routinely constructed to similar depths in similar geologic environments, they may encounter difficulties during construction. The difficulties could include encountering obstructions that require specialized techniques and/or equipment to advance past.
  - Construction of the south trench could require modifications to the EPP AP embankment to provide a working platform for construction equipment. The modifications may require the use of temporary excavation shoring and/or other methods to avoid instability of the dike during construction.
  - In addition to likely requiring a permit from the IDNR Office of Water Resources, Dam Safety section, the construction would require the detailed geotechnical design of the working platform.
  - The modification would likely need to use risk management systems, such as a geotechnical monitoring program to evaluate the embankment for signs of distress during construction.
  - In the event that distress is noted, construction may need to be temporarily paused to evaluate the sources of the distress and mitigate, if needed.
  - The high-voltage power lines crossing the northern trench alignment may need to be raised in order to provide a safe working distance between the energized lines and construction equipment.
  - Naturally occurring methane is known to be present at the AP. The presence of methane would require the implementation of a methane monitoring and response plan. This may result in periodic safety shutdowns during construction, where work activity is stopped to allow methane concentrations to decrease to safe levels.
- Expected Operational Reliability of the Remedy - 35 I.A.C. § 845.670(e)(3)(B)
  - The trenches are expected to have high operational reliability if they are constructed in accordance with the design and specifications.

  - The extraction systems are mechanical systems that would require routine maintenance in order to reliably operate, as outlined in **Section 3.2.3**.

- Need to Coordinate with and Obtain Necessary Approvals and Permits from Other Agencies - 35 I.A.C. § 845.670(e)(3)(C)
  - Agency permits would need to be obtained from IEPA for construction of stormwater controls and BMPs, in addition to a joint water pollution control construction and operating permit, modifications to the site's NDPES permit, and an IDNR Dam Safety modification permit. These permits typically take 18 to 24 months to obtain.
    - While these permits may also be obtained for the AP final closure, the schedule for approval of both the Final Closure Plan and the eventual CAP is uncertain at this time; therefore, it has been assumed that separate permit applications for both the closure and corrective action construction would be submitted.
- Availability of Necessary Equipment and Specialists - 35 I.A.C. § 845.670(e)(3)(D)
  - Construction of the trenches would require a specialized contractor experienced with construction of similar types of trenches in similar geologic environments. Relatively few construction contractors with this experience, particularly using one-pass equipment, are available. The contractor would likely need specialized and often custom-built one-pass construction equipment.
  - Specialists in one-pass trenching methods would also need to be utilized during the design and construction phase. The specialists would include design engineers, construction managers, and contractor staff experienced with trench construction and equipment operation.
  - Geotechnical specialists would be needed to design the working platform and monitor the AP embankment for signs of distress during one-pass trench installation.
  - These types of equipment and specialists have been utilized in the past for other similar types of trench design and construction projects. However, there may be backlogs associated with the equipment and specialists, due to high existing demand for specialty subsurface contractors and design specialists who are supporting similar types of projects in the electric utility, dam/levee, and other market sectors. These backlogs could add additional delay to the project schedule above current assumptions.
  - Equipment and specialists for field data collection and groundwater sampling are required for the remedy. Laboratory equipment and specialists would also be required to assess groundwater concentrations of site COCs. Groundwater professionals (*i.e.*, geologists, hydrogeologists, statisticians, geochemists) would be required to perform statistical analysis and other assessments to confirm that the remedy is functioning as intended and prepare corrective action-related groundwater monitoring and progress reports.
    - The equipment and specialists required for site groundwater monitoring and analysis are currently performing this work in accordance with 35 I.A.C. § 845.220(c)(4). Therefore, no new equipment or specialists are required for groundwater monitoring for this alternative.

- Available Capacity and Location of Needed Treatment, Storage, and Disposal Services – 35 I.A.C. § 845.670(e)(3)(E)
  - Wastes generated during trench construction would be limited to spoils; these would be disposed of on-site in the AP during closure construction as compacted contouring fill beneath the final cover system. Completing the trench construction at the same time as the AP closure would provide sufficient on-site capacity for the disposal of generated spoils.
  - The trench system would send extracted groundwater to an on-site settling pond to settle solids extracted during groundwater recovery via the pneumatic extraction pumps and transfer piping. This settling pond would be new construction that would need to be sited, designed, constructed, and maintained. Additionally, either a new NDPES outfall would need to be constructed, or outflow from the settling pond would need to be pumped to the existing NPDES outfall.
  - Relatively limited right-of-way is available at EPP for siting a settling pond in areas that avoid conflicts with planned solar redevelopment, wetlands, floodplains, or other site infrastructure.

4. ALTERNATIVE 3 REMEDY: SOURCE CONTROL WITH PHYTOREMEDIATION

The Alternative 3 remedy, source control with phytoremediation, would include the installation of two tree segments on the western side of the AP to control the westerly off-site migration of CCR constituents in groundwater. The tree segments would be installed concurrently with source control (*e.g.*, final closure) implementation. It is anticipated that each segment would contain a narrow grid of plantings. Each individual planting would consist of one tree and a well system to passively draw groundwater upward to the root zone. With the assistance of the tree well, roots would access and uptake water from the UA, allowing phytoremediation of boron and sulfate to occur.

Tree segments would consist of a grid of tree plantings. At each planting location, a tree well structure would also be installed consisting of a borehole advanced into the UA and backfilled with a tree cutting, porous material to allow groundwater from the UA and PMP to rise to the potentiometric surface elevation, a standpipe to provide a passive source of oxygen to the subsurface, and (at some locations) soil moisture sensors and piezometers to monitor subsurface moisture and groundwater levels. Downward root growth at each planting would be encouraged via the use of a surface liner to reduce precipitation inflow and a drip irrigation system installed near targeted depths.

Feasibility-level design drawings of the Alternative 3 source control with phytoremediation are provided in **Appendix A.**

4.1 Remedy Scoping and Groundwater Modeling Results

The size and scope of the remedy (*e.g.,* number and location of plantings, root depths) were selected using iterative, three-dimensional groundwater fate and transport modeling. Initial locations where plantings could feasibly be constructed were evaluated by reviewing physical constraints around the AP and designating locations on IPRG property where the tree wells would have limited impacts to other site features. The locations were additionally selected to avoid sensitive areas such as wetlands and floodplains [10, 11] while limiting adverse impacts or conflicts with the AP final closure construction, and other site utilities or features.

Various depth intervals and configurations were evaluated during groundwater modeling simulations to identify optimal designs to achieve reduction in the time to reach GWPS while also remaining feasible to construct and maintain. During these groundwater modeling simulations, a single continuous tree segment was determined not to be beneficial and did not result in additional reduction in the time to reach GWPS. Thus, two separate segments were selected to address exceedances in the northern areas and southern areas, respectively. This resulted in the northern tree segment extending along the berm within the CBR area and the southern tree segment being located along the exterior toe of the former perimeter dike of the AP. The target areas are in the vicinity of AW-19 on the northwestern side of the AP and AW-15S on the southwestern side of the AP. These locations have areas where accessible space exists or can be created that is not within regulatory floodplains or known wetlands to allow for the tree well systems to be constructed. Additionally, the areas are outside the limits of the AP final closure, and therefore would reduce impacts to the final closure to the extent practicable.

The two tree segments would include an approximately 1,700-foot-long northern segment extending along the inboard side of the CBR area and an approximately 1,900-foot-long segment near the downstream toe at the southwestern side of the existing embankment. The southern segment would require construction of a work platform into the existing dike. The segments would include a total of approximately 550 trees. The work platform is anticipated to be at an elevation of approximately 440 feet. Each tree segment is further described below.

- Northern Tree Segment
  - The northern tree segment would be located in the vicinity of monitoring wells AW-06, AW-18, AW-19, and AW-20 to address impacts of boron at AP07S, AW-05, AW-19, AW-20, and AW-21.
  - Trees would be planted at the post-closure construction surface grade at an elevation of 440 feet, and the co-located tree wells would be used to passively draw groundwater from the PMP and UA upward to the potentiometric surface elevation of approximately 433 feet.
  - Approximately 200 trees are anticipated to be planted in the northern tree segment, with a spacing of 8 to 10 feet between the trees.
- Southern Tree Segment
  - The southern tree segment would be located in the vicinity of monitoring wells AW-09, AW-15S, AW-16, and AW-17 to address impacts of boron and sulfate at AW-15S.
  - Trees would be planted at the post-closure construction surface grade at an approximate elevation of 438 feet, and the co-located tree wells would be used to passively draw groundwater from the PMP and UA upward to the potentiometric surface elevation of approximately 431 feet.
  - Approximately 350 trees are anticipated to be planted in the southern tree segment, with a spacing of 8 to 10 feet between the trees.

Groundwater modeling estimated that the tree wells would result in GWPS being achieved in approximately 48 years for all wells, assuming ideal tree performance, but could take up to 77 years with suboptimal growth or tree performance. The groundwater modeling also indicated that the phytoremediation system would need to remain operating for a total time period of 70 years with ideal tree performance and 150 years with sub-optimal performance, in order to reduce the potential for post-operational rebound above GWPS. This would result in the system operating for approximately 22 to 73 years after GWPS's have been met. Groundwater modeling assumed no uptake for the first five years while roots are established at target depths and no uptake during winter seasons (*i.e.,* October to March). A Groundwater Modeling Technical Memorandum, providing additional information on the groundwater modeling used to support the feasibility-level design of this remedy, is provided in **Appendix B**. This memorandum also includes estimated times to meet GWPS at each well.

4.2 Remedy Implementation

Implementation of the Alternative 3 phytoremediation remedy is expected to include multiple tasks spread out over three phases, including pre-construction activities (Phase 1), corrective action construction (Phase 2), and corrective action operations, maintenance, and closure (Phase 3). Information for each phase is described in this section.

4.2.1 Phase 1: Pre-Construction Activities

Pre-construction activities would include further pre-design investigation, obtaining permits from other agencies, completing the final design of the remedy, and selecting a remedy implementation contractor via a bidding process. Information associated with each of these activities is described below.

- Completing pre-design investigation, final design and bid activities, including:
  - Completion of additional subsurface investigations and groundwater monitoring to further refine the necessary extents of both tree segments.
  - Collection of geotechnical data to support the design of dike modifications to allow construction of the southern segment.
  - Additional data collection and analyses may be required to characterize the potential impact of known naturally occurring sources of subsurface methane on the construction and design of the phytoremediation system.
  - Implementation of a pilot study to optimize tree species/variety, backfill materials, irrigation depth and flow rates, and other parameters that are specific to the site.
  - Completion of engineering calculations, design drawings, specifications, and a construction quality assurance plan.
  - Bidding and selection of the tree well system construction contractor.
- Obtaining permits or modifications from other agencies including:
  - A general stormwater permit for construction site activities though IEPA, including construction stormwater controls and other BMPs such as installation of silt fences and other measures.
  - IDNR Office of Water Resources, Dam Safety modification permit, for modification of the embankment.

4.2.2 Phase 2: Corrective Action Construction

Corrective action construction would be initiated after pre-construction activities are complete. It would include mobilizing construction equipment to the site, preparing the site for construction activities, constructing the tree well systems, and performing post-construction and site restoration activities.

Phytoremediation construction is assumed to occur concurrently within the latter phases of the with AP closure construction. This would allow spoils generated during tree well installation to be placed beneath the final cover system within the AP, in addition to reducing the risk of intrusive construction activities from negatively impacting the stability of the AP dikes while they still retain water and/or free liquids. This would likely mean that phytoremediation would be implemented after the AP has been dewatered; after free liquids have been removed from the CCR; after CCR has been removed from the CBR portions of the AP; and after the existing sewer force main has been abandoned, but before the final cover system has been completed. It was assumed that a construction contractor separate from the closure construction contractor would complete installation of the tree segments.

Information associated with each of these activities is described below.

- The contractor would mobilize equipment, construction facilities, and materials to the site, and implement stormwater BMPs around the construction area, construct a staging and laydown area, and construct temporary access roads leading from the tree well system alignment to the existing site access road.
- Site utilities would be modified and/or abandoned, as necessary, to provide suitable clearance. This may require raising existing high-voltage power lines that cross the northern trench alignment to provide a safe working distance between the energized lines and construction equipment and for mature tree canopy growth.
- A 30-foot wide, level, and stable work platform would be constructed into the existing dike in the vicinity of the southern segment. The work platform is required due to the lack of right-of-way between the existing AP perimeter dike and the adjacent stormwater drainage channel and property boundary. The excavation would require substantial physical modification to the AP dike and may require the use of temporary or permanent shoring to supplement embankment grading to construct the work platform.
- Geotechnical monitoring would be performed to evaluate the AP embankment for signs of distress during construction.
- The phytoremediation installations are assumed to be constructed using a hollow stem auger drill rig capable of drilling approximately 10-inch diameter boreholes which would allow enough space for a tree cutting, appropriate backfill, and any additional items associated with the phytoremediation installation (irrigation tube, aeration tube, moisture meter, piezometer).
  - The phytoremediation installations would be installed along the design alignment on the outer side of the existing dike.
  - The upper portion of each borehole, above the groundwater potentiometric surface elevation, would be backfilled with mixture of porous material, organic moisture-wicking material, and compost/fertilizer (60% sand, 30% peat, 10% compost, trace extended-release fertilizer).
  - Methane is known to be present in aquifers throughout Illinois, due to both natural and anthropogenic processes (coal mining), and has been encountered at the AP [12]. A detailed methane monitoring plan would be developed and implemented during on-site construction activities where the potential to encounter methane has been identified.
- Following completion of the phytoremediation installations, the work platform area would be permanently stabilized. This may entail the partial or complete backfill of the excavated materials, or reinforcement of the excavation shoring to convert into a permanent retaining wall, with less or no backfill. As such, tree plantings would be located along the outer (downslope) edge of the work platform.
- Site restoration would be completed following the completion of the phytoremediation installations. This would include repairing site infrastructure that was relocated or damaged during construction and minor regrading and seeding of disturbed areas.
- Temporary BMPs would also be installed during the site restoration period, if required in accordance with site land disturbance permits. The BMPs would be removed once vegetation is established.

Following installation of the trees, it is expected that there would be a period of approximately five years where no or limited uptake of groundwater occurs, in order to allow the roots to become established at target depths. It is also assumed that the trees would be dormant with no uptake during winter seasons (*i.e.,* October to March). During these periods, monitoring of trees and conditions would be conducted to encourage appropriate growth.

4.2.3 Phase 3: Corrective Action Operations, Maintenance, and Closure

Corrective action operations, maintenance, and closure would be initiated after corrective action construction is completed. It would include operating and maintaining the remedy, performing corrective action groundwater compliance monitoring, and, after GWPS have been met, performing corrective action closure and completion activities. Information associated with each of these activities is described below.

- Corrective Action O&M
  - Continued operation of the phytoremediation installations would require routine, scheduled inspections and associated maintenance including, but not limited to, irrigation, maintenance of water delivery systems and/or the delivery of irrigation water, maintenance to irrigation systems, maintenance and pruning of the trees, mowing and clearing other vegetation around the trees, collection of tree tissue samples, harvesting tree waste (*i.e.*, fallen leaves and branches), and maintenance of phytoremediation installation components.
  - Non-routine maintenance that may occur during extended operation of the tree wells may include complete replacement of the trees and repair or replacement of phytoremediation installation components.
  - Groundwater modeling provided in **Appendix B** indicates that ongoing operation and associated O&M of the tree installations may need to continue for a total of 70 to 150 years (*i.e.,* 22 to 73 years after GWPS have been met). Therefore, it was assumed that O&M will occur over a period of 70 to 150 years, after which O&M of the tree installations will be ceased.
- Corrective Action Groundwater Monitoring
  - Regular corrective action groundwater monitoring would be conducted using a corrective action groundwater monitoring system designed in accordance with 35 I.A.C. § 845.680(c), which specifies that wells must be installed within the plume of contamination that lies beyond the waste boundary.
    - Samples would be collected for each constituent required by 35 I.A.C. § 845.600(a)(1). Samples would be collected on a quarterly basis initially and potentially reduced to a semiannual basis once five years of monitoring have occurred, in accordance with 35 I.A.C. § 845.650(b)(4).
    - Monitoring results would be submitted to IEPA after each monitoring event, in addition to an annual groundwater monitoring and corrective action report, in accordance with 35 I.A.C. § 845.640(c). The annual corrective action report would include an evaluation of the actual performance of the remedy relative to the remedy's expected performance.

  - Routine maintenance of the monitoring system would be conducted during the monitoring period. This would include inspection of the wells, making repairs to the wells (as and if needed), and rehabilitation and/or replacing the wells to improve performance (as and if needed).
  - If the remedy does not achieve its expected performance, additional methods or techniques to achieve compliance with GWPS would be evaluated and, if feasible, implemented in accordance with 35 I.A.C. § 845.680(b).

- Adaptive Management during Monitoring
  - Groundwater monitoring results will be evaluated and documented in in the monitoring reports submitted to IEPA, in accordance with 35 I.A.C. § 845.610(e).
  - Remedy progress evaluation as part of adaptive site management may include additional investigation to inform updates to the conceptual site, groundwater, and geochemical models.
  - If remedy progress does not correspond with expectations, additional methods or techniques to achieve compliance with GWPS will be evaluated and, if feasible, implemented in accordance with 35 I.A.C. § 845.680(b).
- Corrective Action Confirmation Monitoring and Completion
  - After GWPS have been met for all corrective action monitoring wells for a period of three years after O&M of the phytoremediation system has ceased, corrective action would be considered complete, per 35 I.A.C. § 845.680(c).
  - After completion of the corrective action confirmation monitoring period, a Corrective Action Completion Report and Certification would be prepared and submitted to IEPA, in accordance with 35 I.A.C. § 845.680(e).

4.2.4 Remedy Implementation Schedule

A feasibility-level implementation schedule for the Alternative 3 source control with phytoremediation is provided in **Table C** below.

Table C. Feasibility-Level Implementation Schedule – Alternative 3: Source Control with Phytoremediation

Implementation Phase	Implementation Task	Timeframe (Preliminary Estimates)
1: Pre-Construction	Agency Coordination, Approvals, and Permitting	18 to 24 months
	Pilot Study	6 to 12 months
	Final Design and Bid Process	24 to 36 months
	Timeframe to Complete Corrective Action Pre-Construction Activities	48 to 72 months
2: Corrective Action Construction	Corrective Action Construction	9 to 18 months
	Timeframe to Complete Corrective Action Construction	9 to 18 months
3: Corrective Action O&M and Closure*	Corrective Action Monitoring and O&M	840 to 1800 months (70 to 150 years)
	Corrective Action Groundwater Compliance Monitoring	36 months
	Corrective Action Completion	6 months
	Timeframe to Complete Corrective Action O&M and Closure	882 to 1,842 months (74 to 154 years)
	Total Timeline to Complete Corrective Action	939 to 1,932 months (78 to 161 years)

*Denotes a timeframe that is assumed to start after source control (*e.g.,* final closure of the SI) is complete.

It should be noted that Phases 1 and 2 were assumed to occur concurrently with closure construction, to allow spoils to be disposed of beneath the AP final cover system. Therefore, the start of Phase 3 (Corrective Action O&M and Closure) is assumed to begin at the completion of source control (final closure of the AP). In the event that Phases 1 and 2 could not be completed concurrently with source control due to a delay in receiving permits or construction-related conflicts, the total schedule would likely increase.

4.2.5 Management of Extracted Groundwater

No groundwater extraction would occur under this remedy.

4.2.6 35 I.A.C. § 845.670(e)(1)(H) and 35 I.A.C. § 845.670(e)(3) Information

As requested by Gradient, the following information required by 35 I.A.C. § 845.670(e)(1)(H) and 35 I.A.C. § 845.670(e)(3) has been developed for the remedy. The information was developed based on preliminary-level information contained within the CMA for the AP and then refined based on additional feasibility-level design activities performed as part of the development of this CAAA-SIR.

- Potential Need for Replacement of the Remedy – 35 I.A.C. § 845.670(e)(1)(H)
  - Tree replacement is expected to be required during the design life of the remedy. It is estimated that trees would need to be replaced one to five times (assuming a 30- to 50-year tree lifespan), depending on the timeframe required to achieve GWPS and overall tree performance at the site.

  - The remedy would require ongoing monitoring and maintenance to retain its effectiveness. Replacement of the trees was assumed to be at a rate of 10% annually (*i.e.*, approximately 60 trees) for the first five years, followed by 5% annually after the first five years. Larger tree replacement events may be difficult due to the space and access limitations.

- Degree of Difficulty Associated with Constructing the Remedy – 35 I.A.C. § 845.670(e)(3)(A)
  - The remedy would require use of a hollow stem auger drill rig for installation of the tree well systems in addition to general construction equipment (*i.e.*, excavation and grading equipment) for the installation of a working platform for the southern tree segment. These types of construction equipment are readily available at a regional level and construction of these portions for the remedy are not expected to present significant challenges.
  - Construction of the southern tree segment would require modifications to the EPP AP embankment in order to provide a working platform for construction equipment. The modifications may require the use of temporary excavation shoring and/or other methods to avoid instability of the dike during construction.
  - In addition to likely requiring a permit from the IDNR Office of Water Resources, Dam Safety section, the construction would require a detailed geotechnical design of the working platform.
  - The modification would likely need to use risk management systems, such as a geotechnical monitoring program to evaluate the embankment for signs of distress during construction.
  - In the event that distress is noted, construction may need to be temporarily paused to evaluate the sources of the distress and mitigate, if needed.
  - Although embankments are routinely modified, the modifications required for this work platform are intrusive and could temporarily increase the risk of dike instability relative to current conditions.
  - The high-voltage power lines crossing the northern tree alignment may need to be raised in order to provide a safe working distance between the energized lines and construction equipment.
  - Naturally occurring methane is known to be present at the EPP AP. During field activities in 2021, methane was detected above 10% of the lower explosive limit (LEL) at borehole monitoring well locations AW-13, AW-14, AW-15, AW-15C, AW-16, AW-17, AW-22, and P002. Levels quickly dissipated after venting the monitoring wells to the atmosphere [12]. The presence of methane would require the implementation of a methane monitoring and response plan. This may result in periodic safety shutdowns during construction, where work activity is stopped to allow methane concentrations to decrease to safe levels.
- Expected Operational Reliability of the Remedy - 35 I.A.C. § 845.670(e)(3)(B)
  - While the phytoremediation installations are expected to have high operational reliability if they are constructed in accordance with the design and specifications, performance of the phytoremediation installations would be dependent on the trees' ability to grow in site conditions.

  - Performance of the system would require establishment of root systems to achieve desired uptake rates (approximately 40 gallons per day per tree).
  - Sensitivity analyses evaluating a range of uptake rates performed during modeling indicate a wide variation in time to reach GWPS (48 to 77 years) and total required remedy duration (70 to 150 years) to prevent rebounding concentrations; this indicates that the overall operational reliability is highly sensitive to the performance of the living/biological phytoremediation system, and therefore results in uncertain operational reliability.
  - While studies have found that low concentrations of boron and inorganics can be addressed by phytoremediation [13, 14, 15, 16, 17], few case studies could be found that document the use of phytoremediation on a large scale to remediate boron in groundwater or specifically CCR. The limited nature of these examples provides additional uncertainty on tree health and the corresponding long-term operational reliability of phytoremediation in this application.
  - The phytoremediation systems are a combination of mechanical and biological systems that would require routine and ongoing maintenance in order to reliably operate, as outlined in **Section 4.2.3**.
- Need to Coordinate with and Obtain Necessary Approvals and Permits from Other Agencies - 35 I.A.C. § 845.670(e)(3)(C)
  - Agency permits would need to be obtained for an IDNR Dam Safety modification permit. These permits typically take 18 to 24 months to obtain.
  - While these permits may also be obtained for the AP final closure, the schedule for approval of both the Final Closure Plan and the eventual CAP is uncertain at this time; therefore, it has been assumed that separate permit applications for both the closure and corrective action construction would be submitted.
- Availability of Necessary Equipment and Specialists - 35 I.A.C. § 845.670(e)(3)(D)
  - Construction of the phytoremediation installations would require a hollow stem auger drill rig, which are widely available at a regional level. The drilling crew would not need specialized skills outside of typical capabilities.
  - Specialists in phytoremediation design may need to be utilized during the design and construction phase.
  - Geotechnical specialists would be needed to design the working platform and monitor the AP embankment for signs of distress during phytoremediation installations.
  - These types of equipment and specialists have been utilized in the past for other similar types of phytoremediation design and construction projects.
  - Equipment and specialists for field data collection and groundwater sampling are required for the remedy. Laboratory equipment and specialists would also be required to assess groundwater concentrations of site COCs. Groundwater professionals (*i.e.*, geologists, hydrogeologists, statisticians, geochemists) would be required to perform statistical analysis and other assessments to confirm that the remedy is functioning as intended and prepare corrective action-related groundwater monitoring and progress reports.

    - The equipment and specialists required for site groundwater monitoring and analysis are currently performing this work in accordance with 35 I.A.C. § 845.220(c)(4). Therefore, no new equipment or specialists are required for groundwater monitoring for this alternative.

- Available Capacity and Location of Needed Treatment, Storage, and Disposal Services – 35 I.A.C. § 845.670(e)(3)(E)
  - Wastes generated during phytoremediation installations would be limited to spoils; these would be disposed of on-site in the AP during closure construction. Completing the phytoremediation installations at the same time as the AP closure would provide sufficient on-site capacity for the disposal of generated spoils.
  - Organic waste would be generated annually during the lifespan of the phytoremediation remedy. Trees that have been removed for replacement and seasonal fallen leaves and branches would be periodically sampled to profile the waste. Based on organic waste sampling results, the material may be chipped and used for mulch/compost on-site or may require off-site disposal. If material requires off-site disposal, Waste Management Peoria City, a local landfill, is 18 miles from the site, and has sufficient capacity to receive the expected small volume of organic waste.

5. MATERIAL QUANTITY, LABOR, AND MILEAGE ESTIMATES

Estimates of material quantities, total labor hours, and mileage were prepared for Alternative 2 source control with GWE and Alternative 3 source control with phytoremediation, to support Gradient in preparing their CAAA. Estimates were not prepared for Alternative 1 source control with GWP as the alternative does not require remedial construction or O&M of a physical remedy.

These estimates were prepared utilizing the following approach:

- Major implementation (*e.g.*, construction) components and line items were identified, in accordance with the remedy implementation narratives contained within this CAAA-SIR.
- Construction quantities were estimated based on quantity estimates for volumes, areas, and units, as obtained from the feasibility-level engineering drawings and schedules included within this CAAA-SIR.
- RS Means Heavy Construction Cost Data (RS Means) [18] was utilized to estimate the crew size, equipment description, and daily output associated with each line item.
- For line items where RS Means data was not available, the crew size, equipment description, and daily output were estimated based on Ramboll's experience, information from contractors, and/or information from material suppliers.
- For the Alternative 2 source control with GWE and Alternative 3 source control with phytoremediation, daily construction and O&M labor mobilization miles were estimated assuming a weekly mobilization/demobilization from Chicago (340 miles round trip) and a local commute of 30 miles round trip per day. The number of working days and hours per week were estimated from the construction schedule developed for each remedy.
- Estimates of material delivery miles were prepared based on Ramboll's experience.

The detailed material quantity, labor, and mileage estimates are provided in **Appendix C** for each alternative.

6. REFERENCES

[1] "Illinois Administrative Code, Title 35, Subtitle G, Chapter I, Subchapter J, Part 845: Standards for The Disposal Of Coal Combustion Residuals In Surface Impoundments," effective April 21, 2021.

[2] Code of Federal Regulations, "Title 40, Chapter I, Subchapter I, Part 257, Subpart D, Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments," April 17, 2015.

[3] Ramboll Americas Engineering Solutions, Inc., "35 I.A.C. § 845 Corrective Measures Assessment, Edwards Power Plant, Ash Pond, IEPA ID No. W1438050005-01," June 4, 2024.

[4] IngenAE, LLC, "Final Closure Plan Edwards Power Plant Ash Pond, Bartonville, Illinois," June 2022.

[5] United States Environmental Protection Agency, "Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites," OSWER Directive Number 9200.4-17P," April 21, 1999.

[6] Ramboll Americas Engineering Solutions, Inc., "2024 35 I.A.C. § 845 Annual Groundwater Monitoring and Corrective Action Report, Ash Pond, Edwards Power Plant, IEPA ID No. W1438050005-01," Bartonville, Illinois, January 2025.

[7] Ramboll Americas Engineering Solutions, Inc., "Groundwater Modeling Report, Ash Pond, Edwards Power Plant," Bartonville, Illinois, June 30, 2022.

[8] Life Cycle Geo, LLC, "Groundwater Polishing Evaluation Report," April 2025.

[9] IngenAE LLC, "Construction Permit Application, Edwards Power Station, Ash Pond," Bartonville, IL, 2022.

[10] Federal Emergency Management Agency, *Flood Insurance Rate Map, County of Peoria, Illinois (Unincorporated Areas),* National Flood Insurance Program, June 1, 1983.

[11] U.S. Fish and Wildlife Service, "National Wetlands Inventory, surface waters and wetlands," [Online]. Available: https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/.

[12] Ramboll Americas Engineering Solutions, Inc., "Hydrogeologic Site Characterization Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois," October 25, 2021.

[13] R. Rees, B. H. Robinson, C. J. Rog, A. Papritz and R. Schulin, "Boron accumulation and tolerance of hybrid poplars grown on a B-laden mixed paper mill waste landfill," *Science of the Total Environment,* vol. 447, no. March 2013, pp. 515-524, 2013.

[14] R. Rees, B. H. Robinson, M. Menon, E. Lehmann, M. S. Günthardt-Goerg‖ and R. Schulin, "Boron Accumulation and Toxicity in Hybrid Poplar (Populus nigra × euramericana)," *Environmental Science and Technology,* vol. 45, no. 24, 2011.

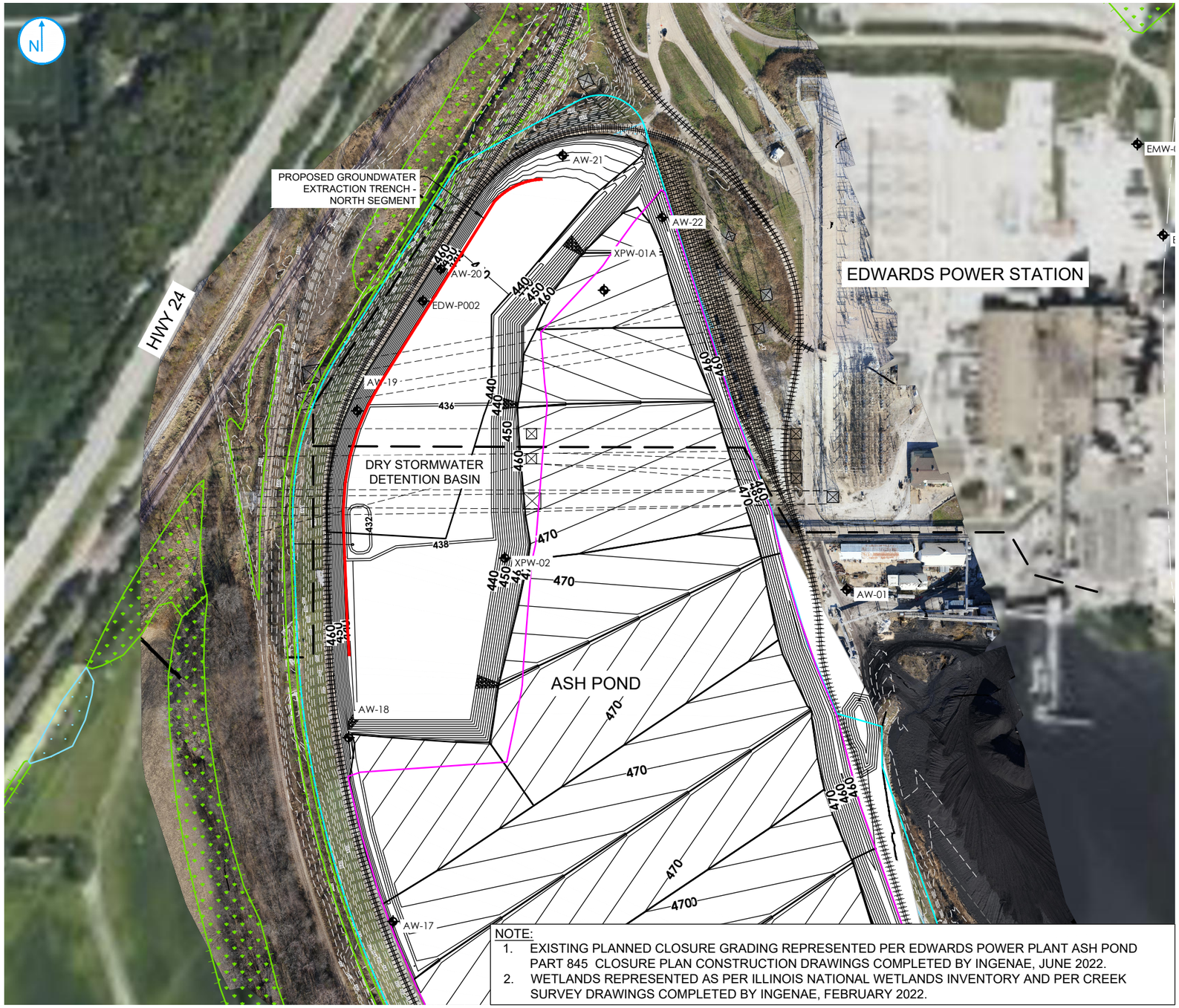
[15] K. Yildirim and G. Citir Kasim, Phytoremediation potential of poplar and willow species in small scale constructed wetland for boron removal, Chemosphere, 2018.

[16] B. H. Robinson, S. R. Green, B. Chanceral, T. M. Mills and B. E. Clothier, "Poplar for the phytomanagement of boron contaminated sites," *Environmental Pollution,* vol. 150, pp. 225-233, 2007.

[17] Z. Chen, A. A. Taylor, S. R. Astor, J. Xin and N. Terry, "Removal of boron from wastewater: Evaluation of seven poplar clones for B accumulation and tolerance," *Chemosphere,* vol. 167, no. January 2017, pp. 146-154, 2017.

[18] Gordian, RS Means Data version 8.7, Peoria, IL: Gordian, 2023.

APPENDIX A
FEASIBILITY-LEVEL DESIGN DRAWINGS FOR ALTERNATIVES 2 AND 3 REMEDIES



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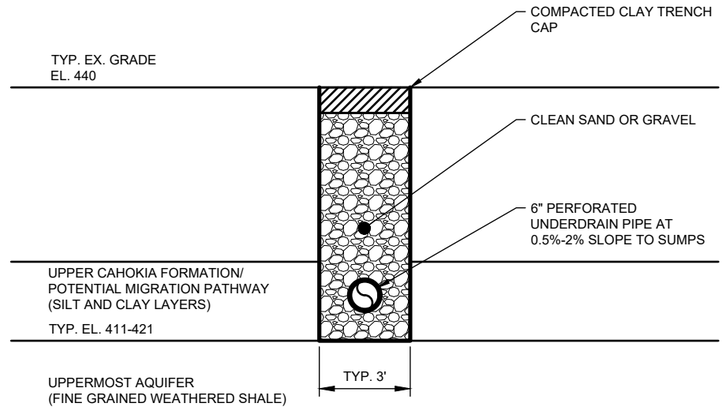

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EXISTING

- BODY OF WATER
- WETLANDS BOUNDARY (SEE NOTE 2)
- HIGH VOLTAGE UTILITY TOWER AND OVERHEAD POWER LINES
- MONITORING WELLS
- MAJOR CONTOUR
- MAJOR CONTOUR
- RAILROAD TRACKS
- SEWER FORCEMAIN
- CCR BOUNDARY
- EXTENT OF CAP

PROPOSED

- 360 MAJOR CONTOUR
- MAJOR CONTOUR
- GROUNDWATER EXTRACTION TRENCH

0 300 Feet

NORTH EXTRACTION TRENCH
FEASIBILITY-LEVEL DESIGN

Edwards Ash Pond
Edwards Power Plant 7800 Cilco Lane Bartonville, IL 61607

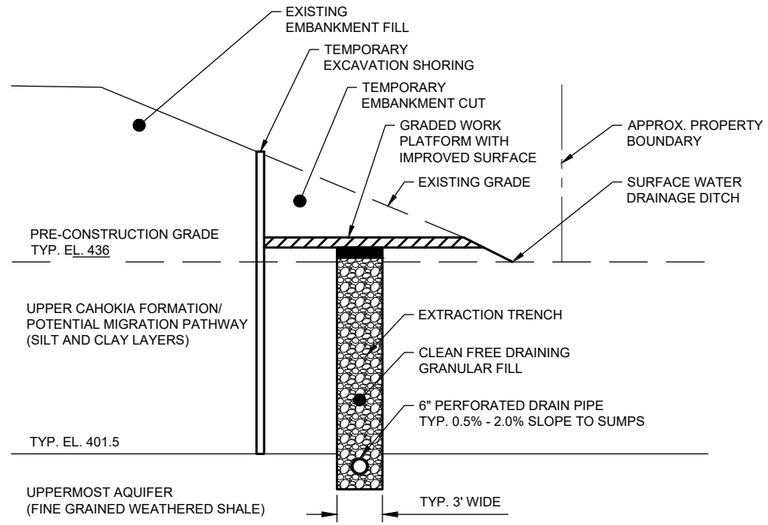
FIGURE 1

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL



NOTE:
1. EXISTING PLANNED CLOSURE GRADING REPRESENTED PER EDWARDS POWER PLANT ASH POND PART 845 CLOSURE PLAN CONSTRUCTION DRAWINGS COMPLETED BY INGENAE, JUNE 2022.
2. WETLANDS REPRESENTED AS PER ILLINOIS NATIONAL WETLANDS INVENTORY AND PER CREEK SURVEY DRAWINGS COMPLETED BY INGENAE, FEBRUARY 2022.



WORK PAD AND TRENCH DETAIL

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EXISTING

- BODY OF WATER
- WETLANDS BOUNDARY (SEE NOTE 2)
- HIGH VOLTAGE UTILITY TOWER AND OVERHEAD POWER LINES
- MONITORING WELLS
- MAJOR CONTOUR
- MAJOR CONTOUR
- RAILROAD TRACKS
- SEWER FORCEMAIN
- CCR BOUNDARY
- EXTENT OF CAP

PROPOSED

- 360 MAJOR CONTOUR
- MAJOR CONTOUR
- GROUNDWATER EXTRACTION TRENCH

0 300 Feet

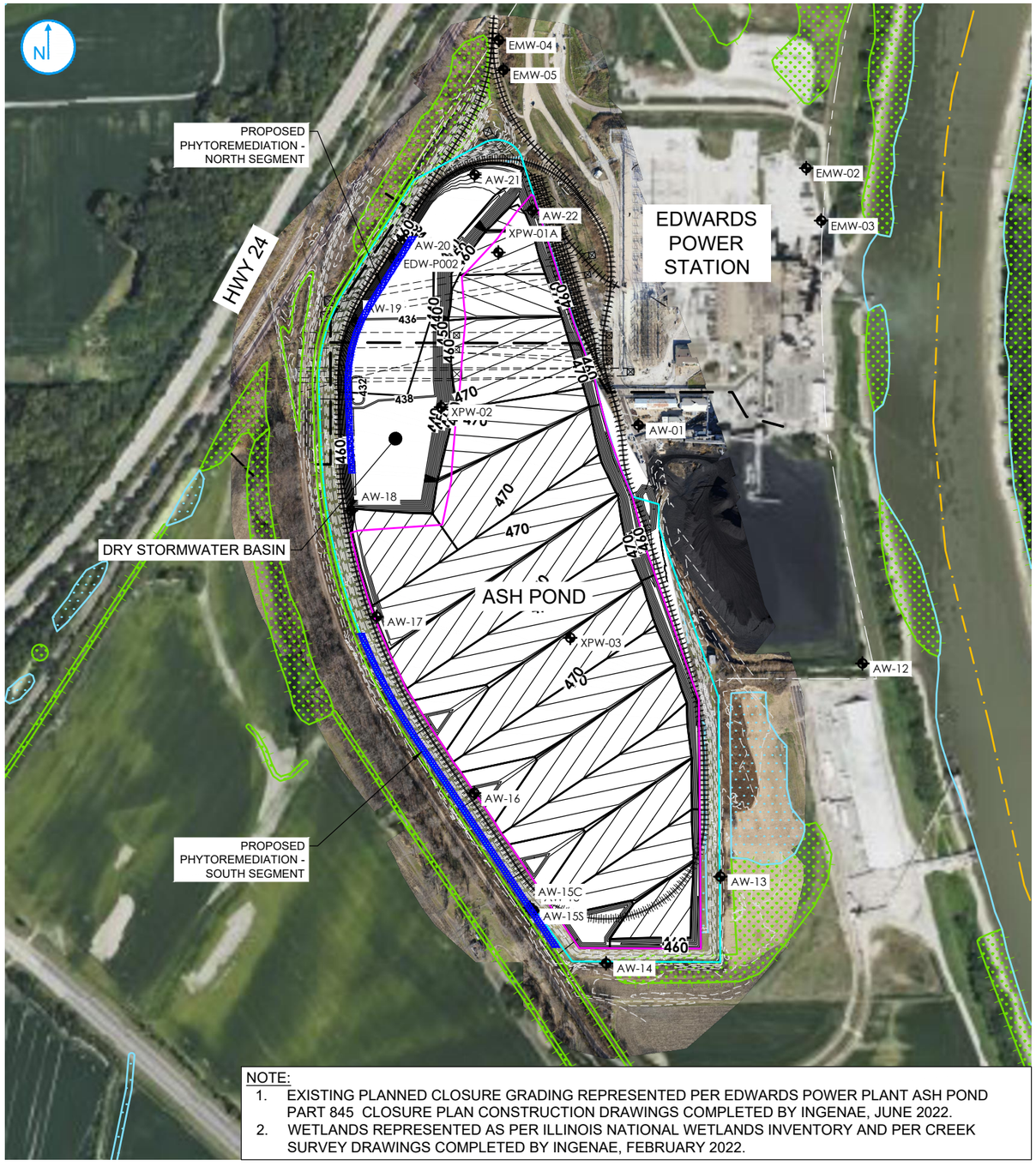
SOUTH TRENCH
FEASIBILITY-LEVEL DESIGN

Edwards Ash Pond
Edwards Power Plant 7800 Cilco Lane Bartonville, IL 61607

FIGURE 2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL



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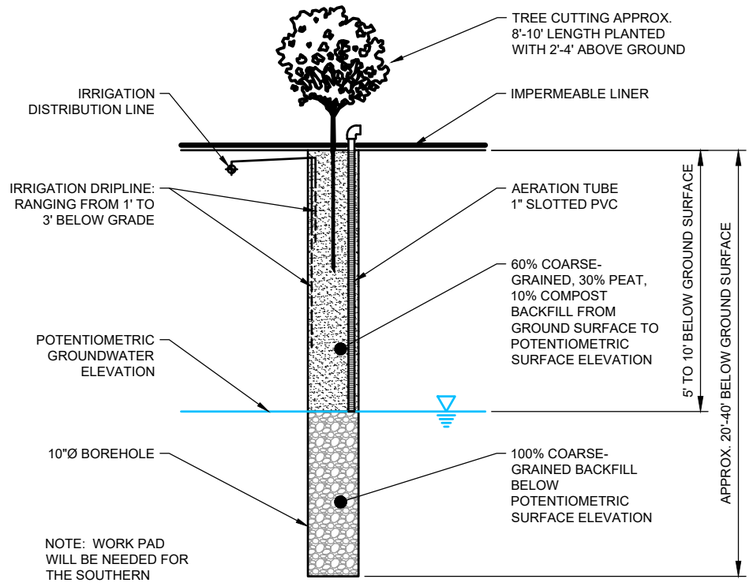

TREE PLANTING SYSTEM DETAIL

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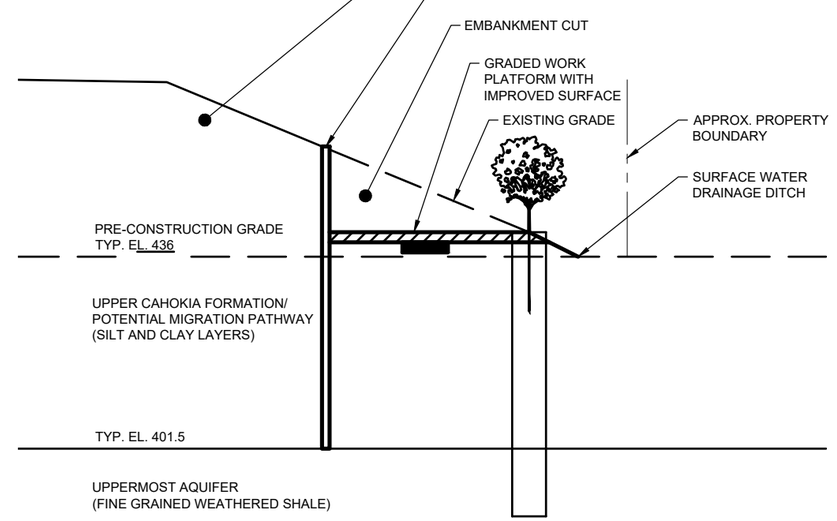


WORK PAD DETAIL

NOT TO SCALE

EXISTING

- BODY OF WATER
- WETLANDS BOUNDARY (SEE NOTE 2)
- HIGH VOLTAGE UTILITY TOWER AND OVERHEAD POWER LINES
- MONITORING WELLS
- MAJOR CONTOUR
- MAJOR CONTOUR
- RAILROAD TRACKS
- SEWER FORCEMAIN
- CCR BOUNDARY
- EXTENT OF CAP

PROPOSED

- MAJOR CONTOUR (360)
- MAJOR CONTOUR
- PHYTOREMEDIATION AREA

0 600 Feet

PHYTOREMEDIATION
FEASIBILITY-LEVEL DESIGN

Edwards Ash Pond
Edwards Power Plant 7800 Cilco Lane Bartonville, IL 61607

FIGURE 3

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.
A RAMBOLL COMPANY

RAMBOLL

PROJECT: ---- DATED: 4/4/2024 DESIGNER: EMMONSN C:\DOCS\Ramboll Gruppen AS\RUS-1940103584-004 Vistra Energy EDW-AP\Project Files\4 Delivery\40 WIP\401 Civil\Drawings\03_CAAA-SIR\EDW-AP CAAA-SIR.dwg

APPENDIX B
GROUNDWATER MODELING DOCUMENTS

APPENDIX B1
GROUNDWATER MODELING TECHNICAL MEMORANDUM

Intended for
Illinois Power Resources Generating, LLC
7800 Cilco Lane
Bartonville, Illinois, 61607

Date
June 2, 2025

Project No.
1940110241-003

GROUNDWATER MODELING TECHNICAL MEMORANDUM

ASH POND

EDWARDS POWER PLANT

BARTONVILLE, ILLINOIS

IEPA ID NO. W1438050005-01

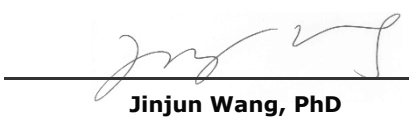
RAMBOLL Bright ideas. Sustainable change.

GROUNDWATER MODELING TECHNICAL MEMORANDUM EDWARDS POWER PLANT ASH POND, IEPA ID NO. W1438050005-01

Project name	**Edwards Power Plant Ash Pond**
Project no.	**1940110241-003**
Recipient	**Illinois Power Resources Generating, LLC**
Document type	**Technical Memorandum**
Revision	**FINAL**
Date	**June 2, 2025**
Prepared by	**Jinjun Wang, PhD**
Checked by	**Jake J. Walczak, PG**
Approved by	**Brian G. Hennings, PG**

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

T 414-837-3607
F 414-837-3608
https://ramboll.com



Jinjun Wang, PhD
Senior Managing Consultant



Brian G. Hennings, PG
Project Officer, Hydrogeology

CONTENTS

Executive Summary		**3**
1.	**Introduction**	**4**
1.1	Background	4
1.2	Previous Groundwater Modeling Report	4
2.	**Alternative 1 Simulation**	**5**
2.1	Ramboll (2022) Model Description	5
2.2	Groundwater Model Update	6
2.3	Simulation Results of Updated Model	6
3.	**Alternative 2 and Alternative 3 Simulations**	**7**
3.1	Alternative 2 Remedy – Source Control with GWE	7
3.1.1	Overview	7
3.1.2	Model Approach	7
3.1.3	Simulation Results	7
3.2	Alternative 3 Remedy – Source Control with Phytoremediation	8
3.2.1	Overview	8
3.2.2	Model Approach	8
3.2.3	Simulation Results	9
3.2.4	Uncertainty Analysis	9
4.	**Conclusions**	**11**
5.	**References**	**12**

TABLES (ATTACHED)

Table 1 Simulated Time to Achieve Boron GWPS in EPP AP Monitoring Wells

TABLES (IN TEXT)

Table A Estimated Timeframes to Attain GWPS in Groundwater Monitoring Wells

FIGURES

Figure 1 Monitoring Well Location Map
Figure 2 Simulated Boron Concentrations in EPP AP Monitoring Wells – Alternative 1 Remedy
Figure 3 Proposed Groundwater Extraction Trench Location – Alternative 2 Remedy
Figure 4 Simulated Boron Concentrations in EPP AP Monitoring Wells – Alternative 2 Remedy
Figure 5 Simulated Extraction Rate from the Extraction Trench – Alternative 2 Remedy
Figure 6 Proposed Phytoremediation Zone – Alternative 3 Remedy
Figure 7 Comparison of Simulation Results between Modeling Methods – Alternative 3 Remedy
Figure 8 Simulated Boron Concentrations in EPP AP Monitoring Wells – Alternative 3 Remedy

APPENDICES

Appendix A MODFLOW and MT3DMS Model Files (Electronic Only)

ACRONYMS AND ABBREVIATIONS

35 I.A.C.	Title 35 of the Illinois Administrative Code
AP	Ash Pond
CAAA	Corrective Action Alternatives Analysis
CAP	Corrective Action Plan
CCR	coal combustion residual(s)
CBR	closure-by-removal
CIP	closure-in-place
COC	constituent of concern
EPP	Edwards Power Plant
ft/d	feet per day
gpd/tree	gallons per day per tree
gpm	gallons per minute
GWE	groundwater extraction
GWP	Groundwater Polishing
GWPS	groundwater protection standard(s)
ID	identification
IEPA	Illinois Environmental Protection Agency
IPRG	Illinois Power Resources Generating, LLC
mg/L	milligrams per liter
mL/g	milliliters per gram
NAVD88	North American Vertical Datum of 1988
NID	National Inventory of Dams
No.	number
Ramboll	Ramboll Americas Engineering Solutions, Inc.
UA	uppermost aquifer

EXECUTIVE SUMMARY

Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this Groundwater Modeling Technical Memorandum on behalf of the Edwards Power Plant (EPP), operated by Illinois Power Resources Generating, LLC (IPRG), in accordance with requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845. This document presents the results of predictive groundwater modeling simulations for proposed corrective action. A total of three potential remedial alternatives were evaluated, including (1) Alternative 1: source control with groundwater polishing (GWP), (2) Alternative 2: source control with groundwater extraction (GWE), and (3) Alternative 3: source control with phytoremediation. Each remedial alternative simulation was based off the closure-in-place (CIP) scenario that was selected as the closure plan for EPP AP in 2022 (IngenAE, 2022) and modeled in the Groundwater Modeling Report (Ramboll, 2022).

The groundwater modeling efforts described in this Groundwater Modeling Technical Memorandum include groundwater flow modeling using MODFLOW-NWT (Niswonger et al., 2011) and contaminant fate and transport modeling using MT3DMS (Zheng and Wang, 1999) to evaluate how each corrective action will achieve compliance with the applicable groundwater protection standards (GWPSs); and describe fate and transport of contaminants in accordance with 35 I.A.C. § 845.220 (c)(2). The effectiveness of each corrective action was assessed based on the time for simulated boron concentrations to decrease below the GWPS in each of the groundwater monitoring wells in the vicinity of EPP AP (**Figure 1**). Each corrective action was assumed to be implemented at the completion of the EPP AP final closure.

Alternative 1 remedy consists of source control with GWP, which represents the selected closure alternative for EPP AP in 2022 (IngenAE, 2022). Groundwater modeling results for this remedy indicate the simulated boron concentrations would achieve the applicable GWPS of 2 milligrams per liter (mg/L) in each of the monitoring wells within approximately 800 years[1].

Alternative 2 remedy consists of source control with installation and operation of GWE trench. Groundwater modeling results for this remedy indicate the simulated boron concentrations would achieve the GWPS of 2 mg/L in each of the EPP AP monitoring wells within 37 years. Prediction modeling suggests that operation of Alternative 2 remedy for an additional 13 years (50 years total) may be necessary to reduce the potential for boron concentration to rebound above the GWPS after groundwater extraction operations have ceased.

Alternative 3 remedy consists of source control with phytoremediation. Simulation results from groundwater modeling, including uncertainty analyses based on the assumption of optimal and sub-optimal phytoremediation groundwater uptake rate performance, indicate the simulated boron concentrations would achieve the GWPS of 2 mg/L in all the groundwater monitoring wells within 42 to 77 years. Operation of Alternative 3 remedy for 55 to 150 years is expected to reduce the potential for boron concentration from rebounding above the GWPS after phytoremediation operations have ceased.

[1] The 2022 model results estimated approximately 750 years for all wells to achieve the GWPS. Following model updates described in this document, the estimated time to achieve the GWPS at each well for Alternative 1 remedy has been updated to approximately 800 years.

1. INTRODUCTION

1.1 Background

This Groundwater Modeling Technical Memorandum is prepared to evaluate how potential CAP remedial alternatives would achieve compliance with the applicable GWPSs, and to describe fate and transport of contaminants in accordance with 35 I.A.C. § 845.220 (c)(2). The groundwater modeling efforts consist of predictive groundwater modeling to assess the long-term effectiveness and time to achieve GWPS for boron for the following remedial alternatives: (1) Alternative 1: source control with GWP, (2) Alternative 2: source control with GWE, and (3) Alternative 3: source control with phytoremediation. In all remedial alternatives, source control is the CIP that had been selected as the closure alternative for EPP AP in 2022 (IngenAE, 2022) and modeled in the Groundwater Modeling Report (Ramboll, 2022).

1.2 Previous Groundwater Modeling Report

In accordance with requirements of 35 I.A.C. § 845, Ramboll developed groundwater flow and transport models for EPP AP in 2022 to evaluate the CIP closure scenario (Ramboll, 2022). The groundwater flow model was built using MODFLOW-2005 (Harbaugh, 2005), and the contaminant fate and transport model was built using MT3DMS. The groundwater models were used to evaluate two closure scenarios, including consolidation of the coal combustion residuals (CCR) and CIP, and closure-by-removal (CBR). The CIP was selected as the primary corrective action to meet regulatory requirements for closure of EPP AP. The modeling exercises and results were summarized in the Groundwater Modeling Report (Ramboll, 2022).

The groundwater modeling efforts presented in this Groundwater Modeling Technical Memorandum are based on the Ramboll (2022) groundwater modeling exercises, as detailed in **Section 2**.

2. ALTERNATIVE 1 SIMULATION

2.1 Closure in Place (CIP)

The Groundwater Modeling Report (Ramboll, 2022) simulates the CIP closure of EPP AP as presented in the Final Closure Plan (IngenAE, 2022). The closure of EPP AP consists of a consolidate-and-cap approach for source control.

2.2 Alternative 1 - Source Control with Groundwater Polishing (GWP)

This scenario is consistent with the closure conditions (consolidate-and-cap and CIP of the AP) for source control (Ramboll, 2022), after which GWP will be used to reduce the residual concentration remaining in the groundwater after closure. These activities constitute the Alternative 1 remedy: source control with GWP. Groundwater polishing of boron is further discussed in the Groundwater Polishing Evaluation Report (GPR) (Life Cycle Geo, LLC, 2025) and **Section 3.3** of this document.

2.3 Ramboll (2022) Model Description

The Ramboll (2022) groundwater modeling simulated the fate and transport of boron to support closure of EPP AP. Modeling activities conducted to simulate the CIP closure (*i.e.*, Alternative 1 remedy) included:

- Initial modeling was performed for a 62-year period to represent boron concentrations for site conditions in 2022, 62 years following construction of EPP AP in 1960. The model was calibrated to represent groundwater elevations and concentrations observed in groundwater monitoring wells.
- Prediction modeling was conducted to simulate initial corrective action measures, which include dewatering of the EPP AP (1-year period), consolidation of CCR and cover system construction or removal of CCR.
- Prediction simulation was performed to evaluate the effects of CIP closure scenario for EPP AP on groundwater quality for a period of 1,000 years after the completion of closure activities.
- According to the prediction simulation results for CIP closure, monitoring well AW-16 is the last well to achieve the 2 mg/L GWPS for boron. The simulated boron concentration in well AW-16 would drop below the GWPS 767 years after the implementation of closure.

For the contaminant fate and transport simulations, boron was selected as the constituent to evaluate the effectiveness of the closure scenario. Boron has similar groundwater transport characteristics as the other constituents that have been detected with potential GWPS exceedances[2] (*i.e.,* sulfate and total dissolved solids). Therefore, subsurface transport during closure conditions would be similar for all these constituents. Boron has been detected in EPP AP groundwater at the highest concentrations relative to its GWPS and it will likely take the longest

[2] Throughout this document, "exceedance" or "exceedances" is intended to refer only to potential exceedances of proposed applicable background statistics or GWPS as described in the proposed groundwater monitoring program, which was submitted to the IEPA on October 25, 2021 as part of IPRG's operating permit application for the EPP AP. That operating permit application, including the proposed groundwater monitoring program, remains under review by the IEPA and, therefore, IPRG has not identified any actual exceedances.

time to meet the GWPS. It is not necessary to model all constituents that show GWPS exceedances or have been detected at lower concentrations relative to their GWPSs, because those constituents will likely achieve their GWPSs more quickly (Gradient, 2024).

2.4 Groundwater Model Update

For the purpose of evaluating the potential groundwater remedial alternatives, the groundwater flow modeling program associated with the prediction simulations, including the 1-year dewatering simulation and the 1,000-year CIP simulation, was updated from MODFLOW-2005 to MODFLOW-NWT. MODFLOW-NWT is a modeling program designed to solve nonlinear groundwater flow problems due to unconfined aquifer conditions and is superior in solving problems involving drying and rewetting of unconfined aquifers (Niswonger et al., 2011), which were expected for the selected remedial alternatives. In addition, the layer types associated with model Layers 2 through 5 in the prediction models were updated from "confined" to "unconfined (T Varies)" to accommodate the drying and rewetting conditions. MT3DMS remained as the fate and transport modeling program.

The updated simulation results are discussed in **Section 2.3**. In this Groundwater Modeling Technical Memorandum, it is assumed the CAP remedial alternatives would be implemented simultaneously with the CIP. Therefore, the simulated groundwater elevations and boron concentrations at the end of the 1-year dewatering period also served as the initial conditions for the following remedial alternative simulations described in **Section 3**.

2.5 Simulation Results of Updated Model

The simulated boron concentrations in EPP AP's groundwater monitoring wells versus time are shown in **Figure 2**. The simulated time to achieve boron GWPS in the monitoring wells is summarized in **Table 1**. According to the simulation results, monitoring well AW-16 has the longest time to achieve compliance among all the monitoring wells, which is 801 years. As mentioned in **Section 2.1**, the simulated time to achieve compliance from the Ramboll (2022) modeling is 767 years. The minor difference between the two results is a result of model update as described in **Section 2.2**.

3. ALTERNATIVE 2 AND ALTERNATIVE 3 SIMULATIONS

The source control with CIP (*i.e.*, Alternative 1 remedy) simulation described in **Section 2** provides a baseline scenario for comparison to the two supplemental corrective action remedies, including Alternative 2 (source control with GWE), and Alternative 3 (source control with phytoremediation).

3.1 Alternative 2 Remedy – Source Control with GWE

3.1.1 Overview

Alternative 2 remedy consists of the installation and operation of GWE trenches. The GWE trenches would be installed during the completion of source control (*e.g.*, final closure) construction activities and become operational at the same time source control is complete. The extents and depths of GWE trenches were selected through iterative fate and transport simulations. Various depth intervals and trench lengths were evaluated to identify optimal depths and locations to reduce the time to achieve GWPS while remaining feasible to construct and operate.

The proposed GWE trenches include two segments located near the western boundary of the EPP AP (**Figure 3**): the Northern Segment and the Southern Segment. The Northern Segment is proposed to be installed to the bottom of the uppermost aquifer (UA) to an elevation of approximately 411 to 421 feet[3]. The Southern Segment is proposed to be installed within the UA to an elevation of approximately 401.5 feet[3]. The goal of Alternative 2 remedy is to increase the hydraulic gradient towards the extraction trench by collecting groundwater from the near bottom of the trench and lowering the head in the surrounding soil units. A greater hydraulic gradient will induce higher groundwater flow velocity, which will increase the speed of dissolved phase mass removal from EPP AP. The time to achieve GWPS in the groundwater monitoring wells will be reduced accordingly.

3.1.2 Model Approach

The 1,000-year CIP prediction model described in **Section 2** was modified to simulate the effectiveness of Alternative 2 Remedy. The proposed GWE trench was simulated as drains located within the UA, which was simulated as Layer 4 in the model. The drain stage was set to the bottom of the UA for the Northern Segment, and to 401.5 feet for the Southern Segment. The GWE trench was assumed to be 3-foot thick, and the backfill material for the GWE trench was assumed to be sand with a hydraulic conductivity of 62.4 feet per day (ft/d). The model cells simulating the GWE trench were sized 25 feet by 25 feet, with 12% of the volume being backfill material. Therefore, the hydraulic conductivities in model cells within and above the drain were adjusted to 10 ft/d, both vertically and horizontally, to account for the permeability of fill material in the extraction trench.

3.1.3 Simulation Results

Simulation of Alternative 2 remedy assumed operation of the GWE trench for 50 years. The simulated boron concentrations in the groundwater monitoring wells versus time for Alternative 2 remedy are shown in **Figure 4**. The simulated time to achieve boron GWPS in the monitoring

[3] All elevations in this report are referenced to North American Vertical Datum of 1988 (NAVD88).

wells is summarized in **Table 1**. According to the simulation results, monitoring well AP07S is the last well to reach GWPS, in 37 years under Alternative 2 remedy. The simulation results also indicate that operating the GWE trench for 50 years may be necessary to reduce the potential of boron concentrations from rebounding above GWPS after operation of the trenches has ceased. Monitoring and adaptive site management practices presented in the Corrective Action Groundwater Monitoring Plan (Ramboll, 2025) describe how stability in groundwater data will be evaluated before assessing if compliance with the GWPS has been attained to allow any transient effects of treatment on the groundwater (e.g., rebounding concentrations) to dissipate.

The simulated extraction rate from the GWE trench versus time is plotted in **Figure 5**. As shown in the figure, the extraction rates in both segments are higher at the beginning of the operation (*e.g.,* about 20 gallon per minute [gpm] in Northern Segment and 19 gpm in Southern Segment at the end of year 2) due to higher initial groundwater elevations at the start of extraction. As simulated, groundwater levels near the extraction trench decrease as operation of the GWE trench continues, as does the simulated extraction rates. Groundwater extraction decreases to approximately 6 gpm in Northern Segment and 8 gpm in Southern Segment at the end of 50-year operation.

3.2 Alternative 3 Remedy – Source Control with Phytoremediation

3.2.1 Overview

Alternative 3 remedy consists of source control with phytoremediation. The phytoremediation would be installed during the completion of source control construction activities and become active at the same time source control is complete. The phytoremediation configuration was selected through iterative fate and transport simulations. Various configurations were evaluated to identify optimal designs to reduce the time to achieve GWPS while remaining feasible to construct and maintain.

The proposed phytoremediation zone is composed of two segments: the Northern Segment and the Southern Segment, as shown in **Figure 6**. It is anticipated that each segment would contain a narrow grid (*i.e.,* approximately 8- to 10-foot grid spacing) of plantings with each planting consisting of one tree and a well system designed to passively draw groundwater upward to the root zone from the UA, allowing phytoremediation to occur.

The simulations for optimal phytoremediation performance assumed an ideal uptake rate of 40 gallons per day per tree (gpd/tree) during growing season (*i.e.*, April – September) and 0 uptake rate during dormant season (*i.e.*, October – March). The optimal number of trees for the phytoremediation was determined to be 194 trees in Northern Segment, and 354 trees in Southern Segment.

3.2.2 Model Approach

The 1,000-year CIP prediction model described in **Section 2** was updated to simulate the phytoremediation. In the updated model, groundwater uptake by the trees was simulated as groundwater extraction wells installed within the UA, which was simulated as Layer 4 in the model.

There are two possible approaches in simulating the ideal groundwater uptake rate of 40 gpd/tree during growing season in the model: Method A assumes an uptake rate of 40 gpd/tree for half of year and 0 rate for the other half. Method B assumes a consistent average uptake rate

of 20 gpd/tree throughout the year. The simulated boron concentrations in selected groundwater monitoring wells from both methods are compared and shown in **Figure 7**. As shown in the figure, the simulated concentrations from both methods are in good agreement. Therefore, Method B was chosen for the remaining simulations as this method is both easier to implement in the prediction model simulations and is more computationally efficient.

3.2.3 Simulation Results

Simulation of Alternative 3 remedy assumed maintenance of phytoremediation for 70 years, with an ideal groundwater uptake rate of 40 gpd/tree during growing season. The simulated boron concentrations in the groundwater monitoring wells versus time under Alternative 3 Remedy are shown in **Figure 8**. The simulated time to achieve boron GWPS in the monitoring wells is summarized in **Table 1**. As shown, monitoring well AW-21 is the last monitoring location to achieve GWPS compliance for boron. Under Alternative 3 Remedy, the time for boron concentration in well AW-21 to drop below GWPS is 47 years. The simulation results also indicate that maintenance of phytoremediation for 70 years may be necessary to reduce the potential for boron concentrations from rebounding above GWPS after phytoremediation is ceased.

3.2.4 Uncertainty Analysis

In addition to the simulation described above, uncertainty analysis was conducted to assess the impact of uncertainty in the estimated groundwater uptake rate for Alternative 3 remedy. For the uncertainty analysis, a high-end (*i.e.,* optimal) uptake rate of 50 gpd/tree during growing season and a low-end (*i.e.*, suboptimal) uptake rate of 20 gpd/tree during growing season were applied in the model, respectively.

According to the simulation results, GWPS compliance will be achieved in 42 years under high uptake rate, and maintenance of phytoremediation for 55 years will prevent boron concentrations from rebounding above GWPS. The time to achieve GWPS compliance under low uptake rate is 77 years, and a 150-year maintenance is required to prevent boron concentration from rebounding above GWPS.

3.3 Assessment of Geochemical Processes

This groundwater flow and transport model estimates the time for boron to reach the GWPS under different potential corrective actions based on physical components of groundwater polishing. As described in the Groundwater Modeling Report submitted with the construction permit, it was assumed that boron would not significantly sorb or chemically react with aquifer solids (distribution coefficient [K_d] was set to 0 milliliters per gram [mL/g]), which is a conservative estimate for estimating contaminant transport times.

A Groundwater Polishing Evaluation Report (Life Cycle Geo, 2025) was attached to the Corrective Actions Alternative Analysis (Gradient, 2025). The geochemical modeling effort presented in the GPR supports the assessment of groundwater polishing as a component of the proposed corrective action by evaluating the potential for chemical attenuation of constituents of concern (COCs) before and after source control as a means of contextualizing the times estimated in the flow and transport model. The GPR also provides an initial foundation for understanding groundwater chemistry to inform adaptive site management as a key component of the Corrective Action Groundwater Monitoring Program.

In their report, Life Cycle Geo evaluated the potential for natural groundwater polishing processes, which involve both physical and chemical mechanisms, to attenuate boron and sulfate and evaluate the potential for previously attenuated boron and sulfate to be remobilized into groundwater as concentrations return to background levels. The groundwater polishing evaluation determined that adsorption of both boron and sulfate has occurred in association with the oxidized mineral surfaces found in the underlying soils (based on site-specific SEP results).

Modeling results presented in the GPR show that a substantial proportion of boron and sulfate are retained on the solid phase under current conditions. Base case reaction modeling results indicate that substantial remobilization of COCs back to the groundwater phase is unlikely as conditions return to background. Simulations show a minor increase in adsorbent mineral masses is possible and solid sorbing phases are anticipated to be stable. Notably, the precipitation of barite is also simulated, which provides a further sink for sulfate. These data suggest that the changing geochemical conditions that come with the "return to background" are overall unlikely to cause a longer observed time to reach the GWPS. In other words, the impact of groundwater polishing through chemical attenuation mechanisms has only a minimal effect on the estimated time it takes for boron concentrations to reach the GWPS of 2 mg/L, as modeled by the flow and transport model.

4. CONCLUSIONS

The groundwater modeling efforts in this Groundwater Modeling Technical Memorandum consist of flow and transport modeling using MODFLOW-NWT and MT3DMS to assess the time to achieve GWPS for boron for three CAP remedy alternatives: Alternative 1 remedy (source control with GWP), Alternative 2 remedy (source control with GWE) and Alternative 3 remedy (source control with phytoremediation).

A summary of predicted time for boron concentrations to meet the GWPS at the compliance monitoring wells is provided in **Table 1**. Percentage of compliance monitoring wells predicted to attain GWPS is summarized below in **Table A**. As shown in the tables, the time to achieve boron GWPS compliance in each of the EPP AP groundwater monitoring wells is approximately 800 years under Alternative 1 remedy. Under Alternative 2 remedy, the time to achieve GWPS compliance is estimated to be 37 years. Operation of Alternative 2 remedy for 50 years may be necessary to reduce the potential for boron concentration from rebounding above the GWPS after remedy operations are ceased. The time to achieve GWPS compliance under Alternative 3 remedy is estimated to be 42, 47, and 77 years, depending on assumed phytoremediation uptake rates. Maintenance of phytoremediation for 55, 70, and 150 years, depending on phytoremediation uptake rates, may be necessary to reduce the potential for boron concentration from rebounding above the GWPS after remedy operations have ceased.

Table A. Estimated Timeframes to Attain GWPS in Groundwater Monitoring Wells

Alternative	Impacted Wells†	Percentage of Wells Predicted to Attain GWPS†							
		5 Years‡	10 Years‡	20 Years‡	37 Years‡	42 Years‡	47 Years‡	77 Years‡	801 Years‡
1	16	38%	44%	44%	44%	50%	50%	38%	100%
2	10	20%	60%	80%	100%	100%	100%	100%	100%
3 (40 gpd/tree)	13	23%	38%	62%	62%	85%	100%	100%	100%
3 (20 gpd/tree)	13	23%	31%	38%	62%	69%	62%	100%	100%
3 (50 gpd/tree)	13	23%	38%	62%	77%	100%	100%	100%	100%

†: Estimated timeframes per the number of impacted wells (wells with estimated times to achieve the GWPS) shown in Table 1
‡: Years counted starting from completion of corrective action

5. REFERENCES

Gradient, 2024. Closure Alternatives Analysis Groundwater Modeling Review at the Coffeen Power Plant, Edwards Power Plant, Newton Power Plant, and Hennepin Power Plant, Expert Report of Andrew Bittner, P.E.

Harbaugh, A.W., 2005, MODFLOW-2005. The U.S. Geological Survey modular ground-water model—the Ground-Water Flow Process: U.S. Geological Survey Techniques and Methods 6-A16, variously p.

IngenAE, LLC., 2022. Final Closure Plan, Edwards Power Plant, Ash Pond, (IEPA ID W1438050005-01), Illinois Power Resources Generating, LLC., Bartonville, Illinois, June 2022.

Illinois Administrative Code, Title 35, Subtitle G, Chapter I, Subchapter J, Part 845: Standards for The Disposal of Coal Combustion Residuals In Surface Impoundments, effective April 21, 2021.

Life Cycle Geo, LLC, 2025. Groundwater Polishing Evaluation Report, Edwards Ash Pond.

Niswonger, R.G., Panday, Sorab, and Ibaraki, Motomu, 2011. MODFLOW-NWT, A Newton formulation for MODFLOW-2005: U.S. Geological Survey Techniques and Methods 6–A37, 44 p.

Ramboll Americas Engineering Solutions, Inc (Ramboll), 2022. Groundwater Modeling Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois.

Ramboll Americas Engineering Solutions, Inc (Ramboll), 2025. Corrective Action Groundwater Monitoring Plan, Ash Pond, Edwards Power Plant, Bartonville, Illinois, IEPA ID No. W1438050005-01. March 28, 2025.

Zheng C., and P. Wang, 1999. MT3DMS: A Modular Three-Dimensional Multispecies Transport Model for Simulation of Advection, Dispersion, and Chemical Reactions of Contaminants in Groundwater Systems: Documentation and User's Guide.

TABLES

TABLE 1. SIMULATED TIME TO ACHIEVE BORON GWPS IN EPP AP MONITORING WELLS

GROUNDWATER MODELING TECHNICAL MEMORANDUM

EDWARDS POWER PLANT

ASH POND

BARTONVILLE, ILLINOIS

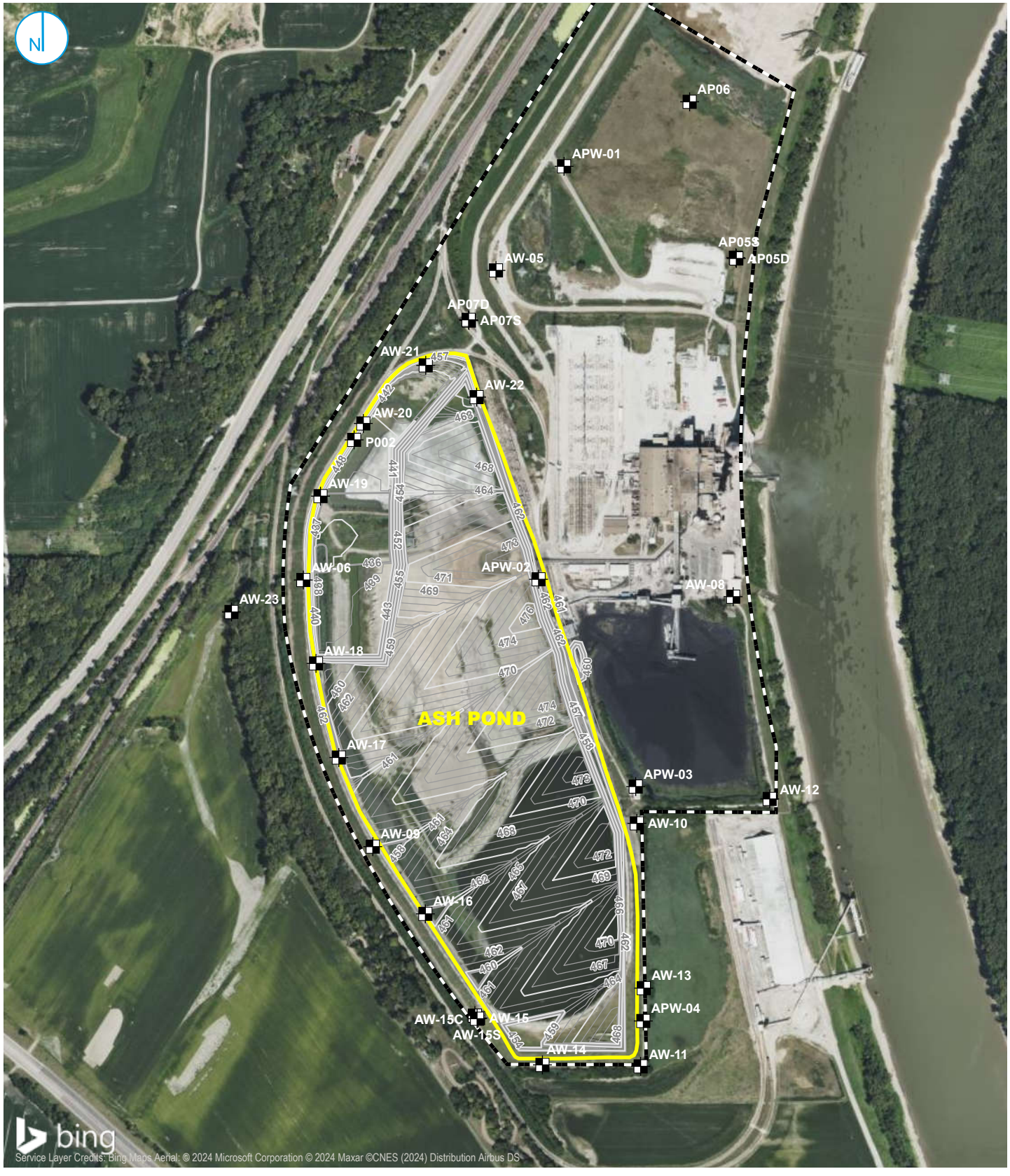
Monitoring Well	Time to Achieve GWPS* in Monitoring Well (Year)				
	Alternative 1 Remedy (Source Control with Groundwater Polishing)	Alternative 2 Remedy (Source Control with Groundwater Extraction)	Alternative 3 Remedy (Source Control with Phytoremediation)		
			Uptake Rate = 40 gpd/tree**	Uptake Rate = 20 gpd/tree**	Uptake Rate = 50 gpd/tree**
AP05S	0	0	0	0	0
AP05D	0	0	0	0	0
AP06	0	0	0	0	0
AP07S	40	37	41	41	42
AP07D	0	0	0	0	0
APW-01	0	0	0	0	0
APW-02	0	0	0	0	0
APW-03	0	0	0	0	0
APW-04	0	0	0	0	0
AW-05	9	1	8	8	7
AW-06	0	0	0	0	0
AW-08	0	0	0	0	0
AW-09	691	0	41	76	34
AW-10	0	0	0	0	0
AW-11	222	0	0	0	0
AW-12	0	0	0	0	0
AW-13	0	0	0	0	0
AW-14	296	0	8	25	0
AW-15	356	0	0	0	0
AW-15C	0	0	0	0	0
AW-15S	2	0	2	2	2
AW-16	801	35	0	0	42
AW-17	455	9	34	77	28
AW-18	212	9	16	22	15
AW-19	190	10	13	18	11
AW-20	146	9	42	63	36
AW-21	126	11	47	63	42
AW-22	156	9	39	58	34
AW-23	14	0	6	7	6
P002	194	12	17	28	15
Minimum	**0**	**0**	**0**	**0**	**0**
Maximum	**801**	**37**	**47**	**77**	**42**
Average	**130**	**5**	**11**	**16**	**11**

* GWPS - groundwater protection standard

** Uptake rate during growing season

RAMBOLL

FIGURES



Y:\Mapping\Projects\22\22685\MXD\Model_Figures\Edwards\CAAA-SIR\EDW_CAAA aprx\Figure 1. Monitoring Well Location Map

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MONITORING WELL

PROPOSED CLOSURE GRADES

5FT ELEVATION CONTOUR

1FT ELEVATION CONTOUR

REGULATED UNIT (SUBJECT UNIT)

PROPERTY BOUNDARY

0 350 700 Feet

MONITORING WELL LOCATION MAP

ASH POND

EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 1

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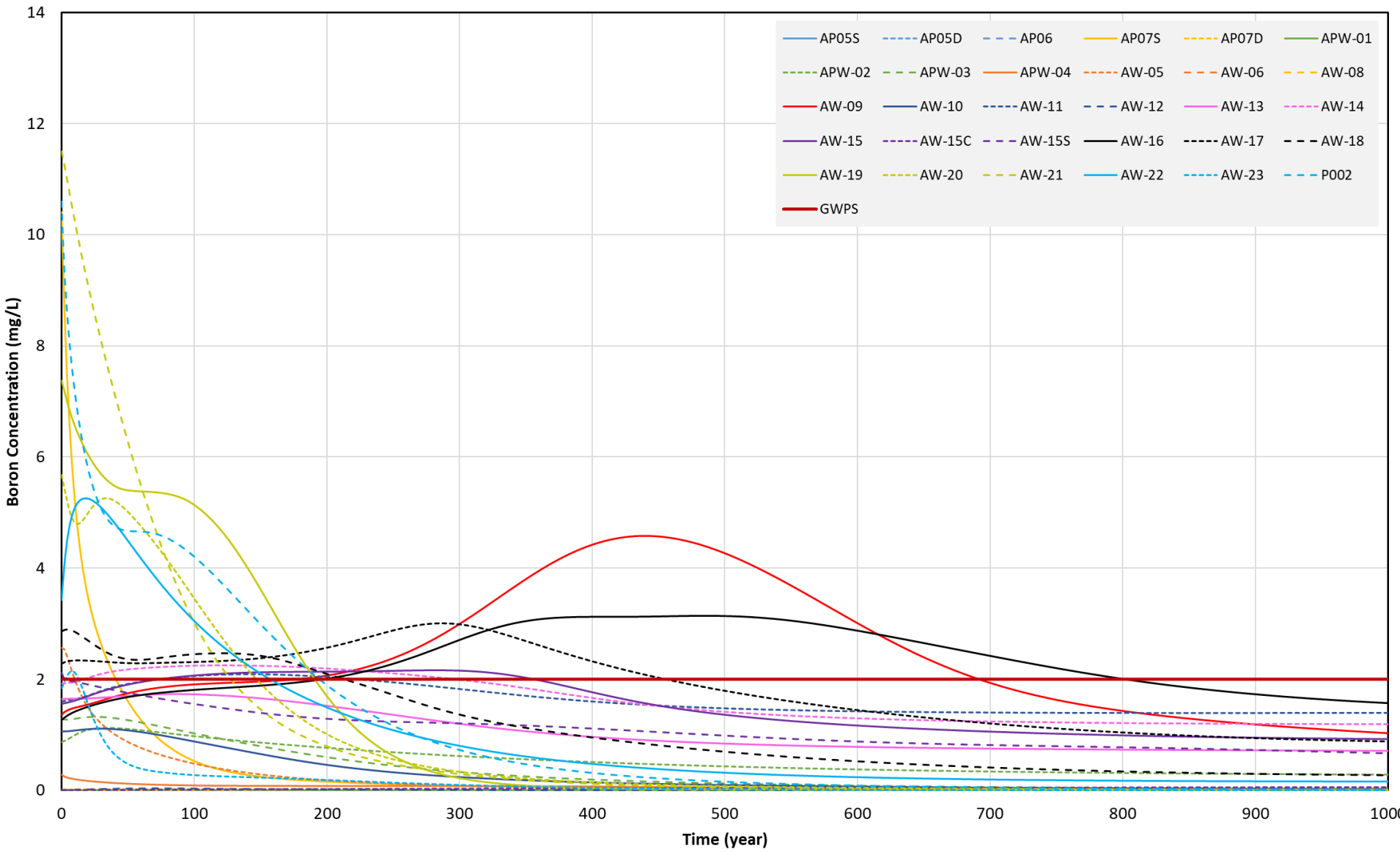

SIMULATED BORON CONCENTRATIONS IN EPP AP MONITORING WELLS - ALTERNATIVE 1 REMEDY

ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 2

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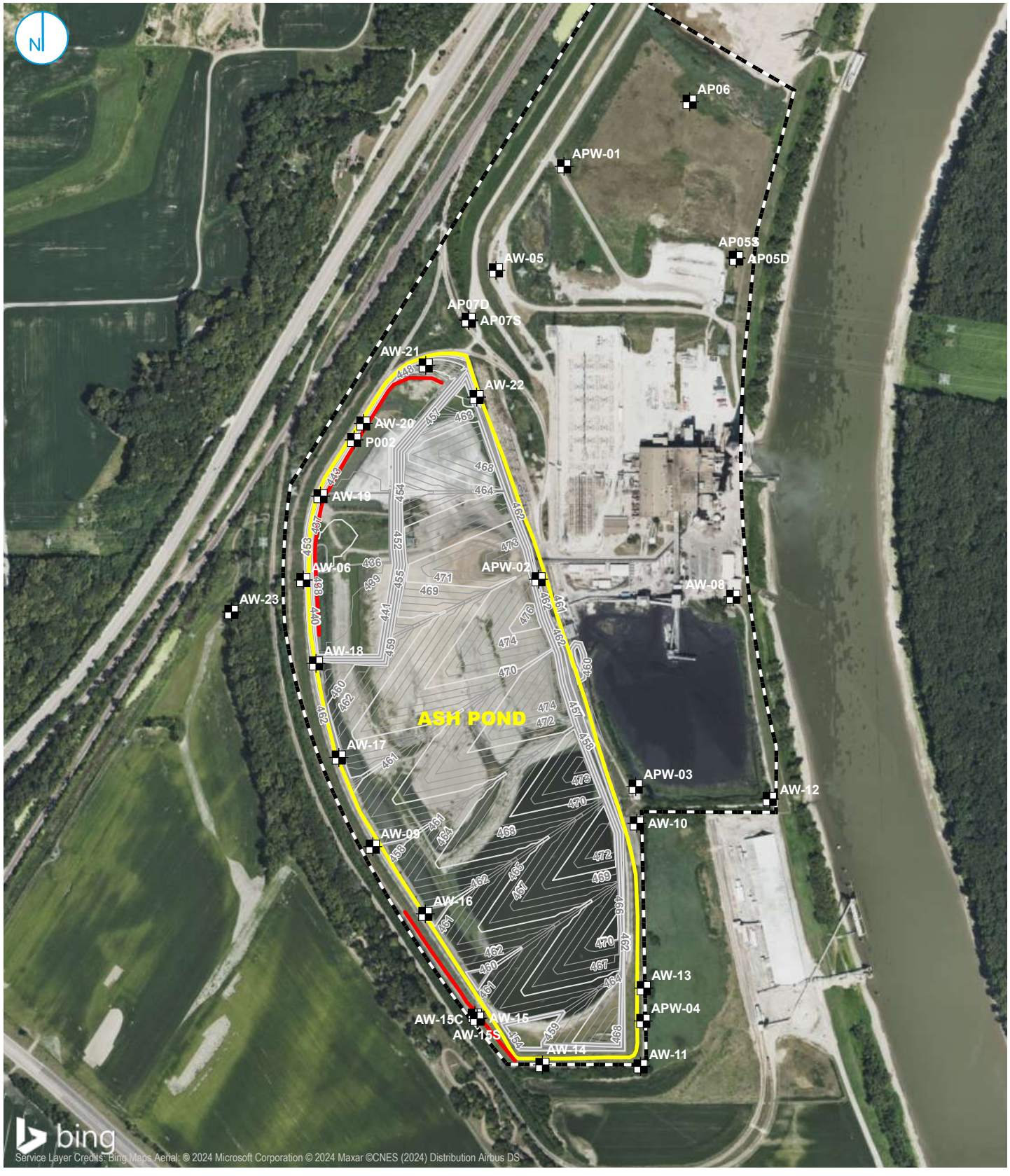

Y:\Mapping\Projects\22\2285\MXD\Model_Figures\Edwards\CAAA-SIR\EDW_CAAA.aprx\Figure 3. Alternative 2 Extraction Trench

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MONITORING WELL
GROUNDWATER EXTRACTION TRENCH
PROPOSED CLOSURE GRADES
5FT ELEVATION CONTOUR
1FT ELEVATION CONTOUR
REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 350 700 Feet

PROPOSED GROUNDWATER EXTRACTION TRENCH LOCATION - ALTERNATIVE 2 REMEDY

ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 3

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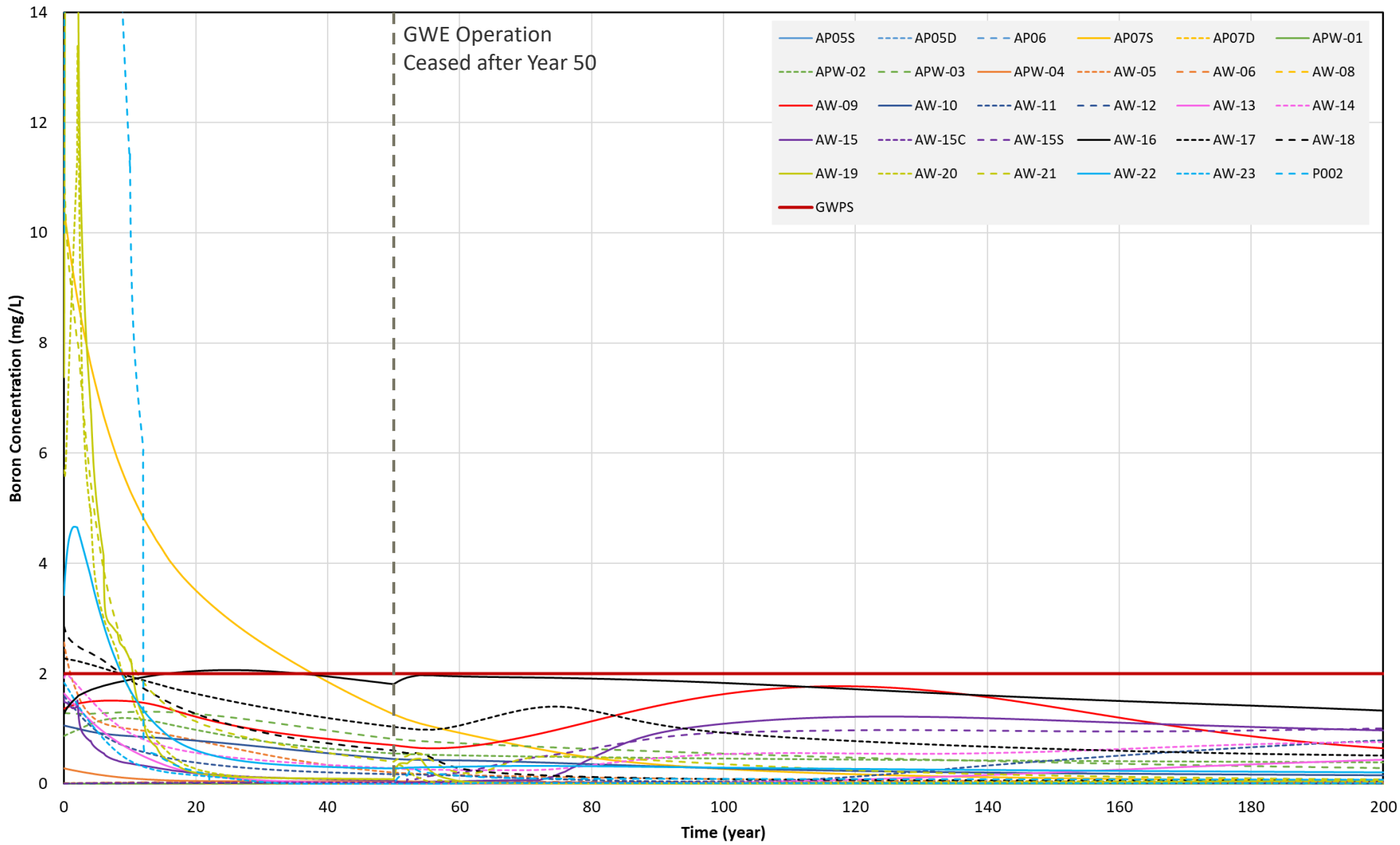

SIMULATED BORON CONCENTRATIONS IN EPP AP MONITORING WELLS - ALTERNATIVE 2 REMEDY

ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 4

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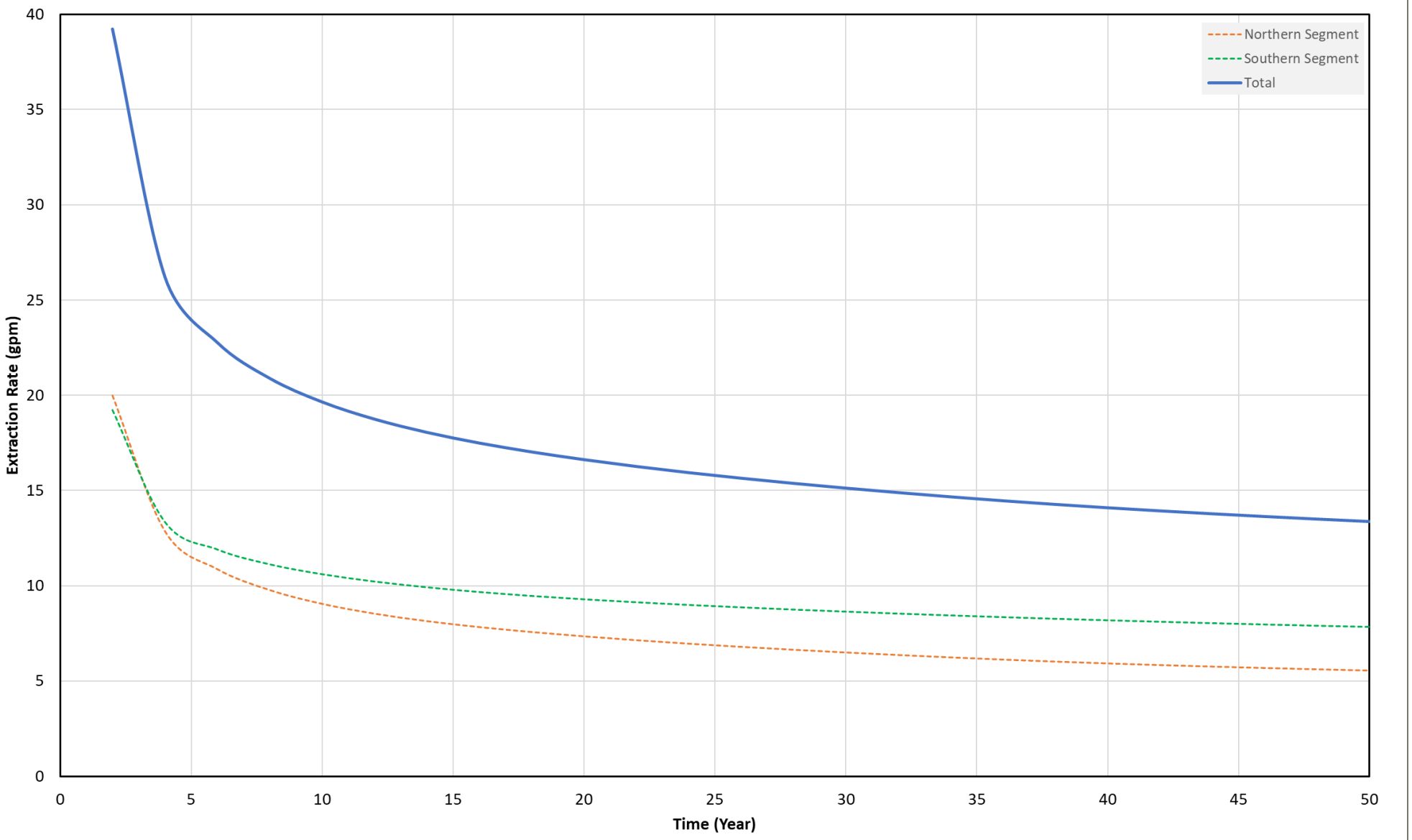

SIMULATED EXTRACTION RATE FROM THE EXTRACTION TRENCH - ALTERNATIVE 2 REMEDY

ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 5

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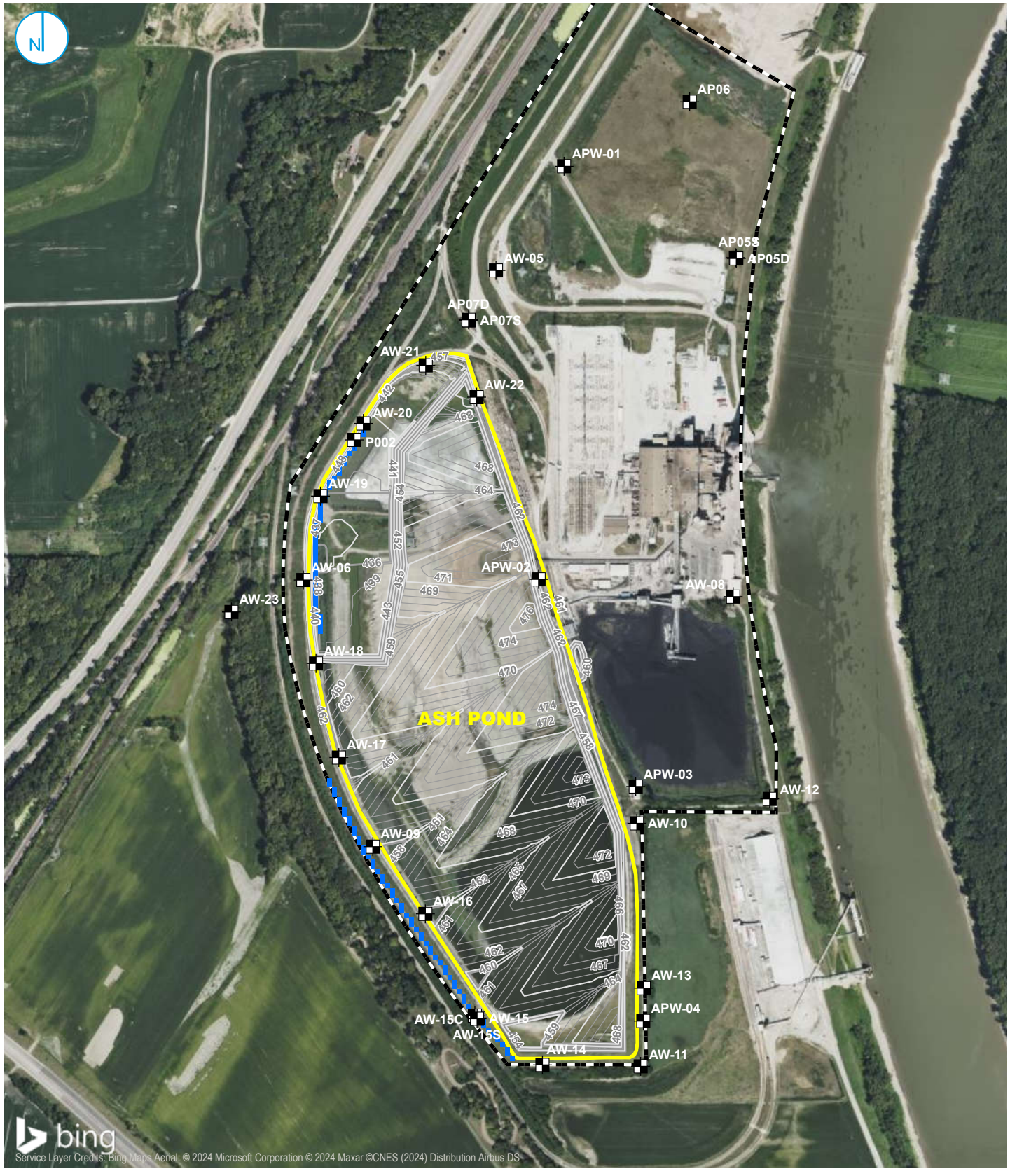

Y:\Mapping\Projects\22\2285\MXD\Model_Figures\Edwards\CAAA-SIR\EDW_CAAA.aprx\Figure 6. Alternative 3 Phytoremediation

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MONITORING WELL
PHYTOREMEDIATION AREA
PROPOSED CLOSURE GRADES
5FT ELEVATION CONTOUR
1FT ELEVATION CONTOUR
REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 350 700 Feet

PROPOSED PHYTOREMEDIATION ZONE - ALTERNATIVE 3 REMEDY

ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 6

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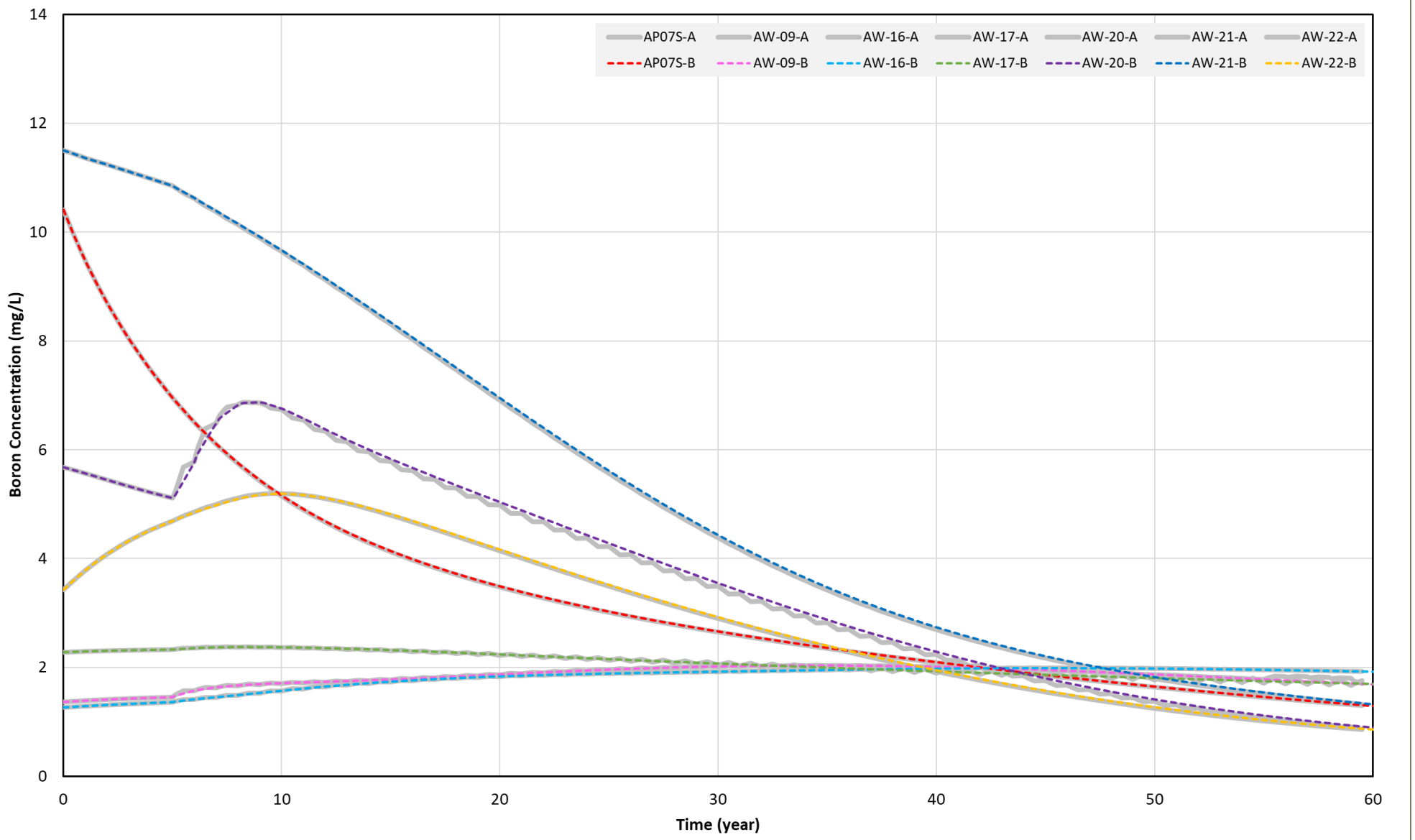

COMPARISON OF SIMULATION RESULTS BETWEEN MODELING METHODS - ALTERNATIVE 3 REMEDY

ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 7

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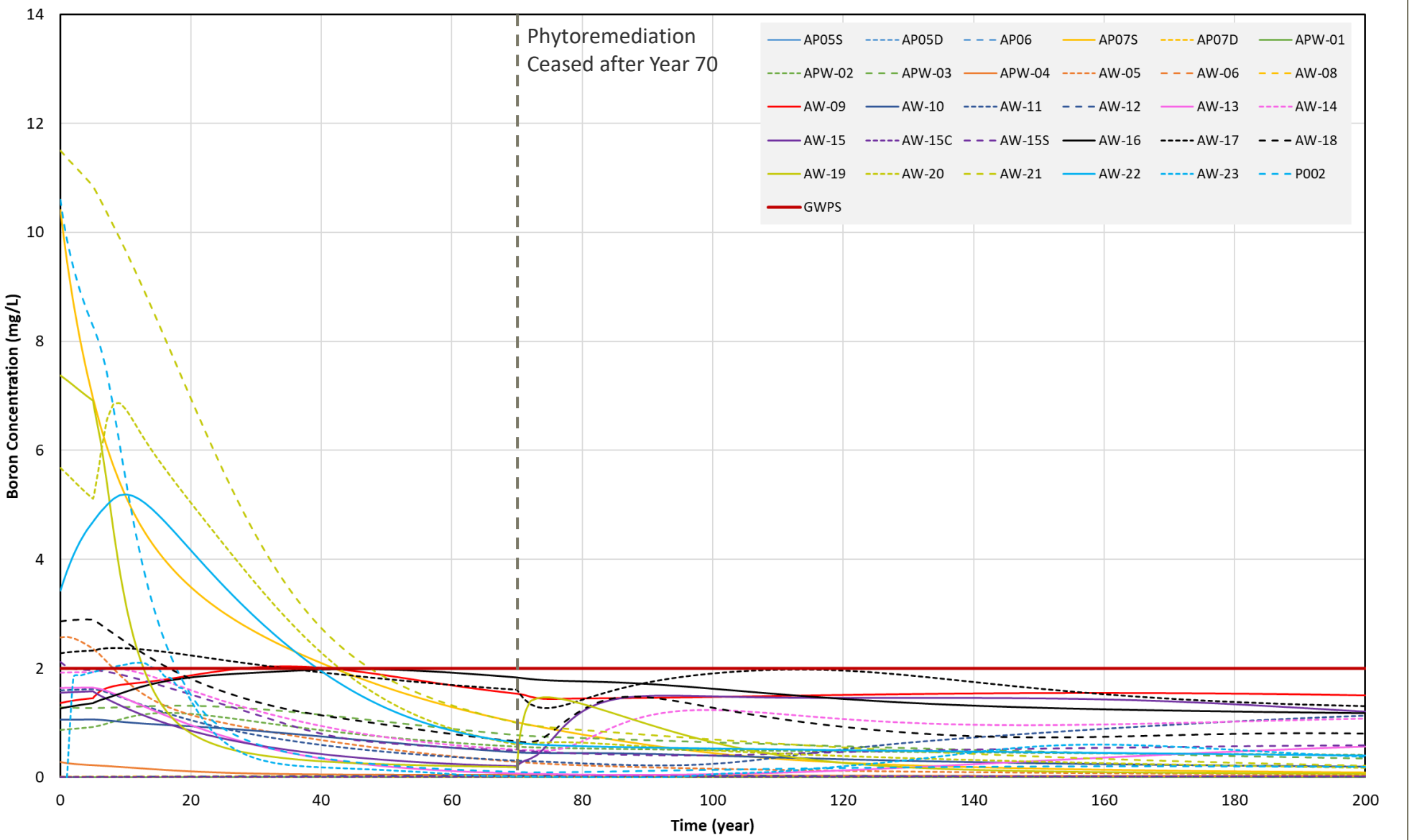

SIMULATED BORON CONCENTRATIONS IN EPP AP MONITORING WELLS - ALTERNATIVE 3 REMEDY

ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 8

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APPENDIX B2
GROUNDWATER MODELING REPORT

Intended for
Illinois Power Resources Generating, LLC

Date
June 30, 2022

Project No.
1940101010-010

GROUNDWATER MODELING REPORT

ASH POND

EDWARDS POWER PLANT

BARTONVILLE, ILLINOIS

GROUNDWATER MODELING REPORT
EDWARDS POWER PLANT ASH POND

Project Name	**Edwards Power Plant Ash Pond**
Project No.	**1940101010-010**
Recipient	**Illinois Power Resources Generating, LLC**
Document Type	**Groundwater Modeling Report**
Revision	**FINAL**
Date	**June 30, 2022**

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

T 414-837-3607
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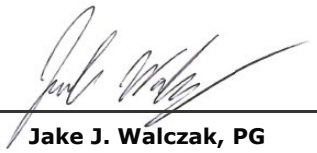


Jake J. Walczak, PG
Senior Hydrogeologist



Brian G. Hennings, PG
Senior Managing Hydrogeologist

CONTENTS

Executive Summary		**6**
1.	**Introduction**	**9**
1.1	Overview	9
1.2	Site Location and Background	9
1.3	Site History and Unit Description	9
2.	**Site Geology and Hydrogeology**	**10**
3.	**Groundwater Quality**	**13**
4.	**Groundwater Model**	**15**
4.1	Overview	15
4.2	Conceptual Site Model	15
4.3	Model Approach	15
5.	**Model Setup and Calibration**	**18**
5.1	Model Descriptions	18
5.2	Flow and Transport Model Setup	19
5.2.1	Grid and Boundary Conditions	19
5.2.2	Flow Model Input Values and Sensitivity	20
5.2.2.1	Model Layers	20
5.2.2.2	Hydraulic Conductivity	20
5.2.2.3	Recharge	21
5.2.2.4	Storage and Specific Yield	22
5.2.2.5	River Parameters	22
5.2.2.6	General Head Boundary Parameters	23
5.2.3	Transport Model Input Values and Sensitivity	23
5.2.3.1	Initial Concentrations	24
5.2.3.2	Source Concentrations	24
5.2.3.3	Effective Porosity	24
5.2.3.4	Storage and Specific Yield Sensitivity	25
5.2.3.5	Dispersivity	25
5.2.3.6	Retardation	25
5.3	Flow and Transport Model Assumptions and Limitations	26
5.4	Calibration Flow and Transport Model Results	26
6.	**Simulation of Closure Scenarios**	**28**
6.1	Overview and Prediction Model Development	28
6.2	HELP Model Setup and Results	29
6.3	Simulation of Closure Scenarios	30
6.3.1	Closure Scenario 1 (CIP) Predicted Boron Concentrations	30
6.3.2	Closure Scenario 2 (CBR) Predicted Boron Concentrations	32
7.	**Conclusions**	**33**
8.	**References**	**35**

TABLES (ATTACHED)

Table 2-1 Monitoring Well Locations and Construction Details
Table 2-2 Flow and Transport Model Calibration Targets
Table 5-1 Flow Model Input and Sensitivity Analysis Results
Table 5-2 Transport Model Input Values (Calibration)
Table 5-3 Transport Model Input Values (Sensitivity)
Table 6-1 HELP Model Input and Output Values
Table 6-2 Prediction Model Input Values

FIGURES (IN TEXT)

Figure A Boron Correlation with Sulfate in UCF and UA Wells
Figure B Boron Correlation with TDS in UCF and UA Wells

FIGURES (ATTACHED)

Figure 1-1 Site Location Map
Figure 1-2 Site Map
Figure 2-1 Site Topographic Map
Figure 2-2 Uppermost Aquifer Potentiometric Surface Map, February 9, 2021
Figure 2-3 Uppermost Aquifer Potentiometric Surface Map, March 22, 2021
Figure 2-4 Monitoring Well Location Map
Figure 4-1 Closure Scenario Calibration and Prediction Model Timeline
Figure 5-1 Model Grid for Layers 1 through 5
Figure 5-2 Boundary Conditions for Layer 1
Figure 5-3 Boundary Conditions for Layer 2
Figure 5-4 Boundary Conditions for Layer 3
Figure 5-5 Boundary Conditions for Layer 4
Figure 5-6 Boundary Conditions for Layer 5
Figure 5-7 Distribution of Hydraulic Conductivity Zones (feet/day) for Layer 1
Figure 5-8 Distribution of Hydraulic Conductivity Zones (feet/day) for Layer 2
Figure 5-9 Distribution of Hydraulic Conductivity Zones (feet/day) for Layer 3
Figure 5-10 Distribution of Hydraulic Conductivity Zones (feet/day) for Layer 4
Figure 5-11 Distribution of Hydraulic Conductivity Zones (feet/day) for Layer 5
Figure 5-12 Distribution of Recharge Zones (feet/day)
Figure 5-13 Observed versus Simulated Groundwater Elevations Layer 1
Figure 5-14 Observed versus Simulated Groundwater Elevations Layer 2
Figure 5-15 Observed versus Simulated Groundwater Elevations Layer 3
Figure 5-16 Observed versus Simulated Groundwater Elevations Layer 4
Figure 5-17 Observed versus Simulated Groundwater Elevations Layer 5
Figure 5-18 Steady State MODFLOW Calibration Results – Observed versus Simulated (ft)
Figure 5-19 Steady State MODFLOW Calibration Results – Observed versus Residuals (ft)
Figure 5-20 Observed and Simulated Boron Concentrations (mg/L)
Figure 5-21 Layer 1 Distribution of Boron Concentrations (mg/L) in the Calibrated Model (UCF)
Figure 5-22 Layer 2 Distribution of Boron Concentrations (mg/L) in the Calibrated Model (UCF [PMP])
Figure 5-23 Layer 3 Distribution of Boron Concentrations (mg/L) in the Calibrated Model (UCF)
Figure 5-24 Layer 4 Distribution of Boron Concentrations (mg/L) in the Calibrated Model (UA)
Figure 5-25 Layer 5 Distribution of Boron Concentrations (mg/L) in the Calibrated Model (BCU)
Figure 6-1 Distribution of Recharge Zones (feet/day) for Closure In Place

Figure 6-2 Distribution of Hydraulic Conductivity Zones (feet/day) for Layer 1 for Closure In Place
Figure 6-3 Distribution of Hydraulic Conductivity Zones (feet/day) for Layer 2 for Closure In Place
Figure 6-4 Distribution of Recharge Zones (feet/day) for Closure By Removal
Figure 6-5 Distribution of Hydraulic Conductivity Zones (feet/day) for Layer 1 for Closure By Removal
Figure 6-6 Distribution of Hydraulic Conductivity Zones (feet/day) for Layer 2 for Closure By Removal
Figure 6-7 CIP - Model Predicted Boron Concentration
Figure 6-8 CIP - (Scenario 1) – Model Predicted Maximum Boron Plume in All Layers Approximately 382 Years after Implementation
Figure 6-9 CIP - (Scenario 1) – Model Predicted Maximum Boron Plume in All Layers Approximately 767 Years after Implementation
Figure 6-10 Scenario 1 (CIP) – Hydraulic Steady State Reductions in Total Flux In and Out of Fill Unit (CCR)
Figure 6-11 Scenario 1 (CIP) – Reductions in Total Flux In and Out of Fill Unit (CCR)
Figure 6-12 CBR - Model Predicted Boron Concentration
Figure 6-13 CBR - (Scenario 2) – Model Predicted Maximum Boron Plume in All Layers Approximately 201 Years after Implementation
Figure 6-14 CBR - (Scenario 2) – Model Predicted Maximum Boron Plume in All Layers Approximately 748 Years after Implementation

APPENDICES

Appendix A Evaluation of Potential GWPS Exceedances (Golder Associates USA Inc., 2022)
Appendix B Figure 5 and Figure 6 of *Burch, S. L. and D. J. Kelly., 1993. Peoria-Pekin Regional Ground-Water Quality Assessment. Illinois State Water Survey (ISWS), Champaign, Research Report 124.*
Appendix C MODFLOW, MT3DMS, HELP Model, and Flux Evaluation Data Export Files (Electronic Only)
Appendix D Evaluation of Partition Coefficient Results (Golder Associates USA Inc., 2022)
Appendix E HELP Model Output Files
Appendix F Flux Evaluation Data

ACRONYMS AND ABBREVIATIONS

§	Section
35 I.A.C.	Title 35 of the Illinois Administrative Code
40 C.F.R.	Title 40 of the Code of Federal Regulations
BCU	bedrock confining unit
bgs	below ground surface
CBR	closure by removal
CCR	coal combustion residuals
CIP	closure in place
cm/s	centimeters per second
CSM	conceptual site model
EPP	Edwards Power Plant
Federal CCR Rule	40 C.F.R. § 257 Subpart D
ft/day	feet/foot per day
ft^2/d	feet squared per day
GHB	general head boundary conditions
GMP	Groundwater Monitoring Plan
GMR	Groundwater Modeling Report
Golder	Golder Associates USA Inc.
GWPS	Groundwater Protection Standard
HCR	Hydrogeologic Site Characterization Report
HELP	Hydrologic Evaluation of Landfill Performance
ID	identification
IEPA	Illinois Environmental Protection Agency
in	inches
in/yr	inches per year
IngenAE	IngenAE, LLC
IPRG	Illinois Power Resources Generating, LLC
ISWS	Illinois State Water Survey
Kd	distribution coefficient
K_D	linear partition coefficients
K_F	Freundlich partition coefficients
K_L	Langmuir partition coefficients
Kh/Kv	vertical anisotropy
L/kg	liters per kilogram
mg/L	milligrams per liter
MGD	million gallons per day
mL/g	milliliters per gram
NAVD88	North American Vertical Datum of 1988
NGVD29	National Geodetic Vertical Datum of 1929
NID	National Inventory of Dams
No.	number
NPDES	National Pollutant Discharge Elimination System
NRT	Natural Resource Technology, Inc.

NRT/OBG	Natural Resource Technology Inc., an OBG Company
p	probability
Part 845	35 I.A.C. § 845: Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments
PMP	Potential Migration Pathway
R2	correlation coefficient
Ramboll	Ramboll Americas Engineering Solutions, Inc.
SI	surface impoundment
SSR	sum of squared residuals
S_y	specific yield
SW	surface water
TDS	total dissolved solids
TVD	total-variation-diminishing
UA	uppermost aquifer
UCF	Upper Cahokia Formation
US	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
Wittman	Wittman Hydro Planning Associates, Inc.

EXECUTIVE SUMMARY

Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this Groundwater Modeling Report (GMR) on behalf of the Edwards Power Plant (EPP), operated by Illinois Power Resources Generating, LLC (IPRG), in accordance with requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) Section (§) 845: Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845) (Illinois Environmental Protection Agency [IEPA], April 15, 2021). This document presents the results of predictive groundwater modeling simulations for proposed closure scenarios for the Ash Pond. The Ash Pond (Vistra identification [ID] number [No.] 301, IEPA ID No. W1438050005-01, and National Inventory of Dams [NID] No. IL50710) is the only coal combustion residuals (CCR) unit present on the EPP property.

The EPP is located in Bartonville, Illinois (**Figure 1-1**). The EPP property is situated in an agricultural/industrial area. The EPP is bound by a salt processing facility to the north, a fertilizer processing plant and the Illinois River to the east, agricultural fields to the south, and railroad tracks, former Orchard Mines, and Highway 24 to the west (**Figure 1-2**).

A detailed summary of site conditions was provided in the Hydrogeologic Site Characterization Report (HCR; Ramboll, 2021a). Four distinct water-bearing units have been identified in the vicinity of the Ash Pond based on stratigraphic relationships and common hydrogeologic characteristics. The units are described as follows from the surface downward:

- **CCR:** Saturated CCR consisting primarily of fly ash within the Ash Pond. CCR is present at thicknesses up to 46.5 feet and at elevations as low as 413.9 feet North American Vertical Datum of 1988 (NAVD88) in the central and northern portion of the Ash Pond.
- **Upper Cahokia Formation (UCF)/Potential Migration Pathway (PMP):** Low permeability clays and silts of the UCF are present at the surface. This unit is considered a PMP at elevations similar to the base of the Ash Pond, and in places where thin discontinuous sand lenses occur within the UCF adjacent to the Ash Pond.
- **Uppermost Aquifer (UA):** Thin (generally less than 4 feet), moderate permeability sand, silty sand, and clayey gravel material within the Lower Cahokia Formation, bedrock, and/or weathered shale bedrock, where present. In locations where higher permeability materials and coarser grained material are absent, the UA is interpreted as the interface between the Lower Cahokia Formation and shale bedrock.
- **Bedrock Confining Unit (BCU):** Thick, very low permeability shales and siltstones of the Carbondale and Modesto Formations. This unit was encountered at elevations ranging from approximately 400 to 422 feet NAVD88 with higher bedrock elevations occurring beneath the northern portion of the Ash Pond.

In general, the UCF consists of low permeability clays and silts, with limited occurrences of thin discontinuous sand lenses. Occasional sand lenses within the UCF, and clay intervals downgradient at elevations similar to the base of ash in the Ash Pond were identified as PMPs. In several locations, generally near the southern and western portions of the unit, coarser grained materials are present at the base of the Lower Cahokia Formation and/or the top of the bedrock is weathered resulting in relatively higher hydraulic conductivities. Because the interface is laterally continuous, and has relatively higher conductivity, the unlithified/lithified contact was designated as the UA.

The underlying bedrock is interpreted as the lower confining unit and has hydraulic conductivities generally an order of magnitude less than those measured in the UA. Groundwater occurs within both the unlithified materials and bedrock and consistently flows east to west in the UA. Offsite groundwater in the Sankoty Aquifer flows to the north and south towards identified Peoria and Pekin pumping centers, respectively. Groundwater in the Sankoty Aquifer may be hydraulically connected to the UA (*i.e.,* unlithified/ lithified contact) identified onsite.

A review and summary of data collected from 2015 through 2021 for parameters with groundwater protection standards (GWPS) listed in 35 I.A.C. § 845.600 is provided in the HCR (Ramboll, 2021a). Concentration results presented in the HCR and summarized in the History of Potential Exceedances (Ramboll, 2021b) are considered potential exceedances because the methodology used to determine them is proposed in the Statistical Analysis Plan (Appendix A to the Groundwater Monitoring Plant [GMP], Ramboll 2021c), which has not been reviewed or approved by IEPA at the time of submittal of the Part 845 operating permit application. The following constituents with potential exceedances of the GWPS listed in 35 I.A.C. § 845.600 were identified: barium, boron, chloride, lithium, sulfate, and total dissolved solids (TDS) (Ramboll, 2021b).

A Technical Memorandum (**Appendix A**) was prepared by Golder Associates USA Inc. (Golder, 2022a), *Evaluation of Potential GWPS Exceedances, Edwards Ash Pond [CCR Unit 301], Edwards Power Plant, Peoria County, Illinois*, to further evaluate potential GWPS exceedances. The results of the evaluation demonstrated that the potential GWPS exceedances of lithium in well AP05D and AP07D, chloride in well AP07D, and barium in well AW-15C are not related to the Ash Pond based on multiple lines of evidence presented in the Technical Memorandum. Statistically significant correlations between boron concentrations and concentrations of sulfate and TDS identified as potential exceedances of the GWPS indicate boron is an acceptable surrogate for these parameters in the groundwater model. Concentrations of these parameters are expected to change along with model predicted boron concentrations.

Groundwater monitoring wells recently installed near the plant's property boundary have detected elevated levels of boron in groundwater. IPRG notified IEPA of the elevated boron detections and letters were issued to neighboring property owners in May of 2022 requesting permission for IPRG's consultants to access their property and collect groundwater samples. Until responses are received, and access granted, the groundwater modeling and available well data are being used to delineate the plume.

It was assumed that boron would not significantly sorb or chemically react with aquifer solids (distribution coefficient [Kd] was set to 0 milliliters per gram [mL/g]) which is a conservative estimate for predicting contaminant transport times in the model. Boron, sulfate, and TDS transport is likely to be affected by both chemical and physical attenuation mechanisms (*i.e.,* adsorption and/or precipitation reactions as well as dilution and dispersion).

Data collected from previous field investigations, as well as the 2021 field investigations, were used to develop a groundwater model for the Ash Pond. The MODFLOW and MT3DMS models were then used to evaluate two closure scenarios, including CCR consolidation and closure in place (CIP), and closure by removal (CBR) scenarios, using information provided in the Final Closure Plan (IngenAE, 2022):

- Scenario 1: CIP (CCR removal from the northwest areas of the Ash Pond, consolidation to the northeast, central and southern areas of the Ash Pond, and construction of a cover system over the remaining CCR)
- Scenario 2: CBR (CCR removal from the Ash Pond)

Prior to the simulation of these scenarios, a dewatering simulation was included for the removal of free liquids from the Ash Pond prior to the implementation of the two scenarios.

Scenario 1 (CIP) was predicted to reduce total flux in and out of the Fill Unit (CCR) by approximately 97% and 94%, respectively, when simulated post-construction heads in the groundwater monitoring wells are predicted to stabilize.

Differences exist in the timeframes to reach the GWPS for most monitoring wells between CIP and CBR. For instance, wells with observations above the standard GWPS for boron (2 milligrams per liter [mg/L]) from November 2015 to August 2021 (AP07S, AW-05, AW-15S, AW-18, AW-19, AW-20, AW-21) are predicted to reach the GWPS in 198 years after CIP implementation, and 104 years after CBR implementation. Shorter timeframes were predicted to reach the GWPS for wells located on the northern edge of the Ash Pond where observed boron concentrations were the highest (AW-21 and AP07S). AW-21 and AP07S, which had the highest concentrations in the UA and UCF, respectively, were predicted to decline below the GWPS at 121 and 32 years, respectively, after CIP implementation, and at 88 and 15 years, respectively, after CBR implementation. However, as a result of the south-southwest trending plume of residual boron concentrations above the standard GWPS for boron (2 mg/L) released prior to closure, which remains for a long period of time following implementation of both scenarios, all monitoring wells are not predicted to reach the GWPS until after 767 years and 748 years following implementation of CIP and CBR, respectively.

The observed timeframes to reach the GWPS for both the CIP and CBR prediction scenarios were on the order of hundreds of years from present. These predicted timeframes to meet the GWPS are less reliable than timeframes that are closer temporally to the data used for calibration (between 2015 and 2021). From a modeling perspective, the 19-year difference between CIP and CBR to reach the GWPS at all monitoring wells surrounding the ash pond is negligible. In other words, both scenarios are predicted to reach the GWPS after approximately 750 years, and the simulated 19-year difference between these two scenarios is not significant. Further, the boron plumes for both CIP and CBR remain in close proximity to the Ash Pond while they recede, indicating they are equally protective.

Results of groundwater fate and transport modeling conservatively estimate that groundwater will attain the GWPS for all constituents identified as potential exceedances of the GWPS in approximately 750 years following closure implementation for both CIP and CBR. The long timeframes observed are a result of the generally low permeability materials adjacent to and underlying the Ash Pond, and generally low groundwater flow velocities observed within the water-bearing units of the site, which results in reduced transport and slow physical attenuation (dilution and dispersion). The predicted maximum extent of the plume above the standard GWPS for boron (2 mg/L) stays in close proximity to the ash pond as it recedes.

1. INTRODUCTION

1.1 Overview

In accordance with requirements of Part 845 (IEPA, 2021), Ramboll has prepared this GMR on behalf of EPP, operated by IPRG. This report will apply specifically to the CCR unit referred to as the Ash Pond (**Figure 1-1**). The Ash Pond is a 91-acre unlined CCR surface impoundment (SI) used to manage CCR and non-CCR waste streams prior to discharge in accordance with the plant's National Pollutant Discharge Elimination System (NPDES) permit (IL0001970) at the EPP. This GMR presents and evaluates the results of predictive groundwater modeling simulations for two proposed closure scenarios, including CCR consolidation and CIP, and CBR scenarios summarized below:

- Scenario 1: CIP (CCR removal from the northwest areas of the Ash Pond, consolidation to the northeast, central and southern areas of the Ash Pond, and construction of a cover system over the remaining CCR)
- Scenario 2: CBR (CCR removal from the Ash Pond)

1.2 Site Location and Background

The EPP is located in Peoria County between Mapleton and Bartonville in Section 11, Township 7 North, Range 7 East (**Figure 1-1**). The EPP is located near the Illinois River adjacent to a levee and has one CCR SI, the Ash Pond.

The EPP is situated in a predominantly agricultural area with industrial parcels bordering the property. Historically several coal mines were operated at depths of 100 to 160 feet below ground surface (bgs) in the vicinity of the EPP. The EPP property is bordered by a salt processing facility to the north, railroad right-of-way and former Orchard Mines to the west, the Illinois River and fertilizer production facility to the east, and agricultural land to the south (**Figure 1-2**).

The Ash Pond was investigated in 2013 (Natural Resource Technology, Inc. [NRT], 2013) and exceedances of Class I Groundwater Standards were reported for pH, chloride, iron, manganese, TDS, and sulfate. Additional wells were installed in 2015 to comply with Title 40 of the Code of Federal Regulations (40 C.F.R) § 257 Subpart D (Federal CCR Rule), and again in 2021 to collect additional data to meet the requirements of 35 I.A.C. § 845.620.

1.3 Site History and Unit Description

The EPP began power generation in 1960 and the original Ash Pond embankments were placed into service at that time. In 2004, modifications to the rail loop surrounding the Ash Pond increased the elevations of the embankments and reduced the footprint of the active impoundment (AECOM, 2016a). CCR material remains between the rail loop and the berm at the south end of the Ash Pond. High power transmission lines bisect the Ash Pond and two sub-basins, referred to as the North and South Ponds, were established. The sub-basins are hydraulically connected and CCR placement is continuous throughout the Ash Pond.

The Ash Pond has a surface area of approximately 91 acres with berms up to 27 feet higher than the surrounding land surface. This pond currently discharges to the Illinois River through Outfall 001 included in the facility NPDES permit, IL0001970. The primary treatment method for the pond water is settlement via reduced velocity whereby solids settle out in various flow channels and in the main South Pond. The permitted total average daily flow is 5.24 million gallons per day (MGD) (Foth, 2017).

2. SITE GEOLOGY AND HYDROGEOLOGY

Ash Pond hydrogeologic and groundwater quality data presented in the HCR (Ramboll, 2021a) was used to establish a conceptual site model (CSM) for this GMR, and is summarized below. The EPP and embankments surrounding the Ash Pond are located at an elevation of approximately 460 feet NAVD88 (**Figure 2-1**). Topographic maps drawn prior to construction indicate the areas of the Ash Pond were generally between 435 and 440 feet National Geodetic Vertical Datum (NGVD29), except for a historic drainage feature or former river channel located in the western portion of the Ash Pond, which has an elevation of approximately 430 feet NGVD29 (Appendix A of the HCR). The areas surrounding the EPP are generally at an elevation of around 435 to 440 feet NVGD29. West of the Ash Pond (across Highway 24), the elevation increases to approximately 600 feet NGVD29 (**Figure 1-1**), where bedrock outcrops are present near the surface at the edge of the former historic Illinois River valley.

There are three principal types of unlithified materials above the bedrock in the vicinity of the Ash Pond, these include the following in descending order: Fill, predominantly coal ash (fly ash, bottom ash, and slag) within the Ash Pond, and materials within constructed berms and railroad embankments, are present around the Ash Pond; UCF (fine-grained deposits of the Cahokia Formation ranging in thickness at the Ash Pond from 5 to 40 feet); and Lower Cahokia Formation (course-grained deposits of the Cahokia Formation consisting of sands and gravels ranging in thickness at the Ash Pond from 1 to 4 feet). Depth to bedrock at the Ash Pond ranges from approximately 20 feet in the north to 58 feet in the southwest.

Four distinct water-bearing units have been identified in the vicinity of the Ash Pond based on stratigraphic relationships and common hydrogeologic characteristics. The units are described as follows from the surface downward:

- **CCR:** Saturated CCR consisting primarily of fly ash within the Ash Pond. CCR is present at thicknesses up to 46.5 feet and at elevations as low as 413.9 feet NAVD88 in the central and northern portion of the Ash Pond**.**
- **UCF/ PMP:** Low permeability clays and silts of the UCF are present at the surface. This unit is considered a PMP at elevations similar to the base of the Ash Pond, and in places where thin discontinuous sand lenses occur within the UCF adjacent to the Ash Pond.
- **UA:** Thin (generally less than 4 feet), moderate permeability sand, silty sand, and clayey gravel material within the Lower Cahokia Formation, bedrock, and/or weathered shale bedrock, where present. In locations where higher permeability materials and coarser grained material are absent, the UA is interpreted as the interface between the Lower Cahokia Formation and shale bedrock.
- **BCU:** Thick, very low permeability shales and siltstones of the Carbondale and Modesto Formations. This unit was encountered at elevations ranging from approximately 400 to 422 feet NAVD88 with higher bedrock elevations occurring beneath the northern portion of the Ash Pond.

In general, the UCF consists of low permeability clays and silts, with limited occurrences of thin discontinuous sand lenses. Occasional sand lenses within the UCF, and clay intervals downgradient at elevations similar to the base of ash in the Ash Pond were identified as PMPs. In several locations, generally near the southern and western portions of the Ash Pond, coarser

grained materials are present at the base of the Lower Cahokia Formation and/or the top of the bedrock is weathered resulting in relatively higher hydraulic conductivities. Because the interface is laterally continuous, and has relatively higher conductivity, the unlithified/lithified contact was designated as the UA.

The underlying bedrock is interpreted as the lower confining unit and has hydraulic conductivities generally an order of magnitude less than those measured in the UA. Groundwater occurs within both the unlithified materials and bedrock and consistently flows east to west in the UA (**Figure 2-2** and **Figure 2-3**). In the northernmost portion of the Ash Pond there is a minor northwest and northern component of flow in both the UA and PMP. In the southern portion of the Ash Pond, groundwater flow has a southerly component of flow towards what is interpreted as a former channel of the Illinois River. Groundwater elevations vary seasonally, generally less than 5 feet, while across the site they range between approximately 430 and 450 feet, although flow directions are generally consistent. Additional groundwater contour maps are located in Appendix E of the HCR (Ramboll, 2021a).

Groundwater elevations in PMP wells range from approximately 455 feet NAVD88 (APW-02) to 430 feet NAVD88 (AW-15S) with flow generally from the east to the south and northwest (**Figure 2-2** and **Figure 2-3**), similar to that observed in the UA. Groundwater elevations measured at APW02 are similar to CCR piezometers and the location of the well (within the berm of the unit) may be affected by water elevations in the active Ash Pond. Given the elevations of groundwater detected in these unconfined wells and the lowest elevation of ash (414 feet NAVD88), portions of the Ash Pond are likely in contact with groundwater. Comparison of elevations in bedrock wells shows flow directions may be consistent with shallower flow systems.

Groundwater velocities in the UA determined in the center portion of the Ash Pond (between AW-08 and AW-06) ranged from approximately 1.7×10^{-4} to 4.0×10^{-4} feet per day (ft/day) in 2021 with an average of 2.5×10^{-4} ft/day. Groundwater velocities determined in the southern portion of the Ash Pond between AW-10 and AW-15 were consistent with an average of 0.26 ft/day. The higher velocities observed in the southern portion of the Ash Pond are a result of coarse-grained materials present there.

The results of a recent review of available offsite groundwater level and flow direction data completed after submittal of the HCR (Ramboll, 2021a) and presented herein supports the CSM presented in the HCR (summarized above) and further describes offsite hydrogeologic conditions. The existing CSM has been refined in this GMR to incorporate additional offsite hydrogeologic information as follows:

- The unlithified/lithified contact designated as the UA onsite may be hydraulically connected to the sands of the Sankoty Aquifer identified offsite and utilized for potable supply in Peoria, East Peoria, and Pekin.
- The thick sand and gravels along the Illinois River from Hennepin to Peoria form what has been commonly referred to as the Sankoty Aquifer. The Sankoty sand and gravels are hydrologically connected to the Illinois River and are a productive aquifer in the Middle Illinois water supply planning (Illinois State Water Survey [ISWS], 2016). At the EPP, the thick sands and gravels of the Sankoty Aquifer are absent. Fine-grained quaternary deposits of the Cahokia Formation are present from ground surface to the top of bedrock. The UA at the EPP represents the most permeable material present above bedrock. Alluvial deposits belonging to either the Cahokia or the Sankoty are present in a north-south orientation along the Illinois

River at the EPP and are not expected to occur in the areas west of United States (US) Highway 24 where the bedrock elevation increases above ground surface at the EPP. US Highway 24 runs along the base of the bluff and areas west of US Highway 24 are coincident with areas where the aquifer is not present as illustrated in Figure 5 of Burch and Kelly, 1993 (**Appendix B**).

- Offsite groundwater in the Sankoty Aquifer flows to the north and south towards identified Peoria and Pekin pumping centers, respectively, as illustrated in Figure 5 and Figure 6 of Burch and Kelly, 1993 (**Appendix B**). As reported by Burch and Kelly (1993), "*Smaller flow domains are sometimes formed by pumpage at municipal well fields, which reverse the ground-water flow direction and frequently capture induced recharge from the river and the ground-water ordinarily moving toward it*."
- A review of pumping data for Peoria (ISWS, 2018) indicates that between 1990 and 2010 potable groundwater supply usage increased approximately three percent, while East Peoria and Pekin estimates (Wittman Hydro Planning Associates, Inc. [Wittman], 2008) indicate an increase of 30 and 60 percent, respectively, between 1990 and 2005. Based on these references and IEPA databases (IEPA, 2022) Peoria and Pekin pumping centers identified in the 1993 ISWS Peoria-Pekin Regional Ground-Water Quality Assessment report (Burch and Kelly, 1993) remain active. The increase in reported usage in conjunction with historic records and reports (Burch and Kelley, 1993) indicate high-capacity wells located in Peoria and Pekin continue to influence groundwater flow directions towards their respective pumping centers.

Prior to 2015, there were four monitoring wells (APW-01 through APW-04) located around the Ash Pond for monitoring groundwater. In 2015 and 2017, additional wells and piezometers were installed within and around the Ash Pond to meet requirements of 40 C.F.R. § 257. In 2021, additional wells were installed to provide information to meet the requirements of Part 845. A summary of monitoring well locations and construction details are included in **Table 2-1** and depicted on **Figure 2-4**. Boring logs, monitoring well and piezometer construction forms are provided in Appendix C of the HCR (Ramboll, 2021a).

3. GROUNDWATER QUALITY

Per 35 I.A.C. § 620.210, groundwater within the UA at the Ash Pond meets the definition of a Class I – Potable Resource Groundwater based on the following criteria:

- Groundwater in the UA extends 10 feet or more below the land surface.
- Hydraulic conductivity exceeds the 1 x 10^{-4} centimeters per second (cm/s) criterion (Table 3-3 of the HCR; Ramboll, 2021a).

Field hydraulic conductivity tests performed on the unlithified geologic materials that include moderate permeability sand, silty sand, and clayey gravel units which includes the Lower Cahokia Formation and the bedrock interface) and lithified materials (shales and siltstones of the Carbondale and Modesto Formations) at the EPP had geometric mean hydraulic conductivities exceeding 1 x 10^{-4} cm/s. Based on this information groundwater is classified as Class I – Potable Resource Groundwater.

A review and summary of data collected from 2015 through 2021 for parameters with GWPSs listed in 35 I.A.C. § 845.600 is provided in the HCR (Ramboll, 2021a). Concentration results presented in the HCR were compared directly to 35 I.A.C. § 845.600 GWPSs to determine potential exceedances. The results are considered potential exceedances because the results were compared directly to the standard and did not include an evaluation of background groundwater quality or utilize the statistical methodologies proposed in the groundwater monitoring plan (GMP; Ramboll, 2021c) attached to the operating permit application.

Groundwater concentrations from 2015 to 2021 are summarized in the History of Potential Exceedances (Ramboll, 2021b) (attached to the operating permit application) and are considered potential exceedances because the methodology used to determine them is proposed in the Statistical Analysis Plan (Appendix A to the GMP, Ramboll 2021c), which has not been reviewed or approved by IEPA at the time of submittal of the Part 845 operating permit application.

The History of Potential Exceedances attached to the operating permit application summarizes all potential groundwater exceedances following the proposed Statistical Analysis Plan. The following potential exceedances were identified:

- Barium – determined at well AW-15C
- Boron – determined at wells AP07S, AW-05, AW-15S, AW-19, AW-20, and AW-21
- Chloride – determined at wells AP07D
- Lithium – determined at wells AP05D and AP07D
- Sulfate – determined at well AW-15S
- TDS – determined at wells AP07S and AW-15S

A Technical Memorandum (**Attachment A**) was prepared by Golder (2022), *Evaluation of Potential GWPS Exceedances, Edwards Ash Pond [CCR Unit 301], Edwards Power Plant, Peoria County, Illinois*, to further evaluate potential GWPS exceedances. The results of the evaluation demonstrated that the potential GWPS exceedances of lithium in well AP05D and AP07D, chloride in well AP07D and barium in well AW-15C are not related to the Ash Pond based on several lines of evidence presented in the Technical Memorandum. Since potential GWPS exceedances for lithium, chloride, and barium are not related to the Ash Pond, these parameters will not be discussed further in this GMR.

Groundwater monitoring wells recently installed near the plant's property boundary have detected elevated levels of boron in groundwater. IPRG notified IEPA of the elevated boron detections and letters were issued to neighboring property owners in May of 2022 requesting permission for IPRG's consultants to access their property and collect groundwater samples. Until responses are received, and access granted, the groundwater modeling and available well data are being used to delineate the plume.

4. GROUNDWATER MODEL

4.1 Overview

Data collected from previous field investigations, as well as the 2021 field investigations, were used to develop a groundwater model for the Ash Pond. The MODFLOW and MT3DMS models were then used to evaluate two closure scenarios, including CCR consolidation and CIP using information provided in the Final Closure Plan (IngenAE, 2022), and CBR scenarios. The results of the CIP and CBR closure scenarios are summarized and evaluated in this GMR. Associated model files are included as **Appendix C.**

4.2 Conceptual Site Model

The HCR (Ramboll, 2021a) is the foundation document for the site setting and CSM that describes groundwater flow at the Site, which was refined to incorporate additional offsite hydrogeologic information summarized in Section 2 of this GMR. The Ash Pond overlies the recharge area for the underlying geologic media (*i.e.,* low permeability clays and silts of the UCF; and moderate permeability sand, silty sand, and clayey gravel material within the Lower Cahokia Formation, bedrock, and/or weathered shale bedrock, where present [UA]). Groundwater enters the model domain vertically via recharge. Groundwater may also enter or exit the model through the stormwater drainage ditches and ponds identified immediately west and north of the Ash Pond, or the Illinois River located east of the Ash Pond. Groundwater occurs within both the unlithified materials and bedrock and consistently flows east to west in the UA. In the northernmost portion of the Ash Pond, there is a minor northwest and northern component of flow in both the UA and PMP. In the southern portion of the Ash Pond groundwater flow has a southerly component of flow towards what is interpreted as a former channel of the Illinois River. Offsite groundwater in the Sankoty Aquifer flows to the north and south towards identified Peoria and Pekin pumping centers, respectively.

Boron was selected for transport modeling. Boron is commonly used as an indicator parameter for contaminant transport modeling for CCR because: (i) it is commonly present in coal ash leachate; (ii) it is mobile and typically not very reactive but conservative (*i.e.*, low rates of sorption or degradation) in groundwater; and (iii) it is less likely than other constituents to be present in background groundwater from natural or other anthropogenic sources. The only significant source of boron is the Ash Pond. The Ash Pond is constructed over low permeability clays and silts of the UCF. Mass (boron) is added to groundwater via vertical recharge through CCR, and horizontal groundwater flow through CCR where it is in contact with the water table. Mass flows with groundwater (onsite and offsite groundwater flow directions described above). The primary transport pathway is the UA, as indicated by groundwater observations. The UCF is also a PMP at elevations similar to the base of the Ash Pond, and in places where thin discontinuous sand lenses occur within the UCF adjacent to the Ash Pond.

4.3 Model Approach

Comparisons of observed sulfate and TDS concentrations to boron (**Figure A** and **Figure B**, respectively, below) indicate statistically significant correlations between these parameters at UCF and UA wells. Observed concentrations were transformed into Log10 concentrations for evaluation. The correlation coefficient (R2) and p values (indicator of statistical significance) are also provided on **Figure A** and **Figure B**. Higher R2 values (*i.e.*, closer to 1) indicate stronger

correlation between parameters. A correlation is considered statistically significant when the probability (p) value is lower than 0.05. Both correlations have p values less than the target of 0.05, indicating correlations are statistically significant. The correlations are strongest between sulfate and boron. The statistically significant correlations associated with boron concentrations indicate boron is an acceptable surrogate for sulfate and TDS in the groundwater model, and concentrations of these parameters are expected to change along with model predicted boron concentrations.

Figure A. Boron Correlation with Sulfate in UCF and UA Wells

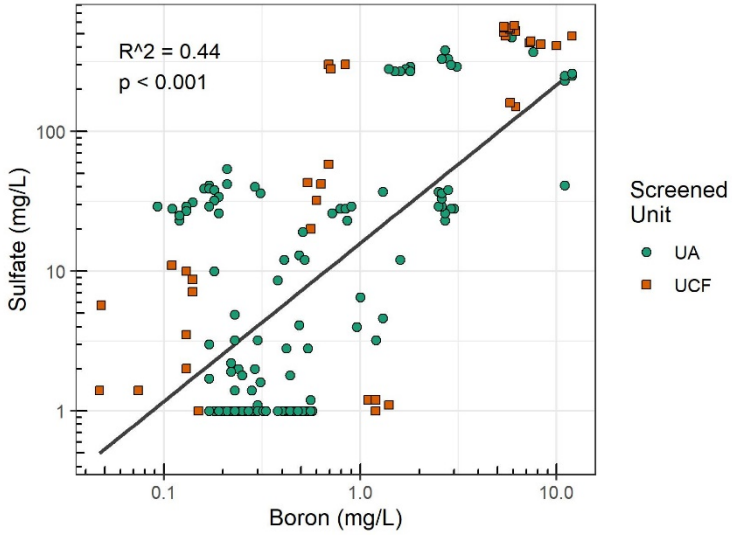
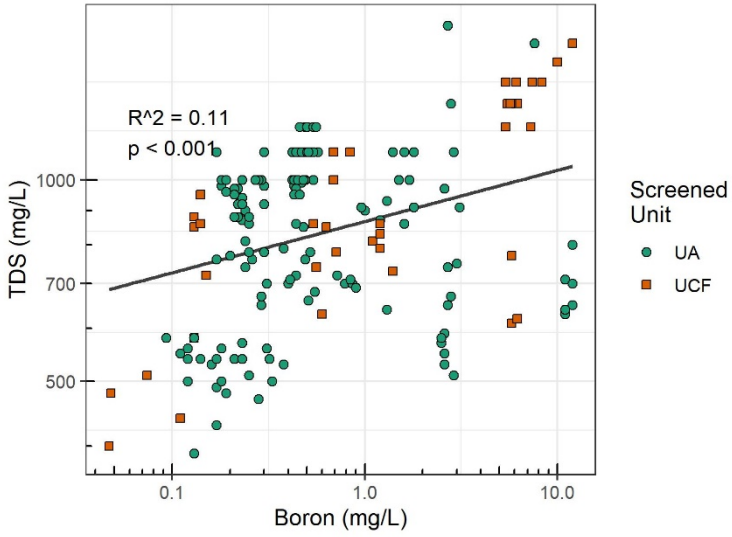


Figure B. Boron Correlation with TDS in UCF and UA Wells



A three-dimensional groundwater flow and transport model was calibrated to represent the conceptual flow system described above. Initial modeling was performed for a 62-year period to

represent boron concentrations for site conditions in 2022, 62 years following construction of the Ash Pond in 1960. The model was calibrated to match groundwater elevation and concentration observed at each monitoring well. Prediction simulations were then performed to evaluate the effects of CIP and CBR closure scenarios for the Ash Pond on groundwater quality for a period of 1,000 years following initial corrective action measures, which include dewatering of the Ash Pond (1-year period), consolidation of CCR and cover system construction or removal of CCR. The calibration and prediction model timelines are illustrated in **Figure 4-1**.

Three model codes were used to simulate groundwater flow and contaminant transport:

- Groundwater flow was modeled in three dimensions using MODFLOW 2005
- Contaminant transport was modeled in three dimensions using MT3DMS
- Percolation (recharge) after consolidation of CCR and cover system construction was modeled using the results of the Hydrologic Evaluation of Landfill Performance (HELP) model.

5. MODEL SETUP AND CALIBRATION

5.1 Model Descriptions

For the construction and calibration of the numerical groundwater flow model for the site, Ramboll selected the model code MODFLOW, a publicly available groundwater flow simulation program developed by the United States Geological Survey (USGS) (McDonald and Harbaugh, 1988). MODFLOW is thoroughly documented, widely used by consultants, government agencies and researchers, and is consistently accepted in regulatory and litigation proceedings. MODFLOW uses a finite difference approximation to solve a three-dimensional head distribution in a transient, multi-layer, heterogeneous, anisotropic, variable-gradient, variable-thickness, confined or unconfined flow system—given user-supplied inputs of hydraulic conductivity, aquifer/layer thickness, recharge, wells, and boundary conditions. The program also calculates water balance at wells, rivers, and drains.

Major assumptions of the MODFLOW code are: (i) groundwater flow is governed by Darcy's law; (ii) the formation behaves as a continuous porous medium; (iii) flow is not affected by chemical, temperature, or density gradients; and (iv) hydraulic properties are constant within a grid cell. Other assumptions concerning the finite difference equation can be found in McDonald and Harbaugh (1988). MODFLOW 2005 was used for these simulations with Groundwater Vistas 7 software for model pre- and post- processing tasks (Environmental Simulations, Inc., 2017).

MT3DMS (Zheng and Wang, 1998) is an update of MT3D. It calculates concentration distribution for a single dissolved solute as a function of time and space. Concentration is distributed over a three-dimensional, non-uniform, transient flow field. Solute mass may be input at discrete points (wells, drains, river nodes, constant head cells), or distributed evenly or unevenly over the land surface (recharge).

MT3DMS accounts for advection, dispersion, diffusion, first-order decay, and sorption. Sorption can be calculated using linear, Freundlich, or Langmuir isotherms. First-order decay terms may be differentiated for the adsorbed and dissolved phases.

The program uses the standard finite difference method, the particle-tracking-based Eulerian-Lagrangian methods, and the higher-order finite-volume total-variation-diminishing (TVD) method for the solution schemes. The finite difference solution has numerical dispersion for low-dispersivity transport scenarios but conserves good mass balance. The particle-tracking method avoids numerical dispersion but was not accurate in conserving mass. The TVD solution is not subject to significant numerical distribution and adequately conserves mass, but is numerically intensive, particularly for long-term models such as developed for the Ash Pond. The finite difference solution was used for this simulation.

Major assumptions of MT3DMS are: (i) changes in the concentration field do not affect the flow field; (ii) changes in the concentration of one solute do not affect the concentration of another solute; (iii) chemical and hydraulic properties are constant within a grid cell; and (iv) sorption is instantaneous and fully reversible, while decay is not reversible.

The HELP model was developed by the United States Environmental Protection Agency (USEPA). HELP is a one-dimensional hydrologic model of water movement across, into, through, and out of a landfill or soil column based on precipitation, evapotranspiration, runoff, and the geometry and

hydrogeologic properties of a layered soil and waste profile. For this modeling, results of the HELP model, HELP Version 4.0 (Tolaymat and Krause, 2020), were used to estimate the hydraulic conditions beneath removal and consolidation areas.

5.2 Flow and Transport Model Setup

The modeled area was approximately 15,975 feet (478 rows) by 9,500 feet (334 columns) with the Ash Pond located in the west-central portion of the model. The eastern edge of the model is bounded by the Illinois River. The north, west, and south edges of the model were selected to maintain sufficient distance from the Ash Pond to reduce boundary interference with model calculations, while not extending too far past the extent of available calibration data. The northwest edge of the model is defined by the edge of the former historic Illinois River valley, where the elevation increases to approximately 600 feet NGVD29, and bedrock outcrops or is present near the surface (across Highway 24). The model grid and boundary conditions are displayed in **Figure 5-1 through Figure 5-6**.

Evaluation of monitoring well data for the Ash Pond has not identified statistically significant seasonal trends in groundwater quality which could affect model applicability for prediction of boron transport. The MODFLOW model was calibrated to mean groundwater elevation collected from November 2015 to August 2021 presented in **Table 2-2**. MT3DMS was run on the calibrated flow model and model-simulated concentrations were calibrated to the range of observed boron concentration values at the monitoring wells from November 2015 to August 2021 presented in **Table 2-2**. Multiple iterations of MODFLOW and MT3DMS calibration were performed to achieve an acceptable match to observed flow and transport data. For the Ash Pond, the calibrated flow and transport models were used in predictive modeling to evaluate the CIP and CBR closure scenarios by removing saturated ash cells and using HELP modeled recharge values to simulate changes proposed in the closure scenarios.

5.2.1 Grid and Boundary Conditions

A five-layer, 478 x 334 node grid was established with 25-foot grid spacing in the vicinity of the Ash Pond and EPP property. The grid increases gradually to a maximum 225-foot row spacing and 112.5-foot column spacing near the edges of the model (**Figure 5-1**). Boundary conditions are illustrated in **Figure 5-2 through Figure 5-6**. The northwest and eastern edges of the model are no-flow (Neumann) boundaries in all layers of the model with the exceptions of the eastern edge in Layer 3, where a river (Mixed) boundary was placed to simulate the mean flow conditions of the Illinois River, and the north and southeast edges in layer 4, where a general head (Dirichlet) boundary (denoted as general head boundary conditions [GHB] on the figure) was placed to simulate the influence of pumping centers located in Peoria and Pekin on groundwater flow direction. The bottom of the model was also a no-flow (Neumann) boundary. The top of the model was a time-dependent specified flux (Neumann) boundary, with specified flux rates equal to the recharge rate. A specified mass flux (Cauchy condition) boundary was used to simulate downward percolation of solute mass from the Ash Pond. This boundary condition assigns a specified concentration to recharge water entering the node, and the resulting concentration in the node is a function of the relative rate and concentration of recharge water (water percolating from the impoundment) compared to the rate and concentration of other water entering the node.

5.2.2 Flow Model Input Values and Sensitivity

Flow model input values and sensitivity analyses results are presented in **Table 5-1** and described below.

The modeled well location layers and flow model calibration targets (*i.e.*, mean groundwater elevations from November 2015 to August 2021 and target well locations) are summarized in **Table 2-2**. Anomalous groundwater elevations (*e.g.,* groundwater elevations that do not represent static groundwater conditions or groundwater elevations measured in error) monitored between November 2015 and August 2021 were removed from the mean groundwater calculations used as flow calibration targets at wells AP05D, AP07D, APW-02, APW-03, AW-08, and AW-14. Wells APW-02, AW-18, AW-19, AW-20, AW-21, AW-22, and P002 are hydraulically connected to multiple hydrostratigraphic units (*i.e.,* modeled layers) and/or screened across multiple hydrostratigraphic units (*i.e.,* modeled layers). In the flow calibration model, flow calibration targets for wells APW-02, AW-18, AW-19, AW-20, AW-21, AW-22, and P002 were placed in model layers that exhibited heads more representative of the groundwater observations in these wells.

Sensitivity analysis was conducted by changing input values and observing changes in the sum of squared residuals (SSR). Horizontal conductivity, vertical conductivity, and river and general head conductance terms were all varied between one-tenth and ten times calibrated values. Recharge terms were varied between one-half and two times calibrated values. River stage for river reach 1 and general head boundary head terms were varied between 98.5 and 101.5 percent of calibrated values. River stage for river reaches 2 through 4 were varied between 99.5 and 100.5 percent of calibrated values. When the calibrated model was tested, SSR was 374.3. Sensitivity test results were categorized into negligible, low, moderate, moderately high, and high sensitivity based on the change in SSR as summarized in the notes in **Table 5-1**.

5.2.2.1 Model Layers

The bottom elevation of the BCU in layer 5 was flat lying and assumed to be an elevation of 200 feet NAVD88. All available boring log data included in the HCR (Ramboll, 2021a) was used to develop surfaces utilizing Surfer® software for each of the four distinct water-bearing units described in **Section 2**. The modeled UCF was split into three modeled layers, where model layer 1 represented the upper clay of the UCF, model layer 2 represented a transmissive zone within the UCF (this unit is considered a PMP at elevations similar to the base of the Ash Pond, and in places where thin discontinuous sand lenses occur within the UCF adjacent to the Ash Pond), and model layer 3 represented the lower clay of the UCF. Model layer 4 represented the UA onsite, as well as the hydraulically connected sands of the Sankoty Aquifer identified offsite. Model layer 5 represented the BCU. The approximate base of ash surface in the Ash Pond was developed from information presented in the HCR (Ramboll, 2021a) and confirmed with IngenAE. The CCR was modeled in layers 1 and 2 within the limits of the Ash Pond, where the base of layer 2 within the limits of the Ash Pond was consistent with the base of ash surface. The resulting surfaces were imported as layers into the model to represent the distribution and change in thickness of each water-bearing unit across the model domain.

5.2.2.2 Hydraulic Conductivity

Hydraulic conductivity values and sensitivity results are summarized in **Table 5-1**. When available, these values were derived from field or laboratory measured values reported in the

Geotechnical Data Report (AECOM, 2016b), Hydrogeologic Monitoring Plan (Natural Resource Technology, an OBG Company [NRT/OBG], 2017), Technical Memorandum: Ash Pond – Underlying Clay and Depth of CCR Evaluation (Haley & Aldrich, Inc., 2018), and Hydrogeologic Site Characterization Report (Ramboll, 2021a), to be representative of site-specific conditions. The sources of the hydraulic conductivity values are summarized in **Table 5-1**. Conductivity zones that did not have representative site data (*i.e.,* zones 7 and 9, representing the cells above the river cells and the Sankoty Aquifer, respectively) were determined through model calibration. No horizontal anisotropy was assumed. Vertical anisotropy (presented as Kh/Kv in **Table 5-1**) was applied to conductivity zones to simulate preferential flow in the horizontal direction in these materials. Permeability tests discussed in the Geotechnical Data Report (AECOM, 2016b), 2017 Hydrogeologic Monitoring Plan (NRT/OBG, 2017), Technical Memorandum: Ash Pond – Underlying Clay and Depth of CCR Evaluation (Haley & Aldrich, Inc., 2018), and 2021 Hydrogeologic Characterization Report (Ramboll, 2021a) indicate vertical conductivity values that are lower than horizontal conductivity values.

The spatial distribution of the hydraulic conductivity zones (**Figure 5-7 through Figure 5-11**) in each layer simulates the distribution of hydrostratigraphic units as reported in the HCR (Ramboll, 2021a). All hydraulic conductivity zones were laterally continuous within the model with the exception of the Fill Unit (CCR) hydraulic conductivity zone (zone 6), the Weathered Shale (UA) hydraulic conductivity zone (zone 4), and the Sankoty Aquifer hydraulic conductivity (zone 9). The limits of the ash fill were determined from data presented in the HCR (Ramboll, 2021a) and confirmed with IngenAE. The ash fill extent was propagated through all related ash fill property zones and boundary conditions (*i.e.*, recharge, storage, effective porosity, and constant concentration cells). The extent of the Weathered Shale (UA) hydraulic conductivity zone and Sankoty Aquifer hydraulic conductivity zone offsite in model layer 4 was determined through a review of available offsite water well boring logs and through calibration. Conductivity zone 7 was also placed above river cells representing the Illinois River to improve communication between the river and the groundwater in layers above the layer in which the river was placed.

The model was highly sensitive to changes in horizontal conductivity in zones 2 (Transmissive Zone [UCF/PMP]), 4 (Weathered Shale [UA]), 6 (Fill Unit [CCR]), and 9 (Sankoty Aquifer - Sands), where the model was moderately sensitive to horizontal conductivity in the remaining hydrostratigraphic units and low in zone 1 (Upper Clay [UCF]). The model was highly sensitive to changes in vertical conductivity in zone 1 (Upper Clay [UCF]) and zone 3 (Lower Clay [UCF]), while the model exhibited a negligible to moderate sensitivity in the remaining zones.

5.2.2.3 Recharge

Recharge rates were determined through calibration of the model to the groundwater elevation and groundwater quality data collected from November 2015 to August 2021 (**Table 5-1**). The spatial distribution of recharge zones were based on the location and type of material present at land surface (**Figure 5-12**). Six different zones were created to simulate recharge in the model area. One zone (zone 1) was used to simulate ambient recharge over the upper clay of the UCF outside the limits of the Ash Pond. The recharge occurring through the ash fill placed in the Ash Pond was split into five different values, where recharge was varied based upon the historical use of each ash fill area (AECOM, 2016a) and the response of flow calibration target heads. Zones 2, 3, 4, 5, and 7 represent recharge in the Ash Pond area. The greatest recharge in the model was simulated in an area on the northeast edge of the pond where the fill materials are sluiced into the Ash Pond (zone 7) and the greatest heads were observed. The remaining ash fill areas

(recharge zones) are listed in order of greatest to least simulated recharge along with their historical use based on the history of construction (AECOM, 2016a): central area (zone 2, Fly Ash Pond), northwest area (zone 4, Process Water Pond), south area (zone 5, Clarification Pond), and south of railroad area (zone 3, Inactive Area). The area south of the railroad (zone 3) was simulated to have recharge values near ambient recharge as a result of the 2004 modifications to the rail loop surrounding the Ash Pond which increased the elevations of the embankments and reduced the footprint of the active impoundment (AECOM, 2016a).

The model had a high sensitivity to changes in recharge in zones 1 (Upper Clay [UCF]), 2 (Fill Unit – CCR [Central, Fly Ash Pond]), and 7 (Fill Unit - CCR [Northeast, Sluice Area]). The model had negligible to moderate sensitivity to changes in recharge in the remaining zones, with the exception of zone 4 (Fill Unit – CCR [Northwest, Process Water Pond), where sensitivity was moderately high.

5.2.2.4 Storage and Specific Yield

The calibration model did not use these terms because it was run at steady state. For the transport model, which was run in transient, no field data defining these terms were available so published values were used consistent with Fetter (1988). Specific yield (S_y) was set to equal effective porosity values described in **Section 5.2.3.3**. The spatial distribution of the storage and specific yield zones were consistent with those of the hydraulic conductivity zones. The sensitivity of these parameters was tested by evaluating their effect on the transport model as described in **Section 5.2.3.4**.

5.2.2.5 River Parameters

The Illinois River was simulated using head-dependent flux nodes in modeled river reach 1 that required inputs for river stage, width, bed thickness, and bed hydraulic conductivity (**Table 5-1**). River width, bed thickness, and bed hydraulic conductivity parameters were used to calculate a conductance term for the boundary node. This conductance term was determined by adjusting hydraulic conductivity during model calibration, while bed thickness was set at 1 foot and river width was set at 750 feet. Final hydraulic conductivity value was set at 1 ft/day. The length of the modeled river extends from the northernmost extent of the model domain to the southernmost extent of the model domain using river reach 1. The modeled river stage in the calibration model was based on available Illinois River stage data at Peoria, Illinois (United States Army Corps of Engineers [USACE] 404208089335201 Illinois River at Peoria, Illinois [Corps]), Edwards Power Plant (Plant Gaging Station), and Kingston, Illinois (USGS 05568500 Illinois River at Kingston Mines, Illinois) gaging stations. The river boundary was placed in layer 3 corresponding with simulated river elevation (**Figure 5-4**).

A median slope was calculated from available data at upstream Peoria, Illinois gaging station (USACE 404208089335201 Illinois River at Peoria, Illinois [Corps]) and downstream Kingston, Illinois gaging station (USGS 05568500 Illinois River at Kingston Mines, Illinois). The mean river stage was then calculated based upon available gage data (hourly data from October 2007 to January 2022) of the Illinois River from Kingston, Illinois (USGS 05568500 Illinois River at Kingston Mines, Illinois) gaging station. The calculated median slope along with the mean river stage at Kingston, Illinois was used to interpolate the mean river stage throughout the model domain. The interpolated mean value near the EPP was confirmed to be within the range of observations at EPP gaging station.

The drainage ditch, bordering the western edge of the Ash Pond and continuing south to the Illinois River, was simulated using head dependent flux nodes in modeled river reach 2 (**Table 5-1**). The conductance term was determined by adjusting hydraulic conductivity during model calibration, while bed thickness was set at 1 foot and river width was set at 20 feet. Final hydraulic conductivity value was set at 0.00001 ft/day to reflect the low vertical hydraulic conductivity of the underlying UCF material. The drainage ditch stage was based on the mean drainage ditch water surface elevation from survey data collected by IngenAE in February 2022. The drainage ditch modeled river reach 2 was placed in layer 1. A second drainage feature, the drainage swale (reach 3) to the north of the Ash Pond had similar input parameters, however the river width was set to 25 and simulated river stage had a slightly lower elevation based on survey data collected by IngenAE in February 2022. A third drainage feature, the drainage pond (reach 4) to the northeast of the Ash Pond had similar input parameters; however, the river stage had a slightly higher elevation based on survey data collected by IngenAE in February 2022. River reaches 3 through 4 were also placed in layer 1.

The model had negligible to low sensitivity to changes in river stage, with the exception of reach 1 (Illinois River), where the sensitivity was moderate. The model had negligible to low sensitivity to changes in river conductance, with the exception of reach 2 (Drainage Ditch West of Ash Pond), where the sensitivity was moderate.

5.2.2.6 General Head Boundary Parameters

GHB were used along the north edge of the model as well as along the southeast edge of the model in layer 4 (**Figure 5-5**). The GHB at the northern limit of the model (reach 1) was used to simulate groundwater flow leaving the model domain in the Sankoty Aquifer due to the influence of pumping centers in Peoria. GHB elevation, conductance, and distance were established during calibration (**Table 5-1**). GHB cell width was set at 150 feet, distance to the GHB head was set at 1 foot, and average saturated thickness of the cell was set at 100 feet. Final hydraulic conductivity value was set at 100 ft/day to be similar in magnitude to the horizontal conductivity of the permeable sands. The GHB at the southeastern limit of the model (reach 1) was used to simulate groundwater flow leaving the model domain in the Sankoty Aquifer due to the influence of pumping centers in Pekin. GHB elevation, conductance, and distance were established during calibration (**Table 5-1**). GHB cell width was set at 750 feet, distance to the GHB head was set at 1 foot, and average saturated thickness of the cell was set at 39 feet. Final hydraulic conductivity value was set at 100 ft/day to be similar in magnitude to the horizontal hydraulic conductivity of the permeable sands. The GHB at the north edge of the model (reach 1) and the southeast edge of the model (reach 1) were placed in layer 4 with a constant elevation of 426 feet NAVD88. The sensitivity to changes in specified head was high for reach 1. The flow calibration model had a negligible sensitivity to changes in conductance.

5.2.3 Transport Model Input Values and Sensitivity

MT3DMS input values are listed in **Table 5-2** and described below. Sensitivity of the transport model is summarized in **Table 5-3**.

Groundwater transport was calibrated to groundwater boron concentration ranges at each well as measured from the monitoring wells between November 2015 and August 2021. The transport model calibration targets are summarized in **Table 2-2**.

Sensitivity analysis was conducted by changing input values and observing percent change in boron concentration at each well from the calibrated model boron concentration. Effective porosity was varied by decreasing and increasing calibrated model values by 0.05. Storage values were multiplied and divided by a factor of 10, and specific yield by a factor of 2. High specific yield sensitivity was not analyzed for zone 8 (UCF above River Boundary Conditions) since the calibration value was already near upper limits of acceptable values for specific yield (0.5).

5.2.3.1 Initial Concentrations

No initial concentrations were placed in the calibration model. The flow model was run as transient and concentration was added to the model through recharge and constant concentration cells starting at the same time as flow simulation. Modeling was performed for two stress periods, where the first stress period (stress period 1) started at the time of Ash Pond construction (1960) and ended in 2004 (44-year stress period) when modifications to the rail loop surrounding the Ash Pond increased the elevations of the embankments and reduced the footprint of the active impoundment (AECOM, 2016a). The second stress period (stress period 2) started in 2005 following the Ash Pond modifications and included reduced recharge in the ash fill area south of the railroad (recharge zone 3) to simulate the reduced activity in this area of the pond. The second stress period ended in 2022 (18-year stress period). The transport model timeline is illustrated in **Figure 4-1**.

5.2.3.2 Source Concentrations

Five concentration sources in the form of vertical percolation (recharge) through CCR were simulated in fill unit layer 1 for calibration (**Table 5-2**) (in order of greatest to least simulated recharge): (i) percolation through CCR in the northeast edge of the pond where the fill materials are sluiced into the Ash Pond (zone 7, Sluice Area), (ii) percolation through CCR in the central area (zone 2, Fly Ash Pond), (iii) percolation through CCR in the northwest area (zone 4, Process Water Pond), (iv) percolation through CCR in the south area (zone 5, Clarification Pond), and (v) percolation through CCR south of railroad (zone 3, Inactive Area)(**Figure 5-12**). All five sources were simulated by assigning concentration to the recharge input. The CCR sources were also simulated with constant concentration cells placed in fill unit layer 1 and layer 2 (**Figure 5-2** and **Figure 5-3**) to simulate saturated ash conditions. From the model perspective, this means that when the simulated water level is above the base of these cells, water that passes through the cell will take on the assigned concentration. All source concentrations were calibrated in the transport model to the boron concentration data collected from November 2015 to August 2021. The source concentrations applied to the recharge zones and saturated ash cells immediately below the recharge zones have the same concentration values.

Because these are the sources of concentration in the model, the model will be highly sensitive to changes in the input values. For that reason, sensitivity testing was not completed for the source values.

5.2.3.3 Effective Porosity

Effective porosity for each modeled hydrostratigraphic unit were derived from an average between estimated values of 0.20 for silt material, 0.267 for gravel, 0.07 for clay, and 0.28 for sand from Morris and Johnson (1967) and Heath (1983) and presented in **Table 5-2**.

The model had a negligible to moderately high sensitivity to decreases in porosity values, with the exception of four monitoring locations where sensitivity was high (*i.e.,* APW-01, APW-04,

AW-05, and AW-12) and not including monitoring locations where the calibration concentration was less than 0.1 mg/L (*i.e.*, AP05S, AP05D, AP07D, AW-06, AW-08, and AW-15C) (**Table 5-3**). The model had a negligible to moderate sensitivity to increases in porosity values, not including monitoring locations where the calibration concentration was less than 0.1 mg/L (*i.e.*, AP05S, AP05D, AP07D, APW-01, APW-04, AW-06, AW-08, AW-12, and AW-15C) (**Table 5-3**).

5.2.3.4 Storage and Specific Yield Sensitivity

The transport model had a negligible to low sensitivity to changes in storage and specific yield, with the exception of sensitivity at monitoring wells AP05S, AP05D, APW-01, APW-04, and AW-12, where sensitivity was moderate to moderately high; however, boron concentration in both the calibrated model and sensitivity models were negligible (<0.1 mg/L) at these wells (**Table 5-3**).

5.2.3.5 Dispersivity

Physical attenuation (dilution and dispersion) of contaminants is simulated in MT3DMS. Dispersion in porous media refers to the spreading of contaminants over a greater region than would be predicted solely from the average groundwater velocity vectors (Anderson, 1979; Anderson, 1984). Dispersion is caused by both mechanical dispersion, a result of deviations of actual velocity at a microscale from the average groundwater velocity, and molecular diffusion driven by concentration gradients. Molecular diffusion is generally secondary and negligible compared to the effects of mechanical dispersion and only becomes important when groundwater velocity is very low. The sum of mechanical dispersion and molecular diffusion is termed hydrodynamic dispersion, or simply dispersion (Zheng and Wang, 1998).

Dispersivity values were applied to the entire model domain and determined during calibration. Longitudinal dispersivity was set at 3 feet. The transverse and vertical dispersivity were set at 1/10 and 1/100 of longitudinal dispersivity. These input values were determined during model calibration. With travel distances of less than 100 feet for groundwater from the source to the majority of the monitoring points, the model is not expected to be sensitive to dispersivity inputs and the sensitivity of the model to dispersivity was not tested.

5.2.3.6 Retardation

It was assumed that boron would not significantly sorb or chemically react with aquifer solids (distribution coefficient [Kd] was set to 0 mL/g) which is a conservative estimate for estimating contaminant transport times. Boron, sulfate, and TDS transport is likely to be affected by both chemical and physical attenuation mechanisms (*i.e.*, adsorption and/or precipitation reactions as well as dilution and dispersion). Batch adsorption testing was conducted to generate site specific partition coefficient results for boron and sulfate (Golder, 2022b, **Appendix D**) for locations AW-15S and AW-19. Results of the testing are summarized below:

- Boron: Calculated linear partition coefficient (K_D) values were 1.50 and -0.19 liters per kilogram (L/kg), respectively. Langmuir partition coefficient (K_L) values were 3.8×10^4 and -2×10^5 L/kg, respectively. Freundlich partition coefficients (K_F) values were 82 and 215 L/kg, respectively. In Strenge and Peterson (1989), partition coefficients for boron range from 0.19 to 1.3 L/kg, depending on pH conditions and the amount of sorbent present.
- Sulfate: Calculated K_D values were 0.47 and -1.0 L/kg, respectively. K_L values were 778 and -2,950 L/kg, respectively. The K_F values for AW-15S and AW-19 were 63 and 1.2 L/kg,

respectively. In Strenge and Peterson (1989), partition coefficients for sulfate are 0.0 L/kg, regardless of pH conditions and the amount of sorbent present.

The results from site samples have a high degree of variation and little correlation with the literature values provided for comparison. The potential exceedances identified in groundwater (boron, sulfate, and TDS) are affected by natural attenuation processes in multiple ways and to varying degrees. Further assessment of these processes and how they may be applied as a potential groundwater remedy will be completed as part of future remedy selection evaluations, as necessary. For the purposes of this GMR, and as mentioned at the beginning of this section, no retardation was applied to boron transport in the model (*i.e.,* Kd was set to 0).

5.3 Flow and Transport Model Assumptions and Limitations

Simplifying assumptions were made while developing this model:

- Leading up to 2022, the groundwater flow system can be simulated as steady state.
- Natural recharge is constant over the long term.
- Fluctuations in river stage do not affect groundwater flow and transport over the long term.
- Hydraulic conductivity is consistent within hydrostratigraphic units
- The approximate base of ash surface in the Ash Pond was developed from information presented in the HCR (Ramboll, 2021a) and confirmed with IngenAE. Observed concentrations in groundwater exhibit no long-term trend.
- Source concentrations are assumed to remain constant over time. Only recharge rate was modified in 2004 to simulate modifications to Ash Pond operation south of the railroad (recharge zone 3).
- Boron is not adsorbed and does not decay, and mixing and dispersion are the only attenuation mechanisms.

The model is limited by the data used for calibration, which adequately define the local groundwater flow system and the source and extent of the plume. Since data used for calibration are near the Ash Pond, model predictions of transport distant spatially and temporally from the calibrated conditions at the CCR units will not be as reliable as predictions closer to the CCR units and concentrations observed between 2015 and 2021.

5.4 Calibration Flow and Transport Model Results

Results of the MODFLOW/MT3DMS modeling are presented below. Electronic copies of the model files are attached to this report (**Appendix C**).

Observed and simulated heads are presented in **Figure 5-13 through Figure 5-17**. The mass balance error for the flow model was -0.19 percent and the ratio of the residual standard deviation to the range was 11.6 percent; the mass balance error for the flow model was within the target for the criteria of 1 percent and the ratio of the residual standard deviation to the range was near target for the criteria of 10 percent. Another flow model calibration goal is that residuals are evenly distributed such that there is no bias affecting modeled flow. The observed heads are plotted versus the simulated heads in **Figure 5-18**. The near-linear relationship between observed and simulated values indicates that the model adequately represents the calibration dataset. The residual mean was -1.81 feet; in general the simulated values were

evenly distributed above and below the observed values. This is also illustrated in the observed versus residuals plot at the bottom of **Figure 5-19**; however, some simulated values were overpredicted in the areas north of the Ash Pond or in model layer 2 immediately adjacent to the Ash Pond (transmissive zone within the UCF) where observed heads in the UCF (flow calibration targets) were significantly lower than observed heads (flow calibration targets) in the adjacent Ash Pond. These residuals plot in the lower left quadrant of **Figure 5-19**.

The range of observed boron concentrations between November 2015 and August 2021 for transport calibration locations are summarized in **Table 2-2**. The goals of the transport model calibration were to have predicted concentrations fall within the range of observed concentrations, and/or have predicted concentrations above and below the GWPS for boron (2 mg/L) match observed concentrations above or below the standard at each well. One or both of these goals were achieved at all but three of the transport calibration location wells, including AW-17, AW-22, and P002, where concentrations were overpredicted (**Figure 5-20**). Deviations from the observed ranges are discussed below.

- P002 is identified as a PMP well in the HCR (Ramboll, 2021a). P002 was modeled in layer 3 which represents the lower clay beneath the Ash Pond rather than layer 2, which represents the transmissive zone of the UCF (PMP) in the model. Since layer 2 was modeled as ash fill at the location of P002, the well was placed in layer 3 of the model immediately beneath the ash fill. The ash fill above the modeled location of P002 had the highest model source concentrations, which contribute to the over-predicted concentrations of boron at P002.
- In general, the model over-predicts boron concentrations to the north of the Ash Pond (AW-19, AW-20, AW-22, and P002) in wells adjacent to wells AP07S and AW021 where the highest boron concentrations were observed. The proximity of P002 and AW-22 to the highest boron concentration targets contributed to the over-predicted boron concentrations at these wells. Similarly, the over-prediction of boron concentration at AW-17 is associated with the proximity of AW-17 to AW-18 where observed boron concentrations are elevated.

The remaining calibration locations had predicted concentrations that fall within the range of observed concentrations and/or have predicted concentrations above and below the GWPS for boron (2 mg/L) matching observed concentrations above or below the standard at each well. In other words, there was a very good match between predicted and observed boron concentrations relative to wells with concentrations above and below the GWPS. UA well AW-21, located north of the Ash Pond, where the highest boron concentrations were observed, was also calibrated near the mean concentration of the observed values from November 2015 to August 2021. Similarly, PMP well AP07S located north of the Ash Pond, where the highest concentrations in the UCF were observed, was calibrated just below the maximum of the observed range from November 2015 to August 2021. The calibration result for wells AW-21 and AP07S indicate the transport calibration model was able to simulate the highest observed concentrations in both the UA and transmissive zone of the UCF (PMP), respectively. The remaining wells with observations above the standard GWPS for boron (2 mg/L) from November 2015 to August 2021 had calibrated concentrations above the GWPS (AW-05, AW-15S, AW-18, AW-19, AW-20). The distribution of boron concentrations in the calibrated model are presented on **Figure 5-21 through Figure 5-25**.

6. SIMULATION OF CLOSURE SCENARIOS

6.1 Overview and Prediction Model Development

Prediction simulations were performed to evaluate the effects of closure (source control) measures (CCR consolidation and CIP and CBR scenarios) for the Ash Pond on groundwater quality following initial corrective action measures, which includes removal of free liquids from the Ash Pond (**Figure 4-1**). As discussed in **Section 5.2.3.5**, physical attenuation (dilution and dispersion) of contaminants in groundwater is simulated in MT3DMS, which captures the physical process of natural attenuation as part of corrective actions for both closure scenarios simulated. No retardation was applied to boron transport in the model (*i.e.,* Kd was set to 0) as discussed in **Section 5.2.3.6**. The following methods were used to develop the prediction models and simulate the CIP and CBR closure scenarios:

- Define ash fill material removal and consolidation areas based on designs provided in the Final Closure Plan (IngenAE, 2022).
- Apply a constant head to the Ash Pond for the dewatering period (approximately 1 year) to remove free liquids within the Ash Pond and simulate heads near ambient conditions.
- Remove source concentrations within the removal areas (source concentrations associated with recharge zones and saturated ash cells [constant concentration cells]).
- Apply drains (drain input parameters approximated designs provided in the Final Closure Plan [IngenAE, 2022]) to simulate storm water management within removal areas following closure.
- Apply hydraulic conductivity, recharge (HELP calculated percolation rates were developed based on soil backfill materials and final grading designs provided in the Final Closure Plan [IngenAE, 2022]), storage, and specific yield property zones to simulate soil backfill materials placed in the Ash Pond removal areas.
- Apply reduced recharge in the consolidation and closure in place areas to simulate the effects of the cover system on transport (HELP calculated percolation rates were developed based on cover system construction materials and designs provided in the Final Closure Plan [IngenAE, 2022]).

HELP modeling input and output values are summarized in **Table 6-1** and described in detail below. Prediction simulations were performed to evaluate changes in boron concentrations from two closure scenarios, including consolidation and CIP, and CBR scenarios. The following simplifying assumptions were made during the simulations:

- In the two closure scenarios, HELP-calculated average annual percolation rates were developed from a 30-year HELP model run. This 30-year HELP-calculated percolation rate remained constant over duration of the closure scenario prediction model runs following closure.
- Changes in recharge resulting from dewatering, ash fill removal, consolidation, construction of the cover system, and soil backfill placement and final grading (recharge rates are based on HELP-calculated average annual percolation rates) have an instantaneous effect on recharge and percolation through surface materials.

- Boron source concentrations were assumed to remain constant as a function of time following the end of the calibration simulation. Boron concentration in the ash fill removal areas was assumed to be 0 mg/L following construction to simulate removal of ash that is the source of boron.
- The start of each closure prediction simulation was initiated at the end of the calibration model period from 1960 to 2022. Two models were included for each closure prediction simulation, where the first model simulated the removal of free liquids period (1 year) and the second model simulated the final closure conditions (1,000 years). The prediction modeling timeline for each scenario is illustrated in **Figure 4-1**.
- The geocomposite drainage layer and geomembrane liner placed over the ash consolidation area were assumed to have good field placement and assumed to have the same slope as the final grade of the overlying cover materials based on the design drawings provided in the Final Closure Plan (IngenAE, 2022).
- Ash fill removal areas were assumed to be graded following placement of soil backfill based on the design drawings provided in the Final Closure Plan (IngenAE, 2022).
- All saturated ash (constant concentration cells) within removal areas in the transport calibration model were removed instantaneously in all prediction models following ash fill removal/final soil backfill grading. Local fill materials assumed to be sourced from surrounding UCF materials replaced ash fill in areas of removal.
- Local fill materials applied to the prediction models have similar hydraulic properties as the UCF materials used in the transport calibration models.

6.2 HELP Model Setup and Results

HELP (Version 4.0; Tolaymat and Krause, 2020) was used to estimate percolation through the Ash Pond areas for two ash fill closure scenarios and three area types, including CBR removal areas, CIP removal areas, and CIP consolidation and cover system areas. HELP files are included electronically (**Appendix C**) and outputs are attached to this report (**Appendix E**).

HELP input data and results are provided in **Table 6-1**. All scenarios were modeled for a period of 30 years. Climatic inputs were synthetically generated using default equations developed for Peoria, Illinois (the closest weather station included in the HELP database). Precipitation, temperature, and solar radiation was simulated based on the latitude of the Ash Pond. Thickness and type of the geosynthetic drainage layer, geomembrane liner, soil backfill, and soil runoff input parameters were developed for the ash fill removal and consolidation scenarios using data provided the Final Closure Plan (IngenAE, 2022).

HELP model results (**Table 6-1**) indicated 5.09 inches of percolation per year for the Ash Pond CBR removal areas, 4.03 inches of percolation per year for the Ash Pond CIP removal areas, and 0.0002 inches of percolation per year for the Ash Pond consolidation and cover system areas. The differences in HELP model runs for each area included the following parameters: evaporation zone thickness (limited by unsaturated soil backfill thickness in the Ash Pond), area, soil backfill thickness, and soil runoff slope length; all other HELP model input parameters were the same for each simulated area. Two additional HELP model simulations were completed to support the *Proposed Alternative Final Protective Layer Equivalency Demonstration*, (Geosyntec, 2022) which is an appendix to the Construction Permit Application to which this report is also attached.

Results of these two HELP simulations were not incorporated in the MODFLOW simulations for closure. Simulation inputs and output results are presented in **Appendix E**.

6.3 Simulation of Closure Scenarios

The calibrated model was used to evaluate the effectiveness of the two closure scenarios by defining ash fill material removal and consolidation area, reducing head to simulate a dewatering period (approximately 1 year), removing source concentrations within the removal areas, applying drains to simulate storm water management within removal areas following closure, applying hydraulic conductivity, recharge, storage, and specific yield property zones to simulate soil backfill materials placed in the Ash Pond removal areas, and applying reduced recharge in the consolidation and closure in place areas to simulate the effects of the cover system on transport.

Each prediction scenario was initiated at the end of the calibration model and consisted of two models where the first model simulated the dewatering period (1 year) and the second model simulated the final closure conditions (**Figure 4-1**). The prediction model input values are summarized in **Table 6-2** and illustrated in **Figure 6-1 through Figure 6-6**.

In general, long predicted timeframes to reach the GWPS were observed for most wells in both CIP and CBR prediction scenarios. The long timeframes observed are a result of the generally low permeability materials adjacent to and underlying the Ash Pond, and generally low groundwater flow velocities observed within the water-bearing units of the site, which results in reduced transport and slow physical attenuation (dilution and dispersion). The observed timeframes to reach the GWPS for some wells in both the CIP and CBR prediction scenarios were on the order of hundreds of years from present. These predicted timeframes to meet the GWPS are less reliable than timeframes that are closer temporally to the data used for calibration (between 2015 and 2021). The two closure scenarios are discussed in this report based on predicted changes in boron concentrations as described below.

6.3.1 Closure Scenario 1 (CIP) Predicted Boron Concentrations

The design for Scenario 1: CIP includes an initial 1-year dewatering period to remove free liquids followed by CCR removal from the northwest areas of the Ash Pond, consolidation to the northeast, central and southern areas of the Ash Pond, and construction of a cover system over the remaining CCR (**Figure 4-1**).

Predicted concentrations start to decline at all monitoring wells with observations above the GWPS for boron (2 mg/L) (AP07S, AW-05, AW-15S, AW-18, AW-19, AW-20, AW-21) once closure actions are initiated within the prediction model. These declines occur as the northwest area of ash fill is removed and saturated ash cells (constant concentration cells) are reduced in the area of the highest modeled source concentrations. Following removal of ash fill in the northwest area, boron concentrations are no longer entering the model domain from recharge or from saturated ash cells (constant concentration cells). Dewatering also reduces the head within the Ash Pond. These low heads are maintained following completion of closure by the drain cells that simulate storm water management designs within the removal area to the northwest, and by the greatly reduced infiltration rates (recharge) that result from placement of the cover system over the consolidated ash fill. As a result of the reduced heads and recharge, downward percolation of solute mass from the Ash Pond is reduced, which decreases the boron concentration entering the model domain. The reduced recharge resulting from placement of the cover system also reduces the number of

active saturated ash cells (constant concentration cells) contributing boron to the model domain. All monitoring wells with observations above the GWPS for boron (2 mg/L) are predicted to be below the GWPS 198 years after CIP implementation (model year 260 as illustrated in **Figure 6-7**). AW-19 takes the longest of these wells to be reduced below the GWPS, but like AW-20, this well is over-predicted in the calibration model. AW-21 and AP07S, which had the highest concentrations in the UA and UCF, respectively, and were among the wells with the best-fit model calibrations for boron concentration, were predicted to decline below the GWPS at 121 (model year 183) and 32 years (model year 94) after CIP implementation, as illustrated in **Figure 6-7**.

With the exception of wells AW-09 and AW-16, located along the southwestern side of the Ash Pond, all other modeled boron concentrations are predicted to decrease below the GWPS 382 years after CIP implementation (model year 444 as illustrated in **Figure 6-7**). The maximum extent of the plume above the standard GWPS for boron (2 mg/L) at this time is illustrated in **Figure 6-8,** where boron exceedances have retreated within the footprint of the former Ash Pond except along the southwestern edge of the pond. Along the southwestern edge of the pond, including wells AW-09 and AW-16, the model indicates concentrations will increase for a period of time following implementation of corrective measures before decreases are predicted.

The predicted increase and delayed reduction in concentration at wells AW-09 and AW-16 is a result of the wells being located along the flow path of the residual boron concentrations released into native geologic materials prior to closure. The prediction model indicates that as the plume recedes over time a south-southwest trending plume of historic boron concentrations above the standard GWPS for boron (2 mg/L) slowly moves along this flow path as physical attenuation takes place, eventually reducing concentrations at these wells to concentrations below the standard GWPS 767 years after implementation of closure (model year 829 as illustrated in **Figure 6-7**). The maximum extent of the plume at this time (model year 829) is illustrated in **Figure 6-9**. As illustrated in **Figure 6-8** and **Figure 6-9** the maximum extent of the plume at 382 (model year 444) and 767 (model year 829) years after CIP implementation remains in close proximity to the Ash Pond as the plume recedes and concentrations at monitoring wells AW-09 and AW-16 decrease (**Figure 6-7**).

Evaluations of post-construction water flux through the consolidated and covered Fill Unit (CCR) were completed using data obtained from the Scenario 1 (CIP) prediction model when simulated post-construction heads in the groundwater monitoring wells are predicted to stabilize (once heads stabilized in the model, the post-construction movement of water in and out of the Fill Unit [CCR] were compared to pre-construction conditions). The pre-construction (calibration model) and post-construction Scenario 1 (CIP) prediction model simulated water flux values are summarized in **Appendix F** and discussed below. Data export files used for flux evaluations are found along with model files in **Appendix C**.

Scenario 1 (CIP) was predicted to reduce total flux in and out of the Fill Unit (CCR) by approximately 97% and 94%, respectively, when simulated post-construction heads in the groundwater monitoring wells are predicted to stabilize (approximate hydraulic steady state) as illustrated in **Figure 6-10**. **Figure 6-11** is a plot showing the changes in flux reduction (shown as negative percentage) over time, starting from implementation of Scenario 1 (CIP) through approximate hydraulic steady state conditions. Following implementation of Scenario 1 (CIP), influx into the CCR unit increases for approximately 2 years as free liquids are no longer being actively removed from the CCR unit, then influx to the CCR unit decreases rapidly as illustrated in

Figure 6-11. Concurrently, outflux from the CCR unit is briefly reduced by approximately 100% following removal of free liquids, after 30 days a reduction of outflux of at least 80% is maintained as heads approach hydraulic stabilization (**Figure 6-11**).

6.3.2 Closure Scenario 2 (CBR) Predicted Boron Concentrations

The design for Scenario 2: CBR includes an initial 1-year dewatering period followed by CCR removal from the Ash Pond (**Figure 4-1**).

Like CIP, predicted concentrations for CBR start to decline at all monitoring wells with observations above the standard GWPS for boron (2 mg/L) (AP07S, AW-05, AW-15S, AW-18, AW-19, AW-20, AW-21) once the closure actions are initiated within the prediction model. In CBR, these declines occur as the ash fill is removed from the Ash Pond and saturated ash cells (constant concentration cells) are removed. Following removal of ash fill, boron concentrations are no longer entering the model domain from recharge or from saturated ash cells (constant concentration cells); all source concentrations are removed. Dewatering through removal of free liquids also reduces the head within the Ash Pond. These low heads are maintained following completion of closure by the drain cells that simulate storm water management designs within the Ash Pond. As a result of the reduced heads, downward percolation of existing solute mass from the Ash Pond is reduced. All monitoring wells with observations above the standard GWPS for boron (2 mg/L) are predicted to be below the GWPS 104 years after closure implementation (model year 166 as illustrated in **Figure 6-12**). Similar to CIP, AW-19 takes the longest of these wells to be reduced below the GWPS. AW-21 and AP07S, which had the highest concentrations in the UA and UCF, respectively, and were among the wells with the best-fit model calibrations for boron concentration, were predicted to decline below the GWPS at 88 (model year 150) and 15 years (model year 77) after CBR implementation, as illustrated in **Figure 6-12**.

With the exception of wells AW-09 and AW-16, boron concentrations are predicted to decrease below the GWPS 201 years after CBR implementation (model year 263 as illustrated in **Figure 6-12**). The maximum extent of the plume at this time is illustrated in **Figure 6-13** where boron exceedances have retreated within the footprint of the former Ash Pond except along a limited portion of the southwestern edge of the pond. Like CIP, at wells AW-09 and AW-16 the model indicates concentrations will increase for a period of time following implementation of closure before decreases are predicted.

Also, like CIP, the predicted increase and delayed reduction in concentration at wells AW-09 and AW-16 is a result of the wells being located along the flow path of the residual boron concentrations released into native geologic materials prior to closure. The prediction model indicates that as the plume recedes over time a south-southwest trending plume of historic boron concentrations above the standard GWPS for boron (2 mg/L) slowly moves along this flow path as physical attenuation takes place, eventually reducing concentrations at these wells to concentrations below the GWPS 748 years after implementation of closure (model year 810 as illustrated in **Figure 6-12**). The maximum extent of the plume at this time is illustrated in **Figure 6-14**. As illustrated in **Figure 6-13** and **Figure 6-14**, the maximum extent of the plume at 201 (model year 263) and 748 (model year 810) years after CBR implementation, remains in close proximity to the Ash Pond as the plume recedes and concentrations at monitoring wells AW-09 and AW-16 decrease (**Figure 6-12**).

7. CONCLUSIONS

This GMR has been prepared to evaluate how proposed CIP and CBR closure scenarios will achieve compliance with the applicable groundwater standards at the EPP. Data collected from sampling events between November 2015 and August 2021 was used to develop a groundwater model for the EPP Ash Pond and surrounding area. The MODFLOW and MT3DMS models were then used to evaluate CIP using information provided in the Final Closure Plan (IngenAE, 2022), and CBR closure scenarios:

- Scenario 1: CIP (CCR removal from the northwest areas of the Ash Pond, consolidation to the northeast, central and southern areas of the Ash Pond, and construction of a cover system over the remaining CCR)
- Scenario 2: CBR (CCR removal from the Ash Pond)

Scenario 1 (CIP) was predicted to reduce total flux in and out of the Fill Unit (CCR) by approximately 97% and 94%, respectively, when simulated post-construction heads in the groundwater monitoring wells are predicted to stabilize.

Differences exist in the timeframes to reach the GWPS for most monitoring wells between CIP and CBR. For instance, wells with observations above the standard GWPS for boron (2 mg/L) from November 2015 to August 2021 (AP07S, AW-05, AW-15S, AW-18, AW-19, AW-20, AW-21) are predicted to reach the GWPS in 198 years after CIP implementation, and 104 years after CBR implementation. Shorter timeframes were predicted to reach the GWPS for wells located on the northern edge of the Ash Pond where observed boron concentrations were the highest (AW-21 and AP07S). AW-21 and AP07S, which had the highest concentrations in the UA and UCF, respectively, were predicted to decline below the GWPS at 121 and 32 years, respectively, after CIP implementation, and at 88 and 15 years, respectively, after CBR implementation. However, as a result of the south-southwest trending plume of residual boron concentrations above the GWPS for boron (2 mg/L) released to native geologic materials prior to closure, which remains for a long period of time following implementation of both scenarios, all monitoring wells are not predicted to reach the GWPS until after 767 years and 748 years following implementation of CIP and CBR, respectively.

The observed timeframes to reach the GWPS for both the CIP and CBR prediction scenarios were on the order of hundreds of years from present; these predicted timeframes to meet the GWPS are less reliable than timeframes that are closer temporally to the data used for calibration (between 2015 and 2021). From a modeling perspective, the 19-year difference between CIP and CBR to reach the GWPS is negligible. In other words, both scenarios are predicted to reach the GWPS after approximately 750 years, and the simulated 19-year difference between these two scenarios is not significant. Further, the boron plumes for both CIP and CBR remain in close proximity to the Ash Pond while they recede, indicating they are equally protective.

Statistically significant correlations between boron concentrations and concentrations of sulfate and TDS identified as potential exceedances of the GWPS indicate boron is an acceptable surrogate for these parameters in the groundwater model. Concentrations of these parameters are expected to change along with model predicted boron concentrations.

Results of groundwater fate and transport modeling conservatively estimate that groundwater will attain the GWPS for all constituents identified as potential exceedances of the GWPS in approximately 750 years following closure implementation for both CIP and CBR. The long timeframes observed are a result of the generally low permeability materials adjacent to and

underlying the Ash Pond, and generally low groundwater flow velocities observed within the water-bearing units of the site, which results in reduced transport and slow physical attenuation (dilution and dispersion). The predicted maximum extent of the plume above the standard GWPS for boron (2 mg/L) stays in close proximity to the ash pond as it recedes.

8. REFERENCES

AECOM, 2016a. *History of Construction*. USEPA Final CCR Rule 40 C.F.R. Part 257.73(c). Edwards Power Station. Bartonville, Illinois. Accessed at https://www.luminant.com/ccr/ on June 7, 2021.

AECOM, 2016b. *Geotechnical Data Report for Dynegy Edwards Power Station*.

Anderson, M.P. 1979. *Using models to simulate the movement of contaminants through groundwater flow systems*. CRC Critical Rev. Environ. Control., 9(2), p. 97-156.

Anderson, M.P. 1984. *Movement of contaminants in groundwater: groundwater transport -- advection and dispersion*. Groundwater Contamination. National Academy Press, Washington, D.C. p. 37-45.

Burch, S. L. and D. J. Kelly., 1993. *Peoria-Pekin Regional Ground-Water Quality Assessment*. Illinois State Water Survey (ISWS), Champaign, Research Report 124.

Environmental Simulations, Inc., 2017. *Groundwater Vistas 7 Software*.

Fetter, C.W., 1988. *Applied Hydrogeology*. Merrill Publishing Company, Columbus, Ohio.

Foth, 2017. Antidegradation Alternative Analysis, Dynegy Midwest Generation, LLC, Edwards Power Station, Bartonville, Illinois. September 8, 2017.

Golder Associates USA Inc. (Golder), 2022a. *Draft Technical Memorandum: Evaluation of Potential GWPS Exceedances, Edwards Ash Pond (CCR Unit 301), Edwards power Plant, Peoria County, Illinois*. March 21, 2022.

Golder Associates USA Inc., (Golder), 2022b. *Technical Memorandum: Evaluation of Partition Coefficient Results, Edwards Ash Pond (CCR Unit 301), Edwards power Plant, Peoria County, Illinois*. March 21, 2022.

Haley & Aldrich, Inc., 2018. *Technical Memorandum: Ash Pond – Underlying Clay and Depth of CCR Evaluation, Edwards Station, Bartonville, Illinois*. February 12, 2018.

Heath, R.C., 1983. *Basic Ground-water Hydrology*, U.S. Geological Survey Water-Supply Paper 2220, 86p.

Illinois Environmental Protection Agency (IEPA), 2021. *In the Matter of: Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Title 35 Illinois Administration Code 845, Addendum*. April 15, 2021.

Illinois Environmental Protection Agency (IEPA), 2022. *Drinking Water Watch*. Public Water Supply Systems (IL-American Peoria and Pekin). http://water.epa.state.il.us/dww/index.jsp . Accessed April 6, 2022.

Illinois State Water Survey (ISWS), 2016. *Water Supply Planning: Middle Illinois Progress Report. Illinois State Water Survey, Prairie Research Institute*. Contract Report 2016-02. February 2016.

Illinois State Water Survey (ISWS), 2018. *Water Demand in the Middle Illinois Water Supply Planning Region, 2010-2060*. Illinois State Water Survey, Prairie Research Institute. November 2018.

IngenAE, LLC (IngenAE), 2022. *Final Closure Plan, Edwards Power Plant, Ash Pond (IEPA ID W1438050005-01), Bartonville, Illinois*, June 2022, attached to the Construction Permit Application to which this report is also attached.

McDonald, M.G., and A.W. Harbaugh, 1988. *A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model: Techniques of Water-Resources Investigations, Techniques of Water-Resources of the United States Geological Survey*. Book 6, Chapter A1.

Morris, D.A and A.I. Johnson, 1967. *Summary of hydrologic and physical properties of rock and soil materials as analyzed by the Hydrologic Laboratory of the U.S. Geological Survey*. U.S. Geological Survey Water-Supply Paper 1839-D, 42p.

Natural Resource Technology, Inc. (NRT), 2013. *Phase I Hydrogeological Assessment Report, Coal Combustion Product Impoundment, E.D. Edwards Energy Center, Peoria County, Illinois*. March 19, 2013.

Natural Resource Technology, an OBG Company (NRT/OBG), 2017. *Hydrogeologic Monitoring Plan – Edwards Ash Pond*. October 17, 2017.

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2021a. *Hydrogeologic Site Characterization Report*. Edwards Ash Pond. Edwards Power Plant. Bartonville, Illinois. October 25, 2021.

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2021b. *History of Potential Exceedances*. Edwards Ash Pond. Edwards Power Plant. Bartonville, Illinois. October 17, 2021.

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2021c. *Groundwater Monitoring Plan*. Edwards Ash Pond. Edwards Power Plant. Bartonville, Illinois. October 25, 2021.

Strenge, D. and Peterson, S. 1989. *Chemical Data Bases for the Multimedia Environmental Pollutant Assessment System (MEPAS) (No. PNL-7145)*. Pacific Northwest Lab., Richland, WA (USA).

Tolaymat, T. and Krause, M, 2020. *Hydrologic Evaluation of Landfill Performance: HELP 4.0 User Manual*. United States Environmental Protection Agency, Washington, DC, EPA/600/B 20/219.

Wittman Hydro Planning Associates, Inc. (Wittman), 2008. *Water Demand Scenarios for the East-Central Illinois Planning Region: 2005-2050*. Wittman Hydro Planning Associates, Inc. Bloomington, IN, August 29, 2008.

Zheng, Z., and P.P. Wang, 1998. *MT3DMS, a Modular Three-Dimensional Multispecies Transport Model.* Model documentation and user's guide prepared by the University of Alabama Hydrogeology Group for the United States Army Corps of Engineers (USACE).

TABLES

TABLE 2-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
GROUNDWATER MODELING REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Well Number	HSU	Date Constructed	Top of PVC Elevation (ft)	Measuring Point Elevation (ft)	Measuring Point Description	Ground Elevation (ft)	Screen Top Depth (ft BGS)	Screen Bottom Depth (ft BGS)	Screen Top Elevation (ft)	Screen Bottom Elevation (ft)	Well Depth (ft bgs)	Bottom of Boring Elevation (ft)	Screen Length (ft)	Screen Diameter (inches)	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)
AP05S	UA	11/29/2016	443.53	443.53	Top of PVC	441.13	32.87	37.64	408.26	403.49	38.06	403.10	4.8	2	40.598807	-89.66191
AP05D	BCU	12/05/2016	443.45	443.45	Top of PVC	441.23	47.09	56.69	394.14	384.54	57.17	382.90	9.6	2	40.598796	-89.661901
AP06	UCF	11/30/2016	442.17	442.17	Top of PVC	439.53	19.93	24.72	419.60	414.81	25.00	414.50	4.8	2	40.601038	-89.662759
AP07S	UCF	12/02/2016	461.08	461.08	Top of PVC	458.31	29.95	34.74	428.36	423.57	35.00	423.30	4.8	2	40.59793	-89.666919
AP07D	BCU	12/08/2016	460.89	460.89	Top of PVC	458.42	55.01	64.59	403.41	393.83	65.00	393.40	9.6	2	40.597941	-89.666926
AP08	CCR	12/06/2016	460.60	460.60	Top of PVC	458.10	9.99	19.58	448.11	438.52	19.98	438.10	9.6	2	40.594578	-89.668728
AP09	CCR	12/07/2016	460.22	460.22	Top of PVC	457.24	9.79	19.39	447.45	437.85	19.80	437.40	9.6	2	40.59149	-89.666303
APW-01	UCF	07/27/2010	441.07	441.07	Top of PVC	437.83	7.60	18.00	430.23	419.83	18.00	419.30	10.4	2	40.600127	-89.66512
APW-02	UCF	07/20/2010	464.92	464.92	Top of PVC	461.72	39.60	50.00	422.12	411.72	50.00	411.70	10.4	2	40.594228	-89.665642
APW-03	UCF	07/19/2010	444.37	444.37	Top of PVC	441.22	19.60	30.00	421.62	411.22	30.00	411.20	10.4	2	40.591259	-89.663843
APW-04	UCF	07/27/2010	439.66	439.66	Top of PVC	437.19	9.60	20.00	427.59	417.19	20.00	417.20	10.4	2	40.587909	-89.663726
AW-01	PMP	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
AW-05	UA	07/22/2015	--	443.37	Top of Disk	440.55	15.87	20.47	424.68	420.08	21.10	419.50	4.6	2	40.598645	-89.666407
AW-06	UA	08/03/2015	--	461.57	Top of Disk	459.19	36.60	41.09	422.59	418.10	41.69	416.90	4.5	2	40.594237	-89.670051
AW-08	UA	07/21/2015	--	462.54	Top of Disk	460.66	47.55	57.19	413.11	403.47	57.70	403.00	9.6	2	40.593964	-89.661996
AW-09	UA	08/03/2015	--	461.45	Top of Disk	458.32	47.14	51.62	411.18	406.70	52.23	406.10	4.5	2	40.590422	-89.668777
AW-10	UA	07/23/2015	--	439.93	Top of Disk	437.64	27.62	32.23	410.02	405.41	32.74	404.90	4.6	2	40.590733	-89.663826
AW-11	UA	07/28/2015	--	439.87	Top of Disk	437.16	24.21	28.81	412.95	408.35	29.31	407.20	4.6	2	40.587261	-89.663781
AW-12	UA	01/07/2021	443.80	443.80	Top of PVC	441.16	26.00	31.00	415.16	410.16	31.00	406.20	5	2	40.591071	-89.661333
AW-13	UA	01/09/2021	441.26	441.26	Top of PVC	438.67	25.00	30.00	413.67	408.67	30.00	408.70	5	2	40.588378	-89.663714
AW-14	UA	01/08/2021	439.40	439.40	Top of PVC	436.83	24.00	29.00	412.83	407.83	29.00	401.80	5	2	40.58729	-89.665621
AW-15	UA	01/08/2021	441.51	441.51	Top of PVC	438.95	33.00	38.00	405.95	400.95	38.00	399.00	5	2	40.587964	-89.666822
AW-15C	BCU	01/08/2021	440.02	440.02	Top of PVC	437.62	43.00	48.00	394.62	389.62	48.00	337.60	5	2	40.588	-89.666882

TABLE 2-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
GROUNDWATER MODELING REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Well Number	HSU	Date Constructed	Top of PVC Elevation (ft)	Measuring Point Elevation (ft)	Measuring Point Description	Ground Elevation (ft)	Screen Top Depth (ft BGS)	Screen Bottom Depth (ft BGS)	Screen Top Elevation (ft)	Screen Bottom Elevation (ft)	Well Depth (ft bgs)	Bottom of Boring Elevation (ft)	Screen Length (ft)	Screen Diameter (inches)	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)
AW-15S	UCF	01/08/2021	440.71	440.71	Top of PVC	437.92	8.00	18.00	429.92	419.92	18.00	417.90	10	2	40.587955	-89.666841
AW-16	UA	01/08/2021	461.79	461.79	Top of PVC	459.45	55.00	60.00	404.45	399.45	60.00	396.50	5	2	40.589457	-89.667799
AW-17	UA	01/08/2021	462.10	462.10	Top of PVC	459.69	51.00	56.00	408.69	403.69	56.00	402.70	5	2	40.591698	-89.669404
AW-18	UA	01/09/2021	462.65	462.65	Top of PVC	460.28	46.00	51.00	414.28	409.28	51.00	405.30	5	2	40.593044	-89.669822
AW-19	UA	01/09/2021	460.74	460.74	Top of PVC	458.53	35.00	40.00	423.53	418.53	40.00	415.50	5	2	40.595434	-89.66972
AW-20	UA	01/10/2021	461.48	461.48	Top of PVC	459.08	36.50	41.50	422.58	417.58	41.50	416.10	5	2	40.596469	-89.66891
AW-21	UA	01/10/2021	460.61	460.61	Top of PVC	458.28	32.00	37.00	426.28	421.28	37.00	420.30	5	2	40.597294	-89.667734
AW-22	UA	01/08/2021	463.19	463.19	Top of PVC	460.30	44.00	49.00	416.30	411.30	49.00	410.30	5	2	40.596836	-89.666783
P002	UCF	--	460.39	460.39	Top of PVC	458.70	30.60	35.60	--	--	35.90	--	5	2	40.596235	-89.669084
XPW01A	CCR	01/09/2021	464.16	464.16	Top of PVC	460.99	33.00	43.00	427.99	417.99	43.00	418.00	10	2	40.596306	-89.667345
XPW02	CCR	01/09/2021	473.79	473.79	Top of PVC	471.16	36.00	46.00	435.16	425.16	46.00	424.20	10	2	40.594351	-89.668312
XPW03	CCR	01/10/2021	466.04	466.04	Top of PVC	462.62	27.00	37.00	435.62	425.62	37.00	422.60	10	2	40.591416	-89.666188
SG-01	SW	--	--	--	--	--	--	--	--	--	--	--	--	--	40.596075	-89.661625

Notes:
All elevation data are presented relative to the North American Vertical Datum 1988 (NAVD88), GEOID 12A
-- = data not available
BCU = bedrock confining unit
bgs = below ground surface
CCR = coal combustion residuals
ft = foot or feet
HSU = Hydrostratigraphic Unit
PMP = potential migration pathway
PVC = polyvinyl chloride
SW = surface water
UA = uppermost aquifer
UCF = Upper Cahokia Formation

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TABLE 2-2. FLOW AND TRANSPORT MODEL CALIBRATION TARGETS
GROUNDWATER MODELING REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, IL

Well ID	Monitored Hydrogeologic Unit	Modeled Well Location (Layer Number)	Modeled Target Location (Layer Number)	Flow Model Target Groundwater Elevation Mean Value November 2015 to August 2021 (feet NAVD88)	Transport Model Target Boron Concentrations November 2015 to August 2021 (mg/L)		
					Minimum	Mean	Maximum
G01D	UA	4	4	438.14	0.2	0.3	0.4
G02D	BCU	5	5	439.88 [1]	1.0	1.3	1.7
G03	UCF	3	3	437.72	No Target		
G04	UCF	2	2	436.45	5.8	7.9	12.0
G05	BCU	5	5	437.92 [1]	1.2	1.4	1.8
G06	CCR	1	1	452.28	3.0	7.5	12.0
G07	CCR	1	1	451.93	3.1	4.2	5.3
APW-01	UCF	3	3	435.62	0.7	0.7	0.8
APW-02	UCF	3	1	454.95 [2]	0.0	0.1	0.1
APW-03	UCF	3	3	436.52 [2]	0.1	0.1	0.2
APW-04	UCF	2	2	432.65	0.5	0.6	0.7
AW-05	UA	4	4	434.93	1.4	2.9	7.6
AW-06	UA	5	5	434.49	0.1	0.2	0.3
AW-08	UA	4	4	440.60 [2]	0.1	0.1	0.2
AW-09	UA	4	4	435.68	0.2	0.5	1.3
AW-10	UA	4	4	438.89	0.4	0.5	0.6
AW-11	UA	4	4	433.79	0.2	0.2	0.3
AW-12	UA	4	4	436.56	0.2	0.2	0.3
AW-13	UA	4	4	435.69	0.3	0.3	0.3
AW-14	UA	4	4	432.85 [3]	0.2	0.2	0.2
AW-15	UA	4	4	433.66	0.3	0.4	0.6
AW-15C	BCU	5	5	433.38	0.6	0.7	0.8
AW-15S	UCF	2	2	430.93	5.4	5.7	6.2
AW-16	UA	4	4	437.68	0.5	0.5	0.6
AW-17	UA	4	4	437.31	0.4	0.4	0.5
AW-18	UA	4	5	435.15	0.4	1.5	3.0
AW-19	UA	4	3	447.39	2.5	2.7	2.9
AW-20	UA	4	3	445.03	2.1	2.2	2.3
AW-21	UA	4	3	443.70	11.0	11.5	12.0
AW-22	UA	3	1	451.58	0.2	0.3	0.4

TABLE 2-2. FLOW AND TRANSPORT MODEL CALIBRATION TARGETS

GROUNDWATER MODELING REPORT

EDWARDS POWER PLANT

ASH POND

BARTONVILLE, IL

Well ID	Monitored Hydrogeologic Unit	Modeled Well Location (Layer Number)	Modeled Target Location (Layer Number)	Flow Model Target Groundwater Elevation Mean Value November 2015 to August 2021 (feet NAVD88)	Transport Model Target Boron Concentrations November 2015 to August 2021 (mg/L)		
					Minimum	Mean	Maximum
P002	UCF	3	2	448.39	1.1	1.2	1.4
XPW01A	CCR	2	2	452.57	15	16.7	19
XPW02	CCR	2	2	453.29	13	14.5	16
XPW03	CCR	2	2	450.75	4.9	5.5	7

[O: EGP4/5/22, C: JJW 4/5/22; JRK 4/11/22]

Notes:

[1] Target groundwater elevations presented are from data collected between February 2020 and February 2021. Groundwater elevations collected prior to and after these dates were recovering between sampling events and do not represent static groundwater conditions in each well.

[2] Target groundwater elevations exclude February 11th, 2021 event due to groundwater elevations recovering between sampling events.

[3] Target groundwater elevations exclude June 15th, 2021 event due to gauging error.

ID = identification

mg/L = milligrams per liter

NAVD88 = North American Vertical Datum of 1988

Hydrogeologic Unit:

BCU = bedrock confining unit

CCR = coal combustion residuals

PMP = primary migration pathway

UA = uppermost aquifer

UCF = upper cahokia formation

TABLE 5-1. FLOW MODEL INPUT AND SENSITIVITY ANALYSIS RESULTS
GROUNDWATER MODELING REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Zone	Hydrostratigraphic Unit	Materials	ft/d	cm/s	Kh/Kv	Value Source	Sensitivity[1]
Horizontal Hydraulic Conductivity			**Calibration Model**			**Calibration Model**	
1	Upper Clay (UCF)	clay and silt	0.002	7.06E-07	NA	Calibrated	low
2	Transmissive Zone (UCF [PMP])	clay and silt at elevations similar to base of ash, thin discontinuous sand lenses	2	7.06E-04	NA	Calibrated - Within Range of Field Test Results (Ramboll, 2021a)	high
3	Lower Clay (UCF)	clay and silt	0.011	3.88E-06	NA	Calibrated	moderate
4	Weathered Shale (UA)	weathered shale, sand, silty sand, clayey gravel, bedrock contact with overlying materials	3	1.06E-03	NA	Calibrated - Within Range of Field Test Results (Ramboll, 2021a)	high
5	Competent Shale (BCU)	shale	0.01	3.53E-06	NA	Geomean of Field Test Results (Ramboll, 2021a)	moderate
6	Fill Unit (CCR)	CCR	0.1	3.53E-05	NA	Calibrated	high
7	UCF above River Boundary Conditions	NA	200	7.06E-02	NA	Calibrated - Conductivity Value to Allow Groundwater Flow from UCF to River Boundary Conditions	moderate
9	Sankoty Aquifer - Sands	sand	42	1.48E-02	NA	Calibrated	high
Vertical Hydraulic Conductivity			**Calibration Model**			**Calibration Model**	
1	Upper Clay (UCF)	clay and silt	0.0002	7.06E-08	10	Geomean of Laboratory Test Results (Ramboll, 2021a)	high
2	Transmissive Zone (UCF [PMP])	clay and silt at elevations similar to base of ash, thin discontinuous sand lenses	0.2	7.06E-05	10	Calibrated	low
3	Lower Clay (UCF)	clay and silt	0.00011	3.88E-08	100	Geomean of Laboratory Test Results (Ramboll, 2021a; Haley & Aldrich, Inc., 2018)	high
4	Weathered Shale (UA)	weathered shale, sand, silty sand, clayey gravel, bedrock contact with overlying materials	0.3	1.06E-04	10	Calibrated	negligible
5	Competent Shale (BCU)	shale	0.0001	3.53E-08	100	Calibrated	moderate
6	Fill Unit (CCR)	CCR	0.006	2.12E-06	17	Calibrated - Within Range Laboratory Test Results (Ramboll, 2021a)	moderate
7	UCF above River Boundary Conditions	NA	200	7.06E-02	1	Calibrated - Conductivity Value to Allow Groundwater Flow from UCF to River Boundary Conditions	negligible
9	Sankoty Aquifer - Sands	sand	42	1.48E-02	1	Calibrated	negligible
Zone	**Hydrostratigraphic Unit**	**Materials**	**ft/d**	**in/yr**	**Kh/Kv**	**Value Source**	**Sensitivity[1]**
Recharge			**Calibration Model**			**Calibration Model**	
1	Upper Clay (UCF)	clay and silt	1.00E-05	0.044	NA	Calibrated	high
2	Fill Unit - CCR (Central, Fly Ash Pond)	CCR	2.20E-04	0.96	NA	Calibrated	high
3	Fill Unit - CCR (South of Railroad, Inactive Area)	CCR	1.00E-05	0.044	NA	Calibrated	negligible
4	Fill Unit - CCR (Northwest, Process Water Pond)	CCR	1.50E-04	0.66	NA	Calibrated	moderately high
5	Fill Unit - CCR (South, Clarification Pond)	CCR	5.00E-05	0.22	NA	Calibrated	moderate
7	Fill Unit - CCR (Northeast, Sluice Area)	CCR	9.00E-04	3.94	NA	Calibrated	high
Storage							
1	Upper Clay (UCF)	clay and silt	*Not used in steady-state calibration model*				
2	Transmissive Zone (UCF [PMP])	clay and silt at elevations similar to base of ash, thin discontinuous sand lenses					
3	Lower Clay (UCF)	clay and silt					
4	Weathered Shale (UA)	weathered shale, sand, silty sand, clayey gravel, bedrock contact with overlying materials					
5	Competent Shale (BCU)	shale					
6	Fill Unit (CCR)	CCR					
7	Sankoty Aquifer - Sands	sand					
8	UCF above River Boundary Conditions	NA					

TABLE 5-1. FLOW MODEL INPUT AND SENSITIVITY ANALYSIS RESULTS
GROUNDWATER MODELING REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

River Parameters

	Relative Location	River Width (feet)	Average Length of River (feet)	Bed Thickness (feet)	Hydraulic Conductivity (ft/d)	Stage (feet)	Average River Conductance (ft^2/d)
Reach 1	Illinois River	750	24.5	1	1	438.44 - 438.24	1.84E+04
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	moderate	negligible
Reach 2	Drainage Ditch West of Ash Pond	20	25	1	0.00001	432	5.00E-03
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	low	moderate
Reach 3	Drainage Swale North of Ash Pond	25	25	1	0.00001	430.07	6.25E-03
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	negligible	low
Reach 4	Drainage Pond Northeast of Ash Pond	25	25	1	0.00001	433.24	6.25E-03
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	low	low
Value Source	NA	Calibrated	Calibrated	Calibrated	Calibrated	Calibrated - Mean Illinois River Stage at Edwards Power Plant Interpolated from Stage Data Provided at Peoria, Illinois (USCE 404208089335201), Edwards Power Plant (Plant Gaging Station), and Kingston, Illinois (USGS 05568500) Gaging Stations; Drainage Feature Stage (Reach 2 - 4) Based on Survey Data Collected by IngenAE in February 2022	Calibrated

General Head Parameters

	Relative Location	Width of General Head Boundary Cell (feet)	Distance to General Head Boundary Head (feet)	Average Saturated Thickness of Cell (feet)	Hydraulic Conductivity (ft/d)	Head (feet)	Average General Head Boundary Conductance (ft^2/d)
Reach 1	North Edge of Model (Peoria Pumping Center) and Southeast Edge of Model (Pekin Pumping Center)	150 (North Edge of Model); 750 (Southeast Edge of Model)	1	100 (North Edge of Model); 39 (Southeast Edge of Model)	100	426	1.50E+06 (North Edge of Model); 2.92E+06 (Southeast Edge of Model)
Sensitivity[1]	NA	- - -	- - -	- - -	- - -	high	negligible
Value Source	NA	Calibrated	Calibrated	Calibrated	Calibrated	Calibrated - Location of General Head Boundaries Based on Data Availabile in Burch and Kelly (1993)	Calibrated

[O: JJW 4/14/22; C: JRK 4/14/22]

Notes:

[1] Sensitivity Explanation:
Negligible - SSR changed by less than 1%
Low - SSR change between 1% and 10%
Moderate - SSR change between 10% and 50%
Moderately High - SSR change between 50% and 100%
High - SSR change greater than 100%
SSR = sum of squared residuals
- - - = not tested
CCR = coal combustion residuals
cm/s = centimeters per second
ft/d = feet per day
ft^2/day = feet squared per day
in/yr = inches per year
Kh/Kv = anisotropy ratio
NA = not applicable

Hydrogeologic Unit:
BCU = bedrock confining unit
CCR = coal combustion residuals
PMP = primary migration pathway
UA = uppermost aquifer
UCF = upper cahokia formation

References:

Burch, S. L. and D. J. Kelly., 1993. Peoria-Pekin Regional Ground-Water Quality Assessment. Illinois State Water Survey (ISWS), Champaign, Research Report 124.
Haley & Aldrich, Inc., 2018. Technical Memorandum: Ash Pond – Underlying Clay and Depth of CCR Evaluation, Edwards Station, Bartonville, Illinois, February 12, 2018.
Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2021a. Hydrogeologic Site Characterization Report. Edwards Ash Pond. Edwards Power Plant. Bartonville, Illinois.

TABLE 5-2. TRANSPORT MODEL INPUT VALUES (CALIBRATION)
GROUNDWATER MODELING REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Zone	Hydrostratigraphic Unit	Materials	Calibration Model						
			Stress Period 1 Dates: 1960-2004 Recharge (ft/d)	Stress Period 2 Dates: 2005-2022 Recharge (ft/d)	Boron Concentration (mg/L)			Value Source	Sensitivity
Initial Concentration									
Entire Domain	NA	NA	NA	NA	0			NA	- - -
Source Concentration (recharge)									
2	Fill Unit - CCR (Central, Fly Ash Pond)	CCR	2.20E-04	2.20E-04	3			calibrated	- - -
3	Fill Unit - CCR (South of Railroad, Inactive Area)	CCR	5.00E-05	1.00E-05	3			calibrated	- - -
4	Fill Unit - CCR (Northwest, Process Water Pond)	CCR	1.50E-04	1.50E-04	13			calibrated	- - -
5	Fill Unit - CCR (South, Clarification Pond)	CCR	5.00E-05	5.00E-05	3			calibrated	- - -
7	Fill Unit - CCR (Northeast, Sluice Area)	CCR	9.00E-04	9.00E-04	0.5			calibrated	- - -
Source Concentration (constant concentration cells)									
Reach 2	Fill Unit - CCR (Central, Fly Ash Pond)	CCR	NA	NA	3			calibrated	- - -
Reach 3	Fill Unit - CCR (South of Railroad, Inactive Area)	CCR	NA	NA	3			calibrated	- - -
Reach 4	Fill Unit - CCR (Northwest, Process Water Pond)	CCR	NA	NA	13			calibrated	- - -
Reach 5	Fill Unit - CCR (South, Clarification Pond)	CCR	NA	NA	3			calibrated	- - -
Reach 7	Fill Unit - CCR (Northeast, Sluice Area)	CCR	NA	NA	0.5			calibrated	- - -
Storage, Specific Yield and Effective Porosity									
Zone	**Hydrostratigraphic Unit**	**Materials**	NA	NA	**Storage**	**Specific Yield**	**Effective Porosity**	**Value Source**	**Sensitivity**
1	Upper Clay (UCF)	clay and silt	NA	NA	0.003	0.135	0.135	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Effective Porosity Esitmated from Literature (Morris and Johnson, 1967; Heath, 1983)	see Table 5-3
2	Transmissive Zone (UCF [PMP])	clay and silt at elevations similar to base of ash, thin discontinuous sand lenses	NA	NA	0.003	0.183	0.183	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Effective Porosity Esitmated from Literature (Morris and Johnson, 1967; Heath, 1983)	see Table 5-3
3	Lower Clay (UCF)	clay and silt	NA	NA	0.003	0.07	0.07	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Effective Porosity Esitmated from Literature (Morris and Johnson, 1967; Heath, 1983)	see Table 5-3
4	Weathered Shale (UA)	weathered shale, sand, silty sand, clayey gravel, bedrock contact with overlying materials	NA	NA	0.003	0.204	0.204	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Effective Porosity Esitmated from Literature (Morris and Johnson, 1967; Heath, 1983)	see Table 5-3
5	Competent Shale (BCU)	shale	NA	NA	0.003	0.1	0.1	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Effective Porosity Esitmated from Literature (Morris and Johnson, 1967; Heath, 1983)	see Table 5-3
6	Fill Unit (CCR)	CCR	NA	NA	0.003	0.2	0.2	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Effective Porosity Esitmated from Literature (Morris and Johnson, 1967; Heath, 1983)	see Table 5-3
7	Sankoty Aquifer - Sands	sand	NA	NA	0.003	0.274	0.274	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Effective Porosity Esitmated from Literature (Morris and Johnson, 1967; Heath, 1983)	see Table 5-3
8	UCF above River Boundary Conditions	NA	NA	NA	0.003	0.5	0.5	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Effective Porosity Esitmated from Literature (Morris and Johnson, 1967; Heath, 1983)	see Table 5-3
Dispersivity									
Applicable Region	**Hydrostratigraphic Unit**	**Materials**	NA	NA	**Longitudinal (feet)**	**Transverse (feet)**	**Vertical (feet)**	**Value Source**	**Sensitivity**
Entire Domain	NA	NA	NA	NA	3	0.3	0.03	calibrated	- - -

[O: JJW 4/11/22; EGP 4/11/22]

Notes:
[1] The concentrations from the end of the calibrated transport model were imported as initial concentrations for the prediction model runs.
- - - = not tested
ft/d = feet per day
mg/L = milligrams per liter
NA = not applicable

References:

Fetter, C.W., 1988, Applied Hydrogeology, Merrill Publishing Company, Columbis, Ohio.
Morris, D.A and A.I. Johnson, 1967. Summary of hydrologic and physical properties of rock and soil materials as analyzed by the Hydrologic Laboratory of the U.S. Geological Survey. U.S. Geological Survey Water-Supply Paper 1839-D, 42p.
Heath, R.C., 1983. Basic ground-water hydrology, U.S. Geological Survey Water-Supply Paper 2220, 86p.

Hydrogeologic Unit:
BCU = bedrock confining unit
CCR = coal combustion residuals
PMP = primary migration pathway
UA = uppermost aquifer
UCF = upper cahokia formation

TABLE 5-3. TRANSPORT MODEL INPUT VALUES (SENSITIVITY)
GROUNDWATER MODELING REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Well ID	Calibration Concentration (mg/L)	Storage and Specific Yield				Effective Porosity			
		File Name		File Name		File Name		File Name	
		EDW_Conc_339_s_sy_low.gwv		EDW_Conc_339_s_sy_high.gwv		EDW_Conc_339_Por_low.gwv		EDW_Conc_339_Por_high.gwv	
		Concentration (mg/L)	Sensitivity [1]	Concentration (mg/L)	Sensitivity [1]	Concentration (mg/L)	Sensitivity [1]	Concentration (mg/L)	Sensitivity [1]
AP05S	0.0	0.0	moderate	0.0	moderate	0.0	high	0.0	moderately high
AP05D	0.0	0.0	moderately high	0.0	moderately high	0.0	high	0.0	moderately high
AP07S	11.6	11.5	negligible	11.5	negligible	11.8	low	11.3	low
AP07D	0.0	0.0	low	0.0	low	0.1	high	0.0	moderately high
AP08	3.0	3.0	negligible	3.0	negligible	3.0	negligible	3.0	negligible
AP09	3.0	3.0	negligible	3.0	negligible	3.0	negligible	3.0	negligible
APW-01	0.0	0.0	moderate	0.0	moderate	0.4	high	0.0	moderately high
APW-02	0.8	0.8	low	0.8	low	1.4	moderately high	0.5	moderate
APW-03	1.3	1.3	low	1.3	low	2.1	moderately high	0.9	moderate
APW-04	0.1	0.1	low	0.1	moderate	0.3	high	0.0	moderately high
AW-05	2.3	2.4	low	2.3	low	7.5	high	0.6	moderately high
AW-06	0.0	0.0	low	0.0	low	0.0	high	0.0	moderately high
AW-08	0.0	0.0	low	0.0	low	0.0	high	0.0	moderately high
AW-09	1.3	1.3	negligible	1.3	negligible	2.3	moderately high	0.7	moderate
AW-10	1.1	1.1	negligible	1.1	negligible	1.9	moderately high	0.7	moderate
AW-11	1.6	1.6	negligible	1.6	negligible	2.0	moderate	1.3	moderate
AW-12	0.0	0.0	moderate	0.0	moderate	0.1	high	0.0	moderately high
AW-13	1.6	1.6	low	1.6	low	2.1	moderate	1.3	moderate
AW-14	1.9	1.9	negligible	1.9	low	2.3	moderate	1.7	moderate
AW-15	1.5	1.5	low	1.6	low	2.1	moderate	1.2	moderate
AW-15C	0.0	0.0	negligible	0.0	low	0.0	high	0.0	moderately high
AW-15S	2.4	2.4	negligible	2.5	negligible	2.6	low	2.2	low
AW-16	1.2	1.2	negligible	1.2	negligible	2.0	moderately high	0.7	moderate
AW-17	2.2	2.2	negligible	2.2	negligible	2.9	moderate	1.6	moderate
AW-18	2.8	2.8	negligible	2.8	negligible	3.3	moderate	2.3	moderate
AW-19	7.3	7.3	negligible	7.3	negligible	9.5	moderate	5.4	moderate
AW-20	5.3	5.5	low	5.5	low	9.4	moderately high	3.2	moderate
AW-21	11.4	11.4	negligible	11.4	negligible	12.4	low	10.2	moderate
AW-22	3.3	3.3	negligible	3.3	negligible	3.6	moderate	2.5	moderate
P002	11.4	11.4	negligible	11.4	negligible	12.3	low	10.4	low
XPW01A	13.0	13.0	negligible	13.0	negligible	13.0	negligible	13.0	negligible
XPW02	3.0	3.0	negligible	3.0	negligible	3.0	negligible	3.0	negligible
XPW03	3.0	3.0	negligible	3.0	negligible	3.0	negligible	3.0	negligible
		S*0.1 Sy*0.5		S*10 Sy*2^2		Porosity-0.05		Porosity+0.05	

[O: JJW 4/14/22; C: JRK 4/14/22]

TABLE 5-3. TRANSPORT MODEL INPUT VALUES (SENSITIVITY)

GROUNDWATER MODELING REPORT

EDWARDS POWER PLANT

ASH POND

BARTONVILLE, ILLINOIS

Notes:

[1] Sensitivity Explanation:
Negligible = concentration changed by less than 1%
Low = concentration change between 1% and 10%
Moderate = concentration change between 10% and 50%
Moderately High = concentration change between 50% and 100%
High = concentration change greater than 100%

[2] High specific yield sensitivity not analyzed for zone 8 (UCF above River Boundary Conditions) since the calibration value was already near upper limits of acceptable values for specific yield

ID = identification

mg/L = milligrams per liter

S = storativity

Sy = specific yield

TABLE 6-1. HELP MODEL INPUT AND OUTPUT VALUES
GROUNDWATER MODELING REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Closure Scenario - Area Description	CBR - Removal Area	CIP - Removal Area	CIP - Consolidation and Cover System Area	Notes
Input Parameter				
Climate-General				
City	Bartonville, IL	Bartonville, IL	Bartonville, IL	Nearby city to the Site within HELP database
Latitude	40.60	40.60	40.60	Site latitude
Evaporative Zone Depth	18	18	18	Estimated based on geographic location (Illinois) and uppermost soil type (Tolaymat, T. and Krause, M, 2020)
Maximum Leaf Area Index	4.5	4.5	4.5	Maximum for geographic location (Illinois) (Tolaymat, T. and Krause, M, 2020)
Growing Season Period, Average Wind Speed, and Quarterly Relative Humidity	Peoria, IL	Peoria, IL	Peoria, IL	Nearby city to the Edwards Ash Pond within HELP database
Number of Years for Synthetic Data Generation	30	30	30	
Temperature, Evapotranspiration, and Precipitation	Precipitation, temperature, and solar radiation was simulated based on HELP V4 weather simulation for: Lat/Long: 40.60/-89.66	Precipitation, temperature, and solar radiation was simulated based on HELP V4 weather simulation for: Lat/Long: 40.60/-89.66	Precipitation, temperature, and solar radiation was simulated based on HELP V4 weather simulation for: Lat/Long: 40.60/-89.66	
Soils-General				
% where runoff possible	100	100	100	
Area (acres)	91	22	69	CBR - Removal Area based on HCR (Ramboll, 2021a); CIP - Consolidation and Cover System Area based on construction drawing for Edwards Ash Pond; CIP -Removal Area equals the difference
Specify Initial Moisture Content	No	No	No	
Surface Water/Snow	Model Calculated	Model Calculated	Model Calculated	
Soils-Layers				
1	Unsaturated Backfill Material (HELP Final Cover Soil [topmost layer])	Unsaturated Backfill Material (HELP Final Cover Soil [topmost layer])	Vegetative Soil Layer (HELP Final Cover Soil [topmost layer])	Layers details for CBR and CIP areas based on grading plans, construction drawings, and cover system design for Edwards Ash Pond
2	--	--	Protective Soil Layer (HELP Vertical Percolation Layer)	
3	--	--	Geocomposite Drainage Layer (HELP Geosynthetic Drainage Net)	
4	--	--	Geomembrane Liner	
5	--	--	Unsaturated CCR Material (HELP Waste)	
Soil Parameters--Layer 1, Unsaturated Backfill Material (HELP Final Cover Soil [topmost layer]) or Vegetative Soil Layer (HELP Final Cover Soil [topmost layer])				
Type	1	1	1	Vertical Percolation Layer (Cover Soil)
Thickness (in)	12	72	6	For CBR and CIP removal areas, layer 1 thickness is the average thickness of unsaturated backfill material placed after removal
Texture	12	12	23	defaults used
Description	Silty Clay Loam	Silty Clay Loam	Silty Loam (Moderate)	
Saturated Hydraulic Conductivity (cm/s)	4.20E-05	4.20E-05	9.00E-06	defaults used
Soil Parameters--Layer 2, Protective Soil Layer (HELP Vertical Percolation Layer)				
Type	--	--	1	Vertical Percolation Layer
Thickness (in)	--	--	18	design thickness
Texture	--	--	10	defaults used
Description	--	--	Sandy Clay Loam	
Saturated Hydraulic Conductivity (cm/s)	--	--	1.20E -4	defaults used

TABLE 6-1. HELP MODEL INPUT AND OUTPUT VALUES
GROUNDWATER MODELING REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Closure Scenario - Area Description	CBR - Removal Area	CIP - Removal Area	CIP - Consolidation and Cover System Area	Notes
Soil Parameters--Layer 3, Geocomposite Drainage Layer(HELP Geosynthetic Drainage Net)				
Type	--	--	2	Lateral Drainage Layer
Thickness (in)	--	--	0.2	design thickness
Texture	--	--	20	defaults used
Description	--	--	Geosynthetic Drainage Net	
Saturated Hydraulic Conductivity (cm/s)	--	--	1.00E+01	defaults used
Soil Parameters--Layer 4, Geomembrane Liner				
Type	--	--	4	Flexible Membrane Liner
Thickness (in)	--	--	0.04	design thickness
Texture	--	--	36	defaults used
Description	--	--	Geomembrane	
Saturated Hydraulic Conductivity (cm/s)			4.00E -13	defaults used
Soil Parameters--Layer 5, Unsaturated CCR Material (HELP Waste)				
Type	--	--	1	Vertical Percolation Layer (Waste)
Thickness (in)	--	--	408	Estimated unsaturated CCR thickness within CIP Consolidation and Cover System Area
Texture	--	--	30	Custom layer, adjusted for site specific hydraulic conductivity
Description	--	--	High-Density Electric Plant Coal Fly Ash	
Saturated Hydraulic Conductivity (cm/s)	--	--	2.08E-06	calibrated flow model vertical hydraulic conductivity for CCR
Soils--Runoff				
Runoff Curve Number	86.1	86.1	89.3	HELP-computed curve number
Slope	0.25%	0.25%	1.27%	Estimated average from construction design drawings for Edwards Ash Pond
Length (ft)	1300	1300	1190	estimated maximum flow path
Texture	12	12	23	uppermost layer texture
Vegetation	fair	fair	fair	fair indicating fair stand of grass on surface of soil backfill
Execution Parameters				
Years	30	30	30	
Report Daily	No	No	No	
Report Monthly	No	No	No	
Report Annual	Yes	Yes	Yes	
Output Parameter				
Percolation Rate (in/yr)	**5.09**	**4.03**	**0.0002**	

O: EGP 4/5/2022 C: JJW 4/5/2022

Notes:
% = percent
cm/s = centimeters per second
ft = feet
HELP = Hydrologic Evaluation of Landfill Performance
IL = Illinois
in = inches
in/yr = inches per year
Lat = latitude
Long = longitude
CBR = Closure By Removal
CIP = Closure In Place
HCR = Hydrogeologic Characterization Report

References:
Tolaymat, T. and Krause, M, 2020. *Hydrologic Evaluation of Landfill Performance: HELP 4.0 User Manual*. United States Environmental Protection Agency, Washington, DC, EPA/600/B 20/219.
Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2021a. Hydrogeologic Site Characterization Report. Edwards Ash Pond. Edwards Power Plant. Bartonville, Illinois.

TABLE 6-2. PREDICTION MODEL INPUT VALUES
GROUNDWATER MODELING REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Scenario 1: CIP (CCR removal from the northwest areas of the Ash Pond, consolidation to the northeast, central and southern areas of the Ash Pond, and construction of a cover system over the remaining CCR)

Prediction Model	Construction Period (years)	Hydrostratigraphic Unit	Recharge Zone	Boron Recharge Concentration (mg/L)	Recharge (ft/day)	Recharge (in/yr)	Constant Head (feet)	Constant Concentration (mg/L)
Dewatering	1	Fill Unit - CCR Consolidation and Cover System (Central, Fly Ash Pond)	2	3	4.44E-08	0.0002	434	3
Dewatering	1	Fill Unit - CCR Consolidation and Cover System (South of Railroad, Inactive Area)	3	3	4.44E-08	0.0002	434	3
Dewatering	1	Fill Unit - CCR Consolidation and Cover System (Northwest, Process Water Pond)	4	13	4.44E-08	0.0002	434	13
Dewatering	1	Fill Unit - CCR Consolidation and Cover System (South, Clarification Pond)	5	3	4.44E-08	0.0002	434	3
Dewatering	1	Fill Unit - CCR Consolidation and Cover System (Northeast, Sluice Area)	7	0.5	4.44E-08	0.0002	434	0.5
Dewatering	1	Fill Unit - CCR Removal (Northwest, Process Water Pond and Fly Ash Pond)	10	0	9.19E-04	4.03	434	0
CIP	1000	Fill Unit - CCR Consolidation and Cover System (Central, Fly Ash Pond)	2	3	4.44E-08	0.0002	--	3
CIP	1000	Fill Unit - CCR Consolidation and Cover System (South of Railroad, Inactive Area)	3	3	4.44E-08	0.0002	--	3
CIP	1000	Fill Unit - CCR Consolidation and Cover System (Northwest, Process Water Pond)	4	13	4.44E-08	0.0002	--	13
CIP	1000	Fill Unit - CCR Consolidation and Cover System (South, Clarification Pond)	5	3	4.44E-08	0.0002	--	3
CIP	1000	Fill Unit - CCR Consolidation and Cover System (Northeast, Sluice Area)	7	0.5	4.44E-08	0.0002	--	0.5
CIP	1000	Fill Unit - CCR Removal (Northwest, Process Water Pond and Fly Ash Pond)	10	0	9.19E-04	4.03	--	--

Prediction Model	Construction Period (years)	Hydrostratigraphic Unit	Hydraulic Conductivity Zone	Horizontal Hydraulic Conductivity (ft/d)	Horizontal Hydraulic Conductivity (cm/s)	Vertical Hydraulic Conductivity (ft/d)		Vertical Hydraulic Conductivity (cm/s)
Dewatering	1	Fill Unit (CCR)	6	0.1	3.53E-05	0.006		2.12E-06
Dewatering	1	Fill Unit (Soil Backfill)	10	1.19	4.20E-04	0.119		4.20E-05
CIP	1000	Fill Unit (CCR)	6	0.1	3.53E-05	0.006		2.12E-06
CIP	1000	Fill Unit (Soil Backfill)	10	1.19	4.20E-04	0.119		4.20E-05

Prediction Model	Construction Period (years)	Hydrostratigraphic Unit	Storage, Specific Yield and Effective Porosity Zone	Storage	Specific Yield		Effective Porosity
Dewatering	1	Fill Unit (CCR)	6	0.003	0.2		0.2
Dewatering	1	Fill Unit (Soil Backfill)	10	0.003	0.16		0.16
CIP	1000	Fill Unit (CCR)	6	0.003	0.2		0.2
CIP	1000	Fill Unit (Soil Backfill)	10	0.003	0.16		0.16

Prediction Model	Construction Period (years)	Drain Width (feet)	Length of Drain Cell (feet)	Drain Bed Thickness (feet)	Hydraulic Conductivity (ft/d)	Stage of Drain (feet)		Drain Conductance (ft^2/d)
Dewatering	1	Fill Unit (Soil Backfill)	--	--	--	--		--
CIP	1000	Fill Unit (Soil Backfill)	25	1	50	433		3.13E+04

TABLE 6-2. PREDICTION MODEL INPUT VALUES
GROUNDWATER MODELING REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Scenario 2: CBR (CCR removal from the Ash Pond)

Prediction Model	Construction Period (years)	Hydrostratigraphic Unit	Recharge Zone	Boron Recharge Concentration (mg/L)	Recharge (ft/day)	Recharge (in/yr)	Constant Head (feet)	Constant Concentration (mg/L)
Dewatering	1	Fill Unit - CCR Removal (Central, Fly Ash Pond)	2	0	1.16E-03	5.08	434	0
Dewatering	1	Fill Unit - CCR Removal (South of Railroad, Inactive Area)	3	0	1.16E-03	5.08	434	0
Dewatering	1	Fill Unit - CCR Removal (Northwest, Process Water Pond)	4	0	1.16E-03	5.08	434	0
Dewatering	1	Fill Unit - CCR Removal (South, Clarification Pond)	5	0	1.16E-03	5.08	434	0
Dewatering	1	Fill Unit - CCR Removal (Northeast, Sluice Area)	7	0	1.16E-03	5.08	434	0
CBR	1000	Fill Unit - CCR Removal (Central, Fly Ash Pond)	2	0	1.16E-03	5.08	--	--
CBR	1000	Fill Unit - CCR Removal (South of Railroad, Inactive Area)	3	0	1.16E-03	5.08	--	--
CBR	1000	Fill Unit - CCR Removal (Northwest, Process Water Pond)	4	0	1.16E-03	5.08	--	--
CBR	1000	Fill Unit - CCR Removal (South, Clarification Pond)	5	0	1.16E-03	5.08	--	--
CBR	1000	Fill Unit - CCR Removal (Northeast, Sluice Area)	7	0	1.16E-03	5.08	--	--

Prediction Model	Construction Period (years)	Hydrostratigraphic Unit	Hydraulic Conductivity Zone	Horizontal Hydraulic Conductivity (ft/d)	Horizontal Hydraulic Conductivity (cm/s)	Vertical Hydraulic Conductivity (ft/d)		Vertical Hydraulic Conductivity (cm/s)
Dewatering	1	Fill Unit (CCR)	--	--	--	--		--
Dewatering	1	Fill Unit (Soil Backfill)	6	1.19	4.20E-04	0.119		4.20E-05
CBR	1000	Fill Unit (CCR)	--	--	--	--		--
CBR	1000	Fill Unit (Soil Backfill)	6	1.19	4.20E-04	0.119		4.20E-05

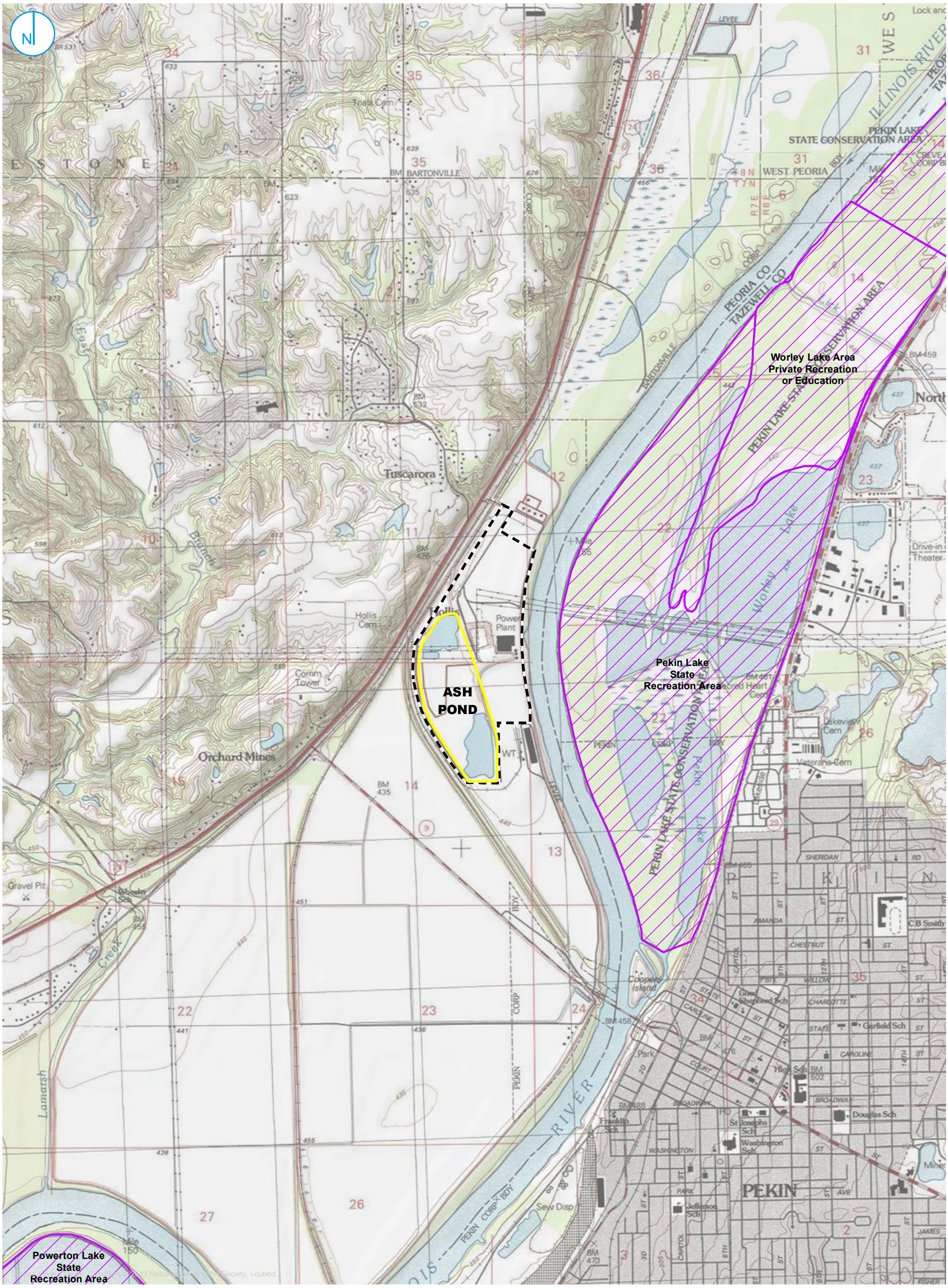
Prediction Model	Construction Period (years)	Hydrostratigraphic Unit	Storage, Specific Yield and Effective Porosity Zone	Storage	Specific Yield		Effective Porosity
Dewatering	1	Fill Unit (CCR)	--	--	--		--
Dewatering	1	Fill Unit (Soil Backfill)	6	0.003	0.16		0.16
CBR	1000	Fill Unit (CCR)	--	--	--		--
CBR	1000	Fill Unit (Soil Backfill)	6	0.003	0.16		0.16

Prediction Model	Construction Period (years)	Drain Width (feet)	Length of Drain Cell (feet)	Drain Bed Thickness (feet)	Hydraulic Conductivity (ft/d)	Stage of Drain (feet)		Drain Conductance (ft^2/d)
Dewatering	1	Fill Unit (Soil Backfill)	--	--	--	--		--
CBR	1000	Fill Unit (Soil Backfill)	25	1	50	433		3.13E+04

[O: JJW 4/11/22; C: EGP 4/12/22]

Notes:
-- = boundary condition or property zone not included in prediction model
CBR = Closure By Removal
CCR = coal combustion residuals
CIP = Closure In Place
ft^2/day = feet squared per day
ft/day = feet per day
in/yr = inches per year
mg/L = milligrams per liter
cm/s = centimeters per second

FIGURES



PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY
PROTECTED AREA

0 1,000 2,000 Feet

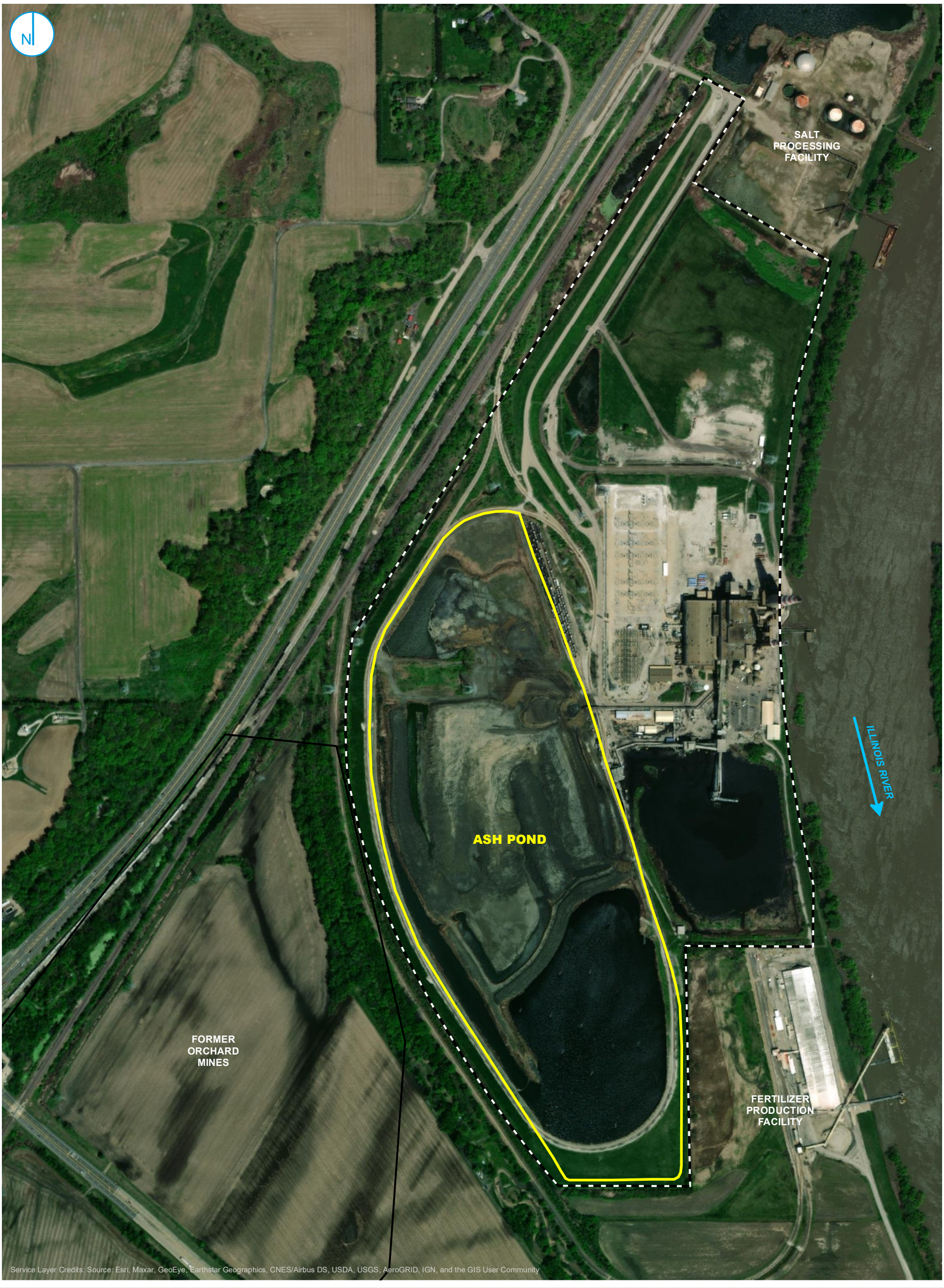
SITE LOCATION MAP

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 1-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



PART 845 REGULATED UNIT (SUBJECT UNIT)
FORMER ORCHARD MINES AREA
PROPERTY BOUNDARY

0 250 500 Feet

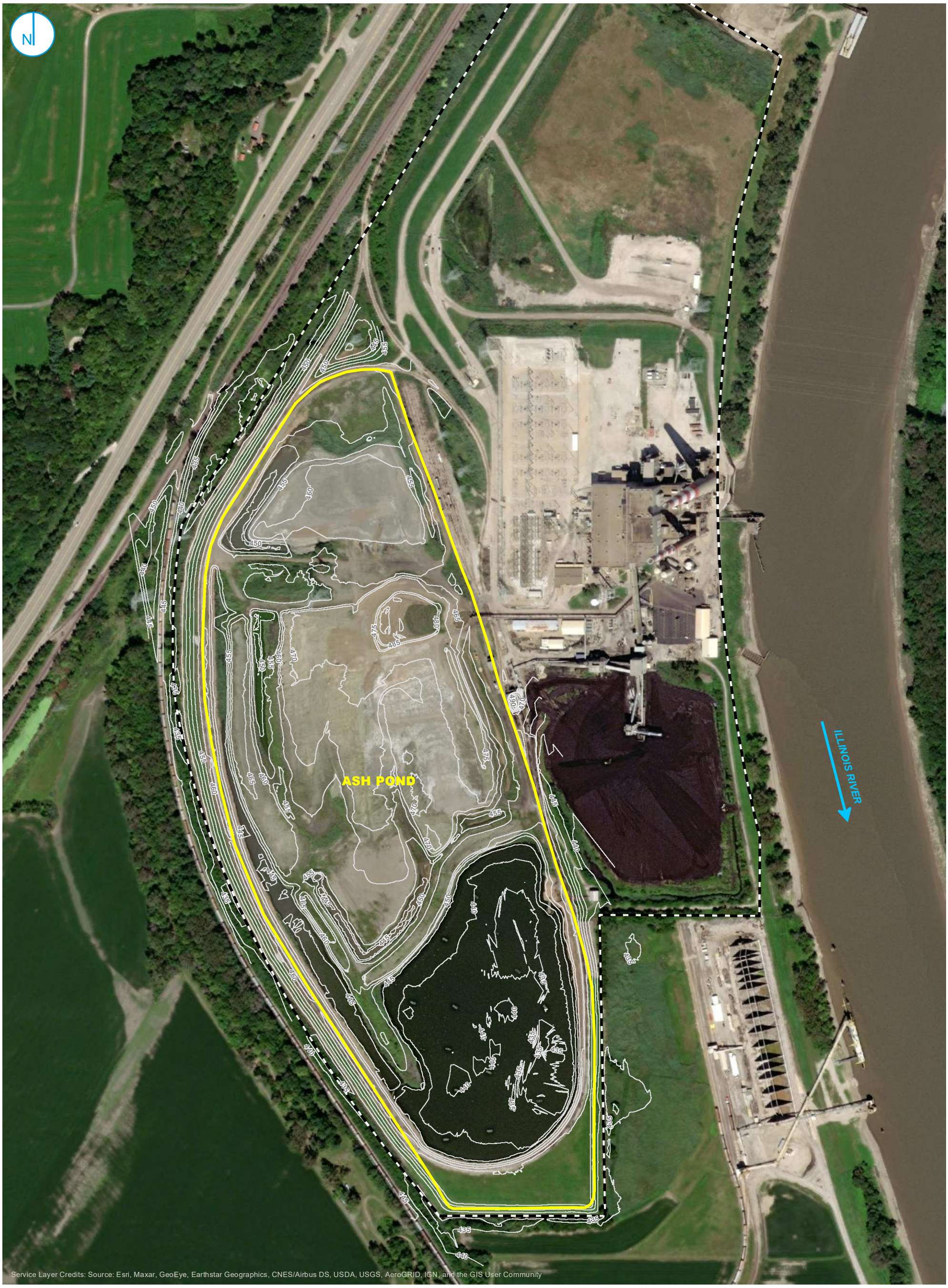
SITE MAP

FIGURE 1-2

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



5FT TOPOGRAPHIC CONTOUR
PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

Note:
Elevation contours shown in feet, North American Vertical Datum of 1988 (NAVD88)

0 200 400
Feet

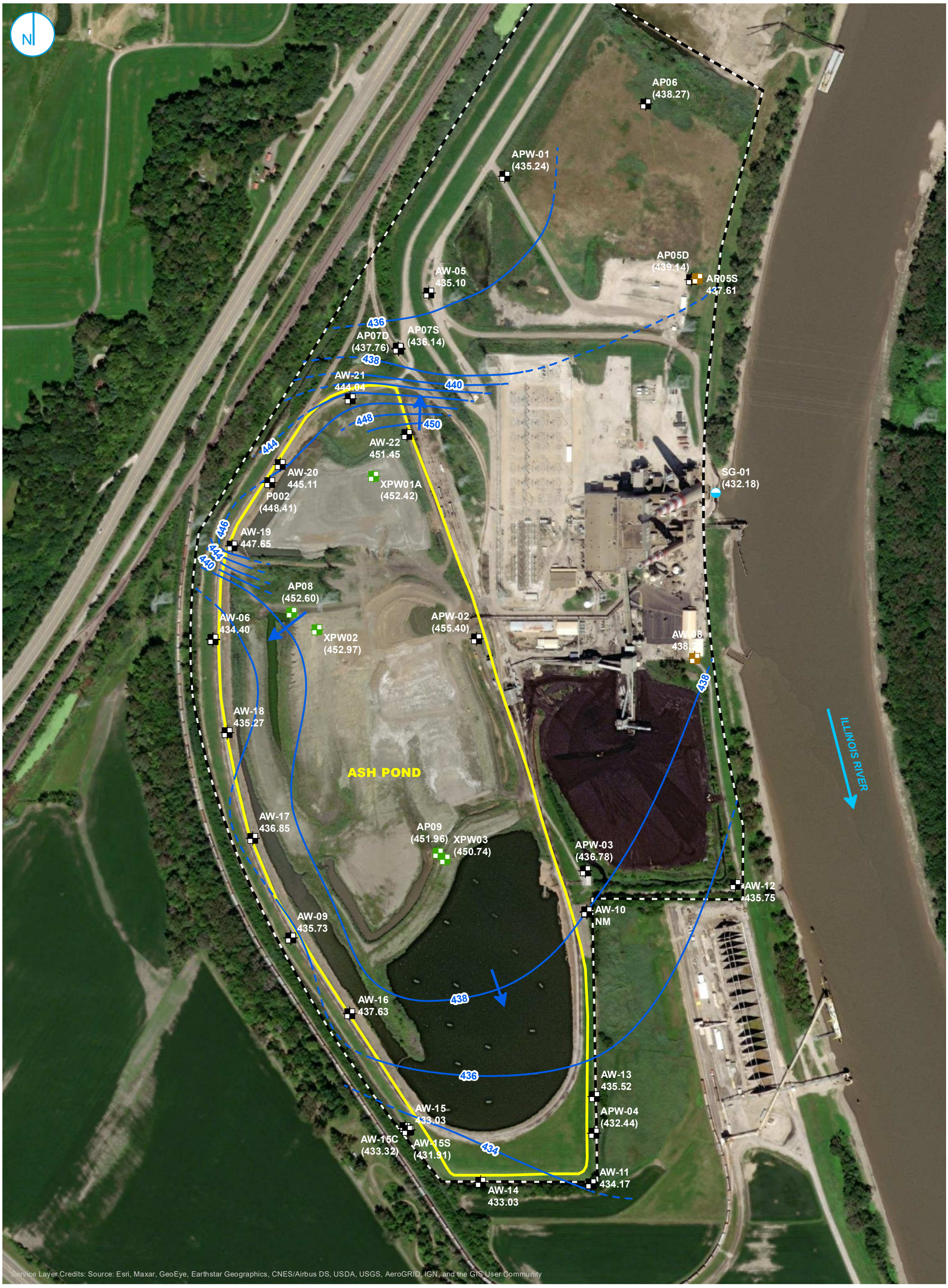
SITE TOPOGRAPHIC MAP

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 2-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



BACKGROUND WELL
MONITORING WELL
PORE WATER WELL
STAFF GAGE, RIVER
PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION

0 212.5 425 Feet

NOTES
1. PARENTHESIS INDICATES WELL NOT USED FOR CONTOURING
2. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988

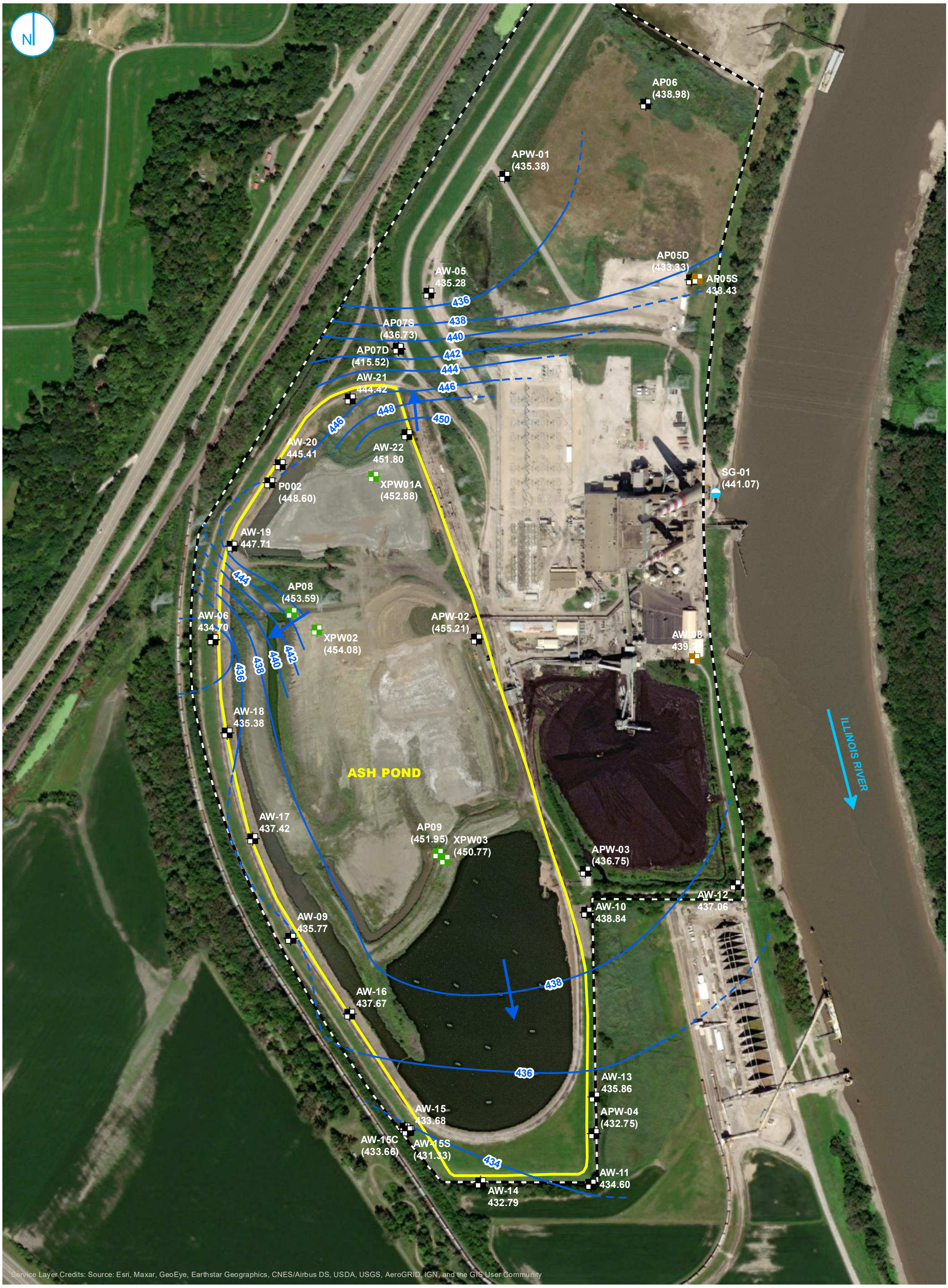
UPPERMOST AQUIFER POTENTIOMETRIC SURFACE MAP FEBRUARY 9, 2021

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 2-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



BACKGROUND WELL
MONITORING WELL
PORE WATER WELL
STAFF GAGE, RIVER
PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION

0 212.5 425 Feet

NOTES
1. PARENTHESIS INDICATES WELL NOT USED FOR CONTOURING
2. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

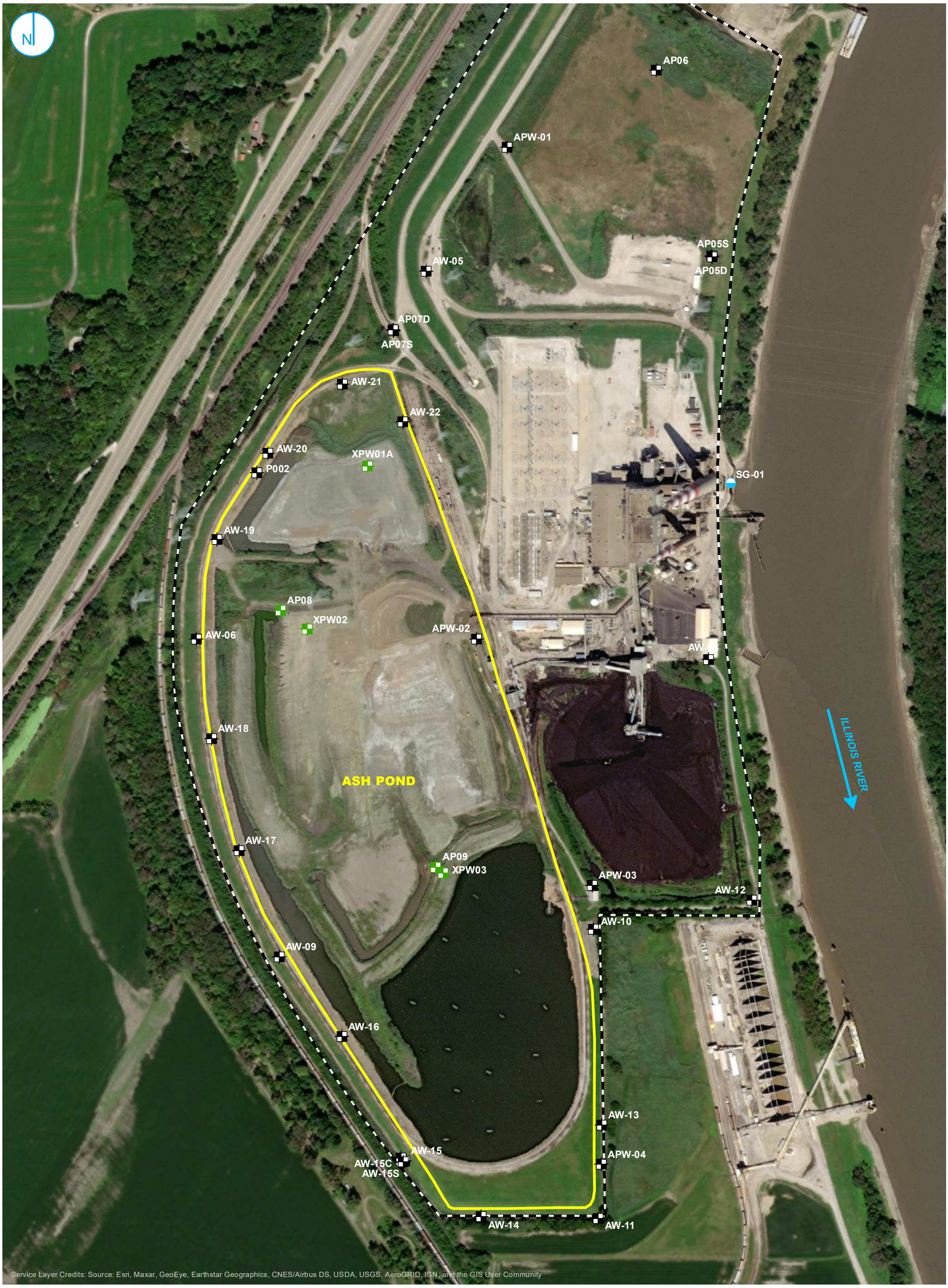
UPPERMOST AQUIFER POTENTIOMETRIC SURFACE MAP MARCH 22, 2021

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 2-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



MONITORING WELL
PORE WATER WELL
STAFF GAGE, RIVER
PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 200 400 Feet

MONITORING WELL LOCATION MAP

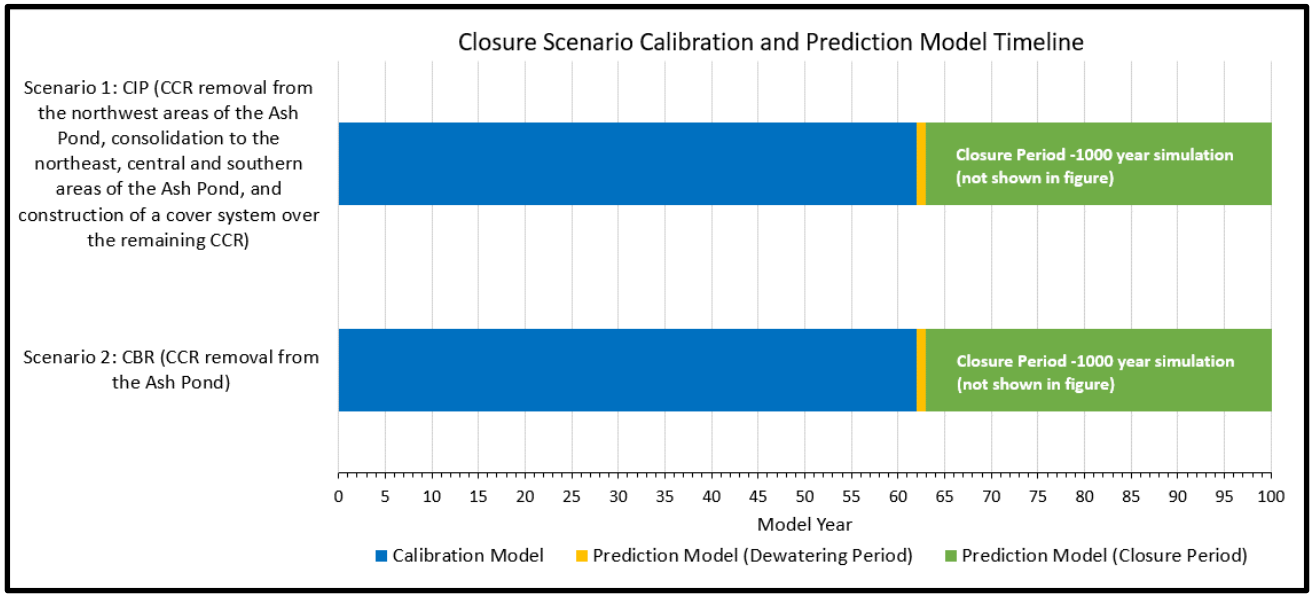
GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 2-4

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

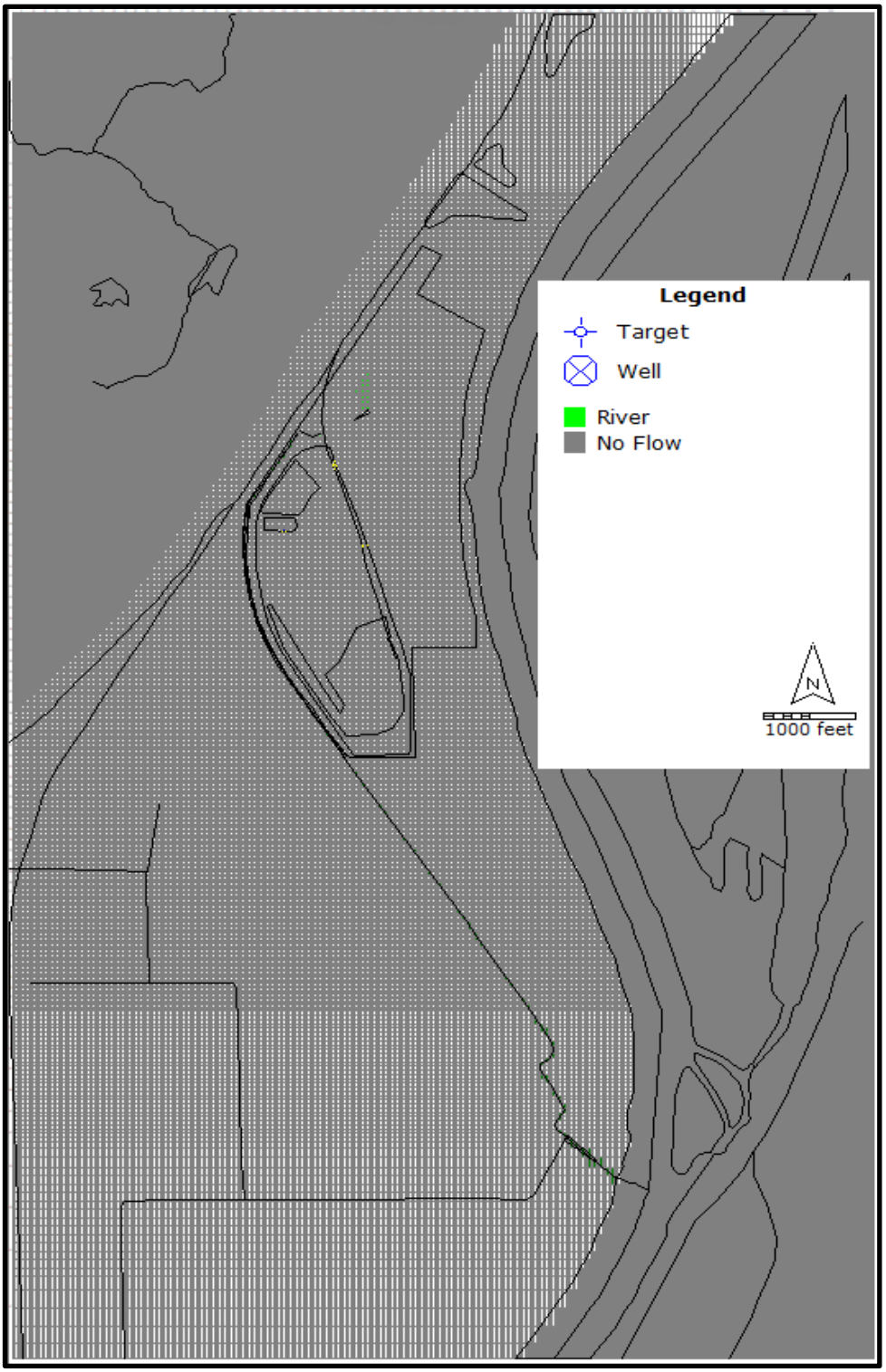
FIGURE 4-1



CLOSURE SCENARIO CALIBRATION AND PREDICTION MODEL TIMELINE

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

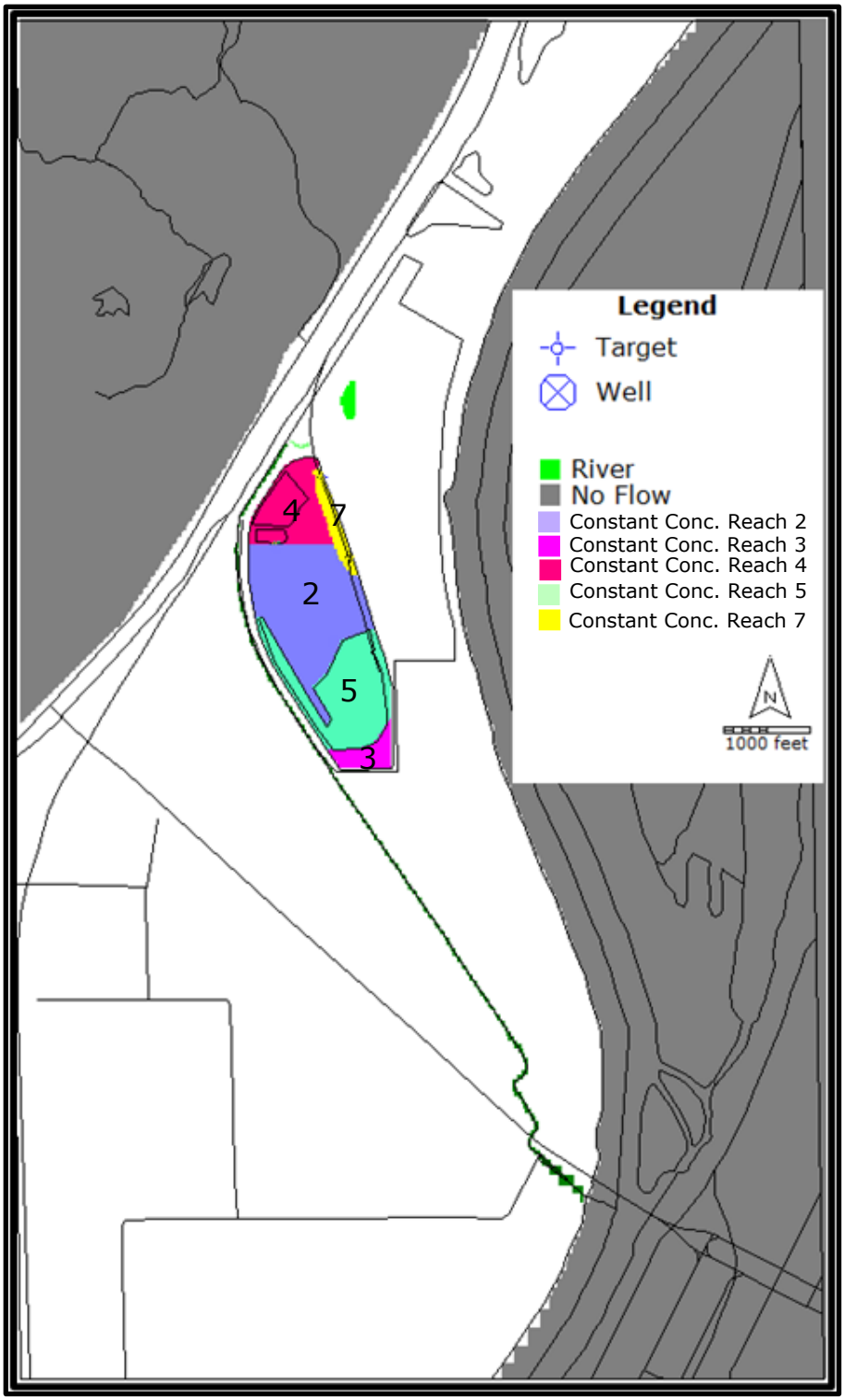
RAMBOLL



MODEL GRID FOR LAYERS 1 THROUGH 5

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

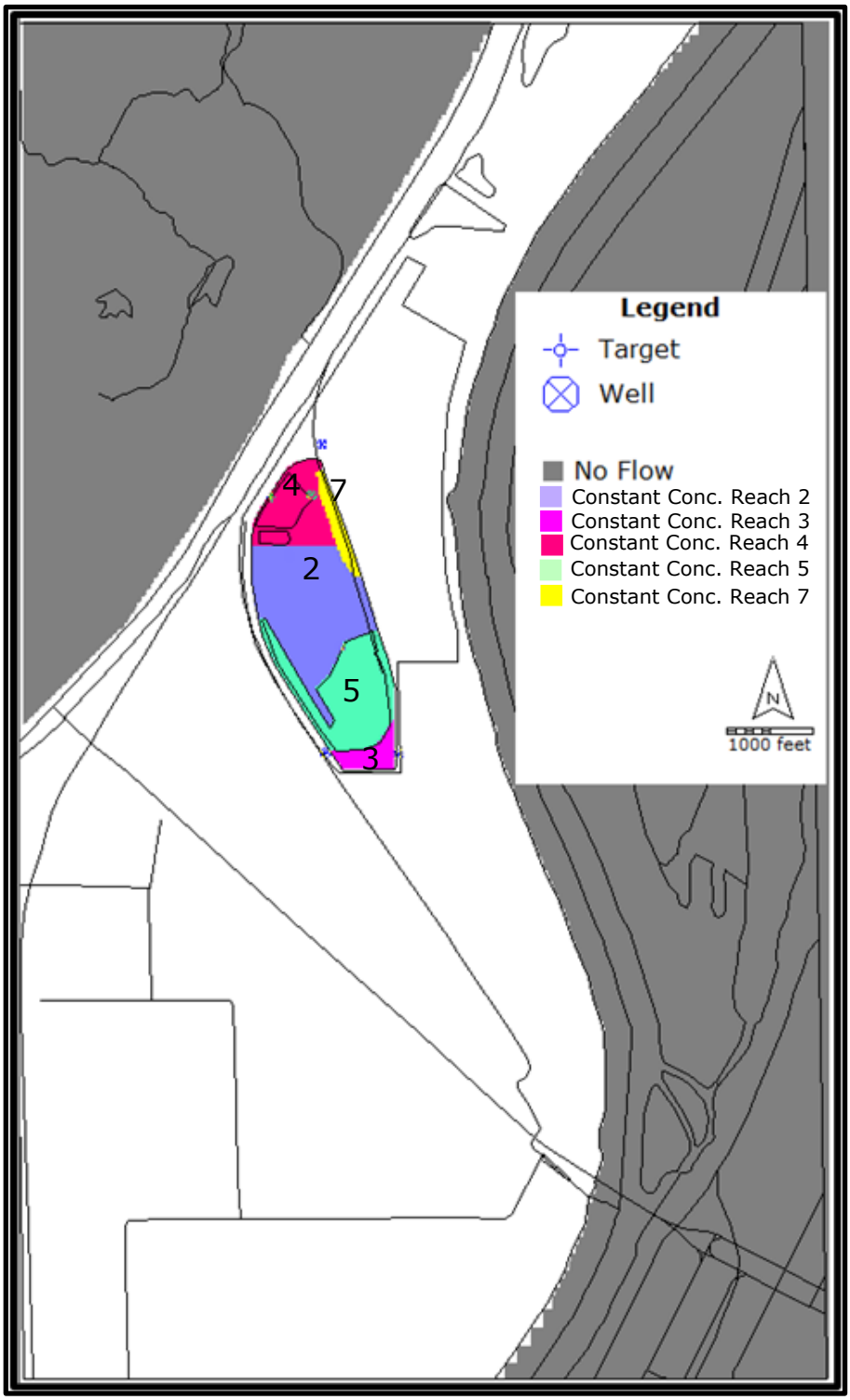
RAMBOLL



BOUNDARY CONDITIONS FOR LAYER 1

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

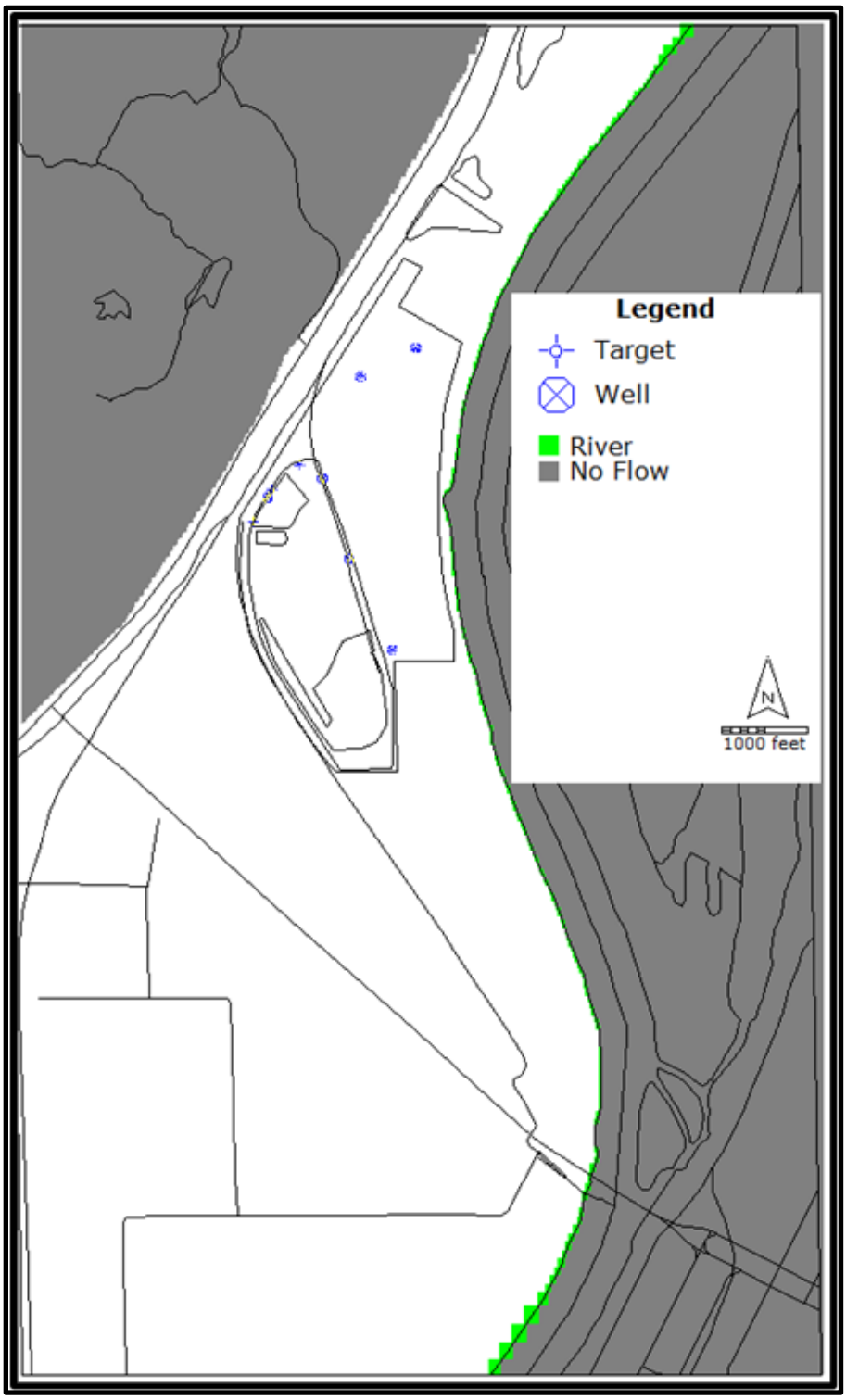
RAMBOLL



BOUNDARY CONDITIONS FOR LAYER 2

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

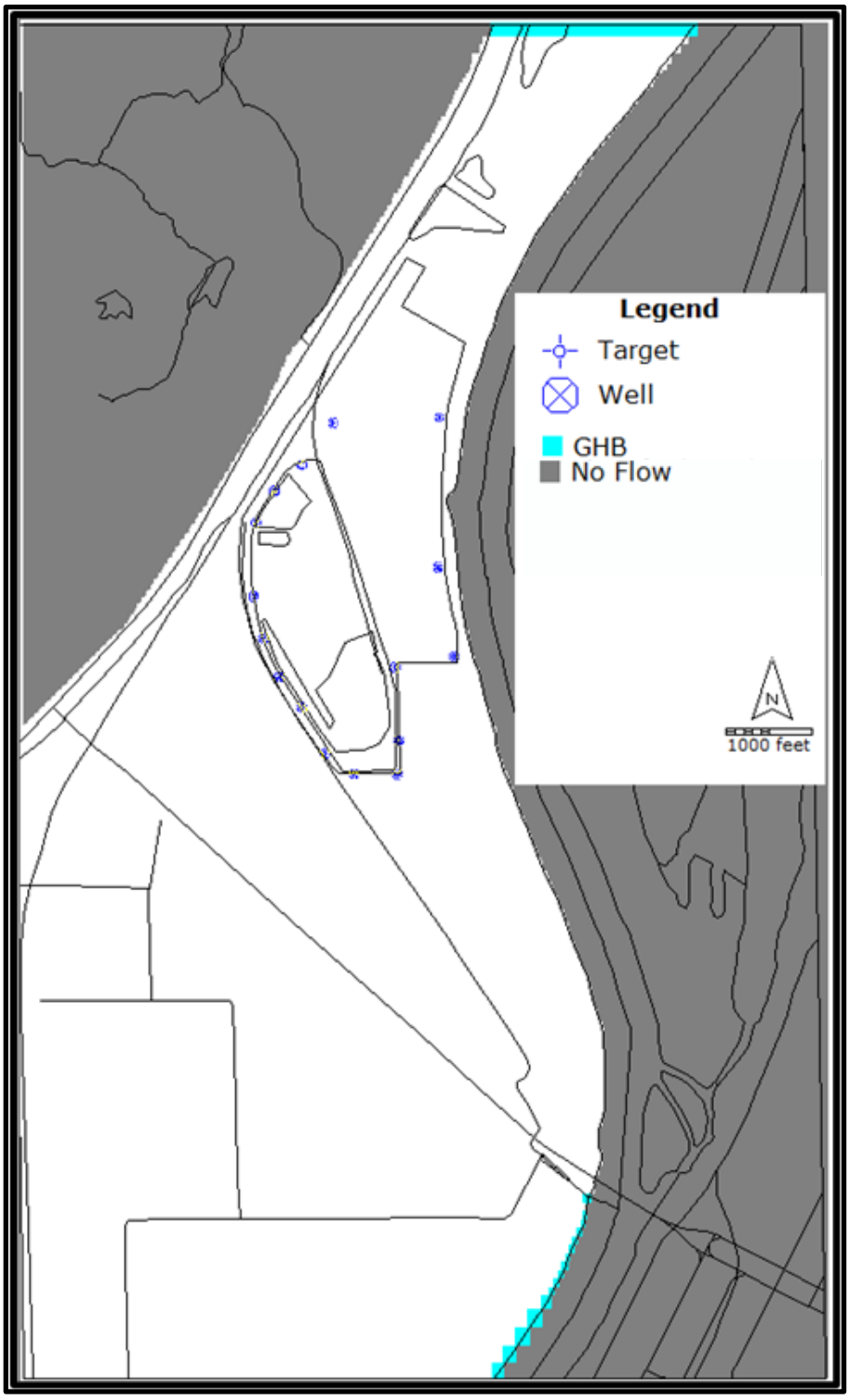
RAMBOLL



BOUNDARY CONDITIONS FOR LAYER 3

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

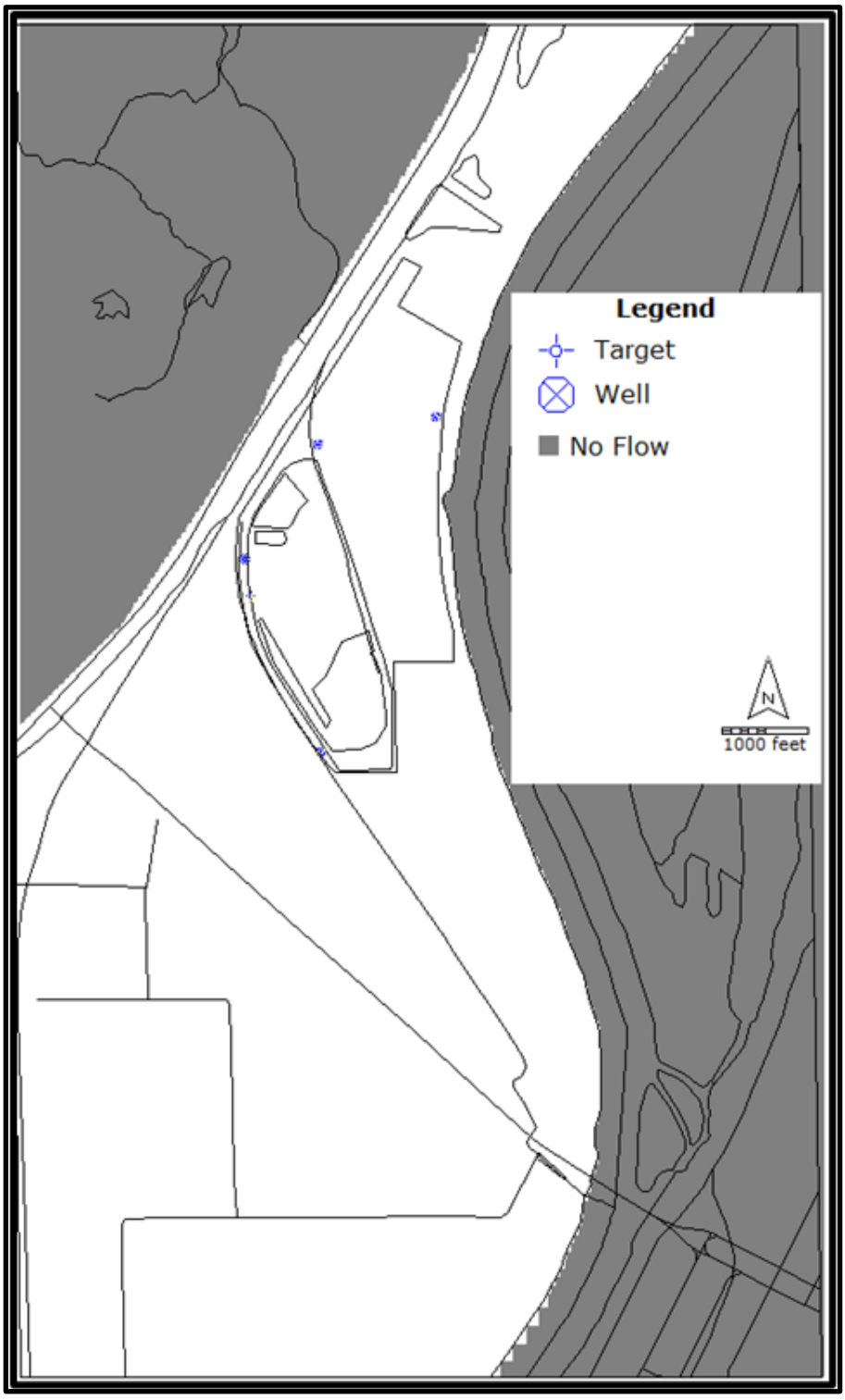
RAMBOLL



BOUNDARY CONDITIONS FOR LAYER 4

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

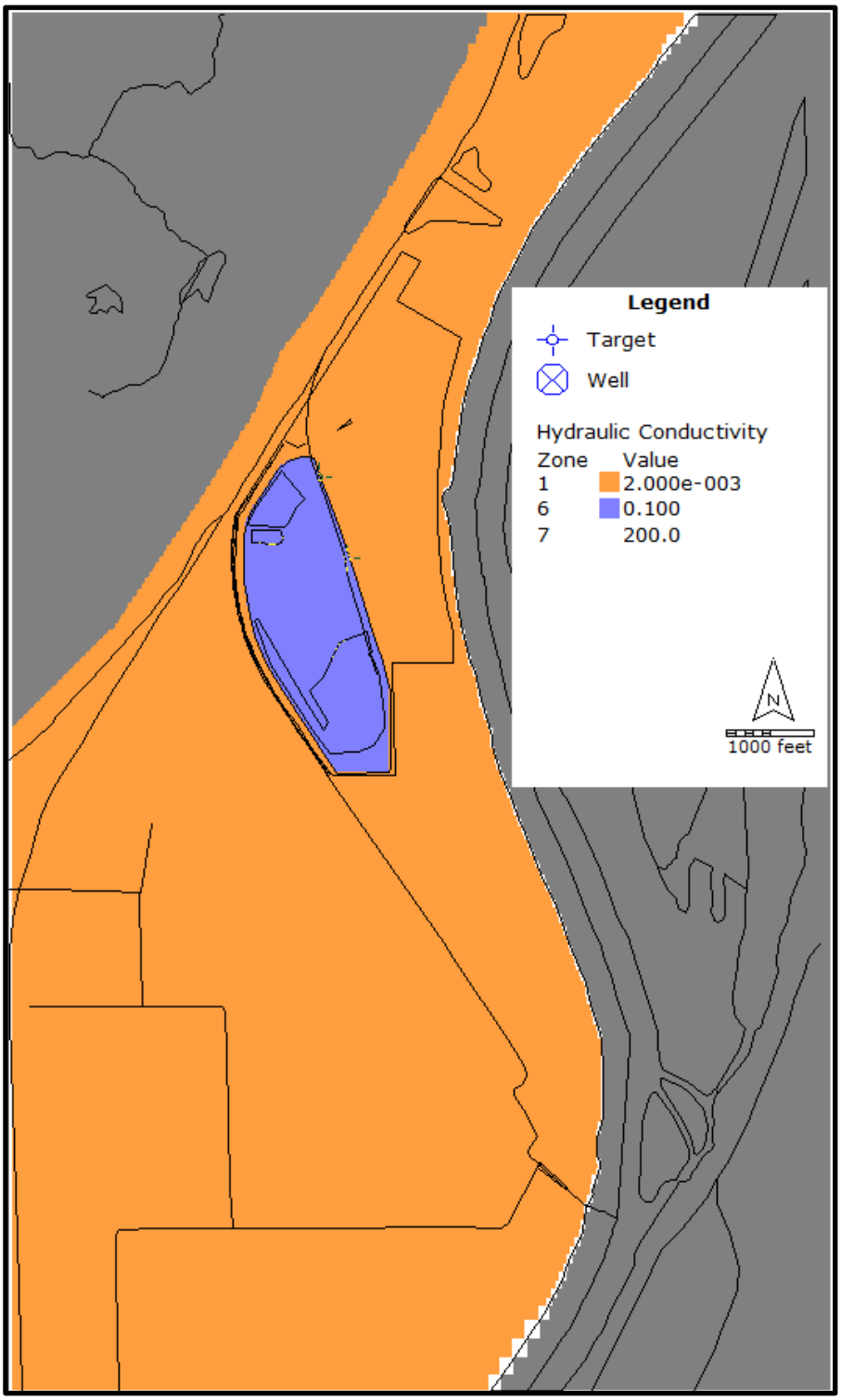
RAMBOLL



BOUNDARY CONDITIONS FOR LAYER 5

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

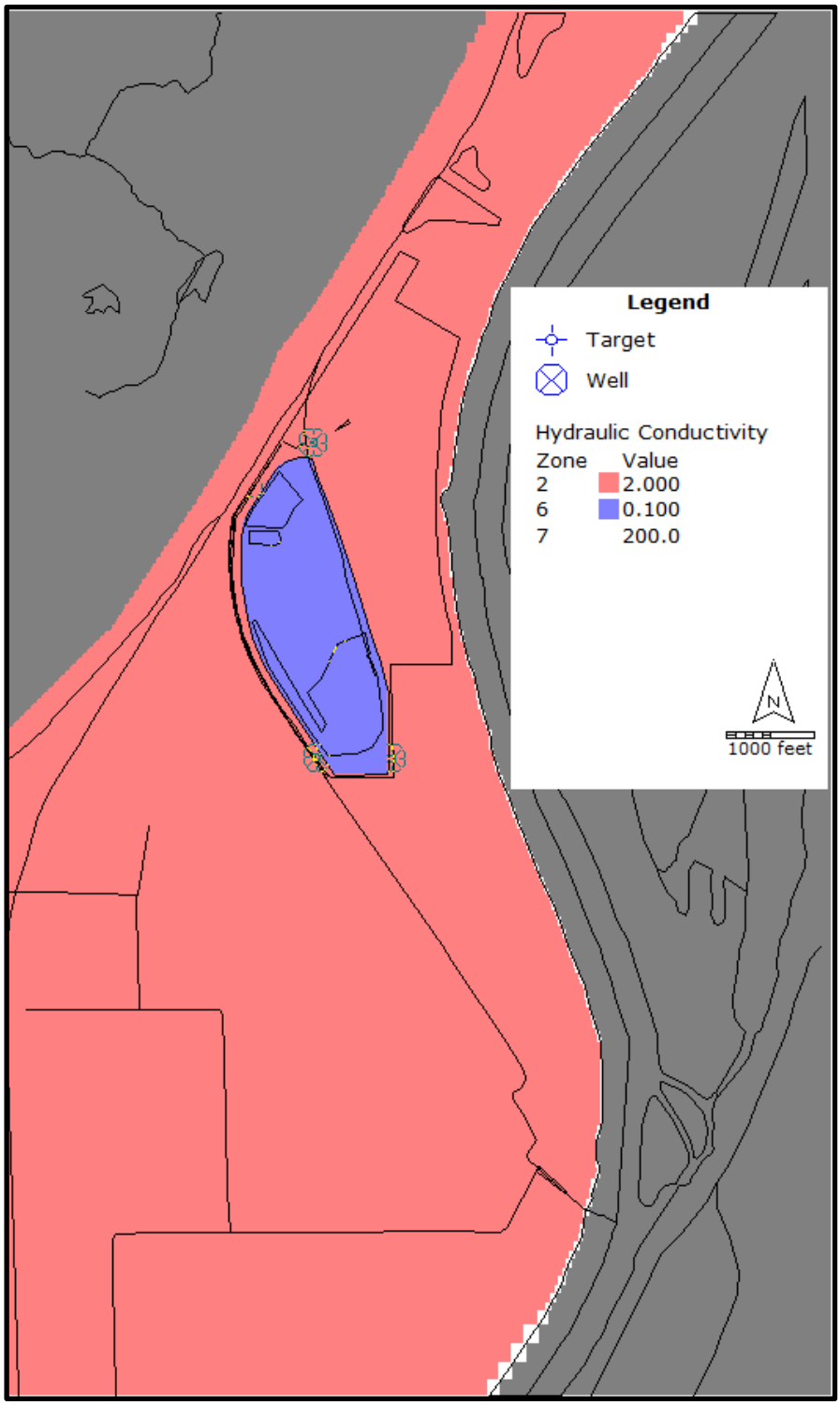
RAMBOLL



DISTRIBUTION OF HYDRAULIC CONDUCTIVITY ZONE (FEET/DAY) FOR LAYER 1

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

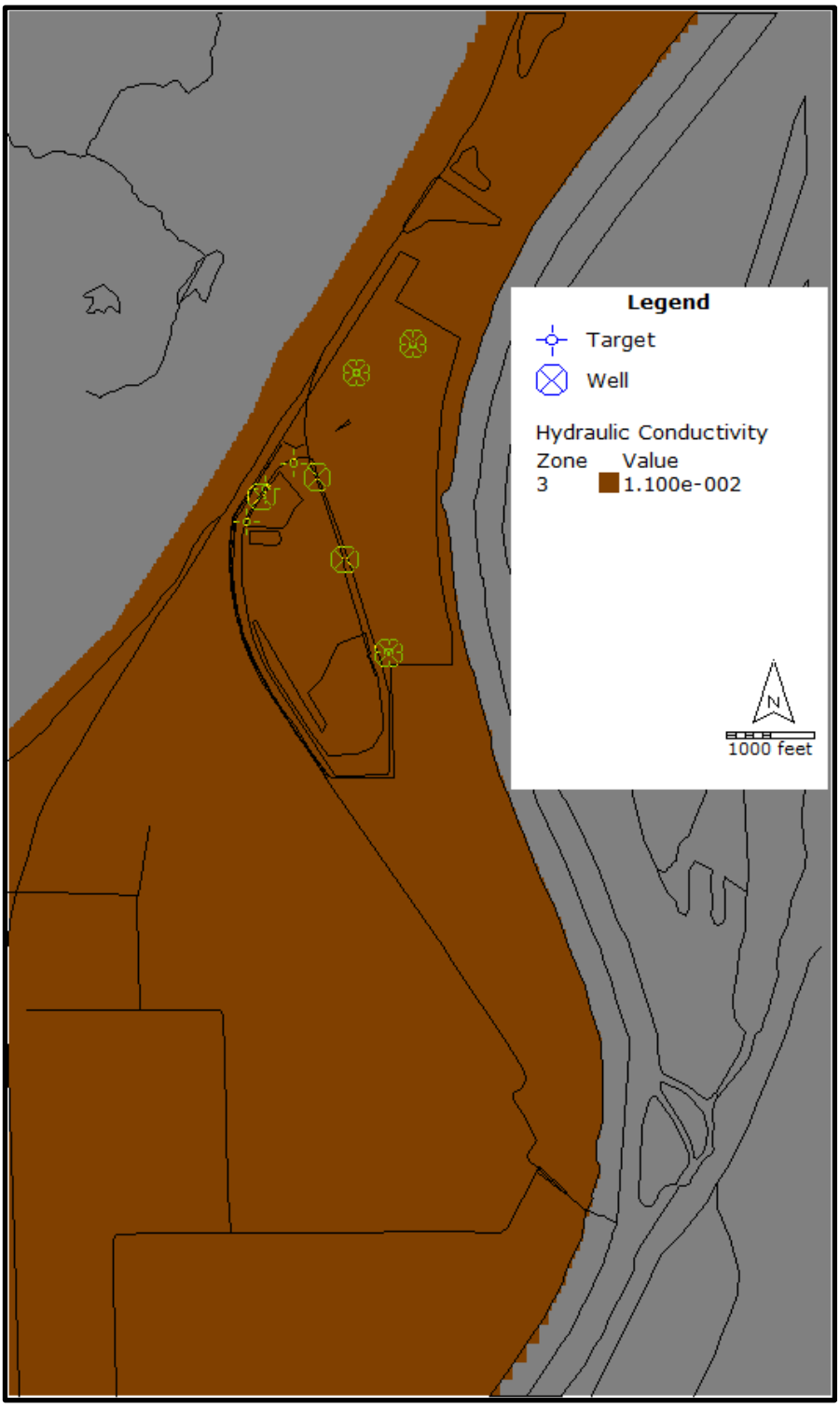
RAMBOLL



DISTRIBUTION OF HYDRAULIC CONDUCTIVITY ZONE (FEET/DAY) FOR LAYER 2

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

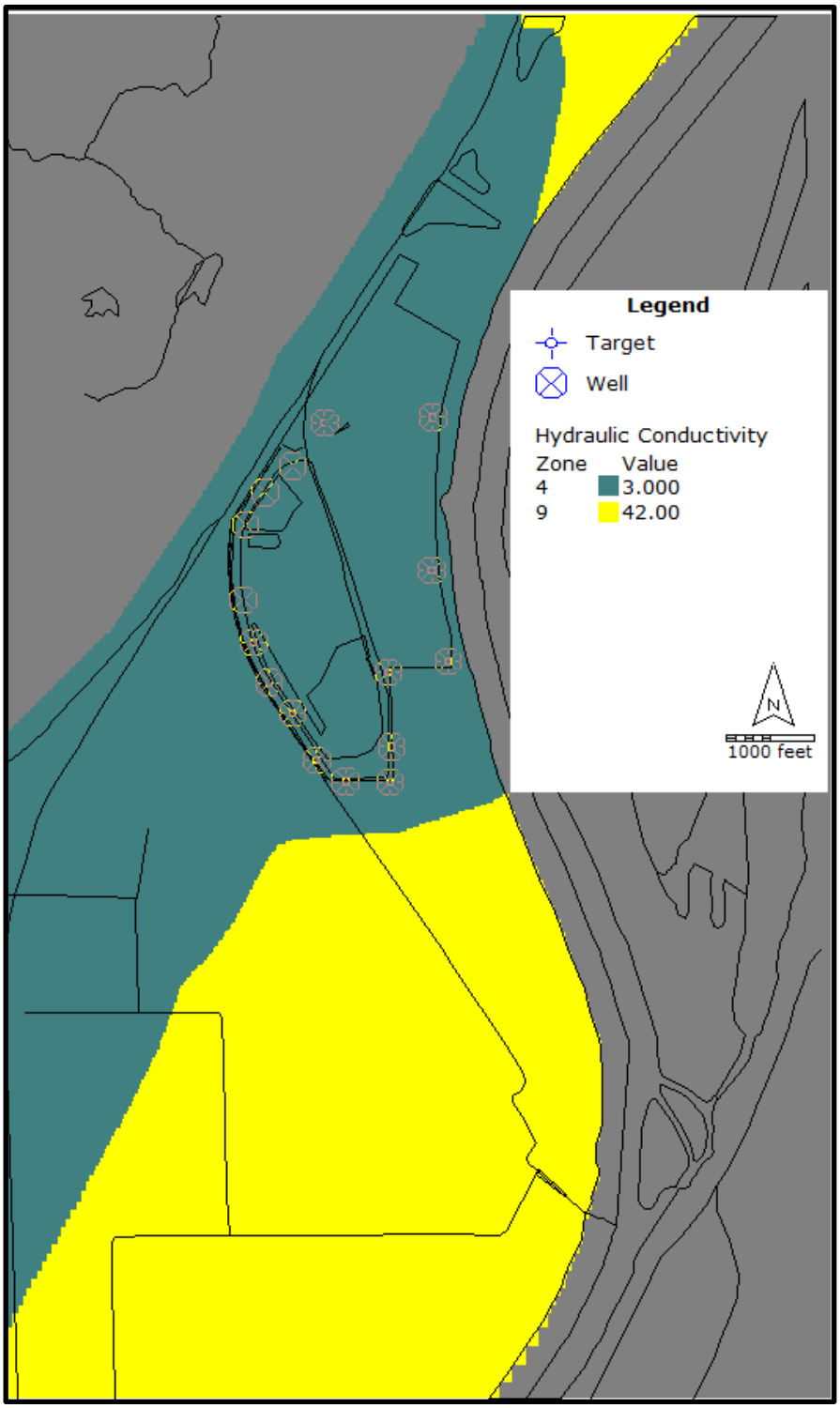
RAMBOLL



DISTRIBUTION OF HYDRAULIC CONDUCTIVITY ZONE (FEET/DAY) FOR LAYER 3

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

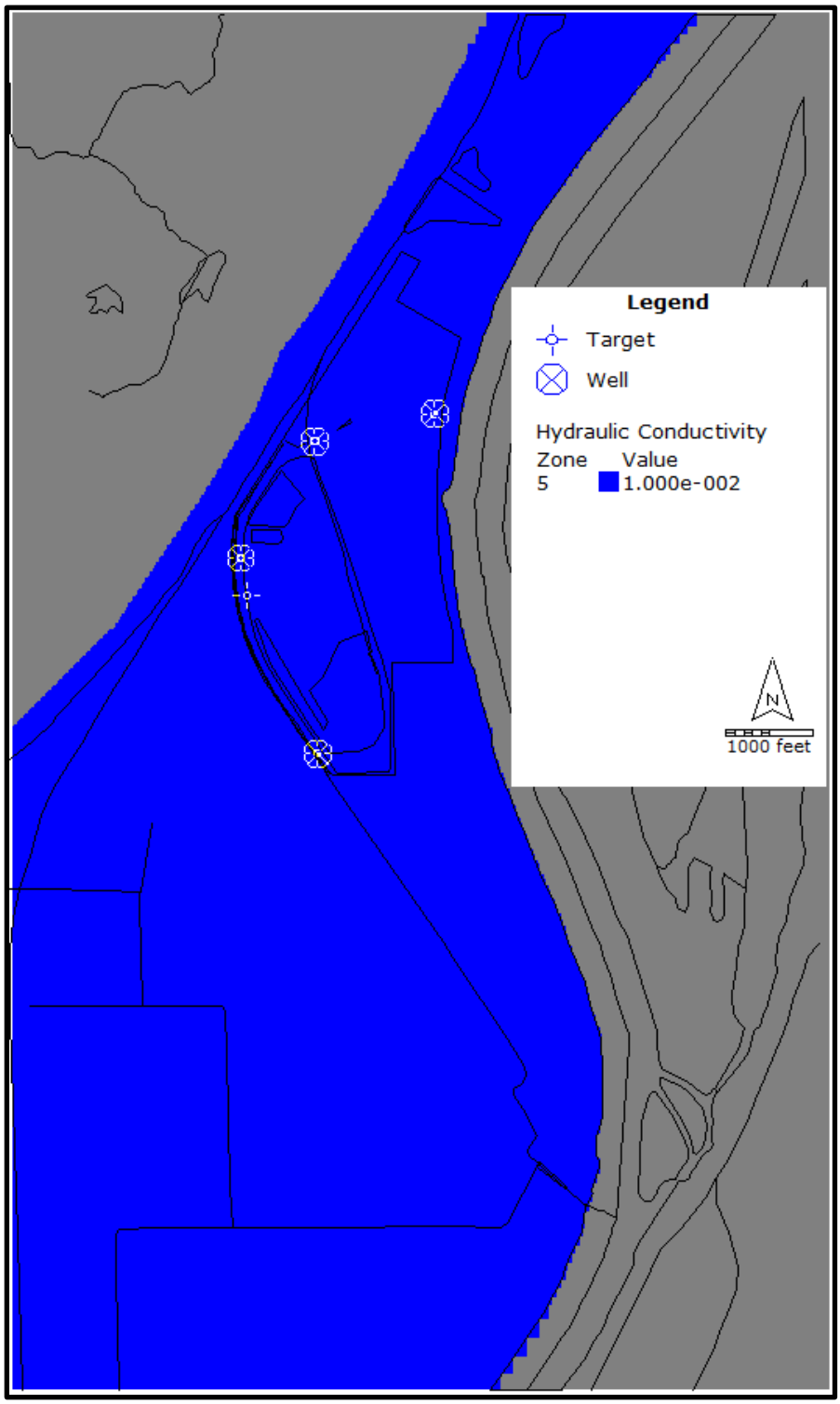
RAMBOLL



DISTRIBUTION OF HYDRAULIC CONDUCTIVITY ZONE (FEET/DAY) FOR LAYER 4

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

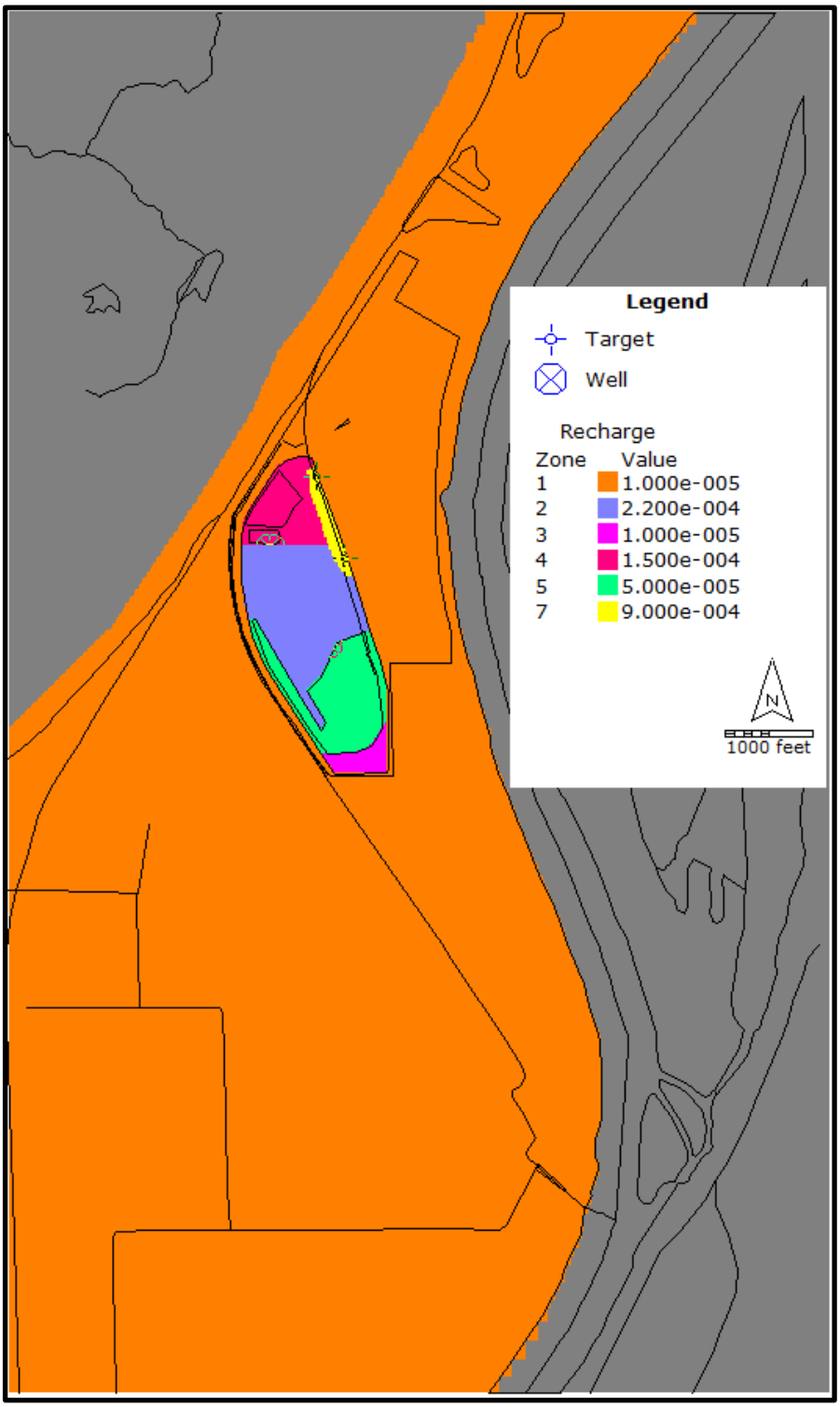
RAMBOLL



DISTRIBUTION OF HYDRAULIC CONDUCTIVITY ZONE (FEET/DAY) FOR LAYER 5

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

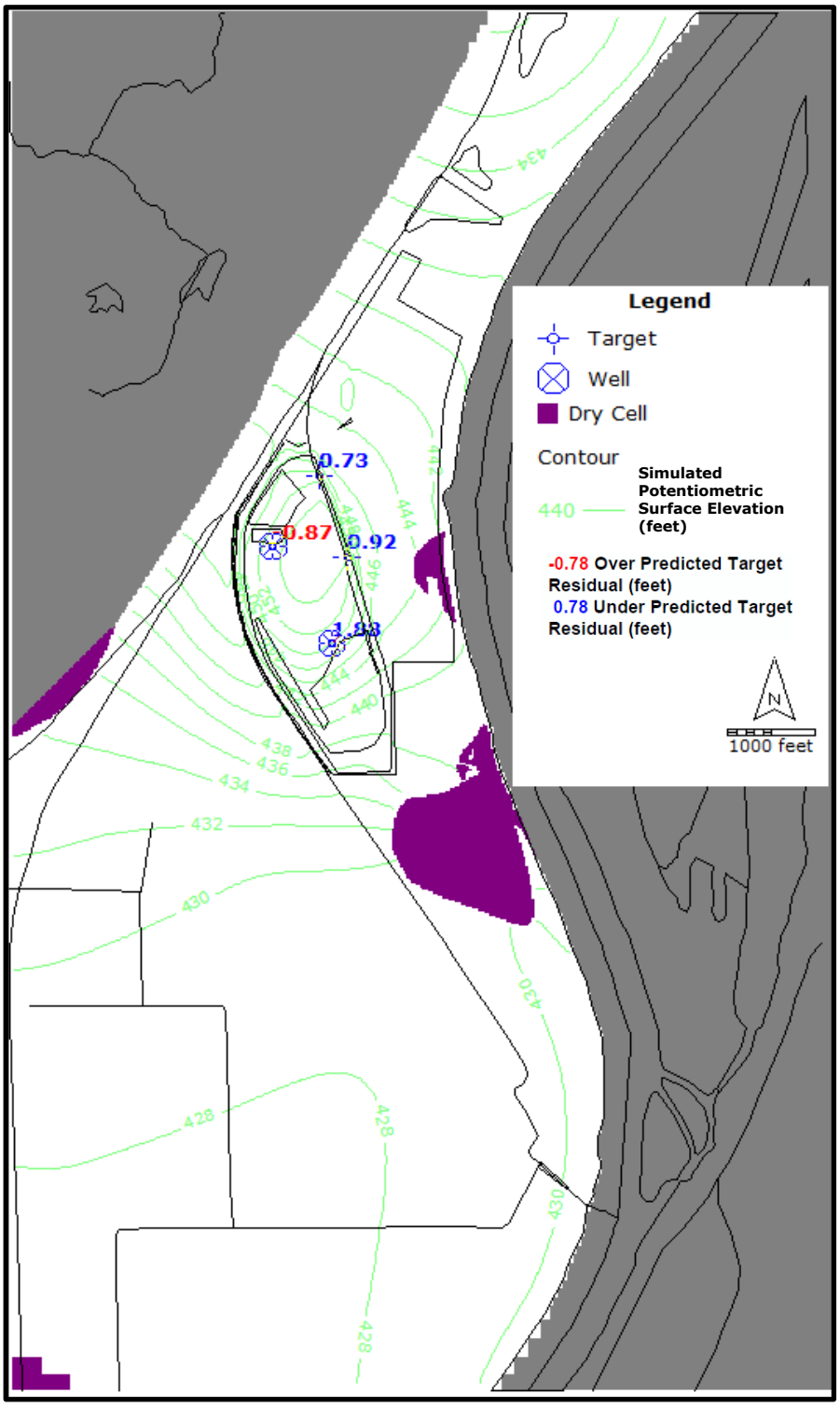
RAMBOLL



DISTRIBUTION OF RECHARGE ZONES (FEET/DAY)

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

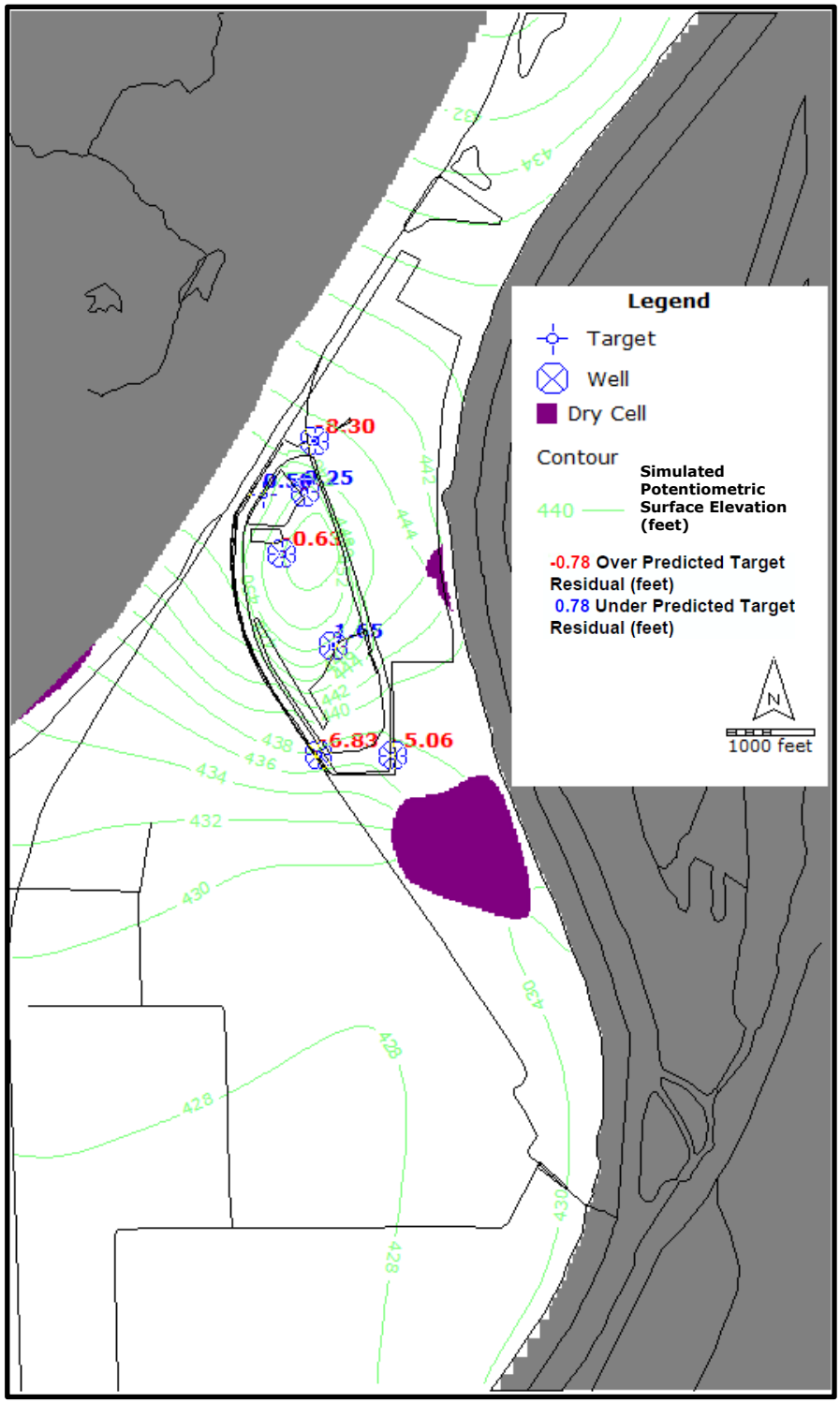
RAMBOLL



OBSERVED VERSUS SIMULATED GROUNDWATER ELEVATIONS FOR LAYER 1

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

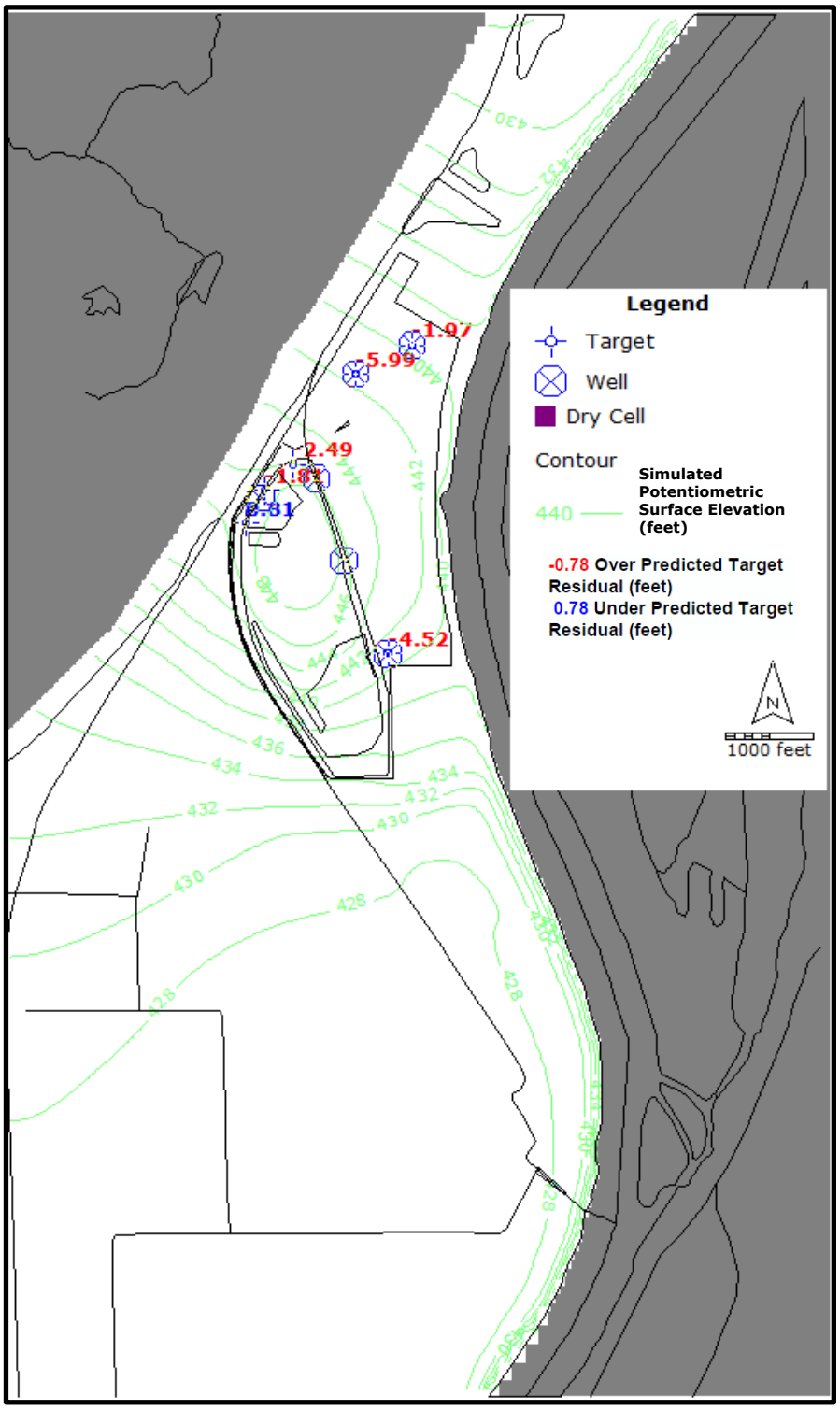
RAMBOLL



OBSERVED VERSUS SIMULATED GROUNDWATER ELEVATIONS FOR LAYER 2

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

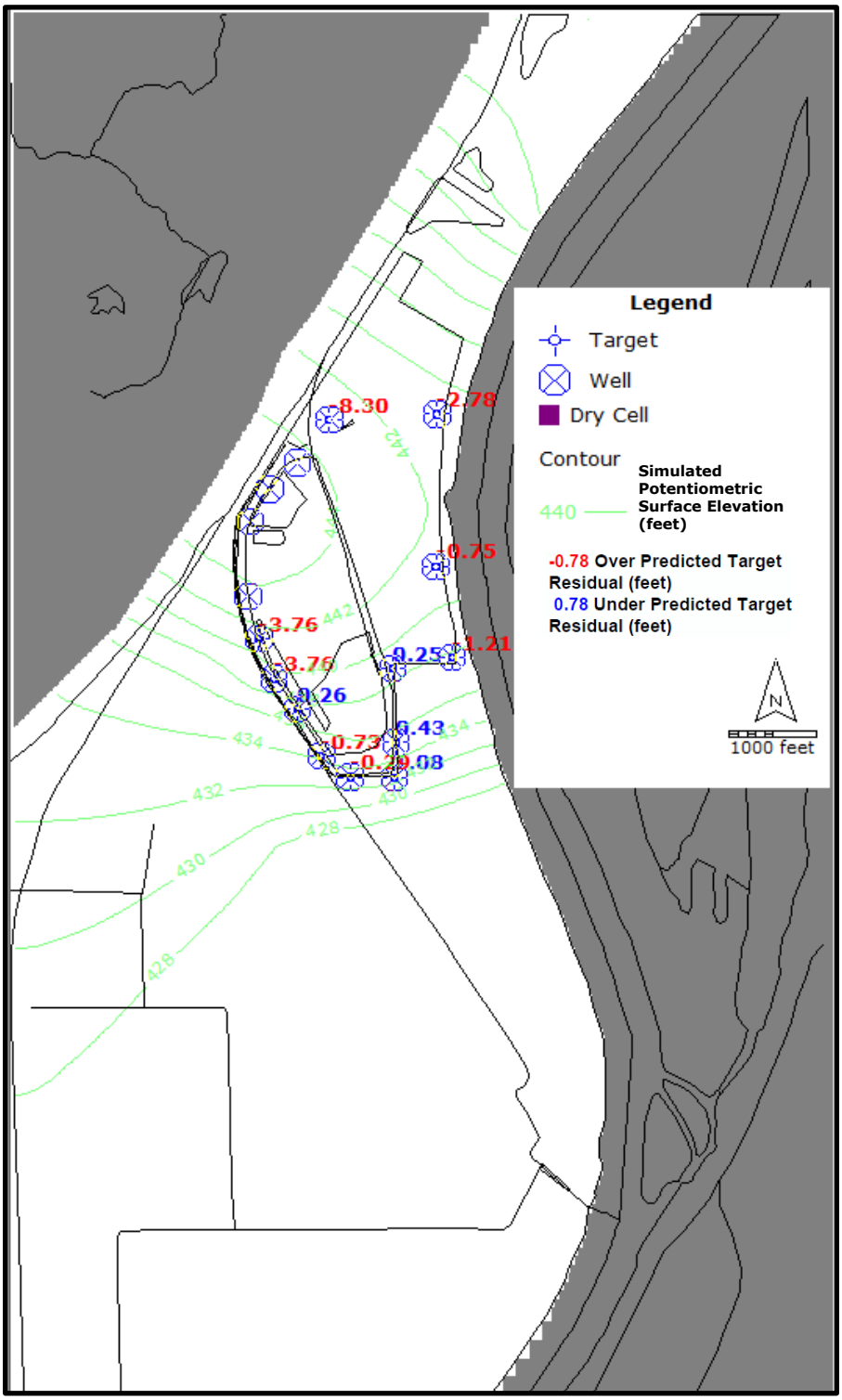
RAMBOLL



OBSERVED VERSUS SIMULATED GROUNDWATER ELEVATIONS FOR LAYER 3

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

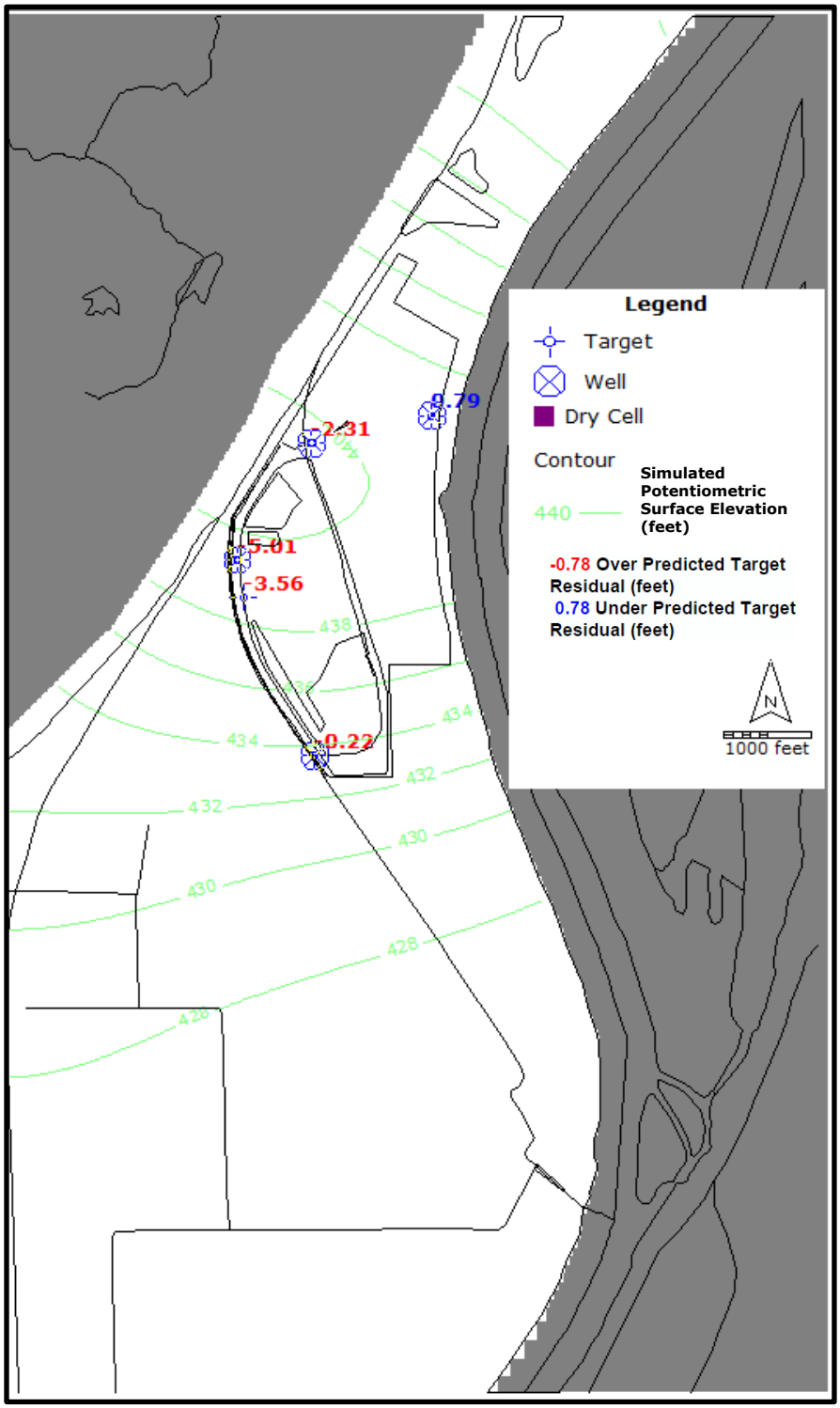
RAMBOLL



OBSERVED VERSUS SIMULATED GROUNDWATER ELEVATIONS FOR LAYER 4

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL

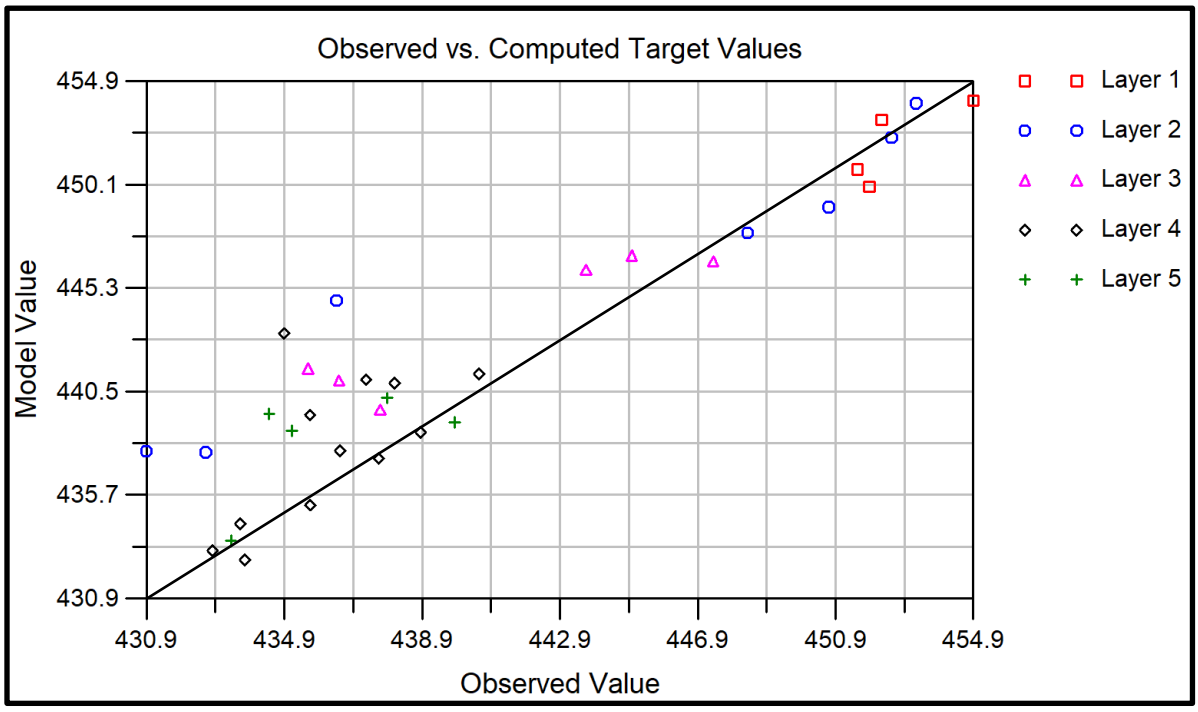


OBSERVED VERSUS SIMULATED GROUNDWATER ELEVATIONS FOR LAYER 5

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL

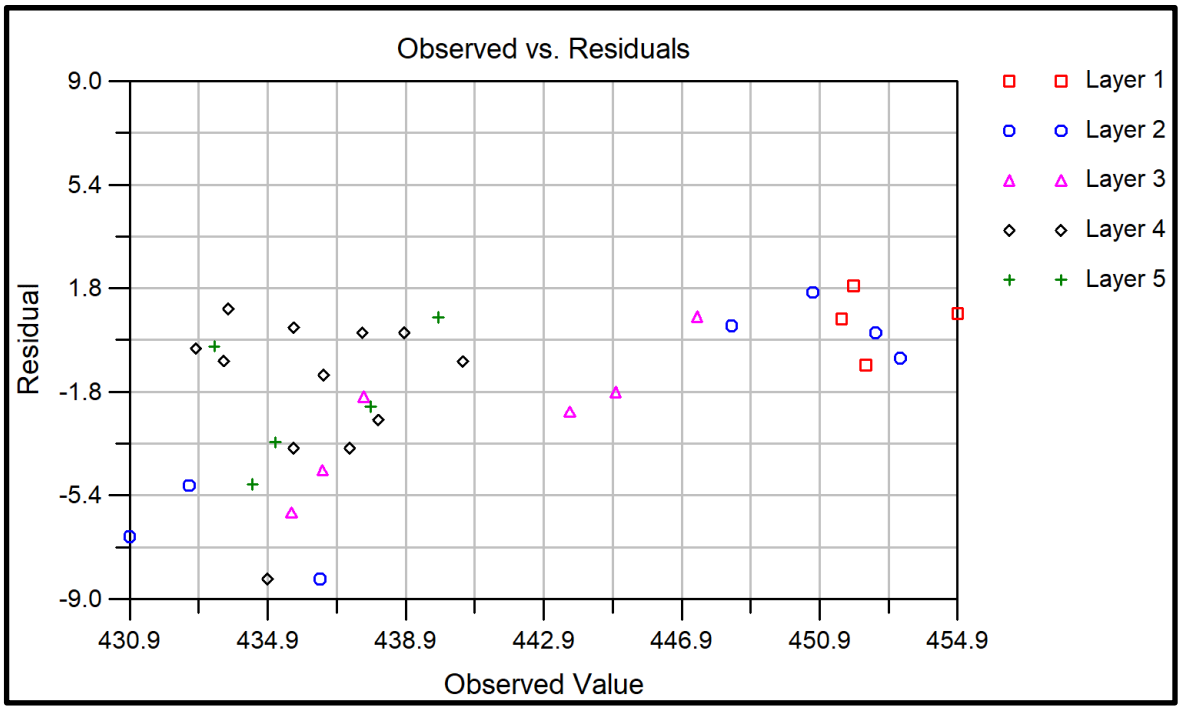
FIGURE 5-18



STEADY STATE MODFLOW CALIBRATION RESULTS – OBSERVED VERSUS SIMULATED (FT)

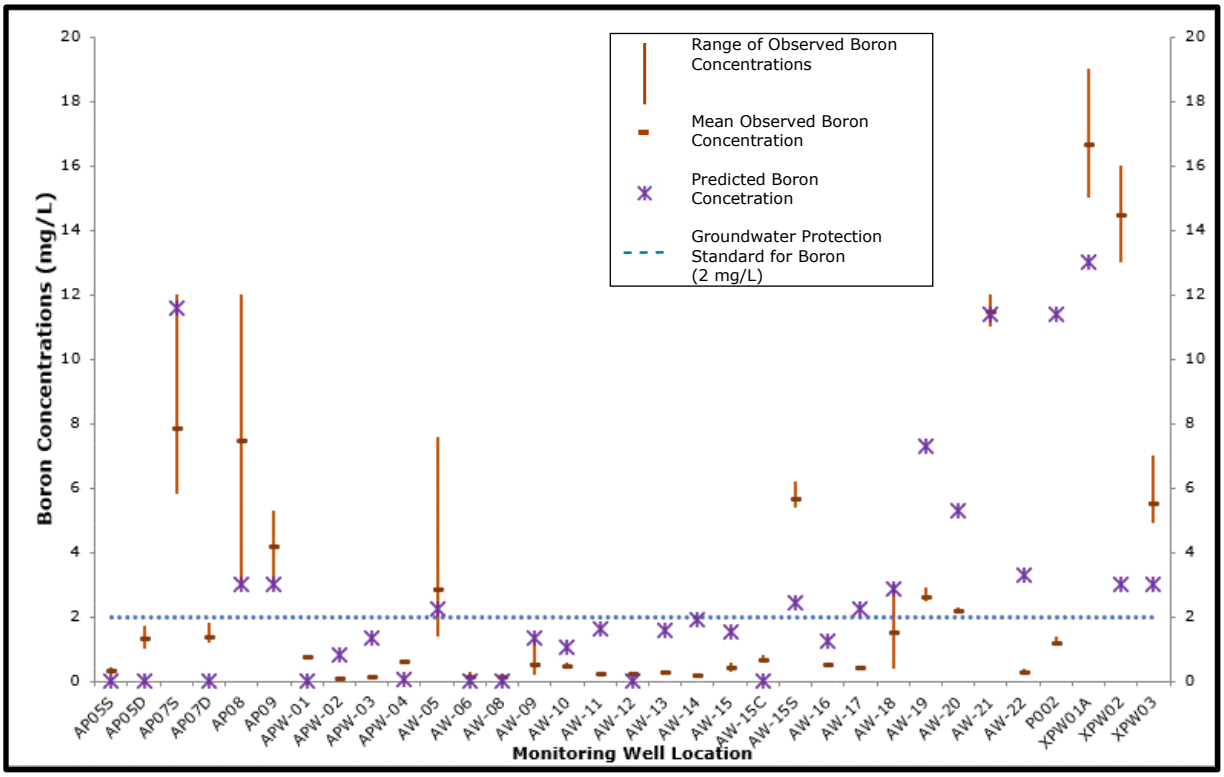
GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL



STEADY STATE MODFLOW CALIBRATION RESULTS – OBSERVED VERSUS RESIDUALS (FT)

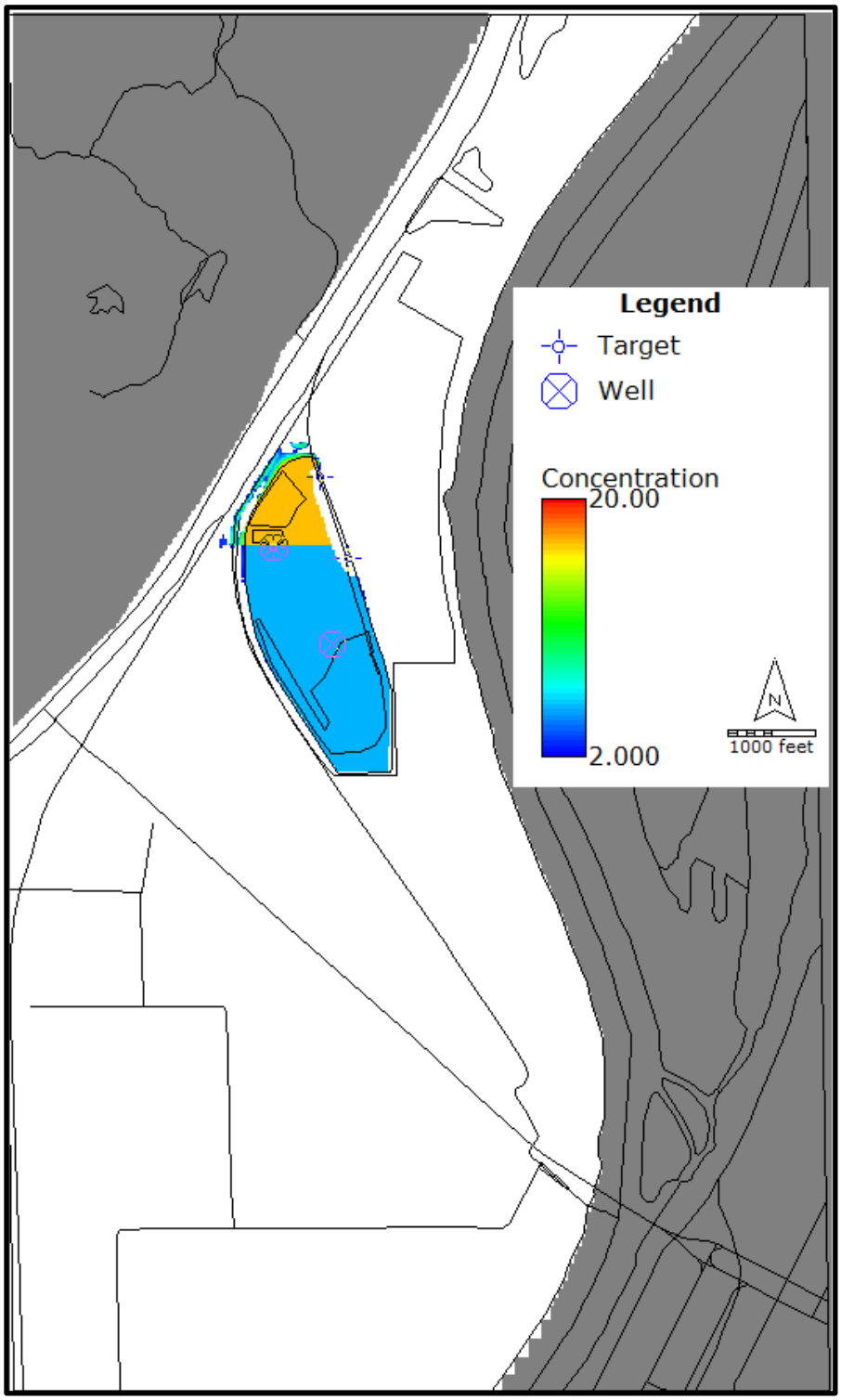
FIGURE 5-20



OBSERVED AND SIMULATED BORON CONCENTRATIONS (mg/L)

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

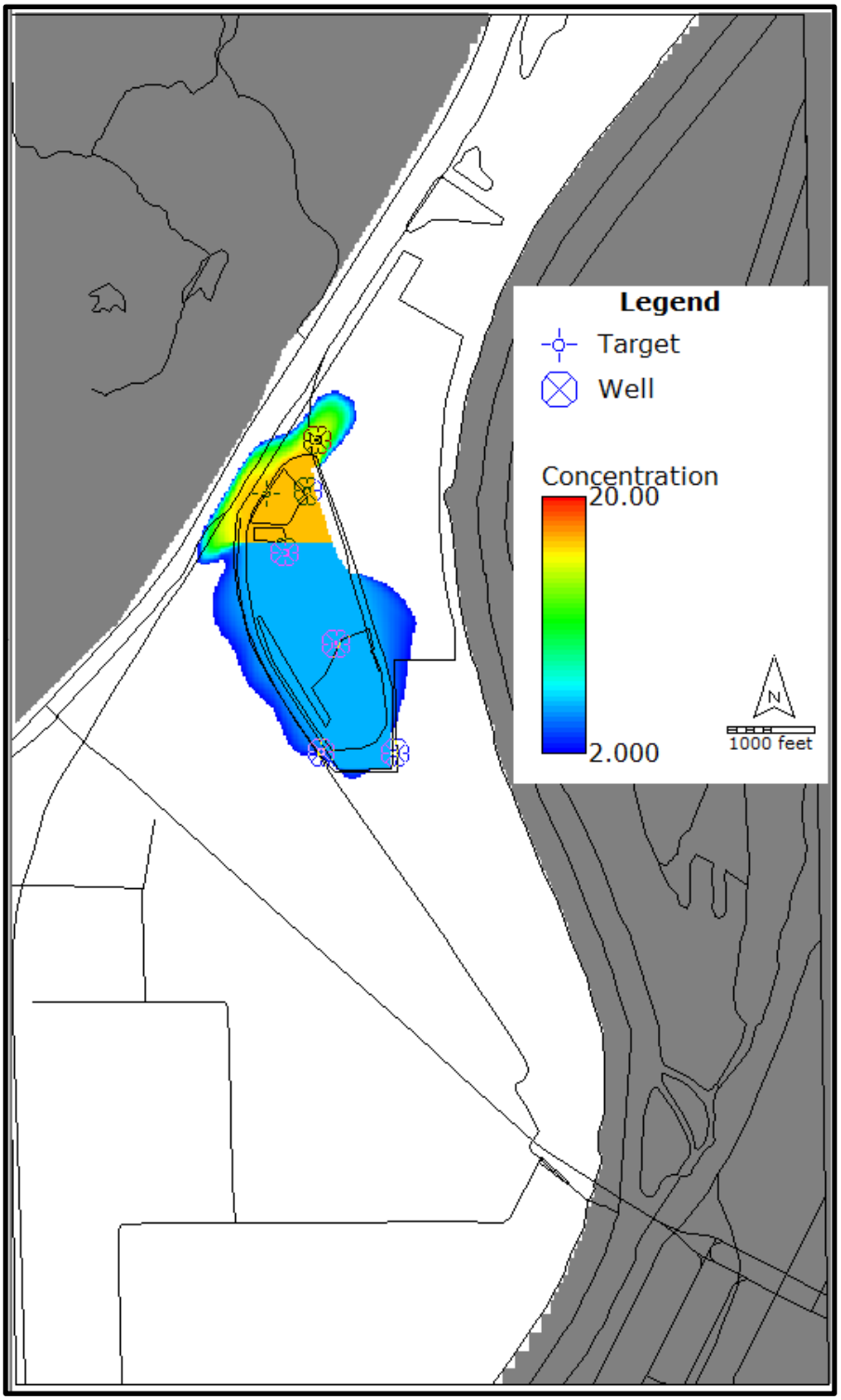
RAMBOLL



LAYER 1 DISTRIBUTION OF BORON CONCENTRATIONS (mg/L) IN THE CALIBRATED MODEL (UCF)

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

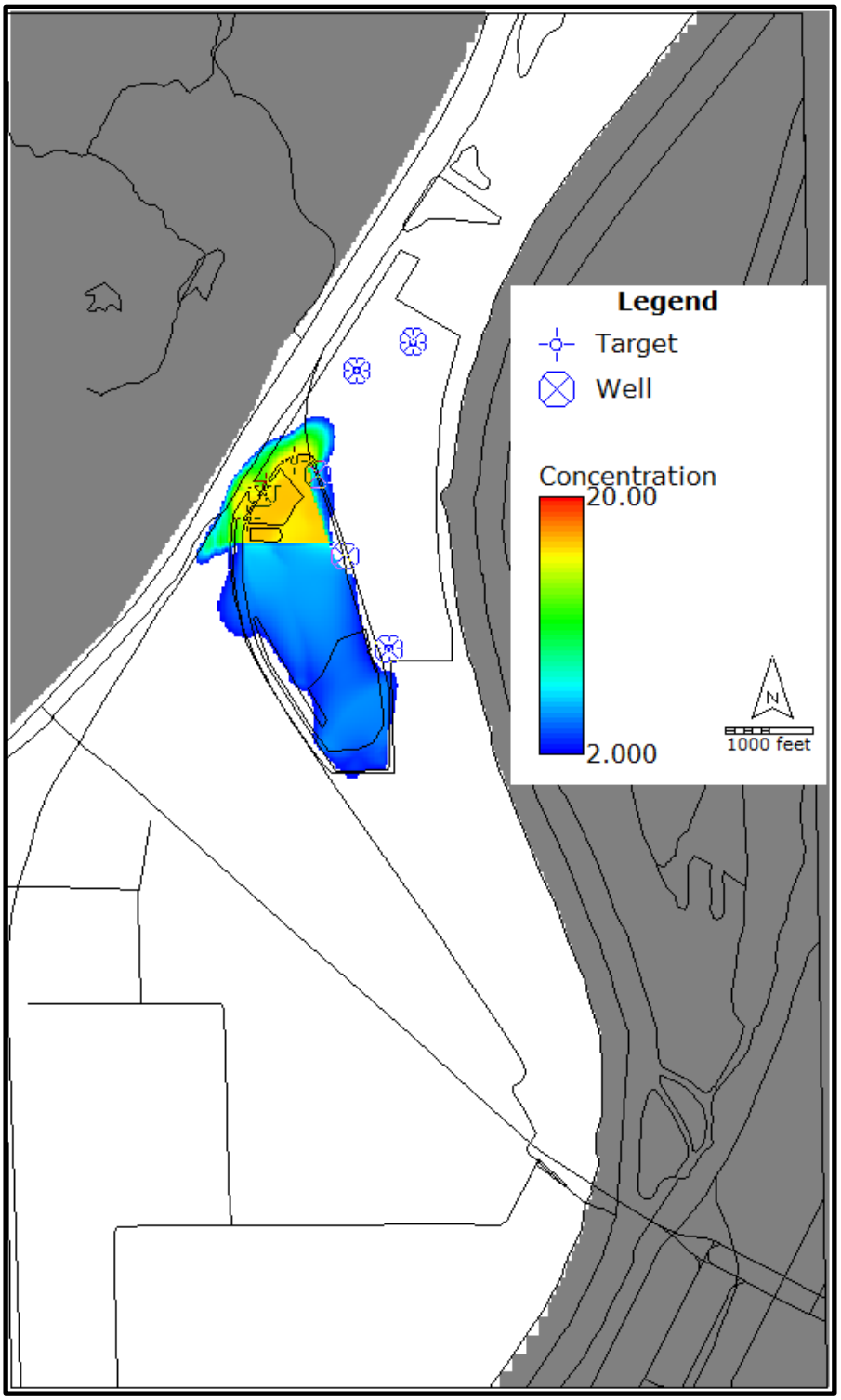
RAMBOLL



LAYER 2 DISTRIBUTION OF BORON CONCENTRATIONS (mg/L) IN THE CALIBRATED MODEL (UCF [PMP])

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

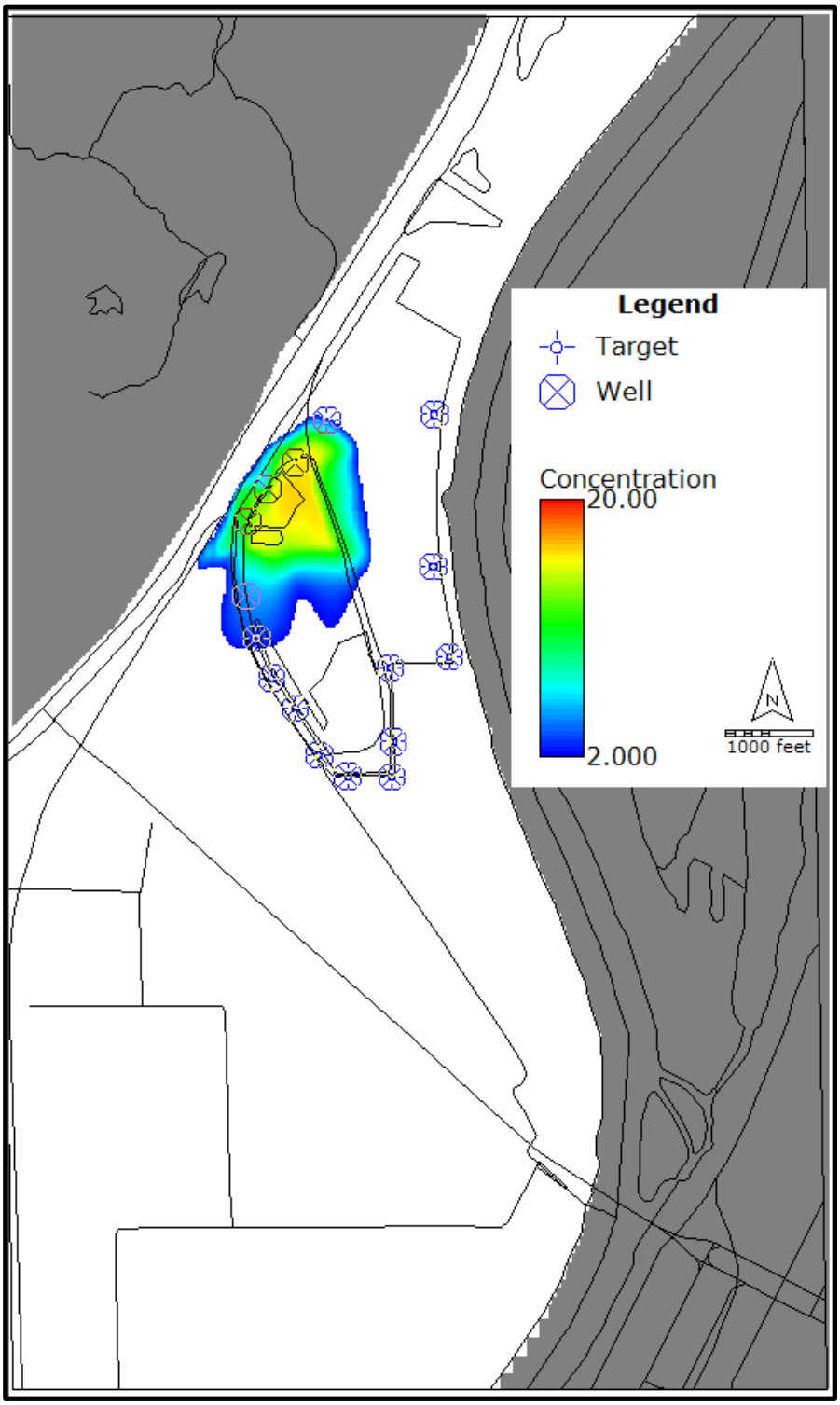
RAMBOLL



LAYER 3 DISTRIBUTION OF BORON CONCENTRATIONS (mg/L) IN THE CALIBRATED MODEL (UCF)

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

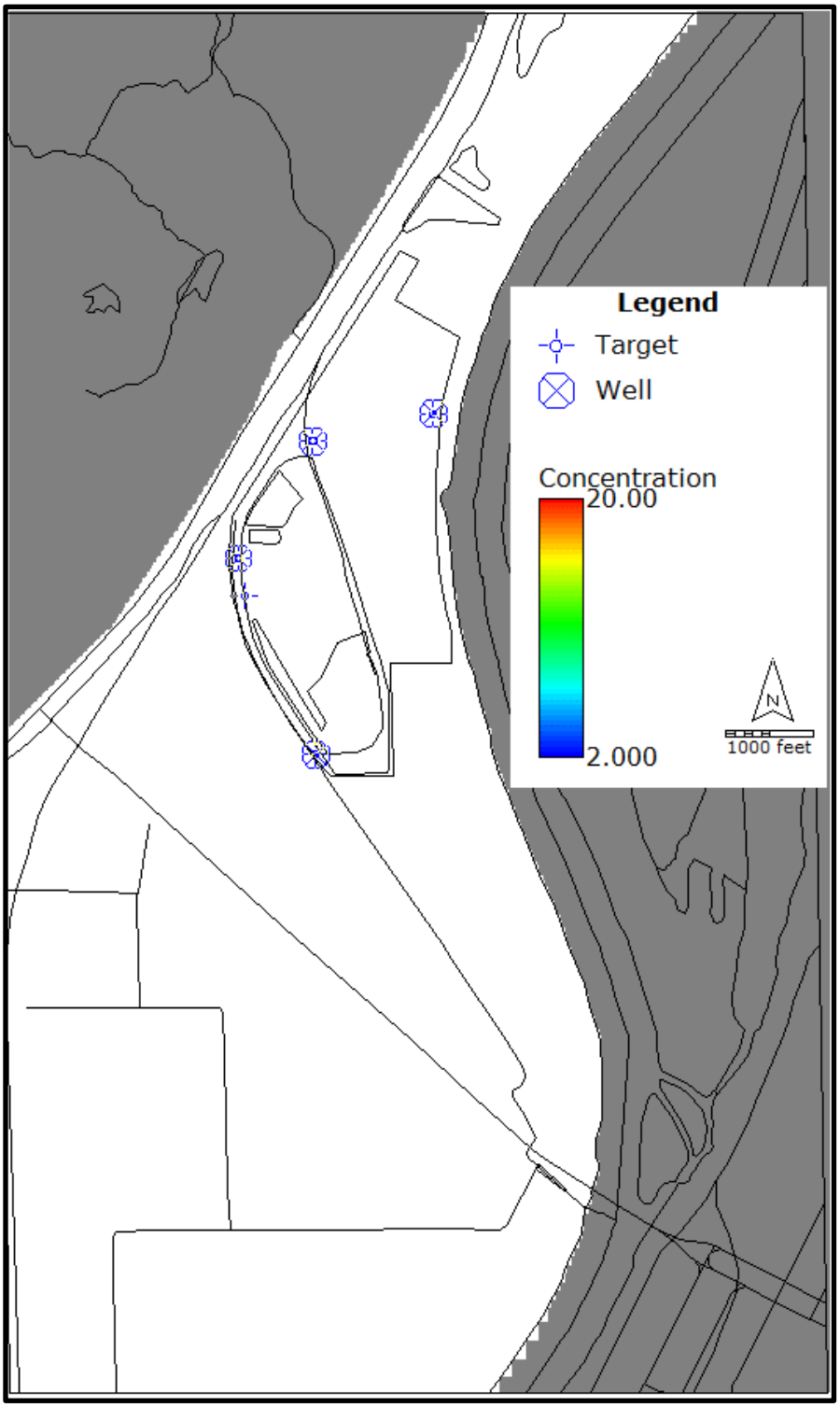
RAMBOLL



LAYER 4 DISTRIBUTION OF BORON CONCENTRATIONS (mg/L) IN THE CALIBRATED MODEL (UA)

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

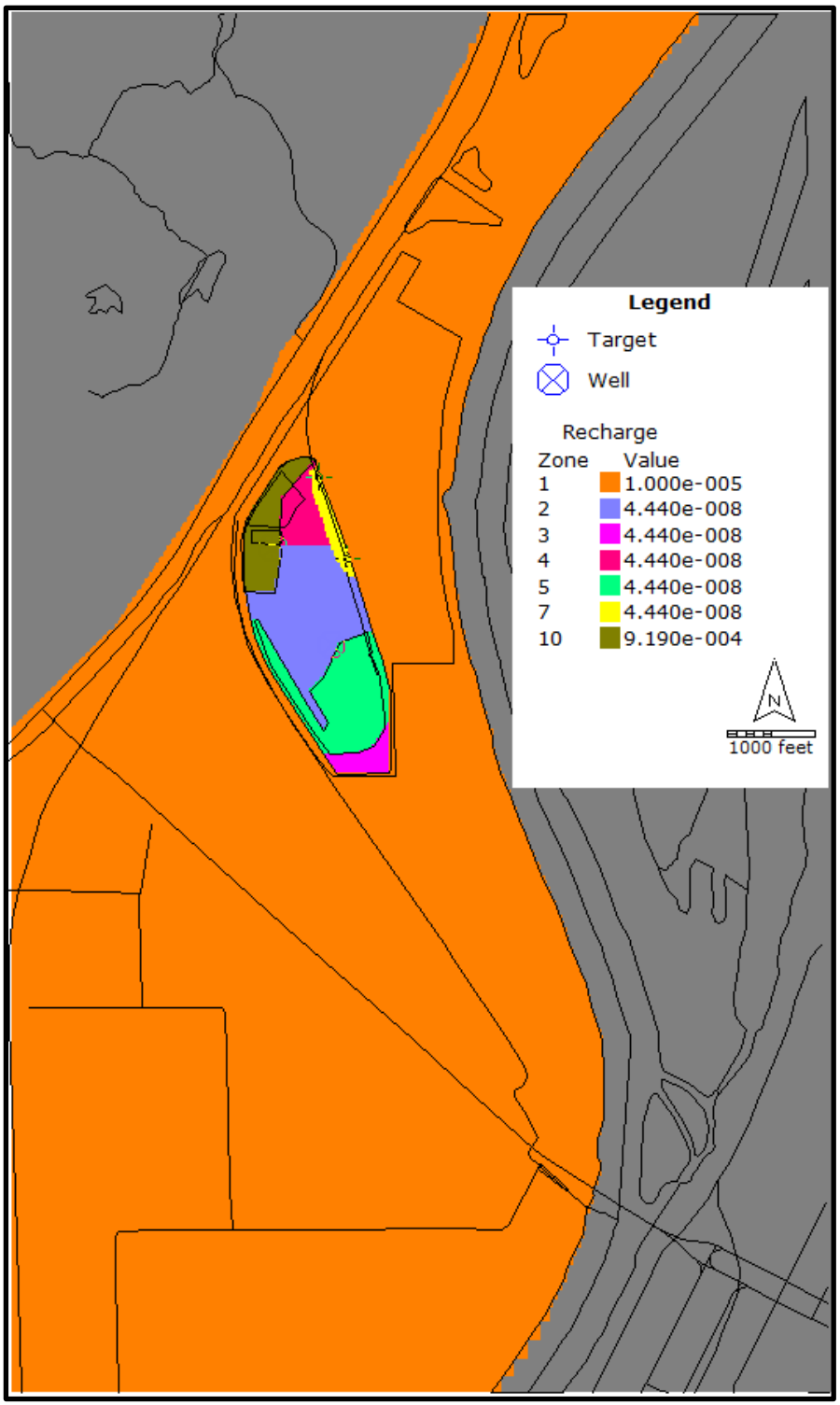
RAMBOLL



LAYER 5 DISTRIBUTION OF BORON CONCENTRATIONS (mg/L) IN THE CALIBRATED MODEL (BCU)

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

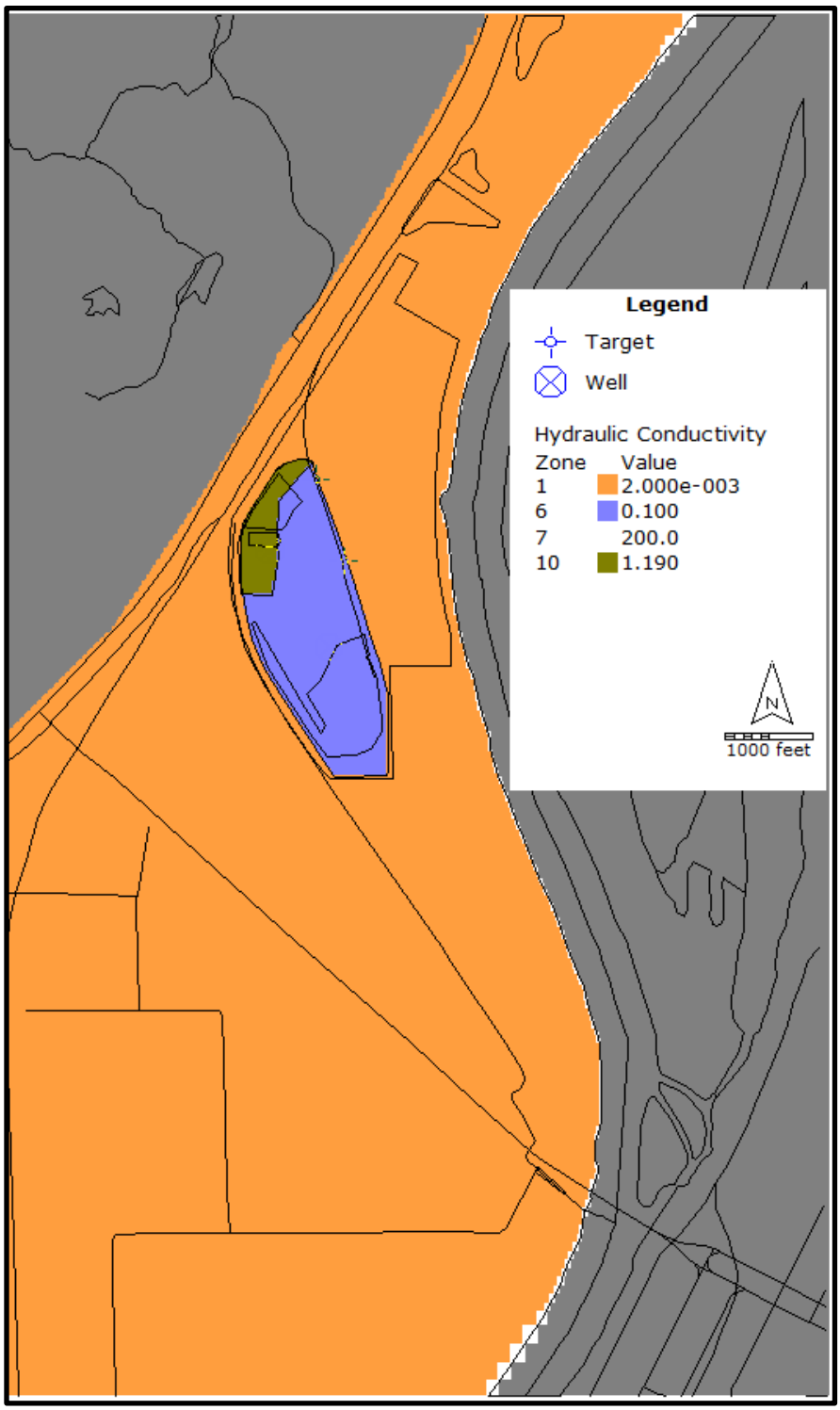
RAMBOLL



DISTRIBUTION OF RECHARGE ZONES (FEET/DAY) FOR CLOSURE IN PLACE

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

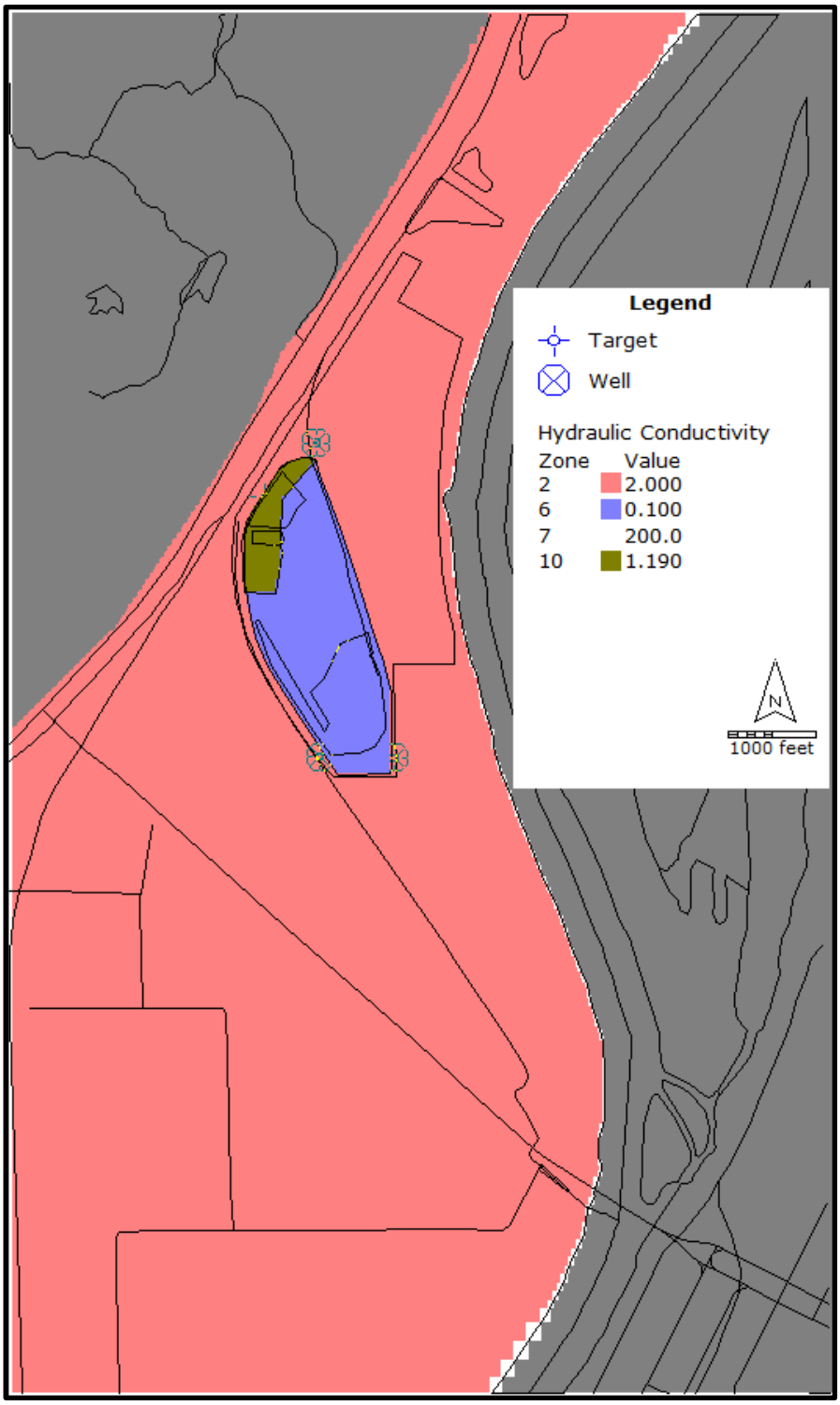
RAMBOLL



DISTRIBUTION OF HYDRAULIC CONDUCTIVITY ZONES (FEET/DAY) FOR LAYER 1 FOR CLOSURE IN PLACE

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

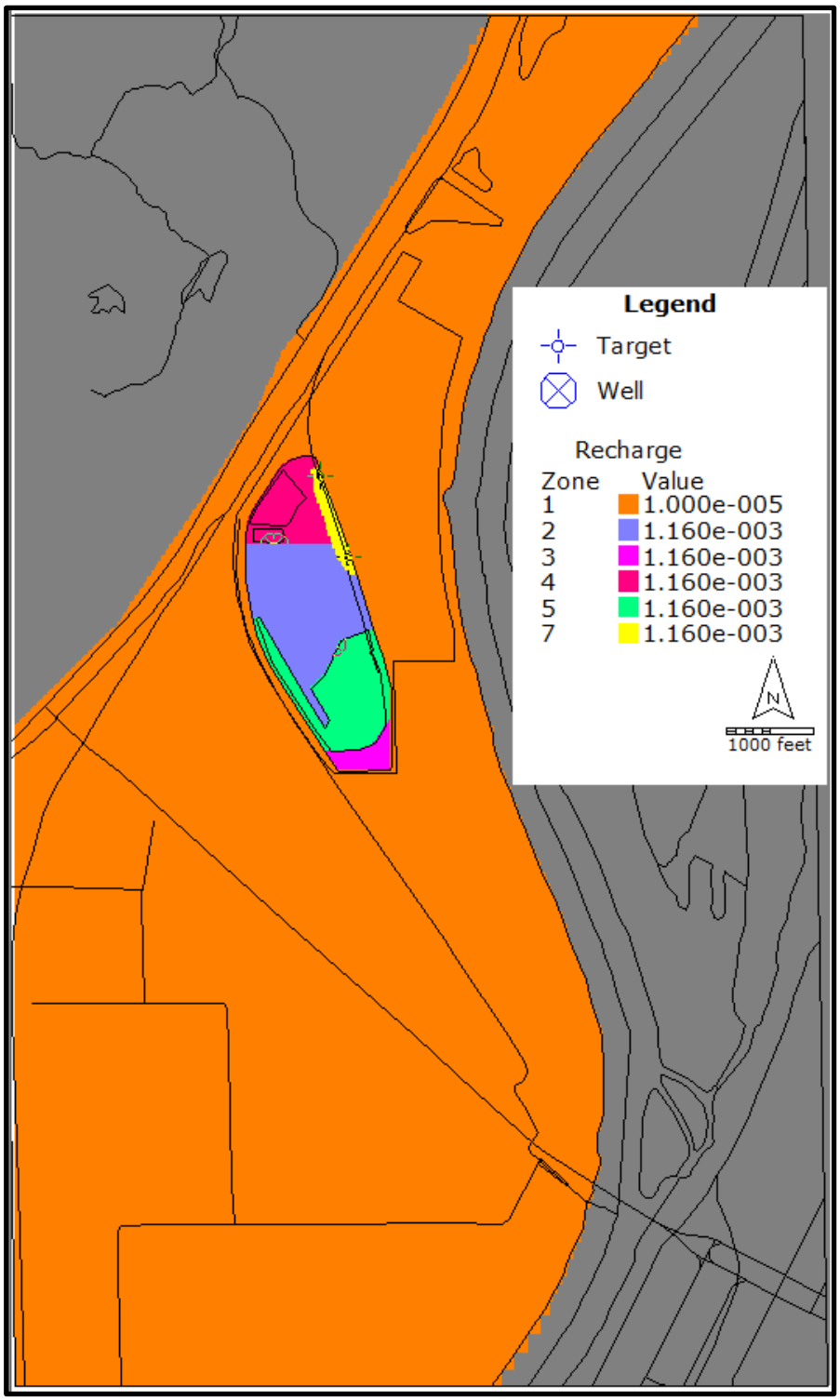
RAMBOLL



DISTRIBUTION OF HYDRAULIC CONDUCTIVITY ZONES (FEET/DAY) FOR LAYER 2 FOR CLOSURE IN PLACE

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

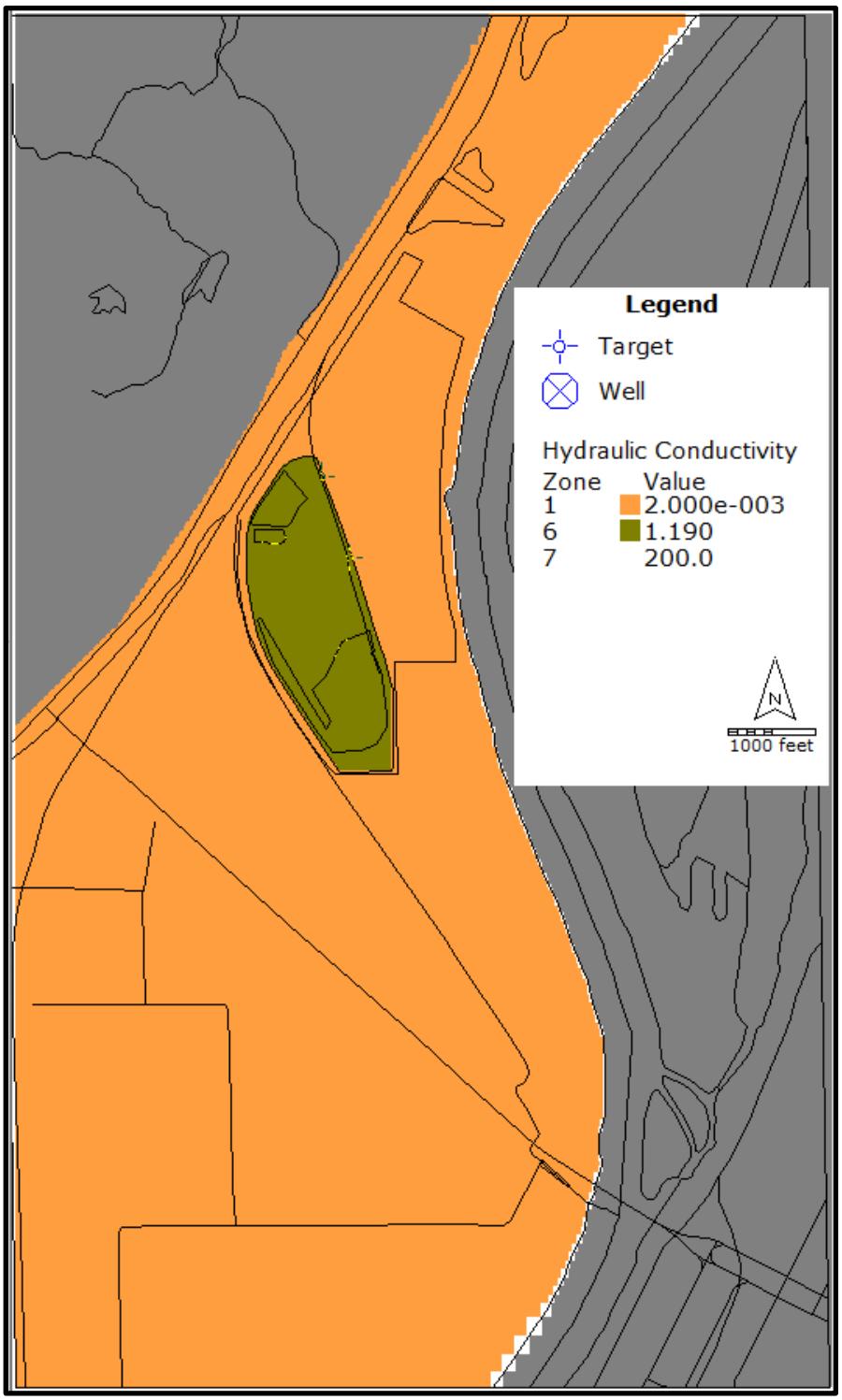
RAMBOLL



DISTRIBUTION OF RECHARGE ZONES (FEET/DAY) FOR CLOSURE BY REMOVAL

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

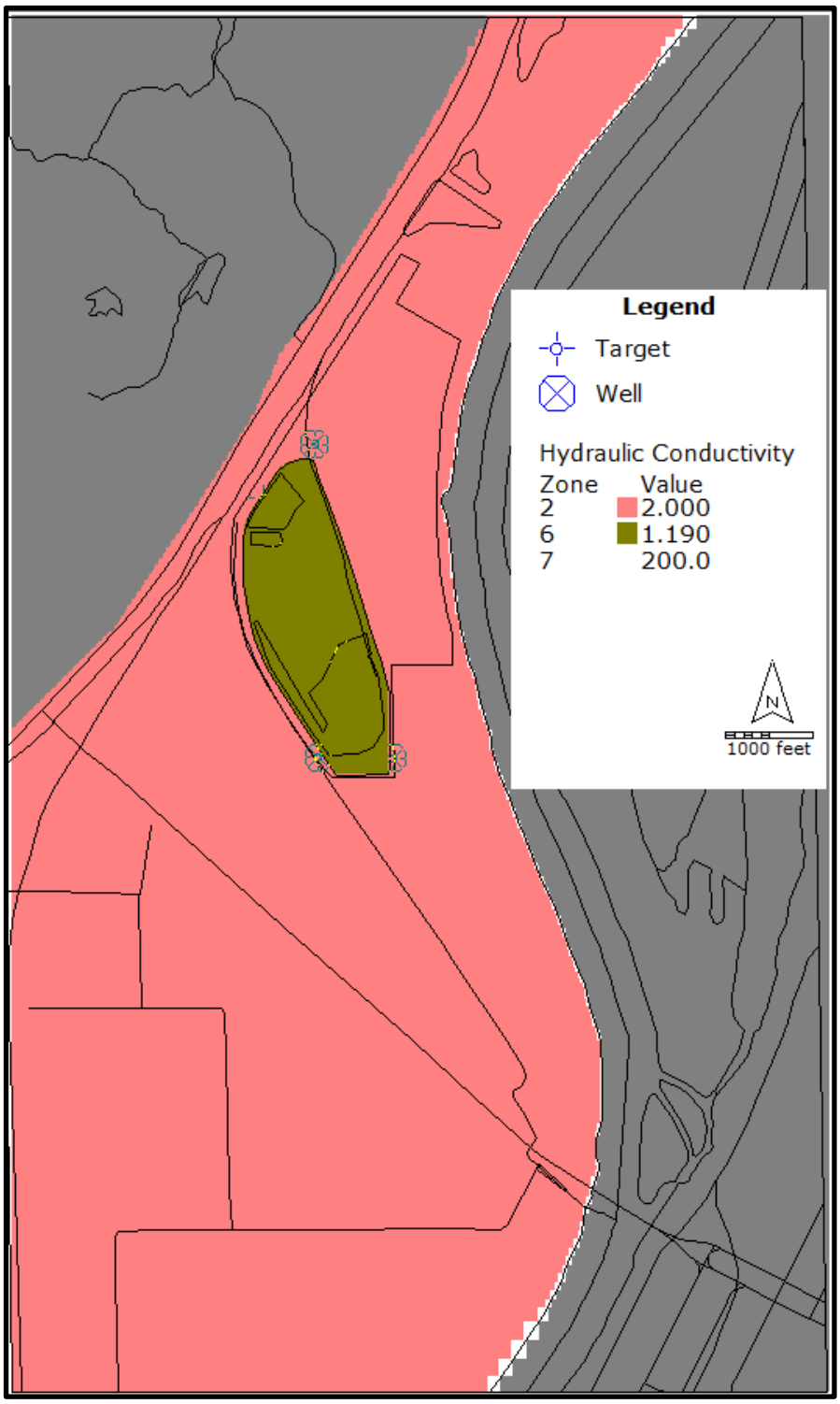
RAMBOLL



DISTRIBUTION OF HYDRAULIC CONDUCTIVITY ZONES (FEET/DAY) FOR LAYER 1 FOR CLOSURE BY REMOVAL

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL

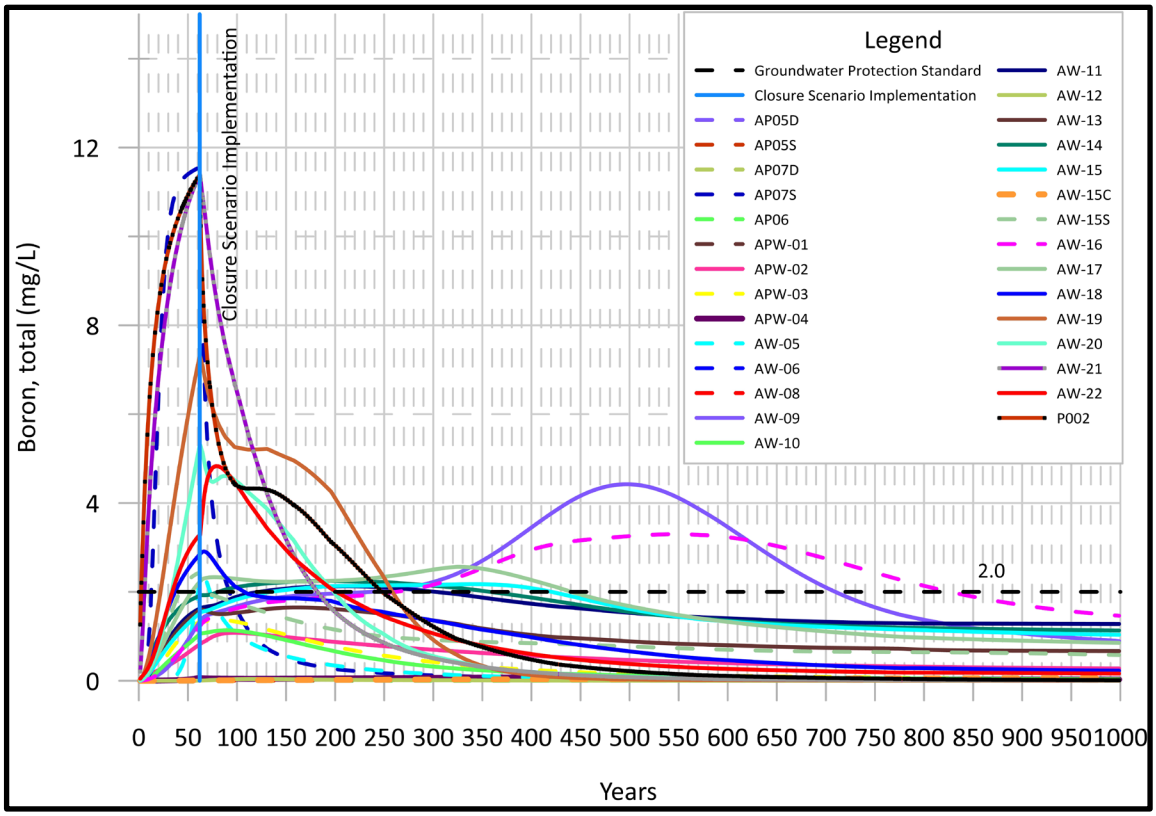


DISTRIBUTION OF HYDRAULIC CONDUCTIVITY ZONES (FEET/DAY) FOR LAYER 2 FOR CLOSURE BY REMOVAL

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL

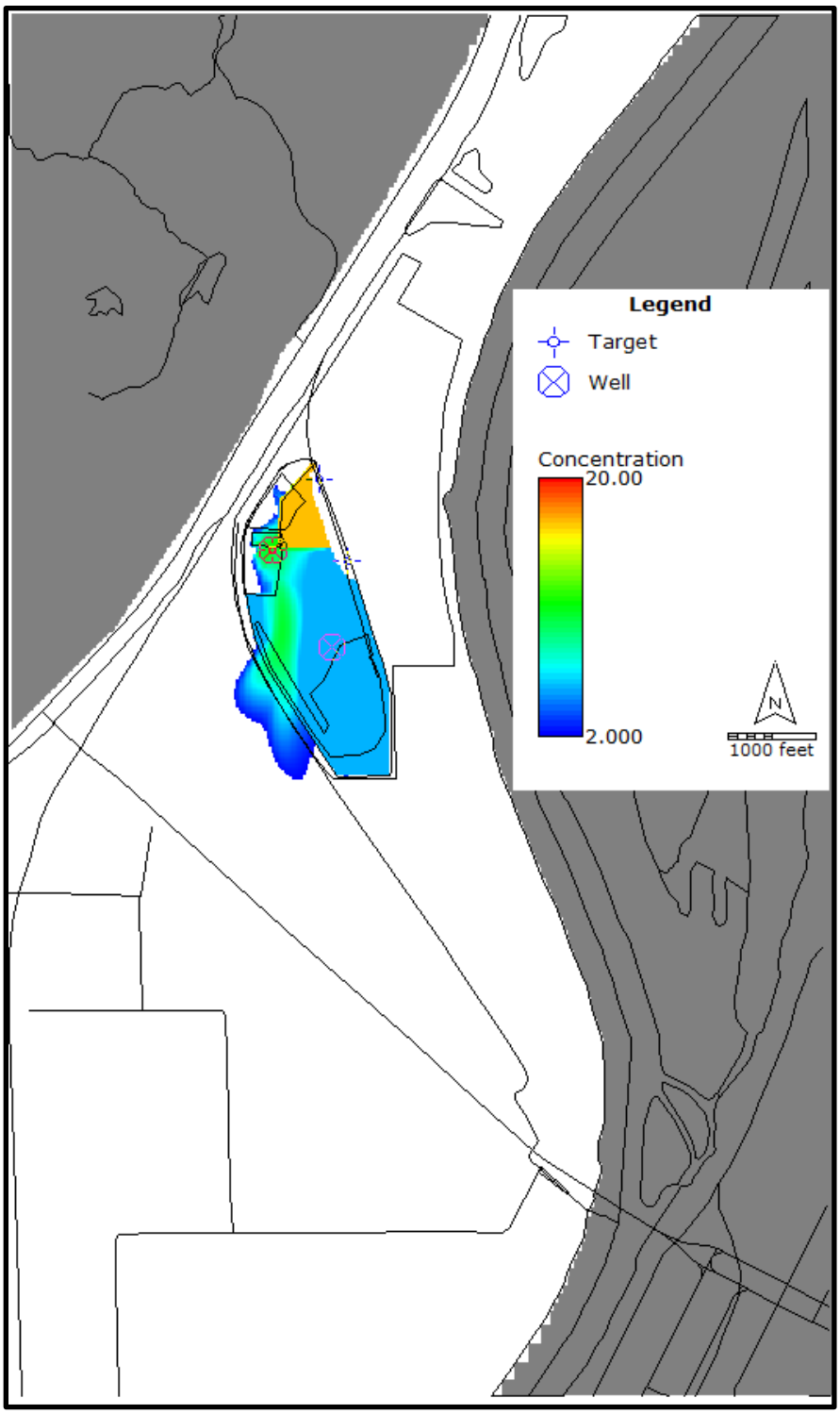
FIGURE 6-7



CIP – MODEL PREDICTED BORON CONCENTRATION

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

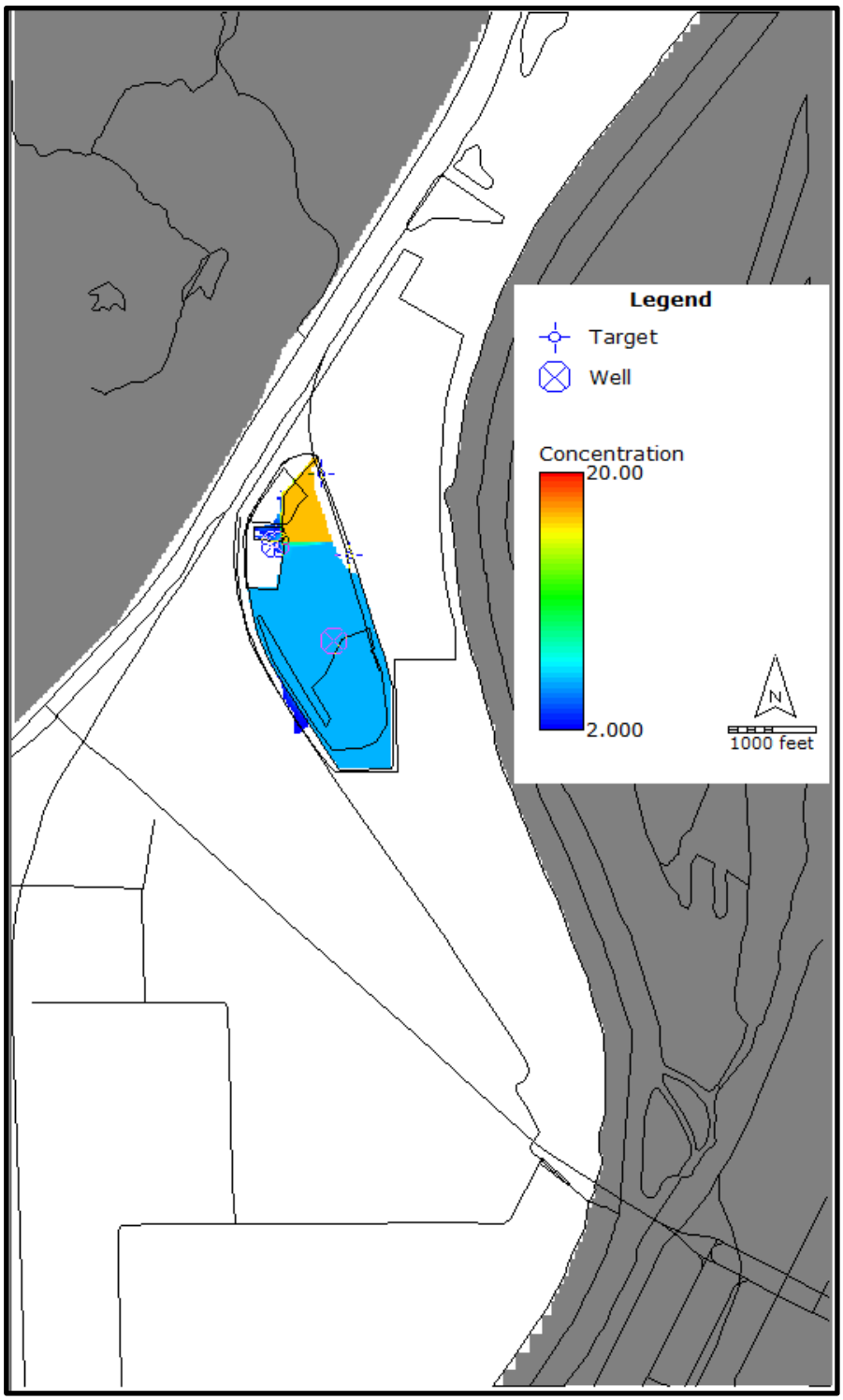
RAMBOLL



CIP – (SCENARIO 1) – MODEL PREDICTED MAXIMUM BORON PLUME IN ALL LAYERS
APPROXIMATELY 382 YEARS AFTER IMPLEMENTATION

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL

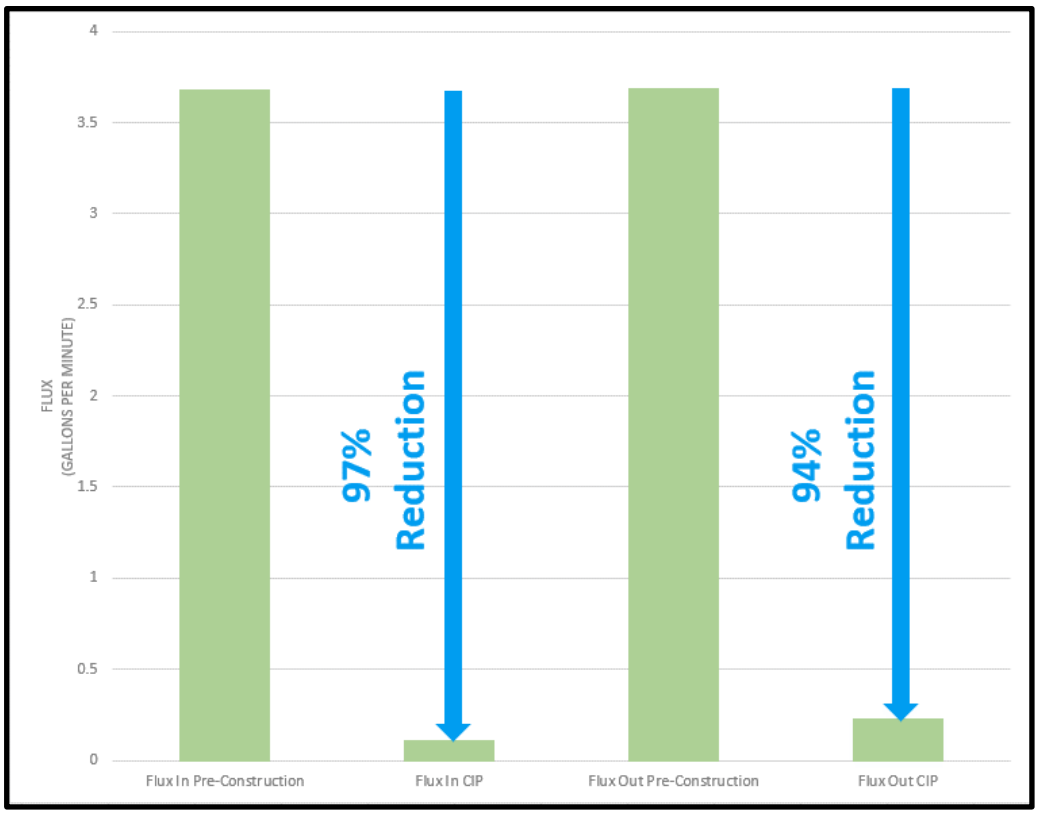


CIP – (SCENARIO 1) – MODEL PREDICTED MAXIMUM BORON PLUME IN ALL LAYERS
APPROXIMATELY 767 YEARS AFTER IMPLEMENTATION

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL

FIGURE 6-10



SCENARIO 1 (CIP) –
HYDRAULIC STEADY STATE REDUCTIONS IN TOTAL FLUX IN AND OUT OF FILL UNIT (CCR)

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

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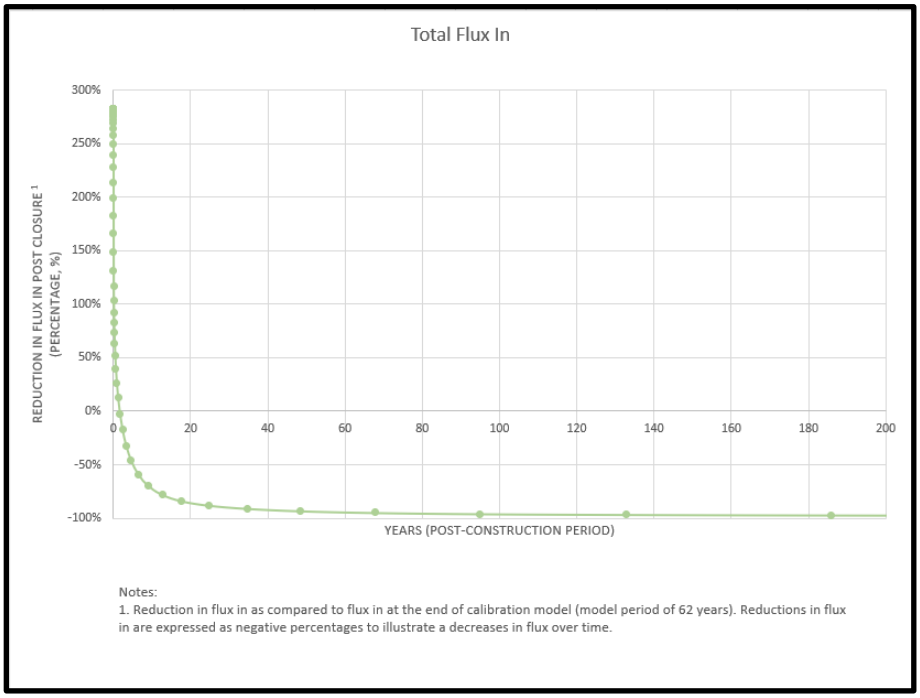
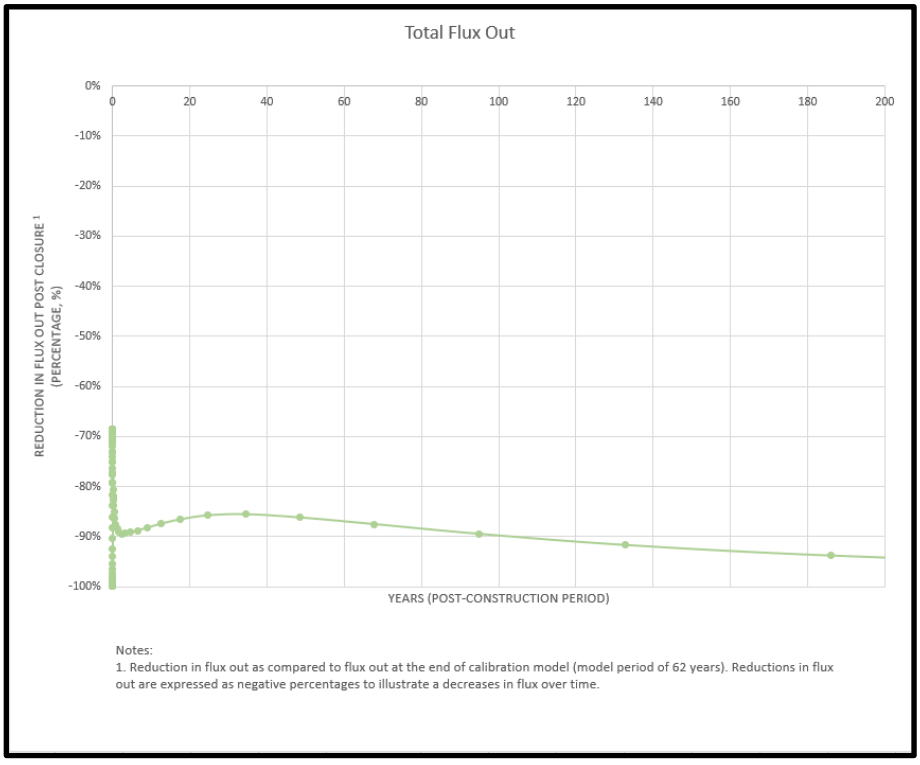


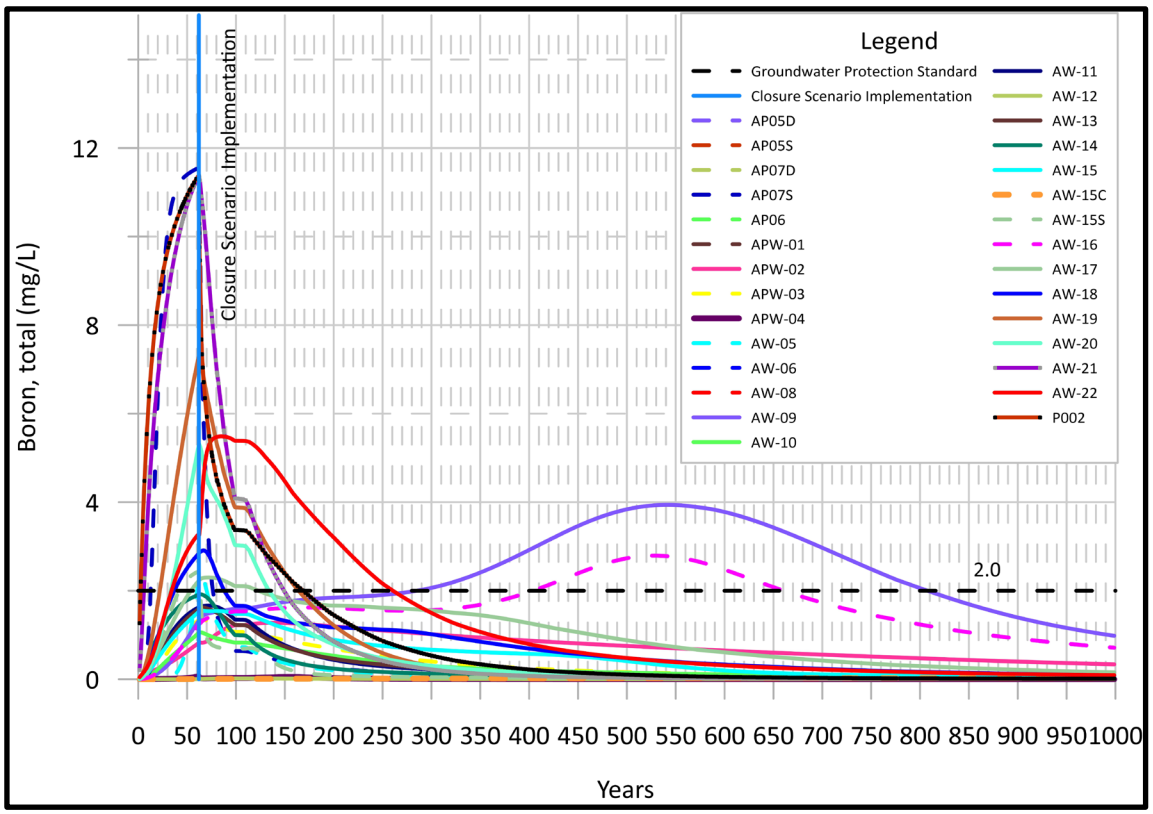


SCENARIO 1 (CIP) –
REDUCTIONS IN TOTAL FLUX IN AND OUT OF FILL UNIT (CCR)

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL

FIGURE 6-12



CBR – MODEL PREDICTED BORON CONCENTRATION

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

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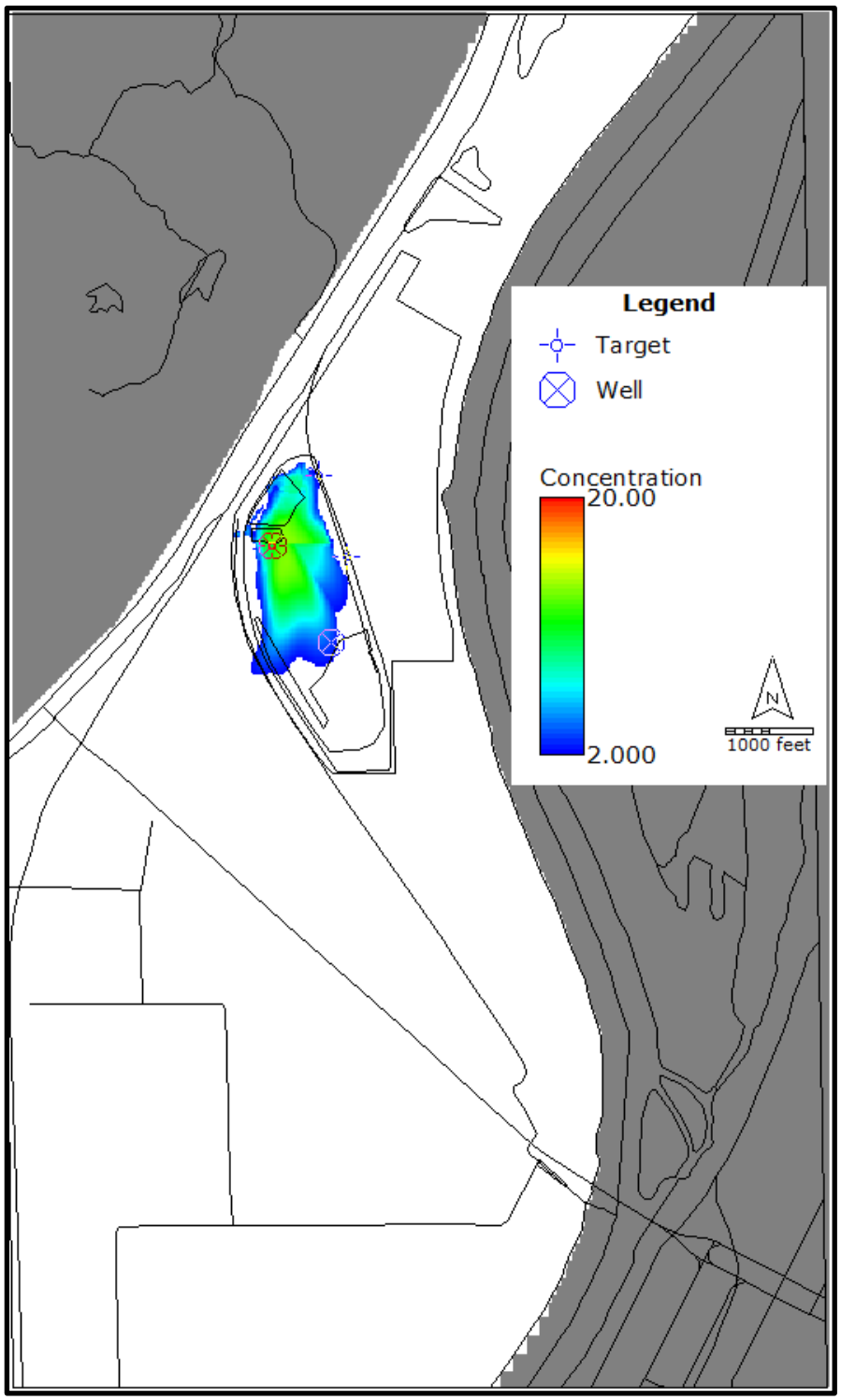
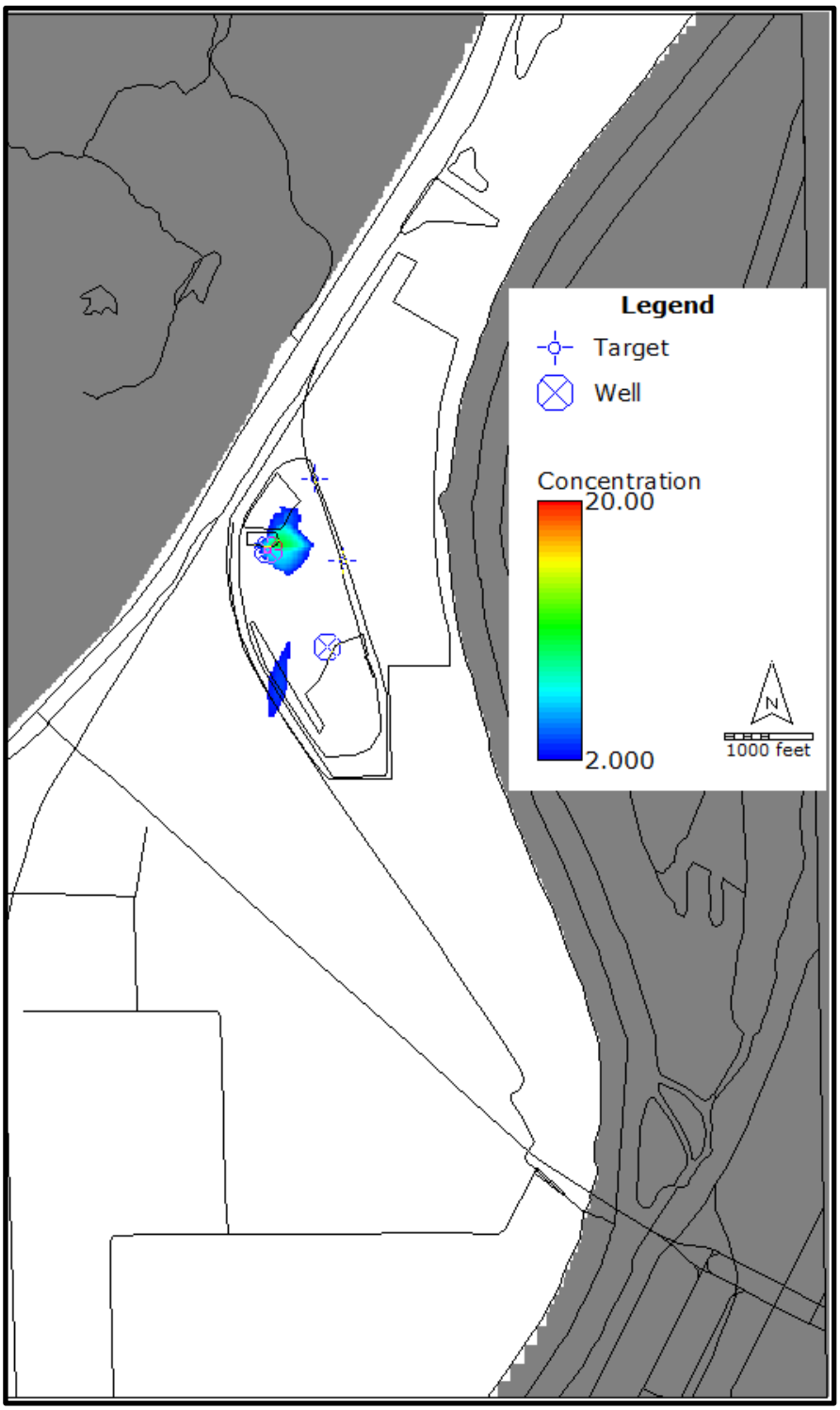


CBR – (SCENARIO 2) – MODEL PREDICTED MAXIMUM BORON PLUME IN ALL LAYERS
APPROXIMATELY 201 YEARS AFTER IMPLEMENTATION

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL



CBR – (SCENARIO 2) – MODEL PREDICTED MAXIMUM BORON PLUME IN ALL LAYERS
APPROXIMATELY 748 YEARS AFTER IMPLEMENTATION

GROUNDWATER MODELING REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

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APPENDIX A
EVALUATION OF POTENTIAL GWPS EXCEEDANCES (GOLDER ASSOCIATES USA INC., 2022)

TECHNICAL MEMORANDUM

DATE April 14, 2022 **Project No.** 21454831

TO David Mitchell, Stu Cravens, Vic Modeer
Illinois Power Resources Generating, LLC.

CC Brian Hennings - Ramboll

FROM Roberta Russell, Jeffrey Ingram, Pat Behling **EMAIL jeffrey.ingram@wsp.com**

EVALUATION OF POTENTIAL GWPS EXCEEDANCES, EDWARDS ASH POND (CCR UNIT 301), EDWARDS POWER PLANT, PEORIA COUNTY, ILLINOIS

1.0 INTRODUCTION

Illinois Power Resource Generating, LLC (IPRG) currently operates the Edwards Power Plant (EPP) located in Peoria County, Illinois. The Edwards Ash Pond (EAP), Illinois Environmental Protection Agency (IEPA ID No. W1438050005 - 01) is a 91-acre unlined surface impoundment used to manage coal combustion residuals (CCRs) at the EPP. The EAP is regulated under Part 845 *"Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments"* (State CCR Rule or Part 845) which was promulgated by the Illinois Pollution Control Board (IPCB) on April 21, 2021.

IPRG is currently preparing a Construction Permit application for the EAP as required under Section 845.220 which requires groundwater modeling be completed for the known potential exceedances of groundwater protection standards (GWPS) as outlined in the Operating Permit application (Burns and McDonnell 2021). In October 2021, Ramboll Americas Engineering Solutions, Inc. (Ramboll) identified potential GWPS exceedances for lithium, chloride and barium in certain monitoring wells in the vicinity of the EAP (Ramboll 2021b). This Technical Memorandum was developed to further evaluate these potential GWPS exceedances.

1.1 Site Setting, Geology, and Hydrogeology

The EPP is located in Peoria County between Mapleton and Bartonville in Section 11, Township 7 North, Range 7 East, on the floodplain of the Illinois River adjacent to a levee. The EPP has one CCR surface impoundment, the Ash Pond, covering approximately 91 surface acres.

The EPP is situated in a predominantly agricultural area with industrial parcels bordering the property. Historically, several coal mines were operated at depths of 100 to 160 feet below ground surface (bgs) in the vicinity of the EPP. The EPP property is bordered by a salt processing facility to the north, railroad right-of-way and former Orchard Mines to the west, the Illinois River and a fertilizer production facility to the east, and agricultural land to the south.

Four hydrogeologic units are present at the EPP. They are described as follows in the Hydrogeologic Site Characterization Report (Ramboll 2021c), in downward order:

- **CCR:** Saturated CCR consisting primarily of fly ash within the Ash Pond. CCR is present at thicknesses up to 46.5 feet and at elevations as low as 413.9 feet North American Vertical Datum of 1988 (NAVD88) in the central and northern portion of the Ash Pond**.**
- **Upper Cahokia Formation/Potential Migration Pathway (PMP):** Low-permeability clays and silts of the Upper Cahokia Formation are present at the surface. This unit is considered a PMP at elevations similar to the base of the Ash Pond, and in places where thin discontinuous sand lenses occur within the Upper Cahokia Formation adjacent to the Ash Pond.
- **Uppermost Aquifer (UA):** Thin (generally less than 4 feet), moderate-permeability sand, silty sand, and clayey gravel material within the Lower Cahokia Formation, bedrock, and/or weathered shale bedrock, where present. In locations where higher-permeability materials and coarser-grained materials are absent, the Uppermost Aquifer is interpreted as the interface between the Lower Cahokia Formation and the Bedrock Confining Unit.
- **Bedrock Confining Unit (BCU):** Thick, very low-permeability shales and siltstones of the Carbondale and Modesto Formations. This unit was encountered at elevations ranging from approximately 400 to 422 feet NAVD88 with higher bedrock elevations occurring beneath the northern portion of the Ash Pond. In general, the Upper Cahokia Formation consists of low-permeability clays and silts, with limited occurrences of thin, discontinuous sand lenses. In several locations, generally near the southern and western portions of the unit, coarser-grained materials are present at the base of the Lower Cahokia Formation and/or the top of the bedrock is weathered, resulting in relatively higher hydraulic conductivities. Because the interface is laterally continuous and has relatively higher conductivity, the unlithified/lithified upper contact was designated as the Uppermost Aquifer.

Occasional sand lenses within the Upper Cahokia Formation and downgradient clay intervals present at elevations similar to the base of ash in the Ash Pond were identified as PMPs. The underlying BCU is interpreted as the confining base of the aquifer, with hydraulic conductivities generally two orders of magnitude lower than those measured in the Uppermost Aquifer (Ramboll 2021c).

Groundwater flows east to west in the central portion of the EAP, south/southeast at the south end of the EAP and to the north/northwest at the north end of the EAP (Ramboll 2021b) (**Figure 1**).

2.0 POTENTIAL GWPS EXCEEDANCES REVIEW

As required by Section 845.230 (d)(2)(M), an evaluation of the history of potential GWPS exceedances was completed for the Operating Permit application (Burns and McDonnell 2021 and Ramboll 2021b). Water quality data from groundwater samples collected from the EAP monitoring well network since February 2021 were evaluated using the statistical methods described in the Statistical Analysis Plan included in the Operating Permit application (Ramboll, 2021b). The following potential exceedances of the GWPSs were evaluated in this Technical Memorandum:

- Barium at monitoring well AW-15C: A barium exceedance (2.9 mg/L) in this well was reported based on calculation of a confidence interval around the mean of samples collected during 2021. AW-15C is located downgradient from the EAP and the screened interval is within a shale unit of the BCU.

- Chloride at monitoring well AP07D: A chloride exceedance (498 mg/L) in this well was reported based on calculation of a confidence interval around the mean of samples collected during 2021. AP07D is located downgradient from the Ash Pond; the screened interval is within a siltstone unit of the BCU.
- Lithium at monitoring well AP05D: A lithium exceedance (0.077 mg/L) in this well was reported based on calculation of a future median (i.e. a median of the three most recent samples) of samples collected during 2021. AP05D is located cross-gradient from the EAP and the screened interval is within a siltstone unit of the BCU.
- Lithium at monitoring well AP07D: A lithium exceedance (0.15 mg/L) in this well was reported based on calculation of a future median of samples collected during 2021. AP07D is located downgradient from the EAP and the screened interval is within a siltstone unit of the BCU.

3.0 COMPOSITIONAL ANALYSIS OF GEOLOGIC MATERIAL

3.1 Chemical Composition and Sequential Extraction

Results from sequential extractions and chemical analysis were used to determine the chemical composition of the BCU and the distribution of barium and lithium over various operationally-defined fractions in the BCU material. This testing was conducted on three samples collected from two boreholes (E-SB-05 and E-SB-07; Figure 1) advanced within the BCU. Results are presented in Section 4.0.

A description of the sequential extractions is presented in Footnote 1, Section 4.0. Metals extracted in steps 1 through 5 are considered environmentally available, whereas metals extracted in steps 6 and 7 are present in refractory fractions and are not expected to be released under conditions typically encountered in aquifers (Tessier et al. 1979). Total metal quantities from the sequential extraction are expressed as “SEP Total”, extracted by a discrete total step (separate aliquot of same sample). The sum of the sequential extraction steps is also calculated but does not represent an analytically determined value. The leachates produced during each step of the sequential extractions and the total metals step were analyzed for metal concentrations using US EPA SW-846 Method 6010B.

3.2 Mineralogical Composition

Quantitative X-ray diffraction (XRD) with Rietveld refinement was used to identify and quantify minerals in three BCU samples collected from two borings (E-SB-05 and E-SB-07) during drilling activities. These samples were obtained to determine the mineralogical composition of the BCU and identify any naturally occurring minerals that have the potential to release constituents of potential concern into groundwater. The mineralogical results are presented in Table 1. The mineralogical composition primarily included quartz and feldspars (58 – 63%) and phyllosilicates muscovite, chlorite and biotite (33 – 36%). The samples also contained from less than 1% - 6% carbonates (e.g. dolomite, calcite, siderite) and 1% iron or titanium oxides.

4.0 EVIDENCE THAT POTENTIAL GWPS EXCEEDANCES ARE NOT RELATED TO THE EAP

Groundwater quality data for samples collected from monitoring wells that exhibited potential GWPS exceedances, background monitoring well AP05S, upgradient monitoring wells, and pore water samples from the EAP were evaluated. The review indicates that the GWPS exceedances are not related to the EAP, as described in the lines of evidence that follow:

- **In accordance with the procedures of the Statistical Analysis Plan, barium, chloride, or lithium did not occur statistically above the GWPS in any wells completed within the shallower UA and paired with or upgradient of AP05D, AP07D and AW-15C.**

Shallow paired wells are completed adjacent to AP05D (AP05S), AP07D (AP07S) and AW-15C (AW-15S and AW-15) in either the PMP or the UA. Groundwater samples collected from the shallow paired wells did not contain concentrations of barium, chloride, or lithium above the site GWPS (Table 2). In addition, wells between these locations and the Ash Pond (in a vertical migration pathway), or upgradient of these locations did not detect concentrations above the GWPS for these parameters. This includes AW-16 (upgradient of AW-15C), AW-21 and AW-22 (upgradient of AP07D). There are no monitoring wells directly upgradient of AP05D. A cross section location map and cross section showing the hydraulic positions of these wells is presented on Figures 2 and 3. The elevated concentrations of barium, chloride or lithium are not attributed to the Ash Pond because the migration pathway is not impacted (i.e. concentrations of the constituents in paired wells completed in the UA, which overlies the BCU, would be equal to or greater than the paired/exceedance wells completed in the BCU). Figures 4 to 6 show concentrations of barium, chloride and lithium in groundwater from the wells with GWPS exceedances; their respective paired wells AP05S, AP07S, AW-15, and AW-15S; and upgradient wells AW-16, AW-21, and AW-22.

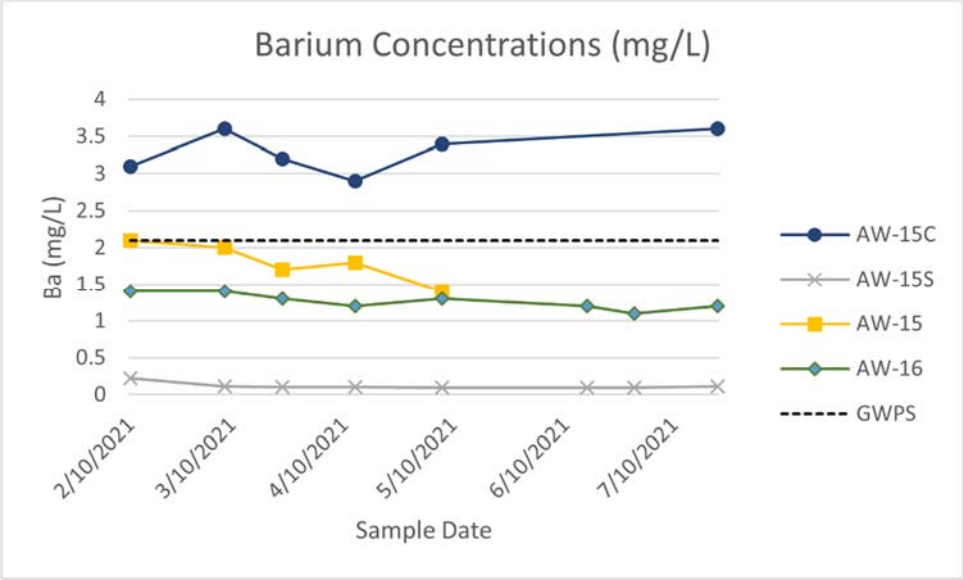

Figure 4. Barium (Ba) concentrations in groundwater from exceedance well AW-15C, shallow paired wells AW-15S and AW-15, and upgradient well AW-16

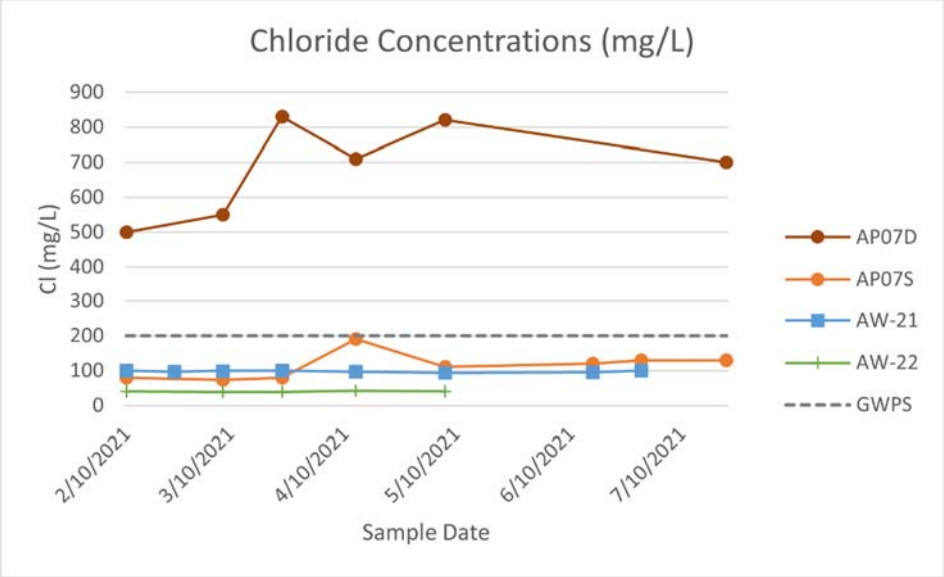

Figure 5. Chloride (Cl) concentrations in groundwater exceedance well AP07D, shallow paired well AP07S, and upgradient wells AW-21 and AW 22

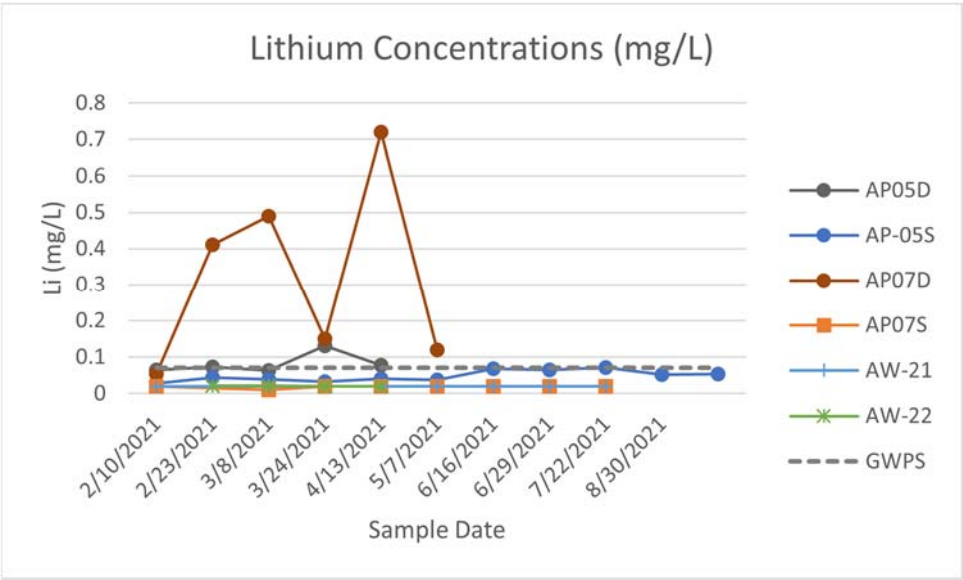

Figure 6. Lithium (Li) concentrations in groundwater exceedance wells AP05D and AP07D, shallow paired wells AP05S and AP07S, and upgradient wells AW21 and AW22

- **Concentrations of key CCR tracer constituents in EAP pore water samples differ significantly from groundwater in BCU monitoring wells AP05D, AP07D, and AW-15C.**

Concentrations of indicator parameters typically associated with the CCR managed in the EAP (e.g., boron, chloride, and sulfate) differ between porewater in the EAP and groundwater in the BCU wells AP05D, AP07D, and AW-15C. Data from the May 2021 sampling event for pore water, the BCU/exceedance wells, the shallow paired wells, and the background well are summarized in Table 3. Boron and sulfate concentrations are higher while chloride concentrations are lower in CCR porewater samples when compared to groundwater concentrations in

the wells with GWPS exceedances and the background well. The relative proportions of these constituents in porewater versus the BCU/exceedance wells differ as well, as shown on the ternary diagram (Figure 7). The BCU/exceedance wells plot with the background well AP05S on the ternary diagram. The EAP porewater plots closer to the sulfate apex than the background and exceedance wells. Given the conservative behavior of sulfate and boron (see next paragraph for more detail on sulfate), if the EAP were the source, groundwater in the exceedance wells would plot in between the background groundwater and EAP pore water compositions. The concentrations of chloride in the porewater are consistently lower than in AP07D, as discussed in the next line of evidence

Sulfate, unlike boron and chloride, is sensitive to redox conditions (e.g., reduction of sulfate to sulfide) and may also be affected by the precipitation of sulfate-bearing minerals. These geochemical processes may alter sulfate concentrations in Site groundwater and affect the interpretive value of graphical methods such as ternary diagrams. To evaluate the potential for sulfate reactions in porewater and groundwater (which could affect the interpretation of sulfate concentration data), precipitation of sulfate-bearing minerals was evaluated with the help of the geochemical modeling code PHREEQC (Parkhurst and Appelo 2013), using a saturation index (SI) calculation:

$$SI = \log (IAP/Ksp)$$

The saturation index is the ratio of the ion activity product (IAP) of a mineral to the solubility product (Ksp). An SI value greater than zero indicates that the solution is supersaturated with respect to a particular mineral phase and, therefore, precipitation of this mineral may occur. An evaluation of precipitation kinetics is then required to determine whether the supersaturated mineral will indeed form. An SI value less than zero indicates the solution is undersaturated with respect to a particular mineral phase. An SI value close to zero indicates equilibrium conditions exist between the mineral and the solution. SI values between -0.5 and 0.5 are generally considered to represent ‘equilibrium’ in this report to account for the uncertainties inherent in the analytical methods and geochemical modeling (Nordstrom and Alpers 1999). The widely accepted thermodynamic database Minteq.v4, 2017 edition (USEPA 1998b, as amended), was used as a basis for the thermodynamic constants required for modeling, with additions and modifications from recent literature as required. Relevant sulfate-bearing minerals that were evaluated included gypsum, barite, and others that would be kinetically feasible to form under low-temperature conditions, as listed in Table 6.10 in Nordstrom and Alpers (1999). Calculated mineral SIs are presented in Table 4.

The geochemical modeling indicates that sulfate-bearing minerals are undersaturated across the Site, with the exception of barite. However, barite precipitation will be minimal, and is not expected to be a significant influence on sulfate concentrations in groundwater. Additionally, slightly oxidizing to oxidizing redox conditions were observed in Site groundwater (average Eh of +270 mV), indicating that reduction of sulfate to sulfide is not occurring. As such, sulfate in Site groundwater behaves conservatively and can be used as a tracer for potential EAP impacts.

These observations support that the GWPS exceedances of Ba in AW-15C, Li in AP05D, and Li and Cl in AP07D are not related to the EAP.

Table 3. Concentrations of boron, sulfate and chloride in exceedance wells and EAP pore water samples.

Well ID	Date	Boron (mg/L)	Sulfate (mg/L)	Chloride (mg/L)
Background Well				
AP-05S	5/7/2021	0.36	2.7	43
Bedrock Confining Unit Wells (GWPS Exceedance Wells)				
AP05D	5/7/2021	1.6	1.3	510
AP07D	5/5/2021	1.4	47	820
AW-15C	5/6/2021	0.63	<1	63
EAP Pore Water Samples				
XPW01A	5/4/2021	17	210	47
XPW02	5/4/2021	15	950	120
XPW03	5/4/2021	5.5	280	86

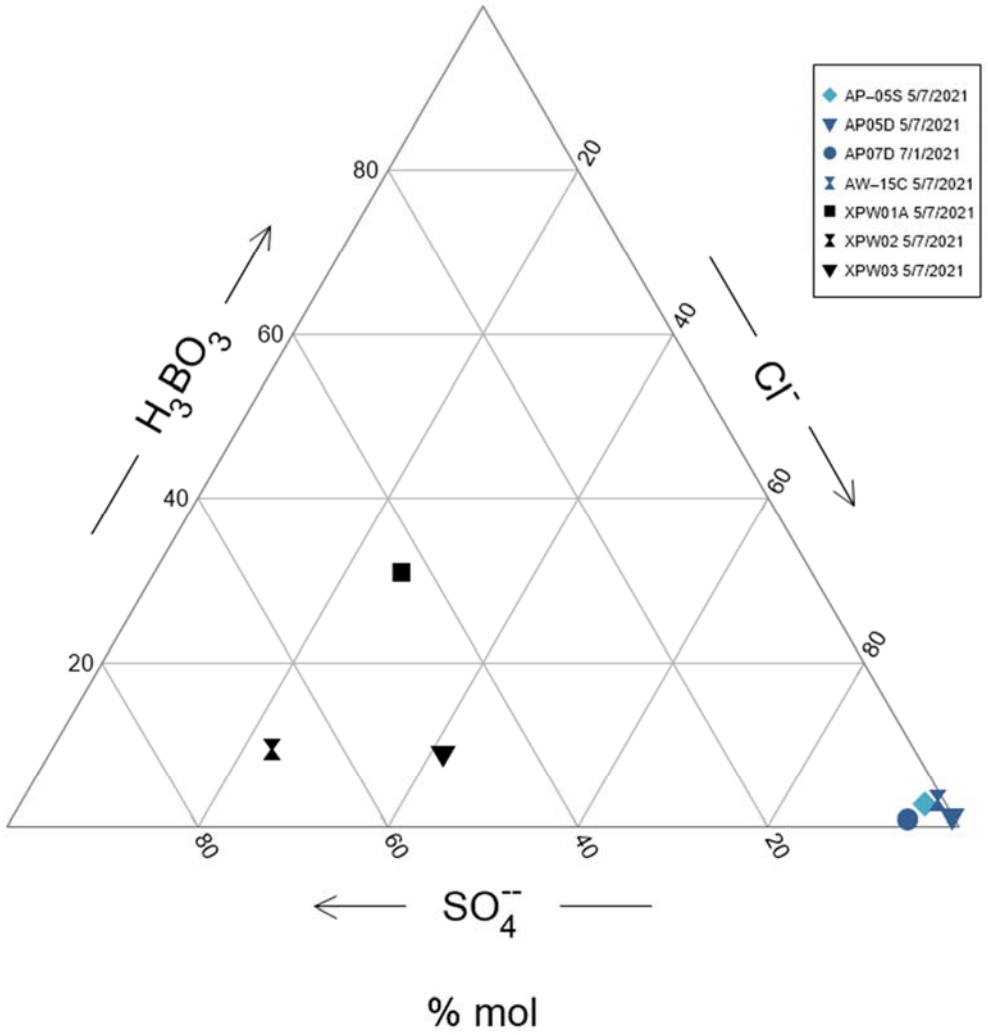

Figure 7: Ternary diagram showing relationships between CCR tracers boron, chloride, and sulfate.

- **Barium and chloride concentrations in CCR porewater are consistently lower than in BCU wells AW-15C and AP07D.**

Barium and chloride concentrations are consistently lower in CCR porewater than in BCU wells AW-15C and AP07D, as shown on **Figures 8 and 9**. Therefore, barium and chloride cannot be sourced from the CCR porewater.

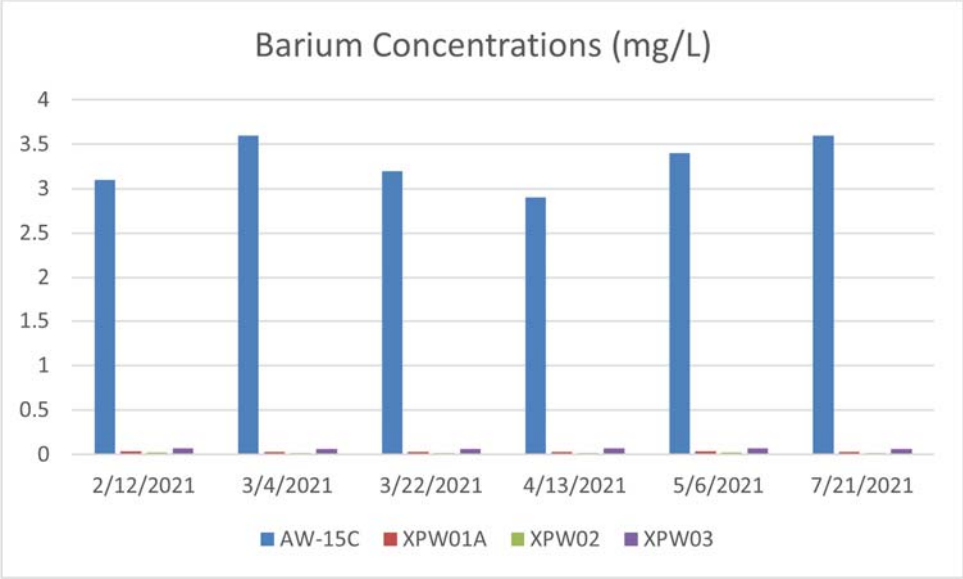

Figure 8. Barium concentrations in monitoring well AW-15C and CCR porewater samples XPW01A, XPW02 and XPW03.

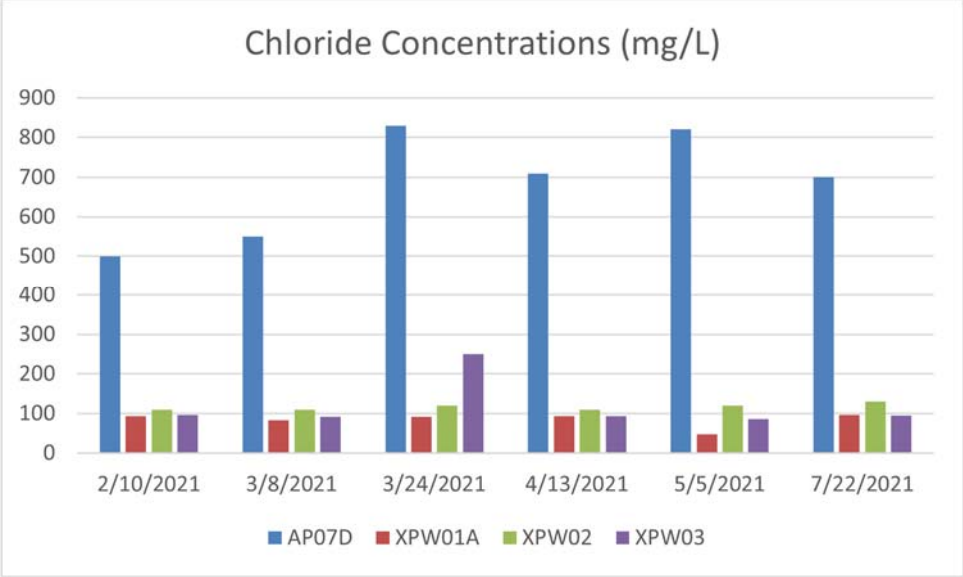

Figure 9. Chloride concentrations in monitoring well AP07D and CCR porewater samples XPW01A, XPW02 and XPW03.

- **Barium, lithium and chloride are naturally occurring constituents of the BCU.**

Barium, lithium, and chloride occur naturally within the BCU. Samples collected from the BCU aquifer matrix were analyzed for total concentrations and sequential extractions[1] were performed for barium and lithium. Total concentrations were between 390 and 480 mg/kg and 42 and 49 mg/kg for barium and lithium, respectively. For comparison, consensus average crustal barium and lithium concentrations are very similar, at 430 mg/kg and 30 mg/kg, respectively, with ranges of 179 to 1,070 mg/kg and 18 to 65 mg/kg (Smith and Huyck 1999). According to Hem (1985), average concentrations of barium and lithium in typical shale, such as the shale that comprises the BCU (Section 1.1) are 250 and 46 mg/kg, respectively.

The results of the sequential extractions are summarized in **Figures 10** and **11** for barium and lithium, respectively. As indicated in the figures, the majority of barium and lithium is present in fractions that have limited environmental availability under typical groundwater conditions, i.e. the acid/sulfide fraction and the residual fraction (and organic fraction for barium). The remainder of the barium and lithium occurs within the environmentally available fractions (exchangeable, carbonate, amorphous and metal hydroxide). As such, a natural reservoir for these parameters is present, albeit that their release from aquifer solids will likely be slow.

[1] Sequential extraction of metals from overburden samples consisted of seven discrete steps for this investigation:

Step 1 - Exchangeable Fraction: This extraction includes trace elements that are reversibly adsorbed to overburden minerals, amorphous solids, and/or organic material by electrostatic forces.

Step 2 - Carbonate Fraction: This extraction targets trace elements that are adsorbed or otherwise bound to carbonate minerals (carbonate minerals comprised between 1-6 percent of BCU samples).

Step 3 - Non-Crystalline Materials Fraction: This extraction targets trace elements that are complexed by amorphous minerals (e.g., iron).

Step 4 - Metal Hydroxide Fraction: Trace elements bound to hydroxides of iron, manganese, and/or aluminum.

Step 5 - Organic Fraction: This extraction targets trace elements strongly bound via chemisorption to organic material.

Step 6 - Acid/Sulfide Fraction: The extraction is used to identify trace elements precipitated as sulfide minerals.

Step 7 - Residual Fraction: Trace elements remaining in the overburden after the previous extractions will be distributed between silicates, phosphates, and refractory oxides (silicates and refractory oxides comprised between 94-99% of BCU samples).

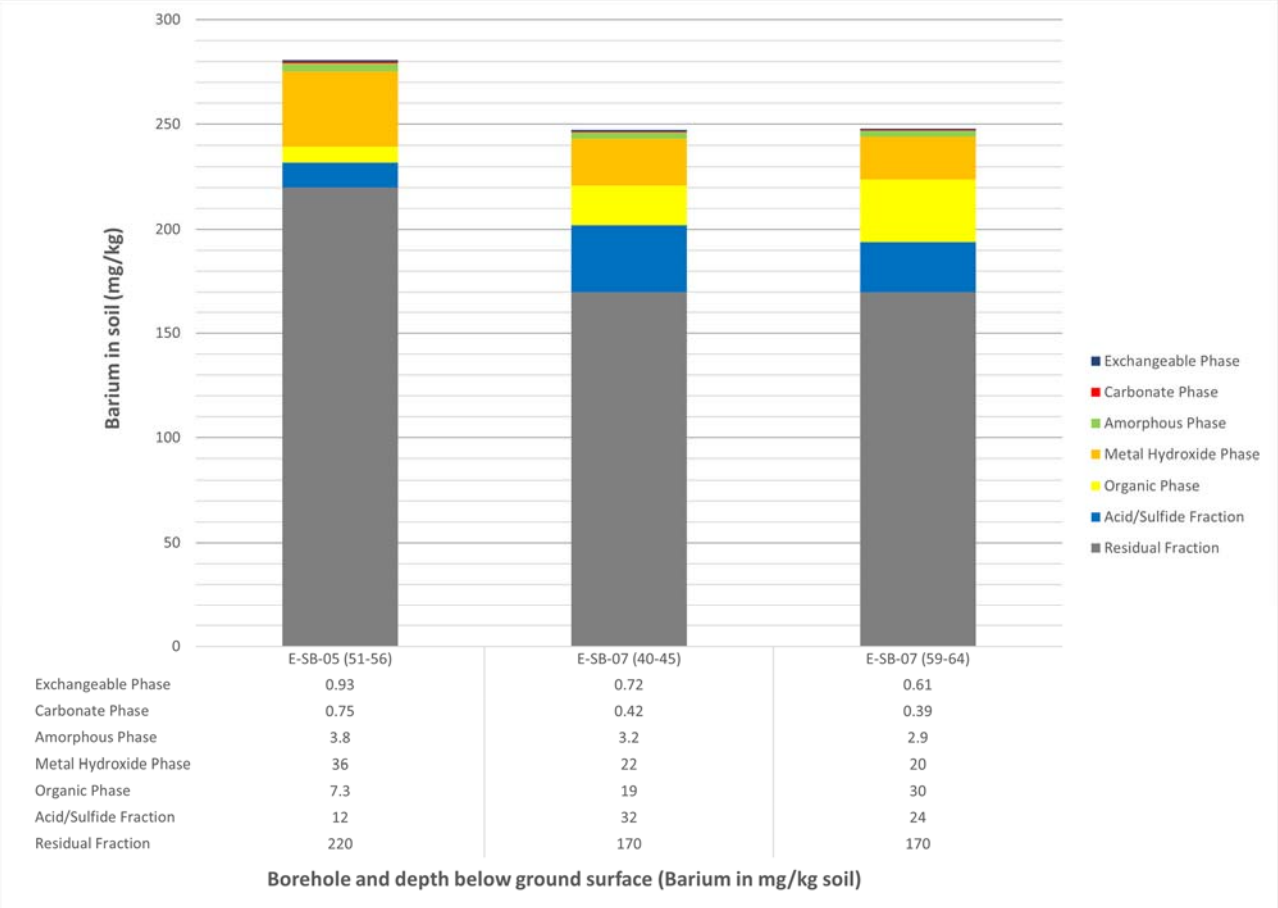

Figure 10. Sequential extraction results for barium. Concentrations in mg/kg are shown at the bottom of the figure, with the distribution presented in the bar graphs.

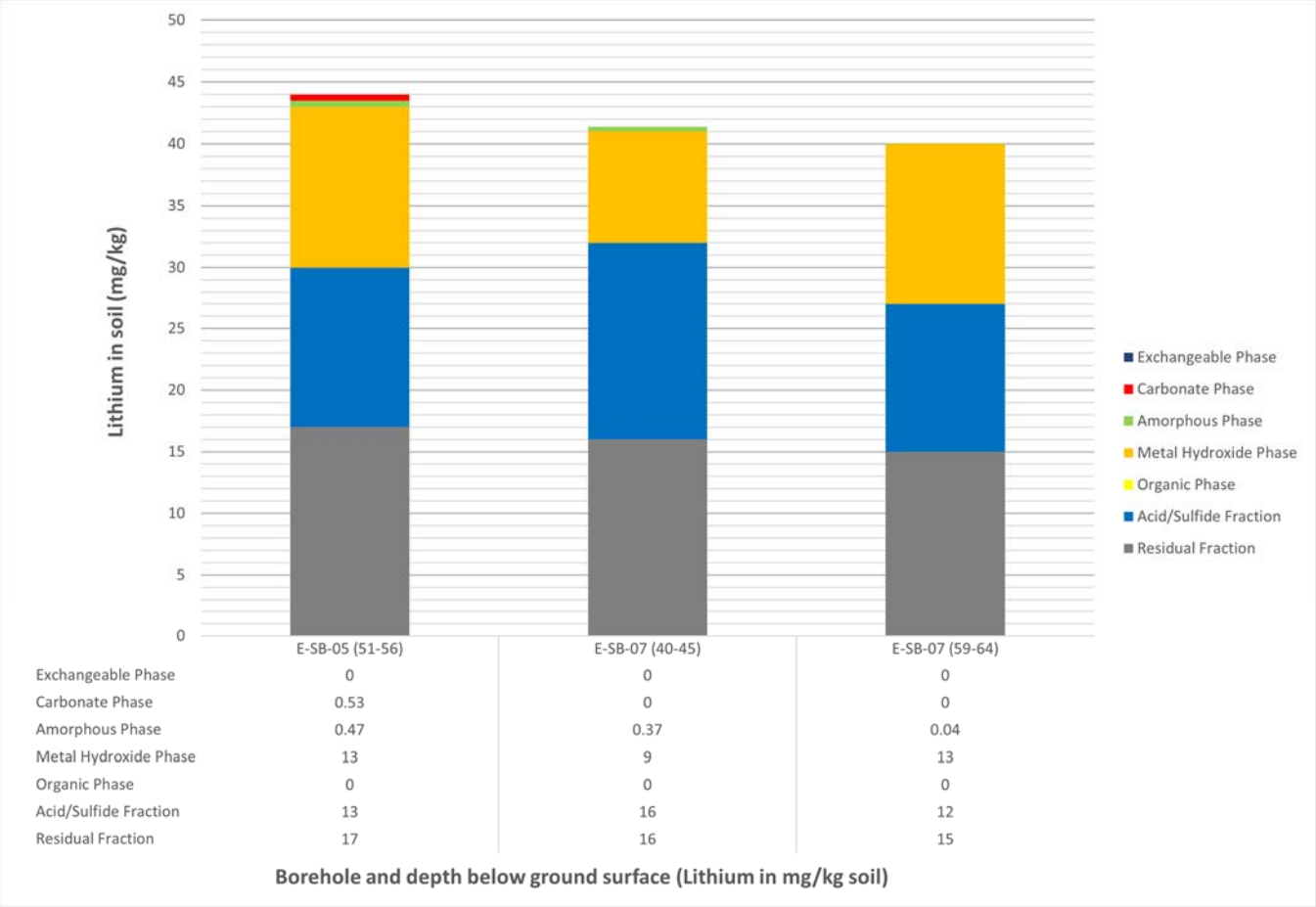

Figure 11. Sequential extraction results for lithium. Concentrations in mg/kg are shown at the bottom of the figure, with the distribution presented in the bar graphs.

Although chloride in aquifer matrix samples was not analyzed in the sequential extraction, chlorides are naturally occurring within shale of marine origin such as that which comprises the BCU. Hem (1985) discusses the geochemistry of various geologic materials. Typical chloride concentrations of shale are indicated as approximately 170 mg/kg in Hem (1985). In addition, the groundwater samples collected from the BCU occurs within a weathered zone of the BCU that is overlain and underlain by very low-permeability shales and siltstones. The constituents released as a product of the weathering process have the potential to increase due to long residence time and limited recharge.

5.0 SUMMARY

The evaluation presented in this document demonstrates that the GWPS exceedances of lithium in well AP05D and AP07D, chloride in well AP07D, and barium in well AW-15C are not attributable to the EAP based on the following lines of evidence:

- The migration pathway between Ash Pond and the wells with GWPS exceedances is not impacted with Ba, Li and/or Cl. Evaluations of groundwater water quality data in accordance with the procedures of the

Statistical Analysis Plan indicate that barium, lithium, and/or chloride do not occur above the GWPS the shallow UA wells paired with, or upgradient of AP05D, AP07D and AW-15C.

- Concentrations and relative proportions of key CCR indicator parameters differ significantly between AP porewater and groundwater from monitoring wells AP05D, AP07D and AW-15C.
- Barium and chloride concentrations in CCR porewater are consistently lower than in BCU wells AW-15C and AP07D.
- Barium, lithium, and chloride occur naturally in the aquifer minerals and/or connate water of siltstones and shales including those of the BCU.

6.0 CLOSING

Golder appreciates the opportunity to serve as your consultant on this project. If you have any questions concerning this Technical Memorandum or need additional information, please contact the undersigned.

Golder Associates USA Inc.



Roberta Russell
Senior Geologist



Patrick J. Behling
Principal, Practice Leader

RR/JSI/PJN/RV/PJB

Attachments: Table 1 – Summary of Rietveld Quantitative Analysis X-Ray Diffraction Results
Table 2 – Evaluation of Potential GWPS Exceedances
Table 4 – Gypsum Saturation Indices

Figure 1 – Edwards Well Locations and Typical Groundwater Flow Direction
Figure 2 – Generalized Fence Diagram Location
Figure 3 – Generalized Fence Diagram of Monitoring Wells

7.0 REFERENCES

Burns and McDonnell 2021. Initial Operating Permit, Edwards Power Plan Ash Pond. October 25.

Hem, John D, 1985. Study and Interpretation of the Chemical Characteristics of Natural Water. United States Geological Survey Water-Supply Paper 2254.

Parkhurst, D. and Appelo, C. 2013. Description of input and examples for PHREEQC version 3: a computer program for speciation, batch-reaction, one-dimensional transport, and inverse geochemical calculations (No. 6-A43). US Geological Survey.

Ramboll, 2021a. Groundwater Sampling and Analysis Program. Ash Pond, Edwards Power Plant, Bartonville, Illinois. October 25.

Ramboll, 2021b. History of Known Groundwater Exceedances. Ash Pond, Edwards Power Plant, Bartonville, Illinois.

Ramboll 2021c. Hydrogeologic Site Characterization Report. Ash Pond, Edwards Power Plant, Bartonville, Illinois. October 25.

Smith, K. and Huyck, H. 1999. An Overview of the Abundance, Relative Mobility, Bioavailability, and Human Toxicity of Metals. The Environmental Geochemistry of Mineral Deposits, Reviews in Economic Geology Vol. 6A, pp.29-70.

Tessier, A., Campbell, P.G. and Bisson, M., 1979. Sequential extraction procedure for the speciation of particulate trace metals. Analytical chemistry, 51(7), pp.844-851.

Tables

Table 1
Evaluation of Potential Exceedances
Summary of Rietveld Quantitative Analysis X-Ray Diffraction Results
Edwards Ash Pond, Peoria County, IL

Mineral	Mineral Formula	E-SB-07 40-45 ft bgs	E-SB-07 59-64 ft bgs	E-SB-05 51-56 ft bgs
Quartz	SiO_2	44.9	43.6	38.7
Albite	$NaAlSi_3O_8$	14.7	15.6	15.0
Microcline	$KAlSi_3O_8$	2.9	3.4	4.3
Chlorite	$(Fe,(Mg,Mn)_5,Al)(Si_3Al)O_{10}(OH)_8$	8.1	9.4	7.5
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	22.4	22.5	24.1
Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$	2.5	3.8	3.7
Ankerite	$CaFe(CO_3)_2$	0.0	0.0	0.1
Dolomite	$CaMg(CO_3)_2$	0.0	0.0	0.8
Calcite	$CaCO_3$	0.4	0.5	0.3
Siderite	$FeCO_3$	3.1	0.2	5.0
Hematite	Fe_2O_3	0.0	0.0	0.0
Magnetite	Fe_3O_4	0.3	0.3	0.4
Ilmenite	$FeTiO_3$	0.1	0.0	0.1
Rutile	TiO_2	0.7	0.6	0.3
Diopside	$CaMgSi_2O_6$	-	-	-
Actinolite	$Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$	-	-	-
Epidote	$Ca_2(Al,Fe)Al_2O(SiO_4)(Si_2O_7)(OH)$	-	-	-
Kaolinite	$Al_2Si_2O_5(OH)_4$	-	-	-
Mullite	$\sim Al_6Si_3O_{15}$	-	-	-
Anorthite	$CaAl_2Si_2O_8$	-	-	-
TOTAL		100	100	100

Notes:
1.) Results provided in weight percentage - percent by weight of each mineral.
2.) ft bgs - feet below ground surface.
3.) Non-detect minerals within a sample are represented by "-".
4.) Zero values indicate that the mineral was included in the refinement, but the calculated concentration is below a measurable value.
5.) Samples were collected by Golder in August 2021.

Created by: CWK
Checked by: RJR
Reviewed by: PJB

Table 2
Evaluation of Potential GWPS Exceedances
Constituent Concentrations
Edwards Ash Pond
Peoria County, Illinois

Well ID	Sample Date	Barium mg/L	Lithium mg/L	Chloride mg/L
Part 845 Groundwater Protection Standards				
Site Background[1]		2.1	0.071	56
Part 845 Standard		2	0.04	200
Part 845 GWPS		2.1	0.071	200
Bedrock Confining Unit Wells				
AP05D	5/7/2021	1.3	0.077	510
AP05D	Statistical Result[2]	0.044	0.077	122
AP07D	5/5/2021	8.6	0.72	820
AP07D	Statistical Result	-1.15	0.15	498
AW-15C	5/6/2021	3.4	0.047	63
AW-15C	Statistical Result	2.9	0.047	46
Wells Paired with Bedrock Confining Unit Wells[3]				
AP05S	5/7/2021	1.2	0.037	43
AP07S	5/5/2021	0.15	<0.02	110
AW-15S	5/6/2021	0.098	<0.02	40
AW-15	5/6/2021	1.8	0.033	41
Wells Upgradient from Bedrock Confining Wells				
AW-16	5/5/2021	1.3	0.039	53
AW-21	5/5/2021	0.067	<0.02	96
AW-22	5/5/2021	0.8	<0.02	40
EAP Pore Water Samples				
XPW01A	5/4/2021	0.034	0.67	47
XPW02	5/4/2021	0.022	0.3	120
XPW03	5/4/2021	0.07	0.16	86

1. Site background is for the uppermost aquifer (UA).
2. Calculated in accordance with Statistical Analysis Plan using constituent concentrations observed at monitoring well during all sampling events from February-July 2021
3. Paired wells are completed in the UA.
4. mg/L - milligrams per liter.
5. EAP - Edwards Ash Pond.
6. GWPS - Groundwater Protection Standard.

Created by: RR
Checked by: BTT
Reviewed by: PJB

Table 4
Evaluation of Potential GWPS Exceedances
Gypsum Saturation Indices
Edwards Ash Pond, Peoria County, Illinois

MINERAL PHASES - Saturation Indices		APW-1	AP-05S	AP05D	AW-05	AW-06	AP07S	AP07D	AW-09	AW-14	AW-15
Gypsum	$CaSO_4:2H_2O$	-1.03	-3.13	-4.10	-1.02	-2.06	-0.73	-2.47	-3.52	-3.45	-3.53
Barite	$BaSO_4$	**0.95**	**-0.14**	**-0.50**	**0.77**	**0.08**	**0.99**	**1.33**	-1.03	-0.82	**-0.41**

MINERAL PHASES - Saturation Indices		AW-15S	AW-15C	AW-16	AW-17	AW-18	AW-19	AW-20	AW-21	AW-22
Gypsum	$CaSO_4:2H_2O$	-0.62	-3.60	-3.55	-3.59	-2.92	-1.98	-1.83	-1.14	-3.62
Barite	$BaSO_4$	**1.03**	**-0.09**	-0.59	-0.59	**-0.09**	**0.19**	**0.09**	**0.63**	-0.64

Notes:

1) SI values between -0.5 and 0.5 are generally considered to represent 'equilibrium' in this report to account for the uncertainties inherent in the analytical methods and geochemical modeling (Nordstrom and Alpers 1999).

2) SI values greater than -0.5 identified by red bold type and grey shading.

Created by: CWK
Checked by: PJN
Reviewed by: PJN

Figures

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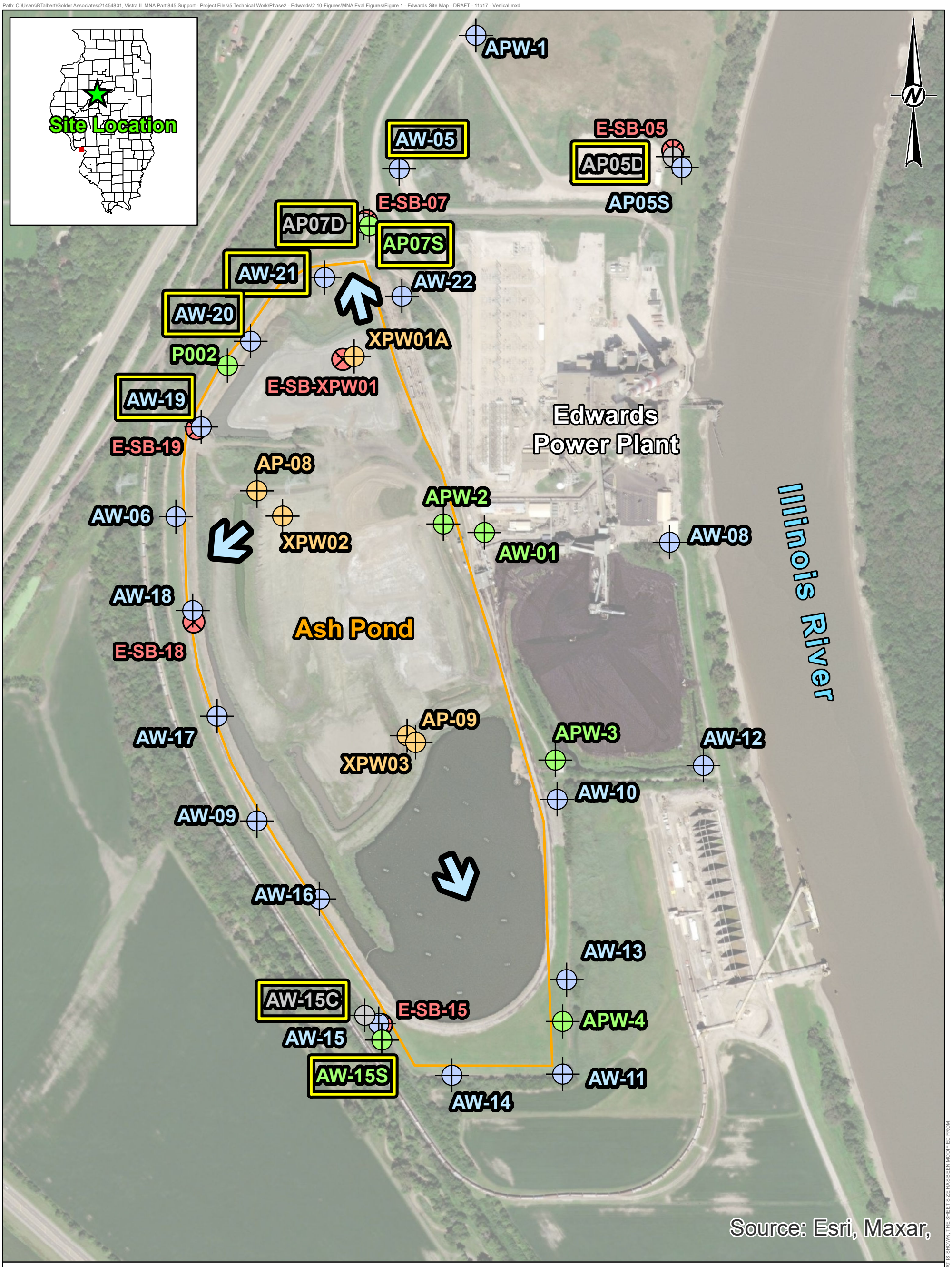

LEGEND

- Ash Pond
- Soil Boring Location

Monitoring Wells

- Monitoring Well Screened in Bedrock
- Monitoring Well Screened in CCR Material
- Monitoring Well Screened in the Upper Cahokia Formation
- Monitoring Well Screened in the Uppermost
- Typical Groundwater Flow Direction
- Potential Exceedance

NOTES

1. SOIL BORING LOCATIONS SURVEYED BY INGENAE ON SEPTEMBER 23, 2021.
2. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
3. GWPS - GROUNDWATER PROTECTION STANDARD

REFERENCE

1. BURNS AND MCDONNELL 2021, INITIAL OPERATING PERMIT - EDWARDS POWER PLANT ASH POND. AVAILABLE ONLINE AT HTTPS://WWW.LUMINANT.COM/ILLINOIS-CCR/

0 500 1,000 Feet

CLIENT
ILLINOIS POWER RESOURCES GENERATING, LLC.

PROJECT
EDWARDS POWER PLANT - EVALUATION OF POTENTIAL GWPS EXCEEDANCES

TITLE
EDWARDS WELL LOCATIONS AND TYPICAL GROUNDWATER FLOW DIRECTION

CONSULTANT

YYYY-MM-DD	2022-02-17
PREPARED	BTT
DESIGN	BTT
REVIEW	JSI
APPROVED	PJB

PROJECT No. 21454831 PHASE 0002A FIGURE **1**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 1 in 0

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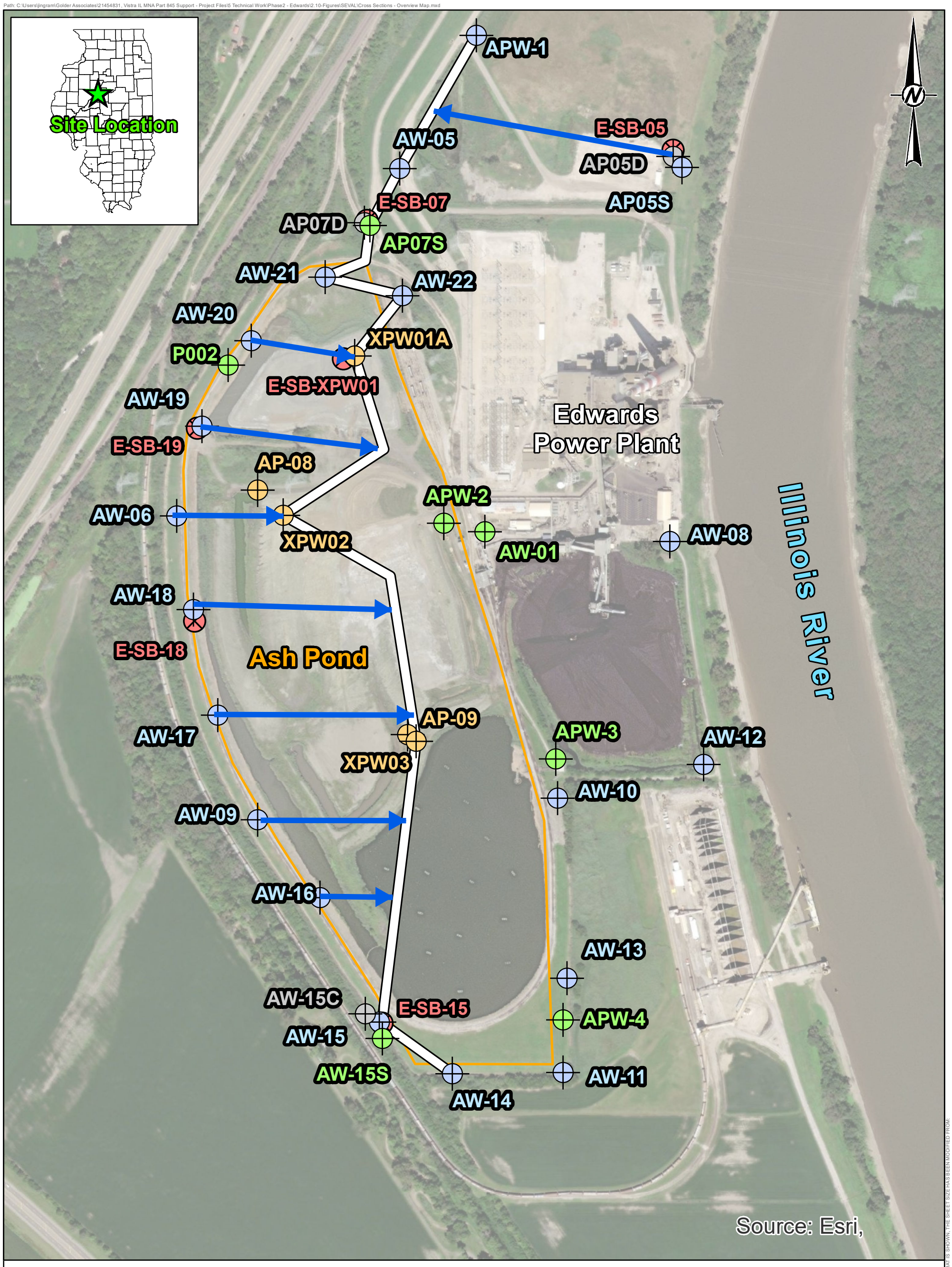


LEGEND

- Ash Pond
- Golder Soil Boring Location
- Monitoring Wells Projected onto the Generalized Fence Diagram Line
- Generalized Fence Diagram Line

Monitoring Wells

- Monitoring Well Screened in Bedrock
- Monitoring Well Screened in CCR Material
- Monitoring Well Screened in the Upper Cahokia Formation
- Monitoring Well Screened in the Uppermost Aquifer

NOTES

1. SOIL BORING LOCATIONS SURVEYED BY INGENAE ON SEPTEMBER 23, 2021.
2. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.

REFERENCE

1. BURNS AND MCDONNELL 2021, INITIAL OPERATING PERMIT - EDWARDS POWER PLANT ASH POND. AVAILABLE ONLINE AT HTTPS://WWW.LUMINANT.COM/ILLINOIS-CCR/

0 500 1,000 Feet

CLIENT
ILLINOIS POWER RESOURCES GENERATING, LLC.

PROJECT
EDWARDS POWER PLANT - EVALUATION OF POTENTIAL GWPS EXCEEDANCES

TITLE
GENERALIZED FENCE DIAGRAM LOCATION

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-02-17
PREPARED	JSI
DESIGN	JSI
REVIEW	BTT
APPROVED	PJB

PROJECT No. 21454831 PHASE 0002 FIGURE **2**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 1 in 0

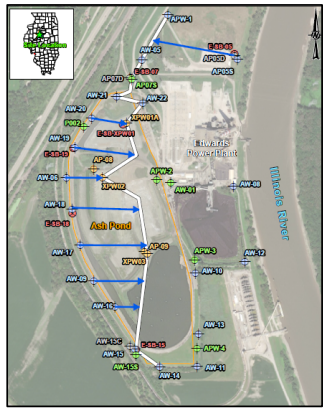
Coal Combustion Residuals (CCR Unit)

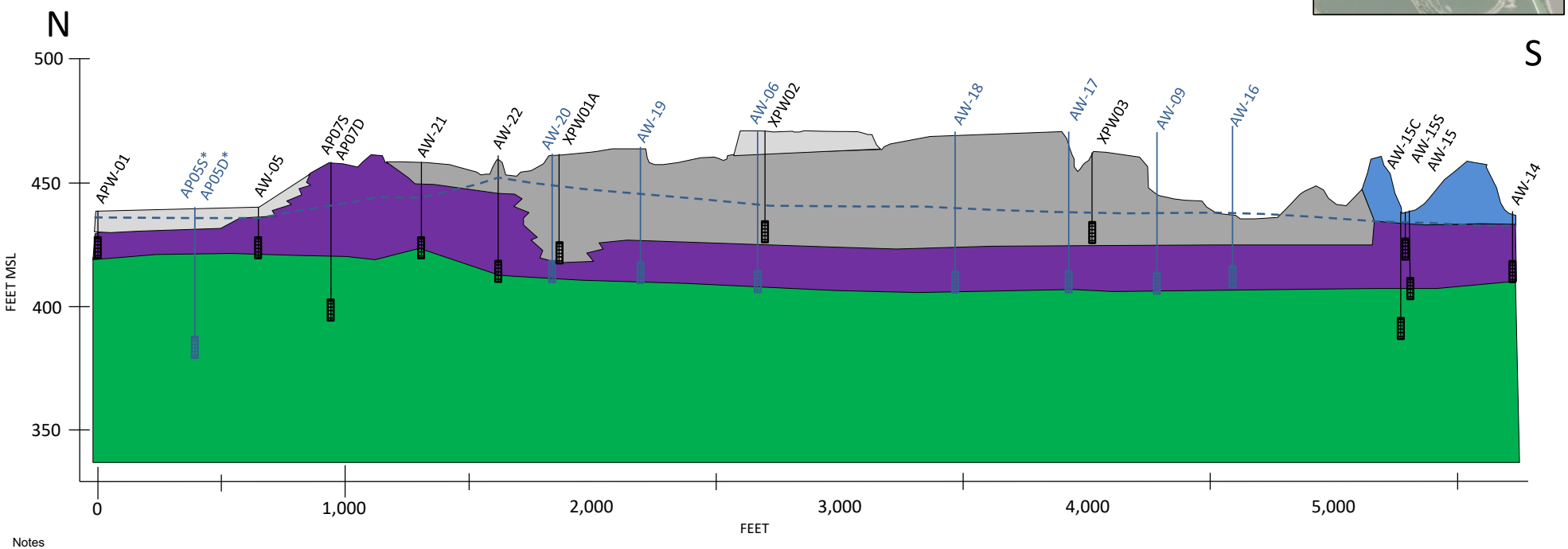
Fill

Upper Cahokia Formation (Clay and Sand)

Silt

Bedrock/Weathered Bedrock (Confining Unit)





Notes
1) mg/L – Milligrams per liter, MSL – mean sea level
2) Wells in blue text indicate wells projected onto the cross section. Well screen location for projected wells are based on geologic unit, not elevation.
3) Wells in black text indicate wells located along the tie line. Well screen locations are based on elevation.
4) Generalized fence diagram based on generalized cross section from Ramboll (2021).
5) * indicates well is upgradient of the Edwards Ash Pond, near the Illinois River north of the plant.
6) Sizes and distances not to scale.
7) GWPS – Groundwater Protection Standards

CLIENT
ILLINOIS POWER RESOURCES GENERATING, LLC.

CONSULTANT
GOLDER

YYYY-MM-DD	2022-03-16
PREPARED	BTT
DESIGNED	JSI
REVIEWED	GTM
APPROVED	PJB

PROJECT
EDWARDS POWER PLANT – EVALUATION OF POTENTIAL GWPS EXCEEDANCES

TITLE
Generalized Fence Diagram of Monitoring Wells

PROJECT NO.	PHASE	REV.	FIGURE
21454831	0002		3

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm

APPENDIX B
FIGURE 5 AND FIGURE 6 OF *BURCH, S. L. AND D. J. KELLY., 1993. PEORIA-PEKIN REGIONAL GROUND-WATER QUALITY ASSESSMENT. ILLINOIS STATE WATER SURVEY (ISWS), CHAMPAIGN, RESEARCH REPORT 124.*

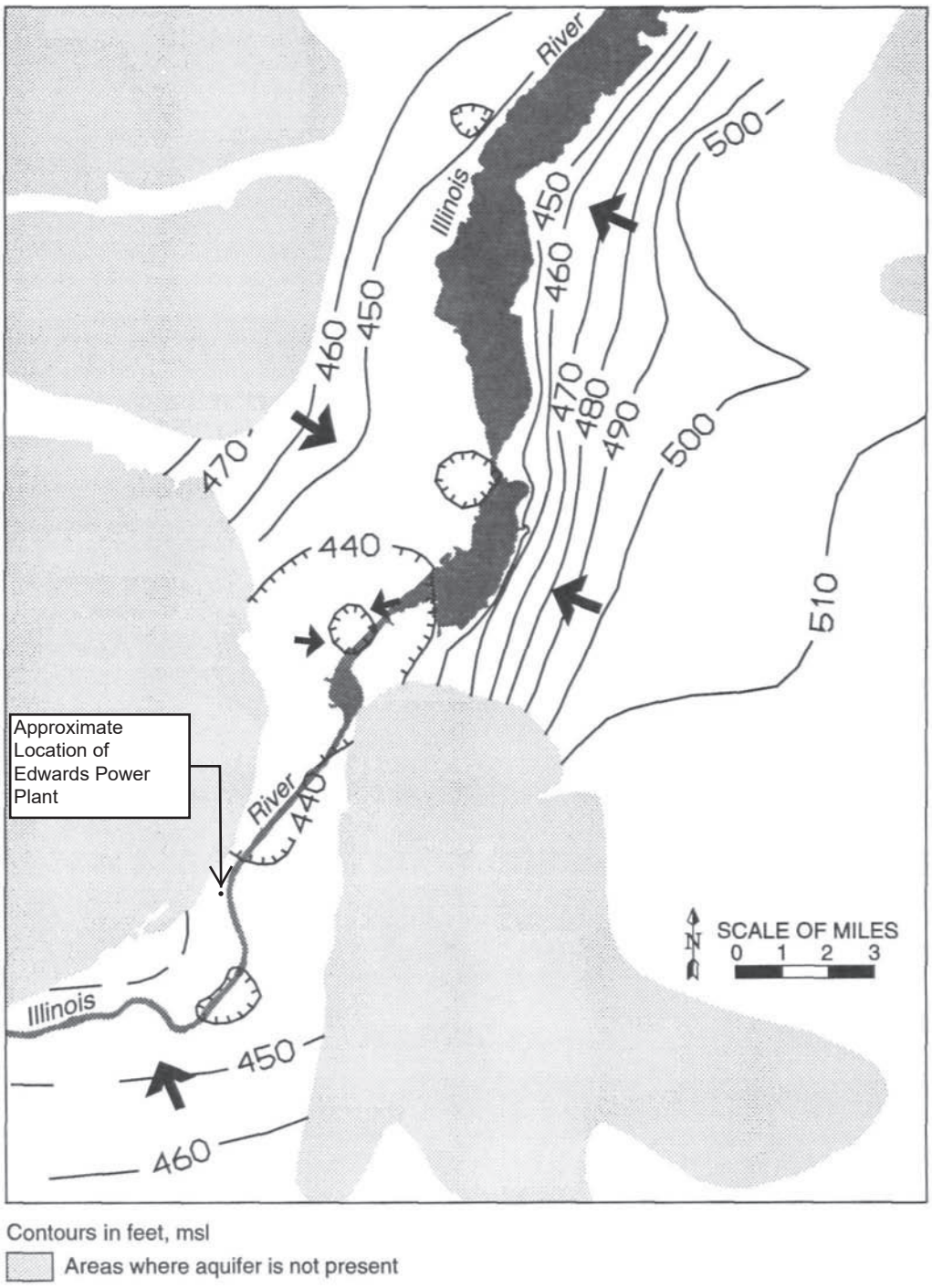


Figure 5. Elevation of potentiometric surface and direction of regional ground-water flow for the Peoria-Pekin region: 1990-1991 data

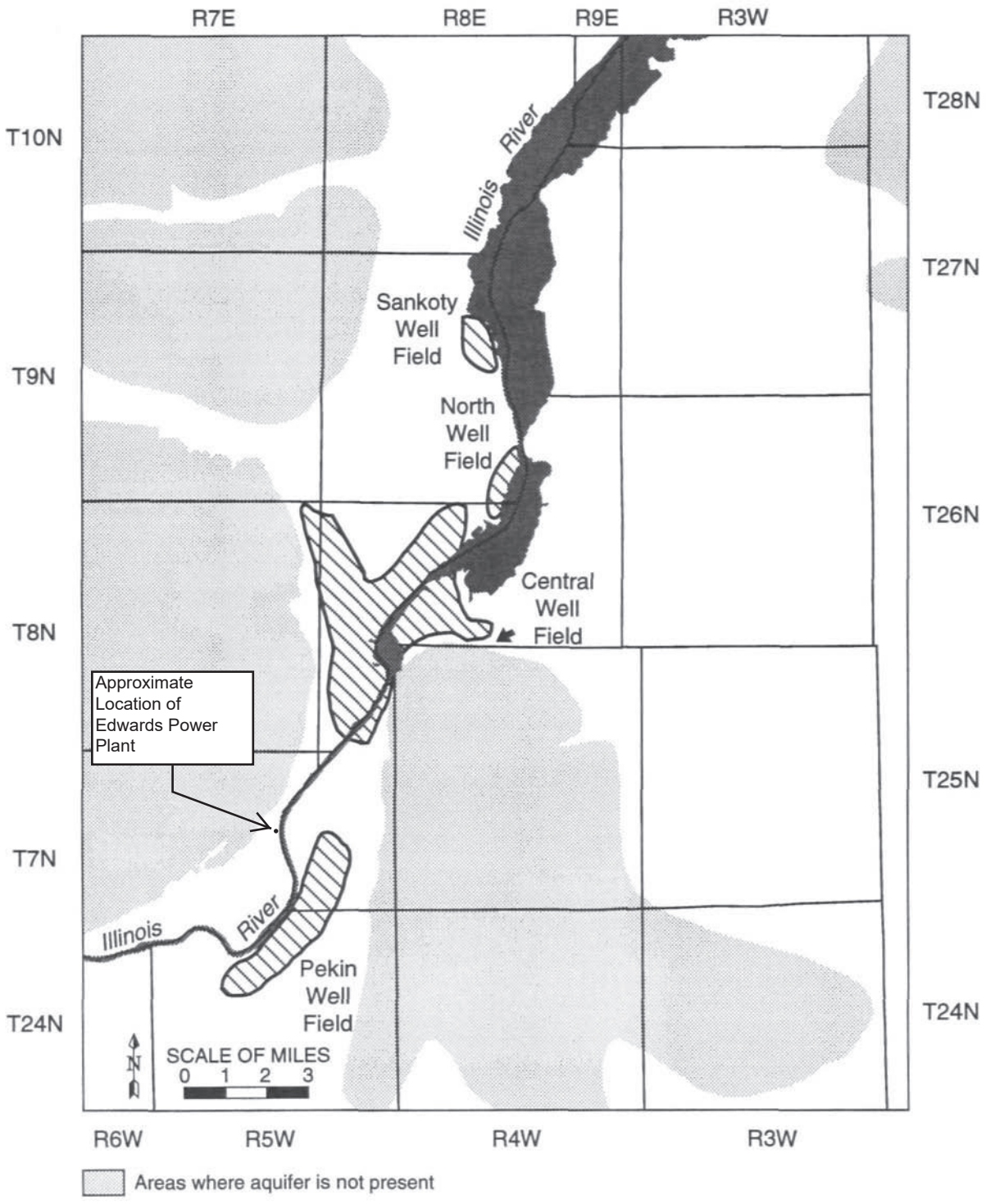


Figure 6. Locations of the Sankoty, North, Central, and Pekin municipal well fields

APPENDIX C
MODFLOW, MT3DMS, HELP MODEL, AND FLUX EVALUATION DATA EXPORT FILES (ELECTRONIC ONLY)

APPENDIX D
EVALUATION OF PARTITION COEFFICIENT RESULTS (GOLDER ASSOCIATES USA INC., 2022)

TECHNICAL MEMORANDUM

DATE March 30, 2022 **Project No.** 21454831

TO David Mitchell, Stu Cravens, Vic Modeer
Illinois Power Resources Generating, LLC

CC Brian Henning - Ramboll

FROM Golder Associates USA Inc. **EMAIL** **Jeffrey_Ingram@golder.com**

EVALUATION OF PARTITION COEFFICIENT RESULTS, EDWARDS ASH POND (CCR UNIT 301), EDWARDS POWER PLANT, PEORIA COUNTY, ILLINOIS

1.0 INTRODUCTION

Illinois Power Resource Generating, LLC (IPRG) operates the Edwards Power Plant (EPP) located in Peoria County, Illinois. The Edwards Ash Pond (EAP or Site), Illinois Environmental Protection Agency [IEPA] ID No. W1438050005 - 01) is a 91-acre unlined surface impoundment used to manage coal combustion residuals (CCRs) at the EPP. The EAP is regulated under Part 845 *"Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments"* (State CCR Rule or Part 845) which was promulgated by the Illinois Pollution Control Board (IPCB) on April 21, 2021. WSP Golder (Golder) is assisting IPRG with Part 845 compliance at the Site.

IPRG is currently preparing a Construction Permit application for the EAP as required under Section 845.220. As a part of the Construction Permit application, groundwater modeling is being completed for known potential exceedances of groundwater protection standards (GWPS) as outlined in the Operating Permit application for the EAP (Burns and McDonnell, 2021). In the Operating Permit (October 2021), Ramboll Americas Engineering Solutions, Inc. (Ramboll) identified potential GWPS exceedances for several compounds potentially associated with the EAP, including barium, boron, lithium, sulfate and total dissolved solids (TDS). Batch adsorption testing was conducted to generate site-specific partition coefficient results for these parameters for use in the groundwater models. This Technical Memorandum summarizes the results of the batch adsorption testing.

2.0 OVERVIEW

In August 2021, Golder conducted a field investigation at the EPP which included the completion of six (6) soil/rock borings ranging in depth from 40 to 64 feet below ground surface. As a part of that investigation, soil and groundwater samples were submitted to SiREM laboratories (Guelph, ON) for batch solid/liquid partitioning testing. A summary of the soil samples used for the batch testing is provided in Table 1.

Table 1: Batch Attenuation Testing Data Summary

Groundwater Sample ID	Soil Sample ID	Soil: Water Ratio
AW-15S	E-SB-05 (30.0-33.5 ft bgs)	2:1
		1:1

Golder Associates USA Inc
18300 NE Union Hill Road, Suite 200, Redmond, Washington, USA 98052 T: +1 425 883-0777 F: +1 425 882-5498

Groundwater Sample ID	Soil Sample ID	Soil: Water Ratio
		1:5
		1:10
		1:20
AW-19	E-SB-05 (30.0-33.5 ft bgs)	2:1
		1:1
		1:5
		1:10
		1:20

Notes:

1) Ft bgs – Feet below ground surface

Site-specific partitioning coefficients were determined for contaminants of interest (COIs) identified based on statical evaluation of potential groundwater exceedances calculated at the Site: barium, boron, lithium, and sulfate (Burns & McDonnell, 2021). Two groundwater samples (AW-15S and AW-19) and one soil sample (E-SB-05) were used for batch attenuation testing at various ratios (Table 1). For each treatment, 0.1 L of groundwater was brought in contact with an amount of soil (0.2 to 2 kg, depending on the ratio) over a seven-day period. Each contact water/soil microcosm was amended (spiked) with barium hydroxide, boric acid, sodium chloride, lithium chloride, and sodium sulfate to a target concentration of barium, boron, lithium, and sulfate, respectively (Table 2). After the seven-day contact period, COI concentrations were analyzed in the contact water. The control samples (i.e., groundwater samples AW-15S and AW-19) were only analyzed at the initiation of testing. The oxidation/reduction potential (redox) and pH were measured for each batch test at the beginning and end of the contact period and in the control samples.

Table 2: Microcosm amendment and target concentration for COIs

COI	Amendment	Target Concentration (mg/L)
Barium	1.75 mL of a 1 g/L $Ba(OH)_2 \cdot 8H_2O$ solution	0.5
Boron	36.43 mL of a 2 g/L H_3BO_3 solution	12
Lithium	5.97 mL of a 1 g/L LiCl solution	0.5
Sulfate	1769.5 mg of Na_2SO_4	1,100

Notes:

1) Mg/L – milligrams per liter
2) $Ba(OH)_2 \cdot 8H_2O$ - barium hydroxide
3) H_3BO_3 - boric acid
4) LiCl - lithium chloride
5) Na_2SO_4 - sodium sulfate

The results of batch attenuation testing (Tables 3 and 4) were used to calculate the following adsorption isotherms for each COI:

- Linear: $q_e = K_D * C_e$

- Langmuir: $C_e/q_e = 1/(K_L * q_m) + C_e/q_m$
- Freundlich: $\log(q_e) = \log(K_F) + (1/n)\log(C_e)$

Where

K_D, K_L, and K_F = the linear, Langmuir, and Freundlich partition coefficients, respectively (in liters per kilogram; L/kg).

q_e = concentration of the adsorbate in soil

C_e = aqueous concentration of the adsorbate

q_m = 1/slope in the linear expression of the isotherm

n = non-linearity constant

3.0 SUMMARY OF RESULTS

Figures that show the linear, Langmuir, and Freundlich isotherms for each COI are provided in Appendix A. The partition coefficient values for AW-15S and AW-19 are presented in Tables 5 and 6, respectively. The results of the batch adsorption testing can be summarized as follows:

- **Barium**: The calculated K_D and K_L values for both AW-15S and AW-19 were negative (AW-15S: -22.9 and -6.5E+8 L/kg; AW-19: -12.4 and -8.5E+8 L/kg), indicating an inverse relationship between the concentration of barium in solution and the concentration of barium in soil. The K_F values for AW-15S and AW-19 were 736 and 738 L/kg, respectively. For comparison, in Strenge and Peterson (1989), partition coefficients for barium range from 53 to 16,000 L/kg, depending on pH conditions and the amount of sorbent (i.e. clay, organic matter, and iron and aluminum oxyhydroxide) present.
- **Boron**: Calculated K_D values for AW-15S and AW-19 were 1.50 and -0.19 L/kg, respectively, K_L values 3.8E+4 and -2E+5 L/kg, respectively, and K_F values 82 and 215 L/kg, respectively. In Strenge and Peterson (1989), partition coefficients for boron range from 0.19 to 1.3 L/kg, depending on pH conditions and the amount of sorbent present.
- **Lithium**: Calculated K_D values for AW-15S and AW-19 were 1.89 and -1.27 L/kg, respectively, K_L values 2.6E+8 and -2.4E+8 L/kg, respectively, and K_F values 234 and 230 L/kg, respectively. In Strenge and Peterson (1989), partition coefficients for lithium range from 0 to 0.8 L/kg, depending on pH conditions and the amount of sorbent present.
- **Sulfate**: Calculated K_D values for AW-15S and AW-19 were 0.47 and -1.0 L/kg, respectively, and K_L values 778 and -2,950 L/kg, respectively. The K_F values for AW-15S and AW-19 were 63 and 1.2 L/kg, respectively. In Strenge and Peterson (1989), partition coefficients for sulfate are 0.0 L/kg, regardless of pH conditions and the amount of sorbent present.
- **pH and Redox**: Generally, after the seven-day contact time, the pH of each contact water was consistent with the pH of the control (6.95 to 6.96), ranging from 6.83 to 6.99 across the batch tests. The redox value of the control sample after the seven-day contact time was +65 mV for AW-15S and +51 for AW-19. The redox value of contact water ranged from -71 to +71 mV across treatments.

4.0 REFERENCES

Burns & McDonnell, 2021. Initial Operating Permit Edwards Power Plant Ash Pond.

Strenge, D. and Peterson, S. 1989. Chemical Data Bases for the Multimedia Environmental Pollutant Assessment System (MEPAS) (No. PNL-7145). Pacific Northwest Lab., Richland, WA (USA).

5.0 CLOSING

Golder appreciates the opportunity to serve as your consultant on this project. If you have any questions concerning this technical memorandum or need additional information, please contact the undersigned.

Golder Associates USA Inc.





Jeffrey Ingram

Senior Consultant, Geologist

Pat Behling

Practice Leader

CK/CK/JSI/PJB

Attachments Appendix A – Partition Coefficient Graphs

Table 3: Batch Attenuation Testing Results, AW-15S

Geologic Material Sample ID	Treatment	Date	Day	Replicate	Dissolved Barium	Dissolved Boron	Dissolved Lithium	Dissolved Sulfate	pH	ORP
					mg/L	mg/L	mg/L	mg/L	SU	mV
	Groundwater Only Control	1/14/2022	0	AW-15S-1a	0.31	12	0.47	390	7.07	202
				AW-15S-2a	0.36	13	0.48	397	7.06	181
				Average Concentration (mg/L)	**0.33**	**13**	**0.48**	**394**	**7.07**	**192**
		1/21/2022	7	AW-15S-1a	0.069	13	0.49	395	6.95	64
				AW-15S-2a	0.074	13	0.48	392	6.96	66
				Average Concentration (mg/L)	**0.072**	**13**	**0.49**	**394**	**6.96**	**65**
AW-15S E-SB-05 (30.0-33.5)	2:1 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-15S 2:1-1	0.39	4.6	0.15	266	6.89	-60
				E-SB-05 (30.0-33.5): AW-15S 2:1-2	0.32	4.4	0.12	274	6.93	-75
				Average Concentration (mg/L)	**0.35**	**4.5**	**0.14**	**270**	**6.91**	**-68**
	1:1 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-15S 1:1-1	0.23	6.5	0.21	313	6.83	-68
				E-SB-05 (30.0-33.5): AW-15S 1:1-2	--	--	--	--	--	--
				Average Concentration (mg/L)	**0.23**	**6.5**	**0.21**	**313**	**6.83**	**-68**
	1:5 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-15S 1:5-1	0.13	10	0.36	375	6.89	15
				E-SB-05 (30.0-33.5): AW-15S 1:5-2	0.12	10	0.36	370	6.86	72
				Average Concentration (mg/L)	**0.13**	**10**	**0.36**	**373**	**6.88**	**44**
	1:10 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-15S 1:10-1	0.12	11	0.42	382	6.91	73
				E-SB-05 (30.0-33.5): AW-15S 1:10-2	0.11	12	0.43	375	6.94	68
				Average Concentration (mg/L)	**0.11**	**11**	**0.43**	**379**	**6.93**	**71**
	1:20 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-15S 1:20-1	0.10	12	0.45	393	6.99	96
				E-SB-05 (30.0-33.5): AW-15S 1:20-2	0.11	12	0.44	383	6.96	42
				Average Concentration (mg/L)	**0.11**	**12**	**0.45**	**388**	**6.98**	**69**

Notes:
1) mg/L- Miligrams per liter
2) SU - Standard Units
3) mV -milivolts
4) ORP - Oxidation Reduction Potential

Table 4: Batch Attenuation Testing Results, AW-19

Geologic Material Sample ID	Treatment	Date	Day	Replicate	Dissolved Barium	Dissolved Boron	Dissolved Lithium	Dissolved Sulfate	pH	ORP
					mg/L	mg/L	mg/L	mg/L	SU	mV
	Groundwater Only Control	1/14/2022	0	AW-19-1a	0.22	12	0.46	386	7.08	156
				AW-19-2a	0.27	12	0.45	380	7.07	133
				Average Concentration (mg/L)	**0.25**	**12**	**0.46**	**383**	**7.08**	**145**
		1/21/2022	7	AW-19-1a	0.048	12	0.48	375	6.98	39
				AW-19-2a	0.049	12	0.51	390	6.92	62
				Average Concentration (mg/L)	**0.049**	**12**	**0.50**	**383**	**6.95**	**51**
AW-19 E-SB-05 (30.0-33.5)	2:1 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-19 2:1-1	0.27	4.3	0.11	270	6.93	-58
				E-SB-05 (30.0-33.5): AW-19 2:1-2	0.51	4.4	0.15	269	6.94	-71
				Average Concentration (mg/L)	**0.39**	**4.4**	**0.13**	**270**	**6.94**	**-65**
	1:1 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-19 1:1-1	0.24	6.6	0.24	314	6.98	-60
				E-SB-05 (30.0-33.5): AW-19 1:1-2	0.32	6.3	0.22	308	6.99	-82
				Average Concentration (mg/L)	**0.28**	**6.5**	**0.23**	**311**	**6.99**	**-71**
	1:5 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-19 1:5-1	0.16	10	0.36	358	6.92	-42
				E-SB-05 (30.0-33.5): AW-19 1:5-2	0.19	10	0.38	360	6.95	-32
				Average Concentration (mg/L)	**0.18**	**10**	**0.37**	**359**	**6.94**	**-37**
	1:10 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-19 1:10-1	0.17	10	0.40	365	6.92	-48
				E-SB-05 (30.0-33.5): AW-19 1:10-2	0.14	11	0.45	389	6.95	-52
				Average Concentration (mg/L)	**0.16**	**11**	**0.43**	**377**	**6.94**	**-50**
	1:20 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-19 1:20-1	0.11	12	0.46	381	7.00	-3
				E-SB-05 (30.0-33.5): AW-19 1:20-2	0.16	12	0.47	387	6.97	-45
				Average Concentration (mg/L)	**0.13**	**12**	**0.47**	**384**	**6.99**	**-24**

Notes:
1) mg/L- Miligrams per liter
2) SU - Standard Units
3) mV -milivolts
4) ORP - Oxidation Reduction Potential

Table 5: Partition Coefficient Results, AW-15S

Analyte	Isotherm	Variable	With Soil Mass
Barium	Raw Data R^2		0.46
	Linear K_D (L/kg)		-22.85
	Langmuir	R^2	1.00
		q_m (mg/g)	0.498
		K_L (L/kg)	-6.48E+08
	Freundlich	R^2	0.55
		1/n	-0.01
		K_F (L/kg)	736.03
Boron	Raw Data R^2		0.99
	Linear K_D (L/kg)		1.50
	Langmuir	R^2	0.79
		q_m (mg/g)	0.068
		K_L (L/kg)	3.79E+04
	Freundlich	R^2	0.98
		1/n	0.764
		K_F (L/kg)	82.21
Lithium	Raw Data R^2		0.80
	Linear K_D (L/kg)		1.89
	Langmuir	R^2	1.00
		q_m (mg/g)	0.035
		K_L (L/kg)	2.58E+08
	Freundlich	R^2	0.79
		1/n	0.014
		K_F (L/kg)	234.30
Sulfate	Raw Data R^2		0.54
	Linear K_D (L/kg)		0.47
	Langmuir	R^2	0.07
		q_m (mg/g)	0.88
		K_L (L/kg)	7.78E+02
	Freundlich	R^2	0.56
		1/n	0.8
		K_F (L/kg)	63.43

Note(s):
K_D: linear partition coefficient
K_L: Langmuir partition coefficient
K_F: Freundlich partition coefficient
qm: 1/slope in the linear expression of the isotherm
n: non-linearity constant

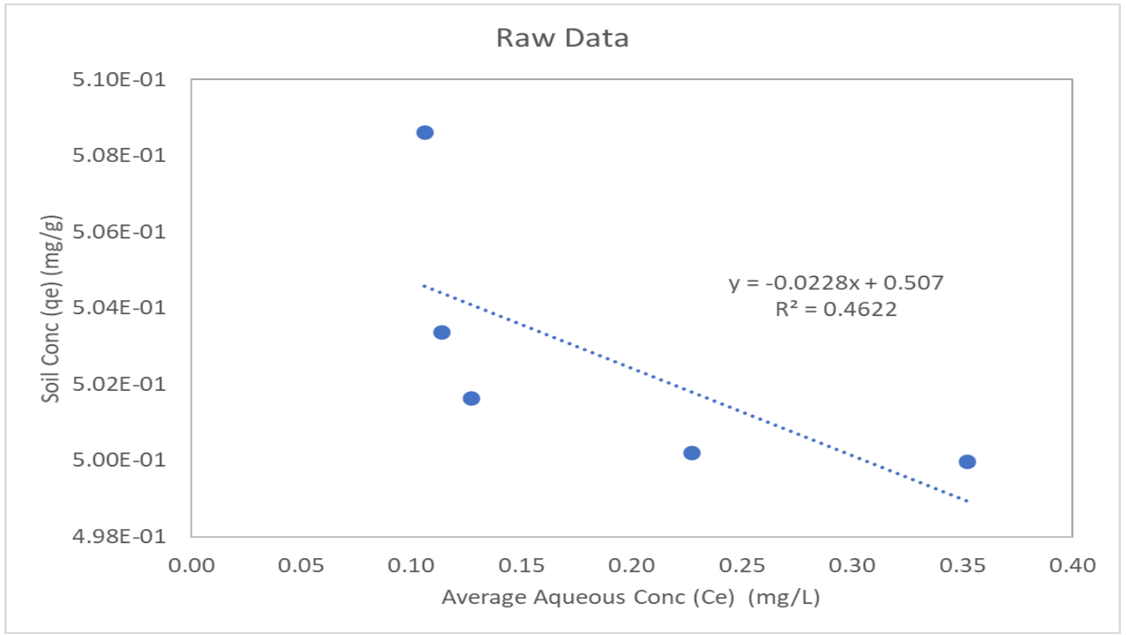
Table 6: Partition Coefficient Results, AW-19

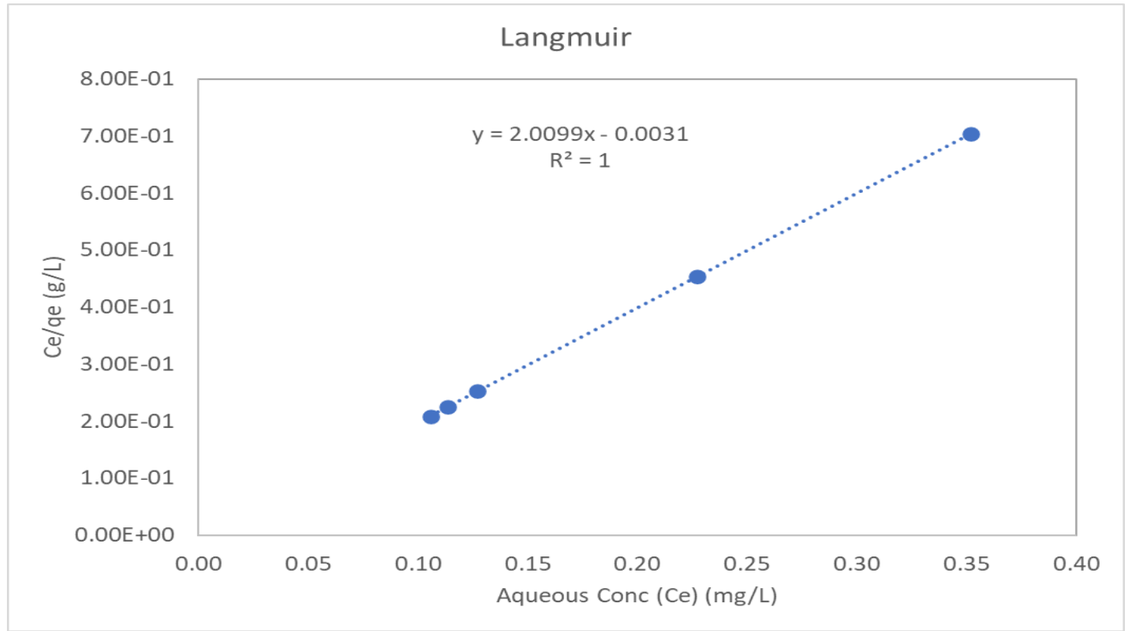
Analyte	Isotherm	Variable	With Soil Mass
Barium	Raw Data R^2		0.51
	Linear K_D (L/kg)		-12.44
	Langmuir	R^2	1.00
		q_m (mg/g)	0.498
		K_L (L/kg)	-8.45E+08
	Freundlich	R^2	0.62
		1/n	-0.007
		K_F (L/kg)	737.55
Boron	Raw Data R^2		0.01
	Linear K_D (L/kg)		-0.19
	Langmuir	R^2	0.35
		q_m (mg/g)	0.002
		K_L (L/kg)	-1.99E+05
	Freundlich	R^2	0.07
		1/n	-0.578
		K_F (L/kg)	215.36
Lithium	Raw Data R^2		0.19
	Linear K_D (L/kg)		-1.27
	Langmuir	R^2	1.00
		q_m (mg/g)	0.034
		K_L (L/kg)	-2.37E+08
	Freundlich	R^2	0.119
		1/n	-0.008
		K_F (L/kg)	230.26
Sulfate	Raw Data R^2		0.28
	Linear K_D (L/kg)		-1.00
	Langmuir	R^2	0.16
		q_m (mg/g)	-0.021
		K_L (L/kg)	-2.95E+03
	Freundlich	R^2	0.16
		1/n	2.40
		K_F (L/kg)	1.16

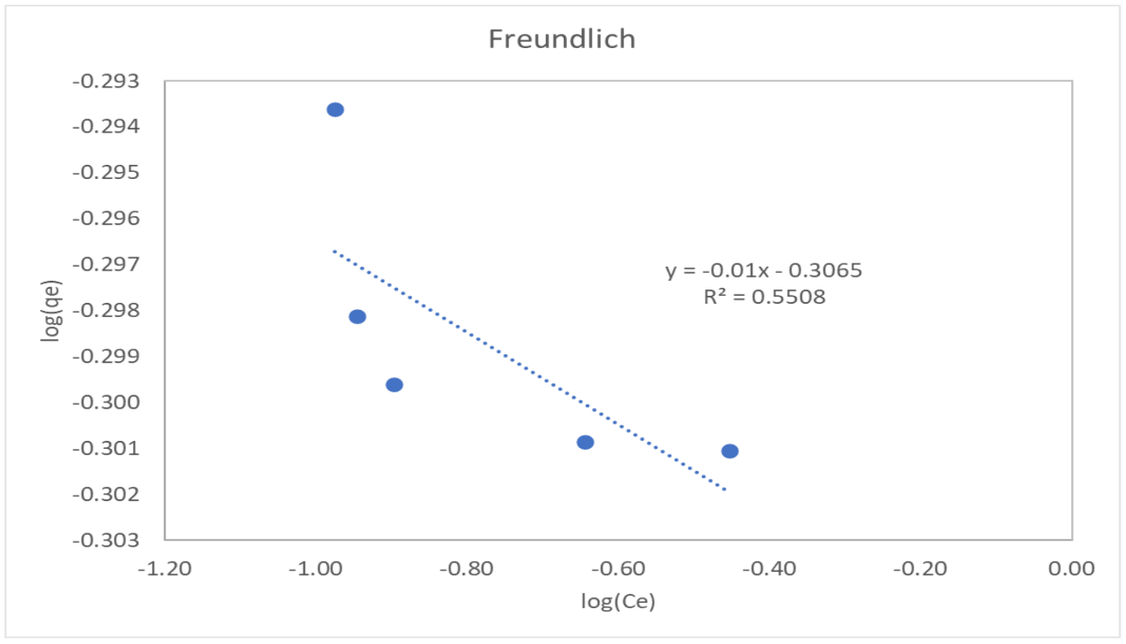
Note(s):
K_D: linear partition coefficient
K_L: Langmuir partition coefficient
K_F: Freundlich partition coefficient
qm: 1/slope in the linear expression of the isotherm
n: non-linearity constant

APPENDIX A

Partition Coefficient Graphs







Note(s):
mg/L: milligrams per liter
mg/g: milligrams per gram
g/L: grams per liter
Ce: aqueous concentration of the adsorbate

CLIENT
ILLIONIS POWER RESOURCES GENERATING, LLC
EDWARDS ASH POND (CCR UNIT 301)

CONSULTANT
WSP GOLDER

PROJECT
EVALUATION OF PARTITION COEFFICIENT RESULTS EAP

TITLE
AW-15S BARIUM PARTITION COEFFICIENTS

PROJECT NO.	PHASE	REV.	FIGURE
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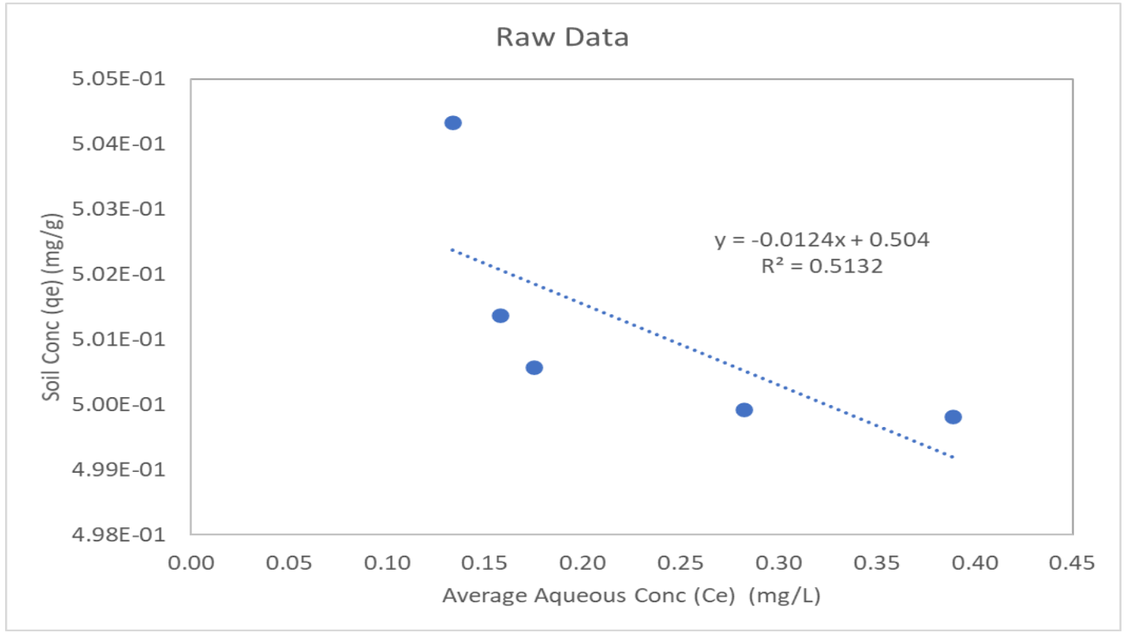

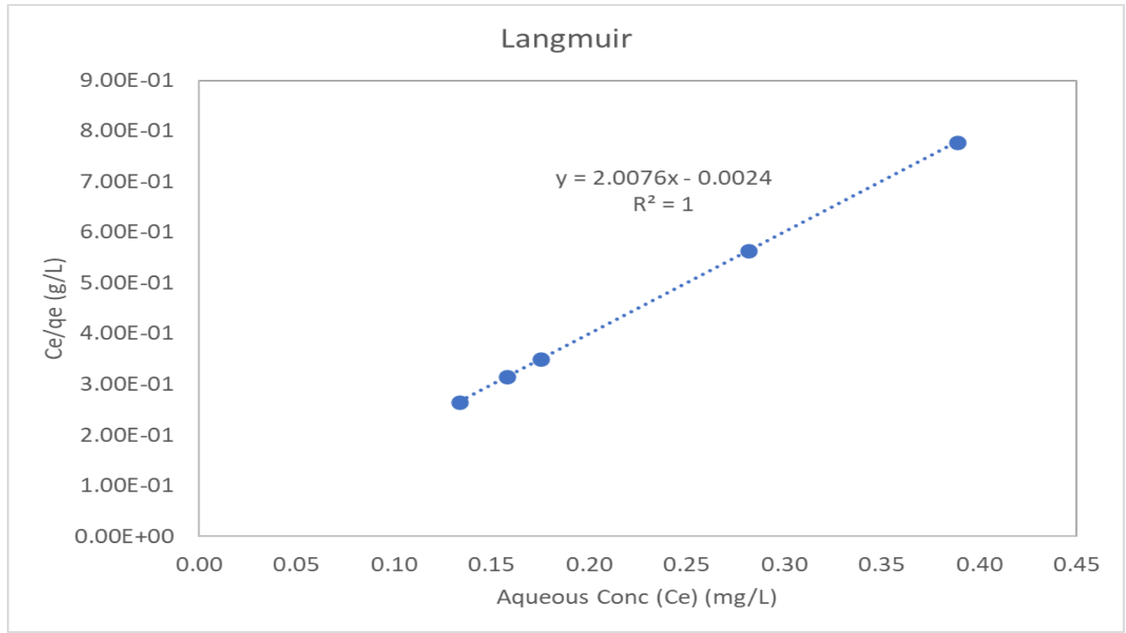

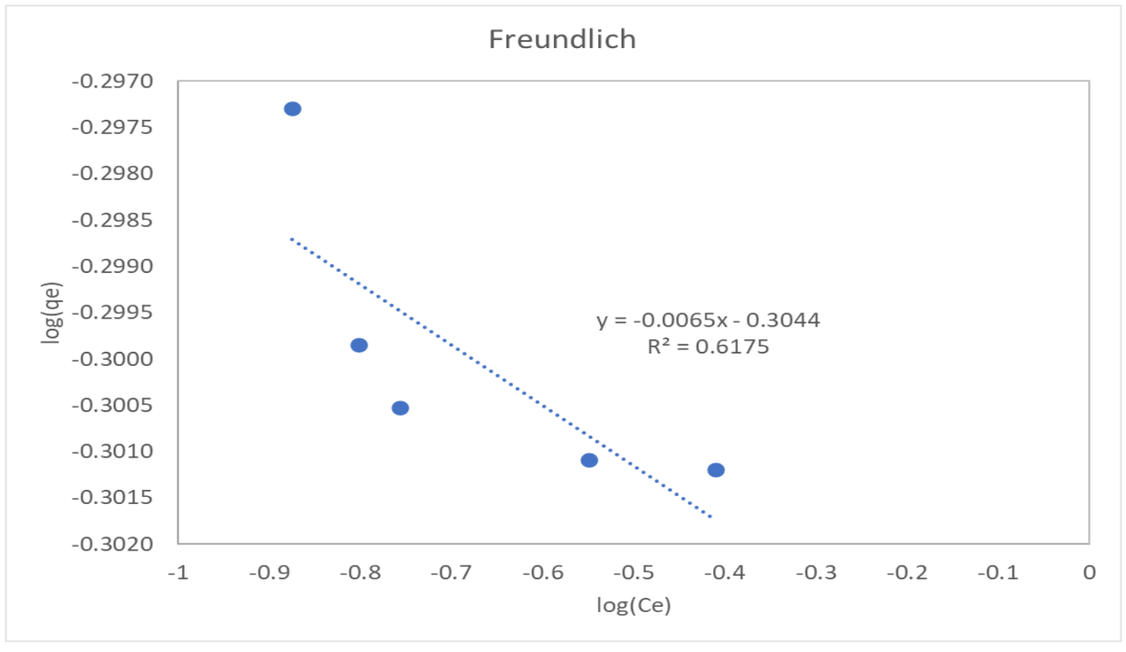

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EDWARDS ASH POND (CCR UNIT 301)

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EVALUATION OF PARTITION COEFFICIENT RESULTS EAP

TITLE
AW-19 BARIUM PARTITION COEFFICIENTS

PROJECT NO.	PHASE	REV.	FIGURE
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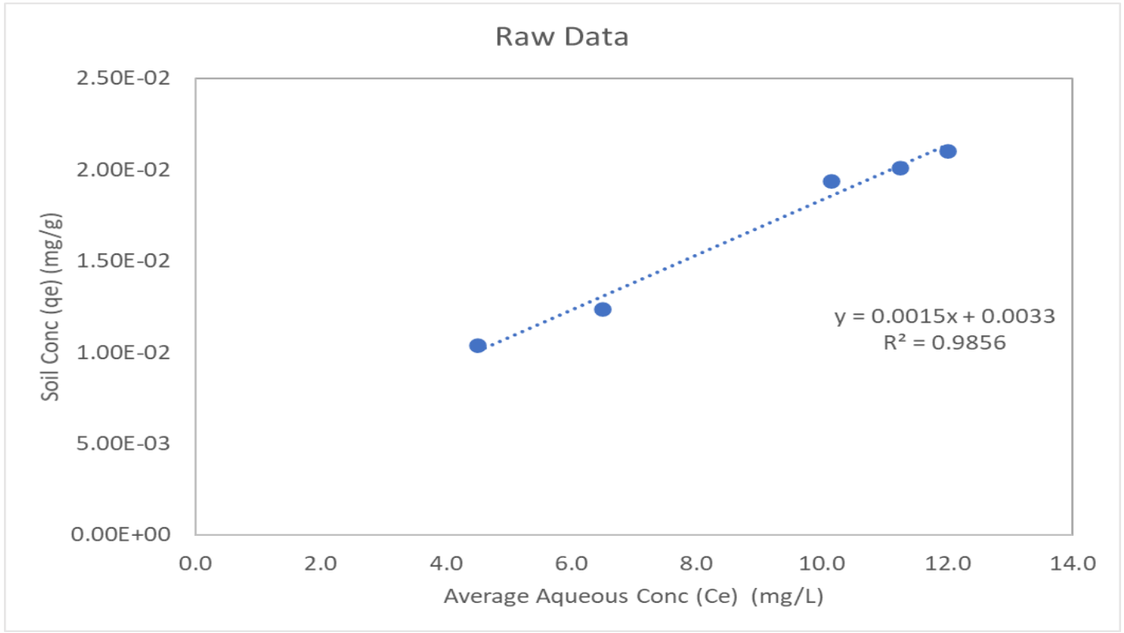

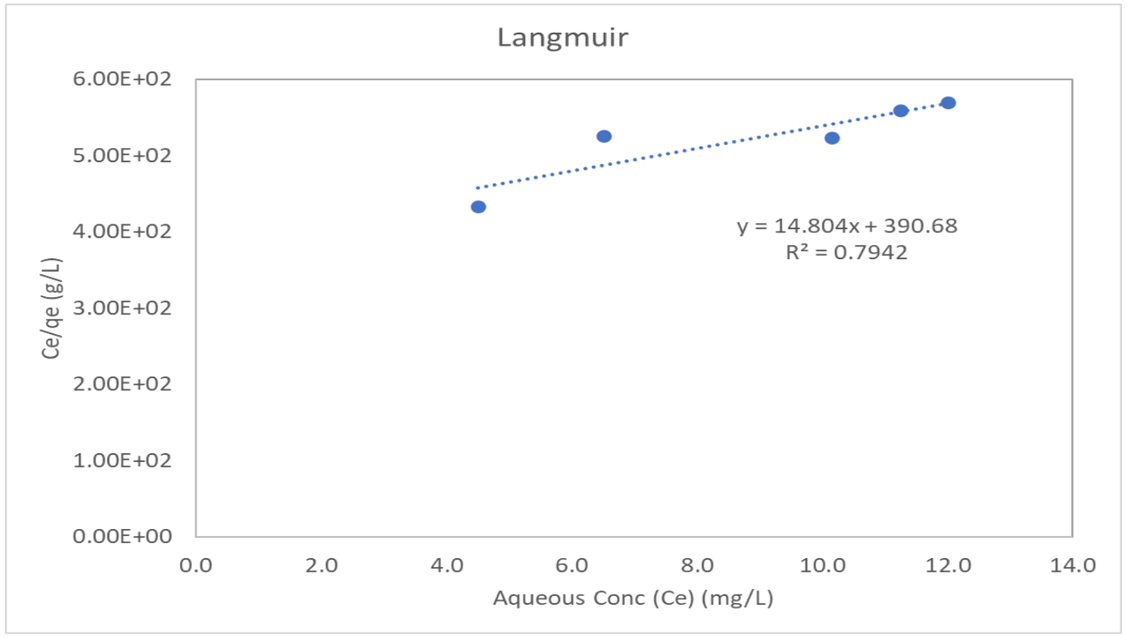

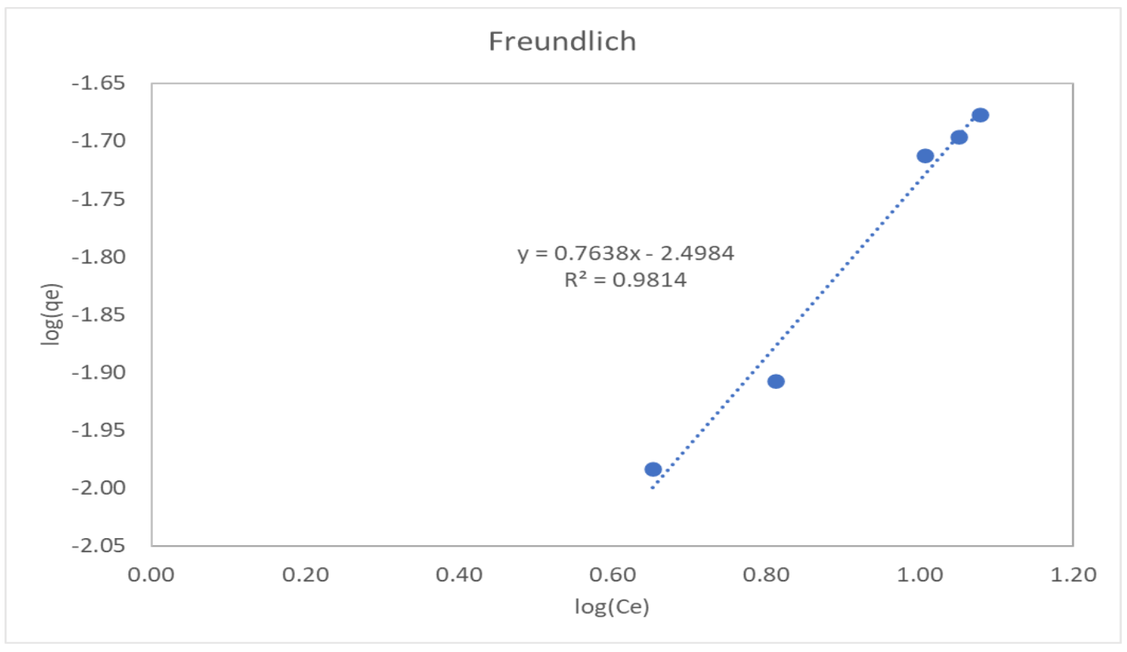

Note(s):
mg/L: milligrams per liter
mg/g: milligrams per gram
g/L: grams per liter
Ce: aqueous concentration of the adsorbate

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EVALUATION OF PARTITION COEFFICIENT RESULTS EAP

TITLE
AW-15S BORON PARTITION COEFFICIENTS

PROJECT NO.	PHASE	REV.	FIGURE
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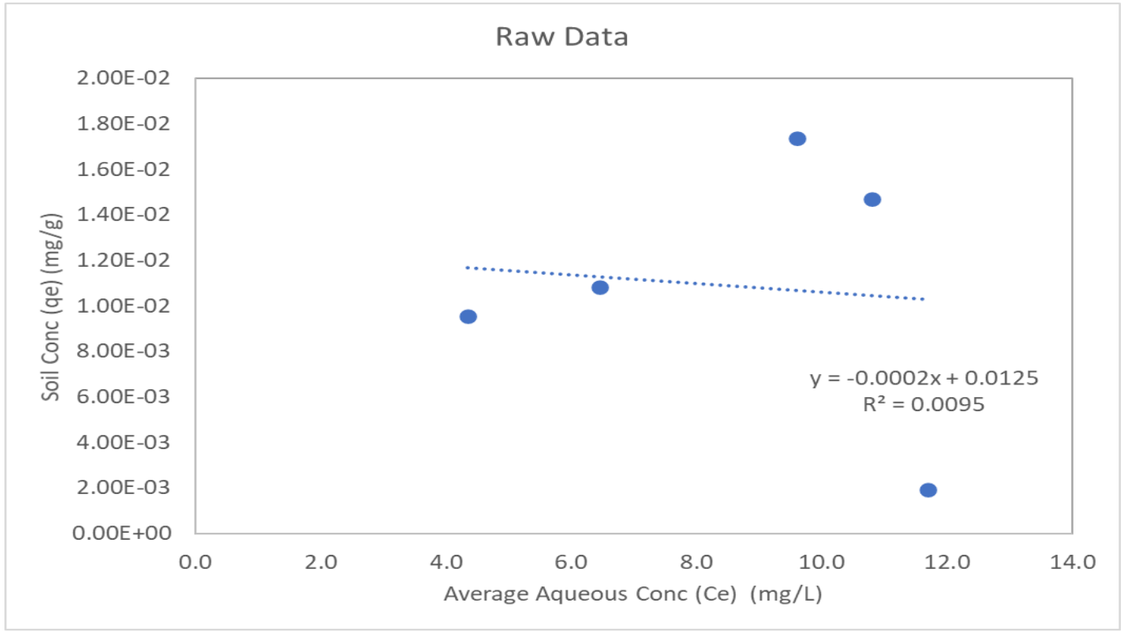

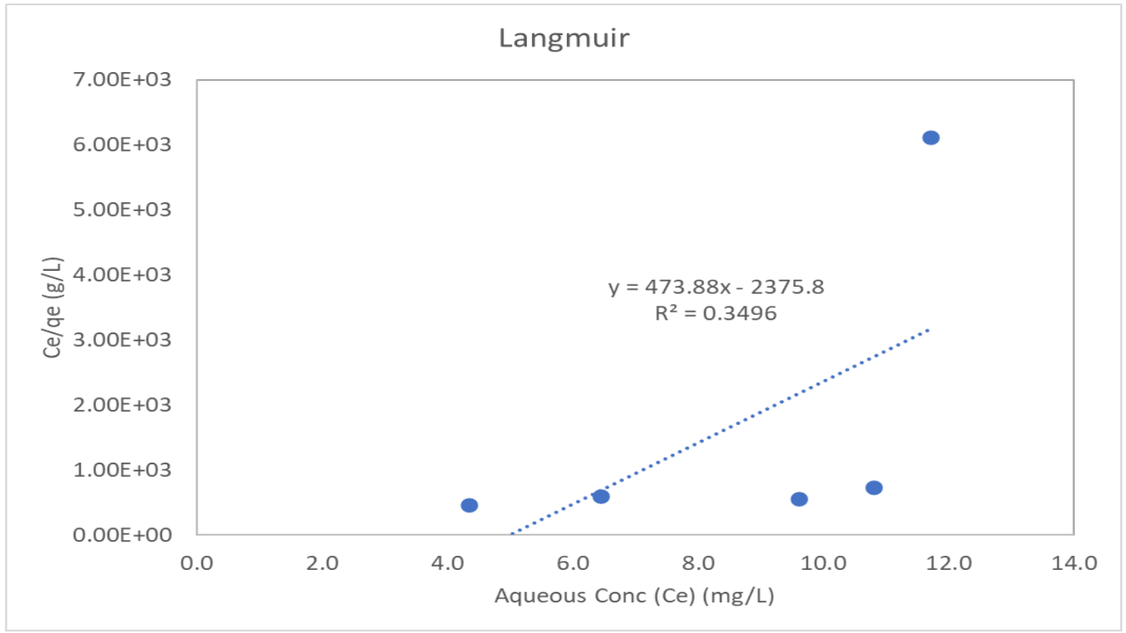

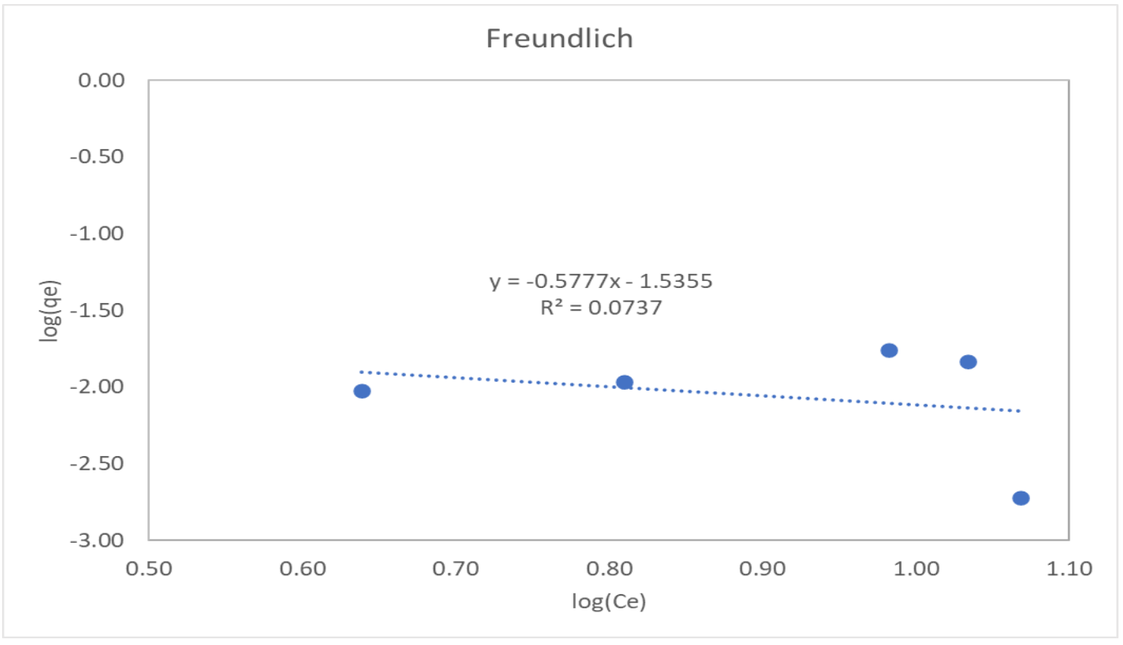

Note(s):
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mg/g: milligrams per gram
g/L: grams per liter
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TITLE
AW-19 BORON PARTITION COEFFICIENTS

PROJECT NO.	PHASE	REV.	FIGURE
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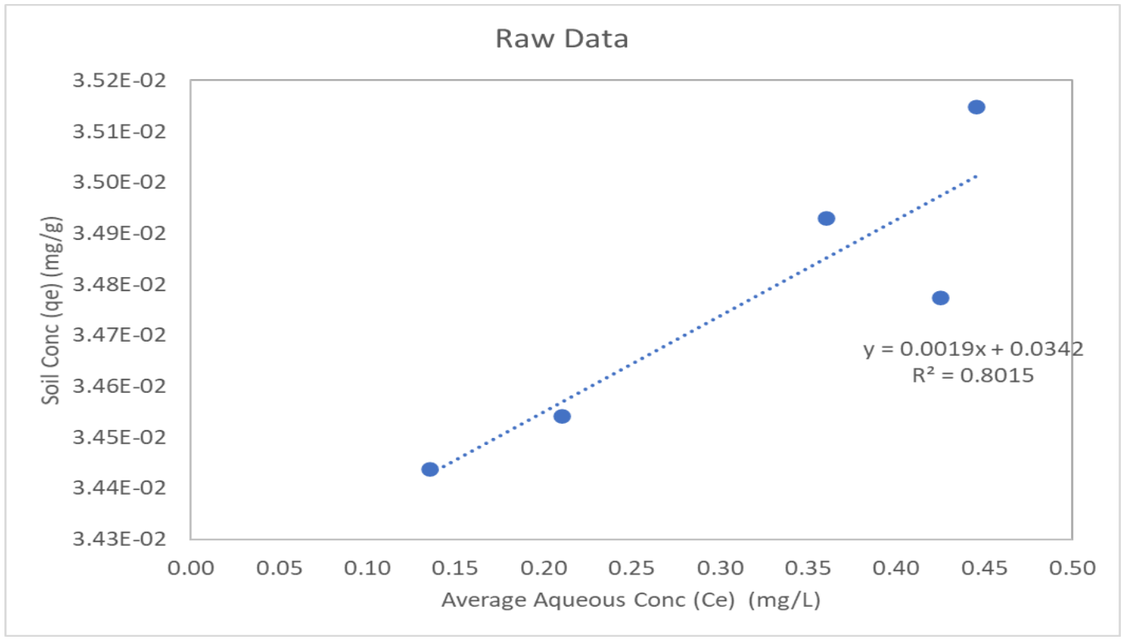

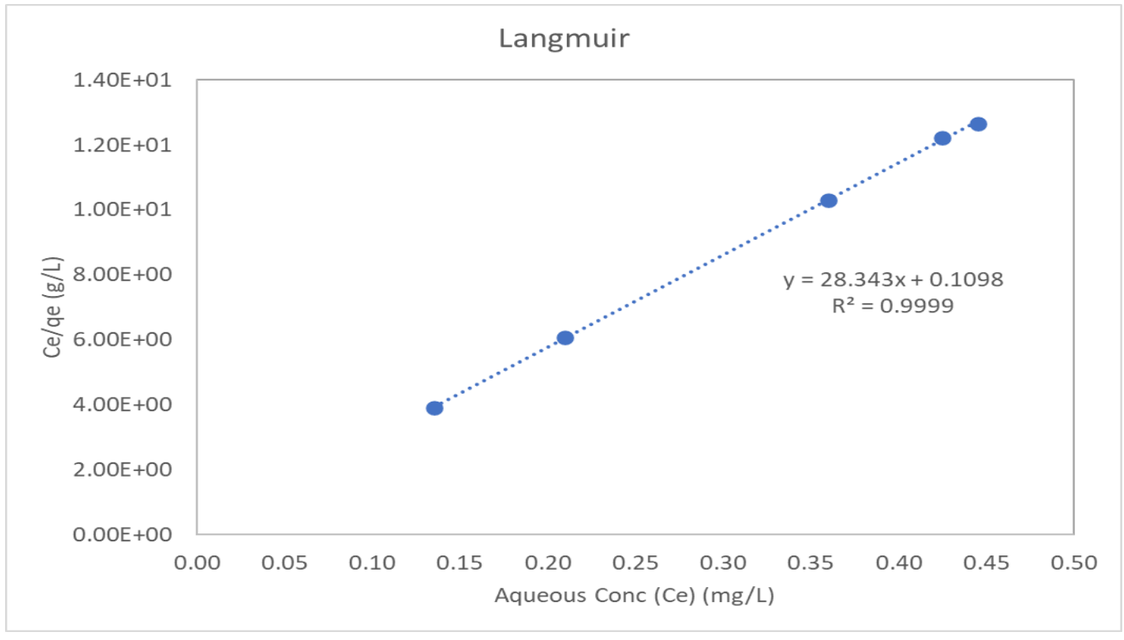

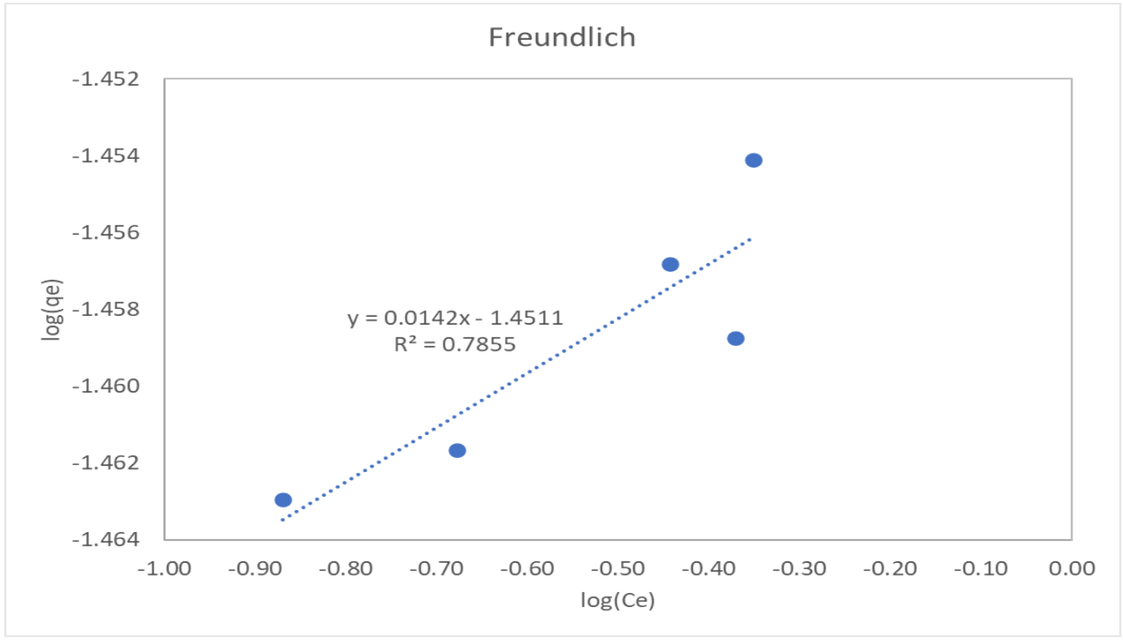

Note(s):
mg/L: milligrams per liter
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g/L: grams per liter
Ce: aqueous concentration of the adsorbate

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EVALUATION OF PARTITION COEFFICIENT RESULTS EAP

TITLE
AW-15S LITHIUM PARTITION COEFFICIENTS

PROJECT NO.	PHASE	REV.	FIGURE
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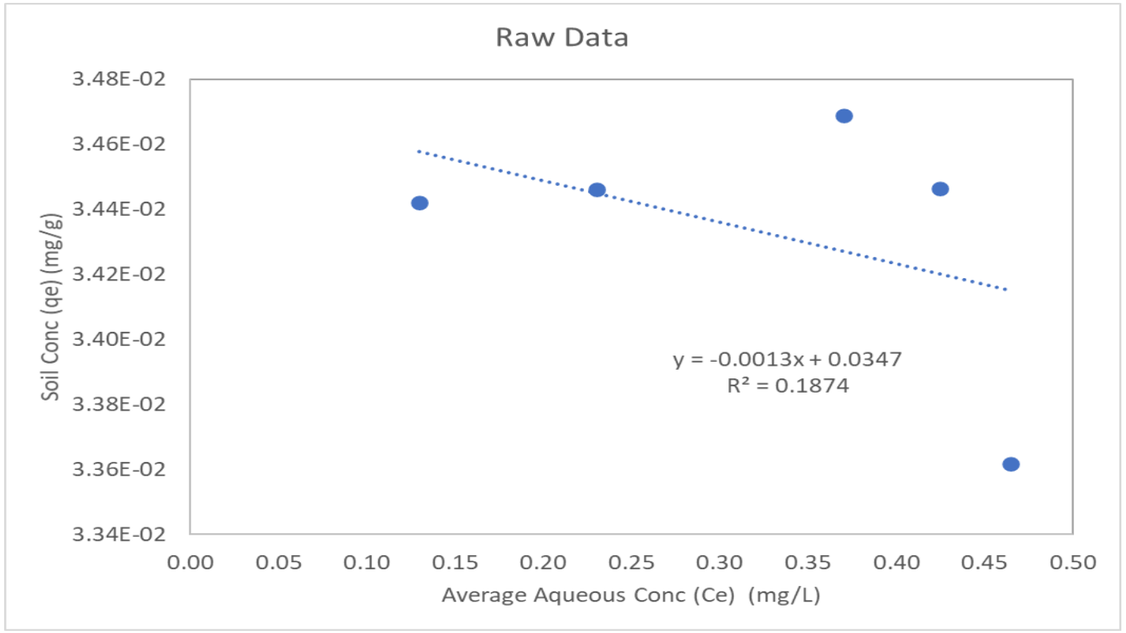

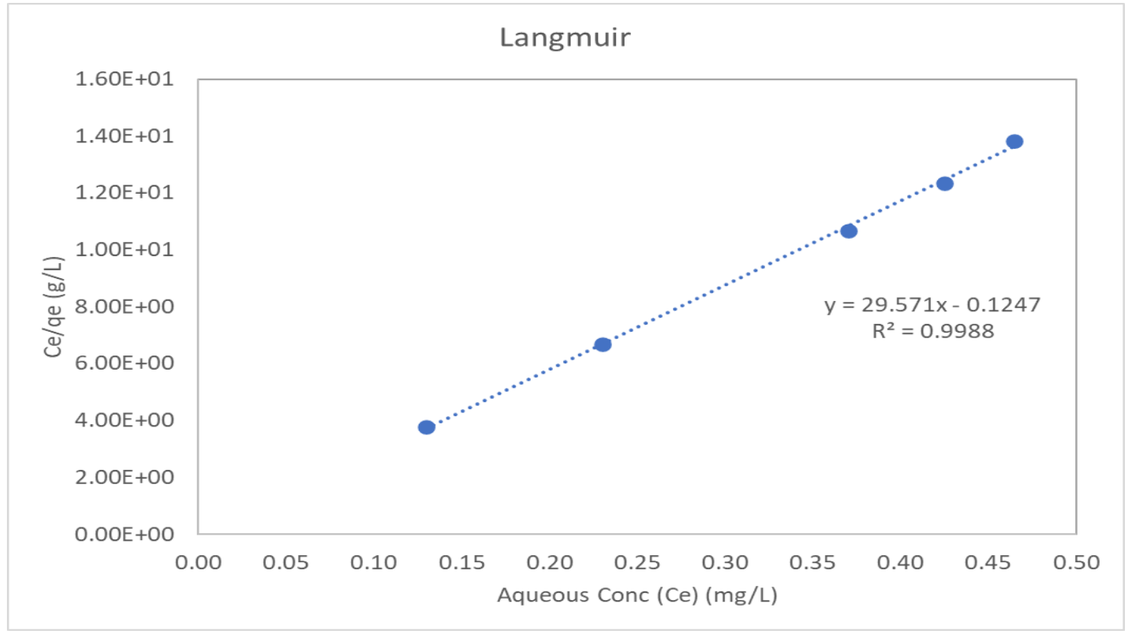

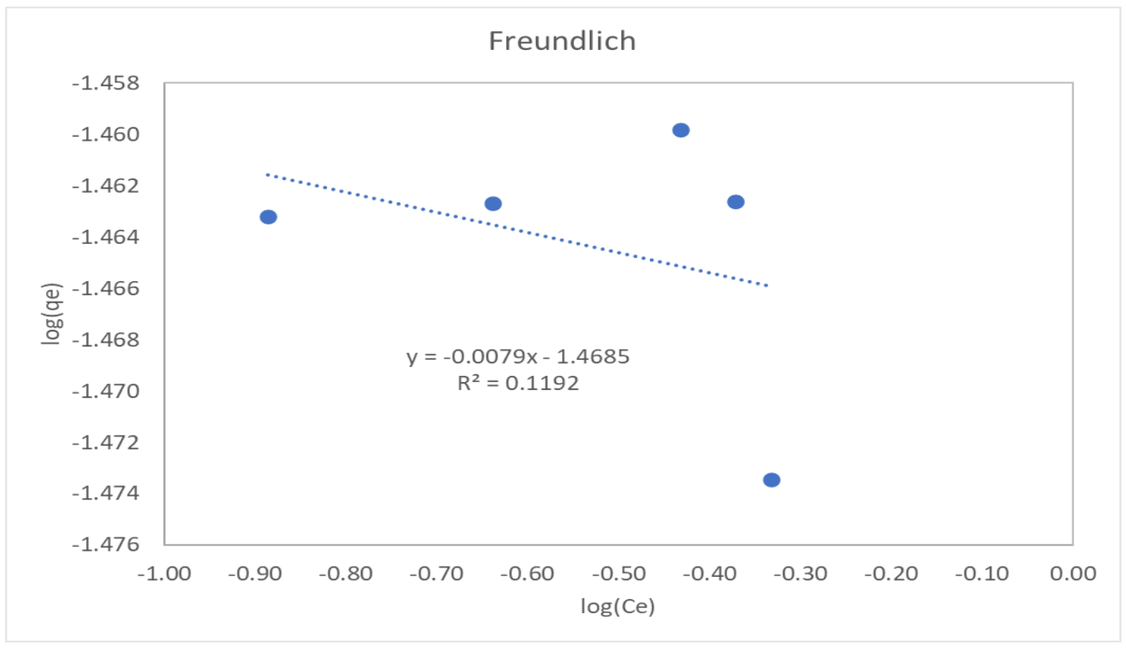

Note(s):
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mg/g: milligrams per gram
g/L: grams per liter
Ce: aqueous concentration of the adsorbate

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EVALUATION OF PARTITION COEFFICIENT RESULTS EAP

TITLE
AW-19 LITHIUM PARTITION COEFFICIENTS

PROJECT NO.	PHASE	REV.	FIGURE
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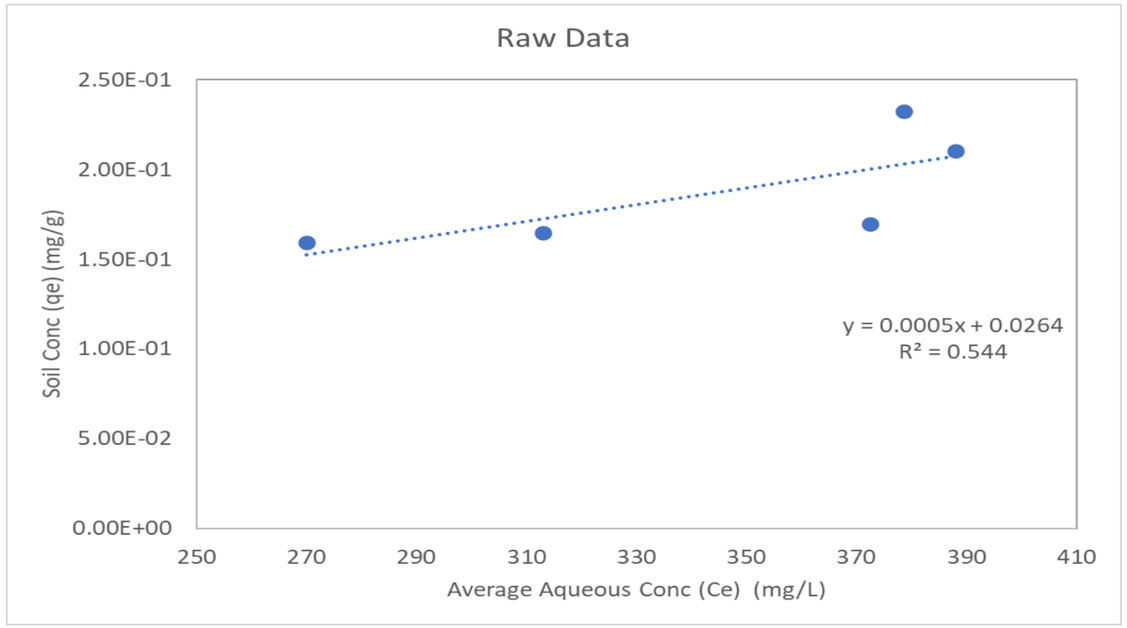

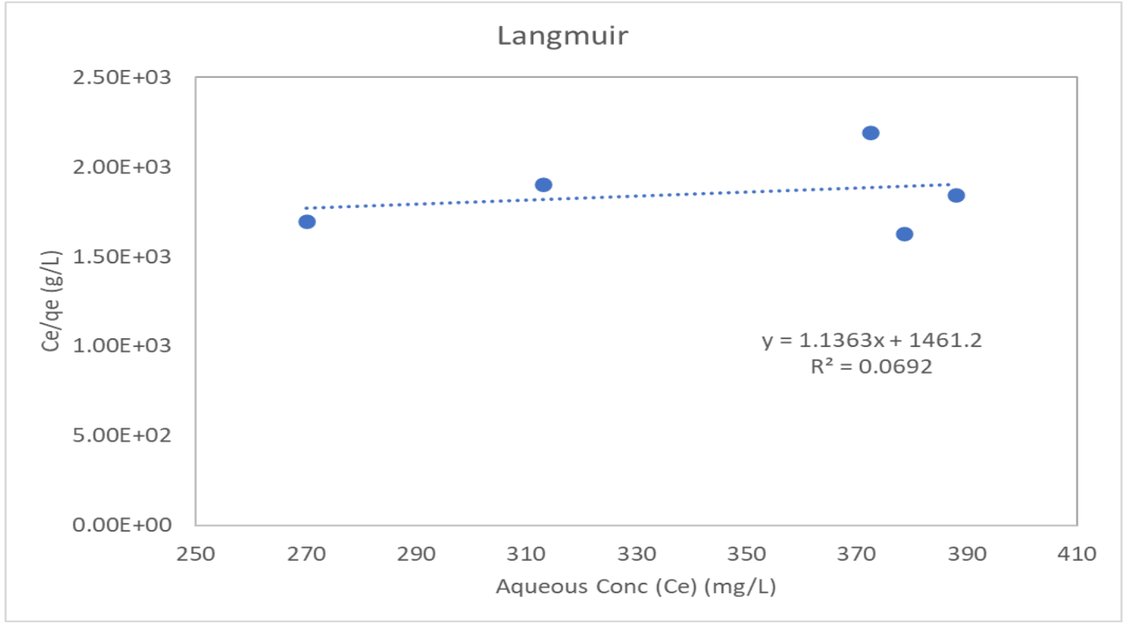

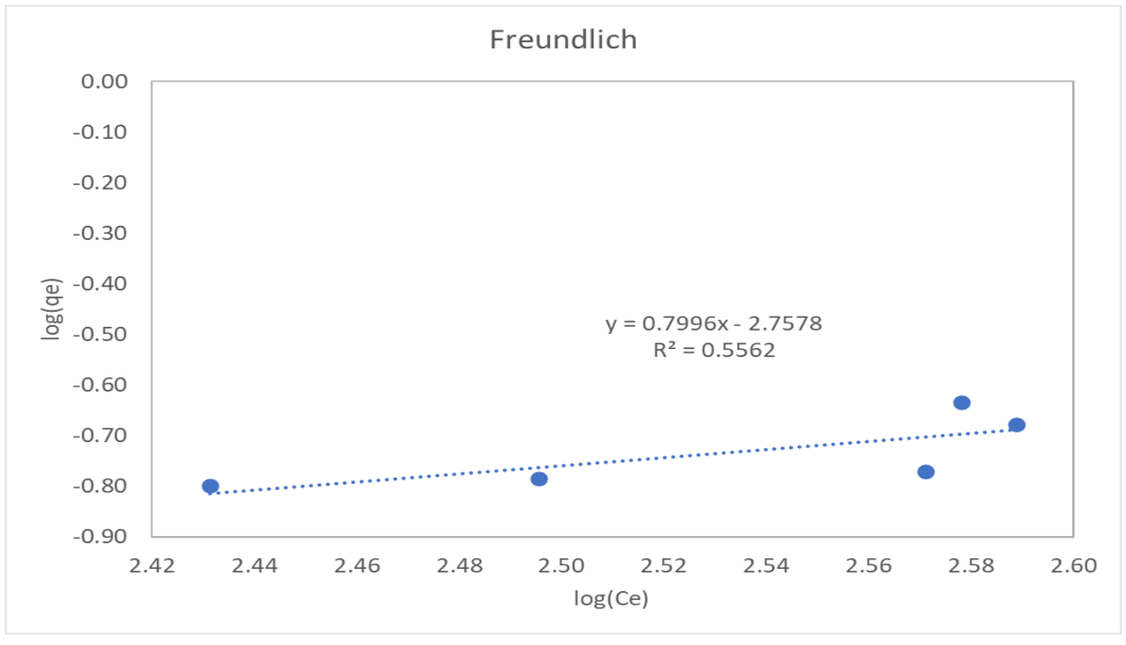

Note(s):
mg/L: milligrams per liter
mg/g: milligrams per gram
g/L: grams per liter
Ce: aqueous concentration of the adsorbate

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PROJECT
EVALUATION OF PARTITION COEFFICIENT RESULTS EAP

TITLE
AW-15S SULFATE PARTITION COEFFICIENTS

PROJECT NO.	PHASE	REV.	FIGURE
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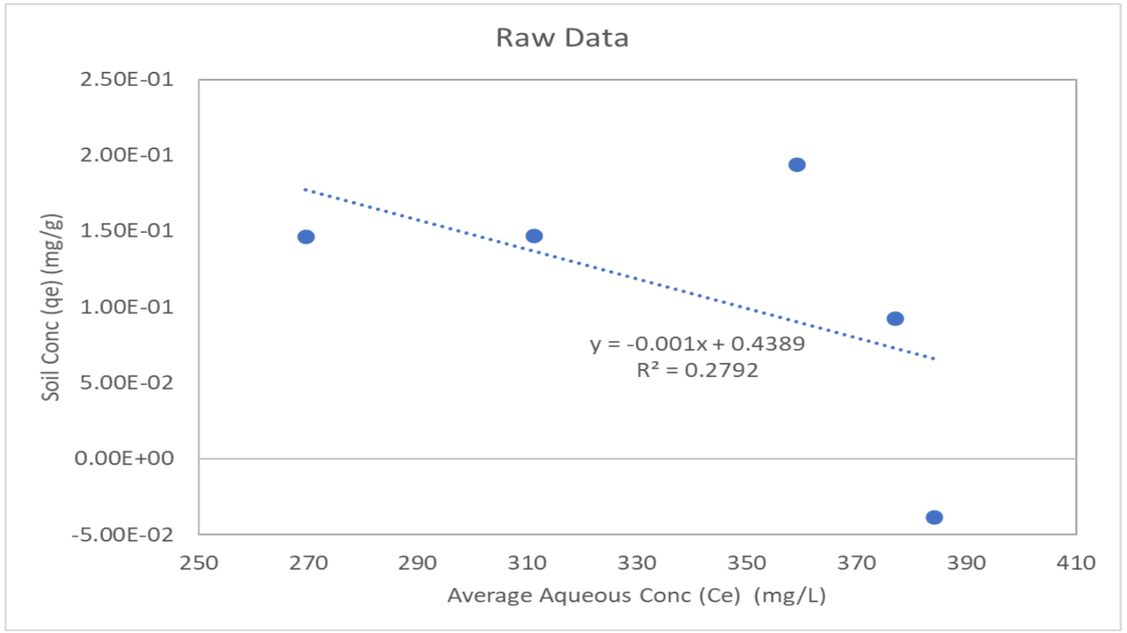

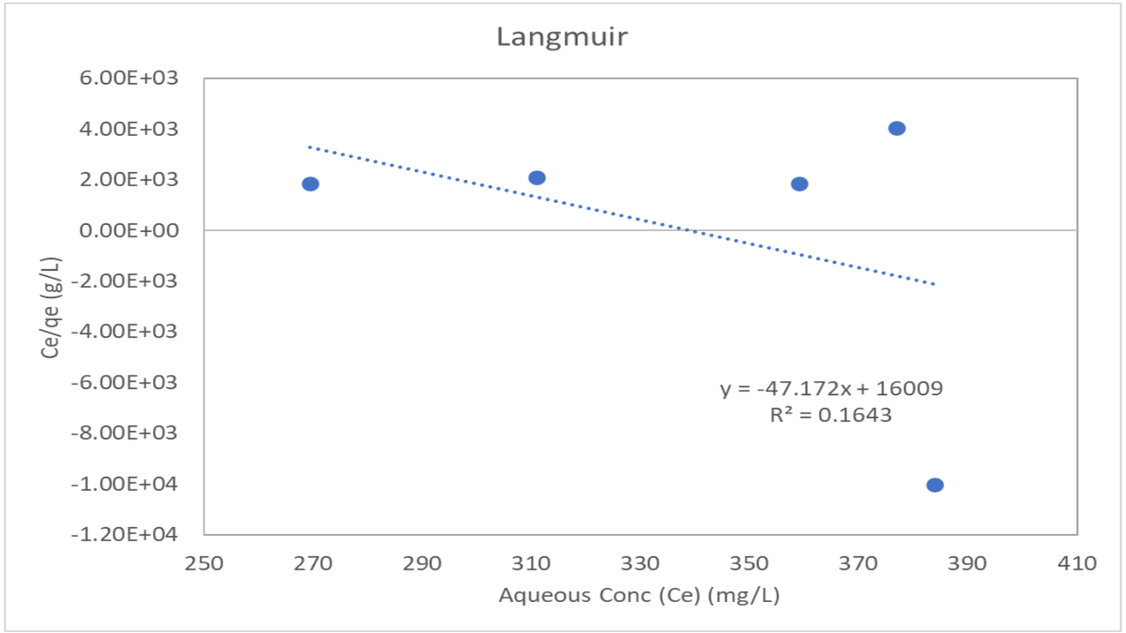

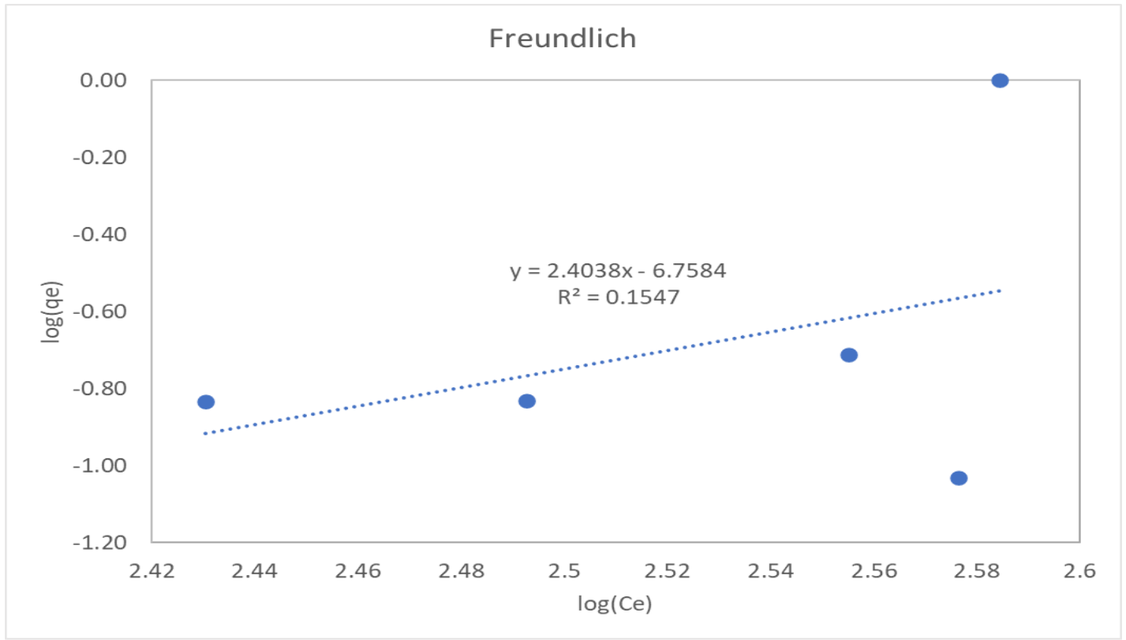

Note(s):
mg/L: milligrams per liter
mg/g: milligrams per gram
g/L: grams per liter
Ce: aqueous concentration of the adsorbate

CLIENT
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EDWARDS ASH POND (CCR UNIT 301)

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PROJECT
EVALUATION OF PARTITION COEFFICIENT RESULTS EAP

TITLE
AW-19 SULFATE PARTITION COEFFICIENTS

PROJECT NO.	PHASE	REV.	FIGURE
21454831	002	0	A-8

APPENDIX E
HELP MODEL OUTPUT FILES

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: EDW AP CBR **Simulated On:** 6/24/2022 15:45

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
SiCL - Silty Clay Loam
Material Texture Number 12

Thickness	=	12	inches
Porosity	=	0.471	vol/vol
Field Capacity	=	0.342	vol/vol
Wilting Point	=	0.21	vol/vol
Initial Soil Water Content	=	0.3322	vol/vol
Effective Sat. Hyd. Conductivity	=	4.20E-05	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	86.1	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	91	acres
Evaporative Zone Depth	=	12	inches
Initial Water in Evaporative Zone	=	3.987	inches
Upper Limit of Evaporative Storage	=	5.652	inches
Lower Limit of Evaporative Storage	=	2.52	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	3.987	inches
Total Initial Water	=	3.987	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	40.6	Degrees
Maximum Leaf Area Index	=	4.5	
Start of Growing Season (Julian Date)	=	120	days
End of Growing Season (Julian Date)	=	300	days
Average Wind Speed	=	9	mph

Average 1st Quarter Relative Humidity	=	70 %
Average 2nd Quarter Relative Humidity	=	66 %
Average 3rd Quarter Relative Humidity	=	74 %
Average 4th Quarter Relative Humidity	=	77 %

Note: Evapotranspiration data was obtained for Bartonville, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.919862	1.515505	2.970702	3.839356	3.771468	3.644309
3.594188	3.45941	2.562909	2.359867	2.871942	2.037439

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 40.6/-89.66

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
29.8	35.5	42.2	56.1	68.7	78.2
83.2	80.7	72	62.3	43.5	35.6

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 40.6/-89.66
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 40.6/-89.66

Average Annual Totals Summary

Title: EDW AP CBR
Simulated on: 6/24/2022 15:46

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	34.55	[4.31]	11,411,896.6	100.00
Runoff	3.704	[2.301]	1,223,418.2	10.72
Evapotranspiration	25.760	[3.86]	8,509,175.3	74.56
Subprofile1				
Percolation/leakage through Layer 1	5.087551	[1.891252]	1,680,570.9	14.73
Water storage				
Change in water storage	-0.0038	[0.8344]	-1,267.8	-0.01

* Note: Average inches are converted to volume based on the user-specified area.

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: EDW AP CIP Rem **Simulated On:** 6/24/2022 15:41

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
SiCL - Silty Clay Loam
Material Texture Number 12

Thickness	=	72	inches
Porosity	=	0.471	vol/vol
Field Capacity	=	0.342	vol/vol
Wilting Point	=	0.21	vol/vol
Initial Soil Water Content	=	0.3456	vol/vol
Effective Sat. Hyd. Conductivity	=	4.20E-05	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	86.1	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	22	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	6.174	inches
Upper Limit of Evaporative Storage	=	8.478	inches
Lower Limit of Evaporative Storage	=	3.78	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	24.883	inches
Total Initial Water	=	24.883	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	40.6	Degrees
Maximum Leaf Area Index	=	4.5	
Start of Growing Season (Julian Date)	=	120	days
End of Growing Season (Julian Date)	=	300	days
Average Wind Speed	=	9	mph

Average 1st Quarter Relative Humidity	=	70 %
Average 2nd Quarter Relative Humidity	=	66 %
Average 3rd Quarter Relative Humidity	=	74 %
Average 4th Quarter Relative Humidity	=	77 %

Note: Evapotranspiration data was obtained for Bartonville, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.919862	1.515505	2.970702	3.839356	3.771468	3.644309
3.594188	3.45941	2.562909	2.359867	2.871942	2.037439

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 40.6/-89.66

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
29.8	35.5	42.2	56.1	68.7	78.2
83.2	80.7	72	62.3	43.5	35.6

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 40.6/-89.66
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 40.6/-89.66

Average Annual Totals Summary

Title: EDW AP CIP Rem
Simulated on: 6/24/2022 15:41

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	34.55	[4.31]	2,758,920.1	100.00
Runoff	3.567	[2.195]	284,844.6	10.32
Evapotranspiration	26.939	[3.969]	2,151,375.4	77.98
Subprofile1				
Percolation/leakage through Layer 1	4.025858	[1.305157]	321,505.0	11.65
Water storage				
Change in water storage	0.0150	[1.5498]	1,195.0	0.04

* Note: Average inches are converted to volume based on the user-specified area.

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: EDW AP CIP Cons **Simulated On:** 6/27/2022 16:01

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
SiL - Silty Loam(Moderate)
Material Texture Number 23

Thickness	=	6	inches
Porosity	=	0.461	vol/vol
Field Capacity	=	0.36	vol/vol
Wilting Point	=	0.203	vol/vol
Initial Soil Water Content	=	0.3485	vol/vol
Effective Sat. Hyd. Conductivity	=	9.00E-06	cm/sec

Layer 2

Type 1 - Vertical Percolation Layer
SCL - Sandy Clay Loam
Material Texture Number 10

Thickness	=	18	inches
Porosity	=	0.398	vol/vol
Field Capacity	=	0.244	vol/vol
Wilting Point	=	0.136	vol/vol
Initial Soil Water Content	=	0.2559	vol/vol
Effective Sat. Hyd. Conductivity	=	1.20E-04	cm/sec

Layer 3

Type 2 - Lateral Drainage Layer
Drainage Net (0.5 cm)
Material Texture Number 20

Thickness	=	0.2	inches
Porosity	=	0.85	vol/vol
Field Capacity	=	0.01	vol/vol
Wilting Point	=	0.005	vol/vol
Initial Soil Water Content	=	0.0126	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E+01	cm/sec
Slope	=	1.27	%
Drainage Length	=	1190	ft

Layer 4

Type 4 - Flexible Membrane Liner

LDPE Membrane
Material Texture Number 36

Thickness	=	0.04	inches
Effective Sat. Hyd. Conductivity	=	4.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	1	Holes/Acre
FML Placement Quality	=	3	Good

Layer 5

Type 1 - Vertical Percolation Layer (Waste)
High-Density Electric Plant Coal Fly Ash
Material Texture Number 30

Thickness	=	408	inches
Porosity	=	0.541	vol/vol
Field Capacity	=	0.187	vol/vol
Wilting Point	=	0.047	vol/vol
Initial Soil Water Content	=	0.187	vol/vol
Effective Sat. Hyd. Conductivity	=	2.08E-06	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	89.3	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	69.1	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	5.231	inches
Upper Limit of Evaporative Storage	=	7.542	inches
Lower Limit of Evaporative Storage	=	2.85	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	82.995	inches
Total Initial Water	=	82.995	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	40.6	Degrees
Maximum Leaf Area Index	=	2	
Start of Growing Season (Julian Date)	=	120	days
End of Growing Season (Julian Date)	=	300	days
Average Wind Speed	=	9	mph

Average 1st Quarter Relative Humidity	=	70 %
Average 2nd Quarter Relative Humidity	=	66 %
Average 3rd Quarter Relative Humidity	=	74 %
Average 4th Quarter Relative Humidity	=	77 %

Note: Evapotranspiration data was obtained for Bartonville, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.919862	1.515505	2.970702	3.839356	3.771468	3.644309
3.594188	3.45941	2.562909	2.359867	2.871942	2.037439

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 40.6/-89.66

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
29.8	35.5	42.2	56.1	68.7	78.2
83.2	80.7	72	62.3	43.5	35.6

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 40.6/-89.66
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 40.6/-89.66

Average Annual Totals Summary

Title: EDW AP CIP Cons
Simulated on: 6/27/2022 16:02

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	34.55	[4.31]	8,665,517.1	100.00
Runoff	5.498	[2.429]	1,379,079.0	15.91
Evapotranspiration	26.321	[3.85]	6,602,232.4	76.19
Subprofile1				
Lateral drainage collected from Layer 3	2.7222	[1.0387]	682,816.5	7.88
Percolation/leakage through Layer 4	0.000194	[0.000197]	48.6	0.00
Average Head on Top of Layer 4	0.0594	[0.0662]	---	---
Subprofile2				
Percolation/leakage through Layer 5	0.000195	[0.000191]	48.8	0.00
Water storage				
Change in water storage	0.0053	[1.0273]	1,340.4	0.02

* Note: Average inches are converted to volume based on the user-specified area.

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: EDW AP Default **Simulated On:** 6/24/2022 16:19

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
SiL - Silty Loam(Moderate)
Material Texture Number 23

Thickness	=	6	inches
Porosity	=	0.461	vol/vol
Field Capacity	=	0.36	vol/vol
Wilting Point	=	0.203	vol/vol
Initial Soil Water Content	=	0.3485	vol/vol
Effective Sat. Hyd. Conductivity	=	9.00E-06	cm/sec

Layer 2

Type 1 - Vertical Percolation Layer
SCL - Sandy Clay Loam
Material Texture Number 10

Thickness	=	30	inches
Porosity	=	0.398	vol/vol
Field Capacity	=	0.244	vol/vol
Wilting Point	=	0.136	vol/vol
Initial Soil Water Content	=	0.2511	vol/vol
Effective Sat. Hyd. Conductivity	=	1.20E-04	cm/sec

Layer 3

Type 2 - Lateral Drainage Layer
Drainage Net (0.5 cm)
Material Texture Number 20

Thickness	=	0.2	inches
Porosity	=	0.85	vol/vol
Field Capacity	=	0.01	vol/vol
Wilting Point	=	0.005	vol/vol
Initial Soil Water Content	=	0.0126	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E+01	cm/sec
Slope	=	1.27	%
Drainage Length	=	1190	ft

Layer 4

Type 4 - Flexible Membrane Liner
LDPE Membrane
Material Texture Number 36

Thickness	=	0.04	inches
Effective Sat. Hyd. Conductivity	=	4.00E-13	cm/sec
FML Pinhole Density	=	1	Holes/Acre
FML Installation Defects	=	1	Holes/Acre
FML Placement Quality	=	3	Good

Layer 5

Type 1 - Vertical Percolation Layer (Waste)
High-Density Electric Plant Coal Fly Ash
Material Texture Number 30

Thickness	=	408	inches
Porosity	=	0.541	vol/vol
Field Capacity	=	0.187	vol/vol
Wilting Point	=	0.047	vol/vol
Initial Soil Water Content	=	0.187	vol/vol
Effective Sat. Hyd. Conductivity	=	2.08E-06	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	89.3	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	69.1	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	5.231	inches
Upper Limit of Evaporative Storage	=	7.542	inches
Lower Limit of Evaporative Storage	=	2.85	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	85.923	inches
Total Initial Water	=	85.923	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	40.6	Degrees
Maximum Leaf Area Index	=	2	
Start of Growing Season (Julian Date)	=	120	days

End of Growing Season (Julian Date)	=	300	days
Average Wind Speed	=	9	mph
Average 1st Quarter Relative Humidity	=	70	%
Average 2nd Quarter Relative Humidity	=	66	%
Average 3rd Quarter Relative Humidity	=	74	%
Average 4th Quarter Relative Humidity	=	77	%

Note: Evapotranspiration data was obtained for Bartonville, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.919862	1.515505	2.970702	3.839356	3.771468	3.644309
3.594188	3.45941	2.562909	2.359867	2.871942	2.037439

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 40.6/-89.66

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
29.8	35.5	42.2	56.1	68.7	78.2
83.2	80.7	72	62.3	43.5	35.6

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 40.6/-89.66
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 40.6/-89.66

Average Annual Totals Summary

Title: EDW AP Default
Simulated on: 6/24/2022 16:20

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	34.55	[4.31]	8,665,517.1	100.00
Runoff	5.500	[2.427]	1,379,467.8	15.92
Evapotranspiration	26.321	[3.847]	6,602,070.5	76.19
Subprofile1				
Lateral drainage collected from Layer 3	2.7200	[0.9825]	682,274.9	7.87
Percolation/leakage through Layer 4	0.000098	[0.000126]	24.6	0.00
Average Head on Top of Layer 4	0.0267	[0.0439]	---	---
Subprofile2				
Percolation/leakage through Layer 5	0.000098	[0.000117]	24.7	0.00
Water storage				
Change in water storage	0.0067	[1.1405]	1,679.2	0.02

* Note: Average inches are converted to volume based on the user-specified area.

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: EDW AP Default Earth **Simulated On:** 6/24/2022 16:16

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
SiL - Silty Loam(Moderate)
Material Texture Number 23

Thickness	=	6	inches
Porosity	=	0.461	vol/vol
Field Capacity	=	0.36	vol/vol
Wilting Point	=	0.203	vol/vol
Initial Soil Water Content	=	0.3485	vol/vol
Effective Sat. Hyd. Conductivity	=	9.00E-06	cm/sec

Layer 2

Type 1 - Vertical Percolation Layer
SCL - Sandy Clay Loam
Material Texture Number 10

Thickness	=	30	inches
Porosity	=	0.398	vol/vol
Field Capacity	=	0.244	vol/vol
Wilting Point	=	0.136	vol/vol
Initial Soil Water Content	=	0.2563	vol/vol
Effective Sat. Hyd. Conductivity	=	1.20E-04	cm/sec

Layer 3

Type 3 - Barrier Soil Liner
Liner Soil (High)
Material Texture Number 16

Thickness	=	36	inches
Porosity	=	0.427	vol/vol
Field Capacity	=	0.418	vol/vol
Wilting Point	=	0.367	vol/vol
Initial Soil Water Content	=	0.427	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-07	cm/sec

Layer 4

Type 1 - Vertical Percolation Layer (Waste)
High-Density Electric Plant Coal Fly Ash
Material Texture Number 30

Thickness	=	408	inches
Porosity	=	0.541	vol/vol
Field Capacity	=	0.187	vol/vol
Wilting Point	=	0.047	vol/vol
Initial Soil Water Content	=	0.1894	vol/vol
Effective Sat. Hyd. Conductivity	=	2.08E-06	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	89.3	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	69.1	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	5.235	inches
Upper Limit of Evaporative Storage	=	7.542	inches
Lower Limit of Evaporative Storage	=	2.85	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	102.427	inches
Total Initial Water	=	102.427	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	40.6	Degrees
Maximum Leaf Area Index	=	2	
Start of Growing Season (Julian Date)	=	120	days
End of Growing Season (Julian Date)	=	300	days
Average Wind Speed	=	9	mph
Average 1st Quarter Relative Humidity	=	70	%
Average 2nd Quarter Relative Humidity	=	66	%
Average 3rd Quarter Relative Humidity	=	74	%
Average 4th Quarter Relative Humidity	=	77	%

Note: Evapotranspiration data was obtained for Bartonville, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.919862	1.515505	2.970702	3.839356	3.771468	3.644309
3.594188	3.45941	2.562909	2.359867	2.871942	2.037439

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 40.6/-89.66

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
29.8	35.5	42.2	56.1	68.7	78.2
83.2	80.7	72	62.3	43.5	35.6

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 40.6/-89.66
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 40.6/-89.66

Average Annual Totals Summary

Title: EDW AP Default Earth
Simulated on: 6/24/2022 16:17

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	34.55	[4.31]	8,665,517.1	100.00
Runoff	5.205	[2.496]	1,305,465.6	15.07
Evapotranspiration	27.450	[3.924]	6,885,299.6	79.46
Subprofile1				
Percolation/leakage through Layer 3	1.826281	[0.161421]	458,091.5	5.29
Average Head on Top of Layer 3	16.9565	[4.5453]	---	---
Subprofile2				
Percolation/leakage through Layer 4	0.000191	[0.001041]	47.8	0.00
Water storage				
Change in water storage	1.8925	[1.6409]	474,704.0	5.48

* Note: Average inches are converted to volume based on the user-specified area.

APPENDIX F
FLUX EVALUATION DATA

APPENDIX F. FLUX EVALUATION DATA
GROUNDWATER MODELING REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Calibration Model					
Model	**Years (Model Period)**	**HSU**	**Total Flux In[1] (ft^3/d)**	**Total Flux In (gpm)**	
Calibration Model	62	Fill Unit (CCR)	708.27	3.68	
Model	**Years (Model Period)**	**HSU**	**Total Flux Out[1] (ft^3/d)**	**Total Flux Out (gpm)**	
Calibration Model	62	Fill Unit (CCR)	-709.88	-3.69	
Scenario 1: CIP (CCR removal from the northwest areas of the Ash Pond, consolidation to the northeast, central and southern areas of the Ash Pond, and construction of a cover system over the remaining CCR)					
Prediction Model	**Years (Post-Construction Period)**	**HSU**	**Total Flux In[1] (ft^3/d)**	**Total Flux In (gpm)**	**Reduction in Flux In Post Closure[2] (Percentage, %)**
CIP	186	Fill Unit (CCR)	20.95	0.11	97%
Prediction Model	**Years (Post-Construction Period)**	**HSU**	**Total Flux Out[1] (ft^3/d)**	**Total Flux Out (gpm)**	**Reduction in Flux Out Post Closure[2] (Percentage, %)**
CIP	186	Fill Unit (CCR)	-43.80	-0.23	94%

[O: JJW 6/20/22; C: EGP 6/16/22; U: JJW 6/24/22;U: BGH 6/27/22]

Notes:
1. Reduction in flux in as compared to flux in at the end of calibration model (model period of 62 years).
2. Total flux in and out source data provided in flux calculation data files included in Appendix C.

CCR = coal combustion residuals
CIP = closure in place
HSU = Hydrostratigraphic Unit
% = percentage
ft^3/d = cubic feet per day
gpm = gallons per minute

APPENDIX C
MATERIAL QUANTITY, LABOR, AND MILEAGE ESTIMATES FOR ALTERNATIVE 2 AND ALTERNATIVE 3 REMEDIES

ILLINOIS POWER RESOURCES GENERATING, LLC - EDWARDS POWER PLANT
CORRECTIVE ACTION ALTERNATIVES ANALYSIS SUPPORTING INFORMATION REPORT (CAAA-SIR)
ALTERNATIVE 2 - SOURCE CONTROL WITH GROUNDWATER EXTRACTION TRENCH[1]

ITEM NO.	ENGINEERING, PRE-CONSTRUCTION, AND CONSTRUCTION SUPPORT TASKS	Units	Quantity	Crew	Daily Output	Labor Hours	Equipment Hours	Notes
1	Pre-Design Investigation, Final Groundwater Extraction Trench Design and Bid Support	LS	1	-	-	-	-	Assumes pre-design investigation is needed as part of the Final Groundwater Extraction Trench design.
2	Engineering Support and CQA During Construction	LS	1	Eng	12	3,600	3,000	Assumed labor and equipment hours based on Ramboll project experience.
	ENGINEERING, PRE-CONSTRUCTION, AND CONSTRUCTION SUPPORT ESTIMATED SUBTOTAL			**-**	**-**	**3,600**	**3000**	
ITEM NO.	**SITE PREPARATION**	**Units**	**Quantity**	**Crew**	**Daily Output**	**Labor Hours**	**Equipment Hours**	**Notes**
3	Mobilization and De-Mobilization	LS	-	-	-	-	-	Assumes general construction and One-Pass mobilization and demoibilization.
	General Construction Mobilization and De-Mobilization	LS	1	-	-	-	-	Assumes general construction contractor is mobilizing equipment from out of state.
	One-Pass Trencher Mobilization, Assembly, and De-Mobilization	LS	1	-	-	-	-	Assumes construction contractor is mobilizing One-Pass equipment from out of state.
4	Staging Area & Temporary Roads Preparation	-	-	-	-	1,569	1,140	Assumes some work general preparation of temporary access roads along the trench alignment will be needed specific to extraction trench construction.
	Subsurface Stabilization Nonwoven Geotextile	SY	6,000	2 Clab	2500	38	0	313219161550: Geosynthetic soil stabilization, geotextile fabric, non-woven, 120 lb tensile strength includes scarifying and compaction. Assumes 1 acre (4800 sy) staging area and approximately 2000 ft of temporary access road (15 ft wide). 2000 ft is to improve access road for the southern trench area.
	Offsite Fill for South Area Ramp	CY	8,000	B13D	376	340	340	Imported clay for south area ramp. Assumes 8000 CY. Based on Ramboll experience.
	Haul Fill to Site	LCY	8,000	B34C	99	646	646	312323203104: Cycle hauling(wait, load, travel, unload or dump & reutrn) time per cycle, excavated or borrow, loose cubic yards, 15 min load/wait/unload, 16.5 C.Y. truck, cycle 50 miles, 45 mph, excludes loading equipment
	Haul Material to South Area Ramp	CY	8,000	B34G	850	75	75	312323206170: Hauling; no loading equipment, including hauling, waiting, loading/dumping; 34 C.Y. off-road, 15 min wait/ld./uld., 15 MPH, cycle 1 mile. Daily output extrapolated down to 10 min wait. Assumes onsite stockpile location approximately 1/2 mile from south ramp area. Assumes hauling of clay to south ramp area.
	Construct Staging Area & Temporary Roads	SY	6,000	B14	615	468	78	015523500100: Temporary, roads, gravel fill, 8" gravel depth, excluding surfacing. Assumes 1 acre staging area and approximately 2000 ft of temporary access road.
5	Construction Soil Erosion & Sediment Controls	-	-	-	-	278	93	Assumes soil erosion and sediment controls will be implemented only during the groundwater extraction trench construction.
	Silt Fence	LF	5,200	B62	650	192	64	312514161000: Synthetic erosion control, silt fence, install and remove, 3' high. Assumes silt fence is installed on downgradient side of the extraction trench alignments [2,600 ft of combined extraction trenches (1,700 feet in the north, 900 feet in the south)]. Assumes the silt fence will get replaced once during construction.
	Sediment Log, Filter Sock	LF	3,600	A2	1000	86	29	312514160705: Sediment Log, Filter Sock, 9". Assume sediment log is needed along alignment of extraction trench (2,600 LF total) and settling pond perimeter (1,000 LF).
6	Construction Facilities	-	-	-	-	-	-	Assumes office trailer, storage boxes, and portable toilets are required during the construction phase of the alternative.
	Office Trailer	MO - in use	12	-	-	-	-	015213200350: Office trailer, furnished, no hookups, 32' x 8'. Assume quantity of one (1).
	Storage Trailers	MO - in use	12	-	-	-	-	015213201350: Storage boxes, 40' x 8'. Assume quantity of two (2) boxes onsite.
	Portable Toilet	MO - in use	12	-	-	-	-	015433406410: Toilet, portable chemical. Assume quantity of four (4) units onsite.
7	Electrical Installation	EA	3	R1B	-	720	0	Assumes electrical installation based on Ramboll experience to install one power drop for low-voltage (120V) power for the irrigation pumps, control equipment, etc. For each power drop, consider the distances from existing power sources.
8	Existing Site Utilities Preparation	-	-	-	-	216	158	Assumes utility survey, relocate, and power line relocation to identify/inventory existing active or abandoned site utilities in conflict with proposed extraction trench activities. Assumes updated layout will be determined during design phase.
	Utility Survey	LS	-	UL	-	40	20	Private and public utility location services to adequately locate and inventory existing site utilities that may be in conflict with proposed extraction trench locations based on Ramboll experience.
	Utility Relocate/Removal	EA	1	R6	1	88	69	Addressing potential conflicting of abandoned section of sewer force main based on Ramboll experience. Sewer force main crossing the AP is to be abandoned as part of AP closure activities, but if abandoned main is to remain in place, then sections may need to be removed to accomodate extraction trench installation.
	Power Line Relocation	EA	1	R6	1	88	69	Relocation/raising of high voltage power lines crossing the CBR portion of the AP to allow for adqueate clearance for construction equipment for trench installation based on Ramboll experience.
9	Geotechnical Monitoring	LS	-	GM	-	600	0	Assumes installation of inclinometers, survey prisms, and settlement monitoring devices along the southern trench where the dike will be modified for work pad installation. Assumes a 4-person crew installs the monitoring system over a period of 3 weeks. Based on Ramboll experience

10	Extraction Trench Alignment Preparation Work Pad	-	-	-	-	4,405	1,116	Assumes construction of a 30-ft wide work pad for the full length of the northern and southern trenches. For the southern trench, excavation of berm material on the upslope side and fill along the downslope side will be required to level off the work area. The slope will be reinforced to ensure structural integrity (*e.g.* , by installation of excavation shoring or other means). Once prepared, surface grading and stabilization will be completed along the southern trench work pad. For the northern trench, it is anticipated that only surface grading and stabilization will be required for the work pad.
	Excavation of Berm Material and Stockpiling for South Trench	CY	6,000	B12C	1320	73	36	312316420260: Excavating, bulk bank measure, hydraulic, crawler mtd., 2 C.Y. cap (165 CY/hr). Using 900 ft long, 12 ft deep, and 20 ft wide.
	Concrete Jersey Barriers for South Trench	EA	90	B21B	24	150	30	347113171500. Security vehicle barriers, concrete barrier, jersey, 10' L x 2' by 6" W x 32" H, 10 or more same site. Assumes silt fence is installed on downgradient side of the extraction trench alignments 900 ft. Requested by specialty contractor to protect the limit of disturbance.
	Temporary Excavation Shoring	S.F	49,500	B40	960	3,300	825	314116101500. 20' deep excavation, 27 psf, left in place. Assumes length of 900 ft and retained height of 15 ft and 40 ft embedment. Based on Ramboll experience.
	Loading Stockpiled Berm Material for South Trench	BCY	6,000	B10S	970	74	49	312323154060: Borrow, common earth, 1-1/2 C.Y. bucket, loading and/or spreading, front end loader, wheel-mounted. Assumes stockpiling of upslope material adjacent to work area.
	Hauling Berm Material to Stockpile for South Trench	LCY	6,000	B34G	986	49	49	312323206130: Hauling; no loading equipment, including hauling, waiting, loading/dumping; 34 C.Y. off-road, 15 min wait/ld./uld., 15 MPH, cycle 2,000 ft.
	Surface Grading for North Trench	MSF	51	B11L	30	27	14	312216103600: Fine grading, work pad area. Assumes grading along the northern (1,700 ft) alignment.
	Subsurface Stabilization Nonwoven Geotextile for North and South Trenches	SY	8,667	2 Clab	2500	55	-	313219161550: Geosynthetic soil stabilization, geotextile fabric, non-woven, 120 lb tensile strength includes scarifying and compaction; assume we need for working pad. At northern trench, work pad will span 1,700 ft long and 30 ft wide. At southern trench, work pad will span 900 ft long and 30 ft wide.
	Install Crushed Gravel Work Pad (8" Thick) for North and South Trenches	SY	8,667	B14	615	676	113	015523500100: Temporary, roads, gravel fill, 8" gravel depth, excluding surfacing. At northern trench, work pad will span 1,700 ft long and 30 ft wide. At southern trench, work pad will span 900 ft long and 30 ft wide.
	SITE PREPARATION ESTIMATED SUBTOTAL			-	-	**7,788**	**2,506**	
ITEM NO.	**GROUNDWATER EXTRACTION TRENCH CONSTRUCTION**	**Units**	**Quantity**	**Crew**	**Daily Output**	**Labor Hours**	**Equipment Hours**	**Notes**
11	Materials	-	-	-	-	1,182	1,182	Purchase of sand/granular material for backfilling the extraction trenches.
	Sand/Granular Backfill	CY	8,906	B13D	376	379	379	Sand/granular backfill for extraction trenches. Assumes northern trench is 1,700 ft with an approximate depth of 26.5 ft (depth varies between 24-29 ft deep) and southern trench is 900 ft and 39 ft deep. Assumes both trenches are 3 ft wide. Based on Ramboll experience.
	Haul Material to Site	LCY	8,906	B34C	99	720	720	312323203104: Cycle hauling(wait, load, travel, unload or dump & reutrn) time per cycle, excavated or borrow, loose cubic yards, 15 min load/wait/unload, 16.5 C.Y. truck, cycle 50 miles, 45 mph, excludes loading equipment
	Haul Material to Trench Locations	CY	8,906	B34G	850	84	84	312323206170: Hauling; no loading equipment, including hauling, waiting, loading/dumping; 34 C.Y. off-road, 15 min wait/ld./uld., 15 MPH, cycle 1 mile. Daily output extrapolated down to 10 min wait. Assumes onsite stockpile location approximately 1/2 mile from each trench. Assumes hauling of granular material to trenches.
12	Installation of Groundwater Extraction Trench	-	-	-	-	1,433	878	Installation of groundwater extraction trench performed by a specialty contractor and associated clay cap surface completion activities. Also includes restabilization of the slope along the work pad alignment.
	Trench Excavation (North)	LF	1,835	OP	200	459	459	OP crew determined from crew information provided by specialty contractor. Assumes one trench totaling 1,700 ft in length with an approximate depth of 26.5 ft (depth varies between 24-29 feet). Adding on 135 LF per Contractor's additional length requirements.
	Trench Excavation (South)	LF	1,035	OP	200	259	259	OP crew determined from crew information provided by specialty contractor. Assumes one trench totaling 900 ft in length with an approximate depth of 39 ft. Adding on 135 LF per Contractor's additional length requirements.
	Methane Monitoring during Trench Excavation	LS	1	M	1	500	0	Health and safety monitoring for potential presence of methane.
	CONTINGENCY: STANDBY TIME FOR METHANE IMPACTS	LS	1	-	-	-	-	Standby time for potential stop work related to presence of methane in the subsurface.
	Restabilization of Work Pad - Loading Backfill Material for South Trench	BCY	6,000	B10S	970	74	49	312323154060: Borrow, common earth, 1-1/2 C.Y. bucket, loading and/or spreading, front end loader, wheel-mounted. Assumes stockpiling of upslope material adjacent to work area.
	Restabilization of Work Pad - Hauling Backfill Material to South Trench	LCY	6,000	B34G	986	49	49	312323206130: Hauling; no loading equipment, including hauling, waiting, loading/dumping; 34 C.Y. off-road, 15 min wait/ld./uld., 15 MPH, cycle 2,000 ft.
	Restabilization of Work Pad - Spreading of Backfill Material for South Trench	CY - as excavated	6,000	B10B	1000	72	48	312323170020: Spread dumped material, no compaction, by dozer. Daily output edited to match excavation based on experience. Assumes use of overexcavated berm material.
	Restabilization of Work Pad - Compaction of Backfill Material for South Trench	CY - in place	6,000	B10G	5200	14	9	312323235680: Compaction; Riding, sheepfoot roller, 12" lifts, 2 passes. RS Means Crew is B10G.
	Hauling Berm Stockpiled Clay for Trench Cap	LCY	289	B34G	850	3	3	312323206170: Hauling; no loading equipment, including hauling, waiting, loading/dumping; 34 C.Y. off-road, 15 min wait/ld./uld., 15 MPH, cycle 1 mile. Daily output extrapolated down to 10 min wait. Assumes onsite stockpile location approximately 1/2 mile from each trench. Assumes hauling of excavated berm material for use as trench cap.
	Spread Lifts for Clay Trench Cap	CY - as excavated	289	B10B	1000	3	2	312323170020: Spread dumped material, no compaction, by dozer. Daily output edited to match excavation based on experience. Assumes use of overexcavated berm material.
	Compaction of Clay Trench Cap	CY - in place	289	B10Y	5200	1	0	312323235060: Compaction; Riding, vibrating roller, 12" lifts, 2 passes. RS Means Crew is B10Y.

13	Spoils Management	-	-	-	-	258	203	Hauling and management of trench excavation spoils to the AP for placement beneath the final cover system.
	Loading	CY - as excavated	9,888	B14B	5000	24	16	312316435320: Excavating, large volume projects; excavation with truck loading; excavator, 6 C.Y. bucket, 100% fill factor (assume 10% fluff factor from ground to excavated).
	Hauling and Placement at AP	CY - as excavated	9,888	B34G	850	93	93	312323206170: Hauling; no loading equipment, including hauling, waiting, loading/dumping; 34 C.Y. off-road, 15 min wait/ld./uld., 15 MPH, cycle 1 mile. Daily output extrapolated down to 10 min wait.
	Spreading Lifts	CY - as excavated	9,888	B10B	1000	119	79	312323170020: Spread dumped material, no compaction, by dozer. Daily output edited to match excavation based on experience.
	Compaction of Material	BCY	9,888	B10G	5200	23	15	312323235680: Compaction, 2 passes, 12" lifts, sheepsfoot or wobbly wheel roller.
14	Groundwater Extraction Trench Mechanical Installation	-	-	-	-	1,712	553	Installion of a system to pump and convey extracted groundwater from the trenches to the new settling pond and associated discharge.
	Install Pneumatic Pumps	EA	10	Q1	1.8	90	0	221429132010: Wet-pit-mounted, vertical sump pump, single stage, 25 GPM, 1 HP, 1-1/2" discharge. Assumes one pump per 200 ft of extraction trench.
	Install Equalization Tank	EA	2	B6	1.0	48	16	Installation of equalization tank at each trench and associated site preparation and instrumentation based on Ramboll project experience. Assumes 2 days for installation.
	Install Transfer Pumps and Controllers	EA	2	R30	1.0	52	0	Installation of transfer pump and pump controller at each extraction trench to convey water from settling pond to discharge outfall based on Ramboll project experience. Assumes inclusion of housing structure and 2 days for installation.
	Excavate Utility Trench for Lines to Compressors and Extraction Pumps	LF	5,000	B54	860	47	47	312316142750: Utility trench excavating, chain trencher, 40 HP operator riding, 12" wide trench and backfill, 18" deep. Trench installed from power drop/compressor shed to extraction trench to supply compressed air and power to sump pits.
	Install Mechanical Elements and Piping	EA	1	R30	-	390	0	Assumes furnishing all mechanical elements (air compressors, pneumatic extraction pumps, transfer pumps) and associated HDPE housing piping for distribution of power and housing of mechanical elements throughout the extraction trench system. Assumes approximately 15 days of work.
	Excavate Utility Trench for Conveyance to Settling Pond	LF	7,700	B54	860	72	72	312316142750: Utility trench excavating, chain trencher, 40 HP operator riding, 12" wide trench and backfill, 18" deep. Utility trench installed from groundwater extraction trench to convey extracted water to the settling pond.
	Install 8" HDPE Conveyance Pipe to Settling Pond	LF	7,700	B22A	320	963	385	331413350300: Water supply distribution piping, piping HDPE, butt fusion joints, 40' lengths, 8" diameter, SDR 21. Includes labor, materials, and machine for installation and welding of HDPE pipe for conveying extracted water from trenches to settling pond.
	Backfill Utility Trench with Granular Trench Backfill	LCY	428	B10R	100	51	34	312316133060: Backfill trench, F.E. loader, wheel mtd., 1 C.Y. bucket, 200' haul. Backfill with granular trench backfill. Quantity based on trench dimensions 12" wide, 18" deep, 7,700 ft long.
15	Construction of Compressor & Mechanical Sheds	-	-	-	-	540	180	Assumes two compressor sheds are required to operate vertical sump pumps and compressor shed system components.
	Construct Compressor Shed	EA	2	B6	-	540	180	Assumes pre-fabricated mechnical instrumentation shelter, installed primarily by hand with light equipment assistance. Hours are based on Ramboll experience. Two sheds will include extraction equipment (air compressor and transfer pump) and will be located at the trenches.
16	Installation of Settling Pond	-	-	-	-	1,079	386	Quantity based on 1-acre pond, 5 feet deep. Assume all excavated material is reused for berm construction.
	Excavation and Loading of Settling Pond Material	BCY	8,148	B12C	1320	99	49	312316420260: Excavating, bulk bank measure, hydraulic, crawler mtd., 2 C.Y. cap (165 CY/hr). Assumes size of settling pond to be 1 acre and 5 feet deep.
	Hauling and Placement of Settling Pond Material	LCY	8,148	B34G	986	66	66	312323206130: Hauling; no loading equipment, including hauling, waiting, loading/dumping; 34 C.Y. off-road, 15 min wait/ld./uld., 15 MPH, cycle 2,000 ft. Daily output extrapolated down to 600 ft cycle.
	Spreading/Drying Material in Berm	CY	8,148	B10B	1000	98	65	312323170020: Spread dumped material, no compaction, by dozer. Daily output edited to match excavation based on experience.
	Compaction of Material in Berm	BCY	8,148	B10G	5200	19	13	312323235680: Compaction, 2 passes, 12" lifts, sheepsfoot or wobbly wheel roller
	Fine Grading of Berm	MSF	8	B11L	30	4	2	312216103600: Fine grading, tops of lagoon banks for compaction. Assumes 10 ft-wide berm around perimeter of 1-acre settling pond.
	Subsurface Stabilization Nonwoven Geotextile	SY	5,000	2 Clab	2500	32	0	313219161550: Geosynthetic soil stabilization, geotextile fabric, non-woven, 120 lb tensile strength includes scarifying and compaction. Assumes 1 acre (≈5000 SY) settling pond.
	Settling Pond Liner	SF	44,000	B63B	1850	761	190	310519531100: Reservoir liners, membrane lining, 40 mil, LLDPE. Assumes 1 acre ft print.
17	Extracted Water Discharge Management	-	-	-	-	263	96	Based on approximate 1,500 ft distance from settling pond to discharge outfall.
	Install Transfer Pump and Controller	EA	1	R30	1	52	0	Lump sum for installation of transfer pump and pump controller to convey water from settling pond to discharge outfall based on Ramboll project experience. Assumes inclusion of housing structure and 2 days for installation.
	Excavate Utility Trench for Conveyance to Discharge	LF	1,500	B54	860	14	14	312316142750: Utility trench excavating, chain trencher, 40 HP operator riding, 12" wide trench and backfill, 18" deep. Trench installed from settling pond to convey settled water to outfall for discharge.
	Install 8" HDPE Conveyance Pipe to Discharge	LF	1,500	B22A	320	188	75	331413350300: Water supply distribution piping, piping HDPE, butt fusion joints, 40' lengths, 8" diameter, SDR 21. Includes labor, materials, and machine for installation and welding of HDPE pipe for conveying water from settling pond to discharge point.
	Backfill with Granular Trench Backfill	LCY	83	B10R	100	10	7	312316133060: Backfill trench, F.E. loader, wheel mtd., 1 C.Y. bucket, 200' haul. Backfill with granular trench backfill. Quantity based on trench dimensions 12" wide, 18" deep, 1,500 ft long.
	GROUNDWATER EXTRACTION TRENCH CONSTRUCTION			-	-	**6,468**	**3,479**	

ITEM NO.	SITE RESTORATION	Units	Quantity	Crew	Daily Output	Labor Hours	Equipment Hours	Notes
18	Site Restoration	-	-	-	-	346	56	Assumes restoration of grade surface following extraction trench installation activities.
	Erosion Control Blanket	SY	30,000	B1	2500	288	0	312514160100: Rolled erosion control mats and blankets, plastic nettling stapled, 2" x 1" mesh, 20 mil. Assumes approximately 6 acres of erosion control.
	Lime	MSF	270	B66	700	4	3	329113234250: Soil preparation, structural soil mixing, spread soil conditioners, ground limestone, 1#/S.Y., tractor spreader. Assume soils possibly being void of nutrients. Quantity assumes approximately 6 acreas of disturbed areas including staging area and temporary roads, as well as adjacent areas.
	Fertilizer	MSF	270	B66	700	4	3	329113234150: Soil preparation, structural soil .mixing, spread soil conditioners, fertilizer, 0.2#/S.Y., tractor spreader. Assume soils possibly being void of nutrients. Quantity assumes approximately 6 acreas of disturbed areas including staging area and temporary roads, as well as adjacent areas.
	Grassland Mix	MSF	270	B66	52	42	42	329219142300: Seeding athletic fields, seeding fescue, tall, 5.5 lb. per M.S.F., tractor spreader. Quantity assumes approximately 6 acreas of disturbed areas including staging area and temporary roads, as well as adjacent areas.
	Mulch	MSF	270	B65	530	8	8	329113160350: Mulching, Hay, 1" deep, power mulcher, large. Quantity assumes approximately 6 acreas of disturbed areas including staging area and temporary roads, as well as adjacent areas.
	SITE RESTORATION ESTIMATED SUBTOTAL			-	-	**346**	**56**	

ITEM NO.	Corrective Action Operation and Maintenance	Units	Quantity	Crew	Daily Output	Labor Hours	Equipment Hours	Notes
Corrective Action Operation and Maintenance								
19	Groundwater Extraction Trench Operation & Maintenance	-	-	-	-	9,600	0	Assumes routine monitoring, maintenance, and electrical service charges for the duration of system operation.
	Field Maintenance	Day	480	TM	-	9,600	0	Assumes quarterly maintenance on pneumatic pumps and air compressors over 30 years of operation. Each quarterly maintenance event assumes 2 staff for 4 days to check, clean, and service all mechanical parts.
	Electrical Distribution	MO	360	-	-	-	-	Assumes Ameren Corporation will supply power to the GWET electrical distribution system to power extraction and transfer pumps.
20	Non-routine System O&M	-	-	-	-	4,800	900	Assumes non-routine tasks including flushing of groundwater conveyance lines and periodic site visits (e.g., alarm responses or equipment troubleshooting).
	Groundwater Conveyance Line Flushing - Vacuum Truck	LF	240,000	VT	-	3,000	900	330130116140: Pipe, internal cleaning and inspection, cleaning, power rodder with header & cutts, 4"-12" diameter. Assumes one 5-day cleaning event of 8,000 LF of 6" HDPE pipe per year for a total of 30 years.
	Non-Routine Site Visits/Alarm Responses	LS	180	OM	-	1,800	0	Assumes 6 non-routine site visits per year over 30 years of operation. Each non-routine event assumes 2 staff for 1 day.
21	Engineering Oversight/Support	LS	30	-	-	-	-	Assumes office-based engineering support over 30 years of operation.
	CORRECTIVE ACTION OPERATION AND MAINTENANCE SUBTOTAL			-	-	**14,400**	**900**	

	Total Labor Hours	Total Equipment Hours
ENGINEERING AND CONSTRUCTION SUBTOTAL	**18,200**	**9,000**
CORRECTIVE ACTION OPERATION AND MAINTENANCE SUBTOTAL	**14,400**	**900**
ALTERNATIVE 2 SUBTOTAL	**32,600**	**9,900**

NOTES:

1. Alternative 2: Source Control with groundwater extraction trench is estimated to take approximately 37 years to achieve groundwater protection standards (GWPS-35 I.A.C Section 845.600) at all perimeter wells associated with the Ash Pond (AP) following AP closure in place (CIP). Assumes the monitoring period has been capped at 30 years total, plus 3 additional years of compliance monitoring.
2. RS Means refers to the 2023 Quarter 4 online edition of RS Means Commercial New Construction.
3. See crew tab (Alt 2 - Crews) for assumptions regarding crew size, total labor hours and required construction equipment, as needed, for each task.
4. See mileage tab (Alt 2 - Mileage) for assumptions regarding total mileage for tasks outlined in this alternative.

ACRONYMS:

AC = Acre
CIP = closure in place
CY = Cubic Yard
Loose: Material swelled when removed from compacted state
EA = Each
GWPS = groundwater protection standards
LCY = Loose Cubic Yards
LF = Linear Foot
LS = Lump Sum
MSF = square feet divided by 1000
MO = Month
O&M = Operation and Maintenance
AP = Ash Pond
SF = Square Feet
SY = Square Yard

RAMBOLL

CREW CODES
ILLINOIS POWER RESOURCES GENERATING, LLC - EDWARDS POWER PLANT
CORRECTIVE ACTION ALTERNATIVES ANALYSIS SUPPORTING INFORMATION REPORT (CAAA-SIR)
ALTERNATIVE 2 - SOURCE CONTROL WITH GROUNDWATER EXTRACTION TRENCH

Item No.	Crew Code	Labor	Daily Labor Hours	Equipment	Daily Equipment Hours	Onsite Labor Hours	Onsite Heavy Equipment Hours
Construction							
4,10,16	2 Clab	Laborer x 2	16	None	0	126	0
5	A2	Laborer x 2 Truck Driver (light) x 1	24	Flatbed Truck, Gas, 1.5 ton	8	86	29
18	B1	Labor Foreman x 1 Laborer x 2	24	None	0	288	0
14,15	B6	Laborer x 2 Operator (light) x 1	24	Backhoe Loader, 48 H.P.	8	588	196
12,13,16	B10B	Operator (med) x1 Laborer x0.5	12	Dozer, 200 H.P.	8	292	195
16	B10G	Operator (med) x 1 Laborer x 0.5	12	1 Sheepsfoot Roller, 240 HP	8	55	37
10,12	B10S	Operator (med) x 1 Laborer x 0.5	12	1 F.E. Loader, W.M., 1.5 C.Y.	8	148	99
14,17	B10R	Operator (med) x 1 Laborer x 0.5	12	Frontend loader, W.M., 1 C.Y.	8	61	41
12,13	B10Y	Operator (med) x1 Laborer x0.5	12	1 Vibr. Roller, Towed, 12 ton	8	1	0
10,16	B11L	Operator (med) x 1 Laborer x 1	16	Grader, 30,000lb	8	32	16
10,16	B12C	Operator (med) x 1 Laborer x 1	16	Hydraulic excavator, 2 C.Y.	8	171	86
4,11	B13D	Operator (crane) x 1 Laborer x 1	16	Hydraulic excavator, 1 C.Y. Trench Box	16	719	719
4,10	B14	Labor Foreman x 1 Operator (light) x1 Laborer x 4	48	Backhoe Loader, 48 H.P.	8	1,145	191
13	B14B	Operator (crane) x 1 Laborer x 0.5	12	Hydraulic excavator, 6. C.Y.	8	24	16
10	B21B	Labor Foreman (outside) x 1 Laborer x 3 Operator (crane) x 1	40	1 Hydraulic Crane, 12 Ton	8	150	30
14,17	B22A	Labor Foreman x 1 Skilled Worker x 1 Laborer x 2 Operator (crane) x 1	40	S.P. Crane, 4x4, 5 ton Butt Fusion Machine, 4-12" diam.	16	1,150	460
4,11	B34C	Truck Driver x 1	8	Truck Tractor, 6x4, 380 H.P. Dump Trailer, 16.5 C.Y.	8	1,366	1,366
4,10,11,12,13,16	B34G	Truck Driver x 1	8	Dump Truck, Off Hwy., 50 ton	8	418	418
10	B40	Pile Driver Foreman (outside) x 1 Pile Drivers x 4 Operator (Crane) x 1 Operator (Oiler) x 1	64	1 Crawler Crane, 40 Ton 1 Vibratory Hammer & Gen.	16	3,300	825
14,17	B54	Operator (light) x 1	8	Trencher, Chain, 40 H.P.	8	132	132
5	B62	Laborer x 2 Operator (light) x 1	24	Loader, Skid Steer, 30 H.P.	8	192	64
16	B63B	Labor Foreman x 1 Laborer x 2 Operator (light) x 1	32	Loader, Skid Steer, 78 H.P.	8	761	190
18	B65	Laborer x1 Truck Driver (light) x 1	16	Power Mulcher (large) Flatbed Truck, Gas, 1.5 ton	16	8	8
18	B66	Operator (light) x 1	8	Loader-Backhoe, 40 H.P.	8	50	48
14	Q1	Plumber x1 Plumber Apprentice x1	16	None	0	90	0
7	R1B	Electrician x 1 Electrician Apprentice x 2	16	None	0	720	0
8	R6	Electrician Foreman x1 Electrician Lineman x4 Electrician Operators x2 Electrician Groundmen x4	88	Crew Truck x1 Flatbed Truck, 20,000 GVW x1 Pickup Truck, 3/4 Ton x1 Hyd. Crane, 12 Ton x0.2 Hyd. Crane, 55 Ton x0.2 Earth Auger, Truck-Mtd x0.2 Tractor w/Winch x1 Cable Trailers x3 Tensioning Rig x0.5 Cable Pulling Rig x0.5	68.8	176	138
14,17	R30	Electrician Foreman x 0.25 Electrician x 1 Laborer (Semi-Skilled) x 2	26	None	0	494	0
12	M	Laborer x 1	10	Service Truck x1	0	500	0

2	Eng	Engineering Staff x 1.2	10	Side by Side x1	10	3,600	3,000
9	GM	Engineering Staff x 4	40	Service Vehicle X 2	0	600	0
12	OP	Operator x 3 Laborer x 2	50	CAT 950 Loader x 3, CAT 374 Excavator x 1 CAT 349 Excavator x 1 Manlift x 1, Telehandlers x 2	50	718	718
8	UL	Laborer x 2	20	Service Truck x1	20	40	20
				Construction Subtotals		18,200	9,000
Corrective Action Operation & Maintenance							
20	OM	Laborer x 1	10	Service Truck x1	0	1,800	0
19	TM	Maintenance Crew x 2	20	Service Truck x2 Hand Tools	0	9,600	0
20	VT	Laborer x 1 Operator x 1	20	Vacuum Truck with Flushing Capabilities	10	3,000	900
				O&M Subtotals		14,400	900
Note: Blue shaded crew codes were created by Ramboll based on experience (not pulled from RS Means).					**Totals**	**32,600**	**9,900**

ACRONYMS:
O&M = Operation and Maintenance

CONSTRUCTION MILEAGE AND LABOR ESTIMATES
ILLINOIS POWER RESOURCES GENERATING, LLC - EDWARDS POWER PLANT
CORRECTIVE ACTION ALTERNATIVES ANALYSIS SUPPORTING INFORMATION REPORT (CAAA-SIR)
ALTERNATIVE 2 - SOURCE CONTROL WITH GROUNDWATER EXTRACTION TRENCH

Item	Quantity	Assumptions
Labor Total Hours	18,189	Per projected Construction total in cost estimate (does not include contingency)
Duration of Onsite Construction Days	300	Total Days
Average Daily Crew Size	15	Assumes multiple crew sizes and a 10 hour work day Assumes 1 Ramboll personnel daily for construction oversight
Daily Labor Mobilization Miles	315,000	Includes light and medium commercial vehicles Average of 70 miles round trip per day, as proposed in construction permit for AP Closure
Vehicles Miles Onsite	67,500	Includes light and medium commercial vehicles 15 miles per day, including onsite mileage and local trips No contingency Included
Equipment Mobilization Miles - Unloaded	8,500	Average of 170 miles one-way trip for equipment hauling (from Chicago, IL) Average 1 load of equipment per working week for a 6 day work week.
Equipment Mobilization Miles - Loaded	8,500	Average of 170 miles one-way trip for equipment hauling (from Chicago, IL) Average 1 load of equipment per working week for a 6 day work week.
Onsite Haul Truck Miles - Unloaded	484	34 CY Off Road Dump Truck 1/2 mile per trip per load
Onsite Haul Truck Miles - Loaded	484	34 CY Off Road Dump Truck 1/2 mile per trip per load
Offsite Haul Truck Miles - Unloaded	62,500	Assumes 20,000 CY delivered in 16 CY loads of fill material (granular and low permeability material) are delivered to the site from a regional supplier located within 50 miles of the site. Assumes truck is returning to the origin location.
Offsite Haul Truck Miles - Loaded	62,500	Assumes 20,000 CY delivered in 16 CY loads of fill material (granular and low permeability material) are delivered to the site from a regional supplier located within 50 miles of the site.
Material Delivery Miles - Unloaded	12,000	Misc. construction materials (erosion controls, piping, geotextile) Assumes 100 mile one-way trip, average 2 trips per working week
Material Delivery Miles - Loaded	12,000	Misc. construction materials (erosion controls, piping, geotextile) Assumes 100 mile one-way trip, average 2 trips per working week

O&M Mileage and Labor Estimates - Alternative 2: Groundwater Extraction Trench

Item	Quantity	Assumptions
Labor Total Hours	14,400	Per projected O&M total in cost estimate (does not include contingency)
Duration of Onsite O&M Days	810	Total Days
Average Daily Crew Size	2	Assumes multiple crew sizes and a 10 hour work day
Daily Labor Mobilization Miles	244,800	Includes mob/demob from Chicago (340 miles round trip) and local daily commute mileage (30 miles per day) for an average of 170 miles round trip per day
Vehicles Miles Onsite	21,600	Includes light and medium commercial vehicles 15 miles per day, including onsite mileage and local trips No contingency Included
Equipment Mobilization Miles - Unloaded	5,100	Average of 170 miles one-way trip for equipment hauling (from Chicago, IL) Average 1 load of equipment per year.
Equipment Mobilization Miles - Loaded	5,100	Average of 170 miles one-way trip for equipment hauling (from Chicago, IL) Average 1 load of equipment per year.
Onsite Haul Truck Miles - Unloaded	0	No material hauling onsite will occur under this alternative
Onsite Haul Truck Miles - Loaded	0	No material hauling onsite will occur under this alternative
Offsite Haul Truck Miles - Unloaded	0	No material hauling offsite will occur under this alternative
Offsite Haul Truck Miles - Loaded	0	No material hauling offsite will occur under this alternative
Material Delivery Miles - Unloaded	0	No materials will be delivered during O&M
Material Delivery Miles - Loaded	0	No materials will be delivered during O&M

ACRONYMS:
CAGM = Corrective Action Groundwater Monitoring
CY = Cubic yard
O&M = Operation and Maintenance

ILLINOIS POWER RESOURCES GENERATING, LLC - EDWARDS POWER PLANT
CORRECTIVE ACTION ALTERNATIVES ANALYSIS SUPPORTING INFORMATION REPORT (CAAA-SIR)
ALTERNATIVE 3 - SOURCE CONTROL WITH PHYTOREMEDIATION[1]

ITEM NO.	ENGINEERING, PRE-CONSTRUCTION, AND CONSTRUCTION SUPPORT TASKS	Units	Quantity	Crew	Daily Output	Labor Hours	Equipment Hours	Notes
1	Pre-Design Investigation, Pilot Test, Final Phytoremediation Design and Bid Support	LS	1	-	-	0	0	Assumes pre-design investigation is needed as part of the Phytoremediation design.
2	Engineering Support and CQA During Construction	LS	1	Eng	12	3,000	2,500	Assumed labor and equipment hours based on Ramboll project experience.
	ENGINEERING, PRE-CONSTRUCTION, AND CONSTRUCTION SUPPORT ESTIMATED SUBTOTAL			**-**	**-**	**3,000**	**2500**	
ITEM NO.	**SITE PREPARATION**	**Units**	**Quantity**	**Crew**	**Daily Output**	**Labor Hours**	**Equipment Hours**	**Notes**
3	Mobilization and De-Mobilization	LS	-	-	-	-	-	Assumes general construction mobilization and demoibilization.
	General Construction Mobilization and De-Mobilization	LS	1	-	-	-	-	Assumes general construction contractor is mobilizing equipment from out of state.
4	Staging Area & Temporary Roads Preparation	-	-	-	-	1,569	1,140	Assumes some work general preparation of temporary access roads along the tree alignment will be needed specific to tree system installation.
	Subsurface Stabilization Nonwoven Geotextile	SY	6,000	2 Clab	2500	38	0	313219161550: Geosynthetic soil stabilization, geotextile fabric, non-woven, 120 lb tensile strength includes scarifying and compaction. Assumes 1 acre staging area and approximately 3,500 ft of temporary access road.
	Offsite Fill for South Area Ramp	CY	8,000	B13D	376	340	340	Imported clay for south area ramp. Assumes 8000 CY. Based on Ramboll experience.
	Haul Fill to Site	LCY	8,000	B34C	99	646	646	312323203104: Cycle hauling(wait, load, travel, unload or dump & reutrn) time per cycle, excavated or borrow, loose cubic yards, 15 min load/wait/unload, 16.5 C.Y. truck, cycle 50 miles, 45 mph, excludes loading equipment
	Haul Material to South Area Ramp	CY	8,000	B34G	850	75	75	312323206170: Hauling; no loading equipment, including hauling, waiting, loading/dumping; 34 C.Y. off-road, 15 min wait/ld./uld., 15 MPH, cycle 1 mile. Daily output extrapolated down to 10 min wait. Assumes onsite stockpile location approximately 1/2 mile from south ramp area. Assumes hauling of clay to south ramp area.
	Construct Staging Area & Temporary Roads	SY	6,000	B14	615	468	78	015523500100: Temporary, roads, gravel fill, 8" gravel depth, excluding surfacing. Assumes 1 acre staging area and approximately 3,500 ft of temporary access road.
5	Construction Soil Erosion & Sediment Controls	-	-	-	-	391	130	Assumes soil erosion and sediment controls will be implemented only during the tree alignment construction.
	Silt Fence	LF	8,000	B62	650	295	98	312514161000: Synthetic erosion control, silt fence, install and remove, 3' high. Assumes silt fence is installed on downgradient side of the tree alignments (4,000 ft total). Assumes the silt fence will get replaced once during construction.
	Sediment Log, Filter Sock	LF	4,000	A2	1000	96	32	312514160705: Sediment Log, Filter Sock, 9". Assume sediment log is needed along tree allignment (4,000 LF total).
6	Construction Facilities	-	-	-	-	-	-	Assumes office trailer, storage boxes, and portable toilets are required during the construction phase of the alternative.
	Office Trailer	MO - in use	12	-	-	-	-	015213200350: Office trailer, furnished, no hookups, 32' x 8'. Assume quantity of one (1).
	Storage Trailers	MO - in use	12	-	-	-	-	015213201350: Storage boxes, 40' x 8'. Assume quantity of two (2) boxes onsite.
	Portable Toilet	MO - in use	12	-	-	-	-	015433406410: Toilet, portable chemical. Assume quantity of four (4) units onsite.
7	Electrical Installation	EA	1	R1B	-	720	0	Assumes electrical installation based on Ramboll experience to install one power drop for low-voltage (120V) power for the irrigation pumps, control equipment, etc. For each power drop, consider the distances from existing power sources.
8	Existing Site Utilities Preparation	-	-	-	-	216	158	Assumes utility survey, relocate, and power line relocation. Assumes updated layout will be determined during design phase.
	Utility Survey	LS	-	UL	-	40	20	Private and public utility location services to adequately locate and inventory existing site utilities that may be in conflict with proposed tree segment locations based on Ramboll experience.
	Utility Relocate/Removal	EA	1	R6	1	88	69	Addressing potential conflicting of abandoned section of sewer force main based on Ramboll experience. Sewer force main crossing the AP is to be abandoned as part of AP closure activities, but if abandoned main is to remain in place, then sections may need to be removed to accomodate tree segment installation.
	Power Line Relocation	EA	1	R6	1	88	69	Relocation/raising of high voltage power lines crossing the CBR portion of the AP to allow for adqueate clearance for construction equipment for tree segment installation based on Ramboll experience.

9	Geotechnical Monitoring	LS	-	GM	-	600	0	Assumes installation of inclinometers, survey prisms, and settlement monitoring devices along the south tree alignment where the embankment will be modified. Assumes a 4-person crew installs the monitoring system over a period of 3 weeks. Based on Ramboll experience
10	Phytoremediation Alignment Preparation Work Pad	-	-	-	-	7,840	2,056	Assumes construction of a 30-ft wide work pad for the full length of the northern and southern tree segments. For the southern tree segment, excavation of berm material on the upslope side and fill along the downslope side will be required to level off the work area. Once prepared, surface grading and stabilization will be completed along the southern tree segment work pad. For the northern tree segment, it is anticipated that only surface grading and stabilization will be required for the work pad.
	Excavation of Berm Material and Stockpiling for South Tree Well Segment	CY	12,000	B12C	1320	145	73	312316420260: Excavating, bulk bank measure, hydraulic, crawler mtd., 2 C.Y. cap (165 CY/hr). 15% addition included for loading of material onto trucks. Using 1800 ft long, 12 ft deep, and 30 ft wide.
	Loading Stockpiled Berm Material for South Tree Well Segment	BCY	12,000	B10S	970	148	99	312323154060: Borrow, common earth, 1-1/2 C.Y. bucket, loading and/or spreading, front end loader, wheel-mounted. Assumes stockpiling of upslope material adjacent to work area.
	Temporary Excavation Shoring	SF	99,000	B40	960	6,600	1,650	314116101500. 20' deep excavation, 27 psf, left in place. Assumes length of 900 ft and retained height of 15 ft and 40 ft embedment. Based on Ramboll experience.
	Hauling Berm Material to Stockpile for South Tree Well Segment	LCY	12,000	B34G	986	97	97	312323206130: Hauling; no loading equipment, including hauling, waiting, loading/dumping; 34 C.Y. off-road, 15 min wait/ld./uld., 15 MPH, cycle 2,000 ft.
	Surface Grading for North Tree Well Segment	MSF	35	B11L	30	18	9	312216103600: Fine grading, work pad area. Assumes grading along the northern (1,150 ft) alignment.
	Subsurface Stabilization Nonwoven Geotextile for North and South Tree Well Segments	SY	9,833	2 Clab	2500	63	-	313219161550: Geosynthetic soil stabilization, geotextile fabric, non-woven, 120 lb tensile strength includes scarifying and compaction; assume we need for working pad. At northern tree segment, work pad will span 1,150 ft long and 30 ft wide. At southern tree segment, work pad will span 1800 ft long and 30 ft wide.
	Install Crushed Gravel Work Pad (8" Thick) for North and South Tree Well Segments	SY	9,833	B14	615	767	128	015523500100: Temporary, roads, gravel fill, 8" gravel depth, excluding surfacing. At northern tree segment, work pad will span 1,700 ft long and 30 ft wide. At southern tree segment, work pad will span 900 ft long and 30 ft wide.
	SITE PREPARATION ESTIMATED SUBTOTAL			-	**-**	**11,336**	**3,484**	
ITEM NO.	**TREE WELL SYSTEM INSTALLATIONS**	**Units**	**Quantity**	**Crew**	**Daily Output**	**Labor Hours**	**Equipment Hours**	**Notes**
11	Materials	-	-	-	-	366	99	Materials for approximately 550 phytoremediation plantings, including backfill soil and ammendments, tree cuttings, and monitoring equipment.
	Tree Cuttings	Each	550	-	-	-	-	Assumes tree cutting based on Ramboll experience.
	Tree Well Aeration Tubes	Each	550	-	-	-	-	Perforated pipe from 2-3 feet above ground surface to just above groundwater table. Assuming 15 ft to groundwater. 90-degree elbow on top. Allows passive oxygenation of subsurface root zone. Based on Ramboll experience.
	Tree Well Moisture Sensors	Each	12	-	-	-	-	Assuming 1% of trees will have soil moisture sensors at two depths per tree. Based onsupplier and Ramboll experience.
	Tree Moisture Sensor Meter	Each	1	-	-	-	-	Device for reading moisture levels. Based on supplier and Ramboll experience.
	Tree Well Piezometers	Each	6	-	-	-	-	Assuming 1% of trees will have piezometers to monitor groundwater potentiometric surface elevation
	Sand / Granular Backfill	CY	333	-	-	-	-	Sand/granular backfill for tree well boring backfill material. Assumes average boring total depth of 40 feet backfilled with 100% sand/granular backfill from total depth to 10 feet below surface grade then 60% by volume sand/granular fill for top 10 feet for 550 total trees. Based on Ramboll experience.
	Peat Moss	CY	133	-	-	-	-	Shallow tree backfill material. Assumes 10-inch diameter borehole backfilled to 10 feet with 30% by volume peat moss for 550 total trees. Based on Ramboll experience.
	Compost	CY	44	-	-	-	-	Shallow tree backfill material. Assumes 10-inch diameter borehole backfilled to 10 feet with 10% by volume compost for 550 total trees. Based on Ramboll experience.
	Surface Cover Soil	SY	6,667	B14	1,000	320	53	015523500100: Topsoil placement and grading, loam or topsoil, fine grading and seeding, with equipment. Assumes placement of cover soil along approximately 15 feet in width across both tree segments (4,000 total feet in length).
	Haul Material to Site	LCY	511	B34C	99	41	41	312323203104: Cycle hauling(wait, load, travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 15 min load/wait/unload, 16.5 C.Y. truck, cycle 50 miles, 45 mph, excludes loading equipment.
	Haul Material to Tree Well Locations	CY	511	B34G	850	5	5	312323206170: Hauling; no loading equipment, including hauling, waiting, loading/dumping; 34 C.Y. off-road, 15 min wait/ld./uld., 15 MPH, cycle 1 mile. Daily output extrapolated down to 10 min wait. Assumes onsite stockpile location approximately 1/2 mile from each trench. Assumes hauling of granular material to trenches.

12	Installation of Tree Well Systems	-	-	-	-	4,668	5,931	Equipment and labor required for installation of tree plantings in the northern tree segment (200 trees) and southern tree segment (350 trees).
	Borehole Drilling, Backfill, and Tree Installation	Each	550	B56B	3	4,400	5,867	Assumes 10" borehole, backfilling with sand/peat/compost mix, installing tree cutting, aeration tube, irrigation. Assuming 3 tree locations per day. Track mounted hollow stem auger drill rig. Excludes spoils management. Based on Ramboll experience.
	Installing Geomembrane (Material and Labor)	SF	32,000	B47H	4000	256	64	025613100610: Secure burial cell construction, polymeric liner and cover system, top cover, polyvinyl chloride (PVC) 60 mil. Assumes 4000 ft length by 8 ft wide area.
	Installing Moisture Sensor Components (Labor)	Each	12	2 Clab	24	8	0	Installing moisture sensors at correct depths when borehole already created prior to backfilling by driling crew. Select locations only. Based on Ramboll experience.
	Installing Piezometers (Labor)	Each	6	2 Clab	24	4	0	Installing piezometers at correct depths when borehole already created prior to backfilling by driling crew. Select locations only. Based on Ramboll experience.
	Methane Monitoring during Drilling	LS	1	M	1	500	0	Health and safety monitoring for potential presence of methane.
	CONTINGENCY: STANDBY TIME FOR METHANE IMPACTS	*LS*	*1*	-	-	-	-	*Standby time for potential stop work related to presence of naturally occuring methane in the subsurface. Percentage applied to subsurface work (drilling) line item only.*
13	Spoils Management	-	-	-	-	13	10	Quantities assume that soil cuttings generated from installation of tree well borings will be managed under the CIP areas of the AP.
	Loading	CY - as excavated	500	B10S	5000	1	1	312323154060: Borrow, common earth, 1-1/2 C.Y. bucket, loading and/or spreading, front end loader, wheel-mounted. Assumes stockpiling of borehole cuttings. Volume of borehole used, assuming 10% fluff factor from ground to excavated.
	Hauling and Placement at AP	CY - as excavated	500	B34G	850	5	5	312323206170: Hauling; no loading equipment, including hauling, waiting, loading/dumping; 34 C.Y. off-road, 15 min wait/ld./uld., 15 MPH, cycle 1 mile. Daily output extrapolated down to 10 min wait.
	Spreading Lifts	CY - as excavated	500	B10B	1000	6	4	312323170020: Spread dumped material, no compaction, by dozer. Daily output edited to match excavation based on experience.
	Compaction of Material	BCY	500	B10G	5200	1	1	312323235680: Compaction, 2 passes, 12" lifts, sheepsfoot or wobbly wheel roller.
14	Irrigation System Installation	-	-	-	-	710	241	Irrigation system will include a water storage tank, main irrigation lines, and drip lines to deliver water to each planting during the growing season for the first few years of establishment prior to tree roots reaching groundwater. Irrigation lines will be installed below ground surface.
	Install Irrigation Water Storage Tank	Each	1	B6	1.0	24	8	Installation of irrigation tank and associated site preparation and instrumentation assumes 2 days for installation.
	Install Irrigation Pump and Controller	Each	1	R30	1.0	26	0	Installation of irrigation pump and pump controller at irrigation tank to convey water from tank to irrigation main lines and individual drip lines based on Ramboll project experience. Assumes inclusion of housing structure and 1 day for installation.
	Trenching, Installing, and Backfilling Main Lines	LF	4,000	Q1C	220	436	145	331413254120: Water supply, polyvinyl chloride pipe. Including trenching to 3' deep, 2" diameter. Trench installed from power drop/irrigation tank to ends of north and south tree alignments.
	Installing Main Irrigation Fittings (Labor)	EA	550	Q1A	48	115	0	331413254370: Water supply, distribution piping, fitting, tee, class 200 polyvinyl chloride pipe, pressure pipe, 2", includes gaskets. Assumes one tee in main line at each tree location (550 total tees).
	Irrigation Fittings (Materials)	Each	1,100	-	-	-	-	2" x 2" x 3/4" Schedule 40 PVC Reducing Tee, 3/4" threaded to 1/2" barbed fitting, 15 feet blank 1/2" tubing, 1/2" barbed elbow, 5 feet drip tubing, and drip end closure. Two of each at 550 tree locations.
	Irrigation Various Fittings (Materials)	Each	100	Q1A	48	21	0	Various components that will be necessary for the irrigation system including elbows, tees, valves, valve boxes, filters, pressure regulators, and labor to install them.
	Trenching, Placing Drip Irrigation to Each Tree, Backfilling	LF	5,500	B53	500	88	88	328413100700: Subsurface drip irrigation, looped grid, pressure compensating, preinserted emitter, line, trenching, and backfill. Trenches installed from main irrigation line to each tree system. Assuming 10 ft span from main line to each tree location. Labor only.
15	Irrigation Water Delivery	-	-	-	-	542	542	Purchase and delivery of water from off site. Water will be hauled to site by truck and stored in the irrigation water tank.
	Water Delivery	Each	271	B34C	4	542	542	Assumes 2 gallons of water per day per tree. 1,100 total gallons per day. 10,000-gallon tank on site. Can have 6,000 gallons delivered per load. Need delivery every 5.4 days. Allows for 11 gallons of losses per tank refill. 67.6 refills needed per year for 4 years. 271 total refills. 30 mile water haul.
	TREE WELL SYSTEM CONSTRUCTION			**-**	**-**	**6,299**	**6,282**	

ITEM NO.	SITE RESTORATION	Units	Quantity	Crew	Daily Output	Labor Hours	Equipment Hours	Notes
16	Site Restoration	-	-	-	-	346	56	Assumes restoration of grade surface following tree segment installation activities.
	Erosion Control Blanket	SY	30,000	B1	2500	288	0	312514160100: Rolled erosion control mats and blankets, plastic nettling stapled, 2" x 1" mesh, 20 mil. Assumes approximately 6 acres of erosion control.
	Lime	MSF	270	B66	700	4	3	329113234250: Soil preparation, structural soil mixing, spread soil conditioners, ground limestone, 1#/S.Y., tractor spreader. Assume soils possibly being void of nutrients. Quantity assumes approximately 6 acreas of disturbed areas including staging area and temporary roads, as well as adjacent areas.
	Fertilizer	MSF	270	B66	700	4	3	329113234150: Soil preparation, structural soil .mixing, spread soil conditioners, fertilizer, 0.2#/S.Y., tractor spreader. Assume soils possibly being void of nutrients. Quantity assumes approximately 6 acreas of disturbed areas including staging area and temporary roads, as well as adjacent areas.
	Grassland Mix	MSF	270	B66	52	42	42	329219142300: Seeding athletic fields, seeding fescue, tall, 5.5 lb. per M.S.F., tractor spreader. Quantity assumes approximately 6 acreas of disturbed areas including staging area and temporary roads, as well as adjacent areas.
	Mulch	MSF	270	B65-modified	530	8	8	329113160350: Mulching, Hay, 1" deep, power mulcher, large. Quantity assumes approximately 6 acres of disturbed areas including staging area and temporary roads, as well as adjacent areas.
	SITE RESTORATION ESTIMATED SUBTOTAL			**-**	**-**	**346**	**56**	

ITEM NO.	Corrective Action Operation and Maintenance	Units	Quantity	Crew	Daily Output	Labor Hours	Equipment Hours	Notes
Corrective Action Operation and Maintenance								
17	Tree Well System O&M	-	-	-	-	1,264	700	Operation and Maintenance requirements assuming 30 year maintenance period.
	Monthly Tree System O&M first 6 months	Each	6	Eng	1	60	60	Assumes one ten hour day by Ramboll staff to perform survey with side by side for site access. Monthly O&M while trees first establishing.
	Semiannual Tree Health Survey	Each	60	Eng	1	600	600	Assumes one ten hour day by Ramboll staff to perform survey with side by side for site access. Two surveys per year: Spring and Autumn
	Annual Leaf Collection and Disposal	MSF	2,400	B66	480	40	40	320190194170: Mowing, lawn mowing improved areas, 48"- 58", riding mower. Collect and mulch leaves with mower. Assuming 4,000 ft x 20 ft area for tree alignments. One collection per year. Testing material and disposal based on Ramboll experience.
	Annual Tree Tissue Sampling	Each	300	-	-	-	-	Assumes 10 tree tissue samples per year. Tree tissue sample analysis only. Samples will be collected during tree health survey. Based on Ramboll experience.
	Start-up Moisture and Irrigation Monitoring	LS	1	Eng	-	-	-	Monitoring moisture and tree health for first few months while rooting. Adjusting irrigation as needed.
	Annual Irrigation Winterization	Each	30	OM	1	300	0	Assumes one laborer can drain water from system, insulate aboveground infrastructure in one ten hour day. Conduct prior to freezing temperatures each year.
	Pruning	Each	330	2 Clab	20	264	0	311313203100: Selective clearing and grubbing, 8" to 12" diameter, remove selective trees, on site using chain saws and chipper, excludes stump. Assuming 10% of trees would need significant reduction pruning every 5 years. Treating pruning as tree removal since significant amount of tree will be cut and removed. Modified crew type and daily output for this scenario based on Ramboll experience.
18	Non-routine System O&M	-	-	-	-	6,968	8,489	Assumes non-routine tasks including replacement of trees and other items.
	Site Visits for Irrigation or Maintenance Issues	LS	120	OM	-	960	960	Assumes 4 non-routine site visits per year over 30 years of operation. Each non-routine event assumes 2 staff for 1 day. Based on Ramboll experience.
	Periodic Pesticide Treatment	Each	3,300	PA	300	88	88	Assumes treatment approximately every 5 years for poplar borer required for duration of project. Annual application in Spring.
	Periodic Tree Replacement - Mobilization/ Demobilization	LS	1	-	-	-	-	Assumes mobilization, re-installation, spoils and tree debris management, and irrigation re-installation. Based on Ramboll experience.
	Periodic Tree Replacement - Dead Tree Removal and Disposal	Each	550	B7R	20	660	1,155	311313203100: Selective clearing and grubbing, 8" to 12" diameter, remove selective trees, on site using chain saws and chipper, excludes stump. Modified crew type and daily output for this scenario based on Ramboll experience. Assumes 3 replacement events of approximately 180 trees (1/3 of total trees) each event. Assuming tree material is non-hazardous and can be disposed of via regular green waste disposal.
	Periodic Tree Replacement - Installation	Each	550	B56B	3	4,400	5,867	Assumes 3 replacement events of approximately 180 trees (1/3 of total trees) each event. Includes materials and equipment/labor based on Items 11 and 12.
	Periodic Tree Replacement - Spoils Disposal	CY	489	B34C	20	196	196	Assumes non-hazardous soil needs disposed of off site. Volume of borehole used, assuming 10% fluff factor from ground to excavated. Based on Ramboll experience.
	Periodic Tree Replacement - Irrigation Installation	Each	550	Q1C	20	660	220	Assumes all trees that are replaced will need irrigation system re-installed. Assumes irrigation storage tank, pump and controller, and main irrigation lines will not need replaced, but other irrigation plumbing will need replaced for replacement trees.
	Periodic Tree Replacement - Water Delivery for Irrigation during Re-establishment	Each	2	B34C	4	4	4	Assumes water will need hauled to site for two additional four-year periods in addition to the initial four-year period when trees are originally installed.

19	Engineering Oversight/Support	LS	30	-	-	-	-	Assumes office-based engineering support over 30 years of operation.
	CORRECTIVE ACTION OPERATION AND MAINTENANCE SUBTOTAL			**-**	**-**	**8,230**	**9,190**	

	Total Labor Hours	**Total Equipment Hours**
ENGINEERING AND CONSTRUCTION SUBTOTAL	**21,000**	**12,300**
CORRECTIVE ACTION OPERATION AND MAINTENANCE SUBTOTAL	**8,200**	**9,200**
ALTERNATIVE 3 SUBTOTAL	**29,200**	**21,500**

NOTES:

1. Alternative 3: Source Control with phytoremediation is estimated to take an estimated 42 to 77 years to achieve groundwater protection standards (GWPS-35 I.A.C Section 845.600) at all perimeter wells associated with the Ash Pond (AP) following AP closure in place (CIP). Assumes the monitoring period has been capped at 30 years total, plus 3 additional years of compliance monitoring.
2. RS Means refers to the 2023 Quarter 4 online edition of RS Means Commercial New Construction.
3. See crew tab (Alt 3 - Crews) for assumptions regarding crew size, total labor hours and required construction equipment, as needed, for each task.
4. See mileage tab (Alt 3 - Mileage) for assumptions regarding total mileage for tasks outlined in this alternative.

ACRONYMS:

AC = Acre
CIP = closure in place
CY = Cubic Yard
Loose: Material swelled when removed from compacted state
EA = Each
GWPS = groundwater protection standards
LCY = Loose Cubic Yards
LF = Linear Foot
LS = Lump Sum
MSF = square feet divided by 1000
MO = Month
O&M = Operation and Maintenance
AP = Ash Pond
SF = Square Feet
SY = Square Yard

CREW CODES
ILLINOIS POWER RESOURCES GENERATING, LLC - EDWARDS POWER PLANT
CORRECTIVE ACTION ALTERNATIVES ANALYSIS SUPPORTING INFORMATION REPORT (CAAA-SIR)
ALTERNATIVE 3 - SOURCE CONTROL WITH PHYTOREMEDIATION

Item No.	Crew Code	Labor	Daily Labor Hours	Equipment	Daily Equipment Hours	Onsite Labor Hours	Onsite Heavy Equipment Hours
Construction							
4,10,12,17	2 Clab	Laborer x2	16	None	0	377	0
5	A2	Laborer x2 Truck Driver (light) x1	24	Flatbed Truck, Gas, 1.5 ton	8	96	32
16	B1	Labor Foreman x1 Laborer x2	24	None	0	288	0
14	B6	Laborer x 2 Operator (light) x 1	24	Backhoe Loader, 48 H.P.	8	24	8
13	B10B	Operator (med) x1 Laborer x0.5	12	Dozer, 200 H.P.	8	6	4
13	B10G	Operator (med) x 1 Laborer x 0.5	12	1 Sheepsfoot Roller, 240 HP	8	55	37
10, 13	B10S	Operator (med) x 1 Laborer x 0.5	12	1 F.E. Loader, W.M., 1.5 C.Y.	8	150	100
10	B11L	Operator (med) x 1 Laborer x 1	16	Grader, 30,000lb	8	18	9
10	B12C	Operator (med) x 1 Laborer x 1	16	Hydraulic excavator, 2 C.Y.	8	145	73
4	B13D	Operator (crane) x 1 Laborer x 1	16	Hydraulic excavator, 1 C.Y. Trench Box	16	719	719
4,10,11	B14	Labor Foreman x 1 Operator (light) x1 Laborer x 4	48	Backhoe Loader, 48 H.P.	8	1,556	259
4,11,18	B34C	Truck Driver x1	8	Truck Tractor, 6x4, 380 H.P. Dump Trailer, 16.5 C.Y.	8	1,429	1,429
4,10,11,13	B34G	Truck Driver x1	8	Dump Truck, Off Hwy., 50 ton	8	182	182
10	B40	Pile Driver Foreman (outside) x 1 Pile Drivers x 4 Operator (Crane) x 1 Operator (Oiler) x 1	64	1 Crawler Crane, 40 Ton 1 Vibratory Hammer & Gen.	16	6,600	1,650
12	B47H	Skilled Worker Foreman (out) x1 Skilled Workers x3	32	1 Flatbed Truck, Gas, 3 Ton	8	256	64
14	B53	1 Equipment Operator (light)	8	1 Trencher, Chain, 12 HP	8	88	88
12	B56B	Laborer x2 Equipment operator (light) x1	24	1 Track Mounted Auger Drill, 10" 2 Support Trucks 1 Decontamination Trailer	32	8,800	11,733
5	B62	Laborer x2 Operator (light) x 1	24	Loader, Skid Steer, 30 H.P.	8	295	98
16,17	B66	Operator (light) x1	8	Loader-Backhoe, 40 H.P.	8	90	88
14	Q1A	Plumber Foreman (outside x0.25 Plumber x1	10	None	0	135	0
14	Q1C	Plumber x1 Plumber Apprentice x1 Equipment Operator (medium) x1	24	Trencher, Chain, 8' D	8	1,096	365
7	R1B	Electrician x1 Electrician Apprentice x2	16	None	0	720	0
8	R6	Electrician Foreman x1 Electrician Lineman x4 Electrician Operators x2 Electrician Groundmen x4	88	Crew Truck x1 Flatbed Truck, 20,000 GVW x1 Pickup Truck, 3/4 Ton x1 Hyd. Crane, 12 Ton x0.2 Hyd. Crane, 55 Ton x0.2 Earth Auger, Truck-Mtd x0.2 Tractor w/Winch x1 Cable Trailers x3 Tensioning Rig x0.5 Cable Pulling Rig x0.5	68.8	176	138
14	R30	Electrician Foreman x0.25 Electrician x1 Laborer (Semi-Skilled) x2	26	None	0	26	0
17,18	M	Laborer x1	10	Service Truck x1	0	500	0
16	B65-modified	Laborer x1 Truck Driver (light) x1	16	Power Mulcher (large) Flatbed Truck, Gas, 1.5 ton	16	8	8
2,17,19	Eng	Engineering Staff x1.2	10	Side by Side x1	10	3,660	3,160
9	GM	Engineering Staff x4	40	Service Vehicle X 2	0	600	0
				Construction Subtotals		28,100	20,200

Corrective Action Operation & Maintenance							
17	1 Clab	Laborer x1	8	None	0	0	0
4,10,12,17	2 Clab	Laborer x2	16	None	0	377	0
17	B7R	Labor Foreman (outside) x1 Laborers x2	24	1 Bruch Chipper, 12", 130 H.P. 1 Dump Truck, 8 CY, 220 H.P. 2 Chain Saws, Gas, 18" bar	42	660	1,155
16,17	B66	Operator (light) x1	8	Loader-Backhoe, 40 H.P.	8	90	88
17	B86	Equiment Operator (medium) x1	8	1 Stump Grinder, S.P.	8	0	0
2,17,19	Eng	Engineering Staff x1.2	10	Side by Side x1	10	3,660	3,160
17,18	OM	Laborer x1	10	Service Truck x1	0	1,260	960
17	PA	Operator x1	8	Pesticide Application Truck x1	8	88	88
				O&M Subtotals		6,135	5,451
					Totals	**34,200**	**25,700**

Note: Blue shaded crew codes were created by Ramboll based on experience (not pulled from RS Means).

ACRONYMS:
O&M = Operation and Maintenance

CONSTRUCTION MILEAGE AND LABOR ESTIMATES
ILLINOIS POWER RESOURCES GENERATING, LLC - EDWARDS POWER PLANT
CORRECTIVE ACTION ALTERNATIVES ANALYSIS SUPPORTING INFORMATION REPORT (CAAA-SIR)
ALTERNATIVE 3 - SOURCE CONTROL WITH PHYTOREMEDIATION

Item	Quantity	Assumptions
Labor Total Hours	14,602	Per projected Construction total in cost estimate (does not include contingency)
Duration of Onsite Construction Days	250	Total Days
Average Daily Crew Size	15	Assumes multiple crew sizes and a 10 hour work day Assumes 1 Ramboll personnel daily for construction oversight
Daily Labor Mobilization Miles	262,500	Includes light and medium commercial vehicles Average of 70 miles round trip per day, as proposed in construction permit for AP Closure
Vehicles Miles Onsite	56,250	Includes light and medium commercial vehicles 15 miles per day, including onsite mileage and local trips No contingency Included
Equipment Mobilization Miles - Unloaded	7,083	Average of 170 miles one-way trip for equipment hauling (from Chicago, IL) Average 1 load of equipment per working week for a 6 day work week.
Equipment Mobilization Miles - Loaded	7,083	Average of 170 miles one-way trip for equipment hauling (from Chicago, IL) Average 1 load of equipment per working week for a 6 day work week.
Onsite Haul Truck Miles - Unloaded	191	34 CY Off Road Dump Truck 1/2 mile per trip per load
Onsite Haul Truck Miles - Loaded	191	34 CY Off Road Dump Truck 1/2 mile per trip per load
Offsite Haul Truck Miles - Unloaded	15,625	Assumes 10,000 CY delivered in 16 CY loads of fill material (granular and low permeability material) are delivered to the site from a regional supplier located within 50 miles of the site. Assumes truck is returning to the origin location.
Offsite Haul Truck Miles - Loaded	15,625	Assumes 10,000 CY delivered in 16 CY loads of fill material (granular and low permeability material) are delivered to the site from a regional supplier located within 50 miles of the site.
Material Delivery Miles - Unloaded	8,333	Misc. construction materials (erosion controls, piping, geotextile) Assumes 100 mile one-way trip, average 2 trips per working week
Material Delivery Miles - Loaded	8,333	Misc. construction materials (erosion controls, piping, geotextile) Assumes 100 mile one-way trip, average 2 trips per working week

O&M Mileage and Labor Estimates - Alternative 3: Phytoremediation

Item	Quantity	Assumptions
Labor Total Hours	8,230	Per projected O&M total in cost estimate (does not include contingency)
Duration of Onsite O&M Days	565	Total Days
Average Daily Crew Size	1	Assumes multiple crew sizes and a 10 hour work day
Daily Labor Mobilization Miles	139,910	Includes mob/demob from Chicago (340 miles round trip) and local daily commute mileage (30 miles per day) for an average of 170 miles round trip per day
Vehicles Miles Onsite	12,345	Includes light and medium commercial vehicles 15 miles per day, including onsite mileage and local trips No contingency Included
Equipment Mobilization Miles - Unloaded	26,010	Average of 170 miles one-way trip for equipment hauling (from Chicago, IL) Average 5 mobilizations per year plus additional mobilizations during tree replacement years.
Equipment Mobilization Miles - Loaded	26,010	Average of 170 miles one-way trip for equipment hauling (from Chicago, IL) Average 5 mobilizations per year plus additional mobilizations during tree replacement years.
Onsite Haul Truck Miles - Unloaded	565	34 CY Off Road Dump Truck 1/2 mile per trip per load
Onsite Haul Truck Miles - Loaded	565	34 CY Off Road Dump Truck 1/2 mile per trip per load
Offsite Haul Truck Miles - Unloaded	1500	Assumes one offsite disposal event each year of tree material to a disposal facility located within 50 miles of the site. Assumes truck is returning to the origin location.
Offsite Haul Truck Miles - Loaded	1500	Assumes one offsite disposal event each year of tree material to a disposal facility located within 50 miles of the site. Assumes truck is returning to the origin location.
Material Delivery Miles - Unloaded	300	Assumes two deliveries every 10 years for replacement tree cuttings and associated materials from a supplier located within 50 miles of the site. Assumes truck is returning to the origin location.
Material Delivery Miles - Loaded	300	Assumes two deliveries every 10 years for replacement tree cuttings and associated materials from a supplier located within 50 miles of the site. Assumes truck is returning to the origin location.

ACRONYMS:
CAGM = Corrective Action Groundwater Monitoring
CY = Cubic yard
O&M = Operation and Maintenance

Appendix C

Corrective Measures Assessment

Intended for
Illinois Power Generating Company

Date
June 4, 2024

Project No.
1940103584-008

35 I.A.C. § 845 CORRECTIVE MEASURES ASSESSMENT

EDWARDS POWER PLANT, ASH POND, IEPA ID: W1438050005-01

RAMBOLL Bright ideas. Sustainable change.

35 I.A.C. § 845 CORRECTIVE MEASURES ASSESSMENT EDWARDS POWER PLANT EDWARDS POWER PLANT, ASH POND, IEPA ID: W1438050005-01

Project name	**Edwards Power Plant Ash Pond**
Project no.	**1940103584-004**
Recipient	**Illinois Power Resources Generating, LLC**
Document type	**35 I.A.C. § 845 Corrective Measures Assessment**
Revision	**Final**
Date	**June 4, 2024**
Prepared by	**Frances Ackerman, RG, PE**
Checked by	**Lucas P. Carr, PE**
Approved by	**Brian G. Hennings, PG**



Frances Ackerman, RG, PE
Senior Managing Engineer



Brian Hennings, PG
Project Officer, Hydrogeology

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CONTENTS

1.	**Introduction**	**1**
1.1	Source Control and Residual Plume Management	1
1.2	Adaptive Site Management	2
2.	**Site Information**	**4**
2.1	Conceptual Site Model	4
2.2	Groundwater Quality	5
3.	**Corrective Measures Assessment Methodology**	**6**
4.	**Description of Potential Corrective Measure Technologies**	**7**
4.1	Source Control with Groundwater Polishing	7
4.2	Source Control with Groundwater Extraction	8
4.3	Source Control with Groundwater Cutoff Wall	9
4.4	Source Control with In-Situ Chemical Treatment	9
4.5	Source Control with Phytoremediation	11
5.	**Assessment of Corrective Measure Technologies**	**14**
5.1	Requirements	14
5.2	Groundwater Corrective Technology Assessment	14
5.2.1	Source Control with Groundwater Polishing	14
5.2.2	Source Control with Groundwater Extraction	15
5.2.3	Source Control with Groundwater Cutoff Wall	16
5.2.4	Source Control with In-Situ Chemical Treatment	17
5.2.5	Source Control with Phytoremediation	18
5.3	Technologies Advanced to CAAA	19
6.	**References**	**20**

TABLES

Table 5-1	35 I.A.C. § 845 Corrective Measures Assessment Matrix

FIGURES

Figure 2-1	Site Location Map
Figure 2-2	Site Map
Figure 2-3	Uppermost Aquifer Potentiometric Surface Map - June 12, 2023
Figure 2-4	35 I.A.C § 845 Monitoring Well Location Map

ATTACHMENTS

Attachment A	Selected Construction Permit Application Plans

ACRONYMS AND ABBREVIATIONS

%	percent
35 I.A.C.	Title 35 of the Illinois Administrative Code
AP	Ash Pond
ASD	alternative source demonstration
CAAA	Corrective Action Alternatives Analysis
CAP	Corrective Action Plan
CBR	closure-by-removal
CCR	coal combustion residuals
CIP	closure-in-place
CMA	Corrective Measures Assessment
cm/s	centimeters per second
CSM	conceptual site model
EPP	Edwards Power Plant, also referred to as Site
EPRI	Electric Power Research Institute
E001	Event 1
E002	Event 2
E003	Event 3
GMP	Groundwater Monitoring Plan
GWPS	groundwater protection standard(s)
ID	identification
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
IPRG	Illinois Power Resources Generating, LLC
ITRC	National Research Council, Interstate Technology & Regulatory Council
LLDPE	linear low-density polyethylene
NAVD88	North American Vertical Datum of 1988
NID	National Inventory of Dams
No.	number
NPDES	National Pollutant Discharge Elimination System
NRT/OBG	Natural Resource Technology, an OBG Company
PRB	Permeable Reactive Barrier
PMP	Potential Migration Pathway
Ramboll	Ramboll Americas Engineering Solutions, Inc.
SI	surface impoundment
UA	uppermost aquifer
UCF	Upper Cahokia Formation
USEPA	United States Environmental Protection Agency
ZVI	zero-valent iron

1. INTRODUCTION

Ramboll Americas Engineering Solutions, Inc. (Ramboll) has developed this assessment of groundwater corrective measures on behalf of Illinois Power Resources Generating, LLC (IPRG) to assist in the compliance with the requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845 Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments. This assessment applies specifically to the coal combustion residuals (CCR) unit referred to as the Ash Pond (AP) at the Edwards Power Plant (EPP), also identified by CCR unit identification (ID) number (No.) 301, Illinois Environmental Protection Agency (IEPA) ID No. W143805000501, and National Inventory of Dams (NID) No. IL 50710. This report addresses content requirements specific to 35 I.A.C. § 845.660 (Assessment of Corrective Measures) for exceedances of boron and sulfate at the AP.

1.1 Source Control and Residual Plume Management

IPRG intends to initiate significant source and residual plume management efforts as part of the AP closure, as documented in the Construction Permit Application that was submitted to IEPA in June 2022 (IngenAE, 2022). The proposed closure exceeds the minimum Closure Performance Standards listed in 35 I.A.C § 845.750. The closure will include removing free liquids in accordance with the performance standard in 35 I.A.C. § 845 and maintaining that condition during the closure construction period. The closure will control infiltration in accordance with the performance standard in 35 I.A.C. § 845, thus removing the hydraulic head that can force leachate into subsurface soils and is the mechanism that can drive risk (United States Environmental Protection Agency [USEPA], 2015a, p. 21342):

> *EPA's risk assessment shows that the highest risks are associated with CCR surface impoundments due to the hydraulic head imposed by impounded water. Dewatered CCR surface impoundments will no longer be subjected to hydraulic head so the risk of releases, including the risk that the unit will leach into the groundwater, would be no greater than those from CCR landfills.*

The AP will be closed using a consolidate-and-cap approach consisting of excavating over 1.3 million cubic yards of CCR and placing it in a consolidated CCR footprint to provide a minimum separation of 5 feet above the uppermost aquifer (UA). The consolidated CCR will be covered with an alternate geomembrane final cover system having performance that exceeds the minimum final cover requirements per 35 I.A.C. § 845.750(c)(2) (IngenAE, 2022). The proposed source control is predicted to reduce water flux into and out of the AP by approximately 97% and 94%, respectively (Ramboll, 2022). These source control activities will serve as the primary groundwater corrective measure at the AP. The potentially feasible corrective measures presented herein are intended to be supplementary to the primary source control and are intended to serve as management measures to address any residual plumes that remain after completion of source control. These source control activities will serve as the primary groundwater corrective measure at the AP. The potentially feasible corrective measures presented herein are intended to be supplementary to the primary source control and are intended to serve as management measures to address any residual plumes that remain after completion of source control.

Attachment A includes summary figures from the Construction Permit Application that show the proposed final source control and primary corrective action.

1.2 Adaptive Site Management

Adaptive site management strategies will be employed as an integral part of ongoing corrective action at the AP. The adaptive site management approach will allow timely incorporation of new site information over the closure and post-closure life cycle of the AP to ensure the achievement of the GWPS. The adaptive site management approach is proposed to expedite progress toward meeting the GWPS while acknowledging uncertainties, such as the persistence of current groundwater flow directions and flux quantities and potential related changes in geochemical conditions. A structured decision-making process and explicitly planned iterations between the implemented corrective measures and monitoring results will ensure that remediation is occurring. System performance and the condition of the residual plume will be monitored as the corrective measure(s) selected through the 35 I.A.C. § 845.710 Corrective Action Plan (CAP) process, are implemented to supplement the source control measures described above. The adaptive site management approach will facilitate timely modifications or enhancements to the corrective measure(s), as needed in accordance with 35 I.A.C. § 845.680(b). This approach will be employed in response to new site information and/or the performance of the selected corrective measure(s).

The planned adaptive site management strategies are generally consistent with National Research Council, Interstate Technology & Regulatory Council (ITRC) and USEPA methodologies developed to address sites with long remediation times and high levels of uncertainty regarding the remedial actions necessary to achieve final and protective remediation goals (USEPA, 2022). The elements of the proposed adaptive site management strategy at the AP will be responsive to the changing conditions associated with pond closure and performance of the selected corrective measure(s) and will include the following:

1. Implementing the groundwater corrective measure(s) selected as part of the CAP for the current conditions at the AP. The selected corrective measures may include a combination of the technologies presented in this Corrective Measures Assessment (CMA).
2. Establishing both the absolute remedial objective and functional (interim) goals to monitor progress toward the remedial objective. Achieving the GWPS for 35 I.A.C. § 845.600 constituents at the downgradient waste boundary is the remedial objective for the AP. Specific functional goals will be developed as part of the CAP process. The functional goals will be measurable thresholds for future action and may include short-term or technology-specific objectives and triggers. Functional goals may vary for different locations, CCR constituents or other site-specific considerations (ITRC, 2017) and will serve as benchmarks for comparison to ongoing groundwater monitoring at the AP.
3. Ongoing groundwater monitoring at the AP will continue throughout the implementation of source control and residual plume management activities. Post-closure monitoring will continue for a period of at least 30 years, in accordance 35 I.A.C. § 845.780(c). A comprehensive groundwater monitoring plan (GMP) will be developed as part of the CAP process in accordance with 35 I.A.C. § 845.670 and 35 I.A.C. § 845.220(c)(4). The GMP will include the functional goals and proposed action levels.

4. Groundwater monitoring information will be used to guide decisions regarding whether progress toward the remedial goal is advancing as expected and/or whether additional actions may be needed to achieve the remedial objective, in conjunction with IEPA, as required by 35 I.A.C. § 845.680(b).

2. SITE INFORMATION

The EPP is located in Peoria County between Mapleton and Bartonville in Section 11, Township 7 North, Range 7 East (**Figure 2-1**). The EPP is situated in a predominantly agricultural area with industrial properties bordering the property. The EPP property is bordered by a salt processing facility to the north, railroad right-of-way and former Orchard Mines to the west, the Illinois River and a fertilizer production facility to the east, and agricultural land to the south (**Figure 2-1**). The EPP is located on the floodplain of the Illinois River adjacent to a levee and has one CCR SI, the AP. (**Figure 2-2**).

The AP has a surface area of approximately 91 acres with berms up to 27 feet higher than the surrounding land surface. This pond currently discharges to the Illinois River through Outfall 001 included in the facility National Pollutant Discharge Elimination System (NPDES) permit, IL0001970. A construction permit application for the closure of the AP (*e.g.,* source control) was submitted to IEPA on July 28, 2022 (IngenAE, 2022); permit approval is pending at this time.

2.1 Conceptual Site Model

Significant site investigation has been completed at the EPP to characterize the geology, hydrogeology, and groundwater quality. Based on extensive investigation and monitoring, the AP has been well-characterized and detailed in the Hydrogeologic Site Characterization Report (Ramboll, 2021), which was prepared to comply with the requirements specified in 35 I.A.C. § 845.620 and expands upon the Hydrogeologic Monitoring Plan (Natural Resource Technology/O'Brien & Gere Engineers, Inc. [NRT/OBG], 2017). The conceptual site model (CSM) is presented below.

The AP is located in the Illinois Valley where the general sequence of unlithified Quaternary deposits consists of poorly sorted sand, silt, and clay of the Cahokia Formation. The upper part of the Cahokia Formation consists of overbank silts and clays, while the coarser textured lower portion is mainly sandy channel and lateral accretion deposits (Willman and Frye, 1970). The Site is characterized by three hydrostratigraphic units:

- **Upper Cahokia Formation (UCF)/Potential Migration Pathway (PMP):** Low permeability clays and silts of the UCF are present at the surface. This unit is considered a PMP at elevations similar to the base of the AP, and in places where thin discontinuous sand lenses occur within the UCF adjacent to the AP. The thickness of the UCF is variable beneath the AP and ranges from 5 feet to approximately 40 feet across the site. The geometric mean horizontal hydraulic conductivity for the PMP wells is 9.2×10^{-4} centimeters per second (cm/s) (Ramboll, 2021).
- **Uppermost Aquifer (UA):** Thin (generally less than 4 feet), moderate permeability sand, silty sand, and clayey gravel material within the Lower Cahokia Formation, bedrock, and/or weathered shale bedrock, where present. In locations where higher permeability materials and coarser grained materials are absent, the UA is interpreted as the interface between the Lower Cahokia Formation and shale bedrock. The geometric mean horizontal hydraulic conductivity for UA wells is 1.7×10^{-4} cm/s (Ramboll, 2021).
- **Bedrock Confining Unit:** Thick, very low permeability shales and siltstones of the Carbondale and Modesto Formations. This unit was encountered at elevations ranging from

approximately 400 to 422 feet[1] with higher bedrock elevations occurring beneath the northern portion of the AP. The geometric mean horizontal hydraulic conductivity at monitoring wells AP05D, AP07D, and AW-15C results in 3.2 x 10^{-6} cm/s, which is likely representative of the bedrock underlying the Site (Ramboll, 2021).

Groundwater occurs within both the unlithified materials and bedrock and consistently flows from east to west/southwest at the central portion of the AP towards what is interpreted as a former channel of the Illinois River, and south/southeast at the south end of the AP. In the northernmost portion of the Ash Pond there is a minor northwest and northern component of flow in both the uppermost aquifer and PMP. Upward vertical gradients have been calculated between the bedrock and the UA, indicating the Illinois River may be a regional discharge zone for bedrock near the AP. Groundwater elevations vary seasonally, generally less than 5 feet, while across the site they range between approximately 430 and 450 feet, although flow directions are generally consistent. Groundwater elevations and contours for the UA from the monitoring event on June 12, 2023 are presented in **Figure 2-3**.

2.2 Groundwater Quality

Groundwater monitoring in accordance with the proposed GMP and sampling methodologies provided in the operating permit application for the AP began in the second quarter of 2023. The 35 I.A.C § 845 groundwater monitoring system is displayed on **Figure 2-4** and consists of 17 wells screened in the UA (two background and 15 compliance) and three temporary water level only wells screened in CCR material, and one temporary water level only surface water staff gage (SG-01). The groundwater samples collected from the 17 wells are used to monitor and evaluate groundwater quality and demonstrate compliance with the groundwater quality standards listed in 35 I.A.C. § 845.600(a). The proposed monitoring wells yield groundwater samples that represent the quality of downgradient groundwater at the CCR boundary (as required in 35 I.A.C. § 845.630(a)(2)).

The first quarterly sampling event (Event 1 [E001]) was completed on June 15, 2023. In accordance with 35 I.A.C. § 845.610(b)(3)(C), statistically derived values were compared with the GWPSs summarized in 35 I.A.C. § 845.600 to determine exceedances of the GWPS. The statistical determination identified the following GWPS exceedances at compliance and supplemental groundwater monitoring wells (Ramboll, 2023a)[1]:

- Boron in UCF/PMP wells AP07S and AW-15S, and in UA wells AW-19, AW-20, and AW-21
- Sulfate in UCF/PMP well AW-15S

Subsequent compliance sampling events for Quarter 3 and Quarter 4 2023 (Event 2 [E002] and Event 3 [E003]) were completed in August and November 2023 and groundwater samples were evaluated for exceedances of the GWPS as described in 35 I.A.C. § 845.600 (Ramboll, 2023b; Ramboll, 2024). The following additional exceedance was identified during the E002 monitoring event:

- Boron in UA well AW-05

Boron and sulfate exceedances are addressed in this CMA, in accordance with 35 I.A.C. § 845.660.

3. CORRECTIVE MEASURES ASSESSMENT METHODOLOGY

This section describes the CMA methodology initiated in response to the identification of exceedances of the GWPSs for 35 I.A.C. § 845.600 constituents at the downgradient waste boundary of the AP during the E001 groundwater monitoring event (Ramboll, 2023a). The CMA was initiated on January 6, 2024, within 90 days after the detection of exceedance(s) of GWPS. Under 35 I.A.C. § 845, owners and operators of existing CCR SI must initiate the assessment of corrective measures in accordance with 35 I.A.C. § 845.660 if one or more constituents are detected, and confirmed by an immediate resample, to be in exceedance of a GWPS in 35 I.A.C. § 845.600, and the owner or operator has not demonstrated that: a source other than the CCR SI caused the exceedance; or that the exceedance of the GWPS resulted from error in sampling, analysis, statistical evaluation, natural variation in groundwater quality or a change in the potentiometric surface and groundwater flow direction (an ASD).

The CMA is the first step in developing a long-term CAP to address the GWPS exceedances at CCR SIs. The process provides a systematic, rational method for evaluating potential corrective measures by first identifying potentially viable technologies and assessing them using qualitative information to eliminate from consideration infeasible or otherwise unacceptable remedial technologies (*i.e.,* the 35 I.A.C. § 845.660 CMA). The remaining technologies will be evaluated individually, or assembled into combined alternatives, and further evaluated under the 35 I.A.C. § 845.670 CAP process.

This CMA identified applicable corrective measure technologies and evaluated them for viability, given the site-specific conditions and considerations at the AP, by addressing the following 35 I.A.C § 845.660 evaluation criteria:

- Performance, reliability, ease of implementation and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination;
- Time required to begin and complete the CAP; and
- Institutional requirements, such as State or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the CAP.

The evaluation included qualitative and/or semi-quantitative screening of the potential corrective measures (technologies) relative to their general performance, reliability, and ease of implementation characteristics and their potential impacts, timeframes, and institutional requirements to assess the viability of each technology to address the GWPS exceedances at the AP. This approach provided a reasoned set of corrective measures that could be used, either individually or in combination, to supplement the primary source control measures described in **Section 1.1**. This set of corrective measures will be further evaluated in the Corrective Action Alternatives Analysis (CAAA).

4. DESCRIPTION OF POTENTIAL CORRECTIVE MEASURE TECHNOLOGIES

The potential groundwater corrective measures summarized below are applicable to the AP and were included in the CMA development and analysis. Site-specific considerations provided in **Section 2** were used to evaluate potential groundwater corrective measures. Each of the corrective measures evaluated may be capable of satisfying the requirements and objectives, listed in **Section 3**, to varying degrees of effectiveness. The corrective measure review process was intended to yield a set of applicable corrective measures that could be used to supplement the primary corrective action, which will be the source control activities described in **Section 1.1** (hybrid consolidate-and-cap approach with a geomembrane final cover system). The source control is expected to reduce the total groundwater flux in and out of the CCR by approximately 97% and 94%, respectively, relative to pre-closure conditions. Ongoing monitoring will be an integral part of all corrective measures to verify and document the remedial process. The corrective measures ultimately advanced to the Corrective Action Alternatives Analysis (CAAA) and selected in the CAP will be used to enhance the effectiveness of the source control and may be used independently or combined into specific remedial alternatives to leverage the advantages of multiple corrective measures to attain GWPSs.

Source control measures will be initiated for the AP, as described in **Section 1.1**; all of the evaluated additional corrective measure technologies are proposed to be supplemental and complementary to source control activities. The following potential corrective measures, commonly used to mitigate groundwater impacts, were considered as a part of the CMA process:

- Source Control with Groundwater Polishing;
- Source Control with Groundwater Extraction (groundwater pumping wells or collection trenches);
- Source Control with a Cutoff Wall;
- Source Control with In-Situ Treatment (Permeable Reactive Barrier [PRB] or In-Situ Chemical Treatment); and
- Source Control with Phytoremediation

4.1 Source Control with Groundwater Polishing

Both federal and state regulators have long recognized that natural geochemical processes can be an acceptable component of a remedial action when it can achieve remedial action objectives in a reasonable timeframe. In 1999, the United States Environmental Protection Agency (USEPA) published a final policy directive (USEPA, 1999a) for groundwater remediation and described the process as follows:

- *"The reliance on natural attenuation processes (within the context of a carefully controlled and monitored site cleanup approach) to achieve site-specific remediation objectives within a time frame that is reasonable compared to that offered by other more active methods. The natural attenuation processes that are at work in such a remediation approach include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. These in-situ processes include biodegradation;*

dispersion; dilution; sorption; volatilization; radioactive decay; and chemical or biological stabilization, transformation, or destruction of contaminants."

The USEPA has stated that source control is the most effective means of ensuring the timely attainment of remediation objectives (USEPA, 1999a). Natural geochemical processes may be appropriate as a "finishing step" after effective source control implementation (*i.e.*, groundwater polishing), to reduce the residual mass remaining in the groundwater after closure, if there are no risks to receptors and/or the contaminant plume is not expanding. Thus, groundwater polishing would be used in conjunction with the significant planned source control effort at the site, which will consist of a hybrid consolidate-and-cap approach with a final cover system described in **Section 1.1**.

In 2015, USEPA addressed remediation of inorganic compounds in groundwater and noted that the use of natural geochemical processes to address inorganic contaminants: (1) is not intended to constitute a treatment process for inorganic contaminants; (2) when appropriately implemented, can help to restore an aquifer to beneficial uses by immobilizing contaminants onto aquifer solids and providing the primary means for attenuation of contaminants in groundwater; and (3) is not intended to be a "do nothing" response (USEPA, 2015b). Rather, documenting the applicability of natural geochemical processes for groundwater remediation should be thoroughly and adequately supported with site-specific characterization data and analysis (USEPA, 1999a; USEPA, 2007; USEPA, 2015b):

Both physical and chemical processes can contribute to the reduction of the small amount of residual mass remaining after closure of the AP, and the toxicity, mobility, volume, or concentration of contaminants in groundwater. Physical processes applicable to CCR constituents in groundwater include dilution, dispersion, and flushing. Chemical processes applicable to CCR constituents in groundwater include precipitation and coprecipitation (*e.g.,* incorporation into sulfide minerals), sorption (*e.g.,* to iron, manganese, aluminum; to other metal oxides or oxyhydroxides; or to sulfide minerals or organic matter), and ion exchange.

All inorganic compounds are subject to physical processes and under typical environmental conditions, physical mechanisms most often exert the dominant control on the CCR constituents of interest. Chemical mechanisms are also likely to be active, though not often dominant, such as adsorption, ion exchange, and organic complexation. In combination with source control, these natural controls can provide an effective means to polish residual loading and achieve the GWPS in a reasonable timeframe. Additional data collection and analysis may be required to evaluate site-specific geochemical attenuation processes and obtain regulatory approval.

4.2 Source Control with Groundwater Extraction

Groundwater extraction is one of the most widely used groundwater corrective technologies and has a long history of performance. This corrective measure includes installation of one or more groundwater pumping wells or an extraction trench to control and extract impacted groundwater. Groundwater extraction captures and contains impacted groundwater and can limit plume expansion and/or off-site migration. Construction of a groundwater extraction system typically includes, but is not limited to, the following primary components:

- Designing and constructing a groundwater extraction system consisting of one or more extraction wells or trenches and operating at a rate to allow capture of CCR impacted groundwater within the UA and or the UCF/PMP.

- Management of extracted groundwater, which may include modification to the existing NPDES permit.
- Ongoing inspection and maintenance of the groundwater extraction system.

Remediation of inorganics by groundwater extraction can be effective, but systems do not always perform as expected. A combination of factors, including geologic heterogeneities, difficulty in flushing low-permeability zones, and rates of contaminant desorption from aquifer solids can limit effectiveness. Groundwater extraction systems require ongoing operation and maintenance to address issues such as iron bacteria and well fouling and to ensure optimal performance. The extracted groundwater must be managed, either by ex-situ treatment or disposal.

Groundwater extraction may reduce the timeframe to achieve GWPS and limit the off-site migration of constituents that exceed the GWPS. Extraction could be accomplished using a groundwater pumping well system or an extraction trench.

4.3 Source Control with Groundwater Cutoff Wall

Since the late 1970s and early 1980s, vertical cutoff walls have been used to control and/or isolate impacted groundwater. Low-permeability cutoff walls can be used to prevent horizontal off-site migration of potentially impacted groundwater. Cutoff walls act as barriers to lateral transport of impacted groundwater and can isolate soils that have been impacted by CCR to prevent flow between unimpacted groundwater. Cutoff walls are often used in conjunction with an interior pumping system to establish an inward gradient within the cutoff wall. The gradient imparted by the pumping system maintains an inward flow through the wall, keeping it from acting as a groundwater dam and controlling potential end-around or breakout flow of contaminated groundwater. Constructing the cutoff wall such that it intersects a low-permeability material at its base, referred to as "keying", greatly increases its effectiveness.

A commonly used cutoff wall construction technology is the slurry trench method, which consists of excavating a trench and backfilling it with a soil-bentonite mixture, often created with the excavated soils, or, for deeper walls, a cement-bentonite mixture that is produced at an onsite batch plant. The trench is temporarily supported with bentonite slurry pumped into the trench during excavation (D'Appolonia & Ryan, 1979). Cutoff wall excavation uses conventional hydraulic excavators, hydraulic excavators equipped with specialized booms to extend their reach (*i.e.,* long-stick excavators), clamshells, or more specialized equipment such as hydromills, secant-pile drill rigs, or one-pass machines, depending upon trench depth, material excavated, and type of material that the wall is keyed into.

Cutoff walls are a widely accepted technology for containing impacted groundwater. Combining groundwater polishing with a limited cutoff wall and groundwater extraction in specific areas may provide advantages over independent use of these potential corrective technologies. Cutoff walls can be used in combination with groundwater extraction or as part of a PRB system (as the "funnel" in a funnel-and-gate system; **Section 4.4**).

4.4 Source Control with In-Situ Chemical Treatment

The use of in-situ treatment, either by injection or PRBs is a widely used technology for treating impacted groundwater. However, in-situ treatment techniques for boron and sulfate are not well established, therefore performance is unknown.

Chemical treatment could consist of injection of reactive materials into the subsurface to treat contaminants at specific, targeted locations. Alternatively, treatment could be accomplished via PRB, where subsurface barriers (*i.e.,* cutoff walls) are placed at locations designed to direct the contaminant plume along a flow path through the reactive media. In either system, the contaminants are transformed or otherwise rendered into environmentally acceptable forms to attain remediation concentration goals downgradient of the barrier (Electric Power Research Institute [EPRI], 2006).

As groundwater passes through the PRB under natural gradients, dissolved constituents in the groundwater react with the reactive media and are transformed or immobilized. A variety of media have been used or proposed for use in PRBs. Zero-valent iron (ZVI) has been shown to effectively immobilize some CCR constituents, including arsenic, chromium, cobalt, molybdenum, selenium, and sulfate. Use of a combination media consisting of ZVI and a boron-selective ion exchange (IX) resin to treat boron has been documented in a pilot-scale test (EPRI, 2006).

System configurations include continuous PRBs, in which the reactive media extends across the entire path of the contaminant plume; and funnel-and-gate systems, where low-permeability barriers are installed to control groundwater flow through a permeable gate containing the reactive media. Continuous PRBs intersect the entire contaminant plume and do not materially impact the groundwater flow system. Design may or may not include keying the PRB into a low-permeability unit at depth. Funnel-and-gate systems utilize a system of barriers to groundwater flow (funnels) to direct the contaminant plume through the reactive gate. The barriers, typically some form of cutoff wall, are keyed into a low-permeability unit at depth to prevent short circuiting of the plume. Funnel-and-gate design must consider the residence time to allow chemical reactions to occur. Directing the contaminant plume through the reactive gate can significantly increase the flow velocity, thus reducing residence time.

Design of in-situ treatment systems requires rigorous site investigation to characterize the site hydrogeology and to delineate the contaminant plume. A thorough understanding of the geochemical and redox characteristics of the plume is critical to assess the feasibility of the process and select appropriate reactive media. Laboratory studies, including batch studies and column studies using samples of site groundwater, are needed to determine the effectiveness of the selected reactive media at the site (EPRI, 2006). The main considerations in selecting reactive media are as follows (Gavaskar et al., 1998; cited by EPRI, 2006):

- Reactivity - The media should be of adequate reactivity to immobilize a contaminant within the residence time of the design.
- Hydraulic performance - The media should provide adequate flow through the PRB, meaning a greater particle size than the surrounding aquifer materials. Alternatively, gravel beds have been emplaced in front of barriers to direct flow through the barrier.
- Stability - The media should remain reactive for an amount of time that makes its use economically advantageous over other technologies.
- Environmentally compatible by-products - Any by-products of media reaction should be environmentally acceptable. For example, iron released by zero-valent iron corrosion should not occur at levels exceeding regulatory acceptance levels.
- Availability and price: The media should be easy to obtain in large quantities at a price that does not negate the economic feasibility of using a PRB.

4.5 Source Control with Phytoremediation

Phytoremediation has been shown to be effective for treating groundwater up to 30 feet below ground surface when correctly implemented. Phytoremediation is an accepted and proven remedial technology that refers to several ways in which plants are used to remediate sites by removing pollutants from soil and water. Phytoremediation can provide an aesthetically pleasing, solar-energy driven technique that can be used to clean up sites with shallow, low to moderate levels of contamination (USEPA, 1999b).

The specific mechanisms that contribute to phytoremediation are largely a function of the site conditions, plant species, and the nature of the contaminant. Phytoremediation can be an effective treatment for boron (Bañuelos et al., 1999), and boron is an essential micronutrient for plant growth. However, if boron concentrations in irrigation water become too elevated (greater than approximately 20 mg/L for poplars and willows), the water can be toxic to plants (Yıldırım & Kasım, 2018). While sulfate phytoremediation is not well documented, sulfate is a necessary nutrient for plant growth, and phytoremediation would likely reduce sulfate concentrations in groundwater. Boron and sulfate impacts to groundwater would also be reduced via increased groundwater uptake by the phytoremediation plantation.

Several different phytoremediation mechanisms can contribute to contaminant degradation, removal (through accumulation or dissipation), or immobilization:

- Degradation (for destruction or alteration of organic contaminants)
  - Rhizodegradation: enhancement of biodegradation in the below-ground root zone by microorganisms;
  - Phytodegradation: contaminant uptake and metabolism above or below ground, within the root, stem, or leaves;
- Accumulation (for containment or removal of organic and/or metal contaminants)
  - Phytoextraction: contaminant uptake and accumulation for removal;
  - Rhizofiltration: contaminant adsorption on roots for containment and/or removal;
- Dissipation (for removal of organic and/or inorganic contaminants into the atmosphere)
  - Phytovolatilization: contaminant uptake and volatilization;
- Immobilization (for containment of organic and/or inorganic contaminants)
  - Hydraulic Control: control of ground-water flow by plant uptake of water;
  - Phytostabilization: contaminant immobilization in the soil.

In most circumstances, multiple mechanisms act simultaneously and synergistically to remediate contaminants.

Phytoremediation requires more effort than simply planting vegetation and, with minimal maintenance, and assuming that the contaminant will disappear. Phytoremediation requires an understanding of the applicable remediation mechanisms, careful plant species selection, and the provision of an environment conducive to successful plant growth to achieve optimal results. Site specific verification of the applicability and efficacy of phytoremediation would be required (USEPA, 2001).

At the AP, two phytoremediation mechanisms would be the predominant contributors to reduction of contaminants in groundwater: phytoextraction and hydraulic control. Phytoextraction would consist of uptake impacted of groundwater through tree roots and storage of the contaminants in the above-ground tree tissues (predominantly leaves). Simultaneously, the plantings would improve hydraulic control of impacted groundwater due to the root systems impeding the downgradient groundwater flux and thereby reducing the downgradient contaminant mass flux.

Phytoremediation could be implemented in a variety of different ways. One straightforward approach involves planting directly into contaminated soil or in areas where roots can directly contact contaminated groundwater. This strategy provides a simple approach under the proper conditions (roots can naturally reach contamination, environment is not toxic to plants, etc.); however, in some cases contaminated groundwater cannot be easily accessed by plant roots and other strategies are required.

Where groundwater is too deep for roots to naturally access it, specialized planting systems can be utilized to provide access to the groundwater. At each planting location, the groundwater wells or soil borings are backfilled with a course grained material allowing groundwater to rise to its potentiometric surface elevation. When designed correctly, these systems provide significantly increased access to groundwater for the tree roots, especially when combined with other cultivation techniques to encourage deep root growth such as deep irrigation during the tree establishment, aeration tubes to provide oxygen to the subsurface, and utilizing long tree cuttings planted deeply. An additional technique to encourage deep root growth is to install a casing or liner around the root zone that requires tree roots to advance downward toward groundwater.

Phytoremediation implementation at the AP would consist of planting phreatophytes (plants that thrive with roots submerged in water) in downgradient area(s) where elevated concentrations of boron and sulfate in groundwater have been observed. Following installation, the trees would require an initial establishment period of several (3 to 5) years to grow large enough for roots to reach the groundwater table and begin uptake of groundwater. During this establishment period supplemental irrigation would be necessary. Once the trees have sufficiently matured to uptake groundwater, boron (and possibly sulfate) would be incorporated into tree tissues including the leaves of the trees. Leaves from the trees would be collected and removed from the tree plantation thereby providing for a mechanism of boron (and possibly sulfate) removal from the site.

Since phytoremediation is dependent upon the tree roots contacting and extracting groundwater, enhancements could be implemented to promote downward root growth. Examples include planting long tree cuttings deeper in the ground, having deep irrigation systems that encourage downward root growth, and planting boron accumulating grass cover or utilizing impermeable membranes to reduce infiltration and thereby encourage tree root growth toward the groundwater table. Phreatophytes are favored for their ability to grow deep root systems quickly as well as their capability to utilize high volumes of water once established. Phytoremediation using phreatophytes has been shown to be effective for treating groundwater up to 30 feet below ground surface if appropriate measures are implemented.

Phytoremediation can offer several advantages over traditional remedial technologies. When properly applied, phytoremediation can be a low cost, low maintenance, environmentally friendly, and aesthetically pleasing technology while also providing effective contaminant reduction.

Phytoremediation can be well-suited for projects with longer time frames (tens of years) or low concentration contaminant fluxes. However, under some conditions clean up can be achieved in shorter time frames (several years).

5. ASSESSMENT OF CORRECTIVE MEASURE TECHNOLOGIES

This CMA was initiated to address exceedances of the 35 I.A.C. § 845.600 GWPS for boron and sulfate at the downgradient waste boundary of the AP identified during the E001 groundwater monitoring event (**Section 2.2**).

5.1 Requirements

The potential groundwater corrective technologies described in the previous section were evaluated relative to the requirements presented in **Section 3** and reiterated below:

- Performance, reliability, ease of implementation and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination;
- Time required to begin and complete the CAP; and
- Institutional requirements, such as State or local permit requirement or other environmental or public health requirements that may substantially affect implementation of the CAP.

Table 5-1 presents the qualitative CMA evaluation of each corrective technology relative to these requirements, as well as their ability to address boron and sulfate GWPS exceedances. The following sections provide a summary of these evaluations and a discussion of the potential groundwater corrective measure technologies that may be viable, either independently or in combination, to address GWPS exceedances. This section also provides a summary of corrective measure technologies that have been retained and advanced for evaluation as part of the 35 I.A.C. § 845.670 CAAA process for selecting the final remedy for the AP.

5.2 Groundwater Corrective Technology Assessment

Source control, consisting of CCR consolidation and CIP with a final cover system, will be the primary groundwater corrective measure for the AP. Closure is expected to be completed in 2028 and each of the potential groundwater corrective measure technologies would supplement the positive impact of the closure activities. The following sections evaluate groundwater corrective measure technologies that, when combined with site closure, may be viable to address the boron and sulfate GWPS exceedances. Technologies that are not viable for addressing the GWPS at the AP will be eliminated from further evaluation and viable technologies will be advanced for further evaluation as part of the 35 I.A.C. § 845.600 CAAA process.

5.2.1 Source Control with Groundwater Polishing

Source control corrective measures (**Section 1.1**) will reduce the mass loading to the groundwater system and the groundwater polishing process could decrease the timeframe for attainment of GWPS in the UA. Groundwater flow and fate and transport modeling indicated that the total groundwater flux in and out of the CCR would be reduced by approximately 97% and 94%, respectively, relative to pre-closure conditions.

Groundwater polishing by natural geochemical processes is a widely accepted component of groundwater remediation and is routinely approved by the IEPA when paired with source control. The performance of groundwater polishing as a groundwater corrective measure varies based on site-specific conditions and additional data collection may be needed to support the design and

regulatory approval. Site conditions may be favorable for contaminant degradation by physical processes. The chemical processes in the fine-grained PMP require further evaluation.

Naturally occurring geochemical processes are ongoing at the AP and will continue to affect groundwater constituent concentrations during and after AP closure. Ongoing monitoring of groundwater conditions is needed to better understand the mechanisms and efficacy of the groundwater polishing process and to confirm the effectiveness over time. Thus, additional groundwater sample collection and analyses would be required to characterize potential mechanisms, as discussed above, and to provide long term monitoring of the remedial progress. Enhancements to the groundwater monitoring system may be required to ensure that groundwater polishing is occurring as predicted and consistent with the adaptive site management approach. The reliability of groundwater polishing as a groundwater corrective measure is high because operation and maintenance requirements are limited. However, the reliability can also vary based on site-specific hydrogeologic and geochemical conditions.

Following characterization and approval of the CAP, monitoring of the groundwater polishing processes and comparison to functional goals established to monitor progress toward the remedial objective could begin prior to, or concurrently with, site closure activities. Installing additional monitoring wells could begin as quickly as within a few months of CAP approval. The time required could be reduced if existing groundwater monitoring well systems could be utilized for monitoring.

No potential safety impacts or exposure to human health or environmental receptors are expected to result from the groundwater polishing processes. Timeframes to achieve GWPS are dependent on site-specific conditions, which require detailed technical analysis which are ongoing and will be evaluated in connection with the CAAA. Selecting groundwater polishing as a corrective measure for the AP will require approval of the closure and CAP permits by the IEPA.

Groundwater polishing processes will continue before and after source control implementation and may be a viable corrective measure for the boron and sulfate exceedances at the AP. Therefore, these processes are being advanced to the CAAA for further evaluation.

Monitoring the groundwater polishing to track progress toward achievement of the GWPS, in conjunction with source control at the AP, would require long-term maintenance and monitoring of the groundwater monitoring system to confirm source control and verify the effectiveness in reducing groundwater concentrations to levels below the GWPS. System design could begin immediately after approval of the CAP permit. Additional investigations to characterize site conditions and installation of the final monitoring system could be performed concurrently with the source control (unit closure) activities, which are currently expected to be completed in 2028.

5.2.2 Source Control with Groundwater Extraction

Source control will reduce the mass loading to the groundwater system and implementing a groundwater extraction system may reduce the time required to attain the GWPS in the UA. However, the groundwater impacts present in the low permeability PMP may limit the reduction in time to attain the GWPS that can be achieved by a groundwater extraction system.

Groundwater extraction is a widely accepted corrective measure with a long track record of performance and reliability. It is routinely approved by the IEPA. For a corrective measure using groundwater extraction to effectively control off-site flow and/or to remove potentially

contaminated groundwater, horizontal and vertical capture zone(s) must be created. However, the variability and heterogeneity of the UA, and the low permeability PMP, would constrain the ability to pump at rates high enough to establish the required capture zone(s). An extraction trench or an extraction system consisting of a high density, low flow wells would be required. Variable performance of a groundwater extraction system would be expected in the heterogeneous UA.

Implementation of a groundwater extraction system presents design challenges due to the heterogeneous and varied nature of the UA and the low permeability of the PMP. Site access limitations would impose construction challenges and construction of an extraction system between the AP and the property boundary would be challenging due to the physical site constraints (limited construction area due to adjacent surface water drainage and associated wetlands). The AP embankment would need to be modified to provide an access road and a working platform for trench construction. Extracted groundwater would need to be managed, which may include modification to the existing NPDES permit and treatment prior to discharge, if necessary. Specialized treatment equipment may be required, and ongoing operations and maintenance activities would be necessary.

There could be some impacts associated with constructing and operating a groundwater extraction system, including some limited exposure to extracted groundwater. Construction could be completed within 1 year following completion of a final design. Time of implementation is approximately 3 to 4 years after approval of the CAP permit, including characterization, design, permitting, and construction. Timeframes to achieve GWPS are dependent on site-specific conditions. An extraction system may reduce the time to attain GWPS in the UA relative to the post-closure timeframe predicted by the groundwater modeling. However, accelerated attainment of the GWPS is expected to be limited by the low permeability of the PMP.

Implementing a groundwater extraction system at the AP would require IEPA approval of the CAP permit, and discharge of extracted groundwater may require a modification to the NPDES permit, as well as possible permitting and construction of a new outfall.

Groundwater extraction could be viable corrective measure for the boron and sulfate exceedances at the AP. Therefore, groundwater extraction is being advanced to the CAAA for further evaluation.

5.2.3 Source Control with Groundwater Cutoff Wall

Source control will reduce the mass loading to the groundwater system and implementing additional groundwater corrective measures may reduce the time required to attain the GWPS in the UA. However, the groundwater impacts already present in the low permeability PMP may limit the reduction in time to attain the GWPS. Groundwater cutoff walls are a widely accepted corrective measure used to control and/or isolate impacted groundwater and are routinely approved by the IEPA. Cutoff walls have a long history of reliable performance as hydraulic barriers, provided they are properly designed and constructed. If not coupled with a groundwater extraction system, a cutoff wall will provide directional groundwater control only and may result in redistribution of contaminants and potentially GWPS exceedances at new locations.

The effectiveness of a cutoff wall as a hydraulic barrier relies on the contrast between the hydraulic conductivity of the aquifer and the cutoff wall. The most effective barriers have hydraulic conductivity values that are several orders of magnitude lower than the aquifer they

are in contact with. A cutoff wall could be used to address groundwater impacts in the UA; however, the effectiveness of a cutoff wall, typically designed with hydraulic conductivity of 1×10^{-7} cm/s, constructed in the low permeability PMP would be limited. Site access limitations would impose construction challenges and construction of an extraction system between the AP and the property boundary would be challenging due to the physical site constraints (limited construction area). The AP embankment would need to be modified to provide an access road and a working platform for trench construction.

Cutoff walls are designed to act as hydraulic barriers; as a result, cutoff walls inherently alter the existing groundwater flow system. Changes to the existing groundwater flow system may need to be controlled to maximize the effectiveness of the remedy by, for example, combining a cutoff wall with groundwater extraction to control build-up of hydraulic head upgradient and around the cutoff walls.

Construction could be completed within 1 year following completion of a final design. Time of implementation is approximately 4 to 5 years, including characterization, design, permitting, and construction. To attain GWPSs, cutoff walls require a separate groundwater corrective measure to operate in concert with the cutoff wall(s). Constructing a cutoff wall at the AP would require IEPA approval of the CAP permit.

A cutoff wall alone would not be a viable corrective measure for the boron and sulfate exceedances at the AP. Cutoff walls are commonly coupled with groundwater polishing and/or groundwater extraction or other groundwater corrective measures. The time to attain GWPS is dependent on the selected groundwater corrective measure or measures that are coupled with the cutoff walls. Use of a cutoff wall coupled groundwater extraction to supplement the ongoing groundwater polishing may provide improvement over source control in the time required to attain GWPS.

Due to the uncertain performance, reliability, and requirement that a cutoff wall be coupled with other groundwater corrective measures, a cutoff wall is not a viable corrective measure for the boron and sulfate exceedances at the AP. Therefore, it is not being advanced to the CAAA for further evaluation.

5.2.4 Source Control with In-Situ Chemical Treatment

Source control will reduce the mass loading to the groundwater system and implementing additional groundwater corrective measures may reduce the time required to attain the GWPS in the UA. Use of in-situ treatment, either through targeted injection of reactive media or in PRB systems, to transform contaminants into environmentally-acceptable forms to attain the GWPS was considered.

In-situ treatment using ion exchange to address boron and sulfate exceedances in groundwater is not an established or widely accepted groundwater corrective measure; therefore, its performance and reliability are unknown. Regulatory acceptance of this innovative approach to achieving the GWPS is uncertain.

In-situ treatment presents design and construction challenges, including targeted reactive media delivery via injection to the heterogeneous UA and the low permeability PMP. Construction of a PRB would be complicated by the site access limitations (proximity of the AP embankment to the property line, adjacent surface water drainage and associated wetlands). The embankment would

need to be modified to provide an access road and a working platform for PRB construction. Depending upon the location of the PRB system, construction may affect the AP embankment and/or final cover system and periodic change-outs of ion-exchange resin media may be required.

Additional data collection and analyses would be required to design an in-situ treatment system and bench scale and/or pilot scale testing may be required to demonstrate performance and reliability. Time of implementation is approximately 4 to 6 years after approval of the CAP permit, including characterization, design, permitting, and construction. Timeframes to achieve GWPS are dependent on demonstrations of performance and reliability and on ultimate regulatory acceptance. It is not known whether in-situ treatment would reduce the time to attain GWPS in the UA relative to the post-closure timeframe predicted by the groundwater modeling.

Due to the uncertain performance, reliability, and potential for regulatory acceptance, in-situ chemical treatment is not a viable corrective measure for the boron and sulfate exceedances at the AP and is not being advanced to the CAAA for further evaluation.

5.2.5 Source Control with Phytoremediation

Source control will reduce the mass loading to the groundwater system, and implementing a groundwater phytoremediation system may reduce the time required to attain the GWPS in the UA and in the PMP. Groundwater extraction via phytoremediation ("phytoextraction") is a proven and accepted corrective measure with a track record of performance and reliability and has been approved by the IEPA. However, phytoremediation has not been widely implemented to reduce groundwater contaminant migration from CCR impoundments to date. For phytoextraction to effectively control off-site flow and/or to remove potentially contaminated groundwater, horizontal and vertical capture zone(s) must be created. Implementation of phytoremediation for the relatively deep UA would require installing a tree system with passive wells and potentially root liners (*i.e.,* TreeWell® technology or similar) to create a hydraulic connection between the tree roots and the UA. Site access limitations would impose construction challenges and construction of a phytoextraction system between the AP and the property boundary would be challenging due to the physical site constraints (limited construction area). The AP embankment would need to be modified to provide an access road and a working platform for tree installation.

Implementation of a groundwater phytoextraction system presents design challenges due to the heterogeneous and varied nature of the UA and the low permeability of the PMP. Construction challenges to implementing a phytoremediation system between the AP and the property boundary would include access issues due to the physical site constraints (limited construction area) and close proximity of property boundary and adjacent wetlands and water bodies The AP embankment would need to be modified to provide an access road and a working platform for construction. Specialized contractors may be required to install the system. Uptake of impacted groundwater would occur through the tree roots and contaminants would be stored in the above-ground tree tissues (stems and leaves), which would need to be managed and/or disposed of following extraction. Specialized treatment equipment may be required, and ongoing operations and maintenance activities would be necessary, including leaf collection and disposal, and possible tree replacement, depending upon the time required to achieve GWPS.

Additional data collection and analyses would be required to design a phytoextraction system. Construction could be completed within 1 year following design. Time of implementation is

approximately 4 to 5 years after approval of the CAP permit, including characterization, design, pilot-scale testing of phytoremediation at the site, permitting, and construction. Timeframes to achieve GWPS are dependent on site-specific conditions. A phytoextraction system may reduce the time to attain GWPS in the UA relative to the post-closure timeframe predicted by the groundwater modeling. Implementing a groundwater phytoextraction system at the AP would require IEPA approval of the CAP permit.

Groundwater phytoextraction could be viable corrective measure for the boron and sulfate exceedances at the AP. Therefore, phytoremediation is being advanced to the CAAA for further evaluation.

5.3 Technologies Advanced to CAAA

Based on the evaluations presented above, the following potential corrective technologies are being advanced to the CAAA, individually or in combination, for more detailed evaluations:

- Source control with groundwater polishing;
- Source control and with groundwater extraction; and
- Source control with phytoremediation.

6. REFERENCES

D'Appolonia, D.J., and Ryan, C.R., 1979, *Soil-Bentonite Slurry Trench Cut-Off Wall*s, Geotechnical Exhibition and Technical Conference, Chicago, Illinois.

Electric Power Research Institute (EPRI), 2006. *Groundwater Remediation of Inorganic Constituents at Coal Combustion Project Management Sites, Technical Report #1012584*, October 2006.

Bañuelos, G. S., Shannon, M. C., Ajwa, H., Draper, J. H., Jordahl, J., and Licht, J., 1999, *Phytoextraction and Accumulation of Boron and Selenium by Poplar (Populus) Hybrid Clones*, International Journal of Phytoremediation, 1:1, 81-96, DOI: 10.1080/15226519908500006

Gavaskar, A.R., N Gupta, B.M. Sass, R.J. Janosy and D. O'Sullivan, 1998. *Permeable Reactive Barriers for Groundwater Remediation: Design, Construction and Monitoring*. Battelle Press.

Geosyntec Consultants, 2022. *Technical Memorandum – Proposed Alternative Final Protective Layer Equivalency Demonstration, Ash Pond, Edwards Power Plant, Bartonville, Illinois.* June 30, 2022.

IngenAE, LLC, 2022. *Final Closure Plan Edwards Power Plant Ash Pond, Bartonville, Illinois.* June 2022.

ITRC (Interstate Technology & Regulatory Council). 2017. *Remediation Management of Complex Sites*. RMCS-1. Washington, D.C.: Interstate Technology & Regulatory Council, Remediation Management of Complex Sites Team. https://rmcs-1.itrcweb.org.

Natural Resource Technology, an OBG Company (NRT/OBG), 2017. *Hydrogeologic Monitoring Plan, Edwards Ash Pond – CCR Unit ID 301, Edwards Power Station, Bartonville, Illinois*, Illinois Power Resources Generating, LLC. October 17, 2017.

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2021. *Hydrogeologic Site Characterization Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois*. October 25, 2021.

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2022. *Groundwater Modeling Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois*. June 30, 2022.

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2023a. 35 I.A.C. § 845.610(B)(3)(D) *Groundwater Monitoring Data and Detected Exceedances, 2023 Quarter 2, Ash Pond, Edwards Power Plant, Bartonville, Illinois*. October 8, 2023.

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2024b. 35 I.A.C. § 845.610(B)(3)(D) *Groundwater Monitoring Data and Detected Exceedances – Quarter 3, 2023. Ash Pond, Edwards Power Plant, Bartonville, Illinois*. December 13, 2023.

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2024. *35 I.A.C. § 845.610(B)(3)(D) Groundwater Monitoring Data and Detected Exceedances – Quarter 4, 2023. Ash Pond, Edwards Power Plant, Bartonville, Illinois*. February 12, 2024.

USEPA (United States Environmental Protection Agency), 1999a. *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites. Directive No. 9200.U-17P*. Washington, D.C.: EPA, Office of Solid Waste and Emergency Response.

USEPA (United States Environmental Protection Agency), 1999b. *Phytoremediation Resource Guide*, EPA 542-B-99-003. Washington, D.C.: EPA, Office of Solid Waste and Emergency Response. June 1999.

USEPA (United States Environmental Protection Agency), 2001. *Phytoremediation of Contaminated Soil and Ground Water at Hazardous Waste Sites,* EPA/540/S-01/500. Washington, D.C.: EPA, Technology Innovation Office, Office of Solid Waste and Emergency Response. February 2001.

USEPA (United States Environmental Protection Agency), 2007*. Monitored Natural Attenuation of Inorganic Contaminants in Ground Water, Volume 1 – Technical Basis for Assessment. EPA/600/R-07/139*. National Risk Management Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio. October 2007.

United States Environmental Protection Agency (USEPA), 2015a. *80 FR 21302 - Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals From Electric Utilities*. Federal Register Volume 80, Issue 74. April 17, 2015.

USEPA (United States Environmental Protection Agency), 2015b. *Use of Monitored Natural Attenuation for Inorganic Contaminants in Groundwater at Superfund Sites. Directive No. 9283.1-36*. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. August 2015.

USEPA (United States Environmental Protection Agency), 2022. *Adaptive Site Management – A Framework for Implementing Adaptive Management at Contaminated Sediment Superfund Sites. Directive No. 9200.1-166*. U.S. Environmental Protection Agency. June 2022.

Willman, H.B., and J.C. Frye, 1970. *Pleistocene Stratigraphy of Illinois: Illinois State Geological Survey, Bulletin 94*, 204 p.

Yıldırım, K., Kasım, G.Ç., 2018. *Phytoremediation potential of poplar and willow species in small scale constructed wetland for boron removal*. Chemosphere. 2018 Mar;194:722-736. doi: 10.1016/j.chemosphere.2017.12.036. Epub 2017 Dec 7. PMID: 29247932.

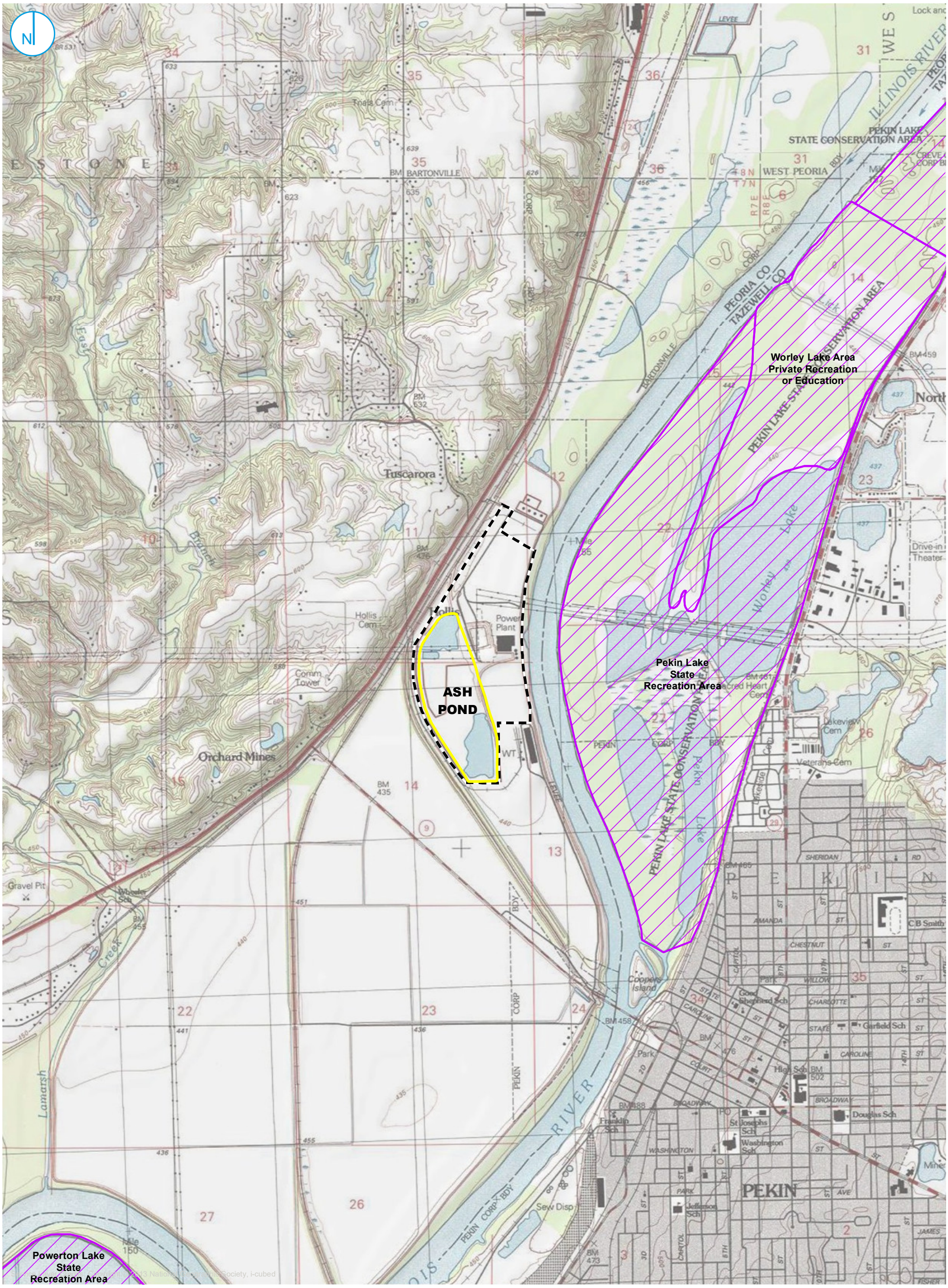
TABLES

TABLE 5-1.
Table 5-1. 35 I.A.C. § 845 Corrective Measures Assessment Matrix
Ash Pond
Edwards Power Plane
Peoria, Illinois
June 4, 2024

Remedy	Evaluation Factors						
	Performance	**Reliability**	**Ease of Implementation**	**Potential Impacts of Remedy (safety impacts, cross-media impacts, control of exposure to any residual contamination)**	**Time Required to Begin and Implement Remedy[1]**	**Time to Attain Groundwater Protection Standards**	**Institutional Requirements (state/local permit requirements, environmental/public health requirements that affect implementation of remedy)**
Source Control with Groundwater Polishing	Performs best paired with source control, which is expected to be completed prior to 2028. Site conditions are favorable for physical processes, while chemical processes may be limited under normal aquifer conditions.	Evaluation is underway and is expected to be completed in 2024. Ongoing analysis will evaluate if geochemical processes have low reversibility and the aquifer has sufficient capacity.	Long-term monitoring would be required. Implementing would not require extensive specialized equipment or contractors	None identified.	90 days after closure (source control) is completed.	Dependent on site-specific conditions including source decay rate. Attainment of groundwater protection standards will be limited by the low permeability Upper Confining Unit. Hence timeframes for groundwater polishing and other measures may be similar.	Illinois Environmental Protection Agency approval of the closure and Corrective Action Plan permits is required. A Groundwater Management Zone would be required, which may potentially impact nearby property owners.
Source Control with Groundwater Extraction	Widely accepted, routinely approved technology; variable performance anticipated due to the heterogeneous, varied nature of Uppermost Aquifer. Would likely be a trench along the north and west side of the unit between AW21 to AW15.	Reliable if properly designed, constructed and maintained. The heterogeneous, varied nature of Uppermost Aquifer may present reliability challenges for pumping wells; a trench may be more reliable.	Design challenges due to heterogeneous, varied nature of Uppermost Aquifer. Site access limitations (proximity to railroad, property boundary and adjacent wetlands) may be challenging. Specialized contractors may be necessary. Extracted groundwater would require management, possibly including treatment, which may require specialized equipment/contractors.	Alters groundwater flow system and there is the some limited potential for contact exposure to extracted groundwater. Groundwater extraction may induce settlement, which could cause impacts to adjacent structures. Trench construction may also cause structural impacts to adjacent embankments, due to site access challenges.	Design, permitting and construction is expected to take 3 to 4 years after closure.	Time to attain groundwater protection standards may be similar to groundwater polishing due to the low permeability Upper Confining Unit.	Illinois Environmental Protection Agency approval of the closure and Corrective Action Plan permits is required. Extracted groundwater could likely be discharged under the National Pollutant Discharge Elimination System permit. May also require an evaluation and/or permitting of wetlands and/or Waters of the US impacts, if determined to be necessary.
Source Control with Cutoff Wall	Widely accepted, routinely approved if properly designed and constructed. If not combined with groundwater extraction, a cutoff wall will provide directional control only, thus redirecting flow to other areas where groundwater protection standards may be exceeded. Would not be effective in the PMP, but could be used to address impacts in UA.	Reliable for groundwater directional control in UA if properly designed and constructed.	Widely used, established technology. May require specialized contractors depending upon the construction/implementation method.	Alters groundwater flow system but does not provide any treatment. Can result in unintended consequences resulting from redirecting contaminants to areas where they are not currently present. May cause structural impacts to existing embankments, depending on the location of the cutoff wall.	Design, permitting and construction would take 4 to 5 years after closure. Implementation could be accelerated by combining with closure construction activities.	Provides groundwater directional control only. Combination with other groundwater corrective measure(s), such as groundwater extraction, has the potential to reduce the time required to achieve and attain groundwater protection standards. Time required to achieve groundwater protection standards may be similar to groundwater polishing due to the low permeability Upper Confining Unit.	Illinois Environmental Protection Agency approval of the closure and Corrective Action Plan permits is required. May also require an evaluation and/or permitting of wetlands and/or Waters of the United States impacts, if determined to be necessary.
Source Control with In-Situ Treatment	In-situ treatment using ion exchange (IX) not well established for sulfate or boron, therefore performance is unknown.	Unknown reliability for sulfate or boron.	Design challenges related to reactive material delivery due to heterogeneous, discontinuous nature of Uppermost Aquifer. Could require periodic change-outs of IX resin media.	May cause structural impacts to existing embankments, depending on the location of the permeable reactive barrier.	May require bench scale and/or pilot scale testing as part of design. Design, permitting and construction would take 4 to 6 years after Corrective Action Plan approval.	There is uncertainty regarding whether a in-situ treatment would reduce sulfate or boron concentrations to achieve the groundwater protection standards. Dependent on conditions specific to the reactive media used and the site. Treatment technology is not well understood.	Illinois Environmental Protection Agency approval of the Corrective Action Plan permit is required. Illinois Environmental Protection Agency approval of this innovative and relatively unproved solution may be challenging. May also require an evaluation and/or permitting of wetlands and/or Waters of the United States impacts, if determined to be necessary.
Source Control with Phytoremediation	Accepted and proven remedial strategy. Accumulation through phytoextraction may be viable for boron impacts in the northern portion of the Site and may be equally viable for the Potential Migration Pathway or the Uppermost Aquifer.	Reliable for boron if tree variety is properly selected for site conditions. Unknown reliability for sulfate.	Less complicated engineering design but may require specialized contractors depending upon the construction/implementation method.	Potential need for future management/disposal of trees following accumulation of contaminant mass.	Permitting and construction would take 4 to 5 years after closure. Could be combined with closure.	Phytoremediation has the potential to reduce the time required to achieve and attain groundwater protection standards. Time required is dependent on ability of root structure to access low permeability unit.	Illinois Environmental Protection Agency approval of the Corrective Action Plan permit is required. Illinois Environmental Protection Agency approval of this innovative and relatively unproved solution for CCR impacts may be challenging. May also require an evaluation and/or permitting of wetlands and/or Waters of the United States impacts, if determined to be necessary.

Notes:
[1] Time required to begin and implement remedy includes design, permitting, and construction.

FIGURES



REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY
PROTECTED AREA

SITE LOCATION MAP

35 I.A.C. § 845 CORRECTIVE MEASURES ASSESSMENT
ASH POND

EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

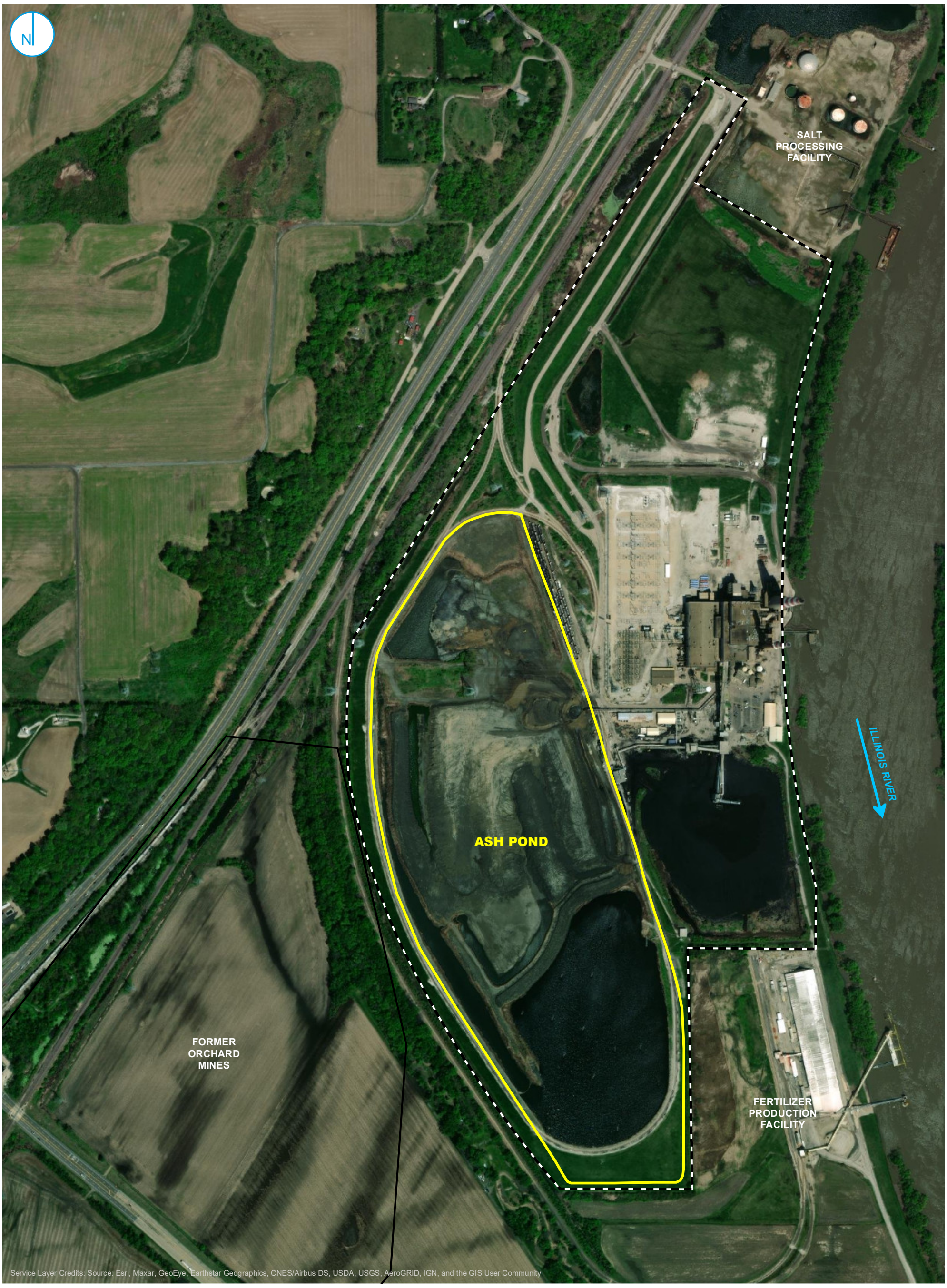
FIGURE 2-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 8/12/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Edwards\GMP\Figure 1-2_Site Map.mxd



REGULATED UNIT (SUBJECT UNIT)

FORMER ORCHARD MINES AREA

PROPERTY BOUNDARY

0 250 500 Feet

SITE MAP

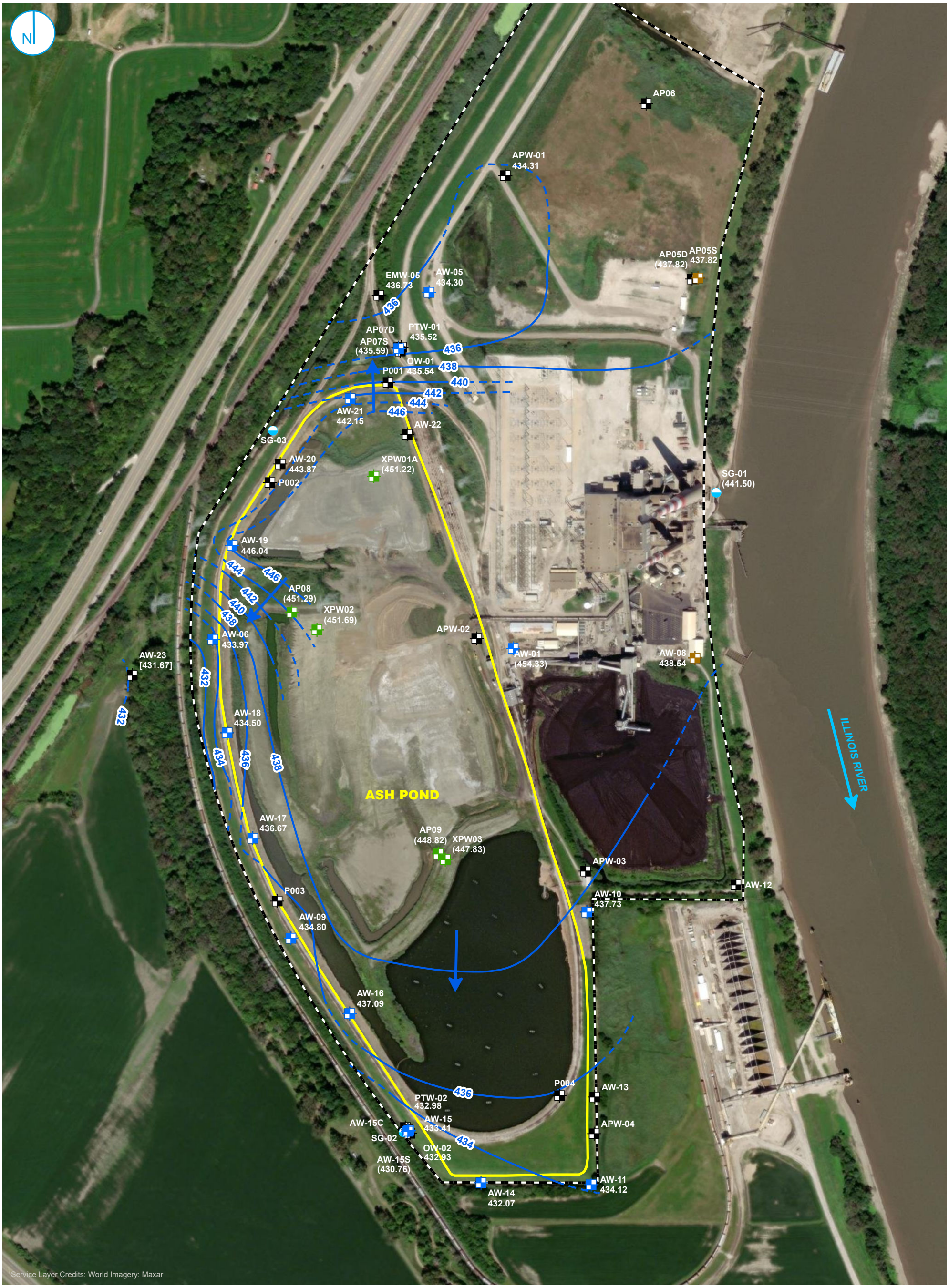
35 I.A.C. § 845 CORRECTIVE MEASURES ASSESSMENT ASH POND

EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 2-2

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL



- COMPLIANCE MONITORING WELL
- BACKGROUND MONITORING WELL
- MONITORING WELL
- PORE WATER WELL
- STAFF GAGE, RIVER
- GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- REGULATED UNIT (SUBJECT UNIT)
- PROPERTY BOUNDARY

0 212.5 425 Feet

NOTES
1. ELEVATIONS IN PARENTHESES WERE NOT USED FOR CONTOURING.
2. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)
3. ELEVATIONS IN BRACKETS WERE OBTAINED OUTSIDE OF THE 24-HOUR PERIOD FROM INITIATION OF DEPTH TO GROUNDWATER MEASUREMENTS BUT WITHIN THE SAME SAMPLING EVENT.

UPPERMOST AQUIFER POTENTIOMETRIC SURFACE MAP JUNE 12, 2023

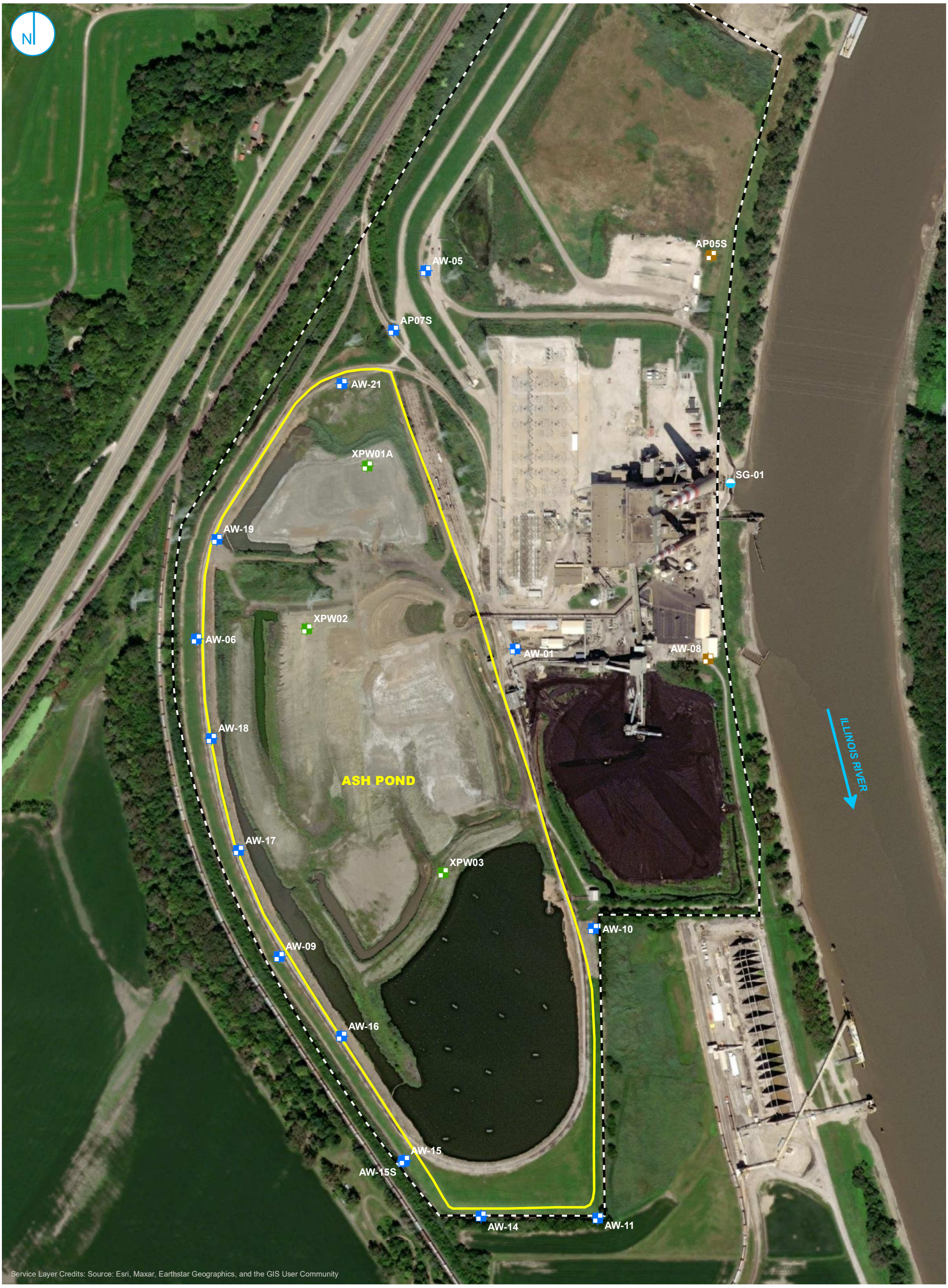
2023 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT ASH POND

EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 2-3

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL



COMPLIANCE MONITORING WELL
BACKGROUND MONITORING WELL
PORE WATER WELL
STAFF GAGE, RIVER
REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 200 400 Feet

35 I.A.C. § 845 MONITORING WELL LOCATION MAP

35 I.A.C. § 845 CORRECTIVE MEASURES ASSESSMENT ASH POND

EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 2-4

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

ATTACHMENT A
Selected Construction Permit Application Plans

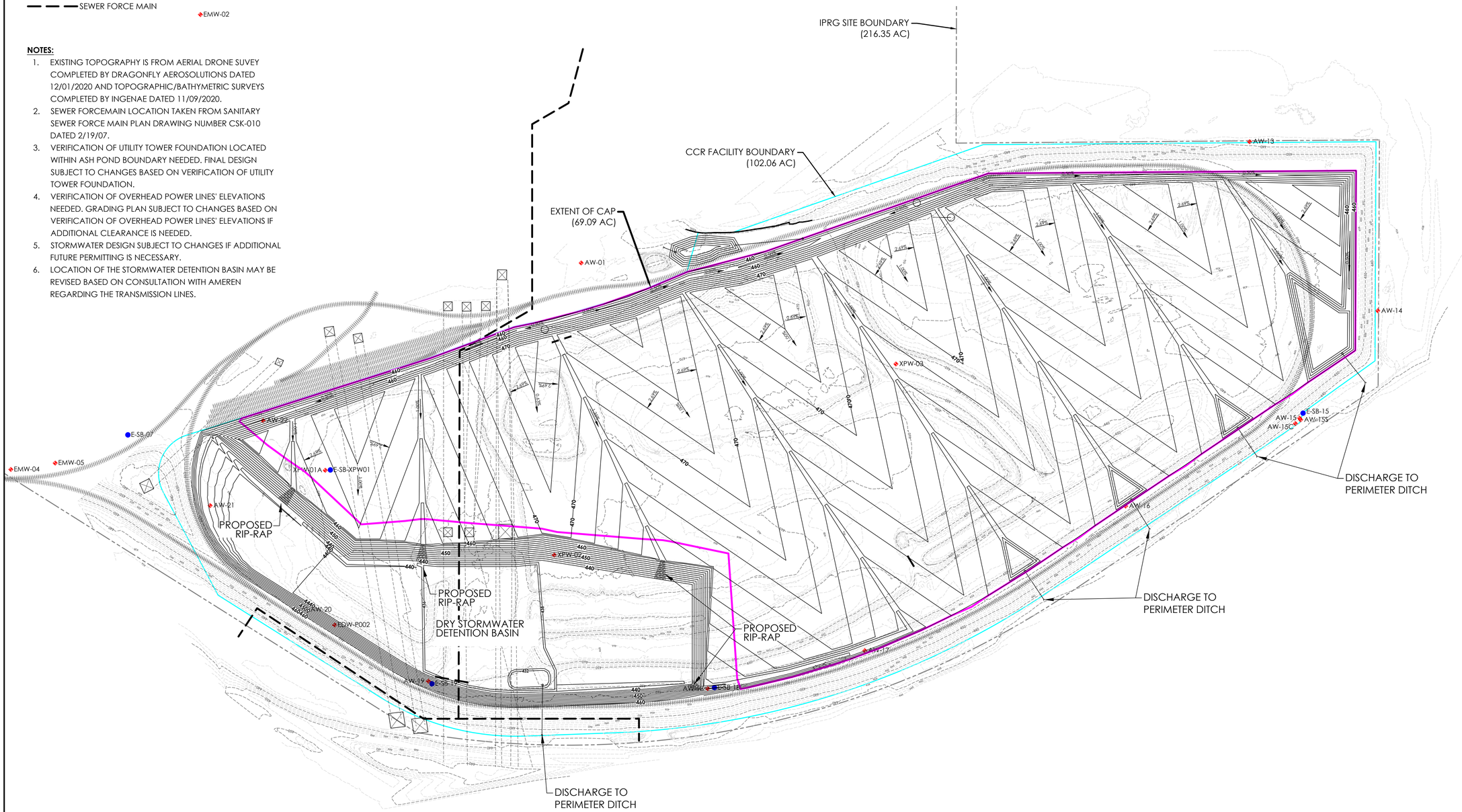
LEGEND

- EXISTING CONTOUR (2' INTERVAL)
- EXISTING CONTOUR (10' INTERVAL)
- IPRG SITE BOUNDARY
- ASH POND BOUNDARY
- PROPOSED FINAL COVER CONTOUR (2' INTERVAL)
- PROPOSED FINAL COVER CONTOUR (10' INTERVAL)
- WELL
- BORING
- EXTENT OF CAP (69.00 AC)
- SEWER FORCE MAIN

EMW-02

NOTES:

1. EXISTING TOPOGRAPHY IS FROM AERIAL DRONE SUVEY COMPLETED BY DRAGONFLY AEROSOLUTIONS DATED 12/01/2020 AND TOPOGRAPHIC/BATHYMETRIC SURVEYS COMPLETED BY INGENAE DATED 11/09/2020.
2. SEWER FORCEMAIN LOCATION TAKEN FROM SANITARY SEWER FORCE MAIN PLAN DRAWING NUMBER CSK-010 DATED 2/19/07.
3. VERIFICATION OF UTILITY TOWER FOUNDATION LOCATED WITHIN ASH POND BOUNDARY NEEDED. FINAL DESIGN SUBJECT TO CHANGES BASED ON VERIFICATION OF UTILITY TOWER FOUNDATION.
4. VERIFICATION OF OVERHEAD POWER LINES' ELEVATIONS NEEDED. GRADING PLAN SUBJECT TO CHANGES BASED ON VERIFICATION OF OVERHEAD POWER LINES' ELEVATIONS IF ADDITIONAL CLEARANCE IS NEEDED.
5. STORMWATER DESIGN SUBJECT TO CHANGES IF ADDITIONAL FUTURE PERMITTING IS NECESSARY.
6. LOCATION OF THE STORMWATER DETENTION BASIN MAY BE REVISED BASED ON CONSULTATION WITH AMEREN REGARDING THE TRANSMISSION LINES.



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FINAL COVER & STORMWATER PLAN

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Drawn By: CB	
Approved By: BH	
Scale: AS NOTED	

LEGEND

- EXISTING CONTOUR (2' INTERVAL)
- EXISTING CONTOUR (10' INTERVAL)
- IPRG SITE BOUNDARY
- ASH POND BOUNDARY
- BATHYMETRIC BOUNDARY
- PROPOSED TOP OF ASH CONTOUR (2' INTERVAL)
- PROPOSED TOP OF ASH CONTOUR (10' INTERVAL)
- WELL
- BORING
- EXTENT OF CAP (69.00 AC)
- SEWER FORCE MAIN

EMW-02

Elevations Table			
Number	Minimum Elevation	Maximum Elevation	Color
1	-60.00	-50.00	
2	-50.00	-40.00	
3	-40.00	-30.00	
4	-30.00	-20.00	
5	-20.00	-10.00	
6	-10.00	0.00	
7	0.00	10.00	
8	10.00	20.00	
9	20.00	30.00	
10	30.00	40.00	

Volume
Base Surface EXIST TOPO
Comparison Surface PRO GRADING 03-01
Cut volume 734,593.53 Cu. Yd.
Fill volume 1,191,865.38 Cu. Yd.
Net volume 457,271.85 Cu. Yd.<Fill>

NOTES:

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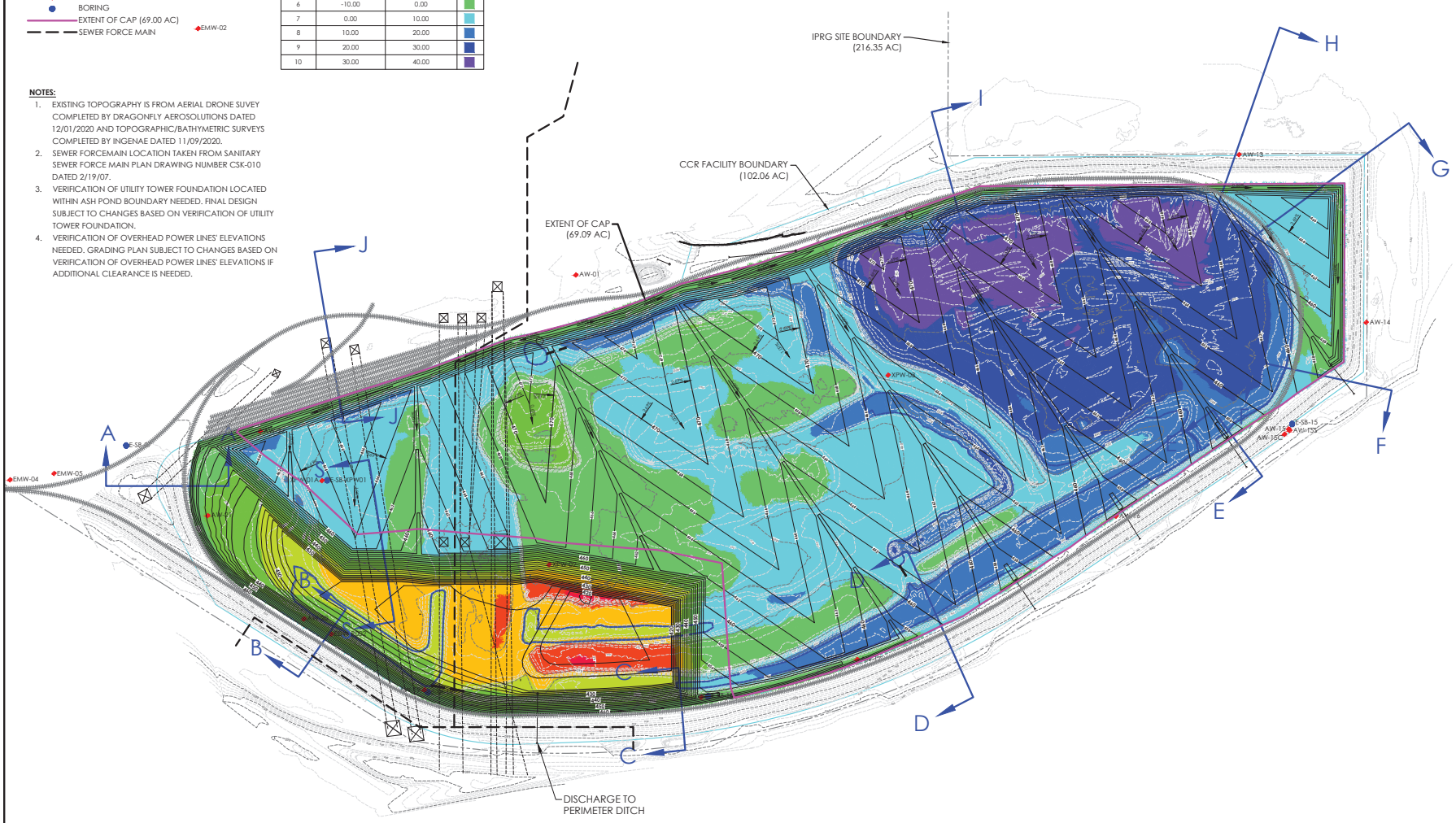

0' 150' 300'

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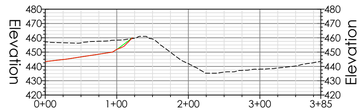

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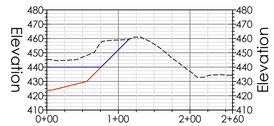

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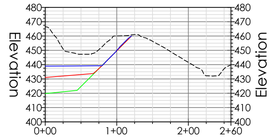

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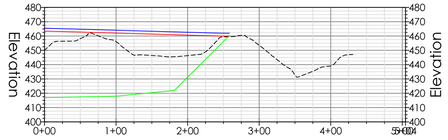

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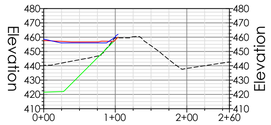

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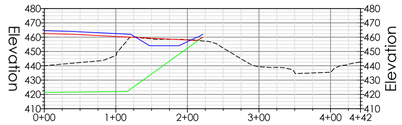

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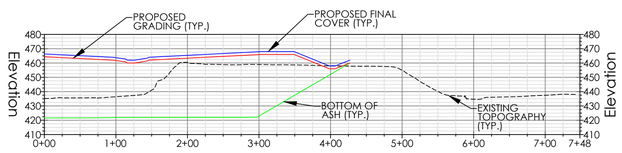

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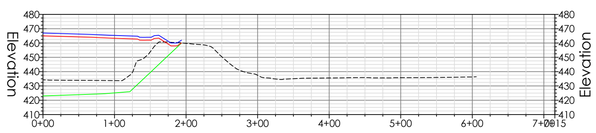

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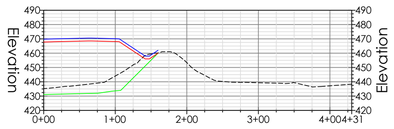

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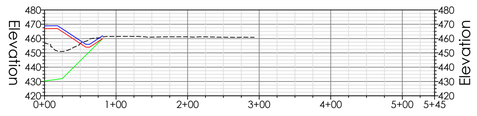

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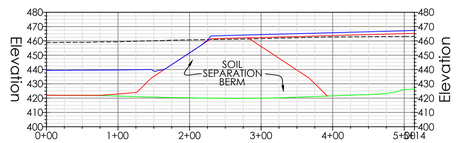

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Appendix D

Nature and Extent Report

NATURE & EXTENT REPORT

Intended for

Illinois Power Resources Generating, LLC
7800 Cilco Lane
Bartonville, Illinois 61607

Date

June 4, 2024

Project No.

1940103584-004

NATURE AND EXTENT REPORT

EDWARDS POWER PLANT, ASH POND, IEPA ID NO. W1438050005-01

RAMBOLL Bright ideas. Sustainable change.

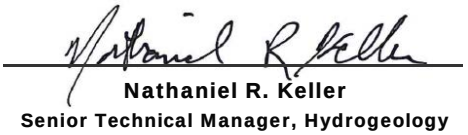
NATURE AND EXTENT REPORT
EDWARDS POWER PLANT, ASH POND, IEPA ID NO. W1438050005-01

Project name	**Edwards Power Plant Ash Pond**
Project no.	**1940103584-004**
Recipient	**Illinois Power Resources Generating, LLC**
Document type	**Nature and Extent Report**
Revision	**Final**
Date	**June 4, 2024**
Prepared by	**Alison O'Connor and Nathaniel Keller**
Checked by	**Melanie Conklin**
Approved by	**Brian G. Hennings, PG**

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

T 414-837-3607
F 414-837-3608
https://ramboll.com

Alison O'Connor, PhD
Geochemist



Nathaniel R. Keller
Senior Technical Manager, Hydrogeology



Brian G. Hennings, PG
Project Officer, Hydrogeology

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CONTENTS

EXECUTIVE SUMMARY		**4**
1.	**Introduction**	**5**
2.	**Unit Background**	**6**
2.1	Site Location and Description	6
2.2	Description of CCR SI	6
2.3	Geology and Hydrogeology	7
2.3.1	Hydrostratigraphic Units	7
2.3.2	Uppermost Aquifer	7
2.3.3	Potential Migration Pathways	8
2.3.4	Regional Bedrock Geology	8
2.3.5	Water Table Elevation and Groundwater Flow Direction	8
2.3.5.1	Vertical Hydraulic Gradients	9
2.3.5.2	Impact of Surface Water Bodies on Groundwater Flow	10
2.3.6	Hydraulic Conductivities	10
2.3.6.1	Field Hydraulic Conductivities	10
2.3.6.2	Laboratory Hydraulic Conductivities	10
2.3.6.3	Pump Test Evaluation	11
2.4	Groundwater Monitoring	11
2.5	Hydrogeologic Conceptual Site Model	12
3.	**Occurrence and Distribution of Groundwater Exceedances (Extent)**	**14**
3.1	Additional Investigations to Define Nature and Extent	14
3.1.1	Geochemical Investigation	14
3.1.2	Hydrogeologic Supplemental Site Investigation	15
3.2	Extent in the Uppermost Aquifer	15
3.2.1	Boron	15
3.3	Extents in Upper Cahokia Formation/Potential Migration Pathways	16
3.3.1	Boron	16
3.3.2	Sulfate	17
4.	**Geochemical Conceptual Site Model (Nature)**	**18**
5.	**Combined Geochemical and Hydrogeologic Conceptual Site Models**	**20**
5.1	Boron and Sulfate Conceptual Site Model	20
6.	**Conclusions and Future Activities**	**21**
7.	**References**	**22**

TABLES (ATTACHED)

Table 2-1 Summary of Groundwater Elevation Data
Table 2-2 Field Horizontal Hydraulic Conductivities
Table 3-1 Monitoring Well Construction Details
Table 3-2 Exceedance Parameter Statistical Results
Table 3-3 Summary of Groundwater Data

FIGURES (ATTACHED)

Figure 2-1 Site Location Map
Figure 2-2 Site Map
Figure 2-3 Base of CCR
Figure 2-4 Monitoring Well Location Map
Figure 2-5 Geologic Cross Section A-A'
Figure 2-6 Geologic Cross Section B-B'
Figure 2-7 Geologic Cross Section C-C'
Figure 2-8 Top of Bedrock
Figure 2-9 Top of Uppermost Aquifer
Figure 2-10 Uppermost Aquifer Potentiometric Surface Map, June 12, 2023 (E001)
Figure 3-1 GWPS Exceedance Map Uppermost Aquifer
Figure 3-2 GWPS Exceedance Map Potential Migration Pathway

APPENDICES

Appendix A CCR Geotechnical and Analytical Results
Appendix B 2023 Supplemental Site Investigation Report
Appendix C Vertical Hydraulic Gradients
Appendix D Hydrographs Supporting Vertical Hydraulic Gradients
Appendix E Geochemical Conceptual Site Model

ACRONYMS AND ABBREVIATIONS

35 I.A.C.	Title 35 of the Illinois Administrative Code
40 C.F.R.	Title 40 of the Code of Federal Regulations
AP	Ash Pond
BCU	bedrock confining unit
CCR	coal combustion residuals
CMA	Corrective Measures Assessment
cm/s	centimeters per second
CSM	conceptual site model
E001	Event 1
E002	Event 2
E003	Event 3
EPP	Edwards Power Plant
GCSM	geochemical conceptual site model
GMR	Groundwater Modeling Report
GPM	gallons per minute
GWPS	groundwater protection standard
HCR	Hydrogeologic Site Characterization Report
HSU	hydrostratigraphic unit
IEPA	Illinois Environmental Protection Agency
LCL	lower confidence limit
mg/L	milligrams per liter
NAVD88	North American Vertical Datum 1988
redox	reduction and oxidation
PMP	potential migration pathway
SI	surface impoundment
SSI	supplemental site investigation
UA	uppermost aquifer
UCF	Upper Cahokia Formation
US	United States
USEPA	United States Environmental Protection Agency

EXECUTIVE SUMMARY

Groundwater samples collected at the Edwards Power Plant (EPP) Ash Pond (AP) during June 2023 for the Quarter 2, 2023 compliance sampling event (Event 1 [E001]) were evaluated for exceedances of the groundwater protection standards (GWPS) described in Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845.600. Exceedances were identified in the following hydrostratigraphic units (HSUs) and wells:

- Detected uppermost aquifer (UA) Exceedances:
  - Boron at AW-05, AW-19 and AW-21
- Detected Upper Cahokia Formation (UCF) (potential migration pathway [PMP]) Exceedances:
  - Boron at AP07S and AW-15S
  - Sulfate at AW-15S

Supplemental data for monitoring wells APW-01, AW-20, AW-23, and EMW-05 was provided for events E001, E002, and E003 as part of on-going nature and extent characterization activities consistent with 35 I.A.C. § 845.650(d)(1) at the EPP AP. In accordance with 35 I.A.C. § 845.610(b)(3)(C) statistically derived values for constituent concentrations observed at supplemental monitoring wells were also evaluated quarterly for exceedances of the GWPS [1].

The following supplemental GWPS exceedance was also determined during E001:

- Detected UA Exceedance:
  - Boron at AW-20

As a result of the identified E001 exceedances, a Corrective Measures Assessment (CMA) was initiated on December 7, 2023 and submitted June 4, 2024 [2] in accordance with 35 I.A.C. § 845.660. The subsequent compliance sampling events for the Quarter 3 and Quarter 4, 2023 sampling events (Event 2 [E002] and Event 3 [E003]) were completed in August and November 2023 and groundwater samples were evaluated for exceedances of the GWPS as described in 35 I.A.C. § 845.600. In addition to the exceedances listed above, the following exceedance was identified in the UA during the E002 event:

- Boron at AW-05

Exceedances identified during the E003 event were consistent with those listed above.

The additional boron exceedance at AW-05 was evaluated with respect to the groundwater model, feasible alternatives, and remedy extents and was determined to not substantially affect the findings and conclusions of the previously initiated CMA evaluations and has been incorporated into the CMA and this report.

As required by 35 I.A.C. § 845.650(d)(1) this report characterizes the nature and extent of boron and sulfate and relevant site conditions to determine how they may affect the corrective measures ultimately selected for the AP and documents the additional measures taken in accordance with 35 I.A.C. § 845.650(d).

Boron and sulfate above the GWPS were encountered within the two HSUs: the UCF and associated PMP, and in the UA where it occurs at its highest elevation.

1. INTRODUCTION

35 I.A.C. § 845.650(d)(1) requires the owner or operator of a coal combustion residuals (CCR) surface impoundment (SI) to characterize the nature and extent of a release and relevant site conditions that may affect the remedy ultimately selected for a CCR SI if any constituent regulated under 35 I.A.C. § 845 is found to exceed the GWPS. This report documents the nature and extent of constituents detected above the GWPS that are attributable to the EPP AP.

The groundwater data and analysis in this report includes results from historical sampling (initiated in 2015) through E001, which was completed on June 15, 2023. Results of events E001, E002, and E003 were submitted and placed in the facility's operating record within 60 days of receiving final laboratory analytical data [3, 4, 5] as required by 35 I.A.C. § 845.800(d)(15). The statistical determination presented in the reports identified the following exceedances of the GWPS at compliance groundwater wells in the following HSUs:

- Detected UA Exceedances:
  - Boron at AW-05, AW-19, and AW-21
- Detected UCF/PMP Exceedances:
  - Boron at AP07S and AW-15S
  - Sulfate at AW-15S

Supplemental data for monitoring wells APW-01, AW-20, AW-23, and EMW-05 was provided for events E001, E002, and E003 as part of on-going nature and extent characterization activities consistent with 35 I.A.C. § 845.650(d)(1) at the EPP AP. In accordance with 35 I.A.C. § 845.610(b)(3)(C) statistically derived values for constituent concentrations observed at supplemental monitoring wells were also evaluated quarterly for exceedances of the GWPS [1].The following supplemental GWPS exceedance was also determined in E001:

- Detected UA Exceedance:
  - Boron at AW-20

This report discusses in detail the extent of the boron and sulfate exceedances as well as a geochemical conceptual site model (GCSM) describing the nature of these exceedances.

2. UNIT BACKGROUND

2.1 Site Location and Description

The EPP is located in Peoria County, Illinois between Mapleton and Bartonville in Section 11, Township 7 North, Range 7 East (**Figure 2-1**). The EPP is located on the floodplain of the Illinois River adjacent to a levee and has one CCR SI, the AP. The AP is located west of the EPP and the EPP property is bordered by a salt processing facility to the north, railroad right-of-way and former Orchard Mines to the west, the Illinois River and a fertilizer production facility to the east, and agricultural land to the south (**Figure 2-2**).

2.2 Description of CCR SI

The AP (Illinois Environmental Protection Agency [IEPA] Unit Identification W1438050005-01) is an unlined CCR SI used to manage CCR and non-CCR waste streams at the EPP. The AP has a surface area of approximately 91 acres with berms up to 27 feet higher than the surrounding land surface. This pond currently discharges to the Illinois River through Outfall 001 included in the facility National Pollutant Discharge Elimination System permit IL0001970. The primary treatment method for the pond water is settlement via reduced velocity whereby solids settle out in various flow channels and in the main South Pond. The permitted total average daily flow is 5.24 million gallons per day [6].

The EPP began power generation in 1960 and the original AP embankments were placed into service at that time. In 2004, modifications to the rail loop surrounding the AP increased the elevations of the embankments and reduced the footprint of the active impoundment [7]. CCR material remains between the rail loop and the berm at the south end of the AP. High power transmission lines bisect the AP and two sub-basins, referred to as the North and South Ponds. The sub-basins are hydraulically connected and CCR placement is continuous throughout the AP.

Characterization of the CCR material was completed in 2021 and included in the Hydrogeologic Site Characterization Report (HCR) [8]. Summary geotechnical and solid analytical data tables from CCR samples are included in **Appendix A**. CCR consisting primarily of fly ash is present within the AP at thicknesses up to 46.5 feet as measured in XPW02 and ash is generally between 30.5 and 43 feet thick as observed in XPW01, XPW01A, XPW03, EDW-B002, EDW-B003, and EDW-B014 (**Figure 2-3**). The AP overlies the UCF, and the lowest base of ash elevation at 413.9 feet[1] was observed in the central and northern portion (HAB-03) of the AP while the highest base of CCR elevation was observed along the berms around 450 feet (**Figure 2-3**). Water that may come into contact with CCR within the footprint of the AP becomes CCR source water. CCR source water samples collected from porewater monitoring wells (**Figure 2-4**) screened within the CCR materials at the AP are used to provide information for Alternative Source Demonstrations and groundwater transport modeling[2].

[1] All elevations in this report are referenced to North American Vertical Datum of 1988 (NAVD88) unless otherwise noted.

[2] Per Federal Register 80 (21302), which promulgated the final Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257 rule, porewater concentrations should be used to characterize potential leaching from impoundments. As discussed further in the United States Environmental Protection Agency's (USEPA) risk assessment of CCR surface impoundments [24], porewater is "collected from the interstitial water between waste particles in surface impoundments as it occurs in the field," and concentrations within the porewater are "the most representative data available for impoundments because these data are field-measured concentrations of leachate." Therefore, CCR source water collected from porewater wells screened near the base of ash within the unit represents the CCR source term.

2.3 Geology and Hydrogeology

Significant site investigation has been completed at the EPP to characterize the geology, hydrogeology, and groundwater quality. Based on extensive investigation and monitoring, the AP has been well characterized and detailed in the HCR [8].

2.3.1 Hydrostratigraphic Units

In addition to the CCR present at the AP, there are two principal layers of unlithified material present above the bedrock, which are categorized into the HSUs described below (from surface downward) based on stratigraphic relationships, geologic composition, and common hydrogeologic properties.

- **Upper Cahokia Formation (UCF) / Potential Migration Pathway (PMP):** Low permeability clays and silts of the UCF present from the ground surface to the top of bedrock. The formation is generally characterized by lean and fat clays with siltier composition along the southern portion of the site. Within the low permeability materials thin discontinuous sand lenses (less than five feet in thickness) were encountered at 436.8 feet at EMW-05 and 429.4 feet at PTW-01 (**Appendix B, Figures 1-4** and **4-1**). These unconfined sandy lenses, where present, and silt and clay material near the former land surface (approximately 425 to 430 feet) adjacent to the base of ash in the southern portion of the property have been identified as PMPs.
- **Uppermost Aquifer (UA):** Thin (generally less than four feet in thickness), moderate permeability sand, silty sand, and clayey gravel material within the Lower Cahokia Formation, and bedrock interface, including weathered shale bedrock where present. In locations where higher permeability materials and coarser grained materials are absent, the UA is interpreted as the interface between the Lower Cahokia Formation and weathered bedrock of the Carbondale and Modesto Formations, with an interpreted thickness of 1.5 feet in PTW-01 to 2.5 feet in PTW-02 (**Appendix B, Figures 1-4** and **4-1**).
- **Bedrock Confining Unit (BCU):** Thick, very low permeability shales and siltstones of the Carbondale and Modesto Formations. The elevation of the top of bedrock (**Figure 2-8**) is highest north of the AP at AW-21 (422.88 feet) and declines in elevation to the east towards AW-08 (404.5 feet) and south toward AW-16 (400.92 feet). The geologic cross sections (**Figures 2-5** through **2-7**) and top of bedrock interpretation (**Figure 2-8**) indicate the presence of a bedrock valley/depression in the west and southwest portion of the AP. Based on the distribution of coarser grained materials of the Lower Cahokia Formation, it appears that the materials are likely present in limited areas on the southern side of this bedrock valley.

2.3.2 Uppermost Aquifer

The UA includes the lower portions of the Cahokia Formation in the vicinity of the site. Higher permeability materials are generally present at the interface between the unlithified materials and the underlying bedrock. Groundwater monitoring for the UA is focused on this zone because it is continuous, moderate permeability, and likely to indicate potential impacts from the AP. The top of UA was evaluated with respect to the location restrictions in 2018 [9] and is presented in **Figure 2-9**. The UA immediately overlies the BCU, except where comprised of weathered bedrock, and as described above occurs at a higher elevation north of the AP (422.88 feet at AW-21; **Figure 2-8**) and generally slopes downward to the south along the bedrock surface.

2.3.3 Potential Migration Pathways

The UCF consists of low permeability clays and silts, with limited occurrences of thin discontinuous sand lenses. Isolated sand lenses of limited extent within the UCF, and clay intervals downgradient of the AP at elevations similar to the base of ash and above the unlithified/lithified interface, were identified as PMPs. Monitoring wells AP06, APW-02 through APW-04, P002, AW-15S (clay and silts of the UCF) and AP07S (discontinuous sand lens) are considered to be screened within PMPs.

2.3.4 Regional Bedrock Geology

The unlithified deposits are underlain by Pennsylvanian age bedrock, much of which is shale, of the Carbondale and Modesto Formations [10, 11]. The Carbondale Formation varies in thickness from less than 150 feet in western and northeastern Illinois to more than 400 feet in southern Illinois. The Carbondale Formation consists of sandstones, shales, limestones, and coals. Gray shales make up the greatest part of the formation, with the thicker gray shales representing delta front or prodelta deposits.

The Modesto Formation overlies the Carbondale Formation and varies in thickness from less than 125 feet along the LaSalle Anticlinal Belt in east-central Illinois to over 450 feet in southern Illinois, averaging approximately 350 feet. The Modesto Formation consists of sediments similar to those found in the underlying Carbondale Formation, but the coals are thinner and less extensive, the limestones tend to be thicker and less argillaceous, and several red claystones and shales are associated with the open-marine limestones. Gray shales constitute a major part of the Modesto Formation and individual beds tend to be extremely thick.

The elevation of the bedrock surface in the study area ranges from approximately 400 to 450 feet above mean sea level [12]. Well logs indicate that the depth to bedrock ranges from more than 50 feet in the Illinois Valley to less than 20 feet in the adjacent uplands, and the lithology of the uppermost bedrock is mainly shale.

2.3.5 Water Table Elevation and Groundwater Flow Direction

The elevations of water within the AP, as observed in XPW01A, XPW02, XPW03, AP08, and AP09 between 2021 and 2023, averaged 451.71 feet with a range from 447.68 feet at XPW03 (central southern third of the AP) to 454.08 feet at XPW02 (central northern third of the AP). Groundwater elevations supporting the discussion presented in this section are provided in **Table 2-1**.

The groundwater elevation in monitoring wells screened in the UA averaged 437.47 feet between 2021 and 2023, with a range from 430.48 feet at AW-14 (south of the AP) to 452.04 feet in AW-22 (north of the AP). Groundwater in the UA generally flows from east to west in the central portion of the AP towards what is interpreted as a former channel of the Illinois River, and south/southeast at the south end of the AP (**Figure 2-10**). In the northernmost portion of the AP there is a minor northwest and northern component of flow in both the UA and PMP that may be attributed to a surface water drainage ditch constructed at an elevation below surrounding groundwater elevations with the stage ranging from 430.07 to 432 feet [13] along the northern and western side of the AP. Groundwater elevations vary seasonally in both the UA and PMP, generally less than 5 feet, although flow directions are consistent.

Groundwater elevations in UCF/PMP wells range from approximately 429.63 feet at AW-15S (southwest of the AP) to 460.23 feet at AW-01 (east of the AP), with flow generally from the east to the south and northwest similar to that observed in the UA (**Figure 2-10**). Groundwater elevations measured at APW-02 are similar to CCR piezometers and the location of the well (within the berm of the unit) may be affected by water elevations in the AP. Elevations of groundwater detected in these unconfined wells are higher than the lowest elevation of ash (413.9 feet) measured in borings.

Groundwater elevations within the BCU at wells AP05D and AW-15C averaged 434.79 feet between 2021 and 2023 and ranged from 430.80 feet to 439.14 feet in AP05D (northeast of the AP). Well AP07D was not included in this analysis because the elevations did not equilibrate between sampling events in 2021. BCU groundwater elevations are not contoured because the wells are screened at different elevations and within different lithologic materials in this confining unit. However, comparison of elevations in bedrock wells shows flow directions may be consistent with shallower flow systems.

2.3.5.1 Vertical Hydraulic Gradients

Vertical hydraulic gradients calculated using available groundwater elevation data from February to August 2021 at nested well locations within the UCF (*i.e.,* PMP) and UA wells indicated downward gradients [8] which were consistent with historical results [14]. Recent data collected through December 2023 is also consistent with these results (**Appendices C** and **D**). The results of the vertical hydraulic gradient calculations for these HSUs are summarized below:

- CCR (shallow to deep):
  - Gradients calculated between AP08 (shallow) and XPW02 (deep) were upward for all events.
  - Gradients calculated between AP09 (shallow) and XPW03 (deep) were downward for all events.
- UCF (*i.e.,* PMP) to UA:
  - Gradients calculated between AW-15S (PMP) and AW-15 (UA) were upward for all events.
  - Gradients calculated between AP07S (PMP) and OW-01 (UA) were consistently upward, with the exception of one event in October 2023.
  - Gradients calculated between APW-03 (PMP) and AW-10 (UA) were upward for all events.
  - Gradients calculated between P002 (PMP) and AW-20 (UA) were downward for all events.
  - Gradients calculated between APW-04 (PMP) and AW-13 (UA) were upward for all events.
- UA to BCU:
  - Gradients calculated between AW-15 (UA) and AW-15C (BCU) alternated between upward, flat, and downward during various events.
  - Gradients calculated between AP05S (UA) and AP05D (BCU) are typically upward, with downward gradients coinciding with elevated Illinois River elevations.

2.3.5.2 Impact of Surface Water Bodies on Groundwater Flow

Based on groundwater elevations and flow maps, groundwater from the UA adjacent to the AP does not typically flow eastward towards the Illinois River adjacent to the EPP property (**Figure 2-10**). However, the river is likely a regional receiving body for groundwater from the unlithified materials and bedrock, although not along this section of the EPP property. Vertical gradients observed in 2021, as discussed in the previous section, indicate that water within the bedrock periodically migrates vertically upward into the Illinois River.

2.3.6 Hydraulic Conductivities

2.3.6.1 Field Hydraulic Conductivities

Field hydraulic conductivity tests were performed within the HSUs at the AP as part of the 2017 field investigation [14] and were supplemented with additional data collected from field investigations in 2021 [8]. The results of the 2021 field investigations are summarized in **Table 2-2**, and discussed below:

- **CCR**: Field hydraulic conductivity tests from wells screened within the ash (XPW01A, XPW02, and XPW03) resulted in a geometric mean horizontal hydraulic conductivity of 6.8 x 10^{-4} centimeters per second (cm/s) (**Table 2-2**). This is an order of magnitude lower than previous field hydraulic conductivity tests performed in 2017, which resulted in a geometric mean of 2.7 x 10^{-3} cm/s at AP08 and 1.44 x 10^{-3} cm/s at AP09 [14].
- **UCF/PMP**: Field hydraulic conductivity tests performed in UCF monitoring well AW-15S in 2021 resulted in a horizontal hydraulic conductivity of 3.2 x 10^{-3} cm/s (**Table 2-2**), which is an order of magnitude higher than previous results of approximately 5 x 10^{-4} cm/s from tests conducted in AP06 and AP07S [14].
- **UA**: In the UA wells (AW-12, AW-15, AW-16, AW-17, AW-18, AW-19, AW-20, AW-21, and AW-22) analysis of hydraulic conductivity tests resulted in a geometric mean horizontal conductivity of 1.6 x 10^{-4} cm/s (**Table 2-2**). These results are consistent with previous field hydraulic conductivity tests in wells screened within the UA, which indicated a geometric mean horizontal hydraulic conductivity of 2.1 x 10^{-4} cm/s [14].
- **BCU**: Previous field hydraulic conductivity tests [14] performed in bedrock wells AP07D and AP05D resulted in horizontal hydraulic conductivities that ranged 1.1 x 10^{-7} to 3.49 x 10^{-7} cm/s. A field hydraulic conductivity test from bedrock well AW-15C resulted in a horizontal hydraulic conductivity of 8.2 x 10^{-4} cm/s. AW-15C is located in the southern portion of the site within the top 15 feet of shale bedrock. The hydraulic conductivity measured at this location indicates that the surficial bedrock is likely weathered, while it is more competent in the northern portions of the site and at greater depths. The overall geometric mean hydraulic conductivity calculated from AP05D, AP07D, and AW-15C results in a horizontal hydraulic conductivity of 3.2 x 10^{-6} cm/s which is likely more representative of the bedrock underlying the site.

2.3.6.2 Laboratory Hydraulic Conductivities

Falling head permeability tests (ASTM D5084 Method F) were performed in the laboratory on samples collected during the 2021 investigations [8]. The results are summarized in **Appendix A** and discussed below.

- **CCR**: Six samples collected in 2021 from ash borings XPW01, XPW01A, XPW02, and XPW03. Vertical permeability test results in the ash indicated a geometric mean vertical hydraulic conductivity of 9.3 x 10^{-6} cm/s. Historical results from two samples collected from ash borings EDW-B002 and EDW-B003 indicated a geometric mean vertical hydraulic conductivity of 7.9 x 10^{-5} cm/s [15].
- **UCF:** Four samples were collected in 2021 from clayey materials within soil borings AW-13A, AW-15, AW-20, and AW-22 for geotechnical testing. Falling head permeability tests results in the UCF from these locations indicated a geometric mean vertical hydraulic conductivity of 6.4 x 10^{-8} cm/s. This result is consistent with results of historical samples collected by Haley & Aldrich, Inc. [16] and AECOM [17] which indicated a geometric mean vertical hydraulic conductivity of 7.3 x 10^{-8} cm/s.
- **Lower Cahokia Formation:** Samples were either unable to be collected or analyzed due to their composition.
- **BCU:** Samples were either unable to be collected or analyzed due to their composition.

2.3.6.3 Pump Test Evaluation

Following installation and development of PTW-01 and PTW-02 (**Figure 2-10**), constant-rate tests for these UA wells were conducted in October 2022. The constant-rate tests performed did not fully identify appropriate well yields due to continued drawdown at pumped rates of 0.25 gallons per minute (gpm) and 1 gpm. Lower pumping rates were not sustainable with the field equipment utilized and the constant rate tests were terminated due to the drawdown and release of methane gas in both of the pumping wells. Sustainable yield at these locations may be much lower than the tested rates. However, measurable drawdown was identified at nearby observation wells screened within the UA and used to develop estimates of transmissivity and storativity for the geologic materials near the tested locations. Transmissivity calculated from the two pump tests ranged from 19 to 52 feet square per day and storativity ranged from 1.1 x 10^{-3} to 5 x 10^{-3} [18], which is consistent with thin aquifers containing fine grained material [19].

2.4 Groundwater Monitoring

The monitoring system for the AP is shown on **Figure 2-4** and consists of two background monitoring wells (AP05S and AW-08), 15 compliance monitoring wells (AP07S, AW-01, AW-05, AW-06, AW-09, AW-10, AW-11, AW-14, AW-15, AW-15S, AW-16, AW-17, AW-18, AW-19, and AW-21), and one temporary water level only surface water staff gage (SG-01) to monitor potential impacts from the AP [20]. These monitoring wells are screened within the UCF/PMP (AP07S, AW-01, and AW-15S) and the UA (AP05S, AW-05, AW-06, AW-08, AW-09, AW-10, AW-11, AW-14, AW-15, AW-16, AW-17, AW-18, AW-19, and AW-21) along the perimeter of the AP. Porewater (*i.e.*, CCR source water) samples are collected from locations XPW01A and XPW02 on the northern side of the AP and XPW03 on the southern side of the AP (**Figure 2-4**).

Supplemental data for monitoring wells APW-01, AW-20, AW-23, and EMW-05 was provided for events E001, E002, and E003 as part of on-going nature and extent characterization activities consistent with 35 I.A.C. § 845.650(d)(1) at the EPP AP. In accordance with 35 I.A.C. § 845.610(b)(3)(C), statistically derived values for constituent concentrations observed at supplemental monitoring wells were also evaluated quarterly for exceedances of the GWPS [1].

2.5 Hydrogeologic Conceptual Site Model

The HCR [8] and information provided above forms the foundation of the AP hydrogeological setting. The AP overlies the recharge area for the underlying geologic media (*i.e.,* low permeability clays and silts of the UCF; and moderate permeability sand, silty sand, and clayey gravel material within the Lower Cahokia Formation, bedrock, and/or weathered shale bedrock, where present [UA]). Thin sandy lenses within the UCF have been identified as potential migration pathways within the UCF.

The geologic conceptual model for the site used for groundwater modeling and summarized in the Groundwater Modeling Report (GMR) [13] consists of the following layers:

- Fill, predominantly coal ash (fly ash, bottom ash, and slag) within the AP, and materials within constructed berms and railroad embankments.
- Fine-grained clays and silts of the UCF ranging in thickness from 5 to 40 feet at the AP.
- Coarse-grained sands and gravels of the Lower Cahokia Formation ranging in thickness from 1 to 4 feet at the AP.

Bedrock at the AP consists of thick, very low permeability shales and siltstones of the Carbondale and Modesto Formations and is encountered at elevations ranging from 400 to 422 feet at the AP.

The overall groundwater flow system within the unlithified materials is consistent with previous reports [8]. Additional off-site groundwater level and flow direction data evaluated after 2021 was used to refine the existing conceptual site model (CSM) to incorporate the following interpreted hydrogeologic conditions:

- The unlithified/lithified contact designated as the UA on-site may be hydraulically connected to the sands of the Sankoty Aquifer which are present off-site and used for potable supply in nearby Peoria, East Peoria, and Pekin.
- The thick sand and gravels along the Illinois River from Hennepin to Peoria form the Sankoty Aquifer. The Sankoty sand and gravels are hydrologically connected to the Illinois River and are a productive aquifer in the Middle Illinois water supply planning [21]. At the EPP, the thick sands and gravels of the Sankoty Aquifer are absent. The UA at the EPP represents the most permeable material present above bedrock. Alluvial deposits belonging either to the Cahokia or the Sankoty are present in a north-south orientation along the Illinois River at the EPP and are not expected to occur in areas west of the United States (US) Highway 24, where the bedrock elevation increases above ground surface at the EPP. US Highway 24 runs along the base of the bluff and areas west of US Highway 24 are coincident with areas where the aquifer is not present [22].
- Off-site groundwater in the Sankoty Aquifer flows to the north and south towards identified Peoria and Pekin pumping centers, respectively [22]. As reported by Burch and Kelly [22], "*Smaller flow domains are sometimes formed by pumpage at municipal well fields, which reverse the ground-water flow direction and frequently capture induced recharge from the river and the ground-water ordinarily moving toward it*".

Infiltration of precipitation into the AP or nearby surface water bodies, including the Illinois River and adjacent stormwater drainage ditches and ponds, recharges groundwater and flows to the north and northwest within the northernmost portion of the AP and generally flows south,

towards what is interpreted as a former channel of the Illinois River, within the southern portion of the AP. The northward flow in the northernmost portion of the AP may be a result of the drainage ditch that borders the AP. Additional survey work completed in 2022 [18] (**Appendix B**) and included in the GMR [13], indicates that the surface water drainage ditch along the northern and western side of the AP is at a lower elevation than surrounding groundwater elevations. As a result, the ditch is likely a discharge point for shallow groundwater.

Groundwater occurs within both the unlithified materials and bedrock and consistently flows east to west in the UA. In the southern portion of the AP, groundwater flow has a southerly component of flow towards what is interpreted as a former channel of the Illinois River. Groundwater elevations vary seasonally, generally less than five feet, while across the site they range between approximately 430 and 450 feet, although flow directions are generally consistent. Off-site groundwater in the coarse sand and gravel Sankoty Aquifer is expected to flow to the north and south towards identified Peoria and Pekin pumping centers, respectively. Groundwater in the Sankoty Aquifer may be hydraulically connected to the UA (*i.e.,* unlithified/lithified contact) identified on site.

Vertical gradients are generally upward between the UCF/PMP and UA across the site, with the exception of P002 (PMP) and AW-20 (UA) in the northwest corner of the AP and adjacent to the drainage ditch. Upward gradients are also generally observed between the BCU and UA. The upward gradients are likely a result of the proximity of the site to the Illinois River which is a regional receiving body for groundwater.

3. OCCURRENCE AND DISTRIBUTION OF GROUNDWATER EXCEEDANCES (EXTENT)

In accordance with 35 I.A.C. § 845.610(b)(3)(C), comparison of statistically derived values with the GWPSs described in 35 I.A.C. § 845.600 to determine exceedances of the GWPS was completed for sampling events E001, E002, and E003 [4, 3, 5] as described in **Section 1**. Exceedances include the following parameters and wells by HSU:

- Detected UA Exceedances (**Figure 3-1**):
  - Boron in compliance wells AW-05, AW-19, and AW-21 and supplemental well AW-20[3]
- Detected UCF/PMP Exceedances (**Figure 3-2**):
  - Boron at AP07S and AW-15S
  - Sulfate at AW-15S
  -

The extents of exceedances discussed below were defined using existing monitoring wells, including wells present on-site that may not be included in the 35 I.A.C. § 845 monitoring program for the AP (**Table 3-1**).

3.1 Additional Investigations to Define Nature and Extent

3.1.1 Geochemical Investigation

Following initial sampling in 2021, potential exceedances of the GWPS were identified for the parameters and locations identified above [23]. Additional investigation was completed in 2021 and 2022 to collect soil samples to further evaluate the concentrations and potential attenuation mechanisms near the AP. A total of seven borings were advanced at the AP in 2021 and 2022 and samples were collected from the following: the UA adjacent to compliance monitoring wells AP05S, AP07S and AP07D, AW-15, AW-18, AW-19, and AW-23; the UCF/PMP adjacent to compliance monitoring well AW-15S, the BCU adjacent to compliance monitoring wells AP05S, AP07S, and AW-19; and the CCR material adjacent to porewater well XPW01 (**Appendix E**).

Solids samples were collected and analyzed for the following:

- EPA 6010B for 7-step sequential extraction (aluminum, arsenic, barium, boron, calcium, cobalt, iron, lead, lithium, manganese, molybdenum, selenium) for samples collected in 2021;
- EPA 6010B for 6-step sequential extraction (aluminum, arsenic, barium, boron, calcium, cobalt, iron, lead, lithium, manganese, molybdenum, selenium) for samples collected in 2022 and archived samples collected in 2021;
- EPA 6010B for Total Metals (aluminum, arsenic, barium, boron, calcium, cobalt, iron, lead, lithium, manganese, molybdenum, selenium);
- Bulk Mineralogy by Reitveld x-ray diffraction analysis;

[3] Supplemental data was provided as part of on-going nature and extent characterization activities consistent with 35 I.A.C. § 845.650(d)(1) at the Edwards AP.

- Bulk Elemental Composition by x-ray fluorescence analysis;
- Cation Exchange Capacity analysis; and
- Total Organic Carbon analysis.

In addition, four monitoring wells (AP05S, AW-15S, AW-15, and AW-19) were sampled for groundwater polishing parameters, including 35 I.A.C. § 845.600 parameters (total and dissolved), ferrous and ferric iron, and major ions.

3.1.2 Hydrogeologic Supplemental Site Investigation

An additional supplemental site investigation (SSI) was conducted from September 2021 through February 2023 [18] (**Appendix B**). The objective of the SSI was to further assess the nature, degree, and extent of boron concentrations downgradient (west and north) of the AP. Access requests were sent to adjacent property owners to obtain permission to install monitoring wells north and west of the AP (**Appendix B**). Only a single response was received, and a monitoring well was installed on this property. The SSI included the installation and development of one additional plume delineation monitoring well (AW-23), two observation wells (OW-01 and OW-02), and two pump test wells (PTW-01 and PTW-02) to further delineate the previously identified boron impacts associated with the EPP AP and complete aquifer testing to assess aquifer parameters and evaluate potential corrective actions.

3.2 Extent in the Uppermost Aquifer

Exceedances are identified quarterly following comparison of lower confidence limits (LCLs) to the GWPSs described in 35 I.A.C. § 845.600. The LCLs vary as the dataset is updated to include additional quarterly events (**Table 3-2**). The discussion below includes ranges of concentrations measured in wells with exceedances, because there is no single value for LCLs. The statistical results from the three compliance monitoring events are presented in **Table 3-2** and all data evaluated has been summarized in **Table 3-3**.

3.2.1 Boron

Boron concentrations in UA monitoring wells AW-19, AW-21, and AW-05 resulted in exceedances of the GWPS (2 milligrams per liter [mg/L]; **Table 3-2**; **Figure 3-1**). Additionally, boron concentrations in UA delineation monitoring well AW-20 resulted in LCLs above the GWPS (**Table 3-2**; **Figure 3-1**). The concentrations and extent of boron exceedances at the AP are summarized as follows:

- AW-19, AW-21, AW-05, and delineation monitoring well AW-20 - Concentrations of boron between 2021 and 2023 at AW-19 range from 2.30 to 3.20 mg/L and from 8.70 to 13.0 mg/L at AW-21 (**Table 3-3**). Concentrations of boron between 2015 and 2023 at AW-05 range from 1.40 to 11.0 mg/L. Boron concentrations between 2021 and 2023 at AW-20 range from 2.10 to 3.40 mg/L. Monitoring wells AW-19, AW-21 and AW-05, and delineation well AW-20 are situated at the northern end of the AP.

  As discussed in **Section 2.3.5**, there is a northern to northwest component of groundwater flow in the northern section of the AP and a western component to groundwater flow in the central portion of the AP. The extent of boron concentrations is defined laterally in the UA to the west of AW-05 by EMW-05, with boron concentrations ranging from 0.32 to 1.50 mg/L between 2022 and 2023, and to the northeast by APW-01 with boron concentrations ranging from 0.69 to 1.10 mg/L between 2021 and 2023 (**Figure 3-1**). Landowners to the northwest

did not respond to access agreement requests to perform additional investigations. In addition, it is expected that the UA pinches out to the northwest of the AP where the bedrock is present near or at the ground surface (defined by the bluff west of US Highway 24). Boron concentrations are defined laterally to the east by AW-22 **(Figure 3-1),** which reported boron concentrations ranging from 0.23 to 0.38 mg/L in 2021. The extent of boron concentrations is defined laterally to the south by AW-06, which had concentrations ranging from 0.093 to 0.31 mg/L between 2015 and 2023, and to the southwest by AW-23 where boron concentrations ranged from 0.48 to 0.60 mg/L between 2022 and 2023 (**Table 3-3**).

Downward migration of boron in the UA is inhibited by the underlying low permeability shales and siltstones of the Carbondale and Modesto Formations comprising the BCU. Vertical gradients observed at nearby paired monitoring wells AP05S (UA) and AP05D (BCU) are typically upward, with downward gradients coinciding with elevated Illinois River elevations.

3.3 Extents in Upper Cahokia Formation / Potential Migration Pathways

Exceedances are identified quarterly following comparison of the LCLs to the GWPSs described in 35 I.A.C. § 845.600. The LCLs vary as the dataset is updated to include additional quarterly events (**Table 3-2**). The discussion below includes ranges of concentrations measured in wells with exceedances, because there is no single value for LCLs.

3.3.1 Boron

Concentrations of boron in UCF/PMP monitoring wells AP07S and AW-15S resulted in exceedances of the GWPS (2 mg/L) for the three compliance monitoring events (**Table 3-2**; **Figure 3-2**). Concentrations and the extent of boron at these locations are summarized as follows:

- AP07S – Concentrations of boron between 2021 and 2023 at AP07S range from 5.8 to 18.0 mg/L (**Table 3-3**). Monitoring well AP07S is located north of the unit, and the extent of boron is limited by the discontinuous nature of the sand lenses acting as the PMP in the UCF. These sand lenses were not encountered in borings completed at AW-05 to the north or AW-21 to the south of AP07S. Boron is defined laterally in the UCF/PMP to the southeast by AW-01 with boron concentrations in 2022 through 2023 ranging from 0.072 to 1.10 mg/L (**Table 3-3**).

  Vertical migration of boron is limited by the upward gradients observed between wells AP07S (PMP) and OW-01 (UA). Additionally, the absence of measurable drawdown at AP07D during the pump test conducted in 2022 at PTW-01 indicate that the UCF is isolated from bedrock in this area [18].

- AW-15S - Concentrations of boron between 2021 and 2023 at AW-15S range from 5.4 to 6.8 mg/L (**Table 3-3**). Monitoring well AW-15S is located near the southwest side of the unit and screened within the low conductivity materials of the UCF. The extent of boron is limited laterally in the UCF/PMP by the discontinuous nature of the sand lenses acting as the PMP and low permeability clay and silt in the UCF. No sand lenses were encountered in the boring or at AW-14 to the southeast, and the landowner did not respond to requests for access to perform additional investigations to the west.

  The vertical migration of boron is limited by the upward gradients observed between wells AW-15 (UA) and APW-15S (UCF/PMP). Appreciable drawdown was observed at AW-15 but not AW-15S during the pump test conducted in 2022 at PTW-02, indicating that the shallow

materials are isolated from the UA. Concentrations of boron between 2021 and 2023 at UA well AW-15 range from 0.30 to 0.57 mg/L (**Table 3-3**) which supports there is no significant downward migration.

3.3.2 Sulfate

Concentrations of sulfate in UCF/PMP monitoring well AW-15S resulted in exceedances of the GWPS (400 mg/L) for the three compliance monitoring events (**Table 3-2**; **Figure 3-2**). Concentrations of sulfate at AW-15S between 2021 and 2023 range from 480 to 590 mg/L (**Table 3-3**). Monitoring well AW-15S is located near the southwest side of the AP and screened within the low conductivity materials of the UCF. Sulfate is limited laterally by the discontinuous nature of the sand lenses acting as the PMP and the low permeability clay and silt in the UCF. No sand lenses were encountered in the boring, or at AW-14 to the southeast, and access requests to perform additional investigations to the west did not receive a response from landowners.

Like boron at this location, sulfate is limited by the upward gradients observed between wells AW-15 (UA) and APW-15S (UCF/PMP). Appreciable drawdown was observed at AW-15 during the pump test conducted in 2022 at PTW-02 but not in AW-15S [18] indicating that the shallow materials are isolated from the UA. Concentrations of sulfate between 2021 and 2023 at UA well AW-15 range from below laboratory method detection limits (0.18 mg/L) to 1.0 mg/L (**Table 3-3**), which also supports the lack of downward migration.

4. GEOCHEMICAL CONCEPTUAL SITE MODEL (NATURE)

A GCSM was developed to describe the conditions of the groundwater in the vicinity of the EPP AP and is summarized here (full analysis presented in **Appendix E**). The GCSM describes the geochemical processes that contribute to the mobilization, distribution, and attenuation of chemicals in the environment. Only parameters that have exceeded the GWPS in AP groundwater and will be addressed in the Corrective Action Plan are included in the GCSM. As discussed in previous sections, the exceedances observed at the AP include boron and sulfate.

CCR porewater is water "collected from the interstitial water between waste particles in surface impoundments as it occurs in the field" [24] and represents the material potentially leached from impoundments. The CCR materials are the primary source of constituent loading to the CCR porewater (*i.e.*, CCR source water). Over an extended period (*e.g.*, months to years), the CCR porewater (*i.e.*, water contained within the interstitial pore spaces of the CCR that can be sampled by low-flow groundwater sampling methods) reaches equilibrium with the CCR materials. The porewater is therefore representative of the mobile phase constituents capable of migrating into the underlying materials and potentially downgradient in groundwater. The AP CCR source water is therefore the primary indicator of constituents *available* to the groundwater and is considered as the primary source term for environmental investigation and fate and transport modeling. Boron and sulfate are assessed as indicators of influence from the CCR materials. Where observed in shallow groundwater at concentrations above the GWPSs, concentrations of boron and sulfate are indicative of influence by CCR porewater. The uneven distribution of sulfate in the shallow UA and PMP groundwater is attributed to physical or chemical heterogeneity along the groundwater flow path.

Geochemical attenuation of constituents in groundwater is a function of groundwater pH, redox potential, availability of adsorbent, and presence of competing ions, among other factors. Groundwater pH exerts a major control on constituent mobility and reflects a neutral and generally stable condition in the range of 6 to 8 S.U., independent of location, lithology, or exceedance status. The stability of pH in groundwater is an indication that groundwater is well buffered, largely due to the widespread presence of carbonate minerals in the aquifer solids which buffer pH within this range. Neutral groundwater pH is generally favorable to attenuation of constituents in groundwater, such that it promotes the precipitation of the mineral phases that adsorb constituents from the aqueous phase. Groundwater pH additionally controls the tendency of various constituents to adsorb to the mineral surface. CCR porewater pH is alkaline, with a pH measured between 11 and 12.5 S.U.

The reduction and oxidation (redox) potential of groundwater exerts another major control on constituent mobility in groundwater. The redox condition is more variable across the site and shows a distinct pattern above and below the elevation of 420 feet, the approximate elevation at which a redox transition appears to occur. The locations with exceedances of either boron or sulfate are all within the shallower elevation of the UCF/PMP. The shallow groundwater (above the 420-foot reference elevation) is more oxidized with low concentrations of dissolved iron and methane, and non-detect sulfide. The deeper groundwater of the UA (Lower Cahokia Formation and BCU interface) reflects a reducing signature based on high concentrations of methane, dissolved and ferrous iron, and presence of sulfide. This deeper, reducing groundwater signature is not attributed to the CCR unit based on (1) the absence of boron and (2) the presence of constituents in the deeper groundwater that are incompatible with the chemistry of the shallower

groundwater (*e.g.,* methane will reduce/consume sulfate if intermixed, and barium, present in the deeper groundwater, will precipitate as barite if in the presence of sulfate). This suggests a physical or hydraulic separation between the shallow and deep water at the site, which limits the extent of the influence from the AP porewater.

Characterization data from the aquifer solids is considered to understand the reactive mineral fractions present in the aquifer solids and the binding mechanisms that control the partitioning of constituents between the solid and aqueous phases. The key finding from the aquifer solids assessment is that adsorptive minerals are present in the aquifer solids and have bound both boron and sulfate within the reactive fraction of the solid matrix. The inference follows that some degree of attenuation of the exceedance constituents by the aquifer solids has occurred in the past, most notably through adsorption to both iron and aluminum hydroxide minerals. The future condition of related attenuation is reserved for subsequent assessment and predictions related to the closure condition and corrective action.

5. COMBINED GEOCHEMICAL AND HYDROGEOLOGIC CONCEPTUAL SITE MODELS

5.1 Boron and Sulfate Conceptual Site Model

The CSM describing current conditions at the AP combining the hydrogeologic and geochemical CSMs for boron and sulfate is as follows. Water that may come into contact with CCR in the AP becomes porewater within the unlined CCR unit. Porewater primarily migrates laterally to the north, west, and south into the UCF/PMP and UA where it occurs at a shallow elevation, similar to the base of the AP, north of the Unit. The porewater mixes with groundwater in the UCF/PMP, and in the UA it mixes with groundwater migrating upward from the bedrock. Downward migration of porewater through the base of the unit and downward movement of groundwater outside the AP is limited by the low permeability clay in the Cahokia Formation. This is supported by the observed redox transition that occurs near an elevation of 420 feet, the lack of elevated concentrations of boron and sulfate in UA wells screened below an elevation of 420 feet, and the lack of response in MW-15S during pumping tests at OW-2.

Continued lateral migration to the west and south in the UCF/PMP is limited due to the discontinuous nature of the sandy zones within the PMP and the general low permeability of the UCF and UA. The surface water drainage may also limit the migration of the impacted groundwater as it is generally at a lower elevation than those measured in monitoring wells. Concentrations are also physically attenuated via dilution, dispersion, and chemical attenuation. The geochemical evaluation indicates that adsorptive minerals are present in the aquifer solids and suggest that attenuation of the exceedance constituents by the aquifer solids has occurred in the past through adsorption to both iron and aluminum hydroxide minerals.

6. CONCLUSIONS AND FUTURE ACTIVITIES

In accordance with 35 I.A.C. § 845.650(d)(1), the nature and extent of GWPS exceedances of boron and sulfate have been described in sufficient detail to support a complete and accurate assessment of the corrective measures necessary to effectively clean up all releases from the AP.

Boron was selected for modeling source control as presented in the Final Closure Plan and was identified as a surrogate for the exceedances of sulfate, as described in the GMR [13]. For modeling purposes it was assumed that boron would not significantly sorb or chemically react with aquifer solids (soil adsorption coefficient [Kd] was set to 0 milliliters per gram [mL/g]), which is a conservative estimate for predicting contaminant transport times in the model. Additional geochemical modeling will be completed to evaluate how sorption to solid phases may affect boron and sulfate mobility and therefore the time to reach the GWPS for these parameters.

7. REFERENCES

[1] Ramboll Americas Engineering Solutions, Inc., "2023 35 I.A.C. § 845 Annual Groundwater Monitoring and Corrective Action Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois," January 31, 2024.

[2] Ramboll Americas Engineering Solutions, Inc., "35 I.A.C. § 845 Corrective Measures Assessment, Ash Pond, Edwards Power Plant, Bartonville, Illinois, IEPA ID: W1438050005-01," June 4, 2024.

[3] Ramboll Americas Engineering Solutions, Inc., "35 I.A.C. § 845.610(B)(3)(D) Groundwater Monitoring Data and Detected Exceedances 2023 Quarter 3, Ash Pond, Edwards Power Plant, Bartonville, Illinois," December 13, 2023.

[4] Ramboll Americas Engineering Solutions, Inc., "35 I.A.C. § 845.610(B)(3)(D) Groundwater Monitoring Data and Detected Exceedances 2023 Quarter 2, Ash Pond, Edwards Power Plant, Bartonville, Illinois," October 8, 2023.

[5] Ramboll Americas Engineering Solutions, Inc., "35 I.A.C. § 845.610(B)(3)(D) Groundwater Monitoring Data and Detected Exceedances 2023 Quarter 4, Ash Pond, Edwards Power Plant, Bartonville, Illinois," February 12, 2024.

[6] Foth, "Antidegradation Alternative Analysis, Dynegy Midwest Generation, LLC, Edwards Power Station, Bartonville, Illinois," September 8, 2017.

[7] AECOM, "History of Construction. USEPA Final CCR Rule 40 C.F.R. Part 257.73(c). Edwards Power Station. Bartonville, Illinois," 2016.

[8] Ramboll Americas Engineering Solutions, Inc., "Hydrogeologic Site Characterization Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois," October 25, 2021.

[9] Haley & Aldrich, Inc., "Memorandum: Location Restriction Demonstration - Placement Above the Uppermost Aquifer, Ash Pond, Edwards Power Station, Bartonville, IL. File No. 129788," October 16, 2018.

[10] D. Kolata, "Bedrock Geology of Illinois: Illinois State Geological Survey map, scale 1:500,000," 2005.

[11] H. B. Willman, J. C. Frye, J. A. Simon, K. E. Clegg, D. H. Swann, E. Atherton, C. Collinson, J. A. Lineback and T. C. Buschbach, "Geologic Map of Illinois: Illinois State Geological Survey map, scale 1:500,000," 1967.

[12] B. L. Herzog, B. J. Stiff, C. A. Chenoweth, K. L. Warner, J. B. Sieverling and C. Avery, "Buried Bedrock Surface of Illinois: Illinois State Geological Survey map, scale 1:500,000," 1994.

[13] Ramboll Americas Engineering Solutions, Inc., "Groundwater Modeling Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois," June 30, 2022.

[14] Natural Resource Technology Inc., an OBG Company, "Hydrogeologic Monitoring Plan – Edwards Ash Pond," October 17, 2017.

[15] Natural Resources Technology, Inc., "Sampling and Analysis Plan, Final, Edwards Ash Pond, Edwards Power Station, Bartonville, Illinois, Project No. 2285, Revision 0," October 2017.

[16] Haley & Aldrich, Inc., "Memorandum: Ash Pond – Underlying Clay and Depth of CCR Evaluation, Edwards Station, Bartonville, IL. File No. 129319-003," February 12, 2018.

[17] AECOM, "Geotechnical Data Report for Dynegy Edwards Power Station," 2016.

[18] Ramboll Americas Engineering Solutions, Inc., "2023 Supplemental Site Investigation Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois," December 1, 2023.

[19] United States Geological Survey, "Groundwater Atlas of the United States, Illinois, Indiana, Kentucky, Ohio, Tennessee 730-K," 1995.

[20] Ramboll Americas Engineering Solutions, Inc., "Groundwater Monitoring Plan, Ash Pond, Edwards Power Plant, Bartonville, Illinois," October 25, 2021.

[21] Illinois State Water Survey, "Water Supply Planning: Middle Illinois Progress Report," Illinois State Water Survey, Prairie Research Institute. Contract Report 2016-02, February 2016.

[22] S. L. Burch and D. J. Kelly, "Peoria-Pekin Regional Ground-Water Quality Assessment," Illinois State Water Survey, Research Report 124, Champaign, Illinois, 1993.

[23] Ramboll Americas Engineering Solutions, Inc., "History of Potential Exceedances. Edwards Power Plant, Ash Pond, Bartonville, Illinois. Illinois Power Resources Generating," October 25, 2021.

[24] United States Environmental Protection Agency, "Human and Ecological Risk Assessment of Coal Combustion Residuals (2050-AE81)," December 2014.

TABLES

Table 2-1. Summary of Groundwater Elevation Data
Nature and Extent Report
Edwards Power Plant
Ash Pond
Bartonville, Illinois

Well ID	Well Type	Monitored Unit	Date	Depth to Groundwater (feet BMP)	Groundwater Elevation (feet NAVD88)
AP05S	Background	UA	02/09/2021	5.92	437.61
AP05S	Background	UA	02/11/2021	5.58	437.95
AP05S	Background	UA	03/02/2021	5.60	437.93
AP05S	Background	UA	03/22/2021	5.10	438.43
AP05S	Background	UA	04/12/2021	4.94	438.59
AP05S	Background	UA	05/04/2021	5.10	438.43
AP05S	Background	UA	06/15/2021	5.23	438.30
AP05S	Background	UA	06/28/2021	5.29	438.24
AP05S	Background	UA	07/21/2021	4.86	438.67
AP05S	Background	UA	08/30/2021	5.40	438.13
AP05S	Background	UA	02/16/2022	5.38	438.15
AP05S	Background	UA	07/25/2022	5.91	437.62
AP05S	Background	UA	11/21/2022	7.65	435.88
AP05S	Background	UA	12/16/2022	6.80	436.73
AP05S	Background	UA	01/09/2023	6.48	437.05
AP05S	Background	UA	02/27/2023	4.82	438.46
AP05S	Background	UA	04/12/2023	4.13	439.14
AP05S	Background	UA	05/12/2023	4.39	438.88
AP05S	Background	UA	06/12/2023	5.45	437.82
AP05S	Background	UA	07/21/2023	5.95	437.32
AP05S	Background	UA	08/21/2023	5.90	437.37
AP05S	Background	UA	09/27/2023	6.42	436.85
AP05S	Background	UA	10/27/2023	6.23	437.05
AP05S	Background	UA	11/20/2023	6.36	436.92
AP05S	Background	UA	12/27/2023	5.83	437.45
AP05D	Water Level	BCU	02/09/2021	4.31	439.14
AP05D	Water Level	BCU	02/11/2021	12.65	430.80
AP05D	Water Level	BCU	03/02/2021	7.64	435.81
AP05D	Water Level	BCU	03/22/2021	10.12	433.33
AP05D	Water Level	BCU	04/12/2021	11.49	431.96
AP05D	Water Level	BCU	05/04/2021	11.16	432.29
AP05D	Water Level	BCU	06/15/2021	8.43	435.02
AP05D	Water Level	BCU	06/28/2021	10.31	433.14
AP05D	Water Level	BCU	07/21/2021	6.30	437.15
AP05D	Water Level	BCU	08/30/2021	5.09	438.36
AP05D	Water Level	BCU	02/16/2022	4.71	438.74
AP05D	Water Level	BCU	07/25/2022	4.67	438.78
AP05D	Water Level	BCU	11/21/2022	5.92	437.53
AP05D	Water Level	BCU	12/16/2022	5.94	437.51
AP05D	Water Level	BCU	01/09/2023	5.90	437.55
AP05D	Water Level	BCU	02/27/2023	5.63	437.82

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Well ID	Well Type	Monitored Unit	Date	Depth to Groundwater (feet BMP)	Groundwater Elevation (feet NAVD88)
AP07S	Compliance	PMP	02/09/2021	24.94	436.14
AP07S	Compliance	PMP	02/11/2021	24.96	436.12
AP07S	Compliance	PMP	03/02/2021	24.58	436.50
AP07S	Compliance	PMP	03/22/2021	24.35	436.73
AP07S	Compliance	PMP	04/12/2021	24.47	436.61
AP07S	Compliance	PMP	05/04/2021	24.85	436.23
AP07S	Compliance	PMP	06/15/2021	25.11	435.97
AP07S	Compliance	PMP	06/28/2021	24.71	436.37
AP07S	Compliance	PMP	07/21/2021	24.82	436.26
AP07S	Compliance	PMP	08/30/2021	25.33	435.75
AP07S	Compliance	PMP	02/16/2022	25.09	435.99
AP07S	Compliance	PMP	07/25/2022	25.51	435.57
AP07S	Compliance	PMP	11/21/2022	25.49	435.59
AP07S	Compliance	PMP	12/16/2022	24.68	436.40
AP07S	Compliance	PMP	01/09/2023	25.08	436.00
AP07S	Compliance	PMP	02/27/2023	24.30	436.78
AP07S	Compliance	PMP	04/12/2023	24.37	436.70
AP07S	Compliance	PMP	05/12/2023	24.74	436.33
AP07S	Compliance	PMP	06/12/2023	25.48	435.59
AP07S	Compliance	PMP	07/21/2023	25.36	435.72
AP07S	Compliance	PMP	08/21/2023	25.01	436.07
AP07S	Compliance	PMP	09/12/2023	[25.47]	[435.61]
AP07S	Compliance	PMP	10/27/2023	25.38	435.70
AP07S	Compliance	PMP	11/20/2023	25.38	435.70
AP07S	Compliance	PMP	12/27/2023	24.63	436.45
AP08	Water Level	CCR	02/09/2021	8.00	452.60
AP08	Water Level	CCR	02/11/2021	8.02	452.58
AP08	Water Level	CCR	03/02/2021	7.75	452.85
AP08	Water Level	CCR	03/22/2021	7.01	453.59
AP08	Water Level	CCR	04/12/2021	7.44	453.16
AP08	Water Level	CCR	05/04/2021	7.90	452.70
AP08	Water Level	CCR	06/15/2021	8.20	452.40
AP08	Water Level	CCR	06/28/2021	7.68	452.92
AP08	Water Level	CCR	07/21/2021	7.63	452.97
AP08	Water Level	CCR	08/30/2021	8.71	451.89
AP08	Water Level	CCR	02/16/2022	7.91	452.69
AP08	Water Level	CCR	07/25/2022	9.18	451.42
AP08	Water Level	CCR	02/27/2023	7.63	452.97
AP08	Water Level	CCR	06/12/2023	9.31	451.29
AP08	Water Level	CCR	08/21/2023	8.20	452.40
AP08	Water Level	CCR	10/27/2023	9.10	451.50

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Bartonville, Illinois

Well ID	Well Type	Monitored Unit	Date	Depth to Groundwater (feet BMP)	Groundwater Elevation (feet NAVD88)
AP09	Water Level	CCR	02/09/2021	8.26	451.96
AP09	Water Level	CCR	02/11/2021	8.38	451.84
AP09	Water Level	CCR	03/02/2021	8.27	451.95
AP09	Water Level	CCR	03/22/2021	8.27	451.95
AP09	Water Level	CCR	04/12/2021	8.36	451.86
AP09	Water Level	CCR	05/04/2021	8.10	452.12
AP09	Water Level	CCR	06/15/2021	8.61	451.61
AP09	Water Level	CCR	06/28/2021	8.13	452.09
AP09	Water Level	CCR	07/21/2021	8.03	452.19
AP09	Water Level	CCR	08/30/2021	8.26	451.96
AP09	Water Level	CCR	02/16/2022	8.36	451.86
AP09	Water Level	CCR	07/25/2022	8.62	451.60
AP09	Water Level	CCR	02/27/2023	9.41	450.81
AP09	Water Level	CCR	06/12/2023	11.40	448.82
AP09	Water Level	CCR	08/21/2023	10.09	450.13
AP09	Water Level	CCR	10/27/2023	10.82	449.40
APW-01	Water Level	UA	02/09/2021	5.83	435.24
APW-01	Water Level	UA	02/11/2021	5.93	435.14
APW-01	Water Level	UA	03/02/2021	5.65	435.42
APW-01	Water Level	UA	03/22/2021	5.69	435.38
APW-01	Water Level	UA	04/12/2021	5.51	435.56
APW-01	Water Level	UA	05/04/2021	5.88	435.19
APW-01	Water Level	UA	06/15/2021	7.45	433.62
APW-01	Water Level	UA	06/28/2021	5.75	435.32
APW-01	Water Level	UA	07/21/2021	6.02	435.05
APW-01	Water Level	UA	08/30/2021	6.09	434.98
APW-01	Water Level	UA	02/16/2022	5.64	435.43
APW-01	Water Level	UA	07/25/2022	6.34	434.73
APW-01	Water Level	UA	06/12/2023	6.76	434.31
APW-01	Water Level	UA	08/21/2023	6.17	434.90
APW-01	Water Level	UA	10/27/2023	5.73	435.34
APW-02	Water Level	UCF	02/09/2021	9.52	455.40
APW-02	Water Level	UCF	02/11/2021	14.55	450.37
APW-02	Water Level	UCF	03/02/2021	9.61	455.31
APW-02	Water Level	UCF	03/22/2021	9.71	455.21
APW-02	Water Level	UCF	04/12/2021	9.49	455.43
APW-02	Water Level	UCF	05/04/2021	9.49	455.43
APW-02	Water Level	UCF	06/15/2021	9.22	455.70
APW-02	Water Level	UCF	06/28/2021	9.29	455.63
APW-02	Water Level	UCF	07/21/2021	9.23	455.69
APW-02	Water Level	UCF	08/30/2021	9.37	455.55

Table 2-1. Summary of Groundwater Elevation Data
Nature and Extent Report
Edwards Power Plant
Ash Pond
Bartonville, Illinois

Well ID	Well Type	Monitored Unit	Date	Depth to Groundwater (feet BMP)	Groundwater Elevation (feet NAVD88)
APW-02	Water Level	UCF	02/16/2022	9.05	455.87
APW-02	Water Level	UCF	07/25/2022	9.21	455.71
APW-02	Water Level	UCF	11/21/2022	9.63	455.29
APW-02	Water Level	UCF	12/16/2022	9.29	455.63
APW-02	Water Level	UCF	01/09/2023	9.17	455.75
APW-02	Water Level	UCF	02/27/2023	9.02	455.90
APW-03	Water Level	UCF	02/09/2021	7.59	436.78
APW-03	Water Level	UCF	02/11/2021	14.56	429.81
APW-03	Water Level	UCF	03/02/2021	7.90	436.47
APW-03	Water Level	UCF	03/22/2021	7.62	436.75
APW-03	Water Level	UCF	04/12/2021	8.12	436.25
APW-03	Water Level	UCF	05/04/2021	8.31	436.06
APW-03	Water Level	UCF	06/15/2021	8.73	435.64
APW-03	Water Level	UCF	06/28/2021	8.15	436.22
APW-03	Water Level	UCF	07/21/2021	8.24	436.13
APW-03	Water Level	UCF	08/30/2021	8.80	435.57
APW-03	Water Level	UCF	02/16/2022	7.90	436.47
APW-03	Water Level	UCF	07/25/2022	9.44	434.93
APW-03	Water Level	UCF	02/27/2023	7.86	436.51
APW-04	Water Level	UCF	02/09/2021	7.22	432.44
APW-04	Water Level	UCF	02/11/2021	7.36	432.30
APW-04	Water Level	UCF	03/02/2021	6.92	432.74
APW-04	Water Level	UCF	03/22/2021	6.91	432.75
APW-04	Water Level	UCF	04/12/2021	6.75	432.91
APW-04	Water Level	UCF	05/04/2021	7.26	432.40
APW-04	Water Level	UCF	06/15/2021	7.87	431.79
APW-04	Water Level	UCF	06/28/2021	8.45	431.21
APW-04	Water Level	UCF	07/21/2021	7.53	432.13
APW-04	Water Level	UCF	08/30/2021	7.68	431.98
APW-04	Water Level	UCF	02/16/2022	7.28	432.38
APW-04	Water Level	UCF	07/25/2022	8.51	431.15
APW-04	Water Level	UCF	02/27/2023	7.01	432.65
AW-01	Compliance	PMP	11/21/2022	13.80	450.63
AW-01	Compliance	PMP	12/15/2022	9.77	454.66
AW-01	Compliance	PMP	01/09/2023	10.70	453.73
AW-01	Compliance	PMP	02/27/2023	4.20	460.23
AW-01	Compliance	PMP	04/12/2023	9.78	454.64
AW-01	Compliance	PMP	05/12/2023	9.88	454.54
AW-01	Compliance	PMP	06/12/2023	10.09	454.33
AW-01	Compliance	PMP	07/21/2023	10.40	454.02
AW-01	Compliance	PMP	08/21/2023	10.33	454.09

Table 2-1. Summary of Groundwater Elevation Data
Nature and Extent Report
Edwards Power Plant
Ash Pond
Bartonville, Illinois

Well ID	Well Type	Monitored Unit	Date	Depth to Groundwater (feet BMP)	Groundwater Elevation (feet NAVD88)
AW-01	Compliance	PMP	09/27/2023	10.54	453.89
AW-01	Compliance	PMP	10/27/2023	10.12	454.31
AW-01	Compliance	PMP	11/20/2023	12.04	452.39
AW-01	Compliance	PMP	12/27/2023	9.74	454.69
AW-05	Compliance	UA	02/09/2021	8.27	435.10
AW-05	Compliance	UA	02/11/2021	8.34	435.03
AW-05	Compliance	UA	03/02/2021	8.20	435.17
AW-05	Compliance	UA	03/22/2021	8.09	435.28
AW-05	Compliance	UA	04/12/2021	7.82	435.55
AW-05	Compliance	UA	05/04/2021	8.21	435.16
AW-05	Compliance	UA	06/15/2021	8.69	434.68
AW-05	Compliance	UA	06/28/2021	8.25	435.12
AW-05	Compliance	UA	07/21/2021	8.46	434.91
AW-05	Compliance	UA	08/30/2021	8.93	434.44
AW-05	Compliance	UA	02/16/2022	8.37	435.00
AW-05	Compliance	UA	07/25/2022	8.99	434.38
AW-05	Compliance	UA	11/21/2022	8.50	434.87
AW-05	Compliance	UA	12/16/2022	7.97	435.40
AW-05	Compliance	UA	01/09/2023	8.53	434.84
AW-05	Compliance	UA	02/27/2023	7.61	435.76
AW-05	Compliance	UA	04/12/2023	7.94	435.43
AW-05	Compliance	UA	05/12/2023	8.19	435.18
AW-05	Compliance	UA	06/12/2023	9.06	434.30
AW-05	Compliance	UA	07/21/2023	8.91	434.46
AW-05	Compliance	UA	08/21/2023	8.79	434.58
AW-05	Compliance	UA	09/27/2023	8.79	434.58
AW-05	Compliance	UA	10/27/2023	8.43	434.94
AW-05	Compliance	UA	11/20/2023	8.81	434.56
AW-05	Compliance	UA	12/27/2023	8.21	435.16
AW-06	Compliance	UA	02/09/2021	27.17	434.40
AW-06	Compliance	UA	02/11/2021	27.07	434.50
AW-06	Compliance	UA	03/02/2021	26.95	434.62
AW-06	Compliance	UA	03/22/2021	26.87	434.70
AW-06	Compliance	UA	04/12/2021	26.72	434.85
AW-06	Compliance	UA	05/04/2021	27.09	434.48
AW-06	Compliance	UA	06/15/2021	27.31	434.26
AW-06	Compliance	UA	06/28/2021	26.97	434.60
AW-06	Compliance	UA	07/21/2021	27.17	434.40
AW-06	Compliance	UA	08/30/2021	25.56	436.01
AW-06	Compliance	UA	02/16/2022	25.61	435.96
AW-06	Compliance	UA	07/25/2022	27.63	433.94

Table 2-1. Summary of Groundwater Elevation Data
Nature and Extent Report
Edwards Power Plant
Ash Pond
Bartonville, Illinois

Well ID	Well Type	Monitored Unit	Date	Depth to Groundwater (feet BMP)	Groundwater Elevation (feet NAVD88)
AW-06	Compliance	UA	11/21/2022	27.57	434.00
AW-06	Compliance	UA	12/16/2022	26.86	434.71
AW-06	Compliance	UA	01/09/2023	27.27	434.30
AW-06	Compliance	UA	02/27/2023	26.89	434.68
AW-06	Compliance	UA	04/12/2023	27.29	434.27
AW-06	Compliance	UA	05/12/2023	27.34	434.22
AW-06	Compliance	UA	06/12/2023	27.59	433.97
AW-06	Compliance	UA	07/21/2023	27.81	433.75
AW-06	Compliance	UA	08/21/2023	27.58	433.98
AW-06	Compliance	UA	09/27/2023	27.67	433.90
AW-06	Compliance	UA	10/27/2023	27.48	434.09
AW-06	Compliance	UA	11/20/2023	27.39	434.18
AW-06	Compliance	UA	12/27/2023	27.00	434.57
AW-08	Background	UA	02/09/2021	24.26	438.28
AW-08	Background	UA	02/11/2021	28.38	434.16
AW-08	Background	UA	03/02/2021	24.77	437.77
AW-08	Background	UA	03/22/2021	23.27	439.27
AW-08	Background	UA	04/12/2021	22.45	440.09
AW-08	Background	UA	05/04/2021	23.07	439.47
AW-08	Background	UA	06/15/2021	22.40	440.14
AW-08	Background	UA	06/28/2021	23.13	439.41
AW-08	Background	UA	07/21/2021	20.80	441.74
AW-08	Background	UA	08/30/2021	23.05	439.49
AW-08	Background	UA	02/16/2022	23.75	438.79
AW-08	Background	UA	07/25/2022	23.37	439.17
AW-08	Background	UA	11/21/2022	25.37	437.17
AW-08	Background	UA	12/16/2022	25.29	437.25
AW-08	Background	UA	01/09/2023	24.98	437.56
AW-08	Background	UA	02/27/2023	24.58	437.96
AW-08	Background	UA	04/12/2023	22.06	440.47
AW-08	Background	UA	05/12/2023	22.88	439.65
AW-08	Background	UA	06/12/2023	23.99	438.54
AW-08	Background	UA	07/21/2023	24.84	437.69
AW-08	Background	UA	08/21/2023	24.84	437.69
AW-08	Background	UA	09/27/2023	25.34	437.20
AW-08	Background	UA	10/27/2023	25.41	437.13
AW-08	Background	UA	11/20/2023	25.78	436.76
AW-08	Background	UA	12/27/2023	25.00	437.54
AW-09	Compliance	UA	02/09/2021	25.72	435.73
AW-09	Compliance	UA	02/11/2021	25.78	435.67
AW-09	Compliance	UA	03/02/2021	26.82	434.63

Table 2-1. Summary of Groundwater Elevation Data
Nature and Extent Report
Edwards Power Plant
Ash Pond
Bartonville, Illinois

Well ID	Well Type	Monitored Unit	Date	Depth to Groundwater (feet BMP)	Groundwater Elevation (feet NAVD88)
AW-09	Compliance	UA	03/22/2021	25.68	435.77
AW-09	Compliance	UA	04/12/2021	25.49	435.96
AW-09	Compliance	UA	05/04/2021	25.82	435.63
AW-09	Compliance	UA	06/15/2021	25.81	435.64
AW-09	Compliance	UA	06/28/2021	24.94	436.51
AW-09	Compliance	UA	07/21/2021	25.55	435.90
AW-09	Compliance	UA	08/30/2021	26.10	435.35
AW-09	Compliance	UA	02/16/2022	25.57	435.88
AW-09	Compliance	UA	07/25/2022	26.43	435.02
AW-09	Compliance	UA	11/21/2022	27.22	434.23
AW-09	Compliance	UA	12/16/2022	26.58	434.87
AW-09	Compliance	UA	01/09/2023	26.56	434.89
AW-09	Compliance	UA	02/27/2023	25.94	435.51
AW-09	Compliance	UA	04/12/2023	26.40	435.04
AW-09	Compliance	UA	05/12/2023	26.50	434.94
AW-09	Compliance	UA	06/12/2023	26.64	434.80
AW-09	Compliance	UA	07/21/2023	26.95	434.50
AW-09	Compliance	UA	08/21/2023	26.81	434.64
AW-09	Compliance	UA	09/27/2023	26.97	434.48
AW-09	Compliance	UA	10/27/2023	27.29	434.16
AW-09	Compliance	UA	11/20/2023	27.09	434.36
AW-09	Compliance	UA	12/27/2023	26.42	435.03
AW-10	Compliance	UA	03/02/2021	1.09	438.84
AW-10	Compliance	UA	03/22/2021	1.09	438.84
AW-10	Compliance	UA	04/12/2021	1.08	438.85
AW-10	Compliance	UA	05/04/2021	1.13	438.80
AW-10	Compliance	UA	06/15/2021	1.31	438.62
AW-10	Compliance	UA	06/28/2021	1.32	438.61
AW-10	Compliance	UA	07/21/2021	1.33	438.60
AW-10	Compliance	UA	08/30/2021	2.00	437.93
AW-10	Compliance	UA	02/16/2022	1.88	438.05
AW-10	Compliance	UA	07/25/2022	2.31	437.62
AW-10	Compliance	UA	11/21/2022	2.74	437.19
AW-10	Compliance	UA	12/16/2022	2.36	437.57
AW-10	Compliance	UA	01/09/2023	2.40	437.53
AW-10	Compliance	UA	02/27/2023	1.55	438.38
AW-10	Compliance	UA	04/12/2023	1.89	438.03
AW-10	Compliance	UA	05/12/2023	1.93	437.99
AW-10	Compliance	UA	06/12/2023	2.19	437.73
AW-10	Compliance	UA	08/28/2023	[2.35]	[437.58]
AW-10	Compliance	UA	09/11/2023	[2.23]	[437.70]

Table 2-1. Summary of Groundwater Elevation Data
Nature and Extent Report
Edwards Power Plant
Ash Pond
Bartonville, Illinois

Well ID	Well Type	Monitored Unit	Date	Depth to Groundwater (feet BMP)	Groundwater Elevation (feet NAVD88)
AW-10	Compliance	UA	10/27/2023	2.33	437.60
AW-10	Compliance	UA	11/20/2023	2.54	437.39
AW-10	Compliance	UA	12/27/2023	2.24	437.69
AW-11	Compliance	UA	02/09/2021	5.70	434.17
AW-11	Compliance	UA	02/11/2021	5.74	434.13
AW-11	Compliance	UA	03/02/2021	5.36	434.51
AW-11	Compliance	UA	03/22/2021	5.27	434.60
AW-11	Compliance	UA	04/12/2021	5.22	434.65
AW-11	Compliance	UA	05/04/2021	5.31	434.56
AW-11	Compliance	UA	06/15/2021	6.47	433.40
AW-11	Compliance	UA	06/28/2021	5.49	434.38
AW-11	Compliance	UA	07/21/2021	5.31	434.56
AW-11	Compliance	UA	08/30/2021	5.82	434.05
AW-11	Compliance	UA	02/16/2022	5.40	434.47
AW-11	Compliance	UA	07/25/2022	6.22	433.65
AW-11	Compliance	UA	11/21/2022	7.78	432.09
AW-11	Compliance	UA	02/27/2023	5.69	434.18
AW-11	Compliance	UA	04/12/2023	5.44	434.42
AW-11	Compliance	UA	05/12/2023	5.42	434.44
AW-11	Compliance	UA	06/12/2023	5.74	434.12
AW-11	Compliance	UA	07/21/2023	6.35	433.51
AW-11	Compliance	UA	08/21/2023	6.32	433.54
AW-11	Compliance	UA	09/27/2023	6.56	433.31
AW-11	Compliance	UA	10/27/2023	7.03	432.84
AW-11	Compliance	UA	11/20/2023	6.88	432.99
AW-11	Compliance	UA	12/27/2023	6.39	433.48
AW-13	Water Level	UA	02/09/2021	5.74	435.52
AW-13	Water Level	UA	03/02/2021	5.42	435.84
AW-13	Water Level	UA	03/22/2021	5.40	435.86
AW-13	Water Level	UA	04/12/2021	5.34	435.92
AW-13	Water Level	UA	05/04/2021	5.43	435.83
AW-13	Water Level	UA	06/15/2021	5.70	435.56
AW-13	Water Level	UA	06/28/2021	5.86	435.40
AW-13	Water Level	UA	07/21/2021	5.28	435.98
AW-13	Water Level	UA	08/30/2021	5.98	435.28
AW-13	Water Level	UA	02/16/2022	5.52	435.74
AW-13	Water Level	UA	07/25/2022	6.61	434.65
AW-13	Water Level	UA	11/21/2022	7.72	433.54
AW-13	Water Level	UA	12/16/2022	7.01	434.25
AW-13	Water Level	UA	01/09/2023	6.65	434.61
AW-13	Water Level	UA	02/27/2023	5.40	435.86

Table 2-1. Summary of Groundwater Elevation Data
Nature and Extent Report
Edwards Power Plant
Ash Pond
Bartonville, Illinois

Well ID	Well Type	Monitored Unit	Date	Depth to Groundwater (feet BMP)	Groundwater Elevation (feet NAVD88)
AW-14	Compliance	UA	02/09/2021	6.37	433.03
AW-14	Compliance	UA	03/02/2021	6.46	432.94
AW-14	Compliance	UA	03/22/2021	6.61	432.79
AW-14	Compliance	UA	04/12/2021	6.45	432.95
AW-14	Compliance	UA	05/04/2021	6.41	432.99
AW-14	Compliance	UA	06/15/2021	6.69	432.71
AW-14	Compliance	UA	06/28/2021	6.53	432.87
AW-14	Compliance	UA	07/21/2021	6.36	433.04
AW-14	Compliance	UA	08/30/2021	7.19	432.21
AW-14	Compliance	UA	02/16/2022	6.44	432.96
AW-14	Compliance	UA	07/25/2022	7.63	431.77
AW-14	Compliance	UA	11/21/2022	8.92	430.48
AW-14	Compliance	UA	12/16/2022	7.67	431.73
AW-14	Compliance	UA	01/09/2023	7.54	431.86
AW-14	Compliance	UA	02/27/2023	6.88	432.52
AW-14	Compliance	UA	06/12/2023	7.33	432.07
AW-14	Compliance	UA	08/21/2023	7.07	432.33
AW-14	Compliance	UA	10/27/2023	8.30	431.10
AW-15	Compliance	UA	02/09/2021	8.48	433.03
AW-15	Compliance	UA	03/02/2021	8.01	433.50
AW-15	Compliance	UA	03/22/2021	7.83	433.68
AW-15	Compliance	UA	04/12/2021	7.75	433.76
AW-15	Compliance	UA	05/04/2021	7.82	433.69
AW-15	Compliance	UA	06/15/2021	7.86	433.65
AW-15	Compliance	UA	06/28/2021	7.92	433.59
AW-15	Compliance	UA	07/21/2021	7.86	433.65
AW-15	Compliance	UA	08/30/2021	7.08	434.43
AW-15	Compliance	UA	02/16/2022	8.00	433.51
AW-15	Compliance	UA	07/25/2022	7.77	433.74
AW-15	Compliance	UA	11/21/2022	10.76	430.75
AW-15	Compliance	UA	02/27/2023	8.92	432.59
AW-15	Compliance	UA	04/12/2023	8.14	433.36
AW-15	Compliance	UA	05/12/2023	8.00	433.50
AW-15	Compliance	UA	06/12/2023	8.09	433.41
AW-15	Compliance	UA	07/21/2023	8.51	432.99
AW-15	Compliance	UA	08/21/2023	8.68	432.82
AW-15	Compliance	UA	10/27/2023	10.02	431.49
AW-15	Compliance	UA	11/20/2023	9.99	431.52
AW-15	Compliance	UA	12/27/2023	9.52	431.99
AW-15C	Water Level	BCU	02/09/2021	6.70	433.32
AW-15C	Water Level	BCU	03/02/2021	6.52	433.50

Table 2-1. Summary of Groundwater Elevation Data
Nature and Extent Report
Edwards Power Plant
Ash Pond
Bartonville, Illinois

Well ID	Well Type	Monitored Unit	Date	Depth to Groundwater (feet BMP)	Groundwater Elevation (feet NAVD88)
AW-15C	Water Level	BCU	03/22/2021	6.36	433.66
AW-15C	Water Level	BCU	04/12/2021	6.22	433.80
AW-15C	Water Level	BCU	05/04/2021	6.31	433.71
AW-15C	Water Level	BCU	06/15/2021	6.39	433.63
AW-15C	Water Level	BCU	06/28/2021	6.44	433.58
AW-15C	Water Level	BCU	07/21/2021	6.35	433.67
AW-15C	Water Level	BCU	08/30/2021	8.51	431.51
AW-15C	Water Level	BCU	02/16/2022	6.50	433.52
AW-15C	Water Level	BCU	07/25/2022	7.16	432.86
AW-15C	Water Level	BCU	02/27/2023	7.46	432.56
AW-15S	Compliance	PMP	02/09/2021	8.80	431.91
AW-15S	Compliance	PMP	03/02/2021	9.52	431.19
AW-15S	Compliance	PMP	03/22/2021	9.38	431.33
AW-15S	Compliance	PMP	04/12/2021	9.58	431.13
AW-15S	Compliance	PMP	05/04/2021	10.89	429.82
AW-15S	Compliance	PMP	06/15/2021	9.71	431.00
AW-15S	Compliance	PMP	06/28/2021	10.85	429.86
AW-15S	Compliance	PMP	07/21/2021	9.46	431.25
AW-15S	Compliance	PMP	08/30/2021	9.84	430.87
AW-15S	Compliance	PMP	02/16/2022	8.92	431.79
AW-15S	Compliance	PMP	07/25/2022	8.64	432.07
AW-15S	Compliance	PMP	02/27/2023	10.05	430.66
AW-15S	Compliance	PMP	04/12/2023	9.46	431.24
AW-15S	Compliance	PMP	05/12/2023	9.46	431.24
AW-15S	Compliance	PMP	06/12/2023	9.94	430.76
AW-15S	Compliance	PMP	07/21/2023	10.06	430.64
AW-15S	Compliance	PMP	08/21/2023	9.82	430.88
AW-15S	Compliance	PMP	09/27/2023	10.25	430.46
AW-15S	Compliance	PMP	10/27/2023	10.04	430.67
AW-15S	Compliance	PMP	11/20/2023	11.08	429.63
AW-15S	Compliance	PMP	12/27/2023	9.52	431.19
AW-16	Compliance	UA	02/09/2021	24.16	437.63
AW-16	Compliance	UA	03/02/2021	24.18	437.61
AW-16	Compliance	UA	03/22/2021	24.12	437.67
AW-16	Compliance	UA	04/12/2021	24.00	437.79
AW-16	Compliance	UA	05/04/2021	24.05	437.74
AW-16	Compliance	UA	06/15/2021	24.02	437.77
AW-16	Compliance	UA	06/28/2021	24.00	437.79
AW-16	Compliance	UA	07/21/2021	24.05	437.74
AW-16	Compliance	UA	08/30/2021	24.38	437.41
AW-16	Compliance	UA	02/16/2022	23.88	437.91

Table 2-1. Summary of Groundwater Elevation Data
Nature and Extent Report
Edwards Power Plant
Ash Pond
Bartonville, Illinois

Well ID	Well Type	Monitored Unit	Date	Depth to Groundwater (feet BMP)	Groundwater Elevation (feet NAVD88)
AW-16	Compliance	UA	07/25/2022	23.75	438.04
AW-16	Compliance	UA	02/27/2023	24.60	437.19
AW-16	Compliance	UA	04/12/2023	24.54	437.24
AW-16	Compliance	UA	05/12/2023	24.44	437.34
AW-16	Compliance	UA	06/12/2023	24.69	437.09
AW-16	Compliance	UA	07/21/2023	25.05	436.73
AW-16	Compliance	UA	08/21/2023	25.21	436.58
AW-16	Compliance	UA	09/27/2023	25.59	436.20
AW-16	Compliance	UA	10/27/2023	25.92	435.87
AW-16	Compliance	UA	11/20/2023	26.05	435.74
AW-16	Compliance	UA	12/27/2023	25.62	436.17
AW-17	Compliance	UA	02/09/2021	25.25	436.85
AW-17	Compliance	UA	03/02/2021	24.90	437.20
AW-17	Compliance	UA	03/22/2021	24.68	437.42
AW-17	Compliance	UA	04/12/2021	24.52	437.58
AW-17	Compliance	UA	05/04/2021	24.70	437.40
AW-17	Compliance	UA	06/15/2021	24.76	437.34
AW-17	Compliance	UA	06/28/2021	24.86	437.24
AW-17	Compliance	UA	07/21/2021	24.40	437.70
AW-17	Compliance	UA	08/30/2021	25.07	437.03
AW-17	Compliance	UA	02/16/2022	24.47	437.63
AW-17	Compliance	UA	07/25/2022	25.34	436.76
AW-17	Compliance	UA	02/27/2023	24.85	437.25
AW-17	Compliance	UA	04/12/2023	25.29	436.80
AW-17	Compliance	UA	05/12/2023	25.32	436.77
AW-17	Compliance	UA	06/12/2023	25.42	436.67
AW-17	Compliance	UA	07/21/2023	25.95	436.14
AW-17	Compliance	UA	08/21/2023	26.14	435.96
AW-17	Compliance	UA	09/27/2023	26.20	435.90
AW-17	Compliance	UA	10/27/2023	26.56	435.54
AW-17	Compliance	UA	11/20/2023	26.52	435.58
AW-17	Compliance	UA	12/27/2023	26.08	436.02
AW-18	Compliance	UA	02/09/2021	27.38	435.27
AW-18	Compliance	UA	03/02/2021	27.48	435.17
AW-18	Compliance	UA	03/22/2021	27.27	435.38
AW-18	Compliance	UA	04/12/2021	27.28	435.37
AW-18	Compliance	UA	05/04/2021	27.61	435.04
AW-18	Compliance	UA	06/15/2021	27.67	434.98
AW-18	Compliance	UA	06/28/2021	27.42	435.23
AW-18	Compliance	UA	07/21/2021	27.40	435.25
AW-18	Compliance	UA	08/30/2021	27.97	434.68

Table 2-1. Summary of Groundwater Elevation Data
Nature and Extent Report
Edwards Power Plant
Ash Pond
Bartonville, Illinois

Well ID	Well Type	Monitored Unit	Date	Depth to Groundwater (feet BMP)	Groundwater Elevation (feet NAVD88)
AW-18	Compliance	UA	02/16/2022	26.82	435.83
AW-18	Compliance	UA	07/25/2022	28.00	434.65
AW-18	Compliance	UA	11/21/2022	27.89	434.76
AW-18	Compliance	UA	12/16/2022	27.20	435.45
AW-18	Compliance	UA	01/09/2023	27.54	435.11
AW-18	Compliance	UA	02/27/2023	26.96	435.69
AW-18	Compliance	UA	04/12/2023	27.84	434.80
AW-18	Compliance	UA	05/12/2023	27.93	434.71
AW-18	Compliance	UA	06/12/2023	28.14	434.50
AW-18	Compliance	UA	07/21/2023	27.99	434.65
AW-18	Compliance	UA	08/21/2023	27.79	434.85
AW-18	Compliance	UA	09/27/2023	28.01	434.64
AW-18	Compliance	UA	10/27/2023	28.00	434.65
AW-18	Compliance	UA	11/20/2023	27.96	434.69
AW-18	Compliance	UA	12/27/2023	27.33	435.32
AW-19	Compliance	UA	02/09/2021	13.09	447.65
AW-19	Compliance	UA	03/02/2021	13.10	447.64
AW-19	Compliance	UA	03/22/2021	13.03	447.71
AW-19	Compliance	UA	04/12/2021	13.19	447.55
AW-19	Compliance	UA	05/04/2021	13.38	447.36
AW-19	Compliance	UA	06/15/2021	13.65	447.09
AW-19	Compliance	UA	06/28/2021	13.34	447.40
AW-19	Compliance	UA	07/21/2021	13.52	447.22
AW-19	Compliance	UA	08/30/2021	13.86	446.88
AW-19	Compliance	UA	02/16/2022	13.74	447.00
AW-19	Compliance	UA	07/25/2022	13.96	446.78
AW-19	Compliance	UA	11/21/2022	13.79	446.95
AW-19	Compliance	UA	12/16/2022	13.52	447.22
AW-19	Compliance	UA	01/09/2023	13.87	446.87
AW-19	Compliance	UA	02/27/2023	13.39	447.35
AW-19	Compliance	UA	04/12/2023	14.46	446.27
AW-19	Compliance	UA	05/12/2023	14.53	446.20
AW-19	Compliance	UA	06/12/2023	14.69	446.04
AW-19	Compliance	UA	07/21/2023	14.34	446.39
AW-19	Compliance	UA	08/21/2023	14.19	446.54
AW-19	Compliance	UA	10/27/2023	14.16	446.58
AW-19	Compliance	UA	11/20/2023	14.05	446.69
AW-19	Compliance	UA	12/27/2023	13.81	446.93
AW-20	Water Level	UA	02/09/2021	16.37	445.11
AW-20	Water Level	UA	03/02/2021	16.25	445.23
AW-20	Water Level	UA	03/22/2021	16.07	445.41

Table 2-1. Summary of Groundwater Elevation Data
Nature and Extent Report
Edwards Power Plant
Ash Pond
Bartonville, Illinois

Well ID	Well Type	Monitored Unit	Date	Depth to Groundwater (feet BMP)	Groundwater Elevation (feet NAVD88)
AW-20	Water Level	UA	04/12/2021	16.19	445.29
AW-20	Water Level	UA	05/04/2021	16.40	445.08
AW-20	Water Level	UA	06/15/2021	16.93	444.55
AW-20	Water Level	UA	06/28/2021	16.40	445.08
AW-20	Water Level	UA	07/21/2021	16.24	445.24
AW-20	Water Level	UA	08/30/2021	17.23	444.25
AW-20	Water Level	UA	02/16/2022	16.78	444.70
AW-20	Water Level	UA	11/21/2022	17.09	444.39
AW-20	Water Level	UA	12/16/2022	16.38	445.10
AW-20	Water Level	UA	01/09/2023	16.69	444.79
AW-20	Water Level	UA	02/27/2023	16.15	445.33
AW-20	Water Level	UA	06/12/2023	17.61	443.87
AW-20	Water Level	UA	08/21/2023	16.80	444.68
AW-20	Water Level	UA	10/27/2023	17.10	444.38
AW-21	Compliance	UA	02/09/2021	16.57	444.04
AW-21	Compliance	UA	03/02/2021	16.41	444.20
AW-21	Compliance	UA	03/22/2021	16.19	444.42
AW-21	Compliance	UA	04/12/2021	16.44	444.17
AW-21	Compliance	UA	05/04/2021	16.87	443.74
AW-21	Compliance	UA	06/15/2021	17.78	442.83
AW-21	Compliance	UA	06/28/2021	16.82	443.79
AW-21	Compliance	UA	07/21/2021	17.15	443.46
AW-21	Compliance	UA	08/30/2021	17.93	442.68
AW-21	Compliance	UA	02/16/2022	17.39	443.22
AW-21	Compliance	UA	07/25/2022	18.46	442.15
AW-21	Compliance	UA	11/21/2022	18.20	442.41
AW-21	Compliance	UA	12/16/2022	18.11	442.50
AW-21	Compliance	UA	01/09/2023	17.58	443.03
AW-21	Compliance	UA	02/27/2023	16.35	444.26
AW-21	Compliance	UA	04/12/2023	17.92	442.68
AW-21	Compliance	UA	05/12/2023	17.99	442.61
AW-21	Compliance	UA	06/12/2023	18.45	442.15
AW-21	Compliance	UA	07/21/2023	18.20	442.40
AW-21	Compliance	UA	08/21/2023	17.41	443.19
AW-21	Compliance	UA	09/27/2023	18.03	442.58
AW-21	Compliance	UA	10/27/2023	17.80	442.81
AW-21	Compliance	UA	11/20/2023	17.84	442.77
AW-21	Compliance	UA	12/27/2023	16.84	443.77
AW-22	Water Level	UA	02/09/2021	11.74	451.45
AW-22	Water Level	UA	03/02/2021	11.55	451.64
AW-22	Water Level	UA	03/22/2021	11.39	451.80

Table 2-1. Summary of Groundwater Elevation Data
Nature and Extent Report
Edwards Power Plant
Ash Pond
Bartonville, Illinois

Well ID	Well Type	Monitored Unit	Date	Depth to Groundwater (feet BMP)	Groundwater Elevation (feet NAVD88)
AW-22	Water Level	UA	04/12/2021	11.64	451.55
AW-22	Water Level	UA	05/04/2021	11.73	451.46
AW-22	Water Level	UA	06/15/2021	11.89	451.30
AW-22	Water Level	UA	06/28/2021	11.75	451.44
AW-22	Water Level	UA	07/21/2021	11.65	451.54
AW-22	Water Level	UA	08/30/2021	11.15	452.04
AW-22	Water Level	UA	02/16/2022	11.73	451.46
AW-22	Water Level	UA	07/25/2022	12.25	450.94
AW-22	Water Level	UA	02/27/2023	11.30	451.89
AW-23	Water Level	UA	11/21/2022	6.72	430.85
AW-23	Water Level	UA	12/16/2022	3.86	433.71
AW-23	Water Level	UA	01/09/2023	3.95	433.62
AW-23	Water Level	UA	06/14/2023	[5.90]	[431.67]
AW-23	Water Level	UA	08/21/2023	4.36	433.21
AW-23	Water Level	UA	10/27/2023	5.46	432.11
AW-23	Water Level	UA	12/27/2023	3.48	434.09
EMW-05	Water Level	UA	11/21/2022	22.02	436.08
EMW-05	Water Level	UA	12/16/2022	21.69	436.25
EMW-05	Water Level	UA	01/09/2023	21.43	436.51
EMW-05	Water Level	UA	02/27/2023	20.29	437.65
EMW-05	Water Level	UA	04/12/2023	18.92	439.01
EMW-05	Water Level	UA	05/12/2023	19.61	438.32
EMW-05	Water Level	UA	06/12/2023	21.20	436.73
EMW-05	Water Level	UA	08/28/2023	[20.84]	[437.10]
EMW-05	Water Level	UA	10/27/2023	21.67	436.27
EMW-05	Water Level	UA	11/20/2023	21.60	436.34
EMW-05	Water Level	UA	12/27/2023	20.85	437.09
OW-01	Water Level	UA	11/21/2022	24.34	435.58
OW-01	Water Level	UA	02/27/2023	23.19	436.74
OW-01	Water Level	UA	06/12/2023	24.39	435.54
OW-01	Water Level	UA	08/21/2023	23.90	436.03
OW-01	Water Level	UA	10/27/2023	24.22	435.71
P002	Water Level	UCF	02/09/2021	11.98	448.41
P002	Water Level	UCF	03/02/2021	11.89	448.50
P002	Water Level	UCF	03/22/2021	11.79	448.60
P002	Water Level	UCF	04/12/2021	11.97	448.42
P002	Water Level	UCF	05/04/2021	12.08	448.31
P002	Water Level	UCF	06/15/2021	12.20	448.19
P002	Water Level	UCF	06/28/2021	12.06	448.33
P002	Water Level	UCF	02/16/2022	12.36	448.03
P002	Water Level	UCF	07/25/2022	12.54	447.85
P002	Water Level	UCF	02/27/2023	12.05	448.34

Table 2-1. Summary of Groundwater Elevation Data
Nature and Extent Report
Edwards Power Plant
Ash Pond
Bartonville, Illinois

Well ID	Well Type	Monitored Unit	Date	Depth to Groundwater (feet BMP)	Groundwater Elevation (feet NAVD88)
XPW01A	Water Level	CCR	02/09/2021	11.74	452.42
XPW01A	Water Level	CCR	03/02/2021	11.44	452.72
XPW01A	Water Level	CCR	03/22/2021	11.28	452.88
XPW01A	Water Level	CCR	04/12/2021	11.51	452.65
XPW01A	Water Level	CCR	05/04/2021	11.75	452.41
XPW01A	Water Level	CCR	06/15/2021	12.03	452.13
XPW01A	Water Level	CCR	06/28/2021	11.18	452.98
XPW01A	Water Level	CCR	07/21/2021	11.53	452.63
XPW01A	Water Level	CCR	08/30/2021	11.84	452.32
XPW01A	Water Level	CCR	02/16/2022	11.58	452.58
XPW01A	Water Level	CCR	07/25/2022	12.10	452.06
XPW01A	Water Level	CCR	02/27/2023	11.16	453.00
XPW01A	Water Level	CCR	04/12/2023	12.58	451.57
XPW01A	Water Level	CCR	05/12/2023	12.58	451.57
XPW01A	Water Level	CCR	06/12/2023	12.93	451.22
XPW01A	Water Level	CCR	07/21/2023	12.14	452.01
XPW01A	Water Level	CCR	08/21/2023	11.86	452.30
XPW01A	Water Level	CCR	09/27/2023	12.05	452.11
XPW01A	Water Level	CCR	10/27/2023	11.89	452.27
XPW01A	Water Level	CCR	11/20/2023	12.24	451.92
XPW01A	Water Level	CCR	12/27/2023	11.34	452.82
XPW02	Water Level	CCR	02/09/2021	20.82	452.97
XPW02	Water Level	CCR	03/02/2021	20.62	453.17
XPW02	Water Level	CCR	03/22/2021	19.71	454.08
XPW02	Water Level	CCR	04/12/2021	20.06	453.73
XPW02	Water Level	CCR	05/04/2021	20.56	453.23
XPW02	Water Level	CCR	06/15/2021	20.89	452.90
XPW02	Water Level	CCR	06/28/2021	20.32	453.47
XPW02	Water Level	CCR	07/21/2021	20.12	453.67
XPW02	Water Level	CCR	08/30/2021	21.43	452.36
XPW02	Water Level	CCR	02/16/2022	20.58	453.21
XPW02	Water Level	CCR	07/25/2022	21.94	451.85
XPW02	Water Level	CCR	02/27/2023	19.78	454.01
XPW02	Water Level	CCR	04/12/2023	21.29	452.49
XPW02	Water Level	CCR	05/12/2023	21.55	452.23
XPW02	Water Level	CCR	06/12/2023	22.09	451.69
XPW02	Water Level	CCR	07/21/2023	21.99	451.79
XPW02	Water Level	CCR	08/21/2023	20.77	453.01
XPW02	Water Level	CCR	10/27/2023	21.63	452.16
XPW02	Water Level	CCR	11/20/2023	21.48	452.31
XPW02	Water Level	CCR	12/27/2023	20.42	453.37

Table 2-1. Summary of Groundwater Elevation Data
Nature and Extent Report
Edwards Power Plant
Ash Pond
Bartonville, Illinois

Well ID	Well Type	Monitored Unit	Date	Depth to Groundwater (feet BMP)	Groundwater Elevation (feet NAVD88)
XPW03	Water Level	CCR	02/09/2021	15.30	450.74
XPW03	Water Level	CCR	03/02/2021	15.32	450.72
XPW03	Water Level	CCR	03/22/2021	15.27	450.77
XPW03	Water Level	CCR	04/12/2021	15.42	450.62
XPW03	Water Level	CCR	05/04/2021	15.20	450.84
XPW03	Water Level	CCR	06/15/2021	15.66	450.38
XPW03	Water Level	CCR	06/28/2021	15.18	450.86
XPW03	Water Level	CCR	07/21/2021	15.01	451.03
XPW03	Water Level	CCR	08/30/2021	15.28	450.76
XPW03	Water Level	CCR	02/16/2022	15.39	450.65
XPW03	Water Level	CCR	07/25/2022	15.71	450.33
XPW03	Water Level	CCR	02/27/2023	16.34	449.70
XPW03	Water Level	CCR	04/12/2023	17.71	448.32
XPW03	Water Level	CCR	05/12/2023	17.77	448.26
XPW03	Water Level	CCR	06/12/2023	18.20	447.83
XPW03	Water Level	CCR	07/21/2023	18.01	448.03
XPW03	Water Level	CCR	08/21/2023	17.20	448.84
XPW03	Water Level	CCR	10/27/2023	18.23	447.81
XPW03	Water Level	CCR	11/20/2023	18.36	447.68
XPW03	Water Level	CCR	12/27/2023	17.34	448.70
SG-01	Water Level	SW	02/09/2021	--	431.82
SG-01	Water Level	SW	06/15/2021	--	434.13
SG-01	Water Level	SW	08/30/2021	--	432.63
SG-01	Water Level	SW	02/16/2022	--	434.07
SG-01	Water Level	SW	07/25/2022	--	433.45
SG-01	Water Level	SW	11/21/2022	--	430.01
SG-01	Water Level	SW	12/16/2022	--	433.03
SG-01	Water Level	SW	02/27/2023	--	441.00
SG-01	Water Level	SW	06/12/2023	--	441.50
SG-01	Water Level	SW	08/21/2023	--	435.00
SG-01	Water Level	SW	10/27/2023	--	431.00
SG-01	Water Level	SW	11/20/2023	--	440.04
SG-01	Water Level	SW	12/27/2023	--	440.64

Notes:
BCU = bedrock confining unit
BMP = below measuring point
CCR = coal combustion residuals
NAVD 88 = North American Vertical Datum of 1988
PMP = potential migration pathway
SW = surface water (Illinois River)
UA = uppermost aquifer
UCF = Upper Cahokia Formation

Table 2-2. Field Horizontal Hydraulic Conductivities
Nature and Extent Report
Edwards Power Plant
Ash Pond
Bartonville, Illinois

Well ID	Gradient Position	Bottom of Screen Elevation (ft NAVD88)	Screen Length [1] (ft)	Field Identified Screened Material	Slug Type	Analysis Method	Number of Field Tests	Test Analyzed [3]	Hydraulic Conductivity (cm/s)	Minimum Hydraulic Conductivity (cm/s)	Maximum Hydraulic Conductivity (cm/s)	Hydraulic Conductivity Geometric Mean (cm/s)
Uppermost Aquifer												
AW-12	U	410.16	5	(GW)s	Solid	Bouwer-Rice	6	RH-2	1.5E-02	4.7E-07	1.5E-02	1.6E-04
AW-15	D	400.95	5	CL/BR [2]	Solid	Cooper-Bredehoeft-Papadopulos	6	RH-3	7.5E-03			
AW-16	D	399.45	5	CL/ML/BR [2]	Solid	Cooper-Bredehoeft-Papadopulos	4	RH-1	7.7E-04			
AW-17	D	403.69	5	CL/ML/BR	Solid	Bouwer-Rice	1	FH-1	4.7E-07			
AW-18	D	409.28	5	CL/ML/BR	Solid	Bouwer-Rice	1	RH-1	7.3E-07			
AW-19	D	418.53	5	CL/ML	Solid	Cooper-Bredehoeft-Papadopulos	1	RH-1	4.1E-05			
AW-20	D	417.58	5	CL/ML/BR [2]	Solid	Cooper-Bredehoeft-Papadopulos	1	RH-1	2.5E-03			
AW-21	D	421.28	5	CL/ML/BR [2]	Solid	Cooper-Bredehoeft-Papadopulos	2	RH-2	2.5E-04			
AW-22	D	411.30	5	CL/BR [2]	Solid	Cooper-Bredehoeft-Papadopulos	2	RH-2	1.1E-04			
Potential Migration Pathway												
AW-15S	D	419.92	10	ML/CL	Solid	Bouwer-Rice	3	RH-1	3.2E-03	3.2E-03	3.2E-03	3.2E-03
Bedrock												
AW-15C	D	389.62	5	BR	Solid	Cooper-Bredehoeft-Papadopulos	6	RH-2	8.2E-04	8.2E-04	8.2E-04	8.2E-04
Ash Pond												
XPW01A	CCR	417.99	10	s(ML)	Solid	Cooper-Bredehoeft-Papadopulos	4	FH-1	3.2E-04	3.2E-04	1.8E-03	6.8E-04
XPW02	CCR	425.16	10	s(ML)	Solid	Kansas Geological Survey	5	RH-2	1.8E-03			
XPW03	CCR	425.62	10	(SP-SM)g	Solid	Cooper-Bredehoeft-Papadopulos	4	RH-1	5.5E-04			

[O:SSW 7/13/21, U: SSW 08/13/21; C:CJC 08/16/21; U:CJC 08/16/21; U: KRP 05/20/24]

Notes:

[1] All wells are constructed from 2 inch PVC with 0.01 inch slotted screens.
[2] Boring log indicates well is screened in weathered shale bedrock.
[3] Test response data (elapsed time and corresponding changes in water levels) were plotted as normalized displacement to evaluate similarity among repeat test data within each well. A single test was selected for analysis at each well based on the quality of the test data (*i.e.,* smooth recovery curve) and coincidence of repeat test data.

cm/s = centimeters per second
BR = bedrock
CCR = coal combustion residuals
CL = lean clay
D = downgradient
FH-1 = Falling Head 1 Test
ft = foot/feet
(GW)s = well graded gravel with sand
ML = silt
NAVD88 = North American Vertical Datum of 1988
RH-1 = Rising Head 1 Test
RH-2 = Rising Head 2 Test
RH-3 = Rising Head 3 Test
s(ML) = sandy silt
(SP-SM)g = poorly graded sand and silt with gravel
U = upgradient

Table 3-1. Monitoring Well Construction Details
Nature and Extent Report
Edwards Power Plant
Ash Pond
Bartonville, Illinois

Location	HSU	Date Constructed	Top of PVC Elevation (ft)	Measuring Point Elevation (ft)	Measuring Point Description	Ground Elevation (ft)	Screen Top Depth (ft bgs)	Screen Bottom Depth (ft bgs)	Screen Top Elevation (ft)	Screen Bottom Elevation (ft)	Well Depth (ft bgs)	Bottom of Boring Elevation (ft)	Screen Length (ft)	Screen Diameter (inches)	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)
AP05S	UA	11/29/2016	443.28	443.01	Top of PVC	441.13	32.87	37.64	408.26	403.49	38.06	403.10	4.8	2	40.598807	-89.66191
AP07S	PMP	12/2/2016	461.08	461.02	Top of PVC	458.31	29.95	34.74	428.36	423.57	35	423.30	4.8	2	40.59793	-89.666919
APW-01	UA	7/27/2010	441.07	441.07	Top of PVC	437.83	7.6	18	430.23	419.83	18	419.30	10.4	2	40.600127	-89.66512
AW-01	PMP	9/8/2021	464.43	464.60	Top of PVC	462.30	28.2	37.7	434.10	424.60	38.2	423.30	9.5	2	40.594098	-89.665033
AW-05	UA	7/22/2015	--	443.31	Top of Disk	440.55	15.87	20.47	424.68	420.08	21.1	419.50	4.6	2	40.598645	-89.666407
AW-06	UA	8/3/2015	--	461.57	Top of Disk	459.19	36.6	41.09	422.59	418.10	41.69	416.90	4.5	2	40.594237	-89.670051
AW-08	UA	7/21/2015	--	462.54	Top of Disk	460.66	47.55	57.19	413.11	403.47	57.7	403.00	9.6	2	40.593964	-89.661996
AW-09	UA	8/3/2015	--	461.45	Top of Disk	458.32	47.14	51.62	411.18	406.70	52.23	406.10	4.5	2	40.590422	-89.668777
AW-10	UA	7/23/2015	--	440.10	Top of Disk	437.64	27.62	32.23	410.02	405.41	32.74	404.90	4.6	2	40.590733	-89.663826
AW-11	UA	7/28/2015	--	440.04	Top of Disk	437.16	24.21	28.81	412.95	408.35	29.31	407.20	4.6	2	40.587261	-89.663781
AW-14	UA	1/8/2021	439.40	439.40	Top of PVC	436.83	24	29	412.83	407.83	29	401.80	5	2	40.58729	-89.665621
AW-15	UA	1/8/2021	441.51	441.68	Top of PVC	438.95	33	38	405.95	400.95	38	399.00	5	2	40.587964	-89.666822
AW-15S	PMP	1/8/2021	440.71	440.88	Top of PVC	437.92	8	18	429.92	419.92	18	417.90	10	2	40.587955	-89.666841
AW-16	UA	1/8/2021	461.79	461.96	Top of PVC	459.45	55	60	404.45	399.45	60	396.50	5	2	40.589457	-89.667799
AW-17	UA	1/8/2021	462.10	462.27	Top of PVC	459.69	51	56	408.69	403.69	56	402.70	5	2	40.591698	-89.669404
AW-18	UA	1/9/2021	462.65	462.82	Top of PVC	460.28	46	51	414.28	409.28	51	405.30	5	2	40.593044	-89.669822
AW-19	UA	1/9/2021	460.74	460.91	Top of PVC	458.53	35	40	423.53	418.53	40	415.50	5	2	40.595434	-89.66972
AW-20	UA	1/10/2021	461.48	461.48	Top of PVC	459.08	36.5	41.5	422.58	417.58	41.5	416.10	5	2	40.596469	-89.66891
AW-21	UA	1/10/2021	460.61	460.78	Top of PVC	458.28	32	37	426.28	421.28	37	420.30	5	2	40.597294	-89.667734
AW-23	UA	10/20/2022	437.57	437.74	Top of PVC	435.69	6	16	429.69	419.69	16	419.69	10	2	40.5937859	-89.6714015
EMW-05	UA	9/9/2021	457.94	458.11	Top of PVC	455.80	25.7	30.2	430.10	425.60	30.7	421.80	4.5	2	40.5986102	-89.6672471
XPW01A	CCR	1/9/2021	464.16	464.33	Top of PVC	460.99	33	43	427.99	417.99	43	418.00	10	2	40.596306	-89.667345
XPW02	CCR	1/9/2021	473.79	473.96	Top of PVC	471.16	36	46	435.16	425.16	46	424.20	10	2	40.594351	-89.668312
XPW03	CCR	1/10/2021	466.04	466.21	Top of PVC	462.62	27	37	435.62	425.62	37	422.60	10	2	40.591416	-89.666188

Notes:
All elevation data are presented relative to the North American Vertical Datum 1988 (NAVD88), GEOID 12A
bgs = below ground surface
CCR = Coal Combustion Residuals
ft = foot or feet
HSU = Hydrostratigraphic Unit
PMP = Potential Migration Pathway
PVC = polyvinyl chloride
UA = Uppermost Aquifer

Table 3-2. Exceedance Parameter Statistical Results
Nature and Extent Report
Edwards Power Plant
Ash Pond
Bartonville, Illinois

Location	Parameter	Unit	Groundwater Protection Standard	2023 Q2 LCL	2023 Q3 LCL	2023 Q4 LCL
AP07S	Boron, total	mg/L	2	6.94	6.34	5.82
AW-05	Boron, total	mg/L	2	1.88	2.16	2.90
AW-15S	Boron, total	mg/L	2	5.43	5.46	5.51
AW-19	Boron, total	mg/L	2	2.47	2.50	2.52
AW-20	Boron, total	mg/L	2	3.10	1.90	2.04
AW-21	Boron, total	mg/L	2	10.3	10.5	11.0
AW-15S	Sulfate, total	mg/L	400	480	503	510

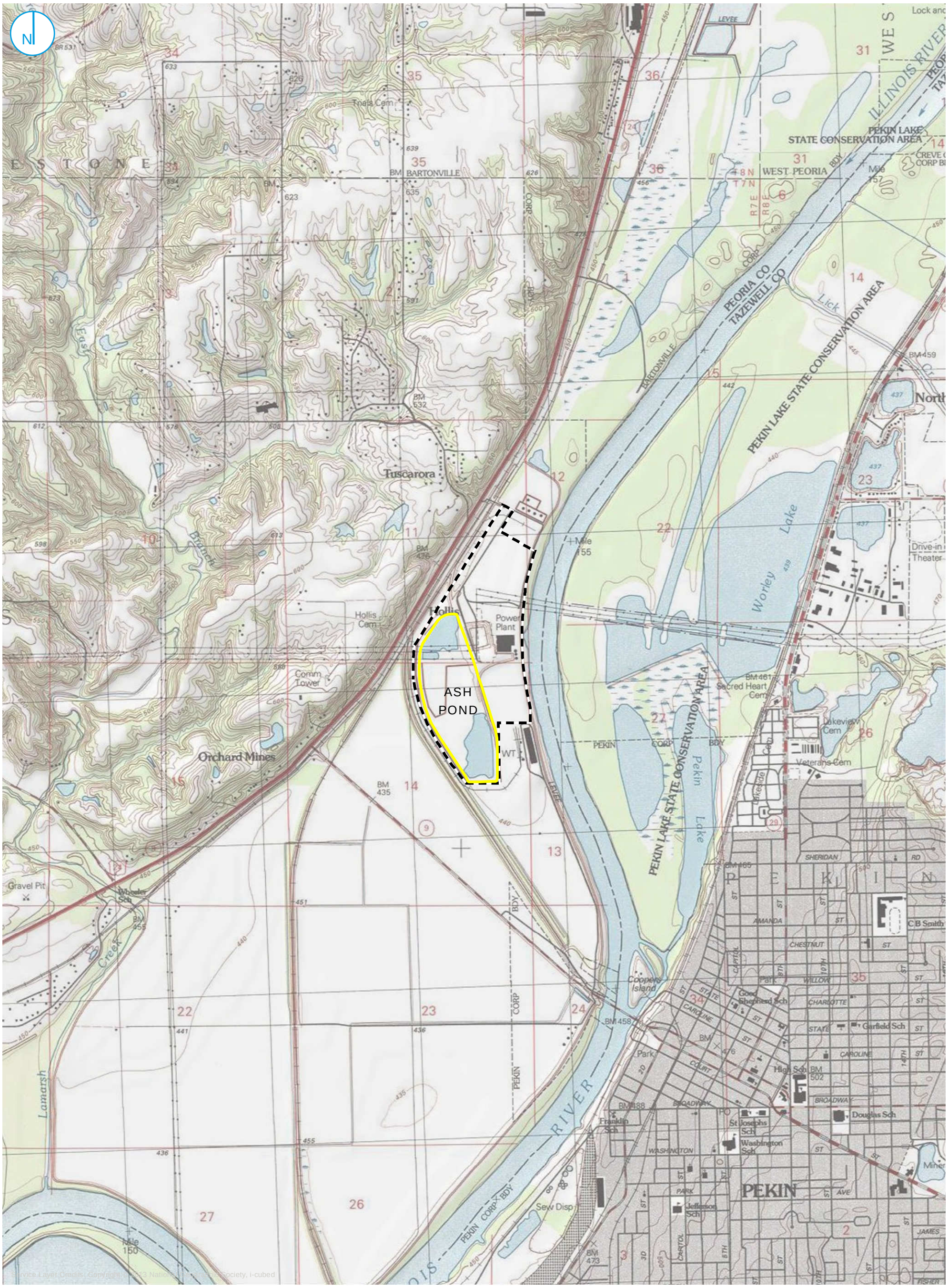
Notes:
LCL = Lower Confidence Level
mg/L = milligrams per liter

Table 3-3. Summary of Groundwater Data
Nature and Extent Report
Edwards Power Plant
Ash Pond
Bartonville, Illinois

HSU	Location	Parameter	Unit	Sample Count	Non-Detect Results	Percent Non-Detect Results	First Sample	Last Sample	Minimum	Median	Mean	Maximum
CCR	XPW01A	Boron, total	mg/L	9	0	0	02/11/2021	08/21/2023	15.0	18.0	17.6	21.0
CCR	XPW01A	Sulfate, total	mg/L	9	0	0	02/11/2021	08/21/2023	210	210	217	230
CCR	XPW02	Boron, total	mg/L	9	0	0	02/11/2021	08/22/2023	13.0	15.0	15.0	17.0
CCR	XPW02	Sulfate, total	mg/L	9	0	0	02/11/2021	08/22/2023	800	930	940	1,100
CCR	XPW03	Boron, total	mg/L	9	0	0	02/11/2021	08/28/2023	4.90	5.50	5.54	7.00
CCR	XPW03	Sulfate, total	mg/L	9	0	0	02/11/2021	08/28/2023	260	280	283	310
PMP	AP07S	Boron, total	mg/L	12	0	0	02/10/2021	11/03/2023	5.80	8.05	8.86	18.0
PMP	AP07S	Sulfate, total	mg/L	12	0	0	02/10/2021	11/03/2023	150	325	311	480
PMP	AW-01	Boron, total	mg/L	7	0	0	11/18/2022	11/06/2023	0.0720	0.0860	0.227	1.10
PMP	AW-01	Sulfate, total	mg/L	7	0	0	11/18/2022	11/06/2023	41.0	50.0	79.9	280
PMP	AW-15S	Boron, total	mg/L	12	0	0	02/12/2021	11/02/2023	5.40	5.75	5.82	6.70
PMP	AW-15S	Sulfate, total	mg/L	12	0	0	02/12/2021	11/02/2023	480	550	542	590
UA	AP05S	Boron, total	mg/L	31	0	0	01/18/2017	11/06/2023	0.240	0.330	0.331	0.420
UA	AP05S	Sulfate, total	mg/L	31	6	19	01/18/2017	11/06/2023	<0.18	3.30	8.91	38.0
UA	APW-01	Boron, total	mg/L	6	0	0	06/17/2021	11/06/2023	0.690	0.920	0.907	1.10
UA	APW-01	Sulfate, total	mg/L	6	0	0	06/17/2021	11/06/2023	280	295	293	300
UA	AW-05	Boron, total	mg/L	17	0	0	11/09/2015	11/06/2023	1.40	2.80	3.83	11.0
UA	AW-05	Sulfate, total	mg/L	17	0	0	11/09/2015	11/06/2023	5.70	300	310	470
UA	AW-06	Boron, total	mg/L	23	0	0	11/10/2015	11/06/2023	0.0930	0.150	0.160	0.310
UA	AW-06	Sulfate, total	mg/L	23	0	0	11/10/2015	11/06/2023	21.0	29.0	30.6	42.0
UA	AW-08	Boron, total	mg/L	31	0	0	11/09/2015	11/06/2023	0.0850	0.120	0.136	0.350
UA	AW-08	Sulfate, total	mg/L	31	11	35	11/09/2015	11/06/2023	<0.18	2.30	15.6	80.0
UA	AW-09	Boron, total	mg/L	23	0	0	11/10/2015	11/06/2023	0.100	0.310	0.461	1.30
UA	AW-09	Sulfate, total	mg/L	23	10	43	11/10/2015	11/06/2023	<0.18	1.00	10.1	37.0
UA	AW-10	Boron, total	mg/L	24	0	0	11/09/2015	11/06/2023	0.420	0.475	0.483	0.560
UA	AW-10	Sulfate, total	mg/L	24	19	79	11/09/2015	11/06/2023	<0.18	1.00	1.15	4.10
UA	AW-11	Boron, total	mg/L	23	0	0	11/09/2015	11/03/2023	0.180	0.230	0.233	0.300
UA	AW-11	Sulfate, total	mg/L	23	14	61	11/09/2015	11/03/2023	<0.18	1.00	1.28	4.90
UA	AW-14	Boron, total	mg/L	11	0	0	02/11/2021	11/03/2023	0.170	0.180	0.187	0.240
UA	AW-14	Sulfate, total	mg/L	11	2	18	02/11/2021	11/03/2023	<0.18	3.00	10.3	54.0
UA	AW-15	Boron, total	mg/L	9	0	0	02/12/2021	11/02/2023	0.300	0.400	0.411	0.570
UA	AW-15	Sulfate, total	mg/L	9	7	78	02/12/2021	11/02/2023	<0.18	1.00	0.639	1.00
UA	AW-16	Boron, total	mg/L	12	0	0	02/11/2021	11/02/2023	0.420	0.495	0.492	0.560
UA	AW-16	Sulfate, total	mg/L	12	9	75	02/11/2021	11/02/2023	<0.18	1.00	1.08	3.40
UA	AW-17	Boron, total	mg/L	12	0	0	02/11/2021	11/01/2023	0.400	0.435	0.435	0.480
UA	AW-17	Sulfate, total	mg/L	12	11	92	02/11/2021	11/01/2023	<0.18	1.00	0.730	<0.18
UA	AW-18	Boron, total	mg/L	12	0	0	02/11/2021	11/01/2023	0.330	1.20	1.28	3.00
UA	AW-18	Sulfate, total	mg/L	12	0	0	02/11/2021	11/01/2023	3.20	7.95	10.5	28.0
UA	AW-19	Boron, total	mg/L	12	0	0	02/11/2021	11/01/2023	2.30	2.65	2.71	3.20
UA	AW-19	Sulfate, total	mg/L	12	0	0	02/11/2021	11/01/2023	26.0	36.5	38.8	57.0
UA	AW-20	Boron, total	mg/L	8	0	0	02/11/2021	11/01/2023	2.10	2.30	2.59	3.40
UA	AW-20	Sulfate, total	mg/L	8	0	0	02/11/2021	11/01/2023	39.0	46.5	48.4	59.0
UA	AW-21	Boron, total	mg/L	12	0	0	02/11/2021	11/02/2023	8.70	12.0	11.5	13.0
UA	AW-21	Sulfate, total	mg/L	12	0	0	02/11/2021	11/02/2023	41.0	250	233	280
UA	AW-23	Boron, total	mg/L	6	0	0	11/21/2022	11/03/2023	0.480	0.550	0.542	0.600
UA	AW-23	Sulfate, total	mg/L	6	0	0	11/21/2022	11/03/2023	180	200	200	230
UA	EMW-05	Boron, total	mg/L	6	0	0	11/18/2022	11/03/2023	0.320	0.760	0.835	1.50
UA	EMW-05	Sulfate, total	mg/L	6	0	0	11/18/2022	11/03/2023	120	125	125	130

Notes:
< = less than the method detection limit
CCR = Coal Combustion Residuals
HSU = Hydrostratigraphic Unit
mg/L = milligrams per liter
PMP = Potential Migration Pathway
UA = Uppermost Aquifer

FIGURES



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REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 1,000 2,000 Feet

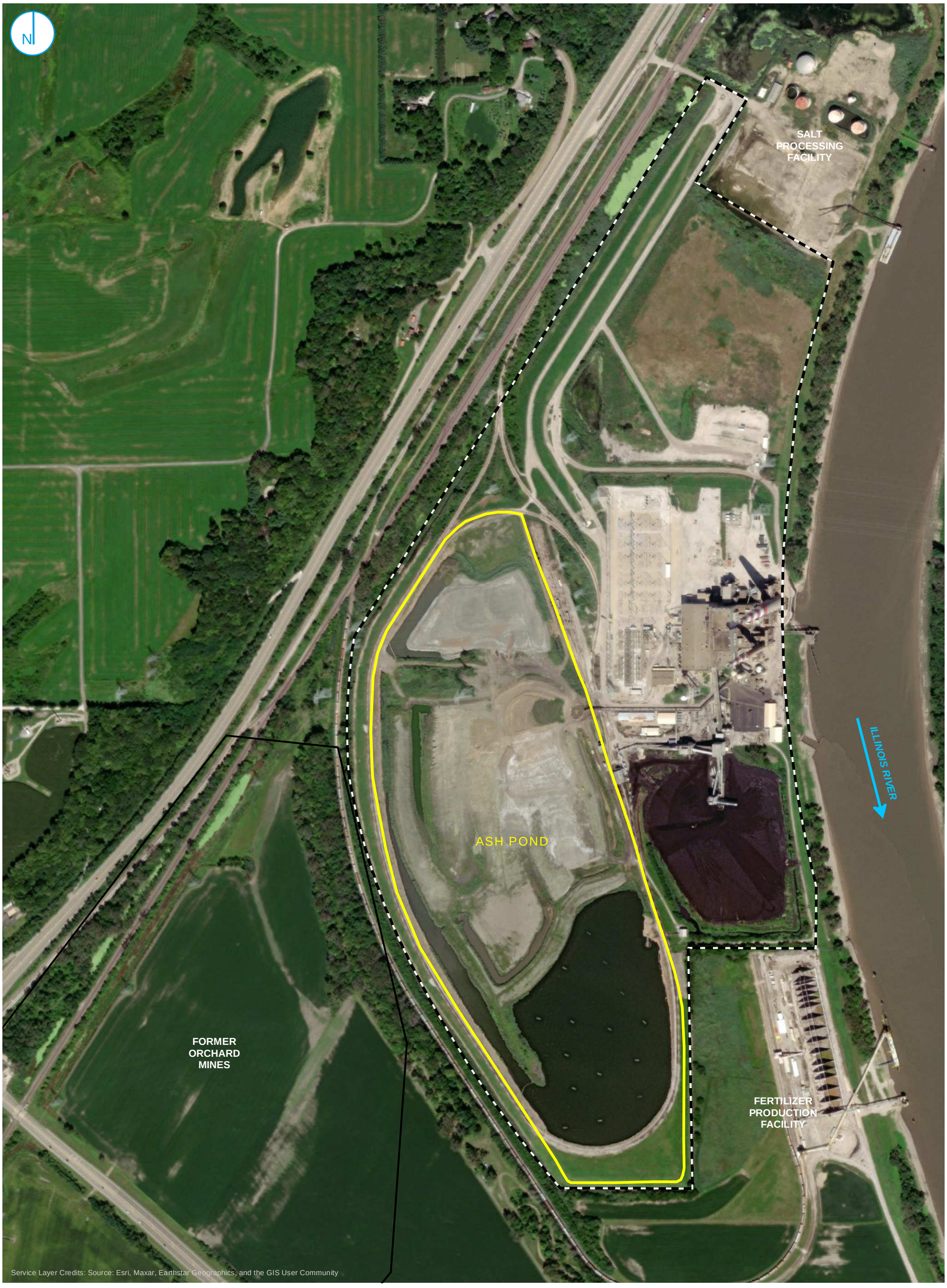
SITE LOCATION MAP

NATURE AND EXTENT REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 2-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



REGULATED UNIT (SUBJECT UNIT)
FORMER ORCHARD MINES AREA
PROPERTY BOUNDARY

0 250 500 Feet

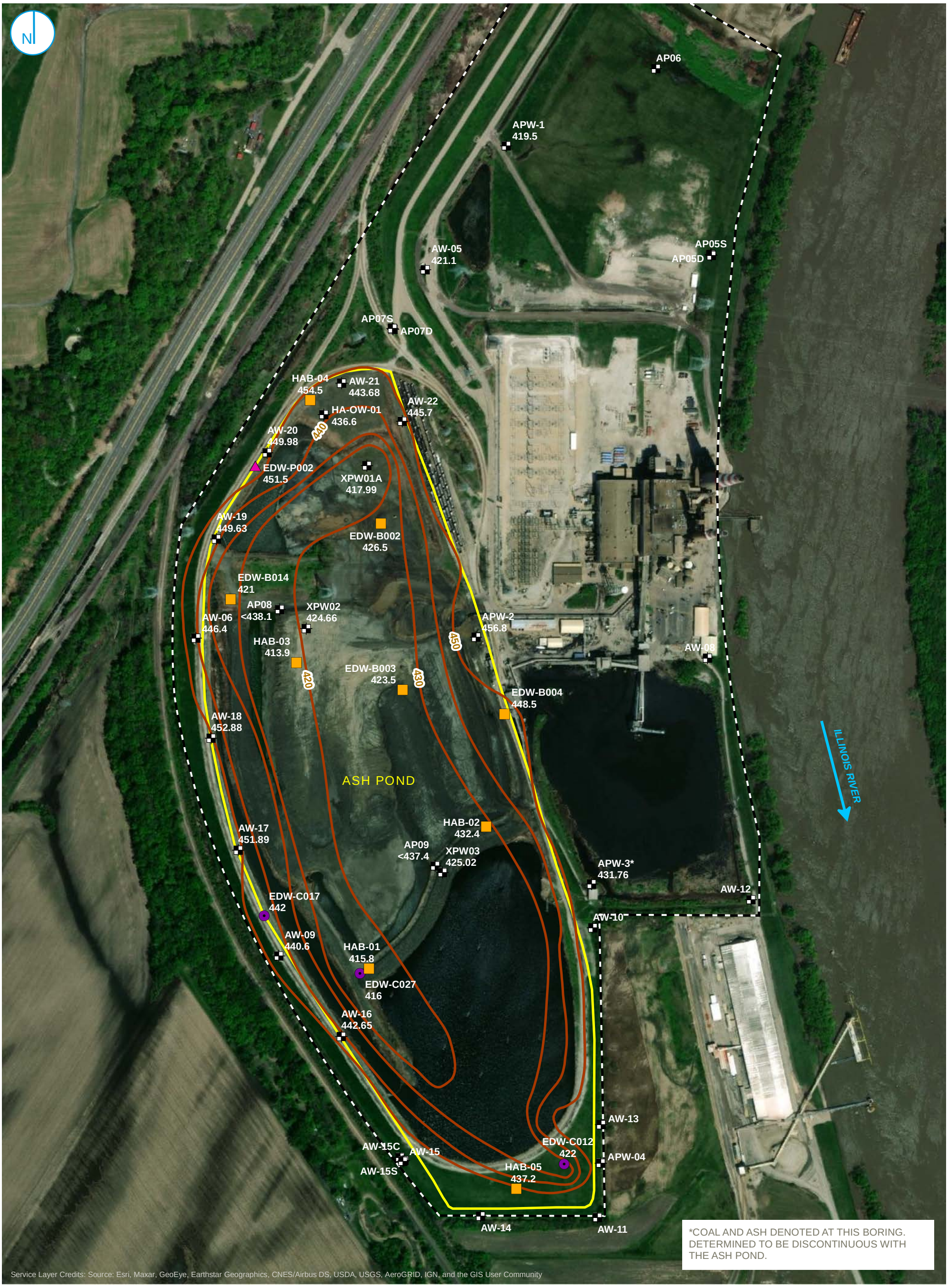
SITE MAP

FIGURE 2-2

NATURE AND EXTENT REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



BORING
MONITORING WELL LOCATION
CPT
PIEZOMETER
BOTTOM OF ASH ELEVATION CONTOUR
REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 200 400 Feet

NOTE:
ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

BASE OF CCR

FIGURE 2-3

NATURE AND EXTENT REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



COMPLIANCE WELL
BACKGROUND WELL
SUPPLEMENTAL WELL
PORE WATER WELL
STAFF GAGE, RIVER
REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 200 400 Feet

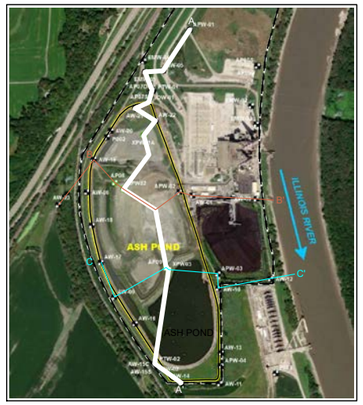
MONITORING WELL LOCATION MAP

FIGURE 2-4

NATURE AND EXTENT REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

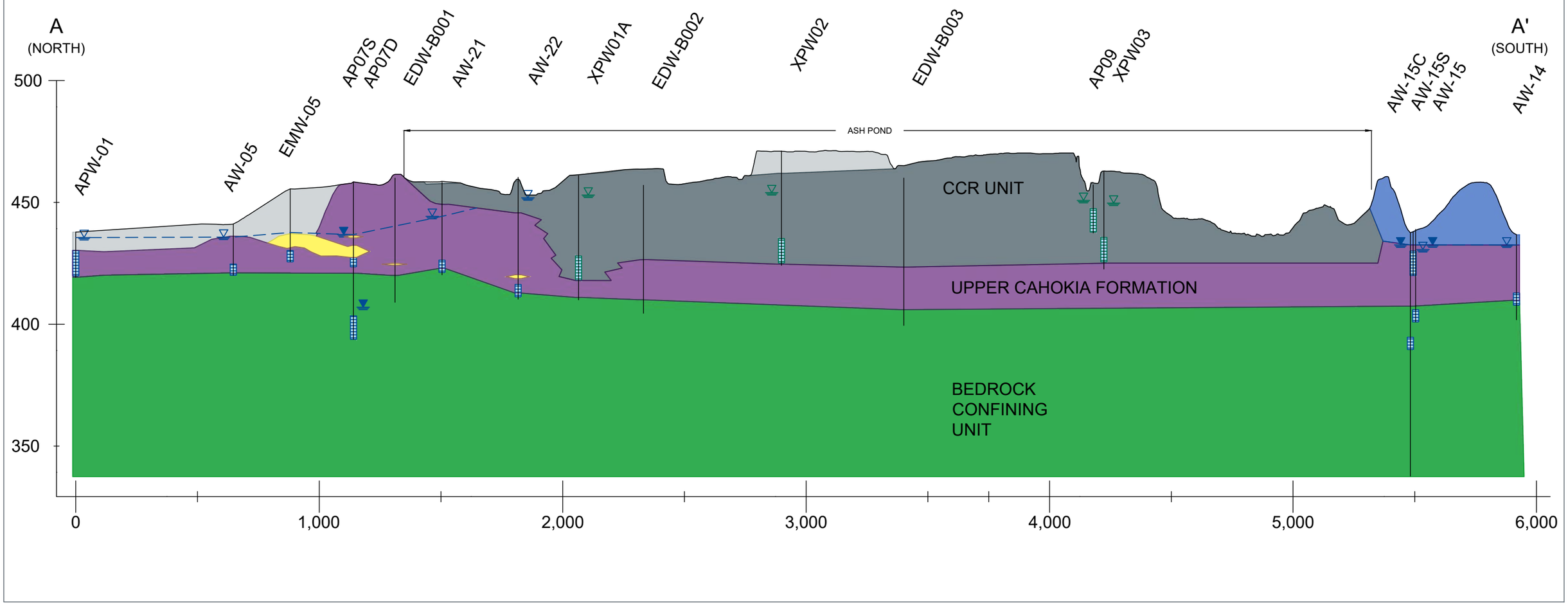
RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



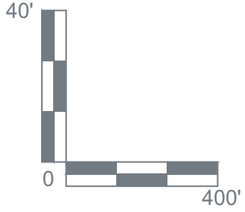
NOTES

1. This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.
2. Scale is approximate.
3. Vertical scale is exaggerated 10X.
4. Groundwater elevations measured February, 2023.



LEGEND

- COAL COMBUSTION RESIDUALS (CCR)
- FILL
- CLAY (CL/CH)
- SILT (ML)
- SAND (SP/SM/SW)
- BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, VERY LITTLE SANDSTONE)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPER AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- BEDROCK GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)



GEOLOGIC CROSS SECTION A-A'

NATURE AND EXTENT REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 2-5

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

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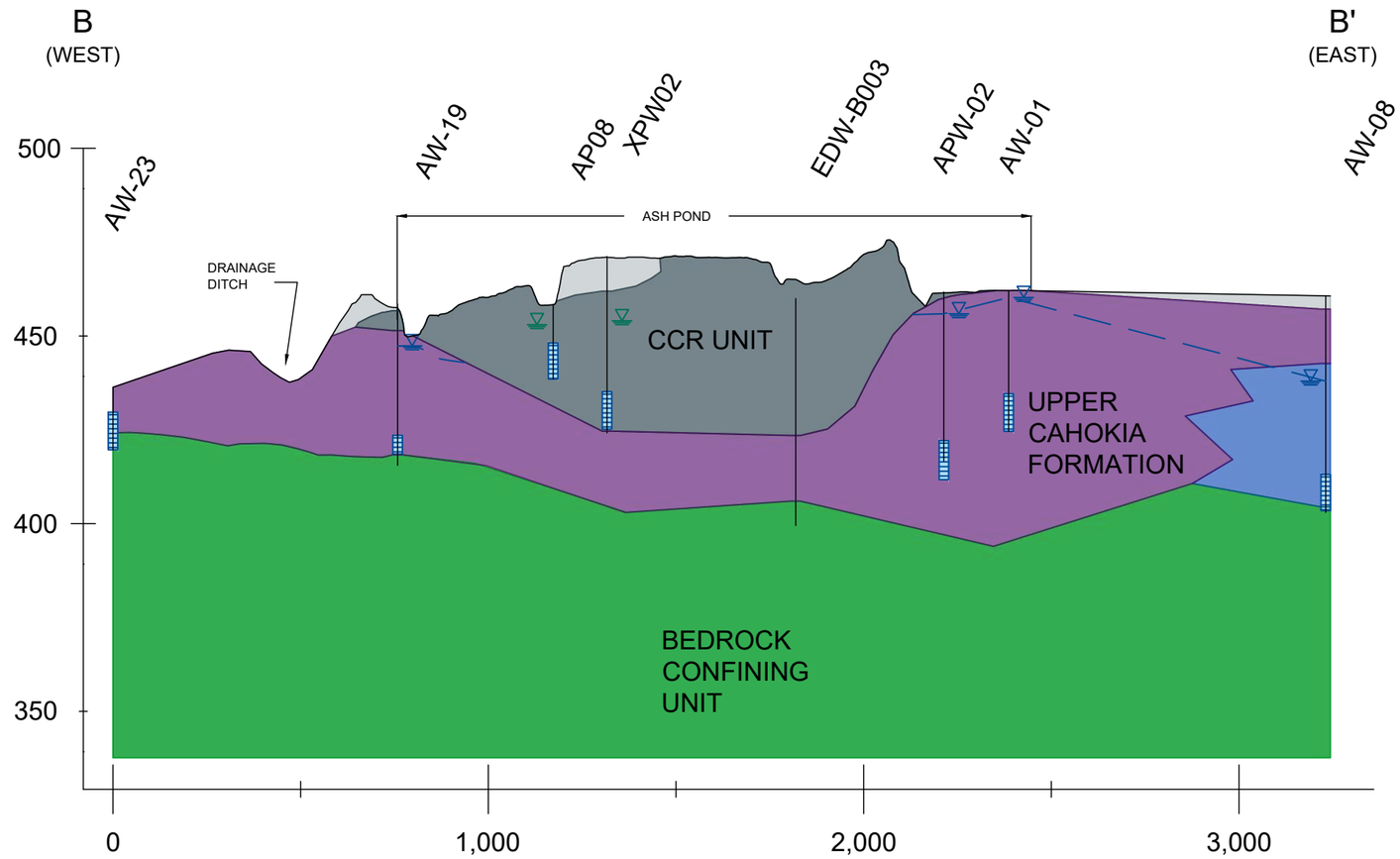
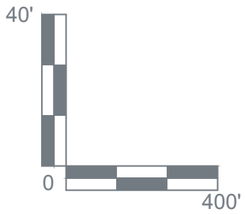
NOTES

1. This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.
2. Scale is approximate.
3. Vertical scale is exaggerated 10X.
4. Groundwater elevations measured February, 2023.



LEGEND

- COAL COMBUSTION RESIDUALS (CCR)
- FILL
- CLAY (CL/CH)
- SILT (ML)
- SAND (SP/SM/SW)
- BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, VERY LITTLE SANDSTONE)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPER AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- BEDROCK GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)



GEOLOGIC CROSS SECTION B-B'

NATURE AND EXTENT REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 2-6

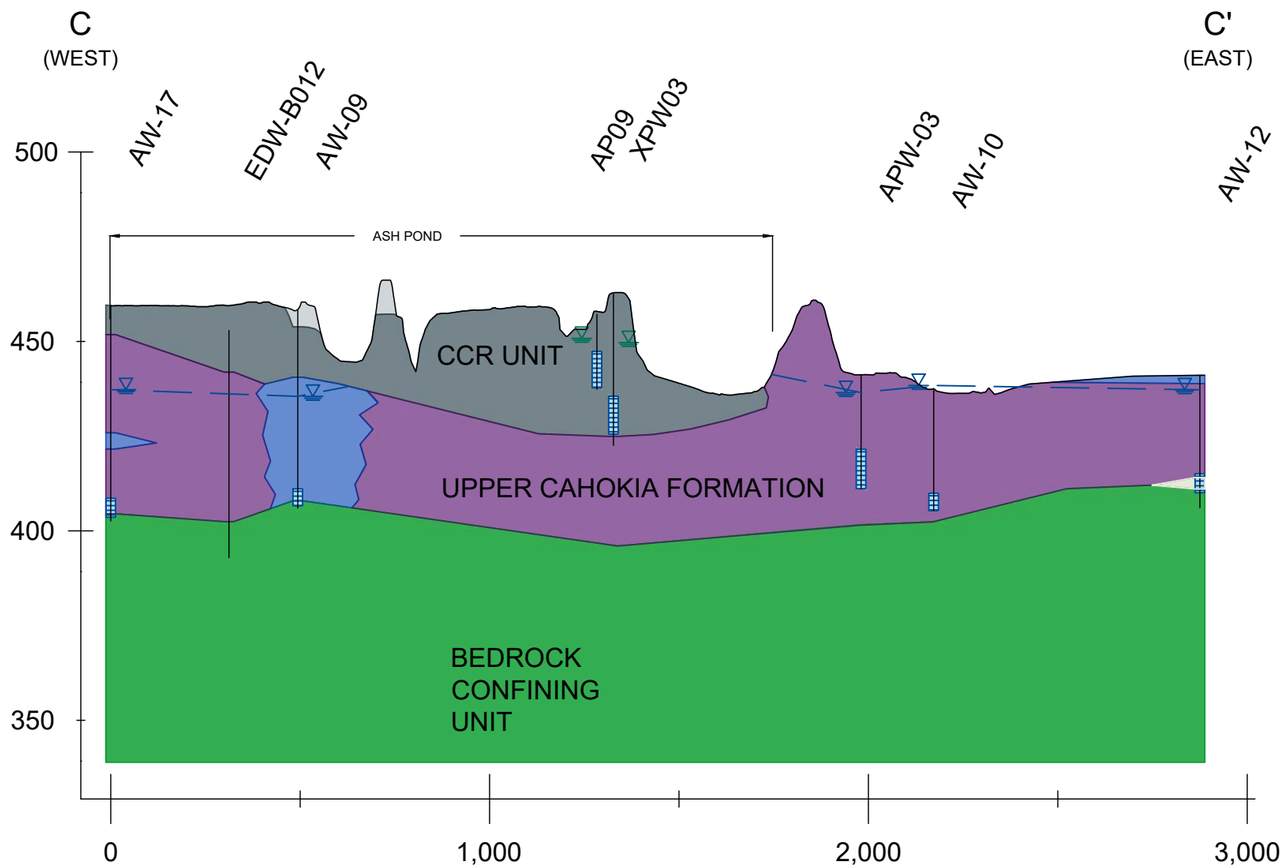
RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



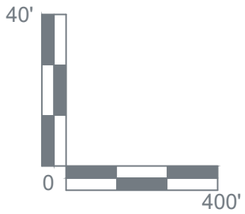
NOTES

1. This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.
2. Scale is approximate.
3. Vertical scale is exaggerated 10X.
4. Groundwater elevations measured February, 2023.



LEGEND

- COAL COMBUSTION RESIDUALS (CCR)
- FILL
- CLAY (CL/CH)
- SILT (ML)
- GRAVEL (GP/GW)
- BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, VERY LITTLE SANDSTONE)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPER AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- BEDROCK GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)



GEOLOGIC CROSS SECTION C-C'

NATURE AND EXTENT REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 2-7

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

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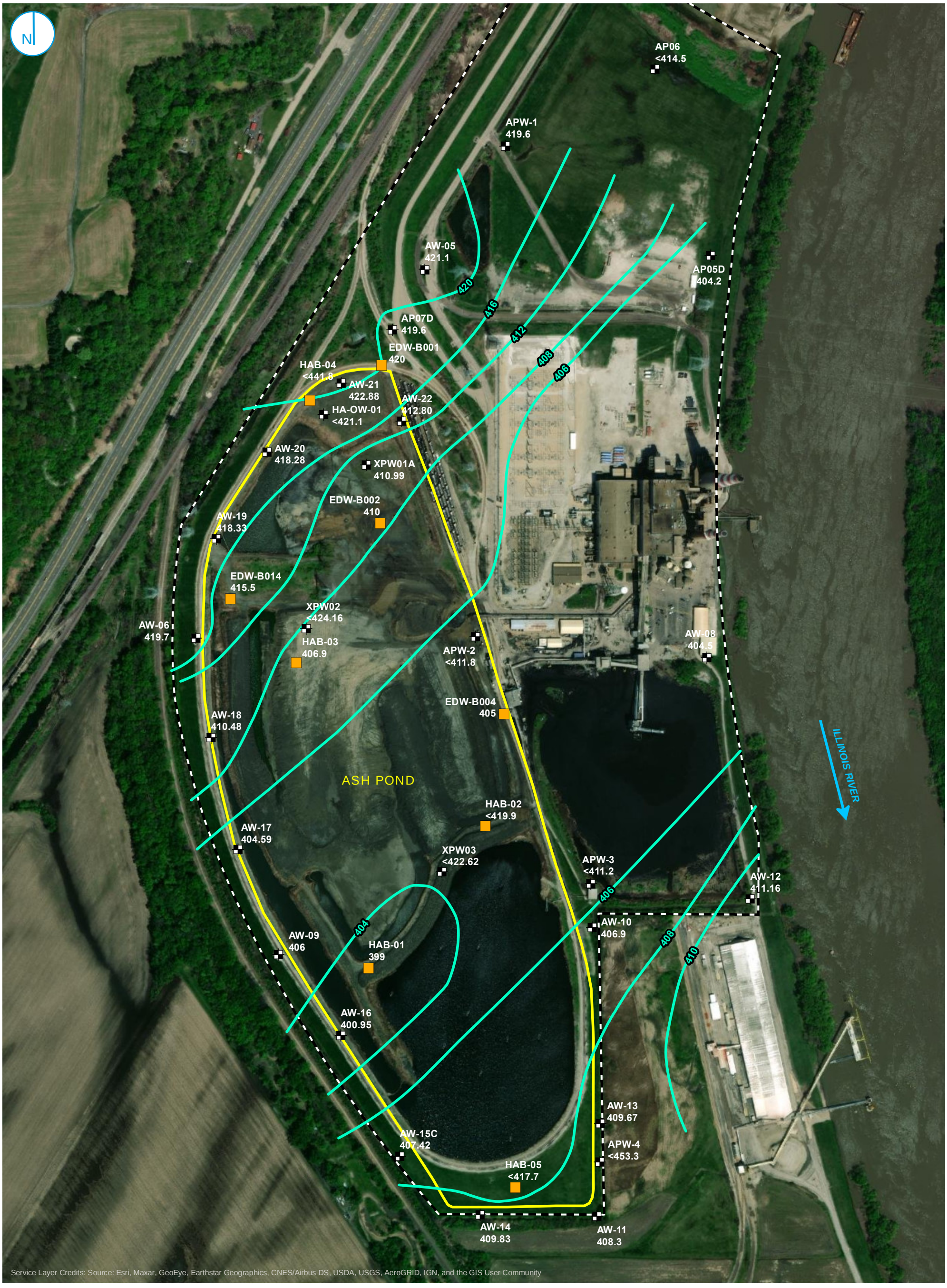


BORINGS
MONITORING WELL
BEDROCK ELEVATION CONTOUR (1-FT INTERVAL)
PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 200 400 Feet

NOTE:
ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

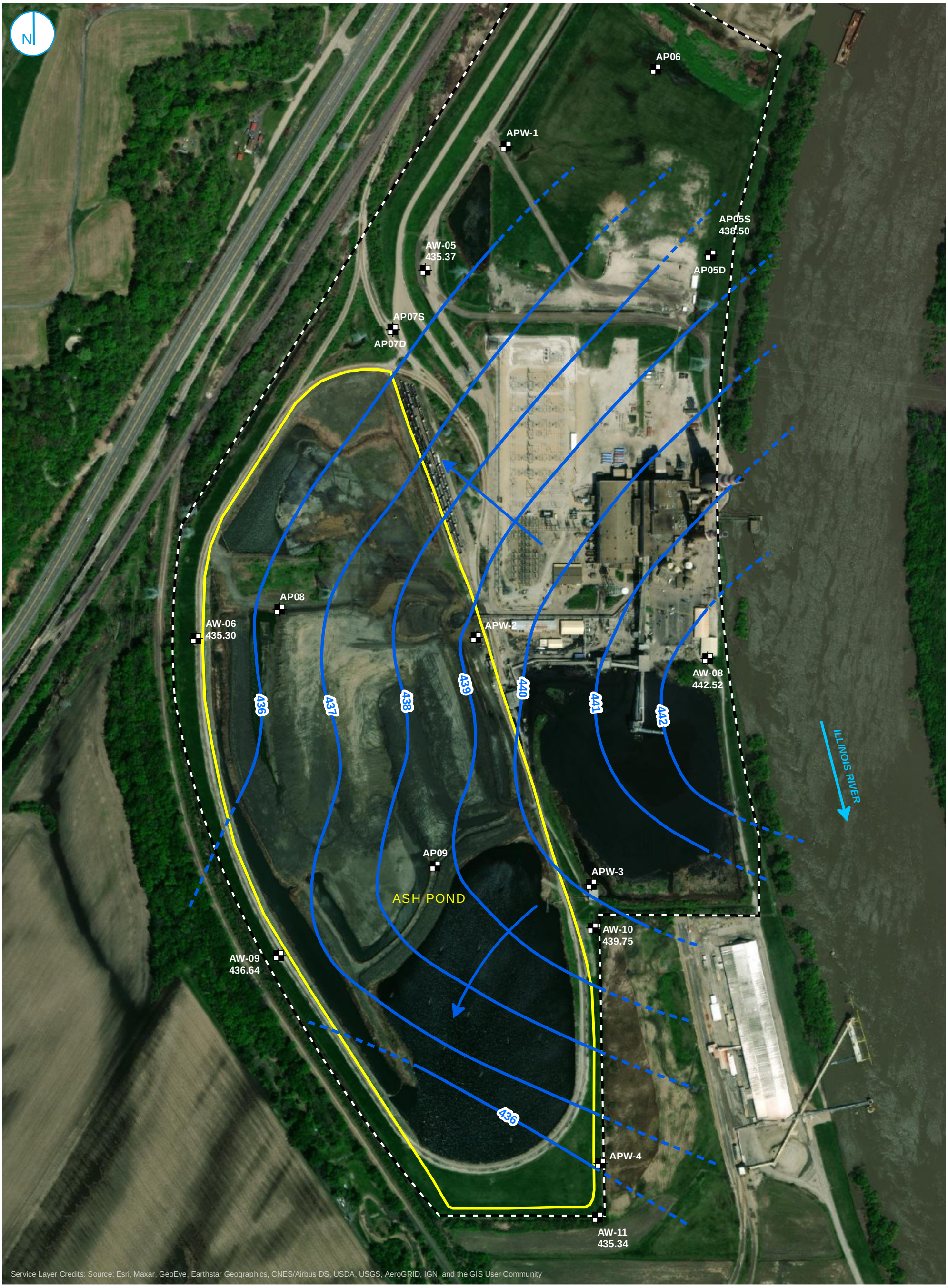
TOP OF BEDROCK

NATURE AND EXTENT REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 2-8

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



MONITORING WELL

INTERPRETED TOP OF UPPERMOST AQUIFER (95TH PERCENTILE GROUNDWATER ELEVATION CONTOURS, 2017)

INFERRED TOP OF UPPERMOST AQUIFER CONTOUR

GROUNDWATER FLOW DIRECTION

REGULATED UNIT (SUBJECT UNIT)

PROPERTY BOUNDARY

0 200 400 Feet

TOP OF UPPERMOST AQUIFER

FIGURE 2-9

NATURE AND EXTENT REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

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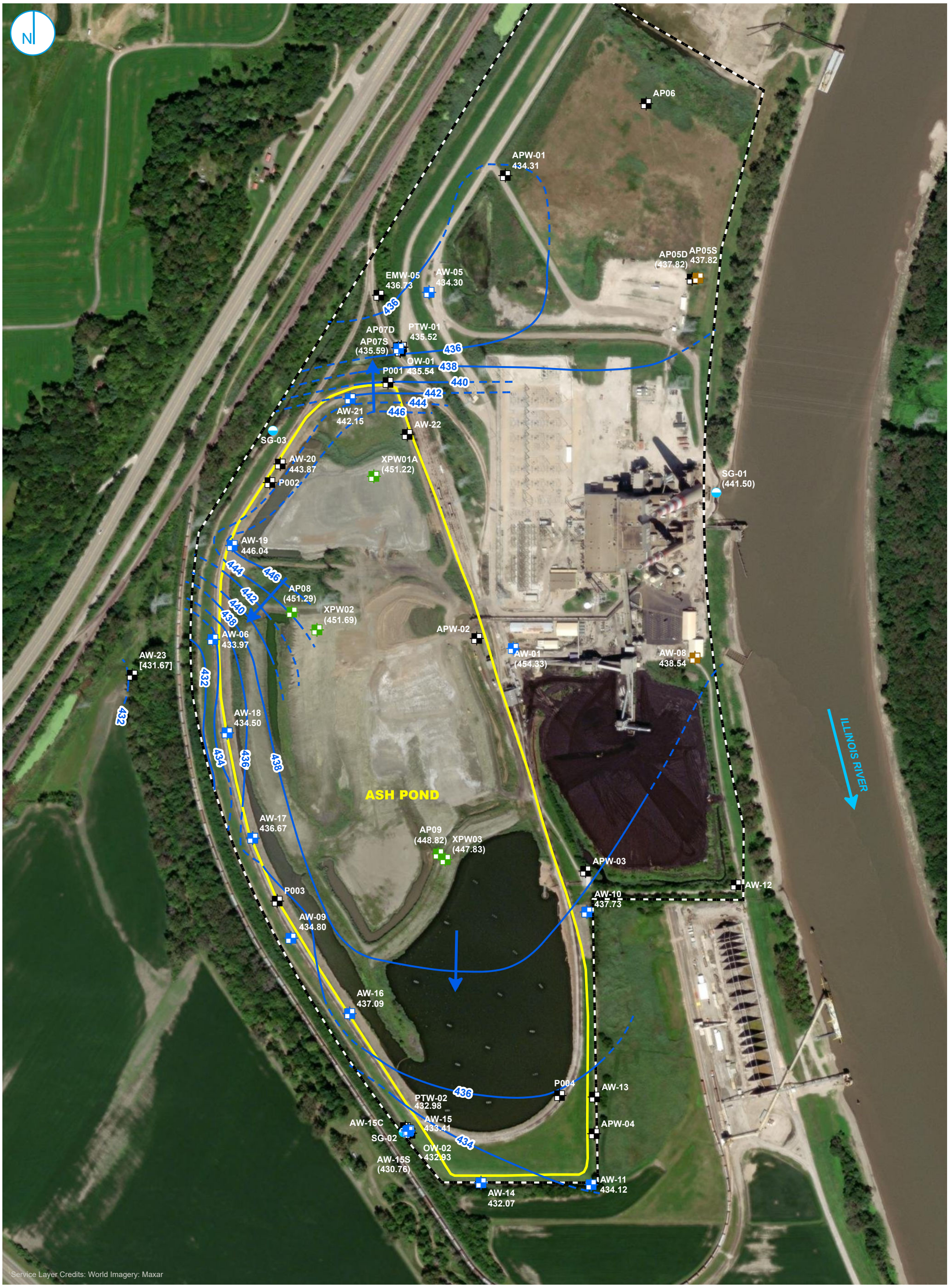

- COMPLIANCE MONITORING WELL
- BACKGROUND MONITORING WELL
- MONITORING WELL
- PORE WATER WELL
- STAFF GAGE, RIVER
- GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- REGULATED UNIT (SUBJECT UNIT)
- PROPERTY BOUNDARY

0 212.5 425 Feet

NOTES
1. ELEVATIONS IN PARENTHESES WERE NOT USED FOR CONTOURING.
2. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)
3. ELEVATIONS IN BRACKETS WERE OBTAINED OUTSIDE OF THE 24-HOUR PERIOD FROM INITIATION OF DEPTH TO GROUNDWATER MEASUREMENTS BUT WITHIN THE SAME SAMPLING EVENT.

UPPERMOST AQUIFER POTENTIOMETRIC SURFACE MAP JUNE 12, 2023 (E001)

NATURE AND EXTENT REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 2-10

RAMBOLL AMERICAS
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- COMPLIANCE WELL WITH TOTAL BORON EXCEEDANCE
- SUPPLEMENTAL WELL WITH TOTAL BORON EXCEEDANCE
- COMPLIANCE WELL WITHOUT EXCEEDANCE
- SUPPLEMENTAL WELL WITHOUT EXCEEDANCE
- REGULATED UNIT (SUBJECT UNIT)
- PROPERTY BOUNDARY

0 212.5 425 Feet

GWPS EXCEEDANCE MAP - UPPERMOST AQUIFER

NATURE AND EXTENT REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 3-1

RAMBOLL AMERICAS
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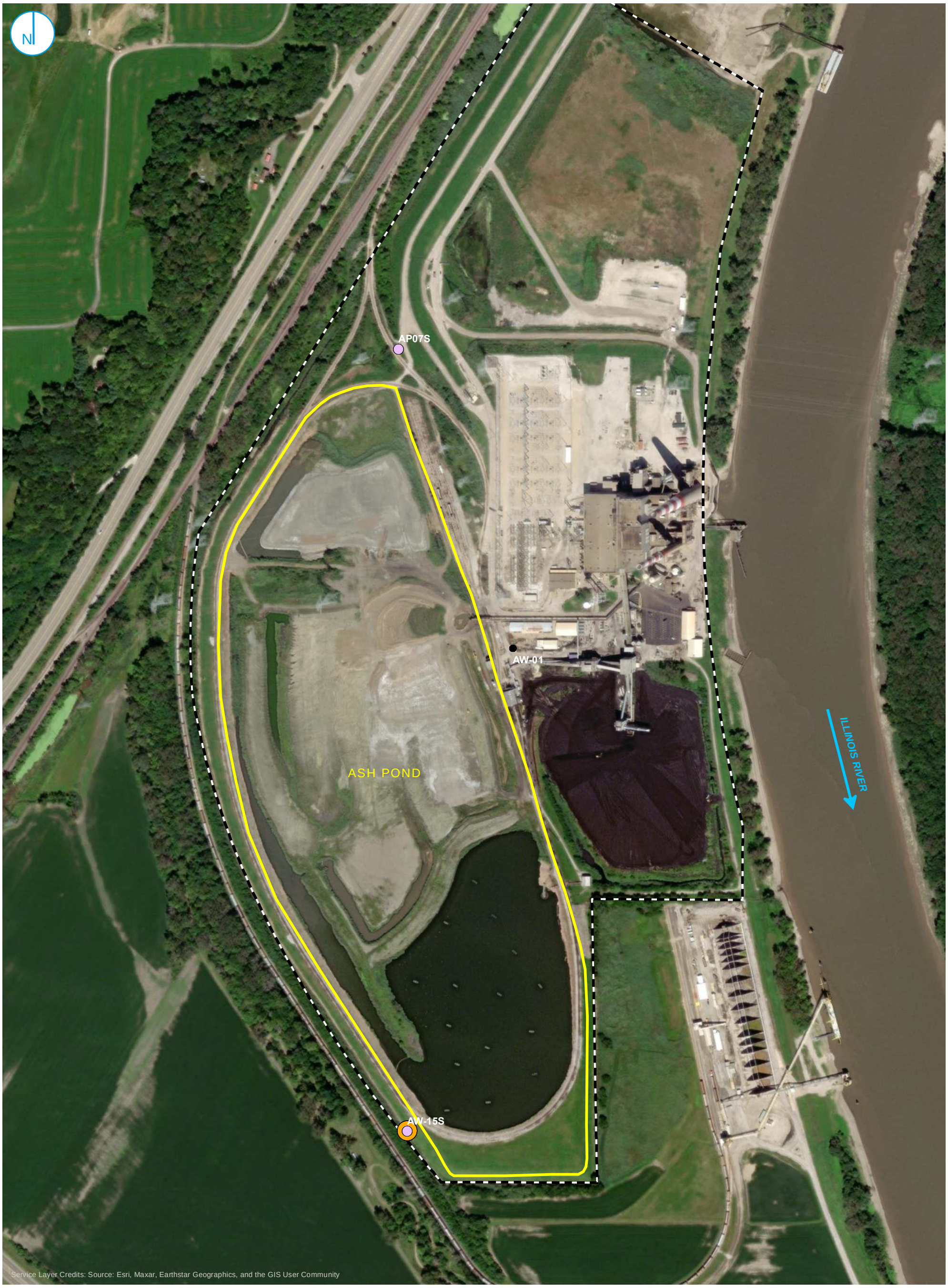
PROJECT: 169000XXXX | DATED: 1/16/2024 | DESIGNER: GALARNMC

Y:\Mapping\Projects\22\2285\MXD\845_AnnualGWM\2023\EDW\Figure 3. EDW GWPS PMP.mxd



TOTAL BORON EXCEEDANCE

TOTAL SULFATE EXCEEDANCE

COMPLIANCE WELL WITHOUT EXCEEDANCE

REGULATED UNIT (SUBJECT UNIT)

PROPERTY BOUNDARY

0 212.5 425 Feet

GWPS EXCEEDANCE MAP
POTENTIAL MIGRATION PATHWAY

NATURE AND EXTENT REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 3-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

APPENDICES

APPENDIX A
CCR Geotechnical and Analytical Results

TABLE 2-1. GEOTECHNICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Field Location ID	Top of Sample (ft bgs)	Bottom of Sample (ft bgs)	Moisture Content (%)	Dry Density (pcf)	Specific Gravity	Total Porosity [1]	Vertical Hydraulic Conductivity (cm/s)	LL	PL	PI	Laboratory USCS	Gravel (%)	Sand (%)	Fines (%)
CCR															
XPW01 (20-22)	XPW01	20	22	43.7	69.8	2.381	53%	1.18E-05	51	53	NP	SM	0	68.9	31.1
XPW01A (41-41.5)	XPW01A	41	41.5	35.1	71.7	2.378	52%	6.77E-06	60	43	17	MH	0	13.7	86.3
XPW02 (10-12)	XPW02	10	12	45.1	67.5	2.414	55%	1.20E-05	52	47	5	MH	0.5	28.1	71.4
XPW02 (22-24)	XPW02	22	24	33.4	77.1	2.335	47%	2.08E-06	38	30	8	ML	0	4.1	95.9
XPW02 (45.5-46.5)	XPW02	45.5	46.5	41.7	73.5	2.397	51%	1.00E-05	39	33	6	ML	0.1	37.4	62.5
XPW03 (10-12)	XPW03	10	12	43.8	68	2.388	54%	3.29E-05	36	29	7	ML	0.4	27.2	72.4
Upper Cahokia Formation															
AW-13A (5-7)	AW-13A	5	7	25.2	96.5	2.661	42%	4.72E-08	30	14	16	CL	0	30.3	69.7
AW-15 (20-22)	AW-15	20	22	27.9	85.8	2.694	49%	2.87E-08	57	19	38	CH	0	2.0	98
AW-20 (15-17)	AW-20	15	17	35.1	83.9	2.690	50%	7.23E-08	47	18	29	CL	0	7.8	92.2
AW-22 (30-32)	AW-22	30	32	23.2	101.3	2.700	40%	1.74E-07	22	13	9	SC	0	57.4	42.6

[O:LTA 7/13/21, U: SSW 08/13/21; C:CJC 08/16/21; U: LDC 09/16/21; C: SSW 09/16/21]

Notes:

[1] Porosity calculated as relationship of bulk density to particle density ($n = 100[1- (p_b/p_d)]$)
bgs = below ground surface
% = Percent
CCR = coal combustion residuals
cm/s = centimeters per second
ft = foot/feet
LL = Liquid limit
NP = Non Plastic
pcf = pounds per cubic foot
PI = Plasticity Index
PL = Plastic Limit

USCS = Unified Soil Classification System
CH = Fat Clay
CL = Lean Clay
MH = Elastic Silt
ML = Silt
SC = Clayey Sand
SM = Silty Sand
SP = Poorly Graded-Sand

TABLE 2-2. ASH ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Sample Location	Sample Depth (ft BGS)	Sample Date	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Boron (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Lead (mg/kg)	Lithium (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Selenium (mg/kg)	Thallium (mg/kg)
XPW01	17-19	01/08/2021	<6.6	24	840	4	170	7.5	67	11	90	47	<0.44	25	4.9	<2.2
XPW01A	40.5-42.5	01/08/2021	<7	22	190	4.7	700	11	37	4.7	93	<12	<0.46	11	4	<2.3
XPW02	24-25	01/09/2021	20	72	160	6.8	400	2.3	60	19	76	20	<0.32	7	5.5	<1.6
XPW02	43-45	01/09/2021	8.9	42	94	8.3	840	8.5	84	19	140	<91	<0.36	14	6.5	2.1
XPW03	13-15	01/09/2021	<5.5	8	1300	2.2	500	<1.8	27	6.1	14	33	<0.37	3.2	2.2	<1.8
XPW03	35-37	01/09/2021	<7	37	600	5.8	970	20	65	8	130	20	<0.47	11	3.6	<2.3

Notes:
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method.
BGS = below ground surface
ft = feet
mg/kg = milligrams per kilogram

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APPENDIX B
2023 Supplemental Site Investigation Report

Prepared for

Illinois Power Resources Generating, LLC

Date

December 1, 2023

Project No.

1940102792

2023 SUPPLEMENTAL SITE INVESTIGATION REPORT

ASH POND

EDWARDS POWER PLANT

BARTONVILLE, ILLINOIS

RAMBOLL Bright ideas. Sustainable change.

2023 SUPPLEMENTAL SITE INVESTIGATION REPORT
EDWARDS POWER PLANT ASH POND

Project name	**Edwards Power Plant Ash Pond**
Project no.	**1940102792**
Recipient	**Illinois Power Resources Generating, LLC**
Document type	**Supplemental Site Investigation Report**
Version	**FINAL**
Date	**December 1, 2023**
Prepared by	**Rachel A. Banoff, EIT**
Checked by	**Nathaniel R. Keller**
Approved by	**Brian G. Hennings, PG**
Description	**Supplemental Site Investigation Report**

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

T 414-837-3607
F 414-837-3608
https://ramboll.com



Rachel A. Banoff, EIT
Environmental Engineer



Brian G. Hennings, PG
Project Officer

CONTENTS

1.	**Introduction**	**3**
1.1	Overview	3
1.2	Site Location and Background	3
1.3	Conceptual Site Model	3
2.	**Hydrogeologic Evaluation Field Activities**	**5**
2.1	Drilling and Well Installation Methods	5
2.2	Monitoring and Observation Well Installation	5
2.3	Pumping Well Installation	6
2.4	Well Development	6
2.5	Monitoring Well Sampling	6
3.	**Pump Test Evaluation**	**7**
4.	**Additional Site Characterization**	**8**
4.1	Geologic Characterization	8
4.2	Hydrogeologic Characterization	8
4.3	Analytical Results	8
5.	**Potential Receptors Analysis**	**10**
6.	**Summary**	**12**
7.	**References**	**13**

TABLES (ATTACHED)

Table 2-1	Well Locations and Construction Details
Table 2-2	Groundwater Elevations
Table 4-2	Analytical Results - Groundwater

FIGURES (ATTACHED)

Figure 1-1	Site Location Map
Figure 1-2	Site Map
Figure 1-3	Potentiometric Surface Map, February 16, 2022
Figure 1-4	Monitoring Well Location Map
Figure 4-1	Geologic Cross-Sections A-A’
Figure 4-2	Geologic Cross-Sections B-B’
Figure 4-3	Geologic Cross-Sections C-C’
Figure 4-4	Potentiometric Surface Map, February 27, 2023
Figure 4-5	Boron Concentrations in Groundwater - Quarter 1, 2023
Figure 5-1	Drinking Water Intakes, Pumps, and Other Water Uses

APPENDICES

Appendix A	Third-Party Letters and Access Requests
Appendix B	Soil Boring Logs
Appendix C	Monitoring Well Construction Logs
Appendix D	Well Development Forms
Appendix E	Groundwater Sampling Records
Appendix F	Analytical Laboratory Reports
Appendix G	Pump Test Memorandum
Appendix H	IEPA No Further Remediation Letter

ACRONYMS AND ABBREVIATIONS

35 I.A.C.	Title 35 of the Illinois Administrative Code
40 C.F.R.	Title 40 of the Code of Federal Regulations
AP	Ash Pond, also referred to as Site
bgs	below ground surface
CCR	coal combustion residuals
CMA	Corrective Measures Assessment
CRT	constant-rate test
CSM	conceptual site model
DO	dissolved oxygen
EPP	Edwards Power Plant
ft^2/d	feet square per day
GPRS	Ground Penetrating Radar Systems
gpm	gallons per minute
GWPS	groundwater protection standard
HCR	Hydrogeologic Site Characterization Report
ID	identification
IEPA	Illinois Environmental Protection Agency
IPRG	Illinois Power Resources Generating, LLC
JULIE	Joint Utility Locating Information Excavators
MET	Midwest Engineering and Testing, Inc.
mg/L	milligrams per liter
NAVD88	North American Vertical Datum of 1988
NID	National Inventory of Dams
No.	number
NRT	Natural Resource Technology
NRT/OBG	Natural Resource Technology, an OBG Company
NTU	Nephelometric Turbidity Units
Pace	Pace Analytical Services, LLC
PMP	potential migration pathway
PVC	polyvinyl chloride
Ramboll	Ramboll Americas Engineering Solutions, Inc.
SAP	Multi-Site Sampling and Analysis Plan
SI	surface impoundment
SSI	Supplemental Site Investigation
UA	uppermost aquifer
USCS	Unified Soil Classification System

1. INTRODUCTION

1.1 Overview

Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this Supplemental Site Investigation (SSI) report on behalf of Edwards Power Plant (EPP), operated by Illinois Power Resources Generating, LLC (IPRG), to document SSI efforts and additional groundwater monitoring completed in September 2021 through February 2023.

This SSI report applies specifically to the coal combustion residuals (CCR) surface impoundment (SI) referred to as the Ash Pond (AP) (CCR unit identification [ID] Number [No.] 301, Illinois Environmental Protection Agency [IEPA] ID No. W1438050005-01, and National Inventory of Dams [NID] No. IL50710). The AP is a 91-acre unlined CCR SI used to manage CCR and non-CCR waste streams at the EPP.

Sampling completed to establish background in accordance with Title 35 of the Illinois Administrative Code (35 I.A.C) § 845.600 found potential exceedances of boron above the anticipated site-specific groundwater protection standard (GWPS) associated with the AP as provided in the Initial Operating Permit (Burns & McDonnell, 2021). The objective of this SSI was to further assess the nature, degree, and extent of boron groundwater impacts downgradient (west and north) of the AP. This includes wells installed by Golder in 2021, as well as the expansion of the study area onto an adjacent property west of the Site. Field efforts documented in this report include groundwater monitoring well installation, aquifer testing to further characterize the hydraulic conductivity of the uppermost aquifer (UA), and groundwater analytical sampling from the monitoring well network.

1.2 Site Location and Background

The EPP is located in Peoria County between Mapleton and Bartonville, Illinois in Section 11, Township 7 North, Range 7 East (**Figure 1-1**). The EPP is located on the floodplain of the Illinois River adjacent to a levee and has one CCR SI, the AP.

The EPP is situated in a predominantly agricultural area with industrial properties bordering the property. Historically, several coal mines were operated at depths of 100 to 160 feet below ground surface (bgs) in the vicinity of the EPP. The EPP property is bordered by a salt processing facility to the north, railroad right-of-way and former Orchard Mines to the west, the Illinois River and a fertilizer production facility to the east, and agricultural land to the south. **Figure 1-1** shows the location of the EPP and surrounding area; **Figure 1-2** is a site map showing the location of the AP. The AP will hereinafter be referred to as the Site.

1.3 Conceptual Site Model

Multiple site investigations have been completed at the EPP to characterize the geology, hydrogeology, and groundwater quality as required by Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.91 (Groundwater Monitoring Systems). The AP has been well characterized and detailed in the Hydrogeologic Site Characterization Report (HCR) (Ramboll, 2021) [https://www.luminant.com/ccr/illinois-ccr/?dir=il-ccr%2FEdwards%2F2021], that was included with the Operating Permit application submitted to IEPA. The HCR was prepared to comply with the requirements specified in 35 I.A.C. § 845.620 and expands upon the Hydrogeologic

Monitoring Plan (Natural Resource Technology, an OBG Company [NRT/OBG], 2017). A conceptual site model (CSM) has been developed and is discussed below.

The Site is characterized by four distinct water bearing units:

- **CCR:** Saturated CCR consisting primarily of fly ash within the AP. CCR is present at thicknesses up to 46.5 feet and at elevations as low as 413.9 feet North American Vertical Datum of 1988 (NAVD88) in the central and northern portion of the AP.
- **Upper Cahokia Formation/Potential Migration Pathway (PMP):** Low permeability clays and silts of the Upper Cahokia Formation are present at the surface. This unit is considered a PMP at elevations similar to the base of the AP, and in places where thin discontinuous sand lenses occur within the Upper Cahokia Formation adjacent to the AP.
- **Uppermost Aquifer (UA):** Thin (generally less than 4 feet), moderate permeability sand, silty sand, and clayey gravel material within the Lower Cahokia Formation, bedrock, and/or weathered shale bedrock, where present. In locations where higher permeability materials and coarser grained materials are absent, the UA is interpreted as the interface between the Lower Cahokia Formation and shale bedrock.
- **Bedrock Confining Unit:** Thick, very low permeability shales and siltstones of the Carbondale and Modesto Formations. This unit was encountered at elevations ranging from approximately 400 to 422 feet NAVD88 with higher bedrock elevations occurring beneath the northern portion of the AP.

In general, the Upper Cahokia Formation consists of low permeability clays and silts, with limited occurrences of thin discontinuous sand lenses. In several locations, generally near the southern and western portions of the unit, coarser grained materials are present at the base of the Lower Cahokia Formation and/or the top of the bedrock is weathered, resulting in relatively higher hydraulic conductivities. Because the interface is laterally continuous, and has relatively higher conductivity, the unlithified/lithified contact was designated as the UA.

Occasional sand lenses within the Upper Cahokia Formation, and clay intervals downgradient at elevations similar to the base of ash in the AP were identified as PMPs. The underlying bedrock is interpreted as the lower confining unit and, in general, has hydraulic conductivities an order of magnitude lower than those measured in the UA.

Groundwater occurs within both the unlithified materials and bedrock and consistently flows from east to west/southwest at the central portion of the AP towards what is interpreted as a former channel of the Illinois River, and south/southeast at the south end of the AP (**Figure 1-3**). In the northernmost portion of the AP, there is a minor northwest and northern component of flow in both the UA and PMP. The unlithified/lithified contact designated as the UA onsite may be hydraulically connected to the sands of the Sankoty Aquifer identified offsite (Ramboll, 2022). Upward vertical gradients have been calculated between the bedrock and the UA, indicating the Illinois River may be the receiving body of water for groundwater in bedrock near the AP.

Additional monitoring wells were installed in 2021 and 2022 and groundwater samples were collected from the newly installed wells and existing wells within the 35 I.A.C § 845 network. The additional monitoring wells were installed for further hydrogeologic investigation and water quality delineation. Monitoring well locations are shown on **Figure 1-4**.

2. HYDROGEOLOGIC EVALUATION FIELD ACTIVITIES

Investigation activities completed between 2009 and February 2023 are discussed herein. Recent investigations were completed to the north and west in response to boron exceedances that have been identified in groundwater migrating in those directions. This report documents field activities completed to provide further delineation of the extent of boron in groundwater and characterize hydrogeologic conditions at the Site.

The following sections summarize the field activities completed to further delineate the extent of boron in groundwater between February 2022 and February 2023. Prior to field activities in 2022, IPRG sent letters to owners of adjacent properties requesting access to install wells and evaluate the extent of boron concentrations (**Appendix A**). A response was received from only one property owner located west of the AP. One well (AW-23) was installed on this property in October 2022. An additional four wells, including two observation wells (OW-01, OW-02) and two pumping wells (PTW-01, PTW-02) were installed during October 2022 to facilitate aquifer testing in the UA.

Further delineation of the boron concentrations was provided by pre-existing wells that were installed by Golder (AW-01 and EMW-05) as shown on **Figure 1-4**. These wells were previously installed in September 2021 and were incorporated into the supplemental site investigation to evaluate the extent of boron concentrations along northern and eastern edges of the AP.

2.1 Drilling and Well Installation Methods

For wells installed in 2022, Ramboll retained Midwest Engineering and Testing, Inc. (MET), a licensed drilling contractor in the state of Illinois, to advance soil borings and install monitoring wells at each boring location. Prior to drilling, all locations were cleared by Joint Utility Locating Information Excavators (JULIE) and Ground Penetrating Radar Systems (GPRS). GPRS utilized an underground scanning ground penetrating radar antenna and an electromagnetic pipe and cable locator to clear a 30-foot radius around each planned boring location.

A drill rig mounted onto an all-terrain vehicle was used to advance the borings. Borings were drilled using a hollow-stem auger. Soil lithology was logged in accordance with the Unified Soil Classification System (USCS) and other observations were noted in the attached boring logs (**Appendix B**). The wells were completed at depths ranging from 16 to 39.5 feet bgs. Well construction details are provided in **Table 2-1**.

2.2 Monitoring and Observation Well Installation

The monitoring and observations wells were constructed using 2-inch diameter, Schedule 40 polyvinyl chloride (PVC) casing and set with a ten-foot PVC screen (five-foot PVC screen at well EMW-05) with a slot width of 0.010 inches. Monitoring well AW-23 was installed with a sand pack around the screen extending to approximately one foot above the top of the screen. Monitoring wells AW-01 and EMW-05 were installed with a sand pack around the screen extending to approximately two feet above the top of the screen. The observation wells were installed with a sand pack around the screen extending to approximately three feet above the top of the screen and at observation well OW-01, approximately two feet of #45-55 fine-grained sand was placed above the sand pack The wells were sealed with bentonite chips or a high solids bentonite grout extending to the ground surface. Riser pipes extend an estimated two feet (AW-23) or three feet (OW-01 and OW-02) above the ground surface and are protected with steel casing, a cement

pad, and three steel bollards. Riser pipes for wells AW-01 and EMW-05 extend an estimated two feet above the ground surface and are protected with aluminum casing, a cement pad, and three steel bollards. Wells are protected from vandalism via J-plug caps and locks. Refer to **Table 2-1** for well construction details. Monitoring well construction forms are included in **Appendix C**.

2.3 Pumping Well Installation

The pumping wells (PTW-01 and PTW-02) were constructed using 4-inch diameter, Schedule 40 PVC casing and set with a ten-foot PVC screen with a slot width of 0.010 inches. A sand pack of #5 sand was placed around the screen extending approximately three feet above the top of the screen at pumping well PTW-01 and five feet above the top of the screen at pumping well PTW-02. In addition, at pumping well PTW-01, two feet of a finer grain sand was placed above the coarse sand pack. The wells were sealed with bentonite chips extending to the ground surface. The riser extends to approximately three feet above the ground surface and is protected with steel casing, a cement pad, and three steel bollards. The wells are protected from vandalism with J-plug caps and locks.

2.4 Well Development

Ramboll developed all monitoring, observation, and pumping wells via submersible pump. Development was completed a minimum of 24 hours following well installation. Wells were surged and pumped until the turbidity was below 100 Nephelometric Turbidity Units (NTU) or at least five well volumes were extracted. Geochemical field parameters (pH, dissolved oxygen [DO], temperature, specific conductance) were also monitored and logged throughout the development process. The volume of water extracted and the depth to water in the well prior to and after development was noted on the well development forms, included in **Appendix D**.

2.5 Monitoring Well Sampling

Three rounds of initial groundwater sampling were performed monthly at AW-01, AW-23, and EMW-05 from November 2022 through January 2023 in accordance with the Multi-Site Sampling and Analysis Plan (SAP) (Ramboll, 2022a). These events were supplemented by sampling that occurred in February 2023. Sampling was performed using a low-flow sampling method. Episodic water level readings were taken on the last day of sample collection for the November and December 2022 sampling events, while the readings for the January 2023 sampling event were taken prior to the first day of sample collection. Groundwater elevation readings from the initial rounds along with additional groundwater elevation readings from February 2023 are included in **Table 2-2**. Groundwater sampling field forms including purge records for the initial three rounds are included in **Appendix E** and the February 2023 purge records are included along with the analytical laboratory reports in **Appendix F**.

3. PUMP TEST EVALUATION

Following installation and development of PTW-01 and PTW-02, constant-rate tests (CRTs) were performed at pumping well PTW-01 on October 25 and October 26, 2022, and at PTW-02 on October 28, 2022. Water levels were monitored during the tests in nearby observation and monitoring wells by in-well pressure transducers throughout the length of the tests.

The constant-rate tests performed at wells PTW-01 and PTW-02 did not fully identify appropriate well yields due to continued drawdown at pumped rates of 0.25 gallons per minute (gpm) and 1 gpm. Lower pumping rates were not sustainable with the field equipment utilized and the constant rate tests were terminated early due to the drawdown and presence of methane gas in both of the pumping wells. Sustainable yield at these locations may be much lower than the tested rates. However, measurable drawdown was identified at nearby observation wells and used to develop estimates of transmissivity and storativity for the geologic materials near the tested locations. Transmissivity calculated from the two pump tests ranged from 19 to 52 feet square per day (ft^2/d) and storativity ranged from 1.1×10^{-3} to 5×10^{-3}. Detailed information on the pump test procedures and results are included in **Appendix G**.

4. ADDITIONAL SITE CHARACTERIZATION

4.1 Geologic Characterization

The lithology encountered during drilling of additional locations is documented in the attached boring logs (**Appendix B**) and visualized using geologic cross sections (**Figures 4-1, 4-2, and 4-3**). Consistent with previous investigations and the HCR (Ramboll, 2021), the following units were observed in investigation borings:

- The shallowest lithologies observed were clays and/or silts and are interpreted as the Upper Cahokia Formation. The formation is generally characterized by lean and fat clays with siltier portions along the southern portion of the Site (Ramboll, 2021). Thin discontinuous sand lenses (less than 5 feet) were noted in two locations (EMW-05 and PTW-01). These materials are considered PMPs within the study area and were encountered at depths of 19 feet bgs (EMW-05) and 30 feet bgs (PTW-01) within the advanced borings.
- The weathered bedrock interface between the Cahokia Formation and bedrock confining unit of the Carbondale and Modesto Formations was observed to be from 1.5 feet (PTW-01) to 2.5 feet thick (PTW-02) at borings that encountered its entire interval. Moderate permeability sand, silty sand, and clayey gravel material within the Lower Cahokia Formation comprise the UA at the Site.
- The shales and siltstones of the Carbondale and Modesto Formations were encountered at depths ranging from 11.5 feet bgs (at AW-23) to greater than 39 feet bgs (at AW-01). The competent bedrock formations underlying the Site comprise the bedrock confining unit.

4.2 Hydrogeologic Characterization

Groundwater elevation readings from the three initial rounds (November 2022 through January 2023) along with additional groundwater elevation readings from February 2023 are included in **Table 2-2**. A potentiometric surface map for the February 2023 sampling event was generated with the additional wells and is presented in **Figure 4-4**. Groundwater flow directions observed during this round are consistent with historical observations. Groundwater flows generally to the west from the Illinois River, with localized flow to the north in the northern portion of the AP, and more southerly in the southern portion of the AP.

The northward flow may be a result of the drainage ditch that borders the AP. Additional survey work completed in 2022 and included in the groundwater modeling (Ramboll, 2022b), indicates that the surface water drainage ditch along the northern and western side of the AP is at a lower elevation than surrounding groundwater elevations. As a result, the ditch is likely a discharge point for shallow groundwater.

4.3 Analytical Results

Groundwater samples collected by Ramboll were submitted to Pace Analytical Services, LLC (Pace) for analytical analysis (**Appendix G**). The results are presented in **Table 4-2** and are visualized in **Figure 4-5**. Concentrations of boron in groundwater exceed the groundwater quality standard (35 I.A.C. § 620.410(a)) for boron (2.0 milligrams per liter [mg/L]) along the western portion of boundary of the EPP property, consistent with the HCR (Ramboll, 2021). However, boron is below the established standard in the delineation well AW-23 installed on the adjacent property west of the EPP AP and also in EMW-05 located north of the AP (**Figure 4-5**).

Access was requested near AW-15S to delineate boron exceedances of the groundwater quality standard (35 I.A.C. § 620.410(a)), but there was no response from adjacent property owners.

5. POTENTIAL RECEPTORS ANALYSIS

Previous water well surveys have been completed in the vicinity of the EPP to identify possible receptors and evaluate the potential for impacts from the AP. Results have been included in the following reports:

- RAPPS, 2009. *Site Characterization and Groundwater Monitoring Plan for CCP Impoundment. Ameren Energy Resources Generating. E.D. Edwards Plant. Peoria County, IL.* November 2009.
- Natural Resource Technology (NRT), 2013. *Phase I Hydrogeological Assessment Report. Coal Combustion Product Impoundment. E.D. Edwards Energy Center. Peoria County, IL.* March 19, 2013.
- Ramboll, 2021. *Hydrogeologic Site Characterization Report, included as Attachment H to Part 845 Operating Permit Application. Ash Pond, Edwards Power Plant, Joppa, Illinois.* October 25, 2021.

The most recent potable water well inventory was completed utilizing federal and state databases to identify nearby pumping wells, drinking water receptors, and other uses of water in the vicinity of the AP as provided in Section 5.1 of the HCR. Boring Logs and well construction information are included in Appendix B of the HCR (Ramboll, 2021).

Additional evaluation of these receptors was completed as part of this investigation to determine the status and use of wells at locations identified in the most recent survey. The evaluation resulted in identification of seven potential water wells within 1,000 meters of the AP boundary (**Figure 5-1**). The well IDs, depths, and status of the wells is summarized as follows:

- Two potential wells north and northeast of the AP (121432221000 and 121432356000) were identified to have depths of 65 and 60 feet bgs, respectively. Well 121432221000 is located upgradient of the AP on the slope of the bedrock bluff and is a 24-inch well drilled approximately 35 feet into bedrock. The well log for 121432356000 indicates there was no water and therefore no well is expected at this location.
- Four potential wells were identified southeast of the AP (121433424000, 1214300133300, 121433566000, and 121433566500) with depths of 20, 30, 98, and 300 feet bgs, respectively. Owners of 121433424000 and 1214300133300 are listed as Cargo Carriers, LLC and Cargill Fertilizer, both of which previously owned and/or had operations at The Mosaic Company parcel located southeast of the AP. The Mosaic Company is listed as owner of wells 121433566000 and 121433566500. The shallower of the two wells indicated no water was present and the deeper well was installed to provide water to the facility. Based on discussions with the Mosaic Company Environmental Manager, there is only one well that remains on the property (121433566500). The well is only used for non-potable water supply. Based on these discussions with the current property owner (the Mosaic Company), wells 121433424000 and 12143001333000 are no longer present and well 121433566000 was only a boring and never completed as a well. In addition, there is a deed restriction on the property that precludes the installation of wells for potable use (**Appendix H**).
- One non-community water supply well was identified west of the AP (shown as NC01 on **Figure 5-1**). The well is located at the Amoco (formerly Freedom) Gas Station and is used only for non-potable purposes (NRT, 2013).

Based on the analysis only 3 wells are present within 1,000-meters of the AP, two are non-potable supplies and the third well is located upgradient of AP and will not be impacted by a potential release from the AP.

6. SUMMARY

Ramboll performed the above-mentioned field activities, including the installation and development of one (1) additional plume delineation monitoring well, two (2) observation wells, and two (2) pump test wells to further delineate the previously identified boron plume associated with the EPP AP and complete aquifer testing to evaluate potential corrective actions. The newly installed wells were sampled by Ramboll and groundwater samples were analyzed by Pace. Conclusions and results are summarized as follows:

- Geologic and hydrogeologic results and findings are consistent with previous investigations and the previous HCR (Ramboll, 2021)
  - Geology identified in the additional wells is consistent with previous observations and consists of clays and silts on top of shale/ siltstone bedrock. Thin and discontinuous sand units were identified in borings completed north of the AP.
  - Groundwater flow was observed to be consistent with previous monitoring events, generally to the west with localized flow to the north toward the drainage ditch.
- No exceedances of boron or sulfate were reported in the additional monitoring wells installed and monitored to define the extent of groundwater concentrations above 35 I.A.C. § 620 standards.
- Aquifer testing did not fully identify appropriate well yields due to limitations of the testing equipment. However, the low well yields observed during testing indicates that extraction technologies will be limited by the clays and silts of the Cahokia formation.

7. REFERENCES

Burns & McDonnell, 2021. *Initial Operating Permit. Edwards Ash Pond. Edwards Power Plant. Bartonville, Illinois. Attachment M: History of Potential Exceedances.* October 25, 2021.

Code of Federal Regulations, Title 40, Chapter I, Subchapter I, Part 257, Subpart D, Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments, effective April 17, 2015.

Illinois Administrative Code, Title 35, Subtitle F, Chapter I, Part 620: Groundwater Quality Standards for Class I: Potable Resource Groundwater, effective October 5, 2012.

Illinois Administrative Code, Title 35, Subtitle G, Chapter I, Subchapter J, Part 845: Standards for The Disposal Of Coal Combustion Residuals In Surface Impoundments, effective April 21, 2021.

Natural Resource Technology, Inc. (NRT), 2013. *Phase I Hydrogeological Assessment Report, Coal Combustion Product Impoundment, E.D. Edwards Energy Center, Peoria County IL.* March 19, 2013.

Natural Resource Technology, an OBG Company (NRT/OGB), 2017. *Hydrogeologic Monitoring Plan, Edwards Ash Pond, Edwards Ash Pond– CCR Unit ID 301. Edwards Power Station, Bartonville, Illinois.* October 17, 2017.

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2021. *Hydrogeologic Site Characterization Report. Edwards Ash Pond. Edwards Power Plant. Bartonville, Illinois*. October 25, 2021.

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2022a. *Multi-Site Sampling and Analysis Plan*. December 28, 2022.

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2022b. *Groundwater Modeling Report. Edwards Ash Pond. Edwards Power Plant. Bartonville, Illinois*. June 30, 2022.

RAPPS, 2009. *Site Characterization and Groundwater Monitoring Plan for CCP Impoundment. Ameren Energy Resources Generating. E.D. Edwards Plant. Peoria County, IL.* November 2009.

TABLES

TABLE 2-1
WELL LOCATIONS AND CONSTRUCTION DETAILS
2023 SUPPLEMENTAL SITE INVESTIGATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, IL

Well Number	HSU	Date Constructed	Top of PVC Elevation (ft)	Measuring Point Elevation (ft)	Measuring Point Description	Ground Elevation (ft)	Screen Top Depth (ft BGS)	Screen Bottom Depth (ft BGS)	Screen Top Elevation (ft)	Screen Bottom Elevation (ft)	Well Depth (ft BGS)	Bottom of Boring Elevation (ft)	Screen Length (ft)	Screen Diameter (inches)	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)
AW-01	PMP	2021-09-08	464.43	464.43	Top of PVC	462.30	28.20	37.70	434.10	424.60	38.20	423.30	9.5	2	40.594098	-89.665033
AW-23	UA	2022-10-20	437.57	437.57	Top of PVC	435.69	6.00	16.00	429.69	419.69	16.00	419.69	10	2	40.5937859	-89.6714015
EMW-05	UA	2021-09-09	457.94	457.94	Top of PVC	455.80	25.70	30.20	430.10	425.60	30.70	421.80	4.5	2	40.5986102	-89.6672471
OW-01	UA	2022-10-21	459.93	459.93	Top of PVC	457.84	26.25	35.92	431.58	421.92	36.42	421.34	9.67	2	40.5979024	-89.6668928
OW-02	UA	2022-10-19	440.88	440.88	Top of PVC	438.66	24.91	34.58	413.75	404.08	35.08	401.66	9.67	2	40.5879278	-89.6668054
PTW-01	UA	2022-10-20	461.60	461.60	Top of PVC	459.38	27.19	36.61	432.19	422.77	38.44	420.88	9.42	4	40.5979486	-89.6668725
PTW-02	UA	2022-10-18	441.12	441.12	Top of PVC	439.02	26.92	36.34	412.10	402.68	38.42	399.52	9.42	4	40.5879725	-89.666839

TABLE 2-2
GROUNDWATER ELEVATIONS
2023 SUPPLEMENTAL SITE INVESTIGATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, IL

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
AP05S	11/21/2022	435.88
	12/16/2022	436.73
	01/09/2023	437.05
	02/27/2023	438.46
AP07S	11/21/2022	435.59
	12/16/2022	436.40
	01/09/2023	436.00
	02/27/2023	436.78
AW-01	11/21/2022	450.63
	12/16/2022	432.95
	01/09/2023	453.73
	02/27/2023	460.23
AW-05	11/21/2022	434.87
	12/16/2022	435.40
	01/09/2023	434.84
	02/27/2023	435.76
AW-06	11/21/2022	434.00
	12/16/2022	434.71
	01/09/2023	434.30
	02/27/2023	434.68
AW-08	11/21/2022	437.17
	12/16/2022	437.25
	01/09/2023	437.56
	02/27/2023	437.96
AW-09	11/21/2022	434.23
	12/16/2022	434.87
	01/09/2023	434.89
	02/27/2023	435.51
AW-10	11/21/2022	437.19
	12/16/2022	437.57
	01/09/2023	437.53
	02/27/2023	438.38
AW-11	11/21/2022	432.09
	02/27/2023	434.18
AW-14	11/21/2022	430.48
	12/16/2022	431.73
	01/09/2023	431.86
	02/27/2023	432.52
AW-15	11/21/2022	430.75
	02/27/2023	432.59
AW-15S	02/27/2023	430.66
AW-16	02/27/2023	437.19
AW-17	02/27/2023	437.25
AW-18	11/21/2022	434.76
	12/16/2022	435.45
	01/09/2023	435.11

TABLE 2-2
GROUNDWATER ELEVATIONS
2023 SUPPLEMENTAL SITE INVESTIGATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, IL

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
	02/27/2023	435.69
AW-19	11/21/2022	446.95
	12/16/2022	447.22
	01/09/2023	446.87
	02/27/2023	447.35
AW-21	11/21/2022	442.41
	12/16/2022	442.50
	01/09/2023	443.03
	02/27/2023	444.26
AW-23	11/21/2022	430.85
	12/16/2022	433.71
	01/09/2023	433.62
EMW-05	11/21/2022	436.08
	12/16/2022	436.25
	01/09/2023	436.51
	02/27/2023	437.65
OW-01	11/21/2022	435.58
	02/27/2023	436.74
PTW-01	11/21/2022	435.51
	02/27/2023	436.77
XPW01A	02/27/2023	453.00
XPW02	02/27/2023	454.01
XPW03	02/27/2023	449.70
SG-01	11/21/2022	430.01
	12/16/2022	433.03
	02/27/2023	441.00

TABLE 4-2
ANALYTICAL RESULTS - GROUNDWATER
2023 SUPPLEMENTAL SITE INVESTIGATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, IL

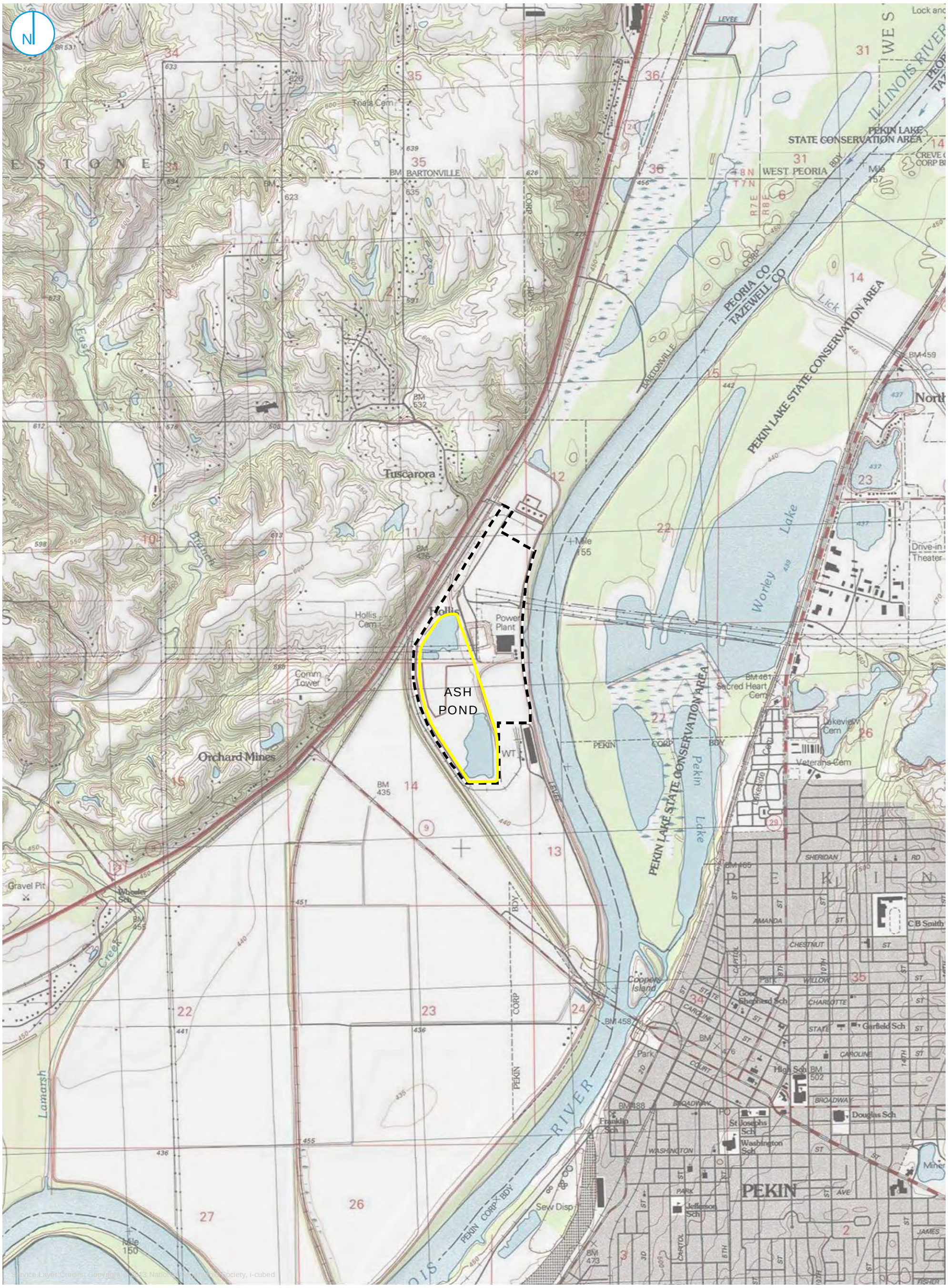
Well ID	Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 + Radium 228, total (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
Groundwater Quality Standards (35 I.A.C. § 620.410)		*0.006*	*0.010*	*2.0*	*0.004*	*2.0*	*0.005*	*NA*	*200.0*	*0.1*	*1.0*	*4.0*	*0.0075*	*NA*	*0.002*	*NA*	*6.5/9.0*	*NA*	*0.05*	*400.0*	*0.002*	*1,200*
AP05S	02/16/2022	0.003 U	0.00390	1.20	0.001 U	0.340	0.001 U	110	48.0	0.0120	0.00680	0.25 U	0.00810	0.0400	0.0002 U	0.00120	6.7	4.40	0.001 U	3.30	0.001 U	840
	07/25/2022	--	0.0140	1.80	0.00190	0.350	--	190	49.0	0.0640	0.0360	0.083	0.0430	0.0740	--	0.00460	6.7	4.00	0.00190	2.40	--	680
	02/28/2023	0.00043 U	0.00730	0.940	0.00063 J	0.340	0.00074 U	120	33.0	0.0250	0.0120	0.088 J	0.0140	0.0390	0.00014 U	0.00210	7.0	3.12	0.00074 U	14.0	0.00038 U	820
AP07S	02/28/2023	0.00043 U	0.00210	0.0870	0.00059 U	7.90	0.00350	130	73.0	0.0250	0.00480	0.248 J	0.00340	0.0067 J	0.00014 U	0.00350	7.1	0.782	0.00074 U	180	0.00038 U	720
AW-01	11/18/2022	0.003 U	0.0170	0.140	0.001 U	0.0900	0.001 U	190	13.0	0.004 U	0.00480	0.268	0.001 U	0.02 U	0.0002 U	0.00330	6.9	0.449	0.001 U	41.0	0.001 U	810 J
	12/15/2022	0.003 U	0.00150 J	0.100 J	0.001 U	0.0720	0.001 U	150	19.0	0.004 U	0.00360 J	0.25 U	0.001 U	0.02 U	0.0002 U	0.00290	7.3	0.288 B	0.001 U	43.0	0.001 U	790
	01/10/2023	0.00064 J	0.00710	0.120	0.00059 U	0.0750	0.00074 U	170	14.0	0.0028 U	0.00370	0.277	0.0007 J	0.0059 J	0.00014 U	0.00510	6.8	0	0.00074 U	41.0	0.00038 U	760
	02/28/2023	0.00043 U	0.0200	0.170	0.00059 U	1.10	0.00074 U	180	110	0.0190	0.00700	0.177 J	0.00920	0.018 J	0.00014 U	0.00220	7.0	2.77 J+	0.00110	280	0.00038 U	1,000
AW-05	02/28/2023	0.00043 U	0.00680	0.210	0.00059 U	4.50	0.00074 U	170	78.0	0.0200	0.0110	0.186 J	0.00910	0.0250	0.00014 U	0.00260	7.2	1.44 J+	0.00120	320	0.00038 U	1,100
AW-06	02/16/2022	0.003 U	0.00470	0.180	0.001 U	0.120	0.001 U	110	37.0	0.004 U	0.002 U	0.338	0.001 U	0.02 U	0.0002 U	0.00450	6.8	1.04	0.001 U	25.0	0.001 U	560
	07/25/2022	--	0.00170	0.150	0.00059 U	0.110	--	110	40.0	0.0028 U	0.00048 U	0.04 U	0.00022 U	0.011	--	0.00460	7.2	0.679	0.00074 U	24.0	--	550
	02/28/2023	0.00043 U	0.00640	0.190	0.00059 U	0.180	0.00074 U	110	31.0	0.0028 U	0.00096 J	0.327	0.00058 J	0.012 J	0.00014 U	0.00530	7.4	0.489	0.00074 U	22.0	0.00038 U	610
AW-08	02/16/2022	0.003 U	0.0180	0.230	0.001 U	0.0980	0.001 U	140	17.0	0.004 U	0.002 U	0.264	0.001 U	0.02 U	0.0002 U	0.00200	7.0	1.20	0.001 U	1 U	0.001 U	760
	07/25/2022	--	0.00730	0.160	0.00059 U	0.100	--	140	18.0	0.0028 U	0.00048 U	0.273	0.00022 U	0.016	--	0.00190	7.3	1.09	0.00074 U	0.94	--	680
	02/28/2023	0.00043 U	0.0110	0.200	0.00059 U	0.100	0.00074 U	140	14.0	0.0028 U	0.00048 U	0.223 J	0.00022 U	0.0097 J	0.00014 U	0.00180	8.9	0.261	0.00074 U	0.35 J	0.00038 U	740
AW-09	02/16/2022	0.003 U	0.0120	0.370	0.001 U	0.250	0.001 U	120	28.0	0.004 U	0.00340	0.25 U	0.00180	0.02 U	0.0002 U	0.0140	6.9	1.34	0.001 U	1 U	0.001 U	780
	07/25/2022	--	0.0170	0.470	0.00059 U	0.250	--	130	30.0	0.0028 U	0.00210	0.19	0.00022 U	0.013	--	0.0140	7.0	0.803	0.00074 U	0.18 U	--	800
	02/28/2023	0.00043 U	0.0120	0.200	0.00059 U	0.100	0.00074 U	140	26.0	0.0028 U	0.00048 U	0.04 U	0.00022 U	0.013 J	0.00014 U	0.00190	7.0	1.12 J+	0.00074 U	0.23 J	0.00038 U	830
AW-10	02/16/2022	0.003 U	0.00990	0.980	0.001 U	0.460	0.001 U	130	92.0	0.004 U	0.002 U	0.25 U	0.001 U	0.0400	0.0002 U	0.001 U	7.0	2.52	0.001 U	1 U	0.001 U	1,200
	07/25/2022	--	0.00990	1.00	0.00059 U	0.460	--	140	100	0.0036	0.00330	0.17	0.00220	0.0330	--	0.00097	7.1	2.16	0.00074 U	0.18 U	--	1,300
	02/28/2023	0.00043 U	0.0160	1.30	0.00059 U	0.520	0.00074 U	140	85.0	0.00950	0.00680	0.0973 J	0.00620	0.0430	0.00014 U	0.00120	7.0	1.57	0.00074 U	0.18 U	0.00038 U	1,300
AW-11	02/16/2022	0.003 U	0.00990	1.10	0.001 U	0.230	0.001 U	150	35.0	0.004 U	0.002 U	0.25 U	0.001 U	0.0230	0.0002 U	0.001 U	6.9	2.79	0.001 U	1 U	0.001 U	1,000
	07/25/2022	--	0.00940	1.00	0.00059 U	0.230	--	160	39.0	0.0028 U	0.0014	0.133	0.00039	0.019	--	0.00110	6.9	0.756	0.00074 U	0.18 U	--	1,000
	02/28/2023	0.00043 U	0.0130	1.10	0.00059 U	0.240	0.00074 U	170	30.0	0.0170	0.0100	0.0647 J	0.0100	0.0310	0.00014 U	0.00320	7.2	2.25	0.00074 U	0.18 U	0.00038 U	1,000
AW-14	02/28/2023	0.002 J	0.0150	0.720	0.00059 U	0.180	0.00074 U	170	21.0	0.0028 U	0.00480	0.0778 J	0.00170	0.017 J	0.00014 U	0.0190	7.0	1.30	0.00086 J	5.70	0.00038 U	1,100

TABLE 4-2
ANALYTICAL RESULTS - GROUNDWATER
2023 SUPPLEMENTAL SITE INVESTIGATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, IL

Well ID	Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 + Radium 228, total (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
AW-15	02/27/2023	0.00043 U	0.00350	1.80	0.00059 U	0.370	0.00074 U	140	32.0	0.0028 U	0.0018 J	0.067 J	0.00027 J	0.0270	0.000210	0.00074 U	6.8	7.65	0.00074 U	0.18 U	0.00038 U	1,100
AW-15S	02/27/2023	0.00043 U	0.00180	0.0810	0.00059 U	5.90	0.00074 U	260	28.0	0.0028 U	0.00048 U	0.252	0.00022 U	0.013 J	0.00015 J	0.00300	6.8	1.99	0.00074 J	510	0.00038 U	1,300
AW-16	02/28/2023	0.00043 U	0.00220	1.30	0.00059 U	0.490	0.00074 U	140	46.0	0.0028 U	0.0015 J	0.0535 J	0.00022 U	0.0370	0.00014 U	0.00074 U	6.8	3.13	0.00074 U	3.40	0.00038 U	1,200
AW-17	02/28/2023	0.00043 U	0.00610	1.20	0.00059 U	0.420	0.00074 U	110	47.0	0.00400	0.00340	0.0605 J	0.00180	0.0340	0.00014 U	0.00078 J	6.9	3.46	0.00074 U	0.18 U	0.00038 U	1,100
AW-18	02/27/2023	0.00049 J	0.00800	1.80	0.00059 U	0.380	0.00074 U	140	81.0	0.0620	0.00620	0.04 U	0.00800	0.0350	0.00014 U	0.00510	6.9	3.69	0.0008 J	10.0	0.00038 U	830
AW-19	02/27/2023	0.00043 U	0.0220	0.370	0.00059 U	2.90	0.00074 U	130	69.0	0.0310	0.00480	0.336	0.00540	0.015 J	0.00014 U	0.00550	7.0	1.59	0.00074 U	46.0	0.00038 U	600
AW-21	02/28/2023	0.00079 J	0.00270	0.0580	0.00059 U	13.0	0.00074 U	110	80.0	0.0033 J	0.00078 J	0.360	0.00022 U	0.005 U	0.00014 U	0.0290	8.0	0.642	0.00170	240	0.00038 U	680
AW-23	11/21/2022	0.003 U	0.001 U	0.0320	0.001 U	0.580	0.001 U	130	42.0	0.004 U	0.002 U	0.294	0.001 U	0.02 U	0.0002 U	0.00110	7.0	0.365 J	0.001 U	200	0.001 U	800
	12/16/2022	0.003 U	0.001 U	0.0270	0.001 U	0.480	0.001 U	130	46.0	0.004 U	0.002 U	0.254	0.001 U	0.02 U	0.0002 U	0.00170	6.6	0.204 UJ	0.001 U	200	0.001 U	720
	01/10/2023	0.00043 U	0.00120	0.0270	0.00059 U	0.550	0.00074 U	130	50.0	0.0028 U	0.00048 U	0.302	0.00022 U	0.016 J	0.00014 U	0.00096 J	6.9	0.666	0.00074 U	190	0.00038 U	760
EMW-05	11/18/2022	0.003 U	0.00130	0.0690	0.001 U	0.670	0.001 U	160	28.0	0.004 U	0.00220	0.25 U	0.001 U	0.02 U	0.0002 U	0.00190	--	0.479	0.001 U	120	0.001 U	890 J
	12/15/2022	0.003 U	0.00120	0.0790	0.001 U	0.770	0.001 U	170	20.0	0.00500	0.00200	0.25 U	0.00290	0.02 U	0.0002 U	0.00170	6.5	1.53	0.001 U	120	0.001 U	860
	01/10/2023	0.00043 U	0.0200 J	0.650 J	0.00390 J	0.320	0.00200 J	230	29.0	0.130 J	0.0670 J	0.264	0.0740 J	0.0920 J	0.000320 J	0.00400	6.6	1.33	0.00360 J	130	0.0008 J	830

Notes:
Exceedance of 35 I.A.C. § 620.410 standard
§ = Section
35 I.A.C. = Title 35 of the Illinois Administrative Code
mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = Standard Units
NA = 35 I.A.C. § 620.410 groundwater quality standard not available
– = data not available
B = The analyte was found in sample and in associated method blank.
J = The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
J+ = The result is an estimated quantity, but the result may be biased high.
U = The analyte was analyzed for, but was not detected above the level of the adjusted detection limit or quantitation limit, as appropriate.
UJ = The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.
Results were compared to applicable 35 I.A.C. § 620.410 standards

FIGURES



REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 1,000 2,000 Feet

SITE LOCATION MAP

FIGURE 1-1

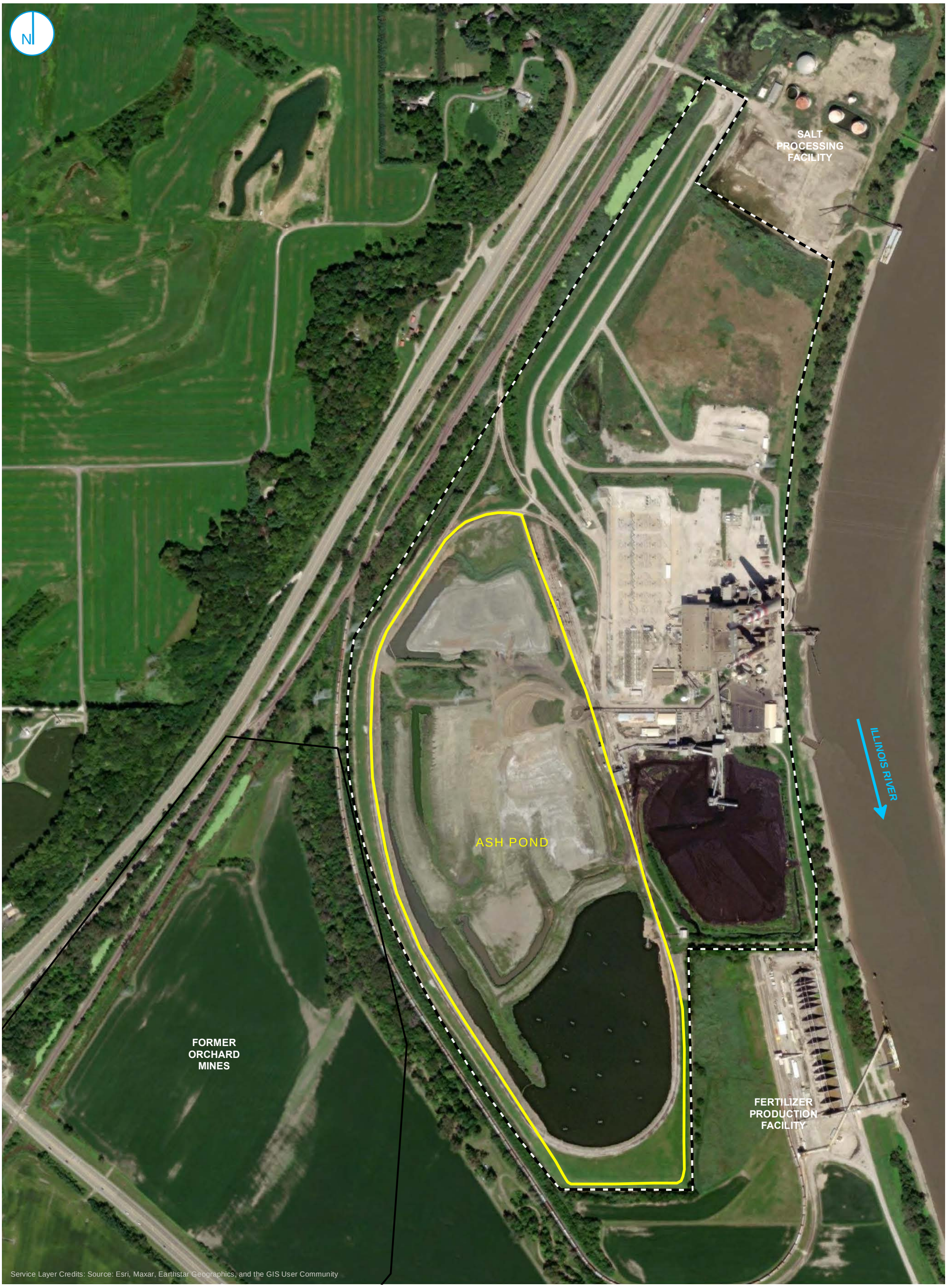
2023 SUPPLEMENTAL SITE INVESTIGATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 6/9/2023 | DESIGNER: GALARNMC

Y:\Mapping\Projects\22\2285\MXD\Supplemental_SI\Edwards\Figure 1-2_Site Map.mxd



REGULATED UNIT (SUBJECT UNIT)

FORMER ORCHARD MINES AREA

PROPERTY BOUNDARY

0 250 500 Feet

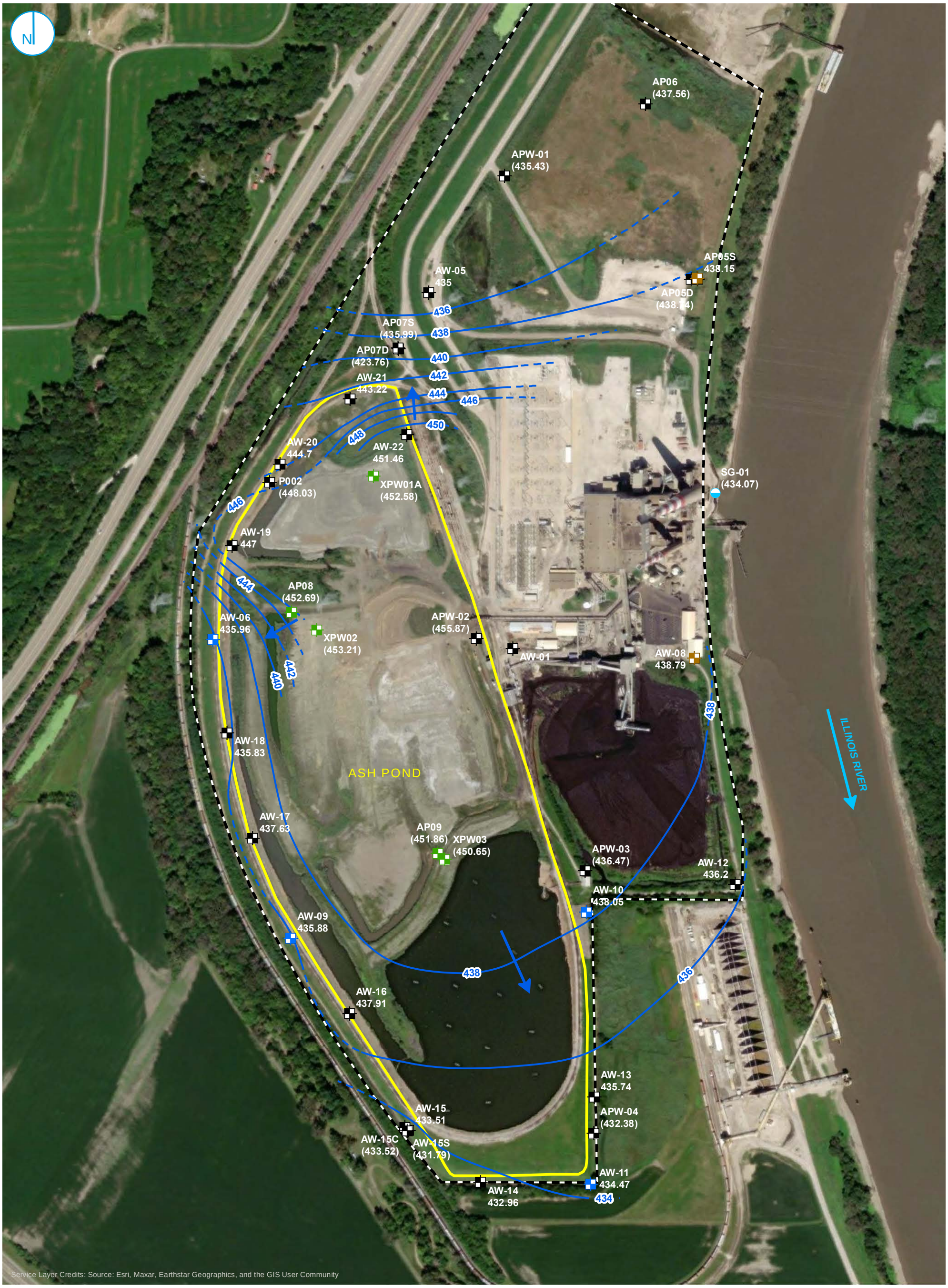
SITE MAP

FIGURE 1-2

2023 SUPPLEMENTAL SITE INVESTIGATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



COMPLIANCE MONITORING WELL
BACKGROUND MONITORING WELL
STAFF GAGE, RIVER
MONITORING WELL
REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY
GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION

0 212.5 425 Feet

NOTES
1. PARENTHESES INDICATES WELL NOT USED FOR CONTOURING
2. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

POTENTIOMETRIC SURFACE MAP FEBRUARY 16, 2022

2023 SUPPLEMENTAL SITE INVESTIGATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 1-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



PORE WATER WELL
MONITORING WELL
STAFF GAGE, RIVER
SITE FEATURE
PROPERTY BOUNDARY

0 212.5 425
Feet

MONITORING WELL LOCATION MAP

ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 1-4

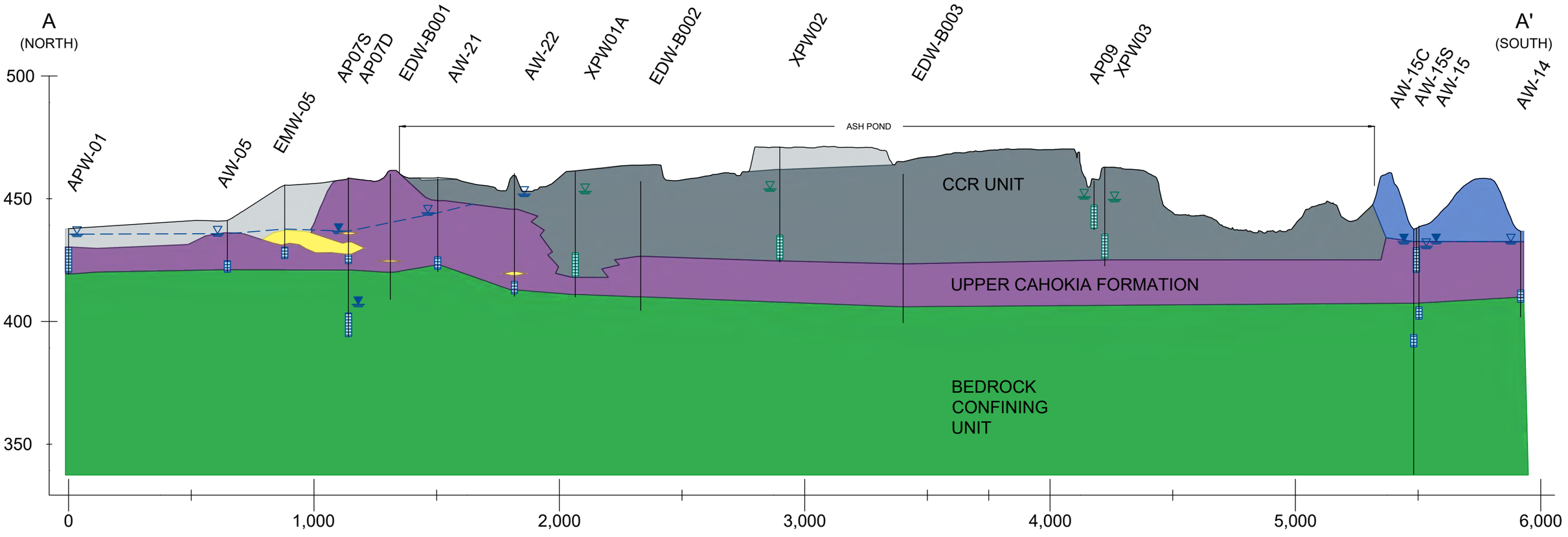
RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



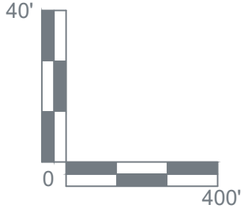
NOTES

1. This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.
2. Scale is approximate.
3. Vertical scale is exaggerated 10X.
4. Groundwater elevations measured February, 2023.



LEGEND

- COAL COMBUSTION RESIDUALS (CCR)
- FILL
- CLAY (CL/CH)
- SILT (ML)
- SAND (SP/SM/SW)
- BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, V. LITTLE SS)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPER AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- BEDROCK GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)



GEOLOGIC CROSS SECTION A-A'

2023 SUPPLEMENTAL SITE INVESTIGATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 4-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

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PROJECT: 1940100806 DATED: 6/9/2023 4:36 PM DESIGNER: LEMMONBN

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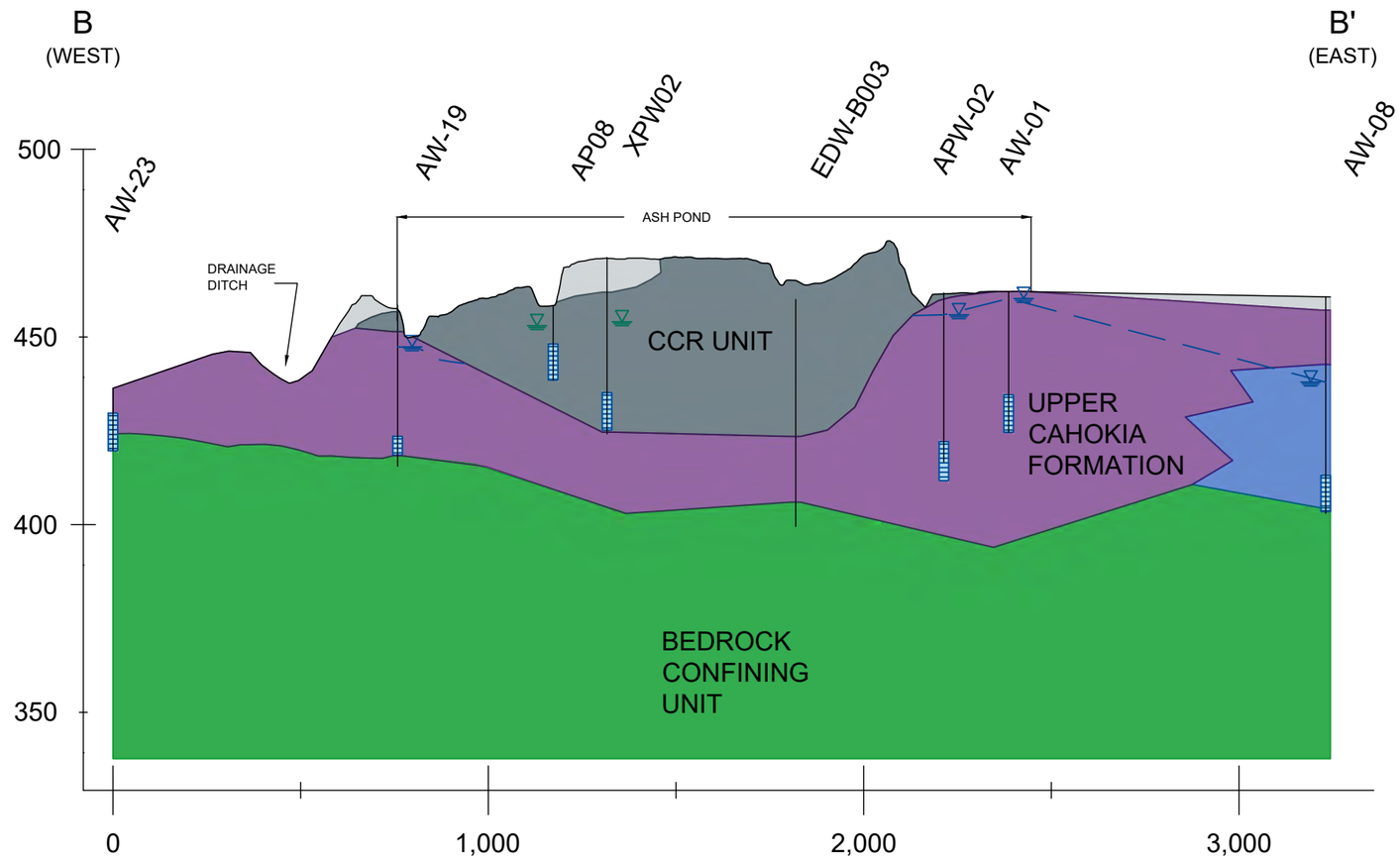
PROJECT: 1940100806 DATED: 6/9/2023 4:36 PM DESIGNER: LEMMONBN



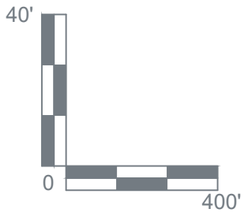
NOTES

1. This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.
2. Scale is approximate.
3. Vertical scale is exaggerated 10X.
4. Groundwater elevations measured February, 2023.



LEGEND

- COAL COMBUSTION RESIDUALS (CCR)
- FILL
- CLAY (CL/CH)
- SILT (ML)
- SAND (SP/SM/SW)
- BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, V. LITTLE SS)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPER AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- BEDROCK GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)



GEOLOGIC CROSS SECTION B-B'

2023 SUPPLEMENTAL SITE INVESTIGATION REPORT ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 4-2

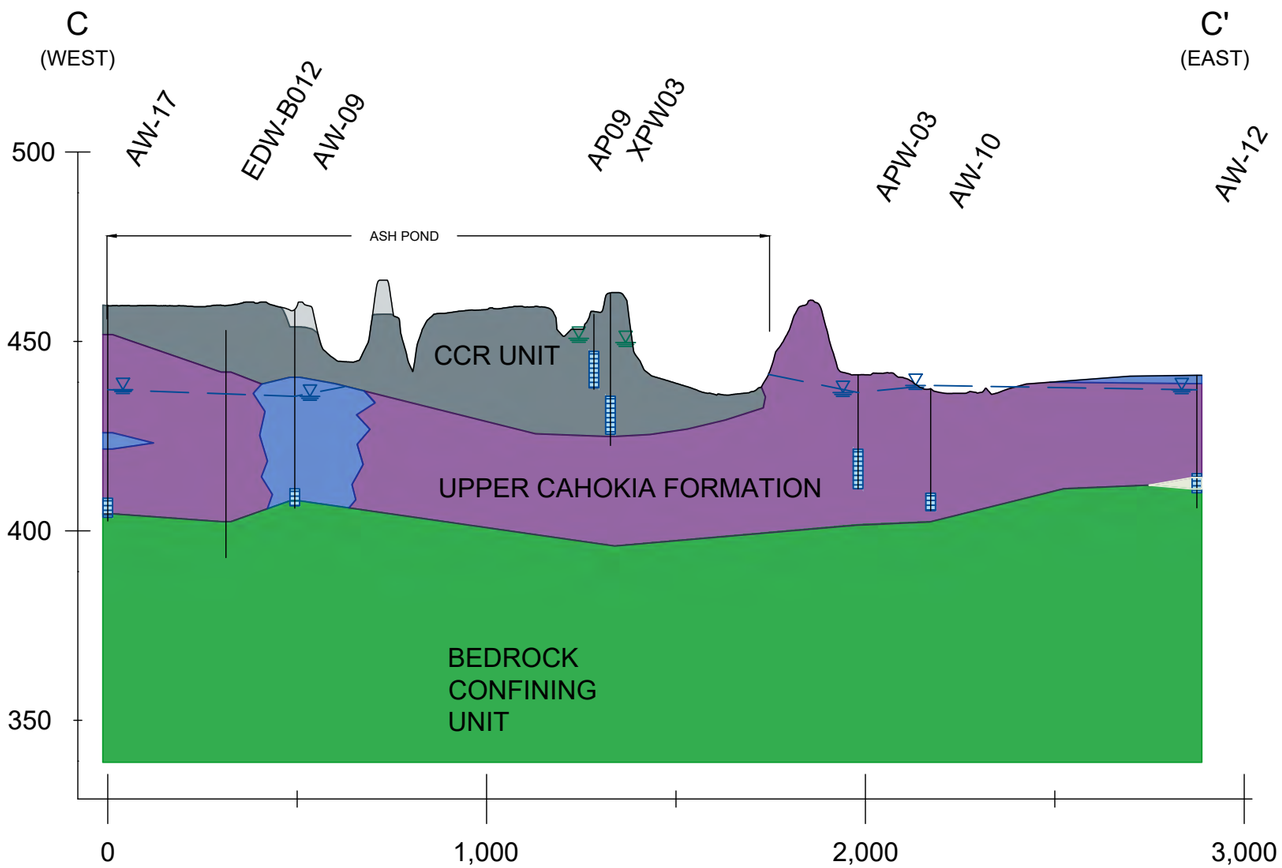
RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



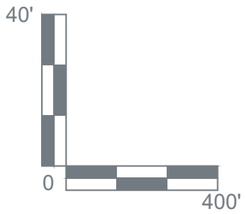
NOTES

1. This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.
2. Scale is approximate.
3. Vertical scale is exaggerated 10X.
4. Groundwater elevations measured February, 2023.



LEGEND

- COAL COMBUSTION RESIDUALS (CCR)
- FILL
- CLAY (CL/CH)
- SILT (ML)
- GRAVEL (GP/GW)
- BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, V. LITTLE SS)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPER AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- BEDROCK GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)



GEOLOGIC CROSS SECTION C-C'

2023 SUPPLEMENTAL SITE INVESTIGATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 4-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

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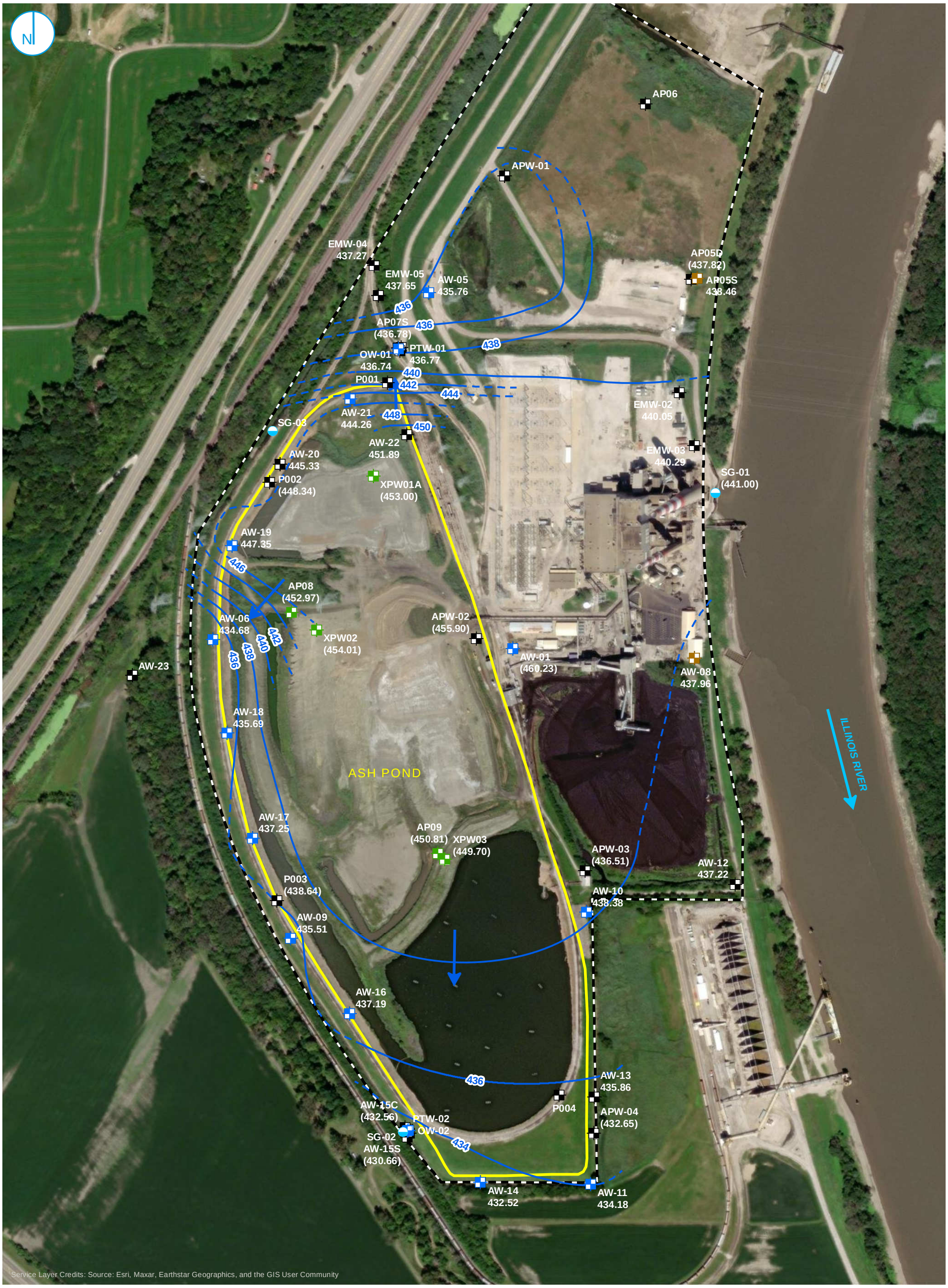
PROJECT: 1940100806 DATED: 6/9/2023 4:36 PM DESIGNER: LEMMONBN



COMPLIANCE MONITORING WELL
BACKGROUND MONITORING WELL
MONITORING WELL
PORE WATER WELL
STAFF GAGE, RIVER

GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 212.5 425
Feet

NOTES
1. PARENTHESES INDICATES WELL NOT USED FOR CONTOURING
2. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

POTENTIOMETRIC SURFACE MAP FEBRUARY 27, 2023

2023 SUPPLEMENTAL SITE INVESTIGATION REPORT ASH POND

EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 4-4

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

N

AP06
APW-01
EMW-04
EMW-05
0.32 mg/L
Sample Date: 1/10/23
AW-05
EMW-05
AP05S
AP05S
0.34 mg/L
Sample Date: 2/28/23
AP05D
AW-05
4.5 mg/L
Sample Date: 2/28/23
AP07S
7.9 mg/L
Sample Date: 2/28/23
AP07D
PTW-01
AP07S
OW-01
AW-21
13 mg/L
Sample Date: 2/28/23
AW-21
EMW-02
AW-22
EMW-03
AW-20
XPW01A
P002
AW-19
AW-19
2.9 mg/L
Sample Date: 2/27/23
AW-06
0.18 mg/L
Sample Date: 2/28/23
AP08
XPW02
AW-06
APW-02
AW-08
0.10 mg/L
Sample Date: 2/28/23
AW-01
AW-08
AW-23
AW-18
0.38 mg/L
Sample Date: 2/27/23
AW-01
1.1 mg/L
Sample Date: 2/28/23
AW-23
0.55 mg/L
Sample Date: 1/10/23
AW-18
ILLINOIS RIVER
AW-17
0.42 mg/L
Sample Date: 2/28/23
ASH POND
UNIT ID: 301
AW-17
AP09
XPW03
APW-03
AW-12
AW-10
0.52 mg/L
Sample Date: 2/28/23
AW-10
AW-09
0.10 mg/L
Sample Date: 2/28/23
AW-09
AW-16
0.49 mg/L
Sample Date: 2/28/23
AW-16
AW-15S
5.9 mg/L
Sample Date: 2/27/23
AW-13
PTW-02
AW-15C
AW-15
APW-04
AW-15S
OW-02
P008
AW-15
0.37 mg/L
Sample Date: 2/27/23
AW-14
AW-11
AW-14
0.18 mg/L
Sample Date: 2/28/23
AW-11
0.24 mg/L
Sample Date: 2/28/23

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

PORE WATER WELL
MONITORING WELL
BORON EXCEEDANCE OF 620.410 STANDARD
SITE FEATURE
PROPERTY BOUNDARY

0 212.5 425
Feet

BORON CONCENTRATIONS IN GROUNDWATER - QUARTER 1, 2023

FIGURE 4-5

2023 SUPPLEMENTAL SITE INVESTIGATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



- NON-COMMUNITY WATER SUPPLY WELL
- WATER
- INSTITUTIONAL CONTROL AREA - NO POTABLE WELLS
- REGULATED UNIT (SUBJECT UNIT)
- 1000 METER UNIT BUFFER
- PROPERTY BOUNDARY

0 500 1,000 Feet

SOURCE
IL WELLS

DRINKING WATER INTAKES, PUMPS, AND OTHER WATER USES

2023 SUPPLEMENTAL SITE INVESTIGATION REPORT
ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 5-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

APPENDICES

APPENDIX A
THIRD-PARTY LETTERS AND ACCESS REQUESTS

May 9, 2022

Ameren Illinois Company
PO Box 66149
MC 210
St. Louis, MO 63166

VIA U.S. MAIL

Re: Parcel ID 2011377001

Dear Neighbor:

The Edwards Power Plant, located at 7800 S. Cilco Lane, is retiring later this year. The Plant's accelerated retirement was in response to a settlement with third-party organizations. Illinois Power Resources Generating, LLC ("IPRG"), the entity that owns the Plant, is committed to facilitating an orderly retirement for our workers and being a good steward of the property.

As part of our diligence, groundwater monitoring stations recently installed near the plant's property boundary pursuant to the requirements of Illinois's new coal ash rule have detected elevated levels of boron in groundwater. The detected levels of boron at these groundwater monitoring stations exceeding the applicable state groundwater standard of 2.0 milligrams per liter (mg/L) range from 2.3 mg/L to 12 mg/L. We are notifying you because there is the potential that neighboring properties may also have elevated levels of boron in groundwater. ***Importantly, there is no indication that local drinking water has been impacted by the plant's operations.***

IPRG has notified the Illinois EPA of the elevated boron detections on its property and is working to gather additional data. As part of these efforts, IPRG requests permission for its consultants to access your property to install a groundwater monitoring station and conduct one or more groundwater sampling events.

Enclosed are two materials; "Graphic One" shows the Plant and adjacent properties where we would like to test, and "Graphic Two" shows where on your property we would like to install the monitoring station. The location of the monitoring station are not exact and may be modified based on access, utilities, and drilling logistics.

IPRG and its consultants will not access your property without your consent. All testing will be conducted at IPRG's expense, and you will be provided with a copy of the results of all data collected on your property. Once this investigation is complete, the monitoring station will be closed and abandoned in accordance with applicable requirements and the attached access agreement.

Please review the attached access agreement that would allow sampling to occur and, if you agree, return a signed copy to the following address:

Brad Watson
Sr. Director, Community Affairs
IPRG Community Relations Department
7800 S. Cilco Lane
Peoria, IL 61607

community.affairs@vistracorp.com

Once we have received your signed access agreement, IPRG personnel will reach out to you to schedule monitoring station installation and sampling activities.

Information about the planned future development at the Edwards Plant site can be accessed at www.renewillinoispower.com.

IPRG is committed to transparency and providing our longtime neighbors with updates during the closure and retirement process. If you have any questions, please contact our community affairs department at 214-812-5777 or community.affairs@vistracorp.com.

Sincerely,



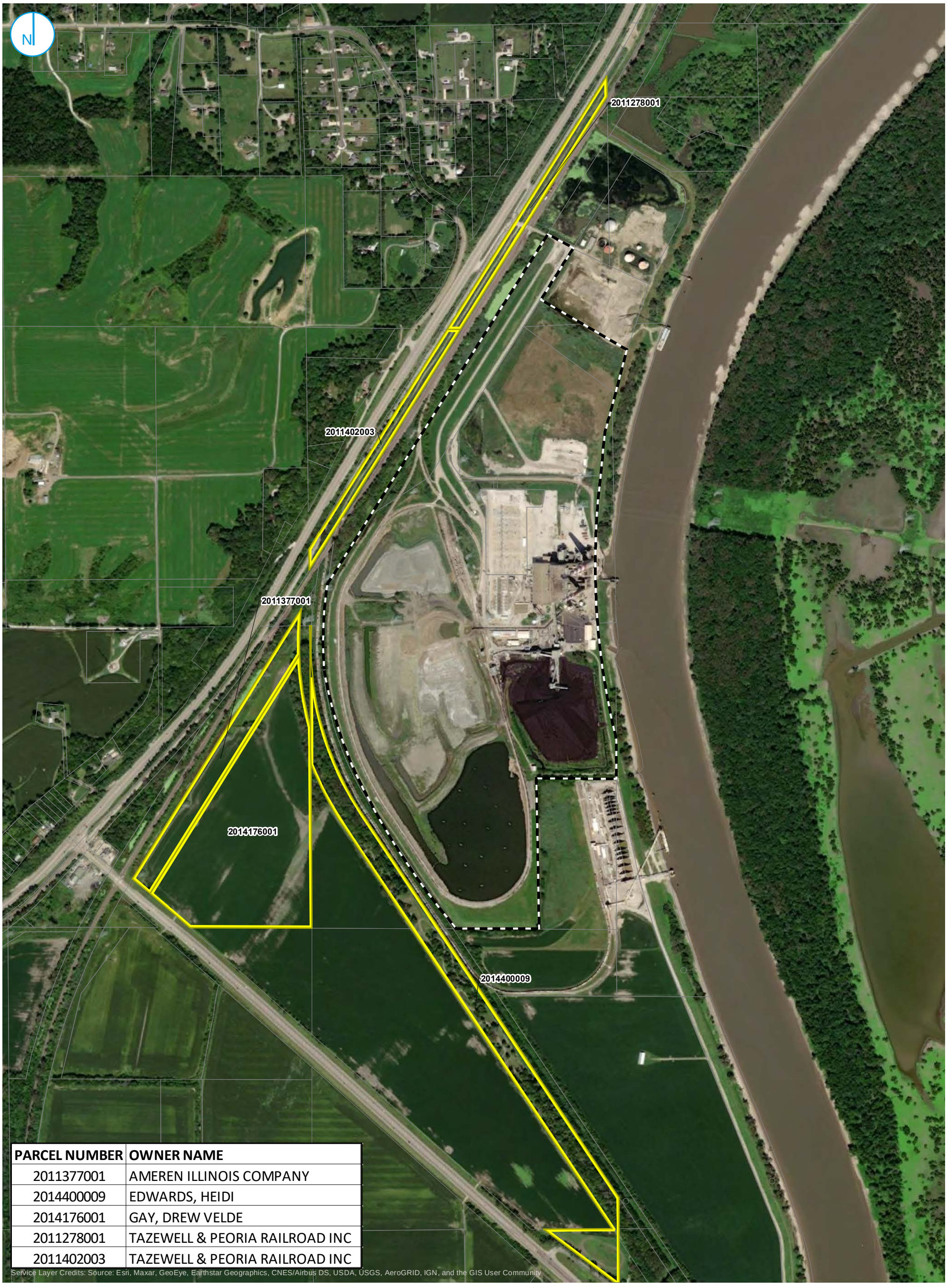
Brad Watson
Sr. Director, Community Affairs
IPRG Community Relations Department
7800 S. Cilco Lane
Peoria, IL 61607
214-812-5777
community.affairs@vistracorp.com

Enclosures

CC: Illinois EPA

PROJECT: 169000XXXX | DATED: 5/2/2022 | DESIGNER: galarnmc

Y:\Mapping\Projects\22\2285\MXD\Plume_Delineation\Edwards\EDW_ProposedWells_202204\EDW Parcel Access.mxd



PARCEL NUMBER	OWNER NAME
2011377001	AMEREN ILLINOIS COMPANY
2014400009	EDWARDS, HEIDI
2014176001	GAY, DREW VELDE
2011278001	TAZEWELL & PEORIA RAILROAD INC
2011402003	TAZEWELL & PEORIA RAILROAD INC

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

PARCEL ACCESS

PARCEL BOUNDARY

PROPERTY BOUNDARY

0 400 800 Feet

ADJACENT PROPERTIES OVERVIEW

ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

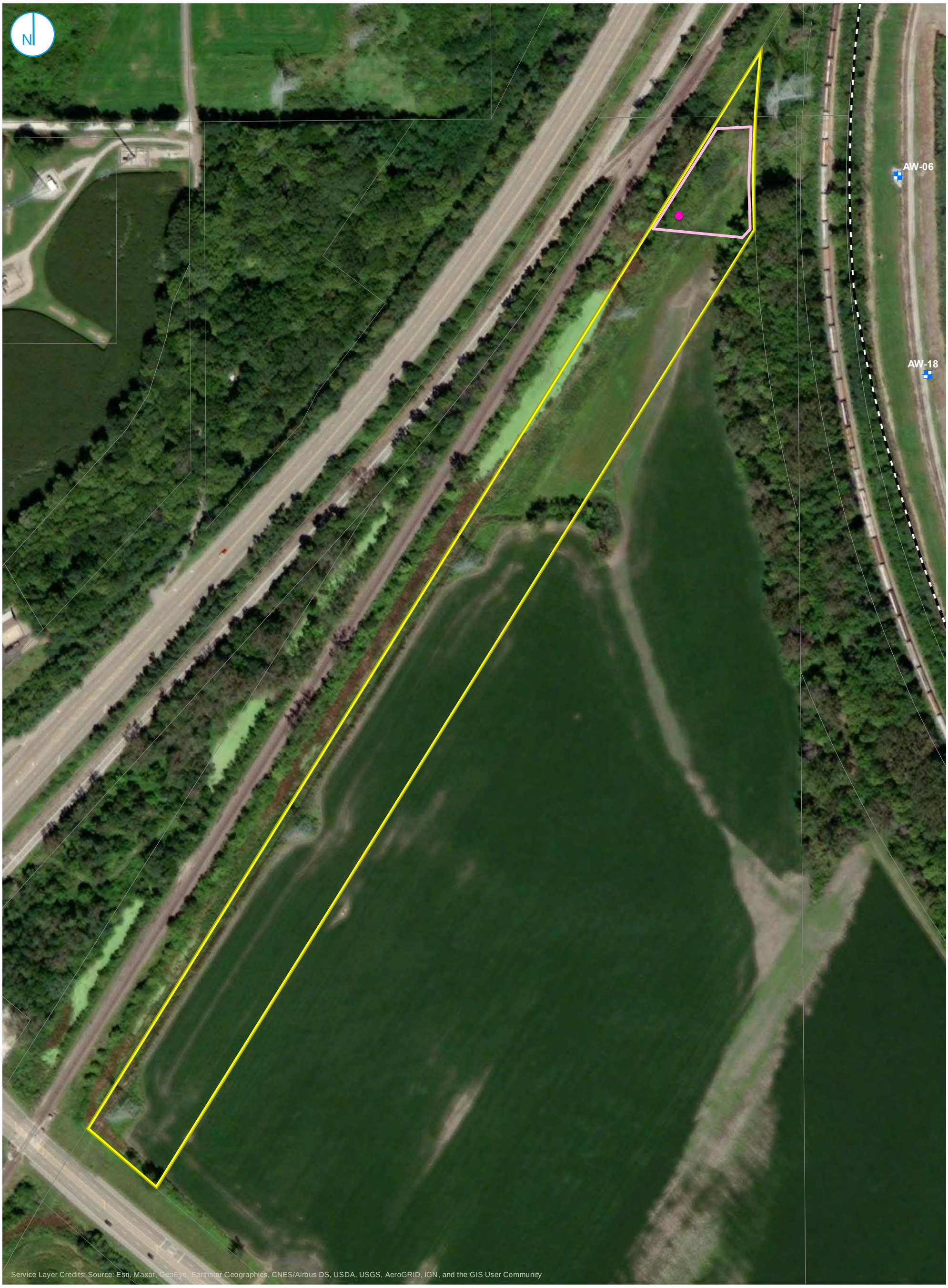
Graphic 1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 4/29/2022 | DESIGNER: galarnmc

Y:\Mapping\Projects\22\2285\MXD\Plume_Delineation\Edwards\EDW_ProposedWells_202204\EDW Proposed Wells_Ameren.mxd



PROPOSED WELL LOCATION
POTENTIAL WELL RELOCATION AREA
UPPERMOST AQUIFER
SUBJECT PARCEL
PARCEL BOUNDARY
PROPERTY BOUNDARY

0 100 200 Feet

PROPOSED WELL LOCATION
AMEREN ILLINOIS COMPANY PROPERTY

BARTONVILLE, ILLINOIS

Graphic 2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

ACCESS AGREEMENT

This Access Agreement ("Agreement") is made on this _____ day of _____, 2022, by and between Ameren Illinois Company ("Owner") and Illinois Power Resources Generating, LLC ("IPRG"), an Illinois corporation with its principal place of business at 601 Travis Street, Suite 1400, Houston, Texas 77002 (collectively, "the Parties" and each a "Party").

WHEREAS, Owner represents that it owns Parcel Number 20-11-377-001, located at the following legal description: SW 1/4 SEC 11-7N-7E 12.064 AC ALL THAT PT OF SE 1/4 SW 1/4 SEC 11 & THE NW 1/4 SEC 14 LYING ELY & ADJACENT TO C&NW RR ROW (the "Property");

WHEREAS, IPRG is conducting certain environmental investigation activities at or around the retired Edwards Power Plant located at 7800 S Cilco Lane, Peoria, Illinois 61607;

WHEREAS, IPRG has contracted with Ramboll US Consulting Inc. ("Ramboll") to perform the environmental investigation; and

WHEREAS, IPRG requests access to the Property to conduct certain groundwater investigation activities described below.

NOW THEREFORE, the Parties agree as follows:

1. Grant of Access. Owner permits IPRG, its consultants, and its contractors, including Ramboll, to enter the Property for the purposes of installing a groundwater monitoring station, located as depicted in the attached graphic, and collecting groundwater samples from that groundwater monitoring station and any existing groundwater well(s) from time to time. The location of the proposed groundwater station depicted in attached graphic is not exact and may be modified based on access, utilities, and drilling logistics and is intended to be on Owner's property. ("The Covered Activities.") Upon

completion of the Covered Activities, which may include more than one sampling event, the Property will be restored pursuant to Paragraph 6. In the event IPRG wishes to propose activities in addition to the Covered Activities, IPRG shall provide Owner advanced written notice of such proposed additional actions and shall not undertake any such additional work until Owner has agreed to provide access for the additional work, the approval of which shall not be unreasonably withheld.

2. Pre-Investigation Obligations. IPRG shall give Owner not less than five (5) business days prior notice each time it plans to enter the Property to conduct the Covered Activities. Prior to commencing any sub-surface work at the Property, IPRG shall contact Illinois's Joint Utility Locating Information for Excavators **(**"JULIE") as well as any applicable local digger's hotline to receive clearance to commence work.
3. Compliance with Laws. IPRG and its agents, consultants, and contractors shall, in performing the Covered Activities, comply with all applicable laws, ordinances, and regulations.
4. Interference. IPRG and its agents, consultants, and contractors shall perform the Covered Activities in a manner that will not unreasonably interfere with the use of the Property by Owner.
5. Data and Sampling. IPRG agrees to timely provide Owner with the analytical results from any sampling conducted by IPRG at the Property.
6. Restoration of Property. To the extent feasible, IPRG shall restore all areas of the Property disturbed by the Covered Activities, including closing and abandoning any monitoring wells installed by IPRG as part of the Covered Activities, to its condition

immediately prior to performance of the Covered Activities. The restoration activities will be completed within sixty (60) days after termination of this Agreement.

7. Indemnity. Owner shall not be liable to IPRG or IPRG's agents, consultants, or contractors for any personal injury, property damage, or loss of life or property caused by or arising out of the Covered Activities. Except as may result from the negligent or willful misconduct of Owner, or any officers, employees, agents, representatives of Owner, or from a breach of this Agreement by Owner, IPRG shall defend against, hold Owner harmless from, and indemnify Owner against any claim, loss, expense, or damage arising out of any negligent act or omission of IPRG or its agents, consultants, or contractors in performing the Covered Activities.

8. Applicable Law. The rights of the Parties under this Agreement shall be governed by the laws of the State of Illinois.

9. Notice. Notices, letters, and other written correspondence relating to this Agreement shall be directed to the respective Party as set forth below, or as modified by that Party by written notice:

For Illinois Power Resources Generating, LLC:
David Mitchell
Vistra Corp.
6555 Sierra Drive
Irving, Texas 75039
David.Mitchell@vistracorp.com
(972) 556-6350

With a copy to:
Joshua R. More
ArentFox Schiff LLP
233 South Wacker Drive, Suite 7100
Chicago, Illinois 60606
joshua.more@afslaw.com
Phone: (312) 258-5769

For Owner:

Name: _____

Address: _____

_____

Email: _____

Phone: _____

10. Assignment. This Agreement shall be binding on the Parties and their successors and assigns. No Party shall assign this Agreement without the consent of the other Party, and such consent shall not be unreasonably withheld.

11. Term. This Agreement shall terminate at the completion of the Covered Activities, unless extended by written agreement of the Parties. IPRG shall notify Owner in writing upon the completion of the Covered Activities.

12. Reservation of Rights. By entering into, and performing under, this Agreement, neither IPRG nor Owner waives any rights, claims, or defenses, nor makes any admission of liability or responsibility.

[The Remainder of This Page Is Intentionally Left Blank]
(signature page follows)

IN WITNESS WHEREOF, the Parties have caused this Agreement to be executed by their duly authorized representative as follows:

OWNER **AMEREN ILLINOIS COMPANY**

Signature: _____

Name: _____

Title: _____

Date: _____

ILLINOIS POWER RESOURCES GENERATING, LLC

Signature: _____

Name: _____

Title: _____

Date: _____

PROJECT: 169000XXXX | DATED: 4/29/2022 | DESIGNER: galarnmc

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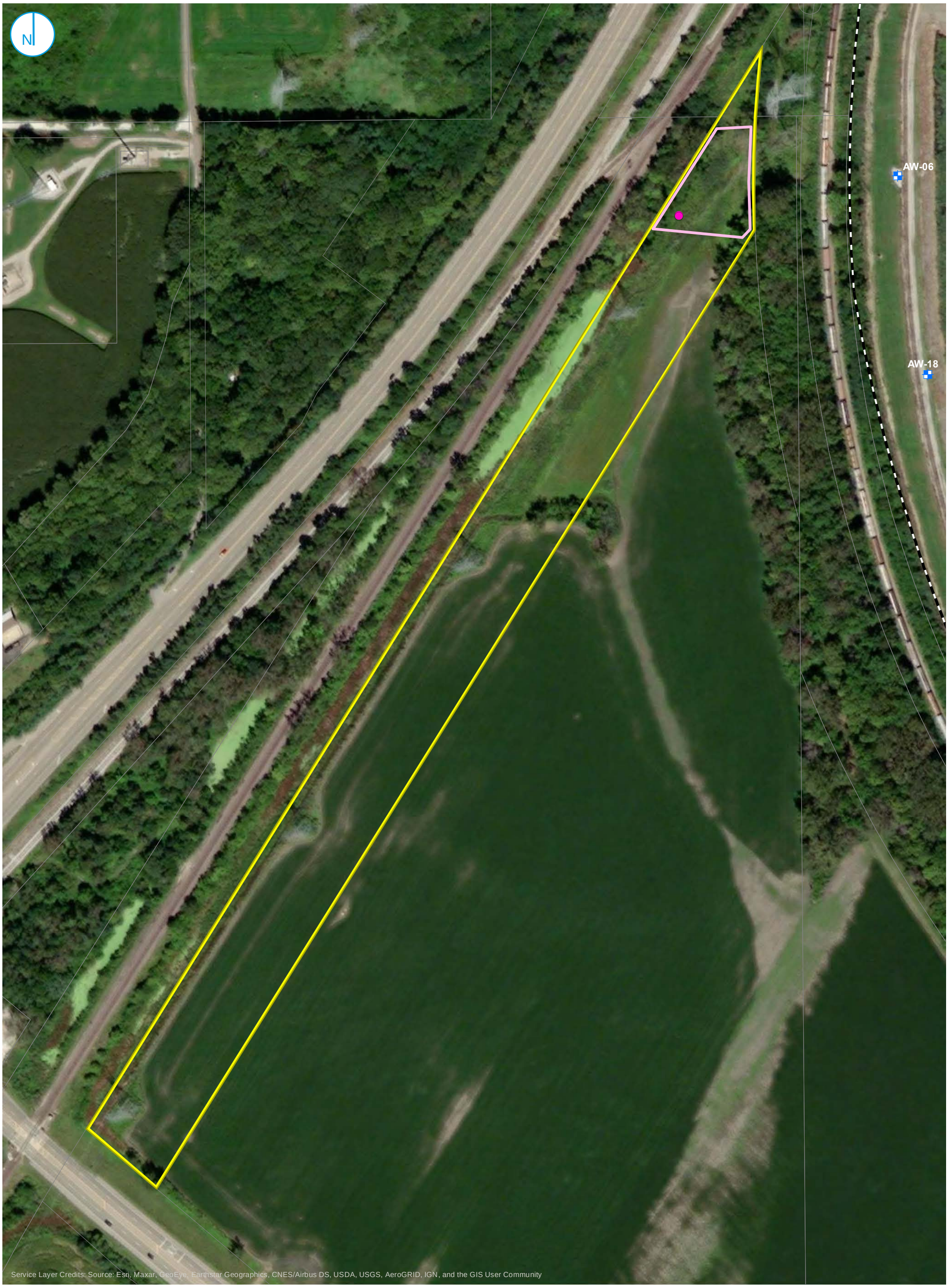


PROPOSED WELL LOCATION
POTENTIAL WELL RELOCATION AREA
UPPERMOST AQUIFER
SUBJECT PARCEL
PARCEL BOUNDARY
PROPERTY BOUNDARY

0 100 200 Feet

PROPOSED WELL LOCATION
AMEREN ILLINOIS COMPANY PROPERTY

BARTONVILLE, ILLINOIS

Access Agreement Attached Graphic

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

May 9, 2022

Drew Velde Gay
7126 N. Willow Bend Pt.
Peoria, IL 61614

VIA U.S. MAIL

Re: Parcel ID 2014176001

Dear Neighbor:

The Edwards Power Plant, located at 7800 S. Cilco Lane, is retiring later this year. The Plant's accelerated retirement was in response to a settlement with third-party organizations. Illinois Power Resources Generating, LLC ("IPRG"), the entity that owns the Plant, is committed to facilitating an orderly retirement for our workers and being a good steward of the property.

As part of our diligence, groundwater monitoring stations recently installed near the plant's property boundary pursuant to the requirements of Illinois's new coal ash rule have detected elevated levels of boron in groundwater. The detected levels of boron at these groundwater monitoring stations exceeding the applicable state groundwater standard of 2.0 milligrams per liter (mg/L) range from 2.3 mg/L to 12 mg/L. We are notifying you because there is the potential that neighboring properties may also have elevated levels of boron in groundwater. ***Importantly, there is no indication that local drinking water has been impacted by the plant's operations.***

IPRG has notified the Illinois EPA of the elevated boron detections on its property and is working to gather additional data. As part of these efforts, IPRG requests permission for its consultants to access your property to install a groundwater monitoring station and conduct one or more groundwater sampling events.

Enclosed are two materials; "Graphic One" shows the Plant and adjacent properties where we would like to test, and "Graphic Two" shows where on your property we would like to install the monitoring station. The location of the monitoring station are not exact and may be modified based on access, utilities, and drilling logistics.

IPRG and its consultants will not access your property without your consent. All testing will be conducted at IPRG's expense, and you will be provided with a copy of the results of all data collected on your property. Once this investigation is complete, the monitoring station will be closed and abandoned in accordance with applicable requirements and the attached access agreement.

Please review the attached access agreement that would allow sampling to occur and, if you agree, return a signed copy to the following address:

Brad Watson
Sr. Director, Community Affairs
IPRG Community Relations Department
7800 S. Cilco Lane
Peoria, IL 61607
community.affairs@vistracorp.com

Once we have received your signed access agreement, IPRG personnel will reach out to you to schedule monitoring station installation and sampling activities.

Information about the planned future development at the Edwards Plant site can be accessed at www.renewillinoispower.com.

IPRG is committed to transparency and providing our longtime neighbors with updates during the closure and retirement process. If you have any questions, please contact our community affairs department at 214-812-5777 or community.affairs@vistracorp.com.

Sincerely,



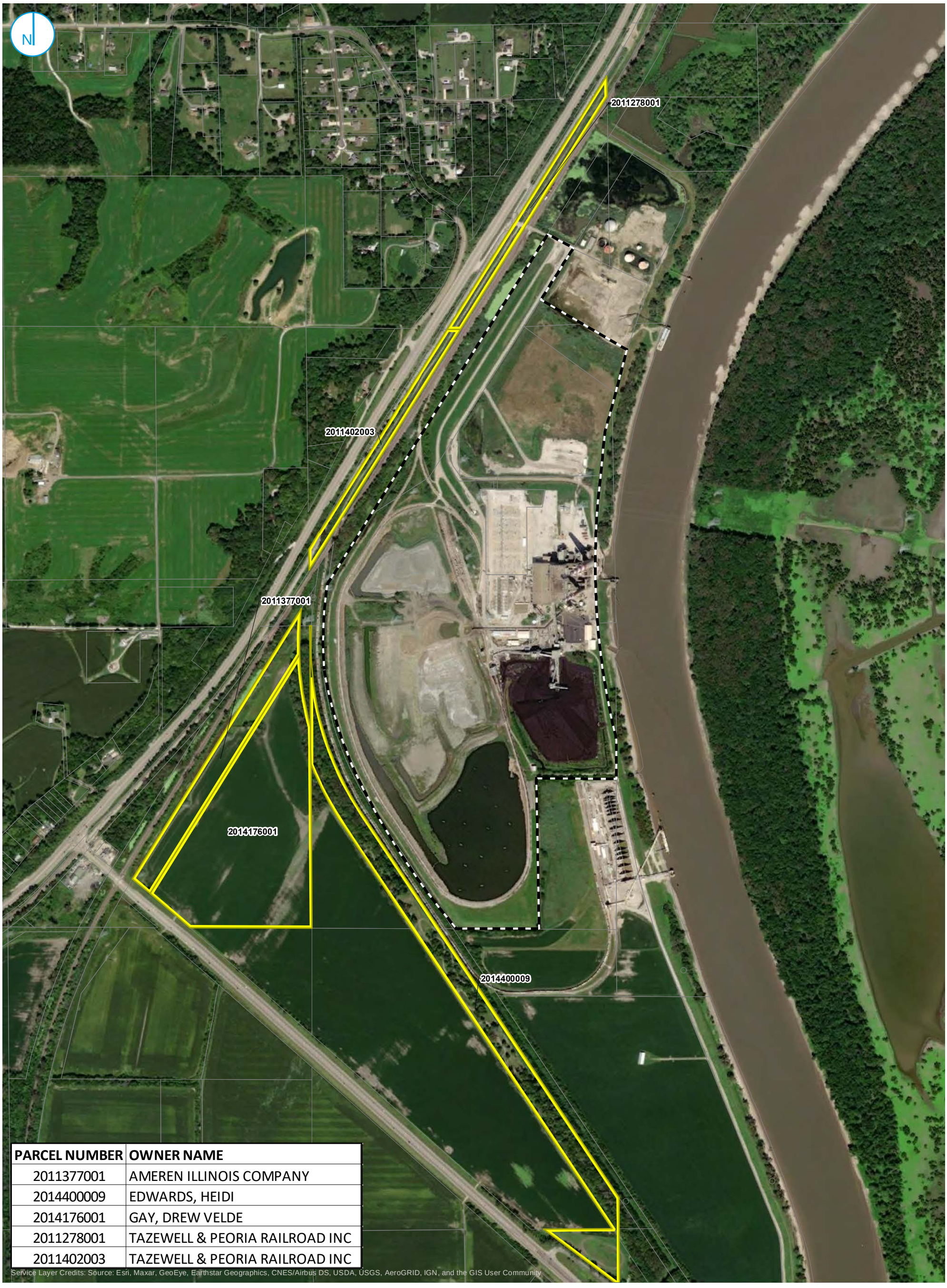
Brad Watson
Sr. Director, Community Affairs
IPRG Community Relations Department
7800 S. Cilco Lane
Peoria, IL 61607
214-812-5777
community.affairs@vistracorp.com

Enclosures

CC: Illinois EPA

PROJECT: 169000XXXX | DATED: 5/2/2022 | DESIGNER: galarnmc

Y:\Mapping\Projects\22\2285\MXD\Plume_Delineation\Edwards\EDW_ProposedWells_202204\EDW Parcel Access.mxd



PARCEL NUMBER	OWNER NAME
2011377001	AMEREN ILLINOIS COMPANY
2014400009	EDWARDS, HEIDI
2014176001	GAY, DREW VELDE
2011278001	TAZEWELL & PEORIA RAILROAD INC
2011402003	TAZEWELL & PEORIA RAILROAD INC

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

PARCEL ACCESS

PARCEL BOUNDARY

PROPERTY BOUNDARY

0 400 800 Feet

ADJACENT PROPERTIES OVERVIEW

ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

Graphic 1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 4/29/2022 | DESIGNER: galarnmc

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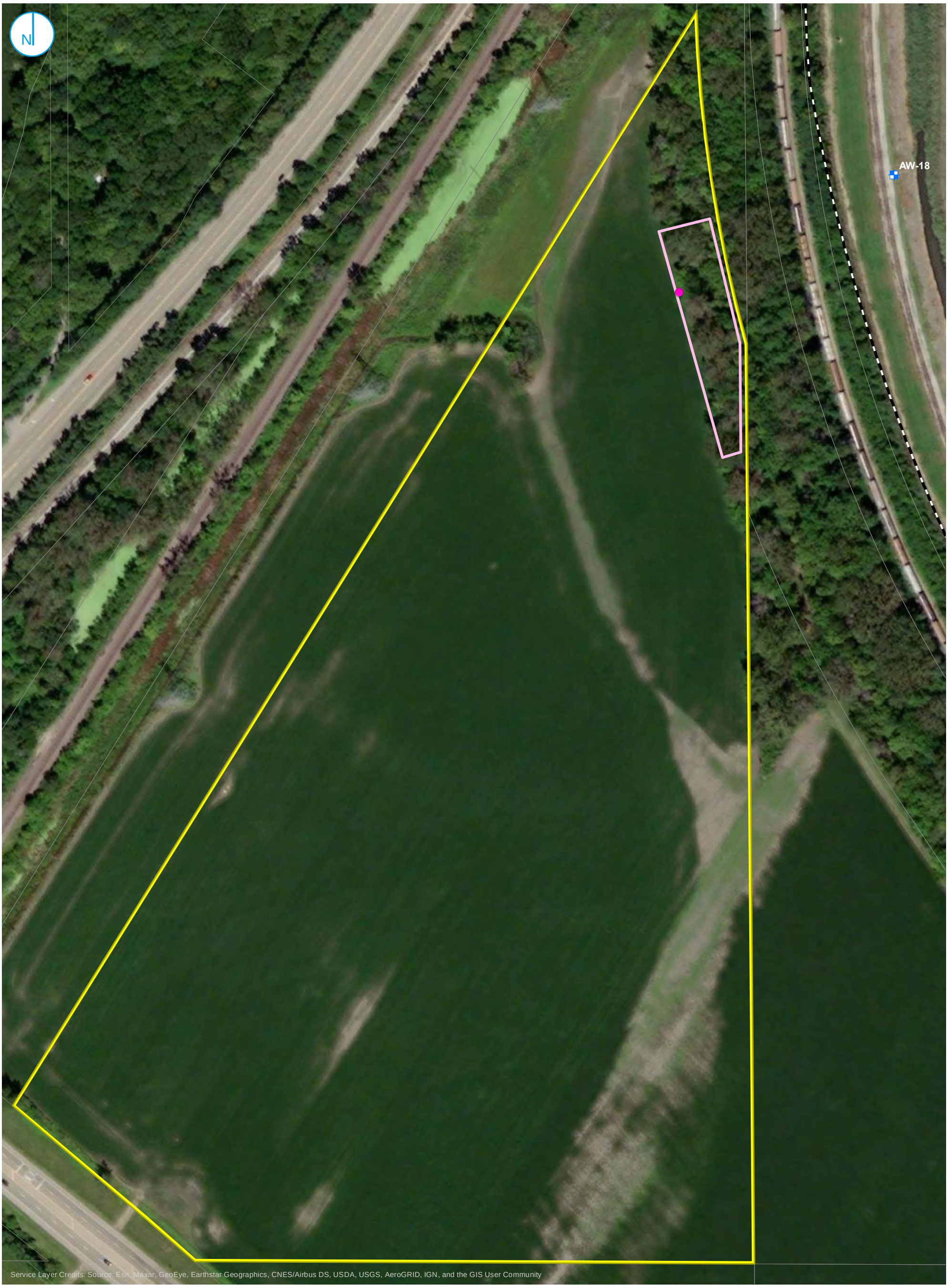

PROPOSED WELL LOCATION
POTENTIAL WELL RELOCATION AREA
UPPERMOST AQUIFER
SUBJECT PARCEL
PARCEL BOUNDARY
PROPERTY BOUNDARY

0 87.5 175 Feet

PROPOSED WELL LOCATION
DREW VELDE GAY PROPERTY

BARTONVILLE, ILLINOIS

Graphic 2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

ACCESS AGREEMENT

This Access Agreement ("Agreement") is made on this _____ day of _____, 2022, by and between Drew Velde Gay ("Owner") and Illinois Power Resources Generating, LLC ("IPRG"), an Illinois corporation with its principal place of business at 601 Travis Street, Suite 1400, Houston, Texas 77002 (collectively, "the Parties" and each a "Party").

WHEREAS, Owner represents that it owns Parcel Number 20-14-176-001, located at the following legal description: NW 1/4 SEC 14-7-7E 42.87 AC (PL) ALL THAT PT NW 1/4 SEC 14 LYING SW OF TR DESC PER DOC #66-04266, SE OF P&PU RR ROW, & N OF RTE #9 ROW (89-00257) (the "Property");

WHEREAS, IPRG is conducting certain environmental investigation activities at or around the retired Edwards Power Plant located at 7800 S Cilco Lane, Peoria, Illinois 61607;

WHEREAS, IPRG has contracted with Ramboll US Consulting Inc. ("Ramboll") to perform the environmental investigation; and

WHEREAS, IPRG requests access to the Property to conduct certain groundwater investigation activities described below.

NOW THEREFORE, the Parties agree as follows:

1. Grant of Access. Owner permits IPRG, its consultants, and its contractors, including Ramboll, to enter the Property for the purposes of installing a groundwater monitoring station, located as depicted in the attached graphic, and collecting groundwater samples from that groundwater monitoring station and any existing groundwater well(s) from time to time. The location of the proposed groundwater station depicted in attached graphic is not exact and may be modified based on access, utilities, and drilling logistics and is intended to be on Owner's property. ("The Covered Activities.") Upon

completion of the Covered Activities, which may include more than one sampling event, the Property will be restored pursuant to Paragraph 6. In the event IPRG wishes to propose activities in addition to the Covered Activities, IPRG shall provide Owner advanced written notice of such proposed additional actions and shall not undertake any such additional work until Owner has agreed to provide access for the additional work, the approval of which shall not be unreasonably withheld.

2. Pre-Investigation Obligations. IPRG shall give Owner not less than five (5) business days prior notice each time it plans to enter the Property to conduct the Covered Activities. Prior to commencing any sub-surface work at the Property, IPRG shall contact Illinois's Joint Utility Locating Information for Excavators **(**"JULIE") as well as any applicable local digger's hotline to receive clearance to commence work.
3. Compliance with Laws. IPRG and its agents, consultants, and contractors shall, in performing the Covered Activities, comply with all applicable laws, ordinances, and regulations.
4. Interference. IPRG and its agents, consultants, and contractors shall perform the Covered Activities in a manner that will not unreasonably interfere with the use of the Property by Owner.
5. Data and Sampling. IPRG agrees to timely provide Owner with the analytical results from any sampling conducted by IPRG at the Property.
6. Restoration of Property. To the extent feasible, IPRG shall restore all areas of the Property disturbed by the Covered Activities, including closing and abandoning any monitoring wells installed by IPRG as part of the Covered Activities, to its condition

immediately prior to performance of the Covered Activities. The restoration activities will be completed within sixty (60) days after termination of this Agreement.

7. Indemnity. Owner shall not be liable to IPRG or IPRG's agents, consultants, or contractors for any personal injury, property damage, or loss of life or property caused by or arising out of the Covered Activities. Except as may result from the negligent or willful misconduct of Owner, or any officers, employees, agents, representatives of Owner, or from a breach of this Agreement by Owner, IPRG shall defend against, hold Owner harmless from, and indemnify Owner against any claim, loss, expense, or damage arising out of any negligent act or omission of IPRG or its agents, consultants, or contractors in performing the Covered Activities.

8. Applicable Law. The rights of the Parties under this Agreement shall be governed by the laws of the State of Illinois.

9. Notice. Notices, letters, and other written correspondence relating to this Agreement shall be directed to the respective Party as set forth below, or as modified by that Party by written notice:

For Illinois Power Resources Generating, LLC:
David Mitchell
Vistra Corp.
6555 Sierra Drive
Irving, Texas 75039
David.Mitchell@vistracorp.com
(972) 556-6350

With a copy to:
Joshua R. More
ArentFox Schiff LLP
233 South Wacker Drive, Suite 7100
Chicago, Illinois 60606
joshua.more@afslaw.com
Phone: (312) 258-5769

For Owner:

Name: _____

Address: _____

_____

Email: _____

Phone: _____

10. Assignment. This Agreement shall be binding on the Parties and their successors and assigns. No Party shall assign this Agreement without the consent of the other Party, and such consent shall not be unreasonably withheld.

11. Term. This Agreement shall terminate at the completion of the Covered Activities, unless extended by written agreement of the Parties. IPRG shall notify Owner in writing upon the completion of the Covered Activities.

12. Reservation of Rights. By entering into, and performing under, this Agreement, neither IPRG nor Owner waives any rights, claims, or defenses, nor makes any admission of liability or responsibility.

[The Remainder of This Page Is Intentionally Left Blank]
(signature page follows)

IN WITNESS WHEREOF, the Parties have caused this Agreement to be executed by their duly authorized representative as follows:

OWNER **DREW VELDE GAY**

Signature: _____

Name: _____

Title: _____

Date: _____

ILLINOIS POWER RESOURCES GENERATING, LLC

Signature: _____

Name: _____

Title: _____

Date: _____

PROJECT: 169000XXXX | DATED: 4/29/2022 | DESIGNER: galarnmc

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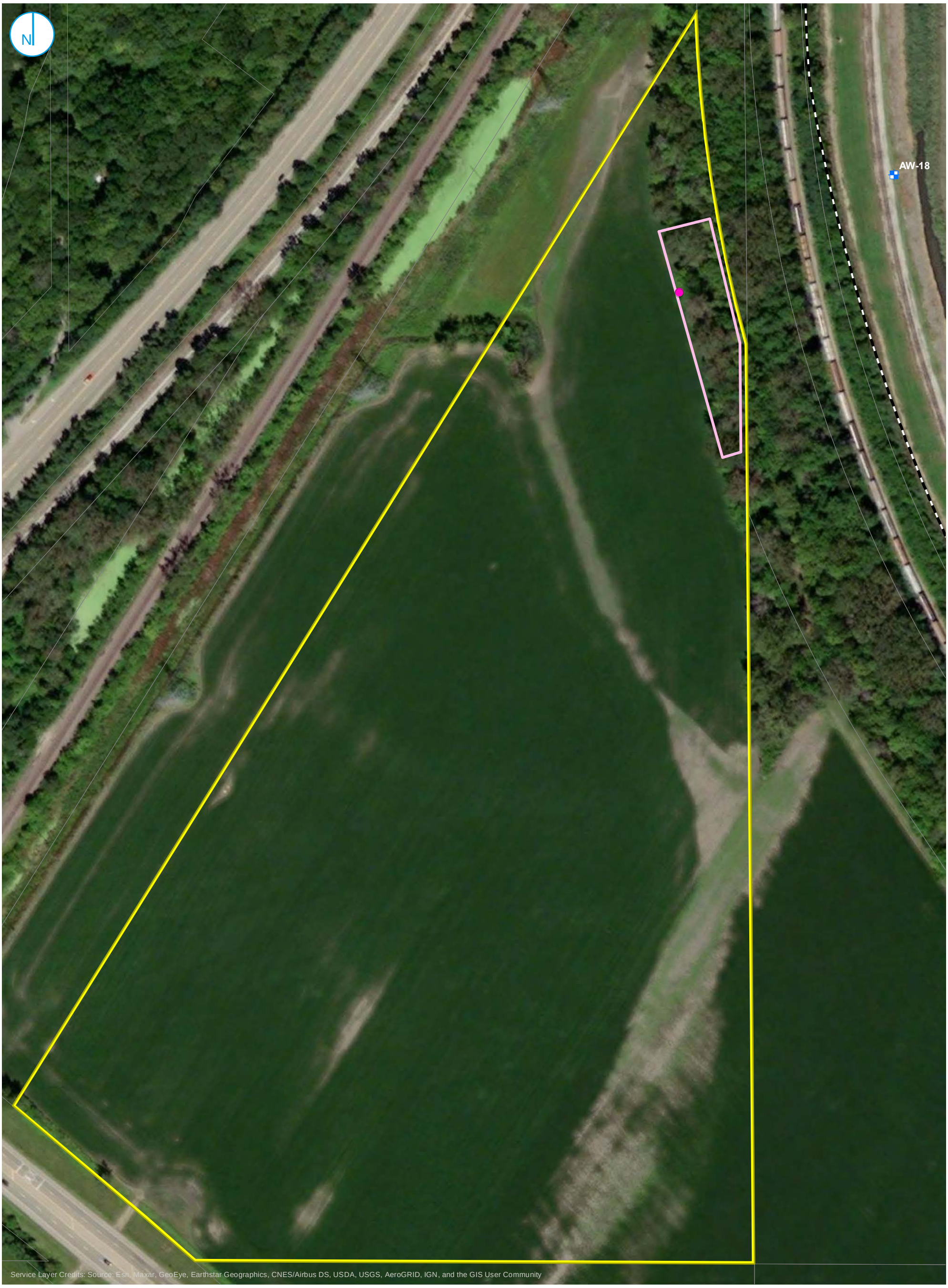


PROPOSED WELL LOCATION
POTENTIAL WELL RELOCATION AREA
UPPERMOST AQUIFER
SUBJECT PARCEL
PARCEL BOUNDARY
PROPERTY BOUNDARY

0 87.5 175 Feet

PROPOSED WELL LOCATION
DREW VELDE GAY PROPERTY

BARTONVILLE, ILLINOIS

Access Agreement Attached Graphic

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

May 9, 2022

Heidi Edwards
1202 Timberlane
Pekin, IL 61554

Re: Parcel ID 2014400009

VIA U.S. MAIL

Dear Neighbor:

The Edwards Power Plant, located at 7800 S. Cilco Lane, is retiring later this year. The Plant's accelerated retirement was in response to a settlement with third-party organizations. Illinois Power Resources Generating, LLC ("IPRG"), the entity that owns the Plant, is committed to facilitating an orderly retirement for our workers and being a good steward of the property.

As part of our diligence, groundwater monitoring stations recently installed near the plant's property boundary pursuant to the requirements of Illinois's new coal ash rule have detected elevated levels of boron in groundwater. The detected levels of boron at these groundwater monitoring stations exceeding the applicable state groundwater standard of 2.0 milligrams per liter (mg/L) range from 2.3 mg/L to 12 mg/L. We are notifying you because there is the potential that neighboring properties may also have elevated levels of boron in groundwater. ***Importantly, there is no indication that local drinking water has been impacted by the plant's operations.***

IPRG has notified the Illinois EPA of the elevated boron detections on its property and is working to gather additional data. As part of these efforts, IPRG requests permission for its consultants to access your property to install a groundwater monitoring station and conduct one or more groundwater sampling events.

Enclosed are two materials; "Graphic One" shows the Plant and adjacent properties where we would like to test, and "Graphic Two" shows where on your property we would like to install the monitoring station. The location of the monitoring station are not exact and may be modified based on access, utilities, and drilling logistics.

IPRG and its consultants will not access your property without your consent. All testing will be conducted at IPRG's expense, and you will be provided with a copy of the results of all data collected on your property. Once this investigation is complete, the monitoring station will be closed and abandoned in accordance with applicable requirements and the attached access agreement.

Please review the attached access agreement that would allow sampling to occur and, if you agree, return a signed copy to the following address:

Brad Watson
Sr. Director, Community Affairs
IPRG Community Relations Department
7800 S. Cilco Lane
Peoria, IL 61607
community.affairs@vistracorp.com

Once we have received your signed access agreement, IPRG personnel will reach out to you to schedule monitoring station installation and sampling activities.

Information about the planned future development at the Edwards Plant site can be accessed at www.renewillinoispower.com.

IPRG is committed to transparency and providing our longtime neighbors with updates during the closure and retirement process. If you have any questions, please contact our community affairs department at 214-812-5777 or community.affairs@vistracorp.com.

Sincerely,



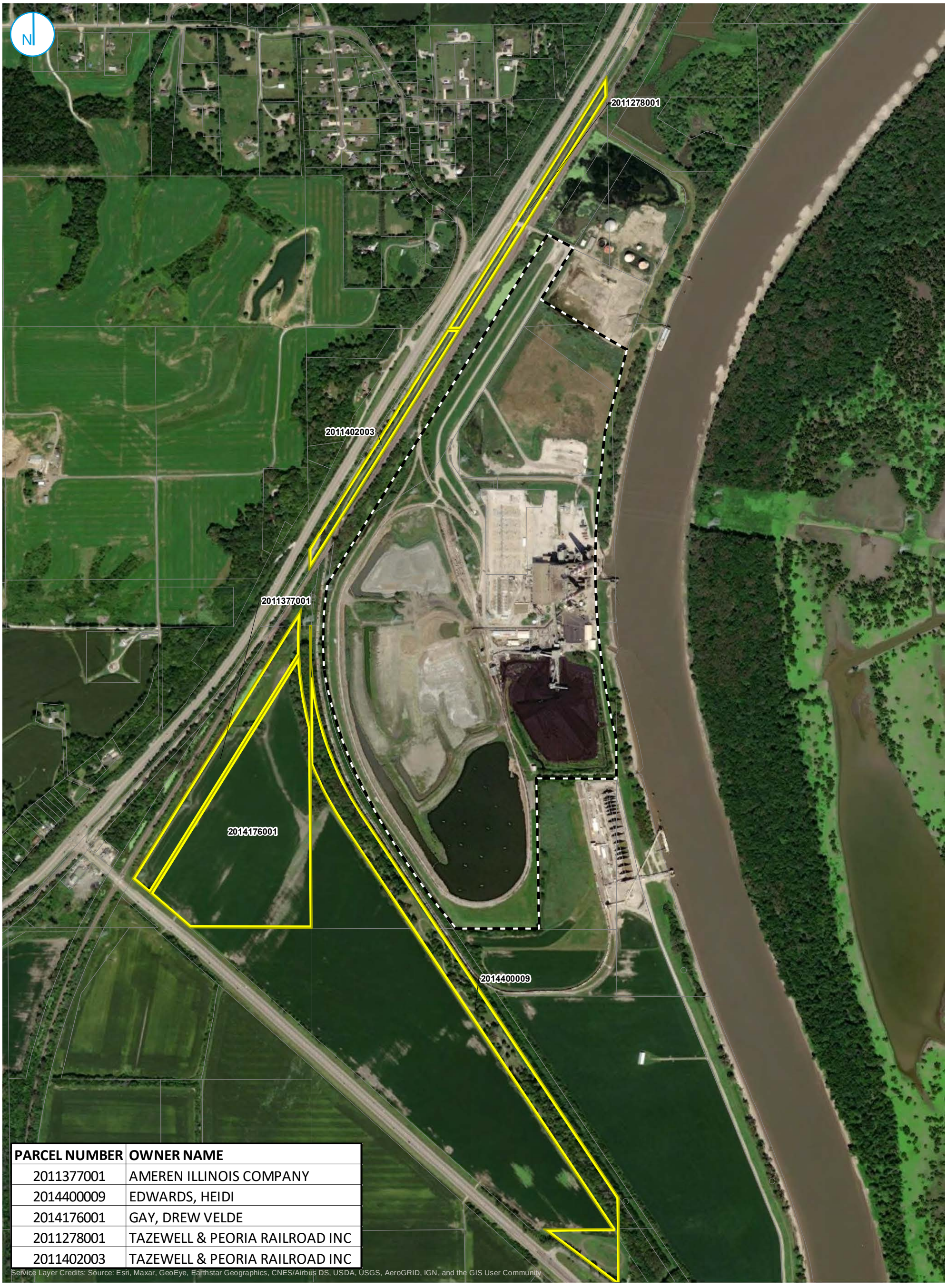
Brad Watson
Sr. Director, Community Affairs
IPRG Community Relations Department
7800 S. Cilco Lane
Peoria, IL 61607
214-812-5777
community.affairs@vistracorp.com

Enclosures

CC: Illinois EPA

PROJECT: 169000XXXX | DATED: 5/2/2022 | DESIGNER: galarnmc

Y:\Mapping\Projects\22\2285\MXD\Plume_Delineation\Edwards\EDW_ProposedWells_202204\EDW Parcel Access.mxd



PARCEL NUMBER	OWNER NAME
2011377001	AMEREN ILLINOIS COMPANY
2014400009	EDWARDS, HEIDI
2014176001	GAY, DREW VELDE
2011278001	TAZEWELL & PEORIA RAILROAD INC
2011402003	TAZEWELL & PEORIA RAILROAD INC

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

PARCEL ACCESS

PARCEL BOUNDARY

PROPERTY BOUNDARY

0 400 800 Feet

ADJACENT PROPERTIES OVERVIEW

ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

Graphic 1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



PROPOSED WELL LOCATION
POTENTIAL WELL RELOCATION AREA
BEDROCK CONFINING UNIT
UPPERMOST AQUIFER
UPPER CONFINING UNIT
SUBJECT PARCEL
PARCEL BOUNDARY
PROPERTY BOUNDARY

0 87.5 175
Feet

PROPOSED WELL LOCATION
HEIDI EDWARDS PROPERTY

BARTONVILLE, ILLINOIS

Graphic 2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

ACCESS AGREEMENT

This Access Agreement ("Agreement") is made on this _____ day of _____, 2022, by and between Heidi Edwards ("Owner") and Illinois Power Resources Generating, LLC ("IPRG"), an Illinois corporation with its principal place of business at 601 Travis Street, Suite 1400, Houston, Texas 77002 (collectively, "the Parties" and each a "Party").

WHEREAS, Owner represents that it owns Parcel Number 20-14-400-009, located at South Cargill Road, Peoria, Illinois, at the following legal description: NE 1/4 & SE 1/4 SEC 14-7N-7E 27.84 AC ALL THAT PT FORMER C&NW RR ROW LYING IN NE 1/4 & SE 1/4 SEC 14; ALSO ALL THAT PT FORMER C&NW RR ROW LYING IN NE COR NE 1/4 SEC 23 & NE 1/4 SEC 23 LYING NW OF ROUTE 9 PT NE 1/4 SEC 23 (the "Property");

WHEREAS, IPRG is conducting certain environmental investigation activities at or around the retired Edwards Power Plant located at 7800 S Cilco Lane, Peoria, Illinois 61607;

WHEREAS, IPRG has contracted with Ramboll US Consulting Inc. ("Ramboll") to perform the environmental investigation; and

WHEREAS, IPRG requests access to the Property to conduct certain groundwater investigation activities described below.

NOW THEREFORE, the Parties agree as follows:

1. Grant of Access. Owner permits IPRG, its consultants, and its contractors, including Ramboll, to enter the Property for the purposes of installing a groundwater monitoring station, located as depicted in the attached graphic, and collecting groundwater samples from that groundwater monitoring station and any existing groundwater well(s) from time to time. The location of the proposed groundwater station depicted in attached graphic is not exact and may be modified based on access, utilities, and drilling logistics

and is intended to be on Owner's property. ("The Covered Activities.") Upon completion of the Covered Activities, which may include more than one sampling event, the Property will be restored pursuant to Paragraph 6. In the event IPRG wishes to propose activities in addition to the Covered Activities, IPRG shall provide Owner advanced written notice of such proposed additional actions and shall not undertake any such additional work until Owner has agreed to provide access for the additional work, the approval of which shall not be unreasonably withheld.

2. Pre-Investigation Obligations. IPRG shall give Owner not less than five (5) business days prior notice each time it plans to enter the Property to conduct the Covered Activities. Prior to commencing any sub-surface work at the Property, IPRG shall contact Illinois's Joint Utility Locating Information for Excavators **(**"JULIE") as well as any applicable local digger's hotline to receive clearance to commence work.
3. Compliance with Laws. IPRG and its agents, consultants, and contractors shall, in performing the Covered Activities, comply with all applicable laws, ordinances, and regulations.
4. Interference. IPRG and its agents, consultants, and contractors shall perform the Covered Activities in a manner that will not unreasonably interfere with the use of the Property by Owner.
5. Data and Sampling. IPRG agrees to timely provide Owner with the analytical results from any sampling conducted by IPRG at the Property.
6. Restoration of Property. To the extent feasible, IPRG shall restore all areas of the Property disturbed by the Covered Activities, including closing and abandoning any monitoring wells installed by IPRG as part of the Covered Activities, to its condition

immediately prior to performance of the Covered Activities. The restoration activities will be completed within sixty (60) days after termination of this Agreement.

7. Indemnity. Owner shall not be liable to IPRG or IPRG's agents, consultants, or contractors for any personal injury, property damage, or loss of life or property caused by or arising out of the Covered Activities. Except as may result from the negligent or willful misconduct of Owner, or any officers, employees, agents, representatives of Owner, or from a breach of this Agreement by Owner, IPRG shall defend against, hold Owner harmless from, and indemnify Owner against any claim, loss, expense, or damage arising out of any negligent act or omission of IPRG or its agents, consultants, or contractors in performing the Covered Activities.

8. Applicable Law. The rights of the Parties under this Agreement shall be governed by the laws of the State of Illinois.

9. Notice. Notices, letters, and other written correspondence relating to this Agreement shall be directed to the respective Party as set forth below, or as modified by that Party by written notice:

For Illinois Power Resources Generating, LLC:
David Mitchell
Vistra Corp.
6555 Sierra Drive
Irving, Texas 75039
David.Mitchell@vistracorp.com
(972) 556-6350

With a copy to:
Joshua R. More
ArentFox Schiff LLP
233 South Wacker Drive, Suite 7100
Chicago, Illinois 60606
joshua.more@afslaw.com
Phone: (312) 258-5769

For Owner:

Name: _____

Address: _____

_____

Email: _____

Phone: _____

10. Assignment. This Agreement shall be binding on the Parties and their successors and assigns. No Party shall assign this Agreement without the consent of the other Party, and such consent shall not be unreasonably withheld.

11. Term. This Agreement shall terminate at the completion of the Covered Activities, unless extended by written agreement of the Parties. IPRG shall notify Owner in writing upon the completion of the Covered Activities.

12. Reservation of Rights. By entering into, and performing under, this Agreement, neither IPRG nor Owner waives any rights, claims, or defenses, nor makes any admission of liability or responsibility.

[The Remainder of This Page Is Intentionally Left Blank]
(signature page follows)

IN WITNESS WHEREOF, the Parties have caused this Agreement to be executed by their duly authorized representative as follows:

OWNER **HEIDI EDWARDS**

Signature: _____

Name: _____

Title: _____

Date: _____

ILLINOIS POWER RESOURCES GENERATING, LLC

Signature: _____

Name: _____

Title: _____

Date: _____

PROJECT: 169000XXXX | DATED: 4/29/2022 | DESIGNER: galarnmc

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PROPOSED WELL LOCATION
POTENTIAL WELL RELOCATION AREA
BEDROCK CONFINING UNIT
UPPERMOST AQUIFER
UPPER CONFINING UNIT
SUBJECT PARCEL
PARCEL BOUNDARY
PROPERTY BOUNDARY

0 87.5 175 Feet

PROPOSED WELL LOCATION
HEIDI EDWARDS PROPERTY

BARTONVILLE, ILLINOIS

Access Agreement Attached Graphic

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

May 9, 2022

Tazewell & Peoria Railroad Inc.
200 Meridian Centre Blvd.
Ste 300
Rochester, NY 14618

VIA U.S. MAIL

Re: Parcel IDs 2011278001 & 2011402003

Dear Neighbor:

The Edwards Power Plant, located at 7800 S. Cilco Lane, is retiring later this year. The Plant's accelerated retirement was in response to a settlement with third-party organizations. Illinois Power Resources Generating, LLC ("IPRG"), the entity that owns the Plant, is committed to facilitating an orderly retirement for our workers and being a good steward of the property.

As part of our diligence, groundwater monitoring stations recently installed near the plant's property boundary pursuant to the requirements of Illinois's new coal ash rule have detected elevated levels of boron in groundwater. The detected levels of boron at these groundwater monitoring stations exceeding the applicable state groundwater standard of 2.0 milligrams per liter (mg/L) range from 2.3 mg/L to 12 mg/L. We are notifying you because there is the potential that neighboring properties may also have elevated levels of boron in groundwater. ***Importantly, there is no indication that local drinking water has been impacted by the plant's operations.***

IPRG has notified the Illinois EPA of the elevated boron detections on its property and is working to gather additional data. As part of these efforts, IPRG requests permission for its consultants to access your property to install groundwater monitoring stations and conduct one or more groundwater sampling events.

Enclosed are two materials; "Graphic One" shows the Plant and adjacent properties where we would like to test, and "Graphic Two" shows where on your property we would like to install the monitoring stations. The location of the monitoring stations are not exact and may be modified based on access, utilities, and drilling logistics.

IPRG and its consultants will not access your property without your consent. All testing will be conducted at IPRG's expense, and you will be provided with a copy of the results of all data collected on your property. Once this investigation is complete, the monitoring station will be closed and abandoned in accordance with applicable requirements and the attached access agreement.

Please review the attached access agreement that would allow sampling to occur and, if you agree, return a signed copy to the following address:

Brad Watson
Sr. Director, Community Affairs
IPRG Community Relations Department
7800 S. Cilco Lane
Peoria, IL 61607
community.affairs@vistracorp.com

Once we have received your signed access agreement, IPRG personnel will reach out to you to schedule monitoring station installation and sampling activities.

Information about the planned future development at the Edwards Plant site can be accessed at www.renewillinoispower.com.

IPRG is committed to transparency and providing our longtime neighbors with updates during the closure and retirement process. If you have any questions, please contact our community affairs department at 214-812-5777 or community.affairs@vistracorp.com.

Sincerely,



Brad Watson
Sr. Director, Community Affairs
IPRG Community Relations Department
7800 S. Cilco Lane
Peoria, IL 61607
214-812-5777
community.affairs@vistracorp.com

Enclosures

CC: Illinois EPA

PROJECT: 169000XXXX | DATED: 5/2/2022 | DESIGNER: galarnmc

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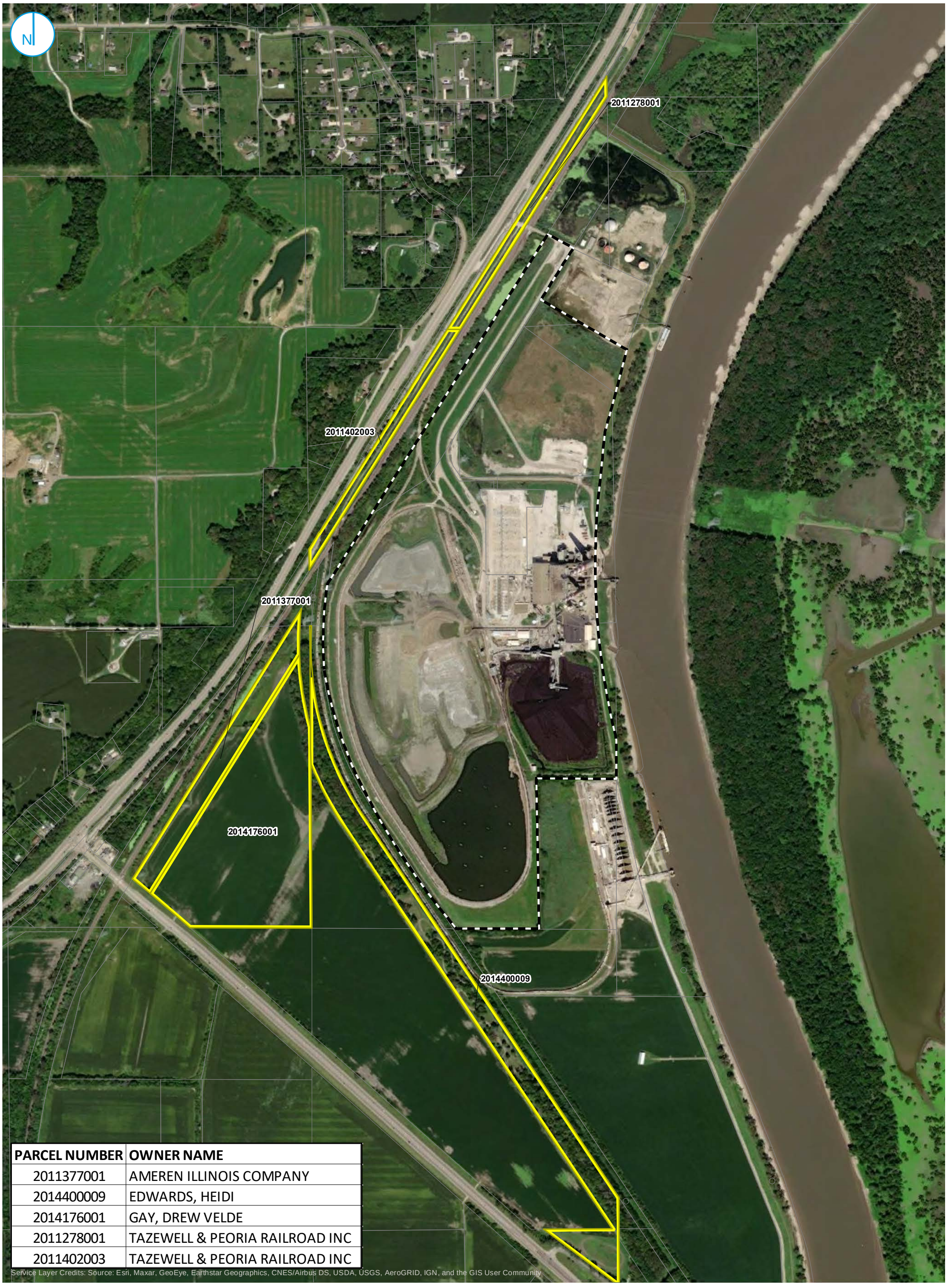

PARCEL NUMBER	OWNER NAME
2011377001	AMEREN ILLINOIS COMPANY
2014400009	EDWARDS, HEIDI
2014176001	GAY, DREW VELDE
2011278001	TAZEWELL & PEORIA RAILROAD INC
2011402003	TAZEWELL & PEORIA RAILROAD INC

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

PARCEL ACCESS

PARCEL BOUNDARY

PROPERTY BOUNDARY

0 400 800 Feet

ADJACENT PROPERTIES OVERVIEW

ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

Graphic 1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 4/29/2022 | DESIGNER: galarnmc

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PROPOSED WELL LOCATION
BEDROCK CONFINING UNIT
UPPERMOST
UPPER CONFINING UNIT
SUBJECT PARCEL
PARCEL BOUNDARY
PROPERTY BOUNDARY

0 100 200 Feet

PROPOSED WELL LOCATION
TAZEWELL & PEORIA RAILROAD INC PROPERTY

BARTONVILLE, ILLINOIS

Graphic 2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

ACCESS AGREEMENT

This Access Agreement ("Agreement") is made on this _____ day of _____, 2022, by and between Tazewell & Peoria Railroad, Inc. ("Owner") and Illinois Power Resources Generating, LLC ("IPRG"), an Illinois corporation with its principal place of business at 601 Travis Street, Suite 1400, Houston, Texas 77002 (collectively, "the Parties" and each a "Party").

WHEREAS, Owner represents that it owns Parcel Number 20-11-278-001, located at the following legal description: NE 1/4 SEC 11-7N-7E 5.75 AC 100' WIDE STRIP OF ABANDONED P&PU RR ROW ACROSS NE 1/4 SEC 11 (20-R/33-8) NON CARRIER REAL ESTATE SCHEDULE 537;

WHEREAS, Owner represents that it also owns Parcel Number 20-11-402-003, located at the following legal description: SE 1/4 SEC 11-7N-7E 4.63 AC IRREG STRIP OF ABANDONED P&PU RR ROW ACROSS SE 1/4 SEC 11 (20-R/33-7) NON CARRIER REAL ESTATE SCHEDULE 537 (both parcels collectively, the "Property");

WHEREAS, IPRG is conducting certain environmental investigation activities at or around the retired Edwards Power Plant located at 7800 S Cilco Lane, Peoria, Illinois 61607;

WHEREAS, IPRG has contracted with Ramboll US Consulting Inc. ("Ramboll") to perform the environmental investigation; and

WHEREAS, IPRG requests access to the Property to conduct certain groundwater investigation activities described below.

NOW THEREFORE, the Parties agree as follows:

1. Grant of Access. Owner permits IPRG, its consultants, and its contractors, including Ramboll, to enter the Property for the purposes of installing groundwater monitoring stations, located as depicted in the attached graphic, and collecting groundwater

samples from those groundwater monitoring stations and any existing groundwater well(s) from time to time. The locations of the proposed groundwater stations depicted in attached graphic are not exact and may be modified based on access, utilities, and drilling logistics and are intended to be on Owner's property. ("The Covered Activities.") Upon completion of the Covered Activities, which may include more than one sampling event, the Property will be restored pursuant to Paragraph 6. In the event IPRG wishes to propose activities in addition to the Covered Activities, IPRG shall provide Owner advanced written notice of such proposed additional actions and shall not undertake any such additional work until Owner has agreed to provide access for the additional work, the approval of which shall not be unreasonably withheld.

2. Pre-Investigation Obligations. IPRG shall give Owner not less than five (5) business days prior notice each time it plans to enter the Property to conduct the Covered Activities. Prior to commencing any sub-surface work at the Property, IPRG shall contact Illinois's Joint Utility Locating Information for Excavators **(**"JULIE") as well as any applicable local digger's hotline to receive clearance to commence work.
3. Compliance with Laws. IPRG and its agents, consultants, and contractors shall, in performing the Covered Activities, comply with all applicable laws, ordinances, and regulations.
4. Interference. IPRG and its agents, consultants, and contractors shall perform the Covered Activities in a manner that will not unreasonably interfere with the use of the Property by Owner.
5. Data and Sampling. IPRG agrees to timely provide Owner with the analytical results from any sampling conducted by IPRG at the Property.

6. Restoration of Property. To the extent feasible, IPRG shall restore all areas of the Property disturbed by the Covered Activities, including closing and abandoning any monitoring wells installed by IPRG as part of the Covered Activities, to its condition immediately prior to performance of the Covered Activities. The restoration activities will be completed within sixty (60) days after termination of this Agreement.

7. Indemnity. Owner shall not be liable to IPRG or IPRG's agents, consultants, or contractors for any personal injury, property damage, or loss of life or property caused by or arising out of the Covered Activities. Except as may result from the negligent or willful misconduct of Owner, or any officers, employees, agents, representatives of Owner, or from a breach of this Agreement by Owner, IPRG shall defend against, hold Owner harmless from, and indemnify Owner against any claim, loss, expense, or damage arising out of any negligent act or omission of IPRG or its agents, consultants, or contractors in performing the Covered Activities.

8. Applicable Law. The rights of the Parties under this Agreement shall be governed by the laws of the State of Illinois.

9. Notice. Notices, letters, and other written correspondence relating to this Agreement shall be directed to the respective Party as set forth below, or as modified by that Party by written notice:

   For Illinois Power Resources Generating, LLC:

   David Mitchell
   Vistra Corp.
   6555 Sierra Drive
   Irving, Texas 75039
   David.Mitchell@vistracorp.com
   (972) 556-6350

With a copy to:

Joshua R. More
ArentFox Schiff LLP
233 South Wacker Drive, Suite 7100
Chicago, Illinois 60606
joshua.more@afslaw.com
Phone: (312) 258-5769

For Owner:

Name: _____

Address: _____

_____

Email: _____

Phone: _____

10. Assignment. This Agreement shall be binding on the Parties and their successors and assigns. No Party shall assign this Agreement without the consent of the other Party, and such consent shall not be unreasonably withheld.

11. Term. This Agreement shall terminate at the completion of the Covered Activities, unless extended by written agreement of the Parties. IPRG shall notify Owner in writing upon the completion of the Covered Activities.

12. Reservation of Rights. By entering into, and performing under, this Agreement, neither IPRG nor Owner waives any rights, claims, or defenses, nor makes any admission of liability or responsibility.

[The Remainder of This Page Is Intentionally Left Blank]
(signature page follows)

IN WITNESS WHEREOF, the Parties have caused this Agreement to be executed by their duly authorized representative as follows:

OWNER **TAZEWELL & PEORIA RAILROAD INC.**

Signature: _____

Name: _____

Title: _____

Date: _____

ILLINOIS POWER RESOURCES GENERATING, LLC

Signature: _____

Name: _____

Title: _____

Date: _____

PROJECT: 169000XXXX | DATED: 4/29/2022 | DESIGNER: galarnmc

Y:\Mapping\Projects\22\2285\MXD\Plume_Delineation\Edwards\EDW_ProposedWells_202204\EDW Proposed Wells_Tazewell.mxd



PROPOSED WELL LOCATION
BEDROCK CONFINING UNIT
UPPERMOST
UPPER CONFINING UNIT
SUBJECT PARCEL
PARCEL BOUNDARY
PROPERTY BOUNDARY

0 100 200 Feet

PROPOSED WELL LOCATION
TAZEWELL & PEORIA RAILROAD INC PROPERTY

BARTONVILLE, ILLINOIS

Access Agreement Attached Graphic

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

APPENDIX B
SOIL BORING LOGS

RECORD OF BOREHOLE AW-1

PROJECT: Part 845 - Edwards Litigation
PROJECT NUMBER: 21454831.0002
LOCATION: Edwards Power Plant

DRILLING METHOD: 6" Sonic
DRILLING DATE: 9/8/2021
DRILL RIG: Terra Sonic 150CC

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,430,685.26 E: 2,435,889.03

ELEVATION: 462.29
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC ATT	REMARKS
0	7" Sonic	(0.0-0.2) FILL - (GW) sandy GRAVEL, fine to coarse sub-angular well-graded gravel, fine sub-rounded poorly-graded sand, trace non-plastic fines; white (N9); non-cohesive, dry, loose.	GW		462.1				
			CCR		0.2				
		(0.2-1.2) (SP) - silty SAND, fine sub-rounded poorly-graded sand, non-plastic fines, some fine to coarse gravel; black (N1), CCR; non-cohesive, dry, loose.			461.1				
			GW		1.2				
		(1.2-2.2) (GW) sandy GRAVEL, fine to coarse sub-angular well-graded gravel, fine sub-rounded poorly-graded sand, trace non-plastic fines; white (N9); non-cohesive, dry, loose.			460.1				
					2.2				
5		(2.2-8.8) (SP) SAND, fine sub-rounded poorly-graded sand, trace fine sub-rounded poorly-graded gravel, trace non-plastic fines; moderate yellowish brown (10YR 5/4); non-cohesive, dry, loose.	SP			1	SO	10.0 / 10.0	▽ Water Level 7.71 ft bgs 9/15/2021
					453.5				
		(8.8-20.0) (CL) SILTY CLAY, medium plasticity fines, trace fine sub-rounded sand; dark yellowish brown (10YR 4/2); cohesive, w~P, firm.			8.8				(8.8) Native wood fragment caked in SILTY CLAY material, 0.7' thick.
10									(10.0) Switched from 7" casing to 6" casing; 7" casing acted as temporary override to prevent migration of CCR fill material down into the native formation.
	6" Sonic		CL			2	SO	10.0 / 10.0	
15									
20					442.3				
		(20.0-39.0) (ML) CLAYEY SILT, non-plastic to medium plasticity fines, trace fine sand, trace fine gravel; dark yellowish brown (10YR 4/2); cohesive, w~PL, firm.			20.0				
	6" Sonic		ML			3	SO	19.0 / 19.0	
25									
30									

Log continued on next page

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon

LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

GOLDER

CONFIDENTIAL ATTORNEY CLIENT PRIVILEGE WORK IN PROGRESS

GOLDER STL RECORD OF BOREHOLE MWD EDWARDS.GPJ GLDR_CO.GDT 11/9/21

RECORD OF BOREHOLE AW-1

PROJECT: Part 845 - Edwards Litigation
PROJECT NUMBER: 21454831.0002
LOCATION: Edwards Power Plant

DRILLING METHOD: 6" Sonic
DRILLING DATE: 9/8/2021
DRILL RIG: Terra Sonic 150CC

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,430,685.26 E: 2,435,889.03

ELEVATION: 462.29
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
30	6" Sonic	(20.0-39.0) (ML) CLAYEY SILT, non-plastic to medium plasticity fines, trace fine sand, trace fine gravel; dark yellowish brown (10YR 4/2); cohesive, w~PL, firm. *(Continued)*	ML			3	SO	19.0 / 19.0	
					430.1 / 32.2				
		(32.2) Same as Above (SAA) except, no gravel; light brown (5YR 5/6).							
35									
					426.3 / 36.0				
		(36.0) SAA except, light olive gray (5Y 5/2).							
					423.3 / 39.0				
		END OF BORING AT 39.0 FEET BELOW GROUND SURFACE.							
40									
45									
50									
55									
60									

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon

LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

GOLDER

GOLDER STL RECORD OF BOREHOLE MWD EDWARDS.GPJ GLDR_CO.GDT 11/9/21

CONFIDENTIAL ATTORNEY CLIENT PRIVILEGE WORK IN PROGRESS

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		AW-23

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dustin Crump Midwest Engineering and Testing, Inc.	10/24/2022	10/24/2022	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
AW-23	Feet (NAVD88)	435.69 Feet (NAVD88)	8.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,430,561.48 N, 2,434,121.16 E E/W

1/4 of 1/4 of Section , T N, R

Lat 40° 35' 16.7"

Long 89° 40' 0.62"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 16	3 4 4 5	1	0 - 11.5' **LEAN CLAY:** CL, very dark gray (10YR 3/1), roots (0-5%), stiff, moist.	CL								SS = Split Spoon
2 SS	24 16	3 3 3 4	2	2' dark grayish brown (10YR 4/2), orange mottling (50%).									
3 SS	24 16	1 1 2 3	3 4	4' dark gray (10YR 4/1), soft.									
4 SS	24 18	1 2 1 2	5 6										
5 SS	24 17	1 1 1 1	7 8	8' gray (10YR 5/1).									
6 SS	24 21	WOH 1 2 40	9 10	10' wet.									WOH = Weight of Hammer
			11	11.5 - 16' **BEDROCK:** BDX, SILTSTONE.	BDX								
			12										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

Boring Number AW-23 Page 2 of 2

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	15 10	1 15 50 for 3"	13	11.5 - 16' **BEDROCK:** BDX, SILTSTONE. *(continued)*									
8 SS	8 8	8 50 for 2"	14		BDX								
			15										
			16	16' End of Boring.									

RECORD OF BOREHOLE EMW-05

PROJECT: Part 845 - Edwards Litigation
PROJECT NUMBER: 21454831.0002A
LOCATION: Edwards Power Plant

DRILLING METHOD: 6" Sonic
DRILLING DATE: 9/9/2021
DRILL RIG: Terra Sonic 150CC

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,432,325.51 E: 2,435,264.90

ELEVATION: 455.78
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
0	6" Sonic	(0.0-7.0) NO RECOVERY - Hydrovac cleared to 7 feet below ground surface.				0	VAC	0.0 / 7.0	
					448.8 / 7.0				
		(7.0-18.5) FILL - (SC) CLAYEY SAND, fine sub-rounded poorly-graded sand, low to medium plasticity fines, trace sub-rounded poorly-graded gravel; moderate yellowish brown (10YR 5/4) with dark yellowish brown (10YR 2/2) mottling; non-cohesive, dry, compact.	SC			1	SO	10.9 / 13.0	
					437.3 / 18.5				
		(18.5-19.0) (ML) CLAYEY SILT, non-plastic to low plasticity fines, some fine sub-rounded poorly-graded sand, trace fine sub-rounded gravel; medium dark gray (N4); cohesive, w<PL, firm.	ML						
					436.8 / 19.0				
			SC						
		(19.0-20.0) (SC) CLAYEY SAND, fine sub-rounded poorly-graded sand, non-plastic to low plasticity fines, trace gravel; dark yellowish brown (10YR 4/2); non-cohesive, dry, loose.			435.8 / 20.0				
		(20.0-24.0) (SP&ML) SAND and SILT, fine sub-rounded poorly-graded sand, non-plastic fines, trace sub-rounded gravel; yellowish gray (5Y 7/2); non-cohesive, moist, compact.	SP&ML						▽ Water Level 21.30 ft bgs 9/15/2021
					431.8 / 24.0				
	6" Sonic	(24.0-31.0) (ML) CLAYEY SILT, low to medium plasticity fines, trace fine sub-rounded sand, trace fine sub-rounded gravel; pale brown (5YR 5/2); cohesive, w~PL, soft.	ML			2	SO	14.0 / 14.0	
30		Log continued on next page							

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon

LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

GOLDER

CONFIDENTIAL ATTORNEY CLIENT PRIVILEGE WORK IN PROGRESS

GOLDER STL RECORD OF BOREHOLE MWD EDWARDS.GPJ GLDR_CO.GDT 11/9/21

RECORD OF BOREHOLE EMW-05

PROJECT: Part 845 - Edwards Litigation
PROJECT NUMBER: 21454831.0002A
LOCATION: Edwards Power Plant

DRILLING METHOD: 6" Sonic
DRILLING DATE: 9/9/2021
DRILL RIG: Terra Sonic 150CC

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,432,325.51 E: 2,435,264.90

ELEVATION: 455.78
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
30	6" Sonic		ML		424.8				
		(31.0-32.0) (SC) CLAYEY SAND, fine sub-rounded poorly-graded sand, medium plasticity fines, trace fine sub-rounded gravel; medium light gray (N6); non-cohesive, dry, compact.	SC		31.0 423.8	2	SO	14.0 14.0	
		(32.0-34.0) Moderately weathered (W3), thinly laminated, light gray (N7), very fine grained, moderately porous, very weak (R1), SILTSTONE, [Carbondale Formation] .			32.0 421.8				
		END OF BORING AT 34.0 FEET BELOW GROUND SURFACE.			34.0				
35									
40									
45									
50									
55									
60									

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon

LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

GOLDER

GOLDER STL RECORD OF BOREHOLE MWD EDWARDS.GPJ GLDR_CO.GDT 11/9/21

CONFIDENTIAL ATTORNEY CLIENT PRIVILEGE WORK IN PROGRESS

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		OW-01

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dustin Crump Midwest Engineering and Testing, Inc.	10/21/2022	10/21/2022	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
OW-01	Feet (NAVD88)	457.84 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,432,068.21 N, 2,435,364.74 E E/W

1/4 of 1/4 of Section , T N, R

Lat 40° 35' 52.61"

Long 89° 40' 0.74"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0	0 - 0.25' **FILL, SILTY SAND:** SM, Blind drilled to 36.5 feet below ground surface (ft bgs). See boring log PTW-01 for detailed lithology..	(FILL) SM								Blind Drill
			1	0.25 - 0.7' **FILL, WELL-GRADED GRAVEL:** GW.	(FILL) GW								
			2	0.7 - 5.75' **FILL, ASH (Coal):** ML.									
			3		(FILL) ML								
			4										
			5										
			6	5.75 - 6.2' **FILL, SANDY SILT WITH GRAVEL:** s(ML)g.	(FILL) s(ML)g								
			7	6.2 - 14' **FILL, SILTY CLAY:** CL/ML.									
			8										
			9		(FILL) CL/ML								
			10										
			11										
			12										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

Boring Number OW-01 Page 2 of 3

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	6.2 - 14' **FILL, SILTY CLAY:** CL/ML. *(continued)*	(FILL) CL/ML								
			14	14 - 22' **FILL, LEAN CLAY:** CL.									
			15										
			16										
			17										
			18		(FILL) CL								
			19										
			20										
			21										
			22	22 - 26' **LEAN CLAY:** CL.									
			23										
			24		CL								
			25										
			26	26 - 30' **SANDY LEAN CLAY:** s(CL).									
			27										
			28		s(CL)								
			29										
			30	30 - 31' **POORLY-GRADED SAND:** SP.									
			31		SP								
			31	31 - 32.7' **LEAN CLAY:** CL.									
			32		CL								

Boring Number OW-01 Page 3 of 3

Sample									Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33	31 - 32.7' **LEAN CLAY:** CL. *(continued)*	CL									
			34	32.7 - 34.4' **SILT WITH SAND:** (ML)s.	(ML)s									
			35	34.4 - 36.5' **SILTY CLAY WITH SAND:** (CL/ML)S.	(CL/ML)S									
			36	36.5' End of Boring.										

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		OW-02

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dustin Crump Midwest Engineering and Testing, Inc.	10/19/2022	10/20/2022	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
OW-02	Feet (NAVD88)	438.66 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,428,434.56 N, 2,435,409.63 E E/W

1/4 of 1/4 of Section , T N, R

Lat 40° 35' 16.54"

Long 89° 40' 0.5"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0	0 - 0.4' **POORLY-GRADED SAND:** SP, Blind drilled to 37 feet below ground surface (ft bgs). See boring log PTW-02 for detailed lithology..	SP								Blind Drill
			1	0.4 - 7.2' **SILT:** ML.									
			2										
			3										
			4		ML								
			5										
			6										
			7	7.2 - 12' **LEAN CLAY:** CL.									
			8										
			9										
			10		CL								
			11										
			12										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

Boring Number OW-02 Page 2 of 3

Sample								Soil Properties					
Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			12	12 - 23' **FAT CLAY:** CH.	CH								
			13										
			14										
			15										
			16										
			17										
			18										
			19										
			20										
			21										
			22										
			23	23 - 36.5' **LEAN CLAY:** CL.	CL								
			24										
			25										
			26										
			27										
			28										
			29										
			30										
			31										
			32										

Boring Number OW-02 Page 3 of 3

Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties					RQD/ Comments
Number and Type	Length Att. & Recovered (in)							Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	
			33	23 - 36.5' **LEAN CLAY:** CL. *(continued)*	CL								
			34										
			35										
			36										
			37	36.5 - 37' **WEATHERED BEDROCK** to **SANDSTONE:** BDX.	BDX								
				37' End of Boring.									

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		PTW-01

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dustin Crump Midwest Engineering and Testing, Inc.	10/20/2022	10/21/2022	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PTW-01	Feet (NAVD88)	459.38 Feet (NAVD88)	10.5 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,432,085.07 N, 2,435,370.28 E E/W
1/4 of 1/4 of Section , T N, R
Lat 40° 35' 52.45"
Long 89° 40' 0.81"
Local Grid Location Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 16	4 4 4 7	1	0 - 0.25' **FILL, SILTY SAND:** SM, dark brown (10YR 3/3) with organics, loose, moist.	(FILL) SM								Drilled and sampled with 3.25" Hollow Stem Auger (HSA). Re-drilled location with 6.25" HSA for well installation. SS = Split Spoon
				0.25 - 0.7' **FILL, WELL-GRADED GRAVEL:** GW, white, loose.	(FILL) GW								
2 SS	24 17	4 4 3 6	2 3	0.7 - 5.75' **FILL, ASH (Coal):** ML, very dark gray (10YR 3/1), silt-sized ash, sand (0-5%), non-plastic, non-cohesive.	(FILL) ML								
3 SS	24 16	3 3 4 6	4 5										
4 SS	24 15	4 3 5 6	6 7	5.75 - 6.2' **FILL, SANDY SILT WITH GRAVEL:** s(ML)g, very dark grayish brown (10YR 3/2), loose, moist.	(FILL) s(ML)g								
				6.2 - 14' **FILL, SILTY CLAY:** CL/ML, dark gray (10YR 4/1), yellowish brown mottling (20%), gravel (0-5%), sand (0-5%), medium to low plasticity, moist.								
5 SS	24 16	1 2 3 4	8 9	8' medium to high plasticity.									
6 SS	24 14	2 1 3 3	10 11	10' medium to low plasticity, trace rootlets.	(FILL) CL/ML								
7 SS	24 17	2 2 4 4	12 13										
8 SS	24 16	1 2 2 3	14 15 16	14 - 22' **FILL, LEAN CLAY:** CL, dark grayish brown (2.5Y 4/2), yellowish brown (10YR 5/4) mottling (20%), silt (15-30%), sand (0-5%), roots (0-5%), soft, medium plasticity, moist.	(FILL) CL								

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

Boring Number PTW-01 Page 2 of 2

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
9 SS	24 21	1 2 3 4	17	14 - 22' **FILL, LEAN CLAY:** CL, dark grayish brown (2.5Y 4/2), yellowish brown (10YR 5/4) mottling (20%), silt (15-30%), sand (0-5%), roots (0-5%), soft, medium plasticity, moist. *(continued)*	(FILL) CL								
10 SS	24 24	1 3 4 5	18 19										
11 SS	24 14	2 2 4 5	20 21										
12 SS	24 22	2 5 7 8	22 23	22 - 26' **LEAN CLAY:** CL, dark gray (2.5Y 4/1), silt (15-30%), high to medium plasticity, moist.	CL								
13 SS	24 24	2 2 3 4	24 25	24' low to medium plasticity. 24.3' - 24.47' layer of silty sand, olive gray, dry.									
14 SS	24 15	1 1 2 2	26 27	26 - 30' **SANDY LEAN CLAY:** s(CL), dark gray (2.5Y 4/1), silt (15-30%), shells (0-5%), sand (0-5%), very soft to soft, low plasticity, wet.	s(CL)								
15 SS	24 14.5	WOH 1 1 1	28 29										
16 SS	24 19	WOH WOH 2 2	30 31	30 - 31' **POORLY-GRADED SAND:** SP, dark gray (2.5Y 4/1), fine to medium-grained sand, silt (15-30%), shells (0-5%), clay (0-5%), loose, wet.	SP								WOH = Weight of Hammer
17 SS	24 24	1 2 2 2	32 33	31 - 32.7' **LEAN CLAY:** CL, olive gray, dark brown (5Y 4/2) mottling, organic material and shells (0-30%), medium to high plasticity, moist. 32.7 - 34.4' **SILT WITH SAND:** (ML)s, dark gray (5Y 4/1), fine-grained sand, black wood (0-5%), roots (0-5%), shells (0-5%), clay (0-5%), loose.	CL (ML)s								
18 SS	24 12	WOH 2 3 3	34 35	34.4 - 36.5' **SILTY CLAY WITH SAND:** (CL/ML)S, dark gray (5Y 4/1), organic material (0-5%), soft to medium stiff, low to medium plasticity, moist.	(CL/ML)S								
19 SS	17 13	2 23 50 for 5"	36 37	36.5 - 38' **WEATHERED BEDROCK** to **SILTY SAND:** BDX, **WEATHERED SILTSTONE** : dark greenish gray (GLEY 1 4/1), olive (5Y 5/4) mottling (50%), dense sand.	BDX								
20 SS	3 3	50 for 3"	38	38 - 38.25' **BEDROCK:** to **SANDSTONE:** BDX, **SILTSTONE** : dark greenish gray (GLEY 1 4/1), olive (5Y 5/4) mottling (50%), fine-grained sandstone, hard, moist. 38.25 - 38.5' Overdrilled to 38.5'. 38.5' End of Boring.	BDX								

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Station		PTW-02

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dustin Crump Midwest Engineering and Testing, Inc.	10/18/2022	10/19/2022	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PTW-02	Feet (NAVD88)	439.02 Feet (NAVD88)	10.5 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,428,450.80 N, 2,435,400.23 E E/W
1/4 of 1/4 of Section , T N, R
Lat 40° 35' 37.63"
Long 89° 40' 17.05"
Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 16	2 6 5 7	0	0 - 0.4' **POORLY-GRADED SAND:** SP, dark grayish brown (10YR 4/2), silt (15-30%), roots (0-5%), moist.	SP								Drilled and sampled with 3.25" Hollow Stem Auger (HSA). Re-drilled location with 6.25" HSA for well installation.
			1	0.4 - 7.2' **SILT:** ML, grayish brown (10YR 5/2), dark brown (7.5YR 3/4) mottling (0-5%), shells (0-5%), gravel (0-5%), sand (0-5%), no dilatancy, medium toughness, non-plastic.									
2 SS	24 12	4 4 6 6	2										
			3										
3 SS	24 10	3 6 7 8	4		ML								SS = Split Spoon
			5										
4 SS	24 19	2 4 3 4	6										
			7	7.2 - 12' **LEAN CLAY:** CL, dark grayish brown (10YR 4/2), grayish brown (10YR 5/2) mottling, slow dilatency, low toughness, medium plasticity, moist.									
5 SS	24 22	2 2 2 2	8										
			9										
6 SS	24 22	1 1 2 2	10	10' organic material (15-30%).	CL								
			11										
			12										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

Boring Number PTW-02 Page 2 of 3

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 24	1 1 1 2	13	12 - 23' **FAT CLAY:** CH, dark gray (2.5Y 4/1), no to slow dilatency, low toughness, high plasticity, moist.									
8 SS	24 21	1 1 WOH 1	14 15										WOH = Weight of Hammer
9 SS	24 24	WOH WOH 2 1	16 17	16' shells (0-5%).									
10 SS	24 24	WOH 1 2 1	18 19	19.2' - 19.3' layer of crushed shells, wet.	CH								
11 SS	24 24	2 WOH 2 1	20 21										
12 SS	24 13	WOH 1 2 1	22 23										
13 SS	24 24	WOH WOH 2 1	24 25	23 - 36.5' **LEAN CLAY:** CL, dark gray (2.5Y 4/1), shells (0-5%), sand (0-5%), slow to no dilatency, low toughness, medium plasticity, moist. 24' organic material (5-10%).									
14 SS	24 24	WOH 1 1 2	26 27	26' organic material (15%), medium to low plasticity.									
15 SS	24 24	WOH WOH 2 1	28 29	28' - 30' organic material (10-20%).	CL								
16 SS	24 24	WOH WOH WOH 2	30 31										
			32										

Boring Number PTW-02 Page 3 of 3

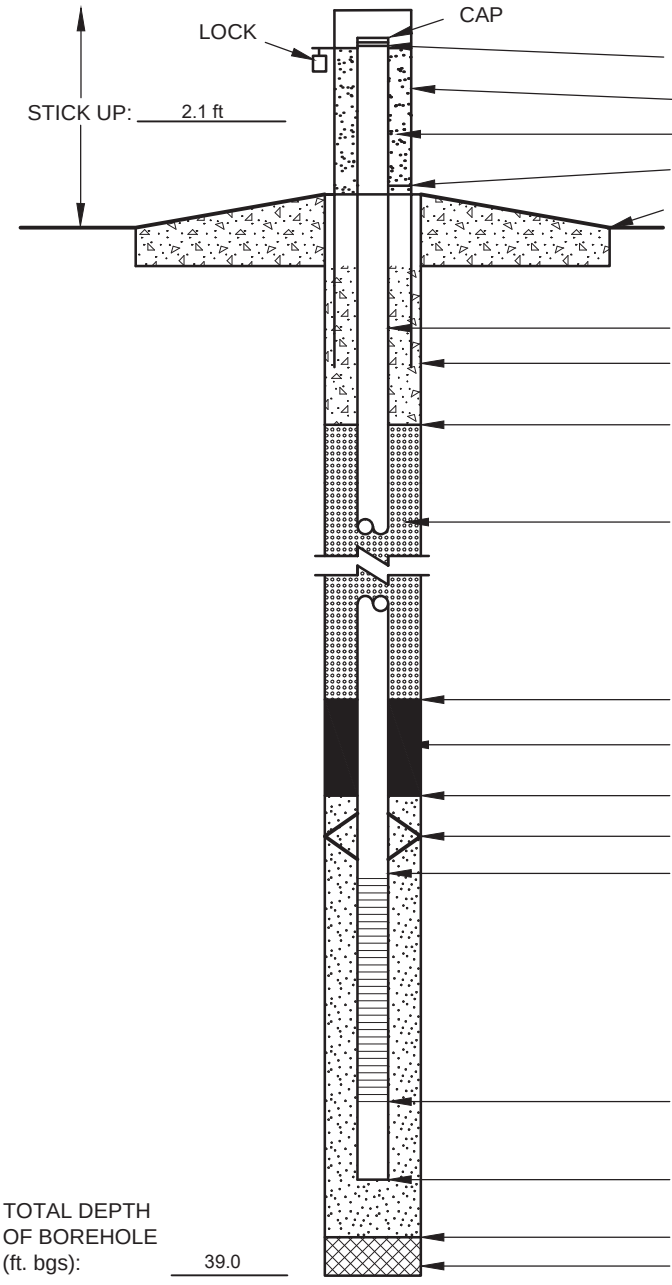
Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 20	WOH 1 1 2	33	23 - 36.5' **LEAN CLAY:** CL, dark gray (2.5Y 4/1), shells (0-5%), sand (0-5%), slow to no dilatency, low toughness, medium plasticity, moist. *(continued)* 32' organic material (0-5%), no shells.									
18 SS	24 24	WOH WOH 1 2	34 35	34' organic material (15%).	CL								
19 SS	11 12	10 50 for 5"	36 37	36.5 - 39' **WEATHERED BEDROCK** to **SANDSTONE:** BDX, **WEATHERED SILTSTONE** : gray (2.5 Y 5/1), fine sandstone, highly decomposed.	BDX								
21 SS	5 5	50 for 5"	38										
23 SS	3 3	50 for 3"	39	39 - 39.25' **BEDROCK:** to **SANDSTONE:** BDX, **SILTSTONE** : gray (2.5 Y 5/1), fine-grained sandstone, hard, wet. 39.25 - 39.5' Overdrilled to 39.5'. 39.5' End of Boring.	BDX								

APPENDIX C
MONITORING WELL CONSTRUCTION LOGS

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG

AW-1

PROJECT NAME: EDWARDS MNA EVALUATION	PROJECT NUMBER: 21454831.0002	
SITE NAME: EDWARDS POWER PLANT	LOCATION: AW-1	
CLIENT: ILLINOIS POWER RESOURCES GENERATING, LLC.	SURFACE ELEVATION: 462.3 FT MSL	
GEOLOGIST: B. TALBERT	NORTHING: 1430685.3	EASTING: 2435889.0
DRILLER: D. GORDON	STATIC WATER LEVEL: 7.71 FT BTOC	COMPLETION DATE: 9/8/2021
DRILLING COMPANY: CASCADE ENVIRONMENTAL	DRILLING METHODS: SONIC	



TOP OF CASING ELEVATION: 464.43 FT MSL

PROTECTIVE CASING (yes) / no): 4" X 5' ALUMINUM

PEA GRAVEL OR SAND

WEEP HOLE

GROUND SURFACE ELEVATION: 462.3 FT MSL

DIAMETER OF RISER PIPE (in.): 2.0

DIAMETER OF BOREHOLE (in.): 7" TO 10.0 FT BGS, 6" TO 39 FT BGS

CONCRETE SEAL DEPTH (ft. bgs): 0.3'

TYPE AND AMOUNT OF ANNULAR SEAL: HIGH SOLIDS BENTONITE
1 BAG

TOP OF BENTONITE SEAL DEPTH (ft. bgs): 24.2

TYPE AND AMOUNT OF BENTONITE SEAL: 3/8" BENTONITE CHIPS - 1 BAG

TOP OF SAND PACK DEPTH (ft. bgs): 26.2

CENTRALIZER (yes (no) - TYPE: NONE

TOP OF SCREEN DEPTH (ft. bgs): 28.2

TYPE OF SCREEN: 2" x 9.5' SCHEDULE 40 PVC

SCREEN SLOT SIZE (in.): 0.010

SIZE OF SAND PACK: 10/20 SILICA SAND

AMOUNT OF SAND: 4 BAGS

BOTTOM OF SCREEN DEPTH (ft. bgs): 37.7

BOTTOM OF WELL DEPTH (ft. bgs): 38.2

TOTAL DEPTH OF BOREHOLE (ft. bgs): 39.0

BOTTOM OF FILTER PACK (ft. bgs): 38.2

TYPE AND AMOUNT OF BACKFILL: 0.8 FT NATIVE FILL

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL. IN = INCHES. 20 GALLONS OF WATER USED DURING DRILLING. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FEET (2000) ILLINOIS WEST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY INGENAE ON SEPTEMBER 23, 2021. SAND AND BENTONITE BAGS WEIGH 50 POUNDS EACH. CONCRETE SEAL IS AT SURFACE.

CHECKED BY: E. SCHNEIDER

DATE CHECKED: 10/11/2021

PREPARED BY: B. TALBERT

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name Edwards Power Station	Local Grid Location of Well _____ft. ☐ N. ☐ S. _____ft. ☐ E. ☐ W.	Well Name AW-23
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 16.7" Long. 89° 40' 0.6" or	
Facility ID	St. Plane 1,430,561 ft. N, 2,434,121 ft. E. E / (W)	Date Well Installed 10/20/2022
Type of Well Well Code 71/dw	Section Location of Waste/Source _____1/4 of _____ 1/4 of Sec. _____, T. _____ N, R. _____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) Dustin Crump
Distance from Waste/ Source ft. / State IL	Location of Well Relative to Waste/Source u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known Gov. Lot Number _____	Midwest Engineering and Testing, Inc.

A. Protective pipe, top elevation 437.81 ft. (NAVD88)

B. Well casing, top elevation 437.57 ft. (NAVD88)

C. Land surface elevation 435.69 ft. (NAVD88)

D. Surface seal, bottom 434.7 ft. (NAVD88) or 1.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☒ CH ☐
Bedrock ☒

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐
Hollow Stem Auger ☒
_____ Other ☐

15. Drilling fluid used: Water ☐ 0 2 Air ☐
Drilling Mud ☐ 0 3 None ☒

16. Drilling additives used? ☐ Yes ☒ No

Describe _____

17. Source of water (attach analysis, if required):
n/a

E. Bentonite seal, top 434.7 ft. (NAVD88) or 1.0 ft.

F. Fine sand, top _____ ft. (NAVD88) or _____ ft.

G. Filter pack, top 430.7 ft. (NAVD88) or 5.0 ft.

H. Screen joint, top 429.7 ft. (NAVD88) or 6.0 ft.

I. Well bottom 419.7 ft. (NAVD88) or 16.0 ft.

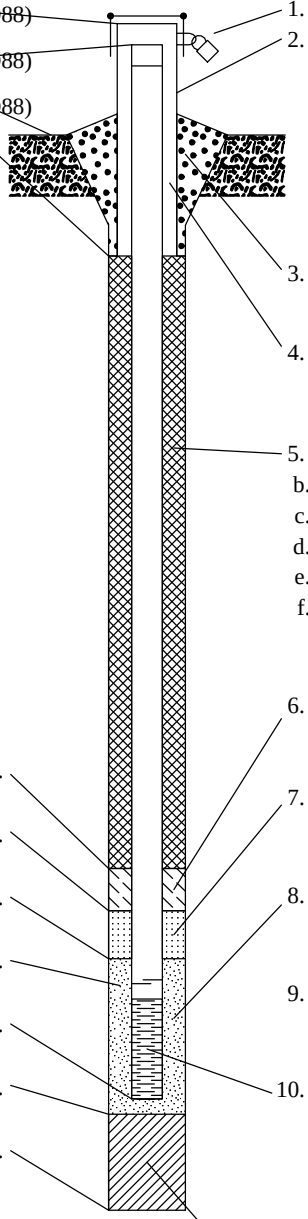
J. Filter pack, bottom 419.7 ft. (NAVD88) or 16.0 ft.

K. Borehole, bottom 419.7 ft. (NAVD88) or 16.0 ft.

L. Borehole, diameter 8.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒
   _____ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: 3 Steel Bollards
3. Surface seal: Bentonite ☐
   Concrete ☒
   _____ Other ☐
4. Material between well casing and protective pipe:
   Bentonite ☐
   Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. _____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. _____Lbs/gal mud weight . . . Bentonite slurry ☐
   d. _____% Bentonite . . . Bentonite-cement grout ☐
   e. 1.39 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐
   Tremie pumped ☐
   Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. _____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. _____
   b. Volume added _____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. RW Ridley NSF #5 Sand
   b. Volume added 3.06 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒
   Flush threaded PVC schedule 80 ☐
   _____ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒
    Continuous slot ☐
    _____ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒
    _____ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge.

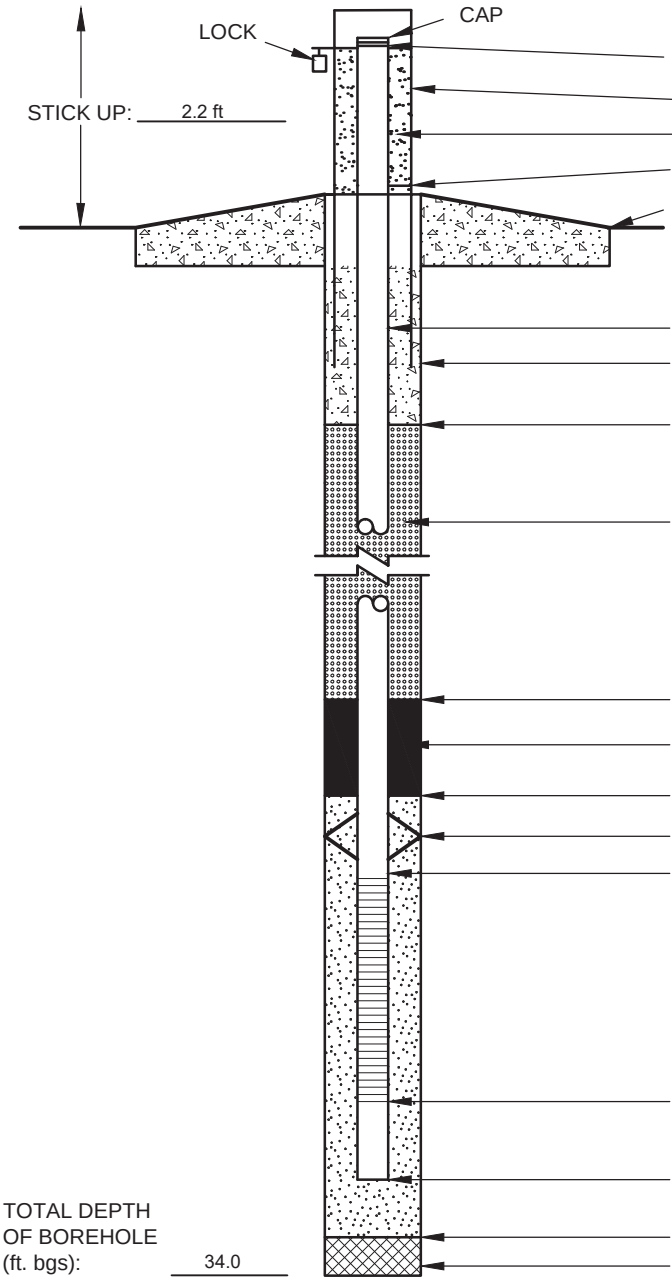
Date Modified: 1/6/2023

Signature	Firm Ramboll 234 W Florida Street, 5th Floor, Milwaukee, WI 53204 Tel: (414)837-3607 Fax: (414)837-3608

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG

EMW-05

PROJECT NAME: EDWARDS LITIGATION	PROJECT NUMBER: 21454831.0002B	
SITE NAME: EDWARDS POWER PLANT	LOCATION: EMW-05	
CLIENT: ILLINOIS POWER RESOURCES GENERATING, LLC.	SURFACE ELEVATION: 455.8 FT MSL	
GEOLOGIST: B. TALBERT	NORTHING: 1432325.5	EASTING: 2435264.9
DRILLER: D. GORDON	STATIC WATER LEVEL: 21.30 FT BTOC	COMPLETION DATE: 9/9/2021
DRILLING COMPANY: CASCADE ENVIRONMENTAL	DRILLING METHODS: SONIC	



TOP OF CASING ELEVATION: 457.94 FT MSL

PROTECTIVE CASING (yes) / no): 4" X 5' ALUMINUM

PEA GRAVEL OR SAND

WEEP HOLE

GROUND SURFACE ELEVATION: 455.8 FT MSL

DIAMETER OF RISER PIPE (in.): 2.0

DIAMETER OF BOREHOLE (in.): 6.0

CONCRETE SEAL DEPTH (ft. bgs): 0.3'

TYPE AND AMOUNT OF ANNULAR SEAL: HIGH SOLIDS BENTONITE GROUT

2 BAGS

TOP OF BENTONITE SEAL DEPTH (ft. bgs): 21.7

TYPE AND AMOUNT OF BENTONITE SEAL: 3/8" BENTONITE CHIPS - 1 BAG

TOP OF SAND PACK DEPTH (ft. bgs): 23.7

CENTRALIZER (yes (no) - TYPE: NONE

TOP OF SCREEN DEPTH (ft. bgs): 25.7

TYPE OF SCREEN: 2" x 4.5' SCHEDULE 40 PVC

SCREEN SLOT SIZE (in.): 0.010

SIZE OF SAND PACK: 10/20 SILICA SAND

AMOUNT OF SAND: 2 BAGS

BOTTOM OF SCREEN DEPTH (ft. bgs): 30.2

BOTTOM OF WELL DEPTH (ft. bgs): 30.7

TOTAL DEPTH OF BOREHOLE (ft. bgs): 34.0

BOTTOM OF FILTER PACK (ft. bgs): 30.7

TYPE AND AMOUNT OF BACKFILL: 3.3 FT NATIVE FILL

ADDITIONAL NOTES: FT BGS = FEET BELOW GROUND SURFACE. FT MSL = FEET ABOVE MEAN SEA LEVEL. IN = INCHES. HORIZONTAL DATUM: STATE PLANE COORDINATES NAD83 US SURVEY FEET (2000) ILLINOIS WEST ZONE. VERTICAL DATUM: NAVD88. WELL SURVEYED BY INGENAE ON SEPTEMBER 23, 2021. SAND AND BENTONITE BAGS WEIGH 50 POUNDS EACH. CONCRETE SEAL IS AT SURFACE.

CHECKED BY: B. TALBERT

DATE CHECKED: 10/6/2021

PREPARED BY: E. SCHNEIDER

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: OW-01
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 52.6" Long. 89° 40' 0.7" or St. Plane 1,432,068 ft. N, 2,435,365 ft. E / Ⓦ	
Facility ID		Date Well Installed: 10/21/2022
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) Dustin Crump, Midwest Engineering and Testing, Inc.
Distance from Waste/Source: ____ ft. State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number:

A. Protective pipe, top elevation 460.17 ft. (NAVD88)

B. Well casing, top elevation 459.93 ft. (NAVD88)

C. Land surface elevation 457.84 ft. (NAVD88)

D. Surface seal, bottom 455.8 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☒ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☒ Other ☐

15. Drilling fluid used: Water ☐ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☒

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): n/a

E. Bentonite seal, top 455.8 ft. (NAVD88) or 2.0 ft.

F. Fine sand, top 436.8 ft. (NAVD88) or 21.0 ft.

G. Filter pack, top 434.8 ft. (NAVD88) or 23.0 ft.

H. Screen joint, top 431.9 ft. (NAVD88) or 25.9 ft.

I. Well bottom 421.4 ft. (NAVD88) or 36.4 ft.

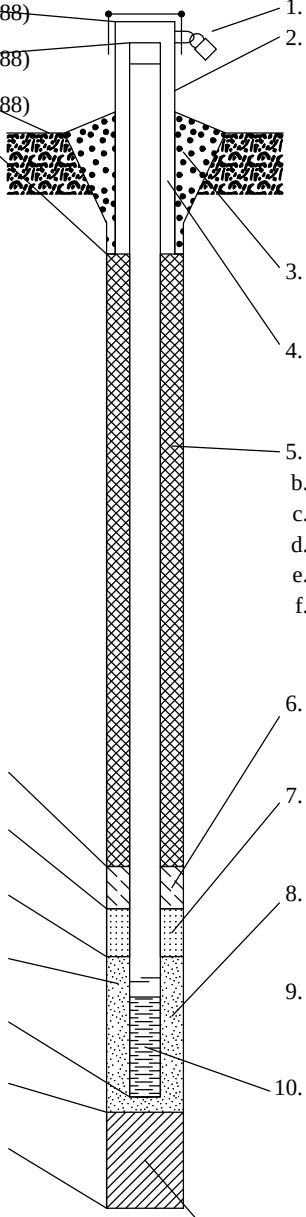
J. Filter pack, bottom 421.3 ft. (NAVD88) or 36.5 ft.

K. Borehole, bottom 421.3 ft. (NAVD88) or 36.5 ft.

L. Borehole, diameter 8.3 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: 3 Steel Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. ____ Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. RW Ridley #45-55 Sand
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. RW Ridley NSF #5 Sand
   b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Monoflex
    c. Slot size: 0.010 in.
    d. Slotted length: 9.7 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 1/6/2023

Signature ____ Firm Ramboll, 234 W Florida Street, 5th Floor, Milwaukee, WI 53204 Tel: (414)837-3607 Fax: (414)837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: OW-02
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 16.5" Long. 89° 40' 0.5" or St. Plane 1,428,435 ft. N, 2,435,410 ft. E / Ⓦ	
Facility ID		Date Well Installed: 10/19/2022
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) Dustin Crump, Midwest Engineering and Testing, Inc.
Distance from Waste/Source: ____ ft. State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number:

A. Protective pipe, top elevation 441.08 ft. (NAVD88)

B. Well casing, top elevation 440.88 ft. (NAVD88)

C. Land surface elevation 438.66 ft. (NAVD88)

D. Surface seal, bottom 436.7 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☒ Other ☐

15. Drilling fluid used: Water ☐ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☒

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): n/a

E. Bentonite seal, top 436.7 ft. (NAVD88) or 2.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 417.7 ft. (NAVD88) or 21.0 ft.

H. Screen joint, top 414.1 ft. (NAVD88) or 24.6 ft.

I. Well bottom 403.6 ft. (NAVD88) or 35.1 ft.

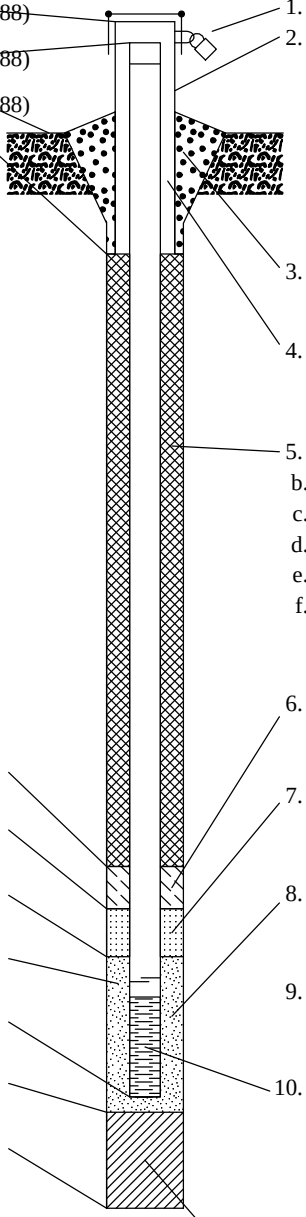
J. Filter pack, bottom 401.7 ft. (NAVD88) or 37.0 ft.

K. Borehole, bottom 401.7 ft. (NAVD88) or 37.0 ft.

L. Borehole, diameter 8.3 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: 3 Steel Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____% Bentonite . . . Bentonite-cement grout ☐
   e. ____Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. RW Ridley NSF #5 Sand
   b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Monoflex
    c. Slot size: 0.010 in.
    d. Slotted length: 9.7 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 12/12/2022

Signature ____ Firm Ramboll, 234 W Florida Street, 5th Floor, Milwaukee, WI 53204 Tel: (414)837-3607 Fax: (414)837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station

Facility License, Permit or Monitoring No.:

Facility ID:

Type of Well: Well Code 72/dp

Distance from Waste/Source: ft. State: IL

Local Grid Location of Well: ft. ☐ N. ☐ S. ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat. 40° 35' 52.5" Long. 89° 40' 0.8" or

St. Plane 1,432,085 ft. N, 2,435,370 ft. E / W

Section Location of Waste/Source: ☐ E ☐ W

1/4 of 1/4 of Sec. , T. N, R.

Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known

Gov. Lot Number:

Well Name: PTW-01

Date Well Installed: 10/20/2022

Well Installed By: (Person's Name and Firm): Dustin Crump; Midwest Engineering and Testing, Inc.

A. Protective pipe, top elevation 461.80 ft. (NAVD88)

B. Well casing, top elevation 461.60 ft. (NAVD88)

C. Land surface elevation 459.38 ft. (NAVD88)

D. Surface seal, bottom 457.4 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☒ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☒ Other ☐

15. Drilling fluid used: Water ☐ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☒

16. Drilling additives used? ☐ Yes ☒ No

Describe

17. Source of water (attach analysis, if required): n/a

E. Bentonite seal, top 457.4 ft. (NAVD88) or 2.0 ft.

F. Fine sand, top 437.4 ft. (NAVD88) or 22.0 ft.

G. Filter pack, top 435.4 ft. (NAVD88) or 24.0 ft.

H. Screen joint, top 432.5 ft. (NAVD88) or 26.9 ft.

I. Well bottom 420.9 ft. (NAVD88) or 38.4 ft.

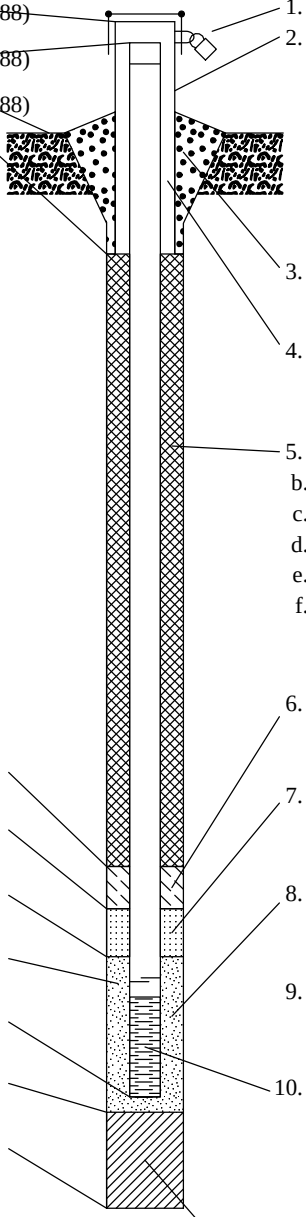
J. Filter pack, bottom 421.1 ft. (NAVD88) or 38.3 ft.

K. Borehole, bottom 420.9 ft. (NAVD88) or 38.5 ft.

L. Borehole, diameter 10.5 in.

M. O.D. well casing 4.50 in.

N. I.D. well casing 4.03 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 6.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: 3 Steel Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. _____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. _____Lbs/gal mud weight . . . Bentonite slurry ☐
   d. _____% Bentonite . . . Bentonite-cement grout ☐
   e. _____Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. _____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. RW Ridley #45-55 Sand
   b. Volume added _____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. RW Ridley NSF #5 Sand
   b. Volume added _____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Monoflex
    c. Slot size: 0.010 in.
    d. Slotted length: 9.4 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 12/12/2022

Signature

Firm: Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Station

Facility License, Permit or Monitoring No.:

Facility ID:

Type of Well: Well Code 72/dp

Distance from Waste/Source: ft. State: IL

Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat. 40° 35' 37.6" Long. 89° 40' 17.1" or

St. Plane 1,428,451 ft. N, 2,435,400 ft. E / Ⓦ

Section Location of Waste/Source: ☐ E ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ W

Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known

Gov. Lot Number:

Well Name: PTW-02

Date Well Installed: 10/18/2022

Well Installed By: (Person's Name and Firm): Dustin Crump; Midwest Engineering and Testing, Inc.

A. Protective pipe, top elevation 441.68 ft. (NAVD88)

B. Well casing, top elevation 441.12 ft. (NAVD88)

C. Land surface elevation 439.02 ft. (NAVD88)

D. Surface seal, bottom 437.0 ft. (NAVD88) or 2.0 ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☒ Other ☐

15. Drilling fluid used: Water ☐ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☒

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): n/a

E. Bentonite seal, top 437.0 ft. (NAVD88) or 2.0 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 417.0 ft. (NAVD88) or 22.0 ft.

H. Screen joint, top 412.5 ft. (NAVD88) or 26.5 ft.

I. Well bottom 400.6 ft. (NAVD88) or 38.4 ft.

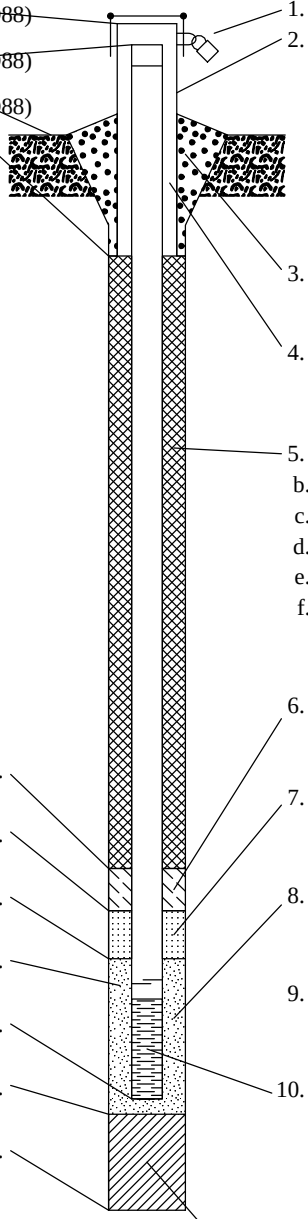
J. Filter pack, bottom 399.8 ft. (NAVD88) or 39.3 ft.

K. Borehole, bottom 399.5 ft. (NAVD88) or 39.5 ft.

L. Borehole, diameter 10.5 in.

M. O.D. well casing 4.50 in.

N. I.D. well casing 4.03 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 6.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: 3 Steel Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____% Bentonite . . . Bentonite-cement grout ☐
   e. ____Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. RW Ridley NSF #5 Sand
   b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Monoflex
    c. Slot size: 0.010 in.
    d. Slotted length: 9.4 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 1/6/2023

Signature: ____

Firm: Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

APPENDIX D
WELL DEVELOPMENT FORMS

GOLDER
MEMBER OF WSP

WELL DEVELOPMENT/PURGING FORM

Project Ref: Edwards Litigation **Project No.:** 21454831

Location AW-01

Monitored By: EMS Date 9/15/2021 Time 1617

Well Piezometer Data

	(circle one)	Inital → Final	
Depth of Well (from top of PVC or ground)		38.35 → 40.30	feet
Depth of Water (from top of PVC or ground)		7.71 → Dry	feet
Radius of Casing		2.0	inches
			feet
Casing Volume			cubic feet
		11.23 x 3 = 33.69	gallons

Development / Purging Discharge Data

Purging Method: Hydrolift - Waterra

Start Purging Date 9/15/2021 Time 1218

Stop Purging Date 9/15/2021 Time 1617

Monitoring

Date	Time	Volume Discharge (gals)	Temp (°C)	pH	Spec.Cond. (µS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Redox Potential (+/- mV)	WL (ft BTOC)	Appearance of Water and Comments
9/15/21	1223	10	16.4	6.88	1228	71000	3.39	67.3	32.21	Dark Brown, Highly
	1228	13	17.2	6.89	1259	71000	6.49	21.7	38.31	Turbid. Flow rate reduced
↓	1615	15							39.50	due to high drawdown
										Well runs dry at 1229
										EMS returns to purge any water that has entered well from formation at 1615.
										Well runs dry at 1617.

RAMBOLL

MONITORING WELL DEVELOPMENT

Facility/Project Name	State	Well Name
Edwards Power Station	IL	AW-23

Facility License, Permit or Monitoring Number

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method:
- surged with bailer and bailed ☐
- surged with bailer and pumped ☐
- surged with block and bailed ☐
- surged with block and pumped ☒
- surged with block, bailed, and pumped ☐
- compressed air ☐
- bailed only ☐
- pumped only ☐
- pumped slowly ☐
- other _____ ☐

3. Time spent developing well 129 min.

4. Depth of well (from top of well casing) 18.8 ft.

5. Inside diameter of well 2.07 in.

6. Volume of water in filter pack and well casing 10.5 gal.

7. Volume of water removed from well 129.0 gal.

8. Volume of water added (if any) 0.0 gal.

9. Source of water added not applicable

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	7.81 ft.	10.73 ft.
Date	b.	10/26/2022	10/26/2022
Time	c.	☐ a.m. 01:01 ☒ p.m.	☐ a.m. 03:10 ☒ p.m.
12. Sediment in well bottom		0.0 inches	0.0 inches
13. Water clarity		Clear ☐ Turbid ☒ (Describe)	Clear ☒ Turbid ☐ (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	mg/l	mg/l
15. COD	mg/l	mg/l

16. Well developed by: Person's Name and Firm
Evvan Plank
Ramboll

17. Additional comments on development:

Facility Address or Owner/Responsible Party Address

Name: Mark Davis

Firm: Illinois Power Generating Company

Street: 7800 S Cilco Ln

City/State/Zip: Peoria IL 61607

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: 

Print Name: Evvan Plank

Firm: Ramboll

Template: RAMBOLL_WELL DEVELOPMENT - Project: 845_EDWARDS_

Date Modified: 1/6/2023

GOLDER
MEMBER OF WSP

WELL DEVELOPMENT/PURGING FORM

Project Ref: Edwards Litigation **Project No.:** 21454831

Location EMW-05

Monitored By: EMS Date 9/15/2021 Time 1720

Well Piezometer Data

(circle one)

	Intial → Final	
Depth of Well (from top of PVC or ground)	32.87 → 32.86	feet
Depth of Water (from top of PVC or ground)	21.30 → Dry	feet
Radius of Casing	20	inches
	~~(ES)~~	~~feet~~
Casing Volume	~~(ES)~~	~~cubic feet~~
	4.99 x 3 = 14.97	gallons

Development / Purging Discharge Data

Purging Method: Hydrolift - Waterra

Start Purging Date 9/15/2021 Time 1540

Stop Purging Date 9/15/2021 Time 1720

Monitoring

Date	Time	Volume Discharge (gals)	Temp (°C)	pH	Spec.Cond. (µS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Redox Potential (+/- mV)	WL (ft BTOC)	Appearance of Water and Comments
9/15/21	1545	~~7~~	16.4	7.24	1224	>1000	4.76	81.3	32.04	Dark Brown, Highly Turbid. Well runs dry at 1548
2	1717	9							30.56	
										EMS returns to remove Water that had entered through formation at 1717.
										Well runs dry at 1720
						(ES)				

RAMBOLL

MONITORING WELL DEVELOPMENT

Facility/Project Name	State	Well Name
Edwards Power Station	IL	OW-01

Facility License, Permit or Monitoring Number

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method:
- surged with bailer and bailed ☐
- surged with bailer and pumped ☐
- surged with block and bailed ☐
- surged with block and pumped ☒
- surged with block, bailed, and pumped ☐
- compressed air ☐
- bailed only ☐
- pumped only ☐
- pumped slowly ☐
- other _____ ☐

3. Time spent developing well 73 min.

4. Depth of well (from top of well casing) 38.5 ft.

5. Inside diameter of well 2.07 in.

6. Volume of water in filter pack and well casing 11.5 gal.

7. Volume of water removed from well 146.0 gal.

8. Volume of water added (if any) 0.0 gal.

9. Source of water added not applicable

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	24.58 ft.	38.51 ft.
Date	b.	10/24/2022	10/24/2022
Time	c.	09:52 ☒ a.m. ☐ p.m.	11:05 ☒ a.m. ☐ p.m.
12. Sediment in well bottom		1.0 inches	0.0 inches
13. Water clarity		Clear ☐ Turbid ☒ (Describe) grayish brown	Clear ☐ Turbid ☒ (Describe) grayish brown
14. Total suspended solids		mg/l	mg/l
15. COD		mg/l	mg/l

Fill in if drilling fluids were used and well is at solid waste facility:

16. Well developed by: Person's Name and Firm
Evvan Plank
Ramboll

17. Additional comments on development:
Purged well dry multiple times

Facility Address or Owner/Responsible Party Address

Name: Mark Davis

Firm: Illinois Power Generating Company

Street: 7800 S Cilco Ln

City/State/Zip: Peoria IL 61607

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: 

Print Name: Evvan Plank

Firm: Ramboll

Template: RAMBOLL_WELL DEVELOPMENT - Project: 845_EDWARDS_

Date Modified: 1/6/2023

RAMBOLL

MONITORING WELL DEVELOPMENT

Facility/Project Name	State	Well Name
Edwards Power Station	IL	OW-02

Facility License, Permit or Monitoring Number

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method:
- surged with bailer and bailed ☐
- surged with bailer and pumped ☐
- surged with block and bailed ☐
- surged with block and pumped ☒
- surged with block, bailed, and pumped ☐
- compressed air ☐
- bailed only ☐
- pumped only ☐
- pumped slowly ☐
- other _____ ☐

3. Time spent developing well 247 min.

4. Depth of well (from top of well casing) 37.3 ft.

5. Inside diameter of well 2.07 in.

6. Volume of water in filter pack and well casing gal.

7. Volume of water removed from well 61.0 gal.

8. Volume of water added (if any) 0.0 gal.

9. Source of water added not applicable

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	10.10 ft.	12.43 ft.
Date	b.	10/26/2022	10/27/2022
Time	c.	03:52 ☐ a.m. ☒ p.m.	04:45 ☐ a.m. ☒ p.m.
12. Sediment in well bottom		0.0 inches	0.0 inches
13. Water clarity		Clear ☐ Turbid ☒ (Describe)	Clear ☒ Turbid ☐ (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	mg/l	mg/l
15. COD	mg/l	mg/l

16. Well developed by: Person's Name and Firm
Evvan Plank
Ramboll

17. Additional comments on development:
10/26/2022: Purging halted at 16:03 dude to LEL for methane. Eleven (11) gallons of water purged.
10/27/2022: Resumed development and purged 50 gallons.

Facility Address or Owner/Responsible Party Address

Name: Mark Davis

Firm: Illinois Power Generating Company

Street: 7800 S Cilco Ln

City/State/Zip: Peoria IL 61607

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: 

Print Name: Evvan Plank

Firm: Ramboll

Template: RAMBOLL_WELL DEVELOPMENT - Project: 845_EDWARDS_

Date Modified: 12/12/2022

RAMBOLL

MONITORING WELL DEVELOPMENT

Facility/Project Name	State	Well Name
Edwards Power Station	IL	PTW-01

Facility License, Permit or Monitoring Number

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method:
- surged with bailer and bailed ☐
- surged with bailer and pumped ☐
- surged with block and bailed ☐
- surged with block and pumped ☒
- surged with block, bailed, and pumped ☐
- compressed air ☐
- bailed only ☐
- pumped only ☐
- pumped slowly ☐
- other _____ ☐

3. Time spent developing well 37 min.

4. Depth of well (from top of well casing) 40.7 ft.

5. Inside diameter of well 4.03 in.

6. Volume of water in filter pack and well casing 13.8 gal.

7. Volume of water removed from well 74.0 gal.

8. Volume of water added (if any) 0.0 gal.

9. Source of water added not applicable

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	26.33 ft.	40.66 ft.
Date	b.	10/24/2022	10/24/2022
Time	c.	11:15 ☒ a.m. ☐ p.m.	02:09 ☐ a.m. ☒ p.m.
12. Sediment in well bottom		13.0 inches	0.0 inches
13. Water clarity		Clear ☐ Turbid ☒ (Describe) grayish brown	Clear ☐ Turbid ☒ (Describe) grayish brown
14. Total suspended solids		mg/l	mg/l
15. COD		mg/l	mg/l

Fill in if drilling fluids were used and well is at solid waste facility:

16. Well developed by: Person's Name and Firm
Evvan Plank
Ramboll

17. Additional comments on development:
Purged well dry multiple times

Facility Address or Owner/Responsible Party Address

Name: Mark Davis

Firm: Illinois Power Generating Company

Street: 7800 S Cilco Ln

City/State/Zip: Peoria IL 61607

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: 

Print Name: Evvan Plank

Firm: Ramboll

Template: RAMBOLL_WELL DEVELOPMENT - Project: 845_EDWARDS_

Date Modified: 12/12/2022

RAMBOLL

MONITORING WELL DEVELOPMENT

Facility/Project Name	State	Well Name
Edwards Power Station	IL	PTW-02

Facility License, Permit or Monitoring Number

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method:
- surged with bailer and bailed ☐
- surged with bailer and pumped ☐
- surged with block and bailed ☐
- surged with block and pumped ☒
- surged with block, bailed, and pumped ☐
- compressed air ☐
- bailed only ☐
- pumped only ☐
- pumped slowly ☐
- other _____ ☐

3. Time spent developing well 210 min.

4. Depth of well (from top of well casing) 40.5 ft.

5. Inside diameter of well 4.03 in.

6. Volume of water in filter pack and well casing gal.

7. Volume of water removed from well 210.0 gal.

8. Volume of water added (if any) 0.0 gal.

9. Source of water added not applicable

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	10.41 ft.	15.87 ft.
Date	b.	10/27/2022	10/27/2022
Time	c.	08:24 ☒ a.m. ☐ p.m.	11:54 ☒ a.m. ☐ p.m.
12. Sediment in well bottom		inches	0.0 inches
13. Water clarity		Clear ☐ Turbid ☒ (Describe) grayish brown	Clear ☒ Turbid ☐ (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	mg/l	mg/l
15. COD	mg/l	mg/l

16. Well developed by: Person's Name and Firm
Evvan Plank
Ramboll

17. Additional comments on development:
Development stopped due to methane exceedance.

Facility Address or Owner/Responsible Party Address

Name: Mark Davis

Firm: Illinois Power Generating Company

Street: 7800 S Cilco Ln

City/State/Zip: Peoria IL 61607

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: 

Print Name: Evvan Plank

Firm: Ramboll

Template: RAMBOLL_WELL DEVELOPMENT - Project: 845_EDWARDS_

Date Modified: 1/6/2023

APPENDIX E
GROUNDWATER SAMPLING RECORDS

Low-Flow Test Report:

Test Date / Time: 11/18/2022 1:28:41 PM
Project: Baldwin, IL (11)
Operator Name:

Location Name: AW01	**Flow Cell Volume: 130 ml**	**Instrument Used: Aqua TROLL 600 Vented** **Serial Number: 454596**

Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP
		+/- 0.1	+/- 0.1	+/- 3 %	+/- 0.3	+/- 10 %	+/- 10
11/18/2022 1:28 PM	00:00	7.21 pH	12.56 °C	1,526.4 µS/cm	1.65 mg/L	131.20 NTU	124.4 mV
11/18/2022 1:31 PM	03:00	6.94 pH	11.20 °C	1,489.9 µS/cm	0.58 mg/L	92.03 NTU	130.8 mV
11/18/2022 1:34 PM	06:00	6.89 pH	10.30 °C	1,504.1 µS/cm	0.44 mg/L	104.40 NTU	132.3 mV
11/18/2022 1:37 PM	09:00	6.87 pH	9.69 °C	1,515.0 µS/cm	0.43 mg/L	103.24 NTU	132.3 mV
11/18/2022 1:40 PM	12:00	6.85 pH	9.31 °C	547.82 µS/cm	0.42 mg/L	361.77 NTU	131.3 mV
11/18/2022 1:43 PM	15:00	6.85 pH	9.02 °C	17.43 µS/cm	0.34 mg/L	371.64 NTU	129.5 mV
11/18/2022 1:46 PM	18:00	6.84 pH	8.63 °C	1.46 µS/cm	0.35 mg/L	306.99 NTU	127.5 mV
11/18/2022 1:49 PM	21:00	6.84 pH	8.24 °C	1,020.1 µS/cm	0.36 mg/L	37.55 NTU	124.3 mV
11/18/2022 1:52 PM	24:00	6.84 pH	7.82 °C	1,328.0 µS/cm	0.44 mg/L	222.47 NTU	121.4 mV
11/18/2022 1:55 PM	27:00	6.84 pH	7.64 °C	924.21 µS/cm	0.50 mg/L	18.36 NTU	118.1 mV
11/18/2022 1:58 PM	30:00	6.84 pH	7.41 °C	570.80 µS/cm	0.55 mg/L	108.77 NTU	114.2 mV
11/18/2022 2:01 PM	33:00	6.85 pH	7.37 °C	1,132.4 µS/cm	0.59 mg/L	12.76 NTU	110.1 mV
11/18/2022 2:04 PM	36:00	6.85 pH	7.18 °C	1,263.7 µS/cm	0.61 mg/L	134.80 NTU	106.0 mV
11/18/2022 2:07 PM	39:00	6.86 pH	6.92 °C	1,149.2 µS/cm	0.63 mg/L	458.28 NTU	102.3 mV
11/18/2022 2:10 PM	42:00	6.86 pH	6.72 °C	746.16 µS/cm	0.68 mg/L	12.32 NTU	98.7 mV
11/18/2022 2:13 PM	45:00	6.86 pH	6.72 °C	1,239.7 µS/cm	0.68 mg/L	8.97 NTU	95.1 mV
11/18/2022 2:16 PM	48:00	6.86 pH	6.57 °C	1,538.1 µS/cm	0.67 mg/L	11.40 NTU	91.3 mV
11/18/2022 2:19 PM	51:00	6.86 pH	6.60 °C	1,256.8 µS/cm	0.67 mg/L	11.53 NTU	88.0 mV

Samples

Sample ID:	Description:

WELL DEVELOPMENT AND GROUNDWATER SAMPLING FIELD FORM

PROJECT INFORMATION

Site: EDWARDS P.P. Client: VISTRA

Project Number: 194027.92 Task #: 1000.LBR Start Date: 11/10/2022 Time: 14:40

Field Personnel: AH, CAL Finish Date: 11/10/2022 Time: 16:28

WELL INFORMATION

(STICK UP) Well ID: EMW-05

Casing ID: 2 Inches

Screen Interval: 27.84 – 32.41' BTOC

Borehole Diameter: 6 Inches

Filter Pack Interval: 25.84 – 32.84' BTOC

EVENT TYPE

- ☐ Well Development
- ☒ Low-Flow / Low-Stress Sampling
- ☐ Well Volume Approach Sampling
- ☐ Other (Specify below)

PURGE INFORMATION

Purge Method: ☐ Bailer ☒ Pump

Bailer Type: n/a

Pump Type and Serial #: EXISTING (IN-WELL) BLADDER Pump w/ MP-50 controller/compressor

Tube/Pump Intake Depth: ~29' BTOC (top of pump)

Stabilized Pumping Rate: 130 ~~120~~ mL/min

DEPTH MEASUREMENTS

	INITIAL		FINAL	
	Depth FT BTOC	Time (24-Hour)	Depth FT BTOC	Time (24-Hour)
LNAPL	N/A			
Groundwater	22.04	14:40	28.65	16:28
DNAPL	N/A			
Casing Base				

VOLUME CALCULATION AND PRODUCTION INFORMATION

Volume Calculation Type: ☐ Well Casing ☐ Borehole

Volume Per Foot:

Standing Water Column: N/A feet

1 Well Volume: Gallons 3 Well Volumes: Gallons

5 Well Volumes: Gallons 10 Well Volumes: Gallons

Total Volumes Produced: Gallons

Well Purged Dry? ☐ Yes ☐ No

Water Level Serial #: SOLINST MODEL 101 S/N: 363824

Water Quality Probe Type and Serial # AT600 # 454596

WATER QUALITY INDICATOR PARAMETERS

Sampling Stage	Time (military)	Volume Removed (gallons)	Depth to Water (Feet)	Drawdown (Feet)	Temp (°C)	pH (SU)	SEC or Cond. (µs/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	ORP (mV)	Visual Clarity
elapsed time											
0:00 initial	1442	—	22.04	—	9.73	1,521.4	6.85	0.74	241.32	87.6	Cloudy
0:600 purge	14:48		23.25	1.21	9.61	1,485.3	6.78	0.41	101.10	89.8	Slightly Cloudy
09:00	14:51		23.88	0.63							
12:00	14:54		24.50	0.62							
15:00	14:57		24.92	0.42							
18:00	15:00		24.25.34	0.42							
21:00	15:03		25.67	0.43							Clear
24:00	15:06		26.00	0.43							Clear

DATA IN

SAMPLE ID: EMW-05 AT 15:13 (MS/MSD)

- sample looked clear at time of sampling, became cloudy while filling up last few lab-ware jars (likely due to dropping water table).

WELL DEVELOPMENT AND GROUNDWATER SAMPLING FIELD FORM

PROJECT INFORMATION

Site: EDWARDS PP
Client: VISTRA
Project Number: 1940107792
Task #: 1000.LBR
Start Date: 11/18/2022
Time: 14:40
Field Personnel: AFH, CAL
Finish Date:
Time: 16:28

WELL INFORMATION

Well ID: EMW-05
Casing ID: 2 inches

EVENT TYPE

- [ ] Well Development
- [x] Low-Flow / Low Stress Sampling
- [ ] Well Volume Approach Sampling
- [ ] Other (Specify):

WATER QUALITY INDICATOR PARAMETERS (continued)

elapsed time (purge)	Sampling Stage	Time (military)	Volume Removed (gallons)	Depth to Water (Feet)	Drawdown (Feet)	Temp. (°C)	pH (SU)	SEC or Cond. (µs/cm)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	ORP (mV)	Visual Clarity
27:00	Purge	15:09		26.41	0.41	DATA IN VU-SITU						Clear
30:00	Stable	15:12	~1 gal	26.82	0.41							Clear
	(sample)	15:13 - sampled well - all stable except turb.										

AFH 11/18/2022

NOTES (continued)

SAMPLE ID: EMW-05 AT 15:13. (M3/MSD)

triple volume

ABBREVIATIONS

Cond. - Actual Conductivity
FT BTOC - Feet Below Top of Casing
na - Not Applicable
nm - Not Measured
ORP - Oxidation-Reduction Potential
SEC - Specific Electrical Conductance
SU - Standard Units
Temp - Temperature
°C - Degrees Celcius

Low-Flow Test Report:

Test Date / Time: 11/21/2022 11:46:19 AM
Project: Baldwin, IL (13)
Operator Name:

Location Name: AW-23	**Flow Cell Volume: 130 ml**	**Instrument Used: Aqua TROLL 600 Vented** **Serial Number: 454596**

Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP
		+/- 0.1	+/- 0.1	+/- 3 %	+/- 0.3	+/- 10 %	+/- 10
11/21/2022 11:46 AM	00:00	7.43 pH	17.04 °C	1,111.4 µS/cm	7.96 mg/L	27.54 NTU	132.0 mV
11/21/2022 11:49 AM	03:00	7.02 pH	14.49 °C	1,128.4 µS/cm	0.76 mg/L	24.09 NTU	134.4 mV
11/21/2022 11:52 AM	06:00	6.98 pH	13.80 °C	1,121.6 µS/cm	0.63 mg/L	11.20 NTU	130.9 mV
11/21/2022 11:55 AM	09:00	6.93 pH	13.55 °C	1,134.9 µS/cm	0.57 mg/L	11.57 NTU	133.6 mV
11/21/2022 11:58 AM	12:00	6.92 pH	13.27 °C	1,138.1 µS/cm	0.43 mg/L	11.54 NTU	131.1 mV
11/21/2022 12:01 PM	15:00	6.91 pH	13.22 °C	1,132.1 µS/cm	0.44 mg/L	6.75 NTU	128.9 mV
11/21/2022 12:04 PM	18:00	6.90 pH	13.12 °C	1,141.8 µS/cm	0.44 mg/L	4.22 NTU	126.9 mV
11/21/2022 12:07 PM	21:00	6.90 pH	13.26 °C	1,152.4 µS/cm	0.46 mg/L	4.70 NTU	122.8 mV
11/21/2022 12:10 PM	24:00	6.92 pH	13.30 °C	1,158.9 µS/cm	0.38 mg/L	3.25 NTU	119.8 mV
11/21/2022 12:13 PM	27:00	6.92 pH	13.38 °C	1,164.6 µS/cm	0.38 mg/L	2.51 NTU	117.2 mV
11/21/2022 12:16 PM	30:00	6.92 pH	13.50 °C	1,174.2 µS/cm	0.84 mg/L	3.08 NTU	114.6 mV
11/21/2022 12:19 PM	33:00	6.93 pH	13.60 °C	1,173.6 µS/cm	0.51 mg/L	2.97 NTU	111.3 mV
11/21/2022 12:22 PM	36:00	6.94 pH	13.45 °C	1,174.6 µS/cm	0.26 mg/L	3.59 NTU	109.3 mV
11/21/2022 12:25 PM	39:10	6.96 pH	13.60 °C	1,179.2 µS/cm	0.27 mg/L	4.55 NTU	106.1 mV
11/21/2022 12:28 PM	42:10	6.96 pH	13.69 °C	1,183.9 µS/cm	0.24 mg/L	4.23 NTU	104.0 mV
11/21/2022 12:31 PM	45:10	6.96 pH	13.59 °C	1,187.2 µS/cm	0.22 mg/L	3.27 NTU	102.4 mV

Samples

Sample ID:	Description:

Created using VuSitu from In-Situ, Inc.

Low-Flow Test Report:

Test Date / Time: 12/16/2022 7:44:00 AM
Project: Edwards
Operator Name: S Mallow

Location Name: AW-23	**Estimated Total Volume Pumped: 9600 ml** **Flow Cell Volume: 130 ml** **Final Flow Rate: 120 ml/min**	**Instrument Used: Aqua TROLL 600 Vented** **Serial Number: 454820**

Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Flow
		+/- 0.1	+/- 0.1	+/- 3 %	+/- 0.3	+/- 10 %	+/- 10	
12/16/2022 7:44 AM	00:00	6.68 pH	6.04 °C	1,249.8 µS/cm	2.57 mg/L	113.92 NTU	200.7 mV	120.00 ml/min
12/16/2022 7:47 AM	03:00	6.69 pH	5.79 °C	1,236.1 µS/cm	0.61 mg/L	87.28 NTU	212.8 mV	120.00 ml/min
12/16/2022 7:50 AM	06:00	6.66 pH	5.91 °C	1,240.1 µS/cm	0.49 mg/L	86.97 NTU	215.4 mV	120.00 ml/min
12/16/2022 7:53 AM	09:00	6.63 pH	5.89 °C	1,239.0 µS/cm	0.42 mg/L	76.25 NTU	214.7 mV	120.00 ml/min
12/16/2022 7:56 AM	12:00	6.62 pH	6.24 °C	1,244.4 µS/cm	0.40 mg/L	71.83 NTU	211.6 mV	120.00 ml/min
12/16/2022 7:59 AM	15:00	6.60 pH	6.46 °C	1,246.1 µS/cm	0.38 mg/L	71.90 NTU	208.7 mV	120.00 ml/min
12/16/2022 8:02 AM	18:00	6.59 pH	6.70 °C	1,251.7 µS/cm	0.34 mg/L	58.84 NTU	206.0 mV	120.00 ml/min
12/16/2022 8:05 AM	21:00	6.58 pH	6.93 °C	1,267.5 µS/cm	0.30 mg/L	41.38 NTU	204.3 mV	120.00 ml/min
12/16/2022 8:08 AM	24:00	6.58 pH	6.45 °C	1,269.2 µS/cm	0.27 mg/L	46.01 NTU	202.2 mV	120.00 ml/min
12/16/2022 8:11 AM	27:00	6.57 pH	6.76 °C	1,293.7 µS/cm	0.25 mg/L	29.72 NTU	200.9 mV	120.00 ml/min
12/16/2022 8:14 AM	30:00	6.57 pH	6.64 °C	1,297.8 µS/cm	0.23 mg/L	25.22 NTU	199.8 mV	120.00 ml/min
12/16/2022 8:14 AM	30:34	6.57 pH	6.87 °C	1,293.0 µS/cm	0.23 mg/L	32.44 NTU	199.9 mV	120.00 ml/min
12/16/2022 8:16 AM	32:11	6.58 pH	6.57 °C	1,293.9 µS/cm	0.27 mg/L	35.13 NTU	188.5 mV	120.00 ml/min
12/16/2022 8:19 AM	35:11	6.54 pH	6.42 °C	1,291.8 µS/cm	0.25 mg/L	24.24 NTU	178.5 mV	120.00 ml/min
12/16/2022 8:22 AM	38:11	6.55 pH	6.81 °C	1,305.3 µS/cm	0.23 mg/L	26.71 NTU	173.6 mV	120.00 ml/min
12/16/2022 8:25 AM	41:11	6.55 pH	6.84 °C	1,312.0 µS/cm	0.22 mg/L	23.83 NTU	166.8 mV	120.00 ml/min
12/16/2022 8:28 AM	44:11	6.55 pH	7.05 °C	1,314.1 µS/cm	0.22 mg/L	21.25 NTU	161.8 mV	120.00 ml/min
12/16/2022 8:31 AM	47:11	6.56 pH	7.10 °C	1,316.6 µS/cm	0.21 mg/L	19.28 NTU	149.2 mV	120.00 ml/min

12/16/2022 8:34 AM	50:11	6.57 pH	6.90 °C	1,322.6 µS/cm	0.20 mg/L	14.32 NTU	133.8 mV	120.00 ml/min
12/16/2022 8:37 AM	53:11	6.56 pH	6.92 °C	1,327.1 µS/cm	0.19 mg/L	12.50 NTU	117.0 mV	120.00 ml/min
12/16/2022 8:40 AM	56:11	6.57 pH	6.43 °C	1,319.9 µS/cm	0.19 mg/L	13.89 NTU	106.2 mV	120.00 ml/min
12/16/2022 8:43 AM	59:11	6.57 pH	6.78 °C	1,334.6 µS/cm	0.19 mg/L	12.36 NTU	97.3 mV	120.00 ml/min
12/16/2022 8:46 AM	01:02:11	6.58 pH	6.66 °C	1,336.3 µS/cm	0.18 mg/L	10.50 NTU	72.1 mV	120.00 ml/min
12/16/2022 8:49 AM	01:05:11	6.59 pH	6.53 °C	1,336.6 µS/cm	0.19 mg/L	10.74 NTU	67.9 mV	120.00 ml/min
12/16/2022 8:52 AM	01:08:11	6.60 pH	6.64 °C	1,337.0 µS/cm	0.18 mg/L	10.01 NTU	48.2 mV	120.00 ml/min
12/16/2022 8:55 AM	01:11:11	6.60 pH	6.82 °C	1,338.3 µS/cm	0.18 mg/L	8.28 NTU	43.7 mV	120.00 ml/min
12/16/2022 8:58 AM	01:14:11	6.61 pH	6.74 °C	1,335.2 µS/cm	0.18 mg/L	8.78 NTU	38.0 mV	120.00 ml/min
12/16/2022 9:01 AM	01:17:11	6.62 pH	6.79 °C	1,349.5 µS/cm	0.17 mg/L	7.06 NTU	31.0 mV	120.00 ml/min
12/16/2022 9:04 AM	01:20:11	6.62 pH	6.75 °C	1,357.2 µS/cm	0.16 mg/L	5.85 NTU	22.6 mV	120.00 ml/min

Samples

Sample ID:	Description:

Low-Flow Test Report:

Test Date / Time: 12/15/2022 3:37:58 PM
Project: Edwards
Operator Name: A Margason, S Mallow

Location Name: AW-01	**Estimated Total Volume Pumped: 7800 ml** **Flow Cell Volume: 130 ml** **Final Flow Rate: 100 ml/min** **Final Draw Down: 15.68 ft**	**Instrument Used: Aqua TROLL 600 Vented** **Serial Number: 449093**

Test Notes:
Sample time at 1702

Weather Conditions:
Snowing

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Flow
		+/- 0.1	+/- 0.1	+/- 3 %	+/- 0.3	+/- 10 %	+/- 10	
12/15/2022 3:37 PM	00:00	7.44 pH	10.70 °C	1,511.0 µS/cm	0.95 mg/L	247.57 NTU	-233.7 mV	100.00 ml/min
12/15/2022 3:40 PM	03:00	7.43 pH	12.29 °C	214.83 µS/cm	0.84 mg/L	303.63 NTU	-230.2 mV	100.00 ml/min
12/15/2022 3:43 PM	06:00	7.42 pH	13.10 °C	204.36 µS/cm	0.69 mg/L	585.87 NTU	-231.0 mV	100.00 ml/min
12/15/2022 3:46 PM	09:00	7.42 pH	13.26 °C	216.60 µS/cm	0.63 mg/L	764.45 NTU	-232.0 mV	100.00 ml/min
12/15/2022 3:49 PM	12:00	7.42 pH	13.07 °C	181.14 µS/cm	0.60 mg/L	936.05 NTU	-233.6 mV	100.00 ml/min
12/15/2022 3:52 PM	15:00	7.42 pH	12.96 °C	173.51 µS/cm	0.59 mg/L	1,162.4 NTU	-234.8 mV	100.00 ml/min
12/15/2022 3:55 PM	18:00	7.42 pH	12.91 °C	141.56 µS/cm	0.58 mg/L	1,164.5 NTU	-234.6 mV	100.00 ml/min
12/15/2022 3:58 PM	21:00	7.42 pH	12.97 °C	87.02 µS/cm	0.58 mg/L	2,099.1 NTU	-235.8 mV	100.00 ml/min
12/15/2022 4:01 PM	24:00	7.42 pH	13.04 °C	97.52 µS/cm	0.58 mg/L	2,207.6 NTU	-216.6 mV	100.00 ml/min
12/15/2022 4:04 PM	27:00	7.42 pH	12.76 °C	73.96 µS/cm	0.57 mg/L	2,378.8 NTU	-197.7 mV	100.00 ml/min
12/15/2022 4:07 PM	30:00	7.40 pH	12.61 °C	77.70 µS/cm	0.57 mg/L	2,579.6 NTU	-188.1 mV	100.00 ml/min
12/15/2022 4:10 PM	33:00	7.40 pH	12.40 °C	83.54 µS/cm	0.58 mg/L	2,693.1 NTU	-182.0 mV	100.00 ml/min
12/15/2022 4:13 PM	36:00	7.40 pH	12.10 °C	90.88 µS/cm	0.59 mg/L	2,832.4 NTU	-177.5 mV	100.00 ml/min
12/15/2022 4:16 PM	39:00	7.40 pH	11.84 °C	96.23 µS/cm	0.60 mg/L	3,098.1 NTU	-174.9 mV	100.00 ml/min
12/15/2022 4:19 PM	42:00	7.40 pH	11.84 °C	52.35 µS/cm	0.62 mg/L	3,267.3 NTU	-171.7 mV	100.00 ml/min

12/15/2022 4:22 PM	45:00	7.34 pH	13.31 °C	71.99 µS/cm	0.57 mg/L	2,989.6 NTU	-166.3 mV	100.00 ml/min
12/15/2022 4:25 PM	48:00	7.32 pH	13.21 °C	74.17 µS/cm	0.55 mg/L	3,300.6 NTU	-164.4 mV	100.00 ml/min
12/15/2022 4:28 PM	51:00	7.31 pH	13.09 °C	78.39 µS/cm	0.54 mg/L	4,345.1 NTU	-165.2 mV	100.00 ml/min
12/15/2022 4:31 PM	54:00	7.31 pH	12.67 °C	83.77 µS/cm	0.55 mg/L	4,234.8 NTU	-169.8 mV	100.00 ml/min
12/15/2022 4:34 PM	57:00	7.31 pH	13.08 °C	61.03 µS/cm	0.57 mg/L	4,389.7 NTU	-170.5 mV	100.00 ml/min
12/15/2022 4:37 PM	01:00:00	7.30 pH	12.93 °C	69.45 µS/cm	0.59 mg/L	3,143.6 NTU	-169.8 mV	100.00 ml/min
12/15/2022 4:40 PM	01:03:00	7.30 pH	12.95 °C	74.71 µS/cm	0.62 mg/L	3,538.8 NTU	-169.4 mV	100.00 ml/min
12/15/2022 4:43 PM	01:06:00	7.30 pH	12.86 °C	80.55 µS/cm	0.65 mg/L	3,509.9 NTU	-168.7 mV	100.00 ml/min
12/15/2022 4:46 PM	01:09:00	7.30 pH	12.94 °C	88.79 µS/cm	0.67 mg/L	3,660.7 NTU	-167.4 mV	100.00 ml/min
12/15/2022 4:49 PM	01:12:00	7.29 pH	12.91 °C	94.76 µS/cm	0.69 mg/L	4,029.5 NTU	-166.0 mV	100.00 ml/min
12/15/2022 4:52 PM	01:15:00	7.30 pH	12.92 °C	95.22 µS/cm	0.70 mg/L	4,120.6 NTU	-164.8 mV	100.00 ml/min
12/15/2022 4:55 PM	01:18:00	7.29 pH	12.97 °C	97.04 µS/cm	0.71 mg/L	4,095.8 NTU	-163.4 mV	100.00 ml/min

Samples

Sample ID:	Description:

Low-Flow Test Report:

Test Date / Time: 12/15/2022 1:21:12 PM
Project: Baldwin
Operator Name: A Tabares, S Mallow

Location Name: EMW-05 **Initial Depth to Water: 20.31 ft** **Volume Removed: 20400 mL**	**Flow Cell Volume: 130 ml** **Final Flow Rate: 150 ml/min** **Final Draw Down: 6.75 ft**	**Instrument Used: Aqua TROLL 600 Vented** **Serial Number: 454820**

Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth To Water (ft)	Flow
		+/- 0.1	+/- 0.1	+/- 3 %	+/- 0.3	+/- 10 %	+/- 10		
12/15/2022 1:21 PM	00:00	6.81 pH	9.59 °C	8.69 µS/cm	11.37 mg/L	9.23 NTU	206.0 mV	20.31	150.00 ml/min
12/15/2022 1:24 PM	03:00	6.73 pH	12.53 °C	2.73 µS/cm	7.75 mg/L	4.23 NTU	-13.3 mV	20.31	150.00 ml/min
12/15/2022 1:27 PM	06:00	6.67 pH	12.23 °C	5.50 µS/cm	7.56 mg/L	3.31 NTU	30.6 mV	24.01	150.00 ml/min
12/15/2022 1:30 PM	09:00	6.60 pH	12.19 °C	2.39 µS/cm	7.44 mg/L	73.66 NTU	61.2 mV	24.01	150.00 ml/min
12/15/2022 1:33 PM	12:00	6.62 pH	11.33 °C	0.46 µS/cm	8.13 mg/L	7.12 NTU	64.4 mV	24.01	150.00 ml/min
12/15/2022 1:36 PM	15:00	6.57 pH	10.39 °C	0.50 µS/cm	8.34 mg/L	3.87 NTU	68.6 mV	24.01	150.00 ml/min
12/15/2022 1:39 PM	18:00	6.59 pH	9.75 °C	0.47 µS/cm	8.45 mg/L	3.79 NTU	71.0 mV	24.29	150.00 ml/min
12/15/2022 1:42 PM	21:00	6.61 pH	9.28 °C	0.23 µS/cm	8.55 mg/L	2.52 NTU	72.3 mV	24.29	150.00 ml/min
12/15/2022 1:45 PM	24:00	6.63 pH	8.91 °C	0.68 µS/cm	8.57 mg/L	2.61 NTU	39.6 mV	24.29	150.00 ml/min
12/15/2022 1:48 PM	27:00	6.57 pH	11.44 °C	4.52 µS/cm	4.93 mg/L	391.88 NTU	37.7 mV	24.29	150.00 ml/min
12/15/2022 1:51 PM	30:00	6.55 pH	11.48 °C	1.66 µS/cm	4.83 mg/L	156.81 NTU	54.2 mV	24.83	150.00 ml/min
12/15/2022 2:00 PM	39:04	6.51 pH	10.71 °C	0.18 µS/cm	7.51 mg/L	1.44 NTU	93.3 mV	25.21	150.00 ml/min
12/15/2022 2:03 PM	42:04	6.50 pH	10.11 °C	1.83 µS/cm	7.10 mg/L		111.2 mV	25.97	150.00 ml/min
12/15/2022 2:06 PM	45:04	6.49 pH	11.10 °C	2.75 µS/cm	5.91 mg/L	616.62 NTU	128.4 mV	26.45	150.00 ml/min
12/15/2022 2:09 PM	48:04	6.48 pH	10.63 °C	51.61 µS/cm	4.99 mg/L	250.44 NTU	132.4 mV	26.45	150.00 ml/min
12/15/2022 2:12 PM	51:04	6.48 pH	10.13 °C	2.00 µS/cm	5.29 mg/L	2.10 NTU	118.0 mV	26.78	150.00 ml/min
12/15/2022 2:15 PM	54:04	6.48 pH	9.99 °C	3.38 µS/cm	5.76 mg/L	19.99 NTU	102.9 mV	27.04	150.00 ml/min
12/15/2022 2:18 PM	57:04	6.48 pH	9.89 °C	1.63 µS/cm	5.69 mg/L	1.86 NTU	117.9 mV	27.04	150.00 ml/min

12/15/2022 2:21 PM	01:00:04	6.48 pH	9.77 °C	5.11 µS/cm	5.47 mg/L	14.98 NTU	134.2 mV	27.04	150.00 ml/min
12/15/2022 2:24 PM	01:03:04	6.48 pH	9.82 °C	1.46 µS/cm	5.52 mg/L	1.97 NTU	150.7 mV	27.04	150.00 ml/min
12/15/2022 2:27 PM	01:06:04	6.48 pH	9.83 °C	1.97 µS/cm	5.22 mg/L	2.47 NTU	152.5 mV	27.06	150.00 ml/min
12/15/2022 2:30 PM	01:09:04	6.47 pH	9.70 °C	2.03 µS/cm	4.80 mg/L	4.08 NTU	144.8 mV	27.06	150.00 ml/min
12/15/2022 2:33 PM	01:12:04	6.47 pH	9.80 °C	2.07 µS/cm	4.68 mg/L	2.46 NTU	131.2 mV	27.06	150.00 ml/min
12/15/2022 2:36 PM	01:15:04	6.47 pH	9.75 °C	24.51 µS/cm	5.44 mg/L	48.23 NTU	89.1 mV	27.06	150.00 ml/min
12/15/2022 2:39 PM	01:18:04	6.48 pH	9.61 °C	1.56 µS/cm	5.23 mg/L	2.65 NTU	89.9 mV	27.06	150.00 ml/min
12/15/2022 2:42 PM	01:21:04	6.48 pH	9.45 °C	2.45 µS/cm	5.14 mg/L	57.62 NTU	104.5 mV	27.06	150.00 ml/min
12/15/2022 2:45 PM	01:24:04	6.48 pH	9.50 °C	2.30 µS/cm	5.07 mg/L	2.71 NTU	119.7 mV	27.06	150.00 ml/min
12/15/2022 2:48 PM	01:27:04	6.48 pH	9.70 °C	23.56 µS/cm	5.09 mg/L	3.82 NTU	123.8 mV	27.06	150.00 ml/min
12/15/2022 2:51 PM	01:30:04	6.48 pH	9.30 °C	0.96 µS/cm	6.41 mg/L	2.12 NTU	119.7 mV	27.06	150.00 ml/min
12/15/2022 2:54 PM	01:33:04	6.48 pH	8.67 °C	0.40 µS/cm	6.65 mg/L	1.75 NTU	118.4 mV	27.06	150.00 ml/min
12/15/2022 2:57 PM	01:36:04	6.47 pH	7.98 °C	0.35 µS/cm	6.86 mg/L	2.21 NTU	117.2 mV	27.06	150.00 ml/min
12/15/2022 3:00 PM	01:39:04	6.48 pH	7.25 °C	0.33 µS/cm	6.98 mg/L	2.47 NTU	115.8 mV	27.06	150.00 ml/min
12/15/2022 3:03 PM	01:42:04	6.49 pH	6.63 °C	0.30 µS/cm	7.14 mg/L	2.46 NTU	114.9 mV	27.06	150.00 ml/min
12/15/2022 3:06 PM	01:45:04	6.50 pH	6.09 °C	0.27 µS/cm	7.26 mg/L	2.40 NTU	113.8 mV	27.06	150.00 ml/min
12/15/2022 3:09 PM	01:48:04	6.53 pH	5.58 °C	0.30 µS/cm	7.25 mg/L	2.66 NTU	112.6 mV	27.06	150.00 ml/min
12/15/2022 3:12 PM	01:51:04	6.55 pH	5.08 °C	0.26 µS/cm	7.40 mg/L	3.08 NTU	111.7 mV	27.06	150.00 ml/min
12/15/2022 3:15 PM	01:54:04	6.57 pH	4.75 °C	0.25 µS/cm	7.51 mg/L	3.16 NTU	111.1 mV	27.06	150.00 ml/min
12/15/2022 3:18 PM	01:57:04	6.66 pH	4.03 °C	1,343.5 µS/cm	7.67 mg/L	277.49 NTU	94.9 mV	27.06	150.00 ml/min
12/15/2022 3:25 PM	02:04:39	6.49 pH	9.40 °C	1,612.2 µS/cm	3.93 mg/L	103.00 NTU	55.9 mV	27.06	150.00 ml/min
12/15/2022 3:28 PM	02:07:39	6.47 pH	9.17 °C	1,607.3 µS/cm	2.71 mg/L	94.02 NTU	54.5 mV	27.06	150.00 ml/min
12/15/2022 3:31 PM	02:10:39	6.46 pH	9.15 °C	1,607.2 µS/cm	2.36 mg/L	106.88 NTU	59.2 mV	27.06	150.00 ml/min
12/15/2022 3:34 PM	02:13:39	6.47 pH	9.14 °C	1,605.7 µS/cm	2.30 mg/L	83.43 NTU	62.4 mV	27.06	150.00 ml/min
12/15/2022 3:37 PM	02:16:39	6.46 pH	9.17 °C	1,605.6 µS/cm	2.22 mg/L	86.08 NTU	65.7 mV	27.06	150.00 ml/min

Samples

Sample ID:	Description:

Created using VuSitu from In-Situ, Inc.

Low-Flow Test Report:

Test Date / Time: 1/10/2023 8:43:04 AM
Project: Edwards Round 3 Sampling
Operator Name: S Mallow

Location Name: AW-23 **Well Diameter: 2 in** **Casing Type: PVC** **Initial Depth to Water: 3.96 ft**	**Pump Type: Peristaltic** **Pump Intake From TOC: ~15 ft** **Estimated Total Volume Pumped: 11610 ml** **Flow Cell Volume: 130 ml** **Final Flow Rate: 260 ml/min** **Final Draw Down: 0.14 ft**	**Instrument Used: Aqua TROLL 600 Vented** **Serial Number: 454660**

Test Notes:

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth To Water	Flow
		+/- 0.1	+/- 0.1	+/- 3 %	+/- 0.3	+/- 10 %	+/- 10	+/- 0.1	
1/10/2023 8:43 AM	00:00	6.96 pH	5.82 °C	1,177.7 µS/cm	1.20 mg/L	4.83 NTU	186.7 mV	3.96 ft	150.00 ml/min
1/10/2023 8:46 AM	03:00	6.94 pH	8.64 °C	1,129.0 µS/cm	0.94 mg/L	9.44 NTU	182.0 mV	4.04 ft	150.00 ml/min
1/10/2023 8:49 AM	06:00	6.93 pH	9.30 °C	1,122.7 µS/cm	0.80 mg/L	3.13 NTU	169.2 mV	4.04 ft	150.00 ml/min
1/10/2023 8:52 AM	09:00	6.92 pH	9.25 °C	1,121.0 µS/cm	0.69 mg/L	4.86 NTU	150.4 mV	4.04 ft	150.00 ml/min
1/10/2023 8:55 AM	12:00	6.91 pH	9.52 °C	1,122.2 µS/cm	0.61 mg/L	1.76 NTU	117.9 mV	4.04 ft	150.00 ml/min
1/10/2023 8:58 AM	15:00	6.91 pH	9.68 °C	1,123.0 µS/cm	0.52 mg/L	1.86 NTU	80.0 mV	4.04 ft	260.00 ml/min
1/10/2023 9:01 AM	18:00	6.90 pH	10.52 °C	1,122.7 µS/cm	0.45 mg/L	0.00 NTU	41.1 mV	4.10 ft	260.00 ml/min
1/10/2023 9:04 AM	21:00	6.90 pH	10.42 °C	1,120.5 µS/cm	0.39 mg/L	0.43 NTU	14.8 mV	4.10 ft	260.00 ml/min
1/10/2023 9:07 AM	24:00	6.89 pH	10.43 °C	1,120.2 µS/cm	0.29 mg/L	0.39 NTU	-4.3 mV	4.10 ft	260.00 ml/min
1/10/2023 9:10 AM	27:00	6.90 pH	10.23 °C	1,120.3 µS/cm	0.29 mg/L	0.26 NTU	-15.0 mV	4.10 ft	260.00 ml/min
1/10/2023 9:13 AM	30:00	6.89 pH	10.64 °C	1,118.7 µS/cm	0.21 mg/L	0.00 NTU	-26.6 mV	4.10 ft	260.00 ml/min
1/10/2023 9:16 AM	33:00	6.89 pH	10.59 °C	1,118.4 µS/cm	0.27 mg/L	0.00 NTU	-32.3 mV	4.10 ft	260.00 ml/min
1/10/2023 9:19 AM	36:00	6.90 pH	10.71 °C	1,117.3 µS/cm	0.19 mg/L	0.00 NTU	-39.5 mV	4.10 ft	260.00 ml/min
1/10/2023 9:22 AM	39:00	6.90 pH	10.45 °C	1,116.9 µS/cm	0.18 mg/L	0.27 NTU	-45.5 mV	4.10 ft	260.00 ml/min
1/10/2023 9:25 AM	42:00	6.90 pH	10.60 °C	1,115.6 µS/cm	0.15 mg/L	0.00 NTU	-50.7 mV	4.10 ft	260.00 ml/min
1/10/2023 9:28 AM	45:00	6.90 pH	10.80 °C	1,116.4 µS/cm	0.20 mg/L	0.00 NTU	-54.2 mV	4.10 ft	260.00 ml/min

1/10/2023 9:31 AM	48:00	6.91 pH	10.83 °C	1,115.5 µS/cm	0.17 mg/L	0.00 NTU	-56.2 mV	4.10 ft	260.00 ml/min
1/10/2023 9:34 AM	51:00	6.91 pH	10.89 °C	1,113.7 µS/cm	0.14 mg/L	0.00 NTU	-60.4 mV	4.10 ft	260.00 ml/min

Samples

Sample ID:	Description:

Created using VuSitu from In-Situ, Inc.

Low-Flow Test Report:

Test Date / Time: 1/10/2023 11:32:24 AM
Project: Edwards Round 3 Sampling
Operator Name: A. Margason

Location Name: EMW-05 **Initial Depth to Water: 24.45 ft**	**Pump Type: QED Micropurge** **Estimated Total Volume Pumped: 6900 ml** **Flow Cell Volume: 130 ml** **Final Flow Rate: 100 ml/min** **Draw Down: 4.10 ft**	**Instrument Used: Aqua TROLL 600 Vented** **Serial Number: 449077**

Test Notes: Dedicated bladder pump appears to not be working. Well purged using portable bladder pump. Final four turbidity readings collected with separate turbidity meter (Geotech SN: 3550-1389).

Weather Conditions:
35F, Sunny

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth To Water	Flow
		+/- 0.1	+/- 0.1	+/- 3 %	+/- 0.3	+/- 10	+/- 10		
1/10/2023 11:32 AM	00:00	6.67 pH	12.89 °C	1,426.5 µS/cm	2.09 mg/L	2,023.3 NTU	-47.6 mV	24.45 ft	100.00 ml/min
1/10/2023 11:35 AM	03:00	6.67 pH	12.55 °C	1,420.7 µS/cm	2.14 mg/L	1,420.0 NTU	-43.4 mV	24.45 ft	100.00 ml/min
1/10/2023 11:38 AM	06:00	6.66 pH	12.60 °C	1,415.8 µS/cm	2.23 mg/L	1,346.4 NTU	-39.1 mV	25.11 ft	100.00 ml/min
1/10/2023 11:41 AM	09:00	6.66 pH	12.72 °C	1,418.4 µS/cm	2.33 mg/L	1,180.1 NTU	-33.5 mV	25.32 ft	100.00 ml/min
1/10/2023 11:44 AM	12:00	6.65 pH	12.77 °C	1,413.5 µS/cm	2.37 mg/L	908.60 NTU	-29.8 mV	25.60 ft	100.00 ml/min
1/10/2023 11:47 AM	15:00	6.65 pH	12.81 °C	1,406.5 µS/cm	2.44 mg/L	808.79 NTU	-28.7 mV	25.89 ft	100.00 ml/min
1/10/2023 11:50 AM	18:00	6.65 pH	12.74 °C	1,402.4 µS/cm	2.54 mg/L	746.63 NTU	-26.0 mV	25.99 ft	100.00 ml/min
1/10/2023 11:53 AM	21:00	6.64 pH	12.85 °C	1,405.4 µS/cm	2.61 mg/L	592.88 NTU	-21.0 mV	26.18 ft	100.00 ml/min
1/10/2023 11:56 AM	24:00	6.64 pH	13.01 °C	1,407.3 µS/cm	2.65 mg/L	497.27 NTU	-17.7 mV	26.58 ft	100.00 ml/min
1/10/2023 11:59 AM	27:00	6.64 pH	13.14 °C	1,403.3 µS/cm	2.73 mg/L	403.54 NTU	-15.9 mV	26.72 ft	100.00 ml/min
1/10/2023 12:02 PM	30:00	6.64 pH	13.10 °C	1,398.6 µS/cm	2.86 mg/L	314.52 NTU	-14.8 mV	26.88 ft	100.00 ml/min
1/10/2023 12:05 PM	33:00	6.64 pH	13.15 °C	1,398.0 µS/cm	2.93 mg/L	247.42 NTU	-12.9 mV	26.98 ft	100.00 ml/min
1/10/2023 12:08 PM	36:00	6.64 pH	13.14 °C	1,394.4 µS/cm	2.96 mg/L	217.06 NTU	-11.9 mV	27.23 ft	100.00 ml/min
1/10/2023 12:11 PM	39:00	6.64 pH	13.56 °C	1,398.0 µS/cm	2.95 mg/L	181.23 NTU	-10.6 mV	27.45 ft	100.00 ml/min
1/10/2023 12:14 PM	42:00	6.64 pH	13.73 °C	1,390.2 µS/cm	3.00 mg/L	164.93 NTU	-8.9 mV	27.45 ft	100.00 ml/min

1/10/2023 12:17 PM	45:00	6.65 pH	13.66 °C	1,393.4 µS/cm	3.04 mg/L	152.80 NTU	-6.9 mV	27.45 ft	100.00 ml/min
1/10/2023 12:20 PM	48:00	6.65 pH	13.67 °C	1,391.7 µS/cm	3.00 mg/L	126.22 NTU	-4.1 mV	27.45 ft	100.00 ml/min
1/10/2023 12:23 PM	51:00	6.65 pH	13.50 °C	1,389.4 µS/cm	3.01 mg/L	126.94 NTU	-1.4 mV	28.01 ft	100.00 ml/min
1/10/2023 12:26 PM	54:00	6.69 pH	13.67 °C	1.91 µS/cm	6.50 mg/L	0.31 NTU	0.0 mV	28.01 ft	100.00 ml/min
1/10/2023 12:29 PM	57:00	6.64 pH	13.36 °C	1,405.5 µS/cm	2.84 mg/L	234.54 NTU	3.7 mV	28.01 ft	100.00 ml/min
1/10/2023 12:32 PM	01:00:00	6.63 pH	13.35 °C	1,411.6 µS/cm	2.47 mg/L	75.3 NTU	3.6 mV	28.18 ft	100.00 ml/min
1/10/2023 12:35 PM	01:03:00	6.63 pH	13.31 °C	1,412.8 µS/cm	2.04 mg/L	77.3 NTU	10.2 mV	28.26 ft	100.00 ml/min
1/10/2023 12:38 PM	01:06:00	6.63 pH	13.29 °C	1,414.9 µS/cm	1.83 mg/L	82.1 NTU	12.3 mV	28.48 ft	100.00 ml/min
1/10/2023 12:41 PM	01:09:00	6.63 pH	13.25 °C	1,414.6 µS/cm	1.86 mg/L	85.8 NTU	13.6 mV	28.55 ft	100.00 ml/min

Samples

Sample ID:	Description:

Created using VuSitu from In-Situ, Inc.

Low-Flow Test Report:

Test Date / Time: 1/10/2023 2:10:37 PM
Project: Edwards Round 3 Sampling
Operator Name: A. Margason

Location Name: AW-01 **Initial Depth to Water: 12.07 ft**	**Pump Type: QED Micropurge** **Estimated Total Volume Pumped: 6300 ml** **Flow Cell Volume: 130 ml** **Final Flow Rate: 100 ml/min Final Draw Down: 8.98 ft**	**Instrument Used: Aqua TROLL 600 Vented** **Serial Number: 449077**

Test Notes: Dedicated bladder pump does not appear to be working. Well purged using portable bladder pump. Final three turbidity readings collected with separate turbidity meter (Geotech SN: 3550-1389).

Low-Flow Readings:

Date Time	Elapsed Time	pH	Temperature	Specific Conductivity	RDO Concentration	Turbidity	ORP	Depth To Water	Flow
		+/- 0.1	+/- 0.1	+/- 3 %	+/- 0.3	+/- 10	+/- 10		
1/10/2023 2:10 PM	00:00	6.82 pH	14.65 °C	1,370.7 µS/cm	0.72 mg/L	400.04 NTU	-156.3 mV	12.07 ft	100.00 ml/min
1/10/2023 2:13 PM	03:00	6.83 pH	14.38 °C	1,366.6 µS/cm	0.87 mg/L	255.90 NTU	-154.6 mV	12.07 ft	100.00 ml/min
1/10/2023 2:16 PM	06:00	6.83 pH	14.14 °C	1,364.1 µS/cm	0.85 mg/L	226.41 NTU	-151.8 mV	15.53 ft	100.00 ml/min
1/10/2023 2:19 PM	09:00	6.83 pH	14.06 °C	1,372.1 µS/cm	0.81 mg/L	283.76 NTU	-149.8 mV	15.89 ft	100.00 ml/min
1/10/2023 2:22 PM	12:00	6.82 pH	14.17 °C	1,366.0 µS/cm	0.76 mg/L	303.24 NTU	-148.5 mV	16.07 ft	100.00 ml/min
1/10/2023 2:25 PM	15:00	6.82 pH	14.08 °C	1,366.0 µS/cm	0.74 mg/L	385.99 NTU	-147.3 mV	16.21 ft	100.00 ml/min
1/10/2023 2:28 PM	18:00	6.82 pH	14.14 °C	1,354.3 µS/cm	0.70 mg/L	457.43 NTU	-146.4 mV	16.50 ft	100.00 ml/min
1/10/2023 2:31 PM	21:00	6.83 pH	14.03 °C	1,316.8 µS/cm	0.66 mg/L	506.68 NTU	-144.7 mV	16.92 ft	100.00 ml/min
1/10/2023 2:34 PM	24:00	6.83 pH	13.74 °C	1,309.9 µS/cm	0.63 mg/L	601.45 NTU	-143.4 mV	17.11 ft	100.00 ml/min
1/10/2023 2:37 PM	27:00	6.83 pH	13.86 °C	1,302.6 µS/cm	0.59 mg/L	666.59 NTU	-142.1 mV	17.34 ft	100.00 ml/min
1/10/2023 2:40 PM	30:00	6.83 pH	13.80 °C	1,274.9 µS/cm	0.56 mg/L	577.02 NTU	-141.0 mV	17.56 ft	100.00 ml/min
1/10/2023 2:43 PM	33:00	6.83 pH	13.80 °C	1,305.7 µS/cm	0.54 mg/L	603.80 NTU	-140.2 mV	17.89 ft	100.00 ml/min
1/10/2023 2:46 PM	36:00	6.83 pH	13.57 °C	1,263.8 µS/cm	0.51 mg/L	503.22 NTU	-139.1 mV	18.17 ft	100.00 ml/min
1/10/2023 2:49 PM	39:00	6.83 pH	13.55 °C	1,331.6 µS/cm	0.48 mg/L	338.39 NTU	-137.8 mV	18.36 ft	100.00 ml/min
1/10/2023 2:52 PM	42:00	6.83 pH	13.66 °C	1,321.8 µS/cm	0.46 mg/L	374.51 NTU	-136.6 mV	18.36 ft	100.00 ml/min
1/10/2023 2:55 PM	45:00	6.84 pH	13.55 °C	1,314.5 µS/cm	0.43 mg/L	387.44 NTU	-135.7 mV	18.36 ft	100.00 ml/min
1/10/2023 2:58 PM	48:00	6.84 pH	13.60 °C	1,314.7 µS/cm	0.43 mg/L	451.51 NTU	-134.4 mV	18.36 ft	100.00 ml/min

1/10/2023 3:01 PM	51:00	6.84 pH	13.53 °C	1,324.2 µS/cm	0.43 mg/L	483.55 NTU	-133.4 mV	18.36 ft	100.00 ml/min
1/10/2023 3:04 PM	54:00	6.84 pH	13.57 °C	1,324.1 µS/cm	0.44 mg/L	509.66 NTU	-132.6 mV	20.00 ft	100.00 ml/min
1/10/2023 3:07 PM	57:00	6.84 pH	13.55 °C	1,317.8 µS/cm	0.45 mg/L	39.5 NTU	-131.6 mV	20.45 ft	100.00 ml/min
1/10/2023 3:10 PM	01:00:00	6.84 pH	13.60 °C	1,352.0 µS/cm	0.46 mg/L	37.9 NTU	-131.0 mV	20.71 ft	100.00 ml/min
1/10/2023 3:13 PM	01:03:00	6.84 pH	13.77 °C	1,350.8 µS/cm	0.46 mg/L	37.2 NTU	-129.9 mV	21.05 ft	100.00 ml/min

Samples

Sample ID:	Description:

Created using VuSitu from In-Situ, Inc.

APPENDIX F
ANALYTICAL LABORATORY REPORTS

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

December 06, 2022

Brian Voelker
Vistra - Edwards
604 Pierce Boulevard
O'Fallon, IL 62269

RE: RAMBOLL DELINEATION

Dear Brian Voelker:

Please find enclosed the analytical results for the **6** sample(s) the laboratory received on **11/21/22 4:50 pm** and logged in under work order **FK04074**. All testing is performed according to our current TNI accreditations unless otherwise noted. This report cannot be reproduced, except in full, without the written permission of Pace Analytical Services, LLC.

If you have any questions regarding your report, please contact your project manager. Quality and timely data is of the utmost importance to us.

Pace Analytical Services appreciates the opportunity to provide you with analytical expertise . We are always trying to improve our customer service and we welcome you to contact the Director of Client Services, Lisa Grant, with any feedback you have about your experience with our laboratory at 309-683-1764 or lisa.grant@pacelabs.com.

Gail Schindler
Project Manager
(309) 692-9688 x1716
gail.schindler@pacelabs.com

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

SAMPLE RECEIPT CHECK LIST

Items not applicable will be marked as in compliance

Work Order FK04074

YES	Samples received within temperature compliance when applicable
YES	COC present upon sample receipt
YES	COC completed & legible
YES	Sampler name & signature present
YES	Unique sample IDs assigned
YES	Sample collection location recorded
YES	Date & time collected recorded on COC
YES	Relinquished by client signature on COC
YES	COC & labels match
YES	Sample labels are legible
YES	Appropriate bottle(s) received
YES	Sufficient sample volume received
YES	Sample containers received undamaged
NO	Zero headspace, <6 mm present in VOA vials
NO	Trip blank(s) received
YES	All non-field analyses received within holding times
NO	Short hold time analysis
YES	Current PDC COC submitted
NO	Case narrative provided

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

ANALYTICAL RESULTS

Sample: FK04074-01
Name: AW-01
Matrix: Ground Water - Grab

Sampled: 11/18/22 14:21
Received: 11/21/22 16:50

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	13	mg/L		12/03/22 00:46	5	5.0	12/03/22 00:46	CRD	EPA 300.0 REV 2.1
Fluoride	0.268	mg/L		12/02/22 01:19	1	0.250	12/02/22 01:19	CRD	EPA 300.0 REV 2.1
Sulfate	41	mg/L		12/03/22 00:46	5	5.0	12/03/22 00:46	CRD	EPA 300.0 REV 2.1
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	520	mg/L		12/01/22 14:53	1	10	12/01/22 14:53	HRF	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		12/01/22 14:53	1	10	12/01/22 14:53	HRF	SM 2320B 1997*
Solids - total dissolved solids (TDS)	810	mg/L	M	11/23/22 14:15	1	26	11/23/22 15:51	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		11/30/22 09:21	5	3.0	12/01/22 12:01	JMW	EPA 6020A
Arsenic	17	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:01	JMW	EPA 6020A
Barium	140	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:01	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/02/22 08:28	JMW	EPA 6020A
Boron	90	ug/L		11/30/22 09:21	5	10	12/01/22 12:01	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:01	JMW	EPA 6020A
Calcium	190	mg/L		11/30/22 09:21	5	0.20	12/01/22 12:01	JMW	EPA 6020A
Chromium	< 4.0	ug/L		11/30/22 09:21	5	4.0	12/01/22 12:01	JMW	EPA 6020A
Cobalt	4.8	ug/L		11/30/22 09:21	5	2.0	12/01/22 12:01	JMW	EPA 6020A
Lead	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:01	JMW	EPA 6020A
Magnesium	86	mg/L		11/30/22 09:21	5	0.10	12/01/22 12:01	JMW	EPA 6020A
Mercury	< 0.20	ug/L		11/30/22 09:21	5	0.20	12/01/22 12:01	JMW	EPA 6020A
Molybdenum	3.3	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:01	JMW	EPA 6020A
Potassium	0.32	mg/L		11/30/22 09:21	5	0.10	12/01/22 12:01	JMW	EPA 6020A
Selenium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:01	JMW	EPA 6020A
Sodium	18	mg/L		11/30/22 09:21	5	0.10	12/01/22 12:01	JMW	EPA 6020A
Thallium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:01	JMW	EPA 6020A
Lithium	< 0.020	mg/L		11/30/22 09:21	1	0.020	11/30/22 13:15	TJJ	EPA 6010B

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
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ANALYTICAL RESULTS

Sample: FK04074-02
Name: EMW-05
Matrix: Ground Water - Grab

Sampled: 11/18/22 15:13
Received: 11/21/22 16:50

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	28	mg/L		12/02/22 02:13	10	10	12/02/22 02:13	CRD	EPA 300.0 REV 2.1
Fluoride	< 0.250	mg/L		12/02/22 01:55	1	0.250	12/02/22 01:55	CRD	EPA 300.0 REV 2.1
Sulfate	120	mg/L		12/02/22 02:31	100	100	12/02/22 02:31	CRD	EPA 300.0 REV 2.1
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	490	mg/L		12/01/22 14:53	1	10	12/01/22 14:53	HRF	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		12/01/22 14:53	1	10	12/01/22 14:53	HRF	SM 2320B 1997*
Solids - total dissolved solids (TDS)	890	mg/L	M	11/23/22 14:15	1	26	11/23/22 15:51	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		11/30/22 09:21	5	3.0	12/01/22 12:05	JMW	EPA 6020A
Arsenic	1.3	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:05	JMW	EPA 6020A
Barium	69	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:05	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/02/22 08:32	JMW	EPA 6020A
Boron	670	ug/L		11/30/22 09:21	5	10	12/01/22 12:05	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:05	JMW	EPA 6020A
Calcium	160	mg/L	Q4	11/30/22 09:21	5	0.20	12/01/22 12:05	JMW	EPA 6020A
Chromium	< 4.0	ug/L		11/30/22 09:21	5	4.0	12/01/22 12:05	JMW	EPA 6020A
Cobalt	2.2	ug/L		11/30/22 09:21	5	2.0	12/01/22 12:05	JMW	EPA 6020A
Lead	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:05	JMW	EPA 6020A
Magnesium	79	mg/L	Q4	11/30/22 09:21	5	0.10	12/01/22 12:05	JMW	EPA 6020A
Mercury	< 0.20	ug/L		11/30/22 09:21	5	0.20	12/01/22 12:05	JMW	EPA 6020A
Molybdenum	1.9	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:05	JMW	EPA 6020A
Potassium	0.51	mg/L		11/30/22 09:21	5	0.10	12/01/22 12:05	JMW	EPA 6020A
Selenium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:05	JMW	EPA 6020A
Sodium	22	mg/L		11/30/22 09:21	5	0.10	12/01/22 12:05	JMW	EPA 6020A
Thallium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:05	JMW	EPA 6020A
Lithium	< 0.020	mg/L		11/30/22 09:21	1	0.020	11/30/22 13:17	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: FK04074-03
Name: AW-23
Matrix: Ground Water - Grab

Sampled: 11/21/22 12:32
Received: 11/21/22 16:50

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	42	mg/L		12/02/22 03:08	10	10	12/02/22 03:08	CRD	EPA 300.0 REV 2.1
Fluoride	0.294	mg/L		12/02/22 02:49	1	0.250	12/02/22 02:49	CRD	EPA 300.0 REV 2.1
Sulfate	200	mg/L		12/02/22 03:26	100	100	12/02/22 03:26	CRD	EPA 300.0 REV 2.1
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	280	mg/L		12/01/22 14:53	1	10	12/01/22 14:53	HRF	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		12/01/22 14:53	1	10	12/01/22 14:53	HRF	SM 2320B 1997*
Solids - total dissolved solids (TDS)	800	mg/L		11/23/22 14:15	1	26	11/23/22 15:51	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		11/30/22 09:21	5	3.0	12/01/22 12:08	JMW	EPA 6020A
Arsenic	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:08	JMW	EPA 6020A
Barium	32	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:08	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/02/22 08:42	JMW	EPA 6020A
Boron	580	ug/L		11/30/22 09:21	5	10	12/01/22 12:08	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:08	JMW	EPA 6020A
Calcium	130	mg/L		11/30/22 09:21	5	0.20	12/01/22 12:08	JMW	EPA 6020A
Chromium	< 4.0	ug/L		11/30/22 09:21	5	4.0	12/01/22 12:08	JMW	EPA 6020A
Cobalt	< 2.0	ug/L		11/30/22 09:21	5	2.0	12/01/22 12:08	JMW	EPA 6020A
Lead	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:08	JMW	EPA 6020A
Magnesium	51	mg/L		11/30/22 09:21	5	0.10	12/01/22 12:08	JMW	EPA 6020A
Mercury	< 0.20	ug/L		11/30/22 09:21	5	0.20	12/01/22 12:08	JMW	EPA 6020A
Molybdenum	1.1	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:08	JMW	EPA 6020A
Potassium	0.66	mg/L		11/30/22 09:21	5	0.10	12/01/22 12:08	JMW	EPA 6020A
Selenium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:08	JMW	EPA 6020A
Sodium	51	mg/L		11/30/22 09:21	5	0.10	12/01/22 12:08	JMW	EPA 6020A
Thallium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:08	JMW	EPA 6020A
Lithium	< 0.020	mg/L		11/30/22 09:21	1	0.020	11/30/22 13:25	TJJ	EPA 6010B

Pace Analytical Services, LLC
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(800)752-6651

ANALYTICAL RESULTS

Sample: FK04074-04
Name: EB-01
Matrix: DI Water - Equipment Blank

Sampled: 11/18/22 16:30
Received: 11/21/22 16:50

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Total Metals - PIA									
Antimony	< 3.0	ug/L		11/30/22 09:21	5	3.0	12/01/22 12:12	JMW	EPA 6020A
Arsenic	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:12	JMW	EPA 6020A
Barium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:12	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/02/22 08:46	JMW	EPA 6020A
Boron	16	ug/L		11/30/22 09:21	5	10	12/01/22 12:12	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:12	JMW	EPA 6020A
Calcium	< 0.20	mg/L		11/30/22 09:21	5	0.20	12/01/22 12:12	JMW	EPA 6020A
Chromium	< 4.0	ug/L		11/30/22 09:21	5	4.0	12/01/22 12:12	JMW	EPA 6020A
Cobalt	< 2.0	ug/L		11/30/22 09:21	5	2.0	12/01/22 12:12	JMW	EPA 6020A
Lead	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:12	JMW	EPA 6020A
Magnesium	< 0.10	mg/L		11/30/22 09:21	5	0.10	12/01/22 12:12	JMW	EPA 6020A
Mercury	< 0.20	ug/L		11/30/22 09:21	5	0.20	12/01/22 12:12	JMW	EPA 6020A
Molybdenum	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:12	JMW	EPA 6020A
Potassium	< 0.10	mg/L		11/30/22 09:21	5	0.10	12/01/22 12:12	JMW	EPA 6020A
Selenium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:12	JMW	EPA 6020A
Sodium	< 0.10	mg/L		11/30/22 09:21	5	0.10	12/01/22 12:12	JMW	EPA 6020A
Thallium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:12	JMW	EPA 6020A
Lithium	< 0.020	mg/L		11/30/22 09:21	1	0.020	11/30/22 13:28	TJJ	EPA 6010B

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

ANALYTICAL RESULTS

Sample: FK04074-05
Name: EB-02
Matrix: DI Water - Equipment Blank

Sampled: 11/21/22 13:15
Received: 11/21/22 16:50

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Total Metals - PIA									
Antimony	< 3.0	ug/L		11/30/22 09:21	5	3.0	12/01/22 12:16	JMW	EPA 6020A
Arsenic	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:16	JMW	EPA 6020A
Barium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:16	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/02/22 09:04	JMW	EPA 6020A
Boron	13	ug/L		11/30/22 09:21	5	10	12/01/22 12:16	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:16	JMW	EPA 6020A
Calcium	< 0.20	mg/L		11/30/22 09:21	5	0.20	12/01/22 12:16	JMW	EPA 6020A
Chromium	< 4.0	ug/L		11/30/22 09:21	5	4.0	12/01/22 12:16	JMW	EPA 6020A
Cobalt	< 2.0	ug/L		11/30/22 09:21	5	2.0	12/01/22 12:16	JMW	EPA 6020A
Lead	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:16	JMW	EPA 6020A
Magnesium	< 0.10	mg/L		11/30/22 09:21	5	0.10	12/01/22 12:16	JMW	EPA 6020A
Mercury	< 0.20	ug/L		11/30/22 09:21	5	0.20	12/01/22 12:16	JMW	EPA 6020A
Molybdenum	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:16	JMW	EPA 6020A
Potassium	< 0.10	mg/L		11/30/22 09:21	5	0.10	12/01/22 12:16	JMW	EPA 6020A
Selenium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:16	JMW	EPA 6020A
Sodium	< 0.10	mg/L		11/30/22 09:21	5	0.10	12/01/22 12:16	JMW	EPA 6020A
Thallium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:16	JMW	EPA 6020A
Lithium	< 0.020	mg/L		11/30/22 09:21	1	0.020	11/30/22 13:30	TJJ	EPA 6010B

Pace Analytical Services, LLC
2231 W. Altorfer Drive
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(800)752-6651

ANALYTICAL RESULTS

Sample: FK04074-06
Name: DUP-01
Matrix: Ground Water - Grab

Sampled: 11/21/22 12:45
Received: 11/21/22 16:50

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	45	mg/L		12/02/22 04:38	10	10	12/02/22 04:38	CRD	EPA 300.0 REV 2.1
Fluoride	0.296	mg/L		12/02/22 04:20	1	0.250	12/02/22 04:20	CRD	EPA 300.0 REV 2.1
Sulfate	210	mg/L		12/02/22 04:56	100	100	12/02/22 04:56	CRD	EPA 300.0 REV 2.1
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	290	mg/L		12/01/22 14:53	1	10	12/01/22 14:53	HRF	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		12/01/22 14:53	1	10	12/01/22 14:53	HRF	SM 2320B 1997*
Solids - total dissolved solids (TDS)	780	mg/L		11/23/22 14:15	1	26	11/23/22 15:51	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		11/30/22 09:21	5	3.0	12/01/22 12:33	JMW	EPA 6020A
Arsenic	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:33	JMW	EPA 6020A
Barium	32	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:33	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/02/22 09:08	JMW	EPA 6020A
Boron	580	ug/L		11/30/22 09:21	5	10	12/01/22 12:33	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:33	JMW	EPA 6020A
Calcium	140	mg/L		11/30/22 09:21	5	0.20	12/01/22 12:33	JMW	EPA 6020A
Chromium	< 4.0	ug/L		11/30/22 09:21	5	4.0	12/01/22 12:33	JMW	EPA 6020A
Cobalt	< 2.0	ug/L		11/30/22 09:21	5	2.0	12/01/22 12:33	JMW	EPA 6020A
Lead	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:33	JMW	EPA 6020A
Magnesium	52	mg/L		11/30/22 09:21	5	0.10	12/01/22 12:33	JMW	EPA 6020A
Mercury	< 0.20	ug/L		11/30/22 09:21	5	0.20	12/01/22 12:33	JMW	EPA 6020A
Molybdenum	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:33	JMW	EPA 6020A
Potassium	0.73	mg/L		11/30/22 09:21	5	0.10	12/01/22 12:33	JMW	EPA 6020A
Selenium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:33	JMW	EPA 6020A
Sodium	52	mg/L		11/30/22 09:21	5	0.10	12/01/22 12:33	JMW	EPA 6020A
Thallium	< 1.0	ug/L		11/30/22 09:21	5	1.0	12/01/22 12:33	JMW	EPA 6020A
Lithium	< 0.020	mg/L		11/30/22 09:21	1	0.020	11/30/22 13:33	TJJ	EPA 6010B

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2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

QC SAMPLE RESULTS

Parameter	Result	Unit	Qual	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch B249950 - No Prep - SM 2540C									
Blank (B249950-BLK1)				Prepared & Analyzed: 11/23/22					
Solids - total dissolved solids (TDS)	< 17	mg/L							
LCS (B249950-BS1)				Prepared & Analyzed: 11/23/22					
Solids - total dissolved solids (TDS)	973	mg/L		1000		97	84.9-109		
Duplicate (B249950-DUP1)	**Sample: FK04074-01**			Prepared & Analyzed: 11/23/22					
Solids - total dissolved solids (TDS)	900	mg/L	M		810			11	5
Duplicate (B249950-DUP2)	**Sample: FK04074-02**			Prepared & Analyzed: 11/23/22					
Solids - total dissolved solids (TDS)	820	mg/L	M		890			8	5
Batch B250255 - SW 3015 - EPA 6020A									
Blank (B250255-BLK1)				Prepared: 11/30/22 Analyzed: 12/01/22					
Antimony	< 3.0	ug/L							
Arsenic	< 1.0	ug/L							
Barium	< 1.0	ug/L							
Beryllium	< 1.0	ug/L							
Boron	< 10	ug/L							
Cadmium	< 1.0	ug/L							
Calcium	< 0.20	mg/L							
Chromium	< 4.0	ug/L							
Cobalt	< 2.0	ug/L							
Lead	< 1.0	ug/L							
Magnesium	< 0.10	mg/L							
Mercury	< 0.20	ug/L							
Molybdenum	< 1.0	ug/L							
Potassium	< 0.10	mg/L							
Selenium	< 1.0	ug/L							
Sodium	< 0.10	mg/L							
Thallium	< 1.0	ug/L							
Lithium	< 0.020	mg/L							
LCS (B250255-BS1)				Prepared: 11/30/22 Analyzed: 12/01/22					
Antimony	455	ug/L		555.6		82	80-120		
Arsenic	480	ug/L		555.6		86	80-120		
Barium	464	ug/L		555.6		83	80-120		
Beryllium	488	ug/L		555.6		88	80-120		
Boron	504	ug/L		555.6		91	80-120		
Cadmium	494	ug/L		555.6		89	80-120		
Calcium	4.78	mg/L		5.556		86	80-120		
Chromium	498	ug/L		555.6		90	80-120		
Cobalt	479	ug/L		555.6		86	80-120		
Lead	528	ug/L		555.6		95	80-120		
Magnesium	5.19	mg/L		5.556		93	80-120		
Mercury	48.8	ug/L		55.56		88	80-120		
Molybdenum	463	ug/L		555.6		83	80-120		

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QC SAMPLE RESULTS

Parameter	Result	Unit	Qual	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch B250255 - SW 3015 - EPA 6020A									
LCS (B250255-BS1)				Prepared: 11/30/22 Analyzed: 12/01/22					
Potassium	4.90	mg/L		5.556		88	80-120		
Selenium	473	ug/L		555.6		85	80-120		
Sodium	4.98	mg/L		5.556		90	80-120		
Thallium	506	ug/L		555.6		91	80-120		
Lithium	0.543	mg/L		0.5556		98	80-120		
Matrix Spike (B250255-MS2)	**Sample: FK04074-02**			Prepared: 11/30/22 Analyzed: 12/01/22					
Antimony	512	ug/L		555.6	0.511	92	75-125		
Arsenic	531	ug/L		555.6	1.26	95	75-125		
Barium	576	ug/L		555.6	69.1	91	75-125		
Beryllium	545	ug/L		555.6	ND	98	75-125		
Boron	1240	ug/L		555.6	670	102	75-125		
Cadmium	547	ug/L		555.6	ND	99	75-125		
Calcium	169	mg/L	Q4	5.556	163	108	75-125		
Chromium	545	ug/L		555.6	ND	98	75-125		
Cobalt	503	ug/L		555.6	2.17	90	75-125		
Lead	577	ug/L		555.6	ND	104	75-125		
Magnesium	84.8	mg/L	Q4	5.556	79.3	99	75-125		
Mercury	57.8	ug/L		55.56	ND	104	75-125		
Molybdenum	526	ug/L		555.6	1.92	94	75-125		
Potassium	6.15	mg/L		5.556	0.514	101	75-125		
Selenium	523	ug/L		555.6	ND	94	75-125		
Sodium	27.4	mg/L		5.556	21.6	103	75-125		
Thallium	548	ug/L		555.6	ND	99	75-125		
Matrix Spike Dup (B250255-MSD2)	**Sample: FK04074-02**			Prepared: 11/30/22 Analyzed: 12/01/22					
Antimony	491	ug/L		555.6	0.511	88	75-125	4	20
Arsenic	521	ug/L		555.6	1.26	94	75-125	2	20
Barium	567	ug/L		555.6	69.1	90	75-125	2	20
Beryllium	533	ug/L		555.6	ND	96	75-125	2	20
Boron	1210	ug/L		555.6	670	98	75-125	2	20
Cadmium	531	ug/L		555.6	ND	96	75-125	3	20
Calcium	166	mg/L	Q4	5.556	163	66	75-125	1	20
Chromium	536	ug/L		555.6	ND	97	75-125	2	20
Cobalt	488	ug/L		555.6	2.17	87	75-125	3	20
Lead	557	ug/L		555.6	ND	100	75-125	3	20
Magnesium	83.3	mg/L	Q4	5.556	79.3	72	75-125	2	20
Mercury	55.4	ug/L		55.56	ND	100	75-125	4	20
Molybdenum	512	ug/L		555.6	1.92	92	75-125	3	20
Potassium	5.97	mg/L		5.556	0.514	98	75-125	3	20
Selenium	507	ug/L		555.6	ND	91	75-125	3	20
Sodium	27.0	mg/L		5.556	21.6	97	75-125	1	20
Thallium	528	ug/L		555.6	ND	95	75-125	4	20

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QC SAMPLE RESULTS

Parameter	Result	Unit	Qual	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch B250514 - IC No Prep - EPA 300.0 REV 2.1									
Calibration Blank (B250514-CCB1)				Prepared & Analyzed: 12/01/22					
Sulfate	0.00	mg/L							
Fluoride	0.00	mg/L							
Chloride	0.00	mg/L							
Calibration Check (B250514-CCV1)				Prepared & Analyzed: 12/01/22					
Sulfate	4.93	mg/L		5.000		99	90-110		
Fluoride	5.01	mg/L		5.000		100	90-110		
Chloride	4.93	mg/L		5.000		99	90-110		
Batch B250671 - No Prep - SM 2320B 1997									
Duplicate (B250671-DUP2)	**Sample: FK04074-02**			Prepared & Analyzed: 12/01/22					
Alkalinity - bicarbonate as CaCO3	488	mg/L			488			0	10
Alkalinity - carbonate as CaCO3	< 10	mg/L			ND				10
Batch B250672 - IC No Prep - EPA 300.0 REV 2.1									
Calibration Blank (B250672-CCB1)				Prepared & Analyzed: 12/03/22					
Chloride	0.762	mg/L							
Sulfate	0.00	mg/L							
Calibration Check (B250672-CCV1)				Prepared & Analyzed: 12/03/22					
Chloride	4.71	mg/L		5.000		94	90-110		
Sulfate	4.87	mg/L		5.000		97	90-110		

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NOTES

Specifications regarding method revisions, method modifications, and calculations used for analysis are available upon request. Please contact your project manager.

* Not a TNI accredited analyte

Certifications

CHI - McHenry, IL - 4314-A W. Crystal Lake Road, McHenry, IL 60050
TNI Accreditation for Drinking Water and Wastewater Fields of Testing through IL EPA Accreditation No. 100279
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory Registry No. 17556

PIA - Peoria, IL - 2231 W. Altorfer Drive, Peoria, IL 61615
TNI Accreditation for Drinking Water, Wastewater, Solid and Hazardous Material Fields of Testing through IL EPA Accreditation No. 100230
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory Registry No. 17553
Drinking Water Certifications/Accreditations: Iowa (240); Kansas (E-10338); Missouri (870)
Wastewater Certifications/Accreditations: Arkansas (88-0677); Iowa (240); Kansas (E-10338)
Solid and Hazardous Material Certifications/Accreditations: Arkansas (88-0677); Iowa (240); Kansas (E-10338)

SPMO - Springfield, MO - 1805 W Sunset Street, Springfield, MO 65807
USEPA DMR-QA Program

STL - Hazelwood, MO - 944 Anglum Rd, Hazelwood, MO 63042
TNI Accreditation for Wastewater, Solid and Hazardous Material Fields of Testing through KS KDHE Certification No. E-10389
TNI Accreditation for Wastewater, Solid and Hazardous Material Fields of Testing through IL EPA Accreditation No. - 200080
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory, Registry No. 171050
Missouri Department of Natural Resources - Certificate of Approval for Microbiological Laboratory Service - No. 1050

Qualifiers

M Analyte failed to meet the required acceptance criteria for duplicate analysis.
Q4 The matrix spike recovery result is unusable since the analyte concentration in the sample is greater than four times the spike level. The associated blank spike was acceptable.

Gail J Schindler

Certified by: Gail Schindler, Project Manager

PACE ANALYTICAL SERVICES
WWW.PACELABS.COM

REGULATORY PROGRAM (CIRCLE):	NPDES
MORBCA	RCRA
CCDD	TACO: RES OR IND/COMM

CHAIN OF CUSTODY RECORD

STATE WHERE SAMPLE COLLECTED IL

1 CLIENT	PROJECT NUMBER	PROJECT LOCATION	PURCHASE ORDER #
VISTRA – EDWARDS STATION	RAM.BOU.PN# 1940102792	BARTONVILLE, IL	
ADDRESS: 7800 S CILCO LANE	PHONE NUMBER: (217) 494 753 AFH 8911	E-MAIL: BRIAN.VOELKER@VISTRACORP.COM	DATE SHIPPED: SAMPLES DROPPED OFF AT LAB ON 11/21/22
CITY / STATE / ZIP: BARTONVILLE, IL 61607	SAMPLER (PLEASE PRINT): ANDREW HARDWICK (RAMBOLL)	MATRIX TYPES: WW- WASTEWATER; DW- DRINKING WATER; GW- GROUND WATER; WWSL- SLUDGE; NAS- NON AQUEOUS SOLID; LCHT-LEACHATE; OIL-OIL; SO-SOIL; SOL-SOLID	
CONTACT PERSON: BRIAN VOELKER	SAMPLER'S SIGNATURE		

3 ANALYSIS REQUESTED

4 (FOR LAB USE ONLY)
LOGIN # FK0407406
LOGGED BY: SMB
CLIENT: VISTRA-EDWARDS
PROJECT: EDWARDS DELINEATION
PROJ. MGR.: GJ SCHINDLER

2 SAMPLE DESCRIPTION (UNIQUE DESCRIPTION AS IT WILL APPEAR ON THE ANALYTICAL REPORT)	DATE COLLECTED	TIME COLLECTED	SAMPLE TYPE GRAB	SAMPLE TYPE COMP	MATRIX TYPE	BOTTLE COUNT	PRES CODE CLIENT PROVIDED	CL, F, SO4, HCO3, CO3,	TDS, AS, B, BA, BE, CA, CD	CO, CR, HG, K, LI, MG, MO	NA, PB, SB, SE, TL	RAD 226/228	845 metals only	REMARKS
AW-01	11/18/22	14:21	X		GW	3	3,6	X	X	X	X	X		
EMW-05	11/18/22	15:13	X		GW	9	3,6	X	X	X	X	X		TRIPLE VOLUME PREP FOR MS/MSD
AW-23	11/21/22	12:32	X		GW	3	3,6	X	X	X	X	X		
EB-01	11/18/22 AFH	16:30	X		W	1	3						X	
EB-02	11/21/22	13:15	X		W	1	3						X	
DUP-01	11/21/22	12:45	X		GW	3	3,6	X	X	X	X	X		
		AFH 11/21/2022												

CHEMICAL PRESERVATION CODES: 1 – HCL | 2 – H2SO4 | 3 – HNO3 | 4 – NAOH | 5 – NA2S2O3 | 6 – UNPRESERVED | 7 – OTHER

5 TURNAROUND TIME REQUESTED (PLEASE CIRCLE) (RUSH TAT IS SUBJECT TO PDC LABS APPROVAL AND SURCHARGE): NORMAL RUSH
DATE RESULTS NEEDED:
RUSH RESULTS VIA (PLEASE CIRCLE): EMAIL PHONE
EMAIL IF DIFFERENT FROM ABOVE:
PHONE # IF DIFFERENT FROM ABOVE:

6 *I understand that by initialing this box I give the lab permission to proceed with analysis, even though it may not meet all sample conformance requirements as defined in the receiving facility's Sample Acceptance Policy and the data will be qualified. Qualified data may NOT be acceptable to report to all regulatory authorities.*
PROCEED WITH ANALYSIS AND QUALIFY RESULTS: (INITIALS) AFH

7		DATE	TIME
RELINQUISHED BY: (SIGNATURE)		11/21/22	1650
RELINQUISHED BY: (SIGNATURE)			
RELINQUISHED BY: (SIGNATURE)			
RECEIVED BY: (SIGNATURE)			
RECEIVED BY: (SIGNATURE)			
RECEIVED BY: (SIGNATURE)		11-21-22	16:50

8 COMMENTS: (FOR LAB USE ONLY)

SAMPLE TEMPERATURE UPON RECEIPT 3.2 °C
CHILL PROCESS STARTED PRIOR TO RECEIPT ~~Y OR N~~
SAMPLE(S) RECEIVED ON ICE Y OR N
SAMPLE ACCEPTANCE NONCONFORMANT REPORT IS NEEDED ~~Y OR N~~
DATE AND TIME TAKEN FROM SAMPLE BOTTLE

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

December 22, 2022

Amy Holmes

,

RE: Project: FK04084
Pace Project No.: 30542629

Dear Amy Holmes:

Enclosed are the analytical results for sample(s) received by the laboratory on December 01, 2022. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:

- Pace Analytical Services - Greensburg

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Carla Cmar
carla.cmar@pacelabs.com
(724)850-5600
Project Manager

Enclosures

cc: Chenise Lambert-Sykes, PDC Laboratories, Inc.

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CERTIFICATIONS

Project: FK04084
Pace Project No.: 30542629

Pace Analytical Services Pennsylvania
1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
ANAB DOD-ELAP Rad Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification #: PA01547
Connecticut Certification #: PH-0694
Delaware Certification
EPA Region 4 DW Rad
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Florida: Cert E871149 SEKS WET
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: KY90133
KY WW Permit #: KY0098221
KY WW Permit #: KY0000221
Louisiana DHH/TNI Certification #: LA180012
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: 2017020
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification #: 9991
Missouri Certification #: 235
Montana Certification #: Cert0082
Nebraska Certification #: NE-OS-29-14
Nevada Certification #: PA014572018-1
New Hampshire/TNI Certification #: 297617
New Jersey/TNI Certification #: PA051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Ohio EPA Rad Approval: #41249
Oregon/TNI Certification #: PA200002-010
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: 02867
Texas/TNI Certification #: T104704188-17-3
Utah/TNI Certification #: PA014572017-9
USDA Soil Permit #: P330-17-00091
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Approve List for Rad
Wyoming Certification #: 8TMS-L

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SAMPLE SUMMARY

Project: FK04084
Pace Project No.: 30542629

Lab ID	Sample ID	Matrix	Date Collected	Date Received
30542629001	**FK04084-01**	Water	11/18/22 14:21	12/01/22 09:35
30542629002	**FK04084-02**	Water	11/18/22 15:13	12/01/22 09:35
30542629003	**FK04084-03**	Water	11/21/22 12:32	12/01/22 09:35
30542629004	**FK04084-04**	Water	11/21/22 12:45	12/01/22 09:35

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SAMPLE ANALYTE COUNT

Project: FK04084
Pace Project No.: 30542629

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
30542629001	**FK04084-01**	EPA 903.1	CLM	1	PASI-PA
		EPA 904.0	JJS1	1	PASI-PA
		Total Radium Calculation	JAL	1	PASI-PA
30542629002	**FK04084-02**	EPA 903.1	CLM	1	PASI-PA
		EPA 904.0	JJS1	1	PASI-PA
		Total Radium Calculation	JAL	1	PASI-PA
30542629003	**FK04084-03**	EPA 903.1	CLM	1	PASI-PA
		EPA 904.0	JJS1	1	PASI-PA
		Total Radium Calculation	JAL	1	PASI-PA
30542629004	**FK04084-04**	EPA 903.1	CLM	1	PASI-PA
		EPA 904.0	JJS1	1	PASI-PA
		Total Radium Calculation	JAL	1	PASI-PA

PASI-PA = Pace Analytical Services - Greensburg

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PROJECT NARRATIVE

Project: FK04084
Pace Project No.: 30542629

Method: **EPA 903.1**
Description: 903.1 Radium 226
Client: PDC/Pace Analytical Services (Peoria, IL)
Date: December 22, 2022

General Information:
4 samples were analyzed for EPA 903.1 by Pace Analytical Services Greensburg. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

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PROJECT NARRATIVE

Project: FK04084
Pace Project No.: 30542629

Method: **EPA 904.0**
Description: 904.0 Radium 228
Client: PDC/Pace Analytical Services (Peoria, IL)
Date: December 22, 2022

General Information:
4 samples were analyzed for EPA 904.0 by Pace Analytical Services Greensburg. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

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PROJECT NARRATIVE

Project: FK04084
Pace Project No.: 30542629

Method: **Total Radium Calculation**
Description: Total Radium 228+226
Client: PDC/Pace Analytical Services (Peoria, IL)
Date: December 22, 2022

General Information:
4 samples were analyzed for Total Radium Calculation by Pace Analytical Services Greensburg. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

This data package has been reviewed for quality and completeness and is approved for release.

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Greensburg, PA 15601
(724)850-5600

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: FK04084
Pace Project No.: 30542629

Sample: FK04084-01 **Lab ID: 30542629001** Collected: 11/18/22 14:21 Received: 12/01/22 09:35 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
	Pace Analytical Services - Greensburg					
Radium-226	EPA 903.1	**-0.0634 ± 0.373 (0.832) C:NA T:98%**	pCi/L	12/20/22 16:47	13982-63-3	
	Pace Analytical Services - Greensburg					
Radium-228	EPA 904.0	**0.449 ± 0.341 (0.665) C:77% T:97%**	pCi/L	12/20/22 14:51	15262-20-1	
	Pace Analytical Services - Greensburg					
Total Radium	Total Radium Calculation	**0.449 ± 0.714 (1.50)**	pCi/L	12/22/22 13:17	7440-14-4	

Sample: FK04084-02 **Lab ID: 30542629002** Collected: 11/18/22 15:13 Received: 12/01/22 09:35 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
	Pace Analytical Services - Greensburg					
Radium-226	EPA 903.1	**0.201 ± 0.603 (1.12) C:NA T:89%**	pCi/L	12/20/22 16:47	13982-63-3	
	Pace Analytical Services - Greensburg					
Radium-228	EPA 904.0	**0.278 ± 0.318 (0.667) C:83% T:91%**	pCi/L	12/20/22 14:51	15262-20-1	
	Pace Analytical Services - Greensburg					
Total Radium	Total Radium Calculation	**0.479 ± 0.921 (1.79)**	pCi/L	12/22/22 13:17	7440-14-4	

Sample: FK04084-03 **Lab ID: 30542629003** Collected: 11/21/22 12:32 Received: 12/01/22 09:35 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
	Pace Analytical Services - Greensburg					
Radium-226	EPA 903.1	**0.000 ± 0.474 (0.969) C:NA T:100%**	pCi/L	12/20/22 17:07	13982-63-3	
	Pace Analytical Services - Greensburg					
Radium-228	EPA 904.0	**0.365 ± 0.337 (0.687) C:82% T:87%**	pCi/L	12/20/22 14:51	15262-20-1	
	Pace Analytical Services - Greensburg					
Total Radium	Total Radium Calculation	**0.365 ± 0.811 (1.66)**	pCi/L	12/22/22 13:17	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: FK04084
Pace Project No.: 30542629

Sample: FK04084-04 **Lab ID: 30542629004** Collected: 11/21/22 12:45 Received: 12/01/22 09:35 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
	Pace Analytical Services - Greensburg					
Radium-226	EPA 903.1	**-0.269 ± 0.495 (1.12) C:NA T:94%**	pCi/L	12/20/22 17:07	13982-63-3	
	Pace Analytical Services - Greensburg					
Radium-228	EPA 904.0	**0.0473 ± 0.277 (0.634) C:83% T:96%**	pCi/L	12/20/22 14:52	15262-20-1	
	Pace Analytical Services - Greensburg					
Total Radium	Total Radium Calculation	**0.0473 ± 0.772 (1.75)**	pCi/L	12/22/22 13:17	7440-14-4	

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Greensburg, PA 15601
(724)850-5600

QUALITY CONTROL - RADIOCHEMISTRY

Project: FK04084
Pace Project No.: 30542629

QC Batch: 551101
QC Batch Method: EPA 903.1
Analysis Method: EPA 903.1
Analysis Description: 903.1 Radium-226
Laboratory: Pace Analytical Services - Greensburg
Associated Lab Samples: 30542629001, 30542629002, 30542629003, 30542629004

METHOD BLANK: 2676327 Matrix: Water
Associated Lab Samples: 30542629001, 30542629002, 30542629003, 30542629004

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.0490 ± 0.224 (0.360) C:NA T:95%	pCi/L	12/20/22 16:47	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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Greensburg, PA 15601
(724)850-5600

QUALITY CONTROL - RADIOCHEMISTRY

Project: FK04084
Pace Project No.: 30542629

QC Batch: 551102
QC Batch Method: EPA 904.0
Analysis Method: EPA 904.0
Analysis Description: 904.0 Radium 228
Laboratory: Pace Analytical Services - Greensburg
Associated Lab Samples: 30542629001, 30542629002, 30542629003, 30542629004

METHOD BLANK: 2676329 Matrix: Water
Associated Lab Samples: 30542629001, 30542629002, 30542629003, 30542629004

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.275 ± 0.321 (0.674) C:85% T:82%	pCi/L	12/20/22 14:50	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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Greensburg, PA 15601
(724)850-5600

QUALIFIERS

Project: FK04084
Pace Project No.: 30542629

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Reported results are not rounded until the final step prior to reporting. Therefore, calculated parameters that are typically reported as "Total" may vary slightly from the sum of the reported component parameters.

Act - Activity

Unc - Uncertainty: For Safe Drinking Water Act (SDWA) analyses, the reported Unc. Is the calculated Count Uncertainty (95% confidence interval) using a coverage factor of 1.96. For all other matrices (non-SDWA), the reported Unc. is the calculated Expanded Uncertainty (aka Combined Standard Uncertainty, CSU), reported at the 95% confidence interval using a coverage factor of 1.96.

Gamma Spec: The Unc. reported for all gamma-spectroscopy analyses (EPA 901.1), is the calculated Expanded Uncertainty (CSU) at the 95.4% confidence interval, using a coverage factor of 2.0.

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

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SUBCONTRACT ORDER
Transfer Chain of Custody

Pace Analytical Services, LLC

FK04084

SENDING LABORATORY

PDC Laboratories, Inc.
2231 W Altorfer Dr
Peoria, IL 61615
(800) 752-6651

RECEIVING LABORATORY

PACE Analytical - Greensburg
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724) 850-5600

Sample: FK04084-01
Name: AW-01

Sampled: 11/18/22 14:21
Matrix: Ground Water
Preservative: HNO3, pH <2

Analysis	Due	Expires	Comments
01-Radium 226/228 combined	12/05/22 16:00	05/17/23 14:21	

Sample: FK04084-02
Name: EMW-05

Sampled: 11/18/22 15:13
Matrix: Ground Water
Preservative: HNO3, pH <2

Analysis	Due	Expires	Comments
01-Radium 226/228 combined	12/05/22 16:00	05/17/23 15:13	MS/MSD

Sample: FK04084-03
Name: AW-23

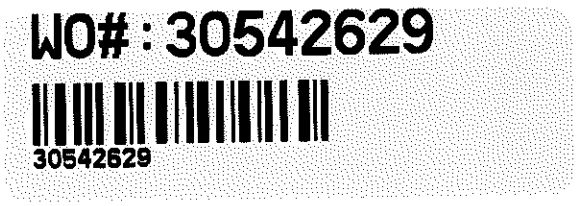
Sampled: 11/21/22 12:32
Matrix: Ground Water
Preservative: HNO3, pH <2

Analysis	Due	Expires	Comments
01-Radium 226/228 combined	12/05/22 16:00	05/20/23 12:32	

Sample: FK04084-04
Name: DUP-01

Sampled: 11/21/22 12:45
Matrix: Ground Water
Preservative: HNO3, pH <2

Analysis	Due	Expires	Comments
01-Radium 226/228 combined	12/05/22 16:00	05/20/23 12:45	



SUBCONTRACT ORDER
Transfer Chain of Custody

Pace Analytical Services, LLC

FK04084

WO# : 30542629

PM: CMC Due Date: 12/22/22

CLIENT: PDC

Please email results to Gail Schindler at gail.schindler@pacelabs.com

Date Shipped: 11-29-22 Total # of Containers: 6 Sample Origin (State): IL PO #: _____

Turn-Around Time Requested ☑ NORMAL ☐ RUSH Date Results Needed: _____

Relinquished By	Date/Time	Received By	Date/Time
[signature]	15:00 11-29-22	[signature]	12-1-22 9:35
Relinquished By	Date/Time	Received By	Date/Time

Sample Temperature Upon Receipt	____ °C
Sample(s) Received on Ice	Y or N
Proper Bottles Received in Good Condition	Y or N
Bottles Filled with Adequate Volume	Y or N
Samples Received Within Hold Time	Y or N
Date/Time Taken From Sample Bottle	Y or N

DC#_Title: ENV-FRM-GBUR-0088 v02_Sample Condition Upon Receipt-Pittsburgh

Effective Date: 10/03/2022

WO# : 30542629

PM: CMC Due Date: 12/22/22

CLIENT: PDC

Client Name: PDC

Courier: ☐ Fed Ex ☑ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ Other

Tracking Number: 1Z647 2960 3694 5692 9

Examined By TH

Labeled By TH

Temped By —

Custody Seal on Cooler/Box Present: ☐ Yes ☑ No **Seals Intact:** ☐ Yes ☑ No

Thermometer Used: — **Type of Ice:** Wet Blue (None)

Cooler Temperature: Observed Temp — °C Correction Factor: — °C Final Temp: — °C

Temp should be above freezing to 6°C

Comments:	Yes	No	NA	pH paper Lot# 10D2221 / D.P.D. Residual Chlorine Lot # —
Chain of Custody Present	✓			1.
Chain of Custody Filled Out:	✓			2.
-Were client corrections present on COC		✓		
Chain of Custody Relinquished	✓			3.
Sampler Name & Signature on COC:		✓		4.
Sample Labels match COC:	✓			5.
-Includes date/time/ID				
Matrix: WT				
Samples Arrived within Hold Time:	✓			6.
Short Hold Time Analysis (<72hr remaining):		✓		7.
Rush Turn Around Time Requested:		✓		8.
Sufficient Volume:	✓			9.
Correct Containers Used:	✓			10.
-Pace Containers Used		✓		
Containers Intact:	✓			11.
Orthophosphate field filtered:			✓	12.
Hex Cr Aqueous samples field filtered:			✓	13.
Organic Samples checked for dechlorination			✓	14:
Filtered volume received for dissolved tests:			✓	15:
All containers checked for preservation:	✓			16. PH<2
exceptions: VOA, coliform, TOC, O&G, Phenolics, Radon, non-aqueous matrix				
All containers meet method preservation requirements:	✓			Initial when completed TH / Date/Time of Preservation / Lot# of added Preservative
Headspace in VOA Vials (>6mm):			✓	17.
Trip Blank Present:			✓	18.
Trip Blank Custody Seals Present			✓	
Rad Samples Screened <0.5 mrem/hr.	✓			Initial when completed TH / Date: 12/01/22 / Survey Meter SN: 1563

Comments:

Note: For NC compliance samples with discrepancies, a copy of this form must be sent to the DEHNR Certification office.
PM Review is documented electronically in LIMS through the SRF Review schedule in the Workorder Edit Screen.

Pace Analytical®

Pace Greensburg Lab -Sample Container Count

Client

Site FK040824

Profile Number 18537

Notes

Sample Line Item	Matrix	AG1H	AG1S	AG1T	AG2U	AG3S	AG3U	AG5U	AG5T	BG1U	BG2U	BP1N	BP1U	BP2S	BP2U	BP3C	BP3N	BP3S	BP3U	DG9S	GCUB	VG9H	VG9T	VG9U	VOAK	WGFU	WGKU	ZPLC	12GN
1	SL																												4
2	SL																												3
3	SL																												1
4	SL																												1
5																													
6																													
7																													
8																													
9																													
10																													
11																													
12																													

Container Codes

Glass

GJN	1 Gallon Jug with HNO3	DG9S	40mL amber VOA vial H2SO4
AG5U	100mL amber glass unprserved	VG9U	40mL clear VOA vial
AG5T	100mL amber glass Na Thiosulfate	VG9T	40mL clear VOA vial Na Thiosul
GJN	1 Gallon Jug	VG9H	40mL clear VOA vial HCl
AG1S	1L amber glass H2SO4	JGFU	4oz amber wide jar
AG1H	1L amber glass HCl	WGFU	4oz wide jar unpreserved
AG1T	1L amber glass Na Thiosulfate	BG2U	500mL clear glass unpreserved
BG1U	1L clear glass unpreserved	AG2U	500mL amber glass unpreserve
AG3S	250mL amber glass H2SO4	WGKU	8oz wide jar unpreserved
AG3U	250mL amber glass unpreserved		

Plastic / Misc.

GCUB	1 Gallon Cubitainer
12GN	1/2 Gallon Cubitainer
SP5T	120mL Coliform Na Thiosulfate
BP1N	1L plastic HNO3
BP1U	1L plastic unpreserved
BP3S	250mL plastic H2SO4
BP3N	250mL plastic HNO3
BP3U	250mL plastic unpreserved
BP3C	250ml plastic NAOH
BP2S	500mL plastic H2SO4
BP2U	500mL plastic unpreserved

EZI	5g Encore
VOAK	Kit for Volatile Solid
I	Wipe/Swab
ZPLC	Ziploc Bag

WT	Water
SL	Solid
OL	Non-aqueous liquid
WP	Wipe

WO: 30542029

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

December 29, 2022

Brian Voelker
Vistra - Edwards
604 Pierce Boulevard
O'Fallon, IL 62269

RE: RAMBOLL DELINEATION

Dear Brian Voelker:

Please find enclosed the analytical results for the **6** sample(s) the laboratory received on **12/16/22 4:14 pm** and logged in under work order **FL03537**. All testing is performed according to our current TNI accreditations unless otherwise noted. This report cannot be reproduced, except in full, without the written permission of Pace Analytical Services, LLC.

If you have any questions regarding your report, please contact your project manager. Quality and timely data is of the utmost importance to us.

Pace Analytical Services appreciates the opportunity to provide you with analytical expertise . We are always trying to improve our customer service and we welcome you to contact the Director of Client Services, Lisa Grant, with any feedback you have about your experience with our laboratory at 309-683-1764 or lisa.grant@pacelabs.com.

Gail J Schindler

Gail Schindler
Project Manager
(309) 692-9688 x1716
gail.schindler@pacelabs.com

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

SAMPLE RECEIPT CHECK LIST

Items not applicable will be marked as in compliance

Work Order FL03537

YES	Samples received within temperature compliance when applicable
YES	COC present upon sample receipt
YES	COC completed & legible
YES	Sampler name & signature present
YES	Unique sample IDs assigned
YES	Sample collection location recorded
YES	Date & time collected recorded on COC
YES	Relinquished by client signature on COC
YES	COC & labels match
YES	Sample labels are legible
YES	Appropriate bottle(s) received
YES	Sufficient sample volume received
YES	Sample containers received undamaged
NO	Zero headspace, <6 mm present in VOA vials
NO	Trip blank(s) received
YES	All non-field analyses received within holding times
NO	Short hold time analysis
YES	Current PDC COC submitted
NO	Case narrative provided

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

ANALYTICAL RESULTS

Sample: FL03537-01
Name: AW-01
Matrix: Ground Water - Grab

Sampled: 12/15/22 17:02
Received: 12/16/22 16:14

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	19	mg/L	Q4	12/27/22 16:46	5	5.0	12/27/22 16:46	LAM	EPA 300.0 REV 2.1
Fluoride	< 0.250	mg/L		12/27/22 15:52	1	0.250	12/27/22 15:52	LAM	EPA 300.0 REV 2.1
Sulfate	43	mg/L	Q4	12/27/22 16:46	5	5.0	12/27/22 16:46	LAM	EPA 300.0 REV 2.1
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	680	mg/L		12/27/22 11:10	1	10	12/27/22 11:10	HRF	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		12/27/22 11:10	1	10	12/27/22 11:10	HRF	SM 2320B 1997*
Solids - total dissolved solids (TDS)	790	mg/L		12/21/22 09:33	1	26	12/21/22 10:56	CPS	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		12/27/22 09:01	5	3.0	12/27/22 14:47	JMW	EPA 6020A
Arsenic	1.5	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:47	JMW	EPA 6020A
Barium	100	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:47	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:47	JMW	EPA 6020A
Boron	72	ug/L		12/27/22 09:01	5	10	12/27/22 14:47	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:47	JMW	EPA 6020A
Calcium	150	mg/L		12/27/22 09:01	5	0.20	12/27/22 14:47	JMW	EPA 6020A
Chromium	< 4.0	ug/L		12/27/22 09:01	5	4.0	12/27/22 14:47	JMW	EPA 6020A
Cobalt	3.6	ug/L		12/27/22 09:01	5	2.0	12/27/22 14:47	JMW	EPA 6020A
Lead	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/28/22 08:28	JMW	EPA 6020A
Magnesium	64	mg/L		12/27/22 09:01	5	0.10	12/27/22 14:47	JMW	EPA 6020A
Mercury	< 0.20	ug/L		12/27/22 09:01	5	0.20	12/28/22 08:28	JMW	EPA 6020A
Molybdenum	2.9	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:47	JMW	EPA 6020A
Potassium	0.54	mg/L		12/27/22 09:01	5	0.10	12/27/22 14:47	JMW	EPA 6020A
Selenium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:47	JMW	EPA 6020A
Sodium	17	mg/L		12/27/22 09:01	5	0.10	12/27/22 14:47	JMW	EPA 6020A
Thallium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/28/22 08:28	JMW	EPA 6020A
Lithium	< 0.020	mg/L		12/27/22 09:01	1	0.020	12/28/22 14:27	TJJ	EPA 6010B

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

ANALYTICAL RESULTS

Sample: FL03537-02
Name: EMW-05
Matrix: Ground Water - Grab

Sampled: 12/15/22 15:38
Received: 12/16/22 16:14

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	20	mg/L	Q4	12/27/22 18:53	5	5.0	12/27/22 18:53	LAM	EPA 300.0 REV 2.1
Fluoride	< 0.250	mg/L		12/27/22 17:22	1	0.250	12/27/22 17:22	LAM	EPA 300.0 REV 2.1
Sulfate	120	mg/L	Q4	12/27/22 19:11	25	25	12/27/22 19:11	LAM	EPA 300.0 REV 2.1
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	600	mg/L		12/27/22 11:10	1	10	12/27/22 11:10	HRF	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		12/27/22 11:10	1	10	12/27/22 11:10	HRF	SM 2320B 1997*
Solids - total dissolved solids (TDS)	860	mg/L		12/21/22 09:33	1	26	12/21/22 10:56	CPS	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		12/27/22 09:01	5	3.0	12/27/22 14:51	JMW	EPA 6020A
Arsenic	1.2	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:51	JMW	EPA 6020A
Barium	79	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:51	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:51	JMW	EPA 6020A
Boron	770	ug/L		12/27/22 09:01	5	10	12/27/22 14:51	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:51	JMW	EPA 6020A
Calcium	170	mg/L		12/27/22 09:01	5	0.20	12/27/22 14:51	JMW	EPA 6020A
Chromium	5.0	ug/L		12/27/22 09:01	5	4.0	12/27/22 14:51	JMW	EPA 6020A
Cobalt	2.0	ug/L		12/27/22 09:01	5	2.0	12/27/22 14:51	JMW	EPA 6020A
Lead	2.9	ug/L		12/27/22 09:01	5	1.0	12/28/22 08:32	JMW	EPA 6020A
Magnesium	70	mg/L		12/27/22 09:01	5	0.10	12/27/22 14:51	JMW	EPA 6020A
Mercury	< 0.20	ug/L		12/27/22 09:01	5	0.20	12/28/22 08:32	JMW	EPA 6020A
Molybdenum	1.7	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:51	JMW	EPA 6020A
Potassium	1.1	mg/L		12/27/22 09:01	5	0.10	12/27/22 14:51	JMW	EPA 6020A
Selenium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:51	JMW	EPA 6020A
Sodium	17	mg/L		12/27/22 09:01	5	0.10	12/27/22 14:51	JMW	EPA 6020A
Thallium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/28/22 08:32	JMW	EPA 6020A
Lithium	< 0.020	mg/L		12/27/22 09:01	1	0.020	12/28/22 14:29	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: FL03537-03
Name: EB-01
Matrix: Ground Water - Grab

Sampled: 12/15/22 17:05
Received: 12/16/22 16:14

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Total Metals - PIA									
Antimony	< 3.0	ug/L		12/27/22 09:01	5	3.0	12/27/22 14:55	JMW	EPA 6020A
Arsenic	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:55	JMW	EPA 6020A
Barium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:55	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:55	JMW	EPA 6020A
Boron	< 10	ug/L		12/27/22 09:01	5	10	12/27/22 14:55	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:55	JMW	EPA 6020A
Calcium	< 0.20	mg/L		12/27/22 09:01	5	0.20	12/27/22 14:55	JMW	EPA 6020A
Chromium	< 4.0	ug/L		12/27/22 09:01	5	4.0	12/27/22 14:55	JMW	EPA 6020A
Cobalt	< 2.0	ug/L		12/27/22 09:01	5	2.0	12/27/22 14:55	JMW	EPA 6020A
Lead	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/28/22 08:35	JMW	EPA 6020A
Magnesium	< 0.10	mg/L		12/27/22 09:01	5	0.10	12/27/22 14:55	JMW	EPA 6020A
Mercury	< 0.20	ug/L		12/27/22 09:01	5	0.20	12/28/22 08:35	JMW	EPA 6020A
Molybdenum	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:55	JMW	EPA 6020A
Potassium	< 0.10	mg/L		12/27/22 09:01	5	0.10	12/27/22 14:55	JMW	EPA 6020A
Selenium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:55	JMW	EPA 6020A
Sodium	< 0.10	mg/L		12/27/22 09:01	5	0.10	12/27/22 14:55	JMW	EPA 6020A
Thallium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/28/22 08:35	JMW	EPA 6020A
Lithium	< 0.020	mg/L		12/27/22 09:01	1	0.020	12/28/22 14:32	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: FL03537-04
Name: EB-02
Matrix: Ground Water - Grab

Sampled: 12/16/22 13:25
Received: 12/16/22 16:14

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Total Metals - PIA									
Antimony	< 3.0	ug/L		12/27/22 09:01	5	3.0	12/27/22 14:58	JMW	EPA 6020A
Arsenic	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:58	JMW	EPA 6020A
Barium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:58	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:58	JMW	EPA 6020A
Boron	< 10	ug/L		12/27/22 09:01	5	10	12/27/22 14:58	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:58	JMW	EPA 6020A
Calcium	< 0.20	mg/L		12/27/22 09:01	5	0.20	12/27/22 14:58	JMW	EPA 6020A
Chromium	< 4.0	ug/L		12/27/22 09:01	5	4.0	12/27/22 14:58	JMW	EPA 6020A
Cobalt	< 2.0	ug/L		12/27/22 09:01	5	2.0	12/27/22 14:58	JMW	EPA 6020A
Lead	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/28/22 08:39	JMW	EPA 6020A
Magnesium	< 0.10	mg/L		12/27/22 09:01	5	0.10	12/27/22 14:58	JMW	EPA 6020A
Mercury	< 0.20	ug/L		12/27/22 09:01	5	0.20	12/28/22 08:39	JMW	EPA 6020A
Molybdenum	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:58	JMW	EPA 6020A
Potassium	< 0.10	mg/L		12/27/22 09:01	5	0.10	12/27/22 14:58	JMW	EPA 6020A
Selenium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 14:58	JMW	EPA 6020A
Sodium	< 0.10	mg/L		12/27/22 09:01	5	0.10	12/27/22 14:58	JMW	EPA 6020A
Thallium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/28/22 08:39	JMW	EPA 6020A
Lithium	< 0.020	mg/L		12/27/22 09:01	1	0.020	12/28/22 14:34	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: FL03537-05
Name: Dup-01
Matrix: Ground Water - Grab

Sampled: 12/15/22 17:02
Received: 12/16/22 16:14

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	16	mg/L		12/27/22 19:47	5	5.0	12/27/22 19:47	LAM	EPA 300.0 REV 2.1
Fluoride	< 0.250	mg/L		12/27/22 19:29	1	0.250	12/27/22 19:29	LAM	EPA 300.0 REV 2.1
Sulfate	40	mg/L		12/27/22 19:47	5	5.0	12/27/22 19:47	LAM	EPA 300.0 REV 2.1
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	710	mg/L		12/27/22 11:10	1	10	12/27/22 11:10	HRF	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		12/27/22 11:10	1	10	12/27/22 11:10	HRF	SM 2320B 1997*
Solids - total dissolved solids (TDS)	820	mg/L		12/21/22 09:33	1	26	12/21/22 10:56	CPS	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		12/27/22 09:01	5	3.0	12/27/22 15:02	JMW	EPA 6020A
Arsenic	15	ug/L		12/27/22 09:01	5	1.0	12/27/22 15:02	JMW	EPA 6020A
Barium	160	ug/L		12/27/22 09:01	5	1.0	12/27/22 15:02	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 15:02	JMW	EPA 6020A
Boron	78	ug/L		12/27/22 09:01	5	10	12/27/22 15:02	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 15:02	JMW	EPA 6020A
Calcium	160	mg/L		12/27/22 09:01	5	0.20	12/27/22 15:02	JMW	EPA 6020A
Chromium	15	ug/L		12/27/22 09:01	5	4.0	12/27/22 15:02	JMW	EPA 6020A
Cobalt	6.9	ug/L		12/27/22 09:01	5	2.0	12/27/22 15:02	JMW	EPA 6020A
Lead	4.5	ug/L		12/27/22 09:01	5	1.0	12/28/22 08:43	JMW	EPA 6020A
Magnesium	69	mg/L		12/27/22 09:01	5	0.10	12/27/22 15:02	JMW	EPA 6020A
Mercury	< 0.20	ug/L		12/27/22 09:01	5	0.20	12/28/22 08:43	JMW	EPA 6020A
Molybdenum	3.7	ug/L		12/27/22 09:01	5	1.0	12/27/22 15:02	JMW	EPA 6020A
Potassium	2.1	mg/L		12/27/22 09:01	5	0.10	12/27/22 15:02	JMW	EPA 6020A
Selenium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 15:02	JMW	EPA 6020A
Sodium	15	mg/L		12/27/22 09:01	5	0.10	12/27/22 15:02	JMW	EPA 6020A
Thallium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/28/22 08:43	JMW	EPA 6020A
Lithium	< 0.020	mg/L		12/27/22 09:01	1	0.020	12/28/22 14:36	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: FL03537-06
Name: AW-23
Matrix: Ground Water - Grab

Sampled: 12/16/22 09:12
Received: 12/16/22 16:14

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	46	mg/L		12/27/22 20:41	5	5.0	12/27/22 20:41	LAM	EPA 300.0 REV 2.1
Fluoride	0.254	mg/L		12/27/22 20:23	1	0.250	12/27/22 20:23	LAM	EPA 300.0 REV 2.1
Sulfate	200	mg/L		12/27/22 20:59	50	50	12/27/22 20:59	LAM	EPA 300.0 REV 2.1
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	340	mg/L		12/27/22 11:10	1	10	12/27/22 11:10	HRF	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		12/27/22 11:10	1	10	12/27/22 11:10	HRF	SM 2320B 1997*
Solids - total dissolved solids (TDS)	720	mg/L		12/21/22 09:33	1	26	12/21/22 10:56	CPS	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		12/27/22 09:01	5	3.0	12/27/22 15:06	JMW	EPA 6020A
Arsenic	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 15:06	JMW	EPA 6020A
Barium	27	ug/L		12/27/22 09:01	5	1.0	12/27/22 15:06	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 15:06	JMW	EPA 6020A
Boron	480	ug/L		12/27/22 09:01	5	10	12/27/22 15:06	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 15:06	JMW	EPA 6020A
Calcium	130	mg/L		12/27/22 09:01	5	0.20	12/27/22 15:06	JMW	EPA 6020A
Chromium	< 4.0	ug/L		12/27/22 09:01	5	4.0	12/27/22 15:06	JMW	EPA 6020A
Cobalt	< 2.0	ug/L		12/27/22 09:01	5	2.0	12/27/22 15:06	JMW	EPA 6020A
Lead	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/28/22 08:46	JMW	EPA 6020A
Magnesium	46	mg/L		12/27/22 09:01	5	0.10	12/27/22 15:06	JMW	EPA 6020A
Mercury	< 0.20	ug/L		12/27/22 09:01	5	0.20	12/28/22 08:46	JMW	EPA 6020A
Molybdenum	1.7	ug/L		12/27/22 09:01	5	1.0	12/27/22 15:06	JMW	EPA 6020A
Potassium	0.61	mg/L		12/27/22 09:01	5	0.10	12/27/22 15:06	JMW	EPA 6020A
Selenium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/27/22 15:06	JMW	EPA 6020A
Sodium	52	mg/L		12/27/22 09:01	5	0.10	12/27/22 15:06	JMW	EPA 6020A
Thallium	< 1.0	ug/L		12/27/22 09:01	5	1.0	12/28/22 08:46	JMW	EPA 6020A
Lithium	< 0.020	mg/L		12/27/22 09:01	1	0.020	12/28/22 14:39	TJJ	EPA 6010B

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QC SAMPLE RESULTS

Parameter	Result	Unit	Qual	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch B252168 - No Prep - SM 2540C									
Blank (B252168-BLK1)				Prepared & Analyzed: 12/21/22					
Solids - total dissolved solids (TDS)	< 17	mg/L							
LCS (B252168-BS1)				Prepared & Analyzed: 12/21/22					
Solids - total dissolved solids (TDS)	997	mg/L		1000		100	84.9-109		
Duplicate (B252168-DUP2)	**Sample: FL03537-05**			Prepared & Analyzed: 12/21/22					
Solids - total dissolved solids (TDS)	825	mg/L			825			0	5
Batch B252441 - SW 3015 - EPA 6020A									
Blank (B252441-BLK1)				Prepared & Analyzed: 12/27/22					
Antimony	< 3.0	ug/L							
Arsenic	< 1.0	ug/L							
Barium	< 1.0	ug/L							
Beryllium	< 1.0	ug/L							
Boron	< 10	ug/L							
Cadmium	< 1.0	ug/L							
Calcium	< 0.20	mg/L							
Chromium	< 4.0	ug/L							
Cobalt	< 2.0	ug/L							
Lead	< 1.0	ug/L							
Magnesium	< 0.10	mg/L							
Mercury	< 0.20	ug/L							
Molybdenum	< 1.0	ug/L							
Potassium	< 0.10	mg/L							
Selenium	< 1.0	ug/L							
Sodium	< 0.10	mg/L							
Thallium	< 1.0	ug/L							
Lithium	< 0.020	mg/L							
LCS (B252441-BS1)				Prepared & Analyzed: 12/27/22					
Antimony	527	ug/L		555.6		95	80-120		
Arsenic	482	ug/L		555.6		87	80-120		
Barium	494	ug/L		555.6		89	80-120		
Beryllium	488	ug/L		555.6		88	80-120		
Boron	489	ug/L		555.6		88	80-120		
Cadmium	479	ug/L		555.6		86	80-120		
Calcium	5.05	mg/L		5.556		91	80-120		
Chromium	513	ug/L		555.6		92	80-120		
Cobalt	522	ug/L		555.6		94	80-120		
Lead	558	ug/L		555.6		100	80-120		
Magnesium	5.52	mg/L		5.556		99	80-120		
Mercury	62.4	ug/L		55.56		112	80-120		
Molybdenum	454	ug/L		555.6		82	80-120		
Potassium	5.30	mg/L		5.556		95	80-120		
Selenium	496	ug/L		555.6		89	80-120		

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QC SAMPLE RESULTS

Parameter	Result	Unit	Qual	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch B252441 - SW 3015 - EPA 6020A									
LCS (B252441-BS1)				Prepared & Analyzed: 12/27/22					
Sodium	5.46	mg/L		5.556		98	80-120		
Thallium	613	ug/L		555.6		110	80-120		
Lithium	0.545	mg/L		0.5556		98	80-120		
Batch B252534 - No Prep - EPA 300.0 REV 2.1									
Calibration Blank (B252534-CCB1)				Prepared & Analyzed: 12/27/22					
Chloride	0.00	mg/L							
Sulfate	0.00	mg/L							
Fluoride	0.00	mg/L							
Calibration Check (B252534-CCV1)				Prepared & Analyzed: 12/27/22					
Chloride	4.83	mg/L		5.000		97	90-110		
Sulfate	4.77	mg/L		5.000		95	90-110		
Fluoride	5.01	mg/L		5.000		100	90-110		
Matrix Spike (B252534-MS1)	**Sample: FL03537-01**			Prepared & Analyzed: 12/27/22					
Sulfate	1.00E9	mg/L	Q4	1.500	43.2	NR	80-120		
Chloride	< 1.0	mg/L	Q4	1.500	19	NR	80-120		
Fluoride	1.51	mg/L		1.500	0.155	90	80-120		
Matrix Spike (B252534-MS2)	**Sample: FL03537-02**			Prepared & Analyzed: 12/27/22					
Fluoride	1.47	mg/L		1.500	0.128	89	80-120		
Sulfate	1.00E9	mg/L	Q4	1.500	117	NR	80-120		
Chloride	< 1.0	mg/L	Q4	1.500	20	NR	80-120		
Matrix Spike Dup (B252534-MSD1)	**Sample: FL03537-01**			Prepared & Analyzed: 12/27/22					
Sulfate	1.00E9	mg/L	Q4	1.500	43.2	NR	80-120	0	20
Chloride	< 1.0	mg/L	Q4	1.500	19	NR	80-120		20
Fluoride	1.53	mg/L		1.500	0.155	92	80-120	1	20
Matrix Spike Dup (B252534-MSD2)	**Sample: FL03537-02**			Prepared & Analyzed: 12/27/22					
Fluoride	1.46	mg/L		1.500	0.128	89	80-120	0.6	20
Chloride	< 1.0	mg/L	Q4	1.500	20	NR	80-120		20
Sulfate	1.00E9	mg/L	Q4	1.500	117	NR	80-120	0	20

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(800)752-6651

NOTES

Specifications regarding method revisions, method modifications, and calculations used for analysis are available upon request. Please contact your project manager.

* Not a TNI accredited analyte

Certifications

CHI - McHenry, IL - 4314-A W. Crystal Lake Road, McHenry, IL 60050
TNI Accreditation for Drinking Water and Wastewater Fields of Testing through IL EPA Accreditation No. 100279
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory Registry No. 17556

PIA - Peoria, IL - 2231 W. Altorfer Drive, Peoria, IL 61615
TNI Accreditation for Drinking Water, Wastewater, Solid and Hazardous Material Fields of Testing through IL EPA Accreditation No. 100230
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory Registry No. 17553
Drinking Water Certifications/Accreditations: Iowa (240); Kansas (E-10338); Missouri (870)
Wastewater Certifications/Accreditations: Arkansas (88-0677); Iowa (240); Kansas (E-10338)
Solid and Hazardous Material Certifications/Accreditations: Arkansas (88-0677); Iowa (240); Kansas (E-10338)

SPMO - Springfield, MO - 1805 W Sunset Street, Springfield, MO 65807
USEPA DMR-QA Program

STL - Hazelwood, MO - 944 Anglum Rd, Hazelwood, MO 63042
TNI Accreditation for Wastewater, Solid and Hazardous Material Fields of Testing through KS KDHE Certification No. E-10389
TNI Accreditation for Wastewater, Solid and Hazardous Material Fields of Testing through IL EPA Accreditation No. - 200080
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory, Registry No. 171050
Missouri Department of Natural Resources - Certificate of Approval for Microbiological Laboratory Service - No. 1050

Qualifiers

Q4 The matrix spike recovery result is unusable since the analyte concentration in the sample is greater than four times the spike level. The associated blank spike was acceptable.

Gail J Schindler

Certified by: Gail Schindler, Project Manager

RAMBOLL COC#: 1940102792-1216-002

FL03537 JPO

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:
Company: Vistra Corp	Report To: Brian Voelker	Attention: Jason Stuckey
Address: 13498 E. 900th St	Copy To: Jason Stuckey	Company Name: Vistra Corp
		Address: see Section A
Email To: Brian.Voelker@Vistracorp.com	Purchase Order No.:	Quote Reference:
Phone: (217) 753-8911 Fax:	Project Name:	Project Manager:
Requested Due Date/TAT: standard	Project Number: 2285	Profile #:

REGULATORY AGENCY

NPDES GROUND WATER DRINKING WATER

UST RCRA OTHER

Site Location STATE: EDWARDS IL

Requested Analysis Filtered (Y/N)

ITEM #	Section D Required Client Information — SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED DATE	COLLECTED TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	EDW-845-301_R2	Residual Chlorine (Y/N)	Project No./ Lab I.D.
1	AW-01	WT	G	12/15/22	1702		2	X		X							X		
2	EMW-05			12/15/22	1538		2	X		X							X		
3	EB-01			12/15/22	1705		1			X							X		
4	EB-02			12/16/22	1325		1			X							X		
5	DUP-01			12/15/22	1702		2	X		X							X		
6																			
7																			
8																			
9																			
10					SM														
11	SM 12/16/22																		
12					12/16/22														
13																			
14																			
15																			
16																			

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
EDW-22Q4-845-301-R2 NO RADIUM 226 + RADIUM 228, TOTAL	SAMUEL MALLOW (RAMBOLL)	12/16/22	1614		12/16/22	1614	2.1

SAMPLER NAME AND SIGNATURE			Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
PRINT Name of SAMPLER:	SAMUEL MALLOW					
SIGNATURE of SAMPLER:	SMallow	DATE Signed (MM/DD/YY): 12/16/22				

RAMBOLL COC#: 1940102792-2022-1216-003

FL03537

CHAIN-OF-CUSTODY / Analytical Request Document

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Page: 1 of 1

Section A Required Client Information:

Company:	Vistra Corp
Address:	13498 E. 900th St
Email To:	Brian.Voelker@Vistracorp.com
Phone: (217) 753-8911	Fax:
Requested Due Date/TAT:	standard

Section B Required Project Information:

Report To:	Brian Voelker
Copy To:	Jason Stuckey
Purchase Order No.:	
Project Name:	
Project Number:	2285

Section C Invoice Information:

Attention:	Jason Stuckey
Company Name:	Vistra Corp
Address:	see Section A
Quote Reference:	
Project Manager:	
Profile #:	

REGULATORY AGENCY

NPDES GROUND WATER DRINKING WATER

UST RCRA OTHER

Site Location STATE: Edwards IL

Section D Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
WIPE	WP
AIR	AR
OTHER	OT
TISSUE	TS

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED DATE	COLLECTED TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	Radium 226 + Radium 228, total	Residual Chlorine (Y/N)	Project No./ Lab I.D.
1	AW-23			12/16/22	0912		3	X									X		
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			

SM 12/16/22

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
EDW-22Q4-845-301-R2	SAMUEL MALLOW	12/16/22	1614		12/16/22	1614	2.1

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: SAMUEL MALLOW

SIGNATURE of SAMPLER:

DATE Signed (MM/DD/YY): 12/16/22

Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

January 27, 2023

Brian Voelker
Vistra - Edwards
604 Pierce Boulevard
O'Fallon, IL 62269

RE: RAMBOLL DELINEATION

Dear Brian Voelker:

Please find enclosed the **revised** analytical results for the **1** sample(s) the laboratory received on **12/16/22 4:14 pm** and logged in under work order **FL03741**. All testing is performed according to our current TNI accreditations unless otherwise noted. This report cannot be reproduced, except in full, without the written permission of Pace Analytical Services, LLC.

If you have any questions regarding your report, please contact your project manager. Quality and timely data is of the utmost importance to us.

Pace Analytical Services appreciates the opportunity to provide you with analytical expertise . We are always trying to improve our customer service and we welcome you to contact the Director of Client Services, Lisa Grant, with any feedback you have about your experience with our laboratory at 309-683-1764 or lisa.grant@pacelabs.com.

Gail J Schindler

Gail Schindler
Project Manager
(309) 692-9688 x1716
gail.schindler@pacelabs.com

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

SAMPLE RECEIPT CHECK LIST

Items not applicable will be marked as in compliance

Work Order FL03741

YES	Samples received within temperature compliance when applicable
YES	COC present upon sample receipt
YES	COC completed & legible
YES	Sampler name & signature present
YES	Unique sample IDs assigned
YES	Sample collection location recorded
YES	Date & time collected recorded on COC
YES	Relinquished by client signature on COC
YES	COC & labels match
YES	Sample labels are legible
YES	Appropriate bottle(s) received
YES	Sufficient sample volume received
YES	Sample containers received undamaged
NO	Zero headspace, <6 mm present in VOA vials
NO	Trip blank(s) received
YES	All non-field analyses received within holding times
NO	Short hold time analysis
YES	Current PDC COC submitted
NO	Case narrative provided

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

ANALYTICAL RESULTS

Sample: FL03741-03
Name: AW-23
Matrix: Ground Water - Grab

Sampled: 12/16/22 09:12
Received: 12/16/22 16:14

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Miscellaneous - Pace Analytical - Mt Juliet, Tn									
Rad 226 and 228-Subcontract	0.204 U	pCi/L			1	0.745	01/09/23 17:39		904.0 903.0

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

QC SAMPLE RESULTS

Parameter	Result	Unit	Qual	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

NOTES

Specifications regarding method revisions, method modifications, and calculations used for analysis are available upon request. Please contact your project manager.

Revised Report - separated wells

* Not a TNI accredited analyte

Memos

Radium Subcontracted - report attached

Certifications

CHI - McHenry, IL - 4314-A W. Crystal Lake Road, McHenry, IL 60050
TNI Accreditation for Drinking Water and Wastewater Fields of Testing through IL EPA Accreditation No. 100279
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory Registry No. 17556

PIA - Peoria, IL - 2231 W. Altorfer Drive, Peoria, IL 61615
TNI Accreditation for Drinking Water, Wastewater, Solid and Hazardous Material Fields of Testing through IL EPA Accreditation No. 100230
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory Registry No. 17553
Drinking Water Certifications/Accreditations: Iowa (240); Kansas (E-10338); Missouri (870)
Wastewater Certifications/Accreditations: Arkansas (88-0677); Iowa (240); Kansas (E-10338)
Solid and Hazardous Material Certifications/Accreditations: Arkansas (88-0677); Iowa (240); Kansas (E-10338)

SPMO - Springfield, MO - 1805 W Sunset Street, Springfield, MO 65807
USEPA DMR-QA Program

STL - Hazelwood, MO - 944 Anglum Rd, Hazelwood, MO 63042
TNI Accreditation for Wastewater, Solid and Hazardous Material Fields of Testing through KS KDHE Certification No. E-10389
TNI Accreditation for Wastewater, Solid and Hazardous Material Fields of Testing through IL EPA Accreditation No. - 200080
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory, Registry No. 171050
Missouri Department of Natural Resources - Certificate of Approval for Microbiological Laboratory Service - No. 1050

Gail J Schindler

Certified by: Gail Schindler, Project Manager

ANALYTICAL REPORT

January 16, 2023

Revised Report

Pace IR - Peoria, IL

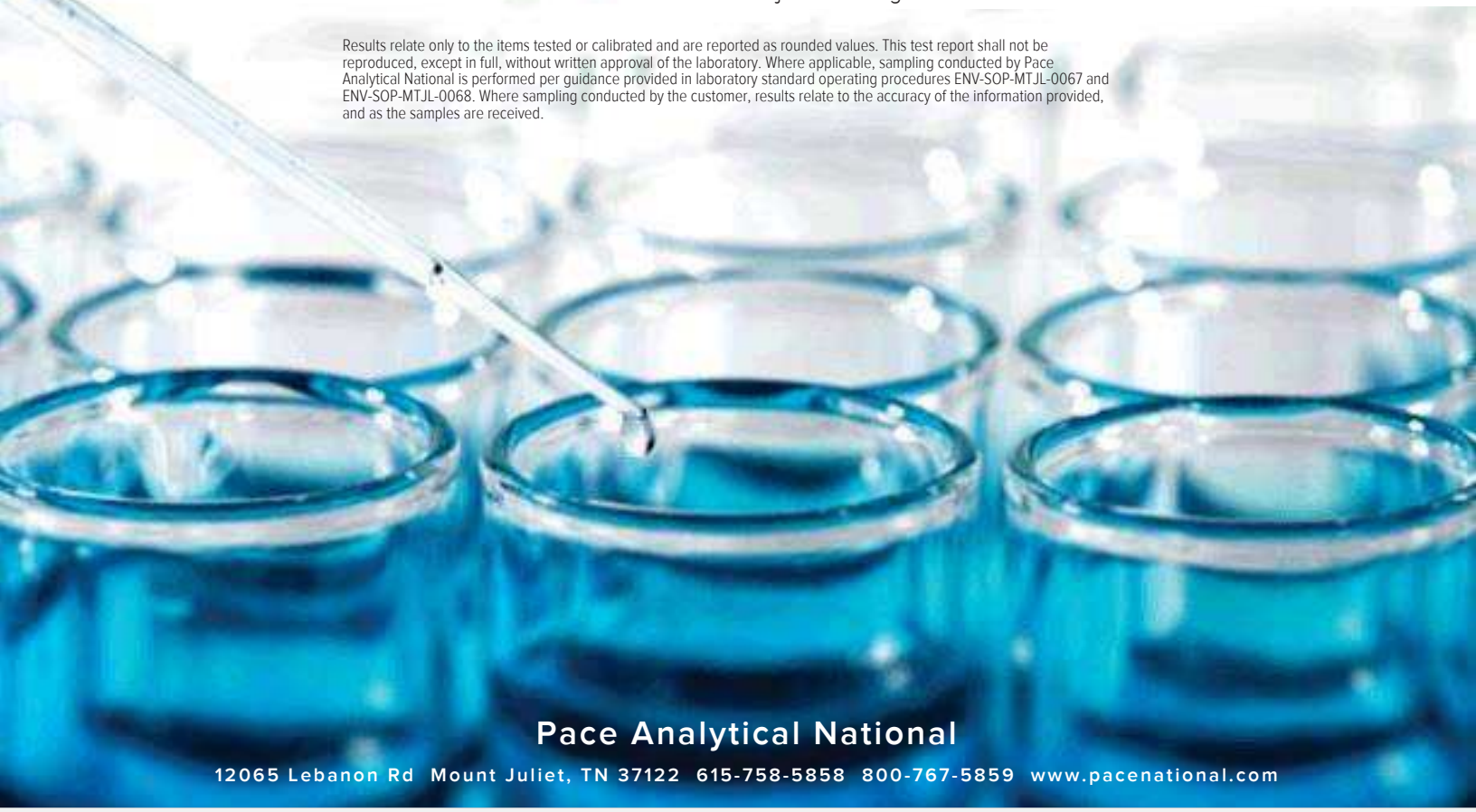
Sample Delivery Group:	L1570267
Samples Received:	12/22/2022
Project Number:	FL03741
Description:	Vistra Edwards
Site:	001
Report To:	Gail Schindler 2231 W. Altorfer Drive Peoria, IL 61615

Entire Report Reviewed By:

Haley Torrence

Haley Torrence
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National

12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

TABLE OF CONTENTS

Cp: Cover Page 1

Tc: Table of Contents 2

Ss: Sample Summary 3

Cn: Case Narrative 4

Sr: Sample Results 5

AW-01 L1570267-01 5

EMW-05 L1570267-02 6

AW-23 L1570267-03 7

Qc: Quality Control Summary 8

Radiochemistry by Method 904/9320 8

Radiochemistry by Method SM7500Ra B M 9

Gl: Glossary of Terms 10

Al: Accreditations & Locations 11

Sc: Sample Chain of Custody 12

AW-01 L1570267-01 Non-Potable Water

Collected by	Collected date/time	Received date/time
	12/15/22 17:02	12/22/22 10:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method 904/9320	WG1982293	1	01/04/23 11:53	01/09/23 15:29	SWM	Mt. Juliet, TN
Radiochemistry by Method Calculation	WG1979914	1	01/03/23 09:45	01/09/23 17:39	SWM	Mt. Juliet, TN
Radiochemistry by Method SM7500Ra B M	WG1979914	1	01/03/23 09:45	01/09/23 17:39	RGT	Mt. Juliet, TN

EMW-05 L1570267-02 Non-Potable Water

Collected by	Collected date/time	Received date/time
	12/15/22 15:38	12/22/22 10:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method 904/9320	WG1982293	1	01/04/23 11:53	01/09/23 15:29	SWM	Mt. Juliet, TN
Radiochemistry by Method Calculation	WG1979914	1	01/03/23 09:45	01/09/23 17:39	SWM	Mt. Juliet, TN
Radiochemistry by Method SM7500Ra B M	WG1979914	1	01/03/23 09:45	01/09/23 17:39	RGT	Mt. Juliet, TN

AW-23 L1570267-03 Non-Potable Water

Collected by	Collected date/time	Received date/time
	12/16/22 09:12	12/22/22 10:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method 904/9320	WG1982293	1	01/04/23 11:53	01/09/23 15:29	SWM	Mt. Juliet, TN
Radiochemistry by Method Calculation	WG1979914	1	01/03/23 09:45	01/09/23 17:39	SWM	Mt. Juliet, TN
Radiochemistry by Method SM7500Ra B M	WG1979914	1	01/03/23 09:45	01/09/23 17:39	RGT	Mt. Juliet, TN

CASE NARRATIVE

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All radiochemical sample results for solids are reported on a dry weight basis with the exception of tritium, carbon-14 and radon, unless wet weight was requested by the client. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



Haley Torrence
Project Manager

Report Revision History

Level II Report - Version 1: 01/13/23 11:41

Project Narrative

sample date correction

Radiochemistry by Method 904/9320

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
RADIUM-228	0.276		0.240	0.209	01/09/2023 15:29	WG1982293
(T) Barium	*99.2*			*30.0-143*	*01/09/2023 15:29*	WG1982293
(T) Yttrium	*102*			*30.0-136*	*01/09/2023 15:29*	WG1982293

Radiochemistry by Method Calculation

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
Combined Radium	0.288	J	0.309	0.403	01/09/2023 17:39	WG1979914

Radiochemistry by Method SM7500Ra B M

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
RADIUM-226	0.0129	U	0.195	0.345	01/09/2023 17:39	WG1979914
(T) Barium-133	*112*			*30.0-143*	*01/09/2023 17:39*	WG1979914

Radiochemistry by Method 904/9320

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
RADIUM-228	1.44		0.277	0.458	01/09/2023 15:29	WG1982293
(T) Barium	*99.0*			*30.0-143*	*01/09/2023 15:29*	WG1982293
(T) Yttrium	*98.9*			*30.0-136*	*01/09/2023 15:29*	WG1982293

Radiochemistry by Method Calculation

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
Combined Radium	1.53		0.326	0.533	01/09/2023 17:39	WG1979914

Radiochemistry by Method SM7500Ra B M

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
RADIUM-226	0.0911	U	0.171	0.272	01/09/2023 17:39	WG1979914
(T) Barium-133	*97.9*			*30.0-143*	*01/09/2023 17:39*	WG1979914

Radiochemistry by Method 904/9320

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
RADIUM-228	-0.169	U	0.370	0.684	01/09/2023 15:29	WG1982293
(T) Barium	*100*			*30.0-143*	*01/09/2023 15:29*	WG1982293
(T) Yttrium	*114*			*30.0-136*	*01/09/2023 15:29*	WG1982293

Radiochemistry by Method Calculation

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
Combined Radium	0.204	U	0.430	0.745	01/09/2023 17:39	WG1979914

Radiochemistry by Method SM7500Ra B M

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
RADIUM-226	0.204	J	0.220	0.294	01/09/2023 17:39	WG1979914
(T) Barium-133	*106*			*30.0-143*	*01/09/2023 17:39*	WG1979914

QUALITY CONTROL SUMMARY

L1570267-01,02,03

Method Blank (MB)

(MB) R3880551-1 01/09/23 15:29

Analyte	MB Result pCi/l	MB Qualifier	MB Uncertainty + / - pCi/l	MB MDA pCi/l
Radium-228	0.0610	J	0.223	0.197
(T) Barium	*103*		*103*	
(T) Yttrium	*94.9*		*94.9*	

L1570267-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1570267-03 01/09/23 15:29 • (DUP) R3880551-4 01/09/23 15:29

Analyte	Original Result pCi/l	Original Uncertainty + / -	Original MDA pCi/l	DUP Result pCi/l	DUP Uncertainty + / -	DUP MDA pCi/l	Dilution	DUP RPD %	DUP RER	DUP Qualifier	DUP RPD Limits %	DUP RER Limit
Radium-228	-0.169	0.370	0.684	0.635	0.336	0.684	1	200	1.61		20	3
(T) Barium	*100*			*102*	*102*							
(T) Yttrium	*114*			*94.9*	*94.9*							

Laboratory Control Sample (LCS)

(LCS) R3880551-5 01/11/23 10:18

Analyte	Spike Amount pCi/l	LCS Result pCi/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Radium-228	5.00	5.45	109	80.0-120	
(T) Barium			*89.7*		
(T) Yttrium			*94.9*		

L1570838-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1570838-01 01/09/23 15:29 • (MS) R3880551-2 01/09/23 15:29 • (MSD) R3880551-3 01/09/23 15:29

Analyte	Spike Amount pCi/l	Original Result pCi/l	MS Result pCi/l	MSD Result pCi/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	MS RER	RPD Limits %
Radium-228	10.0	0.985	10.3	9.63	93.1	86.5	1	70.0-130			6.62		20
(T) Barium		*122*			*102*	*108*							
(T) Yttrium		*113*			*116*	*105*							

Method Blank (MB)

(MB) R3880192-1 01/09/23 17:39

Analyte	MB Result pCi/l	MB Qualifier	MB Uncertainty + / -	MB MDA pCi/l
Radium-226	0.0103	U	0.0439	0.0776
(T) Barium-133	*93.5*		*93.5*	

L1569403-05 Original Sample (OS) • Duplicate (DUP)

(OS) L1569403-05 01/09/23 17:39 • (DUP) R3880192-5 01/09/23 17:39

Analyte	Original Result pCi/l	Original Uncertainty + / -	Original MDA pCi/l	DUP Result pCi/l	DUP Uncertainty + / -	DUP MDA pCi/l	Dilution	DUP RPD %	DUP RER	DUP Qualifier	DUP RPD Limits %	DUP RER Limit
Radium-226	0.204	0.205	0.266	0.0139	0.129	0.266	1	175	0.787	U	20	3
(T) Barium-133	*103*			*95.7*	*95.7*							

Laboratory Control Sample (LCS)

(LCS) R3880192-2 01/09/23 17:39

Analyte	Spike Amount pCi/l	LCS Result pCi/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Radium-226	5.02	5.53	110	80.0-120	
(T) Barium-133			*96.1*		

L1570267-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1570267-03 01/09/23 17:39 • (MS) R3880192-3 01/09/23 17:39 • (MSD) R3880192-4 01/09/23 17:39

Analyte	Spike Amount pCi/l	Original Result pCi/l	MS Result pCi/l	MSD Result pCi/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	MS RER	RPD Limits %
Radium-226	20.0	0.204	23.9	19.7	118	97.3	1	75.0-125			19.3		20
(T) Barium-133		*106*			*91.9*	*90.4*							

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDA	Minimum Detectable Activity.
Rec.	Recovery.
RER	Replicate Error Ratio.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(T)	Tracer - A radioisotope of known concentration added to a solution of chemically equivalent radioisotopes at a known concentration to assist in monitoring the yield of the chemical separation.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
J	The identification of the analyte is acceptable; the reported value is an estimate.
U	Below Detectable Limits: Indicates that the analyte was not detected.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

A187

Internal Transfer Chain of Custody

State of Origin: IL
Cert. Needed: [X] YES [ ] NO

Pace Analytical®
www.pacelabs.com

Workorder: FL03741 | Workorder Name: VISTRA EDWARDS | Owner Received Date: 12/20/2022 | Results Requ By: 1/18/2023

Report To:	Subcontract To:
Christina Pierce Pace Analytical - IL/MO 2231 W. Altorfer Drive Peoria, IL 61615 800-752-6651	Pace Analytical Services, LLC 12065 Lebanon Rd Mt Juliet, TN (615)758-5858

Requested Analysis

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers	Radium 226/228 +2	LAB USE ONLY L1570267
1	AW-01	GRAB	12/15/2022 17:02	FL03741-01	GW		X	-01
2	EMW-05	GRAB	12/15/2022 15:38	FL03741-02	GW		X	-02
3	AW-23	GRAB	12/15/2022 9:12	FL03741-03	GW		X	-03
4								
5								
6								
7								
8								
9								
10								

Transfers	Released By	Date/Time	Reveived By	Date/Time	Comments
1	[signature]	12-20-22 15:20	[signature]	12/22/22 1900	Needs reported as 226, 228 and also combined 226/228
2					Include QC summary
3					

Cooler Temperature on Receipt _____ °C	Custody Seal Y or N	Received on Ice Y or N	Sample Intact Y or N

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC document.
This chain of custody is considered complete as is since this information is available in the owner laboratory.

Sample Receipt Checklist

COC Seal Present/Intact: Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
RAD Screen <0.5 mR/hr: Y N

If Applicable
VOA Zero Headspace: Y N
Pres.Correct/Check: Y N

9.8 TO 2 9.5 GBAL

L1570267

Pace Analytical
www.pacelabs.com

Ship to :
Pace Analytical Services, LLC
12065 Lebanon Rd
Mt Juliet, TN 37122

(615)758-5858

INTER_LABORATORY WORK ORDER # FL03741

(To be complete by sending lab)

Sending Project No:	FL03741
Receiving Project No:	
Check Box for Consolidated Invoice:	
Date Prepared:	12/20/2022
REQUESTED COMPLETION DATE:	1/18/2023

Sending Region	IR72-IL/MO	Sending Project Mgr.	Gail Schindler
Receiving Region	IR80-NATIONAL	External Client	VISTRA - EDWARDS
State of Sample Origin	IL	QC Deliverable	**STD Report**

All questions should be addressed to sending project manager.

Requested Reportable Units _____ Report Wet or Dry Weight? NA Cert Needed: IL

WORK REQUESTED						
Method Description	**Container Type**	**Quantity of**	**Preservative**	**Quantity of**	**Unit Price**	**Amount**
Radium 226/228		1		3	$170.00	$510.00
						$0.00
						$0.00
					TOTAL	$510.00

Special Requirements: Report as 226, 228 & combined 226/228. Include QC summary

Receiving Region Department	Acctg. Code	Totals from above	Revenue Allocation	
			Receiving Region (80%)	Client Services Dept.
radiological	38	$510.00	$408.00	$102.00
* Custom Revenue Allocation		TOTAL	$408.00	$102.00

FOR ANALYTICAL WORK COMPLETED THIS SECTION ALSO

Return Samples to Sending Region: [ ] Yes [X] No

CONFIRMATION OF WORK COMPLETED

Date Completed: _____ Receiving Project Manager: _____

Original sent to the receiving lab - Copy kept at the sending lab.

When work completed: Original sent to the ABM at the receiving laboratory. Copies are made to corporate as needed.

RAMBOLL COC#: 1940102792-2022-1216-003

FL03537

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: 1 of 1

Section A Required Client Information:

Company:	Vistra Corp
Address:	13498 E. 900th St
Email To:	Brian.Voelker@VistraCorp.com
Phone: (217) 753-8911	Fax:
Requested Due Date/TAT:	standard

Section B Required Project Information:

Report To:	Brian Voelker
Copy To:	Jason Stuckey
Purchase Order No.:	
Project Name:	
Project Number:	2285

Section C Invoice Information:

Attention:	Jason Stuckey
Company Name:	Vistra Corp
Address:	see Section A
Quote Reference:	
Project Manager:	
Profile #:	

REGULATORY AGENCY

NPDES GROUND WATER DRINKING WATER

UST RCRA OTHER

Site Location STATE: Edwards IL

Section D Required Client Information

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
WIPE	WP
AIR	AR
OTHER	OT
TISSUE	TS

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED DATE	COLLECTED TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	Radium 226 + Radium 228, total	Residual Chlorine (Y/N)	Project No./ Lab I.D.
1	AW-23			12/16/22	0912		3	X									X		
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			

SM 12/16/22

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
EDW-22Q4-845-301-R2	SAMUEL MALLOW	12/16/22	1614		12/16/22	1614	2.1

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: SAMUEL MALLOW

SIGNATURE of SAMPLER:

DATE Signed (MM/DD/YY): 12/16/22

Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

January 27, 2023

Brian Voelker
Vistra - Edwards
604 Pierce Boulevard
O'Fallon, IL 62269

RE: RAMBOLL DELINEATION

Dear Brian Voelker:

Please find enclosed the **revised** analytical results for the **3** sample(s) the laboratory received on **12/16/22 4:14 pm** and logged in under work order **FL03741**. All testing is performed according to our current TNI accreditations unless otherwise noted. This report cannot be reproduced, except in full, without the written permission of Pace Analytical Services, LLC.

If you have any questions regarding your report, please contact your project manager. Quality and timely data is of the utmost importance to us.

Pace Analytical Services appreciates the opportunity to provide you with analytical expertise . We are always trying to improve our customer service and we welcome you to contact the Director of Client Services, Lisa Grant, with any feedback you have about your experience with our laboratory at 309-683-1764 or lisa.grant@pacelabs.com.

Gail J Schindler

Gail Schindler
Project Manager
(309) 692-9688 x1716
gail.schindler@pacelabs.com

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

SAMPLE RECEIPT CHECK LIST

Items not applicable will be marked as in compliance

Work Order FL03741

YES	Samples received within temperature compliance when applicable
YES	COC present upon sample receipt
YES	COC completed & legible
YES	Sampler name & signature present
YES	Unique sample IDs assigned
YES	Sample collection location recorded
YES	Date & time collected recorded on COC
YES	Relinquished by client signature on COC
YES	COC & labels match
YES	Sample labels are legible
YES	Appropriate bottle(s) received
YES	Sufficient sample volume received
YES	Sample containers received undamaged
NO	Zero headspace, <6 mm present in VOA vials
NO	Trip blank(s) received
YES	All non-field analyses received within holding times
NO	Short hold time analysis
YES	Current PDC COC submitted
NO	Case narrative provided

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

ANALYTICAL RESULTS

Sample: FL03741-01
Name: AW-01
Matrix: Ground Water - Grab

Sampled: 12/15/22 17:02
Received: 12/16/22 16:14

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Miscellaneous - Pace Analytical - Mt Juliet, Tn									
Rad 226 and 228-Subcontract	0.288 J	pCi/L			1	0.403	01/09/23 17:39		904.0 903.0

Sample: FL03741-02
Name: EMW-05
Matrix: Ground Water - Grab

Sampled: 12/15/22 15:38
Received: 12/16/22 16:14

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Miscellaneous - Pace Analytical - Mt Juliet, Tn									
Rad 226 and 228-Subcontract	1.53	pCi/L			1	0.533	01/09/23 17:39		904.0 903.0

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

NOTES

Specifications regarding method revisions, method modifications, and calculations used for analysis are available upon request. Please contact your project manager.

Revised Report - separated wells

* Not a TNI accredited analyte

Memos

Radium Subcontracted - report attached

Certifications

CHI - McHenry, IL - 4314-A W. Crystal Lake Road, McHenry, IL 60050
TNI Accreditation for Drinking Water and Wastewater Fields of Testing through IL EPA Accreditation No. 100279
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory Registry No. 17556

PIA - Peoria, IL - 2231 W. Altorfer Drive, Peoria, IL 61615
TNI Accreditation for Drinking Water, Wastewater, Solid and Hazardous Material Fields of Testing through IL EPA Accreditation No. 100230
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory Registry No. 17553
Drinking Water Certifications/Accreditations: Iowa (240); Kansas (E-10338); Missouri (870)
Wastewater Certifications/Accreditations: Arkansas (88-0677); Iowa (240); Kansas (E-10338)
Solid and Hazardous Material Certifications/Accreditations: Arkansas (88-0677); Iowa (240); Kansas (E-10338)

SPMO - Springfield, MO - 1805 W Sunset Street, Springfield, MO 65807
USEPA DMR-QA Program

STL - Hazelwood, MO - 944 Anglum Rd, Hazelwood, MO 63042
TNI Accreditation for Wastewater, Solid and Hazardous Material Fields of Testing through KS KDHE Certification No. E-10389
TNI Accreditation for Wastewater, Solid and Hazardous Material Fields of Testing through IL EPA Accreditation No. - 200080
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory, Registry No. 171050
Missouri Department of Natural Resources - Certificate of Approval for Microbiological Laboratory Service - No. 1050

Gail J Schindler

Certified by: Gail Schindler, Project Manager

ANALYTICAL REPORT

January 16, 2023

Revised Report

Pace IR - Peoria, IL

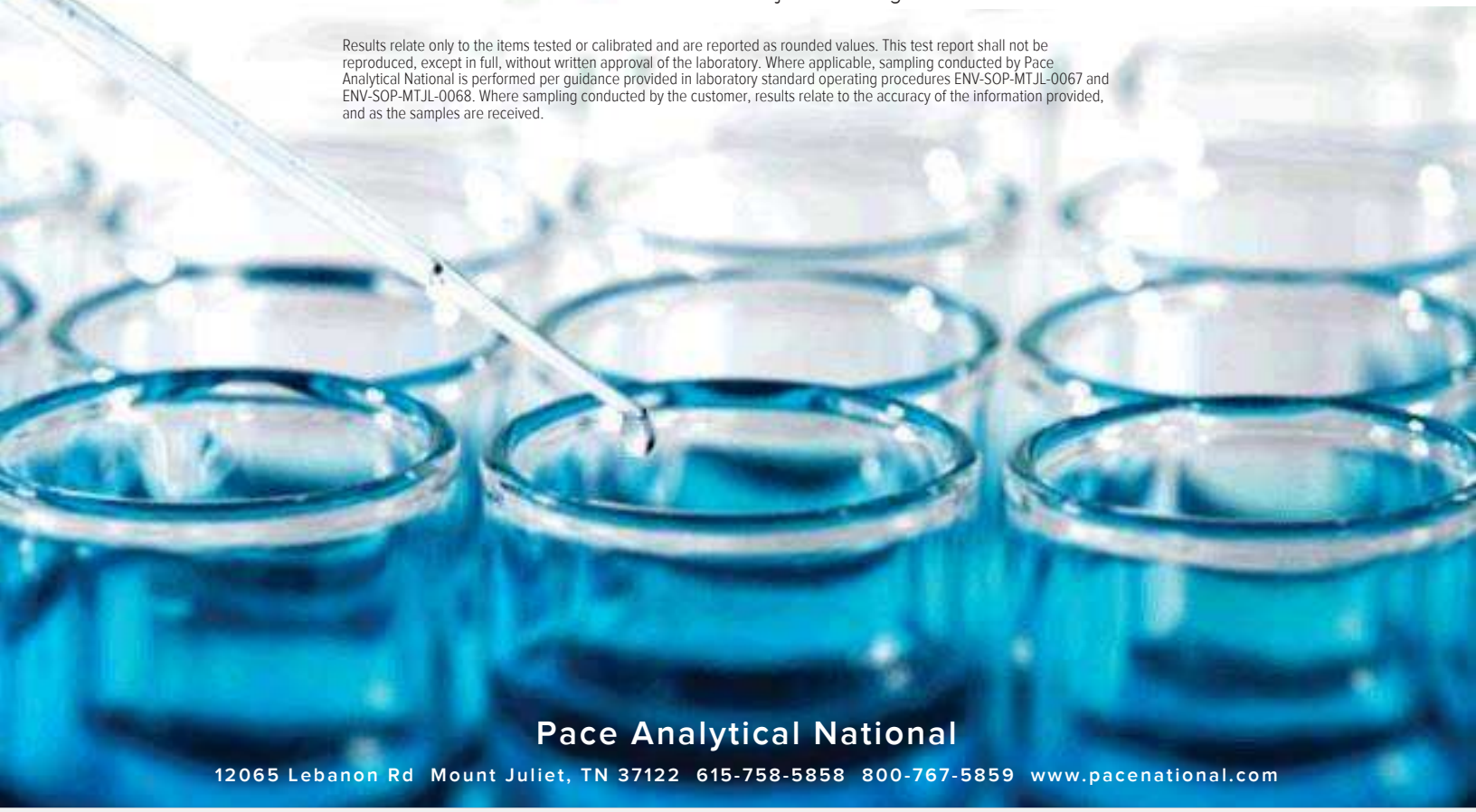
Sample Delivery Group:	L1570267
Samples Received:	12/22/2022
Project Number:	FL03741
Description:	Vistra Edwards
Site:	001
Report To:	Gail Schindler 2231 W. Altorfer Drive Peoria, IL 61615

Entire Report Reviewed By:

Haley Torrence

Haley Torrence
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.



Pace Analytical National

12065 Lebanon Rd Mount Juliet, TN 37122 615-758-5858 800-767-5859 www.pacenational.com

TABLE OF CONTENTS

Cp: Cover Page 1

Tc: Table of Contents 2

Ss: Sample Summary 3

Cn: Case Narrative 4

Sr: Sample Results 5

AW-01 L1570267-01 5

EMW-05 L1570267-02 6

AW-23 L1570267-03 7

Qc: Quality Control Summary 8

Radiochemistry by Method 904/9320 8

Radiochemistry by Method SM7500Ra B M 9

Gl: Glossary of Terms 10

Al: Accreditations & Locations 11

Sc: Sample Chain of Custody 12

AW-01 L1570267-01 Non-Potable Water

Collected by	Collected date/time	Received date/time
	12/15/22 17:02	12/22/22 10:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method 904/9320	WG1982293	1	01/04/23 11:53	01/09/23 15:29	SWM	Mt. Juliet, TN
Radiochemistry by Method Calculation	WG1979914	1	01/03/23 09:45	01/09/23 17:39	SWM	Mt. Juliet, TN
Radiochemistry by Method SM7500Ra B M	WG1979914	1	01/03/23 09:45	01/09/23 17:39	RGT	Mt. Juliet, TN

EMW-05 L1570267-02 Non-Potable Water

Collected by	Collected date/time	Received date/time
	12/15/22 15:38	12/22/22 10:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method 904/9320	WG1982293	1	01/04/23 11:53	01/09/23 15:29	SWM	Mt. Juliet, TN
Radiochemistry by Method Calculation	WG1979914	1	01/03/23 09:45	01/09/23 17:39	SWM	Mt. Juliet, TN
Radiochemistry by Method SM7500Ra B M	WG1979914	1	01/03/23 09:45	01/09/23 17:39	RGT	Mt. Juliet, TN

AW-23 L1570267-03 Non-Potable Water

Collected by	Collected date/time	Received date/time
	12/16/22 09:12	12/22/22 10:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Radiochemistry by Method 904/9320	WG1982293	1	01/04/23 11:53	01/09/23 15:29	SWM	Mt. Juliet, TN
Radiochemistry by Method Calculation	WG1979914	1	01/03/23 09:45	01/09/23 17:39	SWM	Mt. Juliet, TN
Radiochemistry by Method SM7500Ra B M	WG1979914	1	01/03/23 09:45	01/09/23 17:39	RGT	Mt. Juliet, TN

CASE NARRATIVE

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All radiochemical sample results for solids are reported on a dry weight basis with the exception of tritium, carbon-14 and radon, unless wet weight was requested by the client. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.



Haley Torrence
Project Manager

Report Revision History

Level II Report - Version 1: 01/13/23 11:41

Project Narrative

sample date correction

Radiochemistry by Method 904/9320

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
RADIUM-228	0.276		0.240	0.209	01/09/2023 15:29	WG1982293
(T) Barium	*99.2*			*30.0-143*	*01/09/2023 15:29*	WG1982293
(T) Yttrium	*102*			*30.0-136*	*01/09/2023 15:29*	WG1982293

Radiochemistry by Method Calculation

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
Combined Radium	0.288	J	0.309	0.403	01/09/2023 17:39	WG1979914

Radiochemistry by Method SM7500Ra B M

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
RADIUM-226	0.0129	U	0.195	0.345	01/09/2023 17:39	WG1979914
(T) Barium-133	*112*			*30.0-143*	*01/09/2023 17:39*	WG1979914

Radiochemistry by Method 904/9320

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
RADIUM-228	1.44		0.277	0.458	01/09/2023 15:29	WG1982293
(T) Barium	*99.0*			*30.0-143*	*01/09/2023 15:29*	WG1982293
(T) Yttrium	*98.9*			*30.0-136*	*01/09/2023 15:29*	WG1982293

Radiochemistry by Method Calculation

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
Combined Radium	1.53		0.326	0.533	01/09/2023 17:39	WG1979914

Radiochemistry by Method SM7500Ra B M

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
RADIUM-226	0.0911	U	0.171	0.272	01/09/2023 17:39	WG1979914
(T) Barium-133	*97.9*			*30.0-143*	*01/09/2023 17:39*	WG1979914

Radiochemistry by Method 904/9320

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
RADIUM-228	-0.169	U	0.370	0.684	01/09/2023 15:29	WG1982293
(T) Barium	*100*			*30.0-143*	*01/09/2023 15:29*	WG1982293
(T) Yttrium	*114*			*30.0-136*	*01/09/2023 15:29*	WG1982293

Radiochemistry by Method Calculation

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
Combined Radium	0.204	U	0.430	0.745	01/09/2023 17:39	WG1979914

Radiochemistry by Method SM7500Ra B M

Analyte	Result pCi/l	Qualifier	Uncertainty + / -	MDA pCi/l	Analysis Date date / time	Batch
RADIUM-226	0.204	J	0.220	0.294	01/09/2023 17:39	WG1979914
(T) Barium-133	*106*			*30.0-143*	*01/09/2023 17:39*	WG1979914

QUALITY CONTROL SUMMARY

L1570267-01,02,03

Method Blank (MB)

(MB) R3880551-1 01/09/23 15:29

Analyte	MB Result pCi/l	MB Qualifier	MB Uncertainty + / - pCi/l	MB MDA pCi/l
Radium-228	0.0610	J	0.223	0.197
(T) Barium	*103*		*103*	
(T) Yttrium	*94.9*		*94.9*	

L1570267-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1570267-03 01/09/23 15:29 • (DUP) R3880551-4 01/09/23 15:29

Analyte	Original Result pCi/l	Original Uncertainty + / -	Original MDA pCi/l	DUP Result pCi/l	DUP Uncertainty + / -	DUP MDA pCi/l	Dilution	DUP RPD %	DUP RER	DUP Qualifier	DUP RPD Limits %	DUP RER Limit
Radium-228	-0.169	0.370	0.684	0.635	0.336	0.684	1	200	1.61		20	3
(T) Barium	*100*			*102*	*102*							
(T) Yttrium	*114*			*94.9*	*94.9*							

Laboratory Control Sample (LCS)

(LCS) R3880551-5 01/11/23 10:18

Analyte	Spike Amount pCi/l	LCS Result pCi/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Radium-228	5.00	5.45	109	80.0-120	
(T) Barium			*89.7*		
(T) Yttrium			*94.9*		

L1570838-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1570838-01 01/09/23 15:29 • (MS) R3880551-2 01/09/23 15:29 • (MSD) R3880551-3 01/09/23 15:29

Analyte	Spike Amount pCi/l	Original Result pCi/l	MS Result pCi/l	MSD Result pCi/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	MS RER	RPD Limits %
Radium-228	10.0	0.985	10.3	9.63	93.1	86.5	1	70.0-130			6.62		20
(T) Barium		*122*			*102*	*108*							
(T) Yttrium		*113*			*116*	*105*							

Method Blank (MB)

(MB) R3880192-1 01/09/23 17:39

Analyte	MB Result pCi/l	MB Qualifier	MB Uncertainty + / -	MB MDA pCi/l
Radium-226	0.0103	U	0.0439	0.0776
(T) Barium-133	*93.5*		*93.5*	

L1569403-05 Original Sample (OS) • Duplicate (DUP)

(OS) L1569403-05 01/09/23 17:39 • (DUP) R3880192-5 01/09/23 17:39

Analyte	Original Result pCi/l	Original Uncertainty + / -	Original MDA pCi/l	DUP Result pCi/l	DUP Uncertainty + / -	DUP MDA pCi/l	Dilution	DUP RPD %	DUP RER	DUP Qualifier	DUP RPD Limits %	DUP RER Limit
Radium-226	0.204	0.205	0.266	0.0139	0.129	0.266	1	175	0.787	U	20	3
(T) Barium-133	*103*			*95.7*	*95.7*							

Laboratory Control Sample (LCS)

(LCS) R3880192-2 01/09/23 17:39

Analyte	Spike Amount pCi/l	LCS Result pCi/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Radium-226	5.02	5.53	110	80.0-120	
(T) Barium-133			*96.1*		

L1570267-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1570267-03 01/09/23 17:39 • (MS) R3880192-3 01/09/23 17:39 • (MSD) R3880192-4 01/09/23 17:39

Analyte	Spike Amount pCi/l	Original Result pCi/l	MS Result pCi/l	MSD Result pCi/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	MS RER	RPD Limits %
Radium-226	20.0	0.204	23.9	19.7	118	97.3	1	75.0-125			19.3		20
(T) Barium-133		*106*			*91.9*	*90.4*							

GLOSSARY OF TERMS

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDA	Minimum Detectable Activity.
Rec.	Recovery.
RER	Replicate Error Ratio.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
(T)	Tracer - A radioisotope of known concentration added to a solution of chemically equivalent radioisotopes at a known concentration to assist in monitoring the yield of the chemical separation.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
J	The identification of the analyte is acceptable; the reported value is an estimate.
U	Below Detectable Limits: Indicates that the analyte was not detected.

ACCREDITATIONS & LOCATIONS

Pace Analytical National 12065 Lebanon Rd Mount Juliet, TN 37122

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO000356
Kentucky [1 6]	KY90010	South Carolina	84004002
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana	LA018	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN000032021-11
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	110033
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA
A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.

* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace Analytical.

A187

Internal Transfer Chain of Custody

State of Origin: IL
Cert. Needed: [X] YES [ ] NO

Pace Analytical®
www.pacelabs.com

Workorder: FL03741 | Workorder Name: VISTRA EDWARDS | Owner Received Date: 12/20/2022 | Results Requ By: 1/18/2023

Report To:	Subcontract To:
Christina Pierce Pace Analytical - IL/MO 2231 W. Altorfer Drive Peoria, IL 61615 800-752-6651	Pace Analytical Services, LLC 12065 Lebanon Rd Mt Juliet, TN (615)758-5858

Requested Analysis

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers	Radium 226/228 ≤2	LAB USE ONLY L1570267
1	AW-01	GRAB	12/15/2022 17:02	FL03741-01	GW		X	-01
2	EMW-05	GRAB	12/15/2022 15:38	FL03741-02	GW		X	-02
3	AW-23	GRAB	12/15/2022 9:12	FL03741-03	GW		X	-03
4								
5								
6								
7								
8								
9								
10								

Transfers	Released By	Date/Time	Reveived By	Date/Time	Comments
1	[signature]	12-20-22 15:20	[signature]	12/22/22 1900	Needs reported as 226, 228 and also combined 226/228
2					Include QC summary
3					

Cooler Temperature on Receipt ____ °C	Custody Seal Y or N	Received on Ice Y or N	Sample Intact Y or N

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC document.
This chain of custody is considered complete as is since this information is available in the owner laboratory.

Sample Receipt Checklist

COC Seal Present/Intact: Y N
COC Signed/Accurate: Y N
Bottles arrive intact: Y N
Correct bottles used: Y N
Sufficient volume sent: Y N
RAD Screen <0.5 mR/hr: Y N

If Applicable
VOA Zero Headspace: Y N
Pres.Correct/Check: Y N

9.8 TO 29.8 GBAL

L1570267

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Ship to :
Pace Analytical Services, LLC
12065 Lebanon Rd
Mt Juliet, TN 37122

(615)758-5858

INTER_LABORATORY WORK ORDER # FL03741
(To be complete by sending lab)

Sending Project No:	FL03741
Receiving Project No:	
Check Box for Consolidated Invoice:	
Date Prepared:	12/20/2022
REQUESTED COMPLETION DATE:	1/18/2023

Sending Region	IR72-IL/MO	Sending Project Mgr.	Gail Schindler
Receiving Region	IR80-NATIONAL	External Client	VISTRA - EDWARDS
State of Sample Origin	IL	QC Deliverable	**STD Report**

All questions should be addressed to sending project manager.

Requested Reportable Units _____ Report Wet or Dry Weight? NA Cert Needed: IL

WORK REQUESTED						
Method Description	**Container Type**	**Quantity of**	**Preservative**	**Quantity of**	**Unit Price**	**Amount**
Radium 226/228		1		3	$170.00	$510.00
						$0.00
						$0.00
					TOTAL	$510.00

Special Requirements: Report as 226, 228 & combined 226/228. Include QC summary

Receiving Region Department	Acctg. Code	Totals from above	Revenue Allocation	
			Receiving Region (80%)	Client Services Dept.
radiological	38	$510.00	$408.00	$102.00
* Custom Revenue Allocation		TOTAL	$408.00	$102.00

FOR ANALYTICAL WORK COMPLETED THIS SECTION ALSO

Return Samples to Sending Region: [ ] Yes [X] No

CONFIRMATION OF WORK COMPLETED

Date Completed: _____ Receiving Project Manager: _____

Original sent to the receiving lab - Copy kept at the sending lab.
When work completed: Original sent to the ABM at the receiving laboratory. Copies are made to corporate as needed.

RAMBOLL COC#: 1940102792-1216-002

FL03537 JPO

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:
Company: Vistra Corp	Report To: Brian Voelker	Attention: Jason Stuckey
Address: 13498 E. 900th St	Copy To: Jason Stuckey	Company Name: Vistra Corp
		Address: see Section A
Email To: Brian.Voelker@Vistracorp.com	Purchase Order No.:	Quote Reference:
Phone: (217) 753-8911 Fax:	Project Name:	Project Manager:
Requested Due Date/TAT: standard	Project Number: 2285	Profile #:

REGULATORY AGENCY

NPDES GROUND WATER DRINKING WATER

UST RCRA OTHER

Site Location STATE: EDWARDS IL

Requested Analysis Filtered (Y/N)

ITEM #	Section D Required Client Information — SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED DATE	COLLECTED TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	EDW-845-301_R2	Residual Chlorine (Y/N)	Project No./ Lab I.D.
1	AW-01	WT	G	12/15/22	1702		2	X		X							X		
2	EMW-05			12/15/22	1538		2	X		X							X		
3	EB-01			12/15/22	1705		1			X							X		
4	EB-02			12/16/22	1325		1			X							X		
5	DUP-01			12/15/22	1702		2	X		X							X		
6																			
7																			
8																			
9																			
10					SM														
11	SM 12/16/22																		
12					12/16/22														
13																			
14																			
15																			
16																			

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
EDW-22Q4-845-301-R2 NO RADIUM 226 + RADIUM 228, TOTAL	SAMUEL MALLOW (RAMBOLL)	12/16/22	1614		12/16/22	1614	2.1

SAMPLER NAME AND SIGNATURE			Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
PRINT Name of SAMPLER:	SAMUEL MALLOW					
SIGNATURE of SAMPLER:	SMallow	DATE Signed (MM/DD/YY): 12/16/22				

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

February 03, 2023

Brian Voelker
Vistra - Edwards
604 Pierce Boulevard
O'Fallon, IL 62269

RE: RAMBOLL DELINEATION

Dear Brian Voelker:

Please find enclosed the analytical results for the **1** sample(s) the laboratory received on **1/10/23 4:00 pm** and logged in under work order **GA02461**. All testing is performed according to our current TNI accreditations unless otherwise noted. This report cannot be reproduced, except in full, without the written permission of Pace Analytical Services, LLC.

If you have any questions regarding your report, please contact your project manager. Quality and timely data is of the utmost importance to us.

Pace Analytical Services appreciates the opportunity to provide you with analytical expertise . We are always trying to improve our customer service and we welcome you to contact the General Manager, Lisa Grant, with any feedback you have about your experience with our laboratory at 309-683-1764 or lisa.grant@pacelabs.com.

Gail J Schindler

Gail Schindler
Project Manager
(309) 692-9688 x1716
gail.schindler@pacelabs.com

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

SAMPLE RECEIPT CHECK LIST

Items not applicable will be marked as in compliance

Work Order GA02461

YES	Samples received within temperature compliance when applicable
YES	COC present upon sample receipt
YES	COC completed & legible
YES	Sampler name & signature present
YES	Unique sample IDs assigned
YES	Sample collection location recorded
YES	Date & time collected recorded on COC
YES	Relinquished by client signature on COC
YES	COC & labels match
YES	Sample labels are legible
YES	Appropriate bottle(s) received
YES	Sufficient sample volume received
YES	Sample containers received undamaged
NO	Zero headspace, <6 mm present in VOA vials
NO	Trip blank(s) received
YES	All non-field analyses received within holding times
NO	Short hold time analysis
YES	Current PDC COC submitted
NO	Case narrative provided

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

ANALYTICAL RESULTS

Sample: GA02461-01
Name: AW-23
Matrix: Ground Water - Grab

Sampled: 01/10/23 09:36
Received: 01/10/23 16:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Miscellaneous - Pace Analytical - Mt Juliet, Tn									
Rad 226 - Subcontract	0.0563	pCi/L			1	0.738	02/02/22 16:14		904.0 903.0
Rad 226 and 228-Subcontract	0.666	pCi/L			1	1.43	02/03/22 11:55		904.0 903.0
Rad 228- Subcontract	0.61	pCi/L			1	0.691	01/30/22 14:50		904.0 903.0

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

NOTES

Specifications regarding method revisions, method modifications, and calculations used for analysis are available upon request. Please contact your project manager.

* Not a TNI accredited analyte

Certifications

CHI - McHenry, IL - 4314-A W. Crystal Lake Road, McHenry, IL 60050
TNI Accreditation for Drinking Water and Wastewater Fields of Testing through IL EPA Accreditation No. 100279
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory Registry No. 17556

PIA - Peoria, IL - 2231 W. Altorfer Drive, Peoria, IL 61615
TNI Accreditation for Drinking Water, Wastewater, Solid and Hazardous Material Fields of Testing through IL EPA Accreditation No. 100230
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory Registry No. 17553
Drinking Water Certifications/Accreditations: Iowa (240); Kansas (E-10338); Missouri (870)
Wastewater Certifications/Accreditations: Arkansas (88-0677); Iowa (240); Kansas (E-10338)
Solid and Hazardous Material Certifications/Accreditations: Arkansas (88-0677); Iowa (240); Kansas (E-10338)

SPMO - Springfield, MO - 1805 W Sunset Street, Springfield, MO 65807
USEPA DMR-QA Program

STL - Hazelwood, MO - 944 Anglum Rd, Hazelwood, MO 63042
TNI Accreditation for Wastewater, Solid and Hazardous Material Fields of Testing through KS KDHE Certification No. E-10389
TNI Accreditation for Wastewater, Solid and Hazardous Material Fields of Testing through IL EPA Accreditation No. - 200080
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory, Registry No. 171050
Missouri Department of Natural Resources - Certificate of Approval for Microbiological Laboratory Service - No. 1050

Gail J Schindler

Certified by: Gail Schindler, Project Manager

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

February 03, 2023

Gail J. Schindler
PDC Laboratories
2231 W. Altorfer Drive
Peoria, IL 61615

RE: Project: GA02461
Pace Project No.: 30555850

Dear Gail Schindler:

Enclosed are the analytical results for sample(s) received by the laboratory on January 19, 2023. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:

- Pace Analytical Services - Greensburg

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Carla Cmar
carla.cmar@pacelabs.com
(724)850-5600
Project Manager

Enclosures

cc: Chenise Lambert-Sykes, PDC Laboratories, Inc.

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Greensburg, PA 15601
(724)850-5600

CERTIFICATIONS

Project: GA02461
Pace Project No.: 30555850

Pace Analytical Services Pennsylvania
1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
ANAB DOD-ELAP Rad Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification #: PA01547
Connecticut Certification #: PH-0694
Delaware Certification
EPA Region 4 DW Rad
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Florida: Cert E871149 SEKS WET
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: KY90133
KY WW Permit #: KY0098221
KY WW Permit #: KY0000221
Louisiana DHH/TNI Certification #: LA180012
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: 2017020
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification #: 9991
Missouri Certification #: 235
Montana Certification #: Cert0082
Nebraska Certification #: NE-OS-29-14
Nevada Certification #: PA014572018-1
New Hampshire/TNI Certification #: 297617
New Jersey/TNI Certification #: PA051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Ohio EPA Rad Approval: #41249
Oregon/TNI Certification #: PA200002-010
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: 02867
Texas/TNI Certification #: T104704188-17-3
Utah/TNI Certification #: PA014572017-9
USDA Soil Permit #: P330-17-00091
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Approve List for Rad
Wyoming Certification #: 8TMS-L

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(724)850-5600

SAMPLE SUMMARY

Project: GA02461
Pace Project No.: 30555850

Lab ID	Sample ID	Matrix	Date Collected	Date Received
30555850001	**AW-23**	Water	01/10/23 09:36	01/19/23 10:15

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: GA02461
Pace Project No.: 30555850

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
30555850001	**AW-23**	EPA 903.1	JDZ	1	PASI-PA
		EPA 904.0	ZPC	1	PASI-PA
		Total Radium Calculation	JAL	1	PASI-PA

PASI-PA = Pace Analytical Services - Greensburg

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Greensburg, PA 15601
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PROJECT NARRATIVE

Project: GA02461
Pace Project No.: 30555850

Method: **EPA 903.1**
Description: 903.1 Radium 226
Client: PDC/Pace Analytical Services (Peoria, IL)
Date: February 03, 2023

General Information:
1 sample was analyzed for EPA 903.1 by Pace Analytical Services Greensburg. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

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1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

PROJECT NARRATIVE

Project: GA02461
Pace Project No.: 30555850

Method: **EPA 904.0**
Description: 904.0 Radium 228
Client: PDC/Pace Analytical Services (Peoria, IL)
Date: February 03, 2023

General Information:
1 sample was analyzed for EPA 904.0 by Pace Analytical Services Greensburg. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

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1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

PROJECT NARRATIVE

Project: GA02461
Pace Project No.: 30555850

Method: **Total Radium Calculation**
Description: Total Radium 228+226
Client: PDC/Pace Analytical Services (Peoria, IL)
Date: February 03, 2023

General Information:
1 sample was analyzed for Total Radium Calculation by Pace Analytical Services Greensburg. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

This data package has been reviewed for quality and completeness and is approved for release.

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Greensburg, PA 15601
(724)850-5600

ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: GA02461
Pace Project No.: 30555850

Sample: AW-23 **Lab ID: 30555850001** Collected: 01/10/23 09:36 Received: 01/19/23 10:15 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
	Pace Analytical Services - Greensburg					
Radium-226	EPA 903.1	**0.0563 ± 0.366 (0.738) C:NA T:92%**	pCi/L	02/02/23 16:14	13982-63-3	
	Pace Analytical Services - Greensburg					
Radium-228	EPA 904.0	**0.610 ± 0.369 (0.691) C:90% T:88%**	pCi/L	01/30/23 14:50	15262-20-1	
	Pace Analytical Services - Greensburg					
Total Radium	Total Radium Calculation	**0.666 ± 0.735 (1.43)**	pCi/L	02/03/23 11:55	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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Greensburg, PA 15601
(724)850-5600

QUALITY CONTROL - RADIOCHEMISTRY

Project: GA02461
Pace Project No.: 30555850

QC Batch: 561786
QC Batch Method: EPA 904.0
Analysis Method: EPA 904.0
Analysis Description: 904.0 Radium 228
Laboratory: Pace Analytical Services - Greensburg
Associated Lab Samples: 30555850001

METHOD BLANK: 2728640 Matrix: Water
Associated Lab Samples: 30555850001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.107 ± 0.263 (0.587) C:91% T:97%	pCi/L	01/30/23 14:50	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

QUALITY CONTROL - RADIOCHEMISTRY

Project: GA02461
Pace Project No.: 30555850

QC Batch: 561782
QC Batch Method: EPA 903.1
Analysis Method: EPA 903.1
Analysis Description: 903.1 Radium-226
Laboratory: Pace Analytical Services - Greensburg
Associated Lab Samples: 30555850001

METHOD BLANK: 2728633 Matrix: Water
Associated Lab Samples: 30555850001

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.165 ± 0.230 (0.383) C:NA T:99%	pCi/L	02/02/23 16:14	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

QUALIFIERS

Project: GA02461
Pace Project No.: 30555850

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Reported results are not rounded until the final step prior to reporting. Therefore, calculated parameters that are typically reported as "Total" may vary slightly from the sum of the reported component parameters.

Act - Activity

Unc - Uncertainty: For Safe Drinking Water Act (SDWA) analyses, the reported Unc. Is the calculated Count Uncertainty (95% confidence interval) using a coverage factor of 1.96. For all other matrices (non-SDWA), the reported Unc. is the calculated Expanded Uncertainty (aka Combined Standard Uncertainty, CSU), reported at the 95% confidence interval using a coverage factor of 1.96.

Gamma Spec: The Unc. reported for all gamma-spectroscopy analyses (EPA 901.1), is the calculated Expanded Uncertainty (CSU) at the 95.4% confidence interval, using a coverage factor of 2.0.

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

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Internal Transfer Chain of Custody

State of Origin: IL
Cert. Needed: [X] YES [ ] NO

Pace Analytical
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Workorder: GA02461 Workorder Name: VISTRA Owner Received Date: 1/10/2023 Results Requ By: 2/14/2023

Report To:	Subcontract To:
Gail Schindler Pace Analytical - IL/MO 2231 W. Altorfer Drive Peoria, IL 61615 800-752-6651	Pace Analytical Services, LLC 1638 Roseytown Rd - Suites 2,3,4 Greensburg, PA 15601 (724)850-5600

Requested Analysis

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers	Radium 226/228	LAB USE ONLY
1	AW-23	GRAB	1/10/2023 9:36	GA02461-01	GW		X	001
2								
3								
4								
5								
6								
7								
8								
9								
10								

Transfers	Released By	Date/Time	Reveived By	Date/Time	Comments
1	Melissa Ubley	1/17/23 1400	Z Adreger	1-19-23	Needs reported as 226, 228 and also combined 226/228
2				10:15	Include QC summary
3					

Cooler Temperature on Receipt — °C | Custody Seal Y or N | Received on Ice Y or N | Sample Intact Y or N

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC document.
This chain of custody is considered complete as is since this information is available in the owner laboratory.

FMT-ALL-C-002rev.00 24March2009

Page 1 of 1

WO# : 30555850

30555850

DC#_Title: ENV-FRM-GBUR-0088 v02_Sample Condition Upon Receipt-Pittsburgh

Effective Date: 10/03/2022

WO# : 30555850

PM: CMC **Due Date: 02/09/23**

CLIENT: PDC

Client Name: PDC

Courier: ☐ Fed Ex ☑ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ Other

Tracking Number: 1Z 647 296 03 7074 3665

Examined By	PS
Labeled By	PS
Temped By	—

Custody Seal on Cooler/Box Present: ☐ Yes ☐ ~~No~~ **Seals Intact:** ☐ Yes ☐ ~~No~~

Thermometer Used: — **Type of Ice:** Wet Blue ~~None~~

Cooler Temperature: Observed Temp _____ °C Correction Factor: _____ °C Final Temp: _____ °C

Temp should be above freezing to 6°C

Comments:	Yes	No	NA	pH paper Lot# 10D222 1 / D.P.D. Residual Chlorine Lot # —
Chain of Custody Present	—			1.
Chain of Custody Filled Out:	—			2.
-Were client corrections present on COC		—		
Chain of Custody Relinquished	—			3.
Sampler Name & Signature on COC:		—		4.
Sample Labels match COC: -Includes date/time/ID Matrix: WT	—			5.
Samples Arrived within Hold Time:	—			6.
Short Hold Time Analysis (<72hr remaining):		—		7.
Rush Turn Around Time Requested:		—		8.
Sufficient Volume:	—			9.
Correct Containers Used:	—			10.
-Pace Containers Used		—		
Containers Intact:	—			11.
Orthophosphate field filtered:			—	12.
Hex Cr Aqueous samples field filtered:			—	13.
Organic Samples checked for dechlorination			—	14:
Filtered volume received for dissolved tests:			—	15:
All containers checked for preservation: exceptions: VOA, coliform, TOC, O&G, Phenolics, Radon, non-aqueous matrix	—			16. pH<2
All containers meet method preservation requirements:	—			Initial when completed PS / Date/Time of Preservation / Lot# of added Preservative
Headspace in VOA Vials (>6mm):			—	17.
Trip Blank Present:		—		18.
Trip Blank Custody Seals Present		—		
Rad Samples Screened <0.5 mrem/hr.	—			Initial when completed PS / Date: 1/20/23 / Survey Meter SN: 1563

Comments:

~~Amod 1/19/23 10:16~~ PS 1/20/23

Note: For NC compliance samples with discrepancies, a copy of this form must be sent to the DEHNR Certification office.
PM Review is documented electronically in LIMS through the SRF Review schedule in the Workorder Edit Screen.

Qualtrax ID: 55680

Client _____ Profile Number 2232

Site GA02461 Page 1 of 1 Notes _____

		Amber Glass					Plastic								Vials					Other									
Sample Line Item	Matrix	AG1H	AG3S	AG3U	AG5U	AG5T	BP1N	BP1U	BP2S	BP2U	BP3C	BP3N	BP3S	BP3U	DG9S	VG9H	VG9T	VG9U	VOAK	WGFU	WGKU	ZPLC	GCUB	GJN	12GN	GN	BG1U		
001	WT																								1				

WO#: 30555850
PM: CMC Due Date: 02/09/23
CLIENT: PDC

Container Codes

Glass

GJN	1 Gallon Jug with HNO3	DG9S	40mL amber VOA vial H2SO4
AG5U	100mL amber glass unpreserved	VG9U	40mL clear VOA vial
AG5T	100mL amber glass Na Thiosulfate	VG9T	40mL clear VOA vial Na Thiosulfate
GJN	1 Gallon Jug	VG9H	40mL clear VOA vial HCl
AG1S	1L amber glass H2SO4	JGFU	4oz amber wide jar
AG1H	1L amber glass HCl	WGFU	4oz wide jar unpreserved
AG1T	1L amber glass NA Thiosulfate	BG2U	500mL clear glass unpreserved
BG1U	1L clear glass unpreserved	AG2U	500mL amber glass unpreserved
AG3S	250mL amber glass H2SO4	WGKU	8oz wide jar unpreserved
AG3U	250mL amber glass unpreserved	GN	General

Plastic/Misc.

GCUB	1 gallon cubitainer
12GN	1/2 gallon cubitainer
SP5T	120mL coliform Na Thiosulfate
BP1N	1L plastic HNO3
BP1U	1L plastic unpreserved
BP3S	250mL plastic H2SO4
BP3N	250mL plastic HNO3
BP3U	250mL plastic unpreserved
BP3C	250mL plastic NAOH
BP2S	500mL plastic H2SO4
BP2U	500mL plastic unpreserved

EZI	5g Encore
VOAK	Kit Volatile Solid
I	Wipe/Swab
ZPLC	Siploc Bag

WT	Water
SL	Solid
OL	Non-Aq Liquid
WP	Wipe

Quality Control Sample Performance Assessment

Pace Analytical™ www.pacelabs.com

Test:	Ra-226
Analyst:	JDZ
Date:	1/24/2023
Batch ID:	71083
Matrix:	DW

Analyst Must Manually Enter All Fields Highlighted in Yellow.

Method Blank Assessment	
MB Sample ID	2728633
MB concentration:	0.165
M/B Counting Uncertainty:	0.229
MB MDC:	0.383
MB Numerical Performance Indicator:	1.41
MB Status vs Numerical Indicator:	N/A
MB Status vs. MDC:	Pass

Laboratory Control Sample Assessment	LCSD (Y or N)?	N
	LCS71083	LCSD71083
Count Date:	2/2/2023	
Spike I.D.:	21-040	
Spike Concentration (pCi/mL):	32.421	
Volume Used (mL):	0.10	
Aliquot Volume (L, g, F):	0.652	
Target Conc. (pCi/L, g, F):	4.970	
Uncertainty (Calculated):	0.234	
Result (pCi/L, g, F):	4.967	
LCS/LCSD Counting Uncertainty (pCi/L, g, F):	0.942	
Numerical Performance Indicator:	-0.01	
Percent Recovery:	99.93%	
Status vs Numerical Indicator:	N/A	
Status vs Recovery:	Pass	
Upper % Recovery Limits:	133%	
Lower % Recovery Limits:	73%	

Sample Matrix Spike Control Assessment	MS/MSD 1	MS/MSD 2
Sample Collection Date:		
Sample I.D.	TW71083	
Sample MS I.D.	TWMS71083	
Sample MSD I.D.		
Spike I.D.:	21-040	
MS/MSD Decay Corrected Spike Concentration (pCi/mL):	34.197	
Spike Volume Used in MS (mL):	0.20	
Spike Volume Used in MSD (mL):		
MS Aliquot (L, g, F):	0.652	
MS Target Conc.(pCi/L, g, F):	10.496	
MSD Aliquot (L, g, F):		
MSD Target Conc. (pCi/L, g, F):		
MS Spike Uncertainty (calculated):	0.493	
MSD Spike Uncertainty (calculated):		
Sample Result:	0.208	
Sample Result Counting Uncertainty (pCi/L, g, F):	0.245	
Sample Matrix Spike Result:	12.308	
Matrix Spike Result Counting Uncertainty (pCi/L, g, F):	1.424	
Sample Matrix Spike Duplicate Result:		
Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F):		
MS Numerical Performance Indicator:	2.060	
MSD Numerical Performance Indicator:		
MS Percent Recovery:	115.29%	
MSD Percent Recovery:		
MS Status vs Numerical Indicator:	N/A	
MSD Status vs Numerical Indicator:		
MS Status vs Recovery:	Pass	
MSD Status vs Recovery:		
MS/MSD Upper % Recovery Limits:	136%	
MS/MSD Lower % Recovery Limits:	71%	

Duplicate Sample Assessment		
Sample I.D.:	TWDUP71083	Enter Duplicate sample IDs if other than LCS/LCSD in the space below.
Duplicate Sample I.D.	TW71083	
Sample Result (pCi/L, g, F):	0.313	
Sample Result Counting Uncertainty (pCi/L, g, F):	0.243	
Sample Duplicate Result (pCi/L, g, F):	0.208	
Sample Duplicate Result Counting Uncertainty (pCi/L, g, F):	0.245	
Are sample and/or duplicate results below RL?	See Below ##	
Duplicate Numerical Performance Indicator:	0.597	TWDUP71083
Duplicate RPD:	40.26%	TW71083
Duplicate Status vs Numerical Indicator:	N/A	
Duplicate Status vs RPD:	Fail***	
% RPD Limit:	32%	

Matrix Spike/Matrix Spike Duplicate Sample Assessment		
Sample I.D.		
Sample MS I.D.		
Sample MSD I.D.		
Sample Matrix Spike Result:		
Matrix Spike Result Counting Uncertainty (pCi/L, g, F):		
Sample Matrix Spike Duplicate Result:		
Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F):		
Duplicate Numerical Performance Indicator:		
(Based on the Percent Recoveries) MS/ MSD Duplicate RPD:		
MS/ MSD Duplicate Status vs Numerical Indicator:		
MS/ MSD Duplicate Status vs RPD:		
% RPD Limit:		

Evaluation of duplicate precision is not applicable if either the sample or duplicate results are below the RL.

Comments:

~~***Batch must be re-prepped due to unacceptable precision~~ results < MDC, ut
Au 2/3/23

JDZ 2/3/23

Quality Control Sample Performance Assessment

Pace Analytical™ www.pacelabs.com

Test:	Ra-228
Analyst:	ZPC
Date:	1/25/2023
Worklist:	71084
Matrix:	WT

Analyst Must Manually Enter All Fields Highlighted in Yellow.

Method Blank Assessment	
MB Sample ID	2728640
MB concentration:	0.107
M/B 2 Sigma CSU:	0.263
MB MDC:	0.587
MB Numerical Performance Indicator:	0.80
MB Status vs Numerical Indicator:	Pass
MB Status vs. MDC:	Pass

Laboratory Control Sample Assessment	LCSD (Y or N)?	N
	LCS71084	LCSD71084
Count Date:	1/30/2023	
Spike I.D.:	22-040	
Decay Corrected Spike Concentration (pCi/mL):	33.720	
Volume Used (mL):	0.10	
Aliquot Volume (L, g, F):	0.810	
Target Conc. (pCi/L, g, F):	4.165	
Uncertainty (Calculated):	0.204	
Result (pCi/L, g, F):	4.338	
LCS/LCSD 2 Sigma CSU (pCi/L, g, F):	0.994	
Numerical Performance Indicator:	0.33	
Percent Recovery:	104.14%	
Status vs Numerical Indicator:	N/A	
Status vs Recovery:	Pass	
Upper % Recovery Limits:	135%	
Lower % Recovery Limits:	60%	

Sample Matrix Spike Control Assessment	MS/MSD 1	MS/MSD 2
Sample Collection Date:	1/24/2023	
Sample I.D.	TW71084	
Sample MS I.D.	TWMS71084	
Sample MSD I.D.		
Spike I.D.:	22-040	
MS/MSD Decay Corrected Spike Concentration (pCi/mL):	33.788	
Spike Volume Used in MS (mL):	0.20	
Spike Volume Used in MSD (mL):		
MS Aliquot (L, g, F):	0.801	
MS Target Conc.(pCi/L, g, F):	8.442	
MSD Aliquot (L, g, F):		
MSD Target Conc. (pCi/L, g, F):		
MS Spike Uncertainty (calculated):	0.414	
MSD Spike Uncertainty (calculated):		
Sample Result:	0.274	
Sample Result 2 Sigma CSU (pCi/L, g, F):	0.342	
Sample Matrix Spike Result:	6.315	
Matrix Spike Result 2 Sigma CSU (pCi/L, g, F):	1.297	
Sample Matrix Spike Duplicate Result:		
Matrix Spike Duplicate Result 2 Sigma CSU (pCi/L, g, F):		
MS Numerical Performance Indicator:	-3.352	
MSD Numerical Performance Indicator:		
MS Percent Recovery:	71.57%	
MSD Percent Recovery:		
MS Status vs Numerical Indicator:	Fail****	
MSD Status vs Numerical Indicator:		
MS Status vs Recovery:	Pass	
MSD Status vs Recovery:		
MS/MSD Upper % Recovery Limits:	135%	
MS/MSD Lower % Recovery Limits:	60%	

Duplicate Sample Assessment		
Sample I.D.:	TW71084	Enter Duplicate sample IDs if other than LCS/LCSD in the space below.
Duplicate Sample I.D.	TWDUP71084	
Sample Result (pCi/L, g, F):	0.274	
Sample Result 2 Sigma CSU (pCi/L, g, F):	0.342	
Sample Duplicate Result (pCi/L, g, F):	0.074	
Sample Duplicate Result 2 Sigma CSU (pCi/L, g, F):	0.293	
Are sample and/or duplicate results below RL?	See Below ##	
Duplicate Numerical Performance Indicator:	0.869	TW71084
Duplicate RPD:	114.57%	TWDUP71084
Duplicate Status vs Numerical Indicator:	Pass	
Duplicate Status vs RPD:	Fail***	
% RPD Limit:	36%	

Matrix Spike/Matrix Spike Duplicate Sample Assessment		
Sample I.D.		
Sample MS I.D.		
Sample MSD I.D.		
Sample Matrix Spike Result:		
Matrix Spike Result 2 Sigma CSU (pCi/L, g, F):		
Sample Matrix Spike Duplicate Result:		
Matrix Spike Duplicate Result 2 Sigma CSU (pCi/L, g, F):		
Duplicate Numerical Performance Indicator:		
(Based on the Percent Recoveries) MS/ MSD Duplicate RPD:		
MS/ MSD Duplicate Status vs Numerical Indicator:		
MS/ MSD Duplicate Status vs RPD:		
% RPD Limit:		

Evaluation of duplicate precision is not applicable if either the sample or duplicate results are below the MDC.

Comments:

VAM 1/31/23

****If all other QC criteria pass, this batch is acceptable. The matrix spike duplicate result indicates a possible bias for this sample only and may not be applicable to any other samples in this analytical batch.

RAMBOLL COC #: 1440702792-2023-0110-004

GA02461

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: 1 of 1

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:
Company: Vistra Corp	Report To: Brian Voelker	Attention: Jason Stuckey
Address: 13498 E. 900th St	Copy To: Jason Stuckey	Company Name: Vistra Corp
		Address: see Section A
Email To: Brian.Voelker@VistraCorp.com	Purchase Order No.:	Quote Reference:
Phone: (217) 753-8911 Fax:	Project Name:	Project Manager:
Requested Due Date/TAT: standard	Project Number: 2285	Profile #:

REGULATORY AGENCY

NPDES GROUND WATER DRINKING WATER

UST RCRA OTHER

Site Location STATE: IL

Section D Required Client Information

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
WIPE	WP
AIR	AR
OTHER	OT
TISSUE	TS

ITEM #	SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED DATE	COLLECTED TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Requested Analysis Filtered (Y/N) Y/N	Analysis Test: Radium 226 + Radium 228, total	Residual Chlorine (Y/N)	Project No./ Lab I.D.
1	AW-23	WT	G	1/10/22	0936		3			X							X		
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			

SM 1/10/22

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
EDW-23Q1-845-301-R3		01/10/22	1600							
	RAMBOLL				1/10/22	1600	7.9	Y	Y	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: SAMUEL MALLOW

SIGNATURE of SAMPLER: SMallow DATE Signed (MM/DD/YY): 1/10/22

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

February 01, 2023

Brian Voelker
Vistra - Edwards
604 Pierce Boulevard
O'Fallon, IL 62269

RE: RAMBOLL DELINEATION

Dear Brian Voelker:

Please find enclosed the analytical results for the **1** sample(s) the laboratory received on **1/10/23 4:00 pm** and logged in under work order **GA02452**. All testing is performed according to our current TNI accreditations unless otherwise noted. This report cannot be reproduced, except in full, without the written permission of Pace Analytical Services, LLC.

If you have any questions regarding your report, please contact your project manager. Quality and timely data is of the utmost importance to us.

Pace Analytical Services appreciates the opportunity to provide you with analytical expertise . We are always trying to improve our customer service and we welcome you to contact the General Manager, Lisa Grant, with any feedback you have about your experience with our laboratory at 309-683-1764 or lisa.grant@pacelabs.com.

Gail J Schindler

Gail Schindler
Project Manager
(309) 692-9688 x1716
gail.schindler@pacelabs.com

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

SAMPLE RECEIPT CHECK LIST

Items not applicable will be marked as in compliance

Work Order GA02452

YES	Samples received within temperature compliance when applicable
YES	COC present upon sample receipt
YES	COC completed & legible
YES	Sampler name & signature present
YES	Unique sample IDs assigned
YES	Sample collection location recorded
YES	Date & time collected recorded on COC
YES	Relinquished by client signature on COC
YES	COC & labels match
YES	Sample labels are legible
YES	Appropriate bottle(s) received
YES	Sufficient sample volume received
YES	Sample containers received undamaged
NO	Zero headspace, <6 mm present in VOA vials
NO	Trip blank(s) received
YES	All non-field analyses received within holding times
NO	Short hold time analysis
YES	Current PDC COC submitted
NO	Case narrative provided

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

ANALYTICAL RESULTS

Sample: GA02452-01
Name: AW-23
Matrix: Ground Water - Grab

Sampled: 01/10/23 09:36
Received: 01/10/23 16:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	50	mg/L		01/26/23 05:05	10	10	01/26/23 05:05	LAM	EPA 300.0 REV 2.1
Fluoride	0.302	mg/L		01/21/23 11:36	1	0.250	01/21/23 11:36	LAM	EPA 300.0 REV 2.1
Sulfate	190	mg/L		01/21/23 12:12	50	50	01/21/23 12:12	LAM	EPA 300.0 REV 2.1
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	380	mg/L		01/24/23 09:55	1	10	01/24/23 09:55	HRF	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		01/24/23 09:55	1	10	01/24/23 09:55	HRF	SM 2320B 1997*
Solids - total dissolved solids (TDS)	760	mg/L		01/16/23 11:08	1	26	01/16/23 12:25	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		01/18/23 09:10	5	3.0	01/20/23 10:18	JMW	EPA 6020A
Arsenic	1.2	ug/L		01/18/23 09:10	5	1.0	01/20/23 10:18	JMW	EPA 6020A
Barium	27	ug/L		01/18/23 09:10	5	1.0	01/20/23 10:18	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		01/18/23 09:10	5	1.0	01/20/23 10:18	JMW	EPA 6020A
Boron	550	ug/L		01/17/23 09:05	5	10	01/19/23 10:03	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		01/18/23 09:10	5	1.0	01/20/23 10:18	JMW	EPA 6020A
Calcium	130	mg/L		01/17/23 09:05	5	0.20	01/18/23 14:20	JMW	EPA 6020A
Chromium	< 4.0	ug/L		01/18/23 09:10	5	4.0	01/20/23 10:18	JMW	EPA 6020A
Cobalt	< 2.0	ug/L		01/18/23 09:10	5	2.0	01/20/23 10:18	JMW	EPA 6020A
Lead	< 1.0	ug/L		01/18/23 09:10	5	1.0	01/20/23 10:18	JMW	EPA 6020A
Magnesium	50	mg/L		01/17/23 09:05	5	0.10	01/18/23 14:20	JMW	EPA 6020A
Mercury	< 0.20	ug/L		01/18/23 09:10	5	0.20	01/20/23 10:18	JMW	EPA 6020A
Molybdenum	< 1.0	ug/L		01/18/23 09:10	5	1.0	01/20/23 10:18	JMW	EPA 6020A
Potassium	1.1	mg/L	B	01/17/23 09:05	5	0.10	01/18/23 14:20	JMW	EPA 6020A
Selenium	< 1.0	ug/L		01/18/23 09:10	5	1.0	01/20/23 10:18	JMW	EPA 6020A
Sodium	59	mg/L		01/17/23 09:05	5	0.10	01/18/23 14:20	JMW	EPA 6020A
Thallium	< 1.0	ug/L		01/18/23 09:10	5	1.0	01/20/23 10:18	JMW	EPA 6020A
Lithium	< 20	ug/L		01/18/23 09:10	1	20	01/19/23 16:14	TJJ	EPA 6010B

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

QC SAMPLE RESULTS

Parameter	Result	Unit	Qual	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch B323248 - No Prep - SM 2540C									
Blank (B323248-BLK1)				Prepared & Analyzed: 01/16/23					
Solids - total dissolved solids (TDS)	< 17	mg/L							
LCS (B323248-BS1)				Prepared & Analyzed: 01/16/23					
Solids - total dissolved solids (TDS)	920	mg/L		1000		92	84.9-109		
Batch B323334 - SW 3015 - EPA 6020A									
Blank (B323334-BLK1)				Prepared: 01/17/23 Analyzed: 01/18/23					
Boron	< 10	ug/L							
Calcium	< 0.20	mg/L							
Magnesium	< 0.10	mg/L							
Potassium	0.177	mg/L	B						
Sodium	0.195	mg/L							
LCS (B323334-BS1)				Prepared: 01/17/23 Analyzed: 01/18/23					
Boron	506	ug/L		555.6		91	80-120		
Calcium	5.53	mg/L		5.556		100	80-120		
Magnesium	5.59	mg/L		5.556		101	80-120		
Potassium	5.73	mg/L		5.556		103	80-120		
Sodium	5.49	mg/L		5.556		99	80-120		
Batch B323436 - SW 3015 - EPA 6020A									
Blank (B323436-BLK1)				Prepared: 01/18/23 Analyzed: 01/20/23					
Antimony	< 3.0	ug/L							
Arsenic	< 1.0	ug/L							
Barium	< 1.0	ug/L							
Beryllium	< 1.0	ug/L							
Cadmium	< 1.0	ug/L							
Chromium	< 4.0	ug/L							
Cobalt	< 2.0	ug/L							
Lead	< 1.0	ug/L							
Mercury	< 0.20	ug/L							
Molybdenum	< 1.0	ug/L							
Selenium	< 1.0	ug/L							
Thallium	< 1.0	ug/L							
Lithium	< 20	ug/L							
LCS (B323436-BS1)				Prepared: 01/18/23 Analyzed: 01/20/23					
Antimony	524	ug/L		555.6		94	80-120		
Arsenic	552	ug/L		555.6		99	80-120		
Barium	573	ug/L		555.6		103	80-120		
Beryllium	562	ug/L		555.6		101	80-120		
Cadmium	532	ug/L		555.6		96	80-120		
Chromium	533	ug/L		555.6		96	80-120		
Cobalt	545	ug/L		555.6		98	80-120		
Lead	541	ug/L		555.6		97	80-120		

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2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

QC SAMPLE RESULTS

Parameter	Result	Unit	Qual	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch B323436 - SW 3015 - EPA 6020A									
LCS (B323436-BS1)				Prepared: 01/18/23 Analyzed: 01/20/23					
Mercury	53.9	ug/L		55.56		97	80-120		
Molybdenum	542	ug/L		555.6		98	80-120		
Selenium	567	ug/L		555.6		102	80-120		
Thallium	534	ug/L		555.6		96	80-120		
Lithium	516	ug/L		555.6		93	80-120		
Batch B323851 - IC No Prep - EPA 300.0 REV 2.1									
Calibration Blank (B323851-CCB1)				Prepared & Analyzed: 01/21/23					
Fluoride	0.00	mg/L							
Sulfate	0.00	mg/L							
Calibration Check (B323851-CCV1)				Prepared & Analyzed: 01/21/23					
Fluoride	5.11	mg/L		5.000		102	90-110		
Sulfate	4.82	mg/L		5.000		96	90-110		
Batch B324154 - IC No Prep - EPA 300.0 REV 2.1									
Calibration Blank (B324154-CCB1)				Prepared & Analyzed: 01/25/23					
Chloride	0.00	mg/L							
Calibration Check (B324154-CCV1)				Prepared & Analyzed: 01/25/23					
Chloride	4.80	mg/L		5.000		96	90-110		

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NOTES

Specifications regarding method revisions, method modifications, and calculations used for analysis are available upon request. Please contact your project manager.

* Not a TNI accredited analyte

Certifications

CHI - McHenry, IL - 4314-A W. Crystal Lake Road, McHenry, IL 60050
TNI Accreditation for Drinking Water and Wastewater Fields of Testing through IL EPA Accreditation No. 100279
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory Registry No. 17556

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SPMO - Springfield, MO - 1805 W Sunset Street, Springfield, MO 65807
USEPA DMR-QA Program

STL - Hazelwood, MO - 944 Anglum Rd, Hazelwood, MO 63042
TNI Accreditation for Wastewater, Solid and Hazardous Material Fields of Testing through KS KDHE Certification No. E-10389
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Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory, Registry No. 171050
Missouri Department of Natural Resources - Certificate of Approval for Microbiological Laboratory Service - No. 1050

Qualifiers

B Present in the method blank at 177 ug/L.

Gail J Schindler

Certified by: Gail Schindler, Project Manager

RAMBOLL COC#: 1940102792-2023-0110-002

GA07452

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Page: 1 of 1

Section A Required Client Information:		Section B Required Project Information:		Section C Invoice Information:	
Company:	Vistra Corp	Report To:	Brian Voelker	Attention:	Jason Stuckey
Address:	13498 E. 900th St	Copy To:	Jason Stuckey	Company Name:	Vistra Corp
				Address:	see Section A
Email To:	Brian.Voelker@VistraCorp.com	Purchase Order No.:		Quote Reference:	
Phone:	(217) 753-8911	Fax:		Project Name:	
				Project Manager:	
Requested Due Date/TAT:	standard	Project Number:	2285	Profile #:	

REGULATORY AGENCY

NPDES GROUND WATER DRINKING WATER

UST RCRA OTHER

Site Location STATE: IL

Section D Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
WIPE	WP
AIR	AR
OTHER	OT
TISSUE	TS

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED DATE	COLLECTED TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N: EDW-845-301_R3	Residual Chlorine (Y/N)	Project No./ Lab I.D.
1	AW-23	WT	G	1/10/22	0936		6	X		X						X		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		

SM 1/10/22

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
EDW-23Q1-845-301-R3 R3 NO RADIUM 226 + RADIUM 228, TOTAL	RAMBOLL	01/10/23	1600		1/10/23	1600	2.9	Y	Y	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: SAMUEL MALLOW

SIGNATURE of SAMPLER: SMallow DATE Signed (MM/DD/YY): 1/10/22

Public Records Holding Area
Do not remove this sheet

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

February 13, 2023

Brian Voelker
Vistra - Edwards
604 Pierce Boulevard
O'Fallon, IL 62269

RE: RAMBOLL DELINEATION

Dear Brian Voelker:

Please find enclosed the analytical results for the **3** sample(s) the laboratory received on **1/10/23 4:00 pm** and logged in under work order **GA02470**. All testing is performed according to our current TNI accreditations unless otherwise noted. This report cannot be reproduced, except in full, without the written permission of Pace Analytical Services, LLC.

If you have any questions regarding your report, please contact your project manager. Quality and timely data is of the utmost importance to us.

Pace Analytical Services appreciates the opportunity to provide you with analytical expertise . We are always trying to improve our customer service and we welcome you to contact the General Manager, Lisa Grant, with any feedback you have about your experience with our laboratory at 309-683-1764 or lisa.grant@pacelabs.com.

Gail J Schindler

Gail Schindler
Project Manager
(309) 692-9688 x1716
gail.schindler@pacelabs.com

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

SAMPLE RECEIPT CHECK LIST

Items not applicable will be marked as in compliance

Work Order GA02470

YES	Samples received within temperature compliance when applicable
YES	COC present upon sample receipt
YES	COC completed & legible
YES	Sampler name & signature present
YES	Unique sample IDs assigned
YES	Sample collection location recorded
YES	Date & time collected recorded on COC
YES	Relinquished by client signature on COC
YES	COC & labels match
YES	Sample labels are legible
YES	Appropriate bottle(s) received
YES	Sufficient sample volume received
YES	Sample containers received undamaged
NO	Zero headspace, <6 mm present in VOA vials
NO	Trip blank(s) received
YES	All non-field analyses received within holding times
NO	Short hold time analysis
YES	Current PDC COC submitted
NO	Case narrative provided

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(800)752-6651

ANALYTICAL RESULTS

Sample: GA02470-01
Name: AW-01
Matrix: Ground Water - Grab

Sampled: 01/10/23 14:14
Received: 01/10/23 16:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Miscellaneous - Pace Analytical - Mt Juliet, Tn									
Rad 226 - Subcontract	0	pCi/L			1	0.721	02/02/23 16:14		904.0 903.0
Rad 226 and 228-Subcontract	0	pCi/L			1	1.44	02/03/23 11:55		904.0 903.0
Rad 228- Subcontract	-0.138	pCi/L			1	0.721	01/30/23 14:50		904.0 903.0

Sample: GA02470-02
Name: EMW-05
Matrix: Ground Water - Grab

Sampled: 01/10/23 11:41
Received: 01/10/23 16:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Miscellaneous - Pace Analytical - Mt Juliet, Tn									
Rad 226 - Subcontract	-0.724	pCi/L			1	3.16	02/02/23 16:14		904.0 903.0
Rad 226 and 228-Subcontract	1.33	pCi/L			1	4.53	02/03/23 11:55		904.0 903.0
Rad 228- Subcontract	1.33	pCi/L			1	1.37	01/30/23 14:51		904.0 903.0

Sample: GA02470-03
Name: DUP-01
Matrix: Ground Water - Grab

Sampled: 01/10/23 11:41
Received: 01/10/23 16:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Miscellaneous - Pace Analytical - Mt Juliet, Tn									
Rad 226 - Subcontract	0.772	pCi/L			1	1.03	02/02/23 16:14		904.0 903.0
Rad 226 and 228-Subcontract	1.62	pCi/L			1	1.89	02/03/23 11:55		904.0 903.0
Rad 228- Subcontract	0.847	pCi/L			1	0.859	01/30/23 14:51		904.0 903.0

Pace Analytical Services, LLC
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Peoria, IL 61615
(800)752-6651

QC SAMPLE RESULTS

Parameter	Result	Unit	Qual	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

NOTES

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* Not a TNI accredited analyte

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Gail J Schindler

Certified by: Gail Schindler, Project Manager

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

February 06, 2023

Gail J. Schindler
PDC Laboratories
2231 W. Altorfer Drive
Peoria, IL 61615

RE: Project: GA02470
Pace Project No.: 30555853

Dear Gail Schindler:

Enclosed are the analytical results for sample(s) received by the laboratory on January 19, 2023. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:

- Pace Analytical Services - Greensburg

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Carla Cmar
carla.cmar@pacelabs.com
(724)850-5600
Project Manager

Enclosures

cc: Chenise Lambert-Sykes, PDC Laboratories, Inc.

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(724)850-5600

CERTIFICATIONS

Project: GA02470
Pace Project No.: 30555853

Pace Analytical Services Pennsylvania
1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
ANAB DOD-ELAP Rad Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification #: PA01547
Connecticut Certification #: PH-0694
Delaware Certification
EPA Region 4 DW Rad
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Florida: Cert E871149 SEKS WET
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: KY90133
KY WW Permit #: KY0098221
KY WW Permit #: KY0000221
Louisiana DHH/TNI Certification #: LA180012
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: 2017020
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification #: 9991
Missouri Certification #: 235
Montana Certification #: Cert0082
Nebraska Certification #: NE-OS-29-14
Nevada Certification #: PA014572018-1
New Hampshire/TNI Certification #: 297617
New Jersey/TNI Certification #: PA051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Ohio EPA Rad Approval: #41249
Oregon/TNI Certification #: PA200002-010
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: 02867
Texas/TNI Certification #: T104704188-17-3
Utah/TNI Certification #: PA014572017-9
USDA Soil Permit #: P330-17-00091
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Approve List for Rad
Wyoming Certification #: 8TMS-L

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Greensburg, PA 15601
(724)850-5600

SAMPLE SUMMARY

Project: GA02470
Pace Project No.: 30555853

Lab ID	Sample ID	Matrix	Date Collected	Date Received
30555853001	**AW-01**	Water	01/10/23 14:14	01/19/23 10:15
30555853002	**EMW-05**	Water	01/10/23 11:41	01/19/23 10:15
30555853003	**DUP-01**	Water	01/10/23 11:41	01/19/23 10:15

REPORT OF LABORATORY ANALYSIS

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Greensburg, PA 15601
(724)850-5600

SAMPLE ANALYTE COUNT

Project: GA02470
Pace Project No.: 30555853

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
30555853001	**AW-01**	EPA 903.1	JDZ	1	PASI-PA
		EPA 904.0	ZPC	1	PASI-PA
		Total Radium Calculation	JAL	1	PASI-PA
30555853002	**EMW-05**	EPA 903.1	JDZ	1	PASI-PA
		EPA 904.0	ZPC	1	PASI-PA
		Total Radium Calculation	JAL	1	PASI-PA
30555853003	**DUP-01**	EPA 903.1	JDZ	1	PASI-PA
		EPA 904.0	ZPC	1	PASI-PA
		Total Radium Calculation	JAL	1	PASI-PA

PASI-PA = Pace Analytical Services - Greensburg

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Greensburg, PA 15601
(724)850-5600

PROJECT NARRATIVE

Project: GA02470
Pace Project No.: 30555853

Method: **EPA 903.1**
Description: 903.1 Radium 226
Client: PDC/Pace Analytical Services (Peoria, IL)
Date: February 06, 2023

General Information:
3 samples were analyzed for EPA 903.1 by Pace Analytical Services Greensburg. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

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Greensburg, PA 15601
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PROJECT NARRATIVE

Project: GA02470
Pace Project No.: 30555853

Method: **EPA 904.0**
Description: 904.0 Radium 228
Client: PDC/Pace Analytical Services (Peoria, IL)
Date: February 06, 2023

General Information:
3 samples were analyzed for EPA 904.0 by Pace Analytical Services Greensburg. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

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Greensburg, PA 15601
(724)850-5600

PROJECT NARRATIVE

Project: GA02470
Pace Project No.: 30555853

Method: **Total Radium Calculation**
Description: Total Radium 228+226
Client: PDC/Pace Analytical Services (Peoria, IL)
Date: February 06, 2023

General Information:
3 samples were analyzed for Total Radium Calculation by Pace Analytical Services Greensburg. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

This data package has been reviewed for quality and completeness and is approved for release.

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Greensburg, PA 15601
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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: GA02470
Pace Project No.: 30555853

Sample: AW-01 **Lab ID: 30555853001** Collected: 01/10/23 14:14 Received: 01/19/23 10:15 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
	Pace Analytical Services - Greensburg					
Radium-226	EPA 903.1	**0.000 ± 0.347 (0.721) C:NA T:95%**	pCi/L	02/02/23 16:14	13982-63-3	
	Pace Analytical Services - Greensburg					
Radium-228	EPA 904.0	**-0.138 ± 0.300 (0.721) C:88% T:92%**	pCi/L	01/30/23 14:50	15262-20-1	
	Pace Analytical Services - Greensburg					
Total Radium	Total Radium Calculation	**0.000 ± 0.647 (1.44)**	pCi/L	02/03/23 11:55	7440-14-4	

Sample: EMW-05 **Lab ID: 30555853002** Collected: 01/10/23 11:41 Received: 01/19/23 10:15 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
	Pace Analytical Services - Greensburg					
Radium-226	EPA 903.1	**-0.724 ± 1.25 (3.16) C:NA T:51%**	pCi/L	02/02/23 16:14	13982-63-3	
	Pace Analytical Services - Greensburg					
Radium-228	EPA 904.0	**1.33 ± 0.753 (1.37) C:90% T:82%**	pCi/L	01/30/23 14:51	15262-20-1	
	Pace Analytical Services - Greensburg					
Total Radium	Total Radium Calculation	**1.33 ± 2.00 (4.53)**	pCi/L	02/03/23 11:55	7440-14-4	

Sample: DUP-01 **Lab ID: 30555853003** Collected: 01/10/23 11:41 Received: 01/19/23 10:15 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
	Pace Analytical Services - Greensburg					
Radium-226	EPA 903.1	**0.772 ± 0.699 (1.03) C:NA T:57%**	pCi/L	02/02/23 16:14	13982-63-3	
	Pace Analytical Services - Greensburg					
Radium-228	EPA 904.0	**0.847 ± 0.470 (0.859) C:88% T:74%**	pCi/L	01/30/23 14:51	15262-20-1	
	Pace Analytical Services - Greensburg					
Total Radium	Total Radium Calculation	**1.62 ± 1.17 (1.89)**	pCi/L	02/03/23 11:55	7440-14-4	

REPORT OF LABORATORY ANALYSIS

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Greensburg, PA 15601
(724)850-5600

QUALITY CONTROL - RADIOCHEMISTRY

Project: GA02470
Pace Project No.: 30555853

QC Batch: 561786
QC Batch Method: EPA 904.0
Analysis Method: EPA 904.0
Analysis Description: 904.0 Radium 228
Laboratory: Pace Analytical Services - Greensburg
Associated Lab Samples: 30555853001, 30555853002, 30555853003

METHOD BLANK: 2728640
Matrix: Water
Associated Lab Samples: 30555853001, 30555853002, 30555853003

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-228	0.107 ± 0.263 (0.587) C:91% T:97%	pCi/L	01/30/23 14:50	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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Greensburg, PA 15601
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QUALITY CONTROL - RADIOCHEMISTRY

Project: GA02470
Pace Project No.: 30555853

QC Batch: 561782
QC Batch Method: EPA 903.1
Analysis Method: EPA 903.1
Analysis Description: 903.1 Radium-226
Laboratory: Pace Analytical Services - Greensburg
Associated Lab Samples: 30555853001, 30555853002, 30555853003

METHOD BLANK: 2728633 Matrix: Water
Associated Lab Samples: 30555853001, 30555853002, 30555853003

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.165 ± 0.230 (0.383) C:NA T:99%	pCi/L	02/02/23 16:14	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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without the written consent of Pace Analytical Services, LLC.

Pace Analytical Services, LLC
1638 Roseytown Road - Suites 2,3,4
Greensburg, PA 15601
(724)850-5600

QUALIFIERS

Project: GA02470
Pace Project No.: 30555853

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Reported results are not rounded until the final step prior to reporting. Therefore, calculated parameters that are typically reported as "Total" may vary slightly from the sum of the reported component parameters.

Act - Activity

Unc - Uncertainty: For Safe Drinking Water Act (SDWA) analyses, the reported Unc. Is the calculated Count Uncertainty (95% confidence interval) using a coverage factor of 1.96. For all other matrices (non-SDWA), the reported Unc. is the calculated Expanded Uncertainty (aka Combined Standard Uncertainty, CSU), reported at the 95% confidence interval using a coverage factor of 1.96.

Gamma Spec: The Unc. reported for all gamma-spectroscopy analyses (EPA 901.1), is the calculated Expanded Uncertainty (CSU) at the 95.4% confidence interval, using a coverage factor of 2.0.

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

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Internal Transfer Chain of Custody

State of Origin: IL
Cert. Needed: [X] YES [ ] NO

Pace Analytical

Workorder: GA02470 **Workorder Name:** VISTRA - EDWARDS **Owner Received Date:** 1/10/2023 **Results Requ By:** 2/14/2023

Report To:	Subcontract To:
Gail Schindler Pace Analytical - IL/MO 2231 W. Altorfer Drive Peoria, IL 61615 800-752-6651	Pace Analytical Services, LLC 1638 Roseytown Rd - Suites 2,3,4 Greensburg, PA 15601 (724)850-5600

Item	Sample ID	Sample Type	Collect Date/Time	Lab ID	Matrix	Preserved Containers	Requested Analysis: Radium 226/228	LAB USE ONLY
1	AW-01	GRAB	1/10/2023 14:14	GA02470-01	GW		X	
2	EMW-05	GRAB	1/10/2023 11:41	GA02470-02	GW		X	
3	DUP-01	GRAB	1/10/2023 11:41	GA02470-03	GW		X	
4								
5								
6								
7								
8								
9								
10								

Transfers	Released By	Date/Time	Reveived By	Date/Time	Comments
1	Melissa Sibley	1/10/23 10:00			Needs reported as 226, 228 and also combined 226/228
2					Include QC summary
3					

Cooler Temperature on Receipt _____ °C	Custody Seal Y or N	Received on Ice Y or N	Sample Intact Y or N

***In order to maintain client confidentiality, location/name of the sampling site, sampler's name and signature may not be provided on this COC document. This chain of custody is considered complete as is since this information is available in the owner laboratory.

Ship to :

Pace Analytical Services, LLC
1638 Roseytown Rd - Suites 2,3,4
Greensburg, PA 15601

(724)850-5600

INTER_LABORATORY WORK ORDER # GA02470

(To be complete by sending lab)

Sending Project No:	GA02470
Receiving Project No:	
Check Box for Consolidated Invoice:	
Date Prepared:	1/16/2023
REQUESTED COMPLETION DATE:	2/14/2023

Sending Region	**IR72-IL/MO**	Sending Project Mgr.	GAIL SCHINDLER
Receiving Region	GREENSBURG	External Client	VISTRA - EDWARDS
State of Sample Origin	IL	QC Deliverable	**STD Report**

All questions should be addressed to sending project manager.

Requested Reportable Units _____ Report Wet or Dry Weight? _____ Cert Needed: IL

WORK REQUESTED						
Method Description	**Container Type**	**Quantity of**	**Preservative**	**Quantity of**	**Unit Price**	**Amount**
Radium 226/228		1		3	$242.10	$726.30
					$0.00	$0.00
						$0.00
					TOTAL	$726.30

Special Requirements: Report as 226, 228 & combined 226/228. Include QC summary

Receiving Region Department	**Acctg. Code**	**Totals from above**	**Revenue Allocation**	
			Receiving Region (80%)	Client Services Dept.
radiological	38	$726.30	$581.04	$145.26
* Custom Revenue Allocation		TOTAL	$581.04	$145.26

FOR ANALYTICAL WORK COMPLETED THIS SECTION ALSO

Return Samples to Sending Region: [ ] **Yes** [X] **No**

CONFIRMATION OF WORK COMPLETED

Date Completed: _____ Receiving Project Manager: _____

Original sent to the receiving lab - Copy kept at the sending lab.

When work completed: Original sent to the ABM at the receiving laboratory. Copies are made to corporate as needed.

Quality Control Sample Performance Assessment

Pace Analytical™ www.pacelabs.com

Test:	Ra-226
Analyst:	JDZ
Date:	1/24/2023
Batch ID:	71083
Matrix:	DW

Analyst Must Manually Enter All Fields Highlighted in Yellow.

Method Blank Assessment	
MB Sample ID	2728633
MB concentration:	0.165
M/B Counting Uncertainty:	0.229
MB MDC:	0.383
MB Numerical Performance Indicator:	1.41
MB Status vs Numerical Indicator:	N/A
MB Status vs. MDC:	Pass

Laboratory Control Sample Assessment	LCSD (Y or N)?	N
	LCS71083	LCSD71083
Count Date:	2/2/2023	
Spike I.D.:	21-040	
Spike Concentration (pCi/mL):	32.421	
Volume Used (mL):	0.10	
Aliquot Volume (L, g, F):	0.652	
Target Conc. (pCi/L, g, F):	4.970	
Uncertainty (Calculated):	0.234	
Result (pCi/L, g, F):	4.967	
LCS/LCSD Counting Uncertainty (pCi/L, g, F):	0.942	
Numerical Performance Indicator:	-0.01	
Percent Recovery:	99.93%	
Status vs Numerical Indicator:	N/A	
Status vs Recovery:	Pass	
Upper % Recovery Limits:	133%	
Lower % Recovery Limits:	73%	

Sample Matrix Spike Control Assessment	MS/MSD 1	MS/MSD 2
Sample Collection Date:		
Sample I.D.	TW71083	
Sample MS I.D.	TWMS71083	
Sample MSD I.D.		
Spike I.D.:	21-040	
MS/MSD Decay Corrected Spike Concentration (pCi/mL):	34.197	
Spike Volume Used in MS (mL):	0.20	
Spike Volume Used in MSD (mL):		
MS Aliquot (L, g, F):	0.652	
MS Target Conc.(pCi/L, g, F):	10.496	
MSD Aliquot (L, g, F):		
MSD Target Conc. (pCi/L, g, F):		
MS Spike Uncertainty (calculated):	0.493	
MSD Spike Uncertainty (calculated):		
Sample Result:	0.208	
Sample Result Counting Uncertainty (pCi/L, g, F):	0.245	
Sample Matrix Spike Result:	12.308	
Matrix Spike Result Counting Uncertainty (pCi/L, g, F):	1.424	
Sample Matrix Spike Duplicate Result:		
Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F):		
MS Numerical Performance Indicator:	2.060	
MSD Numerical Performance Indicator:		
MS Percent Recovery:	115.29%	
MSD Percent Recovery:		
MS Status vs Numerical Indicator:	N/A	
MSD Status vs Numerical Indicator:		
MS Status vs Recovery:	Pass	
MSD Status vs Recovery:		
MS/MSD Upper % Recovery Limits:	136%	
MS/MSD Lower % Recovery Limits:	71%	

Duplicate Sample Assessment		
Sample I.D.:	TWDUP71083	Enter Duplicate sample IDs if other than LCS/LCSD in the space below.
Duplicate Sample I.D.	TW71083	
Sample Result (pCi/L, g, F):	0.313	
Sample Result Counting Uncertainty (pCi/L, g, F):	0.243	
Sample Duplicate Result (pCi/L, g, F):	0.208	
Sample Duplicate Result Counting Uncertainty (pCi/L, g, F):	0.245	
Are sample and/or duplicate results below RL?	See Below ##	
Duplicate Numerical Performance Indicator:	0.597	TWDUP71083
Duplicate RPD:	40.26%	TW71083
Duplicate Status vs Numerical Indicator:	N/A	
Duplicate Status vs RPD:	Fail***	
% RPD Limit:	32%	

Matrix Spike/Matrix Spike Duplicate Sample Assessment		
Sample I.D.		
Sample MS I.D.		
Sample MSD I.D.		
Sample Matrix Spike Result:		
Matrix Spike Result Counting Uncertainty (pCi/L, g, F):		
Sample Matrix Spike Duplicate Result:		
Matrix Spike Duplicate Result Counting Uncertainty (pCi/L, g, F):		
Duplicate Numerical Performance Indicator:		
(Based on the Percent Recoveries) MS/ MSD Duplicate RPD:		
MS/ MSD Duplicate Status vs Numerical Indicator:		
MS/ MSD Duplicate Status vs RPD:		
% RPD Limit:		

Evaluation of duplicate precision is not applicable if either the sample or duplicate results are below the RL.

Comments:

~~***Batch must be re-prepped due to unacceptable precision~~ results < MDC, nt
Au 2/3/23

JDZ 2/3/23

Quality Control Sample Performance Assessment

Pace Analytical™ www.pacelabs.com

Test:	Ra-228
Analyst:	ZPC
Date:	1/25/2023
Worklist:	71084
Matrix:	WT

Analyst Must Manually Enter All Fields Highlighted in Yellow.

Method Blank Assessment	
MB Sample ID	2728640
MB concentration:	0.107
M/B 2 Sigma CSU:	0.263
MB MDC:	0.587
MB Numerical Performance Indicator:	0.80
MB Status vs Numerical Indicator:	Pass
MB Status vs. MDC:	Pass

Laboratory Control Sample Assessment	LCSD (Y or N)?	N
	LCS71084	LCSD71084
Count Date:	1/30/2023	
Spike I.D.:	22-040	
Decay Corrected Spike Concentration (pCi/mL):	33.720	
Volume Used (mL):	0.10	
Aliquot Volume (L, g, F):	0.810	
Target Conc. (pCi/L, g, F):	4.165	
Uncertainty (Calculated):	0.204	
Result (pCi/L, g, F):	4.338	
LCS/LCSD 2 Sigma CSU (pCi/L, g, F):	0.994	
Numerical Performance Indicator:	0.33	
Percent Recovery:	104.14%	
Status vs Numerical Indicator:	N/A	
Status vs Recovery:	Pass	
Upper % Recovery Limits:	135%	
Lower % Recovery Limits:	60%	

Sample Matrix Spike Control Assessment	MS/MSD 1	MS/MSD 2
Sample Collection Date:	1/24/2023	
Sample I.D.	TW71084	
Sample MS I.D.	TWMS71084	
Sample MSD I.D.		
Spike I.D.:	22-040	
MS/MSD Decay Corrected Spike Concentration (pCi/mL):	33.788	
Spike Volume Used in MS (mL):	0.20	
Spike Volume Used in MSD (mL):		
MS Aliquot (L, g, F):	0.801	
MS Target Conc.(pCi/L, g, F):	8.442	
MSD Aliquot (L, g, F):		
MSD Target Conc. (pCi/L, g, F):		
MS Spike Uncertainty (calculated):	0.414	
MSD Spike Uncertainty (calculated):		
Sample Result:	0.274	
Sample Result 2 Sigma CSU (pCi/L, g, F):	0.342	
Sample Matrix Spike Result:	6.315	
Matrix Spike Result 2 Sigma CSU (pCi/L, g, F):	1.297	
Sample Matrix Spike Duplicate Result:		
Matrix Spike Duplicate Result 2 Sigma CSU (pCi/L, g, F):		
MS Numerical Performance Indicator:	-3.352	
MSD Numerical Performance Indicator:		
MS Percent Recovery:	71.57%	
MSD Percent Recovery:		
MS Status vs Numerical Indicator:	Fail****	
MSD Status vs Numerical Indicator:		
MS Status vs Recovery:	Pass	
MSD Status vs Recovery:		
MS/MSD Upper % Recovery Limits:	135%	
MS/MSD Lower % Recovery Limits:	60%	

Duplicate Sample Assessment		
Sample I.D.:	TW71084	Enter Duplicate sample IDs if other than LCS/LCSD in the space below.
Duplicate Sample I.D.	TWDUP71084	
Sample Result (pCi/L, g, F):	0.274	
Sample Result 2 Sigma CSU (pCi/L, g, F):	0.342	
Sample Duplicate Result (pCi/L, g, F):	0.074	
Sample Duplicate Result 2 Sigma CSU (pCi/L, g, F):	0.293	
Are sample and/or duplicate results below RL?	See Below ##	
Duplicate Numerical Performance Indicator:	0.869	TW71084
Duplicate RPD:	114.57%	TWDUP71084
Duplicate Status vs Numerical Indicator:	Pass	
Duplicate Status vs RPD:	Fail***	
% RPD Limit:	36%	

Matrix Spike/Matrix Spike Duplicate Sample Assessment		
Sample I.D.		
Sample MS I.D.		
Sample MSD I.D.		
Sample Matrix Spike Result:		
Matrix Spike Result 2 Sigma CSU (pCi/L, g, F):		
Sample Matrix Spike Duplicate Result:		
Matrix Spike Duplicate Result 2 Sigma CSU (pCi/L, g, F):		
Duplicate Numerical Performance Indicator:		
(Based on the Percent Recoveries) MS/ MSD Duplicate RPD:		
MS/ MSD Duplicate Status vs Numerical Indicator:		
MS/ MSD Duplicate Status vs RPD:		
% RPD Limit:		

1/31/23

Evaluation of duplicate precision is not applicable if either the sample or duplicate results are below the MDC.

Comments:

VAM 1/31/23

****If all other QC criteria pass, this batch is acceptable. The matrix spike duplicate result indicates a possible bias for this sample only and may not be applicable to any other samples in this analytical batch.

RAMBOLL COC#: 1940102792-2023-0110-0001
GA02470

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:

Company:	Vistra Corp
Address:	13498 E. 900th St
Email To:	Brian.Voelker@VistraCorp.com
Phone: (217) 753-8911	Fax:
Requested Due Date/TAT:	standard

Section B Required Project Information:

Report To:	Brian Voelker
Copy To:	Jason Stuckey
Purchase Order No.:	
Project Name:	
Project Number:	2285

Section C Invoice Information:

Attention:	Jason Stuckey
Company Name:	Vistra Corp
Address:	see Section A
Quote Reference:	
Project Manager:	
Profile #	

REGULATORY AGENCY

NPDES GROUND WATER DRINKING WATER
UST RCRA OTHER

Site Location STATE: IL

Section D Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
WIPE	WP
AIR	AR
OTHER	OT
TISSUE	TS

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED DATE	COLLECTED TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	Analysis Test: Radium 226 + Radium 228, total	Residual Chlorine (Y/N)	Project No./ Lab I.D.
1	AW-01	WT	G	1/10/22	1424		1			X							X		
2	EMW-05	1	1	1	1141		1			X							X		
3	DUP-01	1	1	1	1141		1			X							X		
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12				SM 1/10/22															
13																			
14																			
15																			
16																			

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
EDW-23Q1-845-301-R3		01/10/23	1600				
	RAMBOLL				1/10/23	1600	7.9 / Y / Y / Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: SAMUEL MALLOW

SIGNATURE of SAMPLER: [signature] DATE Signed (MM/DD/YY): 1/10/22

Temp in °C | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

February 01, 2023

Brian Voelker
Vistra - Edwards
604 Pierce Boulevard
O'Fallon, IL 62269

RE: RAMBOLL DELINEATION

Dear Brian Voelker:

Please find enclosed the analytical results for the **4** sample(s) the laboratory received on **1/10/23 4:00 pm** and logged in under work order **GA01675**. All testing is performed according to our current TNI accreditations unless otherwise noted. This report cannot be reproduced, except in full, without the written permission of Pace Analytical Services, LLC.

If you have any questions regarding your report, please contact your project manager. Quality and timely data is of the utmost importance to us.

Pace Analytical Services appreciates the opportunity to provide you with analytical expertise . We are always trying to improve our customer service and we welcome you to contact the General Manager, Lisa Grant, with any feedback you have about your experience with our laboratory at 309-683-1764 or lisa.grant@pacelabs.com.

Gail J Schindler

Gail Schindler
Project Manager
(309) 692-9688 x1716
gail.schindler@pacelabs.com

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

SAMPLE RECEIPT CHECK LIST

Items not applicable will be marked as in compliance

Work Order GA01675

YES	Samples received within temperature compliance when applicable
YES	COC present upon sample receipt
YES	COC completed & legible
YES	Sampler name & signature present
YES	Unique sample IDs assigned
YES	Sample collection location recorded
YES	Date & time collected recorded on COC
YES	Relinquished by client signature on COC
NO	COC & labels match
YES	Sample labels are legible
YES	Appropriate bottle(s) received
YES	Sufficient sample volume received
YES	Sample containers received undamaged
NO	Zero headspace, <6 mm present in VOA vials
NO	Trip blank(s) received
YES	All non-field analyses received within holding times
NO	Short hold time analysis
NO	Current PDC COC submitted
NO	Case narrative provided

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

ANALYTICAL RESULTS

Sample: GA01675-01
Name: AW-01
Matrix: Ground Water - Grab

Sampled: 01/10/23 14:14
Received: 01/10/23 16:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	14	mg/L	Q4	01/21/23 11:07	10	10	01/21/23 11:07	LAM	EPA 300.0 REV 2.1
Sulfate	41	mg/L		01/24/23 19:48	10	10	01/24/23 19:48	CRD	EPA 300.0 REV 2.1
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	440	mg/L		01/17/23 10:08	1	2.0	01/17/23 10:08	HRF	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 2.0	mg/L		01/17/23 10:08	1	2.0	01/17/23 10:08	HRF	SM 2320B 1997*
Fluoride	0.277	mg/L		01/27/23 13:26	1	0.250	01/27/23 13:26	ANK	SM 4500F C 1997
Solids - total dissolved solids (TDS)	760	mg/L		01/16/23 11:08	1	26	01/16/23 12:25	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		01/17/23 08:50	5	3.0	01/19/23 12:32	JMW	EPA 6020A
Arsenic	7.1	ug/L		01/17/23 08:50	5	1.0	01/19/23 12:32	JMW	EPA 6020A
Barium	120	ug/L		01/17/23 08:50	5	1.0	01/19/23 12:32	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		01/17/23 08:50	5	1.0	01/19/23 12:32	JMW	EPA 6020A
Boron	75	ug/L		01/17/23 08:50	5	10	01/19/23 12:32	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		01/17/23 08:50	5	1.0	01/19/23 12:32	JMW	EPA 6020A
Calcium	170	mg/L	Q4	01/17/23 08:50	5	0.20	01/19/23 12:32	JMW	EPA 6020A
Chromium	< 4.0	ug/L		01/17/23 08:50	5	4.0	01/19/23 12:32	JMW	EPA 6020A
Cobalt	3.7	ug/L		01/17/23 08:50	5	2.0	01/19/23 12:32	JMW	EPA 6020A
Lead	< 1.0	ug/L		01/17/23 08:50	5	1.0	01/19/23 12:32	JMW	EPA 6020A
Magnesium	73	mg/L	Q4	01/17/23 08:50	5	0.10	01/19/23 12:32	JMW	EPA 6020A
Mercury	< 0.20	ug/L		01/17/23 08:50	5	0.20	01/19/23 12:32	JMW	EPA 6020A
Molybdenum	5.1	ug/L		01/17/23 08:50	5	1.0	01/19/23 12:32	JMW	EPA 6020A
Potassium	0.98	mg/L	B	01/17/23 08:50	5	0.10	01/19/23 12:32	JMW	EPA 6020A
Selenium	< 1.0	ug/L		01/17/23 08:50	5	1.0	01/19/23 12:32	JMW	EPA 6020A
Sodium	22	mg/L		01/17/23 08:50	5	0.10	01/19/23 12:32	JMW	EPA 6020A
Thallium	< 1.0	ug/L		01/17/23 08:50	5	1.0	01/19/23 12:32	JMW	EPA 6020A
Lithium	< 0.020	mg/L		01/17/23 08:50	1	0.020	01/24/23 14:03	TJJ	EPA 6010B

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

ANALYTICAL RESULTS

Sample: GA01675-02
Name: EMW-05
Matrix: Ground Water - Grab

Sampled: 01/10/23 11:41
Received: 01/10/23 16:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	29	mg/L	Q4	01/21/23 12:20	5	5.0	01/21/23 12:20	LAM	EPA 300.0 REV 2.1
Fluoride	0.264	mg/L		01/21/23 11:26	1	0.250	01/21/23 11:26	LAM	EPA 300.0 REV 2.1
Sulfate	130	mg/L		01/24/23 20:06	25	25	01/24/23 20:06	CRD	EPA 300.0 REV 2.1
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	400	mg/L		01/17/23 10:08	1	2.0	01/17/23 10:08	HRF	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 2.0	mg/L		01/17/23 10:08	1	2.0	01/17/23 10:08	HRF	SM 2320B 1997*
Solids - total dissolved solids (TDS)	830	mg/L		01/16/23 11:08	1	26	01/16/23 12:25	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		01/18/23 09:10	5	3.0	01/20/23 09:25	JMW	EPA 6020A
Arsenic	20	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:25	JMW	EPA 6020A
Barium	650	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:25	JMW	EPA 6020A
Beryllium	3.9	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:25	JMW	EPA 6020A
Boron	320	ug/L		01/17/23 08:50	5	10	01/19/23 12:36	JMW	EPA 6020A
Cadmium	2.0	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:25	JMW	EPA 6020A
Calcium	230	mg/L		01/17/23 08:50	5	0.20	01/19/23 12:36	JMW	EPA 6020A
Chromium	130	ug/L		01/18/23 09:10	5	4.0	01/20/23 09:25	JMW	EPA 6020A
Cobalt	67	ug/L		01/18/23 09:10	5	2.0	01/20/23 09:25	JMW	EPA 6020A
Lead	74	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:25	JMW	EPA 6020A
Magnesium	110	mg/L		01/17/23 08:50	5	0.10	01/19/23 12:36	JMW	EPA 6020A
Mercury	0.32	ug/L		01/18/23 09:10	5	0.20	01/20/23 11:37	JMW	EPA 6020A
Molybdenum	4.0	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:25	JMW	EPA 6020A
Potassium	7.1	mg/L		01/17/23 08:50	5	0.10	01/19/23 12:36	JMW	EPA 6020A
Selenium	3.6	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:25	JMW	EPA 6020A
Sodium	21	mg/L		01/17/23 08:50	5	0.10	01/19/23 12:36	JMW	EPA 6020A
Thallium	< 1.0	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:25	JMW	EPA 6020A
Lithium	0.092	mg/L		01/18/23 09:10	1	0.020	01/19/23 16:01	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GA01675-03
Name: EB-01
Matrix: Ground Water - Grab

Sampled: 01/10/23 15:00
Received: 01/10/23 16:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Total Metals - PIA									
Antimony	< 3.0	ug/L		01/18/23 09:10	5	3.0	01/20/23 09:29	JMW	EPA 6020A
Arsenic	< 1.0	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:29	JMW	EPA 6020A
Barium	< 1.0	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:29	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:29	JMW	EPA 6020A
Boron	26	ug/L		01/17/23 08:50	5	10	01/19/23 12:39	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:29	JMW	EPA 6020A
Calcium	< 0.20	mg/L		01/17/23 08:50	5	0.20	01/19/23 12:39	JMW	EPA 6020A
Chromium	< 4.0	ug/L		01/18/23 09:10	5	4.0	01/20/23 09:29	JMW	EPA 6020A
Cobalt	< 2.0	ug/L		01/18/23 09:10	5	2.0	01/20/23 09:29	JMW	EPA 6020A
Lead	< 1.0	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:29	JMW	EPA 6020A
Magnesium	< 0.10	mg/L		01/17/23 08:50	5	0.10	01/19/23 12:39	JMW	EPA 6020A
Mercury	< 0.20	ug/L		01/18/23 09:10	5	0.20	01/20/23 09:29	JMW	EPA 6020A
Molybdenum	< 1.0	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:29	JMW	EPA 6020A
Potassium	0.17	mg/L	B	01/17/23 08:50	5	0.10	01/19/23 12:39	JMW	EPA 6020A
Selenium	< 1.0	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:29	JMW	EPA 6020A
Sodium	0.27	mg/L	Ba	01/17/23 08:50	5	0.10	01/19/23 12:39	JMW	EPA 6020A
Thallium	< 1.0	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:29	JMW	EPA 6020A
Lithium	< 0.020	mg/L		01/18/23 09:10	1	0.020	01/19/23 16:03	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GA01675-04
Name: DUP-01
Matrix: Ground Water - Grab

Sampled: 01/10/23 11:41
Received: 01/10/23 16:00

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	30	mg/L		01/21/23 13:50	5	5.0	01/21/23 13:50	LAM	EPA 300.0 REV 2.1
Fluoride	0.261	mg/L		01/21/23 13:32	1	0.250	01/21/23 13:32	LAM	EPA 300.0 REV 2.1
Sulfate	130	mg/L		01/24/23 20:24	25	25	01/24/23 20:24	CRD	EPA 300.0 REV 2.1
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	380	mg/L		01/17/23 10:08	1	2.0	01/17/23 10:08	HRF	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 2.0	mg/L		01/17/23 10:08	1	2.0	01/17/23 10:08	HRF	SM 2320B 1997*
Solids - total dissolved solids (TDS)	800	mg/L		01/16/23 11:08	1	26	01/16/23 12:25	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		01/18/23 09:10	5	3.0	01/20/23 09:33	JMW	EPA 6020A
Arsenic	11	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:33	JMW	EPA 6020A
Barium	470	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:33	JMW	EPA 6020A
Beryllium	2.6	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:33	JMW	EPA 6020A
Boron	310	ug/L		01/17/23 08:50	5	10	01/19/23 12:43	JMW	EPA 6020A
Cadmium	1.4	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:33	JMW	EPA 6020A
Calcium	210	mg/L		01/17/23 08:50	5	0.20	01/19/23 12:43	JMW	EPA 6020A
Chromium	89	ug/L		01/18/23 09:10	5	4.0	01/20/23 09:33	JMW	EPA 6020A
Cobalt	46	ug/L		01/18/23 09:10	5	2.0	01/20/23 09:33	JMW	EPA 6020A
Lead	52	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:33	JMW	EPA 6020A
Magnesium	100	mg/L		01/17/23 08:50	5	0.10	01/19/23 12:43	JMW	EPA 6020A
Mercury	0.24	ug/L		01/18/23 09:10	5	0.20	01/20/23 11:40	JMW	EPA 6020A
Molybdenum	3.2	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:33	JMW	EPA 6020A
Potassium	5.5	mg/L		01/17/23 08:50	5	0.10	01/19/23 12:43	JMW	EPA 6020A
Selenium	1.9	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:33	JMW	EPA 6020A
Sodium	22	mg/L		01/17/23 08:50	5	0.10	01/19/23 12:43	JMW	EPA 6020A
Thallium	< 1.0	ug/L		01/18/23 09:10	5	1.0	01/20/23 09:33	JMW	EPA 6020A
Lithium	0.066	mg/L		01/18/23 09:10	1	0.020	01/19/23 16:06	TJJ	EPA 6010B

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QC SAMPLE RESULTS

Parameter	Result	Unit	Qual	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch B323248 - No Prep - SM 2540C									
Blank (B323248-BLK1)				Prepared & Analyzed: 01/16/23					
Solids - total dissolved solids (TDS)	< 17	mg/L							
LCS (B323248-BS1)				Prepared & Analyzed: 01/16/23					
Solids - total dissolved solids (TDS)	920	mg/L		1000		92	84.9-109		
Duplicate (B323248-DUP1)	**Sample: GA01675-01**			Prepared & Analyzed: 01/16/23					
Solids - total dissolved solids (TDS)	780	mg/L			765			2	5
Batch B323330 - SW 3015 - EPA 6020A									
Blank (B323330-BLK1)				Prepared: 01/17/23 Analyzed: 01/19/23					
Antimony	< 3.0	ug/L							
Arsenic	< 1.0	ug/L							
Barium	< 1.0	ug/L							
Beryllium	< 1.0	ug/L							
Boron	< 10	ug/L							
Cadmium	< 1.0	ug/L							
Calcium	< 0.20	mg/L							
Chromium	< 4.0	ug/L							
Cobalt	< 2.0	ug/L							
Lead	< 1.0	ug/L							
Magnesium	< 0.10	mg/L							
Mercury	< 0.20	ug/L							
Molybdenum	< 1.0	ug/L							
Potassium	0.256	mg/L	B						
Selenium	< 1.0	ug/L							
Sodium	0.312	mg/L	Ba						
Thallium	< 1.0	ug/L							
Lithium	< 0.020	mg/L							
LCS (B323330-BS1)				Prepared: 01/17/23 Analyzed: 01/19/23					
Antimony	526	ug/L		555.6		95	80-120		
Arsenic	552	ug/L		555.6		99	80-120		
Barium	541	ug/L		555.6		97	80-120		
Beryllium	561	ug/L		555.6		101	80-120		
Boron	507	ug/L		555.6		91	80-120		
Cadmium	531	ug/L		555.6		96	80-120		
Calcium	5.43	mg/L		5.556		98	80-120		
Chromium	556	ug/L		555.6		100	80-120		
Cobalt	547	ug/L		555.6		98	80-120		
Lead	530	ug/L		555.6		95	80-120		
Magnesium	5.63	mg/L		5.556		101	80-120		
Mercury	54.1	ug/L		55.56		97	80-120		
Molybdenum	546	ug/L		555.6		98	80-120		
Potassium	6.06	mg/L		5.556		109	80-120		
Selenium	536	ug/L		555.6		96	80-120		

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QC SAMPLE RESULTS

Parameter	Result	Unit	Qual	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch B323330 - SW 3015 - EPA 6020A									
LCS (B323330-BS1)				Prepared: 01/17/23 Analyzed: 01/19/23					
Sodium	5.69	mg/L		5.556		102	80-120		
Thallium	530	ug/L		555.6		95	80-120		
Lithium	0.513	mg/L		0.5556		92	80-120		
Matrix Spike (B323330-MS1)	**Sample: GA01675-01**			Prepared: 01/17/23 Analyzed: 01/19/23					
Antimony	523	ug/L		555.6	0.639	94	75-125		
Arsenic	568	ug/L		555.6	7.09	101	75-125		
Barium	671	ug/L		555.6	125	98	75-125		
Beryllium	569	ug/L		555.6	ND	102	75-125		
Boron	586	ug/L		555.6	74.8	92	75-125		
Cadmium	538	ug/L		555.6	ND	97	75-125		
Calcium	175	mg/L	Q4	5.556	173	49	75-125		
Chromium	550	ug/L		555.6	ND	99	75-125		
Cobalt	544	ug/L		555.6	3.66	97	75-125		
Lead	527	ug/L		555.6	0.700	95	75-125		
Magnesium	76.7	mg/L	Q4	5.556	72.6	74	75-125		
Mercury	54.9	ug/L		55.56	ND	99	75-125		
Molybdenum	575	ug/L		555.6	5.08	103	75-125		
Potassium	6.78	mg/L		5.556	0.981	104	75-125		
Selenium	549	ug/L		555.6	ND	99	75-125		
Sodium	26.6	mg/L		5.556	21.7	89	75-125		
Thallium	523	ug/L		555.6	ND	94	75-125		
Lithium	0.526	mg/L		0.5556	0.00591	94	75-125		
Matrix Spike Dup (B323330-MSD1)	**Sample: GA01675-01**			Prepared: 01/17/23 Analyzed: 01/19/23					
Antimony	521	ug/L		555.6	0.639	94	75-125	0.4	20
Arsenic	574	ug/L		555.6	7.09	102	75-125	0.9	20
Barium	664	ug/L		555.6	125	97	75-125	1	20
Beryllium	576	ug/L		555.6	ND	104	75-125	1	20
Boron	595	ug/L		555.6	74.8	94	75-125	2	20
Cadmium	538	ug/L		555.6	ND	97	75-125	0.08	20
Calcium	176	mg/L	Q4	5.556	173	63	75-125	0.4	20
Chromium	556	ug/L		555.6	ND	100	75-125	1	20
Cobalt	547	ug/L		555.6	3.66	98	75-125	0.5	20
Lead	531	ug/L		555.6	0.700	96	75-125	0.8	20
Magnesium	76.9	mg/L	Q4	5.556	72.6	78	75-125	0.3	20
Mercury	56.0	ug/L		55.56	ND	101	75-125	2	20
Molybdenum	572	ug/L		555.6	5.08	102	75-125	0.6	20
Potassium	6.85	mg/L		5.556	0.981	106	75-125	1	20
Selenium	559	ug/L		555.6	ND	101	75-125	2	20
Sodium	27.1	mg/L		5.556	21.7	97	75-125	2	20
Thallium	532	ug/L		555.6	ND	96	75-125	2	20
Lithium	0.530	mg/L		0.5556	0.00591	94	75-125	0.7	200

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QC SAMPLE RESULTS

Parameter	Result	Unit	Qual	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch B323436 - SW 3015 - EPA 6020A									
Blank (B323436-BLK1)				Prepared: 01/18/23 Analyzed: 01/20/23					
Antimony	< 3.0	ug/L							
Arsenic	< 1.0	ug/L							
Barium	< 1.0	ug/L							
Beryllium	< 1.0	ug/L							
Cadmium	< 1.0	ug/L							
Chromium	< 4.0	ug/L							
Cobalt	< 2.0	ug/L							
Lead	< 1.0	ug/L							
Mercury	< 0.20	ug/L							
Molybdenum	< 1.0	ug/L							
Selenium	< 1.0	ug/L							
Thallium	< 1.0	ug/L							
Lithium	< 0.020	mg/L							
LCS (B323436-BS1)				Prepared: 01/18/23 Analyzed: 01/20/23					
Antimony	524	ug/L		555.6		94	80-120		
Arsenic	552	ug/L		555.6		99	80-120		
Barium	573	ug/L		555.6		103	80-120		
Beryllium	562	ug/L		555.6		101	80-120		
Cadmium	532	ug/L		555.6		96	80-120		
Chromium	533	ug/L		555.6		96	80-120		
Cobalt	545	ug/L		555.6		98	80-120		
Lead	541	ug/L		555.6		97	80-120		
Mercury	53.9	ug/L		55.56		97	80-120		
Molybdenum	542	ug/L		555.6		98	80-120		
Selenium	567	ug/L		555.6		102	80-120		
Thallium	534	ug/L		555.6		96	80-120		
Lithium	0.516	mg/L		0.5556		93	80-120		
Batch B323854 - IC No Prep - EPA 300.0 REV 2.1									
Calibration Blank (B323854-CCB1)				Prepared & Analyzed: 01/21/23					
Chloride	0.220	mg/L							
Fluoride	0.00	mg/L							
Calibration Check (B323854-CCV1)				Prepared & Analyzed: 01/21/23					
Fluoride	5.42	mg/L		5.000		108	90-110		
Chloride	5.42	mg/L		5.000		108	90-110		
Matrix Spike (B323854-MS1)	**Sample: GA01675-01**			Prepared & Analyzed: 01/21/23					
Chloride	1.0E9	mg/L	Q4	1.500	14	NR	80-120		
Matrix Spike (B323854-MS2)	**Sample: GA01675-02**			Prepared & Analyzed: 01/21/23					
Chloride	1.0E9	mg/L	Q4	1.500	29	NR	80-120		
Fluoride	1.68	mg/L		1.500	0.264	94	80-120		
Matrix Spike Dup (B323854-MSD1)	**Sample: GA01675-01**			Prepared & Analyzed: 01/21/23					
Chloride	1.0E9	mg/L	Q4	1.500	14	NR	80-120	0	20

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QC SAMPLE RESULTS

Parameter	Result	Unit	Qual	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch B323854 - IC No Prep - EPA 300.0 REV 2.1									
Matrix Spike Dup (B323854-MSD2)	**Sample: GA01675-02**			Prepared & Analyzed: 01/21/23					
Fluoride	1.68	mg/L		1.500	0.264	94	80-120	0.2	20
Chloride	1.0E9	mg/L	Q4	1.500	29	NR	80-120	0	20
Batch B324042 - IC No Prep - EPA 300.0 REV 2.1									
Calibration Blank (B324042-CCB1)				Prepared & Analyzed: 01/24/23					
Sulfate	0.00	mg/L							
Calibration Check (B324042-CCV1)				Prepared & Analyzed: 01/24/23					
Sulfate	4.77	mg/L		5.000		95	90-110		

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NOTES

Specifications regarding method revisions, method modifications, and calculations used for analysis are available upon request. Please contact your project manager.

* Not a TNI accredited analyte

Certifications

CHI - McHenry, IL - 4314-A W. Crystal Lake Road, McHenry, IL 60050
TNI Accreditation for Drinking Water and Wastewater Fields of Testing through IL EPA Accreditation No. 100279
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory Registry No. 17556

PIA - Peoria, IL - 2231 W. Altorfer Drive, Peoria, IL 61615
TNI Accreditation for Drinking Water, Wastewater, Solid and Hazardous Material Fields of Testing through IL EPA Accreditation No. 100230
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory Registry No. 17553
Drinking Water Certifications/Accreditations: Iowa (240); Kansas (E-10338); Missouri (870)
Wastewater Certifications/Accreditations: Arkansas (88-0677); Iowa (240); Kansas (E-10338)
Solid and Hazardous Material Certifications/Accreditations: Arkansas (88-0677); Iowa (240); Kansas (E-10338)

SPMO - Springfield, MO - 1805 W Sunset Street, Springfield, MO 65807
USEPA DMR-QA Program

STL - Hazelwood, MO - 944 Anglum Rd, Hazelwood, MO 63042
TNI Accreditation for Wastewater, Solid and Hazardous Material Fields of Testing through KS KDHE Certification No. E-10389
TNI Accreditation for Wastewater, Solid and Hazardous Material Fields of Testing through IL EPA Accreditation No. - 200080
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory, Registry No. 171050
Missouri Department of Natural Resources - Certificate of Approval for Microbiological Laboratory Service - No. 1050

Qualifiers

B	Present in the method blank at 256 UG/L.
Ba	Present in the method blank at 312 ug/L.
Q4	The matrix spike recovery result is unusable since the analyte concentration in the sample is greater than four times the spike level. The associated blank spike was acceptable.

Gail J Schindler

Certified by: Gail Schindler, Project Manager

RAMBOLL COC#: 1940102792-2023-0110-003

GA01675

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:	Section B Required Project Information:	Section C Invoice Information:
Company: Vistra Corp	Report To: Brian Voelker	Attention: Jason Stuckey
Address: 13498 E. 900th St	Copy To: Jason Stuckey	Company Name: Vistra Corp
		Address: see Section A
Email To: Brian.Voelker@VistraCorp.com	Purchase Order No.:	Quote Reference:
Phone: (217) 753-8911 Fax:	Project Name:	Project Manager:
Requested Due Date/TAT: standard	Project Number: 2285	Profile #:

REGULATORY AGENCY

NPDES GROUND WATER DRINKING WATER

UST RCRA OTHER:

Site Location STATE: IL

Valid Matrix Codes: DRINKING WATER DW; WATER WT; WASTE WATER WW; PRODUCT P; SOIL/SOLID SL; OIL OL; WIPE WP; AIR AR; OTHER OT; TISSUE TS

ITEM #	Section D Required Client Information: SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED DATE	COLLECTED TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	EDW-845-301_R3	Residual Chlorine (Y/N)	Project No./ Lab I.D.
1	AW-01	WT	G	1/10/22	1424		2	X		X							X		
2	EMW-05	1	1	1	1141		2	X		X							X		
3	EB-01	1	1	1	1500		1			X							X		
4	DUP-01	WT	G	1/10/22	1141		2	X		X							X		
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			

SM 1/10/22

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
EDW-23Q1-845-301-R3 NO RADIUM 226 + RADIUM 228, TOTAL		01/10/23	1600							
	RAMBOLL			Jonathan O'Neil	1/10/23	1600	7.9	Y	Y	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: SAMUEL MALLOW

SIGNATURE of SAMPLER: [signature] DATE Signed (MM/DD/YY): 1/10/22

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

March 27, 2023

Brian Voelker
Vistra - Edwards
604 Pierce Boulevard
O'Fallon, IL 62269

Dear Brian Voelker:

Please find enclosed the analytical results for the sample(s) the laboratory received. All testing is performed according to our current TNI accreditations unless otherwise noted. This report cannot be reproduced, except in full, without the written permission of Pace Analytical Services, LLC.

If you have any questions regarding your report, please contact your project manager. Quality and timely data is of the utmost importance to us.

Pace Analytical Services appreciates the opportunity to provide you with analytical expertise. We are always trying to improve our customer service and we welcome you to contact the General Manager, Lisa Grant, with any feedback you have about your experience with our laboratory at 309-683-1764 or lisa.grant@pacelabs.com.

Sincerely,

Gail Schindler
Project Manager
(309) 692-9688 x1716
gail.schindler@pacelabs.com

Pace Analytical Services, LLC
2231 W. Altorfer Drive
Peoria, IL 61615
(800)752-6651

SAMPLE RECEIPT CHECK LIST

Items not applicable will be marked as in compliance

Work Order GB04667

YES	Samples received within temperature compliance when applicable
YES	COC present upon sample receipt
YES	COC completed & legible
YES	Sampler name & signature present
YES	Unique sample IDs assigned
YES	Sample collection location recorded
YES	Date & time collected recorded on COC
YES	Relinquished by client signature on COC
YES	COC & labels match
YES	Sample labels are legible
YES	Appropriate bottle(s) received
YES	Sufficient sample volume received
YES	Sample containers received undamaged
NO	Zero headspace, <6 mm present in VOA vials
NO	Trip blank(s) received
YES	All non-field analyses received within holding times
NO	Short hold time analysis
YES	Current PDC COC submitted
NO	Case narrative provided

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Work Order GC00016

YES	Samples received within temperature compliance when applicable
YES	COC present upon sample receipt
YES	COC completed & legible
YES	Sampler name & signature present
YES	Unique sample IDs assigned
YES	Sample collection location recorded
YES	Date & time collected recorded on COC
YES	Relinquished by client signature on COC
YES	COC & labels match
YES	Sample labels are legible
YES	Appropriate bottle(s) received
YES	Sufficient sample volume received
YES	Sample containers received undamaged
YES	Zero headspace, <6 mm present in VOA vials
YES	Trip blank(s) received
YES	All non-field analyses received within holding times
YES	Short hold time analysis
YES	Current PDC COC submitted
NO	Case narrative provided

Pace Analytical Services, LLC
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(800)752-6651

ANALYTICAL RESULTS

Sample: GB04667-01
Name: AW-15
Matrix: Ground Water - Grab

Sampled: 02/27/23 15:28
Received: 02/28/23 07:20

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	32	mg/L		03/06/23 15:05	10	10	03/06/23 15:05	CRD	EPA 300.0 REV 2.1
Sulfate	< 1.0	mg/L		03/03/23 11:55	1	1.0	03/03/23 11:55	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	9	Feet		02/27/23 15:28	1		02/27/23 15:28	FIELD	Field*
Dissolved oxygen, Field	1.0	mg/L		02/27/23 15:28	1		02/27/23 15:28	FIELD	Field*
Oxidation Reduction Potential	-102	mV		02/27/23 15:28	1	-500	02/27/23 15:28	FIELD	Field*
pH, Field Measured	6.75	pH Units		02/27/23 15:28	1		02/27/23 15:28	FIELD	Field*
Specific Conductance, Field Measured	1840	umhos/cm		02/27/23 15:28	1		02/27/23 15:28	FIELD	Field*
Temperature, Field Measured	12.8	°C		02/27/23 15:28	1		02/27/23 15:28	FIELD	Field*
Turbidity, Field Measured	107	NTU		02/27/23 15:28	1	0.00	02/27/23 15:28	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	890	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Fluoride	< 0.250	mg/L		03/08/23 12:56	1	0.250	03/08/23 12:56	TTH	SM 4500F C 1997
Solids - total dissolved solids (TDS)	1100	mg/L		03/01/23 16:04	1	26	03/01/23 17:00	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		03/06/23 09:21	5	3.0	03/07/23 09:11	JMW	EPA 6020A
Arsenic	3.5	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:11	JMW	EPA 6020A
Barium	1800	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:11	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:11	JMW	EPA 6020A
Boron	370	ug/L		03/06/23 09:21	5	10	03/07/23 09:11	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:11	JMW	EPA 6020A
Calcium	140	mg/L		03/06/23 09:21	5	0.20	03/07/23 09:11	JMW	EPA 6020A
Chromium	< 4.0	ug/L		03/06/23 09:21	5	4.0	03/07/23 09:11	JMW	EPA 6020A
Cobalt	< 2.0	ug/L		03/06/23 09:21	5	2.0	03/07/23 09:11	JMW	EPA 6020A
Lead	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:20	JMW	EPA 6020A
Magnesium	57	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:11	JMW	EPA 6020A
Mercury	0.21	ug/L		03/06/23 09:21	5	0.20	03/07/23 17:20	JMW	EPA 6020A
Molybdenum	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:11	JMW	EPA 6020A
Potassium	3.9	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:11	JMW	EPA 6020A
Selenium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:20	JMW	EPA 6020A
Sodium	210	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:11	JMW	EPA 6020A

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ANALYTICAL RESULTS

Sample: GB04667-01
Name: AW-15
Matrix: Ground Water - Grab

Sampled: 02/27/23 15:28
Received: 02/28/23 07:20

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:11	JMW	EPA 6020A
Lithium	27	ug/L		03/06/23 09:21	1	20	03/07/23 10:10	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GB04667-02
Name: AW-15S
Matrix: Ground Water - Grab

Sampled: 02/27/23 16:30
Received: 02/28/23 07:20

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	28	mg/L		03/03/23 13:25	10	10	03/03/23 13:25	CRD	EPA 300.0 REV 2.1
Fluoride	0.252	mg/L		03/03/23 13:07	1	0.250	03/03/23 13:07	CRD	EPA 300.0 REV 2.1
Sulfate	510	mg/L		03/03/23 13:43	100	100	03/03/23 13:43	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	10.04	Feet		02/27/23 16:30	1		02/27/23 16:30	FIELD	Field*
Dissolved oxygen, Field	0.64	mg/L		02/27/23 16:30	1		02/27/23 16:30	FIELD	Field*
Oxidation Reduction Potential	117	mV		02/27/23 16:30	1	-500	02/27/23 16:30	FIELD	Field*
pH, Field Measured	6.81	pH Units		02/27/23 16:30	1		02/27/23 16:30	FIELD	Field*
Specific Conductance, Field Measured	1670	umhos/cm		02/27/23 16:30	1		02/27/23 16:30	FIELD	Field*
Temperature, Field Measured	11.8	°C		02/27/23 16:30	1		02/27/23 16:30	FIELD	Field*
Turbidity, Field Measured	78.0	NTU		02/27/23 16:30	1	0.00	02/27/23 16:30	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	400	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Solids - total dissolved solids (TDS)	1300	mg/L		03/01/23 16:04	1	26	03/01/23 17:00	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		03/06/23 09:21	5	3.0	03/07/23 09:15	JMW	EPA 6020A
Arsenic	1.8	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:15	JMW	EPA 6020A
Barium	81	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:15	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:15	JMW	EPA 6020A
Boron	5900	ug/L		03/06/23 09:21	5	10	03/07/23 09:15	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:15	JMW	EPA 6020A
Calcium	260	mg/L		03/06/23 09:21	5	0.20	03/07/23 09:15	JMW	EPA 6020A
Chromium	< 4.0	ug/L		03/06/23 09:21	5	4.0	03/07/23 09:15	JMW	EPA 6020A
Cobalt	< 2.0	ug/L		03/06/23 09:21	5	2.0	03/07/23 09:15	JMW	EPA 6020A
Lead	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:23	JMW	EPA 6020A
Magnesium	82	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:15	JMW	EPA 6020A
Mercury	< 0.20	ug/L		03/06/23 09:21	5	0.20	03/07/23 17:23	JMW	EPA 6020A
Molybdenum	3.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:15	JMW	EPA 6020A
Potassium	0.69	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:15	JMW	EPA 6020A
Selenium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:23	JMW	EPA 6020A
Sodium	52	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:15	JMW	EPA 6020A

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ANALYTICAL RESULTS

Sample: GB04667-02
Name: AW-15S
Matrix: Ground Water - Grab

Sampled: 02/27/23 16:30
Received: 02/28/23 07:20

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:15	JMW	EPA 6020A
Lithium	< 20	ug/L		03/06/23 09:21	1	20	03/07/23 10:14	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GB04667-03
Name: AW-18
Matrix: Ground Water - Grab

Sampled: 02/27/23 16:50
Received: 02/28/23 07:20

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	81	mg/L		03/03/23 14:19	10	10	03/03/23 14:19	CRD	EPA 300.0 REV 2.1
Fluoride	< 0.250	mg/L		03/03/23 14:01	1	0.250	03/03/23 14:01	CRD	EPA 300.0 REV 2.1
Sulfate	10	mg/L		03/03/23 14:19	10	10	03/03/23 14:19	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	27	Feet		02/27/23 16:50	1		02/27/23 16:50	FIELD	Field*
Dissolved oxygen, Field	0.77	mg/L		02/27/23 16:50	1		02/27/23 16:50	FIELD	Field*
Oxidation Reduction Potential	-94.0	mV		02/27/23 16:50	1	-500	02/27/23 16:50	FIELD	Field*
pH, Field Measured	6.93	pH Units		02/27/23 16:50	1		02/27/23 16:50	FIELD	Field*
Specific Conductance, Field Measured	1660	umhos/cm		02/27/23 16:50	1		02/27/23 16:50	FIELD	Field*
Temperature, Field Measured	12.2	°C		02/27/23 16:50	1		02/27/23 16:50	FIELD	Field*
Turbidity, Field Measured	499	NTU		02/27/23 16:50	1	0.00	02/27/23 16:50	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	640	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Solids - total dissolved solids (TDS)	830	mg/L		03/01/23 16:04	1	26	03/01/23 17:00	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		03/06/23 09:21	5	3.0	03/07/23 09:19	JMW	EPA 6020A
Arsenic	8.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:19	JMW	EPA 6020A
Barium	1800	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:19	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:19	JMW	EPA 6020A
Boron	380	ug/L		03/06/23 09:21	5	10	03/07/23 09:19	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:19	JMW	EPA 6020A
Calcium	140	mg/L		03/06/23 09:21	5	0.20	03/07/23 09:19	JMW	EPA 6020A
Chromium	62	ug/L		03/06/23 09:21	5	4.0	03/07/23 09:19	JMW	EPA 6020A
Cobalt	6.2	ug/L		03/06/23 09:21	5	2.0	03/07/23 09:19	JMW	EPA 6020A
Lead	8.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:26	JMW	EPA 6020A
Magnesium	59	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:19	JMW	EPA 6020A
Mercury	< 0.20	ug/L		03/06/23 09:21	5	0.20	03/07/23 17:26	JMW	EPA 6020A
Molybdenum	5.1	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:19	JMW	EPA 6020A
Potassium	5.0	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:19	JMW	EPA 6020A
Selenium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:26	JMW	EPA 6020A
Sodium	210	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:19	JMW	EPA 6020A

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(800)752-6651

ANALYTICAL RESULTS

Sample: GB04667-03
Name: AW-18
Matrix: Ground Water - Grab

Sampled: 02/27/23 16:50
Received: 02/28/23 07:20

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:19	JMW	EPA 6020A
Lithium	35	ug/L		03/06/23 09:21	1	20	03/07/23 10:15	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GB04667-04
Name: AW-19
Matrix: Ground Water - Grab

Sampled: 02/27/23 15:29
Received: 02/28/23 07:20

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	69	mg/L		03/03/23 15:31	10	10	03/03/23 15:31	CRD	EPA 300.0 REV 2.1
Fluoride	0.336	mg/L		03/03/23 14:37	1	0.250	03/03/23 14:37	CRD	EPA 300.0 REV 2.1
Sulfate	46	mg/L		03/03/23 15:31	10	10	03/03/23 15:31	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	13.37	Feet		02/27/23 15:29	1		02/27/23 15:29	FIELD	Field*
Dissolved oxygen, Field	1.9	mg/L		02/27/23 15:29	1		02/27/23 15:29	FIELD	Field*
Oxidation Reduction Potential	20.0	mV		02/27/23 15:29	1	-500	02/27/23 15:29	FIELD	Field*
pH, Field Measured	7.00	pH Units		02/27/23 15:29	1		02/27/23 15:29	FIELD	Field*
Specific Conductance, Field Measured	1080	umhos/cm		02/27/23 15:29	1		02/27/23 15:29	FIELD	Field*
Temperature, Field Measured	12.9	°C		02/27/23 15:29	1		02/27/23 15:29	FIELD	Field*
Turbidity, Field Measured	185	NTU		02/27/23 15:29	1	0.00	02/27/23 15:29	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	380	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Solids - total dissolved solids (TDS)	600	mg/L		03/01/23 16:04	1	26	03/01/23 17:00	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		03/06/23 09:21	5	3.0	03/07/23 09:23	JMW	EPA 6020A
Arsenic	22	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:23	JMW	EPA 6020A
Barium	370	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:23	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:23	JMW	EPA 6020A
Boron	2900	ug/L		03/06/23 09:21	5	10	03/07/23 09:23	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:23	JMW	EPA 6020A
Calcium	130	mg/L		03/06/23 09:21	5	0.20	03/07/23 09:23	JMW	EPA 6020A
Chromium	31	ug/L		03/06/23 09:21	5	4.0	03/07/23 09:23	JMW	EPA 6020A
Cobalt	4.8	ug/L		03/06/23 09:21	5	2.0	03/07/23 09:23	JMW	EPA 6020A
Lead	5.4	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:29	JMW	EPA 6020A
Magnesium	58	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:23	JMW	EPA 6020A
Mercury	< 0.20	ug/L		03/06/23 09:21	5	0.20	03/07/23 17:29	JMW	EPA 6020A
Molybdenum	5.5	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:23	JMW	EPA 6020A
Potassium	1.5	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:23	JMW	EPA 6020A
Selenium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:29	JMW	EPA 6020A
Sodium	56	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:23	JMW	EPA 6020A

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Peoria, IL 61615
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ANALYTICAL RESULTS

Sample: GB04667-04
Name: AW-19
Matrix: Ground Water - Grab

Sampled: 02/27/23 15:29
Received: 02/28/23 07:20

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:23	JMW	EPA 6020A
Lithium	< 20	ug/L		03/06/23 09:21	1	20	03/07/23 10:16	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GC00016-01
Name: AP05S
Matrix: Ground Water - Grab

Sampled: 02/28/23 14:40
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	33	mg/L		03/06/23 17:41	10	10	03/06/23 17:41	CRD	EPA 300.0 REV 2.1
Sulfate	14	mg/L		03/06/23 17:41	10	10	03/06/23 17:41	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	5.43	Feet		02/28/23 14:40	1		02/28/23 14:40	FIELD	Field*
Dissolved oxygen, Field	1.2	mg/L		02/28/23 14:40	1		02/28/23 14:40	FIELD	Field*
Oxidation Reduction Potential	-87.0	mV		02/28/23 14:40	1	-500	02/28/23 14:40	FIELD	Field*
pH, Field Measured	7.01	pH Units		02/28/23 14:40	1		02/28/23 14:40	FIELD	Field*
Specific Conductance, Field Measured	1390	umhos/cm		02/28/23 14:40	1		02/28/23 14:40	FIELD	Field*
Temperature, Field Measured	14.0	°C		02/28/23 14:40	1		02/28/23 14:40	FIELD	Field*
Turbidity, Field Measured	>1000	NTU		02/28/23 14:40	1	0.00	02/28/23 14:40	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	660	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Fluoride	< 0.250	mg/L		03/08/23 12:57	1	0.250	03/08/23 12:57	TTH	SM 4500F C 1997
Solids - total dissolved solids (TDS)	820	mg/L		03/01/23 16:04	1	26	03/01/23 17:00	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		03/06/23 09:21	5	3.0	03/07/23 09:26	JMW	EPA 6020A
Arsenic	7.3	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:26	JMW	EPA 6020A
Barium	940	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:26	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:26	JMW	EPA 6020A
Boron	340	ug/L		03/06/23 09:21	5	10	03/07/23 09:26	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:26	JMW	EPA 6020A
Calcium	120	mg/L		03/06/23 09:21	5	0.20	03/07/23 09:26	JMW	EPA 6020A
Chromium	25	ug/L		03/06/23 09:21	5	4.0	03/07/23 09:26	JMW	EPA 6020A
Cobalt	12	ug/L		03/06/23 09:21	5	2.0	03/07/23 09:26	JMW	EPA 6020A
Lead	14	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:32	JMW	EPA 6020A
Magnesium	54	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:26	JMW	EPA 6020A
Mercury	< 0.20	ug/L		03/06/23 09:21	5	0.20	03/07/23 17:32	JMW	EPA 6020A
Molybdenum	2.1	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:26	JMW	EPA 6020A
Potassium	4.6	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:26	JMW	EPA 6020A
Selenium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:32	JMW	EPA 6020A
Sodium	180	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:26	JMW	EPA 6020A

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ANALYTICAL RESULTS

Sample: GC00016-01
Name: AP05S
Matrix: Ground Water - Grab

Sampled: 02/28/23 14:40
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:26	JMW	EPA 6020A
Lithium	39	ug/L		03/06/23 09:21	1	20	03/07/23 10:17	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GC00016-02
Name: AP07S
Matrix: Ground Water - Grab

Sampled: 02/28/23 13:28
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	73	mg/L		03/06/23 18:18	50	50	03/06/23 18:18	CRD	EPA 300.0 REV 2.1
Fluoride	< 0.250	mg/L		03/06/23 18:00	1	0.250	03/06/23 18:00	CRD	EPA 300.0 REV 2.1
Sulfate	180	mg/L		03/06/23 18:18	50	50	03/06/23 18:18	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	24.55	Feet		02/28/23 13:28	1		02/28/23 13:28	FIELD	Field*
Dissolved oxygen, Field	6.8	mg/L		02/28/23 13:28	1		02/28/23 13:28	FIELD	Field*
Oxidation Reduction Potential	100	mV		02/28/23 13:28	1	-500	02/28/23 13:28	FIELD	Field*
pH, Field Measured	7.13	pH Units		02/28/23 13:28	1		02/28/23 13:28	FIELD	Field*
Specific Conductance, Field Measured	3820	umhos/cm		02/28/23 13:28	1		02/28/23 13:28	FIELD	Field*
Temperature, Field Measured	13.5	°C		02/28/23 13:28	1		02/28/23 13:28	FIELD	Field*
Turbidity, Field Measured	>1000	NTU		02/28/23 13:28	1	0.00	02/28/23 13:28	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	280	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Solids - total dissolved solids (TDS)	720	mg/L		03/01/23 16:04	1	26	03/01/23 17:00	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		03/06/23 09:21	5	3.0	03/07/23 09:30	JMW	EPA 6020A
Arsenic	2.1	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:30	JMW	EPA 6020A
Barium	87	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:30	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:30	JMW	EPA 6020A
Boron	7900	ug/L		03/06/23 09:21	5	10	03/07/23 09:30	JMW	EPA 6020A
Cadmium	3.5	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:30	JMW	EPA 6020A
Calcium	130	mg/L		03/06/23 09:21	5	0.20	03/07/23 09:30	JMW	EPA 6020A
Chromium	25	ug/L		03/06/23 09:21	5	4.0	03/07/23 09:30	JMW	EPA 6020A
Cobalt	4.8	ug/L		03/06/23 09:21	5	2.0	03/07/23 09:30	JMW	EPA 6020A
Lead	3.4	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:35	JMW	EPA 6020A
Magnesium	49	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:30	JMW	EPA 6020A
Mercury	< 0.20	ug/L		03/06/23 09:21	5	0.20	03/07/23 17:35	JMW	EPA 6020A
Molybdenum	3.5	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:30	JMW	EPA 6020A
Potassium	1.4	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:30	JMW	EPA 6020A
Selenium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:35	JMW	EPA 6020A
Sodium	63	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:30	JMW	EPA 6020A

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ANALYTICAL RESULTS

Sample: GC00016-02
Name: AP07S
Matrix: Ground Water - Grab

Sampled: 02/28/23 13:28
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:30	JMW	EPA 6020A
Lithium	< 20	ug/L		03/06/23 09:21	1	20	03/07/23 10:22	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GC00016-03
Name: AW-01
Matrix: Ground Water - Grab

Sampled: 02/28/23 15:41
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	110	mg/L		03/07/23 17:51	50	50	03/07/23 17:51	CRD	EPA 300.0 REV 2.1
Fluoride	< 0.250	mg/L		03/06/23 18:36	1	0.250	03/06/23 18:36	CRD	EPA 300.0 REV 2.1
Sulfate	280	mg/L		03/07/23 17:51	50	50	03/07/23 17:51	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	5.47	Feet		02/28/23 15:41	1		02/28/23 15:41	FIELD	Field*
Dissolved oxygen, Field	1.1	mg/L		02/28/23 15:41	1		02/28/23 15:41	FIELD	Field*
Oxidation Reduction Potential	-89.0	mV		02/28/23 15:41	1	-500	02/28/23 15:41	FIELD	Field*
pH, Field Measured	6.98	pH Units		02/28/23 15:41	1		02/28/23 15:41	FIELD	Field*
Specific Conductance, Field Measured	1400	umhos/cm		02/28/23 15:41	1		02/28/23 15:41	FIELD	Field*
Temperature, Field Measured	13.3	°C		02/28/23 15:41	1		02/28/23 15:41	FIELD	Field*
Turbidity, Field Measured	>1000	NTU		02/28/23 15:41	1	0.00	02/28/23 15:41	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	290	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Solids - total dissolved solids (TDS)	1000	mg/L		03/02/23 09:54	1	26	03/02/23 10:44	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		03/06/23 09:21	5	3.0	03/07/23 09:34	JMW	EPA 6020A
Arsenic	20	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:34	JMW	EPA 6020A
Barium	170	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:34	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:34	JMW	EPA 6020A
Boron	1100	ug/L		03/06/23 09:21	5	10	03/07/23 09:34	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:34	JMW	EPA 6020A
Calcium	180	mg/L		03/06/23 09:21	5	0.20	03/07/23 09:34	JMW	EPA 6020A
Chromium	19	ug/L		03/06/23 09:21	5	4.0	03/07/23 09:34	JMW	EPA 6020A
Cobalt	7.0	ug/L		03/06/23 09:21	5	2.0	03/07/23 09:34	JMW	EPA 6020A
Lead	9.2	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:38	JMW	EPA 6020A
Magnesium	82	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:34	JMW	EPA 6020A
Mercury	< 0.20	ug/L		03/06/23 09:21	5	0.20	03/07/23 17:38	JMW	EPA 6020A
Molybdenum	2.2	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:34	JMW	EPA 6020A
Potassium	2.1	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:34	JMW	EPA 6020A
Selenium	1.1	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:38	JMW	EPA 6020A
Sodium	49	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:34	JMW	EPA 6020A

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ANALYTICAL RESULTS

Sample: GC00016-03
Name: AW-01
Matrix: Ground Water - Grab

Sampled: 02/28/23 15:41
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:34	JMW	EPA 6020A
Lithium	< 20	ug/L		03/06/23 09:21	1	20	03/07/23 10:23	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GC00016-04
Name: AW-05
Matrix: Ground Water - Grab

Sampled: 02/28/23 11:57
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	78	mg/L		03/06/23 20:06	10	10	03/06/23 20:06	CRD	EPA 300.0 REV 2.1
Fluoride	< 0.250	mg/L		03/06/23 19:48	1	0.250	03/06/23 19:48	CRD	EPA 300.0 REV 2.1
Sulfate	320	mg/L		03/06/23 20:24	100	100	03/06/23 20:24	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	7.83	Feet		02/28/23 11:57	1		02/28/23 11:57	FIELD	Field*
Dissolved oxygen, Field	3.9	mg/L		02/28/23 11:57	1		02/28/23 11:57	FIELD	Field*
Oxidation Reduction Potential	162	mV		02/28/23 11:57	1	-500	02/28/23 11:57	FIELD	Field*
pH, Field Measured	7.24	pH Units		02/28/23 11:57	1		02/28/23 11:57	FIELD	Field*
Specific Conductance, Field Measured	1440	umhos/cm		02/28/23 11:57	1		02/28/23 11:57	FIELD	Field*
Temperature, Field Measured	12.7	°C		02/28/23 11:57	1		02/28/23 11:57	FIELD	Field*
Turbidity, Field Measured	>1000	NTU		02/28/23 11:57	1	0.00	02/28/23 11:57	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	340	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Solids - total dissolved solids (TDS)	1100	mg/L		03/02/23 09:54	1	26	03/02/23 10:44	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		03/06/23 09:21	5	3.0	03/07/23 09:38	JMW	EPA 6020A
Arsenic	6.8	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:38	JMW	EPA 6020A
Barium	210	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:38	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:38	JMW	EPA 6020A
Boron	4500	ug/L		03/06/23 09:21	5	10	03/07/23 09:38	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:38	JMW	EPA 6020A
Calcium	170	mg/L		03/06/23 09:21	5	0.20	03/07/23 09:38	JMW	EPA 6020A
Chromium	20	ug/L		03/06/23 09:21	5	4.0	03/07/23 09:38	JMW	EPA 6020A
Cobalt	11	ug/L		03/06/23 09:21	5	2.0	03/07/23 09:38	JMW	EPA 6020A
Lead	9.1	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:41	JMW	EPA 6020A
Magnesium	82	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:38	JMW	EPA 6020A
Mercury	< 0.20	ug/L		03/06/23 09:21	5	0.20	03/07/23 17:41	JMW	EPA 6020A
Molybdenum	2.6	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:38	JMW	EPA 6020A
Potassium	3.2	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:38	JMW	EPA 6020A
Selenium	1.2	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:41	JMW	EPA 6020A
Sodium	76	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:38	JMW	EPA 6020A

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ANALYTICAL RESULTS

Sample: GC00016-04
Name: AW-05
Matrix: Ground Water - Grab

Sampled: 02/28/23 11:57
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:38	JMW	EPA 6020A
Lithium	25	ug/L		03/06/23 09:21	1	20	03/07/23 10:24	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GC00016-05
Name: AW-06
Matrix: Ground Water - Grab

Sampled: 02/28/23 10:03
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	31	mg/L		03/06/23 21:00	10	10	03/06/23 21:00	CRD	EPA 300.0 REV 2.1
Fluoride	0.327	mg/L		03/06/23 20:42	1	0.250	03/06/23 20:42	CRD	EPA 300.0 REV 2.1
Sulfate	22	mg/L		03/06/23 21:00	10	10	03/06/23 21:00	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	26.79	Feet		02/28/23 10:03	1		02/28/23 10:03	FIELD	Field*
Dissolved oxygen, Field	1.6	mg/L		02/28/23 10:03	1		02/28/23 10:03	FIELD	Field*
Oxidation Reduction Potential	-65.0	mV		02/28/23 10:03	1	-500	02/28/23 10:03	FIELD	Field*
pH, Field Measured	7.39	pH Units		02/28/23 10:03	1		02/28/23 10:03	FIELD	Field*
Specific Conductance, Field Measured	971.0	umhos/cm		02/28/23 10:03	1		02/28/23 10:03	FIELD	Field*
Temperature, Field Measured	11.2	°C		02/28/23 10:03	1		02/28/23 10:03	FIELD	Field*
Turbidity, Field Measured	1000	NTU		02/28/23 10:03	1	0.00	02/28/23 10:03	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	400	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Solids - total dissolved solids (TDS)	610	mg/L		03/02/23 09:54	1	26	03/02/23 10:44	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		03/06/23 09:21	5	3.0	03/07/23 09:42	JMW	EPA 6020A
Arsenic	6.4	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:42	JMW	EPA 6020A
Barium	190	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:42	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:42	JMW	EPA 6020A
Boron	180	ug/L		03/06/23 09:21	5	10	03/07/23 09:42	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:42	JMW	EPA 6020A
Calcium	110	mg/L		03/06/23 09:21	5	0.20	03/07/23 09:42	JMW	EPA 6020A
Chromium	< 4.0	ug/L		03/06/23 09:21	5	4.0	03/07/23 09:42	JMW	EPA 6020A
Cobalt	< 2.0	ug/L		03/06/23 09:21	5	2.0	03/07/23 09:42	JMW	EPA 6020A
Lead	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:44	JMW	EPA 6020A
Magnesium	45	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:42	JMW	EPA 6020A
Mercury	< 0.20	ug/L		03/06/23 09:21	5	0.20	03/07/23 17:44	JMW	EPA 6020A
Molybdenum	5.3	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:42	JMW	EPA 6020A
Potassium	0.84	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:42	JMW	EPA 6020A
Selenium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:44	JMW	EPA 6020A
Sodium	57	mg/L		03/06/23 09:21	5	0.10	03/07/23 09:42	JMW	EPA 6020A

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ANALYTICAL RESULTS

Sample: GC00016-05
Name: AW-06
Matrix: Ground Water - Grab

Sampled: 02/28/23 10:03
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 09:42	JMW	EPA 6020A
Lithium	< 20	ug/L		03/06/23 09:21	1	20	03/07/23 10:25	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GC00016-06
Name: AW-08
Matrix: Ground Water - Grab

Sampled: 02/28/23 15:57
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	14	mg/L		03/06/23 21:37	5	5.0	03/06/23 21:37	CRD	EPA 300.0 REV 2.1
Fluoride	< 0.250	mg/L		03/06/23 21:18	1	0.250	03/06/23 21:18	CRD	EPA 300.0 REV 2.1
Sulfate	< 1.0	mg/L		03/06/23 21:18	1	1.0	03/06/23 21:18	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	24.6	Feet		02/28/23 15:57	1		02/28/23 15:57	FIELD	Field*
Dissolved oxygen, Field	1.6	mg/L		02/28/23 15:57	1		02/28/23 15:57	FIELD	Field*
Oxidation Reduction Potential	-133	mV		02/28/23 15:57	1	-500	02/28/23 15:57	FIELD	Field*
pH, Field Measured	8.92	pH Units		02/28/23 15:57	1		02/28/23 15:57	FIELD	Field*
Specific Conductance, Field Measured	725.0	umhos/cm		02/28/23 15:57	1		02/28/23 15:57	FIELD	Field*
Temperature, Field Measured	13.7	°C		02/28/23 15:57	1		02/28/23 15:57	FIELD	Field*
Turbidity, Field Measured	11.9	NTU		02/28/23 15:57	1	0.00	02/28/23 15:57	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	620	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		03/03/23 13:45	1	10	03/03/23 13:45	CPS	SM 2320B 1997*
Solids - total dissolved solids (TDS)	740	mg/L		03/02/23 09:54	1	26	03/02/23 10:44	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		03/06/23 09:21	5	3.0	03/07/23 10:14	JMW	EPA 6020A
Arsenic	11	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:14	JMW	EPA 6020A
Barium	200	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:14	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:14	JMW	EPA 6020A
Boron	100	ug/L		03/06/23 09:21	5	10	03/07/23 10:14	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:14	JMW	EPA 6020A
Calcium	140	mg/L		03/06/23 09:21	5	0.20	03/07/23 10:14	JMW	EPA 6020A
Chromium	< 4.0	ug/L		03/06/23 09:21	5	4.0	03/07/23 10:14	JMW	EPA 6020A
Cobalt	< 2.0	ug/L		03/06/23 09:21	5	2.0	03/07/23 10:14	JMW	EPA 6020A
Lead	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:47	JMW	EPA 6020A
Magnesium	58	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:14	JMW	EPA 6020A
Mercury	< 0.20	ug/L		03/06/23 09:21	5	0.20	03/07/23 17:47	JMW	EPA 6020A
Molybdenum	1.8	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:14	JMW	EPA 6020A
Potassium	1.4	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:14	JMW	EPA 6020A
Selenium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:47	JMW	EPA 6020A
Sodium	63	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:14	JMW	EPA 6020A

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ANALYTICAL RESULTS

Sample: GC00016-06
Name: AW-08
Matrix: Ground Water - Grab

Sampled: 02/28/23 15:57
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:47	JMW	EPA 6020A
Lithium	< 20	ug/L		03/06/23 09:21	1	20	03/07/23 10:26	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GC00016-07
Name: AW-09
Matrix: Ground Water - Grab

Sampled: 02/28/23 12:05
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	26	mg/L		03/03/23 16:08	10	10	03/03/23 16:08	CRD	EPA 300.0 REV 2.1
Fluoride	< 0.250	mg/L		03/03/23 15:50	1	0.250	03/03/23 15:50	CRD	EPA 300.0 REV 2.1
Sulfate	< 1.0	mg/L		03/03/23 15:50	1	1.0	03/03/23 15:50	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	26.01	Feet		02/28/23 12:05	1		02/28/23 12:05	FIELD	Field*
Dissolved oxygen, Field	1.0	mg/L		02/28/23 12:05	1		02/28/23 12:05	FIELD	Field*
Oxidation Reduction Potential	-130	mV		02/28/23 12:05	1	-500	02/28/23 12:05	FIELD	Field*
pH, Field Measured	7.02	pH Units		02/28/23 12:05	1		02/28/23 12:05	FIELD	Field*
Specific Conductance, Field Measured	1330	umhos/cm		02/28/23 12:05	1		02/28/23 12:05	FIELD	Field*
Temperature, Field Measured	12.6	°C		02/28/23 12:05	1		02/28/23 12:05	FIELD	Field*
Turbidity, Field Measured	77.2	NTU		02/28/23 12:05	1	0.00	02/28/23 12:05	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	750	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Solids - total dissolved solids (TDS)	830	mg/L		03/02/23 09:54	1	26	03/02/23 10:44	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		03/06/23 09:21	5	3.0	03/07/23 10:18	JMW	EPA 6020A
Arsenic	12	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:18	JMW	EPA 6020A
Barium	200	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:18	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:18	JMW	EPA 6020A
Boron	100	ug/L		03/06/23 09:21	5	10	03/07/23 10:18	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:18	JMW	EPA 6020A
Calcium	140	mg/L		03/06/23 09:21	5	0.20	03/07/23 10:18	JMW	EPA 6020A
Chromium	< 4.0	ug/L		03/06/23 09:21	5	4.0	03/07/23 10:18	JMW	EPA 6020A
Cobalt	< 2.0	ug/L		03/06/23 09:21	5	2.0	03/07/23 10:18	JMW	EPA 6020A
Lead	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:59	JMW	EPA 6020A
Magnesium	59	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:18	JMW	EPA 6020A
Mercury	< 0.20	ug/L		03/06/23 09:21	5	0.20	03/07/23 17:59	JMW	EPA 6020A
Molybdenum	1.9	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:18	JMW	EPA 6020A
Potassium	1.4	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:18	JMW	EPA 6020A
Selenium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:59	JMW	EPA 6020A
Sodium	64	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:18	JMW	EPA 6020A

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ANALYTICAL RESULTS

Sample: GC00016-07
Name: AW-09
Matrix: Ground Water - Grab

Sampled: 02/28/23 12:05
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 17:59	JMW	EPA 6020A
Lithium	< 20	ug/L		03/06/23 09:21	1	20	03/07/23 10:28	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GC00016-08
Name: AW-10
Matrix: Ground Water - Grab

Sampled: 02/28/23 15:45
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	85	mg/L		03/03/23 16:44	25	25	03/03/23 16:44	CRD	EPA 300.0 REV 2.1
Fluoride	< 0.250	mg/L		03/03/23 16:26	1	0.250	03/03/23 16:26	CRD	EPA 300.0 REV 2.1
Sulfate	< 1.0	mg/L		03/03/23 16:26	1	1.0	03/03/23 16:26	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	2	Feet		02/28/23 15:45	1		02/28/23 15:45	FIELD	Field*
Dissolved oxygen, Field	0.82	mg/L		02/28/23 15:45	1		02/28/23 15:45	FIELD	Field*
Oxidation Reduction Potential	-89.0	mV		02/28/23 15:45	1	-500	02/28/23 15:45	FIELD	Field*
pH, Field Measured	7.00	pH Units		02/28/23 15:45	1		02/28/23 15:45	FIELD	Field*
Specific Conductance, Field Measured	2030	umhos/cm		02/28/23 15:45	1		02/28/23 15:45	FIELD	Field*
Temperature, Field Measured	12.3	°C		02/28/23 15:45	1		02/28/23 15:45	FIELD	Field*
Turbidity, Field Measured	>1000	NTU		02/28/23 15:45	1	0.00	02/28/23 15:45	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	1100	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Solids - total dissolved solids (TDS)	1300	mg/L		03/02/23 09:54	1	26	03/02/23 10:44	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		03/06/23 09:21	5	3.0	03/07/23 10:22	JMW	EPA 6020A
Arsenic	16	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:22	JMW	EPA 6020A
Barium	1300	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:22	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:22	JMW	EPA 6020A
Boron	520	ug/L		03/06/23 09:21	5	10	03/07/23 10:22	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:22	JMW	EPA 6020A
Calcium	140	mg/L		03/06/23 09:21	5	0.20	03/07/23 10:22	JMW	EPA 6020A
Chromium	9.5	ug/L		03/06/23 09:21	5	4.0	03/07/23 10:22	JMW	EPA 6020A
Cobalt	6.8	ug/L		03/06/23 09:21	5	2.0	03/07/23 10:22	JMW	EPA 6020A
Lead	6.2	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:02	JMW	EPA 6020A
Magnesium	66	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:22	JMW	EPA 6020A
Mercury	< 0.20	ug/L		03/06/23 09:21	5	0.20	03/07/23 18:02	JMW	EPA 6020A
Molybdenum	1.2	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:22	JMW	EPA 6020A
Potassium	4.2	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:22	JMW	EPA 6020A
Selenium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:02	JMW	EPA 6020A
Sodium	290	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:22	JMW	EPA 6020A

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ANALYTICAL RESULTS

Sample: GC00016-08
Name: AW-10
Matrix: Ground Water - Grab

Sampled: 02/28/23 15:45
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:02	JMW	EPA 6020A
Lithium	43	ug/L		03/06/23 09:21	1	20	03/07/23 10:29	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GC00016-09
Name: AW-11
Matrix: Ground Water - Grab

Sampled: 02/28/23 14:24
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	30	mg/L		03/03/23 17:20	10	10	03/03/23 17:20	CRD	EPA 300.0 REV 2.1
Fluoride	< 0.250	mg/L		03/03/23 17:02	1	0.250	03/03/23 17:02	CRD	EPA 300.0 REV 2.1
Sulfate	< 1.0	mg/L		03/03/23 17:02	1	1.0	03/03/23 17:02	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	6.23	Feet		02/28/23 14:24	1		02/28/23 14:24	FIELD	Field*
Dissolved oxygen, Field	0.91	mg/L		02/28/23 14:24	1		02/28/23 14:24	FIELD	Field*
Oxidation Reduction Potential	-103	mV		02/28/23 14:24	1	-500	02/28/23 14:24	FIELD	Field*
pH, Field Measured	7.17	pH Units		02/28/23 14:24	1		02/28/23 14:24	FIELD	Field*
Specific Conductance, Field Measured	1650	umhos/cm		02/28/23 14:24	1		02/28/23 14:24	FIELD	Field*
Temperature, Field Measured	10.8	°C		02/28/23 14:24	1		02/28/23 14:24	FIELD	Field*
Turbidity, Field Measured	>1000	NTU		02/28/23 14:24	1	0.00	02/28/23 14:24	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	990	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Solids - total dissolved solids (TDS)	1000	mg/L		03/02/23 09:54	1	26	03/02/23 10:44	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		03/06/23 09:21	5	3.0	03/07/23 10:26	JMW	EPA 6020A
Arsenic	13	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:26	JMW	EPA 6020A
Barium	1100	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:26	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:26	JMW	EPA 6020A
Boron	240	ug/L		03/06/23 09:21	5	10	03/07/23 10:26	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:26	JMW	EPA 6020A
Calcium	170	mg/L		03/06/23 09:21	5	0.20	03/07/23 10:26	JMW	EPA 6020A
Chromium	17	ug/L		03/06/23 09:21	5	4.0	03/07/23 10:26	JMW	EPA 6020A
Cobalt	10	ug/L		03/06/23 09:21	5	2.0	03/07/23 10:26	JMW	EPA 6020A
Lead	10	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:04	JMW	EPA 6020A
Magnesium	75	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:26	JMW	EPA 6020A
Mercury	< 0.20	ug/L		03/06/23 09:21	5	0.20	03/07/23 18:04	JMW	EPA 6020A
Molybdenum	3.2	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:26	JMW	EPA 6020A
Potassium	3.9	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:26	JMW	EPA 6020A
Selenium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:04	JMW	EPA 6020A
Sodium	150	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:26	JMW	EPA 6020A

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ANALYTICAL RESULTS

Sample: GC00016-09
Name: AW-11
Matrix: Ground Water - Grab

Sampled: 02/28/23 14:24
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:04	JMW	EPA 6020A
Lithium	31	ug/L		03/06/23 09:21	1	20	03/07/23 10:30	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GC00016-10
Name: AW-14
Matrix: Ground Water - Grab

Sampled: 02/28/23 13:13
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	21	mg/L	Q4	03/03/23 19:08	5	5.0	03/03/23 19:08	CRD	EPA 300.0 REV 2.1
Fluoride	< 0.250	mg/L		03/03/23 17:38	1	0.250	03/03/23 17:38	CRD	EPA 300.0 REV 2.1
Sulfate	5.7	mg/L		03/03/23 17:38	1	1.0	03/03/23 17:38	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	6.93	Feet		02/28/23 13:13	1		02/28/23 13:13	FIELD	Field*
Dissolved oxygen, Field	1.1	mg/L		02/28/23 13:13	1		02/28/23 13:13	FIELD	Field*
Oxidation Reduction Potential	-63.0	mV		02/28/23 13:13	1	-500	02/28/23 13:13	FIELD	Field*
pH, Field Measured	6.98	pH Units		02/28/23 13:13	1		02/28/23 13:13	FIELD	Field*
Specific Conductance, Field Measured	1690	umhos/cm		02/28/23 13:13	1		02/28/23 13:13	FIELD	Field*
Temperature, Field Measured	11.4	°C		02/28/23 13:13	1		02/28/23 13:13	FIELD	Field*
Turbidity, Field Measured	261	NTU		02/28/23 13:13	1	0.00	02/28/23 13:13	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	980	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Solids - total dissolved solids (TDS)	1100	mg/L		03/02/23 09:54	1	26	03/02/23 10:44	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		03/06/23 09:21	5	3.0	03/07/23 10:30	JMW	EPA 6020A
Arsenic	15	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:30	JMW	EPA 6020A
Barium	720	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:30	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:30	JMW	EPA 6020A
Boron	180	ug/L		03/06/23 09:21	5	10	03/07/23 10:30	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:30	JMW	EPA 6020A
Calcium	170	mg/L		03/06/23 09:21	5	0.20	03/07/23 10:30	JMW	EPA 6020A
Chromium	< 4.0	ug/L		03/06/23 09:21	5	4.0	03/07/23 10:30	JMW	EPA 6020A
Cobalt	4.8	ug/L		03/06/23 09:21	5	2.0	03/07/23 10:30	JMW	EPA 6020A
Lead	1.7	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:07	JMW	EPA 6020A
Magnesium	66	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:30	JMW	EPA 6020A
Mercury	< 0.20	ug/L		03/06/23 09:21	5	0.20	03/07/23 18:07	JMW	EPA 6020A
Molybdenum	19	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:30	JMW	EPA 6020A
Potassium	2.5	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:30	JMW	EPA 6020A
Selenium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:07	JMW	EPA 6020A
Sodium	150	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:30	JMW	EPA 6020A

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ANALYTICAL RESULTS

Sample: GC00016-10
Name: AW-14
Matrix: Ground Water - Grab

Sampled: 02/28/23 13:13
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:07	JMW	EPA 6020A
Lithium	< 20	ug/L		03/06/23 09:21	1	20	03/07/23 10:31	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GC00016-11
Name: AW-16
Matrix: Ground Water - Grab

Sampled: 02/28/23 13:08
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	46	mg/L	Q4	03/03/23 20:21	10	10	03/03/23 20:21	CRD	EPA 300.0 REV 2.1
Fluoride	< 0.250	mg/L		03/03/23 19:26	1	0.250	03/03/23 19:26	CRD	EPA 300.0 REV 2.1
Sulfate	3.4	mg/L		03/03/23 19:26	1	1.0	03/03/23 19:26	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	24.89	Feet		02/28/23 13:08	1		02/28/23 13:08	FIELD	Field*
Dissolved oxygen, Field	0.97	mg/L		02/28/23 13:08	1		02/28/23 13:08	FIELD	Field*
Oxidation Reduction Potential	-94.0	mV		02/28/23 13:08	1	-500	02/28/23 13:08	FIELD	Field*
pH, Field Measured	6.83	pH Units		02/28/23 13:08	1		02/28/23 13:08	FIELD	Field*
Specific Conductance, Field Measured	1950	umhos/cm		02/28/23 13:08	1		02/28/23 13:08	FIELD	Field*
Temperature, Field Measured	13.2	°C		02/28/23 13:08	1		02/28/23 13:08	FIELD	Field*
Turbidity, Field Measured	29.3	NTU		02/28/23 13:08	1	0.00	02/28/23 13:08	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	1100	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Solids - total dissolved solids (TDS)	1200	mg/L		03/02/23 09:54	1	26	03/02/23 10:44	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		03/06/23 09:21	5	3.0	03/07/23 10:33	JMW	EPA 6020A
Arsenic	2.2	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:33	JMW	EPA 6020A
Barium	1300	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:33	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:33	JMW	EPA 6020A
Boron	490	ug/L		03/06/23 09:21	5	10	03/07/23 10:33	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:33	JMW	EPA 6020A
Calcium	140	mg/L		03/06/23 09:21	5	0.20	03/07/23 10:33	JMW	EPA 6020A
Chromium	< 4.0	ug/L		03/06/23 09:21	5	4.0	03/07/23 10:33	JMW	EPA 6020A
Cobalt	< 2.0	ug/L		03/06/23 09:21	5	2.0	03/07/23 10:33	JMW	EPA 6020A
Lead	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:10	JMW	EPA 6020A
Magnesium	59	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:33	JMW	EPA 6020A
Mercury	< 0.20	ug/L		03/06/23 09:21	5	0.20	03/07/23 18:10	JMW	EPA 6020A
Molybdenum	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:33	JMW	EPA 6020A
Potassium	4.9	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:33	JMW	EPA 6020A
Selenium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:10	JMW	EPA 6020A
Sodium	260	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:33	JMW	EPA 6020A

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ANALYTICAL RESULTS

Sample: GC00016-11
Name: AW-16
Matrix: Ground Water - Grab

Sampled: 02/28/23 13:08
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:10	JMW	EPA 6020A
Lithium	37	ug/L		03/06/23 09:21	1	20	03/07/23 10:32	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GC00016-12
Name: AW-17
Matrix: Ground Water - Grab

Sampled: 02/28/23 11:06
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	47	mg/L		03/03/23 20:57	10	10	03/03/23 20:57	CRD	EPA 300.0 REV 2.1
Fluoride	< 0.250	mg/L		03/03/23 20:39	1	0.250	03/03/23 20:39	CRD	EPA 300.0 REV 2.1
Sulfate	< 1.0	mg/L		03/03/23 20:39	1	1.0	03/03/23 20:39	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	25.6	Feet		02/28/23 11:06	1		02/28/23 11:06	FIELD	Field*
Dissolved oxygen, Field	0.36	mg/L		02/28/23 11:06	1		02/28/23 11:06	FIELD	Field*
Oxidation Reduction Potential	-108	mV		02/28/23 11:06	1	-500	02/28/23 11:06	FIELD	Field*
pH, Field Measured	6.90	pH Units		02/28/23 11:06	1		02/28/23 11:06	FIELD	Field*
Specific Conductance, Field Measured	1610	umhos/cm		02/28/23 11:06	1		02/28/23 11:06	FIELD	Field*
Temperature, Field Measured	12.6	°C		02/28/23 11:06	1		02/28/23 11:06	FIELD	Field*
Turbidity, Field Measured	869	NTU		02/28/23 11:06	1	0.00	02/28/23 11:06	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	900	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Solids - total dissolved solids (TDS)	1100	mg/L		03/02/23 09:54	1	26	03/02/23 10:44	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		03/06/23 09:21	5	3.0	03/07/23 10:37	JMW	EPA 6020A
Arsenic	6.1	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:37	JMW	EPA 6020A
Barium	1200	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:37	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:37	JMW	EPA 6020A
Boron	420	ug/L		03/06/23 09:21	5	10	03/07/23 10:37	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:37	JMW	EPA 6020A
Calcium	110	mg/L		03/06/23 09:21	5	0.20	03/07/23 10:37	JMW	EPA 6020A
Chromium	4.0	ug/L		03/06/23 09:21	5	4.0	03/07/23 10:37	JMW	EPA 6020A
Cobalt	3.4	ug/L		03/06/23 09:21	5	2.0	03/07/23 10:37	JMW	EPA 6020A
Lead	1.8	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:13	JMW	EPA 6020A
Magnesium	45	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:37	JMW	EPA 6020A
Mercury	< 0.20	ug/L		03/06/23 09:21	5	0.20	03/07/23 18:13	JMW	EPA 6020A
Molybdenum	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:37	JMW	EPA 6020A
Potassium	4.5	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:37	JMW	EPA 6020A
Selenium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:13	JMW	EPA 6020A
Sodium	230	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:37	JMW	EPA 6020A

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ANALYTICAL RESULTS

Sample: GC00016-12
Name: AW-17
Matrix: Ground Water - Grab

Sampled: 02/28/23 11:06
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:13	JMW	EPA 6020A
Lithium	34	ug/L		03/06/23 09:21	1	20	03/07/23 10:37	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GC00016-13
Name: AW-21
Matrix: Ground Water - Grab

Sampled: 02/28/23 10:05
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	80	mg/L		03/03/23 21:33	50	50	03/03/23 21:33	CRD	EPA 300.0 REV 2.1
Fluoride	0.360	mg/L		03/03/23 21:15	1	0.250	03/03/23 21:15	CRD	EPA 300.0 REV 2.1
Sulfate	240	mg/L		03/03/23 21:33	50	50	03/03/23 21:33	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	16.34	Feet		02/28/23 10:05	1		02/28/23 10:05	FIELD	Field*
Dissolved oxygen, Field	6.7	mg/L		02/28/23 10:05	1		02/28/23 10:05	FIELD	Field*
Oxidation Reduction Potential	227	mV		02/28/23 10:05	1	-500	02/28/23 10:05	FIELD	Field*
pH, Field Measured	7.99	pH Units		02/28/23 10:05	1		02/28/23 10:05	FIELD	Field*
Specific Conductance, Field Measured	728.0	umhos/cm		02/28/23 10:05	1		02/28/23 10:05	FIELD	Field*
Temperature, Field Measured	12.2	°C		02/28/23 10:05	1		02/28/23 10:05	FIELD	Field*
Turbidity, Field Measured	125	NTU		02/28/23 10:05	1	0.00	02/28/23 10:05	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	160	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	< 10	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Solids - total dissolved solids (TDS)	680	mg/L		03/02/23 09:54	1	26	03/02/23 10:44	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		03/06/23 09:21	5	3.0	03/07/23 10:41	JMW	EPA 6020A
Arsenic	2.7	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:41	JMW	EPA 6020A
Barium	58	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:41	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:41	JMW	EPA 6020A
Boron	13000	ug/L		03/06/23 09:21	100	200	03/07/23 12:08	JMW	EPA 6020A
Cadmium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:41	JMW	EPA 6020A
Calcium	110	mg/L		03/06/23 09:21	5	0.20	03/07/23 10:41	JMW	EPA 6020A
Chromium	< 4.0	ug/L		03/06/23 09:21	5	4.0	03/07/23 10:41	JMW	EPA 6020A
Cobalt	< 2.0	ug/L		03/06/23 09:21	5	2.0	03/07/23 10:41	JMW	EPA 6020A
Lead	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:16	JMW	EPA 6020A
Magnesium	34	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:41	JMW	EPA 6020A
Mercury	< 0.20	ug/L		03/06/23 09:21	5	0.20	03/07/23 18:16	JMW	EPA 6020A
Molybdenum	29	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:41	JMW	EPA 6020A
Potassium	3.4	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:41	JMW	EPA 6020A
Selenium	1.7	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:16	JMW	EPA 6020A
Sodium	60	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:41	JMW	EPA 6020A

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ANALYTICAL RESULTS

Sample: GC00016-13
Name: AW-21
Matrix: Ground Water - Grab

Sampled: 02/28/23 10:05
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:16	JMW	EPA 6020A
Lithium	< 20	ug/L		03/06/23 09:21	1	20	03/07/23 10:38	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GC00016-14
Name: XPW01A
Matrix: Ground Water - Grab

Sampled: 02/28/23 10:48
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	86	mg/L		03/03/23 22:45	25	25	03/03/23 22:45	CRD	EPA 300.0 REV 2.1
Fluoride	< 0.250	mg/L		03/03/23 21:51	1	0.250	03/03/23 21:51	CRD	EPA 300.0 REV 2.1
Sulfate	220	mg/L		03/03/23 22:45	25	25	03/03/23 22:45	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	11.32	Feet		02/28/23 10:48	1		02/28/23 10:48	FIELD	Field*
Dissolved oxygen, Field	4.2	mg/L		02/28/23 10:48	1		02/28/23 10:48	FIELD	Field*
Oxidation Reduction Potential	54.0	mV		02/28/23 10:48	1	-500	02/28/23 10:48	FIELD	Field*
pH, Field Measured	11.8	pH Units		02/28/23 10:48	1		02/28/23 10:48	FIELD	Field*
Specific Conductance, Field Measured	1970	umhos/cm		02/28/23 10:48	1		02/28/23 10:48	FIELD	Field*
Temperature, Field Measured	11.0	°C		02/28/23 10:48	1		02/28/23 10:48	FIELD	Field*
Turbidity, Field Measured	52.9	NTU		02/28/23 10:48	1	0.00	02/28/23 10:48	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	< 10	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	75	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Solids - total dissolved solids (TDS)	960	mg/L		03/02/23 09:54	1	26	03/02/23 10:44	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		03/06/23 09:21	5	3.0	03/07/23 10:45	JMW	EPA 6020A
Arsenic	120	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:45	JMW	EPA 6020A
Barium	34	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:45	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:45	JMW	EPA 6020A
Boron	19000	ug/L		03/06/23 09:21	100	200	03/07/23 12:12	JMW	EPA 6020A
Cadmium	1.9	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:45	JMW	EPA 6020A
Calcium	57	mg/L		03/06/23 09:21	5	0.20	03/07/23 10:45	JMW	EPA 6020A
Chromium	< 4.0	ug/L		03/06/23 09:21	5	4.0	03/07/23 10:45	JMW	EPA 6020A
Cobalt	< 2.0	ug/L		03/06/23 09:21	5	2.0	03/07/23 10:45	JMW	EPA 6020A
Lead	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:19	JMW	EPA 6020A
Magnesium	< 0.10	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:45	JMW	EPA 6020A
Mercury	< 0.20	ug/L		03/06/23 09:21	5	0.20	03/07/23 18:19	JMW	EPA 6020A
Molybdenum	3200	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:45	JMW	EPA 6020A
Potassium	240	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:45	JMW	EPA 6020A
Selenium	8.5	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:19	JMW	EPA 6020A
Sodium	120	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:45	JMW	EPA 6020A

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ANALYTICAL RESULTS

Sample: GC00016-14
Name: XPW01A
Matrix: Ground Water - Grab

Sampled: 02/28/23 10:48
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:19	JMW	EPA 6020A
Lithium	680	ug/L		03/06/23 09:21	1	20	03/07/23 10:39	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GC00016-15
Name: XPW02
Matrix: Ground Water - Grab

Sampled: 02/28/23 14:27
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	100	mg/L		03/03/23 23:03	100	100	03/03/23 23:03	CRD	EPA 300.0 REV 2.1
Sulfate	930	mg/L		03/03/23 23:03	100	100	03/03/23 23:03	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	20.13	Feet		02/28/23 14:27	1		02/28/23 14:27	FIELD	Field*
Dissolved oxygen, Field	1.6	mg/L		02/28/23 14:27	1		02/28/23 14:27	FIELD	Field*
Oxidation Reduction Potential	-148	mV		02/28/23 14:27	1	-500	02/28/23 14:27	FIELD	Field*
pH, Field Measured	12.2	pH Units		02/28/23 14:27	1		02/28/23 14:27	FIELD	Field*
Specific Conductance, Field Measured	4140	umhos/cm		02/28/23 14:27	1		02/28/23 14:27	FIELD	Field*
Temperature, Field Measured	13.9	°C		02/28/23 14:27	1		02/28/23 14:27	FIELD	Field*
Turbidity, Field Measured	19.8	NTU		02/28/23 14:27	1	0.00	02/28/23 14:27	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	< 10	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	120	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Fluoride	0.319	mg/L		03/06/23 16:44	1	0.250	03/06/23 16:44	TTH	SM 4500F C 1997
Solids - total dissolved solids (TDS)	2400	mg/L		03/02/23 09:54	1	26	03/02/23 10:44	HRF	SM 2540C
Total Metals - PIA									
Antimony	3.2	ug/L		03/06/23 09:21	5	3.0	03/07/23 10:49	JMW	EPA 6020A
Arsenic	170	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:49	JMW	EPA 6020A
Barium	38	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:49	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:49	JMW	EPA 6020A
Boron	16000	ug/L		03/06/23 09:21	100	200	03/07/23 12:15	JMW	EPA 6020A
Cadmium	1.9	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:49	JMW	EPA 6020A
Calcium	37	mg/L		03/06/23 09:21	5	0.20	03/07/23 10:49	JMW	EPA 6020A
Chromium	< 4.0	ug/L		03/06/23 09:21	5	4.0	03/07/23 10:49	JMW	EPA 6020A
Cobalt	< 2.0	ug/L		03/06/23 09:21	5	2.0	03/07/23 10:49	JMW	EPA 6020A
Lead	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:22	JMW	EPA 6020A
Magnesium	0.23	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:49	JMW	EPA 6020A
Mercury	0.28	ug/L		03/06/23 09:21	5	0.20	03/07/23 18:22	JMW	EPA 6020A
Molybdenum	3200	ug/L		03/06/23 09:21	5	1.0	03/07/23 10:49	JMW	EPA 6020A
Potassium	110	mg/L		03/06/23 09:21	5	0.10	03/07/23 10:49	JMW	EPA 6020A
Selenium	160	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:22	JMW	EPA 6020A
Sodium	730	mg/L		03/06/23 09:21	100	2.0	03/08/23 07:55	JMW	EPA 6020A

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ANALYTICAL RESULTS

Sample: GC00016-15
Name: XPW02
Matrix: Ground Water - Grab

Sampled: 02/28/23 14:27
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:22	JMW	EPA 6020A
Lithium	310	ug/L		03/06/23 09:21	1	20	03/07/23 10:40	TJJ	EPA 6010B

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ANALYTICAL RESULTS

Sample: GC00016-16
Name: XPW03
Matrix: Ground Water - Grab

Sampled: 02/28/23 16:33
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Anions - PIA									
Chloride	93	mg/L		03/03/23 23:21	50	50	03/03/23 23:21	CRD	EPA 300.0 REV 2.1
Sulfate	260	mg/L		03/03/23 23:21	50	50	03/03/23 23:21	CRD	EPA 300.0 REV 2.1
Field - PIA									
Depth, From Measuring Point	16.34	Feet		02/28/23 16:33	1		02/28/23 16:33	FIELD	Field*
Dissolved oxygen, Field	2.6	mg/L		02/28/23 16:33	1		02/28/23 16:33	FIELD	Field*
Oxidation Reduction Potential	-51.0	mV		02/28/23 16:33	1	-500	02/28/23 16:33	FIELD	Field*
pH, Field Measured	11.9	pH Units		02/28/23 16:33	1		02/28/23 16:33	FIELD	Field*
Specific Conductance, Field Measured	1930	umhos/cm		02/28/23 16:33	1		02/28/23 16:33	FIELD	Field*
Temperature, Field Measured	15.1	°C		02/28/23 16:33	1		02/28/23 16:33	FIELD	Field*
Turbidity, Field Measured	78.1	NTU		02/28/23 16:33	1	0.00	02/28/23 16:33	FIELD	Field*
General Chemistry - PIA									
Alkalinity - bicarbonate as CaCO3	< 10	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Alkalinity - carbonate as CaCO3	120	mg/L		03/07/23 10:31	1	10	03/07/23 10:31	CPS	SM 2320B 1997*
Fluoride	< 0.250	mg/L		03/06/23 16:45	1	0.250	03/06/23 16:45	TTH	SM 4500F C 1997
Solids - total dissolved solids (TDS)	2000	mg/L		03/02/23 09:54	1	26	03/02/23 10:44	HRF	SM 2540C
Total Metals - PIA									
Antimony	< 3.0	ug/L		03/06/23 09:21	5	3.0	03/08/23 10:03	JMW	EPA 6020A
Arsenic	27	ug/L		03/06/23 09:21	5	1.0	03/07/23 11:41	JMW	EPA 6020A
Barium	120	ug/L		03/06/23 09:21	5	1.0	03/07/23 11:41	JMW	EPA 6020A
Beryllium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 11:41	JMW	EPA 6020A
Boron	5700	ug/L		03/06/23 09:21	5	10	03/07/23 11:41	JMW	EPA 6020A
Cadmium	2.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 11:41	JMW	EPA 6020A
Calcium	61	mg/L		03/06/23 09:21	5	0.20	03/07/23 11:41	JMW	EPA 6020A
Chromium	< 4.0	ug/L		03/06/23 09:21	5	4.0	03/07/23 11:41	JMW	EPA 6020A
Cobalt	< 2.0	ug/L		03/06/23 09:21	5	2.0	03/07/23 11:41	JMW	EPA 6020A
Lead	1.8	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:25	JMW	EPA 6020A
Magnesium	0.36	mg/L		03/06/23 09:21	5	0.10	03/07/23 11:41	JMW	EPA 6020A
Mercury	< 0.20	ug/L		03/06/23 09:21	5	0.20	03/07/23 18:25	JMW	EPA 6020A
Molybdenum	3100	ug/L		03/06/23 09:21	5	1.0	03/07/23 11:41	JMW	EPA 6020A
Potassium	68	mg/L		03/06/23 09:21	5	0.10	03/07/23 11:41	JMW	EPA 6020A
Selenium	18	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:25	JMW	EPA 6020A
Sodium	230	mg/L		03/06/23 09:21	5	0.10	03/08/23 10:03	JMW	EPA 6020A

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ANALYTICAL RESULTS

Sample: GC00016-16
Name: XPW03
Matrix: Ground Water - Grab

Sampled: 02/28/23 16:33
Received: 03/01/23 07:07

Parameter	Result	Unit	Qualifier	Prepared	Dilution	MRL	Analyzed	Analyst	Method
Thallium	< 1.0	ug/L		03/06/23 09:21	5	1.0	03/07/23 18:25	JMW	EPA 6020A
Lithium	130	ug/L		03/06/23 09:21	1	20	03/07/23 10:42	TJJ	EPA 6010B

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QC SAMPLE RESULTS

Parameter	Result	Unit	Qual	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Batch B327096 - No Prep - SM 2540C									
Blank (B327096-BLK1)				Prepared & Analyzed: 03/01/23					
Solids - total dissolved solids (TDS)	< 17	mg/L							
LCS (B327096-BS1)				Prepared & Analyzed: 03/01/23					
Solids - total dissolved solids (TDS)	957	mg/L		1000		96	84.9-109		
Batch B327134 - No Prep - SM 2540C									
Blank (B327134-BLK1)				Prepared & Analyzed: 03/02/23					
Solids - total dissolved solids (TDS)	< 17	mg/L							
LCS (B327134-BS1)				Prepared & Analyzed: 03/02/23					
Solids - total dissolved solids (TDS)	983	mg/L		1000		98	84.9-109		
Duplicate (B327134-DUP1)	**Sample: GC00016-06**			Prepared & Analyzed: 03/02/23					
Solids - total dissolved solids (TDS)	725	mg/L			735			1	5
Duplicate (B327134-DUP2)	**Sample: GC00016-07**			Prepared & Analyzed: 03/02/23					
Solids - total dissolved solids (TDS)	830	mg/L			830			0	5
Batch B327318 - No Prep - SM 2320B 1997									
Blank (B327318-BLK1)				Prepared & Analyzed: 03/03/23					
Alkalinity - bicarbonate as CaCO3	2.50	mg/L							
Batch B327371 - IC No Prep - EPA 300.0 REV 2.1									
Calibration Blank (B327371-CCB1)				Prepared & Analyzed: 03/03/23					
Sulfate	0.00	mg/L							
Fluoride	0.00	mg/L							
Chloride	0.489	mg/L							
Calibration Check (B327371-CCV1)				Prepared & Analyzed: 03/03/23					
Sulfate	4.91	mg/L		5.000		98	90-110		
Fluoride	5.11	mg/L		5.000		102	90-110		
Chloride	4.87	mg/L		5.000		97	90-110		
Matrix Spike (B327371-MS1)	**Sample: GB04667-01**			Prepared & Analyzed: 03/03/23					
Sulfate	1.54	mg/L		1.500	ND	103	80-120		
Matrix Spike (B327371-MS2)	**Sample: GC00016-10**			Prepared & Analyzed: 03/03/23					
Sulfate	7.27	mg/L		1.500	5.68	106	80-120		
Fluoride	1.45	mg/L		1.500	0.0778	91	80-120		
Chloride	< 1.0	mg/L	Q4	1.500	21	NR	80-120		
Matrix Spike (B327371-MS3)	**Sample: GC00016-11**			Prepared & Analyzed: 03/03/23					
Fluoride	1.40	mg/L		1.500	0.0535	90	80-120		
Chloride	< 1.0	mg/L	Q4	1.500	46	NR	80-120		
Sulfate	4.91	mg/L		1.500	3.37	102	80-120		
Matrix Spike Dup (B327371-MSD1)	**Sample: GB04667-01**			Prepared & Analyzed: 03/03/23					
Sulfate	1.57	mg/L		1.500	ND	105	80-120	2	20
Matrix Spike Dup (B327371-MSD2)	**Sample: GC00016-10**			Prepared & Analyzed: 03/03/23					
Fluoride	1.42	mg/L		1.500	0.0778	90	80-120	2	20
Sulfate	7.28	mg/L		1.500	5.68	107	80-120	0.1	20
Chloride	< 1.0	mg/L	Q4	1.500	21	NR	80-120		20
Matrix Spike Dup (B327371-MSD3)	**Sample: GC00016-11**			Prepared & Analyzed: 03/03/23					

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QC SAMPLE RESULTS

Parameter	Result	Unit	Qual	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Matrix Spike Dup (B327371-MSD3)	**Sample: GC00016-11**			Prepared & Analyzed: 03/03/23					
Chloride	< 1.0	mg/L	Q4	1.500	46	NR	80-120		20
Sulfate	4.90	mg/L		1.500	3.37	102	80-120	0.2	20
Fluoride	1.40	mg/L		1.500	0.0535	89	80-120	0.3	20
Batch B327373 - SW 3015 - EPA 6010B									
Blank (B327373-BLK1)				Prepared: 03/06/23 Analyzed: 03/07/23					
Lithium	< 20	ug/L							
LCS (B327373-BS1)				Prepared: 03/06/23 Analyzed: 03/07/23					
Lithium	509	ug/L		555.6		92	80-120		
Matrix Spike (B327373-MS1)	**Sample: GB04667-01**			Prepared: 03/06/23 Analyzed: 03/07/23					
Lithium	511	ug/L		555.6	26.8	87	75-125		
Matrix Spike Dup (B327373-MSD1)	**Sample: GB04667-01**			Prepared: 03/06/23 Analyzed: 03/07/23					
Lithium	537	ug/L		555.6	26.8	92	75-125	5	200
Batch B327373 - SW 3015 - EPA 6020A									
Blank (B327373-BLK1)				Prepared: 03/06/23 Analyzed: 03/07/23					
Antimony	< 3.0	ug/L							
Arsenic	< 1.0	ug/L							
Barium	< 1.0	ug/L							
Beryllium	< 1.0	ug/L							
Boron	< 10	ug/L							
Cadmium	< 1.0	ug/L							
Calcium	< 0.20	mg/L							
Chromium	< 4.0	ug/L							
Cobalt	< 2.0	ug/L							
Lead	< 1.0	ug/L							
Magnesium	< 0.10	mg/L							
Mercury	< 0.20	ug/L							
Molybdenum	< 1.0	ug/L							
Potassium	< 0.10	mg/L							
Selenium	< 1.0	ug/L							
Sodium	< 0.10	mg/L							
Thallium	< 1.0	ug/L							
LCS (B327373-BS1)				Prepared: 03/06/23 Analyzed: 03/07/23					
Antimony	551	ug/L		555.6		99	80-120		
Arsenic	548	ug/L		555.6		99	80-120		
Barium	540	ug/L		555.6		97	80-120		
Beryllium	524	ug/L		555.6		94	80-120		
Boron	531	ug/L		555.6		96	80-120		
Cadmium	557	ug/L		555.6		100	80-120		
Calcium	5.73	mg/L		5.556		103	80-120		
Chromium	557	ug/L		555.6		100	80-120		
Cobalt	556	ug/L		555.6		100	80-120		
Lead	556	ug/L		555.6		100	80-120		
Magnesium	5.95	mg/L		5.556		107	80-120		
Mercury	52.8	ug/L		55.56		95	80-120		
Molybdenum	534	ug/L		555.6		96	80-120		

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QC SAMPLE RESULTS

Parameter	Result	Unit	Qual	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
LCS (B327373-BS1)				Prepared: 03/06/23 Analyzed: 03/07/23					
Potassium	5.51	mg/L		5.556		99	80-120		
Selenium	560	ug/L		555.6		101	80-120		
Sodium	6.07	mg/L		5.556		109	80-120		
Thallium	540	ug/L		555.6		97	80-120		
Matrix Spike (B327373-MS1)	**Sample: GB04667-01**			Prepared: 03/06/23 Analyzed: 03/07/23					
Antimony	553	ug/L		555.6	ND	100	75-125		
Arsenic	548	ug/L		555.6	3.53	98	75-125		
Barium	2220	ug/L		555.6	1770	82	75-125		
Beryllium	531	ug/L		555.6	ND	96	75-125		
Boron	930	ug/L		555.6	366	102	75-125		
Cadmium	557	ug/L		555.6	ND	100	75-125		
Calcium	147	mg/L		5.556	142	85	75-125		
Chromium	546	ug/L		555.6	ND	98	75-125		
Cobalt	545	ug/L		555.6	1.83	98	75-125		
Lead	540	ug/L		555.6	0.272	97	75-125		
Magnesium	62.1	mg/L		5.556	56.8	95	75-125		
Mercury	54.2	ug/L		55.56	0.206	97	75-125		
Molybdenum	550	ug/L		555.6	ND	99	75-125		
Potassium	9.36	mg/L		5.556	3.95	97	75-125		
Selenium	547	ug/L		555.6	ND	98	75-125		
Sodium	214	mg/L		5.556	210	76	75-125		
Thallium	522	ug/L		555.6	ND	94	75-125		
Matrix Spike Dup (B327373-MSD1)	**Sample: GB04667-01**			Prepared: 03/06/23 Analyzed: 03/07/23					
Antimony	556	ug/L		555.6	ND	100	75-125	0.5	20
Arsenic	555	ug/L		555.6	3.53	99	75-125	1	20
Barium	2240	ug/L		555.6	1770	85	75-125	0.8	20
Beryllium	535	ug/L		555.6	ND	96	75-125	0.6	20
Boron	937	ug/L		555.6	366	103	75-125	0.7	20
Cadmium	562	ug/L		555.6	ND	101	75-125	0.9	20
Calcium	148	mg/L		5.556	142	99	75-125	0.5	20
Chromium	551	ug/L		555.6	ND	99	75-125	0.8	20
Cobalt	551	ug/L		555.6	1.83	99	75-125	1	20
Lead	546	ug/L		555.6	0.272	98	75-125	1	20
Magnesium	62.6	mg/L		5.556	56.8	105	75-125	0.9	20
Mercury	55.0	ug/L		55.56	0.206	99	75-125	1	20
Molybdenum	555	ug/L		555.6	ND	100	75-125	1	20
Potassium	9.43	mg/L		5.556	3.95	99	75-125	0.8	20
Selenium	543	ug/L		555.6	ND	98	75-125	0.6	20
Sodium	217	mg/L		5.556	210	117	75-125	1	20
Thallium	529	ug/L		555.6	ND	95	75-125	1	20
Batch B327405 - No Prep - SM 4500F C 1997									
Calibration Blank (B327405-CCB1)				Prepared & Analyzed: 03/06/23					
Fluoride	0.00900	mg/L							
Calibration Blank (B327405-CCB2)				Prepared & Analyzed: 03/06/23					
Fluoride	0.00500	mg/L							
Calibration Check (B327405-CCV1)				Prepared & Analyzed: 03/06/23					

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QC SAMPLE RESULTS

Parameter	Result	Unit	Qual	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit
Calibration Check (B327405-CCV1)				Prepared & Analyzed: 03/06/23					
Fluoride	0.653	mg/L		0.7000		93	90-110		
Calibration Check (B327405-CCV2)				Prepared & Analyzed: 03/06/23					
Fluoride	0.698	mg/L		0.7000		100	90-110		
Batch B327509 - IC No Prep - EPA 300.0 REV 2.1									
Calibration Blank (B327509-CCB1)				Prepared & Analyzed: 03/06/23					
Chloride	0.00	mg/L							
Calibration Check (B327509-CCV1)				Prepared & Analyzed: 03/06/23					
Chloride	4.95	mg/L		5.000		99	90-110		
Batch B327510 - IC No Prep - EPA 300.0 REV 2.1									
Calibration Blank (B327510-CCB1)				Prepared & Analyzed: 03/06/23					
Fluoride	0.00	mg/L							
Chloride	0.194	mg/L							
Sulfate	0.00	mg/L							
Calibration Check (B327510-CCV1)				Prepared & Analyzed: 03/06/23					
Sulfate	4.91	mg/L		5.000		98	90-110		
Fluoride	4.95	mg/L		5.000		99	90-110		
Chloride	4.77	mg/L		5.000		95	90-110		
Batch B327556 - No Prep - SM 2320B 1997									
Duplicate (B327556-DUP2)	**Sample: GC00016-16**			Prepared & Analyzed: 03/07/23					
Alkalinity - carbonate as CaCO3	100	mg/L			125			22	10
Alkalinity - bicarbonate as CaCO3	< 10	mg/L			ND				10
Batch B327620 - No Prep - SM 4500F C 1997									
Calibration Blank (B327620-CCB1)				Prepared & Analyzed: 03/08/23					
Fluoride	0.00800	mg/L							
Calibration Blank (B327620-CCB2)				Prepared & Analyzed: 03/08/23					
Fluoride	0.0100	mg/L							
Calibration Check (B327620-CCV1)				Prepared & Analyzed: 03/08/23					
Fluoride	0.658	mg/L		0.7000		94	90-110		
Calibration Check (B327620-CCV2)				Prepared & Analyzed: 03/08/23					
Fluoride	0.703	mg/L		0.7000		100	90-110		
Batch B327644 - IC No Prep - EPA 300.0 REV 2.1									
Calibration Blank (B327644-CCB1)				Prepared & Analyzed: 03/07/23					
Chloride	0.176	mg/L							
Sulfate	0.00	mg/L							
Calibration Check (B327644-CCV1)				Prepared & Analyzed: 03/07/23					
Sulfate	4.86	mg/L		5.000		97	90-110		
Chloride	4.67	mg/L		5.000		93	90-110		

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NOTES

Specifications regarding method revisions, method modifications, and calculations used for analysis are available upon request. Please contact your project manager.

* Not a TNI accredited analyte

Certifications

CHI - McHenry, IL - 4314-A W. Crystal Lake Road, McHenry, IL 60050
TNI Accreditation for Drinking Water and Wastewater Fields of Testing through IL EPA Accreditation No. 100279
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory Registry No. 17556

PIA - Peoria, IL - 2231 W. Altorfer Drive, Peoria, IL 61615
TNI Accreditation for Drinking Water, Wastewater, Solid and Hazardous Material Fields of Testing through IL EPA Accreditation No. 100230
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory Registry No. 17553
Drinking Water Certifications/Accreditations: Iowa (240); Kansas (E-10338); Missouri (870)
Wastewater Certifications/Accreditations: Arkansas (88-0677); Iowa (240); Kansas (E-10338)
Solid and Hazardous Material Certifications/Accreditations: Arkansas (88-0677); Iowa (240); Kansas (E-10338)

SPMO - Springfield, MO - 1805 W Sunset Street, Springfield, MO 65807
USEPA DMR-QA Program

STL - Hazelwood, MO - 944 Anglum Rd, Hazelwood, MO 63042
TNI Accreditation for Wastewater, Solid and Hazardous Material Fields of Testing through KS KDHE Certification No. E-10389
TNI Accreditation for Wastewater, Solid and Hazardous Material Fields of Testing through IL EPA Accreditation No. - 200080
Illinois Department of Public Health Bacterial Analysis in Drinking Water Approved Laboratory, Registry No. 171050
Missouri Department of Natural Resources - Certificate of Approval for Microbiological Laboratory Service - No. 1050

Qualifiers

Q4 The matrix spike recovery result is unusable since the analyte concentration in the sample is greater than four times the spike level. The associated blank spike was acceptable.

Gail J Schindler

Certified by: Gail Schindler, Project Manager

SAR-3: Depth to Groundwater Measurements
Plant: EDW
Event: EDW-23Q1-845-3013-R3

AP07D 24.57 at 1246 TD 62.23 AM
AP05D 5.63 at 1210 TD 59.58 APP
APW02 9.02 at 1052 TD 48.38 AM
APW03 7.86 at 1152 TD 33.38 APP

Well	Unique ID	Date	Time	Depth to Water, ft bmp		Transducer			Initials	Notes
				Manual	Transducer	Serial No.	Batt %	DL		
AP05S	EDW_AP05#S	2/27/23	1207	4.82					APP	TD 40.07
AP07S	EDW_AP07#S		1242	24.30					AM	TD 37.39
AP08	EDW_AP08		1318	7.63					APP	TD 21.97
AP09	EDW_AP09		1305	9.41					"	TD 20.89
AW-01	EDW_AW-01		1219	4.20					"	TD 21.42
AW-05	EDW_AW-05		1320	7.61					AM	
AW-06	EDW_AW-06		1202	26.89					"	
AW-08	EDW_AW-08		1200	24.58					APP	
AW-09	EDW_AW-09		1219	25.94					AM	
AW-10	EDW_AW-10		1147	1.55					APP	
AW-11	EDW_AW-11		1134	5.69					"	
AW-14	EDW_AW-14		1131	6.88					"	
AW-15	EDW_AW-15		1056	8.92					"	
AW-15S	EDW_AW-15#S		1054	10.05					"	
AW-16	EDW_AW-16		1222	24.60					AM	
AW-17	EDW_AW-17		1208	24.85					"	
AW-18	EDW_AW-18		1204	26.96					"	
AW-19	EDW_AW-19		1139	13.39					"	
AW-21	EDW_AW-21		1151	16.35					"	
AW-23	EDW_AW-23		~	~					APP	could not find
EMW-05	EDW_EMW-05		1300	20.29					AM	
SG-01	EDW_YILRIVER		1234	441.0					APP	
XPW01A	EDW_XPW01A_pore		1324	11.16					"	
XPW02	EDW_XPW02_pore		1244	19.78					"	
XPW03	EDW_XPW03_pore		1301	16.34					"	

APW04 7.01 at 1140 TD 23.01 unable to close casing APP
AW13 5.40 at 1144 APP
AW15c 7.46 at 1051 APP
AW12 6.58 at 1156 APP
AW20 ~~16.3~~ 16.15 at 1147 AM
AW22 11.30 at 1156 AM
EMW02 18.05 at 1226 APP
EMW03 21.22 at 1223 APP
EMW04 19.48 at 1309 AM
POO2 12.05 at 1144 AM
POO3 22.96 at 1212 TD 52.11
PTW01 24.53 at 1252 TD 40.57
OW-1 23.19 at 1254 TD 38.82

Site: Edwards Ash Pond

WELL/SAMPLE POINT ~~APW05~~ APOSS **Purge Method:** Portable

Date: 2-28-23 Start Time: 13:48 Finish/Sample Time: 14:40

Well Depth (Bottom) From MP: 39.85 ft

Depth to Water From MP: 5.43 ft

Water Column Length: 34.42 ft

Well Water Volume: 5.5 Gal / L

Min. Purge Volume: 1.0 Gal / L

Total Purge Volume: 1.3 Gal / L

Max Drawdown: — ft

Total Drawdown: 0.19 ft

Reading (Units)	Time	Depth ft.	Flow Rate mL/min	pH s.u.	Spec Cond umhos/cm	Temp deg C	ORP mV	DO mg/L	Turb NTU
1	13:59	5.62	100	7.03	1,390	13.98	-81	1.29	~~1000+~~ >1000
2	13:59	5.63	|	7.00	1,380	14.00	-85	1.21	~~1000+~~ >1000
3	14:00	5.60	|	7.01	1,390	14.01	-87	1.16	~~1000+~~ >1000
4			|						
5			|						
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA

Field Meter: Horiba

Sample Appearance:

Odor: ☐ None ☐ Slight ☑ Mod. ☐ Strong

Color ☐ None ☐ Slight ☐ Mod. ☑ Strong

Turb: ☐ None ☐ Slight ☐ Mod ☑ Strong

Well Integrity	Yes	No
Well has ID sign	✓	
Casing locked/secure	✓	
Well cap fits securely.	✓	
Good seal/drainage	✓	
Well has weep holes	✓	

BOTTLE INFORMATION:

3

Unfiltered Qty	Unfiltered Bottles
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
	General (P, 250 mL)
1	2.5 L, HNO3
1	1000 ML, P

Filtered Qty	Filtered Bottles
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

Final DTW: 5.62 ft

Comments

Sampler's Signature:

Site: Edwards Ash Pond

WELL/SAMPLE POINT AP07S **Purge Method:** portable pump

Date: 2-28-23 Start Time: 12:35 Finish/Sample Time: 13:28

Well Depth (Bottom) From MP: 37.25 ft Min. Purge Volume: 1.0 Gal / L

Depth to Water From MP: 24.55 ft Total Purge Volume: 1.3 Gal / L

Water Column Length: 12.70 ft Max Drawdown: — ft

Well Water Volume: 2.0 Gal / L Total Drawdown: 1.78 ft

Reading (Units)	Time	Depth ft.	Flow Rate mL/min	pH s.u.	Spec Cond umhos/cm	Temp deg C	ORP mV	DO mg/L	Turb NTU
1	12:45	24.98	100	7.28	3,800	13.47	111	7.00	~~1000+~~ >1000
2	12:46	25.06	|	7.15	3,840	13.49	107	6.97	~~1000+~~ >1000
3	12:47	25.09	|	7.13	3,820	13.53	100	6.83	~~1000+~~ >1000
4			|						
5			|						
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA

Field Meter: Horiba

Sample Appearance:

Odor: ☑ None ☐ Slight ☐ Mod. ☐ Strong

Color ☐ None ☐ Slight ☑ Mod. ☐ Strong

Turb: ☐ None ☐ Slight ☐ Mod ☑ Strong

Well Integrity	Yes	No
Well has ID sign	✓	
Casing locked/secure	✓	
Well cap fits securely.	✓	
Good seal/drainage	✓	
Well has weep holes	✓	

BOTTLE INFORMATION:

3

Unfiltered Qty	Unfiltered Bottles
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
	General (P, 250 mL)
1	2.5 L, HNO3
1	1000 mL, P

Filtered Qty	Filtered Bottles
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

Final DTW: 26.33 ft

Comments

Sampler's Signature: [signature]

Site: Edwards Ash Pond

WELL/SAMPLE POINT AW-01 **Purge Method:** Portable pump

Date: 2-28-23 Start Time: 14:48 Finish/Sample Time: 15:41

Well Depth (Bottom) From MP: 21.12 ft Min. Purge Volume: 1.0 Gal / L

Depth to Water From MP: 5.47 ft Total Purge Volume: 1.3 Gal / L

Water Column Length: 15.65 ft Max Drawdown: — ft

Well Water Volume: 2.5 Gal / L Total Drawdown: 0.33 ft

Reading (Units)	Time	Depth ft.	Flow Rate mL/min	pH s.u.	Spec Cond umhos/cm	Temp deg C	ORP mV	DO mg/L	Turb NTU
1	15:00	5.62	100	7.03	1,380	13.27	-86	1.18	~~1000+~~ >1000
2	15:01	5.64		7.02	1,390	13.29	-87	1.11	~~1000+~~ >1000
3	15:02	5.63		6.98	1,400	13:31	-89	1.07	~~1000+~~ >1000
4									
5									
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA

Field Meter: Horiba

Sample Appearance:

Odor: ☑ None ☐ Slight ☐ Mod. ☐ Strong

Color ☐ None ☐ Slight ☐ Mod. ☑ Strong

Turb: ☐ None ☐ Slight ☐ Mod ☑ Strong

Well Integrity	Yes	No
Well has ID sign	✓	
Casing locked/secure	✓	
Well cap fits securely.	✓	
Good seal/drainage	✓	
Well has weep holes	✓	

BOTTLE INFORMATION:

3

Unfiltered	
Qty	Bottles
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
	General (P, 250 mL)
1	2.5, L, HNO3
1	1000, ML, P

Filtered	
Qty	Bottles
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

Final DTW: 5.80 ft

Comments

Sampler's Signature: [signature]

Site: Edwards Ash Pond

WELL/SAMPLE POINT AW-05 **Purge Method:** Bladder

Date: 2-28-23 Start Time: 11:03 Finish/Sample Time: 11:57

Well Depth (Bottom) From MP: 22.45 ft

Depth to Water From MP: 7.83 ft

Water Column Length: 14.62 ft

Well Water Volume: 2.3 Gal / L

Min. Purge Volume: 1.9 Gal / L

Total Purge Volume: 1.3 Gal / L

Max Drawdown: — ft

Total Drawdown: 0.23 ft

Reading (Units)	Time	Depth ft.	Flow Rate mL/min	pH s.u.	Spec Cond umhos/cm	Temp deg C	ORP mV	DO mg/L	Turb NTU	
1	11:19	7.98	100	7.31	1,450	12.74	169	4.10	~~1000+~~	>1000
2	11:20	7.97		7.27	1,450	12.71	166	3.94	~~1000+~~	>1000
3	11:21	8.01		7.24	1,440	12.69	162	3.89	~~1000+~~	>1000
4										
5										
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA	

Field Meter: HoriBa

Sample Appearance:

Odor: ☑ None ☐ Slight ☐ Mod. ☑ Strong KL

Color ☐ None ☐ Slight ☐ Mod. ☑ Strong

Turb: ☐ None ☐ Slight ☐ Mod ☑ Strong

Well Integrity	Yes	No
Well has ID sign	✓	
Casing locked/secure	✓	
Well cap fits securely.	✓	
Good seal/drainage	✓	
Well has weep holes	✓	

BOTTLE INFORMATION:

3

Unfiltered	
Qty	**Bottles**
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
	General (P, 250 mL)
1	2.5 L, HNO3
1	1000 mL, P

Filtered	
Qty	**Bottles**
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

Final DTW: 8.06 ft

Comments

Sampler's Signature:

Site: Edwards Ash Pond

WELL/SAMPLE POINT AW-06 **Purge Method:** Compressor

Date: 28-Feb-23 Start Time: 0904 Finish/Sample Time: 1003

Well Depth (Bottom) From MP: 42.30 ft Min. Purge Volume: 1 Gal / (L)

Depth to Water From MP: 26.79 ft Total Purge Volume: 1.4 Gal / (L)

Water Column Length: _____ ft Max Drawdown: _____ ft

Well Water Volume: _____ Gal / L Total Drawdown: _____ ft

Reading	Time	Depth	Flow Rate	pH	Spec Cond	Temp	ORP	DO	Turb
(Units)		ft.	mL/min	s.u.	umhos/cm	deg C	mV	mg/L	NTU
1	0927	28.91	100	7.54	972	11.15	-58	2.01	0.0
2	0928	29.05	1	7.46	970	11.22	-62	1.77	528
3	0929	29.20	1	7.39	971	11.21	-65	1.57	1000
4									
5									
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA

Field Meter: Horriba

Sample Appearance:

Odor: ☑ None ☐ Slight ☐ Mod. ☐ Strong

Color ☐ None ☐ Slight ☐ Mod. ☑ Strong

Turb: ☐ None ☐ Slight ☐ Mod ☑ Strong

Well Integrity	Yes	No
Well has ID sign	✓	
Casing locked/secure	✓	
Well cap fits securely.	✓	
Good seal/drainage	✓	
Well has weep holes	✓	

BOTTLE INFORMATION:

Unfiltered	
Qty	Bottles
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
1	General (P, ~~250mL~~ 1L
1	HNO3 (P, 2.5L)

Filtered	
Qty	Bottles
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

Final DTW: 33.47 ft

Comments depth to bottom stops at pump

Sampler's Signature: Austin Moore

Site: Edwards Ash Pond

WELL/SAMPLE POINT AW-08 **Purge Method:** Compressor

Date: 28-Feb-23 Start Time: 1457 Finish/Sample Time: 1557

Well Depth (Bottom) From MP: 46.52 ft Min. Purge Volume: 1 Gal / L

Depth to Water From MP: 24.60 ft Total Purge Volume: 1.5 Gal / L

Water Column Length: _____ ft Max Drawdown: _____ ft

Well Water Volume: _____ Gal / L Total Drawdown: _____ ft

Reading (Units)	Time	Depth ft.	Flow Rate mL/min	pH s.u.	Spec Cond umhos/cm	Temp deg C	ORP mV	DO mg/L	Turb NTU
1	1510	25.61	100	9.35	740	13.74	-142	2.10	11.6
2	1511	25.71	1	9.12	739	13.71	-137	1.74	11.6
3	1512	25.83	1	8.92	725	13.70	-133	1.56	11.9
4									
5									
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA

Field Meter: Horiba

Sample Appearance:

Odor: ☐ None ☑ Slight ☐ Mod. ☐ Strong

Color ☐ None ☑ Slight ☐ Mod. ☐ Strong

Turb: ☐ None ☑ Slight ☐ Mod ☐ Strong

Well Integrity	Yes	No
Well has ID sign	✓	
Casing locked/secure	✓	
Well cap fits securely.	✓	
Good seal/drainage	✓	
Well has weep holes	✓	

BOTTLE INFORMATION:

Unfiltered	
Qty	Bottles
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
1	General (P, ~~250 mL~~ 1L)
1	HNO3 (P, 2.5L)

Filtered	
Qty	Bottles
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

Final DTW: 31.62 ft

Comments

Sampler's Signature: Austin Moore

Site: Edwards Ash Pond

WELL/SAMPLE POINT AW-09 **Purge Method:** Compressor

Date: 28-Feb-23 Start Time: 1114 Finish/Sample Time: 1205

Well Depth (Bottom) From MP: 47.24 ft Min. Purge Volume: 1 Gal / (L)

Depth to Water From MP: 26.01 ft Total Purge Volume: 1.3 Gal / (L)

Water Column Length: ____ ft Max Drawdown: ____ ft

Well Water Volume: ____ Gal / L Total Drawdown: ____ ft

Reading (Units)	Time	Depth ft.	Flow Rate mL/min	pH s.u.	Spec Cond umhos/cm	Temp deg C	ORP mV	DO mg/L	Turb NTU
1	1133	28.53	100	7.03	1340	12.52	-129	1.17	104
2	1134	28.71	1	7.02	1340	12.54	-130	1.08	95.6
3	1135	28.87	1	7.02	1330	12.57	-130	1.01	77.2
4									
5									
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA

Field Meter: Horriba

Sample Appearance:

Odor: ☐ None ☑ Slight ☐ Mod. ☐ Strong

Color ☐ None ☑ Slight ☐ Mod. ☐ Strong

Turb: ☐ None ☑ Slight ☐ Mod ☐ Strong

Well Integrity	Yes	No
Well has ID sign	✓	
Casing locked/secure	✓	
Well cap fits securely.	✓	
Good seal/drainage	✓	
Well has weep holes	✓	

BOTTLE INFORMATION:

Unfiltered	
Qty	Bottles
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
1	General (P, ~~250 mL~~) 1L
1	HNO3 (P,250L)

Filtered	
Qty	Bottles
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

34.03 FTOW

Comments depth to bottom stops at pump

Sampler's Signature: Austin Moore

Site: Edwards Ash Pond

WELL/SAMPLE POINT AW-10 **Purge Method:** Waffen

Date: 2/28/2023 Start Time: 1449 Finish/Sample Time: 1545

Well Depth (Bottom) From MP: _____ ft

Depth to Water From MP: 2.00 ft

Water Column Length: _____ ft

Well Water Volume: _____ Gal / L

Min. Purge Volume: — Gal / L

Total Purge Volume: 1000 Gal / L (mL)

Max Drawdown: — ft

Total Drawdown: 3.65 ft

Reading	Time	Depth	Flow Rate	pH	Spec Cond	Temp	ORP	DO	Turb
(Units)		ft.	mL/min	s.u.	umhos/cm	deg C	mV	mg/L	NTU
1	1301	3.37	100	7.03	2030	12.38	-88	0.89	>1000
2	1303	3.50	100	7.01	2030	12.31	-88	0.86	>1000
3	1305	3.65	100	7.00	2030	12.34	-89	0.82	>1000
4									
5									
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA

Field Meter: Horiba

Sample Appearance:

Odor: ☒ None ☐ Slight ☐ Mod. ☐ Strong

Color ☐ None ☒ Slight ☐ Mod. ☐ Strong

Turb: ☐ None ☐ Slight ☐ Mod ☒ Strong

Well Integrity	Yes	No
Well has ID sign	✓	
Casing locked/secure	✓	
Well cap fits securely.	✓	
Good seal/drainage	✓	
Well has weep holes	✓	

BOTTLE INFORMATION:

Unfiltered	
Qty	Bottles
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
1	General (P, 250 mL)
1	(P, 2.5L HNO3)

(3)

Filtered	
Qty	Bottles
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

Final DTW: 5.65 ft

Comments

Sampler's Signature:

Site: Edwards Ash Pond

WELL/SAMPLE POINT AW-11 **Purge Method:** Bladder

Date: 2/28/2023 Start Time: 1328 Finish/Sample Time: 1424

Well Depth (Bottom) From MP: _____ ft

Depth to Water From MP: 6.23 ft

Water Column Length: _____ ft

Well Water Volume: _____ Gal / L

Min. Purge Volume: ~ Gal / L

Total Purge Volume: 1000 Gal / L (mL)

Max Drawdown: ~ ft

Total Drawdown: 0.05 ft

APP 2/28/23

Reading	Time	Depth	Flow Rate	pH	Spec Cond	Temp	ORP	DO	Turb
(Units)		6.35 ft.	mL/min	s.u.	umhos/cm	deg C	mV	mg/L	NTU
1	1341	~~6.25~~	100	7.18	1660	10.90	-100	0.98	>1000
2	1343	6.30	100	7.17	1650	10.85	-101	0.95	>1000
3	1345	6.30	100	7.17	1650	10.81	-103	0.91	>1000
4									
5									
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA

Field Meter: Horiba

Sample Appearance:

Odor: ☒ None ☐ Slight ☐ Mod. ☐ Strong

Color ☐ None ☒ Slight ☐ Mod. ☐ Strong

Turb: ☐ None ☐ Slight ☐ Mod ☒ Strong

Well Integrity	Yes	No
Well has ID sign	✓	
Casing locked/secure	✓	
Well cap fits securely.	✓	
Good seal/drainage	✓	
Well has weep holes	✓	

BOTTLE INFORMATION:

Unfiltered	
Qty	Bottles
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
1	General (P, ~~250 mL~~) 1000mL
1	(P, 2.5L, HNO3)

(3)

Filtered	
Qty	Bottles
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

Final DTW: 6.30 ft

APP 2/28/23

Comments

Sampler's Signature:

Site: Edwards Ash Pond

WELL/SAMPLE POINT AW-14 **Purge Method:** bladder

Date: 2/28/2023 Start Time: 1217 Finish/Sample Time: 1313

Well Depth (Bottom) From MP: _____ ft

Depth to Water From MP: 6.93 ft

Water Column Length: _____ ft

Well Water Volume: _____ Gal / L

Min. Purge Volume: — Gal / L

Total Purge Volume: 1000 Gal / L (#2)

Max Drawdown: — ft

Total Drawdown: 7.04 ft

Reading	Time	Depth	Flow Rate	pH	Spec Cond	Temp	ORP	DO	Turb
(Units)		ft.	mL/min	s.u.	umhos/cm	deg C	mV	mg/L	NTU
1	1230	9.20	100	6.97	1690	11.50	-60	1.24	253
2	1232	9.42	100	6.97	1690	11.48	-61	1.20	257
3	1234	9.64	100	6.98	1696	11.44	-63	1.11	261
4									
5									
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA

Field Meter: Horiba

Sample Appearance:

Odor: ☒ None ☐ Slight ☐ Mod. ☐ Strong

Color ☐ None ☒ Slight ☐ Mod. ☐ Strong

Turb: ☐ None ☐ Slight ☒ Mod ☐ Strong

Well Integrity	Yes	No
Well has ID sign	✓	
Casing locked/secure	✓	
Well cap fits securely.	✓	
Good seal/drainage	✓	
Well has weep holes	J	

BOTTLE INFORMATION:

(3)

Unfiltered	
Qty	Bottles
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
1	General (P, ~~250 mL~~) 1000 mL
1	(P, 2.5L, HNO3)

Filtered	
Qty	Bottles
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

Final DTW: 13.97 ft

Comments

Sampler's Signature:

Site: Edwards Ash Pond

WELL/SAMPLE POINT AW-15 **Purge Method:** bladder

Date: 2/27/2023 Start Time: 1430 Finish/Sample Time: 1528

Well Depth (Bottom) From MP: _____ ft

Depth to Water From MP: 9.00 ft

Water Column Length: _____ ft

Well Water Volume: _____ Gal / L

Min. Purge Volume: – Gal / L

Total Purge Volume: 1000 Gal / L (mL)

Max Drawdown: – ft

Total Drawdown: 0.15 ft

Reading (Units)	Time	Depth ft.	Flow Rate mL/min	pH s.u.	Spec Cond umhos/cm	Temp deg C	ORP mV	DO mg/L	Turb NTU
1	1446	9.15	100	6.78	1850	12.98	-97	1.05	88.0
2	1448	9.15	100	6.75	1850	12.92	-100	1.02	102
3	1450	9.15	100	6.75	1840	12.84	-102	1.04	107
4									
5									
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA

Field Meter: Horiba

Sample Appearance:

Odor: ☒ None ☐ Slight ☐ Mod. ☐ Strong

Color ☐ None ☒ Slight ☐ Mod. ☐ Strong

Turb: ☐ None ☒ Slight ☐ Mod ☐ Strong

Well Integrity	Yes	No
Well has ID sign	√	
Casing locked/secure	√	
Well cap fits securely.	√	
Good seal/drainage	√	
Well has weep holes	√	

BOTTLE INFORMATION:

(3)

Unfiltered	
Qty	Bottles
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
1	General (P, ~~250mL~~ 1000mL
1	(P,2.5L, HNO3)

Filtered	
Qty	Bottles
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

Final DTW: 9.15 ft

Comments

Sampler's Signature: [signature]

Site: Edwards Ash Pond

WELL/SAMPLE POINT AW-15S **Purge Method:** bladder

Date: 2/27/2023 Start Time: 1530 Finish/Sample Time: 1630

Well Depth (Bottom) From MP: _____ ft

Depth to Water From MP: 10.04 ft

Water Column Length: _____ ft

Well Water Volume: _____ Gal / L

Min. Purge Volume: — Gal / L

Total Purge Volume: 1000 Gal / L (mL)

Max Drawdown: — ft

Total Drawdown: 2.36 ft

Reading (Units)	Time	Depth ft.	Flow Rate mL/min	pH s.u.	Spec Cond umhos/cm	Temp deg C	ORP mV	DO mg/L	Turb NTU
1	1545	10.92	100	6.82	1670	11.80	119	0.73	109
2	1547	11.00	100	6.82	1670	11.78	118	0.66	93.7
3	1550	11.08	100	6.81	1670	11.76	114	0.64	78.0
4									
5									
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA

Field Meter: Horiba

Sample Appearance:

Odor: ☒ None ☐ Slight ☐ Mod. ☐ Strong

Color ☐ None ☒ Slight ☐ Mod. ☐ Strong

Turb: ☐ None ☐ Slight ☒ Mod ☐ Strong

Well Integrity	Yes	No
Well has ID sign	✓	
Casing locked/secure	✓	
Well cap fits securely.	✓	
Good seal/drainage	✓	
Well has weep holes	✓	

BOTTLE INFORMATION:

(3)

Unfiltered	
Qty	Bottles
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
1	General (P, ~~250 mL~~ 1000mL
1	(P, 2.5L, HNO3)

Filtered	
Qty	Bottles
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

Final DTW 12.40

Comments

Sampler's Signature:

Site: Edwards Ash Pond

WELL/SAMPLE POINT AW-16 **Purge Method:** Compressor

Date: 28-Feb-23 Start Time: 1213 Finish/Sample Time: 1308

Well Depth (Bottom) From MP: 56.79 ft Min. Purge Volume: 1 Gal / (L)

Depth to Water From MP: 24.89 ft Total Purge Volume: 1.3 Gal / (L)

Water Column Length: _____ ft Max Drawdown: _____ ft

Well Water Volume: _____ Gal / L Total Drawdown: _____ ft

Reading	Time	Depth	Flow Rate	pH	Spec Cond	Temp	ORP	DO	Turb
(Units)		ft.	mL/min	s.u.	umhos/cm	deg C	mV	mg/L	NTU
1	1231	25.64	100	6.85	1950	13.26	-91	1.54	38.1
2	1232	25.64	1	6.84	1950	~~13.28~~	-93	1.17	30.2
3	1233	25.64	1	6.83	1950	13.25	-94	0.97	29.3
4									
5					uS/cm 2943.28				
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA

Field Meter: Horiba

Sample Appearance:

Odor: ☐ None ☐ Slight ☑ Mod. ☐ Strong

Color ☑ None ☐ Slight ☐ Mod. ☐ Strong

Turb: ☐ None ☑ Slight ☐ Mod ☐ Strong

Well Integrity	Yes	No
Well has ID sign	/	
Casing locked/secure	/	
Well cap fits securely.	/	
Good seal/drainage	/	
Well has weep holes		/

BOTTLE INFORMATION:

Unfiltered	
Qty	Bottles
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
	General (P, ~~250 mL~~) 1L
1	HNO3 (P, 2.5L)

Filtered	
Qty	Bottles
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

Final DTW: 25.64 ft

Comments

Sampler's Signature: Austin Moon

Site: Edwards Ash Pond

WELL/SAMPLE POINT AW-17 **Purge Method:** Compressor

Date: 28-Feb-23 Start Time: 1013 Finish/Sample Time: 1106

Well Depth (Bottom) From MP: ~~56.49~~ ft 56.56 Min. Purge Volume: 1 Gal / (L)

Depth to Water From MP: 25.60 ft Total Purge Volume: 1.3 Gal / (L)

Water Column Length: _____ ft Max Drawdown: _____ ft

Well Water Volume: _____ Gal / L Total Drawdown: _____ ft

Reading	Time	Depth	Flow Rate	pH	Spec Cond	Temp	ORP	DO	Turb
(Units)		ft.	mL/min	s.u.	umhos/cm	deg C	mV	mg/L	NTU
1	1031	26.94	100	6.91	1610	12.46	-103	0.53	968
2	1032	26.98	1	6.91	1610	12.50	-106	0.44	988
3	1033	27.01	1	6.90	1610	12.55	-108	0.36	869
4									
5									
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA

Field Meter: Horriba

Sample Appearance:

Odor: ☑ None ☐ Slight ☐ Mod. ☐ Strong

Color ☐ None ☑ Slight ☐ Mod. ☐ Strong

Turb: ☐ None ☐ Slight ☐ Mod ☑ Strong

Well Integrity	Yes	No
Well has ID sign	/	
Casing locked/secure	/	
Well cap fits securely.	/	
Good seal/drainage	/	
Well has weep holes		/

BOTTLE INFORMATION:

Unfiltered	
Qty	Bottles
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
1	General (P, ~~250mL~~) 1 L
1	HNO3 (P, 2.5L)

Filtered	
Qty	Bottles
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

Final DTW: 27.25 ft

Comments

Sampler's Signature: Austin Moore

Site: Edwards Ash Pond

WELL/SAMPLE POINT AW-18 **Purge Method:** Compressor

Date: 2/27/23 Start Time: 1545 Finish/Sample Time: 1650

Well Depth (Bottom) From MP: 50.68 ft Min. Purge Volume: 1 Gal / L

Depth to Water From MP: 27.00 ft Total Purge Volume: 1.5 Gal / L

Water Column Length: ____ ft Max Drawdown: ____ ft

Well Water Volume: ____ Gal / L Total Drawdown: ____ ft

Reading (Units)	Time	Depth ft.	Flow Rate mL/min	pH s.u.	Spec Cond umhos/cm	Temp deg C	ORP mV	DO mg/L	Turb NTU
1	1601	28.10	100	6.97	1640	12.18	-83	0.95	402
2	1602	28.17	1	6.94	1650	12.24	-89	0.72	497
3	1603	28.25	1	6.93	1660	12.25	-94	0.77	499
4									
5									
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA

Field Meter: Horriba

Sample Appearance:

Odor: ☐ None ☑ Slight ☐ Mod. ☐ Strong

Color ☐ None ☐ Slight ☑ Mod. ☐ Strong

Turb: ☐ None ☐ Slight ☐ Mod ☑ Strong

Well Integrity	Yes	No
Well has ID sign	✓	
Casing locked/secure	✓	
Well cap fits securely.	✓	
Good seal/drainage	✓	
Well has weep holes		✓

BOTTLE INFORMATION:

Unfiltered	
Qty	Bottles
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
1	General (P, ~~250 mL~~) 1L
1	HNO3 (P, 2.5L)

Filtered	
Qty	Bottles
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

Final DTW: 28.39 ft

Comments Depth to bottom stops at pump

Sampler's Signature: Austin Moore

Site: Edwards Ash Pond

WELL/SAMPLE POINT AW-19 **Purge Method:** Compressor

Date: 2/27/23 Start Time: 1425 Finish/Sample Time: 1529

Well Depth (Bottom) From MP: 38.60 ft Min. Purge Volume: 1 Gal (D)

Depth to Water From MP: 13.37 ft Total Purge Volume: 1.4 Gal (D)

Water Column Length: ____ ft Max Drawdown: ____ ft

Well Water Volume: ____ Gal / L Total Drawdown: ____ ft

Reading (Units)	Time	Depth ft.	Flow Rate mL/min	pH s.u.	Spec Cond umhos/cm	Temp deg C	ORP mV	DO mg/L	Turb NTU
1	1448	14.32	100	7.02	1081	12.88	49	2.17	185
2	1449	14.34	1	7.01	1080	12.86	33	2.01	184
3	1450	14.36	1	7.00	1080	12.86	20	1.89	185
4									
5									
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA

Field Meter: Horiba

Sample Appearance:

Odor: ☑ None ☐ Slight ☐ Mod. ☐ Strong

Color ☐ None ☑ Slight ☐ Mod. ☐ Strong

Turb: ☐ None ☐ Slight ☐ Mod ☑ Strong

Well Integrity	Yes	No
Well has ID sign	✓	
Casing locked/secure	✓	
Well cap fits securely.	✓	
Good seal/drainage	✓	
Well has weep holes		✓

BOTTLE INFORMATION:

Unfiltered	
Qty	Bottles
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
1	General (P, ~~250 mL~~) 1 L
1	HNO3 (P, 2.5L)

Filtered	
Qty	Bottles
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

Final DTW: 16.03 ft

Comments Depth to bottom stops at pump

Sampler's Signature: Austin Moore

Site: Edwards Ash Pond

WELL/SAMPLE POINT AW-21 **Purge Method:** Bladder

Date: 2-28-23 Start Time: 09:08 Finish/Sample Time: 10:05

Well Depth (Bottom) From MP: 33.53 ft top of pump Min. Purge Volume: 1.0 Gal / L

Depth to Water From MP: 16.34 ft Total Purge Volume: 1.3 Gal / L

Water Column Length: 17.19 ft Max Drawdown: — ft

Well Water Volume: 2.7 Gal / L Total Drawdown: 1.20 ft

Reading (Units)	Time	Depth ft.	Flow Rate mL/min	pH s.u.	Spec Cond umhos/cm	Temp deg C	ORP mV	DO mg/L	Turb NTU
1	09:22	17.10	100	7.89	8,772	12.13	228	6.60	136
2	09:23	17.12		7.95	8,754	12.14	227	6.64	133
3	09:24	17.13		7.99	8,728	12.15	227	6.72	125
4									
5									
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA

Field Meter: Horiba

Sample Appearance:

Odor: ☑ None ☐ Slight ☐ Mod. ☐ Strong

Color ☑ None ☐ Slight ☐ Mod. ☐ Strong

Turb: ☑ None ☐ Slight ☐ Mod ☐ Strong

Well Integrity	Yes	No
Well has ID sign	✓	
Casing locked/secure	✓	
Well cap fits securely.	✓	
Good seal/drainage	✓	
Well has weep holes	✓	

BOTTLE INFORMATION:

3

Unfiltered	
Qty	Bottles
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
	General (P, 250 mL)
1	250 mL, HNO3
1	100, mL, P

Filtered	
Qty	Bottles
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

Final DTW: 17.54 ft

Comments

Sampler's Signature:

Site: Edwards Ash Pond

WELL/SAMPLE POINT XPW01A **Purge Method:** Bladder

Date: 2-28-23 Start Time: 10:08 Finish/Sample Time: 10:48

Well Depth (Bottom) From MP: 36.34 ft top of Pump Min. Purge Volume: 1.0 Gal / L

Depth to Water From MP: 11.32 ft Total Purge Volume: 1.3 Gal / L

Water Column Length: 25.02 ft Max Drawdown: — ft

Well Water Volume: 4.0 Gal / L Total Drawdown: 0.25 ft

Reading (Units)	Time	Depth ft.	Flow Rate mL/min	pH s.u.	Spec Cond umhos/cm	Temp deg C	ORP mV	DO mg/L	Turb NTU	DO
1	10:23	11.45	100	11.73	1,940	10.96	66	~~52.4~~	56.4	4.40
2	10:24	11.47		11.75	1,950	10.98	59	~~51.8~~	55.0	4.38
3	10:25	11.48		11.76	1,970	10.97	54	~~49.~~	52.9	4.23
4										
5										
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA	

Field Meter: HoriBa

Sample Appearance:

Odor: ☑ None ☐ Slight ☐ Mod. ☐ Strong

Color ☑ None ☐ Slight ☐ Mod. ☐ Strong

Turb: ☑ None ☐ Slight ☐ Mod ☐ Strong

Well Integrity	Yes	No
Well has ID sign	✓	
Casing locked/secure	✓	
Well cap fits securely.	✓	
Good seal/drainage	✓	
Well has weep holes	✓	

BOTTLE INFORMATION:

2

Unfiltered	
Qty	Bottles
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
	General (P, 250 mL)
1	lead, ML, P

Filtered	
Qty	Bottles
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

Final DTW: 11:57 ft

Comments

Sampler's Signature:

Site: Edwards Ash Pond

WELL/SAMPLE POINT XPW02 **Purge Method:** Compressor

Date: 28-Feb-23 Start Time: 1356 Finish/Sample Time: 1427

Well Depth (Bottom) From MP: 40.63 ft Min. Purge Volume: 1 Gal / (L)

Depth to Water From MP: 20.13 ft Total Purge Volume: 1.3 Gal / (L)

Water Column Length: _____ ft Max Drawdown: ~~_____~~ ft

Well Water Volume: _____ Gal / L Total Drawdown: _____ ft

Reading (Units)	Time	Depth ft.	Flow Rate mL/min	pH s.u.	Spec Cond umhos/cm	Temp deg C	ORP mV	DO mg/L	Turb NTU
1	1413	20.30	100	12.20	4110	17.07	-143	2.00	18.00
2	1414	20.30	"	12.19	4140	13.98	-145	1.84	20.8
3	1415	20.30	"	12.19	4140	13.91	-148	1.69	19.8
4									
5									
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA

Field Meter: Horriba

Sample Appearance:

Odor: ☐ None ☑ Slight ☐ Mod. ☐ Strong

Color ☑ None ☐ Slight ☐ Mod. ☐ Strong

Turb: ☐ None ☑ Slight ☐ Mod ☐ Strong

Well Integrity	Yes	No
Well has ID sign	/	
Casing locked/secure	/	
Well cap fits securely.	/	
Good seal/drainage	/	
Well has weep holes		/

BOTTLE INFORMATION:

Unfiltered	
Qty	Bottles
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
1	General (P, ~~250 mL~~) 1L

Filtered	
Qty	Bottles
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

Final DTW: 20.30 ft

Comments depth to bottom stops at pump

Sampler's Signature: [signature]

Site: Edwards Ash Pond

WELL/SAMPLE POINT XPW03 **Purge Method:** bladder

Date: 2/28/2023 Start Time: 1551 Finish/Sample Time: 1633

Well Depth (Bottom) From MP: _____ ft

Depth to Water From MP: 16.34 ft

Water Column Length: _____ ft

Well Water Volume: _____ Gal / L

Min. Purge Volume: — Gal / L

Total Purge Volume: 1000 Gal / L

Max Drawdown: — ft

Total Drawdown: 0.21 ft

Reading (Units)	Time	Depth ft.	Flow Rate mL/min	pH s.u.	Spec Cond umhos/cm	Temp deg C	ORP mV	DO mg/L	Turb NTU
1	1610	16.55	100	11.92	1940	15.09	-46	2.75	104
2	1612	16.55	100	11.94	1930	15.13	-49	2.68	88.9
3	1614	16.55	100	11.94	1930	15.07	-51	2.55	78.1
4									
5									
Stabilization	NA	NA	NA	± 0.2	± 3%	± 0.2	± 20	± 10% or 0.2	NA

Field Meter: Horiba

Sample Appearance:

Odor: ☒ None ☐ Slight ☐ Mod. ☐ Strong

Color ☒ None ☐ Slight ☐ Mod. ☐ Strong

Turb: ☐ None ☒ Slight ☐ Mod ☐ Strong

Well Integrity	Yes	No
Well has ID sign	✓	
Casing locked/secure	✓	
Well cap fits securely.	✓	
Good seal/drainage	✓	
Well has weep holes	✓	

BOTTLE INFORMATION:

Unfiltered	
Qty	Bottles
	VOAs (C,V, 40mL, HCL)
	VOAS (C,V, 40mL)
	Organics (A,G,U 1000mL)
	Organics (A,G,U 500mL)
	TOC (A,V 40mL, H2SO4)
	TOX (A,G 250mL, H2SO4)
1	Metals (P,250mL, HNO3)
	Cyanide (P, 250mL, NaOH)
	Phenols (A,G,250mL, H2SO4)
1	General (P, ~~250~~ mL) 1000mL

(2)

Filtered	
Qty	Bottles
	Metals (P,250mL, HNO3)
	Ammonia (P,250mL, H2S04)
	General (P,500mL)

Final DTW 16.55 ft

Comments

Sampler's Signature:

Multiparameter Meter Field Calibration Checklist

Field Personnel:	AP	Location:	Edwards Power Station
Weather:	54°F cloudy, rain, wind 11 mph	Environment:	grass, mud
Multiparameter Water Meter	Make: Horiba	Model: U-52000	Serial Number: UKVIFVTF
Water Level Meter	Make: Heron	Model: Dipper T	Serial Number: 3717-T

Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
pH 4.00a	3.75	s.u.	±0.1 s.u.	P	Yes	4.00	MSI	L344-09	12/14/2023
pH 7.00a	6.87	s.u.	±0.1 s.u.	P	Yes	7.00	MSI	L343-07	12/9/2023
pH 10.00a	10.06	s.u.	±0.1 s.u.	P	NO	—	MSI	M082-04	3/25/2024
SC Zero (DI)	00	µS/cm	0<25 µS/cm	P	NO	—	Pace Labs	N/A (DI)	N/A (DI)
SC 2000	2020	µS/cm	±5%	P	NO	—	Geotech	2GE1442	May-23
ORP	241	mV	±15 mV	P	NO	—	InSitu	2G1762	Jun-23
DO (Zero pt)	0.00	mg/L	±0.1	P	NO	—	Macron	#000228049	8/26/2025
DO (Saturated)	99.7	%	97-100%	P	NO	—	Pace Labs	N/A (DI)	N/A (DI)
Turbidity (DI)	0.0	NTU	<2 NTU	P	No	—	Pace Labs	N/A (DI)	N/A (DI)

Approx. every 4 hrs, unless only one well

241 @ 16°C

ICV (Initial Calibration Verification) — Time: 1415

Buffer	Check Value	Units	Range	Pass/Fail	Action Taken?	Manufacturer	Lot#	Exp.
pH 4.00b	3.99	s.u.	±0.15 s.u.	P	—	Geotech	2GC243	Mar-24
pH 7.00b	6.88	s.u.	±0.15 s.u.	P	—	Geotech	2GC931	Mar-24
pH 10.00b	10.04	s.u.	±0.15 s.u.	P	—	Geotech	2GE820	May-24
SC 1000	1010	µS/cm	±5%	P	—	Ricca	4205H64	May-24

Approx. every 4 hrs, unless only one well

CCV (Continued Calibration Verification): — Time: 1645

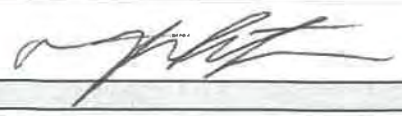
Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
pH 4.00a	4.01	s.u.	±0.1 s.u.	P	NO	NA	MSI	L315-04	11/22/2023
pH 7.00a	7.02	s.u.	±0.1 s.u.				MSI	L172-33	6/23/2023
pH 10.00a	10.07	s.u.	±0.1 s.u.				MSI	L354-22	1/5/2024
SC 1000	1030	µS/cm	±5%				Ricca	2108D48	Jul-23
DO (Zero pt)	0.09	mg/L	±0.1 mg/L				Macron	#000228049	8/26/2025
Turbidity (DI)	0.0	NTU	<2 NTU			—	Pace Labs	N/A (DI)	N/A (DI)

Approx. every 4 hrs, unless only one well

CCV (Continued Calibration Verification): — Time:

Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
4.00a		s.u.	±0.1 s.u.				MSI	L315-04	11/22/2023
7.00a		s.u.	±0.1 s.u.				MSI	L172-33	6/23/2023
10.00a		s.u.	±0.1 s.u.				MSI	L354-22	1/5/2024
SC 1000		µS/cm	±5%				Ricca	2108D48	Jul-23
DO (Zero pt)		mg/L	±0.1 mg/L				Macron	#000228049	8/26/2025
Turbidity (DI)		NTU	<2 NTU				Pace Labs	N/A (DI)	N/A (DI)

Comments:

Signature:		Date:	2/27/2023

Multiparameter Meter Field Calibration Checklist

Field Personnel:	Austin Moore	Location:	Edwards
Weather:	39-41° cloudy 14 mph wind NE	Environment:	Mud/Grass

Multiparameter Water Meter	Make: Horiba	Model: U-5000	Serial Number:	PW2GYJD3	
Water Level Meter	Make: WT	Model: Heron	Serial Number:	1FF220930ML	

Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
pH 4.00a	4.06	s.u.	±0.1 s.u.	P	N	N/A	MSI	L344-09	12/14/2023
pH 7.00a	6.93	s.u.	±0.1 s.u.				MSI	L343-07	12/9/2023
pH 10.00a	10.01	s.u.	±0.1 s.u.				MSI	M082-04	3/25/2024
SC Zero (DI)	0	µS/cm	0<25 µS/cm				Pace Labs	N/A (DI)	N/A (DI)
SC 2000	2020	µS/cm	±5%				Geotech	2GE1442	May-23
ORP	244	mV	±15 mV				InSitu	2G1762	Jun-23
DO (Zero pt)	0.05	mg/L	±0.1				Macron	#000228049	8/26/2025
DO (Saturated)	95.1	%	97-100%				Pace Labs	N/A (DI)	N/A (DI)
Turbidity (DI)	0.0	NTU	<2 NTU				Pace Labs	N/A (DI)	N/A (DI)

Approx. every 4 hrs, unless only one well

ICV (Initial Calibration Verification) — Time: 1358

Buffer	Check Value	Units	Range	Pass/Fail	Action Taken?	Manufacturer	Lot#	Exp.
pH 4.00b	4.14	s.u.	±0.15 s.u.	P	N/A	Geotech	2GC243	Mar-24
pH 7.00b	6.99	s.u.	±0.15 s.u.			Geotech	2GC931	Mar-24
pH 10.00b	10.03	s.u.	±0.15 s.u.			Geotech	2GE820	May-24
SC 1000	980	µS/cm	±5%			Ricca	4205H64	May-24

Approx. every 4 hrs, unless only one well

CCV (Continued Calibration Verification): — Time: 1700

Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
pH 4.00a	4.03	s.u.	±0.1 s.u.	P	N	N/A	MSI	L315-04	11/22/2023
pH 7.00a	7.01	s.u.	±0.1 s.u.				MSI	L172-33	6/23/2023
pH 10.00a	10.00	s.u.	±0.1 s.u.				MSI	L354-22	1/5/2024
SC 1000	1010	µS/cm	±5%				Ricca	2108D48	Jul-23
DO (Zero pt)	0.05	mg/L	±0.1 mg/L				Macron	#000228049	8/26/2025
Turbidity (DI)	0.0	NTU	<2 NTU				Pace Labs	N/A (DI)	N/A (DI)

Approx. every 4 hrs, unless only one well

CCV (Continued Calibration Verification): — Time:

Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
4.00a		s.u.	±0.1 s.u.				MSI	L315-04	11/22/2023
7.00a		s.u.	±0.1 s.u.				MSI	L172-33	6/23/2023
10.00a		s.u.	±0.1 s.u.				MSI	L354-22	1/5/2024
SC 1000		µS/cm	±5%				Ricca	2108D48	Jul-23
DO (Zero pt)		mg/L	±0.1 mg/L				Macron	#000228049	8/26/2025
Turbidity (DI)		NTU	<2 NTU				Pace Labs	N/A (DI)	N/A (DI)

Comments:

Signature:	Austin Moore	Date:	27-Feb-23

Multiparameter Meter Field Calibration Checklist

Field Personnel:	Aaron Pemberton	Location:	Edwards
Weather:	46°-52°L Partly Cloudy wind E 7mph	Environment:	grass, gravel, mud

Multiparameter Water Meter	Make:	Horiba	Model:	U5000	Serial Number:	YL9K59HA
Water Level Meter	Make:	Heron	Model:	Dipper T	Serial Number:	3717-T

Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
pH 4.00a	4.00	s.u.	±0.1 s.u.	P	NO	N/A	MSI	L344-09	12/14/2023
pH 7.00a	7.03	s.u.	±0.1 s.u.				MSI	L343-07	12/9/2023
pH 10.00a	10.05	s.u.	±0.1 s.u.				MSI	M082-04	3/25/2024
SC Zero (DI)	18	µS/cm	0<25 µS/cm				Pace Labs	N/A (DI)	N/A (DI)
SC 2000	2000	µS/cm	±5%				Geotech	2GE1442	May-23
ORP	242	mV	±15 mV				InSitu	2G1762	Jun-23
DO (Zero pt)	0.09	mg/L	±0.1				Macron	#000228049	8/26/2025
DO (Saturated)	98.2	%	97-100%				Pace Labs	N/A (DI)	N/A (DI)
Turbidity (DI)	0.0	NTU	<2 NTU				Pace Labs	N/A (DI)	N/A (DI)

Approx. every 4 hrs, unless only one well

240 @ 17°C

App 2/28/23

ICV (Initial Calibration Verification)

Time: 1200

Buffer	Check Value	Units	Range	Pass/Fail	Action Taken?	Manufacturer	Lot#	Exp.
pH 4.00b	3.98	s.u.	±0.15 s.u.	P	NA	Geotech	2GC243	Mar-24
pH 7.00b	~~5~~ 6.88	s.u.	±0.15 s.u.			Geotech	2GC931	Mar-24
pH 10.00b	10.06	s.u.	±0.15 s.u.			Geotech	2GE820	May-24
SC 1000 1020	~~1020~~	µS/cm	±5%			Ricca	4205H64	May-24

Approx. every 4 hrs, unless only one well

CCV (Continued Calibration Verification):

Time: 1649

Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
pH 4.00a	4.03	s.u.	±0.1 s.u.	P	NO	N/A	MSI	L315-04	11/22/2023
pH 7.00a	7.02	s.u.	±0.1 s.u.				MSI	L172-33	6/23/2023
pH 10.00a	10.08	s.u.	±0.1 s.u.				MSI	L354-22	1/5/2024
SC 1000	1030	µS/cm	±5%				Ricca	2108D48	Jul-23
DO (Zero pt)	0.09	mg/L	±0.1 mg/L				Macron	#000228049	8/26/2025
Turbidity (DI)	0.0	NTU	<2 NTU				Pace Labs	N/A (DI)	N/A (DI)

Approx. every 4 hrs, unless only one well

CCV (Continued Calibration Verification):

Time:

Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
4.00a		s.u.	±0.1 s.u.				MSI	L315-04	11/22/2023
7.00a		s.u.	±0.1 s.u.				MSI	L172-33	6/23/2023
10.00a		s.u.	±0.1 s.u.				MSI	L354-22	1/5/2024
SC 1000		µS/cm	±5%				Ricca	2108D48	Jul-23
DO (Zero pt)		mg/L	±0.1 mg/L				Macron	#000228049	8/26/2025
Turbidity (DI)		NTU	<2 NTU				Pace Labs	N/A (DI)	N/A (DI)

Comments:

Signature:	[signature]	Date:	2/28/2023

Multiparameter Meter Field Calibration Checklist

Field Personnel:	Austin Moore	Location:	Edwards Power Station
Weather:	33-37° sunny wind 10NW	Environment:	Grass Mud
Multiparameter Water Meter	Make: Horiba	Model: U-5000	Serial Number: PW2GKJD3
Water Level Meter	Make: Heron	Model: Water tape	Serial Number: IIFF220930SML

Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
pH 4.00a	4.00	s.u.	±0.1 s.u.	P	N	N/A	MSI	L344-09	12/14/2023
pH 7.00a	6.97	s.u.	±0.1 s.u.				MSI	L343-07	12/9/2023
pH 10.00a	10.04	s.u.	±0.1 s.u.				MSI	M082-04	3/25/2024
SC Zero (DI)	18.45	µS/cm	0<25 µS/cm				Pace Labs	N/A (DI)	N/A (DI)
SC 2000	2031	µS/cm	±5%				Geotech	2GE1442	May-23
ORP	234	mV	±15 mV				InSitu	2G1762	Jun-23
DO (Zero pt)	0.00	mg/L	±0.1				Macron	#000228049	8/26/2025
DO (Saturated)	97.98	%	97-100%				Pace Labs	N/A (DI)	N/A (DI)
Turbidity (DI)	0.58	NTU	<2 NTU				Pace Labs	N/A (DI)	N/A (DI)

Approx. every 4 hrs, unless only one well

ICV (Initial Calibration Verification) — Time: 0830

Buffer	Check Value	Units	Range	Pass/Fail	Action Taken?	Manufacturer	Lot#	Exp.
pH 4.00b	3.99	s.u.	±0.15 s.u.	P	N	Geotech	2GC243	Mar-24
pH 7.00b	6.94	s.u.	±0.15 s.u.			Geotech	2GC931	Mar-24
pH 10.00b	9.96	s.u.	±0.15 s.u.			Geotech	2GE820	May-24
SC 1000	1015	µS/cm	±5%			Ricca	4205H64	May-24

Approx. every 4 hrs, unless only one well

CCV (Continued Calibration Verification): — Time: 1630

Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
pH 4.00a	4.03	s.u.	±0.1 s.u.	P	N	N/A	MSI	L315-04	11/22/2023
pH 7.00a	7.02	s.u.	±0.1 s.u.				MSI	L172-33	6/23/2023
pH 10.00a	10.05	s.u.	±0.1 s.u.				MSI	L354-22	1/5/2024
SC 1000	1020	µS/cm	±5%				Ricca	2108D48	Jul-23
DO (Zero pt)	0.06	mg/L	±0.1 mg/L				Macron	#000228049	8/26/2025
Turbidity (DI)	0.0	NTU	<2 NTU				Pace Labs	N/A (DI)	N/A (DI)

Approx. every 4 hrs, unless only one well

CCV (Continued Calibration Verification): — Time:

Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
4.00a		s.u.	±0.1 s.u.				MSI	L315-04	11/22/2023
7.00a		s.u.	±0.1 s.u.				MSI	L172-33	6/23/2023
10.00a		s.u.	±0.1 s.u.				MSI	L354-22	1/5/2024
SC 1000		µS/cm	±5%				Ricca	2108D48	Jul-23
DO (Zero pt)		mg/L	±0.1 mg/L				Macron	#000228049	8/26/2025
Turbidity (DI)		NTU	<2 NTU				Pace Labs	N/A (DI)	N/A (DI)

Comments:

Signature:	Austin Moore	Date:	28-Feb-23

Multiparameter Meter Field Calibration Checklist

Field Personnel:	Kyle Lane			Location:	Edwards Power
Weather:	37° to 52° Cloudy			Environment:	Wet / Muddy
Multiparameter Water Meter		Make:	Horiba	Model:	U-5000	Serial Number:	VHFV1FVTF
Water Level Meter		Make:	Heron	Model:	water tape	Serial Number:	19FF220213IML

Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
pH 4.00a	4.08	s.u.	±0.1 s.u.	P	N/A	N/A	MSI	L344-09	12/14/2023
pH 7.00a	7.04	s.u.	±0.1 s.u.				MSI	L343-07	12/9/2023
pH 10.00a	10.01	s.u.	±0.1 s.u.				MSI	M082-04	3/25/2024
SC Zero (DI)	20.48	µS/cm	0<25 µS/cm				Pace Labs	N/A (DI)	N/A (DI)
SC 2000	2020	µS/cm	±5%				Geotech	2GE1442	May-23
ORP	244	mV	±15 mV				InSitu	2G1762	Jun-23
DO (Zero pt)	0.84	mg/L	±0.1				Macron	#000228049	8/26/2025
DO (Saturated)	99.40	%	97-100%				Pace Labs	N/A (DI)	N/A (DI)
Turbidity (DI)	0.26	NTU	<2 NTU				Pace Labs	N/A (DI)	N/A (DI)

Approx. every 4 hrs, unless only one well

ICV (Initial Calibration Verification)					Time: 0952			
Buffer	Check Value	Units	Range	Pass/Fail	Action Taken?	Manufacturer	Lot#	Exp.
pH 4.00b	3.96	s.u.	±0.15 s.u.	P	N/A	Geotech	2GC243	Mar-24
pH 7.00b	6.84	s.u.	±0.15 s.u.			Geotech	2GC931	Mar-24
pH 10.00b	10.11	s.u.	±0.15 s.u.			Geotech	2GE820	May-24
SC 1000	1044	µS/cm	±5%			Ricca	4205H64	May-24

Approx. every 4 hrs, unless only one well

CCV (Continued Calibration Verification):					Time: X				
Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
pH 4.00a	X	s.u.	±0.1 s.u.	X	X	X	MSI	L315-04	11/22/2023
pH 7.00a		s.u.	±0.1 s.u.				MSI	L172-33	6/23/2023
pH 10.00a		s.u.	±0.1 s.u.				MSI	L354-22	1/5/2024
SC 1000		µS/cm	±5%				Ricca	2108D48	Jul-23
DO (Zero pt)		mg/L	±0.1 mg/L				Macron	#000228049	8/26/2025
Turbidity (DI)		NTU	<2 NTU				Pace Labs	N/A (DI)	N/A (DI)

Approx. every 4 hrs, unless only one well

CCV (Continued Calibration Verification):					Time: 1457				
Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
4.00a	4.03	s.u.	±0.1 s.u.	P	N/A	N/A	MSI	L315-04	11/22/2023
7.00a	7.04	s.u.	±0.1 s.u.				MSI	L172-33	6/23/2023
10.00a	10.00	s.u.	±0.1 s.u.				MSI	L354-22	1/5/2024
SC 1000	1028	µS/cm	±5%				Ricca	2108D48	Jul-23
DO (Zero pt)	0.04	mg/L	±0.1 mg/L				Macron	#000228049	8/26/2025
Turbidity (DI)	0.49	NTU	<2 NTU				Pace Labs	N/A (DI)	N/A (DI)

Comments:

Signature:		Date:	2-28-23

Multiparameter Meter Field Calibration Checklist

Field Personnel:	AP	Location:	Edwards Power Station
Weather:	54°F cloudy, rain wind 11 mph	Environment:	grass, mud

Multiparameter Water Meter	Make: Horiba	Model: DSC00	Serial Number:	UKVIFVTF	
Water Level Meter	Make: Heron	Model: Dipper T	Serial Number:	3717-T	

Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
pH 4.00a	3.75	s.u.	±0.1 s.u.	F	Yes	4.00	MSI	L344-09	12/14/2023
pH 7.00a	6.87	s.u.	±0.1 s.u.	F	Yes	7.00	MSI	L343-07	12/9/2023
pH 10.00a	10.06	s.u.	±0.1 s.u.	P	NO	—	MSI	M082-04	3/25/2024
SC Zero (DI)	20	µS/cm	0<25 µS/cm	P	NO	—	Pace Labs	N/A (DI)	N/A (DI)
SC 2000	2020	µS/cm	±5%	P	NO	—	Geotech	2GE1442	May-23
ORP	241	mV	±15 mV	P	NO	—	InSitu	2G1762	Jun-23
DO (Zero pt)	0.00	mg/L	±0.1	P	NO	—	Macron	#000228049	8/26/2025
DO (Saturated)	99.7	%	97-100%	P	NO	—	Pace Labs	N/A (DI)	N/A (DI)
Turbidity (DI)	0.0	NTU	<2 NTU	P	No	—	Pace Labs	N/A (DI)	N/A (DI)

Approx. every 4 hrs, unless only one well

241 @ 16°C

ICV (Initial Calibration Verification) — Time: 1415

Buffer	Check Value	Units	Range	Pass/Fail	Action Taken?	Manufacturer	Lot#	Exp.
pH 4.00b	3.99	s.u.	±0.15 s.u.	P	—	Geotech	2GC243	Mar-24
pH 7.00b	6.88	s.u.	±0.15 s.u.	P	—	Geotech	2GC931	Mar-24
pH 10.00b	10.04	s.u.	±0.15 s.u.	P	—	Geotech	2GE820	May-24
SC 1000	1010	µS/cm	±5%	P	—	Ricca	4205H64	May-24

Approx. every 4 hrs, unless only one well

CCV (Continued Calibration Verification): — Time: 1645

Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
pH 4.00a	4.01	s.u.	±0.1 s.u.	P	NO	NA	MSI	L315-04	11/22/2023
pH 7.00a	7.02	s.u.	±0.1 s.u.				MSI	L172-33	6/23/2023
pH 10.00a	10.07	s.u.	±0.1 s.u.				MSI	L354-22	1/5/2024
SC 1000	1030	µS/cm	±5%				Ricca	2108D48	Jul-23
DO (Zero pt)	0.09	mg/L	±0.1 mg/L				Macron	#000228049	8/26/2025
Turbidity (DI)	0.0	NTU	<2 NTU				Pace Labs	N/A (DI)	N/A (DI)

Approx. every 4 hrs, unless only one well

CCV (Continued Calibration Verification): — Time:

Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
4.00a		s.u.	±0.1 s.u.				MSI	L315-04	11/22/2023
7.00a		s.u.	±0.1 s.u.				MSI	L172-33	6/23/2023
10.00a		s.u.	±0.1 s.u.				MSI	L354-22	1/5/2024
SC 1000		µS/cm	±5%				Ricca	2108D48	Jul-23
DO (Zero pt)		mg/L	±0.1 mg/L				Macron	#000228049	8/26/2025
Turbidity (DI)		NTU	<2 NTU				Pace Labs	N/A (DI)	N/A (DI)

Comments:

Signature:	[signature]	Date:	2/27/2023

Multiparameter Meter Field Calibration Checklist

Field Personnel:	Austin Moore	Location:	Edwards
Weather:	59°-71° cloudy 14mph wind NE	Environment:	Mud/Grass
Multiparameter Water Meter	Make: Horiba	Model: U-5000	Serial Number: PW26YJD3
Water Level Meter	Make: WT	Model: Heron	Serial Number: 1IFF220930ML

Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
pH 4.00a	4.06	s.u.	±0.1 s.u.	P	N	N/A	MSI	L344-09	12/14/2023
pH 7.00a	6.93	s.u.	±0.1 s.u.				MSI	L343-07	12/9/2023
pH 10.00a	10.01	s.u.	±0.1 s.u.				MSI	M082-04	3/25/2024
SC Zero (DI)	0	µS/cm	0<25 µS/cm				Pace Labs	N/A (DI)	N/A (DI)
SC 2000	2020	µS/cm	±5%				Geotech	2GE1442	May-23
ORP	244	mV	±15 mV				InSitu	2G1762	Jun-23
DO (Zero pt)	0.05	mg/L	±0.1				Macron	#000228049	8/26/2025
DO (Saturated)	—	%	97-100%				Pace Labs	N/A (DI)	N/A (DI)
Turbidity (DI)	0.0	NTU	<2 NTU				Pace Labs	N/A (DI)	N/A (DI)

Approx. every 4 hrs, unless only one well

ICV (Initial Calibration Verification) Time: 1358

Buffer	Check Value	Units	Range	Pass/Fail	Action Taken?	Manufacturer	Lot#	Exp.
pH 4.00b	4.17	s.u.	±0.15 s.u.	P	N/A	Geotech	2GC243	Mar-24
pH 7.00b	6.99	s.u.	±0.15 s.u.			Geotech	2GC931	Mar-24
pH 10.00b	10.03	s.u.	±0.15 s.u.			Geotech	2GE820	May-24
SC 1000	980	µS/cm	±5%			Ricca	4205H64	May-24

Approx. every 4 hrs, unless only one well

CCV (Continued Calibration Verification): Time: 1700

Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
pH 4.00a	4.03	s.u.	±0.1 s.u.	P	N	N/A	MSI	L315-04	11/22/2023
pH 7.00a	7.01	s.u.	±0.1 s.u.				MSI	L172-33	6/23/2023
pH 10.00a	10.00	s.u.	±0.1 s.u.				MSI	L354-22	1/5/2024
SC 1000	1010	µS/cm	±5%				Ricca	2108D48	Jul-23
DO (Zero pt)	0.05	mg/L	±0.1 mg/L				Macron	#000228049	8/26/2025
Turbidity (DI)	0.0	NTU	<2 NTU				Pace Labs	N/A (DI)	N/A (DI)

Approx. every 4 hrs, unless only one well

CCV (Continued Calibration Verification): Time:

Buffer	Check Value	Units	Range	Pass/Fail	Calibrate?	Adjusted Reading	Manufacturer	Lot#	Exp.
4.00a		s.u.	±0.1 s.u.				MSI	L315-04	11/22/2023
7.00a		s.u.	±0.1 s.u.				MSI	L172-33	6/23/2023
10.00a		s.u.	±0.1 s.u.				MSI	L354-22	1/5/2024
SC 1000		µS/cm	±5%				Ricca	2108D48	Jul-23
DO (Zero pt)		mg/L	±0.1 mg/L				Macron	#000228049	8/26/2025
Turbidity (DI)		NTU	<2 NTU				Pace Labs	N/A (DI)	N/A (DI)

Comments:

Signature:	Austin Moore	Date:	27-Feb-23

~~GBO 8AB~~
GC00016-16 8AB

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:

Company:	Vistra Corp
Address:	13498 E. 900th St
Email To:	Brian.Voelker@VistraCorp.com
Phone: (217) 753-8911	Fax:
Requested Due Date/TAT:	10 day

Section B Required Project Information:

Report To:	Brian Voelker
Copy To:	Jason Stuckey
Purchase Order No.:	
Project Name:	
Project Number:	2285

Section C Invoice Information:

Attention:	Jason Stuckey
Company Name:	Vistra Corp
Address:	see Section A
Quote Reference:	
Project Manager:	
Profile #:	

REGULATORY AGENCY

NPDES | GROUND WATER | DRINKING WATER
UST | RCRA | OTHER

Site Location STATE: IL

Section D Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
WIPE	WP
AIR	AR
OTHER	OT
TISSUE	TS

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED DATE	COLLECTED TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	EDW_257_301	Residual Chlorine (Y/N)	Project No./ Lab I.D.
1	AP05S	WT	G	2/28/23	1440		3	X		X									
2	AP07S	WT	G	2/28/23	1328		3	X		X									
3	AW-01	WT	G	2/28/23	1541		3	X		X									
4	AW-05	WT	G	2/28/23	1157		3	X		X									
5	AW-06	WT	G	2/28/23	1003		3	X		X									
6	AW-08	WT	G	2/28/23	~~1440~~ 1505		3	X		X									
7	AW-09	WT	G	2/28/23	1205		3	X		X									
8	AW-10	WT	G	2/28/23	1545		3	X		X									
9	AW-11	WT	G	2/28/23	1424		3	X		X									
10	AW-14	WT	G	2/28/23	1313		3	X		X									
11	AW-15																		
12	AW-15S																		
13	AW-16	WT	G	2/28/23	1305		3	X		X									
14	AW-17	WT	G	2/28/23	1106		3	X		X									
15	AW-18																		
16	AW-19																		

Requested Analysis Filtered (Y/N)

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS
EDW-23Q1-Rev 1		2/28/23	1725				
							2.7 / Y / N / Y

Temp in °C | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Aaron Pemberton

SIGNATURE of SAMPLER: [signature] DATE Signed (MM/DD/YY): 02/28/23

Vance Wagner 3-1-23 707
Courier

GB04667-04
SRD

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:

Company:	Vistra Corp
Address:	13498 E. 900th St
Email To:	Brian.Voelker@VistraCorp.com
Phone: (217) 753-8911	Fax:
Requested Due Date/TAT:	10 day

Section B Required Project Information:

Report To:	Brian Voelker
Copy To:	Jason Stuckey
Purchase Order No.:	
Project Name:	
Project Number:	2285

Section C Invoice Information:

Attention:	Jason Stuckey
Company Name:	Vistra Corp
Address:	see Section A
Quote Reference:	
Project Manager:	
Profile #:	

REGULATORY AGENCY

NPDES GROUND WATER DRINKING WATER

UST RCRA OTHER

Site Location STATE: IL

Section D Required Client Information

SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
WIPE	WP
AIR	AR
OTHER	OT
TISSUE	TS

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED DATE	COLLECTED TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Requested Analysis Filtered (Y/N) Y/N	Analysis Test: EDW_257_301	Residual Chlorine (Y/N)	Project No./ Lab I.D.
1	AP05S																		
2	AP07S																		
3	AW-01																		
4	AW-05																		
5	AW-06																		
6	AW-08																		
7	AW-09																		
8	AW-10																		
9	AW-11																		
10	AW-14																		
11	AW-15	WT	G	2/27/23	1528		3	W	X		X								
12	AW-15S	WT	G	2/27/23	1630		3	W	X		X								
13	AW-16																		
14	AW-17																		
15	AW-18	WT	G	2/27/23	1650		3	W	X		X								
16	AW-19	WT	G	2/27/23	1529		3	W	X		X								

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
EDW-23Q1-Rev 1		2/27/23	1752		2-28-23	720	1.3	Y	N	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Aaron Pemberton

SIGNATURE of SAMPLER: DATE Signed (MM/DD/YY): 02/27/23

Courier

GC00016-16

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

Section A Required Client Information:

Company:	Vistra Corp
Address:	13498 E. 900th St
Email To:	Brian.Voelker@VistraCorp.com
Phone: (217) 753-8911	Fax:
Requested Due Date/TAT:	10 day

Section B Required Project Information:

Report To:	Brian Voelker
Copy To:	Jason Stuckey
Purchase Order No.:	
Project Name:	
Project Number:	2285

Section C Invoice Information:

Attention:	Jason Stuckey
Company Name:	Vistra Corp
Address:	see Section A
Quote Reference:	
Project Manager:	
Profile #:	

REGULATORY AGENCY

NPDES | GROUND WATER | DRINKING WATER

UST | RCRA | OTHER

Site Location STATE: IL

Section D Required Client Information

SAMPLE ID
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

Valid Matrix Codes

MATRIX	CODE
DRINKING WATER	DW
WATER	WT
WASTE WATER	WW
PRODUCT	P
SOIL/SOLID	SL
OIL	OL
WIPE	WP
AIR	AR
OTHER	OT
TISSUE	TS

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED DATE	COLLECTED TIME	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N	EDW_257_301	Residual Chlorine (Y/N)	Project No./ Lab I.D.
1	AW-21	WT	G	2/28/23	1005		3	X		X									
2	SG-01																		
3	XPW01A	WT	G	2/28/23	1048		2	X		X									
4	XPW02	WT	G	2/28/23	1127		2	X		X									
5	XPW03	WT	G	2/28/23	1633		2	X		X									
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			

Requested Analysis Filtered (Y/N)

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
EDW-23Q1-Rev 1		2/28/23	1723				2.7	Y	N	Y

SAMPLER NAME AND SIGNATURE

PRINT Name of SAMPLER: Aaron Kimberlin

SIGNATURE of SAMPLER: [signature] DATE Signed (MM/DD/YY): 02/28/23

Vance Wagner 3-1-23 707
Courier

APPENDIX G
PUMP TEST MEMORANDUM

RAMBOLL

ENVIRONMENT
& HEALTH

MEMO

Project name **Edwards Power Plant Pump Tests**
To **Stu Cravens, Luminant**

From **Katie Moran, Ramboll**
Copy to **Brian Hennings, Ramboll**
Nate Keller, Ramboll

December 01, 2023

Ramboll
4435 Waterfront Drive
Suite 205
Glen Allen, VA 23060
USA

T 804-822-4200
F 804-270-5808
https://ramboll.com

Introduction

Midwest Engineering and Testing, Inc. installed two 4-inch pilot test wells (PTW-01 and PTW-02) in October 2022 to evaluate aquifer characteristics and develop potential interim remedial measures. Following installation and development of PTW-01 and PTW-02, constant-rate tests (CRTs) were performed by Ramboll at pumping well PTW-01 on October 25 and October 26, 2022, and at PTW-02 on October 28, 2022. Water levels were monitored during the tests in nearby observation and monitoring wells by in-well pressure transducers during the length of the tests. Recovery data was not recorded due to methane generation which delayed the CRT and associated field activities.

PTW-01 Constant Rate Test

The CRT performed at PTW-01 consisted of pumping at 0.25 gallons per minute (gpm) for 125 minutes. The test was stopped immediately prior to dewatering of the pumping well and a maximum drawdown of 11.53 feet was obtained during pumping. A step-drawdown test to identify yield characteristics at PTW-01 was not performed due to failure to obtain stable water levels at the lowest consistent pumping rate achievable with the pump (0.25 gpm, indicating a low yield well). The calculated specific capacity from the CRT for PTW-01 is 0.02 gpm per foot (gpm/ft); however, this does not represent a reasonable well yield given continued dewatering of the well at this rate.

Drawdown from pumping at PTW-01 was observed at wells OW-01 and AP07S, which are screened at similar depths as PTW-01, either across a discontinuous sandy material and/or weathered rock. Measurable drawdown was not identified at AP07D, which is screened approximately 20 feet below the pumping well within low permeability bedrock (Ramboll Americas Engineering Solutions, Inc. [Ramboll], 2021). The three observation wells (OW-01 and two monitoring wells) used for the pump test are located at distances of 13 to 18 feet from PTW-01.

Time-drawdown data for observation wells were analyzed using AQTESOLV for Windows® (Duffield, 2007). Evaluation of time-drawdown data collected at OW-01 with the Theis solution (Theis, 1935) yielded estimated transmissivity of 52 feet square per day (ft^2/d) and aquifer storativity of 2.5×10^{-3} (**Attachment 1**). As shown, this solution yields an approximate fit to data collected at AP07S; however, drawdown data collected from this well had a higher level of noise / fluctuation during the test. **Table 1** presents well construction information and observed drawdown.

A second CRT with a lower pumping rate was attempted at PTW-01 on October 26, 2022; however, the selected pump struggled to consistently maintain the lower pumping rate of 0.12 gpm and was shut off after 89 minutes. Data from this test was not evaluated.

PTW-02 Constant-Rate Test

The CRT at PTW-02 was initially attempted on October 26, 2022 at a rate of 0.5 gpm; however, the test was stopped after eight minutes due to elevated sediment and methane readings at the wellhead. Another CRT at PTW-02 was performed on October 28, 2022 and consisted of pumping at a rate of 1 gpm for 154 minutes. A step-drawdown test to identify yield characteristics at PTW-02 was not performed due to the challenges and safety considerations associated with the methane generated during pumping. Maximum drawdown obtained at PTW-02 was 8.15 feet after 154 minutes of pumping. The calculated specific capacity from the CRT for PTW-02 is 0.12 gpm/ft; however, this does not represent a conclusive well yield given failure of water levels to stabilize during the test.

Drawdown from pumping at PTW-02 was observed at wells OW-02 (1.98 feet) and AW-15 (2.36 feet), which are screened at similar depths as PTW-01 within the same clay material at the bedrock interface. Drawdown of 0.64 feet was also identified at AW-15C, which is completed in the shale bedrock (the top of which is weathered) underlying the clay. This indicates that vertical flow can occur between the clay and the bedrock when a hydraulic gradient is present. Measurable drawdown was not identified at AW-15S, which is screened above the pumping well in the shallower confining materials (Upper Cahokia Formation). The four observation wells (OW-02 and three monitoring wells) used for the pump test are located at distances of 7 to 19 feet from PTW-01.

Time-drawdown data for observation wells were analyzed using AQTESOLV for Windows® (Duffield, 2007). Evaluation of time-drawdown data collected at AW-15 with the Theis solution (Theis, 1935) yielded estimated transmissivity of 19 ft^2/d and aquifer storativity of 5 x 10^{-3} (**Attachment 1**). The fit to data from OW-02 yielded estimated transmissivity of 20 ft^2/d and aquifer storativity of 1.1 x 10^{-3} (**Attachment 1**). Drawdown data for AW-15C were not analyzed in AQTESOLV due to its completion in a different aquifer unit. **Table 1** presents well construction information and observed drawdown.

Discussion

The abbreviated constant-rate tests performed at wells PTW-01 and PTW-02 did not fully identify appropriate well yields due to continued drawdown at pumped rates of 0.25 gpm and 1 gpm, and difficulty obtaining lower pumping rates with the field equipment. Sustainable yield at these locations may be much lower than the tested rates. However, measurable drawdown was identified at nearby observation wells and used to develop estimates of transmissivity and storativity for the materials near the tested locations.

Attachments

Table 1 Well Information and Observed Drawdown
Figure 1 Pump Test Well Locations
Attachment 1 Aqtesolv Plots

References

Duffield, G., 2007. AQTESOLV® Professional Version 4.5. Hydrosolve, Inc.

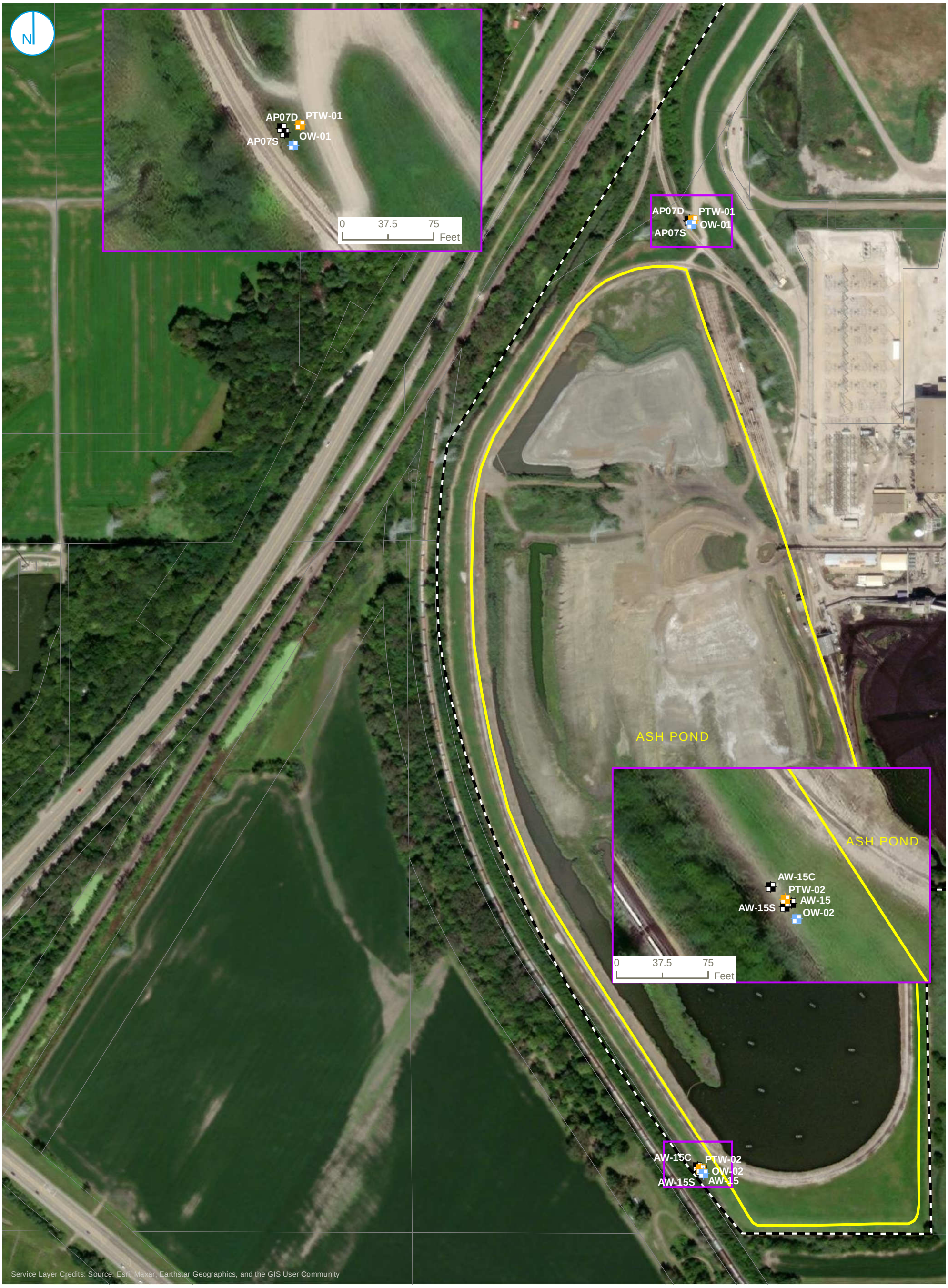
Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2021. Hydrogeologic Site Characterization Report. Edwards Power Plant, Ash Pond, Bartonville, IL. October 25, 2021.

Theis, C.V., 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage, Am. Geophys. Union Trans., vol. 16, pp. 519-524.

Table 1. Well Information and Observed Drawdown
Edwards Power Plant Pump Tests
Edwards Power Plant Bartonville, IL

Well ID	Hydrostratigraphic Unit	Distance from Pumping Well (ft)	Maximum Drawdown (ft)	Well Depth (ft bTOC)	Screened Inverval (ft bgs)	Static Depth-to-water (ft bTOC)
PTW-01 Pump Test						
PTW-01	UA	--	11.5	38.4	27 - 37	26.4
OW-01	UA	17.7	0.2	36.4	26 - 36	24.6
AP07S	UA	13.3	0.2	35.0	30 - 35	25.8
AP07D	Bedrock	15.4	ND	65.0	55 - 65	26.2
PTW-02 Pump Test						
PTW-02	UA	--	8.2	38.4	27 - 36	10.3
OW-02	UA	18.9	2.0	35.1	25 - 35	10.0
AW-15	UA	7.3	2.4	38.0	33 - 38	10.6
AW-15C	Bedrock	14.1	0.6	48.0	43 - 48	9.1
AW-15S	UCF	8.7	ND	18.0	8 - 18	9.6

Notes and Abbreviations
bgs = below ground surface
ft amsl = feet above mean sea level
ft = feet
UCF = Upper Cahokia Formation
bTOC = below top of casing
UA = uppermost aquifer
ND = not detected



OBSERVATION WELL
PILOT TEST WELL
MONITORING WELL
REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 175 350 Feet

PUMP TEST WELL LOCATIONS

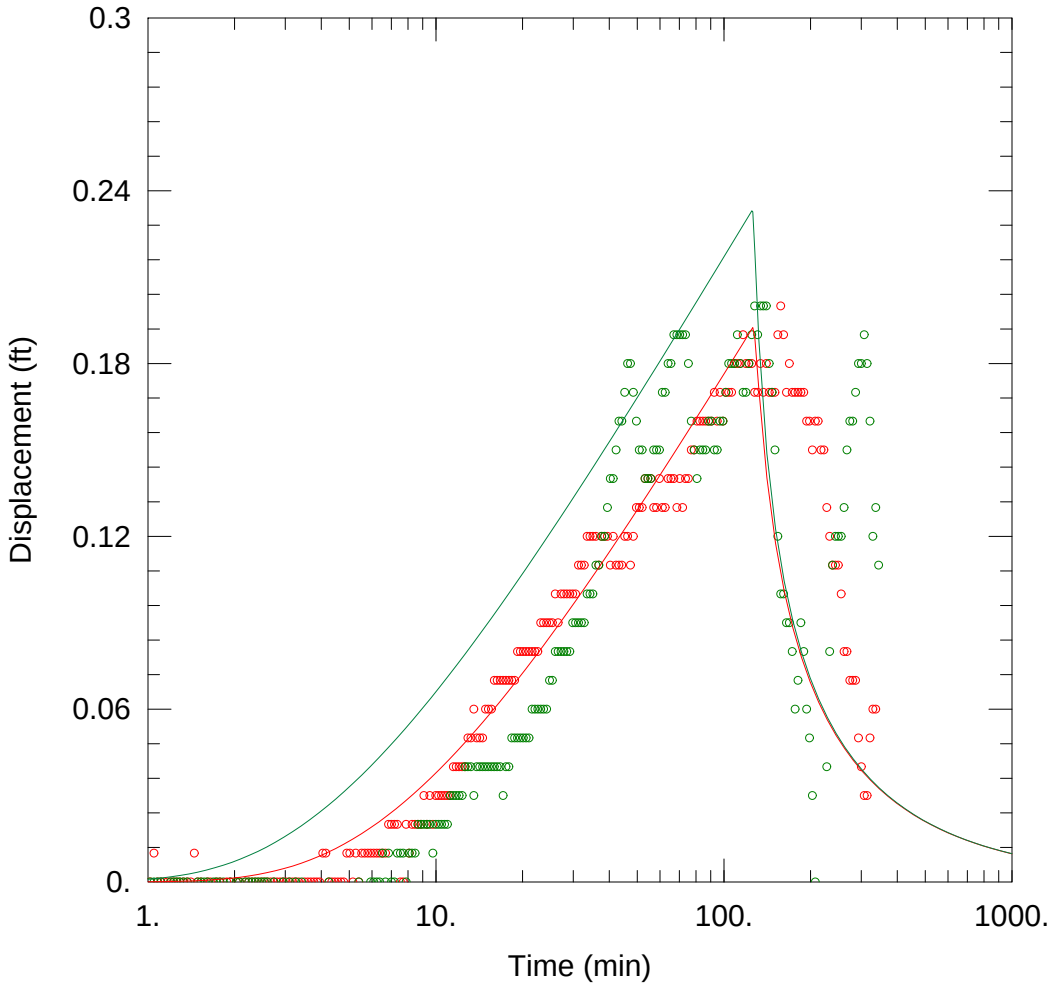
EDWARDS POWER PLANT PUMP TESTS
ASH POND
BARTONVILLE, ILLINOIS

FIGURE 1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

ATTACHMENT 1
AQTESOLV PLOTS



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: Ramboll
Location: Edwards Power Station
Test Well: PTW-01
Test Date: 10/25/2022

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PTW-01	0	0

Observation Wells

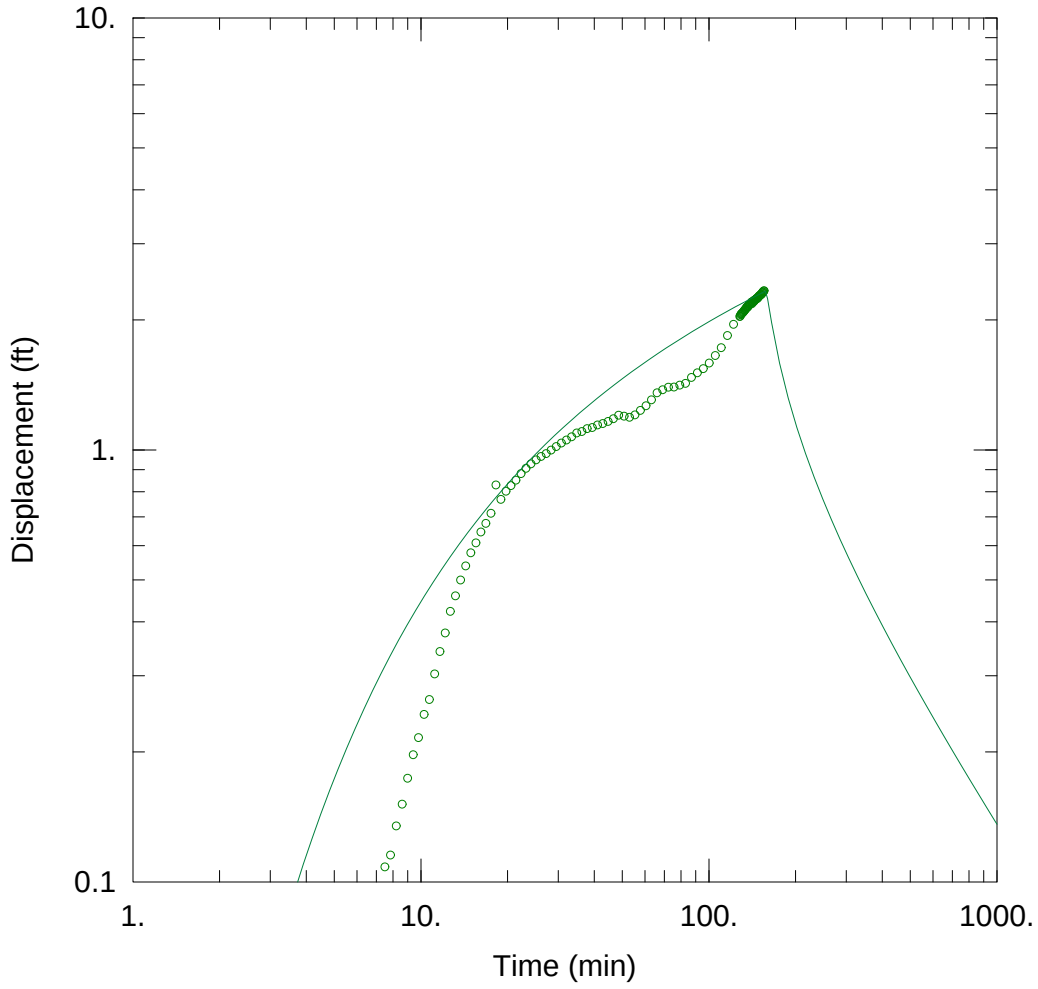
Well Name	X (ft)	Y (ft)
○ OW-01	17.67	0
○ AP-07S	13.25	0

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 52. ft^2/day
Kz/Kr = 1.

S = 0.0025
b = 12. ft



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: Ramboll
Location: Edwards Power Station
Test Well: PTW-02
Test Date: 10/28/2022

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PTW-02	0	0

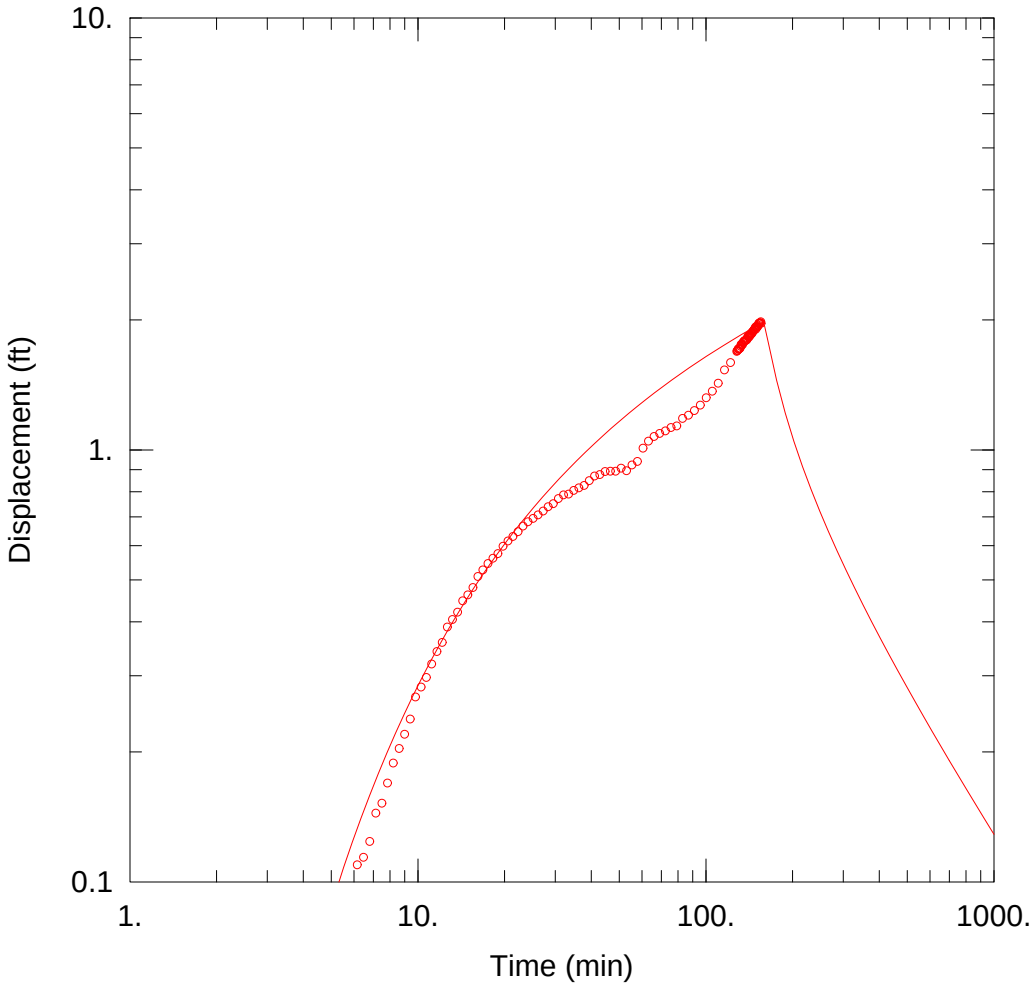
Observation Wells

Well Name	X (ft)	Y (ft)
○ AW-15	7.31	0

SOLUTION

Aquifer Model: Confined
T = 19. ft^2/day
Kz/Kr = 1.

Solution Method: Theis
S = 0.005
b = 20. ft



WELL TEST ANALYSIS

PROJECT INFORMATION

Company: Ramboll
Location: Edwards Power Station
Test Well: PTW-02
Test Date: 10/28/2022

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
PTW-02	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
○ OW-02	18.85	0

SOLUTION

Aquifer Model: Confined
T = 20. ft^2/day
Kz/Kr = 1.

Solution Method: Theis
S = 0.0011
b = 20. ft

APPENDIX H
NO FURTHER REMEDIATION LETTER

03-47717

FILED
PEORIA COUNTY
STATE OF ILLINOIS

03 SEP 22 14 16

RECORDER OF DEEDS

PREPARED BY:

Name: Mr. Dennis Klein for Mr. Gerry Brown
President, Cargill Marine and Terminal, Inc.

Address: Box 9300
Minneapolis, MN 55440

RETURN TO:

Name: Mr. Dennis Klein for Mr. Gerry Brown
President, Cargill Marine and Terminal, Inc.

Address: Box 9300
Minneapolis, MN 55440

33

THE ABOVE SPACE FOR RECORDER'S OFFICE

This Environmental No Further Remediation Letter must be submitted by the remediation applicant within 45 days of its receipt, to the Office of the Recorder of Peoria County.

Illinois State EPA Number: 1434730002

Cargill Marine and Terminal Inc., the Remediation Applicant, whose address is Box 9300, Mail Stop # 8, Minneapolis, Minnesota, 55440, has performed investigative and/or remedial activities for the remediation site depicted on the attached Site Base Map and identified by the following:

1. Legal description or Reference to a Plat Showing the Boundaries: A part of the Northeast Quarter of Section 14, and part of a fraction of Section 13, all in Township 7 North, Range 7 East of the Fourth Principal Meridian, Peoria County, Illinois, more particularly described as follows. Bearings are for descriptive purposes only. Commencing at a found iron pipe in concrete at the North Quarter of said Section 14, as described in Document Number 67-11458, also, as recorded in Plat Book N, page 23, at the Peoria County Recorder's Office, as the Point of Beginning of the tract to be described; thence along the North line of said Southeast Quarter of said Northeast Quarter bearing South 88 degrees, 59 minutes, 23 seconds East, a distance of 725.75 feet to the Westerly Right of Way line of Pekin-LaMarsh Drainage and Levee District; thence along said Westerly Right of Way line for the next two courses bearing South 11 degrees, 23 minutes, 1 second East, a distance of 653.24 feet to a found iron pipe; thence bearing South 15 degrees, 45 minutes, 8 seconds East, a distance of 228.05 feet; thence leaving said Westerly Right of Way line bearing North 90 degrees, 0 minutes, 0 seconds West, a distance of 922.88 feet to the West line of said Southeast Quarter of said Northeast Quarter; thence along said West line bearing North 0 degrees, 25 minutes, 12 seconds East, a distance of 872.7 feet to the Point of Beginning, containing 16.248 acres, more or less.

LLH-50

2. Common Address: 8710 South Cargill Road, Pekin, Illinois 61555

3. Real Estate Tax Index/Parcel Index Number: 20-13-100-001 and 20-14-200-005

4. Remediation Site Owner: Cargill Marine and Terminal, Inc.

5. Land Use: Industrial/Commercial

6. Site Investigation: Focused

See NFR letter for other terms.

L1114-03

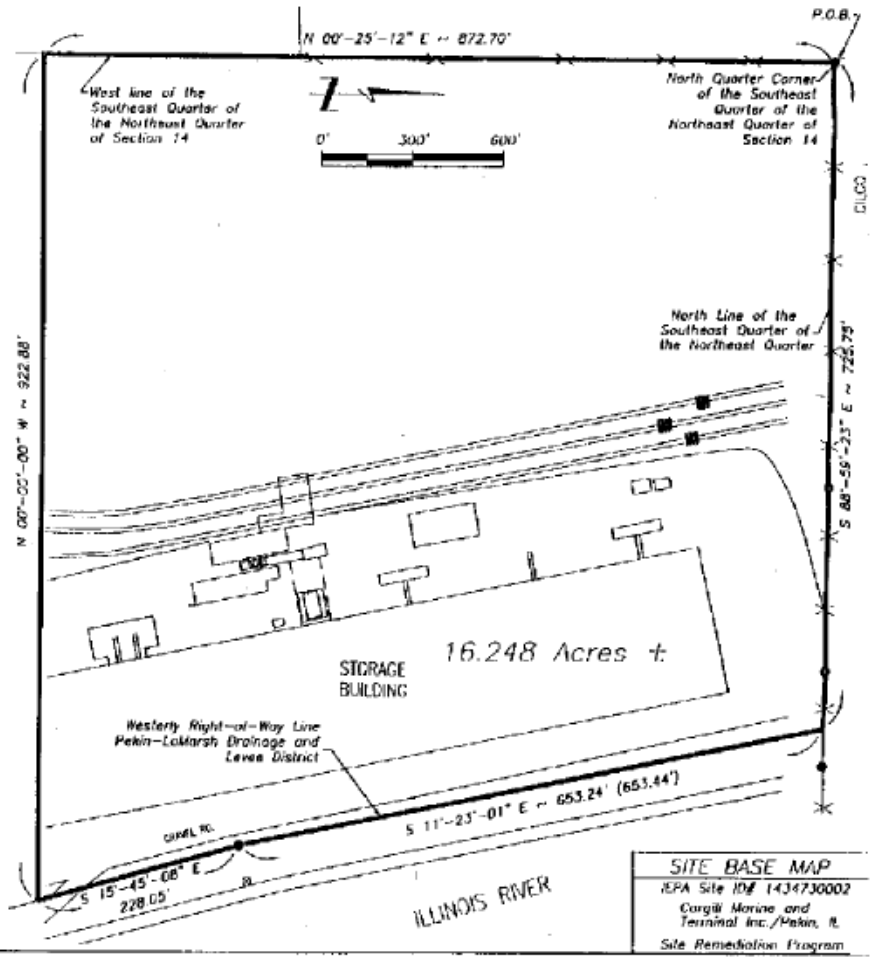
Remediation Site Description

A part of the Northeast Quarter of Section 14, and a part of Fractional Section 13, all in Township 7 North, Range 7 East of the Fourth Principal Meridian, Peoria County, Illinois, more particularly described as follows. Bearings are for descriptive purposes only.

Commencing at a found iron pipe in concrete at the North Quarter corner of the Southeast Quarter of said Northeast Quarter of Section 14, as described in document number 87-11458, also, as recorded in Plat Book N, page 23, at the Peoria County Recorder's office, as the Point of Beginning of the tract to be described; thence along the north line of said Southeast Quarter of said Northeast Quarter bearing South 88°-59'-23" East, a distance of 725.75 feet to the Westerly Right-of-Way line of Pekin-LaMarsh Drainage and Levee District; thence along said Westerly Right-of-Way line for the next 2 courses bearing South 11°-23'-01" East, a distance of 653.24 feet to a found iron pipe; thence bearing South 15°-45'-08" East, a distance of 228.05 feet; thence leaving said Westerly Right-of-Way line bearing North 90°-00'-00" West, a distance of 922.88 feet to the west line of said Southeast Quarter of said Northeast Quarter; thence along said west line bearing North 00°-25'-12" East, a distance of 872.70 feet to the Point of Beginning, containing 16.248 Acres, more or less.

LEGEND

P.O.B.	Point of Beginning
(653.44')	Record Distance
●	Found Survey Monument
⊕	Found Illinois Waterways Disk
▬▬	Remediation Site Boundary



REVISIONS					
NO.	DATE	DESCRIPTION	APPROVED		
				SURVEYED	AC, BB
				DRAWN	BJS
				CHECKED	CCS
				APP. CLR. OF SURV.	6/7/96

MACTEC
ENGINEERING & CONSULTING, INC.

SITE BASE MAP
IEPA Site ID# 1434730002
Cargill Marine and Terminal Inc./Pekin, IL
Site Remediation Program

3

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ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276
JAMES R. THOMPSON CENTER, 100 WEST RANDOLPH, SUITE 11-300, CHICAGO, IL 60601

ROD R. BLAGOJEVICH, GOVERNOR RENEE CIPRIANO, DIRECTOR

(217) 782-6761

August 12, 2003

CERTIFIED MAIL
7002 3150 0000 1222 7749

Cargill Marine and Terminal, Inc./Pekin
Box 9300, Mail Stop No. 8
Minneapolis, Minnesota 55440
Attn: Mr. Gerry Brown
C/o Mr. Dennis Klein

Re: 1434730002—Peoria County
Cargo Carriers/Pekin
Site Remediation Program/Technical Reports

Dear Mr. Brown:

The *Remedial Completion Report, Cargill Fertilizer, Inc. (Formerly Cargo Carriers), Pekin, Illinois Terminal), Log No. 02-3288*, as prepared by Harding ESE, Inc. for the Cargill Marine and Terminal, Inc. property (previously referenced as Cargo Carriers and Cargill Fertilizer, Inc.), has been reviewed by the Illinois Environmental Protection Agency ("Illinois EPA"). The approved remediation objectives at the Site are equal to or are above the existing levels of regulated substances and the *Remedial Completion Report, Cargill Fertilizer, Inc. (Formerly Cargo Carriers), Pekin, Illinois Terminal, Log No. 02-3288*, shall serve as the approved Remedial Action Completion Report.

The Remediation Site, consisting of 16.248 acres, is located at 8710 South Cargill Road, Bartonville, Illinois. Pursuant to Section 58.10 of the Illinois Environmental Protection Act ("Act") (415 ILCS 5/1 et seq.), your request for a no further remediation determination is granted under the conditions and terms specified in this letter. The Remediation Applicant, as identified on the Illinois EPA's Site Remediation Program DRM-1 Form, Dated November 7, 1991, is Cargill Marine and Terminal, Inc.

This focused No Further Remediation Letter ("Letter") signifies a release from further responsibilities under the Act for the performance of the approved remedial action. This Letter shall be considered prima facie evidence that the Remediation Site described in the attached Illinois EPA Site Remediation Program Environmental Notice and shown in the attached Site Base Map does not constitute a threat to human health and the environment for the specified recognized environmental conditions so long as the Site is utilized in accordance with the terms of this Letter.

03-4111

Conditions and Terms of Approval

Level of Remediation and Land Use Limitations

1) The recognized environmental conditions, as characterized by the focused site investigation, consist of the following:

   a) Regulated substances of concern that have been successfully addressed are Atrazine, Metolachlor, Chloride, and Sulfate.

2) The Remediation Site is restricted to Industrial/Commercial land use.

3) The land use specified in this Letter may be revised if:

   a) Further investigation or remedial action has been conducted that documents the attainment of objectives appropriate for the new land use; and

   b) A new Letter is obtained and recorded in accordance with Title XVII of the Act and regulations adopted thereunder.

Preventive, Engineering, and Institutional Controls

4) The implementation and maintenance of the following controls are required as part of the approval of the remediation objectives for this Remediation Site:

Institutional Controls:

5) No person shall construct, install, maintain, or operate a potable water supply well at the Remediation Site.

Other Terms

6) Where the Remediation Applicant is not the sole owner of the Remediation Site, the Remediation Applicant shall complete the attached *Property Owner Certification of the No Further Remediation Letter under the Site Remediation Program* Form. This certification, by original signature of each property owner, or the authorized agent of the owner(s), of the Remediation Site or any portion thereof who is not a Remediation Applicant shall be recorded along with this Letter.

7) Further information regarding this Remediation Site can be obtained through a written request under the Freedom of Information Act (5 ILCS 140) to:

Illinois Environmental Protection Agency
Attn: Freedom of Information Act Officer
Bureau of Land-#24
1021 North Grand Avenue East
Post Office Box 19276
Springfield, IL 62794-9276

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8) Pursuant to Section 58.10(f) of the Act (415 ILCS 5/58.10(f)), should the Illinois EPA seek to void this Letter, the Illinois EPA shall provide notice to the current title holder and to the Remediation Applicant at the last known address. The notice shall specify the cause for the voidance, explain the provisions for appeal, and describe the facts in support of this cause. Specific acts or omissions that may result in the voidance of the Letter under Sections 58.10(e)(1)-(7) of the Act (415 ILCS 5/58.10(e)(1)-(7)) include, but shall not be limited to:

   a) Any violation of institutional controls or the designated land use restrictions;

   b) The failure to operate and maintain preventive or engineering controls or to comply with any applicable groundwater monitoring plan;

   c) The disturbance or removal of contamination that has been left in-place in accordance with the Remedial Action Plan. Access to soil contamination may be allowed if, during and after any access, public health and the environment are protected consistent with the Remedial Action Plan;

   d) The failure to comply with the recording requirements for this Letter;

   e) Obtaining the Letter by fraud or misrepresentation;

   f) Subsequent discovery of contaminants, not identified as part of the investigative or remedial activities upon which the issuance of the Letter was based, that pose a threat to human health or the environment;

   g) The failure to pay the No Further Remediation Assessment Fee within forty-five (45) days after receiving a request for payment from the Illinois EPA;

   h) The failure to pay in full the applicable fees under the Review and Evaluation Services Agreement within forty-five (45) days after receiving a request for payment from the Illinois EPA.

9) Pursuant to Section 58.10(d) of the Act, this Letter shall apply in favor of the following persons:

   a) Cargill Marine and Terminal, Inc.;

   b) The owner and operator of the Remediation Site;

   c) Any parent corporation or subsidiary of the owner of the Remediation Site;

   d) Any co-owner, either by joint-tenancy, right of survivorship, or any other party sharing a relationship with the owner of the Remediation Site;

   e) Any holder of a beneficial interest of a land trust or inter vivos trust, whether revocable or irrevocable, involving the Remediation Site;

   f) Any mortgagee or trustee of a deed of trust of the owner of the Remediation Site or any assignee, transferee, or any successor-in-interest thereto;

03-4777

g) Any successor-in-interest of the owner of the Remediation Site;

h) Any transferee of the owner of the Remediation Site whether the transfer was by sale, bankruptcy proceeding, partition, dissolution of marriage, settlement or adjudication of any civil action, charitable gift, or bequest;

i) Any heir or devisee of the owner of the Remediation Site;

j) Any financial institution, as that term is defined in Section 2 of the Illinois Banking Act and to include the Illinois Housing Development Authority, that has acquired the ownership, operation, management, or control of the Remediation Site through foreclosure or under the terms of a security interest held by the financial institution, under the terms of an extension of credit made by the financial institution, or any successor-in-interest thereto; or

k) In the case of a fiduciary (other than a land trustee), the estate, trust estate, or other interest in property held in a fiduciary capacity, and a trustee, executor, administrator, guardian, receiver, conservator, or other person who holds the remediated site in a fiduciary capacity, or a transferee of such party.

10) This letter, including all attachments, must be recorded as a single instrument within forty-five (45) days of receipt with the Office of the Recorder of Peoria County. For recording purposes, the Illinois EPA Site Remediation Program Environmental Notice attached to this Letter should be the first page of the instrument filed. This Letter shall not be effective until officially recorded by the Office of the Recorder of Peoria County in accordance with Illinois law so that it forms a permanent part of the chain of title for the Cargill Marine and Terminal, Inc. property.

11) Within thirty (30) days of this Letter being recorded by the Office of the Recorder of Peoria County, a certified copy of this Letter, as recorded, shall be obtained and submitted to the Illinois EPA to:

Robert E. O'Hara
Illinois Environmental Protection Agency
Bureau of Land/RPMS
1021 North Grand Avenue East
Post Office Box 19276
Springfield, IL 62794-9276

12) In accordance with Section 58.10(g) of the Act, a No Further Remediation Assessment Fee based on the costs incurred for the Remediation Site by the Illinois EPA for review and evaluation services will be applied in addition to the fees applicable under the Review and Evaluation Services Agreement. Request for payment of the No Further Remediation Assessment Fee will be included with the billing statement.

LLLA-50

If you have any questions regarding this correspondence, you may contact the Illinois EPA project manager, Todd Gross, at 217/524-4862.

Sincerely,

Lawrence W. Eastep, P.E., Manager
Remedial Project Management Section
Division of Remediation Management
Bureau of Land

Attachments(3): Illinois EPA Site Remediation Program Environmental Notice
Site Base Map
Property Owner Certification of No Further Remediation Letter under the Site Remediation Program Form

cc: Christopher J. Everts, P.E., Ph. D.
Senior Project Engineer
MACTEC Engineering and Consulting, Inc.
8901 North Industrial Road
Peoria, Illinois 61615

03-4774

8 of 8

APPENDIX C
Vertical Hydraulic Gradients

APPENDIX C. VERTICAL HYDRAULIC GRADIENTS

Nature and Extent Report

Edwards Power Plant

Ash Pond

Bartonville, Illinois

Date	AP08 Groundwater Elevation (ft NAVD88) CCR-shallow	XPW02 Groundwater Elevation (ft NAVD88) CCR-deep	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
2/9/2021	452.60	452.97	-0.37	13.16	-0.03	up
3/2/2021	452.85	453.17	-0.32	13.16	-0.02	up
3/22/2021	453.59	454.08	-0.49	13.16	-0.04	up
4/12/2021	453.16	453.73	-0.57	13.16	-0.04	up
5/4/2021	452.70	453.23	-0.53	13.16	-0.04	up
6/15/2021	452.40	452.90	-0.50	13.16	-0.04	up
6/28/2021	452.92	453.47	-0.55	13.16	-0.04	up
7/21/2021	452.97	453.67	-0.70	13.16	-0.05	up
8/30/2021	451.89	452.36	-0.47	13.16	-0.04	up
2/16/2022	452.69	453.21	-0.52	13.16	-0.04	up
7/25/2022	451.42	451.85	-0.43	13.16	-0.03	up
2/27/2023	452.97	454.01	-1.04	13.16	-0.08	up
6/12/2023	451.29	451.69	-0.40	13.16	-0.03	up
8/21/2023	452.40	453.01	-0.61	13.16	-0.05	up
10/27/2023	451.50	452.16	-0.66	13.16	-0.05	up
			Middle of screen elevation AP08			443.32
			Middle of screen elevation XPW02			430.16

APPENDIX C. VERTICAL HYDRAULIC GRADIENTS

Nature and Extent Report

Edwards Power Plant

Ash Pond

Bartonville, Illinois

Date	AP09 Groundwater Elevation (ft NAVD88) CCR-shallow	XPW03 Groundwater Elevation (ft NAVD88) CCR-deep	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
2/9/2021	451.96	450.74	1.22	12.03	0.10	down
3/2/2021	451.95	450.72	1.23	12.03	0.10	down
3/22/2021	451.95	450.77	1.18	12.03	0.10	down
4/12/2021	451.86	450.62	1.24	12.03	0.10	down
5/4/2021	452.12	450.84	1.28	12.03	0.11	down
6/15/2021	451.61	450.38	1.23	12.03	0.10	down
6/28/2021	452.09	450.86	1.23	12.03	0.10	down
7/21/2021	452.19	451.03	1.16	12.03	0.10	down
8/30/2021	451.96	450.76	1.20	12.03	0.10	down
2/16/2022	451.86	450.65	1.21	12.03	0.10	down
7/25/2022	451.60	450.33	1.27	12.03	0.11	down
2/27/2023	450.81	449.70	1.11	12.03	0.09	down
6/12/2023	448.82	447.83	0.99	12.03	0.08	down
8/21/2023	450.13	448.84	1.29	12.03	0.11	down
10/27/2023	449.40	447.81	1.59	12.03	0.13	down
			Middle of screen elevation AP09			442.65
			Middle of screen elevation XPW03			430.62

APPENDIX C. VERTICAL HYDRAULIC GRADIENTS

Nature and Extent Report

Edwards Power Plant

Ash Pond

Bartonville, Illinois

Date	AW-15S Groundwater Elevation (ft NAVD88) UCF/PMP	AW-15 Groundwater Elevation (ft NAVD88) UA	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
2/9/2021	431.91	433.03	-1.12	21.47	-0.05	up
3/2/2021	431.19	433.50	-2.31	21.47	-0.11	up
3/22/2021	431.33	433.68	-2.35	21.47	-0.11	up
4/12/2021	431.13	433.76	-2.63	21.47	-0.12	up
5/4/2021	429.82	433.69	-3.87	26.37	-0.15	up
6/15/2021	431.00	433.65	-2.65	21.47	-0.12	up
6/28/2021	429.86	433.59	-3.73	26.41	-0.14	up
7/21/2021	431.25	433.65	-2.40	21.47	-0.11	up
8/30/2021	430.87	434.43	-3.56	21.47	-0.17	up
2/16/2022	431.79	433.51	-1.72	21.47	-0.08	up
7/25/2022	432.07	433.74	-1.67	21.47	-0.08	up
2/27/2023	430.66	432.59	-1.93	21.47	-0.09	up
4/12/2023	431.24	433.36	-2.12	21.47	-0.10	up
5/12/2023	431.24	433.50	-2.26	21.47	-0.11	up
6/12/2023	430.76	433.41	-2.65	21.47	-0.12	up
7/21/2023	430.64	432.99	-2.35	21.47	-0.11	up
8/21/2023	430.88	432.82	-1.94	21.47	-0.09	up
10/27/2023	430.67	431.49	-0.82	21.47	-0.04	up
11/20/2023	429.63	431.52	-1.89	26.18	-0.07	up
12/27/2023	431.19	431.99	-0.80	21.47	-0.04	up
			Middle of screen elevation AW-15S			424.92
			Middle of screen elevation AW-15			403.45
			Top of screen elevation AW-15S			429.92
			Top of screen elevation AW-15			405.95

Date	AP07S Groundwater Elevation (ft NAVD88) UCF/PMP	OW-01 Groundwater Elevation (ft NAVD88) UA	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
11/21/2022	435.59	435.58	0.01	-0.79	-0.01	up
2/27/2023	436.78	436.74	0.04	-0.79	-0.05	up
6/12/2023	435.59	435.54	0.05	-0.79	-0.06	up
8/21/2023	436.07	436.03	0.04	-0.79	-0.05	up
10/27/2023	435.70	435.71	-0.01	-0.79	0.01	down
			Middle of screen elevation AP07S			425.97
			Middle of screen elevation OW-01			426.75

APPENDIX C. VERTICAL HYDRAULIC GRADIENTS

Nature and Extent Report

Edwards Power Plant

Ash Pond

Bartonville, Illinois

Date	APW-03 Groundwater Elevation (ft NAVD88)	AW-10 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UCF/PMP	UA				
2/9/2021	436.78	- - -	- - -	- - -	- - -	- - -
3/2/2021	436.47	438.84	-2.37	8.70	-0.27	up
3/22/2021	436.75	438.84	-2.09	8.70	-0.24	up
4/12/2021	436.25	438.85	-2.60	8.70	-0.30	up
5/4/2021	436.06	438.80	-2.74	8.70	-0.31	up
6/15/2021	435.64	438.62	-2.98	8.70	-0.34	up
6/28/2021	436.22	438.61	-2.39	8.70	-0.27	up
7/21/2021	436.13	438.60	-2.47	8.70	-0.28	up
8/30/2021	435.57	437.93	-2.36	8.70	-0.27	up
2/16/2022	436.47	438.05	-1.58	8.70	-0.18	up
7/25/2022	434.93	437.62	-2.69	8.70	-0.31	up
2/27/2023	436.51	438.38	-1.87	8.70	-0.21	up
			Middle of screen elevation APW-03			416.42
			Middle of screen elevation AW-10			407.72

Date	P002 Groundwater Elevation (ft NAVD88)	AW-20 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UCF/PMP	UA				
2/9/2021	448.41	445.11	3.30	12.27	0.27	down
3/2/2021	448.50	445.23	3.27	12.27	0.27	down
3/22/2021	448.60	445.41	3.19	12.27	0.26	down
4/12/2021	448.42	445.29	3.13	12.27	0.26	down
5/4/2021	448.31	445.08	3.23	12.27	0.26	down
6/15/2021	448.19	444.55	3.64	12.27	0.30	down
6/28/2021	448.33	445.08	3.25	12.27	0.26	down
2/16/2022	448.03	444.70	3.33	12.27	0.27	down
2/27/2023	448.34	445.33	3.01	12.27	0.25	down
			Middle of screen elevation P002			432.35
			Middle of screen elevation AW-20			420.08

APPENDIX C. VERTICAL HYDRAULIC GRADIENTS

Nature and Extent Report

Edwards Power Plant

Ash Pond

Bartonville, Illinois

Date	APW-04 Groundwater Elevation (ft NAVD88)	AW-13 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UCF/PMP	UA				
2/9/2021	432.44	435.52	-3.08	11.22	-0.27	up
3/2/2021	432.74	435.84	-3.10	11.22	-0.28	up
3/22/2021	432.75	435.86	-3.11	11.22	-0.28	up
4/12/2021	432.91	435.92	-3.01	11.22	-0.27	up
5/4/2021	432.40	435.83	-3.43	11.22	-0.31	up
6/15/2021	431.79	435.56	-3.77	11.22	-0.34	up
6/28/2021	431.21	435.40	-4.19	11.22	-0.37	up
7/21/2021	432.13	435.98	-3.85	11.22	-0.34	up
8/30/2021	431.98	435.28	-3.30	11.22	-0.29	up
2/16/2022	432.38	435.74	-3.36	11.22	-0.30	up
7/25/2022	431.15	434.65	-3.50	11.22	-0.31	up
2/27/2023	432.65	435.86	-3.21	11.22	-0.29	up
			Middle of screen elevation APW-04			422.39
			Middle of screen elevation AW-13			411.17

Date	AW-15 Groundwater Elevation (ft NAVD88)	AW-15C Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UA	BCU				
2/9/2021	433.03	433.32	-0.29	11.33	-0.03	up
3/2/2021	433.50	433.50	0.00	11.33	0.000	flat
3/22/2021	433.68	433.66	0.02	11.33	0.002	down
4/12/2021	433.76	433.80	-0.04	11.33	-0.004	up
5/4/2021	433.69	433.71	-0.02	11.33	-0.002	up
6/15/2021	433.65	433.63	0.02	11.33	0.002	down
6/28/2021	433.59	433.58	0.01	11.33	0.001	flat
7/21/2021	433.65	433.67	-0.02	11.33	-0.002	up
8/30/2021	434.43	431.51	2.92	11.33	0.26	down
2/16/2022	433.51	433.52	-0.01	11.33	-0.001	flat
7/25/2022	433.74	432.86	0.88	11.33	0.08	down
2/27/2023	432.59	432.56	0.03	11.33	0.003	down
			Middle of screen elevation AW-15			403.45
			Middle of screen elevation AW-15C			392.12

APPENDIX C. VERTICAL HYDRAULIC GRADIENTS

Nature and Extent Report

Edwards Power Plant

Ash Pond

Bartonville, Illinois

Date	AP05S Groundwater Elevation (ft NAVD88) UA	AP05D Groundwater Elevation (ft NAVD88) BCU	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
2/9/2021	437.61	439.14	-1.53	16.54	-0.09	up
3/2/2021	437.93	435.81	2.12	16.54	0.13	down
3/22/2021	438.43	433.33	5.10	16.54	0.31	down
4/12/2021	438.59	431.96	6.63	16.54	0.40	down
5/4/2021	438.43	432.29	6.14	16.54	0.37	down
6/15/2021	438.30	435.02	3.28	16.54	0.20	down
6/28/2021	438.24	433.14	5.10	16.54	0.31	down
7/21/2021	438.67	437.15	1.52	16.54	0.09	down
8/30/2021	438.13	438.36	-0.23	16.54	-0.01	up
2/16/2022	438.15	438.74	-0.59	16.54	-0.04	up
7/25/2022	437.62	438.78	-1.16	16.54	-0.07	up
11/21/2022	435.88	437.53	-1.65	16.54	-0.10	up
12/16/2022	436.73	437.51	-0.78	16.54	-0.05	up
1/9/2023	437.05	437.55	-0.50	16.54	-0.03	up
2/27/2023	438.46	437.82	0.64	16.54	0.04	down
			Middle of screen elevation AP05S			405.88
			Middle of screen elevation AP05D			389.34

[O:SSW 7/13/21, U: RAB 5/14/24, C: KRP 5/16/24]

Notes:

[1] Distance change was calculated using the midpoint of the piezometer screen and water table surface. If the water table surface was above the top of the monitoring well screen, then distance change was calculated using the midpoint of both screens.

[2] Vertical gradients between ±0.0015 are considered flat, and typically have less than 0.02 foot difference in groundwater elevation between wells.

- - - = no data collected on date / no vertical gradient calculated

BCU = bedrock confining unit

CCR = coal combustion residuals

dh = head change

dl = distance change

ft = foot/feet

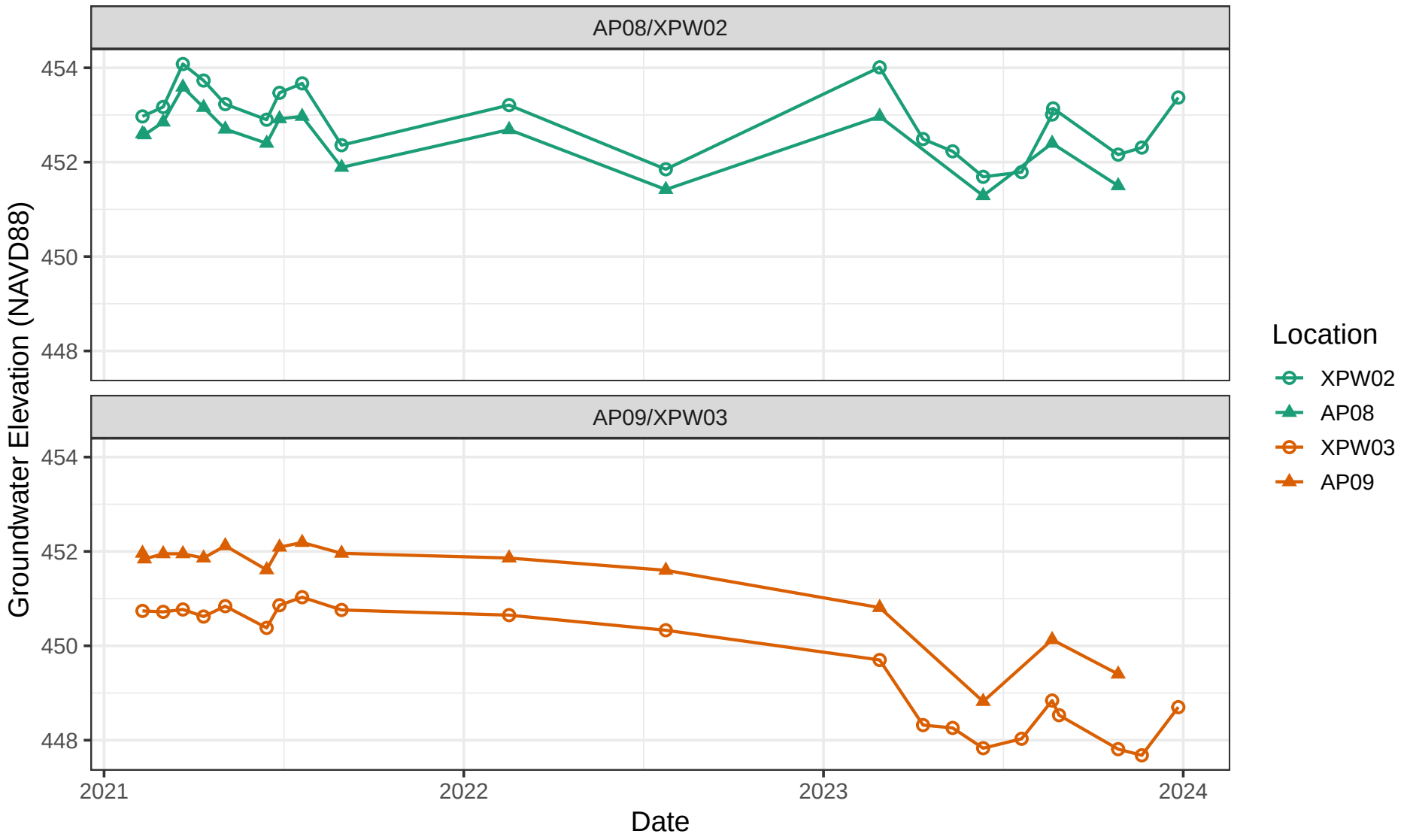
NAVD88 = North American Vertical Datum of 1988

UCF/PMP = Upper Cahokia Formation/potential migration pathway

UA = uppermost aquifer

APPENDIX D
Hydrographs Supporting Vertical Hydraulic Gradients

Path: dara/Vistra – 845/Corrective Action Assessment/Nature and Extent/Hydrographs



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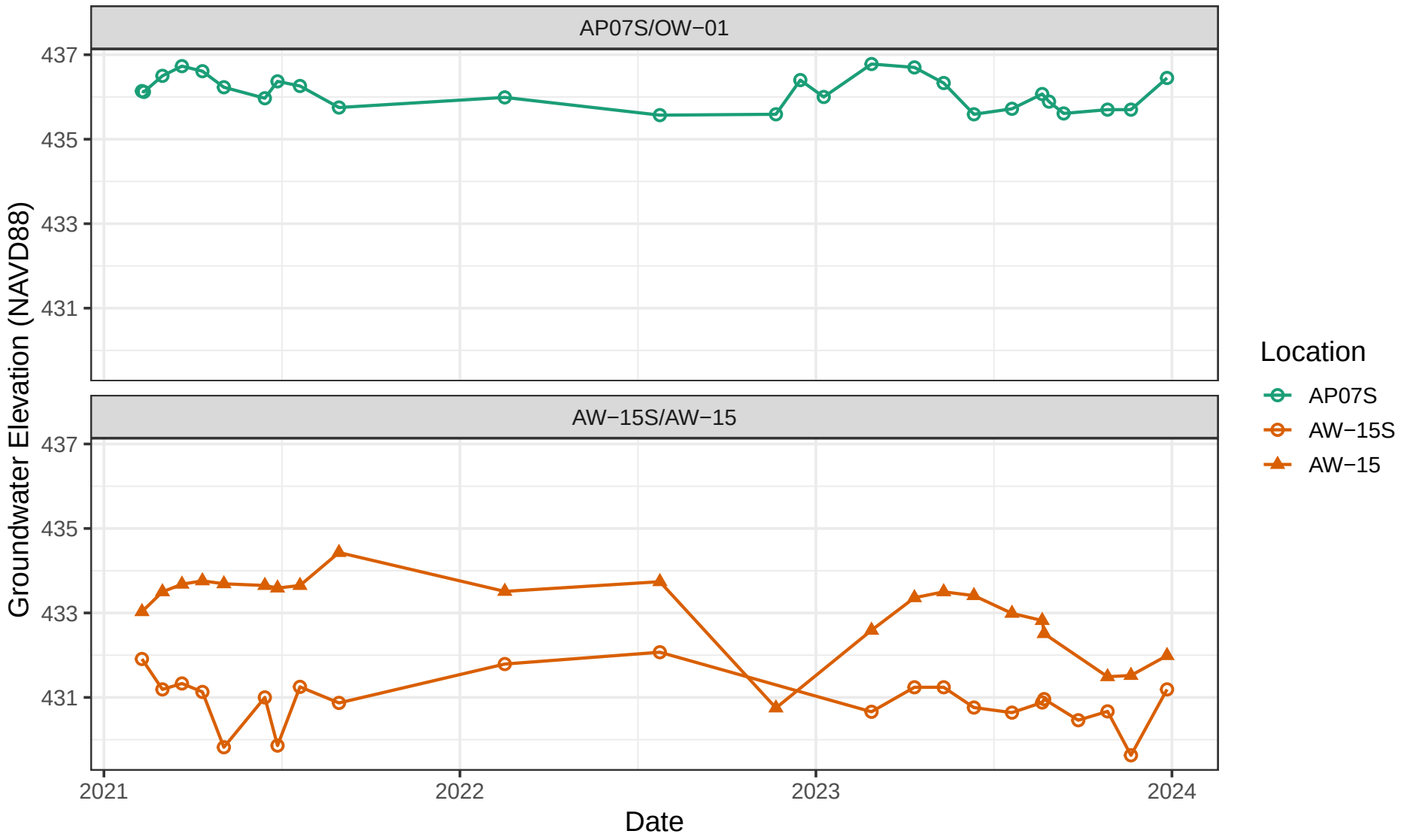
Hydrographs
Nature and Extent Report
Edwards Ash Pond
Bartonville, IL

Figure
1

Drafter: RAB Date: 2024-05-17 Contract Number: 1940103584

Path: dara/Vistra − 845/Corrective Action Assessment/Nature and Extent/Hydrographs

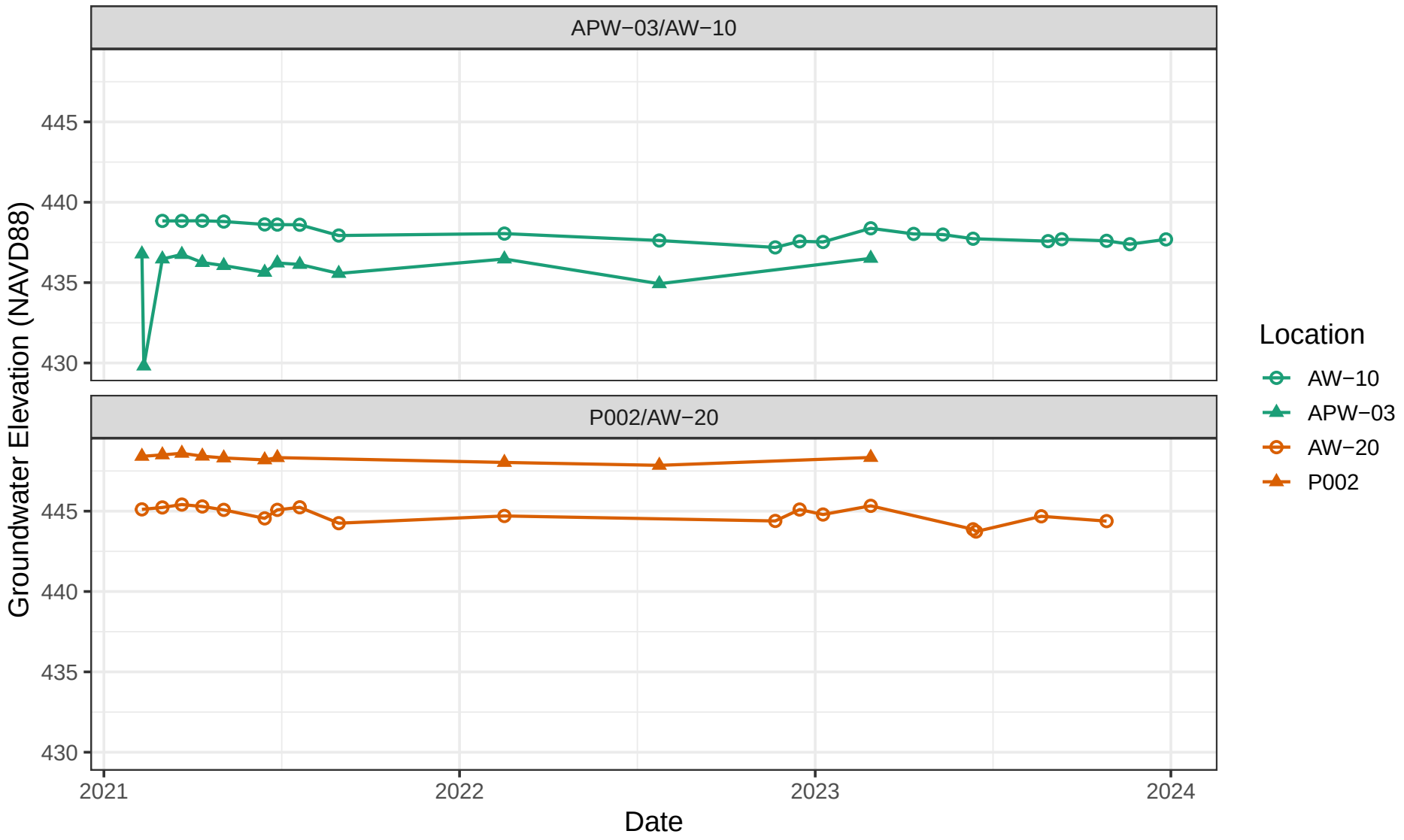


Hydrographs
Nature and Extent Report
Edwards Ash Pond
Bartonville, IL

Figure
2

Drafter: RAB Date: 2024−05−17 Contract Number: 1940103584

Path: dara/Vistra − 845/Corrective Action Assessment/Nature and Extent/Hydrographs



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Hydrographs
Nature and Extent Report
Edwards Ash Pond
Bartonville, IL

Figure
3

Drafter: RAB Date: 2024−05−17 Contract Number: 1940103584

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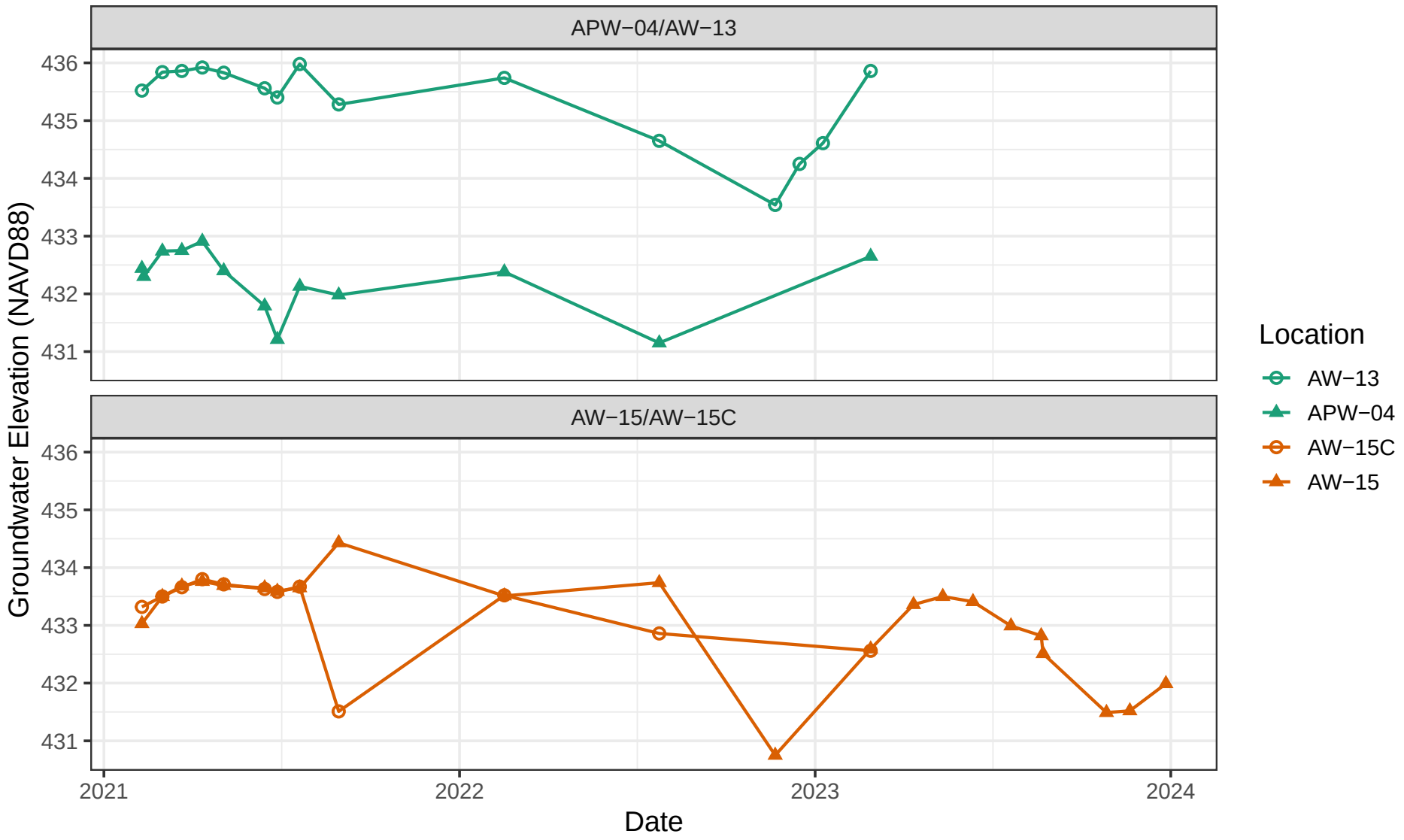

RAMBOLL

Hydrographs
Nature and Extent Report
Edwards Ash Pond
Bartonville, IL

Figure
4

Drafter: RAB Date: 2024−05−17 Contract Number: 1940103584

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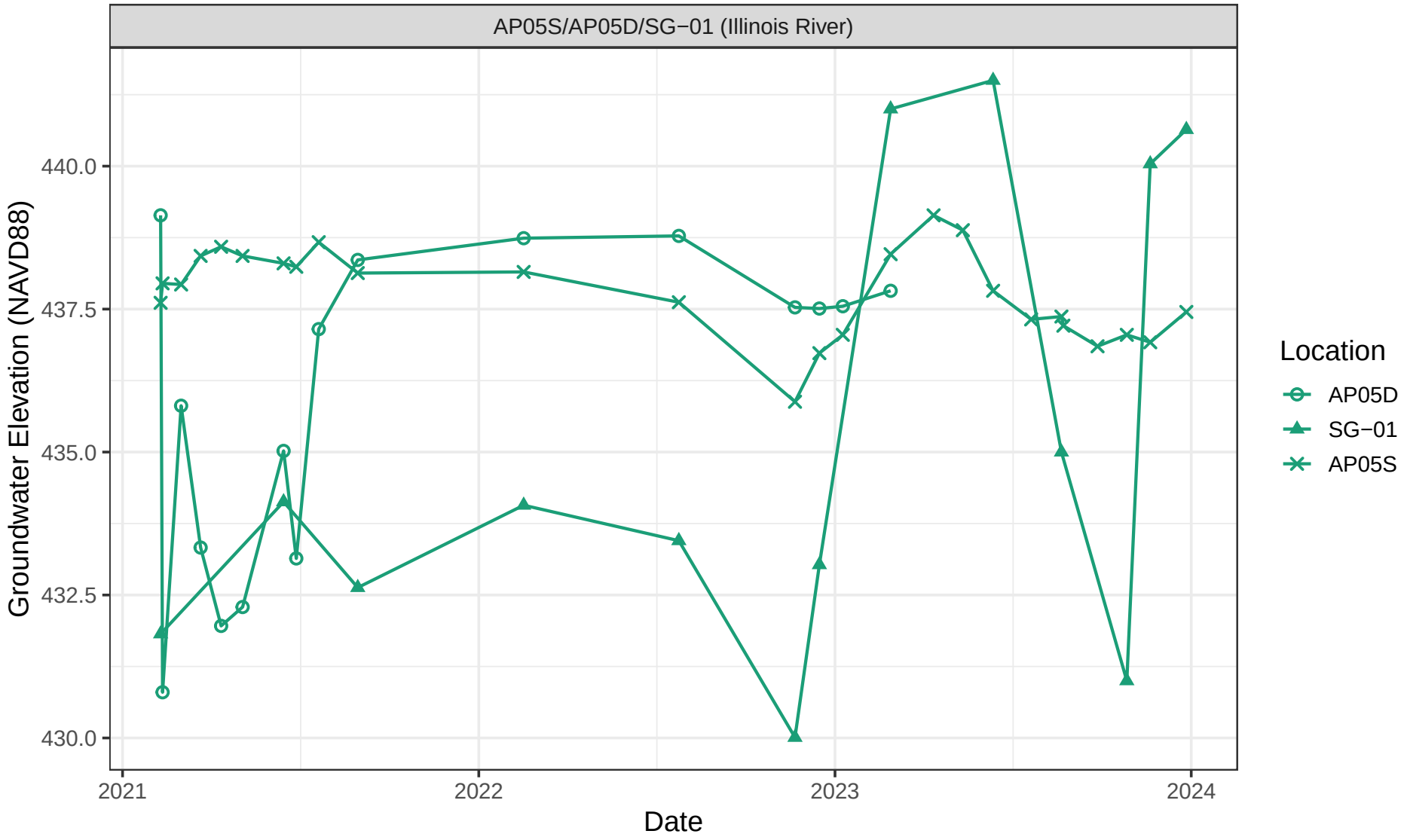

RAMBOLL

Hydrographs
Nature and Extent Report
Edwards Ash Pond
Bartonville, IL

Figure
5

Drafter: RAB Date: 2024−05−17 Contract Number: 1940103584

APPENDIX E
Geochemical Conceptual Site Model

GEOCHEMICAL CONCEPTUAL SITE MODEL

EDWARDS ASH POND

Submitted to:

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

Submitted by:

Life Cycle Geo, LLC
729 Main Street
Longmont, Colorado 80501

23RAM01-1
May 31, 2024

TABLE OF CONTENTS

1 Executive Summary 4
2 Introduction 5
2.1 Site Overview 5
2.2 Groundwater Monitoring Network 6
3 Constituent Transport and fate 6
4 Solids characterization 6
4.1 Methods 6
4.2 Results 8
4.2.1 CCR 8
4.2.2 Aquifer Solids 8
4.2.2.1 Bulk Characterization 8
4.2.2.2 SEP Analysis 9
4.2.2.3 Mineralogical Analysis 10
4.3 Sorption and Desorption Batch Studies 11
5 Aqueous Geochemistry 11
5.1 Exceedance Parameters and CCR Constituents 12
5.2 Major Ion Distribution 12
5.3 pH and Redox Conditions 13
5.4 Pourbaix Diagram 15
5.5 Supporting Statistical Analysis and Correlations 15
5.5.1 Principal Component analysis 15
5.5.2 Correlations 16
6 Geochemical Conceptual Site Model 17
6.1 Source and Mobilization mechanisms 17
6.2 Potential/Likely Attenuation Mechanisms 17
7 References 20
8 Acronymns and Abbreviationspr 21

FIGURES

Figure 2-1 Edwards Ash Pond Well Location and Hydrogeology
Figure 4-1 Edwards Ash Pond Soil Boring Locations and Hydrogeology
Figure 4-2a Edwards Ash Pond 2021 SEP Results
Figure 4-2b Edwards Ash Pond 2023 SEP Results
Figure 5-1 Edwards Ash Pond Boron and Sulfate Time Series
Figure 5-2 Edwards Ash Pond Piper Diagram
Figure 5-3 Edwards Ash Pond Oxidation Reduction Potential and pH Time Series
Figure 5-4 Edwards Ash Pond Pourbaix Diagram
Figure 5-5 Edwards Ash Pond Principal Component Analysis
Figure 5-6 Edwards Ash Pond Barium and Radium 226+228
Figure 5-7 Edwards Ash Pond Methane by Depth and Location
Figure 5-8 Edwards Ash Pond Boron, Sulfate, Barium, Radium Scatterplots

TABLES

Table 4-1 Summary of Solid Samples
Table 4-2 CEC Results
Table 4-3 XRF Results from 2023 Analysis
Table 4-4 LOI Results
Table 4-5a XRD Results from 2021 Analysis
Table 4-5b XRD Results from 2023 Analysis
Table 4-6 TIMA Results
Table 4-7 Total Metals Data for Iron, Manganese, Aluminum, Boron, and Sulfur
Table 4-8 SEP Results for Iron, Manganese, Aluminum, Boron, and Sulfur
Table 5-1 Groundwater Analytical Data

ATTACHMENTS

Attachment 1 Monitored Natural Attenuation Field Investigation Status Update, Primary Ash Pond (CCR Unit 301) Edwards Power Plant, Peoria County, Illinois
Attachment 2 SGS Analysis Report (SEP Data)
Attachment 3 Evaluation of Partition Coefficient Results, Edwards Ash Pond (CCR Unit 301), Edwards Power Plant, Peoria County, Illinois

1 EXECUTIVE SUMMARY

This report documents the geochemical conceptual site model (GCSM) describing the conditions of the groundwater in the vicinity of the Edwards (EDW) Ash Pond (AP). A GCSM describes the geochemical processes that contribute to mobilization and attenuation of constituents in the environment. This report describes the GCSM for parameters that have exceeded the GWPS in AP groundwater and which will be addressed in the corrective action plan. The exceedances observed at the AP occur in the uppermost aquifer (UA) and potential migration pathway (PMP) and include boron and sulfate.

The CCR materials are the primary source of constituent loading to the CCR porewater. Over an extended period (e.g., months to years), the CCR porewater (i.e., water contained within the interstitial pore spaces of the CCR that can be sampled by low-flow groundwater sampling methods) reaches equilibrium with the CCR materials. The porewater is therefore representative of the mobile phase constituents capable of migrating into the underlying materials and potentially downgradient in groundwater. The AP CCR porewater is therefore the primary vector of sulfate and boron *available* to the shallow groundwater and is considered as the primary source term for environmental investigation.

Boron and sulfate are assessed as indicators of influence from the CCR materials. Where observed in shallow groundwater at concentrations above the groundwater protection standard, concentrations of boron and sulfate are indicative of influence by CCR porewater. The uneven distribution of sulfate in the shallow UA/PMP groundwater is attributed to physical or chemical heterogeneity along the groundwater flow path.

Geochemical attenuation of constituents in groundwater is a function of groundwater pH, redox potential, availability of adsorbent, and presence of competing ions, among other factors. Groundwater pH exerts a major control on constituent mobility and reflects a neutral and generally stable condition in the range of 6 to 8 S.U. independent of location, lithology, or exceedance status. The stability of pH in groundwater is an indication that groundwater is well buffered, largely due to the widespread presence of carbonate minerals in the aquifer solids which buffer pH within this range. Neutral groundwater pH is generally favorable to attenuation of constituents in groundwater, such that it promotes the precipitation of the mineral phases that adsorb constituents from the aqueous phase. Groundwater pH additionally controls the tendency of various constituents to adsorb to the mineral surface. CCR porewater pH is alkaline, with a pH measured between 11 and 12.5 S.U.

The oxidation and reduction potential (redox potential) of groundwater exerts another major control on constituent mobility in groundwater. The redox condition is more variable across the site and shows a distinct pattern above and below the elevation of 420 feet elevation referenced to North American Vertical Datum of 1988 (ft NAVD88), the *approximate* elevation at which a redox transition appears to occur. The locations with exceedances of either boron or sulfate are all within the shallower elevation of the aquifer. The shallow groundwater (above the 420 ft NAVD88 approximate reference elevation) is more oxidized with low concentrations of dissolved iron and methane, and non-detect sulfide. The deeper groundwater reflects a reducing signature based on high concentrations of methane, dissolved and ferrous iron, and presence of sulfide. This deeper, reducing groundwater signature is not attributed to the CCR unit based on (1) the absence of boron and (2) the presence of constituents in the deeper groundwater that are

incompatible with the chemistry of the shallower groundwater (e.g., methane will reduce/consume sulfate if intermixed, and barium, present in the deeper groundwater, will precipitate as barite if in the presence of sulfate). This suggests a physical or hydraulic separation between the shallow and deep water at the site, which limits the extent of the influence from the AP.

Characterization data from the aquifer solids is considered to understand the reactive mineral fractions present in the aquifer solids and the binding mechanisms that control the partitioning of constituents between the solid and aqueous phases. The key finding from the aquifer solids assessment is that adsorptive minerals are present in the aquifer solids and have currently bound both boron and sulfate within the reactive fraction of the solid matrix. The inference follows that some degree of attenuation of the exceedance constituents by the aquifer solids has occurred in the past, most notably through adsorption to both iron and aluminum hydroxide minerals. The future condition of related attenuation is reserved for subsequent assessment and predictions related to the closure condition and corrective action.

2 INTRODUCTION

This report documents the development of a geochemical conceptual site model (GCSM) to describe conditions at the Edwards (EDW) Ash Pond (AP), which is part of the Edwards Power Plant (EPP). The GCSM was prepared in support of an evaluation of the nature and extent (N&E) of exceedances of constituents of concern (COCs) above the groundwater protection standards (GWPS) at the AP. This document has been prepared as an attachment to the EDW N&E Report (Ramboll, 2024). Boron and sulfate are the constituents with exceedances above the GWPS at the EDW AP. Exceedances were observed at compliance monitoring wells AW-05, AP07S, AW-15S, AW-19, and AW-21 during the second through fourth quarter 2023 sampling event completed under 35 IAC §845. Boron exceedances are in the uppermost aquifer (UA; AW-05, AW-19, and AW-21) and the potential migration pathway (PMP; AP07S and AW-15S). Sulfate exceedances are exclusively in the PMP (AW-15S).

2.1 SITE OVERVIEW

A thorough overview of site characteristics is presented in EDW N&E Report (Ramboll, 2024). Briefly, the EPP is located in Bartonville, Illinois. The EDW AP is bordered to the north by a salt processing facility, to east by a fertilizer processing plant and the Illinois River, to the south by agricultural fields, and to the west by the EPP, railroad tracks, and the former Orchard Mines. The AP is an unlined 91-acre surface impoundment that began operations in 1960 and primarily contains fly ash.

Full descriptions of site geology and hydrogeology are available in the Hydrogeologic Site Characterization Report (Ramboll, 2021a). In addition to the coal combustion residuals (CCR) present at the AP, there are three hydrostratigraphic units (HSU) in the vicinity of the EPP, including the Upper Cahokia Formation (UCF), the uppermost aquifer (UA), and the bedrock confining unit (BCU). The UCF consists of low permeability clays and silts and is considered the potential migration pathway (PMP) at elevations similar to the base of the ash pond and where thin discontinuous sand lenses occur. The UA is a thin, moderately permeable sand, silty sand, and clayey gravel. The BCU is low permeability shales and siltstones.

Exceedance wells AW-05, AW-19 and AW-21 are screened in the UA, while AP07S and AW-15S are screened in the UCF/PMP.

2.2 GROUNDWATER MONITORING NETWORK

A groundwater monitoring network was proposed in accordance with I.A.C Title 35 Section 845.630 to monitor groundwater quality which passes the waste boundary as part of the Operating Permit Application to Illinois Environmental Protection Agency (IEPA) for the AP. The proposed groundwater monitoring network is described in the Groundwater Monitoring Plan (Ramboll, 2021a). Groundwater flow in the UA is northwest in the northernmost portion of the pond, east to west in the central portion of the pond, and south/southeast in the southern portion of the pond (Figure 1). A detailed discussion of the hydrogeology is presented in EDW N&E Report (Ramboll, 2024).

3 CONSTITUENT TRANSPORT AND FATE

The two exceedance parameters at EDW AP are sulfate and boron. Sulfate is the dominant form of oxidized sulfur (S(VI) in the environment and is present as a divalent oxyanion at pH values greater than 2 S.U. (Stumm and Morgan, 1996). Under reducing conditions, sulfate in groundwater can be reduced to elemental sulfur (S(0)) or sulfide (S(-II)). Sulfur species in groundwater may sorb onto positively charged sites on solid metal oxide phases, most commonly iron and manganese oxides (Brown et al., 1999). The extent and strength of sorption to metal oxide surfaces depends on pH, ionic strength, size, and charge of the dissolved constituent, and available sorbing surface area. Sulfate can also form insoluble to low solubility complexes such as barite ($BaSO_4$) and gypsum ($CaSO_4$), while reduced sulfur readily precipitates as metal sulfide. Generally, reduced sulfur is less mobile in groundwater than sulfate.

Boron is primarily present in groundwater as boric acid (H_3BO_3) or borate ($B[OH]_4^-$) (Bolan et al., 2023). Boron speciation is pH dependent, with the charged $B(OH)_4^-$ being more dominant at higher pH. This species is more likely to sorb onto positively charged sites on solid metal oxide phases, most commonly aluminum and iron oxides (Bolan et al., 2023). Boron sorbs best to amorphous aluminum or iron phases (Goldberg and Glaubig, 1985). Boron adsorption is pH dependent, with maximum sorption occurring between pH 7 and 8 S.U. and dropping off at progressively higher or lower pH (Goldberg and Glaubig, 1985). Boron is not subject to oxidation-reduction reactions (Lemarchand et al., 2015; Bolan et al., 2023).

4 SOLIDS CHARACTERIZATION

4.1 METHODS

Aquifer solids were collected in 2021 to support the development of this GCSM. One additional aquifer solid sample was collected in 2022, during installation of monitoring well AW-23. **Attachment 1** details CCR and aquifer solids boring locations and collection methodology. **Table 4-1** summarizes boring identifiers, collection depth, associated monitoring well names, and methods of analysis. Three samples were

collected at upgradient location AP05S, two from the UA just above the screened interval, and one corresponding to the BCU. Aquifer solids were sampled at exceedance locations AP07S, AW-15S, and AW-19 and generally coincide with the screened intervals of the respective monitoring well.

Bulk solid characterization included CEC, XRF, and loss-on-ignition (LOI). The CEC describes the capacity of a soil to exchange positively charged ions, aiding in understanding aquifer capacity for undergoing ion exchange reactions. The CEC is dependent on organic matter and types and quantity of clay minerals. Ten samples were analyzed for CEC by SiREM in Guelph, Ontario in 2021, including one sample of CCR. XRF analysis measures the fluorescent X-rays emitted from a solid sample excited by a primary X-ray source to quantify the relative proportions of major elements in a sample. This data is presented as weight percent of individual elements based on electron properties. Results from XRF analysis are reported as oxides due to the borate fusion preparation method used. LOI was quantified in conjunction with XRD and describes the combustible portion of the solid material, which is interpreted to represent the proportion of organic matter in the solids. This test involves heating a sample at a high temperature, combusting volatile compounds.

Mineralogy was determined through XRD and TIMA. The XRD analysis quantifies crystalline mineral phases with Rietveld refinement offering increased precision in quantification calculations. Identifying mineral phases aids in understanding attenuation mechanisms and aquifer capacity. TIMA identifies amorphous and crystalline mineral phases using a combination of energy dispersive X-ray silicon drift detectors and backscattered electron and secondary electron detectors.

Total metals content is a measure of bulk concentration and is a useful measure of metal content within a solid sample. It does not, however, provide meaningful information on the extent to which a metal may or may not be released from the solid. Total metal results for boron, sulfur, iron, manganese, and aluminum are presented to aid understanding of bulk condition. Refer to the SEP results for understanding of metal binding mechanisms and to infer conditions that may lead to the mobilization of a given fraction of the total metal from the solid phase.

For the SEP test, a fraction of the total metal content is isolated from a solid sample based on the metal association with different operationally defined fractions of the solid sample. Initial extractions target loosely bound metals, representing the fraction of the total metal concentration that is more likely to become mobile under near-surface environmental conditions. Subsequent steps progressively extract metals associated with more recalcitrant fractions of the soil. This method allows for a nuanced understanding of metal partitioning with various phases in the soils, aiding interpretation of conditions that may contribute to metal attenuation or release.

The SEP analyses conducted in 2021 and 2023 followed two different methodologies. The 2021 samples were analyzed by Eurofins Test America (Eurofins; Knoxville, Tennessee), whereas the 2023 samples were analyzed by SGS (Burnaby, British Columbia, Canada). Eurofins uses a seven-step extraction procedure (**Attachment 1**), while SGS uses a six-step procedure (**Attachment 2**). The extractions performed for the two test methods generally target a similar set of soil fractions, though variations in extraction conditions and reagents may lead to differences in absolute values. Other differences can result from sample heterogeneity and alterations due to sample storage conditions, particularly for the samples analyzed in 2023. Despite these differences, the trends and relative distribution patterns from both tests can still be

informative. Results are presented for extracted iron (2021 and 2023), manganese (2021 and 2023), aluminum (2021 and 2023), boron (2023), and sulfur (2023). Boron and sulfur are included as the constituents of interest. Iron, manganese, and aluminum are presented due to their relevance for interpreting geochemical conditions and because they form the basis of the dominant adsorbent minerals in the aquifer matrix (iron, manganese, and aluminum hydroxides).

4.2 RESULTS

This section describes results of bulk characterization (CEC, **Table 4-2**; XRF, **Table 4-3**), mineralogical analysis (XRD, **Table 4-4**; TIMA, **Table 4-5**), organic carbon (TOC and LOI, **Table 4-6**), and SEP analysis and total metals (**Table 4-7**, **Table 4-8**, and **Figure 4-2**) for CCR (Section 4.2.1) and aquifer solids (Section 4.2.2).

4.2.1 CCR

The CCR sample collected in August 2021 from XPW01 was subjected to the analytical testing previously described (Section 3.1). The CCR sample had a LOI of 10.2% and a CEC of 86.5 meq/100g. The LOI is similar to the aquifer solids, but the CEC is significantly higher. Total iron concentrations (150,000 to 200,000 mg/kg) are an order of magnitude higher than those observed within the aquifer solids while total manganese (810 to 840 mg/kg) is similar to manganese found within the aquifer solids. The mineralogical analysis (Table 7) revealed the CCR material is distinct from aquifer materials with high proportions of anorthite (29.6%), hematite (23%), and magnetite (26%) and relatively low percentage of quartz (10.4%) and calcite (2.7%).

Most of the iron was detected in the residual fraction, followed by the acid sulfide fraction, indicating iron is not likely to become mobilized from the CCR solids. Overall manganese concentrations (850 mg/kg) were marginally higher than the aquifer solids (average 540 mg/kg). Manganese was predominantly associated with the carbonate fraction, followed by the non-crystalline and metal hydroxide fractions. Total aluminum concentrations in the CCR are similar to aquifer materials and the majority of aluminum was associated with the residual fraction.

4.2.2 AQUIFER SOLIDS

Results of the aquifer solids characterization are described below in order of bulk characterization, SEP, and mineralogy.

4.2.2.1 Bulk Characterization

Results of the CEC, XRF, and LOI bulk characterization are summarized as follows:

- **CEC:** The measured CEC in aquifer material ranges from 11.18 meq/100g in E-SB-07 to 36.47 meq/100g in E-SB-18, with an average of 22 meq/100g.

- **XRF:** The dominant species in the XRF analysis was SiO_2 with Al_2O_3 as the next most abundant species. In addition, CaO and MgO, common carbonate components, are present in all samples.

Similarly, Fe_2O_3 is present in all samples indicating the presence of iron-bearing minerals in the aquifer solids.

- **LOI:** The LOI values range from 4.6% to 19.3% in the aquifer solids, demonstrating a substantial proportion of carbon, particularly for the UA solids. LOI results are presented in Table 5.

4.2.2.2 SEP Analysis

Figure 4a shows the concentration of iron, manganese, and aluminum in each SEP fraction and the proportion each fraction represents from the 2021 analysis (Figure 4-2a) and 2023 (Figure 4-2b). Boron analysis was attempted for the 2021 samples but all results for aquifer solids were below method detection limits. The mass of iron associated with the metal hydroxide and non-crystalline minerals fractions is interpreted to represent the equivalent molar mass of crystalline or amorphous iron hydroxide mineralization that is a key contributor to aquifer sorption capacity (further discussed in Section 5.0). The acid/sulfide, organic, and residual fractions are the most recalcitrant fractions of the solid sample and are generally interpreted to indicate iron mass that is not likely to be mobilized from the aquifer under typical environmental conditions.

Results are summarized as follows:

- **Iron:** In all samples, the non-crystalline and metal hydroxide fractions represent 30% or more of the total iron in each of the aquifer solid samples with the remaining iron balance associated with the recalcitrant acid/sulfide and residual fractions. The residual fraction captured in the 2023 SEP analysis is inferred to represent the sum of the residual and acid/sulfide fraction measured from the 2021 samples (acid/sulfide fraction was not differentiated in the 2023 samples due to a change in SEP methodology). The higher concentration of iron found in association with the 2021 samples could be due to a shift in iron from the oxide fraction into the residual fraction, different laboratory methodology, sample heterogeneity, or the aging process of the soils during the archive period. The bedrock BCU sample E-SB-19 contains substantially higher total iron than the UA and PMP samples analyzed.

- **Manganese:** The distribution of manganese within the SEP extractions is interpreted similarly to iron in that the metal hydroxide and non-crystalline (amorphous) fractions are inferred to be associated with the adsorptive manganese hydroxide minerals and the later extraction steps are associated with the recalcitrant mineral phases. Like iron, most manganese is bound with the combined metal hydroxide and non-crystalline fractions. In addition, a sizable portion of manganese is found in association with the carbonate fraction (approximately 1 to 30%). The distribution of manganese indicates most manganese is associated with the more reactive phases and thus is available to participate in redox and sorption reactions, contributing to overall attenuation capacity.

- **Aluminum:** The majority of aluminum is bound with the residual fraction with small proportions associated with the iron and manganese oxide and carbonate fractions. This distribution indicates aluminum is not substantially available to participate in redox and sorption reactions.

- **Boron:** Boron was generally detected in all fractions in each of the samples. The highest boron concentrations were observed at exceedance location E-SB-15. The remaining samples are relatively consistent in overall concentration with the majority detected in association with the iron and manganese oxide fraction (39 to 55%), and the second most dominant association with the carbonate fraction (14 to 28%). These fractions are closely related to redox and pH conditions on site and constituents associated with these phases may be mobilized through mineral dissolution or other change in the geochemical regime. Boron is also associated with the organic fraction in most samples (9 to 18 %), suggesting attenuation with organic phases is possible.

- **Total sulfur:** Understanding sulfur distribution is valuable for understanding sulfate speciation and attenuation by the solid phase. Sulfur concentrations are generally similar across all samples, with a comparatively high concentration associated with sample E-SB-05. Sulfur was detected in every fraction except the carbonate fraction. The exchangeable metals fraction is the dominant association for sulfur, with additional mass measured in the organic and residual fractions. The organic and residual fractions are the most recalcitrant and indicate tightly bound and possibly reduced sulfur species. The exchangeable metals fraction is one of the least stable solid fractions, indicating this proportion of sulfur is likely loosely bound and relatively mobile, likely in the form of sulfate.

4.2.2.3 Mineralogical Analysis

Results of the XRD and TIMA are summarized as follows:

- **XRD:** The XRD results indicate quartz is the predominant mineral in all samples (34.6 to 59.7%). The next most abundant minerals are the silicate minerals albitic feldspar (4.6 to 19.3%) and muscovite mica (8.8 to 28.3%). Carbonates are present in high abundance and the distribution varies with depth (hydrostratigraphic unit) (0.0 to 9.5% in BCU; 0.0 to 21.4% in UA; 5.9% in the PMP). For most locations, dolomite is the predominant carbonate mineral present, with other phases including calcite, ankerite, and siderite. Trace amounts of the crystalline iron minerals hematite, magnetite, ilmenite, and siderite were additionally identified by XRD. Siderite is a reduced iron carbonate mineral, and magnetite, hematite, and ilmenite are iron oxide minerals that may contribute to adsorption and attenuation of dissolved constituents (though to much less extent than ferrihydrite). The presence of both siderite ($FeCO_3$) and magnetite (Fe_3O_4) in the aquifer matrix is suggestive of a dynamic iron equilibrium, whereby iron is cycling between the oxidized (magnetite) and reduced (siderite) forms. Ferrihydrite ($Fe[OH]_3$) is an amorphous precursor to magnetite that forms when dissolved iron first precipitates. Ferrihydrite is not identified by XRD because it is not a crystalline mineral. It is, however, inferred to be present based on the dynamic iron equilibrium and the SEP results, discussed further in Section 4.2.2.2. Ferrihydrite is a particularly effective adsorbent due to its electrochemical properties and the disordered nature of the elemental

arrangement, which leads to a high reactive surface area available for interaction with dissolved constituents in groundwater.

- **TIMA:** Results of the TIMA are overall consistent with the XRD results and indicate quartz (29.0 to 42.3%) and mixed clays/micas (30.2 to 47.6%) are the dominant mineral phases. Moderate amounts of plagioclase (8.36 to 14.5%) and carbonates (0.12 to 20.11%) were also detected.

4.3 SORPTION AND DESORPTION BATCH STUDIES

In August 2021, select aquifer solids and groundwater samples were submitted by WSP to SiREM laboratory to test the sorption behavior of boron and sulfate (**Attachment 3**). Sorption studies pair groundwater with parameters above the GWPS with soils from upgradient background locations to evaluate both attenuation mechanisms and capacity of aquifer solids for sorption of contaminants. Soils from background location E-SB-05 (30-33.5 ft) were paired with groundwaters from AW-15S (PMP) and AW-19 (UA), which were selected based on statistical evaluation of potential exceedances in 2021 (WSP 2022). Each groundwater-soil sample was spiked to achieve a target concentration of boron, sulfate, lithium, and barium. Samples were equilibrated over a 7-day period, with concentrations of target constituents analyzed on day zero and day seven. This was repeated for different soil-water ratios. Sorption was estimated by calculating the difference between initial (day 0) concentrations and final (day 7) concentrations. For both samples, there was no appreciable difference between initial concentrations of boron and sulfate and final concentrations, regardless of the soil-water ratio. This indicates neither constituent sorbed onto the solid surface in any sample. Partition coefficients were very low for both samples, further indicating a lack of available additional sorption capacity for the aquifer solids. Calculated partition coefficients are reported in **Attachment 3**.

While the batch studies largely confirm the conservative nature of both boron and sulfate, the SEP results presented in Section 4.2.2.2 demonstrate that boron and sulfate are sorbed to solids collected from downgradient of the AP, indicating some degree of attenuation by the aquifer solids has occurred. Subsequent evaluation associated with a Corrective Action Plan will assess the sorption behavior of both boron and sulfate under return to background conditions, where it is anticipated that geochemical conditions will shift from the present condition, thereby influencing adsorption behavior under dynamic conditions not reflected by the sorption batch studies.

5 AQUEOUS GEOCHEMISTRY

This section summarizes groundwater conditions at the AP. The AP porewater and groundwater data discussed in this section are detailed in **Table 5-1**. Over time, different parameters have been collected at different frequencies at various wells due to the regulatory history of the unit. Groundwater chemistry for UA wells above 420 ft NAVD88 is similar to PMP wells across the site. These UA wells are discussed together with the PMP, henceforth referred to as “shallow UA/PMP” wells.

5.1 EXCEEDANCE PARAMETERS AND CCR CONSTITUENTS

Boron and sulfate are the two exceedance parameters for the EDW AP. **Figure 5-1** shows timeseries of boron and sulfate collected from porewater and groundwater locations starting in 2020. Concentrations of boron are higher in all CCR porewater wells relative to groundwater. UA exceedance well AW-21 consistently maintains the highest boron concentrations in groundwater, followed by the other exceedance locations. In addition, UA wells AW-05 and AW-20, located near the northern exceedance wells, also exhibit relatively high boron concentrations near the GWPS with an increasing trend. Several other UA (APW-01, AW-01, AW-18, and AW-20) and BCU (AP05D and AP07D) wells also exhibit concentrations above UA background, though concentrations are stable and do not exceed the GWPS.

Groundwater well AW-15S is the only groundwater well that exhibits sulfate concentrations statistically exceeding the GWPS. This PMP well is located at the southern edge of the AP. All other wells (including UCF, UA, and BCU wells) at the southern edge of the AP are installed at a lower elevation and exhibit low sulfate concentrations (<0.18 to 58 mg/L). Wells at the most northern edge of the AP reflect relatively high concentrations of sulfate upwards of 480 mg/L, though no wells have statistical exceedances of the GWPS. Exceedance locations AP07S, AW-05, and AW-21 and UA well APW-01 have sulfate concentrations similar to porewater locations XPW01A and XPW03. These wells are downgradient from XPW01A and are all within the same hydrogeologic flow path.

5.2 MAJOR ION DISTRIBUTION

A Piper diagram shows proportions of major ions within groundwater and porewater. **Figure 5-2** shows a Piper diagram for samples from 2020 to the fourth quarter of 2023. Porewater is characterized by a high proportion of sodium and sulfate. Porewater locations XPW01A and XPW03 have slightly lower proportions of sulfate and higher proportions of chloride.

Groundwater samples exhibit heterogeneity in ion distribution. The background groundwater and all shallower wells, including exceedance locations, exhibit a calcium-magnesium dominant signature. In contrast, the deeper wells have a more even distribution of cations. BCU well AP05D and two AP07D samples have a similar cation signature to porewater while AW-15C and most AP07D samples have higher proportions of magnesium and calcium, though still predominantly a sodium-potassium signature. Most groundwater (including background, deep, and shallow wells) exhibits a carbonate dominated anion signature, including exceedance well AW-19. However, several shallow wells, including the other exceedance locations, have a similar anion signature to porewater locations XPW01A and XPW03. BCU wells have distinct anion signature, dominated by high carbonate and chloride proportions.

5.3 PH AND REDOX CONDITIONS

Groundwater pH and the oxidation-reduction (redox) potential of the groundwater are dominant controls on the solubility, fate, and transport of many constituents in the groundwater. These so-called master variables govern the chemical interaction of dissolved phase constituents (mobile phase) with the solid matrix (immobile phase). This section provides a description of the measured pH and redox conditions for both groundwater and CCR porewater. The geochemical controls on constituent release and attenuation of boron and sulfate are discussed further in Section 5.0.

Groundwater pH is neutral and generally stable within the range of 6 to 8 S.U. independent of location, lithology, or exceedance status. This stable pH indicates groundwater is well buffered against change, likely due to the widespread presence of carbonate minerals in the aquifer solids which buffer pH within this range (Section 5.2).

Groundwater redox conditions are evaluated based on field measured oxidation-reduction potential (ORP) (**Figure 5-3**) and ferrous iron as well as laboratory analytical measurements of redox-sensitive constituents such as iron, manganese, sulfate, sulfide, and methane. Groundwater ORP represents the average electrical potential of an aqueous solution and is relied upon as a field measure of redox condition. Discussion of aqueous analysis is focused on data collected from 2020 through present[1].

While groundwater ORP is useful as an initial estimation of redox condition, ORP is influenced by multiple aqueous reactions and can prove an inadequate or incomplete measure of redox if disequilibrium exists within the aquifer. Evaluation of redox sensitive parameters and redox couples such as dissolved manganese, dissolved and ferrous iron, sulfate and sulfide, and methane in combination with ORP provide a more complete understanding of redox conditions within the aquifer. These species exist along a spectrum of more oxidizing to more reducing conditions, with sulfate dominant in an oxidized environment and species such as ferrous iron, sulfide, and methane more dominant in increasingly reducing environments. The presence of dissolved iron and manganese are also generally suggestive of a reducing environment.

Redox condition is evaluated spatially based on the combined dataset, with reference to the elevation of 420 ft NAVD88), the *approximate* depth at which a redox transition appears to occur based on observed chemistry, as follows:

- **Background** – The background wells are installed within the UA at a depth below the elevation of approximately 420 ft NAVD88, immediately east of the AP (AW-08) and to the northeast of the AP (AP05S). Background groundwater is interpreted to be chemically reduced based on consistently negative ORP, high concentrations of methane, dissolved and ferrous iron, and the presence of sulfide in background well AP05S.

[1] A substantial shift in ORP occurred in 2020 from a positive ORP to a more commonly negative ORP, which prevails through present. While it is not known with certainty, this shift is most likely the result of a change in the field equipment used to collect the measurements, which occurred around this same time. The more recent data is therefore inferred to provide the best representation of current aquifer conditions.

- **Shallow UA/PMP groundwater (above 420 ft NAVD88)** – The redox condition associated with the shallow UA/PMP groundwater is mildly oxidized to mildly reduced as indicated by slightly negative to positive ORP in combination with ample sulfate and much lower concentrations of dissolved iron and methane, and an absence of sulfide (despite ample sulfate).

    - **Exceedance wells** – The five wells with either boron or sulfate exceedances all fall within the category of shallow UA/PMP wells screened at an elevation above 420 ft NAVD88 and exhibit the mildly oxidized conditions discussed.

- **Deep UA groundwater (below 420 ft NAVD88)** - The presence of methane, sulfide, dissolved iron, and ferrous iron in the deeper wells indicates a chemically reduced groundwater at depth in the UA. Sulfate concentrations are low (non-detect to <100 mg/L) in deeper wells. Sulfate is reduced to sulfide under highly reducing conditions and generally precipitates as metal sulfide with sufficient time. While the ORP measured at depth is generally more negative than that measured for the shallow UA/PMP wells, the range of ORP measurements is not as low as would be expected if the sulfide and methane were generated in-situ. It is likely that the methane (and sulfide) associated with the deeper UA clay lenses migrated from an organic-rich source at depth. One plausible source of methane is the former coal mine workings that underlies the EDW AP property (Ramboll, 2021a).

- **Bedrock** – Sulfate concentrations are low (non-detect to <100 mg/L) in the BCU and ORP measurements are predominantly negative. Dissolved iron, manganese, sulfide, and methane were not measured in BCU samples. The lack of measured redox couples inhibits complete understanding of BCU redox conditions, though ORP measurements suggest a reducing environment.

- **CCR porewater** - The CCR porewater pH and redox condition is important for understanding how porewater interacts with the natural groundwater. The CCR porewater is highly alkaline with pH measured from 11 to 12 S.U. and the ORP is generally negative. The CCR porewater also contained low concentrations of measurable sulfide (0.4 to 0.8 mg/L) and methane (150 to 950 mg/L), though very low concentrations of dissolved manganese and iron. Low concentrations of dissolved iron and manganese are consistent with SEP results indicating most iron is bound into recalcitrant phases and most manganese is bound into carbonates, which is unlikely to be released under high pH conditions. The sulfide and methane are likely formed as residual organic matter within the CCR decomposes. Methane concentrations are one to two orders of magnitude lower in CCR porewater than concentrations found within deeper UA wells, as discussed further in Section 5.5.2.

In addition to the redox distinction observed at depth, there is additional spatial variability observed from north to south of the AP. In general, the wells installed on the north end of the AP are shallower due to the bedrock surface being at a higher elevation to the north of the AP. This leads to a redox condition of more oxidized water in the north. In the south, the groundwater wells are generally screened deeper within the UA below the elevation of 420 ft NAVD88. This leads to a more reducing signature in the south with redox chemistry dominated by methane and ferrous iron. It is notable that exceedance well AW-15S, located at

the southern end of the AP, is screened in a shallower PMP horizon, and exhibits the oxidized condition discussed for the shallower wells.

5.4 POURBAIX DIAGRAM

Pourbaix diagrams show possible thermodynamically stable phases at equilibrium conditions across pH values and redox potentials. **Figure 5-4** shows second quarter 2023 (June 2023) samples plotted on a Pourbaix diagram for iron phases. The ORP was converted to Eh by adding a correction factor of 200 mV to measured field data. The iron diagram shows a distinct separation between porewater and groundwater, largely driven by differences in pH. The porewater indicates stability of iron hydroxides. The groundwater samples plot around the equilibrium line of dissolved iron (Fe^{++}) and iron hydroxide ($Fe[OH]_3$).

5.5 SUPPORTING STATISTICAL ANALYSIS AND CORRELATIONS

5.5.1 PRINCIPAL COMPONENT ANALYSIS

Groundwater chemistry data are multivariate by nature given the high number of parameters observed per sampling location and within a given timeframe. With such a large number of variables, advanced statistical analysis of multivariate groundwater data can provide important insights into spatial, temporal, and chemical relationships influencing constituent distribution and compliance in groundwater. The multivariate technique Principal Component Analysis (PCA) is used to interrogate the groundwater chemistry around the exceedance wells. PCA is a multivariate technique that reduces dataset dimensionality to its principal, independent components thereby revealing the inner structure of the dataset. Multivariate techniques such as PCA are valuable because they identify variables that are highly dependent on each other and reduce the multivariate data dimensionality to eliminate this redundant information. This reveals inner structures in the data that might otherwise be obscured by these dependencies. In the case of groundwater data, these structures might include groups of related variables, chemical evolution through time, or spatial locations with similar chemical signatures.

The PCA analysis includes samples from the second and third quarters of 2023. This dataset was chosen as it includes a full analytical suite, including methane and total organic carbon measurements. All samples and analytes with a high percentage (≥40%) of missing data or data below a method detection limit (MDL) were first assessed to ensure that meaningful statistical variance exists. If overall analyte variance was determined to be low, the analyte was removed, otherwise the data were included in the analysis. Any data reported as below the MDL were converted to half the MDL. The final dataset contains 19 measured analytes (including the hydrogen ion (H+), which represents acidity in groundwater and is inversely proportional to pH), 912 total measurements from 48 individual groundwater samples at 24 wells (3 CCR, 18 UA, 3 PMP). All data were log transformed, scaled, and centered so parameters with larger concentrations do not unduly influence results.

PCA results are most easily viewed on a biplot (**Figure 5-5**), which depicts the sample population plotted on two axes, each representing a principal component. The principal components are created from a linear combination of the original variables in the dataset and variance in the data. Principal component 1 (PC1)

and principal component 2 (PC2) are represented on the x and y axis and explain 52% and 25% of the statistical variance in the water quality dataset, respectively. Constituent variables are expressed as vectors. The grouping of samples relative to the component vectors is useful for providing immediate insight into geochemical relationships among groups of variables and samples. The biplot exhibits the following key features:

- PCA identifies three distinct geochemical clusters at the AP: porewater, deep groundwater, and shallow groundwater (including the exceedance locations).
- The porewater chemical cluster dominates the right side of the plot and is closely associated with potassium, molybdenum, aluminum, arsenic, sodium, silica, and lithium.
- The shallow UA/PMP groundwater disposition plots in the upper left corner and is dominated by sulfate and calcium. This includes all exceedance wells and several other nearby shallow wells.
- The deeper UA groundwater group plots near the bottom of the PCA and is dominated by barium, total organic carbon (TOC), and methane (CH4) association. The well locations nearest to the TOC and methane vectors tend to be deeper than the wells nearest to the barium vector. The two background wells plot near the barium vector.
- The barium, TOC, and methane vectors are pointing in opposite directions from the sulfate and boron vectors, indicating a negative correlation between these analytes, further supporting the distinction between the shallow and deep UA water signatures.

Observations from the PCA support and align with the observed redox signature that separates the shallow UA/PMP zones compared from the signature observed in the deeper UA.

5.5.2 CORRELATIONS

There is a distinct spatial pattern in the distribution of barium, radium, and methane in groundwater downgradient of the EDW AP. **Figures 5-6** and **5-7** demonstrates that barium, radium, and methane are elevated in deeper wells compared to the shallower wells. Figure 9 similarly shows elevated barium, radium, and methane in the southernmost wells, compared to more northern wells. The north-south spatial distribution should not be overinterpreted as the northernmost wells are all generally shallower than the southernmost wells. While these analytes are among the CCR regulated parameters, these parameters are known to be naturally occurring in Illinois aquifers (Gilkeson et al, 1983). Furthermore, barium and radium correlations with boron and sulfate (**Figure 5-8**) demonstrate that the presence of one constituent is associated with very low concentrations of the other constituent. While single-variate statistical analysis (i.e., Pearson correlation) would indicate these parameters are completely uncorrelated, their positioning relative to one another on the PCA indicates a strong negative correlation when considered in the context of other variables. Similarly, the organized distribution of data on the correlation plots also indicates a meaningful pattern in the data. This distribution is suggestive of two different and separate waters and aligns with the redox signature and PCA results as discussed. The separation of the shallow UA/PMP and deep UA groundwater is most likely due to a physical or hydraulic separation of the shallow and deep water. This interpretation is based primarily on the observed boron behavior. If a strong geochemical mechanism were responsible for controlling the chemistry observed, boron being a generally conservative and not highly reactive constituent, would not separate between the two waters in this manner. This separation of deep and shallow groundwater additionally aligns with the fact that the CCR signature, as

indicated by high boron and sulfate and low barium, is observed only in the shallow wells and is absent in the deeper wells.

6 GEOCHEMICAL CONCEPTUAL SITE MODEL

6.1 SOURCE AND MOBILIZATION MECHANISMS

The CCR materials are the primary source of constituent loading to the CCR porewater. Over an extended period (e.g., months to years), the porewater reaches equilibrium with the CCR materials, signifying the constituents within the porewater are representative of the mobile phase capable of migrating to downgradient groundwater. This conclusion is drawn from the prolonged interaction between the CCR solids and the porewater, allowing for the transfer of soluble constituents like sulfate and boron into the porewater. The AP CCR porewater is therefore the primary vector of sulfate and boron *available* to the shallow groundwater and is considered as the primary source term for environmental investigation.

Both boron and sulfate are common CCR indicator parameters and are observed in shallow groundwater at some locations at concentrations indicative of influence from porewater. The uneven distribution of boron and sulfate in the groundwater is attributed to be a function of the observed chemical and physical heterogeneity along the groundwater flow path. The mobilization mechanism is advective transport from the CCR porewater source into the underlying groundwater.

Two distinct groundwater types are identified at the EDW AP, including:

- Shallow UA/PMP groundwater (above an elevation of approximately 420 ft NAVD88) that exhibits boron and sulfate exceedances. This water is mildly reduced to mildly oxidized and exhibits a signature that is influenced by the CCR porewater. The UA and PMP groundwater are chemically similar in this shallow zone, particularly to the north of the AP.

- Deep UA groundwater (below an elevation of approximately 420 ft NAVD88) exhibits a distinct signature of strongly reducing conditions associated with high concentrations of methane, TOC, traces of sulfide, and a low ORP. This deeper groundwater additionally is characterized by low concentrations of boron and sulfate and a signature of barium and radium that is less apparent in the shallow UA/PMP groundwater. This deep UA groundwater is not influenced by the CCR porewater.

6.2 POTENTIAL/LIKELY ATTENUATION MECHANISMS

Boron and sulfate are generally regarded as conservative CCR constituents under most environmental conditions; however, downgradient of the EDW AP, several attenuation mechanisms are inferred to be active within the UA/PMP groundwater based on the available data and measured geochemical condition.

The specific attenuation mechanisms are discussed for the two exceedance parameters as follows:

Sulfate

- **Mineral precipitation** – Mineral precipitation of the barium sulfate mineral barite ($BaSO_4$) is identified as a probable and dominant attenuation mechanism and control on sulfate mobility in the shallow UA/PMP groundwater. Barium is measured in association with the UA and PMP groundwater (higher concentrations in the deep UA groundwater) and bedrock groundwater. Precipitation of barite is a likely attenuation mechanism for sulfate in the shallow UA/PMP groundwater, despite the low concentrations of barium relative to the deep UA and bedrock groundwater. Barite precipitation is similarly observed in groundwaters in northern Illinois (Gilkeson et al, 1983), providing further evidence that this natural attenuation mechanism is an important influence on sulfate mobility broadly for Illinois groundwater.

- **Adsorption** – Sulfate is known to sorb to iron and manganese oxide phases (Kitadai, 2018; He, 1996; Geelhoed, 1997). A relatively small amount of sulfur is observed from the 2023 SEP results in association with the iron and manganese oxide phases and is interpreted to represent adsorbed sulfate on the mineral surfaces. This mechanism is not likely a dominant attenuation mechanism for sulfate given the mildly reducing conditions within the aquifer that will tend to limit the stability of the hydroxide phases such as ferrihydrite. In addition, the sorption batch studies conducted demonstrated little additional adsorption to the soil surface under the conditions evaluated, suggesting that the existing adsorption capacity may be exhausted. The batch studies largely confirmed the conservative nature of sulfate, whereas the SEP results demonstrate that sulfate is sorbed to solids collected from downgradient of the AP, indicating some degree of attenuation by the aquifer solids has occurred. It is anticipated that geochemical conditions will shift from the present condition in response to source control and unit closure, thereby influencing adsorption behavior under dynamic conditions not reflected by the sorption batch studies. Evaluation of longer-term changes in adsorption behavior under a "return to background" scenario will be addressed in subsequent evaluation associated with a Corrective Action Plan.

- **Organic complexation** – Sulfur is an essential element for living organisms and is a critical component of many amino acids. Soil organic matter represents a major source and sink for sulfur in the environment, the partitioning and speciation of which depends on the geochemical conditions of the soil and groundwater (Schroth et al, 2007). Sulfur cycles through multiple different oxidation states and undergoes both biotic and abiotic transformations in relation to soil and groundwater pH, redox condition, groundwater ionic strength, and available organic compounds, among other additional factors. The 2023 SEP results identified a sizable proportion of sulfur associated with the organic fraction. Given the predominance of organic sulfur within most soils, it is likely the sulfur bound with this fraction is innate and not necessarily attenuated.

- **Chemical reduction** - Sulfate reduction is a biologically mediated redox reaction that readily occurs under strongly reducing conditions such as is observed in the deep UA groundwater.

Sulfate reduces to hydrogen sulfide through a transfer of electrons, and subsequently precipitates as metal sulfide mineralization within the solid matrix. The net result of these reactions is removal of sulfate from the aqueous phase. While the exceedance locations in the shallow UA/PMP groundwater are not sufficiently reducing for this mechanism to occur (at present), this reaction is believed to be a controlling factor in the deep UA zone based on presence of sulfide, very low concentrations of sulfate, and the high concentrations of methane that confirm conditions are sufficiently reducing for sulfate reduction to occur. Should the upward gradient become stronger following closure, in response to source control, this redox mechanism may be a plausible sink for sulfate in the shallow UA/PMP long-term.

Boron

- **Adsorption** – Boron is known to sorb to aluminum and iron hydroxide mineralization in the solid phase (Goldberg and Glaubig, 1985) and to organic compounds (Lemarchand et al., 2005; Goli et al., 2019). Roughly 50% of the solid phase boron measured from the 2023 SEP results is found to be associated with the iron and manganese oxide phases and is therefore interpreted to represent adsorbed boron on the mineral surfaces. Similarly, 2023 SEP results found boron associated with the organic fraction, possibly indicating boron is adsorbed to organic material or in the form of boron-organic complexes (discussed below). Studies have found boron ($B(OH)_4^-$) sorption onto organic matter is three to six times higher than onto aluminum and iron oxides (Lemarchand et al., 2005). Sorption onto solid surfaces is likely to be the dominant attenuation mechanism for boron in the shallow UA/PMP based on the available data and overall limited reactivity of the borate molecule. The sorption/desorption batch studies conducted demonstrated little additional adsorption to the soil surface under the conditions evaluated, suggesting that the existing adsorption capacity of the soils is limited. The batch studies largely confirmed the conservative nature of boron, whereas the SEP results demonstrate that boron is sorbed to solids collected from downgradient of the AP, indicating some degree of attenuation by the aquifer solids has occurred. It is anticipated that geochemical conditions will shift from the present condition in response to source control and unit closure, thereby influencing adsorption behavior under dynamic conditions not reflected by the sorption batch studies. Evaluation of longer-term changes in adsorption behavior under a "return to background" scenario will be addressed in subsequent evaluation associated with a Corrective Action Plan.

- **Organic complexation** – Boron is known to form complexes with organic compounds including, but not limited to carbohydrates, polyols, esters, malic acids, and humic acids (Lemarchand et al., 2005; Geffen et al., 2006; Goli et al., 2019; Bolan et al., 2023). Boron complexation with organic matter is dependent on pH, ionic strength, and available organic compounds. The 2023 SEP results identified boron associated with the organic fraction. It is unknown if this boron was adsorbed to the organic matter or in the form of boron-organic complexes.

The combined solid and aqueous phase data collected from around the EDW AP suggests that multiple interrelated attenuation mechanisms may be active and influencing partitioning of both boron and sulfate in

the groundwater. The predominance, long-term stability, and rates of the discussed geochemical reactions in response to planned closure and source control activities will be further documented in subsequent geochemical evaluations.

7 REFERENCES

Aitchison, J. 1986. The Statistical Analysis of Compositional Data. Chapman and Hall. London

Bolan, S., Wijesekara, H., Amarasiri, D., Zhang, T., Ragályi, P., Brdar-Jokanović, M., Rékási, M., Lin, J., Padhye, L., Zhao, H., Wang, L., Rinklebe, J., Wang, H., Siddique, K., Kirkhamn, M., Bolan, N. (2023). Boron contamination and its risk management in terrestrial and aquatic environmental settings. Science of the total Environment. 164744.

Brown, G., Henrich, V., Casey, W., Clark, D., Eggleston, C., Felmy, A., Goodman, D., Gratzel, M., Maciel, G., McCarthy, M., Nealson, K., Sverjensky, D., Toney M., and Zachara, J. (1999). Metal Oxide Surfaces and Their Interactions with Aqueous Solutions and Microbial Organisms. Chemical Reviews, vol. 99, pp. 77-174.

Burns & McDonnell, 2021. Initial Operating Permit Edwards Power Plant Ash Pond.

Geelhoed, J., Hiemstra, T., Van Riemsdijk, W. (1997). Phosphate and sulfate adsorption on goethite: Single anion and competitive adsorption. Geochimica et Cosmochimica Acta, vol 61, pp. 2389-2396.

Geffen, N., Semiat, R., Eisen, M.S., Balazs, Y., Katz, I., and Dosoretz, C.G. (2006). Boron removal from water by complexation to polyol compounds. Journal of Membrane Science, vol 286, pp 45-51.

Gilkeson, R.H., Cartwright, K., Cowart, J. B., Holtzman, R. B. (1983). Hydrogeologic and geochemical studies of selected natural radioisotopes and barium in groundwater in Illinois. Illinois State Geological Survey.

Goli, E., Hiemstra, T., and Rahnemaie, R. (2019). Interaction of boron with humic acid and natural organic matter: Experiments and modeling. Chemical Geology, vol 515, pp. 1-8.

Goldberg, S. and Glaubig R. (1985). Boron adsorption on aluminum and iron oxide minerals. Division S-2 Soil Chemistry. 1374-1379.

He, L. M., Zelazny, L.W., Baligar, V.C., Ritchey, K.D., and Martens, D.C. (1996). Hydroxyl-Sulfate exchange stoichiometry on γ–Al_2O_3 and Kaolinite. Soil Science of America Journal, vol 60, pp. 442-452.

Kitadai, N., Nishiuchi, K., and Tanaka, M. (2018). A comprehensive predictive model for sulfate adsorption on oxide minerals. Geochimica et Cosmochimica Acta, vol 238, pp. 150-168.

Lemarchand, E., Schott, J., and Gaillardet J. (2005). Boron isotopic fractionation related to boron sorption on humic acid and the structure of surface complexes formed. Geochimica et Cosmochimica Acta, vol 69, pp. 3519-3533.

Lemarchand, E., Jacobson, A.D, Cividini D. (2015). The major ion, $^{87}Sr/^{86}Sr$ and $\delta^{11}B$ geochemistry of groundwater in the Wyodak-Anderson coal bed aquifer (Powder River Basin, Wyoming, USA). Comptes Rendus Geoscience, vol 347, pp. 348-357.

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2021a. Hydrogeologic Site Characterization Report. Ash Pond. Edwards Power Plant. Bartonville, Illinois.

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2021b. Groundwater Monitoring Plan. Ash Pond. Edwards Power Plant. Peoria, Illinois.

Schroth, A.W., Bostick, B.C., Graham, M., Kaste, J.M., Mitchell, M.J., and Friedland, A.J. (2007). Sulfur Species Behavior in Soil Organic Matter During Decomposition. Journal of Geophysical Research: Biogeosciences / Volume 112, Issue G4.

Stumm, W. and Morgan, J.J. (1996) Aquatic Chemistry: Chemical Equilibria and Rates in Natural Waters, 3rd ed., Wiley-Interscience.

WSP Golder 2022. Evaluation of partition coefficient results, Edwards Ash Pond (CCR Unit 301), Edwards power plant, Peoria County, Illinois. Technical Memorandum.

8 ACRONYMNS AND ABBREVIATIONS

Alk	Total Alkalinity
Al	Aluminum
amsl	above mean sea level
AP	Ash Pond
As	Arsenic
B	Boron
Ba	Barium
$BaSO_4$	Barite
BCU	Bedrock confining unit
Ca	Calcium
CCR	Coal combustion residual
CEC	Cation exchange capacity
CH4	Methane
Cl	Chloride
EDW	Edwards
Fe	Iron
ft	feet
g	grams
GCSM	Geochemical conceptual site model
GWPS	Groundwater Protection Standard
H+	Hydrogen ion, represents acidity in groundwater
K	Potassium
Li	Lithium
LOI	Loss-on-ignition
meq	milliequivalents
Mg	Magnesium
mg/L	milligrams per liter
mg/kg	milligrams per kilogram

Mn	Manganese
Mo	Molybdenum
mV	millivolts
Na	Sodium
NAVD88	North American Vertical Datum of 1988
ORP	Oxidation reduction potential
PCA	Principal components analysis
pCi/L	picocuries per liter
PMP	Potential Migration Pathway
Ramboll	Ramboll Americas Engineering Solutions, Inc.
Redox	Oxidation-Reduction
SEP	Sequential extraction procedure
Si	Silica
SO4	Sulfate
TIMA	Tescan Integrated Mineral Analyzer
TOC	Total organic carbon
UA	Uppermost Aquifer
UCF	Upper Cahokia Formation
XRD	X-ray diffraction
XRF	X-ray fluorescence

TABLES

Table 4-1. Summary of Solid Samples

HSU	Location	Depth Range (ft bgs)	CEC	LOI	SEP	XRD	XRF	TIMA	Total Metals
UA	E-SB-05	25-30	--	2023 (SGS)	2023 (SGS)	2023 (SGS)	2023 (SGS)	2023 (SGS)	2023 (SGS)
UA	E-SB-05	30-33.5	2021 (SGS)	2021 (SGS)	2021 (Eurofins)	2021 (SGS)	--	--	2021 (SGS)
BCU	E-SB-05	51-56	2021 (SGS)	2021 (SGS) 2023 (SGS)	2021 (Eurofins) 2023 (SGS)	2021 (SGS) 2023 (SGS)	--	--	2021 (SGS) 2023 (SGS)
UA	E-SB-07	21-27	2021 (SGS)	2021 (SGS)	2021 (Eurofins)	2021 (SGS)	--	--	2021 (SGS)
UA	E-SB-07	27-30	--	2023 (SGS)	2023 (SGS)	2023 (SGS)	2023 (SGS)	2023 (SGS)	2023 (SGS)
BCU	E-SB-07	40-45	2021 (SGS)	2021 (SGS)	2021 (Eurofins)	2021 (SGS)	--	--	2021 (SGS)
BCU	E-SB-07	59-64	2021 (SGS)	2021 (SGS) 2023 (SGS)	2021 (Eurofins) 2023 (SGS)	2021 (SGS) 2023 (SGS)	--	--	2021 (SGS) 2023 (SGS)
PMP	E-SB-15	10-15	2021 (SGS)	2021 (SGS) 2023 (SGS)	2021 (Eurofins) 2023 (SGS)	2021 (SGS) 2023 (SGS)	--	--	2021 (SGS) 2023 (SGS)
UA	E-SB-15	30-35	2021 (SGS)	2021 (SGS)	2021 (Eurofins)	2021 (SGS)	--	--	2021 (SGS)
UA	E-SB-15	35-40	--	2023 (SGS)	2023 (SGS)	2023 (SGS)	2023 (SGS)	2023 (SGS)	2023 (SGS)
UA	E-SB-18	40-44	2021 (SGS)	2021 (SGS)	2021 (Eurofins)	2021 (SGS)	--	--	2021 (SGS)
UA	E-SB-19	35-40	2021 (SGS)	2021 (SGS) 2023 (SGS)	2021 (Eurofins) 2023 (SGS)	2021 (SGS) 2023 (SGS)	--	--	2021 (SGS) 2023 (SGS)
BCU	E-SB-19	40-44	--	2023 (SGS)	2023 (SGS)	2023 (SGS)	2023 (SGS)	2023 (SGS)	2023 (SGS)
UA	AW-23	6-11.5	--	2023 (SGS)	2023 (SGS)	2023 (SGS)	2023 (SGS)	2023 (SGS)	2023 (SGS)
CCR	E-SB-XPW01	25-30	2021 (SGS)	2021 (SGS)	2021 (Eurofins)	2021 (SGS)	--	--	2021 (SGS)

Notes:

CEC = cation exchange capacity
ft bgs = feet below ground surface
LOI = loss on ignition
SEP = sequential extraction procedure
TIMA = TESCAN integrated mineral analysis
XRD = X-ray diffraction
XRF = X-ray fluorescence
HSU = hydrostratigraphic unit
CCR = coal combustion residual
UA = uppermost aquifer
PMP = potential migration pathway
BCU = bedrock confining unit
-- = not measured
SGS, Eurofins = labs that perform the analysis

Table 4-2. CEC Results

Sample ID	HSU	CEC Actual (meq/100g)
E-SB-07 (21.0-27.0)	UA	25.70
E-SB-07 (40.0-45.0)	BCU	12.16
E-SB-07 (59.0-64.0)	BCU	11.18
E-SB-05 (30.0-33.5)	UA	30.59
E-SB-05 (51.0-56.0)	BCU	19.28
E-SB-19 (35.0-40.0)	UA	20.95
E-SB-18 (40.0-44.0)	UA	36.47
E-SB-15 (10.0-15.0)	PMP	25.73
E-SB-15 (30.0-35.0)	UA	20.83
E-SB-XPW01 (25.0-30.0)	CCR	86.50

Notes:

CEC = cation exchange capacity

meq = milliequivalents

g = grams

HSU = hydrostratigraphic unit

CCR = coal combustion residual

UA = uppermost aquifer

PMP = potential migration pathway

BCU = bedrock confining unit

Table 4-3. XRF Results from 2023 Analysis

Mineral/Compound	E-SB-05 (51-56) (wt %) BCU	E-SB-07 (59-64) (wt %) BCU	E-SB-15 (35-40) (wt %) UA	E-SB-07 (27-30) (wt %) UA	E-SB-15 (10-15) (wt %) UA	E-SB-19 (35-40) (wt %) UA	AW-23 (6-11.5) (wt %) UA	E-SB-19 (40-44) (wt %) BCU	E-SB-05 (25-30) (wt %) UA
S	0.11	0.05	0.04	0.04	0.12	0.04	0.06	0.05	0.33
Cl	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Al2O3	14.33	15.53	13.92	11.29	13.58	14.03	12.97	14.76	10.45
CaO	2.36	0.26	0.32	2.94	2.71	1.30	2.15	0.63	8.90
Cr2O3	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Fe2O3	6.36	4.30	3.77	4.50	5.70	6.10	5.85	7.65	4.22
K2O	2.63	2.74	2.38	2.57	2.92	2.57	2.55	2.50	2.35
MgO	2.66	1.75	1.47	2.62	2.54	1.89	1.81	2.17	3.02
Mn3O4	0.10	0.04	0.04	0.04	0.04	0.09	0.06	0.09	0.08
Na2O	1.28	1.60	1.58	0.93	0.69	1.19	0.84	1.27	0.70
P2O5	0.15	0.13	0.14	0.15	0.16	0.12	0.16	0.11	0.16
SiO2	60.93	67.35	71.02	64.96	58.57	64.99	62.86	62.50	49.43
TiO2	0.85	1.05	1.00	0.71	0.75	0.92	0.75	0.95	0.61
V2O5	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Sum	91.90	94.86	95.74	90.88	87.94	93.34	90.18	92.76	80.70

Notes:
wt % = weight percent

Table 4-4. LOI Results

HSU	Location	Depth Range (ft bgs)	LOI (%) 2021	LOI (%) 2023
UA	E-SB-05	25-30	--	19.0
UA	E-SB-05	30-33.5	15.5	--
BCU	E-SB-05	51-56	8.80	8.2
UA	E-SB-07	21-27	6.78	--
UA	E-SB-07	27-30	--	8.7
BCU	E-SB-07	40-45	6.17	--
BCU	E-SB-07	59-64	4.58	4.4
PMP	E-SB-15	10-15	11.0	11.7
UA	E-SB-15	30-35	15.3	--
UA	E-SB-15	35-40	--	4.1
UA	E-SB-18	40-44	19.3	--
UA	E-SB-19	35-40	10.5	6.3
BCU	E-SB-19	40-44	--	6.8
UA	AW-23	6-11.5	--	8.6
CCR	E-SB-XPW01	25-30	10.2	--

HSU = hydrostratigraphic unit
CCR = coal combustion residual
UA = uppermost aquifer
PMP = potential migration pathway
BCU = bedrock confining unit
LOI = loss on ignition
ft bgs= feet below ground surface

Table 4-5a. XRD Results from 2021 Analysis

Well ID Depth (ft bgs)			E-SB-07 (21.0-27.0)	E-SB-07 (40.0-45.0)	E-SB-07 (59.0-64.0)	E-SB-05 (30.0-33.5)	E-SB-05 (51.0-56.0)	E-SB-19 (35.0-40.0)	E-SB-18 (40.0-44.0)	E-SB-15 (10.0-15.0)	E-SB-15 (30.0-35.0)	E-SB-XPW01 (25.0-30.0)
Sampled Aquifer Unit			(wt %)	(wt %)	(wt %)	(wt %)	(wt %)	(wt %)	(wt %)	(wt %)	(wt %)	(wt %)
Mineral/Compound	Formula	Mineral Type	UA	BCU	BCU	UA	BCU	UA	UA	PMP	UA	CCR
Quartz	SiO_2	Silicate	59.7	44.9	43.6	39.0	38.7	46.8	34.6	38.6	37.0	10.4
Albite	$NaAlSi_3O_8$	Feldspar	8.6	14.7	15.6	9.6	15.0	12.0	10.0	12.1	11.6	--
Microcline	$KAlSi_3O_8$	Feldspar	9.3	2.9	3.4	9.8	4.3	7.5	8.8	10.7	10.2	--
Chlorite	$(Fe,(Mg,Mn)_5,Al)(Si_3Al)O_{10}(OH)_8$	Phyllosilicate	3.4	8.1	9.4	4.5	7.5	4.8	5.2	5.8	4.5	--
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	Mica	8.8	22.4	22.5	16.3	24.1	14.5	17.8	16.8	15.5	--
Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$	Mica	1.5	2.5	3.8	1.9	3.7	2.2	2.1	2.6	2.6	--
Ankerite	$CaFe(CO_3)_2$	Carbonate	2.5	0.0	0.0	3.5	0.1	2.6	3.5	1.5	3.3	--
Dolomite	$CaMg(CO_3)_2$	Carbonate	4.4	0.0	0.0	8.5	0.8	7.7	6.7	3.5	6.5	--
Calcite	$CaCO_3$	Carbonate	0.9	0.4	0.5	4.6	0.3	0.0	3.5	0.7	2.0	2.7
Siderite	$FeCO_3$	Carbonate	0.0	3.1	0.2	1.0	5.0	1.0	1.1	0.2	0.7	--
Hematite	Fe_2O_3	Oxide	0.4	0.0	0.0	0.1	0.0	0.1	0.2	0.0	0.2	23
Magnetite	Fe_3O_4	Oxide	0.1	0.3	0.3	0.6	0.4	0.3	0.0	0.1	0.0	25.5
Ilmenite	$FeTiO_3$	Oxide	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	--
Rutile	TiO_2	Oxide	0.3	0.7	0.6	0.7	0.3	0.5	0.5	1.0	0.5	0.2
Diopside	$CaMgSi_2O_6$	Silicate	--	--	--	--	--	--	1.4	0.6	0.7	--
Actinolite	$Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$	Amphibole	--	--	--	--	--	--	0.3	0.2	0.4	--
Epidote	$Ca_2(Al,Fe)Al_2O(SiO_4)(Si_2O_7)(OH)$	Silicate	--	--	--	--	--	--	0.3	0.4	0.4	--
Kaolinite	$Al_2Si_2O_5(OH)_4$	Clay	--	--	--	--	--	--	4.0	5.1	3.8	--
Mullite	$Al_6Si_3O_{15}$	Silicate	--	--	--	--	--	--	--	--	--	8.7
Anorthite	$CaAl_2Si_2O_8$	Feldspar	--	--	--	--	--	--	--	--	--	29.6
Total			100	100	100	100	100	100	100	100	100	100

Notes:

wt % = weight percent

Zero values indicate that the mineral was included in the refinement, but the calculated concentration is below a measurable value.

Dashes indicate that the mineral was not identified by the analyst and not included in the refinement calculation for the sample.

The weight percent quantities indicated have been normalized to a sum of 100%. The quantity of amorphous material has not been determined.

ft bgs = feet below ground surface

Table 4-5b. XRD Results from 2023 Analysis

Well ID Depth (ft bgs)			E-SB-05 (51-56)	E-SB-07 (59-64)	E-SB-15 (35-40)	E-SB-07 (27-30)	E-SB-15 (10-15)	E-SB-19 (35-40)	AW-23 (6-11.5)	E-SB-19 (40-44)	E-SB-05 (25-30)
Sampled Aquifer Unit			(wt %)	(wt %)	(wt %)	(wt %)	(wt %)	(wt %)	(wt %)	(wt %)	(wt %)
Mineral/Compound	Formula	Mineral Type	BCU	BCU	UA	UA	UA	UA	UA	BCU	UA
Quartz	SiO_2	Silicate	44.4	44.4	50.2	51.2	40.1	49.0	51.4	45.3	38.4
Albite	$NaAlSi_3O_8$	Feldspar	13.0	14.2	14.9	11.9	10.6	12.4	10.9	14.5	9.2
Orthoclase	$KAlSi_3O_8$	Silicate	1.2	0.5	1.3	5.3	7.0	1.8	1.8	--	4.8
Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$	Mica	1.2	2.1	1.3	1.0	0.8	3.7	3.7	1.3	1.7
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	Mica	25.1	28.3	22.7	16.8	24.1	25.0	25.6	23.8	20.5
Chlorite	$(Fe,(Mg,Mn)_5,Al)(Si_3Al)O_{10}(OH)_8$	Phyllosilicate	5.2	10.5	9.6	8.5	13.2	3.5	3.1	5.5	4.1
Fluorapatite	$Ca_5(PO_4)_3F$	Phosphate	--	--	--	--	--	--	--	--	--
Magnetite	Fe_3O_4	Oxide	0.5	--	--	--	--	0.5	--	0.3	--
Ankerite	$CaFe(CO_3)_2$	Carbonate	2.3	--	--	--	0.5	--	--	--	1.0
Calcite	$CaCO_3$	Carbonate	0.9	--	--	--	--	0.5	1.2	--	12.3
Siderite	$FeCO_3$	Carbonate	4.2	--	--	--	--	0.3	--	9.2	--
Dolomite	$CaMg(CO_3)_2$	Carbonate	2.1	--	--	5.4	3.7	3.2	2.2	--	8.1
Total			100	100	100	100	100	100	100	100	100

Notes:

wt % = weight percent

Zero values indicate that the mineral was included in the refinement, but the calculated concentration is below a measurable value.

Dashes indicate that the mineral was not identified by the analyst and not included in the refinement calculation for the sample.

The weight percent quantities indicated have been normalized to a sum of 100%. The quantity of amorphous material has not been determined.

LOI = loss on ignition

ft bgs = feet below ground surface

Table 4-6. TIMA Results

Mineral	E-SB-05 (51.0-56.0)	E-SB-07 (59.0-64.0)	E-SB-19 (35-40)	AW-23 (6.0-11.5)	E-SB 19 (40.0-44.0)	E-SB-05 (25.0-30.0)
Quartz	39.2	42.3	38.5	33.3	36.5	29
Plagioclase	12	14.5	10.6	8.36	10.9	11.7
K-Feldspar	0.76	0.67	1.42	2.33	0.58	2.69
Mixed Clays/Micas	30.6	34.5	36.9	47.6	35.3	30.2
Chlorites	4.25	5.58	4.05	1.79	4.69	1.51
Other Silicates	0.71	0.51	1.14	1.71	0.65	1.6
Iron Oxides	4.83	0.14	3.31	0.15	10	0.2
Ti Fe Oxide	1.06	1.36	1.07	0.74	1.01	1.68
Other Oxides	0.01	0.01	0.03	0.03	0	0.07
Calcite	1.04	0.02	0.62	1.21	0.05	11
Dolomite	3.75	0.01	2.14	2.59	0.01	8.53
Ankerite	1.52	0.09	0.07	0.03	0.14	0.58
Sulphides	0.08	0.02	0.01	0.02	0.03	0.61
Sulphates/Phosphates	0.27	0.28	0.19	0.13	0.16	0.48
Other	0.03	0.02	0.02	0.03	0.02	0.09
Total	100	100	100	100	100	100

NOTES:

High-Resolution Mapping (THRM), was the selected scan mode. The THRM collects a Backscattered Electron signal and an X-ray spectrum at a set resolution (3 micrometer) to map the particles.

It collects modal and textural information, such as liberation or exposure analysis of grains of interest

Due to the chemical properties of the iron carbonate mineral siderite, it will be indistinguishable from iron oxide using TIMA and, therefore, would be classified along with the iron oxides.

Table 4-7. Total Metals Data for Iron, Manganese, Aluminum, Boron, and Sulfate

HSU	Location	Depth Range (ft bgs)	Iron (mg/kg)			Manganese (mg/kg)			Aluminum (mg/kg)			Boron (mg/kg)		Sulfate (%)	Sulfur (mg/kg)
			2021 (SGS)	2021 (Eurofins)	2023 (SGS)	2021 (SGS)	2021 (Eurofins)	2023 (SGS)	2021 (SGS)	2021 (Eurofins)	2023 (SGS)	2021 (SGS)	2023 (SGS)	2021 (SGS)	2023 (SGS)
UA	E-SB-05	25-30	NA	NA	31000	NA	NA	580	NA	NA	47000	NA	<1	NA	4700
UA	E-SB-05	30-33.5	35000	23000	NA	680	550	NA	52000	64000	NA	<40	NA	<0.1	NA
BCU	E-SB-05	51-56	55000	27000	45000	870	460	710	72000	95000	70000	51	<1	<0.1	1800
UA	E-SB-07	21-27	22000	17000	NA	490	400	NA	36000	53000	NA	<40	NA	<0.1	NA
UA	E-SB-07	27-30	NA	NA	34000	NA	NA	330	NA	NA	55000	NA	<1	NA	1300
BCU	E-SB-07	40-45	45000	37000	NA	510	440	NA	67000	76000	NA	47	NA	<0.1	NA
BCU	E-SB-07	59-64	31000	21000	31000	340	300	340	70000	76000	79000	49	<1	<0.1	710
PMP	E-SB-15	10-15	49000	27000	42000	340	170	280	68000	91000	65000	54	<1	<0.1	1500
UA	E-SB-15	30-35	32000	26000	NA	630	520	NA	57000	69000	NA	43	NA	<0.1	NA
UA	E-SB-15	35-40	NA	NA	27000	NA	NA	320	NA	NA	66000	NA	<1	NA	650
UA	E-SB-18	40-44	48000	28000	NA	850	490	NA	50000	72000	NA	<40	NA	<0.1	NA
UA	E-SB-19	35-40	35000	18000	46000	600	360	680	52000	54000	71000	<40	<1	<0.1	1300
BCU	E-SB-19	40-44	NA	NA	56000	NA	NA	650	NA	NA	74000	NA	<1	NA	1200
UA	AW-23	6-11.5	NA	NA	44000	NA	NA	450	NA	NA	62000	NA	<1	NA	990
CCR	E-SB-XPW01	25-30	200000	150000	NA	810	840	NA	71000	85000	NA	896	NA	0.7	NA

Notes:

mg/kg = milligrams per kilogram

% = percent

< = less than

SGS, Eurofins = labs that perform the analysis

Full total metals data available in Attachment 1.

NA = not applicable

Table 4-8. SEP Results for Iron, Manganese, Aluminum, Boron, and Sulfur

HSU	Location	Depth Range (ft bgs)	Analyst	Analysis Year	SEP Fraction	Iron		Manganese	
						Concentration (mg/kg)	Percent of Sum (%)	Concentration (mg/kg)	Percent of Sum (%)
UA	E-SB-07	21-27	Eurofins	2021	Exchangeable Fraction	<14	NA	<0.15	NA
UA	E-SB-07	21-27	Eurofins	2021	Carbonate Fraction	13	0.07	74	14
UA	E-SB-07	21-27	Eurofins	2021	Non-Crystalline Minerals Fraction	440	2.2	190	35
UA	E-SB-07	21-27	Eurofins	2021	Metal Hydroxide Fraction	6900	35	160	30
UA	E-SB-07	21-27	Eurofins	2021	Organic Fraction	<54	NA	3.1	0.57
UA	E-SB-07	21-27	Eurofins	2021	Acid/Sulfide Fraction	8400	42	75	14
UA	E-SB-07	21-27	Eurofins	2021	Residual Fraction	4600	23	40	7.4
UA	E-SB-07	21-27	Eurofins	2021	Sum	20000	NA	540	NA
UA	E-SB-07	21-27	Eurofins	2021	Total/NA	17000	NA	400	NA
BCU	E-SB-07	40-45	Eurofins	2021	Exchangeable Fraction	<12	NA	4.0	0.68
BCU	E-SB-07	40-45	Eurofins	2021	Carbonate Fraction	150	0.38	7.4	1.3
BCU	E-SB-07	40-45	Eurofins	2021	Non-Crystalline Minerals Fraction	1700	4.4	30	5.1
BCU	E-SB-07	40-45	Eurofins	2021	Metal Hydroxide Fraction	17000	44	260	44
BCU	E-SB-07	40-45	Eurofins	2021	Organic Fraction	<47	NA	13	2.2
BCU	E-SB-07	40-45	Eurofins	2021	Acid/Sulfide Fraction	15000	38	220	37
BCU	E-SB-07	40-45	Eurofins	2021	Residual Fraction	5300	14	47	8.0
BCU	E-SB-07	40-45	Eurofins	2021	Sum	39000	NA	590	NA
BCU	E-SB-07	40-45	Eurofins	2021	Total/NA	37000	NA	440	NA
BCU	E-SB-07	59-64	Eurofins	2021	Exchangeable Fraction	<13	NA	1.7	0.47
BCU	E-SB-07	59-64	Eurofins	2021	Carbonate Fraction	84	0.35	3.9	1.1
BCU	E-SB-07	59-64	Eurofins	2021	Non-Crystalline Minerals Fraction	740	3.1	19	5.3
BCU	E-SB-07	59-64	Eurofins	2021	Metal Hydroxide Fraction	10000	42	180	50
BCU	E-SB-07	59-64	Eurofins	2021	Organic Fraction	<48	NA	<2	NA
BCU	E-SB-07	59-64	Eurofins	2021	Acid/Sulfide Fraction	8400	35	120	33
BCU	E-SB-07	59-64	Eurofins	2021	Residual Fraction	4400	18	34	9.4
BCU	E-SB-07	59-64	Eurofins	2021	Sum	24000	NA	360	NA
BCU	E-SB-07	59-64	Eurofins	2021	Total/NA	21000	NA	300	NA
UA	E-SB-05	30-33.5	Eurofins	2021	Exchangeable Fraction	<16	NA	7.2	1.0
UA	E-SB-05	30-33.5	Eurofins	2021	Carbonate Fraction	250	0.81	150	21
UA	E-SB-05	30-33.5	Eurofins	2021	Non-Crystalline Minerals Fraction	5500	18	150	21
UA	E-SB-05	30-33.5	Eurofins	2021	Metal Hydroxide Fraction	11000	35	270	37
UA	E-SB-05	30-33.5	Eurofins	2021	Organic Fraction	<61	NA	54	7.4
UA	E-SB-05	30-33.5	Eurofins	2021	Acid/Sulfide Fraction	8300	27	63	8.6
UA	E-SB-05	30-33.5	Eurofins	2021	Residual Fraction	5400	17	45	6.2
UA	E-SB-05	30-33.5	Eurofins	2021	Sum	31000	NA	730	NA
UA	E-SB-05	30-33.5	Eurofins	2021	Total/NA	23000	NA	550	NA

Table 4-8. SEP Results for Iron, Manganese, Aluminum, Boron, and Sulfur

HSU	Location	Depth Range (ft bgs)	Analyst	Analysis Year	SEP Fraction	Aluminum		Boron		Sulfur	
						Concentration (mg/kg)	Percent of Sum (%)	Concentration (mg/kg)	Percent of Sum (%)	Concentration (mg/kg)	Percent of Sum (%)
UA	E-SB-07	21-27	Eurofins	2021	Exchangeable Fraction	<7.9	NA	<49	NA	NA	NA
UA	E-SB-07	21-27	Eurofins	2021	Carbonate Fraction	13	0.04	<37	NA	NA	NA
UA	E-SB-07	21-27	Eurofins	2021	Non-Crystalline Minerals Fraction	210	0.58	<12	NA	NA	NA
UA	E-SB-07	21-27	Eurofins	2021	Metal Hydroxide Fraction	1600	4.4	<12	NA	NA	NA
UA	E-SB-07	21-27	Eurofins	2021	Organic Fraction	140	0.39	<180	NA	NA	NA
UA	E-SB-07	21-27	Eurofins	2021	Acid/Sulfide Fraction	4900	14	<12	NA	NA	NA
UA	E-SB-07	21-27	Eurofins	2021	Residual Fraction	30000	83	NA	NA	NA	NA
UA	E-SB-07	21-27	Eurofins	2021	Sum	36000	NA	NA	NA	NA	NA
UA	E-SB-07	21-27	Eurofins	2021	Total/NA	53000	NA	NA	NA	NA	NA
BCU	E-SB-07	40-45	Eurofins	2021	Exchangeable Fraction	<6.8	NA	<43	NA	NA	NA
BCU	E-SB-07	40-45	Eurofins	2021	Carbonate Fraction	94	0.21	<32	NA	NA	NA
BCU	E-SB-07	40-45	Eurofins	2021	Non-Crystalline Minerals Fraction	370	0.82	<11	NA	NA	NA
BCU	E-SB-07	40-45	Eurofins	2021	Metal Hydroxide Fraction	3100	6.9	<11	NA	NA	NA
BCU	E-SB-07	40-45	Eurofins	2021	Organic Fraction	41	0.09	<160	NA	NA	NA
BCU	E-SB-07	40-45	Eurofins	2021	Acid/Sulfide Fraction	7600	17	<11	NA	NA	NA
BCU	E-SB-07	40-45	Eurofins	2021	Residual Fraction	34000	76	NA	NA	NA	NA
BCU	E-SB-07	40-45	Eurofins	2021	Sum	45000	NA	NA	NA	NA	NA
BCU	E-SB-07	40-45	Eurofins	2021	Total/NA	76000	NA	NA	NA	NA	NA
BCU	E-SB-07	59-64	Eurofins	2021	Exchangeable Fraction	<7.0	NA	<44	NA	NA	NA
BCU	E-SB-07	59-64	Eurofins	2021	Carbonate Fraction	76.0	0.17	<33	NA	NA	NA
BCU	E-SB-07	59-64	Eurofins	2021	Non-Crystalline Minerals Fraction	280	0.64	<11	NA	NA	NA
BCU	E-SB-07	59-64	Eurofins	2021	Metal Hydroxide Fraction	4400	10	<11	NA	NA	NA
BCU	E-SB-07	59-64	Eurofins	2021	Organic Fraction	40	NA	<160	NA	NA	NA
BCU	E-SB-07	59-64	Eurofins	2021	Acid/Sulfide Fraction	5800	13	<11	NA	NA	NA
BCU	E-SB-07	59-64	Eurofins	2021	Residual Fraction	34000	77	NA	NA	NA	NA
BCU	E-SB-07	59-64	Eurofins	2021	Sum	44000	NA	NA	NA	NA	NA
BCU	E-SB-07	59-64	Eurofins	2021	Total/NA	76000	NA	NA	NA	NA	NA
UA	E-SB-05	30-33.5	Eurofins	2021	Exchangeable Fraction	<8.9	NA	<55	NA	NA	NA
UA	E-SB-05	30-33.5	Eurofins	2021	Carbonate Fraction	22	0.05	<42	NA	NA	NA
UA	E-SB-05	30-33.5	Eurofins	2021	Non-Crystalline Minerals Fraction	210	0.47	<14	NA	NA	NA
UA	E-SB-05	30-33.5	Eurofins	2021	Metal Hydroxide Fraction	2400	5.3	<14	NA	NA	NA
UA	E-SB-05	30-33.5	Eurofins	2021	Organic Fraction	40	0.09	<210	NA	NA	NA
UA	E-SB-05	30-33.5	Eurofins	2021	Acid/Sulfide Fraction	5000	11	<14	NA	NA	NA
UA	E-SB-05	30-33.5	Eurofins	2021	Residual Fraction	37000	82	NA	NA	NA	NA
UA	E-SB-05	30-33.5	Eurofins	2021	Sum	45000	NA	NA	NA	NA	NA
UA	E-SB-05	30-33.5	Eurofins	2021	Total/NA	64000	NA	NA	NA	NA	NA

Table 4-8. SEP Results for Iron, Manganese, Aluminum, Boron, and Sulfur

HSU	Location	Depth Range (ft bgs)	Analyst	Analysis Year	SEP Fraction	Iron		Manganese	
						Concentration (mg/kg)	Percent of Sum (%)	Concentration (mg/kg)	Percent of Sum (%)
BCU	E-SB-05	51-56	Eurofins	2021	Exchangeable Fraction	<13	NA	3.4	0.64
BCU	E-SB-05	51-56	Eurofins	2021	Carbonate Fraction	180	0.60	12	2.3
BCU	E-SB-05	51-56	Eurofins	2021	Non-Crystalline Minerals Fraction	2000	6.7	47	8.9
BCU	E-SB-05	51-56	Eurofins	2021	Metal Hydroxide Fraction	14000	47	290	55
BCU	E-SB-05	51-56	Eurofins	2021	Organic Fraction	<49	NA	11	2.1
BCU	E-SB-05	51-56	Eurofins	2021	Acid/Sulfide Fraction	9700	32	140	26
BCU	E-SB-05	51-56	Eurofins	2021	Residual Fraction	4600	15	33	6.2
BCU	E-SB-05	51-56	Eurofins	2021	Sum	30000	NA	530	NA
BCU	E-SB-05	51-56	Eurofins	2021	Total/NA	27000	NA	460	NA
UA	E-SB-19	35-40	Eurofins	2021	Exchangeable Fraction	<14	NA	19	3.4
UA	E-SB-19	35-40	Eurofins	2021	Carbonate Fraction	160	0.64	150	27
UA	E-SB-19	35-40	Eurofins	2021	Non-Crystalline Minerals Fraction	1200	4.8	79	14
UA	E-SB-19	35-40	Eurofins	2021	Metal Hydroxide Fraction	9600	38	170	30
UA	E-SB-19	35-40	Eurofins	2021	Organic Fraction	<54	NA	8.0	1.4
UA	E-SB-19	35-40	Eurofins	2021	Acid/Sulfide Fraction	9800	39	94	17
UA	E-SB-19	35-40	Eurofins	2021	Residual Fraction	4600	18	38	6.8
UA	E-SB-19	35-40	Eurofins	2021	Sum	25000	NA	560	NA
UA	E-SB-19	35-40	Eurofins	2021	Total/NA	18000	NA	360	NA
UA	E-SB-18	40-44	Eurofins	2021	Exchangeable Fraction	<17	NA	7.9	1.3
UA	E-SB-18	40-44	Eurofins	2021	Carbonate Fraction	200	0.51	100	16
UA	E-SB-18	40-44	Eurofins	2021	Non-Crystalline Minerals Fraction	5500	14	110	18
UA	E-SB-18	40-44	Eurofins	2021	Metal Hydroxide Fraction	17000	44	270	44
UA	E-SB-18	40-44	Eurofins	2021	Organic Fraction	93	0.24	38	6.1
UA	E-SB-18	40-44	Eurofins	2021	Acid/Sulfide Fraction	10000	26	51	8.2
UA	E-SB-18	40-44	Eurofins	2021	Residual Fraction	6300	16	42	6.8
UA	E-SB-18	40-44	Eurofins	2021	Sum	39000	NA	620	NA
UA	E-SB-18	40-44	Eurofins	2021	Total/NA	28000	NA	490	NA
PMP	E-SB-15	10-15	Eurofins	2021	Exchangeable Fraction	<18	NA	1.2	0.57
PMP	E-SB-15	10-15	Eurofins	2021	Carbonate Fraction	100	0.31	19	9.0
PMP	E-SB-15	10-15	Eurofins	2021	Non-Crystalline Minerals Fraction	1900	5.9	10	4.7
PMP	E-SB-15	10-15	Eurofins	2021	Metal Hydroxide Fraction	10000	31	90	43
PMP	E-SB-15	10-15	Eurofins	2021	Organic Fraction	320	1.0	15	7.1
PMP	E-SB-15	10-15	Eurofins	2021	Acid/Sulfide Fraction	13000	41	42	20
PMP	E-SB-15	10-15	Eurofins	2021	Residual Fraction	6800	21	29	14
PMP	E-SB-15	10-15	Eurofins	2021	Sum	32000	NA	210	NA
PMP	E-SB-15	10-15	Eurofins	2021	Total/NA	27000	NA	170	NA

Table 4-8. SEP Results for Iron, Manganese, Aluminum, Boron, and Sulfur

HSU	Location	Depth Range (ft bgs)	Analyst	Analysis Year	SEP Fraction	Aluminum		Boron		Sulfur	
						Concentration (mg/kg)	Percent of Sum (%)	Concentration (mg/kg)	Percent of Sum (%)	Concentration (mg/kg)	Percent of Sum (%)
BCU	E-SB-05	51-56	Eurofins	2021	Exchangeable Fraction	9.7	0.02	<44	NA	NA	NA
BCU	E-SB-05	51-56	Eurofins	2021	Carbonate Fraction	110	0.21	<33	NA	NA	NA
BCU	E-SB-05	51-56	Eurofins	2021	Non-Crystalline Minerals Fraction	380	0.73	<11	NA	NA	NA
BCU	E-SB-05	51-56	Eurofins	2021	Metal Hydroxide Fraction	4500	8.7	<11	NA	NA	NA
BCU	E-SB-05	51-56	Eurofins	2021	Organic Fraction	37	0.07	<170	NA	NA	NA
BCU	E-SB-05	51-56	Eurofins	2021	Acid/Sulfide Fraction	6700	13	<11	NA	NA	NA
BCU	E-SB-05	51-56	Eurofins	2021	Residual Fraction	41000	79	NA	NA	NA	NA
BCU	E-SB-05	51-56	Eurofins	2021	Sum	52000	NA	NA	NA	NA	NA
BCU	E-SB-05	51-56	Eurofins	2021	Total/NA	95000	NA	NA	NA	NA	NA
UA	E-SB-19	35-40	Eurofins	2021	Exchangeable Fraction	<7.8	NA	<49	NA	NA	NA
UA	E-SB-19	35-40	Eurofins	2021	Carbonate Fraction	40	0.11	<37	NA	NA	NA
UA	E-SB-19	35-40	Eurofins	2021	Non-Crystalline Minerals Fraction	200	0.53	<12	NA	NA	NA
UA	E-SB-19	35-40	Eurofins	2021	Metal Hydroxide Fraction	1600	4.2	<12	NA	NA	NA
UA	E-SB-19	35-40	Eurofins	2021	Organic Fraction	99	0.26	<180	NA	NA	NA
UA	E-SB-19	35-40	Eurofins	2021	Acid/Sulfide Fraction	5700	15	<12	NA	NA	NA
UA	E-SB-19	35-40	Eurofins	2021	Residual Fraction	31000	82	NA	NA	NA	NA
UA	E-SB-19	35-40	Eurofins	2021	Sum	38000	NA	NA	NA	NA	NA
UA	E-SB-19	35-40	Eurofins	2021	Total/NA	54000	NA	NA	NA	NA	NA
UA	E-SB-18	40-44	Eurofins	2021	Exchangeable Fraction	<9.1	NA	<57	NA	NA	NA
UA	E-SB-18	40-44	Eurofins	2021	Carbonate Fraction	18	0.04	<43	NA	NA	NA
UA	E-SB-18	40-44	Eurofins	2021	Non-Crystalline Minerals Fraction	220	0.51	<14	NA	NA	NA
UA	E-SB-18	40-44	Eurofins	2021	Metal Hydroxide Fraction	3900	9.1	<14	NA	NA	NA
UA	E-SB-18	40-44	Eurofins	2021	Organic Fraction	50	0.12	<210	NA	NA	NA
UA	E-SB-18	40-44	Eurofins	2021	Acid/Sulfide Fraction	5400	13	<14	NA	NA	NA
UA	E-SB-18	40-44	Eurofins	2021	Residual Fraction	34000	79	NA	NA	NA	NA
UA	E-SB-18	40-44	Eurofins	2021	Sum	43000	NA	NA	NA	NA	NA
UA	E-SB-18	40-44	Eurofins	2021	Total/NA	72000	NA	NA	NA	NA	NA
PMP	E-SB-15	10-15	Eurofins	2021	Exchangeable Fraction	<9.8	NA	<62	NA	NA	NA
PMP	E-SB-15	10-15	Eurofins	2021	Carbonate Fraction	12	0.02	<46	NA	NA	NA
PMP	E-SB-15	10-15	Eurofins	2021	Non-Crystalline Minerals Fraction	320	0.65	<15	NA	NA	NA
PMP	E-SB-15	10-15	Eurofins	2021	Metal Hydroxide Fraction	5300	11	<15	NA	NA	NA
PMP	E-SB-15	10-15	Eurofins	2021	Organic Fraction	130	0.27	<230	NA	NA	NA
PMP	E-SB-15	10-15	Eurofins	2021	Acid/Sulfide Fraction	8700	18	<15	NA	NA	NA
PMP	E-SB-15	10-15	Eurofins	2021	Residual Fraction	35000	71	NA	NA	NA	NA
PMP	E-SB-15	10-15	Eurofins	2021	Sum	49000	NA	NA	NA	NA	NA
PMP	E-SB-15	10-15	Eurofins	2021	Total/NA	91000	NA	NA	NA	NA	NA

Table 4-8. SEP Results for Iron, Manganese, Aluminum, Boron, and Sulfur

HSU	Location	Depth Range (ft bgs)	Analyst	Analysis Year	SEP Fraction	Iron		Manganese	
						Concentration (mg/kg)	Percent of Sum (%)	Concentration (mg/kg)	Percent of Sum (%)
UA	E-SB-15	30-35	Eurofins	2021	Exchangeable Fraction	<18	NA	4.9	0.67
UA	E-SB-15	30-35	Eurofins	2021	Carbonate Fraction	280	0.90	130	18
UA	E-SB-15	30-35	Eurofins	2021	Non-Crystalline Minerals Fraction	6500	21	170	23
UA	E-SB-15	30-35	Eurofins	2021	Metal Hydroxide Fraction	11000	35	270	37
UA	E-SB-15	30-35	Eurofins	2021	Organic Fraction	200	0.65	53	7.3
UA	E-SB-15	30-35	Eurofins	2021	Acid/Sulfide Fraction	7800	25	56	7.7
UA	E-SB-15	30-35	Eurofins	2021	Residual Fraction	6000	19	47	6.4
UA	E-SB-15	30-35	Eurofins	2021	Sum	31000	NA	730	NA
UA	E-SB-15	30-35	Eurofins	2021	Total/NA	26000	NA	520	NA
CCR	E-SB-XPW01	25-30	Eurofins	2021	Exchangeable Fraction	<19	NA	0.92	0.11
CCR	E-SB-XPW01	25-30	Eurofins	2021	Carbonate Fraction	2600	1.7	320	38
CCR	E-SB-XPW01	25-30	Eurofins	2021	Non-Crystalline Minerals Fraction	2400	1.6	150	18
CCR	E-SB-XPW01	25-30	Eurofins	2021	Metal Hydroxide Fraction	12000	8.0	150	18
CCR	E-SB-XPW01	25-30	Eurofins	2021	Organic Fraction	<72	NA	<3	NA
CCR	E-SB-XPW01	25-30	Eurofins	2021	Acid/Sulfide Fraction	53000	35	78	9.2
CCR	E-SB-XPW01	25-30	Eurofins	2021	Residual Fraction	80000	53	150	18
CCR	E-SB-XPW01	25-30	Eurofins	2021	Sum	150000	NA	850	NA
CCR	E-SB-XPW01	25-30	Eurofins	2021	Total/NA	150000	NA	840	NA
UA	AW-23	6-11.5	SGS	2023	Water Soluble Metals	200	0.45	1.8	0.38
UA	AW-23	6-11.5	SGS	2023	Exchangeable Metals	150	0.34	20	4.3
UA	AW-23	6-11.5	SGS	2023	Metals Bound to Carbonates	530	1.2	180	38
UA	AW-23	6-11.5	SGS	2023	Metals Bound to Fe and Mn Oxides	2900	6.6	65	14
UA	AW-23	6-11.5	SGS	2023	Metals Bound to Organics	62	0.14	20	4.3
UA	AW-23	6-11.5	SGS	2023	Residual	40000	91	190	40
UA	AW-23	6-11.5	SGS	2023	Sum	44000	NA	470	NA
UA	AW-23	6-11.5	SGS	2023	Total	44000	NA	450	NA
UA	E-SB-05	25-30	SGS	2023	Water Soluble Metals	43	0.14	0.78	0.14
UA	E-SB-05	25-30	SGS	2023	Exchangeable Metals	12	0.04	20	3.5
UA	E-SB-05	25-30	SGS	2023	Metals Bound to Carbonates	1100	3.7	310	54
UA	E-SB-05	25-30	SGS	2023	Metals Bound to Fe and Mn Oxides	6500	22	130	23
UA	E-SB-05	25-30	SGS	2023	Metals Bound to Organics	1400	4.7	15	2.6
UA	E-SB-05	25-30	SGS	2023	Residual	21000	70	100	18
UA	E-SB-05	25-30	SGS	2023	Sum	30000	NA	570	NA
UA	E-SB-05	25-30	SGS	2023	Total	31000	NA	580	NA

Table 4-8. SEP Results for Iron, Manganese, Aluminum, Boron, and Sulfur

HSU	Location	Depth Range (ft bgs)	Analyst	Analysis Year	SEP Fraction	Aluminum		Boron		Sulfur	
						Concentration (mg/kg)	Percent of Sum (%)	Concentration (mg/kg)	Percent of Sum (%)	Concentration (mg/kg)	Percent of Sum (%)
UA	E-SB-15	30-35	Eurofins	2021	Exchangeable Fraction	<9.8	NA	<61	NA	NA	NA
UA	E-SB-15	30-35	Eurofins	2021	Carbonate Fraction	20	0.04	<46	NA	NA	NA
UA	E-SB-15	30-35	Eurofins	2021	Non-Crystalline Minerals Fraction	260	0.50	<15	NA	NA	NA
UA	E-SB-15	30-35	Eurofins	2021	Metal Hydroxide Fraction	3600	6.9	<15	NA	NA	NA
UA	E-SB-15	30-35	Eurofins	2021	Organic Fraction	98	0.19	<230	NA	NA	NA
UA	E-SB-15	30-35	Eurofins	2021	Acid/Sulfide Fraction	5500	11	<15	NA	NA	NA
UA	E-SB-15	30-35	Eurofins	2021	Residual Fraction	43000	83	NA	NA	NA	NA
UA	E-SB-15	30-35	Eurofins	2021	Sum	52000	NA	NA	NA	NA	NA
UA	E-SB-15	30-35	Eurofins	2021	Total/NA	69000	NA	NA	NA	NA	NA
CCR	E-SB-XPW01	25-30	Eurofins	2021	Exchangeable Fraction	<10	NA	<65	NA	NA	NA
CCR	E-SB-XPW01	25-30	Eurofins	2021	Carbonate Fraction	2900	3.5	590	NA	NA	NA
CCR	E-SB-XPW01	25-30	Eurofins	2021	Non-Crystalline Minerals Fraction	4700	5.6	100	NA	NA	NA
CCR	E-SB-XPW01	25-30	Eurofins	2021	Metal Hydroxide Fraction	4900	5.8	76	NA	NA	NA
CCR	E-SB-XPW01	25-30	Eurofins	2021	Organic Fraction	<38	NA	<240	NA	NA	NA
CCR	E-SB-XPW01	25-30	Eurofins	2021	Acid/Sulfide Fraction	4700	5.6	20	NA	NA	NA
CCR	E-SB-XPW01	25-30	Eurofins	2021	Residual Fraction	67000	80	NA	NA	NA	NA
CCR	E-SB-XPW01	25-30	Eurofins	2021	Sum	84000	NA	NA	NA	NA	NA
CCR	E-SB-XPW01	25-30	Eurofins	2021	Total/NA	85000	NA	NA	NA	NA	NA
UA	AW-23	6-11.5	SGS	2023	Water Soluble Metals	180	0.32	1.1	13	89	5.9
UA	AW-23	6-11.5	SGS	2023	Exchangeable Metals	8.9	0.02	0.81	9.3	510	34
UA	AW-23	6-11.5	SGS	2023	Metals Bound to Carbonates	650	1.2	1.3	15	<32	NA
UA	AW-23	6-11.5	SGS	2023	Metals Bound to Fe and Mn Oxides	780	1.4	4.2	48	130	8.7
UA	AW-23	6-11.5	SGS	2023	Metals Bound to Organics	460	0.82	1.3	15	350	23
UA	AW-23	6-11.5	SGS	2023	Residual	54000	96	<0.9	NA	390	26
UA	AW-23	6-11.5	SGS	2023	Sum	56000	NA	8.7	NA	1500	NA
UA	AW-23	6-11.5	SGS	2023	Total	62000	NA	<1	NA	990	NA
UA	E-SB-05	25-30	SGS	2023	Water Soluble Metals	29	0.07	0.89	9.9	710	18
UA	E-SB-05	25-30	SGS	2023	Exchangeable Metals	9.8	0.02	0.54	6.0	520	13
UA	E-SB-05	25-30	SGS	2023	Metals Bound to Carbonates	250	0.63	1.9	21	<32	NA
UA	E-SB-05	25-30	SGS	2023	Metals Bound to Fe and Mn Oxides	690	1.7	4.5	50	220	5.6
UA	E-SB-05	25-30	SGS	2023	Metals Bound to Organics	960	2.4	1.2	13	2200	56
UA	E-SB-05	25-30	SGS	2023	Residual	38000	95	<0.7	NA	280	7.2
UA	E-SB-05	25-30	SGS	2023	Sum	40000	NA	9.0	NA	3900	NA
UA	E-SB-05	25-30	SGS	2023	Total	47000	NA	<1	NA	4700	NA

Table 4-8. SEP Results for Iron, Manganese, Aluminum, Boron, and Sulfur

HSU	Location	Depth Range (ft bgs)	Analyst	Analysis Year	SEP Fraction	Iron		Manganese	
						Concentration (mg/kg)	Percent of Sum (%)	Concentration (mg/kg)	Percent of Sum (%)
UA	E-SB-07	27-30	SGS	2023	Water Soluble Metals	2.0	0.01	0.02	0.005
UA	E-SB-07	27-30	SGS	2023	Exchangeable Metals	61	0.18	15	4.5
UA	E-SB-07	27-30	SGS	2023	Metals Bound to Carbonates	800	2.4	100	30
UA	E-SB-07	27-30	SGS	2023	Metals Bound to Fe and Mn Oxides	2400	7.3	37	11
UA	E-SB-07	27-30	SGS	2023	Metals Bound to Organics	31	0.09	11	3.3
UA	E-SB-07	27-30	SGS	2023	Residual	30000	91	160	48
UA	E-SB-07	27-30	SGS	2023	Sum	33000	NA	330	NA
UA	E-SB-07	27-30	SGS	2023	Total	34000	NA	330	NA
UA	E-SB-15	35-40	SGS	2023	Water Soluble Metals	570	2.0	4.4	1.3
UA	E-SB-15	35-40	SGS	2023	Exchangeable Metals	460	1.6	9.0	2.6
UA	E-SB-15	35-40	SGS	2023	Metals Bound to Carbonates	1600	5.5	33	9.4
UA	E-SB-15	35-40	SGS	2023	Metals Bound to Fe and Mn Oxides	4700	16	110	31
UA	E-SB-15	35-40	SGS	2023	Metals Bound to Organics	47	0.16	14	4.0
UA	E-SB-15	35-40	SGS	2023	Residual	21000	72	180	51
UA	E-SB-15	35-40	SGS	2023	Sum	29000	NA	350	NA
UA	E-SB-15	35-40	SGS	2023	Total	27000	NA	320	NA
UA	E-SB-19	35-40	SGS	2023	Water Soluble Metals	78	0.17	0.74	0.11
UA	E-SB-19	35-40	SGS	2023	Exchangeable Metals	630	1.4	45	6.4
UA	E-SB-19	35-40	SGS	2023	Metals Bound to Carbonates	1100	2.4	300	43
UA	E-SB-19	35-40	SGS	2023	Metals Bound to Fe and Mn Oxides	3400	7.6	84	12
UA	E-SB-19	35-40	SGS	2023	Metals Bound to Organics	52	0.12	23	3.3
UA	E-SB-19	35-40	SGS	2023	Residual	40000	89	260	37
UA	E-SB-19	35-40	SGS	2023	Sum	45000	NA	700	NA
UA	E-SB-19	35-40	SGS	2023	Total	46000	NA	680	NA
PMP	E-SB-15	10-15	SGS	2023	Water Soluble Metals	120	0.30	0.61	0.22
PMP	E-SB-15	10-15	SGS	2023	Exchangeable Metals	15	0.04	10	3.5
PMP	E-SB-15	10-15	SGS	2023	Metals Bound to Carbonates	820	2.1	75	27
PMP	E-SB-15	10-15	SGS	2023	Metals Bound to Fe and Mn Oxides	2800	7.0	31	11
PMP	E-SB-15	10-15	SGS	2023	Metals Bound to Organics	240	0.60	13	4.6
PMP	E-SB-15	10-15	SGS	2023	Residual	36000	90	150	54
PMP	E-SB-15	10-15	SGS	2023	Sum	40000	NA	280	NA
PMP	E-SB-15	10-15	SGS	2023	Total	42000	NA	280	NA
BCU	E-SB-19	40-44	SGS	2023	Water Soluble Metals	61	0.11	0.75	0.11
BCU	E-SB-19	40-44	SGS	2023	Exchangeable Metals	84	0.15	12	1.7
BCU	E-SB-19	40-44	SGS	2023	Metals Bound to Carbonates	2200	4.0	55	8.0
BCU	E-SB-19	40-44	SGS	2023	Metals Bound to Fe and Mn Oxides	23000	42	340	49
BCU	E-SB-19	40-44	SGS	2023	Metals Bound to Organics	140	0.25	23	3.3
BCU	E-SB-19	40-44	SGS	2023	Residual	30000	55	250	36
BCU	E-SB-19	40-44	SGS	2023	Sum	55000	NA	690	NA
BCU	E-SB-19	40-44	SGS	2023	Total	56000	NA	650	NA

Table 4-8. SEP Results for Iron, Manganese, Aluminum, Boron, and Sulfur

HSU	Location	Depth Range (ft bgs)	Analyst	Analysis Year	SEP Fraction	Aluminum		Boron		Sulfur	
						Concentration (mg/kg)	Percent of Sum (%)	Concentration (mg/kg)	Percent of Sum (%)	Concentration (mg/kg)	Percent of Sum (%)
UA	E-SB-07	27-30	SGS	2023	Water Soluble Metals	1.5	0.003	<0.044	NA	<21	NA
UA	E-SB-07	27-30	SGS	2023	Exchangeable Metals	13	0.02	<0.054	NA	540	36
UA	E-SB-07	27-30	SGS	2023	Metals Bound to Carbonates	600	1.1	1.6	28	<31	NA
UA	E-SB-07	27-30	SGS	2023	Metals Bound to Fe and Mn Oxides	810	1.5	3.2	55	130	8.7
UA	E-SB-07	27-30	SGS	2023	Metals Bound to Organics	300	0.57	1.0	17	320	21
UA	E-SB-07	27-30	SGS	2023	Residual	51000	96	<0.9	NA	520	35
UA	E-SB-07	27-30	SGS	2023	Sum	53000	NA	5.8	NA	1500	NA
UA	E-SB-07	27-30	SGS	2023	Total	55000	NA	<1	NA	1300	NA
UA	E-SB-15	35-40	SGS	2023	Water Soluble Metals	260	0.39	1.5	23	<21	2.1
UA	E-SB-15	35-40	SGS	2023	Exchangeable Metals	10	0.01	<0.053	NA	530	53
UA	E-SB-15	35-40	SGS	2023	Metals Bound to Carbonates	1000	1.5	0.93	15	<31	NA
UA	E-SB-15	35-40	SGS	2023	Metals Bound to Fe and Mn Oxides	1900	2.9	2.8	44	<31	NA
UA	E-SB-15	35-40	SGS	2023	Metals Bound to Organics	210	0.32	1.2	19	280	28
UA	E-SB-15	35-40	SGS	2023	Residual	63000	95	<0.9	NA	240	24
UA	E-SB-15	35-40	SGS	2023	Sum	66000	NA	6.4	NA	1000	NA
UA	E-SB-15	35-40	SGS	2023	Total	66000	NA	<1	NA	650	NA
UA	E-SB-19	35-40	SGS	2023	Water Soluble Metals	270	0.42	0.66	8.7	<22	NA
UA	E-SB-19	35-40	SGS	2023	Exchangeable Metals	10	0.01	<0.054	NA	490	45
UA	E-SB-19	35-40	SGS	2023	Metals Bound to Carbonates	870	1.3	1.6	21	<31	NA
UA	E-SB-19	35-40	SGS	2023	Metals Bound to Fe and Mn Oxides	1100	1.7	4.1	54	32	2.9
UA	E-SB-19	35-40	SGS	2023	Metals Bound to Organics	330	0.51	1.2	16	290	26
UA	E-SB-19	35-40	SGS	2023	Residual	62000	95	<0.9	NA	290	26
UA	E-SB-19	35-40	SGS	2023	Sum	65000	NA	7.6	NA	1100	NA
UA	E-SB-19	35-40	SGS	2023	Total	71000	NA	<1	NA	1300	NA
PMP	E-SB-15	10-15	SGS	2023	Water Soluble Metals	130	0.23	2.7	19	360	21
PMP	E-SB-15	10-15	SGS	2023	Exchangeable Metals	13	0.02	1.1	7.9	540	32
PMP	E-SB-15	10-15	SGS	2023	Metals Bound to Carbonates	380	0.67	3.5	25	<32	NA
PMP	E-SB-15	10-15	SGS	2023	Metals Bound to Fe and Mn Oxides	540	0.95	5.5	39	130	7.6
PMP	E-SB-15	10-15	SGS	2023	Metals Bound to Organics	650	1.1	1.3	9.3	610	36
PMP	E-SB-15	10-15	SGS	2023	Residual	56000	98	<0.9	NA	42	2.5
PMP	E-SB-15	10-15	SGS	2023	Sum	57000	NA	14	NA	1700	NA
PMP	E-SB-15	10-15	SGS	2023	Total	65000	NA	<1	NA	1500	NA
BCU	E-SB-19	40-44	SGS	2023	Water Soluble Metals	210	0.31	0.89	11	200	14
BCU	E-SB-19	40-44	SGS	2023	Exchangeable Metals	62	0.09	0.54	6.8	540	39
BCU	E-SB-19	40-44	SGS	2023	Metals Bound to Carbonates	1000	1.5	1.3	16	<32	NA
BCU	E-SB-19	40-44	SGS	2023	Metals Bound to Fe and Mn Oxides	1500	2.2	4.2	53	130	9.3
BCU	E-SB-19	40-44	SGS	2023	Metals Bound to Organics	200	0.30	1.0	13	350	25
BCU	E-SB-19	40-44	SGS	2023	Residual	64000	96	<0.9	NA	180	13
BCU	E-SB-19	40-44	SGS	2023	Sum	67000	NA	7.9	NA	1400	NA
BCU	E-SB-19	40-44	SGS	2023	Total	74000	NA	<1	NA	1200	NA

Table 4-8. SEP Results for Iron, Manganese, Aluminum, Boron, and Sulfur

HSU	Location	Depth Range (ft bgs)	Analyst	Analysis Year	SEP Fraction	Iron		Manganese	
						Concentration (mg/kg)	Percent of Sum (%)	Concentration (mg/kg)	Percent of Sum (%)
BCU	E-SB-05	51-56	SGS	2023	Water Soluble Metals	170	0.41	1.6	0.24
BCU	E-SB-05	51-56	SGS	2023	Exchangeable Metals	24	0.06	9.1	1.4
BCU	E-SB-05	51-56	SGS	2023	Metals Bound to Carbonates	2400	5.9	130	19
BCU	E-SB-05	51-56	SGS	2023	Metals Bound to Fe and Mn Oxides	11000	27	270	40
BCU	E-SB-05	51-56	SGS	2023	Metals Bound to Organics	110	0.27	31	4.6
BCU	E-SB-05	51-56	SGS	2023	Residual	28000	68	230	34
BCU	E-SB-05	51-56	SGS	2023	Sum	41000	NA	670	NA
BCU	E-SB-05	51-56	SGS	2023	Total	45000	NA	710	NA
BCU	E-SB-07	59-64	SGS	2023	Water Soluble Metals	100	0.31	0.94	0.29
BCU	E-SB-07	59-64	SGS	2023	Exchangeable Metals	14	0.04	10	3.1
BCU	E-SB-07	59-64	SGS	2023	Metals Bound to Carbonates	1100	3.4	33	10
BCU	E-SB-07	59-64	SGS	2023	Metals Bound to Fe and Mn Oxides	4800	15	67	21
BCU	E-SB-07	59-64	SGS	2023	Metals Bound to Organics	49	0.15	13	4.1
BCU	E-SB-07	59-64	SGS	2023	Residual	26000	81	200	63
BCU	E-SB-07	59-64	SGS	2023	Sum	32000	NA	320	NA
BCU	E-SB-07	59-64	SGS	2023	Total	31000	NA	340	NA

Notes:

Values below detection limits not included in percent of sum calculation or figures

NA = not applicable

< = below method detection limit

SEP = sequential extraction procedure

ft bgs = feet below ground surface

mg/kg = milligrams per kilogram

% = percent

HSU = hydrostratigraphic unit

CCR = coal combustion residual

UA = uppermost aquifer

PMP = potential migration pathway

BCU = bedrock confining unit

Total = total metals, 2023 data analyzed by SGS, 2021 data analyzed by Eurofins. Full total metal analysis presented in Attachments 2 and 3

Percentages may not sum to 100 for each fraction due to results below the reporting limit and rounding

2023 data was converted from mg/L to mg/kg based on provided sample weights and volumes

Table 4-8. SEP Results for Iron, Manganese, Aluminum, Boron, and Sulfur

HSU	Location	Depth Range (ft bgs)	Analyst	Analysis Year	SEP Fraction	Aluminum		Boron		Sulfur	
						Concentration (mg/kg)	Percent of Sum (%)	Concentration (mg/kg)	Percent of Sum (%)	Concentration (mg/kg)	Percent of Sum (%)
BCU	E-SB-05	51-56	SGS	2023	Water Soluble Metals	220	0.35	0.90	13	160	9.4
BCU	E-SB-05	51-56	SGS	2023	Exchangeable Metals	42	0.07	<0.055	NA	580	34
BCU	E-SB-05	51-56	SGS	2023	Metals Bound to Carbonates	970	1.6	1.9	27	<32	NA
BCU	E-SB-05	51-56	SGS	2023	Metals Bound to Fe and Mn Oxides	940	1.5	2.9	41	160	9.4
BCU	E-SB-05	51-56	SGS	2023	Metals Bound to Organics	270	0.44	1.3	18	620	36
BCU	E-SB-05	51-56	SGS	2023	Residual	60000	97	<0.9	NA	140	8.2
BCU	E-SB-05	51-56	SGS	2023	Sum	62000	NA	7.1	NA	1700	NA
BCU	E-SB-05	51-56	SGS	2023	Total	70000	NA	<1	NA	1800	NA
BCU	E-SB-07	59-64	SGS	2023	Water Soluble Metals	320	0.46	1.5	17	87	7.3
BCU	E-SB-07	59-64	SGS	2023	Exchangeable Metals	52	0.07	<0.053	NA	560	47
BCU	E-SB-07	59-64	SGS	2023	Metals Bound to Carbonates	970	1.4	1.9	21	<31	NA
BCU	E-SB-07	59-64	SGS	2023	Metals Bound to Fe and Mn Oxides	2100	3.0	4.4	49	<31	NA
BCU	E-SB-07	59-64	SGS	2023	Metals Bound to Organics	260	0.37	1.1	12	280	23
BCU	E-SB-07	59-64	SGS	2023	Residual	67000	96	<0.9	NA	270	23
BCU	E-SB-07	59-64	SGS	2023	Sum	70000	NA	8.9	NA	1200	NA
BCU	E-SB-07	59-64	SGS	2023	Total	79000	NA	<1	NA	710	NA

Notes:

Values below detection limits not included in percent of sum calculation or figures

NA = not applicable

< = below method detection limit

SEP = sequential extraction procedure

ft bgs = feet below ground surface

mg/kg = milligrams per kilogram

% = percent

HSU = hydrostratigraphic unit

CCR = coal combustion residual

UA = uppermost aquifer

PMP = potential migration pathway

BCU = bedrock confining unit

Total = total metals, 2023 data analyzed by SGS, 2021 data analyzed by Eurofins. Full total metal analysis presented in Appendix <<XX>>

Percentages may not sum to 100 for each fraction due to results below the reporting limit and rounding

2023 data was converted from mg/L to mg/kg based on provided sample weights and volumes

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	pH (field) (SU)	Turbidity, field (NTU)	Alkalinity, total (mg/L)	Oxidation Reduction Potential (mV)	Dissolved Oxygen (mg/L)	Aluminum, total (mg/L)
AP05D	2/10/2021	BCU	7.71	3.9	620	125.8	0.33	--
AP05D	3/8/2021	BCU	7.25	27.53	790	-67.3	0.20	--
AP05D	3/24/2021	BCU	7.60	0	640	-54.0	6.13	--
AP05D	4/15/2021	BCU	7.42	36.6	1000	-97.9	0.43	--
AP05D	5/7/2021	BCU	7.66	323	990	-106.0	1.50	--
AP05S	2/27/2020	UA	6.70	518	850	-102.0	0.20	--
AP05S	9/1/2020	UA	6.86	466	--	-118.0	0.14	--
AP05S	2/10/2021	UA	6.94	15.05	820	8.3	0.19	--
AP05S	2/23/2021	UA	6.82	1410	880	-120.0	0.50	--
AP05S	3/8/2021	UA	6.79	447.42	840	-85.9	0.11	--
AP05S	3/24/2021	UA	6.32	275.87	840	-26.3	0.17	--
AP05S	4/13/2021	UA	6.96	380	820	-138.0	0.06	--
AP05S	5/7/2021	UA	6.84	271	820	-112.0	0.72	--
AP05S	6/16/2021	UA	6.90	2780	880	-201.0	0.12	--
AP05S	6/29/2021	UA	6.88	2500	840	-152.0	0.30	--
AP05S	7/22/2021	UA	6.97	1450	840	-122.0	0.20	--
AP05S	8/30/2021	UA	6.78	3050	820	-132.0	0.04	--
AP05S	2/16/2022	UA	6.68	3050	800	-115.0	0.29	--
AP05S	7/25/2022	UA	6.73	1000	--	-154.0	1.50	--
AP05S	2/28/2023	UA	7.01	1000	660	-87.0	1.20	--
AP05S	6/14/2023	UA	6.85	1900	850	-151.0	0.06	3.1
AP05S	8/23/2023	UA	6.88	39.7	840	-133.0	1.30	0.49
AP05S	11/6/2023	UA	6.80	531	800	-127.0	1.50	--
AP07D	2/10/2021	BCU	8.16	21.09	580	128.3	6.63	--
AP07D	3/8/2021	BCU	7.82	6827.08	610	30.9	7.44	--
AP07D	3/24/2021	BCU	7.48	13949.9	680	9.5	5.54	--
AP07D	4/13/2021	BCU	7.82	1620	690	-129.0	0.26	--
AP07D	5/5/2021	BCU	7.88	635	700	-168.0	0.00	--
AP07D	7/22/2021	BCU	7.54	1930	740	47.4	3.60	--
AP07S	2/10/2021	PMP	6.85	16.19	320	80.3	0.76	--
AP07S	3/4/2021	PMP	6.66	12.03	320	79.5	0.69	--
AP07S	3/24/2021	PMP	6.23	0	340	26.4	0.43	--
AP07S	4/13/2021	PMP	6.77	146	540	29.9	0.60	--
AP07S	5/5/2021	PMP	6.63	1240	590	20.9	0.61	--
AP07S	6/16/2021	PMP	6.55	27.5	600	21.8	1.60	--
AP07S	6/28/2021	PMP	6.85	34.3	580	55.8	2.20	--
AP07S	7/22/2021	PMP	6.62	591	550	16.5	1.20	--
AP07S	2/28/2023	PMP	7.13	1000	280	100.0	6.80	--
AP07S	6/15/2023	PMP	6.82	901	490	61.5	2.00	2.7
AP07S	8/28/2023	PMP	6.95	101	360	44.0	9.80	0.48
AP07S	11/3/2023	PMP	7.50	2.9	310	-56.0	0.00	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Arsenic, total (mg/L)	Barium, total (mg/L)	Boron, total (mg/L)	Calcium, total (mg/L)	Carbon, total organic (mg/L)	Chloride, total (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)
AP05D	2/10/2021	BCU	<0.001	0.44	1.10	22	--	230	0.28	--
AP05D	3/8/2021	BCU	0.0017	0.82	1.30	28	--	260	0.38	--
AP05D	3/24/2021	BCU	0.0012	0.43	1.00	21	--	240	0.065	--
AP05D	4/15/2021	BCU	0.0018	1.6	1.70	33	--	410	1.3	--
AP05D	5/7/2021	BCU	0.0035	1.3	1.60	30	--	510	6	--
AP05S	2/27/2020	UA	0.0088	1.4	0.31	170	--	40	--	--
AP05S	9/1/2020	UA	0.003	1.2	0.38	110	--	41	--	--
AP05S	2/10/2021	UA	0.0016	0.56	0.26	110	--	38	6	--
AP05S	2/23/2021	UA	0.0059	1.3	0.39	120	--	47	--	--
AP05S	3/8/2021	UA	0.0022	1.1	0.39	110	--	45	14	--
AP05S	3/24/2021	UA	0.0024	1	0.31	110	--	45	15	--
AP05S	4/13/2021	UA	0.0026	1.2	0.34	99	--	42	18	--
AP05S	5/7/2021	UA	0.0044	1.2	0.36	120	--	43	27	--
AP05S	6/16/2021	UA	0.01	1.7	0.35	170	--	47	75	--
AP05S	6/29/2021	UA	0.0066	1.3	0.36	120	--	56	40	--
AP05S	7/22/2021	UA	0.012	1.4	0.42	160	--	44	80	--
AP05S	8/30/2021	UA	0.0072	1.2	0.33	140	--	44	--	--
AP05S	2/16/2022	UA	0.0039	1.2	0.34	110	--	48	--	--
AP05S	7/25/2022	UA	0.014	1.8	0.35	190	--	49	--	--
AP05S	2/28/2023	UA	0.0073	0.94	0.34	120	--	33	--	--
AP05S	6/14/2023	UA	0.0036	1.1	0.33	110	21	46	20	9
AP05S	8/23/2023	UA	0.001	0.83	0.32	100	22	41	9.7	8.9
AP05S	11/6/2023	UA	0.0027	1	0.33	110	--	46	--	--
AP07D	2/10/2021	BCU	0.0049	0.31	1.30	16	--	500	0.79	--
AP07D	3/8/2021	BCU	0.036	2.6	1.40	90	--	550	390	--
AP07D	3/24/2021	BCU	0.033	4.1	1.20	78	--	830	420	--
AP07D	4/13/2021	BCU	0.0088	1.3	1.30	18	--	710	49	--
AP07D	5/5/2021	BCU	0.057	8.6	1.40	58	--	820	630	--
AP07D	7/22/2021	BCU	0.0044	1.2	1.80	18	--	700	31	--
AP07S	2/10/2021	PMP	<0.001	0.064	5.80	120	--	80	0.35	--
AP07S	3/4/2021	PMP	<0.001	0.08	6.20	130	--	74	3.9	--
AP07S	3/24/2021	PMP	<0.001	0.065	5.80	120	--	79	0.19	--
AP07S	4/13/2021	PMP	<0.001	0.14	7.30	230	--	190	2.9	--
AP07S	5/5/2021	PMP	<0.001	0.15	8.30	260	--	110	6.2	--
AP07S	6/16/2021	PMP	<0.001	0.12	7.40	280	--	120	2.2	--
AP07S	6/28/2021	PMP	<0.001	0.12	10.00	280	--	130	1.8	--
AP07S	7/22/2021	PMP	<0.001	0.13	12.00	260	--	130	2.4	--
AP07S	2/28/2023	PMP	0.0021	0.087	7.90	130	--	73	--	--
AP07S	6/15/2023	PMP	0.0011	0.11	18.00	240	2.6	76	6	0.05
AP07S	8/28/2023	PMP	<0.00069	0.073	9.40	160	2.4	83	1.2	0.087
AP07S	11/3/2023	PMP	<0.00069	0.048	8.20	130	--	73	--	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Ferrous Iron, dissolved (mg/L)	Lithium, total (mg/L)	Magnesium, total (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	Methane, total (mg/L)	Molybdenum, total (mg/L)
AP05D	2/10/2021	BCU	--	0.065	11	0.036	--	--	0.017
AP05D	3/8/2021	BCU	--	0.073	12	0.092	--	--	0.017
AP05D	3/24/2021	BCU	--	0.063	11	0.012	--	--	0.016
AP05D	4/15/2021	BCU	--	0.13	13	0.031	--	--	0.0029
AP05D	5/7/2021	BCU	--	0.077	12	0.092	--	--	0.0057
AP05S	2/27/2020	UA	--	0.059	73	--	--	--	0.0026
AP05S	9/1/2020	UA	--	0.036	--	--	--	--	<0.001
AP05S	2/10/2021	UA	--	0.028	47	0.26	--	--	<0.001
AP05S	2/23/2021	UA	--	0.044	50	--	--	--	0.002
AP05S	3/8/2021	UA	--	0.039	45	0.25	--	--	0.004
AP05S	3/24/2021	UA	--	0.033	45	0.25	--	--	<0.001
AP05S	4/13/2021	UA	--	0.04	42	0.29	--	--	<0.001
AP05S	5/7/2021	UA	--	0.037	47	0.39	--	--	0.0013
AP05S	6/16/2021	UA	--	0.068	70	1.5	--	--	0.0029
AP05S	6/29/2021	UA	--	0.065	53	0.71	--	--	0.002
AP05S	7/22/2021	UA	--	0.071	69	1.7	--	--	0.0034
AP05S	8/30/2021	UA	--	0.051	59	--	--	--	0.0027
AP05S	2/16/2022	UA	--	0.04	46	--	--	--	0.0012
AP05S	7/25/2022	UA	--	0.074	--	--	--	--	0.0046
AP05S	2/28/2023	UA	--	0.039	54	--	--	--	0.0021
AP05S	6/14/2023	UA	>6	0.035	50	0.4	0.19	10400	<0.00079
AP05S	8/23/2023	UA	>6	0.027	46	0.26	0.23	14800	<0.00074
AP05S	11/6/2023	UA	--	0.032	48	--	--	--	<0.00082
AP07D	2/10/2021	BCU	--	0.053	6.3	0.07	--	--	0.011
AP07D	3/8/2021	BCU	--	0.41	96	5.7	--	--	0.01
AP07D	3/24/2021	BCU	--	0.49	110	5.7	--	--	0.0092
AP07D	4/13/2021	BCU	--	0.15	19	0.62	--	--	0.015
AP07D	5/5/2021	BCU	--	0.72	120	5.9	--	--	0.015
AP07D	7/22/2021	BCU	--	0.12	14	0.35	--	--	0.0087
AP07S	2/10/2021	PMP	--	<0.02	45	0.4	--	--	<0.001
AP07S	3/4/2021	PMP	--	<0.01	47	0.51	--	--	0.0017
AP07S	3/24/2021	PMP	--	<0.02	46	0.43	--	--	<0.001
AP07S	4/13/2021	PMP	--	<0.02	89	0.89	--	--	0.001
AP07S	5/5/2021	PMP	--	<0.02	99	1.1	--	--	0.0023
AP07S	6/16/2021	PMP	--	<0.02	110	1.1	--	--	<0.001
AP07S	6/28/2021	PMP	--	<0.02	110	1.1	--	--	<0.001
AP07S	7/22/2021	PMP	--	<0.02	110	1.2	--	--	<0.001
AP07S	2/28/2023	PMP	--	<0.0067	49	--	--	--	0.0035
AP07S	6/15/2023	PMP	0.097	<0.0088	93	0.93	0.9	<10.0	0.0012
AP07S	8/28/2023	PMP	0.25	<0.0061	57	0.51	0.4	<10.0	0.0011
AP07S	11/3/2023	PMP	--	<0.005	49	--	--	--	0.001

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Potassium, total (mg/L)	Radium 226 + Radium 228, total (pCi/L)	Silicon, total (ug/L)	Sodium, total (mg/L)	Sulfate, total (mg/L)	Sulfide, total (mg/L)
AP05D	2/10/2021	BCU	8.5	1.21	--	390	40	--
AP05D	3/8/2021	BCU	8.4	1.19	--	450	32	--
AP05D	3/24/2021	BCU	8.6	0.997	--	390	43	--
AP05D	4/15/2021	BCU	8.6	2.75	--	680	1.6	--
AP05D	5/7/2021	BCU	10	3.75	--	760	1.3	--
AP05S	2/27/2020	UA	6.8	2.85	--	190	<1.0	--
AP05S	9/1/2020	UA	--	3.16	--	--	<1.0	--
AP05S	2/10/2021	UA	3.2	0.773	--	160	1.2	--
AP05S	2/23/2021	UA	5.1	2.9	--	180	<1.0	--
AP05S	3/8/2021	UA	4.6	2.7	--	190	<1.0	--
AP05S	3/24/2021	UA	4.1	4.48	--	190	2.2	--
AP05S	4/13/2021	UA	4.6	2.66	--	190	5	--
AP05S	5/7/2021	UA	6.6	3.38	--	190	2.7	--
AP05S	6/16/2021	UA	6.8	9.64	--	180	1.8	--
AP05S	6/29/2021	UA	4.7	8.25	--	180	1.6	--
AP05S	7/22/2021	UA	6.2	6.09	--	180	2.5	--
AP05S	8/30/2021	UA	5.5	9.63	--	180	1.4	--
AP05S	2/16/2022	UA	4.9	4.4	--	200	3.3	--
AP05S	7/25/2022	UA	--	4	--	--	2.4	--
AP05S	2/28/2023	UA	4.6	3.12	--	180	14	--
AP05S	6/14/2023	UA	4.5	4.53	28000	200	3.1	<2
AP05S	8/23/2023	UA	3.8	1.4	21000	180	5.6	0.4
AP05S	11/6/2023	UA	4.3	3.94	--	180	<0.18	--
AP07D	2/10/2021	BCU	4.8	0.268	--	580	130	--
AP07D	3/8/2021	BCU	23	12.2	--	690	96	--
AP07D	3/24/2021	BCU	26	19.4	--	760	51	--
AP07D	4/13/2021	BCU	10	4.24	--	740	54	--
AP07D	5/5/2021	BCU	62	23	--	930	47	--
AP07D	7/22/2021	BCU	9.7	1.68	--	890	100	--
AP07S	2/10/2021	PMP	0.46	0.123	--	54	160	--
AP07S	3/4/2021	PMP	1.3	1.22	--	56	150	--
AP07S	3/24/2021	PMP	0.38	0.207	--	52	160	--
AP07S	4/13/2021	PMP	0.89	0.336	--	50	430	--
AP07S	5/5/2021	PMP	1.6	1.2	--	51	420	--
AP07S	6/16/2021	PMP	0.76	1.82	--	49	440	--
AP07S	6/28/2021	PMP	0.8	1.85	--	58	410	--
AP07S	7/22/2021	PMP	0.93	1.4	--	62	480	--
AP07S	2/28/2023	PMP	1.4	0.782	--	63	180	--
AP07S	6/15/2023	PMP	1.2	1.2	13000	73	480	<2
AP07S	8/28/2023	PMP	0.59	1.26	7600	59	240	<2
AP07S	11/3/2023	PMP	0.48	1.02	--	63	180	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	pH (field) (SU)	Turbidity, field (NTU)	Alkalinity, total (mg/L)	Oxidation Reduction Potential (mV)	Dissolved Oxygen (mg/L)	Aluminum, total (mg/L)
AP08	2/28/2020	CCR	12.00	251	490	-97.2	0.56	--
AP09	2/28/2020	CCR	11.90	3430	500	-278.0	0.31	--
APW-01	6/17/2021	UA	6.86	2000	340	-103.0	0.63	--
APW-01	6/29/2021	UA	6.80	3560	320	-95.6	24.00	--
APW-01	7/22/2021	UA	6.91	3280	340	-135.0	0.09	--
APW-01	6/14/2023	UA	7.03	160.62	340	-197.3	0.15	<0.019
APW-01	8/23/2023	UA	6.50	16.9	390	-83.0	2.80	1.1
APW-01	11/6/2023	UA	6.91	490	360	-97.0	2.70	--
APW-02	2/10/2021	UCF	7.04	1.24	490	-104.2	0.22	--
APW-02	3/3/2021	UCF	6.99	34.33	490	-76.8	0.17	--
APW-02	3/24/2021	UCF	6.47	249.42	520	-41.6	0.30	--
APW-02	4/13/2021	UCF	6.92	123	510	-93.7	1.50	--
APW-02	5/6/2021	UCF	6.82	71.1	520	-118.0	0.67	--
APW-03	2/10/2021	UCF	6.80	106.14	880	-111.2	0.14	--
APW-03	3/4/2021	UCF	6.62	67.28	860	-52.9	0.19	--
APW-03	3/24/2021	UCF	6.36	0	910	-51.7	0.23	--
APW-03	4/13/2021	UCF	6.77	732	900	-128.0	0.23	--
APW-03	5/7/2021	UCF	6.78	595	860	-106.0	0.98	--
APW-04	2/10/2021	UCF	6.89	141.35	550	-89.8	0.18	--
APW-04	3/4/2021	UCF	6.85	131.41	540	-55.0	0.21	--
APW-04	3/22/2021	UCF	6.89	514.43	520	-50.9	0.21	--
APW-04	4/13/2021	UCF	6.83	1300	520	-123.0	0.26	--
APW-04	5/7/2021	UCF	6.84	114	450	-125.0	0.19	--
AW-01	11/18/2022	PMP	6.86	11.53	520	88.0	0.67	--
AW-01	12/15/2022	PMP	7.29	4095.8	680	-163.4	0.71	--
AW-01	1/10/2023	PMP	6.84	37.2	440	-129.9	0.46	--
AW-01	2/28/2023	PMP	6.98	1000	290	-89.0	1.10	--
AW-01	6/14/2023	PMP	6.82	196	720	-72.0	0.15	0.075
AW-01	8/22/2023	PMP	6.64	8.5	760	-95.0	0.51	0.076
AW-01	11/6/2023	PMP	6.76	304	700	-83.0	1.80	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Arsenic, total (mg/L)	Barium, total (mg/L)	Boron, total (mg/L)	Calcium, total (mg/L)	Carbon, total organic (mg/L)	Chloride, total (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)
AP08	2/28/2020	CCR	0.047	0.11	12.00	71	--	94	--	--
AP09	2/28/2020	CCR	0.17	8.3	5.30	320	--	90	--	--
APW-01	6/17/2021	UA	0.025	0.12	0.69	190	--	210	31	--
APW-01	6/29/2021	UA	0.023	0.19	0.71	180	--	160	50	--
APW-01	7/22/2021	UA	0.018	0.13	0.84	180	--	160	33	--
APW-01	6/14/2023	UA	0.0079	0.064	1.10	170	1.7	120	9.5	9
APW-01	8/23/2023	UA	0.0065	0.069	1.00	170	1.9	130	11	8.5
APW-01	11/6/2023	UA	0.014	0.085	1.10	170	--	120	--	--
APW-02	2/10/2021	UCF	<0.001	0.15	0.05	100	--	12	6.7	--
APW-02	3/3/2021	UCF	<0.001	0.17	0.07	120	--	10	11	--
APW-02	3/24/2021	UCF	<0.001	0.17	0.05	120	--	12	11	--
APW-02	4/13/2021	UCF	0.0012	0.19	0.11	130	--	9.7	11	--
APW-02	5/6/2021	UCF	<0.001	0.16	0.13	120	--	13	11	--
APW-03	2/10/2021	UCF	<0.001	0.26	0.15	160	--	27	7	--
APW-03	3/4/2021	UCF	<0.001	0.3	0.13	180	--	28	8.8	--
APW-03	3/24/2021	UCF	<0.001	0.3	0.13	170	--	28	8.2	--
APW-03	4/13/2021	UCF	0.0011	0.35	0.14	200	--	28	11	--
APW-03	5/7/2021	UCF	0.0011	0.34	0.14	200	--	33	10	--
APW-04	2/10/2021	UCF	0.0089	0.34	0.56	160	--	170	26	--
APW-04	3/4/2021	UCF	0.0094	0.38	0.60	180	--	180	30	--
APW-04	3/22/2021	UCF	0.0064	0.33	0.63	180	--	230	25	--
APW-04	4/13/2021	UCF	0.016	0.5	0.54	180	--	220	52	--
APW-04	5/7/2021	UCF	0.0054	0.33	0.69	200	--	350	23	--
AW-01	11/18/2022	PMP	0.017	0.14	0.09	190	--	13	--	--
AW-01	12/15/2022	PMP	0.0015	0.1	0.07	150	--	19	--	--
AW-01	1/10/2023	PMP	0.0071	0.12	0.08	170	--	14	--	--
AW-01	2/28/2023	PMP	0.02	0.17	1.10	180	--	110	--	--
AW-01	6/14/2023	PMP	0.0063	0.14	0.07	180	5.4	10	9.4	6.7
AW-01	8/22/2023	PMP	0.0051	0.13	0.09	190	5.4	12	12	7.3
AW-01	11/6/2023	PMP	0.012	0.14	0.09	190	--	10	--	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Ferrous Iron, dissolved (mg/L)	Lithium, total (mg/L)	Magnesium, total (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	Methane, total (mg/L)	Molybdenum, total (mg/L)
AP08	2/28/2020	CCR	--	0.56	1.3	--	--	--	4.4
AP09	2/28/2020	CCR	--	0.35	48	--	--	--	1.3
APW-01	6/17/2021	UA	--	0.028	84	2.8	--	--	0.0025
APW-01	6/29/2021	UA	--	0.032	83	3.4	--	--	0.0023
APW-01	7/22/2021	UA	--	<0.02	83	2.8	--	--	0.0024
APW-01	6/14/2023	UA	--	<0.0077	78	1.8	1.8	<10.0	0.0013
APW-01	8/23/2023	UA	>6	<0.0096	77	1.7	1.6	35.7	0.0013
APW-01	11/6/2023	UA	--	<0.012	76	--	--	--	0.0019
APW-02	2/10/2021	UCF	--	<0.02	42	0.56	--	--	<0.001
APW-02	3/3/2021	UCF	--	<0.02	45	0.61	--	--	<0.001
APW-02	3/24/2021	UCF	--	<0.02	45	0.54	--	--	<0.001
APW-02	4/13/2021	UCF	--	<0.02	47	0.75	--	--	<0.001
APW-02	5/6/2021	UCF	--	<0.02	45	0.62	--	--	<0.001
APW-03	2/10/2021	UCF	--	<0.02	72	0.39	--	--	<0.001
APW-03	3/4/2021	UCF	--	0.018	71	0.42	--	--	<0.001
APW-03	3/24/2021	UCF	--	<0.02	73	0.37	--	--	<0.001
APW-03	4/13/2021	UCF	--	<0.02	77	0.47	--	--	<0.001
APW-03	5/7/2021	UCF	--	<0.02	77	0.43	--	--	<0.001
APW-04	2/10/2021	UCF	--	<0.02	66	1.2	--	--	0.0034
APW-04	3/4/2021	UCF	--	0.012	73	1.3	--	--	0.0046
APW-04	3/22/2021	UCF	--	<0.02	74	1.2	--	--	0.0015
APW-04	4/13/2021	UCF	--	<0.02	76	1.4	--	--	0.0049
APW-04	5/7/2021	UCF	--	<0.02	76	1.3	--	--	0.0014
AW-01	11/18/2022	PMP	--	<0.02	86	--	--	--	0.0033
AW-01	12/15/2022	PMP	--	<0.02	64	--	--	--	0.0029
AW-01	1/10/2023	PMP	--	<0.0059	73	--	--	--	0.0051
AW-01	2/28/2023	PMP	--	<0.018	82	--	--	--	0.0022
AW-01	6/14/2023	PMP	>6	<0.005	78	3.6	3.7	982	0.0034
AW-01	8/22/2023	PMP	6.3	<0.006	79	3.9	3.7	2680	0.0041
AW-01	11/6/2023	PMP	--	<0.007	84	--	--	--	0.0034

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Potassium, total (mg/L)	Radium 226 + Radium 228, total (pCi/L)	Silicon, total (ug/L)	Sodium, total (mg/L)	Sulfate, total (mg/L)	Sulfide, total (mg/L)
AP08	2/28/2020	CCR	140	2.05	--	260	360	--
AP09	2/28/2020	CCR	92	1.09	--	290	260	--
APW-01	6/17/2021	UA	1.8	1.62	--	55	300	--
APW-01	6/29/2021	UA	2.7	4.15	--	45	280	--
APW-01	7/22/2021	UA	2.1	1.73	--	48	300	--
APW-01	6/14/2023	UA	0.44	--	7600	57	290	<2
APW-01	8/23/2023	UA	0.79	0.737	9600	53	300	<2
APW-01	11/6/2023	UA	1.3	3.7	--	53	290	--
APW-02	2/10/2021	UCF	0.67	0.207	--	35	1.4	--
APW-02	3/3/2021	UCF	0.72	0.836	--	36	1.4	--
APW-02	3/24/2021	UCF	0.71	0.578	--	34	5.7	--
APW-02	4/13/2021	UCF	0.89	0.0707	--	35	11	--
APW-02	5/6/2021	UCF	0.76	0.365	--	34	10	--
APW-03	2/10/2021	UCF	1.2	0.37	--	82	<1.0	--
APW-03	3/4/2021	UCF	1.3	1.1	--	78	2	--
APW-03	3/24/2021	UCF	1.2	0.756	--	82	3.5	--
APW-03	4/13/2021	UCF	1.4	0.547	--	87	7.1	--
APW-03	5/7/2021	UCF	1.6	1.38	--	85	8.7	--
APW-04	2/10/2021	UCF	1.8	0.551	--	66	20	--
APW-04	3/4/2021	UCF	1.7	1.18	--	70	32	--
APW-04	3/22/2021	UCF	1.6	0.748	--	75	42	--
APW-04	4/13/2021	UCF	2.1	3.85	--	65	43	--
APW-04	5/7/2021	UCF	1.8	0.553	--	76	58	--
AW-01	11/18/2022	PMP	0.32	0.449	--	18	41	--
AW-01	12/15/2022	PMP	0.54	0.288	--	17	43	--
AW-01	1/10/2023	PMP	0.98	0	--	22	41	--
AW-01	2/28/2023	PMP	2.1	2.77	--	49	280	--
AW-01	6/14/2023	PMP	0.3	0.773	8500	18	52	<2
AW-01	8/22/2023	PMP	0.33	1.13	8200	17	52	<2
AW-01	11/6/2023	PMP	0.77	4.72	--	18	50	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	pH (field) (SU)	Turbidity, field (NTU)	Alkalinity, total (mg/L)	Oxidation Reduction Potential (mV)	Dissolved Oxygen (mg/L)	Aluminum, total (mg/L)
AW-05	2/27/2020	UA	7.00	922	400	51.4	3.80	--
AW-05	6/17/2021	UA	6.98	186	420	-42.2	0.64	--
AW-05	6/28/2021	UA	7.04	39.2	410	6.8	0.80	--
AW-05	7/22/2021	UA	7.06	19	420	-35.6	0.73	--
AW-05	2/28/2023	UA	7.24	1000	340	162.0	3.90	--
AW-05	6/15/2023	UA	6.96	1000	410	95.0	0.27	5.4
AW-05	8/28/2023	UA	7.01	697	390	26.0	0.49	4.4
AW-05	11/6/2023	UA	6.85	699	350	-42.0	1.50	--
AW-06	2/27/2020	UA	7.00	119	440	16.2	2.40	--
AW-06	8/31/2020	UA	7.27	36	--	-42.6	5.40	--
AW-06	2/23/2021	UA	7.07	1650	490	-30.1	2.00	--
AW-06	8/30/2021	UA	7.11	319	450	-93.4	0.60	--
AW-06	2/16/2022	UA	6.84	600	400	-49.5	0.51	--
AW-06	7/25/2022	UA	7.17	1.49	--	-96.5	0.37	--
AW-06	2/28/2023	UA	7.39	1000	400	-65.0	1.60	--
AW-06	6/14/2023	UA	7.09	340	500	-99.0	1.40	0.49
AW-06	8/28/2023	UA	7.00	36.3	480	-85.0	2.00	0.55
AW-06	11/6/2023	UA	7.41	609	480	-91.0	1.60	--
AW-08	2/27/2020	UA	6.93	33.5	700	-140.0	0.23	--
AW-08	9/1/2020	UA	7.07	3.3	--	-149.0	0.07	--
AW-08	2/10/2021	UA	7.11	2.51	650	-103.9	0.26	--
AW-08	2/23/2021	UA	6.91	1310	720	-144.0	0.46	--
AW-08	3/5/2021	UA	6.91	3.75	600	-64.0	0.33	--
AW-08	3/24/2021	UA	6.34	1.32	660	-83.6	0.28	--
AW-08	4/13/2021	UA	6.77	500	710	-154.0	0.64	--
AW-08	5/7/2021	UA	7.02	59.8	640	-156.0	1.70	--
AW-08	6/16/2021	UA	7.01	87.9	710	-152.0	3.50	--
AW-08	6/28/2021	UA	7.00	133	700	-98.8	7.90	--
AW-08	7/21/2021	UA	6.86	16.9	720	-126.0	0.00	--
AW-08	8/30/2021	UA	7.15	<0.0	680	-150.0	7.90	--
AW-08	2/16/2022	UA	6.99	3.13	650	-86.9	8.30	--
AW-08	7/25/2022	UA	7.33	1.15	--	-112.0	9.50	--
AW-08	2/28/2023	UA	8.92	11.9	620	-133.0	1.60	--
AW-08	6/14/2023	UA	7.09	<0.0	710	-141.0	8.20	0.058
AW-08	8/28/2023	UA	6.93	116	690	-120.0	12.00	0.034
AW-08	11/6/2023	UA	7.32	1000	940	-150.0	0.07	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Arsenic, total (mg/L)	Barium, total (mg/L)	Boron, total (mg/L)	Calcium, total (mg/L)	Carbon, total organic (mg/L)	Chloride, total (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)
AW-05	2/27/2020	UA	0.032	0.4	1.80	170	--	81	--	--
AW-05	6/17/2021	UA	0.0039	0.12	2.60	160	--	110	5.7	--
AW-05	6/28/2021	UA	0.0035	0.11	3.10	170	--	69	5.2	--
AW-05	7/22/2021	UA	0.0032	0.11	2.90	150	--	67	4.3	--
AW-05	2/28/2023	UA	0.0068	0.21	4.50	170	--	78	--	--
AW-05	6/15/2023	UA	0.0045	0.16	3.60	170	1.9	71	14	2.9
AW-05	8/28/2023	UA	0.0033	0.13	8.60	180	1.6	78	12	4.4
AW-05	11/6/2023	UA	0.0032	0.11	11.00	180	--	81	--	--
AW-06	2/27/2020	UA	0.0053	0.21	0.12	110	--	33	--	--
AW-06	8/31/2020	UA	0.0024	0.15	0.12	100	--	34	--	--
AW-06	2/23/2021	UA	0.026	0.4	0.13	130	--	36	--	--
AW-06	8/30/2021	UA	0.0029	0.16	0.11	110	--	35	--	--
AW-06	2/16/2022	UA	0.0047	0.18	0.12	110	--	37	--	--
AW-06	7/25/2022	UA	0.0017	0.15	0.11	110	--	40	--	--
AW-06	2/28/2023	UA	0.0064	0.19	0.18	110	--	31	--	--
AW-06	6/14/2023	UA	0.003	0.16	0.12	100	4.5	35	2.5	0.96
AW-06	8/28/2023	UA	0.0052	0.19	0.13	120	3.9	33	11	0.62
AW-06	11/6/2023	UA	0.0044	0.18	0.15	110	--	37	--	--
AW-08	2/27/2020	UA	0.019	0.23	0.11	140	--	16	--	--
AW-08	9/1/2020	UA	0.0086	0.17	0.17	130	--	16	--	--
AW-08	2/10/2021	UA	0.0081	0.16	0.12	130	--	17	14	--
AW-08	2/23/2021	UA	0.018	0.28	0.12	150	--	5.2	--	--
AW-08	3/5/2021	UA	0.0065	0.18	0.17	140	--	16	19	--
AW-08	3/24/2021	UA	0.0063	0.16	0.10	130	--	20	13	--
AW-08	4/13/2021	UA	0.024	0.33	0.19	150	--	14	42	--
AW-08	5/7/2021	UA	0.014	0.24	0.12	150	--	14	32	--
AW-08	6/16/2021	UA	0.024	0.27	0.18	150	--	15	35	--
AW-08	6/28/2021	UA	0.018	0.24	0.13	150	--	17	28	--
AW-08	7/21/2021	UA	0.02	0.26	0.11	140	--	14	32	--
AW-08	8/30/2021	UA	0.018	0.25	0.09	150	--	18	--	--
AW-08	2/16/2022	UA	0.018	0.23	0.10	140	--	17	--	--
AW-08	7/25/2022	UA	0.0073	0.16	0.10	140	--	18	--	--
AW-08	2/28/2023	UA	0.011	0.2	0.10	140	--	14	--	--
AW-08	6/14/2023	UA	0.01	0.19	0.09	140	9.8	16	16	7.3
AW-08	8/28/2023	UA	0.0098	0.19	0.12	140	9.5	15	17	16
AW-08	11/6/2023	UA	0.088	5.8	0.35	760	--	20	--	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Ferrous Iron, dissolved (mg/L)	Lithium, total (mg/L)	Magnesium, total (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	Methane, total (mg/L)	Molybdenum, total (mg/L)
AW-05	2/27/2020	UA	--	0.053	78	--	--	--	0.004
AW-05	6/17/2021	UA	--	0.024	70	1.9	--	--	0.0022
AW-05	6/28/2021	UA	--	<0.02	78	1.5	--	--	0.0018
AW-05	7/22/2021	UA	--	<0.02	71	1.8	--	--	0.002
AW-05	2/28/2023	UA	--	0.025	82	--	--	--	0.0026
AW-05	6/15/2023	UA	3	<0.017	82	1.9	1.4	<10.0	0.0023
AW-05	8/28/2023	UA	4.2	<0.017	81	2.1	1.6	<10.0	0.0025
AW-05	11/6/2023	UA	--	<0.013	92	--	--	--	0.0022
AW-06	2/27/2020	UA	--	0.02	44	--	--	--	0.0049
AW-06	8/31/2020	UA	--	<0.02	--	--	--	--	0.0046
AW-06	2/23/2021	UA	--	0.033	56	--	--	--	0.0063
AW-06	8/30/2021	UA	--	<0.02	46	--	--	--	0.0053
AW-06	2/16/2022	UA	--	<0.02	45	--	--	--	0.0045
AW-06	7/25/2022	UA	--	0.011	--	--	--	--	0.0046
AW-06	2/28/2023	UA	--	<0.012	45	--	--	--	0.0053
AW-06	6/14/2023	UA	0.55	<0.012	45	0.57	0.44	<10.0	0.0049
AW-06	8/28/2023	UA	2.2	<0.013	46	1.4	0.23	<10.0	0.006
AW-06	11/6/2023	UA	--	<0.014	49	--	--	--	0.0047
AW-08	2/27/2020	UA	--	<0.02	57	--	--	--	0.0051
AW-08	9/1/2020	UA	--	<0.02	--	--	--	--	0.0023
AW-08	2/10/2021	UA	--	<0.02	55	1.1	--	--	0.0015
AW-08	2/23/2021	UA	--	<0.02	59	--	--	--	0.0033
AW-08	3/5/2021	UA	--	<0.02	59	1.3	--	--	0.0051
AW-08	3/24/2021	UA	--	<0.02	57	1.3	--	--	0.0056
AW-08	4/13/2021	UA	--	<0.02	57	1.5	--	--	0.0027
AW-08	5/7/2021	UA	--	<0.02	57	1.3	--	--	0.0025
AW-08	6/16/2021	UA	--	<0.02	59	1.4	--	--	0.0041
AW-08	6/28/2021	UA	--	<0.02	61	1.3	--	--	0.0017
AW-08	7/21/2021	UA	--	<0.02	57	1.3	--	--	0.0014
AW-08	8/30/2021	UA	--	<0.02	59	--	--	--	0.0017
AW-08	2/16/2022	UA	--	<0.02	59	--	--	--	0.002
AW-08	7/25/2022	UA	--	0.016	--	--	--	--	0.0019
AW-08	2/28/2023	UA	--	<0.0097	58	--	--	--	0.0018
AW-08	6/14/2023	UA	>6	<0.0099	59	1.1	1.1	3530	0.0016
AW-08	8/28/2023	UA	>6	<0.013	56	1	1	5070	0.0018
AW-08	11/6/2023	UA	--	0.66	450	--	--	--	0.014

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Potassium, total (mg/L)	Radium 226 + Radium 228, total (pCi/L)	Silicon, total (ug/L)	Sodium, total (mg/L)	Sulfate, total (mg/L)	Sulfide, total (mg/L)
AW-05	2/27/2020	UA	7.7	0.809	--	68	270	--
AW-05	6/17/2021	UA	1.1	0.801	--	63	330	--
AW-05	6/28/2021	UA	1	0.14	--	70	290	--
AW-05	7/22/2021	UA	0.81	3.77	--	64	300	--
AW-05	2/28/2023	UA	3.2	1.44	--	76	320	--
AW-05	6/15/2023	UA	2	3.09	19000	74	350	<2
AW-05	8/28/2023	UA	1.8	0.0965	17000	79	460	<2
AW-05	11/6/2023	UA	1.3	0.465	--	91	5.7	--
AW-06	2/27/2020	UA	1.6	0.242	--	55	23	--
AW-06	8/31/2020	UA	--	0.945	--	--	25	--
AW-06	2/23/2021	UA	2.8	1.97	--	44	27	--
AW-06	8/30/2021	UA	0.88	0.982	--	49	28	--
AW-06	2/16/2022	UA	0.74	1.04	--	57	25	--
AW-06	7/25/2022	UA	--	0.679	--	--	24	--
AW-06	2/28/2023	UA	0.84	0.489	--	57	22	--
AW-06	6/14/2023	UA	0.78	0.91	11000	59	21	<2
AW-06	8/28/2023	UA	0.57	0.107	11000	41	27	<2
AW-06	11/6/2023	UA	1	0.785	--	60	23	--
AW-08	2/27/2020	UA	1.6	0.933	--	62	<1.0	--
AW-08	9/1/2020	UA	--	0.124	--	--	2.3	--
AW-08	2/10/2021	UA	1.6	0.158	--	56	<1.0	--
AW-08	2/23/2021	UA	2.2	1.82	--	58	<1.0	--
AW-08	3/5/2021	UA	1.6	0.291	--	64	3.2	--
AW-08	3/24/2021	UA	1.7	0.251	--	58	3.9	--
AW-08	4/13/2021	UA	2.3	0.416	--	59	<1.0	--
AW-08	5/7/2021	UA	1.5	0.0155	--	61	1.5	--
AW-08	6/16/2021	UA	1.5	0.139	--	57	<1.0	--
AW-08	6/28/2021	UA	1.4	0.568	--	62	1.5	--
AW-08	7/21/2021	UA	1.3	0.589	--	56	<1.0	--
AW-08	8/30/2021	UA	1.4	0.33	--	56	<1.0	--
AW-08	2/16/2022	UA	1.5	1.2	--	62	<1.0	--
AW-08	7/25/2022	UA	--	1.09	--	--	0.94	--
AW-08	2/28/2023	UA	1.4	0.261	--	63	<0.35	--
AW-08	6/14/2023	UA	1.5	0.815	14000	61	<0.18	<2
AW-08	8/28/2023	UA	1.5	0.434	14000	61	<0.18	<2
AW-08	11/6/2023	UA	41	29.1	--	93	<0.18	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	pH (field) (SU)	Turbidity, field (NTU)	Alkalinity, total (mg/L)	Oxidation Reduction Potential (mV)	Dissolved Oxygen (mg/L)	Aluminum, total (mg/L)
AW-09	2/27/2020	UA	6.90	135	720	-114.0	1.00	--
AW-09	8/31/2020	UA	6.93	352	--	-115.0	1.80	--
AW-09	2/23/2021	UA	6.89	485	760	-123.0	1.10	--
AW-09	8/30/2021	UA	7.00	480	710	-175.0	0.38	--
AW-09	2/16/2022	UA	6.88	138	660	-105.0	1.70	--
AW-09	7/25/2022	UA	6.98	1.6	--	-146.0	0.44	--
AW-09	2/28/2023	UA	7.02	77.2	750	-130.0	1.00	--
AW-09	6/12/2023	UA	6.89	67.2	790	-122.0	1.70	0.11
AW-09	8/29/2023	UA	7.12	177	720	-94.0	4.50	1.2
AW-09	11/6/2023	UA	7.07	234	750	-110.0	1.80	--
AW-10	2/27/2020	UA	6.76	863	1100	-127.0	0.04	--
AW-10	8/31/2020	UA	6.81	375	--	-135.0	0.05	--
AW-10	2/23/2021	UA	6.91	740	1100	-138.0	0.00	--
AW-10	3/23/2021	UA	6.82	1610.37	1100	-55.7	0.13	--
AW-10	8/30/2021	UA	6.96	509	1000	-176.0	0.00	--
AW-10	2/16/2022	UA	6.97	32.8	960	-153.0	0.00	--
AW-10	7/25/2022	UA	7.08	4.87	--	-122.0	2.00	--
AW-10	2/28/2023	UA	7.00	1000	1100	-89.0	0.82	--
AW-10	6/13/2023	UA	6.91	991	1000	-151.0	0.01	1.2
AW-10	8/28/2023	UA	6.42	<0.0	990	-111.0	0.00	5.3
AW-10	11/6/2023	UA	7.31	520	980	-125.0	1.60	--
AW-11	2/27/2020	UA	6.72	2400	960	-152.0	0.00	--
AW-11	8/31/2020	UA	6.92	170	--	-163.0	0.01	--
AW-11	2/23/2021	UA	6.96	582	960	-140.0	0.00	--
AW-11	8/30/2021	UA	6.90	269	900	-132.0	0.72	--
AW-11	2/16/2022	UA	6.86	95.7	900	-161.0	0.00	--
AW-11	7/25/2022	UA	6.94	2.8	--	-140.0	0.04	--
AW-11	2/28/2023	UA	7.17	1000	990	-103.0	0.91	--
AW-11	6/13/2023	UA	7.03	329	1000	-160.0	0.10	0.3
AW-11	8/28/2023	UA	6.29	100	900	-96.0	0.24	0.46
AW-11	11/3/2023	UA	6.87	169	980	-148.0	1.90	--
AW-12	2/11/2021	UA	6.79	531.09	760	-113.5	0.10	--
AW-12	3/4/2021	UA	6.76	6.58	750	-65.1	0.07	--
AW-12	3/24/2021	UA	6.45	48.1	760	-57.8	0.09	--
AW-12	4/12/2021	UA	7.01	139	750	-89.6	0.09	--
AW-12	5/7/2021	UA	6.97	3.07	750	-128.0	0.91	--
AW-13	2/11/2021	UA	6.86	133.66	950	-90.2	0.15	--
AW-13	3/4/2021	UA	6.73	46.94	940	-28.8	0.05	--
AW-13	3/23/2021	UA	6.70	112.4	960	-48.2	0.09	--
AW-13	4/12/2021	UA	6.85	1200	940	-86.0	0.14	--
AW-13	5/7/2021	UA	6.82	30.1	880	-96.5	0.08	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Arsenic, total (mg/L)	Barium, total (mg/L)	Boron, total (mg/L)	Calcium, total (mg/L)	Carbon, total organic (mg/L)	Chloride, total (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)
AW-09	2/27/2020	UA	0.017	0.46	0.24	130	--	24	--	--
AW-09	8/31/2020	UA	0.02	0.46	0.26	120	--	26	--	--
AW-09	2/23/2021	UA	0.017	0.46	0.28	140	--	8.1	--	--
AW-09	8/30/2021	UA	0.018	0.46	0.24	130	--	27	--	--
AW-09	2/16/2022	UA	0.012	0.37	0.25	120	--	28	--	--
AW-09	7/25/2022	UA	0.017	0.47	0.25	130	--	30	--	--
AW-09	2/28/2023	UA	0.012	0.2	0.10	140	--	26	--	--
AW-09	6/12/2023	UA	0.01	0.29	0.26	120	21	29	16	11
AW-09	8/29/2023	UA	0.017	0.39	0.31	120	21	28	20	13
AW-09	11/6/2023	UA	0.024	0.43	0.31	120	--	29	--	--
AW-10	2/27/2020	UA	0.011	1.2	0.46	140	--	83	--	--
AW-10	8/31/2020	UA	0.014	1.3	0.54	140	--	88	--	--
AW-10	2/23/2021	UA	0.01	1	0.55	130	--	110	--	--
AW-10	3/23/2021	UA	0.0095	0.98	0.50	130	--	96	14	--
AW-10	8/30/2021	UA	0.011	1.1	0.49	130	--	94	--	--
AW-10	2/16/2022	UA	0.0099	0.98	0.46	130	--	92	--	--
AW-10	7/25/2022	UA	0.0099	1	0.46	140	--	100	--	--
AW-10	2/28/2023	UA	0.016	1.3	0.52	140	--	85	--	--
AW-10	6/13/2023	UA	0.0099	0.99	0.46	130	20	89	16	9.8
AW-10	8/28/2023	UA	0.013	1.1	0.50	140	20	86	27	14
AW-10	11/6/2023	UA	0.012	1	0.47	140	--	84	--	--
AW-11	2/27/2020	UA	0.013	1.3	0.22	170	--	30	--	--
AW-11	8/31/2020	UA	0.011	0.77	0.21	150	--	29	--	--
AW-11	2/23/2021	UA	0.011	0.98	0.25	160	--	33	--	--
AW-11	8/30/2021	UA	0.011	0.93	0.23	160	--	32	--	--
AW-11	2/16/2022	UA	0.0099	1.1	0.23	150	--	35	--	--
AW-11	7/25/2022	UA	0.0094	1	0.23	160	--	39	--	--
AW-11	2/28/2023	UA	0.013	1.1	0.24	170	--	30	--	--
AW-11	6/13/2023	UA	0.0099	0.94	0.24	160	23	33	23	17
AW-11	8/28/2023	UA	0.011	0.87	0.24	170	24	32	28	21
AW-11	11/3/2023	UA	0.011	0.84	0.26	160	--	33	--	--
AW-12	2/11/2021	UA	0.0021	1.4	0.27	130	--	43	14	--
AW-12	3/4/2021	UA	0.0026	1.5	0.24	120	--	41	12	--
AW-12	3/24/2021	UA	0.0025	1.4	0.21	120	--	45	13	--
AW-12	4/12/2021	UA	0.0068	1.5	0.23	130	--	39	14	--
AW-12	5/7/2021	UA	0.0038	1.5	0.26	140	--	34	15	--
AW-13	2/11/2021	UA	0.013	1.5	0.30	140	--	80	16	--
AW-13	3/4/2021	UA	0.0098	1.2	0.29	140	--	74	11	--
AW-13	3/23/2021	UA	0.012	1.3	0.28	140	--	89	13	--
AW-13	4/12/2021	UA	0.014	1.3	0.27	140	--	81	12	--
AW-13	5/7/2021	UA	0.014	1.4	0.30	150	--	86	12	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Ferrous Iron, dissolved (mg/L)	Lithium, total (mg/L)	Magnesium, total (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	Methane, total (mg/L)	Molybdenum, total (mg/L)
AW-09	2/27/2020	UA	--	0.023	53	--	--	--	0.012
AW-09	8/31/2020	UA	--	0.022	--	--	--	--	0.016
AW-09	2/23/2021	UA	--	0.034	57	--	--	--	0.018
AW-09	8/30/2021	UA	--	<0.02	54	--	--	--	0.012
AW-09	2/16/2022	UA	--	<0.02	52	--	--	--	0.014
AW-09	7/25/2022	UA	--	0.013	--	--	--	--	0.014
AW-09	2/28/2023	UA	--	<0.013	59	--	--	--	0.0019
AW-09	6/12/2023	UA	>6	<0.015	51	1.6	1.5	23700	0.021
AW-09	8/29/2023	UA	>6	<0.019	50	1.6	1.6	38800	0.021
AW-09	11/6/2023	UA	--	<0.017	50	--	--	--	0.021
AW-10	2/27/2020	UA	--	0.065	67	--	--	--	0.0012
AW-10	8/31/2020	UA	--	0.051	--	--	--	--	<0.001
AW-10	2/23/2021	UA	--	0.047	63	--	--	--	<0.001
AW-10	3/23/2021	UA	--	0.04	60	0.19	--	--	<0.001
AW-10	8/30/2021	UA	--	0.038	65	--	--	--	<0.001
AW-10	2/16/2022	UA	--	0.04	63	--	--	--	<0.001
AW-10	7/25/2022	UA	--	0.033	--	--	--	--	0.00097
AW-10	2/28/2023	UA	--	0.043	66	--	--	--	0.0012
AW-10	6/13/2023	UA	>6	0.037	65	0.21	0.14	65500	0.0012
AW-10	8/28/2023	UA	>6	0.048	65	0.34	0.16	68200	0.0011
AW-10	11/6/2023	UA	--	0.058	74	--	--	--	0.0019
AW-11	2/27/2020	UA	--	0.029	71	--	--	--	0.0028
AW-11	8/31/2020	UA	--	0.025	--	--	--	--	0.0021
AW-11	2/23/2021	UA	--	0.024	67	--	--	--	0.0016
AW-11	8/30/2021	UA	--	<0.02	70	--	--	--	0.0018
AW-11	2/16/2022	UA	--	0.023	67	--	--	--	<0.001
AW-11	7/25/2022	UA	--	0.019	--	--	--	--	0.0011
AW-11	2/28/2023	UA	--	0.031	75	--	--	--	0.0032
AW-11	6/13/2023	UA	>6	<0.018	71	0.68	0.54	47300	0.0014
AW-11	8/28/2023	UA	>6	0.021	72	0.77	0.54	33500	0.0017
AW-11	11/3/2023	UA	--	<0.018	72	--	--	--	0.002
AW-12	2/11/2021	UA	--	0.036	58	0.32	--	--	0.023
AW-12	3/4/2021	UA	--	0.028	58	0.35	--	--	0.0048
AW-12	3/24/2021	UA	--	0.026	60	0.33	--	--	0.0037
AW-12	4/12/2021	UA	--	0.031	62	0.38	--	--	0.0048
AW-12	5/7/2021	UA	--	0.025	62	0.37	--	--	0.004
AW-13	2/11/2021	UA	--	0.033	67	0.28	--	--	0.0028
AW-13	3/4/2021	UA	--	0.03	60	0.25	--	--	0.0015
AW-13	3/23/2021	UA	--	0.029	63	0.19	--	--	<0.001
AW-13	4/12/2021	UA	--	0.036	65	0.19	--	--	0.0014
AW-13	5/7/2021	UA	--	0.03	64	0.15	--	--	<0.001

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Potassium, total (mg/L)	Radium 226 + Radium 228, total (pCi/L)	Silicon, total (ug/L)	Sodium, total (mg/L)	Sulfate, total (mg/L)	Sulfide, total (mg/L)
AW-09	2/27/2020	UA	2.8	1.51	--	120	<1.0	--
AW-09	8/31/2020	UA	--	1.43	--	--	<1.0	--
AW-09	2/23/2021	UA	3.5	1.01	--	110	<1.0	--
AW-09	8/30/2021	UA	1.9	0.876	--	110	<1.0	--
AW-09	2/16/2022	UA	2.1	1.34	--	130	<1.0	--
AW-09	7/25/2022	UA	--	0.803	--	--	<0.18	--
AW-09	2/28/2023	UA	1.4	1.12	--	64	<0.23	--
AW-09	6/12/2023	UA	2.1	0.23	17000	130	<0.18	<2
AW-09	8/29/2023	UA	2.3	1.52	19000	130	<0.22	<2
AW-09	11/6/2023	UA	2.3	1.35	--	140	<0.18	--
AW-10	2/27/2020	UA	6.4	2.19	--	280	<1.0	--
AW-10	8/31/2020	UA	--	3.43	--	--	<1.0	--
AW-10	2/23/2021	UA	4.2	3.1	--	270	<1.0	--
AW-10	3/23/2021	UA	3.5	1.77	--	260	<1.0	--
AW-10	8/30/2021	UA	3.9	3.21	--	270	<1.0	--
AW-10	2/16/2022	UA	3.9	2.52	--	300	<1.0	--
AW-10	7/25/2022	UA	--	2.16	--	--	<0.18	--
AW-10	2/28/2023	UA	4.2	1.57	--	290	<0.18	--
AW-10	6/13/2023	UA	3.8	2.95	15000	280	<0.18	<2
AW-10	8/28/2023	UA	4.2	4.03	22000	270	<0.18	<2
AW-10	11/6/2023	UA	5.2	3.58	--	260	<0.18	--
AW-11	2/27/2020	UA	3.7	3.68	--	160	<1.0	--
AW-11	8/31/2020	UA	--	1.52	--	--	<1.0	--
AW-11	2/23/2021	UA	2.8	2.46	--	140	<1.0	--
AW-11	8/30/2021	UA	2.7	2.31	--	150	<1.0	--
AW-11	2/16/2022	UA	2.7	2.79	--	160	<1.0	--
AW-11	7/25/2022	UA	--	0.756	--	--	<0.18	--
AW-11	2/28/2023	UA	3.9	2.25	--	150	<0.18	--
AW-11	6/13/2023	UA	2.7	2.29	17000	160	<0.18	<2
AW-11	8/28/2023	UA	2.9	2.45	18000	160	<0.18	<2
AW-11	11/3/2023	UA	2.8	1.94	--	160	<0.18	--
AW-12	2/11/2021	UA	4.9	1.62	--	120	2.8	--
AW-12	3/4/2021	UA	3.1	0.828	--	120	<1.0	--
AW-12	3/24/2021	UA	3	0.846	--	120	<1.0	--
AW-12	4/12/2021	UA	3.6	1.87	--	120	1.2	--
AW-12	5/7/2021	UA	3.1	1.24	--	130	<1.0	--
AW-13	2/11/2021	UA	3.8	3.05	--	200	3.2	--
AW-13	3/4/2021	UA	3.5	3.02	--	180	2	--
AW-13	3/23/2021	UA	3.1	2.98	--	190	1.4	--
AW-13	4/12/2021	UA	3.4	1.39	--	190	<1.0	--
AW-13	5/7/2021	UA	2.9	3.14	--	200	<1.0	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	pH (field) (SU)	Turbidity, field (NTU)	Alkalinity, total (mg/L)	Oxidation Reduction Potential (mV)	Dissolved Oxygen (mg/L)	Aluminum, total (mg/L)
AW-14	2/11/2021	UA	7.00	473.16	960	-85.8	0.21	--
AW-14	3/4/2021	UA	6.90	85.82	1000	-80.7	0.08	--
AW-14	3/22/2021	UA	6.92	88.76	1000	-79.4	0.08	--
AW-14	4/12/2021	UA	6.85	67.7	1000	-127.0	0.10	--
AW-14	5/6/2021	UA	6.81	67	1000	-146.0	0.83	--
AW-14	6/28/2021	UA	6.78	30.6	1000	-150.0	0.06	--
AW-14	7/21/2021	UA	6.65	40.4	1000	-131.0	0.00	--
AW-14	2/28/2023	UA	6.98	261	980	-63.0	1.10	--
AW-14	6/13/2023	UA	6.88	10.4	1000	-152.0	0.14	0.089
AW-14	8/23/2023	UA	6.99	<0.0	1100	-132.0	1.10	0.21
AW-14	11/3/2023	UA	6.76	330	1000	-128.0	1.60	--
AW-15	2/12/2021	UA	6.84	24.42	990	-81.8	0.20	--
AW-15	3/5/2021	UA	6.73	78.33	1000	-47.7	0.16	--
AW-15	3/22/2021	UA	6.82	383.49	1000	-51.5	0.60	--
AW-15	5/6/2021	UA	6.59	30.6	1000	-118.0	0.53	--
AW-15	6/17/2021	UA	--	--	780	--	--	--
AW-15	2/27/2023	UA	6.75	107	890	-102.0	1.00	--
AW-15	6/12/2023	UA	6.63	46.5	1100	-101.0	0.27	0.047
AW-15	8/23/2023	UA	6.78	<0.0	1000	-140.0	0.45	0.054
AW-15	11/2/2023	UA	6.98	2.5	1000	-95.0	0.00	--
AW-15	11/17/2023	UA	--	--		--	--	--
AW-15C	2/12/2021	BCU	6.95	155.28	990	-84.2	0.16	--
AW-15C	3/4/2021	BCU	6.84	110.74	1000	-76.4	0.10	--
AW-15C	3/22/2021	BCU	6.69	782.44	1100	-36.5	0.08	--
AW-15C	4/13/2021	BCU	7.00	0.67	1000	-53.6	0.01	--
AW-15C	5/6/2021	BCU	6.84	33.2	1000	-99.3	0.72	--
AW-15C	7/21/2021	BCU	6.81	30.1	990	-85.0	0.00	--
AW-15S	2/12/2021	PMP	6.99	702.02	480	62.9	1.79	--
AW-15S	3/4/2021	PMP	7.07	24.77	490	-3.5	0.67	--
AW-15S	3/22/2021	PMP	6.92	73.06	500	50.1	0.52	--
AW-15S	4/26/2021	PMP	6.97	0.89	450	7.1	1.10	--
AW-15S	5/6/2021	PMP	6.73	38.4	500	64.5	0.89	--
AW-15S	6/17/2021	PMP	6.65	32.1	510	-47.1	0.47	--
AW-15S	6/29/2021	PMP	6.92	23.3	450	117.0	0.24	--
AW-15S	7/21/2021	PMP	6.63	326	500	-5.0	0.00	--
AW-15S	2/27/2023	PMP	6.81	78	400	117.0	0.64	--
AW-15S	6/12/2023	PMP	6.65	29.1	510	38.0	6.00	<0.013
AW-15S	8/23/2023	PMP	6.92	<0.0	510	-29.0	0.35	0.046
AW-15S	11/2/2023	PMP	6.96	1.6	500	1.0	0.00	--
AW-15S	11/17/2023	PMP	--	--		--	--	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Arsenic, total (mg/L)	Barium, total (mg/L)	Boron, total (mg/L)	Calcium, total (mg/L)	Carbon, total organic (mg/L)	Chloride, total (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)
AW-14	2/11/2021	UA	0.0064	0.63	0.21	170	--	28	13	--
AW-14	3/4/2021	UA	0.011	0.59	0.19	170	--	26	15	--
AW-14	3/22/2021	UA	0.011	0.63	0.18	170	--	37	19	--
AW-14	4/12/2021	UA	0.01	0.7	0.17	170	--	24	22	--
AW-14	5/6/2021	UA	0.0096	0.75	0.19	180	--	25	23	--
AW-14	6/28/2021	UA	0.009	0.76	0.17	180	--	26	23	--
AW-14	7/21/2021	UA	0.0085	0.75	0.17	170	--	25	23	--
AW-14	2/28/2023	UA	0.015	0.72	0.18	170	--	21	--	--
AW-14	6/13/2023	UA	0.0078	0.8	0.18	180	33	24	18	16
AW-14	8/23/2023	UA	0.0052	0.84	0.18	170	32	24	18	15
AW-14	11/3/2023	UA	0.0041	0.83	0.24	170	--	28	--	--
AW-15	2/12/2021	UA	0.0023	2.1	0.57	130	--	49	8.2	--
AW-15	3/5/2021	UA	0.0037	2	0.43	140	--	43	11	--
AW-15	3/22/2021	UA	0.0041	1.7	0.47	140	--	51	10	--
AW-15	5/6/2021	UA	0.0058	1.8	0.43	140	--	41	12	--
AW-15	6/17/2021	UA	0.0063	1.4	0.30	140	--	38	16	--
AW-15	2/27/2023	UA	0.0035	1.8	0.37	140	--	32	--	--
AW-15	6/12/2023	UA	0.002	1.9	0.36	140	31	35	10	8.3
AW-15	8/23/2023	UA	0.0013	1.8	0.37	140	29	34	9.8	8.9
AW-15	11/2/2023	UA	0.0018	1.9	0.40	140	--	34	--	--
AW-15	11/17/2023	UA	--	--	--	--	--	--	--	--
AW-15C	2/12/2021	BCU	0.0059	3.1	0.81	99	--	92	8.6	--
AW-15C	3/4/2021	BCU	0.0038	3.6	0.73	110	--	55	6.8	--
AW-15C	3/22/2021	BCU	0.0035	3.2	0.60	110	--	59	5.7	--
AW-15C	4/13/2021	BCU	0.011	2.9	0.68	92	--	110	8.7	--
AW-15C	5/6/2021	BCU	0.0056	3.4	0.63	110	--	63	5.5	--
AW-15C	7/21/2021	BCU	0.0064	3.6	0.69	99	--	72	6	--
AW-15S	2/12/2021	PMP	0.0043	0.22	5.50	250	--	50	23	--
AW-15S	3/4/2021	PMP	0.001	0.11	5.40	270	--	47	2.4	--
AW-15S	3/22/2021	PMP	0.001	0.1	6.20	260	--	42	3.1	--
AW-15S	4/26/2021	PMP	<0.001	0.1	5.40	270	--	41	1.8	--
AW-15S	5/6/2021	PMP	<0.001	0.098	5.80	270	--	40	0.9	--
AW-15S	6/17/2021	PMP	<0.001	0.093	5.70	270	--	37	0.39	--
AW-15S	6/29/2021	PMP	<0.001	0.097	5.40	260	--	39	0.52	--
AW-15S	7/21/2021	PMP	0.0015	0.11	6.10	260	--	38	3.5	--
AW-15S	2/27/2023	PMP	0.0018	0.081	5.90	260	--	28	--	--
AW-15S	6/12/2023	PMP	<0.00069	0.075	6.70	280	3.4	31	0.12	0.033
AW-15S	8/23/2023	PMP	<0.00069	0.087	5.70	270	3.7	31	0.8	0.055
AW-15S	11/2/2023	PMP	<0.00069	0.084	6.00	270	--	30	--	--
AW-15S	11/17/2023	PMP	--	--	--	--	--	--	--	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Ferrous Iron, dissolved (mg/L)	Lithium, total (mg/L)	Magnesium, total (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	Methane, total (mg/L)	Molybdenum, total (mg/L)
AW-14	2/11/2021	UA	--	0.027	66	0.98	--	--	0.046
AW-14	3/4/2021	UA	--	0.023	62	1	--	--	0.022
AW-14	3/22/2021	UA	--	0.02	65	0.92	--	--	0.0044
AW-14	4/12/2021	UA	--	0.025	67	0.86	--	--	0.0037
AW-14	5/6/2021	UA	--	<0.02	65	0.73	--	--	<0.001
AW-14	6/28/2021	UA	--	0.029	72	0.73	--	--	<0.001
AW-14	7/21/2021	UA	--	<0.02	67	0.66	--	--	<0.001
AW-14	2/28/2023	UA	--	<0.017	66	--	--	--	0.019
AW-14	6/13/2023	UA	>6	<0.014	70	0.41	0.41	42600	0.0039
AW-14	8/23/2023	UA	>6	<0.016	69	0.42	0.37	44700	0.0014
AW-14	11/3/2023	UA	--	<0.016	69	--	--	--	0.0018
AW-15	2/12/2021	UA	--	0.049	50	0.099	--	--	0.001
AW-15	3/5/2021	UA	--	0.041	53	0.14	--	--	<0.001
AW-15	3/22/2021	UA	--	0.039	54	0.15	--	--	<0.001
AW-15	5/6/2021	UA	--	0.033	52	0.13	--	--	<0.001
AW-15	6/17/2021	UA	--	0.041	66	0.41	--	--	0.0031
AW-15	2/27/2023	UA	--	0.027	57	--	--	--	<0.00074
AW-15	6/12/2023	UA	>6	0.03	58	0.085	0.078	48500	<0.00074
AW-15	8/23/2023	UA	>6	0.028	59	0.079	0.072	67200	<0.00074
AW-15	11/2/2023	UA	--	0.029	59	--	--	--	<0.00074
AW-15	11/17/2023	UA	--	--	--	--	--	--	--
AW-15C	2/12/2021	BCU	--	0.06	41	0.17	--	--	0.0088
AW-15C	3/4/2021	BCU	--	0.058	45	0.098	--	--	0.0082
AW-15C	3/22/2021	BCU	--	0.056	44	0.086	--	--	0.0014
AW-15C	4/13/2021	BCU	--	0.062	37	0.16	--	--	0.0059
AW-15C	5/6/2021	BCU	--	0.047	42	0.067	--	--	0.0016
AW-15C	7/21/2021	BCU	--	0.045	43	0.063	--	--	0.0011
AW-15S	2/12/2021	PMP	--	0.032	82	0.65	--	--	0.0042
AW-15S	3/4/2021	PMP	--	<0.02	80	0.48	--	--	0.0043
AW-15S	3/22/2021	PMP	--	<0.02	80	0.4	--	--	0.0033
AW-15S	4/26/2021	PMP	--	<0.02	73	0.64	--	--	0.0034
AW-15S	5/6/2021	PMP	--	<0.02	78	0.43	--	--	0.0034
AW-15S	6/17/2021	PMP	--	0.021	81	0.67	--	--	0.0031
AW-15S	6/29/2021	PMP	--	<0.02	82	0.69	--	--	0.0033
AW-15S	7/21/2021	PMP	--	<0.02	83	0.69	--	--	0.003
AW-15S	2/27/2023	PMP	--	<0.013	82	--	--	--	0.003
AW-15S	6/12/2023	PMP	0.11	<0.013	84	0.87	0.81	<10.0	0.003
AW-15S	8/23/2023	PMP	0.43	<0.014	88	0.9	0.67	13	0.0027
AW-15S	11/2/2023	PMP	--	<0.014	88	--	--	--	0.0035
AW-15S	11/17/2023	PMP	--	--	--	--	--	--	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Potassium, total (mg/L)	Radium 226 + Radium 228, total (pCi/L)	Silicon, total (ug/L)	Sodium, total (mg/L)	Sulfate, total (mg/L)	Sulfide, total (mg/L)
AW-14	2/11/2021	UA	4	2.69	--	170	54	--
AW-14	3/4/2021	UA	3.2	2.67	--	150	26	--
AW-14	3/22/2021	UA	2.7	2.38	--	140	10	--
AW-14	4/12/2021	UA	2.7	2.36	--	130	3	--
AW-14	5/6/2021	UA	2.5	1.99	--	130	<1.0	--
AW-14	6/28/2021	UA	2.4	3.66	--	150	1.7	--
AW-14	7/21/2021	UA	2.3	1.94	--	140	<1.0	--
AW-14	2/28/2023	UA	2.5	1.3	--	150	5.7	--
AW-14	6/13/2023	UA	2.3	3.46	22000	150	2.9	<2
AW-14	8/23/2023	UA	2.4	3.53	23000	150	1.8	<2
AW-14	11/3/2023	UA	3.1	1.87	--	150	6.5	--
AW-15	2/12/2021	UA	4.9	2.96	--	220	1	--
AW-15	3/5/2021	UA	5.5	5.14	--	230	<1.0	--
AW-15	3/22/2021	UA	5.1	6.89	--	220	<1.0	--
AW-15	5/6/2021	UA	5.3	4.14	--	210	<1.0	--
AW-15	6/17/2021	UA	3.4	1.49	--	140	<1.0	--
AW-15	2/27/2023	UA	3.9	7.65	--	210	<0.18	--
AW-15	6/12/2023	UA	4.2	3.8	17000	210	<0.18	<2
AW-15	8/23/2023	UA	4.2	6.12	17000	200	<0.18	0.4
AW-15	11/2/2023	UA	4.4	5.52	--	220	<0.21	--
AW-15	11/17/2023	UA	--	--	--	--	--	--
AW-15C	2/12/2021	BCU	10	4.84	--	290	3.1	--
AW-15C	3/4/2021	BCU	9.1	7.49	--	280	<1.0	--
AW-15C	3/22/2021	BCU	8.6	7.52	--	270	<1.0	--
AW-15C	4/13/2021	BCU	12	5.25	--	310	1.9	--
AW-15C	5/6/2021	BCU	9.4	4.68	--	260	<1.0	--
AW-15C	7/21/2021	BCU	9.5	4.92	--	280	<1.0	--
AW-15S	2/12/2021	PMP	3	0.74	--	53	480	--
AW-15S	3/4/2021	PMP	1.4	1.08	--	53	510	--
AW-15S	3/22/2021	PMP	1.4	0.236	--	54	520	--
AW-15S	4/26/2021	PMP	1	--	--	46	550	--
AW-15S	5/6/2021	PMP	0.88	0.532	--	49	540	--
AW-15S	6/17/2021	PMP	0.84	0.229	--	48	550	--
AW-15S	6/29/2021	PMP	0.8	0.582	--	48	560	--
AW-15S	7/21/2021	PMP	1	1.09	--	49	570	--
AW-15S	2/27/2023	PMP	0.69	1.99	--	52	510	--
AW-15S	6/12/2023	PMP	0.54	0.203	7600	57	590	<2
AW-15S	8/23/2023	PMP	0.76	1.02	8700	51	570	<2
AW-15S	11/2/2023	PMP	0.84	1.7	--	55	550	--
AW-15S	11/17/2023	PMP	--	--	--	--	--	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	pH (field) (SU)	Turbidity, field (NTU)	Alkalinity, total (mg/L)	Oxidation Reduction Potential (mV)	Dissolved Oxygen (mg/L)	Aluminum, total (mg/L)
AW-16	2/11/2021	UA	6.83	0	1100	-69.5	0.28	--
AW-16	3/3/2021	UA	6.83	146.26	1100	-63.7	0.13	--
AW-16	3/24/2021	UA	6.40	0	1200	-40.7	0.14	--
AW-16	4/23/2021	UA	6.83	3.19	1200	-99.4	0.52	--
AW-16	5/5/2021	UA	6.70	312	1100	-107.0	0.08	--
AW-16	6/24/2021	UA	6.62	0	1100	-100.0	2.00	--
AW-16	6/29/2021	UA	6.83	18.8	1100	-108.0	0.01	--
AW-16	7/21/2021	UA	6.85	38.9	1100	-136.0	0.16	--
AW-16	2/28/2023	UA	6.83	29.3	1100	-94.0	0.97	--
AW-16	6/12/2023	UA	6.51	77.4	1100	-101.0	0.51	0.074
AW-16	8/21/2023	UA	6.96	9.7	1200	-120.0	0.12	0.036
AW-16	11/2/2023	UA	6.71	<0.0	1100	-126.0	0.86	--
AW-16	11/17/2023	UA	--	--		--	--	--
AW-17	2/11/2021	UA	6.99	182.23	840	-103.9	0.25	--
AW-17	3/3/2021	UA	6.83	461.55	860	-86.3	0.20	--
AW-17	3/23/2021	UA	6.21	11.33	890	-35.6	0.18	--
AW-17	4/23/2021	UA	6.93	110	950	-136.0	0.23	--
AW-17	5/5/2021	UA	6.79	79.6	910	-133.0	0.13	--
AW-17	6/24/2021	UA	6.57	44.1	900	-96.0	2.60	--
AW-17	6/29/2021	UA	6.87	751	850	-130.0	0.03	--
AW-17	7/21/2021	UA	6.96	245	900	-157.0	0.40	--
AW-17	2/28/2023	UA	6.90	869	900	-108.0	0.36	--
AW-17	6/13/2023	UA	7.05	124	880	-111.0	0.69	0.55
AW-17	8/21/2023	UA	6.95	140	890	-106.0	1.30	0.47
AW-17	11/1/2023	UA	6.80	118	890	-115.0	0.88	--
AW-18	2/11/2021	UA	7.04	100.59	680	-70.8	0.36	--
AW-18	3/3/2021	UA	7.04	217.05	800	-112.8	0.25	--
AW-18	3/23/2021	UA	6.39	329.72	690	-69.4	0.15	--
AW-18	4/13/2021	UA	6.87	81.4	780	-136.0	0.32	--
AW-18	5/5/2021	UA	6.86	48.4	810	-164.0	0.11	--
AW-18	6/23/2021	UA	6.89	8.23	800	-142.0	0.12	--
AW-18	6/29/2021	UA	6.93	20.1	500	-144.0	0.14	--
AW-18	7/21/2021	UA	6.96	60	790	-149.0	0.02	--
AW-18	2/27/2023	UA	6.93	499	640	-94.0	0.77	--
AW-18	6/14/2023	UA	6.73	218	800	-105.0	1.70	0.83
AW-18	8/22/2023	UA	6.59	29.3	800	-119.0	1.00	0.45
AW-18	11/1/2023	UA	6.84	149	780	-111.0	0.88	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Arsenic, total (mg/L)	Barium, total (mg/L)	Boron, total (mg/L)	Calcium, total (mg/L)	Carbon, total organic (mg/L)	Chloride, total (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)
AW-16	2/11/2021	UA	0.0013	1.4	0.52	130	--	59	6	--
AW-16	3/3/2021	UA	0.0015	1.4	0.54	140	--	53	5.8	--
AW-16	3/24/2021	UA	<0.001	1.3	0.49	130	--	53	5.3	--
AW-16	4/23/2021	UA	0.0016	1.2	0.45	140	--	55	7.8	--
AW-16	5/5/2021	UA	0.0016	1.3	0.50	140	--	53	7.7	--
AW-16	6/24/2021	UA	0.0018	1.2	0.54	150	--	49	8	--
AW-16	6/29/2021	UA	0.002	1.1	0.51	140	--	54	10	--
AW-16	7/21/2021	UA	0.002	1.2	0.56	130	--	56	8.5	--
AW-16	2/28/2023	UA	0.0022	1.3	0.49	140	--	46	--	--
AW-16	6/12/2023	UA	0.0017	1.3	0.45	150	33	50	11	6.9
AW-16	8/21/2023	UA	<0.00069	1.1	0.44	140	34	51	8.3	6.1
AW-16	11/2/2023	UA	0.0012	1.1	0.42	150	--	48	--	--
AW-16	11/17/2023	UA	--	--	--	--	--	--	--	--
AW-17	2/11/2021	UA	0.0064	1.2	0.48	100	--	56	18	--
AW-17	3/3/2021	UA	0.0079	1.2	0.44	120	--	52	28	--
AW-17	3/23/2021	UA	0.0052	1.1	0.43	100	--	60	15	--
AW-17	4/23/2021	UA	0.0054	1	0.40	110	--	57	18	--
AW-17	5/5/2021	UA	0.0053	1.1	0.44	110	--	55	14	--
AW-17	6/24/2021	UA	0.0052	1	0.46	110	--	59	13	--
AW-17	6/29/2021	UA	0.0058	1.1	0.44	110	--	55	21	--
AW-17	7/21/2021	UA	0.0051	1.2	0.48	100	--	56	14	--
AW-17	2/28/2023	UA	0.0061	1.2	0.42	110	--	47	--	--
AW-17	6/13/2023	UA	0.0045	1.1	0.40	110	30	53	13	9.3
AW-17	8/21/2023	UA	0.0032	1	0.41	110	30	54	12	8.7
AW-17	11/1/2023	UA	0.0036	0.97	0.42	100	--	53	--	--
AW-18	2/11/2021	UA	0.0037	0.6	2.70	110	--	69	21	--
AW-18	3/3/2021	UA	0.0095	1	1.00	140	--	75	55	--
AW-18	3/23/2021	UA	0.0059	0.59	3.00	110	--	64	37	--
AW-18	4/13/2021	UA	0.005	0.85	1.60	110	--	80	37	--
AW-18	5/5/2021	UA	0.0055	0.97	0.96	140	--	81	42	--
AW-18	6/23/2021	UA	0.0051	1	1.20	140	--	88	26	--
AW-18	6/29/2021	UA	0.0031	1.4	0.41	130	--	74	27	--
AW-18	7/21/2021	UA	0.0033	1.1	1.30	120	--	85	22	--
AW-18	2/27/2023	UA	0.008	1.8	0.38	140	--	81	--	--
AW-18	6/14/2023	UA	0.0033	1.3	1.30	120	14	97	17	16
AW-18	8/22/2023	UA	0.0026	1.3	1.20	130	14	91	18	16
AW-18	11/1/2023	UA	0.0042	1.5	0.33	120	--	89	--	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Ferrous Iron, dissolved (mg/L)	Lithium, total (mg/L)	Magnesium, total (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	Methane, total (mg/L)	Molybdenum, total (mg/L)
AW-16	2/11/2021	UA	--	0.045	54	0.056	--	--	<0.001
AW-16	3/3/2021	UA	--	0.045	55	0.047	--	--	<0.001
AW-16	3/24/2021	UA	--	0.046	55	0.045	--	--	<0.001
AW-16	4/23/2021	UA	--	0.036	51	0.059	--	--	<0.001
AW-16	5/5/2021	UA	--	0.039	55	0.052	--	--	<0.001
AW-16	6/24/2021	UA	--	0.1	58	0.059	--	--	<0.001
AW-16	6/29/2021	UA	--	0.043	58	0.08	--	--	<0.001
AW-16	7/21/2021	UA	--	0.036	57	0.066	--	--	<0.001
AW-16	2/28/2023	UA	--	0.037	59	--	--	--	<0.00074
AW-16	6/12/2023	UA	5.2	0.031	61	0.078	0.05	60400	<0.00074
AW-16	8/21/2023	UA	>6	0.032	60	0.066	0.047	59000	<0.00074
AW-16	11/2/2023	UA	--	0.029	63	--	--	--	<0.00074
AW-16	11/17/2023	UA	--	--	--	--	--	--	--
AW-17	2/11/2021	UA	--	0.071	42	0.27	--	--	0.0024
AW-17	3/3/2021	UA	--	0.057	45	0.34	--	--	0.003
AW-17	3/23/2021	UA	--	0.043	42	0.16	--	--	0.0014
AW-17	4/23/2021	UA	--	0.041	39	0.19	--	--	0.0017
AW-17	5/5/2021	UA	--	0.04	41	0.14	--	--	0.0012
AW-17	6/24/2021	UA	--	0.094	43	0.14	--	--	<0.001
AW-17	6/29/2021	UA	--	0.064	45	0.25	--	--	0.0015
AW-17	7/21/2021	UA	--	0.039	42	0.14	--	--	0.0016
AW-17	2/28/2023	UA	--	0.034	45	--	--	--	<0.00078
AW-17	6/13/2023	UA	>6	0.031	44	0.13	0.099	59600	<0.00074
AW-17	8/21/2023	UA	>6	0.034	43	0.12	0.094	70800	<0.00074
AW-17	11/1/2023	UA	--	0.033	41	--	--	--	<0.00074
AW-18	2/11/2021	UA	--	0.11	43	0.62	--	--	0.022
AW-18	3/3/2021	UA	--	0.13	55	0.96	--	--	0.022
AW-18	3/23/2021	UA	--	0.062	42	0.53	--	--	0.027
AW-18	4/13/2021	UA	--	0.067	47	0.51	--	--	0.011
AW-18	5/5/2021	UA	--	0.055	54	0.55	--	--	0.0071
AW-18	6/23/2021	UA	--	0.093	56	0.4	--	--	0.0044
AW-18	6/29/2021	UA	--	0.07	55	0.34	--	--	0.0051
AW-18	7/21/2021	UA	--	0.039	51	0.37	--	--	0.0033
AW-18	2/27/2023	UA	--	0.035	59	--	--	--	0.0051
AW-18	6/14/2023	UA	>6	0.022	52	0.26	0.25	46200	0.0026
AW-18	8/22/2023	UA	>6	0.025	59	0.26	0.24	49500	0.0032
AW-18	11/1/2023	UA	--	0.027	55	--	--	--	0.0015

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Potassium, total (mg/L)	Radium 226 + Radium 228, total (pCi/L)	Silicon, total (ug/L)	Sodium, total (mg/L)	Sulfate, total (mg/L)	Sulfide, total (mg/L)
AW-16	2/11/2021	UA	5.5	5.73	--	270	<1.0	--
AW-16	3/3/2021	UA	5.9	7.02	--	260	<1.0	--
AW-16	3/24/2021	UA	5.5	7.46	--	240	<1.0	--
AW-16	4/23/2021	UA	5.3	4.69	--	230	<1.0	--
AW-16	5/5/2021	UA	5.6	5.52	--	250	<1.0	--
AW-16	6/24/2021	UA	5.5	4.41	--	260	<1.0	--
AW-16	6/29/2021	UA	4.5	5.84	--	230	<1.0	--
AW-16	7/21/2021	UA	5.2	4.77	--	240	<1.0	--
AW-16	2/28/2023	UA	4.9	3.13	--	260	3.4	--
AW-16	6/12/2023	UA	4.6	3.74	18000	250	<0.18	0.4
AW-16	8/21/2023	UA	4.8	3.95	20000	240	<0.61	0.4
AW-16	11/2/2023	UA	4.7	3.93	--	260	<0.81	--
AW-16	11/17/2023	UA	--	--	--	--	--	--
AW-17	2/11/2021	UA	5.4	2.91	--	210	<1.0	--
AW-17	3/3/2021	UA	5.7	3.57	--	220	<1.0	--
AW-17	3/23/2021	UA	4.8	2.41	--	200	<1.0	--
AW-17	4/23/2021	UA	5.5	2.33	--	190	<1.0	--
AW-17	5/5/2021	UA	5.3	3.1	--	210	<1.0	--
AW-17	6/24/2021	UA	5.2	2.85	--	220	<1.0	--
AW-17	6/29/2021	UA	5.5	2.8	--	210	<1.0	--
AW-17	7/21/2021	UA	5.1	2.98	--	210	<1.0	--
AW-17	2/28/2023	UA	4.5	3.46	--	230	<0.18	--
AW-17	6/13/2023	UA	4.3	2.97	18000	220	<0.18	<2
AW-17	8/21/2023	UA	4.5	2.64	18000	210	<0.22	<2
AW-17	11/1/2023	UA	4.2	2.75	--	210	<0.18	--
AW-18	2/11/2021	UA	4.4	2.68	--	130	23	--
AW-18	3/3/2021	UA	6.6	4.7	--	150	6.5	--
AW-18	3/23/2021	UA	3.5	2.82	--	130	28	--
AW-18	4/13/2021	UA	5.4	1.29	--	150	12	--
AW-18	5/5/2021	UA	5.4	2.23	--	150	4	--
AW-18	6/23/2021	UA	4.4	2.86	--	160	3.2	--
AW-18	6/29/2021	UA	6.6	3.42	--	190	12	--
AW-18	7/21/2021	UA	4.5	2.34	--	150	4.6	--
AW-18	2/27/2023	UA	5	3.69	--	210	10	--
AW-18	6/14/2023	UA	3.5	2.92	18000	170	7.7	<2
AW-18	8/22/2023	UA	4.2	6.06	16000	190	6.9	<2
AW-18	11/1/2023	UA	4.5	4.06	--	200	8.2	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	pH (field) (SU)	Turbidity, field (NTU)	Alkalinity, total (mg/L)	Oxidation Reduction Potential (mV)	Dissolved Oxygen (mg/L)	Aluminum, total (mg/L)
AW-19	2/11/2021	UA	6.96	396.76	450	-55.5	0.34	--
AW-19	3/3/2021	UA	7.10	444.93	450	-37.9	0.52	--
AW-19	3/23/2021	UA	6.43	97.72	460	9.6	0.26	--
AW-19	4/12/2021	UA	6.86	20.7	450	-59.5	1.40	--
AW-19	5/5/2021	UA	7.07	111	440	-90.4	0.91	--
AW-19	6/23/2021	UA	6.99	0.95	440	-61.9	0.87	--
AW-19	6/29/2021	UA	7.11	14.7	680	-79.1	0.85	--
AW-19	7/21/2021	UA	7.20	18.9	320	-111.0	0.44	--
AW-19	2/27/2023	UA	7.00	185	380	20.0	1.90	--
AW-19	6/14/2023	UA	6.94	27.9	490	-52.0	2.30	1.4
AW-19	8/22/2023	UA	6.49	24.6	480	-57.0	0.96	0.75
AW-19	11/1/2023	UA	7.05	79.1	460	-66.0	1.00	--
AW-20	2/11/2021	UA	6.80	144.03	610	-52.9	0.25	--
AW-20	3/3/2021	UA	6.94	51.89	590	-41.5	0.12	--
AW-20	3/23/2021	UA	6.44	21.92	600	-1.2	0.19	--
AW-20	4/12/2021	UA	6.87	4.52	590	-62.2	1.30	--
AW-20	5/5/2021	UA	6.87	37.8	590	-93.2	0.70	--
AW-20	6/15/2023	UA	7.04	44.93	550	-178.1	1.90	0.74
AW-20	8/22/2023	UA	6.24	18.6	600	-60.0	0.54	0.12
AW-20	11/1/2023	UA	6.95	94.2	580	-77.0	0.80	--
AW-21	2/11/2021	UA	7.16	17.85	160	-92.6	1.09	--
AW-21	3/3/2021	UA	7.25	0	150	-38.5	0.28	--
AW-21	3/23/2021	UA	6.68	11.06	160	1.6	0.30	--
AW-21	4/12/2021	UA	7.16	17.4	150	-18.3	1.90	--
AW-21	5/5/2021	UA	7.18	37.7	150	-40.6	0.55	--
AW-21	6/23/2021	UA	7.25	33.7	150	-26.5	0.93	--
AW-21	6/29/2021	UA	7.25	14.9	160	-36.9	0.85	--
AW-21	7/21/2021	UA	7.35	39.9	150	9.5	1.90	--
AW-21	2/28/2023	UA	7.99	125	160	227.0	6.70	--
AW-21	6/14/2023	UA	7.12	6.4	190	-28.0	2.70	0.1
AW-21	8/22/2023	UA	6.53	15	180	130.0	7.70	0.05
AW-21	11/2/2023	UA	7.16	20	160	46.0	2.40	--
AW-21	11/17/2023	UA	--	--		--	--	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Arsenic, total (mg/L)	Barium, total (mg/L)	Boron, total (mg/L)	Calcium, total (mg/L)	Carbon, total organic (mg/L)	Chloride, total (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)
AW-19	2/11/2021	UA	0.016	0.23	2.90	110	--	81	9.5	--
AW-19	3/3/2021	UA	0.02	0.24	2.70	120	--	80	11	--
AW-19	3/23/2021	UA	0.014	0.2	2.60	110	--	88	5.6	--
AW-19	4/12/2021	UA	0.016	0.18	2.50	110	--	77	4.9	--
AW-19	5/5/2021	UA	0.015	0.18	2.60	120	--	86	4.9	--
AW-19	6/23/2021	UA	0.016	0.18	2.50	120	--	88	3.3	--
AW-19	6/29/2021	UA	0.0075	0.19	2.60	110	--	80	1.7	--
AW-19	7/21/2021	UA	0.0092	0.18	2.80	110	--	86	1.9	--
AW-19	2/27/2023	UA	0.022	0.37	2.90	130	--	69	--	--
AW-19	6/14/2023	UA	0.015	0.2	2.30	120	2.2	82	4.8	2.9
AW-19	8/22/2023	UA	0.012	0.2	2.90	120	2.2	79	3.6	2.6
AW-19	11/1/2023	UA	0.01	0.19	3.20	120	--	77	--	--
AW-20	2/11/2021	UA	0.012	0.15	2.30	150	--	90	11	--
AW-20	3/3/2021	UA	0.013	0.13	2.20	170	--	89	9	--
AW-20	3/23/2021	UA	0.011	0.13	2.30	160	--	89	7.8	--
AW-20	4/12/2021	UA	0.012	0.13	2.10	160	--	87	7.1	--
AW-20	5/5/2021	UA	0.012	0.14	2.20	160	--	93	7.9	--
AW-20	6/15/2023	UA	0.013	0.14	3.10	160	4.1	85	7.4	5.9
AW-20	8/22/2023	UA	0.011	0.14	3.40	160	4	88	6.3	6
AW-20	11/1/2023	UA	0.012	0.14	3.10	150	--	87	--	--
AW-21	2/11/2021	UA	<0.001	0.079	12.00	110	--	100	1.9	--
AW-21	3/3/2021	UA	0.0011	0.063	11.00	120	--	96	1.2	--
AW-21	3/23/2021	UA	0.0011	0.08	12.00	110	--	99	2.2	--
AW-21	4/12/2021	UA	0.0016	0.085	11.00	110	--	100	3.4	--
AW-21	5/5/2021	UA	0.0011	0.067	11.00	120	--	96	1.7	--
AW-21	6/23/2021	UA	0.0022	0.062	12.00	120	--	93	1.7	--
AW-21	6/29/2021	UA	0.0013	0.075	11.00	110	--	95	2.5	--
AW-21	7/21/2021	UA	0.0015	0.075	12.00	110	--	100	2.6	--
AW-21	2/28/2023	UA	0.0027	0.058	13.00	110	--	80	--	--
AW-21	6/14/2023	UA	0.0018	0.059	8.70	110	1.4	97	0.69	0.46
AW-21	8/22/2023	UA	<0.00069	0.058	12.00	120	1.6	83	0.3	0.23
AW-21	11/2/2023	UA	<0.00097	0.051	12.00	120	--	97	--	--
AW-21	11/17/2023	UA	--	--	--	--	--	--	--	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Ferrous Iron, dissolved (mg/L)	Lithium, total (mg/L)	Magnesium, total (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	Methane, total (mg/L)	Molybdenum, total (mg/L)
AW-19	2/11/2021	UA	--	0.033	50	0.48	--	--	0.0097
AW-19	3/3/2021	UA	--	0.025	53	0.49	--	--	0.0052
AW-19	3/23/2021	UA	--	<0.02	50	0.4	--	--	0.0034
AW-19	4/12/2021	UA	--	<0.02	49	0.36	--	--	0.004
AW-19	5/5/2021	UA	--	<0.02	49	0.37	--	--	0.0043
AW-19	6/23/2021	UA	--	0.023	53	0.34	--	--	0.0036
AW-19	6/29/2021	UA	--	0.021	50	0.36	--	--	0.0035
AW-19	7/21/2021	UA	--	<0.02	49	0.38	--	--	0.0033
AW-19	2/27/2023	UA	--	<0.015	58	--	--	--	0.0055
AW-19	6/14/2023	UA	2.7	<0.011	55	0.39	0.37	17.1	0.0039
AW-19	8/22/2023	UA	>6	<0.012	55	0.32	0.33	17.2	0.0036
AW-19	11/1/2023	UA	--	<0.011	54	--	--	--	0.0041
AW-20	2/11/2021	UA	--	0.027	60	0.36	--	--	0.0028
AW-20	3/3/2021	UA	--	<0.02	62	0.33	--	--	0.0028
AW-20	3/23/2021	UA	--	<0.02	60	0.3	--	--	0.0025
AW-20	4/12/2021	UA	--	0.021	59	0.31	--	--	0.0022
AW-20	5/5/2021	UA	--	<0.02	59	0.32	--	--	0.0026
AW-20	6/15/2023	UA	--	<0.014	63	0.27	0.25	28.7	0.0027
AW-20	8/22/2023	UA	5.7	<0.014	61	0.26	0.25	30.2	0.0024
AW-20	11/1/2023	UA	--	<0.016	59	--	--	--	0.0023
AW-21	2/11/2021	UA	--	<0.02	35	0.92	--	--	0.019
AW-21	3/3/2021	UA	--	<0.02	35	0.9	--	--	0.024
AW-21	3/23/2021	UA	--	<0.02	35	0.88	--	--	0.018
AW-21	4/12/2021	UA	--	<0.02	37	0.92	--	--	0.021
AW-21	5/5/2021	UA	--	<0.02	35	0.91	--	--	0.02
AW-21	6/23/2021	UA	--	<0.02	38	0.84	--	--	0.015
AW-21	6/29/2021	UA	--	<0.02	37	0.81	--	--	0.016
AW-21	7/21/2021	UA	--	<0.02	36	0.77	--	--	0.016
AW-21	2/28/2023	UA	--	<0.005	34	--	--	--	0.029
AW-21	6/14/2023	UA	1.4	<0.005	36	0.8	0.78	<10.0	0.017
AW-21	8/22/2023	UA	>6	<0.0064	38	0.68	0.71	<10.0	0.029
AW-21	11/2/2023	UA	--	<0.005	39	--	--	--	0.028
AW-21	11/17/2023	UA	--	--	--	--	--	--	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Potassium, total (mg/L)	Radium 226 + Radium 228, total (pCi/L)	Silicon, total (ug/L)	Sodium, total (mg/L)	Sulfate, total (mg/L)	Sulfide, total (mg/L)
AW-19	2/11/2021	UA	2.1	0.483	--	53	28	--
AW-19	3/3/2021	UA	1.9	0.795	--	54	26	--
AW-19	3/23/2021	UA	1.1	0.129	--	50	29	--
AW-19	4/12/2021	UA	1.1	0.492	--	48	29	--
AW-19	5/5/2021	UA	1.1	0.882	--	52	33	--
AW-19	6/23/2021	UA	0.88	0.658	--	55	37	--
AW-19	6/29/2021	UA	0.9	2.15	--	52	36	--
AW-19	7/21/2021	UA	0.88	0.458	--	52	38	--
AW-19	2/27/2023	UA	1.5	1.59	--	56	46	--
AW-19	6/14/2023	UA	1.2	0.471	14000	54	52	<2
AW-19	8/22/2023	UA	1	1.75	11000	52	55	<2
AW-19	11/1/2023	UA	0.9	0.982	--	54	57	--
AW-20	2/11/2021	UA	1.8	0.606	--	60	48	--
AW-20	3/3/2021	UA	1.3	0.515	--	63	45	--
AW-20	3/23/2021	UA	1	1.38	--	58	43	--
AW-20	4/12/2021	UA	0.9	1.17	--	60	39	--
AW-20	5/5/2021	UA	1.1	0.448	--	62	41	--
AW-20	6/15/2023	UA	1.1	--	11000	68	57	<2
AW-20	8/22/2023	UA	0.98	2.04	10000	64	59	<2
AW-20	11/1/2023	UA	1.2	1.72	--	64	55	--
AW-21	2/11/2021	UA	0.58	0.645	--	56	250	--
AW-21	3/3/2021	UA	0.32	0.493	--	57	240	--
AW-21	3/23/2021	UA	0.5	0.223	--	52	250	--
AW-21	4/12/2021	UA	0.77	0.83	--	53	41	--
AW-21	5/5/2021	UA	0.44	0.237	--	55	230	--
AW-21	6/23/2021	UA	0.43	1.08	--	58	250	--
AW-21	6/29/2021	UA	0.53	0.645	--	55	250	--
AW-21	7/21/2021	UA	0.54	1	--	57	260	--
AW-21	2/28/2023	UA	3.4	0.642	--	60	240	--
AW-21	6/14/2023	UA	2	0.326	5900	55	240	<2
AW-21	8/22/2023	UA	3.8	0.936	5500	59	280	<2
AW-21	11/2/2023	UA	1.6	1.26	--	62	260	--
AW-21	11/17/2023	UA	--	--	--	--	--	--

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	pH (field) (SU)	Turbidity, field (NTU)	Alkalinity, total (mg/L)	Oxidation Reduction Potential (mV)	Dissolved Oxygen (mg/L)	Aluminum, total (mg/L)
AW-22	2/12/2021	UA	7.01	47.29	520	-73.7	1.00	--
AW-22	3/3/2021	UA	6.93	5951.54	520	-89.6	0.09	--
AW-22	3/23/2021	UA	6.54	0	540	-51.3	0.08	--
AW-22	4/23/2021	UA	6.92	4.17	540	-99.3	0.59	--
AW-22	5/5/2021	UA	6.88	292	510	-122.0	0.19	--
AW-23	11/21/2022	UA	6.96	3.27	280	102.4	0.22	--
AW-23	12/16/2022	UA	6.62	5.85	340	22.6	0.16	--
AW-23	1/10/2023	UA	6.91	0	380	-60.4	0.14	--
AW-23	6/14/2023	UA	6.92	35.3	360	-32.5	0.27	0.049
AW-23	8/23/2023	UA	6.82	133	390	-34.0	0.44	0.99
AW-23	11/3/2023	UA	6.80	1000	380	108.0	2.10	--
EMW-05	11/18/2022	UA	--	--	490	--	--	--
EMW-05	12/15/2022	UA	6.46	86.08	600	65.7	2.22	--
EMW-05	1/10/2023	UA	6.63	82.1	400	12.3	1.86	--
EMW-05	6/15/2023	UA	7.01	3.09	610	-76.6	3.84	0.27
EMW-05	8/28/2023	UA	6.82	70.5	600	52.0	1.00	0.23
EMW-05	11/3/2023	UA	7.13	32.8	620	27.0	0.01	--
P002	2/12/2021	UCF	6.60	25.79	740	-30.8	0.64	--
P002	3/3/2021	UCF	6.80	19.89	710	-4.6	0.25	--
P002	3/23/2021	UCF	6.31	6.77	760	21.5	0.39	--
P002	4/13/2021	UCF	6.79	18.1	740	-50.1	0.86	--
P002	5/4/2021	UCF	6.79	20.7	720	-55.7	0.89	--
XPW01A	2/11/2021	CCR	11.97	6.02	430	-175.9	0.53	--
XPW01A	3/4/2021	CCR	11.44	0	75	-39.0	0.32	--
XPW01A	3/23/2021	CCR	11.19	0	100	-101.5	0.17	--
XPW01A	4/12/2021	CCR	11.90	0.72	75	-69.2	2.90	--
XPW01A	5/4/2021	CCR	11.90	6.3	75	-73.0	0.95	--
XPW01A	7/21/2021	CCR	11.80	0.01	75	-111.0	1.10	--
XPW01A	2/28/2023	CCR	11.80	52.9	75	54.0	4.20	--
XPW01A	6/12/2023	CCR	11.90	<0.0	100	-125.0	2.20	4.2
XPW01A	8/21/2023	CCR	11.60	<0.0	75	29.0	1.40	4.1

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Arsenic, total (mg/L)	Barium, total (mg/L)	Boron, total (mg/L)	Calcium, total (mg/L)	Carbon, total organic (mg/L)	Chloride, total (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)
AW-22	2/12/2021	UA	0.0043	0.76	0.32	78	--	40	15	--
AW-22	3/3/2021	UA	0.0029	0.8	0.23	82	--	39	14	--
AW-22	3/23/2021	UA	0.0016	0.73	0.23	77	--	39	11	--
AW-22	4/23/2021	UA	0.0032	0.99	0.33	110	--	42	14	--
AW-22	5/5/2021	UA	0.0017	0.8	0.38	80	--	40	12	--
AW-23	11/21/2022	UA	<0.001	0.032	0.58	130	--	42	--	--
AW-23	12/16/2022	UA	<0.001	0.027	0.48	130	--	46	--	--
AW-23	1/10/2023	UA	0.0012	0.027	0.55	130	--	50	--	--
AW-23	6/14/2023	UA	<0.00085	0.031	0.49	140	2	41	0.37	0.12
AW-23	8/23/2023	UA	<0.00069	0.045	0.55	140	2.4	49	2.2	0.53
AW-23	11/3/2023	UA	0.0025	0.31	0.60	140	--	35	--	--
EMW-05	11/18/2022	UA	0.0013	0.069	0.67	160	--	28	--	--
EMW-05	12/15/2022	UA	0.0012	0.079	0.77	170	--	20	--	--
EMW-05	1/10/2023	UA	0.02	0.65	0.32	230	--	29	--	--
EMW-05	6/15/2023	UA	0.0011	0.07	0.75	190	2.7	23	0.57	0.15
EMW-05	8/28/2023	UA	<0.00079	0.062	1.00	190	3.1	18	0.77	<0.0065
EMW-05	11/3/2023	UA	<0.00069	0.053	1.50	180	--	20	--	--
P002	2/12/2021	UCF	0.0046	0.11	1.40	170	--	78	5.3	--
P002	3/3/2021	UCF	0.0071	0.1	1.10	180	--	70	7.3	--
P002	3/23/2021	UCF	0.0062	0.096	1.20	170	--	71	6.8	--
P002	4/13/2021	UCF	0.0084	0.097	1.20	170	--	74	9.4	--
P002	5/4/2021	UCF	0.0079	0.1	1.20	180	--	69	10	--
XPW01A	2/11/2021	CCR	0.069	0.04	18.00	39	--	93	0.44	--
XPW01A	3/4/2021	CCR	0.082	0.031	15.00	39	--	83	0.085	--
XPW01A	3/23/2021	CCR	0.072	0.028	15.00	36	--	91	0.02	--
XPW01A	4/12/2021	CCR	0.088	0.029	16.00	38	--	93	0.16	--
XPW01A	5/4/2021	CCR	0.079	0.034	17.00	51	--	47	0.081	--
XPW01A	7/21/2021	CCR	0.096	0.032	19.00	52	--	96	0.023	--
XPW01A	2/28/2023	CCR	0.12	0.034	19.00	57	--	86	--	--
XPW01A	6/12/2023	CCR	0.12	0.031	21.00	58	4	97	0.027	0.013
XPW01A	8/21/2023	CCR	0.12	0.031	18.00	58	3.8	97	0.028	<0.00072

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Ferrous Iron, dissolved (mg/L)	Lithium, total (mg/L)	Magnesium, total (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	Methane, total (mg/L)	Molybdenum, total (mg/L)
AW-22	2/12/2021	UA	--	0.023	34	0.26	--	--	0.0015
AW-22	3/3/2021	UA	--	0.022	33	0.21	--	--	0.0013
AW-22	3/23/2021	UA	--	0.022	33	0.17	--	--	0.0017
AW-22	4/23/2021	UA	--	<0.02	39	0.21	--	--	0.0021
AW-22	5/5/2021	UA	--	<0.02	32	0.16	--	--	<0.001
AW-23	11/21/2022	UA	--	<0.02	51	--	--	--	0.0011
AW-23	12/16/2022	UA	--	<0.02	46	--	--	--	0.0017
AW-23	1/10/2023	UA	--	<0.016	50	--	--	--	<0.00096
AW-23	6/14/2023	UA	--	<0.01	52	0.79	0.68	<10.0	<0.00092
AW-23	8/23/2023	UA	0.46	<0.013	55	0.92	0.86	<10.0	<0.00074
AW-23	11/3/2023	UA	--	0.038	59	--	--	--	<0.00098
EMW-05	11/18/2022	UA	--	<0.02	79	--	--	--	0.0019
EMW-05	12/15/2022	UA	--	<0.02	70	--	--	--	0.0017
EMW-05	1/10/2023	UA		0.092	110	--	--	--	0.004
EMW-05	6/15/2023	UA	--	<0.0063	85	0.27	0.96	<10.0	0.002
EMW-05	8/28/2023	UA	0.066	<0.0087	79	0.45	0.22	<10.0	0.0013
EMW-05	11/3/2023	UA	--	<0.0058	83	--	--	--	0.001
P002	2/12/2021	UCF	--	<0.02	77	1.6	--	--	0.0016
P002	3/3/2021	UCF	--	<0.02	77	1.7	--	--	0.0017
P002	3/23/2021	UCF	--	<0.02	79	1.7	--	--	0.0017
P002	4/13/2021	UCF	--	<0.02	76	1.8	--	--	0.0017
P002	5/4/2021	UCF	--	<0.02	79	1.9	--	--	0.002
XPW01A	2/11/2021	CCR	--	0.64	0.16	0.011	--	--	4
XPW01A	3/4/2021	CCR	--	0.57	<0.1	0.0012	--	--	5
XPW01A	3/23/2021	CCR	--	0.61	<0.1	<0.001	--	--	4.6
XPW01A	4/12/2021	CCR	--	0.64	<0.1	<0.001	--	--	4.3
XPW01A	5/4/2021	CCR	--	0.67	0.11	0.0012	--	--	3.8
XPW01A	7/21/2021	CCR	--	0.72	<0.1	<0.001	--	--	3.3
XPW01A	2/28/2023	CCR	--	0.68	<0.035	--	--	--	3.2
XPW01A	6/12/2023	CCR	0.13	0.66	<0.021	0.0011	<0.00023	951	3.2
XPW01A	8/21/2023	CCR	<0.02	0.66	<0.011	<0.00085	<0.00023	888	3

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Potassium, total (mg/L)	Radium 226 + Radium 228, total (pCi/L)	Silicon, total (ug/L)	Sodium, total (mg/L)	Sulfate, total (mg/L)	Sulfide, total (mg/L)
AW-22	2/12/2021	UA	2.3	1.55	--	110	<1.0	--
AW-22	3/3/2021	UA	2.1	1	--	110	<1.0	--
AW-22	3/23/2021	UA	1.8	1.12	--	100	<1.0	--
AW-22	4/23/2021	UA	2.3	2.37	--	130	<1.0	--
AW-22	5/5/2021	UA	1.9	2.13	--	110	<1.0	--
AW-23	11/21/2022	UA	0.66	0.365	--	51	200	--
AW-23	12/16/2022	UA	0.61	0.204	--	52	200	--
AW-23	1/10/2023	UA	1.1	0.666	--	59	190	--
AW-23	6/14/2023	UA	0.69	--	7000	56	200	<2
AW-23	8/23/2023	UA	1.1	0.803	9100	64	230	<2
AW-23	11/3/2023	UA	5.3	1.85	--	47	180	--
EMW-05	11/18/2022	UA	0.51	0.479	--	22	120	--
EMW-05	12/15/2022	UA	1.1	1.53	--	17	120	--
EMW-05	1/10/2023	UA	7.1	1.33	--	21	130	--
EMW-05	6/15/2023	UA	0.48	--	7800	23	120	<2
EMW-05	8/28/2023	UA	0.39	0.499	8300	21	130	<2
EMW-05	11/3/2023	UA	0.29	0.519	--	22	130	--
P002	2/12/2021	UCF	0.16	0.166	--	42	1.1	--
P002	3/3/2021	UCF	<0.1	0.4	--	42	1.2	--
P002	3/23/2021	UCF	0.14	0.195	--	39	1.2	--
P002	4/13/2021	UCF	<0.1	0.124	--	42	<1.0	--
P002	5/4/2021	UCF	<0.1	0.0443	--	42	<1.0	--
XPW01A	2/11/2021	CCR	250	0.256	--	120	210	--
XPW01A	3/4/2021	CCR	280	0.275	--	130	210	--
XPW01A	3/23/2021	CCR	270	0.261	--	120	210	--
XPW01A	4/12/2021	CCR	270	0.233	--	110	220	--
XPW01A	5/4/2021	CCR	250	0.425	--	120	210	--
XPW01A	7/21/2021	CCR	250	0.604	--	120	230	--
XPW01A	2/28/2023	CCR	240	--	--	120	220	--
XPW01A	6/12/2023	CCR	250	0.076	14000	110	210	<2
XPW01A	8/21/2023	CCR	250	1.01	14000	100	230	0.4

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	pH (field) (SU)	Turbidity, field (NTU)	Alkalinity, total (mg/L)	Oxidation Reduction Potential (mV)	Dissolved Oxygen (mg/L)	Aluminum, total (mg/L)
XPW02	2/11/2021	CCR	12.24	15.7	700	-131.4	0.22	--
XPW02	3/3/2021	CCR	11.93	0	120	-155.1	0.14	--
XPW02	3/23/2021	CCR	11.59	0	120	-124.9	0.16	--
XPW02	4/12/2021	CCR	12.20	0.58	120	-104.0	1.20	--
XPW02	5/4/2021	CCR	12.20	20.9	120	-103.0	1.10	--
XPW02	7/22/2021	CCR	12.10	9.97	100	-197.0	0.53	--
XPW02	2/28/2023	CCR	12.20	19.8	120	-148.0	1.60	--
XPW02	6/13/2023	CCR	12.30	8.8	200	-113.0	1.30	9.3
XPW02	8/22/2023	CCR	11.90	<0.0	100	-89.0	2.50	9.2
XPW03	2/11/2021	CCR	11.91	0	450	-293.3	0.25	--
XPW03	3/3/2021	CCR	11.66	0	120	-226.3	0.44	--
XPW03	3/23/2021	CCR	11.22	0	75	-180.8	0.23	--
XPW03	4/12/2021	CCR	12.00	0.14	100	-185.0	0.91	--
XPW03	5/4/2021	CCR	12.00	23.2	75	-196.0	0.69	--
XPW03	7/22/2021	CCR	11.70	3.07	100	-205.0	0.84	--
XPW03	2/28/2023	CCR	11.90	78.1	120	-51.0	2.60	--
XPW03	6/13/2023	CCR	11.90	5	120	-199.0	3.70	9.5
XPW03	8/28/2023	CCR	11.80	21.2	100	-70.0	1.70	8.9

Notes:

-- = not measured
< = below method detection limit
> = maximum detection limit
mg/L = milligrams per liter
SU= standard units
NTU = Nephelometric Turbidity unit
mV= millivolts
ug/L = micrograms per liter
pCi/L = picocuries per liter
HSU = hydrostratigraphic unit
CCR = coal combustion residual
UA = uppermost aquifer
PMP = potential migration pathway
BCU = bedrock confining unit

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Arsenic, total (mg/L)	Barium, total (mg/L)	Boron, total (mg/L)	Calcium, total (mg/L)	Carbon, total organic (mg/L)	Chloride, total (mg/L)	Iron, total (mg/L)	Iron, dissolved (mg/L)
XPW02	2/11/2021	CCR	0.13	0.022	15.00	40	--	110	0.3	--
XPW02	3/3/2021	CCR	0.16	0.017	14.00	37	--	110	0.053	--
XPW02	3/23/2021	CCR	0.15	0.017	16.00	37	--	120	0.023	--
XPW02	4/12/2021	CCR	0.18	0.015	13.00	27	--	110	0.033	--
XPW02	5/4/2021	CCR	0.18	0.022	15.00	29	--	120	0.14	--
XPW02	7/22/2021	CCR	0.2	0.018	14.00	28	--	130	0.069	--
XPW02	2/28/2023	CCR	0.17	0.038	16.00	37	--	100	--	--
XPW02	6/13/2023	CCR	0.17	0.018	17.00	36	7.2	120	0.045	0.017
XPW02	8/22/2023	CCR	0.17	0.02	15.00	32	6.8	110	0.1	<0.00072
XPW03	2/11/2021	CCR	0.026	0.071	5.40	50	--	96	0.09	--
XPW03	3/3/2021	CCR	0.028	0.066	4.90	53	--	91	0.072	--
XPW03	3/23/2021	CCR	0.027	0.063	5.30	49	--	250	0.021	--
XPW03	4/12/2021	CCR	0.027	0.067	5.00	51	--	93	0.016	--
XPW03	5/4/2021	CCR	0.027	0.07	5.50	52	--	86	0.12	--
XPW03	7/22/2021	CCR	0.025	0.065	7.00	52	--	94	0.055	--
XPW03	2/28/2023	CCR	0.027	0.12	5.70	61	--	93	--	--
XPW03	6/13/2023	CCR	0.025	0.079	5.60	61	4.1	130	0.075	<0.0056
XPW03	8/28/2023	CCR	0.024	0.069	5.50	59	4.2	100	0.013	<0.00072

Notes:

-- = not measured
< = below method detection limit
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mg/L = milligrams per liter
SU= standard units
NTU = Nephelometric Turbidity unit
mV= millivolts
ug/L = micrograms per liter
pCi/L = picocuries per liter
HSU = hydrostratigraphic unit
CCR = coal combustion residual
UA = uppermost aquifer
PMP = potential migration pathway
BCU = bedrock confining unit

Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Ferrous Iron, dissolved (mg/L)	Lithium, total (mg/L)	Magnesium, total (mg/L)	Manganese, total (mg/L)	Manganese, dissolved (mg/L)	Methane, total (mg/L)	Molybdenum, total (mg/L)
XPW02	2/11/2021	CCR	--	0.34	0.13	0.0064	--	--	2.9
XPW02	3/3/2021	CCR	--	0.33	0.15	0.0031	--	--	3.2
XPW02	3/23/2021	CCR	--	0.32	<0.1	<0.001	--	--	2.8
XPW02	4/12/2021	CCR	--	0.34	<0.1	<0.001	--	--	2.9
XPW02	5/4/2021	CCR	--	0.3	0.13	0.0093	--	--	3.3
XPW02	7/22/2021	CCR	--	0.32	0.12	0.0017	--	--	3
XPW02	2/28/2023	CCR	--	0.31	0.23	--	--	--	3.2
XPW02	6/13/2023	CCR	0.035	0.29	<0.037	<0.00085	<0.00023	145	3.2
XPW02	8/22/2023	CCR	6.5	0.29	<0.067	0.0014	<0.00023	155	2.9
XPW03	2/11/2021	CCR	--	0.18	0.11	0.0019	--	--	3.1
XPW03	3/3/2021	CCR	--	0.16	0.1	0.0013	--	--	3.6
XPW03	3/23/2021	CCR	--	0.18	<0.1	<0.001	--	--	3.1
XPW03	4/12/2021	CCR	--	0.17	<0.1	<0.001	--	--	3.6
XPW03	5/4/2021	CCR	--	0.16	<0.1	0.0015	--	--	3.8
XPW03	7/22/2021	CCR	--	0.17	<0.1	0.0011	--	--	3.3
XPW03	2/28/2023	CCR	--	0.13	0.36	--	--	--	3.1
XPW03	6/13/2023	CCR	0.084	0.12	<0.063	0.0023	<0.00023	920	3.2
XPW03	8/28/2023	CCR	5.5	0.12	<0.1	<0.00085	<0.00023	826	3.2

Notes:

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< = below method detection limit
> = maximum detection limit
mg/L = milligrams per liter
SU= standard units
NTU = Nephelometric Turbidity unit
mV= millivolts
ug/L = micrograms per liter
pCi/L = picocuries per liter
HSU = hydrostratigraphic unit
CCR = coal combustion residual
UA = uppermost aquifer
PMP = potential migration pathway
BCU = bedrock confining unit

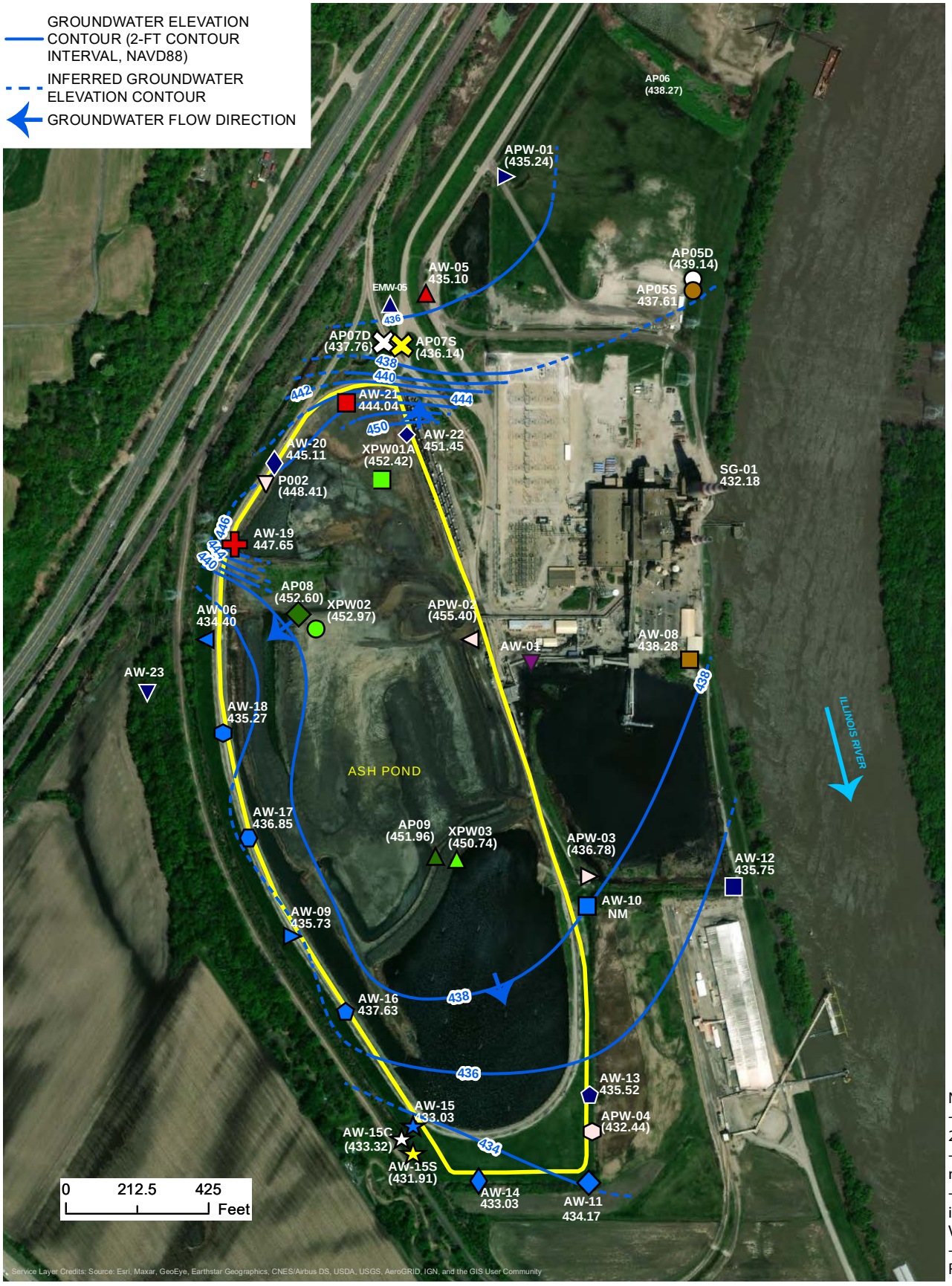
Table 5-1. Groundwater Analytical Data

Well ID	Date	HSU	Potassium, total (mg/L)	Radium 226 + Radium 228, total (pCi/L)	Silicon, total (ug/L)	Sodium, total (mg/L)	Sulfate, total (mg/L)	Sulfide, total (mg/L)
XPW02	2/11/2021	CCR	100	0.548	--	620	800	--
XPW02	3/3/2021	CCR	110	0.179	--	710	840	--
XPW02	3/23/2021	CCR	110	0.101	--	760	890	--
XPW02	4/12/2021	CCR	110	0.464	--	730	880	--
XPW02	5/4/2021	CCR	120	0.133	--	690	950	--
XPW02	7/22/2021	CCR	120	0.427	--	800	970	--
XPW02	2/28/2023	CCR	110	--	--	730	930	--
XPW02	6/13/2023	CCR	120	0.481	20000	1100	1100	<2
XPW02	8/22/2023	CCR	110	1.12	21000	770	1100	<2
XPW03	2/11/2021	CCR	75	0.194	--	240	270	--
XPW03	3/3/2021	CCR	83	0.349	--	250	280	--
XPW03	3/23/2021	CCR	83	0.065	--	260	300	--
XPW03	4/12/2021	CCR	77	0.208	--	240	290	--
XPW03	5/4/2021	CCR	80	0.213	--	240	280	--
XPW03	7/22/2021	CCR	74	0.211	--	250	270	--
XPW03	2/28/2023	CCR	68	--	--	230	260	--
XPW03	6/13/2023	CCR	72	0.897	8200	240	290	0.8
XPW03	8/28/2023	CCR	68	0.261	8100	230	310	0.8

Notes:

-- = not measured
< = below method detection limit
> = maximum detection limit
mg/L = milligrams per liter
SU= standard units
NTU = Nephelometric Turbidity unit
mV= millivolts
ug/L = micrograms per liter
pCi/L = picocuries per liter
HSU = hydrostratigraphic unit
CCR = coal combustion residual
UA = uppermost aquifer
PMP = potential migration pathway
BCU = bedrock confining unit

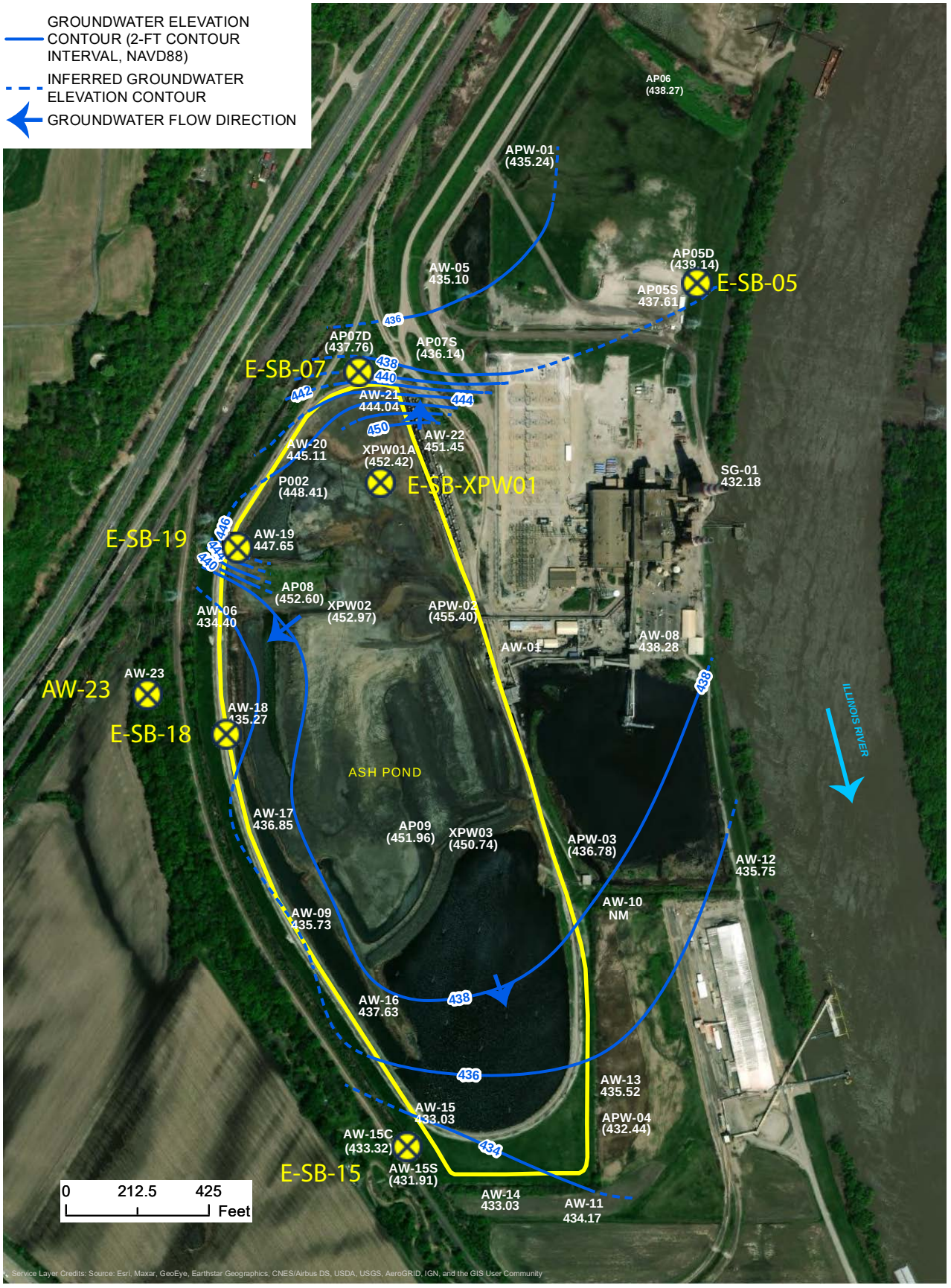
FIGURES



Notes:
-Contours from February 2021.
-Parenthesis indicates well not used in contouring
-Elevation contours shown in feet, North American Vertical Datum of 1988
-Figure adapted from Ramboll 2021

LIFECYCLEGEO

Title: Edwards Ash Pond Well Locations and Hydrogeology		
Project Name: Edwards - Ash Pond Evaluation	Project Number: [23RAM01-1] Vistra CCR	Figure: 2-1
Client Name: Ramboll Americas Engineering Solutions, Inc.	Date: 02/08/2024	

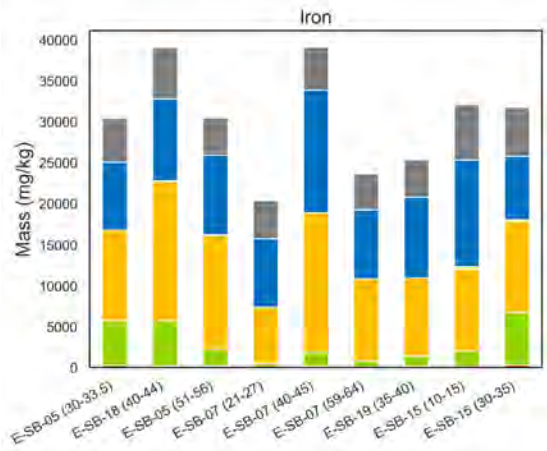


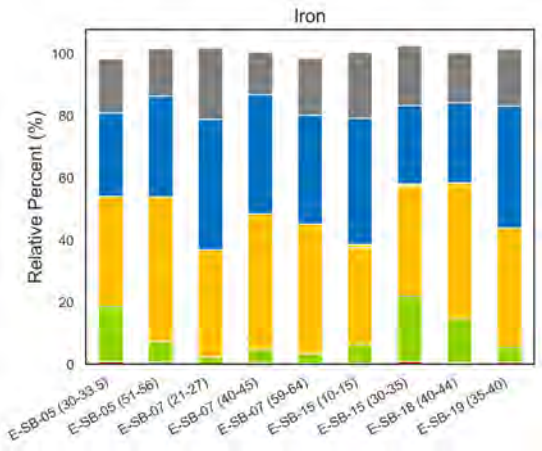
Notes:
-Contours from February 2021.
-Parenthesis indicates well not used in contouring
-Elevation contours shown in feet, North American Vertical Datum of 1988
-Figure adapted from Ramboll 2021

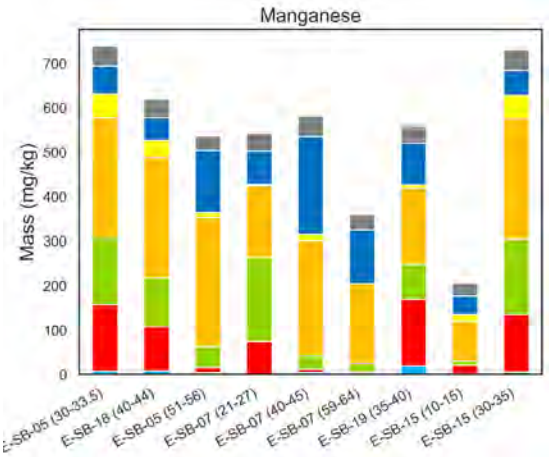
LIFECYCLEGEO

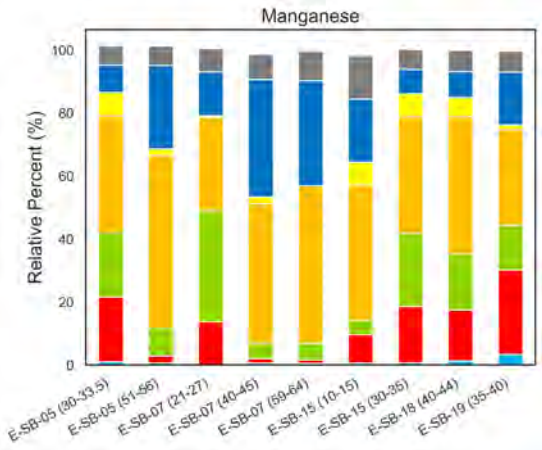
Title
Edwards Ash Pond Soil Boring Locations and Hydrogeology

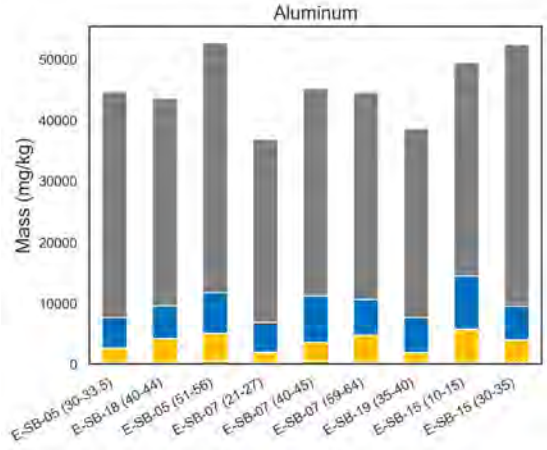
Project Name	Project Number	Figure
Edwards - Ash Pond Evaluation	[23RAM01-1] Vistra CCR	4-1
Client Name	Date	
Ramboll Americas Engineering Solutions, Inc.	02/08/2024	

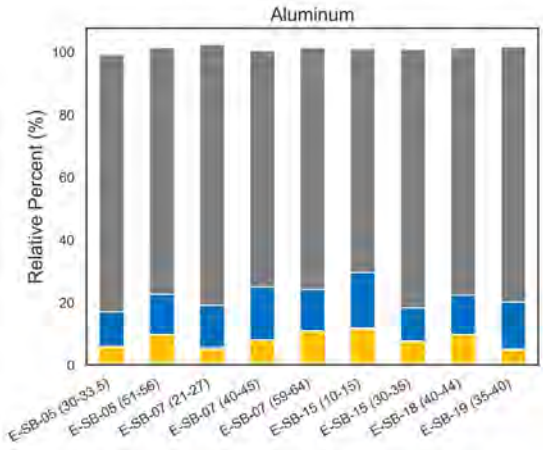






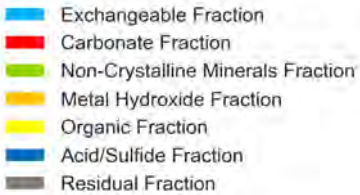






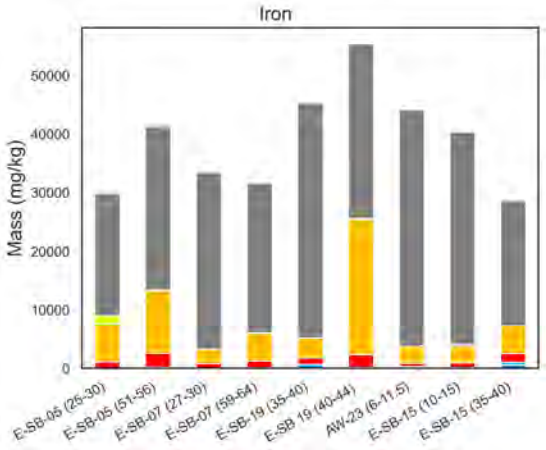
Notes:

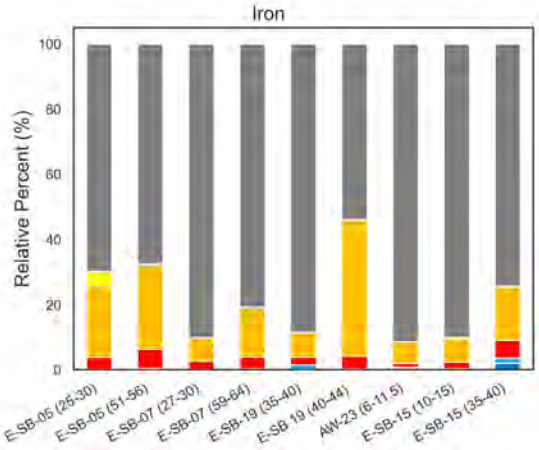
- SEP results from Eurofins (2021) analysis.
- Non-detects are removed from the analysis.
- The percentages for each individual fraction may not sum to 100 due to results below the reporting limit and rounding.

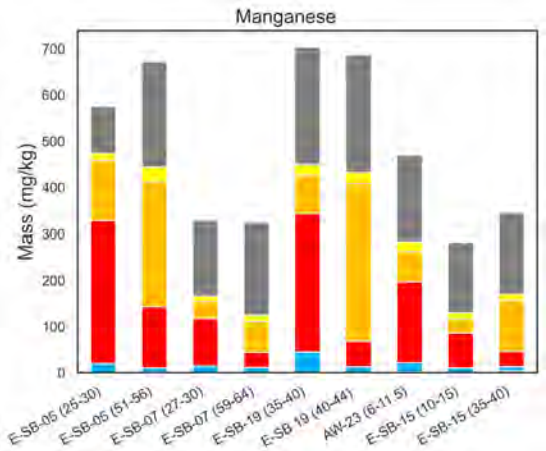


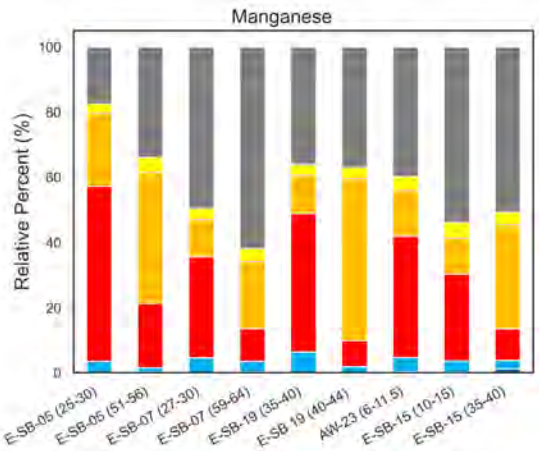
LIFECYCLEGEO

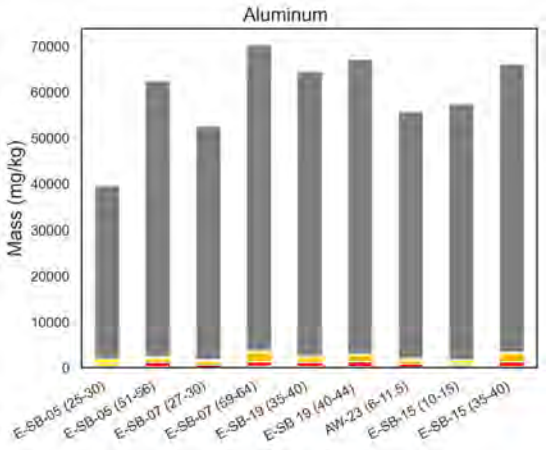
Title: Edwards Ash Pond 2021 SEP results			
Project Name: Edwards - Ash Pond Evaluation		Project Number: [23RAM01-1] Vistra CCR	Figure: 4-2a
Client Name: Ramboll Americas Engineering Solutions, Inc.		Date: 02/08/2024	

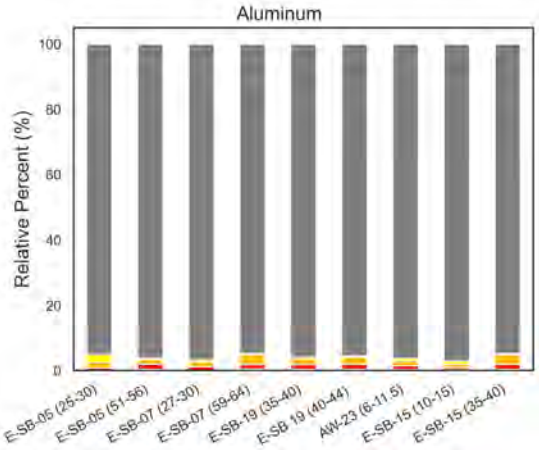






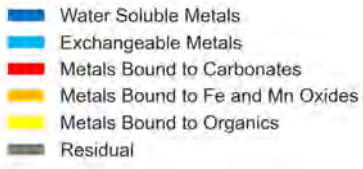






Notes:

-SEP results from SGS (2023) analysis.
-Non-detects are removed from the analysis.
-The percentages for each individual fraction may not sum to 100 due to results below the reporting limit and rounding.



LIFECYCLEGEO

Title
Edwards Ash Pond 2023 SEP results

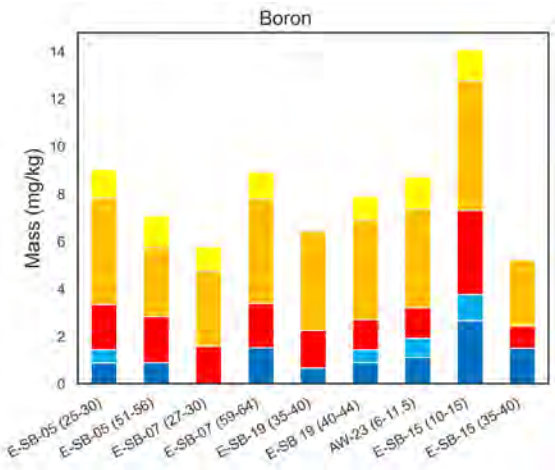
Project Name
Edwards - Ash Pond Evaluation

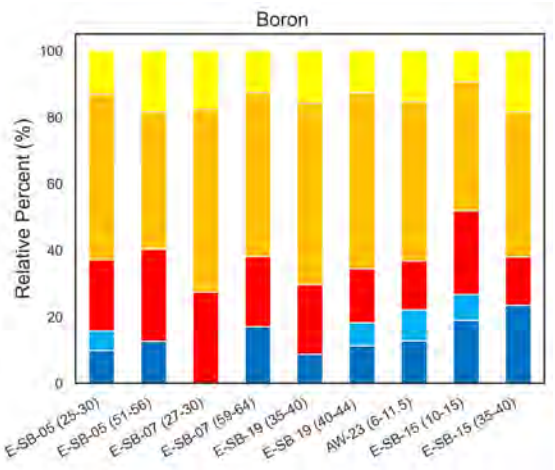
Project Number
[23RAM01-1] Vistra CCR

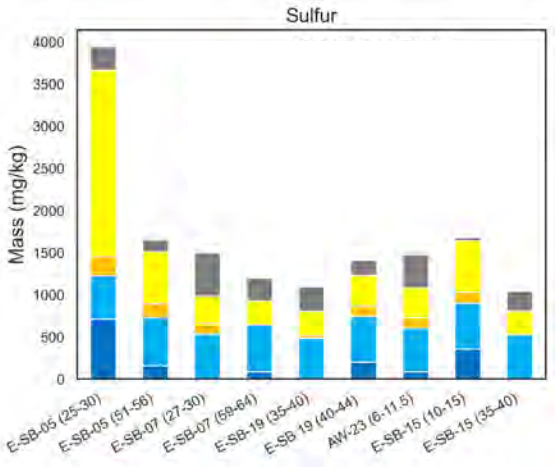
Figure
4-2b

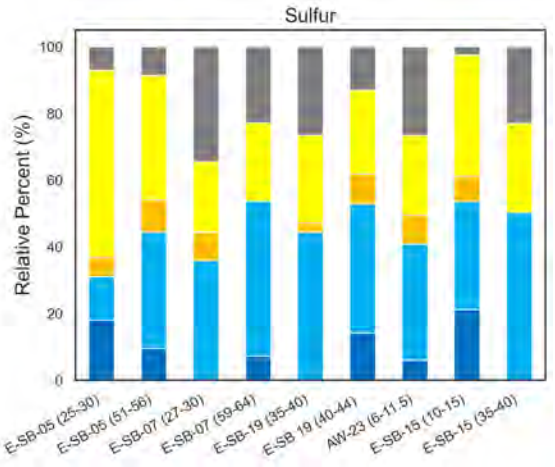
Client Name
Ramboll Americas Engineering Solutions, Inc.

Date
02/08/2024









Notes:

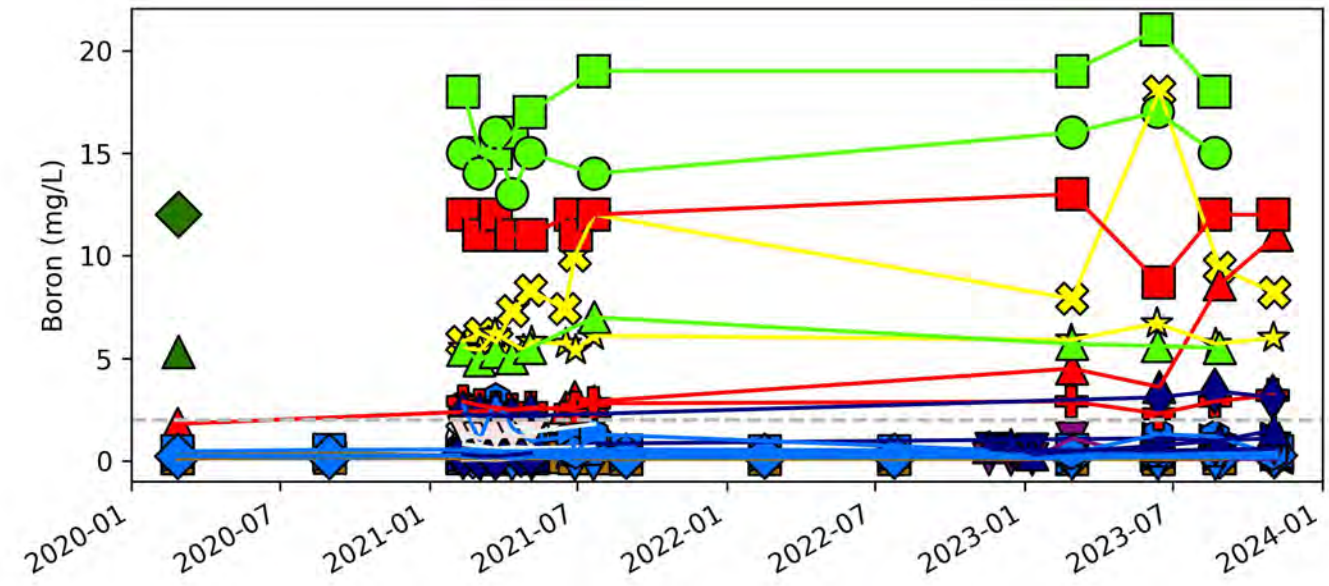
-SEP results from SGS (2023) analysis.
-Non-detects are removed from the analysis.
-The percentages for each individual fraction may not sum to 100 due to results below the reporting limit and rounding.

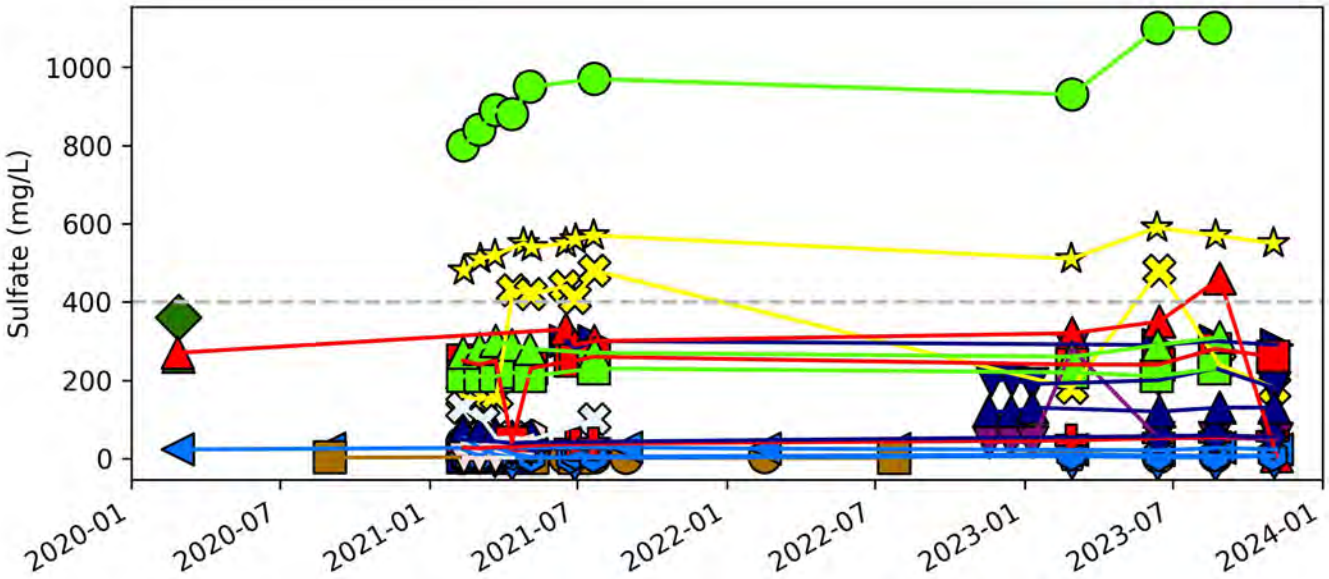
SEP Fraction

- Water Soluble Metals
- Exchangeable Metals
- Metals Bound to Carbonates
- Metals Bound to Fe and Mn Oxides
- Metals Bound to Organics
- Residual

LIFECYCLEGEO

Title: Edwards Ash Pond 2023 SEP results			
Project Name: Edwards - Ash Pond Evaluation		Project Number: [23RAM01-1] Vistra CCR	Figure: 4-2b
Client Name: Ramboll Americas Engineering Solutions, Inc.		Date: 02/08/2024	





AP05S, AP05D, AP07S, AP07D, AP08, AP09, APW-01, APW-02, APW-03, APW-04, AW-01, AW-05, AW-06, AW-08, AW-09, AW-10, AW-11, AW-12, AW-13, AW-14, AW-15, AW-15C, AW-15S, AW-16, AW-17, AW-18, AW-19, AW-20, AW-21, AW-22, AW-23, EMW-05, P002, XPW01A, XPW02, XPW03

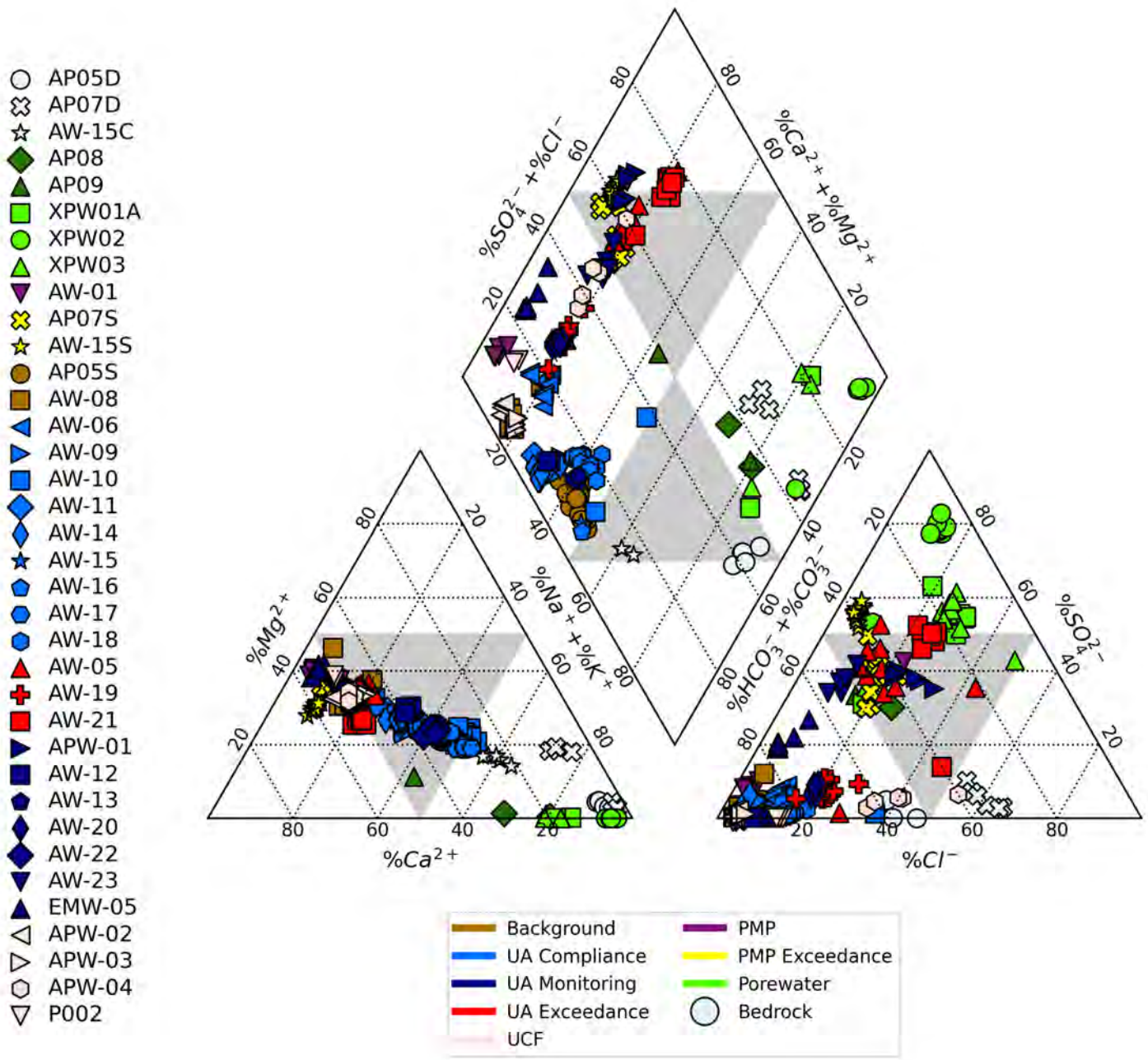
Background, UA Compliance, UA Monitoring, UA Exceedance, UCF, PMP, PMP Exceedance, Porewater, Pond, Bedrock, GWPS

Notes:

- Gray symbols indicate BCU samples

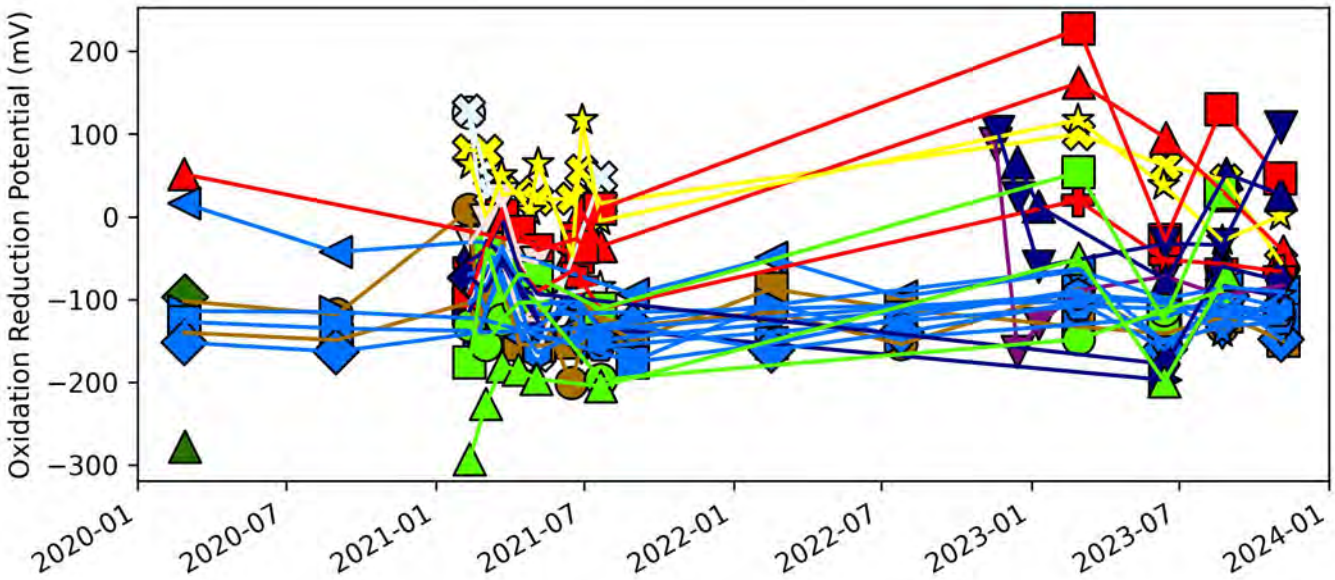
LIFECYCLEGEO

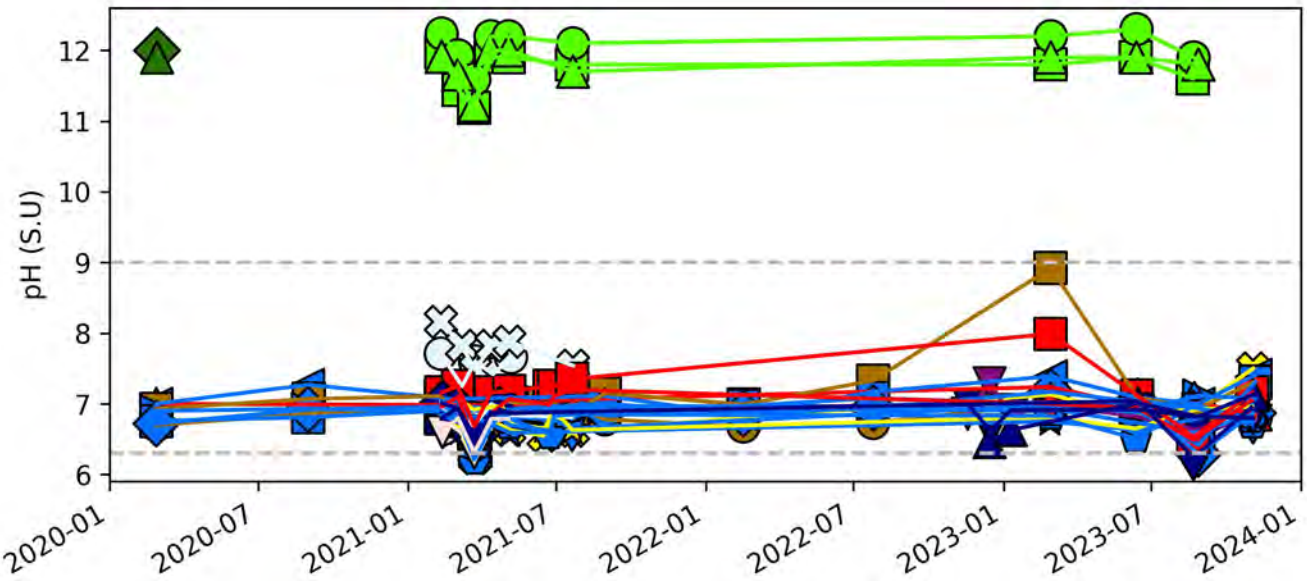
Title: Edwards Ash Pond Sulfate and Boron Time Series			
Project Name: Edwards - Ash Pond Evaluation		Project Number: [23RAM01-1] Vistra CCR	Figure: 5-1
Client Name: Ramboll Americas Engineering Solutions, Inc.		Date: 02/07/2024	



Notes:
- Gray symbols indicate BCU samples

LIFECYCLEGEO	Title: Edwards Ash Pond Piper Diagram		
	Project Name: Edwards - Ash Pond Evaluation	Project Number: [23RAM01-1] Vistra CCR	Figure: 5-2
	Client Name: Ramboll Americas Engineering Solutions, Inc.	Date: 02/08/2024	





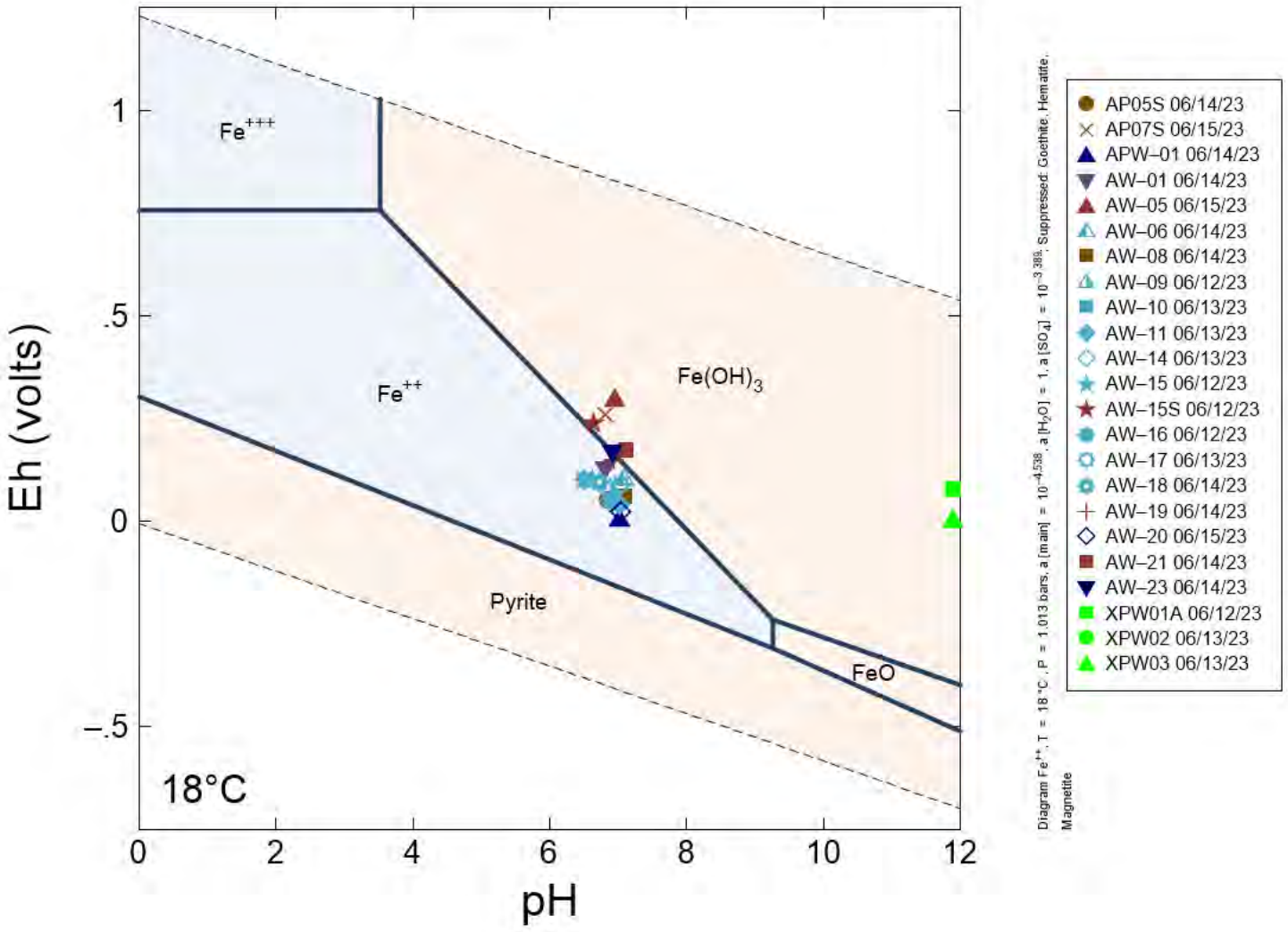
AP05S
AP05D
AP07S
AP07D
AP08
AP09
APW-01
APW-02
APW-03
APW-04
AW-01
AW-05
AW-06
AW-08
AW-09
AW-10
AW-11
AW-12
AW-13
AW-14
AW-15
AW-15C
AW-15S
AW-16
AW-17
AW-18
AW-19
AW-20
AW-21
AW-22
AW-23
EMW-05
P002
XPW01A
XPW02
XPW03

Background
UA Compliance
UA Monitoring
UA Exceedance
UCF
PMP
PMP Exceedance
Porewater
Pond
Bedrock
GWPS

Notes:
- Gray symbols indicate BCU samples

LIFECYCLEGEO

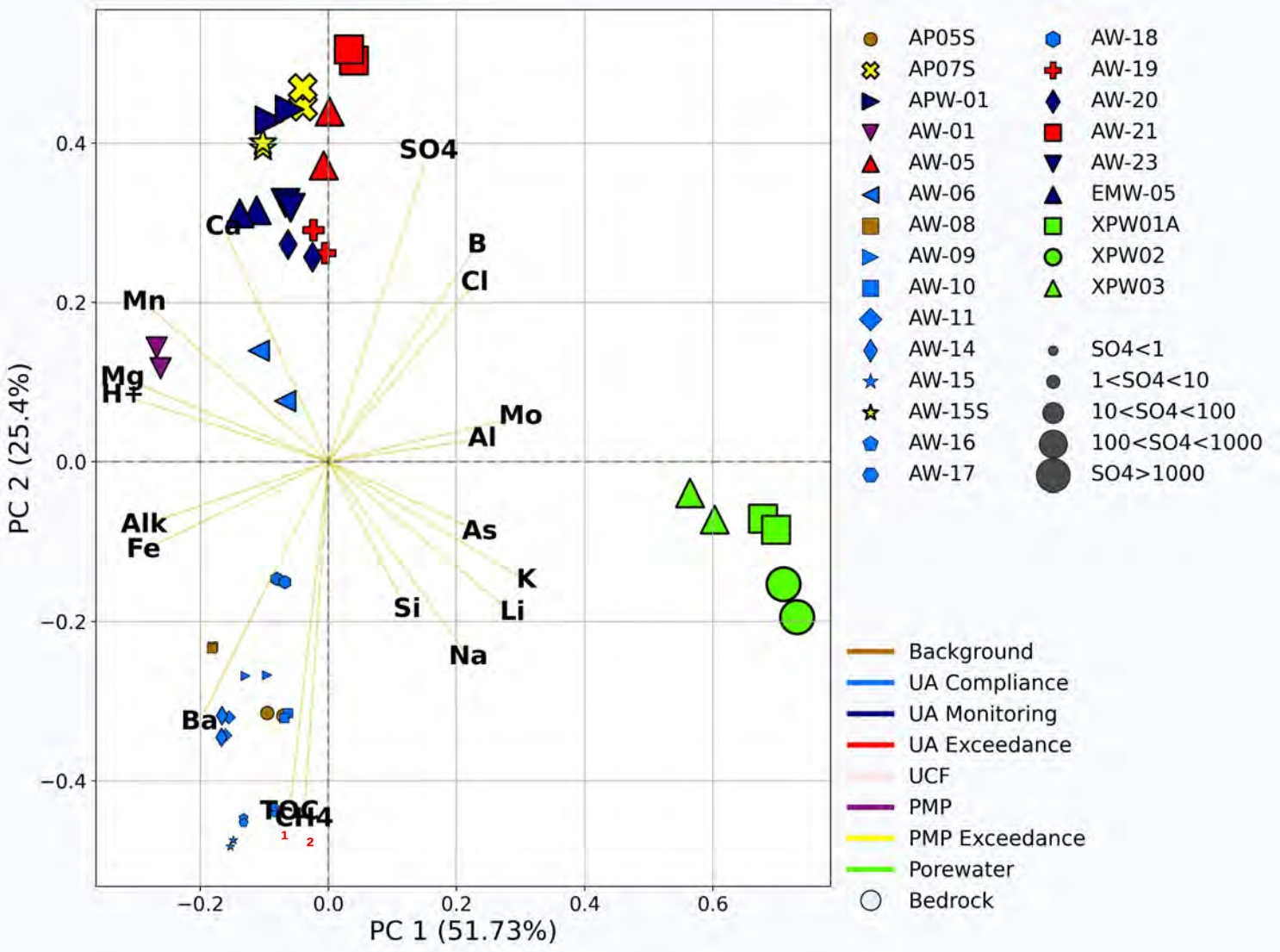
Title: Edwards Ash Pond Oxidation Reduction Potential and pH Time Series		
Project Name: Edwards - Ash Pond Evaluation	Project Number: [23RAM01-1] Vistra CCR	Figure: 5-3
Client Name: Ramboll Americas Engineering Solutions, Inc.	Date: 02/08/2024	



Notes:

- Data from June 2023
- Plot produced using average of measured groundwater temperatures

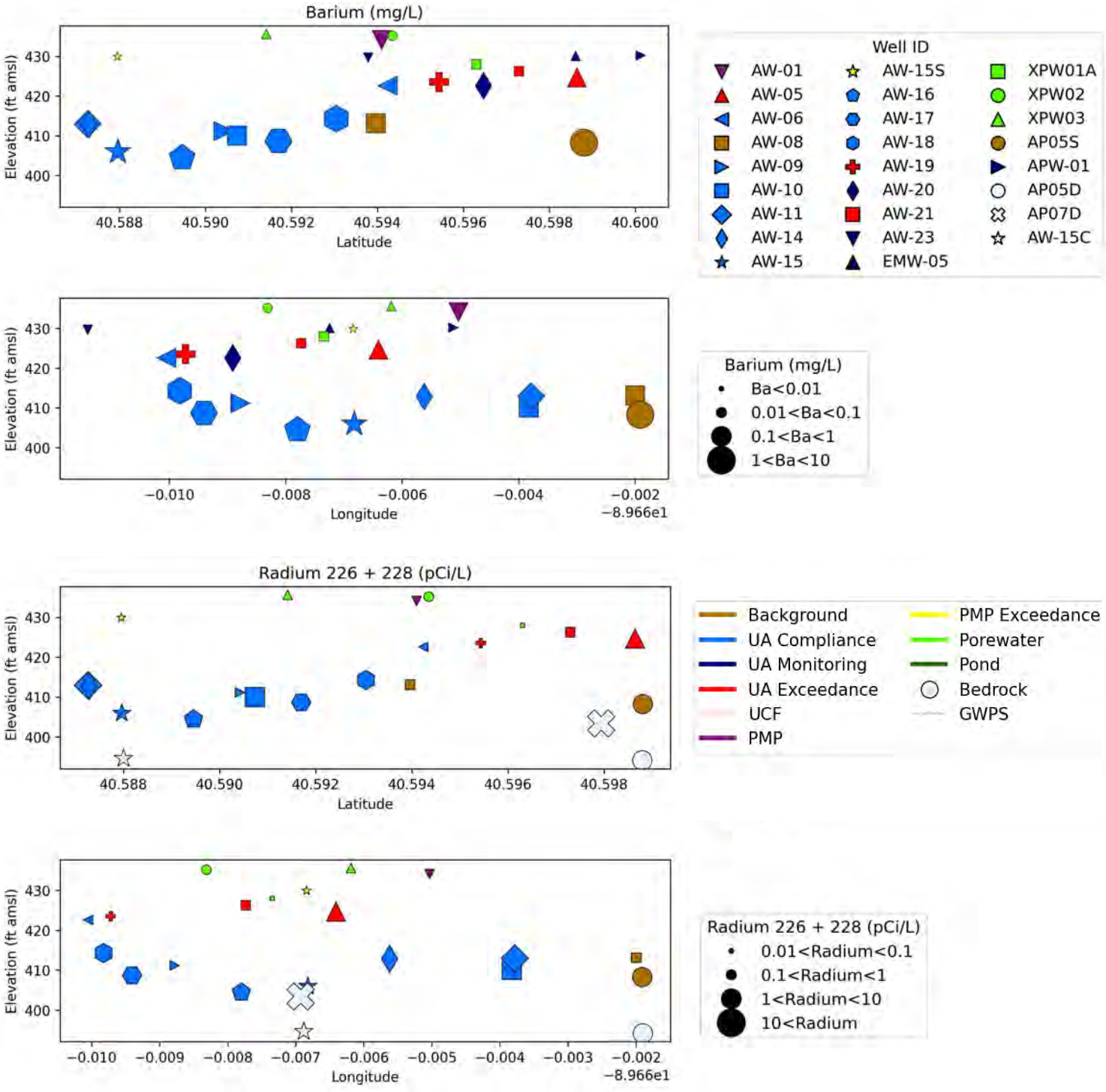
LIFECYCLEGEO	Title: Edwards Ash Pond Pourbaix Diagram		
	Project Name: Edwards - Ash Pond Evaluation	Project Number: [23RAM01-1] Vistra CCR	Figure: 5-4
	Client Name: Ramboll Americas Engineering Solutions, Inc.	Date: 02/08/2024	



Notes:

- Data from June and August 2023.
- See abbreviation list for full analyte names.
- [1] TOC vector
- [2] CH4 vector

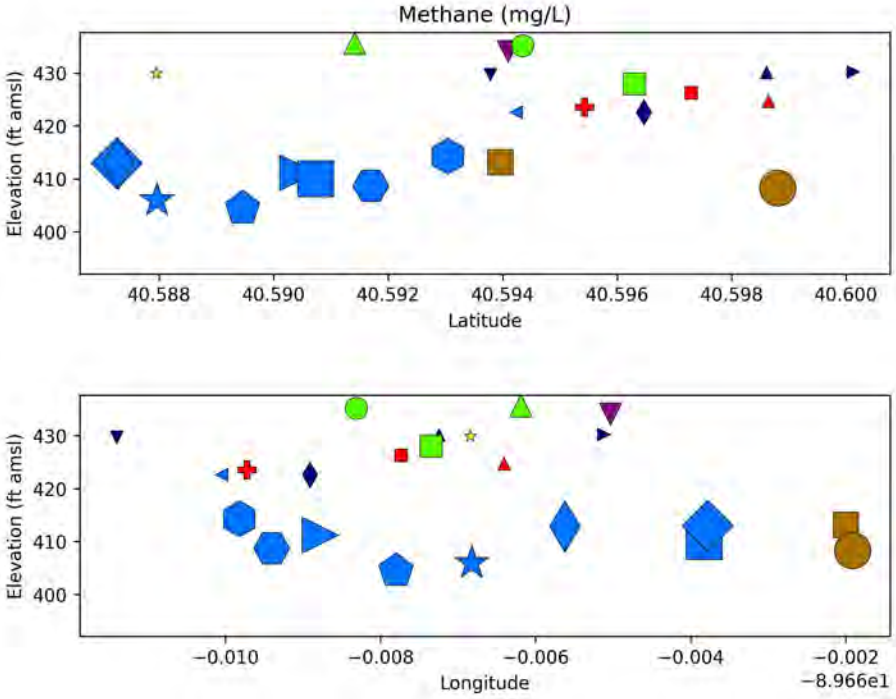
LIFECYCLEGEO	Title: Edwards Ash Pond Principal Component Analysis		
	Project Name: Edwards - Ash Pond Evaluation	Project Number: [23RAM01-1] Vistra CCR	Figure: 5-5
	Client Name: Ramboll Americas Engineering Solutions, Inc.	Date: 02/08/2024	



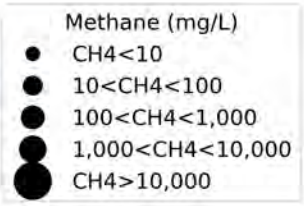
Notes:

- BCU data from May 2021
- All other data from June 2023
- Gray symbols indicate BCU samples
- Depth measurements referenced to North American Vertical Datum of 1988 (NAVD88)

LIFECYCLEGEO	Title: Edwards Ash Pond Barium and Radium 226+228		
	Project Name: Edwards - Ash Pond Evaluation	Project Number: [23RAM01-1] Vistra CCR	Figure: 5-6
	Client Name: Ramboll Americas Engineering Solutions, Inc.	Date: 02/08/2024	

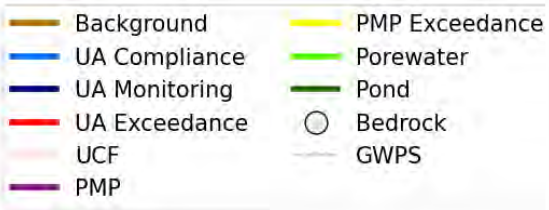






Notes:

- Data from June 2023
- Depth measurements referenced to North American Vertical Datum of 1988 (NAVD88)



LIFECYCLEGEO

Title: Edwards Ash Pond Methane by Depth and Location

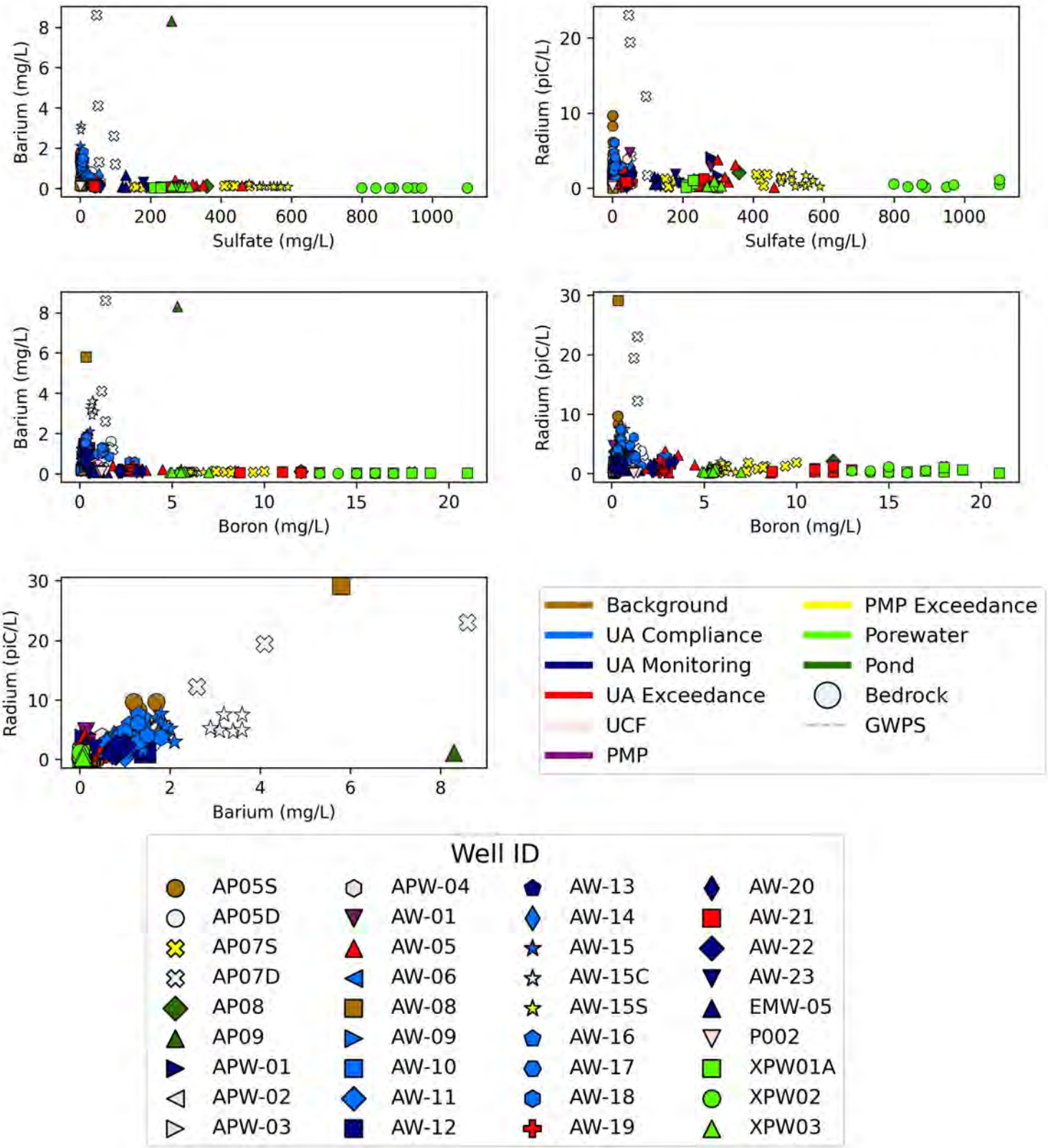
Project Name: Edwards - Ash Pond Evaluation

Project Number: [23RAM01-1] Vistra CCR

Figure: 5-7

Client Name: Ramboll Americas Engineering Solutions, Inc.

Date: 02/08/2024



Notes:

- Data from 2020 through November 2023
- Radium is Radium 226 + 228
- Gray symbols indicate BCU samples

LIFECYCLEGEO

Title: Edwards Ash Pond Boron, Sulfate, Barium, Radium Scatterplots			
Project Name: Edwards - Ash Pond Evaluation		Project Number: [23RAM01-1] Vistra CCR	Figure: 5-8
Client Name: Ramboll Americas Engineering Solutions, Inc.		Date: 02/08/2024	

ATTACHMENT 1

Monitored Natural Attenuation Field Investigation Status Update, Ash Pond (CCR Unit 301) Edwards Power Plant, Peoria County, Illinois

TECHNICAL MEMORANDUM

DATE March 1, 2022

TO David Mitchell, Stu Cravens, Vic Modeer
Illinois Power Resources Generating, LLC

CC Brian Hennings - Ramboll

FROM Jeffrey Ingram, Patrick J. Behling - Golder Associates USA Inc

EMAIL JIngram@golder.com

MONITORED NATURAL ATTENUATION FIELD INVESTIGATION STATUS UPDATE, EDWARDS ASH POND (CCR UNIT 301) EDWARDS POWER PLANT, PEORIA COUNTY, ILLINOIS

1.0 INTRODUCTION AND BACKGROUND

The following Technical Memorandum summarizes the results received from the Monitored Natural Attenuation (MNA) Field Investigation completed by Golder Associates USA Inc (Golder) for the Edwards Ash Pond (EAP or Site) located at the Edwards Power Plant (EPP) operated by Illinois Power Resources Generating, LLC (IPRG) in Peoria County, Illinois. Data collected as a part of this investigation will be an integral part of the MNA Feasibility Demonstration for the EAP and will be used for IPRG's Illinois Part 845 Coal Combustion Residual (CCR) compliance program. A Site plan showing the EAP, existing Part 845 monitoring wells, and the MNA boring locations is provided in **Figure 1**.

This memorandum only includes laboratory analytical data that has been received to date. Once the desorption and leachability data are received and reviewed, Golder will update this memorandum.

2.0 PROJECT SCOPE OF WORK

As part of the MNA Feasibility Demonstration, Golder completed the following activities as part of this Field Investigation:

- Screened for potential underground utilities in the vicinity of the proposed borings prior to completing any drilling or ground disturbance activities.
- Advanced a total of six (6) soil borings ranging in depth from 40 to 64 feet below ground surface (ft bgs).
- Collected ten (10) soil samples from six (6) soil borings.
- Collected groundwater samples from four (4) existing monitoring wells.

NOTE: MEMORANDUM WAS PROVIDED IN DRAFT, NO FINAL VERSION WAS COMPLETED. INFORMATION WITHIN BODY AND BORING LOGS ARE UNSIGNED BUT SIGNIFICANT CHANGES ARE UNLIKELY. LABORATORY REPORTS ARE SIGNED, AND THEREFORE CONSIDERED FINAL.

3.0 FIELD INVESTIGATION

3.1 Private Utility Locate

Prior to conducting any work onsite, Golder reviewed Site plans/drawings provided by IPGC and/or Site representatives and met with Site representatives to assist in identifying underground utility locations in the vicinity of the proposed borings. Golder also sub-contracted with GPRS to provide ground penetrating radar (GPR) and electromagnetic (EM) tracing services to screen the proposed boring locations in the field. All boring locations were cleared by GPRS personnel before drilling commenced.

3.2 Drilling and Aquifer Solids Testing

Drilling was completed by Cascade Environmental Drilling using a roto-sonic drill rig under direct supervision of a Golder Geologist. Continuous soil core samples were obtained at each borehole location and were logged in the field by Golder personnel. Soils were classified according to the Unified Soil Classification System (USCS) and in accordance with the standard Golder Soil Logging Technical Procedure.

During the field investigation, six (6) soil borings were advanced at the locations shown on **Figure 1**. Soil boring logs are provided in **Appendix A**. The following units were encountered during the field investigation (Ramboll, 2021):

- Potential Migration Pathway – This zone is made up of the Upper Cahokia Formation and is generally low permeability silts and clays with varying degrees of saturation on site. The contact between the potential migration pathway and uppermost aquifer ranges from 419 feet above mean sea level (ft msl) to 428 ft msl in the borings completed for this investigation. Samples from this unit are shown in **Table 1**.
- Uppermost Aquifer – This thin (generally less than 4 feet thick) zone is made up of material of the Lower Cahokia Formation, consisting of moderately permeable silts and clays with occasional sand and gravel. Since the moderately permeable materials are not present throughout the entirety of site, the uppermost aquifer is interpreted to directly overlie bedrock in those areas. The contact for the uppermost aquifer and bedrock unit ranges from 404 ft msl to 425 ft msl in the borings completed for this investigation. Samples from this unit are shown in **Table 1**.
- Bedrock Confining Unit – This unit consists of low permeability shales and siltstones of the Carbondale and Modesto Formations. The majority of borings were terminated in bedrock, therefore, evaluation of the full thickness of the unit was not completed as part of this investigation. Samples from this unit are shown in **Table 1**.

Ten (10) soil samples were collected for laboratory analysis from the soil borings (see **Figure 1** for sample location). Details regarding collected samples are included in **Table 1**.

Table 1: Laboratory Sample Locations and Intervals

Borehole ID	Sample ID	Sample Depth (ft bgs)	Soil Type / Geologic Unit Sampled
E-SB-05	E-SB-05 (30.0 – 33.5)	30.0 – 33.5	Silty Clay / Uppermost Aquifer

Borehole ID	Sample ID	Sample Depth (ft bgs)	Soil Type / Geologic Unit Sampled
	E-SB-05 (51.0 – 56.0)	51.0 – 56.0	Siltstone / Bedrock Confining Unit
E-SB-07	E-SB-07 (21.0 – 27.0)	21.0 – 27.0	Clayey Sand / Uppermost Aquifer
	E-SB-07 (40.0 – 45.0)	40.0 – 45.0	Shale / Bedrock Confining Unit
	E-SB-07 (59.0 – 64.0)	59.0 – 64.0	Siltstone / Bedrock Confining Unit
E-SB-15	E-SB-15 (10.0 – 15.0)	10.0 – 15.0	Silty Clay / Potential Migration Pathway
	E-SB-15 (30.0 – 35.0)	30.0 – 35.0	Silty Clay / Uppermost Aquifer
E-SB-18	E-SB-18 (40.0 – 44.0)	40.0 – 44.0	Silty Clay / Uppermost Aquifer
E-SB-19	E-SB-19 (35.0 – 40.0)	35.0 – 40.0	Silty Clay / Uppermost Aquifer
E-SB-XPW01	E-SB-XPW01 (25.0 – 30.0)	25.0 – 30.0	CCR

Notes
1) ft bgs – feet below ground surface.
2) CCR – Coal Combustion Residuals.

3.2.1 Soil Laboratory Analysis

Soil samples collected during the field investigation were placed in clean containers and properly labeled with sample location, depth, project name, sampler initials, analyses to be performed, date, and time of collection. Sample information was logged on a chain of custody (COC) and shipped to the following laboratories analysis:

- Eurofins TestAmerica for 7 Step Sequential Extraction;
- SiREM for the Batch Testing, Total Metals, Rietveld X-Ray Diffraction (XRD), leachability, Cation Exchange Capacity (CEC), and Total Organic Carbon (TOC) analyses.

The following laboratory analyses were conducted for each soil sample:

- 6010B 7-step sequential extraction (Aluminum, Arsenic, Barium, Boron, Calcium, Cobalt, Iron, Lead, Lithium, Manganese, Molybdenum, Selenium);

- EPA 6010B for Total Metals (Aluminum, Arsenic, Barium, Boron, Calcium, Cobalt, Iron, Lead, Lithium, Manganese, Molybdenum, Selenium);
- Bulk Mineralogy by Reitveld XRD Analysis;
- Cation Exchange Capacity (CEC) Analysis;
- Total Organic Carbon Analysis; and,
- SPLP Method 1312 Leachability Test (for CCR source samples only).

Available results from this analysis are provided in **Attachments B – E**. Results for the leachability and desorption testing have not yet been received and are not included in this Technical Memorandum.

3.2.2 Borehole Survey

On September 23, 2021, IngenAE completed a survey of the boring locations including the longitude/latitude of and elevation of each borehole location. Survey information is included in the boring logs in **Appendix F**.

3.3 Groundwater Sampling

Groundwater sampling was completed by Golder personnel concurrently with drilling activities. Four (4) previously existing monitoring wells were sampled (see **Figure 1** for sample locations). Groundwater sample collection locations for the MNA evaluation are included in **Table 2**.

Table 2: Groundwater Sample Locations

Well ID	Adjacent Borehole Sample
AP-05S (background)	E-SB-05 (30.0 – 33.5)
AW-15S	E-SB-15 (10.0 – 15.0)
AW-15	E-SB-15 (30.0 – 35.0)
AW-19	E-SB-19 (35.0 – 40.0)

3.3.1 Groundwater Sample Laboratory Analysis

Groundwater samples collected during the field investigation were placed in clean containers and properly labeled with well ID, project name, sampler initials, analyses to be performed, date, and time of collection. Sample information was logged on a chain of custody (COC) and shipped to SiREM Laboratories to be included in batch testing analysis along with soil samples collected at adjacent boreholes. Groundwater sampling results are provided in **Appendix G**. Batch testing results are included in **Appendix H**.

4.0 CLOSING

Golder appreciates the opportunity to serve as your consultant on this project. If you have any questions concerning this technical memorandum or need additional information, please contact the undersigned.

Golder Associates USA Inc.

UNSIGNED DRAFT

Jeffrey Ingram
Senior Consultant, Geologist

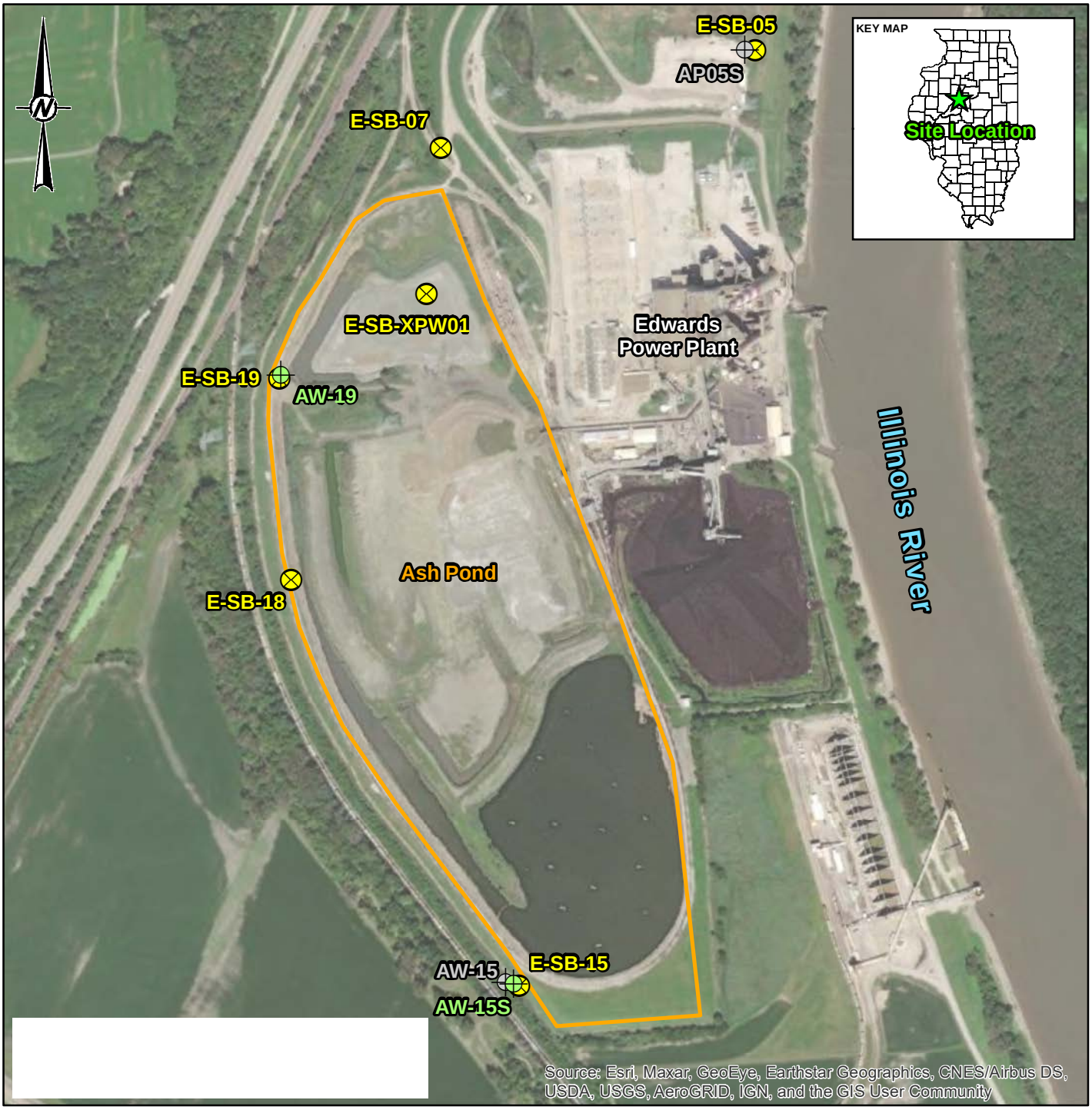
UNSIGNED DRAFT

Patrick J. Behling
Practice Leader

BTT/JSI/PJB

Attachments: Figure 1 – Edwards Power Plant Monitored Natural Attenuation Boring and Groundwater Sample Locations
Appendix A - Soil Boring Logs
Appendix B - Eurofins TestAmerica Laboratory Data
Appendix C - Bulk Mineralogy by Rietveld XRD Analysis
Appendix D - Cation Exchange Capacity Analysis
Appendix E - SGS Soil Analysis
Appendix F - Borehole Survey
Appendix G - Groundwater Sampling Results
Appendix H - Batch Testing Results

Figures



LEGEND

- Ash Pond
- MNA Soil Boring Location
- Groundwater Sampling Location - Part 845 Well With Potential Exceedances
- Groundwater Sampling Location - Part 845 Well With No Potential Exceedances

0 2,000 Feet

REFERENCE(S)

1. RAMBOLL 2021, TABLE 2 SUMMARY OF POTENTIAL EXCEEDANCES.
2. RAMBOLL 2021, GROUNDWATER MONITORING PLAN, ASH POND, EDWARDS POWER PLANT, BARTONVILLE, ILLINOIS.

NOTE(S)

1. SOIL BORING LOCATIONS SURVEYED BY INGENAE ON SEPTEMBER 23, 2021.

CLIENT
ILLINOIS POWER RESOURCES GENERATING, LLC.

PROJECT
EDWARDS POWER PLANT MNA FEASABILITY STUDY

TITLE
EDWARDS POWER PLANT MONITORED NATURAL ATTENUATION BORING AND GROUNDWATER SAMPLE LOCATIONS

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-02-21
DESIGNED	BTT
PREPARED	BTT
REVIEWED	GTM
APPROVED	PJB

PROJECT NO.	PHASE	REV.	FIGURE
21454831	0002	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

PATH: C:\Users\BTalbert\Golder Associates\21454831 Vistra IL MNA Part 845 Support - Project Files\5 Technical Work\Phase2 - Edwards\2-10-Figures\Report Figures\Edwards - Soil_GW_Sample_Locations.mxd PRINTED ON: 2022-02-23 AT: 7:38:49 AM

APPENDIX A

Soil Boring Logs

RECORD OF BOREHOLE E-SB-05

PROJECT: Part 845 MNA Evaluation
PROJECT NUMBER: 21454831.0002
LOCATION: Edwards Power Plant

DRILLING METHOD: 6" Sonic
DRILLING DATE: 8/30/2021
DRILL RIG: Terra Sonic 150CC

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,432,419.27 E: 2,436,748.91

ELEVATION: 440.98
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
0	6 Sonic	(0.0-10.0) (CL) SILTY CLAY, medium plasticity fines, some fine poorly graded sub-rounded sand, trace organics (roots); dusky brown (5YR 2/2); cohesive, w~PL, stiff.	ML			1	SO	7.0 / 10.0	(0.0) Run #1, Poor recovery due to material falling out of core barrel during recovery.
5		(7.0) Same As Above (SAA) except, no organics (roots) dark yellowish brown (10YR 4/2).			434.0 / 7.0				
10	6 Sonic	(10.0-12.0) (ML) CLAYEY SILT, non-plastic to low plasticity fines, trace fine sub-rounded sand; light olive gray (5YR 5.2); cohesive, w<PL, firm.	ML		431.0 / 10.0	2	SO	10.0 / 10.0	
15		(12.0-30.0) (CL) SILTY CLAY, low to medium plasticity fines, trace fine sub-rounded sand; light olive gray (5Y 5/2) with light brown (5YR 6/4) mottling; cohesive, w~PL, soft.	CL		429.0 / 12.0				
20	6 Sonic					3	SO	10.0 / 10.0	
25		(28.0) SAA except, firm.			413.0 / 28.0				
30		Log continued on next page			411.0				

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon

LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

WSP GOLDER

GOLDER STL RECORD OF BOREHOLE MWD NEWTON.GPJ GLDR_CO.GDT 2/21/22

RECORD OF BOREHOLE E-SB-05

PROJECT: Part 845 MNA Evaluation
PROJECT NUMBER: 21454831.0002
LOCATION: Edwards Power Plant

DRILLING METHOD: 6" Sonic
DRILLING DATE: 8/30/2021
DRILL RIG: Terra Sonic 150CC

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,432,419.27 E: 2,436,748.91

ELEVATION: 440.98
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC ATT	REMARKS
30	6 Sonic	(12.0-30.0) (CL) SILTY CLAY, low to medium plasticity fines, trace fine sub-rounded sand; light olive gray (5Y 5/2) with light brown (5YR 6/4) mottling; cohesive, w~PL, soft. *(Continued)* (30.0) SAA except, trace fine sub-rounded sand.	CL		30.0 407.5				(30.0-35.0) Silty clay sample collected at 16:50 - 8/30/2021.
		(33.5-60.0) Highly weathered (W4), thickly bedded to very thickly bedded, medium light gray (N6), fine, non-porous to faintly porous, weak rock (R2), SILTSTONE [CARBONDALE FORMATION].			33.5				
35						4	SO	10.0 10.0	
40									
45						5	SO	10.0 10.0	
50									(51.0-56.0) Siltstone sample collected at 17:20 - 8/30/2021.
55						6	SO	10.0 10.0	
60					381.0				

Log continued on next page

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon

LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

WSP GOLDER

RECORD OF BOREHOLE E-SB-05

PROJECT: Part 845 MNA Evaluation
PROJECT NUMBER: 21454831.0002
LOCATION: Edwards Power Plant
DRILLING METHOD: 6" Sonic
DRILLING DATE: 8/30/2021
DRILL RIG: Terra Sonic 150CC
DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,432,419.27 E: 2,436,748.91
ELEVATION: 440.98
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
60		END OF BORING AT 60.0 FEET BELOW GROUND SURFACE.			60.0				
65									
70									
75									
80									
85									
90									

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon
LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

GOLDER STL RECORD OF BOREHOLE MWD NEWTON.GPJ GLDR_CO.GDT 2/21/22

RECORD OF BOREHOLE E-SB-07

PROJECT: Part 845 MNA Evaluation
PROJECT NUMBER: 21454831.0002
LOCATION: Edwards Power Plant

DRILLING METHOD: 6" Sonic
DRILLING DATE: 8/30/2021
DRILL RIG: Terra Sonic 150CC

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,432,098.87 E: 2,435,352.83

ELEVATION: 458.40
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
0	6 Sonic	(0.0-3.0) (GW) FILL, sandy GRAVEL, fine to coarse well graded sub-angular to sub-rounded gravel, fine to coarse sub-angular to sub-rounded sand; grayish orange pink (5YR 7/2) and white (N9); non-cohesive, dry, very loose.	GW		455.4 3.0				
		(3.0-10.0) (CL) sandy SILTY CLAY, low to medium plasticity fines, fine poorly graded sub-rounded sand; dusky yellowish brown (10YR 2/2); cohesive, w~PL, stiff.							
5		(5.0) Same As Above (SAA) except, dark yellowish brown (10YR 4/2), firm.	CL		453.4 5.0	1	SO	8.0 10.0	
10		(10.0-21.0) (CL) SILTY CLAY, low to medium plasticity fines, some fine poorly graded sub-rounded sand; dark yellowish brown (10YR 4/2); cohesive, w~PL, firm.			448.4 10.0				
15						2	SO	10.0 10.0	
20	6 Sonic				437.4				
		(21.0-27.0) (SC) CLAYEY SAND, fine poorly graded sub-rounded sand, low to medium plasticity fines; moderate olive brown (5Y 4/4); non-cohesive, moist, compact.	SC		21.0				(21.0-27.0) Clayey sand sample collected at 13:20 - 8/30/2021.
25						3	SO	20.0 20.0	
		(27.0-37.0) (CL) sandy SILTY CLAY, low to medium plasticity fines, fine poorly graded sub-rounded sand; moderate olive brown (5Y 4/4); cohesive, w~PL, firm.			431.4 27.0				
30			CL						

Log continued on next page

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon

LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

WSP GOLDER

GOLDER STL RECORD OF BOREHOLE MWD NEWTON.GPJ GLDR_CO.GDT 2/21/22

RECORD OF BOREHOLE E-SB-07

PROJECT: Part 845 MNA Evaluation
PROJECT NUMBER: 21454831.0002
LOCATION: Edwards Power Plant
DRILLING METHOD: 6" Sonic
DRILLING DATE: 8/30/2021
DRILL RIG: Terra Sonic 150CC
DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,432,098.87 E: 2,435,352.83
ELEVATION: 458.40
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
30	6 Sonic	(27.0-37.0) (CL) sandy SILTY CLAY, low to medium plasticity fines, fine poorly graded sub-rounded sand; moderate olive brown (5Y 4/4); cohesive, w~PL, firm. *(Continued)*	CL		421.4	3	SO	20.0 / 20.0	
35		(37.0-40.0) Moderately weathered (W3), thickly bedded to very thickly bedded, pale yellowish brown (10YR 6/2) to dark yellowish orange (10YR 6/6), fine grained, non-porous to faintly porous, weak rock (R2), SILTSTONE [CARBONDALE FORMATION].			37.0 418.4				
40	6 Sonic	(40.0-49.0) Moderately weathered (W3), thinly laminated to laminated, medium light gray (N6), very fine grained, non-porous to faintly porous, weak rock (R2), SHALE [CARBONDALE FORMATION].			40.0 409.4	4	SO	10.0 / 10.0	(40.0-45.0) Shale sample collected at 14:05 - 8/30/2021.
45		(49.0-64.0) Highly weathered (W4), thickly bedded to very thickly bedded, medium light gray (N6), fine, non-porous to faintly porous, weak rock (R2), SILTSTONE [CARBONDALE FORMATION].			49.0				
50	6 Sonic	(52.0) SAA except, moderately weathered (W3).			406.4 52.0	5	SO	5.0 / 5.0	
55	6 Sonic	(55.0) SAA except, light gray (N7)			403.4 55.0	6	SO	9.0 / 9.0	(59.0-64.0) Siltstone sample collected at 14:45 - 8/30/2021.
60		Log continued on next page							

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon
LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

WSP GOLDER

GOLDER STL RECORD OF BOREHOLE MWD NEWTON.GPJ GLDR_CO.GDT 2/21/22

RECORD OF BOREHOLE E-SB-07

PROJECT: Part 845 MNA Evaluation
PROJECT NUMBER: 21454831.0002
LOCATION: Edwards Power Plant

DRILLING METHOD: 6" Sonic
DRILLING DATE: 8/30/2021
DRILL RIG: Terra Sonic 150CC

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,432,098.87 E: 2,435,352.83

ELEVATION: 458.40
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
60	6 Sonic	(49.0-64.0) Highly weathered (W4), thickly bedded to very thickly bedded, medium light gray (N6), fine, non-porous to faintly porous, weak rock (R2), SILTSTONE [CARBONDALE FORMATION]. *(Continued)*				6	SO	9.0 / 9.0	
					394.4				
		END OF BORING AT 64.0 FEET BELOW GROUND SURFACE.			64.0				
65									
70									
75									
80									
85									
90									

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon

LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

WSP GOLDER

GOLDER STL RECORD OF BOREHOLE MWD NEWTON.GPJ GLDR_CO.GDT 2/21/22

RECORD OF BOREHOLE E-SB-15

PROJECT: Part 845 MNA Evaluation
PROJECT NUMBER: 21454831.0002
LOCATION: Edwards Power Plant

DRILLING METHOD: 6" Sonic
DRILLING DATE: 8/31/2021
DRILL RIG: Terra Sonic 150CC

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,428,434.09 E: 2,435,420.64

ELEVATION: 439.08
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
0	6 Sonic	(0.0-20.0) (CL) SILTY CLAY, low to medium plasticity fines, trace fine sub-rounded sand; dusky yellowish brown (10YR 2/2) with light brown (5YR 5/6) mottling; cohesive, w~PL, stiff.	CL		429.1	1	SO	10.0 / 10.0	(10.0-15.0) Silty clay sample collected at 15:40 - 8/31/2021.
10	6 Sonic	(10.0) Same As Above (SAA) except, medium dark gray (N4).			10.0	2	SO	10.0 / 10.0	
20	6 Sonic	(20.0-30.0) (CL) sandy SILTY CLAY, low to medium plasticity fines, fine poorly graded sub-rounded sand; light olive gray (5Y 5/2); cohesive, w~PL, soft.	CL		419.1 20.0	3	SO	10.0 / 10.0	
30		Log continued on next page			409.1				

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon

LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

WSP GOLDER

GOLDER STL RECORD OF BOREHOLE MWD NEWTON.GPJ GLDR_CO.GDT 2/21/22

RECORD OF BOREHOLE E-SB-15

PROJECT: Part 845 MNA Evaluation
PROJECT NUMBER: 21454831.0002
LOCATION: Edwards Power Plant

DRILLING METHOD: 6" Sonic
DRILLING DATE: 8/31/2021
DRILL RIG: Terra Sonic 150CC

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,428,434.09 E: 2,435,420.64

ELEVATION: 439.08
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
30	6 Sonic	(30.0-35.0) (CL) SILTY CLAY, medium plasticity fines, trace fine sub-rounded sand; medium light gray (N6); cohesive, w>PL, firm.	CL		30.0				(30.0-35.0) Silty clay sample collected at 16:20 - 8/31/2021.
35		(35.0-40.0) Highly weathered (W4), thinly laminated to laminated, medium light gray (N6), very fine, non-porous to faintly porous, weak rock (R2), SHALE [CARBONDALE FORMATION].			404.1 35.0	4	SO	10.0 10.0	
40		END OF BORING AT 40.0 FEET BELOW GROUND SURFACE.			399.1 40.0				
45									
50									
55									
60									

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon

LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

WSP GOLDER

GOLDER STL RECORD OF BOREHOLE MWD NEWTON.GPJ GLDR_CO.GDT 2/21/22

RECORD OF BOREHOLE E-SB-18

SHEET 1 of 2

PROJECT: Part 845 MNA Evaluation
PROJECT NUMBER: 21454831.0002
LOCATION: Edwards Power Plant

DRILLING METHOD: 6" Sonic
DRILLING DATE: 8/31/2021
DRILL RIG: Terra Sonic 150CC

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,430,269.65 E: 2,434,564.52

ELEVATION: 459.99
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
0	6 Sonic	(0.0-1.0) FILL - (SP) SAND, fine poorly graded sub-rounded sand, some fine to coarse well graded sub-rounded gravel, trace non-plastic fines; medium brown (5YR 4/4); non-cohesive, dry, loose.	SP		459.0 / 1.0				
		(1.0-7.1) CCR - (ML) SILT, non-plastic fines, some fine poorly graded sub-rounded sand, trace fine sub-rounded gravel; dark gray (N3), ASH; non-cohesive, dry, loose.	ML						
5						1	SO	8.0 / 10.0	
					452.9 / 7.1				
		(7.1-32.0) (CL) SILTY CLAY, low to medium plasticity fines, trace fine sub-rounded sand, trace fine sub-rounded gravel, trace organics (roots and shells); moderate brown (5YR 4/4) with light brown (5YR 5/6) mottling; cohesive, w~PL, firm.							
10		(10.0) Same As Above (SAA) except, except no roots.			450.0 / 10.0				
15	6 Sonic		CL			2	SO	8.0 / 10.0	
20		(20.0) SAA except, light olive gray (5Y 5/2).			440.0 / 20.0				
25	6 Sonic					3	SO	10.0 / 10.0	
		(29.0) SAA except, no mottling.			431.0 / 29.0				
30		Log continued on next page							

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon

LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

WSP GOLDER

GOLDER STL RECORD OF BOREHOLE MWD NEWTON.GPJ GLDR_CO.GDT 2/21/22

RECORD OF BOREHOLE E-SB-18

PROJECT: Part 845 MNA Evaluation
PROJECT NUMBER: 21454831.0002
LOCATION: Edwards Power Plant

DRILLING METHOD: 6" Sonic
DRILLING DATE: 8/31/2021
DRILL RIG: Terra Sonic 150CC

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,430,269.65 E: 2,434,564.52

ELEVATION: 459.99
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
30	6 Sonic	(7.1-32.0) (CL) SILTY CLAY, low to medium plasticity fines, trace fine sub-rounded sand, trace fine sub-rounded gravel, trace organics (roots and shells); moderate brown (5YR 4/4) with light brown (5YR 5/6) mottling; cohesive, w~PL, firm. *(Continued)*	CL		428.0				
		(32.0-35.0) (ML) sandy CLAYEY SILT, non-plastic to low plasticity fines, fine poorly graded sub-rounded sand, trace fine gravel, trace organics (wood); light olive gray (5Y 5/2); cohesive, w<PL, very soft.	ML		32.0 425.0				
35		(35.0-44.0) (CL) SILTY CLAY, low to medium plasticity fines, trace fine sub-rounded sand; light olive gray (5Y 5/2); cohesive, w~PL, firm.	CL		35.0	4	SO	10.0 10.0	
40					416.0				(40.0-44.0) Silty clay sample collected at 11:45 - 8/31/2021.
	6 Sonic	(44.0-55.0) Moderately weathered (N3), thinly laminated to laminated, medium light gray (N6), very fine grained, non-porous to porous, weak rock (R2), SHALE [CARBONDALE FORMATION].			44.0	5	SO	15.0 15.0	
45									
50									
55					405.0				
		END OF BORING AT 55.0 FEET BELOW GROUND SURFACE.			55.0				
60									

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon

LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

WSP GOLDER

RECORD OF BOREHOLE E-SB-19

PROJECT: Part 845 MNA Evaluation
PROJECT NUMBER: 21454831.0002
LOCATION: Edwards Power Plant

DRILLING METHOD: 6" Sonic
DRILLING DATE: 8/31/2021
DRILL RIG: Terra Sonic 150CC

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,431,150.52 E: 2,434,576.77

ELEVATION: 458.41
INCLINATION: -90

DEPTH (feet)	BORING METHOD	DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	NUMBER	TYPE	REC / ATT	REMARKS
0	6 Sonic	(0.0-1.0) FILL - (SP) SAND, fine poorly graded sub-rounded sand, some fine to coarse well graded sub-rounded gravel, trace non-plastic fines; medium brown (5YR 4/4); non-cohesive, dry, loose.	SP		457.4 / 1.0				
		(1.0-7.0) CCR - (ML) SILTY SAND, fine poorly graded sub-rounded sand, non-plastic fines; dark gray (N3), ASH; non-cohesive, dry, loose.	ML						
5		(6.0) Same As Above (SAA) except, moist.			452.4 / 6.0	1	SO	10.0 / 10.0	
		(7.0-23.0) (CL) SILTY CLAY, low to medium plasticity fines, trace fine sub-rounded sand, trace fine sub-rounded gravel; light olive gray (5Y 5/2); cohesive, w~PL, stiff.			451.4 / 7.0				
10									
15			CL			2	SO	10.0 / 10.0	
20									(20.0) Run #3, Poor recovery due to material falling out of core barrel during recovery. Appears to be SAA.
					435.4				
25	6 Sonic	(23.0-27.5) (SC) CLAYEY SAND, fine poorly graded sub-rounded sand, low to medium plasticity fines, some fine sub-rounded gravel; dark brown (5Y 2/2); non-cohesive, moist, compact.	SC		23.0	3	SO	5.5 / 10.0	
					430.9				
		(27.5-35.0) (CL) SILTY CLAY, medium to high plasticity fines, trace fine sub-rounded sand, trace fine sub-rounded gravel; dusky yellowish brown (10YR 2/2); cohesive, w>PL, stiff.	CL		27.5				
30					428.4				

Log continued on next page

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon

LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

WSP GOLDER

GOLDER STL RECORD OF BOREHOLE MWD NEWTON.GPJ GLDR_CO.GDT 2/21/22

RECORD OF BOREHOLE E-SB-19

PROJECT: Part 845 MNA Evaluation
PROJECT NUMBER: 21454831.0002
LOCATION: Edwards Power Plant

DRILLING METHOD: 6" Sonic
DRILLING DATE: 8/31/2021
DRILL RIG: Terra Sonic 150CC

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,431,150.52 E: 2,434,576.77

ELEVATION: 458.41
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
30	6 Sonic	(27.5-35.0) (CL) SILTY CLAY, medium to high plasticity fines, trace fine sub-rounded sand, trace fine sub-rounded gravel; dusky yellowish brown (10YR 2/2); cohesive, w>PL, stiff. *(Continued)* (30.0) SAA except, light olive gray (5Y 5/2); soft.	CL		30.0 423.4				
35		(35.0-40.0) (CL) SILTY CLAY, low to medium plasticity fines, trace fine sub-rounded sand, trace fine sub-rounded gravel; dark yellowish brown (10YR 4/2); cohesive, w~PL, soft.	CL		35.0 418.4	4	SO	14.0 14.0	(35.0-40.0) Silty clay sample collected at 10:00 - 8/31/2021.
40		(40.0-44.0) Moderately weathered (N3), laminated to thinly laminated, medium light gray (N6), very fine grainded, non-porous to faintly porous, weak rock (R2), SHALE [CARBONDALE FORMATION].			40.0 414.4				
		END OF BORING AT 44.0 FEET BELOW GROUND SURFACE.			44.0				
45									
50									
55									
60									

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon

LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

WSP GOLDER

GOLDER STL RECORD OF BOREHOLE MWD NEWTON.GPJ GLDR_CO.GDT 2/21/22

RECORD OF BOREHOLE E-SB-XPW01

SHEET 1 of 2

PROJECT: Part 845 MNA Evaluation
PROJECT NUMBER: 21454831.0002
LOCATION: Edwards Power Plant

DRILLING METHOD: 6" Sonic
DRILLING DATE: 8/31/2021
DRILL RIG: Terra Sonic 150CC

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,431,467.42 E: 2,435,243.55

ELEVATION: 460.83
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
0	6 Sonic	(0.0-7.0) CCR - (ML&SW) gravelly SILT & SAND, non-plastic fines, fine poorly graded sub-rounded sand, fine poorly graded rounded gravel; dark gray (N3), ASH; non-cohesive, dry, loose.	ML&sw						
5						1	SO	10.0 / 10.0	
		(6.5) Same As Above (SAA) except, moist.			454.3 6.5				
		(7.0-10.0) FILL - (CL) gravelly SILTY CLAY, low to medium plasticity fines, fine poorly graded sub-rounded gravel; dusky yellowish brown (10YR 2/2); cohesive, w~PL, firm.	CL		453.8 7.0				
10	6 Sonic	(10.0-23.0) CCR - (ML&SP) SILT & SAND, non-plastic fines, fine sub-rounded sand, trace sub-rounded gravel; grayish black (N2), ASH; non-cohesive, wet, very loose.	ML&SP		450.8 10.0				
15						2	SO	10.0 / 10.0	
20		(20.0) SAA except, some fine sub-rounded gravel.			440.8 20.0				
		(23.0-30.0) CCR - (ML&SW) gravelly SILT & SAND, non-plastic fines, fine sub-rounded sand, fine rounded gravel; grayish black (N2), ASH; non-cohesive, dry, loose.	ML&sw		437.8 23.0				
25	6 Sonic					3	SO	9.0 / 10.0	(25.0-30.0) CCR sample collected at 13:50 - 8/31/2021.
30					430.8				

Log continued on next page

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon

LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

WSP GOLDER

GOLDER STL RECORD OF BOREHOLE MWD NEWTON.GPJ GLDR_CO.GDT 2/21/22

RECORD OF BOREHOLE E-SB-XPW01

PROJECT: Part 845 MNA Evaluation
PROJECT NUMBER: 21454831.0002
LOCATION: Edwards Power Plant

DRILLING METHOD: 6" Sonic
DRILLING DATE: 8/31/2021
DRILL RIG: Terra Sonic 150CC

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 1,431,467.42 E: 2,435,243.55

ELEVATION: 460.83
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEVATION / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC / ATT	REMARKS
30	6 Sonic	(30.0-40.0) NO RECOVERY.			30.0	4	SO	0.0 / 10.0	(30.0) Run #4, No recovery. Over saturated material falls out of core barrel upon retreival of sample.
35									
40		END OF BORING AT 40.0 FEET BELOW GROUND SURFACE.			420.8 / 40.0				
45									
50									
55									
60									

SCALE: 1 in = 3.8 ft
DRILLING CONTRACTOR: Cascade Environmental
DRILLER: D. Gordon

LOGGED: BTT
CHECKED: EMS
REVIEWED: PJB

WSP GOLDER

GOLDER STL RECORD OF BOREHOLE MWD NEWTON.GPJ GLDR_CO.GDT 2/21/22

APPENDIX B

Eurofins TestAmerica Laboratory Data

eurofins | Environment Testing America



ANALYTICAL REPORT

Eurofins Knoxville
5815 Middlebrook Pike
Knoxville, TN 37921
Tel: (865)291-3000

Laboratory Job ID: 140-24457-1
Client Project/Site: Edwards Power Station - Illinois

For:
Golder Associates Inc.
701 Emerson Road
Suite 250
Creve Coeur, Missouri 63141

Attn: Jeffrey Ingram

Ryan Henry

Authorized for release by:
2/4/2022 2:54:55 PM

Ryan Henry, Project Manager I
(865)291-3000
williamr.henry@eurofinset.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at:
www.eurofinsus.com/Env

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

Cover Page 1
Table of Contents 2
Definitions/Glossary 3
Case Narrative 4
Sample Summary 7
Client Sample Results 8
Default Detection Limits 38
QC Sample Results 41
QC Association Summary 54
Lab Chronicle 63
Certification Summary 83
Method Summary 84
Chain of Custody 85

Definitions/Glossary

Client: Golder Associates Inc.
Job ID: 140-24457-1
Project/Site: Edwards Power Station - Illinois

Qualifiers

Metals

Qualifier	Qualifier Description
*-	LCS and/or LCSD is outside acceptance limits, low biased.
*1	LCS/LCSD RPD exceeds control limits.
B	Compound was found in the blank and sample.
F5	Duplicate RPD exceeds limit, and one or both sample results are less than 5 times RL, and the absolute difference between results is < the upper reporting limits for both.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
L	A negative instrument reading had an absolute value greater than the reporting limit

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CFU	Colony Forming Unit
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MCL	EPA recommended "Maximum Contaminant Level"
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
MPN	Most Probable Number
MQL	Method Quantitation Limit
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
NEG	Negative / Absent
POS	Positive / Present
PQL	Practical Quantitation Limit
PRES	Presumptive
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)
TNTC	Too Numerous To Count

Job ID: 140-24457-1

Laboratory: Eurofins Knoxville

Narrative

Job Narrative
140-24457-1

Receipt
The samples were received on 9/2/2021 at 9:45am and arrived in good condition, and where required, properly preserved and on ice. The temperature of the cooler at receipt was 1.2º C.

Metals
7 Step Sequential Extraction Procedure

These soil samples were prepared and analyzed using Eurofins TestAmerica Knoxville standard operating procedure KNOX-MT-0008, "7 Step Sequential Extraction Procedure". SW-846 Method 6010B as incorporated in Eurofins TestAmerica Knoxville standard operating procedure KNOX-MT-0007 was used to perform the final instrument analyses.

An aliquot of each sample was sequentially extracted using the steps listed below:

· Step 1 - Exchangeable Fraction: A 5 gram aliquot of sample was extracted with 25 mL of 1M magnesium sulfate (MgSO4), centrifuged and filtered. 5 mL of the resulting leachate was digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 2 - Carbonate Fraction: The sample residue from step 1 was extracted with 25 mL of 1M sodium acetate/acetic acid (NaOAc/HOAc) at pH 5, centrifuged and filtered. 5 mL of the resulting leachate was digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 3 - Non-crystalline Materials Fraction: The sample residue from step 2 was extracted with 25 mL of 0.2M ammonium oxalate (pH 3), centrifuged and filtered. 5 mL of the resulting leachate was digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 4 - Metal Hydroxide Fraction: The sample residue from step 3 was extracted with 25 mL of 1M hydroxylamine hydrochloride solution in 25% v/v acetic acid, centrifuged and filtered. 5 mL of the resulting leachate was digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 5 - Organic-bound Fraction: The sample residue from step 4 was extracted three times with 25 mL of 5% sodium hypochlorite (NaClO) at pH 9.5, centrifuged and filtered. The resulting leachates were combined and 5 mL were digested using method 3010A and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 6 - Acid/Sulfide Fraction: The sample residue from step 5 was extracted with 25 mL of a 3:1:2 v/v solution of HCl-HNO3-H2O, centrifuged and filtered. 5 mL of the resulting leachate was diluted to 50 mL with reagent water and analyzed by method 6010B. Results are reported in mg/kg on a dry weight basis.
· Step 7 - Residual Fraction: A 1.0 g aliquot of the sample residue from step 6 was digested using HF, HNO3, HCl and H3BO3. The digestate was analyzed by ICP using method 6010B. Results are reported in mg/kg on a dry weight basis.

In addition, a 1.0 g aliquot of the original sample was digested using HF, HNO3, HCl and H3BO3. The digestate was analyzed by ICP using method 6010B. Total metal results are reported in mg/kg on a dry weight basis.

Results were calculated using the following equation:

Result, µg/g or mg/Kg, dry weight = (C × V × V1 × D) / (W × S × V2)

Where:
C = Concentration from instrument readout, µg/mL
V = Final volume of digestate, mL
D = Instrument dilution factor
V1 = Total volume of leachate, mL
V2 = Volume of leachate digested, mL
W = Wet weight of sample, g
S = Percent solids/100

A method blank, laboratory control sample and laboratory control sample duplicate were prepared and analyzed with each SEP step in

Job ID: 140-24457-1 (Continued)

Laboratory: Eurofins Knoxville (Continued)

order to provide information about both the presence of elements of interest in the extraction solutions, and the recovery of elements of interest from the extraction solutions. Results outside of laboratory QC limits do not reflect out of control performance, but rather the effect of the extraction solution upon the analyte.

A laboratory sample duplicate was prepared and analyzed with each batch of samples in order to provide information regarding the reproducibility of the procedure.

SEP Report Notes:

The final report lists the results for each step, the result for the total digestion of the sample, and a sum of the results of steps 1 through 7 by element.

Magnesium was not reported for step 1 because the extraction solution for this step (magnesium sulfate) contains high levels of magnesium. Sodium was not reported for steps 2 and 5 since the extraction solutions for these steps contain high levels of sodium. The sum of steps 1 through 7 is much higher than the total result for sodium and magnesium due to the magnesium and sodium introduced by the extraction solutions.

The digestates for steps 1, 2 and 5 were analyzed at a dilution due to instrument problems caused by the high solids content of the digestates. The reporting limits were adjusted accordingly.

Method 6010B: The serial dilution performed for the following sample associated with batch 140-58419 was outside control limits: (140-24457-A-8-C SD ^25)

Method 6010B: The following samples were diluted due to the nature of the sample matrix: E-SB-07 (21-27) (140-24457-1), E-SB-07 (40-45) (140-24457-2), E-SB-07 (59-64) (140-24457-3), E-SB-05 (30-33.5) (140-24457-4), E-SB-05 (51-56) (140-24457-5), E-SB-19 (35-40) (140-24457-6), E-SB-18 (40-44) (140-24457-7), E-SB-XPW01 (25-30) (140-24457-8), E-SB-15 (10-15) (140-24457-9) and E-SB-15 (30-35) (140-24457-10). Elevated reporting limits (RLs) are provided for aluminum, barium and calcium.

Method 6010B: Due to sample matrix effect on the internal standard (ISTD), a dilution was required for the following sample: E-SB-XPW01 (25-30) (140-24457-8).

Method 6010B: The following samples were diluted to bring the concentration of target analytes within the calibration range: E-SB-07 (40-45) (140-24457-2) and E-SB-XPW01 (25-30) (140-24457-8). Elevated reporting limits (RLs) are provided for iron.

Method 6010B: The following samples were diluted due to the presence of titanium which interferes with Cobalt and Lead: E-SB-07 (40-45) (140-24457-2), E-SB-07 (59-64) (140-24457-3), E-SB-05 (51-56) (140-24457-5) and E-SB-XPW01 (25-30) (140-24457-8). Elevated reporting limits (RLs) are provided.

Method 6010B: The following samples were diluted due to the presence of Iron which interferes with Arsenic and Selenium: E-SB-07 (40-45) (140-24457-2) and E-SB-XPW01 (25-30) (140-24457-8). Elevated reporting limits (RLs) are provided.

Method 6010B: The following samples were diluted due to the presence of Aluminum which interferes with Lead: E-SB-07 (40-45) (140-24457-2), E-SB-07 (59-64) (140-24457-3), E-SB-05 (30-33.5) (140-24457-4), E-SB-05 (51-56) (140-24457-5), E-SB-19 (35-40) (140-24457-6), E-SB-18 (40-44) (140-24457-7), E-SB-15 (10-15) (140-24457-9) and E-SB-15 (30-35) (140-24457-10). Elevated reporting limits (RLs) are provided.

Method 6010B: The following samples were diluted due to the presence of silicon which interferes with Arsenic, Lead and Selenium: E-SB-07 (21-27) (140-24457-1), E-SB-07 (40-45) (140-24457-2), E-SB-07 (59-64) (140-24457-3), E-SB-05 (30-33.5) (140-24457-4), E-SB-05 (51-56) (140-24457-5), E-SB-19 (35-40) (140-24457-6), E-SB-18 (40-44) (140-24457-7) and E-SB-15 (30-35) (140-24457-10). Elevated reporting limits (RLs) are provided.

Method 6010B SEP: The serial dilution performed for the following sample associated with batch 140-57991 was outside control limits: (140-24457-A-8-K SD ^15)

Job ID: 140-24457-1 (Continued)

Laboratory: Eurofins Knoxville (Continued)

Method 6010B SEP: The method blank for step 1 has manganese result above the reporting limit.

(MB 140-56440/14-B ^4)

Method 6010B SEP: The laboratory control sample duplicate (LCSD) recovered outside advisory limits for Barium.

(LCSD 140-56818/3-B)

Method 6010B SEP: The following sample was diluted to bring the concentration of target analyte, Iron, within the calibration range: E-SB-XPW01 (25-30) (140-24457-8). Elevated reporting limits (RLs) are provided.

Method 6010B SEP: The following sample was diluted due to the presence of Iron which interferes with Arsenic and Selenium: E-SB-XPW01 (25-30) (140-24457-8). Elevated reporting limits (RLs) are provided.

Method 6010B SEP: The % RPD for the LCSD for manganese was outside acceptance limits.

(LCSD 140-56926/3-B ^5)

Method 6010B SEP: The sample duplicate (DUP) precision for preparation batch 140-56604 and 140-56654 and analytical batch 140-58290 was outside control limits. Sample matrix interference and/or non-homogeneity are suspected because the associated laboratory control sample / laboratory control sample duplicate (LCS/LCSD) precision was within acceptance limits.

Method 6010B SEP: The serial dilution performed for the following samples associated with batch 140-58328 was outside control limits: (140-24457-A-8-AA SD ^10) and (140-24457-A-8-AA SD ^5)

Method 6010B SEP: The following samples were diluted due to the presence of titanium which interferes with Cobalt and Lead: E-SB-07 (40-45) (140-24457-2), E-SB-07 (59-64) (140-24457-3), E-SB-05 (51-56) (140-24457-5), E-SB-19 (35-40) (140-24457-6), E-SB-18 (40-44) (140-24457-7), E-SB-XPW01 (25-30) (140-24457-8) and E-SB-15 (30-35) (140-24457-10). Elevated reporting limits (RLs) are provided.

Method 6010B SEP: The following samples were diluted due to the presence of silicon which interferes with Arsenic, Lead and Selenium: E-SB-05 (30-33.5) (140-24457-4), E-SB-05 (51-56) (140-24457-5), E-SB-19 (35-40) (140-24457-6), E-SB-18 (40-44) (140-24457-7), E-SB-15 (10-15) (140-24457-9) and E-SB-15 (30-35) (140-24457-10). Elevated reporting limits (RLs) are provided.

Method 6010B SEP: The following sample was diluted to bring the concentration of target analyte, iron, within the calibration range: E-SB-XPW01 (25-30) (140-24457-8). Elevated reporting limits (RLs) are provided.

Method 6010B SEP: The following sample was diluted due to the presence of Iron which interferes with Arsenic and Selenium: E-SB-XPW01 (25-30) (140-24457-8). Elevated reporting limits (RLs) are provided.

Method 6010B SEP: The following samples were diluted due to the nature of the sample matrix: E-SB-07 (21-27) (140-24457-1), E-SB-07 (40-45) (140-24457-2), E-SB-07 (59-64) (140-24457-3), E-SB-05 (30-33.5) (140-24457-4), E-SB-05 (51-56) (140-24457-5), E-SB-19 (35-40) (140-24457-6), E-SB-18 (40-44) (140-24457-7), E-SB-XPW01 (25-30) (140-24457-8), E-SB-15 (10-15) (140-24457-9) and E-SB-15 (30-35) (140-24457-10). Elevated reporting limits (RLs) are provided for aluminum, barium and calcium.

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

General Chemistry
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Sample Summary

Client: Golder Associates Inc.
Project/Site: Edwards Power Station - Illinois

Job ID: 140-24457-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
140-24457-1	E-SB-07 (21-27)	Solid	08/30/21 13:20	09/02/21 09:45
140-24457-2	E-SB-07 (40-45)	Solid	08/30/21 14:05	09/02/21 09:45
140-24457-3	E-SB-07 (59-64)	Solid	08/30/21 14:45	09/02/21 09:45
140-24457-4	E-SB-05 (30-33.5)	Solid	08/30/21 16:50	09/02/21 09:45
140-24457-5	E-SB-05 (51-56)	Solid	08/30/21 17:20	09/02/21 09:45
140-24457-6	E-SB-19 (35-40)	Solid	08/31/21 10:00	09/02/21 09:45
140-24457-7	E-SB-18 (40-44)	Solid	08/31/21 11:45	09/02/21 09:45
140-24457-8	E-SB-XPW01 (25-30)	Solid	08/31/21 13:50	09/02/21 09:45
140-24457-9	E-SB-15 (10-15)	Solid	08/31/21 15:40	09/02/21 09:45
140-24457-10	E-SB-15 (30-35)	Solid	08/31/21 16:20	09/02/21 09:45

Client Sample ID: E-SB-07 (21-27)

Date Collected: 08/30/21 13:20
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-1

Matrix: Solid
Percent Solids: 81.5

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		49	7.9	mg/Kg	☼	12/02/21 12:30	01/17/22 11:30	4
Arsenic	ND		2.5	0.64	mg/Kg	☼	12/02/21 12:30	01/17/22 11:30	4
Barium	**2.3**	**J**	12	0.59	mg/Kg	☼	12/02/21 12:30	01/17/22 11:30	4
Boron	ND		49	49	mg/Kg	☼	12/02/21 12:30	01/17/22 11:30	4
Calcium	**1500**	**B**	1200	9.3	mg/Kg	☼	12/02/21 12:30	01/17/22 11:30	4
Cobalt	ND		12	0.22	mg/Kg	☼	12/02/21 12:30	01/17/22 11:30	4
Iron	ND		25	14	mg/Kg	☼	12/02/21 12:30	01/17/22 11:30	4
Lead	ND		2.5	0.54	mg/Kg	☼	12/02/21 12:30	01/17/22 11:30	4
Lithium	ND		12	0.74	mg/Kg	☼	12/02/21 12:30	01/17/22 11:30	4
Manganese	ND		3.7	0.15	mg/Kg	☼	12/02/21 12:30	01/17/22 11:30	4
Molybdenum	ND		9.8	0.40	mg/Kg	☼	12/02/21 12:30	01/17/22 11:30	4
Selenium	ND		2.5	0.83	mg/Kg	☼	12/02/21 12:30	01/17/22 11:30	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**13**	**J**	37	5.9	mg/Kg	☼	12/07/21 09:37	01/17/22 15:03	3
Arsenic	ND		1.8	0.48	mg/Kg	☼	12/07/21 09:37	01/17/22 15:03	3
Barium	**1.5**	**J**	9.2	0.44	mg/Kg	☼	12/07/21 09:37	01/17/22 15:03	3
Boron	ND		37	37	mg/Kg	☼	12/07/21 09:37	01/17/22 15:03	3
Calcium	**3100**		920	8.1	mg/Kg	☼	12/07/21 09:37	01/17/22 15:03	3
Cobalt	ND		9.2	0.23	mg/Kg	☼	12/07/21 09:37	01/17/22 15:03	3
Iron	**13**	**J**	18	11	mg/Kg	☼	12/07/21 09:37	01/17/22 15:03	3
Lead	**1.4**	**J**	1.8	0.41	mg/Kg	☼	12/07/21 09:37	01/17/22 15:03	3
Lithium	ND		9.2	0.55	mg/Kg	☼	12/07/21 09:37	01/17/22 15:03	3
Manganese	**74**		2.8	1.0	mg/Kg	☼	12/07/21 09:37	01/17/22 15:03	3
Molybdenum	ND		7.4	0.30	mg/Kg	☼	12/07/21 09:37	01/17/22 15:03	3
Selenium	**1.4**	**J B**	1.8	0.63	mg/Kg	☼	12/07/21 09:37	01/17/22 15:03	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**210**		12	2.6	mg/Kg	☼	12/09/21 11:51	01/26/22 11:10	1
Arsenic	**0.52**	**J**	0.61	0.16	mg/Kg	☼	12/09/21 11:51	01/26/22 11:10	1
Barium	**5.0**	***-**	3.1	0.15	mg/Kg	☼	12/09/21 11:51	01/26/22 11:10	1
Boron	ND		12	12	mg/Kg	☼	12/09/21 11:51	01/26/22 11:10	1
Calcium	**13**	**J**	310	1.8	mg/Kg	☼	12/09/21 11:51	01/26/22 11:10	1
Cobalt	**1.8**	**J**	3.1	0.055	mg/Kg	☼	12/09/21 11:51	01/26/22 11:10	1
Iron	**440**		6.1	3.6	mg/Kg	☼	12/09/21 11:51	01/26/22 11:10	1
Lead	ND		0.61	0.14	mg/Kg	☼	12/09/21 11:51	01/26/22 11:10	1
Lithium	ND		3.1	0.18	mg/Kg	☼	12/09/21 11:51	01/26/22 11:10	1
Manganese	**190**	**B**	0.92	0.033	mg/Kg	☼	12/09/21 11:51	01/26/22 11:10	1
Molybdenum	ND		2.5	0.10	mg/Kg	☼	12/09/21 11:51	01/26/22 11:10	1
Selenium	ND		0.61	0.21	mg/Kg	☼	12/09/21 11:51	01/26/22 11:10	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**1600**		12	2.0	mg/Kg	☼	12/13/21 09:30	01/26/22 13:01	1
Arsenic	**2.2**	**B**	0.61	0.27	mg/Kg	☼	12/13/21 09:30	01/26/22 13:01	1
Barium	**30**		3.1	0.15	mg/Kg	☼	12/13/21 09:30	01/26/22 13:01	1
Boron	ND		12	12	mg/Kg	☼	12/13/21 09:30	01/26/22 13:01	1
Calcium	**5300**		310	2.7	mg/Kg	☼	12/13/21 09:30	01/26/22 13:01	1

Client Sample ID: E-SB-07 (21-27)

Date Collected: 08/30/21 13:20
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-1

Matrix: Solid
Percent Solids: 81.5

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	3.7		3.1	0.065	mg/Kg	☼	12/13/21 09:30	01/26/22 13:01	1
Iron	6900		6.1	3.6	mg/Kg	☼	12/13/21 09:30	01/26/22 13:01	1
Lead	5.7		0.61	0.14	mg/Kg	☼	12/13/21 09:30	01/26/22 13:01	1
Lithium	2.6	J	3.1	0.18	mg/Kg	☼	12/13/21 09:30	01/26/22 13:01	1
Manganese	160		0.92	0.16	mg/Kg	☼	12/13/21 09:30	01/26/22 13:01	1
Molybdenum	0.15	J	2.5	0.10	mg/Kg	☼	12/13/21 09:30	01/26/22 13:01	1
Selenium	ND		0.61	0.58	mg/Kg	☼	12/13/21 09:30	01/26/22 13:01	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	140	J	180	29	mg/Kg	☼	12/15/21 10:40	01/26/22 14:25	5
Arsenic	ND		9.2	2.3	mg/Kg	☼	12/15/21 10:40	01/26/22 14:25	5
Barium	7.2	J	46	2.2	mg/Kg	☼	12/15/21 10:40	01/26/22 14:25	5
Boron	ND		180	180	mg/Kg	☼	12/15/21 10:40	01/26/22 14:25	5
Calcium	4500	J B	4600	14	mg/Kg	☼	12/15/21 10:40	01/26/22 14:25	5
Cobalt	ND		46	0.74	mg/Kg	☼	12/15/21 10:40	01/26/22 14:25	5
Iron	ND		92	54	mg/Kg	☼	12/15/21 10:40	01/26/22 14:25	5
Lead	ND		9.2	2.0	mg/Kg	☼	12/15/21 10:40	01/26/22 14:25	5
Lithium	5.1	J B	46	2.7	mg/Kg	☼	12/15/21 10:40	01/26/22 14:25	5
Manganese	3.1	J *1	14	2.3	mg/Kg	☼	12/15/21 10:40	01/26/22 14:25	5
Molybdenum	ND		37	1.5	mg/Kg	☼	12/15/21 10:40	01/26/22 14:25	5
Selenium	ND		9.2	3.2	mg/Kg	☼	12/15/21 10:40	01/26/22 14:25	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	4900		12	2.0	mg/Kg	☼	12/15/21 17:10	01/26/22 16:00	1
Arsenic	2.2		0.61	0.18	mg/Kg	☼	12/15/21 17:10	01/26/22 16:00	1
Barium	8.8		3.1	0.15	mg/Kg	☼	12/15/21 17:10	01/26/22 16:00	1
Boron	ND		12	12	mg/Kg	☼	12/15/21 17:10	01/26/22 16:00	1
Calcium	1600		310	2.6	mg/Kg	☼	12/15/21 17:10	01/26/22 16:00	1
Cobalt	2.6	J	3.1	0.056	mg/Kg	☼	12/15/21 17:10	01/26/22 16:00	1
Iron	8400		6.1	3.6	mg/Kg	☼	12/15/21 17:10	01/26/22 16:00	1
Lead	2.5		0.61	0.14	mg/Kg	☼	12/15/21 17:10	01/26/22 16:00	1
Lithium	6.1		3.1	0.18	mg/Kg	☼	12/15/21 17:10	01/26/22 16:00	1
Manganese	75		0.92	0.31	mg/Kg	☼	12/15/21 17:10	01/26/22 16:00	1
Molybdenum	ND		2.5	0.12	mg/Kg	☼	12/15/21 17:10	01/26/22 16:00	1
Selenium	0.35	J	0.61	0.21	mg/Kg	☼	12/15/21 17:10	01/26/22 16:00	1

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	30000		120	20	mg/Kg	☼	12/18/21 15:38	01/27/22 12:30	10
Arsenic	1.5	B	0.61	0.16	mg/Kg	☼	12/18/21 15:38	01/27/22 13:37	1
Barium	220		31	0.56	mg/Kg	☼	12/18/21 15:38	01/27/22 12:30	10
Calcium	1300		310	3.2	mg/Kg	☼	12/18/21 15:38	01/27/22 13:37	1
Cobalt	0.45	J	3.1	0.032	mg/Kg	☼	12/18/21 15:38	01/27/22 13:37	1
Iron	4600		6.1	5.0	mg/Kg	☼	12/18/21 15:38	01/27/22 13:37	1
Lead	1.4		0.61	0.14	mg/Kg	☼	12/18/21 15:38	01/27/22 13:37	1
Lithium	14		3.1	0.18	mg/Kg	☼	12/18/21 15:38	01/27/22 13:37	1
Manganese	40		0.92	0.14	mg/Kg	☼	12/18/21 15:38	01/27/22 13:37	1
Molybdenum	ND		2.5	0.10	mg/Kg	☼	12/18/21 15:38	01/27/22 13:37	1

Client Sample ID: E-SB-07 (21-27)

Date Collected: 08/30/21 13:20
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-1

Matrix: Solid
Percent Solids: 81.5

Method: 6010B SEP - SEP Metals (ICP) - Step 7 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	ND		0.61	0.21	mg/Kg	☼	12/18/21 15:38	01/27/22 13:37	1

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	36000		10	1.6	mg/Kg			02/04/22 13:55	1
Arsenic	6.4		0.50	0.13	mg/Kg			02/04/22 13:55	1
Barium	280		2.5	0.12	mg/Kg			02/04/22 13:55	1
Calcium	17000		250	0.74	mg/Kg			02/04/22 13:55	1
Cobalt	8.5		2.5	0.023	mg/Kg			02/04/22 13:55	1
Iron	20000		5.0	4.1	mg/Kg			02/04/22 13:55	1
Lead	11		0.50	0.11	mg/Kg			02/04/22 13:55	1
Lithium	28		2.5	0.15	mg/Kg			02/04/22 13:55	1
Manganese	540		0.75	0.052	mg/Kg			02/04/22 13:55	1
Molybdenum	0.15	J	2.0	0.082	mg/Kg			02/04/22 13:55	1
Selenium	1.7		0.50	0.17	mg/Kg			02/04/22 13:55	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	53000		120	20	mg/Kg	☼	12/01/21 08:54	01/31/22 11:28	10
Arsenic	7.9	B	1.2	0.32	mg/Kg	☼	12/01/21 08:54	01/31/22 14:02	2
Barium	400		31	0.56	mg/Kg	☼	12/01/21 08:54	01/31/22 11:28	10
Calcium	21000	B	3100	32	mg/Kg	☼	12/01/21 08:54	01/31/22 11:28	10
Cobalt	6.2		3.1	0.032	mg/Kg	☼	12/01/21 08:54	01/31/22 12:34	1
Iron	17000		6.1	5.0	mg/Kg	☼	12/01/21 08:54	01/31/22 12:34	1
Lead	11		1.2	0.27	mg/Kg	☼	12/01/21 08:54	01/31/22 14:02	2
Lithium	21		3.1	0.18	mg/Kg	☼	12/01/21 08:54	01/31/22 12:34	1
Manganese	400		0.92	0.14	mg/Kg	☼	12/01/21 08:54	01/31/22 12:34	1
Molybdenum	0.34	J B	2.5	0.10	mg/Kg	☼	12/01/21 08:54	01/31/22 12:34	1
Selenium	1.4		1.2	0.42	mg/Kg	☼	12/01/21 08:54	01/31/22 14:02	2

Client Sample ID: E-SB-07 (40-45)

Date Collected: 08/30/21 14:05
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-2

Matrix: Solid
Percent Solids: 93.6

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		43	6.8	mg/Kg	☼	12/02/21 12:30	01/17/22 11:35	4
Arsenic	ND		2.1	0.56	mg/Kg	☼	12/02/21 12:30	01/17/22 11:35	4
Barium	**0.72**	**J**	11	0.51	mg/Kg	☼	12/02/21 12:30	01/17/22 11:35	4
Boron	ND		43	43	mg/Kg	☼	12/02/21 12:30	01/17/22 11:35	4
Calcium	**480**	**J B**	1100	8.1	mg/Kg	☼	12/02/21 12:30	01/17/22 11:35	4
Cobalt	ND		11	0.19	mg/Kg	☼	12/02/21 12:30	01/17/22 11:35	4
Iron	ND		21	12	mg/Kg	☼	12/02/21 12:30	01/17/22 11:35	4
Lead	ND		2.1	0.47	mg/Kg	☼	12/02/21 12:30	01/17/22 11:35	4
Lithium	ND		11	0.64	mg/Kg	☼	12/02/21 12:30	01/17/22 11:35	4
Manganese	**4.0**	**B**	3.2	0.13	mg/Kg	☼	12/02/21 12:30	01/17/22 11:35	4
Molybdenum	ND		8.5	0.35	mg/Kg	☼	12/02/21 12:30	01/17/22 11:35	4
Selenium	ND		2.1	0.73	mg/Kg	☼	12/02/21 12:30	01/17/22 11:35	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**94**		32	5.1	mg/Kg	☼	12/07/21 09:37	01/17/22 15:08	3
Arsenic	ND		1.6	0.42	mg/Kg	☼	12/07/21 09:37	01/17/22 15:08	3
Barium	**0.42**	**J**	8.0	0.38	mg/Kg	☼	12/07/21 09:37	01/17/22 15:08	3
Boron	ND		32	32	mg/Kg	☼	12/07/21 09:37	01/17/22 15:08	3
Calcium	**120**	**J**	800	7.1	mg/Kg	☼	12/07/21 09:37	01/17/22 15:08	3
Cobalt	ND		8.0	0.20	mg/Kg	☼	12/07/21 09:37	01/17/22 15:08	3
Iron	**150**		16	9.3	mg/Kg	☼	12/07/21 09:37	01/17/22 15:08	3
Lead	**2.3**		1.6	0.35	mg/Kg	☼	12/07/21 09:37	01/17/22 15:08	3
Lithium	ND		8.0	0.48	mg/Kg	☼	12/07/21 09:37	01/17/22 15:08	3
Manganese	**7.4**		2.4	0.90	mg/Kg	☼	12/07/21 09:37	01/17/22 15:08	3
Molybdenum	ND		6.4	0.26	mg/Kg	☼	12/07/21 09:37	01/17/22 15:08	3
Selenium	**1.2**	**J B**	1.6	0.54	mg/Kg	☼	12/07/21 09:37	01/17/22 15:08	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**370**		11	2.2	mg/Kg	☼	12/09/21 11:51	01/26/22 11:15	1
Arsenic	**0.28**	**J**	0.53	0.14	mg/Kg	☼	12/09/21 11:51	01/26/22 11:15	1
Barium	**3.2**	***-**	2.7	0.13	mg/Kg	☼	12/09/21 11:51	01/26/22 11:15	1
Boron	ND		11	11	mg/Kg	☼	12/09/21 11:51	01/26/22 11:15	1
Calcium	**6.2**	**J**	270	1.6	mg/Kg	☼	12/09/21 11:51	01/26/22 11:15	1
Cobalt	**0.22**	**J**	2.7	0.048	mg/Kg	☼	12/09/21 11:51	01/26/22 11:15	1
Iron	**1700**		5.3	3.1	mg/Kg	☼	12/09/21 11:51	01/26/22 11:15	1
Lead	**0.23**	**J**	0.53	0.12	mg/Kg	☼	12/09/21 11:51	01/26/22 11:15	1
Lithium	**0.37**	**J**	2.7	0.16	mg/Kg	☼	12/09/21 11:51	01/26/22 11:15	1
Manganese	**30**	**B**	0.80	0.029	mg/Kg	☼	12/09/21 11:51	01/26/22 11:15	1
Molybdenum	ND		2.1	0.088	mg/Kg	☼	12/09/21 11:51	01/26/22 11:15	1
Selenium	ND		0.53	0.18	mg/Kg	☼	12/09/21 11:51	01/26/22 11:15	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**3100**		11	1.7	mg/Kg	☼	12/13/21 09:30	01/26/22 13:06	1
Arsenic	**1.1**	**B**	0.53	0.24	mg/Kg	☼	12/13/21 09:30	01/26/22 13:06	1
Barium	**22**		2.7	0.13	mg/Kg	☼	12/13/21 09:30	01/26/22 13:06	1
Boron	ND		11	11	mg/Kg	☼	12/13/21 09:30	01/26/22 13:06	1
Calcium	**2100**		270	2.4	mg/Kg	☼	12/13/21 09:30	01/26/22 13:06	1

Client Sample ID: E-SB-07 (40-45)
Date Collected: 08/30/21 14:05
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-2
Matrix: Solid
Percent Solids: 93.6

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	5.1		2.7	0.057	mg/Kg	☼	12/13/21 09:30	01/26/22 13:06	1
Iron	17000		5.3	3.1	mg/Kg	☼	12/13/21 09:30	01/26/22 13:06	1
Lead	4.4		0.53	0.12	mg/Kg	☼	12/13/21 09:30	01/26/22 13:06	1
Lithium	9.0		2.7	0.16	mg/Kg	☼	12/13/21 09:30	01/26/22 13:06	1
Manganese	260		0.80	0.14	mg/Kg	☼	12/13/21 09:30	01/26/22 13:06	1
Molybdenum	ND		2.1	0.088	mg/Kg	☼	12/13/21 09:30	01/26/22 13:06	1
Selenium	1.2		0.53	0.50	mg/Kg	☼	12/13/21 09:30	01/26/22 13:06	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	41	J	160	25	mg/Kg	☼	12/15/21 10:40	01/26/22 14:30	5
Arsenic	ND		8.0	2.0	mg/Kg	☼	12/15/21 10:40	01/26/22 14:30	5
Barium	19	J	40	1.9	mg/Kg	☼	12/15/21 10:40	01/26/22 14:30	5
Boron	ND		160	160	mg/Kg	☼	12/15/21 10:40	01/26/22 14:30	5
Calcium	480	J B	4000	12	mg/Kg	☼	12/15/21 10:40	01/26/22 14:30	5
Cobalt	ND		40	0.64	mg/Kg	☼	12/15/21 10:40	01/26/22 14:30	5
Iron	ND		80	47	mg/Kg	☼	12/15/21 10:40	01/26/22 14:30	5
Lead	ND		8.0	1.8	mg/Kg	☼	12/15/21 10:40	01/26/22 14:30	5
Lithium	5.7	J B	40	2.4	mg/Kg	☼	12/15/21 10:40	01/26/22 14:30	5
Manganese	13	*1	12	2.0	mg/Kg	☼	12/15/21 10:40	01/26/22 14:30	5
Molybdenum	ND		32	1.3	mg/Kg	☼	12/15/21 10:40	01/26/22 14:30	5
Selenium	ND		8.0	2.8	mg/Kg	☼	12/15/21 10:40	01/26/22 14:30	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	7600		11	1.7	mg/Kg	☼	12/15/21 17:10	01/26/22 16:05	1
Arsenic	1.3		0.53	0.16	mg/Kg	☼	12/15/21 17:10	01/26/22 16:05	1
Barium	32		2.7	0.13	mg/Kg	☼	12/15/21 17:10	01/26/22 16:05	1
Boron	ND		11	11	mg/Kg	☼	12/15/21 17:10	01/26/22 16:05	1
Calcium	380		270	2.2	mg/Kg	☼	12/15/21 17:10	01/26/22 16:05	1
Cobalt	8.1		2.7	0.049	mg/Kg	☼	12/15/21 17:10	01/26/22 16:05	1
Iron	15000		5.3	3.1	mg/Kg	☼	12/15/21 17:10	01/26/22 16:05	1
Lead	2.3		0.53	0.12	mg/Kg	☼	12/15/21 17:10	01/26/22 16:05	1
Lithium	16		2.7	0.16	mg/Kg	☼	12/15/21 17:10	01/26/22 16:05	1
Manganese	220		0.80	0.27	mg/Kg	☼	12/15/21 17:10	01/26/22 16:05	1
Molybdenum	ND		2.1	0.11	mg/Kg	☼	12/15/21 17:10	01/26/22 16:05	1
Selenium	0.68		0.53	0.18	mg/Kg	☼	12/15/21 17:10	01/26/22 16:05	1

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	34000		110	17	mg/Kg	☼	12/18/21 15:38	01/27/22 12:35	10
Arsenic	1.4	B	0.53	0.14	mg/Kg	☼	12/18/21 15:38	01/27/22 13:42	1
Barium	170		27	0.49	mg/Kg	☼	12/18/21 15:38	01/27/22 12:35	10
Calcium	100	J	270	2.8	mg/Kg	☼	12/18/21 15:38	01/27/22 13:42	1
Cobalt	1.3	J	5.3	0.056	mg/Kg	☼	12/18/21 15:38	01/27/22 15:18	2
Iron	5300		5.3	4.4	mg/Kg	☼	12/18/21 15:38	01/27/22 13:42	1
Lead	ND		1.1	0.24	mg/Kg	☼	12/18/21 15:38	01/27/22 15:18	2
Lithium	16		2.7	0.16	mg/Kg	☼	12/18/21 15:38	01/27/22 13:42	1
Manganese	47		0.80	0.12	mg/Kg	☼	12/18/21 15:38	01/27/22 13:42	1
Molybdenum	ND		2.1	0.088	mg/Kg	☼	12/18/21 15:38	01/27/22 13:42	1

Client Sample ID: E-SB-07 (40-45)

Date Collected: 08/30/21 14:05
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-2

Matrix: Solid
Percent Solids: 93.6

Method: 6010B SEP - SEP Metals (ICP) - Step 7 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	ND		0.53	0.18	mg/Kg	☼	12/18/21 15:38	01/27/22 13:42	1

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**45000**		10	1.6	mg/Kg			02/04/22 13:55	1
Arsenic	**4.1**		0.50	0.13	mg/Kg			02/04/22 13:55	1
Barium	**240**		2.5	0.12	mg/Kg			02/04/22 13:55	1
Calcium	**3600**		250	0.74	mg/Kg			02/04/22 13:55	1
Cobalt	**15**		2.5	0.023	mg/Kg			02/04/22 13:55	1
Iron	**39000**		5.0	4.1	mg/Kg			02/04/22 13:55	1
Lead	**9.3**		0.50	0.11	mg/Kg			02/04/22 13:55	1
Lithium	**47**		2.5	0.15	mg/Kg			02/04/22 13:55	1
Manganese	**590**		0.75	0.052	mg/Kg			02/04/22 13:55	1
Molybdenum	ND		2.0	0.082	mg/Kg			02/04/22 13:55	1
Selenium	**3.1**		0.50	0.17	mg/Kg			02/04/22 13:55	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**76000**		110	17	mg/Kg	☼	12/01/21 08:54	01/31/22 11:33	10
Arsenic	**4.0**	**B**	1.1	0.28	mg/Kg	☼	12/01/21 08:54	01/31/22 14:07	2
Barium	**390**		27	0.49	mg/Kg	☼	12/01/21 08:54	01/31/22 11:33	10
Calcium	**4000**	**B**	2700	28	mg/Kg	☼	12/01/21 08:54	01/31/22 11:33	10
Cobalt	**12**		5.3	0.056	mg/Kg	☼	12/01/21 08:54	01/31/22 14:07	2
Iron	**37000**		11	8.8	mg/Kg	☼	12/01/21 08:54	01/31/22 14:07	2
Lead	**7.4**		1.1	0.24	mg/Kg	☼	12/01/21 08:54	01/31/22 14:07	2
Lithium	**42**		2.7	0.16	mg/Kg	☼	12/01/21 08:54	01/31/22 12:40	1
Manganese	**440**		0.80	0.12	mg/Kg	☼	12/01/21 08:54	01/31/22 12:40	1
Molybdenum	ND		2.1	0.088	mg/Kg	☼	12/01/21 08:54	01/31/22 12:40	1
Selenium	**2.0**		1.1	0.36	mg/Kg	☼	12/01/21 08:54	01/31/22 14:07	2

Client: Golder Associates Inc.
Project/Site: Edwards Power Station - Illinois

Job ID: 140-24457-1

Client Sample ID: E-SB-07 (59-64)

Date Collected: 08/30/21 14:45
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-3

Matrix: Solid
Percent Solids: 91.2

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		44	7.0	mg/Kg	☼	12/02/21 12:30	01/17/22 11:40	4
Arsenic	ND		2.2	0.57	mg/Kg	☼	12/02/21 12:30	01/17/22 11:40	4
Barium	**0.61**	**J**	11	0.53	mg/Kg	☼	12/02/21 12:30	01/17/22 11:40	4
Boron	ND		44	44	mg/Kg	☼	12/02/21 12:30	01/17/22 11:40	4
Calcium	**220**	**J B**	1100	8.3	mg/Kg	☼	12/02/21 12:30	01/17/22 11:40	4
Cobalt	ND		11	0.20	mg/Kg	☼	12/02/21 12:30	01/17/22 11:40	4
Iron	ND		22	13	mg/Kg	☼	12/02/21 12:30	01/17/22 11:40	4
Lead	ND		2.2	0.48	mg/Kg	☼	12/02/21 12:30	01/17/22 11:40	4
Lithium	ND		11	0.66	mg/Kg	☼	12/02/21 12:30	01/17/22 11:40	4
Manganese	**1.7**	**J B**	3.3	0.14	mg/Kg	☼	12/02/21 12:30	01/17/22 11:40	4
Molybdenum	ND		8.8	0.36	mg/Kg	☼	12/02/21 12:30	01/17/22 11:40	4
Selenium	ND		2.2	0.75	mg/Kg	☼	12/02/21 12:30	01/17/22 11:40	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**76**		33	5.3	mg/Kg	☼	12/07/21 09:37	01/17/22 15:23	3
Arsenic	ND		1.6	0.43	mg/Kg	☼	12/07/21 09:37	01/17/22 15:23	3
Barium	**0.39**	**J**	8.2	0.39	mg/Kg	☼	12/07/21 09:37	01/17/22 15:23	3
Boron	ND		33	33	mg/Kg	☼	12/07/21 09:37	01/17/22 15:23	3
Calcium	**90**	**J**	820	7.2	mg/Kg	☼	12/07/21 09:37	01/17/22 15:23	3
Cobalt	ND		8.2	0.21	mg/Kg	☼	12/07/21 09:37	01/17/22 15:23	3
Iron	**84**		16	9.5	mg/Kg	☼	12/07/21 09:37	01/17/22 15:23	3
Lead	**3.0**		1.6	0.36	mg/Kg	☼	12/07/21 09:37	01/17/22 15:23	3
Lithium	ND		8.2	0.49	mg/Kg	☼	12/07/21 09:37	01/17/22 15:23	3
Manganese	**3.9**		2.5	0.92	mg/Kg	☼	12/07/21 09:37	01/17/22 15:23	3
Molybdenum	ND		6.6	0.27	mg/Kg	☼	12/07/21 09:37	01/17/22 15:23	3
Selenium	ND		1.6	0.56	mg/Kg	☼	12/07/21 09:37	01/26/22 09:51	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**280**		11	2.3	mg/Kg	☼	12/09/21 11:51	01/26/22 11:20	1
Arsenic	**0.53**	**J**	0.55	0.14	mg/Kg	☼	12/09/21 11:51	01/26/22 11:20	1
Barium	**2.9**	***-**	2.7	0.13	mg/Kg	☼	12/09/21 11:51	01/26/22 11:20	1
Boron	ND		11	11	mg/Kg	☼	12/09/21 11:51	01/26/22 11:20	1
Calcium	**6.4**	**J**	270	1.6	mg/Kg	☼	12/09/21 11:51	01/26/22 11:20	1
Cobalt	**0.23**	**J**	2.7	0.049	mg/Kg	☼	12/09/21 11:51	01/26/22 11:20	1
Iron	**740**		5.5	3.2	mg/Kg	☼	12/09/21 11:51	01/26/22 11:20	1
Lead	**0.31**	**J**	0.55	0.12	mg/Kg	☼	12/09/21 11:51	01/26/22 11:20	1
Lithium	**0.40**	**J**	2.7	0.16	mg/Kg	☼	12/09/21 11:51	01/26/22 11:20	1
Manganese	**19**	**B**	0.82	0.030	mg/Kg	☼	12/09/21 11:51	01/26/22 11:20	1
Molybdenum	ND		2.2	0.090	mg/Kg	☼	12/09/21 11:51	01/26/22 11:20	1
Selenium	ND		0.55	0.19	mg/Kg	☼	12/09/21 11:51	01/26/22 11:20	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**4400**		11	1.8	mg/Kg	☼	12/13/21 09:30	01/26/22 13:11	1
Arsenic	**1.0**	**B**	0.55	0.24	mg/Kg	☼	12/13/21 09:30	01/26/22 13:11	1
Barium	**20**		2.7	0.13	mg/Kg	☼	12/13/21 09:30	01/26/22 13:11	1
Boron	ND		11	11	mg/Kg	☼	12/13/21 09:30	01/26/22 13:11	1
Calcium	**1000**		270	2.4	mg/Kg	☼	12/13/21 09:30	01/26/22 13:11	1

Client Sample ID: E-SB-07 (59-64)

Date Collected: 08/30/21 14:45
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-3

Matrix: Solid
Percent Solids: 91.2

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	**6.9**		2.7	0.058	mg/Kg	☼	12/13/21 09:30	01/26/22 13:11	1
Iron	**10000**		5.5	3.2	mg/Kg	☼	12/13/21 09:30	01/26/22 13:11	1
Lead	**4.7**		0.55	0.12	mg/Kg	☼	12/13/21 09:30	01/26/22 13:11	1
Lithium	**13**		2.7	0.16	mg/Kg	☼	12/13/21 09:30	01/26/22 13:11	1
Manganese	**180**		0.82	0.14	mg/Kg	☼	12/13/21 09:30	01/26/22 13:11	1
Molybdenum	ND		2.2	0.090	mg/Kg	☼	12/13/21 09:30	01/26/22 13:11	1
Selenium	**0.84**		0.55	0.52	mg/Kg	☼	12/13/21 09:30	01/26/22 13:11	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**40**	**J**	160	26	mg/Kg	☼	12/15/21 10:40	01/26/22 14:35	5
Arsenic	ND		8.2	2.1	mg/Kg	☼	12/15/21 10:40	01/26/22 14:35	5
Barium	**30**	**J**	41	2.0	mg/Kg	☼	12/15/21 10:40	01/26/22 14:35	5
Boron	ND		160	160	mg/Kg	☼	12/15/21 10:40	01/26/22 14:35	5
Calcium	**170**	**J B**	4100	12	mg/Kg	☼	12/15/21 10:40	01/26/22 14:35	5
Cobalt	ND		41	0.66	mg/Kg	☼	12/15/21 10:40	01/26/22 14:35	5
Iron	ND		82	48	mg/Kg	☼	12/15/21 10:40	01/26/22 14:35	5
Lead	ND		8.2	1.8	mg/Kg	☼	12/15/21 10:40	01/26/22 14:35	5
Lithium	**6.1**	**J B**	41	2.4	mg/Kg	☼	12/15/21 10:40	01/26/22 14:35	5
Manganese	ND	*1	12	2.0	mg/Kg	☼	12/15/21 10:40	01/26/22 14:35	5
Molybdenum	ND		33	1.4	mg/Kg	☼	12/15/21 10:40	01/26/22 14:35	5
Selenium	ND		8.2	2.9	mg/Kg	☼	12/15/21 10:40	01/26/22 14:35	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**5800**		11	1.8	mg/Kg	☼	12/15/21 17:10	01/26/22 16:10	1
Arsenic	**0.99**		0.55	0.16	mg/Kg	☼	12/15/21 17:10	01/26/22 16:10	1
Barium	**24**		2.7	0.13	mg/Kg	☼	12/15/21 17:10	01/26/22 16:10	1
Boron	ND		11	11	mg/Kg	☼	12/15/21 17:10	01/26/22 16:10	1
Calcium	**85**	**J**	270	2.3	mg/Kg	☼	12/15/21 17:10	01/26/22 16:10	1
Cobalt	**4.8**		2.7	0.050	mg/Kg	☼	12/15/21 17:10	01/26/22 16:10	1
Iron	**8400**		5.5	3.2	mg/Kg	☼	12/15/21 17:10	01/26/22 16:10	1
Lead	**1.3**		0.55	0.12	mg/Kg	☼	12/15/21 17:10	01/26/22 16:10	1
Lithium	**12**		2.7	0.16	mg/Kg	☼	12/15/21 17:10	01/26/22 16:10	1
Manganese	**120**		0.82	0.27	mg/Kg	☼	12/15/21 17:10	01/26/22 16:10	1
Molybdenum	ND		2.2	0.11	mg/Kg	☼	12/15/21 17:10	01/26/22 16:10	1
Selenium	**0.37**	**J**	0.55	0.19	mg/Kg	☼	12/15/21 17:10	01/26/22 16:10	1

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**34000**		110	18	mg/Kg	☼	12/18/21 15:38	01/27/22 12:39	10
Arsenic	**1.4**	**B**	0.55	0.14	mg/Kg	☼	12/18/21 15:38	01/27/22 13:47	1
Barium	**170**		27	0.50	mg/Kg	☼	12/18/21 15:38	01/27/22 12:39	10
Calcium	**62**	**J**	270	2.9	mg/Kg	☼	12/18/21 15:38	01/27/22 13:47	1
Cobalt	**0.76**	**J**	5.5	0.057	mg/Kg	☼	12/18/21 15:38	01/27/22 15:23	2
Iron	**4400**		5.5	4.5	mg/Kg	☼	12/18/21 15:38	01/27/22 13:47	1
Lead	ND		1.1	0.24	mg/Kg	☼	12/18/21 15:38	01/27/22 15:23	2
Lithium	**15**		2.7	0.16	mg/Kg	☼	12/18/21 15:38	01/27/22 13:47	1
Manganese	**34**		0.82	0.12	mg/Kg	☼	12/18/21 15:38	01/27/22 13:47	1
Molybdenum	ND		2.2	0.090	mg/Kg	☼	12/18/21 15:38	01/27/22 13:47	1

Client Sample ID: E-SB-07 (59-64)

Date Collected: 08/30/21 14:45
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-3

Matrix: Solid
Percent Solids: 91.2

Method: 6010B SEP - SEP Metals (ICP) - Step 7 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	ND		0.55	0.19	mg/Kg	☼	12/18/21 15:38	01/27/22 13:47	1

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**44000**		10	1.6	mg/Kg			02/04/22 13:55	1
Arsenic	**3.9**		0.50	0.13	mg/Kg			02/04/22 13:55	1
Barium	**250**		2.5	0.12	mg/Kg			02/04/22 13:55	1
Calcium	**1700**		250	0.74	mg/Kg			02/04/22 13:55	1
Cobalt	**13**		2.5	0.023	mg/Kg			02/04/22 13:55	1
Iron	**24000**		5.0	4.1	mg/Kg			02/04/22 13:55	1
Lead	**9.4**		0.50	0.11	mg/Kg			02/04/22 13:55	1
Lithium	**46**		2.5	0.15	mg/Kg			02/04/22 13:55	1
Manganese	**360**		0.75	0.052	mg/Kg			02/04/22 13:55	1
Molybdenum	ND		2.0	0.082	mg/Kg			02/04/22 13:55	1
Selenium	**1.2**		0.50	0.17	mg/Kg			02/04/22 13:55	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**76000**		110	18	mg/Kg	☼	12/01/21 08:54	01/31/22 11:37	10
Arsenic	**3.9**	**B**	1.1	0.29	mg/Kg	☼	12/01/21 08:54	01/31/22 14:13	2
Barium	**400**		27	0.50	mg/Kg	☼	12/01/21 08:54	01/31/22 11:37	10
Calcium	**1500**	**B**	270	2.9	mg/Kg	☼	12/01/21 08:54	01/31/22 12:45	1
Cobalt	**11**		5.5	0.057	mg/Kg	☼	12/01/21 08:54	01/31/22 14:13	2
Iron	**21000**		5.5	4.5	mg/Kg	☼	12/01/21 08:54	01/31/22 12:45	1
Lead	**8.7**		1.1	0.24	mg/Kg	☼	12/01/21 08:54	01/31/22 14:13	2
Lithium	**42**		2.7	0.16	mg/Kg	☼	12/01/21 08:54	01/31/22 12:45	1
Manganese	**300**		0.82	0.12	mg/Kg	☼	12/01/21 08:54	01/31/22 12:45	1
Molybdenum	ND		2.2	0.090	mg/Kg	☼	12/01/21 08:54	01/31/22 12:45	1
Selenium	**1.3**		1.1	0.37	mg/Kg	☼	12/01/21 08:54	01/31/22 14:13	2

Client Sample ID: E-SB-05 (30-33.5)

Date Collected: 08/30/21 16:50
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-4

Matrix: Solid
Percent Solids: 72.1

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		55	8.9	mg/Kg	☼	12/02/21 12:30	01/17/22 11:44	4
Arsenic	ND		2.8	0.72	mg/Kg	☼	12/02/21 12:30	01/17/22 11:44	4
Barium	**1.3**	**J**	14	0.67	mg/Kg	☼	12/02/21 12:30	01/17/22 11:44	4
Boron	ND		55	55	mg/Kg	☼	12/02/21 12:30	01/17/22 11:44	4
Calcium	**2000**	**B**	1400	11	mg/Kg	☼	12/02/21 12:30	01/17/22 11:44	4
Cobalt	ND		14	0.25	mg/Kg	☼	12/02/21 12:30	01/17/22 11:44	4
Iron	ND		28	16	mg/Kg	☼	12/02/21 12:30	01/17/22 11:44	4
Lead	ND		2.8	0.61	mg/Kg	☼	12/02/21 12:30	01/17/22 11:44	4
Lithium	ND		14	0.83	mg/Kg	☼	12/02/21 12:30	01/17/22 11:44	4
Manganese	**7.2**	**B**	4.2	0.17	mg/Kg	☼	12/02/21 12:30	01/17/22 11:44	4
Molybdenum	ND		11	0.45	mg/Kg	☼	12/02/21 12:30	01/17/22 11:44	4
Selenium	ND		2.8	0.94	mg/Kg	☼	12/02/21 12:30	01/17/22 11:44	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**22**	**J**	42	6.7	mg/Kg	☼	12/07/21 09:37	01/17/22 15:28	3
Arsenic	ND		2.1	0.54	mg/Kg	☼	12/07/21 09:37	01/17/22 15:28	3
Barium	**4.6**	**J**	10	0.50	mg/Kg	☼	12/07/21 09:37	01/17/22 15:28	3
Boron	ND		42	42	mg/Kg	☼	12/07/21 09:37	01/17/22 15:28	3
Calcium	**11000**		1000	9.1	mg/Kg	☼	12/07/21 09:37	01/17/22 15:28	3
Cobalt	**1.4**	**J**	10	0.26	mg/Kg	☼	12/07/21 09:37	01/17/22 15:28	3
Iron	**250**		21	12	mg/Kg	☼	12/07/21 09:37	01/17/22 15:28	3
Lead	**2.0**	**J**	2.1	0.46	mg/Kg	☼	12/07/21 09:37	01/17/22 15:28	3
Lithium	ND		10	0.62	mg/Kg	☼	12/07/21 09:37	01/17/22 15:28	3
Manganese	**150**		3.1	1.2	mg/Kg	☼	12/07/21 09:37	01/17/22 15:28	3
Molybdenum	ND		8.3	0.34	mg/Kg	☼	12/07/21 09:37	01/17/22 15:28	3
Selenium	ND		2.1	0.71	mg/Kg	☼	12/07/21 09:37	01/26/22 09:56	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**210**		14	2.9	mg/Kg	☼	12/09/21 11:51	01/26/22 11:25	1
Arsenic	**1.7**		0.69	0.18	mg/Kg	☼	12/09/21 11:51	01/26/22 11:25	1
Barium	**6.8**	***-**	3.5	0.17	mg/Kg	☼	12/09/21 11:51	01/26/22 11:25	1
Boron	ND		14	14	mg/Kg	☼	12/09/21 11:51	01/26/22 11:25	1
Calcium	**16**	**J**	350	2.1	mg/Kg	☼	12/09/21 11:51	01/26/22 11:25	1
Cobalt	**1.6**	**J**	3.5	0.062	mg/Kg	☼	12/09/21 11:51	01/26/22 11:25	1
Iron	**5500**		6.9	4.0	mg/Kg	☼	12/09/21 11:51	01/26/22 11:25	1
Lead	ND		0.69	0.15	mg/Kg	☼	12/09/21 11:51	01/26/22 11:25	1
Lithium	ND		3.5	0.21	mg/Kg	☼	12/09/21 11:51	01/26/22 11:25	1
Manganese	**150**	**B**	1.0	0.037	mg/Kg	☼	12/09/21 11:51	01/26/22 11:25	1
Molybdenum	**0.20**	**J**	2.8	0.11	mg/Kg	☼	12/09/21 11:51	01/26/22 11:25	1
Selenium	**0.38**	**J**	0.69	0.24	mg/Kg	☼	12/09/21 11:51	01/26/22 11:25	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**2400**		14	2.2	mg/Kg	☼	12/13/21 09:30	01/26/22 13:16	1
Arsenic	**2.0**	**B**	0.69	0.30	mg/Kg	☼	12/13/21 09:30	01/26/22 13:16	1
Barium	**34**		3.5	0.17	mg/Kg	☼	12/13/21 09:30	01/26/22 13:16	1
Boron	ND		14	14	mg/Kg	☼	12/13/21 09:30	01/26/22 13:16	1
Calcium	**14000**		350	3.0	mg/Kg	☼	12/13/21 09:30	01/26/22 13:16	1

Client Sample ID: E-SB-05 (30-33.5)

Date Collected: 08/30/21 16:50
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-4

Matrix: Solid
Percent Solids: 72.1

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	3.4	J	3.5	0.073	mg/Kg	☼	12/13/21 09:30	01/26/22 13:16	1
Iron	11000		6.9	4.0	mg/Kg	☼	12/13/21 09:30	01/26/22 13:16	1
Lead	7.0		0.69	0.15	mg/Kg	☼	12/13/21 09:30	01/26/22 13:16	1
Lithium	7.2		3.5	0.21	mg/Kg	☼	12/13/21 09:30	01/26/22 13:16	1
Manganese	270		1.0	0.18	mg/Kg	☼	12/13/21 09:30	01/26/22 13:16	1
Molybdenum	0.16	J	2.8	0.11	mg/Kg	☼	12/13/21 09:30	01/26/22 13:16	1
Selenium	1.1		0.69	0.65	mg/Kg	☼	12/13/21 09:30	01/26/22 13:16	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	40	J	210	33	mg/Kg	☼	12/15/21 10:40	01/26/22 14:40	5
Arsenic	ND		10	2.6	mg/Kg	☼	12/15/21 10:40	01/26/22 14:40	5
Barium	35	J	52	2.5	mg/Kg	☼	12/15/21 10:40	01/26/22 14:40	5
Boron	ND		210	210	mg/Kg	☼	12/15/21 10:40	01/26/22 14:40	5
Calcium	11000	B	5200	15	mg/Kg	☼	12/15/21 10:40	01/26/22 14:40	5
Cobalt	0.91	J	52	0.83	mg/Kg	☼	12/15/21 10:40	01/26/22 14:40	5
Iron	ND		100	61	mg/Kg	☼	12/15/21 10:40	01/26/22 14:40	5
Lead	ND		10	2.3	mg/Kg	☼	12/15/21 10:40	01/26/22 14:40	5
Lithium	7.1	J B	52	3.0	mg/Kg	☼	12/15/21 10:40	01/26/22 14:40	5
Manganese	54	*1	16	2.6	mg/Kg	☼	12/15/21 10:40	01/26/22 14:40	5
Molybdenum	ND		42	1.7	mg/Kg	☼	12/15/21 10:40	01/26/22 14:40	5
Selenium	ND		10	3.6	mg/Kg	☼	12/15/21 10:40	01/26/22 14:40	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	5000		14	2.2	mg/Kg	☼	12/15/21 17:10	01/26/22 16:15	1
Arsenic	1.7		0.69	0.21	mg/Kg	☼	12/15/21 17:10	01/26/22 16:15	1
Barium	37		3.5	0.17	mg/Kg	☼	12/15/21 17:10	01/26/22 16:15	1
Boron	ND		14	14	mg/Kg	☼	12/15/21 17:10	01/26/22 16:15	1
Calcium	2000		350	2.9	mg/Kg	☼	12/15/21 17:10	01/26/22 16:15	1
Cobalt	2.2	J	3.5	0.064	mg/Kg	☼	12/15/21 17:10	01/26/22 16:15	1
Iron	8300		6.9	4.0	mg/Kg	☼	12/15/21 17:10	01/26/22 16:15	1
Lead	2.6		0.69	0.15	mg/Kg	☼	12/15/21 17:10	01/26/22 16:15	1
Lithium	6.7		3.5	0.21	mg/Kg	☼	12/15/21 17:10	01/26/22 16:15	1
Manganese	63		1.0	0.35	mg/Kg	☼	12/15/21 17:10	01/26/22 16:15	1
Molybdenum	ND		2.8	0.14	mg/Kg	☼	12/15/21 17:10	01/26/22 16:15	1
Selenium	0.32	J	0.69	0.24	mg/Kg	☼	12/15/21 17:10	01/26/22 16:15	1

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	37000		140	22	mg/Kg	☼	12/18/21 15:38	01/27/22 12:44	10
Arsenic	1.6	B	1.4	0.36	mg/Kg	☼	12/18/21 15:38	01/27/22 15:28	2
Barium	280		35	0.64	mg/Kg	☼	12/18/21 15:38	01/27/22 12:44	10
Calcium	1700		350	3.6	mg/Kg	☼	12/18/21 15:38	01/27/22 13:52	1
Cobalt	0.23	J	3.5	0.036	mg/Kg	☼	12/18/21 15:38	01/27/22 13:52	1
Iron	5400		6.9	5.7	mg/Kg	☼	12/18/21 15:38	01/27/22 13:52	1
Lead	0.72	J	1.4	0.30	mg/Kg	☼	12/18/21 15:38	01/27/22 15:28	2
Lithium	16		3.5	0.21	mg/Kg	☼	12/18/21 15:38	01/27/22 13:52	1
Manganese	45		1.0	0.15	mg/Kg	☼	12/18/21 15:38	01/27/22 13:52	1
Molybdenum	ND		2.8	0.11	mg/Kg	☼	12/18/21 15:38	01/27/22 13:52	1

Client Sample ID: E-SB-05 (30-33.5)

Date Collected: 08/30/21 16:50
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-4

Matrix: Solid
Percent Solids: 72.1

Method: 6010B SEP - SEP Metals (ICP) - Step 7 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	ND		1.4	0.47	mg/Kg	☼	12/18/21 15:38	01/27/22 15:28	2

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	45000		10	1.6	mg/Kg			02/04/22 13:55	1
Arsenic	7.0		0.50	0.13	mg/Kg			02/04/22 13:55	1
Barium	400		2.5	0.12	mg/Kg			02/04/22 13:55	1
Calcium	42000		250	0.74	mg/Kg			02/04/22 13:55	1
Cobalt	9.8		2.5	0.023	mg/Kg			02/04/22 13:55	1
Iron	31000		5.0	4.1	mg/Kg			02/04/22 13:55	1
Lead	12		0.50	0.11	mg/Kg			02/04/22 13:55	1
Lithium	37		2.5	0.15	mg/Kg			02/04/22 13:55	1
Manganese	730		0.75	0.052	mg/Kg			02/04/22 13:55	1
Molybdenum	0.35	J	2.0	0.082	mg/Kg			02/04/22 13:55	1
Selenium	1.8		0.50	0.17	mg/Kg			02/04/22 13:55	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	64000		140	22	mg/Kg	☼	12/01/21 08:54	01/31/22 11:42	10
Arsenic	8.2	B	1.4	0.36	mg/Kg	☼	12/01/21 08:54	01/31/22 14:18	2
Barium	470		35	0.64	mg/Kg	☼	12/01/21 08:54	01/31/22 11:42	10
Calcium	53000	B	3500	36	mg/Kg	☼	12/01/21 08:54	01/31/22 11:42	10
Cobalt	6.8		3.5	0.036	mg/Kg	☼	12/01/21 08:54	01/31/22 12:51	1
Iron	23000		6.9	5.7	mg/Kg	☼	12/01/21 08:54	01/31/22 12:51	1
Lead	12		1.4	0.30	mg/Kg	☼	12/01/21 08:54	01/31/22 14:18	2
Lithium	31		3.5	0.21	mg/Kg	☼	12/01/21 08:54	01/31/22 12:51	1
Manganese	550		1.0	0.15	mg/Kg	☼	12/01/21 08:54	01/31/22 12:51	1
Molybdenum	0.65	J B	2.8	0.11	mg/Kg	☼	12/01/21 08:54	01/31/22 12:51	1
Selenium	1.8		1.4	0.47	mg/Kg	☼	12/01/21 08:54	01/31/22 14:18	2

Client Sample ID: E-SB-05 (51-56)

Date Collected: 08/30/21 17:20
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-5

Matrix: Solid
Percent Solids: 89.9

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**9.7**	**J**	44	7.1	mg/Kg	☼	12/02/21 12:30	01/17/22 11:49	4
Arsenic	ND		2.2	0.58	mg/Kg	☼	12/02/21 12:30	01/17/22 11:49	4
Barium	**0.93**	**J**	11	0.53	mg/Kg	☼	12/02/21 12:30	01/17/22 11:49	4
Boron	ND		44	44	mg/Kg	☼	12/02/21 12:30	01/17/22 11:49	4
Calcium	**550**	**J B**	1100	8.4	mg/Kg	☼	12/02/21 12:30	01/17/22 11:49	4
Cobalt	ND		11	0.20	mg/Kg	☼	12/02/21 12:30	01/17/22 11:49	4
Iron	ND		22	13	mg/Kg	☼	12/02/21 12:30	01/17/22 11:49	4
Lead	ND		2.2	0.49	mg/Kg	☼	12/02/21 12:30	01/17/22 11:49	4
Lithium	ND		11	0.67	mg/Kg	☼	12/02/21 12:30	01/17/22 11:49	4
Manganese	**3.4**	**B**	3.3	0.14	mg/Kg	☼	12/02/21 12:30	01/17/22 11:49	4
Molybdenum	ND		8.9	0.36	mg/Kg	☼	12/02/21 12:30	01/17/22 11:49	4
Selenium	ND		2.2	0.76	mg/Kg	☼	12/02/21 12:30	01/17/22 11:49	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**110**		33	5.3	mg/Kg	☼	12/07/21 09:37	01/17/22 15:33	3
Arsenic	ND		1.7	0.43	mg/Kg	☼	12/07/21 09:37	01/17/22 15:33	3
Barium	**0.75**	**J**	8.3	0.40	mg/Kg	☼	12/07/21 09:37	01/17/22 15:33	3
Boron	ND		33	33	mg/Kg	☼	12/07/21 09:37	01/17/22 15:33	3
Calcium	**370**	**J**	830	7.3	mg/Kg	☼	12/07/21 09:37	01/17/22 15:33	3
Cobalt	**0.47**	**J**	8.3	0.21	mg/Kg	☼	12/07/21 09:37	01/17/22 15:33	3
Iron	**180**		17	9.7	mg/Kg	☼	12/07/21 09:37	01/17/22 15:33	3
Lead	**3.8**		1.7	0.37	mg/Kg	☼	12/07/21 09:37	01/17/22 15:33	3
Lithium	**0.53**	**J**	8.3	0.50	mg/Kg	☼	12/07/21 09:37	01/17/22 15:33	3
Manganese	**12**		2.5	0.93	mg/Kg	☼	12/07/21 09:37	01/17/22 15:33	3
Molybdenum	ND		6.7	0.27	mg/Kg	☼	12/07/21 09:37	01/17/22 15:33	3
Selenium	ND		1.7	0.57	mg/Kg	☼	12/07/21 09:37	01/26/22 10:01	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**380**		11	2.3	mg/Kg	☼	12/09/21 11:51	01/26/22 11:30	1
Arsenic	**0.76**		0.56	0.14	mg/Kg	☼	12/09/21 11:51	01/26/22 11:30	1
Barium	**3.8**	***-**	2.8	0.13	mg/Kg	☼	12/09/21 11:51	01/26/22 11:30	1
Boron	ND		11	11	mg/Kg	☼	12/09/21 11:51	01/26/22 11:30	1
Calcium	**7.0**	**J**	280	1.7	mg/Kg	☼	12/09/21 11:51	01/26/22 11:30	1
Cobalt	**0.63**	**J**	2.8	0.050	mg/Kg	☼	12/09/21 11:51	01/26/22 11:30	1
Iron	**2000**		5.6	3.2	mg/Kg	☼	12/09/21 11:51	01/26/22 11:30	1
Lead	ND		0.56	0.12	mg/Kg	☼	12/09/21 11:51	01/26/22 11:30	1
Lithium	**0.47**	**J**	2.8	0.17	mg/Kg	☼	12/09/21 11:51	01/26/22 11:30	1
Manganese	**47**	**B**	0.83	0.030	mg/Kg	☼	12/09/21 11:51	01/26/22 11:30	1
Molybdenum	ND		2.2	0.091	mg/Kg	☼	12/09/21 11:51	01/26/22 11:30	1
Selenium	**0.19**	**J**	0.56	0.19	mg/Kg	☼	12/09/21 11:51	01/26/22 11:30	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**4500**		11	1.8	mg/Kg	☼	12/13/21 09:30	01/26/22 13:21	1
Arsenic	**1.0**	**B**	0.56	0.24	mg/Kg	☼	12/13/21 09:30	01/26/22 13:21	1
Barium	**36**		2.8	0.13	mg/Kg	☼	12/13/21 09:30	01/26/22 13:21	1
Boron	ND		11	11	mg/Kg	☼	12/13/21 09:30	01/26/22 13:21	1
Calcium	**2700**		280	2.4	mg/Kg	☼	12/13/21 09:30	01/26/22 13:21	1

Client Sample ID: E-SB-05 (51-56)
Date Collected: 08/30/21 17:20
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-5
Matrix: Solid
Percent Solids: 89.9

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	6.4		2.8	0.059	mg/Kg	☼	12/13/21 09:30	01/26/22 13:21	1
Iron	14000		5.6	3.2	mg/Kg	☼	12/13/21 09:30	01/26/22 13:21	1
Lead	5.5		0.56	0.12	mg/Kg	☼	12/13/21 09:30	01/26/22 13:21	1
Lithium	13		2.8	0.17	mg/Kg	☼	12/13/21 09:30	01/26/22 13:21	1
Manganese	290		0.83	0.14	mg/Kg	☼	12/13/21 09:30	01/26/22 13:21	1
Molybdenum	ND		2.2	0.091	mg/Kg	☼	12/13/21 09:30	01/26/22 13:21	1
Selenium	1.1		0.56	0.52	mg/Kg	☼	12/13/21 09:30	01/26/22 13:21	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	37	J	170	26	mg/Kg	☼	12/15/21 10:40	01/26/22 14:45	5
Arsenic	ND		8.3	2.1	mg/Kg	☼	12/15/21 10:40	01/26/22 14:45	5
Barium	7.3	J	42	2.0	mg/Kg	☼	12/15/21 10:40	01/26/22 14:45	5
Boron	ND		170	170	mg/Kg	☼	12/15/21 10:40	01/26/22 14:45	5
Calcium	390	J B	4200	12	mg/Kg	☼	12/15/21 10:40	01/26/22 14:45	5
Cobalt	1.5	J	42	0.67	mg/Kg	☼	12/15/21 10:40	01/26/22 14:45	5
Iron	ND		83	49	mg/Kg	☼	12/15/21 10:40	01/26/22 14:45	5
Lead	ND		8.3	1.8	mg/Kg	☼	12/15/21 10:40	01/26/22 14:45	5
Lithium	7.3	J B	42	2.4	mg/Kg	☼	12/15/21 10:40	01/26/22 14:45	5
Manganese	11	J *1	13	2.1	mg/Kg	☼	12/15/21 10:40	01/26/22 14:45	5
Molybdenum	ND		33	1.4	mg/Kg	☼	12/15/21 10:40	01/26/22 14:45	5
Selenium	ND		8.3	2.9	mg/Kg	☼	12/15/21 10:40	01/26/22 14:45	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	6700		11	1.8	mg/Kg	☼	12/15/21 17:10	01/26/22 16:20	1
Arsenic	1.3		0.56	0.17	mg/Kg	☼	12/15/21 17:10	01/26/22 16:20	1
Barium	12		2.8	0.13	mg/Kg	☼	12/15/21 17:10	01/26/22 16:20	1
Boron	ND		11	11	mg/Kg	☼	12/15/21 17:10	01/26/22 16:20	1
Calcium	140	J	280	2.3	mg/Kg	☼	12/15/21 17:10	01/26/22 16:20	1
Cobalt	5.7		2.8	0.051	mg/Kg	☼	12/15/21 17:10	01/26/22 16:20	1
Iron	9700		5.6	3.2	mg/Kg	☼	12/15/21 17:10	01/26/22 16:20	1
Lead	1.8		0.56	0.12	mg/Kg	☼	12/15/21 17:10	01/26/22 16:20	1
Lithium	13		2.8	0.17	mg/Kg	☼	12/15/21 17:10	01/26/22 16:20	1
Manganese	140		0.83	0.28	mg/Kg	☼	12/15/21 17:10	01/26/22 16:20	1
Molybdenum	ND		2.2	0.11	mg/Kg	☼	12/15/21 17:10	01/26/22 16:20	1
Selenium	0.44	J	0.56	0.19	mg/Kg	☼	12/15/21 17:10	01/26/22 16:20	1

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	41000		110	18	mg/Kg	☼	12/18/21 15:38	01/27/22 12:49	10
Arsenic	1.8	B	1.1	0.29	mg/Kg	☼	12/18/21 15:38	01/27/22 15:33	2
Barium	220		28	0.51	mg/Kg	☼	12/18/21 15:38	01/27/22 12:49	10
Calcium	100	J	280	2.9	mg/Kg	☼	12/18/21 15:38	01/27/22 14:07	1
Cobalt	0.50	J	5.6	0.058	mg/Kg	☼	12/18/21 15:38	01/27/22 15:33	2
Iron	4600		5.6	4.6	mg/Kg	☼	12/18/21 15:38	01/27/22 14:07	1
Lead	ND		1.1	0.24	mg/Kg	☼	12/18/21 15:38	01/27/22 15:33	2
Lithium	17		2.8	0.17	mg/Kg	☼	12/18/21 15:38	01/27/22 14:07	1
Manganese	33		0.83	0.12	mg/Kg	☼	12/18/21 15:38	01/27/22 14:07	1
Molybdenum	ND		2.2	0.091	mg/Kg	☼	12/18/21 15:38	01/27/22 14:07	1

Client Sample ID: E-SB-05 (51-56)

Date Collected: 08/30/21 17:20
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-5

Matrix: Solid
Percent Solids: 89.9

Method: 6010B SEP - SEP Metals (ICP) - Step 7 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	ND		1.1	0.38	mg/Kg	☼	12/18/21 15:38	01/27/22 15:33	2

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**52000**		10	1.6	mg/Kg			02/04/22 13:55	1
Arsenic	**4.8**		0.50	0.13	mg/Kg			02/04/22 13:55	1
Barium	**280**		2.5	0.12	mg/Kg			02/04/22 13:55	1
Calcium	**4300**		250	0.74	mg/Kg			02/04/22 13:55	1
Cobalt	**15**		2.5	0.023	mg/Kg			02/04/22 13:55	1
Iron	**30000**		5.0	4.1	mg/Kg			02/04/22 13:55	1
Lead	**11**		0.50	0.11	mg/Kg			02/04/22 13:55	1
Lithium	**51**		2.5	0.15	mg/Kg			02/04/22 13:55	1
Manganese	**530**		0.75	0.052	mg/Kg			02/04/22 13:55	1
Molybdenum	ND		2.0	0.082	mg/Kg			02/04/22 13:55	1
Selenium	**1.7**		0.50	0.17	mg/Kg			02/04/22 13:55	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**95000**		110	18	mg/Kg	☼	12/01/21 08:54	01/31/22 11:47	10
Arsenic	**9.6**	**B**	1.1	0.29	mg/Kg	☼	12/01/21 08:54	01/31/22 14:23	2
Barium	**480**		28	0.51	mg/Kg	☼	12/01/21 08:54	01/31/22 11:47	10
Calcium	**4200**	**B**	2800	29	mg/Kg	☼	12/01/21 08:54	01/31/22 11:47	10
Cobalt	**16**		5.6	0.058	mg/Kg	☼	12/01/21 08:54	01/31/22 14:23	2
Iron	**27000**		5.6	4.6	mg/Kg	☼	12/01/21 08:54	01/31/22 12:57	1
Lead	**12**		1.1	0.24	mg/Kg	☼	12/01/21 08:54	01/31/22 14:23	2
Lithium	**49**		2.8	0.17	mg/Kg	☼	12/01/21 08:54	01/31/22 12:57	1
Manganese	**460**		0.83	0.12	mg/Kg	☼	12/01/21 08:54	01/31/22 12:57	1
Molybdenum	**0.31**	**J B**	2.2	0.091	mg/Kg	☼	12/01/21 08:54	01/31/22 12:57	1
Selenium	**1.8**		1.1	0.38	mg/Kg	☼	12/01/21 08:54	01/31/22 14:23	2

Client Sample ID: E-SB-19 (35-40)
Date Collected: 08/31/21 10:00
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-6
Matrix: Solid
Percent Solids: 81.8

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		49	7.8	mg/Kg	☼	12/02/21 12:30	01/17/22 11:54	4
Arsenic	ND		2.4	0.64	mg/Kg	☼	12/02/21 12:30	01/17/22 11:54	4
Barium	**1.2**	**J**	12	0.59	mg/Kg	☼	12/02/21 12:30	01/17/22 11:54	4
Boron	ND		49	49	mg/Kg	☼	12/02/21 12:30	01/17/22 11:54	4
Calcium	**950**	**J B**	1200	9.3	mg/Kg	☼	12/02/21 12:30	01/17/22 11:54	4
Cobalt	ND		12	0.22	mg/Kg	☼	12/02/21 12:30	01/17/22 11:54	4
Iron	ND		24	14	mg/Kg	☼	12/02/21 12:30	01/17/22 11:54	4
Lead	ND		2.4	0.54	mg/Kg	☼	12/02/21 12:30	01/17/22 11:54	4
Lithium	ND		12	0.73	mg/Kg	☼	12/02/21 12:30	01/17/22 11:54	4
Manganese	**19**	**B**	3.7	0.15	mg/Kg	☼	12/02/21 12:30	01/17/22 11:54	4
Molybdenum	ND		9.8	0.40	mg/Kg	☼	12/02/21 12:30	01/17/22 11:54	4
Selenium	**0.86**	**J**	2.4	0.83	mg/Kg	☼	12/02/21 12:30	01/17/22 11:54	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**40**		37	5.9	mg/Kg	☼	12/07/21 09:37	01/17/22 15:38	3
Arsenic	ND		1.8	0.48	mg/Kg	☼	12/07/21 09:37	01/17/22 15:38	3
Barium	**1.2**	**J**	9.2	0.44	mg/Kg	☼	12/07/21 09:37	01/17/22 15:38	3
Boron	ND		37	37	mg/Kg	☼	12/07/21 09:37	01/17/22 15:38	3
Calcium	**1500**		920	8.1	mg/Kg	☼	12/07/21 09:37	01/17/22 15:38	3
Cobalt	ND		9.2	0.23	mg/Kg	☼	12/07/21 09:37	01/17/22 15:38	3
Iron	**160**		18	11	mg/Kg	☼	12/07/21 09:37	01/17/22 15:38	3
Lead	**2.6**		1.8	0.40	mg/Kg	☼	12/07/21 09:37	01/17/22 15:38	3
Lithium	ND		9.2	0.55	mg/Kg	☼	12/07/21 09:37	01/17/22 15:38	3
Manganese	**150**		2.8	1.0	mg/Kg	☼	12/07/21 09:37	01/17/22 15:38	3
Molybdenum	ND		7.3	0.30	mg/Kg	☼	12/07/21 09:37	01/17/22 15:38	3
Selenium	ND		1.8	0.62	mg/Kg	☼	12/07/21 09:37	01/26/22 10:06	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**200**		12	2.6	mg/Kg	☼	12/09/21 11:51	01/26/22 11:45	1
Arsenic	**0.40**	**J**	0.61	0.16	mg/Kg	☼	12/09/21 11:51	01/26/22 11:45	1
Barium	**2.5**	**J *-**	3.1	0.15	mg/Kg	☼	12/09/21 11:51	01/26/22 11:45	1
Boron	ND		12	12	mg/Kg	☼	12/09/21 11:51	01/26/22 11:45	1
Calcium	**11**	**J**	310	1.8	mg/Kg	☼	12/09/21 11:51	01/26/22 11:45	1
Cobalt	**0.37**	**J**	3.1	0.055	mg/Kg	☼	12/09/21 11:51	01/26/22 11:45	1
Iron	**1200**		6.1	3.5	mg/Kg	☼	12/09/21 11:51	01/26/22 11:45	1
Lead	ND		0.61	0.13	mg/Kg	☼	12/09/21 11:51	01/26/22 11:45	1
Lithium	**0.20**	**J**	3.1	0.18	mg/Kg	☼	12/09/21 11:51	01/26/22 11:45	1
Manganese	**79**	**B**	0.92	0.033	mg/Kg	☼	12/09/21 11:51	01/26/22 11:45	1
Molybdenum	ND		2.4	0.10	mg/Kg	☼	12/09/21 11:51	01/26/22 11:45	1
Selenium	ND		0.61	0.21	mg/Kg	☼	12/09/21 11:51	01/26/22 11:45	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**1600**		12	2.0	mg/Kg	☼	12/13/21 09:30	01/26/22 13:26	1
Arsenic	**2.3**	**B**	0.61	0.27	mg/Kg	☼	12/13/21 09:30	01/26/22 13:26	1
Barium	**35**		3.1	0.15	mg/Kg	☼	12/13/21 09:30	01/26/22 13:26	1
Boron	ND		12	12	mg/Kg	☼	12/13/21 09:30	01/26/22 13:26	1
Calcium	**13000**		310	2.7	mg/Kg	☼	12/13/21 09:30	01/26/22 13:26	1

Client Sample ID: E-SB-19 (35-40)
Date Collected: 08/31/21 10:00
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-6
Matrix: Solid
Percent Solids: 81.8

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	4.2		3.1	0.065	mg/Kg	☼	12/13/21 09:30	01/26/22 13:26	1
Iron	9600		6.1	3.5	mg/Kg	☼	12/13/21 09:30	01/26/22 13:26	1
Lead	5.3		0.61	0.13	mg/Kg	☼	12/13/21 09:30	01/26/22 13:26	1
Lithium	4.3		3.1	0.18	mg/Kg	☼	12/13/21 09:30	01/26/22 13:26	1
Manganese	170		0.92	0.16	mg/Kg	☼	12/13/21 09:30	01/26/22 13:26	1
Molybdenum	0.33	J	2.4	0.10	mg/Kg	☼	12/13/21 09:30	01/26/22 13:26	1
Selenium	0.89		0.61	0.57	mg/Kg	☼	12/13/21 09:30	01/26/22 13:26	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	99	J	180	29	mg/Kg	☼	12/15/21 10:40	01/26/22 15:00	5
Arsenic	ND		9.2	2.3	mg/Kg	☼	12/15/21 10:40	01/26/22 15:00	5
Barium	11	J	46	2.2	mg/Kg	☼	12/15/21 10:40	01/26/22 15:00	5
Boron	ND		180	180	mg/Kg	☼	12/15/21 10:40	01/26/22 15:00	5
Calcium	10000	B	4600	13	mg/Kg	☼	12/15/21 10:40	01/26/22 15:00	5
Cobalt	ND		46	0.73	mg/Kg	☼	12/15/21 10:40	01/26/22 15:00	5
Iron	ND		92	54	mg/Kg	☼	12/15/21 10:40	01/26/22 15:00	5
Lead	ND		9.2	2.0	mg/Kg	☼	12/15/21 10:40	01/26/22 15:00	5
Lithium	7.0	J B	46	2.7	mg/Kg	☼	12/15/21 10:40	01/26/22 15:00	5
Manganese	8.0	J *1	14	2.3	mg/Kg	☼	12/15/21 10:40	01/26/22 15:00	5
Molybdenum	ND		37	1.5	mg/Kg	☼	12/15/21 10:40	01/26/22 15:00	5
Selenium	ND		9.2	3.2	mg/Kg	☼	12/15/21 10:40	01/26/22 15:00	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	5700		12	2.0	mg/Kg	☼	12/15/21 17:10	01/26/22 16:25	1
Arsenic	2.1		0.61	0.18	mg/Kg	☼	12/15/21 17:10	01/26/22 16:25	1
Barium	13		3.1	0.15	mg/Kg	☼	12/15/21 17:10	01/26/22 16:25	1
Boron	ND		12	12	mg/Kg	☼	12/15/21 17:10	01/26/22 16:25	1
Calcium	3100		310	2.6	mg/Kg	☼	12/15/21 17:10	01/26/22 16:25	1
Cobalt	3.7		3.1	0.056	mg/Kg	☼	12/15/21 17:10	01/26/22 16:25	1
Iron	9800		6.1	3.5	mg/Kg	☼	12/15/21 17:10	01/26/22 16:25	1
Lead	2.5		0.61	0.13	mg/Kg	☼	12/15/21 17:10	01/26/22 16:25	1
Lithium	8.5		3.1	0.18	mg/Kg	☼	12/15/21 17:10	01/26/22 16:25	1
Manganese	94		0.92	0.31	mg/Kg	☼	12/15/21 17:10	01/26/22 16:25	1
Molybdenum	ND		2.4	0.12	mg/Kg	☼	12/15/21 17:10	01/26/22 16:25	1
Selenium	0.45	J	0.61	0.21	mg/Kg	☼	12/15/21 17:10	01/26/22 16:25	1

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	31000		120	20	mg/Kg	☼	12/18/21 15:38	01/27/22 12:54	10
Arsenic	1.6	B	1.2	0.32	mg/Kg	☼	12/18/21 15:38	01/27/22 15:38	2
Barium	220		31	0.56	mg/Kg	☼	12/18/21 15:38	01/27/22 12:54	10
Calcium	1300		310	3.2	mg/Kg	☼	12/18/21 15:38	01/27/22 14:13	1
Cobalt	0.35	J	6.1	0.064	mg/Kg	☼	12/18/21 15:38	01/27/22 15:38	2
Iron	4600		6.1	5.0	mg/Kg	☼	12/18/21 15:38	01/27/22 14:13	1
Lead	0.58	J	1.2	0.27	mg/Kg	☼	12/18/21 15:38	01/27/22 15:38	2
Lithium	14		3.1	0.18	mg/Kg	☼	12/18/21 15:38	01/27/22 14:13	1
Manganese	38		0.92	0.13	mg/Kg	☼	12/18/21 15:38	01/27/22 14:13	1
Molybdenum	ND		2.4	0.10	mg/Kg	☼	12/18/21 15:38	01/27/22 14:13	1

Client Sample ID: E-SB-19 (35-40)

Date Collected: 08/31/21 10:00
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-6

Matrix: Solid
Percent Solids: 81.8

Method: 6010B SEP - SEP Metals (ICP) - Step 7 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	ND		1.2	0.42	mg/Kg	☼	12/18/21 15:38	01/27/22 15:38	2

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	38000		10	1.6	mg/Kg			02/04/22 13:55	1
Arsenic	6.4		0.50	0.13	mg/Kg			02/04/22 13:55	1
Barium	280		2.5	0.12	mg/Kg			02/04/22 13:55	1
Calcium	30000		250	0.74	mg/Kg			02/04/22 13:55	1
Cobalt	8.7		2.5	0.023	mg/Kg			02/04/22 13:55	1
Iron	25000		5.0	4.1	mg/Kg			02/04/22 13:55	1
Lead	11		0.50	0.11	mg/Kg			02/04/22 13:55	1
Lithium	34		2.5	0.15	mg/Kg			02/04/22 13:55	1
Manganese	560		0.75	0.052	mg/Kg			02/04/22 13:55	1
Molybdenum	0.33	J	2.0	0.082	mg/Kg			02/04/22 13:55	1
Selenium	2.2		0.50	0.17	mg/Kg			02/04/22 13:55	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	54000		120	20	mg/Kg	☼	12/01/21 08:54	01/31/22 11:51	10
Arsenic	6.5	B	1.2	0.32	mg/Kg	☼	12/01/21 08:54	01/31/22 14:28	2
Barium	380		31	0.56	mg/Kg	☼	12/01/21 08:54	01/31/22 11:51	10
Calcium	32000	B	3100	32	mg/Kg	☼	12/01/21 08:54	01/31/22 11:51	10
Cobalt	5.5		3.1	0.032	mg/Kg	☼	12/01/21 08:54	01/31/22 13:12	1
Iron	18000		6.1	5.0	mg/Kg	☼	12/01/21 08:54	01/31/22 13:12	1
Lead	11		1.2	0.27	mg/Kg	☼	12/01/21 08:54	01/31/22 14:28	2
Lithium	24		3.1	0.18	mg/Kg	☼	12/01/21 08:54	01/31/22 13:12	1
Manganese	360		0.92	0.13	mg/Kg	☼	12/01/21 08:54	01/31/22 13:12	1
Molybdenum	0.52	J B	2.4	0.10	mg/Kg	☼	12/01/21 08:54	01/31/22 13:12	1
Selenium	1.9		1.2	0.42	mg/Kg	☼	12/01/21 08:54	01/31/22 14:28	2

Client Sample ID: E-SB-18 (40-44)

Date Collected: 08/31/21 11:45
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-7

Matrix: Solid
Percent Solids: 70.1

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		57	9.1	mg/Kg	☼	12/02/21 12:30	01/17/22 11:59	4
Arsenic	ND		2.9	0.74	mg/Kg	☼	12/02/21 12:30	01/17/22 11:59	4
Barium	**0.81**	**J**	14	0.68	mg/Kg	☼	12/02/21 12:30	01/17/22 11:59	4
Boron	ND		57	57	mg/Kg	☼	12/02/21 12:30	01/17/22 11:59	4
Calcium	**2100**	**B**	1400	11	mg/Kg	☼	12/02/21 12:30	01/17/22 11:59	4
Cobalt	ND		14	0.26	mg/Kg	☼	12/02/21 12:30	01/17/22 11:59	4
Iron	ND		29	17	mg/Kg	☼	12/02/21 12:30	01/17/22 11:59	4
Lead	**0.75**	**J**	2.9	0.63	mg/Kg	☼	12/02/21 12:30	01/17/22 11:59	4
Lithium	ND		14	0.86	mg/Kg	☼	12/02/21 12:30	01/17/22 11:59	4
Manganese	**7.9**	**B**	4.3	0.18	mg/Kg	☼	12/02/21 12:30	01/17/22 11:59	4
Molybdenum	ND		11	0.47	mg/Kg	☼	12/02/21 12:30	01/17/22 11:59	4
Selenium	ND		2.9	0.97	mg/Kg	☼	12/02/21 12:30	01/17/22 11:59	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**18**	**J**	43	6.8	mg/Kg	☼	12/07/21 09:37	01/17/22 15:43	3
Arsenic	ND		2.1	0.56	mg/Kg	☼	12/07/21 09:37	01/17/22 15:43	3
Barium	**4.1**	**J**	11	0.51	mg/Kg	☼	12/07/21 09:37	01/17/22 15:43	3
Boron	ND		43	43	mg/Kg	☼	12/07/21 09:37	01/17/22 15:43	3
Calcium	**9500**		1100	9.4	mg/Kg	☼	12/07/21 09:37	01/17/22 15:43	3
Cobalt	**0.76**	**J**	11	0.27	mg/Kg	☼	12/07/21 09:37	01/17/22 15:43	3
Iron	**200**		21	12	mg/Kg	☼	12/07/21 09:37	01/17/22 15:43	3
Lead	**1.9**	**J**	2.1	0.47	mg/Kg	☼	12/07/21 09:37	01/17/22 15:43	3
Lithium	ND		11	0.64	mg/Kg	☼	12/07/21 09:37	01/17/22 15:43	3
Manganese	**100**		3.2	1.2	mg/Kg	☼	12/07/21 09:37	01/17/22 15:43	3
Molybdenum	ND		8.6	0.35	mg/Kg	☼	12/07/21 09:37	01/17/22 15:43	3
Selenium	ND		2.1	0.73	mg/Kg	☼	12/07/21 09:37	01/26/22 10:11	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**220**		14	3.0	mg/Kg	☼	12/09/21 11:51	01/26/22 11:50	1
Arsenic	**1.6**		0.71	0.19	mg/Kg	☼	12/09/21 11:51	01/26/22 11:50	1
Barium	**3.6**	***-**	3.6	0.17	mg/Kg	☼	12/09/21 11:51	01/26/22 11:50	1
Boron	ND		14	14	mg/Kg	☼	12/09/21 11:51	01/26/22 11:50	1
Calcium	**12**	**J**	360	2.1	mg/Kg	☼	12/09/21 11:51	01/26/22 11:50	1
Cobalt	**1.5**	**J**	3.6	0.064	mg/Kg	☼	12/09/21 11:51	01/26/22 11:50	1
Iron	**5500**		7.1	4.1	mg/Kg	☼	12/09/21 11:51	01/26/22 11:50	1
Lead	ND		0.71	0.16	mg/Kg	☼	12/09/21 11:51	01/26/22 11:50	1
Lithium	ND		3.6	0.21	mg/Kg	☼	12/09/21 11:51	01/26/22 11:50	1
Manganese	**110**	**B**	1.1	0.039	mg/Kg	☼	12/09/21 11:51	01/26/22 11:50	1
Molybdenum	**0.26**	**J**	2.9	0.12	mg/Kg	☼	12/09/21 11:51	01/26/22 11:50	1
Selenium	**0.38**	**J**	0.71	0.24	mg/Kg	☼	12/09/21 11:51	01/26/22 11:50	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**3900**		14	2.3	mg/Kg	☼	12/13/21 09:30	01/26/22 13:31	1
Arsenic	**2.9**	**B**	0.71	0.31	mg/Kg	☼	12/13/21 09:30	01/26/22 13:31	1
Barium	**37**		3.6	0.17	mg/Kg	☼	12/13/21 09:30	01/26/22 13:31	1
Boron	ND		14	14	mg/Kg	☼	12/13/21 09:30	01/26/22 13:31	1
Calcium	**10000**		360	3.1	mg/Kg	☼	12/13/21 09:30	01/26/22 13:31	1

Client Sample ID: E-SB-18 (40-44)

Date Collected: 08/31/21 11:45
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-7

Matrix: Solid
Percent Solids: 70.1

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	5.6		3.6	0.076	mg/Kg	☼	12/13/21 09:30	01/26/22 13:31	1
Iron	17000		7.1	4.1	mg/Kg	☼	12/13/21 09:30	01/26/22 13:31	1
Lead	8.9		0.71	0.16	mg/Kg	☼	12/13/21 09:30	01/26/22 13:31	1
Lithium	9.9		3.6	0.21	mg/Kg	☼	12/13/21 09:30	01/26/22 13:31	1
Manganese	270		1.1	0.19	mg/Kg	☼	12/13/21 09:30	01/26/22 13:31	1
Molybdenum	0.28	J	2.9	0.12	mg/Kg	☼	12/13/21 09:30	01/26/22 13:31	1
Selenium	1.5		0.71	0.67	mg/Kg	☼	12/13/21 09:30	01/26/22 13:31	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	50	J	210	34	mg/Kg	☼	12/15/21 10:40	01/26/22 15:05	5
Arsenic	2.7	J	11	2.7	mg/Kg	☼	12/15/21 10:40	01/26/22 15:05	5
Barium	23	J	53	2.6	mg/Kg	☼	12/15/21 10:40	01/26/22 15:05	5
Boron	ND		210	210	mg/Kg	☼	12/15/21 10:40	01/26/22 15:05	5
Calcium	5800	B	5300	16	mg/Kg	☼	12/15/21 10:40	01/26/22 15:05	5
Cobalt	1.2	J	53	0.86	mg/Kg	☼	12/15/21 10:40	01/26/22 15:05	5
Iron	93	J	110	63	mg/Kg	☼	12/15/21 10:40	01/26/22 15:05	5
Lead	ND		11	2.4	mg/Kg	☼	12/15/21 10:40	01/26/22 15:05	5
Lithium	8.2	J B	53	3.1	mg/Kg	☼	12/15/21 10:40	01/26/22 15:05	5
Manganese	38	*1	16	2.6	mg/Kg	☼	12/15/21 10:40	01/26/22 15:05	5
Molybdenum	ND		43	1.8	mg/Kg	☼	12/15/21 10:40	01/26/22 15:05	5
Selenium	ND		11	3.7	mg/Kg	☼	12/15/21 10:40	01/26/22 15:05	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	5400		14	2.3	mg/Kg	☼	12/15/21 17:10	01/26/22 16:30	1
Arsenic	2.2		0.71	0.21	mg/Kg	☼	12/15/21 17:10	01/26/22 16:30	1
Barium	98		3.6	0.17	mg/Kg	☼	12/15/21 17:10	01/26/22 16:30	1
Boron	ND		14	14	mg/Kg	☼	12/15/21 17:10	01/26/22 16:30	1
Calcium	540		360	3.0	mg/Kg	☼	12/15/21 17:10	01/26/22 16:30	1
Cobalt	2.3	J	3.6	0.066	mg/Kg	☼	12/15/21 17:10	01/26/22 16:30	1
Iron	10000		7.1	4.1	mg/Kg	☼	12/15/21 17:10	01/26/22 16:30	1
Lead	2.6		0.71	0.16	mg/Kg	☼	12/15/21 17:10	01/26/22 16:30	1
Lithium	6.2		3.6	0.21	mg/Kg	☼	12/15/21 17:10	01/26/22 16:30	1
Manganese	51		1.1	0.36	mg/Kg	☼	12/15/21 17:10	01/26/22 16:30	1
Molybdenum	0.14	J	2.9	0.14	mg/Kg	☼	12/15/21 17:10	01/26/22 16:30	1
Selenium	0.36	J	0.71	0.24	mg/Kg	☼	12/15/21 17:10	01/26/22 16:30	1

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	34000		140	23	mg/Kg	☼	12/18/21 15:38	01/27/22 13:08	10
Arsenic	2.0	B	1.4	0.37	mg/Kg	☼	12/18/21 15:38	01/27/22 15:43	2
Barium	240		36	0.66	mg/Kg	☼	12/18/21 15:38	01/27/22 13:08	10
Calcium	970		360	3.7	mg/Kg	☼	12/18/21 15:38	01/27/22 14:18	1
Cobalt	0.62	J	7.1	0.074	mg/Kg	☼	12/18/21 15:38	01/27/22 15:43	2
Iron	6300		7.1	5.8	mg/Kg	☼	12/18/21 15:38	01/27/22 14:18	1
Lead	0.51	J	1.4	0.31	mg/Kg	☼	12/18/21 15:38	01/27/22 15:43	2
Lithium	18		3.6	0.21	mg/Kg	☼	12/18/21 15:38	01/27/22 14:18	1
Manganese	42		1.1	0.16	mg/Kg	☼	12/18/21 15:38	01/27/22 14:18	1
Molybdenum	0.14	J	2.9	0.12	mg/Kg	☼	12/18/21 15:38	01/27/22 14:18	1

Client Sample ID: E-SB-18 (40-44)

Date Collected: 08/31/21 11:45
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-7

Matrix: Solid
Percent Solids: 70.1

Method: 6010B SEP - SEP Metals (ICP) - Step 7 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	ND		1.4	0.48	mg/Kg	☼	12/18/21 15:38	01/27/22 15:43	2

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	43000		10	1.6	mg/Kg			02/04/22 13:55	1
Arsenic	11		0.50	0.13	mg/Kg			02/04/22 13:55	1
Barium	400		2.5	0.12	mg/Kg			02/04/22 13:55	1
Calcium	29000		250	0.74	mg/Kg			02/04/22 13:55	1
Cobalt	12		2.5	0.023	mg/Kg			02/04/22 13:55	1
Iron	39000		5.0	4.1	mg/Kg			02/04/22 13:55	1
Lead	15		0.50	0.11	mg/Kg			02/04/22 13:55	1
Lithium	43		2.5	0.15	mg/Kg			02/04/22 13:55	1
Manganese	620		0.75	0.052	mg/Kg			02/04/22 13:55	1
Molybdenum	0.82	J	2.0	0.082	mg/Kg			02/04/22 13:55	1
Selenium	2.3		0.50	0.17	mg/Kg			02/04/22 13:55	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	72000		140	23	mg/Kg	☼	12/01/21 08:54	01/31/22 11:56	10
Arsenic	10	B	1.4	0.37	mg/Kg	☼	12/01/21 08:54	01/31/22 14:33	2
Barium	550		36	0.66	mg/Kg	☼	12/01/21 08:54	01/31/22 11:56	10
Calcium	40000	B	3600	37	mg/Kg	☼	12/01/21 08:54	01/31/22 11:56	10
Cobalt	8.3		3.6	0.037	mg/Kg	☼	12/01/21 08:54	01/31/22 13:18	1
Iron	28000		7.1	5.8	mg/Kg	☼	12/01/21 08:54	01/31/22 13:18	1
Lead	14		1.4	0.31	mg/Kg	☼	12/01/21 08:54	01/31/22 14:33	2
Lithium	38		3.6	0.21	mg/Kg	☼	12/01/21 08:54	01/31/22 13:18	1
Manganese	490		1.1	0.16	mg/Kg	☼	12/01/21 08:54	01/31/22 13:18	1
Molybdenum	0.95	J B	2.9	0.12	mg/Kg	☼	12/01/21 08:54	01/31/22 13:18	1
Selenium	2.3		1.4	0.48	mg/Kg	☼	12/01/21 08:54	01/31/22 14:33	2

Client: Golder Associates Inc.
Project/Site: Edwards Power Station - Illinois

Job ID: 140-24457-1

Client Sample ID: E-SB-XPW01 (25-30)

Date Collected: 08/31/21 13:50
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-8

Matrix: Solid
Percent Solids: 61.3

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		65	10	mg/Kg	☼	12/02/21 12:30	01/17/22 14:23	4
Arsenic	ND		3.3	0.85	mg/Kg	☼	12/02/21 12:30	01/17/22 14:23	4
Barium	**4.6**	**J**	16	0.78	mg/Kg	☼	12/02/21 12:30	01/17/22 14:23	4
Boron	ND		65	65	mg/Kg	☼	12/02/21 12:30	01/17/22 14:23	4
Calcium	**5000**	**B**	1600	12	mg/Kg	☼	12/02/21 12:30	01/17/22 14:23	4
Cobalt	ND		16	0.29	mg/Kg	☼	12/02/21 12:30	01/17/22 14:23	4
Iron	ND		33	19	mg/Kg	☼	12/02/21 12:30	01/17/22 14:23	4
Lead	ND		3.3	0.72	mg/Kg	☼	12/02/21 12:30	01/17/22 14:23	4
Lithium	ND		16	0.98	mg/Kg	☼	12/02/21 12:30	01/17/22 14:23	4
Manganese	**0.92**	**J B**	4.9	0.20	mg/Kg	☼	12/02/21 12:30	01/17/22 14:23	4
Molybdenum	**1.0**	**J**	13	0.54	mg/Kg	☼	12/02/21 12:30	01/17/22 14:23	4
Selenium	ND		3.3	1.1	mg/Kg	☼	12/02/21 12:30	01/17/22 14:23	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**2900**		49	7.8	mg/Kg	☼	12/07/21 09:37	01/17/22 15:48	3
Arsenic	**23**		2.4	0.64	mg/Kg	☼	12/07/21 09:37	01/17/22 15:48	3
Barium	**5.8**	**J**	12	0.59	mg/Kg	☼	12/07/21 09:37	01/17/22 15:48	3
Boron	**590**		49	49	mg/Kg	☼	12/07/21 09:37	01/17/22 15:48	3
Calcium	**23000**		1200	11	mg/Kg	☼	12/07/21 09:37	01/17/22 15:48	3
Cobalt	**0.53**	**J**	12	0.31	mg/Kg	☼	12/07/21 09:37	01/17/22 15:48	3
Iron	**2600**		24	14	mg/Kg	☼	12/07/21 09:37	01/17/22 15:48	3
Lead	**32**		2.4	0.54	mg/Kg	☼	12/07/21 09:37	01/17/22 15:48	3
Lithium	**1.8**	**J**	12	0.73	mg/Kg	☼	12/07/21 09:37	01/17/22 15:48	3
Manganese	**320**		3.7	1.4	mg/Kg	☼	12/07/21 09:37	01/17/22 15:48	3
Molybdenum	**3.3**	**J**	9.8	0.40	mg/Kg	☼	12/07/21 09:37	01/17/22 15:48	3
Selenium	**2.1**	**J B**	2.4	0.83	mg/Kg	☼	12/07/21 09:37	01/26/22 10:16	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**4700**		16	3.4	mg/Kg	☼	12/09/21 11:51	01/26/22 11:55	1
Arsenic	**11**		0.82	0.21	mg/Kg	☼	12/09/21 11:51	01/26/22 11:55	1
Barium	**6.0**	***-**	4.1	0.20	mg/Kg	☼	12/09/21 11:51	01/26/22 11:55	1
Boron	**100**		16	16	mg/Kg	☼	12/09/21 11:51	01/26/22 11:55	1
Calcium	**11**	**J**	410	2.4	mg/Kg	☼	12/09/21 11:51	01/26/22 11:55	1
Cobalt	**0.89**	**J**	4.1	0.073	mg/Kg	☼	12/09/21 11:51	01/26/22 11:55	1
Iron	**2400**		8.2	4.7	mg/Kg	☼	12/09/21 11:51	01/26/22 11:55	1
Lead	**0.52**	**J**	0.82	0.18	mg/Kg	☼	12/09/21 11:51	01/26/22 11:55	1
Lithium	**1.4**	**J**	4.1	0.24	mg/Kg	☼	12/09/21 11:51	01/26/22 11:55	1
Manganese	**150**	**B**	1.2	0.044	mg/Kg	☼	12/09/21 11:51	01/26/22 11:55	1
Molybdenum	**1.7**	**J**	3.3	0.13	mg/Kg	☼	12/09/21 11:51	01/26/22 11:55	1
Selenium	**0.60**	**J**	0.82	0.28	mg/Kg	☼	12/09/21 11:51	01/26/22 11:55	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**4900**		16	2.6	mg/Kg	☼	12/13/21 09:30	01/26/22 17:19	1
Arsenic	**4.4**	**B**	0.82	0.36	mg/Kg	☼	12/13/21 09:30	01/26/22 17:19	1
Barium	**9.6**		4.1	0.20	mg/Kg	☼	12/13/21 09:30	01/26/22 17:19	1
Boron	**76**		16	16	mg/Kg	☼	12/13/21 09:30	01/26/22 17:19	1
Calcium	**12000**		410	3.6	mg/Kg	☼	12/13/21 09:30	01/26/22 17:19	1

Client Sample ID: E-SB-XPW01 (25-30)

Date Collected: 08/31/21 13:50
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-8

Matrix: Solid
Percent Solids: 61.3

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	3.6	J	4.1	0.087	mg/Kg	☼	12/13/21 09:30	01/26/22 17:19	1
Iron	12000		8.2	4.7	mg/Kg	☼	12/13/21 09:30	01/26/22 17:19	1
Lead	83		0.82	0.18	mg/Kg	☼	12/13/21 09:30	01/26/22 17:19	1
Lithium	5.1		4.1	0.24	mg/Kg	☼	12/13/21 09:30	01/26/22 17:19	1
Manganese	150		1.2	0.21	mg/Kg	☼	12/13/21 09:30	01/26/22 17:19	1
Molybdenum	1.6	J	3.3	0.13	mg/Kg	☼	12/13/21 09:30	01/26/22 17:19	1
Selenium	0.96		0.82	0.77	mg/Kg	☼	12/13/21 09:30	01/26/22 17:19	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		240	38	mg/Kg	☼	12/15/21 10:40	01/26/22 15:10	5
Arsenic	ND		12	3.1	mg/Kg	☼	12/15/21 10:40	01/26/22 15:10	5
Barium	63		61	2.9	mg/Kg	☼	12/15/21 10:40	01/26/22 15:10	5
Boron	ND		240	240	mg/Kg	☼	12/15/21 10:40	01/26/22 15:10	5
Calcium	9400	B	6100	18	mg/Kg	☼	12/15/21 10:40	01/26/22 15:10	5
Cobalt	ND		61	0.98	mg/Kg	☼	12/15/21 10:40	01/26/22 15:10	5
Iron	ND		120	72	mg/Kg	☼	12/15/21 10:40	01/26/22 15:10	5
Lead	ND		12	2.7	mg/Kg	☼	12/15/21 10:40	01/26/22 15:10	5
Lithium	8.4	J B	61	3.6	mg/Kg	☼	12/15/21 10:40	01/26/22 15:10	5
Manganese	ND	*1	18	3.0	mg/Kg	☼	12/15/21 10:40	01/26/22 15:10	5
Molybdenum	ND		49	2.0	mg/Kg	☼	12/15/21 10:40	01/26/22 15:10	5
Selenium	ND		12	4.2	mg/Kg	☼	12/15/21 10:40	01/26/22 15:10	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	4700		16	2.6	mg/Kg	☼	12/15/21 17:10	01/26/22 16:35	1
Arsenic	5.6		1.6	0.49	mg/Kg	☼	12/15/21 17:10	01/26/22 17:24	2
Barium	110		4.1	0.20	mg/Kg	☼	12/15/21 17:10	01/26/22 16:35	1
Boron	20		16	16	mg/Kg	☼	12/15/21 17:10	01/26/22 16:35	1
Calcium	4500		410	3.4	mg/Kg	☼	12/15/21 17:10	01/26/22 16:35	1
Cobalt	5.4		4.1	0.075	mg/Kg	☼	12/15/21 17:10	01/26/22 16:35	1
Iron	53000		16	9.5	mg/Kg	☼	12/15/21 17:10	01/26/22 17:24	2
Lead	30		0.82	0.18	mg/Kg	☼	12/15/21 17:10	01/26/22 16:35	1
Lithium	3.7	J	4.1	0.24	mg/Kg	☼	12/15/21 17:10	01/26/22 16:35	1
Manganese	78		1.2	0.41	mg/Kg	☼	12/15/21 17:10	01/26/22 16:35	1
Molybdenum	1.1	J	3.3	0.16	mg/Kg	☼	12/15/21 17:10	01/26/22 16:35	1
Selenium	2.7		1.6	0.55	mg/Kg	☼	12/15/21 17:10	01/26/22 17:24	2

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	67000		160	26	mg/Kg	☼	12/18/21 15:38	01/27/22 13:13	10
Arsenic	7.0	B	1.6	0.42	mg/Kg	☼	12/18/21 15:38	01/27/22 15:48	2
Barium	270		41	0.75	mg/Kg	☼	12/18/21 15:38	01/27/22 13:13	10
Calcium	9000		4100	42	mg/Kg	☼	12/18/21 15:38	01/27/22 13:13	10
Cobalt	18	J	20	0.21	mg/Kg	☼	12/18/21 15:38	01/27/22 15:53	5
Iron	80000		16	13	mg/Kg	☼	12/18/21 15:38	01/27/22 15:48	2
Lead	240		4.1	0.90	mg/Kg	☼	12/18/21 15:38	01/27/22 15:53	5
Lithium	43		4.1	0.24	mg/Kg	☼	12/18/21 15:38	01/27/22 14:23	1
Manganese	150		1.2	0.18	mg/Kg	☼	12/18/21 15:38	01/27/22 14:23	1
Molybdenum	1.3	J	3.3	0.13	mg/Kg	☼	12/18/21 15:38	01/27/22 14:23	1

Client Sample ID: E-SB-XPW01 (25-30)

Date Collected: 08/31/21 13:50
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-8

Matrix: Solid
Percent Solids: 61.3

Method: 6010B SEP - SEP Metals (ICP) - Step 7 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	ND	L	1.6	0.55	mg/Kg	☼	12/18/21 15:38	01/27/22 15:48	2

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	84000		10	1.6	mg/Kg			02/04/22 13:55	1
Arsenic	51		0.50	0.13	mg/Kg			02/04/22 13:55	1
Barium	470		2.5	0.12	mg/Kg			02/04/22 13:55	1
Calcium	63000		250	0.74	mg/Kg			02/04/22 13:55	1
Cobalt	28		2.5	0.023	mg/Kg			02/04/22 13:55	1
Iron	150000		5.0	4.1	mg/Kg			02/04/22 13:55	1
Lead	390		0.50	0.11	mg/Kg			02/04/22 13:55	1
Lithium	63		2.5	0.15	mg/Kg			02/04/22 13:55	1
Manganese	850		0.75	0.052	mg/Kg			02/04/22 13:55	1
Molybdenum	10		2.0	0.082	mg/Kg			02/04/22 13:55	1
Selenium	6.4		0.50	0.17	mg/Kg			02/04/22 13:55	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	85000		160	26	mg/Kg	☼	12/01/21 08:54	01/31/22 12:11	10
Arsenic	49	B	4.1	1.1	mg/Kg	☼	12/01/21 08:54	01/31/22 14:39	5
Barium	460		41	0.75	mg/Kg	☼	12/01/21 08:54	01/31/22 12:11	10
Calcium	71000	B	4100	42	mg/Kg	☼	12/01/21 08:54	01/31/22 12:11	10
Cobalt	26		20	0.21	mg/Kg	☼	12/01/21 08:54	01/31/22 14:39	5
Iron	150000		41	33	mg/Kg	☼	12/01/21 08:54	01/31/22 14:39	5
Lead	330		4.1	0.90	mg/Kg	☼	12/01/21 08:54	01/31/22 14:39	5
Lithium	59		20	1.2	mg/Kg	☼	12/01/21 08:54	01/31/22 14:39	5
Manganese	840		6.1	0.90	mg/Kg	☼	12/01/21 08:54	01/31/22 14:39	5
Molybdenum	10	J B	16	0.67	mg/Kg	☼	12/01/21 08:54	01/31/22 14:39	5
Selenium	10		4.1	1.4	mg/Kg	☼	12/01/21 08:54	01/31/22 14:39	5

Client: Golder Associates Inc.
Project/Site: Edwards Power Station - Illinois

Job ID: 140-24457-1

Client Sample ID: E-SB-15 (10-15)

Date Collected: 08/31/21 15:40
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-9

Matrix: Solid
Percent Solids: 65.0

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		62	9.8	mg/Kg	☼	12/02/21 12:30	01/17/22 14:33	4
Arsenic	ND		3.1	0.80	mg/Kg	☼	12/02/21 12:30	01/17/22 14:33	4
Barium	**1.2**	**J**	15	0.74	mg/Kg	☼	12/02/21 12:30	01/17/22 14:33	4
Boron	ND		62	62	mg/Kg	☼	12/02/21 12:30	01/17/22 14:33	4
Calcium	**2600**	**B**	1500	12	mg/Kg	☼	12/02/21 12:30	01/17/22 14:33	4
Cobalt	ND		15	0.28	mg/Kg	☼	12/02/21 12:30	01/17/22 14:33	4
Iron	ND		31	18	mg/Kg	☼	12/02/21 12:30	01/17/22 14:33	4
Lead	**0.87**	**J**	3.1	0.68	mg/Kg	☼	12/02/21 12:30	01/17/22 14:33	4
Lithium	ND		15	0.92	mg/Kg	☼	12/02/21 12:30	01/17/22 14:33	4
Manganese	**1.2**	**J B**	4.6	0.19	mg/Kg	☼	12/02/21 12:30	01/17/22 14:33	4
Molybdenum	ND		12	0.50	mg/Kg	☼	12/02/21 12:30	01/17/22 14:33	4
Selenium	ND		3.1	1.0	mg/Kg	☼	12/02/21 12:30	01/17/22 14:33	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**12**	**J**	46	7.4	mg/Kg	☼	12/07/21 09:37	01/17/22 15:58	3
Arsenic	ND		2.3	0.60	mg/Kg	☼	12/07/21 09:37	01/17/22 15:58	3
Barium	**1.2**	**J**	12	0.55	mg/Kg	☼	12/07/21 09:37	01/17/22 15:58	3
Boron	ND		46	46	mg/Kg	☼	12/07/21 09:37	01/17/22 15:58	3
Calcium	**1400**		1200	10	mg/Kg	☼	12/07/21 09:37	01/17/22 15:58	3
Cobalt	**0.63**	**J**	12	0.29	mg/Kg	☼	12/07/21 09:37	01/17/22 15:58	3
Iron	**100**		23	13	mg/Kg	☼	12/07/21 09:37	01/17/22 15:58	3
Lead	**2.9**		2.3	0.51	mg/Kg	☼	12/07/21 09:37	01/17/22 15:58	3
Lithium	ND		12	0.69	mg/Kg	☼	12/07/21 09:37	01/17/22 15:58	3
Manganese	**19**		3.5	1.3	mg/Kg	☼	12/07/21 09:37	01/17/22 15:58	3
Molybdenum	ND		9.2	0.38	mg/Kg	☼	12/07/21 09:37	01/17/22 15:58	3
Selenium	ND		2.3	0.78	mg/Kg	☼	12/07/21 09:37	01/26/22 10:26	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**320**		15	3.2	mg/Kg	☼	12/09/21 11:51	01/26/22 12:04	1
Arsenic	**1.1**		0.77	0.20	mg/Kg	☼	12/09/21 11:51	01/26/22 12:04	1
Barium	**2.7**	**J *-**	3.8	0.18	mg/Kg	☼	12/09/21 11:51	01/26/22 12:04	1
Boron	ND		15	15	mg/Kg	☼	12/09/21 11:51	01/26/22 12:04	1
Calcium	**18**	**J**	380	2.3	mg/Kg	☼	12/09/21 11:51	01/26/22 12:04	1
Cobalt	**1.1**	**J**	3.8	0.069	mg/Kg	☼	12/09/21 11:51	01/26/22 12:04	1
Iron	**1900**		7.7	4.5	mg/Kg	☼	12/09/21 11:51	01/26/22 12:04	1
Lead	**0.75**	**J**	0.77	0.17	mg/Kg	☼	12/09/21 11:51	01/26/22 12:04	1
Lithium	ND		3.8	0.23	mg/Kg	☼	12/09/21 11:51	01/26/22 12:04	1
Manganese	**9.8**	**B**	1.2	0.042	mg/Kg	☼	12/09/21 11:51	01/26/22 12:04	1
Molybdenum	**0.14**	**J**	3.1	0.13	mg/Kg	☼	12/09/21 11:51	01/26/22 12:04	1
Selenium	**0.37**	**J**	0.77	0.26	mg/Kg	☼	12/09/21 11:51	01/26/22 12:04	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**5300**		15	2.5	mg/Kg	☼	12/13/21 09:30	01/26/22 14:00	1
Arsenic	**1.8**	**B**	0.77	0.34	mg/Kg	☼	12/13/21 09:30	01/26/22 14:00	1
Barium	**15**		3.8	0.18	mg/Kg	☼	12/13/21 09:30	01/26/22 14:00	1
Boron	ND		15	15	mg/Kg	☼	12/13/21 09:30	01/26/22 14:00	1
Calcium	**2100**		380	3.4	mg/Kg	☼	12/13/21 09:30	01/26/22 14:00	1

Client Sample ID: E-SB-15 (10-15)
Date Collected: 08/31/21 15:40
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-9
Matrix: Solid
Percent Solids: 65.0

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	7.7		3.8	0.082	mg/Kg	☼	12/13/21 09:30	01/26/22 14:00	1
Iron	10000		7.7	4.5	mg/Kg	☼	12/13/21 09:30	01/26/22 14:00	1
Lead	12		0.77	0.17	mg/Kg	☼	12/13/21 09:30	01/26/22 14:00	1
Lithium	14		3.8	0.23	mg/Kg	☼	12/13/21 09:30	01/26/22 14:00	1
Manganese	90		1.2	0.20	mg/Kg	☼	12/13/21 09:30	01/26/22 14:00	1
Molybdenum	ND		3.1	0.13	mg/Kg	☼	12/13/21 09:30	01/26/22 14:00	1
Selenium	1.0		0.77	0.72	mg/Kg	☼	12/13/21 09:30	01/26/22 14:00	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	130	J	230	36	mg/Kg	☼	12/15/21 10:40	01/26/22 15:20	5
Arsenic	ND		12	2.9	mg/Kg	☼	12/15/21 10:40	01/26/22 15:20	5
Barium	73		58	2.8	mg/Kg	☼	12/15/21 10:40	01/26/22 15:20	5
Boron	ND		230	230	mg/Kg	☼	12/15/21 10:40	01/26/22 15:20	5
Calcium	460	J B	5800	17	mg/Kg	☼	12/15/21 10:40	01/26/22 15:20	5
Cobalt	1.7	J	58	0.92	mg/Kg	☼	12/15/21 10:40	01/26/22 15:20	5
Iron	320		120	68	mg/Kg	☼	12/15/21 10:40	01/26/22 15:20	5
Lead	ND		12	2.5	mg/Kg	☼	12/15/21 10:40	01/26/22 15:20	5
Lithium	8.9	J B	58	3.4	mg/Kg	☼	12/15/21 10:40	01/26/22 15:20	5
Manganese	15	J *1	17	2.8	mg/Kg	☼	12/15/21 10:40	01/26/22 15:20	5
Molybdenum	ND		46	1.9	mg/Kg	☼	12/15/21 10:40	01/26/22 15:20	5
Selenium	ND		12	4.0	mg/Kg	☼	12/15/21 10:40	01/26/22 15:20	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	8700		15	2.5	mg/Kg	☼	12/15/21 17:10	01/26/22 16:59	1
Arsenic	2.0		0.77	0.23	mg/Kg	☼	12/15/21 17:10	01/26/22 16:59	1
Barium	72		3.8	0.18	mg/Kg	☼	12/15/21 17:10	01/26/22 16:59	1
Boron	ND		15	15	mg/Kg	☼	12/15/21 17:10	01/26/22 16:59	1
Calcium	150	J	380	3.2	mg/Kg	☼	12/15/21 17:10	01/26/22 16:59	1
Cobalt	2.7	J	3.8	0.071	mg/Kg	☼	12/15/21 17:10	01/26/22 16:59	1
Iron	13000		7.7	4.5	mg/Kg	☼	12/15/21 17:10	01/26/22 16:59	1
Lead	2.5		0.77	0.17	mg/Kg	☼	12/15/21 17:10	01/26/22 16:59	1
Lithium	8.3		3.8	0.23	mg/Kg	☼	12/15/21 17:10	01/26/22 16:59	1
Manganese	42		1.2	0.38	mg/Kg	☼	12/15/21 17:10	01/26/22 16:59	1
Molybdenum	ND		3.1	0.15	mg/Kg	☼	12/15/21 17:10	01/26/22 16:59	1
Selenium	0.65	J	0.77	0.26	mg/Kg	☼	12/15/21 17:10	01/26/22 16:59	1

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	35000		150	25	mg/Kg	☼	12/18/21 15:38	01/27/22 13:23	10
Arsenic	1.9	B	1.5	0.40	mg/Kg	☼	12/18/21 15:38	01/27/22 16:26	2
Barium	200		38	0.71	mg/Kg	☼	12/18/21 15:38	01/27/22 13:23	10
Calcium	340	J	380	4.0	mg/Kg	☼	12/18/21 15:38	01/27/22 14:34	1
Cobalt	0.37	J	3.8	0.040	mg/Kg	☼	12/18/21 15:38	01/27/22 14:34	1
Iron	6800		7.7	6.3	mg/Kg	☼	12/18/21 15:38	01/27/22 14:34	1
Lead	ND		1.5	0.34	mg/Kg	☼	12/18/21 15:38	01/27/22 16:26	2
Lithium	20		3.8	0.23	mg/Kg	☼	12/18/21 15:38	01/27/22 14:34	1
Manganese	29		1.2	0.17	mg/Kg	☼	12/18/21 15:38	01/27/22 14:34	1
Molybdenum	0.14	J	3.1	0.13	mg/Kg	☼	12/18/21 15:38	01/27/22 14:34	1

Client Sample ID: E-SB-15 (10-15)

Date Collected: 08/31/21 15:40
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-9

Matrix: Solid
Percent Solids: 65.0

Method: 6010B SEP - SEP Metals (ICP) - Step 7 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	ND		1.5	0.52	mg/Kg	☼	12/18/21 15:38	01/27/22 16:26	2

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	49000		10	1.6	mg/Kg			02/04/22 13:55	1
Arsenic	6.8		0.50	0.13	mg/Kg			02/04/22 13:55	1
Barium	360		2.5	0.12	mg/Kg			02/04/22 13:55	1
Calcium	7000		250	0.74	mg/Kg			02/04/22 13:55	1
Cobalt	14		2.5	0.023	mg/Kg			02/04/22 13:55	1
Iron	32000		5.0	4.1	mg/Kg			02/04/22 13:55	1
Lead	19		0.50	0.11	mg/Kg			02/04/22 13:55	1
Lithium	51		2.5	0.15	mg/Kg			02/04/22 13:55	1
Manganese	210		0.75	0.052	mg/Kg			02/04/22 13:55	1
Molybdenum	0.28	J	2.0	0.082	mg/Kg			02/04/22 13:55	1
Selenium	2.1		0.50	0.17	mg/Kg			02/04/22 13:55	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	91000		150	25	mg/Kg	☼	12/01/21 08:54	01/31/22 12:20	10
Arsenic	6.2	B	0.77	0.20	mg/Kg	☼	12/01/21 08:54	01/31/22 13:35	1
Barium	560		38	0.71	mg/Kg	☼	12/01/21 08:54	01/31/22 12:20	10
Calcium	7700	B	3800	40	mg/Kg	☼	12/01/21 08:54	01/31/22 12:20	10
Cobalt	9.9		3.8	0.040	mg/Kg	☼	12/01/21 08:54	01/31/22 13:35	1
Iron	27000		7.7	6.3	mg/Kg	☼	12/01/21 08:54	01/31/22 13:35	1
Lead	18		1.5	0.34	mg/Kg	☼	12/01/21 08:54	01/31/22 15:03	2
Lithium	51		3.8	0.23	mg/Kg	☼	12/01/21 08:54	01/31/22 13:35	1
Manganese	170		1.2	0.17	mg/Kg	☼	12/01/21 08:54	01/31/22 13:35	1
Molybdenum	0.58	J B	3.1	0.13	mg/Kg	☼	12/01/21 08:54	01/31/22 13:35	1
Selenium	2.5		0.77	0.26	mg/Kg	☼	12/01/21 08:54	01/31/22 13:35	1

Client Sample ID: E-SB-15 (30-35)
Date Collected: 08/31/21 16:20
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-10
Matrix: Solid
Percent Solids: 65.1

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		61	9.8	mg/Kg	☼	12/02/21 12:30	01/17/22 14:38	4
Arsenic	ND		3.1	0.80	mg/Kg	☼	12/02/21 12:30	01/17/22 14:38	4
Barium	**1.5**	**J**	15	0.74	mg/Kg	☼	12/02/21 12:30	01/17/22 14:38	4
Boron	ND		61	61	mg/Kg	☼	12/02/21 12:30	01/17/22 14:38	4
Calcium	**2200**	**B**	1500	12	mg/Kg	☼	12/02/21 12:30	01/17/22 14:38	4
Cobalt	ND		15	0.28	mg/Kg	☼	12/02/21 12:30	01/17/22 14:38	4
Iron	ND		31	18	mg/Kg	☼	12/02/21 12:30	01/17/22 14:38	4
Lead	ND		3.1	0.68	mg/Kg	☼	12/02/21 12:30	01/17/22 14:38	4
Lithium	ND		15	0.92	mg/Kg	☼	12/02/21 12:30	01/17/22 14:38	4
Manganese	**4.9**	**B**	4.6	0.19	mg/Kg	☼	12/02/21 12:30	01/17/22 14:38	4
Molybdenum	ND		12	0.50	mg/Kg	☼	12/02/21 12:30	01/17/22 14:38	4
Selenium	ND		3.1	1.0	mg/Kg	☼	12/02/21 12:30	01/17/22 14:38	4

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**20**	**J**	46	7.4	mg/Kg	☼	12/07/21 09:37	01/17/22 16:03	3
Arsenic	ND		2.3	0.60	mg/Kg	☼	12/07/21 09:37	01/26/22 10:46	3
Barium	**4.1**	**J**	12	0.55	mg/Kg	☼	12/07/21 09:37	01/17/22 16:03	3
Boron	ND		46	46	mg/Kg	☼	12/07/21 09:37	01/17/22 16:03	3
Calcium	**9700**		1200	10	mg/Kg	☼	12/07/21 09:37	01/17/22 16:03	3
Cobalt	**2.4**	**J**	12	0.29	mg/Kg	☼	12/07/21 09:37	01/26/22 10:46	3
Iron	**280**		23	13	mg/Kg	☼	12/07/21 09:37	01/17/22 16:03	3
Lead	**2.1**	**J**	2.3	0.51	mg/Kg	☼	12/07/21 09:37	01/26/22 10:46	3
Lithium	**0.71**	**J**	12	0.69	mg/Kg	☼	12/07/21 09:37	01/17/22 16:03	3
Manganese	**130**		3.5	1.3	mg/Kg	☼	12/07/21 09:37	01/17/22 16:03	3
Molybdenum	ND		9.2	0.38	mg/Kg	☼	12/07/21 09:37	01/26/22 10:46	3
Selenium	ND		2.3	0.78	mg/Kg	☼	12/07/21 09:37	01/26/22 10:46	3

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**260**		15	3.2	mg/Kg	☼	12/09/21 11:51	01/26/22 12:09	1
Arsenic	**2.5**		0.77	0.20	mg/Kg	☼	12/09/21 11:51	01/26/22 12:09	1
Barium	**7.7**	***-**	3.8	0.18	mg/Kg	☼	12/09/21 11:51	01/26/22 12:09	1
Boron	ND		15	15	mg/Kg	☼	12/09/21 11:51	01/26/22 12:09	1
Calcium	**19**	**J**	380	2.3	mg/Kg	☼	12/09/21 11:51	01/26/22 12:09	1
Cobalt	**2.1**	**J**	3.8	0.069	mg/Kg	☼	12/09/21 11:51	01/26/22 12:09	1
Iron	**6500**		7.7	4.5	mg/Kg	☼	12/09/21 11:51	01/26/22 12:09	1
Lead	ND		0.77	0.17	mg/Kg	☼	12/09/21 11:51	01/26/22 12:09	1
Lithium	ND		3.8	0.23	mg/Kg	☼	12/09/21 11:51	01/26/22 12:09	1
Manganese	**170**	**B**	1.2	0.041	mg/Kg	☼	12/09/21 11:51	01/26/22 12:09	1
Molybdenum	**0.15**	**J**	3.1	0.13	mg/Kg	☼	12/09/21 11:51	01/26/22 12:09	1
Selenium	**0.47**	**J**	0.77	0.26	mg/Kg	☼	12/09/21 11:51	01/26/22 12:09	1

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	**3600**		15	2.5	mg/Kg	☼	12/13/21 09:30	01/26/22 14:05	1
Arsenic	**2.3**	**B**	0.77	0.34	mg/Kg	☼	12/13/21 09:30	01/26/22 14:05	1
Barium	**24**		3.8	0.18	mg/Kg	☼	12/13/21 09:30	01/26/22 14:05	1
Boron	ND		15	15	mg/Kg	☼	12/13/21 09:30	01/26/22 14:05	1
Calcium	**12000**		380	3.4	mg/Kg	☼	12/13/21 09:30	01/26/22 14:05	1

Client Sample ID: E-SB-15 (30-35)
Date Collected: 08/31/21 16:20
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-10
Matrix: Solid
Percent Solids: 65.1

Method: 6010B SEP - SEP Metals (ICP) - Step 4 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Cobalt	3.9		3.8	0.081	mg/Kg	☼	12/13/21 09:30	01/26/22 14:05	1
Iron	11000		7.7	4.5	mg/Kg	☼	12/13/21 09:30	01/26/22 14:05	1
Lead	8.3		0.77	0.17	mg/Kg	☼	12/13/21 09:30	01/26/22 14:05	1
Lithium	10		3.8	0.23	mg/Kg	☼	12/13/21 09:30	01/26/22 14:05	1
Manganese	270		1.2	0.20	mg/Kg	☼	12/13/21 09:30	01/26/22 14:05	1
Molybdenum	0.14	J	3.1	0.13	mg/Kg	☼	12/13/21 09:30	01/26/22 14:05	1
Selenium	1.2		0.77	0.72	mg/Kg	☼	12/13/21 09:30	01/26/22 14:05	1

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	98	J	230	36	mg/Kg	☼	12/15/21 10:40	01/26/22 15:26	5
Arsenic	3.2	J	12	2.9	mg/Kg	☼	12/15/21 10:40	01/26/22 15:26	5
Barium	39	J	58	2.8	mg/Kg	☼	12/15/21 10:40	01/26/22 15:26	5
Boron	ND		230	230	mg/Kg	☼	12/15/21 10:40	01/26/22 15:26	5
Calcium	11000	B	5800	17	mg/Kg	☼	12/15/21 10:40	01/26/22 15:26	5
Cobalt	1.7	J	58	0.92	mg/Kg	☼	12/15/21 10:40	01/26/22 15:26	5
Iron	200		120	68	mg/Kg	☼	12/15/21 10:40	01/26/22 15:26	5
Lead	ND		12	2.5	mg/Kg	☼	12/15/21 10:40	01/26/22 15:26	5
Lithium	7.8	J B	58	3.4	mg/Kg	☼	12/15/21 10:40	01/26/22 15:26	5
Manganese	53	*1	17	2.8	mg/Kg	☼	12/15/21 10:40	01/26/22 15:26	5
Molybdenum	ND		46	1.9	mg/Kg	☼	12/15/21 10:40	01/26/22 15:26	5
Selenium	ND		12	4.0	mg/Kg	☼	12/15/21 10:40	01/26/22 15:26	5

Method: 6010B SEP - SEP Metals (ICP) - Step 6

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	5500		15	2.5	mg/Kg	☼	12/15/21 17:10	01/26/22 17:04	1
Arsenic	2.0		0.77	0.23	mg/Kg	☼	12/15/21 17:10	01/26/22 17:04	1
Barium	62		3.8	0.18	mg/Kg	☼	12/15/21 17:10	01/26/22 17:04	1
Boron	ND		15	15	mg/Kg	☼	12/15/21 17:10	01/26/22 17:04	1
Calcium	1100		380	3.2	mg/Kg	☼	12/15/21 17:10	01/26/22 17:04	1
Cobalt	2.0	J	3.8	0.071	mg/Kg	☼	12/15/21 17:10	01/26/22 17:04	1
Iron	7800		7.7	4.5	mg/Kg	☼	12/15/21 17:10	01/26/22 17:04	1
Lead	2.5		0.77	0.17	mg/Kg	☼	12/15/21 17:10	01/26/22 17:04	1
Lithium	6.7		3.8	0.23	mg/Kg	☼	12/15/21 17:10	01/26/22 17:04	1
Manganese	56		1.2	0.38	mg/Kg	☼	12/15/21 17:10	01/26/22 17:04	1
Molybdenum	ND		3.1	0.15	mg/Kg	☼	12/15/21 17:10	01/26/22 17:04	1
Selenium	ND		0.77	0.26	mg/Kg	☼	12/15/21 17:10	01/26/22 17:04	1

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	43000		150	25	mg/Kg	☼	12/18/21 15:38	01/27/22 13:28	10
Arsenic	2.1	B	1.5	0.40	mg/Kg	☼	12/18/21 15:38	01/27/22 16:31	2
Barium	320		38	0.71	mg/Kg	☼	12/18/21 15:38	01/27/22 13:28	10
Calcium	1700		380	4.0	mg/Kg	☼	12/18/21 15:38	01/27/22 14:39	1
Cobalt	0.27	J	7.7	0.080	mg/Kg	☼	12/18/21 15:38	01/27/22 16:31	2
Iron	6000		7.7	6.3	mg/Kg	☼	12/18/21 15:38	01/27/22 14:39	1
Lead	1.1	J	1.5	0.34	mg/Kg	☼	12/18/21 15:38	01/27/22 16:31	2
Lithium	19		3.8	0.23	mg/Kg	☼	12/18/21 15:38	01/27/22 14:39	1
Manganese	47		1.2	0.17	mg/Kg	☼	12/18/21 15:38	01/27/22 14:39	1
Molybdenum	0.13	J	3.1	0.13	mg/Kg	☼	12/18/21 15:38	01/27/22 14:39	1

Client Sample ID: E-SB-15 (30-35)

Date Collected: 08/31/21 16:20
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-10

Matrix: Solid
Percent Solids: 65.1

Method: 6010B SEP - SEP Metals (ICP) - Step 7 (Continued)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Selenium	ND		1.5	0.52	mg/Kg	☼	12/18/21 15:38	01/27/22 16:31	2

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	52000		10	1.6	mg/Kg			02/04/22 13:55	1
Arsenic	12		0.50	0.13	mg/Kg			02/04/22 13:55	1
Barium	460		2.5	0.12	mg/Kg			02/04/22 13:55	1
Calcium	37000		250	0.74	mg/Kg			02/04/22 13:55	1
Cobalt	12		2.5	0.023	mg/Kg			02/04/22 13:55	1
Iron	31000		5.0	4.1	mg/Kg			02/04/22 13:55	1
Lead	14		0.50	0.11	mg/Kg			02/04/22 13:55	1
Lithium	45		2.5	0.15	mg/Kg			02/04/22 13:55	1
Manganese	730		0.75	0.052	mg/Kg			02/04/22 13:55	1
Molybdenum	0.42	J	2.0	0.082	mg/Kg			02/04/22 13:55	1
Selenium	1.7		0.50	0.17	mg/Kg			02/04/22 13:55	1

Method: 6010B - SEP Metals (ICP) - Total

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	69000		150	25	mg/Kg	☼	12/01/21 08:54	01/31/22 12:25	10
Arsenic	11	B	1.5	0.40	mg/Kg	☼	12/01/21 08:54	01/31/22 15:09	2
Barium	490		38	0.71	mg/Kg	☼	12/01/21 08:54	01/31/22 12:25	10
Calcium	35000	B	3800	40	mg/Kg	☼	12/01/21 08:54	01/31/22 12:25	10
Cobalt	8.4		3.8	0.040	mg/Kg	☼	12/01/21 08:54	01/31/22 13:40	1
Iron	26000		7.7	6.3	mg/Kg	☼	12/01/21 08:54	01/31/22 13:40	1
Lead	13		1.5	0.34	mg/Kg	☼	12/01/21 08:54	01/31/22 15:09	2
Lithium	38		3.8	0.23	mg/Kg	☼	12/01/21 08:54	01/31/22 13:40	1
Manganese	520		1.2	0.17	mg/Kg	☼	12/01/21 08:54	01/31/22 13:40	1
Molybdenum	0.83	J B	3.1	0.13	mg/Kg	☼	12/01/21 08:54	01/31/22 13:40	1
Selenium	2.6		1.5	0.52	mg/Kg	☼	12/01/21 08:54	01/31/22 15:09	2

Default Detection Limits

Client: Golder Associates Inc.
Job ID: 140-24457-1
Project/Site: Edwards Power Station - Illinois

Method: 6010B SEP - SEP Metals (ICP) - Step 1

Prep: 3010A

SEP: Exchangeable

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Arsenic	0.50	0.13	mg/Kg
Barium	2.5	0.12	mg/Kg
Boron	10	10	mg/Kg
Calcium	250	1.9	mg/Kg
Cobalt	2.5	0.045	mg/Kg
Iron	5.0	2.9	mg/Kg
Lead	0.50	0.11	mg/Kg
Lithium	2.5	0.15	mg/Kg
Manganese	0.75	0.031	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Selenium	0.50	0.17	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 2

Prep: 3010A

SEP: Carbonate

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Arsenic	0.50	0.13	mg/Kg
Barium	2.5	0.12	mg/Kg
Boron	10	10	mg/Kg
Calcium	250	2.2	mg/Kg
Cobalt	2.5	0.063	mg/Kg
Iron	5.0	2.9	mg/Kg
Lead	0.50	0.11	mg/Kg
Lithium	2.5	0.15	mg/Kg
Manganese	0.75	0.28	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Selenium	0.50	0.17	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 3

Prep: 3010A

SEP: Non-Crystalline

Analyte	RL	MDL	Units
Aluminum	10	2.1	mg/Kg
Arsenic	0.50	0.13	mg/Kg
Barium	2.5	0.12	mg/Kg
Boron	10	10	mg/Kg
Calcium	250	1.5	mg/Kg
Cobalt	2.5	0.045	mg/Kg
Iron	5.0	2.9	mg/Kg
Lead	0.50	0.11	mg/Kg
Lithium	2.5	0.15	mg/Kg
Manganese	0.75	0.027	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Selenium	0.50	0.17	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Prep: 3010A

SEP: Metal Hydroxide

Default Detection Limits

Client: Golder Associates Inc.
Job ID: 140-24457-1
Project/Site: Edwards Power Station - Illinois

Method: 6010B SEP - SEP Metals (ICP) - Step 4

Prep: 3010A

SEP: Metal Hydroxide

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Arsenic	0.50	0.22	mg/Kg
Barium	2.5	0.12	mg/Kg
Boron	10	10	mg/Kg
Calcium	250	2.2	mg/Kg
Cobalt	2.5	0.053	mg/Kg
Iron	5.0	2.9	mg/Kg
Lead	0.50	0.11	mg/Kg
Lithium	2.5	0.15	mg/Kg
Manganese	0.75	0.13	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Selenium	0.50	0.47	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 5

Prep: 3010A

SEP: Organic-Bound

Analyte	RL	MDL	Units
Aluminum	30	4.7	mg/Kg
Arsenic	1.5	0.38	mg/Kg
Barium	7.5	0.36	mg/Kg
Boron	30	30	mg/Kg
Calcium	750	2.2	mg/Kg
Cobalt	7.5	0.12	mg/Kg
Iron	15	8.8	mg/Kg
Lead	1.5	0.33	mg/Kg
Lithium	7.5	0.44	mg/Kg
Manganese	2.3	0.37	mg/Kg
Molybdenum	6.0	0.25	mg/Kg
Selenium	1.5	0.52	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 6

SEP: Acid/Sulfide

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Arsenic	0.50	0.15	mg/Kg
Barium	2.5	0.12	mg/Kg
Boron	10	10	mg/Kg
Calcium	250	2.1	mg/Kg
Cobalt	2.5	0.046	mg/Kg
Iron	5.0	2.9	mg/Kg
Lead	0.50	0.11	mg/Kg
Lithium	2.5	0.15	mg/Kg
Manganese	0.75	0.25	mg/Kg
Molybdenum	2.0	0.099	mg/Kg
Selenium	0.50	0.17	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Step 7

Prep: Residual

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg

Default Detection Limits

Client: Golder Associates Inc.
Job ID: 140-24457-1
Project/Site: Edwards Power Station - Illinois

Method: 6010B SEP - SEP Metals (ICP) - Step 7 (Continued)

Prep: Residual

Analyte	RL	MDL	Units
Arsenic	0.50	0.13	mg/Kg
Barium	2.5	0.046	mg/Kg
Calcium	250	2.6	mg/Kg
Cobalt	2.5	0.026	mg/Kg
Iron	5.0	4.1	mg/Kg
Lead	0.50	0.11	mg/Kg
Lithium	2.5	0.15	mg/Kg
Manganese	0.75	0.11	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Selenium	0.50	0.17	mg/Kg

Method: 6010B SEP - SEP Metals (ICP) - Sum of Steps 1-7

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Arsenic	0.50	0.13	mg/Kg
Barium	2.5	0.12	mg/Kg
Calcium	250	0.74	mg/Kg
Cobalt	2.5	0.023	mg/Kg
Iron	5.0	4.1	mg/Kg
Lead	0.50	0.11	mg/Kg
Lithium	2.5	0.15	mg/Kg
Manganese	0.75	0.052	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Selenium	0.50	0.17	mg/Kg

Method: 6010B - SEP Metals (ICP) - Total

Prep: Total

Analyte	RL	MDL	Units
Aluminum	10	1.6	mg/Kg
Arsenic	0.50	0.13	mg/Kg
Barium	2.5	0.046	mg/Kg
Calcium	250	2.6	mg/Kg
Cobalt	2.5	0.026	mg/Kg
Iron	5.0	4.1	mg/Kg
Lead	0.50	0.11	mg/Kg
Lithium	2.5	0.15	mg/Kg
Manganese	0.75	0.11	mg/Kg
Molybdenum	2.0	0.082	mg/Kg
Selenium	0.50	0.17	mg/Kg

Method: 6010B - SEP Metals (ICP) - Total

Lab Sample ID: MB 140-56470/14-A
Matrix: Solid
Analysis Batch: 58419

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 56470

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		10	1.6	mg/Kg		12/01/21 08:54	01/31/22 11:13	1
Arsenic	0.194	J	0.50	0.13	mg/Kg		12/01/21 08:54	01/31/22 11:13	1
Barium	ND		2.5	0.046	mg/Kg		12/01/21 08:54	01/31/22 11:13	1
Calcium	10.0	J	250	2.6	mg/Kg		12/01/21 08:54	01/31/22 11:13	1
Cobalt	ND		2.5	0.026	mg/Kg		12/01/21 08:54	01/31/22 11:13	1
Iron	ND		5.0	4.1	mg/Kg		12/01/21 08:54	01/31/22 11:13	1
Lead	ND		0.50	0.11	mg/Kg		12/01/21 08:54	01/31/22 11:13	1
Lithium	ND		2.5	0.15	mg/Kg		12/01/21 08:54	01/31/22 11:13	1
Manganese	ND		0.75	0.11	mg/Kg		12/01/21 08:54	01/31/22 11:13	1
Molybdenum	0.104	J	2.0	0.082	mg/Kg		12/01/21 08:54	01/31/22 11:13	1
Selenium	ND		0.50	0.17	mg/Kg		12/01/21 08:54	01/31/22 11:13	1

Lab Sample ID: LCS 140-56470/12-A
Matrix: Solid
Analysis Batch: 58419

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 56470

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	100	96.6		mg/Kg		97	80 - 120
Arsenic	5.00	5.22		mg/Kg		104	80 - 120
Barium	5.00	5.00		mg/Kg		100	80 - 120
Calcium	2500	2500		mg/Kg		100	80 - 120
Chromium	10.0	10.7		mg/Kg		107	80 - 120
Cobalt	5.00	5.22		mg/Kg		104	80 - 125
Iron	50.0	51.7		mg/Kg		103	80 - 120
Lead	5.00	5.24		mg/Kg		105	80 - 120
Lithium	5.00	4.93		mg/Kg		99	80 - 120
Manganese	5.00	5.40		mg/Kg		108	80 - 120
Molybdenum	25.0	26.3		mg/Kg		105	80 - 125
Selenium	7.50	7.36		mg/Kg		98	80 - 120

Lab Sample ID: LCSD 140-56470/13-A
Matrix: Solid
Analysis Batch: 58419

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 56470

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	100	98.5		mg/Kg		98	80 - 120	2	30
Arsenic	5.00	5.13		mg/Kg		103	80 - 120	2	30
Barium	5.00	5.04		mg/Kg		101	80 - 120	1	30
Calcium	2500	2540		mg/Kg		101	80 - 120	1	30
Chromium	10.0	10.4		mg/Kg		104	80 - 120	2	30
Cobalt	5.00	5.07		mg/Kg		101	80 - 125	3	30
Iron	50.0	52.7		mg/Kg		105	80 - 120	2	30
Lead	5.00	5.04		mg/Kg		101	80 - 120	4	30
Lithium	5.00	4.93		mg/Kg		99	80 - 120	0	30
Manganese	5.00	5.24		mg/Kg		105	80 - 120	3	30
Molybdenum	25.0	25.8		mg/Kg		103	80 - 125	2	30
Selenium	7.50	7.11		mg/Kg		95	80 - 120	4	30

Method: 6010B - SEP Metals (ICP) - Total (Continued)

Lab Sample ID: 140-24457-8 DU
Matrix: Solid
Analysis Batch: 58419

Client Sample ID: E-SB-XPW01 (25-30)
Prep Type: Total/NA
Prep Batch: 56470

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Aluminum	85000		80600		mg/Kg	☼	5	30
Barium	460		425		mg/Kg	☼	8	30
Calcium	71000	B	69200		mg/Kg	☼	3	30

Lab Sample ID: 140-24457-8 DU
Matrix: Solid
Analysis Batch: 58419

Client Sample ID: E-SB-XPW01 (25-30)
Prep Type: Total/NA
Prep Batch: 56470

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Arsenic	49	B	48.9		mg/Kg	☼	0.3	30
Cobalt	26		25.8		mg/Kg	☼	0.5	30
Iron	150000		148000		mg/Kg	☼	0.6	30
Lead	330		329		mg/Kg	☼	0.4	30
Lithium	59		59.1		mg/Kg	☼	0.3	30
Manganese	840		846		mg/Kg	☼	0.2	30
Molybdenum	10	J B	10.2	J	mg/Kg	☼	0.4	30
Selenium	10		10.9		mg/Kg	☼	5	30

Method: 6010B SEP - SEP Metals (ICP)

Lab Sample ID: MB 140-56440/14-B ^4
Matrix: Solid
Analysis Batch: 57991

Client Sample ID: Method Blank
Prep Type: Step 1
Prep Batch: 56613

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		40	6.4	mg/Kg		12/02/21 12:30	01/17/22 11:15	4
Arsenic	ND		2.0	0.52	mg/Kg		12/02/21 12:30	01/17/22 11:15	4
Barium	ND		10	0.48	mg/Kg		12/02/21 12:30	01/17/22 11:15	4
Boron	ND		40	40	mg/Kg		12/02/21 12:30	01/17/22 11:15	4
Calcium	27.2	J	1000	7.6	mg/Kg		12/02/21 12:30	01/17/22 11:15	4
Cobalt	ND		10	0.18	mg/Kg		12/02/21 12:30	01/17/22 11:15	4
Iron	ND		20	12	mg/Kg		12/02/21 12:30	01/17/22 11:15	4
Lead	ND		2.0	0.44	mg/Kg		12/02/21 12:30	01/17/22 11:15	4
Lithium	ND		10	0.60	mg/Kg		12/02/21 12:30	01/17/22 11:15	4
Manganese	103		3.0	0.12	mg/Kg		12/02/21 12:30	01/17/22 11:15	4
Molybdenum	ND		8.0	0.33	mg/Kg		12/02/21 12:30	01/17/22 11:15	4
Selenium	ND		2.0	0.68	mg/Kg		12/02/21 12:30	01/17/22 11:15	4

Lab Sample ID: LCS 140-56440/12-B ^5
Matrix: Solid
Analysis Batch: 57991

Client Sample ID: Lab Control Sample
Prep Type: Step 1
Prep Batch: 56613

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	100	103		mg/Kg		103	80 - 120
Arsenic	5.00	4.52		mg/Kg		90	80 - 120
Barium	5.00	5.02	J	mg/Kg		100	80 - 120
Boron	50.0	ND		mg/Kg		97	
Calcium	2500	2490		mg/Kg		100	80 - 120
Chromium	10.0	9.71		mg/Kg		97	80 - 120

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: LCS 140-56440/12-B ^5
Matrix: Solid
Analysis Batch: 57991

Client Sample ID: Lab Control Sample
Prep Type: Step 1
Prep Batch: 56613

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Cobalt			5.00	4.90	J	mg/Kg		98	80 - 120		
Iron			50.0	50.6		mg/Kg		101	80 - 120		
Lead			5.00	5.15		mg/Kg		103	80 - 120		
Lithium			5.00	5.35	J	mg/Kg		107	80 - 120		
Manganese			5.00	5.39		mg/Kg		108	80 - 120		
Molybdenum			25.0	26.0		mg/Kg		104	80 - 120		
Selenium			7.50	7.93		mg/Kg		106	80 - 120		

Lab Sample ID: LCSD 140-56440/13-B ^5
Matrix: Solid
Analysis Batch: 57991

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 1
Prep Batch: 56613

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum			100	109		mg/Kg		109	80 - 120	6	30
Arsenic			5.00	4.74		mg/Kg		95	80 - 120	5	30
Barium			5.00	5.25	J	mg/Kg		105	80 - 120	4	30
Boron			50.0	ND		mg/Kg		98		1	
Calcium			2500	2540		mg/Kg		102	80 - 120	2	30
Chromium			10.0	9.93		mg/Kg		99	80 - 120	2	30
Cobalt			5.00	5.01	J	mg/Kg		100	80 - 120	2	30
Iron			50.0	51.8		mg/Kg		104	80 - 120	3	30
Lead			5.00	4.97		mg/Kg		99	80 - 120	4	30
Lithium			5.00	5.32	J	mg/Kg		106	80 - 120	1	30
Manganese			5.00	5.38		mg/Kg		108	80 - 120	0	30
Molybdenum			25.0	26.4		mg/Kg		105	80 - 120	2	30
Selenium			7.50	7.72		mg/Kg		103	80 - 120	3	30

Lab Sample ID: 140-24457-8 DU
Matrix: Solid
Analysis Batch: 57991

Client Sample ID: E-SB-XPW01 (25-30)
Prep Type: Step 1
Prep Batch: 56613

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Aluminum	ND			ND		mg/Kg	☼			NC	30
Arsenic	ND			ND		mg/Kg	☼			NC	30
Barium	4.6	J		4.51	J	mg/Kg	☼			2	30
Boron	ND			ND		mg/Kg	☼			NC	
Calcium	5000	B		4730		mg/Kg	☼			6	30
Cobalt	ND			ND		mg/Kg	☼			NC	30
Iron	ND			ND		mg/Kg	☼			NC	30
Lead	ND			ND		mg/Kg	☼			NC	30
Lithium	ND			ND		mg/Kg	☼			NC	30
Manganese	0.92	J B		0.800	J	mg/Kg	☼			14	30
Molybdenum	1.0	J		0.979	J	mg/Kg	☼			6	30
Selenium	ND			1.44	J	mg/Kg	☼			NC	30

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: MB 140-56604/1-C ^3
Matrix: Solid
Analysis Batch: 57991

Client Sample ID: Method Blank
Prep Type: Step 2
Prep Batch: 56654

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		30	4.8	mg/Kg		12/07/21 09:37	01/17/22 14:48	3
Arsenic	ND		1.5	0.39	mg/Kg		12/07/21 09:37	01/17/22 14:48	3
Barium	ND		7.5	0.36	mg/Kg		12/07/21 09:37	01/17/22 14:48	3
Boron	ND		30	30	mg/Kg		12/07/21 09:37	01/17/22 14:48	3
Calcium	ND		750	6.6	mg/Kg		12/07/21 09:37	01/17/22 14:48	3
Cobalt	ND		7.5	0.19	mg/Kg		12/07/21 09:37	01/17/22 14:48	3
Iron	ND		15	8.7	mg/Kg		12/07/21 09:37	01/17/22 14:48	3
Lead	ND		1.5	0.33	mg/Kg		12/07/21 09:37	01/17/22 14:48	3
Lithium	ND		7.5	0.45	mg/Kg		12/07/21 09:37	01/17/22 14:48	3
Manganese	ND		2.3	0.84	mg/Kg		12/07/21 09:37	01/17/22 14:48	3
Molybdenum	ND		6.0	0.25	mg/Kg		12/07/21 09:37	01/17/22 14:48	3
Selenium	0.824	J	1.5	0.51	mg/Kg		12/07/21 09:37	01/17/22 14:48	3

Lab Sample ID: LCS 140-56604/2-C ^5
Matrix: Solid
Analysis Batch: 57991

Client Sample ID: Lab Control Sample
Prep Type: Step 2
Prep Batch: 56654

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	100	ND		mg/Kg		-2	
Arsenic	5.00	3.15		mg/Kg		63	60 - 120
Barium	5.00	2.23	J	mg/Kg		45	30 - 60
Boron	50.0	ND		mg/Kg		87	
Calcium	2500	733	J	mg/Kg		29	10 - 40
Chromium	10.0	8.43		mg/Kg		84	60 - 120
Cobalt	5.00	4.34	J	mg/Kg		87	80 - 120
Iron	50.0	ND		mg/Kg		8	
Lead	5.00	4.36		mg/Kg		87	70 - 120
Lithium	5.00	4.62	J	mg/Kg		92	80 - 120
Manganese	5.00	4.74		mg/Kg		95	80 - 120
Molybdenum	25.0	20.1		mg/Kg		81	70 - 120
Selenium	7.50	7.10		mg/Kg		95	70 - 120

Lab Sample ID: LCSD 140-56604/3-C ^5
Matrix: Solid
Analysis Batch: 57991

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 2
Prep Batch: 56654

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	100	ND		mg/Kg		-0.8		77	
Arsenic	5.00	3.32		mg/Kg		66	60 - 120	5	30
Barium	5.00	2.36	J	mg/Kg		47	30 - 60	6	30
Boron	50.0	ND		mg/Kg		91		4	
Calcium	2500	780	J	mg/Kg		31	10 - 40	6	30
Chromium	10.0	8.58		mg/Kg		86	60 - 120	2	30
Cobalt	5.00	4.51	J	mg/Kg		90	80 - 120	4	30
Iron	50.0	ND		mg/Kg		8		4	
Lead	5.00	4.61		mg/Kg		92	70 - 120	6	30
Lithium	5.00	4.55	J	mg/Kg		91	80 - 120	1	30
Manganese	5.00	4.96		mg/Kg		99	80 - 120	5	30
Molybdenum	25.0	20.7		mg/Kg		83	70 - 120	3	30

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: LCSD 140-56604/3-C ^5
Matrix: Solid
Analysis Batch: 57991

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 2
Prep Batch: 56654

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Selenium			7.50	7.34		mg/Kg		98	70 - 120	3	30

Lab Sample ID: 140-24457-8 DU
Matrix: Solid
Analysis Batch: 57991

Client Sample ID: E-SB-XPW01 (25-30)
Prep Type: Step 2
Prep Batch: 56654

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Aluminum	2900			3050		mg/Kg	☼			4	
Arsenic	23			22.8		mg/Kg	☼			0.8	30
Barium	5.8	J		5.92	J	mg/Kg	☼			2	30
Boron	590			596		mg/Kg	☼			1	
Calcium	23000			22500		mg/Kg	☼			1	30
Cobalt	0.53	J		0.514	J	mg/Kg	☼			4	30
Iron	2600			2590		mg/Kg	☼			0.7	
Lead	32			33.3		mg/Kg	☼			4	30
Lithium	1.8	J		1.92	J	mg/Kg	☼			6	30
Manganese	320			318		mg/Kg	☼			1	30
Molybdenum	3.3	J		3.33	J	mg/Kg	☼			1	30

Lab Sample ID: 140-24457-8 DU
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: E-SB-XPW01 (25-30)
Prep Type: Step 2
Prep Batch: 56654

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Selenium	2.1	J B		1.32	J F5	mg/Kg	☼			46	30

Lab Sample ID: MB 140-56818/1-B
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: Method Blank
Prep Type: Step 3
Prep Batch: 56824

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		10	2.1	mg/Kg		12/09/21 11:51	01/26/22 10:56	1
Arsenic	ND		0.50	0.13	mg/Kg		12/09/21 11:51	01/26/22 10:56	1
Barium	ND		2.5	0.12	mg/Kg		12/09/21 11:51	01/26/22 10:56	1
Boron	ND		10	10	mg/Kg		12/09/21 11:51	01/26/22 10:56	1
Calcium	ND		250	1.5	mg/Kg		12/09/21 11:51	01/26/22 10:56	1
Cobalt	ND		2.5	0.045	mg/Kg		12/09/21 11:51	01/26/22 10:56	1
Iron	ND		5.0	2.9	mg/Kg		12/09/21 11:51	01/26/22 10:56	1
Lead	ND		0.50	0.11	mg/Kg		12/09/21 11:51	01/26/22 10:56	1
Lithium	ND		2.5	0.15	mg/Kg		12/09/21 11:51	01/26/22 10:56	1
Manganese	0.0970	J	0.75	0.027	mg/Kg		12/09/21 11:51	01/26/22 10:56	1
Molybdenum	ND		2.0	0.082	mg/Kg		12/09/21 11:51	01/26/22 10:56	1
Selenium	ND		0.50	0.17	mg/Kg		12/09/21 11:51	01/26/22 10:56	1

Lab Sample ID: LCS 140-56818/2-B
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: Lab Control Sample
Prep Type: Step 3
Prep Batch: 56824

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Aluminum			100	83.5		mg/Kg		84	80 - 120		

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: LCS 140-56818/2-B
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: Lab Control Sample
Prep Type: Step 3
Prep Batch: 56824

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	5.00	4.93		mg/Kg		99	80 - 120
Barium	5.00	3.82		mg/Kg		76	70 - 120
Boron	50.0	50.4		mg/Kg		101	
Calcium	2500	28.3	J	mg/Kg		1	
Chromium	10.0	10.5		mg/Kg		105	80 - 120
Cobalt	5.00	4.73		mg/Kg		95	80 - 120
Iron	50.0	52.4		mg/Kg		105	80 - 120
Lead	5.00	ND		mg/Kg		0	
Lithium	5.00	5.03		mg/Kg		101	80 - 120
Manganese	5.00	4.87		mg/Kg		97	80 - 120
Molybdenum	25.0	24.9		mg/Kg		100	80 - 120
Selenium	7.50	7.49		mg/Kg		100	80 - 120

Lab Sample ID: LCSD 140-56818/3-B
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 3
Prep Batch: 56824

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	100	88.0		mg/Kg		88	80 - 120	5	30
Arsenic	5.00	4.78		mg/Kg		96	80 - 120	3	30
Barium	5.00	3.21	*-	mg/Kg		64	70 - 120	17	30
Boron	50.0	49.9		mg/Kg		100		1	
Calcium	2500	23.3	J	mg/Kg		0.9		19	
Chromium	10.0	10.4		mg/Kg		104	80 - 120	1	30
Cobalt	5.00	4.38		mg/Kg		88	80 - 120	8	30
Iron	50.0	51.6		mg/Kg		103	80 - 120	2	30
Lead	5.00	ND		mg/Kg		0		NC	
Lithium	5.00	4.93		mg/Kg		99	80 - 120	2	30
Manganese	5.00	4.53		mg/Kg		91	80 - 120	7	30
Molybdenum	25.0	24.4		mg/Kg		98	80 - 120	2	30
Selenium	7.50	7.27		mg/Kg		97	80 - 120	3	30

Lab Sample ID: 140-24457-8 DU
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: E-SB-XPW01 (25-30)
Prep Type: Step 3
Prep Batch: 56824

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Aluminum	4700		4510		mg/Kg	☼	3	30
Arsenic	11		11.2		mg/Kg	☼	1	30
Barium	6.0	*-	6.29	*-	mg/Kg	☼	5	30
Boron	100		104		mg/Kg	☼	4	
Calcium	11	J	10.7	J	mg/Kg	☼	7	
Cobalt	0.89	J	0.847	J	mg/Kg	☼	5	30
Iron	2400		2300		mg/Kg	☼	5	30
Lead	0.52	J	0.367	J	mg/Kg	☼	34	
Lithium	1.4	J	1.37	J	mg/Kg	☼	1	30
Manganese	150	B	141		mg/Kg	☼	7	30
Molybdenum	1.7	J	1.73	J	mg/Kg	☼	0.7	30
Selenium	0.60	J	0.625	J	mg/Kg	☼	4	30

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: MB 140-56871/1-B
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: Method Blank
Prep Type: Step 4
Prep Batch: 56879

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		10	1.6	mg/Kg		12/13/21 09:30	01/26/22 12:37	1
Arsenic	0.387	J	0.50	0.22	mg/Kg		12/13/21 09:30	01/26/22 12:37	1
Barium	ND		2.5	0.12	mg/Kg		12/13/21 09:30	01/26/22 12:37	1
Boron	ND		10	10	mg/Kg		12/13/21 09:30	01/26/22 12:37	1
Calcium	ND		250	2.2	mg/Kg		12/13/21 09:30	01/26/22 12:37	1
Cobalt	ND		2.5	0.053	mg/Kg		12/13/21 09:30	01/26/22 12:37	1
Iron	ND		5.0	2.9	mg/Kg		12/13/21 09:30	01/26/22 12:37	1
Lead	ND		0.50	0.11	mg/Kg		12/13/21 09:30	01/26/22 12:37	1
Lithium	ND		2.5	0.15	mg/Kg		12/13/21 09:30	01/26/22 12:37	1
Manganese	ND		0.75	0.13	mg/Kg		12/13/21 09:30	01/26/22 12:37	1
Molybdenum	ND		2.0	0.082	mg/Kg		12/13/21 09:30	01/26/22 12:37	1
Selenium	ND		0.50	0.47	mg/Kg		12/13/21 09:30	01/26/22 12:37	1

Lab Sample ID: LCS 140-56871/2-B
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: Lab Control Sample
Prep Type: Step 4
Prep Batch: 56879

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	100	96.3		mg/Kg		96	80 - 120
Arsenic	5.00	5.27		mg/Kg		105	80 - 130
Barium	5.00	4.97		mg/Kg		99	80 - 120
Boron	50.0	47.8		mg/Kg		96	
Calcium	2500	2450		mg/Kg		98	80 - 120
Chromium	10.0	10.0		mg/Kg		100	80 - 120
Cobalt	5.00	4.95		mg/Kg		99	80 - 120
Iron	50.0	51.0		mg/Kg		102	80 - 120
Lead	5.00	4.83		mg/Kg		97	80 - 120
Lithium	5.00	4.89		mg/Kg		98	80 - 120
Manganese	5.00	5.20		mg/Kg		104	80 - 120
Molybdenum	25.0	26.0		mg/Kg		104	80 - 120
Selenium	7.50	ND		mg/Kg		5	

Lab Sample ID: LCSD 140-56871/3-B
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 4
Prep Batch: 56879

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	100	109		mg/Kg		109	80 - 120	12	30
Arsenic	5.00	5.88		mg/Kg		118	80 - 130	11	30
Barium	5.00	5.63		mg/Kg		113	80 - 120	12	30
Boron	50.0	54.0		mg/Kg		108		12	
Calcium	2500	2770		mg/Kg		111	80 - 120	12	30
Chromium	10.0	11.4		mg/Kg		114	80 - 120	13	30
Cobalt	5.00	5.60		mg/Kg		112	80 - 120	12	30
Iron	50.0	57.2		mg/Kg		114	80 - 120	11	30
Lead	5.00	5.48		mg/Kg		110	80 - 120	13	30
Lithium	5.00	5.40		mg/Kg		108	80 - 120	10	30
Manganese	5.00	5.84		mg/Kg		117	80 - 120	12	30
Molybdenum	25.0	29.4		mg/Kg		118	80 - 120	12	30

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: LCSD 140-56871/3-B
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 4
Prep Batch: 56879

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Selenium			7.50	0.474	J	mg/Kg		6		22	

Lab Sample ID: 140-24457-8 DU
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: E-SB-XPW01 (25-30)
Prep Type: Step 4
Prep Batch: 56879

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Aluminum	4900			4870		mg/Kg	☼			0.1	30
Arsenic	4.4	B		4.63		mg/Kg	☼			6	30
Barium	9.6			8.70		mg/Kg	☼			10	30
Boron	76			79.4		mg/Kg	☼			4	
Calcium	12000			12200		mg/Kg	☼			0.2	30
Cobalt	3.6	J		3.47	J	mg/Kg	☼			5	30
Iron	12000			12100		mg/Kg	☼			1	30
Lead	83			79.1		mg/Kg	☼			5	30
Lithium	5.1			4.71		mg/Kg	☼			7	30
Manganese	150			146		mg/Kg	☼			2	30
Molybdenum	1.6	J		1.63	J	mg/Kg	☼			0.7	30
Selenium	0.96			0.982		mg/Kg	☼			2	

Lab Sample ID: MB 140-56926/1-B ^5
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: Method Blank
Prep Type: Step 5
Prep Batch: 57076

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		150	24	mg/Kg		12/15/21 10:40	01/26/22 14:10	5
Arsenic	ND		7.5	1.9	mg/Kg		12/15/21 10:40	01/26/22 14:10	5
Barium	ND		38	1.8	mg/Kg		12/15/21 10:40	01/26/22 14:10	5
Boron	ND		150	150	mg/Kg		12/15/21 10:40	01/26/22 14:10	5
Calcium	15.4	J	3800	11	mg/Kg		12/15/21 10:40	01/26/22 14:10	5
Cobalt	ND		38	0.60	mg/Kg		12/15/21 10:40	01/26/22 14:10	5
Iron	ND		75	44	mg/Kg		12/15/21 10:40	01/26/22 14:10	5
Lead	ND		7.5	1.7	mg/Kg		12/15/21 10:40	01/26/22 14:10	5
Lithium	2.79	J	38	2.2	mg/Kg		12/15/21 10:40	01/26/22 14:10	5
Manganese	ND		11	1.9	mg/Kg		12/15/21 10:40	01/26/22 14:10	5
Molybdenum	ND		30	1.3	mg/Kg		12/15/21 10:40	01/26/22 14:10	5
Selenium	ND		7.5	2.6	mg/Kg		12/15/21 10:40	01/26/22 14:10	5

Lab Sample ID: LCS 140-56926/2-B ^5
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: Lab Control Sample
Prep Type: Step 5
Prep Batch: 57076

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Aluminum			300	ND		mg/Kg		-0.6			
Arsenic			15.0	11.6		mg/Kg		77	60 - 100		
Barium			15.0	9.23	J	mg/Kg		62	40 - 70		
Boron			150	171		mg/Kg		114			
Calcium			7500	2390	J	mg/Kg		32	20 - 50		
Chromium			30.0	34.6		mg/Kg		115	80 - 130		

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: LCS 140-56926/2-B ^5
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: Lab Control Sample
Prep Type: Step 5
Prep Batch: 57076

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Cobalt			15.0	1.10	J	mg/Kg		7	1 - 60		
Iron			150	ND		mg/Kg		2			
Lead			15.0	8.54		mg/Kg		57	40 - 80		
Lithium			15.0	18.8	J	mg/Kg		126	80 - 150		
Manganese			15.0	2.27	J	mg/Kg		15	1 - 60		
Molybdenum			75.0	56.6		mg/Kg		75	60 - 100		
Selenium			22.5	26.3		mg/Kg		117	80 - 140		

Lab Sample ID: LCSD 140-56926/3-B ^5
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 5
Prep Batch: 57076

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum			300	ND		mg/Kg		2		404	
Arsenic			15.0	11.2		mg/Kg		75	60 - 100	3	30
Barium			15.0	9.50	J	mg/Kg		63	40 - 70	3	30
Boron			150	165		mg/Kg		110		4	
Calcium			7500	2360	J	mg/Kg		31	20 - 50	1	30
Chromium			30.0	32.8		mg/Kg		109	80 - 130	5	30
Cobalt			15.0	0.998	J	mg/Kg		7	1 - 60	9	30
Iron			150	ND		mg/Kg		0.7		80	
Lead			15.0	9.25		mg/Kg		62	40 - 80	8	30
Lithium			15.0	18.9	J	mg/Kg		126	80 - 150	0	30
Manganese			15.0	3.67	J *1	mg/Kg		24	1 - 60	47	30
Molybdenum			75.0	53.9		mg/Kg		72	60 - 100	5	30
Selenium			22.5	24.4		mg/Kg		108	80 - 140	8	30

Lab Sample ID: 140-24457-8 DU
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: E-SB-XPW01 (25-30)
Prep Type: Step 5
Prep Batch: 57076

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Aluminum	ND			ND		mg/Kg	☼			NC	
Arsenic	ND			ND		mg/Kg	☼			NC	30
Barium	63			60.3	J	mg/Kg	☼			4	30
Boron	ND			ND		mg/Kg	☼			NC	
Calcium	9400	B		9430		mg/Kg	☼			0.4	30
Cobalt	ND			ND		mg/Kg	☼			NC	30
Iron	ND			ND		mg/Kg	☼			NC	
Lead	ND			ND		mg/Kg	☼			NC	30
Lithium	8.4	J B		8.80	J	mg/Kg	☼			4	30
Manganese	ND	*1		5.20	J *1	mg/Kg	☼			NC	30
Molybdenum	ND			ND		mg/Kg	☼			NC	30
Selenium	ND			ND		mg/Kg	☼			NC	30

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: MB 140-57110/1-A
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: Method Blank
Prep Type: Step 6
Prep Batch: 57110

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		10	1.6	mg/Kg		12/15/21 17:10	01/26/22 15:36	1
Arsenic	ND		0.50	0.15	mg/Kg		12/15/21 17:10	01/26/22 15:36	1
Barium	ND		2.5	0.12	mg/Kg		12/15/21 17:10	01/26/22 15:36	1
Boron	ND		10	10	mg/Kg		12/15/21 17:10	01/26/22 15:36	1
Calcium	ND		250	2.1	mg/Kg		12/15/21 17:10	01/26/22 15:36	1
Cobalt	ND		2.5	0.046	mg/Kg		12/15/21 17:10	01/26/22 15:36	1
Iron	ND		5.0	2.9	mg/Kg		12/15/21 17:10	01/26/22 15:36	1
Lead	ND		0.50	0.11	mg/Kg		12/15/21 17:10	01/26/22 15:36	1
Lithium	ND		2.5	0.15	mg/Kg		12/15/21 17:10	01/26/22 15:36	1
Manganese	ND		0.75	0.25	mg/Kg		12/15/21 17:10	01/26/22 15:36	1
Molybdenum	ND		2.0	0.099	mg/Kg		12/15/21 17:10	01/26/22 15:36	1
Selenium	ND		0.50	0.17	mg/Kg		12/15/21 17:10	01/26/22 15:36	1

Lab Sample ID: LCS 140-57110/2-A
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: Lab Control Sample
Prep Type: Step 6
Prep Batch: 57110

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Aluminum	100	105		mg/Kg		105	80 - 120
Arsenic	5.00	5.34		mg/Kg		107	80 - 120
Barium	5.00	5.39		mg/Kg		108	80 - 120
Boron	50.0	54.7		mg/Kg		109	
Calcium	2500	2670		mg/Kg		107	80 - 120
Chromium	10.0	11.0		mg/Kg		110	80 - 120
Cobalt	5.00	5.39		mg/Kg		108	80 - 120
Iron	50.0	53.9		mg/Kg		108	80 - 120
Lead	5.00	5.39		mg/Kg		108	80 - 120
Lithium	5.00	5.12		mg/Kg		102	80 - 120
Manganese	5.00	5.58		mg/Kg		112	80 - 120
Molybdenum	25.0	27.7		mg/Kg		111	80 - 120
Selenium	7.50	7.96		mg/Kg		106	80 - 120

Lab Sample ID: LCSD 140-57110/3-A
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 6
Prep Batch: 57110

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	100	106		mg/Kg		106	80 - 120	1	30
Arsenic	5.00	5.39		mg/Kg		108	80 - 120	1	30
Barium	5.00	5.45		mg/Kg		109	80 - 120	1	30
Boron	50.0	55.3		mg/Kg		111		1	
Calcium	2500	2700		mg/Kg		108	80 - 120	1	30
Chromium	10.0	11.0		mg/Kg		110	80 - 120	1	30
Cobalt	5.00	5.47		mg/Kg		109	80 - 120	1	30
Iron	50.0	54.7		mg/Kg		109	80 - 120	1	30
Lead	5.00	5.46		mg/Kg		109	80 - 120	1	30
Lithium	5.00	5.27		mg/Kg		105	80 - 120	3	30
Manganese	5.00	5.63		mg/Kg		113	80 - 120	1	30
Molybdenum	25.0	28.2		mg/Kg		113	80 - 120	2	30

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: LCSD 140-57110/3-A
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 6
Prep Batch: 57110

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Selenium			7.50	8.12		mg/Kg		108	80 - 120	2	30

Lab Sample ID: 140-24457-8 DU
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: E-SB-XPW01 (25-30)
Prep Type: Step 6
Prep Batch: 57110

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Aluminum	4700			5210		mg/Kg	☼			10	30
Barium	110			124		mg/Kg	☼			8	30
Boron	20			22.6		mg/Kg	☼			13	
Calcium	4500			4790		mg/Kg	☼			7	30
Cobalt	5.4			5.84		mg/Kg	☼			7	30
Lead	30			32.6		mg/Kg	☼			9	30
Lithium	3.7	J		4.17		mg/Kg	☼			13	30
Manganese	78			80.6		mg/Kg	☼			3	30
Molybdenum	1.1	J		1.17	J	mg/Kg	☼			9	30

Lab Sample ID: 140-24457-8 DU
Matrix: Solid
Analysis Batch: 58290

Client Sample ID: E-SB-XPW01 (25-30)
Prep Type: Step 6
Prep Batch: 57110

Analyte	Sample Result	Sample Qualifier		DU Result	DU Qualifier	Unit	D			RPD	RPD Limit
Arsenic	5.6			5.81		mg/Kg	☼			4	30
Iron	53000			54700		mg/Kg	☼			4	30
Selenium	2.7			2.90		mg/Kg	☼			6	30

Lab Sample ID: MB 140-57211/1-A
Matrix: Solid
Analysis Batch: 58328

Client Sample ID: Method Blank
Prep Type: Step 7
Prep Batch: 57211

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Aluminum	ND		10	1.6	mg/Kg		12/18/21 15:38	01/27/22 12:10	1
Arsenic	0.138	J	0.50	0.13	mg/Kg		12/18/21 15:38	01/27/22 12:10	1
Barium	ND		2.5	0.046	mg/Kg		12/18/21 15:38	01/27/22 12:10	1
Calcium	ND		250	2.6	mg/Kg		12/18/21 15:38	01/27/22 12:10	1
Cobalt	ND		2.5	0.026	mg/Kg		12/18/21 15:38	01/27/22 12:10	1
Iron	ND		5.0	4.1	mg/Kg		12/18/21 15:38	01/27/22 12:10	1
Lead	ND		0.50	0.11	mg/Kg		12/18/21 15:38	01/27/22 12:10	1
Lithium	ND		2.5	0.15	mg/Kg		12/18/21 15:38	01/27/22 12:10	1
Manganese	ND		0.75	0.11	mg/Kg		12/18/21 15:38	01/27/22 12:10	1
Molybdenum	ND		2.0	0.082	mg/Kg		12/18/21 15:38	01/27/22 12:10	1
Selenium	ND		0.50	0.17	mg/Kg		12/18/21 15:38	01/27/22 12:10	1

Lab Sample ID: LCS 140-57211/2-A
Matrix: Solid
Analysis Batch: 58328

Client Sample ID: Lab Control Sample
Prep Type: Step 7
Prep Batch: 57211

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Aluminum			100	97.0		mg/Kg		97	80 - 120		
Arsenic			5.00	5.17		mg/Kg		103	80 - 120		

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: LCS 140-57211/2-A
Matrix: Solid
Analysis Batch: 58328

Client Sample ID: Lab Control Sample
Prep Type: Step 7
Prep Batch: 57211

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Barium	5.00	5.20		mg/Kg		104	80 - 120
Calcium	2500	2510		mg/Kg		100	80 - 120
Chromium	10.0	10.4		mg/Kg		104	80 - 120
Cobalt	5.00	5.17		mg/Kg		103	80 - 125
Iron	50.0	52.1		mg/Kg		104	80 - 120
Lead	5.00	5.22		mg/Kg		104	80 - 120
Lithium	5.00	5.04		mg/Kg		101	80 - 120
Manganese	5.00	5.29		mg/Kg		106	80 - 120
Molybdenum	25.0	25.3		mg/Kg		101	80 - 125
Selenium	7.50	7.23		mg/Kg		96	80 - 120

Lab Sample ID: LCSD 140-57211/3-A
Matrix: Solid
Analysis Batch: 58328

Client Sample ID: Lab Control Sample Dup
Prep Type: Step 7
Prep Batch: 57211

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Aluminum	100	97.9		mg/Kg		98	80 - 120	1	30
Arsenic	5.00	5.22		mg/Kg		104	80 - 120	1	30
Barium	5.00	5.14		mg/Kg		103	80 - 120	1	30
Calcium	2500	2520		mg/Kg		101	80 - 120	1	30
Chromium	10.0	10.3		mg/Kg		103	80 - 120	1	30
Cobalt	5.00	5.14		mg/Kg		103	80 - 125	1	30
Iron	50.0	54.2		mg/Kg		108	80 - 120	4	30
Lead	5.00	5.19		mg/Kg		104	80 - 120	1	30
Lithium	5.00	4.94		mg/Kg		99	80 - 120	2	30
Manganese	5.00	5.29		mg/Kg		106	80 - 120	0	30
Molybdenum	25.0	25.5		mg/Kg		102	80 - 125	1	30
Selenium	7.50	7.10		mg/Kg		95	80 - 120	2	30

Lab Sample ID: 140-24457-8 DU
Matrix: Solid
Analysis Batch: 58328

Client Sample ID: E-SB-XPW01 (25-30)
Prep Type: Step 7
Prep Batch: 57211

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Aluminum	67000		61600		mg/Kg	☼	9	30
Barium	270		246		mg/Kg	☼	8	30
Calcium	9000		8460		mg/Kg	☼	6	30

Lab Sample ID: 140-24457-8 DU
Matrix: Solid
Analysis Batch: 58328

Client Sample ID: E-SB-XPW01 (25-30)
Prep Type: Step 7
Prep Batch: 57211

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Lithium	43		40.6		mg/Kg	☼	5	30
Manganese	150		138		mg/Kg	☼	7	30
Molybdenum	1.3	J	1.40	J	mg/Kg	☼	7	30

Method: 6010B SEP - SEP Metals (ICP) (Continued)

Lab Sample ID: 140-24457-8 DU
Matrix: Solid
Analysis Batch: 58328

Client Sample ID: E-SB-XPW01 (25-30)
Prep Type: Step 7
Prep Batch: 57211

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Arsenic	7.0	B	6.76		mg/Kg	☼	3	30
Iron	80000		74800		mg/Kg	☼	6	30
Selenium	ND	L	ND	L	mg/Kg	☼	NC	30

Lab Sample ID: 140-24457-8 DU
Matrix: Solid
Analysis Batch: 58328

Client Sample ID: E-SB-XPW01 (25-30)
Prep Type: Step 7
Prep Batch: 57211

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Cobalt	18	J	16.7	J	mg/Kg	☼	6	30
Lead	240		216		mg/Kg	☼	11	30

Metals

SEP Batch: 56440

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Step 1	Solid	Exchangeable	
140-24457-2	E-SB-07 (40-45)	Step 1	Solid	Exchangeable	
140-24457-3	E-SB-07 (59-64)	Step 1	Solid	Exchangeable	
140-24457-4	E-SB-05 (30-33.5)	Step 1	Solid	Exchangeable	
140-24457-5	E-SB-05 (51-56)	Step 1	Solid	Exchangeable	
140-24457-6	E-SB-19 (35-40)	Step 1	Solid	Exchangeable	
140-24457-7	E-SB-18 (40-44)	Step 1	Solid	Exchangeable	
140-24457-8	E-SB-XPW01 (25-30)	Step 1	Solid	Exchangeable	
140-24457-9	E-SB-15 (10-15)	Step 1	Solid	Exchangeable	
140-24457-10	E-SB-15 (30-35)	Step 1	Solid	Exchangeable	
MB 140-56440/14-B ^4	Method Blank	Step 1	Solid	Exchangeable	
LCS 140-56440/12-B ^5	Lab Control Sample	Step 1	Solid	Exchangeable	
LCSD 140-56440/13-B ^5	Lab Control Sample Dup	Step 1	Solid	Exchangeable	
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 1	Solid	Exchangeable	

Prep Batch: 56470

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Total/NA	Solid	Total	
140-24457-2	E-SB-07 (40-45)	Total/NA	Solid	Total	
140-24457-3	E-SB-07 (59-64)	Total/NA	Solid	Total	
140-24457-4	E-SB-05 (30-33.5)	Total/NA	Solid	Total	
140-24457-5	E-SB-05 (51-56)	Total/NA	Solid	Total	
140-24457-6	E-SB-19 (35-40)	Total/NA	Solid	Total	
140-24457-7	E-SB-18 (40-44)	Total/NA	Solid	Total	
140-24457-8	E-SB-XPW01 (25-30)	Total/NA	Solid	Total	
140-24457-9	E-SB-15 (10-15)	Total/NA	Solid	Total	
140-24457-10	E-SB-15 (30-35)	Total/NA	Solid	Total	
MB 140-56470/14-A	Method Blank	Total/NA	Solid	Total	
LCS 140-56470/12-A	Lab Control Sample	Total/NA	Solid	Total	
LCSD 140-56470/13-A	Lab Control Sample Dup	Total/NA	Solid	Total	
140-24457-8 DU	E-SB-XPW01 (25-30)	Total/NA	Solid	Total	

SEP Batch: 56604

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Step 2	Solid	Carbonate	
140-24457-2	E-SB-07 (40-45)	Step 2	Solid	Carbonate	
140-24457-3	E-SB-07 (59-64)	Step 2	Solid	Carbonate	
140-24457-4	E-SB-05 (30-33.5)	Step 2	Solid	Carbonate	
140-24457-5	E-SB-05 (51-56)	Step 2	Solid	Carbonate	
140-24457-6	E-SB-19 (35-40)	Step 2	Solid	Carbonate	
140-24457-7	E-SB-18 (40-44)	Step 2	Solid	Carbonate	
140-24457-8	E-SB-XPW01 (25-30)	Step 2	Solid	Carbonate	
140-24457-9	E-SB-15 (10-15)	Step 2	Solid	Carbonate	
140-24457-10	E-SB-15 (30-35)	Step 2	Solid	Carbonate	
MB 140-56604/1-C ^3	Method Blank	Step 2	Solid	Carbonate	
LCS 140-56604/2-C ^5	Lab Control Sample	Step 2	Solid	Carbonate	
LCSD 140-56604/3-C ^5	Lab Control Sample Dup	Step 2	Solid	Carbonate	
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 2	Solid	Carbonate	

Metals

Prep Batch: 56613

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Step 1	Solid	3010A	56440
140-24457-2	E-SB-07 (40-45)	Step 1	Solid	3010A	56440
140-24457-3	E-SB-07 (59-64)	Step 1	Solid	3010A	56440
140-24457-4	E-SB-05 (30-33.5)	Step 1	Solid	3010A	56440
140-24457-5	E-SB-05 (51-56)	Step 1	Solid	3010A	56440
140-24457-6	E-SB-19 (35-40)	Step 1	Solid	3010A	56440
140-24457-7	E-SB-18 (40-44)	Step 1	Solid	3010A	56440
140-24457-8	E-SB-XPW01 (25-30)	Step 1	Solid	3010A	56440
140-24457-9	E-SB-15 (10-15)	Step 1	Solid	3010A	56440
140-24457-10	E-SB-15 (30-35)	Step 1	Solid	3010A	56440
MB 140-56440/14-B ^4	Method Blank	Step 1	Solid	3010A	56440
LCS 140-56440/12-B ^5	Lab Control Sample	Step 1	Solid	3010A	56440
LCSD 140-56440/13-B ^5	Lab Control Sample Dup	Step 1	Solid	3010A	56440
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 1	Solid	3010A	56440

Prep Batch: 56654

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Step 2	Solid	3010A	56604
140-24457-2	E-SB-07 (40-45)	Step 2	Solid	3010A	56604
140-24457-3	E-SB-07 (59-64)	Step 2	Solid	3010A	56604
140-24457-4	E-SB-05 (30-33.5)	Step 2	Solid	3010A	56604
140-24457-5	E-SB-05 (51-56)	Step 2	Solid	3010A	56604
140-24457-6	E-SB-19 (35-40)	Step 2	Solid	3010A	56604
140-24457-7	E-SB-18 (40-44)	Step 2	Solid	3010A	56604
140-24457-8	E-SB-XPW01 (25-30)	Step 2	Solid	3010A	56604
140-24457-9	E-SB-15 (10-15)	Step 2	Solid	3010A	56604
140-24457-10	E-SB-15 (30-35)	Step 2	Solid	3010A	56604
MB 140-56604/1-C ^3	Method Blank	Step 2	Solid	3010A	56604
LCS 140-56604/2-C ^5	Lab Control Sample	Step 2	Solid	3010A	56604
LCSD 140-56604/3-C ^5	Lab Control Sample Dup	Step 2	Solid	3010A	56604
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 2	Solid	3010A	56604

SEP Batch: 56818

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Step 3	Solid	Non-Crystalline	
140-24457-2	E-SB-07 (40-45)	Step 3	Solid	Non-Crystalline	
140-24457-3	E-SB-07 (59-64)	Step 3	Solid	Non-Crystalline	
140-24457-4	E-SB-05 (30-33.5)	Step 3	Solid	Non-Crystalline	
140-24457-5	E-SB-05 (51-56)	Step 3	Solid	Non-Crystalline	
140-24457-6	E-SB-19 (35-40)	Step 3	Solid	Non-Crystalline	
140-24457-7	E-SB-18 (40-44)	Step 3	Solid	Non-Crystalline	
140-24457-8	E-SB-XPW01 (25-30)	Step 3	Solid	Non-Crystalline	
140-24457-9	E-SB-15 (10-15)	Step 3	Solid	Non-Crystalline	
140-24457-10	E-SB-15 (30-35)	Step 3	Solid	Non-Crystalline	
MB 140-56818/1-B	Method Blank	Step 3	Solid	Non-Crystalline	
LCS 140-56818/2-B	Lab Control Sample	Step 3	Solid	Non-Crystalline	
LCSD 140-56818/3-B	Lab Control Sample Dup	Step 3	Solid	Non-Crystalline	
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 3	Solid	Non-Crystalline	

Metals

Prep Batch: 56824

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Step 3	Solid	3010A	56818
140-24457-2	E-SB-07 (40-45)	Step 3	Solid	3010A	56818
140-24457-3	E-SB-07 (59-64)	Step 3	Solid	3010A	56818
140-24457-4	E-SB-05 (30-33.5)	Step 3	Solid	3010A	56818
140-24457-5	E-SB-05 (51-56)	Step 3	Solid	3010A	56818
140-24457-6	E-SB-19 (35-40)	Step 3	Solid	3010A	56818
140-24457-7	E-SB-18 (40-44)	Step 3	Solid	3010A	56818
140-24457-8	E-SB-XPW01 (25-30)	Step 3	Solid	3010A	56818
140-24457-9	E-SB-15 (10-15)	Step 3	Solid	3010A	56818
140-24457-10	E-SB-15 (30-35)	Step 3	Solid	3010A	56818
MB 140-56818/1-B	Method Blank	Step 3	Solid	3010A	56818
LCS 140-56818/2-B	Lab Control Sample	Step 3	Solid	3010A	56818
LCSD 140-56818/3-B	Lab Control Sample Dup	Step 3	Solid	3010A	56818
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 3	Solid	3010A	56818

SEP Batch: 56871

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Step 4	Solid	Metal Hydroxide	
140-24457-2	E-SB-07 (40-45)	Step 4	Solid	Metal Hydroxide	
140-24457-3	E-SB-07 (59-64)	Step 4	Solid	Metal Hydroxide	
140-24457-4	E-SB-05 (30-33.5)	Step 4	Solid	Metal Hydroxide	
140-24457-5	E-SB-05 (51-56)	Step 4	Solid	Metal Hydroxide	
140-24457-6	E-SB-19 (35-40)	Step 4	Solid	Metal Hydroxide	
140-24457-7	E-SB-18 (40-44)	Step 4	Solid	Metal Hydroxide	
140-24457-8	E-SB-XPW01 (25-30)	Step 4	Solid	Metal Hydroxide	
140-24457-9	E-SB-15 (10-15)	Step 4	Solid	Metal Hydroxide	
140-24457-10	E-SB-15 (30-35)	Step 4	Solid	Metal Hydroxide	
MB 140-56871/1-B	Method Blank	Step 4	Solid	Metal Hydroxide	
LCS 140-56871/2-B	Lab Control Sample	Step 4	Solid	Metal Hydroxide	
LCSD 140-56871/3-B	Lab Control Sample Dup	Step 4	Solid	Metal Hydroxide	
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 4	Solid	Metal Hydroxide	

Prep Batch: 56879

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Step 4	Solid	3010A	56871
140-24457-2	E-SB-07 (40-45)	Step 4	Solid	3010A	56871
140-24457-3	E-SB-07 (59-64)	Step 4	Solid	3010A	56871
140-24457-4	E-SB-05 (30-33.5)	Step 4	Solid	3010A	56871
140-24457-5	E-SB-05 (51-56)	Step 4	Solid	3010A	56871
140-24457-6	E-SB-19 (35-40)	Step 4	Solid	3010A	56871
140-24457-7	E-SB-18 (40-44)	Step 4	Solid	3010A	56871
140-24457-8	E-SB-XPW01 (25-30)	Step 4	Solid	3010A	56871
140-24457-9	E-SB-15 (10-15)	Step 4	Solid	3010A	56871
140-24457-10	E-SB-15 (30-35)	Step 4	Solid	3010A	56871
MB 140-56871/1-B	Method Blank	Step 4	Solid	3010A	56871
LCS 140-56871/2-B	Lab Control Sample	Step 4	Solid	3010A	56871
LCSD 140-56871/3-B	Lab Control Sample Dup	Step 4	Solid	3010A	56871
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 4	Solid	3010A	56871

Metals

SEP Batch: 56926

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Step 5	Solid	Organic-Bound	
140-24457-2	E-SB-07 (40-45)	Step 5	Solid	Organic-Bound	
140-24457-3	E-SB-07 (59-64)	Step 5	Solid	Organic-Bound	
140-24457-4	E-SB-05 (30-33.5)	Step 5	Solid	Organic-Bound	
140-24457-5	E-SB-05 (51-56)	Step 5	Solid	Organic-Bound	
140-24457-6	E-SB-19 (35-40)	Step 5	Solid	Organic-Bound	
140-24457-7	E-SB-18 (40-44)	Step 5	Solid	Organic-Bound	
140-24457-8	E-SB-XPW01 (25-30)	Step 5	Solid	Organic-Bound	
140-24457-9	E-SB-15 (10-15)	Step 5	Solid	Organic-Bound	
140-24457-10	E-SB-15 (30-35)	Step 5	Solid	Organic-Bound	
MB 140-56926/1-B ^5	Method Blank	Step 5	Solid	Organic-Bound	
LCS 140-56926/2-B ^5	Lab Control Sample	Step 5	Solid	Organic-Bound	
LCSD 140-56926/3-B ^5	Lab Control Sample Dup	Step 5	Solid	Organic-Bound	
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 5	Solid	Organic-Bound	

Prep Batch: 57076

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Step 5	Solid	3010A	56926
140-24457-2	E-SB-07 (40-45)	Step 5	Solid	3010A	56926
140-24457-3	E-SB-07 (59-64)	Step 5	Solid	3010A	56926
140-24457-4	E-SB-05 (30-33.5)	Step 5	Solid	3010A	56926
140-24457-5	E-SB-05 (51-56)	Step 5	Solid	3010A	56926
140-24457-6	E-SB-19 (35-40)	Step 5	Solid	3010A	56926
140-24457-7	E-SB-18 (40-44)	Step 5	Solid	3010A	56926
140-24457-8	E-SB-XPW01 (25-30)	Step 5	Solid	3010A	56926
140-24457-9	E-SB-15 (10-15)	Step 5	Solid	3010A	56926
140-24457-10	E-SB-15 (30-35)	Step 5	Solid	3010A	56926
MB 140-56926/1-B ^5	Method Blank	Step 5	Solid	3010A	56926
LCS 140-56926/2-B ^5	Lab Control Sample	Step 5	Solid	3010A	56926
LCSD 140-56926/3-B ^5	Lab Control Sample Dup	Step 5	Solid	3010A	56926
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 5	Solid	3010A	56926

SEP Batch: 57110

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Step 6	Solid	Acid/Sulfide	
140-24457-2	E-SB-07 (40-45)	Step 6	Solid	Acid/Sulfide	
140-24457-3	E-SB-07 (59-64)	Step 6	Solid	Acid/Sulfide	
140-24457-4	E-SB-05 (30-33.5)	Step 6	Solid	Acid/Sulfide	
140-24457-5	E-SB-05 (51-56)	Step 6	Solid	Acid/Sulfide	
140-24457-6	E-SB-19 (35-40)	Step 6	Solid	Acid/Sulfide	
140-24457-7	E-SB-18 (40-44)	Step 6	Solid	Acid/Sulfide	
140-24457-8	E-SB-XPW01 (25-30)	Step 6	Solid	Acid/Sulfide	
140-24457-9	E-SB-15 (10-15)	Step 6	Solid	Acid/Sulfide	
140-24457-10	E-SB-15 (30-35)	Step 6	Solid	Acid/Sulfide	
MB 140-57110/1-A	Method Blank	Step 6	Solid	Acid/Sulfide	
LCS 140-57110/2-A	Lab Control Sample	Step 6	Solid	Acid/Sulfide	
LCSD 140-57110/3-A	Lab Control Sample Dup	Step 6	Solid	Acid/Sulfide	
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 6	Solid	Acid/Sulfide	

Metals

Prep Batch: 57211

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Step 7	Solid	Residual	
140-24457-2	E-SB-07 (40-45)	Step 7	Solid	Residual	
140-24457-3	E-SB-07 (59-64)	Step 7	Solid	Residual	
140-24457-4	E-SB-05 (30-33.5)	Step 7	Solid	Residual	
140-24457-5	E-SB-05 (51-56)	Step 7	Solid	Residual	
140-24457-6	E-SB-19 (35-40)	Step 7	Solid	Residual	
140-24457-7	E-SB-18 (40-44)	Step 7	Solid	Residual	
140-24457-8	E-SB-XPW01 (25-30)	Step 7	Solid	Residual	
140-24457-9	E-SB-15 (10-15)	Step 7	Solid	Residual	
140-24457-10	E-SB-15 (30-35)	Step 7	Solid	Residual	
MB 140-57211/1-A	Method Blank	Step 7	Solid	Residual	
LCS 140-57211/2-A	Lab Control Sample	Step 7	Solid	Residual	
LCSD 140-57211/3-A	Lab Control Sample Dup	Step 7	Solid	Residual	
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 7	Solid	Residual	

Analysis Batch: 57991

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Step 1	Solid	6010B SEP	56613
140-24457-1	E-SB-07 (21-27)	Step 2	Solid	6010B SEP	56654
140-24457-2	E-SB-07 (40-45)	Step 1	Solid	6010B SEP	56613
140-24457-2	E-SB-07 (40-45)	Step 2	Solid	6010B SEP	56654
140-24457-3	E-SB-07 (59-64)	Step 1	Solid	6010B SEP	56613
140-24457-3	E-SB-07 (59-64)	Step 2	Solid	6010B SEP	56654
140-24457-4	E-SB-05 (30-33.5)	Step 1	Solid	6010B SEP	56613
140-24457-4	E-SB-05 (30-33.5)	Step 2	Solid	6010B SEP	56654
140-24457-5	E-SB-05 (51-56)	Step 1	Solid	6010B SEP	56613
140-24457-5	E-SB-05 (51-56)	Step 2	Solid	6010B SEP	56654
140-24457-6	E-SB-19 (35-40)	Step 1	Solid	6010B SEP	56613
140-24457-6	E-SB-19 (35-40)	Step 2	Solid	6010B SEP	56654
140-24457-7	E-SB-18 (40-44)	Step 1	Solid	6010B SEP	56613
140-24457-7	E-SB-18 (40-44)	Step 2	Solid	6010B SEP	56654
140-24457-8	E-SB-XPW01 (25-30)	Step 1	Solid	6010B SEP	56613
140-24457-8	E-SB-XPW01 (25-30)	Step 2	Solid	6010B SEP	56654
140-24457-9	E-SB-15 (10-15)	Step 1	Solid	6010B SEP	56613
140-24457-9	E-SB-15 (10-15)	Step 2	Solid	6010B SEP	56654
140-24457-10	E-SB-15 (30-35)	Step 1	Solid	6010B SEP	56613
140-24457-10	E-SB-15 (30-35)	Step 2	Solid	6010B SEP	56654
MB 140-56440/14-B ^4	Method Blank	Step 1	Solid	6010B SEP	56613
MB 140-56604/1-C ^3	Method Blank	Step 2	Solid	6010B SEP	56654
LCS 140-56440/12-B ^5	Lab Control Sample	Step 1	Solid	6010B SEP	56613
LCS 140-56604/2-C ^5	Lab Control Sample	Step 2	Solid	6010B SEP	56654
LCSD 140-56440/13-B ^5	Lab Control Sample Dup	Step 1	Solid	6010B SEP	56613
LCSD 140-56604/3-C ^5	Lab Control Sample Dup	Step 2	Solid	6010B SEP	56654
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 1	Solid	6010B SEP	56613
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 2	Solid	6010B SEP	56654

Analysis Batch: 58290

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Step 3	Solid	6010B SEP	56824
140-24457-1	E-SB-07 (21-27)	Step 4	Solid	6010B SEP	56879
140-24457-1	E-SB-07 (21-27)	Step 5	Solid	6010B SEP	57076

Metals (Continued)

Analysis Batch: 58290 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Step 6	Solid	6010B SEP	57110
140-24457-2	E-SB-07 (40-45)	Step 3	Solid	6010B SEP	56824
140-24457-2	E-SB-07 (40-45)	Step 4	Solid	6010B SEP	56879
140-24457-2	E-SB-07 (40-45)	Step 5	Solid	6010B SEP	57076
140-24457-2	E-SB-07 (40-45)	Step 6	Solid	6010B SEP	57110
140-24457-3	E-SB-07 (59-64)	Step 2	Solid	6010B SEP	56654
140-24457-3	E-SB-07 (59-64)	Step 3	Solid	6010B SEP	56824
140-24457-3	E-SB-07 (59-64)	Step 4	Solid	6010B SEP	56879
140-24457-3	E-SB-07 (59-64)	Step 5	Solid	6010B SEP	57076
140-24457-3	E-SB-07 (59-64)	Step 6	Solid	6010B SEP	57110
140-24457-4	E-SB-05 (30-33.5)	Step 2	Solid	6010B SEP	56654
140-24457-4	E-SB-05 (30-33.5)	Step 3	Solid	6010B SEP	56824
140-24457-4	E-SB-05 (30-33.5)	Step 4	Solid	6010B SEP	56879
140-24457-4	E-SB-05 (30-33.5)	Step 5	Solid	6010B SEP	57076
140-24457-4	E-SB-05 (30-33.5)	Step 6	Solid	6010B SEP	57110
140-24457-5	E-SB-05 (51-56)	Step 2	Solid	6010B SEP	56654
140-24457-5	E-SB-05 (51-56)	Step 3	Solid	6010B SEP	56824
140-24457-5	E-SB-05 (51-56)	Step 4	Solid	6010B SEP	56879
140-24457-5	E-SB-05 (51-56)	Step 5	Solid	6010B SEP	57076
140-24457-5	E-SB-05 (51-56)	Step 6	Solid	6010B SEP	57110
140-24457-6	E-SB-19 (35-40)	Step 2	Solid	6010B SEP	56654
140-24457-6	E-SB-19 (35-40)	Step 3	Solid	6010B SEP	56824
140-24457-6	E-SB-19 (35-40)	Step 4	Solid	6010B SEP	56879
140-24457-6	E-SB-19 (35-40)	Step 5	Solid	6010B SEP	57076
140-24457-6	E-SB-19 (35-40)	Step 6	Solid	6010B SEP	57110
140-24457-7	E-SB-18 (40-44)	Step 2	Solid	6010B SEP	56654
140-24457-7	E-SB-18 (40-44)	Step 3	Solid	6010B SEP	56824
140-24457-7	E-SB-18 (40-44)	Step 4	Solid	6010B SEP	56879
140-24457-7	E-SB-18 (40-44)	Step 5	Solid	6010B SEP	57076
140-24457-7	E-SB-18 (40-44)	Step 6	Solid	6010B SEP	57110
140-24457-8	E-SB-XPW01 (25-30)	Step 2	Solid	6010B SEP	56654
140-24457-8	E-SB-XPW01 (25-30)	Step 3	Solid	6010B SEP	56824
140-24457-8	E-SB-XPW01 (25-30)	Step 4	Solid	6010B SEP	56879
140-24457-8	E-SB-XPW01 (25-30)	Step 5	Solid	6010B SEP	57076
140-24457-8	E-SB-XPW01 (25-30)	Step 6	Solid	6010B SEP	57110
140-24457-8	E-SB-XPW01 (25-30)	Step 6	Solid	6010B SEP	57110
140-24457-9	E-SB-15 (10-15)	Step 2	Solid	6010B SEP	56654
140-24457-9	E-SB-15 (10-15)	Step 3	Solid	6010B SEP	56824
140-24457-9	E-SB-15 (10-15)	Step 4	Solid	6010B SEP	56879
140-24457-9	E-SB-15 (10-15)	Step 5	Solid	6010B SEP	57076
140-24457-9	E-SB-15 (10-15)	Step 6	Solid	6010B SEP	57110
140-24457-10	E-SB-15 (30-35)	Step 2	Solid	6010B SEP	56654
140-24457-10	E-SB-15 (30-35)	Step 3	Solid	6010B SEP	56824
140-24457-10	E-SB-15 (30-35)	Step 4	Solid	6010B SEP	56879
140-24457-10	E-SB-15 (30-35)	Step 5	Solid	6010B SEP	57076
140-24457-10	E-SB-15 (30-35)	Step 6	Solid	6010B SEP	57110
MB 140-56818/1-B	Method Blank	Step 3	Solid	6010B SEP	56824
MB 140-56871/1-B	Method Blank	Step 4	Solid	6010B SEP	56879
MB 140-56926/1-B ^5	Method Blank	Step 5	Solid	6010B SEP	57076
MB 140-57110/1-A	Method Blank	Step 6	Solid	6010B SEP	57110
LCS 140-56818/2-B	Lab Control Sample	Step 3	Solid	6010B SEP	56824

Metals (Continued)

Analysis Batch: 58290 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 140-56871/2-B	Lab Control Sample	Step 4	Solid	6010B SEP	56879
LCS 140-56926/2-B ^5	Lab Control Sample	Step 5	Solid	6010B SEP	57076
LCS 140-57110/2-A	Lab Control Sample	Step 6	Solid	6010B SEP	57110
LCSD 140-56818/3-B	Lab Control Sample Dup	Step 3	Solid	6010B SEP	56824
LCSD 140-56871/3-B	Lab Control Sample Dup	Step 4	Solid	6010B SEP	56879
LCSD 140-56926/3-B ^5	Lab Control Sample Dup	Step 5	Solid	6010B SEP	57076
LCSD 140-57110/3-A	Lab Control Sample Dup	Step 6	Solid	6010B SEP	57110
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 2	Solid	6010B SEP	56654
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 3	Solid	6010B SEP	56824
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 4	Solid	6010B SEP	56879
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 5	Solid	6010B SEP	57076
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 6	Solid	6010B SEP	57110
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 6	Solid	6010B SEP	57110

Analysis Batch: 58328

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Step 7	Solid	6010B SEP	57211
140-24457-1	E-SB-07 (21-27)	Step 7	Solid	6010B SEP	57211
140-24457-2	E-SB-07 (40-45)	Step 7	Solid	6010B SEP	57211
140-24457-2	E-SB-07 (40-45)	Step 7	Solid	6010B SEP	57211
140-24457-2	E-SB-07 (40-45)	Step 7	Solid	6010B SEP	57211
140-24457-3	E-SB-07 (59-64)	Step 7	Solid	6010B SEP	57211
140-24457-3	E-SB-07 (59-64)	Step 7	Solid	6010B SEP	57211
140-24457-3	E-SB-07 (59-64)	Step 7	Solid	6010B SEP	57211
140-24457-4	E-SB-05 (30-33.5)	Step 7	Solid	6010B SEP	57211
140-24457-4	E-SB-05 (30-33.5)	Step 7	Solid	6010B SEP	57211
140-24457-4	E-SB-05 (30-33.5)	Step 7	Solid	6010B SEP	57211
140-24457-5	E-SB-05 (51-56)	Step 7	Solid	6010B SEP	57211
140-24457-5	E-SB-05 (51-56)	Step 7	Solid	6010B SEP	57211
140-24457-5	E-SB-05 (51-56)	Step 7	Solid	6010B SEP	57211
140-24457-6	E-SB-19 (35-40)	Step 7	Solid	6010B SEP	57211
140-24457-6	E-SB-19 (35-40)	Step 7	Solid	6010B SEP	57211
140-24457-6	E-SB-19 (35-40)	Step 7	Solid	6010B SEP	57211
140-24457-7	E-SB-18 (40-44)	Step 7	Solid	6010B SEP	57211
140-24457-7	E-SB-18 (40-44)	Step 7	Solid	6010B SEP	57211
140-24457-7	E-SB-18 (40-44)	Step 7	Solid	6010B SEP	57211
140-24457-8	E-SB-XPW01 (25-30)	Step 7	Solid	6010B SEP	57211
140-24457-8	E-SB-XPW01 (25-30)	Step 7	Solid	6010B SEP	57211
140-24457-8	E-SB-XPW01 (25-30)	Step 7	Solid	6010B SEP	57211
140-24457-8	E-SB-XPW01 (25-30)	Step 7	Solid	6010B SEP	57211
140-24457-9	E-SB-15 (10-15)	Step 7	Solid	6010B SEP	57211
140-24457-9	E-SB-15 (10-15)	Step 7	Solid	6010B SEP	57211
140-24457-9	E-SB-15 (10-15)	Step 7	Solid	6010B SEP	57211
140-24457-10	E-SB-15 (30-35)	Step 7	Solid	6010B SEP	57211
140-24457-10	E-SB-15 (30-35)	Step 7	Solid	6010B SEP	57211
140-24457-10	E-SB-15 (30-35)	Step 7	Solid	6010B SEP	57211
MB 140-57211/1-A	Method Blank	Step 7	Solid	6010B SEP	57211
LCS 140-57211/2-A	Lab Control Sample	Step 7	Solid	6010B SEP	57211
LCSD 140-57211/3-A	Lab Control Sample Dup	Step 7	Solid	6010B SEP	57211
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 7	Solid	6010B SEP	57211
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 7	Solid	6010B SEP	57211

Metals (Continued)

Analysis Batch: 58328 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 7	Solid	6010B SEP	57211
140-24457-8 DU	E-SB-XPW01 (25-30)	Step 7	Solid	6010B SEP	57211

Analysis Batch: 58419

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Total/NA	Solid	6010B	56470
140-24457-1	E-SB-07 (21-27)	Total/NA	Solid	6010B	56470
140-24457-1	E-SB-07 (21-27)	Total/NA	Solid	6010B	56470
140-24457-2	E-SB-07 (40-45)	Total/NA	Solid	6010B	56470
140-24457-2	E-SB-07 (40-45)	Total/NA	Solid	6010B	56470
140-24457-2	E-SB-07 (40-45)	Total/NA	Solid	6010B	56470
140-24457-3	E-SB-07 (59-64)	Total/NA	Solid	6010B	56470
140-24457-3	E-SB-07 (59-64)	Total/NA	Solid	6010B	56470
140-24457-3	E-SB-07 (59-64)	Total/NA	Solid	6010B	56470
140-24457-4	E-SB-05 (30-33.5)	Total/NA	Solid	6010B	56470
140-24457-4	E-SB-05 (30-33.5)	Total/NA	Solid	6010B	56470
140-24457-4	E-SB-05 (30-33.5)	Total/NA	Solid	6010B	56470
140-24457-5	E-SB-05 (51-56)	Total/NA	Solid	6010B	56470
140-24457-5	E-SB-05 (51-56)	Total/NA	Solid	6010B	56470
140-24457-5	E-SB-05 (51-56)	Total/NA	Solid	6010B	56470
140-24457-6	E-SB-19 (35-40)	Total/NA	Solid	6010B	56470
140-24457-6	E-SB-19 (35-40)	Total/NA	Solid	6010B	56470
140-24457-6	E-SB-19 (35-40)	Total/NA	Solid	6010B	56470
140-24457-7	E-SB-18 (40-44)	Total/NA	Solid	6010B	56470
140-24457-7	E-SB-18 (40-44)	Total/NA	Solid	6010B	56470
140-24457-7	E-SB-18 (40-44)	Total/NA	Solid	6010B	56470
140-24457-8	E-SB-XPW01 (25-30)	Total/NA	Solid	6010B	56470
140-24457-8	E-SB-XPW01 (25-30)	Total/NA	Solid	6010B	56470
140-24457-9	E-SB-15 (10-15)	Total/NA	Solid	6010B	56470
140-24457-9	E-SB-15 (10-15)	Total/NA	Solid	6010B	56470
140-24457-9	E-SB-15 (10-15)	Total/NA	Solid	6010B	56470
140-24457-10	E-SB-15 (30-35)	Total/NA	Solid	6010B	56470
140-24457-10	E-SB-15 (30-35)	Total/NA	Solid	6010B	56470
140-24457-10	E-SB-15 (30-35)	Total/NA	Solid	6010B	56470
MB 140-56470/14-A	Method Blank	Total/NA	Solid	6010B	56470
LCS 140-56470/12-A	Lab Control Sample	Total/NA	Solid	6010B	56470
LCSD 140-56470/13-A	Lab Control Sample Dup	Total/NA	Solid	6010B	56470
140-24457-8 DU	E-SB-XPW01 (25-30)	Total/NA	Solid	6010B	56470
140-24457-8 DU	E-SB-XPW01 (25-30)	Total/NA	Solid	6010B	56470

Analysis Batch: 58599

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Sum of Steps 1-7	Solid	6010B SEP	
140-24457-2	E-SB-07 (40-45)	Sum of Steps 1-7	Solid	6010B SEP	
140-24457-3	E-SB-07 (59-64)	Sum of Steps 1-7	Solid	6010B SEP	
140-24457-4	E-SB-05 (30-33.5)	Sum of Steps 1-7	Solid	6010B SEP	
140-24457-5	E-SB-05 (51-56)	Sum of Steps 1-7	Solid	6010B SEP	
140-24457-6	E-SB-19 (35-40)	Sum of Steps 1-7	Solid	6010B SEP	
140-24457-7	E-SB-18 (40-44)	Sum of Steps 1-7	Solid	6010B SEP	
140-24457-8	E-SB-XPW01 (25-30)	Sum of Steps 1-7	Solid	6010B SEP	
140-24457-9	E-SB-15 (10-15)	Sum of Steps 1-7	Solid	6010B SEP	

Metals (Continued)

Analysis Batch: 58599 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-10	E-SB-15 (30-35)	Sum of Steps 1-7	Solid	6010B SEP	

General Chemistry

Analysis Batch: 53527

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-1	E-SB-07 (21-27)	Total/NA	Solid	Moisture	
140-24457-2	E-SB-07 (40-45)	Total/NA	Solid	Moisture	
140-24457-3	E-SB-07 (59-64)	Total/NA	Solid	Moisture	
140-24457-4	E-SB-05 (30-33.5)	Total/NA	Solid	Moisture	
140-24457-5	E-SB-05 (51-56)	Total/NA	Solid	Moisture	
140-24457-6	E-SB-19 (35-40)	Total/NA	Solid	Moisture	
140-24457-7	E-SB-18 (40-44)	Total/NA	Solid	Moisture	
140-24457-8	E-SB-XPW01 (25-30)	Total/NA	Solid	Moisture	

Analysis Batch: 53579

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
140-24457-9	E-SB-15 (10-15)	Total/NA	Solid	Moisture	
140-24457-10	E-SB-15 (30-35)	Total/NA	Solid	Moisture	
140-24457-9 DU	E-SB-15 (10-15)	Total/NA	Solid	Moisture	

Client Sample ID: E-SB-07 (21-27)

Lab Sample ID: 140-24457-1

Date Collected: 08/30/21 13:20

Matrix: Solid

Date Received: 09/02/21 09:45

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			58599	02/04/22 13:55	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			53527	09/08/21 10:48	LDP	TAL KNX
	Instrument ID: NOEQUIP									

Client Sample ID: E-SB-07 (21-27)

Lab Sample ID: 140-24457-1

Date Collected: 08/30/21 13:20

Matrix: Solid

Date Received: 09/02/21 09:45

Percent Solids: 81.5

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		10			58419	01/31/22 11:28	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		1			58419	01/31/22 12:34	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		2			58419	01/31/22 14:02	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5 g	25 mL	56440	11/30/21 13:09	JMD	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	56613	12/02/21 12:30	MAC	TAL KNX
Step 1	Analysis	6010B SEP		4			57991	01/17/22 11:30	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			57991	01/17/22 15:03	JMD	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	56818	12/08/21 11:40	MAC	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	56824	12/09/21 11:51	MAC	TAL KNX
Step 3	Analysis	6010B SEP		1			58290	01/26/22 11:10	JMD	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5 g	25 mL	56871	12/09/21 10:26	MAC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	56879	12/13/21 09:30	MAC	TAL KNX
Step 4	Analysis	6010B SEP		1			58290	01/26/22 13:01	JMD	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5 g	75 mL	56926	12/10/21 15:00	MAC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	57076	12/15/21 10:40	MAC	TAL KNX
Step 5	Analysis	6010B SEP		5			58290	01/26/22 14:25	JMD	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57110	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		1			58290	01/26/22 16:00	JMD	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		10			58328	01/27/22 12:30	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Job ID: 140-24457-1
Project/Site: Edwards Power Station - Illinois

Client Sample ID: E-SB-07 (21-27)
Lab Sample ID: 140-24457-1
Date Collected: 08/30/21 13:20
Matrix: Solid
Date Received: 09/02/21 09:45
Percent Solids: 81.5

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		1			58328	01/27/22 13:37	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: E-SB-07 (40-45)
Lab Sample ID: 140-24457-2
Date Collected: 08/30/21 14:05
Matrix: Solid
Date Received: 09/02/21 09:45

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			58599	02/04/22 13:55	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			53527	09/08/21 10:48	LDP	TAL KNX
	Instrument ID: NOEQUIP									

Client Sample ID: E-SB-07 (40-45)
Lab Sample ID: 140-24457-2
Date Collected: 08/30/21 14:05
Matrix: Solid
Date Received: 09/02/21 09:45
Percent Solids: 93.6

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		10			58419	01/31/22 11:33	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		1			58419	01/31/22 12:40	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		2			58419	01/31/22 14:07	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5 g	25 mL	56440	11/30/21 13:09	JMD	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	56613	12/02/21 12:30	MAC	TAL KNX
Step 1	Analysis	6010B SEP		4			57991	01/17/22 11:35	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			57991	01/17/22 15:08	JMD	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	56818	12/08/21 11:40	MAC	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	56824	12/09/21 11:51	MAC	TAL KNX
Step 3	Analysis	6010B SEP		1			58290	01/26/22 11:15	JMD	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5 g	25 mL	56871	12/09/21 10:26	MAC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	56879	12/13/21 09:30	MAC	TAL KNX
Step 4	Analysis	6010B SEP		1			58290	01/26/22 13:06	JMD	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Job ID: 140-24457-1
Project/Site: Edwards Power Station - Illinois

Client Sample ID: E-SB-07 (40-45)
Lab Sample ID: 140-24457-2
Date Collected: 08/30/21 14:05
Matrix: Solid
Date Received: 09/02/21 09:45
Percent Solids: 93.6

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 5	SEP	Organic-Bound			5 g	75 mL	56926	12/10/21 15:00	MAC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	57076	12/15/21 10:40	MAC	TAL KNX
Step 5	Analysis	6010B SEP		5			58290	01/26/22 14:30	JMD	TAL KNX
	Instrument ID:	DUO								
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57110	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		1			58290	01/26/22 16:05	JMD	TAL KNX
	Instrument ID:	DUO								
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		10			58328	01/27/22 12:35	KNC	TAL KNX
	Instrument ID:	DUO								
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		1			58328	01/27/22 13:42	KNC	TAL KNX
	Instrument ID:	DUO								
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		2			58328	01/27/22 15:18	KNC	TAL KNX
	Instrument ID:	DUO								

Client Sample ID: E-SB-07 (59-64)
Lab Sample ID: 140-24457-3
Date Collected: 08/30/21 14:45
Matrix: Solid
Date Received: 09/02/21 09:45

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			58599	02/04/22 13:55	DKW	TAL KNX
	Instrument ID:	NOEQUIP								
Total/NA	Analysis	Moisture		1			53527	09/08/21 10:48	LDP	TAL KNX
	Instrument ID:	NOEQUIP								

Client Sample ID: E-SB-07 (59-64)
Lab Sample ID: 140-24457-3
Date Collected: 08/30/21 14:45
Matrix: Solid
Date Received: 09/02/21 09:45
Percent Solids: 91.2

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		10			58419	01/31/22 11:37	KNC	TAL KNX
	Instrument ID:	DUO								
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		1			58419	01/31/22 12:45	KNC	TAL KNX
	Instrument ID:	DUO								
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		2			58419	01/31/22 14:13	KNC	TAL KNX
	Instrument ID:	DUO								
Step 1	SEP	Exchangeable			5 g	25 mL	56440	11/30/21 13:09	JMD	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	56613	12/02/21 12:30	MAC	TAL KNX
Step 1	Analysis	6010B SEP		4			57991	01/17/22 11:40	JMD	TAL KNX
	Instrument ID:	DUO								

Lab Chronicle

Client: Golder Associates Inc.
Job ID: 140-24457-1
Project/Site: Edwards Power Station - Illinois

Client Sample ID: E-SB-07 (59-64)
Lab Sample ID: 140-24457-3

Date Collected: 08/30/21 14:45
Matrix: Solid
Date Received: 09/02/21 09:45
Percent Solids: 91.2

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			57991	01/17/22 15:23	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			58290	01/26/22 09:51	JMD	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	56818	12/08/21 11:40	MAC	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	56824	12/09/21 11:51	MAC	TAL KNX
Step 3	Analysis	6010B SEP		1			58290	01/26/22 11:20	JMD	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5 g	25 mL	56871	12/09/21 10:26	MAC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	56879	12/13/21 09:30	MAC	TAL KNX
Step 4	Analysis	6010B SEP		1			58290	01/26/22 13:11	JMD	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5 g	75 mL	56926	12/10/21 15:00	MAC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	57076	12/15/21 10:40	MAC	TAL KNX
Step 5	Analysis	6010B SEP		5			58290	01/26/22 14:35	JMD	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57110	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		1			58290	01/26/22 16:10	JMD	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		10			58328	01/27/22 12:39	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		1			58328	01/27/22 13:47	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		2			58328	01/27/22 15:23	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: E-SB-05 (30-33.5)
Lab Sample ID: 140-24457-4

Date Collected: 08/30/21 16:50
Matrix: Solid
Date Received: 09/02/21 09:45

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			58599	02/04/22 13:55	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			53527	09/08/21 10:48	LDP	TAL KNX
	Instrument ID: NOEQUIP									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Edwards Power Station - Illinois

Job ID: 140-24457-1

Client Sample ID: E-SB-05 (30-33.5)

Date Collected: 08/30/21 16:50
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-4

Matrix: Solid
Percent Solids: 72.1

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		10			58419	01/31/22 11:42	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		1			58419	01/31/22 12:51	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		2			58419	01/31/22 14:18	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5 g	25 mL	56440	11/30/21 13:09	JMD	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	56613	12/02/21 12:30	MAC	TAL KNX
Step 1	Analysis	6010B SEP		4			57991	01/17/22 11:44	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			57991	01/17/22 15:28	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			58290	01/26/22 09:56	JMD	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	56818	12/08/21 11:40	MAC	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	56824	12/09/21 11:51	MAC	TAL KNX
Step 3	Analysis	6010B SEP		1			58290	01/26/22 11:25	JMD	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5 g	25 mL	56871	12/09/21 10:26	MAC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	56879	12/13/21 09:30	MAC	TAL KNX
Step 4	Analysis	6010B SEP		1			58290	01/26/22 13:16	JMD	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5 g	75 mL	56926	12/10/21 15:00	MAC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	57076	12/15/21 10:40	MAC	TAL KNX
Step 5	Analysis	6010B SEP		5			58290	01/26/22 14:40	JMD	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57110	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		1			58290	01/26/22 16:15	JMD	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		10			58328	01/27/22 12:44	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		1			58328	01/27/22 13:52	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		2			58328	01/27/22 15:28	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: E-SB-05 (51-56)
Lab Sample ID: 140-24457-5

Date Collected: 08/30/21 17:20
Matrix: Solid
Date Received: 09/02/21 09:45

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			58599	02/04/22 13:55	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			53527	09/08/21 10:48	LDP	TAL KNX
	Instrument ID: NOEQUIP									

Client Sample ID: E-SB-05 (51-56)
Lab Sample ID: 140-24457-5

Date Collected: 08/30/21 17:20
Matrix: Solid
Date Received: 09/02/21 09:45
Percent Solids: 89.9

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		10			58419	01/31/22 11:47	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		1			58419	01/31/22 12:57	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		2			58419	01/31/22 14:23	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5 g	25 mL	56440	11/30/21 13:09	JMD	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	56613	12/02/21 12:30	MAC	TAL KNX
Step 1	Analysis	6010B SEP		4			57991	01/17/22 11:49	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			57991	01/17/22 15:33	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			58290	01/26/22 10:01	JMD	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	56818	12/08/21 11:40	MAC	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	56824	12/09/21 11:51	MAC	TAL KNX
Step 3	Analysis	6010B SEP		1			58290	01/26/22 11:30	JMD	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5 g	25 mL	56871	12/09/21 10:26	MAC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	56879	12/13/21 09:30	MAC	TAL KNX
Step 4	Analysis	6010B SEP		1			58290	01/26/22 13:21	JMD	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5 g	75 mL	56926	12/10/21 15:00	MAC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	57076	12/15/21 10:40	MAC	TAL KNX
Step 5	Analysis	6010B SEP		5			58290	01/26/22 14:45	JMD	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57110	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		1			58290	01/26/22 16:20	JMD	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Job ID: 140-24457-1
Project/Site: Edwards Power Station - Illinois

Client Sample ID: E-SB-05 (51-56)
Lab Sample ID: 140-24457-5
Date Collected: 08/30/21 17:20
Matrix: Solid
Date Received: 09/02/21 09:45
Percent Solids: 89.9

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		10			58328	01/27/22 12:49	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		1			58328	01/27/22 14:07	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		2			58328	01/27/22 15:33	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: E-SB-19 (35-40)
Lab Sample ID: 140-24457-6
Date Collected: 08/31/21 10:00
Matrix: Solid
Date Received: 09/02/21 09:45

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			58599	02/04/22 13:55	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			53527	09/08/21 10:48	LDP	TAL KNX
	Instrument ID: NOEQUIP									

Client Sample ID: E-SB-19 (35-40)
Lab Sample ID: 140-24457-6
Date Collected: 08/31/21 10:00
Matrix: Solid
Date Received: 09/02/21 09:45
Percent Solids: 81.8

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		10			58419	01/31/22 11:51	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		1			58419	01/31/22 13:12	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		2			58419	01/31/22 14:28	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5 g	25 mL	56440	11/30/21 13:09	JMD	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	56613	12/02/21 12:30	MAC	TAL KNX
Step 1	Analysis	6010B SEP		4			57991	01/17/22 11:54	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			57991	01/17/22 15:38	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			58290	01/26/22 10:06	JMD	TAL KNX
	Instrument ID: DUO									

Client Sample ID: E-SB-19 (35-40)
Lab Sample ID: 140-24457-6

Date Collected: 08/31/21 10:00
Matrix: Solid
Date Received: 09/02/21 09:45
Percent Solids: 81.8

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 3	SEP	Non-Crystalline			5 g	25 mL	56818	12/08/21 11:40	MAC	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	56824	12/09/21 11:51	MAC	TAL KNX
Step 3	Analysis	6010B SEP		1			58290	01/26/22 11:45	JMD	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5 g	25 mL	56871	12/09/21 10:26	MAC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	56879	12/13/21 09:30	MAC	TAL KNX
Step 4	Analysis	6010B SEP		1			58290	01/26/22 13:26	JMD	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5 g	75 mL	56926	12/10/21 15:00	MAC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	57076	12/15/21 10:40	MAC	TAL KNX
Step 5	Analysis	6010B SEP		5			58290	01/26/22 15:00	JMD	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57110	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		1			58290	01/26/22 16:25	JMD	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		10			58328	01/27/22 12:54	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		1			58328	01/27/22 14:13	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		2			58328	01/27/22 15:38	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: E-SB-18 (40-44)
Lab Sample ID: 140-24457-7

Date Collected: 08/31/21 11:45
Matrix: Solid
Date Received: 09/02/21 09:45

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			58599	02/04/22 13:55	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			53527	09/08/21 10:48	LDP	TAL KNX
	Instrument ID: NOEQUIP									

Client Sample ID: E-SB-18 (40-44)
Lab Sample ID: 140-24457-7

Date Collected: 08/31/21 11:45
Matrix: Solid
Date Received: 09/02/21 09:45
Percent Solids: 70.1

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		10			58419	01/31/22 11:56	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		1			58419	01/31/22 13:18	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Edwards Power Station - Illinois

Job ID: 140-24457-1

Client Sample ID: E-SB-18 (40-44)

Date Collected: 08/31/21 11:45
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-7

Matrix: Solid
Percent Solids: 70.1

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		2			58419	01/31/22 14:33	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5 g	25 mL	56440	11/30/21 13:09	JMD	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	56613	12/02/21 12:30	MAC	TAL KNX
Step 1	Analysis	6010B SEP		4			57991	01/17/22 11:59	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			57991	01/17/22 15:43	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			58290	01/26/22 10:11	JMD	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	56818	12/08/21 11:40	MAC	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	56824	12/09/21 11:51	MAC	TAL KNX
Step 3	Analysis	6010B SEP		1			58290	01/26/22 11:50	JMD	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5 g	25 mL	56871	12/09/21 10:26	MAC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	56879	12/13/21 09:30	MAC	TAL KNX
Step 4	Analysis	6010B SEP		1			58290	01/26/22 13:31	JMD	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5 g	75 mL	56926	12/10/21 15:00	MAC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	57076	12/15/21 10:40	MAC	TAL KNX
Step 5	Analysis	6010B SEP		5			58290	01/26/22 15:05	JMD	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57110	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		1			58290	01/26/22 16:30	JMD	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		10			58328	01/27/22 13:08	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		1			58328	01/27/22 14:18	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		2			58328	01/27/22 15:43	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: E-SB-XPW01 (25-30)

Lab Sample ID: 140-24457-8

Date Collected: 08/31/21 13:50

Matrix: Solid

Date Received: 09/02/21 09:45

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			58599	02/04/22 13:55	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			53527	09/08/21 10:48	LDP	TAL KNX
	Instrument ID: NOEQUIP									

Client Sample ID: E-SB-XPW01 (25-30)

Lab Sample ID: 140-24457-8

Date Collected: 08/31/21 13:50

Matrix: Solid

Date Received: 09/02/21 09:45

Percent Solids: 61.3

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		10			58419	01/31/22 12:11	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		5			58419	01/31/22 14:39	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5 g	25 mL	56440	11/30/21 13:09	JMD	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	56613	12/02/21 12:30	MAC	TAL KNX
Step 1	Analysis	6010B SEP		4			57991	01/17/22 14:23	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			57991	01/17/22 15:48	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			58290	01/26/22 10:16	JMD	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	56818	12/08/21 11:40	MAC	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	56824	12/09/21 11:51	MAC	TAL KNX
Step 3	Analysis	6010B SEP		1			58290	01/26/22 11:55	JMD	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5 g	25 mL	56871	12/09/21 10:26	MAC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	56879	12/13/21 09:30	MAC	TAL KNX
Step 4	Analysis	6010B SEP		1			58290	01/26/22 17:19	JMD	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5 g	75 mL	56926	12/10/21 15:00	MAC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	57076	12/15/21 10:40	MAC	TAL KNX
Step 5	Analysis	6010B SEP		5			58290	01/26/22 15:10	JMD	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57110	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		1			58290	01/26/22 16:35	JMD	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57110	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		2			58290	01/26/22 17:24	JMD	TAL KNX
	Instrument ID: DUO									

Client Sample ID: E-SB-XPW01 (25-30)
Lab Sample ID: 140-24457-8

Date Collected: 08/31/21 13:50
Matrix: Solid
Date Received: 09/02/21 09:45
Percent Solids: 61.3

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		10			58328	01/27/22 13:13	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		1			58328	01/27/22 14:23	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		2			58328	01/27/22 15:48	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		5			58328	01/27/22 15:53	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: E-SB-15 (10-15)
Lab Sample ID: 140-24457-9

Date Collected: 08/31/21 15:40
Matrix: Solid
Date Received: 09/02/21 09:45

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			58599	02/04/22 13:55	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			53579	09/09/21 10:14	LDP	TAL KNX
	Instrument ID: NOEQUIP									

Client Sample ID: E-SB-15 (10-15)
Lab Sample ID: 140-24457-9

Date Collected: 08/31/21 15:40
Matrix: Solid
Date Received: 09/02/21 09:45
Percent Solids: 65.0

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		10			58419	01/31/22 12:20	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		1			58419	01/31/22 13:35	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		2			58419	01/31/22 15:03	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5 g	25 mL	56440	11/30/21 13:09	JMD	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	56613	12/02/21 12:30	MAC	TAL KNX
Step 1	Analysis	6010B SEP		4			57991	01/17/22 14:33	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			57991	01/17/22 15:58	JMD	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Job ID: 140-24457-1
Project/Site: Edwards Power Station - Illinois

Client Sample ID: E-SB-15 (10-15)
Lab Sample ID: 140-24457-9

Date Collected: 08/31/21 15:40
Matrix: Solid
Date Received: 09/02/21 09:45
Percent Solids: 65.0

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			58290	01/26/22 10:26	JMD	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	56818	12/08/21 11:40	MAC	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	56824	12/09/21 11:51	MAC	TAL KNX
Step 3	Analysis	6010B SEP		1			58290	01/26/22 12:04	JMD	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5 g	25 mL	56871	12/09/21 10:26	MAC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	56879	12/13/21 09:30	MAC	TAL KNX
Step 4	Analysis	6010B SEP		1			58290	01/26/22 14:00	JMD	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5 g	75 mL	56926	12/10/21 15:00	MAC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	57076	12/15/21 10:40	MAC	TAL KNX
Step 5	Analysis	6010B SEP		5			58290	01/26/22 15:20	JMD	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57110	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		1			58290	01/26/22 16:59	JMD	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		10			58328	01/27/22 13:23	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		1			58328	01/27/22 14:34	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		2			58328	01/27/22 16:26	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: E-SB-15 (30-35)
Lab Sample ID: 140-24457-10

Date Collected: 08/31/21 16:20
Matrix: Solid
Date Received: 09/02/21 09:45

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Sum of Steps 1-7	Analysis	6010B SEP		1			58599	02/04/22 13:55	DKW	TAL KNX
	Instrument ID: NOEQUIP									
Total/NA	Analysis	Moisture		1			53579	09/09/21 10:14	LDP	TAL KNX
	Instrument ID: NOEQUIP									

Lab Chronicle

Client: Golder Associates Inc.
Project/Site: Edwards Power Station - Illinois

Job ID: 140-24457-1

Client Sample ID: E-SB-15 (30-35)

Date Collected: 08/31/21 16:20
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-10

Matrix: Solid
Percent Solids: 65.1

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		10			58419	01/31/22 12:25	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		1			58419	01/31/22 13:40	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		2			58419	01/31/22 15:09	KNC	TAL KNX
	Instrument ID: DUO									
Step 1	SEP	Exchangeable			5 g	25 mL	56440	11/30/21 13:09	JMD	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	56613	12/02/21 12:30	MAC	TAL KNX
Step 1	Analysis	6010B SEP		4			57991	01/17/22 14:38	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			57991	01/17/22 16:03	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			58290	01/26/22 10:46	JMD	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	56818	12/08/21 11:40	MAC	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	56824	12/09/21 11:51	MAC	TAL KNX
Step 3	Analysis	6010B SEP		1			58290	01/26/22 12:09	JMD	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5 g	25 mL	56871	12/09/21 10:26	MAC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	56879	12/13/21 09:30	MAC	TAL KNX
Step 4	Analysis	6010B SEP		1			58290	01/26/22 14:05	JMD	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5 g	75 mL	56926	12/10/21 15:00	MAC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	57076	12/15/21 10:40	MAC	TAL KNX
Step 5	Analysis	6010B SEP		5			58290	01/26/22 15:26	JMD	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57110	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		1			58290	01/26/22 17:04	JMD	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		10			58328	01/27/22 13:28	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		1			58328	01/27/22 14:39	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		2			58328	01/27/22 16:31	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Job ID: 140-24457-1
Project/Site: Edwards Power Station - Illinois

Client Sample ID: Method Blank
Lab Sample ID: MB 140-56440/14-B ^4
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 1	SEP	Exchangeable			5 g	25 mL	56440	11/30/21 13:09	JMD	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	56613	12/02/21 12:30	MAC	TAL KNX
Step 1	Analysis	6010B SEP		4			57991	01/17/22 11:15	JMD	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Method Blank
Lab Sample ID: MB 140-56470/14-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		1			58419	01/31/22 11:13	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Method Blank
Lab Sample ID: MB 140-56604/1-C ^3
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			57991	01/17/22 14:48	JMD	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Method Blank
Lab Sample ID: MB 140-56818/1-B
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 3	SEP	Non-Crystalline			5 g	25 mL	56818	12/08/21 11:40	MAC	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	56824	12/09/21 11:51	MAC	TAL KNX
Step 3	Analysis	6010B SEP		1			58290	01/26/22 10:56	JMD	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Method Blank
Lab Sample ID: MB 140-56871/1-B
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 4	SEP	Metal Hydroxide			5 g	25 mL	56871	12/09/21 10:26	MAC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	56879	12/13/21 09:30	MAC	TAL KNX
Step 4	Analysis	6010B SEP		1			58290	01/26/22 12:37	JMD	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Job ID: 140-24457-1
Project/Site: Edwards Power Station - Illinois

Client Sample ID: Method Blank
Lab Sample ID: MB 140-56926/1-B ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 5	SEP	Organic-Bound			5 g	75 mL	56926	12/10/21 15:00	MAC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	57076	12/15/21 10:40	MAC	TAL KNX
Step 5	Analysis	6010B SEP		5			58290	01/26/22 14:10	JMD	TAL KNX
	Instrument ID:	DUO								

Client Sample ID: Method Blank
Lab Sample ID: MB 140-57110/1-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57110	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		1			58290	01/26/22 15:36	JMD	TAL KNX
	Instrument ID:	DUO								

Client Sample ID: Method Blank
Lab Sample ID: MB 140-57211/1-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		1			58328	01/27/22 12:10	KNC	TAL KNX
	Instrument ID:	DUO								

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-56440/12-B ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 1	SEP	Exchangeable			5 g	25 mL	56440	11/30/21 13:09	JMD	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	56613	12/02/21 12:30	MAC	TAL KNX
Step 1	Analysis	6010B SEP		5			57991	01/17/22 11:20	JMD	TAL KNX
	Instrument ID:	DUO								

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-56470/12-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		1			58419	01/31/22 11:18	KNC	TAL KNX
	Instrument ID:	DUO								

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-56604/2-C ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		5			57991	01/17/22 14:53	JMD	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-56818/2-B
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 3	SEP	Non-Crystalline			5 g	25 mL	56818	12/08/21 11:40	MAC	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	56824	12/09/21 11:51	MAC	TAL KNX
Step 3	Analysis	6010B SEP		1			58290	01/26/22 11:01	JMD	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-56871/2-B
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 4	SEP	Metal Hydroxide			5 g	25 mL	56871	12/09/21 10:26	MAC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	56879	12/13/21 09:30	MAC	TAL KNX
Step 4	Analysis	6010B SEP		1			58290	01/26/22 12:42	JMD	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-56926/2-B ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 5	SEP	Organic-Bound			5 g	75 mL	56926	12/10/21 15:00	MAC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	57076	12/15/21 10:40	MAC	TAL KNX
Step 5	Analysis	6010B SEP		5			58290	01/26/22 14:15	JMD	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-57110/2-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57110	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		1			58290	01/26/22 15:41	JMD	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Job ID: 140-24457-1
Project/Site: Edwards Power Station - Illinois

Client Sample ID: Lab Control Sample
Lab Sample ID: LCS 140-57211/2-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		1			58328	01/27/22 12:15	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-56440/13-B ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 1	SEP	Exchangeable			5 g	25 mL	56440	11/30/21 13:09	JMD	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	56613	12/02/21 12:30	MAC	TAL KNX
Step 1	Analysis	6010B SEP		5			57991	01/17/22 11:25	JMD	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-56470/13-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		1			58419	01/31/22 11:23	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-56604/3-C ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		5			57991	01/17/22 14:58	JMD	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-56818/3-B
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 3	SEP	Non-Crystalline			5 g	25 mL	56818	12/08/21 11:40	MAC	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	56824	12/09/21 11:51	MAC	TAL KNX
Step 3	Analysis	6010B SEP		1			58290	01/26/22 11:05	JMD	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Job ID: 140-24457-1
Project/Site: Edwards Power Station - Illinois

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-56871/3-B
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 4	SEP	Metal Hydroxide			5 g	25 mL	56871	12/09/21 10:26	MAC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	56879	12/13/21 09:30	MAC	TAL KNX
Step 4	Analysis	6010B SEP		1			58290	01/26/22 12:46	JMD	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-56926/3-B ^5
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 5	SEP	Organic-Bound			5 g	75 mL	56926	12/10/21 15:00	MAC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	57076	12/15/21 10:40	MAC	TAL KNX
Step 5	Analysis	6010B SEP		5			58290	01/26/22 14:20	JMD	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-57110/3-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57110	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		1			58290	01/26/22 15:45	JMD	TAL KNX
	Instrument ID: DUO									

Client Sample ID: Lab Control Sample Dup
Lab Sample ID: LCSD 140-57211/3-A
Date Collected: N/A
Matrix: Solid
Date Received: N/A

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		1			58328	01/27/22 12:20	KNC	TAL KNX
	Instrument ID: DUO									

Client Sample ID: E-SB-XPW01 (25-30)
Lab Sample ID: 140-24457-8 DU
Date Collected: 08/31/21 13:50
Matrix: Solid
Date Received: 09/02/21 09:45
Percent Solids: 61.3

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		10			58419	01/31/22 12:15	KNC	TAL KNX
	Instrument ID: DUO									
Total/NA	Prep	Total			1 g	50 mL	56470	12/01/21 08:54	MAC	TAL KNX
Total/NA	Analysis	6010B		5			58419	01/31/22 14:44	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Job ID: 140-24457-1
Project/Site: Edwards Power Station - Illinois

Client Sample ID: E-SB-XPW01 (25-30)
Date Collected: 08/31/21 13:50
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-8 DU
Matrix: Solid
Percent Solids: 61.3

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Step 1	SEP	Exchangeable			5 g	25 mL	56440	11/30/21 13:09	JMD	TAL KNX
Step 1	Prep	3010A			5 mL	50 mL	56613	12/02/21 12:30	MAC	TAL KNX
Step 1	Analysis	6010B SEP		4			57991	01/17/22 14:28	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			57991	01/17/22 15:53	JMD	TAL KNX
	Instrument ID: DUO									
Step 2	SEP	Carbonate			5 g	25 mL	56604	12/03/21 09:00	MAC	TAL KNX
Step 2	Prep	3010A			5 mL	50 mL	56654	12/07/21 09:37	MAC	TAL KNX
Step 2	Analysis	6010B SEP		3			58290	01/26/22 10:21	JMD	TAL KNX
	Instrument ID: DUO									
Step 3	SEP	Non-Crystalline			5 g	25 mL	56818	12/08/21 11:40	MAC	TAL KNX
Step 3	Prep	3010A			5 mL	50 mL	56824	12/09/21 11:51	MAC	TAL KNX
Step 3	Analysis	6010B SEP		1			58290	01/26/22 11:59	JMD	TAL KNX
	Instrument ID: DUO									
Step 4	SEP	Metal Hydroxide			5 g	25 mL	56871	12/09/21 10:26	MAC	TAL KNX
Step 4	Prep	3010A			5 mL	50 mL	56879	12/13/21 09:30	MAC	TAL KNX
Step 4	Analysis	6010B SEP		1			58290	01/26/22 13:41	JMD	TAL KNX
	Instrument ID: DUO									
Step 5	SEP	Organic-Bound			5 g	75 mL	56926	12/10/21 15:00	MAC	TAL KNX
Step 5	Prep	3010A			5 mL	50 mL	57076	12/15/21 10:40	MAC	TAL KNX
Step 5	Analysis	6010B SEP		5			58290	01/26/22 15:15	JMD	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57110	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		1			58290	01/26/22 16:40	JMD	TAL KNX
	Instrument ID: DUO									
Step 6	SEP	Acid/Sulfide			5 g	250 mL	57110	12/15/21 17:10	MAC	TAL KNX
Step 6	Analysis	6010B SEP		2			58290	01/26/22 17:29	JMD	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		10			58328	01/27/22 13:18	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		1			58328	01/27/22 14:28	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		2			58328	01/27/22 16:12	KNC	TAL KNX
	Instrument ID: DUO									
Step 7	Prep	Residual			1 g	50 mL	57211	12/18/21 15:38	MAC	TAL KNX
Step 7	Analysis	6010B SEP		5			58328	01/27/22 16:17	KNC	TAL KNX
	Instrument ID: DUO									

Lab Chronicle

Client: Golder Associates Inc.
Job ID: 140-24457-1
Project/Site: Edwards Power Station - Illinois

Client Sample ID: E-SB-15 (10-15)
Date Collected: 08/31/21 15:40
Date Received: 09/02/21 09:45

Lab Sample ID: 140-24457-9 DU
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dil Factor	Initial Amount	Final Amount	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	Moisture		1			53579	09/09/21 10:14	LDP	TAL KNX
	Instrument ID: NOEQUIP									

Laboratory References:

TAL KNX = Eurofins Knoxville, 5815 Middlebrook Pike, Knoxville, TN 37921, TEL (865)291-3000

Accreditation/Certification Summary

Client: Golder Associates Inc.
Job ID: 140-24457-1
Project/Site: Edwards Power Station - Illinois

Laboratory: Eurofins Knoxville

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	Identification Number	Expiration Date
	AFCEE	N/A	
ANAB	Dept. of Defense ELAP	L2311	02-13-22
ANAB	Dept. of Energy	L2311.01	02-13-22
ANAB	ISO/IEC 17025	L2311	02-13-22
Arkansas DEQ	State	88-0688	06-17-22
California	State	2423	06-30-22
Colorado	State	TN00009	02-28-22
Connecticut	State	PH-0223	09-30-23
Florida	NELAP	E87177	06-30-22
Georgia (DW)	State	906	12-11-22
Hawaii	State	NA	12-11-22
Kansas	NELAP	E-10349	10-31-22
Kentucky (DW)	State	90101	12-31-22
Louisiana	NELAP	83979	06-30-22
Louisiana (DW)	State	LA019	12-31-22
Maryland	State	277	03-31-22
Michigan	State	9933	12-11-22
Nevada	State	TN00009	07-31-22
New Hampshire	NELAP	299919	01-17-23
New Jersey	NELAP	TN001	06-30-22
New York	NELAP	10781	03-31-22
North Carolina (DW)	State	21705	07-31-22
North Carolina (WW/SW)	State	64	12-31-22
Ohio VAP	State	CL0059	06-02-23
Oklahoma	State	9415	08-31-22
Oregon	NELAP	TNI0189	12-31-22
Pennsylvania	NELAP	68-00576	12-31-22
Tennessee	State	02014	12-11-22
Texas	NELAP	T104704380-18-12	08-31-22
US Fish & Wildlife	US Federal Programs	058448	07-31-22
USDA	US Federal Programs	P330-19-00236	08-20-22
Utah	NELAP	TN00009	07-31-22
Virginia	NELAP	460176	09-14-22
Washington	State	C593	01-19-23
West Virginia (DW)	State	9955C	12-31-22
West Virginia DEP	State	345	04-30-22
Wisconsin	State	998044300	08-31-22

Method Summary

Client: Golder Associates Inc.
Job ID: 140-24457-1
Project/Site: Edwards Power Station - Illinois

Method	Method Description	Protocol	Laboratory
6010B	SEP Metals (ICP) - Total	SW846	TAL KNX
6010B SEP	SEP Metals (ICP)	SW846	TAL KNX
Moisture	Percent Moisture	EPA	TAL KNX
3010A	Preparation, Total Metals	SW846	TAL KNX
Acid/Sulfide	Sequential Extraction Procedure, Acid/Sulfide Fraction	TAL-KNOX	TAL KNX
Carbonate	Sequential Extraction Procedure, Carbonate Fraction	TAL-KNOX	TAL KNX
Exchangeable	Sequential Extraction Procedure, Exchangeable Fraction	TAL-KNOX	TAL KNX
Metal Hydroxide	Sequential Extraction Procedure, Metal Hydroxide Fraction	TAL-KNOX	TAL KNX
Non-Crystalline	Sequential Extraction Procedure, Non-crystalline Materials	TAL-KNOX	TAL KNX
Organic-Bound	Sequential Extraction Procedure, Organic Bound Fraction	TAL-KNOX	TAL KNX
Residual	Sequential Extraction Procedure, Residual Fraction	TAL-KNOX	TAL KNX
Total	Preparation, Total Material	TAL-KNOX	TAL KNX

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

TAL-KNOX = TestAmerica Laboratories, Knoxville, Facility Standard Operating Procedure.

Laboratory References:

TAL KNX = Eurofins Knoxville, 5815 Middlebrook Pike, Knoxville, TN 37921, TEL (865)291-3000

Eurofins TestAmerica, Knoxville
5815 Middlebrook F
Knoxville, TN 3792
Phone: 865-291-3000 Fax: 865-584-4315

Chain of Custody R ord

eurofins | Environ esting America

Client Information	Sampler: B. Talbert	Lab PM: Henry, Ryan	Carrier Tracking No(s):	COC No: 140-9736-2903.2
Client Contact: Jeffrey Ingram	Phone: 636-485-8185	E-Mail: williamr.henry@eurofinset.com	State of Origin: IL	Page: Page 2 of 2
Company: Golder Associates Inc.	PWSID:			Job #:
Address: 13515 Barrett Parkway Drive Suite 260	Due Date Requested:			
City: Ballwin	TAT Requested (days):			
State, Zip: MO, 63021	Compliance Project: \ Yes \ No			
Phone: 314-984-8800(Tel) 636-724-9323(Fax)	PO #: Purchase Order not required			
Email: Jeffrey_Ingram@golder.com	WO #:			
Project Name: Edwards ~~Kincaid~~ Power Station - Illinois	Project #: 14006434			
Site:	SSOW#:			

Analysis Requested

Preservation Codes:

A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2O3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - pH 4-5, Z - other (specify)

140-24457 Chain of Custody

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	6010B - Select Total Metals	6010B_SEP - SEP	Total Numb	Special Instructions/Note:
			Preservation Code:				N	N		
E-SB-07(21-27)	8-30-21	1320	G	S				/		
E-SB-07(40-45)		1405						/		CUSTODY SEALS INTACT
E-SB-07(59-64)		1445						/		RECEIVED AT AT 1.1/CT1.2C
E-SB-05(30-33.5)		1650						/		AND 9-2-21
E-SB-05(51-56)		1720						/		1 COOLER FED X#
E-SB-19(35-40)	8-31-21	1000						/		283232938733 PD
E-SB-18(40-44)		1145						/		
E-SB-XPW01(25-30)		1350						/		
E-SB-15(10-15)		1540						/		
E-SB-15(30-35)		1620						/		

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months

Deliverable Requested: I, II, III, IV, Other (specify)

Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Brendan Talbert	9-1-2021 @ 1800	Golder		9.2.21 09:45	EST KNX
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: \ Yes \ No | Custody Seal No.:

Cooler Temperature(s) °C and Other Remarks:

2/4/2022

EUROFINS/TESTAMERICA KNOXVILLE SAMPLE RECEIPT/CONDITION UPON RECEIPT ANOMALY CHECKLIST

Log In Number:

Review Items	Yes	No	NA	If No, what was the problem?
1. Are the shipping containers intact?	✓		✓	☐ **Containers, Broken**
2. Were ambient air containers received intact?			✓	☐ Checked in lab
3. The coolers/containers custody seal if present, is it intact?	✓			☐ Yes ☐ NA
4. Is the cooler temperature within limits? (> freezing temp. of water to 6 °C, VOST: 10°C) Thermometer ID : SG7J Correction factor: +0.1°C	✓			☐ **Cooler Out of Temp, Client Contacted, Proceed/Cancel** ☐ **Cooler Out of Temp, Same Day Receipt**
5. Were all of the sample containers received intact?	✓			☐ **Containers, Broken**
6. Were samples received in appropriate containers?	✓			☐ **Containers, Improper; Client Contacted; Proceed/Cancel**
7. Do sample container labels match COC? (IDs, Dates, Times)	✓			☐ **COC & Samples Do Not Match** ☐ **COC Incorrect/Incomplete** ☐ **COC Not Received**
8. Were all of the samples listed on the COC received?	✓			☐ **Sample Received, Not on COC** ☐ **Sample on COC, Not Received**
9. Is the date/time of sample collection noted?	✓			☐ **COC; No Date/Time; Client Contacted**
10. Was the sampler identified on the COC?	✓			☐ **Sampler Not Listed on COC**
11. Is the client and project name/# identified?	✓			☐ **COC Incorrect/Incomplete**
12. Are tests/parameters listed for each sample?	✓			☐ **COC No tests on COC**
13. Is the matrix of the samples noted?	✓			☐ **COC Incorrect/Incomplete**
14. Was COC relinquished? (Signed/Dated/Timed)	✓			☐ **COC Incorrect/Incomplete**
15. Were samples received within holding time?	✓			☐ **Holding Time - Receipt**
16. Were samples received with correct chemical preservative (excluding Encore)?			✓	☐ **pH Adjusted, pH Included (See box 16A)** ☐ **Incorrect Preservative**
17. Were VOA samples received without headspace?			✓	☐ **Headspace (VOA only)**
18. Did you check for residual chlorine, if necessary? (e.g. 1613B, 1668) Chlorine test strip lot number:			✓	☐ **Residual Chlorine**
19. For 1613B water samples is pH<9?			✓	☐ If no, notify lab to adjust
20. For rad samples was sample activity info. Provided?			✓	☐ Project missing info

Comments/Actions Taken

Labeling Verified by: **Date:**

pH test strip lot number:

	Box 16A: pH Preservation	Box 18A: Residual Chlorine
Preservative:		
Lot Number:		
Exp Date:		
Analyst:		
Date:		
Time:		

Project #: _____ PM Instructions: _____

Sample Receiving Associate: _____ Date: 9.2.21

QA026R32.doc, 062719

APPENDIX C

Bulk Mineralogy by Rietveld XRD Analysis

Quantitative X-Ray Diffraction by Rietveld Refinement

Report Prepared for:	*Environmental Services*
Project Number/ LIMS No.	*Custom XRD/MI4503-NOV21*
Sample Receipt:	*November 3, 2021*
Sample Analysis:	*November 8, 2021*
Reporting Date:	*November 11, 2021*

Instrument:	BRUKER AXS D8 Advance Diffractometer
Test Conditions:	Co radiation, 35 kV, 40 mA Regular Scanning: Step: 0.02°, Step time: 1s, 2θ range: 3-80°
Interpretations :	PDF2/PDF4 powder diffraction databases issued by the International Center for Diffraction Data (ICDD). DiffracPlus Eva and Topas software.
Detection Limit :	0.5-2%. Strongly dependent on crystallinity.

Contents:

1) Method Summary
2) Quantitative XRD Results
3) XRD Pattern(s)

Kim Gibbs, H.B.Sc., P.Geo.
Senior Mineralogist

Huyun Zhou, Ph.D., P.Geo.
Senior Mineralogist

ACCREDITATION: SGS Natural Resources Lakefield is accredited to the requirements of ISO/IEC 17025 for specific tests as listed on our scope of accreditation, including geochemical, mineralogical and trade mineral tests. To view a list of the accredited methods, please visit the following website and search SGS Canada Inc. - Minerals: https://www.scc.ca/en/search/palcan.

Method Summary

The Rietveld Method of Mineral Identification by XRD (ME-LR-MIN-MET-MN-D05) method used by SGS Natural Resources is accredited to the requirements of ISO/IEC 17025.

Mineral Identification and Interpretation:

Mineral identification and interpretation involves matching the diffraction pattern of an unknown material to patterns of single-phase reference materials. The reference patterns are compiled by the Joint Committee on Powder Diffraction Standards - International Center for Diffraction Data (JCPDS-ICDD) database and released on software as Powder Diffraction Files (PDF).

Interpretations do not reflect the presence of non-crystalline and/or amorphous compounds, except when internal standards have been added by request. Mineral proportions may be strongly influenced by crystallinity, crystal structure and preferred orientations. Mineral or compound identification and quantitative analysis results should be accompanied by supporting chemical assay data or other additional tests.

Quantitative Rietveld Analysis:

Quantitative Rietveld Analysis is performed by using Topas 4.2 (Bruker AXS), a graphics based profile analysis program built around a non-linear least squares fitting system, to determine the amount of different phases present in a multicomponent sample. Whole pattern analyses are predicated by the fact that the X-ray diffraction pattern is a total sum of both instrumental and specimen factors. Unlike other peak intensity-based methods, the Rietveld method uses a least squares approach to refine a theoretical line profile until it matches the obtained experimental patterns.

Rietveld refinement is completed with a set of minerals specifically identified for the sample. Zero values indicate that the mineral was included in the refinement calculations, but the calculated concentration was less than 0.05wt%. Minerals not identified by the analyst are not included in refinement calculations for specific samples and are indicated with a dash.

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WARNING: The sample(s) to which the findings recorded herein (the "Findings") relate was(were) drawn and / or provided by the Client or by a third party acting at the Client's direction. The Findings constitute no warranty of the sample's representativeness of any goods and strictly relate to the sample(s). The Company accepts no liability with regard to the origin or source from which the sample(s) is/are said to be extracted.

Summary of Rietveld Quantitative Analysis X-Ray Diffraction Results

Mineral/Compound	E-SB-07 (21.0-27.0)	E-SB-07 (40.0-45.0)	E-SB-07 (59.0-64.0)	E-SB-05 (30.0-33.5)	E-SB-05 (51.0-56.0)	E-SB-19 (35.0-40.0)	E-SB-18 (40.0-44.0)	E-SB-XPW01 (25.0-30.0)	E-SB-15 (10.0-15.0)	E-SB-15 (30.0-35.0)
	(wt %)	(wt %)	(wt %)	(wt %)	(wt %)	(wt %)	(wt %)	(wt %)	(wt %)	(wt %)
Quartz	59.7	44.9	43.6	39.0	38.7	46.8	34.6	10.4	38.6	37.0
Albite	8.6	14.7	15.6	9.6	15.0	12.0	10.0	-	12.1	11.6
Microcline	9.3	2.9	3.4	9.8	4.3	7.5	8.8	-	10.7	10.2
Chlorite	3.4	8.1	9.4	4.5	7.5	4.8	5.2	-	5.8	4.5
Muscovite	8.8	22.4	22.5	16.3	24.1	14.5	17.8	-	16.8	15.5
Biotite	1.5	2.5	3.8	1.9	3.7	2.2	2.1	-	2.6	2.6
Ankerite	2.5	0.0	0.0	3.5	0.1	2.6	3.5	-	1.5	3.3
Dolomite	4.4	0.0	0.0	8.5	0.8	7.7	6.7	-	3.5	6.5
Calcite	0.9	0.4	0.5	4.6	0.3	0.0	3.5	2.7	0.7	2.0
Siderite	0.0	3.1	0.2	1.0	5.0	1.0	1.1	-	0.2	0.7
Hematite	0.4	0.0	0.0	0.1	0.0	0.1	0.2	23.0	0.0	0.2
Magnetite	0.1	0.3	0.3	0.6	0.4	0.3	0.0	25.5	0.1	0.0
Ilmenite	0.1	0.1	0.0	0.0	0.1	0.0	0.0	-	0.0	0.1
Rutile	0.3	0.7	0.6	0.7	0.3	0.5	0.5	0.2	1.0	0.5
Diopside	-	-	-	-	-	-	1.4	-	0.6	0.7
Actinolite	-	-	-	-	-	-	0.3	-	0.2	0.4
Epidote	-	-	-	-	-	-	0.3	-	0.4	0.4
Kaolinite	-	-	-	-	-	-	4.0	-	5.1	3.8
Mullite	-	-	-	-	-	-	-	8.7	-	-
Anorthite	-	-	-	-	-	-	-	29.6	-	-
TOTAL	100	100	100	100	100	100	100	100	100	100

Zero values indicate that the mineral was included in the refinement, but the calculated concentration is below a measurable value.

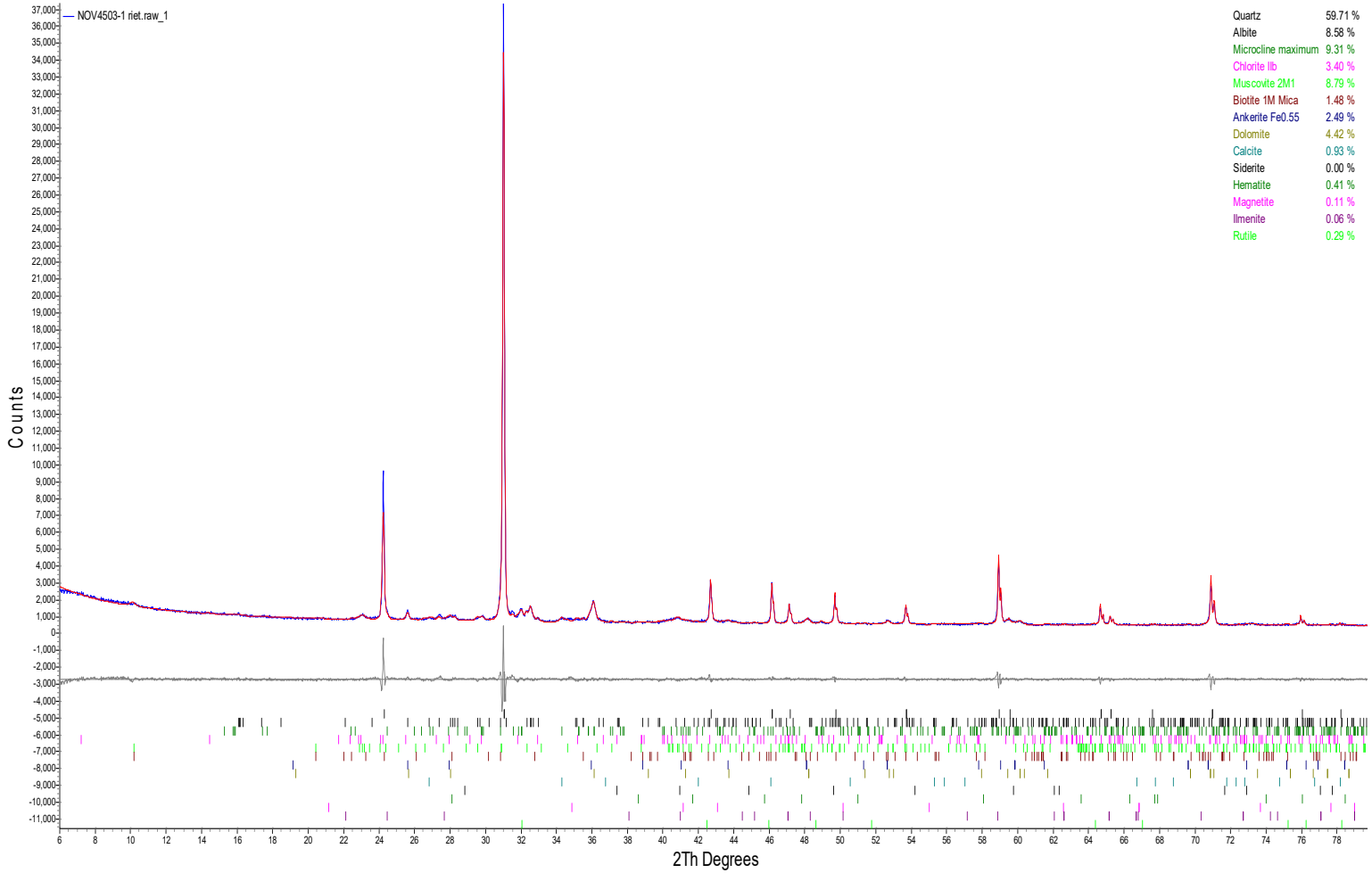
Dashes indicate that the mineral was not identified by the analyst and not included in the refinement calculation for the sample.

The weight percent quantities indicated have been normalized to a sum of 100%. The quantity of amorphous material has not been determined.

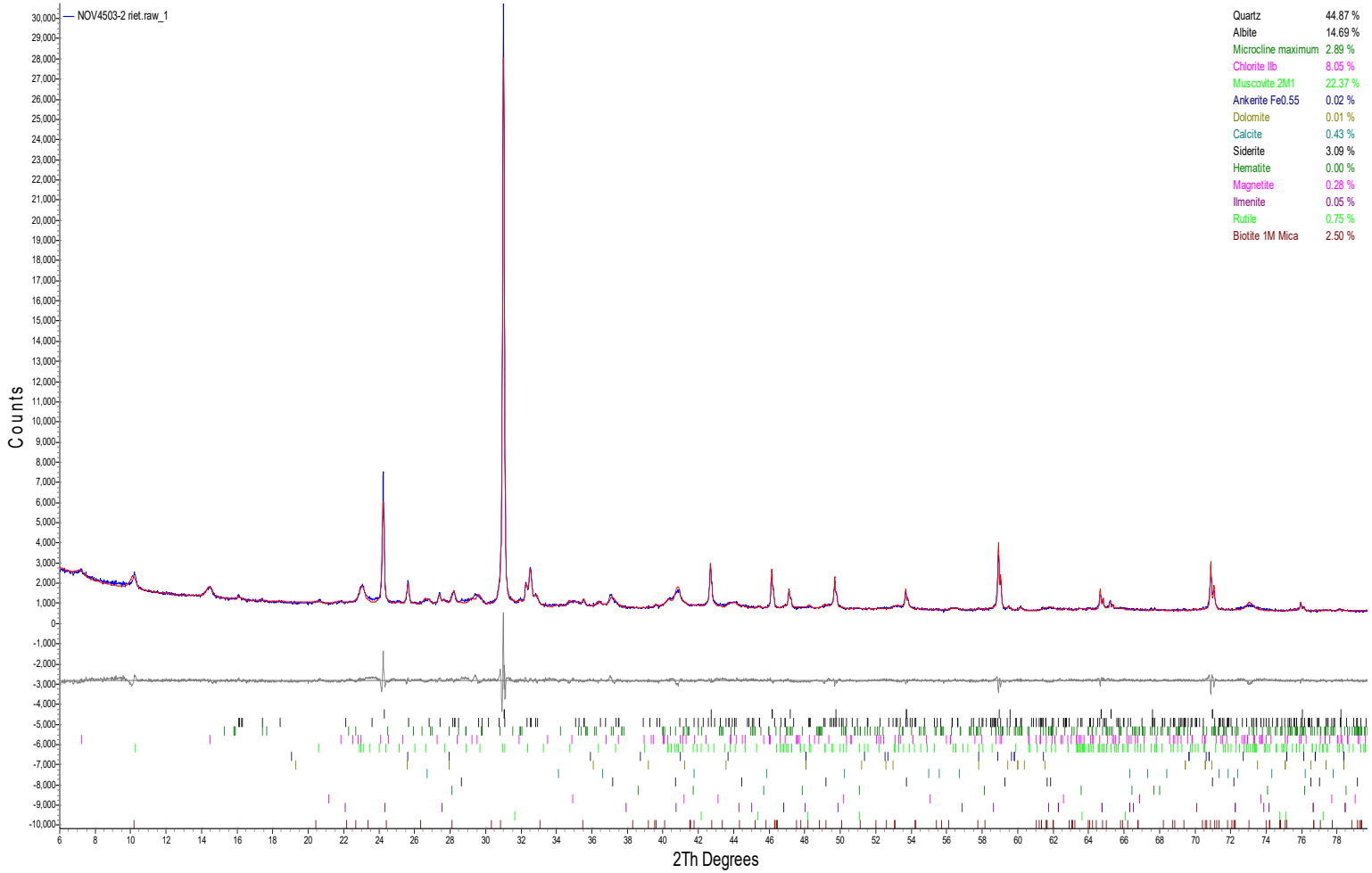
Mineral List

Mineral/Compound	Formula
Quartz	SiO_2
Albite	$NaAlSi_3O_8$
Microcline	$KAlSi_3O_8$
Chlorite	$(Fe,(Mg,Mn)_5,Al)(Si_3Al)O_{10}(OH)_8$
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$
Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$
Ankerite	$CaFe(CO_3)_2$
Dolomite	$CaMg(CO_3)_2$
Calcite	$CaCO_3$
Siderite	$FeCO_3$
Hematite	Fe_2O_3
Magnetite	Fe_3O_4
Ilmenite	$FeTiO_3$
Rutile	TiO_2
Diopside	$CaMgSi_2O_6$
Actinolite	$Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$
Epidote	$Ca_2(Al,Fe)Al_2O(SiO_4)(Si_2O_7)(OH)$
Kaolinite	$Al_2Si_2O_5(OH)_4$
Mullite	$\sim Al_6Si_3O_{15}$
Anorthite	$CaAl_2Si_2O_8$

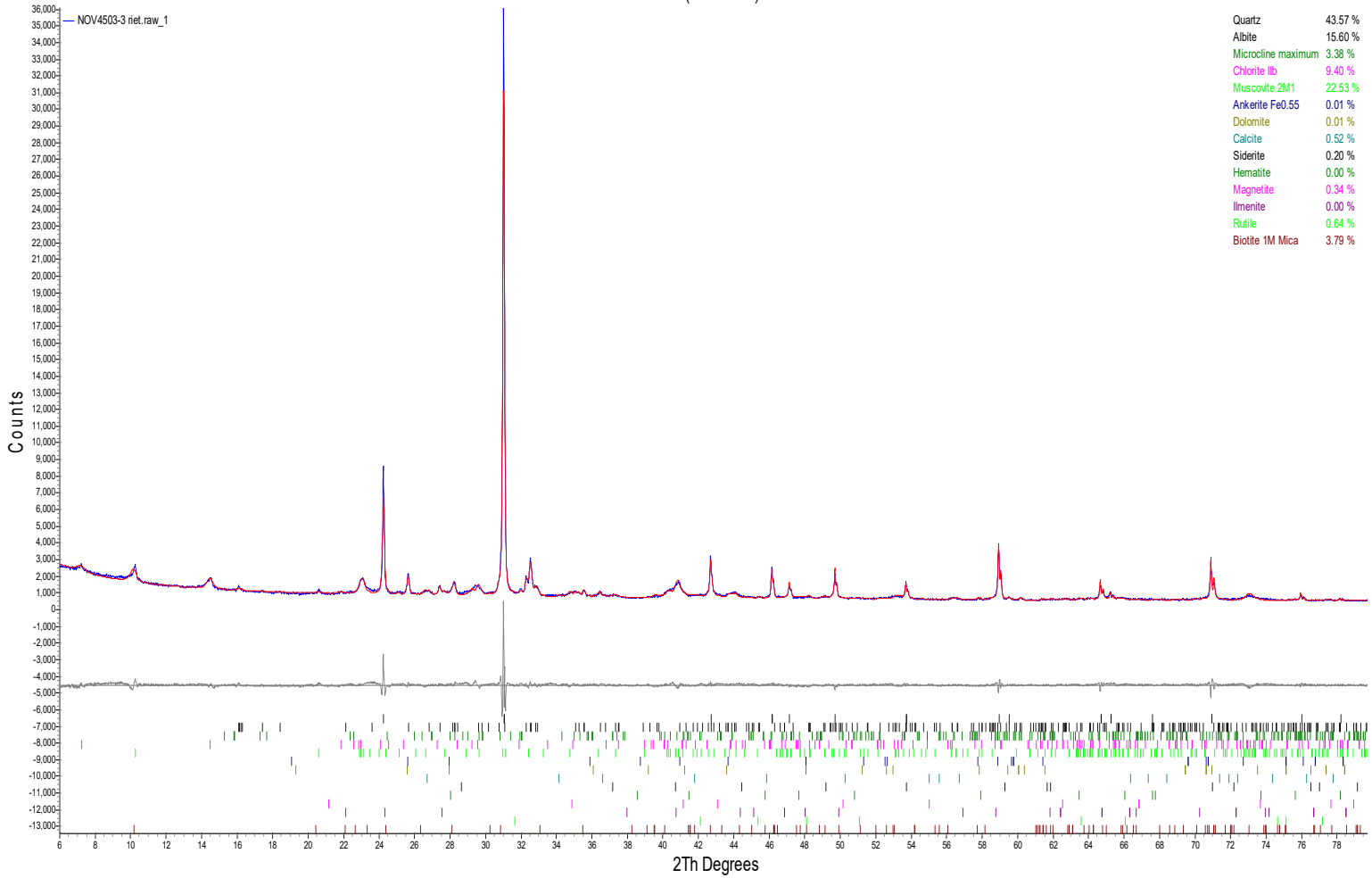
E-SB-07 (21.0-27.0)



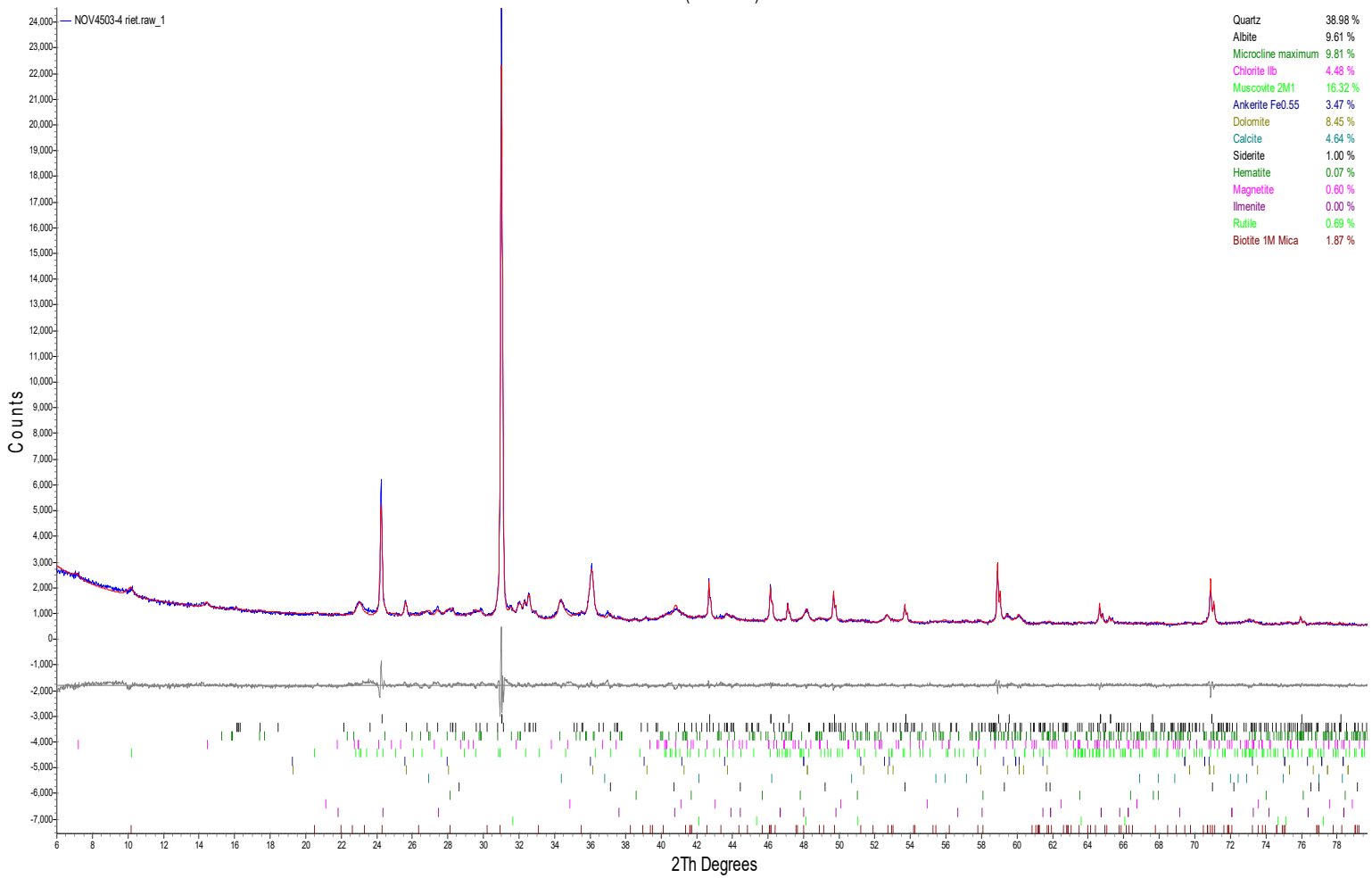
E-SB-07 (40.0-45.0)



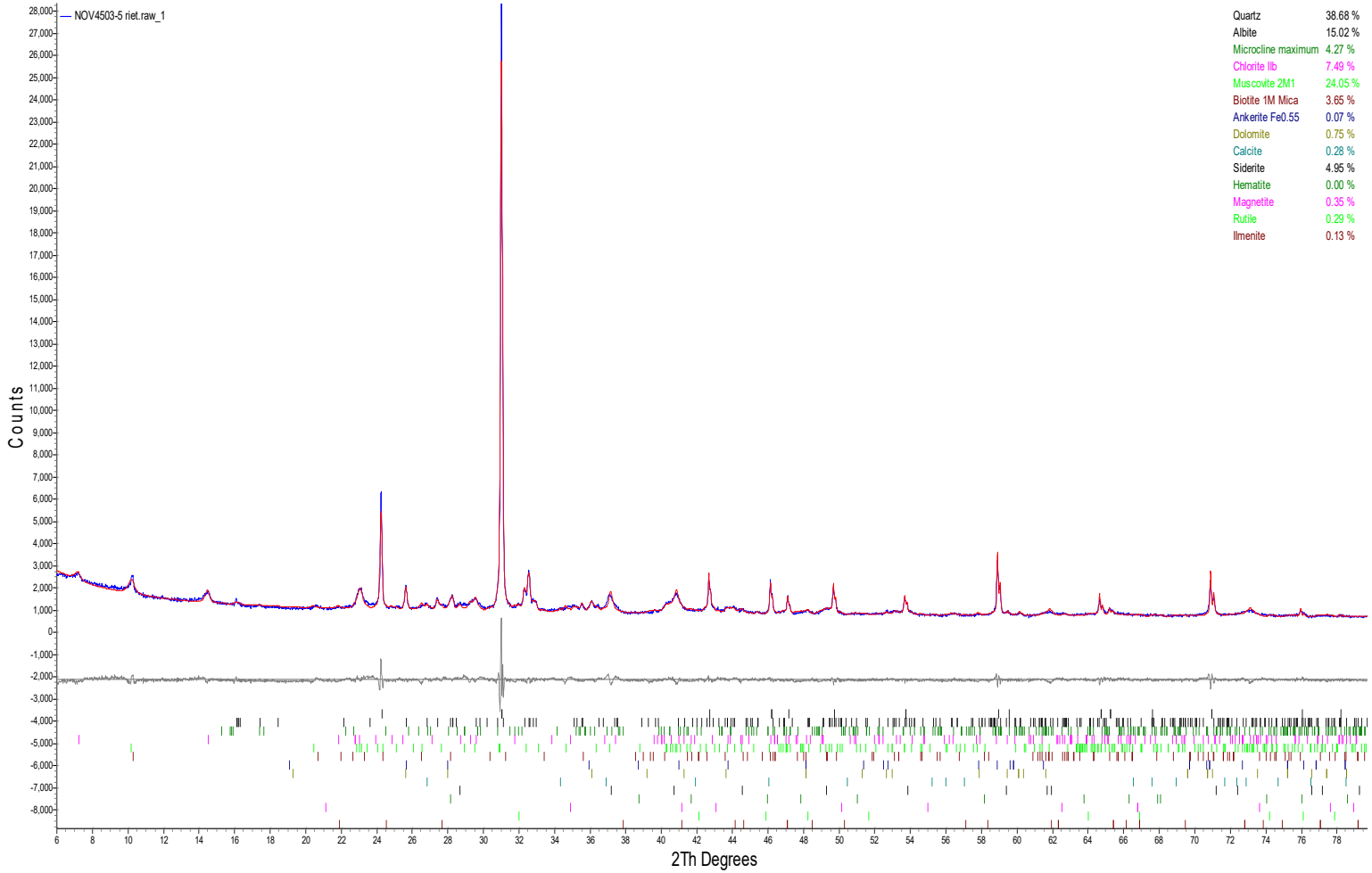
E-SB-07 (59.0-64.0)



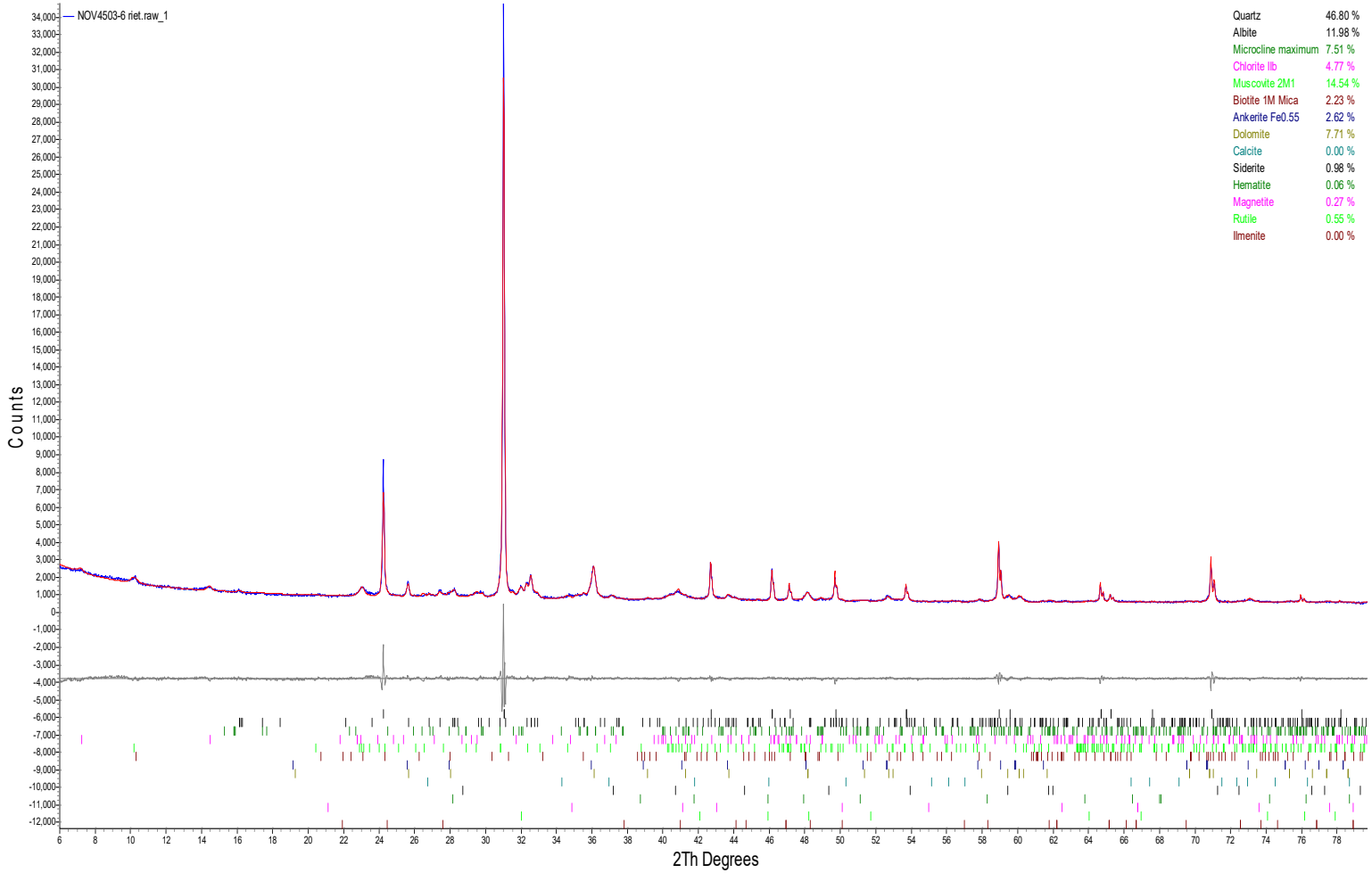
E-SB-05 (30.0-33.5)



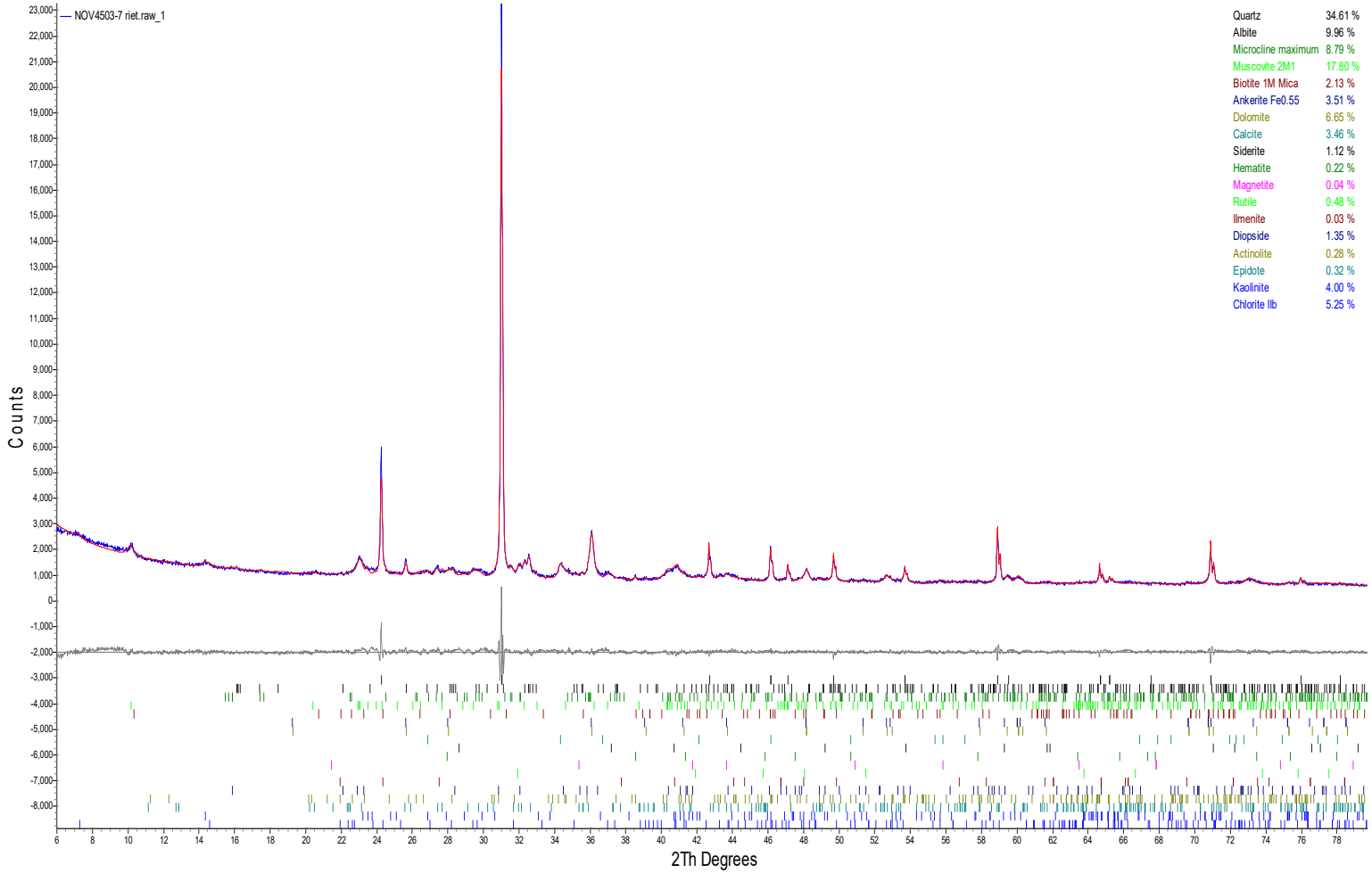
E-SB-05 (51.0-56.0)

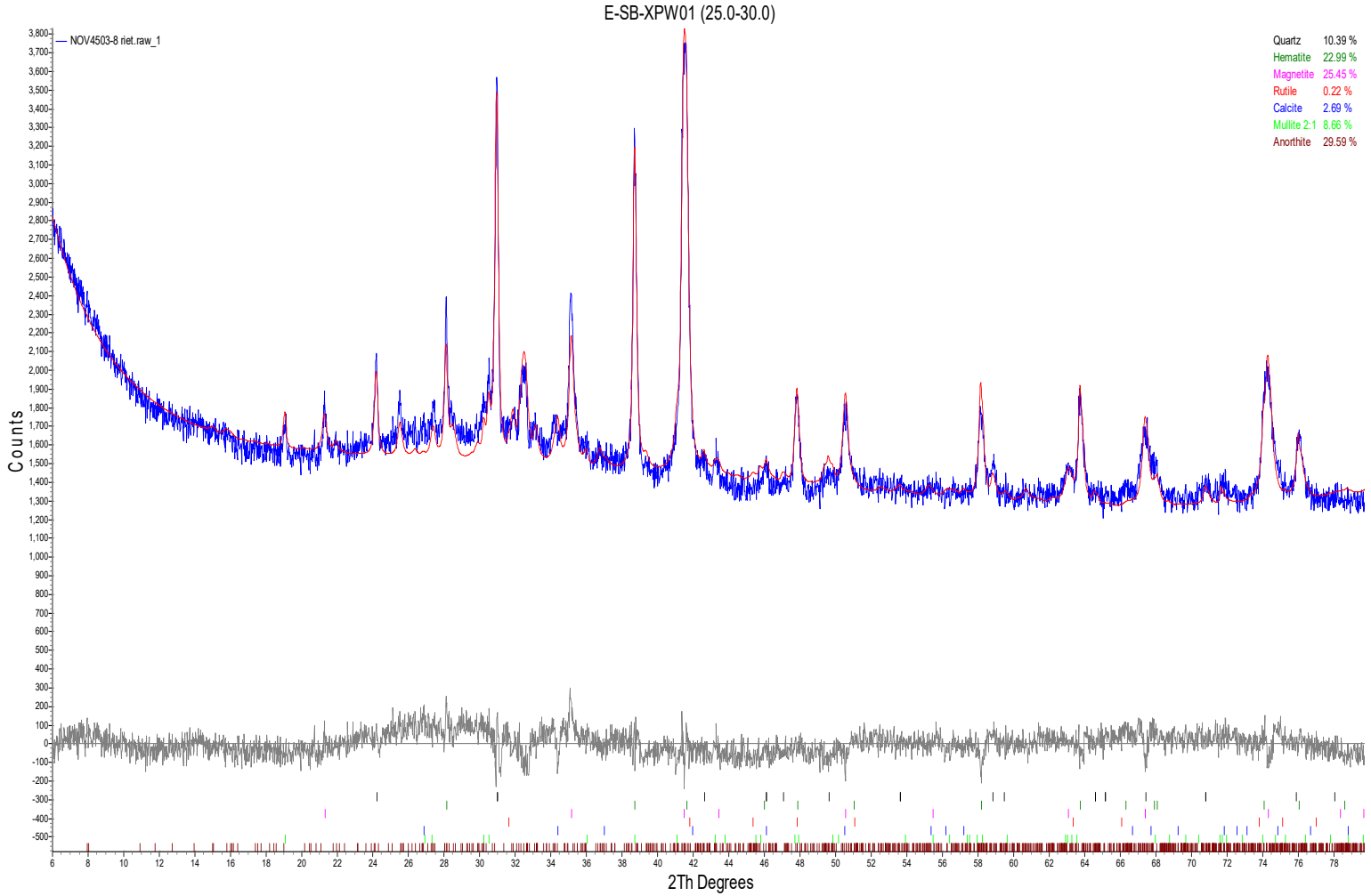


E-SB-19 (35.0-40.0)

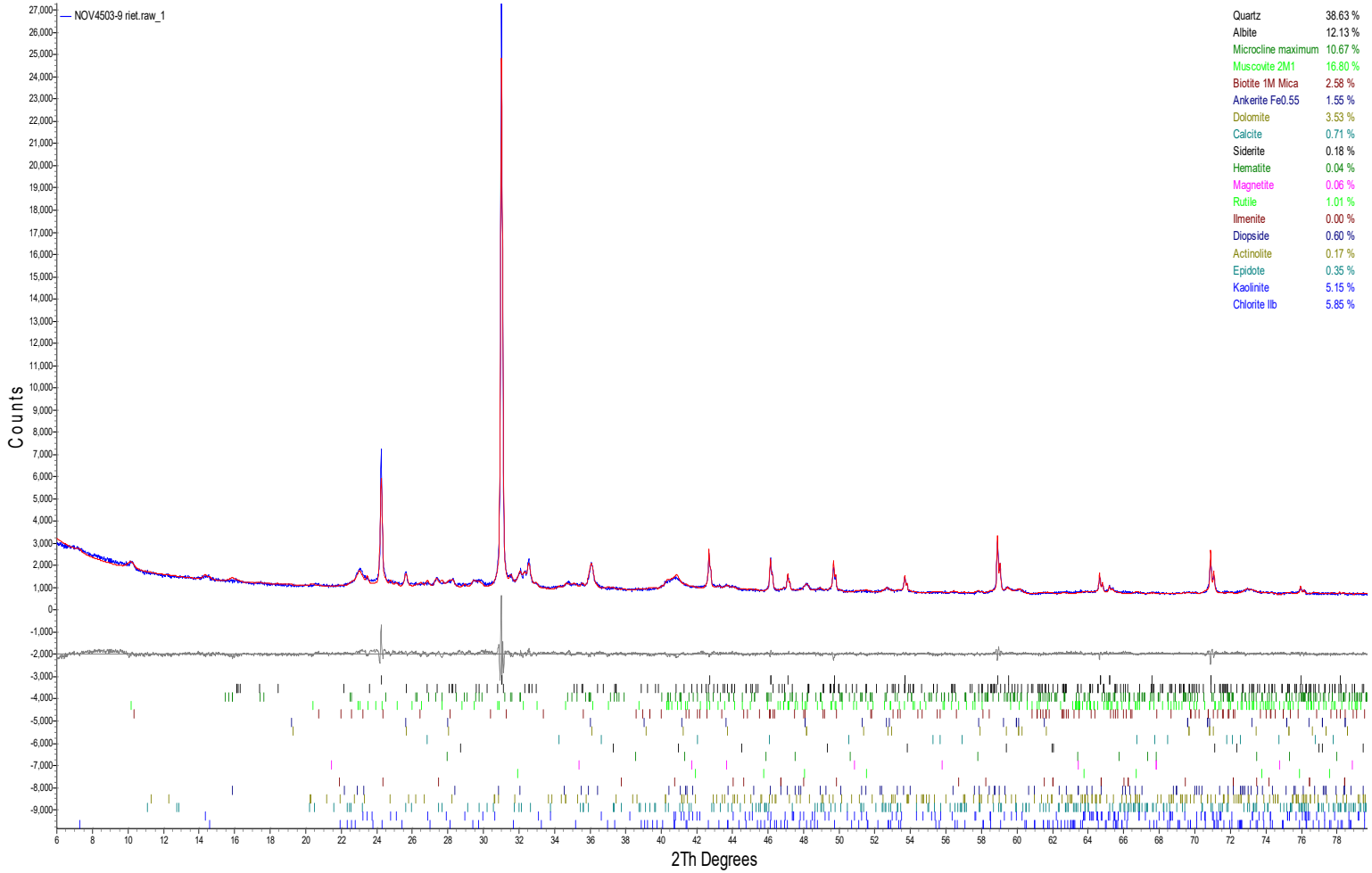


E-SB-18 (40.0-44.0)

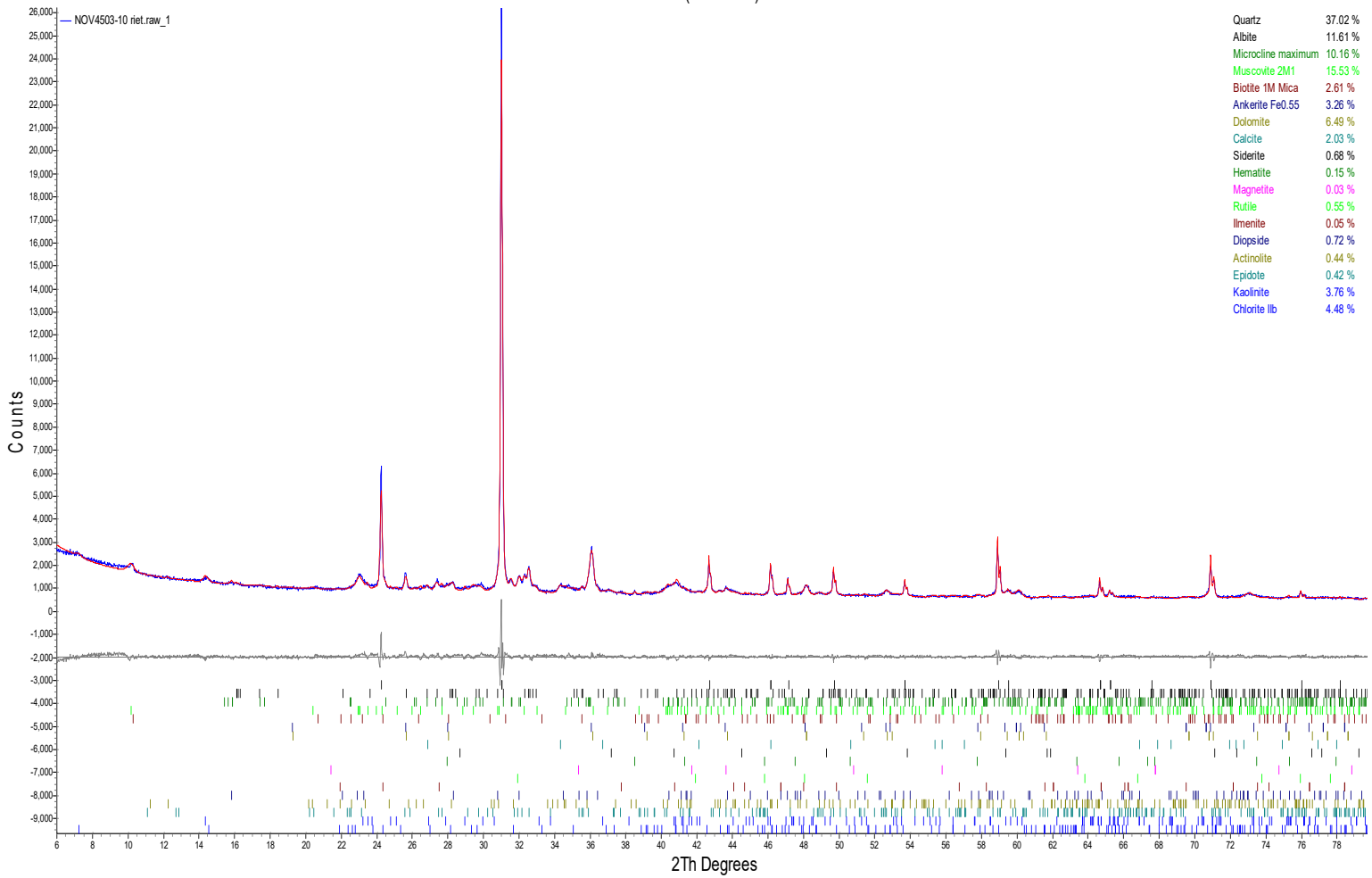



E-SB-XPW01 (25.0-30.0)
NOV4503-8 riet.raw_1
Quartz 10.39 %
Hematite 22.99 %
Magnetite 25.45 %
Rutile 0.22 %
Calcite 2.69 %
Mullite 2:1 8.66 %
Anorthite 29.59 %
Counts
2Th Degrees

E-SB-15 (10.0-15.0)



E-SB-15 (30.0-35.0)



SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : Edwards MNA

02-November-2021

SiREM Laboratory
Attn : Michael Healey

130 Stone Road W
Guelph, ON
N1G 3Z2, Canada

Phone: 519-822-2265
Fax:519-822-3151

Date Rec. : 07 October 2021
LR Report: **CA14145-OCT21**
Reference: P.O# 800003210A

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	1: Analysis Start Date	3: Analysis Completed Date	5: E-SB-07 (21.0-27.0)	6: E-SB-07 (40.0-45.0)	7: E-SB-07 (59.0-64.0)	8: E-SB-05 (30.0-33.5)	9: E-SB-05 (51.0-56.0)
Sample Date & Time			06-Oct-21 10:00	06-Oct-21 10:15	06-Oct-21 10:30	06-Oct-21 10:45	06-Oct-21 11:00
SiO2 [%]	26-Oct-21	27-Oct-21	73.2	64.5	67.2	53.8	58.8
Al2O3 [%]	26-Oct-21	27-Oct-21	7.23	15.1	15.3	10.8	14.9
Fe2O3 [%]	26-Oct-21	27-Oct-21	2.85	6.16	4.21	4.79	7.34
MgO [%]	26-Oct-21	27-Oct-21	2.07	1.95	1.70	3.44	2.61
CaO [%]	26-Oct-21	27-Oct-21	3.41	0.55	0.28	6.85	1.73
Na2O [%]	26-Oct-21	27-Oct-21	0.87	1.47	1.66	0.91	1.36
K2O [%]	26-Oct-21	27-Oct-21	1.91	2.61	2.65	2.35	2.70
TiO2 [%]	26-Oct-21	27-Oct-21	0.44	1.02	1.03	0.64	0.90
P2O5 [%]	26-Oct-21	27-Oct-21	0.08	0.13	0.14	0.17	0.16
MnO [%]	26-Oct-21	27-Oct-21	0.06	0.06	0.04	0.08	0.10
Cr2O3 [%]	26-Oct-21	27-Oct-21	< 0.01	0.02	< 0.01	< 0.01	0.01
V2O5 [%]	26-Oct-21	27-Oct-21	< 0.01	0.02	0.02	0.02	0.02
LOI [%]	26-Oct-21	27-Oct-21	6.78	6.17	4.58	15.5	8.80
Sum [%]	26-Oct-21	27-Oct-21	98.9	99.7	98.8	99.4	99.4

Analysis	10: E-SB-19 (35.0-40.0)	11: E-SB-18 (40.0-44.0)	12: E-SB-XPW01 (25.0-30.0)	13: E-SB-15 (10.0-15.0)	14: E-SB-15 (30.0-35.0)
Sample Date & Time	06-Oct-21 11:15	06-Oct-21 11:30	06-Oct-21 11:45	06-Oct-21 12:00	06-Oct-21 12:15
SiO2 [%]	60.9	46.9	37.6	59.7	56.0
Al2O3 [%]	10.6	10.2	13.9	14.3	11.7
Fe2O3 [%]	4.69	6.42	25.9	6.54	4.31
MgO [%]	3.85	4.11	0.76	2.24	3.14
CaO [%]	4.78	8.95	8.26	2.31	4.64
Na2O [%]	1.10	0.74	0.35	0.77	0.95
K2O [%]	2.16	1.97	1.32	2.85	2.53
TiO2 [%]	0.68	0.56	0.80	0.78	0.71
P2O5 [%]	0.12	0.14	0.07	0.31	0.14

OnLine LIMS

0002697897

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Test method information available upon request. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples. SGS Canada Inc. Environment-Health & Safety statement of conformity decision rule does not consider uncertainty when analytical results are compared to a specified standard or regulation.

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : Edwards MNA

LR Report : **CA14145-OCT21**

Analysis	10: E-SB-19 (35.0-40.0)	11: E-SB-18 (40.0-44.0)	12: E-SB-XPW01 (25.0-30.0)	13: E-SB-15 (10.0-15.0)	14: E-SB-15 (30.0-35.0)
MnO [%]	0.08	0.10	0.09	0.04	0.08
Cr2O3 [%]	< 0.01	< 0.01	0.02	0.01	0.01
V2O5 [%]	0.01	0.01	0.04	0.02	0.02
LOI [%]	10.5	19.3	10.2	11.0	15.3
Sum [%]	99.5	99.4	99.3	100.9	99.5

Catharine Arnold

CHARTERED CATHARINE ARNOLD CHEMIST

Catharine Arnold, B.Sc., C.Chem
Project Specialist,
Environment, Health & Safety

OnLine LIMS

0002697897

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APPENDIX D

Cation Exchange Capacity Analysis

Analysis Report
GS21-05061

F402001 SGS LAKEFIELD RESEARCH
PO BOX 4300
185 CONCESSION STREET
LAKEFIELD, ONTARIO ON K0L 2H0
CANADA

Received : 04-Nov-2021
Completed : 11-Nov-2021
Order Reference : Lisa/Catharine - ESB07...ESB15

Laboratory ID:	GS21-05061.001	GS21-05061.002	GS21-05061.003	GS21-05061.004
Client Sample #:	E-SB-07(21.0-27.0)	E-SB-07(40.0-45.0)	E-SB-07(59.0-64.0)	E-SB-05(30.0-33.5)
Description:	CA14146-OCT21			
CEC Actual (meq/100g)	25.70	12.16	11.18	30.59

NOTE:
The analysis report above refers to the time and place of testing, and strictly to the supplied sample(s) only, without reference to any other matter. This report does not evidence or refer to any consignment or shipment or/and SGS sampling and inspection.

Report File Reference Number: 0000198573

Signed and dated in Guelph, ON
On 11-Nov-2021

For and on behalf of SGS Canada Inc., Agriculture and Food

Jack Legg, CCA-ON, 4R NMS
Branch Manager, Agronomist

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Analysis Report
GS21-05061

F402001 SGS LAKEFIELD RESEARCH
PO BOX 4300
185 CONCESSION STREET
LAKEFIELD, ONTARIO ON K0L 2H0
CANADA

Received : 04-Nov-2021
Completed : 11-Nov-2021
Order Reference : Lisa/Catharine - ESB07...ESB15

Laboratory ID:	GS21-05061.005	GS21-05061.006	GS21-05061.007	GS21-05061.008
Client Sample #: Description:	E-SB-05(51.0-56.0)	E-SB-19(35.0-40.0)	E-SB-18(40.0-44.0)	E-SB-XPW01(25.0-30.0)
CEC Actual (meq/100g)	19.28	20.95	36.47	86.50

NOTE:
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Report File Reference Number: 0000198573

Signed and dated in Guelph, ON
On 11-Nov-2021

For and on behalf of SGS Canada Inc., Agriculture and Food

Jack Legg, CCA-ON, 4R NMS
Branch Manager, Agronomist

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Analysis Report
GS21-05061

F402001 SGS LAKEFIELD RESEARCH
PO BOX 4300
185 CONCESSION STREET
LAKEFIELD, ONTARIO ON K0L 2H0
CANADA

Received : 04-Nov-2021
Completed : 11-Nov-2021
Order Reference : Lisa/Catharine - ESB07...ESB15

Laboratory ID:	GS21-05061.009	GS21-05061.010
Client Sample #:	E-SB-15(10.0-15.0)	E-SB-15(30.0-35.0)
Description:		
CEC Actual (meq/100g)	25.73	20.83

NOTE:
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Report File Reference Number: 0000198573

Signed and dated in Guelph, ON
On 11-Nov-2021

For and on behalf of SGS Canada Inc., Agriculture and Food

Jack Legg, CCA-ON, 4R NMS
Branch Manager, Agronomist

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APPENDIX E

SGS Soil Analysis

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : Edwards MNA

11-November-2021

SiREM Laboratory
Attn : Michael Healey

130 Stone Road W
Guelph, ON
N1G 3Z2, Canada

Phone: 519-822-2265
Fax:519-822-3151

Date Rec. : 07 October 2021
LR Report: **CA14143-OCT21**
Reference: P.O# 800003210A

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: E-SB-07 (21.0-27.0)	6: E-SB-07 (40.0-45.0)
Sample Date & Time					06-Oct-21 10:00	06-Oct-21 10:15
SO4 [%]	02-Nov-21	20:59	04-Nov-21	17:00	< 0.1	< 0.1
B [g/t]	11-Nov-21	10:26	11-Nov-21	10:26	< 40	47
TOC [%]	18-Oct-21	08:11	18-Oct-21	10:55	0.366	0.626
Ag [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	< 0.5	< 0.5
Al [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	36000	67000
As [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	5.0	2.5
Ba [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	390	480
Be [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	0.95	2
Bi [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	0.13	0.24
Ca [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	24000	3800
Cd [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	0.22	0.04
Co [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	9	17
Cr [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	20	25
Cu [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	11	22
Fe [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	22000	45000
K [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	16000	20000
Li [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	18	46
Mg [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	13000	11000
Mn [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	490	510
Mo [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	0.5	0.2
Na [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	6200	10000
Ni [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	19	40
P [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	340	550
Pb [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	16	14
Sb [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	< 0.8	< 0.8
Se [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	< 0.7	< 0.7
Sn [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	< 6	< 6

OnLine LIMS

00027068869

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SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : Edwards MNA

LR Report : **CA14143-OCT21**

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: E-SB-07 (21.0-27.0)	6: E-SB-07 (40.0-45.0)
Sr [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	110	92
Ti [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	2000	3600
Tl [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	0.44	0.53
U [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	1.61	2.32
V [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	48	100
Y [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	13.2	17.2
Zn [µg/g]	20-Oct-21	17:57	22-Oct-21	11:22	43	76

Analysis	7: E-SB-07 (59.0-64.0)	8: E-SB-05 (30.0-33.5)	9: E-SB-05 (51.0-56.0)	10: E-SB-19 (35.0-40.0)	11: E-SB-18 (40.0-44.0)
Sample Date & Time	06-Oct-21 10:30	06-Oct-21 10:45	06-Oct-21 11:00	06-Oct-21 11:15	06-Oct-21 11:30
SO4 [%]	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
B [g/t]	49	< 40	51	< 40	< 40
TOC [%]	0.154	2.42	1.12	0.528	2.60
Ag [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Al [µg/g]	70000	52000	72000	52000	50000
As [µg/g]	3.5	9.3	11	6.4	12
Ba [µg/g]	450	500	460	410	720
Be [µg/g]	2	1	2	1	2
Bi [µg/g]	0.28	0.24	0.30	0.24	0.24
Ca [µg/g]	2200	47000	12000	34000	62000
Cd [µg/g]	0.02	0.46	0.24	0.28	0.59
Co [µg/g]	17	13	20	13	14
Cr [µg/g]	23	31	42	50	63
Cu [µg/g]	25	21	25	33	22
Fe [µg/g]	31000	35000	55000	35000	48000
K [µg/g]	21000	19000	22000	18000	17000
Li [µg/g]	48	34	48	30	33
Mg [µg/g]	10000	20000	16000	24000	24000
Mn [µg/g]	340	680	870	600	850
Mo [µg/g]	0.1	1.2	0.6	1.0	1.7
Na [µg/g]	12000	6300	10000	8000	5100
Ni [µg/g]	41	32	43	31	32
P [µg/g]	610	680	710	500	580
Pb [µg/g]	16	19	18	16	19
Sb [µg/g]	< 0.8	< 0.8	0.9	< 0.8	< 0.8
Se [µg/g]	< 0.7	0.7	< 0.7	0.8	0.8
Sn [µg/g]	< 6	< 6	< 6	< 6	< 6
Sr [µg/g]	110	130	110	110	120
Ti [µg/g]	3700	2500	3300	2900	2400

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Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : Edwards MNA

LR Report : **CA14143-OCT21**

Analysis	7: E-SB-07 (59.0-64.0)	8: E-SB-05 (30.0-33.5)	9: E-SB-05 (51.0-56.0)	10: E-SB-19 (35.0-40.0)	11: E-SB-18 (40.0-44.0)
Tl [µg/g]	0.53	0.61	0.56	0.51	0.54
U [µg/g]	2.28	2.48	2.61	2.13	2.46
V [µg/g]	100	86	110	84	82
Y [µg/g]	17.9	18.2	21.3	18.6	18.2
Zn [µg/g]	77	84	89	68	86

Analysis	12: E-SB-XPW01 (25.0-30.0)	13: E-SB-15 (10.0-15.0)	14: E-SB-15 (30.0-35.0)
Sample Date & Time	06-Oct-21 11:45	06-Oct-21 12:00	06-Oct-21 12:15
SO4 [%]	0.7	< 0.1	< 0.1
B [g/t]	896	54	43
TOC [%]	3.62	1.10	1.64
Ag [µg/g]	0.6	< 0.5	< 0.5
Al [µg/g]	71000	68000	57000
As [µg/g]	50	5.6	13
Ba [µg/g]	450	540	550
Be [µg/g]	21	2	2
Bi [µg/g]	0.44	0.36	0.32
Ca [µg/g]	59000	16000	33000
Cd [µg/g]	17	0.45	0.51
Co [µg/g]	37	17	15
Cr [µg/g]	170	35	36
Cu [µg/g]	78	26	26
Fe [µg/g]	200000	49000	32000
K [µg/g]	11000	22000	21000
Li [µg/g]	55	45	37
Mg [µg/g]	4800	14000	19000
Mn [µg/g]	810	340	630
Mo [µg/g]	12	1.0	1.2
Na [µg/g]	2600	5600	6900
Ni [µg/g]	130	40	36
P [µg/g]	280	1300	620
Pb [µg/g]	350	24	21
Sb [µg/g]	8.0	< 0.8	< 0.8
Se [µg/g]	3.0	1.2	0.8
Sn [µg/g]	< 6	< 6	< 6
Sr [µg/g]	170	110	130
Ti [µg/g]	4600	3600	3400
Tl [µg/g]	3	0.83	0.66
U [µg/g]	10.4	2.87	2.67

OnLine LIMS

00027068969

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Test method information available upon request. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples. SGS Canada Inc. Environment-Health & Safety statement of conformity decision rule does not consider uncertainty when analytical results are compared to a specified standard or regulation.

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : Edwards MNA

LR Report : **CA14143-OCT21**

Analysis	12: E-SB-XPW01 (25.0-30.0)	13: E-SB-15 (10.0-15.0)	14: E-SB-15 (30.0-35.0)
V [µg/g]	200	99	87
Y [µg/g]	40.4	22.6	20.5
Zn [µg/g]	1700	120	90

Catharine Arnold

CHARTERED CHEMIST CATHARINE ARNOLD

Catharine Arnold, B.Sc., C.Chem
Project Specialist,
Environment, Health & Safety

OnLine LIMS

00027068

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Test method information available upon request. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples. SGS Canada Inc. Environment-Health & Safety statement of conformity decision rule does not consider uncertainty when analytical results are compared to a specified standard or regulation.

APPENDIX F

Borehole Survey

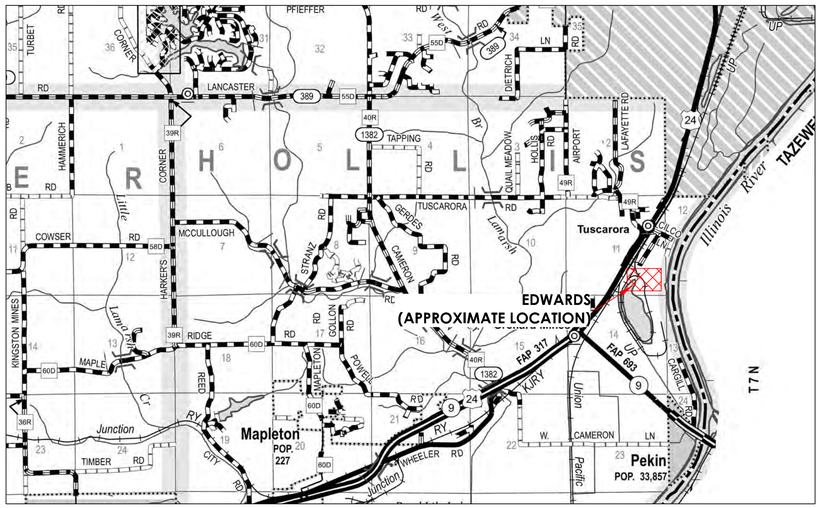
Luminant

ILLINOIS POWER RESOURCES GENERATING, LLC.
EDWARDS POWER STATION
DECEMBER 2020 TOPOGRAPHY

BARTONVILLE, ILLINOIS

ADDRESS
7800 S. CILCO LN.
BARTONVILLE, ILLINOIS 61607

VISTRA ENERGY



PROJECT LOCATION MAP
N.T.S.



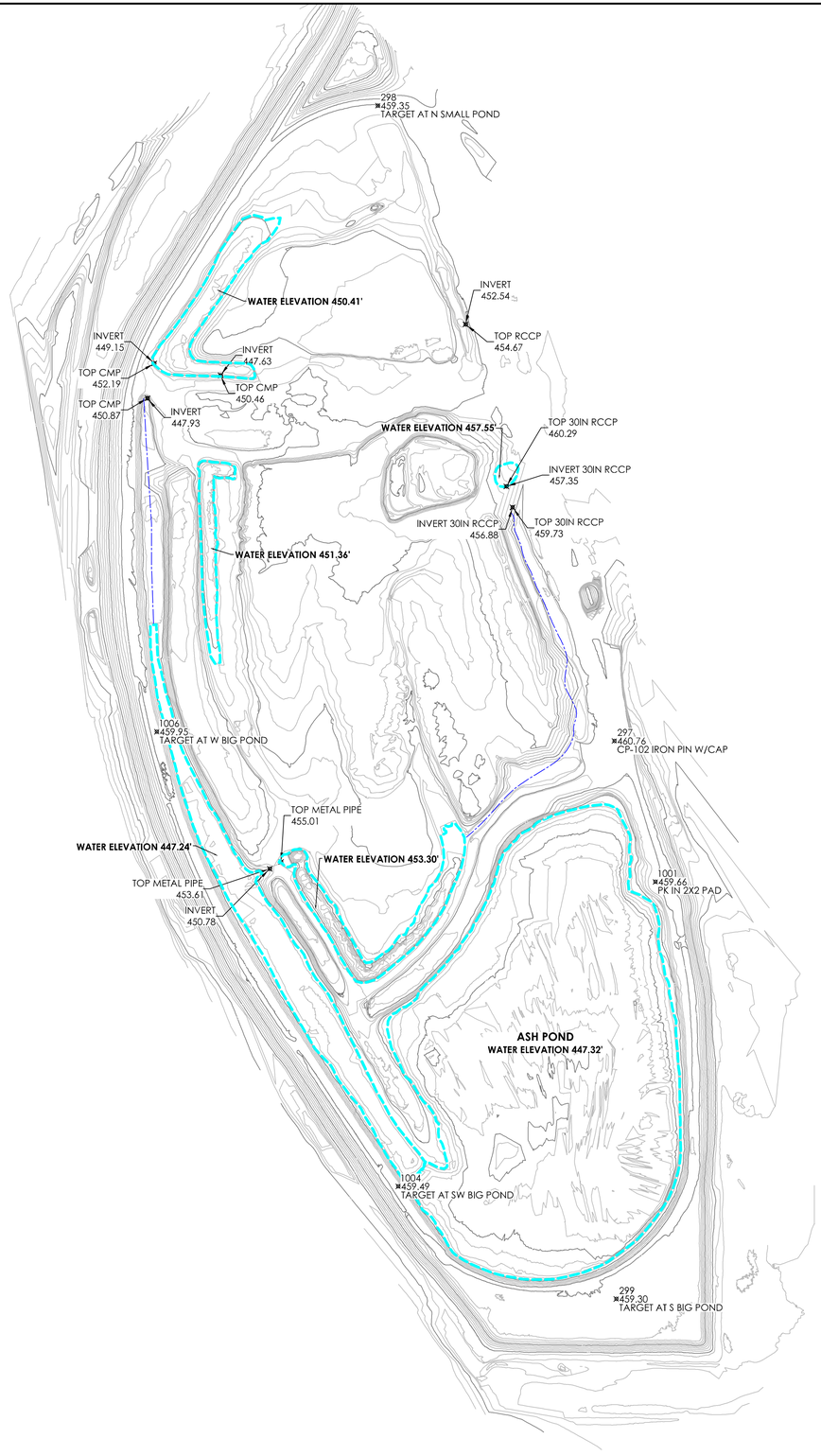
VICINITY MAP
N.T.S.

LIST OF DRAWINGS

1 - COVER SHEET
2 - EXISTING TOPOGRAPHY EAST ASH POND
3 - AERIAL PHOTOGRAPHY EAST ASH POND

PREPARED BY:

IngenAE
502 Earth City Plaza, Suite 120
Earth City, MO 63045
www.ingenae.com



N

0' 200' 400'

LEGEND

- EXISTING CONTOUR (2' INTERVAL)
- EXISTING CONTOUR (10' INTERVAL)
- LIMITS OF BATHYMETRIC SURVEY
- APPROXIMATE CREEK CENTERLINE

NOTES:

1. THIS EXHIBIT REPRESENTS A TOPOGRAPHIC FIELD SURVEY AND IS NOT INTENDED TO BE A BOUNDARY SURVEY.
2. EXISTING CONTOURS SHOWN ARE FROM AERIAL DRONE SURVEY COMPLETED BY DRAGONFLY AEROSOLUTIONS DATED 12/01/2020 AND TOPOGRAPHIC/BATHYMETRIC SURVEYS COMPLETED BY INGENAE DATED 11/9/2020.
3. NO UNDERGROUND OR OVERHEAD UTILITIES WERE LOCATED DURING THIS SURVEY.
4. THE ACCUMULATED DATA FROM AERIAL DRONE SURVEY, GROUND TRUTHING FIELD DATA COLLECTION SURVEYS AND TOPOGRAPHIC/BATHYMETRIC SURVEYS USED TO PRODUCE THE TOPOGRAPHIC DRAWING AS SHOWN HEREON IS BASED ON ILLINOIS STATE PLANE COORDINATE-ZONE WEST NAD 1983 AND NAVD 88 ELEVATION DATUM.

AERIAL TARGET POINT TABLE

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
297	1430025.4	2435960.5	460.77	CP-102 IRON PIN W/CAP
298	1431902.5	2435261.5	459.35	TARGET AT N SMALL POND
299	1428376.4	2435966.1	459.30	TARGET AT S BIG POND
1001	1429609.0	2436081.7	459.66	PK IN 2X2 PAD
1004	1428709.0	2435321.7	459.49	TARGET AT SW BIG POND
1006	1430052.4	2434608.2	459.95	TARGET AT W BIG POND

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Earth City, MO 63045
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Submissions / Revisions: Date:

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13		

Luminant

Project Name & Location:

EDWARDS
POWER STATION

7800 S. CILCO LN.
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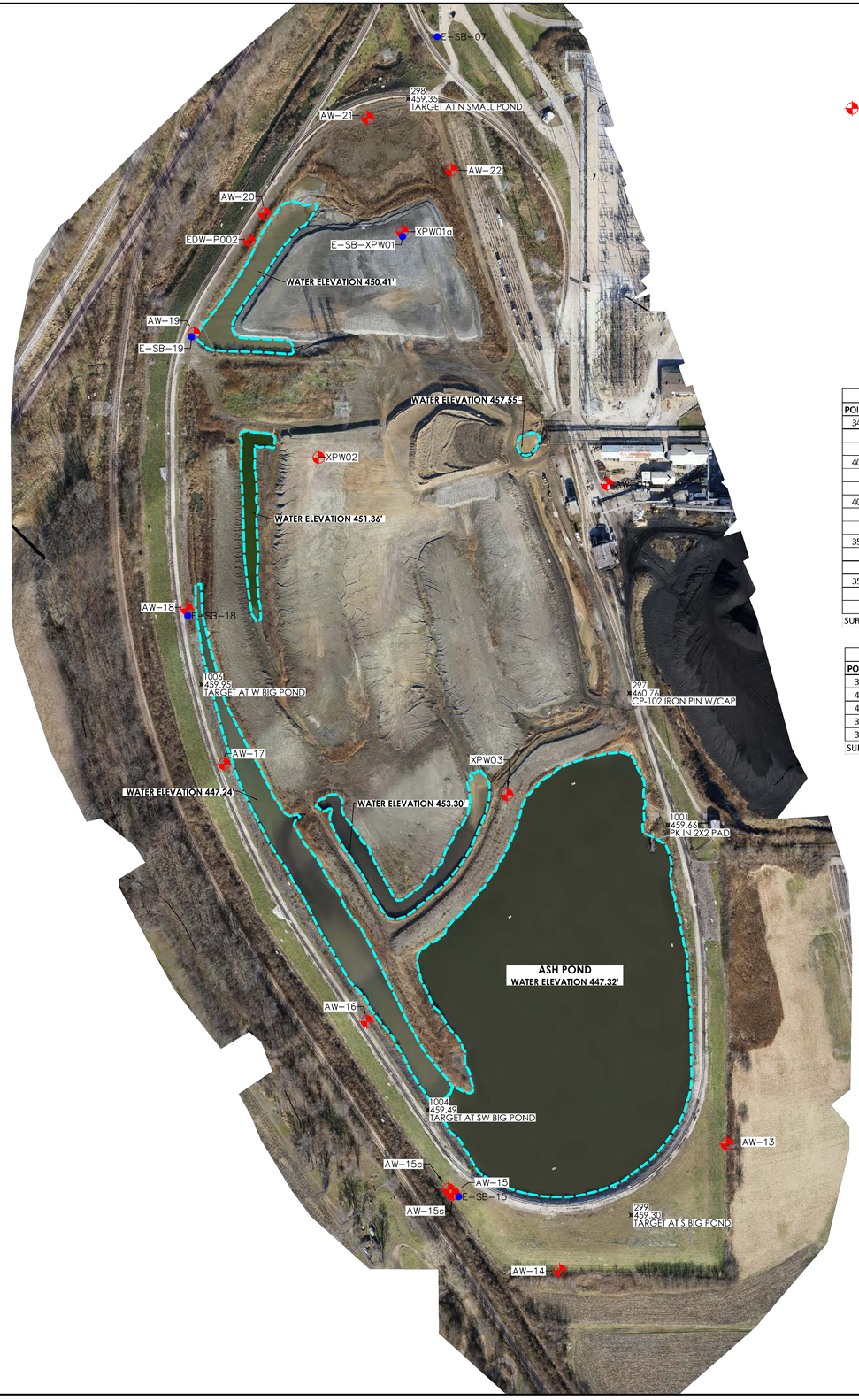
Drawing Name:

EXISTING TOPOGRAPHY ASH POND 1

Date: 9/28/2021	Project No.
Type: SITE	Drawing No. 2
Drawn By: CB	
Approved By: BH	
Scale: AS NOTED	



EMW-02

EMW-03

AW-12

0' 200' 400'

LEGEND

- LIMITS OF BATHYMETRIC SURVEY
- WELL NAME
- BORING NAME

NOTES:

1. EXISTING AERIAL SHOWN ARE FROM AERIAL SURVEY COMPLETED BY DRAGONFLY AEROSOLUTIONS DATED 12-01-2020.
2. THE WELL LOCATIONS AND ELEVATIONS, BORING LOCATIONS AND BENCHMARK DATA WAS RETRIEVED IN A SUBSEQUENT SURVEY DONE BY INGENAE DATED FEBRUARY 10, 2021.

BORING LOCATION POINT TABLE

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
3515	1428434.09	2435420.64	439.08	E-SB-15
3516	1430269.65	2434564.52	459.99	E-SB-18
3517	1431150.52	2434576.77	458.41	E-SB-19
3520	1431467.42	2435243.55	460.83	E-SB-XPW01
3525	1432098.87	2435352.83	458.40	E-SB-07
3528	1432419.27	2436748.91	440.98	E-SB-05

SURVEY PERFORMED BY INGENAE SEPT. 23, 2021

WELL LOCATION POINT TABLE

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
3494	1430685.26	2435889.03	464.43	AW-01 TOP PVC WELL
			462.29	AW-01 GROUND
			464.78	AW-01 TOP METAL CASING
4005	1431872.71	2436663.77	458.10	EMW-02 TOP PVC WELL
			455.40	EMW-02 GROUND
			458.38	EMW-02 TOP METAL CASING
4002	1431630.17	2436732.63	461.51	EMW-03 TOP PVC WELL
			458.95	EMW-03 GROUND
			461.97	EMW-03 TOP METAL CASING
3500	1432463.94	2435244.94	456.75	EMW-04 TOP PVC WELL
			454.51	EMW-04 GROUND
			457.29	EMW-04 TOP METAL CASING
3502	1432325.51	2435264.90	457.94	EMW-05 TOP PVC WELL
			455.78	EMW-05 GROUND
			458.40	EMW-05 TOP METAL CASING

SURVEY PERFORMED BY INGENAE ON SEPT. 23, 2021

WELL LOCATION POINT TABLE

POINT #	LATITUDE	LONGITUDE	DESCRIPTION
3494	40° 35' 38.75338"	89° 39' 54.11930"	AW-01
4005	40° 35' 50.44422"	89° 39' 43.98889"	EMW-02
4002	40° 35' 48.04334"	89° 39' 43.11351"	EMW-03
3500	40° 35' 56.36532"	89° 40' 02.33824"	EMW-04
3502	40° 35' 54.99767"	89° 40' 02.08969"	EMW-05

SURVEY PERFORMED BY INGENAE ON SEPT. 23, 2021

AERIAL TARGET POINT TABLE

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
297	1430025.4	2435960.5	460.77	CP-102 IRON PIN W/CAP
298	1431902.5	2435261.5	459.35	TARGET AT N SMALL POND
299	1428376.4	2435966.1	459.30	TARGET AT S BIG POND
1001	1429609.0	2436081.7	459.66	PK IN 2X2 PAD
1004	1428709.0	2435321.7	459.49	TARGET AT SW BIG POND
1006	1430052.4	2434608.2	459.95	TARGET AT W BIG POND

WELL LOCATION POINT TABLE

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
1018	1429585.5	2436922.9	441.16	AW-12 GROUND
1016	1429585.5	2436922.9	444.31	AW-12 TOP METAL CASING
1017	1429585.5	2436922.9	443.80	AW-12 TOP PVC WELL
1001	1428600.7	2436267.2	438.67	AW-13 GROUND
1002	1428600.7	2436267.2	441.67	AW-13 TOP METAL CASING
1003	1428600.7	2436267.2	441.26	AW-13 TOP PVC WELL
1004	1428201.1	2435739.9	436.83	AW-14 GROUND
1005	1428201.1	2435739.9	439.99	AW-14 TOP METAL CASING
1006	1428201.1	2435739.9	439.40	AW-14 TOP PVC WELL
1012	1428445.0	2435405.1	438.95	AW-15 GROUND
1011	1428445.0	2435405.1	442.02	AW-15 TOP METAL CASING
1010	1428445.0	2435405.1	441.51	AW-15 TOP PVC WELL
1015	1428458.1	2435388.2	437.62	AW-15C GROUND
1013	1428458.1	2435388.2	440.67	AW-15C TOP METAL CASING
1014	1428458.1	2435388.2	440.02	AW-15C TOP PVC WELL
1007	1428441.6	2435399.8	437.92	AW-15S GROUND
1008	1428441.6	2435399.8	441.29	AW-15S TOP METAL CASING
1009	1428441.6	2435399.8	440.71	AW-15S TOP PVC WELL
1021	1428987.3	2435130.5	459.45	AW-16 GROUND
1019	1428987.3	2435130.5	462.46	AW-16 TOP METAL CASING
1020	1428987.3	2435130.5	461.79	AW-16 TOP PVC WELL
1024	1429801.1	2434680.2	459.69	AW-17 GROUND
1022	1429801.1	2434680.2	462.76	AW-17 TOP METAL CASING
1023	1429801.1	2434680.2	462.10	AW-17 TOP PVC WELL
1027	1430291.0	2434561.4	460.28	AW-18 GROUND
1025	1430291.0	2434561.4	463.32	AW-18 TOP METAL CASING
1026	1430291.0	2434561.4	462.65	AW-18 TOP PVC WELL
1030	1431161.8	2434584.7	458.53	AW-19 TOP GROUND
1028	1431161.8	2434584.7	461.14	AW-19 TOP TOP METAL CASING
1029	1431161.8	2434584.7	460.74	AW-19 TOP TOP PVC WELL
1033	1431540.0	2434807.4	459.08	AW-20 GROUND
1031	1431540.0	2434807.4	461.57	AW-20 TOP METAL CASING
1032	1431540.0	2434807.4	461.48	AW-20 TOP PVC WELL
1039	1431842.4	2435132.3	458.28	AW-21 GROUND
1037	1431842.4	2435132.3	460.84	AW-21 TOP METAL CASING
1038	1431842.4	2435132.3	460.61	AW-21 TOP PVC WELL
1048	1431677.1	2435397.4	460.30	AW-22 GROUND
1046	1431677.1	2435397.4	463.90	AW-22 TOP METAL CASING
1047	1431677.1	2435397.4	463.19	AW-22 TOP PVC WELL
1036	1431454.4	2434759.8	458.70	EDW-P002 GROUND
1034	1431454.4	2434759.8	461.11	EDW-P002 TOP METAL CASING
1035	1431454.4	2434759.8	460.39	EDW-P002 TOP PVC WELL
1051	1431483.3	2435242.4	460.99	XPW-01A GROUND
1049	1431483.3	2435242.4	464.42	XPW-01A TOP METAL CASING
1050	1431483.3	2435242.4	464.16	XPW-01A TOP PVC WELL
1042	1430769.4	2434978.0	471.16	XPW-02 GROUND
1040	1430769.4	2434978.0	474.46	XPW-02 TOP METAL CASING
1041	1430769.4	2434978.0	473.79	XPW-02 TOP PVC WELL
1045	1429703.7	2435574.0	462.62	XPW-03 GROUND
1043	1429703.7	2435574.0	466.56	XPW-03 TOP METAL CASING
1044	1429703.7	2435574.0	466.04	XPW-03 TOP PVC WELL

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Project Name & Location:

EDWARDS
POWER STATION

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Drawing Name:

AERIAL PHOTOGRAPHY ASH POND 1

Date: 9/28/2021	Project No.
Type: SITE	Drawing No. 3
Drawn By: CB	
Approved By: BH	
Scale: AS NOTED	

APPENDIX G

Groundwater Sampling Results

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Env ICP-MS Metals Dissolved

Project : 800003210A

21-October-2021

SiREM Laboratory
Attn : Michael Healey

130 Stone Road W
Guelph, ON
N1G 3Z2, Canada

Phone: 519-822-2265
Fax:519-822-3151

Date Rec. : 07 October 2021
LR Report: **CA14147-OCT21**
Reference: Edwards MNA

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: AP-05S	6: AW-15	7: AW-19
Sample Date & Time					06-Oct-21 13:00	06-Oct-21 13:15	06-Oct-21 13:00
Temp Upon Receipt [°C]	---	---	---	---	10.0	10.0	10.0
As (diss) [mg/L]	14-Oct-21	18:38	15-Oct-21	14:30	0.0005	0.0019	0.0017
B (diss) [mg/L]	14-Oct-21	18:38	15-Oct-21	14:30	0.364	0.570	2.64
Li (diss) [mg/L]	14-Oct-21	18:38	15-Oct-21	14:30	0.0324	0.0454	0.0106
TOC [mg/L]	08-Oct-21	18:36	14-Oct-21	12:12	20	22	3
Cl (diss) [mg/L]	16-Oct-21	00:38	18-Oct-21	09:44	48	52	88
SO4 (diss) [mg/L]	16-Oct-21	00:38	19-Oct-21	15:30	0.8	< 0.2	43

Catharine Arnold

CHARTERED CATHARINE ARNOLD CHEMIST

Catharine Arnold, B.Sc., C.Chem
Project Specialist,
Environment, Health & Safety

OnLine LIMS

0002684943

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SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : 800003210A

05-November-2021

SiREM Laboratory
Attn : Michael Healey

130 Stone Road W, Guelph
Canada, N1G 3Z2
Phone: 519-822-2265, Fax:519-822-3151

Date Rec. : 04 November 2021
LR Report: **CA14100-NOV21**
Reference: Edwards MNA

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: AP-05S	6: AW-15	7: AW-19
Sample Date & Time							
Temp Upon Receipt [°C]	---	---	---	---	4.0	4.0	4.0
Ag (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	< 0.00005	< 0.00005	< 0.00005
Al (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	0.006	0.001	0.001
Ba (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	0.449	2.32	0.155
Be (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	< 0.000007	< 0.000007	< 0.000007
Bi (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	< 0.00001	0.00001	< 0.00001
Ca (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	103	111	121
Cd (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	< 0.000003	< 0.000003	0.000015
Co (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	0.00107	0.00115	0.000604
Cr (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	0.00082	0.00121	0.00103
Cu (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	< 0.0002	< 0.0002	0.0007
Fe (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	0.080	0.066	0.020
K (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	4.29	7.63	0.864
Mg (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	40.8	41.6	49.1
Mn (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	0.157	0.0391	0.361
Mo (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	0.00020	0.00043	0.00368
Na (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	189	245	53.0
Ni (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	0.0007	0.0005	0.0160
Pb (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	< 0.00009	< 0.00009	< 0.00009
Sb (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	< 0.0009	< 0.0009	< 0.0009
S (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	1	1	16
Se (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	0.00019	0.00024	0.00007
Sn (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	< 0.00006	< 0.00006	< 0.00006
Sr (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	0.571	0.937	0.237
Ti (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	0.00022	0.00021	0.00005
Tl (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	< 0.000005	< 0.000005	< 0.000005
U (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	0.000019	0.000082	0.000365

OnLine LIMS

0002702134

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SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : 800003210A

LR Report : **CA14100-NOV21**

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: AP-05S	6: AW-15	7: AW-19
V (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	0.00038	0.00127	0.00004
W (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	0.00006	0.00003	0.00002
Y (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	< 0.00002	< 0.00002	0.00003
Zn (diss) [mg/L]	14-Oct-21	18:38	04-Nov-21	17:10	0.004	0.002	0.010

Full dissolved metals scan for samples originally reproted as CA14147-OCT21. All metals included in this scan.

Catharine Arnold

CHARTERED CATHARINE ARNOLD CHEMIST

Catharine Arnold, B.Sc., C.Chem
Project Specialist,
Environment, Health & Safety

OnLine LIMS

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APPENDIX H

Batch Testing Results

SIREM
ATTN: Michael Healey
130 Stone Road West
Guelph ON N1G 3Z2

Date Received: 21-JAN-22
Report Date: 25-JAN-22 15:02 (MT)
Version: FINAL

Client Phone: 519-822-2265

Certificate of Analysis

Lab Work Order #: L2680648

Project P.O. #: NOT SUBMITTED
Job Reference: EDWARDS MNA
C of C Numbers:
Legal Site Desc:



Gayle Braun
Senior Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2680648-1 AW-15S-1 Sampled By: J.L. on 21-JAN-22 @ 09:00 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.069	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	12.5	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.49	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	395	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-2 AW-15S-2 Sampled By: J.L. on 21-JAN-22 @ 09:15 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.074	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	12.5	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.48	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	392	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-3 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 2:1-1 Sampled By: J.L. on 21-JAN-22 @ 09:30 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.385	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	4.6	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.15	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	266	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-4 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 2:1-2 Sampled By: J.L. on 21-JAN-22 @ 09:45 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.319	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	4.4	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.12	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	274	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-5 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 1:1-1 Sampled By: J.L. on 21-JAN-22 @ 10:00 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.227	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	6.5	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.21	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	313	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-6 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 1:5-1 Sampled By: J.L. on 21-JAN-22 @ 10:30 Matrix:							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2680648-6 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 1:5-1 Sampled By: J.L. on 21-JAN-22 @ 10:30 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.133	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	10.0	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.36	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	375	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-7 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 1:5-2 Sampled By: J.L. on 21-JAN-22 @ 10:45 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.121	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	10.3	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.36	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	370	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-8 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 1:10-1 Sampled By: J.L. on 21-JAN-22 @ 11:00 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.117	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	11.0	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.42	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	382	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-9 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 1:10-2 Sampled By: J.L. on 21-JAN-22 @ 11:15 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.110	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	11.5	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.43	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	375	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-10 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 1:20-1 Sampled By: J.L. on 21-JAN-22 @ 11:30 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.098	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	12.1	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.45	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	393	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-11 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 1:20-2 Sampled By: J.L. on 21-JAN-22 @ 11:45 Matrix:							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2680648-11 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 1:20-2 Sampled By: J.L. on 21-JAN-22 @ 11:45 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.114	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	11.9	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.44	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	383	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-12 AW-19-1 Sampled By: J.L. on 21-JAN-22 @ 12:00 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.048	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	11.9	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.48	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	375	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-13 AW-19-2 Sampled By: J.L. on 21-JAN-22 @ 12:15 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.049	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	12.1	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.51	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	390	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-14 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 2:1-1 Sampled By: J.L. on 21-JAN-22 @ 12:30 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.268	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	4.3	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.11	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	270	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-15 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 2:1-2 Sampled By: J.L. on 21-JAN-22 @ 12:45 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.510	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	4.4	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.15	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	269	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-16 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:1-1 Sampled By: J.L. on 21-JAN-22 @ 13:00 Matrix:							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2680648-16 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:1-1 Sampled By: J.L. on 21-JAN-22 @ 13:00 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.243	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	6.6	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.24	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	314	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-17 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:1-2 Sampled By: J.L. on 21-JAN-22 @ 13:15 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.321	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	6.3	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.22	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	308	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-18 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:5-1 Sampled By: J.L. on 21-JAN-22 @ 13:30 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.159	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	9.5	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.36	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	358	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-19 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:5-2 Sampled By: J.L. on 21-JAN-22 @ 13:45 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.191	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	9.7	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.38	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	360	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-20 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:10-1 Sampled By: J.L. on 21-JAN-22 @ 14:00 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.172	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	10.3	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.40	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	365	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-21 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:10-2 Sampled By: J.L. on 21-JAN-22 @ 14:15 Matrix:							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2680648-21 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:10-2 Sampled By: J.L. on 21-JAN-22 @ 14:15 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704656
Barium (Ba)-Dissolved	0.144	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	11.3	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.45	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	389	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-22 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:20-1 Sampled By: J.L. on 21-JAN-22 @ 14:30 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704656
Barium (Ba)-Dissolved	0.112	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	11.9	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.46	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	381	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-23 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:20-2 Sampled By: J.L. on 21-JAN-22 @ 12:45 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704656
Barium (Ba)-Dissolved	0.155	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	11.5	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.47	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	387	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2680648-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2680648-21, -22, -23
Matrix Spike	Boron (B)-Dissolved	MS-B	L2680648-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Boron (B)-Dissolved	MS-B	L2680648-21, -22, -23
Matrix Spike	Lithium (Li)-Dissolved	MS-B	L2680648-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Lithium (Li)-Dissolved	MS-B	L2680648-21, -22, -23
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L2680648-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L2680648-21, -22, -23

Sample Parameter Qualifier key listed:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MET-D-CCMS-WT	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L2680648 Report Date: 25-JAN-22

Client: SIREM
130 Stone Road West
Guelph ON N1G 3Z2
Contact: Michael Healey

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R5705380								
WG3687838-4 DUP		**WG3687838-3**						
Barium (Ba)-Dissolved		0.385	0.390		mg/L	1.2	20	24-JAN-22
Boron (B)-Dissolved		4.6	4.5		mg/L	0.1	20	24-JAN-22
Lithium (Li)-Dissolved		0.15	0.14		mg/L	4.5	20	24-JAN-22
Sulfur (S)-Dissolved		266	273		mg/L	2.8	20	24-JAN-22
WG3687839-4 DUP		**WG3687839-3**						
Barium (Ba)-Dissolved		0.144	0.149		mg/L	3.5	20	24-JAN-22
Boron (B)-Dissolved		11.3	11.2		mg/L	1.3	20	24-JAN-22
Lithium (Li)-Dissolved		0.45	0.42		mg/L	6.4	20	24-JAN-22
Sulfur (S)-Dissolved		389	387		mg/L	0.6	20	24-JAN-22
WG3687838-2 LCS								
Barium (Ba)-Dissolved			98.3		%		80-120	24-JAN-22
Boron (B)-Dissolved			94.3		%		80-120	24-JAN-22
Lithium (Li)-Dissolved			108.0		%		80-120	24-JAN-22
Sulfur (S)-Dissolved			103.0		%		80-120	24-JAN-22
WG3687839-2 LCS								
Barium (Ba)-Dissolved			98.4		%		80-120	24-JAN-22
Boron (B)-Dissolved			95.6		%		80-120	24-JAN-22
Lithium (Li)-Dissolved			107.1		%		80-120	24-JAN-22
Sulfur (S)-Dissolved			100.8		%		80-120	24-JAN-22
WG3687838-1 MB								
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	24-JAN-22
Boron (B)-Dissolved			<0.010		mg/L		0.01	24-JAN-22
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	24-JAN-22
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	24-JAN-22
WG3687839-1 MB								
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	24-JAN-22
Boron (B)-Dissolved			<0.010		mg/L		0.01	24-JAN-22
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	24-JAN-22
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	24-JAN-22
WG3687838-5 MS		**WG3687838-6**						
Barium (Ba)-Dissolved			N/A	MS-B	%		-	24-JAN-22
Boron (B)-Dissolved			N/A	MS-B	%		-	24-JAN-22
Lithium (Li)-Dissolved			N/A	MS-B	%		-	24-JAN-22
Sulfur (S)-Dissolved			N/A	MS-B	%		-	24-JAN-22
WG3687839-5 MS		**WG3687839-6**						

Quality Control Report

Client: SIREM
130 Stone Road West
Guelph ON N1G 3Z2
Contact: Michael Healey

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R5705380								
WG3687839-5 MS		**WG3687839-6**						
Barium (Ba)-Dissolved			N/A	MS-B	%		-	24-JAN-22
Boron (B)-Dissolved			N/A	MS-B	%		-	24-JAN-22
Lithium (Li)-Dissolved			N/A	MS-B	%		-	24-JAN-22
Sulfur (S)-Dissolved			N/A	MS-B	%		-	24-JAN-22

Quality Control Report

Workorder: L2680648 Report Date: 25-JAN-22

Client: SIREM
130 Stone Road West
Guelph ON N1G 3Z2
Contact: Michael Healey

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Chain of Custody (COC) / Analytical Request Form

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L2680648-COFC

COC Number: 16 -

Page 1 of 2

Report To	
Company:	SiREM
Contact:	Rachel Hallman, Michael Healey
Address:	130 Stone Rd W Guelph, Ontario, Canada, N1G 3Z2
Phone:	519-822-2265
Invoice To	Same as Report To ☐ Yes ☑ No
	Copy of Invoice with Report ☐ Yes ☑ No
Company:	SiREM
Contact:	Karen Broersma, kbroersma@geosyntec.com
Project Information	
ALS Quote #:	
Job #:	Edwards MNA
PO / AFE:	
LSD:	
ALS Lab Work Order # (lab use only)	L2680648

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☐ Yes ☐ No
☐ Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	rhallman@siremlab.com
Email 2	mhealey@siremlab.com
Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	accountspayablecan@siremlab.com
Email 2	
Oil and Gas Required Fields (client use)	
Approver ID:	Cost Center:
GL Account:	Routing Code
Activity Code:	
Location:	
ALS Contact:	Gayle Braun
Sampler:	J. Linkletter

R ☐ Regular (Standard TAT if received by 3 pm - business days) - No surcharge applied (Rush Turnaround Time (TAT) is not available for all tests)
P ☑ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Specify Date Required for E2,E or P:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	F/P Dissolved Metals (incl. B, Li, Ba and S)	Number of Containers
	AW-15S-1	21-Jan-22	9:00	Water	P	1
	AW-15S-2	21-Jan-22	9:15	Water	P	1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 2:1-1	21-Jan-22	9:30	Water	P	1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 2:1-2	21-Jan-22	9:45	Water	P	1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 1:1-1	21-Jan-22	10:00	Water	P	1
	~~E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 1:1-2~~	~~21-Jan-22~~	~~10:15~~	~~Water~~	~~P~~	~~1~~
	E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 1:5-1	21-Jan-22	10:30	Water	P	1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 1:5-2	21-Jan-22	10:45	Water	P	1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 1:10-1	21-Jan-22	11:00	Water	P	1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 1:10-2	21-Jan-22	11:15	Water	P	1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 1:20-1	21-Jan-22	11:30	Water	P	1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 1:20-2	21-Jan-22	11:45	Water	P	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ Yes ☑ No

Are samples for human drinking water use? ☐ Yes ☑ No

Special Instructions / Specify Criteria to add on report (client Use)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐				
Ice packs	Yes ☑	No ☐	SIF Observations	Yes ☐	No ☐
Cooling Initiated	☐		Custody seal intact	Yes ☐	No ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			4.4		

SHIPMENT RELEASE (client use)

Released by:	Date:	Time:
	21 Jan 22	5:30 PM

INITIAL SHIPMENT RECEPTION (lab use only)

Received by:	Date:	Time:

FINAL SHIPMENT RECEPTION (lab use only)

Received by:	Date:	Time:
	21/01/22	18:32

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

L2680648-COFC

COC Number: 16 -

Report To		**Report Format / Distribution**	
Company:	SiREM	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	
Contact:	Rachel Hallman, Michael Healey	Quality Control (QC) Report with Report ☐ Yes ☐ No	
Address:	130 Stone Rd W Guelph, Ontario, Canada, N1G 3Z2	☐ Criteria on Report - provide details below if box checked Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
Phone:	519-822-2265	Email 1 or Fax rhallman@siremlab.com	
		Email 2 mhealey@siremlab.com	
Invoice To	Same as Report To ☐ Yes ☑ No	**Invoice Distribution**	
	Copy of Invoice with Report ☐ Yes ☑ No	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
Company:	SiREM	Email 1 or Fax accountspayablecan@siremlab.com	
Contact:	Karen Broersma, kbroersma@geosyntec.com	Email 2	
Project Information		**Oil and Gas Required Fields (client use)**	
ALS Quote #:		Approver ID:	Cost Center:
Job #:	Edwards MNA	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	L2680648-COFC	**ALS Contact:** Gayle Braun	**Sampler:** J. Linkletter

Turnaround Time (TAT) Option (Rush Turnaround Time (TAT) is not available for all tests)

- R ☐ [illegible] if received by 3 pm - business days)
- P ☑ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
- E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
- E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge

Specify Date Required for E2,E or P:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	F/P	Dissolved Metals (incl. B, Li, Ba and S)	Number of Containers
	AW-19-1	21-Jan-22	12:00	Water	P		1
	AW-19-2	21-Jan-22	12:15	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 2:1-1	21-Jan-22	12:30	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 2:1-2	21-Jan-22	12:45	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 1:1-1	21-Jan-22	13:00	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 1:1-2	21-Jan-22	13:15	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 1:5-1	21-Jan-22	13:30	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 1:5-2	21-Jan-22	13:45	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 1:10-1	21-Jan-22	14:00	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 1:10-2	21-Jan-22	14:15	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 1:20-1	21-Jan-22	14:30	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 1:20-2	21-Jan-22	14:45	Water	P		1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ Yes ☑ No

Are samples for human drinking water use? ☐ Yes ☑ No

Special Instructions / Specify Criteria to add on report (client Use)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice packs Yes ☒ No ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			19.4		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time: 5:30 pm	Received by:	Date:	Time:	Received by:	Date: 01/21/22	Time: 18 30

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

SIREM
ATTN: Michael Healey
130 Stone Road West
Guelph ON N1G 3Z2

Date Received: 15-JAN-22
Report Date: 18-JAN-22 09:03 (MT)
Version: FINAL

Client Phone: 519-822-2265

Certificate of Analysis

Lab Work Order #: L2679139

Project P.O. #: NOT SUBMITTED
Job Reference: EDWARDS
C of C Numbers:
Legal Site Desc:



Gayle Braun
Senior Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2679139-1 AW-15S-1A Sampled By: R.S. on 14-JAN-22 @ 15:00 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					16-JAN-22	R5697192
Barium (Ba)-Dissolved	0.307	DLHC	0.010	mg/L	16-JAN-22	17-JAN-22	R5697850
Boron (B)-Dissolved	12.4	DLHC	1.0	mg/L	16-JAN-22	17-JAN-22	R5697850
Lithium (Li)-Dissolved	0.47	DLHC	0.10	mg/L	16-JAN-22	17-JAN-22	R5697850
Sulfur (S)-Dissolved	390	DLHC	50	mg/L	16-JAN-22	17-JAN-22	R5697850
L2679139-2 AW-15S-2A Sampled By: R.S. on 14-JAN-22 @ 15:15 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					16-JAN-22	R5697192
Barium (Ba)-Dissolved	0.355	DLHC	0.010	mg/L	16-JAN-22	17-JAN-22	R5697850
Boron (B)-Dissolved	12.7	DLHC	1.0	mg/L	16-JAN-22	17-JAN-22	R5697850
Lithium (Li)-Dissolved	0.48	DLHC	0.10	mg/L	16-JAN-22	17-JAN-22	R5697850
Sulfur (S)-Dissolved	397	DLHC	50	mg/L	16-JAN-22	17-JAN-22	R5697850
L2679139-3 AW-19-1A Sampled By: R.S. on 14-JAN-22 @ 15:30 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					16-JAN-22	R5697192
Barium (Ba)-Dissolved	0.220	DLHC	0.010	mg/L	16-JAN-22	17-JAN-22	R5697850
Boron (B)-Dissolved	11.6	DLHC	1.0	mg/L	16-JAN-22	17-JAN-22	R5697850
Lithium (Li)-Dissolved	0.46	DLHC	0.10	mg/L	16-JAN-22	17-JAN-22	R5697850
Sulfur (S)-Dissolved	386	DLHC	50	mg/L	16-JAN-22	17-JAN-22	R5697850
L2679139-4 AW-19-2A Sampled By: R.S. on 14-JAN-22 @ 15:45 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					16-JAN-22	R5697192
Barium (Ba)-Dissolved	0.273	DLHC	0.010	mg/L	16-JAN-22	17-JAN-22	R5697850
Boron (B)-Dissolved	11.9	DLHC	1.0	mg/L	16-JAN-22	17-JAN-22	R5697850
Lithium (Li)-Dissolved	0.45	DLHC	0.10	mg/L	16-JAN-22	17-JAN-22	R5697850
Sulfur (S)-Dissolved	380	DLHC	50	mg/L	16-JAN-22	17-JAN-22	R5697850

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2679139-1, -2, -3, -4
Matrix Spike	Boron (B)-Dissolved	MS-B	L2679139-1, -2, -3, -4
Matrix Spike	Lithium (Li)-Dissolved	MS-B	L2679139-1, -2, -3, -4
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L2679139-1, -2, -3, -4

Sample Parameter Qualifier key listed:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MET-D-CCMS-WT	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: SIREM
130 Stone Road West
Guelph ON N1G 3Z2
Contact: Michael Healey

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R5697850								
WG3685604-4 DUP		**WG3685604-3**						
Barium (Ba)-Dissolved		0.307	0.321		mg/L	4.3	20	17-JAN-22
Boron (B)-Dissolved		12.4	12.6		mg/L	1.3	20	17-JAN-22
Lithium (Li)-Dissolved		0.47	0.45		mg/L	4.5	20	17-JAN-22
Sulfur (S)-Dissolved		390	392		mg/L	0.7	20	17-JAN-22
WG3685604-2 LCS								
Barium (Ba)-Dissolved			103.3		%		80-120	17-JAN-22
Boron (B)-Dissolved			94.5		%		80-120	17-JAN-22
Lithium (Li)-Dissolved			99.4		%		80-120	17-JAN-22
Sulfur (S)-Dissolved			98.7		%		80-120	17-JAN-22
WG3685604-1 MB								
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	17-JAN-22
Boron (B)-Dissolved			<0.010		mg/L		0.01	17-JAN-22
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	17-JAN-22
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	17-JAN-22
WG3685604-5 MS		**WG3685604-6**						
Barium (Ba)-Dissolved			N/A	MS-B	%		-	17-JAN-22
Boron (B)-Dissolved			N/A	MS-B	%		-	17-JAN-22
Lithium (Li)-Dissolved			N/A	MS-B	%		-	17-JAN-22
Sulfur (S)-Dissolved			N/A	MS-B	%		-	17-JAN-22

Quality Control Report

Workorder: L2679139 Report Date: 18-JAN-22

Client: SIREM
130 Stone Road West
Guelph ON N1G 3Z2
Contact: Michael Healey

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

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Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Chain of Custody (COC) / Analytical Request Form

COC Number: 16 -

Page 1 of 1

Canada Toll Free: 1 800 668 987

here

L2679139-COFC

www.alsglobal.com

Report To		Report Format / Distribution	
Company:	SiREM	Select Report Format:	
Contact:	Rachel Hallman, Michael Healey	Quality Control (QC) Report with Report	☐ Yes ☐ No
Address:	130 Research Lane, Suite 2 Guelph, Ontario, Canada, N1G 5G3	☐ Criteria on Report - provide details below if box checked	
Phone:	519-822-2265	Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
		Email 1 or Fax	rhallman@siremlab.com
		Email 2	mhealey@siremlab.com
Invoice To	Same as Report To ☐ Yes ☐ No	**Invoice Distribution**	
	Copy of Invoice with Report ☐ Yes ☐ No	Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Company:	SiREM	Email 1 or Fax	kbroersma@geosyntec.com
Contact:	Karen Broersma, kbroersma@geosyntec.com	Email 2	
Project Information		**Oil and Gas Required Fields (client use)**	
ALS Quote #:		Approver ID:	Cost Center:
Job #:	Edwards	GL Account	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	L2679139	**ALS Contact:**	**Sampler:** Rita Schofield

Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)

- (standard TAT if received by 3 pm - business days)
- P ☑ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
- E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
- E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge

Specify Date Required for E2,E or P:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	F/P	Dissolved Metals (incl. B, SO4, Li, Ba, Cl & analysis)	Number of Containers
	AW-15S-1a	14-Jan-22	3:00	Water	P		1
	AW-15S-2a	14-Jan-22	3:15	Water	P		1
	AW-19-1a	14-Jan-22	3:30	Water	P		1
	AW-19-2a	14-Jan-22	3:45	Water	P		1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ Yes ☑ No

Are samples for human drinking water use? ☐ Yes ☑ No

Special Instructions / Specify Criteria to add on report (client Use)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐ No ☐
Ice packs	Yes ☑ No ☐	Custody seal intact	Yes ☐ No ☐
Cooling Initiated	☐		

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by	Date	Time
	14Jan22	4:00pm					Jan 15/22	8:00

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0326e v09 Front/04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form.**

ATTACHMENT 2

SGS Analysis Report (SEP Data)

SGS proposal: IBD
SGS project #: 2267

Sample receipt date: 13-Dec-22
Report date: 18-Apr-23

Version: Final

Customer details

Name:	Lain Glossop
Address:	SGS Mineralogy

Project reference:

P.O. number:

COC:

ANALYSIS REPORT

SGS WO: 3

Report Distribution

Name	Email
Lain Glossop	
Kim Gibbs	

Special notes:

Tessier sequential extraction

Mineralogy LIMS: MI7009-NOV22
Project: CA20I-00000-211-19465-01

3260 Production Way
Burnaby - British Columbia - V5A 4W4
Phone: 604-638-2349 FAX: 604-444-5486

ANALYSIS REPORT

Method Summaries *Test method information available upon request.*

S(T) and C(T): Total sulfur and total carbon by LECO, Method CSA06V
S(SO4): Sulfate by HCl digestion with ICP finish, Method CSA07V
S(S2-): Sulfide by calculation of S(T) - S(SO4)

TIC: Total inorganic carbon by coulometry, Method CSB02V
AP: Acid generating potential based on sulfide sulfur
NP: Modified neutralisation potential by excess acid addition and back titration to pH 8.3
Net NP: Net neutralisation potential = NP - AP
NPR: Neutralisation potential ratio = NP/AP

Metals by Aqua regia digest with ICP-OES/MS finish, Method ICP21B20/ICM21B20
Metals by multi-acid digest with ICP-OES/MS finish, Method ICP40Q12/IMS40Q12
Tessier Sequential Extraction - method available on request

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Preliminary Data

Noelene Ahern - Manager: ARD

Final Data Approval

Noelene Ahern - Manager: ARD

Tessier Extraction

Water Soluble Metals
Reagent: 15 mL of Nanopure Distilled Water

Sample			E-SB-05 (51-56) Water Soluble	E-SB-07 (59-64) Water Soluble	E-SB-15 (35-40) Water Soluble
Sample weight (g)			1.0020	1.0373	1.0472
Reagent volume (mL)			15	15	15.0
Volume analysed (after wash dilution and preservation) (mL)			22.5	22.5	22.5
Final diluted solution weight (g)			23.19	22.06	21.32
Parameter	**Units**	**RDL**			
Hardness CaCO3	mg/L	0.05	22.7	18.1	41.8
Aluminum Al	mg/L	0.001	10	14.9	11.9
Antimony Sb	mg/L	0.0009	< 0.009	< 0.009	< 0.009
Arsenic As	mg/L	0.0002	< 0.002	0.004	0.003
Barium Ba	mg/L	0.00002	0.0964	0.088	0.0556
Beryllium Be	mg/L	0.000007	0.00052	0.00067	0.00048
Bismuth Bi	mg/L	0.00001	< 0.0001	0.0002	< 0.0001
Boron B	mg/L	0.002	0.04	0.07	0.07
Cadmium Cd	mg/L	0.000003	0.00003	< 0.00003	0.00013
Calcium Ca	mg/L	0.01	4.5	0.6	9.1
Chromium Cr	mg/L	0.00008	0.0191	0.0198	0.0639
Cobalt Co	mg/L	0.000004	0.00273	0.00241	0.00436
Copper Cu	mg/L	0.0002	0.029	0.037	0.025
Iron Fe	mg/L	0.007	7.5	4.71	26.4
Lead Pb	mg/L	0.00009	0.0037	0.0057	0.0068
Lithium Li	mg/L	0.0001	0.012	0.01	0.019
Magnesium Mg	mg/L	0.001	2.79	3.94	4.66
Manganese Mn	mg/L	0.00001	0.0694	0.0435	0.203
Mercury Hg	ug/L	0.01	0.01	0.01	< 0.01
Molybdenum Mo	mg/L	0.00004	0.008	0.0016	0.009
Nickel Ni	mg/L	0.0001	0.01	0.009	0.061
Phosphorus P	mg/L	0.003	< 0.03	0.04	0.23
Potassium K	mg/L	0.003	16	9.04	6.36
Selenium Se	mg/L	0.00004	0.001	0.002	0.0064
Silicon Si	mg/L	0.02	16.8	22.8	26.6
Silver Ag	mg/L	0.00005	< 0.0005	< 0.0005	< 0.0005
Sodium Na	mg/L	0.01	7.4	12.9	2.5
Strontium Sr	mg/L	0.00002	0.0386	0.0198	0.0194
Sulphur (S)	mg/L	1	7	4	< 1
Thallium Tl	mg/L	0.000005	< 0.00005	< 0.00005	< 0.00005
Tin Sn	mg/L	0.00006	0.0012	0.0013	0.0031
Titanium Ti	mg/L	0.00005	0.197	0.236	0.286
Uranium U	mg/L	0.000002	0.0004	0.00024	0.00059
Vanadium V	mg/L	0.00001	0.0193	0.0367	0.0265
Zinc Zn	mg/L	0.002	0.04	0.03	0.05
Zirconium Zr	mg/L	0.002	< 0.02	< 0.02	< 0.02

Tessier Extraction

Water Soluble Metals
Reagent: 15 mL of Nanopure Distilled Water

Sample			E-SB-07 (37-30) Water Soluble	E-SB--15 (10-15) Water Soluble	E-SB-19 (35-40) Water Soluble	AW-23 (6-11.5) Water Soluble
Sample weight (g)			1.0245	1.0102	1.0188	1.0152
Reagent volume (mL)			15.0	15.0	15.0	15.0
Volume analysed (after wash dilution and preservation) (mL)			22.5	22.5	22.5	22.5
Final diluted solution weight (g)			22.18	22.17	22.33	22.88
Parameter	**Units**	**RDL**				
Hardness CaCO3	mg/L	0.05	5.4	73.3	8.5	51.8
Aluminum Al	mg/L	0.001	0.07	6.02	12.3	8.13
Antimony Sb	mg/L	0.0009	< 0.009	< 0.009	< 0.009	< 0.009
Arsenic As	mg/L	0.0002	< 0.002	< 0.002	0.007	0.002
Barium Ba	mg/L	0.00002	0.0021	0.0474	0.0486	0.0534
Beryllium Be	mg/L	0.000007	< 0.00007	0.00028	0.00052	0.00037
Bismuth Bi	mg/L	0.00001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Boron B	mg/L	0.002	< 0.02	0.12	0.03	0.05
Cadmium Cd	mg/L	0.000003	< 0.00003	0.00015	< 0.00003	0.00008
Calcium Ca	mg/L	0.01	1.4	18.6	0.7	10.5
Chromium Cr	mg/L	0.00008	0.011	0.0102	0.0175	0.0146
Cobalt Co	mg/L	0.000004	0.00048	0.00148	0.00193	0.00211
Copper Cu	mg/L	0.0002	< 0.002	0.017	0.011	0.017
Iron Fe	mg/L	0.007	0.09	5.34	3.53	8.91
Lead Pb	mg/L	0.00009	< 0.0009	0.0035	0.0057	0.0031
Lithium Li	mg/L	0.0001	< 0.001	0.018	0.009	0.022
Magnesium Mg	mg/L	0.001	0.46	6.11	1.67	4.95
Manganese Mn	mg/L	0.00001	0.0007	0.0274	0.0333	0.0804
Mercury Hg	ug/L	0.01	0.02	0.01	< 0.01	0.01
Molybdenum Mo	mg/L	0.00004	0.0042	0.0057	0.005	0.0071
Nickel Ni	mg/L	0.0001	0.008	0.006	0.006	0.007
Phosphorus P	mg/L	0.003	12.7	0.09	0.11	0.09
Potassium K	mg/L	0.003	0.2	7.5	11	4.59
Selenium Se	mg/L	0.00004	< 0.0004	0.0065	0.002	0.0051
Silicon Si	mg/L	0.02	< 0.2	16.1	20.5	16.6
Silver Ag	mg/L	0.00005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Sodium Na	mg/L	0.01	14.7	3.1	4.7	3.5
Strontium Sr	mg/L	0.00002	0.0079	0.0332	0.0146	0.022
Sulphur (S)	mg/L	1	< 1	16	< 1	4
Thallium Tl	mg/L	0.000005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Tin Sn	mg/L	0.00006	5.43	0.0013	0.0013	0.0029
Titanium Ti	mg/L	0.00005	0.0028	0.18	0.527	0.212
Uranium U	mg/L	0.000002	0.00007	0.00148	0.00039	0.00094
Vanadium V	mg/L	0.00001	0.0003	0.0174	0.0332	0.0189
Zinc Zn	mg/L	0.002	0.02	0.03	0.03	0.03
Zirconium Zr	mg/L	0.002	< 0.02	< 0.02	0.02	< 0.02

Tessier Extraction

Water Soluble Metals Reagent: 15 mL of Nanopure Distilled Water					
Sample			**E-SB 19 (40-44) Water Soluble**	**E-SB-05 (52-30) Water Soluble**	**Blank Water Soluble**
Sample weight (g)			1.0115	1.0138	0.0000
Reagent volume (mL)			15.0	15.0	15
Volume analysed (after wash dilution and preservation) (mL)			22.5	22.5	22.5
Final diluted solution weight (g)			22.07	22.32	23.18
Parameter	**Units**	**RDL**			
Hardness CaCO3	mg/L	0.05	19.4	138	2.4
Aluminum Al	mg/L	0.001	9.44	1.3	< 0.01
Antimony Sb	mg/L	0.0009	< 0.009	< 0.009	< 0.009
Arsenic As	mg/L	0.0002	< 0.002	< 0.002	< 0.002
Barium Ba	mg/L	0.00002	0.0475	0.0377	0.0036
Beryllium Be	mg/L	0.000007	0.00035	< 0.00007	< 0.00007
Bismuth Bi	mg/L	0.00001	< 0.0001	< 0.0001	< 0.0001
Boron B	mg/L	0.002	0.04	0.04	< 0.02
Cadmium Cd	mg/L	0.000003	< 0.00003	0.00005	< 0.00003
Calcium Ca	mg/L	0.01	1.3	41.9	< 0.1
Chromium Cr	mg/L	0.00008	0.0125	0.0078	0.0449
Cobalt Co	mg/L	0.000004	0.00121	0.00061	0.00139
Copper Cu	mg/L	0.0002	0.005	0.012	0.011
Iron Fe	mg/L	0.007	2.76	1.93	25.4
Lead Pb	mg/L	0.00009	0.0024	< 0.0009	< 0.0009
Lithium Li	mg/L	0.0001	0.013	0.01	< 0.001
Magnesium Mg	mg/L	0.001	1.78	8.1	0.57
Manganese Mn	mg/L	0.00001	0.0336	0.0352	0.174
Mercury Hg	ug/L	0.01	< 0.01	< 0.01	< 0.01
Molybdenum Mo	mg/L	0.00004	0.0029	0.0076	0.0047
Nickel Ni	mg/L	0.0001	0.004	0.003	0.059
Phosphorus P	mg/L	0.003	< 0.03	< 0.03	< 0.03
Potassium K	mg/L	0.003	16.1	9.39	0.09
Selenium Se	mg/L	0.00004	< 0.0004	0.001	< 0.0004
Silicon Si	mg/L	0.02	13.4	5	< 0.2
Silver Ag	mg/L	0.00005	< 0.0005	< 0.0005	< 0.0005
Sodium Na	mg/L	0.01	4.7	5.4	< 0.1
Strontium Sr	mg/L	0.00002	0.0096	0.0762	< 0.0008
Sulphur (S)	mg/L	1	9	32	< 1
Thallium Tl	mg/L	0.000005	< 0.00005	< 0.00005	< 0.00005
Tin Sn	mg/L	0.00006	0.0018	< 0.0006	0.0018
Titanium Ti	mg/L	0.00005	0.366	0.027	0.001
Uranium U	mg/L	0.000002	0.00017	0.00157	0.00002
Vanadium V	mg/L	0.00001	0.0175	0.0048	0.0009
Zinc Zn	mg/L	0.002	0.03	0.03	0.02
Zirconium Zr	mg/L	0.002	< 0.02	< 0.02	< 0.02

Tessier Extraction

Exchangeable Metals
Reagent: 15 mL of 1 M MgCl2 (pH 7)

Sample			E-SB-05 (51-56) Exchangable	E-SB-07 (59-64) Exchangable	E-SB-15 (35-40) Exchangable
Reagent volume (mL)			15	15	15
Volume analysed (after wash dilution and preservation) (mL)			27.5	27.5	27.5
Final diluted solution weight (g)			28.555	29.685	29.3
Parameter	**Units**	**RDL**			
Hardness CaCO3	mg/L	0.05	38900	40800	43600
Aluminum Al	mg/L	0.001	1.52	1.96	0.36
Antimony Sb	mg/L	0.0009	< 0.009	< 0.009	< 0.009
Arsenic As	mg/L	0.0002	0.003	0.002	0.004
Barium Ba	mg/L	0.00002	2.82	0.78	0.277
Beryllium Be	mg/L	0.000007	< 0.00007	0.0001	< 0.00007
Bismuth Bi	mg/L	0.00001	< 0.0001	< 0.0001	< 0.0001
Boron B	mg/L	0.002	< 0.02	< 0.02	< 0.02
Cadmium Cd	mg/L	0.000003	0.00056	< 0.00003	0.00017
Calcium Ca	mg/L	0.01	66.8	12.7	19
Chromium Cr	mg/L	0.00008	0.0216	0.0198	0.0532
Cobalt Co	mg/L	0.000004	0.00257	0.00176	0.00273
Copper Cu	mg/L	0.0002	0.015	0.28	0.12
Iron Fe	mg/L	0.007	0.89	0.51	17.4
Lead Pb	mg/L	0.00009	< 0.0009	< 0.0009	0.0011
Lithium Li	mg/L	0.0001	0.021	0.027	0.023
Magnesium Mg	mg/L	0.001	9430	9920	10600
Manganese Mn	mg/L	0.00001	0.333	0.394	0.341
Mercury Hg	ug/L	0.01	< 0.01	< 0.01	< 0.01
Molybdenum Mo	mg/L	0.00004	0.0041	0.0023	0.0078
Nickel Ni	mg/L	0.0001	0.005	0.004	0.034
Phosphorus P	mg/L	0.003	< 0.03	< 0.03	< 0.03
Potassium K	mg/L	0.003	17.4	25.6	20
Selenium Se	mg/L	0.00004	0.0008	< 0.0004	< 0.0004
Silicon Si	mg/L	0.02	3.9	4.2	2.1
Silver Ag	mg/L	0.00005	< 0.0005	0.0008	0.0009
Sodium Na	mg/L	0.01	3.1	13.4	3.5
Strontium Sr	mg/L	0.00002	0.44	0.303	0.114
Sulphur (S)	mg/L	1	21	21	20
Thallium Tl	mg/L	0.000005	0.00013	0.00007	0.00012
Tin Sn	mg/L	0.00006	0.0025	0.0022	0.0019
Titanium Ti	mg/L	0.00005	0.0759	0.11	0.0047
Uranium U	mg/L	0.000002	0.00182	0.00029	0.00021
Vanadium V	mg/L	0.00001	0.0114	0.011	0.0097
Zinc Zn	mg/L	0.002	0.02	0.07	0.04
Zirconium Zr	mg/L	0.002	< 0.02	< 0.02	< 0.02

Tessier Extraction

Exchangeable Metals
Reagent: 15 mL of 1 M MgCl2 (pH 7)

Sample			E-SB-07 (37-30) Exchangable	E-SB-15 (10-15) Exchangable	E-SB-19 (35-40) Exchangable	AW-23 (6-11.5) Exchangable	E-SB 19 (40-44) Exchangable
Reagent volume (mL)			15	15	15	15	15
Volume analysed (after wash dilution and preservation) (mL)			27.5	27.5	27.5	27.5	27.5
Final diluted solution weight (g)			29.32	29.78	29.50	28.58	28.90
Parameter	**Units**	**RDL**					
Hardness CaCO3	mg/L	0.05	29500	41300	41500	39600	38900
Aluminum Al	mg/L	0.001	0.47	0.46	0.36	0.33	2.27
Antimony Sb	mg/L	0.0009	< 0.009	< 0.009	< 0.009	< 0.009	< 0.009
Arsenic As	mg/L	0.0002	0.002	0.003	0.004	0.003	< 0.002
Barium Ba	mg/L	0.00002	0.555	1.16	0.908	1.35	1.11
Beryllium Be	mg/L	0.000007	< 0.00007	< 0.00007	< 0.00007	< 0.00007	0.00012
Bismuth Bi	mg/L	0.00001	< 0.0001	< 0.0001	< 0.0001	0.0001	< 0.0001
Boron B	mg/L	0.002	< 0.02	0.04	< 0.02	0.03	0.02
Cadmium Cd	mg/L	0.000003	0.00363	0.00709	0.00101	0.00228	0.00003
Calcium Ca	mg/L	0.01	97.9	147	76.2	146	23.6
Chromium Cr	mg/L	0.00008	0.0254	0.0177	0.0589	0.0205	0.0258
Cobalt Co	mg/L	0.000004	0.00358	0.00295	0.00316	0.00328	0.00139
Copper Cu	mg/L	0.0002	0.008	0.018	0.022	0.011	0.104
Iron Fe	mg/L	0.007	2.29	0.56	23.2	5.44	3.08
Lead Pb	mg/L	0.00009	< 0.0009	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Lithium Li	mg/L	0.0001	0.015	0.013	0.019	0.023	0.026
Magnesium Mg	mg/L	0.001	7150	9970	10000	9550	9430
Manganese Mn	mg/L	0.00001	0.556	0.358	1.66	0.741	0.448
Mercury Hg	ug/L	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Molybdenum Mo	mg/L	0.00004	0.009	0.0037	0.0102	0.0034	0.0022
Nickel Ni	mg/L	0.0001	0.009	0.009	0.069	0.022	0.01
Phosphorus P	mg/L	0.003	< 0.03	< 0.03	< 0.03	0.04	< 0.03
Potassium K	mg/L	0.003	11.8	11.5	18	11.3	21.4
Selenium Se	mg/L	0.00004	0.0011	0.002	0.001	0.0031	< 0.0004
Silicon Si	mg/L	0.02	3.1	2.6	2.5	2.4	4.5
Silver Ag	mg/L	0.00005	< 0.0005	< 0.0005	0.0057	0.0027	0.0094
Sodium Na	mg/L	0.01	2.1	2.3	1.7	1.9	1.9
Strontium Sr	mg/L	0.00002	0.178	0.245	0.163	0.282	0.118
Sulphur (S)	mg/L	1	20	20	18	19	20
Thallium Tl	mg/L	0.000005	< 0.00005	< 0.00005	0.00005	< 0.00005	0.00007
Tin Sn	mg/L	0.00006	0.0024	0.0034	0.0031	0.0045	0.0022
Titanium Ti	mg/L	0.00005	0.0127	0.01	0.0143	0.0094	0.123
Uranium U	mg/L	0.000002	0.00056	0.002	0.00098	0.00277	0.00028
Vanadium V	mg/L	0.00001	0.01	0.0103	0.0112	0.0078	0.0118
Zinc Zn	mg/L	0.002	0.03	0.03	0.03	0.03	0.04
Zirconium Zr	mg/L	0.002	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02

Tessier Extraction

Exchangeable Metals Reagent: 15 mL of 1 M MgCl2 (pH 7)				
Sample			**E-SB-05 (52-30) Exchangable**	**Blank Exchangable**
Reagent volume (mL)			15	15
Volume analysed (after wash dilution and preservation) (mL)			27.5	27.5
Final diluted solution weight (g)			28.85	28.52
Parameter	**Units**	**RDL**		
Hardness CaCO3	mg/L	0.05	42200	30600
Aluminum Al	mg/L	0.001	0.36	0.02
Antimony Sb	mg/L	0.0009	< 0.009	< 0.009
Arsenic As	mg/L	0.0002	0.003	0.003
Barium Ba	mg/L	0.00002	0.778	0.0046
Beryllium Be	mg/L	0.000007	< 0.00007	< 0.00007
Bismuth Bi	mg/L	0.00001	< 0.0001	< 0.0001
Boron B	mg/L	0.002	0.02	< 0.02
Cadmium Cd	mg/L	0.000003	0.003	< 0.00003
Calcium Ca	mg/L	0.01	179	1.7
Chromium Cr	mg/L	0.00008	0.0156	0.0599
Cobalt Co	mg/L	0.000004	0.00109	0.00094
Copper Cu	mg/L	0.0002	0.008	0.011
Iron Fe	mg/L	0.007	0.45	20.8
Lead Pb	mg/L	0.00009	< 0.0009	0.001
Lithium Li	mg/L	0.0001	0.011	0.001
Magnesium Mg	mg/L	0.001	10200	7420
Manganese Mn	mg/L	0.00001	0.724	0.149
Mercury Hg	ug/L	0.01	< 0.01	< 0.01
Molybdenum Mo	mg/L	0.00004	0.0034	0.0071
Nickel Ni	mg/L	0.0001	0.003	0.059
Phosphorus P	mg/L	0.003	0.08	< 0.03
Potassium K	mg/L	0.003	9.92	1.91
Selenium Se	mg/L	0.00004	0.0022	< 0.0004
Silicon Si	mg/L	0.02	2.2	< 0.2
Silver Ag	mg/L	0.00005	< 0.0005	0.0076
Sodium Na	mg/L	0.01	1.5	1.3
Strontium Sr	mg/L	0.00002	0.376	0.003
Sulphur (S)	mg/L	1	19	22
Thallium Tl	mg/L	0.000005	0.00008	< 0.00005
Tin Sn	mg/L	0.00006	0.0016	0.0035
Titanium Ti	mg/L	0.00005	0.0078	0.0006
Uranium U	mg/L	0.000002	0.00278	0.00003
Vanadium V	mg/L	0.00001	0.0077	0.0082
Zinc Zn	mg/L	0.002	0.03	0.03
Zirconium Zr	mg/L	0.002	< 0.02	< 0.02

Tessier Extraction

Metals Bound to Carbonates
Reagent: 15 mL of 1 M NaOAc (adjusted to pH 5.0 with Acetic Acid)

Sample			E-SB-05 (51-56) Bound to carbonate	E-SB-07 (59-64) Bound to carbonate	E-SB-15 (35-40) Bound to carbonate
Reagent volume (mL)			15	15	15
Volume analysed (after wash dilution and preservation) (mL)			32.5	32.5	32.5
Final diluted solution weight (g)			32.95	32.99	33.1
Parameter	**Units**	**RDL**			
Hardness CaCO3	mg/L	0.05	1450	324	323
Aluminum Al	mg/L	0.001	29.91	31.1	32.25
Antimony Sb	mg/L	0.0009	< 0.009	< 0.009	< 0.009
Arsenic As	mg/L	0.0002	0.011	0.016	0.013
Barium Ba	mg/L	0.00002	3	1.35	0.7
Beryllium Be	mg/L	0.000007	0.00587	0.00548	0.0049
Bismuth Bi	mg/L	0.00001	0.0028	0.0031	0.0034
Boron B	mg/L	0.002	0.06	0.06	0.03
Cadmium Cd	mg/L	0.000003	0.00169	0.0001	0.00025
Calcium Ca	mg/L	0.01	283	6	10
Chromium Cr	mg/L	0.00008	0.179	0.525	1.05
Cobalt Co	mg/L	0.000004	0.0935	0.0252	0.0249
Copper Cu	mg/L	0.0002	0.586	1.4	0.625
Iron Fe	mg/L	0.007	74.85	36.15	50.24
Lead Pb	mg/L	0.00009	0.106	0.114	0.174
Lithium Li	mg/L	0.0001	0.052	0.049	0.045
Magnesium Mg	mg/L	0.001	180	75	72.4
Manganese Mn	mg/L	0.00001	4.08	1.04	1.07
Mercury Hg	ug/L	0.01	< 0.01	< 0.01	< 0.01
Molybdenum Mo	mg/L	0.00004	0.0056	0.0084	0.003
Nickel Ni	mg/L	0.0001	0.097	0.069	0.088
Phosphorus P	mg/L	0.003	0.23	0.09	0.28
Potassium K	mg/L	0.003	14.12	16.03	15.26
Selenium Se	mg/L	0.00004	0.0021	0.0038	0.0014
Silicon Si	mg/L	0.02	30	26	25
Silver Ag	mg/L	0.00005	< 0.0005	< 0.0005	< 0.0005
Sodium Na	mg/L	0.01	9260	9640	9930
Strontium Sr	mg/L	0.00002	0.234	0.111	0.0534
Sulphur (S)	mg/L	1	< 10	< 10	< 10
Thallium Tl	mg/L	0.000005	0.00008	0.0001	0.00006
Tin Sn	mg/L	0.00006	0.0023	0.0083	0.0013
Titanium Ti	mg/L	0.00005	0.015	0.0535	0.0263
Uranium U	mg/L	0.000002	0.0043	0.00426	0.00458
Vanadium V	mg/L	0.00001	0.0754	0.0528	0.0658
Zinc Zn	mg/L	0.002	0.31	0.32	0.21
Zirconium Zr	mg/L	0.002	< 0.02	< 0.02	< 0.02

Tessier Extraction

Metals Bound to Carbonates
Reagent: 15 mL of 1 M NaOAc (adjusted to pH 5.0 with Acetic Acid)

Sample			E-SB-07 (37-30) Bound to carbonate	E-SB-15 (10-15) Bound to carbonate	E-SB-19 (35-40) Bound to carbonate	AW-23 (6-11.5) Bound to carbonate	E-SB-19 (40-44) Bound to carbonate
Reagent volume (mL)			15	15	15	15	15
Volume analysed (after wash dilution and preservation) (mL)			32.5	32.5	32.5	32.5	32.5
Final diluted solution weight (g)			32.31	32.16	32.41	33.33	33.13
Parameter	**Units**	**RDL**					
Hardness CaCO3	mg/L	0.05	2390	2910	998	2560	352
Aluminum Al	mg/L	0.001	19.03	11.77	27.18	20.43	31.65
Antimony Sb	mg/L	0.0009	< 0.009	< 0.009	< 0.009	< 0.009	< 0.009
Arsenic As	mg/L	0.0002	0.005	0.007	0.016	0.005	0.004
Barium Ba	mg/L	0.00002	1.15	1.72	1.53	2.19	1.33
Beryllium Be	mg/L	0.000007	0.00466	0.00727	0.00536	0.00621	0.00521
Bismuth Bi	mg/L	0.00001	0.0008	0.0017	0.0008	0.0011	0.0042
Boron B	mg/L	0.002	0.05	0.11	0.05	0.04	0.04
Cadmium Cd	mg/L	0.000003	0.00547	0.0117	0.00179	0.00307	0.00008
Calcium Ca	mg/L	0.01	386	302	154	245	13
Chromium Cr	mg/L	0.00008	0.589	0.22	0.72	0.156	0.195
Cobalt Co	mg/L	0.000004	0.0399	0.0575	0.0353	0.0541	0.0214
Copper Cu	mg/L	0.0002	0.374	0.29	0.299	0.381	0.534
Iron Fe	mg/L	0.007	25.33	25.36	33.17	16.59	68.43
Lead Pb	mg/L	0.00009	0.093	0.0995	0.0696	0.0872	0.13
Lithium Li	mg/L	0.0001	0.028	0.028	0.04	0.032	0.046
Magnesium Mg	mg/L	0.001	346	525	149	474	77.9
Manganese Mn	mg/L	0.00001	3.23	2.34	9.32	5.48	1.72
Mercury Hg	ug/L	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Molybdenum Mo	mg/L	0.00004	0.0021	0.0034	0.0056	0.0028	0.0073
Nickel Ni	mg/L	0.0001	0.075	0.109	0.078	0.06	0.054
Phosphorus P	mg/L	0.003	0.31	0.53	0.15	0.29	0.13
Potassium K	mg/L	0.003	8.49	10.53	12.06	8.8	13.98
Selenium Se	mg/L	0.00004	0.0022	0.0044	0.0028	0.0022	0.0014
Silicon Si	mg/L	0.02	27	25	29	28	26
Silver Ag	mg/L	0.00005	< 0.0005	< 0.0005	< 0.0005	0.0008	< 0.0005
Sodium Na	mg/L	0.01	8590	9820	8950	9170	9320
Strontium Sr	mg/L	0.00002	0.153	0.226	0.0815	0.152	0.0439
Sulphur (S)	mg/L	1	< 10	< 10	< 10	< 10	< 10
Thallium Tl	mg/L	0.000005	0.00007	0.00007	< 0.00005	< 0.00005	< 0.00005
Tin Sn	mg/L	0.00006	0.0019	0.0027	0.005	0.0012	0.0017
Titanium Ti	mg/L	0.00005	0.0114	0.0362	0.0116	0.0098	0.0239
Uranium U	mg/L	0.000002	0.00376	0.0132	0.00404	0.00719	0.00349
Vanadium V	mg/L	0.00001	0.0412	0.0672	0.0397	0.0151	0.0678
Zinc Zn	mg/L	0.002	0.21	0.26	0.16	0.19	0.18
Zirconium Zr	mg/L	0.002	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02

Tessier Extraction

Metals Bound to Carbonates Reagent: 15 mL of 1 M NaOAc (adjusted to pH 5.0 with Acetic Acid)				
Sample			**E-SB-05 (52-30) Bound to carbonate**	**Blank Bound to carbonate**
Reagent volume (mL)			15	15
Volume analysed (after wash dilution and preservation) (mL)			32.5	32.5
Final diluted solution weight (g)			26.42	33.42
Parameter	**Units**	**RDL**		
Hardness CaCO3	mg/L	0.05	4020	1
Aluminum Al	mg/L	0.001	7.75	0.02
Antimony Sb	mg/L	0.0009	< 0.009	< 0.009
Arsenic As	mg/L	0.0002	0.009	< 0.002
Barium Ba	mg/L	0.00002	1.42	0.002
Beryllium Be	mg/L	0.000007	0.00447	< 0.00007
Bismuth Bi	mg/L	0.00001	0.0006	< 0.0001
Boron B	mg/L	0.002	0.06	< 0.02
Cadmium Cd	mg/L	0.000003	0.00601	< 0.00003
Calcium Ca	mg/L	0.01	1120	0
Chromium Cr	mg/L	0.00008	0.358	0.004
Cobalt Co	mg/L	0.000004	0.0704	< 0.00004
Copper Cu	mg/L	0.0002	0.0895	< 0.002
Iron Fe	mg/L	0.007	34.2	0.16
Lead Pb	mg/L	0.00009	0.0573	< 0.0009
Lithium Li	mg/L	0.0001	0.022	0.002
Magnesium Mg	mg/L	0.001	294	0.18
Manganese Mn	mg/L	0.00001	9.61	0.0075
Mercury Hg	ug/L	0.01	< 0.01	< 0.01
Molybdenum Mo	mg/L	0.00004	0.0062	0.002
Nickel Ni	mg/L	0.0001	0.106	0.001
Phosphorus P	mg/L	0.003	0.53	< 0.03
Potassium K	mg/L	0.003	6.99	2.78
Selenium Se	mg/L	0.00004	0.002	0.0007
Silicon Si	mg/L	0.02	22	0
Silver Ag	mg/L	0.00005	< 0.0005	0.0065
Sodium Na	mg/L	0.01	6800	9600
Strontium Sr	mg/L	0.00002	0.955	< 0.0008
Sulphur (S)	mg/L	1	< 10	< 10
Thallium Tl	mg/L	0.000005	0.00009	< 0.00005
Tin Sn	mg/L	0.00006	0.0012	0.0015
Titanium Ti	mg/L	0.00005	0.045	0.0005
Uranium U	mg/L	0.000002	0.0093	0.00005
Vanadium V	mg/L	0.00001	0.0373	0.0002
Zinc Zn	mg/L	0.002	0.41	0.02
Zirconium Zr	mg/L	0.002	< 0.02	< 0.02

Tessier Extraction

Metals Bound to Fe and Mn Oxides
Reagent: 15 mL of 0.04M NH2OH. HCl in 25% HOAc

Sample			E-SB-05 (51-56) Bound to Fe&Mn Oxides	E-SB-07 (59-64) Bound to Fe&Mn Oxides	E-SB-15 (35-40) Bound to Fe&Mn Oxides
Reagent volume (mL)			15	15	15
Volume analysed (after wash dilution and preservation) (mL)			32.5	32.5	32.5
Final diluted solution weight (g)			32.79	31.585	31.9
Parameter	**Units**	**RDL**			
Hardness CaCO3	mg/L	0.05	620	190	177
Aluminum Al	mg/L	0.001	29	66.8	61.5
Antimony Sb	mg/L	0.0009	< 0.009	< 0.009	< 0.009
Arsenic As	mg/L	0.0002	0.015	0.015	0.018
Barium Ba	mg/L	0.00002	0.655	0.283	0.206
Beryllium Be	mg/L	0.000007	0.00765	0.0109	0.00929
Bismuth Bi	mg/L	0.00001	0.0021	0.0028	0.0015
Boron B	mg/L	0.002	0.09	0.14	0.09
Cadmium Cd	mg/L	0.000003	0.00078	0.0001	0.00026
Calcium Ca	mg/L	0.01	124	17	20
Chromium Cr	mg/L	0.00008	0.3	0.835	0.789
Cobalt Co	mg/L	0.000004	0.0492	0.092	0.0768
Copper Cu	mg/L	0.0002	0.117	0.323	0.183
Iron Fe	mg/L	0.007	329	152	152
Lead Pb	mg/L	0.00009	0.0747	0.0677	0.083
Lithium Li	mg/L	0.0001	0.0805	0.195	0.173
Magnesium Mg	mg/L	0.001	75.5	35.9	30.6
Manganese Mn	mg/L	0.00001	8.32	2.14	3.54
Mercury Hg	ug/L	0.01	0.01	0.03	0.03
Molybdenum Mo	mg/L	0.00004	0.0243	0.006	0.00515
Nickel Ni	mg/L	0.0001	0.111	0.256	0.223
Phosphorus P	mg/L	0.003	1.76	3.49	3.48
Potassium K	mg/L	0.003	6.31	9.57	8.47
Selenium Se	mg/L	0.00004	0.00242	0.00285	0.00237
Silicon Si	mg/L	0.02	24.5	46.1	43.4
Silver Ag	mg/L	0.00005	0.00019	0.00286	0.00424
Sodium Na	mg/L	0.01	64.7	71.6	62.4
Strontium Sr	mg/L	0.00002	0.155	0.102	0.0794
Sulphur (S)	mg/L	1	5	< 1	< 1
Thallium Tl	mg/L	0.000005	0.0002	0.0002	0.0002
Tin Sn	mg/L	0.00006	0.00149	0.00366	0.00108
Titanium Ti	mg/L	0.00005	0.0122	0.0175	0.0162
Uranium U	mg/L	0.000002	0.00312	0.00246	0.00307
Vanadium V	mg/L	0.00001	0.119	0.125	0.116
Zinc Zn	mg/L	0.002	0.249	0.38	0.328
Zirconium Zr	mg/L	0.002	0.01	0.011	0.012

Tessier Extraction

Metals Bound to Fe and Mn Oxides
Reagent: 15 mL of 0.04M NH2OH. HCl in 25% HOAc

Sample			E-SB-07 (37-30) Bound to Fe&Mn Oxides	E-SB-15 (10-15) Bound to Fe&Mn Oxides	E-SB-19 (35-40) Bound to Fe&Mn Oxides	AW-23 (6-11.5) Bound to Fe&Mn Oxides	E-SB 19 (40-44) Bound to Fe&Mn Oxides
Reagent volume (mL)			15	15	15	15	15
Volume analysed (after wash dilution and preservation) (mL)			32.5	32.5	32.5	32.5	32.5
Final diluted solution weight (g)			31.5	33.49	32.26	32.33	32.55
Parameter	**Units**	**RDL**					
Hardness CaCO3	mg/L	0.05	653	712	255	425	525
Aluminum Al	mg/L	0.001	25.5	16.8	35.7	24.3	47.7
Antimony Sb	mg/L	0.0009	< 0.009	< 0.009	< 0.009	< 0.009	< 0.009
Arsenic As	mg/L	0.0002	0.009	0.008	0.008	0.008	0.007
Barium Ba	mg/L	0.00002	0.254	0.423	0.265	0.401	0.303
Beryllium Be	mg/L	0.000007	0.00782	0.0114	0.00969	0.0106	0.0158
Bismuth Bi	mg/L	0.00001	0.0013	0.0023	0.0012	0.0016	0.0027
Boron B	mg/L	0.002	0.1	0.17	0.13	0.13	0.13
Cadmium Cd	mg/L	0.000003	0.00345	0.00507	0.00106	0.00201	0.00022
Calcium Ca	mg/L	0.01	126	131	43	71	75
Chromium Cr	mg/L	0.00008	0.565	0.273	0.6	0.835	0.875
Cobalt Co	mg/L	0.000004	0.0736	0.0909	0.0803	0.074	0.0841
Copper Cu	mg/L	0.0002	0.251	0.162	0.184	0.264	0.161
Iron Fe	mg/L	0.007	74.6	87.8	107	91.1	717
Lead Pb	mg/L	0.00009	0.0902	0.138	0.0532	0.0986	0.0946
Lithium Li	mg/L	0.0001	0.0918	0.117	0.127	0.119	0.105
Magnesium Mg	mg/L	0.001	82.1	93.6	36.1	60.1	82.2
Manganese Mn	mg/L	0.00001	1.17	0.97	2.62	2.04	10.6
Mercury Hg	ug/L	0.01	0.02	0.02	0.02	0.03	0.02
Molybdenum Mo	mg/L	0.00004	0.0326	0.00397	0.004	0.0246	0.0709
Nickel Ni	mg/L	0.0001	0.193	0.234	0.192	0.184	0.152
Phosphorus P	mg/L	0.003	1.86	2.81	1.15	1.12	2.17
Potassium K	mg/L	0.003	5.57	5.31	6.46	5.31	9.08
Selenium Se	mg/L	0.00004	0.00322	0.0077	0.00223	0.0044	0.00229
Silicon Si	mg/L	0.02	32.3	37.4	33.2	33	34.5
Silver Ag	mg/L	0.00005	0.00427	0.00263	0.00924	0.00438	0.00378
Sodium Na	mg/L	0.01	249	517	91.8	433	59.3
Strontium Sr	mg/L	0.00002	0.0795	0.0864	0.0605	0.0755	0.127
Sulphur (S)	mg/L	1	4	4	1	4	4
Thallium Tl	mg/L	0.000005	0.0001	0.00027	0.00012	0.00006	0.0002
Tin Sn	mg/L	0.00006	0.00199	0.00147	0.00128	0.00119	0.00215
Titanium Ti	mg/L	0.00005	0.009	0.00886	0.00841	0.00776	0.0228
Uranium U	mg/L	0.000002	0.0045	0.00637	0.00394	0.00505	0.00426
Vanadium V	mg/L	0.00001	0.114	0.181	0.104	0.181	0.372
Zinc Zn	mg/L	0.002	0.343	0.354	0.296	0.334	0.336
Zirconium Zr	mg/L	0.002	0.011	0.012	0.012	0.011	0.01

Tessier Extraction

Metals Bound to Fe and Mn Oxides
Reagent: 15 mL of 0.04M NH2OH. HCl in 25% HOAc

Sample			E-SB-05 (52-30) Bound to Fe&Mn Oxides	Blank Bound to Fe&Mn Oxides
Reagent volume (mL)			15	15
Volume analysed (after wash dilution and preservation) (mL)			32.5	32.5
Final diluted solution weight (g)			28.17	33.01
Parameter	**Units**	**RDL**		
Hardness CaCO3	mg/L	0.05	2140	< 0.5
Aluminum Al	mg/L	0.001	21.6	0.02
Antimony Sb	mg/L	0.0009	< 0.009	< 0.009
Arsenic As	mg/L	0.0002	0.031	< 0.002
Barium Ba	mg/L	0.00002	0.496	< 0.0008
Beryllium Be	mg/L	0.000007	0.0103	< 0.00007
Bismuth Bi	mg/L	0.00001	0.0031	< 0.0001
Boron B	mg/L	0.002	0.14	< 0.02
Cadmium Cd	mg/L	0.000003	0.00247	< 0.00003
Calcium Ca	mg/L	0.01	454	< 0.1
Chromium Cr	mg/L	0.00008	0.445	0.0055
Cobalt Co	mg/L	0.000004	0.0965	0.00004
Copper Cu	mg/L	0.0002	0.0592	0.0013
Iron Fe	mg/L	0.007	203	0.073
Lead Pb	mg/L	0.00009	0.203	0.00043
Lithium Li	mg/L	0.0001	0.11	0.0058
Magnesium Mg	mg/L	0.001	244	0.019
Manganese Mn	mg/L	0.00001	4.06	0.0005
Mercury Hg	ug/L	0.01	0.01	< 0.01
Molybdenum Mo	mg/L	0.00004	0.0225	0.00391
Nickel Ni	mg/L	0.0001	0.241	0.0023
Phosphorus P	mg/L	0.003	2.83	0.027
Potassium K	mg/L	0.003	5.32	< 0.009
Selenium Se	mg/L	0.00004	0.00526	0.00082
Silicon Si	mg/L	0.02	35.6	0.03
Silver Ag	mg/L	0.00005	0.00206	0.00014
Sodium Na	mg/L	0.01	236	0.1
Strontium Sr	mg/L	0.00002	0.249	0.00026
Sulphur (S)	mg/L	1	7	5
Thallium Tl	mg/L	0.000005	0.00053	0.00002
Tin Sn	mg/L	0.00006	0.00128	0.00175
Titanium Ti	mg/L	0.00005	0.0281	0.00067
Uranium U	mg/L	0.000002	0.00716	0.00014
Vanadium V	mg/L	0.00001	0.277	0.00021
Zinc Zn	mg/L	0.002	0.756	0.033
Zirconium Zr	mg/L	0.002	0.008	0.002

Tessier Extraction

Metals Bound to Organics
Reagent: 3 mL of 0.02 M HNO3 + 5 mL 30% H2O2
+ 5 mL 1.2 M NH4OAc in 20% HNO3

Sample			E-SB-05 (51-56) Bound in Organics	E-SB-07 (59-64) Bound in Organics	E-SB-15 (35-40) Bound in Organics
Reagent volume (mL)			15	15	15
Volume analysed (after wash dilution and preservation) (mL) (Vol. is approximate)			37.5	37.5	37.5
Final diluted solution weight (g)			36.325	36.37	36.8
Parameter	**Units**	**RDL**			
Hardness CaCO3	mg/L	0.05	71.5	52.7	49.4
Aluminum Al	mg/L	0.001	8.36	8.25	6.73
Antimony Sb	mg/L	0.0009	< 0.0009	< 0.0009	< 0.0009
Arsenic As	mg/L	0.0002	0.0033	0.0029	0.0025
Barium Ba	mg/L	0.00002	0.406	0.129	0.0908
Beryllium Be	mg/L	0.000007	0.00094	0.0009	0.00053
Bismuth Bi	mg/L	0.00001	0.00002	0.00002	0.00133
Boron B	mg/L	0.002	0.04	0.036	0.038
Cadmium Cd	mg/L	0.000003	0.00134	0.00008	0.00024
Calcium Ca	mg/L	0.01	10.4	6.35	6.8
Chromium Cr	mg/L	0.00008	0.0349	0.0738	0.0722
Cobalt Co	mg/L	0.000004	0.034	0.0349	0.024
Copper Cu	mg/L	0.0002	2.78	0.205	0.0875
Iron Fe	mg/L	0.007	3.34	1.55	1.52
Lead Pb	mg/L	0.00009	0.00947	0.00765	0.00641
Lithium Li	mg/L	0.0001	0.0553	0.0705	0.0638
Magnesium Mg	mg/L	0.001	11	8.96	7.87
Manganese Mn	mg/L	0.00001	0.952	0.413	0.436
Mercury Hg	ug/L	0.01	< 0.01	< 0.01	< 0.01
Molybdenum Mo	mg/L	0.00004	0.0477	0.00473	0.00531
Nickel Ni	mg/L	0.0001	0.0638	0.0768	0.0589
Phosphorus P	mg/L	0.003	0.19	0.37	0.46
Potassium K	mg/L	0.003	2.5	3.5	2.84
Selenium Se	mg/L	0.00004	0.00941	0.00193	0.00228
Silicon Si	mg/L	0.02	12.2	13.9	13.8
Silver Ag	mg/L	0.00005	0.00207	0.00164	0.0012
Sodium Na	mg/L	0.01	18.1	17.2	17.2
Strontium Sr	mg/L	0.00002	0.0341	0.0343	0.0308
Sulphur (S)	mg/L	1	19	9	9
Thallium Tl	mg/L	0.000005	0.00028	0.00023	0.0002
Tin Sn	mg/L	0.00006	0.0113	0.0101	0.0117
Titanium Ti	mg/L	0.00005	0.0334	0.108	0.0954
Uranium U	mg/L	0.000002	0.001	0.00075	0.0007
Vanadium V	mg/L	0.00001	0.0023	0.0491	0.0467
Zinc Zn	mg/L	0.002	0.28	0.122	0.142
Zirconium Zr	mg/L	0.002	0.002	< 0.002	0.008

Tessier Extraction

Metals Bound to Organics
Reagent: 3 mL of 0.02 M HNO3 + 5 mL 30% H2O2
+ 5 mL 1.2 M NH4OAc in 20% HNO3

Sample			E-SB-07 (37-30) Bound in Organics	E-SB-15 (10-15) Bound in Organics	E-SB-19 (35-40) Bound in Organics	AW-23 (6-11.5) Bound in Organics	E-SB 19 (40-44) Bound in Organics
Reagent volume (mL)			15	15	15	15	15
Volume analysed (after wash dilution and preservation) (mL) (Vol. is approximate)			37.5	37.5	37.5	37.5	37.5
Final diluted solution weight (g)			36.5	36.71	36.04	36.89	37.30
Parameter	**Units**	**RDL**					
Hardness CaCO3	mg/L	0.05	130	192	63	126	54.5
Aluminum Al	mg/L	0.001	9.5	20.1	10.5	14.5	6.37
Antimony Sb	mg/L	0.0009	< 0.0009	< 0.0009	< 0.0009	< 0.0009	< 0.0009
Arsenic As	mg/L	0.0002	0.0032	0.0047	0.0046	0.005	0.0009
Barium Ba	mg/L	0.00002	0.243	0.398	0.225	0.507	0.132
Beryllium Be	mg/L	0.000007	0.00104	0.00155	0.00099	0.0017	0.00091
Bismuth Bi	mg/L	0.00001	0.00003	0.00004	0.00005	0.00005	0.00001
Boron B	mg/L	0.002	0.032	0.041	0.038	0.042	0.031
Cadmium Cd	mg/L	0.000003	0.00052	0.0009	0.00024	0.0005	0.00012
Calcium Ca	mg/L	0.01	23.4	32.8	9.77	20.7	6.16
Chromium Cr	mg/L	0.00008	0.177	0.209	0.129	0.23	0.0337
Cobalt Co	mg/L	0.000004	0.0252	0.0445	0.0271	0.0316	0.019
Copper Cu	mg/L	0.0002	0.0396	0.292	0.0171	0.101	0.178
Iron Fe	mg/L	0.007	0.98	7.55	1.64	1.93	4.32
Lead Pb	mg/L	0.00009	0.00942	0.0161	0.0058	0.0133	0.00568
Lithium Li	mg/L	0.0001	0.0398	0.0559	0.0515	0.0503	0.0498
Magnesium Mg	mg/L	0.001	17.4	26.7	9.39	18.1	9.51
Manganese Mn	mg/L	0.00001	0.356	0.408	0.706	0.618	0.726
Mercury Hg	ug/L	0.01	0.02	< 0.01	< 0.01	0.02	< 0.01
Molybdenum Mo	mg/L	0.00004	0.0119	0.0113	0.0151	0.0951	0.00346
Nickel Ni	mg/L	0.0001	0.0929	0.17	0.0811	0.109	0.0338
Phosphorus P	mg/L	0.003	0.46	0.61	0.3	0.29	0.16
Potassium K	mg/L	0.003	2.7	2.92	2.83	2.8	2.33
Selenium Se	mg/L	0.00004	0.0085	0.03	0.0046	0.0159	0.00169
Silicon Si	mg/L	0.02	18.9	23.6	16.3	20.2	10.3
Silver Ag	mg/L	0.00005	0.00114	0.00072	0.00177	0.00353	0.002
Sodium Na	mg/L	0.01	22.1	32.5	18.4	34.9	16.7
Strontium Sr	mg/L	0.00002	0.0384	0.048	0.0315	0.0453	0.0214
Sulphur (S)	mg/L	1	10	19	9	11	11
Thallium Tl	mg/L	0.000005	0.00019	0.00025	0.00017	0.00017	0.00024
Tin Sn	mg/L	0.00006	0.00923	0.0407	0.0127	0.0128	0.00848
Titanium Ti	mg/L	0.00005	0.116	0.294	0.0928	0.129	0.0593
Uranium U	mg/L	0.000002	0.00055	0.00239	0.00189	0.00095	0.00054
Vanadium V	mg/L	0.00001	0.101	0.152	0.0843	0.173	0.0102
Zinc Zn	mg/L	0.002	0.091	0.243	0.097	0.12	0.098
Zirconium Zr	mg/L	0.002	< 0.002	0.011	< 0.002	0.003	< 0.002

Tessier Extraction

Metals Bound to Organics Reagent: 3 mL of 0.02 M HNO3 + 5 mL 30% H2O2 + 5 mL 1.2 M NH4OAc in 20% HNO3				
Sample			**E-SB-05 (52-30) Bound in Organics**	**Blank Bound in Organics**
Reagent volume (mL)			15	15
Volume analysed (after wash dilution and preservation) (mL) (Vol. is approximate)			37.5	37.5
Final diluted solution weight (g)			36.01	39.06
Parameter	**Units**	**RDL**		
Hardness CaCO3	mg/L	0.05	214	5.4
Aluminum Al	mg/L	0.001	29.9	0.073
Antimony Sb	mg/L	0.0009	< 0.0009	< 0.0009
Arsenic As	mg/L	0.0002	0.0076	0.0003
Barium Ba	mg/L	0.00002	0.195	0.00219
Beryllium Be	mg/L	0.000007	0.00128	0.00001
Bismuth Bi	mg/L	0.00001	0.00002	0.00001
Boron B	mg/L	0.002	0.037	0.008
Cadmium Cd	mg/L	0.000003	0.0003	0.00001
Calcium Ca	mg/L	0.01	42	1.54
Chromium Cr	mg/L	0.00008	0.189	0.0126
Cobalt Co	mg/L	0.000004	0.0519	0.00035
Copper Cu	mg/L	0.0002	0.755	0.002
Iron Fe	mg/L	0.007	42.2	0.07
Lead Pb	mg/L	0.00009	0.0108	0.00072
Lithium Li	mg/L	0.0001	0.0497	0.0002
Magnesium Mg	mg/L	0.001	26.6	0.37
Manganese Mn	mg/L	0.00001	0.482	0.0016
Mercury Hg	ug/L	0.01	0.02	< 0.01
Molybdenum Mo	mg/L	0.00004	0.0703	0.00711
Nickel Ni	mg/L	0.0001	0.158	0.0087
Phosphorus P	mg/L	0.003	0.69	13.3
Potassium K	mg/L	0.003	1.68	0.19
Selenium Se	mg/L	0.00004	0.0294	0.00106
Silicon Si	mg/L	0.02	20.3	0.11
Silver Ag	mg/L	0.00005	0.00166	0.00018
Sodium Na	mg/L	0.01	22.3	16.7
Strontium Sr	mg/L	0.00002	0.0522	0.00848
Sulphur (S)	mg/L	1	69	< 1
Thallium Tl	mg/L	0.000005	0.00083	< 0.000005
Tin Sn	mg/L	0.00006	0.00711	7.69
Titanium Ti	mg/L	0.00005	0.526	0.00257
Uranium U	mg/L	0.000002	0.00242	0.00009
Vanadium V	mg/L	0.00001	0.0997	0.00016
Zinc Zn	mg/L	0.002	0.225	0.025
Zirconium Zr	mg/L	0.002	0.004	< 0.002

SGS proposal: IBD
SGS project #: 2267

Sample receipt date: 13-Dec-23
Report date: 18-Apr-23

Version: Final

Metals - Multi-Acid Digestion with ICP-OES/MS Finish

Test Units Method Code	Residual wt g	Aluminum µg/g	Antimony µg/g	Arsenic µg/g	Boron µg/g	Barium µg/g	Beryllium µg/g	Bismuth µg/g	Cadmium µg/g	Calcium µg/g	Chromium µg/g	Cobalt µg/g	Copper µg/g	Iron µg/g	Lead µg/g	Lithium µg/g	Magnesium µg/g
Lower detection		3	0.8	0.5	1	0.01	0.02	0.09	0.02	3	0.5	0.01	0.1	3	0.05	2	3
Sample ID																	
E-SB-05 (51-56) Residue	0.8468	71000	< 0.8	7.7	< 1	460	2.1	0.1	0.03	1700	63	12.0	37	33000	8	59	9200
E-SB-07 (59-64) Residue	0.9466	73000	< 0.8	3.5	< 1	410	2.1	0.1	< 0.02	990	76	12.0	20	28000	8	56	8600
E-SB-15 (35-40) Residue	0.9666	68000	< 0.8	3.2	< 1	370	1.8	< 0.09	< 0.02	1100	76	9.7	14	23000	7	46	7100
E-SB-07 (37-30) Residue	0.8826	59000	< 0.8	5.4	< 1	470	1.7	0.19	0.05	2800	73	8.7	24	35000	15	46	6200
E-SB-15 (10-15) Residue	0.8534	66000	1.40	4.1	< 1	460	2.1	0.22	0.04	2000	78	10.0	37	43000	17	63	8200
E-SB-19 (35-40) Residue	0.9280	68000	< 0.8	7.1	< 1	420	2.1	0.22	0.02	1400	97	12.0	20	44000	11	53	7700
AW-23 (6-11.5) Residue	0.9081	60000	0.90	8.1	< 1	430	2.0	0.22	0.06	1900	90	11.0	32	45000	16	58	6900
E-SB 19 (40-44) Residue	0.8887	73000	< 0.8	3.1	< 1	390	2.3	< 0.09	< 0.02	1400	77	16.0	19	34000	8	62	9800
E-SB-05 (52-30) Residue	0.6819	56000	< 0.8	10	< 1	490	1.8	0.18	0.02	2700	67	7.1	30	31000	15	57	7200

3260 Production Way
Burnaby - British Columbia - V5A 4W4
Phone: 604-638-2349 FAX: 604-444-5486

Test Units Method Code	Manganese µg/g	Molybdenum µg/g	Nickel µg/g	Phosphorus µg/g	Potassium µg/g	Selenium µg/g	Tin µg/g	Silver µg/g	Sodium µg/g	Strontium µg/g	Sulfur µg/g	Thallium µg/g	Titanium µg/g	Uranium µg/g	Vanadium µg/g	Zinc µg/g	Zirconium µg/g
Lower detection	0.1	0.1	0.1	3	3	0.1	6	0.5	3	0.02		0.02	0.1	0.002	1	0.7	0.03
Sample ID																	
E-SB-05 (51-56) Residue	270	4.7	33	1100	23000	< 0.1	260	< 0.5	9800	86	170.0	0.5	4500	2.5	100	68	270
E-SB-07 (59-64) Residue	220	0.4	31	990	22000	< 0.1	230	< 0.5	11000	82	300.0	0.5	5300	2.4	94	63	310
E-SB-15 (35-40) Residue	190	0.3	26	910	19000	< 0.1	210	< 0.5	11000	77	260.0	0.4	5000	2.3	81	55	300
E-SB-07 (37-30) Residue	190	0.6	26	1200	24000	0.1	250	< 0.5	7300	98	600.0	0.7	4000	2.5	81	78	260
E-SB-15 (10-15) Residue	180	0.6	29	1200	27000	0.3	240	< 0.5	5500	83	50.0	1.1	3700	2.8	110	110	210
E-SB-19 (35-40) Residue	280	0.8	34	950	22000	0.2	230	< 0.5	9000	79	320.0	0.6	4700	2.6	93	74	250
AW-23 (6-11.5) Residue	210	3.5	33	1200	22000	0.2	250	< 0.5	6300	84	440.0	0.8	4000	2.4	100	89	230
E-SB 19 (40-44) Residue	290	2.5	38	970	21000	< 0.1	230	< 0.5	9900	80	210.0	0.5	4800	2.1	94	74	270
E-SB-05 (52-30) Residue	150	3.7	23	1300	25000	< 0.1	290	0.6	6900	92	420.0	0.8	3900	2.7	97	67	220

3260 Production Way
Burnaby - British Columbia - V5A 4W4
Phone: 604-638-2349 FAX: 604-444-5486

ATTACHMENT 3

Evaluation of Partition Coefficient Results, Ash Pond (CCR Unit 301) Edwards Power Plant, Peoria County, Illinois

TECHNICAL MEMORANDUM

DATE March 30, 2022 **Project No.** 21454831

TO David Mitchell, Stu Cravens, Vic Modeer
Illinois Power Resources Generating, LLC

CC Brian Henning - Ramboll

FROM Golder Associates USA Inc. **EMAIL** **Jeffrey_Ingram@golder.com**

EVALUATION OF PARTITION COEFFICIENT RESULTS, EDWARDS ASH POND (CCR UNIT 301), EDWARDS POWER PLANT, PEORIA COUNTY, ILLINOIS

1.0 INTRODUCTION

Illinois Power Resource Generating, LLC (IPRG) operates the Edwards Power Plant (EPP) located in Peoria County, Illinois. The Edwards Ash Pond (EAP or Site), Illinois Environmental Protection Agency [IEPA] ID No. W1438050005 - 01) is a 91-acre unlined surface impoundment used to manage coal combustion residuals (CCRs) at the EPP. The EAP is regulated under Part 845 *"Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments"* (State CCR Rule or Part 845) which was promulgated by the Illinois Pollution Control Board (IPCB) on April 21, 2021. WSP Golder (Golder) is assisting IPRG with Part 845 compliance at the Site.

IPRG is currently preparing a Construction Permit application for the EAP as required under Section 845.220. As a part of the Construction Permit application, groundwater modeling is being completed for known potential exceedances of groundwater protection standards (GWPS) as outlined in the Operating Permit application for the EAP (Burns and McDonnell, 2021). In the Operating Permit (October 2021), Ramboll Americas Engineering Solutions, Inc. (Ramboll) identified potential GWPS exceedances for several compounds potentially associated with the EAP, including barium, boron, lithium, sulfate and total dissolved solids (TDS). Batch adsorption testing was conducted to generate site-specific partition coefficient results for these parameters for use in the groundwater models. This Technical Memorandum summarizes the results of the batch adsorption testing.

2.0 OVERVIEW

In August 2021, Golder conducted a field investigation at the EPP which included the completion of six (6) soil/rock borings ranging in depth from 40 to 64 feet below ground surface. As a part of that investigation, soil and groundwater samples were submitted to SiREM laboratories (Guelph, ON) for batch solid/liquid partitioning testing. A summary of the soil samples used for the batch testing is provided in Table 1.

Table 1: Batch Attenuation Testing Data Summary

Groundwater Sample ID	Soil Sample ID	Soil: Water Ratio
AW-15S	E-SB-05 (30.0-33.5 ft bgs)	2:1
		1:1

Golder Associates USA Inc
18300 NE Union Hill Road, Suite 200, Redmond, Washington, USA 98052 T: +1 425 883-0777 F: +1 425 882-5498

Groundwater Sample ID	Soil Sample ID	Soil: Water Ratio
		1:5
		1:10
		1:20
AW-19	E-SB-05 (30.0-33.5 ft bgs)	2:1
		1:1
		1:5
		1:10
		1:20

Notes:

1) Ft bgs – Feet below ground surface

Site-specific partitioning coefficients were determined for contaminants of interest (COIs) identified based on statical evaluation of potential groundwater exceedances calculated at the Site: barium, boron, lithium, and sulfate (Burns & McDonnell, 2021). Two groundwater samples (AW-15S and AW-19) and one soil sample (E-SB-05) were used for batch attenuation testing at various ratios (Table 1). For each treatment, 0.1 L of groundwater was brought in contact with an amount of soil (0.2 to 2 kg, depending on the ratio) over a seven-day period. Each contact water/soil microcosm was amended (spiked) with barium hydroxide, boric acid, sodium chloride, lithium chloride, and sodium sulfate to a target concentration of barium, boron, lithium, and sulfate, respectively (Table 2). After the seven-day contact period, COI concentrations were analyzed in the contact water. The control samples (i.e., groundwater samples AW-15S and AW-19) were only analyzed at the initiation of testing. The oxidation/reduction potential (redox) and pH were measured for each batch test at the beginning and end of the contact period and in the control samples.

Table 2: Microcosm amendment and target concentration for COIs

COI	Amendment	Target Concentration (mg/L)
Barium	1.75 mL of a 1 g/L $Ba(OH)_2 \cdot 8H_2O$ solution	0.5
Boron	36.43 mL of a 2 g/L H_3BO_3 solution	12
Lithium	5.97 mL of a 1 g/L LiCl solution	0.5
Sulfate	1769.5 mg of Na_2SO_4	1,100

Notes:

1) Mg/L – milligrams per liter
2) $Ba(OH)_2 \cdot 8H_2O$ - barium hydroxide
3) H_3BO_3 - boric acid
4) LiCl - lithium chloride
5) Na_2SO_4 - sodium sulfate

The results of batch attenuation testing (Tables 3 and 4) were used to calculate the following adsorption isotherms for each COI:

- Linear: $q_e = K_D * C_e$

- Langmuir: $C_e/q_e = 1/(K_L * q_m) + C_e/q_m$
- Freundlich: $\log(q_e) = \log(K_F) + (1/n)\log(C_e)$

Where

K_D, K_L, and K_F = the linear, Langmuir, and Freundlich partition coefficients, respectively (in liters per kilogram; L/kg).

q_e = concentration of the adsorbate in soil

C_e = aqueous concentration of the adsorbate

q_m = 1/slope in the linear expression of the isotherm

n = non-linearity constant

3.0 SUMMARY OF RESULTS

Figures that show the linear, Langmuir, and Freundlich isotherms for each COI are provided in Appendix A. The partition coefficient values for AW-15S and AW-19 are presented in Tables 5 and 6, respectively. The results of the batch adsorption testing can be summarized as follows:

- **Barium**: The calculated K_D and K_L values for both AW-15S and AW-19 were negative (AW-15S: -22.9 and -6.5E+8 L/kg; AW-19: -12.4 and -8.5E+8 L/kg), indicating an inverse relationship between the concentration of barium in solution and the concentration of barium in soil. The K_F values for AW-15S and AW-19 were 736 and 738 L/kg, respectively. For comparison, in Strenge and Peterson (1989), partition coefficients for barium range from 53 to 16,000 L/kg, depending on pH conditions and the amount of sorbent (i.e. clay, organic matter, and iron and aluminum oxyhydroxide) present.
- **Boron**: Calculated K_D values for AW-15S and AW-19 were 1.50 and -0.19 L/kg, respectively, K_L values 3.8E+4 and -2E+5 L/kg, respectively, and K_F values 82 and 215 L/kg, respectively. In Strenge and Peterson (1989), partition coefficients for boron range from 0.19 to 1.3 L/kg, depending on pH conditions and the amount of sorbent present.
- **Lithium**: Calculated K_D values for AW-15S and AW-19 were 1.89 and -1.27 L/kg, respectively, K_L values 2.6E+8 and -2.4E+8 L/kg, respectively, and K_F values 234 and 230 L/kg, respectively. In Strenge and Peterson (1989), partition coefficients for lithium range from 0 to 0.8 L/kg, depending on pH conditions and the amount of sorbent present.
- **Sulfate**: Calculated K_D values for AW-15S and AW-19 were 0.47 and -1.0 L/kg, respectively, and K_L values 778 and -2,950 L/kg, respectively. The K_F values for AW-15S and AW-19 were 63 and 1.2 L/kg, respectively. In Strenge and Peterson (1989), partition coefficients for sulfate are 0.0 L/kg, regardless of pH conditions and the amount of sorbent present.
- **pH and Redox**: Generally, after the seven-day contact time, the pH of each contact water was consistent with the pH of the control (6.95 to 6.96), ranging from 6.83 to 6.99 across the batch tests. The redox value of the control sample after the seven-day contact time was +65 mV for AW-15S and +51 for AW-19. The redox value of contact water ranged from -71 to +71 mV across treatments.

4.0 REFERENCES

Burns & McDonnell, 2021. Initial Operating Permit Edwards Power Plant Ash Pond.

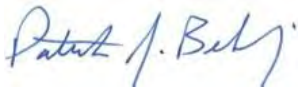
Strenge, D. and Peterson, S. 1989. Chemical Data Bases for the Multimedia Environmental Pollutant Assessment System (MEPAS) (No. PNL-7145). Pacific Northwest Lab., Richland, WA (USA).

5.0 CLOSING

Golder appreciates the opportunity to serve as your consultant on this project. If you have any questions concerning this technical memorandum or need additional information, please contact the undersigned.

Golder Associates USA Inc.





Jeffrey Ingram

Senior Consultant, Geologist

Pat Behling

Practice Leader

CK/CK/JSI/PJB

Attachments Appendix A – Partition Coefficient Graphs

Table 3: Batch Attenuation Testing Results, AW-15S

Geologic Material Sample ID	Treatment	Date	Day	Replicate	Dissolved Barium	Dissolved Boron	Dissolved Lithium	Dissolved Sulfate	pH	ORP
					mg/L	mg/L	mg/L	mg/L	SU	mV
	Groundwater Only Control	1/14/2022	0	AW-15S-1a	0.31	12	0.47	390	7.07	202
				AW-15S-2a	0.36	13	0.48	397	7.06	181
				Average Concentration (mg/L)	**0.33**	**13**	**0.48**	**394**	**7.07**	**192**
		1/21/2022	7	AW-15S-1a	0.069	13	0.49	395	6.95	64
				AW-15S-2a	0.074	13	0.48	392	6.96	66
				Average Concentration (mg/L)	**0.072**	**13**	**0.49**	**394**	**6.96**	**65**
AW-15S E-SB-05 (30.0-33.5)	2:1 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-15S 2:1-1	0.39	4.6	0.15	266	6.89	-60
				E-SB-05 (30.0-33.5): AW-15S 2:1-2	0.32	4.4	0.12	274	6.93	-75
				Average Concentration (mg/L)	**0.35**	**4.5**	**0.14**	**270**	**6.91**	**-68**
	1:1 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-15S 1:1-1	0.23	6.5	0.21	313	6.83	-68
				E-SB-05 (30.0-33.5): AW-15S 1:1-2	--	--	--	--	--	--
				Average Concentration (mg/L)	**0.23**	**6.5**	**0.21**	**313**	**6.83**	**-68**
	1:5 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-15S 1:5-1	0.13	10	0.36	375	6.89	15
				E-SB-05 (30.0-33.5): AW-15S 1:5-2	0.12	10	0.36	370	6.86	72
				Average Concentration (mg/L)	**0.13**	**10**	**0.36**	**373**	**6.88**	**44**
	1:10 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-15S 1:10-1	0.12	11	0.42	382	6.91	73
				E-SB-05 (30.0-33.5): AW-15S 1:10-2	0.11	12	0.43	375	6.94	68
				Average Concentration (mg/L)	**0.11**	**11**	**0.43**	**379**	**6.93**	**71**
	1:20 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-15S 1:20-1	0.10	12	0.45	393	6.99	96
				E-SB-05 (30.0-33.5): AW-15S 1:20-2	0.11	12	0.44	383	6.96	42
				Average Concentration (mg/L)	**0.11**	**12**	**0.45**	**388**	**6.98**	**69**

Notes:
1) mg/L- Miligrams per liter
2) SU - Standard Units
3) mV -milivolts
4) ORP - Oxidation Reduction Potential

Table 4: Batch Attenuation Testing Results, AW-19

Geologic Material Sample ID	Treatment	Date	Day	Replicate	Dissolved Barium	Dissolved Boron	Dissolved Lithium	Dissolved Sulfate	pH	ORP
					mg/L	mg/L	mg/L	mg/L	SU	mV
	Groundwater Only Control	1/14/2022	0	AW-19-1a	0.22	12	0.46	386	7.08	156
				AW-19-2a	0.27	12	0.45	380	7.07	133
				Average Concentration (mg/L)	**0.25**	**12**	**0.46**	**383**	**7.08**	**145**
		1/21/2022	7	AW-19-1a	0.048	12	0.48	375	6.98	39
				AW-19-2a	0.049	12	0.51	390	6.92	62
				Average Concentration (mg/L)	**0.049**	**12**	**0.50**	**383**	**6.95**	**51**
AW-19 E-SB-05 (30.0-33.5)	2:1 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-19 2:1-1	0.27	4.3	0.11	270	6.93	-58
				E-SB-05 (30.0-33.5): AW-19 2:1-2	0.51	4.4	0.15	269	6.94	-71
				Average Concentration (mg/L)	**0.39**	**4.4**	**0.13**	**270**	**6.94**	**-65**
	1:1 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-19 1:1-1	0.24	6.6	0.24	314	6.98	-60
				E-SB-05 (30.0-33.5): AW-19 1:1-2	0.32	6.3	0.22	308	6.99	-82
				Average Concentration (mg/L)	**0.28**	**6.5**	**0.23**	**311**	**6.99**	**-71**
	1:5 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-19 1:5-1	0.16	10	0.36	358	6.92	-42
				E-SB-05 (30.0-33.5): AW-19 1:5-2	0.19	10	0.38	360	6.95	-32
				Average Concentration (mg/L)	**0.18**	**10**	**0.37**	**359**	**6.94**	**-37**
	1:10 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-19 1:10-1	0.17	10	0.40	365	6.92	-48
				E-SB-05 (30.0-33.5): AW-19 1:10-2	0.14	11	0.45	389	6.95	-52
				Average Concentration (mg/L)	**0.16**	**11**	**0.43**	**377**	**6.94**	**-50**
	1:20 Soil:Water Ratio	1/14/2022	0							
		1/21/2022	7	E-SB-05 (30.0-33.5): AW-19 1:20-1	0.11	12	0.46	381	7.00	-3
				E-SB-05 (30.0-33.5): AW-19 1:20-2	0.16	12	0.47	387	6.97	-45
				Average Concentration (mg/L)	**0.13**	**12**	**0.47**	**384**	**6.99**	**-24**

Notes:
1) mg/L- Miligrams per liter
2) SU - Standard Units
3) mV -milivolts
4) ORP - Oxidation Reduction Potential

Table 5: Partition Coefficient Results, AW-15S

Analyte	Isotherm	Variable	With Soil Mass
Barium	Raw Data R^2		0.46
	Linear K_D (L/kg)		-22.85
	Langmuir	R^2	1.00
		q_m (mg/g)	0.498
		K_L (L/kg)	-6.48E+08
	Freundlich	R^2	0.55
		1/n	-0.01
		K_F (L/kg)	736.03
Boron	Raw Data R^2		0.99
	Linear K_D (L/kg)		1.50
	Langmuir	R^2	0.79
		q_m (mg/g)	0.068
		K_L (L/kg)	3.79E+04
	Freundlich	R^2	0.98
		1/n	0.764
		K_F (L/kg)	82.21
Lithium	Raw Data R^2		0.80
	Linear K_D (L/kg)		1.89
	Langmuir	R^2	1.00
		q_m (mg/g)	0.035
		K_L (L/kg)	2.58E+08
	Freundlich	R^2	0.79
		1/n	0.014
		K_F (L/kg)	234.30
Sulfate	Raw Data R^2		0.54
	Linear K_D (L/kg)		0.47
	Langmuir	R^2	0.07
		q_m (mg/g)	0.88
		K_L (L/kg)	7.78E+02
	Freundlich	R^2	0.56
		1/n	0.8
		K_F (L/kg)	63.43

Note(s):
K_D: linear partition coefficient
K_L: Langmuir partition coefficient
K_F: Freundlich partition coefficient
qm: 1/slope in the linear expression of the isotherm
n: non-linearity constant

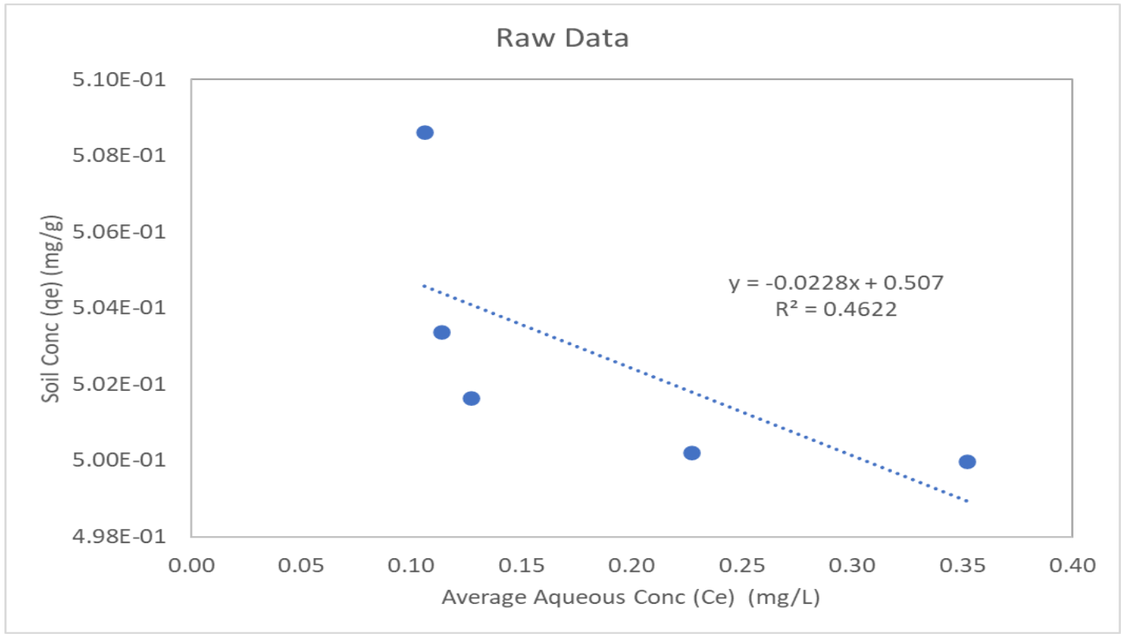
Table 6: Partition Coefficient Results, AW-19

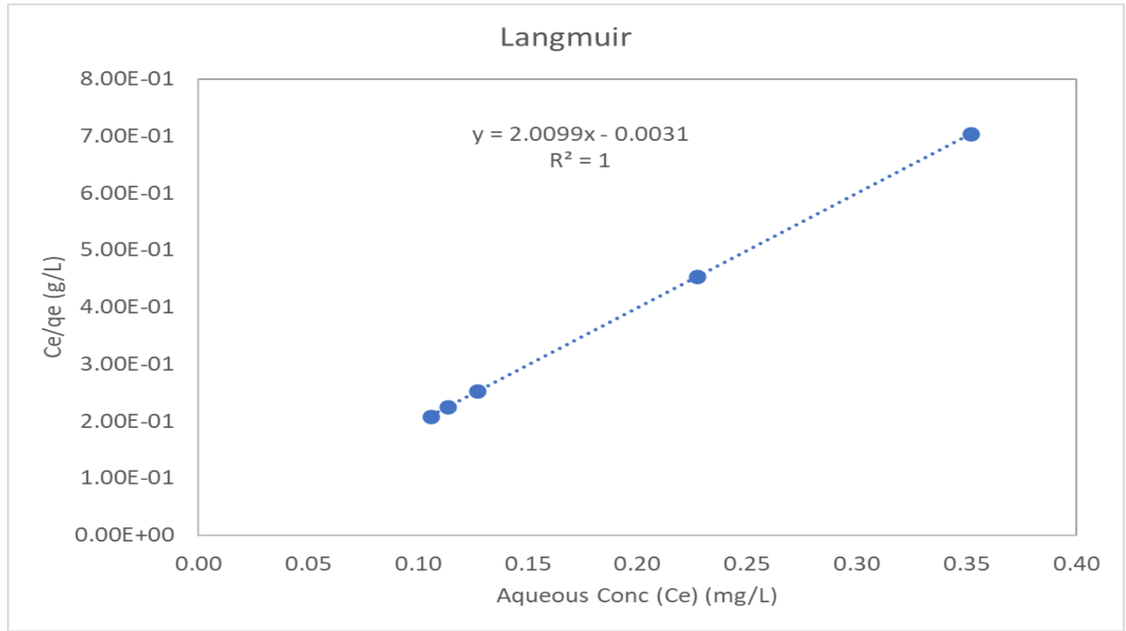
Analyte	Isotherm	Variable	With Soil Mass
Barium	Raw Data R^2		0.51
	Linear K_D (L/kg)		-12.44
	Langmuir	R^2	1.00
		q_m (mg/g)	0.498
		K_L (L/kg)	-8.45E+08
	Freundlich	R^2	0.62
		1/n	-0.007
		K_F (L/kg)	737.55
Boron	Raw Data R^2		0.01
	Linear K_D (L/kg)		-0.19
	Langmuir	R^2	0.35
		q_m (mg/g)	0.002
		K_L (L/kg)	-1.99E+05
	Freundlich	R^2	0.07
		1/n	-0.578
		K_F (L/kg)	215.36
Lithium	Raw Data R^2		0.19
	Linear K_D (L/kg)		-1.27
	Langmuir	R^2	1.00
		q_m (mg/g)	0.034
		K_L (L/kg)	-2.37E+08
	Freundlich	R^2	0.119
		1/n	-0.008
		K_F (L/kg)	230.26
Sulfate	Raw Data R^2		0.28
	Linear K_D (L/kg)		-1.00
	Langmuir	R^2	0.16
		q_m (mg/g)	-0.021
		K_L (L/kg)	-2.95E+03
	Freundlich	R^2	0.16
		1/n	2.40
		K_F (L/kg)	1.16

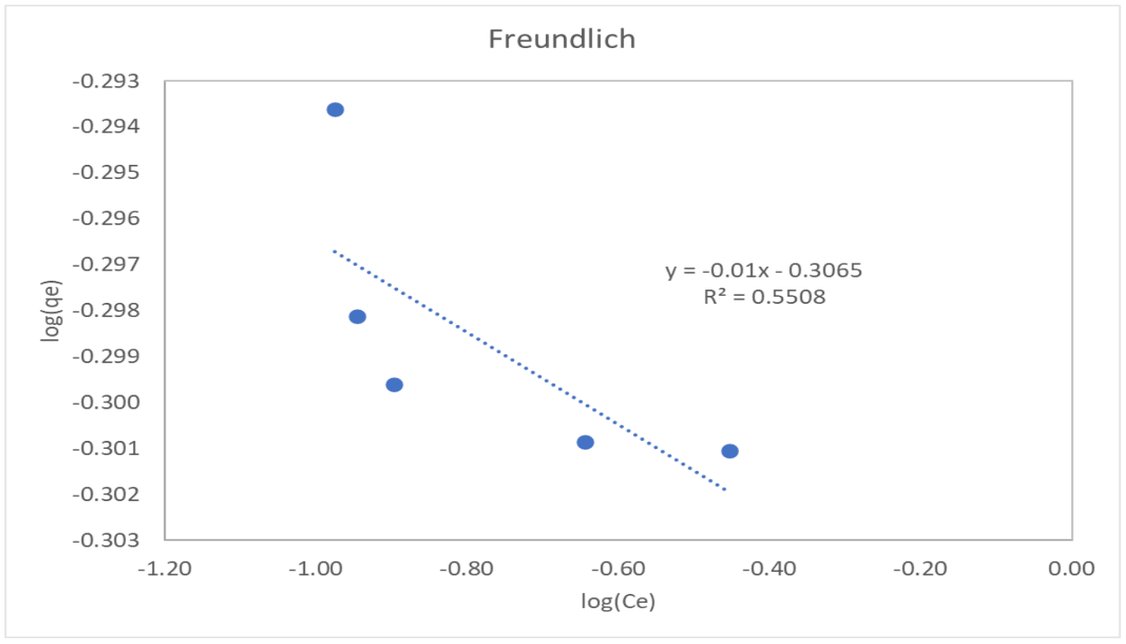
Note(s):
K_D: linear partition coefficient
K_L: Langmuir partition coefficient
K_F: Freundlich partition coefficient
qm: 1/slope in the linear expression of the isotherm
n: non-linearity constant

APPENDIX A

Partition Coefficient Graphs







Note(s):
mg/L: milligrams per liter
mg/g: milligrams per gram
g/L: grams per liter
Ce: aqueous concentration of the adsorbate

CLIENT
ILLIONIS POWER RESOURCES GENERATING, LLC
EDWARDS ASH POND (CCR UNIT 301)

CONSULTANT
WSP GOLDER

PROJECT
EVALUATION OF PARTITION COEFFICIENT RESULTS EAP

TITLE
AW-15S BARIUM PARTITION COEFFICIENTS

PROJECT NO.	PHASE	REV.	FIGURE
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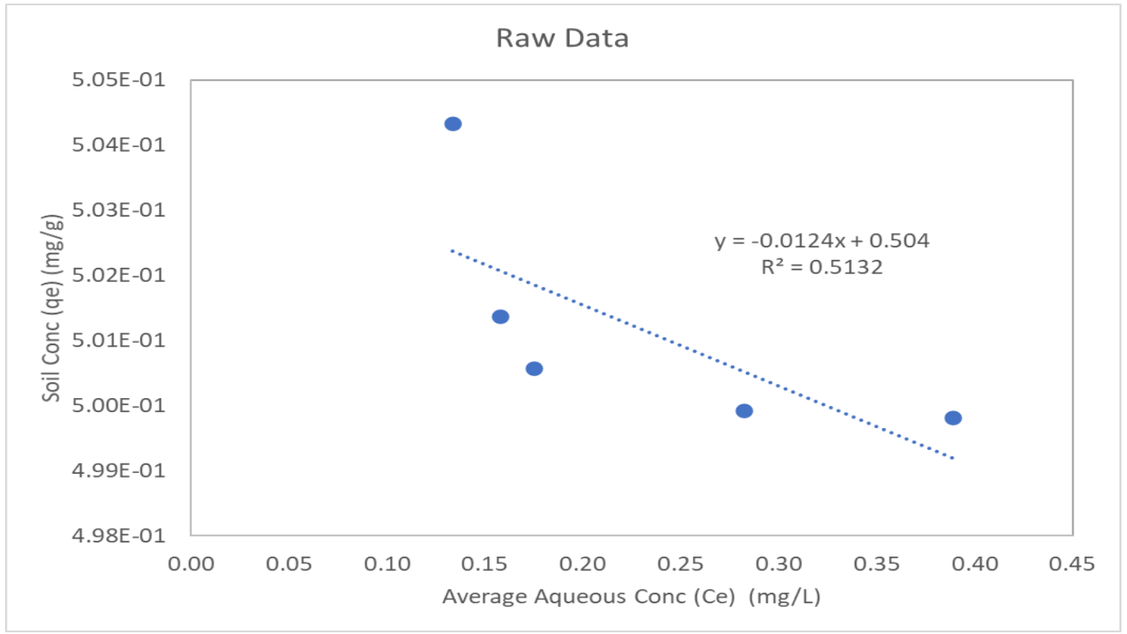

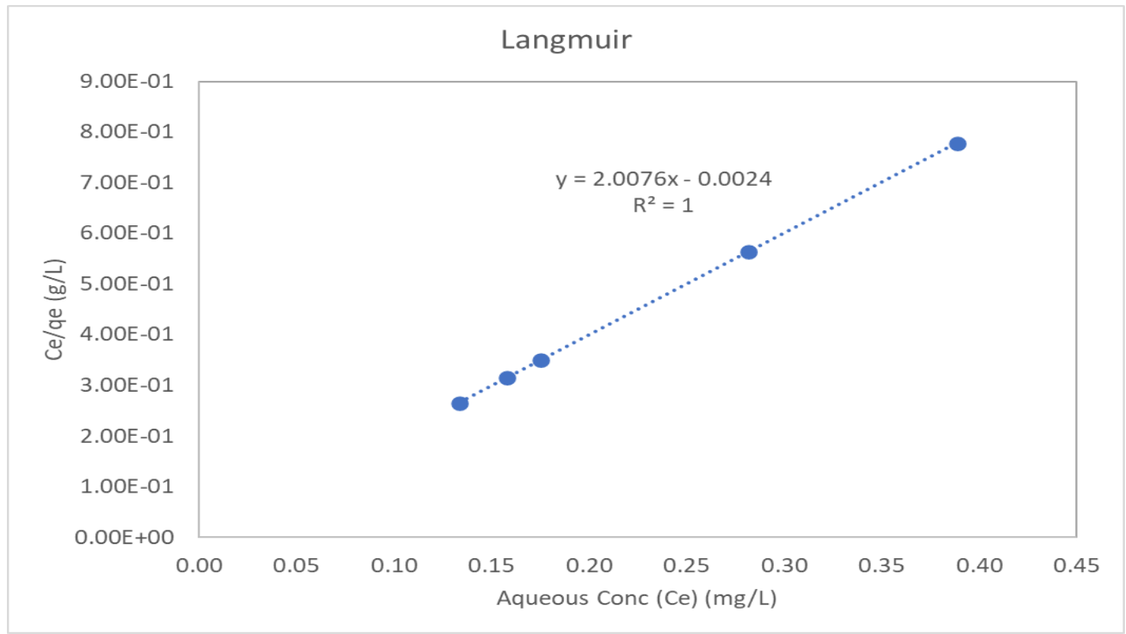

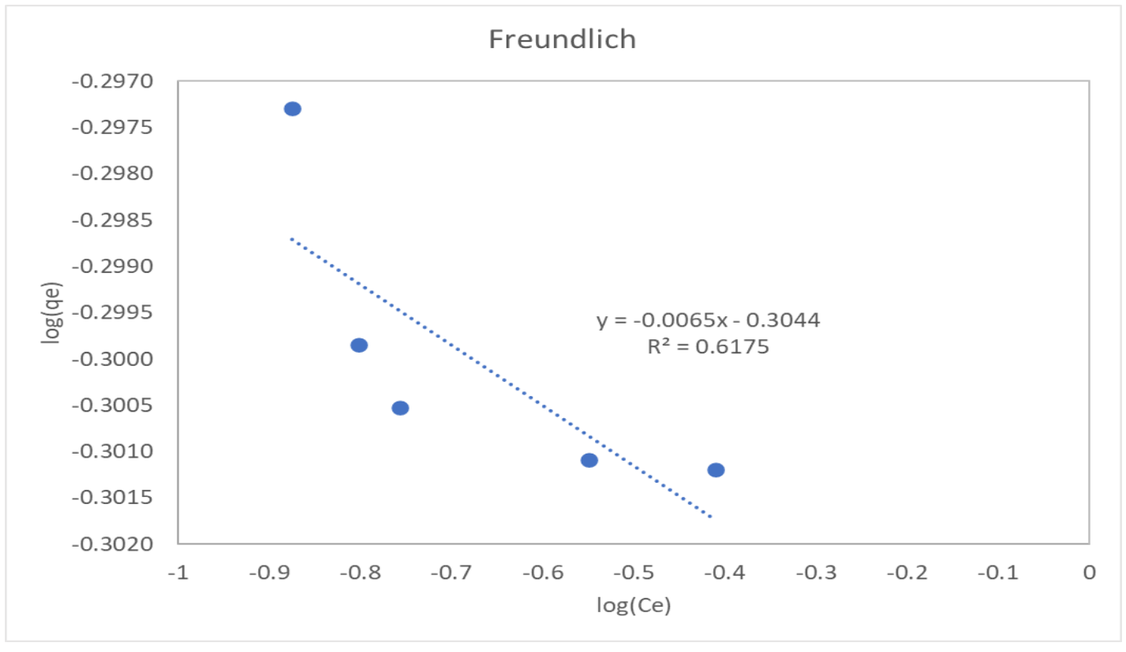

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TITLE
AW-19 BARIUM PARTITION COEFFICIENTS

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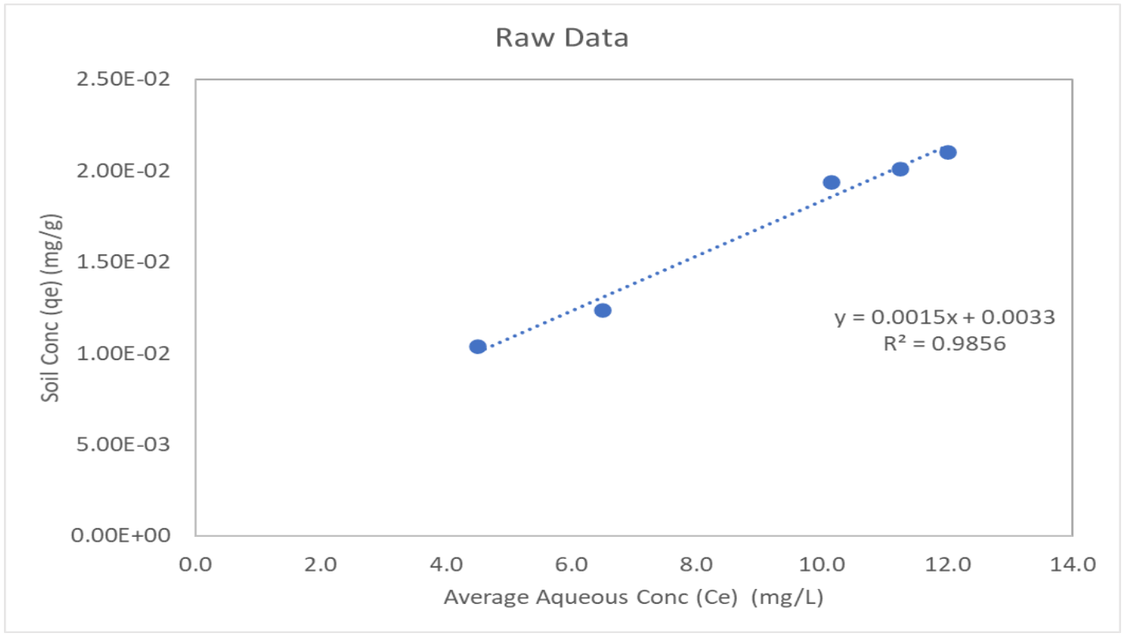

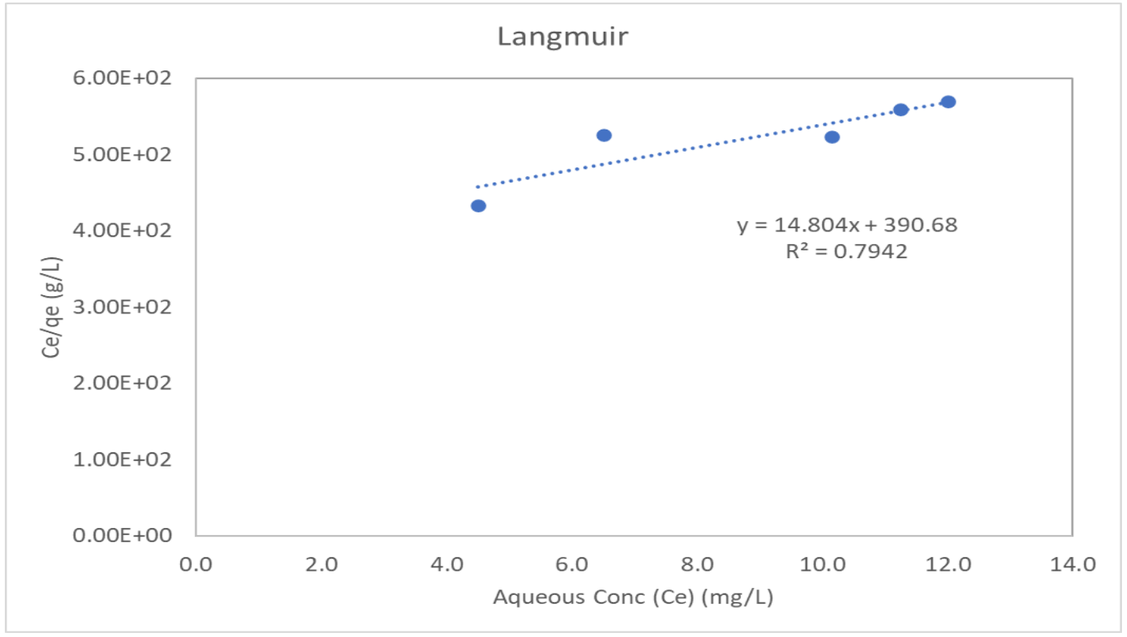

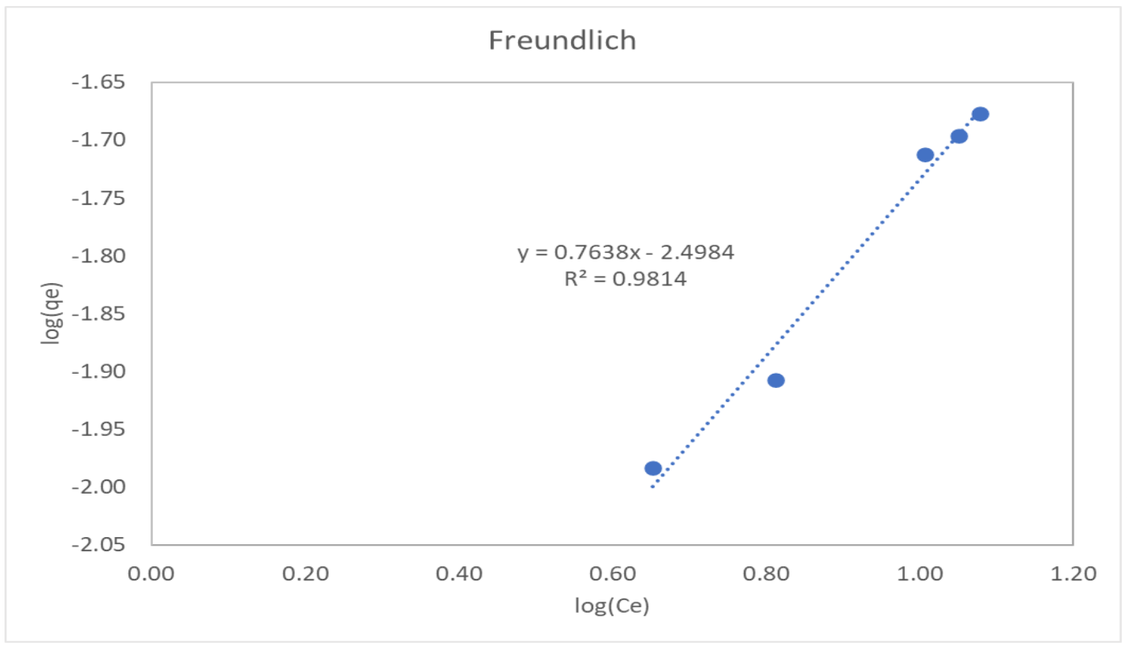

Note(s):
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mg/g: milligrams per gram
g/L: grams per liter
Ce: aqueous concentration of the adsorbate

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TITLE
AW-15S BORON PARTITION COEFFICIENTS

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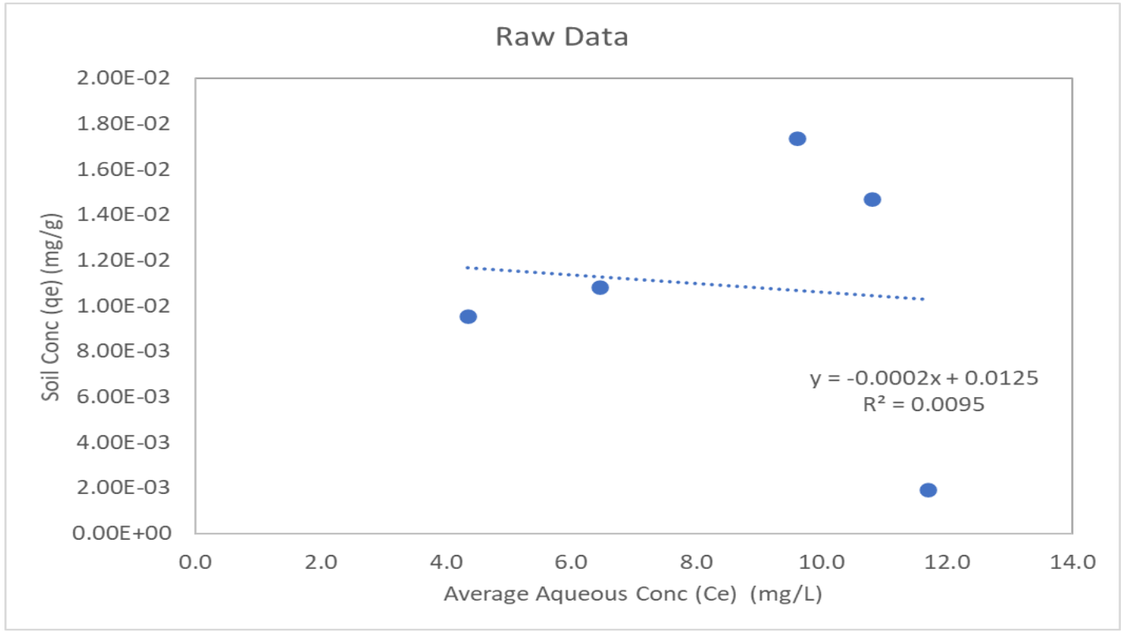

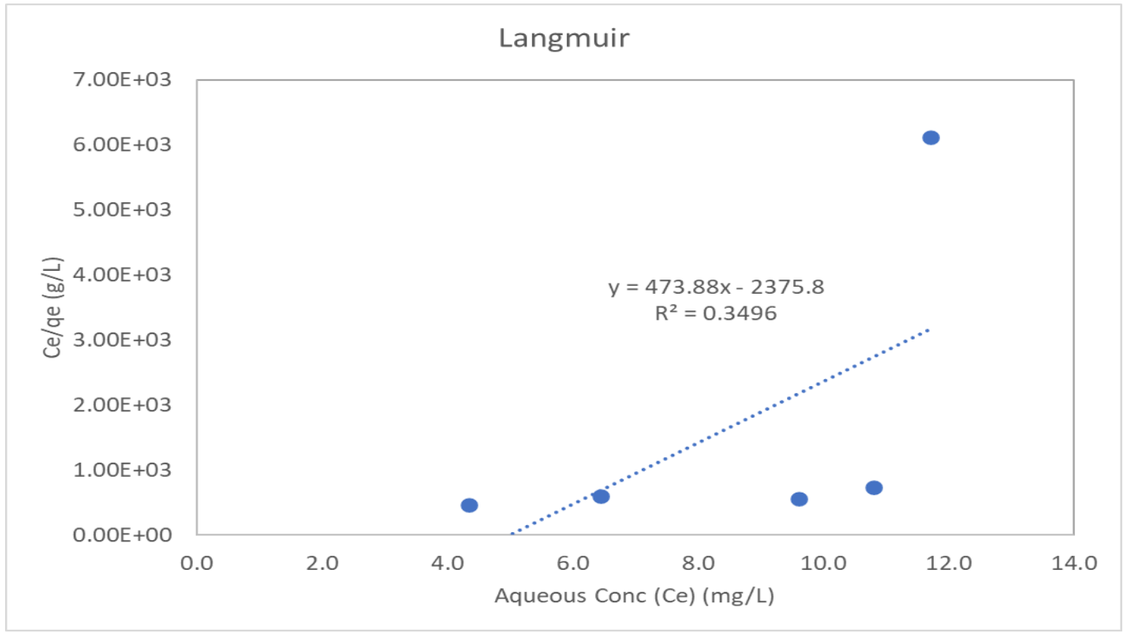

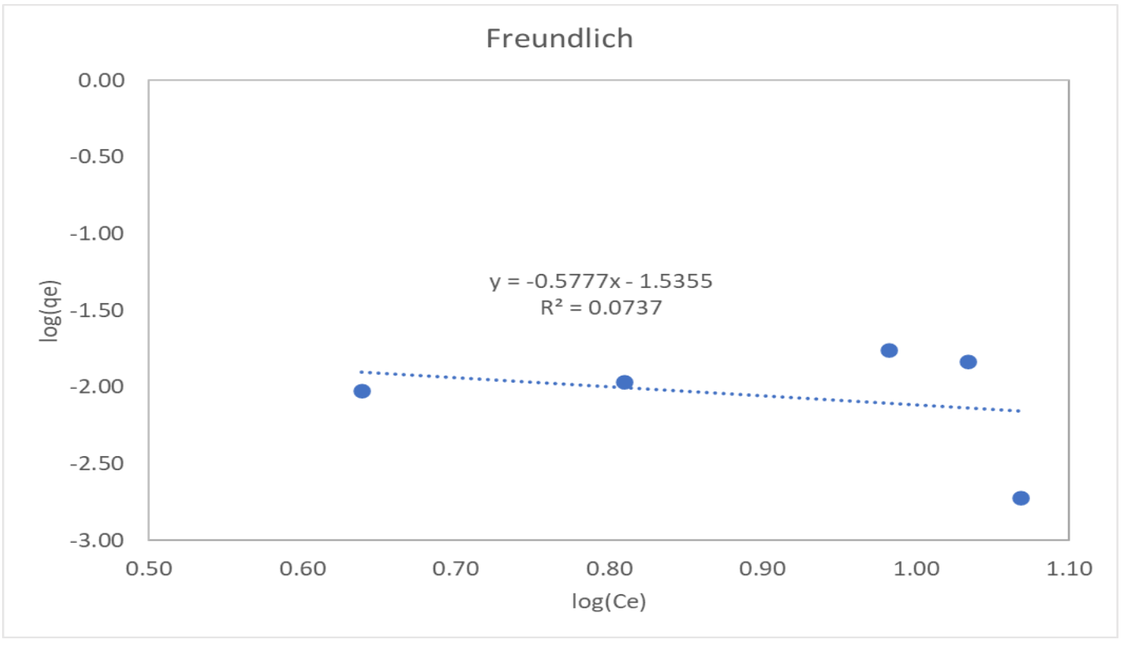

Note(s):
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g/L: grams per liter
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TITLE
AW-19 BORON PARTITION COEFFICIENTS

PROJECT NO.	PHASE	REV.	FIGURE
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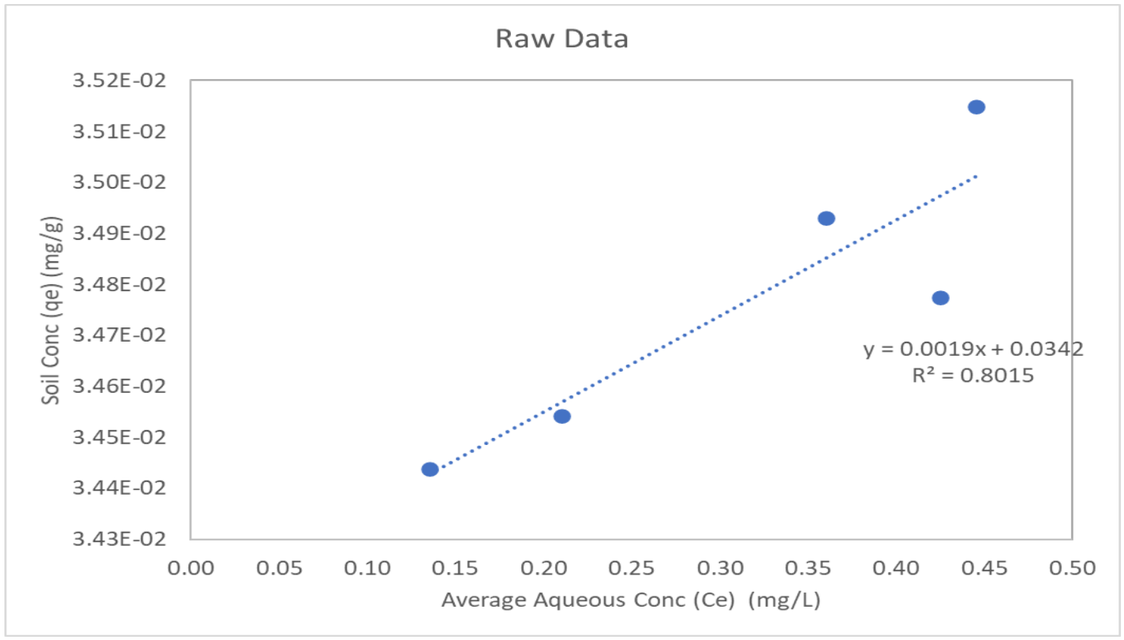

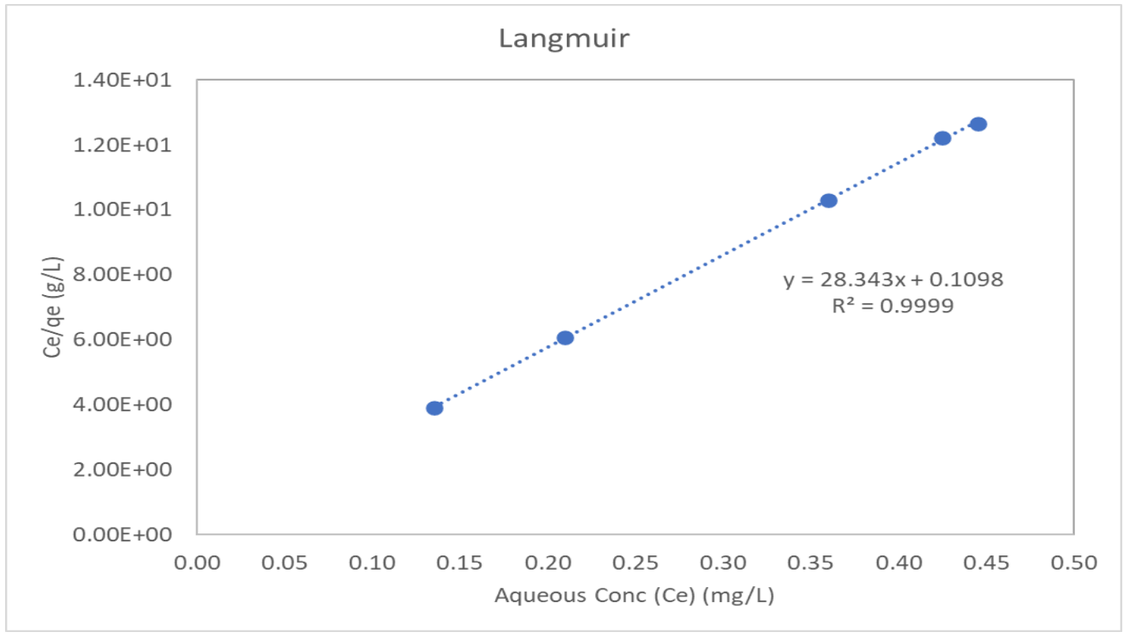

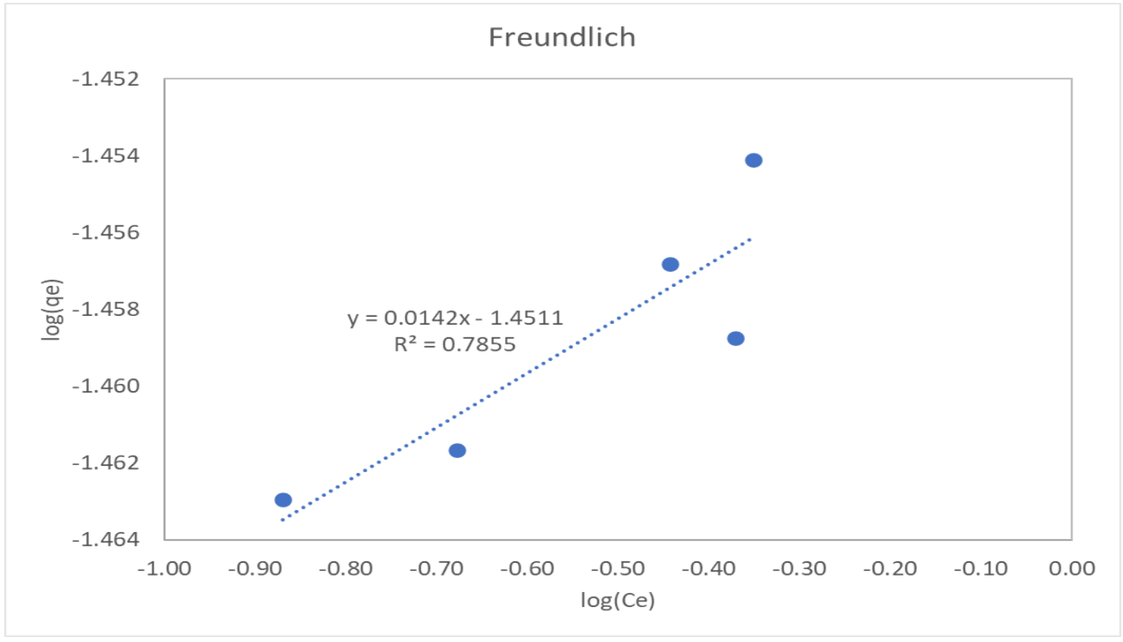

Note(s):
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mg/g: milligrams per gram
g/L: grams per liter
Ce: aqueous concentration of the adsorbate

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TITLE
AW-15S LITHIUM PARTITION COEFFICIENTS

PROJECT NO.	PHASE	REV.	FIGURE
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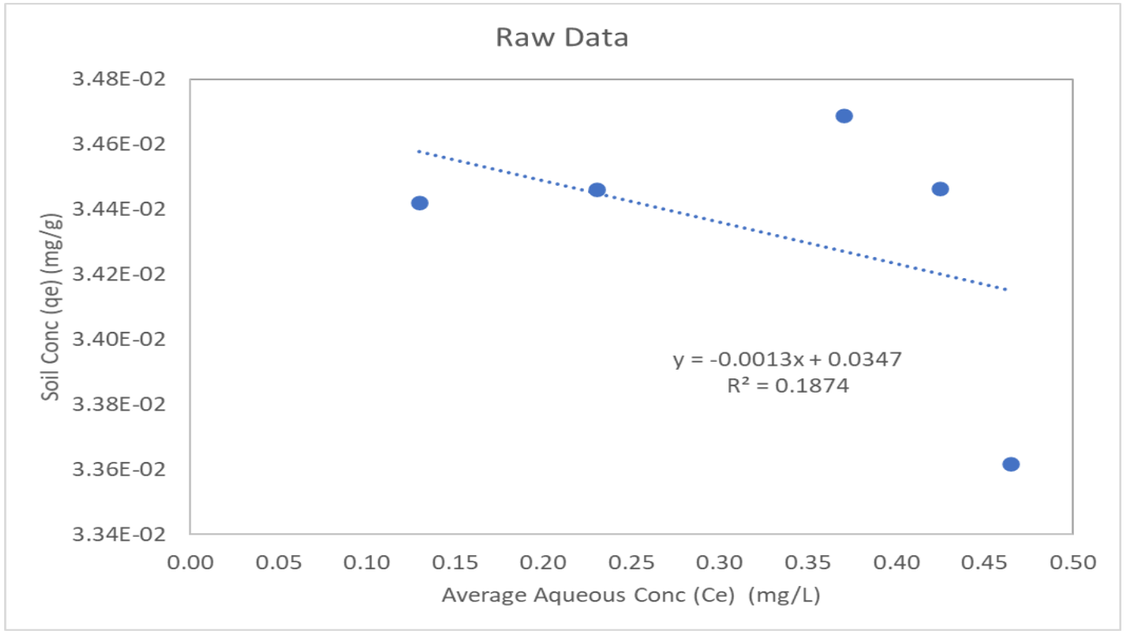

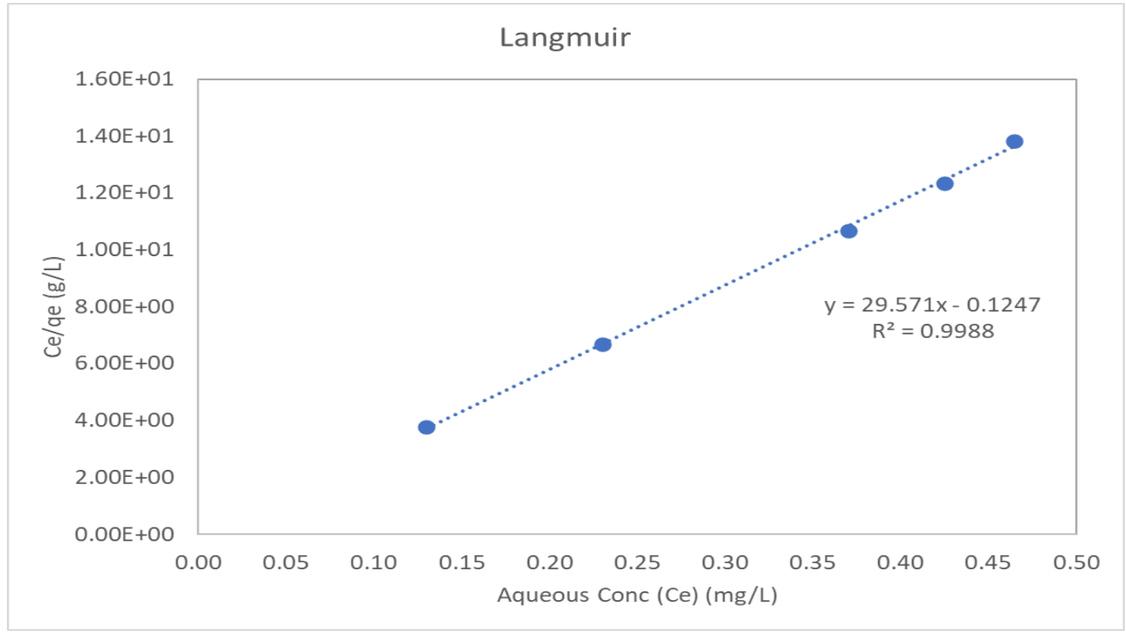

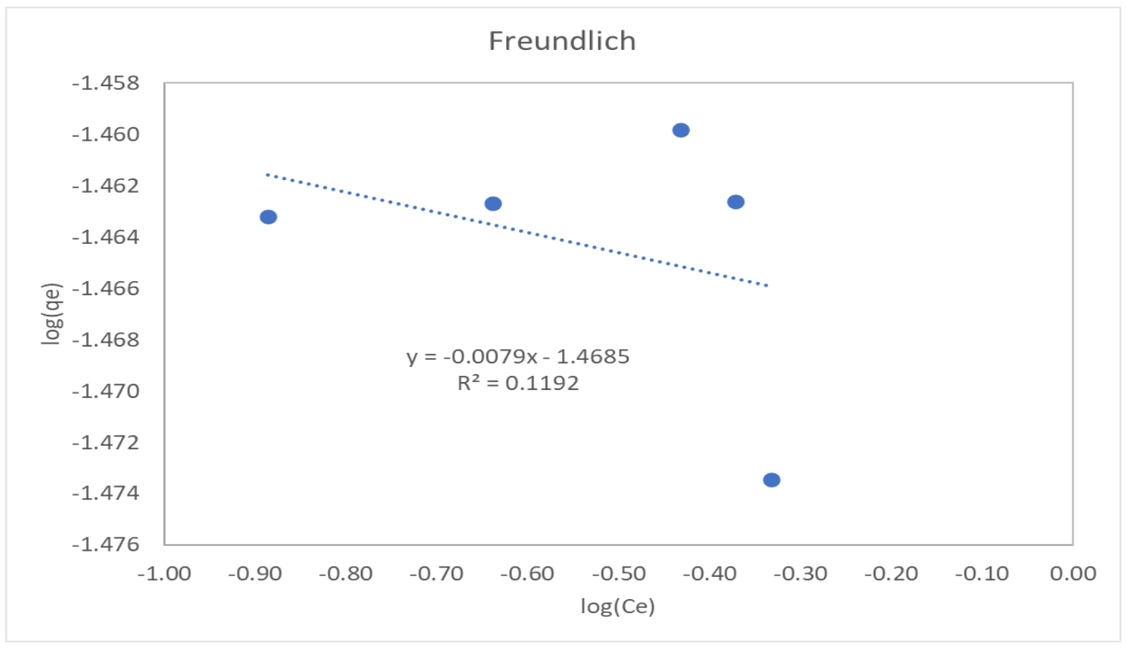

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mg/g: milligrams per gram
g/L: grams per liter
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EVALUATION OF PARTITION COEFFICIENT RESULTS EAP

TITLE
AW-19 LITHIUM PARTITION COEFFICIENTS

PROJECT NO.	PHASE	REV.	FIGURE
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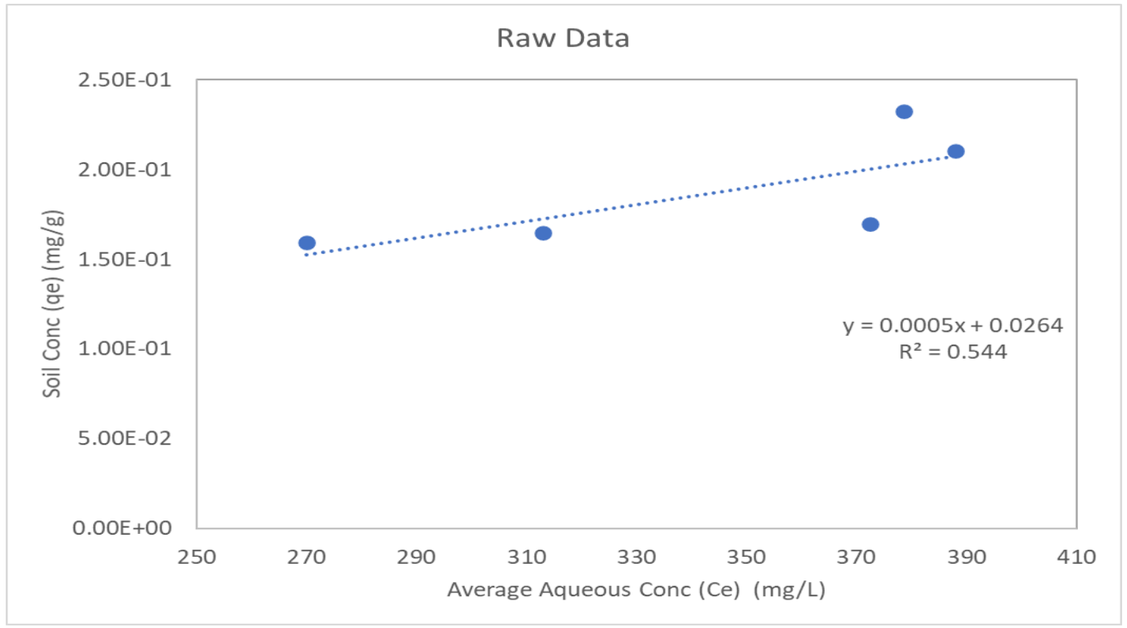

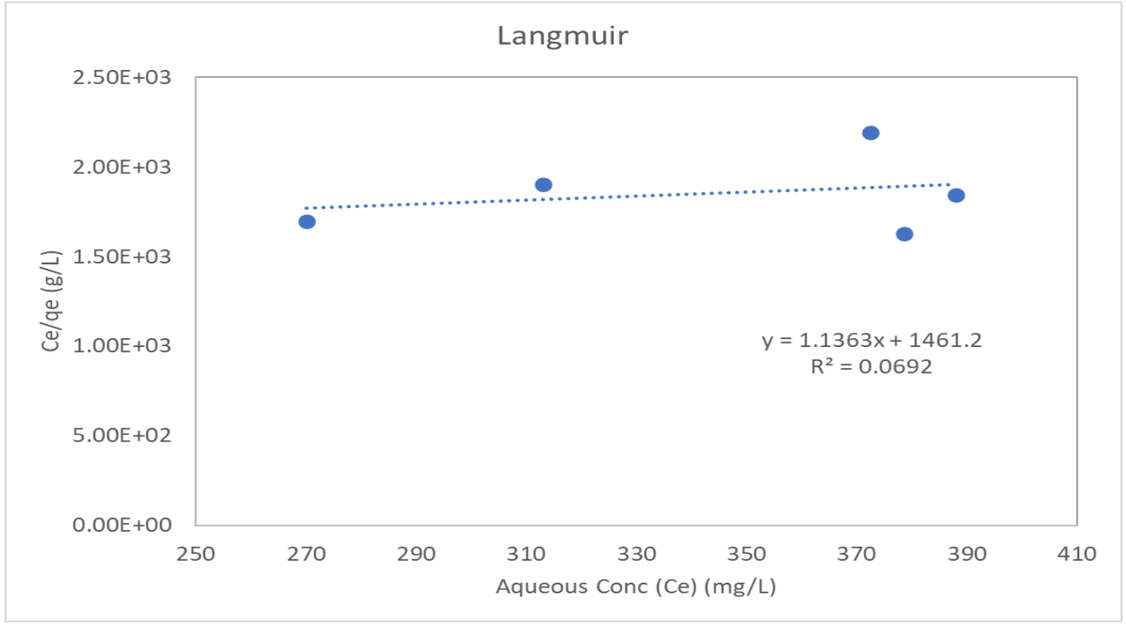

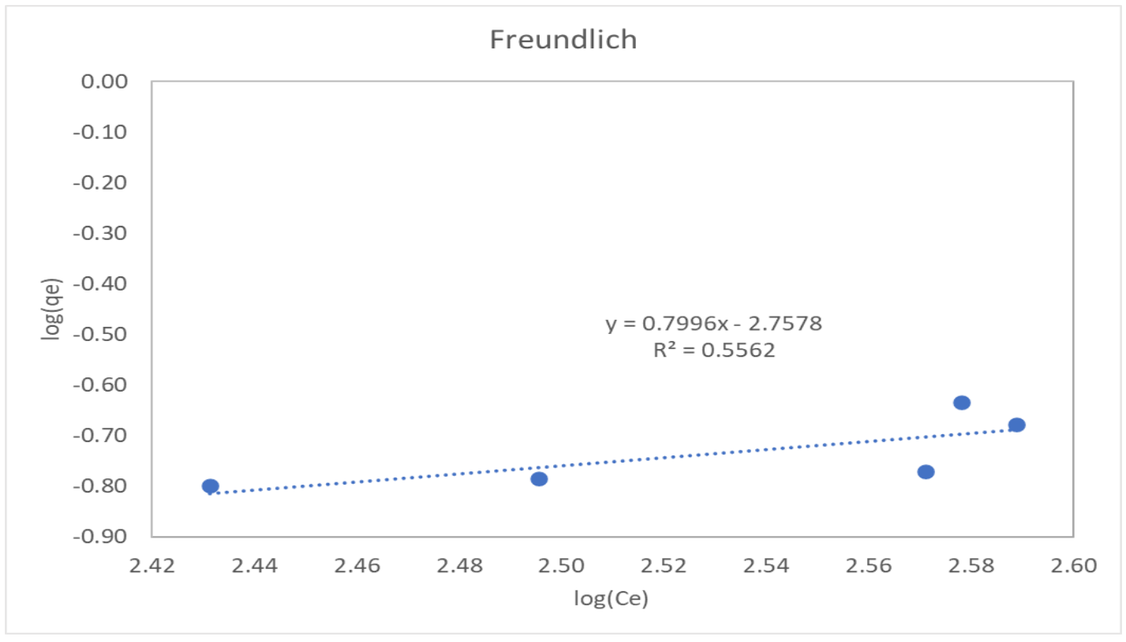

Note(s):
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g/L: grams per liter
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PROJECT
EVALUATION OF PARTITION COEFFICIENT RESULTS EAP

TITLE
AW-15S SULFATE PARTITION COEFFICIENTS

PROJECT NO.	PHASE	REV.	FIGURE
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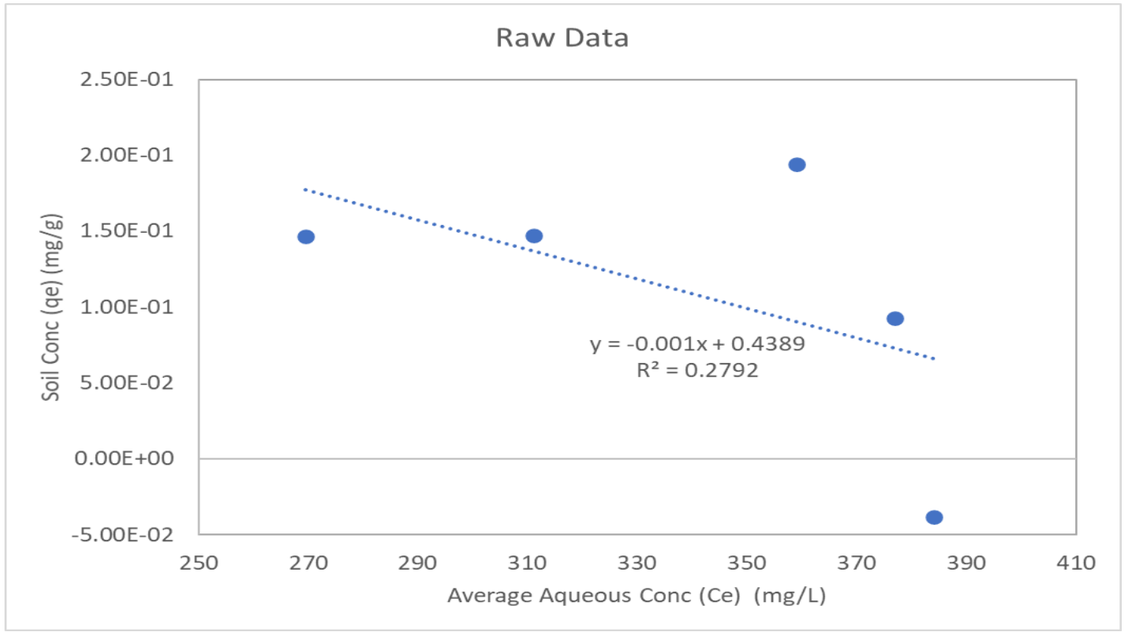

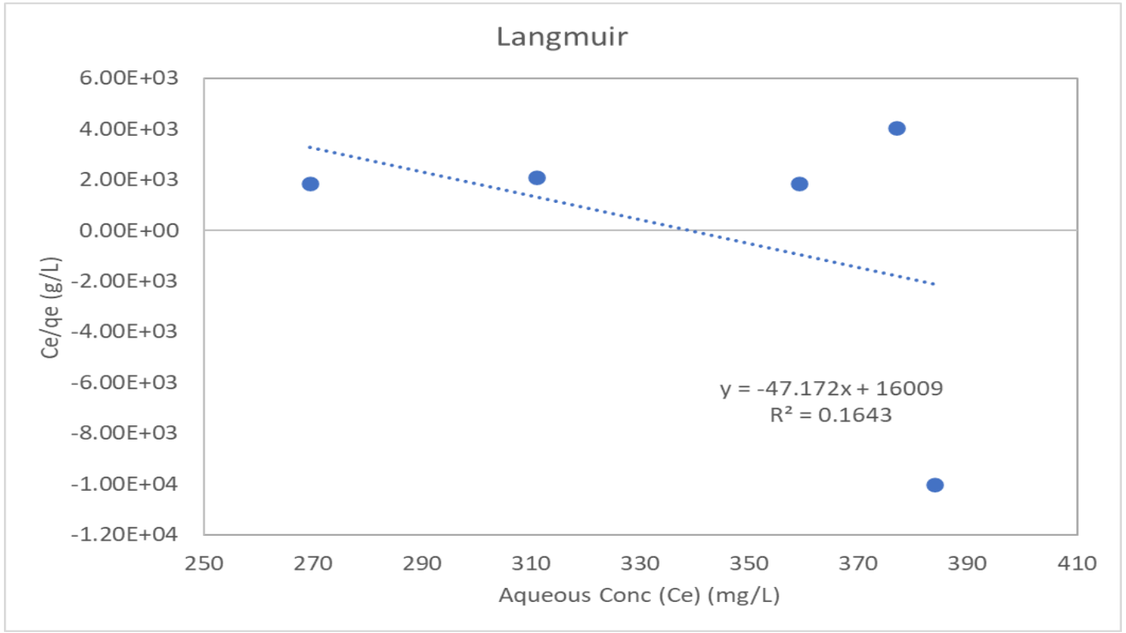

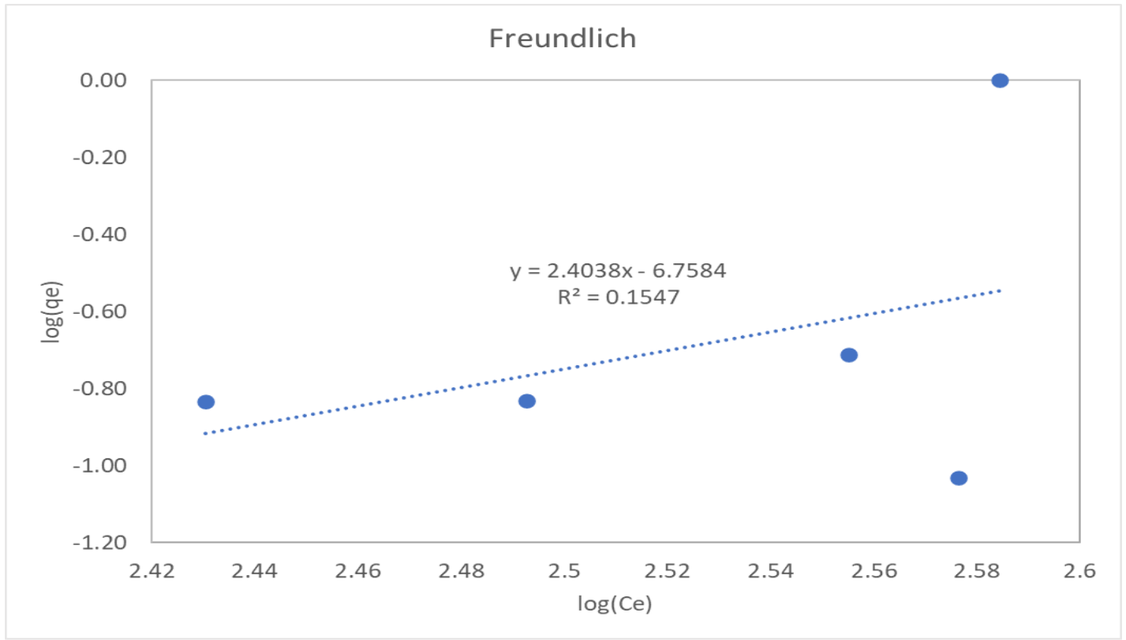

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g/L: grams per liter
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CLIENT
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PROJECT
EVALUATION OF PARTITION COEFFICIENT RESULTS EAP

TITLE
AW-19 SULFATE PARTITION COEFFICIENTS

PROJECT NO.	PHASE	REV.	FIGURE
21454831	002	0	A-8

SIREM
ATTN: Michael Healey
130 Stone Road West
Guelph ON N1G 3Z2

Date Received: 21-JAN-22
Report Date: 25-JAN-22 15:02 (MT)
Version: FINAL

Client Phone: 519-822-2265

Certificate of Analysis

Lab Work Order #: L2680648

Project P.O. #: NOT SUBMITTED
Job Reference: EDWARDS MNA
C of C Numbers:
Legal Site Desc:



Gayle Braun
Senior Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2680648-1 AW-15S-1 Sampled By: J.L. on 21-JAN-22 @ 09:00 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.069	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	12.5	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.49	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	395	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-2 AW-15S-2 Sampled By: J.L. on 21-JAN-22 @ 09:15 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.074	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	12.5	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.48	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	392	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-3 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 2:1-1 Sampled By: J.L. on 21-JAN-22 @ 09:30 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.385	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	4.6	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.15	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	266	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-4 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 2:1-2 Sampled By: J.L. on 21-JAN-22 @ 09:45 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.319	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	4.4	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.12	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	274	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-5 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 1:1-1 Sampled By: J.L. on 21-JAN-22 @ 10:00 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.227	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	6.5	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.21	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	313	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-6 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 1:5-1 Sampled By: J.L. on 21-JAN-22 @ 10:30 Matrix:							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2680648-6 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 1:5-1 Sampled By: J.L. on 21-JAN-22 @ 10:30 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.133	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	10.0	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.36	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	375	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-7 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 1:5-2 Sampled By: J.L. on 21-JAN-22 @ 10:45 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.121	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	10.3	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.36	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	370	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-8 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 1:10-1 Sampled By: J.L. on 21-JAN-22 @ 11:00 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.117	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	11.0	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.42	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	382	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-9 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 1:10-2 Sampled By: J.L. on 21-JAN-22 @ 11:15 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.110	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	11.5	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.43	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	375	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-10 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 1:20-1 Sampled By: J.L. on 21-JAN-22 @ 11:30 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.098	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	12.1	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.45	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	393	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-11 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 1:20-2 Sampled By: J.L. on 21-JAN-22 @ 11:45 Matrix:							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2680648-11 E-SB-05 (SSZ/UA) (30.0-33.5) : AW-15S 1:20-2 Sampled By: J.L. on 21-JAN-22 @ 11:45 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.114	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	11.9	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.44	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	383	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-12 AW-19-1 Sampled By: J.L. on 21-JAN-22 @ 12:00 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.048	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	11.9	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.48	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	375	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-13 AW-19-2 Sampled By: J.L. on 21-JAN-22 @ 12:15 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.049	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	12.1	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.51	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	390	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-14 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 2:1-1 Sampled By: J.L. on 21-JAN-22 @ 12:30 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.268	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	4.3	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.11	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	270	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-15 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 2:1-2 Sampled By: J.L. on 21-JAN-22 @ 12:45 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.510	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	4.4	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.15	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	269	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-16 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:1-1 Sampled By: J.L. on 21-JAN-22 @ 13:00 Matrix:							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2680648-16 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:1-1 Sampled By: J.L. on 21-JAN-22 @ 13:00 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.243	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	6.6	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.24	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	314	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-17 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:1-2 Sampled By: J.L. on 21-JAN-22 @ 13:15 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.321	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	6.3	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.22	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	308	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-18 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:5-1 Sampled By: J.L. on 21-JAN-22 @ 13:30 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.159	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	9.5	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.36	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	358	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-19 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:5-2 Sampled By: J.L. on 21-JAN-22 @ 13:45 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.191	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	9.7	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.38	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	360	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-20 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:10-1 Sampled By: J.L. on 21-JAN-22 @ 14:00 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704658
Barium (Ba)-Dissolved	0.172	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	10.3	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.40	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	365	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-21 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:10-2 Sampled By: J.L. on 21-JAN-22 @ 14:15 Matrix:							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2680648-21 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:10-2 Sampled By: J.L. on 21-JAN-22 @ 14:15 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704656
Barium (Ba)-Dissolved	0.144	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	11.3	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.45	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	389	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-22 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:20-1 Sampled By: J.L. on 21-JAN-22 @ 14:30 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704656
Barium (Ba)-Dissolved	0.112	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	11.9	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.46	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	381	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380
L2680648-23 E-SB-05 (SSZ/UA) (30.0-33.5) : AW19 1:20-2 Sampled By: J.L. on 21-JAN-22 @ 12:45 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					23-JAN-22	R5704656
Barium (Ba)-Dissolved	0.155	DLHC	0.010	mg/L	23-JAN-22	24-JAN-22	R5705380
Boron (B)-Dissolved	11.5	DLHC	1.0	mg/L	23-JAN-22	24-JAN-22	R5705380
Lithium (Li)-Dissolved	0.47	DLHC	0.10	mg/L	23-JAN-22	24-JAN-22	R5705380
Sulfur (S)-Dissolved	387	DLHC	50	mg/L	23-JAN-22	24-JAN-22	R5705380

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2680648-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2680648-21, -22, -23
Matrix Spike	Boron (B)-Dissolved	MS-B	L2680648-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Boron (B)-Dissolved	MS-B	L2680648-21, -22, -23
Matrix Spike	Lithium (Li)-Dissolved	MS-B	L2680648-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Lithium (Li)-Dissolved	MS-B	L2680648-21, -22, -23
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L2680648-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L2680648-21, -22, -23

Sample Parameter Qualifier key listed:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MET-D-CCMS-WT	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L2680648 Report Date: 25-JAN-22

Client: SIREM
130 Stone Road West
Guelph ON N1G 3Z2
Contact: Michael Healey

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R5705380								
WG3687838-4 DUP		**WG3687838-3**						
Barium (Ba)-Dissolved		0.385	0.390		mg/L	1.2	20	24-JAN-22
Boron (B)-Dissolved		4.6	4.5		mg/L	0.1	20	24-JAN-22
Lithium (Li)-Dissolved		0.15	0.14		mg/L	4.5	20	24-JAN-22
Sulfur (S)-Dissolved		266	273		mg/L	2.8	20	24-JAN-22
WG3687839-4 DUP		**WG3687839-3**						
Barium (Ba)-Dissolved		0.144	0.149		mg/L	3.5	20	24-JAN-22
Boron (B)-Dissolved		11.3	11.2		mg/L	1.3	20	24-JAN-22
Lithium (Li)-Dissolved		0.45	0.42		mg/L	6.4	20	24-JAN-22
Sulfur (S)-Dissolved		389	387		mg/L	0.6	20	24-JAN-22
WG3687838-2 LCS								
Barium (Ba)-Dissolved			98.3		%		80-120	24-JAN-22
Boron (B)-Dissolved			94.3		%		80-120	24-JAN-22
Lithium (Li)-Dissolved			108.0		%		80-120	24-JAN-22
Sulfur (S)-Dissolved			103.0		%		80-120	24-JAN-22
WG3687839-2 LCS								
Barium (Ba)-Dissolved			98.4		%		80-120	24-JAN-22
Boron (B)-Dissolved			95.6		%		80-120	24-JAN-22
Lithium (Li)-Dissolved			107.1		%		80-120	24-JAN-22
Sulfur (S)-Dissolved			100.8		%		80-120	24-JAN-22
WG3687838-1 MB								
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	24-JAN-22
Boron (B)-Dissolved			<0.010		mg/L		0.01	24-JAN-22
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	24-JAN-22
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	24-JAN-22
WG3687839-1 MB								
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	24-JAN-22
Boron (B)-Dissolved			<0.010		mg/L		0.01	24-JAN-22
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	24-JAN-22
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	24-JAN-22
WG3687838-5 MS		**WG3687838-6**						
Barium (Ba)-Dissolved			N/A	MS-B	%		-	24-JAN-22
Boron (B)-Dissolved			N/A	MS-B	%		-	24-JAN-22
Lithium (Li)-Dissolved			N/A	MS-B	%		-	24-JAN-22
Sulfur (S)-Dissolved			N/A	MS-B	%		-	24-JAN-22
WG3687839-5 MS		**WG3687839-6**						

Quality Control Report

Client: SIREM
130 Stone Road West
Guelph ON N1G 3Z2
Contact: Michael Healey

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R5705380								
WG3687839-5 MS		**WG3687839-6**						
Barium (Ba)-Dissolved			N/A	MS-B	%		-	24-JAN-22
Boron (B)-Dissolved			N/A	MS-B	%		-	24-JAN-22
Lithium (Li)-Dissolved			N/A	MS-B	%		-	24-JAN-22
Sulfur (S)-Dissolved			N/A	MS-B	%		-	24-JAN-22

Quality Control Report

Workorder: L2680648 Report Date: 25-JAN-22

Client: SIREM
130 Stone Road West
Guelph ON N1G 3Z2
Contact: Michael Healey

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Chain of Custody (COC) / Analytical Request Form

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L2680648-COFC

COC Number: 16 -

Page 1 of 2

Report To	
Company:	SiREM
Contact:	Rachel Hallman, Michael Healey
Address:	130 Stone Rd W Guelph, Ontario, Canada, N1G 3Z2
Phone:	519-822-2265
Invoice To	Same as Report To ☐ Yes ☑ No
	Copy of Invoice with Report ☐ Yes ☑ No
Company:	SiREM
Contact:	Karen Broersma, kbroersma@geosyntec.com
Project Information	
ALS Quote #:	
Job #:	Edwards MNA
PO / AFE:	
LSD:	
ALS Lab Work Order # (lab use only)	L2680648

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☐ Yes ☐ No
☐ Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	rhallman@siremlab.com
Email 2	mhealey@siremlab.com
Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	accountspayablecan@siremlab.com
Email 2	
Oil and Gas Required Fields (client use)	
Approver ID:	Cost Center:
GL Account:	Routing Code
Activity Code:	
Location:	
ALS Contact:	Gayle Braun
Sampler:	J. Linkletter

R ☐ Regular (Standard TAT if received by 3 pm - business days) - No surcharge applied (Rush Turnaround Time (TAT) is not available for all tests)
P ☑ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge
Specify Date Required for E2,E or P:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	F/P Dissolved Metals (incl. B, Li, Ba and S)	Number of Containers
	AW-15S-1	21-Jan-22	9:00	Water	P	1
	AW-15S-2	21-Jan-22	9:15	Water	P	1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 2:1-1	21-Jan-22	9:30	Water	P	1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 2:1-2	21-Jan-22	9:45	Water	P	1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 1:1-1	21-Jan-22	10:00	Water	P	1
	~~E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 1:1-2~~	~~21-Jan-22~~	~~10:15~~	~~Water~~	~~P~~	~~1~~
	E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 1:5-1	21-Jan-22	10:30	Water	P	1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 1:5-2	21-Jan-22	10:45	Water	P	1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 1:10-1	21-Jan-22	11:00	Water	P	1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 1:10-2	21-Jan-22	11:15	Water	P	1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 1:20-1	21-Jan-22	11:30	Water	P	1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW-15S 1:20-2	21-Jan-22	11:45	Water	P	1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ Yes ☑ No

Are samples for human drinking water use? ☐ Yes ☑ No

Special Instructions / Specify Criteria to add on report (client Use)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐				
Ice packs	Yes ☑	No ☐	SIF Observations	Yes ☐	No ☐
Cooling Initiated	☐		Custody seal intact	Yes ☐	No ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			4.4		

SHIPMENT RELEASE (client use)

Released by:	Date:	Time:
	21 Jan 22	5:30 PM

INITIAL SHIPMENT RECEPTION (lab use only)

Received by:	Date:	Time:

FINAL SHIPMENT RECEPTION (lab use only)

Received by:	Date:	Time:
	21/01/22	18:32

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

L2680648-COFC

COC Number: 16 -

Report To		**Report Format / Distribution**	
Company:	SiREM	Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)	
Contact:	Rachel Hallman, Michael Healey	Quality Control (QC) Report with Report ☐ Yes ☐ No	
Address:	130 Stone Rd W Guelph, Ontario, Canada, N1G 3Z2	☐ Criteria on Report - provide details below if box checked Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
Phone:	519-822-2265	Email 1 or Fax rhallman@siremlab.com	
		Email 2 mhealey@siremlab.com	
Invoice To	Same as Report To ☐ Yes ☑ No	**Invoice Distribution**	
	Copy of Invoice with Report ☐ Yes ☑ No	Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX	
Company:	SiREM	Email 1 or Fax accountspayablecan@siremlab.com	
Contact:	Karen Broersma, kbroersma@geosyntec.com	Email 2	
Project Information		**Oil and Gas Required Fields (client use)**	
ALS Quote #:		Approver ID:	Cost Center:
Job #:	Edwards MNA	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	L2680648-COFC	**ALS Contact:** Gayle Braun	**Sampler:** J. Linkletter

Turnaround Time (TAT) Option (Rush Turnaround Time (TAT) is not available for all tests)

- R ☐ [illegible] if received by 3 pm - business days)
- P ☑ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
- E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
- E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge

Specify Date Required for E2,E or P:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	F/P	Dissolved Metals (incl. B, Li, Ba and S)	Number of Containers
	AW-19-1	21-Jan-22	12:00	Water	P		1
	AW-19-2	21-Jan-22	12:15	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 2:1-1	21-Jan-22	12:30	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 2:1-2	21-Jan-22	12:45	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 1:1-1	21-Jan-22	13:00	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 1:1-2	21-Jan-22	13:15	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 1:5-1	21-Jan-22	13:30	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 1:5-2	21-Jan-22	13:45	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 1:10-1	21-Jan-22	14:00	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 1:10-2	21-Jan-22	14:15	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 1:20-1	21-Jan-22	14:30	Water	P		1
	E-SB-05 (SSZ/UA) (30.0-33.5): AW19 1:20-2	21-Jan-22	14:45	Water	P		1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ Yes ☑ No

Are samples for human drinking water use? ☐ Yes ☑ No

Special Instructions / Specify Criteria to add on report (client Use)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice packs Yes ☒ No ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			19.4		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time: 5:30 pm	Received by:	Date:	Time:	Received by:	Date: 01/21/22	Time: 18 30

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION WHITE - LABORATORY COPY YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

SIREM
ATTN: Michael Healey
130 Stone Road West
Guelph ON N1G 3Z2

Date Received: 15-JAN-22
Report Date: 18-JAN-22 09:03 (MT)
Version: FINAL

Client Phone: 519-822-2265

Certificate of Analysis

Lab Work Order #: L2679139

Project P.O. #: NOT SUBMITTED
Job Reference: EDWARDS
C of C Numbers:
Legal Site Desc:



Gayle Braun
Senior Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2679139-1 AW-15S-1A Sampled By: R.S. on 14-JAN-22 @ 15:00 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					16-JAN-22	R5697192
Barium (Ba)-Dissolved	0.307	DLHC	0.010	mg/L	16-JAN-22	17-JAN-22	R5697850
Boron (B)-Dissolved	12.4	DLHC	1.0	mg/L	16-JAN-22	17-JAN-22	R5697850
Lithium (Li)-Dissolved	0.47	DLHC	0.10	mg/L	16-JAN-22	17-JAN-22	R5697850
Sulfur (S)-Dissolved	390	DLHC	50	mg/L	16-JAN-22	17-JAN-22	R5697850
L2679139-2 AW-15S-2A Sampled By: R.S. on 14-JAN-22 @ 15:15 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					16-JAN-22	R5697192
Barium (Ba)-Dissolved	0.355	DLHC	0.010	mg/L	16-JAN-22	17-JAN-22	R5697850
Boron (B)-Dissolved	12.7	DLHC	1.0	mg/L	16-JAN-22	17-JAN-22	R5697850
Lithium (Li)-Dissolved	0.48	DLHC	0.10	mg/L	16-JAN-22	17-JAN-22	R5697850
Sulfur (S)-Dissolved	397	DLHC	50	mg/L	16-JAN-22	17-JAN-22	R5697850
L2679139-3 AW-19-1A Sampled By: R.S. on 14-JAN-22 @ 15:30 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					16-JAN-22	R5697192
Barium (Ba)-Dissolved	0.220	DLHC	0.010	mg/L	16-JAN-22	17-JAN-22	R5697850
Boron (B)-Dissolved	11.6	DLHC	1.0	mg/L	16-JAN-22	17-JAN-22	R5697850
Lithium (Li)-Dissolved	0.46	DLHC	0.10	mg/L	16-JAN-22	17-JAN-22	R5697850
Sulfur (S)-Dissolved	386	DLHC	50	mg/L	16-JAN-22	17-JAN-22	R5697850
L2679139-4 AW-19-2A Sampled By: R.S. on 14-JAN-22 @ 15:45 Matrix: WATER							
Dissolved Metals							
Dissolved Metals Filtration Location	FIELD					16-JAN-22	R5697192
Barium (Ba)-Dissolved	0.273	DLHC	0.010	mg/L	16-JAN-22	17-JAN-22	R5697850
Boron (B)-Dissolved	11.9	DLHC	1.0	mg/L	16-JAN-22	17-JAN-22	R5697850
Lithium (Li)-Dissolved	0.45	DLHC	0.10	mg/L	16-JAN-22	17-JAN-22	R5697850
Sulfur (S)-Dissolved	380	DLHC	50	mg/L	16-JAN-22	17-JAN-22	R5697850

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L2679139-1, -2, -3, -4
Matrix Spike	Boron (B)-Dissolved	MS-B	L2679139-1, -2, -3, -4
Matrix Spike	Lithium (Li)-Dissolved	MS-B	L2679139-1, -2, -3, -4
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L2679139-1, -2, -3, -4

Sample Parameter Qualifier key listed:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MET-D-CCMS-WT	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: SIREM
130 Stone Road West
Guelph ON N1G 3Z2
Contact: Michael Healey

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-WT	**Water**							
Batch R5697850								
WG3685604-4 DUP		**WG3685604-3**						
Barium (Ba)-Dissolved		0.307	0.321		mg/L	4.3	20	17-JAN-22
Boron (B)-Dissolved		12.4	12.6		mg/L	1.3	20	17-JAN-22
Lithium (Li)-Dissolved		0.47	0.45		mg/L	4.5	20	17-JAN-22
Sulfur (S)-Dissolved		390	392		mg/L	0.7	20	17-JAN-22
WG3685604-2 LCS								
Barium (Ba)-Dissolved			103.3		%		80-120	17-JAN-22
Boron (B)-Dissolved			94.5		%		80-120	17-JAN-22
Lithium (Li)-Dissolved			99.4		%		80-120	17-JAN-22
Sulfur (S)-Dissolved			98.7		%		80-120	17-JAN-22
WG3685604-1 MB								
Barium (Ba)-Dissolved			<0.00010		mg/L		0.0001	17-JAN-22
Boron (B)-Dissolved			<0.010		mg/L		0.01	17-JAN-22
Lithium (Li)-Dissolved			<0.0010		mg/L		0.001	17-JAN-22
Sulfur (S)-Dissolved			<0.50		mg/L		0.5	17-JAN-22
WG3685604-5 MS		**WG3685604-6**						
Barium (Ba)-Dissolved			N/A	MS-B	%		-	17-JAN-22
Boron (B)-Dissolved			N/A	MS-B	%		-	17-JAN-22
Lithium (Li)-Dissolved			N/A	MS-B	%		-	17-JAN-22
Sulfur (S)-Dissolved			N/A	MS-B	%		-	17-JAN-22

Quality Control Report

Workorder: L2679139 Report Date: 18-JAN-22

Client: SIREM
130 Stone Road West
Guelph ON N1G 3Z2
Contact: Michael Healey

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

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Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Chain of Custody (COC) / Analytical Request Form

COC Number: 16 -

Page 1 of 1

Canada Toll Free: 1 800 668 987

here

L2679139-COFC

www.alsglobal.com

Report To		Report Format / Distribution	
Company:	SiREM	Select Report Format:	
Contact:	Rachel Hallman, Michael Healey	Quality Control (QC) Report with Report	☐ Yes ☐ No
Address:	130 Research Lane, Suite 2 Guelph, Ontario, Canada, N1G 5G3	☐ Criteria on Report - provide details below if box checked	
Phone:	519-822-2265	Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
		Email 1 or Fax	rhallman@siremlab.com
		Email 2	mhealey@siremlab.com
Invoice To	Same as Report To ☐ Yes ☐ No	**Invoice Distribution**	
	Copy of Invoice with Report ☐ Yes ☐ No	Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Company:	SiREM	Email 1 or Fax	kbroersma@geosyntec.com
Contact:	Karen Broersma, kbroersma@geosyntec.com	Email 2	
Project Information		**Oil and Gas Required Fields (client use)**	
ALS Quote #:		Approver ID:	Cost Center:
Job #:	Edwards	GL Account	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)	L2679139	**ALS Contact:**	**Sampler:** Rita Schofield

Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)

- (standard TAT if received by 3 pm - business days)
- P ☑ Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
- E ☐ Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
- E2 ☐ Same day or weekend emergency - contact ALS to confirm TAT and surcharge

Specify Date Required for E2,E or P:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	F/P	Dissolved Metals (incl. B, SO4, Li, Ba, Cl & analysis)	Number of Containers
	AW-15S-1a	14-Jan-22	3:00	Water	P		1
	AW-15S-2a	14-Jan-22	3:15	Water	P		1
	AW-19-1a	14-Jan-22	3:30	Water	P		1
	AW-19-2a	14-Jan-22	3:45	Water	P		1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ Yes ☑ No

Are samples for human drinking water use? ☐ Yes ☑ No

Special Instructions / Specify Criteria to add on report (client Use)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐ No ☐
Ice packs	Yes ☑ No ☐	Custody seal intact	Yes ☐ No ☐
Cooling Initiated	☐		

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by	Date	Time
	14Jan22	4:00pm					Jan 15/22	8:00

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0326e v09 Front/04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form.**

NATURE & EXTENT REPORT ADDENDUM

Intended for
Illinois Power Resources Generating, LLC
7800 Cilco Lane
Bartonville, Illinois 61607

Date
June 2, 2025

Project No.
1940110241-003

NATURE AND EXTENT REPORT ADDENDUM

EDWARDS POWER PLANT, ASH POND, IEPA ID NO. W1438050005-01

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NATURE AND EXTENT REPORT ADDENDUM
EDWARDS POWER PLANT, ASH POND, IEPA ID NO. W1438050005-01

Project name	**Edwards Power Plant Ash Pond**
Project no.	**1940110241-003**
Recipient	**Illinois Power Resources Generating, LLC**
Document type	**Nature and Extent Report Addendum**
Revision	**Final**
Date	**June 2, 2025**
Prepared by	**Alison O'Connor and Nathaniel Keller**
Checked by	**Lauren Cook**
Approved by	**Brian Hennings**

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

T 414-837-3607
F 414-837-3608
https://ramboll.com



Alison O'Connor, PhD
Geochemist



Nathaniel R. Keller
Senior Technical Manager, Hydrogeology



Brian G. Hennings, PG
Project Officer, Hydrogeology

CONTENTS

1.	**Introduction**	**3**
2.	**Additional Investigation Results**	**5**
2.1	Geology	5
2.2	Hydrogeology	6
2.2.1	Field Hydraulic Conductivities	6
2.2.2	Laboratory Hydraulic Conductivities	6
2.3	Hydrogeologic Conceptual Site Model	6
3.	**Conclusions**	**9**
4.	**References**	**10**

TABLES (ATTACHED)

Table 2-1 Horizontal Hydraulic Gradients and Groundwater Flow Velocities

FIGURES (ATTACHED)

Figure 1-1 Investigation Locations

APPENDICES

Appendix A Technical Memorandum: Summary of Investigation Work Completed in September and October 2024

ACRONYMS AND ABBREVIATIONS

35 I.A.C.	Title 35 of the Illinois Administrative Code
AP	Ash Pond
BCU	bedrock confining unit
CCR	coal combustion residuals
cm/s	centimeters per second
CSM	conceptual site model
E001	Event 1
E002	Event 2
E003	Event 3
EPP	Edwards Power Plant
GMR	Groundwater Modeling Report
GWPS	groundwater protection standard
HCR	Hydrogeologic Site Characterization Report
HSU	hydrostratigraphic unit
IEPA	Illinois Environmental Protection Agency
Kd	soil adsorption coefficient
mL/g	milliliters per gram
NAVD88	North American Vertical Datum 1988
PMP	potential migration pathway
SI	surface impoundment
UA	uppermost aquifer
UCF	Upper Cahokia Formation
US	United States

1. INTRODUCTION

Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845.650(d)(1) requires the owner or operator of a coal combustion residuals (CCR) surface impoundment (SI) to characterize the nature and extent of a release and relevant site conditions that may affect the remedy ultimately selected for a CCR SI if any constituent regulated under 35 I.A.C. § 845 is found to exceed the groundwater protection standard (GWPS). A report documenting the nature and extent of constituents detected above the GWPS that are attributable to the Edwards Power Plant (EPP) Ash Pond (AP) was prepared and submitted to the Illinois Environmental Protection Agency (IEPA) dated June 4, 2024 [1]. Additional investigation to further characterize the nature and extent as described in the Nature and Extent Report was performed in 2024 following the submittal of the Report.

The additional investigation to evaluate the nature and extent included the following (**Figure 1-1**):

- Advancement of two borings (TPZ-100 and TPZ-101) and installation of temporary piezometers along the west side of the AP to determine whether potential migration pathways (PMPs) are present.
- Advancement of three borings within the AP (TPZX-200, TPZX-201, and TPZ-XP03) and collection of Shelby tubes from two locations (TPZX-200 and TPZ-XP03) at the base of the CCR for laboratory hydraulic conductivity testing.
- Completion of slug tests within wells and temporary piezometers screened within the Upper Cahokia Formation (UCF) to further characterize the hydraulic conductivity of the geologic material surrounding the AP.

As discussed in the Nature and Extent Report, the following exceedances[1] of the GWPS were identified at compliance groundwater wells in the following hydrostratigraphic units (HSUs):

- Uppermost aquifer (UA) Exceedances:
  - Boron at AW-05, AW-19, and AW-21
- UCF/PMP Exceedances:
  - Boron at AP07S and AW-15S
  - Sulfate at AW-15S

Supplemental data for monitoring wells APW-01, AW-20, AW-23, and EMW-05 was provided for the first, second, and third quarterly monitoring events (E001, E002, and E003) as part of on-going nature and extent characterization activities consistent with 35 I.A.C. § 845.650(d)(1) at the EPP AP. The following supplemental GWPS potential exceedance was included in the Nature and Extent Report [1]:

[1] Throughout this document, "exceedance" or "exceedances" is intended to refer only to potential exceedances of proposed applicable background statistics or GWPSs as described in the proposed groundwater monitoring plan, which was submitted to the IEPA on October 25, 2021 as part of Illinois Power Resources Generating, LLC's operating permit application for the EPP AP. That operating permit application, including the proposed groundwater monitoring plan, remains under review by the IEPA and, therefore, Illinois Power Resources Generating, LLC has not identified any actual exceedances.

- Detected UA Exceedance:
  - Boron at AW-20

Descriptions of the nature and extent of these parameters and locations was discussed in detail in the Nature and Extent Report [1] and no additional discussion regarding groundwater quality or geochemistry is included in this Addendum. This Addendum only provides additional characterization of the geologic materials surrounding the AP. Documentation of site investigation activities described above and performed during 2024 is included in **Appendix A**. .

2. ADDITIONAL INVESTIGATION RESULTS

2.1 Geology

As previously detailed in the Nature and Extent Report [1], there are two principal layers of unlithified material present above the bedrock in addition to the CCR present at the AP, which are categorized into the HSUs described below (from surface downward) based on stratigraphic relationships, geologic composition, and common hydrogeologic properties.

- **Upper Cahokia Formation (UCF)/Potential Migration Pathway (PMP):** Low permeability clays and silts of the UCF present from the ground surface to the top of bedrock. The formation is generally characterized by lean and fat clays with siltier composition along the southern portion of the site. Within the low permeability materials thin discontinuous sand lenses (less than five feet in thickness) were encountered at 436.8 feet[2] at EMW-05 and 429.4 feet at PTW-01 [1]. These unconfined sandy lenses, where present, and silt and clay material near the former land surface (approximately 425 to 430 feet) adjacent to the base of ash in the southern portion of the property have been identified as PMPs.
- **Uppermost Aquifer (UA):** Thin (generally less than four feet in thickness), moderate permeability sand, silty sand, and clayey gravel material within the Lower Cahokia Formation, and bedrock interface, including weathered shale bedrock where present. In locations where higher permeability materials and coarser grained materials are absent, the UA is interpreted as the interface between the Lower Cahokia Formation and weathered bedrock of the Carbondale and Modesto Formations, with an interpreted thickness of 1.5 feet in PTW-01 to 2.5 feet in PTW-02 [1].
- **Bedrock Confining Unit (BCU):** Thick, very low permeability shales and siltstones of the Carbondale and Modesto Formations. The elevation of the top of bedrock is highest north of the AP at AW-21 (422.88 feet) and declines in elevation to the east towards AW-08 (404.5 feet) and south toward AW-16 (400.92 feet). The geologic cross-sections and top of bedrock interpretation indicate the presence of a bedrock valley/depression in the west and southwest portion of the AP [1]. Based on the distribution of coarser grained materials of the Lower Cahokia Formation, it appears that the materials are likely present in limited areas on the southern side of this bedrock valley.

Borings and monitoring wells installed to further define and understand the distribution of potential PMPs and the UCF (**Figure 1-1**, TPZ-100, TPZ-101, TPZX-200, and TPZ-XP03; nature and extent borings) indicate consistent geologic materials and stratigraphic relationships. The four borings encountered the following units:

- **CCR:** Borings TPX-200 and TPZ-XPW03 were installed through the AP into the underlying UCF. CCR material consisted of interbedded layers (ranging from inches to feet) of fly ash and bottom ash with a zone of harder drilling and/or partially cemented material observed between 10 to 13 feet in both borings.
- **UCF/PMP:** The UCF was encountered in all borings advanced in 2024. The UCF consisted of lean clay and silt with minor amounts of sand. In boring TPZ-100, a six-inch clayey sand lens

[2] All elevations in this report are referenced to North American Vertical Datum of 1988 (NAVD88) unless otherwise noted.

was encountered at 37 feet below ground surface. Borings did not penetrate the entire thickness of the UCF.

2.2 Hydrogeology

Hydrogeologic conditions at the AP generally remain consistent with those summarized in the Nature and Extent Report [1]. This section provides additional information regarding hydraulic conductivity measurements in the materials surrounding the AP.

2.2.1 Field Hydraulic Conductivities

Field hydraulic conductivity tests were performed within the UCF/PMP at the AP as part of the 2024 field investigation to supplement data collected in 2017 [2] and 2021 [3]. The results of the 2024 field investigations are included in **Appendix A** and discussed below.

- Field hydraulic conductivity tests were performed in UCF monitoring wells APW02, APW03, APW04, P003, and P004; and in the temporary piezometers TPZ-100 and TPZ-101. The results from P004 which was screened within the footprint of the AP ranged from 5.2×10^{-6} to 2.2×10^{-5} centimeters per second (cm/s). This material (gravel with sand) is likely part of the fill used to construct the rail loop and not representative of the UCF outside the AP and excluded from the summary statistics included in this section. The results of the remaining tests indicate that the hydraulic conductivity ranged from 1.1×10^{-9} to 2.5×10^{-7} cm/s, with a geometric mean of 1.9×10^{-8} cm/s. Prior to the 2024 investigation, hydraulic conductivity testing in the UCF/PMP indicated a range from 3.2×10^{-3} cm/s in AW-15S to approximately 5×10^{-4} cm/s from tests conducted in AP06 and AP07S [2]. The 2024 results indicate that UCF areas with moderate hydraulic conductivity (10^{-4} to 10^{-3} cm/s) are limited to small portions of the site near AP07S and AW15S, while the remainder of the surrounding materials have much lower conductivity and limit migration of groundwater.
- Hydraulic gradients and groundwater flow velocities within the UCF/PMP between APW-03 and APW-04 (**Table 2-1**) have been updated using the 2024 aquifer testing results obtained from these wells. The updated calculations result in an estimated groundwater flow velocity of 0.0000090 feet per day (or 0.04 inches per year).

2.2.2 Laboratory Hydraulic Conductivities

Falling head permeability tests (ASTM D5084 Method F) were performed in the laboratory on two samples collected during the 2024 investigations. The results are summarized in **Appendix A** and discussed below.

- Two samples were collected from UCF clayey materials underlying the AP within temporary piezometers TPZ-XP03 and TPZX-200 for geotechnical testing. The geometric mean vertical hydraulic conductivity, calculated from the falling head permeability results measured at TPZ-XP03 and TPZX-200, was 1.3×10^{-7} cm/s. This result is generally consistent with results of historical samples collected by Haley & Aldrich, Inc. [4] and AECOM [5] which indicated a geometric mean vertical hydraulic conductivity of 7.3×10^{-8} cm/s.

2.3 Hydrogeologic Conceptual Site Model

The Hydrogeologic Site Characterization Report (HCR) [3] and information provided above forms the foundation of the AP hydrogeological setting. The AP overlies the recharge area for the underlying geologic media (*i.e.,* low permeability clays and silts of the UCF; and moderate

permeability sand, silty sand, and clayey gravel material within the Lower Cahokia Formation, bedrock, and/or weathered shale bedrock, where present (*i.e.,* UA). Thin sandy lenses within the UCF have been identified as PMPs within the UCF but they are limited in occurrence and extent.

The geologic conceptual model for the site used for groundwater modeling and summarized in the Groundwater Modeling Report (GMR) [6] consists of the following layers:

- Fill, predominantly coal ash (fly ash, bottom ash, and slag) within the AP, and materials within constructed berms and railroad embankments.
- Fine-grained clays and silts of the UCF ranging in thickness from 5 to 40 feet at the AP.
- Coarse-grained sands and gravels of the Lower Cahokia Formation ranging in thickness from 1 to 4 feet at the AP.

Bedrock at the AP consists of thick, very low permeability shales and siltstones of the Carbondale and Modesto Formations and is encountered at elevations ranging from 400 to 422 feet at the AP.

The overall groundwater flow system within the unlithified materials is consistent with previous reports [3]. Additional off-site groundwater level and flow direction data evaluated after 2021 was used to refine the existing conceptual site model (CSM) to incorporate the following interpreted hydrogeologic conditions:

- The unlithified/lithified contact designated as the UA on-site may be hydraulically connected to the sands of the Sankoty Aquifer which are present off-site and used for potable supply in nearby Peoria, East Peoria, and Pekin.
- The thick sand and gravels along the Illinois River from Hennepin to Peoria form the Sankoty Aquifer. The Sankoty sand and gravels are hydrologically connected to the Illinois River and are a productive aquifer in the Middle Illinois water supply planning [7]. At the EPP, the thick sands and gravels of the Sankoty Aquifer are absent. The UA at the EPP represents the most permeable material present above bedrock. Alluvial deposits belonging either to the Cahokia or the Sankoty are present in a north-south orientation along the Illinois River at the EPP and are not expected to occur in areas west of the United States (US) Highway 24, where the bedrock elevation increases above ground surface at the EPP. US Highway 24 runs along the base of the bluff and areas west of US Highway 24 are coincident with areas where the aquifer is not present [8].
- Off-site groundwater in the Sankoty Aquifer flows to the north and south towards identified Peoria and Pekin pumping centers, respectively [8]. As reported by Burch and Kelly, "*Smaller flow domains are sometimes formed by pumpage at municipal well fields, which reverse the ground-water flow direction and frequently capture induced recharge from the river and the ground-water ordinarily moving toward it*" [8].

Infiltration of precipitation into the AP or nearby surface water bodies, including the Illinois River and adjacent stormwater drainage ditches and ponds, recharges groundwater and flows generally east to west, and to the north and northwest within the northernmost portion of the AP. The northward flow in the northernmost portion of the AP may be a result of the drainage ditch that borders the AP. Additional survey work completed in 2022 [9] and included in the GMR [6], indicates that the surface water drainage ditch along the northern and western side of the AP is at a lower elevation than surrounding groundwater elevations. As a result, the ditch likely receives shallow groundwater.

In the southern portion of the AP, groundwater flow has a southerly component of flow towards what is interpreted as a former channel of the Illinois River. Groundwater elevations vary seasonally, generally less than five feet, while across the site they range between approximately 430 and 450 feet, although flow directions are generally consistent. Off-site groundwater in the coarse sand and gravel of the Sankoty Aquifer is expected to flow to the north and south towards identified Peoria and Pekin pumping centers, respectively. Groundwater in the Sankoty Aquifer may be hydraulically connected to the UA (*i.e.,* unlithified/lithified contact) identified on site.

Vertical gradients are generally upward between the UCF/PMP and UA across the site, with the exception of P002 (*i.e.,* PMP) and AW-20 (*i.e.,* UA) in the northwest corner of the AP and adjacent to the drainage ditch. Upward gradients are also generally observed between the BCU and UA. The upward gradients are likely a result of the proximity of the site to the Illinois River which is a regional receiving body for groundwater.

3. CONCLUSIONS

In accordance with 35 I.A.C. § 845.650(d)(1), the nature and extent of GWPS exceedances of boron and sulfate have been described in sufficient detail to support a complete and accurate assessment of the corrective measures necessary to effectively clean up all releases from the AP.

Boron was selected for modeling source control as presented in the Final Closure Plan and was identified as a surrogate for the exceedances of sulfate, as described in the GMR [6]. For modeling purposes it was assumed that boron would not significantly sorb or chemically react with aquifer solids (soil adsorption coefficient [Kd] was set to 0 milliliters per gram [mL/g]), which is a conservative estimate for predicting contaminant transport times in the model. The results of additional testing to determine hydraulic properties surrounding the UCF indicate very low hydraulic conductivities and flow velocities which limit the potential migration of constituents. Additional geochemical modeling was completed to evaluate how sorption to solid phases may affect boron and sulfate mobility and therefore the time to reach the GWPS for these parameters[3]. Results of the modeling showed that a substantial proportion of boron and some sulfate are retained in the solid phase under current conditions and are unlikely to be substantially re-mobilized as conditions return to background.

[3] The Groundwater Polishing Report serves as Appendix E of the Corrective Action Alternatives Analysis to which this Nature and Extent report is attached.

4. REFERENCES

[1] Ramboll Americas Engineering Solutions, Inc., "Nature and Extent Report, Edwards Power Plant, Ash Pond," June 4, 2024.

[2] Natural Resource Technology Inc., an OBG Company, "Hydrogeologic Monitoring Plan – Edwards Ash Pond," October 17, 2017.

[3] Ramboll Americas Engineering Solutions, Inc., "Hydrogeologic Site Characterization Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois," October 25, 2021.

[4] Haley & Aldrich, Inc., "Memorandum: Ash Pond – Underlying Clay and Depth of CCR Evaluation, Edwards Station, Bartonville, IL. File No. 129319-003," February 12, 2018.

[5] AECOM, "Geotechnical Data Report for Dynegy Edwards Power Station," 2016.

[6] Ramboll Americas Engineering Solutions, Inc., "Groundwater Modeling Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois," June 30, 2022.

[7] Illinois State Water Survey, "Water Supply Planning: Middle Illinois Progress Report," Illinois State Water Survey, Prairie Research Institute. Contract Report 2016-02, February 2016.

[8] S. L. Burch and D. J. Kelly, "Peoria-Pekin Regional Ground-Water Quality Assessment," Illinois State Water Survey, Research Report 124, Champaign, Illinois, 1993.

[9] Ramboll Americas Engineering Solutions, Inc., "2023 Supplemental Site Investigation Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois," December 1, 2023.

[10] AECOM, "History of Construction. USEPA Final CCR Rule 40 C.F.R. Part 257.73(c). Edwards Power Station. Bartonville, Illinois," 2016.

[11] Haley & Aldrich, Inc., "Memorandum: Location Restriction Demonstration - Placement Above the Uppermost Aquifer, Ash Pond, Edwards Power Station, Bartonville, IL. File No. 129788," October 16, 2018.

[12] D. Kolata, "Bedrock Geology of Illinois: Illinois State Geological Survey map, scale 1:500,000," 2005.

[13] H. B. Willman, J. C. Frye, J. A. Simon, K. E. Clegg, D. H. Swann, E. Atherton, C. Collinson, J. A. Lineback and T. C. Buschbach, "Geologic Map of Illinois: Illinois State Geological Survey map, scale 1:500,000," 1967.

[14] B. L. Herzog, B. J. Stiff, C. A. Chenoweth, K. L. Warner, J. B. Sieverling and C. Avery, "Buried Bedrock Surface of Illinois: Illinois State Geological Survey map, scale 1:500,000," 1994.

[15] Ramboll Americas Engineering Solutions, Inc., "History of Potential Exceedances. Edwards Power Plant, Ash Pond, Bartonville, Illinois. Illinois Power Resources Generating," October 25, 2021.

[16] Ramboll Americas Engineering Solutions, Inc., "Groundwater Monitoring Plan, Ash Pond, Edwards Power Plant, Bartonville, Illinois," October 25, 2021.

[17] Natural Resources Technology, Inc., "Sampling and Analysis Plan, Final, Edwards Ash Pond, Edwards Power Station, Bartonville, Illinois, Project No. 2285, Revision 0," October 2017.

[18] Ramboll Americas Engineering Solutions, Inc., "35 I.A.C. § 845.610(B)(3)(D) Groundwater Monitoring Data and Detected Exceedances 2023 Quarter 3, Ash Pond, Edwards Power Plant, Bartonville, Illinois," December 13, 2023.

[19] Ramboll Americas Engineering Solutions, Inc., "35 I.A.C. § 845.610(B)(3)(D) Groundwater Monitoring Data and Detected Exceedances 2023 Quarter 2, Ash Pond, Edwards Power Plant, Bartonville, Illinois," October 8, 2023.

[20] Ramboll Americas Engineering Solutions, Inc., "35 I.A.C. § 845.610(B)(3)(D) Groundwater Monitoring Data and Detected Exceedances 2023 Quarter 4, Ash Pond, Edwards Power Plant, Bartonville, Illinois," February 12, 2024.

[21] Foth, "Antidegradation Alternative Analysis, Dynegy Midwest Generation, LLC, Edwards Power Station, Bartonville, Illinois," September 8, 2017.

[22] United States Environmental Protection Agency, "Human and Ecological Risk Assessment of Coal Combustion Residuals (2050-AE81)," December 2014.

[23] Ramboll Americas Engineering Solutions, Inc., "35 I.A.C. § 845 Corrective Measures Assessment, Ash Pond, Edwards Power Plant, Bartonville, Illinois, IEPA ID: W1438050005-01," June 4, 2024.

[24] United States Geological Survey, "Groundwater Atlas of the United States, Illinois, Indiana, Kentucky, Ohio, Tennessee 730-K," 1995.

[25] Ramboll Americas Engineering Solutions, Inc., "2023 35 I.A.C. § 845 Annual Groundwater Monitoring and Corrective Action Report, Ash Pond, Edwards Power Plant, Bartonville, Illinois," January 31, 2024.

[26] Ramboll Americas Engineering Solutions, Nature and Extent Report, Fly Ash Pond System, Baldwin Power Plant, Baldwin Illinois, April 2024.

[27] Ramboll Ameria Engineering Solutions, Inc., "35 I.A.C. 845.610(b)(3)(D) Groundwater Monitoring Data and Detected Exceedances, Quarter 2, 2024, Ash Pond, Edwards Power Plant, Bartonville, Illinois," August 4, 2024.

TABLES

TABLE 2-1. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

$V = K i / n_e$ V = Groundwater Velocity
K = Hydraulic Conductivity [1]
i = hydraulic gradient
n_e = Effective Porosity [2]

Central Portion of CCR Unit (AW-08 to AW-06): Uppermost Aquifer

Distance between Wells (ft): 2213
Hydraulic Conductivity (ft/day): 0.02
Effective Porosity (%): 13 Assumes: silt/clay

Date	AW-08 Elevation (ft NAVD88)	AW-06 Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/day)
2/9/2021	438.28	434.40	3.88	0.002	2.1E-04
3/2/2021	437.77	434.62	3.15	0.001	1.7E-04
3/22/2021	439.27	434.70	4.57	0.002	2.5E-04
4/12/2021	440.09	434.85	5.24	0.002	2.9E-04
5/4/2021	439.47	434.48	4.99	0.002	2.7E-04
6/15/2021	440.14	434.26	5.88	0.003	3.2E-04
6/28/2021	439.41	434.60	4.81	0.002	2.6E-04
7/21/2021	441.74	434.40	7.34	0.003	4.0E-04
			Average	0.002	2.5E-04

Southern Portion of CCR Unit (AW-10 to AW-15): Uppermost Aquifer

Distance between Wells (ft): 1300
Hydraulic Conductivity (ft/day): 10.7
Effective Porosity (%): 16 Assumes: gravel/ clay

Date	AW-10 Elevation (ft NAVD88)	AW-15 Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/day)
2/9/2021	--	433.03	--	--	--
3/2/2021	438.84	433.50	5.34	0.004	0.27
3/22/2021	438.84	433.68	5.16	0.004	0.27
4/12/2021	438.85	433.76	5.09	0.004	0.26
5/4/2021	438.80	433.69	5.11	0.004	0.26
6/15/2021	438.62	433.65	4.97	0.004	0.26
6/28/2021	438.61	433.59	5.02	0.004	0.26
7/21/2021	438.60	433.65	4.95	0.004	0.25
			Average	0.004	0.26

TABLE 2-1. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
EDWARDS POWER PLANT
ASH POND
BARTONVILLE, ILLINOIS

Southeastern Portion of CCR Unit (APW-03 to APW-04): Potential Migration Pathway

Distance between Wells (ft): 1220
Hydraulic Conductivity (ft/day): 0.00019
Effective Porosity (%): 7 Assumes: clay

Date	APW-03 Elevation (ft NAVD88)	APW-04 Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/day)
2/9/2021	436.78	432.44	4.34	0.004	0.0000099
3/2/2021	436.47	432.74	3.73	0.003	0.0000085
3/22/2021	436.75	432.75	4.00	0.003	0.0000091
4/12/2021	436.25	432.91	3.34	0.003	0.0000076
5/4/2021	436.06	432.40	3.66	0.003	0.0000083
6/15/2021	435.64	431.79	3.85	0.003	0.0000088
6/28/2021	436.22	431.21	5.01	0.004	0.0000114
7/21/2021	436.13	432.13	4.00	0.003	0.0000091
8/30/2021	435.57	431.98	3.59	0.003	0.0000082
2/16/2022	436.47	432.38	4.09	0.003	0.0000093
7/25/2022	434.93	431.15	3.78	0.003	0.0000086
2/27/2023	436.51	432.65	3.86	0.003	0.0000088
			Average	0.003	0.0000090

[O:SSW 7/13/21, U: CJC 08/13/21; NRK 8/16/21; C:CJC 08/17/21, U: RAB 4/24/25, C:NRK 5/19/25]

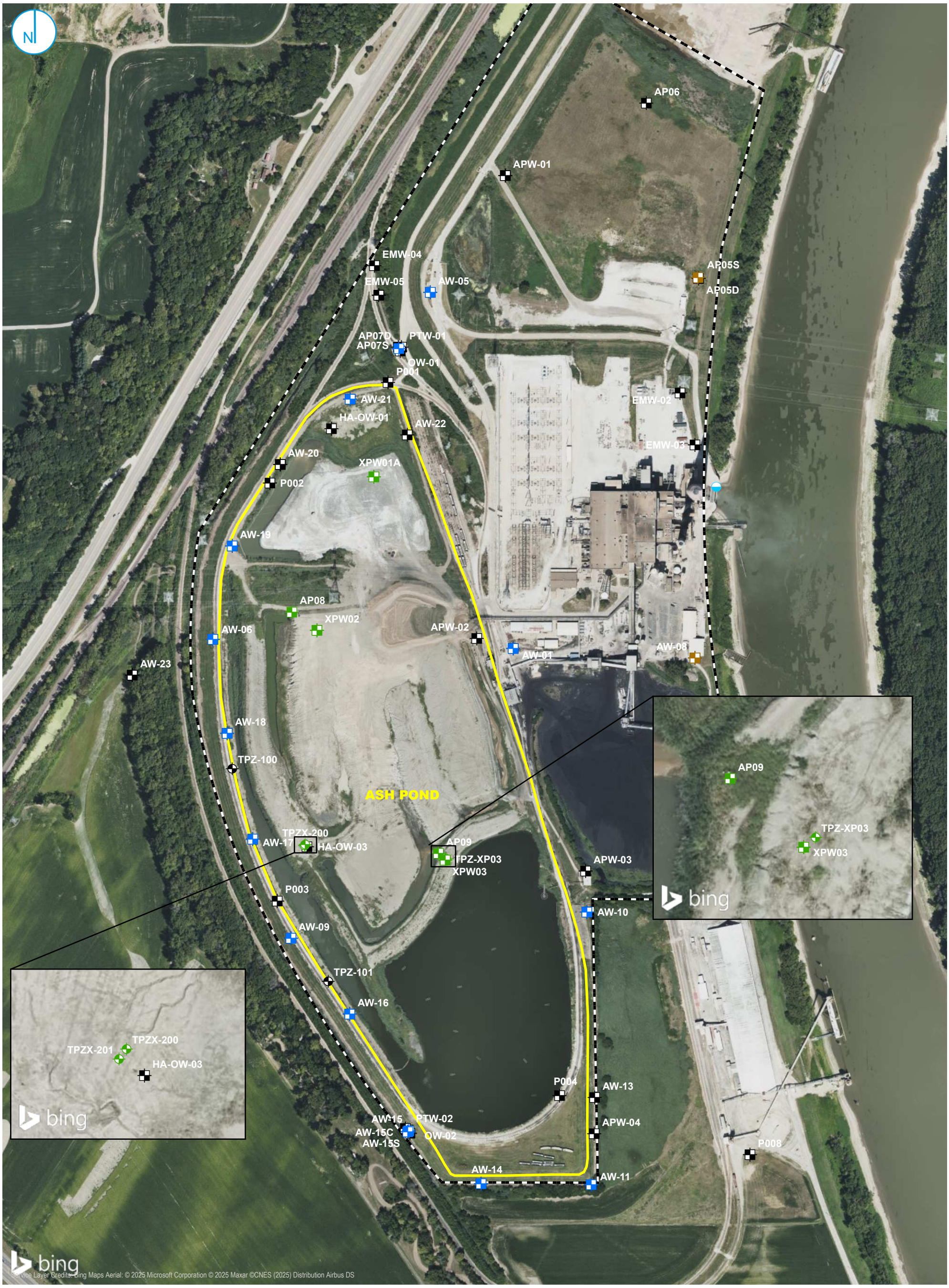
Notes:

[1] Hydraulic conductivity values used above are average of the individual wells or average of the hydrostratigraphic unit as derived from slug tests completed in March and April 2021 by Ramboll and published in the 2017 Hydrogeologic Monitoring Plan - Edwards Ash Pond (OBG/NRT, 2017).

[2]Effective porosity used in these calculations was derived from an average between estimated values of 0.20 for silt material, 0.267 for gravel, 0.07 for clay, and 0.28 for sand from *Morris, D.A. and A.I. Johnson, 1967. Summary of hydrologic and physical properties of rock and soil materials as analyzed by the Hydrologic Laboratoryof the U.S. Geological Survey, U.S. Geological Survey Water-Supply Paper 1839-D, 42p. and Heath, R.C., 1983. Basicground-water hydrology, U.S. Geological Survey Water-Supply Paper 2220, 86p*. Effective porosity may be as high as maximum total porosity (50%) calculated in Table 2-1

-- = data not available
% = percent
ft = foot/feet
ft/day = feet per day
ft/ft = feet per foot
NAVD88 = North American Vertical Datum of 1988

FIGURES



- COMPLIANCE MONITORING WELL
- BACKGROUND MONITORING WELL
- MONITORING WELL
- PORE WATER WELL
- TEMPORARY PIEZOMETER
- TEMPORARY PORE WATER PIEZOMETER
- REGULATED UNIT (SUBJECT UNIT)
- PROPERTY BOUNDARY

0 212.5 425 Feet

INVESTIGATION LOCATIONS

ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 1-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

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APPENDIX A
Technical Memorandum: Summary of Investigation Work Completed in September and October 2024

RAMBOLL

ENVIRONMENT
& HEALTH

TECHNICAL MEMORANDUM

To: Ms. Sam Davies, Environmental Manager, Vistra Corp

From: Nikki Pagano and Michael Davis

Re: Summary of Investigation Work Completed in September and October 2024
Edwards Power Plant
Bartonville, Illinois

June 2, 2025

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

T 414-837-3607
F 414-837-3608
www.ramboll.com

Ref. 1940110482

INTRODUCTION

This Technical Memorandum (Tech Memo) for Edwards Power Plant (EPP) was prepared by Ramboll America's Engineering Solutions, Inc. (Ramboll) for Illinois Power Resources Generating, LLC. This Tech Memo documents the results of additional investigation to characterize the geologic materials surrounding and underlying the Ash Pond.

OBJECTIVES

The objectives of the field event were to collect additional information to further define properties and interaction of the coal combustion residuals (CCR) and adjacent and underlying soils/geologic units. The objectives of the field events were to: (1) advance three borings and install three temporary porewater piezometers at two locations in the Ash Pond closure-in-place (CIP) footprint and collect samples from the CCR material for grain size analysis and samples from the underlying clay materials for analysis of hydraulic conductivity via Shelby tube; (2) advance two borings and install two temporary piezometers along the western boundary of the Ash Pond and collect soil samples for grain size analysis; (3) perform slug testing at select existing shallow monitoring wells around the Ash Pond and the temporary piezometers installed along the western boundary of the Ash Pond; and (4) conduct pump tests at the two porewater piezometer locations.

SITE WORK ACTIVITIES

At the request of Vistra Corp, Ramboll performed and/or oversaw completion of the on-site work activities on September 23 through October 4, 2024. Piezometer installation was performed by Cascade Drilling (Cascade) with oversight from Ramboll.

The following sections discuss site work methods and documentation of completed work.

UTILITY CLEARANCE

Prior to drilling, Ground Penetrating Radar Systems (GPRS) utilized a ground penetrating radar antenna to scan a 10-foot radius around the proposed temporary piezometer locations. Ramboll completed a subsurface clearance checklist, confirming all locations requiring intrusive work were cleared by GPRS and safe for ground disturbance.

PIEZOMETER INSTALLATION

Cascade utilized a Boart Longyear 200C mini sonic drill rig equipped with a 6-inch diameter core barrel to advance borings for temporary piezometers TPZ-XPW03, TPZX-200, TPZX-201, TPZ-100, and TPZ-101 to their final depths as directed by Ramboll field staff.

The soil lithology was logged continuously using the Unified Soil Classification System (USCS). The boring logs are provided in **Attachment A**. Based on observations in the field, soil samples from each boring location were collected by Ramboll for laboratory and geotechnical analysis from within the screened interval of each piezometer and from the soil just above the screen interval as summarized in **Table A** below. Soil samples were submitted by Ramboll for grain size analysis (sieve [ASTM D6913] and hydrometer [ASTM D7928]) or hydraulic conductivity via Shelby tube (ASTM D5084).

Table A. Soil Sample Collection Summary

Sample Location	Top of Sample (feet bgs)	Bottom of Sample (feet bgs)	Sample Type
CCR			
TPZ-XP03	4	6	Grain Size
TPZ-XP03	14	16	Grain Size
TPZ-XP03	32	34	Grain Size
TPZX-200	16	18	Grain Size
TPZX-200	26	28	Grain Size
TPZX-200	37	39	Grain Size
Upper Cahokia Formation			
TPZ-XP03	40.5	42.5	Shelby Tube
TPZX-200	45	47	Shelby Tube
TPZ-100	37	37.5	Grain Size
TPZ-101	34	36	Grain Size

bgs = below ground surface

The temporary piezometers were constructed using 2-inch diameter schedule 40 polyvinyl chloride (PVC) casing and installed with a 10-foot PVC screen with a slot diameter of 0.010-inches. Filter sand was placed in the annular space surrounding the PVC extending to approximately two feet above the PVC screen. The annular space was sealed with 3/8-inch bentonite chips to at least two feet above the filter pack and the remaining annular space sealed with 3/8-inch bentonite chips to the surface. Piezometer construction logs are provided in **Attachment B**. The soil boring and piezometer construction activities were completed September 24 through 26, 2024. The locations of the piezometers are depicted on **Figure 1**. The piezometers were surveyed by Ramboll using a Trimble GeoXH Model 6000 on September 30, 2024.

Each of the piezometers was developed following installation by Cascade and Ramboll using a pump and surge technique. The piezometers were surged and pumped until the purge water from the piezometers was clear or the piezometers went dry a minimum of two times. The volume of water removed and the depth to water in the piezometers before and after development are recorded on the piezometer development logs provided in **Attachment C**.

GEOTECHNICAL RESULTS

Geotechnical analysis results from six samples collected from the CCR at soil borings TPZ-XP03 and TPZX-200 yielded USCS soil classifications of clayey silt, silt with clay, sandy silt, and sandy silt with clay. Geotechnical analysis results from two samples collected from the Upper Cahokia Formation at soil borings TPZ-100 and TPZ-101 yielded USCS soil classifications of lean clay and sandy clayey silt. Vertical hydraulic conductivity results from two samples collected from the Upper Cahokia Formation at soil borings TPZ-XP03 and TPZX-200 (below the CCR) ranged from 5.4×10^{-7} to 3.0×10^{-8} centimeters per second (cm/s).

The geotechnical analysis results collected from the CCR and Upper Cahokia Formation are summarized in **Table 1** and the geotechnical laboratory report is provided in **Attachment D**. Sample locations are depicted on **Figure 1**.

SLUG TESTING

Field hydraulic conductivity tests were performed in select existing shallow monitoring around the Ash Pond and the temporary piezometers installed along the western boundary of the Ash Pond on September 25 and 26, and October 3, 2024. A total of seven wells were successfully tested. The wells and piezometers were screened in the Upper Cahokia Formation with the exception of P004 which was screened within the footprint of the AP and the material encountered (gravel with sand) is likely part of the fill used to construct the rail loop and not representative of the UCF outside the unit. Physical slugs were used to perform tests at five wells (APW-02, APW-03, APW-04, P003, and P004). One set of paired tests (falling head/rising head) was performed at wells with adequate response time (APW-4 and P004), and one test (falling head) was performed on three wells (APW-02, APW-03, and P003) due to inadequate response time. Bail down (rising head) tests were performed at the two temporary piezometers (TPZ-100 and TWZ-101) due to very slow response time. Groundwater levels were measured and recorded by deployed pressure transducers in each of the above wells or piezometers during the tests.

Time-displacement data were analyzed using AQTESOLV Version 4.5 to obtain-near well hydraulic conductivity estimates. Slug test details and hydraulic conductivity test analyses and results are summarized in **Table 2** and AQTESOLV solution plots are provided in **Attachment E**. The locations of the wells and piezometers tested are depicted on **Figure 1**. The results from P004 which was screened within the footprint of the AP ranged from 5.2×10^{-6} to 2.2×10^{-5} centimeters per second (cm/s). The results of the remaining tests indicate that the hydraulic conductivity ranged from 1.1×10^{-9} to 2.5×10^{-7} cm/s, with a geometric mean of 1.9×10^{-8} cm/s.

PUMP TESTING

Following installation and development of TPZ-XP03 and TPZX-201, pumping tests were performed at pumping wells TPZ-XP03 on October 1, 2024, and at TPZX-201 on October 3 and October 4, 2024. Water levels were monitored during the tests in nearby observation and monitoring wells by in-well pressure transducers (**Figure 1**). **Table 3** presents a summary of well construction information for the pumping wells and observation wells. **Attachment F** presents a summary of pump test results.

TPZX-201 Pump Test

A modified step-drawdown test was conducted at well TPZX-201 on October 1, 2024. Despite difficulties in maintaining a constant rate with the well pump, two rate steps of 0.5 gallons per minute (gpm) and 0.63 gpm were completed, with total pumping time of 352 minutes. **Attachment F** presents a summary of step-drawdown test results. As shown, a maximum drawdown of 24.1 feet was observed at the pumping well

during a period of rate fluctuations, and a stable drawdown of 18.9 feet was obtained at the 0.63 gpm rate step, resulting in a well specific capacity of 0.03 gallons per minute per foot (gpm/ft) at this rate.

Measurable drawdown to pumping at TPZX-201 was identified in wells TPZX-200 and HA-OW-03, which are located at distances of 5.1 and 10.7 feet from TPZX-201, respectively. Distance-drawdown analysis using the Theis solution yielded an estimated transmissivity (T) of 2.4 square feet per day (ft^2/d) and a storativity (S) of 0.008 (**Attachment F**).

TPZ-XP03 Pump Test

A step-drawdown test was conducted at well TPZ-XP03 on October 2, 2024, followed by a constant-rate test on October 3, 2024. **Attachment F** presents a summary of the step-drawdown step test results, which include three rate steps conducted on October 2 (0.23 gpm, 0.5 gpm, and 1 gpm) along with the rate from the constant-rate test (1.5 gpm). As shown, a stable drawdown of 18.7 feet was obtained at the 1.5 gpm rate step, resulting in a specific capacity of 0.08 gpm/ft.

Measurable drawdown to pumping at TPZ-XP03 was identified at well XPW03, located 7.2 feet from the pumping well. Distance-drawdown analysis using the Theis solution yielded an estimated T of 0.27 ft^2/d and an S of 0.008 (**Attachment F**).

PIEZOMETER ABANDONMENT

After sample collection and pump or slug testing were completed, the temporary piezometers were abandoned on October 4, 2024. Time-release coated bentonite pellets followed by borehole material were used to seal the wells. Well casing was removed to a minimum of two feet bgs at each well location. Additional details can be found in the abandonment forms in **Attachment G**.

REFERENCES

Duffield, G. 2007. AQTESOLV® Professional Version 4.5. Hydrosolve, Inc.

Ramboll Americas Engineering Solutions, Inc., 2024. *Proposal for Data Gap Evaluation, CCR Characterization, and Post-Closure Removal of Free Liquids, Baldwin Bottom Ash Pond and Edwards Ash Pond.* August 28, 2024.

Theis, C.V., 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage, Am. Geophys. Union Trans., vol. 16, pp. 519-524.

TABLES

Table 1 Summary of Geotechnical Analytical Results
Table 2 Summary of Slug Test Results
Table 3 Piezometer and Well Construction Information and Observed Drawdown

FIGURE

Figure 1 Monitoring Well and Temporary Piezometer Map

ATTACHMENTS

Attachment A Soil Boring Logs
Attachment B Piezometer Construction Forms
Attachment C Piezometer Development Forms
Attachment D Geotechnical Laboratory Report
Attachment E Slug Test Results
Attachment F Pump Test Results
Attachment G Piezometer Abandonment Forms

TABLES

Table 1. Summary of Geotechnical Analytical Results

Summary of Investigation Work Technical Memorandum

Edwards Power Plant

Ash Pond (Unit ID: 301)

Bartonville, IL

Sample Location	Sample Interval (ft bgs)	Moisture Content (%)	Dry Density (pcf)	Vertical Hydraulic Conductivity (cm/s)	Laboratory USCS	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
CCR									
TPZ-XP03	4 - 6	-	-	-	CL-ML	1	10.0	78.4	10.6
TPZ-XP03	14 - 16	-	-	-	ML	2.2	31.9	47.0	18.9
TPZ-XP03	32 - 34	-	-	-	CL-ML	0.4	7.7	67.8	24.1
TPZX-200	16 - 18	-	-	-	ML	0	10.8	72.2	17.0
TPZX-200	26 - 28	-	-	-	ML	0.3	45.1	43.6	11.0
TPZX-200	37 - 39	-	-	-	ML	0	4.3	77.2	18.5
Upper Cahokia Formation									
TPZ-XP03	40.5 - 42.5	33.2	69.3	5.43E-07	CL	-	-	-	-
TPZX-200	45 - 47	48.7	84.8	2.99E-08	CL	-	-	-	-
TPZ-100	37 - 37.5	-	-	-	CL-ML	0	20.7	50.6	28.7
TPZ-101	34 - 36	-	-	-	CL	0	10.1	42.3	47.6

[O: MJD 1/13/2025; C: NRK 5/19/2025]

Notes:

bgs = below ground surface

% = Percent

CCR = coal combustion residuals

cm/s = centimeters per second

ft = feet

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Table 2. Summary of Slug Test Results
Summary of Investigation Work Technical Memorandum
Edwards Power Plant
Ash Pond (Unit ID: 301)
Bartonville, IL

Well ID	Gradient Position	Bottom of Screen Elevation (ft NAVD88)	Screen Length [1] (ft)	Field Identified Screened Material	Slug Type	Slug Length (ft)	Slug Radius (ft)	Manual Static Water Level (ft BMP)	Theoretical Initial Displacement (ft)	Analysis Method	Falling Head (Slug In) K (cm/s)	Rising Head (Slug Out) K (cm/s)	Minimum Hydraulic Conductivity (cm/s)	Maximum Hydraulic Conductivity (cm/s)	Hydraulic Conductivity Geometric Mean (cm/s)
Upper Cahokia Formation															
APW-02	U	411.91	10.4	Silty Clay	Solid	4.90	0.068	9.04	3.03	Cooper-Bredehoeft-Papadopulos	1.1E-09		1.1E-09	2.5E-07	1.9E-08
APW-03	S	411.34	10.4	Silty Clay	Solid	4.90	0.068	9.09	3.03	Bouwer-Rice	8.3E-09				
APW-04	D	417.54	10.4	Silty Clay	Solid	4.90	0.068	8.19	3.03	Bouwer-Rice	2.5E-07	1.6E-07			
P003	D	410.00	5.3	Silty Clay to Clay	Solid	4.90	0.068	22.85	3.03	Cooper-Bredehoeft-Papadopulos	3.0E-08				
P004[2]	D	425.40	5	Gravel with Sand	Solid	1.60	0.068	15.25	1.01	Kansas Geological Survey Model	2.2E-05	5.2E-06			
TPZ-100	D	414.93	10	Clayey Sand to Silty Clay	NA	NA	NA	14.96	14.96	Bouwer-Rice		9.6E-09			
TPZ-101	D	411.74	10	Silty Clay	NA	NA	NA	9.13	9.13	Bouwer-Rice		9.1E-09			

[O: KLT 12/24/24, C: MJD 1/15/25]

Notes:
Test not performed
[1] All wells are constructed from 2 inch PVC with 0.01 inch slotted screens.
[2] Well is screened within the footprint of the Ash Pond in sandy gravel material used to construct the rail loop. It was not included in the summary statistics.
It is not includedin determining the minimum and maximum hydraulic conductivity of the UCF.
cm/s = centimeters per second
D = Downgradient
ft = foot/feet
K = Hydraulic Conductivity
NA = Not Applicable (bail-down test was performed)
NAVD88 = North American Vertical Datum of 1988
S = Sidegradient
U = Upgradient

Table 3. Piezometer and Well Construction Information and Observed Drawdown

Summary of Investigation Work Technical Memorandum

Edwards Power Plant

Ash Pond (Unit ID: 301)

Bartonville, IL

Well ID	Hydrostratigraphic Unit	Distance from Pumping Well (ft)	Terminal Drawdown (ft)	Well Depth (ft bTOC)	Screened Interval (ft bgs)	Static Depth-to-water (ft bTOC)
TPZX-201 Pump Test						
TPZX-201	CCR	0.5	18.9	45.61	33 - 43	16.14
TPZX-200	CCR	5.1	3.6	44.37	32 - 42	16.01
HA-OW-03	CCR	10.7	0.7	42.86	Unknown	15.09
TPZ-XPW03 Pump Test						
TPZ-XPW03	CCR	0.5	18.7	42.65	30 - 40	17.32
XPW03	CCR	7.2	3.6	31.63 (top of pump)	27 - 37	16.18

[O: MJD 2/3/2025; C: KEM 2/4/2025]

Notes:

bgs = below ground surface

bTOC = below top of casing

ft = feet

NA = not applicable

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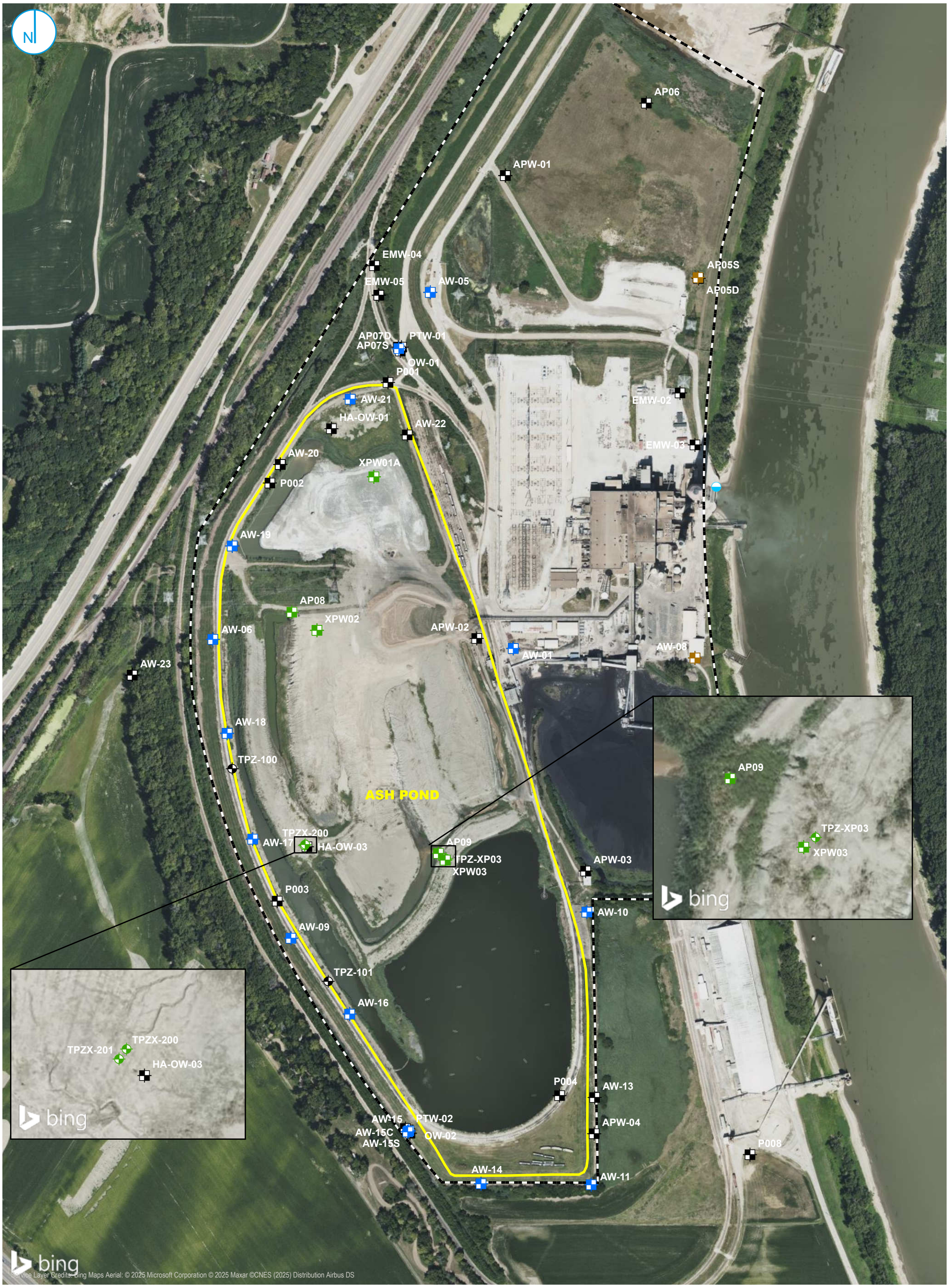
FIGURES



- COMPLIANCE MONITORING WELL
- BACKGROUND MONITORING WELL
- MONITORING WELL
- PORE WATER WELL
- TEMPORARY PIEZOMETER
- TEMPORARY PORE WATER PIEZOMETER
- REGULATED UNIT (SUBJECT UNIT)
- PROPERTY BOUNDARY

0 212.5 425 Feet

MONITORING WELL AND TEMPORARY PIEZOMETER MAP

ASH POND
EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

FIGURE 1

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ENGINEERING SOLUTIONS, INC.

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ATTACHMENT A
Soil Boring Logs

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Plant		TPZ-100

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jeremy Triepke Cascade Drilling LP	9/26/2024	9/26/2024	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
TPZ-100	Feet (NAVD88)	454.93 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,430,125.99 N, 2,434,584.11 E E/Ⓦ

1/4 of 4 1/4 of Section 14, T 7 N, R 7 E

Lat 40° 35' 33.3002"

Long -89° 40' 11.0761"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 52		0	0 - 1.5' **FILL, WELL-GRADED SAND WITH GRAVEL:** (SW)g, brown (10YR 4/3), fine to medium sand, fine to coarse gravel, subrounded to rounded gravel, loose, moist.	(FILL) (SW)g									
			1											
			2	1.5 - 5' **FILL, ASH:** very dark gray (10YR 3/1), silt-sized ash, coal fragments (0-5%), moist.										
			3		(FILL)									
			4											
			5											
2 CS	60 48		6	5 - 7.5' **FILL, ASH:** very dark gray (10YR 3/1), silt to medium gravel-sized ash (primarily sand and gravel), subangular to subrounded, loose, moist.	(FILL)									
			7											
			8	7.5 - 20' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2) to dark grayish brown (10YR 4/2), yellowish brown (10YR 5/6) mottling (10-20%), shells (0-5%), roots (0-5%), low to medium plasticity, moist.					2					
			9						2					
3 CS	60 50		10		CL/ML									
			11						0.5					
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	Tel:
Michael Panic	Ramboll 333 W. Wacker Drive Suite 1050, Chicago IL, 60640	Fax:

Boring Number TPZ-100 Page 2 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	7.5 - 20' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2) to dark grayish brown (10YR 4/2), yellowish brown (10YR 5/6) mottling (10-20%), shells (0-5%), roots (0-5%), low to medium plasticity, moist. *(continued)*					1.5					
			14											
4 CS	60 54		15						2					
			16		CL/ML									
			17						0.5					
			18	18' transitions to dark greenish gray (GLEY 1 4/10Y).					1					
			19						1.5					
5 CS	60 60		20	20 - 37' **SILTY CLAY:** CL/ML, dark greenish gray (GLEY 1 4/10Y), yellowish brown (10YR 5/6) mottling (5-10%), medium plasticity, moist to wet.										
			21						0.5					
			22											
			23						0.5					
			24											
6 CS	60 58		25											
			26		CL/ML				0.5					
			27											
			28						0.5					
			29											
7 CS	60 48		30						0.5					
			31											
			32											

Boring Number TPZ-100 Page 3 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	20 - 37' **SILTY CLAY:** CL/ML, dark greenish gray (GLEY 1 4/10Y), yellowish brown (10YR 5/6) mottling (5-10%), medium plasticity, moist to wet. *(continued)*					0.5					
			34						1					
8 CS	60 55		35		CL/ML									
			36						0.5					
			37	37 - 37.5' **CLAYEY SAND:** SC, dark greenish gray (GLEY 1 4/10Y), fine sand, subrounded to rounded, shells (0-5%), wet.	SC									Soil sample collected 37'-37.5' below ground surface
			38	37.5 - 40' **SILTY CLAY:** CL/ML, dark greenish gray (GLEY 1 4/10Y), yellowish brown (10YR 5/6) mottling (5-10%), medium plasticity, moist to wet.	CL/ML									
			39						0.5					
			40	40' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Plant		TPZ-101

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jeremy Triepke Cascade Drilling LP	9/26/2024	9/26/2024	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
TPZ-101	Feet (NAVD88)	456.74 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,429,137.67 N, 2,435,032.14 E E/Ⓦ

1/4 of 4 1/4 of Section 14, T 7 N, R 7 E

Lat 40° 35' 23.5091"

Long -89° 40' 5.341"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 / 45		0	0 - 1' **FILL, SILTY CLAY:** CL/ML, dark gray (10YR 4/1), roots (0-5%), medium plasticity, moist.	(FILL) CL/ML				0.5					
			1	1 - 2' **FILL, WELL-GRADED GRAVEL WITH SAND:** (GW)s, dark grayish brown (10YR 4/2), fine to coarse gravel, angular, fine to medium sand, roots (0-5%), loose, moist.	(FILL) (GW)s									
			2	2 - 4' **FILL, WELL-GRADED SAND:** SW, dark grayish brown (10YR 4/2), fine to medium, subrounded to rounded, gravel (5-10%), coal fragments (0-5%), loose, moist.	(FILL) SW									
			3											
			4	4 - 5' **FILL, SILT:** ML, dark grayish brown (10YR 4/2), fine sand (5-10%), gravel (0-5%), loose, moist.	(FILL) ML									
2 CS	60 / 60		5	5 - 13' **FILL, ASH:** very dark gray (10YR 3/1), silt to coarse sand-sized ash, coarse gravel to cobble-sized slag-like material (5-10%), loose, moist.	(FILL)									
			6											
			7											
			8											
			9											
3 CS	60 / 60		10											
			11											
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	Tel:
Michael Panic	Ramboll 333 W. Wacker Drive Suite 1050, Chicago IL, 60640	Fax:

Boring Number TPZ-101 Page 2 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			12	12.5' wet.	(FILL)									
			13	13 - 29' **SILTY CLAY:** CL/ML, dark gray (10YR 4/1), dark yellowish brown (10YR 4/4) mottling (20-30%), shells (0-5%), low plasticity, loose, moist.					1.5					
			14											
4 CS	60 50		15	14.5' grayish brown (10YR 5/2), dark yellowish brown (10YR 4/4) mottling (5-10%).					1					
			16											
			17						0.5					
			18											
			19						1					
5 CS	60 60		20											
			21		CL/ML				0.5					
			22	21.5' 1" wet seam.										
			23	22.5' transitions to dark greenish gray (GLEY 4/10Y).					0.5					
			24											
6 CS	60 48		25						0.5					
			26	25.5' 1" wet seam. 26' 1" wet seam.										
			27						0.5					
			28											
			29	29 - 30' **SILTY CLAY:** CL/ML, black (GLEY 1 2.5/N), roots (0-5%), low plasticity, moist.	CL/ML				2					
7 CS	60 48		30	30 - 45' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), dark yellowish brown (10YR 4/4) mottling (5-10%), shells (0-5%), low plasticity, moist.	CL/ML				0.5					
			31											
			32											

Boring Number TPZ-101 Page 3 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	30 - 45' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), dark yellowish brown (10YR 4/4) mottling (5-10%), shells (0-5%), low plasticity, moist. *(continued)*					0.5					
			34	34' dark yellowish brown (10YR 4/4) mottling (10-20%), 1" wet seam. 34.5' 1" wet seam.					1					Soil sample collected at 34'-36' below ground surface
8 CS	60 55		35											
			36	36' 1" wet seam.					0.5					
			37						0.5					
			38	37.5' dark greenish gray (GLEY 4/10Y), no mottling.	CL/ML									
			39						0.5					
9 CS	60 60		40											
			41											
			42						0.5					
			43						0.5					
			44						0.5					
			45	45' End of Boring.										

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Plant		TPZX-200

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jeremy Triepke Cascade Drilling LP	9/25/2024	9/25/2024	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
TPZX-200	Feet (NAVD88)	458.63 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,429,773.45 N, 2,434,925.75 E E/W

1/4 of 4 1/4 of Section 14, T 7 N, R 7 E

Lat 40° 25' 29.7976"

Long -89° 40' 6.6734"

Local Grid Location: ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 60		1	0 - 11.5' **FILL, ASH:** dark gray (10YR 4/1), silt to fine sand-sized ash, white (GLEY 1 5/10Y) inclusions (5-10%), roots (0-5%), very loose, moist to wet.										
			2	2' - 4.0' gravel (0-5%).										
			3											
			4	4' no white inclusions.										
				4.5' silt-sized ash.										
2 CS	60 60		5											
			6		(FILL)									
			7											
			8											
			9											
3 CS	60 55		10											
			11											
			12	11.5 - 12' **FILL, LEAN CLAY:** CL, dark grayish	(FILL) CL				1					

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	
Michael Panic	Ramboll 333 W. Wacker Drive Suite 1050, Chicago IL, 60640	Tel: Fax:

Boring Number TPZX-200 Page 2 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	brown (10YR 4/2), shells (0-5%), medium plasticity, moist. 12 - 16' **FILL, ASH:** alternating dark gray (10YR 4/1) and white (GLEY 1 5/10Y) in 2-4mm laminations, silt-sized ash, loose, wet.										Driller noted "hard drilling" at 12'-13' below ground surface
			14		(FILL)									
4 CS	60 44		15											
			16	16 - 20' **FILL, ASH:** dark gray (10YR 4/1), fine to medium sand-sized ash, coal fragments (5-10%), laminated (1-2mm), loose, wet.										Soil sample collected at 16'-18' below ground surface
			17											
			18		(FILL)									
			19											
5 CS	120 84		20	20 - 35' **FILL, ASH:** alternating dark gray (10YR 4/1) and white (GLEY 1 5/10Y) in 2-6mm laminations, silt to medium sand-sized ash, coal fragments (5-10%), loose, wet.										
			21											
			22											
			23											
			24											
			25											
			26		(FILL)									Soil sample collected at 26'-28' below ground surface
			27	27' - 27.5' silt to coarse sand-sized ash.										
			28											
			29											
			30	29.5' - 30.0' gravel-sized coal fragments (5-10%).										
6 CS	120 88		31											
			32											

Boring Number TPZX-200 Page 3 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	20 - 35' **FILL, ASH:** alternating dark gray (10YR 4/1) and white (GLEY 1 5/10Y) in 2-6mm laminations, silt to medium sand-sized ash, coal fragments (5-10%), loose, wet. *(continued)*	(FILL)									
			34											
			35	34.5' gravel-sized coal fragments (5-10%).										
			36	35 - 40.5' **FILL, ASH:** very dark gray (10YR 3/1), silt to fine sand-sized ash, soft, wet.	(FILL)									
			37											
			38											
			39											
7 CS	60 56		40											Soil sample collected at 37'-39' below ground surface
			41	40.5 - 45' **FAT CLAY:** CH, dark greenish gray (GLEY 4/10Y), shells (0-5%), roots (0-5%), high plasticity, moist.					0.5					
			42											
			43		CH				0.5					
			44											
8 ST	24 24		45	45 - 47' **LEAN CLAY:** CL.										
			46		CL									
			47	47' End of Boring.										

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Plant		TPZX-201

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jeremy Triepke Cascade Drilling LP	9/25/2024	9/25/2024	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
TPZX-201	Feet (NAVD88)	459.07 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,429,769.47 N, 2,434,922.48 E E/W

1/4 of 4 1/4 of Section 14, T 7 N, R 7 E

Lat 40° 35' 29.7584"

Long -89° 40' 6.7161"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 58		0	0 - 12' **FILL, ASH:** See TPZX-200 for detailed log.	(FILL)									
2 CS	60 20		5											
3 CS	60 15		10											
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	Tel:
Michael Panic	Ramboll 333 W. Wacker Drive Suite 1050, Chicago IL, 60640	Fax:

Boring Number TPZX-201 Page 2 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			12	12 - 16' **FILL, ASH:**.										
			13											
			14		(FILL)									
4 CS	60 50		15											
			16	16 - 20' **FILL, ASH:**.										
			17											
			18		(FILL)									
			19											
5 CS	120 100		20	20 - 35' **FILL, ASH:**.										
			21											
			22											
			23											
			24											
			25											
			26		(FILL)									
			27											
			28											
			29											
6 CS	120 90		30											
			31											
			32											

Boring Number TPZX-201 Page 3 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	20 - 35' **FILL, ASH:**. *(continued)*	(FILL)									
			34											
			35	35 - 41' **FILL, ASH:**.										
			36											
			37											
			38		(FILL)									
			39											
7 CS	60 58		40											
			41	41 - 41.5' **FILL, ASH:** black (10YR 2/1) silt-sized ash.	(FILL)									
			42	41.5 - 45' **FAT CLAY:** CH. 42' - 43.5' brown (10YR 4.2).										
			43		CH									
			44											
			45	45' End of Boring.										

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Edwards Power Plant		TPZ-XP03

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jeremy Triepke Cascade Drilling LP	9/24/2024	9/24/2024	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
TPZ-XP03	Feet (NAVD88)	460.67 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒

State Plane 1,429,705.73 N, 2,435,581.10 E E/W

1/4 of 4 1/4 of Section 14, T 7 N, R 7 E

Lat 40° 35' 29.0917"

Long -89° 39' 58.1834"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Peoria	IL	Peoria

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 58		0	0 - 5.5' **FILL, ASH:** dark gray (10YR 4/1), silt to fine sand-sized ash, pale brown (10YR 6/3) inclusions (0-5%), roots (0-5%), loose, very loose, moist to wet. 0.5' no roots.	(FILL)									
2 CS	60 60		5	5.5 - 12' **FILL, ASH:** dark gray (10YR 4/1), silt to fine sand-sized ash, gravel to cobble-sized coal fragments (0-5%), roots (0-5%), white (GLEY 1 8/N) inclusions (0-5%), very loose, moist.	(FILL)									
3 CS	60 21		10	9.5' - 11.5' silt to medium sand-sized ash, gravel (0-5%).										
			11	11.5' dense, hard, laminated (2-4mm).										
			12											

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm	Tel:
Michael Panic	Ramboll 333 W. Wacker Drive Suite 1050, Chicago IL, 60640	Fax:

Boring Number TPZ-XP03 Page 2 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			12	12 - 15' No Recovery.										Driller noted "hard drilling" at 12.5'-15' below ground surface
4 CS	60 60		15	15 - 38' **FILL, ASH:** dark gray (10YR 4/1), silt to medium sand-sized ash, gravel sized coal fragments (0-5%), white (GLEY 1 8/N) inclusions (0-5%), laminated (2-4mm), loose, wet.										Soil sample collected at 14'-16' below ground surface
			16											
			17	17' no laminations.										
			18											
			19											
5 CS	120 95		20											
			21											
			22											
			23		(FILL)									
			24	24' - 24.5' coal fragments (10-20%).										
			25	24.5' - 27.0' silt to fine sand sized ash, alternating dark gray (10YR 4/1), white (GLEY 1 8/N) and black (10YR 2/1) laminations (1-8mm).										
			26											
			27											
			28											
			29											
6 CS	120 95		30	30' no laminations.	(FILL)									
			31											
			32											

Boring Number TPZ-XP03 Page 3 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	15 - 38' **FILL, ASH:** dark gray (10YR 4/1), silt to medium sand-sized ash, gravel sized coal fragments (0-5%), white (GLEY 1 8/N) inclusions (0-5%), laminated (2-4mm), loose, wet. *(continued)*	(FILL)									Soil sample collected at 32'-38' below ground surface
			34											
			35											
			36											
			37											
			38	38 - 40' **FAT CLAY:** CH, greenish gray (GLEY 1 5/10Y), yellowish brown (10YR 5/6) mottling (0-5%), roots (0-5%), shells (0-5%), gravel (0-5%), high plasticity, moist. 38.5' dark gray (10YR 4/1).	CH				0.5					
			39											
			40	40 - 40.5' No Recovery.										
7 ST	24 24		41	40.5 - 42.5' **SILTY CLAY:** CL/ML.	CL/ML									
			42											
				42.5' End of Boring.										

ATTACHMENT B
Piezometer Construction Forms

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Plant	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: TPZ-100
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 33.300" Long. -89° 40' 11.076" or	
Facility ID	St. Plane 1,430,125.99 ft. N, 2,434,584.11 ft. E. E/Ⓦ	Date Well Installed: 09/26/2024
Type of Well	Section Location of Waste/Source: ____ 1/4 of 4 1/4 of Sec. 14, T. 7 N, R. 7 ☒ E ☐ W	Well Installed By: (Person's Name and Firm): Jeremy Triepke; Cascade Drilling LP
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number

A. Protective pipe, top elevation ____ ft. (NAVD88)

B. Well casing, top elevation 458.38 ft. (NAVD88)

C. Land surface elevation 454.93 ft. (NAVD88)

D. Surface seal, bottom ____ ft. (NAVD88) or ____ ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 429.4 ft. (NAVD88) or 25.5 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 426.9 ft. (NAVD88) or 28.0 ft.

H. Screen joint, top 424.9 ft. (NAVD88) or 30.0 ft.

I. Well bottom 414.9 ft. (NAVD88) or 40.0 ft.

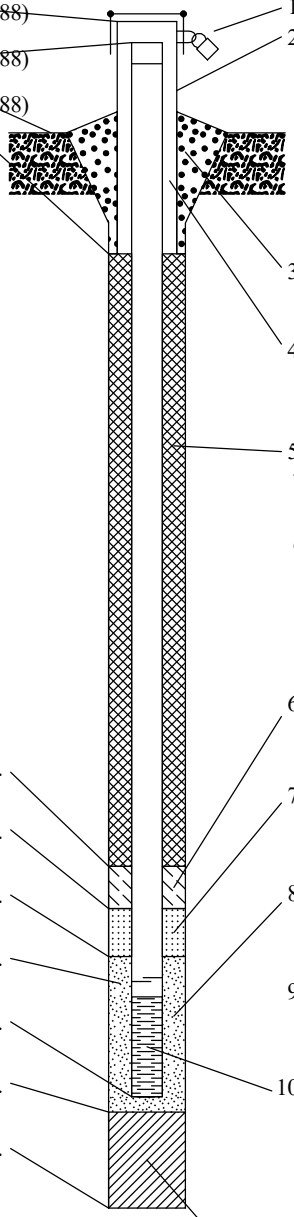
J. Filter pack, bottom 414.9 ft. (NAVD88) or 40.0 ft.

K. Borehole, bottom 414.9 ft. (NAVD88) or 40.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☐ Yes ☒ No
2. Protective cover pipe:
a. Inside diameter: ____ in.
b. Length: ____ ft.
c. Material: Steel ☐ ____ Other ☐
d. Additional protection? ☐ Yes ☒ No
If yes, describe: ____
3. Surface seal: Bentonite ☒ Concrete ☐ ____ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ ____ Other ☐
5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
d. 20 % Bentonite . . . Bentonite-cement grout ☒
e. 3.2 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. Red Flint #40
b. Volume added 1.75 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ ____ Other ☐
10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ ____ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ ____ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 1/15/2025

Signature	Firm	
Michael Panic	Ramboll Americas Engineering Solutions, Inc. 333 W. Wacker Dr. Suite 1050, Chicago, IL 60606	Tel: (312) 288-3800 Fax:

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Plant	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: TPZ-101
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 23.509" Long. -89° 40' 5.341" or	
Facility ID	St. Plane 1,429,137.67 ft. N, 2,435,032.14 ft. E. E/Ⓦ	Date Well Installed: 09/26/2024
Type of Well	Section Location of Waste/Source: ____ 1/4 of 4 1/4 of Sec. 14, T. 7 N, R. 7 ☒ E ☐ W	Well Installed By: (Person's Name and Firm): Jeremy Triepke
Distance from Waste/Source: ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known / Gov. Lot Number:	Cascade Drilling LP

A. Protective pipe, top elevation ____ ft. (NAVD88)

B. Well casing, top elevation 457.39 ft. (NAVD88)

C. Land surface elevation 456.74 ft. (NAVD88)

D. Surface seal, bottom ____ ft. (NAVD88) or ____ ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 431.2 ft. (NAVD88) or 25.5 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 428.7 ft. (NAVD88) or 28.0 ft.

H. Screen joint, top 426.7 ft. (NAVD88) or 30.0 ft.

I. Well bottom 416.7 ft. (NAVD88) or 40.0 ft.

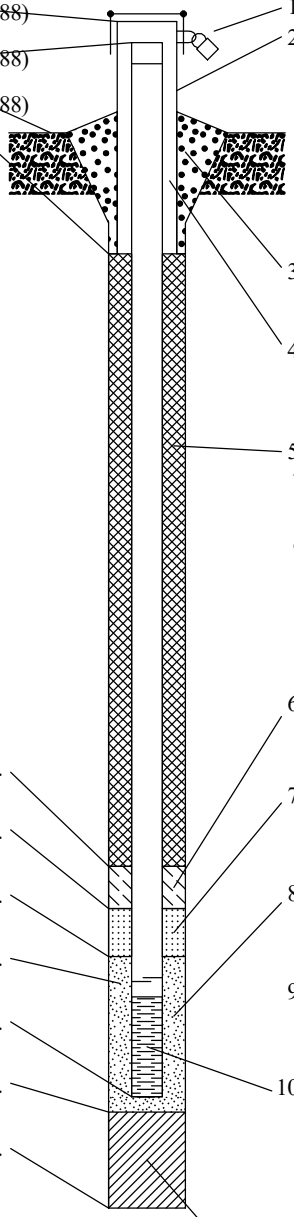
J. Filter pack, bottom 411.7 ft. (NAVD88) or 45.0 ft.

K. Borehole, bottom 411.7 ft. (NAVD88) or 45.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☐ Yes ☒ No

2. Protective cover pipe:
a. Inside diameter: ____ in.
b. Length: ____ ft.
c. Material: Steel ☐ ____ Other ☐
d. Additional protection? ☐ Yes ☒ No
If yes, describe: ____

3. Surface seal: Bentonite ☒ Concrete ☐ ____ Other ☐

4. Material between well casing and protective pipe: Bentonite ☒ ____ Other ☐

5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
d. 20 % Bentonite . . . Bentonite-cement grout ☒
e. 3.2 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐

6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐

7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. Red Flint #40
b. Volume added 2.25 ft^3

9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ ____ Other ☐

10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ ____ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☒ ____ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 1/15/2025

Signature: Michael Panic

Firm: Ramboll Americas Engineering Solutions, Inc. Tel: (312) 288-3800
333 W. Wacker Dr. Suite 1050, Chicago, IL 60606 Fax:

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Plant	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: TPZX-200
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 25' 29.798" Long. -89° 40' 6.673" or	
Facility ID	St. Plane 1,429,773.45 ft. N, 2,434,925.75 ft. E. E/Ⓦ	Date Well Installed: 09/25/2024
Type of Well	Section Location of Waste/Source: ____ 1/4 of 4 1/4 of Sec. 14, T. 7 N, R. 7 ☒ E ☐ W	Well Installed By: (Person's Name and Firm): Jeremy Triepke; Cascade Drilling LP
Distance from Waste/Source ____ ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____

A. Protective pipe, top elevation ____ ft. (NAVD88)

B. Well casing, top elevation 458.97 ft. (NAVD88)

C. Land surface elevation 458.63 ft. (NAVD88)

D. Surface seal, bottom ____ ft. (NAVD88) or ____ ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 431.1 ft. (NAVD88) or 27.5 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 428.6 ft. (NAVD88) or 30.0 ft.

H. Screen joint, top 426.6 ft. (NAVD88) or 32.0 ft.

I. Well bottom 416.6 ft. (NAVD88) or 42.0 ft.

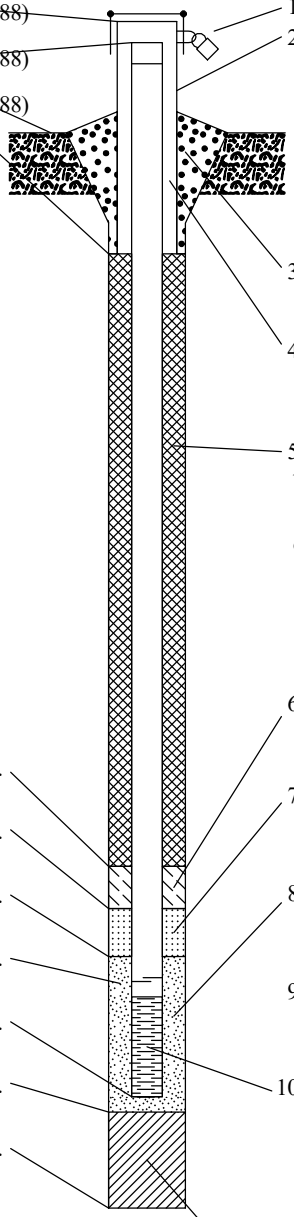
J. Filter pack, bottom 411.6 ft. (NAVD88) or 47.0 ft.

K. Borehole, bottom 411.6 ft. (NAVD88) or 47.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☐ Yes ☒ No
2. Protective cover pipe:
a. Inside diameter: ____ in.
b. Length: ____ ft.
c. Material: Steel ☐ ____ Other ☐
d. Additional protection? ☐ Yes ☒ No
If yes, describe: ____
3. Surface seal: Bentonite ☒ Concrete ☐ ____ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ ____ Other ☐
5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
d. 20 % Bentonite . . . Bentonite-cement grout ☒
e. 3.2 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. Red Flint #40
b. Volume added 3 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ ____ Other ☐
10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ ____ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ ____ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 1/15/2025

Signature: Michael Panic

Firm: Ramboll Americas Engineering Solutions, Inc. Tel: (312) 288-3800
333 W. Wacker Dr. Suite 1050, Chicago, IL 60606 Fax:

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Plant	Local Grid Location of Well: _____ ft. ☐ N. ☐ S. _____ ft. ☐ E. ☐ W.	Well Name: TPZX-201
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 29.758" Long. -89° 40' 6.716" or	
Facility ID	St. Plane 1,429,769.47 ft. N, 2,434,922.48 ft. E. E/Ⓦ	Date Well Installed: 09/25/2024
Type of Well	Section Location of Waste/Source: ☒ E ☐ W _____ 1/4 of 4 1/4 of Sec. 14, T. 7 N, R. 7	Well Installed By: (Person's Name and Firm): Jeremy Triepke
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known / Gov. Lot Number	Cascade Drilling LP

A. Protective pipe, top elevation _____ ft. (NAVD88)

B. Well casing, top elevation 459.20 ft. (NAVD88)

C. Land surface elevation 459.07 ft. (NAVD88)

D. Surface seal, bottom _____ ft. (NAVD88) or _____ ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe _____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 430.6 ft. (NAVD88) or 28.5 ft.

F. Fine sand, top _____ ft. (NAVD88) or _____ ft.

G. Filter pack, top 428.1 ft. (NAVD88) or 31.0 ft.

H. Screen joint, top 426.1 ft. (NAVD88) or 33.0 ft.

I. Well bottom 416.1 ft. (NAVD88) or 43.0 ft.

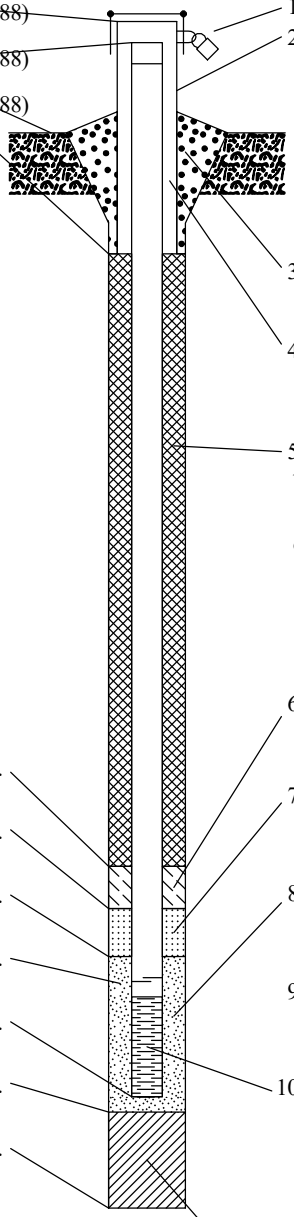
J. Filter pack, bottom 414.1 ft. (NAVD88) or 45.0 ft.

K. Borehole, bottom 414.1 ft. (NAVD88) or 45.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☐ Yes ☒ No
2. Protective cover pipe:
a. Inside diameter: _____ in.
b. Length: _____ ft.
c. Material: Steel ☐ _____ Other ☐
d. Additional protection? ☐ Yes ☒ No
If yes, describe: _____
3. Surface seal: Bentonite ☒ Concrete ☐ _____ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ _____ Other ☐
5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. _____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. _____ Lbs/gal mud weight . . . Bentonite slurry ☐
d. 20 % Bentonite . . . Bentonite-cement grout ☒
e. 3.2 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. _____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. Red Flint #40
b. Volume added 2.75 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ _____ Other ☐
10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ _____ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ _____ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 1/15/2025

Signature: Michael Panic

Firm: Ramboll Americas Engineering Solutions, Inc. Tel: (312) 288-3800
333 W. Wacker Dr. Suite 1050, Chicago, IL 60606 Fax:

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Edwards Power Plant	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: TPZ-XP03
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 40° 35' 29.092" Long. -89° 39' 58.183" or	
Facility ID	St. Plane 1,429,705.73 ft. N, 2,435,581.10 ft. E. E/Ⓦ	Date Well Installed: 09/24/2024
Type of Well	Section Location of Waste/Source: ____ 1/4 of 4 1/4 of Sec. 14, T. 7 N, R. 7 ☒ E ☐ W	Well Installed By: (Person's Name and Firm): Jeremy Triepke
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known / Gov. Lot Number	Cascade Drilling LP

A. Protective pipe, top elevation ____ ft. (NAVD88)

B. Well casing, top elevation 460.89 ft. (NAVD88)

C. Land surface elevation 460.67 ft. (NAVD88)

D. Surface seal, bottom ____ ft. (NAVD88) or ____ ft.

12. USCS classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☒ MH ☐ CL ☒ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Mini Sonic Other ☒

15. Drilling fluid used: Water ☒ 0 2 Air ☐ Drilling Mud ☐ 0 3 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Potable Water from Site - City of Peoria

E. Bentonite seal, top 435.2 ft. (NAVD88) or 25.5 ft.

F. Fine sand, top ____ ft. (NAVD88) or ____ ft.

G. Filter pack, top 432.7 ft. (NAVD88) or 28.0 ft.

H. Screen joint, top 430.7 ft. (NAVD88) or 30.0 ft.

I. Well bottom 420.7 ft. (NAVD88) or 40.0 ft.

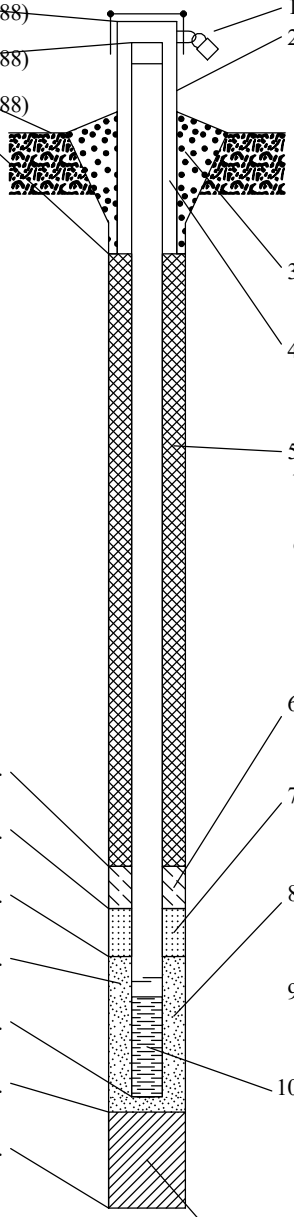
J. Filter pack, bottom 418.2 ft. (NAVD88) or 42.5 ft.

K. Borehole, bottom 418.2 ft. (NAVD88) or 42.5 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☐ Yes ☒ No
2. Protective cover pipe:
a. Inside diameter: ____ in.
b. Length: ____ ft.
c. Material: Steel ☐ ____ Other ☐
d. Additional protection? ☐ Yes ☒ No
If yes, describe: ____
3. Surface seal: Bentonite ☒ Concrete ☐ ____ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ ____ Other ☐
5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
d. 20 % Bentonite . . . Bentonite-cement grout ☒
e. 3.2 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. Not Applicable
b. Volume added 0 ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. Red Flint #40
b. Volume added 2.25 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ ____ Other ☐
10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ ____ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ ____ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 1/15/2025

Signature: Michael Panic

Firm: Ramboll Americas Engineering Solutions, Inc. Tel: (312) 288-3800
333 W. Wacker Dr. Suite 1050, Chicago, IL 60606 Fax:

ATTACHMENT C
Piezometer Development Forms

RAMBOLL

MONITORING WELL DEVELOPMENT

Facility/Project Name	State	Well Name
Edwards Power Plant	IL	TPZ-100

Facility License, Permit or Monitoring Number

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method:
- surged with bailer and bailed ☐
- surged with bailer and pumped ☐
- surged with block and bailed ☐
- surged with block and pumped ☐
- surged with block, bailed, and pumped ☐
- compressed air ☐
- bailed only ☐
- pumped only ☐
- pumped slowly ☐
- other surged with pump and pumped ☒

3. Time spent developing well 49 min.

4. Depth of well (from top of well casing) 42.17 ft.

5. Inside diameter of well 2.07 in.

6. Volume of water in filter pack and well casing 8.51 gal.

7. Volume of water removed from well 9.8 gal.

8. Volume of water added (if any) 70.0 gal.

9. Source of water added Potable water from site - City of Peoria

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	14.96 ft.	DRY ft.
Date	b.	9/27/2024	9/30/2024
Time	c.	☐ a.m. 01:17 ☒ p.m.	☐ a.m. 01:05 ☒ p.m.
12. Sediment in well bottom		inches	inches
13. Water clarity		Clear ☐ Turbid ☒ (Describe) dark gray	Clear ☐ Turbid ☒ (Describe) light gray

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	mg/l	mg/l
15. COD	mg/l	mg/l

16. Well developed by: Person's Name and Firm
Michael Davis
Ramboll

17. Additional comments on development:
Well developed twice on two seperate days. Pumped dry 3 times total.

Facility Address or Owner/Responsible Party Address

Name: Mark Davis

Firm: Illinois Power Generating Company

Street: 7800 S Cilco Ln

City/State/Zip: Peoria IL 61607

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: Michael Davis

Print Name: Michael Davis

Firm: Ramboll

Template: RAMBOLL_WELL DEVELOPMENT - Project: 845_EDWARDS_

Date Modified: 1/15/2025

RAMBOLL

MONITORING WELL DEVELOPMENT

Facility/Project Name	State	Well Name
Edwards Power Plant	IL	TPZ-101

Facility License, Permit or Monitoring Number

1. Can this well be purged dry? ☒ Yes ☐ No

2. Well development method:
- surged with bailer and bailed ☐
- surged with bailer and pumped ☐
- surged with block and bailed ☐
- surged with block and pumped ☐
- surged with block, bailed, and pumped ☐
- compressed air ☐
- bailed only ☐
- pumped only ☐
- pumped slowly ☐
- other surged with pump and pumped ☒

3. Time spent developing well 46 min.

4. Depth of well (from top of well casing) 42.18 ft.

5. Inside diameter of well 2.07 in.

6. Volume of water in filter pack and well casing 9.5 gal.

7. Volume of water removed from well 12.3 gal.

8. Volume of water added (if any) 100.0 gal.

9. Source of water added Potable water from site - City of Peoria

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	9.13 ft.	DRY ft.
Date	b.	9/27/2024	9/30/2024
Time	c.	☐ a.m. 01:42 ☒ p.m.	☐ a.m. 01:45 ☒ p.m.
12. Sediment in well bottom		inches	inches
13. Water clarity		Clear ☐ Turbid ☒ (Describe) dark gray	Clear ☐ Turbid ☒ (Describe) light gray
14. Total suspended solids		mg/l	mg/l
15. COD		mg/l	mg/l

Fill in if drilling fluids were used and well is at solid waste facility:

16. Well developed by: Person's Name and Firm
Michael Davis
Ramboll

17. Additional comments on development:
Well developed twice on two seperate days. Pumped dry 3 times total.

Facility Address or Owner/Responsible Party Address

Name: Mark Davis

Firm: Illinois Power Generating Company

Street: 7800 S Cilco Ln

City/State/Zip: Peoria IL 61607

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: Michael Davis

Print Name: Michael Davis

Firm: Ramboll

Template: RAMBOLL_WELL DEVELOPMENT - Project: 845_EDWARDS_

Date Modified: 1/15/2025

RAMBOLL

MONITORING WELL DEVELOPMENT

Facility/Project Name	State	Well Name
Edwards Power Plant	IL	TPZX-200

Facility License, Permit or Monitoring Number

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method:
- surged with bailer and bailed ☐
- surged with bailer and pumped ☐
- surged with block and bailed ☐
- surged with block and pumped ☐
- surged with block, bailed, and pumped ☐
- compressed air ☐
- bailed only ☐
- pumped only ☐
- pumped slowly ☐
- other surged with pump and pumped ☒

3. Time spent developing well 123 min.

4. Depth of well (from top of well casing) 44.37 ft.

5. Inside diameter of well 2.07 in.

6. Volume of water in filter pack and well casing 8.76 gal.

7. Volume of water removed from well 80.0 gal.

8. Volume of water added (if any) 120.0 gal.

9. Source of water added Potable water from site - City of Peoria

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	15.77 ft.	32.31 ft.
Date	b.	9/27/2024	9/27/2024
Time	c.	09:05 ☒ a.m. ☐ p.m.	11:14 ☒ a.m. ☐ p.m.
12. Sediment in well bottom		inches	inches
13. Water clarity		Clear ☐ Turbid ☒ (Describe) dark gray	Clear ☒ Turbid ☐ (Describe)
Fill in if drilling fluids were used and well is at solid waste facility:			
14. Total suspended solids		mg/l	mg/l
15. COD		mg/l	mg/l

16. Well developed by: Person's Name and Firm
Jeremy Triepke
Cascade Drilling LP

17. Additional comments on development:

Facility Address or Owner/Responsible Party Address

Name: Mark Davis

Firm: Illinois Power Generating Company

Street: 7800 S Cilco Ln

City/State/Zip: Peoria IL 61607

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: Michael Davis

Print Name: Michael Davis

Firm: Ramboll

Template: RAMBOLL_WELL DEVELOPMENT - Project: 845_EDWARDS_

Date Modified: 1/15/2025

RAMBOLL

MONITORING WELL DEVELOPMENT

Facility/Project Name	State	Well Name
Edwards Power Plant	IL	TPZX-201

Facility License, Permit or Monitoring Number

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method:
- surged with bailer and bailed ☐
- surged with bailer and pumped ☐
- surged with block and bailed ☐
- surged with block and pumped ☐
- surged with block, bailed, and pumped ☐
- compressed air ☐
- bailed only ☐
- pumped only ☐
- pumped slowly ☐
- other surged with pump and pumped ☒

3. Time spent developing well 57 min.

4. Depth of well (from top of well casing) 45.61 ft.

5. Inside diameter of well 2.07 in.

6. Volume of water in filter pack and well casing 8.95 gal.

7. Volume of water removed from well 65.0 gal.

8. Volume of water added (if any) 70.0 gal.

9. Source of water added Potable water from site - City of Peoria

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	15.91 ft.	19.07 ft.
Date	b.	9/27/2024	9/27/2024
Time	c.	09:10 ☒ a.m. ☐ p.m.	12:12 ☐ a.m. ☒ p.m.
12. Sediment in well bottom		inches	inches
13. Water clarity		Clear ☐ Turbid ☒ (Describe) dark gray	Clear ☒ Turbid ☐ (Describe)
14. Total suspended solids		mg/l	mg/l
15. COD		mg/l	mg/l

Fill in if drilling fluids were used and well is at solid waste facility:

16. Well developed by: Person's Name and Firm
Jeremy Triepke
Cascade Drilling LP

17. Additional comments on development:

Facility Address or Owner/Responsible Party Address

Name: Mark Davis

Firm: Illinois Power Generating Company

Street: 7800 S Cilco Ln

City/State/Zip: Peoria IL 61607

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: Michael Davis

Print Name: Michael Davis

Firm: Ramboll

Template: RAMBOLL_WELL DEVELOPMENT - Project: 845_EDWARDS_

Date Modified: 1/15/2025

RAMBOLL

MONITORING WELL DEVELOPMENT

Facility/Project Name	State	Well Name
Edwards Power Plant	IL	TPZ-XP03

Facility License, Permit or Monitoring Number

1. Can this well be purged dry? ☐ Yes ☒ No

2. Well development method:
- surged with bailer and bailed ☐
- surged with bailer and pumped ☐
- surged with block and bailed ☐
- surged with block and pumped ☐
- surged with block, bailed, and pumped ☐
- compressed air ☐
- bailed only ☐
- pumped only ☐
- pumped slowly ☐
- other surged with pump and pumped ☒

3. Time spent developing well 45 min.

4. Depth of well (from top of well casing) 42.65 ft.

5. Inside diameter of well 2.07 in.

6. Volume of water in filter pack and well casing 8.45 gal.

7. Volume of water removed from well 55.0 gal.

8. Volume of water added (if any) 80.0 gal.

9. Source of water added Potable water from site - City of Peoria

10. Analysis performed on water added? ☐ Yes ☒ No
(If yes, attach results)

		Before Development	After Development
11. Depth to Water (from top of well casing)	a.	15.91 ft.	22.80 ft.
Date	b.	9/27/2024	9/27/2024
Time	c.	☒ a.m. 08:00 ☐ p.m.	☒ a.m. 08:55 ☐ p.m.
12. Sediment in well bottom		inches	inches
13. Water clarity		Clear ☐ Turbid ☒ (Describe) dark gray	Clear ☒ Turbid ☐ (Describe)
14. Total suspended solids		mg/l	mg/l
15. COD		mg/l	mg/l

Fill in if drilling fluids were used and well is at solid waste facility:

16. Well developed by: Person's Name and Firm
Jeremy Triepke
Cascade Drilling LP

17. Additional comments on development:

Facility Address or Owner/Responsible Party Address

Name: Mark Davis

Firm: Illinois Power Generating Company

Street: 7800 S Cilco Ln

City/State/Zip: Peoria IL 61607

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: Michael Davis

Print Name: Michael Davis

Firm: Ramboll

Template: RAMBOLL_WELL DEVELOPMENT - Project: 845_EDWARDS_

Date Modified: 1/15/2025

ATTACHMENT D
Geotechnical Laboratory Report

HYDRAULIC CONDUCTIVITY DETERMINATION RISING TAILWATER METHOD C ASTM D5084

Terracon
Laboratory Services Group 192 Exchange Blvd Glendale Heights, Illinois 60139 Ph. (630) 717-4263

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO.: **11245037** **10/25/2024**
PROJECT NAME: **EDWARDS POWER PLANT**
CLIENT: **RAMBOLL ENVIRON US CORPORATION**
LOCATION : **BARTONVILLE, IL**

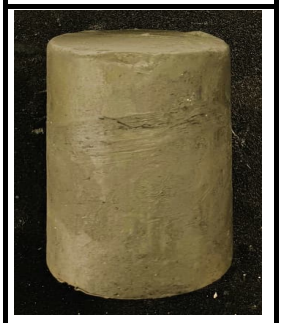
SUMMARY OF TEST RESULTS

BORING NO.	TPZX-200
SAMPLE ID.	N/A
DEPTH:	45.0'-47.0'
CLASSIFICATION	BROWNISH GRAY LEAN CLAY TRACE SAND AND GRAVEL (CL)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	69.3	73.8
WATER CONTENT (%)	48.7	47.9
DIAMETER (cm)	7.215	6.973
LENGTH (cm)	10.313	10.364
B VALUE PARAMETER:	0.97	
HYDRAULIC GRADIENT (MAXIMUM)	15.96	
PERCENT SATURATION	99.6	

(Percent saturation calculation is based on final measurements and an estimated specific gravity.)

SPECIMEN PHOTO



HYDRAULIC CONDUCTIVITY k (cm/sec): 2.99E-08

Deaired water was used as the liquid permeant.

Laboratory Services Group 192 Exchange Blvd Glendale Heights, Illinois 60139 Ph. (630) 717-4263

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO.:	**11245037**	**10/25/2024**
PROJECT NAME:	**EDWARDS POWER PLANT**	
CLIENT:	**RAMBOLL ENVIRON US CORPORATION**	
LOCATION :	**BARTONVILLE, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	TPZ-XP03
SAMPLE ID.	N/A
DEPTH:	40.5'-42.5'
CLASSIFICATION	GRAY SILTY LEAN CLAY TRACE SAND (CL)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	84.8	88.5
WATER CONTENT (%)	33.2	34.0
DIAMETER (cm)	7.204	7.058
LENGTH (cm)	10.165	10.151
B VALUE PARAMETER:	0.96	
HYDRAULIC GRADIENT (MAXIMUM)	16.19	
PERCENT SATURATION	100.0	
HYDRAULIC CONDUCTIVITY k (cm/sec)	5.43E-07	

SPECIMEN PHOTO



(Percent saturation calculation is based on final measurements and an estimated specific gravity.)

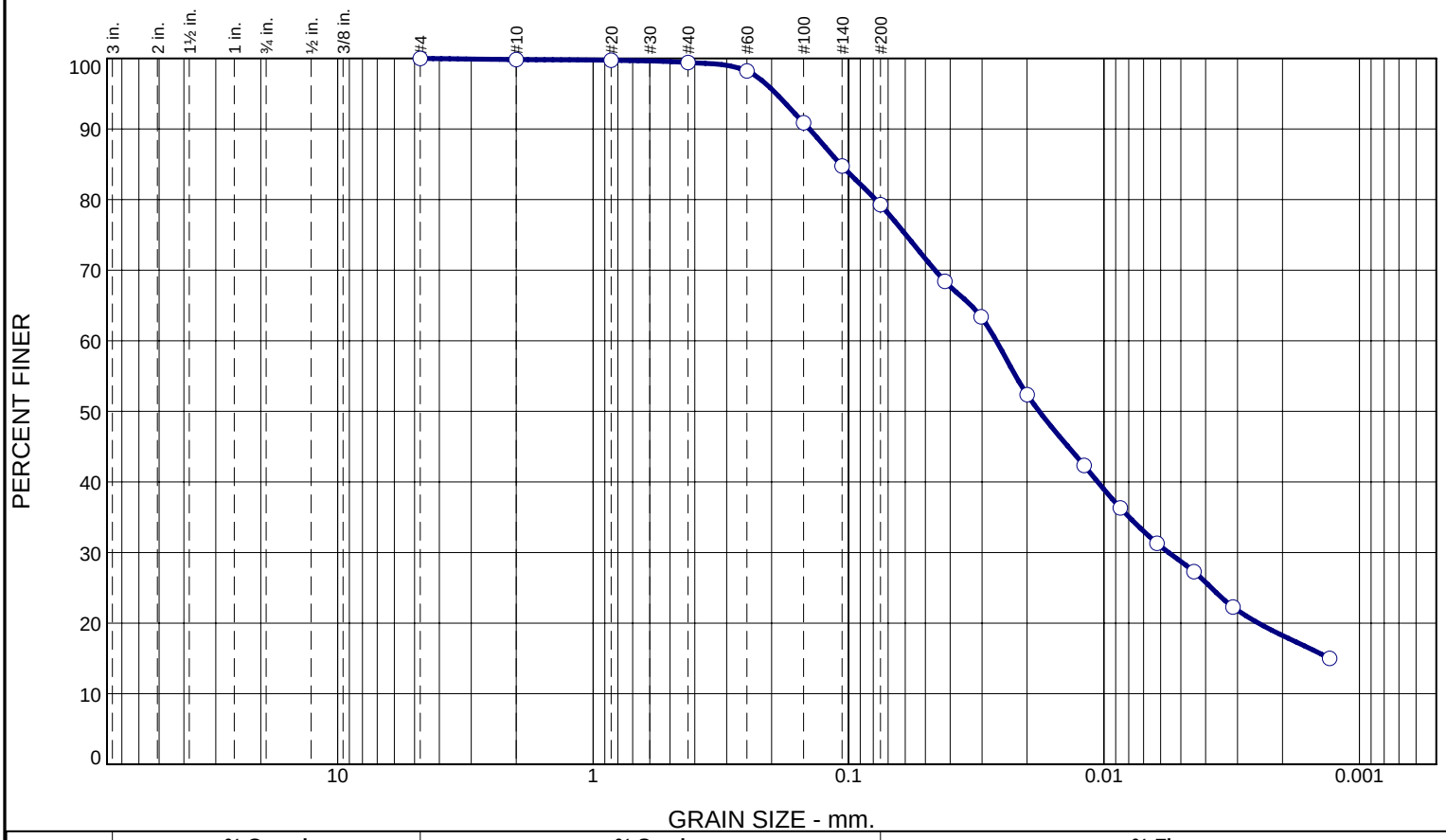
Deaired water was used as the liquid permeant.

PARTICLE SIZE DISTRIBUTION (GRADATION) OF SOILS USING SIEVE ANALYSIS
ASTM D6913

PARTICLE SIZE DISTRIBUTION (GRADATION) OF FINE GRAINED SOILS USING THE SEDIMENTATION (HYDROMETER) ANALYSIS
ASTM D7928

PARTICLE SIZE ANALYSIS OF SOILS

ASTM D6913 & D7928



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.2	0.4	20.1	50.6	28.7

Test Results (ASTM D422 & D1140)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
#4	100.0			
#10	99.8			
#20	99.7			
#40	99.4			
#60	98.2			
#100	90.9			
#140	84.8			
#200	79.3			
0.0420 mm.	68.4			
0.0303 mm.	63.4			
0.0200 mm.	52.4			
0.0120 mm.	42.3			
0.0086 mm.	36.3			
0.0062 mm.	31.3			
0.0044 mm.	27.3			
0.0031 mm.	22.3			
0.0013 mm.	15.0			

* (no specification provided)

GRAY SANDY CLAYEY SILT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1422 D_{85}= 0.1075 D_{60}= 0.0264
D_{50}= 0.0179 D_{30}= 0.0056 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL-ML AASHTO=

Test Remarks

F.M.=0.11

Source of Sample: TPZ-100 **Depth:** 37.0'-37.5'
Sample Number: N/A **Sample Date:** 10-10-24

Terracon

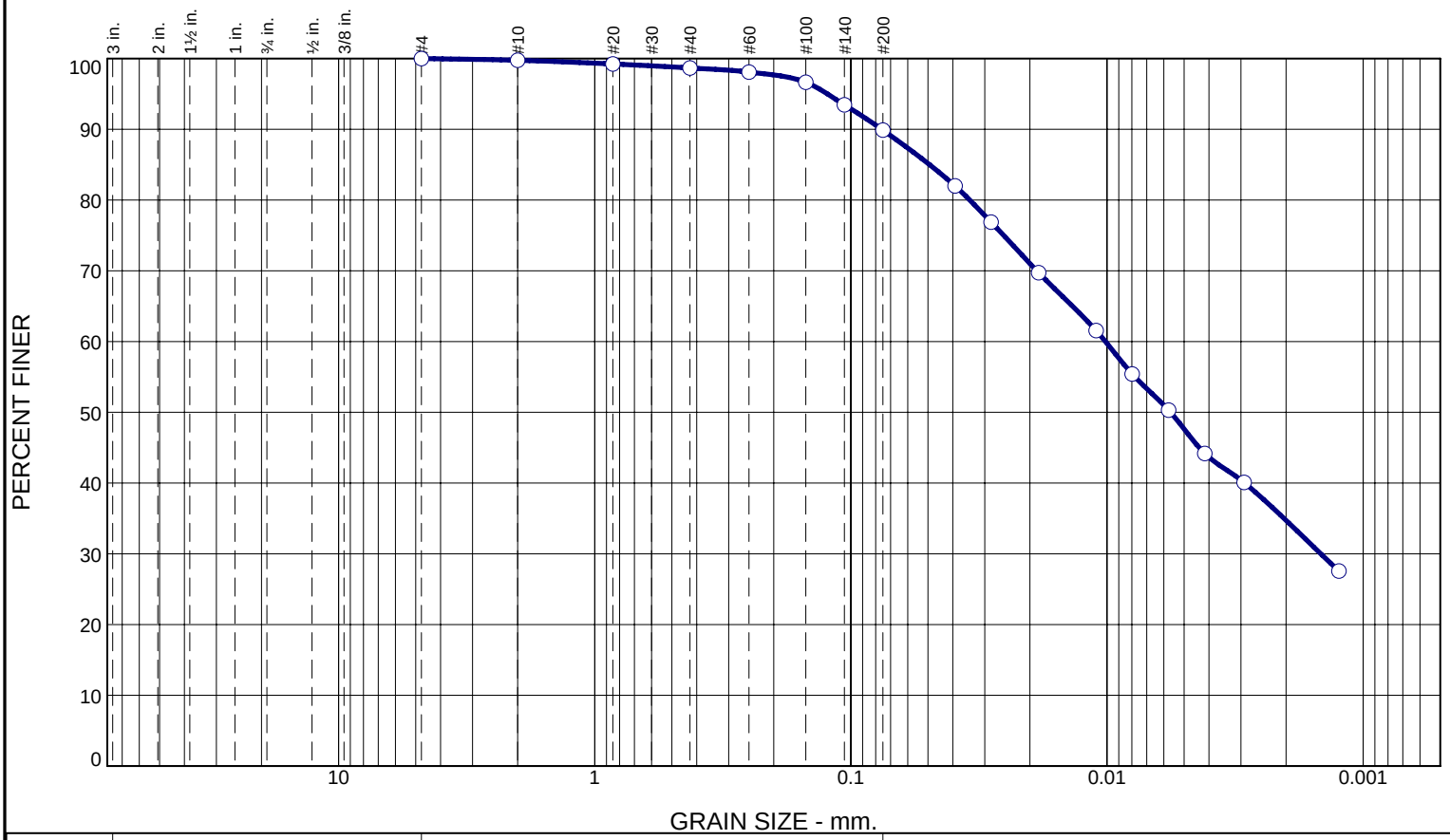
Client: RAMBOLL ENVIRON US CORPORATION
Project: EDWARDS POWER STATION

Project No: 11245037

Tested By: SJH **Checked By:** BCM

PARTICLE SIZE ANALYSIS OF SOILS

ASTM D6913 & D7928



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.2	1.1	8.8	42.3	47.6

Test Results (ASTM D422 & D1140)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
#4	100.0			
#10	99.8			
#20	99.2			
#40	98.7			
#60	98.1			
#100	96.6			
#140	93.5			
#200	89.9			
0.0392 mm.	82.0			
0.0284 mm.	76.9			
0.0185 mm.	69.8			
0.0110 mm.	61.6			
0.0080 mm.	55.4			
0.0057 mm.	50.3			
0.0042 mm.	44.2			
0.0029 mm.	40.1			
0.0012 mm.	27.6			

* (no specification provided)

GRAYISH BROWN LEAN CLAY

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0758 D_{85}= 0.0493 D_{60}= 0.0101
D_{50}= 0.0056 D_{30}= 0.0015 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO=

Test Remarks

F.M.=0.07

Source of Sample: TPZ-101 **Depth:** 34.0'-36.0'
Sample Number: N/A **Sample Date:** 10-10-24

Terracon

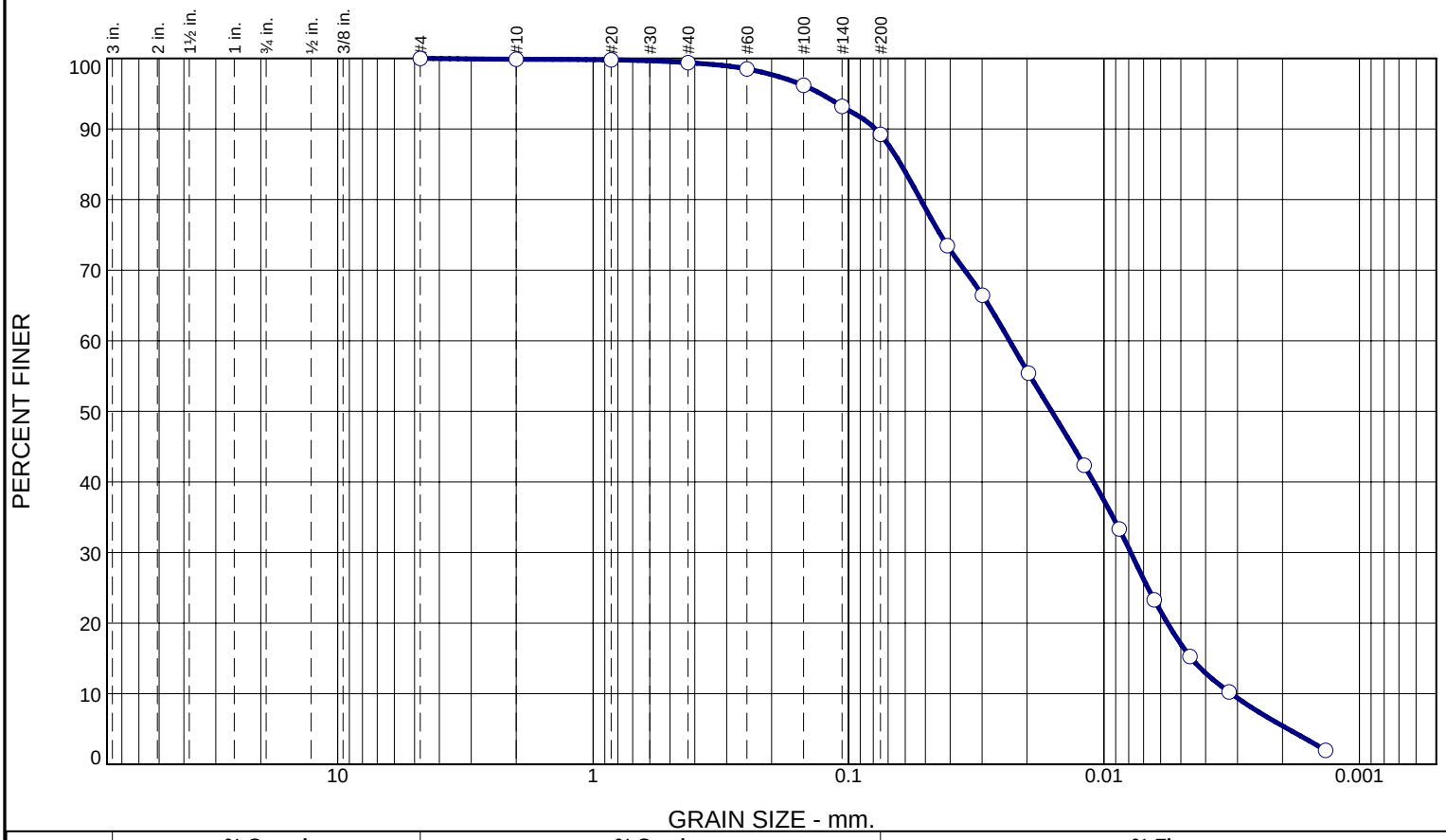
Client: RAMBOLL ENVIRON US CORPORATION
Project: EDWARDS POWER STATION

Project No: 11245037

Tested By: SJH **Checked By:** BCM

PARTICLE SIZE ANALYSIS OF SOILS

ASTM D6913 & D7928



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	0.5	10.2	72.2	17.0

Test Results (ASTM D422 & D1140)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
#4	100.0			
#10	99.9			
#20	99.8			
#40	99.4			
#60	98.5			
#100	96.2			
#140	93.2			
#200	89.2			
0.0411 mm.	73.5			
0.0299 mm.	66.5			
0.0198 mm.	55.4			
0.0120 mm.	42.4			
0.0087 mm.	33.3			
0.0064 mm.	23.3			
0.0046 mm.	15.3			
0.0032 mm.	10.3			
0.0014 mm.	2.0			

* (no specification provided)

GRAY SILT WITH CLAY

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0784 D_{85}= 0.0624 D_{60}= 0.0234
D_{50}= 0.0160 D_{30}= 0.0079 D_{15}= 0.0045
D_{10}= 0.0032 C_u= 7.39 C_c= 0.83

Classification

USCS= ML AASHTO=

Test Remarks

F.M.=0.05

Source of Sample: TPZX-200 **Depth:** 16.0'-18.0'
Sample Number: N/A **Sample Date:** 10-10-24

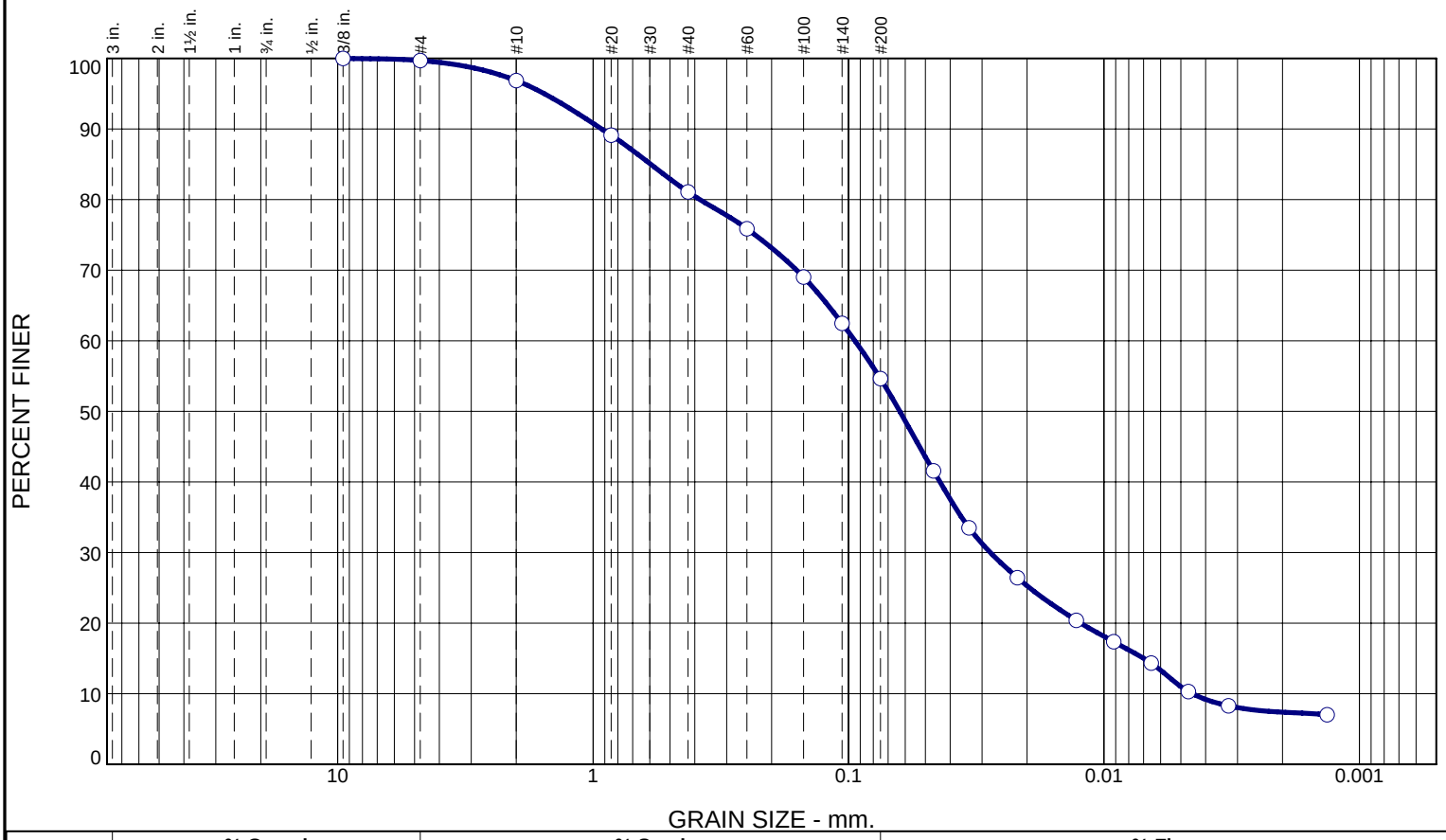
Client: RAMBOLL ENVIRON US CORPORATION
Project: EDWARDS POWER STATION

Project No: 11245037

Tested By: SJH **Checked By:** BCM

PARTICLE SIZE ANALYSIS OF SOILS

ASTM D6913 & D7928



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	2.8	15.8	26.5	43.6	11.0

Test Results (ASTM D422 & D1140)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
.375	100.0			
#4	99.7			
#10	96.9			
#20	89.1			
#40	81.1			
#60	75.9			
#100	69.0			
#140	62.5			
#200	54.6			
0.0465 mm.	41.6			
0.0338 mm.	33.5			
0.0218 mm.	26.5			
0.0128 mm.	20.4			
0.0092 mm.	17.4			
0.0065 mm.	14.3			
0.0047 mm.	10.3			
0.0033 mm.	8.3			
0.0013 mm.	7.0			

* (no specification provided)

DARK GRAY SANDY SILT WITH CLAY

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.9252 D_{85}= 0.5944 D_{60}= 0.0944
D_{50}= 0.0630 D_{30}= 0.0279 D_{15}= 0.0070
D_{10}= 0.0045 C_u= 20.95 C_c= 1.82

Classification

USCS= ML AASHTO=

Test Remarks

F.M.=0.78

Source of Sample: TPZX-200 **Depth:** 26.0'-28.0'
Sample Number: N/A **Sample Date:** 10-10-24

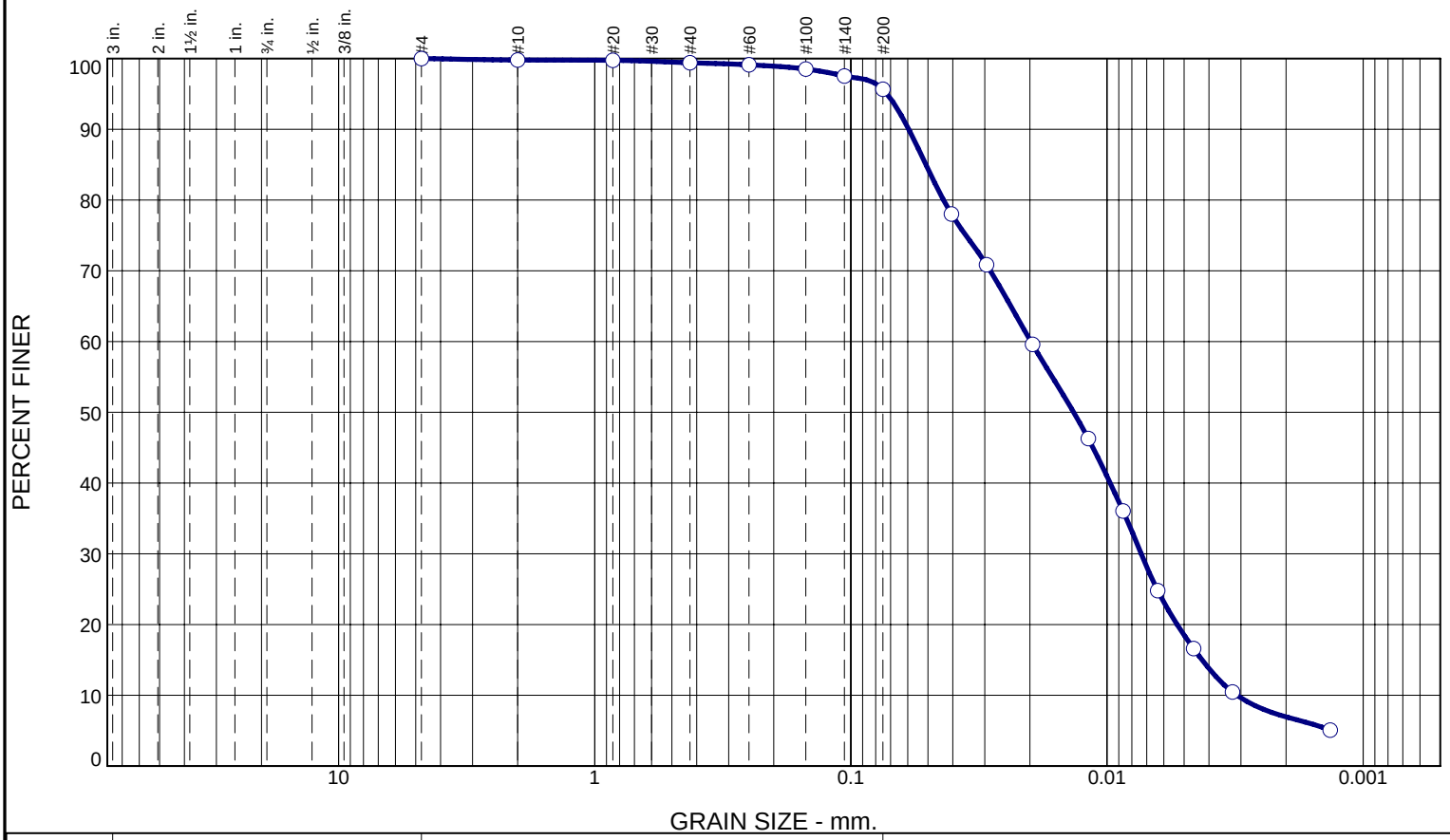
Client: RAMBOLL ENVIRON US CORPORATION
Project: EDWARDS POWER STATION

Project No: 11245037

Tested By: SJH **Checked By:** BCM

PARTICLE SIZE ANALYSIS OF SOILS

ASTM D6913 & D7928



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.2	0.4	3.7	77.2	18.5

Test Results (ASTM D422 & D1140)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
#4	100.0			
#10	99.8			
#20	99.8			
#40	99.4			
#60	99.1			
#100	98.5			
#140	97.5			
#200	95.7			
0.0405 mm.	78.0			
0.0295 mm.	70.9			
0.0195 mm.	59.6			
0.0118 mm.	46.3			
0.0087 mm.	36.1			
0.0063 mm.	24.8			
0.0046 mm.	16.6			
0.0032 mm.	10.5			
0.0013 mm.	5.1			

* (no specification provided)

GRAY SILT WITH CLAY

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0594 D_{85}= 0.0509 D_{60}= 0.0198
D_{50}= 0.0135 D_{30}= 0.0074 D_{15}= 0.0043
D_{10}= 0.0031 C_u= 6.38 C_c= 0.88

Classification

USCS= ML AASHTO=

Test Remarks

F.M.=0.03

Source of Sample: TPZX-200 **Depth:** 37.0'-39.0'
Sample Number: N/A **Sample Date:** 10-10-24

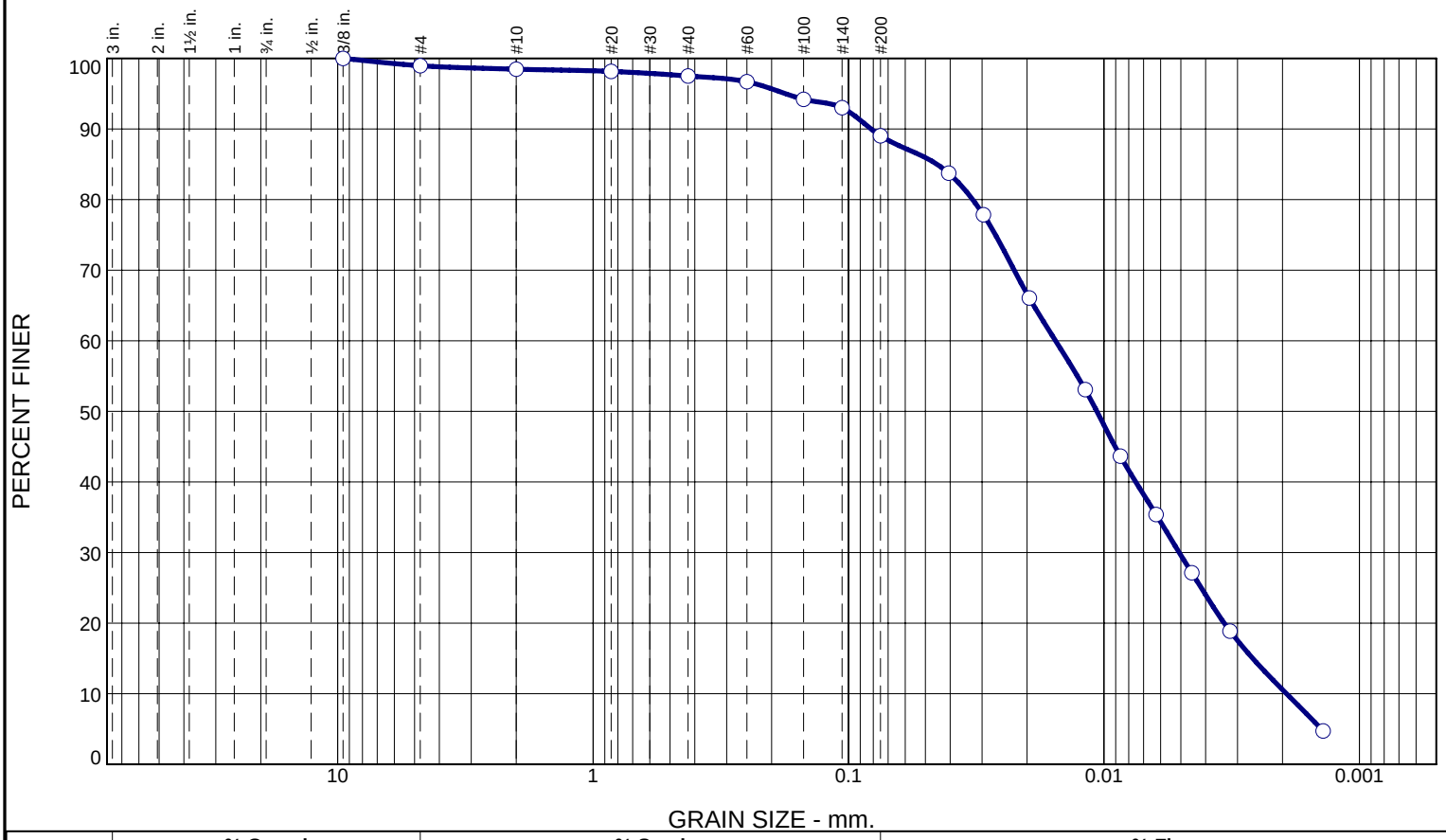
Client: RAMBOLL ENVIRON US CORPORATION
Project: EDWARDS POWER STATION

Project No: 11245037

Tested By: SJH **Checked By:** BCM

PARTICLE SIZE ANALYSIS OF SOILS

ASTM D6913 and D7928



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.0	0.5	1.0	8.5	78.4	10.6

Test Results (ASTM D6913 and D7928)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
.375	100.0			
#4	99.0			
#10	98.5			
#20	98.2			
#40	97.5			
#60	96.7			
#100	94.2			
#140	93.0			
#200	89.0			
0.0405 mm.	83.8			
0.0296 mm.	77.9			
0.0196 mm.	66.1			
0.0118 mm.	53.1			
0.0086 mm.	43.7			
0.0063 mm.	35.4			
0.0045 mm.	27.1			
0.0032 mm.	18.9			
0.0014 mm.	4.7			

* (no specification provided)

GRAY CLAYEY SILT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0816 D_{85}= 0.0450 D_{60}= 0.0155
D_{50}= 0.0107 D_{30}= 0.0051 D_{15}= 0.0026
D_{10}= 0.0019 C_u= 8.02 C_c= 0.86

Classification

USCS= CL-ML AASHTO=

Test Remarks

F.M.=0.15

Source of Sample: TPZ-XP03 **Depth:** 4.0'-6.0'
Sample Number: N/A **Sample Date:** 10-10-24

Terracon

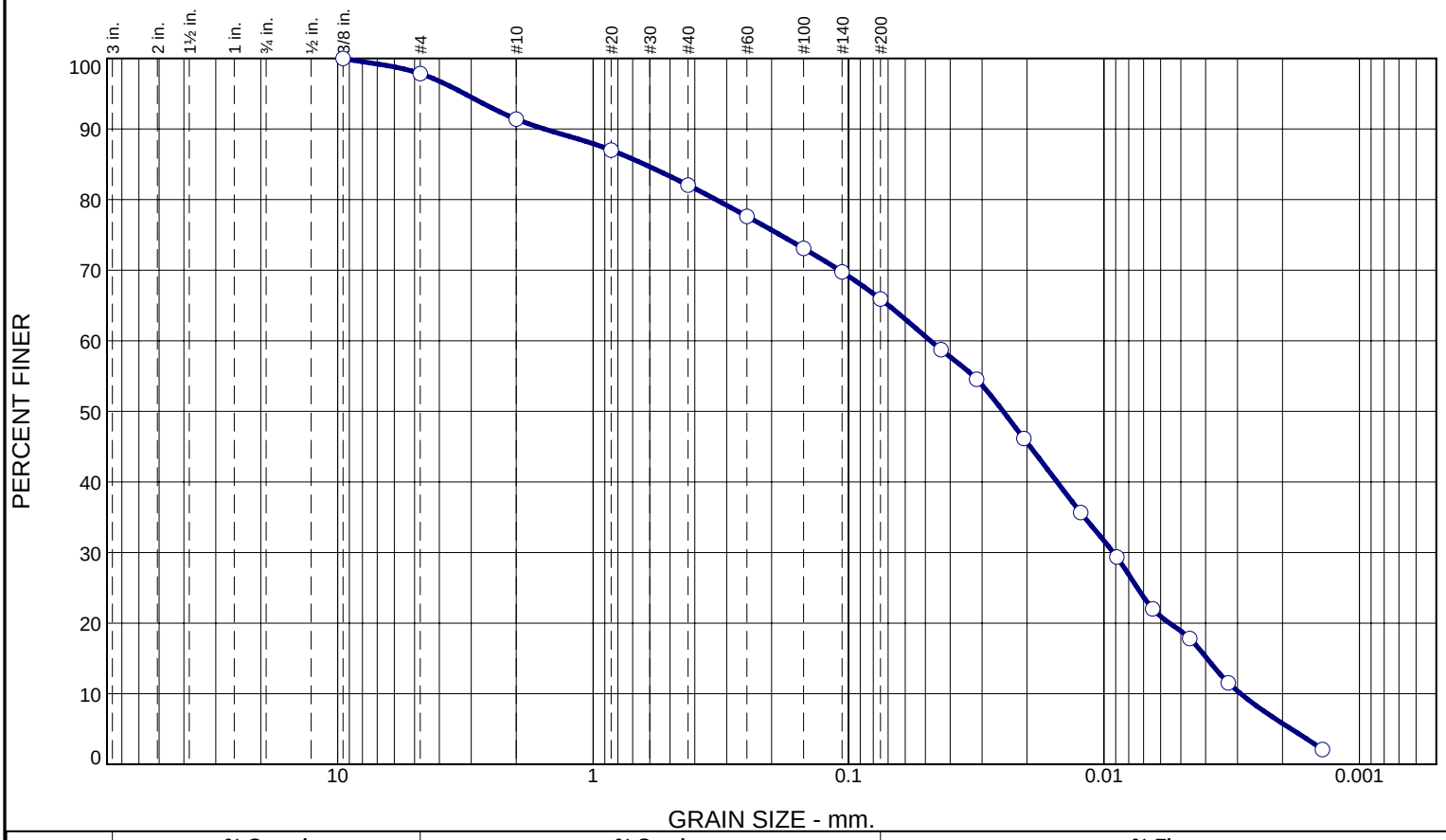
Client: RAMBOLL ENVIRON US CORPORATION
Project: EDWARDS POWER STATION

Project No: 11245037

Tested By: SJH **Checked By:** BCM

PARTICLE SIZE ANALYSIS OF SOILS

ASTM D6913 and D7928



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.2	6.4	9.3	16.2	47.0	18.9

Test Results (ASTM D6913 and D7928)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
.375	100.0			
#4	97.8			
#10	91.4			
#20	87.0			
#40	82.1			
#60	77.6			
#100	73.1			
#140	69.8			
#200	65.9			
0.0435 mm.	58.7			
0.0315 mm.	54.5			
0.0206 mm.	46.2			
0.0123 mm.	35.7			
0.0089 mm.	29.4			
0.0064 mm.	22.0			
0.0046 mm.	17.8			
0.0033 mm.	11.5			
0.0014 mm.	2.1			

* (no specification provided)

GRAY SANDY SILT WITH CLAY

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.5503 D_{85}= 0.6293 D_{60}= 0.0478
D_{50}= 0.0248 D_{30}= 0.0092 D_{15}= 0.0039
D_{10}= 0.0029 C_u= 16.40 C_c= 0.61

Classification

USCS= ML AASHTO=

Test Remarks

F.M.=0.84

Source of Sample: TPZ-XP03 **Depth:** 14.0'-16.0'
Sample Number: N/A **Sample Date:** 10-10-24

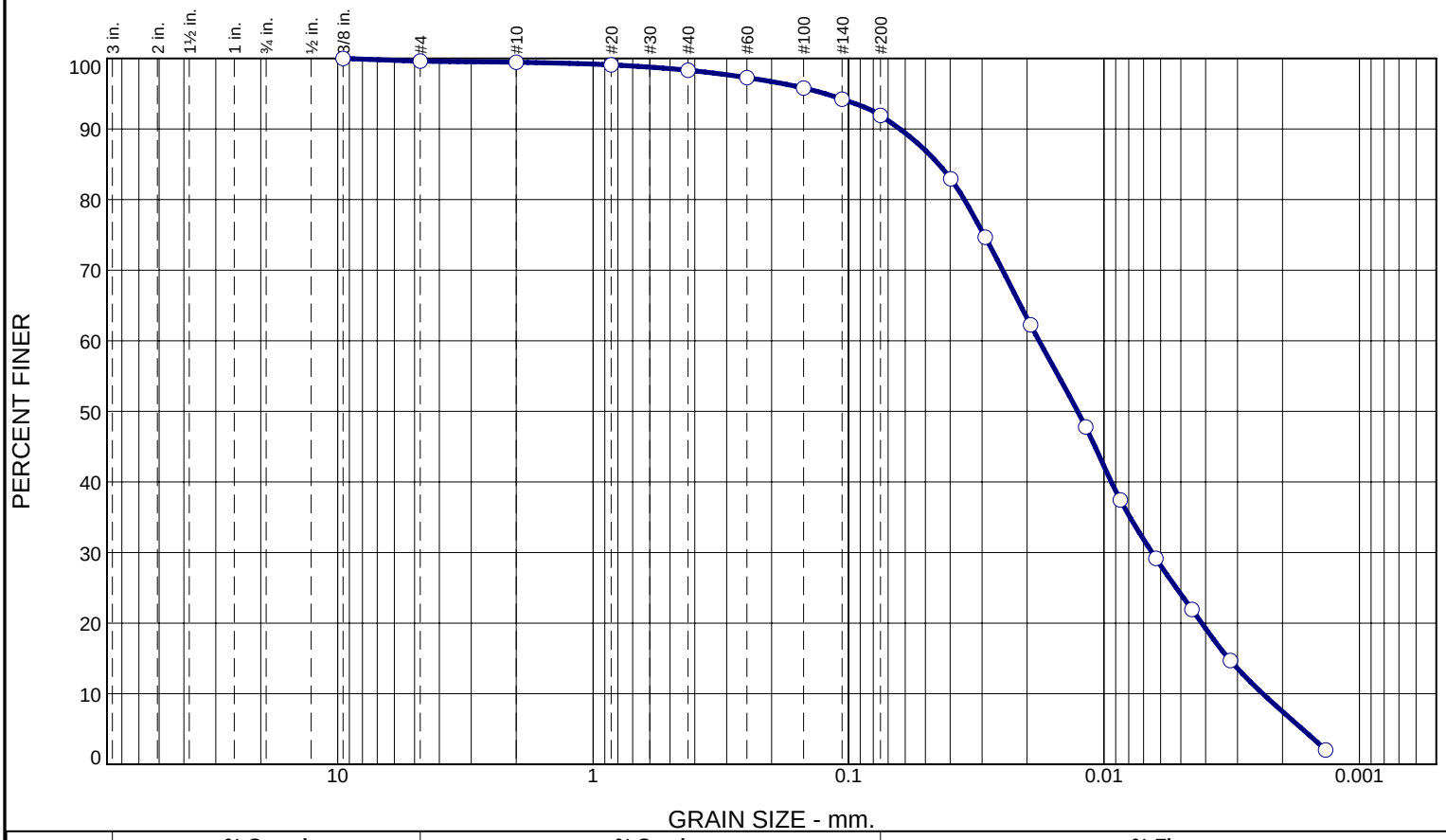
Client: RAMBOLL ENVIRON US CORPORATION
Project: EDWARDS POWER STATION

Project No: 11245037

Tested By: SJH **Checked By:** BCM

PARTICLE SIZE ANALYSIS OF SOILS

ASTM D6913 & D7928



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.4	0.1	1.2	6.4	67.8	24.1

Test Results (ASTM D422 & D1140)

Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)	Pct. of Fines
.375	100.0			
#4	99.6			
#10	99.5			
#20	99.1			
#40	98.3			
#60	97.3			
#100	95.8			
#140	94.2			
#200	91.9			
0.0398 mm.	83.0			
0.0292 mm.	74.7			
0.0194 mm.	62.3			
0.0118 mm.	47.8			
0.0086 mm.	37.5			
0.0063 mm.	29.2			
0.0045 mm.	21.9			
0.0032 mm.	14.7			
0.0014 mm.	2.0			

* (no specification provided)

GRAY CLAYEY SILT

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0629 D_{85}= 0.0443 D_{60}= 0.0179
D_{50}= 0.0127 D_{30}= 0.0065 D_{15}= 0.0033
D_{10}= 0.0024 C_u= 7.51 C_c= 0.98

Classification

USCS= CL-ML AASHTO=

Test Remarks

F.M.=0.09

Source of Sample: TPZ-XP03 **Depth:** 32.0'-34.0'
Sample Number: N/A **Sample Date:** 10-10-24

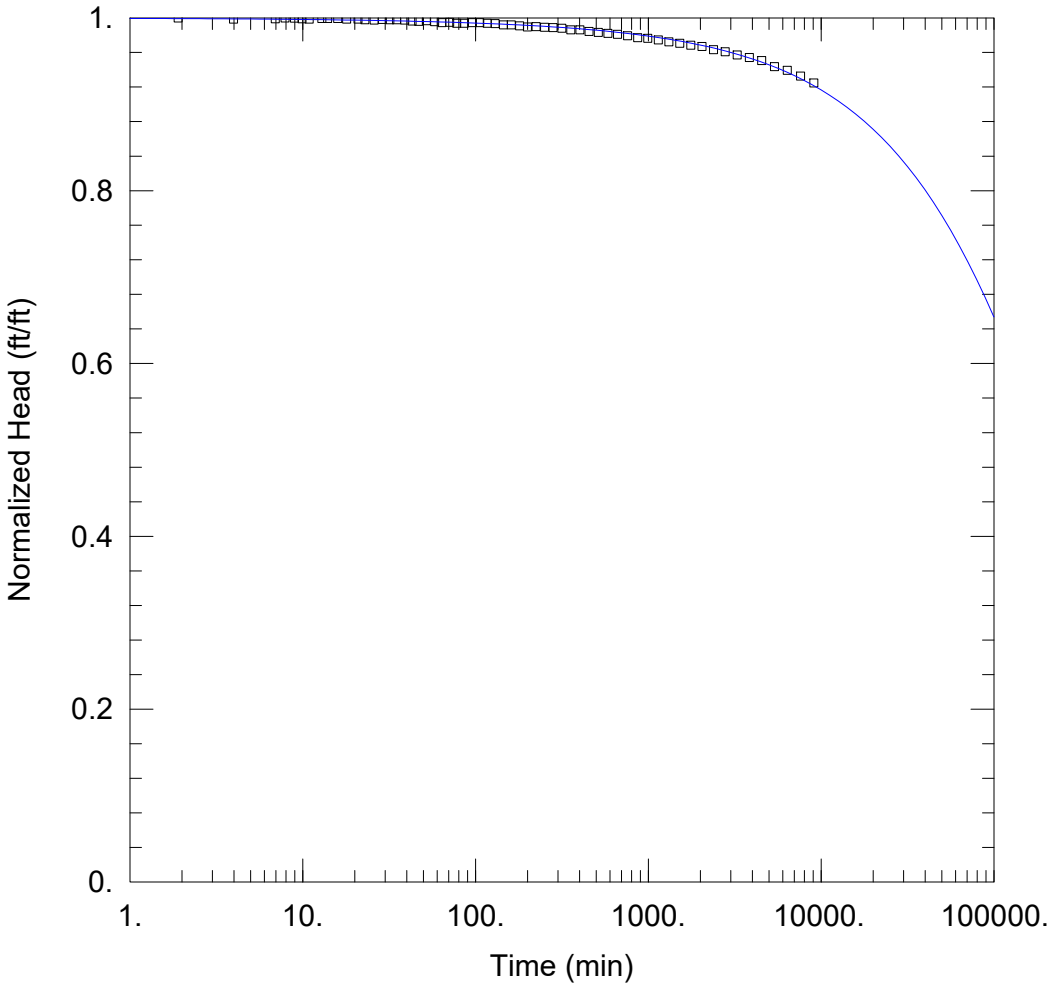
Terracon

Client: RAMBOLL ENVIRON US CORPORATION
Project: EDWARDS POWER STATION

Project No: 11245037

Tested By: SJH **Checked By:** BCM

ATTACHMENT E
Slug Test Results



SLUG IN 1

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940110482
Location: Bartonville, IL
Test Well: APW-02
Test Date: 9/25/2024

AQUIFER DATA

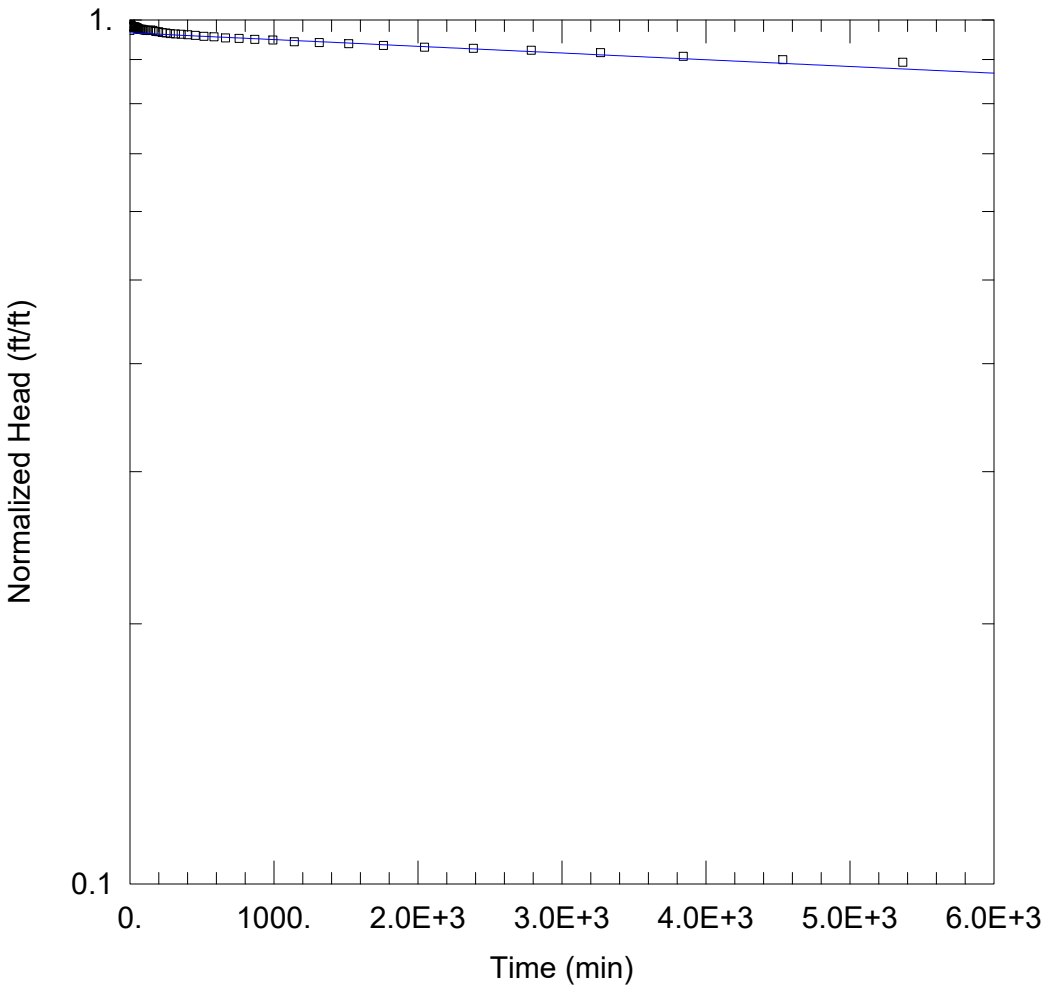
Saturated Thickness: 10.4 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW-02)

Initial Displacement: 2.751 ft
Total Well Penetration Depth: 43.98 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 43.98 ft
Screen Length: 10.4 ft
Well Radius: 0.323 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 3.6E-7 cm^2/sec
S = 0.00093



SLUG IN 1

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940110482
Location: Bartonville, IL
Test Well: APW-03
Test Date: 9/25/2024

AQUIFER DATA

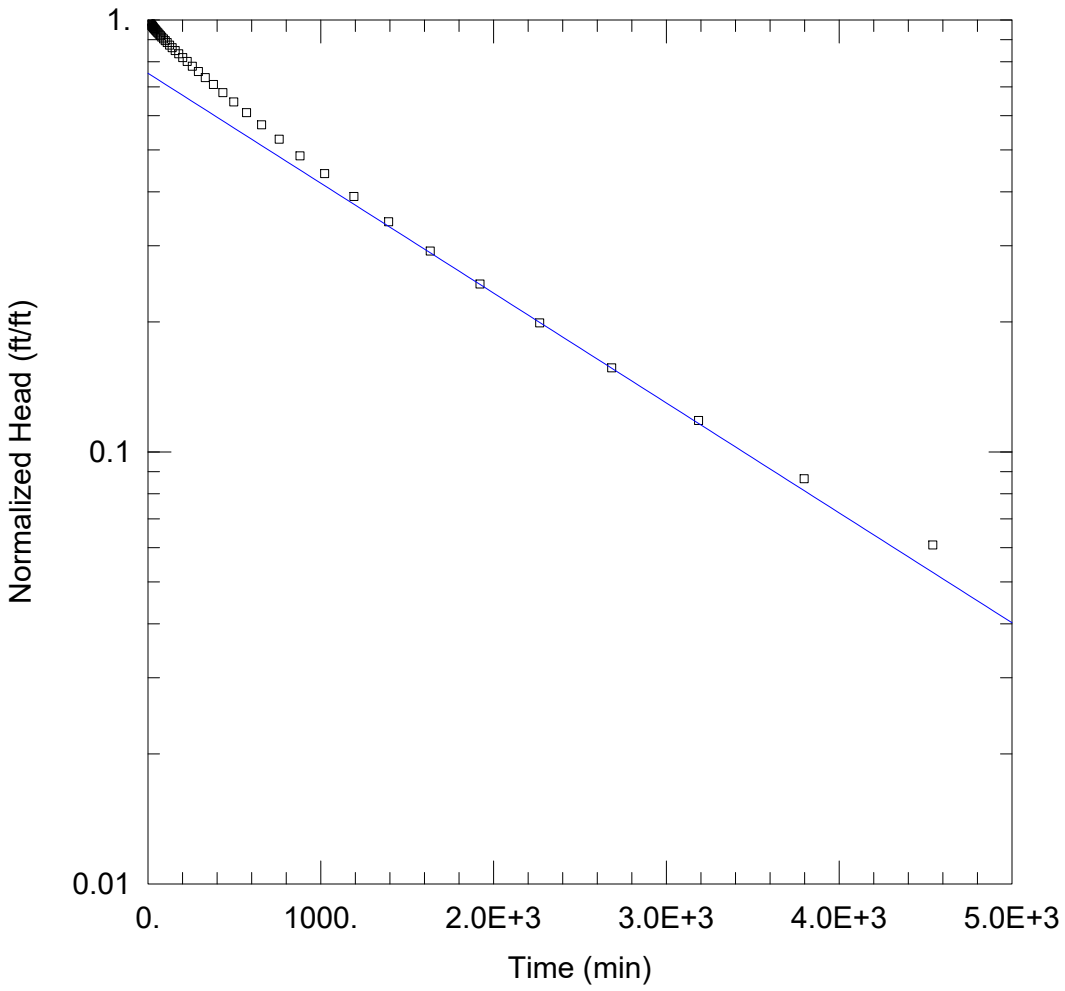
Saturated Thickness: 24.13 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW-03)

Initial Displacement: 2.536 ft
Total Well Penetration Depth: 24.13 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 24.13 ft
Screen Length: 10.4 ft
Well Radius: 0.323 ft

SOLUTION

Aquifer Model: Unconfined
K = 8.3E-9 cm/sec
Solution Method: Bouwer-Rice
y0 = 2.45 ft



SLUG IN 1

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940110482
Location: Bartonville, IL
Test Well: APW-04
Test Date: 9/26/2024

AQUIFER DATA

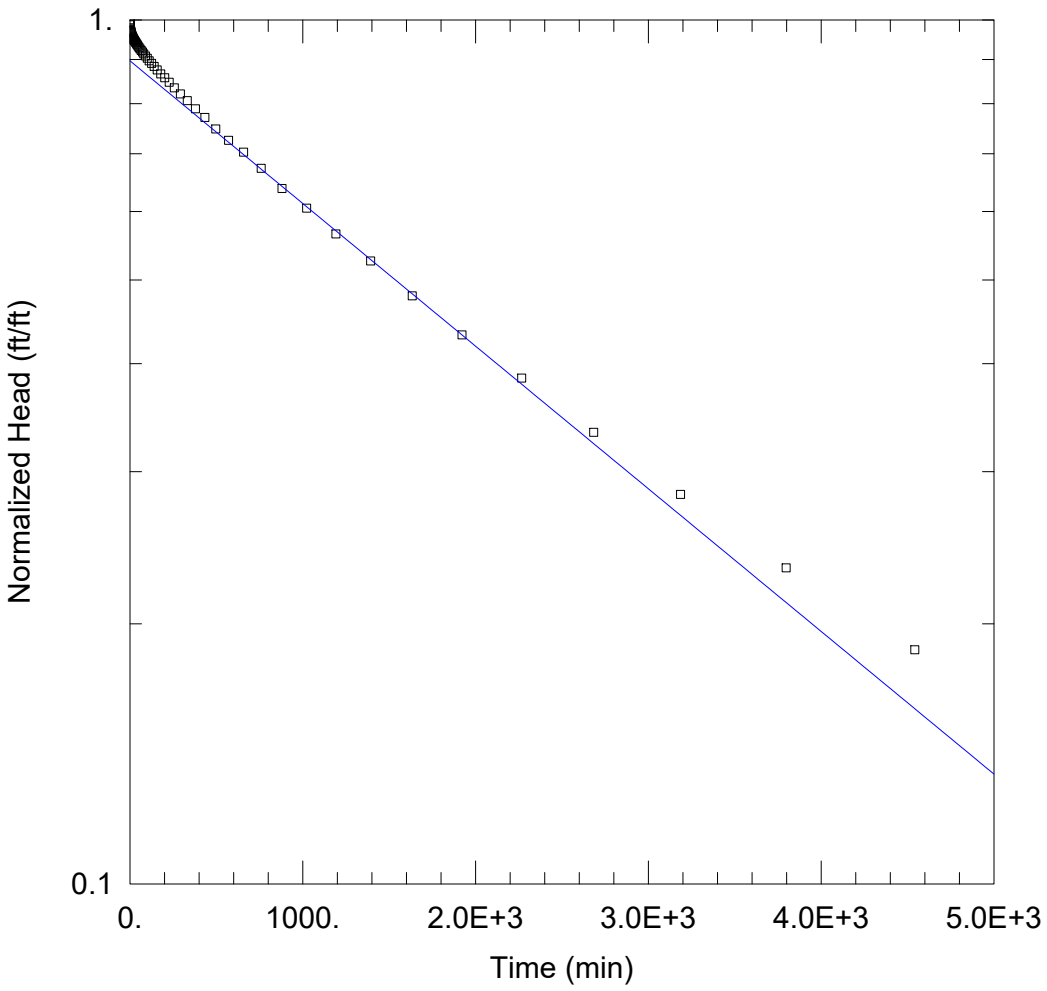
Saturated Thickness: 14.47 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW-04)

Initial Displacement: 2.791 ft
Total Well Penetration Depth: 14.47 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 14.47 ft
Screen Length: 10.4 ft
Well Radius: 0.323 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 2.45E-7 cm/sec
y0 = 2.1 ft



SLUG OUT 1

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940110482
Location: Bartonville, IL
Test Well: APW-04
Test Date: 9/26/2024

AQUIFER DATA

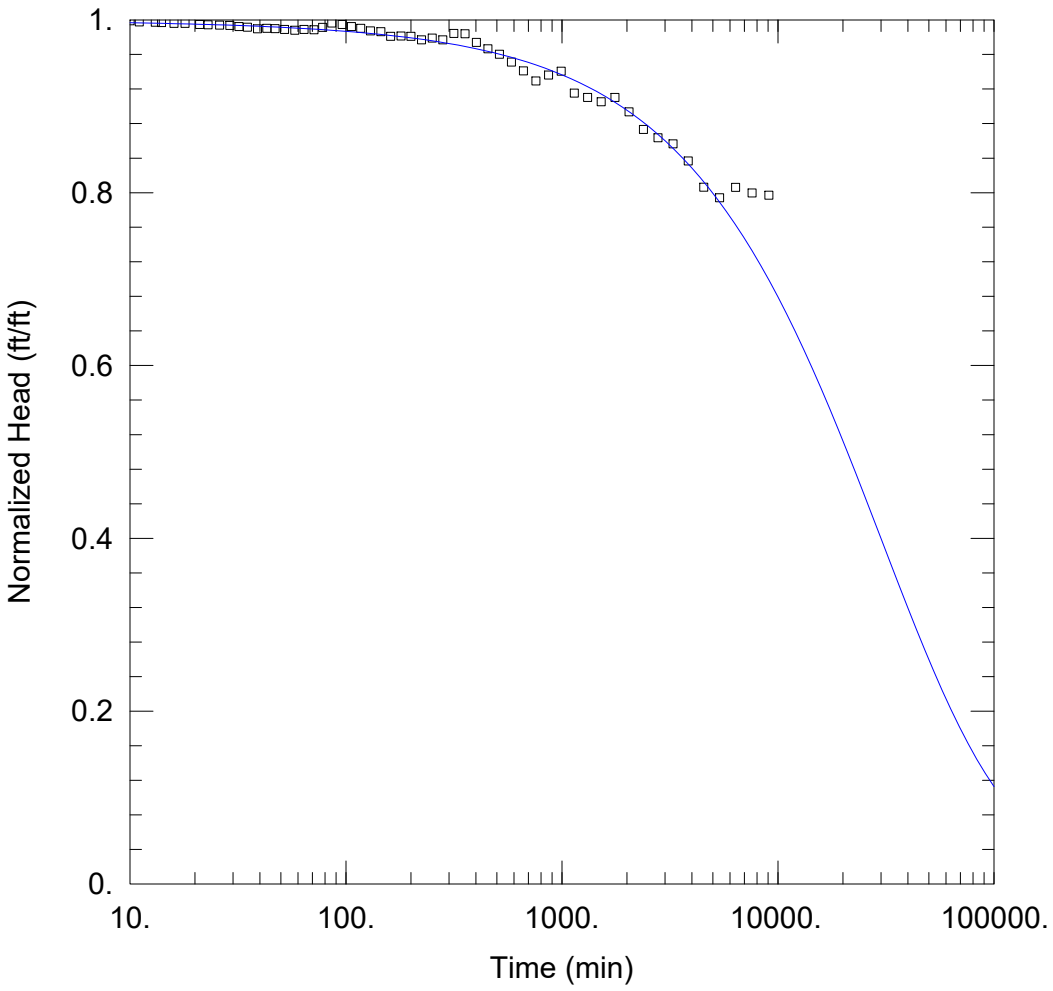
Saturated Thickness: 14.47 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (APW-04)

Initial Displacement: 2.989 ft
Total Well Penetration Depth: 14.47 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 14.47 ft
Screen Length: 10.4 ft
Well Radius: 0.323 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 1.59E-7 cm/sec
y0 = 2.68 ft



SLUG IN 1

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940110482
Location: Bartonville, IL
Test Well: P003
Test Date: 9/26/2024

AQUIFER DATA

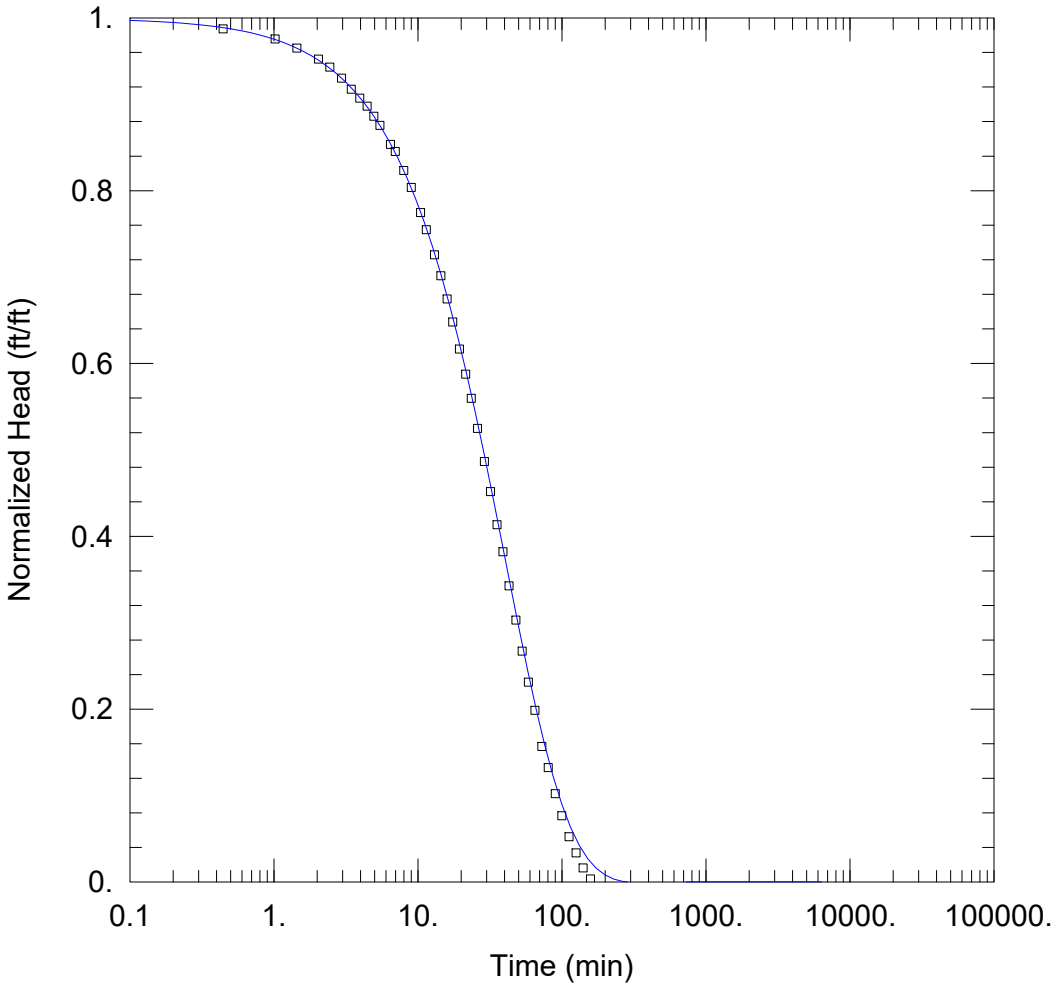
Saturated Thickness: 5.3 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (P003)

Initial Displacement: 2.997 ft
Total Well Penetration Depth: 28.75 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 28.75 ft
Screen Length: 5.3 ft
Well Radius: 0.167 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 4.9E-6 cm^2/sec
S = 0.00063



SLUG IN 1

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940110482
Location: Bartonville, IL
Test Well: P004
Test Date: 9/26/2024

AQUIFER DATA

Saturated Thickness: 18.35 ft

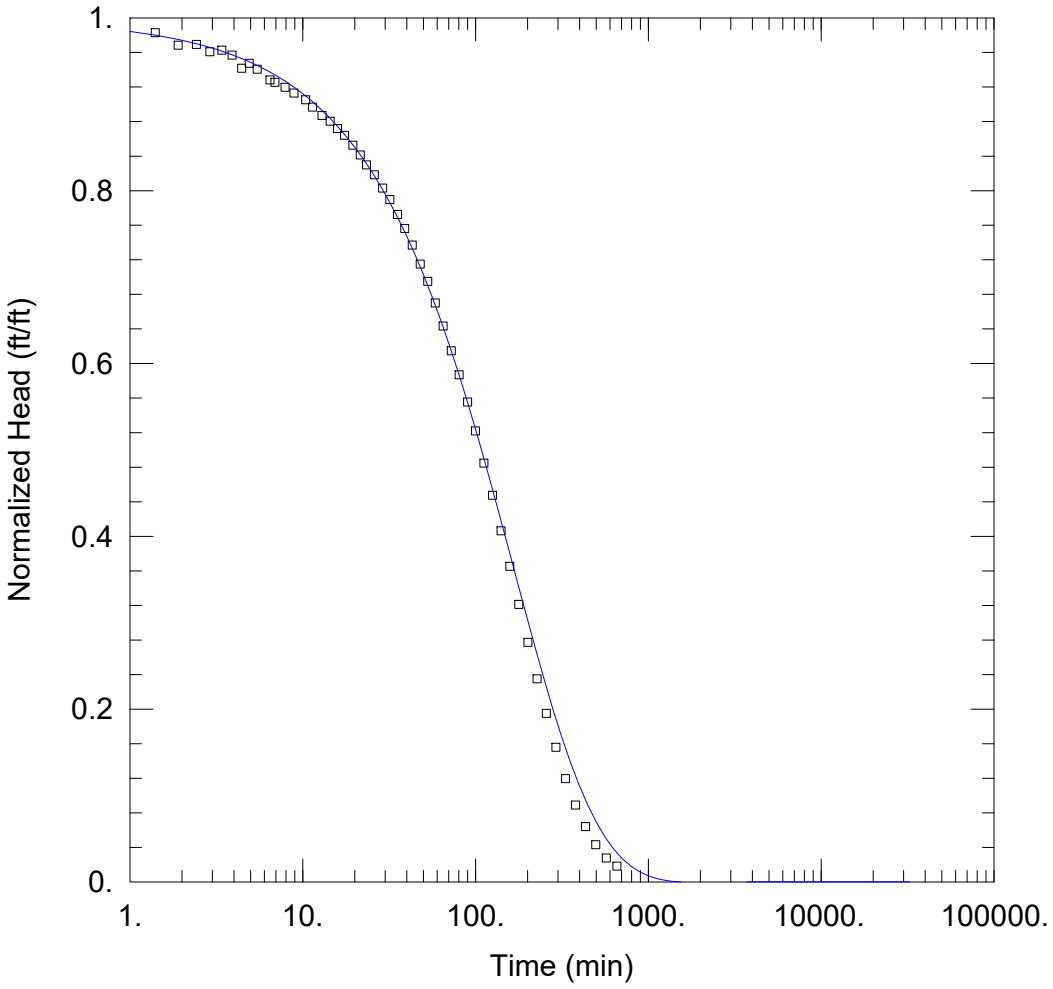
WELL DATA (P004)

Initial Displacement: 0.861 ft
Total Well Penetration Depth: 22.45 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 18.35 ft
Screen Length: 10.4 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 2.2E-5 cm/sec
Kz/Kr = 1.
Ss = 7.6E-8 ft^{-1}



SLUG OUT 1

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940110482
Location: Bartonville, IL
Test Well: P004
Test Date: 9/26/2024

AQUIFER DATA

Saturated Thickness: 18.35 ft

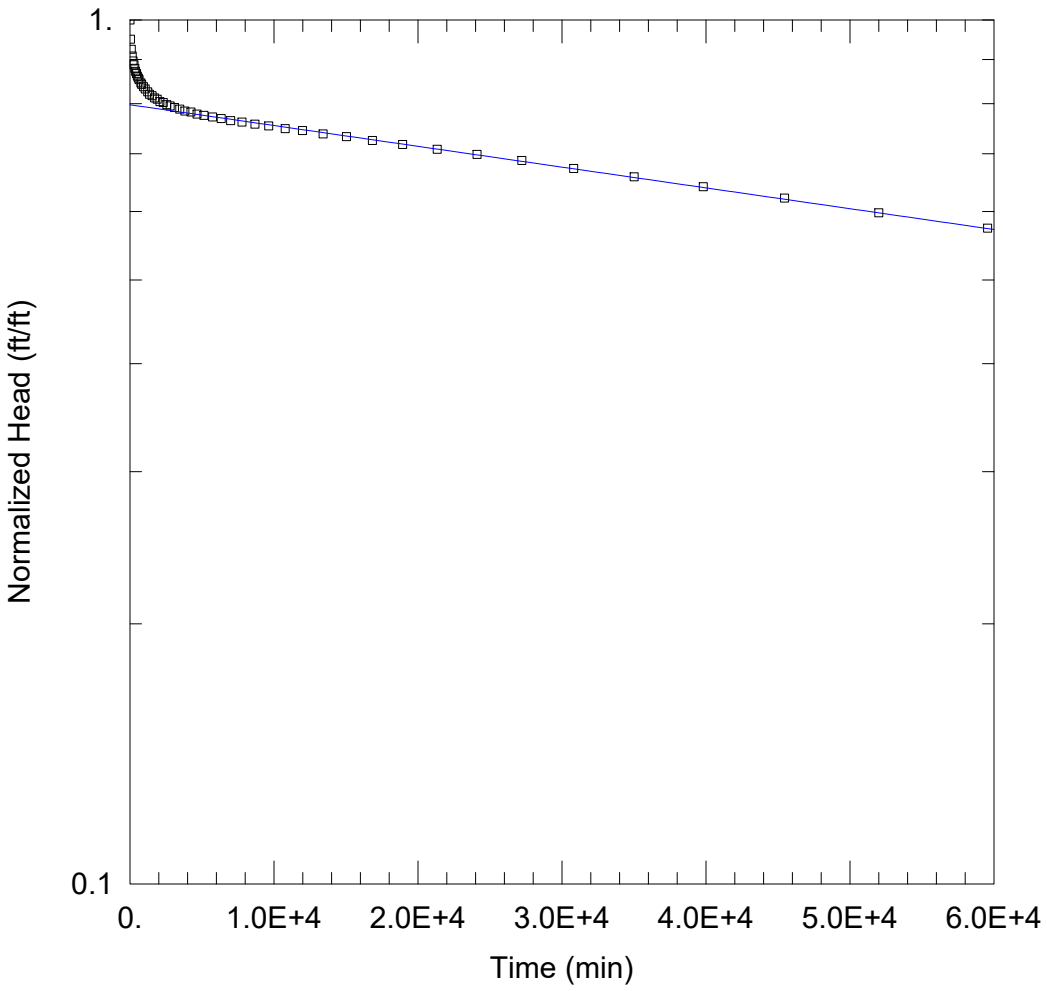
WELL DATA (P004)

Initial Displacement: 1.046 ft
Total Well Penetration Depth: 22.45 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 18.35 ft
Screen Length: 10.4 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 5.2E-6 cm/sec
Kz/Kr = 1.
Ss = 2.1E-5 ft^{-1}



SLUG IN 1

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940110482
Location: Bartonville, IL
Test Well: TPZ-100
Test Date: 10/3/2024

AQUIFER DATA

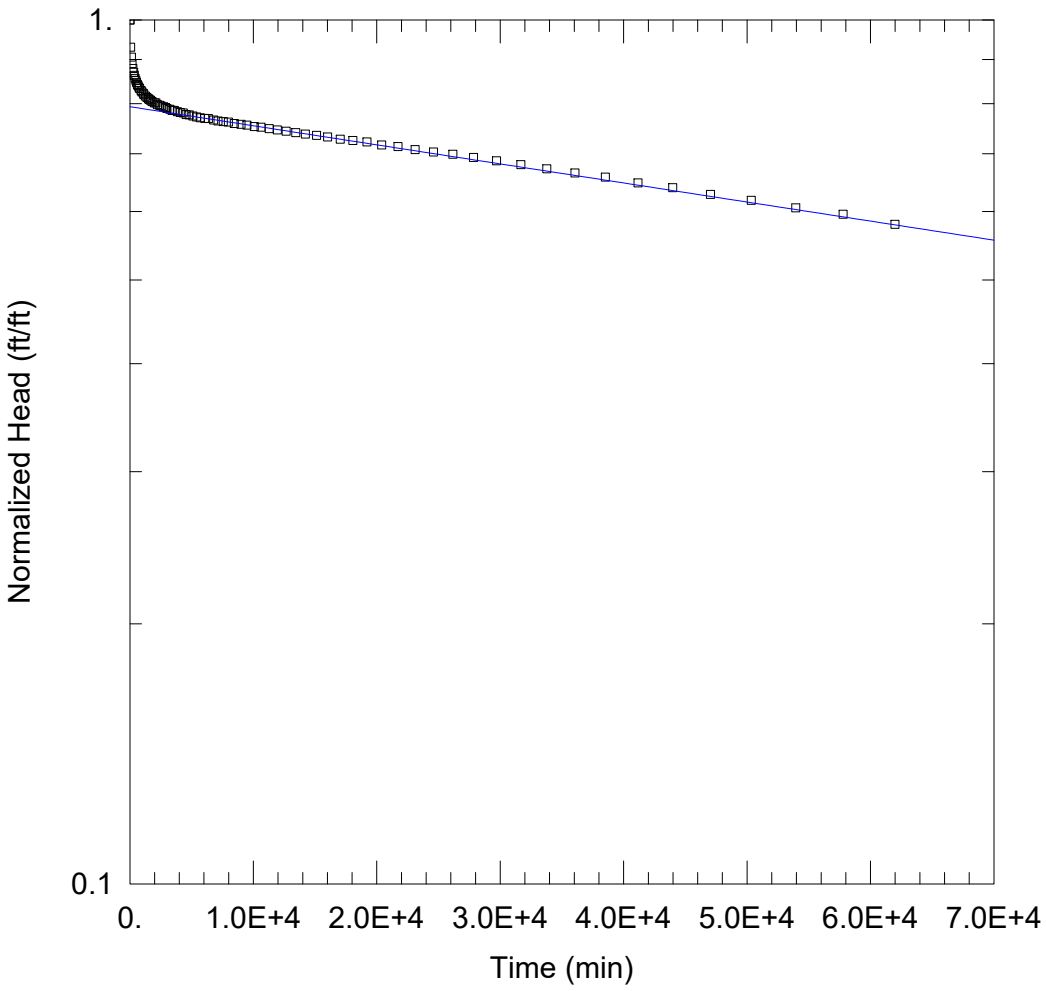
Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (TPZ-100)

Initial Displacement: 5.767 ft
Total Well Penetration Depth: 27.12 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 27.12 ft
Screen Length: 10. ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 9.6E-9 cm/sec
y0 = 4.6 ft



SLUG IN 1

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940110482
Location: Bartonville, IL
Test Well: TPZ-101
Test Date: 10/3/2024

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 1.

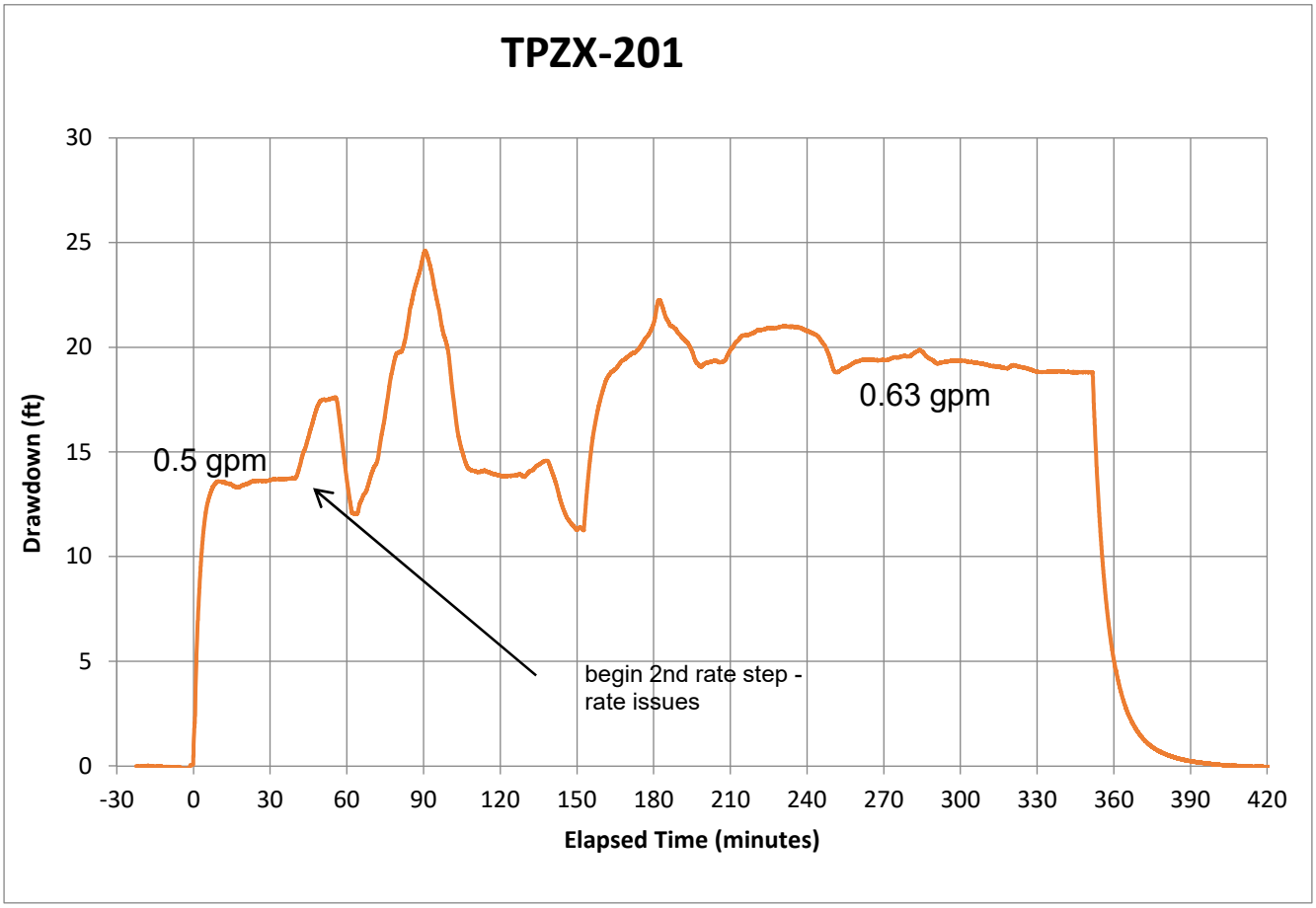
WELL DATA (TPZ-101)

Initial Displacement: 4.474 ft
Total Well Penetration Depth: 33.04 ft
Casing Radius: 0.0833 ft
Static Water Column Height: 10. ft
Screen Length: 10. ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 9.1E-9 cm/sec
y0 = 3.55 ft

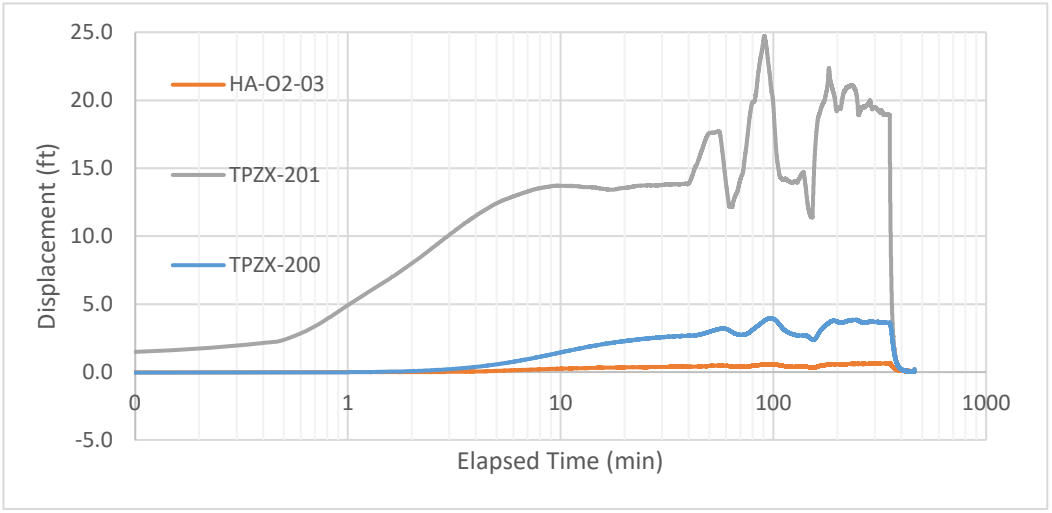
ATTACHMENT F
Pump Test Results



Start pumping: 10/1/2024 9:21
Stop pumping: 10/1/2024 15:13

Total pumping time: 352 minutes
5.87 hours

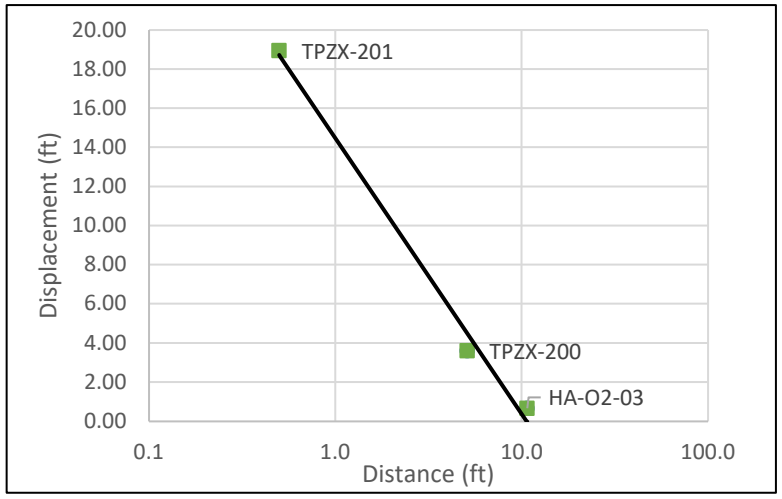
Step	Rate (gpm)	Drawdown (ft)	SpC (gpm/ft)
1	0.5	13.73	0.04
2	0.63	18.90	0.03



Well	Distance (ft)	Drawdown (ft)
TPZX-201	0.5	18.94
TPZX-200	5.1	3.60
HA-O2-03	10.7	0.66

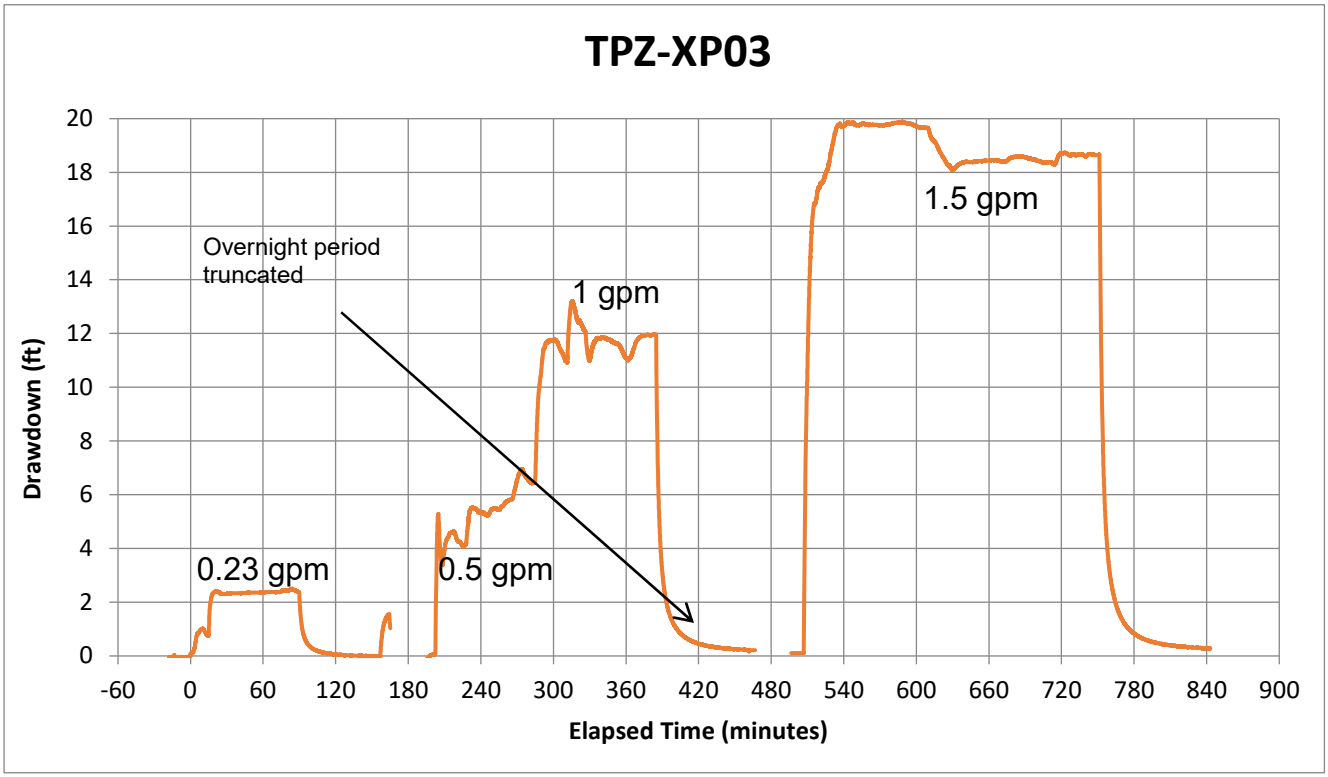
$$T = \frac{2.3Q}{4pi\Delta s} \qquad S = \frac{2.25Tt}{r_0^2}$$

Pumping Rate	0.63	gpm
Test Duration	352	minutes
Transmissivity, T	2.4	ft2/d
Aquifer Thickness, b	15	feet
Hydraulic Conductivity, K	**0.16**	ft/d
Storativity, S	**0.008**	



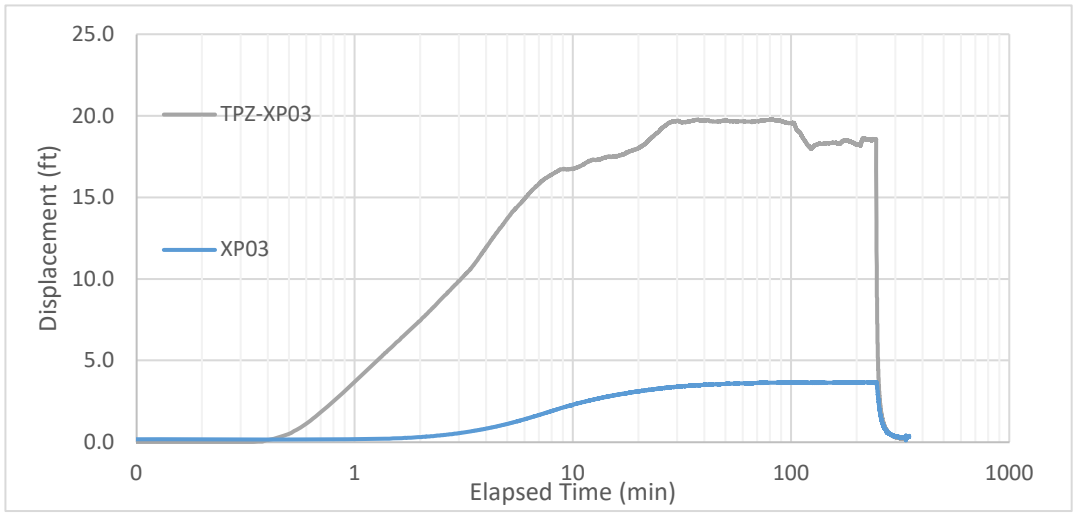
DRAFT
TPZX-201, Distance-Drawdown
Edwards Power Plant
Vistra

RAMBOLL



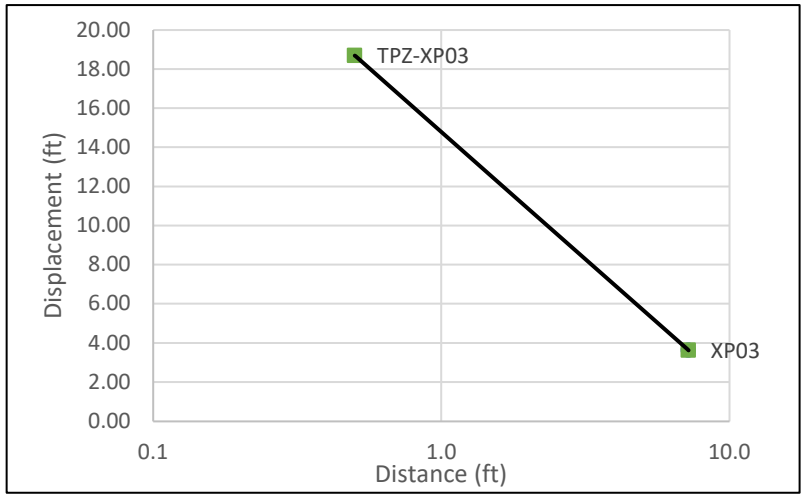
Start pumping: 6547479%=?:=%FR overnight period omitted

Step	Rate (gpm)	Drawdown (ft)	SpC (gpm/ft)
1	0.23	2.47	0.093
2	0.5	6.47	0.077
3	1.0	11.95	0.084
4 (CRT)	1.5	18.70	0.080



Well	Distance (ft)	Drawdown (ft)
TPZ-XP03	0.5	18.70
XP03	7.2	3.63

$$T = \frac{2.3Q}{4pi\Delta s} \qquad S = \frac{2.25Tt}{r_0^2}$$



Pumping Rate	1.5	gpm
Test Duration	244	minutes
Transmissivity, T	4.1	ft2/d
Aquifer Thickness, b	15	feet
Hydraulic Conductivity, K	**0.27**	ft/d
Storativity, S	**0.008**	

DRAFT
TPZ-XP03, Distance-Drawdown
Edwards Power Plant
Vistra

RAMBOLL

ATTACHMENT G
Piezometer Abandonment Forms

WELL/DRILLHOLE/BOREHOLE ABANDONMENT

(1) GENERAL INFORMATION

Unique Well No.	Well ID No.	County
EDW_TPZ-100	TPZ-100	Peoria

Common Well Name: TPZ-100 ____ Gov't Lot (if applicable)

____ 1/4 of 4 1/4 of Sec. 14 ; T. 7 R. 7

Grid Location

____ ft. ☐ N. ☐ S., ____ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat 40° 35' 33.3" Long -89° 40' 11.1" or

State Plane 1,430,126 ft. N. 2,434,584 ft. E.

Reason For Abandonment	Unique Well No.
Temporary Well	

(2) FACILITY /OWNER INFORMATION

Facility Name: Edwards Power Plant

Facility ID	License/Permit/Monitoring No.

Street Address of Well: 7800 S Cilco Ln

City, Village, or Town: Peoria

Present Well Owner	Original Owner
Mark Davis	Illinois Power Generating Company

Street Address or Route of Owner: 7800 S Cilco Ln

City, State, Zip Code: Peoria, IL 61607

(3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 9/26/2024

☒ Monitoring Well
☐ Water Well
☐ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:

☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ____

Formation Type:

☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 40.0

Casing Diameter (in.): 2.00

Casing Depth (ft.): ____

Lower Drillhole Diameter (in.): 6.0

Was Well Annular Space Grouted? ☒ Yes ☐ No ☐ Unknown

If Yes, To What Depth? 25.5 Feet

Depth to Water (Feet): 32.8

(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed?	☐ Yes	☐ No	☒ Not Applicable
Liner(s) Removed?	☐ Yes	☐ No	☒ Not Applicable
Screen Removed?	☐ Yes	☒ No	☐ Not Applicable
Casing Left in Place?	☒ Yes	☐ No	
Was Casing Cut Off Below Surface?	☒ Yes	☐ No	
Did Sealing Material Rise to Surface?	☒ Yes	☐ No	
Did Material Settle After 24 Hours?	☐ Yes	☒ No	
If Yes, Was Hole Retopped?	☐ Yes	☒ No	

Required Method of Placing Sealing Material

☐ Conductor Pipe - Gravity ☐ Conductor Pipe - Pumped
☒ Screened & Poured ☐ Other (Explain)
(Bentonite Chips)

Sealing Materials

☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☐ Bentonite-Sand Slurry
☒ Chipped Bentonite

(5) Sealing Material Used	From (Ft.)	To (Ft.)	Sacks Sealant	Mix Ratio or Mud Weight
Borehole Material	Surface	25.4		
Time-Release Coated Bentonite Chips	25.4	40.0		

(6) Comments: Well casing removed to 10 feet below ground surface.

(7) Name of Person or Firm Doing Sealing Work	Date of Abandonment
Ramboll Americas Engineering Solutions, Inc.	10/4/24

Signature of Person Doing Work	Date Signed
Michael Davie	3/6/25

Street or Route	Telephone Number
333 W. Wacker Dr. Suite 1050	(414) 837-3607

City, State, Zip Code: Chicago, IL 60606

Comments

Template: RAMBOLL_ABANDONMENT - Project: 845_EDWARDS_2021, 2024.GPJ

WELL/DRILLHOLE/BOREHOLE ABANDONMENT

(1) GENERAL INFORMATION

Unique Well No.	Well ID No.	County
EDW_TPZ-101	TPZ-101	Peoria

Common Well Name: TPZ-101 ____ Gov't Lot (if applicable)

Grid Location: ____ 1/4 of 4 1/4 of Sec. 14 ; T. 7 R. 7

____ ft. ☐ N. ☐ S., ____ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat 40° 35' 23.5" Long -89° 40' 5.3" or

State Plane 1,429,138 ft. N. 2,435,032 ft. E.

Reason For Abandonment	Unique Well No.
Temporary Well	

(2) FACILITY /OWNER INFORMATION

Facility Name: Edwards Power Plant

Facility ID: | License/Permit/Monitoring No.:

Street Address of Well: 7800 S Cilco Ln

City, Village, or Town: Peoria

Present Well Owner: Mark Davis | Original Owner: Illinois Power Generating Company

Street Address or Route of Owner: 7800 S Cilco Ln

City, State, Zip Code: Peoria, IL 61607

(3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 9/26/2024

☒ Monitoring Well
☐ Water Well
☐ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:

☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ____

Formation Type:

☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 40.0 Casing Diameter (in.): 2.00

Casing Depth (ft.): ____

Lower Drillhole Diameter (in.): 6.0

Was Well Annular Space Grouted? ☒ Yes ☐ No ☐ Unknown

If Yes, To What Depth? 25.5 Feet

Depth to Water (Feet): 36.9

(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed?	☐ Yes	☐ No	☒ Not Applicable
Liner(s) Removed?	☐ Yes	☐ No	☒ Not Applicable
Screen Removed?	☐ Yes	☒ No	☐ Not Applicable
Casing Left in Place?	☒ Yes	☐ No	
Was Casing Cut Off Below Surface?	☒ Yes	☐ No	
Did Sealing Material Rise to Surface?	☒ Yes	☐ No	
Did Material Settle After 24 Hours?	☐ Yes	☒ No	
If Yes, Was Hole Retopped?	☐ Yes	☒ No	

Required Method of Placing Sealing Material

☐ Conductor Pipe - Gravity ☐ Conductor Pipe - Pumped
☒ Screened & Poured ☐ Other (Explain)
(Bentonite Chips)

Sealing Materials

☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☐ Bentonite-Sand Slurry
☒ Chipped Bentonite

(5) Sealing Material Used	From (Ft.)	To (Ft.)	Sacks Sealant	Mix Ratio or Mud Weight
Borehole Material	Surface	28.6		
Time-Release Coated Bentonite Chips	28.6	45.0		

(6) Comments: Well casing removed to 10 feet below ground surface.

(7) Name of Person or Firm Doing Sealing Work: Ramboll Americas Engineering Solutions, Inc.

Date of Abandonment: 10/4/24

Signature of Person Doing Work: Michael Davie

Date Signed: 3/6/25

Street or Route: 333 W. Wacker Dr. Suite 1050

Telephone Number: (414) 837-3607

City, State, Zip Code: Chicago, IL 60606

Comments

Template: RAMBOLL_ABANDONMENT - Project: 845_EDWARDS_2021, 2024.GPJ

WELL/DRILLHOLE/BOREHOLE ABANDONMENT

(1) GENERAL INFORMATION

Unique Well No.	Well ID No.	County
EDW_TPZX-200_pore	TPZX-200	Peoria

Common Well Name: TPZX-200 ____ Gov't Lot (if applicable)

____ 1/4 of 4 1/4 of Sec. 14 ; T. 7 R. 7

Grid Location

____ ft. ☐ N. ☐ S., ____ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat 40° 25' 29.8" Long -89° 40' 6.7" or

State Plane 1,429,773 ft. N. 2,434,926 ft. E.

Reason For Abandonment	Unique Well No.
Temporary Well	

(2) FACILITY /OWNER INFORMATION

Facility Name: Edwards Power Plant

Facility ID	License/Permit/Monitoring No.

Street Address of Well: 7800 S Cilco Ln

City, Village, or Town: Peoria

Present Well Owner	Original Owner
Mark Davis	Illinois Power Generating Company

Street Address or Route of Owner: 7800 S Cilco Ln

City, State, Zip Code: Peoria, IL 61607

(3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 9/25/2024

☒ Monitoring Well
☐ Water Well
☐ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:

☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ____

Formation Type:

☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 42.0

Casing Diameter (in.): 2.00

Casing Depth (ft.): ____

Lower Drillhole Diameter (in.): 6.0

Was Well Annular Space Grouted? ☒ Yes ☐ No ☐ Unknown

If Yes, To What Depth? 27.5 Feet

Depth to Water (Feet): ____

(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed?	☐ Yes	☐ No	☒ Not Applicable
Liner(s) Removed?	☐ Yes	☐ No	☒ Not Applicable
Screen Removed?	☐ Yes	☒ No	☐ Not Applicable
Casing Left in Place?	☒ Yes	☐ No	
Was Casing Cut Off Below Surface?	☒ Yes	☐ No	
Did Sealing Material Rise to Surface?	☒ Yes	☐ No	
Did Material Settle After 24 Hours?	☐ Yes	☒ No	
If Yes, Was Hole Retopped?	☐ Yes	☒ No	

Required Method of Placing Sealing Material

☐ Conductor Pipe - Gravity ☐ Conductor Pipe - Pumped
☒ Screened & Poured ☐ Other (Explain)
(Bentonite Chips)

Sealing Materials

☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☐ Bentonite-Sand Slurry
☒ Chipped Bentonite

(5) Sealing Material Used	From (Ft.)	To (Ft.)	Sacks Sealant	Mix Ratio or Mud Weight
Borehole Material	Surface	31.7		
Time-Release Coated Bentonite Chips	31.7	45.0		

(6) Comments: Well casing removed to 2 feet below ground surface.

(7) Name of Person or Firm Doing Sealing Work	Date of Abandonment
Ramboll Americas Engineering Solutions, Inc.	10/4/24

Signature of Person Doing Work	Date Signed
Michael Davie	3/6/25

Street or Route	Telephone Number
333 W. Wacker Dr. Suite 1050	(414) 837-3607

City, State, Zip Code: Chicago, IL 60606

Comments

Template: RAMBOLL_ABANDONMENT - Project: 845_EDWARDS_2021, 2024.GPJ

WELL/DRILLHOLE/BOREHOLE ABANDONMENT

(1) GENERAL INFORMATION

Unique Well No.	Well ID No.	County
EDW_TPZX-201_pore	TPZX-201	Peoria

Common Well Name: TPZX-201 ____ Gov't Lot (if applicable)

____ 1/4 of 4 1/4 of Sec. 14 ; T. 7 R. 7

Grid Location

____ ft. ☐ N. ☐ S., ____ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat 40° 35' 29.8" Long -89° 40' 6.7" or

State Plane 1,429,769 ft. N. 2,434,922 ft. E.

Reason For Abandonment	Unique Well No.
Temporary Well	

(2) FACILITY /OWNER INFORMATION

Facility Name: Edwards Power Plant

Facility ID	License/Permit/Monitoring No.

Street Address of Well: 7800 S Cilco Ln

City, Village, or Town: Peoria

Present Well Owner	Original Owner
Mark Davis	Illinois Power Generating Company

Street Address or Route of Owner: 7800 S Cilco Ln

City, State, Zip Code: Peoria, IL 61607

(3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 9/25/2024

☒ Monitoring Well
☐ Water Well
☐ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:

☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ____

Formation Type:

☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 43.0

Casing Diameter (in.): 2.00

Casing Depth (ft.): ____

Lower Drillhole Diameter (in.): 6.0

Was Well Annular Space Grouted? ☒ Yes ☐ No ☐ Unknown

If Yes, To What Depth? 28.5 Feet

Depth to Water (Feet): ____

(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed?	☐ Yes	☐ No	☒ Not Applicable
Liner(s) Removed?	☐ Yes	☐ No	☒ Not Applicable
Screen Removed?	☐ Yes	☒ No	☐ Not Applicable
Casing Left in Place?	☒ Yes	☐ No	
Was Casing Cut Off Below Surface?	☒ Yes	☐ No	
Did Sealing Material Rise to Surface?	☒ Yes	☐ No	
Did Material Settle After 24 Hours?	☐ Yes	☒ No	
If Yes, Was Hole Retopped?	☐ Yes	☒ No	

Required Method of Placing Sealing Material

☐ Conductor Pipe - Gravity ☐ Conductor Pipe - Pumped
☒ Screened & Poured ☐ Other (Explain)
(Bentonite Chips)

Sealing Materials

☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☐ Bentonite-Sand Slurry
☒ Chipped Bentonite

(5) Sealing Material Used	From (Ft.)	To (Ft.)	Sacks Sealant	Mix Ratio or Mud Weight
Borehole Material	Surface	32.0		
Time-Release Coated Bentonite Chips	32.0	45.0		

(6) Comments: Well casing removed to 2 feet below ground surface.

(7) Name of Person or Firm Doing Sealing Work	Date of Abandonment
Ramboll Americas Engineering Solutions, Inc.	10/4/24

Signature of Person Doing Work	Date Signed
Michael Davie	3/6/25

Street or Route	Telephone Number
333 W. Wacker Dr. Suite 1050	(414) 837-3607

City, State, Zip Code: Chicago, IL 60606

Comments

Template: RAMBOLL_ABANDONMENT - Project: 845_EDWARDS_2021, 2024.GPJ

WELL/DRILLHOLE/BOREHOLE ABANDONMENT

(1) GENERAL INFORMATION

Unique Well No.	Well ID No.	County
EDW_TPZ-XP03_pore	TPZ-XP03	Peoria

Common Well Name: TPZ-XP03 ____ Gov't Lot (if applicable)

____ 1/4 of 4 1/4 of Sec. 14 ; T. 7 R. 7

Grid Location

____ ft. ☐ N. ☐ S., ____ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☒

Lat 40 ° 35 ' 29.1 " Long -89 ° 39 ' 58.2 " or

S C N

State Plane 1,429,706 ft. N. 2,435,581 ft. E.

Reason For Abandonment	Unique Well No.
Temporary Well	

(2) FACILITY /OWNER INFORMATION

Facility Name: Edwards Power Plant

Facility ID	License/Permit/Monitoring No.

Street Address of Well: 7800 S Cilco Ln

City, Village, or Town: Peoria

Present Well Owner	Original Owner
Mark Davis	Illinois Power Generating Company

Street Address or Route of Owner: 7800 S Cilco Ln

City, State, Zip Code: Peoria, IL 61607

(3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 9/24/2024

☒ Monitoring Well
☐ Water Well
☐ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:

☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) ____

Formation Type:

☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 40.0

Casing Diameter (in.): 2.00

Casing Depth (ft.): ____

Lower Drillhole Diameter (in.): 6.0

Was Well Annular Space Grouted? ☒ Yes ☐ No ☐ Unknown

If Yes, To What Depth? 25.5 Feet

Depth to Water (Feet): 32.8

(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed?	☐ Yes	☐ No	☒ Not Applicable
Liner(s) Removed?	☐ Yes	☐ No	☒ Not Applicable
Screen Removed?	☐ Yes	☒ No	☐ Not Applicable
Casing Left in Place?	☒ Yes	☐ No	
Was Casing Cut Off Below Surface?	☒ Yes	☐ No	
Did Sealing Material Rise to Surface?	☒ Yes	☐ No	
Did Material Settle After 24 Hours?	☐ Yes	☒ No	
If Yes, Was Hole Retopped?	☐ Yes	☒ No	

Required Method of Placing Sealing Material

☐ Conductor Pipe - Gravity ☐ Conductor Pipe - Pumped
☒ Screened & Poured ☐ Other (Explain)
(Bentonite Chips)

Sealing Materials

☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☐ Bentonite-Sand Slurry
☒ Chipped Bentonite

(5) Sealing Material Used	From (Ft.)	To (Ft.)	Sacks Sealant	Mix Ratio or Mud Weight
Borehole Material	Surface	36.8		
Time-Release Coated Bentonite Chips	36.8	40.0		

(6) Comments: Well casing removed to 10 feet below ground surface.

(7) Name of Person or Firm Doing Sealing Work	Date of Abandonment
Ramboll Americas Engineering Solutions, Inc.	10/4/24

Signature of Person Doing Work	Date Signed
Michael Davie	3/6/25

Street or Route	Telephone Number
333 W. Wacker Dr. Suite 1050	(414) 837-3607

City, State, Zip Code: Chicago, IL 60606

Comments

Template: RAMBOLL_ABANDONMENT - Project: 845_EDWARDS_2021, 2024.GPJ

Appendix E

Groundwater Polishing Evaluation Report

GROUNDWATER POLISHING EVALUATION REPORT

EDWARDS ASH POND

Submitted to:

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

Submitted by:

Life Cycle Geo, LLC
729 Main Street
Longmont, Colorado 80501

23RAM01-1
June 2, 2025

TABLE OF CONTENTS

Acronyms and Abbreviations 4
Executive Summary 5
1 Introduction 6
2 Site Background 7
2.1 Site Overview 7
2.2 Identified Exceedances of GWPS 8
2.3 Geochemical Conceptual Site Model 8
3 Groundwater Polishing Remedy Evaluation 9
3.1 Methods 10
3.1.1 Model set-up 10
3.1.1.1 Solid Phase Inputs 11
3.1.1.2 Aqueous Inputs 11
3.2 Results and Discussion 12
3.2.1 Speciation Modeling 12
3.2.2 Reaction Modeling 12
3.2.2.1 Base Case 12
3.2.2.2 Supplemental Sensitivity 13
4 Conclusions 14
5 References 14

TABLES

Table 3-1 Summary of Geochemical Model Inputs
Table 3-2 Response of Sorbing Phases

FIGURES

Figure 3-1 Speciation Model Results for Boron
Figure 3-2 Speciation Model Results for Sulfate
Figure 3-3 Speciation and Reaction Model Results for Boron
Figure 3-4 Speciation and Reaction Model Results for Sulfate

ATTACHMENTS

Attachment A Operating permit network map and potentiometric surface August 2023
Attachment B PHREEQC input file and thermodynamic database
Attachment C Details of geochemical model parameterization
Attachment D PHREEQC model output
Attachment E Sensitivity testing parameterization and model output

ACRONYMS AND ABBREVIATIONS

BCU	Bedrock Confining Unit
CAAA	Corrective Actions Alternative Analysis
CCR	Coal combustion residuals
COCs	Constituents of concern
GCSM	Geochemical conceptual site model
GWPS	Groundwater protection standards
I.A.C.	Illinois Administrative Code
IEPA	Illinois Environmental Protection Agency
EDW AP	Edwards Ash Pond
ORP	oxidation-reduction potential
PMP	Potential migration pathway
SEP	Sequential extraction
S.U.	Standard units
TDS	Total dissolved solids
UA	Uppermost Aquifer
UCF	Upper Cahokia Formation
USCU	Upper Semi-Confining Aquifer
USGS	United States Geological Survey
USEPA	United States Environmental Agency

EXECUTIVE SUMMARY

This document has been prepared as an attachment to the Corrective Actions Alternative Analysis (CAAA) prepared by Gradient for Edwards Power Plant, Edwards Ash Pond (EDW AP). The constituents of concern (COCs) addressed in this document are boron and sulfate, which have been identified as having exceedances[1] of the site-specific groundwater protection standards (GWPS) at the time of this analysis. Natural geochemical processes may be appropriate as a "polishing step" for residual plume management after effective source control implementation if there are no risks to receptors and/or the contaminant plume is not expanding (United States Environmental Protection Agency [USEPA], 1999; USEPA, 2015). Source control is a major component of every corrective action considered in the CAAA, and there are no risks to human health or the environment at EDW AP.

Natural groundwater polishing processes, which include both physical and chemical mechanisms, reduce the concentration of COCs in the groundwater. After source control is implemented, a geochemical trailing gradient may form in the subsurface as conditions undergo a return to background water quality which could affect chemical groundwater polishing mechanisms (Savannah River National Laboratory, 2011). This report supports groundwater polishing as a component of the proposed corrective action by evaluating the contribution of chemical mechanisms to groundwater polishing under current conditions and after source control implementation. The groundwater flow and transport model estimated the time to reach the GWPS based on hydraulic properties of the aquifer. The results of this groundwater polishing evaluation contextualize these estimates by evaluating the potential for attenuation of COCs and for previously attenuated COCs to be mobilized to groundwater as groundwater quality returns to background conditions.

Groundwater polishing mechanisms were assessed using speciation and reaction geochemical models: speciation models assess the distribution of constituents between solid and aqueous phases, and reaction models evaluate how that distribution may change with changing site conditions (USEPA, 2015). Inputs to the model include geochemically reactive solid mineral phases, compliance well groundwater composition, and background groundwater composition based on site-specific data.

Results from the speciation modeling show that a substantial proportion of boron and some sulfate are retained on the solid phase under current conditions. Reaction modeling results indicate that limited remobilization of COCs back to the groundwater phase will occur as conditions return to background. Simulations show a minor increase in adsorbent mineral masses is possible and adsorbent minerals are anticipated to be stable. The precipitation of barite is additionally predicted, providing a further stable sink for sulfate. These results suggest that the changing geochemical conditions that come with the "return to background" are overall unlikely to cause the observed time to reach the GWPS to be longer than estimated by the groundwater flow and transport model.

[1] Throughout this document, "exceedance" or "exceedances" is intended to refer only to potential exceedances of proposed applicable background statistics or Groundwater Protection Standards as described in the proposed groundwater monitoring program which was submitted to the IEPA on October 25, 2021 as part of Illinois Power Resource Generating, LLC's operating permit application for the Edwards Ash Pond. That operating permit application, including the proposed groundwater monitoring program, remains under review by the IEPA and therefore Illinois Power Resource Generating, LLC has not identified any actual exceedances.

Sensitivity assessment suggests that the observed time to achieve the boron GWPS could be longer than currently modeled results as a function of changing redox conditions, such that strongly reducing conditions (i.e., more chemically reduced than currently observed in the background groundwater) may result in more extensive boron remobilization from the solid phase. Such conditions are not expected based on the current understanding of likely post-closure hydrologic conditions but are assessed with this modeling exercise to aid the establishment of adaptive management monitoring criteria. These results will inform corrective action groundwater monitoring and adaptive site management, critical components of every corrective action considered in the CAAA.

1 INTRODUCTION

This document has been prepared as an attachment to the Corrective Actions Alternatives Analysis (CAAA) prepared by Gradient for Edwards Power Plant Ash Pond (EDW AP). The purpose of the CAAA is to holistically evaluate potentially viable corrective actions to remediate groundwater and achieve compliance with groundwater protection standards (GWPSs) for all monitored parameters under Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845.600. The constituents of concern (COCs) addressed in this document are boron and sulfate, which have been identified as having exceedances of the site-specific GWPSs at the time of this analysis. In the CAAA, all corrective actions considered consist of source control and residual plume management. Natural geochemical processes may be appropriate as a "polishing step" for residual plume management after effective source control implementation, if there are no risks to receptors and/or the contaminant plume is not expanding (United States Environmental Protection Agency [USEPA], 1999; USEPA, 2015). Source control is a major component of every corrective action considered in the CAAA, and there are no risks to human health or the environment at EDW AP.[2]

Groundwater polishing processes include both physical and chemical mechanisms within the subsurface which reduce the concentrations of COCs in the groundwater. Physical components of groundwater polishing, including advection, dilution, and dispersion, are assessed by groundwater flow and transport modeling (Groundwater Modeling Technical Memorandum[3]). Chemical mechanisms of groundwater polishing include sorption and mineral precipitation. After source control is implemented, a geochemical trailing gradient may form in the subsurface as conditions undergo a return to background water quality which could affect chemical groundwater polishing mechanisms (Savannah River National Laboratory [SRNL], 2011). The chemical mechanisms of groundwater polishing at EDW AP are evaluated herein using a geochemical modeling-based approach informed by site-specific data. This report uses geochemical modeling to evaluate the influence of chemical mechanisms on groundwater polishing under current conditions and after source control implementation.

The groundwater flow and transport model (Groundwater Modeling Technical Memorandum[4]) estimated the time for boron (as a conservative surrogate) to reach the GWPS under different potential corrective actions based on physical components of groundwater polishing and did not incorporate any potential chemical controls on constituent distribution. This geochemical modeling effort supports the assessment of

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[2] The Human Health and Ecological Risk Assessment serves as Appendix A of the CAAA to which this report is attached.
[3] The Groundwater Modeling Technical Memorandum serves as Appendix B.1 of the CAAA Supporting Information Report; the CAAA Supporting Information Report serves as Appendix B of the CAAA to which this report is attached.
[4] Ibid.

groundwater polishing as a component of the proposed corrective action by evaluating the potential for chemical attenuation of COCs before and after source control as a means of contextualizing the times estimated in the flow and transport model. This analysis also provides an initial foundation for understanding groundwater chemistry to inform adaptive site management as a key component of the Corrective Action Groundwater Monitoring Plan[5].

2 SITE BACKGROUND

2.1 SITE OVERVIEW

A thorough overview of general site characteristics is presented in Section 1 of the CAAA to which this document is attached and summarized here. The facility is located between Mapleton and Bartonville in Peoria County and is situated along the Illinois River (Ramboll, 2021). The facility is a 91-acre unlined surface impoundment that began operating in 1960 and was retired in 2022 (Ramboll, 2021).

A groundwater monitoring network was proposed in the Operating Permit Application (Burns and McDonnell, 2021) in accordance with 35 I.A.C. § 845.630, to monitor groundwater quality which passes the waste boundary as part of the Operating Permit Application to Illinois Environmental Protection Agency (IEPA) for the EDW AP unit. The proposed groundwater monitoring network is shown in **Attachment A**. The monitoring network consists of 15 compliance monitoring wells (AP07S, AW-01, AW-05, AW-06, AW-09, AW-10, AW-11, AW-14, AW-15, AW-15S, AW-16, AW-17, AW-18, AW-19, and AW-21) and two background wells (AP05S and AW-08).

The geology underlying the Site in the vicinity of the EDW AP consists of three distinct hydrostratigraphic units (Ramboll, 2021):

- **Upper Cahokia Formation (UCF)/Potential Migration Pathway (PMP):** Low permeability clays and silts comprise the Upper Cahokia Formation. This unit also includes discontinuous lenses of sand, sandy clay to clayey sand, and sandy silt. The saturated and unconfined sandy lenses within the UCF have been identified as a PMP. The thickness of the UCF ranges between 5 and 40 feet (ft) in the vicinity of the Ash Pond.
- **Uppermost Aquifer (UA):** Thin (generally less than four feet in thickness), moderate permeability sand, silty sand, and clayey gravel material within the Lower Cahokia Formation, and bedrock interface, including weathered shale bedrock where present. In locations where higher permeability materials and coarser grained materials are absent, the UA is interpreted as the interface between the Lower Cahokia Formation and weathered bedrock of the Carbondale and Modesto Formations.
- **Bedrock Confining Unit (BCU):** This confining layer consists of thick and low permeability shales and siltstones of the Carbondale and Modesto Formations.

Groundwater within the UA flows predominantly to the west in the central portion of the AP towards a former channel of the Illinois River, and to the south/southeast in the southern end of the AP. There is a minor component in the northernmost portion of the AP where groundwater in the UA and PMP flows to the north and northwest (Ramboll, 2021). Both background wells are screened within the UA and are generally

[5] The Corrective Action Groundwater Monitoring Program serves as Appendix B.1 to the Construction Permit Application.

deeper than most other UA wells but are considered upgradient of the unit based on observed flow patterns. Groundwater flow occurs primarily in the more permeable zones within the LCF in the UA (Ramboll, 2021), though the vertical and horizontal hydraulic gradients are dynamic at the EDW AP and are predicted to shift in response to dewatering and closure. A map showing current groundwater flow direction at the site is shown in **Attachment A**. Identified Exceedances of GWPS

The following GWPS exceedances at compliance groundwater monitoring wells likely attributable to the EDW AP were observed from 2023 Q2 through 2023 Q4 (Ramboll, 2024):

- Boron – Observed at monitoring wells AP07S, AW-05, AW-15S, AW-19, and AW-21.
- Sulfate – Observed at monitoring well AW-15S.

The data set for geochemical modeling was finalized after the 2023 Q4 sampling event. Groundwater at these compliance wells is representative of groundwater conditions downgradient of the unit, and samples may be referred to as downgradient groundwater.

Boron is identified above the GWPS in both the UA and the PMP. Boron exceedances are found in the UA to the north and northwest of the unit and in the PMP to the north and south of the unit. Sulfate exceedances only occur south of the unit in the PMP. The boron and sulfate exceedances are identified in shallow groundwater above the approximate elevation of 420 feet North American Vertical Datum of 1988 (NAVD88).

Modeling parameters with observed exceedances is appropriate to the scope of the CAAA. Modeling these parameters is conservative because they represent the most widespread and persistent exceedances at EDW AP. Additionally, the selected remedy, which will meet the performance standards of 35 I.A.C. § 845.670(d) and the Corrective Action Plan, will be submitted to the Agency on or before June 4, 2025. Once implemented and completed, the selected remedy will attain the GWPSs.

2.2 GEOCHEMICAL CONCEPTUAL SITE MODEL

A Geochemical Conceptual Site Model (GCSM)[6] was developed for EDW AP to describe the geochemical processes that contribute to mobilization and attenuation of constituents in the environment under current conditions, including evaluating whether chemical interactions of COCs with aquifer solids contribute to attenuation of aqueous concentrations at compliance monitoring wells. This discussion relies on lab reports and raw data previously presented in the Nature and Extent Report submitted to IEPA on June 4, 2024 (Ramboll, 2024) in accordance with 35 I.A.C. § 845.650(d)(1) and provided again in full as Appendix D of the CAAA to which this report is attached.

The main findings of the GCSM are summarized as follows:

- Where observed in shallow groundwater at concentrations above the GWPS, concentrations of boron and sulfate are indicative of impacts by CCR porewater.

[6] The GCSM is a component of the Nature and Extent Report previously submitted to IEPA (Ramboll 2024) and is provided as Appendix D of the CAAA to which this report is attached.

- Oxidation and reduction potential (ORP) shows a distinct pattern above and below the elevation of 420 ft NAVD88, the approximate elevation at which a redox transition appears to occur. The locations with exceedances of either boron and/or sulfate are all within the shallower elevation of the aquifer and are generally more oxidizing. The deeper background waters have a more reducing signature.
- The background groundwater, and more generally the deep groundwater, at the EDW AP has measurable methane and sulfide, indicating potentially more reduced conditions than estimated by ORP measurements.
- Groundwater pH is neutral and generally stable within the range of 6 to 8 S.U. independent of location, lithology, or exceedance status. This stable pH indicates groundwater is well buffered against change, likely due to the widespread presence of carbonate minerals in the aquifer solids which buffer pH within this range.
- The key finding from the aquifer solids assessment is that adsorptive minerals such as iron and aluminum hydroxides are present in the aquifer solids and have currently bound both boron and sulfate within the reactive fraction of the solid matrix.

The geochemical characterization data demonstrate that some degree of attenuation of the exceedance constituents by the aquifer solids has occurred in the past, most notably through adsorption to both iron and aluminum hydroxide mineral phases. However, the vertical and horizontal hydraulic gradients are dynamic at the EDW AP and are predicted to shift in response to dewatering and closure, which could in turn drive a shifting redox condition in the shallow UA groundwater. A shift in redox conditions, particularly toward reducing conditions, could impact the long-term stability of attenuating minerals.

The following section describes the application of a geochemical modeling assessment conducted to evaluate the stability of the attenuation mechanism(s) under a return to background following source control as well as evaluate the impact of extreme reducing conditions on aquifer solid and boron and sulfate concentrations.

3 GROUNDWATER POLISHING REMEDY EVALUATION

This groundwater polishing evaluation uses geochemical modeling to evaluate chemical attenuation of COCs under current conditions and to predict changes in attenuation at exceedance locations following source control to further assess if chemical mechanisms of groundwater polishing will contribute to the remedy achieving the GWPS in a reasonable amount of time. Speciation and reaction models are geochemical models that can be used to evaluate the potential for chemical attenuation in groundwater. Speciation models assess the distribution of constituents between solid and aqueous phases, and reaction models evaluate how that distribution may change with changing site conditions (USEPA, 2015). The results of geochemical modeling provide insight into groundwater polishing mechanisms and additional context for the time estimated to reach the GWPS determined by the groundwater flow and transport model[7], which is based on hydraulic properties of the aquifer and does not take into account chemical interactions of boron within the hydrologic unit.

[7] The Groundwater Modeling Technical Memorandum serves as Appendix B.1 of the Corrective Action Supporting Information Report; the Corrective Action Supporting Information Report serves as Appendix B of the CAAA to which this report is attached.

3.1 METHODS

Geochemical modeling was done in PHREEQC Version 3 (USGS, 2021) using a modified MINTEQ v4 thermodynamic database (as described in relevant sections below). The geochemical modeling of groundwater polishing under current conditions and conditions after source control is completed includes speciation and reaction modeling (USEPA, 2015):

1. Speciation: To understand groundwater polishing mechanisms under current conditions, a solid phase representative of site conditions is equilibrated with current downgradient groundwater. The results of speciation modeling represent the association of COCs with the solid phase under current conditions through mechanisms such as sorption or precipitation.

2. Reaction: In the reaction modeling, the solid phase generated during the speciation modeling phase is reacted iteratively with background groundwater. These results represent the geochemical conditions expected after the source is controlled during which a trailing geochemical gradient may be created (SRNL, 2011). The reactions with background groundwater assess the potential for a trailing geochemical gradient to drive changes in groundwater chemistry. Persistence of elevated groundwater COC concentrations over several reaction iterations suggests a trailing geochemical gradient may affect the time to reach the GWPS.

The equilibrium thermodynamic modeling approach used herein allows that the solid and aqueous phases reach equilibrium during each step. The primary goal of this model is to inform the assessment of groundwater polishing as an appropriate remedy for the site by evaluating dominant geochemical reactions that may occur at time scales relevant to groundwater flow, including adsorption and certain mineral dissolution/precipitation (i.e., iron and aluminum (hydr)oxides, carbonates, and some sulfates) as identified in the GCSM[8]. The model therefore includes those parameters that are expected to contribute to those reactions (as discussed below) and does not include every constituent of the solid phase and groundwater in order to capture "the salient aspects of the system's behavior without introducing unnecessary complexity" (USEPA, 2015). This model is therefore a semi-quantitative estimation of chemical behavior in the subsurface rather than a prediction of groundwater quality, consistent with USEPA guidance that geochemical modeling "is often most helpful for identifying relative changes in contaminant speciation and distribution" (USEPA, 2015).

3.1.1 MODEL SET-UP

Inputs to the model include solid phase composition, downgradient groundwater composition for wells with exceedances of any COC, and background groundwater composition. The data included for model parameterization is summarized in **Table 3-1** and detailed below. The PHREEQC input file and modified MINTEQ v4 database are provided in **Attachment B**. All data used in the model and discussed below are provided in the Nature and Extent Report.[9]

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[8] The GCSM is a component of the Nature and Extent Report previously submitted to IEPA (Ramboll 2024) and is provided as Appendix D of the CAAA to which this report is attached.
[9] The Nature and Extent Report was previously submitted to IEPA (Ramboll 2024) and is provided as Appendix D of the CAAA to which this report is attached. The Nature and Extent report contains laboratory

3.1.1.1 Solid Phase Inputs

Iron hydroxide (ferrihydrite) and aluminum hydroxide (gibbsite) are widespread in the environment and are known to act as sorbing phases for many groundwater constituents, including boron and sulfate (Dzombak and Morel, 1990; Karamalidis and Dzombak, 2010). Site-specific data support the occurrence of both in site solids. Model input concentrations for ferrihydrite and goethite were derived using site-specific sequential extraction procedure (SEP) data (details provided in **Attachment C**). SEP data were available from two solid phase samples of the PMP and from four samples of the UA. Metal oxide concentrations representing the 25th percentile, median (50th percentile), and 75th percentile of the observed data were used to test the sensitivity of the model to the amount of sorbing phase present. Both ferrihydrite and goethite were allowed to dissolve or precipitate in the reactive phase of the model.

Calcite and dolomite were included as mineral phases in the model because carbonate mineral formation and dissolution are often major controls on groundwater pH (Stumm and Morgan, 1996; Stackelberg et al., 2020). Calcite and dolomite are present in site aquifer solids in excess, and model input concentrations were based on site-specific X-ray diffraction (XRD) results. Both calcite and dolomite were allowed to dissolve or precipitate in the reactive phase of the model.

Barite ($BaSO_4$) and gypsum ($CaSO_4$) are minerals that contain sulfate and have the potential to form under ambient environmental conditions in a timeframe consistent with the remedial effort. These minerals may therefore affect sulfate attenuation. Neither mineral phase was observed in mineralogical results for the site; therefore, both were made available to precipitate from the aqueous solution but did not have an initial concentration provided.

3.1.1.2 Aqueous Inputs

In addition to the COCs, the following parameters are included to capture the expected attenuation and mobilization mechanisms (see **Section 2.3**):

- Temperature, pH, and redox (represented in the model as pe[10])
- Major ions: Carbonate and bicarbonate alkalinity, chloride, fluoride, calcium, magnesium, potassium, and sodium
- Oxyanions: Silicon and phosphate
- Redox-active metals: Aluminum, iron, and manganese
- Remaining constituents regulated under 35 I.A.C. § 845.600[11]

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reports and tabulated results from solid phase analysis and tabulated results from groundwater analyses. Laboratory reports for groundwater data are provided quarterly to IEPA and posted to the facility's operating record in accordance with 35 I.A.C. § 845.800(d)(15).

[10] See **Appendix C** for details.

[11] Mercury, thallium, total dissolved solids, and radium were not included in the model. Mercury reactions within the environment are highly complex and would require a separate modeling effort, and the high frequency of non-detect concentrations in the groundwater indicate it would not contribute to model outcomes. Thallium forms a non-reactive monovalent cation and is rarely detected in the groundwater and is therefore not expected to contribute to model outcomes. Total dissolved solids are not a chemical parameter, but rather the result of other chemical abundances taken together. Radium is not included in most thermodynamic databases.

This full suite of geochemical parameters for this model was measured in Quarter 2 and Quarter 3, 2023. The medians of these results were used in the model to represent average groundwater interacting with the solid phase (details provided in **Attachment C**). For downgradient wells with exceedances of the COCs (**Section 2.2**), the median for each parameter was calculated for each location individually. For background wells, a single median for each parameter was calculated using pooled data from both background locations (see **Section 2.1**).

3.2 RESULTS AND DISCUSSION

Modeling outputs are presented in full in **Attachment D** and discussed below.

3.2.1 SPECIATION MODELING

Results of the speciation modeling are presented in **Figure 3-1 through Figure 3-4**. Model results indicate the majority of boron (on the order of 75 to 98 percent [%]; Figure 3-1) and a lesser proportion of sulfate (on the order of 5 to 60%; Figure 3-2) present in the aquifer are likely sorbed to the mineral surfaces and are not mobile in groundwater under current conditions. The sensitivity assessment conducted using a range of adsorbent mass indicated that the amount of sorbing phase modeled does influence the proportion of boron and sulfate predicted to be sorbed to the mineral surfaces. However, these results are broadly consistent with conclusions presented in the GCSM which confirmed adsorption of both boron and sulfate has occurred in association with the oxidized mineral surfaces found in the underlying soils (based on site-specific SEP results). These results in combination are interpreted to confirm that chemical attenuation has occurred at the site under the current conditions.

3.2.2 REACTION MODELING

In the reaction modeling, the solid phase generated during the speciation modeling phase is reacted iteratively with background groundwater. The reaction modeling results represent the geochemical conditions expected after the source is controlled during which a trailing geochemical gradient may be created (SRNL, 2011). Two reaction models are discussed here including (1) the base case and (2) supplemental sensitivity analysis.

1. The base case utilized measured average background groundwater quality to assess the most likely conditions after source control implementation based on measured values (Section 3.2.2.1).

2. Supplemental sensitivity analysis was designed to assess the effect of lowering ORP beyond what is currently measured on attenuating phase stability and COC mobilization (Section 3.2.2.2). This assessment was conducted to assess the potential consequence of strongly reduced groundwater on previously attenuated constituent mass, specifically to address the uncertainty related to the apparent redox disequilibrium inferred based on the measured sulfide and methane in the groundwater and discussed in the GCSM.

3.2.2.1 Base Case

Table 3-2 presents the results of the base case reaction modeling and shows the modeled mass of ferrihydrite and gibbsite during each reaction, the change in mass from the previous step, and the percent

of total mass that change represents. The changes in ferrihydrite quantities are positive, indicating that ferrihydrite may precipitate and will remain stable as conditions return towards background groundwater quality. The mass of gibbsite does not change for most locations, though the model does predict a minor decrease in AW-21. This indicates gibbsite is predominately stable as conditions return to background groundwater quality. In both cases, the change during each reaction step represents less than 0.01% to 0.06% of the total mass available, indicating that any changes in ferrihydrite or gibbsite mass would likely be minor as conditions return to background.

Barite is predicted to precipitate based on model simulations and would therefore additionally limit the transport of sulfate. Barite mass is predicted to increase in the first reaction model and decrease in the second, suggesting a temporary sink for sulfate over time. In all cases, the modeled mass of sulfate removal via barite was relatively low in comparison to the adsorbed fraction (Figure 3-4, Attachment D).

The base case reaction model results show both boron and sulfate attenuation by adsorption to the aquifer solids is likely to be sustained upon return to background. Although most simulations demonstrate a small proportion of boron is released during the first reaction step, sorption to the solid phase is predicted to rebound during the second reaction step. Boron concentrations approach the GWPS during the first reaction and largely achieve GWPS during the second reaction step for most conditions evaluated. The reaction modeling for AW-21 for all sensitivity tests did reflect a concentration of boron above GWPS (**Figure 3-2**) after the second reaction step, indicating that under some circumstances, there may be discrete areas where a residual trailing gradient is observed. These results suggest overall that the trailing gradient will not be persistent over the long-term.

Sulfate sorption was demonstrated to decrease with each reaction step; however, for all conditions evaluated, sulfate concentrations are predicted to drop below the GWPS during the first reaction step, indicating the likelihood of a persistent attenuation of sulfate in all areas of the site (**Figure 3-2**) with little indicated potential for a trailing gradient.

3.2.2.2 Supplemental Sensitivity

Redox condition is often estimated using groundwater ORP measured in the field. However, ORP can be influenced by multiple reactions and can be an incomplete measure of redox if disequilibrium exists in the aquifer. The background groundwater, and more generally the deep groundwater, at the EDW AP have measurable methane and sulfide, indicating potentially more reduced conditions than estimated by field ORP measurements. The introduction of reduced groundwaters to downgradient aquifer solids could promote ferrihydrite dissolution and potentially remobilize boron and sulfate. Due to the presence of measurable methane and sulfide in the background waters, supplemental sensitivity testing was conducted to assess the impact of more extreme reducing conditions on aquifer solids and boron and sulfate concentrations (Attachment E).

Numerical modeling results from the base case model indicate that reactions with a redox condition established from measured background ORP are unlikely to influence mineral stability or time to reach the GWPS (Section 3.2.2.1). Numerical modeling model results from the redox sensitivity testing indicate substantially more reducing (i.e., lower ORP) conditions do present the possibility for dissolution of iron and/or aluminum hydroxides to occur, and that dissolution of hydroxide minerals does have a resulting influence on boron attenuation and time to reach the GWPS (results described in Attachment E). While the probability of reduced redox conditions is considered to be low based on current conditions and anticipated

future conditions, future monitoring of redox conditions should be emphasized within the context of adaptive management. Redox conditions are assessed holistically through measurement of multiple redox-sensitive parameters, often including parameters such as ORP, dissolved oxygen, dissolved iron and manganese, sulfide, and methane.

4 CONCLUSIONS

This report evaluated the contribution of chemical mechanisms to groundwater polishing using geochemical modeling. The results of the groundwater polishing evaluation also contextualize estimates of the modeled time to reach the GWPS by evaluating potential changes in COC attenuation as groundwater quality returns to background conditions.

Results from the speciation modeling show that a substantial proportion of boron and sulfate are retained on the solid phase under current conditions. Base case reaction modeling results indicate that substantial remobilization of COCs back to the groundwater phase is unlikely as conditions return to background. Simulations show a minor increase in adsorbent mineral masses is possible and solid sorbing phases are anticipated to be stable. Notably the precipitation of barite is also simulated, which provides a further sink for sulfate. These data suggest that the changing geochemical conditions that come with the “return to background” are overall unlikely to cause a longer observed time to reach the GWPS. A sensitivity test of the background groundwater ORP suggests that more reducing conditions have the potential to influence mineral stability and time to achieve the GWPS. Future work should include monitoring of redox conditions. These results will inform corrective action groundwater monitoring and adaptive management, critical components of every corrective action considered in the CAAA.

5 REFERENCES

Burns and McDonnell. 2021. Initial Operating Permit Edwards Power Plant Ash Pond. https://www.luminant.com/documents/ccr/il-ccr/Edwards/2021/2021%2010%2030%20Edwards%20AP%20Op%20Permit%20App%20W1438050005-01.pdf

Dzombak D.A. and Morel F.M.M. 1990. Surface Complexation Modeling: Hydrous Ferric Oxide. John Wiley & Sons, New York.

Karamalidis A.K. and Dzombak D.A. 2010. Surface Complexation Modeling: Gibbsite. John Wiley & Sons, New York.

Ramboll. 2021. Groundwater Flow and Contaminant Transport Model Report for the Ash Pond Complex at the Vistra Power Plant. Report No. 222-1902. Prepared for Vistra Corp.

Ramboll. 2024. Nature and Extent Report – Edwards Power Plant, Ash Pond, IEPA ID No. W1438050005-01. June.

Savannah River National Laboratory (2011). The Scenarios Approach to Attenuation-Based Remedies for Inorganic and Radionuclide Contaminants. SRNL-STI-2011-00459.

Stackelberg P.E., Belitz K., Brown C.J., Erickson M.L., Elliot S.M., Kauffman L.J., Ransom K.M., and Reddy J.E. 2020. Machine Learning Predictions of pH in the Glacial Aquifer System, Northern USA. Groundwater, 59(3):352-368. https://doi.org/10.1111/gwat.13063

Stumm W. and Morgan J.J. 1996. Aquatic Chemistry: Chemical Equilibria and Rates in Natural Waters. Third edition. John Wiley & Sons, New York.

USEPA. 1999. Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites. Office of Solid Waste and Emergency Response. Directive 9200.4-17P. April.

USEPA. 2015. Use of Monitored Natural Attenuation for Inorganic Contaminants in Groundwater at Superfund Sites. Office of Solid Waste and Emergency Response. Directive 9283.1-36. August.

United States Geological Survey (USGS). 2021. PHREEQC Version 3. December. https://www.usgs.gov/software/phreeqc-version-3

TABLES

Table 3-1. Summary of geochemical model inputs.

Model Component	Parameters	Data source(s)
Solid Phase	Iron (hydr)oxides, aluminum (hydr)oxides	Site-specific concentrations from sequential extraction data
	Calcite and dolomite	X-ray diffraction results
Downgradient groundwater (COC exceedance locations)	Boron, sulfate, iron, manganese, major ions[1], 845 constituents[1]	Median concentrations per well from data collected in Q2 and Q3 2023
Background groundwater		Median concentrations from representative wells using data collected in Q2 2023

[1]See Section 3.1.1.2 for details.

Table 3-2. Response of sorbing phases.

Parameter	HSU	Location	Summary Type	Speciation	First Reaction			Second Reaction		
				mg/kg	mg/kg	Δ mg/kg	%	mg/kg	Δ mg/kg	%
Barite	PMP	AP07S	25p	<0.1	<0.1	<0.1	NA	<0.1	<0.1	NA
			median	<0.1	<0.1	<0.1	NA	<0.1	<0.1	NA
			75p	<0.1	0.09	0.09	NA	<0.1	-0.09	<0.01
Barite	PMP	AW-15S	25p	<0.1	0.15	0.15	NA	<0.1	-0.15	<0.01
			median	<0.1	0.27	0.27	NA	<0.1	-0.27	<0.01
			75p	<0.1	0.33	0.33	NA	<0.1	-0.33	<0.01
Barite	UA	AW-05	25p	<0.1	0.25	0.25	NA	<0.1	-0.25	<0.01
			median	<0.1	0.29	0.29	NA	<0.1	-0.29	<0.01
			75p	<0.1	0.30	0.30	NA	0.02	-0.28	<0.01
Barite	UA	AW-19	25p	<0.1	0.00	0.00	NA	<0.1	<0.1	NA
			median	<0.1	0.00	0.00	NA	<0.1	<0.1	NA
			75p	<0.1	0.00	0.00	NA	<0.1	<0.1	NA
Barite	UA	AW-21	25p	<0.1	0.35	0.35	NA	<0.1	-0.35	<0.01
			median	<0.1	0.37	0.37	NA	0.09	-0.28	<0.01
			75p	<0.1	0.37	0.37	NA	0.19	-0.19	<0.01
Ferrihydrite	PMP	AP07S	25p	2990	2990	0.06	<0.01	2990	0.23	<0.01
			median	3890	3890	0.04	<0.01	3890	0.19	<0.01
			75p	4710	4710	0.03	<0.01	4710	0.13	<0.01
Ferrihydrite	PMP	AW-15S	25p	2990	2990	0.02	<0.01	2990	0.14	<0.01
			median	3890	3890	0.01	<0.01	3890	0.05	<0.01
			75p	4710	4710	0.01	<0.01	4710	0.03	<0.01
Ferrihydrite	UA	AW-05	25p	10600	10600	0.55	<0.01	10600	1.29	0.01
			median	12800	12800	0.49	<0.01	12800	1.07	<0.01
			75p	13400	13400	0.42	<0.01	13400	0.84	<0.01
Ferrihydrite	UA	AW-19	25p	10600	10600	4.67	0.04	10600	3.03	0.03
			median	12800	12800	5.15	0.04	12900	3.00	0.02
			75p	13400	13400	5.33	0.04	13400	2.84	0.02
Ferrihydrite	UA	AW-21	25p	10600	10600	0.28	<0.01	10600	1.19	0.01
			median	12800	12800	0.22	<0.01	12800	0.77	<0.01
			75p	13400	13400	0.18	<0.01	13400	0.53	<0.01
Gibbsite	PMP	AP07S	25p	7090	7090	-0.001	<0.01	7090	<0.1	<0.01
			median	9810	9810	-0.001	<0.01	9810	<0.1	<0.01
			75p	12500	12500	-0.001	<0.01	12500	<0.1	<0.01
Gibbsite	PMP	AW-15S	25p	7090	7090	<0.01	<0.01	7090	<0.1	<0.01
			median	9810	9810	<0.01	<0.01	9810	<0.1	<0.01
			75p	12500	12500	<0.01	<0.01	12500	<0.1	<0.01
Gibbsite	UA	AW-05	25p	6520	6520	-0.001	<0.01	6520	<0.1	<0.01
			median	8560	8560	-0.001	<0.01	8560	<0.1	<0.01
			75p	10600	10600	-0.001	<0.01	10600	<0.1	<0.01
Gibbsite	UA	AW-19	25p	6520	6520	<0.1	<0.01	6520	<0.1	<0.01
			median	8560	8560	<0.1	<0.01	8560	<0.1	<0.01
			75p	10600	10600	<0.1	<0.01	10600	<0.1	<0.01
Gibbsite	UA	AW-21	25p	6520	6520	-0.001	<0.01	6520	-0.001	<0.01
			median	8560	8560	-0.001	<0.01	8560	-0.001	<0.01
			75p	10600	10600	-0.001	<0.01	10600	-0.001	<0.01

Notes: HSU – Hydrostratigraphic Units; UA – Upper Aquifer; PMP – Potential Migration Pathway
25p – 25th percentile; 75p – 75th percentile; NA – not applicable or not measured
mg/kg – milligrams per kilograms; Δ mg/kg – change in milligrams per kilograms; % - percent

FIGURES

Figure 3-1: Speciation Model Results for Boron

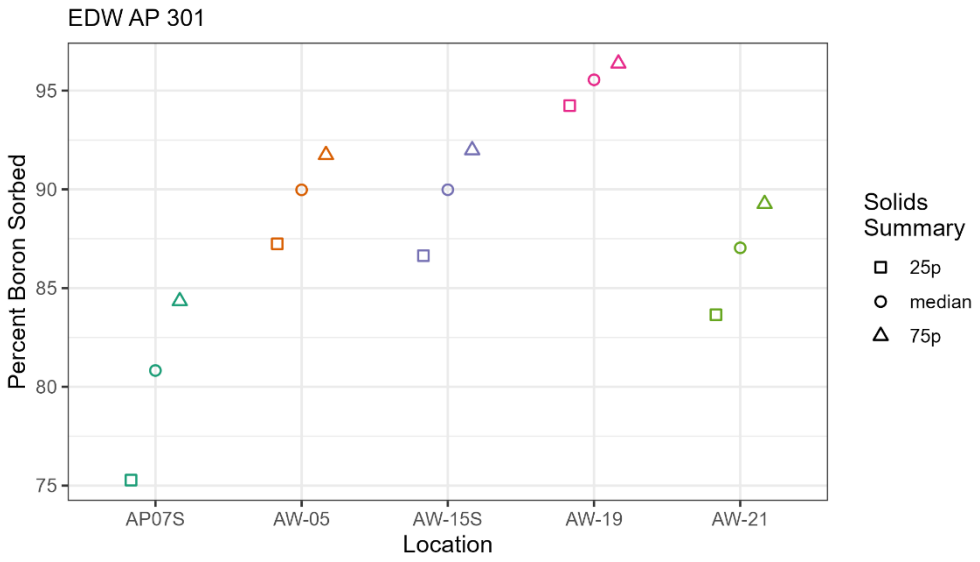


Figure 3-2: Speciation Model Results for Sulfate

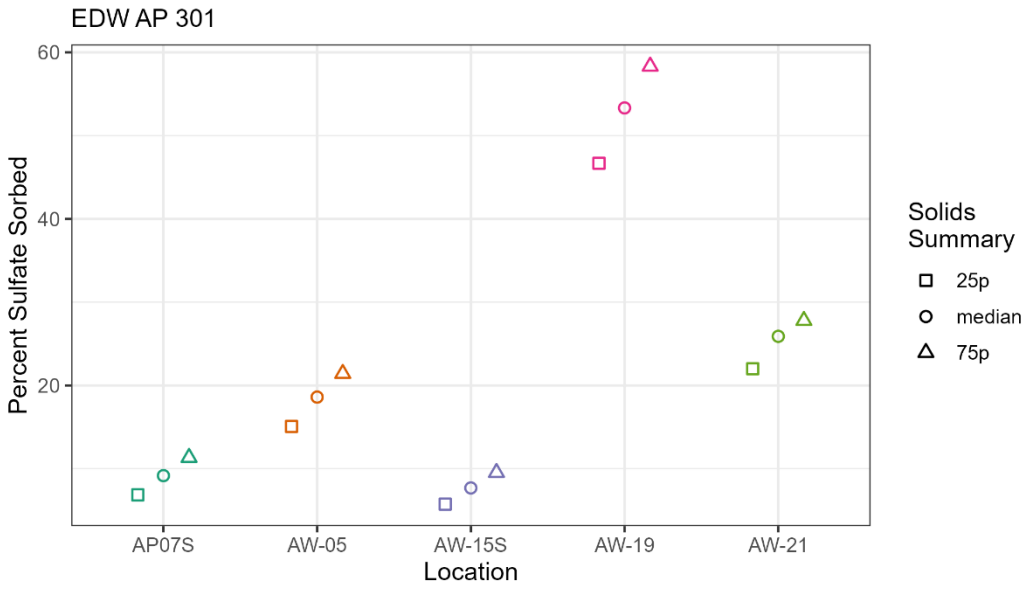


Figure 3-3: Speciation and Reaction Model Results for Boron

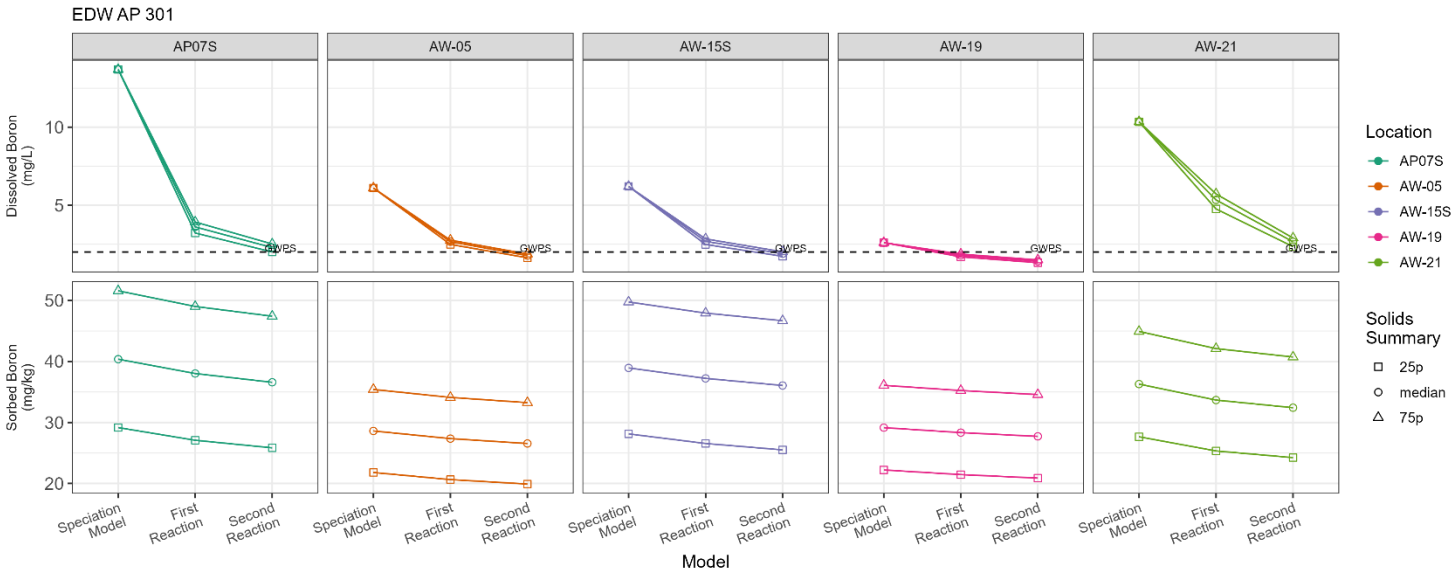
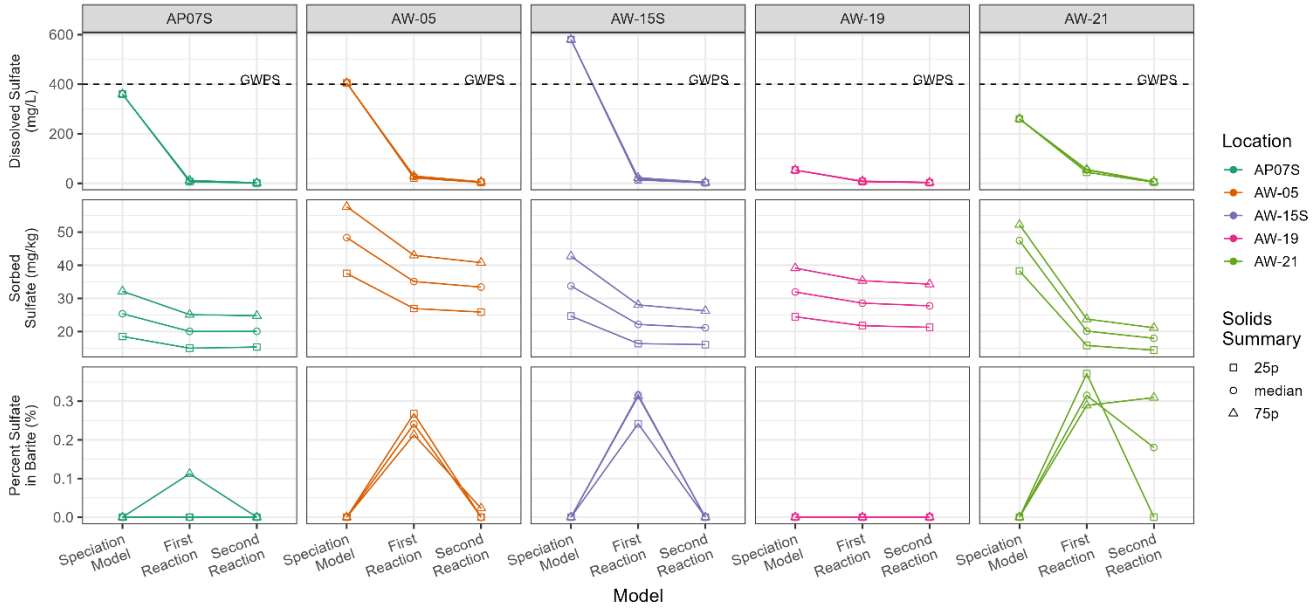
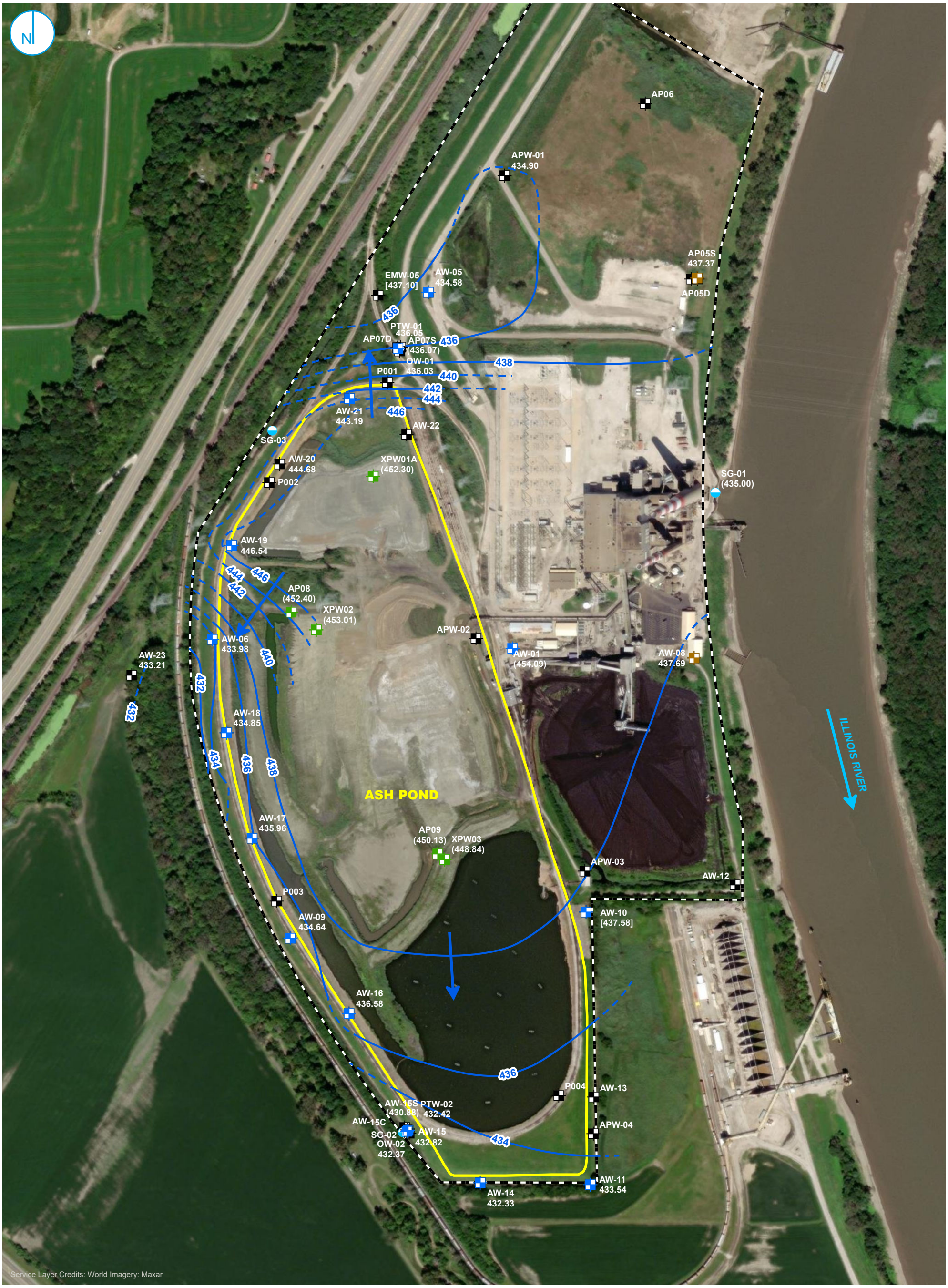


Figure 3-4: Speciation and Reaction Model Results for Sulfate



ATTACHMENT A



- COMPLIANCE MONITORING WELL
- BACKGROUND MONITORING WELL
- PORE WATER WELL
- STAFF GAGE, RIVER
- MONITORING WELL
- REGULATED UNIT (SUBJECT UNIT)
- PROPERTY BOUNDARY
- GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION

0 212.5 425 Feet

NOTES
1. ELEVATIONS IN PARENTHESES WERE NOT USED FOR CONTOURING.
2. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)
3. ELEVATIONS IN BRACKETS WERE OBTAINED OUTSIDE OF THE 24-HOUR PERIOD FROM INITIATION OF DEPTH TO GROUNDWATER MEASUREMENTS BUT WITHIN THE SAME SAMPLING EVENT.

POTENTIOMETRIC SURFACE MAP AUGUST 21, 2023

2023 ANNUAL GROUNDWATER MONITORING AND CORRECTIVE ACTION REPORT ASH POND

EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

ATTACHMENT B

25th Percentile Metal Oxides/No Charge Balance

```
SELECTED_OUTPUT 1
-file EDW_845_301_25p_cb-false_out.csv
-charge_balance true
-percent_error true
-totals S(6) B Li As C(4) Cl F Ca Mg Na K Ba Si P Mn Fe Al Sb Be Cd Cr Co Pb Mo Se Hfo_s
Hfo_w Hao_
-molalities Hfo_wOH Hfo_wOH2+ Hfo_wOHSO4-2 Hfo_wSO4- Hfo_wOSi(OH)3
Hfo_wOSiO(OH)2- Hfo_wHCO3 Hfo_wCO3- Hfo_wPO4-2
Hfo_wHPO4- Hfo_wH2PO4 Hfo_sCO3- Hfo_sHCO3
Hfo_sHPO4- Hfo_sH2BO3 Hfo_sH2PO4 Hfo_sOSi(OH)3
Hfo_sOSiO(OH)2- Hfo_sOHSO4-2 Hfo_sSO4-
Hao_SO4- Hao_OHSO4-2 Hao_H2BO3 Hao_H3BO4-
-equilibrium_phases Ferrihydrite Gibbsite Barite Calcite Dolomite(ordered) Gypsum
-saturation_indices Ferrihydrite Gibbsite Barite Calcite Dolomite(ordered) Gypsum

SOLUTION 1 #AP07S (C - PMP)
redox pe
units mg/l
density 1
pH 6.885
pe 4.49
temp 20.6
S(6) 360 as SO4
B 13.7
Li 0.00745
As 0.0007225
C(4) 255 as CO3
Cl 79.5
F 0.183
Ca 200
Mg 75
Na 66
K 0.895
Ba 0.0915
Si 7.65
P 0.04
Mn 0.65
Fe 0.0685
Al 0.0007
Sb 0.000215
Be 0.000295
Cd 0.000835
Cr 0.0072
Co 0.0036
Pb 0.00205
Mo 0.00115
Se 0.00037
end

SOLUTION 2 #AW-15S (C - PMP)
redox pe
units mg/l
density 1
```

pH 6.785
pe 3.68
temp 20.45
S(6) 580 as SO4
B 6.2
Li 0.0135
As 0.000345
C(4) 306 as CO3
Cl 31
F 0.152
Ca 275
Mg 86
Na 54
K 0.65
Ba 0.081
Si 8
P 0.034
Mn 0.74
Fe 0.044
Al 0.00735
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.00054
Pb 0.00011
Mo 0.00285
Se 0.001085
end

SOLUTION 3 #AW-05 (C - UA)
redox pe
units mg/l
density 1
pH 6.985
pe 4.565
temp 22.65
S(6) 405 as SO4
B 6.1
Li 0.017
As 0.0039
C(4) 240 as CO3
Cl 74.5
F 0.1695
Ca 175
Mg 81.5
Na 76.5
K 1.9
Ba 0.145
Si 10
P 0.022
Mn 1.5
Fe 3.65
Al 0.0007

Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.00865
Co 0.00585
Pb 0.00405
Mo 0.0024
Se 0.00037
end

SOLUTION 4 #AW-19 (C - UA)
redox pe
units mg/l
density 1
pH 6.715
pe 2.695
temp 18.5
S(6) 53.5 as SO4
B 2.6
Li 0.0115
As 0.0135
C(4) 291 as CO3
Cl 80.5
F 0.2895
Ca 120
Mg 55
Na 53
K 1.1
Ba 0.2
Si 10.5
P 0.00395
Mn 0.35
Fe 2.75
Al 0.0007
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.0014
Pb 0.00129
Mo 0.00375
Se 0.00037
end

SOLUTION 5 #AW-21 (C - UA)
redox pe
units mg/l
density 1
pH 6.825
pe 4.53
temp 18
S(6) 260 as SO4
B 10.35
Li 0.00445
As 0.0010725

```
C(4) 111 as CO3
Cl 90
F 0.3075
Ca 115
Mg 37
Na 57
K 2.9
Ba 0.0585
Si 5.6
P 0.00395
Mn 0.745
Fe 0.345
Al 0.00195
Sb 0.000885
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.000595
Pb 0.00011
Mo 0.023
Se 0.002085
end

EQUILIBRIUM_PHASES 1 #AP07S (C - PMP) - 25p
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.13
Ferrihydrite 0 0.04
Calcite 0 0.1
Dolomite(ordered) 0 0.3

SURFACE 1
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 1
save surface 1
end

EQUILIBRIUM_PHASES 2 #AW-15S (C - PMP) - 25p
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.13
Ferrihydrite 0 0.04
Calcite 0 0.1
Dolomite(ordered) 0 0.3

SURFACE 2
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 2
save surface 2
end

EQUILIBRIUM_PHASES 3 #AW-05 (C - UA) - 25p
Barite 0 0
```

```
Gypsum 0 0
Gibbsite 0 0.16
Ferrihydrite 0 0.19
Calcite 0 0.4
Dolomite(ordered) 0 0.7

SURFACE 3
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 3
save surface 3
end

EQUILIBRIUM_PHASES 4 #AW-19 (C - UA) - 25p
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.16
Ferrihydrite 0 0.19
Calcite 0 0.4
Dolomite(ordered) 0 0.7

SURFACE 4
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 4
save surface 4
end

EQUILIBRIUM_PHASES 5 #AW-21 (C - UA) - 25p
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.16
Ferrihydrite 0 0.19
Calcite 0 0.4
Dolomite(ordered) 0 0.7

SURFACE 5
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 5
save surface 5
end

SOLUTION 6 #average background
redox pe
units mg/l
density 1
pH 6.905
pe 1.2
temp 19.65
S(6) 1.595
B 0.22
Li 0.02
As 0.0067
```

```
C(4) 464.5
Cl 28.5 charge
F 0.08095
Ca 125
Mg 53
Na 120.5
K 2.65
Ba 0.51
Si 16.5
P 1.545
Mn 0.615
Fe 8.95
Al 0.0007
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.00067
Pb 0.00023
Mo 0.001195
Se 0.00037

SAVE solution 6

end

#FIRST REACTION

#AP07S (C - PMP) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 1
USE SURFACE 1
SAVE equilibrium_phases 1
SAVE surface 1
end

#AP07S (C - PMP) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 1
USE SURFACE 1
SAVE equilibrium_phases 1
SAVE surface 1
end

#AW-15S (C - PMP) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 2
USE SURFACE 2
SAVE equilibrium_phases 2
SAVE surface 2
end

#AW-15S (C - PMP) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 2
USE SURFACE 2
SAVE equilibrium_phases 2
```

```
SAVE surface 2
end

#AW-05 (C - UA) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 3
USE SURFACE 3
SAVE equilibrium_phases 3
SAVE surface 3
end

#AW-05 (C - UA) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 3
USE SURFACE 3
SAVE equilibrium_phases 3
SAVE surface 3
end

#AW-19 (C - UA) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 4
USE SURFACE 4
SAVE equilibrium_phases 4
SAVE surface 4
end

#AW-19 (C - UA) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 4
USE SURFACE 4
SAVE equilibrium_phases 4
SAVE surface 4
end

#AW-21 (C - UA) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 5
USE SURFACE 5
SAVE equilibrium_phases 5
SAVE surface 5
end

#AW-21 (C - UA) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 5
USE SURFACE 5
SAVE equilibrium_phases 5
SAVE surface 5
end
```

25th Percentile Metal Oxides/Charge Balance on Chloride

```
SELECTED_OUTPUT 1
-file EDW_845_301_25p_cb-true_out.csv
-charge_balance true
-percent_error true
-totals S(6) B Li As C(4) Cl F Ca Mg Na K Ba Si P Mn Fe Al Sb Be Cd Cr Co Pb Mo Se Hfo_s
Hfo_w Hao_
-molalities Hfo_wOH Hfo_wOH2+ Hfo_wOHSO4-2 Hfo_wSO4- Hfo_wOSi(OH)3
Hfo_wOSiO(OH)2- Hfo_wHCO3 Hfo_wCO3- Hfo_wPO4-2
Hfo_wHPO4- Hfo_wH2PO4 Hfo_sCO3- Hfo_sHCO3
Hfo_sHPO4- Hfo_sH2BO3 Hfo_sH2PO4 Hfo_sOSi(OH)3
Hfo_sOSiO(OH)2- Hfo_sOHSO4-2 Hfo_sSO4-
Hao_SO4- Hao_OHSO4-2 Hao_H2BO3 Hao_H3BO4-
-equilibrium_phases Ferrihydrite Gibbsite Barite Calcite Dolomite(ordered) Gypsum
-saturation_indices Ferrihydrite Gibbsite Barite Calcite Dolomite(ordered) Gypsum

SOLUTION 1 #AP07S (C - PMP)
redox pe
units mg/l
density 1
pH 6.885
pe 4.49
temp 20.6
S(6) 360 as SO4
B 13.7
Li 0.00745
As 0.0007225
C(4) 255 as CO3
Cl 79.5 charge
F 0.183
Ca 200
Mg 75
Na 66
K 0.895
Ba 0.0915
Si 7.65
P 0.04
Mn 0.65
Fe 0.0685
Al 0.0007
Sb 0.000215
Be 0.000295
Cd 0.000835
Cr 0.0072
Co 0.0036
Pb 0.00205
Mo 0.00115
Se 0.00037
end

SOLUTION 2 #AW-15S (C - PMP)
redox pe
units mg/l
density 1
```

pH 6.785
pe 3.68
temp 20.45
S(6) 580 as SO4
B 6.2
Li 0.0135
As 0.000345
C(4) 306 as CO3
Cl 31 charge
F 0.152
Ca 275
Mg 86
Na 54
K 0.65
Ba 0.081
Si 8
P 0.034
Mn 0.74
Fe 0.044
Al 0.00735
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.00054
Pb 0.00011
Mo 0.00285
Se 0.001085
end

SOLUTION 3 #AW-05 (C - UA)
redox pe
units mg/l
density 1
pH 6.985
pe 4.565
temp 22.65
S(6) 405 as SO4
B 6.1
Li 0.017
As 0.0039
C(4) 240 as CO3
Cl 74.5 charge
F 0.1695
Ca 175
Mg 81.5
Na 76.5
K 1.9
Ba 0.145
Si 10
P 0.022
Mn 1.5
Fe 3.65
Al 0.0007

Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.00865
Co 0.00585
Pb 0.00405
Mo 0.0024
Se 0.00037
end

SOLUTION 4 #AW-19 (C - UA)
redox pe
units mg/l
density 1
pH 6.715
pe 2.695
temp 18.5
S(6) 53.5 as SO4
B 2.6
Li 0.0115
As 0.0135
C(4) 291 as CO3
Cl 80.5 charge
F 0.2895
Ca 120
Mg 55
Na 53
K 1.1
Ba 0.2
Si 10.5
P 0.00395
Mn 0.35
Fe 2.75
Al 0.0007
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.0014
Pb 0.00129
Mo 0.00375
Se 0.00037
end

SOLUTION 5 #AW-21 (C - UA)
redox pe
units mg/l
density 1
pH 6.825
pe 4.53
temp 18
S(6) 260 as SO4
B 10.35
Li 0.00445
As 0.0010725

```
C(4) 111 as CO3
Cl 90 charge
F 0.3075
Ca 115
Mg 37
Na 57
K 2.9
Ba 0.0585
Si 5.6
P 0.00395
Mn 0.745
Fe 0.345
Al 0.00195
Sb 0.000885
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.000595
Pb 0.00011
Mo 0.023
Se 0.002085
end

EQUILIBRIUM_PHASES 1 #AP07S (C - PMP) - 25p
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.13
Ferrihydrite 0 0.04
Calcite 0 0.1
Dolomite(ordered) 0 0.3

SURFACE 1
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 1
save surface 1
end

EQUILIBRIUM_PHASES 2 #AW-15S (C - PMP) - 25p
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.13
Ferrihydrite 0 0.04
Calcite 0 0.1
Dolomite(ordered) 0 0.3

SURFACE 2
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 2
save surface 2
end

EQUILIBRIUM_PHASES 3 #AW-05 (C - UA) - 25p
Barite 0 0
```

```
Gypsum 0 0
Gibbsite 0 0.16
Ferrihydrite 0 0.19
Calcite 0 0.4
Dolomite(ordered) 0 0.7

SURFACE 3
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 3
save surface 3
end

EQUILIBRIUM_PHASES 4 #AW-19 (C - UA) - 25p
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.16
Ferrihydrite 0 0.19
Calcite 0 0.4
Dolomite(ordered) 0 0.7

SURFACE 4
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 4
save surface 4
end

EQUILIBRIUM_PHASES 5 #AW-21 (C - UA) - 25p
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.16
Ferrihydrite 0 0.19
Calcite 0 0.4
Dolomite(ordered) 0 0.7

SURFACE 5
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 5
save surface 5
end

SOLUTION 6 #average background
redox pe
units mg/l
density 1
pH 6.905
pe 1.2
temp 19.65
S(6) 1.595
B 0.22
Li 0.02
As 0.0067
```

```
C(4) 464.5
Cl 28.5 charge
F 0.08095
Ca 125
Mg 53
Na 120.5
K 2.65
Ba 0.51
Si 16.5
P 1.545
Mn 0.615
Fe 8.95
Al 0.0007
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.00067
Pb 0.00023
Mo 0.001195
Se 0.00037

SAVE solution 6

end

#FIRST REACTION

#AP07S (C - PMP) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 1
USE SURFACE 1
SAVE equilibrium_phases 1
SAVE surface 1
end

#AP07S (C - PMP) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 1
USE SURFACE 1
SAVE equilibrium_phases 1
SAVE surface 1
end

#AW-15S (C - PMP) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 2
USE SURFACE 2
SAVE equilibrium_phases 2
SAVE surface 2
end

#AW-15S (C - PMP) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 2
USE SURFACE 2
SAVE equilibrium_phases 2
```

```
SAVE surface 2
end

#AW-05 (C - UA) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 3
USE SURFACE 3
SAVE equilibrium_phases 3
SAVE surface 3
end

#AW-05 (C - UA) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 3
USE SURFACE 3
SAVE equilibrium_phases 3
SAVE surface 3
end

#AW-19 (C - UA) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 4
USE SURFACE 4
SAVE equilibrium_phases 4
SAVE surface 4
end

#AW-19 (C - UA) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 4
USE SURFACE 4
SAVE equilibrium_phases 4
SAVE surface 4
end

#AW-21 (C - UA) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 5
USE SURFACE 5
SAVE equilibrium_phases 5
SAVE surface 5
end

#AW-21 (C - UA) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 5
USE SURFACE 5
SAVE equilibrium_phases 5
SAVE surface 5
end
```

75th Percentile Metal Oxides/No Charge Balance

```
SELECTED_OUTPUT 1
-file EDW_845_301_75p_cb-false_out.csv
-charge_balance true
-percent_error true
-totals S(6) B Li As C(4) Cl F Ca Mg Na K Ba Si P Mn Fe Al Sb Be Cd Cr Co Pb Mo Se Hfo_s
Hfo_w Hao_
-molalities Hfo_wOH Hfo_wOH2+ Hfo_wOHSO4-2 Hfo_wSO4- Hfo_wOSi(OH)3
Hfo_wOSiO(OH)2- Hfo_wHCO3 Hfo_wCO3- Hfo_wPO4-2
Hfo_wHPO4- Hfo_wH2PO4 Hfo_sCO3- Hfo_sHCO3
Hfo_sHPO4- Hfo_sH2BO3 Hfo_sH2PO4 Hfo_sOSi(OH)3
Hfo_sOSiO(OH)2- Hfo_sOHSO4-2 Hfo_sSO4-
Hao_SO4- Hao_OHSO4-2 Hao_H2BO3 Hao_H3BO4-
-equilibrium_phases Ferrihydrite Gibbsite Barite Calcite Dolomite(ordered) Gypsum
-saturation_indices Ferrihydrite Gibbsite Barite Calcite Dolomite(ordered) Gypsum

SOLUTION 1 #AP07S (C - PMP)
redox pe
units mg/l
density 1
pH 6.885
pe 4.49
temp 20.6
S(6) 360 as SO4
B 13.7
Li 0.00745
As 0.0007225
C(4) 255 as CO3
Cl 79.5
F 0.183
Ca 200
Mg 75
Na 66
K 0.895
Ba 0.0915
Si 7.65
P 0.04
Mn 0.65
Fe 0.0685
Al 0.0007
Sb 0.000215
Be 0.000295
Cd 0.000835
Cr 0.0072
Co 0.0036
Pb 0.00205
Mo 0.00115
Se 0.00037
end

SOLUTION 2 #AW-15S (C - PMP)
redox pe
units mg/l
density 1
```

pH 6.785
pe 3.68
temp 20.45
S(6) 580 as SO4
B 6.2
Li 0.0135
As 0.000345
C(4) 306 as CO3
Cl 31
F 0.152
Ca 275
Mg 86
Na 54
K 0.65
Ba 0.081
Si 8
P 0.034
Mn 0.74
Fe 0.044
Al 0.00735
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.00054
Pb 0.00011
Mo 0.00285
Se 0.001085
end

SOLUTION 3 #AW-05 (C - UA)
redox pe
units mg/l
density 1
pH 6.985
pe 4.565
temp 22.65
S(6) 405 as SO4
B 6.1
Li 0.017
As 0.0039
C(4) 240 as CO3
Cl 74.5
F 0.1695
Ca 175
Mg 81.5
Na 76.5
K 1.9
Ba 0.145
Si 10
P 0.022
Mn 1.5
Fe 3.65
Al 0.0007

```
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.00865
Co 0.00585
Pb 0.00405
Mo 0.0024
Se 0.00037
end
SOLUTION 4 #AW-19 (C - UA)
redox pe
units mg/l
density 1
pH 6.715
pe 2.695
temp 18.5
S(6) 53.5 as SO4
B 2.6
Li 0.0115
As 0.0135
C(4) 291 as CO3
Cl 80.5
F 0.2895
Ca 120
Mg 55
Na 53
K 1.1
Ba 0.2
Si 10.5
P 0.00395
Mn 0.35
Fe 2.75
Al 0.0007
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.0014
Pb 0.00129
Mo 0.00375
Se 0.00037
end
SOLUTION 5 #AW-21 (C - UA)
redox pe
units mg/l
density 1
pH 6.825
pe 4.53
temp 18
S(6) 260 as SO4
B 10.35
Li 0.00445
As 0.0010725
```

```
C(4) 111 as CO3
Cl 90
F 0.3075
Ca 115
Mg 37
Na 57
K 2.9
Ba 0.0585
Si 5.6
P 0.00395
Mn 0.745
Fe 0.345
Al 0.00195
Sb 0.000885
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.000595
Pb 0.00011
Mo 0.023
Se 0.002085
end

EQUILIBRIUM_PHASES 1 #AP07S (C - PMP) - 75p
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.23
Ferrihydrite 0 0.063
Calcite 0 0.1
Dolomite(ordered) 0 0.3

SURFACE 1
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 1
save surface 1
end

EQUILIBRIUM_PHASES 2 #AW-15S (C - PMP) - 75p
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.23
Ferrihydrite 0 0.063
Calcite 0 0.1
Dolomite(ordered) 0 0.3

SURFACE 2
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 2
save surface 2
end

EQUILIBRIUM_PHASES 3 #AW-05 (C - UA) - 75p
Barite 0 0
```

```
Gypsum 0 0
Gibbsite 0 0.26
Ferrihydrite 0 0.24
Calcite 0 0.4
Dolomite(ordered) 0 0.7

SURFACE 3
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 3
save surface 3
end

EQUILIBRIUM_PHASES 4 #AW-19 (C - UA) - 75p
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.26
Ferrihydrite 0 0.24
Calcite 0 0.4
Dolomite(ordered) 0 0.7

SURFACE 4
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 4
save surface 4
end

EQUILIBRIUM_PHASES 5 #AW-21 (C - UA) - 75p
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.26
Ferrihydrite 0 0.24
Calcite 0 0.4
Dolomite(ordered) 0 0.7

SURFACE 5
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 5
save surface 5
end

SOLUTION 6 #average background
redox pe
units mg/l
density 1
pH 6.905
pe 1.2
temp 19.65
S(6) 1.595
B 0.22
Li 0.02
As 0.0067
```

```
C(4) 464.5
Cl 28.5 charge
F 0.08095
Ca 125
Mg 53
Na 120.5
K 2.65
Ba 0.51
Si 16.5
P 1.545
Mn 0.615
Fe 8.95
Al 0.0007
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.00067
Pb 0.00023
Mo 0.001195
Se 0.00037

SAVE solution 6

end

#FIRST REACTION

#AP07S (C - PMP) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 1
USE SURFACE 1
SAVE equilibrium_phases 1
SAVE surface 1
end

#AP07S (C - PMP) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 1
USE SURFACE 1
SAVE equilibrium_phases 1
SAVE surface 1
end

#AW-15S (C - PMP) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 2
USE SURFACE 2
SAVE equilibrium_phases 2
SAVE surface 2
end

#AW-15S (C - PMP) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 2
USE SURFACE 2
SAVE equilibrium_phases 2
```

```
SAVE surface 2
end

#AW-05 (C - UA) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 3
USE SURFACE 3
SAVE equilibrium_phases 3
SAVE surface 3
end

#AW-05 (C - UA) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 3
USE SURFACE 3
SAVE equilibrium_phases 3
SAVE surface 3
end

#AW-19 (C - UA) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 4
USE SURFACE 4
SAVE equilibrium_phases 4
SAVE surface 4
end

#AW-19 (C - UA) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 4
USE SURFACE 4
SAVE equilibrium_phases 4
SAVE surface 4
end

#AW-21 (C - UA) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 5
USE SURFACE 5
SAVE equilibrium_phases 5
SAVE surface 5
end

#AW-21 (C - UA) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 5
USE SURFACE 5
SAVE equilibrium_phases 5
SAVE surface 5
end
```

75th Percentile Metal Oxides/Charge Balance on Chloride

```
SELECTED_OUTPUT 1
-file EDW_845_301_75p_cb-true_out.csv
-charge_balance true
-percent_error true
-totals S(6) B Li As C(4) Cl F Ca Mg Na K Ba Si P Mn Fe Al Sb Be Cd Cr Co Pb Mo Se Hfo_s
Hfo_w Hao_
-molalities Hfo_wOH Hfo_wOH2+ Hfo_wOHSO4-2 Hfo_wSO4- Hfo_wOSi(OH)3
Hfo_wOSiO(OH)2- Hfo_wHCO3 Hfo_wCO3- Hfo_wPO4-2
Hfo_wHPO4- Hfo_wH2PO4 Hfo_sCO3- Hfo_sHCO3
Hfo_sHPO4- Hfo_sH2BO3 Hfo_sH2PO4 Hfo_sOSi(OH)3
Hfo_sOSiO(OH)2- Hfo_sOHSO4-2 Hfo_sSO4-
Hao_SO4- Hao_OHSO4-2 Hao_H2BO3 Hao_H3BO4-
-equilibrium_phases Ferrihydrite Gibbsite Barite Calcite Dolomite(ordered) Gypsum
-saturation_indices Ferrihydrite Gibbsite Barite Calcite Dolomite(ordered) Gypsum

SOLUTION 1 #AP07S (C - PMP)
redox pe
units mg/l
density 1
pH 6.885
pe 4.49
temp 20.6
S(6) 360 as SO4
B 13.7
Li 0.00745
As 0.0007225
C(4) 255 as CO3
Cl 79.5 charge
F 0.183
Ca 200
Mg 75
Na 66
K 0.895
Ba 0.0915
Si 7.65
P 0.04
Mn 0.65
Fe 0.0685
Al 0.0007
Sb 0.000215
Be 0.000295
Cd 0.000835
Cr 0.0072
Co 0.0036
Pb 0.00205
Mo 0.00115
Se 0.00037
end

SOLUTION 2 #AW-15S (C - PMP)
redox pe
units mg/l
density 1
```

pH 6.785
pe 3.68
temp 20.45
S(6) 580 as SO4
B 6.2
Li 0.0135
As 0.000345
C(4) 306 as CO3
Cl 31 charge
F 0.152
Ca 275
Mg 86
Na 54
K 0.65
Ba 0.081
Si 8
P 0.034
Mn 0.74
Fe 0.044
Al 0.00735
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.00054
Pb 0.00011
Mo 0.00285
Se 0.001085
end

SOLUTION 3 #AW-05 (C - UA)
redox pe
units mg/l
density 1
pH 6.985
pe 4.565
temp 22.65
S(6) 405 as SO4
B 6.1
Li 0.017
As 0.0039
C(4) 240 as CO3
Cl 74.5 charge
F 0.1695
Ca 175
Mg 81.5
Na 76.5
K 1.9
Ba 0.145
Si 10
P 0.022
Mn 1.5
Fe 3.65
Al 0.0007

```
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.00865
Co 0.00585
Pb 0.00405
Mo 0.0024
Se 0.00037
end
SOLUTION 4 #AW-19 (C - UA)
redox pe
units mg/l
density 1
pH 6.715
pe 2.695
temp 18.5
S(6) 53.5 as SO4
B 2.6
Li 0.0115
As 0.0135
C(4) 291 as CO3
Cl 80.5 charge
F 0.2895
Ca 120
Mg 55
Na 53
K 1.1
Ba 0.2
Si 10.5
P 0.00395
Mn 0.35
Fe 2.75
Al 0.0007
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.0014
Pb 0.00129
Mo 0.00375
Se 0.00037
end
SOLUTION 5 #AW-21 (C - UA)
redox pe
units mg/l
density 1
pH 6.825
pe 4.53
temp 18
S(6) 260 as SO4
B 10.35
Li 0.00445
As 0.0010725
```

```
C(4) 111 as CO3
Cl 90 charge
F 0.3075
Ca 115
Mg 37
Na 57
K 2.9
Ba 0.0585
Si 5.6
P 0.00395
Mn 0.745
Fe 0.345
Al 0.00195
Sb 0.000885
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.000595
Pb 0.00011
Mo 0.023
Se 0.002085
end

EQUILIBRIUM_PHASES 1 #AP07S (C - PMP) - 75p
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.23
Ferrihydrite 0 0.063
Calcite 0 0.1
Dolomite(ordered) 0 0.3

SURFACE 1
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 1
save surface 1
end

EQUILIBRIUM_PHASES 2 #AW-15S (C - PMP) - 75p
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.23
Ferrihydrite 0 0.063
Calcite 0 0.1
Dolomite(ordered) 0 0.3

SURFACE 2
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 2
save surface 2
end

EQUILIBRIUM_PHASES 3 #AW-05 (C - UA) - 75p
Barite 0 0
```

```
Gypsum 0 0
Gibbsite 0 0.26
Ferrihydrite 0 0.24
Calcite 0 0.4
Dolomite(ordered) 0 0.7

SURFACE 3
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 3
save surface 3
end

EQUILIBRIUM_PHASES 4 #AW-19 (C - UA) - 75p
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.26
Ferrihydrite 0 0.24
Calcite 0 0.4
Dolomite(ordered) 0 0.7

SURFACE 4
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 4
save surface 4
end

EQUILIBRIUM_PHASES 5 #AW-21 (C - UA) - 75p
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.26
Ferrihydrite 0 0.24
Calcite 0 0.4
Dolomite(ordered) 0 0.7

SURFACE 5
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 5
save surface 5
end

SOLUTION 6 #average background
redox pe
units mg/l
density 1
pH 6.905
pe 1.2
temp 19.65
S(6) 1.595
B 0.22
Li 0.02
As 0.0067
```

```
C(4) 464.5
Cl 28.5 charge
F 0.08095
Ca 125
Mg 53
Na 120.5
K 2.65
Ba 0.51
Si 16.5
P 1.545
Mn 0.615
Fe 8.95
Al 0.0007
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.00067
Pb 0.00023
Mo 0.001195
Se 0.00037

SAVE solution 6

end

#FIRST REACTION

#AP07S (C - PMP) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 1
USE SURFACE 1
SAVE equilibrium_phases 1
SAVE surface 1
end

#AP07S (C - PMP) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 1
USE SURFACE 1
SAVE equilibrium_phases 1
SAVE surface 1
end

#AW-15S (C - PMP) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 2
USE SURFACE 2
SAVE equilibrium_phases 2
SAVE surface 2
end

#AW-15S (C - PMP) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 2
USE SURFACE 2
SAVE equilibrium_phases 2
```

```
SAVE surface 2
end

#AW-05 (C - UA) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 3
USE SURFACE 3
SAVE equilibrium_phases 3
SAVE surface 3
end

#AW-05 (C - UA) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 3
USE SURFACE 3
SAVE equilibrium_phases 3
SAVE surface 3
end

#AW-19 (C - UA) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 4
USE SURFACE 4
SAVE equilibrium_phases 4
SAVE surface 4
end

#AW-19 (C - UA) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 4
USE SURFACE 4
SAVE equilibrium_phases 4
SAVE surface 4
end

#AW-21 (C - UA) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 5
USE SURFACE 5
SAVE equilibrium_phases 5
SAVE surface 5
end

#AW-21 (C - UA) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 5
USE SURFACE 5
SAVE equilibrium_phases 5
SAVE surface 5
end
```

Median Metal Oxides/No Charge Balance

```
SELECTED_OUTPUT 1
-file EDW_845_301_median_cb-false_out.csv
-charge_balance true
-percent_error true
-totals S(6) B Li As C(4) Cl F Ca Mg Na K Ba Si P Mn Fe Al Sb Be Cd Cr Co Pb Mo Se Hfo_s
Hfo_w Hao_
-molalities Hfo_wOH Hfo_wOH2+ Hfo_wOHSO4-2 Hfo_wSO4- Hfo_wOSi(OH)3
Hfo_wOSiO(OH)2- Hfo_wHCO3 Hfo_wCO3- Hfo_wPO4-2
Hfo_wHPO4- Hfo_wH2PO4 Hfo_sCO3- Hfo_sHCO3
Hfo_sHPO4- Hfo_sH2BO3 Hfo_sH2PO4 Hfo_sOSi(OH)3
Hfo_sOSiO(OH)2- Hfo_sOHSO4-2 Hfo_sSO4-
Hao_SO4- Hao_OHSO4-2 Hao_H2BO3 Hao_H3BO4-
-equilibrium_phases Ferrihydrite Gibbsite Barite Calcite Dolomite(ordered) Gypsum
-saturation_indices Ferrihydrite Gibbsite Barite Calcite Dolomite(ordered) Gypsum

SOLUTION 1 #AP07S (C - PMP)
redox pe
units mg/l
density 1
pH 6.885
pe 4.49
temp 20.6
S(6) 360 as SO4
B 13.7
Li 0.00745
As 0.0007225
C(4) 255 as CO3
Cl 79.5
F 0.183
Ca 200
Mg 75
Na 66
K 0.895
Ba 0.0915
Si 7.65
P 0.04
Mn 0.65
Fe 0.0685
Al 0.0007
Sb 0.000215
Be 0.000295
Cd 0.000835
Cr 0.0072
Co 0.0036
Pb 0.00205
Mo 0.00115
Se 0.00037
end

SOLUTION 2 #AW-15S (C - PMP)
redox pe
units mg/l
density 1
```

pH 6.785
pe 3.68
temp 20.45
S(6) 580 as SO4
B 6.2
Li 0.0135
As 0.000345
C(4) 306 as CO3
Cl 31
F 0.152
Ca 275
Mg 86
Na 54
K 0.65
Ba 0.081
Si 8
P 0.034
Mn 0.74
Fe 0.044
Al 0.00735
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.00054
Pb 0.00011
Mo 0.00285
Se 0.001085
end

SOLUTION 3 #AW-05 (C - UA)
redox pe
units mg/l
density 1
pH 6.985
pe 4.565
temp 22.65
S(6) 405 as SO4
B 6.1
Li 0.017
As 0.0039
C(4) 240 as CO3
Cl 74.5
F 0.1695
Ca 175
Mg 81.5
Na 76.5
K 1.9
Ba 0.145
Si 10
P 0.022
Mn 1.5
Fe 3.65
Al 0.0007

```
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.00865
Co 0.00585
Pb 0.00405
Mo 0.0024
Se 0.00037
end
SOLUTION 4 #AW-19 (C - UA)
redox pe
units mg/l
density 1
pH 6.715
pe 2.695
temp 18.5
S(6) 53.5 as SO4
B 2.6
Li 0.0115
As 0.0135
C(4) 291 as CO3
Cl 80.5
F 0.2895
Ca 120
Mg 55
Na 53
K 1.1
Ba 0.2
Si 10.5
P 0.00395
Mn 0.35
Fe 2.75
Al 0.0007
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.0014
Pb 0.00129
Mo 0.00375
Se 0.00037
end
SOLUTION 5 #AW-21 (C - UA)
redox pe
units mg/l
density 1
pH 6.825
pe 4.53
temp 18
S(6) 260 as SO4
B 10.35
Li 0.00445
As 0.0010725
```

```
C(4) 111 as CO3
Cl 90
F 0.3075
Ca 115
Mg 37
Na 57
K 2.9
Ba 0.0585
Si 5.6
P 0.00395
Mn 0.745
Fe 0.345
Al 0.00195
Sb 0.000885
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.000595
Pb 0.00011
Mo 0.023
Se 0.002085
end

EQUILIBRIUM_PHASES 1 #AP07S (C - PMP) - median
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.18
Ferrihydrite 0 0.052
Calcite 0 0.1
Dolomite(ordered) 0 0.3

SURFACE 1
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 1
save surface 1
end

EQUILIBRIUM_PHASES 2 #AW-15S (C - PMP) - median
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.18
Ferrihydrite 0 0.052
Calcite 0 0.1
Dolomite(ordered) 0 0.3

SURFACE 2
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 2
save surface 2
end

EQUILIBRIUM_PHASES 3 #AW-05 (C - UA) - median
Barite 0 0
```

```
Gypsum 0 0
Gibbsite 0 0.21
Ferrihydrite 0 0.23
Calcite 0 0.4
Dolomite(ordered) 0 0.7

SURFACE 3
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 3
save surface 3
end

EQUILIBRIUM_PHASES 4 #AW-19 (C - UA) - median
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.21
Ferrihydrite 0 0.23
Calcite 0 0.4
Dolomite(ordered) 0 0.7

SURFACE 4
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 4
save surface 4
end

EQUILIBRIUM_PHASES 5 #AW-21 (C - UA) - median
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.21
Ferrihydrite 0 0.23
Calcite 0 0.4
Dolomite(ordered) 0 0.7

SURFACE 5
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 5
save surface 5
end

SOLUTION 6 #average background
redox pe
units mg/l
density 1
pH 6.905
pe 1.2
temp 19.65
S(6) 1.595
B 0.22
Li 0.02
As 0.0067
```

```
C(4) 464.5
Cl 28.5 charge
F 0.08095
Ca 125
Mg 53
Na 120.5
K 2.65
Ba 0.51
Si 16.5
P 1.545
Mn 0.615
Fe 8.95
Al 0.0007
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.00067
Pb 0.00023
Mo 0.001195
Se 0.00037

SAVE solution 6

end

#FIRST REACTION

#AP07S (C - PMP) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 1
USE SURFACE 1
SAVE equilibrium_phases 1
SAVE surface 1
end

#AP07S (C - PMP) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 1
USE SURFACE 1
SAVE equilibrium_phases 1
SAVE surface 1
end

#AW-15S (C - PMP) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 2
USE SURFACE 2
SAVE equilibrium_phases 2
SAVE surface 2
end

#AW-15S (C - PMP) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 2
USE SURFACE 2
SAVE equilibrium_phases 2
```

```
SAVE surface 2
end

#AW-05 (C - UA) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 3
USE SURFACE 3
SAVE equilibrium_phases 3
SAVE surface 3
end

#AW-05 (C - UA) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 3
USE SURFACE 3
SAVE equilibrium_phases 3
SAVE surface 3
end

#AW-19 (C - UA) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 4
USE SURFACE 4
SAVE equilibrium_phases 4
SAVE surface 4
end

#AW-19 (C - UA) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 4
USE SURFACE 4
SAVE equilibrium_phases 4
SAVE surface 4
end

#AW-21 (C - UA) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 5
USE SURFACE 5
SAVE equilibrium_phases 5
SAVE surface 5
end

#AW-21 (C - UA) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 5
USE SURFACE 5
SAVE equilibrium_phases 5
SAVE surface 5
end
```

Median Metal Oxides/Charge Balance on Chloride

```
SELECTED_OUTPUT 1
-file EDW_845_301_median_cb-true_out.csv
-charge_balance true
-percent_error true
-totals S(6) B Li As C(4) Cl F Ca Mg Na K Ba Si P Mn Fe Al Sb Be Cd Cr Co Pb Mo Se Hfo_s
Hfo_w Hao_
-molalities Hfo_wOH Hfo_wOH2+ Hfo_wOHSO4-2 Hfo_wSO4- Hfo_wOSi(OH)3
Hfo_wOSiO(OH)2- Hfo_wHCO3 Hfo_wCO3- Hfo_wPO4-2
Hfo_wHPO4- Hfo_wH2PO4 Hfo_sCO3- Hfo_sHCO3
Hfo_sHPO4- Hfo_sH2BO3 Hfo_sH2PO4 Hfo_sOSi(OH)3
Hfo_sOSiO(OH)2- Hfo_sOHSO4-2 Hfo_sSO4-
Hao_SO4- Hao_OHSO4-2 Hao_H2BO3 Hao_H3BO4-
-equilibrium_phases Ferrihydrite Gibbsite Barite Calcite Dolomite(ordered) Gypsum
-saturation_indices Ferrihydrite Gibbsite Barite Calcite Dolomite(ordered) Gypsum

SOLUTION 1 #AP07S (C - PMP)
redox pe
units mg/l
density 1
pH 6.885
pe 4.49
temp 20.6
S(6) 360 as SO4
B 13.7
Li 0.00745
As 0.0007225
C(4) 255 as CO3
Cl 79.5 charge
F 0.183
Ca 200
Mg 75
Na 66
K 0.895
Ba 0.0915
Si 7.65
P 0.04
Mn 0.65
Fe 0.0685
Al 0.0007
Sb 0.000215
Be 0.000295
Cd 0.000835
Cr 0.0072
Co 0.0036
Pb 0.00205
Mo 0.00115
Se 0.00037
end

SOLUTION 2 #AW-15S (C - PMP)
redox pe
units mg/l
density 1
```

pH 6.785
pe 3.68
temp 20.45
S(6) 580 as SO4
B 6.2
Li 0.0135
As 0.000345
C(4) 306 as CO3
Cl 31 charge
F 0.152
Ca 275
Mg 86
Na 54
K 0.65
Ba 0.081
Si 8
P 0.034
Mn 0.74
Fe 0.044
Al 0.00735
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.00054
Pb 0.00011
Mo 0.00285
Se 0.001085
end

SOLUTION 3 #AW-05 (C - UA)
redox pe
units mg/l
density 1
pH 6.985
pe 4.565
temp 22.65
S(6) 405 as SO4
B 6.1
Li 0.017
As 0.0039
C(4) 240 as CO3
Cl 74.5 charge
F 0.1695
Ca 175
Mg 81.5
Na 76.5
K 1.9
Ba 0.145
Si 10
P 0.022
Mn 1.5
Fe 3.65
Al 0.0007

```
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.00865
Co 0.00585
Pb 0.00405
Mo 0.0024
Se 0.00037
end
SOLUTION 4 #AW-19 (C - UA)
redox pe
units mg/l
density 1
pH 6.715
pe 2.695
temp 18.5
S(6) 53.5 as SO4
B 2.6
Li 0.0115
As 0.0135
C(4) 291 as CO3
Cl 80.5 charge
F 0.2895
Ca 120
Mg 55
Na 53
K 1.1
Ba 0.2
Si 10.5
P 0.00395
Mn 0.35
Fe 2.75
Al 0.0007
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.0014
Pb 0.00129
Mo 0.00375
Se 0.00037
end
SOLUTION 5 #AW-21 (C - UA)
redox pe
units mg/l
density 1
pH 6.825
pe 4.53
temp 18
S(6) 260 as SO4
B 10.35
Li 0.00445
As 0.0010725
```

```
C(4) 111 as CO3
Cl 90 charge
F 0.3075
Ca 115
Mg 37
Na 57
K 2.9
Ba 0.0585
Si 5.6
P 0.00395
Mn 0.745
Fe 0.345
Al 0.00195
Sb 0.000885
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.000595
Pb 0.00011
Mo 0.023
Se 0.002085
end

EQUILIBRIUM_PHASES 1 #AP07S (C - PMP) - median
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.18
Ferrihydrite 0 0.052
Calcite 0 0.1
Dolomite(ordered) 0 0.3

SURFACE 1
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 1
save surface 1
end

EQUILIBRIUM_PHASES 2 #AW-15S (C - PMP) - median
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.18
Ferrihydrite 0 0.052
Calcite 0 0.1
Dolomite(ordered) 0 0.3

SURFACE 2
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 2
save surface 2
end

EQUILIBRIUM_PHASES 3 #AW-05 (C - UA) - median
Barite 0 0
```

```
Gypsum 0 0
Gibbsite 0 0.21
Ferrihydrite 0 0.23
Calcite 0 0.4
Dolomite(ordered) 0 0.7

SURFACE 3
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 3
save surface 3
end

EQUILIBRIUM_PHASES 4 #AW-19 (C - UA) - median
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.21
Ferrihydrite 0 0.23
Calcite 0 0.4
Dolomite(ordered) 0 0.7

SURFACE 4
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 4
save surface 4
end

EQUILIBRIUM_PHASES 5 #AW-21 (C - UA) - median
Barite 0 0
Gypsum 0 0
Gibbsite 0 0.21
Ferrihydrite 0 0.23
Calcite 0 0.4
Dolomite(ordered) 0 0.7

SURFACE 5
Hfo_wOH Ferrihydrite equilibrium_phase 0.2 53400
Hfo_sOH Ferrihydrite equilibrium_phase 0.005 53400
Hao_OH Gibbsite equilibrium_phase 0.033 2496
-equil 5
save surface 5
end

SOLUTION 6 #average background
redox pe
units mg/l
density 1
pH 6.905
pe 1.2
temp 19.65
S(6) 1.595
B 0.22
Li 0.02
As 0.0067
```

```
C(4) 464.5
Cl 28.5 charge
F 0.08095
Ca 125
Mg 53
Na 120.5
K 2.65
Ba 0.51
Si 16.5
P 1.545
Mn 0.615
Fe 8.95
Al 0.0007
Sb 0.000215
Be 0.000295
Cd 0.00037
Cr 0.0014
Co 0.00067
Pb 0.00023
Mo 0.001195
Se 0.00037

SAVE solution 6

end

#FIRST REACTION

#AP07S (C - PMP) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 1
USE SURFACE 1
SAVE equilibrium_phases 1
SAVE surface 1
end

#AP07S (C - PMP) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 1
USE SURFACE 1
SAVE equilibrium_phases 1
SAVE surface 1
end

#AW-15S (C - PMP) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 2
USE SURFACE 2
SAVE equilibrium_phases 2
SAVE surface 2
end

#AW-15S (C - PMP) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 2
USE SURFACE 2
SAVE equilibrium_phases 2
```

```
SAVE surface 2
end

#AW-05 (C - UA) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 3
USE SURFACE 3
SAVE equilibrium_phases 3
SAVE surface 3
end

#AW-05 (C - UA) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 3
USE SURFACE 3
SAVE equilibrium_phases 3
SAVE surface 3
end

#AW-19 (C - UA) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 4
USE SURFACE 4
SAVE equilibrium_phases 4
SAVE surface 4
end

#AW-19 (C - UA) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 4
USE SURFACE 4
SAVE equilibrium_phases 4
SAVE surface 4
end

#AW-21 (C - UA) - First Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 5
USE SURFACE 5
SAVE equilibrium_phases 5
SAVE surface 5
end

#AW-21 (C - UA) - Second Reaction
USE SOLUTION 6
USE EQUILIBRIUM_PHASES 5
USE SURFACE 5
SAVE equilibrium_phases 5
SAVE surface 5
end
```

Database

```
#$Id: minteq.v4.dat 12387 2017-02-09 16:41:47Z dlpark $
SOLUTION_MASTER_SPECIES
Alkalinity CO3-2 2.0 HCO3 61.0173
E e- 0 0 0
O H2O 0 O 16.00
O(-2) H2O 0 O
O(0) O2 0 O
Ag Ag+ 0.0 Ag 107.868
Al Al+3 0.0 Al 26.9815
As H3AsO4 -1.0 As 74.9216
As(3) H3AsO3 0.0 As
As(5) H3AsO4 -1.0 As
B H3BO3 0.0 B 10.81
Ba Ba+2 0.0 Ba 137.33
Be Be+2 0.0 Be 9.0122
Br Br- 0.0 Br 79.904
C CO3-2 2.0 CO3 12.0111
C(4) CO3-2 2.0 CO3 12.0111
Cyanide Cyanide- 1.0 Cyanide 26.0177
Dom_a Dom_a 0.0 C 12.0111
Dom_b Dom_b 0.0 C 12.0111
Dom_c Dom_c 0.0 C 12.0111
Ca Ca+2 0.0 Ca 40.078
Cd Cd+2 0.0 Cd 112.41
Cl Cl- 0.0 Cl 35.453
Co Co+3 -1.0 Co 58.9332
Co(2) Co+2 0.0 Co
Co(3) Co+3 -1.0 Co
Cr CrO4-2 1.0 Cr 51.996
Cr(2) Cr+2 0.0 Cr
Cr(3) Cr(OH)2+ 0.0 Cr
Cr(6) CrO4-2 1.0 Cr
Cu Cu+2 0.0 Cu 63.546
Cu(1) Cu+ 0.0 Cu
Cu(2) Cu+2 0.0 Cu
F F- 0.0 F 18.9984
Fe Fe+3 -2.0 Fe 55.847
Fe(2) Fe+2 0.0 Fe
Fe(3) Fe+3 -2.0 Fe
H H+ -1.0 H 1.0079
H(0) H2 0 H
H(1) H+ -1.0 H
Hg Hg(OH)2 0.0 Hg 200.59
Hg(0) Hg 0.0 Hg
Hg(1) Hg2+2 0.0 Hg
Hg(2) Hg(OH)2 0.0 Hg
I I- 0.0 I 126.904
K K+ 0.0 K 39.0983
Li Li+ 0.0 Li 6.941
Mg Mg+2 0.0 Mg 24.305
Mn Mn+3 0.0 Mn 54.938
```

Mn(2) Mn+2 0.0 Mn
Mn(3) Mn+3 0.0 Mn
Mn(6) MnO4-2 0.0 Mn
Mn(7) MnO4- 0.0 Mn
Mo MoO4-2 0.0 Mo 95.94
N NO3- 0.0 N 14.0067
N(-3) NH4+ 0.0 N
N(3) NO2- 0.0 N
N(5) NO3- 0.0 N
Na Na+ 0.0 Na 22.9898
Ni Ni+2 0.0 Ni 58.69
P PO4-3 2.0 P 30.9738
Pb Pb+2 0.0 Pb 207.2
S SO4-2 0.0 SO4 32.066
S(-2) HS- 1.0 S
#S(0) S 0.0 S
S(6) SO4-2 0.0 SO4
Sb Sb(OH)6- 0.0 Sb 121.75
Sb(3) Sb(OH)3 0.0 Sb
Sb(5) Sb(OH)6- 0.0 Sb
Se SeO4-2 0.0 Se 78.96
Se(-2) HSe- 0.0 Se
Se(4) HSeO3- 0.0 Se
Se(6) SeO4-2 0.0 Se
Si H4SiO4 0.0 SiO2 28.0843
Sn Sn(OH)6-2 0.0 Sn 118.71
Sn(2) Sn(OH)2 0.0 Sn
Sn(4) Sn(OH)6-2 0.0 Sn
Sr Sr+2 0.0 Sr 87.62
Tl Tl(OH)3 0.0 Tl 204.383
Tl(1) Tl+ 0.0 Tl
Tl(3) Tl(OH)3 0.0 Tl
U UO2+2 0.0 U 238.029
U(3) U+3 0.0 U
U(4) U+4 -4.0 U
U(5) UO2+ 0.0 U
U(6) UO2+2 0.0 U
V VO2+ -2.0 V 50.94
V(2) V+2 0.0 V
V(3) V+3 -3.0 V
V(4) VO+2 0.0 V
V(5) VO2+ -2.0 V
Zn Zn+2 0.0 Zn 65.39
Benzoate Benzoate- 0.0 121.116 121.116
Phenylacetate Phenylacetate- 0.0 135.142 135.142
Isophthalate Isophthalate-2 0.0 164.117 164.117
Diethylamine Diethylamine 1.0 73.138 73.138
Butylamine Butylamine 1.0 73.138 73.138
Methylamine Methylamine 1.0 31.057 31.057
Dimethylamine Dimethylamine 1.0 45.084 45.084
Hexylamine Hexylamine 1.0 101.192 101.192
Ethylenediamine Ethylenediamine 2.0 60.099 60.099
Propylamine Propylamine 1.0 59.111 59.111
Isopropylamine Isopropylamine 1.0 59.111 59.111

Trimethylamine Trimethylamine 1.0 59.111 59.111
Citrate Citrate-3 2.0 189.102 189.102
Nta Nta-3 1.0 188.117 188.117
Edta Edta-4 2.0 288.214 288.214
Propionate Propionate- 1.0 73.072 73.072
Butyrate Butyrate- 1.0 87.098 87.098
Isobutyrate Isobutyrate- 1.0 87.098 87.098
Two_picoline Two_picoline 1.0 93.128 93.128
Three_picoline Three_picoline 1.0 93.128 93.128
Four_picoline Four_picoline 1.0 93.128 93.128
Formate Formate- 0.0 45.018 45.018
Isovalerate Isovalerate- 1.0 101.125 101.125
Valerate Valerate- 1.0 101.125 101.125
Acetate Acetate- 1.0 59.045 59.045
Tartarate Tartarate-2 0.0 148.072 148.072
Glycine Glycine- 1.0 74.059 74.059
Salicylate Salicylate-2 1.0 136.107 136.107
Glutamate Glutamate-2 1.0 145.115 145.115
Phthalate Phthalate-2 1.0 164.117 164.117
SOLUTION_SPECIES
e- = e-
log_k 0
H2O = H2O
log_k 0
Ag+ = Ag+
log_k 0
Al+3 = Al+3
log_k 0
H3AsO4 = H3AsO4
log_k 0
H3BO3 = H3BO3
log_k 0
Ba+2 = Ba+2
log_k 0
Be+2 = Be+2
log_k 0
Br- = Br-
log_k 0
CO3-2 = CO3-2
log_k 0
Cyanide- = Cyanide-
log_k 0
Dom_a = Dom_a
log_k 0
Dom_b = Dom_b
log_k 0
Dom_c = Dom_c
log_k 0
Ca+2 = Ca+2
log_k 0
Cd+2 = Cd+2
log_k 0
Cl- = Cl-
log_k 0

Co+3 = Co+3
log_k 0
CrO4-2 = CrO4-2
log_k 0
Cu+2 = Cu+2
log_k 0
F- = F-
log_k 0
Fe+3 = Fe+3
log_k 0
H+ = H+
log_k 0
Hg(OH)2 = Hg(OH)2
log_k 0
I- = I-
log_k 0
K+ = K+
log_k 0
Li+ = Li+
log_k 0
Mg+2 = Mg+2
log_k 0
Mn+3 = Mn+3
log_k 0
MoO4-2 = MoO4-2
log_k 0
NO3- = NO3-
log_k 0
Na+ = Na+
log_k 0
Ni+2 = Ni+2
log_k 0
PO4-3 = PO4-3
log_k 0
Pb+2 = Pb+2
log_k 0
SO4-2 = SO4-2
log_k 0
Sb(OH)6- = Sb(OH)6-
log_k 0
SeO4-2 = SeO4-2
log_k 0
H4SiO4 = H4SiO4
log_k 0
Sn(OH)6-2 = Sn(OH)6-2
log_k 0
Sr+2 = Sr+2
log_k 0
Tl(OH)3 = Tl(OH)3
log_k 0
UO2+2 = UO2+2
log_k 0
VO2+ = VO2+
log_k 0

Benzoate- = Benzoate-
log_k 0
Phenylacetate- = Phenylacetate-
log_k 0
Isophthalate-2 = Isophthalate-2
log_k 0
Zn+2 = Zn+2
log_k 0
Diethylamine = Diethylamine
log_k 0
Butylamine = Butylamine
log_k 0
Methylamine = Methylamine
log_k 0
Dimethylamine = Dimethylamine
log_k 0
Hexylamine = Hexylamine
log_k 0
Ethylenediamine = Ethylenediamine
log_k 0
Propylamine = Propylamine
log_k 0
Isopropylamine = Isopropylamine
log_k 0
Trimethylamine = Trimethylamine
log_k 0
Citrate-3 = Citrate-3
log_k 0
Nta-3 = Nta-3
log_k 0
Edta-4 = Edta-4
log_k 0
Propionate- = Propionate-
log_k 0
Butyrate- = Butyrate-
log_k 0
Isobutyrate- = Isobutyrate-
log_k 0
Two_picoline = Two_picoline
log_k 0
Three_picoline = Three_picoline
log_k 0
Four_picoline = Four_picoline
log_k 0
Formate- = Formate-
log_k 0
Isovalerate- = Isovalerate-
log_k 0
Valerate- = Valerate-
log_k 0
Acetate- = Acetate-
log_k 0
Tartarate-2 = Tartarate-2
log_k 0

```
Glycine- = Glycine-
log_k 0
Salicylate-2 = Salicylate-2
log_k 0
Glutamate-2 = Glutamate-2
log_k 0
Phthalate-2 = Phthalate-2
log_k 0
SOLUTION_SPECIES
Fe+3 + e- = Fe+2
log_k 13.032
delta_h -42.7 kJ
-gamma 0 0
# Id: 2802810
# log K source: Bard85
# Delta H source: Bard85
#T and ionic strength:
H3AsO4 + 2e- + 2H+ = H3AsO3 + H2O
log_k 18.898
delta_h -125.6 kJ
-gamma 0 0
# Id: 600610
# log K source: Bard85
# Delta H source: MTQ3.11
#T and ionic strength:
Sb(OH)6- + 2e- + 3H+ = Sb(OH)3 + 3H2O
log_k 24.31
delta_h 0 kJ
-gamma 0 0
# Id: 7407410
# log K source: Bard85
# Delta H source: MTQ3.11
#T and ionic strength:
UO2+2 + 3e- + 4H+ = U+3 + 2H2O
log_k 0.42
delta_h -42 kJ
-gamma 0 0
# Id: 8908930
# log K source: MTQ3.11
# Delta H source: MTQ3.11
#T and ionic strength:
UO2+2 + 2e- + 4H+ = U+4 + 2H2O
log_k 9.216
delta_h -144.1 kJ
-gamma 0 0
# Id: 8918930
# log K source: MTQ3.11
# Delta H source: MTQ3.11
#T and ionic strength:
UO2+2 + e- = UO2+
log_k 2.785
delta_h -13.8 kJ
-gamma 0 0
# Id: 8928930
```

log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
e- + Mn+3 = Mn+2
log_k 25.35
delta_h -107.8 kJ
-gamma 0 0
Id: 4704710
log K source: Bard85
Delta H source: MTQ3.11
#T and ionic strength:
Co+3 + e- = Co+2
log_k 32.4
delta_h 0 kJ
-gamma 0 0
Id: 2002010
log K source: Bard85
Delta H source: MTQ3.11
#T and ionic strength:
Cu+2 + e- = Cu+
log_k 2.69
delta_h 6.9 kJ
-gamma 0 0
Id: 2302310
log K source: Bard85
Delta H source: MTQ3.11
#T and ionic strength:
V+3 + e- = V+2
log_k -4.31
delta_h 0 kJ
-gamma 0 0
Id: 9009010
log K source: Bard85
Delta H source: MTQ3.11
#T and ionic strength:
VO+2 + e- + 2H+ = V+3 + H2O
log_k 5.696
delta_h 0 kJ
-gamma 0 0
Id: 9019020
log K source: Bard85
Delta H source: MTQ3.11
#T and ionic strength:
VO2+ + e- + 2H+ = VO+2 + H2O
log_k 16.903
delta_h -122.7 kJ
-gamma 0 0
Id: 9029030
log K source: Bard85
Delta H source: MTQ3.11
#T and ionic strength:
SO4-2 + 9H+ + 8e- = HS- + 4H2O
log_k 33.66
delta_h -60.14 kJ

-gamma 0 0
Id: 7307320
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Sn(OH)6-2 + 2e- + 4H+ = Sn(OH)2 + 4H2O
log_k 19.2
delta_h 0 kJ
-gamma 0 0
Id: 7907910
log K source: Bard85
Delta H source: MTQ3.11
#T and ionic strength:
Tl(OH)3 + 2e- + 3H+ = Tl+ + 3H2O
log_k 45.55
delta_h 0 kJ
-gamma 0 0
Id: 8708710
log K source: Bard85
Delta H source: MTQ3.11
#T and ionic strength:
HSeO3- + 6e- + 6H+ = HSe- + 3H2O
log_k 44.86
delta_h 0 kJ
-gamma 0 0
Id: 7607610
log K source: Bard85
Delta H source: MTQ3.11
#T and ionic strength:
SeO4-2 + 2e- + 3H+ = HSeO3- + H2O
log_k 36.308
delta_h -201.2 kJ
-gamma 0 0
Id: 7617620
log K source: Bard85
Delta H source: MTQ3.11
#T and ionic strength:
0.5Hg2+2 + e- = Hg
log_k 6.5667
delta_h -45.735 kJ
-gamma 0 0
Id: 3600000
log K source: NIST2.1.1
Delta H source: NIST2.1.1
#T and ionic strength:

2Hg(OH)2 + 4H+ + 2e- = Hg2+2 + 4H2O
log_k 43.185
delta_h -63.59 kJ
-gamma 0 0
Id: 3603610
log K source: Bard85
Delta H source: MTQ3.11
#T and ionic strength:

Cr(OH)2+ + 2H+ + e- = Cr+2 + 2H2O
log_k 2.947
delta_h 6.36 kJ
-gamma 0 0
Id: 2102110
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
CrO4-2 + 6H+ + 3e- = Cr(OH)2+ + 2H2O
log_k 67.376
delta_h -103 kJ
-gamma 0 0
Id: 2112120
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:

2H2O = O2 + 4H+ + 4e-
# Adjusted for equation to aqueous species
log_k -85.9951
-analytic 38.0229 7.99407E-03 -2.7655e+004 -1.4506e+001 199838.45

2 H+ + 2 e- = H2
log_k -3.15
delta_h -1.759 kcal

NO3- + 2 H+ + 2 e- = NO2- + H2O
log_k 28.570
delta_h -43.760 kcal
-gamma 3.0000 0.0000

NO3- + 10 H+ + 8 e- = NH4+ + 3 H2O
log_k 119.077
delta_h -187.055 kcal
-gamma 2.5000 0.0000

Mn+2 + 4H2O = MnO4- + 8H+ + 5e-
log_k -127.794
delta_h 822.67 kJ
-gamma 3 0
Id: 4700020
log K source: NIST2.1.1
Delta H source: NIST2.1.1
#T and ionic strength:
Mn+2 + 4H2O = MnO4-2 + 8H+ + 4e-
log_k -118.422
delta_h 711.07 kJ
-gamma 5 0
Id: 4700021
log K source: NIST2.1.1
Delta H source: NIST2.1.1
#T and ionic strength:
HS- = S-2 + H+
log_k -17.3
delta_h 49.4 kJ
-gamma 5 0
Id: 3307301

log K source: LMa1987
Delta H source: NIST2.1.1
#T and ionic strength: 0.00 25.0
HSe- = Se-2 + H+
log_k -15
delta_h 48.116 kJ
-gamma 0 0
Id: 3307601
log K source: SCD3.02 (1968 DKa)
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Tl(OH)3 + 3H+ = Tl+3 + 3H2O
log_k 3.291
delta_h 0 kJ
-gamma 0 0
Id: 8713300
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
0.5Hg2+2 + e- = Hg
log_k 6.5667
delta_h -45.735 kJ
-gamma 0 0
Id: 3600000
log K source: NIST2.1.1
Delta H source: NIST2.1.1
#T and ionic strength:
Hg(OH)2 + 2H+ = Hg+2 + 2H2O
log_k 6.194
delta_h -39.72 kJ
-gamma 0 0
Id: 3613300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Cr(OH)2+ + 2H+ = Cr+3 + 2H2O
log_k 9.5688
delta_h -129.62 kJ
-gamma 0 0
Id: 2113300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.10 20.0
H2O = OH- + H+
log_k -13.997
delta_h 55.81 kJ
-gamma 3.5 0
Id: 3300020
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Sn(OH)2 + 2H+ = Sn+2 + 2H2O
log_k 7.094
delta_h 0 kJ

-gamma 0 0
Id: 7903301
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Sn(OH)2 + H+ = SnOH+ + H2O
log_k 3.697
delta_h 0 kJ
-gamma 0 0
Id: 7903302
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Sn(OH)2 + H2O = Sn(OH)3- + H+
log_k -9.497
delta_h 0 kJ
-gamma 0 0
Id: 7903303
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
2Sn(OH)2 + 2H+ = Sn2(OH)2+2 + 2H2O
log_k 9.394
delta_h 0 kJ
-gamma 0 0
Id: 7903304
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
3Sn(OH)2 + 2H+ = Sn3(OH)4+2 + 2H2O
log_k 14.394
delta_h 0 kJ
-gamma 0 0
Id: 7903305
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Sn(OH)2 = HSnO2- + H+
log_k -8.9347
delta_h 0 kJ
-gamma 0 0
Id: 7903306
log K source: Bard85
Delta H source: MTQ3.11
#T and ionic strength:
Sn(OH)6-2 + 6H+ = Sn+4 + 6H2O
log_k 21.2194
delta_h 0 kJ
-gamma 0 0
Id: 7913301
log K source: Bard85
Delta H source: MTQ3.11
#T and ionic strength:
Sn(OH)6-2 = SnO3-2 + 3H2O

log_k -2.2099
delta_h 0 kJ
-gamma 0 0
Id: 7913302
log K source: Bard85
Delta H source: MTQ3.11
#T and ionic strength:
Pb+2 + H2O = PbOH+ + H+
log_k -7.597
delta_h 0 kJ
-gamma 0 0
Id: 6003300
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Pb+2 + 2H2O = Pb(OH)2 + 2H+
log_k -17.094
delta_h 0 kJ
-gamma 0 0
Id: 6003301
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Pb+2 + 3H2O = Pb(OH)3- + 3H+
log_k -28.091
delta_h 0 kJ
-gamma 0 0
Id: 6003302
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
2Pb+2 + H2O = Pb2OH+3 + H+
log_k -6.397
delta_h 0 kJ
-gamma 0 0
Id: 6003303
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
3Pb+2 + 4H2O = Pb3(OH)4+2 + 4H+
log_k -23.888
delta_h 115.24 kJ
-gamma 0 0
Id: 6003304
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Pb+2 + 4H2O = Pb(OH)4-2 + 4H+
log_k -39.699
delta_h 0 kJ
-gamma 0 0
Id: 6003305
log K source: MTQ3.11
Delta H source: MTQ3.11

#T and ionic strength:
4Pb+2 + 4H2O = Pb4(OH)4+4 + 4H+
log_k -19.988
delta_h 88.24 kJ
-gamma 0 0
Id: 6003306
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
H3BO3 + F- = BF(OH)3-
log_k -0.399
delta_h 7.7404 kJ
-gamma 2.5 0
Id: 902700
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
H3BO3 + 2F- + H+ = BF2(OH)2- + H2O
log_k 7.63
delta_h 6.8408 kJ
-gamma 2.5 0
Id: 902701
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
H3BO3 + 3F- + 2H+ = BF3OH- + 2H2O
log_k 13.22
delta_h -20.4897 kJ
-gamma 2.5 0
Id: 902702
log K source: NIST2.1.1
Delta H source: NIST2.1.1
#T and ionic strength:
Al+3 + H2O = AlOH+2 + H+
log_k -4.997
delta_h 47.81 kJ
-gamma 5.4 0
Id: 303300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Al+3 + 2H2O = Al(OH)2+ + 2H+
log_k -10.094
delta_h 0 kJ
-gamma 5.4 0
Id: 303301
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Al+3 + 3H2O = Al(OH)3 + 3H+
log_k -16.791
delta_h 0 kJ
-gamma 0 0
Id: 303303

log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Al+3 + 4H2O = Al(OH)4- + 4H+
log_k -22.688
delta_h 173.24 kJ
-gamma 4.5 0
Id: 303302
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Tl+ + H2O = TlOH + H+
log_k -13.207
delta_h 56.81 kJ
-gamma 0 0
Id: 8703300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Tl(OH)3 + 2H+ = TlOH+2 + 2H2O
log_k 2.694
delta_h 0 kJ
-gamma 0 0
Id: 8713301
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Tl(OH)3 + H+ = Tl(OH)2+ + H2O
log_k 1.897
delta_h 0 kJ
-gamma 0 0
Id: 8713302
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Tl(OH)3 + H2O = Tl(OH)4- + H+
log_k -11.697
delta_h 0 kJ
-gamma 0 0
Id: 8713303
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Zn+2 + H2O = ZnOH+ + H+
log_k -8.997
delta_h 55.81 kJ
-gamma 0 0
Id: 9503300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Zn+2 + 2H2O = Zn(OH)2 + 2H+
log_k -17.794
delta_h 0 kJ

-gamma 0 0
Id: 9503301
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Zn+2 + 3H2O = Zn(OH)3- + 3H+
log_k -28.091
delta_h 0 kJ
-gamma 0 0
Id: 9503302
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Zn+2 + 4H2O = Zn(OH)4-2 + 4H+
log_k -40.488
delta_h 0 kJ
-gamma 0 0
Id: 9503303
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Cd+2 + H2O = CdOH+ + H+
log_k -10.097
delta_h 54.81 kJ
-gamma 0 0
Id: 1603300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Cd+2 + 2H2O = Cd(OH)2 + 2H+
log_k -20.294
delta_h 0 kJ
-gamma 0 0
Id: 1603301
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Cd+2 + 3H2O = Cd(OH)3- + 3H+
log_k -32.505
delta_h 0 kJ
-gamma 0 0
Id: 1603302
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 3.00 25.0
Cd+2 + 4H2O = Cd(OH)4-2 + 4H+
log_k -47.288
delta_h 0 kJ
-gamma 0 0
Id: 1603303
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
2Cd+2 + H2O = Cd2OH+3 + H+

log_k -9.397
delta_h 45.81 kJ
-gamma 0 0
Id: 1603304
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Hg(OH)2 + H+ = HgOH+ + H2O
log_k 2.797
delta_h -18.91 kJ
-gamma 0 0
Id: 3613302
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Hg(OH)2 + H2O = Hg(OH)3- + H+
log_k -14.897
delta_h 0 kJ
-gamma 0 0
Id: 3613303
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Cu+2 + H2O = CuOH+ + H+
log_k -7.497
delta_h 35.81 kJ
-gamma 4 0
Id: 2313300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Cu+2 + 2H2O = Cu(OH)2 + 2H+
log_k -16.194
delta_h 0 kJ
-gamma 0 0
Id: 2313301
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Cu+2 + 3H2O = Cu(OH)3- + 3H+
log_k -26.879
delta_h 0 kJ
-gamma 0 0
Id: 2313302
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Cu+2 + 4H2O = Cu(OH)4-2 + 4H+
log_k -39.98
delta_h 0 kJ
-gamma 0 0
Id: 2313303
log K source: NIST46.3
Delta H source: MTQ3.11

#T and ionic strength: 1.00 25.0
2Cu+2 + 2H2O = Cu2(OH)2+2 + 2H+
log_k -10.594
delta_h 76.62 kJ
-gamma 0 0
Id: 2313304
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Ag+ + H2O = AgOH + H+
log_k -11.997
delta_h 0 kJ
-gamma 0 0
Id: 203300
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Ag+ + 2H2O = Ag(OH)2- + 2H+
log_k -24.004
delta_h 0 kJ
-gamma 0 0
Id: 203301
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Ni+2 + H2O = NiOH+ + H+
log_k -9.897
delta_h 51.81 kJ
-gamma 0 0
Id: 5403300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Ni+2 + 2H2O = Ni(OH)2 + 2H+
log_k -18.994
delta_h 0 kJ
-gamma 0 0
Id: 5403301
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Ni+2 + 3H2O = Ni(OH)3- + 3H+
log_k -29.991
delta_h 0 kJ
-gamma 0 0
Id: 5403302
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Co+2 + H2O = CoOH+ + H+
log_k -9.697
delta_h 0 kJ
-gamma 0 0
Id: 2003300

log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Co+2 + 2H2O = Co(OH)2 + 2H+
log_k -18.794
delta_h 0 kJ
-gamma 0 0
Id: 2003301
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Co+2 + 3H2O = Co(OH)3- + 3H+
log_k -31.491
delta_h 0 kJ
-gamma 0 0
Id: 2003302
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Co+2 + 4H2O = Co(OH)4-2 + 4H+
log_k -46.288
delta_h 0 kJ
-gamma 0 0
Id: 2003303
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
2Co+2 + H2O = Co2OH+3 + H+
log_k -10.997
delta_h 0 kJ
-gamma 0 0
Id: 2003304
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
4Co+2 + 4H2O = Co4(OH)4+4 + 4H+
log_k -30.488
delta_h 0 kJ
-gamma 0 0
Id: 2003306
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Co+2 + 2H2O = CoOOH- + 3H+
log_k -32.0915
delta_h 260.454 kJ
-gamma 0 0
Id: 2003305
log K source: NIST2.1.1
Delta H source: MTQ3.11
#T and ionic strength:
Co+3 + H2O = CoOH+2 + H+
log_k -1.291
delta_h 0 kJ

-gamma 0 0
Id: 2013300
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 3.00 25.0
Fe+2 + H2O = FeOH+ + H+
log_k -9.397
delta_h 55.81 kJ
-gamma 5 0
Id: 2803300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Fe+2 + 2H2O = Fe(OH)2 + 2H+
log_k -20.494
delta_h 119.62 kJ
-gamma 0 0
Id: 2803302
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Fe+2 + 3H2O = Fe(OH)3- + 3H+
log_k -28.991
delta_h 126.43 kJ
-gamma 5 0
Id: 2803301
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Fe+3 + H2O = FeOH+2 + H+
log_k -2.187
delta_h 41.81 kJ
-gamma 5 0
Id: 2813300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Fe+3 + 2H2O = Fe(OH)2+ + 2H+
log_k -4.594
delta_h 0 kJ
-gamma 5.4 0
Id: 2813301
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Fe+3 + 3H2O = Fe(OH)3 + 3H+
log_k -12.56
delta_h 103.8 kJ
-gamma 0 0
Id: 2813302
log K source: Nord90
Delta H source: Nord90
#T and ionic strength: 0.00 25.0
Fe+3 + 4H2O = Fe(OH)4- + 4H+

log_k -21.588
delta_h 0 kJ
-gamma 5.4 0
Id: 2813303
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
2Fe+3 + 2H2O = Fe2(OH)2+4 + 2H+
log_k -2.854
delta_h 57.62 kJ
-gamma 0 0
Id: 2813304
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
3Fe+3 + 4H2O = Fe3(OH)4+5 + 4H+
log_k -6.288
delta_h 65.24 kJ
-gamma 0 0
Id: 2813305
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Mn+2 + H2O = MnOH+ + H+
log_k -10.597
delta_h 55.81 kJ
-gamma 5 0
Id: 4703300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Mn+2 + 3H2O = Mn(OH)3- + 3H+
log_k -34.8
delta_h 0 kJ
-gamma 5 0
Id: 4703301
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Mn+2 + 4H2O = Mn(OH)4-2 + 4H+
log_k -48.288
delta_h 0 kJ
-gamma 5 0
Id: 4703302
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Mn+2 + 4H2O = MnO4- + 8H+ + 5e-
log_k -127.794
delta_h 822.67 kJ
-gamma 3 0
Id: 4700020
log K source: NIST2.1.1
Delta H source: NIST2.1.1

#T and ionic strength:
Mn+2 + 4H2O = MnO4-2 + 8H+ + 4e-
log_k -118.422
delta_h 711.07 kJ
-gamma 5 0
Id: 4700021
log K source: NIST2.1.1
Delta H source: NIST2.1.1
#T and ionic strength:
Cr(OH)2+ + H+ = Cr(OH)+2 + H2O
log_k 5.9118
delta_h -77.91 kJ
-gamma 0 0
Id: 2113301
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Cr(OH)2+ + H2O = Cr(OH)3 + H+
log_k -8.4222
delta_h 0 kJ
-gamma 0 0
Id: 2113302
log K source: SCD3.02 (1983 RCa)
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Cr(OH)2+ + 2H2O = Cr(OH)4- + 2H+
log_k -17.8192
delta_h 0 kJ
-gamma 0 0
Id: 2113303
log K source: SCD3.02 (1983 RCa)
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Cr(OH)2+ = CrO2- + 2H+
log_k -17.7456
delta_h 0 kJ
-gamma 0 0
Id: 2113304
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
V+2 + H2O = VOH+ + H+
log_k -6.487
delta_h 59.81 kJ
-gamma 0 0
Id: 9003300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
V+3 + H2O = VOH+2 + H+
log_k -2.297
delta_h 43.81 kJ
-gamma 0 0
Id: 9013300

log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
V+3 + 2H2O = V(OH)2+ + 2H+
log_k -6.274
delta_h 0 kJ
-gamma 0 0
Id: 9013301
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 20.0
V+3 + 3H2O = V(OH)3 + 3H+
log_k -3.0843
delta_h 0 kJ
-gamma 0 0
Id: 9013302
log K source: SCD3.02 (1978 TKa)
Delta H source: MTQ3.11
#T and ionic strength: 0.10 20.0
2V+3 + 2H2O = V2(OH)2+4 + 2H+
log_k -3.794
delta_h 0 kJ
-gamma 0 0
Id: 9013304
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
2V+3 + 3H2O = V2(OH)3+3 + 3H+
log_k -10.1191
delta_h 0 kJ
-gamma 0 0
Id: 9013303
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 3.00 25.0
VO+2 + 2H2O = V(OH)3+ + H+
log_k -5.697
delta_h 0 kJ
-gamma 0 0
Id: 9023300
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
2VO+2 + 2H2O = H2V2O4+2 + 2H+
log_k -6.694
delta_h 53.62 kJ
-gamma 0 0
Id: 9023301
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
U+4 + H2O = UOH+3 + H+
log_k -0.597
delta_h 47.81 kJ

-gamma 0 0
Id: 8913300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
U+4 + 2H2O = U(OH)2+2 + 2H+
log_k -2.27
delta_h 74.1823 kJ
-gamma 0 0
Id: 8913301
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
U+4 + 3H2O = U(OH)3+ + 3H+
log_k -4.935
delta_h 94.7467 kJ
-gamma 0 0
Id: 8913302
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
U+4 + 4H2O = U(OH)4 + 4H+
log_k -8.498
delta_h 103.596 kJ
-gamma 0 0
Id: 8913303
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
U+4 + 5H2O = U(OH)5- + 5H+
log_k -13.12
delta_h 115.374 kJ
-gamma 0 0
Id: 8913304
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
6U+4 + 15H2O = U6(OH)15+9 + 15H+
log_k -17.155
delta_h 0 kJ
-gamma 0 0
Id: 8913305
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
UO2+2 + H2O = UO2OH+ + H+
log_k -5.897
delta_h 47.81 kJ
-gamma 0 0
Id: 8933300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
2UO2+2 + 2H2O = (UO2)2(OH)2+2 + 2H+

log_k -5.574
delta_h 41.82 kJ
-gamma 0 0
Id: 8933301
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
3UO2+2 + 5H2O = (UO2)3(OH)5+ + 5H+
log_k -15.585
delta_h 108.05 kJ
-gamma 0 0
Id: 8933302
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Be+2 + H2O = BeOH+ + H+
log_k -5.397
delta_h 0 kJ
-gamma 6.5 0
Id: 1103301
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Be+2 + 2H2O = Be(OH)2 + 2H+
log_k -13.594
delta_h 0 kJ
-gamma 6.5 0
Id: 1103302
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Be+2 + 3H2O = Be(OH)3- + 3H+
log_k -23.191
delta_h 0 kJ
-gamma 6.5 0
Id: 1103303
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Be+2 + 4H2O = Be(OH)4-2 + 4H+
log_k -37.388
delta_h 0 kJ
-gamma 6.5 0
Id: 1103304
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
2Be+2 + H2O = Be2OH+3 + H+
log_k -3.177
delta_h 0 kJ
-gamma 6.5 0
Id: 1103305
log K source: NIST46.4
Delta H source: MTQ3.11

#T and ionic strength: 0.10 25.0
3Be+2 + 3H2O = Be3(OH)3+3 + 3H+
log_k -8.8076
delta_h 0 kJ
-gamma 6.5 0
Id: 1103306
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.10 25.0
Mg+2 + H2O = MgOH+ + H+
log_k -11.397
delta_h 67.81 kJ
-gamma 6.5 0
Id: 4603300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Ca+2 + H2O = CaOH+ + H+
log_k -12.697
delta_h 64.11 kJ
-gamma 6 0
Id: 1503300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Sr+2 + H2O = SrOH+ + H+
log_k -13.177
delta_h 60.81 kJ
-gamma 5 0
Id: 8003300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Ba+2 + H2O = BaOH+ + H+
log_k -13.357
delta_h 60.81 kJ
-gamma 5 0
Id: 1003300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
H+ + F- = HF
log_k 3.17
delta_h 13.3 kJ
-gamma 0 0
Id: 3302700
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
H+ + 2F- = HF2-
log_k 3.75
delta_h 17.4 kJ
-gamma 3.5 0
Id: 3302701

log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
2F- + 2H+ = H2F2
log_k 6.768
delta_h 0 kJ
-gamma 0 0
Id: 3302702
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Sb(OH)3 + F- + H+ = SbOF + 2H2O
log_k 6.1864
delta_h 0 kJ
-gamma 0 0
Id: 7402700
log K source: PNL89
Delta H source: PNL89
#T and ionic strength:
Sb(OH)3 + F- + H+ = Sb(OH)2F + H2O
log_k 6.1937
delta_h 0 kJ
-gamma 0 0
Id: 7402702
log K source: PNL89
Delta H source: PNL89
#T and ionic strength:
H4SiO4 + 4H+ + 6F- = SiF6-2 + 4H2O
log_k 30.18
delta_h -68 kJ
-gamma 5 0
Id: 7702700
log K source: Nord90
Delta H source: Nord90
#T and ionic strength: 0.00 25.0
Sn(OH)2 + 2H+ + F- = SnF+ + 2H2O
log_k 11.582
delta_h 0 kJ
-gamma 0 0
Id: 7902701
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Sn(OH)2 + 2H+ + 2F- = SnF2 + 2H2O
log_k 14.386
delta_h 0 kJ
-gamma 0 0
Id: 7902702
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Sn(OH)2 + 2H+ + 3F- = SnF3- + 2H2O
log_k 17.206
delta_h 0 kJ

-gamma 0 0
Id: 7902703
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Sn(OH)6-2 + 6H+ + 6F- = SnF6-2 + 6H2O
log_k 33.5844
delta_h 0 kJ
-gamma 0 0
Id: 7912701
log K source: Bard85
Delta H source: MTQ3.11
#T and ionic strength:
Pb+2 + F- = PbF+
log_k 1.848
delta_h 0 kJ
-gamma 0 0
Id: 6002700
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Pb+2 + 2F- = PbF2
log_k 3.142
delta_h 0 kJ
-gamma 0 0
Id: 6002701
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Pb+2 + 3F- = PbF3-
log_k 3.42
delta_h 0 kJ
-gamma 0 0
Id: 6002702
log K source: SCD3.02 (1956 TKa)
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Pb+2 + 4F- = PbF4-2
log_k 3.1
delta_h 0 kJ
-gamma 0 0
Id: 6002703
log K source: SCD3.02 (1956 TKa)
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
H3BO3 + 3H+ + 4F- = BF4- + 3H2O
log_k 19.912
delta_h -18.67 kJ
-gamma 2.5 0
Id: 902703
log K source: NIST46.3
Delta H source: NIST2.1.1
#T and ionic strength: 1.00 25.0
Al+3 + F- = AlF+2

log_k 7
delta_h 4.6 kJ
-gamma 5.4 0
Id: 302700
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Al+3 + 2F- = AlF2+
log_k 12.6
delta_h 8.3 kJ
-gamma 5.4 0
Id: 302701
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Al+3 + 3F- = AlF3
log_k 16.7
delta_h 8.7 kJ
-gamma 0 0
Id: 302702
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Al+3 + 4F- = AlF4-
log_k 19.4
delta_h 8.7 kJ
-gamma 4.5 0
Id: 302703
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Tl+ + F- = TlF
log_k 0.1
delta_h 0 kJ
-gamma 0 0
Id: 8702700
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Zn+2 + F- = ZnF+
log_k 1.3
delta_h 11 kJ
-gamma 0 0
Id: 9502700
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Cd+2 + F- = CdF+
log_k 1.2
delta_h 5 kJ
-gamma 0 0
Id: 1602700
log K source: NIST46.3
Delta H source: NIST46.3

#T and ionic strength: 0.00 25.0
Cd+2 + 2F- = CdF2
log_k 1.5
delta_h 0 kJ
-gamma 0 0
Id: 1602701
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Hg(OH)2 + 2H+ + F- = HgF+ + 2H2O
log_k 7.763
delta_h -35.72 kJ
-gamma 0 0
Id: 3612701
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.50 25.0
Cu+2 + F- = CuF+
log_k 1.8
delta_h 13 kJ
-gamma 0 0
Id: 2312700
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Ag+ + F- = AgF
log_k 0.4
delta_h 12 kJ
-gamma 0 0
Id: 202700
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Ni+2 + F- = NiF+
log_k 1.4
delta_h 7.1 kJ
-gamma 0 0
Id: 5402700
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Co+2 + F- = CoF+
log_k 1.5
delta_h 9.2 kJ
-gamma 0 0
Id: 2002700
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Fe+3 + F- = FeF+2
log_k 6.04
delta_h 10 kJ
-gamma 5 0
Id: 2812700

log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Fe+3 + 2F- = FeF2+
log_k 10.4675
delta_h 17 kJ
-gamma 5 0
Id: 2812701
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.50 25.0
Fe+3 + 3F- = FeF3
log_k 13.617
delta_h 29 kJ
-gamma 0 0
Id: 2812702
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.50 25.0
Mn+2 + F- = MnF+
log_k 1.6
delta_h 11 kJ
-gamma 5 0
Id: 4702700
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Cr(OH)2+ + 2H+ + F- = CrF+2 + 2H2O
log_k 14.7688
delta_h -70.2452 kJ
-gamma 0 0
Id: 2112700
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
VO+2 + F- = VOF+
log_k 3.778
delta_h 7.9 kJ
-gamma 0 0
Id: 9022700
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 1.00 25.0
VO+2 + 2F- = VOF2
log_k 6.352
delta_h 14 kJ
-gamma 0 0
Id: 9022701
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 1.00 25.0
VO+2 + 3F- = VOF3-
log_k 7.902
delta_h 20 kJ

-gamma 0 0
Id: 9022702
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 1.00 25.0
VO+2 + 4F- = VOF4-2
log_k 8.508
delta_h 26 kJ
-gamma 0 0
Id: 9022703
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 1.00 25.0
VO2+ + F- = VO2F
log_k 3.244
delta_h 0 kJ
-gamma 0 0
Id: 9032700
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
VO2+ + 2F- = VO2F2-
log_k 5.804
delta_h 0 kJ
-gamma 0 0
Id: 9032701
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 20.0
VO2+ + 3F- = VO2F3-2
log_k 6.9
delta_h 0 kJ
-gamma 0 0
Id: 9032702
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 20.0
VO2+ + 4F- = VO2F4-3
log_k 6.592
delta_h 0 kJ
-gamma 0 0
Id: 9032703
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 20.0
U+4 + F- = UF+3
log_k 9.3
delta_h 21.1292 kJ
-gamma 0 0
Id: 8912700
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
U+4 + 2F- = UF2+2

log_k 16.4
delta_h 30.1248 kJ
-gamma 0 0
Id: 8912701
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
U+4 + 3F- = UF3+
log_k 21.6
delta_h 29.9156 kJ
-gamma 0 0
Id: 8912702
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
U+4 + 4F- = UF4
log_k 23.64
delta_h 19.2464 kJ
-gamma 0 0
Id: 8912703
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
U+4 + 5F- = UF5-
log_k 25.238
delta_h 20.2924 kJ
-gamma 0 0
Id: 8912704
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
U+4 + 6F- = UF6-2
log_k 27.718
delta_h 13.8072 kJ
-gamma 0 0
Id: 8912705
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
UO2+2 + F- = UO2F+
log_k 5.14
delta_h 1 kJ
-gamma 0 0
Id: 8932700
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
UO2+2 + 2F- = UO2F2
log_k 8.6
delta_h 2 kJ
-gamma 0 0
Id: 8932701
log K source: NIST46.3
Delta H source: NIST46.3

#T and ionic strength: 0.00 25.0
UO2+2 + 3F- = UO2F3-
log_k 11
delta_h 2 kJ
-gamma 0 0
Id: 8932702
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
UO2+2 + 4F- = UO2F4-2
log_k 11.9
delta_h 0.4 kJ
-gamma 0 0
Id: 8932703
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Be+2 + F- = BeF+
log_k 5.249
delta_h 0 kJ
-gamma 0 0
Id: 1102701
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.50 25.0
Be+2 + 2F- = BeF2
log_k 9.1285
delta_h -4 kJ
-gamma 0 0
Id: 1102702
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.50 25.0
Be+2 + 3F- = BeF3-
log_k 11.9085
delta_h -8 kJ
-gamma 0 0
Id: 1102703
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.50 25.0
Mg+2 + F- = MgF+
log_k 2.05
delta_h 13 kJ
-gamma 4.5 0
Id: 4602700
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Ca+2 + F- = CaF+
log_k 1.038
delta_h 14 kJ
-gamma 5 0
Id: 1502700

log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 1.00 25.0
Sr+2 + F- = SrF+
log_k 0.548
delta_h 16 kJ
-gamma 0 0
Id: 8002701
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 1.00 25.0
Na+ + F- = NaF
log_k -0.2
delta_h 12 kJ
-gamma 0 0
Id: 5002700
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Sn(OH)2 + 2H+ + Cl- = SnCl+ + 2H2O
log_k 8.734
delta_h 0 kJ
-gamma 0 0
Id: 7901801
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Sn(OH)2 + 2H+ + 2Cl- = SnCl2 + 2H2O
log_k 9.524
delta_h 0 kJ
-gamma 0 0
Id: 7901802
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Sn(OH)2 + 2H+ + 3Cl- = SnCl3- + 2H2O
log_k 8.3505
delta_h 0 kJ
-gamma 0 0
Id: 7901803
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 2.00 25.0
Pb+2 + Cl- = PbCl+
log_k 1.55
delta_h 8.7 kJ
-gamma 0 0
Id: 6001800
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Pb+2 + 2Cl- = PbCl2
log_k 2.2
delta_h 12 kJ

-gamma 0 0
Id: 6001801
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Pb+2 + 3Cl- = PbCl3-
log_k 1.8
delta_h 4 kJ
-gamma 0 0
Id: 6001802
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Pb+2 + 4Cl- = PbCl4-2
log_k 1.46
delta_h 14.7695 kJ
-gamma 0 0
Id: 6001803
log K source: SCD3.02 (1984 SEa)
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Tl+ + Cl- = TlCl
log_k 0.51
delta_h -6.2 kJ
-gamma 0 0
Id: 8701800
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Tl+ + 2Cl- = TlCl2-
log_k 0.28
delta_h 0 kJ
-gamma 0 0
Id: 8701801
log K source: SCD3.02 (1992 RAb)
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Tl(OH)3 + 3H+ + Cl- = TlCl+2 + 3H2O
log_k 11.011
delta_h 0 kJ
-gamma 0 0
Id: 8711800
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Tl(OH)3 + 3H+ + 2Cl- = TlCl2+ + 3H2O
log_k 16.771
delta_h 0 kJ
-gamma 0 0
Id: 8711801
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Tl(OH)3 + 3H+ + 3Cl- = TlCl3 + 3H2O

log_k 19.791
delta_h 0 kJ
-gamma 0 0
Id: 8711802
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Tl(OH)3 + 3H+ + 4Cl- = TlCl4- + 3H2O
log_k 21.591
delta_h 0 kJ
-gamma 0 0
Id: 8711803
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Tl(OH)3 + Cl- + 2H+ = TlOHCl+ + 2H2O
log_k 10.629
delta_h 0 kJ
-gamma 0 0
Id: 8711804
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Zn+2 + Cl- = ZnCl+
log_k 0.4
delta_h 5.4 kJ
-gamma 4 0
Id: 9501800
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Zn+2 + 2Cl- = ZnCl2
log_k 0.6
delta_h 37 kJ
-gamma 0 0
Id: 9501801
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Zn+2 + 3Cl- = ZnCl3-
log_k 0.5
delta_h 39.999 kJ
-gamma 4 0
Id: 9501802
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Zn+2 + 4Cl- = ZnCl4-2
log_k 0.199
delta_h 45.8566 kJ
-gamma 5 0
Id: 9501803
log K source: MTQ3.11
Delta H source: MTQ3.11

#T and ionic strength:
Zn+2 + H2O + Cl- = ZnOHCl + H+
log_k -7.48
delta_h 0 kJ
-gamma 0 0
Id: 9501804
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Cd+2 + Cl- = CdCl+
log_k 1.98
delta_h 1 kJ
-gamma 0 0
Id: 1601800
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Cd+2 + 2Cl- = CdCl2
log_k 2.6
delta_h 3 kJ
-gamma 0 0
Id: 1601801
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Cd+2 + 3Cl- = CdCl3-
log_k 2.4
delta_h 10 kJ
-gamma 0 0
Id: 1601802
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Cd+2 + H2O + Cl- = CdOHCl + H+
log_k -7.404
delta_h 18.2213 kJ
-gamma 0 0
Id: 1601803
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Hg(OH)2 + 2H+ + Cl- = HgCl+ + 2H2O
log_k 13.494
delta_h -62.72 kJ
-gamma 0 0
Id: 3611800
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Hg(OH)2 + 2H+ + 2Cl- = HgCl2 + 2H2O
log_k 20.194
delta_h -92.42 kJ
-gamma 0 0
Id: 3611801

log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Hg(OH)2 + 2H+ + 3Cl- = HgCl3- + 2H2O
log_k 21.194
delta_h -94.02 kJ
-gamma 0 0
Id: 3611802
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Hg(OH)2 + 2H+ + 4Cl- = HgCl4-2 + 2H2O
log_k 21.794
delta_h -100.72 kJ
-gamma 0 0
Id: 3611803
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Hg(OH)2 + Cl- + I- + 2H+ = HgClI + 2H2O
log_k 25.532
delta_h -135.3 kJ
-gamma 0 0
Id: 3611804
log K source: NIST2.1.1
Delta H source: NIST2.1.1
#T and ionic strength:
Hg(OH)2 + H+ + Cl- = HgClOH + H2O
log_k 10.444
delta_h -42.72 kJ
-gamma 0 0
Id: 3611805
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 1.00 25.0
Cu+2 + Cl- = CuCl+
log_k 0.2
delta_h 8.3 kJ
-gamma 4 0
Id: 2311800
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Cu+2 + 2Cl- = CuCl2
log_k -0.26
delta_h 44.183 kJ
-gamma 0 0
Id: 2311801
log K source: SCD3.02 (1989 IPa)
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Cu+2 + 3Cl- = CuCl3-
log_k -2.29
delta_h 57.279 kJ

-gamma 4 0
Id: 2311802
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Cu+2 + 4Cl- = CuCl4-2
log_k -4.59
delta_h 32.5515 kJ
-gamma 5 0
Id: 2311803
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Cu+ + 2Cl- = CuCl2-
log_k 5.42
delta_h -1.7573 kJ
-gamma 4 0
Id: 2301800
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Cu+ + 3Cl- = CuCl3-2
log_k 4.75
delta_h 1.0878 kJ
-gamma 5 0
Id: 2301801
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Cu+ + Cl- = CuCl
log_k 3.1
delta_h 0 kJ
-gamma 0 0
Id: 2301802
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Ag+ + Cl- = AgCl
log_k 3.31
delta_h -12 kJ
-gamma 0 0
Id: 201800
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Ag+ + 2Cl- = AgCl2-
log_k 5.25
delta_h -16 kJ
-gamma 0 0
Id: 201801
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Ag+ + 3Cl- = AgCl3-2

log_k 5.2
delta_h 0 kJ
-gamma 0 0
Id: 201802
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Ag+ + 4Cl- = AgCl4-3
log_k 5.51
delta_h 0 kJ
-gamma 0 0
Id: 201803
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Ni+2 + Cl- = NiCl+
log_k 0.408
delta_h 2 kJ
-gamma 0 0
Id: 5401800
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 1.00 25.0
Ni+2 + 2Cl- = NiCl2
log_k -1.89
delta_h 0 kJ
-gamma 0 0
Id: 5401801
log K source: SCD3.02 (1989 IPa)
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Co+2 + Cl- = CoCl+
log_k 0.539
delta_h 2 kJ
-gamma 0 0
Id: 2001800
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.50 25.0
Co+3 + Cl- = CoCl+2
log_k 2.3085
delta_h 16 kJ
-gamma 0 0
Id: 2011800
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.50 25.0
Fe+3 + Cl- = FeCl+2
log_k 1.48
delta_h 23 kJ
-gamma 5 0
Id: 2811800
log K source: NIST46.3
Delta H source: NIST46.3

#T and ionic strength: 0.00 25.0
Fe+3 + 2Cl- = FeCl2+
log_k 2.13
delta_h 0 kJ
-gamma 5 0
Id: 2811801
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Fe+3 + 3Cl- = FeCl3
log_k 1.13
delta_h 0 kJ
-gamma 0 0
Id: 2811802
log K source: Nord90
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Mn+2 + Cl- = MnCl+
log_k 0.1
delta_h 0 kJ
-gamma 5 0
Id: 4701800
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 20.0
Mn+2 + 2Cl- = MnCl2
log_k 0.25
delta_h 0 kJ
-gamma 0 0
Id: 4701801
log K source: Nord90
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Mn+2 + 3Cl- = MnCl3-
log_k -0.31
delta_h 0 kJ
-gamma 5 0
Id: 4701802
log K source: Nord90
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Cr(OH)2+ + 2H+ + Cl- = CrCl+2 + 2H2O
log_k 9.6808
delta_h -103.62 kJ
-gamma 0 0
Id: 2111800
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 1.00 25.0
Cr(OH)2+ + 2Cl- + 2H+ = CrCl2+ + 2H2O
log_k 8.658
delta_h -39.2208 kJ
-gamma 0 0
Id: 2111801

log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Cr(OH)2+ + 2Cl- + H+ = CrOHCl2 + H2O
log_k 2.9627
delta_h 0 kJ
-gamma 0 0
Id: 2111802
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
VO+2 + Cl- = VOCl+
log_k 0.448
delta_h 0 kJ
-gamma 0 0
Id: 9021800
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 20.0
U+4 + Cl- = UCl+3
log_k 1.7
delta_h -20 kJ
-gamma 0 0
Id: 8911800
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
UO2+2 + Cl- = UO2Cl+
log_k 0.21
delta_h 16 kJ
-gamma 0 0
Id: 8931800
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Be+2 + Cl- = BeCl+
log_k 0.2009
delta_h 0 kJ
-gamma 5 0
Id: 1101801
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.70 20.0
Sn(OH)2 + 2H+ + Br- = SnBr+ + 2H2O
log_k 8.254
delta_h 0 kJ
-gamma 0 0
Id: 7901301
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Sn(OH)2 + 2H+ + 2Br- = SnBr2 + 2H2O
log_k 8.794
delta_h 0 kJ

-gamma 0 0
Id: 7901302
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Sn(OH)2 + 2H+ + 3Br- = SnBr3- + 2H2O
log_k 7.48
delta_h 0 kJ
-gamma 0 0
Id: 7901303
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 3.00 25.0
Pb+2 + Br- = PbBr+
log_k 1.7
delta_h 8 kJ
-gamma 0 0
Id: 6001300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Pb+2 + 2Br- = PbBr2
log_k 2.6
delta_h -4 kJ
-gamma 0 0
Id: 6001301
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Tl+ + Br- = TlBr
log_k 0.91
delta_h -12 kJ
-gamma 0 0
Id: 8701300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Tl+ + 2Br- = TlBr2-
log_k -0.384
delta_h 12.36 kJ
-gamma 0 0
Id: 8701301
log K source: NIST46.3
Delta H source: NIST2.1.1
#T and ionic strength: 4.00 25.0
Tl+ + Br- + Cl- = TlBrCl-
log_k 0.8165
delta_h 0 kJ
-gamma 0 0
Id: 8701302
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Tl+ + I- + Br- = TlIBr-

log_k 2.185
delta_h 0 kJ
-gamma 0 0
Id: 8703802
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Tl(OH)3 + 3H+ + Br- = TlBr+2 + 3H2O
log_k 12.803
delta_h 0 kJ
-gamma 0 0
Id: 8711300
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Tl(OH)3 + 3H+ + 2Br- = TlBr2+ + 3H2O
log_k 20.711
delta_h 0 kJ
-gamma 0 0
Id: 8711301
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Tl(OH)3 + 3Br- + 3H+ = TlBr3 + 3H2O
log_k 27.0244
delta_h 0 kJ
-gamma 0 0
Id: 8711302
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Tl(OH)3 + 4Br- + 3H+ = TlBr4- + 3H2O
log_k 31.1533
delta_h 0 kJ
-gamma 0 0
Id: 8711303
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Zn+2 + Br- = ZnBr+
log_k -0.07
delta_h 1 kJ
-gamma 0 0
Id: 9501300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Zn+2 + 2Br- = ZnBr2
log_k -0.98
delta_h 0 kJ
-gamma 0 0
Id: 9501301
log K source: MTQ3.11
Delta H source: MTQ3.11

#T and ionic strength:
Cd+2 + Br- = CdBr+
log_k 2.15
delta_h -3 kJ
-gamma 0 0
Id: 1601300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Cd+2 + 2Br- = CdBr2
log_k 3
delta_h -3 kJ
-gamma 0 0
Id: 1601301
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Hg(OH)2 + 2H+ + Br- = HgBr+ + 2H2O
log_k 15.803
delta_h -81.92 kJ
-gamma 0 0
Id: 3611301
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.50 25.0
Hg(OH)2 + 2H+ + 2Br- = HgBr2 + 2H2O
log_k 24.2725
delta_h -127.12 kJ
-gamma 0 0
Id: 3611302
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.50 25.0
Hg(OH)2 + 2H+ + 3Br- = HgBr3- + 2H2O
log_k 26.7025
delta_h -138.82 kJ
-gamma 0 0
Id: 3611303
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.50 25.0
Hg(OH)2 + 2H+ + 4Br- = HgBr4-2 + 2H2O
log_k 27.933
delta_h -153.72 kJ
-gamma 0 0
Id: 3611304
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.50 25.0
Hg(OH)2 + Br- + Cl- + 2H+ = HgBrCl + 2H2O
log_k 22.1811
delta_h -113.77 kJ
-gamma 0 0
Id: 3611305

log K source: NIST2.1.1
Delta H source: NIST2.1.1
#T and ionic strength:
Hg(OH)2 + Br- + I- + 2H+ = HgBrI + 2H2O
log_k 27.3133
delta_h -151.27 kJ
-gamma 0 0
Id: 3611306
log K source: NIST2.1.1
Delta H source: NIST2.1.1
#T and ionic strength:
Hg(OH)2 + Br- + 3I- + 2H+ = HgBrI3-2 + 2H2O
log_k 34.2135
delta_h 0 kJ
-gamma 0 0
Id: 3611307
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Hg(OH)2 + 2Br- + 2I- + 2H+ = HgBr2I2-2 + 2H2O
log_k 32.3994
delta_h 0 kJ
-gamma 0 0
Id: 3611308
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Hg(OH)2 + 3Br- + I- + 2H+ = HgBr3I-2 + 2H2O
log_k 30.1528
delta_h 0 kJ
-gamma 0 0
Id: 3611309
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Hg(OH)2 + H+ + Br- = HgBrOH + H2O
log_k 12.433
delta_h 0 kJ
-gamma 0 0
Id: 3613301
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.50 25.0
Ag+ + Br- = AgBr
log_k 4.6
delta_h 0 kJ
-gamma 0 0
Id: 201300
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Ag+ + 2Br- = AgBr2-
log_k 7.5
delta_h 0 kJ

-gamma 0 0
Id: 201301
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Ag+ + 3Br- = AgBr3-2
log_k 8.1
delta_h 0 kJ
-gamma 0 0
Id: 201302
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Ni+2 + Br- = NiBr+
log_k 0.5
delta_h 0 kJ
-gamma 0 0
Id: 5401300
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Cr(OH)2+ + Br- + 2H+ = CrBr+2 + 2H2O
log_k 7.5519
delta_h -46.9068 kJ
-gamma 0 0
Id: 2111300
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Be+2 + Br- = BeBr+
log_k 0.1009
delta_h 0 kJ
-gamma 5 0
Id: 1101301
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.70 20.0
Pb+2 + I- = PbI+
log_k 2
delta_h 0 kJ
-gamma 0 0
Id: 6003800
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Pb+2 + 2I- = PbI2
log_k 3.2
delta_h 0 kJ
-gamma 0 0
Id: 6003801
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Tl+ + I- = TlI

log_k 1.4279
delta_h 0 kJ
-gamma 0 0
Id: 8703800
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Tl+ + 2I- = TlI2-
log_k 1.8588
delta_h 0 kJ
-gamma 0 0
Id: 8703801
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Tl(OH)3 + 4I- + 3H+ = TlI4- + 3H2O
log_k 34.7596
delta_h 0 kJ
-gamma 0 0
Id: 8713800
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Zn+2 + I- = ZnI+
log_k -2.0427
delta_h -4 kJ
-gamma 0 0
Id: 9503800
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 3.00 25.0
Zn+2 + 2I- = ZnI2
log_k -1.69
delta_h 0 kJ
-gamma 0 0
Id: 9503801
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Cd+2 + I- = CdI+
log_k 2.28
delta_h -9.6 kJ
-gamma 0 0
Id: 1603800
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Cd+2 + 2I- = CdI2
log_k 3.92
delta_h -12 kJ
-gamma 0 0
Id: 1603801
log K source: NIST46.3
Delta H source: NIST46.3

#T and ionic strength: 0.00 25.0
Hg(OH)2 + 2H+ + I- = HgI+ + 2H2O
log_k 19.603
delta_h -111.22 kJ
-gamma 0 0
Id: 3613801
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.50 25.0
Hg(OH)2 + 2H+ + 2I- = HgI2 + 2H2O
log_k 30.8225
delta_h -182.72 kJ
-gamma 0 0
Id: 3613802
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.50 25.0
Hg(OH)2 + 2H+ + 3I- = HgI3- + 2H2O
log_k 34.6025
delta_h -194.22 kJ
-gamma 0 0
Id: 3613803
log K source: NIST46.4
Delta H source: NIST2.1.1
#T and ionic strength: 0.50 25.0
Hg(OH)2 + 2H+ + 4I- = HgI4-2 + 2H2O
log_k 36.533
delta_h -220.72 kJ
-gamma 0 0
Id: 3613804
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.50 25.0
Ag+ + I- = AgI
log_k 6.6
delta_h 0 kJ
-gamma 0 0
Id: 203800
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 18.0
Ag+ + 2I- = AgI2-
log_k 11.7
delta_h 0 kJ
-gamma 0 0
Id: 203801
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 18.0
Ag+ + 3I- = AgI3-2
log_k 12.6
delta_h -122 kJ
-gamma 0 0
Id: 203802

log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Ag+ + 4I- = AgI4-3
log_k 14.229
delta_h 0 kJ
-gamma 0 0
Id: 203803
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 2.00 25.0
Cr(OH)2+ + I- + 2H+ = CrI+2 + 2H2O
log_k 4.8289
delta_h 0 kJ
-gamma 0 0
Id: 2113800
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
H+ + HS- = H2S
log_k 7.02
delta_h -22 kJ
-gamma 0 0
Id: 3307300
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Pb+2 + 2HS- = Pb(HS)2
log_k 15.27
delta_h 0 kJ
-gamma 0 0
Id: 6007300
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Pb+2 + 3HS- = Pb(HS)3-
log_k 16.57
delta_h 0 kJ
-gamma 0 0
Id: 6007301
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Tl+ + HS- = TlHS
log_k 2.474
delta_h 0 kJ
-gamma 0 0
Id: 8707300
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
2Tl+ + HS- = Tl2HS+
log_k 5.974
delta_h 0 kJ

-gamma 0 0
Id: 8707301
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
2Tl+ + 3HS- + H2O = Tl2OH(HS)3-2 + H+
log_k 1.0044
delta_h 0 kJ
-gamma 0 0
Id: 8707302
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
2Tl+ + 2HS- + 2H2O = Tl2(OH)2(HS)2-2 + 2H+
log_k -11.0681
delta_h 0 kJ
-gamma 0 0
Id: 8707303
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Zn+2 + 2HS- = Zn(HS)2
log_k 12.82
delta_h 0 kJ
-gamma 0 0
Id: 9507300
log K source: DHa1993
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Zn+2 + 3HS- = Zn(HS)3-
log_k 16.1
delta_h 0 kJ
-gamma 0 0
Id: 9507301
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Zn+2 + 3HS- = ZnS(HS)2-2 + H+
log_k 6.12
delta_h 0 kJ
-gamma 0 0
Id: 9507302
log K source: DHa1993
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Zn+2 + 2HS- + 2HS- = Zn(HS)4-2
log_k 14.64
delta_h 0 kJ
-gamma 0 0
Id: 9507303
log K source: DHa1993
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Zn+2 + 2HS- = ZnS(HS)- + H+

log_k 6.81
delta_h 0 kJ
-gamma 0 0
Id: 9507304
log K source: DHa1993
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Cd+2 + HS- = CdHS+
log_k 8.008
delta_h 0 kJ
-gamma 0 0
Id: 1607300
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Cd+2 + 2HS- = Cd(HS)2
log_k 15.212
delta_h 0 kJ
-gamma 0 0
Id: 1607301
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Cd+2 + 3HS- = Cd(HS)3-
log_k 17.112
delta_h 0 kJ
-gamma 0 0
Id: 1607302
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Cd+2 + 4HS- = Cd(HS)4-2
log_k 19.308
delta_h 0 kJ
-gamma 0 0
Id: 1607303
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Hg(OH)2 + 2HS- = HgS2-2 + 2H2O
log_k 29.414
delta_h 0 kJ
-gamma 0 0
Id: 3617300
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 1.00 20.0
Hg(OH)2 + 2H+ + 2HS- = Hg(HS)2 + 2H2O
log_k 44.516
delta_h 0 kJ
-gamma 0 0
Id: 3617301
log K source: NIST46.3
Delta H source: MTQ3.11

#T and ionic strength: 1.00 20.0
Hg(OH)2 + H+ + 2HS- = HgHS2- + 2H2O
log_k 38.122
delta_h 0 kJ
-gamma 0 0
Id: 3617302
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 1.00 20.0
Cu+2 + 3HS- = Cu(HS)3-
log_k 25.899
delta_h 0 kJ
-gamma 0 0
Id: 2317300
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Ag+ + HS- = AgHS
log_k 13.8145
delta_h 0 kJ
-gamma 0 0
Id: 207300
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.10 20.0
Ag+ + 2HS- = Ag(HS)2-
log_k 17.9145
delta_h 0 kJ
-gamma 0 0
Id: 207301
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.10 20.0
Fe+2 + 2HS- = Fe(HS)2
log_k 8.95
delta_h 0 kJ
-gamma 0 0
Id: 2807300
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Fe+2 + 3HS- = Fe(HS)3-
log_k 10.987
delta_h 0 kJ
-gamma 0 0
Id: 2807301
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
HS- = S2-2 + H+
log_k -11.7828
delta_h 46.4 kJ
-gamma 0 0
-no_check

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# Id: 7317300
# log K source: NIST2.1.1
# Delta H source: NIST2.1.1
#T and ionic strength:
HS- = S3-2 + H+
log_k -10.7667
delta_h 42.2 kJ
-gamma 0 0
-no_check
# Id: 7317301
# log K source: NIST2.1.1
# Delta H source: NIST2.1.1
#T and ionic strength:
HS- = S4-2 + H+
log_k -9.9608
delta_h 39.3 kJ
-gamma 0 0
-no_check
# Id: 7317302
# log K source: NIST2.1.1
# Delta H source: NIST2.1.1
#T and ionic strength:
HS- = S5-2 + H+
log_k -9.3651
delta_h 37.6 kJ
-gamma 0 0
-no_check
# Id: 7317303
# log K source: NIST2.1.1
# Delta H source: NIST2.1.1
#T and ionic strength:
HS- = S6-2 + H+
log_k -9.881
delta_h 0 kJ
-gamma 0 0
-no_check
# Id: 7317304
# log K source: MTQ3.11
# Delta H source: MTQ3.11
#T and ionic strength:
2Sb(OH)3 + 4HS- + 2H+ = Sb2S4-2 + 6H2O
log_k 49.3886
delta_h -321.78 kJ
-gamma 0 0
# Id: 7407300
# log K source: NIST2.1.1
# Delta H source: NIST2.1.1
#T and ionic strength:
Cu+ + 2HS- = Cu(S4)2-3 + 2H+
log_k 3.39
delta_h 0 kJ
-gamma 23 0
-no_check
# Id: 2307300
```

log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Cu+ + 2HS- = CuS4S5-3 + 2H+
log_k 2.66
delta_h 0 kJ
-gamma 25 0
-no_check
Id: 2307301
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Ag+ + 2HS- = Ag(S4)2-3 + 2H+
log_k 0.991
delta_h 0 kJ
-gamma 22 0
-no_check
Id: 207302
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Ag+ + 2HS- = AgS4S5-3 + 2H+
log_k 0.68
delta_h 0 kJ
-gamma 24 0
-no_check
Id: 207303
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Ag+ + 2HS- = Ag(HS)S4-2 + H+
log_k 10.431
delta_h 0 kJ
-gamma 15 0
-no_check
Id: 207304
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
H+ + SO4-2 = HSO4-
log_k 1.99
delta_h 22 kJ
-gamma 4.5 0
Id: 3307320
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
NH4+ + SO4-2 = NH4SO4-
log_k 1.03
delta_h 0 kJ
-gamma 5 0
Id: 4907320
log K source: NIST46.3
Delta H source: MTQ3.11

#T and ionic strength: 0.00 25.0
Pb+2 + SO4-2 = PbSO4
log_k 2.69
delta_h 0 kJ
-gamma 0 0
Id: 6007320
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Pb+2 + 2SO4-2 = Pb(SO4)2-2
log_k 3.47
delta_h 0 kJ
-gamma 0 0
Id: 6007321
log K source: SCD3.02 (1960 RKa)
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Al+3 + SO4-2 = AlSO4+
log_k 3.89
delta_h 28 kJ
-gamma 4.5 0
Id: 307320
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Al+3 + 2SO4-2 = Al(SO4)2-
log_k 4.92
delta_h 11.9 kJ
-gamma 4.5 0
Id: 307321
log K source: Nord90
Delta H source: Nord90
#T and ionic strength: 0.00 25.0
Tl+ + SO4-2 = TlSO4-
log_k 1.37
delta_h -0.8 kJ
-gamma 0 0
Id: 8707320
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Zn+2 + SO4-2 = ZnSO4
log_k 2.34
delta_h 6.2 kJ
-gamma 0 0
Id: 9507320
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Zn+2 + 2SO4-2 = Zn(SO4)2-2
log_k 3.28
delta_h 0 kJ
-gamma 0 0
Id: 9507321

log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Cd+2 + SO4-2 = CdSO4
log_k 2.37
delta_h 8.7 kJ
-gamma 0 0
Id: 1607320
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Cd+2 + 2SO4-2 = Cd(SO4)2-2
log_k 3.5
delta_h 0 kJ
-gamma 0 0
Id: 1607321
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Hg(OH)2 + 2H+ + SO4-2 = HgSO4 + 2H2O
log_k 8.612
delta_h 0 kJ
-gamma 0 0
Id: 3617320
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.50 25.0
Cu+2 + SO4-2 = CuSO4
log_k 2.36
delta_h 8.7 kJ
-gamma 0 0
Id: 2317320
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Ag+ + SO4-2 = AgSO4-
log_k 1.3
delta_h 6.2 kJ
-gamma 0 0
Id: 207320
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Ni+2 + SO4-2 = NiSO4
log_k 2.3
delta_h 5.8 kJ
-gamma 0 0
Id: 5407320
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Ni+2 + 2SO4-2 = Ni(SO4)2-2
log_k 0.82
delta_h 0 kJ

-gamma 0 0
Id: 5407321
log K source: SCD3.02 (1978 BLa)
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Co+2 + SO4-2 = CoSO4
log_k 2.3
delta_h 6.2 kJ
-gamma 0 0
Id: 2007320
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Fe+2 + SO4-2 = FeSO4
log_k 2.39
delta_h 8 kJ
-gamma 0 0
Id: 2807320
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Fe+3 + SO4-2 = FeSO4+
log_k 4.05
delta_h 25 kJ
-gamma 5 0
Id: 2817320
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Fe+3 + 2SO4-2 = Fe(SO4)2-
log_k 5.38
delta_h 19.2 kJ
-gamma 0 0
Id: 2817321
log K source: Nord90
Delta H source: Nord90
#T and ionic strength: 0.00 25.0
Mn+2 + SO4-2 = MnSO4
log_k 2.25
delta_h 8.7 kJ
-gamma 0 0
Id: 4707320
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Cr(OH)2+ + 2H+ + SO4-2 = CrSO4+ + 2H2O
log_k 12.9371
delta_h -98.62 kJ
-gamma 0 0
Id: 2117320
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 1.00 50.0
Cr(OH)2+ + H+ + SO4-2 = CrOHSO4 + H2O

log_k 8.2871
delta_h 0 kJ
-gamma 0 0
Id: 2117321
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.10 25.0
2Cr(OH)2+ + SO4-2 + 2H+ = Cr2(OH)2SO4+2 + 2H2O
log_k 16.155
delta_h 0 kJ
-gamma 0 0
Id: 2117323
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
2Cr(OH)2+ + 2SO4-2 + 2H+ = Cr2(OH)2(SO4)2 + 2H2O
log_k 17.9288
delta_h 0 kJ
-gamma 0 0
Id: 2117324
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
U+4 + SO4-2 = USO4+2
log_k 6.6
delta_h 8 kJ
-gamma 0 0
Id: 8917320
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
U+4 + 2SO4-2 = U(SO4)2
log_k 10.5
delta_h 33 kJ
-gamma 0 0
Id: 8917321
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
UO2+2 + SO4-2 = UO2SO4
log_k 3.18
delta_h 20 kJ
-gamma 0 0
Id: 8937320
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
UO2+2 + 2SO4-2 = UO2(SO4)2-2
log_k 4.3
delta_h 38 kJ
-gamma 0 0
Id: 8937321
log K source: NIST46.3
Delta H source: NIST46.3

#T and ionic strength: 0.00 25.0
V+3 + SO4-2 = VSO4+
log_k 2.674
delta_h 0 kJ
-gamma 0 0
Id: 9017320
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
VO+2 + SO4-2 = VOSO4
log_k 2.44
delta_h 17 kJ
-gamma 0 0
Id: 9027320
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
VO2+ + SO4-2 = VO2SO4-
log_k 1.378
delta_h 0 kJ
-gamma 0 0
Id: 9037320
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 20.0
Be+2 + SO4-2 = BeSO4
log_k 2.19
delta_h 29 kJ
-gamma 0 0
Id: 1107321
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Be+2 + 2SO4-2 = Be(SO4)2-2
log_k 2.596
delta_h 0 kJ
-gamma 0 0
Id: 1107322
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Mg+2 + SO4-2 = MgSO4
log_k 2.26
delta_h 5.8 kJ
-gamma 0 0
Id: 4607320
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Ca+2 + SO4-2 = CaSO4
log_k 2.36
delta_h 7.1 kJ
-gamma 0 0
Id: 1507320

log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Sr+2 + SO4-2 = SrSO4
log_k 2.3
delta_h 8 kJ
-gamma 0 0
Id: 8007321
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Li+ + SO4-2 = LiSO4-
log_k 0.64
delta_h 0 kJ
-gamma 5 0
Id: 4407320
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Na+ + SO4-2 = NaSO4-
log_k 0.73
delta_h 1 kJ
-gamma 5.4 0
Id: 5007320
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
K+ + SO4-2 = KSO4-
log_k 0.85
delta_h 4.1 kJ
-gamma 5.4 0
Id: 4107320
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
HSe- + H+ = H2Se
log_k 3.89
delta_h 3.3 kJ
-gamma 0 0
Id: 3307600
log K source: NIST46.3
Delta H source: NIST2.1.1
#T and ionic strength: 0.00 25.0
2Ag+ + HSe- = Ag2Se + H+
log_k 34.911
delta_h 0 kJ
-gamma 0 0
Id: 207600
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Ag+ + H2O + 2HSe- = AgOH(Se)2-4 + 3H+
log_k -20.509
delta_h 0 kJ

-gamma 0 0
Id: 207601
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Mn+2 + HSe- = MnSe + H+
log_k -5.385
delta_h 0 kJ
-gamma 0 0
Id: 4707600
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
HSeO3- = SeO3-2 + H+
log_k -8.4
delta_h 5.02 kJ
-gamma 0 0
Id: 3307611
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
HSeO3- + H+ = H2SeO3
log_k 2.63
delta_h 6.2 kJ
-gamma 0 0
Id: 3307610
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Cd+2 + 2HSeO3- = Cd(SeO3)2-2 + 2H+
log_k -10.884
delta_h 0 kJ
-gamma 0 0
Id: 1607610
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Ag+ + HSeO3- = AgSeO3- + H+
log_k -5.592
delta_h 0 kJ
-gamma 0 0
Id: 207610
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Ag+ + 2HSeO3- = Ag(SeO3)2-3 + 2H+
log_k -13.04
delta_h 0 kJ
-gamma 0 0
Id: 207611
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Fe+3 + HSeO3- = FeHSeO3+2

log_k 3.422
delta_h 25 kJ
-gamma 0 0
Id: 2817610
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 1.00 25.0
SeO4-2 + H+ = HSeO4-
log_k 1.7
delta_h 23 kJ
-gamma 0 0
Id: 3307620
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Zn+2 + SeO4-2 = ZnSeO4
log_k 2.19
delta_h 0 kJ
-gamma 0 0
Id: 9507620
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Zn+2 + 2SeO4-2 = Zn(SeO4)2-2
log_k 2.196
delta_h 0 kJ
-gamma 0 0
Id: 9507621
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Cd+2 + SeO4-2 = CdSeO4
log_k 2.27
delta_h 0 kJ
-gamma 0 0
Id: 1607620
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Ni+2 + SeO4-2 = NiSeO4
log_k 2.67
delta_h 14 kJ
-gamma 0 0
Id: 5407620
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Co+2 + SeO4-2 = CoSeO4
log_k 2.7
delta_h 12 kJ
-gamma 0 0
Id: 2007621
log K source: NIST46.4
Delta H source: NIST46.4

#T and ionic strength: 0.00 25.0
Mn+2 + SeO4-2 = MnSeO4
log_k 2.43
delta_h 14 kJ
-gamma 0 0
Id: 4707620
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
NH4+ = NH3 + H+
log_k -9.244
delta_h 52 kJ
-gamma 0 0
Id: 3304900
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Ag+ + NH4+ = AgNH3+ + H+
log_k -5.934
delta_h -72 kJ
-gamma 0 0
Id: 204901
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ag+ + 2NH4+ = Ag(NH3)2+ + 2H+
log_k -11.268
delta_h -160 kJ
-gamma 0 0
Id: 204902
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Hg(OH)2 + H+ + NH4+ = HgNH3+2 + 2H2O
log_k 5.75
delta_h 0 kJ
-gamma 0 0
Id: 3614900
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 2.00 22.0
Hg(OH)2 + 2NH4+ = Hg(NH3)2+2 + 2H2O
log_k 5.506
delta_h -246.72 kJ
-gamma 0 0
Id: 3614901
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 1.00 25.0
Hg(OH)2 + 3NH4+ = Hg(NH3)3+2 + 2H2O + H+
log_k -3.138
delta_h -312.72 kJ
-gamma 0 0
Id: 3614902

log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 2.00 25.0
Hg(OH)2 + 4NH4+ = Hg(NH3)4+2 + 2H2O + 2H+
log_k -11.482
delta_h -379.72 kJ
-gamma 0 0
Id: 3614903
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.10 25.0
Cu+2 + NH4+ = CuNH3+2 + H+
log_k -5.234
delta_h -72 kJ
-gamma 0 0
Id: 2314901
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ni+2 + NH4+ = NiNH3+2 + H+
log_k -6.514
delta_h -67 kJ
-gamma 0 0
Id: 5404901
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
Ni+2 + 2NH4+ = Ni(NH3)2+2 + 2H+
log_k -13.598
delta_h -111.6 kJ
-gamma 0 0
Id: 5404902
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
Co+2 + NH4+ = Co(NH3)+2 + H+
log_k -7.164
delta_h -65 kJ
-gamma 0 0
Id: 2004900
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
Co+2 + 2NH4+ = Co(NH3)2+2 + 2H+
log_k -14.778
delta_h 0 kJ
-gamma 0 0
Id: 2004901
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 2.00 25.0
Co+2 + 3NH4+ = Co(NH3)3+2 + 3H+
log_k -22.922
delta_h 0 kJ

-gamma 0 0
Id: 2004902
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 2.00 25.0
Co+2 + 4NH4+ = Co(NH3)4+2 + 4H+
log_k -31.446
delta_h 0 kJ
-gamma 0 0
Id: 2004903
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 2.00 30.0
Co+2 + 5NH4+ = Co(NH3)5+2 + 5H+
log_k -40.47
delta_h 0 kJ
-gamma 0 0
Id: 2004904
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 2.00 30.0
Co+3 + 6NH4+ + H2O = Co(NH3)6OH+2 + 7H+
log_k -43.7148
delta_h 0 kJ
-gamma 0 0
Id: 2014901
log K source: NIST2.1.1
Delta H source: MTQ3.11
#T and ionic strength:
Co+3 + 5NH4+ + Cl- = Co(NH3)5Cl+2 + 5H+
log_k -17.9584
delta_h 113.38 kJ
-gamma 0 0
Id: 2014902
log K source: NIST2.1.1
Delta H source: NIST2.1.1
#T and ionic strength:
Co+3 + 6NH4+ + Cl- = Co(NH3)6Cl+2 + 6H+
log_k -33.9179
delta_h 104.34 kJ
-gamma 0 0
Id: 2014903
log K source: NIST2.1.1
Delta H source: NIST2.1.1
#T and ionic strength:
Co+3 + 6NH4+ + Br- = Co(NH3)6Br+2 + 6H+
log_k -33.8884
delta_h 110.57 kJ
-gamma 0 0
Id: 2014904
log K source: NIST2.1.1
Delta H source: NIST2.1.1
#T and ionic strength:
Co+3 + 6NH4+ + I- = Co(NH3)6I+2 + 6H+

log_k -33.4808
delta_h 115.44 kJ
-gamma 0 0
Id: 2014905
log K source: NIST2.1.1
Delta H source: NIST2.1.1
#T and ionic strength:
Co+3 + 6NH4+ + SO4-2 = Co(NH3)6SO4+ + 6H+
log_k -28.9926
delta_h 124.5 kJ
-gamma 0 0
Id: 2014906
log K source: NIST2.1.1
Delta H source: NIST2.1.1
#T and ionic strength:
Cr(OH)2+ + 6NH4+ = Cr(NH3)6+3 + 2H2O + 4H+
log_k -32.8952
delta_h 0 kJ
-gamma 0 0
Id: 2114900
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 4.50 25.0
Cr(OH)2+ + 5NH4+ = Cr(NH3)5OH+2 + 4H+ + H2O
log_k -30.2759
delta_h 0 kJ
-gamma 0 0
Id: 2114901
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Cr(OH)2+ + 6NH4+ + Cl- = Cr(NH3)6Cl+2 + 2H2O + 4H+
log_k -31.7932
delta_h 0 kJ
-gamma 0 0
Id: 2114904
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Cr(OH)2+ + 6NH4+ + Br- = Cr(NH3)6Br+2 + 4H+ + 2H2O
log_k -31.887
delta_h 0 kJ
-gamma 0 0
Id: 2114905
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Cr(OH)2+ + 6NH4+ + I- = Cr(NH3)6I+2 + 4H+ + 2H2O
log_k -32.008
delta_h 0 kJ
-gamma 0 0
Id: 2114906
log K source: MTQ3.11
Delta H source: MTQ3.11

#T and ionic strength:
#Cr(OH)2+ + 4NH4+ = cis+ + 4H+
log_k -29.8574
delta_h 0 kJ
-gamma 0 0
Id: 4902113
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
#Cr(OH)2+ + 4NH4+ = trans+ + 4H+
log_k -30.5537
delta_h 0 kJ
-gamma 0 0
Id: 4902114
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Ca+2 + NH4+ = CaNH3+2 + H+
log_k -9.144
delta_h 0 kJ
-gamma 0 0
Id: 1504901
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.50 25.0
Ca+2 + 2NH4+ = Ca(NH3)2+2 + 2H+
log_k -18.788
delta_h 0 kJ
-gamma 0 0
Id: 1504902
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.50 25.0
Sr+2 + NH4+ = SrNH3+2 + H+
log_k -9.344
delta_h 0 kJ
-gamma 0 0
Id: 8004901
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.50 25.0
Ba+2 + NH4+ = BaNH3+2 + H+
log_k -9.444
delta_h 0 kJ
-gamma 0 0
Id: 1004901
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.50 25.0
Tl+ + NO2- = TlNO2
log_k 0.83
delta_h 0 kJ
-gamma 0 0
Id: 8704910

log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Ag+ + NO2- = AgNO2
log_k 2.32
delta_h -29 kJ
-gamma 0 0
Id: 204911
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ag+ + 2NO2- = Ag(NO2)2-
log_k 2.51
delta_h -46 kJ
-gamma 0 0
Id: 204910
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Cu+2 + NO2- = CuNO2+
log_k 2.02
delta_h 0 kJ
-gamma 0 0
Id: 2314911
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Cu+2 + 2NO2- = Cu(NO2)2
log_k 3.03
delta_h 0 kJ
-gamma 0 0
Id: 2314912
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Co+2 + NO2- = CoNO2+
log_k 0.848
delta_h 0 kJ
-gamma 0 0
Id: 2004911
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Sn(OH)2 + 2H+ + NO3- = SnNO3+ + 2H2O
log_k 7.942
delta_h 0 kJ
-gamma 0 0
Id: 7904921
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Pb+2 + NO3- = PbNO3+
log_k 1.17
delta_h 2 kJ

-gamma 0 0
Id: 6004920
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Pb+2 + 2NO3- = Pb(NO3)2
log_k 1.4
delta_h -6.6 kJ
-gamma 0 0
Id: 6004921
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Tl+ + NO3- = TlNO3
log_k 0.33
delta_h -2 kJ
-gamma 0 0
Id: 8704920
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Tl(OH)3 + NO3- + 3H+ = TlNO3+2 + 3H2O
log_k 7.0073
delta_h 0 kJ
-gamma 0 0
Id: 8714920
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Cd+2 + NO3- = CdNO3+
log_k 0.5
delta_h -21 kJ
-gamma 0 0
Id: 1604920
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Cd+2 + 2NO3- = Cd(NO3)2
log_k 0.2
delta_h 0 kJ
-gamma 0 0
Id: 1604921
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Hg(OH)2 + 2H+ + NO3- = HgNO3+ + 2H2O
log_k 5.7613
delta_h 0 kJ
-gamma 0 0
Id: 3614920
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 3.00 25.0
Hg(OH)2 + 2H+ + 2NO3- = Hg(NO3)2 + 2H2O

log_k 5.38
delta_h 0 kJ
-gamma 0 0
Id: 3614921
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 3.00 25.0
Cu+2 + NO3- = CuNO3+
log_k 0.5
delta_h -4.1 kJ
-gamma 0 0
Id: 2314921
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Cu+2 + 2NO3- = Cu(NO3)2
log_k -0.4
delta_h 0 kJ
-gamma 0 0
Id: 2314922
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Zn+2 + NO3- = ZnNO3+
log_k 0.4
delta_h -4.6 kJ
-gamma 0 0
Id: 9504921
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Zn+2 + 2NO3- = Zn(NO3)2
log_k -0.3
delta_h 0 kJ
-gamma 0 0
Id: 9504922
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Ag+ + NO3- = AgNO3
log_k -0.1
delta_h 22.6 kJ
-gamma 0 0
Id: 204920
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Ni+2 + NO3- = NiNO3+
log_k 0.4
delta_h 0 kJ
-gamma 0 0
Id: 5404921
log K source: NIST46.4
Delta H source: MTQ3.11

#T and ionic strength: 0.00 25.0
Co+2 + NO3- = CoNO3+
log_k 0.2
delta_h 0 kJ
-gamma 0 0
Id: 2004921
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Co+2 + 2NO3- = Co(NO3)2
log_k 0.5085
delta_h 0 kJ
-gamma 0 0
Id: 2004922
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.50 25.0
Fe+3 + NO3- = FeNO3+2
log_k 1
delta_h -37 kJ
-gamma 0 0
Id: 2814921
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Mn+2 + NO3- = MnNO3+
log_k 0.2
delta_h 0 kJ
-gamma 0 0
Id: 4704921
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Mn+2 + 2NO3- = Mn(NO3)2
log_k 0.6
delta_h -1.6569 kJ
-gamma 0 0
Id: 4704920
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Cr(OH)2+ + NO3- + 2H+ = CrNO3+2 + 2H2O
log_k 8.2094
delta_h -65.4378 kJ
-gamma 0 0
Id: 2114920
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
UO2+2 + NO3- = UO2NO3+
log_k 0.3
delta_h -12 kJ
-gamma 0 0
Id: 8934921

log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
VO2+ + NO3- = VO2NO3
log_k -0.296
delta_h 0 kJ
-gamma 0 0
Id: 9034920
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 1.00 20.0
Ca+2 + NO3- = CaNO3+
log_k 0.5
delta_h -5.4 kJ
-gamma 0 0
Id: 1504921
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Sr+2 + NO3- = SrNO3+
log_k 0.6
delta_h -10 kJ
-gamma 0 0
Id: 8004921
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ba+2 + NO3- = BaNO3+
log_k 0.7
delta_h -13 kJ
-gamma 0 0
Id: 1004921
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
H+ + Cyanide- = HCyanide
log_k 9.21
delta_h -43.63 kJ
-gamma 0 0
Id: 3301431
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Cd+2 + Cyanide- = CdCyanide+
log_k 6.01
delta_h -30 kJ
-gamma 0 0
Id: 1601431
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Cd+2 + 2Cyanide- = Cd(Cyanide)2
log_k 11.12
delta_h -54.3 kJ

-gamma 0 0
Id: 1601432
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Cd+2 + 3Cyanide- = Cd(Cyanide)3-
log_k 15.65
delta_h -90.3 kJ
-gamma 0 0
Id: 1601433
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Cd+2 + 4Cyanide- = Cd(Cyanide)4-2
log_k 17.92
delta_h -112 kJ
-gamma 0 0
Id: 1601434
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Hg(OH)2 + 2H+ + Cyanide- = HgCyanide+ + 2H2O
log_k 23.194
delta_h -136.72 kJ
-gamma 0 0
Id: 3611431
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Hg(OH)2 + 2H+ + 2Cyanide- = Hg(Cyanide)2 + 2H2O
log_k 38.944
delta_h 154.28 kJ
-gamma 0 0
Id: 3611432
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Hg(OH)2 + 2H+ + 3Cyanide- = Hg(Cyanide)3- + 2H2O
log_k 42.504
delta_h -262.72 kJ
-gamma 0 0
Id: 3611433
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Hg(OH)2 + 2H+ + 4Cyanide- = Hg(Cyanide)4-2 + 2H2O
log_k 45.164
delta_h -288.72 kJ
-gamma 0 0
Id: 3611434
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Cu+ + 2Cyanide- = Cu(Cyanide)2-

log_k 21.9145
delta_h -121 kJ
-gamma 0 0
Id: 2301432
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
Cu+ + 3Cyanide- = Cu(Cyanide)3-2
log_k 27.2145
delta_h -167.4 kJ
-gamma 0 0
Id: 2301433
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Cu+ + 4Cyanide- = Cu(Cyanide)4-3
log_k 28.7145
delta_h -214.2 kJ
-gamma 0 0
Id: 2301431
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ag+ + 2Cyanide- = Ag(Cyanide)2-
log_k 20.48
delta_h -137 kJ
-gamma 0 0
Id: 201432
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ag+ + 3Cyanide- = Ag(Cyanide)3-2
log_k 21.7
delta_h -140 kJ
-gamma 0 0
Id: 201433
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ag+ + H2O + Cyanide- = Ag(Cyanide)OH- + H+
log_k -0.777
delta_h 0 kJ
-gamma 0 0
Id: 201431
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Ni+2 + 4Cyanide- = Ni(Cyanide)4-2
log_k 30.2
delta_h -180 kJ
-gamma 0 0
Id: 5401431
log K source: NIST46.4
Delta H source: NIST46.4

#T and ionic strength: 0.00 25.0
Ni+2 + 4Cyanide- + H+ = NiH(Cyanide)4-
log_k 36.0289
delta_h 0 kJ
-gamma 0 0
Id: 5401432
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.10 25.0
Ni+2 + 4Cyanide- + 2H+ = NiH2Cyanide4
log_k 40.7434
delta_h 0 kJ
-gamma 0 0
Id: 5401433
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.10 25.0
Ni+2 + 4Cyanide- + 3H+ = NiH3(Cyanide)4+
log_k 43.3434
delta_h 0 kJ
-gamma 0 0
Id: 5401434
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.10 25.0
Co+2 + 3Cyanide- = Co(Cyanide)3-
log_k 14.312
delta_h 0 kJ
-gamma 0 0
Id: 2001431
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 1.00 25.0
Co+2 + 5Cyanide- = Co(Cyanide)5-3
log_k 23
delta_h -257 kJ
-gamma 0 0
Id: 2001432
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 1.00 25.0
Fe+2 + 6Cyanide- = Fe(Cyanide)6-4
log_k 35.4
delta_h -358 kJ
-gamma 0 0
Id: 2801431
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
H+ + Fe+2 + 6Cyanide- = HFe(Cyanide)6-3
log_k 39.71
delta_h -356 kJ
-gamma 0 0
Id: 2801432

log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
2H+ + Fe+2 + 6Cyanide- = H2Fe(Cyanide)6-2
log_k 42.11
delta_h -352 kJ
-gamma 0 0
Id: 2801433
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Fe+3 + 6Cyanide- = Fe(Cyanide)6-3
log_k 43.6
delta_h -293 kJ
-gamma 0 0
Id: 2811431
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
2Fe+3 + 6Cyanide- = Fe2(Cyanide)6
log_k 47.6355
delta_h -218 kJ
-gamma 0 0
Id: 2811432
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.50 25.0
Sn(OH)2 + Fe+3 + 6Cyanide- + 2H+ = SnFe(Cyanide)6- + 2H2O
log_k 53.54
delta_h 0 kJ
-gamma 0 0
Id: 7901431
log K source: Ba1987
Delta H source:
#T and ionic strength: 0.00 25.0
NH4+ + Fe+2 + 6Cyanide- = NH4Fe(Cyanide)6-3
log_k 37.7
delta_h -354 kJ
-gamma 0 0
Id: 4901431
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Tl+ + Fe+2 + 6Cyanide- = TlFe(Cyanide)6-3
log_k 38.4
delta_h -365.5 kJ
-gamma 0 0
Id: 8701432
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Mg+2 + Fe+3 + 6Cyanide- = MgFe(Cyanide)6-
log_k 46.39
delta_h -290 kJ

-gamma 0 0
Id: 4601431
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Mg+2 + Fe+2 + 6Cyanide- = MgFe(Cyanide)6-2
log_k 39.21
delta_h -346 kJ
-gamma 0 0
Id: 4601432
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ca+2 + Fe+3 + 6Cyanide- = CaFe(Cyanide)6-
log_k 46.43
delta_h -291 kJ
-gamma 0 0
Id: 1501431
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ca+2 + Fe+2 + 6Cyanide- = CaFe(Cyanide)6-2
log_k 39.1
delta_h -347 kJ
-gamma 0 0
Id: 1501432
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
2Ca+2 + Fe+2 + 6Cyanide- = Ca2Fe(Cyanide)6
log_k 40.6
delta_h -350.201 kJ
-gamma 0 0
Id: 1501433
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Sr+2 + Fe+3 + 6Cyanide- = SrFe(Cyanide)6-
log_k 46.45
delta_h -292 kJ
-gamma 0 0
Id: 8001431
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Sr+2 + Fe+2 + 6Cyanide- = SrFe(Cyanide)6-2
log_k 39.1
delta_h -350 kJ
-gamma 0 0
Id: 8001432
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ba+2 + Fe+2 + 6Cyanide- = BaFe(Cyanide)6-2

log_k 39.19
delta_h -342 kJ
-gamma 0 0
Id: 1001430
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ba+2 + Fe+3 + 6Cyanide- = BaFe(Cyanide)6-
log_k 46.48
delta_h -292 kJ
-gamma 0 0
Id: 1001431
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Na+ + Fe+2 + 6Cyanide- = NaFe(Cyanide)6-3
log_k 37.6
delta_h -354 kJ
-gamma 0 0
Id: 5001431
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
K+ + Fe+2 + 6Cyanide- = KFe(Cyanide)6-3
log_k 37.75
delta_h -353.9 kJ
-gamma 0 0
Id: 4101433
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
K+ + Fe+3 + 6Cyanide- = KFe(Cyanide)6-2
log_k 45.04
delta_h -291 kJ
-gamma 0 0
Id: 4101430
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
H+ + PO4-3 = HPO4-2
log_k 12.375
delta_h -15 kJ
-gamma 5 0
Id: 3305800
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
2H+ + PO4-3 = H2PO4-
log_k 19.573
delta_h -18 kJ
-gamma 5.4 0
Id: 3305801
log K source: NIST46.3
Delta H source: NIST46.3

#T and ionic strength: 0.00 25.0
3H+ + PO4-3 = H3PO4
log_k 21.721
delta_h -10.1 kJ
-gamma 0 0
Id: 3305802
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Co+2 + H+ + PO4-3 = CoHPO4
log_k 15.4128
delta_h 0 kJ
-gamma 0 0
Id: 2005800
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.10 25.0
Fe+2 + 2H+ + PO4-3 = FeH2PO4+
log_k 22.273
delta_h 0 kJ
-gamma 5.4 0
Id: 2805800
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Fe+2 + H+ + PO4-3 = FeHPO4
log_k 15.975
delta_h 0 kJ
-gamma 0 0
Id: 2805801
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Fe+3 + 2H+ + PO4-3 = FeH2PO4+2
log_k 23.8515
delta_h 0 kJ
-gamma 5.4 0
Id: 2815801
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.50 25.0
Fe+3 + H+ + PO4-3 = FeHPO4+
log_k 22.292
delta_h -30.5432 kJ
-gamma 5.4 0
Id: 2815800
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.50 25.0
Cr(OH)2+ + 4H+ + PO4-3 = CrH2PO4+2 + 2H2O
log_k 31.9068
delta_h 0 kJ
-gamma 0 0
Id: 2115800

log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
U+4 + PO4-3 + H+ = UHPO4+2
log_k 24.443
delta_h 31.38 kJ
-gamma 0 0
Id: 8915800
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
U+4 + 2PO4-3 + 2H+ = U(HPO4)2
log_k 46.833
delta_h 7.1128 kJ
-gamma 0 0
Id: 8915801
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
U+4 + 3PO4-3 + 3H+ = U(HPO4)3-2
log_k 67.564
delta_h -32.6352 kJ
-gamma 0 0
Id: 8915802
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
U+4 + 4PO4-3 + 4H+ = U(HPO4)4-4
log_k 88.483
delta_h -110.876 kJ
-gamma 0 0
Id: 8915803
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
UO2+2 + H+ + PO4-3 = UO2HPO4
log_k 19.655
delta_h -8.7864 kJ
-gamma 0 0
Id: 8935800
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
UO2+2 + 2PO4-3 + 2H+ = UO2(HPO4)2-2
log_k 42.988
delta_h -47.6934 kJ
-gamma 0 0
Id: 8935801
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
UO2+2 + 2H+ + PO4-3 = UO2H2PO4+
log_k 22.833
delta_h -15.4808 kJ

-gamma 0 0
Id: 8935802
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
UO2+2 + 2PO4-3 + 4H+ = UO2(H2PO4)2
log_k 44.7
delta_h -69.036 kJ
-gamma 0 0
Id: 8935803
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
UO2+2 + 3PO4-3 + 6H+ = UO2(H2PO4)3-
log_k 66.245
delta_h -119.662 kJ
-gamma 0 0
Id: 8935804
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
UO2+2 + PO4-3 = UO2PO4-
log_k 13.25
delta_h 0 kJ
-gamma 0 0
Id: 8935805
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Mg+2 + PO4-3 = MgPO4-
log_k 4.654
delta_h 12.9704 kJ
-gamma 5.4 0
Id: 4605800
log K source: SCD3.02 (1993 GMa)
Delta H source: MTQ3.11
#T and ionic strength: 0.20 25.0
Mg+2 + 2H+ + PO4-3 = MgH2PO4+
log_k 21.2561
delta_h -4.6861 kJ
-gamma 5.4 0
Id: 4605801
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 37.0
Mg+2 + H+ + PO4-3 = MgHPO4
log_k 15.175
delta_h -3 kJ
-gamma 0 0
Id: 4605802
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Ca+2 + H+ + PO4-3 = CaHPO4

log_k 15.035
delta_h -3 kJ
-gamma 0 0
Id: 1505800
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Ca+2 + PO4-3 = CaPO4-
log_k 6.46
delta_h 12.9704 kJ
-gamma 5.4 0
Id: 1505801
log K source: SCD3.02 (1993 GMa)
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Ca+2 + 2H+ + PO4-3 = CaH2PO4+
log_k 20.923
delta_h -6 kJ
-gamma 5.4 0
Id: 1505802
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Sr+2 + H+ + PO4-3 = SrHPO4
log_k 14.8728
delta_h 0 kJ
-gamma 0 0
Id: 8005800
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.10 25.0
Sr+2 + 2H+ + PO4-3 = SrH2PO4+
log_k 20.4019
delta_h 0 kJ
-gamma 0 0
Id: 8005801
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.10 20.0
Na+ + H+ + PO4-3 = NaHPO4-
log_k 13.445
delta_h 0 kJ
-gamma 5.4 0
Id: 5005800
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
K+ + H+ + PO4-3 = KHPO4-
log_k 13.255
delta_h 0 kJ
-gamma 5.4 0
Id: 4105800
log K source: NIST46.3
Delta H source: MTQ3.11

#T and ionic strength: 0.00 25.0
H3AsO3 = AsO3-3 + 3H+
log_k -34.744
delta_h 84.726 kJ
-gamma 0 0
Id: 3300602
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
H3AsO3 = HAsO3-2 + 2H+
log_k -21.33
delta_h 59.4086 kJ
-gamma 0 0
Id: 3300601
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
H3AsO3 = H2AsO3- + H+
log_k -9.29
delta_h 27.41 kJ
-gamma 0 0
Id: 3300600
log K source: NIST46.4
Delta H source: NIST2.1.1
#T and ionic strength: 0.00 25.0
H3AsO3 + H+ = H4AsO3+
log_k -0.305
delta_h 0 kJ
-gamma 0 0
Id: 3300603
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
H3AsO4 = AsO4-3 + 3H+
log_k -20.7
delta_h 12.9 kJ
-gamma 0 0
Id: 3300613
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
H3AsO4 = HAsO4-2 + 2H+
log_k -9.2
delta_h -4.1 kJ
-gamma 0 0
Id: 3300612
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
H3AsO4 = H2AsO4- + H+
log_k -2.24
delta_h -7.1 kJ
-gamma 0 0
Id: 3300611

log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Sb(OH)3 + H2O = Sb(OH)4- + H+
log_k -12.0429
delta_h 69.8519 kJ
-gamma 0 0
Id: 7400020
log K source: PNL89
Delta H source: PNL89
#T and ionic strength:
Sb(OH)3 + H+ = Sb(OH)2+ + H2O
log_k 1.3853
delta_h 0 kJ
-gamma 0 0
Id: 7403302
log K source: PNL89
Delta H source: PNL89
#T and ionic strength:
Sb(OH)3 = HSbO2 + H2O
log_k -0.0105
delta_h -0.13 kJ
-gamma 0 0
Id: 7400021
log K source: NIST2.1.1
Delta H source: NIST2.1.1
#T and ionic strength:
Sb(OH)3 = SbO2- + H2O + H+
log_k -11.8011
delta_h 70.1866 kJ
-gamma 0 0
Id: 7403301
log K source: PNL89
Delta H source: PNL89
#T and ionic strength:
Sb(OH)3 + H+ = SbO+ + 2H2O
log_k 0.9228
delta_h 8.2425 kJ
-gamma 0 0
Id: 7403300
log K source: PNL89
Delta H source: PNL89
#T and ionic strength:
Sb(OH)6- = SbO3- + 3H2O
log_k 2.9319
delta_h 0 kJ
-gamma 0 0
Id: 7410021
log K source: PNL89
Delta H source: PNL89
#T and ionic strength:
Sb(OH)6- + 2H+ = SbO2+ + 4H2O
log_k 2.3895
delta_h 0 kJ

-gamma 0 0
Id: 7413300
log K source: PNL89
Delta H source: PNL89
#T and ionic strength:
H+ + CO3-2 = HCO3-
log_k 10.329
delta_h -14.6 kJ
-gamma 5.4 0
Id: 3301400
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
2H+ + CO3-2 = H2CO3
log_k 16.681
delta_h -23.76 kJ
-gamma 0 0
Id: 3301401
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Pb+2 + 2CO3-2 = Pb(CO3)2-2
log_k 9.938
delta_h 0 kJ
-gamma 0 0
Id: 6001400
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.50 25.0
Pb+2 + CO3-2 = PbCO3
log_k 6.478
delta_h 0 kJ
-gamma 0 0
Id: 6001401
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.50 25.0
Pb+2 + CO3-2 + H+ = PbHCO3+
log_k 13.2
delta_h 0 kJ
-gamma 0 0
Id: 6001402
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
Zn+2 + CO3-2 = ZnCO3
log_k 4.76
delta_h 0 kJ
-gamma 0 0
Id: 9501401
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Zn+2 + H+ + CO3-2 = ZnHCO3+

log_k 11.829
delta_h 0 kJ
-gamma 0 0
Id: 9501400
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Hg(OH)2 + 2H+ + CO3-2 = HgCO3 + 2H2O
log_k 18.272
delta_h 0 kJ
-gamma 0 0
Id: 3611401
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.50 25.0
Hg(OH)2 + 2H+ + 2CO3-2 = Hg(CO3)2-2 + 2H2O
log_k 21.772
delta_h 0 kJ
-gamma 0 0
Id: 3611402
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.50 25.0
Hg(OH)2 + 3H+ + CO3-2 = HgHCO3+ + 2H2O
log_k 22.542
delta_h 0 kJ
-gamma 0 0
Id: 3611403
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.50 25.0
Cd+2 + CO3-2 = CdCO3
log_k 4.3578
delta_h 0 kJ
-gamma 0 0
Id: 1601401
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.10 25.0
Cd+2 + H+ + CO3-2 = CdHCO3+
log_k 10.6863
delta_h 0 kJ
-gamma 0 0
Id: 1601400
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 3.00 25.0
Cd+2 + 2CO3-2 = Cd(CO3)2-2
log_k 7.2278
delta_h 0 kJ
-gamma 0 0
Id: 1601403
log K source: NIST46.4
Delta H source: MTQ3.11

#T and ionic strength: 0.10 20.0
Cu+2 + CO3-2 = CuCO3
log_k 6.77
delta_h 0 kJ
-gamma 0 0
Id: 2311400
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Cu+2 + H+ + CO3-2 = CuHCO3+
log_k 12.129
delta_h 0 kJ
-gamma 0 0
Id: 2311402
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Cu+2 + 2CO3-2 = Cu(CO3)2-2
log_k 10.2
delta_h 0 kJ
-gamma 0 0
Id: 2311401
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Ni+2 + CO3-2 = NiCO3
log_k 4.5718
delta_h 0 kJ
-gamma 0 0
Id: 5401401
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.70 25.0
Ni+2 + H+ + CO3-2 = NiHCO3+
log_k 12.4199
delta_h 0 kJ
-gamma 0 0
Id: 5401400
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.70 25.0
Co+2 + CO3-2 = CoCO3
log_k 4.228
delta_h 0 kJ
-gamma 0 0
Id: 2001400
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.50 25.0
Co+2 + H+ + CO3-2 = CoHCO3+
log_k 12.2199
delta_h 0 kJ
-gamma 0 0
Id: 2001401

log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.70 25.0
Fe+2 + H+ + CO3-2 = FeHCO3+
log_k 11.429
delta_h 0 kJ
-gamma 6 0
Id: 2801400
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Mn+2 + H+ + CO3-2 = MnHCO3+
log_k 11.629
delta_h -10.6 kJ
-gamma 5 0
Id: 4701400
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
UO2+2 + CO3-2 = UO2CO3
log_k 9.6
delta_h 4 kJ
-gamma 0 0
Id: 8931400
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
UO2+2 + 2CO3-2 = UO2(CO3)2-2
log_k 16.9
delta_h 16 kJ
-gamma 0 0
Id: 8931401
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
UO2+2 + 3CO3-2 = UO2(CO3)3-4
log_k 21.6
delta_h -40 kJ
-gamma 0 0
Id: 8931402
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Be+2 + CO3-2 = BeCO3
log_k 6.2546
delta_h 0 kJ
-gamma 0 0
Id: 1101401
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 3.00 25.0
Mg+2 + CO3-2 = MgCO3
log_k 2.92
delta_h 12 kJ

-gamma 0 0
Id: 4601400
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Mg+2 + H+ + CO3-2 = MgHCO3+
log_k 11.339
delta_h -10.6 kJ
-gamma 4 0
Id: 4601401
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Ca+2 + H+ + CO3-2 = CaHCO3+
log_k 11.599
delta_h 5.4 kJ
-gamma 6 0
Id: 1501400
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
CO3-2 + Ca+2 = CaCO3
log_k 3.2
delta_h 16 kJ
-gamma 0 0
Id: 1501401
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
Sr+2 + CO3-2 = SrCO3
log_k 2.81
delta_h 20 kJ
-gamma 0 0
Id: 8001401
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Sr+2 + H+ + CO3-2 = SrHCO3+
log_k 11.539
delta_h 10.4 kJ
-gamma 6 0
Id: 8001400
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ba+2 + CO3-2 = BaCO3
log_k 2.71
delta_h 16 kJ
-gamma 0 0
Id: 1001401
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ba+2 + H+ + CO3-2 = BaHCO3+

log_k 11.309
delta_h 10.4 kJ
-gamma 6 0
Id: 1001400
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Na+ + CO3-2 = NaCO3-
log_k 1.27
delta_h -20.35 kJ
-gamma 5.4 0
Id: 5001400
log K source: NIST46.3
Delta H source: NIST2.1.1
#T and ionic strength: 0.00 25.0
Na+ + H+ + CO3-2 = NaHCO3
log_k 10.079
delta_h -28.3301 kJ
-gamma 0 0
Id: 5001401
log K source: NIST46.3
Delta H source: NIST2.1.1
#T and ionic strength: 0.00 25.0
H4SiO4 = H2SiO4-2 + 2H+
log_k -23.04
delta_h 61 kJ
-gamma 5.4 0
Id: 3307701
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
H4SiO4 = H3SiO4- + H+
log_k -9.84
delta_h 20 kJ
-gamma 4 0
Id: 3307700
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
UO2+2 + H4SiO4 = UO2H3SiO4+ + H+
log_k -1.9111
delta_h 0 kJ
-gamma 0 0
Id: 8937700
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.10 25.0
H3BO3 = H2BO3- + H+
log_k -9.236
delta_h 13 kJ
-gamma 2.5 0
Id: 3300900
log K source: NIST46.4
Delta H source: NIST46.4

#T and ionic strength: 0.00 25.0
2H3BO3 = H5(BO3)2- + H+
log_k -9.306
delta_h 8.4 kJ
-gamma 2.5 0
Id: 3300901
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
3H3BO3 = H8(BO3)3- + H+
log_k -7.306
delta_h 29.4 kJ
-gamma 2.5 0
Id: 3300902
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ag+ + H3BO3 = AgH2BO3 + H+
log_k -8.036
delta_h 0 kJ
-gamma 2.5 0
Id: 200901
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Mg+2 + H3BO3 = MgH2BO3+ + H+
log_k -7.696
delta_h 13 kJ
-gamma 2.5 0
Id: 4600901
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ca+2 + H3BO3 = CaH2BO3+ + H+
log_k -7.476
delta_h 17 kJ
-gamma 2.5 0
Id: 1500901
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Sr+2 + H3BO3 = SrH2BO3+ + H+
log_k -7.686
delta_h 17 kJ
-gamma 2.5 0
Id: 8000901
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ba+2 + H3BO3 = BaH2BO3+ + H+
log_k -7.746
delta_h 17 kJ
-gamma 2.5 0
Id: 1000901

log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Na+ + H3BO3 = NaH2BO3 + H+
log_k -9.036
delta_h 0 kJ
-gamma 2.5 0
Id: 5000901
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
CrO4-2 + H+ = HCrO4-
log_k 6.51
delta_h 2 kJ
-gamma 0 0
Id: 2123300
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
CrO4-2 + 2H+ = H2CrO4
log_k 6.4188
delta_h 39 kJ
-gamma 0 0
Id: 2123301
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 20.0
2CrO4-2 + 2H+ = Cr2O7-2 + H2O
log_k 14.56
delta_h -15 kJ
-gamma 0 0
Id: 2123302
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
CrO4-2 + Cl- + 2H+ = CrO3Cl- + H2O
log_k 7.3086
delta_h 0 kJ
-gamma 0 0
Id: 2121800
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
CrO4-2 + SO4-2 + 2H+ = CrO3SO4-2 + H2O
log_k 8.9937
delta_h 0 kJ
-gamma 0 0
Id: 2127320
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
CrO4-2 + 4H+ + PO4-3 = CrO3H2PO4- + H2O
log_k 29.3634
delta_h 0 kJ

-gamma 0 0
Id: 2125800
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
CrO4-2 + 3H+ + PO4-3 = CrO3HPO4-2 + H2O
log_k 26.6806
delta_h 0 kJ
-gamma 0 0
Id: 2125801
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
CrO4-2 + Na+ = NaCrO4-
log_k 0.6963
delta_h 0 kJ
-gamma 0 0
Id: 5002120
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
K+ + CrO4-2 = KCrO4-
log_k 0.57
delta_h 0 kJ
-gamma 0 0
Id: 4102120
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.00 18.0
MoO4-2 + H+ = HMoO4-
log_k 4.2988
delta_h 20 kJ
-gamma 0 0
Id: 3304801
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 20.0
MoO4-2 + 2H+ = H2MoO4
log_k 8.1636
delta_h -26 kJ
-gamma 0 0
Id: 3304802
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 20.0
7MoO4-2 + 8H+ = Mo7O24-6 + 4H2O
log_k 52.99
delta_h -228 kJ
-gamma 0 0
Id: 3304803
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
7MoO4-2 + 9H+ = HMo7O24-5 + 4H2O

log_k 59.3768
delta_h -218 kJ
-gamma 0 0
Id: 3304804
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
7MoO4-2 + 10H+ = H2Mo7O24-4 + 4H2O
log_k 64.159
delta_h -215 kJ
-gamma 0 0
Id: 3304805
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
7MoO4-2 + 11H+ = H3Mo7O24-3 + 4H2O
log_k 67.405
delta_h -217 kJ
-gamma 0 0
Id: 3304806
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 1.00 25.0
6MoO4-2 + Al+3 + 6H+ = AlMo6O21-3 + 3H2O
log_k 54.9925
delta_h 0 kJ
-gamma 0 0
Id: 304801
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.50 25.0
MoO4-2 + 2Ag+ = Ag2MoO4
log_k -0.4219
delta_h -1.18 kJ
-gamma 0 0
Id: 204801
log K source: Bard85
Delta H source: Bard85
#T and ionic strength:
VO2+ + 2H2O = VO4-3 + 4H+
log_k -30.2
delta_h -25 kJ
-gamma 0 0
Id: 9033303
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
VO2+ + 2H2O = HVO4-2 + 3H+
log_k -15.9
delta_h 0 kJ
-gamma 0 0
Id: 9033302
log K source: NIST46.3
Delta H source: NIST46.3

#T and ionic strength: 0.00 25.0
VO2+ + 2H2O = H2VO4- + 2H+
log_k -7.3
delta_h 0 kJ
-gamma 0 0
Id: 9033301
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
VO2+ + 2H2O = H3VO4 + H+
log_k -3.3
delta_h 44.4759 kJ
-gamma 0 0
Id: 9033300
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
2VO2+ + 3H2O = V2O7-4 + 6H+
log_k -31.24
delta_h -28 kJ
-gamma 0 0
Id: 9030020
log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
2VO2+ + 3H2O = HV2O7-3 + 5H+
log_k -20.67
delta_h 0 kJ
-gamma 0 0
Id: 9030021
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
2VO2+ + 3H2O = H3V2O7- + 3H+
log_k -3.79
delta_h 0 kJ
-gamma 0 0
Id: 9030022
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
3VO2+ + 3H2O = V3O9-3 + 6H+
log_k -15.88
delta_h 0 kJ
-gamma 0 0
Id: 9030023
log K source: MTQ3.11
Delta H source: MTQ3.11
#T and ionic strength:
4VO2+ + 4H2O = V4O12-4 + 8H+
log_k -20.56
delta_h -87 kJ
-gamma 0 0
Id: 9030024

log K source: NIST46.3
Delta H source: NIST46.3
#T and ionic strength: 0.00 25.0
10VO2+ + 8H2O = V10O28-6 + 16H+
log_k -24.0943
delta_h 0 kJ
-gamma 0 0
Id: 9030025
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.10 20.0
10VO2+ + 8H2O = HV10O28-5 + 15H+
log_k -15.9076
delta_h 90.0397 kJ
-gamma 0 0
Id: 9030026
log K source: NIST46.4
Delta H source: MTQ3.11
#T and ionic strength: 0.10 20.0
10VO2+ + 8H2O = H2V10O28-4 + 14H+
log_k -10.7
delta_h 0 kJ
-gamma 0 0
Id: 9030027
log K source: NIST46.3
Delta H source: MTQ3.11
#T and ionic strength: 0.00 25.0
Benzoate- + H+ = H(Benzoate)
log_k 4.202
delta_h -0.4602 kJ
-gamma 0 0
Id: 3309171
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Benzoate- + Pb+2 = Pb(Benzoate)+
log_k 2.4
delta_h 0 kJ
-gamma 0 0
Id: 6009171
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Benzoate- + Al+3 = Al(Benzoate)+2
log_k 2.05
delta_h 0 kJ
-gamma 0 0
Id: 309171
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Benzoate- + Al+3 + H2O = AlOH(Benzoate)+ + H+
log_k -0.56
delta_h 0 kJ

-gamma 0 0
Id: 309172
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Benzoate- + Zn+2 = Zn(Benzoate)+
log_k 1.7
delta_h 0 kJ
-gamma 0 0
Id: 9509171
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Benzoate- + Cd+2 = Cd(Benzoate)+
log_k 1.8
delta_h 0 kJ
-gamma 0 0
Id: 1609171
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
2Benzoate- + Cd+2 = Cd(Benzoate)2
log_k 1.82
delta_h 0 kJ
-gamma 0 0
Id: 1609172
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Benzoate- + Cu+2 = Cu(Benzoate)+
log_k 2.19
delta_h 0 kJ
-gamma 0 0
Id: 2319171
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Benzoate- + Ag+ = Ag(Benzoate)
log_k 0.91
delta_h 0 kJ
-gamma 0 0
Id: 209171
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Benzoate- + Ni+2 = Ni(Benzoate)+
log_k 1.86
delta_h 0 kJ
-gamma 0 0
Id: 5409171
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Co+2 + Benzoate- = Co(Benzoate)+

log_k 1.0537
delta_h 12 kJ
-gamma 0 0
Id: 2009171
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.50 30.0
Benzoate- + Mn+2 = Mn(Benzoate)+
log_k 2.06
delta_h 0 kJ
-gamma 0 0
Id: 4709171
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Benzoate- + Mg+2 = Mg(Benzoate)+
log_k 1.26
delta_h 0 kJ
-gamma 0 0
Id: 4609171
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Benzoate- + Ca+2 = Ca(Benzoate)+
log_k 1.55
delta_h 0 kJ
-gamma 0 0
Id: 1509171
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Phenylacetate- + H+ = H(Phenylacetate)
log_k 4.31
delta_h 2.1757 kJ
-gamma 0 0
Id: 3309181
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Phenylacetate- + Zn+2 = Zn(Phenylacetate)+
log_k 1.57
delta_h 0 kJ
-gamma 0 0
Id: 9509181
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Phenylacetate- + Cu+2 = Cu(Phenylacetate)+
log_k 1.97
delta_h 0 kJ
-gamma 0 0
Id: 2319181
log K source: NIST46.2
Delta H source: NIST46.2

#T and ionic strength:
Co+2 + Phenylacetate- = Co(Phenylacetate)+
log_k 0.591
delta_h 0 kJ
-gamma 0 0
Id: 2009181
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 2.00 25.0
Co+2 + 2Phenylacetate- = Co(Phenylacetate)2
log_k 0.4765
delta_h 0 kJ
-gamma 0 0
Id: 2009182
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 2.00 25.0
Isophthalate-2 + H+ = H(Isophthalate)-
log_k 4.5
delta_h 1.6736 kJ
-gamma 0 0
Id: 3309201
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Isophthalate-2 + 2H+ = H2(Isophthalate)
log_k 8
delta_h 1.6736 kJ
-gamma 0 0
Id: 3309202
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Isophthalate-2 + Pb+2 = Pb(Isophthalate)
log_k 2.99
delta_h 0 kJ
-gamma 0 0
Id: 6009201
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
2Isophthalate-2 + Pb+2 = Pb(Isophthalate)2-2
log_k 4.18
delta_h 0 kJ
-gamma 0 0
Id: 6009202
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Isophthalate-2 + Pb+2 + H+ = PbH(Isophthalate)+
log_k 6.69
delta_h 0 kJ
-gamma 0 0
Id: 6009203

log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Isophthalate-2 + Cd+2 = Cd(Isophthalate)
log_k 2.15
delta_h 0 kJ
-gamma 0 0
Id: 1609201
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
2Isophthalate-2 + Cd+2 = Cd(Isophthalate)2-2
log_k 2.99
delta_h 0 kJ
-gamma 0 0
Id: 1609202
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Isophthalate-2 + Cd+2 + H+ = CdH(Isophthalate)+
log_k 5.73
delta_h 0 kJ
-gamma 0 0
Id: 1609203
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Isophthalate-2 + Ca+2 = Ca(Isophthalate)
log_k 2
delta_h 0 kJ
-gamma 0 0
Id: 1509200
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Isophthalate-2 + Ba+2 = Ba(Isophthalate)
log_k 1.55
delta_h 0 kJ
-gamma 0 0
Id: 1009201
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
H+ + Diethylamine = H(Diethylamine)+
log_k 10.933
delta_h -53.1368 kJ
-gamma 0 0
Id: 3309551
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Diethylamine = Zn(Diethylamine)+2
log_k 2.74
delta_h 0 kJ

-gamma 0 0
Id: 9509551
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Zn+2 + 2Diethylamine = Zn(Diethylamine)2+2
log_k 5.27
delta_h 0 kJ
-gamma 0 0
Id: 9509552
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Zn+2 + 3Diethylamine = Zn(Diethylamine)3+2
log_k 7.71
delta_h 0 kJ
-gamma 0 0
Id: 9509553
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Zn+2 + 4Diethylamine = Zn(Diethylamine)4+2
log_k 9.84
delta_h 0 kJ
-gamma 0 0
Id: 9509554
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cd+2 + Diethylamine = Cd(Diethylamine)+2
log_k 2.73
delta_h 0 kJ
-gamma 0 0
Id: 1609551
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cd+2 + 2Diethylamine = Cd(Diethylamine)2+2
log_k 4.86
delta_h 0 kJ
-gamma 0 0
Id: 1609552
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cd+2 + 3Diethylamine = Cd(Diethylamine)3+2
log_k 6.37
delta_h 0 kJ
-gamma 0 0
Id: 1609553
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cd+2 + 4Diethylamine = Cd(Diethylamine)4+2

log_k 7.32
delta_h 0 kJ
-gamma 0 0
Id: 1609554
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Ag+ + Diethylamine = Ag(Diethylamine)+
log_k 2.98
delta_h 0 kJ
-gamma 0 0
Id: 209551
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + 2Diethylamine = Ag(Diethylamine)2+
log_k 6.38
delta_h -44.7688 kJ
-gamma 0 0
Id: 209552
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Diethylamine = Ni(Diethylamine)+2
log_k 2.78
delta_h 0 kJ
-gamma 0 0
Id: 5409551
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Ni+2 + 2Diethylamine = Ni(Diethylamine)2+2
log_k 4.97
delta_h 0 kJ
-gamma 0 0
Id: 5409552
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Ni+2 + 3Diethylamine = Ni(Diethylamine)3+2
log_k 6.72
delta_h 0 kJ
-gamma 0 0
Id: 5409553
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Ni+2 + 4Diethylamine = Ni(Diethylamine)4+2
log_k 7.93
delta_h 0 kJ
-gamma 0 0
Id: 5409554
log K source: SCD2.62
Delta H source: SCD2.62

#T and ionic strength:
Ni+2 + 5Diethylamine = Ni(Diethylamine)5+2
log_k 8.87
delta_h 0 kJ
-gamma 0 0
Id: 5409555
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
H+ + Butylamine = H(Butylamine)+
log_k 10.64
delta_h -58.2831 kJ
-gamma 0 0
Id: 3309561
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Hg(OH)2 + Butylamine + 2H+ = Hg(Butylamine)+2 + 2H2O
log_k 14.84
delta_h 0 kJ
-gamma 0 0
Id: 3619561
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Hg(OH)2 + 2Butylamine + 2H+ = Hg(Butylamine)2+2 + 2H2O
log_k 24.24
delta_h 0 kJ
-gamma 0 0
Id: 3619562
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Hg(OH)2 + 3Butylamine + 2H+ = Hg(Butylamine)3+2 + 2H2O
log_k 25.1
delta_h 0 kJ
-gamma 0 0
Id: 3619563
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Hg(OH)2 + 4Butylamine + 2H+ = Hg(Butylamine)4+2 + 2H2O
log_k 26.1
delta_h 0 kJ
-gamma 0 0
Id: 3619564
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + Butylamine = Ag(Butylamine)+
log_k 3.42
delta_h -16.736 kJ
-gamma 0 0
Id: 209561

log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + 2Butylamine = Ag(Butylamine)2+
log_k 7.47
delta_h -52.7184 kJ
-gamma 0 0
Id: 209562
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
H+ + Methylamine = H(Methylamine)+
log_k 10.64
delta_h -55.2288 kJ
-gamma 0 0
Id: 3309581
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + Methylamine = Cd(Methylamine)+2
log_k 2.75
delta_h 0 kJ
-gamma 0 0
Id: 1609581
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + 2Methylamine = Cd(Methylamine)2+2
log_k 4.81
delta_h -29.288 kJ
-gamma 0 0
Id: 1609582
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + 3Methylamine = Cd(Methylamine)3+2
log_k 5.94
delta_h 0 kJ
-gamma 0 0
Id: 1609583
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + 4Methylamine = Cd(Methylamine)4+2
log_k 6.55
delta_h -58.576 kJ
-gamma 0 0
Id: 1609584
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Hg(OH)2 + Methylamine + 2H+ = Hg(Methylamine)+2 + 2H2O
log_k 14.76
delta_h 0 kJ

-gamma 0 0
Id: 3619581
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Hg(OH)2 + 2Methylamine + 2H+ = Hg(Methylamine)2+2 + 2H2O
log_k 23.96
delta_h 0 kJ
-gamma 0 0
Id: 3619582
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Hg(OH)2 + 3Methylamine + 2H+ = Hg(Methylamine)3+2 + 2H2O
log_k 24.3
delta_h 0 kJ
-gamma 0 0
Id: 3619583
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Hg(OH)2 + 4Methylamine + 2H+ = Hg(Methylamine)4+2 + 2H2O
log_k 24.6
delta_h 0 kJ
-gamma 0 0
Id: 3619584
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Methylamine = Cu(Methylamine)+2
log_k 4.11
delta_h 0 kJ
-gamma 0 0
Id: 2319581
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + 2Methylamine = Cu(Methylamine)2+2
log_k 7.51
delta_h 0 kJ
-gamma 0 0
Id: 2319582
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + 3Methylamine = Cu(Methylamine)3+2
log_k 10.21
delta_h 0 kJ
-gamma 0 0
Id: 2319583
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + 4Methylamine = Cu(Methylamine)4+2

log_k 12.08
delta_h 0 kJ
-gamma 0 0
Id: 2319584
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + Methylamine = Ag(Methylamine)+
log_k 3.07
delta_h -12.552 kJ
-gamma 0 0
Id: 209581
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + 2Methylamine = Ag(Methylamine)2+
log_k 6.89
delta_h -48.9528 kJ
-gamma 0 0
Id: 209582
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Methylamine = Ni(Methylamine)+2
log_k 2.23
delta_h 0 kJ
-gamma 0 0
Id: 5409581
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
H+ + Dimethylamine = H(Dimethylamine)+
log_k 10.774
delta_h -50.208 kJ
-gamma 0 0
Id: 3309591
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + 2Dimethylamine = Ag(Dimethylamine)2+
log_k 5.37
delta_h -40.5848 kJ
-gamma 0 0
Id: 209591
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Dimethylamine = Ni(Dimethylamine)+2
log_k 1.47
delta_h 0 kJ
-gamma 0 0
Id: 5409591
log K source: NIST46.2
Delta H source: NIST46.2

#T and ionic strength:
H+ + Hexylamine = H(Hexylamine)+
log_k 10.63
delta_h -58.576 kJ
-gamma 0 0
Id: 3309611
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + Hexylamine = Ag(Hexylamine)+
log_k 3.54
delta_h -25.104 kJ
-gamma 0 0
Id: 209611
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + 2Hexylamine = Ag(Hexylamine)2+
log_k 7.55
delta_h -53.1368 kJ
-gamma 0 0
Id: 209612
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
H+ + Ethylenediamine = H(Ethylenediamine)+
log_k 9.928
delta_h -49.7896 kJ
-gamma 0 0
Id: 3309631
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
2H+ + Ethylenediamine = H2(Ethylenediamine)+2
log_k 16.776
delta_h -95.3952 kJ
-gamma 0 0
Id: 3309632
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Pb+2 + Ethylenediamine = Pb(Ethylenediamine)+2
log_k 5.04
delta_h 0 kJ
-gamma 0 0
Id: 6009631
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Pb+2 + 2Ethylenediamine = Pb(Ethylenediamine)2+2
log_k 8.5
delta_h 0 kJ
-gamma 0 0
Id: 6009632

log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Ethylenediamine = Zn(Ethylenediamine)+2
log_k 5.66
delta_h -29.288 kJ
-gamma 0 0
Id: 9509631
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + 2Ethylenediamine = Zn(Ethylenediamine)2+2
log_k 10.6
delta_h -48.116 kJ
-gamma 0 0
Id: 9509632
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + 3Ethylenediamine = Zn(Ethylenediamine)3+2
log_k 13.9
delta_h -71.5464 kJ
-gamma 0 0
Id: 9509633
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + Ethylenediamine = Cd(Ethylenediamine)+2
log_k 5.41
delta_h -28.4512 kJ
-gamma 0 0
Id: 1609631
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + 2Ethylenediamine = Cd(Ethylenediamine)2+2
log_k 9.9
delta_h -55.6472 kJ
-gamma 0 0
Id: 1609632
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + 3Ethylenediamine = Cd(Ethylenediamine)3+2
log_k 11.6
delta_h -82.4248 kJ
-gamma 0 0
Id: 1609633
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Hg(OH)2 + Ethylenediamine + 2H+ = Hg(Ethylenediamine)+2 + 2H2O
log_k 20.4
delta_h 0 kJ

-gamma 0 0
Id: 3619631
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Hg(OH)2 + 2Ethylenediamine + 2H+ = Hg(Ethylenediamine)2+2 + 2H2O
log_k 29.3
delta_h -173.218 kJ
-gamma 0 0
Id: 3619632
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Hg(OH)2 + 2Ethylenediamine + 3H+ = HgH(Ethylenediamine)2+3 + 2H2O
log_k 34.7
delta_h 0 kJ
-gamma 0 0
Id: 3619633
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+ + 2Ethylenediamine = Cu(Ethylenediamine)2+
log_k 11.2
delta_h 0 kJ
-gamma 0 0
Id: 2309631
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Ethylenediamine = Cu(Ethylenediamine)+2
log_k 10.5
delta_h -52.7184 kJ
-gamma 0 0
Id: 2319631
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + 2Ethylenediamine = Cu(Ethylenediamine)2+2
log_k 19.6
delta_h -105.437 kJ
-gamma 0 0
Id: 2319632
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + Ethylenediamine = Ag(Ethylenediamine)+
log_k 4.6
delta_h -48.9528 kJ
-gamma 0 0
Id: 209631
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + 2Ethylenediamine = Ag(Ethylenediamine)2+

log_k 7.5
delta_h -52.3 kJ
-gamma 0 0
Id: 209632
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + Ethylenediamine + H+ = AgH(Ethylenediamine)+2
log_k 11.99
delta_h -75.312 kJ
-gamma 0 0
Id: 209633
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
2Ag+ + Ethylenediamine = Ag2(Ethylenediamine)+2
log_k 6.5
delta_h 0 kJ
-gamma 0 0
Id: 209634
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
2Ag+ + 2Ethylenediamine = Ag2(Ethylenediamine)2+2
log_k 12.7
delta_h -97.0688 kJ
-gamma 0 0
Id: 209635
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + 2Ethylenediamine + 2H+ = Ag(HEthylenediamine)2+3
log_k 24
delta_h -150.206 kJ
-gamma 0 0
Id: 209636
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + 2Ethylenediamine + H+ = AgH(Ethylenediamine)2+2
log_k 8.4
delta_h -47.6976 kJ
-gamma 0 0
Id: 209637
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Ethylenediamine = Ni(Ethylenediamine)+2
log_k 7.32
delta_h -37.656 kJ
-gamma 0 0
Id: 5409631
log K source: NIST46.2
Delta H source: NIST46.2

#T and ionic strength:
Ni+2 + 2Ethylenediamine = Ni(Ethylenediamine)2+2
log_k 13.5
delta_h -76.5672 kJ
-gamma 0 0
Id: 5409632
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + 3Ethylenediamine = Ni(Ethylenediamine)3+2
log_k 17.6
delta_h -117.152 kJ
-gamma 0 0
Id: 5409633
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Co+2 + Ethylenediamine = Co(Ethylenediamine)+2
log_k 5.5
delta_h -28 kJ
-gamma 0 0
Id: 2009631
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
Co+2 + 2Ethylenediamine = Co(Ethylenediamine)2+2
log_k 10.1
delta_h -58.5 kJ
-gamma 0 0
Id: 2009632
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
Co+2 + 3Ethylenediamine = Co(Ethylenediamine)3+2
log_k 13.2
delta_h -92.8 kJ
-gamma 0 0
Id: 2009633
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
Co+3 + 2Ethylenediamine = Co(Ethylenediamine)2+3
log_k 34.7
delta_h 0 kJ
-gamma 0 0
Id: 2019631
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 1.00 25.0
Co+3 + 3Ethylenediamine = Co(Ethylenediamine)3+3
log_k 48.69
delta_h 0 kJ
-gamma 0 0
Id: 2019632

log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 1.50 30.0
Fe+2 + Ethylenediamine = Fe(Ethylenediamine)+2
log_k 4.26
delta_h 0 kJ
-gamma 0 0
Id: 2809631
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+2 + 2Ethylenediamine = Fe(Ethylenediamine)2+2
log_k 7.73
delta_h 0 kJ
-gamma 0 0
Id: 2809632
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+2 + 3Ethylenediamine = Fe(Ethylenediamine)3+2
log_k 10.17
delta_h 0 kJ
-gamma 0 0
Id: 2809633
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Mn+2 + Ethylenediamine = Mn(Ethylenediamine)+2
log_k 2.74
delta_h -11.7152 kJ
-gamma 0 0
Id: 4709631
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Mn+2 + 2Ethylenediamine = Mn(Ethylenediamine)2+2
log_k 4.8
delta_h -25.104 kJ
-gamma 0 0
Id: 4709632
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cr(OH)2+ + 2Ethylenediamine + 2H+ = Cr(Ethylenediamine)2+3 + 2H2O
log_k 22.57
delta_h 0 kJ
-gamma 0 0
Id: 2119631
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cr(OH)2+ + 3Ethylenediamine + 2H+ = Cr(Ethylenediamine)3+3 + 2H2O
log_k 29
delta_h 0 kJ

-gamma 0 0
Id: 2119632
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Mg+2 + Ethylenediamine = Mg(Ethylenediamine)+2
log_k 0.37
delta_h 0 kJ
-gamma 0 0
Id: 4609631
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ca+2 + Ethylenediamine = Ca(Ethylenediamine)+2
log_k 0.11
delta_h 0 kJ
-gamma 0 0
Id: 1509631
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
H+ + Propylamine = H(Propylamine)+
log_k 10.566
delta_h -57.53 kJ
-gamma 0 0
Id: 3309641
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Propylamine = Zn(Propylamine)+2
log_k 2.42
delta_h 0 kJ
-gamma 0 0
Id: 9509641
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Zn+2 + 2Propylamine = Zn(Propylamine)2+2
log_k 4.85
delta_h 0 kJ
-gamma 0 0
Id: 9509642
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Zn+2 + 3Propylamine = Zn(Propylamine)3+2
log_k 7.38
delta_h 0 kJ
-gamma 0 0
Id: 9509643
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Zn+2 + 4Propylamine = Zn(Propylamine)4+2

log_k 9.49
delta_h 0 kJ
-gamma 0 0
Id: 9509644
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cd+2 + Propylamine = Cd(Propylamine)+2
log_k 2.62
delta_h 0 kJ
-gamma 0 0
Id: 1609641
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cd+2 + 2Propylamine = Cd(Propylamine)2+2
log_k 4.64
delta_h 0 kJ
-gamma 0 0
Id: 1609642
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cd+2 + 3Propylamine = Cd(Propylamine)3+2
log_k 6.03
delta_h 0 kJ
-gamma 0 0
Id: 1609643
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Ag+ + Propylamine = Ag(Propylamine)+
log_k 3.45
delta_h -12.552 kJ
-gamma 0 0
Id: 209641
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + 2Propylamine = Ag(Propylamine)2+
log_k 7.44
delta_h -53.1368 kJ
-gamma 0 0
Id: 209642
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Propylamine = Ni(Propylamine)+2
log_k 2.81
delta_h 0 kJ
-gamma 0 0
Id: 5409641
log K source: SCD2.62
Delta H source: SCD2.62

#T and ionic strength:
Ni+2 + 2Propylamine = Ni(Propylamine)2+2
log_k 5.02
delta_h 0 kJ
-gamma 0 0
Id: 5409642
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Ni+2 + 3Propylamine = Ni(Propylamine)3+2
log_k 6.79
delta_h 0 kJ
-gamma 0 0
Id: 5409643
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Ni+2 + 4Propylamine = Ni(Propylamine)4+2
log_k 8.31
delta_h 0 kJ
-gamma 0 0
Id: 5409644
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
H+ + Isopropylamine = H(Isopropylamine)+
log_k 10.67
delta_h -58.3668 kJ
-gamma 0 0
Id: 3309651
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Isopropylamine = Zn(Isopropylamine)+2
log_k 2.37
delta_h 0 kJ
-gamma 0 0
Id: 9509651
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Zn+2 + 2Isopropylamine = Zn(Isopropylamine)2+2
log_k 4.67
delta_h 0 kJ
-gamma 0 0
Id: 9509652
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Zn+2 + 3Isopropylamine = Zn(Isopropylamine)3+2
log_k 7.14
delta_h 0 kJ
-gamma 0 0
Id: 9509653

log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Zn+2 + 4Isopropylamine = Zn(Isopropylamine)4+2
log_k 9.44
delta_h 0 kJ
-gamma 0 0
Id: 9509654
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cd+2 + Isopropylamine = Cd(Isopropylamine)+2
log_k 2.55
delta_h 0 kJ
-gamma 0 0
Id: 1609651
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cd+2 + 2Isopropylamine = Cd(Isopropylamine)2+2
log_k 4.57
delta_h 0 kJ
-gamma 0 0
Id: 1609652
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cd+2 + 3Isopropylamine = Cd(Isopropylamine)3+2
log_k 6.07
delta_h 0 kJ
-gamma 0 0
Id: 1609653
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cd+2 + 4Isopropylamine = Cd(Isopropylamine)4+2
log_k 6.9
delta_h 0 kJ
-gamma 0 0
Id: 1609654
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Hg(OH)2 + Isopropylamine + 2H+ = Hg(Isopropylamine)+2 + 2H2O
log_k 14.85
delta_h 0 kJ
-gamma 0 0
Id: 3619651
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Hg(OH)2 + 2Isopropylamine + 2H+ = Hg(Isopropylamine)2+2 + 2H2O
log_k 24.37
delta_h 0 kJ

-gamma 0 0
Id: 3619652
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + Isopropylamine = Ag(Isopropylamine)+
log_k 3.67
delta_h -23.8488 kJ
-gamma 0 0
Id: 209651
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + 2Isopropylamine = Ag(Isopropylamine)2+
log_k 7.77
delta_h -59.8312 kJ
-gamma 0 0
Id: 209652
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Isopropylamine = Ni(Isopropylamine)+2
log_k 2.71
delta_h 0 kJ
-gamma 0 0
Id: 5409651
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Ni+2 + 2Isopropylamine = Ni(Isopropylamine)2+2
log_k 4.86
delta_h 0 kJ
-gamma 0 0
Id: 5409652
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Ni+2 + 3Isopropylamine = Ni(Isopropylamine)3+2
log_k 6.57
delta_h 0 kJ
-gamma 0 0
Id: 5409653
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Ni+2 + 4Isopropylamine = Ni(Isopropylamine)4+2
log_k 7.83
delta_h 0 kJ
-gamma 0 0
Id: 5409654
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Ni+2 + 5Isopropylamine = Ni(Isopropylamine)5+2

log_k 8.43
delta_h 0 kJ
-gamma 0 0
Id: 5409655
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
H+ + Trimethylamine = H(Trimethylamine)+
log_k 9.8
delta_h -36.8192 kJ
-gamma 0 0
Id: 3309661
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + Trimethylamine = Ag(Trimethylamine)+
log_k 1.701
delta_h 0 kJ
-gamma 0 0
Id: 209661
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
H+ + Citrate-3 = H(Citrate)-2
log_k 6.396
delta_h 3.3472 kJ
-gamma 0 0
Id: 3309671
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
2H+ + Citrate-3 = H2(Citrate)-
log_k 11.157
delta_h 1.297 kJ
-gamma 0 0
Id: 3309672
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
3H+ + Citrate-3 = H3(Citrate)
log_k 14.285
delta_h -2.7614 kJ
-gamma 0 0
Id: 3309673
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Pb+2 + Citrate-3 = Pb(Citrate)-
log_k 7.27
delta_h 0 kJ
-gamma 0 0
Id: 6009671
log K source: SCD2.62
Delta H source: SCD2.62

#T and ionic strength:
Pb+2 + 2Citrate-3 = Pb(Citrate)2-4
log_k 6.53
delta_h 0 kJ
-gamma 0 0
Id: 6009672
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Al+3 + Citrate-3 = Al(Citrate)
log_k 9.97
delta_h 0 kJ
-gamma 0 0
Id: 309671
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Al+3 + 2Citrate-3 = Al(Citrate)2-3
log_k 14.8
delta_h 0 kJ
-gamma 0 0
Id: 309672
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Al+3 + Citrate-3 + H+ = AlH(Citrate)+
log_k 12.85
delta_h 0 kJ
-gamma 0 0
Id: 309673
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Tl+ + Citrate-3 = Tl(Citrate)-2
log_k 1.48
delta_h 0 kJ
-gamma 0 0
Id: 8709671
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Citrate-3 = Zn(Citrate)-
log_k 6.21
delta_h 8.368 kJ
-gamma 0 0
Id: 9509671
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + 2Citrate-3 = Zn(Citrate)2-4
log_k 7.4
delta_h 25.104 kJ
-gamma 0 0
Id: 9509672

log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Citrate-3 + H+ = ZnH(Citrate)
log_k 10.2
delta_h 3.3472 kJ
-gamma 0 0
Id: 9509673
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Citrate-3 + 2H+ = ZnH2(Citrate)+
log_k 12.84
delta_h 0 kJ
-gamma 0 0
Id: 9509674
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cd+2 + Citrate-3 = Cd(Citrate)-
log_k 4.98
delta_h 8.368 kJ
-gamma 0 0
Id: 1609671
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + Citrate-3 + H+ = CdH(Citrate)
log_k 9.44
delta_h 3.3472 kJ
-gamma 0 0
Id: 1609672
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + Citrate-3 + 2H+ = CdH2(Citrate)+
log_k 12.9
delta_h 0 kJ
-gamma 0 0
Id: 1609673
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + 2Citrate-3 = Cd(Citrate)2-4
log_k 5.9
delta_h 20.92 kJ
-gamma 0 0
Id: 1609674
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Hg(OH)2 + Citrate-3 + 2H+ = Hg(Citrate)- + 2H2O
log_k 18.3
delta_h 0 kJ

-gamma 0 0
Id: 3619671
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Citrate-3 = Cu(Citrate)-
log_k 7.57
delta_h 0 kJ
-gamma 0 0
Id: 2319671
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cu+2 + 2Citrate-3 = Cu(Citrate)2-4
log_k 8.9
delta_h 0 kJ
-gamma 0 0
Id: 2319672
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cu+2 + Citrate-3 + H+ = CuH(Citrate)
log_k 10.87
delta_h 11.7152 kJ
-gamma 0 0
Id: 2319673
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Citrate-3 + 2H+ = CuH2(Citrate)+
log_k 13.23
delta_h 0 kJ
-gamma 0 0
Id: 2319674
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
2Cu+2 + 2Citrate-3 = Cu2(Citrate)2-2
log_k 16.9
delta_h 41.84 kJ
-gamma 0 0
Id: 2319675
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Citrate-3 = Ni(Citrate)-
log_k 6.59
delta_h 16.736 kJ
-gamma 0 0
Id: 5409671
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Citrate-3 + H+ = NiH(Citrate)

log_k 10.5
delta_h 15.8992 kJ
-gamma 0 0
Id: 5409672
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Citrate-3 + 2H+ = NiH2(Citrate)+
log_k 13.3
delta_h 0 kJ
-gamma 0 0
Id: 5409673
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + 2Citrate-3 = Ni(Citrate)2-4
log_k 8.77
delta_h 12.552 kJ
-gamma 0 0
Id: 5409674
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + 2Citrate-3 + H+ = NiH(Citrate)2-3
log_k 14.9
delta_h 32.6352 kJ
-gamma 0 0
Id: 5409675
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Co+2 + Citrate-3 = Co(Citrate)-
log_k 6.1867
delta_h 0 kJ
-gamma 0 0
Id: 2009671
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
Co+2 + H+ + Citrate-3 = CoHCitrate
log_k 10.4438
delta_h 0 kJ
-gamma 0 0
Id: 2009672
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
Co+2 + 2H+ + Citrate-3 = CoH2Citrate+
log_k 12.7859
delta_h 0 kJ
-gamma 0 0
Id: 2009673
log K source: NIST46.4
Delta H source: NIST46.2

#T and ionic strength: 0.10 20.0
Fe+2 + Citrate-3 = Fe(Citrate)-
log_k 6.1
delta_h 0 kJ
-gamma 0 0
Id: 2809671
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+2 + Citrate-3 + H+ = FeH(Citrate)
log_k 10.2
delta_h 0 kJ
-gamma 0 0
Id: 2809672
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+3 + Citrate-3 = Fe(Citrate)
log_k 13.1
delta_h 0 kJ
-gamma 0 0
Id: 2819671
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+3 + Citrate-3 + H+ = FeH(Citrate)+
log_k 14.4
delta_h 0 kJ
-gamma 0 0
Id: 2819672
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Mn+2 + Citrate-3 = Mn(Citrate)-
log_k 4.28
delta_h 0 kJ
-gamma 0 0
Id: 4709671
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Mn+2 + Citrate-3 + H+ = MnH(Citrate)
log_k 9.6
delta_h 0 kJ
-gamma 0 0
Id: 4709672
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Be+2 + Citrate-3 = Be(Citrate)-
log_k 5.534
delta_h 0 kJ
-gamma 0 0
Id: 1109671

```
# log K source: NIST46.4
# Delta H source: NIST46.2
#T and ionic strength: 1.00 25.0
Be+2 + H+ + Citrate-3 = BeH(Citrate)
log_k 9.442
delta_h 0 kJ
-gamma 0 0
# Id: 1109672
# log K source: NIST46.4
# Delta H source: NIST46.2
#T and ionic strength: 1.00 25.0
Ca+2 + Citrate-3 = Ca(Citrate)-
log_k 4.87
delta_h -8.368 kJ
-gamma 0 0
# Id: 1509671
# log K source: NIST46.2
# Delta H source: NIST46.2
#T and ionic strength:
Ca+2 + Citrate-3 + H+ = CaH(Citrate)
log_k 9.26
delta_h -0.8368 kJ
-gamma 0 0
# Id: 1509672
# log K source: NIST46.2
# Delta H source: NIST46.2
#T and ionic strength:
Ca+2 + Citrate-3 + 2H+ = CaH2(Citrate)+
log_k 12.257
delta_h 0 kJ
-gamma 0 0
# Id: 1509673
# log K source: SCD2.62
# Delta H source: SCD2.62
#T and ionic strength:
Mg+2 + Citrate-3 = Mg(Citrate)-
log_k 4.89
delta_h 8.368 kJ
-gamma 0 0
# Id: 4609671
# log K source: NIST46.2
# Delta H source: NIST46.2
#T and ionic strength:
Mg+2 + Citrate-3 + H+ = MgH(Citrate)
log_k 8.91
delta_h 3.3472 kJ
-gamma 0 0
# Id: 4609672
# log K source: NIST46.2
# Delta H source: NIST46.2
#T and ionic strength:
Mg+2 + Citrate-3 + 2H+ = MgH2(Citrate)+
log_k 12.2
delta_h 0 kJ
```

-gamma 0 0
Id: 4609673
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Sr+2 + Citrate-3 = Sr(Citrate)-
log_k 4.3367
delta_h 0 kJ
-gamma 0 0
Id: 8009671
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
Sr+2 + H+ + Citrate-3 = SrH(Citrate)
log_k 8.9738
delta_h 0 kJ
-gamma 0 0
Id: 8009672
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
Sr+2 + 2H+ + Citrate-3 = SrH2(Citrate)+
log_k 12.4859
delta_h 0 kJ
-gamma 0 0
Id: 8009673
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
Ba+2 + Citrate-3 = Ba(Citrate)-
log_k 4.1
delta_h 0 kJ
-gamma 0 0
Id: 1009671
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ba+2 + Citrate-3 + H+ = BaH(Citrate)
log_k 8.74
delta_h 0 kJ
-gamma 0 0
Id: 1009672
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ba+2 + Citrate-3 + 2H+ = BaH2(Citrate)+
log_k 12.3
delta_h 0 kJ
-gamma 0 0
Id: 1009673
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Na+ + Citrate-3 = Na(Citrate)-2

log_k 1.03
delta_h -2.8033 kJ
-gamma 0 0
Id: 5009671
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
2Na+ + Citrate-3 = Na2(Citrate)-
log_k 1.5
delta_h -5.1045 kJ
-gamma 0 0
Id: 5009672
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Na+ + Citrate-3 + H+ = NaH(Citrate)-
log_k 6.45
delta_h -3.5982 kJ
-gamma 0 0
Id: 5009673
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
K+ + Citrate-3 = K(Citrate)-2
log_k 1.1
delta_h 5.4392 kJ
-gamma 0 0
Id: 4109671
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
H+ + Nta-3 = H(Nta)-2
log_k 10.278
delta_h -18.828 kJ
-gamma 0 0
Id: 3309681
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
2H+ + Nta-3 = H2(Nta)-
log_k 13.22
delta_h -17.9912 kJ
-gamma 0 0
Id: 3309682
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
3H+ + Nta-3 = H3(Nta)
log_k 15.22
delta_h -16.3176 kJ
-gamma 0 0
Id: 3309683
log K source: NIST46.2
Delta H source: NIST46.2

#T and ionic strength:
4H+ + Nta-3 = H4(Nta)+
log_k 16.22
delta_h -16.3176 kJ
-gamma 0 0
Id: 3309684
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Pb+2 + Nta-3 = Pb(Nta)-
log_k 12.7
delta_h -15.8992 kJ
-gamma 0 0
Id: 6009681
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Pb+2 + Nta-3 + H+ = PbH(Nta)
log_k 15.3
delta_h 0 kJ
-gamma 0 0
Id: 6009682
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Al+3 + Nta-3 = Al(Nta)
log_k 13.3
delta_h 0 kJ
-gamma 0 0
Id: 309681
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Al+3 + Nta-3 + H+ = AlH(Nta)+
log_k 15.2
delta_h 0 kJ
-gamma 0 0
Id: 309682
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Al+3 + Nta-3 + H2O = AlOH(Nta)- + H+
log_k 8
delta_h 0 kJ
-gamma 0 0
Id: 309683
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Tl+ + Nta-3 = Tl(Nta)-2
log_k 5.39
delta_h 0 kJ
-gamma 0 0
Id: 8709681

log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Nta-3 = Zn(Nta)-
log_k 11.95
delta_h -3.7656 kJ
-gamma 0 0
Id: 9509681
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + 2Nta-3 = Zn(Nta)2-4
log_k 14.88
delta_h -15.0624 kJ
-gamma 0 0
Id: 9509682
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Nta-3 + H2O = ZnOH(Nta)-2 + H+
log_k 1.46
delta_h 46.4424 kJ
-gamma 0 0
Id: 9509683
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + Nta-3 = Cd(Nta)-
log_k 11.07
delta_h -16.736 kJ
-gamma 0 0
Id: 1609681
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + 2Nta-3 = Cd(Nta)2-4
log_k 15.03
delta_h -38.0744 kJ
-gamma 0 0
Id: 1609682
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + Nta-3 + H2O = CdOH(Nta)-2 + H+
log_k -0.61
delta_h 29.288 kJ
-gamma 0 0
Id: 1609683
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Hg(OH)2 + Nta-3 + 2H+ = Hg(Nta)- + 2H2O
log_k 21.7
delta_h 0 kJ

-gamma 0 0
Id: 3619681
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Nta-3 = Cu(Nta)-
log_k 14.4
delta_h -7.9496 kJ
-gamma 0 0
Id: 2319681
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + 2Nta-3 = Cu(Nta)2-4
log_k 18.1
delta_h -37.2376 kJ
-gamma 0 0
Id: 2319682
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Nta-3 + H+ = CuH(Nta)
log_k 16.2
delta_h 0 kJ
-gamma 0 0
Id: 2319683
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Nta-3 + H2O = CuOH(Nta)-2 + H+
log_k 4.8
delta_h 25.5224 kJ
-gamma 0 0
Id: 2319684
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + Nta-3 = Ag(Nta)-2
log_k 6
delta_h -26.3592 kJ
-gamma 0 0
Id: 209681
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Nta-3 = Ni(Nta)-
log_k 12.79
delta_h -10.0416 kJ
-gamma 0 0
Id: 5409681
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + 2Nta-3 = Ni(Nta)2-4

log_k 16.96
delta_h -32.6352 kJ
-gamma 0 0
Id: 5409682
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Nta-3 + H2O = NiOH(Nta)-2 + H+
log_k 1.5
delta_h 15.0624 kJ
-gamma 0 0
Id: 5409683
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Co+2 + Nta-3 = Co(Nta)-
log_k 11.6667
delta_h -0.4 kJ
-gamma 0 0
Id: 2009681
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
Co+2 + 2Nta-3 = Co(Nta)2-4
log_k 14.9734
delta_h -20 kJ
-gamma 0 0
Id: 2009682
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
Co+2 + Nta-3 + H2O = CoOH(Nta)-2 + H+
log_k 0.4378
delta_h 45.6 kJ
-gamma 0 0
Id: 2009683
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
Fe+2 + Nta-3 = Fe(Nta)-
log_k 10.19
delta_h 0 kJ
-gamma 0 0
Id: 2809681
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+2 + 2Nta-3 = Fe(Nta)2-4
log_k 12.62
delta_h 0 kJ
-gamma 0 0
Id: 2809682
log K source: NIST46.2
Delta H source: NIST46.2

#T and ionic strength:
Fe+2 + Nta-3 + H+ = FeH(Nta)
log_k 12.29
delta_h 0 kJ
-gamma 0 0
Id: 2809683
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+2 + Nta-3 + H2O = FeOH(Nta)-2 + H+
log_k -1.06
delta_h 0 kJ
-gamma 0 0
Id: 2809684
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+3 + Nta-3 = Fe(Nta)
log_k 17.8
delta_h 13.3888 kJ
-gamma 0 0
Id: 2819681
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+3 + 2Nta-3 = Fe(Nta)2-3
log_k 25.9
delta_h 0 kJ
-gamma 0 0
Id: 2819682
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+3 + Nta-3 + H2O = FeOH(Nta)- + H+
log_k 13.23
delta_h 0 kJ
-gamma 0 0
Id: 2819683
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Mn+2 + Nta-3 = Mn(Nta)-
log_k 8.573
delta_h 5.8576 kJ
-gamma 0 0
Id: 4709681
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Mn+2 + 2Nta-3 = Mn(Nta)2-4
log_k 11.58
delta_h -17.1544 kJ
-gamma 0 0
Id: 4709682

log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cr(OH)2+ + Nta-3 + 2H+ = Cr(Nta) + 2H2O
log_k 21.2
delta_h 0 kJ
-gamma 0 0
Id: 2119681
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cr(OH)2+ + 2Nta-3 + 2H+ = Cr(Nta)2-3 + 2H2O
log_k 29.5
delta_h 0 kJ
-gamma 0 0
Id: 2119682
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
MoO4-2 + 2H+ + Nta-3 = MoO3(Nta)-3 + H2O
log_k 19.5434
delta_h -69 kJ
-gamma 0 0
Id: 4809681
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
MoO4-2 + 3H+ + Nta-3 = MoO3H(Nta)-2 + H2O
log_k 23.3954
delta_h -71 kJ
-gamma 0 0
Id: 4809682
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 1.00 25.0
MoO4-2 + 4H+ + Nta-3 = MoO3H2(Nta)- + H2O
log_k 25.3534
delta_h -71 kJ
-gamma 0 0
Id: 4809683
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 1.00 25.0
Be+2 + Nta-3 = Be(Nta)-
log_k 9.0767
delta_h 25 kJ
-gamma 0 0
Id: 1109681
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
Mg+2 + Nta-3 = Mg(Nta)-
log_k 6.5
delta_h 17.9912 kJ

-gamma 0 0
Id: 4609681
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ca+2 + Nta-3 = Ca(Nta)-
log_k 7.608
delta_h -5.6902 kJ
-gamma 0 0
Id: 1509681
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ca+2 + 2Nta-3 = Ca(Nta)2-4
log_k 8.81
delta_h -32.6352 kJ
-gamma 0 0
Id: 1509682
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Sr+2 + Nta-3 = Sr(Nta)-
log_k 6.2767
delta_h -2.2 kJ
-gamma 0 0
Id: 8009681
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
Ba+2 + Nta-3 = Ba(Nta)-
log_k 5.875
delta_h -6.025 kJ
-gamma 0 0
Id: 1009681
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
H+ + Edta-4 = H(Edta)-3
log_k 10.948
delta_h -23.4304 kJ
-gamma 0 0
Id: 3309691
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
2H+ + Edta-4 = H2(Edta)-2
log_k 17.221
delta_h -41.0032 kJ
-gamma 0 0
Id: 3309692
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
3H+ + Edta-4 = H3(Edta)-

log_k 20.34
delta_h -35.564 kJ
-gamma 0 0
Id: 3309693
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
4H+ + Edta-4 = H4(Edta)
log_k 22.5
delta_h -34.3088 kJ
-gamma 0 0
Id: 3309694
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
5H+ + Edta-4 = H5(Edta)+
log_k 24
delta_h -32.2168 kJ
-gamma 0 0
Id: 3309695
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Sn(OH)2 + 2H+ + Edta-4 = Sn(Edta)-2 + 2H2O
log_k 27.026
delta_h 0 kJ
-gamma 0 0
Id: 7909691
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 1.00 20.0
Sn(OH)2 + 3H+ + Edta-4 = SnH(Edta)- + 2H2O
log_k 29.934
delta_h 0 kJ
-gamma 0 0
Id: 7909692
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 1.00 20.0
Sn(OH)2 + 4H+ + Edta-4 = SnH2(Edta) + 2H2O
log_k 31.638
delta_h 0 kJ
-gamma 0 0
Id: 7909693
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 1.00 20.0
Pb+2 + Edta-4 = Pb(Edta)-2
log_k 19.8
delta_h -54.8104 kJ
-gamma 0 0
Id: 6009691
log K source: NIST46.2
Delta H source: NIST46.2

#T and ionic strength:
Pb+2 + Edta-4 + H+ = PbH(Edta)-
log_k 23
delta_h 0 kJ
-gamma 0 0
Id: 6009692
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Pb+2 + Edta-4 + 2H+ = PbH2(Edta)
log_k 24.9
delta_h 0 kJ
-gamma 0 0
Id: 6009693
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Al+3 + Edta-4 = Al(Edta)-
log_k 19.1
delta_h 52.7184 kJ
-gamma 0 0
Id: 309690
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Al+3 + Edta-4 + H+ = AlH(Edta)
log_k 21.8
delta_h 36.4008 kJ
-gamma 0 0
Id: 309691
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Al+3 + Edta-4 + H2O = AlOH(Edta)-2 + H+
log_k 12.8
delta_h 73.6384 kJ
-gamma 0 0
Id: 309692
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Tl+ + Edta-4 = Tl(Edta)-3
log_k 7.27
delta_h -43.5136 kJ
-gamma 0 0
Id: 8709691
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Tl+ + Edta-4 + H+ = TlH(Edta)-2
log_k 13.68
delta_h 0 kJ
-gamma 0 0
Id: 8709692

log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Edta-4 = Zn(Edta)-2
log_k 18
delta_h -19.2464 kJ
-gamma 0 0
Id: 9509691
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Edta-4 + H+ = ZnH(Edta)-
log_k 21.4
delta_h -28.4512 kJ
-gamma 0 0
Id: 9509692
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Edta-4 + H2O = ZnOH(Edta)-3 + H+
log_k 5.8
delta_h 0 kJ
-gamma 0 0
Id: 9509693
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + Edta-4 = Cd(Edta)-2
log_k 18.2
delta_h -38.0744 kJ
-gamma 0 0
Id: 1609691
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + Edta-4 + H+ = CdH(Edta)-
log_k 21.5
delta_h -39.748 kJ
-gamma 0 0
Id: 1609692
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Hg(OH)2 + Edta-4 + 2H+ = Hg(Edta)-2 + 2H2O
log_k 29.3
delta_h -125.102 kJ
-gamma 0 0
Id: 3619691
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Hg(OH)2 + Edta-4 + 3H+ = HgH(Edta)- + 2H2O
log_k 32.9
delta_h -128.449 kJ

-gamma 0 0
Id: 3619692
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Edta-4 = Cu(Edta)-2
log_k 20.5
delta_h -34.7272 kJ
-gamma 0 0
Id: 2319691
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Edta-4 + H+ = CuH(Edta)-
log_k 24
delta_h -43.0952 kJ
-gamma 0 0
Id: 2319692
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Edta-4 + 2H+ = CuH2(Edta)
log_k 26.2
delta_h 0 kJ
-gamma 0 0
Id: 2319693
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Edta-4 + H2O = CuOH(Edta)-3 + H+
log_k 8.5
delta_h 0 kJ
-gamma 0 0
Id: 2319694
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + Edta-4 = Ag(Edta)-3
log_k 8.08
delta_h -31.38 kJ
-gamma 0 0
Id: 209691
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + Edta-4 + H+ = AgH(Edta)-2
log_k 15.21
delta_h 0 kJ
-gamma 0 0
Id: 209693
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Ni+2 + Edta-4 = Ni(Edta)-2

log_k 20.1
delta_h -30.9616 kJ
-gamma 0 0
Id: 5409691
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Edta-4 + H+ = NiH(Edta)-
log_k 23.6
delta_h -38.4928 kJ
-gamma 0 0
Id: 5409692
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Edta-4 + H2O = NiOH(Edta)-3 + H+
log_k 7.6
delta_h 0 kJ
-gamma 0 0
Id: 5409693
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Co+2 + Edta-4 = Co(Edta)-2
log_k 18.1657
delta_h -15 kJ
-gamma 0 0
Id: 2009691
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
Co+2 + Edta-4 + H+ = CoH(Edta)-
log_k 21.5946
delta_h -22.9 kJ
-gamma 0 0
Id: 2009692
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
Co+2 + Edta-4 + 2H+ = CoH2(Edta)
log_k 23.4986
delta_h 0 kJ
-gamma 0 0
Id: 2009693
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 1.00 25.0
Co+3 + Edta-4 = Co(Edta)-
log_k 43.9735
delta_h 0 kJ
-gamma 0 0
Id: 2019691
log K source: NIST46.4
Delta H source: NIST46.2

#T and ionic strength: 0.10 25.0
Co+3 + Edta-4 + H+ = CoH(Edta)
log_k 47.168
delta_h 0 kJ
-gamma 0 0
Id: 2019692
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 20.0
Fe+2 + Edta-4 = Fe(Edta)-2
log_k 16
delta_h -16.736 kJ
-gamma 0 0
Id: 2809690
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+2 + Edta-4 + H+ = FeH(Edta)-
log_k 19.06
delta_h -27.6144 kJ
-gamma 0 0
Id: 2809691
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+2 + Edta-4 + H2O = FeOH(Edta)-3 + H+
log_k 6.5
delta_h 0 kJ
-gamma 0 0
Id: 2809692
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Fe+2 + Edta-4 + 2H2O = Fe(OH)2(Edta)-4 + 2H+
log_k -4
delta_h 0 kJ
-gamma 0 0
Id: 2809693
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Fe+3 + Edta-4 = Fe(Edta)-
log_k 27.7
delta_h -11.2968 kJ
-gamma 0 0
Id: 2819690
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+3 + Edta-4 + H+ = FeH(Edta)
log_k 29.2
delta_h -11.7152 kJ
-gamma 0 0
Id: 2819691

log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+3 + Edta-4 + H2O = FeOH(Edta)-2 + H+
log_k 19.9
delta_h 0 kJ
-gamma 0 0
Id: 2819692
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+3 + Edta-4 + 2H2O = Fe(OH)2(Edta)-3 + 2H+
log_k 9.85
delta_h 0 kJ
-gamma 0 0
Id: 2819693
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Mn+2 + Edta-4 = Mn(Edta)-2
log_k 15.6
delta_h -19.2464 kJ
-gamma 0 0
Id: 4709691
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Mn+2 + Edta-4 + H+ = MnH(Edta)-
log_k 19.1
delta_h -24.2672 kJ
-gamma 0 0
Id: 4709692
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cr+2 + Edta-4 = Cr(Edta)-2
log_k 15.3
delta_h 0 kJ
-gamma 0 0
Id: 2109691
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cr+2 + Edta-4 + H+ = CrH(Edta)-
log_k 19.1
delta_h 0 kJ
-gamma 0 0
Id: 2109692
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cr(OH)2+ + Edta-4 + 2H+ = Cr(Edta)- + 2H2O
log_k 35.5
delta_h 0 kJ

-gamma 0 0
Id: 2119691
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cr(OH)2+ + Edta-4 + 3H+ = CrH(Edta) + 2H2O
log_k 37.4
delta_h 0 kJ
-gamma 0 0
Id: 2119692
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cr(OH)2+ + Edta-4 + H+ = CrOH(Edta)-2 + H2O
log_k 27.7
delta_h 0 kJ
-gamma 0 0
Id: 2119693
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Be+2 + Edta-4 = Be(Edta)-2
log_k 11.4157
delta_h 41 kJ
-gamma 0 0
Id: 1109691
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
Mg+2 + Edta-4 = Mg(Edta)-2
log_k 10.57
delta_h 13.8072 kJ
-gamma 0 0
Id: 4609690
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Mg+2 + Edta-4 + H+ = MgH(Edta)-
log_k 14.97
delta_h 0 kJ
-gamma 0 0
Id: 4609691
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ca+2 + Edta-4 = Ca(Edta)-2
log_k 12.42
delta_h -25.5224 kJ
-gamma 0 0
Id: 1509690
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ca+2 + Edta-4 + H+ = CaH(Edta)-

log_k 15.9
delta_h 0 kJ
-gamma 0 0
Id: 1509691
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Sr+2 + Edta-4 = Sr(Edta)-2
log_k 10.4357
delta_h -17 kJ
-gamma 0 0
Id: 8009691
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
Sr+2 + Edta-4 + H+ = SrH(Edta)-
log_k 14.7946
delta_h 0 kJ
-gamma 0 0
Id: 8009692
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 20.0
Ba+2 + Edta-4 = Ba(Edta)-2
log_k 7.72
delta_h -20.5016 kJ
-gamma 0 0
Id: 1009691
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Na+ + Edta-4 = Na(Edta)-3
log_k 2.7
delta_h -5.8576 kJ
-gamma 0 0
Id: 5009690
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
K+ + Edta-4 = K(Edta)-3
log_k 1.7
delta_h 0 kJ
-gamma 0 0
Id: 4109690
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
H+ + Propionate- = H(Propionate)
log_k 4.874
delta_h 0.66 kJ
-gamma 0 0
Id: 3309711
log K source: NIST46.4
Delta H source: NIST46.4

#T and ionic strength: 0.00 25.0
Pb+2 + Propionate- = Pb(Propionate)+
log_k 2.64
delta_h 0 kJ
-gamma 0 0
Id: 6009711
log K source: NIST46.4
Delta H source: SCD2.62
#T and ionic strength: 0.00 35.0
Pb+2 + 2Propionate- = Pb(Propionate)2
log_k 3.1765
delta_h 0 kJ
-gamma 0 0
Id: 6009712
log K source: NIST46.4
Delta H source: SCD2.62
#T and ionic strength: 2.00 25.0
Zn+2 + Propionate- = Zn(Propionate)+
log_k 1.4389
delta_h 0 kJ
-gamma 0 0
Id: 9509711
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
Zn+2 + 2Propionate- = Zn(Propionate)2
log_k 1.842
delta_h 0 kJ
-gamma 0 0
Id: 9509712
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 1.00 25.0
Cd+2 + Propionate- = Cd(Propionate)+
log_k 1.598
delta_h 0 kJ
-gamma 0 0
Id: 1609711
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 1.00 25.0
Cd+2 + 2Propionate- = Cd(Propionate)2
log_k 2.472
delta_h 0 kJ
-gamma 0 0
Id: 1609712
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 1.00 25.0
Hg(OH)2 + 2H+ + Propionate- = Hg(Propionate)+ + 2H2O
log_k 10.594
delta_h 0 kJ
-gamma 0 0
Id: 3619711

log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.00 25.0
Cu+2 + Propionate- = Cu(Propionate)+
log_k 2.22
delta_h 4.1 kJ
-gamma 0 0
Id: 2319711
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Cu+2 + 2Propionate- = Cu(Propionate)2
log_k 3.5
delta_h 0 kJ
-gamma 0 0
Id: 2319712
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.00 25.0
Ni+2 + Propionate- = Ni(Propionate)+
log_k 0.908
delta_h 0 kJ
-gamma 0 0
Id: 5409711
log K source: NIST46.4
Delta H source: SCD2.62
#T and ionic strength: 1.00 25.0
Co+2 + Propionate- = Co(Propionate)+
log_k 0.671
delta_h 4.6 kJ
-gamma 0 0
Id: 2009711
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 2.00 25.0
Co+2 + 2Propionate- = Co(Propionate)2
log_k 0.5565
delta_h 16 kJ
-gamma 0 0
Id: 2009712
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 2.00 25.0
Fe+3 + Propionate- = Fe(Propionate)+2
log_k 4.012
delta_h 0 kJ
-gamma 0 0
Id: 2819711
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 1.00 20.0
Cr(OH)2+ + 2H+ + Propionate- = Cr(Propionate)+2 + 2H2O
log_k 15.0773
delta_h 0 kJ

-gamma 0 0
Id: 2119711
log K source: NIST46.4
Delta H source: SCD2.62
#T and ionic strength: 0.50 25.0
Cr(OH)2+ + 2H+ + 2Propionate- = Cr(Propionate)2+ + 2H2O
log_k 17.9563
delta_h 0 kJ
-gamma 0 0
Id: 2119712
log K source: NIST46.4
Delta H source: SCD2.62
#T and ionic strength: 0.50 25.0
Cr(OH)2+ + 2H+ + 3Propionate- = Cr(Propionate)3 + 2H2O
log_k 20.8858
delta_h 0 kJ
-gamma 0 0
Id: 2119713
log K source: NIST46.4
Delta H source: SCD2.62
#T and ionic strength: 0.50 25.0
Mg+2 + Propionate- = Mg(Propionate)+
log_k 0.9689
delta_h 4.2677 kJ
-gamma 0 0
Id: 4609710
log K source: NIST46.4
Delta H source: SCD2.62
#T and ionic strength: 0.10 25.0
Ca+2 + Propionate- = Ca(Propionate)+
log_k 0.9289
delta_h 3.3472 kJ
-gamma 0 0
Id: 1509710
log K source: NIST46.4
Delta H source: SCD2.62
#T and ionic strength: 0.10 25.0
Sr+2 + Propionate- = Sr(Propionate)+
log_k 0.8589
delta_h 0 kJ
-gamma 0 0
Id: 8009711
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
Ba+2 + Propionate- = Ba(Propionate)+
log_k 0.7689
delta_h 0 kJ
-gamma 0 0
Id: 1009711
log K source: NIST46.4
Delta H source: SCD2.62
#T and ionic strength: 0.10 25.0
Ba+2 + 2Propionate- = Ba(Propionate)2

log_k 0.9834
delta_h 0 kJ
-gamma 0 0
Id: 1009712
log K source: NIST46.4
Delta H source: SCD2.62
#T and ionic strength: 0.10 25.0
H+ + Butyrate- = H(Butyrate)
log_k 4.819
delta_h 2.8 kJ
-gamma 0 0
Id: 3309721
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Pb+2 + Butyrate- = Pb(Butyrate)+
log_k 2.101
delta_h 0 kJ
-gamma 0 0
Id: 6009721
log K source: NIST46.4
Delta H source: SCD2.62
#T and ionic strength: 2.00 25.0
Zn+2 + Butyrate- = Zn(Butyrate)+
log_k 1.4289
delta_h 0 kJ
-gamma 0 0
Id: 9509721
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
Hg(OH)2 + 2H+ + Butyrate- = Hg(Butyrate)+ + 2H2O
log_k 10.3529
delta_h 0 kJ
-gamma 0 0
Id: 3619721
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
Cu+2 + Butyrate- = Cu(Butyrate)+
log_k 2.14
delta_h 0 kJ
-gamma 0 0
Id: 2319721
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.00 25.0
Ni+2 + Butyrate- = Ni(Butyrate)+
log_k 0.691
delta_h 0 kJ
-gamma 0 0
Id: 5409721
log K source: NIST46.4
Delta H source: SCD2.62

#T and ionic strength: 2.00 25.0
Co+2 + Butyrate- = Co(Butyrate)+
log_k 0.591
delta_h 0 kJ
-gamma 0 0
Id: 2009721
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 2.00 25.0
Co+2 + 2Butyrate- = Co(Butyrate)2
log_k 0.7765
delta_h 0 kJ
-gamma 0 0
Id: 2009722
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 2.00 25.0
Mg+2 + Butyrate- = Mg(Butyrate)+
log_k 0.9589
delta_h 0 kJ
-gamma 0 0
Id: 4609720
log K source: NIST46.4
Delta H source: SCD2.62
#T and ionic strength: 0.10 25.0
Ca+2 + Butyrate- = Ca(Butyrate)+
log_k 0.9389
delta_h 3.3472 kJ
-gamma 0 0
Id: 1509720
log K source: NIST46.4
Delta H source: SCD2.62
#T and ionic strength: 0.10 25.0
Sr+2 + Butyrate- = Sr(Butyrate)+
log_k 0.7889
delta_h 0 kJ
-gamma 0 0
Id: 8009721
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
Ba+2 + Butyrate- = Ba(Butyrate)+
log_k 0.7389
delta_h 0 kJ
-gamma 0 0
Id: 1009721
log K source: NIST46.4
Delta H source: SCD2.62
#T and ionic strength: 0.10 25.0
Ba+2 + 2Butyrate- = Ba(Butyrate)2
log_k 0.88
delta_h 0 kJ
-gamma 0 0
Id: 1009722

log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
H+ + Isobutyrate- = H(Isobutyrate)
log_k 4.849
delta_h 3.2217 kJ
-gamma 0 0
Id: 3309731
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Isobutyrate- = Zn(Isobutyrate)+
log_k 1.44
delta_h 0 kJ
-gamma 0 0
Id: 9509731
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Isobutyrate- = Cu(Isobutyrate)+
log_k 2.17
delta_h 0 kJ
-gamma 0 0
Id: 2319731
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + 2Isobutyrate- = Cu(Isobutyrate)2
log_k 3.3
delta_h 0 kJ
-gamma 0 0
Id: 2319732
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+3 + Isobutyrate- = Fe(Isobutyrate)+2
log_k 4.2
delta_h 0 kJ
-gamma 0 0
Id: 2819731
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ca+2 + Isobutyrate- = Ca(Isobutyrate)+
log_k 0.51
delta_h 0 kJ
-gamma 0 0
Id: 1509731
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
H+ + Two_picoline = H(Two_picoline)+
log_k 5.95
delta_h -25.5224 kJ

-gamma 0 0
Id: 3309801
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Two_picoline = Cu(Two_picoline)+2
log_k 1.3
delta_h 0 kJ
-gamma 0 0
Id: 2319801
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + 2Two_picoline = Cu(Two_picoline)2+2
log_k 2.8
delta_h 0 kJ
-gamma 0 0
Id: 2319802
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+ + Two_picoline = Cu(Two_picoline)+
log_k 5.4
delta_h 0 kJ
-gamma 0 0
Id: 2309801
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+ + 2Two_picoline = Cu(Two_picoline)2+
log_k 7.65
delta_h 0 kJ
-gamma 0 0
Id: 2309802
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+ + 3Two_picoline = Cu(Two_picoline)3+
log_k 8.5
delta_h 0 kJ
-gamma 0 0
Id: 2309803
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + Two_picoline = Ag(Two_picoline)+
log_k 2.32
delta_h -24.2672 kJ
-gamma 0 0
Id: 209801
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + 2Two_picoline = Ag(Two_picoline)2+

log_k 4.68
delta_h -42.6768 kJ
-gamma 0 0
Id: 209802
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Two_picoline = Ni(Two_picoline)+2
log_k 0.4
delta_h 0 kJ
-gamma 0 0
Id: 5409801
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
H+ + Three_picoline = H(Three_picoline)+
log_k 5.7
delta_h -23.8488 kJ
-gamma 0 0
Id: 3309811
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Three_picoline = Zn(Three_picoline)+2
log_k 1
delta_h 0 kJ
-gamma 0 0
Id: 9509811
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + 2Three_picoline = Zn(Three_picoline)2+2
log_k 2.1
delta_h 0 kJ
-gamma 0 0
Id: 9509812
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + 3Three_picoline = Zn(Three_picoline)3+2
log_k 2.6
delta_h 0 kJ
-gamma 0 0
Id: 9509813
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + 4Three_picoline = Zn(Three_picoline)4+2
log_k 3.7
delta_h 0 kJ
-gamma 0 0
Id: 9509814
log K source: NIST46.2
Delta H source: NIST46.2

#T and ionic strength:
Cd+2 + Three_picoline = Cd(Three_picoline)+2
log_k 1.42
delta_h 0 kJ
-gamma 0 0
Id: 1609811
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cd+2 + 2Three_picoline = Cd(Three_picoline)2+2
log_k 2.27
delta_h 0 kJ
-gamma 0 0
Id: 1609812
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cd+2 + 3Three_picoline = Cd(Three_picoline)3+2
log_k 3.6
delta_h 0 kJ
-gamma 0 0
Id: 1609813
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + 4Three_picoline = Cd(Three_picoline)4+2
log_k 4
delta_h 0 kJ
-gamma 0 0
Id: 1609814
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+ + Three_picoline = Cu(Three_picoline)+
log_k 5.6
delta_h 0 kJ
-gamma 0 0
Id: 2309811
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+ + 2Three_picoline = Cu(Three_picoline)2+
log_k 7.78
delta_h 0 kJ
-gamma 0 0
Id: 2309812
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+ + 3Three_picoline = Cu(Three_picoline)3+
log_k 8.6
delta_h 0 kJ
-gamma 0 0
Id: 2309813

log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+ + 4Three_picoline = Cu(Three_picoline)4+
log_k 9
delta_h 0 kJ
-gamma 0 0
Id: 2309814
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Three_picoline = Cu(Three_picoline)+2
log_k 2.77
delta_h 0 kJ
-gamma 0 0
Id: 2319811
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + 2Three_picoline = Cu(Three_picoline)2+2
log_k 4.8
delta_h 0 kJ
-gamma 0 0
Id: 2319812
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + 3Three_picoline = Cu(Three_picoline)3+2
log_k 6.3
delta_h 0 kJ
-gamma 0 0
Id: 2319813
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + 4Three_picoline = Cu(Three_picoline)4+2
log_k 7.2
delta_h 0 kJ
-gamma 0 0
Id: 2319814
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + Three_picoline = Ag(Three_picoline)+
log_k 2.2
delta_h -21.7568 kJ
-gamma 0 0
Id: 209811
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + 2Three_picoline = Ag(Three_picoline)2+
log_k 4.46
delta_h -49.7896 kJ

-gamma 0 0
Id: 209812
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Three_picoline = Ni(Three_picoline)+2
log_k 1.87
delta_h 0 kJ
-gamma 0 0
Id: 5409811
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + 2Three_picoline = Ni(Three_picoline)2+2
log_k 3.3
delta_h 0 kJ
-gamma 0 0
Id: 5409812
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + 3Three_picoline = Ni(Three_picoline)3+2
log_k 4.1
delta_h 0 kJ
-gamma 0 0
Id: 5409813
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + 4Three_picoline = Ni(Three_picoline)4+2
log_k 4.6
delta_h 0 kJ
-gamma 0 0
Id: 5409814
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Co+2 + Three_picoline = Co(Three_picoline)+2
log_k 1.4
delta_h 0 kJ
-gamma 0 0
Id: 2009811
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.50 25.0
Co+2 + 2Three_picoline = Co(Three_picoline)2+2
log_k 2.2
delta_h 0 kJ
-gamma 0 0
Id: 2009812
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.50 25.0
Co+2 + 3Three_picoline = Co(Three_picoline)3+2

log_k 2.5
delta_h 0 kJ
-gamma 0 0
Id: 2009813
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.50 25.0
H+ + Four_picoline = H(Four_picoline)+
log_k 6.03
delta_h -25.3132 kJ
-gamma 0 0
Id: 3309821
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Four_picoline = Zn(Four_picoline)+2
log_k 1.4
delta_h 0 kJ
-gamma 0 0
Id: 9509821
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + 2Four_picoline = Zn(Four_picoline)2+2
log_k 2.11
delta_h 0 kJ
-gamma 0 0
Id: 9509822
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + 3Four_picoline = Zn(Four_picoline)3+2
log_k 2.85
delta_h 0 kJ
-gamma 0 0
Id: 9509823
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + Four_picoline = Cd(Four_picoline)+2
log_k 1.59
delta_h 0 kJ
-gamma 0 0
Id: 1609821
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cd+2 + 2Four_picoline = Cd(Four_picoline)2+2
log_k 2.4
delta_h 0 kJ
-gamma 0 0
Id: 1609822
log K source: SCD2.62
Delta H source: SCD2.62

#T and ionic strength:
Cd+2 + 3Four_picoline = Cd(Four_picoline)3+2
log_k 3.18
delta_h 0 kJ
-gamma 0 0
Id: 1609823
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cd+2 + 4Four_picoline = Cd(Four_picoline)4+2
log_k 4
delta_h 0 kJ
-gamma 0 0
Id: 1609824
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+ + Four_picoline = Cu(Four_picoline)+
log_k 5.65
delta_h 0 kJ
-gamma 0 0
Id: 2309821
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+ + 2Four_picoline = Cu(Four_picoline)2+
log_k 8.2
delta_h 0 kJ
-gamma 0 0
Id: 2309822
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+ + 3Four_picoline = Cu(Four_picoline)3+
log_k 8.8
delta_h 0 kJ
-gamma 0 0
Id: 2309823
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+ + 4Four_picoline = Cu(Four_picoline)4+
log_k 9.2
delta_h 0 kJ
-gamma 0 0
Id: 2309824
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Four_picoline = Cu(Four_picoline)+2
log_k 2.88
delta_h 0 kJ
-gamma 0 0
Id: 2319821

log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + 2Four_picoline = Cu(Four_picoline)2+2
log_k 5.16
delta_h 0 kJ
-gamma 0 0
Id: 2319822
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + 3Four_picoline = Cu(Four_picoline)3+2
log_k 6.77
delta_h 0 kJ
-gamma 0 0
Id: 2319823
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + 4Four_picoline = Cu(Four_picoline)4+2
log_k 8.08
delta_h 0 kJ
-gamma 0 0
Id: 2319824
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + 5Four_picoline = Cu(Four_picoline)5+2
log_k 8.3
delta_h 0 kJ
-gamma 0 0
Id: 2319825
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + Four_picoline = Ag(Four_picoline)+
log_k 2.03
delta_h -25.5224 kJ
-gamma 0 0
Id: 209821
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + 2Four_picoline = Ag(Four_picoline)2+
log_k 4.39
delta_h -53.5552 kJ
-gamma 0 0
Id: 209822
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Four_picoline = Ni(Four_picoline)+2
log_k 2.11
delta_h 0 kJ

-gamma 0 0
Id: 5409821
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + 2Four_picoline = Ni(Four_picoline)2+2
log_k 3.59
delta_h 0 kJ
-gamma 0 0
Id: 5409822
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + 3Four_picoline = Ni(Four_picoline)3+2
log_k 4.34
delta_h 0 kJ
-gamma 0 0
Id: 5409823
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + 4Four_picoline = Ni(Four_picoline)4+2
log_k 4.7
delta_h 0 kJ
-gamma 0 0
Id: 5409824
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Co+2 + Four_picoline = Co(Four_picoline)+2
log_k 1.56
delta_h 0 kJ
-gamma 0 0
Id: 2009821
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.50 25.0
Co+2 + 2Four_picoline = Co(Four_picoline)2+2
log_k 2.51
delta_h 0 kJ
-gamma 0 0
Id: 2009822
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.50 25.0
Co+2 + 3Four_picoline = Co(Four_picoline)3+2
log_k 2.94
delta_h 0 kJ
-gamma 0 0
Id: 2009823
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.50 25.0
Co+2 + 4Four_picoline = Co(Four_picoline)4+2

log_k 3.17
delta_h 0 kJ
-gamma 0 0
Id: 2009824
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.50 25.0
H+ + Formate- = H(Formate)
log_k 3.745
delta_h 0.1674 kJ
-gamma 0 0
Id: 3309831
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Pb+2 + Formate- = Pb(Formate)+
log_k 2.2
delta_h 0 kJ
-gamma 0 0
Id: 6009831
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Zn+2 + Formate- = Zn(Formate)+
log_k 1.44
delta_h 0 kJ
-gamma 0 0
Id: 9509831
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + Formate- = Cd(Formate)+
log_k 1.7
delta_h 0 kJ
-gamma 0 0
Id: 1609831
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Hg(OH)2 + Formate- + 2H+ = Hg(Formate)+ + 2H2O
log_k 9.6
delta_h 0 kJ
-gamma 0 0
Id: 3619831
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Formate- = Cu(Formate)+
log_k 2
delta_h 0 kJ
-gamma 0 0
Id: 2319831
log K source: NIST46.2
Delta H source: NIST46.2

#T and ionic strength:
Ni+2 + Formate- = Ni(Formate)+
log_k 1.22
delta_h 0 kJ
-gamma 0 0
Id: 5409831
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Co+2 + Formate- = Co(Formate)+
log_k 1.209
delta_h 0 kJ
-gamma 0 0
Id: 2009831
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.50 30.0
Co+2 + 2Formate- = Co(Formate)2
log_k 1.1365
delta_h 0 kJ
-gamma 0 0
Id: 2009832
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 2.00 25.0
Cr+2 + Formate- = Cr(Formate)+
log_k 1.07
delta_h 0 kJ
-gamma 0 0
Id: 2109831
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Mg+2 + Formate- = Mg(Formate)+
log_k 1.43
delta_h 0 kJ
-gamma 0 0
Id: 4609831
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ca+2 + Formate- = Ca(Formate)+
log_k 1.43
delta_h 4.184 kJ
-gamma 0 0
Id: 1509831
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Sr+2 + Formate- = Sr(Formate)+
log_k 1.39
delta_h 4 kJ
-gamma 0 0
Id: 8009831

log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ba+2 + Formate- = Ba(Formate)+
log_k 1.38
delta_h 0 kJ
-gamma 0 0
Id: 1009831
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
H+ + Isovalerate- = H(Isovalerate)
log_k 4.781
delta_h 4.5606 kJ
-gamma 0 0
Id: 3309841
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Isovalerate- = Zn(Isovalerate)+
log_k 1.39
delta_h 0 kJ
-gamma 0 0
Id: 9509841
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Isovalerate- = Cu(Isovalerate)+
log_k 2.08
delta_h 0 kJ
-gamma 0 0
Id: 2319841
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ca+2 + Isovalerate- = Ca(Isovalerate)+
log_k 0.2
delta_h 0 kJ
-gamma 0 0
Id: 1509841
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
H+ + Valerate- = H(Valerate)
log_k 4.843
delta_h 2.887 kJ
-gamma 0 0
Id: 3309851
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Valerate- = Cu(Valerate)+
log_k 2.12
delta_h 0 kJ

-gamma 0 0
Id: 2319851
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ca+2 + Valerate- = Ca(Valerate)+
log_k 0.3
delta_h 0 kJ
-gamma 0 0
Id: 1509851
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Ba+2 + Valerate- = Ba(Valerate)+
log_k -0.2
delta_h 0 kJ
-gamma 0 0
Id: 1009851
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
H+ + Acetate- = H(Acetate)
log_k 4.757
delta_h 0.41 kJ
-gamma 0 0
Id: 3309921
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Sn(OH)2 + 2H+ + Acetate- = Sn(Acetate)+ + 2H2O
log_k 10.0213
delta_h 0 kJ
-gamma 0 0
Id: 7909921
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 3.00 25.0
Sn(OH)2 + 2H+ + 2Acetate- = Sn(Acetate)2 + 2H2O
log_k 12.32
delta_h 0 kJ
-gamma 0 0
Id: 7909922
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 3.00 25.0
Sn(OH)2 + 2H+ + 3Acetate- = Sn(Acetate)3- + 2H2O
log_k 13.55
delta_h 0 kJ
-gamma 0 0
Id: 7909923
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 3.00 25.0
Pb+2 + Acetate- = Pb(Acetate)+

log_k 2.68
delta_h -0.4 kJ
-gamma 0 0
Id: 6009921
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Pb+2 + 2Acetate- = Pb(Acetate)2
log_k 4.08
delta_h -0.8 kJ
-gamma 0 0
Id: 6009922
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Tl+ + Acetate- = Tl(Acetate)
log_k -0.11
delta_h 0 kJ
-gamma 0 0
Id: 8709921
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.00 25.0
Zn+2 + Acetate- = Zn(Acetate)+
log_k 1.58
delta_h 8.3 kJ
-gamma 0 0
Id: 9509921
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Zn+2 + 2Acetate- = Zn(Acetate)2
log_k 2.6434
delta_h 22 kJ
-gamma 0 0
Id: 9509922
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
Cd+2 + Acetate- = Cd(Acetate)+
log_k 1.93
delta_h 9.6 kJ
-gamma 0 0
Id: 1609921
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Cd+2 + 2Acetate- = Cd(Acetate)2
log_k 2.86
delta_h 15 kJ
-gamma 0 0
Id: 1609922
log K source: NIST46.4
Delta H source: NIST46.4

#T and ionic strength: 0.00 25.0
Hg(OH)2 + 2H+ + Acetate- = Hg(Acetate)+ + 2H2O
log_k 10.494
delta_h 0 kJ
-gamma 0 0
Id: 3619920
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.00 25.0
Hg(OH)2 + 2H+ + 2Acetate- = Hg(Acetate)2 + 2H2O
log_k 13.83
delta_h 0 kJ
-gamma 0 0
Id: 3619921
log K source: NIST46.4
Delta H source: SCD2.62
#T and ionic strength: 3.00 25.0
Cu+2 + Acetate- = Cu(Acetate)+
log_k 2.21
delta_h 7.1 kJ
-gamma 0 0
Id: 2319921
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Cu+2 + 2Acetate- = Cu(Acetate)2
log_k 3.4
delta_h 12 kJ
-gamma 0 0
Id: 2319922
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Cu+2 + 3Acetate- = Cu(Acetate)3-
log_k 3.9434
delta_h 6.2 kJ
-gamma 0 0
Id: 2319923
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
Ag+ + Acetate- = Ag(Acetate)
log_k 0.73
delta_h 3 kJ
-gamma 0 0
Id: 209921
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ag+ + 2Acetate- = Ag(Acetate)2-
log_k 0.64
delta_h 3 kJ
-gamma 0 0
Id: 209922

log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ni+2 + Acetate- = Ni(Acetate)+
log_k 1.37
delta_h 8.7 kJ
-gamma 0 0
Id: 5409921
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Ni+2 + 2Acetate- = Ni(Acetate)2
log_k 2.1
delta_h 10 kJ
-gamma 0 0
Id: 5409922
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Co+2 + Acetate- = Co(Acetate)+
log_k 1.38
delta_h 0 kJ
-gamma 0 0
Id: 2009921
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.00 25.0
Co+2 + 2Acetate- = Co(Acetate)2
log_k 0.7565
delta_h 0 kJ
-gamma 0 0
Id: 2009922
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 2.00 25.0
Fe+2 + Acetate- = Fe(Acetate)+
log_k 1.4
delta_h 0 kJ
-gamma 0 0
Id: 2809920
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.00 25.0
Fe+3 + Acetate- = Fe(Acetate)+2
log_k 4.0234
delta_h 0 kJ
-gamma 0 0
Id: 2819920
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 20.0
Fe+3 + 2Acetate- = Fe(Acetate)2+
log_k 7.5723
delta_h 0 kJ

-gamma 0 0
Id: 2819921
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 20.0
Fe+3 + 3Acetate- = Fe(Acetate)3
log_k 9.5867
delta_h 0 kJ
-gamma 0 0
Id: 2819922
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 20.0
Mn+2 + Acetate- = Mn(Acetate)+
log_k 1.4
delta_h 0 kJ
-gamma 0 0
Id: 4709920
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.00 25.0
Cr+2 + Acetate- = Cr(Acetate)+
log_k 1.8
delta_h 0 kJ
-gamma 0 0
Id: 2109921
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.00 25.0
Cr+2 + 2Acetate- = Cr(Acetate)2
log_k 2.92
delta_h 0 kJ
-gamma 0 0
Id: 2109922
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.00 25.0
Cr(OH)2+ + 2H+ + Acetate- = Cr(Acetate)+2 + 2H2O
log_k 15.0073
delta_h -125.62 kJ
-gamma 0 0
Id: 2119921
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.50 25.0
Cr(OH)2+ + 2H+ + 2Acetate- = Cr(Acetate)2+ + 2H2O
log_k 17.9963
delta_h -117.62 kJ
-gamma 0 0
Id: 2119922
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.50 25.0
Cr(OH)2+ + 2H+ + 3Acetate- = Cr(Acetate)3 + 2H2O

log_k 20.7858
delta_h -96.62 kJ
-gamma 0 0
Id: 2119923
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.50 25.0
Be+2 + Acetate- = Be(Acetate)+
log_k 2.0489
delta_h 0 kJ
-gamma 0 0
Id: 1109921
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
Be+2 + 2Acetate- = Be(Acetate)2
log_k 3.0034
delta_h 0 kJ
-gamma 0 0
Id: 1109922
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
Mg+2 + Acetate- = Mg(Acetate)+
log_k 1.27
delta_h 0 kJ
-gamma 0 0
Id: 4609920
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.00 25.0
Ca+2 + Acetate- = Ca(Acetate)+
log_k 1.18
delta_h 4 kJ
-gamma 0 0
Id: 1509920
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Sr+2 + Acetate- = Sr(Acetate)+
log_k 1.14
delta_h 0 kJ
-gamma 0 0
Id: 8009921
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.00 25.0
Ba+2 + Acetate- = Ba(Acetate)+
log_k 1.07
delta_h 0 kJ
-gamma 0 0
Id: 1009921
log K source: NIST46.4
Delta H source: NIST46.2

#T and ionic strength: 0.00 25.0
Na+ + Acetate- = Na(Acetate)
log_k -0.18
delta_h 12 kJ
-gamma 0 0
Id: 5009920
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
K+ + Acetate- = K(Acetate)
log_k -0.1955
delta_h 4.184 kJ
-gamma 0 0
Id: 4109921
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
H+ + Tartarate-2 = H(Tartarate)-
log_k 4.366
delta_h -0.7531 kJ
-gamma 0 0
Id: 3309931
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
2H+ + Tartarate-2 = H2(Tartarate)
log_k 7.402
delta_h -3.6819 kJ
-gamma 0 0
Id: 3309932
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Sn(OH)2 + 2H+ + Tartarate-2 = Sn(Tartarate) + 2H2O
log_k 13.1518
delta_h 0 kJ
-gamma 0 0
Id: 7909931
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 20.0
Pb+2 + Tartarate-2 = Pb(Tartarate)
log_k 3.98
delta_h 0 kJ
-gamma 0 0
Id: 6009931
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Al+3 + 2Tartarate-2 = Al(Tartarate)2-
log_k 9.37
delta_h 0 kJ
-gamma 0 0
Id: 309931

log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Tl+ + Tartarate-2 = Tl(Tartarate)-
log_k 1.4
delta_h 0 kJ
-gamma 0 0
Id: 8709931
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Tl+ + Tartarate-2 + H+ = TlH(Tartarate)
log_k 4.8
delta_h 0 kJ
-gamma 0 0
Id: 8709932
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Tartarate-2 = Zn(Tartarate)
log_k 3.43
delta_h 0 kJ
-gamma 0 0
Id: 9509931
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + 2Tartarate-2 = Zn(Tartarate)2-2
log_k 5.5
delta_h 0 kJ
-gamma 0 0
Id: 9509932
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Tartarate-2 + H+ = ZnH(Tartarate)+
log_k 5.9
delta_h 0 kJ
-gamma 0 0
Id: 9509933
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + Tartarate-2 = Cd(Tartarate)
log_k 2.7
delta_h 0 kJ
-gamma 0 0
Id: 1609931
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + 2Tartarate-2 = Cd(Tartarate)2-2
log_k 4.1
delta_h 0 kJ

-gamma 0 0
Id: 1609932
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Hg(OH)2 + Tartarate-2 + 2H+ = Hg(Tartarate) + 2H2O
log_k 14
delta_h 0 kJ
-gamma 0 0
Id: 3619931
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Tartarate-2 = Cu(Tartarate)
log_k 3.97
delta_h 0 kJ
-gamma 0 0
Id: 2319931
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Tartarate-2 + H+ = CuH(Tartarate)+
log_k 6.7
delta_h 0 kJ
-gamma 0 0
Id: 2319932
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Tartarate-2 = Ni(Tartarate)
log_k 3.46
delta_h 0 kJ
-gamma 0 0
Id: 5409931
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Tartarate-2 + H+ = NiH(Tartarate)+
log_k 5.89
delta_h 0 kJ
-gamma 0 0
Id: 5409932
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Co+2 + Tartarate-2 = Co(Tartarate)
log_k 3.05
delta_h 0 kJ
-gamma 0 0
Id: 2009931
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.00 25.0
Co+2 + 2Tartarate-2 = Co(Tartarate)2-2

log_k 4
delta_h 0 kJ
-gamma 0 0
Id: 2009932
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.00 25.0
Co+2 + H+ + Tartarate-2 = CoH(Tartarate)+
log_k 5.754
delta_h 0 kJ
-gamma 0 0
Id: 2009933
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 1.00 20.0
Fe+2 + Tartarate-2 = Fe(Tartarate)
log_k 3.1
delta_h 0 kJ
-gamma 0 0
Id: 2809931
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+3 + Tartarate-2 = Fe(Tartarate)+
log_k 7.78
delta_h 0 kJ
-gamma 0 0
Id: 2819931
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Mn+2 + Tartarate-2 = Mn(Tartarate)
log_k 3.38
delta_h 0 kJ
-gamma 0 0
Id: 4709931
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Mn+2 + Tartarate-2 + H+ = MnH(Tartarate)+
log_k 6
delta_h 0 kJ
-gamma 0 0
Id: 4709932
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Mg+2 + Tartarate-2 = Mg(Tartarate)
log_k 2.3
delta_h 0 kJ
-gamma 0 0
Id: 4609931
log K source: NIST46.2
Delta H source: NIST46.2

#T and ionic strength:
Mg+2 + Tartarate-2 + H+ = MgH(Tartarate)+
log_k 5.75
delta_h 0 kJ
-gamma 0 0
Id: 4609932
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Be+2 + Tartarate-2 = Be(Tartarate)
log_k 2.768
delta_h 0 kJ
-gamma 0 0
Id: 1109931
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.50 25.0
Be+2 + 2Tartarate-2 = Be(Tartarate)2-2
log_k 4.008
delta_h 0 kJ
-gamma 0 0
Id: 1109932
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.50 25.0
Ca+2 + Tartarate-2 = Ca(Tartarate)
log_k 2.8
delta_h -8.368 kJ
-gamma 0 0
Id: 1509931
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ca+2 + Tartarate-2 + H+ = CaH(Tartarate)+
log_k 5.86
delta_h -9.1211 kJ
-gamma 0 0
Id: 1509932
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Sr+2 + Tartarate-2 = Sr(Tartarate)
log_k 2.55
delta_h 0 kJ
-gamma 0 0
Id: 8009931
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.00 20.0
Sr+2 + H+ + Tartarate-2 = SrH(Tartarate)+
log_k 5.8949
delta_h 0 kJ
-gamma 0 0
Id: 8009932

log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
Ba+2 + Tartarate-2 = Ba(Tartarate)
log_k 2.54
delta_h 0 kJ
-gamma 0 0
Id: 1009931
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ba+2 + Tartarate-2 + H+ = BaH(Tartarate)+
log_k 5.77
delta_h 0 kJ
-gamma 0 0
Id: 1009932
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Na+ + Tartarate-2 = Na(Tartarate)-
log_k 0.9
delta_h -0.8368 kJ
-gamma 0 0
Id: 5009931
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Na+ + Tartarate-2 + H+ = NaH(Tartarate)
log_k 4.58
delta_h -2.8451 kJ
-gamma 0 0
Id: 5009932
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
K+ + Tartarate-2 = K(Tartarate)-
log_k 0.8
delta_h 0 kJ
-gamma 0 0
Id: 4109931
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
H+ + Glycine- = H(Glycine)
log_k 9.778
delta_h -44.3504 kJ
-gamma 0 0
Id: 3309941
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
2H+ + Glycine- = H2(Glycine)+
log_k 12.128
delta_h -48.4507 kJ

-gamma 0 0
Id: 3309942
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Pb+2 + Glycine- = Pb(Glycine)+
log_k 5.47
delta_h 0 kJ
-gamma 0 0
Id: 6009941
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Pb+2 + 2Glycine- = Pb(Glycine)2
log_k 8.86
delta_h 0 kJ
-gamma 0 0
Id: 6009942
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Tl+ + Glycine- = Tl(Glycine)
log_k 1.72
delta_h 0 kJ
-gamma 0 0
Id: 8709941
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Glycine- = Zn(Glycine)+
log_k 5.38
delta_h -11.7152 kJ
-gamma 0 0
Id: 9509941
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + 2Glycine- = Zn(Glycine)2
log_k 9.81
delta_h -24.2672 kJ
-gamma 0 0
Id: 9509942
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + 3Glycine- = Zn(Glycine)3-
log_k 12.3
delta_h -39.748 kJ
-gamma 0 0
Id: 9509943
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + Glycine- = Cd(Glycine)+

log_k 4.69
delta_h -8.7864 kJ
-gamma 0 0
Id: 1609941
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + 2Glycine- = Cd(Glycine)2
log_k 8.4
delta_h -22.5936 kJ
-gamma 0 0
Id: 1609942
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + 3Glycine- = Cd(Glycine)3-
log_k 10.7
delta_h -35.9824 kJ
-gamma 0 0
Id: 1609943
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Hg(OH)2 + Glycine- + 2H+ = Hg(Glycine)+ + 2H2O
log_k 17
delta_h 0 kJ
-gamma 0 0
Id: 3619941
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Hg(OH)2 + 2Glycine- + 2H+ = Hg(Glycine)2 + 2H2O
log_k 25.8
delta_h 0 kJ
-gamma 0 0
Id: 3619942
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cu+ + 2Glycine- = Cu(Glycine)2-
log_k 10.3
delta_h 0 kJ
-gamma 0 0
Id: 2309941
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Glycine- = Cu(Glycine)+
log_k 8.57
delta_h -25.104 kJ
-gamma 0 0
Id: 2319941
log K source: NIST46.2
Delta H source: NIST46.2

#T and ionic strength:
Cu+2 + 2Glycine- = Cu(Glycine)2
log_k 15.7
delta_h -54.8104 kJ
-gamma 0 0
Id: 2319942
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + Glycine- = Ag(Glycine)
log_k 3.51
delta_h -19.2464 kJ
-gamma 0 0
Id: 209941
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + 2Glycine- = Ag(Glycine)2-
log_k 6.89
delta_h -48.116 kJ
-gamma 0 0
Id: 209942
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Glycine- = Ni(Glycine)+
log_k 6.15
delta_h -18.828 kJ
-gamma 0 0
Id: 5409941
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + 2Glycine- = Ni(Glycine)2
log_k 11.12
delta_h -38.0744 kJ
-gamma 0 0
Id: 5409942
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + 3Glycine- = Ni(Glycine)3-
log_k 14.63
delta_h -62.3416 kJ
-gamma 0 0
Id: 5409943
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Co+2 + Glycine- = Co(Glycine)+
log_k 5.07
delta_h -12 kJ
-gamma 0 0
Id: 2009941

log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Co+2 + 2Glycine- = Co(Glycine)2
log_k 9.07
delta_h -26 kJ
-gamma 0 0
Id: 2009942
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Co+2 + 3Glycine- = Co(Glycine)3-
log_k 11.6
delta_h -41 kJ
-gamma 0 0
Id: 2009943
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Co+2 + Glycine- + H2O = CoOH(Glycine) + H+
log_k -5.02
delta_h 0 kJ
-gamma 0 0
Id: 2009944
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
Fe+2 + Glycine- = Fe(Glycine)+
log_k 4.31
delta_h -15.0624 kJ
-gamma 0 0
Id: 2809941
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+2 + 2Glycine- = Fe(Glycine)2
log_k 8.29
delta_h 0 kJ
-gamma 0 0
Id: 2809942
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+3 + Glycine- = Fe(Glycine)+2
log_k 9.38
delta_h 0 kJ
-gamma 0 0
Id: 2819941
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+3 + Glycine- + H+ = FeH(Glycine)+3
log_k 11.55
delta_h 0 kJ

-gamma 0 0
Id: 2819942
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Mn+2 + Glycine- = Mn(Glycine)+
log_k 3.19
delta_h -1.2552 kJ
-gamma 0 0
Id: 4709941
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Mn+2 + 2Glycine- = Mn(Glycine)2
log_k 5.4
delta_h 0 kJ
-gamma 0 0
Id: 4709942
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cr(OH)2+ + Glycine- + 2H+ = Cr(Glycine)+2 + 2H2O
log_k 18.7
delta_h 0 kJ
-gamma 0 0
Id: 2119941
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cr(OH)2+ + 2Glycine- + 2H+ = Cr(Glycine)2+ + 2H2O
log_k 25.6
delta_h 0 kJ
-gamma 0 0
Id: 2119942
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cr(OH)2+ + 3Glycine- + 2H+ = Cr(Glycine)3 + 2H2O
log_k 31.6
delta_h 0 kJ
-gamma 0 0
Id: 2119943
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Mg+2 + Glycine- = Mg(Glycine)+
log_k 2.08
delta_h 4.184 kJ
-gamma 0 0
Id: 4609941
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ca+2 + Glycine- = Ca(Glycine)+

log_k 1.39
delta_h -4.184 kJ
-gamma 0 0
Id: 1509941
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ca+2 + Glycine- + H+ = CaH(Glycine)+2
log_k 10.1
delta_h -35.9824 kJ
-gamma 0 0
Id: 1509942
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Sr+2 + Glycine- = Sr(Glycine)+
log_k 0.91
delta_h 0 kJ
-gamma 0 0
Id: 8009941
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.00 25.0
Ba+2 + Glycine- = Ba(Glycine)+
log_k 0.77
delta_h 0 kJ
-gamma 0 0
Id: 1009941
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
H+ + Salicylate-2 = H(Salicylate)-
log_k 13.7
delta_h -35.7732 kJ
-gamma 0 0
Id: 3309951
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
2H+ + Salicylate-2 = H2(Salicylate)
log_k 16.8
delta_h -38.7857 kJ
-gamma 0 0
Id: 3309952
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Salicylate-2 = Zn(Salicylate)
log_k 7.71
delta_h 0 kJ
-gamma 0 0
Id: 9509951
log K source: SCD2.62
Delta H source: SCD2.62

#T and ionic strength:
Zn+2 + Salicylate-2 + H+ = ZnH(Salicylate)+
log_k 15.5
delta_h 0 kJ
-gamma 0 0
Id: 9509952
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + Salicylate-2 = Cd(Salicylate)
log_k 6.2
delta_h 0 kJ
-gamma 0 0
Id: 1609951
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + Salicylate-2 + H+ = CdH(Salicylate)+
log_k 16
delta_h 0 kJ
-gamma 0 0
Id: 1609952
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Salicylate-2 = Cu(Salicylate)
log_k 11.3
delta_h -17.9912 kJ
-gamma 0 0
Id: 2319951
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + 2Salicylate-2 = Cu(Salicylate)2-2
log_k 19.3
delta_h 0 kJ
-gamma 0 0
Id: 2319952
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Salicylate-2 + H+ = CuH(Salicylate)+
log_k 14.8
delta_h 0 kJ
-gamma 0 0
Id: 2319953
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Salicylate-2 = Ni(Salicylate)
log_k 8.2
delta_h 0 kJ
-gamma 0 0
Id: 5409951

log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + 2Salicylate-2 = Ni(Salicylate)2-2
log_k 12.64
delta_h 0 kJ
-gamma 0 0
Id: 5409952
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Co+2 + Salicylate-2 = Co(Salicylate)
log_k 7.4289
delta_h 0 kJ
-gamma 0 0
Id: 2009951
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 20.0
Co+2 + 2Salicylate-2 = Co(Salicylate)2-2
log_k 11.8
delta_h 0 kJ
-gamma 0 0
Id: 2009952
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 20.0
Fe+2 + Salicylate-2 = Fe(Salicylate)
log_k 7.2
delta_h 0 kJ
-gamma 0 0
Id: 2809951
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+2 + 2Salicylate-2 = Fe(Salicylate)2-2
log_k 11.6
delta_h 0 kJ
-gamma 0 0
Id: 2809952
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+3 + Salicylate-2 = Fe(Salicylate)+
log_k 17.6
delta_h 0 kJ
-gamma 0 0
Id: 2819951
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Fe+3 + 2Salicylate-2 = Fe(Salicylate)2-
log_k 29.3
delta_h 0 kJ

-gamma 0 0
Id: 2819952
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Mn+2 + Salicylate-2 = Mn(Salicylate)
log_k 6.5
delta_h 0 kJ
-gamma 0 0
Id: 4709951
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Mn+2 + 2Salicylate-2 = Mn(Salicylate)2-2
log_k 10.1
delta_h 0 kJ
-gamma 0 0
Id: 4709952
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Be+2 + Salicylate-2 = Be(Salicylate)
log_k 13.3889
delta_h -31.7732 kJ
-gamma 0 0
Id: 1109951
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.10 25.0
Be+2 + 2Salicylate-2 = Be(Salicylate)2-2
log_k 23.25
delta_h 0 kJ
-gamma 0 0
Id: 1109952
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
Mg+2 + Salicylate-2 = Mg(Salicylate)
log_k 5.76
delta_h 0 kJ
-gamma 0 0
Id: 4609951
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Mg+2 + Salicylate-2 + H+ = MgH(Salicylate)+
log_k 15.3
delta_h 0 kJ
-gamma 0 0
Id: 4609952
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Ca+2 + Salicylate-2 = Ca(Salicylate)

log_k 4.05
delta_h 0 kJ
-gamma 0 0
Id: 1509951
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ca+2 + Salicylate-2 + H+ = CaH(Salicylate)+
log_k 14.3
delta_h 0 kJ
-gamma 0 0
Id: 1509952
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ba+2 + Salicylate-2 + H+ = BaH(Salicylate)+
log_k 13.9
delta_h 0 kJ
-gamma 0 0
Id: 1009951
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
H+ + Glutamate-2 = H(Glutamate)-
log_k 9.96
delta_h -41.0032 kJ
-gamma 0 0
Id: 3309961
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
2H+ + Glutamate-2 = H2(Glutamate)
log_k 14.26
delta_h -43.5136 kJ
-gamma 0 0
Id: 3309962
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
3H+ + Glutamate-2 = H3(Glutamate)+
log_k 16.42
delta_h -46.8608 kJ
-gamma 0 0
Id: 3309963
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Pb+2 + Glutamate-2 = Pb(Glutamate)
log_k 6.43
delta_h 0 kJ
-gamma 0 0
Id: 6009961
log K source: SCD2.62
Delta H source: SCD2.62

#T and ionic strength:
Pb+2 + 2Glutamate-2 = Pb(Glutamate)2-2
log_k 8.61
delta_h 0 kJ
-gamma 0 0
Id: 6009962
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Pb+2 + Glutamate-2 + H+ = PbH(Glutamate)+
log_k 14.08
delta_h 0 kJ
-gamma 0 0
Id: 6009963
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Al+3 + Glutamate-2 + H+ = AlH(Glutamate)+2
log_k 13.07
delta_h 0 kJ
-gamma 0 0
Id: 309961
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Glutamate-2 = Zn(Glutamate)
log_k 6.2
delta_h 0 kJ
-gamma 0 0
Id: 9509961
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Zn+2 + 2Glutamate-2 = Zn(Glutamate)2-2
log_k 9.13
delta_h 0 kJ
-gamma 0 0
Id: 9509962
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Zn+2 + 3Glutamate-2 = Zn(Glutamate)3-4
log_k 9.8
delta_h 0 kJ
-gamma 0 0
Id: 9509963
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cd+2 + Glutamate-2 = Cd(Glutamate)
log_k 4.7
delta_h 0 kJ
-gamma 0 0
Id: 1609961

log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + 2Glutamate-2 = Cd(Glutamate)2-2
log_k 7.59
delta_h 0 kJ
-gamma 0 0
Id: 1609962
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Hg(OH)2 + Glutamate-2 + 2H+ = Hg(Glutamate) + 2H2O
log_k 19.8
delta_h 0 kJ
-gamma 0 0
Id: 3619961
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Hg(OH)2 + 2Glutamate-2 + 2H+ = Hg(Glutamate)2-2 + 2H2O
log_k 26.2
delta_h 0 kJ
-gamma 0 0
Id: 3619962
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cu+2 + Glutamate-2 = Cu(Glutamate)
log_k 9.17
delta_h -20.92 kJ
-gamma 0 0
Id: 2319961
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + 2Glutamate-2 = Cu(Glutamate)2-2
log_k 15.78
delta_h -48.116 kJ
-gamma 0 0
Id: 2319962
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Glutamate-2 + H+ = CuH(Glutamate)+
log_k 13.3
delta_h -28.0328 kJ
-gamma 0 0
Id: 2319963
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + Glutamate-2 = Ag(Glutamate)-
log_k 4.22
delta_h 0 kJ

-gamma 0 0
Id: 209961
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ag+ + 2Glutamate-2 = Ag(Glutamate)2-3
log_k 7.36
delta_h 0 kJ
-gamma 0 0
Id: 209962
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
2Ag+ + Glutamate-2 = Ag2(Glutamate)
log_k 3.4
delta_h 0 kJ
-gamma 0 0
Id: 209963
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Glutamate-2 = Ni(Glutamate)
log_k 6.47
delta_h 0 kJ
-gamma 0 0
Id: 5409961
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + 2Glutamate-2 = Ni(Glutamate)2-2
log_k 10.7
delta_h -30.9616 kJ
-gamma 0 0
Id: 5409962
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Co+2 + Glutamate-2 = Co(Glutamate)
log_k 5.4178
delta_h 0 kJ
-gamma 0 0
Id: 2009961
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
Co+2 + 2Glutamate-2 = Co(Glutamate)2-2
log_k 8.7178
delta_h 0 kJ
-gamma 0 0
Id: 2009962
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
Mn+2 + Glutamate-2 = Mn(Glutamate)

log_k 4.95
delta_h 0 kJ
-gamma 0 0
Id: 4709961
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Mn+2 + 2Glutamate-2 = Mn(Glutamate)2-2
log_k 8.48
delta_h 0 kJ
-gamma 0 0
Id: 4709962
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cr(OH)2+ + Glutamate-2 + 2H+ = Cr(Glutamate)+ + 2H2O
log_k 22.6
delta_h 0 kJ
-gamma 0 0
Id: 2119961
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cr(OH)2+ + 2Glutamate-2 + 2H+ = Cr(Glutamate)2- + 2H2O
log_k 30.7
delta_h 0 kJ
-gamma 0 0
Id: 2119962
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cr(OH)2+ + Glutamate-2 + 3H+ = CrH(Glutamate)+2 + 2H2O
log_k 25.2
delta_h 0 kJ
-gamma 0 0
Id: 2119963
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Mg+2 + Glutamate-2 = Mg(Glutamate)
log_k 2.8
delta_h 0 kJ
-gamma 0 0
Id: 4609961
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ca+2 + Glutamate-2 = Ca(Glutamate)
log_k 2.06
delta_h 0 kJ
-gamma 0 0
Id: 1509961
log K source: NIST46.2
Delta H source: NIST46.2

#T and ionic strength:
Ca+2 + Glutamate-2 + H+ = CaH(Glutamate)+
log_k 11.13
delta_h 0 kJ
-gamma 0 0
Id: 1509962
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Sr+2 + Glutamate-2 = Sr(Glutamate)
log_k 2.2278
delta_h 0 kJ
-gamma 0 0
Id: 8009961
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
Ba+2 + Glutamate-2 = Ba(Glutamate)
log_k 2.14
delta_h 0 kJ
-gamma 0 0
Id: 1009961
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
H+ + Phthalate-2 = H(Phthalate)-
log_k 5.408
delta_h 2.1757 kJ
-gamma 0 0
Id: 3309971
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
2H+ + Phthalate-2 = H2(Phthalate)
log_k 8.358
delta_h 4.8534 kJ
-gamma 0 0
Id: 3309972
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Pb+2 + Phthalate-2 = Pb(Phthalate)
log_k 4.26
delta_h 0 kJ
-gamma 0 0
Id: 6009971
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Pb+2 + 2Phthalate-2 = Pb(Phthalate)2-2
log_k 4.83
delta_h 0 kJ
-gamma 0 0
Id: 6009972

log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Pb+2 + Phthalate-2 + H+ = PbH(Phthalate)+
log_k 6.98
delta_h 0 kJ
-gamma 0 0
Id: 6009973
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Al+3 + Phthalate-2 = Al(Phthalate)+
log_k 4.56
delta_h 0 kJ
-gamma 0 0
Id: 309971
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Al+3 + 2Phthalate-2 = Al(Phthalate)2-
log_k 7.2
delta_h 0 kJ
-gamma 0 0
Id: 309972
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + Phthalate-2 = Zn(Phthalate)
log_k 2.91
delta_h 13.3888 kJ
-gamma 0 0
Id: 9509971
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Zn+2 + 2Phthalate-2 = Zn(Phthalate)2-2
log_k 4.2
delta_h 0 kJ
-gamma 0 0
Id: 9509972
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + Phthalate-2 = Cd(Phthalate)
log_k 3.43
delta_h 0 kJ
-gamma 0 0
Id: 1609971
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + Phthalate-2 + H+ = CdH(Phthalate)+
log_k 6.3
delta_h 0 kJ

-gamma 0 0
Id: 1609973
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cd+2 + 2Phthalate-2 = Cd(Phthalate)2-2
log_k 3.7
delta_h 0 kJ
-gamma 0 0
Id: 1609972
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Phthalate-2 = Cu(Phthalate)
log_k 4.02
delta_h 8.368 kJ
-gamma 0 0
Id: 2319971
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + Phthalate-2 + H+ = CuH(Phthalate)+
log_k 7.1
delta_h 3.8493 kJ
-gamma 0 0
Id: 2319970
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cu+2 + 2Phthalate-2 = Cu(Phthalate)2-2
log_k 5.3
delta_h 15.8992 kJ
-gamma 0 0
Id: 2319972
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Phthalate-2 = Ni(Phthalate)
log_k 2.95
delta_h 7.5312 kJ
-gamma 0 0
Id: 5409971
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ni+2 + Phthalate-2 + H+ = NiH(Phthalate)+
log_k 6.6
delta_h 0 kJ
-gamma 0 0
Id: 5409972
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Co+2 + Phthalate-2 = Co(Phthalate)

log_k 2.83
delta_h 7.9 kJ
-gamma 0 0
Id: 2009971
log K source: NIST46.4
Delta H source: NIST46.4
#T and ionic strength: 0.00 25.0
Co+2 + H+ + Phthalate-2 = CoH(Phthalate)+
log_k 7.227
delta_h 0 kJ
-gamma 0 0
Id: 2009972
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.50 25.0
Mn+2 + Phthalate-2 = Mn(Phthalate)
log_k 2.74
delta_h 10.0416 kJ
-gamma 0 0
Id: 4709971
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Cr(OH)2+ + Phthalate-2 + 2H+ = Cr(Phthalate)+ + 2H2O
log_k 16.3
delta_h 0 kJ
-gamma 0 0
Id: 2119971
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cr(OH)2+ + 2Phthalate-2 + 2H+ = Cr(Phthalate)2- + 2H2O
log_k 21.2
delta_h 0 kJ
-gamma 0 0
Id: 2119972
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Cr(OH)2+ + 3Phthalate-2 + 2H+ = Cr(Phthalate)3-3 + 2H2O
log_k 23.3
delta_h 0 kJ
-gamma 0 0
Id: 2119973
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Be+2 + Phthalate-2 = Be(Phthalate)
log_k 4.8278
delta_h 0 kJ
-gamma 0 0
Id: 1109971
log K source: NIST46.4
Delta H source: NIST46.2

#T and ionic strength: 0.10 25.0
Be+2 + 2Phthalate-2 = Be(Phthalate)2-2
log_k 6.5478
delta_h 0 kJ
-gamma 0 0
Id: 1109972
log K source: NIST46.4
Delta H source: NIST46.2
#T and ionic strength: 0.10 25.0
Mg+2 + Phthalate-2 = Mg(Phthalate)
log_k 2.49
delta_h 0 kJ
-gamma 0 0
Id: 4609971
log K source: SCD2.62
Delta H source: SCD2.62
#T and ionic strength:
Ca+2 + Phthalate-2 = Ca(Phthalate)
log_k 2.45
delta_h 0 kJ
-gamma 0 0
Id: 1509970
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ca+2 + Phthalate-2 + H+ = CaH(Phthalate)+
log_k 6.43
delta_h 0 kJ
-gamma 0 0
Id: 1509971
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Ba+2 + Phthalate-2 = Ba(Phthalate)
log_k 2.33
delta_h 0 kJ
-gamma 0 0
Id: 1009971
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
Na+ + Phthalate-2 = Na(Phthalate)-
log_k 0.8
delta_h 4.184 kJ
-gamma 0 0
Id: 5009970
log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
K+ + Phthalate-2 = K(Phthalate)-
log_k 0.7
delta_h 3.7656 kJ
-gamma 0 0
Id: 4109971

log K source: NIST46.2
Delta H source: NIST46.2
#T and ionic strength:
PHASES
Sulfur
S + H+ + 2e- = HS-
log_k -2.1449
delta_h -16.3 kJ
Semetal(hex
Se + H+ + 2e- = HSe-
log_k -7.7084
delta_h 15.9 kJ
Semetal(am)
Se + H+ + 2e- = HSe-
log_k -7.1099
delta_h 10.8784 kJ
Sbmetal
Sb + 3H2O = Sb(OH)3 + 3H+ + 3e-
log_k -11.6889
delta_h 83.89 kJ
Snmetal(wht)
Sn + 2H2O = Sn(OH)2 + 2H+ + 2e-
log_k -2.3266
delta_h -0 kJ
Pbmetal
Pb = Pb+2 + 2e-
log_k 4.2462
delta_h 0.92 kJ
Tlmetal
Tl = Tl+ + e-
log_k 5.6762
delta_h 5.36 kJ
Znmetal
Zn = Zn+2 + 2e-
log_k 25.7886
delta_h -153.39 kJ
Cdmetal(alpha)
Cd = Cd+2 + 2e-
log_k 13.5147
delta_h -75.33 kJ
Cdmetal(gamma)
Cd = Cd+2 + 2e-
log_k 13.618
delta_h -75.92 kJ
Hgmetal(l)
Hg = 0.5Hg2+2 + e-
log_k -13.4517
delta_h 83.435 kJ
Cumetal
Cu = Cu+ + e-
log_k -8.756
delta_h 71.67 kJ
Agmetal
Ag = Ag+ + e-

log_k -13.5065
delta_h 105.79 kJ
Crmetal
Cr = Cr+2 + 2e-
log_k 30.4831
delta_h -172 kJ
Vmetal
V = V+3 + 3e-
log_k 44.0253
delta_h -259 kJ
Stibnite
Sb2S3 + 6H2O = 2Sb(OH)3 + 3H+ + 3HS-
log_k -50.46
delta_h 293.78 kJ
Orpiment
As2S3 + 6H2O = 2H3AsO3 + 3HS- + 3H+
log_k -61.0663
delta_h 350.68 kJ
Realgar
AsS + 3H2O = H3AsO3 + HS- + 2H+ + e-
log_k -19.747
delta_h 127.8 kJ
SnS
SnS + 2H2O = Sn(OH)2 + H+ + HS-
log_k -19.114
delta_h -0 kJ
SnS2
SnS2 + 6H2O = Sn(OH)6-2 + 4H+ + 2HS-
log_k -57.4538
delta_h -0 kJ
Galena
PbS + H+ = Pb+2 + HS-
log_k -13.97
delta_h 80 kJ
Tl2S
Tl2S + H+ = 2Tl+ + HS-
log_k -7.19
delta_h 91.52 kJ
ZnS(am)
ZnS + H+ = Zn+2 + HS-
log_k -9.052
delta_h 15.3553 kJ
Sphalerite
ZnS + H+ = Zn+2 + HS-
log_k -11.45
delta_h 30 kJ
Wurtzite
ZnS + H+ = Zn+2 + HS-
log_k -8.95
delta_h 21.171 kJ
Greenockite
CdS + H+ = Cd+2 + HS-
log_k -14.36
delta_h 55 kJ

Hg2S
Hg2S + H+ = Hg2+2 + HS-
log_k -11.6765
delta_h 69.7473 kJ
Cinnabar
HgS + 2H2O = Hg(OH)2 + H+ + HS-
log_k -45.694
delta_h 253.76 kJ
Metacinnabar
HgS + 2H2O = Hg(OH)2 + H+ + HS-
log_k -45.094
delta_h 253.72 kJ
Chalcocite
Cu2S + H+ = 2Cu+ + HS-
log_k -34.92
delta_h 168 kJ
Djurleite
Cu0.066Cu1.868S + H+ = 0.066Cu+2 + 1.868Cu+ + HS-
log_k -33.92
delta_h 200.334 kJ
Anilite
Cu0.25Cu1.5S + H+ = 0.25Cu+2 + 1.5Cu+ + HS-
log_k -31.878
delta_h 182.15 kJ
BlaubleiII
Cu0.6Cu0.8S + H+ = 0.6Cu+2 + 0.8Cu+ + HS-
log_k -27.279
delta_h -0 kJ
BlaubleiI
Cu0.9Cu0.2S + H+ = 0.9Cu+2 + 0.2Cu+ + HS-
log_k -24.162
delta_h -0 kJ
Covellite
CuS + H+ = Cu+2 + HS-
log_k -22.3
delta_h 97 kJ
Chalcopyrite
CuFeS2 + 2H+ = Cu+2 + Fe+2 + 2HS-
log_k -35.27
delta_h 148.448 kJ
Acanthite
Ag2S + H+ = 2Ag+ + HS-
log_k -36.22
delta_h 227 kJ
NiS(alpha)
NiS + H+ = Ni+2 + HS-
log_k -5.6
delta_h -0 kJ
NiS(beta)
NiS + H+ = Ni+2 + HS-
log_k -11.1
delta_h -0 kJ
NiS(gamma)
NiS + H+ = Ni+2 + HS-

log_k -12.8
delta_h -0 kJ
CoS(alpha)
CoS + H+ = Co+2 + HS-
log_k -7.44
delta_h -0 kJ
CoS(beta)
CoS + H+ = Co+2 + HS-
log_k -11.07
delta_h -0 kJ
FeS(ppt)
FeS + H+ = Fe+2 + HS-
log_k -2.95
delta_h -11 kJ
Greigite
Fe3S4 + 4H+ = 2Fe+3 + Fe+2 + 4HS-
log_k -45.035
delta_h -0 kJ
Mackinawite
FeS + H+ = Fe+2 + HS-
log_k -3.6
delta_h -0 kJ
Pyrite
FeS2 + 2H+ + 2e- = Fe+2 + 2HS-
log_k -18.5082
delta_h 49.844 kJ
MnS(grn)
MnS + H+ = Mn+2 + HS-
log_k 0.17
delta_h -32 kJ
MnS(pnk)
MnS + H+ = Mn+2 + HS-
log_k 3.34
delta_h -0 kJ
MoS2
MoS2 + 4H2O = MoO4-2 + 6H+ + 2HS- + 2e-
log_k -70.2596
delta_h 389.02 kJ
BeS
BeS + H+ = Be+2 + HS-
log_k 19.38
delta_h -0 kJ
BaS
BaS + H+ = Ba+2 + HS-
log_k 16.18
delta_h -0 kJ
Hg2(Cyanide)2
Hg2(Cyanide)2 = Hg2+2 + 2Cyanide-
log_k -39.3
delta_h -0 kJ
CuCyanide
CuCyanide = Cu+ + Cyanide-
log_k -19.5
delta_h -19 kJ

AgCyanide
AgCyanide = Ag+ + Cyanide-
log_k -15.74
delta_h 110.395 kJ
Ag2(Cyanide)2
Ag2(Cyanide)2 = 2Ag+ + 2Cyanide-
log_k -11.3289
delta_h -0 kJ
NaCyanide(cubic)
NaCyanide = Cyanide- + Na+
log_k 1.6012
delta_h 0.969 kJ
KCyanide(cubic)
KCyanide = Cyanide- + K+
log_k 1.4188
delta_h 11.93 kJ
Pb2Fe(Cyanide)6
Pb2Fe(Cyanide)6 = 2Pb+2 + Fe+2 + 6Cyanide-
log_k -53.42
delta_h -0 kJ
Zn2Fe(Cyanide)6
Zn2Fe(Cyanide)6 = 2Zn+2 + Fe+2 + 6Cyanide-
log_k -51.08
delta_h -0 kJ
Cd2Fe(Cyanide)6
Cd2Fe(Cyanide)6 = 2Cd+2 + Fe+2 + 6Cyanide-
log_k -52.78
delta_h -0 kJ
Ag4Fe(Cyanide)6
Ag4Fe(Cyanide)6 = 4Ag+ + Fe+2 + 6Cyanide-
log_k -79.47
delta_h -0 kJ
Ag3Fe(Cyanide)6
Ag3Fe(Cyanide)6 = 3Ag+ + Fe+3 + 6Cyanide-
log_k -72.7867
delta_h -0 kJ
Mn3(Fe(Cyanide)6)2
Mn3(Fe(Cyanide)6)2 = 3Mn+2 + 2Fe+3 + 12Cyanide-
log_k -105.4
delta_h -0 kJ
Sb2Se3
Sb2Se3 + 6H2O = 2Sb(OH)3 + 3HSe- + 3H+
log_k -67.7571
delta_h 343.046 kJ
SnSe
SnSe + 2H2O = Sn(OH)2 + H+ + HSe-
log_k -30.494
delta_h -0 kJ
SnSe2
SnSe2 + 6H2O = Sn(OH)6-2 + 4H+ + 2HSe-
log_k -65.1189
delta_h -0 kJ
Clausthalite
PbSe + H+ = Pb+2 + HSe-

log_k -27.1
delta_h 119.72 kJ
Tl2Se
Tl2Se + H+ = 2Tl+ + HSe-
log_k -18.1
delta_h 85.62 kJ
ZnSe
ZnSe + H+ = Zn+2 + HSe-
log_k -14.4
delta_h 25.51 kJ
CdSe
CdSe + H+ = Cd+2 + HSe-
log_k -20.2
delta_h 75.9814 kJ
HgSe
HgSe + 2H2O = Hg(OH)2 + H+ + HSe-
log_k -55.694
delta_h -0 kJ
Cu2Se(alpha)
Cu2Se + H+ = 2Cu+ + HSe-
log_k -45.8
delta_h 214.263 kJ
Cu3Se2
Cu3Se2 + 2H+ = 2HSe- + 2Cu+ + Cu+2
log_k -63.4911
delta_h 340.327 kJ
CuSe
CuSe + H+ = Cu+2 + HSe-
log_k -33.1
delta_h 121.127 kJ
CuSe2
CuSe2 + 2H+ + 2e- = 2HSe- + Cu+2
log_k -33.3655
delta_h 140.582 kJ
Ag2Se
Ag2Se + H+ = 2Ag+ + HSe-
log_k -48.7
delta_h 265.48 kJ
NiSe
NiSe + H+ = Ni+2 + HSe-
log_k -17.7
delta_h -0 kJ
CoSe
CoSe + H+ = Co+2 + HSe-
log_k -16.2
delta_h -0 kJ
FeSe
FeSe + H+ = Fe+2 + HSe-
log_k -11
delta_h 2.092 kJ
Ferroselite
FeSe2 + 2H+ + 2e- = 2HSe- + Fe+2
log_k -18.5959
delta_h 47.2792 kJ

MnSe
MnSe + H+ = Mn+2 + HSe-
log_k 3.5
delta_h -98.15 kJ
AlSb
AlSb + 3H2O = Sb(OH)3 + 6e- + Al+3 + 3H+
log_k 65.6241
delta_h -0 kJ
ZnSb
ZnSb + 3H2O = Sb(OH)3 + 5e- + Zn+2 + 3H+
log_k 11.0138
delta_h -54.8773 kJ
CdSb
CdSb + 3H2O = Sb(OH)3 + 5e- + 3H+ + Cd+2
log_k -0.3501
delta_h 22.36 kJ
Cu2Sb:3H2O
Cu2Sb:3H2O = Sb(OH)3 + 6e- + 3H+ + Cu+ + Cu+2
log_k -34.8827
delta_h 233.237 kJ
Cu3Sb
Cu3Sb + 3H2O = Sb(OH)3 + 6e- + 3H+ + 3Cu+
log_k -42.5937
delta_h 308.131 kJ
#Ag4Sb
Ag4Sb + 3H2O = Sb(OH)3 + 6e- + 3Ag+ + 3H+
log_k -56.1818
delta_h -0 kJ
Breithauptite
NiSb + 3H2O = Sb(OH)3 + 5e- + 3H+ + Ni+2
log_k -18.5225
delta_h 96.0019 kJ
MnSb
MnSb + 3H2O = Mn+3 + Sb(OH)3 + 6e- + 3H+
log_k -2.9099
delta_h 21.1083 kJ
Mn2Sb
Mn2Sb + 3H2O = 2Mn+2 + Sb(OH)3 + 7e- + 3H+
log_k 61.0796
delta_h -0 kJ
USb2
USb2 + 8H2O = UO2+2 + 2Sb(OH)3 + 12e- + 10H+
log_k 29.5771
delta_h -103.56 kJ
U3Sb4
U3Sb4 + 12H2O = 3U+4 + 4Sb(OH)3 + 24e- + 12H+
log_k 152.383
delta_h -986.04 kJ
Mg2Sb3
Mg2Sb3 + 9H2O = 2Mg+2 + 3Sb(OH)3 + 9H+ + 13e-
log_k 74.6838
delta_h -0 kJ
Ca3Sb2
Ca3Sb2 + 6H2O = 3Ca+2 + 2Sb(OH)3 + 6H+ + 12e-

log_k 142.974
delta_h -732.744 kJ
NaSb
NaSb + 3H2O = Na+ + Sb(OH)3 + 3H+ + 4e-
log_k 23.1658
delta_h -93.45 kJ
Na3Sb
Na3Sb + 3H2O = 3Na+ + Sb(OH)3 + 3H+ + 6e-
log_k 94.4517
delta_h -432.13 kJ
SeO2
SeO2 + H2O = HSeO3- + H+
log_k 0.1246
delta_h 1.4016 kJ
SeO3
SeO3 + H2O = SeO4-2 + 2H+
log_k 21.044
delta_h -146.377 kJ
Sb2O5
Sb2O5 + 7H2O = 2Sb(OH)6- + 2H+
log_k -9.6674
delta_h -0 kJ
SbO2
SbO2 + 4H2O = Sb(OH)6- + e- + 2H+
log_k -27.8241
delta_h -0 kJ
Sb2O4
Sb2O4 + 2H2O + 2H+ + 2e- = 2Sb(OH)3
log_k 3.4021
delta_h -68.04 kJ
Sb4O6(cubic)
Sb4O6 + 6H2O = 4Sb(OH)3
log_k -18.2612
delta_h 61.1801 kJ
Sb4O6(orth)
Sb4O6 + 6H2O = 4Sb(OH)3
log_k -17.9012
delta_h 37.6801 kJ
Sb(OH)3
Sb(OH)3 = Sb(OH)3
log_k -7.1099
delta_h 30.1248 kJ
Senarmontite
Sb2O3 + 3H2O = 2Sb(OH)3
log_k -12.3654
delta_h 30.6478 kJ
Valentinite
Sb2O3 + 3H2O = 2Sb(OH)3
log_k -8.4806
delta_h 19.0163 kJ
Chalcedony
SiO2 + 2H2O = H4SiO4
log_k -3.55
delta_h 19.7 kJ

Cristobalite
SiO2 + 2H2O = H4SiO4
log_k -3.35
delta_h 20.006 kJ
Quartz
SiO2 + 2H2O = H4SiO4
log_k -4
delta_h 22.36 kJ
SiO2(am-gel)
SiO2 + 2H2O = H4SiO4
log_k -2.71
delta_h 14 kJ
SiO2(am-ppt)
SiO2 + 2H2O = H4SiO4
log_k -2.74
delta_h 15.15 kJ
SnO
SnO + H2O = Sn(OH)2
log_k -4.9141
delta_h -0 kJ
SnO2
SnO2 + 4H2O = Sn(OH)6-2 + 2H+
log_k -28.9749
delta_h -0 kJ
Sn(OH)2
Sn(OH)2 = Sn(OH)2
log_k -5.4309
delta_h -0 kJ
Sn(OH)4
Sn(OH)4 + 2H2O = Sn(OH)6-2 + 2H+
log_k -22.2808
delta_h -0 kJ
H2Sn(OH)6
H2Sn(OH)6 = Sn(OH)6-2 + 2H+
log_k -23.5281
delta_h -0 kJ
Massicot
PbO + 2H+ = Pb+2 + H2O
log_k 12.894
delta_h -66.848 kJ
Litharge
PbO + 2H+ = Pb+2 + H2O
log_k 12.694
delta_h -65.501 kJ
PbO:0.3H2O
PbO:0.33H2O + 2H+ = Pb+2 + 1.33H2O
log_k 12.98
delta_h -0 kJ
Plattnerite
PbO2 + 4H+ + 2e- = Pb+2 + 2H2O
log_k 49.6001
delta_h -296.27 kJ
Pb(OH)2
Pb(OH)2 + 2H+ = Pb+2 + 2H2O

log_k 8.15
delta_h -58.5342 kJ
Pb2O(OH)2
Pb2O(OH)2 + 4H+ = 2Pb+2 + 3H2O
log_k 26.188
delta_h -0 kJ
Al(OH)3(am)
Al(OH)3 + 3H+ = Al+3 + 3H2O
log_k 10.8
delta_h -111 kJ
Boehmite
AlOOH + 3H+ = Al+3 + 2H2O
log_k 8.578
delta_h -117.696 kJ
Diaspore
AlOOH + 3H+ = Al+3 + 2H2O
log_k 6.873
delta_h -103.052 kJ
Gibbsite
Al(OH)3 + 3H+ = Al+3 + 3H2O
log_k 8.291
delta_h -95.3952 kJ
Tl2O
Tl2O + 2H+ = 2Tl+ + H2O
log_k 27.0915
delta_h -96.41 kJ
TlOH
TlOH + H+ = Tl+ + H2O
log_k 12.9186
delta_h -41.57 kJ
Avicennite
Tl2O3 + 3H2O = 2Tl(OH)3
log_k -13
delta_h -0 kJ
Tl(OH)3
Tl(OH)3 = Tl(OH)3
log_k -5.441
delta_h -0 kJ
Zn(OH)2(am)
Zn(OH)2 + 2H+ = Zn+2 + 2H2O
log_k 12.474
delta_h -80.62 kJ
Zn(OH)2
Zn(OH)2 + 2H+ = Zn+2 + 2H2O
log_k 12.2
delta_h -0 kJ
Zn(OH)2(beta)
Zn(OH)2 + 2H+ = Zn+2 + 2H2O
log_k 11.754
delta_h -83.14 kJ
Zn(OH)2(gamma)
Zn(OH)2 + 2H+ = Zn+2 + 2H2O
log_k 11.734
delta_h -0 kJ

Zn(OH)2(epsilon)
Zn(OH)2 + 2H+ = Zn+2 + 2H2O
log_k 11.534
delta_h -81.8 kJ
ZnO(active)
ZnO + 2H+ = Zn+2 + H2O
log_k 11.1884
delta_h -88.76 kJ
Zincite
ZnO + 2H+ = Zn+2 + H2O
log_k 11.334
delta_h -89.62 kJ
Cd(OH)2(am)
Cd(OH)2 + 2H+ = Cd+2 + 2H2O
log_k 13.73
delta_h -86.9017 kJ
Cd(OH)2
Cd(OH)2 + 2H+ = Cd+2 + 2H2O
log_k 13.644
delta_h -94.62 kJ
Monteponite
CdO + 2H+ = Cd+2 + H2O
log_k 15.1034
delta_h -103.4 kJ
Hg2(OH)2
Hg2(OH)2 + 2H+ = Hg2+2 + 2H2O
log_k 5.2603
delta_h -0 kJ
Montroydite
HgO + H2O = Hg(OH)2
log_k -3.64
delta_h -38.9 kJ
Hg(OH)2
Hg(OH)2 = Hg(OH)2
log_k -3.4963
delta_h -0 kJ
Cuprite
Cu2O + 2H+ = 2Cu+ + H2O
log_k -1.406
delta_h -124.02 kJ
Cu(OH)2
Cu(OH)2 + 2H+ = Cu+2 + 2H2O
log_k 8.674
delta_h -56.42 kJ
Tenorite
CuO + 2H+ = Cu+2 + H2O
log_k 7.644
delta_h -64.867 kJ
Ag2O
Ag2O + 2H+ = 2Ag+ + H2O
log_k 12.574
delta_h -45.62 kJ
Ni(OH)2
Ni(OH)2 + 2H+ = Ni+2 + 2H2O

log_k 12.794
delta_h -95.96 kJ
Bunsenite
NiO + 2H+ = Ni+2 + H2O
log_k 12.4456
delta_h -100.13 kJ
CoO
CoO + 2H+ = Co+2 + H2O
log_k 13.5864
delta_h -106.295 kJ
Co(OH)2
Co(OH)2 + 2H+ = Co+2 + 2H2O
log_k 13.094
delta_h -0 kJ
Co(OH)3
Co(OH)3 + 3H+ = Co+3 + 3H2O
log_k -2.309
delta_h -92.43 kJ
#Wustite-0.11
WUSTITE-0.11 + 2H+ = 0.947Fe+2 + H2O
log_k 11.6879
delta_h -103.938 kJ
Fe(OH)2
Fe(OH)2 + 2H+ = Fe+2 + 2H2O
log_k 13.564
delta_h -0 kJ
Ferrihydrite
Fe(OH)3 + 3H+ = Fe+3 + 3H2O
log_k 3.191
delta_h -73.374 kJ
Fe3(OH)8
Fe3(OH)8 + 8H+ = 2Fe+3 + Fe+2 + 8H2O
log_k 20.222
delta_h -0 kJ
Goethite
FeOOH + 3H+ = Fe+3 + 2H2O
log_k 0.491
delta_h -60.5843 kJ
Pyrolusite
MnO2 + 4H+ + 2e- = Mn+2 + 2H2O
log_k 41.38
delta_h -272 kJ
Birnessite
MnO2 + 4H+ + e- = Mn+3 + 2H2O
log_k 18.091
delta_h -0 kJ
Nsutite
MnO2 + 4H+ + e- = Mn+3 + 2H2O
log_k 17.504
delta_h -0 kJ
Pyrochroite
Mn(OH)2 + 2H+ = Mn+2 + 2H2O
log_k 15.194
delta_h -97.0099 kJ

Manganite
MnOOH + 3H+ + e- = Mn+2 + 2H2O
log_k 25.34
delta_h -0 kJ
Cr(OH)2
Cr(OH)2 + 2H+ = Cr+2 + 2H2O
log_k 10.8189
delta_h -35.6058 kJ
Cr(OH)3(am)
Cr(OH)3 + H+ = Cr(OH)2+ + H2O
log_k -0.75
delta_h -0 kJ
Cr(OH)3
Cr(OH)3 + H+ = Cr(OH)2+ + H2O
log_k 1.3355
delta_h -29.7692 kJ
CrO3
CrO3 + H2O = CrO4-2 + 2H+
log_k -3.2105
delta_h -5.2091 kJ
MoO3
MoO3 + H2O = MoO4-2 + 2H+
log_k -8
delta_h -0 kJ
VO
VO + 2H+ = V+3 + H2O + e-
log_k 14.7563
delta_h -113.041 kJ
V(OH)3
V(OH)3 + 3H+ = V+3 + 3H2O
log_k 7.591
delta_h -0 kJ
VO(OH)2
VO(OH)2 + 2H+ = VO+2 + 2H2O
log_k 5.1506
delta_h -0 kJ
Uraninite
UO2 + 4H+ = U+4 + 2H2O
log_k -4.6693
delta_h -77.86 kJ
UO2(am)
UO2 + 4H+ = U+4 + 2H2O
log_k 0.934
delta_h -109.746 kJ
UO3
UO3 + 2H+ = UO2+2 + H2O
log_k 7.7
delta_h -81.0299 kJ
Gummite
UO3 + 2H+ = UO2+2 + H2O
log_k 7.6718
delta_h -81.0299 kJ
UO2(OH)2(beta)
UO2(OH)2 + 2H+ = UO2+2 + 2H2O

log_k 5.6116
delta_h -56.7599 kJ
Schoepite
UO2(OH)2:H2O + 2H+ = UO2+2 + 3H2O
log_k 5.994
delta_h -49.79 kJ
Be(OH)2(am)
Be(OH)2 + 2H+ = Be+2 + 2H2O
log_k 7.194
delta_h -0 kJ
Be(OH)2(alpha)
Be(OH)2 + 2H+ = Be+2 + 2H2O
log_k 6.894
delta_h -0 kJ
Be(OH)2(beta)
Be(OH)2 + 2H+ = Be+2 + 2H2O
log_k 6.494
delta_h -0 kJ
Brucite
Mg(OH)2 + 2H+ = Mg+2 + 2H2O
log_k 16.844
delta_h -113.996 kJ
Periclase
MgO + 2H+ = Mg+2 + H2O
log_k 21.5841
delta_h -151.23 kJ
Mg(OH)2(active)
Mg(OH)2 + 2H+ = Mg+2 + 2H2O
log_k 18.794
delta_h -0 kJ
Lime
CaO + 2H+ = Ca+2 + H2O
log_k 32.6993
delta_h -193.91 kJ
Portlandite
Ca(OH)2 + 2H+ = Ca+2 + 2H2O
log_k 22.804
delta_h -128.62 kJ
Ba(OH)2:8H2O
Ba(OH)2:8H2O + 2H+ = Ba+2 + 10H2O
log_k 24.394
delta_h -54.32 kJ
Cu(SbO3)2
Cu(SbO3)2 + 6H+ + 4e- = 2Sb(OH)3 + Cu+2
log_k 45.2105
delta_h -0 kJ
Arsenolite
As4O6 + 6H2O = 4H3AsO3
log_k -2.76
delta_h 59.9567 kJ
Claudetite
As4O6 + 6H2O = 4H3AsO3
log_k -3.065
delta_h 55.6054 kJ

As2O5
As2O5 + 3H2O = 2H3AsO4
log_k 6.7061
delta_h -22.64 kJ
Pb2O3
Pb2O3 + 6H+ + 2e- = 2Pb+2 + 3H2O
log_k 61.04
delta_h -0 kJ
Minium
Pb3O4 + 8H+ + 2e- = 3Pb+2 + 4H2O
log_k 73.5219
delta_h -421.874 kJ
Al2O3
Al2O3 + 6H+ = 2Al+3 + 3H2O
log_k 19.6524
delta_h -258.59 kJ
Co3O4
Co3O4 + 8H+ = Co+2 + 2Co+3 + 4H2O
log_k -10.4956
delta_h -107.5 kJ
CoFe2O4
CoFe2O4 + 8H+ = Co+2 + 2Fe+3 + 4H2O
log_k -3.5281
delta_h -158.82 kJ
Magnetite
Fe3O4 + 8H+ = 2Fe+3 + Fe+2 + 4H2O
log_k 3.4028
delta_h -208.526 kJ
Hercynite
FeAl2O4 + 8H+ = Fe+2 + 2Al+3 + 4H2O
log_k 22.893
delta_h -313.92 kJ
Hematite
Fe2O3 + 6H+ = 2Fe+3 + 3H2O
log_k -1.418
delta_h -128.987 kJ
Maghemite
Fe2O3 + 6H+ = 2Fe+3 + 3H2O
log_k 6.386
delta_h -0 kJ
Lepidocrocite
FeOOH + 3H+ = Fe+3 + 2H2O
log_k 1.371
delta_h -0 kJ
Hausmannite
Mn3O4 + 8H+ + 2e- = 3Mn+2 + 4H2O
log_k 61.03
delta_h -421 kJ
Bixbyite
Mn2O3 + 6H+ = 2Mn+3 + 3H2O
log_k -0.6445
delta_h -124.49 kJ
Cr2O3
Cr2O3 + H2O + 2H+ = 2Cr(OH)2+

log_k -2.3576
delta_h -50.731 kJ
#V2O3
V2O3 + 3H+ = V+3 + 1.5H2O
log_k 4.9
delta_h -82.5085 kJ
V3O5
V3O5 + 4H+ = 3VO+2 + 2H2O + 2e-
log_k 1.8361
delta_h -98.46 kJ
#V2O4
V2O4 + 2H+ = VO+2 + H2O
log_k 4.27
delta_h -58.8689 kJ
V4O7
V4O7 + 6H+ = 4VO+2 + 3H2O + 2e-
log_k 7.1865
delta_h -163.89 kJ
V6O13
V6O13 + 2H+ = 6VO2+ + H2O + 4e-
log_k -60.86
delta_h 271.5 kJ
V2O5
V2O5 + 2H+ = 2VO2+ + H2O
log_k -1.36
delta_h 34 kJ
U4O9
U4O9 + 18H+ + 2e- = 4U+4 + 9H2O
log_k -3.0198
delta_h -426.87 kJ
U3O8
U3O8 + 16H+ + 4e- = 3U+4 + 8H2O
log_k 21.0834
delta_h -485.44 kJ
Spinel
MgAl2O4 + 8H+ = Mg+2 + 2Al+3 + 4H2O
log_k 36.8476
delta_h -388.012 kJ
Magnesioferrite
Fe2MgO4 + 8H+ = Mg+2 + 2Fe+3 + 4H2O
log_k 16.8597
delta_h -278.92 kJ
Natron
Na2CO3:10H2O = 2Na+ + CO3-2 + 10H2O
log_k -1.311
delta_h 65.8771 kJ
Cuprousferrite
CuFeO2 + 4H+ = Cu+ + Fe+3 + 2H2O
log_k -8.9171
delta_h -15.89 kJ
Cupricferrite
CuFe2O4 + 8H+ = Cu+2 + 2Fe+3 + 4H2O
log_k 5.9882
delta_h -210.21 kJ

FeCr2O4
FeCr2O4 + 4H+ = 2Cr(OH)2+ + Fe+2
log_k 7.2003
delta_h -140.4 kJ
MgCr2O4
MgCr2O4 + 4H+ = 2Cr(OH)2+ + Mg+2
log_k 16.2007
delta_h -179.4 kJ
SbF3
SbF3 + 3H2O = Sb(OH)3 + 3H+ + 3F-
log_k -10.2251
delta_h -6.7279 kJ
PbF2
PbF2 = Pb+2 + 2F-
log_k -7.44
delta_h 20 kJ
ZnF2
ZnF2 = Zn+2 + 2F-
log_k -0.5343
delta_h -59.69 kJ
CdF2
CdF2 = Cd+2 + 2F-
log_k -1.2124
delta_h -46.22 kJ
Hg2F2
Hg2F2 = Hg2+2 + 2F-
log_k -10.3623
delta_h -18.486 kJ
CuF
CuF = Cu+ + F-
log_k -4.9056
delta_h 16.648 kJ
CuF2
CuF2 = Cu+2 + 2F-
log_k 1.115
delta_h -66.901 kJ
CuF2:2H2O
CuF2:2H2O = Cu+2 + 2F- + 2H2O
log_k -4.55
delta_h -15.2716 kJ
AgF:4H2O
AgF:4H2O = Ag+ + F- + 4H2O
log_k 1.0491
delta_h 15.4202 kJ
CoF2
CoF2 = Co+2 + 2F-
log_k -1.5969
delta_h -57.368 kJ
CoF3
CoF3 = Co+3 + 3F-
log_k -1.4581
delta_h -123.692 kJ
CrF3
CrF3 + 2H2O = Cr(OH)2+ + 3F- + 2H+

log_k -11.3367
delta_h -23.3901 kJ
VF4
VF4 + H2O = VO+2 + 4F- + 2H+
log_k 14.93
delta_h -199.117 kJ
UF4
UF4 = U+4 + 4F-
log_k -29.5371
delta_h -79.0776 kJ
UF4:2.5H2O
UF4:2.5H2O = U+4 + 4F- + 2.5H2O
log_k -32.7179
delta_h 24.325 kJ
MgF2
MgF2 = Mg+2 + 2F-
log_k -8.13
delta_h -8 kJ
Fluorite
CaF2 = Ca+2 + 2F-
log_k -10.5
delta_h 8 kJ
SrF2
SrF2 = Sr+2 + 2F-
log_k -8.58
delta_h 4 kJ
BaF2
BaF2 = Ba+2 + 2F-
log_k -5.82
delta_h 4 kJ
Cryolite
Na3AlF6 = 3Na+ + Al+3 + 6F-
log_k -33.84
delta_h 38 kJ
SbCl3
SbCl3 + 3H2O = Sb(OH)3 + 3Cl- + 3H+
log_k 0.5719
delta_h -35.18 kJ
SnCl2
SnCl2 + 2H2O = Sn(OH)2 + 2H+ + 2Cl-
log_k -9.2752
delta_h -0 kJ
Cotunnite
PbCl2 = Pb+2 + 2Cl-
log_k -4.78
delta_h 26.166 kJ
Matlockite
PbClF = Pb+2 + Cl- + F-
log_k -8.9733
delta_h 33.19 kJ
Phosgenite
PbCl2:PbCO3 = 2Pb+2 + 2Cl- + CO3-2
log_k -19.81
delta_h -0 kJ

Laurionite
PbOHCl + H+ = Pb+2 + Cl- + H2O
log_k 0.623
delta_h -0 kJ
Pb2(OH)3Cl
Pb2(OH)3Cl + 3H+ = 2Pb+2 + 3H2O + Cl-
log_k 8.793
delta_h -0 kJ
TlCl
TlCl = Tl+ + Cl-
log_k -3.74
delta_h 41 kJ
ZnCl2
ZnCl2 = Zn+2 + 2Cl-
log_k 7.05
delta_h -72.5 kJ
Zn2(OH)3Cl
Zn2(OH)3Cl + 3H+ = 2Zn+2 + 3H2O + Cl-
log_k 15.191
delta_h -0 kJ
Zn5(OH)8Cl2
Zn5(OH)8Cl2 + 8H+ = 5Zn+2 + 8H2O + 2Cl-
log_k 38.5
delta_h -0 kJ
CdCl2
CdCl2 = Cd+2 + 2Cl-
log_k -0.6588
delta_h -18.58 kJ
CdCl2:1H2O
CdCl2:1H2O = Cd+2 + 2Cl- + H2O
log_k -1.6932
delta_h -7.47 kJ
CdCl2:2.5H2O
CdCl2:2.5H2O = Cd+2 + 2Cl- + 2.5H2O
log_k -1.913
delta_h 7.2849 kJ
CdOHCl
CdOHCl + H+ = Cd+2 + H2O + Cl-
log_k 3.5373
delta_h -30.93 kJ
Calomel
Hg2Cl2 = Hg2+2 + 2Cl-
log_k -17.91
delta_h 92 kJ
HgCl2
HgCl2 + 2H2O = Hg(OH)2 + 2Cl- + 2H+
log_k -21.2621
delta_h 107.82 kJ
Nantokite
CuCl = Cu+ + Cl-
log_k -6.73
delta_h 42.662 kJ
Melanothallite
CuCl2 = Cu+2 + 2Cl-

log_k 6.2572
delta_h -63.407 kJ
Atacamite
Cu2(OH)3Cl + 3H+ = 2Cu+2 + 3H2O + Cl-
log_k 7.391
delta_h -93.43 kJ
Cerargyrite
AgCl = Ag+ + Cl-
log_k -9.75
delta_h 65.2 kJ
CoCl2
CoCl2 = Co+2 + 2Cl-
log_k 8.2672
delta_h -79.815 kJ
CoCl2:6H2O
CoCl2:6H2O = Co+2 + 2Cl- + 6H2O
log_k 2.5365
delta_h 8.0598 kJ
(Co(NH3)6)Cl3
(Co(NH3)6)Cl3 + 6H+ = Co+3 + 6NH4+ + 3Cl-
log_k 20.0317
delta_h -33.1 kJ
(Co(NH3)5OH2)Cl3
(Co(NH3)5OH2)Cl3 + 5H+ = Co+3 + 5NH4+ + 3Cl- + H2O
log_k 11.7351
delta_h -25.37 kJ
(Co(NH3)5Cl)Cl2
(Co(NH3)5Cl)Cl2 + 5H+ = Co+3 + 5NH4+ + 3Cl-
log_k 4.5102
delta_h -10.74 kJ
Fe(OH)2.7Cl.3
Fe(OH)2.7Cl.3 + 2.7H+ = Fe+3 + 2.7H2O + 0.3Cl-
log_k -3.04
delta_h -0 kJ
MnCl2:4H2O
MnCl2:4H2O = Mn+2 + 2Cl- + 4H2O
log_k 2.7151
delta_h -10.83 kJ
CrCl2
CrCl2 = Cr+2 + 2Cl-
log_k 14.0917
delta_h -110.76 kJ
CrCl3
CrCl3 + 2H2O = Cr(OH)2+ + 3Cl- + 2H+
log_k 15.1145
delta_h -121.08 kJ
VCl2
VCl2 = V+3 + 2Cl- + e-
log_k 18.8744
delta_h -141.16 kJ
VCl3
VCl3 = V+3 + 3Cl-
log_k 23.4326
delta_h -179.54 kJ

VOCl
VOCl + 2H+ = V+3 + Cl- + H2O
log_k 11.1524
delta_h -104.91 kJ
VOCl2
VOCl2 = VO+2 + 2Cl-
log_k 12.7603
delta_h -117.76 kJ
VO2Cl
VO2Cl = VO2+ + Cl-
log_k 2.8413
delta_h -40.28 kJ
Halite
NaCl = Na+ + Cl-
log_k 1.6025
delta_h 3.7 kJ
SbBr3
SbBr3 + 3H2O = Sb(OH)3 + 3Br- + 3H+
log_k 0.9689
delta_h -20.94 kJ
SnBr2
SnBr2 + 2H2O = Sn(OH)2 + 2H+ + 2Br-
log_k -9.5443
delta_h -0 kJ
SnBr4
SnBr4 + 6H2O = Sn(OH)6-2 + 6H+ + 4Br-
log_k -28.8468
delta_h -0 kJ
PbBr2
PbBr2 = Pb+2 + 2Br-
log_k -5.3
delta_h 35.499 kJ
PbBrF
PbBrF = Pb+2 + Br- + F-
log_k -8.49
delta_h -0 kJ
TlBr
TlBr = Tl+ + Br-
log_k -5.44
delta_h 54 kJ
ZnBr2:2H2O
ZnBr2:2H2O = Zn+2 + 2Br- + 2H2O
log_k 5.2005
delta_h -30.67 kJ
CdBr2:4H2O
CdBr2:4H2O = Cd+2 + 2Br- + 4H2O
log_k -2.425
delta_h 30.5001 kJ
Hg2Br2
Hg2Br2 = Hg2+2 + 2Br-
log_k -22.25
delta_h 133 kJ
HgBr2
HgBr2 + 2H2O = Hg(OH)2 + 2Br- + 2H+

log_k -25.2734
delta_h 138.492 kJ
CuBr
CuBr = Cu+ + Br-
log_k -8.3
delta_h 54.86 kJ
Cu2(OH)3Br
Cu2(OH)3Br + 3H+ = 2Cu+2 + 3H2O + Br-
log_k 7.9085
delta_h -93.43 kJ
Bromyrite
AgBr = Ag+ + Br-
log_k -12.3
delta_h 84.5 kJ
(Co(NH3)6)Br3
(Co(NH3)6)Br3 + 6H+ = Co+3 + 6NH4+ + 3Br-
log_k 18.3142
delta_h -21.1899 kJ
(Co(NH3)5Cl)Br2
(Co(NH3)5Cl)Br2 + 5H+ = Co+3 + 5NH4+ + Cl- + 2Br-
log_k 5.0295
delta_h -6.4 kJ
CrBr3
CrBr3 + 2H2O = Cr(OH)2+ + 3Br- + 2H+
log_k 19.9086
delta_h -141.323 kJ
AsI3
AsI3 + 3H2O = H3AsO3 + 3I- + 3H+
log_k 4.2307
delta_h 3.15 kJ
SbI3
SbI3 + 3H2O = Sb(OH)3 + 3H+ + 3I-
log_k -0.538
delta_h 13.5896 kJ
PbI2
PbI2 = Pb+2 + 2I-
log_k -8.1
delta_h 62 kJ
TlI
TlI = Tl+ + I-
log_k -7.23
delta_h 75 kJ
ZnI2
ZnI2 = Zn+2 + 2I-
log_k 7.3055
delta_h -58.92 kJ
CdI2
CdI2 = Cd+2 + 2I-
log_k -3.5389
delta_h 13.82 kJ
Hg2I2
Hg2I2 = Hg2+2 + 2I-
log_k -28.34
delta_h 163 kJ

Coccinite
HgI2 + 2H2O = Hg(OH)2 + 2H+ + 2I-
log_k -34.9525
delta_h 210.72 kJ
HgI2:2NH3
HgI2:2NH3 + 2H2O = Hg(OH)2 + 2I- + 2NH4+
log_k -16.2293
delta_h 132.18 kJ
HgI2:6NH3
HgI2:6NH3 + 2H2O + 4H+ = Hg(OH)2 + 2I- + 6NH4+
log_k 33.7335
delta_h -90.3599 kJ
CuI
CuI = Cu+ + I-
log_k -12
delta_h 82.69 kJ
Iodyrite
AgI = Ag+ + I-
log_k -16.08
delta_h 110 kJ
(Co(NH3)6)I3
(Co(NH3)6)I3 + 6H+ = Co+3 + 6NH4+ + 3I-
log_k 16.5831
delta_h -9.6999 kJ
(Co(NH3)5Cl)I2
(Co(NH3)5Cl)I2 + 5H+ = Co+3 + 5NH4+ + Cl- + 2I-
log_k 5.5981
delta_h 0.66 kJ
CrI3
CrI3 + 2H2O = Cr(OH)2+ + 3I- + 2H+
log_k 20.4767
delta_h -134.419 kJ
Cerussite
PbCO3 = Pb+2 + CO3-2
log_k -13.13
delta_h 24.79 kJ
Pb2OCO3
Pb2OCO3 + 2H+ = 2Pb+2 + H2O + CO3-2
log_k -0.5578
delta_h -40.8199 kJ
Pb3O2CO3
Pb3O2CO3 + 4H+ = 3Pb+2 + CO3-2 + 2H2O
log_k 11.02
delta_h -110.583 kJ
Hydrocerussite
Pb3(OH)2(CO3)2 + 2H+ = 3Pb+2 + 2H2O + 2CO3-2
log_k -18.7705
delta_h -0 kJ
Pb10(OH)6O(CO3)6
Pb10(OH)6O(CO3)6 + 8H+ = 10Pb+2 + 6CO3-2 + 7H2O
log_k -8.76
delta_h -0 kJ
Tl2CO3
Tl2CO3 = 2Tl+ + CO3-2

log_k -3.8367
delta_h 35.49 kJ
Smithsonite
ZnCO3 = Zn+2 + CO3-2
log_k -10
delta_h -15.84 kJ
ZnCO3:1H2O
ZnCO3:1H2O = Zn+2 + CO3-2 + H2O
log_k -10.26
delta_h -0 kJ
Otavite
CdCO3 = Cd+2 + CO3-2
log_k -12
delta_h -0.55 kJ
Hg2CO3
Hg2CO3 = Hg2+2 + CO3-2
log_k -16.05
delta_h 45.14 kJ
Hg3O2CO3
Hg3O2CO3 + 4H2O = 3Hg(OH)2 + 2H+ + CO3-2
log_k -29.682
delta_h -0 kJ
CuCO3
CuCO3 = Cu+2 + CO3-2
log_k -11.5
delta_h -0 kJ
Malachite
Cu2(OH)2CO3 + 2H+ = 2Cu+2 + 2H2O + CO3-2
log_k -5.306
delta_h 76.38 kJ
Azurite
Cu3(OH)2(CO3)2 + 2H+ = 3Cu+2 + 2H2O + 2CO3-2
log_k -16.906
delta_h -95.22 kJ
Ag2CO3
Ag2CO3 = 2Ag+ + CO3-2
log_k -11.09
delta_h 42.15 kJ
NiCO3
NiCO3 = Ni+2 + CO3-2
log_k -6.87
delta_h -41.589 kJ
CoCO3
CoCO3 = Co+2 + CO3-2
log_k -9.98
delta_h -12.7612 kJ
Siderite
FeCO3 = Fe+2 + CO3-2
log_k -10.24
delta_h -16 kJ
Rhodochrosite
MnCO3 = Mn+2 + CO3-2
log_k -10.58
delta_h -1.88 kJ

Rutherfordine
UO2CO3 = UO2+2 + CO3-2
log_k -14.5
delta_h -3.03 kJ
Artinite
MgCO3:Mg(OH)2:3H2O + 2H+ = 2Mg+2 + CO3-2 + 5H2O
log_k 9.6
delta_h -120.257 kJ
Hydromagnesite
Mg5(CO3)4(OH)2:4H2O + 2H+ = 5Mg+2 + 4CO3-2 + 6H2O
log_k -8.766
delta_h -218.447 kJ
Magnesite
MgCO3 = Mg+2 + CO3-2
log_k -7.46
delta_h 20 kJ
Nesquehonite
MgCO3:3H2O = Mg+2 + CO3-2 + 3H2O
log_k -4.67
delta_h -24.2212 kJ
Aragonite
CaCO3 = Ca+2 + CO3-2
log_k -8.3
delta_h -12 kJ
Calcite
CaCO3 = Ca+2 + CO3-2
log_k -8.48
delta_h -8 kJ
Dolomite(ordered)
CaMg(CO3)2 = Ca+2 + Mg+2 + 2CO3-2
log_k -17.09
delta_h -39.5 kJ
Dolomite(disordered)
CaMg(CO3)2 = Ca+2 + Mg+2 + 2CO3-2
log_k -16.54
delta_h -46.4 kJ
Huntite
CaMg3(CO3)4 = 3Mg+2 + Ca+2 + 4CO3-2
log_k -29.968
delta_h -107.78 kJ
Strontianite
SrCO3 = Sr+2 + CO3-2
log_k -9.27
delta_h -0 kJ
Witherite
BaCO3 = Ba+2 + CO3-2
log_k -8.57
delta_h 4 kJ
Thermonatrite
Na2CO3:H2O = 2Na+ + CO3-2 + H2O
log_k 0.637
delta_h -10.4799 kJ
TlNO3
TlNO3 = Tl+ + NO3-

log_k -1.6127
delta_h 42.44 kJ
Zn(NO3)2:6H2O
Zn(NO3)2:6H2O = Zn+2 + 2NO3- + 6H2O
log_k 3.3153
delta_h 24.5698 kJ
Cu2(OH)3NO3
Cu2(OH)3NO3 + 3H+ = 2Cu+2 + 3H2O + NO3-
log_k 9.251
delta_h -72.5924 kJ
(Co(NH3)6)(NO3)3
(Co(NH3)6)(NO3)3 + 6H+ = Co+3 + 6NH4+ + 3NO3-
log_k 17.9343
delta_h 1.59 kJ
(Co(NH3)5Cl)(NO3)2
(Co(NH3)5Cl)(NO3)2 + 5H+ = Co+3 + 5NH4+ + Cl- + 2NO3-
log_k 6.2887
delta_h 6.4199 kJ
UO2(NO3)2
UO2(NO3)2 = UO2+2 + 2NO3-
log_k 12.1476
delta_h -83.3999 kJ
UO2(NO3)2:2H2O
UO2(NO3)2:2H2O = UO2+2 + 2NO3- + 2H2O
log_k 4.851
delta_h -25.355 kJ
UO2(NO3)2:3H2O
UO2(NO3)2:3H2O = UO2+2 + 2NO3- + 3H2O
log_k 3.39
delta_h -9.1599 kJ
UO2(NO3)2:6H2O
UO2(NO3)2:6H2O = UO2+2 + 2NO3- + 6H2O
log_k 2.0464
delta_h 20.8201 kJ
Pb(BO2)2
Pb(BO2)2 + 2H2O + 2H+ = Pb+2 + 2H3BO3
log_k 6.5192
delta_h -15.6119 kJ
Zn(BO2)2
Zn(BO2)2 + 2H2O + 2H+ = Zn+2 + 2H3BO3
log_k 8.29
delta_h -0 kJ
Cd(BO2)2
Cd(BO2)2 + 2H2O + 2H+ = Cd+2 + 2H3BO3
log_k 9.84
delta_h -0 kJ
Co(BO2)2
Co(BO2)2 + 2H2O + 2H+ = Co+2 + 2H3BO3
log_k 27.0703
delta_h -0 kJ
SnSO4
SnSO4 + 2H2O = Sn(OH)2 + 2H+ + SO4-2
log_k -56.9747
delta_h -0 kJ

Sn(SO4)2
Sn(SO4)2 + 6H2O = Sn(OH)6-2 + 6H+ + 2SO4-2
log_k -15.2123
delta_h -0 kJ
Larnakite
PbO:PbSO4 + 2H+ = 2Pb+2 + SO4-2 + H2O
log_k -0.4344
delta_h -21.83 kJ
Pb3O2SO4
Pb3O2SO4 + 4H+ = 3Pb+2 + SO4-2 + 2H2O
log_k 10.6864
delta_h -79.14 kJ
Pb4O3SO4
Pb4O3SO4 + 6H+ = 4Pb+2 + SO4-2 + 3H2O
log_k 21.8772
delta_h -136.45 kJ
Anglesite
PbSO4 = Pb+2 + SO4-2
log_k -7.79
delta_h 12 kJ
Pb4(OH)6SO4
Pb4(OH)6SO4 + 6H+ = 4Pb+2 + SO4-2 + 6H2O
log_k 21.1
delta_h -0 kJ
AlOHSO4
AlOHSO4 + H+ = Al+3 + SO4-2 + H2O
log_k -3.23
delta_h -0 kJ
Al4(OH)10SO4
Al4(OH)10SO4 + 10H+ = 4Al+3 + SO4-2 + 10H2O
log_k 22.7
delta_h -0 kJ
Tl2SO4
Tl2SO4 = 2Tl+ + SO4-2
log_k -3.7868
delta_h 33.1799 kJ
Zn2(OH)2SO4
Zn2(OH)2SO4 + 2H+ = 2Zn+2 + 2H2O + SO4-2
log_k 7.5
delta_h -0 kJ
Zn4(OH)6SO4
Zn4(OH)6SO4 + 6H+ = 4Zn+2 + 6H2O + SO4-2
log_k 28.4
delta_h -0 kJ
Zn3O(SO4)2
Zn3O(SO4)2 + 2H+ = 3Zn+2 + 2SO4-2 + H2O
log_k 18.9135
delta_h -258.08 kJ
Zincosite
ZnSO4 = Zn+2 + SO4-2
log_k 3.9297
delta_h -82.586 kJ
ZnSO4:1H2O
ZnSO4:1H2O = Zn+2 + SO4-2 + H2O

log_k -0.638
delta_h -44.0699 kJ
Bianchite
ZnSO4:6H2O = Zn+2 + SO4-2 + 6H2O
log_k -1.765
delta_h -0.6694 kJ
Goslarite
ZnSO4:7H2O = Zn+2 + SO4-2 + 7H2O
log_k -2.0112
delta_h 14.21 kJ
Cd3(OH)4SO4
Cd3(OH)4SO4 + 4H+ = 3Cd+2 + 4H2O + SO4-2
log_k 22.56
delta_h -0 kJ
Cd3(OH)2(SO4)2
Cd3(OH)2(SO4)2 + 2H+ = 3Cd+2 + 2H2O + 2SO4-2
log_k 6.71
delta_h -0 kJ
Cd4(OH)6SO4
Cd4(OH)6SO4 + 6H+ = 4Cd+2 + 6H2O + SO4-2
log_k 28.4
delta_h -0 kJ
CdSO4
CdSO4 = Cd+2 + SO4-2
log_k -0.1722
delta_h -51.98 kJ
CdSO4:1H2O
CdSO4:1H2O = Cd+2 + SO4-2 + H2O
log_k -1.7261
delta_h -31.5399 kJ
CdSO4:2.67H2O
CdSO4:2.67H2O = Cd+2 + SO4-2 + 2.67H2O
log_k -1.873
delta_h -17.9912 kJ
Hg2SO4
Hg2SO4 = Hg2+2 + SO4-2
log_k -6.13
delta_h 5.4 kJ
HgSO4
HgSO4 + 2H2O = Hg(OH)2 + SO4-2 + 2H+
log_k -9.4189
delta_h 14.6858 kJ
Cu2SO4
Cu2SO4 = 2Cu+ + SO4-2
log_k -1.95
delta_h -19.079 kJ
Antlerite
Cu3(OH)4SO4 + 4H+ = 3Cu+2 + 4H2O + SO4-2
log_k 8.788
delta_h -0 kJ
Brochantite
Cu4(OH)6SO4 + 6H+ = 4Cu+2 + 6H2O + SO4-2
log_k 15.222
delta_h -202.86 kJ

Langite
Cu4(OH)6SO4:H2O + 6H+ = 4Cu+2 + 7H2O + SO4-2
log_k 17.4886
delta_h -165.55 kJ
CuOCuSO4
CuOCuSO4 + 2H+ = 2Cu+2 + H2O + SO4-2
log_k 10.3032
delta_h -137.777 kJ
CuSO4
CuSO4 = Cu+2 + SO4-2
log_k 2.9395
delta_h -73.04 kJ
Chalcanthite
CuSO4:5H2O = Cu+2 + SO4-2 + 5H2O
log_k -2.64
delta_h 6.025 kJ
Ag2SO4
Ag2SO4 = 2Ag+ + SO4-2
log_k -4.82
delta_h 17 kJ
Ni4(OH)6SO4
Ni4(OH)6SO4 + 6H+ = 4Ni+2 + SO4-2 + 6H2O
log_k 32
delta_h -0 kJ
Retgersite
NiSO4:6H2O = Ni+2 + SO4-2 + 6H2O
log_k -2.04
delta_h 4.6024 kJ
Morenosite
NiSO4:7H2O = Ni+2 + SO4-2 + 7H2O
log_k -2.1449
delta_h 12.1802 kJ
CoSO4
CoSO4 = Co+2 + SO4-2
log_k 2.8024
delta_h -79.277 kJ
CoSO4:6H2O
CoSO4:6H2O = Co+2 + SO4-2 + 6H2O
log_k -2.4726
delta_h 1.0801 kJ
Melanterite
FeSO4:7H2O = Fe+2 + SO4-2 + 7H2O
log_k -2.209
delta_h 20.5 kJ
Fe2(SO4)3
Fe2(SO4)3 = 2Fe+3 + 3SO4-2
log_k -3.7343
delta_h -242.028 kJ
H-Jarosite
(H3O)Fe3(SO4)2(OH)6 + 5H+ = 3Fe+3 + 2SO4-2 + 7H2O
log_k -12.1
delta_h -230.748 kJ
Na-Jarosite
NaFe3(SO4)2(OH)6 + 6H+ = Na+ + 3Fe+3 + 2SO4-2 + 6H2O

log_k -11.2
delta_h -151.377 kJ
K-Jarosite
KFe3(SO4)2(OH)6 + 6H+ = K+ + 3Fe+3 + 2SO4-2 + 6H2O
log_k -14.8
delta_h -130.875 kJ
MnSO4
MnSO4 = Mn+2 + SO4-2
log_k 2.5831
delta_h -64.8401 kJ
Mn2(SO4)3
Mn2(SO4)3 = 2Mn+3 + 3SO4-2
log_k -5.711
delta_h -163.427 kJ
VOSO4
VOSO4 = VO+2 + SO4-2
log_k 3.6097
delta_h -86.7401 kJ
Epsomite
MgSO4:7H2O = Mg+2 + SO4-2 + 7H2O
log_k -2.1265
delta_h 11.5601 kJ
Anhydrite
CaSO4 = Ca+2 + SO4-2
log_k -4.36
delta_h -7.2 kJ
Gypsum
CaSO4:2H2O = Ca+2 + SO4-2 + 2H2O
log_k -4.61
delta_h 1 kJ
Celestite
SrSO4 = Sr+2 + SO4-2
log_k -6.62
delta_h 2 kJ
Barite
BaSO4 = Ba+2 + SO4-2
log_k -9.98
delta_h 23 kJ
Mirabilite
Na2SO4:10H2O = 2Na+ + SO4-2 + 10H2O
log_k -1.114
delta_h 79.4416 kJ
Thenardite
Na2SO4 = 2Na+ + SO4-2
log_k 0.3217
delta_h -9.121 kJ
K-Alum
KAl(SO4)2:12H2O = K+ + Al+3 + 2SO4-2 + 12H2O
log_k -5.17
delta_h 30.2085 kJ
Alunite
KAl3(SO4)2(OH)6 + 6H+ = K+ + 3Al+3 + 2SO4-2 + 6H2O
log_k -1.4
delta_h -210 kJ

(NH4)2CrO4
(NH4)2CrO4 = CrO4-2 + 2NH4+
log_k 0.4046
delta_h 9.163 kJ
PbCrO4
PbCrO4 = Pb+2 + CrO4-2
log_k -12.6
delta_h 44.18 kJ
Tl2CrO4
Tl2CrO4 = 2Tl+ + CrO4-2
log_k -12.01
delta_h 74.27 kJ
Hg2CrO4
Hg2CrO4 = Hg2+2 + CrO4-2
log_k -8.7
delta_h -0 kJ
CuCrO4
CuCrO4 = Cu+2 + CrO4-2
log_k -5.44
delta_h -0 kJ
Ag2CrO4
Ag2CrO4 = 2Ag+ + CrO4-2
log_k -11.59
delta_h 62 kJ
MgCrO4
MgCrO4 = CrO4-2 + Mg+2
log_k 5.3801
delta_h -88.9518 kJ
CaCrO4
CaCrO4 = Ca+2 + CrO4-2
log_k -2.2657
delta_h -26.945 kJ
SrCrO4
SrCrO4 = Sr+2 + CrO4-2
log_k -4.65
delta_h -10.1253 kJ
BaCrO4
BaCrO4 = Ba+2 + CrO4-2
log_k -9.67
delta_h 33 kJ
Li2CrO4
Li2CrO4 = CrO4-2 + 2Li+
log_k 4.8568
delta_h -45.2792 kJ
Na2CrO4
Na2CrO4 = CrO4-2 + 2Na+
log_k 2.9302
delta_h -19.6301 kJ
Na2Cr2O7
Na2Cr2O7 + H2O = 2CrO4-2 + 2Na+ + 2H+
log_k -9.8953
delta_h 22.1961 kJ
K2CrO4
K2CrO4 = CrO4-2 + 2K+

log_k -0.5134
delta_h 18.2699 kJ
K2Cr2O7
K2Cr2O7 + H2O = 2CrO4-2 + 2K+ + 2H+
log_k -17.2424
delta_h 80.7499 kJ
Hg2SeO3
Hg2SeO3 + H+ = Hg2+2 + HSeO3-
log_k -4.657
delta_h -0 kJ
HgSeO3
HgSeO3 + 2H2O = Hg(OH)2 + H+ + HSeO3-
log_k -12.43
delta_h -0 kJ
Ag2SeO3
Ag2SeO3 + H+ = 2Ag+ + HSeO3-
log_k -7.15
delta_h 39.68 kJ
CuSeO3:2H2O
CuSeO3:2H2O + H+ = Cu+2 + HSeO3- + 2H2O
log_k 0.5116
delta_h -36.861 kJ
NiSeO3:2H2O
NiSeO3:2H2O + H+ = HSeO3- + Ni+2 + 2H2O
log_k 2.8147
delta_h -31.0034 kJ
CoSeO3
CoSeO3 + H+ = Co+2 + HSeO3-
log_k 1.32
delta_h -0 kJ
Fe2(SeO3)3:2H2O
Fe2(SeO3)3:2H2O + 3H+ = 3HSeO3- + 2Fe+3 + 2H2O
log_k -20.6262
delta_h -0 kJ
Fe2(OH)4SeO3
Fe2(OH)4SeO3 + 5H+ = HSeO3- + 2Fe+3 + 4H2O
log_k 1.5539
delta_h -0 kJ
MnSeO3
MnSeO3 + H+ = Mn+2 + HSeO3-
log_k 1.13
delta_h -0 kJ
MnSeO3:2H2O
MnSeO3:2H2O + H+ = HSeO3- + Mn+2 + 2H2O
log_k 0.9822
delta_h 8.4935 kJ
MgSeO3:6H2O
MgSeO3:6H2O + H+ = Mg+2 + HSeO3- + 6H2O
log_k 3.0554
delta_h 5.23 kJ
CaSeO3:2H2O
CaSeO3:2H2O + H+ = HSeO3- + Ca+2 + 2H2O
log_k 2.8139
delta_h -19.4556 kJ

SrSeO3
SrSeO3 + H+ = Sr+2 + HSeO3-
log_k 2.3
delta_h -0 kJ
BaSeO3
BaSeO3 + H+ = Ba+2 + HSeO3-
log_k 1.83
delta_h 11.98 kJ
Na2SeO3:5H2O
Na2SeO3:5H2O + H+ = 2Na+ + HSeO3- + 5H2O
log_k 10.3
delta_h -0 kJ
PbSeO4
PbSeO4 = Pb+2 + SeO4-2
log_k -6.84
delta_h 15 kJ
Tl2SeO4
Tl2SeO4 = 2Tl+ + SeO4-2
log_k -4.1
delta_h 43 kJ
ZnSeO4:6H2O
ZnSeO4:6H2O = Zn+2 + SeO4-2 + 6H2O
log_k -1.52
delta_h -0 kJ
CdSeO4:2H2O
CdSeO4:2H2O = Cd+2 + SeO4-2 + 2H2O
log_k -1.85
delta_h -0 kJ
Ag2SeO4
Ag2SeO4 = 2Ag+ + SeO4-2
log_k -8.91
delta_h -43.5 kJ
CuSeO4:5H2O
CuSeO4:5H2O = Cu+2 + SeO4-2 + 5H2O
log_k -2.44
delta_h -0 kJ
NiSeO4:6H2O
NiSeO4:6H2O = Ni+2 + SeO4-2 + 6H2O
log_k -1.52
delta_h -0 kJ
CoSeO4:6H2O
CoSeO4:6H2O = Co+2 + SeO4-2 + 6H2O
log_k -1.53
delta_h -0 kJ
MnSeO4:5H2O
MnSeO4:5H2O = Mn+2 + SeO4-2 + 5H2O
log_k -2.05
delta_h -0 kJ
UO2SeO4:4H2O
UO2SeO4:4H2O = UO2+2 + SeO4-2 + 4H2O
log_k -2.25
delta_h -0 kJ
MgSeO4:6H2O
MgSeO4:6H2O = Mg+2 + SeO4-2 + 6H2O

log_k -1.2
delta_h -0 kJ
CaSeO4:2H2O
CaSeO4:2H2O = Ca+2 + SeO4-2 + 2H2O
log_k -3.02
delta_h -8.3 kJ
SrSeO4
SrSeO4 = Sr+2 + SeO4-2
log_k -4.4
delta_h 0.4 kJ
BaSeO4
BaSeO4 = Ba+2 + SeO4-2
log_k -7.46
delta_h 22 kJ
BeSeO4:4H2O
BeSeO4:4H2O = Be+2 + SeO4-2 + 4H2O
log_k -2.94
delta_h -0 kJ
Na2SeO4
Na2SeO4 = 2Na+ + SeO4-2
log_k 1.28
delta_h -0 kJ
K2SeO4
K2SeO4 = 2K+ + SeO4-2
log_k -0.73
delta_h -0 kJ
(NH4)2SeO4
(NH4)2SeO4 = 2NH4+ + SeO4-2
log_k 0.45
delta_h -0 kJ
H2MoO4
H2MoO4 = MoO4-2 + 2H+
log_k -12.8765
delta_h 49 kJ
PbMoO4
PbMoO4 = Pb+2 + MoO4-2
log_k -15.62
delta_h 53.93 kJ
Al2(MoO4)3
Al2(MoO4)3 = 3MoO4-2 + 2Al+3
log_k 2.3675
delta_h -260.8 kJ
Tl2MoO4
Tl2MoO4 = MoO4-2 + 2Tl+
log_k -7.9887
delta_h -0 kJ
ZnMoO4
ZnMoO4 = MoO4-2 + Zn+2
log_k -10.1254
delta_h -10.6901 kJ
CdMoO4
CdMoO4 = MoO4-2 + Cd+2
log_k -14.1497
delta_h 19.48 kJ

CuMoO4
CuMoO4 = MoO4-2 + Cu+2
log_k -13.0762
delta_h 12.2 kJ
Ag2MoO4
Ag2MoO4 = 2Ag+ + MoO4-2
log_k -11.55
delta_h 52.7 kJ
NiMoO4
NiMoO4 = MoO4-2 + Ni+2
log_k -11.1421
delta_h 1.3 kJ
CoMoO4
CoMoO4 = MoO4-2 + Co+2
log_k -7.7609
delta_h -23.3999 kJ
FeMoO4
FeMoO4 = MoO4-2 + Fe+2
log_k -10.091
delta_h -11.1 kJ
BeMoO4
BeMoO4 = MoO4-2 + Be+2
log_k -1.7817
delta_h -56.4 kJ
MgMoO4
MgMoO4 = Mg+2 + MoO4-2
log_k -1.85
delta_h -0 kJ
CaMoO4
CaMoO4 = Ca+2 + MoO4-2
log_k -7.95
delta_h -2 kJ
BaMoO4
BaMoO4 = MoO4-2 + Ba+2
log_k -6.9603
delta_h 10.96 kJ
Li2MoO4
Li2MoO4 = MoO4-2 + 2Li+
log_k 2.4416
delta_h -33.9399 kJ
Na2MoO4
Na2MoO4 = MoO4-2 + 2Na+
log_k 1.4901
delta_h -9.98 kJ
Na2MoO4:2H2O
Na2MoO4:2H2O = MoO4-2 + 2Na+ + 2H2O
log_k 1.224
delta_h -0 kJ
Na2Mo2O7
Na2Mo2O7 + H2O = 2MoO4-2 + 2Na+ + 2H+
log_k -16.5966
delta_h 56.2502 kJ
K2MoO4
K2MoO4 = MoO4-2 + 2K+

log_k 3.2619
delta_h -3.38 kJ
PbHPO4
PbHPO4 = Pb+2 + H+ + PO4-3
log_k -23.805
delta_h -0 kJ
Pb3(PO4)2
Pb3(PO4)2 = 3Pb+2 + 2PO4-3
log_k -43.53
delta_h -0 kJ
Pyromorphite
Pb5(PO4)3Cl = 5Pb+2 + 3PO4-3 + Cl-
log_k -84.43
delta_h -0 kJ
Hydroxylpyromorphite
Pb5(PO4)3OH + H+ = 5Pb+2 + 3PO4-3 + H2O
log_k -62.79
delta_h -0 kJ
Plumbgummite
PbAl3(PO4)2(OH)5:H2O + 5H+ = Pb+2 + 3Al+3 + 2PO4-3 + 6H2O
log_k -32.79
delta_h -0 kJ
Hinsdalite
PbAl3PO4SO4(OH)6 + 6H+ = Pb+2 + 3Al+3 + PO4-3 + SO4-2 + 6H2O
log_k -2.5
delta_h -0 kJ
Tsumebite
Pb2CuPO4(OH)3:3H2O + 3H+ = 2Pb+2 + Cu+2 + PO4-3 + 6H2O
log_k -9.79
delta_h -0 kJ
Zn3(PO4)2:4H2O
Zn3(PO4)2:4H2O = 3Zn+2 + 2PO4-3 + 4H2O
log_k -35.42
delta_h -0 kJ
Cd3(PO4)2
Cd3(PO4)2 = 3Cd+2 + 2PO4-3
log_k -32.6
delta_h -0 kJ
Hg2HPO4
Hg2HPO4 = Hg2+2 + H+ + PO4-3
log_k -24.775
delta_h -0 kJ
Cu3(PO4)2
Cu3(PO4)2 = 3Cu+2 + 2PO4-3
log_k -36.85
delta_h -0 kJ
Cu3(PO4)2:3H2O
Cu3(PO4)2:3H2O = 3Cu+2 + 2PO4-3 + 3H2O
log_k -35.12
delta_h -0 kJ
Ag3PO4
Ag3PO4 = 3Ag+ + PO4-3
log_k -17.59
delta_h -0 kJ

Ni3(PO4)2
Ni3(PO4)2 = 3Ni+2 + 2PO4-3
log_k -31.3
delta_h -0 kJ
CoHPO4
CoHPO4 = Co+2 + PO4-3 + H+
log_k -19.0607
delta_h -0 kJ
Co3(PO4)2
Co3(PO4)2 = 3Co+2 + 2PO4-3
log_k -34.6877
delta_h -0 kJ
Vivianite
Fe3(PO4)2:8H2O = 3Fe+2 + 2PO4-3 + 8H2O
log_k -36
delta_h -0 kJ
Strengite
FePO4:2H2O = Fe+3 + PO4-3 + 2H2O
log_k -26.4
delta_h -9.3601 kJ
Mn3(PO4)2
Mn3(PO4)2 = 3Mn+2 + 2PO4-3
log_k -23.827
delta_h 8.8701 kJ
MnHPO4
MnHPO4 = Mn+2 + PO4-3 + H+
log_k -25.4
delta_h -0 kJ
(VO)3(PO4)2
(VO)3(PO4)2 = 3VO+2 + 2PO4-3
log_k -25.1
delta_h -0 kJ
Mg3(PO4)2
Mg3(PO4)2 = 3Mg+2 + 2PO4-3
log_k -23.28
delta_h -0 kJ
MgHPO4:3H2O
MgHPO4:3H2O = Mg+2 + H+ + PO4-3 + 3H2O
log_k -18.175
delta_h -0 kJ
FCO3Apatite
Ca9.316Na0.36Mg0.144(PO4)4.8(CO3)1.2F2.48 = 9.316Ca+2 + 0.36Na+ + 0.144Mg+2 +
4.8PO4-3 + 1.2CO3-2 + 2.48F-
log_k -114.4
delta_h 164.808 kJ
Hydroxylapatite
Ca5(PO4)3OH + H+ = 5Ca+2 + 3PO4-3 + H2O
log_k -44.333
delta_h -0 kJ
CaHPO4:2H2O
CaHPO4:2H2O = Ca+2 + H+ + PO4-3 + 2H2O
log_k -18.995
delta_h 23 kJ
CaHPO4

CaHPO4 = Ca+2 + H+ + PO4-3
log_k -19.275
delta_h 31 kJ
Ca3(PO4)2(beta)
Ca3(PO4)2 = 3Ca+2 + 2PO4-3
log_k -28.92
delta_h 54 kJ
Ca4H(PO4)3:3H2O
Ca4H(PO4)3:3H2O = 4Ca+2 + H+ + 3PO4-3 + 3H2O
log_k -47.08
delta_h -0 kJ
SrHPO4
SrHPO4 = Sr+2 + H+ + PO4-3
log_k -19.295
delta_h -0 kJ
BaHPO4
BaHPO4 = Ba+2 + H+ + PO4-3
log_k -19.775
delta_h -0 kJ
U(HPO4)2:4H2O
U(HPO4)2:4H2O = U+4 + 2PO4-3 + 2H+ + 4H2O
log_k -51.584
delta_h 16.0666 kJ
(UO2)3(PO4)2
(UO2)3(PO4)2 = 3UO2+2 + 2PO4-3
log_k -49.4
delta_h 397.062 kJ
UO2HPO4
UO2HPO4 = UO2+2 + H+ + PO4-3
log_k -24.225
delta_h -0 kJ
Uramphite
(NH4)2(UO2)2(PO4)2 = 2UO2+2 + 2NH4+ + 2PO4-3
log_k -51.749
delta_h 40.5848 kJ
Przhevalskite
Pb(UO2)2(PO4)2 = 2UO2+2 + Pb+2 + 2PO4-3
log_k -44.365
delta_h -46.024 kJ
Torbernite
Cu(UO2)2(PO4)2 = 2UO2+2 + Cu+2 + 2PO4-3
log_k -45.279
delta_h -66.5256 kJ
Bassetite
Fe(UO2)2(PO4)2 = 2UO2+2 + Fe+2 + 2PO4-3
log_k -44.485
delta_h -83.2616 kJ
Saleeite
Mg(UO2)2(PO4)2 = 2UO2+2 + Mg+2 + 2PO4-3
log_k -43.646
delta_h -84.4331 kJ
Ningyoite
CaU(PO4)2:2H2O = U+4 + Ca+2 + 2PO4-3 + 2H2O
log_k -53.906

delta_h -9.4977 kJ
H-Autunite
H2(UO2)2(PO4)2 = 2UO2+2 + 2H+ + 2PO4-3
log_k -47.931
delta_h -15.0624 kJ
Autunite
Ca(UO2)2(PO4)2 = 2UO2+2 + Ca+2 + 2PO4-3
log_k -43.927
delta_h -59.9986 kJ
Sr-Autunite
Sr(UO2)2(PO4)2 = 2UO2+2 + Sr+2 + 2PO4-3
log_k -44.457
delta_h -54.6012 kJ
Na-Autunite
Na2(UO2)2(PO4)2 = 2UO2+2 + 2Na+ + 2PO4-3
log_k -47.409
delta_h -1.9246 kJ
K-Autunite
K2(UO2)2(PO4)2 = 2UO2+2 + 2K+ + 2PO4-3
log_k -48.244
delta_h 24.5182 kJ
Uranocircite
Ba(UO2)2(PO4)2 = 2UO2+2 + Ba+2 + 2PO4-3
log_k -44.631
delta_h -42.2584 kJ
Pb3(AsO4)2
Pb3(AsO4)2 + 6H+ = 3Pb+2 + 2H3AsO4
log_k 5.8
delta_h -0 kJ
AlAsO4:2H2O
AlAsO4:2H2O + 3H+ = Al+3 + H3AsO4 + 2H2O
log_k 4.8
delta_h -0 kJ
Zn3(AsO4)2:2.5H2O
Zn3(AsO4)2:2.5H2O + 6H+ = 3Zn+2 + 2H3AsO4 + 2.5H2O
log_k 13.65
delta_h -0 kJ
Cu3(AsO4)2:2H2O
Cu3(AsO4)2:2H2O + 6H+ = 3Cu+2 + 2H3AsO4 + 2H2O
log_k 6.1
delta_h -0 kJ
Ag3AsO3
Ag3AsO3 + 3H+ = 3Ag+ + H3AsO3
log_k 2.1573
delta_h -0 kJ
Ag3AsO4
Ag3AsO4 + 3H+ = 3Ag+ + H3AsO4
log_k -2.7867
delta_h -0 kJ
Ni3(AsO4)2:8H2O
Ni3(AsO4)2:8H2O + 6H+ = 3Ni+2 + 2H3AsO4 + 8H2O
log_k 15.7
delta_h -0 kJ
Co3(AsO4)2

Co3(AsO4)2 + 6H+ = 3Co+2 + 2H3AsO4
log_k 13.0341
delta_h -0 kJ
FeAsO4:2H2O
FeAsO4:2H2O + 3H+ = Fe+3 + H3AsO4 + 2H2O
log_k 0.4
delta_h -0 kJ
Mn3(AsO4)2:8H2O
Mn3(AsO4)2:8H2O + 6H+ = 3Mn+2 + 2H3AsO4 + 8H2O
log_k 12.5
delta_h -0 kJ
Ca3(AsO4)2:4H2O
Ca3(AsO4)2:4H2O + 6H+ = 3Ca+2 + 2H3AsO4 + 4H2O
log_k 22.3
delta_h -0 kJ
Ba3(AsO4)2
Ba3(AsO4)2 + 6H+ = 3Ba+2 + 2H3AsO4
log_k -8.91
delta_h 11.0458 kJ
#NH4VO3
NH4VO3 + 2H+ = 2VO2+ + H2O
log_k 3.8
delta_h 30 kJ
Pb3(VO4)2
Pb3(VO4)2 + 8H+ = 3Pb+2 + 2VO2+ + 4H2O
log_k 6.14
delta_h -72.6342 kJ
Pb2V2O7
Pb2V2O7 + 6H+ = 2Pb+2 + 2VO2+ + 3H2O
log_k -1.9
delta_h -26.945 kJ
AgVO3
AgVO3 + 2H+ = Ag+ + VO2+ + H2O
log_k 0.77
delta_h -0 kJ
Ag2HVO4
Ag2HVO4 + 3H+ = 2Ag+ + VO2+ + 2H2O
log_k 1.48
delta_h -0 kJ
Ag3H2VO5
Ag3H2VO5 + 4H+ = 3Ag+ + VO2+ + 3H2O
log_k 5.18
delta_h -0 kJ
Fe(VO3)2
Fe(VO3)2 + 4H+ = Fe+2 + 2VO2+ + 2H2O
log_k -3.72
delta_h -61.6722 kJ
Mn(VO3)2
Mn(VO3)2 + 4H+ = Mn+2 + 2VO2+ + 2H2O
log_k 4.9
delta_h -92.4664 kJ
Mg(VO3)2
Mg(VO3)2 + 4H+ = Mg+2 + 2VO2+ + 2H2O
log_k 11.28

delta_h -136.649 kJ
Mg2V2O7
Mg2V2O7 + 6H+ = 2Mg+2 + 2VO2+ + 3H2O
log_k 26.36
delta_h -255.224 kJ
Carnotite
KUO2VO4 + 4H+ = K+ + UO2+2 + VO2+ + 2H2O
log_k 0.23
delta_h -36.4008 kJ
Tyuyamunite
Ca(UO2)2(VO4)2 + 8H+ = Ca+2 + 2UO2+2 + 2VO2+ + 4H2O
log_k 4.08
delta_h -153.134 kJ
Ca(VO3)2
Ca(VO3)2 + 4H+ = Ca+2 + 2VO2+ + 2H2O
log_k 5.66
delta_h -84.7678 kJ
Ca3(VO4)2
Ca3(VO4)2 + 8H+ = 3Ca+2 + 2VO2+ + 4H2O
log_k 38.96
delta_h -293.466 kJ
Ca2V2O7
Ca2V2O7 + 6H+ = 2Ca+2 + 2VO2+ + 3H2O
log_k 17.5
delta_h -159.494 kJ
Ca3(VO4)2:4H2O
Ca3(VO4)2:4H2O + 8H+ = 3Ca+2 + 2VO2+ + 8H2O
log_k 39.86
delta_h -0 kJ
Ca2V2O7:2H2O
Ca2V2O7:2H2O + 6H+ = 2Ca+2 + 2VO2+ + 5H2O
log_k 21.552
delta_h -0 kJ
Ba3(VO4)2:4H2O
Ba3(VO4)2:4H2O + 8H+ = 3Ba+2 + 2VO2+ + 8H2O
log_k 32.94
delta_h -0 kJ
Ba2V2O7:2H2O
Ba2V2O7:2H2O + 6H+ = 2Ba+2 + 2VO2+ + 5H2O
log_k 15.872
delta_h -0 kJ
NaVO3
NaVO3 + 2H+ = Na+ + VO2+ + H2O
log_k 3.8582
delta_h -30.1799 kJ
Na3VO4
Na3VO4 + 4H+ = 3Na+ + VO2+ + 2H2O
log_k 36.6812
delta_h -184.61 kJ
Na4V2O7
Na4V2O7 + 6H+ = 4Na+ + 2VO2+ + 3H2O
log_k 37.4
delta_h -201.083 kJ
Halloysite

Al2Si2O5(OH)4 + 6H+ = 2Al+3 + 2H4SiO4 + H2O
log_k 9.5749
delta_h -181.43 kJ
Kaolinite
Al2Si2O5(OH)4 + 6H+ = 2Al+3 + 2H4SiO4 + H2O
log_k 7.435
delta_h -148 kJ
Greenalite
Fe3Si2O5(OH)4 + 6H+ = 3Fe+2 + 2H4SiO4 + H2O
log_k 20.81
delta_h -0 kJ
Chrysotile
Mg3Si2O5(OH)4 + 6H+ = 3Mg+2 + 2H4SiO4 + H2O
log_k 32.2
delta_h -196 kJ
Sepiolite
Mg2Si3O7.5OH:3H2O + 4H+ + 0.5H2O = 2Mg+2 + 3H4SiO4
log_k 15.76
delta_h -114.089 kJ
Sepiolite(A)
Mg2Si3O7.5OH:3H2O + 0.5H2O + 4H+ = 2Mg+2 + 3H4SiO4
log_k 18.78
delta_h -0 kJ
PHASES
O2(g)
O2 + 4H+ + 4e- = 2H2O
log_k 83.0894
delta_h -571.66 kJ
CH4(g)
CH4 + 3H2O = CO3-2 + 8e- + 10H+
log_k -41.0452
delta_h 257.133 kJ
CO2(g)
CO2 + H2O = 2H+ + CO3-2
log_k -18.147
delta_h 4.06 kJ
H2S(g)
H2S = H+ + HS-
log_k -8.01
delta_h -0 kJ
H2Se(g)
H2Se = HSe- + H+
log_k -4.96
delta_h -15.3 kJ
Hg(g)
Hg = 0.5Hg2+2 + e-
log_k -7.8733
delta_h 22.055 kJ
Hg2(g)
Hg2 = Hg2+2 + 2e-
log_k -14.9554
delta_h 58.07 kJ
Hg(CH3)2(g)
Hg(CH3)2 + 8H2O = Hg(OH)2 + 2CO3-2 + 16e- + 20H+

log_k -73.7066
delta_h 481.99 kJ
HgF(g)
HgF = 0.5Hg2+2 + F-
log_k 32.6756
delta_h -254.844 kJ
HgF2(g)
HgF2 + 2H2O = Hg(OH)2 + 2F- + 2H+
log_k 12.5652
delta_h -165.186 kJ
HgCl(g)
HgCl = 0.5Hg2+2 + Cl-
log_k 19.4966
delta_h -162.095 kJ
HgBr(g)
HgBr = 0.5Hg2+2 + Br-
log_k 16.7566
delta_h -142.157 kJ
HgBr2(g)
HgBr2 + 2H2O = Hg(OH)2 + 2Br- + 2H+
log_k -18.3881
delta_h 54.494 kJ
HgI(g)
HgI = 0.5Hg2+2 + I-
log_k 11.3322
delta_h -106.815 kJ
HgI2(g)
HgI2 + 2H2O = Hg(OH)2 + 2I- + 2H+
log_k -27.2259
delta_h 114.429 kJ
SURFACE_MASTER_SPECIES
Hfo_s Hfo_sOH
Hfo_w Hfo_wOH
Hao_ Hao_OH #hydrous aluminum oxides - gibbsite
SURFACE_SPECIES
Hfo_wOH = Hfo_wOH
log_k 0.0
Hfo_sOH = Hfo_sOH
log_k 0.0
Hao_OH = Hao_OH
log_k 0.0

Hfo_sOH + H+ = Hfo_sOH2+
log_k 7.29
delta_h 0 kJ
Id: 8113302
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH = Hfo_sO- + H+
log_k -8.93
delta_h 0 kJ
Id: 8113301
log K source:

Delta H source:
#T and ionic strength:
Hfo_wOH + H+ = Hfo_wOH2+
log_k 7.29
delta_h 0 kJ
Id: 8123302
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH = Hfo_wO- + H+
log_k -8.93
delta_h 0 kJ
Id: 8123301
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + Ba+2 = Hfo_sOHBa+2
log_k 5.46
delta_h 0 kJ
Id: 8111000
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + Ba+2 = Hfo_wOBa+ + H+
log_k -7.2
delta_h 0 kJ
Id: 8121000
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + Ca+2 = Hfo_sOHCa+2
log_k 4.97
delta_h 0 kJ
Id: 8111500
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + Ca+2 = Hfo_wOCa+ + H+
log_k -5.85
delta_h 0 kJ
Id: 8121500
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + Mg+2 = Hfo_wOMg+ + H+
log_k -4.6
delta_h 0 kJ
Id: 8124600
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + Ag+ = Hfo_sOAg + H+
log_k -1.72
delta_h 0 kJ

Id: 8110200
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + Ag+ = Hfo_wOAg + H+
log_k -5.3
delta_h 0 kJ
Id: 8120200
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + Ni+2 = Hfo_sONi+ + H+
log_k 0.37
delta_h 0 kJ
Id: 8115400
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + Ni+2 = Hfo_wONi+ + H+
log_k -2.5
delta_h 0 kJ
Id: 8125400
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + Cd+2 = Hfo_sOCd+ + H+
log_k 0.47
delta_h 0 kJ
Id: 8111600
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + Cd+2 = Hfo_wOCd+ + H+
log_k -2.9
delta_h 0 kJ
Id: 8121600
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + Co+2 = Hfo_sOCo+ + H+
log_k -0.46
delta_h 0 kJ
Id: 8112000
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + Co+2 = Hfo_wOCo+ + H+
log_k -3.01
delta_h 0 kJ
Id: 8122000
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + Zn+2 = Hfo_sOZn+ + H+

log_k 0.99
delta_h 0 kJ
Id: 8119500
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + Zn+2 = Hfo_wOZn+ + H+
log_k -1.99
delta_h 0 kJ
Id: 8129500
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + Cu+2 = Hfo_sOCu+ + H+
log_k 2.89
delta_h 0 kJ
Id: 8112310
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + Cu+2 = Hfo_wOCu+ + H+
log_k 0.6
delta_h 0 kJ
Id: 8123100
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + Pb+2 = Hfo_sOPb+ + H+
log_k 4.65
delta_h 0 kJ
Id: 8116000
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + Pb+2 = Hfo_wOPb+ + H+
log_k 0.3
delta_h 0 kJ
Id: 8126000
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + Be+2 = Hfo_sOBe+ + H+
log_k 5.7
delta_h 0 kJ
Id: 8111100
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + Be+2 = Hfo_wOBe+ + H+
log_k 3.3
delta_h 0 kJ
Id: 8121100
log K source:
Delta H source:

#T and ionic strength:
Hfo_sOH + Hg(OH)2 + H+ = Hfo_sOHg+ + 2H2O
log_k 13.95
delta_h 0 kJ
Id: 8113610
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + Hg(OH)2 + H+ = Hfo_wOHg+ + 2H2O
log_k 12.64
delta_h 0 kJ
Id: 8123610
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + Sn(OH)2 + H+ = Hfo_sOSn+ + 2H2O
log_k 15.1
delta_h 0 kJ
Id: 8117900
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + Sn(OH)2 + H+ = Hfo_wOSn+ + 2H2O
log_k 13
delta_h 0 kJ
Id: 8127900
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + Cr(OH)2+ = Hfo_sOCrOH+ + H2O
log_k 11.63
delta_h 0 kJ
Id: 8112110
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + H3AsO3 = Hfo_sH2AsO3 + H2O
log_k 5.41
delta_h 0 kJ
Id: 8110600
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + H3AsO3 = Hfo_wH2AsO3 + H2O
log_k 5.41
delta_h 0 kJ
Id: 8120600
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + H3BO3 = Hfo_sH2BO3 + H2O
log_k 0.62
delta_h 0 kJ
Id: 8110900

log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + H3BO3 = Hfo_wH2BO3 + H2O
log_k 0.62
delta_h 0 kJ
Id: 8120900
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + PO4-3 + 3H+ = Hfo_sH2PO4 + H2O
log_k 31.29
delta_h 0 kJ
Id: 8115800
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + PO4-3 + 3H+ = Hfo_wH2PO4 + H2O
log_k 31.29
delta_h 0 kJ
Id: 8125800
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + PO4-3 + 2H+ = Hfo_sHPO4- + H2O
log_k 25.39
delta_h 0 kJ
Id: 8115801
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + PO4-3 + 2H+ = Hfo_wHPO4- + H2O
log_k 25.39
delta_h 0 kJ
Id: 8125801
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + PO4-3 + H+ = Hfo_sPO4-2 + H2O
log_k 17.72
delta_h 0 kJ
Id: 8115802
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + PO4-3 + H+ = Hfo_wPO4-2 + H2O
log_k 17.72
delta_h 0 kJ
Id: 8125802
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + H3AsO4 = Hfo_sH2AsO4 + H2O
log_k 8.61

delta_h 0 kJ
Id: 8110610
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + H3AsO4 = Hfo_wH2AsO4 + H2O
log_k 8.61
delta_h 0 kJ
Id: 8120610
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + H3AsO4 = Hfo_sHAsO4- + H2O + H+
log_k 2.81
delta_h 0 kJ
Id: 8110611
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + H3AsO4 = Hfo_wHAsO4- + H2O + H+
log_k 2.81
delta_h 0 kJ
Id: 8120611
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + H3AsO4 = Hfo_sOHAsO4-3 + 3H+
log_k -10.12
delta_h 0 kJ
Id: 8110613
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + H3AsO4 = Hfo_wOHAsO4-3 + 3H+
log_k -10.12
delta_h 0 kJ
Id: 8120613
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + VO2+ + 2H2O = Hfo_sOHVO4-3 + 4H+
log_k -16.63
delta_h 0 kJ
Id: 8119031
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + VO2+ + 2H2O = Hfo_wOHVO4-3 + 4H+
log_k -16.63
delta_h 0 kJ
Id: 8129031
log K source:
Delta H source:
#T and ionic strength:

Hfo_sOH + SO4-2 + H+ = Hfo_sSO4- + H2O
log_k 7.78
delta_h 0 kJ
Id: 8117320
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + SO4-2 + H+ = Hfo_wSO4- + H2O
log_k 7.78
delta_h 0 kJ
Id: 8127320
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + SO4-2 = Hfo_sOHSO4-2
log_k 0.79
delta_h 0 kJ
Id: 8117321
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + SO4-2 = Hfo_wOHSO4-2
log_k 0.79
delta_h 0 kJ
Id: 8127321
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + HSeO3- = Hfo_sSeO3- + H2O
log_k 4.29
delta_h 0 kJ
Id: 8117610
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + HSeO3- = Hfo_wSeO3- + H2O
log_k 4.29
delta_h 0 kJ
Id: 8127610
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + HSeO3- = Hfo_sOHSeO3-2 + H+
log_k -3.23
delta_h 0 kJ
Id: 8117611
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + HSeO3- = Hfo_wOHSeO3-2 + H+
log_k -3.23
delta_h 0 kJ
Id: 8127611
log K source:

Delta H source:
#T and ionic strength:
Hfo_sOH + SeO4-2 + H+ = Hfo_sSeO4- + H2O
log_k 7.73
delta_h 0 kJ
Id: 8117620
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + SeO4-2 + H+ = Hfo_wSeO4- + H2O
log_k 7.73
delta_h 0 kJ
Id: 8127620
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + SeO4-2 = Hfo_sOHSeO4-2
log_k 0.8
delta_h 0 kJ
Id: 8117621
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + SeO4-2 = Hfo_wOHSeO4-2
log_k 0.8
delta_h 0 kJ
Id: 8127621
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + CrO4-2 + H+ = Hfo_sCrO4- + H2O
log_k 10.85
delta_h 0 kJ
Id: 8112120
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + CrO4-2 + H+ = Hfo_wCrO4- + H2O
log_k 10.85
delta_h 0 kJ
Id: 8122120
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + CrO4-2 = Hfo_sOHCrO4-2
log_k 3.9
delta_h 0 kJ
Id: 8112121
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + CrO4-2 = Hfo_wOHCrO4-2
log_k 3.9
delta_h 0 kJ

Id: 8122121
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + MoO4-2 + H+ = Hfo_sMoO4- + H2O
log_k 9.5
delta_h 0 kJ
Id: 8114800
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + MoO4-2 + H+ = Hfo_wMoO4- + H2O
log_k 9.5
delta_h 0 kJ
Id: 8124800
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + MoO4-2 = Hfo_sOHMoO4-2
log_k 2.4
delta_h 0 kJ
Id: 8114801
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + MoO4-2 = Hfo_wOHMoO4-2
log_k 2.4
delta_h 0 kJ
Id: 8124801
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + Sb(OH)6- + H+ = Hfo_sSbO(OH)4 + 2H2O
log_k 8.4
delta_h 0 kJ
Id: 8117410
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + Sb(OH)6- + H+ = Hfo_wSbO(OH)4 + 2H2O
log_k 8.4
delta_h 0 kJ
Id: 8127410
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + Sb(OH)6- = Hfo_sOHSbO(OH)4- + H2O
log_k 1.3
delta_h 0 kJ
Id: 8117411
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + Sb(OH)6- = Hfo_wOHSbO(OH)4- + H2O

log_k 1.3
delta_h 0 kJ
Id: 8127411
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + Cyanide- + H+ = Hfo_sCyanide + H2O
log_k 13
delta_h 0 kJ
Id: 8111430
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + Cyanide- + H+ = Hfo_wCyanide + H2O
log_k 13
delta_h 0 kJ
Id: 8121430
log K source:
Delta H source:
#T and ionic strength:
Hfo_sOH + Cyanide- = Hfo_sOHCyanide-
log_k 5.7
delta_h 0 kJ
Id: 8111431
log K source:
Delta H source:
#T and ionic strength:
Hfo_wOH + Cyanide- = Hfo_wOHCyanide-
log_k 5.7
delta_h 0 kJ
Id: 8121431
log K source:
Delta H source:
#T and ionic strength:
#Additions from GWB Minteq
Hfo_wOH + H4SiO4 = Hfo_wOSi(OH)3 + H2O
log_k 4.28
delta_h 0 kJ
Hfo_wOH + H4SiO4 = Hfo_wOSiO(OH)2- + H+ + H2O
log_k -3.22
delta_h 0 kJ
Hfo_sOH + H4SiO4 = Hfo_sOSi(OH)3 + H2O
log_k 4.28
delta_h 0
Hfo_sOH + H4SiO4 = Hfo_sOSiO(OH)2- + H+ + H2O
log_k -3.22
delta_h 0
Hfo_wOH + CO3-2 + H+ = Hfo_wCO3- + H2O
log_k 12.56
delta_h 0
Hfo_wOH + CO3-2 + 2H+= Hfo_wHCO3 + H2O
log_k 20.62
delta_h 0
Hfo_sOH + CO3-2 + H+ = Hfo_sCO3- + H2O

log_k 12.56
delta_h 0
Hfo_sOH + CO3-2 + 2H+= Hfo_sHCO3 + H2O
log_k 20.62
delta_h 0

#Karamalidis and Dzombak sorption to gibbsite (hao) as compiled in Cravotta 2021 (https://doi.org/10.1016/j.apgeochem.2020.104845) Table S4 unless otherwise noted
Hao_OH + Cu+2 = Hao_OCu+ + H+
log_k 0.25
Hao_OH + Pb+2 = Hao_OPb+ + H+
log_k 0.37
Hao_OH + Co+2 = Hao_OCo+ + H+
log_k -2.52
Hao_OH + Cd+2 = Hao_OCd+ + H+
log_k -2.73
Hao_OH + Mn+2 = Hao_OMn+ + H+
log_k -5.49
Hao_OH + Fe+2 = Hao_OFe+ + H+
log_k -3.77
Hao_OH + Ca+2 = Hao_OCa+ + H+
log_k -10.49
Hao_OH + Mg+2 = Hao_OMg+ + H+
log_k -5.93
Hao_OH + Ba+2 = Hao_OBa+ + H+
log_k -8.5
Hao_OH + Sr+2 = Hao_OSr+ + H+
log_k -8.26
Hao_OH + Zn+2 = Hao_OZn+ + H+
log_k -0.96
Hao_OH + PO4-3 + 3 H+ = Hao_H2PO4 + H2O
log_k 26.89
Hao_OH + PO4-3 + 2H+ = Hao_HPO4- + H2O
log_k 19.37
Hao_OH + PO4-3 + H+ = Hao_PO4-2 + H2O
log_k 13.57
#Hao_OH + SO4-2 + H+ = Hao_SO4- + H2O
log_k -0.45
#Hao_OH + SO4-2 = Hao_OHSO4-2
log_k 1.19
Hao_OH + F- + H+ = Hao_F + H2O
log_k 8.78
Hao_OH + F- = Hao_OHF-
log_k 2.88
Hao_OH + 2 F- + H+ = Hao_F2- + H2O
log_k 11.94
Hao_OH + H4SiO4 = Hao_OH4SiO4- + H+
log_k -4.16

#Modified value from Goldberg and Glaubig (1985)
Hao_OH + H3BO3 = Hao_H2BO3 + H2O
Log_k 4.83
Hao_OH + H3BO3 = Hao_H3BO4- + H+
Log_k -7.40

#Modified value from Kitadai et al. (2018)

```
Hao_OH + SO4-2 + H+ = Hao_SO4- + H2O
log_k 2.4
#Modified value from Kitadai et al. (2018)
Hao_OH + SO4-2 = Hao_OHSO4-2
log_k 7.5

END
```

ATTACHMENT C

ATTACHMENT C. DETAILS OF GEOCHEMICAL MODEL PARAMETERIZATION

INTRODUCTION

This appendix to the Groundwater Polishing Report for the Edwards Power Plant Ash Pond provides detailed information regarding geochemical model parameterization. The information provided includes sources of thermodynamic data, sources of data used in model parameterization, summarized values, and calculation methods. All data is fully documented in the Nature and Extent Report[1].

SOLID PHASE INPUTS

The solid phase inputs to the model included iron (hydr)oxides and aluminum (hydr)oxides. These phases tend to have relatively rapid precipitation kinetics and form an outer layer on the surfaces of aquifer solids, creating surface area for sorption and attenuation of boron and sulfate. Input concentrations for iron and aluminum (hydr)oxides were derived using sequential extraction procedure (SEP) data. SEP methods are described in the Geochemical Conceptual Site Model (GCSM)[2] Section 4 and employ chemical extractants to dissolve metals from specific solid-associated phases. SEP methods use progressively stronger reagents to solubilize metals from increasingly recalcitrant phases. Although these procedures do not identify the discrete solid phases in a soil/aquifer matrix, they provide a means to evaluate and characterize the metal binding mechanisms and relative stability of metals in each phase, and to estimate the available mass of the respective attenuating phase(s) (i.e., aluminum and iron [hydr]oxide). As described in the GCSM, the SEP used for these samples included a more reactive non-crystalline metal oxide fraction and a less reactive metal hydroxide fraction.

Sorption of inorganic constituents to iron (hydr)oxides in the MINTEQ v4 database[3] is represented by the hydrous ferric oxide (HFO) thermodynamic data set presented in Dzombak and Morel (1990). HFO is a non-crystalline iron hydroxide phase with high surface area. Therefore, the mass of iron extracted in the non-crystalline SEP fraction is used in the HFO model input. Crystalline metal oxides are also capable of sorbing inorganic constituents although they typically have a lower surface area available for sorption. Because magnetite was observed in X-ray diffraction (XRD) results from site, 10% of the iron concentration (which represents the lower surface area, consistent with Appelo and Postma, 2005) from the metal hydroxide fraction was included in the HFO model input.

Sorption of inorganic constituents to aluminum (hydr)oxides is represented by the hydrous aluminum oxide (HAO) thermodynamic data presented in Karamalidis and Dzombak (2010), Goldberg and Glaubig (1985) (boron), and Kitadai et al. (2018) (sulfate). These sorption data are based on gibbsite, a nearly ubiquitous crystalline aluminum hydroxide mineral (Karamalidis and Dzombak 2010). Because gibbsite is a more crystalline hydroxide, the mass of aluminum extracted in the crystalline SEP fraction is used in the HAO input in the model.

SEP data were available from four solid phase samples for the Uppermost Aquifer (UA) and two solid phase samples were available from the Potential Migration Pathway (PMP). In thermodynamic modeling,

[1] The Nature and Extent Report was previously submitted to IEPA (Ramboll 2024) and provided as Appendix D of the CAAA to which this report is attached.

[2] Ibid.; the GCSM is an appendix of the Nature and Extent Report.

[3] The default MINTEQ v4 database for PHREEQC does not include sorption data for carbonate and silicate to HFO. Thermodynamic constants for sorption of carbonate and silicate to HFO were added from the MINTEQ database associated with the Geochemist's Workbench software program.

the amount of sorbing phase present is one of the dominant controls on the concentration of constituents sorbed. Therefore, different amounts of metal oxides were used to test the sensitivity of the model to the amount of sorbing phase present. The amount of metal oxides used were based on the 25th percentile, median (i.e., 50th percentile), and 75th percentile of the SEP results for iron and aluminum.

The quantities of HFO and HAO in the model are represented by ferrihydrite and gibbsite, respectively. Ferrihydrite is the most similar naturally occurring iron oxide to HFO (Dzombak and Morel, 1990), and sorption data for HAO was determined using gibbsite (Karamalidis and Dzombak 2010). SEP results were used to calculate the quantities of HFO and HAO because there are often environmentally relevant masses of iron and aluminum (hydr)oxides within solids that are not sufficiently crystalline to be characterized by other methods (e.g. X-ray diffraction [XRD]). Additionally, the SEP analysis can detect a much lower constituent concentration than is typically attainable by XRD. SEP metal concentrations are presented in milligrams per kilogram of dry weight (mg/kg dw), whereas ferrihydrite and gibbsite inputs to the model represent moles of solid phase associated with one liter of aqueous phase. The concentrations of iron and aluminum reported in SEP results (**Table C-1**) were converted to moles of ferrihydrite and gibbsite (respectively) according to the following:

The mass in kilograms (kg) of solid in the model (i.e., per 1 liter [L] of water) was calculated by:

$$Solid\ Mass\ In\ Model\ (kg) = \frac{(1-\phi)}{\phi} \times \frac{1000\ cm^3\ water}{L\ water} \times 1\ L\ water\ \times \rho\ (\frac{g}{cm^3})\ \times \frac{1\ kg\ solid}{1000\ g\ solid}$$

Where:

ϕ = porosity (water volume in cubic centimeters (cm^3) / total volume in cm^3)

ρ = Density of the solid (grams (g)/cm^3)

Porosity and density (**Table C-1**) represent the median of measurements each hydrostratigraphic unit as reported in the Hydrogeologic Characterization Report[4].

Moles of ferrihydrite and gibbsite were determined using the SEP concentration as described above, the molar mass of iron or aluminum, and the mass of solid phase in the model:

$$Moles\ of\ Metal\ Oxide = \frac{mg\ Fe\ or\ Al}{kg\ solid} \times \frac{g}{1000\ mg} \times \frac{moles\ Fe\ or\ Al}{g\ Fe\ or\ Al} \times kg\ solid\ mass\ in\ model$$

The moles of ferrihydrite and gibbsite are represented by moles of Fe or Al (respectively) in a 1:1 ratio based on the mineral formula. Ferrihydrite and gibbsite were allowed to precipitate or dissolve in the flushing phase of the model to evaluate the impact of closure on sorbing phase availability.

Barite and gypsum are common sulfate minerals that have the potential to form under ambient environmental conditions. Neither mineral was detected in XRD results for the site. Therefore, barite and gypsum did not have initial concentrations in the model but were allowed to precipitate or dissolve during flushing.

AQUEOUS INPUTS

[4] The Hydrogeologic Characterization Report was previously submitted to IEPA as part of the Closure Permit Application and is provided as Appendix B.2 to the Construction Permit Application.

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In addition to the COCs, the following parameters are included in the model and are anticipated to capture the expected attenuation and mobilization mechanisms for reasons detailed below:

- Temperature, pH and pe: pH and pe (a measure of redox potential) are major controls on chemical attenuation and mobility.
- Chloride, potassium, and sodium: Major ions in groundwater typically required for the model to reach charge balance.
- Carbonate, calcium, magnesium, sulfate: Major ions in groundwater that may also form common minerals, including carbonates. Carbonate mineral formation and dissolution is often a major control on groundwater pH. Bicarbonate and carbonate ions, a major component of groundwater alkalinity, may also compete with sulfate/boron for sorbing sites.
- Silicon and phosphate: Silicate (silicon oxide) and phosphate are oxyanions that compete with sulfate/boron for sorbing sites.
- Aluminum, iron, and manganese: As discussed above, iron and aluminum form reactive metal (hydr)oxide minerals which have high capacities for sorbing other ions on their surfaces. Although sorption to manganese oxides was not considered in this model, manganese behaves similarly to iron and is included for completeness.
- Remaining constituents regulated under 35 IAC § 845.600[5]: Although these parameters are not subject to corrective action at EDW AP, they are included in the model for completeness to assess reactions such as competition for available adsorption sites.

Values for pe (derived from ORP) and carbonate ion concentrations were calculated from values previously reported in the analytical data according to the following methods.

Groundwater ORP is used to calculate pe, a non-dimension scale of redox potential. First, the field-measured ORP was converted to Eh, the redox potential normalized to the standard hydrogen electrode. The following equation provided in the Horiba water quality meter instruction manual[6] was used:

$$Eh = ORP + 206 - 0.7*(T - 25)$$

Where both Eh and ORP are in volts (V) and T is temperature in degrees Celsius. Eh is then converted to pe:

$$pe = (Eh * F) / (2.303 * R * T)$$

Where:

F = Faraday constant (96,500 Joules (J) / V-equivalent)

R = Molar gas constant (8.31 J / Kelvin (K)-mole)

T = temperature in Kelvin

Data reported for groundwater at the site included carbonate and bicarbonate alkalinity in units of mg of calcium carbonate per liter (mg $CaCO_3$/L). For use in modeling, it is convenient to convert these values to a single carbonate (CO_3^{2-}) ion concentration. Because carbonate and bicarbonate alkalinity are reported in the same units (i.e., standardized to mg $CaCO_3$) and represent different protonation states of the same inorganic carbon oxyanion, they were summed to represent total alkalinity due to carbonate. This summed alkalinity was converted to concentration of carbonate ion according to the following equation:

[5] Mercury, thallium, total dissolved solids, and radium were not included in the model. Mercury reactions within the environment are highly complex and would require a separate modeling effort. Thallium forms a non-reactive monovalent cation and is rarely detected in the groundwater and is therefore not expected to contribute to model outcomes. Total dissolved solids are not a chemical parameter, but rather the result of other chemical abundances taken together. Radium is not included in most thermodynamic databases.

[6] https://static.horiba.com/fileadmin/Horiba/Products/Process_and_Environmental/Water_Pollution/Instruction_Manuals/U-50/U-50_Manual.pdf

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$$\frac{mg\ CO_3^{2-}}{L} = \frac{mg\ CaCO_3}{L} \times \frac{mole\ CaCO_3}{100.1\ mg\ CaCO_3} \times \frac{1\ mole\ CO_3^{2-}}{1\ mole\ CaCO_3} \times \frac{60\ mg\ CO_3^{2-}}{mole\ CO_3^{2-}}$$

The full suite of geochemical parameters for this model was measured in Quarter 2 and Quarter 3, 2023. The median values of these results were used in the model to represent average groundwater interacting with the solid phase. For downgradient wells the median for each parameter was calculated for each location individually. For background wells, a single median for each parameter was calculated using data from both background locations.

The charge imbalance of the initial solution was less than 30% for all samples. The results presented in the Groundwater Polishing Report represent the model results using charge balancing on chloride.

REFERENCES

Appelo C.A.J. and Postma D. 2010. Geochemistry, Groundwater, and Pollution. 2nd Edition. A.A. Balkema Publishers, member of Taylor & Francis Group. The Netherlands.

Dzombak D.A. and Morel F.M.M. 1990. Surface Complexation Modeling: Hydrous Ferric Oxide. John Wiley & Sons, New York.

Goldberg S. and Glaubig R.A. 1985. Boron Adsorption on Aluminum and Iron Oxide Minerals. *Soil Science Society of America Journal* **49**(6):1374-1379.

Karamalidis A.K. and Dzombak D.A. 2010. Surface Complexation Modeling: Gibbsite. John Wiley & Sons, New York.

Kitadai N., Nishiuchi K, and Tanaka M. 2018. A comprehensive predictive model for sulfate adsorption on oxide minerals. *Geochimica et Cosmochimica Acta* **238**:150-168.

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Table C-1. Summary of Solid Phase Parameters
Attachment C. Details of Geochemical Model Parameterization
Edwards Ash Pond
Edwards Power Plant
Bartonville, IL

Hydrostratigraphic Unit	Porosity	Dry Density (g/cm3)	Solid Mass In Model (kg)	Metal Summary Statistic	Iron		Aluminum	
					mg/kg	moles	mg/kg	moles
PMP[1]	0.49	1.37	1.43	25th Percentile	1573	0.04	2525	0.13
				Median	2015	0.05	3450	0.18
				75th Percentile	2458	0.06	4375	0.23
UA[2]	0.44	1.50	1.91	25th Percentile	5490	0.19	2200	0.16
				Median	6600	0.23	3000	0.21
				75th Percentile	7000	0.24	3675	0.26

Notes:
1. Table 2-1 in 2021 HCR; includes samples from AP07S and AW-15S
2. Table 2-1 in 2021 HCR; includes samples from AW-05, AW-19, and AW-21
g/cm^3 = grams per cubic centimeter
kg = kilograms
mg/kg = milligrams per kilogram dry weight

ATTACHMENT D

Attachment D. PHREEQC modeling output
Groundwater Polishing Report
Ash Pond
Edwards Power Plant
Bartonville, IL

Location	Location Description	Model	Charge Balance	Solids Summary	pH	pe	charge	pct_err	S(6)	B	Li	As	C(4)	Cl
AP07S	C - PMP	Initial Soln	TRUE	25p	6.88	4.49	-1.02e-10	-3.05e-07	0.00375	0.00127	1.07e-06	9.65e-09	0.00425	0.00817
AW-15S	C - PMP	Initial Soln	TRUE	25p	6.79	3.68	3.29e-14	8.57e-11	0.00605	0.000574	1.95e-06	4.61e-09	0.00511	0.00723
AW-05	C - UA	Initial Soln	TRUE	25p	6.99	4.57	8.21e-15	2.50e-11	0.00422	0.000565	2.45e-06	5.21e-08	0.00400	0.00716
AW-19	C - UA	Initial Soln	TRUE	25p	6.71	2.69	6.80e-18	2.71e-14	0.000557	0.000241	1.66e-06	1.80e-07	0.00485	0.00837
AW-21	C - UA	Initial Soln	TRUE	25p	6.83	4.53	-4.57e-12	-2.25e-08	0.00271	0.000958	6.42e-07	1.43e-08	0.00185	0.00454
AP07S	C - PMP	Speciation Model	TRUE	25p	6.88	4.49	-1.02e-10	-3.05e-07	0.00375	0.00127	1.07e-06	9.65e-09	0.00425	0.00817
AW-15S	C - PMP	Speciation Model	TRUE	25p	6.79	3.68	3.29e-14	8.56e-11	0.00605	0.000574	1.95e-06	4.61e-09	0.00511	0.00723
AW-05	C - UA	Speciation Model	TRUE	25p	6.99	4.57	1.00e-14	3.05e-11	0.00422	0.000565	2.45e-06	5.21e-08	0.00400	0.00716
AW-19	C - UA	Speciation Model	TRUE	25p	6.71	2.69	5.28e-18	2.11e-14	0.000557	0.000241	1.66e-06	1.80e-07	0.00485	0.00837
AW-21	C - UA	Speciation Model	TRUE	25p	6.83	4.53	-4.60e-12	-2.26e-08	0.00271	0.000958	6.42e-07	1.43e-08	0.00185	0.00454
AP07S	C - PMP	First Reaction	TRUE	25p	6.98	0.440	-8.13e-05	-2.50e-01	6.93e-05	0.000298	2.88e-06	2.57e-08	0.00788	0.00996
AP07S	C - PMP	Second Reaction	TRUE	25p	6.97	0.114	-4.02e-05	-1.23e-01	1.12e-05	0.000185	2.88e-06	4.47e-08	0.00806	0.00996
AW-15S	C - PMP	First Reaction	TRUE	25p	6.96	0.713	-1.22e-04	-3.69e-01	0.000139	0.000230	2.88e-06	8.08e-09	0.00815	0.00996
AW-15S	C - PMP	Second Reaction	TRUE	25p	6.97	0.282	-4.84e-05	-1.48e-01	2.22e-05	0.000160	2.88e-06	1.23e-08	0.00814	0.00996
AW-05	C - UA	First Reaction	TRUE	25p	7.04	0.341	6.94e-05	0.219	0.000226	0.000230	2.88e-06	1.01e-07	0.00683	0.00995
AW-05	C - UA	Second Reaction	TRUE	25p	7.01	0.142	-8.77e-05	-2.75e-01	3.99e-05	0.000151	2.88e-06	1.46e-07	0.00747	0.00996
AW-19	C - UA	First Reaction	TRUE	25p	6.95	0.356	0.000298	0.896	7.01e-05	0.000156	2.88e-06	4.95e-07	0.00824	0.00996
AW-19	C - UA	Second Reaction	TRUE	25p	6.96	0.226	-1.48e-05	-4.48e-02	2.64e-05	0.000122	2.88e-06	5.52e-07	0.00822	0.00996
AW-21	C - UA	First Reaction	TRUE	25p	7.09	0.392	0.000351	1.11	0.000462	0.000441	2.88e-06	6.60e-08	0.00599	0.00995
AW-21	C - UA	Second Reaction	TRUE	25p	7.04	0.214	-1.07e-04	-3.42e-01	4.74e-05	0.000217	2.88e-06	9.93e-08	0.00702	0.00995
AP07S	C - PMP	Initial Soln	TRUE	75p	6.88	4.49	-1.02e-10	-3.05e-07	0.00375	0.00127	1.07e-06	9.65e-09	0.00425	0.00817
AW-15S	C - PMP	Initial Soln	TRUE	75p	6.79	3.68	3.29e-14	8.57e-11	0.00605	0.000574	1.95e-06	4.61e-09	0.00511	0.00723
AW-05	C - UA	Initial Soln	TRUE	75p	6.99	4.57	8.21e-15	2.50e-11	0.00422	0.000565	2.45e-06	5.21e-08	0.00400	0.00716
AW-19	C - UA	Initial Soln	TRUE	75p	6.71	2.69	6.80e-18	2.71e-14	0.000557	0.000241	1.66e-06	1.80e-07	0.00485	0.00837
AW-21	C - UA	Initial Soln	TRUE	75p	6.83	4.53	-4.57e-12	-2.25e-08	0.00271	0.000958	6.42e-07	1.43e-08	0.00185	0.00454
AP07S	C - PMP	Speciation Model	TRUE	75p	6.88	4.49	-1.02e-10	-3.05e-07	0.00375	0.00127	1.07e-06	9.65e-09	0.00425	0.00817
AW-15S	C - PMP	Speciation Model	TRUE	75p	6.79	3.68	3.29e-14	8.56e-11	0.00605	0.000574	1.95e-06	4.61e-09	0.00511	0.00723
AW-05	C - UA	Speciation Model	TRUE	75p	6.99	4.57	1.00e-14	3.05e-11	0.00422	0.000565	2.45e-06	5.21e-08	0.00400	0.00716
AW-19	C - UA	Speciation Model	TRUE	75p	6.71	2.69	5.28e-18	2.11e-14	0.000557	0.000241	1.66e-06	1.80e-07	0.00485	0.00837
AW-21	C - UA	Speciation Model	TRUE	75p	6.83	4.53	-4.60e-12	-2.26e-08	0.00271	0.000958	6.42e-07	1.43e-08	0.00185	0.00454
AP07S	C - PMP	First Reaction	TRUE	75p	6.99	0.650	-1.31e-04	-4.03e-01	0.000121	0.000363	2.88e-06	2.19e-08	0.00778	0.00996
AP07S	C - PMP	Second Reaction	TRUE	75p	6.97	0.323	-7.93e-05	-2.43e-01	2.22e-05	0.000233	2.88e-06	3.05e-08	0.00804	0.00996
AW-15S	C - PMP	First Reaction	TRUE	75p	6.96	0.973	-2.06e-04	-6.20e-01	0.000233	0.000263	2.88e-06	7.29e-09	0.00814	0.00996
AW-15S	C - PMP	Second Reaction	TRUE	75p	6.97	0.567	-8.95e-05	-2.73e-01	4.57e-05	0.000186	2.88e-06	8.87e-09	0.00816	0.00996
AW-05	C - UA	First Reaction	TRUE	75p	7.05	0.434	5.39e-05	0.170	0.000307	0.000255	2.88e-06	9.32e-08	0.00670	0.00995
AW-05	C - UA	Second Reaction	TRUE	75p	7.02	0.254	-1.22e-04	-3.83e-01	6.26e-05	0.000173	2.88e-06	1.23e-07	0.00732	0.00995
AW-19	C - UA	First Reaction	TRUE	75p	6.95	0.382	0.000359	1.07	9.17e-05	0.000172	2.88e-06	4.86e-07	0.00825	0.00996
AW-19	C - UA	Second Reaction	TRUE	75p	6.96	0.268	-2.46e-05	-7.47e-02	3.78e-05	0.000138	2.88e-06	5.28e-07	0.00824	0.00996
AW-21	C - UA	First Reaction	TRUE	75p	7.10	0.504	0.000436	1.38	0.000581	0.000530	2.88e-06	6.03e-08	0.00579	0.00995
AW-21	C - UA	Second Reaction	TRUE	75p	7.06	0.323	-1.39e-04	-4.48e-01	7.07e-05	0.000268	2.88e-06	8.41e-08	0.00677	0.00995
AP07S	C - PMP	Initial Soln	TRUE	median	6.88	4.49	-1.02e-10	-3.05e-07	0.00375	0.00127	1.07e-06	9.65e-09	0.00425	0.00817
AW-15S	C - PMP	Initial Soln	TRUE	median	6.79	3.68	3.29e-14	8.57e-11	0.00605	0.000574	1.95e-06	4.61e-09	0.00511	0.00723
AW-05	C - UA	Initial Soln	TRUE	median	6.99	4.57	8.21e-15	2.50e-11	0.00422	0.000565	2.45e-06	5.21e-08	0.00400	0.00716
AW-19	C - UA	Initial Soln	TRUE	median	6.71	2.69	6.80e-18	2.71e-14	0.000557	0.000241	1.66e-06	1.80e-07	0.00485	0.00837
AW-21	C - UA	Initial Soln	TRUE	median	6.83	4.53	-4.57e-12	-2.25e-08	0.00271	0.000958	6.42e-07	1.43e-08	0.00185	0.00454
AP07S	C - PMP	Speciation Model	TRUE	median	6.88	4.49	-1.02e-10	-3.05e-07	0.00375	0.00127	1.07e-06	9.65e-09	0.00425	0.00817
AW-15S	C - PMP	Speciation Model	TRUE	median	6.79	3.68	3.29e-14	8.56e-11	0.00605	0.000574	1.95e-06	4.61e-09	0.00511	0.00723
AW-05	C - UA	Speciation Model	TRUE	median	6.99	4.57	1.00e-14	3.05e-11	0.00422	0.000565	2.45e-06	5.21e-08	0.00400	0.00716
AW-19	C - UA	Speciation Model	TRUE	median	6.71	2.69	5.28e-18	2.11e-14	0.000557	0.000241	1.66e-06	1.80e-07	0.00485	0.00837
AW-21	C - UA	Speciation Model	TRUE	median	6.83	4.53	-4.60e-12	-2.26e-08	0.00271	0.000958	6.42e-07	1.43e-08	0.00185	0.00454
AP07S	C - PMP	First Reaction	TRUE	median	6.98	0.559	-1.07e-04	-3.29e-01	9.60e-05	0.000334	2.88e-06	2.32e-08	0.00783	0.00996
AP07S	C - PMP	Second Reaction	TRUE	median	6.97	0.227	-6.08e-05	-1.86e-01	1.63e-05	0.000211	2.88e-06	3.54e-08	0.00805	0.00996
AW-15S	C - PMP	First Reaction	TRUE	median	6.96	0.862	-1.65e-04	-4.97e-01	0.000188	0.000248	2.88e-06	7.56e-09	0.00815	0.00996
AW-15S	C - PMP	Second Reaction	TRUE	median	6.97	0.441	-6.97e-05	-2.12e-01	3.37e-05	0.000175	2.88e-06	9.92e-09	0.00815	0.00996
AW-05	C - UA	First Reaction	TRUE	median	7.05	0.394	8.30e-05	0.261	0.000278	0.000246	2.88e-06	9.52e-08	0.00672	0.00995
AW-05	C - UA	Second Reaction	TRUE	median	7.02	0.203	-1.06e-04	-3.33e-01	5.26e-05	0.000164	2.88e-06	1.30e-07	0.00735	0.00995
AW-19	C - UA	First Reaction	TRUE	median	6.95	0.380	0.000357	1.07	8.35e-05	0.000165	2.88e-06	4.87e-07	0.00824	0.00996
AW-19	C - UA	Second Reaction	TRUE	median	6.96	0.259	-1.80e-05	-5.47e-02	3.28e-05	0.000131	2.88e-06	5.33e-07	0.00824	0.00996
AW-21	C - UA	First Reaction	TRUE	median	7.10	0.452	0.000430	1.36	0.000558	0.000494	2.88e-06	6.15e-08	0.00582	0.00995
AW-21	C - UA	Second Reaction	TRUE	median	7.06	0.267	-1.21e-04	-3.88e-01	6.20e-05	0.000246	2.88e-06	8.82e-08	0.00681	0.00995
AP07S	C - PMP	Initial Soln	FALSE	25p	6.88	4.49	0.00593	21.7	0.00375	0.00127	1.07e-06	9.65e-09	0.00425	0.00224
AW-15S	C - PMP	Initial Soln	FALSE	25p	6.79	3.68	0.00636	20.0	0.00605	0.000574	1.95e-06	4.61e-09	0.00511	0.000876
AW-05	C - UA	Initial Soln	FALSE	25p	6.99	4.57	0.00506	18.3	0.00422	0.000565	2.45e-06	5.21e-08	0.00400	0.00210
AW-19	C - UA	Initial Soln	FALSE	25p	6.71	2.69	0.00610	32.2	0.000557	0.000241	1.66e-06	1.80e-07	0.00485	0.00227
AW-21	C - UA	Initial Soln	FALSE	25p	6.83	4.53	0.00200	10.9	0.00271	0.000958	6.42e-07	1.43e-08	0.00185	0.00254
AP07S	C - PMP	Speciation Model	FALSE	25p	6.88	4.49	0.00593	21.7	0.00375	0.00127	1.07e-06	9.65e-09	0.00425	0.00224
AW-15S	C - PMP	Speciation Model	FALSE	25p	6.79	3.68	0.00636	20.0	0.00605	0.000574	1.95e-06	4.61e-09	0.00511	0.000876
AW-05	C - UA	Speciation Model	FALSE	25p	6.99	4.57	0.00506	18.3	0.00422	0.000565	2.45e-06	5.21e-08	0.00400	0.00210
AW-19	C - UA	Speciation Model	FALSE	25p	6.71	2.69	0.00610	32.2	0.000557	0.000241	1.66e-06	1.80e-07	0.00485	0.00227
AW-21	C - UA	Speciation Model	FALSE	25p	6.83	4.53	0.00200	10.9	0.00271	0.000958	6.42e-07	1.43e-08	0.00185	0.00254
AP07S	C - PMP	First Reaction	FALSE	25p	6.98	0.430	-8.00e-05	-2.46e-01	6.56e-05	0.000297	2.88e-06	2.71e-08	0.00788	0.00996
AP07S	C - PMP	Second Reaction	FALSE	25p	6.97	0.109	-3.93e-05	-1.20e-01	1.08e-05	0.000185	2.88e-06	4.74e-08	0.00806	0.00996
AW-15S	C - PMP	First Reaction	FALSE	25p	6.96	0.709	-1.16e-04	-3.53e-01	0.000135	0.000229	2.88e-06	8.47e-09	0.00814	0.00996
AW-15S	C - PMP	Second Reaction	FALSE	25p	6.97	0.280	-4.79e-05	-1.46e-01	2.18e-05	0.000159	2.88e-06	1.29e-08	0.00814	0.00996
AW-05	C - UA	First Reaction	FALSE	25p	7.04	0.334	4.26e-05	0.134	0.000223	0.000229	2.88e-06	1.05e-07	0.00683	0.00995
AW-05	C - UA	Second Reaction	FALSE	25p	7.01	0.140	-8.86e-05	-2.78e-01	3.97e-05	0.000150	2.88e-06	1.53e-07	0.00746	0.00996
AW-19	C - UA	First Reaction	FALSE	25p	6.95	0.345	0.000245	0.737	6.75e-05	0.000153	2.88e-06	5.26e-07	0.00824	0.00996
AW-19	C - UA	Second Reaction	FALSE	25p	6.96	0.222	-1.59e-05	-4.84e-02	2.62e-05	0.000119	2.88e-06	5.83e-07	0.00822	0.00996
AW-21	C - UA	First Reaction	FALSE	25p	7.09	0.390	0.000325	1.03	0.000463	0.000442	2.88e-06	6.74e-08	0.00599	0.00995
AW-21	C - UA	Second Reaction	FALSE	25p	7.04	0.213	-1.08e-04	-3.45e-01	4.74e-05	0.000217	2.88e-06	1.01e-07	0.00702	0.00995
AP07S	C - PMP	Initial Soln	FALSE	75p	6.88	4.49	0.00593	21.7	0.00375	0.00127	1.07e-06	9.65e-09	0.00425	0.00224
AW-15S	C - PMP	Initial Soln	FALSE	75p	6.79	3.68	0.00636	20.0	0.00605	0.000574	1.95e-06	4.61e-09	0.00511	0.000876
AW-05	C - UA	Initial Soln	FALSE	75p	6.99	4.57	0.00506	18.3	0.00422	0.000565	2.45e-06	5.21e-08	0.00400	0.00210
AW-19	C - UA	Initial Soln	FALSE	75p	6.71	2.69	0.00610	32.2	0.000557	0.000241	1.66e-06	1.80e-07	0.00485	0.00227
AW-21	C - UA	Initial Soln	FALSE	75p	6.83	4.53	0.00200	10.9	0.00271	0.000958	6.42e-07	1.43e-08	0.00185	0.00254
AP07S	C - PMP	Speciation Model	FALSE	75p	6.88	4.49	0.00593	21.7	0.00375	0.00127	1.07e-06	9.65e-09	0.00425	0.00224
AW-15S	C - PMP	Speciation Model	FALSE	75p	6.79	3.68	0.00636	20.0	0.00605	0.000574	1.95e-06	4.61e-09	0.00511	0.000876
AW-05	C - UA	Speciation Model	FALSE	75p	6.99	4.57	0.00506	18.3	0.00422	0.000565	2.45e-06	5.21e-08	0.00400	0.00210
AW-19	C - UA	Speciation Model	FALSE	75p	6.71	2.69	0.00610	32.2	0.000557	0.000241	1.66e-06	1.80e-07	0.00485	0.00227
AW-21	C - UA	Speciation Model	FALSE	75p	6.83	4.53	0.00200	10.9	0.00271	0.000958	6.42e-07	1.43e-08	0.00185	0.00254
AP07S	C - PMP	First Reaction	FALSE	75p	6.99	0.639	-1.27e-04	-3.90e-01	0.000115	0.000363	2.88e-06	2.30e-08	0.00777	0.00996
AP07S	C - PMP	Second Reaction	FALSE	75p	6.97	0.315	-7.80e-05	-2.39e-01	2.12e-05	0.000233	2.88e-06	3.23e-08	0.00804	0.00996
AW-15S	C - PMP	First Reaction	FALSE	75p	6.96	0.968	-1.94e-04	-5.85e-01	0.000225	0.000261	2.88e-06	7.64e-09	0.00813	0.00996
AW-15S	C - PMP	Second Reaction	FALSE	75p	6.97	0.563	-8.84e-05	-2.69e-01	4.48e-05	0.000186	2.88e-06	9.32e-09	0.00815	0.00996
AW-05	C - UA	First Reaction	FALSE	75p	7.05	0.425	2.64e-05	0.0832	0.000301	0.000254	2.88e-06	9.74e-08	0.00669	0.00995
AW-05	C - UA	Second Reaction	FALSE	75p	7.02	0.249	-1.23e-04	-3.86e-01	6.20e-05	0.000173	2.88e-06	1.28e-07	0.00731	0.00995
AW-19	C - UA	First Reaction	FALSE	75p	6.95	0.367	0.000299	0.894	8.73e-05	0.000168	2.88e-06	5.18e-07	0.00825	0.00996
AW-19	C - UA	Second Reaction	FALSE	75p	6.96	0.260	-2.58e-05	-7.82e-02	3.71e-05	0.000136	2.88e-06	5.60e-07	0.00824	0.00996
AW-21	C - UA	First Reaction	FALSE	75p	7.10	0.500	0.000406	1.28	0.000582	0.000531	2.88e-06	6.16e-08	0.00579	0.00995
AW-21	C - UA	Second Reaction	FALSE	75p	7.06	0.322	-1.40e-04	-4.52e-01	7.05e-05	0.000268	2.88e-06	8.58e-08	0.00676	0.00995
AP07S	C - PMP	Initial Soln	FALSE	median	6.88	4.49	0.00593	21.7	0.00375	0.00127	1.07e-06	9.65e-09	0.00425	0.00224
AW-15S	C - PMP	Initial Soln	FALSE	median	6.79	3.68	0.00636	20.0	0.00605	0.000574	1.95e-06	4.61e-09	0.00511	0.000876
AW-05	C - UA	Initial Soln	FALSE	median	6.99	4.57	0.00506	18.3	0.00422	0.000565	2.45e-06	5.21e-08	0.00400	0.00210
AW-19	C - UA	Initial Soln	FALSE	median	6.71	2.69	0.00610	32.2	0.000557	0.000241	1.66e-06	1.80e-07	0.00485	0.00227
AW-21	C - UA	Initial Soln	FALSE	median	6.83	4.53	0.00200	10.9	0.00271	0.000958	6.42e-07	1.43e-08	0.00185	0.00254
AP07S	C - PMP	Speciation Model	FALSE	median	6.88	4.49	0.00593	21.7	0.00375	0.00127	1.07e-06	9.65e-09	0.00425	0.00224
AW-15S	C - PMP	Speciation Model	FALSE	median	6.79	3.68	0.00636	20.0	0.00605	0.000574	1.95e-06	4.61e-09	0.00511	0.000876
AW-05	C - UA	Speciation Model	FALSE	median	6.99	4.57	0.00506	18.3	0.00422	0.000565	2.45e-06	5.21e-08	0.00400	0.00210
AW-19	C - UA	Speciation Model	FALSE	median	6.71	2.69	0.00610	32.2	0.000557	0.000241	1.66e-06	1.80e-07	0.00485	0.00227
AW-21	C - UA	Speciation Model	FALSE	median	6.83	4.53	0.00200	10.9	0.00271	0.000958	6.42e-07	1.43e-08	0.00185	0.00254
AP07S	C - PMP	First Reaction	FALSE	median	6.99	0.549	-1.04e-04	-3.21e-01	9.08e-05	0.000334	2.88e-06	2.44e-08	0.00782	0.00996
AP07S	C - PMP	Second Reaction	FALSE	median	6.97	0.220	-5.96e-05	-1.83e-01	1.56e-05	0.000211	2.88e-06	3.75e-08	0.00805	0.00996
AW-15S	C - PMP	First Reaction	FALSE	median	6.96	0.857	-1.56e-04	-4.71e-01	0.000182	0.000247	2.88e-06	7.92e-09	0.00814	0.00996
AW-15S	C - PMP	Second Reaction	FALSE	median	6.97	0.438	-6.88e-05	-2.10e-01	3.30e-05	0.000175	2.88e-06	1.04e-08	0.00815	0.00996
AW-05	C - UA	First Reaction	FALSE	median	7.05	0.385	5.26e-05	0.166	0.000274	0.000245	2.88e-06	9.95e-08	0.00672	0.00995
AW-05	C - UA	Second Reaction	FALSE	median	7.02	0.199	-1.07e-04	-3.37e-01	5.22e-05	0.000163	2.88e-06	1.36e-07	0.00734	0.00995
AW-19	C - UA	First Reaction	FALSE	median	6.95	0.366	0.000295	0.884	8.00e-05	0.000161	2.88e-06	5.18e-07	0.00825	0.00996
AW-19	C - UA	Second Reaction	FALSE	median	6.96	0.252	-1.96e-05	-5.95e-02	3.24e-05	0.000128	2.88e-06	5.65e-07	0.00824	0.00996
AW-21	C - UA	First Reaction	FALSE	median	7.10	0.449	0.000400	1.26	0.000559	0.000496	2.88e-06	6.28e-08	0.00582	0.00995
AW-21	C - UA	Second Reaction	FALSE	median	7.06	0.266	-1.22e-04	-3.93e-01	6.19e-05	0.000246	2.88e-06	9.00e-08	0.00681	0.00995

NOTES:
All model results are in units of moles with the exceptions of:
pH and pe (standard units)
charge (equivalents)
Results beginning with 'd_' (change from prior model step)
Results beginning with 'si_' (saturation index)

Attachment D. PHRE
Groundwater Polishi
Ash Pond
Edwards Power Plant
Bartonville, IL

Location	F	Ca	Mg	Na	K	Ba	Si	P	Mn	Fe	Al	Sb	Be	Cd
AP07S	9.64e-06	0.00500	0.00309	0.00287	2.29e-05	6.67e-07	0.000127	1.29e-06	1.18e-05	1.23e-06	2.60e-08	1.77e-09	3.28e-08	7.44e-09
AW-15S	8.01e-06	0.00687	0.00354	0.00235	1.66e-05	5.91e-07	0.000133	1.10e-06	1.35e-05	7.89e-07	2.73e-07	1.77e-09	3.28e-08	3.30e-09
AW-05	8.93e-06	0.00437	0.00336	0.00333	4.86e-05	1.06e-06	0.000167	7.11e-07	2.73e-05	6.54e-05	2.60e-08	1.77e-09	3.28e-08	3.30e-09
AW-19	1.52e-05	0.00300	0.00226	0.00231	2.82e-05	1.46e-06	0.000175	1.28e-07	6.38e-06	4.93e-05	2.60e-08	1.77e-09	3.28e-08	3.29e-09
AW-21	1.62e-05	0.00287	0.00152	0.00248	7.42e-05	4.26e-07	9.33e-05	1.28e-07	1.36e-05	6.18e-06	7.23e-08	7.27e-09	3.28e-08	3.29e-09
AP07S	9.64e-06	0.00500	0.00309	0.00287	2.29e-05	6.67e-07	0.000127	1.29e-06	1.18e-05	1.23e-06	2.60e-08	1.77e-09	3.28e-08	7.44e-09
AW-15S	8.01e-06	0.00687	0.00354	0.00235	1.66e-05	5.91e-07	0.000133	1.10e-06	1.35e-05	7.89e-07	2.73e-07	1.77e-09	3.28e-08	3.30e-09
AW-05	8.93e-06	0.00437	0.00336	0.00333	4.86e-05	1.06e-06	0.000167	7.11e-07	2.73e-05	6.54e-05	2.60e-08	1.77e-09	3.28e-08	3.30e-09
AW-19	1.52e-05	0.00300	0.00226	0.00231	2.82e-05	1.46e-06	0.000175	1.28e-07	6.38e-06	4.93e-05	2.60e-08	1.77e-09	3.28e-08	3.29e-09
AW-21	1.62e-05	0.00287	0.00152	0.00248	7.42e-05	4.26e-07	9.33e-05	1.28e-07	1.36e-05	6.18e-06	7.23e-08	7.27e-09	3.28e-08	3.29e-09
AP07S	9.64e-06	0.00500	0.00309	0.00287	2.29e-05	6.67e-07	0.000127	1.29e-06	1.18e-05	1.23e-06	2.60e-08	1.77e-09	3.28e-08	7.44e-09
AW-15S	8.01e-06	0.00687	0.00354	0.00235	1.66e-05	5.91e-07	0.000133	1.10e-06	1.35e-05	7.89e-07	2.73e-07	1.77e-09	3.28e-08	3.30e-09
AW-05	8.93e-06	0.00437	0.00336	0.00333	4.86e-05	1.06e-06	0.000167	7.11e-07	2.73e-05	6.54e-05	2.60e-08	1.77e-09	3.28e-08	3.30e-09
AW-19	1.52e-05	0.00300	0.00226	0.00231	2.82e-05	1.46e-06	0.000175	1.28e-07	6.38e-06	4.93e-05	2.60e-08	1.77e-09	3.28e-08	3.29e-09
AW-21	1.62e-05	0.00287	0.00152	0.00248	7.42e-05	4.26e-07	9.33e-05	1.28e-07	1.36e-05	6.18e-06	7.23e-08	7.27e-09	3.28e-08	3.29e-09
AP07S	4.24e-06	0.00299	0.00258	0.00525	6.78e-05	3.16e-06	0.000189	2.80e-06	1.07e-05	1.99e-05	3.55e-08	1.77e-09	3.56e-08	4.62e-09
AP07S	4.20e-06	0.00299	0.00258	0.00525	6.78e-05	4.27e-06	0.000209	3.23e-06	1.14e-05	4.60e-05	3.49e-08	1.77e-09	3.73e-08	5.87e-09
AW-15S	4.27e-06	0.00310	0.00267	0.00525	6.78e-05	1.67e-06	0.000157	2.11e-06	1.09e-05	1.14e-05	3.43e-08	1.77e-09	3.71e-08	2.66e-09
AW-15S	4.21e-06	0.00303	0.00261	0.00525	6.78e-05	5.75e-06	0.000169	2.43e-06	1.17e-05	2.80e-05	3.45e-08	1.77e-09	2.64e-08	3.52e-09
AW-05	4.26e-06	0.00293	0.00253	0.00525	6.78e-05	1.23e-06	0.000219	1.22e-06	1.34e-05	2.12e-05	3.88e-08	1.77e-09	3.64e-08	2.97e-09
AW-05	4.20e-06	0.00287	0.00248	0.00525	6.78e-05	6.00e-06	0.000252	1.36e-06	1.22e-05	3.87e-05	3.72e-08	1.77e-09	4.22e-08	3.93e-09
AW-19	4.68e-06	0.00317	0.00273	0.00525	6.78e-05	3.67e-06	0.000195	3.67e-07	1.03e-05	4.87e-05	3.38e-08	1.77e-09	2.24e-08	3.19e-09
AW-19	4.23e-06	0.00304	0.00262	0.00525	6.78e-05	3.71e-06	0.000193	4.29e-07	1.12e-05	5.76e-05	3.43e-08	1.77e-09	2.17e-08	3.45e-09
AW-21	4.38e-06	0.00301	0.00259	0.00525	6.78e-05	6.52e-07	0.000148	6.09e-07	1.07e-05	1.29e-05	4.21e-08	1.77e-09	2.91e-08	2.45e-09
AW-21	4.21e-06	0.00277	0.00240	0.00525	6.78e-05	5.21e-06	0.000187	7.28e-07	1.13e-05	2.51e-05	3.93e-08	1.77e-09	3.60e-08	2.77e-09
AP07S	9.64e-06	0.00500	0.00309	0.00287	2.29e-05	6.67e-07	0.000127	1.29e-06	1.18e-05	1.23e-06	2.60e-08	1.77e-09	3.28e-08	7.44e-09
AW-15S	8.01e-06	0.00687	0.00354	0.00235	1.66e-05	5.91e-07	0.000133	1.10e-06	1.35e-05	7.89e-07	2.73e-07	1.77e-09	3.28e-08	3.30e-09
AW-05	8.93e-06	0.00437	0.00336	0.00333	4.86e-05	1.06e-06	0.000167	7.11e-07	2.73e-05	6.54e-05	2.60e-08	1.77e-09	3.28e-08	3.30e-09
AW-19	1.52e-05	0.00300	0.00226	0.00231	2.82e-05	1.46e-06	0.000175	1.28e-07	6.38e-06	4.93e-05	2.60e-08	1.77e-09	3.28e-08	3.29e-09
AW-21	1.62e-05	0.00287	0.00152	0.00248	7.42e-05	4.26e-07	9.33e-05	1.28e-07	1.36e-05	6.18e-06	7.23e-08	7.27e-09	3.28e-08	3.29e-09
AP07S	9.64e-06	0.00500	0.00309	0.00287	2.29e-05	6.67e-07	0.000127	1.29e-06	1.18e-05	1.23e-06	2.60e-08	1.77e-09	3.28e-08	7.44e-09
AW-15S	8.01e-06	0.00687	0.00354	0.00235	1.66e-05	5.91e-07	0.000133	1.10e-06	1.35e-05	7.89e-07	2.73e-07	1.77e-09	3.28e-08	3.30e-09
AW-05	8.93e-06	0.00437	0.00336	0.00333	4.86e-05	1.06e-06	0.000167	7.11e-07	2.73e-05	6.54e-05	2.60e-08	1.77e-09	3.28e-08	3.30e-09
AW-19	1.52e-05	0.00300	0.00226	0.00231	2.82e-05	1.46e-06	0.000175	1.28e-07	6.38e-06	4.93e-05	2.60e-08	1.77e-09	3.28e-08	3.29e-09
AW-21	1.62e-05	0.00287	0.00152	0.00248	7.42e-05	4.26e-07	9.33e-05	1.28e-07	1.36e-05	6.18e-06	7.23e-08	7.27e-09	3.28e-08	3.29e-09
AP07S	4.24e-06	0.00299	0.00258	0.00525	6.78e-05	3.16e-06	0.000189	2.80e-06	1.07e-05	1.99e-05	3.55e-08	1.77e-09	3.56e-08	4.62e-09
AP07S	4.20e-06	0.00299	0.00258	0.00525	6.78e-05	4.27e-06	0.000209	3.23e-06	1.14e-05	4.60e-05	3.49e-08	1.77e-09	3.73e-08	5.87e-09
AW-15S	4.27e-06	0.00310	0.00267	0.00525	6.78e-05	1.67e-06	0.000157	2.11e-06	1.09e-05	1.14e-05	3.43e-08	1.77e-09	2.71e-08	2.66e-09
AW-15S	4.21e-06	0.00303	0.00261	0.00525	6.78e-05	5.75e-06	0.000169	2.43e-06	1.17e-05	2.80e-05	3.45e-08	1.77e-09	2.64e-08	3.52e-09
AW-05	4.26e-06	0.00293	0.00253	0.00525	6.78e-05	1.23e-06	0.000219	1.22e-06	1.34e-05	2.12e-05	3.88e-08	1.77e-09	3.64e-08	2.97e-09
AW-05	4.20e-06	0.00287	0.00248	0.00525	6.78e-05	6.00e-06	0.000252	1.36e-06	1.22e-05	3.87e-05	3.72e-08	1.77e-09	4.22e-08	3.93e-09
AW-19	4.68e-06	0.00317	0.00273	0.00525	6.78e-05	3.67e-06	0.000195	3.67e-07	1.03e-05	4.87e-05	3.38e-08	1.77e-09	2.24e-08	3.19e-09
AW-19	4.23e-06	0.00304	0.00262	0.00525	6.78e-05	3.71e-06	0.000193	4.29e-07	1.12e-05	5.76e-05	3.43e-08	1.77e-09	2.17e-08	3.45e-09
AW-21	4.38e-06	0.00301	0.00259	0.00525	6.78e-05	6.52e-07	0.000148	6.09e-07	1.07e-05	1.29e-05	4.21e-08	1.77e-09	2.91e-08	2.45e-09
AW-21	4.21e-06	0.00277	0.00240	0.00525	6.78e-05	5.21e-06	0.000187	7.28e-07	1.13e-05	2.51e-05	3.93e-08	1.77e-09	3.60e-08	2.77e-09
AP07S	9.64e-06	0.00500	0.00309	0.00287	2.29e-05	6.67e-07	0.000127	1.29e-06	1.18e-05	1.23e-06	2.60e-08	1.77e-09	3.28e-08	7.44e-09
AW-15S	8.01e-06	0.00687	0.00354	0.00235	1.66e-05	5.91e-07	0.000133	1.10e-06	1.35e-05	7.89e-07	2.73e-07	1.77e-09	3.28e-08	3.30e-09
AW-05	8.93e-06	0.00437	0.00336	0.00333	4.86e-05	1.06e-06	0.000167	7.11e-07	2.73e-05	6.54e-05	2.60e-08	1.77e-09	3.28e-08	3.30e-09
AW-19	1.52e-05	0.00300	0.00226	0.00231	2.82e-05	1.46e-06	0.000175	1.28e-07	6.38e-06	4.93e-05	2.60e-08	1.77e-09	3.28e-08	3.29e-09
AW-21	1.62e-05	0.00287	0.00152	0.00248	7.42e-05	4.26e-07	9.33e-05	1.28e-07	1.36e-05	6.18e-06	7.23e-08	7.27e-09	3.28e-08	3.29e-09
AP07S	9.64e-06	0.00500	0.00309	0.00287	2.29e-05	6.67e-07	0.000127	1.29e-06	1.18e-05	1.23e-06	2.60e-08	1.77e-09	3.28e-08	7.44e-09
AW-15S	8.01e-06	0.00687	0.00354	0.00235	1.66e-05	5.91e-07	0.000133	1.10e-06	1.35e-05	7.89e-07	2.73e-07	1.77e-09	3.28e-08	3.30e-09
AW-05	8.93e-06	0.00437	0.00336	0.00333	4.86e-05	1.06e-06	0.000167	7.11e-07	2.73e-05	6.54e-05	2.60e-08	1.77e-09	3.28e-08	3.30e-09
AW-19	1.52e-05	0.00300	0.00226	0.00231	2.82e-05	1.46e-06	0.000175	1.28e-07	6.38e-06	4.93e-05	2.60e-08	1.77e-09	3.28e-08	3.29e-09
AW-21	1.62e-05	0.00287	0.00152	0.00248	7.42e-05	4.26e-07	9.33e-05	1.28e-07	1.36e-05	6.18e-06	7.23e-08	7.27e-09	3.28e-08	3.29e-09
AP07S	4.24e-06	0.00299	0.00258	0.00525	6.78e-05	3.05e-06	0.000197	3.05e-06	1.10e-05	3.41e-05	3.52e-08	1.77e-09	3.59e-08	6.42e-09
AP07S	4.21e-06	0.00298	0.00257	0.00525	6.78e-05	3.72e-06	0.000219	3.71e-06	1.14e-05	7.54e-05	3.49e-08	1.77e-09	3.66e-08	8.35e-09
AW-15S	4.26e-06	0.00307	0.00265	0.00525	6.78e-05	2.87e-06	0.000163	2.30e-06	1.12e-05	2.06e-05	3.44e-08	1.77e-09	2.66e-08	3.81e-09
AW-15S	4.22e-06	0.00301	0.00260	0.00525	6.78e-05	4.55e-06	0.000180	2.85e-06	1.16e-05	5.34e-05	3.46e-08	1.77e-09	2.56e-08	5.60e-09
AW-05	4.25e-06	0.00291	0.00251	0.00525	6.78e-05	1.69e-06	0.000225	1.27e-06	1.28e-05	2.78e-05	3.85e-08	1.77e-09	3.75e-08	3.83e-09
AW-05	4.21e-06	0.00288	0.00249	0.00525	6.78e-05	5.74e-06	0.000260	1.42e-06	1.18e-05	5.36e-05	3.67e-08	1.77e-09	4.37e-08	5.29e-09
AW-19	4.51e-06	0.00313	0.00270	0.00525	6.78e-05	3.68e-06	0.000193	3.87e-07	1.07e-05	5.15e-05	3.39e-08	1.77e-09	2.21e-08	4.21e-09
AW-19	4.23e-06	0.00303	0.00261	0.00525	6.78e-05	3.72e-06	0.000192	4.65e-07	1.13e-05	6.32e-05	3.43e-08	1.77e-09	2.15e-08	4.59e-09
AW-21	4.33e-06	0.00295	0.00255	0.00525	6.78e-05	8.12e-07	0.000156	6.40e-07	1.08e-05	1.78e-05	4.14e-08	1.77e-09	3.05e-08	2.56e-09
AW-21	4.22e-06	0.00281	0.00243	0.00525	6.78e-05	6.58e-06	0.000200	7.78e-07	1.14e-05	3.65e-05	3.83e-08	1.77e-09	3.87e-08	3.18e-09
AP07S	9.64e-06	0.00500	0.00309	0.00287	2.29e-05	6.67e-07	0.000127	1.29e-06	1.18e-05	1.23e-06	2.60e-08	1.77e-09	3.28e-08	7.44e-09
AW-15S	8.01e-06	0.00687	0.00354	0.00235	1.66e-05	5.91e-07	0.000133	1.10e-06	1.35e-05	7.89e-07	2.73e-07	1.77e-09	3.28e-08	3.30e-09
AW-05	8.93e-06	0.00437	0.00336	0.00333	4.86e-05	1.06e-06	0.000167	7.11e-07	2.73e-05	6.54e-05	2.60e-08	1.77e-09	3.28e-08	3.30e-09
AW-19	1.52e-05	0.00300	0.00226	0.00231	2.82e-05	1.46e-06	0.000175	1.28e-07	6.38e-06	4.93e-05	2.60e-08	1.77e-09	3.28e-08	3.29e-09
AW-21	1.62e-05	0.00287	0.00152	0.00248	7.42e-05	4.26e-07	9.33e-05	1.28e-07	1.36e-05	6.18e-06	7.23e-08	7.27e-09	3.28e-08	3.29e-09
AP07S	9.64e-06	0.00500	0.00309	0.00287	2.29e-05	6.67e-07	0.000127	1.29e-06	1.18e-05	1.23e-06	2.60e-08	1.77e-09	3.28e-08	7.44e-09
AW-15S	8.01e-06	0.00687	0.00354	0.00235	1.66e-05	5.91e-07	0.000133	1.10e-06	1.35e-05	7.89e-07	2.73e-07	1.77e-09	3.28e-08	3.30e-09
AW-05	8.93e-06	0.00437	0.00336	0.00333	4.86e-05	1.06e-06	0.000167	7.11e-07	2.73e-05	6.54e-05	2.60e-08	1.77e-09	3.28e-08	3.30e-09
AW-19	1.52e-05	0.00300	0.00226	0.00231	2.82e-05	1.46e-06	0.000175	1.28e-07	6.38e-06	4.93e-05	2.60e-08	1.77e-09	3.28e-08	3.29e-09
AW-21	1.62e-05	0.00287	0.00152	0.00248	7.42e-05	4.26e-07	9.33e-05	1.28e-07	1.36e-05	6.18e-06	7.23e-08	7.27e-09	3.28e-08	3.29e-09
AP07S	4.24e-06	0.00299	0.00258	0.00525	6.78e-05	3.71e-06	0.000192	2.91e-06	1.09e-05	2.55e-05	3.54e-08	1.77e-09	3.56e-08	6.23e-09
AP07S	4.21e-06	0.00298	0.00258	0.00525	6.78e-05	3.72e-06	0.000213	3.43e-06	1.14e-05	5.85e-05	3.49e-08	1.77e-09	3.69e-08	8.07e-09
AW-15S	4.27e-06	0.00309	0.00266	0.00525	6.78e-05	2.14e-06	0.000159	2.19e-06	1.11e-05	1.48e-05	3.44e-08	1.77e-09	2.68e-08	3.59e-09
AW-15S	4.22e-06	0.00302	0.00260	0.00525	6.78e-05	5.28e-06	0.000173	2.59e-06	1.17e-05	3.74e-05	3.45e-08	1.77e-09	2.60e-08	5.00e-09
AW-05	4.26e-06	0.00292	0.00252	0.00525	6.78e-05	1.37e-06	0.000219	1.24e-06	1.32e-05	2.37e-05	3.88e-08	1.77e-09	3.64e-08	3.70e-09
AW-05	4.21e-06	0.00287	0.00248	0.00525	6.78e-05	6.05e-06	0.000253	1.38e-06	1.21e-05	4.44e-05	3.71e-08	1.77e-09	4.23e-08	4.98e-09
AW-19	4.59e-06	0.00315	0.00271	0.00525	6.78e-05	3.68e-06	0.000194	3.74e-07	1.05e-05	4.98e-05	3.38e-08	1.77e-09	2.22e-08	4.21e-09
AW-19	4.23e-06	0.00304	0.00262	0.00525	6.78e-05	3.71e-06	0.000192	4.38e-07	1.12e-05	5.95e-05	3.43e-08	1.77e-09	2.16e-08	4.55e-09
AW-21	4.35e-06	0.00299	0.00258	0.00525	6.78e-05	6.76e-07	0.000149	6.17e-07	1.08e-05	1.47e-05	4.20e-08	1.77e-09	2.92e-08	2.61e-09
AW-21	4.21e-06	0.00278	0.00240	0.00525	6.78e-05	5.96e-06	0.000189	7.40e-07	1.14e-05	2.92e-05	3.92e-08	1.77e-09	3.63e-08	3.05e-09

NOTES:
All model results are
pH and pe (standarc
charge (equivalents
Results beginning w
Results beginning w

Attachment D. PHRE
Groundwater Polishi
Ash Pond
Edwards Power Plant
Bartonville, IL

Location	Cr	Co	Pb	Mo	Se	Hfo_s	Hfo_w	Hao_	m_Hfo_wOH	m_Hfo_wOH2+	m_Hfo_wOHSO4-2	m_Hfo_wSO4-	m_Hfo_wOSi(OH)3	m_Hfo_wOSiO(OH)2-
AP07S	1.39e-07	6.12e-08	9.90e-09	1.20e-08	4.69e-09	0	0	0	0	0	0	0	0	0
AW-15S	2.70e-08	9.18e-09	5.32e-10	2.97e-08	1.38e-08	0	0	0	0	0	0	0	0	0
AW-05	1.67e-07	9.94e-08	1.96e-08	2.50e-08	4.69e-09	0	0	0	0	0	0	0	0	0
AW-19	2.69e-08	2.38e-08	6.23e-09	3.91e-08	4.69e-09	0	0	0	0	0	0	0	0	0
AW-21	2.69e-08	1.01e-08	5.31e-10	2.40e-07	2.64e-08	0	0	0	0	0	0	0	0	0
AP07S	1.39e-07	6.12e-08	9.90e-09	1.20e-08	4.69e-09	0.000200	0.00800	0.00429	0.000415	0.000356	3.22e-05	1.38e-05	0.00101	0.000727
AW-15S	2.70e-08	9.18e-09	5.32e-10	2.97e-08	1.38e-08	0.000200	0.00800	0.00429	0.000366	0.000380	4.59e-05	2.39e-05	0.000936	0.000556
AW-05	1.67e-07	9.94e-08	1.96e-08	2.50e-08	4.69e-09	0.000950	0.0380	0.00528	0.00193	0.00149	0.000132	5.14e-05	0.00615	0.00489
AW-19	2.69e-08	2.38e-08	6.23e-09	3.91e-08	4.69e-09	0.000950	0.0380	0.00528	0.00165	0.00210	2.14e-05	1.37e-05	0.00551	0.00266
AW-21	2.69e-08	1.01e-08	5.31e-10	2.40e-07	2.64e-08	0.000950	0.0380	0.00528	0.00306	0.00217	0.000406	0.000145	0.00545	0.00473
AP07S	1.38e-07	3.98e-08	1.16e-08	1.64e-08	2.38e-08	0.000200	0.00800	0.00429	0.000285	0.000258	2.58e-07	1.17e-07	0.00108	0.000737
AP07S	1.43e-07	5.28e-08	1.56e-08	1.38e-08	1.25e-07	0.000200	0.00800	0.00429	0.000271	0.000258	3.65e-08	1.75e-08	0.00114	0.000734
AW-15S	1.91e-08	7.75e-09	8.14e-10	2.59e-08	2.18e-08	0.000200	0.00800	0.00429	0.000312	0.000301	5.39e-07	2.61e-07	0.000978	0.000625
AW-15S	1.85e-08	1.16e-08	1.19e-09	1.64e-08	2.12e-07	0.000200	0.00800	0.00429	0.000306	0.000310	7.51e-08	3.82e-08	0.00105	0.000642
AW-05	1.88e-07	8.81e-08	2.79e-08	3.10e-08	3.06e-08	0.000950	0.0380	0.00528	0.00144	0.00113	4.24e-06	1.68e-06	0.00622	0.00487
AW-05	2.24e-07	1.23e-07	3.97e-08	2.45e-08	3.12e-07	0.000950	0.0380	0.00528	0.00127	0.00105	7.00e-07	2.89e-07	0.00635	0.00475
AW-19	1.78e-08	2.46e-08	1.03e-08	7.35e-08	8.03e-08	0.000950	0.0380	0.00528	0.00146	0.00174	8.75e-07	5.21e-07	0.00543	0.00282
AW-19	1.75e-08	2.70e-08	1.12e-08	4.66e-08	2.11e-07	0.000951	0.0380	0.00528	0.00148	0.00174	3.27e-07	1.93e-07	0.00546	0.00286
AW-21	2.23e-08	6.71e-09	8.54e-10	9.22e-07	1.52e-07	0.000950	0.0380	0.00528	0.00182	0.00125	1.16e-05	4.00e-06	0.00543	0.00487
AW-21	2.83e-08	8.47e-09	1.15e-09	6.66e-07	1.71e-06	0.000950	0.0380	0.00528	0.00148	0.00111	1.04e-06	3.89e-07	0.00568	0.00469
AP07S	1.39e-07	6.12e-08	9.90e-09	1.20e-08	4.69e-09	0	0	0	0	0	0	0	0	0
AW-15S	2.70e-08	9.18e-09	5.32e-10	2.97e-08	1.38e-08	0	0	0	0	0	0	0	0	0
AW-05	1.67e-07	9.94e-08	1.96e-08	2.50e-08	4.69e-09	0	0	0	0	0	0	0	0	0
AW-19	2.69e-08	2.38e-08	6.23e-09	3.91e-08	4.69e-09	0	0	0	0	0	0	0	0	0
AW-21	2.69e-08	1.01e-08	5.31e-10	2.40e-07	2.64e-08	0	0	0	0	0	0	0	0	0
AP07S	1.39e-07	6.12e-08	9.90e-09	1.20e-08	4.69e-09	0.000315	0.0126	0.00759	0.000654	0.000561	5.06e-05	2.18e-05	0.00160	0.00115
AW-15S	2.70e-08	9.18e-09	5.32e-10	2.97e-08	1.38e-08	0.000315	0.0126	0.00759	0.000577	0.000598	7.23e-05	3.76e-05	0.00147	0.000876
AW-05	1.67e-07	9.94e-08	1.96e-08	2.50e-08	4.69e-09	0.00120	0.0480	0.00858	0.00244	0.00189	0.000167	6.49e-05	0.00777	0.00618
AW-19	2.69e-08	2.38e-08	6.23e-09	3.91e-08	4.69e-09	0.00120	0.0480	0.00858	0.00208	0.00265	2.71e-05	1.73e-05	0.00696	0.00336
AW-21	2.69e-08	1.01e-08	5.31e-10	2.40e-07	2.64e-08	0.00120	0.0480	0.00858	0.00386	0.00274	0.000513	0.000183	0.00688	0.00597
AP07S	1.36e-07	3.78e-08	1.09e-08	1.76e-08	9.36e-09	0.000315	0.0126	0.00759	0.000461	0.000407	7.47e-07	3.31e-07	0.00166	0.00116
AP07S	1.44e-07	4.84e-08	1.41e-08	1.46e-08	7.77e-08	0.000315	0.0126	0.00759	0.000434	0.000401	1.24e-07	5.75e-08	0.00173	0.00116
AW-15S	1.93e-08	7.05e-09	7.43e-10	3.04e-08	2.03e-08	0.000315	0.0126	0.00759	0.000497	0.000471	1.49e-06	7.10e-07	0.00149	0.000973
AW-15S	1.89e-08	9.37e-09	9.83e-10	1.95e-08	2.97e-08	0.000315	0.0126	0.00759	0.000489	0.000478	2.68e-07	1.31e-07	0.00158	0.000995
AW-05	1.81e-07	8.42e-08	2.65e-08	3.24e-08	1.29e-08	0.00120	0.0480	0.00858	0.00187	0.00146	7.40e-06	2.89e-06	0.00782	0.00618
AW-05	2.13e-07	1.12e-07	3.61e-08	2.67e-08	1.10e-07	0.00120	0.0480	0.00858	0.00166	0.00135	1.41e-06	5.75e-07	0.00798	0.00604
AW-19	1.80e-08	2.49e-08	1.06e-08	7.95e-08	6.39e-08	0.00120	0.0480	0.00858	0.00184	0.00219	1.45e-06	8.66e-07	0.00685	0.00355
AW-19	1.76e-08	2.69e-08	1.15e-08	5.40e-08	1.72e-07	0.00120	0.0480	0.00858	0.00186	0.00219	5.92e-07	3.50e-07	0.00688	0.00360
AW-21	2.13e-08	7.13e-09	8.82e-10	9.71e-07	9.11e-08	0.00120	0.0480	0.00858	0.00240	0.00162	1.90e-05	6.42e-06	0.00678	0.00620
AW-21	2.62e-08	8.13e-09	1.10e-09	7.66e-07	4.08e-07	0.00120	0.0480	0.00858	0.00198	0.00144	2.02e-06	7.37e-07	0.00707	0.00599
AP07S	1.39e-07	6.12e-08	9.90e-09	1.20e-08	4.69e-09	0	0	0	0	0	0	0	0	0
AW-15S	2.70e-08	9.18e-09	5.32e-10	2.97e-08	1.38e-08	0	0	0	0	0	0	0	0	0
AW-05	1.67e-07	9.94e-08	1.96e-08	2.50e-08	4.69e-09	0	0	0	0	0	0	0	0	0
AW-19	2.69e-08	2.38e-08	6.23e-09	3.91e-08	4.69e-09	0	0	0	0	0	0	0	0	0
AW-21	2.69e-08	1.01e-08	5.31e-10	2.40e-07	2.64e-08	0	0	0	0	0	0	0	0	0
AP07S	1.39e-07	6.12e-08	9.90e-09	1.20e-08	4.69e-09	0.000260	0.0104	0.00594	0.000539	0.000463	4.18e-05	1.80e-05	0.00132	0.000945
AW-15S	2.70e-08	9.18e-09	5.32e-10	2.97e-08	1.38e-08	0.000260	0.0104	0.00594	0.000476	0.000494	5.97e-05	3.11e-05	0.00122	0.000723
AW-05	1.67e-07	9.94e-08	1.96e-08	2.50e-08	4.69e-09	0.00115	0.0460	0.00693	0.00233	0.00181	0.000160	6.22e-05	0.00744	0.00592
AW-19	2.69e-08	2.38e-08	6.23e-09	3.91e-08	4.69e-09	0.00115	0.0460	0.00693	0.00199	0.00254	2.60e-05	1.66e-05	0.00667	0.00322
AW-21	2.69e-08	1.01e-08	5.31e-10	2.40e-07	2.64e-08	0.00115	0.0460	0.00693	0.00370	0.00263	0.000492	0.000175	0.00659	0.00572
AP07S	1.37e-07	3.85e-08	1.12e-08	1.70e-08	1.17e-08	0.000260	0.0104	0.00594	0.000376	0.000335	4.79e-07	2.14e-07	0.00139	0.000959
AP07S	1.44e-07	5.06e-08	1.48e-08	1.42e-08	1.31e-07	0.000260	0.0104	0.00594	0.000355	0.000333	7.27e-08	3.41e-08	0.00145	0.000954
AW-15S	1.92e-08	7.30e-09	7.69e-10	2.84e-08	2.05e-08	0.000260	0.0104	0.00594	0.000409	0.000390	9.74e-07	4.66e-07	0.00125	0.000807
AW-15S	1.87e-08	1.02e-08	1.07e-09	1.80e-08	6.62e-08	0.000260	0.0104	0.00594	0.000401	0.000398	1.57e-07	7.79e-08	0.00133	0.000827
AW-05	1.83e-07	8.50e-08	2.68e-08	3.21e-08	1.75e-08	0.00115	0.0460	0.00693	0.00178	0.00139	6.42e-06	2.51e-06	0.00750	0.00592
AW-05	2.16e-07	1.16e-07	3.72e-08	2.63e-08	1.91e-07	0.00115	0.0460	0.00693	0.00158	0.00129	1.13e-06	4.63e-07	0.00766	0.00578
AW-19	1.79e-08	2.46e-08	1.03e-08	7.85e-08	6.52e-08	0.00115	0.0460	0.00693	0.00176	0.00210	1.26e-06	7.55e-07	0.00657	0.00340
AW-19	1.76e-08	2.67e-08	1.12e-08	5.26e-08	1.85e-07	0.00115	0.0460	0.00693	0.00179	0.00210	4.93e-07	2.91e-07	0.00659	0.00345
AW-21	2.15e-08	6.83e-09	8.50e-10	9.62e-07	1.05e-07	0.00115	0.0460	0.00693	0.00228	0.00154	1.74e-05	5.90e-06	0.00651	0.00593
AW-21	2.65e-08	8.08e-09	1.09e-09	7.48e-07	7.85e-07	0.00115	0.0460	0.00693	0.00188	0.00138	1.69e-06	6.19e-07	0.00680	0.00573
AP07S	1.39e-07	6.12e-08	9.90e-09	1.20e-08	4.69e-09	0	0	0	0	0	0	0	0	0
AW-15S	2.70e-08	9.18e-09	5.32e-10	2.97e-08	1.38e-08	0	0	0	0	0	0	0	0	0
AW-05	1.67e-07	9.94e-08	1.96e-08	2.50e-08	4.69e-09	0	0	0	0	0	0	0	0	0
AW-19	2.69e-08	2.38e-08	6.23e-09	3.91e-08	4.69e-09	0	0	0	0	0	0	0	0	0
AW-21	2.69e-08	1.01e-08	5.31e-10	2.40e-07	2.64e-08	0	0	0	0	0	0	0	0	0
AP07S	1.39e-07	6.12e-08	9.90e-09	1.20e-08	4.69e-09	0.000200	0.00800	0.00429	0.000413	0.000354	3.28e-05	1.41e-05	0.00101	0.000727
AW-15S	2.70e-08	9.18e-09	5.32e-10	2.97e-08	1.38e-08	0.000200	0.00800	0.00429	0.000365	0.000377	4.68e-05	2.42e-05	0.000932	0.000557
AW-05	1.67e-07	9.94e-08	1.96e-08	2.50e-08	4.69e-09	0.000950	0.0380	0.00528	0.00192	0.00149	0.000134	5.20e-05	0.00613	0.00488
AW-19	2.69e-08	2.38e-08	6.23e-09	3.91e-08	4.69e-09	0.000950	0.0380	0.00528	0.00164	0.00209	2.18e-05	1.39e-05	0.00547	0.00265
AW-21	2.69e-08	1.01e-08	5.31e-10	2.40e-07	2.64e-08	0.000950	0.0380	0.00528	0.00305	0.00216	0.000410	0.000146	0.00544	0.00472
AP07S	1.39e-07	4.33e-08	1.25e-08	1.66e-08	2.61e-08	0.000200	0.00800	0.00429	0.000286	0.000259	2.42e-07	1.10e-07	0.00108	0.000734
AP07S	1.45e-07	5.71e-08	1.67e-08	1.38e-08	1.26e-07	0.000200	0.00800	0.00429	0.000271	0.000259	3.49e-08	1.68e-08	0.00114	0.000731
AW-15S	1.92e-08	8.28e-09	8.62e-10	2.65e-08	2.23e-08	0.000200	0.00800	0.00429	0.000313	0.000303	5.20e-07	2.52e-07	0.000977	0.000623
AW-15S	1.86e-08	1.23e-08	1.26e-09	1.65e-08	2.18e-07	0.000200	0.00800	0.00429	0.000306	0.000311	7.33e-08	3.73e-08	0.00105	0.000640
AW-05	1.89e-07	9.20e-08	2.88e-08	3.18e-08	3.30e-08	0.000950	0.0380	0.00528	0.00144	0.00114	4.15e-06	1.65e-06	0.00621	0.00484
AW-05	2.26e-07	1.29e-07	4.09e-08	2.50e-08	3.20e-07	0.000950	0.0380	0.00528	0.00127	0.00106	6.90e-07	2.87e-07	0.00634	0.00472
AW-19	1.81e-08	2.59e-08	1.07e-08	7.66e-08	9.13e-08	0.000950	0.0380	0.00528	0.00146	0.00175	8.29e-07	4.97e-07	0.00541	0.00279
AW-19	1.78e-08	2.84e-08	1.16e-08	4.80e-08	2.17e-07	0.000951	0.0380	0.00528	0.00148	0.00175	3.20e-07	1.90e-07	0.00545	0.00284
AW-21	2.24e-08	6.91e-09	8.80e-10	9.37e-07	1.55e-07	0.000950	0.0380	0.00528	0.00182	0.00125	1.16e-05	4.00e-06	0.00542	0.00486
AW-21	2.83e-08	8.73e-09	1.18e-09	6.75e-07	1.73e-06	0.000950	0.0380	0.00528	0.00148	0.00111	1.03e-06	3.88e-07	0.00567	0.00468
AP07S	1.39e-07	6.12e-08	9.90e-09	1.20e-08	4.69e-09	0	0	0	0	0	0	0	0	0
AW-15S	2.70e-08	9.18e-09	5.32e-10	2.97e-08	1.38e-08	0	0	0	0	0	0	0	0	0
AW-05	1.67e-07	9.94e-08	1.96e-08	2.50e-08	4.69e-09	0	0	0	0	0	0	0	0	0
AW-19	2.69e-08	2.38e-08	6.23e-09	3.91e-08	4.69e-09	0	0	0	0	0	0	0	0	0
AW-21	2.69e-08	1.01e-08	5.31e-10	2.40e-07	2.64e-08	0	0	0	0	0	0	0	0	0
AP07S	1.39e-07	6.12e-08	9.90e-09	1.20e-08	4.69e-09	0.000315	0.0126	0.00759	0.000651	0.000557	5.16e-05	2.21e-05	0.00159	0.00114
AW-15S	2.70e-08	9.18e-09	5.32e-10	2.97e-08	1.38e-08	0.000315	0.0126	0.00759	0.000575	0.000594	7.37e-05	3.82e-05	0.00147	0.000877
AW-05	1.67e-07	9.94e-08	1.96e-08	2.50e-08	4.69e-09	0.00120	0.0480	0.00858	0.00243	0.00188	0.000169	6.56e-05	0.00774	0.00616
AW-19	2.69e-08	2.38e-08	6.23e-09	3.91e-08	4.69e-09	0.00120	0.0480	0.00858	0.00207	0.00264	2.75e-05	1.76e-05	0.00691	0.00334
AW-21	2.69e-08	1.01e-08	5.31e-10	2.40e-07	2.64e-08	0.00120	0.0480	0.00858	0.00385	0.00273	0.000518	0.000184	0.00687	0.00597
AP07S	1.37e-07	4.11e-08	1.18e-08	1.79e-08	9.67e-09	0.000315	0.0126	0.00759	0.000462	0.000409	7.03e-07	3.12e-07	0.00166	0.00116
AP07S	1.46e-07	5.26e-08	1.52e-08	1.48e-08	8.47e-08	0.000315	0.0126	0.00759	0.000434	0.000403	1.18e-07	5.48e-08	0.00173	0.00115
AW-15S	1.94e-08	7.52e-09	7.86e-10	3.12e-08	2.06e-08	0.000315	0.0126	0.00759	0.000498	0.000473	1.44e-06	6.85e-07	0.00149	0.000970
AW-15S	1.90e-08	1.00e-08	1.04e-09	1.98e-08	3.06e-08	0.000315	0.0126	0.00759	0.000490	0.000480	2.61e-07	1.28e-07	0.00158	0.000992
AW-05	1.82e-07	8.81e-08	2.74e-08	3.33e-08	1.38e-08	0.00120	0.0480	0.00858	0.00187	0.00147	7.20e-06	2.83e-06	0.00781	0.00615
AW-05	2.15e-07	1.18e-07	3.74e-08	2.73e-08	1.17e-07	0.00120	0.0480	0.00858	0.00166	0.00136	1.38e-06	5.67e-07	0.00797	0.00601
AW-19	1.83e-08	2.63e-08	1.11e-08	8.30e-08	7.63e-08	0.00120	0.0480	0.00858	0.00184	0.00221	1.36e-06	8.15e-07	0.00683	0.00351
AW-19	1.79e-08	2.83e-08	1.19e-08	5.58e-08	1.86e-07	0.00120	0.0480	0.00858	0.00186	0.00221	5.72e-07	3.40e-07	0.00685	0.00356
AW-21	2.14e-08	7.36e-09	9.09e-10	9.88e-07	9.24e-08	0.00120	0.0480	0.00858	0.00240	0.00162	1.89e-05	6.41e-06	0.00677	0.00618
AW-21	2.62e-08	8.40e-09	1.13e-09	7.78e-07	4.18e-07	0.00120	0.0480	0.00858	0.00199	0.00145	2.01e-06	7.34e-07	0.00707	0.00598
AP07S	1.39e-07	6.12e-08	9.90e-09	1.20e-08	4.69e-09	0	0	0	0	0	0	0	0	0
AW-15S	2.70e-08	9.18e-09	5.32e-10	2.97e-08	1.38e-08	0	0	0	0	0	0	0	0	0
AW-05	1.67e-07	9.94e-08	1.96e-08	2.50e-08	4.69e-09	0	0	0	0	0	0	0	0	0
AW-19	2.69e-08	2.38e-08	6.23e-09	3.91e-08	4.69e-09	0	0	0	0	0	0	0	0	0
AW-21	2.69e-08	1.01e-08	5.31e-10	2.40e-07	2.64e-08	0	0	0	0	0	0	0	0	0
AP07S	1.39e-07	6.12e-08	9.90e-09	1.20e-08	4.69e-09	0.000260	0.0104	0.00594	0.000537	0.000460	4.26e-05	1.83e-05	0.00131	0.000945
AW-15S	2.70e-08	9.18e-09	5.32e-10	2.97e-08	1.38e-08	0.000260	0.0104	0.00594	0.000474	0.000490	6.08e-05	3.15e-05	0.00121	0.000724
AW-05	1.67e-07	9.94e-08	1.96e-08	2.50e-08	4.69e-09	0.00115	0.0460	0.00693	0.00233	0.00180	0.000162	6.29e-05	0.00741	0.00591
AW-19	2.69e-08	2.38e-08	6.23e-09	3.91e-08	4.69e-09	0.00115	0.0460	0.00693	0.00198	0.00253	2.64e-05	1.69e-05	0.00663	0.00320
AW-21	2.69e-08	1.01e-08	5.31e-10	2.40e-07	2.64e-08	0.00115	0.0460	0.00693	0.00369	0.00262	0.000496	0.000177	0.00658	0.00572
AP07S	1.38e-07	4.19e-08	1.20e-08	1.74e-08	1.24e-08	0.000260	0.0104	0.00594	0.000377	0.000337	4.51e-07	2.02e-07	0.00138	0.000955
AP07S	1.46e-07	5.49e-08	1.59e-08	1.43e-08	1.37e-07	0.000260	0.0104	0.00594	0.000356	0.000334	6.93e-08	3.27e-08	0.00145	0.000950
AW-15S	1.94e-08	7.80e-09	8.14e-10	2.91e-08	2.09e-08	0.000260	0.0104	0.00594	0.000410	0.000391	9.39e-07	4.50e-07	0.00125	0.000804
AW-15S	1.89e-08	1.09e-08	1.13e-09	1.83e-08	6.91e-08	0.000260	0.0104	0.00594	0.000402	0.000399	1.53e-07	7.62e-08	0.00133	0.000824
AW-05	1.84e-07	8.88e-08	2.76e-08	3.30e-08	1.88e-08	0.00115	0.0460	0.00693	0.00179	0.00140	6.27e-06	2.46e-06	0.00749	0.00589
AW-05	2.18e-07	1.21e-07	3.84e-08	2.68e-08	2.00e-07	0.00115	0.0460	0.00693	0.00158	0.00130	1.11e-06	4.58e-07	0.00765	0.00575
AW-19	1.82e-08	2.58e-08	1.08e-08	8.19e-08	7.60e-08	0.00115	0.0460	0.00693	0.00177	0.00212	1.19e-06	7.15e-07	0.00654	0.00337
AW-19	1.79e-08	2.81e-08	1.16e-08	5.43e-08	1.96e-07	0.00115	0.0460	0.00693	0.00179	0.00212	4.79e-07	2.85e-07	0.00657	0.00342
AW-21	2.15e-08	7.05e-09	8.76e-10	9.79e-07	1.07e-07	0.00115	0.0460	0.00693	0.00228	0.00155	1.74e-05	5.90e-06	0.00650	0.00592
AW-21	2.66e-08	8.33e-09	1.13e-09	7.59e-07	7.99e-07	0.00115	0.0460	0.00693	0.00188	0.00138	1.68e-06	6.17e-07	0.00679	0.00572

NOTES:
All model results are
pH and pe (standarc
charge (equivalents
Results beginning w
Results beginning w

Attachment D. PHRE
Groundwater Polishi
Ash Pond
Edwards Power Plant
Bartonville, IL

Location	m_Hfo_ wHCO3	m_Hfo_ wCO3-	m_Hfo_ wPO4-2	m_Hfo_ wHPO4-	m_Hfo_ wH2PO4	m_Hfo_ sCO3-	m_Hfo_ sHCO3	m_Hfo_ sHPO4-	m_Hfo_ sH2BO3	m_Hfo_ sH2PO4	m_Hfo_ sOSi(OH)3	m_Hfo_ sOSi(OH)2-	m_Hfo_ sOHSO4-2	m_Hfo_ sSO4-
AP07S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-15S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP07S	0.00269	0.000532	0.000149	0.000307	1.07e-05	1.91e-08	9.67e-08	1.10e-08	7.90e-11	3.86e-10	3.64e-08	2.61e-08	1.16e-09	4.98e-10
AW-15S	0.00335	0.000547	0.000103	0.000256	1.08e-05	9.82e-08	6.00e-07	4.60e-08	1.58e-10	1.95e-09	1.68e-07	9.98e-08	8.24e-09	4.29e-09
AW-05	0.0102	0.00224	0.000337	0.000627	1.98e-05	5.61e-08	2.56e-07	1.57e-08	1.14e-10	4.97e-10	1.54e-07	1.23e-07	3.31e-09	1.29e-09
AW-19	0.0160	0.00213	4.97e-05	0.000152	7.91e-06	3.76e-07	2.82e-06	2.69e-08	2.92e-10	1.40e-09	9.72e-07	4.70e-07	3.79e-09	2.42e-09
AW-21	0.00937	0.00224	0.000223	0.000380	1.10e-05	2.89e-07	1.21e-06	4.90e-08	1.57e-09	1.42e-09	7.02e-07	6.09e-07	5.24e-08	1.86e-08
AP07S	0.00284	0.000534	0.000158	0.000343	1.26e-05	1.99e-08	1.06e-07	1.27e-08	1.32e-11	4.69e-10	4.02e-08	2.74e-08	9.58e-12	4.34e-12
AP07S	0.00280	0.000497	0.000166	0.000379	1.48e-05	1.81e-08	1.02e-07	1.38e-08	7.59e-12	5.37e-10	4.13e-08	2.67e-08	1.33e-12	6.35e-13
AW-15S	0.00333	0.000586	0.000123	0.000284	1.12e-05	1.05e-07	5.95e-07	5.08e-08	5.35e-11	1.99e-09	1.75e-07	1.12e-07	9.63e-11	4.66e-11
AW-15S	0.00323	0.000542	0.000132	0.000320	1.32e-05	9.61e-08	5.73e-07	5.68e-08	3.60e-11	2.34e-09	1.87e-07	1.14e-07	1.33e-11	6.77e-12
AW-05	0.0111	0.00238	0.000350	0.000662	2.13e-05	6.03e-08	2.80e-07	1.68e-08	3.48e-11	5.39e-10	1.58e-07	1.23e-07	1.07e-10	4.25e-11
AW-05	0.0114	0.00234	0.000355	0.000703	2.36e-05	5.81e-08	2.82e-07	1.74e-08	1.98e-11	5.86e-10	1.58e-07	1.18e-07	1.74e-11	7.18e-12
AW-19	0.0161	0.00230	6.50e-05	0.000185	8.98e-06	3.72e-07	2.61e-06	3.00e-08	1.54e-10	1.45e-09	8.80e-07	4.56e-07	1.42e-10	8.45e-11
AW-19	0.0159	0.00230	7.81e-05	0.000220	1.06e-05	3.67e-07	2.54e-06	3.51e-08	1.19e-10	1.68e-09	8.71e-07	4.56e-07	5.21e-11	3.07e-11
AW-21	0.0112	0.00276	0.000246	0.000406	1.14e-05	3.51e-07	1.42e-06	5.17e-08	4.24e-10	1.45e-09	6.91e-07	6.20e-07	1.48e-09	5.09e-10
AW-21	0.0118	0.00268	0.000251	0.000449	1.36e-05	3.43e-07	1.51e-06	5.75e-08	1.71e-10	1.75e-09	7.28e-07	6.01e-07	1.33e-10	4.98e-11
AP07S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-15S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP07S	0.00424	0.000837	0.000235	0.000484	1.69e-05	3.01e-08	1.52e-07	1.74e-08	1.24e-10	6.08e-10	5.74e-08	4.12e-08	1.82e-09	7.84e-10
AW-15S	0.00527	0.000862	0.000162	0.000404	1.71e-05	1.55e-07	9.46e-07	7.24e-08	2.49e-10	3.06e-09	2.65e-07	1.57e-07	1.30e-08	6.75e-09
AW-05	0.0129	0.00283	0.000426	0.000792	2.50e-05	7.09e-08	3.24e-07	1.99e-08	1.44e-10	6.27e-10	1.95e-07	1.55e-07	4.19e-09	1.63e-09
AW-19	0.0202	0.00269	6.28e-05	0.000192	9.99e-06	4.74e-07	3.57e-06	3.39e-08	3.69e-10	1.76e-09	1.23e-06	5.93e-07	4.78e-09	3.06e-09
AW-21	0.0118	0.00283	0.000282	0.000480	1.39e-05	3.65e-07	1.53e-06	6.19e-08	1.99e-09	1.79e-09	8.87e-07	7.70e-07	6.61e-08	2.36e-08
AP07S	0.00450	0.000865	0.000245	0.000519	1.86e-05	3.22e-08	1.67e-07	1.93e-08	2.59e-11	6.94e-10	6.19e-08	4.32e-08	2.78e-11	1.23e-11
AP07S	0.00447	0.000821	0.000251	0.000557	2.10e-05	3.01e-08	1.64e-07	2.04e-08	1.54e-11	7.70e-10	6.37e-08	4.24e-08	4.55e-12	2.11e-12
AW-15S	0.00530	0.000951	0.000188	0.000426	1.65e-05	1.70e-07	9.50e-07	7.64e-08	9.74e-11	2.95e-09	2.68e-07	1.74e-07	2.68e-10	1.27e-10
AW-15S	0.00520	0.000903	0.000197	0.000463	1.84e-05	1.61e-07	9.26e-07	8.24e-08	6.76e-11	3.28e-09	2.81e-07	1.77e-07	4.77e-11	2.34e-11
AW-05	0.0139	0.00302	0.000441	0.000825	2.62e-05	7.64e-08	3.51e-07	2.09e-08	5.01e-11	6.63e-10	1.98e-07	1.56e-07	1.87e-10	7.31e-11
AW-05	0.0143	0.00297	0.000444	0.000868	2.88e-05	7.41e-08	3.56e-07	2.16e-08	2.98e-11	7.19e-10	1.99e-07	1.51e-07	3.51e-11	1.43e-11
AW-19	0.0204	0.00290	7.87e-05	0.000225	1.09e-05	4.69e-07	3.29e-06	3.64e-08	2.14e-10	1.77e-09	1.11e-06	5.73e-07	2.34e-10	1.40e-10
AW-19	0.0202	0.00291	9.19e-05	0.000260	1.25e-05	4.63e-07	3.21e-06	4.13e-08	1.70e-10	1.98e-09	1.09e-06	5.72e-07	9.41e-11	5.56e-11
AW-21	0.0139	0.00351	0.000310	0.000502	1.38e-05	4.45e-07	1.77e-06	6.37e-08	6.70e-10	1.75e-09	8.60e-07	7.87e-07	2.41e-09	8.15e-10
AW-21	0.0147	0.00342	0.000313	0.000546	1.62e-05	4.38e-07	1.88e-06	6.98e-08	2.83e-10	2.07e-09	9.05e-07	7.66e-07	2.58e-10	9.43e-11
AP07S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-15S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP07S	0.00350	0.000691	0.000194	0.000399	1.40e-05	2.48e-08	1.26e-07	1.43e-08	1.03e-10	5.02e-10	4.74e-08	3.40e-08	1.50e-09	6.47e-10
AW-15S	0.00435	0.000712	0.000134	0.000333	1.41e-05	1.28e-07	7.81e-07	5.98e-08	2.05e-10	2.53e-09	2.18e-07	1.30e-07	1.07e-08	5.57e-09
AW-05	0.0124	0.00271	0.000408	0.000759	2.40e-05	6.79e-08	3.10e-07	1.90e-08	1.38e-10	6.01e-10	1.87e-07	1.49e-07	4.01e-09	1.56e-09
AW-19	0.0194	0.00258	6.02e-05	0.000184	9.58e-06	4.55e-07	3.42e-06	3.25e-08	3.53e-10	1.69e-09	1.18e-06	5.69e-07	4.58e-09	2.93e-09
AW-21	0.0113	0.00271	0.000270	0.000480	1.33e-05	3.49e-07	1.46e-06	5.93e-08	1.90e-09	1.72e-09	8.50e-07	7.38e-07	6.34e-08	2.26e-08
AP07S	0.00371	0.000706	0.000203	0.000435	1.58e-05	2.63e-08	1.38e-07	1.62e-08	1.95e-11	5.87e-10	5.15e-08	3.57e-08	1.78e-11	7.96e-12
AP07S	0.00367	0.000666	0.000210	0.000472	1.80e-05	2.43e-08	1.34e-07	1.73e-08	1.14e-11	6.58e-10	5.30e-08	3.49e-08	2.66e-12	1.25e-12
AW-15S	0.00436	0.000776	0.000157	0.000358	1.39e-05	1.39e-07	7.80e-07	6.41e-08	7.56e-11	2.49e-09	2.23e-07	1.44e-07	1.74e-10	8.34e-11
AW-15S	0.00426	0.000730	0.000166	0.000394	1.59e-05	1.30e-07	7.57e-07	7.02e-08	5.20e-11	2.83e-09	2.36e-07	1.47e-07	2.79e-11	1.39e-11
AW-05	0.0133	0.00289	0.000423	0.000792	2.52e-05	7.32e-08	3.37e-07	2.00e-08	4.60e-11	6.38e-10	1.90e-07	1.50e-07	1.62e-10	6.36e-11
AW-05	0.0137	0.00285	0.000426	0.000835	2.78e-05	7.07e-08	3.40e-07	2.08e-08	2.67e-11	6.91e-10	1.90e-07	1.44e-07	2.81e-11	1.15e-11
AW-19	0.0195	0.00278	7.60e-05	0.000217	1.05e-05	4.51e-07	3.16e-06	3.52e-08	1.97e-10	1.71e-09	1.06e-06	5.51e-07	2.05e-10	1.22e-10
AW-19	0.0193	0.00279	8.91e-05	0.000252	1.21e-05	4.45e-07	3.08e-06	4.02e-08	1.55e-10	1.93e-09	1.05e-06	5.51e-07	7.86e-11	4.64e-11
AW-21	0.0134	0.00336	0.000297	0.000483	1.33e-05	4.27e-07	1.70e-06	6.13e-08	5.95e-10	1.69e-09	8.27e-07	7.54e-07	2.21e-09	7.50e-10
AW-21	0.0141	0.00327	0.000300	0.000527	1.57e-05	4.19e-07	1.80e-06	6.74e-08	2.46e-10	2.01e-09	8.70e-07	7.33e-07	2.16e-10	7.92e-11
AP07S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-15S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP07S	0.00269	0.000534	0.000150	0.000308	1.07e-05	1.90e-08	9.58e-08	1.10e-08	7.78e-11	3.82e-10	3.59e-08	2.59e-08	1.17e-09	5.00e-10
AW-15S	0.00335	0.000550	0.000104	0.000257	1.08e-05	9.80e-08	5.96e-07	4.59e-08	1.56e-10	1.93e-09	1.66e-07	9.91e-08	8.34e-09	4.32e-09
AW-05	0.0102	0.00224	0.000338	0.000628	1.98e-05	5.58e-08	2.54e-07	1.56e-08	1.12e-10	4.92e-10	1.52e-07	1.21e-07	3.33e-09	1.29e-09
AW-19	0.0160	0.00213	4.97e-05	0.000152	7.90e-06	3.70e-07	2.78e-06	2.64e-08	2.85e-10	1.37e-09	9.51e-07	4.60e-07	3.78e-09	2.42e-09
AW-21	0.00937	0.00224	0.000224	0.000381	1.10e-05	2.88e-07	1.20e-06	4.89e-08	1.56e-09	1.41e-09	6.98e-07	6.06e-07	5.26e-08	1.87e-08
AP07S	0.00284	0.000533	0.000158	0.000345	1.27e-05	1.95e-08	1.04e-07	1.26e-08	1.30e-11	4.66e-10	3.95e-08	2.69e-08	8.88e-12	4.04e-12
AP07S	0.00280	0.000496	0.000166	0.000381	1.49e-05	1.78e-08	1.00e-07	1.37e-08	7.48e-12	5.33e-10	4.07e-08	2.62e-08	1.25e-12	6.01e-13
AW-15S	0.00333	0.000585	0.000123	0.000286	1.12e-05	1.04e-07	5.91e-07	5.06e-08	5.29e-11	1.99e-09	1.73e-07	1.10e-07	9.22e-11	4.47e-11
AW-15S	0.00323	0.000541	0.000132	0.000322	1.33e-05	9.51e-08	5.69e-07	5.66e-08	3.57e-11	2.34e-09	1.85e-07	1.13e-07	1.29e-11	6.57e-12
AW-05	0.0111	0.00237	0.000350	0.000664	2.14e-05	5.93e-08	2.76e-07	1.66e-08	3.43e-11	5.34e-10	1.55e-07	1.21e-07	1.04e-10	4.12e-11
AW-05	0.0114	0.00233	0.000355	0.000705	2.38e-05	5.71e-08	2.78e-07	1.73e-08	1.95e-11	5.82e-10	1.55e-07	1.16e-07	1.69e-11	7.02e-12
AW-19	0.0161	0.00228	6.46e-05	0.000186	9.05e-06	3.62e-07	2.55e-06	2.95e-08	1.48e-10	1.44e-09	8.60e-07	4.43e-07	1.32e-10	7.90e-11
AW-19	0.0159	0.00228	7.76e-05	0.000220	1.06e-05	3.57e-07	2.49e-06	3.44e-08	1.15e-10	1.66e-09	8.51e-07	4.43e-07	5.00e-11	2.97e-11
AW-21	0.0112	0.00276	0.000247	0.000407	1.14e-05	3.49e-07	1.42e-06	5.16e-08	4.23e-10	1.45e-09	6.87e-07	6.15e-07	1.47e-09	5.06e-10
AW-21	0.0118	0.00267	0.000251	0.000450	1.37e-05	3.41e-07	1.50e-06	5.75e-08	1.71e-10	1.75e-09	7.24e-07	5.97e-07	1.32e-10	4.95e-11
AP07S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-15S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP07S	0.00424	0.000841	0.000236	0.000485	1.69e-05	3.00e-08	1.51e-07	1.73e-08	1.23e-10	6.02e-10	5.65e-08	4.08e-08	1.84e-09	7.88e-10
AW-15S	0.00527	0.000867	0.000164	0.000406	1.71e-05	1.54e-07	9.39e-07	7.22e-08	2.46e-10	3.04e-09	2.62e-07	1.56e-07	1.31e-08	6.80e-09
AW-05	0.0129	0.00283	0.000427	0.000793	2.50e-05	7.04e-08	3.21e-07	1.97e-08	1.42e-10	6.22e-10	1.92e-07	1.53e-07	4.20e-09	1.63e-09
AW-19	0.0202	0.00269	6.28e-05	0.000192	9.98e-06	4.67e-07	3.51e-06	3.34e-08	3.61e-10	1.73e-09	1.20e-06	5.81e-07	4.78e-09	3.05e-09
AW-21	0.0118	0.00283	0.000283	0.000482	1.39e-05	3.64e-07	1.52e-06	6.18e-08	1.97e-09	1.79e-09	8.81e-07	7.66e-07	6.65e-08	2.36e-08
AP07S	0.00450	0.000863	0.000246	0.000521	1.88e-05	3.16e-08	1.65e-07	1.91e-08	2.56e-11	6.89e-10	6.09e-08	4.24e-08	2.58e-11	1.14e-11
AP07S	0.00447	0.000819	0.000252	0.000560	2.12e-05	2.96e-08	1.62e-07	2.02e-08	1.52e-11	7.65e-10	6.26e-08	4.16e-08	4.26e-12	1.98e-12
AW-15S	0.00530	0.000949	0.000189	0.000429	1.66e-05	1.69e-07	9.42e-07	7.62e-08	9.64e-11	2.95e-09	2.65e-07	1.72e-07	2.56e-10	1.22e-10
AW-15S	0.00520	0.000901	0.000198	0.000465	1.86e-05	1.59e-07	9.19e-07	8.22e-08	6.70e-11	3.28e-09	2.79e-07	1.75e-07	4.62e-11	2.27e-11
AW-05	0.0139	0.00301	0.000441	0.000827	2.64e-05	7.51e-08	3.46e-07	2.06e-08	4.93e-11	6.57e-10	1.95e-07	1.53e-07	1.80e-10	7.04e-11
AW-05	0.0143	0.00296	0.000443	0.000870	2.90e-05	7.28e-08	3.51e-07	2.14e-08	2.93e-11	7.14e-10	1.96e-07	1.48e-07	3.40e-11	1.39e-11
AW-19	0.0203	0.00288	7.83e-05	0.000225	1.10e-05	4.56e-07	3.22e-06	3.57e-08	2.04e-10	1.74e-09	1.08e-06	5.56e-07	2.15e-10	1.29e-10
AW-19	0.0202	0.00289	9.14e-05	0.000260	1.26e-05	4.50e-07	3.14e-06	4.05e-08	1.64e-10	1.96e-09	1.07e-06	5.55e-07	8.91e-11	5.30e-11
AW-21	0.0139	0.00350	0.000311	0.000503	1.38e-05	4.43e-07	1.76e-06	6.36e-08	6.69e-10	1.75e-09	8.56e-07	7.81e-07	2.39e-09	8.10e-10
AW-21	0.0147	0.00341	0.000313	0.000548	1.63e-05	4.35e-07	1.87e-06	6.97e-08	2.82e-10	2.07e-09	9.00e-07	7.61e-07	2.55e-10	9.35e-11
AP07S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-15S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP07S	0.00350	0.000695	0.000195	0.000401	1.40e-05	2.47e-08	1.25e-07	1.43e-08	1.01e-10	4.97e-10	4.67e-08	3.36e-08	1.52e-09	6.50e-10
AW-15S	0.00435	0.000716	0.000135	0.000335	1.41e-05	1.27e-07	7.75e-07	5.96e-08	2.03e-10	2.51e-09	2.16e-07	1.29e-07	1.08e-08	5.61e-09
AW-05	0.0124	0.00272	0.000410	0.000760	2.40e-05	6.75e-08	3.08e-07	1.89e-08	1.36e-10	5.96e-10	1.84e-07	1.47e-07	4.03e-09	1.56e-09
AW-19	0.0194	0.00258	6.02e-05	0.000184	9.56e-06	4.48e-07	3.36e-06	3.20e-08	3.45e-10	1.66e-09	1.15e-06	5.57e-07	4.58e-09	2.93e-09
AW-21	0.0113	0.00272	0.000271	0.000462	1.33e-05	3.48e-07	1.46e-06	5.92e-08	1.89e-09	1.71e-09	8.45e-07	7.34e-07	6.37e-08	2.27e-08
AP07S	0.00371	0.000704	0.000204	0.000437	1.59e-05	2.58e-08	1.36e-07	1.60e-08	1.92e-11	5.83e-10	5.07e-08	3.50e-08	1.65e-11	7.40e-12
AP07S	0.00367	0.000664	0.000211	0.000475	1.82e-05	2.39e-08	1.32e-07	1.71e-08	1.13e-11	6.53e-10	5.21e-08	3.42e-08	2.50e-12	1.18e-12
AW-15S	0.00436	0.000775	0.000157	0.000360	1.40e-05	1.38e-07	7.74e-07	6.40e-08	7.48e-11	2.49e-09	2.21e-07	1.43e-07	1.67e-10	7.99e-11
AW-15S	0.00426	0.000728	0.000166	0.000397	1.60e-05	1.28e-07	7.51e-07	7.00e-08	5.15e-11	2.83e-09	2.34e-07	1.45e-07	2.70e-11	1.34e-11
AW-05	0.0133	0.00288	0.000422	0.000795	2.54e-05	7.19e-08	3.32e-07	1.98e-08	4.53e-11	6.33e-10	1.87e-07	1.47e-07	1.56e-10	6.14e-11
AW-05	0.0137	0.00284	0.000426	0.000837	2.80e-05	6.95e-08	3.36e-07	2.05e-08	2.63e-11	6.86e-10	1.87e-07	1.41e-07	2.73e-11	1.12e-11
AW-19	0.0195	0.00276	7.56e-05	0.000217	1.06e-05	4.39e-07	3.10e-06	3.45e-08	1.89e-10	1.69e-09	1.04e-06	5.35e-07	1.89e-10	1.14e-10
AW-19	0.0193	0.00277	8.86e-05	0.000252	1.22e-05	4.33e-07	3.02e-06	3.94e-08	1.49e-10	1.90e-09	1.03e-06	5.34e-07	7.49e-11	4.46e-11
AW-21	0.0134	0.00335	0.000298	0.000484	1.34e-05	4.24e-07	1.69e-06	6.12e-08	5.95e-10	1.69e-09	8.22e-07	7.49e-07	2.20e-09	7.46e-10
AW-21	0.0141	0.00327	0.000301	0.000528	1.58e-05	4.16e-07	1.80e-06	6.73e-08	2.45e-10	2.01e-09	8.65e-07	7.28e-07	2.14e-10	7.86e-11

NOTES:
All model results are
pH and pe (standarc
charge (equivalents
Results beginning w
Results beginning w

Attachment D. PHRE
Groundwater Polishi
Ash Pond
Edwards Power Plant
Bartonville, IL

Location	m_Hao_ SO4-	m_Hao_ OHSO4-2	m_Hao_ H2BO3	m_Hao_ H3BO4-	Ferrihydrite	d_Ferrihydrite	Gibbsite	d_Gibbsite	Barite	d_Barite	Calcite	d_Calcite	Dolomite (ordered)	d_Dolomite (ordered)
AP07S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-15S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP07S	2.25e-14	0.000230	0.00386	1.85e-10	0.0400	0	0.130	0	0	0	0.100	0	0.300	0
AW-15S	5.73e-14	0.000298	0.00373	9.06e-11	0.0400	0	0.130	0	0	0	0.100	0	0.300	0
AW-05	4.48e-14	0.000565	0.00386	2.28e-10	0.190	0	0.160	0	0	0	0.400	0	0.700	0
AW-19	4.45e-14	0.000453	0.00394	1.87e-10	0.190	0	0.160	0	0	0	0.400	0	0.700	0
AW-21	3.03e-14	0.000213	0.00490	1.61e-10	0.190	0	0.160	0	0	0	0.400	0	0.700	0
AP07S	5.00e-15	0.000223	0.00359	7.48e-10	0.0400	7.51e-07	0.130	-9.26e-09	0	0	0.101	0.000555	0.300	-4.22e-04
AP07S	2.56e-15	0.000229	0.00342	1.43e-09	0.0400	3.06e-06	0.130	-8.90e-09	0	0	0.101	0.000509	0.299	-3.68e-04
AW-15S	8.68e-15	0.000243	0.00352	4.61e-10	0.0400	2.22e-07	0.130	-8.42e-09	9.29e-07	9.29e-07	0.101	0.000527	0.300	-4.76e-04
AW-15S	4.01e-15	0.000239	0.00338	9.42e-10	0.0400	1.81e-06	0.130	-8.60e-09	0	-9.29e-07	0.101	0.000478	0.299	-3.66e-04
AW-05	1.40e-14	0.000531	0.00366	6.49e-10	0.190	9.76e-06	0.160	-1.24e-08	2.05e-06	2.05e-06	0.400	0.000494	0.700	-2.87e-04
AW-05	7.55e-15	0.000515	0.00353	1.13e-09	0.190	2.31e-05	0.160	-1.07e-08	0	-2.05e-06	0.401	0.000454	0.700	-2.13e-04
AW-19	1.06e-14	0.000433	0.00380	7.26e-10	0.190	8.36e-05	0.160	-7.91e-09	0	0	0.401	0.000692	0.699	-7.27e-04
AW-19	7.06e-15	0.000424	0.00370	1.04e-09	0.190	5.42e-05	0.160	-8.37e-09	0	0	0.401	0.000509	0.699	-4.17e-04
AW-21	1.08e-14	0.000300	0.00449	5.83e-10	0.190	4.97e-06	0.160	-1.54e-08	2.90e-06	2.90e-06	0.401	0.000868	0.699	-7.21e-04
AW-21	5.28e-15	0.000286	0.00430	1.09e-09	0.190	2.13e-05	0.160	-1.23e-08	0	-2.90e-06	0.401	0.000422	0.699	-1.00e-04
AP07S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-15S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP07S	3.97e-14	0.000407	0.00683	3.27e-10	0.0630	0	0.230	0	0	0	0.100	0	0.300	0
AW-15S	1.01e-13	0.000527	0.00659	1.60e-10	0.0630	0	0.230	0	0	0	0.100	0	0.300	0
AW-05	7.28e-14	0.000918	0.00628	3.70e-10	0.240	0	0.260	0	0	0	0.400	0	0.700	0
AW-19	7.23e-14	0.000736	0.00640	3.05e-10	0.240	0	0.260	0	0	0	0.400	0	0.700	0
AW-21	4.93e-14	0.000346	0.00797	2.61e-10	0.240	0	0.260	0	0	0	0.400	0	0.700	0
AP07S	1.03e-14	0.000373	0.00649	1.10e-09	0.0630	4.31e-07	0.230	-9.50e-09	5.57e-07	5.57e-07	0.101	0.000582	0.300	-4.53e-04
AP07S	5.54e-15	0.000369	0.00628	1.96e-09	0.0630	1.80e-06	0.230	-8.90e-09	0	-5.57e-07	0.101	0.000493	0.299	-3.58e-04
AW-15S	1.85e-14	0.000416	0.00635	6.68e-10	0.0630	1.80e-07	0.230	-8.38e-09	2.04e-06	2.04e-06	0.101	0.000554	0.299	-5.35e-04
AW-15S	9.25e-15	0.000391	0.00618	1.22e-09	0.0630	3.77e-07	0.230	-8.51e-09	0	-2.04e-06	0.101	0.000449	0.299	-3.53e-04
AW-05	2.47e-14	0.000847	0.00605	9.70e-10	0.240	7.49e-06	0.260	-1.29e-08	2.49e-06	2.49e-06	0.401	0.000501	0.700	-3.09e-04
AW-05	1.40e-14	0.000812	0.00589	1.60e-09	0.240	1.51e-05	0.260	-1.12e-08	2.00e-07	-2.29e-06	0.401	0.000419	0.700	-1.59e-04
AW-19	1.90e-14	0.000703	0.00625	1.08e-09	0.240	9.54e-05	0.260	-7.80e-09	0	0	0.401	0.000747	0.699	-8.14e-04
AW-19	1.30e-14	0.000683	0.00613	1.51e-09	0.240	5.08e-05	0.260	-8.29e-09	0	0	0.401	0.000499	0.699	-4.17e-04
AW-21	1.70e-14	0.000449	0.00747	9.23e-10	0.240	3.22e-06	0.260	-1.61e-08	3.06e-06	3.06e-06	0.401	0.00101	0.699	-9.13e-04
AW-21	8.77e-15	0.000419	0.00722	1.61e-09	0.240	9.44e-06	0.260	-1.34e-08	1.53e-06	-1.53e-06	0.401	0.000392	0.699	-3.08e-05
AP07S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-15S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP07S	3.11e-14	0.000318	0.00535	2.56e-10	0.0520	0	0.180	0	0	0	0.100	0	0.300	0
AW-15S	7.93e-14	0.000412	0.00516	1.25e-10	0.0520	0	0.180	0	0	0	0.100	0	0.300	0
AW-05	5.88e-14	0.000742	0.00507	2.99e-10	0.230	0	0.210	0	0	0	0.400	0	0.700	0
AW-19	5.84e-14	0.000594	0.00517	2.46e-10	0.230	0	0.210	0	0	0	0.400	0	0.700	0
AW-21	3.98e-14	0.000279	0.00643	2.11e-10	0.230	0	0.210	0	0	0	0.400	0	0.700	0
AP07S	7.57e-15	0.000298	0.00504	9.28e-10	0.0520	5.30e-07	0.180	-9.38e-09	0	0	0.101	0.000568	0.300	-4.38e-04
AP07S	3.94e-15	0.000299	0.00485	1.72e-09	0.0520	2.54e-06	0.180	-8.89e-09	0	0	0.101	0.000500	0.299	-3.63e-04
AW-15S	1.34e-14	0.000329	0.00493	5.68e-10	0.0520	1.92e-07	0.180	-8.39e-09	1.64e-06	1.64e-06	0.101	0.000540	0.299	-5.07e-04
AW-15S	6.45e-15	0.000315	0.00478	1.09e-09	0.0520	6.99e-07	0.180	-8.54e-09	0	-1.64e-06	0.101	0.000461	0.299	-3.59e-04
AW-05	1.95e-14	0.000691	0.00485	8.05e-10	0.230	8.73e-06	0.210	-1.28e-08	2.36e-06	2.36e-06	0.401	0.000501	0.700	-3.05e-04
AW-05	1.07e-14	0.000665	0.00471	1.36e-09	0.230	1.92e-05	0.210	-1.11e-08	0	-2.36e-06	0.401	0.000432	0.700	-1.75e-04
AW-19	1.49e-14	0.000568	0.00502	8.97e-10	0.230	9.23e-05	0.210	-7.82e-09	0	0	0.401	0.000732	0.699	-7.93e-04
AW-19	1.00e-14	0.000553	0.00491	1.27e-09	0.230	5.37e-05	0.210	-8.31e-09	0	0	0.401	0.000503	0.699	-4.19e-04
AW-21	1.42e-14	0.000378	0.00597	7.44e-10	0.230	4.00e-06	0.210	-1.60e-08	3.03e-06	3.03e-06	0.401	0.000967	0.699	-8.63e-04
AW-21	7.11e-15	0.000356	0.00575	1.35e-09	0.230	1.38e-05	0.210	-1.32e-08	7.60e-07	-2.27e-06	0.401	0.000398	0.699	-4.33e-05
AP07S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-15S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP07S	2.24e-14	0.000225	0.00386	1.82e-10	0.0400	0	0.130	0	0	0	0.100	0	0.300	0
AW-15S	5.70e-14	0.000291	0.00372	8.90e-11	0.0400	0	0.130	0	0	0	0.100	0	0.300	0
AW-05	4.50e-14	0.000565	0.00385	2.26e-10	0.190	0	0.160	0	0	0	0.400	0	0.700	0
AW-19	4.49e-14	0.000456	0.00391	1.86e-10	0.190	0	0.160	0	0	0	0.400	0	0.700	0
AW-21	3.02e-14	0.000209	0.00490	1.59e-10	0.190	0	0.160	0	0	0	0.400	0	0.700	0
AP07S	4.86e-15	0.000223	0.00358	7.69e-10	0.0400	8.13e-07	0.130	-9.28e-09	0	0	0.101	0.000551	0.300	-4.15e-04
AP07S	2.51e-15	0.000229	0.00342	1.46e-09	0.0400	3.21e-06	0.130	-8.91e-09	0	0	0.101	0.000510	0.299	-3.69e-04
AW-15S	8.54e-15	0.000242	0.00352	4.67e-10	0.0400	2.27e-07	0.130	-8.44e-09	8.40e-07	8.40e-07	0.101	0.000520	0.300	-4.67e-04
AW-15S	3.97e-15	0.000239	0.00338	9.50e-10	0.0400	1.88e-06	0.130	-8.60e-09	0	-8.40e-07	0.101	0.000478	0.299	-3.66e-04
AW-05	1.39e-14	0.000536	0.00364	6.55e-10	0.190	1.04e-05	0.160	-1.25e-08	2.03e-06	2.03e-06	0.400	0.000488	0.700	-2.72e-04
AW-05	7.56e-15	0.000520	0.00351	1.13e-09	0.190	2.42e-05	0.160	-1.07e-08	0	-2.03e-06	0.401	0.000454	0.700	-2.12e-04
AW-19	1.05e-14	0.000439	0.00378	7.35e-10	0.190	9.19e-05	0.160	-7.96e-09	0	0	0.401	0.000690	0.699	-7.09e-04
AW-19	7.12e-15	0.000430	0.00368	1.04e-09	0.190	5.56e-05	0.160	-8.38e-09	0	0	0.401	0.000509	0.699	-4.16e-04
AW-21	1.08e-14	0.000300	0.00449	5.84e-10	0.190	5.10e-06	0.160	-1.54e-08	2.90e-06	2.90e-06	0.401	0.000867	0.699	-7.14e-04
AW-21	5.28e-15	0.000286	0.00430	1.09e-09	0.190	2.17e-05	0.160	-1.24e-08	0	-2.90e-06	0.401	0.000422	0.699	-9.96e-05
AP07S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-15S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP07S	3.96e-14	0.000399	0.00683	3.22e-10	0.0630	0	0.230	0	0	0	0.100	0	0.300	0
AW-15S	1.01e-13	0.000515	0.00659	1.57e-10	0.0630	0	0.230	0	0	0	0.100	0	0.300	0
AW-05	7.31e-14	0.000917	0.00625	3.67e-10	0.240	0	0.260	0	0	0	0.400	0	0.700	0
AW-19	7.29e-14	0.000741	0.00635	3.02e-10	0.240	0	0.260	0	0	0	0.400	0	0.700	0
AW-21	4.91e-14	0.000340	0.00797	2.58e-10	0.240	0	0.260	0	0	0	0.400	0	0.700	0
AP07S	1.00e-14	0.000373	0.00649	1.13e-09	0.0630	4.61e-07	0.230	-9.53e-09	3.80e-07	3.80e-07	0.101	0.000574	0.300	-4.41e-04
AP07S	5.42e-15	0.000370	0.00628	2.00e-09	0.0630	1.95e-06	0.230	-8.91e-09	0	-3.80e-07	0.101	0.000494	0.299	-3.58e-04
AW-15S	1.82e-14	0.000414	0.00635	6.78e-10	0.0630	1.81e-07	0.230	-8.40e-09	1.99e-06	1.99e-06	0.101	0.000541	0.299	-5.20e-04
AW-15S	9.15e-15	0.000390	0.00618	1.23e-09	0.0630	3.91e-07	0.230	-8.52e-09	0	-1.99e-06	0.101	0.000449	0.299	-3.53e-04
AW-05	2.46e-14	0.000855	0.00602	9.80e-10	0.240	8.07e-06	0.260	-1.30e-08	2.47e-06	2.47e-06	0.400	0.000491	0.700	-2.89e-04
AW-05	1.40e-14	0.000820	0.00587	1.61e-09	0.240	1.60e-05	0.260	-1.12e-08	1.23e-07	-2.34e-06	0.401	0.000419	0.700	-1.58e-04
AW-19	1.87e-14	0.000713	0.00620	1.10e-09	0.240	0.000107	0.260	-7.86e-09	0	0	0.401	0.000741	0.699	-7.90e-04
AW-19	1.30e-14	0.000694	0.00609	1.52e-09	0.240	5.26e-05	0.260	-8.31e-09	0	0	0.401	0.000500	0.699	-4.17e-04
AW-21	1.69e-14	0.000449	0.00747	9.25e-10	0.240	3.32e-06	0.260	-1.62e-08	3.06e-06	3.06e-06	0.401	0.00101	0.699	-9.04e-04
AW-21	8.76e-15	0.000419	0.00722	1.62e-09	0.240	9.68e-06	0.260	-1.34e-08	1.52e-06	-1.54e-06	0.401	0.000392	0.699	-2.98e-05
AP07S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-15S	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AW-21	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AP07S	3.10e-14	0.000312	0.00534	2.52e-10	0.0520	0	0.180	0	0	0	0.100	0	0.300	0
AW-15S	7.90e-14	0.000403	0.00516	1.23e-10	0.0520	0	0.180	0	0	0	0.100	0	0.300	0
AW-05	5.91e-14	0.000741	0.00505	2.96e-10	0.230	0	0.210	0	0	0	0.400	0	0.700	0
AW-19	5.89e-14	0.000598	0.00513	2.44e-10	0.230	0	0.210	0	0	0	0.400	0	0.700	0
AW-21	3.97e-14	0.000275	0.00643	2.08e-10	0.230	0	0.210	0	0	0	0.400	0	0.700	0
AP07S	7.36e-15	0.000298	0.00503	9.54e-10	0.0520	5.69e-07	0.180	-9.41e-09	0	0	0.101	0.000562	0.300	-4.28e-04
AP07S	3.86e-15	0.000300	0.00484	1.76e-09	0.0520	2.70e-06	0.180	-8.89e-09	0	0	0.101	0.000501	0.299	-3.64e-04
AW-15S	1.31e-14	0.000328	0.00493	5.75e-10	0.0520	1.95e-07	0.180	-8.41e-09	1.57e-06	1.57e-06	0.101	0.000530	0.300	-4.94e-04
AW-15S	6.39e-15	0.000314	0.00478	1.10e-09	0.0520	7.31e-07	0.180	-8.55e-09	0	-1.57e-06	0.101	0.000461	0.299	-3.59e-04
AW-05	1.94e-14	0.000697	0.00483	8.13e-10	0.230	9.37e-06	0.210	-1.29e-08	2.34e-06	2.34e-06	0.400	0.000493	0.700	-2.86e-04
AW-05	1.07e-14	0.000671	0.00469	1.37e-09	0.230	2.02e-05	0.210	-1.11e-08	0	-2.34e-06	0.401	0.000432	0.700	-1.73e-04
AW-19	1.48e-14	0.000576	0.00499	9.11e-10	0.230	0.000102	0.210	-7.88e-09	0	0	0.401	0.000728	0.699	-7.72e-04
AW-19	1.01e-14	0.000562	0.00488	1.27e-09	0.230	5.53e-05	0.210	-8.32e-09	0	0	0.401	0.000504	0.699	-4.19e-04
AW-21	1.42e-14	0.000378	0.00597	7.45e-10	0.230	4.12e-06	0.210	-1.60e-08	3.04e-06	3.04e-06	0.401	0.000966	0.699	-8.56e-04
AW-21	7.10e-15	0.000356	0.00575	1.35e-09	0.230	1.41e-05	0.210	-1.32e-08	7.57e-07	-2.28e-06	0.401	0.000398	0.699	-4.24e-05

NOTES:
All model results are
pH and pe (standarc
charge (equivalents
Results beginning w
Results beginning w

Attachment D. PHRE
Groundwater Polishi
Ash Pond
Edwards Power Plant
Bartonville, IL

Location	Gypsum	d_Gypsum	si_Ferrihydrite	si_Gibbsite	si_Barite	si_Calcite	si_Dolomite (ordered)	si_Gypsum
AP07S	0	0	1.89	-9.87e-02	0.749	-2.27e-01	-5.77e-01	-8.78e-01
AW-15S	0	0	0.885	0.966	0.851	-1.86e-01	-5.72e-01	-6.12e-01
AW-05	0	0	3.90	-2.10e-01	0.978	-1.72e-01	-3.43e-01	-8.89e-01
AW-19	0	0	1.56	-6.68e-02	0.386	-5.32e-01	-1.14e+00	-1.78e+00
AW-21	0	0	2.40	0.372	0.594	-8.68e-01	-1.97e+00	-1.11e+00
AP07S	0	0	1.89	-9.87e-02	0.749	-2.27e-01	-5.77e-01	-8.78e-01
AW-15S	0	0	0.885	0.966	0.851	-1.86e-01	-5.72e-01	-6.12e-01
AW-05	0	0	3.90	-2.10e-01	0.978	-1.72e-01	-3.43e-01	-8.89e-01
AW-19	0	0	1.56	-6.68e-02	0.386	-5.32e-01	-1.14e+00	-1.78e+00
AW-21	0	0	2.40	0.372	0.594	-8.68e-01	-1.97e+00	-1.11e+00
AP07S	0	0	0	0	-1.72e-01	0	0	-2.72e+00
AP07S	0	0	0	0	-9.67e-01	0	0	-3.52e+00
AW-15S	0	0	0	0	0	0	0	-2.41e+00
AW-15S	0	0	0	0	-5.72e-01	0	0	-3.21e+00
AW-05	0	0	0	0	0	0	0	-2.21e+00
AW-05	0	0	0	0	-2.15e-01	0	0	-2.97e+00
AW-19	0	0	0	0	-1.81e-01	0	0	-2.71e+00
AW-19	0	0	0	0	-5.95e-01	0	0	-3.14e+00
AW-21	0	0	0	0	0	0	0	-1.90e+00
AW-21	0	0	0	0	-7.60e-02	0	0	-2.90e+00
AP07S	0	0	1.89	-9.87e-02	0.749	-2.27e-01	-5.77e-01	-8.78e-01
AW-15S	0	0	0.885	0.966	0.851	-1.86e-01	-5.72e-01	-6.12e-01
AW-05	0	0	3.90	-2.10e-01	0.978	-1.72e-01	-3.43e-01	-8.89e-01
AW-19	0	0	1.56	-6.68e-02	0.386	-5.32e-01	-1.14e+00	-1.78e+00
AW-21	0	0	2.40	0.372	0.594	-8.68e-01	-1.97e+00	-1.11e+00
AP07S	0	0	1.89	-9.87e-02	0.749	-2.27e-01	-5.77e-01	-8.78e-01
AW-15S	0	0	0.885	0.966	0.851	-1.86e-01	-5.72e-01	-6.12e-01
AW-05	0	0	3.90	-2.10e-01	0.978	-1.72e-01	-3.43e-01	-8.89e-01
AW-19	0	0	1.56	-6.68e-02	0.386	-5.32e-01	-1.14e+00	-1.78e+00
AW-21	0	0	2.40	0.372	0.594	-8.68e-01	-1.97e+00	-1.11e+00
AP07S	0	0	0	0	0	0	0	-2.48e+00
AP07S	0	0	0	0	-6.07e-01	0	0	-3.22e+00
AW-15S	0	0	0	0	0	0	0	-2.19e+00
AW-15S	0	0	0	0	-1.66e-01	0	0	-2.90e+00
AW-05	0	0	0	0	0	0	0	-2.08e+00
AW-05	0	0	0	0	0	0	0	-2.77e+00
AW-19	0	0	0	0	-6.72e-02	0	0	-2.59e+00
AW-19	0	0	0	0	-4.40e-01	0	0	-2.98e+00
AW-21	0	0	0	0	0	0	0	-1.80e+00
AW-21	0	0	0	0	0	0	0	-2.73e+00
AP07S	0	0	1.89	-9.87e-02	0.749	-2.27e-01	-5.77e-01	-8.78e-01
AW-15S	0	0	0.885	0.966	0.851	-1.86e-01	-5.72e-01	-6.12e-01
AW-05	0	0	3.90	-2.10e-01	0.978	-1.72e-01	-3.43e-01	-8.89e-01
AW-19	0	0	1.56	-6.68e-02	0.386	-5.32e-01	-1.14e+00	-1.78e+00
AW-21	0	0	2.40	0.372	0.594	-8.68e-01	-1.97e+00	-1.11e+00
AP07S	0	0	1.89	-9.87e-02	0.749	-2.27e-01	-5.77e-01	-8.78e-01
AW-15S	0	0	0.885	0.966	0.851	-1.86e-01	-5.72e-01	-6.12e-01
AW-05	0	0	3.90	-2.10e-01	0.978	-1.72e-01	-3.43e-01	-8.89e-01
AW-19	0	0	1.56	-6.68e-02	0.386	-5.32e-01	-1.14e+00	-1.78e+00
AW-21	0	0	2.40	0.372	0.594	-8.68e-01	-1.97e+00	-1.11e+00
AP07S	0	0	0	0	-3.07e-02	0	0	-2.58e+00
AP07S	0	0	0	0	-8.03e-01	0	0	-3.35e+00
AW-15S	0	0	0	0	0	0	0	-2.28e+00
AW-15S	0	0	0	0	-3.30e-01	0	0	-3.03e+00
AW-05	0	0	0	0	0	0	0	-2.12e+00
AW-05	0	0	0	0	-7.08e-02	0	0	-2.85e+00
AW-19	0	0	0	0	-1.08e-01	0	0	-2.63e+00
AW-19	0	0	0	0	-5.01e-01	0	0	-3.04e+00
AW-21	0	0	0	0	0	0	0	-1.82e+00
AW-21	0	0	0	0	0	0	0	-2.78e+00
AP07S	0	0	1.90	-9.59e-02	0.768	-2.14e-01	-5.52e-01	-8.61e-01
AW-15S	0	0	0.898	0.969	0.869	-1.75e-01	-5.50e-01	-5.97e-01
AW-05	0	0	3.90	-2.07e-01	0.995	-1.62e-01	-3.22e-01	-8.75e-01
AW-19	0	0	1.58	-6.37e-02	0.411	-5.13e-01	-1.10e+00	-1.75e+00
AW-21	0	0	2.40	0.373	0.603	-8.62e-01	-1.95e+00	-1.10e+00
AP07S	0	0	1.90	-9.59e-02	0.768	-2.14e-01	-5.52e-01	-8.61e-01
AW-15S	0	0	0.898	0.969	0.869	-1.75e-01	-5.50e-01	-5.97e-01
AW-05	0	0	3.90	-2.07e-01	0.995	-1.62e-01	-3.22e-01	-8.75e-01
AW-19	0	0	1.58	-6.37e-02	0.411	-5.13e-01	-1.10e+00	-1.75e+00
AW-21	0	0	2.40	0.373	0.603	-8.62e-01	-1.95e+00	-1.10e+00
AP07S	0	0	0	0	-1.96e-01	0	0	-2.75e+00
AP07S	0	0	0	0	-9.83e-01	0	0	-3.53e+00
AW-15S	0	0	0	0	0	0	0	-2.43e+00
AW-15S	0	0	0	0	-5.89e-01	0	0	-3.22e+00
AW-05	0	0	0	0	0	0	0	-2.22e+00
AW-05	0	0	0	0	-2.19e-01	0	0	-2.97e+00
AW-19	0	0	0	0	-1.97e-01	0	0	-2.72e+00
AW-19	0	0	0	0	-5.99e-01	0	0	-3.14e+00
AW-21	0	0	0	0	0	0	0	-1.90e+00
AW-21	0	0	0	0	-7.59e-02	0	0	-2.90e+00
AP07S	0	0	1.90	-9.59e-02	0.768	-2.14e-01	-5.52e-01	-8.61e-01
AW-15S	0	0	0.898	0.969	0.869	-1.75e-01	-5.50e-01	-5.97e-01
AW-05	0	0	3.90	-2.07e-01	0.995	-1.62e-01	-3.22e-01	-8.75e-01
AW-19	0	0	1.58	-6.37e-02	0.411	-5.13e-01	-1.10e+00	-1.75e+00
AW-21	0	0	2.40	0.373	0.603	-8.62e-01	-1.95e+00	-1.10e+00
AP07S	0	0	1.90	-9.59e-02	0.768	-2.14e-01	-5.52e-01	-8.61e-01
AW-15S	0	0	0.898	0.969	0.869	-1.75e-01	-5.50e-01	-5.97e-01
AW-05	0	0	3.90	-2.07e-01	0.995	-1.62e-01	-3.22e-01	-8.75e-01
AW-19	0	0	1.58	-6.37e-02	0.411	-5.13e-01	-1.10e+00	-1.75e+00
AW-21	0	0	2.40	0.373	0.603	-8.62e-01	-1.95e+00	-1.10e+00
AP07S	0	0	0	0	0	0	0	-2.50e+00
AP07S	0	0	0	0	-6.45e-01	0	0	-3.24e+00
AW-15S	0	0	0	0	0	0	0	-2.20e+00
AW-15S	0	0	0	0	-1.79e-01	0	0	-2.91e+00
AW-05	0	0	0	0	0	0	0	-2.09e+00
AW-05	0	0	0	0	0	0	0	-2.78e+00
AW-19	0	0	0	0	-8.79e-02	0	0	-2.61e+00
AW-19	0	0	0	0	-4.49e-01	0	0	-2.99e+00
AW-21	0	0	0	0	0	0	0	-1.80e+00
AW-21	0	0	0	0	0	0	0	-2.73e+00
AP07S	0	0	1.90	-9.59e-02	0.768	-2.14e-01	-5.52e-01	-8.61e-01
AW-15S	0	0	0.898	0.969	0.869	-1.75e-01	-5.50e-01	-5.97e-01
AW-05	0	0	3.90	-2.07e-01	0.995	-1.62e-01	-3.22e-01	-8.75e-01
AW-19	0	0	1.58	-6.37e-02	0.411	-5.13e-01	-1.10e+00	-1.75e+00
AW-21	0	0	2.40	0.373	0.603	-8.62e-01	-1.95e+00	-1.10e+00
AP07S	0	0	1.90	-9.59e-02	0.768	-2.14e-01	-5.52e-01	-8.61e-01
AW-15S	0	0	0.898	0.969	0.869	-1.75e-01	-5.50e-01	-5.97e-01
AW-05	0	0	3.90	-2.07e-01	0.995	-1.62e-01	-3.22e-01	-8.75e-01
AW-19	0	0	1.58	-6.37e-02	0.411	-5.13e-01	-1.10e+00	-1.75e+00
AW-21	0	0	2.40	0.373	0.603	-8.62e-01	-1.95e+00	-1.10e+00
AP07S	0	0	0	0	-5.46e-02	0	0	-2.60e+00
AP07S	0	0	0	0	-8.20e-01	0	0	-3.37e+00
AW-15S	0	0	0	0	0	0	0	-2.30e+00
AW-15S	0	0	0	0	-3.44e-01	0	0	-3.04e+00
AW-05	0	0	0	0	0	0	0	-2.13e+00
AW-05	0	0	0	0	-7.53e-02	0	0	-2.85e+00
AW-19	0	0	0	0	-1.25e-01	0	0	-2.65e+00
AW-19	0	0	0	0	-5.07e-01	0	0	-3.05e+00
AW-21	0	0	0	0	0	0	0	-1.82e+00
AW-21	0	0	0	0	0	0	0	-2.79e+00

NOTES:
All model results are
pH and pe (standarc
charge (equivalents
Results beginning w
Results beginning w

ATTACHMENT E

ATTACHMENT E. SENSITIVITY TESTING PARAMETERIZATION AND MODEL OUTPUT

INTRODUCTION

This attachment to the Groundwater Polishing Report for the Edwards Power Plant Ash Pond (EDW AP) provides detailed information regarding the results of sensitivity testing. The background groundwater at the EDW AP has a lower redox condition (represented by oxidation reduction potential [ORP]) than downgradient groundwater but a higher redox than is typical for water containing highly reduced species such as methane and hydrogen sulfide. Return to background conditions may thus result in more reduced conditions downgradient than indicated by the measured ORP alone, which may influence the long-term stability of attenuating mineral phases, ferrihydrite in particular, and thus, the long-term sorption capacity of the aquifer. Sensitivity testing was conducted to assess the impact of more chemically reduced redox condition on aquifer sorption capacity.

SUPPLEMENTAL SENSITIVITY TESTING

Additional modeling was conducted using the solid and aqueous phase setup described in Attachment C. A chemically reduced redox condition was simulated using a constant redox potential (input to geochemical model as electron potential [pe]) in two downgradient locations with boron exceedances (AP07S and AW-15S) and running ten reaction steps. As described in Attachment C, the solid surfaces were initially reacted with downgradient water from AP07S and AW-15S, respectively, then interacted with background groundwater at constant (reducing) pe for the remaining reaction steps. This was repeated for a pe equal to background conditions (pe=1.11), and for subsequently lower pe (-1, -2, and -3). The lower pe scenarios are tested to account for redox conditions typically indicative of the highly reduced species methane and hydrogen sulfide, both of which have been detected in the deeper groundwater and background groundwater. Results are presented in Table E-1.

BASE CASE RESULTS

In simulations where the model pe was fixed at measured background levels (pe=1.11), ferrihydrite concentrations increased, indicating minor amounts of mineral precipitation, while gibbsite concentrations decreased slightly. Sulfate concentrations are below the groundwater protection standard (GWPS) during the first reaction and remain so for the subsequent simulations. Boron concentrations fall below the GWPS during the second and third reaction steps for AW-15S and AP07S, respectively, and remain so for the subsequent simulations. This indicates that pe conditions similar to measured background will not influence the long-term mineral stability and will likely not impact the time to reach the GWPS for both sulfate and boron.

SUPPLEMENTAL SENSITIVITY TEST RESULTS

In the remaining scenarios where the pe is moderately to strongly reducing, ferrihydrite concentrations decrease, with more dissolution occurring at subsequently lower pe conditions. Gibbsite concentrations do not change. In all scenarios, sulfate concentrations are well below the GWPS during the first reaction and remain so for all simulations. Boron concentrations, however, take longer to reach the GWPS. For AP07S boron does not reach the GWPS until reaction step four, five, and eight for pe -1, -2, and -3 scenarios, respectively. For AW-15S, boron reaches the GWPS in reaction step three for pe conditions -1 and -2 and

reaction step five for pe condition -3. This is likely indicating that boron sorbed to ferrihydrite is released as ferrihydrite dissolution is occurring.

While these scenarios simulate a pe condition not currently observed in the background groundwaters, the presence of highly reduced species indicates extremely reducing conditions may be possible. This highly reduced condition is therefore identified as a potential future condition, which could elongate the time to reach the GWPS. The probability of this occurring is, however, considered to be relatively low, as a redox condition as low as that modeled in the supplemental sensitivity has not been directly measured in the background groundwater. Future groundwater monitoring should include the redox condition, with primary emphasis on redox indicators including ORP, dissolved oxygen, dissolved iron and manganese, sulfide, and methane concentrations.

REFERENCES

Appelo C.A.J. and Postma D. 2010. Geochemistry, Groundwater, and Pollution. 2nd Edition. A.A. Balkema Publishers, member of Taylor & Francis Group. The Netherlands.

Dzombak D.A. and Morel F.M.M. 1990. Surface Complexation Modeling: Hydrous Ferric Oxide. John Wiley & Sons, New York.

Goldberg S. and Glaubig R.A. 1985. Boron Adsorption on Aluminum and Iron Oxide Minerals. *Soil Science Society of America Journal* **49**(6):1374-1379.

Karamalidis A.K. and Dzombak D.A. 2010. Surface Complexation Modeling: Gibbsite. John Wiley & Sons, New York.

Kitadai N., Nishiuchi K, and Tanaka M. 2018. A comprehensive predictive model for sulfate adsorption on oxide minerals. *Geochimica et Cosmochimica Acta* **238**:150-168.

729 Main Street, Longmont, CO 80501 720.550.0745 contact@lifecyclegeo.com www.lifecyclegeo.com

APPENDIX B
DRAWINGS AND MATERIALS SPECIFICATIONS FOR SELECTED REMEDY

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CORRECTIVE ACTION PERMIT-LEVEL DESIGN

ASH POND

EDWARDS POWER PLANT, BARTONVILLE, ILLINOIS

GROUNDWATER EXTRACTION SYSTEM

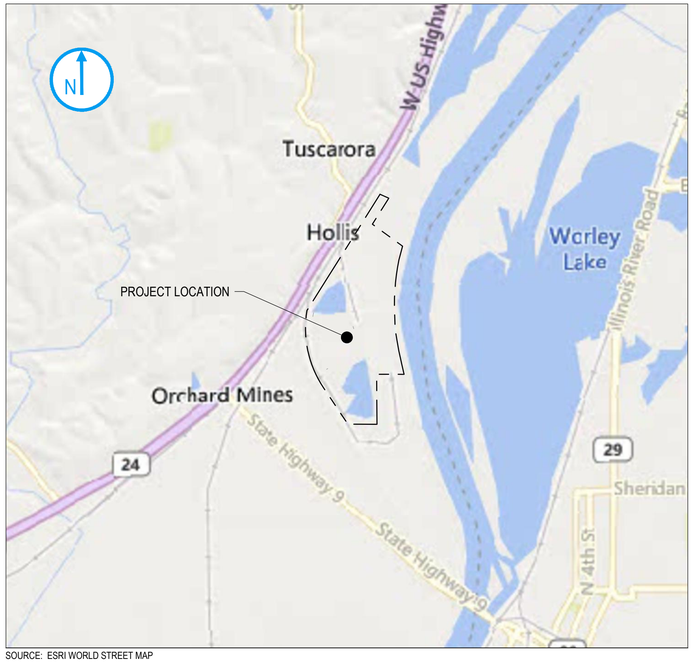


AERIAL IMAGERY: ESRI WORLD IMAGERY

LOCATION MAP

500' 0 500'

SCALE: 1"=500'



SOURCE: ESRI WORLD STREET MAP

VICINITY MAP

2000' 0 2000'

SCALE: 1"=2000'

INDEX OF DRAWINGS	
GENERAL	
G-000	COVER
CIVIL	
C-101	OVERALL SITE PLAN
C-201	NORTH GROUNDWATER EXTRACTION TRENCH ENLARGED PLAN AND PROFILE 1
C-202	NORTH GROUNDWATER EXTRACTION TRENCH ENLARGED PLAN AND PROFILE 2
C-203	NORTH GROUNDWATER EXTRACTION TRENCH TYPICAL SECTIONS
C-301	SOUTH GROUNDWATER EXTRACTION TRENCH ENLARGED PLAN AND PROFILE
C-302	SOUTH GROUNDWATER EXTRACTION TRENCH TYPICAL SECTIONS
C-401	COMPRESSOR SHED DETAIL
C-501	TRENCH AND COLLECTION SUMP DETAIL
PROCESS MECHANICAL	
P-001	SYSTEM PROCESS FLOW DIAGRAM

ILLINOIS POWER RESOURCES GENERATING, LLC (IPRG)

EDWARDS POWER PLANT

7800 CILCO LANE PEORIA, IL 61607

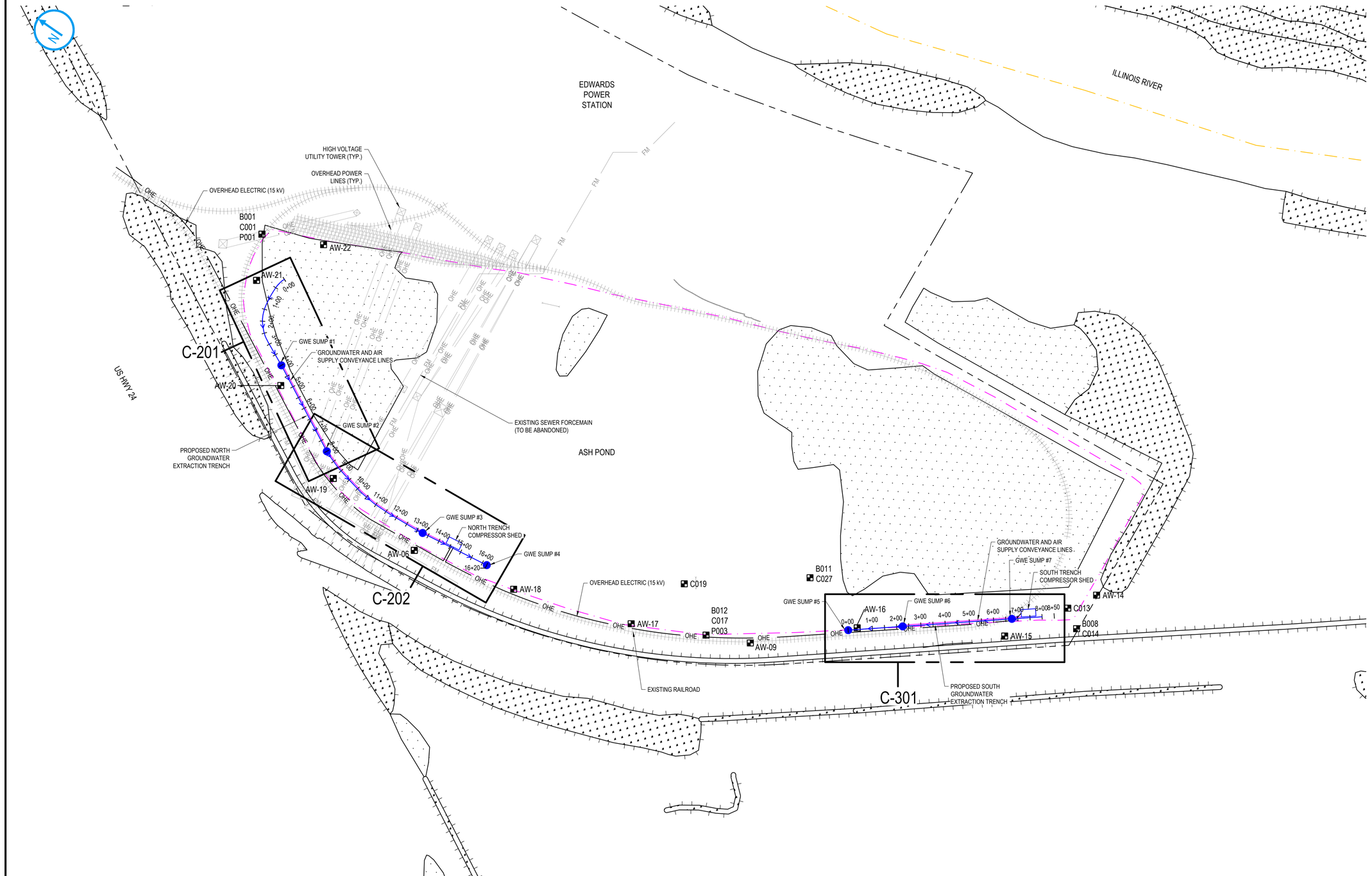
JUNE 2025

RAMBOLL

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

C:\DOCACCDOCS\RAMBOLL GRUPPEN AS\RJS-1940110781-007 VISTRA - EDWARDS AP\PROJECT FILES\4 DELIVERY\40 WP\401 CIVIL\DRAWING\SIG-G00 EDW-AP.DWG

SAVED: 6/2/25 12:31 PM



LEGEND

EXISTING

- APPROXIMATE SITE BOUNDARY
- CCR UNIT BOUNDARY
- WETLANDS
- BODY OF WATER (LAKE, POND, RAVINE, ETC.)
- RAILROAD
- FM — SEWER - FORCEMAIN
- OHE — OVERHEAD ELECTRIC
- HIGH VOLTAGE UTILITY TOWER
- STORMDRAIN, AND CULVERT
- BORING

CORRECTIVE ACTION CONSTRUCTION

- GROUNDWATER EXTRACTION TRENCH
- GROUNDWATER EXTRACTION SUMP
- WATER AND AIR CONVEYANCE PIPING
- ELECTRICAL CONDUIT AND WATER AND AIR CONVEYANCE PIPING
- OHE — OVERHEAD ELECTRIC
- STRUCTURE
- LOD — LIMITS OF DISTURBANCE

NOTE:
1. EXISTING TOPOGRAPHY IS FROM AERIAL DRONE SURVEY COMPLETED BY DRAGONFLY AEROSOLUTIONS DATED 12/01/2020 AND TOPOGRAPHIC/BATHYMETRIC SURVEYS COMPLETED BY INGENAE DATED 11/09/2020.
2. SEWER FORCEMAIN LOCATION TAKEN FROM SANITARY SEWER FORCE MAIN PLAN DRAWING NUMBER CSK-010 DATED 02/19/2007.
3. UTILITY TOWER LOCATIONS ARE APPROXIMATE.
4. TRENCHES TO BE INSTALLED DURING CLOSURE CONSTRUCTION. CLOSE COORDINATION WITH CLOSURE CONSTRUCTION IS REQUIRED FOR SEQUENCING TRENCH INSTALLATION WITH COVER CONSTRUCTION.
5. WETLANDS REPRESENTED AS PER ILLINOIS NATIONAL WETLANDS INVENTORY AND PER CREEK SURVEY DRAWINGS COMPLETED BY INGENAE, FEBRUARY 2022.

OVERALL SITE PLAN

200' 0 200'

SCALE: 1"=200'

NO.	REV DATE	REVISION	INT.

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Project Details: **ILLINOIS POWER RESOURCES GENERATING, LLC (IPRG)** EDWARDS POWER PLANT 7800 CILCO LANE PEORIA, IL 61607	Drawing Title: **OVERALL SITE PLAN**				RAMBOLL	RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.
Location: ASH POND	Designer / Professional Engineer Responsible: B. RICHTER					
Project Number: **1940110241-003**	Designed by F. ACKERMAN	Drawn by B. LENMON	Checked by B. RICHTER	Approved by L. CARR	Date JUNE 2025	
Project Status: CORRECTIVE ACTION PERMIT-LEVEL DESIGN	Drawing Number: **C-101**			Scale: AS NOTED	Sc: x	Rev.: x

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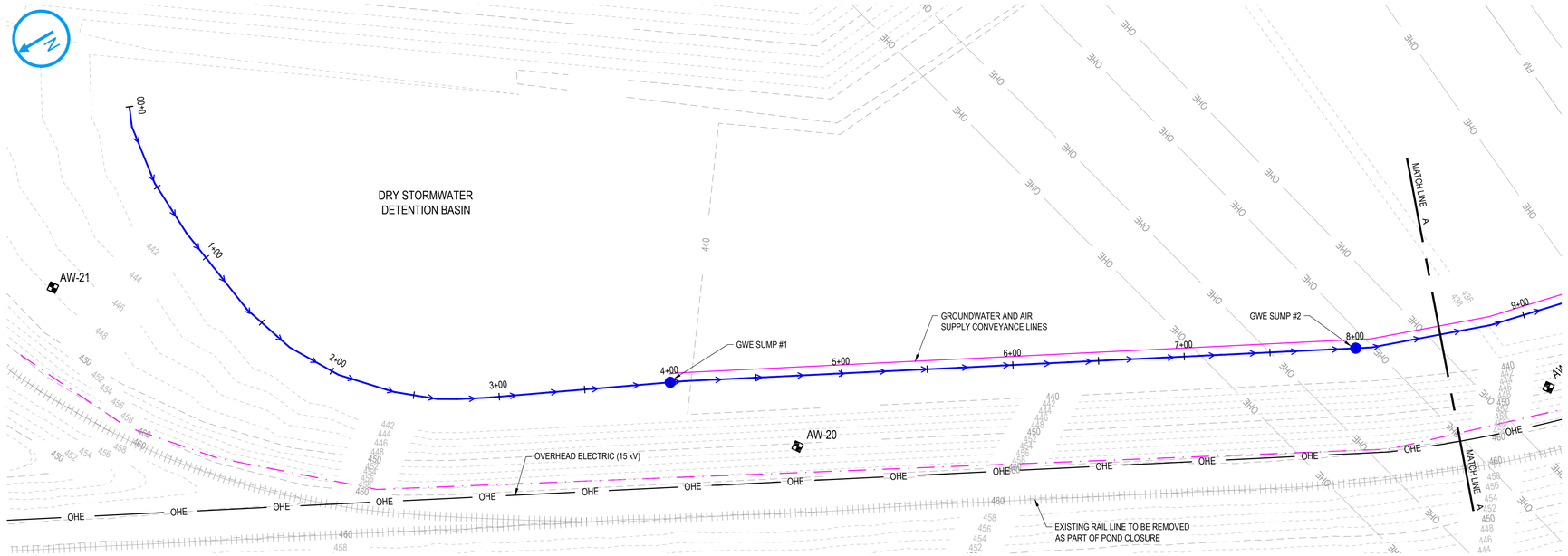
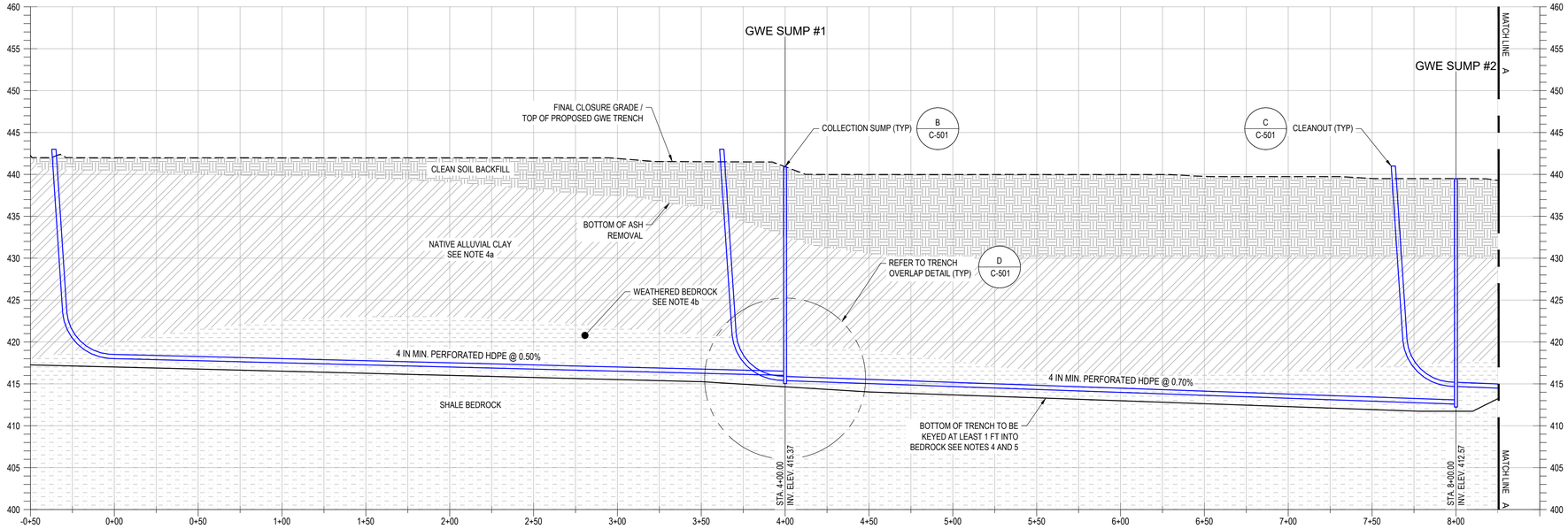


PLAN VIEW

40' 0 40'

SCALE: 1"=40'



PROFILE STATION 0+00 TO 8+50

40' 0 40' — SCALE HORZ. 1" = 40'

8' 0 8' — SCALE: VERT. 1"=8'

LEGEND

EXISTING

- 360 — MAJOR CONTOUR
- 358 — MINOR CONTOUR
- APPROXIMATE SITE BOUNDARY
- CCR UNIT BOUNDARY
- RAILROAD
- FM — SEWER - FORCEMAIN
- OHE — OVERHEAD ELECTRIC
- HIGH VOLTAGE UTILITY TOWER
- STORMDRAIN, AND CULVERT
- BORING

CORRECTIVE ACTION CONSTRUCTION

- GROUNDWATER EXTRACTION TRENCH
- GROUNDWATER EXTRACTION SUMP
- WATER AND AIR CONVEYANCE PIPING
- ELECTRICAL CONDUIT AND WATER AND AIR CONVEYANCE PIPING
- OHE — OVERHEAD ELECTRIC
- STRUCTURE
- LOD — LIMITS OF DISTURBANCE
- X / C-000 — NON-TRENCH DETAIL
- X / C-000 — TRENCH SECTION DETAIL

NOTES:

1. FINAL CLOSURE GRADES ARE BASED ON THE FINAL DESIGN PRESENTED IN THE JUNE 2022 FINAL CLOSURE PLAN BY INGENAE, LLC.
2. THE NORTH GROUNDWATER EXTRACTION TRENCH WILL BE INSTALLED AFTER CCR HAS BEEN REMOVED FROM THE CLOSURE-BY-REMOVAL PORTIONS OF THE ASH POND, BUT PRIOR TO THE COMPLETION OF FINAL CLOSURE OF THE ASH POND.
3. COLLECTION SUMPS WILL CONSIST OF A PIT TO HOLD EXTRACTED WATER, A PNEUMATIC PUMP AND A DISCHARGE PIPE THAT WILL CARRY EXTRACTED WATER TO AN EQUALIZATION TANK INTO A NEARBY COMPRESSOR SHED.
4. SUBSURFACE INTERFACES BETWEEN DIFFERENT UNITS ARE APPROXIMATE AND BASED ON DATA FROM THE 2021 HYDROGEOLOGICAL SITE CHARACTERIZATION REPORT AND MODEL LAYERS DESCRIBED IN THE GROUNDWATER MODELING TECHNICAL MEMORANDUM. ADDITIONAL SUBSURFACE INVESTIGATIONS WILL BE ADVANCED ALONG THE TRENCH PROFILES AS PART OF FUTURE PRE-DESIGN INVESTIGATION ACTIVITIES TO VERIFY MATERIAL INTERFACES AND REFINE THE DESIGN PROFILE.
   a. THE LOW PERMEABILITY CLAYS AND SILTS OF THE UPPER CAHOKIA FORMATION ARE CONSIDERED A POTENTIAL MIGRATION PATHWAY (PMP) AT ELEVATIONS SIMILAR TO THE BASE OF THE ASH POND, AND IN PLACES WHERE THIN DISCONTINUOUS SAND LENSES OCCUR WITHIN THE UPPER CAHOKIA FORMATION ADJACENT TO THE ASH POND.
   b. THE UPPERMOST AQUIFER (UA) IS A THIN (GENERALLY LESS THAN 4 FEET), MODERATE PERMEABILITY SAND, SILTY SAND, AND CLAYEY GRAVEL MATERIAL WITHIN THE LOWER CAHOKIA FORMATION, BEDROCK, AND/OR WEATHERED SHALE BEDROCK, WHERE PRESENT. IN LOCATIONS WHERE HIGHER PERMEABILITY MATERIALS AND COARSER GRAINED MATERIAL ARE ABSENT, THE UPPERMOST AQUIFER IS INTERPRETED AS THE INTERFACE BETWEEN THE LOWER CAHOKIA FORMATION AND SHALE BEDROCK.
5. THE EXTRACTION TRENCH DESIGN WILL BE FURTHER REFINED AS PART OF FINAL DESIGN ACTIVITIES FOR BOTH THE EXTRACTION TRENCHES AND FINAL CLOSURE DESIGN. THESE ACTIVITIES MAY INCLUDE, BUT ARE NOT LIMITED TO, THE COLLECTION OF ADDITIONAL SITE SURVEY AND/OR SUBSURFACE INVESTIGATION DATA, ADDITIONAL REFINED DESIGN EVALUATIONS, ADDITIONAL ENGINEERING ANALYSES, AND/OR PERMIT-RELATED CONSIDERATIONS. ELEMENTS OF THE EXTRACTION TRENCH DESIGN THAT WILL BE REFINED INCLUDE, BUT ARE NOT LIMITED TO, THE EXTENT OF THE EXTRACTION TRENCHES, WORK PAD DESIGN AND GEOMETRY, TRENCH DEPTHS, TRENCH WIDTHS, AND LOCATION OF THE TRENCHES RELATIVE TO EXISTING EMBANKMENTS.
6. LIMITS OF DISTURBANCE WILL BE COORDINATED WITH FINAL CLOSURE DESIGN.

NO.	REV DATE	REVISION	INT.

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Project Details: **ILLINOIS POWER RESOURCES GENERATING, LLC (IPRG)** EDWARDS POWER PLANT 7800 CILCO LANE PEORIA, IL 61607	Drawing Title: **NORTH GROUNDWATER EXTRACTION TRENCH ENLARGED PLAN AND PROFILE 1**					RAMBOLL RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.
Location: ASH POND	Designer / Professional Engineer Responsible: B. RICHTER					
Project Number: **1940110241-003**	Designed by: F. ACKERMAN	Drawn by: B. LEMMON	Checked by: B. RICHTER	Approved by: L. CARR	Date: JUNE 2025	
Project Status: CORRECTIVE ACTION PERMIT-LEVEL DESIGN	Drawing Number: **C-201**			Scale: AS NOTED	Sc: x	Rev.: x

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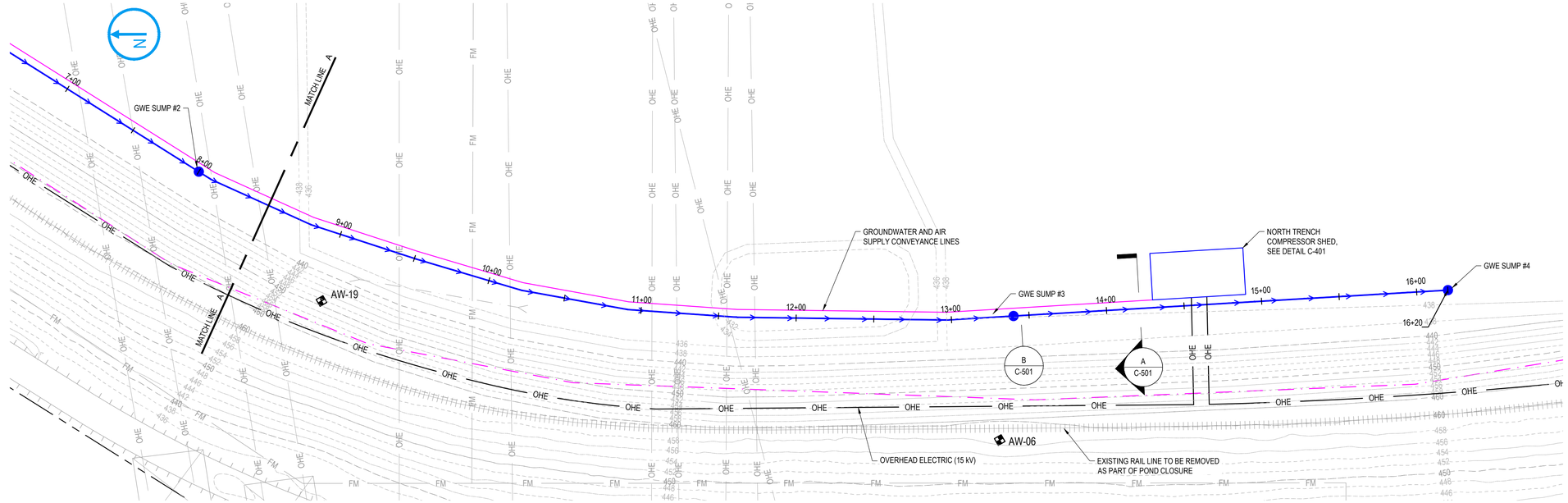
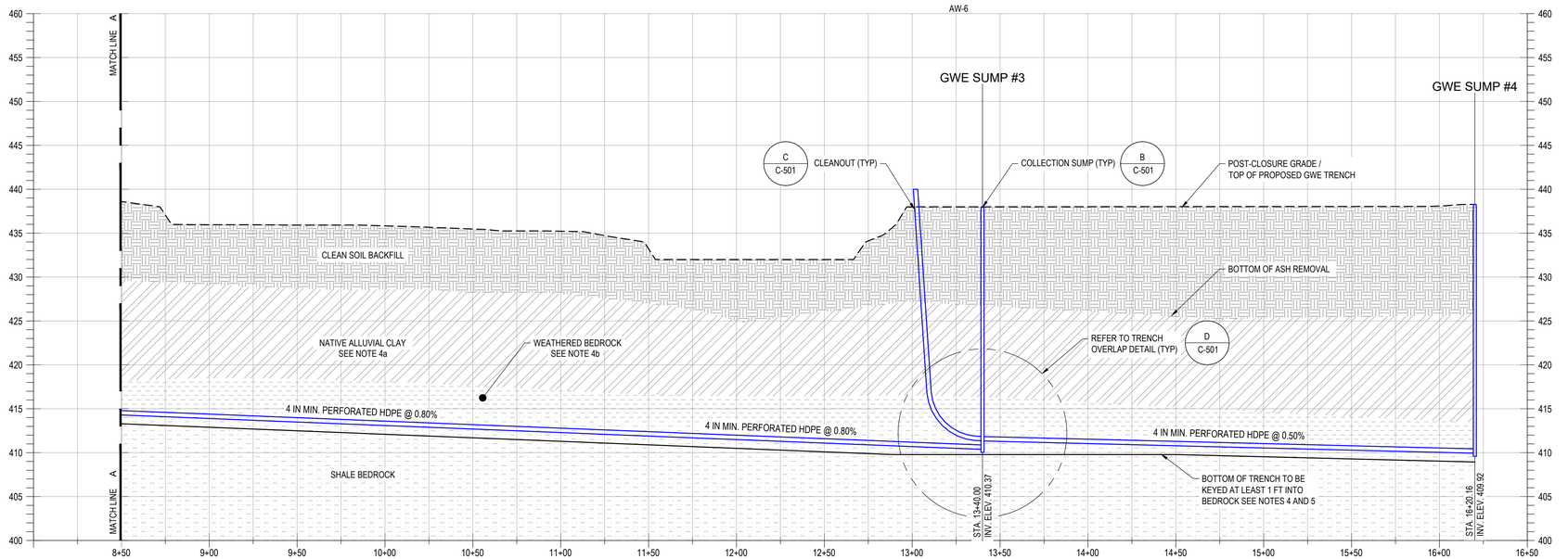


PLAN VIEW

40' 0 40'

SCALE: 1"=40'



PROFILE STATION 8+50 TO 16+20

40' 0 40' — SCALE HORZ. 1" = 40'

8' 0 8' — SCALE: VERT. 1"=8'

LEGEND

EXISTING

- 360 — MAJOR CONTOUR
- 358 — MINOR CONTOUR
- APPROXIMATE SITE BOUNDARY
- CCR UNIT BOUNDARY
- RAILROAD
- FM — SEWER - FORCEMAIN
- OHE — OVERHEAD ELECTRIC
- HIGH VOLTAGE UTILITY TOWER
- STORMDRAIN, AND CULVERT
- BORING

CORRECTIVE ACTION CONSTRUCTION

- GROUNDWATER EXTRACTION TRENCH
- GROUNDWATER EXTRACTION SUMP
- WATER AND AIR CONVEYANCE PIPING
- ELECTRICAL CONDUIT AND WATER AND AIR CONVEYANCE PIPING
- OHE — OVERHEAD ELECTRIC
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- X / C-000 — NON-TRENCH DETAIL
- X / C-000 — TRENCH SECTION DETAIL

NOTES:

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3. COLLECTION SUMPS WILL CONSIST OF A PIT TO HOLD EXTRACTED WATER, A PNEUMATIC PUMP AND A DISCHARGE PIPE THAT WILL CARRY EXTRACTED WATER TO AN EQUALIZATION TANK INTO A NEARBY COMPRESSOR SHED.
4. SUBSURFACE INTERFACES BETWEEN DIFFERENT UNITS ARE APPROXIMATE AND BASED ON DATA FROM THE 2021 HYDROGEOLOGICAL SITE CHARACTERIZATION REPORT AND MODEL LAYERS DESCRIBED IN THE GROUNDWATER MODELING TECHNICAL MEMORANDUM. ADDITIONAL SUBSURFACE INVESTIGATIONS WILL BE ADVANCED ALONG THE TRENCH PROFILES AS PART OF FUTURE PRE-DESIGN INVESTIGATION ACTIVITIES TO VERIFY MATERIAL INTERFACES AND REFINE THE DESIGN PROFILE.
   a. THE LOW PERMEABILITY CLAYS AND SILTS OF THE UPPER CAHOKIA FORMATION ARE CONSIDERED A POTENTIAL MIGRATION PATHWAY (PMP) AT ELEVATIONS SIMILAR TO THE BASE OF THE ASH POND, AND IN PLACES WHERE THIN DISCONTINUOUS SAND LENSES OCCUR WITHIN THE UPPER CAHOKIA FORMATION ADJACENT TO THE ASH POND.
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6. LIMITS OF DISTURBANCE WILL BE COORDINATED WITH FINAL CLOSURE DESIGN.

NO.	REV DATE	REVISION	INT.

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Project Details: **ILLINOIS POWER RESOURCES GENERATING, LLC (IPRG)** EDWARDS POWER PLANT 7800 CILCO LANE PEORIA, IL 61607	Drawing Title: **NORTH GROUNDWATER EXTRACTION TRENCH ENLARGED PLAN AND PROFILE 2**				RAMBOLL **RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.**	
Location: ASH POND	Designer / Professional Engineer Responsible: B. RICHTER					
Project Number: **1940110241-003**	Designed by: F. ACKERMAN	Drawn by: B. LEMMON	Checked by: B. RICHTER	Approved by: L. CARR	Date: JUNE 2025	
Project Status: CORRECTIVE ACTION PERMIT-LEVEL DESIGN	Drawing Number: **C-202**			Scale: AS NOTED	Sc: x	Rev.: x

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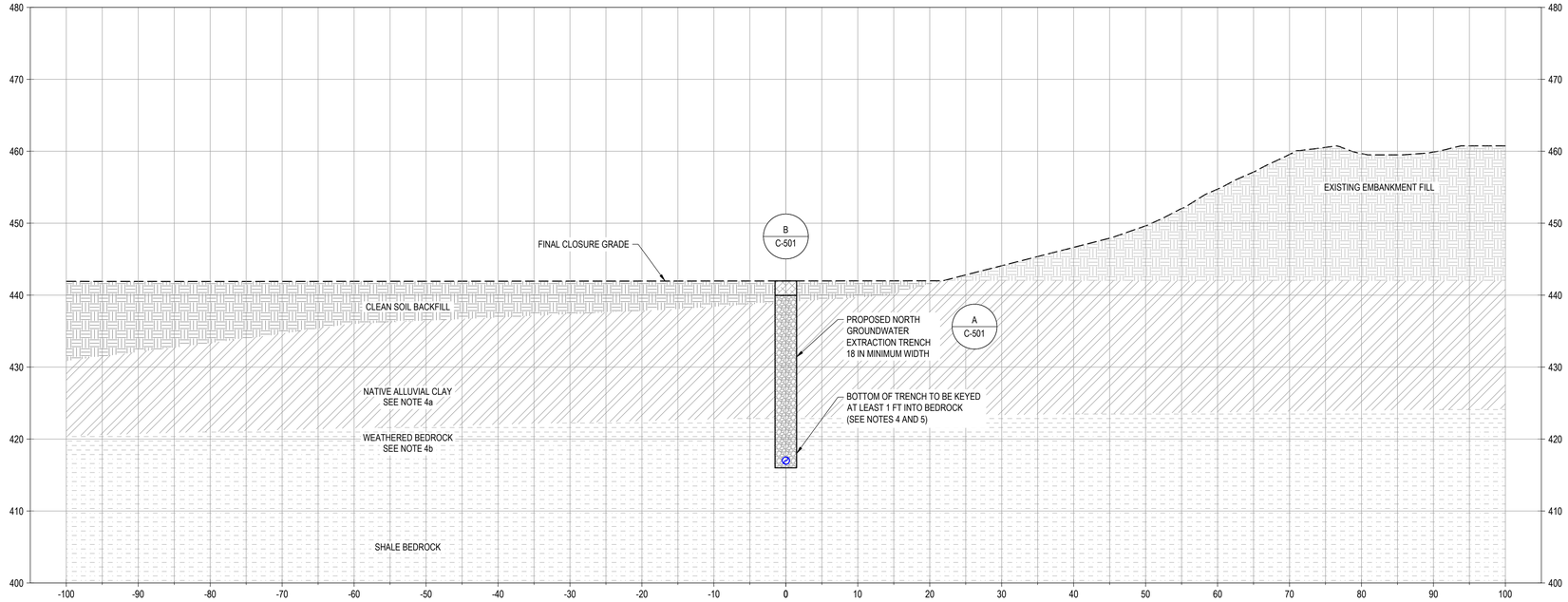
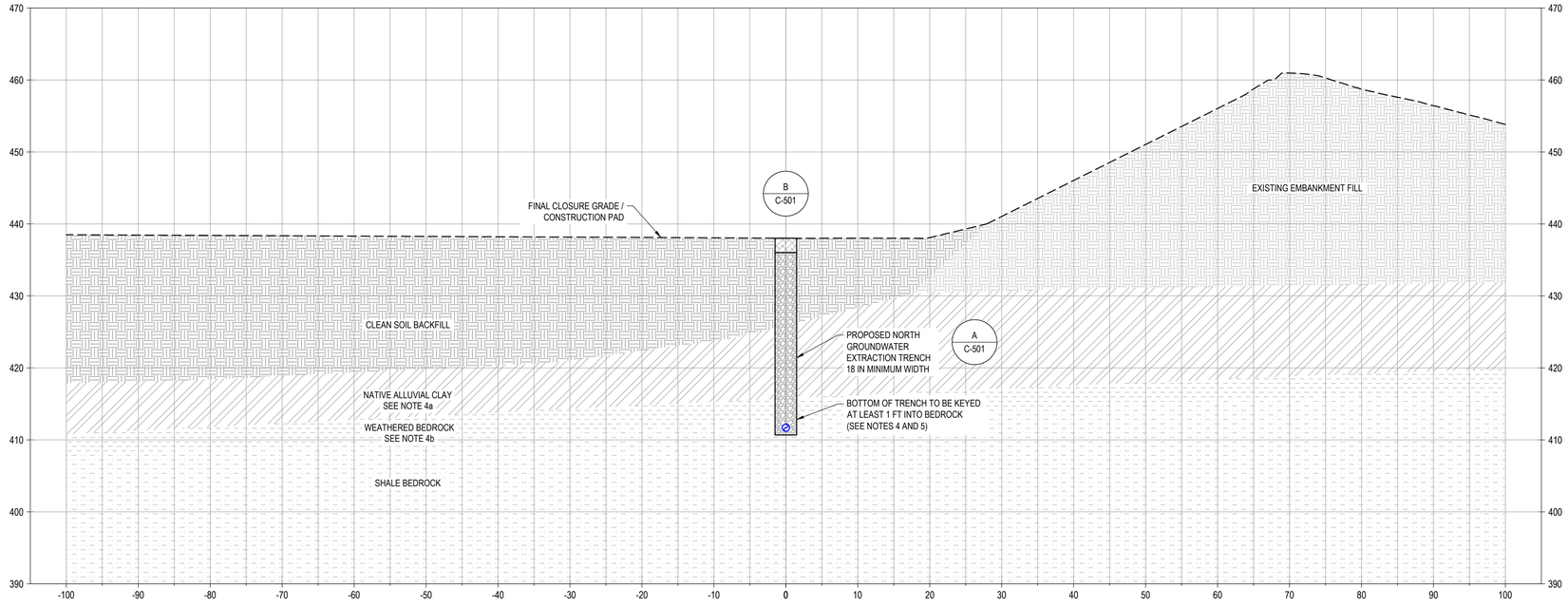


TYPICAL SECTION - 0+00 TO 4+00

10' 0 10' SCALE HORZ. 1" = 10'

10' 0 10' SCALE: VERT. 1"=10'



TYPICAL SECTION - 4+00 TO 16+20

10' 0 10' SCALE HORZ. 1" = 10'

10' 0 10' SCALE: VERT. 1"=10'

NOTES:

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6. LIMITS OF DISTURBANCE WILL BE COORDINATED WITH FINAL CLOSURE DESIGN.

NO.	REV DATE	REVISION	INT.

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Project Details: **ILLINOIS POWER RESOURCES GENERATING, LLC (IPRG)** EDWARDS POWER PLANT 7800 CILCO LANE PEORIA, IL 61607	Drawing Title: **NORTH GROUNDWATER EXTRACTION TRENCH TYPICAL SECTIONS**				RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.	
Location: ASH POND	Designer / Professional Engineer Responsible: B. RICHTER					
Project Number: **1940110241-003**	Designed by: F. ACKERMAN	Drawn by: B. LEMMON	Checked by: B. RICHTER	Approved by: L. CARR	Date: JUNE 2025	
Project Status: CORRECTIVE ACTION PERMIT-LEVEL DESIGN	Drawing Number: **C-203**			Scale: AS NOTED	Sc: X	Rev: X

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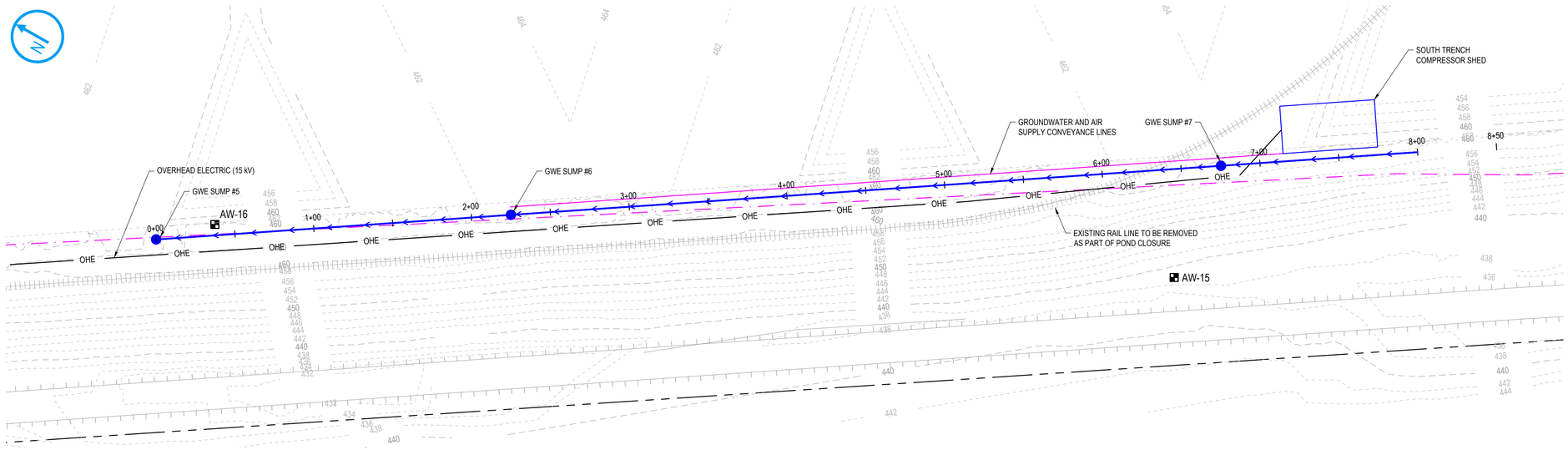
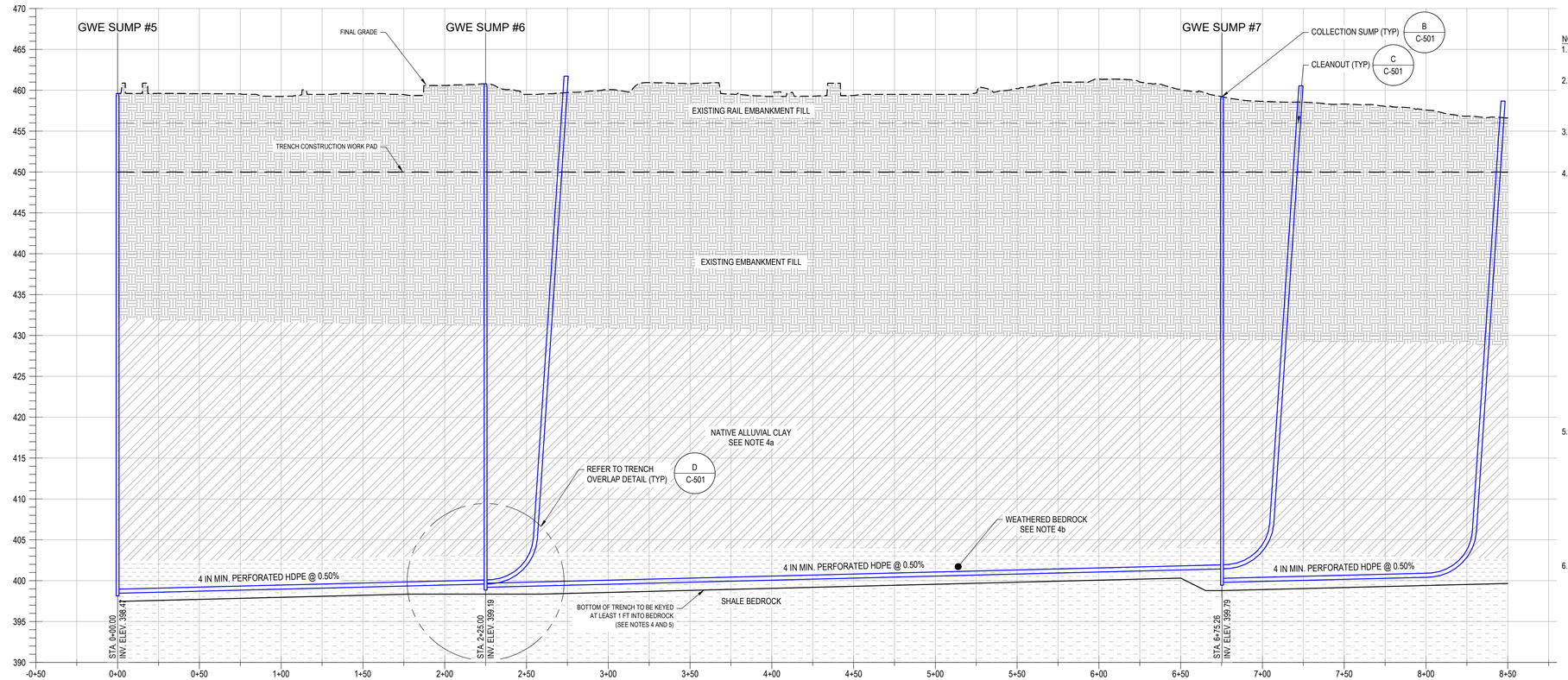


PLAN VIEW

40' 0 40'

SCALE: 1"=40'



PROFILE STATION 0+00 TO 8+00

40' 0 40' SCALE HORZ. 1" = 40'

8' 0 8' SCALE: VERT. 1"=8'

LEGEND

EXISTING

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CORRECTIVE ACTION CONSTRUCTION

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NOTES:

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NO.	REV DATE	REVISION	INT.

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Project Details: **ILLINOIS POWER RESOURCES GENERATING, LLC (IPRG)** EDWARDS POWER PLANT 7800 CILCO LANE PEORIA, IL 61607	Drawing Title: **SOUTH GROUNDWATER EXTRACTION TRENCH ENLARGED PLAN AND PROFILE**				RAMBOLL **RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.**
Location: ASH POND	Designer / Professional Engineer Responsible: B. RICHTER				
Project Number: **1940110241-003**	Designed by: F. ACKERMAN	Drawn by: B. LEMMON	Checked by: B. RICHTER	Approved by: L. CARR	Date: JUNE 2025
Project Status: CORRECTIVE ACTION PERMIT-LEVEL DESIGN	Drawing Number: **C-301**			Scale: AS NOTED	Sc: x / Rev.: x

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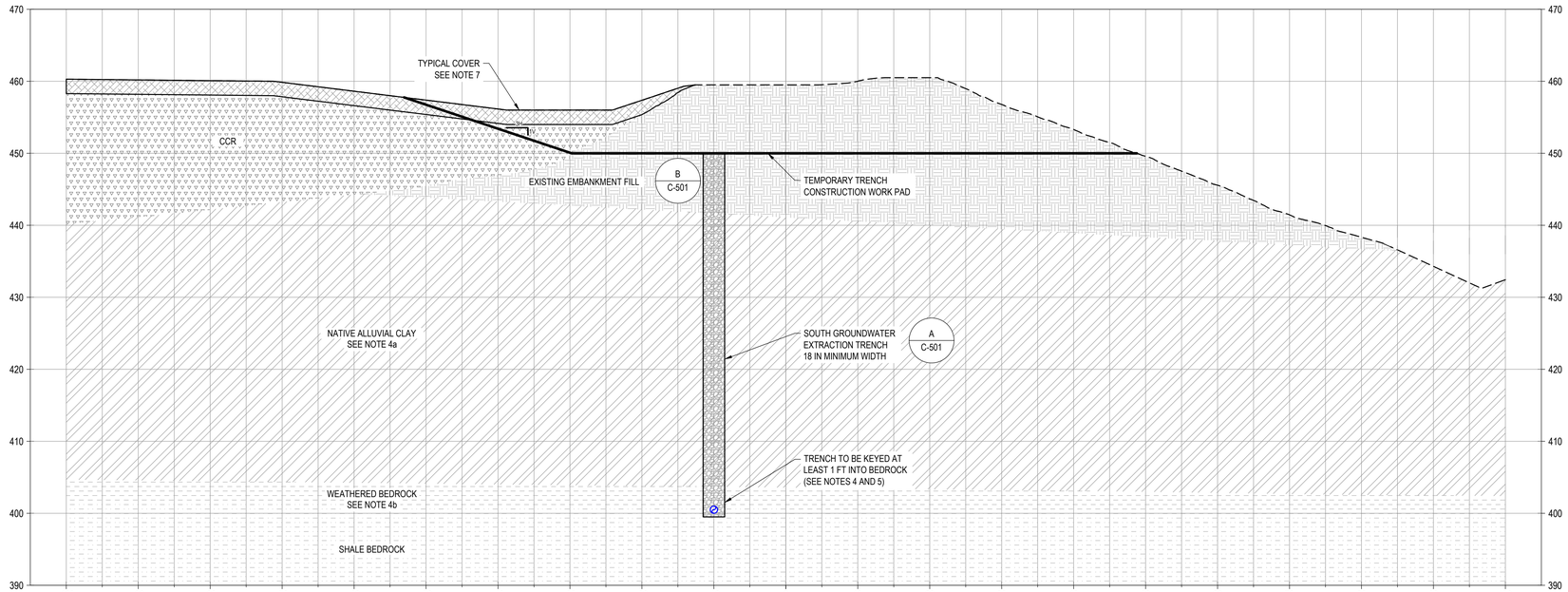
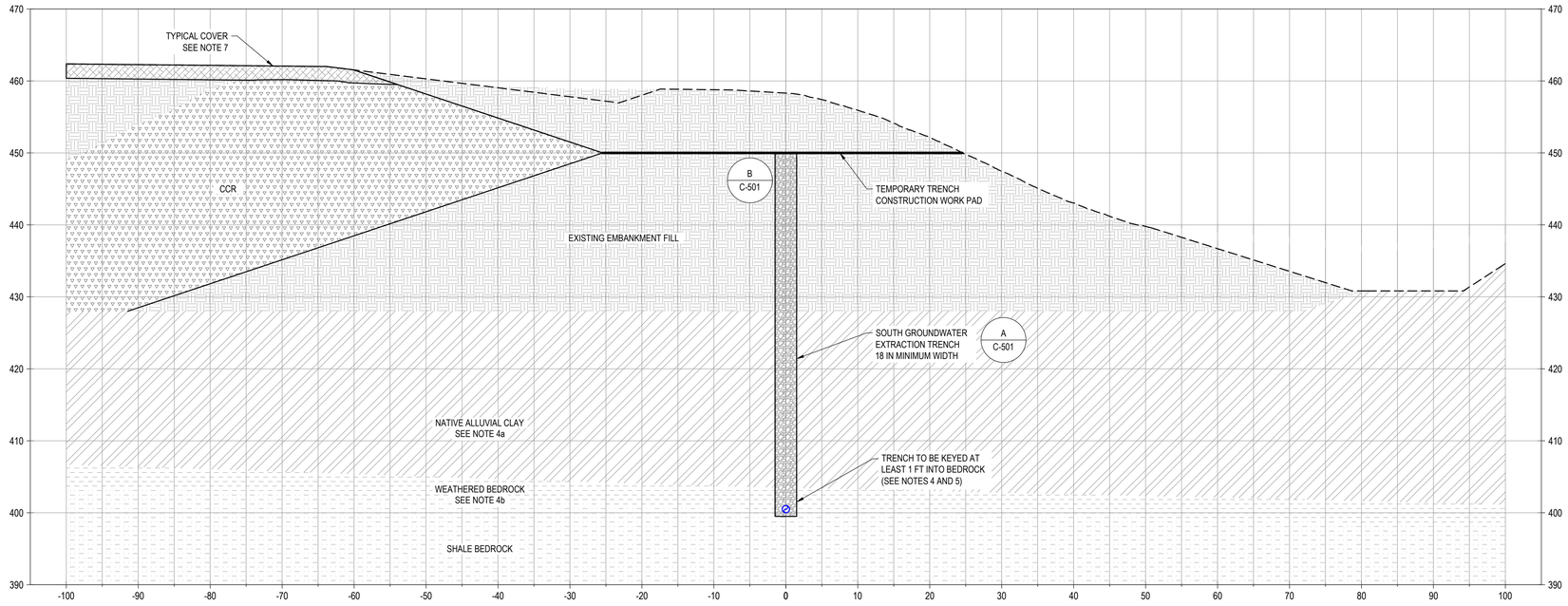


TYPICAL SECTION - 0+00 TO 5+50

10' 0 10' SCALE HORZ. 1" = 10'

10' 0 10' SCALE: VERT. 1"=10'



TYPICAL SECTION - 5+50 TO 8+00

10' 0 10' SCALE HORZ. 1" = 10'

10' 0 10' SCALE: VERT. 1"=10'

NOTES:

1. FINAL CLOSURE GRADES ARE BASED ON THE FINAL DESIGN PRESENTED IN THE JUNE 2022 FINAL CLOSURE PLAN BY INGENAE, LLC.
2. THE NORTH GROUNDWATER EXTRACTION TRENCH WILL BE INSTALLED AFTER CCR HAS BEEN REMOVED FROM THE CLOSURE-BY-REMOVAL PORTIONS OF THE ASH POND, BUT PRIOR TO THE COMPLETION OF FINAL CLOSURE OF THE ASH POND.
3. COLLECTION SUMPS WILL CONSIST OF A PIT TO HOLD EXTRACTED WATER, A PNEUMATIC PUMP AND A DISCHARGE PIPE THAT WILL CARRY EXTRACTED WATER TO AN EQUALIZATION TANK INTO A NEARBY COMPRESSOR SHED.
4. SUBSURFACE INTERFACES BETWEEN DIFFERENT UNITS ARE APPROXIMATE AND BASED ON DATA FROM THE 2021 HYDROGEOLOGICAL SITE CHARACTERIZATION REPORT AND MODEL LAYERS DESCRIBED IN THE GROUNDWATER MODELING TECHNICAL MEMORANDUM. ADDITIONAL SUBSURFACE INVESTIGATIONS WILL BE ADVANCED ALONG THE TRENCH PROFILES AS PART OF FUTURE PRE-DESIGN INVESTIGATION ACTIVITIES TO VERIFY MATERIAL INTERFACES AND REFINE THE DESIGN PROFILE.
   a. THE LOW PERMEABILITY CLAYS AND SILTS OF THE UPPER CAHOKIA FORMATION ARE CONSIDERED A POTENTIAL MIGRATION PATHWAY (PMP) AT ELEVATIONS SIMILAR TO THE BASE OF THE ASH POND, AND IN PLACES WHERE THIN DISCONTINUOUS SAND LENSES OCCUR WITHIN THE UPPER CAHOKIA FORMATION ADJACENT TO THE ASH POND.
   b. THE UPPERMOST AQUIFER (UA) IS A THIN (GENERALLY LESS THAN 4 FEET), MODERATE PERMEABILITY SAND, SILTY SAND, AND CLAYEY GRAVEL MATERIAL WITHIN THE LOWER CAHOKIA FORMATION, BEDROCK, AND/OR WEATHERED SHALE BEDROCK, WHERE PRESENT. IN LOCATIONS WHERE HIGHER PERMEABILITY MATERIALS AND COARSER GRAINED MATERIAL ARE ABSENT, THE UPPERMOST AQUIFER IS INTERPRETED AS THE INTERFACE BETWEEN THE LOWER CAHOKIA FORMATION AND SHALE BEDROCK.
5. THE EXTRACTION TRENCH DESIGN WILL BE FURTHER REFINED AS PART OF FINAL DESIGN ACTIVITIES FOR BOTH THE EXTRACTION TRENCHES AND FINAL CLOSURE DESIGN. THESE ACTIVITIES MAY INCLUDE, BUT ARE NOT LIMITED TO, THE COLLECTION OF ADDITIONAL SITE SURVEY AND/OR SUBSURFACE INVESTIGATION DATA, ADDITIONAL REFINED DESIGN EVALUATIONS, ADDITIONAL ENGINEERING ANALYSES, AND/OR PERMIT-RELATED CONSIDERATIONS. ELEMENTS OF THE EXTRACTION TRENCH DESIGN THAT WILL BE REFINED INCLUDE, BUT ARE NOT LIMITED TO, THE EXTENT OF THE EXTRACTION TRENCHES, WORK PAD DESIGN AND GEOMETRY, TRENCH DEPTHS, TRENCH WIDTHS, AND LOCATION OF THE TRENCHES RELATIVE TO EXISTING EMBANKMENTS.
6. LIMITS OF DISTURBANCE WILL BE COORDINATED WITH FINAL CLOSURE DESIGN.
7. THE WORKING PLATFORM (TEMPORARY) WILL BE CONSTRUCTED WITHIN THE EXISTING ASH POND PERIMETER DIKE, AFTER FREE WATER (I.E., STANDING WATER) HAS BEEN REMOVED FROM THE ASH POND, AND THEREBY IS NO LONGER FUNCTIONING AS A DAM, BUT BEFORE THE FINAL CLOSURE HAS BEEN COMPLETED. REMOVAL OF THE RAIL LINE, BALLAST, AND CCR WITHIN THE PERIMETER EMBANKMENTS WILL BE COMPLETED DURING CLOSURE ACTIVITIES AND THE SURFACE ELEVATION FOLLOWING THESE ACTIVITIES WILL BE A MAXIMUM OF 450 FEET, DUE TO EQUIPMENT OPERATION REQUIREMENTS, FOR CONSTRUCTION OF THE WORKING PLATFORM. CLOSURE ACTIVITIES WILL BE CONDUCTED IN ACCORDANCE WITH THE JUNE 2022 FINAL CLOSURE PLAN BY INGENAE, LLC. THE GEOMETRY OF THE WORKING PLATFORM, GEOMETRY OF THE RAIL EMBANKMENT REMOVAL, GEOMETRY OF THE FINAL/RECONSTRUCTED EMBANKMENT, AND LIMITS OF THE FINAL COVER SYSTEM ARE SHOWN APPROXIMATELY AND WILL BE REFINED DURING FINAL DESIGN OF THE CLOSURE AND GROUNDWATER EXTRACTION TRENCH.

NO.	REV DATE	REVISION	INT.

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Project Details: **ILLINOIS POWER RESOURCES GENERATING, LLC (IPRG)** EDWARDS POWER PLANT 7800 CILCO LANE PEORIA, IL 61607	Drawing Title: **SOUTH GROUNDWATER EXTRACTION TRENCH TYPICAL SECTIONS**				RAMBOLL RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.
Location: ASH POND	Designer / Professional Engineer Responsible: B. RICHTER				
Project Number: **194011O241-003**	Designed by: F. ACKERMAN	Drawn by: B. LEMMON	Checked by: B. RICHTER	Approved by: L. CARR	Date: JUNE 2025
Project Status: CORRECTIVE ACTION PERMIT-LEVEL DESIGN	Drawing Number: **C-302**			Scale: AS NOTED	Sc: x / Rev.: x

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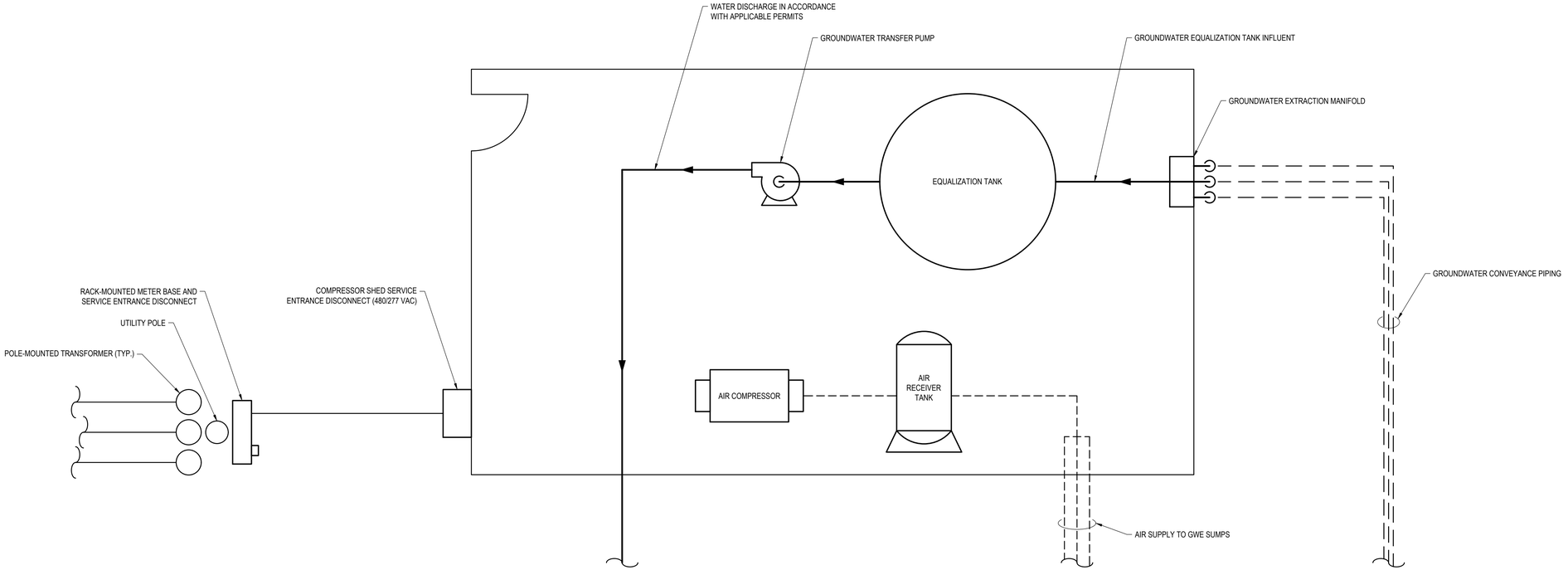
NOTES:

1. FINAL DESIGN AND CONSTRUCTION OF THE PROPOSED GWE TRENCHES AND ASSOCIATED APPURTENANT STRUCTURES AND INFRASTRUCTURE WILL BE CLOSELY COORDINATED WITH THE AP CLOSURE CONSTRUCTION.



COMPRESSOR SHED DETAIL

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NO.	REV DATE	REVISION	INT.

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Project Details: **ILLINOIS POWER RESOURCES GENERATING, LLC (IPRG)** EDWARDS POWER PLANT 7800 CILCO LANE PEORIA, IL 61607	Drawing Title: **COMPRESSOR SHED DETAIL**			RAMBOLL **RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.**	
Location: ASH POND	Designer / Professional Engineer Responsible: B. RICHTER				
Project Number: **1940110241-003**	Designed by: C. GLIDDEN	Drawn by: B. LEMMON	Checked by: B. RICHTER	Approved by: L. CARR	Date: JUNE 2025
Project Status: CORRECTIVE ACTION PERMIT-LEVEL DESIGN	Drawing Number: **C-401**			Scale: AS NOTED	Sc: x / Rev.: x

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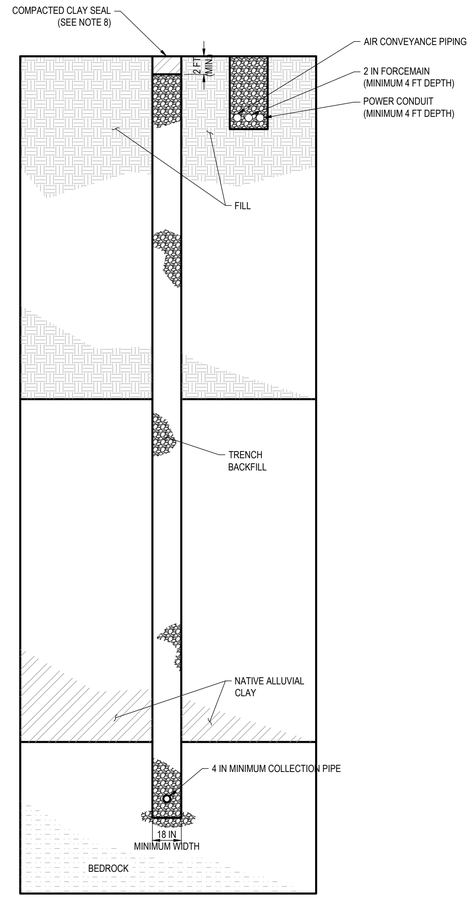

A GROUNDWATER COLLECTION TRENCH
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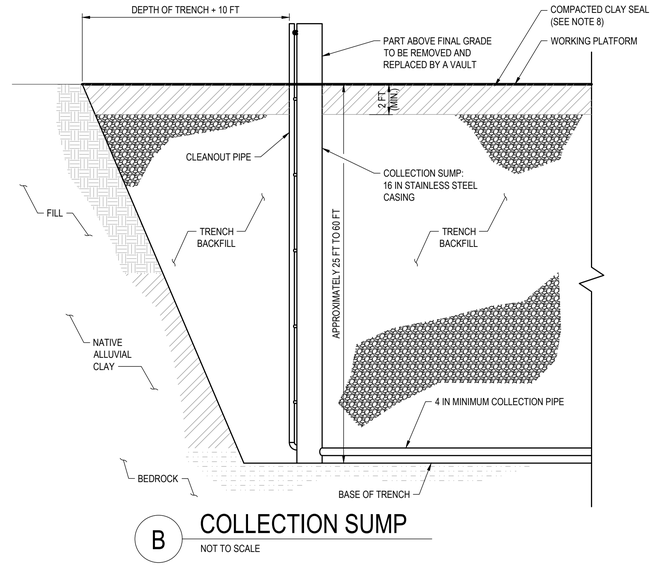
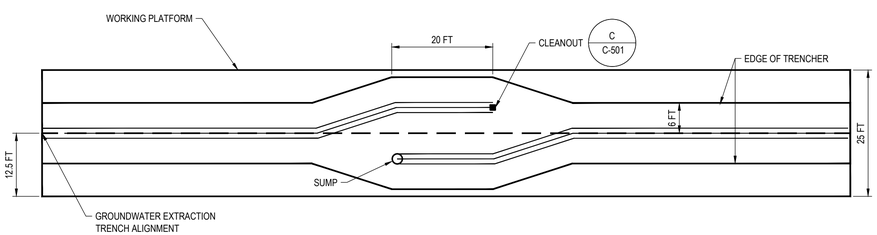


B COLLECTION SUMP
NOT TO SCALE



D TRENCH OVERLAP
NOT TO SCALE

C CLEANOUT
NOT TO SCALE

NOTES:

1. COLLECTION PIPE IS TO BE 4" MINIMUM DIAMETER IRON PIPE SIZING (IPS) STANDARD DIMENSION RATIO (SDR) 11 0.020 MILLED SLOTTED PERFORATED HIGH DENSITY POLYETHYLENE PIPING WITH PE4710 PRESSURE RATING OF 200 PSI AND MINIMUM WALL THICKNESS OF 0.409 INCHES. SUMP RISER PIPE IS TO BE 16" DIAMETER, SCHEDULE 40, 304 STAINLESS STEEL (S.S.) RISER CASING.
2. CLEANOUT PIPE IS TO BE 4" MINIMUM DIAMETER IRON PIPE SIZING (IPS) STANDARD DIMENSION RATIO (SDR) 11 HIGH DENSITY POLYETHYLENE PIPING WITH PE4710 PRESSURE RATING OF 200 PSI AND MINIMUM WALL THICKNESS OF 0.409 INCHES.
3. FORCED MAIN PIPE IS TO BE 2" DIAMETER IRON PIPE SIZING (IPS) STANDARD DIMENSION RATIO (SDR) 11 HIGH DENSITY POLYETHYLENE PIPING WITH PE4710 PRESSURE RATING OF 200 PSI AND MINIMUM WALL THICKNESS OF 0.216 INCHES.
4. ELECTRICAL CONDUIT IS TO BE 2" DIAMETER SCHEDULE 40 POLYVINYL CHLORIDE (PVC) DUCT BANK CONDUIT WITH DUCT BANK SPACERS.
5. BEDDING SAND USED BELOW PIPE BEDDING IS TO BE WELL-GRADED, CLEAN, AND FREE OF CONTAMINANTS, TYPICALLY CONFORMING TO ASTM C33 GRADATION FOR CONCRETE SANDS WITH ADDITIONAL LIMITS ON FINES.
6. PUMPS ARE TO BE 4" DIAMETER PNEUMATIC BOTTOM LOADING QED AUTOPUMP AP4 ULTRA STYLE PUMPS, OR ENGINEERING EQUIVALENT, CONSTRUCTED OF 316-GRADE STAINLESS STEEL (S.S.).
7. TRENCH BACKFILL IS TO BE A HOMOGENEOUS MIXTURE OF APPROXIMATELY 60% IDOT FINE AGGREGATE NO. 1 AND 40% OF IDOT COARSE AGGREGATE NO. 13. SAMPLES OF THE MIX ARE TO BE PROVIDED TO THE CQA OFFICER THREE WEEKS IN ADVANCE OF MOBILIZATION FOR GRAIN SIZE TESTING AND APPROVAL.
8. ALL PORTIONS OF THE FINAL COVER SYSTEM DAMAGED OR OTHERWISE IMPACTED DURING TRENCH CONSTRUCTION ARE TO BE REPLACED AFTER THE TRENCH IS CONSTRUCTED. ALL REPLACEMENT FINAL COVER MATERIALS, INCLUDING VEGETATIVE SOIL COVER AND SOIL COVER, ARE TO BE CONSTRUCTED TO THE SAME GRADES, THICKNESSES, AND SPECIFICATIONS AS INDICATED IN THE FINAL CLOSURE DESIGN. THIS INCLUDES, BUT IS NOT LIMITED TO, ALL ENGINEERING MATERIAL PROPERTIES SUCH AS MATERIAL CLASSIFICATION AND HYDRAULIC CONDUCTIVITY AND CONSTRUCTION SPECIFICATIONS.
9. COMPACTED CLAY SEAL IS TO BE INSTALLED TO REDUCE SURFACE WATER INFILTRATION IN AREAS WHERE THE GROUNDWATER EXTRACTION TRENCH WILL NOT BE BURIED BENEATH COMPACTED EMBANKMENT FILL AND/OR THE FINAL COVER SYSTEM THAT WILL BE CONSTRUCTED AS PART OF FINAL CLOSURE DESIGN.
10. WHERE UTILIZED, THE COMPACTED CLAY SEAL IS TO:
    a. BE CLASSIFIED AS A CL, CL-ML, OR CH (PER ASTM D2487);
    b. BE COMPACTED TO AT LEAST 95% OF THE STANDARD PROCTOR (PER ASTM D698), AND
    c. HAVE A HYDRAULIC CONDUCTIVITY OF NO HIGHER THAN 1X10-5 CM/SEC (PER ASTM D5084).

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Project Details: **ILLINOIS POWER RESOURCES GENERATING, LLC (IPRG)** EDWARDS POWER PLANT 7800 CILCO LANE PEORIA, IL 61607	Drawing Title: **TRENCH AND COLLECTION SUMP DETAIL**				RAMBOLL **RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.**	
Location: ASH POND	Designer / Professional Engineer Responsible: B. RICHTER					
Project Number: **1940110241-003**	Designed by: C. GLIDDEN	Drawn by: B. LEMMON	Checked by: B. RICHTER	Approved by: L. CARR	Date: JUNE 2025	
Project Status: CORRECTIVE ACTION PERMIT-LEVEL DESIGN	Drawing Number: **C-501**			Scale: AS NOTED	Sc: x	Rev.: x

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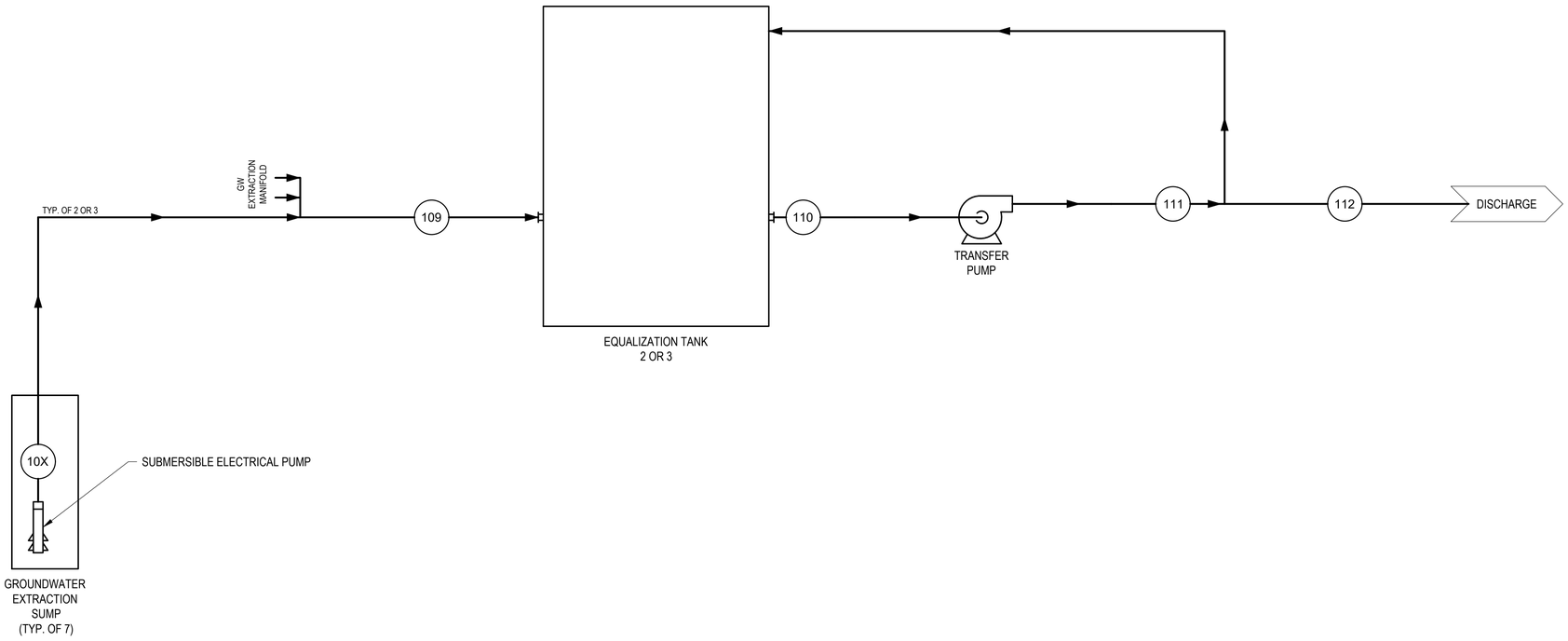
NOTE:

1. SYSTEM EQUIPMENT CONFIGURATION, FLOW RATE, AND OTHER DETAILS MAY CHANGE ONCE THE HYDRAULIC MODEL IS UPDATED.

   GPM = GALLONS PER MINUTE
   GW = GROUNDWATER

2. FINAL DESIGN AND CONSTRUCTION OF THE PROPOSED GWE TRENCHES AND ASSOCIATED APPURTENANT STRUCTURES AND INFRASTRUCTURE WILL BE CLOSELY COORDINATED WITH THE AP CLOSURE CONSTRUCTION.



STREAM ID	10X	109	110	111	112	60X	601
DESIGN FLOW (GPM)	1-10	1-10	1-10	1-10	1-10	NA	NA
DESIGN FLOW (SCFM)	NA	NA	NA	NA	NA	2.5	7.5

NO.	REV DATE	REVISION	INT.

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Project Details: **ILLINOIS POWER RESOURCES GENERATING, LLC (IPRG)** EDWARDS POWER PLANT 7800 CILCO LANE PEORIA, IL 61607	Drawing Title: **SYSTEM PROCESS FLOW DIAGRAM**			RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.	
Location: ASH POND	Designer / Professional Engineer Responsible: B. RICHTER				
Project Number: **1940110241-003**	Designed by: C. GLIDDEN	Drawn by: B. LEMMON	Checked by: B. RICHTER	Approved by: L. CARR	Date: JUNE 2025
Project Status: CORRECTIVE ACTION PERMIT-LEVEL DESIGN	Drawing Number: **P-001**			Scale: AS NOTED	Sc: x / Rev: x

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APPENDIX H
GEOTECHNICAL INFORMATION

RAMBOLL

ENVIRONMENT
& HEALTH

South Groundwater Extraction Trench Stability Calculation Package

Project name	**Corrective Action Plan, Edwards Power Plant Ash Pond**
Project no.	**1940110241-003**
Client	**Illinois Power Resources Generating, LLC**
Version	**Initial Draft**
Prepared by	**Frances Ackerman, PE / Nguyet Nguyen, EIT**
Checked by	**Omer Bozok**
Approved by	**Lucas Carr, PE**

Date June 2, 2025

Ramboll
234 W. Florida Street
Fifth Floor
Milwaukee, WI 53204
USA

T 414-837-3607
F 414-837-3608
https://ramboll.com

1 Introduction

This calculation summarizes the limit equilibrium slope stability analyses performed for the proposed south groundwater extraction (GWE) trench at the existing Edwards Power Plant Ash Pond (AP). The AP is a Coal Combustion Residual (CCR) surface impoundment at the inactive coal-fired Edwards Power Plant owned by Illinois Power Resources Generating, LLC (IPRG) in Bartonville, Peoria County, Illinois. The analyses were performed as part of the Corrective Action Plan (CAP) being prepared for the AP to satisfy Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments.

The GWE remedy includes the construction of two GWE trenches, a North Trench and a South Trench, that are assumed to be constructed in conjunction with source control (e.g. final closure) implementation. Both trenches are discussed in more detail in the Construction Permit Application and Corrective Action Plan.

The south trench will be constructed from a temporary working platform, assumed to be at El. 450 ft, constructed within the south dike of the Edwards AP. It was also assumed that the south trench will be constructed using one-pass trenching technology, which uses a large, tracked trencher to excavate subgrade soils and backfill the trench with a perforated collection pipe and drainage media in a single pass, without requiring the trench to be open at any time. The trench will be installed during AP closure activities, after impounded water has been removed from the AP, but prior to the completion of the AP's final closure system.

Preliminary, proof-of-concept slope stability analyses were performed for two cross sections along the south trench alignment to calculate stability factors of safety for embankment/working pad stability during trench construction, with a one-pass trencher located along the trench alignment. A slope stability analysis was not performed for the north trench as it will be constructed on level ground, outside of an embankment, therefore there is no risk of embankment-related stability concerns.

2 Analysis Methodology

2.1 Selected Analysis Type

Slope stability analyses were performed to support and inform design of the south GWE trench. Factors of safety (FS) were calculated using the software program SLOPE/W Version 2023.1.0.520. The analyses were performed using Spencer's Method, a limit equilibrium method of slices that satisfies both force and moment equilibrium and incorporates the effects of interslice forces. The SLOPE/W optimization routine was used to consider noncircular slip surfaces for determining the global minimum FS. The analyses incorporate material properties and pore pressure distributions described in Sections 3 and 4. The slope stability model outputs are presented in **Attachment A**.

2.2 Analysis Source Data

Several recent stability analyses have been performed for the AP and were used as a source for this slope stability analysis. These include the initial Safety Factor Assessment (SFA) prepared by AECOM in 2016 and the 2021 periodic SFA update prepared by Geosyntec, which was based on the 2016 AECOM SFA. Both SFAs, which are included in **Attachment B**, were performed to satisfy the requirements of Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257 (the CCR Rule). Both SFAs were supported by a geotechnical investigation program completed by AECOM consisting of 14 auger borings, installation of 4 piezometers to monitor groundwater levels, 22 Cone Penetration Test (CPT) soundings with shear wave velocity measurements and pore pressure dissipation testing, and laboratory program including strength, consolidation, and index testing.

Ramboll reviewed the 2021 SLOPE/W model files and the supporting geotechnical investigation and testing data from 2016 to assess the completeness and adequacy of and the analysis methodology, cross-section locations, stratigraphic interpretations, material properties and loading conditions used for the SFAs. Based on this review, Ramboll elected to use the existing 2021 Geosyntec periodic SFA SLOPE/W files as the basis for the slope stability analyses performed to support design of the south GWE trench, as they are most representative of the current (2025) conditions at the AP. Input data utilized includes, but is not limited to, subsurface stratigraphy and soil strengths, phreatic conditions, ground surface geometry, software package, slip surface search routines and methods and input data for the seismic analyses. Changes to embankment geometry, addition of the GWE trench, and revised water levels within the AP were made to represent the expected conditions during and after GWE trench construction.

2.3 Minimum Safety Factor Criteria

Minimum safety factors for CCR surface impoundments are provided in 35 Illinois Administrative Code (I.A.C.) Part § 845.460(a) (Part 845) [[1]. Part 845 does not specify minimum safety factors for temporary loading conditions on existing CCR surface impoundment dikes, such as loading during groundwater extraction trench construction. However, it does provide a minimum safety factor of 1.30 for end-of-construction conditions for new CCR impoundment dikes. Due to the absence of specific regulatory guidance for temporary loading conditions on existing CCR dikes, the same minimum safety factor of 1.30 was assumed for temporary trench construction, as it also represents a temporary condition that is not dissimilar to end-of-construction conditions.

2.4 Analysis Cross-Sections

Slope stability FS values were calculated for the two cross sections along the south GWE trench alignment (Sta. 5+00 and Sta. 8+00), which correspond to AECOM/Geosyntec Sections E-E' and Section F-F'. These locations were selected to represent different embankment geometries, heights, and stratigraphic

conditions to provide confidence that the critical cross section was identified. The model sections were also updated to represent the embankment configuration during trench construction, as described below.

Cross Section E-E at Station 5+00: This section represents the northern portion of the trench between Station 0+00 and Station 5+00 and was determined to be the critical cross section for steady state conditions during the 40 CFR Section 257 SFAs. The existing embankment is approximately 20 feet high, with an approximate 3.5H:1V outboard slope and an approximate 2.5H:1V inboard slope. Approximately 35 feet of native alluvial clay is present beneath the embankment, with shale bedrock beneath the alluvial clay. A temporary working pad elevation[1] of El 450 was assumed to facilitate trench construction. A surcharge load of 2,160 psf (15 psi) across two 78-inch track widths was included to represent loading from the assumed one-pass trench construction equipment.

For this cross section, the work pad is expected to be higher in elevation than both the upstream (inboard) and downstream (outboard) toe elevation of the embankment. Therefore, movement could conceivably occur in either direction, and the stability of both the inboard and outboard slopes were analyzed.

Cross Section F-F at Station 8+00: This cross section is located near the south end of GWE trench, south of the raised embankment. This section geometry is used to represent southern portion of the trench, between Station 5+00 and Station 8+00, where the alignment no longer follows the rail embankment. It should be noted that the south trench stops north of Station 8+00, however section F-F was still analyzed as a conservative representation of this area, even though the trench does not extend all of the way to Section F-F. The existing embankment in this area is approximately 20 feet high on the outboard side, with an approximate 3H:1V outboard slope; the inboard existing grade is at approximate El. 460 and will require grading to El. 450 to facilitate the south trench construction. Thus, a crest elevation of El. 450 was used for the stability analyses. A surcharge load of 2,160 psf (15 psi) across two 78-inch track widths was included to represent loading from the assumed one-pass trench construction equipment.

For this section, the work pad is lower in elevation than the crest of the embankment, and higher in elevation than the downstream (outboard) toe of the embankment. Therefore, movement could conceivably only occur in the outboard direction, and the stability of the inboard slope was not analyzed.

3 Development of Input Parameters

Engineering parameters including Mohr-Coulomb shear strengths (friction angles, effective cohesion, and undrained shear strength with phi=0) and unit weights were developed by AECOM using both laboratory testing data (index and strength testing) and strength correlations from CPT and SPT data. Ramboll utilized the same shear strength materials for each soil unit, and Geosyntec also utilized these units for their calculations in 2021 SFA. The material properties are presented in **Table 1**.

[1] All elevations in this report are in the North American Vertical Datum of 1988 (NAVD88), unless otherwise noted.

Table 1 – Material Properties Used for the Preliminary Slope Stability Analyses

Material	Unit weight (pcf)	Effective (Drained) Shear Strength		Total (Undrained) Shear Strength	
		c' (psf)	f' (^{0})	c (psf)	f (^{0})
Old Embankment 1	125	200	28	2500	0
Old Embankment 2	125	100	29	1250	0
Native Clay Crust	120	200	27.5	1250	0
Native Clay 1	117	100	26	650	0
Native Clay 2	105	200	26	700	0
Native Clay 3	105	200	26	900	0
Fly Ash	105	100	27	600	0
New Embankment (Shot Rock)	120	0	32	0	32
Shale Bedrock	140	1000	36	1000	36
GWE Trench	120	0	35	0	35

4 Loading Conditions

4.1 Soil Drainage and Phreatic Assumptions

Trench construction is assumed to be a short-duration event (i.e., construction over several weeks using one-pass technology). However, trench construction could be prolonged due to weather delays and/or construction equipment breakdowns, so there is some potential that the trencher could remain on the embankment for an extended amount of time. To account for the potential for both drained and undrained conditions, each cross-section included the separate analysis of effective shear strength (drained) and total shear strength (undrained) conditions in cohesive foundation and embankment soils, as listed in **Table 1**.

The pore pressure distribution(s) within the AP embankment were modeled using piezometric lines. The pore pressure distribution in the embankment was estimated using the water levels at the base of the AP (assuming that impounded water removal would occur prior to GWE trench construction) and a straight-line phreatic surface between the water level in the pond and the downstream toe of the embankment.

5 Results

Table 2 summarizes the results of the safety factor analysis for the AP. The factors of safety for constructing the south GWE trench along the crest of the existing rail embankment (after regrading to an elevation of 450 feet) using assumed one-pass trenching technology, significantly exceed the design criteria, for both drained and undrained conditions. Therefore, the analyses indicates that distress to the AP embankment are unlikely to occur during trench construction.

Table 2 – Preliminary Slope Stability Analysis Results

Cross Section	Loading Condition			
	Minimum Short Term (Drained) Minimum Required = 1.30		Minimum Short Term (Undrained) Minimum Required = 1.30	
	Inboard	Outboard	Inboard	Outboard
5+00	1.75	1.95	1.76	1.71
8+00*	2.40		1.85	

*Only outboard stability was analyzed for cross-section 8+00, as the work pad elevation is lower than the crest elevation of the embankment, and therefore instability in the inboard direction caused by the trencher is unlikely.

6 Conclusions and Recommendations

This preliminary, concept-level stability analysis indicates that safety factors during trench construction are expected to meet or exceed the minimum 1.30 requirements listed in 845.460(a) [1]. This analysis only covers short-term loading conditions during construction, for both drained and undrained conditions. The long-term, post-closure stability of the AP embankments with the GWE trench included should be evaluated by the closure engineer during final closure system design.

Additional investigation and analysis should be performed as part of final design to further refine this assessment. This should include collecting more subsurface data along the trench alignment and updating the analysis based on actual trench equipment weights, geometry, and final work pad details. These analyses should maintain a safety factor of at least 1.30 as required in 845.460(a) [1].

In addition, a geotechnical program should be implemented to monitor distress or signs of adverse embankment performance during of construction of the trench.

7 Bibliography

[1] Illinois Polution Control Board, "Title 35: Environmental Protection, Part 845: Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments," Springfield, 2021.

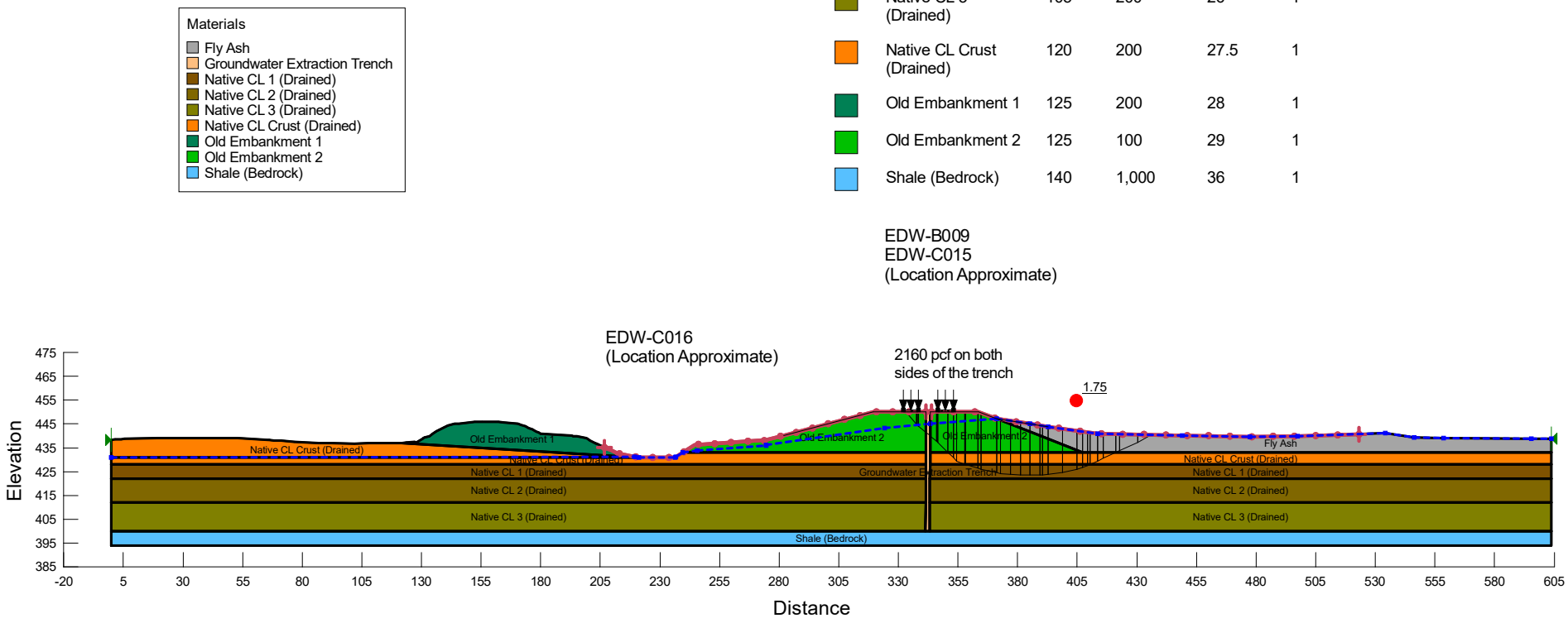
8 Attachments

Attachment A – Slope Stability Results
Attachment B – Historic Safety Factor Assessments

ATTACHMENT A
SLOPE STABILITY RESULTS

Edwards Power Plant Ash Pond
Cross-section 5+00
01. Inboard - Drained

Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface
	Fly Ash	75	100	27	1
	Groundwater Extraction Trench	120	0	35	1
	Native CL 1 (Drained)	117	100	26	1
	Native CL 2 (Drained)	105	200	26	1
	Native CL 3 (Drained)	105	200	26	1
	Native CL Crust (Drained)	120	200	27.5	1
	Old Embankment 1	125	200	28	1
	Old Embankment 2	125	100	29	1
	Shale (Bedrock)	140	1,000	36	1



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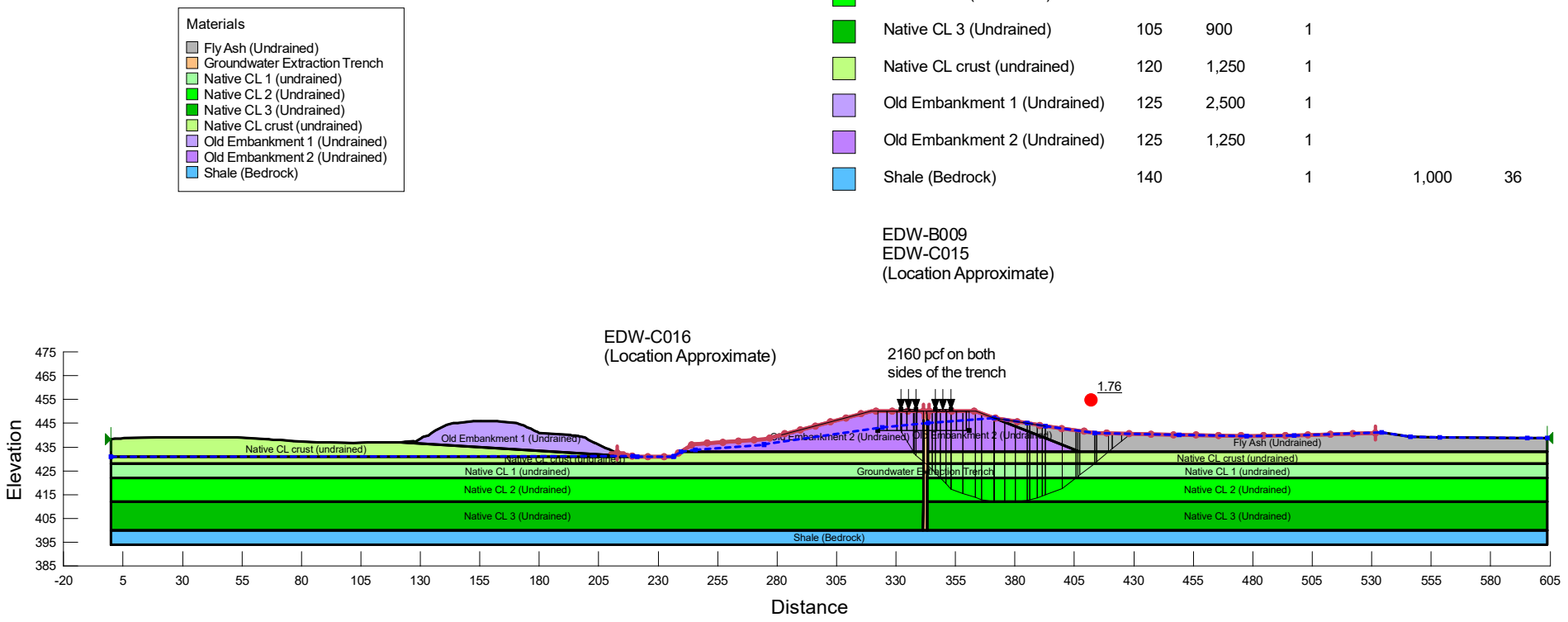
Edwards Power Plant Ash Pond
Cross-section 5+00
02. Inboard - Undrained

Color	Name	Unit Weight (pcf)	Undrained Shear Strength (psf)	Piezometric Surface	Effective Cohesion (psf)	Effective Friction Angle (°)
	Fly Ash (Undrained)	75	600	1		
	Groundwater Extraction Trench	120		1	0	35
	Native CL 1 (undrained)	117	650	1		
	Native CL 2 (Undrained)	105	700	1		
	Native CL 3 (Undrained)	105	900	1		
	Native CL crust (undrained)	120	1,250	1		
	Old Embankment 1 (Undrained)	125	2,500	1		
	Old Embankment 2 (Undrained)	125	1,250	1		
	Shale (Bedrock)	140		1	1,000	36



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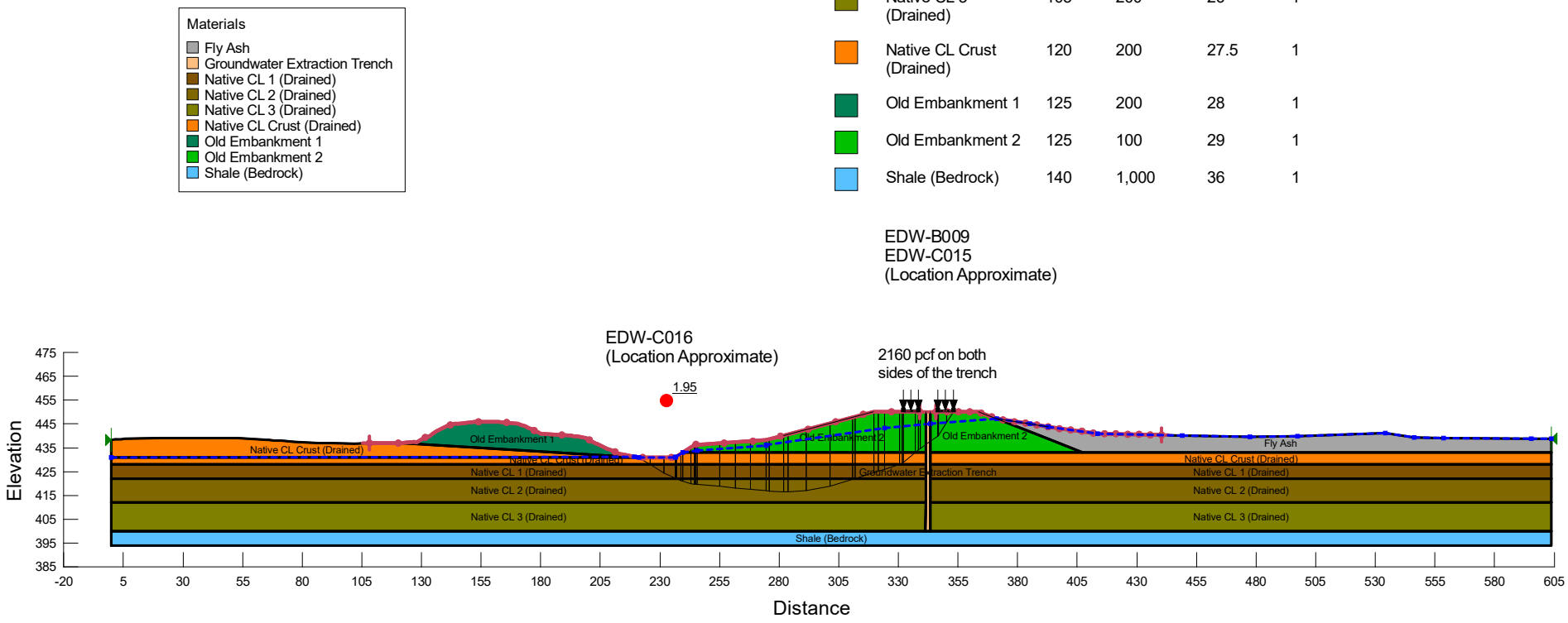
Edwards Power Plant Ash Pond
Cross-section 5+00
03. Outboard - Drained

Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface
	Fly Ash	75	100	27	1
	Groundwater Extraction Trench	120	0	35	1
	Native CL 1 (Drained)	117	100	26	1
	Native CL 2 (Drained)	105	200	26	1
	Native CL 3 (Drained)	105	200	26	1
	Native CL Crust (Drained)	120	200	27.5	1
	Old Embankment 1	125	200	28	1
	Old Embankment 2	125	100	29	1
	Shale (Bedrock)	140	1,000	36	1



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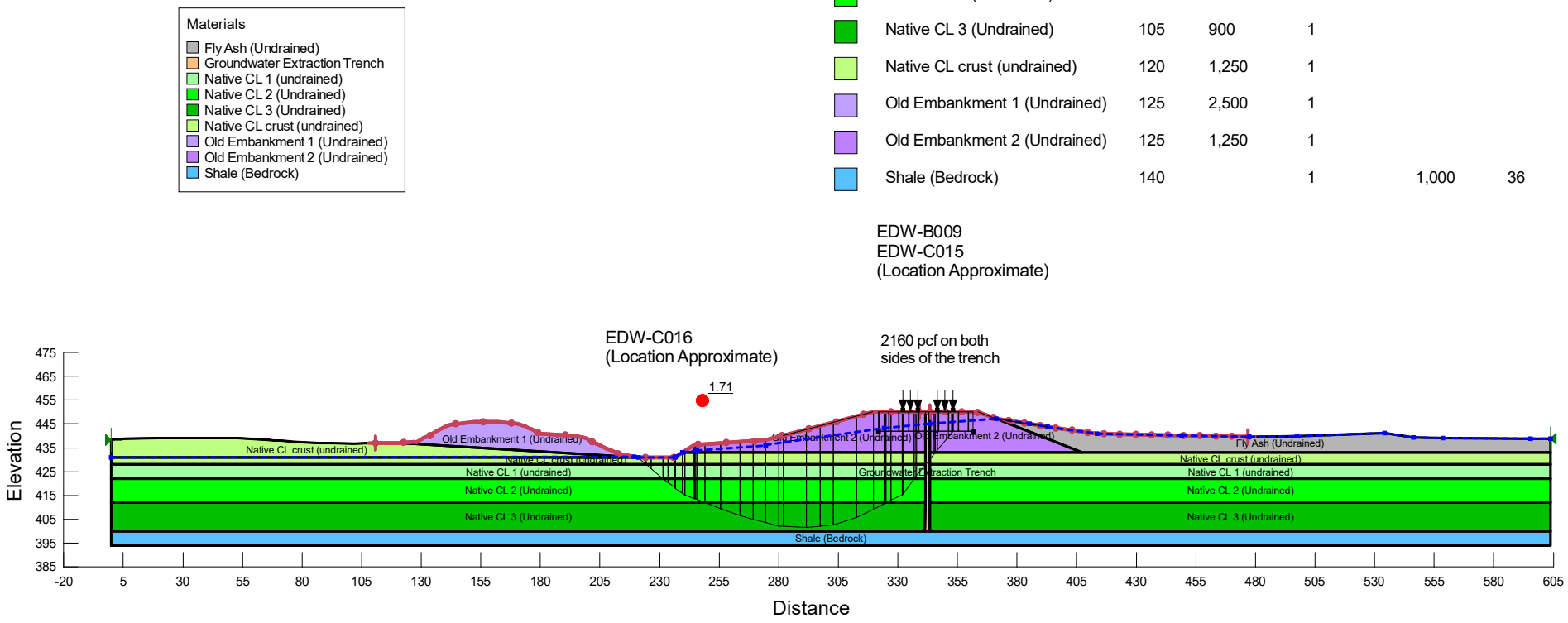
Edwards Power Plant Ash Pond
Cross-section 5+00
04. Outboard - Undrained

Color	Name	Unit Weight (pcf)	Undrained Shear Strength (psf)	Piezometric Surface	Effective Cohesion (psf)	Effective Friction Angle (°)
	Fly Ash (Undrained)	75	600	1		
	Groundwater Extraction Trench	120		1	0	35
	Native CL 1 (undrained)	117	650	1		
	Native CL 2 (Undrained)	105	700	1		
	Native CL 3 (Undrained)	105	900	1		
	Native CL crust (undrained)	120	1,250	1		
	Old Embankment 1 (Undrained)	125	2,500	1		
	Old Embankment 2 (Undrained)	125	1,250	1		
	Shale (Bedrock)	140		1	1,000	36



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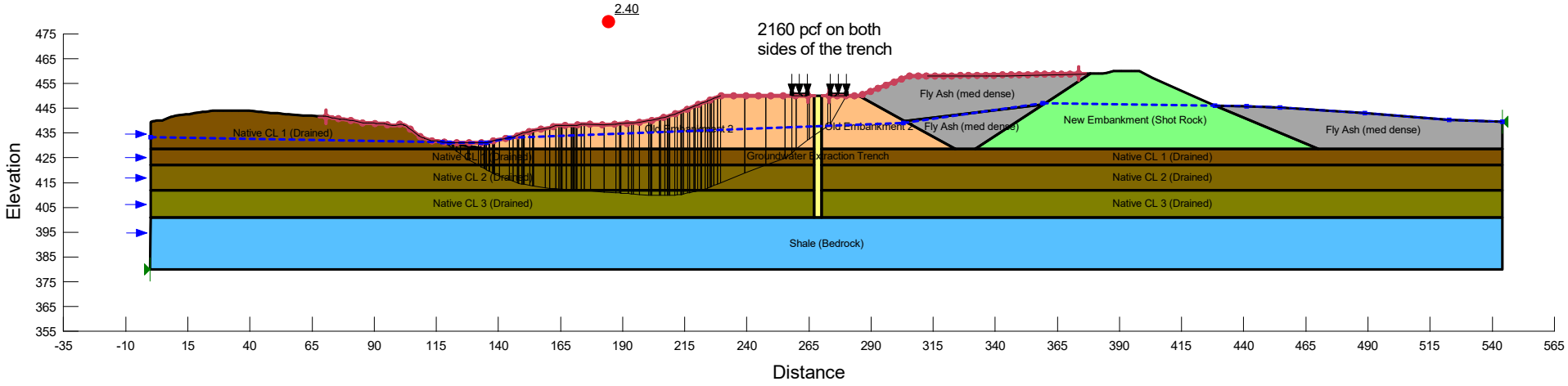
Edwards Power Plant Ash Pond
Cross-section 8+00
01. Drained

Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Effective Friction Angle (°)	Piezometric Surface
	Fly Ash (med dense)	105	100	27	1
	Groundwater Extraction Trench	120	0	35	1
	Native CL 1 (Drained)	117	100	26	1
	Native CL 2 (Drained)	105	200	26	1
	Native CL 3 (Drained)	105	200	26	1
	New Embankment (Shot Rock)	120	0	32	1
	Old Embankment 2	125	100	29	1
	Shale (Bedrock)	140	1,000	36	1

Materials
- Fly Ash (med dense)
- Groundwater Extraction Trench
- Native CL 1 (Drained)
- Native CL 2 (Drained)
- Native CL 3 (Drained)
- New Embankment (Shot Rock)
- Old Embankment 2
- Shale (Bedrock)



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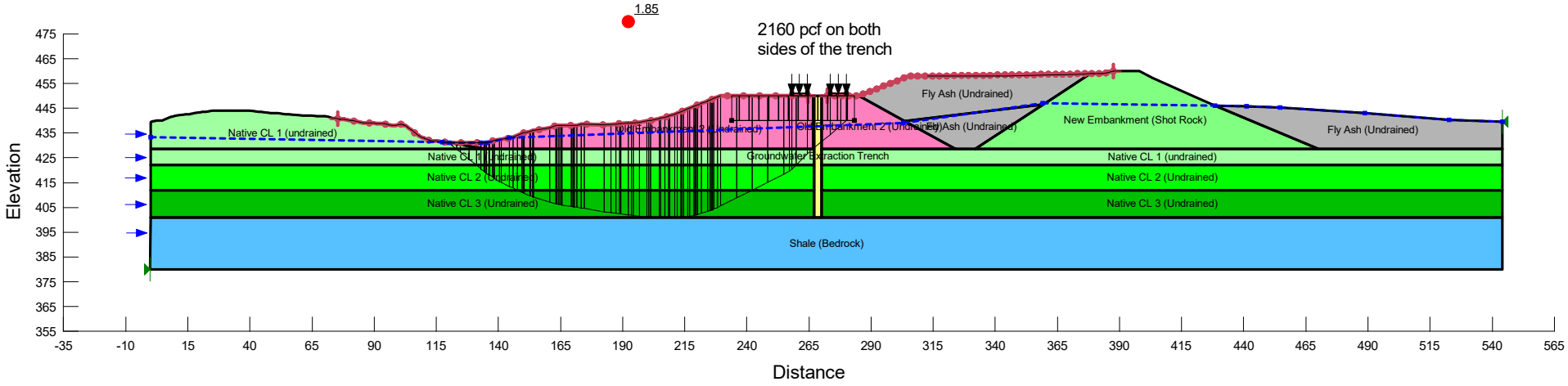
Edwards Power Plant Ash Pond
Cross-section 8+00
02. Undrained

Color	Name	Unit Weight (pcf)	Undrained Shear Strength (psf)	Piezometric Surface	Effective Cohesion (psf)	Effective Friction Angle (°)
	Fly Ash (Undrained)	105	600	1		
	Groundwater Extraction Trench	120		1	0	35
	Native CL 1 (undrained)	117	650	1		
	Native CL 2 (Undrained)	105	700	1		
	Native CL 3 (Undrained)	105	900	1		
	New Embankment (Shot Rock)	120		1	0	32
	Old Embankment 2 (Undrained)	125	1,250	1		
	Shale (Bedrock)	140		1	1,000	36

Materials
- Fly Ash (Undrained)
- Groundwater Extraction Trench
- Native CL 1 (undrained)
- Native CL 2 (Undrained)
- Native CL 3 (Undrained)
- New Embankment (Shot Rock)
- Old Embankment 2 (Undrained)
- Shale (Bedrock)



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ATTACHMENT B
HISTORIC SAFETY FACTOR ASSESSMENTS

AECOM

Submitted to
Illinois Power Resources
Generating, LLC
7800 S. Cilco Lane
Bartonville, IL 61607

Submitted by
AECOM
1001 Highlands Plaza Drive West,
Suite 300
St. Louis, MO 63110

October 2016

CCR Certification Report: Initial Structural Stability Assessment, Initial Safety Factor Assessment, and Initial Inflow Design Flood Control System Plan

For

Ash Pond

At Edwards Power Station

Table of Contents

Executive Summary **1**
1 Introduction **1-1**
2 Facility Description and Location Map **2-1**
2.1 Overview of Existing Surface Impoundments 2-1
3 Initial Structural Stability Assessments **3-1**
3.1 Foundations and Abutments (§257.73(d)(1)(i)) 3-1
3.2 Slope Protection (§257.73(d)(1)(ii)) 3-1
3.3 Dike Compaction (§257.73(d)(1)(iii)) 3-2
3.4 Vegetated Slopes (§257.73(d)(1)(iv)) 3-2
3.5 Spillways (§257.73(d)(1)(v)(A) and (B)) 3-2
3.6 Stability and Structural Integrity of Hydraulic Structures (§257.73(d)(1)(vi)) 3-3
3.7 Downstream Slope Inundation/Stability (§257.73(d)(1)(vii)) 3-3
4 Initial Safety Factor Assessments **4-1**
4.1 Factor of Safety: Maximum Storage Pool Loading (§257.73(e)(1)(i)) 4-1
4.2 Factor of Safety: Maximum Surcharge Pool Loading (§257.73(e)(1)(ii)) 4-2
4.3 Factor of Safety: Seismic (§257.73(e)(1)(iii)) 4-3
4.4 Factor of Safety: Soils Susceptible to Liquefaction (§257.73(e)(1)(iv)) 4-3
5 Initial Inflow Design Flood Control System Plan **5-1**
5.1 Inflow Design Flood Control Systems (§257.82(a)(1), (2), (3)) 5-1
5.2 Discharge from the CCR Unit (§257.82(b)) 5-2
6 Conclusions **6-1**
7 References **7-1**
8 Appendices **8-1**

Tables

Table ES-1 – Certification Summary
Table 1 – Summary of Factors of Safety – Maximum Storage Pool Loading Condition
Table 2 – Summary of Factors of Safety – Maximum Surcharge Pool Loading Condition
Table 3 – Summary of Factors of Safety – Seismic Loading Condition

Figures

Figure 1 – Edwards Power Station Location Map
Figure 2 – Edwards Power Station Site Plan

Appendices

Appendix A – Pipe Inspection Report
Appendix B – Geotechnical Report
Appendix C – Hydrologic and Hydraulic Report

Executive Summary

The initial structural stability assessment, initial safety factor assessment, and initial inflow design flood control system plan for the Ash Pond at the Edwards Power Station have been prepared in accordance with the United States Environmental Protection Agency (USEPA) Coal Combustion Residual (CCR) Rule 40 Code of Federal Regulations (CFR) §257.73(d), §257.73(e), and §257.82, respectively. These regulations require that the specified structural stability, safety factor, and hydrologic and hydraulic (supporting the inflow design flood control system plan) assessments for an existing CCR surface impoundment be completed by October 17, 2016.

The engineering investigations, analyses, and evaluations determined that the Ash Pond meets all requirements for the safety factor assessment and hydrologic and hydraulic analysis, as summarized in Table ES-1. All requirements for structural stability are met, except for the structural integrity of hydraulic structures (§257.73(d)(1)(vi)). In accordance with §257.73(d)(2), AECOM recommends that a CCTV pipe inspection be performed on the hydraulic structure pipes as soon as feasible and that this assessment report be updated with documentation of that inspection.

Table ES-1 – Certification Summary

Report Section	CCR Rule Reference	Requirement Summary	Requirement Met?	Comments
Initial Structural Stability Assessment				
3.1	§257.73(d)(1)(i)	Stable foundations and abutments	Yes	Foundations and abutments were found to be stable.
3.2	§257.73(d)(1)(ii)	Adequate slope protection	Yes	Slope protection is adequate.
3.3	§257.73(d)(1)(iii)	Sufficiency of dike compaction	Yes	Dike compaction is sufficient for expected ranges in loading conditions.
3.4	§257.73(d)(1)(iv)	Presence and condition of slope vegetation	Yes	Vegetation is present on interior and exterior slopes and is maintained. Interior slopes also have alternate protection (crushed stone) in some areas.
3.5	§257.73(d)(1)(v)(A) and (B)	Adequacy of spillway design and management	Yes	Spillways are adequately designed and constructed and adequately manage flow during the probable maximum flood (PMF).
3.6	§257.73(d)(1)(vi)	Structural integrity of hydraulic structures	No	Requirement cannot be certified at this time due to inability to complete CCTV pipe inspections of the hydraulic structures. AECOM recommends CCTV inspections of the pipes as soon as feasible to address this issue.
3.7	§257.73(d)(1)(vii)	Stability of downstream slopes inundated by water body	Not Applicable	Inundation of exterior slopes is not expected.
Initial Safety Factor Assessment				
4.1	§257.73(e)(1)(i)	Maximum storage pool safety factor must be at least 1.50	Yes	Safety factors were calculated to be 1.54 and higher.
4.2	§257.73(e)(1)(ii)	Maximum surcharge pool safety factor must be at least 1.40	Yes	Safety factors were calculated to be 1.54 and higher.
4.3	§257.73(e)(1)(iii)	Seismic safety factor must be at least 1.00	Yes	Safety factors were calculated to be 1.08 and higher.
4.4	§257.73(e)(1)(iv)	For dikes constructed of soils that have susceptibility to liquefaction safety factor must be at least 1.20	Not Applicable	Dike soils are not susceptible to liquefaction.
Initial Inflow Design Flood Control System Plan				
5.1	§257.82(a)(1), (2), (3)	Adequacy of inflow design flood control system	Yes	Flood control system adequately manages inflow and peak discharge during the 1,000-hour, 24-hour, Inflow Design Flood.
5.2	§257.82(b)	Discharge from the CCR Unit	Yes	Discharge from CCR Unit is routed through a NPDES-permitted outfall during both normal and 1,000-year, 24-hour, Inflow Design Flood conditions.

1 Introduction

This report documents that the structural stability assessment, safety factor assessment, and inflow design flood control system plan meet the requirements specified in 40 CFR §257.73(d), §257.73(e), and §257.82, respectively, to support the certification required under each of those regulatory provisions for the Edwards Power Station Ash Pond, except as noted herein. The Ash Pond is an existing CCR surface impoundment as defined by 40 CFR §257.53. The CCR Rule requires that the specified initial structural stability assessment, initial safety factor assessment, and initial inflow design flood control system plan (i.e., hydrologic and hydraulic analysis) for an existing CCR surface impoundment be completed by October 17, 2016.

The Edwards Power Station has one existing CCR surface impoundment, the Ash Pond. The Ash Pond has been evaluated to determine whether the structural stability, safety factor, and inflow design flood control system plan requirements are met. The following sections describe the evaluations performed and the results from the analyses, as supported by the underlying data and analyses included in the appendices.

2 Facility Description and Location Map

2.1 Overview of Existing Surface Impoundments

The Edwards Power Station is a coal-fired power plant located near Bartonville, Illinois in Peoria County. The Edwards Power Station is located on the west bank of the Illinois River, and the Ash Pond is located approximately 0.1 miles west of the station. A site location map showing the Edwards Power Station is in **Figure 1. Figure 2** presents the Edwards Power Station site plan.

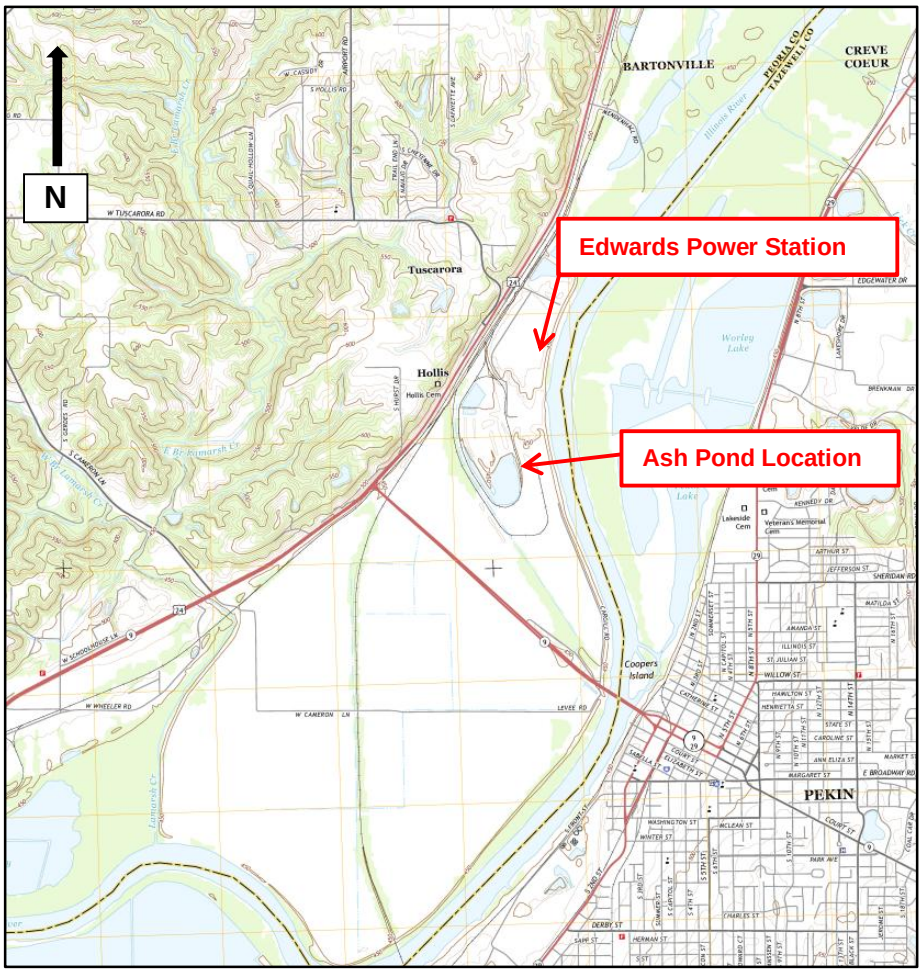


Figure 1 – Edwards Power Station Location Map
(from United States Geological Survey Pekin, IL 7.5' Topographic Maps, 2015)

One active CCR surface impoundment – the Ash Pond – is utilized for managing CCRs generated by the Edwards Power Station. The Ash Pond has a high hazard potential based on the initial hazard potential classification assessment performed by Stantec in 2016 in accordance with 257.73(a)(2).

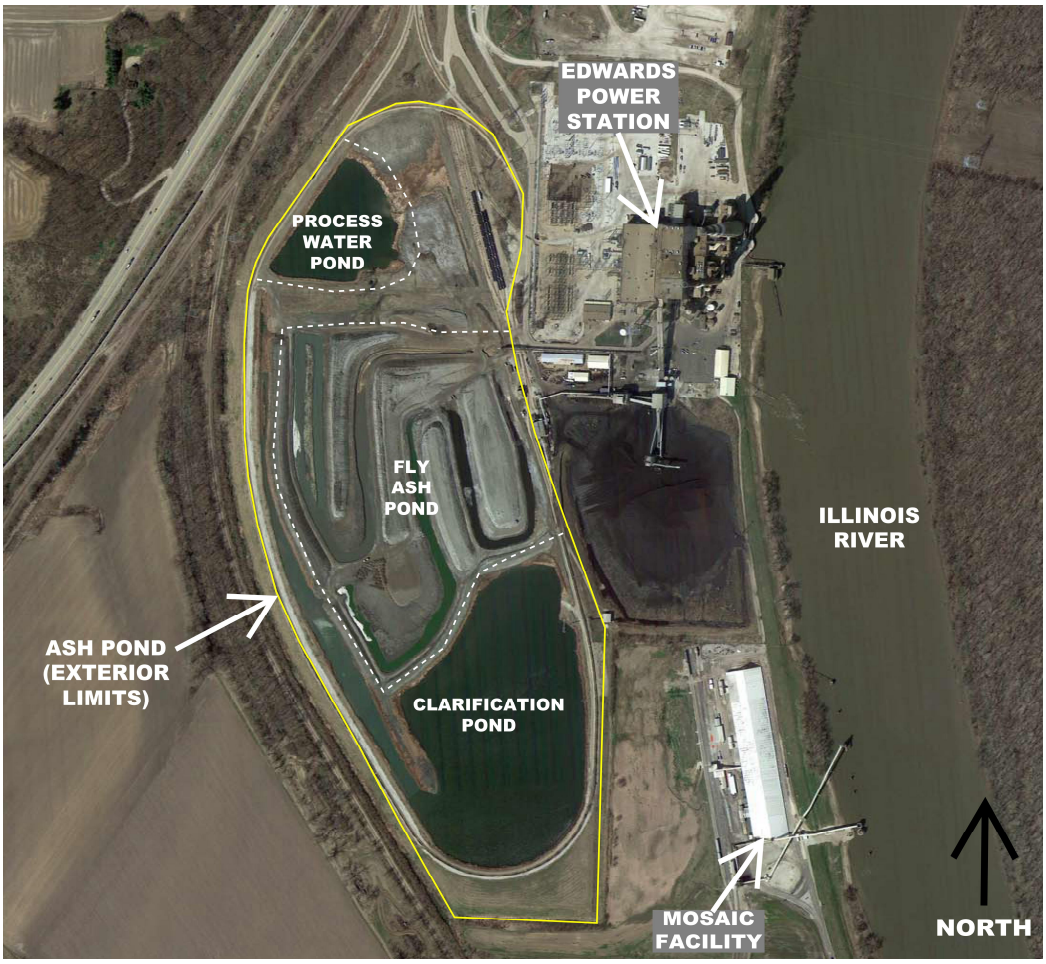


Figure 2 – Edwards Power Station Site Plan
(Imagery from Google Earth Pro, 2016)

The Ash Pond receives sluiced CCR materials and plant process water from the Edwards Power Station through sluice pipes that discharge into the eastern side of the Ash Pond, immediately west of the Edwards Power Station. Within the Ash Pond, there are three separate sub-basins: the Process Water Pond, the Fly Ash Pond, and the Clarification Pond. The Process Water Pond is located within the northwest portions of the Ash Pond, and receives water from miscellaneous sumps, pumps, and processes at the Edwards Power Station, as well as stormwater. The Process Water Pond transmits outflow to the Clarification Pond, which is located in the southern portion of the Ash Pond, through a 24-inch diameter corrugated metal pipe (CMP) culvert. The Fly Ash Pond receives sluiced bottom ash and fly ash from the plant and directs it into a settling channel, where ash is mechanically dipped out and stacked in windrows within the Fly Ash Pond. The Fly Ash Pond discharges into the Clarification Pond through a reinforced concrete pipe (RCP) culvert. The Clarification Pond then discharges the clear water to the Illinois River through a 36-inch diameter vertical drop inlet spillway structure (invert elevation of 447.2 feet, as listed in the 2011 Kleinfelder site assessment report) (all elevations in this report are in the NAVD88 datum, unless stated otherwise), with a skimmer/trash rack structure. Original design drawings indicate that the vertical morning glory spillway is a CMP; however, 2004 design drawings for replacement of the skimmer/trash rack indicate that the vertical portions of the spillway may have been replaced with RCP pipe at some time. The pipe material has not been verified as it is typically submerged and high flows into the pipe have prevented inspection. Within the embankment, the spillway structure transitions to a nearly horizontal 36-inch CMP that discharges to the Illinois River at the site's NPDES-permitted outfall. A flap gate backflow prevention device is present at the pipe's discharge. A sanitary sewer force main, consisting of 6-inch high-density polyethylene (HDPE) pipe, crosses the Ash Pond, between the Process Water Pond and the Fly Ash Pond, and is buried at a shallow depth within the Ash Pond. However, the pipe penetrates the west dike of the Ash Pond at a depth of approximately 10 feet. The pipe was installed in 2008 and transmits sewer flow from east to west.

The Ash Pond earthen embankments were constructed in the 1960s and an engineered raise of the embankment was completed in 2004 to facilitate the addition of a rail loop at the crest of the embankment. The engineered raise included

increasing the dike height from its original elevation of approximately 455 feet (based on the 2015 Maurer-Stutz survey) to approximately 460 feet (Clarification Pond) and 461 feet (Process Water Pond) using fly ash as a beneficial use material. The maximum height above the exterior grade of the current embankment is approximately 29 feet. Within the southern portions of the Clarification Pond, the rail loop was constructed approximately 250 feet inside the crest of the earthen embankment out of crushed stone. This effectively cut off a portion of the Ash Pond from the Clarification Pond, creating an area which was filled with CCR and vegetated. The original embankment acts as the perimeter of the Ash Pond at the southern end of the filled and vegetated area, and was also raised in 2004 to a similar elevation as the remainder of the embankment.

The perimeter embankment forms the exterior of the impoundment on all but the northeast side of the Ash Pond. The northeast side is bordered by the Edwards Station building grounds and switch yard which are at approximately the same elevation as the top of the pond embankment. The perimeter dike was constructed to include a crest width of approximately 15 to 42 feet with narrower crest widths along the northern portion of the embankment, and wider crest widths along the south, east, and west sides of the embankment. Both the rail loop and a gravel crest access road are located at the crest of the embankment. Based on 2015 LiDAR data from the State of Illinois, the exterior slopes have orientations ranging from 2.5H:1V (southern end of Ash pond) to 3.4H:1V (western side of Ash Pond). The interior slopes have a typical orientation of 2H:1V. Based on the 2015 Maurer-Stutz survey, minimum crest elevations range from 458.8 feet for the Process Water Pond to 459.6 feet for the Clarification Pond, although the typical crest elevations are similar to the design crest elevations of 460 feet and 461 feet for each pond, respectively.

An engineered liner system is not present at the Ash Pond. As currently operated, the normal pool of the Process Water Pond is El. 449.5 feet, as controlled by the 24-inch diameter CMP connecting it to the Clarification Pond. The normal pool of the Clarification Pond is El. 447.2 feet (as listed in the 2011 Kleinfelder site assessment report), as controlled by the 36-inch diameter morning glory spillway. The Ash Pond is approximately 95 acres in size and has a total perimeter length of approximately 8,800 feet, as measured in 2016 aerial photography from Google Earth. Additional details about the geometry and configuration of the pond are provided in the Geotechnical Report in **Appendix B**.

3 Initial Structural Stability Assessment

40 CFR §257.73(d)(1)
The owner or operator of the CCR unit must conduct initial and periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein. The assessment must, at a minimum, document whether the CCR unit has been designed, constructed, operated, and maintained with [the standards in (d)(1)(i)-(vii)].

Analyses completed for the initial structural stability assessment of the Edwards Power Station's Ash Pond are described in this section. Data and analysis results in the following subsections were developed using recent and historical data provided by Illinois Power Resources Generating, LLC (IPRG), including impoundment design information, spillway design information, survey data, historical data, analysis reports, and information about operational and maintenance procedures. These data were supplemented with subsurface investigation and laboratory data collected by AECOM in 2015.

IPRG's operation of the Ash Pond is consistent with the design and construction of the CCR unit. IPRG follows an established maintenance program that quickly identifies and resolves issues of concern.

3.1 Foundations and Abutments (§257.73(d)(1)(i))

CCR unit designed, constructed, operated, and maintained with stable foundations and abutments.

Stability of the foundations of the Ash Pond was evaluated by reviewing soil consistencies and phreatic data estimated from Standard Penetration Test (SPT) values, Cone Penetration testing (CPT), piezometer installation, and collected soil laboratory test data from the 2015 AECOM field investigation, which is discussed in more detail in **Section 4**. Based on these data, foundation materials generally consist of stiff alluvial clay, overlying soft to medium stiff alluvial clay, which in turn overlies shale bedrock. The phreatic surface is typically located above the embankment/foundation interface beneath the crest of the dike and at the embankment/foundation interface near the toe of the dike.

This information was used to perform slope stability analyses as required by §257.73(e)(1), which is discussed in more detail in **Section 4**. Safety factors for slip surfaces passing through the dike and foundation were found to meet or exceed the minimum requirements required by §257.73(e)(1), which indicates that the foundation of the Ash Pond is stable. One stability analysis cross-section representing the abutments of the Ash Pond was also analyzed, and was found to exceed the minimum requirements required by §257.73(e)(1).

Based on this evaluation, the Ash Pond meets the requirements presented in §257.73(d)(1)(i). A detailed presentation of the field and laboratory data collected for the foundations and the completed slope stability analyses can be found in **Appendix B**.

3.2 Slope Protection (§257.73(d)(1)(ii))

CCR unit designed, constructed, operated, and maintained with adequate slope protection to protect against surface erosion, wave action and adverse effects of sudden drawdown.

The adequacy of slope protection present at the Ash Pond was evaluated by reviewing design drawings, operational and maintenance procedures, and conditions observed in the field during AECOM's June 10, 2015 site visit.

The exterior dike slopes have a 2.5H:1V or shallower orientation and are covered with vegetation for slope protection, although some limited areas of crushed stone are present. IPRG regularly maintains the slopes, including repairing observed surface erosion and addressing areas of poor vegetation growth, as required. As the exterior slopes are not adjacent to a downstream water body, they are not susceptible to wave action or sudden drawdown. AECOM observed the vegetation to be adequately protecting against surface erosion.

The interior dike slopes have a 2H:1V orientation and are covered with crushed stone in most areas and vegetation in some areas for erosion protection. IPRG regularly maintains the interior slopes, including repairing observed surface erosion or wave action by backfilling the erosion with soil or crushed stone and addressing areas of poor vegetation growth.

The pool level in the Ash Pond is controlled by the vertical 36-inch drop inlet spillway and several interior culverts which separate the Process Water Pond and Fly Ash Pond sub-basins from the Clarification Pond sub-basin. The drop inlet spillway structure and interior culverts do not include low-level outlets or any means to lower the pool below the normal pool elevation of 449.5 feet for the Process Water Pond and 447.2 feet for the Clarification Pond. Therefore, an intentional or unintentional sudden drawdown of the pool level in the Ash Pond is not expected to occur as the pool cannot be drawn down suddenly using the existing spillway structures. Therefore, slope protection to protect against the adverse effects of sudden drawdown is not required.

Based on this evaluation, the Ash Pond meets the requirements in §257.73(d)(1)(ii).

3.3 Dike Compaction (§257.73(d)(1)(iii))

CCR unit designed, constructed, operated, and maintained with dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit.

Compaction of the Ash Pond dikes was evaluated using field data obtained from the 2015 AECOM geotechnical investigation and by reviewing design drawings and operational and maintenance procedures. Based on the 2015 AECOM data, the embankment materials consist of soft to very stiff materials that are stiff on average, which is indicative of mechanically-compacted dikes. Slope stability analyses as required by §257.73(e)(1) found acceptable safety factors for each required loading condition, as presented in **Section 4**. Therefore, the dike compaction and density is sufficient for withstanding required ranges in loading conditions.

Based on this evaluation, the Ash Pond meets the requirements in §257.73(d)(1)(iii). A detailed presentation of the field and laboratory data collected for the dikes and the completed slope stability analyses can be found in **Appendix B**.

3.4 Vegetated Slopes (§257.73(d)(1)(iv))[1]

CCR unit designed, constructed, operated, and maintained with vegetated slopes of dikes and surrounding areas, except for slopes which have an alternate form or forms of slope protection.

The adequacy of slope vegetation at the Ash Pond was evaluated by reviewing conditions observed in the field during AECOM's June 10, 2015 site visit and by reviewing design drawings and operational and maintenance procedures. At the time of the site visit, the exterior slopes were vegetated and the interior slopes were covered with vegetation or crushed stone, which is an alternate form of vegetation. The vegetation on the exterior and interior slopes is well-maintained. Regular maintenance manages the vegetation as described in this section.

Based on this evaluation, the Ash Pond meets the requirements in §257.73(d)(1)(iv).

3.5 Spillways (§257.73(d)(1)(v))

CCR unit designed, constructed, operated, and maintained with a single spillway or a combination of spillways configured as specified in [paragraph (A) and (B)]:

(A) All spillways must be either:

(1) of non-erodible construction and designed to carry sustained flows; or

(2) earth- or grass-lined and designed to carry short-term, infrequent flows at non-erosive velocities where sustained flows are not expected.

(B) The combined capacity of all spillways must adequately manage flow during and following the peak discharge from a:

(1) Probable maximum flood (PMF) for a high hazard potential CCR surface impoundment; or

(2) 1000-year flood for a significant hazard potential CCR surface impoundment; or

(3) 100-year flood for a low hazard potential CCR surface impoundment.

The spillway at the Ash Pond were evaluated using hydrologic and hydraulic analyses, conditions observed during AECOM's June 10, 2015 site visit, and historic design and construction information provided by IPRG. The Ash Pond has a high hazard

[1] As modified by court order issued June 14, 2016, Utility Solid Waste Activities Group v. EPA, D.C. Cir. No. 15-1219 (order granting remand and vacatur of specific regulatory provisions).

potential; therefore, the Probable Maximum Flood (PMF) storm event is the design flood event for the Ash Pond, per §257.73(d)(1)(v)(B).

The spillway system for the Ash Pond includes a 36-inch diameter CMP or RCP drop inlet spillway, either of which is a non-erodible material designed to carry sustained flows. Interior pipes between the various sub-basins are not considered spillways, as they are used to manage flow within the Ash Pond and do not manage ultimate discharge leaving the Ash Pond. The capacity of the spillway was evaluated using hydrologic and hydraulic analyses. The analysis found that the spillway can adequately manage flow during peak discharge resulting from the PMF storm event without overtopping of the embankments, as discussed in more detail in **Section 5**.

Based on these evaluations, the Ash Pond meets the requirements in §257.73(d)(1)(v). A detailed presentation of the hydraulic and hydrologic analyses can be found in **Appendix C**.

3.6 Stability and Structural Integrity of Hydraulic Structures (§257.73(d)(1)(vi))

CCR unit designed, constructed, operated, and maintained with hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure.

The structural stability and integrity of the Ash Pond hydraulic structures were evaluated using design drawings, operational and maintenance procedures, conditions observed in the field, inspection data, and structural analyses collected and performed by AECOM. There are two hydraulic structures that pass through the dike of the Ash Pond, the 36-inch primary spillway (either CMP or RCP) and a 6-inch HDPE sewer force main. No other hydraulic structures are known to pass through the dike of or underlie the base of the Edwards Ash Pond.

An evaluation of both the primary spillway and the sewer force main design drawings, operational and maintenance procedures, and conditions observed in the field did not identify any issues. Inspection of both the primary spillway and sewer force main was attempted on July 19, 2016, using closed-circuit television (CCTV) inspection equipment. The primary spillway could not be inspected due to high sustained flows in the pipe, which are critical to station operation and preclude camera inspection. Approximately 600 feet of the approximately 2,400-foot long sewer force main was inspected, but available access points on the sewer force main did not allow the CCTV rover to access the entirety of the pipe. The portion of the pipe that passes through the Ash Pond dike could not be inspected. The inspected portions of the sewer force main were free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris.

Because a thorough visual inspection of the sewer force main and the primary spillway pipes has not yet been completed, AECOM cannot currently conclude that the §257.73(d)(1)(vi) requirements have been met for the sewer force main and primary spillway at the Edwards Power Station. As a corrective measure, AECOM recommends that the sewer force main and the primary spillway pipes be inspected using CCTV equipment as soon as feasible and that this assessment be updated with documentation of the inspection at that time.

3.7 Downstream Slope Inundation/Stability (§257.73(d)(1)(vii))

CCR unit designed, constructed, operated, and maintained with, for CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.

The structural stability of the downstream slope of the Ash Pond was evaluated by comparing the location of the Ash Pond relative to adjacent water bodies. The FEMA Federal Insurance Rate Map (FIRM) map for the County of Peoria, Illinois shows the Ash Pond as being within the flood zone of the Illinois River. However, a United States Army Corps of Engineers (USACE) levee protects the Ash Pond from slope inundation. The USACE levee was constructed to an elevation of 462.0 feet, which is 3 feet higher than the flood pool of the Illinois River listed on the FIRM (El. 459 feet). Therefore, adjacent water bodies that can inundate the downstream slopes of the Ash Pond are not present.

Based on this assessment, the requirements in §257.73(d)(1)(vii) are not applicable to the Ash Pond, as inundation of the downstream slopes is not expected to occur.

4 Initial Safety Factor Assessment

40 CFR §257.73(e)(1)
The owner or operator must conduct initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors specified in (e)(1)(i) through (iv) of this section for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations.

A geotechnical investigation program and stability analyses were performed by AECOM in 2015 to evaluate the design, performance, and condition of the earthen dikes of the Ash Pond. The exploration consisted of 14 auger borings, installation of 4 piezometers to monitor groundwater levels, 22 Cone Penetration Test (CPT) soundings with shear wave velocity measurements and pore pressure dissipation testing, and laboratory program including strength, consolidation, and index testing. Data collected from the 2015 AECOM investigation, available design drawings, construction records, inspection reports, previous engineering investigations, and other pertinent historic documents were utilized to perform the safety factor assessment and geotechnical analyses.

In general, the subsurface conditions at the Ash Pond consist of a soft to very stiff compacted ash and clay dike, overlying stiff alluvial clay, overlying soft to medium stuff alluvial clay, which in turn overlies shale bedrock. The phreatic surface is typically located above the embankment/foundation interface beneath the crest of the dike, and at the embankment/foundation interface near the toe of the dike.

Ten (10) cross sections (A through J) were analyzed using GeoStudio SLOPE/W limit equilibrium slope stability analysis software to evaluate stability of the perimeter dike system and foundations. Slip surface search routines in SLOPE/W relied on circular slip surfaces using the entry and exit point-based method to define the initial critical slip surface. The slip surface was then optimized to find a critical, non-circular slip surface, and factors of safety were calculated using the Spencer method. This methodology was selected as it evaluates a wide range of slip surface geometries through the dike system and foundation, and the Spencer method satisfies both moment and force equilibrium. The cross section locations were based on the critical slope orientation, height, and subsurface conditions. The cross sections were evaluated for each of the loading conditions stipulated in §257.73(e)(1).

The results of the initial safety factor assessment are summarized in the following sub-sections. A detailed presentation of the analyses performed, including development of site stratigraphy, strength parameters, stability analysis methodology, and figures showing the location of cross-sections and investigation locations can be found in **Appendix B**.

4.1 Factor of Safety: Maximum Storage Pool Loading (§257.73(e)(1)(i))

The calculated static factor of safety under long-term, maximum storage pool loading condition must equal or exceed 1.50.

This calculation models the dike stability under static, long-term conditions, under the normal storage water level (El. 449.5 feet and 447.2 feet for the Process Water Pond and the Clarification Pond, respectively) within the impoundments, which corresponds to the normal water level in each sub-basin, based on the configuration of the outfall structures. Drained (effective stress) shear strength parameters were used for all materials, and phreatic conditions were estimated based on available piezometer and boring data. The calculated minimum factors of safety are identified in **Table 1.**

Table 1 – Summary of Factors of Safety – Maximum Storage Pool Loading Condition

Cross Section	Calculated Factor of Safety (§257.73(e)(1)(i) Minimum = 1.50)
A	2.02
B	1.59
C	1.83
D	1.79
E	1.54*
F	2.31
G	2.12
H	2.08
I	2.26
J	2.08

*Indicates critical cross section (i.e., lowest calculated factor of safety out of the 10 cross sections analyzed)

The calculated factors of safety exceed 1.50 for all cross sections analyzed, which meets the requirements in §257.73(e)(1)(i).

4.2 Factor of Safety: Maximum Surcharge Pool Loading (§257.73(e)(1)(ii))

The calculated static factor of safety under maximum surcharge pool loading condition must equal or exceed 1.40.

This calculation models the dike stability under short-term, surcharge pool conditions. The pool level for analysis was modeled at El. 457.8 feet in the Process Water Pond and El. 457.4 feet in the Clarification Pond, which is equal to the PMF flood pools in each sub-basin (See **Section 5.1**). Drained (effective stress) shear strength parameters were used for all materials, as the embankment is relatively wide, and the increase in pool level is not expected to result in the development of undrained conditions in the downstream slopes of the embankment, which is where the critical slip surface from the Maximum Surcharge Pool case is located. Pore pressures in the embankment were assumed to be similar to the Maximum Surcharge Pool loading condition; however, the pool level in the Ash Pond was increased to model additional loading from the surcharge pool. The calculated factors of safety are identified in **Table 2**.

Table 2 – Summary of Factors of Safety – Maximum Surcharge Pool Loading Condition

Cross Section	Calculated Factor of Safety (§257.73(e)(1)(ii) Minimum = 1.40)
A	2.02
B	1.59
C	1.82
D	1.79
E	1.54*
F	2.31
G	2.12
H	2.08
I	2.26
J	2.00

*Indicates critical cross section (i.e., lowest calculated factor of safety out of the 10 cross sections analyzed)

The calculated factors of safety exceed 1.40 for all cross sections analyzed, which meets the requirements in §257.73(e)(1)(ii).

4.3 Factor of Safety: Seismic (§257.73(e)(1)(iii))

The calculated seismic factor of safety must equal or exceed 1.00.

This calculation models the dike stability under short-term, seismic loading conditions during the design 2,500-year return period seismic event. Seismic loading is modeled as a horizontal force acting outward on the dike and foundation. This analysis is intended to model conditions during earthquake shaking. Therefore, peak undrained (total stress) shear strength parameters were used for all embankment and foundation materials. The pool elevation and phreatic conditions were assumed to be the same as the Maximum Storage Pool case (**Section 4.1**), and correspond to normal operating conditions at the Ash Pond. The calculated factors of safety are identified in **Table 3**.

Table 3 – Summary of Factor of Safety – Seismic Loading Condition

Cross Section	Calculated Factor of Safety (§257.73(e)(1)(iii) Minimum = 1.00)
A	1.37
B	1.28
C	1.09
D	1.18
E	1.11
F	1.08*
G	1.13
H	1.08*
I	1.30
J	2.08

*Indicates critical cross section (i.e., lowest calculated factor of safety out of the 10 cross sections analyzed)

The calculated factors of safety exceed 1.00 for all cross sections analyzed, which meets the requirements in §257.73(e)(1)(iii).

4.4 Factor of Safety: Soils Susceptible to Liquefaction (§257.73(e)(1)(iv))

For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

The 2015 AECOM field investigation did not identify any soil layers susceptible to liquefaction within either the embankments or the foundations at the Ash Pond. Therefore, the §257.73(e)(1)(iv) requirements are not applicable to the Ash Pond at the Edwards Power Station, and a liquefaction factor of safety analysis was not performed.

5 Initial Inflow Design Flood Control System Plan

40 CFR §257.82
(a) The owner or operator of an existing … CCR surface impoundment … must design, construct, operate, and maintain an inflow design flood control system as specified in paragraphs (a)(1) and (2) of this section.

(1) The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood specified in paragraph (a)(3) of this section.

(2) The inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood specified in paragraph (a)(3) of this section.

(3) The inflow design flood is:

(i) For a high hazard potential CCR surface impoundment, …, the probable maximum flood;

(ii) For a significant hazard potential CCR surface impoundment, …, the 1,000-year flood;

(iii) For a low hazard potential CCR surface impoundment, …, the 100-year flood; or

(iv) For an incised CCR surface impoundment, the 25-year flood.

(b) Discharge from the CCR unit must be handled in accordance with the surface water requirements under §257.3-3.

Analyses completed for the initial inflow design flood control system plan of the Ash Pond are described in the following subsections. Data and analysis results in the following subsection are based on spillway design information shown on design drawings, construction information, topographic surveys, information about operational and maintenance procedures provided by IPRG and field measurements collected by AECOM. The analysis approach and results of the hydrologic and hydraulic analyses are presented in the following subsections. A detailed presentation of the analyses performed can be found in **Appendix C**.

The Ash Pond has a high hazard potential; therefore, the inflow design flood (IDF) is the PMF.

5.1 Initial Inflow Design Flood Control Systems (§257.82(a))

An initial inflow design flood control system plan, supported by a hydraulic and hydrologic analysis, was developed for the Ash Pond by evaluating the effects of a 24-hour duration design storm for the PMF using a hydraulic HydroCAD (Version 10) computer model and a starting water surface elevation of 449.5 feet in the Process Water Pond and 447.2 feet in the Clarification Pond, based on the configuration of the outfall structures for each sub-basin as reported in the 2011 Kleinfelder site assessment report. The computer model evaluated the Ash Pond's ability to collect and control the PMF under existing operational and maintenance procedures. Rainfall data for the PMF, which corresponds to the Probable Maximum Precipitation (PMP) rainfall event, was obtained from the National Weather Service Hydrometeorological Report No. 51 (HMR 51) for the 10-square mile all-season Probable Maximum Precipitation. The HMR 51 24-hour PMP rainfall depth is 32.8 inches.

The HydroCAD model results for the Ash Pond indicate that the CCR unit has sufficient storage capacity and spillway structures to adequately manage (1) flow into the CCR unit during and following the peak discharge of the PMF and (2) flow from the CCR unit to collect and control the peak discharge resulting from the PMF. The peak water surface elevation is 457.8 feet in the Process Water Pond and 457.4 feet in the Clarification Pond during the PMF, and the minimum crest elevation of the Ash Pond dike is 458.8 feet in the Process Water Pond and 459.6 feet in the Fly Ash Pond and Clarification Pond. Therefore, overtopping is not expected.

Based on this evaluation, the Ash Pond meets the requirements in §257.82(a), and the hydrologic and hydraulic analysis is presented in **Appendix C**.

5.2 Discharge from the CCR Unit (§257.82(b))

40 CFR §257.82(b) provides that the discharge from the CCR unit must be handled in accordance with the surface water requirements under 40 CFR §257.3-3, which states the following:

(a) For purposes of section 4004(a) of the Act, a facility shall not cause a discharge of pollutants into waters of the United States that is in violation of the requirements of the National Pollutant Discharge Elimination System (NPDES) under section 402 of the Clean Water Act, as amended.

(b) For purposes of section 4004(a) of the Act, a facility shall not cause a discharge of dredged material or fill material to waters of the United States that is in violation of the requirements under section 404 of the Clean Water Act, as amended.

(c) A facility or practice shall not cause non-point source pollution of waters of the United States that violates applicable legal requirements implementing an areawide or Statewide water quality management plan that has been approved by the Administrator under section 208 of the Clean Water Act, as amended.

(d) Definitions of the terms Discharge of dredged material, Point source, Pollutant, Waters of the United States, and Wetlands can be found in the Clean Water Act, as amended, 33 U.S.C. 1251 et seq., and implementing regulations, specifically 33 CFR part 323 (42 FR 37122, July 19, 1977).

The handling of discharge was evaluated by reviewing design drawings, operational and maintenance procedures, conditions observed in the field by AECOM, and the inflow design flood control system plan developed per §257.82(a).

Based on this evaluation, outflow from the Ash Pond is ultimately routed through a NPDES-permitted discharge into the Illinois River. Hydraulic and hydrologic analyses performed as part of the initial inflow design flood control system plan found that the Ash Pond adequately manages outflow during the PMF, as overtopping of the Ash Pond embankments is not expected.

Therefore, discharge of pollutants in violation of the NPDES permit is not expected as all discharge is routed and controlled through the existing spillway system and NPDES-permitted outfall during both normal and IDF conditions. Based on this evaluation, the Ash Pond meets the requirements in §257.82(b).

6 Conclusions

The Ash Pond at the Edwards Power Station was evaluated relative to the USEPA CCR Rule requirements for initial structural stability assessments (§257.73(d)), initial safety factor assessments (§257.73(e)), and initial inflow design flood control system plan (§257.82). Based on the evaluations presented herein, the referenced requirements are satisfied for safety factor assessments and hydrologic and hydraulic analyses. The requirements for structural stability (§257.73(d)) are also satisfied, except for §257.73(d)(1)(vi).

At this time, the structural integrity of the hydraulic structures passing through the dike of the Ash Pond (§257.73(d)(1)(vi)) cannot be certified because the sewer force main and the primary spillway pipes have not been fully visually inspected using CCTV equipment. In accordance with §257.73(d)(2), AECOM recommends performing a CCTV inspection of the sewer force main and the primary spillway pipes as soon as feasible and updating this assessment once the inspection has been performed.

7 References

AECOM (2016). *Hydrologic and Hydraulic Summary Report, Edwards Power Station, Ash Pond.* Bartonville, Illinois.

AECOM (2016). *Geotechnical Report, Edwards Power Station, Ash Pond.* Bartonville, Illinois.

Federal Emergency Management Agency (FEMA). (1983). *Flood Hazard Boundary Map, Peoria County, Illinois, Unincorporated Area, Panel 175 of 200*. Community-Panel Number 170533 0175 B.

Illinois Geospatial Data Clearing House (2015). *LiDAR Data for Peoria County, Illinois*. Accessed December, 2015.

Kleinfelder (2011). *Coal Ash Impoundment Site Assessment Final Report.* E.D. Edwards Power Generating Station, Ameren Energy Generating Company, Bartonville, Illinois. May 10, 2011.

Maurer-Stutz (2015). *Topographical and Bathymetric Survey, Edwards Ash Pon*d. Performed in June and July 2015.

National Weather Service. *Hydrometeorological Report No. 51.*

U.S. Environmental Protection Agency [USEPA]. (2015). *Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments.* 40 CFR Part 257, Subpart D. 80 Fed. Reg. 21468 April 17, 2015.

8 Appendices

A. Pipe Inspection Report

B. Geotechnical Report

C. Hydrologic and Hydraulic Report

Appendix A. Pipe Inspection Report

Tel:
Fax:
E-mail:

Inspection Report

Date	P/O. No.	Weather	Surveyor's Name	Pipe Segment Reference	Section No.
9/22/2016			**Mike Bennett**		**1**
Certificate No.	Survey Customer	System Owner	Date Cleaned	Pre-Cleaning	Sewer Category
U-313-17480				**No Pre-Cleaning**	

Street123	**7800 S. Cilco Ln**	Use of Sewer		Upstream MH	**East**
City	**Bartonville, IL**	Drainage Area		Dowstream MH	**West**
Loc. details		Flow Control		Dir. of Survey	**Downstream**
Location Code		Length surveyed	**193.90 ft**	Section Length	**193.90 ft**

Purpose of Survey		Joint Length	
Year Laid		Dia./Height	**6 inch**
Year Rehabilitated		Material	**Polyethylene**
Tape / Media No.		Lining Method	

Add. Information :

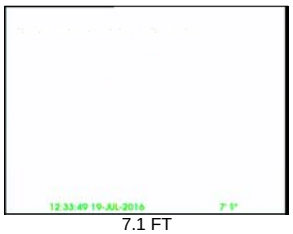
1:480	Position	Observation
East		
	0.00	Cleanout Mainline
	0.00	Water Level, 5 %of cross sectional area
	2.30	Tap Factory Made, at 03 o'clock, -, within 8 inches of joint: YES, 4"
	7.10	Water Level, 40 %of cross sectional area
	42.50	Water Level, 5 %of cross sectional area
	51.80	Water Level, 40 %of cross sectional area
	105.60	Water Level, 5 %of cross sectional area
	143.00	Water Level, 40 %of cross sectional area
	193.90	General Observation
West		



0 FT

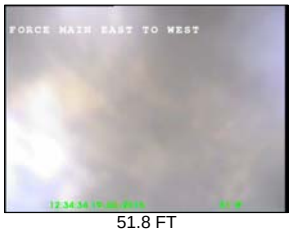


2.3 FT


7.1 FT



42.5 FT



51.8 FT

QSR	QMR	SPR	MPR	OPR	SPRI	MPRI	OPRI
0000	**0000**	**0**	**0**	**0**	**0**	**0**	**0**

Tel:
Fax:
E-mail:

Inspection photos

City :	Street :	Date :	Pipe Segment Reference :	Section No :
Bartonville, IL	**7800 S. Cilco Ln**			**1**

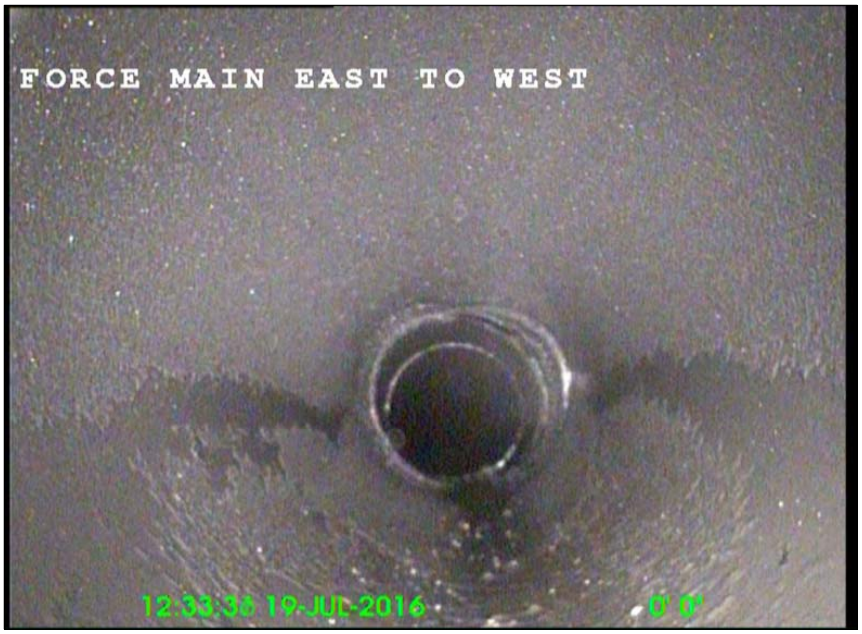


Photo: 1_1_1_A.jpg
0FT, Cleanout Mainline



Photo: 1_1_4_A.jpg
2.3FT, Tap Factory Made, at 03 o'clock, -, within 8 inches of joint: YES, 4"

Tel:
Fax:
E-mail:

Inspection photos

City :	Street :	Date :	Pipe Segment Reference :	Section No :
Bartonville, IL	**7800 S. Cilco Ln**			**1**

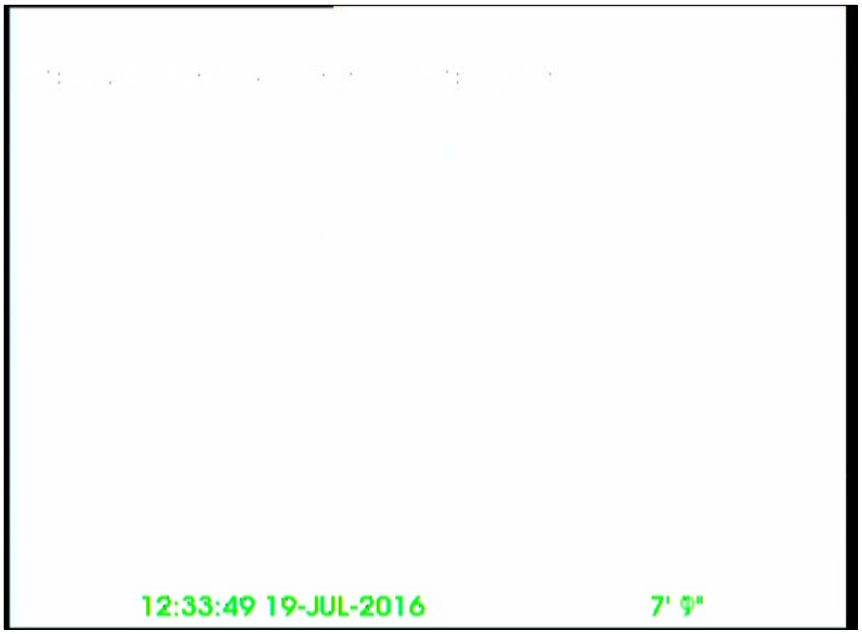


Photo: 1_1_5_A.jpg
7.1FT, Water Level, 40 %of cross sectional area



Photo: 1_1_6_A.jpg
42.5FT, Water Level, 5 %of cross sectional area

Tel:
Fax:
E-mail:

Inspection photos

City :	Street :	Date :	Pipe Segment Reference :	Section No :
Bartonville, IL	**7800 S. Cilco Ln**			**1**



Photo: 1_1_7_A.jpg
51.8FT, Water Level, 40 %of cross sectional area



Photo: 1_1_8_A.jpg
105.6FT, Water Level, 5 %of cross sectional area

Tel:
Fax:
E-mail:

Inspection photos

City :	Street :	Date :	Pipe Segment Reference :	Section No :
Bartonville, IL	**7800 S. Cilco Ln**			**1**

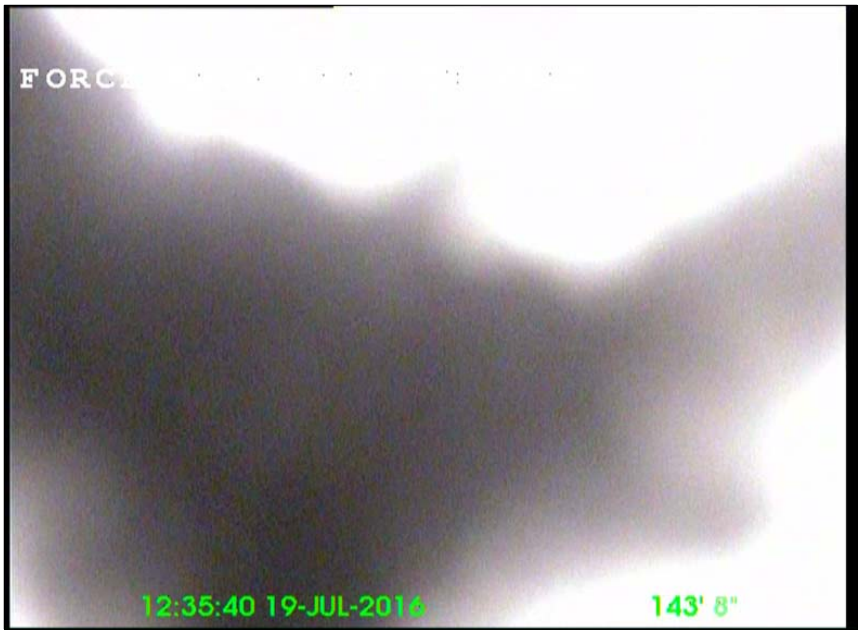


Photo: 1_1_9_A.jpg
143FT, Water Level, 40 %of cross sectional area



Photo: 1_1_10_A.jpg
193.9FT, General Observation

Tel:
Fax:
E-mail:

Inspection Report

Date	P/O. No.	Weather	Surveyor's Name	Pipe Segment Reference	Section No.
9/22/2016			**Mike Bennett**		**2**
Certificate No.	**Survey Customer**	**System Owner**	**Date Cleaned**	**Pre-Cleaning**	**Sewer Category**
U-313-17480				**No Pre-Cleaning**	

Street123	**7800 S. Cilco Ln.**	Use of Sewer		Upstream MH	**Middle 1**
City	**Bartonville, IL**	Drainage Area		Dowstream MH	**Middle 2**
Loc. details		Flow Control		Dir. of Survey	**Downstream**
Location Code		Length surveyed	**193.80 ft**	Section Length	**193.80 ft**

Purpose of Survey		Joint Length	
Year Laid		Dia./Height	**6 inch**
Year Rehabilitated		Material	**Polyethylene**
Tape / Media No.		Lining Method	

Add. Information :

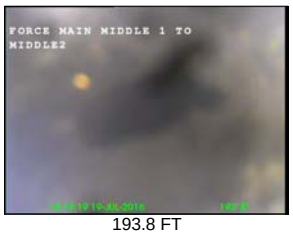
1:480	Position	Observation
Middle 1		
	0.00	Cleanout Mainline
	0.00	Water Level, 5 %of cross sectional area
	0.30	Water Level, 40 %of cross sectional area
	193.80	General Observation
Middle 2		



0 FT



0.3 FT



193.8 FT

QSR	QMR	SPR	MPR	OPR	SPRI	MPRI	OPRI
0000	**0000**	**0**	**0**	**0**	**0**	**0**	**0**

Tel:
Fax:
E-mail:

Inspection photos

City :	Street :	Date :	Pipe Segment Reference :	Section No :
Bartonville, IL	**7800 S. Cilco Ln.**			**2**



Photo: 3_3_11_A.jpg
0FT, Cleanout Mainline



Photo: 3_3_13_A.jpg
0.3FT, Water Level, 40 %of cross sectional area

Tel:
Fax:
E-mail:

Inspection photos

City :	Street :	Date :	Pipe Segment Reference :	Section No :
Bartonville, IL	**7800 S. Cilco Ln.**			**2**



Photo: 3_3_14_A.jpg
193.8FT, General Observation

Tel:
Fax:
E-mail:

Inspection Report

Date	P/O. No.	Weather	Surveyor's Name	Pipe Segment Reference	Section No.
9/22/2016			**Mike Bennett**		**3**
Certificate No.	**Survey Customer**	**System Owner**	**Date Cleaned**	**Pre-Cleaning**	**Sewer Category**
U-313-17480				**No Pre-Cleaning**	

Street123	**7800 S. Cilco Ln.**	Use of Sewer		Upstream MH	**Middle Pond**
City	**Bartonville, IL**	Drainage Area		Dowstream MH	**West**
Loc. details		Flow Control		Dir. of Survey	**Downstream**
Location Code		Length surveyed	**195.10 ft**	Section Length	**195.10 ft**

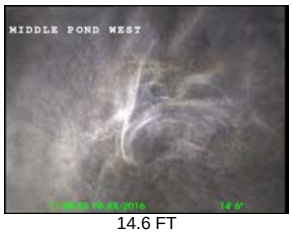
Purpose of Survey		Joint Length	
Year Laid		Dia./Height	**6 inch**
Year Rehabilitated		Material	**Polyethylene**
Tape / Media No.		Lining Method	

Add. Information :

1:480	Position	Observation
Middle Pond		
	0.00	Cleanout Mainline
	0.00	Water Level, 40 %of cross sectional area
	14.60	Water Level, 10 %of cross sectional area
	52.70	Water Level, 40 %of cross sectional area
	195.10	General Observation
West		



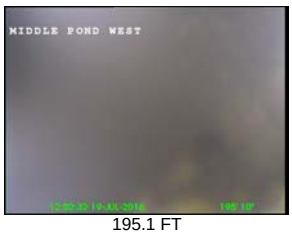
0 FT



14.6 FT



52.7 FT



195.1 FT

QSR	QMR	SPR	MPR	OPR	SPRI	MPRI	OPRI
0000	**0000**	**0**	**0**	**0**	**0**	**0**	**0**

Tel:
Fax:
E-mail:

Inspection photos

City :	Street :	Date :	Pipe Segment Reference :	Section No :
Bartonville, IL	**7800 S. Cilco Ln.**			**3**



Photo: 4_4_15_A.jpg
0FT, Cleanout Mainline

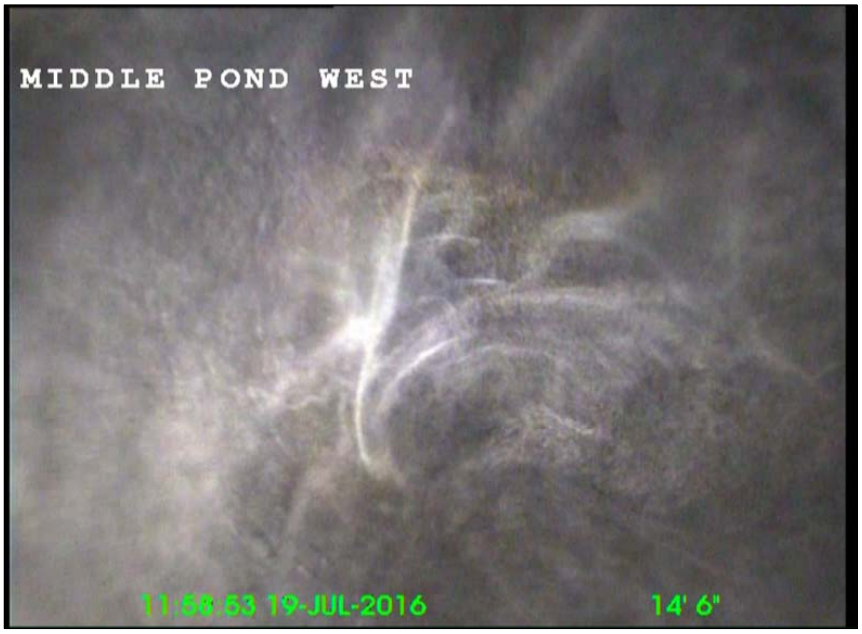


Photo: 4_4_17_A.jpg
14.6FT, Water Level, 10 %of cross sectional area

Tel:
Fax:
E-mail:

Inspection photos

City :	Street :	Date :	Pipe Segment Reference :	Section No :
Bartonville, IL	**7800 S. Cilco Ln.**			**3**



Photo: 4_4_18_A.jpg
52.7FT, Water Level, 40 %of cross sectional area



Photo: 4_4_19_A.jpg
195.1FT, General Observation

Appendix B. Geotechnical Report

AECOM
1001 Highlands Plaza Drive West
Suite 300
St. Louis, MO 63110-1337
www.aecom.com

314.429.0100 tel
314.429.0462 fax

October 7, 2016

Mr. Matt Ballance, PE
Senior Project Engineer
Dynegy Inc.
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

RE: Geotechnical Report
Edwards Power Station
Ash Pond

Dear Mr. Ballance:

AECOM is pleased to provide this Geotechnical Report for the Illinois Power Resource Generating, LLC (IPRG) Ash Pond Coal Combustion Residuals (CCR) unit at the Edwards Power Station located in Bartonville, Illinois. This Geotechnical Report has been prepared to document the analysis performed to check that the facility meets the geotechnical slope stability requirements including Factors of Safety required by 40 CFR § 257.73.

AECOM looks forward to providing continued support to Illinois Power Resource Generating, LLC and working together on this important program. Please do not hesitate to call Ron Hager at 314-429-0100 (office) / 440-591-7868 (mobile), if you have any questions or comments on this Geotechnical Report.

Sincerely,

AECOM

Jeremy Thomas, PE
Site Manager
jeremy.thomas@aecom.com

Ronald Hager
Program Manager
ronald.hager@aecom.com

cc: Mark Rokoff, PE – AECOM

Attachments:

A. Figures
B. Boring Logs
C. Piezometer Logs
D. CPT Data Report
E. Laboratory Test Data
F. Material Characterization Calculations
G. Slope Stability Analysis
H. Liquefaction Analysis

1. INTRODUCTION

1.1. Purpose of This Report

This report presents the results of the geotechnical analyses prepared by AECOM for the Illinois Power Resources Generating, LLC (IPRG[1]) Coal Combustion Residuals (CCR) Ash Pond at the Edwards Power Station, located in Bartonville, Illinois (see **Figure 1, Attachment A** for Location Map). The purpose of the geotechnical investigation and analyses performed is to evaluate the design, performance, and condition of the impoundment and associated structures using the data collected from surface and subsurface investigations, available design drawings, construction records, inspection reports, previous engineering investigations, and other pertinent historic documents provided to AECOM by IPRG. This information was then used to evaluate the design and operation of the surface impoundment against the regulatory standards set in 40 CFR § 257.73.

The geotechnical field exploration was conducted between August 19 and November 5, 2015. The field program consisted of conventional mud rotary borings, Standard Penetration Testing (SPT), Cone Penetration testing (CPT), and piezometer installation. Laboratory testing was conducted on the materials obtained through various sampling techniques to assist in characterization of the subsurface conditions, especially with respect to defining material parameters in stability analyses. Stability analyses were performed by AECOM to evaluate the potential for slope instabilities, in accordance with the Environmental Protection Agency (EPA) regulation 40 CFR § 257.73(d) and (e).

A summary of the geotechnical field program, laboratory testing program, and stability evaluations are presented herein. Detailed interpretations, calculations, and presentation of analysis results are provided in the Attachments to this report.

1.2. Description of Impoundment

There is one CCR unit at the Edwards Power Station: the Ash Pond. The Ash Pond is approximately 95 acres in size and is contained by a perimeter embankment that forms the exterior of the impoundment on all but the northeast side of the Ash Pond. The northeast side is bordered by the Edwards Station building grounds and switch yard which are at approximately the same elevation as the top of the pond embankment.

The original Ash Pond embankment is composed primarily of low plasticity compacted clays. An engineered raise of the embankment, constructed of ash placed on the crest and outboard side of the existing embankment, was completed in 2004 to facilitate the addition of a rail loop at the crest of the embankment. Additionally, this raise project also included constructing a new crushed stone embankment through and within the southern end of the Ash Pond, isolating a portion of the Ash Pond that was filled with ash and is vegetated. The original embankment still forms the perimeter of the Ash Pond at the southern end of this filled and vegetated area.

[1] Although the Ash Pond is owned by IPRG, Dynegy Administrative Services Company (Dynegy) contracted AECOM to develop this geotechnical report on behalf of IPRG. Therefore, “Dynegy” is referenced in materials attached to this geotechnical report.

Embankment heights range from approximately 0 feet (east and northeastern side of the embankment) to 29 feet (south and western side of the embankment), relative to the outboard toe. The typical crest elevation is approximately elevation 460 to 461 feet (all elevations in this report are listed in the NAVD88 datum, unless otherwise stated), based on the 2015 Maurer-Stutz survey for the site. Based on 2015 Illinois state LiDAR data, embankment outboard slopes range from approximately 2.5H:1V (horizontal to vertical) at the southern end of Ash Pond to 3.4H:1V at the western side of Ash Pond. Embankment crest widths range from approximately 15 feet to 42 feet, with narrower crest widths along the northern portion of the embankment and wider crest widths along the south, east, and west sides of the CCR unit.

Site location and site vicinity maps are included **Attachment A**, **Figure 1**.

2. SUMMARY OF FIELD INVESTIGATIONS

A subsurface exploration program was undertaken at the Ash Pond, including 14 soil borings, installation of 4 standpipe piezometers, and 22 cone penetration test (CPT) soundings with shear wave velocity (Vs) measurements and pore pressure dissipation (PPD) testing. The borings were drilled by AECOM's subcontractor Strata Earth Services, LLC of Palatine, IL, under the full-time supervision of AECOM geotechnical personnel. Strata Earth Services used both an All-Terrain Vehicle-mounted Diedrich D-120 drill rig and a truck-mounted Mobile B-57 drill rig, in conjunction with 3¼-inch inner diameter hollow stem augers and mud rotary methods to drill the borings. CPT soundings were performed by AECOM's subcontractor ConeTec, Inc., again with full-time oversight by AECOM personnel.

Boring depths varied from 37 to 66.5 feet below ground surface (bgs) and CPT depths varied from approximately 15 to 56 feet bgs. Boring and CPT sounding locations are depicted in **Figure 2** and piezometer locations are depicted in **Figure 3**. Logs of the borings are presented in **Attachment B**. Logs of the CPT soundings are presented in **Attachment D**, and piezometer logs are presented in **Attachment C**. Approximate locations of borings and CPTs are listed in **Table 1**.

Representative soil samples were collected from each of the borings for classification and/or testing. The SPT soil samples were obtained with a split-spoon sampler, in accordance with ASTM D 1586. Undisturbed samples of fly ash and fine-grained soils were obtained using 3-inch outside diameter steel (Shelby) tubes, either conventionally pushed in accordance with ASTM D 1587 or by utilizing a piston sampler in accordance with ASTM D 6519 (in ash and very soft soils). Results of the laboratory testing are presented in **Attachment E**.

Table 1
Boring and CPT Exploration Location[1] Data

Exploration ID	Easting (ft NAD83)	Northing (ft NAD83)	Elevation (ft NAVD88)
Auger Borings			
EDW-B001	2435307.9	1431922.3	461.0
EDW-B002	2435311.8	1431230.1	454.9
EDW-B003	2435399.3	1430502.0	460.0
EDW-B003A	2435404.3	1430502.0	460.0
EDW-B004	2435844.2	1430395.2	460.5
EDW-B005	2436105.4	1428429.4	459.0
EDW-B006	2436239.1	1429340.9	436.0
EDW-B008	2435578.9	1428207.8	438.8
EDW-B009	2435438.4	1428498.4	460.1
EDW-B010	2434755.0	1431482.0	459.0
EDW-B011	2435211.9	1429262.2	456.4
EDW-B012	2434793.9	1429514.9	459.0
EDW-B013	2436189.5	1428284.1	457.0
EDW-B014	2434647.2	1430898.4	457.7
EDW-B015	2436104.4	1428611.5	460.0
EDW-B015A	2436099.4	1428606.5	460.0
CPT Soundings			
EDW-C001	2435307.9	1431922.3	461.0
EDW-C003	2435533.2	1431377.1	461.9
EDW-C005	2435844.2	1430395.2	460.5
EDW-C006	2435902.5	1429921.9	462.0
EDW-C007	2436127.3	1429449.6	458.1
EDW-C008	2436239.1	1429340.9	436.0
EDW-C009	2436104.4	1428611.5	460.0
EDW-C010	2436245.5	1428211.6	437.8
EDW-C011	2436189.5	1428284.1	457.0
EDW-C012	2436105.4	1428429.4	459.0
EDW-C013	2435634.1	1428281.0	457.9
EDW-C014	2435578.9	1428207.8	438.8
EDW-C015	2435438.4	1428498.4	460.1
EDW-C015A	2435501.3	1428444.5	460.1
EDW-C016	2435383.1	1428461.7	436.9
EDW-C017	2434793.9	1429514.9	459.0
EDW-C019	2434931.7	1429697.8	457.0
EDW-C021	2434538.8	1430424.2	460.0
EDW-C022	2434647.2	1430898.4	457.7
EDW-C023	2434755.0	1431482.0	459.0
EDW-C025	2435311.8	1431230.1	454.9
EDW-C026	2435399.3	1430502.0	460.0
EDW-C026B	2435404.2	1430505.4	460.0
EDW-C027	2435211.9	1429262.2	456.4

[1] Locations above were not surveyed. Locations were approximated based on handheld GPS measurements taken during the investigation. Elevations are based on site topographic LiDAR survey from Illinois Geospatial Data Clearinghouse for Peoria County downloaded in December of 2015. The expected accuracy of these measurements is expected to be approximately ±5 feet horizontal and ±1 foot vertical.

3. SUMMARY OF SITE-SPECIFIC SUBSURFACE CONDITIONS

3.1. Site Stratigraphy

New Embankment Fill Materials: The perimeter embankment dike of the Ash Pond was constructed in two stages, with an original embankment, and a later raise constructed on top of and on the outboard slope of the existing embankment. This raise brought the embankment crest from an original elevation around 455 feet to the current elevation around 460 to 461 feet. This newer embankment fill material is comprised of fly ash from the plant (as beneficial use material), classified as lean silt (United Soil Classification of ML) to poorly graded silty sand with gravel (SP). The consistency of the new embankment fill, as measured by uncorrected SPT N-values, ranged from soft to very stiff, but generally had a stiff to very stiff consistency and appeared to be well-compacted.

Old Embankment Fill Materials: The original perimeter embankment of the Ash Pond is largely comprised of clay fill with trace sand and shell fragments, classified as lean clay (CL). The consistency of the old embankment fill, as measured by uncorrected SPT N-values, ranged from soft to stiff, but generally had a stiff consistency and appeared to be well-compacted. It was noted that the old embankment fill generally had a higher measured shear strength above approximately elevation 450 ft, so this material was split into two materials within the slope stability analytical models.

Impounded Ash Materials: Ash materials were encountered in the borings drilled within the Ash Pond. The material was classified as a silt (ML - fly ash) with some sand and clay and trace gravel. The measured consistency of the ash ranged from very loose to very dense, though generally, the consistency of ash was loose to very loose and was saturated below the pool level in the Ash Pond.

Native Alluvial Clay Crust: The Ash Pond is underlain by native clay of alluvial origin. This material was typically classified as lean clay (CL), with occasional zones of interbedded fat clay (CH). Much of the clay has a liquid limit near 50, denoting borderline fat/lean clay. The uppermost approximate 5 feet of this native alluvial clay measured significantly higher in strength, signifying a desiccated crust layer near the original ground surface. The consistency of this clay was generally stiff.

Native Alluvial Clay: As noted above, the Ash Pond is underlain by native clay of alluvial origin, typically classified as lean clay (CL) with occasional zones of interbedded fat clay (CH). Much of the clay has a liquid limit near 50 moderate to high plasticity. Beneath the upper crust material, the clay exhibited significantly less shear strength, and was normally consolidated to slightly overconsolidated, with shear strengths increasing with depth. The clay consistency varied from soft to medium stiff near the top of the stratum, generally increasing with depth to a consistency of medium stiff to stiff near the level of the bedrock. To capture this strength increase within the stability models, this material was divided into three layers.

Shale Bedrock: Shale bedrock was encountered below the native alluvial soils in the deeper borings. The shale was found to be slightly weathered to weathered near the upper contact, and became hard with depth. The shale was cored in two locations to verify classification, but no further testing was completed on this material.

Other Materials: Other materials were encountered in relatively small quantities at the site, appearing at only one or two exploration locations, and were not considered part of the site-wide stratigraphy. These materials include old and recent fill (similar in properties to the old and new embankment fill materials), historic ash material (similar in properties to the more recent ash fill),

and crushed stone embankment fill in the rail loop embankment that constructed the isolated filled and vegetated area in the southern end of the Ash Pond. The crushed stone embankment fill was observed to be medium dense, fine to coarse, crushed stone gravel with sand, classified as poorly graded gravel (GP). A clean crushed stone toe drain material was also noted on available historical design drawings, but was not encountered in the borings performed for this investigation.

Specific information used to assess and develop the design site stratigraphy can be found in **Attachment B** – Boring Logs, **Attachment D** – CPT Data Report, and **Attachment E** – Lab Test Data.

3.2. Phreatic Conditions

AECOM evaluated piezometer data from five measurement events (10/28/15, 11/24/15, 12/17/15, 1/14/16, and 2/11/16), interpreted pore pressure data from CPT soundings, and measured phreatic water in boreholes immediately after drilling. Piezometer data were judged to be the most representative of in-situ, steady state conditions. Data from CPT PPD tests in ash were judged to be representative of steady state phreatic conditions, but PPD tests within and outboard of the embankment were not consistently representative. Water was encountered in 6 of the 14 borings during drilling, observations which were unlikely to be representative of steady state conditions due to the time required for water levels to equilibrate in the relatively low-permeability embankment and foundation soils.

A total of four open standpipe piezometers were installed at the Ash Pond. All of the piezometers were installed through the perimeter embankment. Two of the piezometers (EDW-P002 and EDW-P004) were installed with the screened elevation within sluiced as in the Ash Pond. The remaining two piezometers (EDW-P001 and EDW-P003) were installed with the screen elevations located within the foundation soils. Piezometer locations and measurements are summarized in **Table 2**.

Table 2
Piezometer Location and Phreatic Level Data

Piezometer No.	Impoundment Embankment	Northing (ft NAD83)[1]	Easting (ft NAD83)	Ground Surface Elevation (ft NAVD88)	Location	Piezometer Type[2]	Total Depth[3] (feet)	Phreatic Elevation (ft NAVD88)				
								10/28/2015[4]	11/24/2015	12/17/2015	1/14/2016	2/11/2016
EDW-P001	North	2440516.6	1426796.5	461	Crest	OSP	36.5	-	436.7	438.9	441.8	438.3
EDW-P002	Northwest	2440043.6	1427380.9	459	Crest	OSP	29.0	449.7	449.8	450.2	451.0	450.4
EDW-P003	West	2438062.1	1427345.5	459.6	Crest	OSP	49.6	437.3	438.7	439.1	439.6	439.8
EDW-P004	Southeast	2437206.1	1426013.0	455.6	Crest	OSP	30.2	-	442.8	442.9	445.2	442.8

Notes:

1. Locations above were not surveyed. Locations are approximated based on handheld GPS measurements taken during investigation. Elevations are based on site topographic LiDAR survey from Illinois Geospatial Data Clearinghouse for Peoria County downloaded in December of 2015. The expected accuracy of these measurements is expected to be approximately ±5 feet horizontal and ±1 foot vertical.
2. OSP = open standpipe piezometer.
3. Total Depth = Approx. bottom of screen for standpipe piezometers.
4. Readings on 10/28/2015 at EDW-P001 and EDW-P004 were before piezometers were developed, and are not presented.

4. SUMMARY OF LABORATORY TESTING

4.1. Summary of Laboratory Testing Scope

Soil samples collected from the subsurface exploration were sealed at the site and were then transported to the lab of AECOM's laboratory testing subcontractors; Terracon of Vernon Hills, Illinois, where an AECOM geotechnical engineer reviewed the samples and selected samples for laboratory testing. The laboratory testing program performed for the Ash Pond was intended to obtain information on index and shear strength properties of the subsurface material at the site. The laboratory testing program for characterization of the materials at the Ash Pond is summarized in **Table 3**.

Table 3
Summary of Laboratory Testing Program for the Ash Pond

ASTM Designation	Test Type	Number of Tests							
		Total	Ash	New Embankment Fill	Old Embankment Fill	Other Fill Materials	Native Clay Crust	Native Clay	Bedrock
D2216	Moisture Content	181	47	15	21	19	5	56	18
D4318	Atterberg Limits	26	4	1	5	1	1	14	-
T311[1], D1140, D422	Gradation / Hydrometer	10	7	3	-	-	-	-	-
D854	Specific Gravity	9	5	-	-	-	4	-	-
D5084	Hydraulic Conductivity	3	2	-	-	-	-	1	-
D2435	Consolidation	2	-	-	-	-	-	2	-
D 2166	Unconfined Compression	5	-	-	-	-	-	5	-
D4767	Consolidated Undrained Triaxial (CIU)	5	-	-	3	-	-	2	-
D6528	Direct Shear (DS)	8	2	-	-	-	1	5	-
G57, G51	Corrosion Suite	5	4	-	-	-	-	1	-

[1] American Association of State Highway and Transportation Officials (AASHTO) test designation

4.2. Summary of Laboratory Testing Results

A summary of laboratory test results for the impounded ash, new embankment fill, old embankment fill, native clay crust, and native clay at the Ash Pond are presented in **Tables 4, 5, 6, 7** and **8**, respectively. A summary of laboratory tests results for other fill materials and shale bedrock are presented in **Tables 9** and **10**. Laboratory test data is included in **Attachment E**. Graphical displays of the shear strength characterization for the stratigraphic materials are included in the Material Characterization Calculation Package in **Attachment F**.

Table 4
Summary of Laboratory Test Results – Impounded Ash

Boring Number	Sample Number	Depth	USCS Classification	Water Content %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	Liquid Limit	Plastic Limit	Plasticity Index	Specific Gravity	Direct Shear		Hydraulic Conductivity (cm/sec)	Corrosion Suite (ANS Point Rating)
														c' (psf)	phi' (deg)		
EDW-B002	S-1	0.0'-1.5'	SM	38.4	4.50+												
EDW-B002	S-2	2.5'-4.0'	ML	62.4	3.50												
EDW-B002	S-3	5.0'-7.0'	MH	66.6						65	36	29					
EDW-B002	S-4	7.5'-10.0'		79.0		0.0	7.4	73.1	19.5								
EDW-B002	S-5	10.0'-12.0'		76.9						17	27	NP		112	29.8	9.19E-05	
EDW-B002	S-6	15.0'-16.5'		52.5													14.5
EDW-B002	S-7	20.0'-21.5'		67.8													
EDW-B002	S-8	25.0'-27.0'		63.9									2.471				
EDW-B003	S-1	0.0'-1.5'		44.4									2.469				
EDW-B003	S-10	35.0'-36.5'		51.9													
EDW-B003	S-2	2.5'-4.0'		27.3	2.00												
EDW-B003	S-3	5.0'-6.5'	OL	37.2	1.00												
EDW-B003	S-4	7.5'-9.5'		55.5													
EDW-B003	S-5	10.0'-11.5'		50.6		2.3	19.8	56.3	21.6								
EDW-B003	S-6	15.0'-16.5'		29.7									2.772				
EDW-B003	S-7	20.0'-21.5'		42.1													
EDW-B003	S-8	25.0'-27.0'		54.9													
EDW-B003	S-9	30.0'-32.0'		71.7		0.0	20.6	66.4	13.0					82.8	26.9	6.79E-05	
EDW-B004	S-1	0.0'-1.5'		18.9	4.50+												
EDW-B004	S-2	2.5'-3.5'		28.5	4.00												
EDW-B004	S-2A	3.5'-4.0'	CL	20.1	3.25												
EDW-B004	S-3	5.0'-6.5'	CL	21.6	1.75												3.0
EDW-B004	S-4	7.5'-9.0'	CL	23.4	4.00	0.0	9.3	43.3	47.4	37	16	21					
EDW-B004	S-5	10.0'-11.5'	CL	21.5	2.25												
EDW-B005	S-1	0.0'-1.5'	SC	45.8	4.50												
EDW-B005	S-2	2.5'-4.0'	ML	26.0													
EDW-B005	S-3	5.0'-6.5'	MH	50.9	3.25					61	54	7					
EDW-B005	S-4	8.5'-10.0'	ML	37.4	4.50+												
EDW-B005	S-5	10.0'-11.5'	SC	44.3													
EDW-B011	S-1	0.0'-1.5'		27.7	4.50+												
EDW-B011	S-10	35.0'-37.0'		93.9													
EDW-B011	S-2	2.5'-4.0'		16.3	4.50+												
EDW-B011	S-3	5.0'-6.5'		29.4	4.50+												
EDW-B011	S-4	7.5'-9.0'		45.3	3.00												
EDW-B011	S-5	9.0'-11.0'		70.0		15.5	21.3	46.0	17.2								
EDW-B011	S-6	15.0'-17.0'		63.2													14.5
EDW-B011	S-7	19.5'-21.5'		84.9		0.2	16.7	58.0	25.1								
EDW-B011	S-8	25.0'-27.0'		74.7									2.691				
EDW-B011	S-9	30.0'-32.0'		73.7													
EDW-B014	S-1	0.0'-1.5'		28.2	4.00												
EDW-B014	S-2	2.5'-3.5'	CL-ML	40.8	1.50												
EDW-B014	S-2A	3.5'-4.0'	CL-ML	50.0													
EDW-B014	S-4	7.0'-8.5'	SM	60.2		0.0	35.1	45.4	19.5								
EDW-B014	S-6	15.0'-17.0'		78.7	3.50												
EDW-B014	S-7	20.0'-22.5'		86.5	1.50								2.524				15.0
EDW-B014	S-8	25.0'-26.7'		73.1													
EDW-B014	S-9	30.0'-31.5'	CL	48.7													

Table 5
Summary of Laboratory Test Results – New Embankment Fill

Boring Number	Sample Number	Depth	USCS Classification	Water Content %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	Liquid Limit	Plastic Limit	Plasticity Index
EDW-B005	S-6	15.0'-16.5'	ML	41.4								
EDW-B005	S-7	20.0'-21.5'		51.1	1.75	3.1	21.3	51.7	23.9			
EDW-B005	S-8	25.0'-26.0'	ML	55.3								
EDW-B010	S-1 BOTTOM	0.0'-0.5'	CL	17.4	4.50+							
EDW-B010	S-1 TOP	0.0'-0.5'	SP	7.2								
EDW-B010	S-1A	0.5'-1.5'		27.9								
EDW-B010	S-2	2.5'-3.0'		20.9								
EDW-B010	S-2A	3.0'-4.0'		30.7	4.50							
EDW-B010	S-3	5.0'-6.5'	SP	14.8		12.6	54.8	26.0	6.6			
EDW-B010	S-4	7.5'-9.0'	CL	22.0	3.75							
EDW-B012	S-1	0.0'-1.5'	ML	23.0								
EDW-B012	S-2	2.5'-4.0'		23.8	4.50+					28	26	2
EDW-B012	S-3	5.0'-6.5'		26.5		0.0	9.6	73.7	16.7			
EDW-B012	S-4	7.5'-9.0'		26.5	4.50							
EDW-B012	S-5	10.0'-11.0'	CL	24.7	3.75							

Table 6
Summary of Laboratory Test Results – Old Embankment Fill

Boring Number	Sample Number	Depth	USCS Classification	Water Content %	Qp (tsf)	Liquid Limit	Plastic Limit	Plasticity Index	Consolidated Undrained Triaxial			
									c (psf)	phi (deg)	c' (psf)	phi' (deg)
EDW-B008	S-1	0.0'-1.5'	CL	13.2	4.50+							
EDW-B008	S-2	2.5'-4.0'	CL	19.5	3.75	42	22	20				
EDW-B008	S-3	5.0'-6.5'	CL	42.3	2.00							
EDW-B008	S-4	7.5'-9.0'	CL	22.8	2.00							
EDW-B010	S-5	10.0'-11.5'	CL	24.0	2.00							
EDW-B010	S-6	12.5'-14.0'	CL	28.0	1.25							
EDW-B010	S-7	15.0'-17.0'	CL	30.5		48	18	30	420	11.1	199.6	24.8
EDW-B010	S-8	20.0'-21.5'	CL	32.9	0.75							
EDW-B010	S-9	25.0'-26.5'	CL	21.4	0.50							
EDW-B012	S-5A	11.0'-11.5'	CL	24.9	2.00							
EDW-B012	S-6	12.5'-14.0'	CL	22.0	3.50							
EDW-B012	S-7	15.0'-16.5'	CL	24.3	3.25	48	19	29	426	14.6	496	23.5
EDW-B012	S-8	20.0'-22.0'	CL	23.8								
EDW-B012	S-9	25.0'-26.5'	CL	23.2	1.25							
EDW-B013	S-2	2.5'-4.0'	CL	17.4	4.50+							
EDW-B013	S-3	6.0'-8.0'	CL	24.3		49	21	28	418	15.2	115.2	29.7
EDW-B013	S-4	8.0'-9.5'	CL	24.3	3.00							
EDW-B013	S-5	10.0'-11.5'	CL	25.4	2.25							
EDW-B013	S-6	15.0'-16.5'	CL	25.5	1.50	41	17	24				
EDW-B013	S-7	20.0'-21.5'	CL	23.5	1.75							
EDW-B013	S-8	25.0'-26.5'	CL	27.7								

Table 7
Summary of Laboratory Test Results – Native Clay Crust

Boring Number	Sample Number	Depth	USCS Classification	Water Content %	Qp (tsf)	Liquid Limit	Plastic Limit	Plasticity Index	Specific Gravity	Direct Shear	
										c' (psf)	phi' (deg)
EDW-B006	S-1	0.0'-1.5'	CL	26.4	2.25						
EDW-B006	S-2	2.5'-5.0'	CL	30.1	1.25						
EDW-B012	S-10	30.0'-31.5'	CL	24.8	1.50						
EDW-B013	S-9	30.0'-31.5'	CL	20.2	0.50						
EDW-B015	S-10	31.0'-33.0'	CL	20.2		24	13	11		193.4	27.6

Table 8

Summary of Laboratory Test Results – Native Clay

Boring Number	Sample Number	Depth	USCS Classification	Water Content %	Qp (tsf)	Liquid Limit	Plastic Limit	Plasticity Index	Specific Gravity	Unconfined Compression	Consolidated Undrained Triaxial				Direct Shear		Hydraulic Conductivity (cm/sec)	Corrosion Suite (ANS Point Rating)	Consolidation, Pc (psf)
										c (psf)	c (psf)	phi (deg)	c' (psf)	phi' (deg)	c' (psf)	phi' (deg)			
EDW-B002	S-10	35.0'-37.0'	CL	31.6		36	18	18		273.46			273.46						
EDW-B002	S-11	40.0'-41.5'	CL	42.9	1.00				2.592										
EDW-B002	S-12	45.0'-46.5'	CL	57.7	0.75														
EDW-B002	S-9	30.0'-30.5'	CL	126.1	<.25														
EDW-B002	S-9A	30.5'-31.5'	CL	31.1	0.50														
EDW-B003	S-10A	36.5'-37.0'	CL	43.0	2.25														
EDW-B003	S-11	40.0'-41.5'	CL	31.6	1.25														
EDW-B003	S-12	45.0'-47.0'	CH	46.0		51	17	34		632.48									2200
EDW-B003	S-13	50.0'-51.5'	CL	55.4	0.50														
EDW-B004	S-11	36.0'-38.0'	CL	20.1		35	17	18		615.04							7.20E-07		
EDW-B004	S-12	40.0'-41.5'	CL	30.0	1.25														
EDW-B004	S-13	45.0'-46.0'	CL	39.5	1.00														
EDW-B004	S-13A	46.0'-46.5'	CL	35.1															
EDW-B004	S-14	50.0'-51.5'	CL	65.2	1.75				2.617										
EDW-B004	S-15	55.0'-56.5'	CL	33.4	1.25														
EDW-B004	S-15A	56.0'-56.5'	ML	13.2															
EDW-B005	S-11	41.0'-43.0'	CH	44.8		57	22	35							262	27.2			
EDW-B005	S-12	45.0'-46.5'	CL	88.7	1.00				2.521									10.0	
EDW-B006	S-10	30.0'-31.0'	CL	43.4	0.50														
EDW-B006	S-10A	31.0'-31.5'	CL	19.6															
EDW-B006	S-3	5.0'-6.5'	CL	24.8	2.25	48	19	29											
EDW-B006	S-4	7.5'-10.0'	CL	26.0	2.50														
EDW-B006	S-5	10.0'-11.5'	CL	34.2	1.25														
EDW-B006	S-6	13.0'-15.0'	CH	31.1		62	20	42							316	23.7			
EDW-B006	S-7	15.0'-16.5'	CL	40.8	1.00														
EDW-B006	S-8	20.0'-21.5'	CL	43.4	0.75														
EDW-B006	S-9	26.0'-28.0'	OH	76.0		72	37	35			666	8.5	396	28.5					
EDW-B008	S-10	35.0'-36.5'	CL	56.9	0.25														
EDW-B008	S-5	11.0'-13.0'	CH	33.6		52	19	33		354									1860
EDW-B008	S-6	15.0'-16.5'	CL	64.6	0.50														
EDW-B008	S-7	20.0'-21.5'	CL	44.4	0.50														
EDW-B008	S-8	24.0'-26.5'	CH	68.9		67	31	36							848	27.3			
EDW-B008	S-9	30.0'-31.5'	CL	71.4	0.50														
EDW-B010	S-10	30.0'-32.0'	CL	30.0		40	15	25							31.8	24.1			
EDW-B010	S-11	35.0'-36.5'	CL	28.2	1.50														
EDW-B011	S-13	40.0'-41.5'	CL	47.9	1.00														
EDW-B011	S-14	45.0'-46.5'	CH	63.3	0.50	63	21	42											
EDW-B011	S-15	50.0'-51.5'	CL	62.5	0.50														
EDW-B011	S-16	55.0'-56.5'	CL	52.9	0.75														
EDW-B012	S-11	35.0'-36.5'	CL	28.3	1.50														
EDW-B012	S-12	40.0'-41.5'	CL	32.2	1.00														
EDW-B012	S-13	45.0'-46.5'	CL	50.2	1.25														
EDW-B012	S-14	47.0'-49.0'	CH	50.8		54	20	34							31.2	26			
EDW-B012	S-15	49.0'-50.5'	CL	67.4	1.00														
EDW-B012	S-16	55.0'-55.5'	CL	50.5	1.75														
EDW-B013	S-10	32.0'-34.0'	CL	33.3		42	23	19			450	11.8	116.6	26.4					
EDW-B013	S-11	34.0'-35.5'	CL	58.0	0.50														
EDW-B013	S-12	40.0'-41.5'	CL	54.5	1.75														
EDW-B013	S-13	45.0'-46.5'	CL	66.2	1.25														
EDW-B014	S-10	35.0'-36.7'	CL	31.6	0.75														
EDW-B014	S-11	40.0'-40.5'	CL	27.3	4.00				2.719										
EDW-B015	S-11	35.0'-36.5'	CL	33.8	1.50														
EDW-B015	S-12	37.0'-39.0'	CH	41.0		66	23	43		1072.18									
EDW-B015	S-13	39.0'-40.5'	CL	36.2	0.50														
EDW-B015	S-14	45.0'-46.5'	CL	49.4	1.00														
EDW-B015	S-15	50.0'-51.0'	CL	30.9	1.50														

Table 9
Summary of Laboratory Test Results – Other Fill Materials

Boring Number	Sample Number	Depth	Material Unit	USCS Classification	Water Content %	Qp (tsf)	Liquid Limit	Plastic Limit	Plasticity Index
EDW-B005	S-10	35.0'-36.5'	Historic Ash Fill	CL	37.3	1.00			
EDW-B005	S-8A	26.0'-27.0'	Historic Ash Fill	OL	47.6		44	29	15
EDW-B005	S-9	29.0'-31.0'	Historic Ash Fill		69.3				
EDW-B013	S-1	0.0'-1.5'	Historic Ash Fill	CL	13.6	4.50+			
EDW-B004	S-10	30.0'-31.5'	Historic Fill	CL	19.7	3.75			
EDW-B004	S-6	12.5'-14.0'	Historic Fill	CL	25.4	1.25			
EDW-B004	S-7	15.0'-16.5'	Historic Fill	CL	25.8	2.50			
EDW-B004	S-8	20.0'-21.5'	Historic Fill	CL	31.3	1.00			
EDW-B004	S-9	25.0'-26.0'	Historic Fill	CL	23.0	1.25			
EDW-B004	S-9A	26.0'-26.5'	Historic Fill	SC	19.5	0.75			
EDW-B015	S-1	0.0'-1.5'	Rock Embankment Fill	ML	54.7				
EDW-B015	S-2	2.5'-4.0'	Rock Embankment Fill	SP	4.5				
EDW-B015	S-3	5.0'-6.5'	Rock Embankment Fill	SP	5.4				
EDW-B015	S-4	7.5'-9.0'	Rock Embankment Fill	SP	7.2				
EDW-B015	S-5	10.0'-11.5'	Rock Embankment Fill	SP	6.5				
EDW-B015	S-6	13.0'-14.25'	Rock Embankment Fill	GP	3.6				
EDW-B015	S-7	15.0'-16.5'	Rock Embankment Fill	GP	8.2				
EDW-B015	S-8	20.0'-21.5'	Rock Embankment Fill	GP	7.8				
EDW-B015	S-9	25.0'-26.5'	Rock Embankment Fill	GP	8.1				

Table 10
Summary of Laboratory Test Results – Shale Bedrock

Boring Number	Sample Number	Depth	USCS Classification	Water Content %	Qp (tsf)
EDW-B002	S-13	50.0'-50.25'	ML	11.1	4.50+
EDW-B003	S-14	55.0'-55.5'	ML	23.3	3.50
EDW-B003	S-14A	55.5'-55.92'	ML	9.8	
EDW-B003	S-15	60.0'-60.25'	ML	7.1	
EDW-B004	S-16	60.0'-60.25'		8.8	
EDW-B005	S-13	50.0'-51.0'	CL-ML	15.9	4.50+
EDW-B005	S-14	51.0'-51.5'		12.8	
EDW-B006	S-11	35.0'-35.42'	ML	14.2	3.50
EDW-B008	S-11	40.0'-40.33'	ML	12.6	3.00
EDW-B010	S-12	40.0'-41.0'	SM	17.0	
EDW-B010	S-13	45.0'-45.25'	CL-ML	16.4	4.50
EDW-B011	S-17	60.0'-60.25'		9.1	
EDW-B012	S-16A	55.5'-56.5'	CL-ML	15.3	4.50
EDW-B012	S-17	60.0'-60.21'	CL-ML	17.9	1.50
EDW-B014	S-11A	40.5'-41.0'	ML	19.6	4.50+
EDW-B014	S-11B	41.0'-41.5'		10.2	
EDW-B014	S-12	45.0'-45.5'	ML	14.5	4.50
EDW-B015	S-16	55.0'-55.5'	ML	11.0	4.25

5. SLOPE STABILITY ANALYSES

Slope stability analyses were performed for varying loading conditions at selected representative embankment cross-sections, as described in the following sub-sections. Development of cross-sections for analysis, soil material properties, and seismic analyses related to the slope stability analysis are also discussed in the following sub-sections.

5.1. Cross-Sections for Analysis

Ten cross sections were identified as representative cross sections for the evaluation of the Ash Pond perimeter embankment slope stability. Cross-sections were selected at various locations around the perimeter embankments based on critical slope orientation, height, and subsurface conditions. The location of each analysis section and the relevant CPT soundings and test borings that were used to develop subsurface stratigraphy are listed in **Table 11** and shown on **Figure 3** (**Attachment A**):

Table 11
Cross Section Locations for Slope Stability Analyses

Cross-Section	Approximate Station	Location (Crest/Toe)	Boring/CPT Number
A	15+00	CREST	EDW-B001, EDW-C001
		TOE	-
B	21+00	CREST	EDW-B010, EDW-C023
		TOE	-
C	31+00	CREST	EDW-C021
		TOE	-
D	40+00	CREST	EDW-B012, EDW-C017
		TOE	-
E	51+00	CREST	EDW-B009, EDW-C015
		TOE	EDW-C016
F	54+00	CREST	EDW-C013
		TOE	EDW-B008, EDW-C014
G	58+00	CREST	EDW-B005, EDW-B013, EDW-C011, EDW-C012
		TOE	EDW-C010
H	60+00	CREST	EDW-B015, EDW-C009
		TOE	-
I	67+00	CREST	EDW-C007
		TOE	EDW-B006, EDW-C008
J	87+00	CREST	EDW-C003
		TOE	-

The surface geometry for each analysis cross-section was determined based on the LiDAR ground surface topographic contours obtained from the Illinois Geospatial Data Clearinghouse (IGDC, 2015), shown on **Figure 3 (Attachment A)**. Additionally, design drawings from "Proposed 150 Car Loop Track For Edwards Power Plant Bartonville, Illinois" by Design Nine, Inc. (2003) were used to supplement the subsurface investigation in developing the subsurface embankment geometry. The phreatic surfaces for each analysis section were estimated based on the normal pool elevations of 447.2 and 449.5 feet for the Clarification Pond and Cooling Pond, respectively, based on the

AECOM hydraulics and hydrology report (AECOM, 2016), and phreatic readings in the piezometers, CPT soundings and borings. The development of the analysis cross-sections is further discussed in **Attachment G**.

5.2. Stability Analysis Conditions Considered

Consistent with the criteria provided in the USEPA CCR Rule § 257.73(e), the stability of the ash pond embankment was evaluated for the following three load cases:

Static, Steady-State, Normal Pool Condition*:* This case models the embankment under static, long-term conditions, at normal water levels within the impoundment. Drained (effective stress) shear strength parameters were used for all materials, and phreatic conditions were estimated based on available piezometer and CPT data. The normal storage pool elevation within the Process Water[2] and Clarification Ponds were modeled at 449.5 ft and 447.2 ft, respectively, based on AECOM's *Hydrologic and Hydraulic Summary Report* for the Ash Pond (AECOM, 2016). ***Target Factor of Safety of 1.50.***

Static, Maximum Surcharge Pool Condition: This case models the conditions under short-term surcharge pool conditions; water surface elevations of 457.8 ft and 457.4 ft for the Process Water and Clarification Ponds, respectively, based on AECOM's *Hydrologic and Hydraulic Summary Report* for the Ash Pond (AECOM, 2016). Drained (effective stress) shear strength parameters were used for all materials, as the critical surface in the normal pool case was found to be in the downstream slope of the embankment. Due to the relatively large width of the embankment, the increase in pool level does not add driving force to this slip surface and is therefore unlikely to initiate total stress mechanisms of failure. It was assumed that the temporary surcharge load was not of a sufficient duration to significantly alter the phreatic surface (i.e. saturation line within the embankment); although the phreatic surface was increased in the raised fill part of the embankment, where more permeable materials are present. Therefore, the phreatic surface was modeled equivalent in the clay embankment fill and foundation to the steady state case in all cases except cross-section J. In this cross-section, horizontal phreatic surfaces at the elevations noted above were assumed as the section is located several hundred feet from the free water pool in the Cooling Pond. ***Target Factor of Safety of 1.40.***

Seismic Slope Stability Analysis: These analyses incorporate a horizontal seismic coefficient k_h selected to be representative of expected loading during the design earthquake event (i.e., a "pseudostatic" analysis). The analyses utilized peak undrained strengths for all materials. The pool levels and phreatic surface corresponding to the steady state pool from the static analyses were utilized. ***Target Factor of Safety of 1.00***.

Post-Liquefaction Slope Stability Analyses: Soils susceptible to liquefaction were not identified in the embankment or foundation soils at the Ash Pond. Therefore, post-liquefaction conditions were not evaluated.

[2] The Process Water Pond was historically referred to as the Cooling Pond, and may be called the Cooling Pond in the attachments to this report.

5.3. Material Properties

Material properties for slope stability analyses were developed using both laboratory testing data (index and strength testing) and strength correlations from CPT and SPT data. The material characterization and development of strength parameters is described further in **Attachment F**.

Unit weights for the materials were evaluated using laboratory test results from relatively undisturbed samples. New embankment fill was conservatively assigned unit weights consistent with the observed material type based on previous experience with similar materials.

Shear strengths for the native alluvial clays and the old embankment fill were evaluated for the normal operating (steady-state) loading condition using results from the consolidated undrained triaxial (CIU) and direct shear (DS) tests, as well as correlations with SPT data. Shear strengths for the native clay crust and the fly ash material for the steady-state loading condition were evaluated using results from DS tests, as well as correlations with SPT data. In general, when assigning lab tests, direct shear tests were assigned for deeper samples and CIU tests were assigned to shallower samples to match the assumed orientation of the slope stability slip surface. For the new embankment fill and the crushed stone (rail loop embankment) materials, where undisturbed Shelby tube samples were not obtained, unit weights and shear strengths were based on published correlations for SPT and CPT data, and previous experience with similar materials.

For the pseudo-static analyses, undrained shear strengths for the old embankment fill and native alluvial clays were developed using CIU and unconfined compression (UC) tests, published correlations for SPT and CPT data, as well as previous experience with similar materials.

The material properties developed for use in slope stability analysis are listed in **Table 12**.

Table 12
Material Properties for Slope Stability Analyses

Material	Total Unit Weight Above and Below Water Table (pcf)	Effective (Drained) Shear Strength Parameters		Total (Undrained) Shear Strength Parameters	
		c' (psf)	Φ' (°)	c (psf)	Φ (°)
New Embankment	115	200	30	2500	0
Old Embankment 1	125	200	28	2500	0
Old Embankment 2	125	100	29	1250	0
Native Clay Crust	120	200	27.5	1250	0
Native Clay 1	117	100	26	650	0
Native Clay 2	105	200	26	700	0
Native Clay 3	105	200	26	900	0
Impounded Ash	105	100	27	600	0
Historic Ash	105	100	26	750	0
Historic Fill	125	200	28	1000	0
Recent Fill	115	200	30	1250	0
GP (Very Dense)	135	0	36	0	36
New Embankment (Crushed Stone - Sandy Gravel)	120	0	32	0	32
Bedrock - Shale	140	1000	36	1000	36

5.4. Methodology of Analyses

Limit equilibrium stability analyses were completed using the two-dimensional SLOPE/W 2012 (v. 8.15.4.11512 by GeoStudio) computer program. Factors of safety were calculated with Spencer's method using circular search routines with optimization to develop non-circular sliding surfaces through lower-strength layers which may represent a lower factor of safety than circular sliding surfaces. Slip surfaces which intersected the embankment crest and could result in a release of CCR materials were analyzed. Pore pressures were assigned as hydrostatic pressures under the phreatic surface.

A brief summary of the analyses is presented in the following sections. A more detailed discussion is provided in **Attachment G**.

5.4.1. Static Analysis Conditions

Static stability was evaluated for steady-state conditions using both the normal pool elevation and the maximum flood surcharge pool elevation. The normal pool elevation of 449.5 feet and surcharge pool elevation of 457.8 ft was used for the northern portion of the site (Cross-Sections A, B, and J). A normal pool elevation of 447.2 feet and surcharge pool elevation of 457.4 ft was used for the southern portion of the site (Cross-Sections C, D, E, F, G, H, and I). All elevations were taken from the 2016 AECOM *Hydrologic and Hydraulic Summary Report* for the Ash Pond (AECOM, 2016).

5.4.2. Earthquake Analysis Conditions

Earthquake ground motions at the site were developed using simplified procedures, as described in the following sub-sections.

5.4.3. Determination of Ground Motion Parameters

Seismic ground motions were estimated using the United States Geological Survey (USGS) 2008 Interactive Deaggregation tool (http:earthquake.usgs.gov/hazards/apps/). This application generates acceleration values, including peak ground acceleration (PGA) for top of rock, and mean and modal moment magnitudes based on user entered values of location, exceedance probability, and spectral period. Results are computed based on the 2008 National Seismic Hazard Mapping Project (NSHMP) Probabilistic Seismic Hazard Analysis (PSHA) Maps.

For the Edwards Power Station, the calculated PGA for an event with a probability of exceedance of 2% in 50 years (approximately a 2,500 year average return period) was 0.067g at the top of hard rock. To estimate the free-field, ground surface horizontal acceleration, the site was classified according to the site classes defined in International Building Code (IBC, 2003) and amplified using the site amplification factors found in National Earthquake Hazards Reduction Program (NEHRP, 2009). The site class was determined based on the weighted average of the shear wave velocity of the upper 100 feet of the stratigraphic profile and found to be Site Class D ($600 \leq Vs \leq 1,200$ ft/sec). This corresponds to a NEHRP amplification factor of 1.6, resulting in a ground surface acceleration of 0.107g. The Peak Transverse Acceleration at the dike crest was estimated using the ground surface acceleration and the procedure proposed by Idriss (2015), resulting in a peak crest acceleration of 0.32g. Details of the estimation of ground motion parameters are included in **Attachment G**.

5.4.4. Seismic Coefficient

The horizontal acceleration (k_h) calculated for use in the pseudostatic slope stability analysis was based on the simplified procedure developed by Makdisi and Seed (1978). For the estimated peak crest acceleration value of 0.32g and the full-height critical slip surfaces that were identified in the analyses (presented in **Attachment G**), a seismic coefficient of 0.109g was estimated for k_h in the pseudostatic analysis.

5.4.5. Liquefaction Triggering Analysis

Liquefaction is used to describe the contraction of coarse-grained (i.e. cohesionless) sand and gravel soils under cyclic loading imposed by earthquake shaking. The result is a reduction in the effective confining stress within the soil and an associated loss of strength (Idriss and Boulanger 2008). Liquefaction only occurs in saturated soils. Liquefaction susceptibility also largely depends on compositional characteristics such as particle size, shape, and gradation; however, laboratory and field observations also indicate that plasticity characteristics influence liquefaction susceptibility (Kramer 1996). Idriss and Boulanger (2008) suggested that soils with a plasticity index (PI) greater than about 7 are not susceptible to liquefaction.

AECOM's field exploration did not encounter cohesionless soils in the embankment or foundation of the Ash Pond. Only cohesive soils were encountered by AECOM, and out of the 52 Atterberg limit tests performed, all but one sample had a PI of above 7. This means that the soils encountered in AECOM's field exploration are not susceptible to liquefaction. Consequently, a formal liquefaction analysis was determined to be unnecessary as the embankment and foundation soils at the site are not susceptible to liquefaction based on their composition and observed index properties. Due to the generally medium stiff to stiff nature of the embankment and foundation clays, and the relatively low seismicity at the site, the embankment and foundation soils are also unlikely to be susceptible to cyclic softening.

6. RESULTS

6.1. Results of Static Stability Analyses

The results of the limit equilibrium slope stability analyses for the static load cases are summarized in **Table 13**. The Slope/W output figures showing the critical slip surfaces and details of the analyses are included in **Attachment G.1**.

Table 13
Summary of Minimum Slope Stability Factors of Safety for Static Load Cases

Load Case	Program Criteria	Section									
		A	B	C	D	E	F	G	H	I	J
Steady State (Normal Pool)	FS≥1.50	2.02	1.59	1.83	1.79	1.54	2.31	2.12	2.08	2.26	2.08
Surcharge Pool (Flood Pool)	FS≥1.40	2.02	1.59	1.82	1.79	1.54	2.31	2.12	2.08	2.26	2.00

6.2. Results of Earthquake Stability Analyses

6.2.2. Seismic Stability Analysis

The results of the slope stability analyses for the seismic load cases are summarized in **Table 14**. The Slope/W output figures showing the critical slip surfaces and details of the analyses are included in **Attachment G.1**.

Table 14
Summary of Minimum Slope Stability Factors of Safety for Earthquake Load Cases

Load Case	Program Criteria	Section									
		A	B	C	D	E	F	G	H	I	J
Seismic (Pseudostatic)	FS ≥ 1.00	1.37	1.28	1.09	1.18	1.11	1.08	1.13	1.08	1.30	2.08

7. CONCLUSIONS

The calculated factors of safety from the limit equilibrium slope stability analysis satisfy the USEPA CCR Rule § 257.73(e) requirements for each loading condition at all of the analysis sections that represent the embankments of Ash Pond at the Edwards Power Station. Load cases analyzed for this study included static (steady-state) normal pool, maximum flood surcharge pool and seismic (pseudo-static).

8. LIMITATIONS

Background information, design basis, and other data have been furnished to AECOM by IPRG. AECOM has used this data in preparing this report. AECOM has relied on this information as furnished, and is not responsible for the accuracy of this information.

Borings have been spaced as closely as economically feasible, but variations in soil properties between borings, that may become evident at a later date, are possible. The conclusions developed in this report are based on the assumption that the subsurface soil, rock, and phreatic conditions do not deviate appreciably from those encountered in the site-specific exploratory borings. If any variations or undesirable conditions are encountered in any future exploration, we should be notified so that additional analyses can be made, if necessary.

The conclusions presented in this report are intended only for the purpose, site location, and project indicated. The recommendations presented in this report should not be used for other projects or purposes. Conclusions or recommendations made from these data by others are their responsibility. The conclusions and recommendations are based on AECOM's understanding of current plant operations, maintenance, stormwater handling, and ash handling procedures at the station, as provided by IPRG. Changes in any of these operations or procedures may invalidate the findings in this report until AECOM has had the opportunity to review the changes, and revise the report if necessary.

This geotechnical investigation was performed in accordance with the standard of care commonly used as state-of-practice in our profession. Specifically, our services have been performed in accordance with accepted principles and practices of the geological and geotechnical engineering profession. The conclusions presented in this report are professional opinions based on the

indicated project criteria and data available at the time this report was prepared. Our services were provided in a manner consistent with the level of care and skill ordinarily exercised by other professional consultants under similar circumstances. No other representation is intended.

9. REFERENCES

AECOM (2016). *Hydrologic and Hydraulic Summary Report, Edwards Power Station, Ash Pond*. (September 2016)

Boulanger, R. W., and Idriss, I. M. (2014). *CPT and SPT Based Liquefaction Triggering Procedures (Report No. UCD/CGM-14/01)*. Davis, California.

Design Nine, Inc. (2003) "*Proposed 150 Car Loop Track For Edwards Power Plant Bartonville, Illinois*" Saint Louis, Missouri

GEO-SLOPE International Ltd. (2015). "GeoStudio 2012 (SLOPE/W and SEEP/W)." Calgary, Alberta, Canada.

Geotechnology, Incorporated (2011). "Global Stability Evaluation of E.D. Edwards Power Station Ash Pond.

Idriss, I.M., (2015), Personal Communication.

Idriss, I. M., and Boulanger, R. W. (2008). *Soil Liquefaction During Earthquakes*. Earthquake Engineering Research Institute, Oakland, California, USA.

Illinois Geospatial Data Clearinghouse [IGDC]. (2015). LiDAR data for Peoria County downloaded in December of 2015.

International Code Council, (2003), 2003 International Building Code.

Makdisi, F. I., and Seed, H. B. (1978). "A Simplified Procedure for Estimating Dam and Embankment Earthquake-Induced Deformations." *Journal of the Geotechnical Engineering Division*, 104(7), 849–867.

NEHRP (National Earthquake Hazards Reduction Program), (2009) Recommended Seismic Provisions for New and Other Structures, (FEMA P-750), 2009 Edition.

United States Army Corps of Engineers [USACE]. (2016). *RiverGages.com, Water Levels of Rivers and Lakes, Illinois River* at Peoria Lock and Dam (MET Station). Downloaded from http://rivergages.mvr.usace.army.mil/ in January of 2016.USACE, 2001- Design and Construction of Levees, EM 1110-2-1913, U. S. Army Corps of Engineers, April 2001.

U.S. Environmental Protection Agency [USEPA]. (2015). *Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments*. 40 CFR §257. Federal Register 80, Subpart D, April 17, 2015.

Attachment A. Figures

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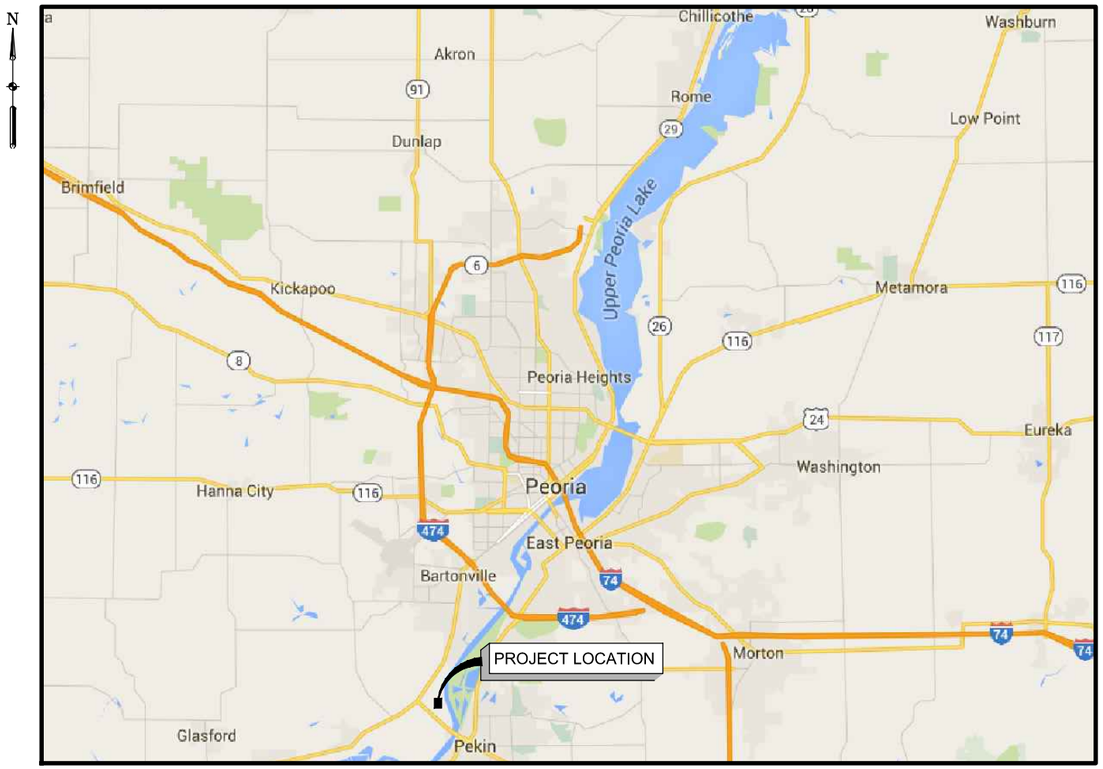

LOCATION MAP
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CCR RULE ASSESSMENT
OF PLANTS

EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

GEOTECHNICAL
REPORT
ASH POND

ISSUED FOR BIDDING	DATE	BY
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REVISIONS

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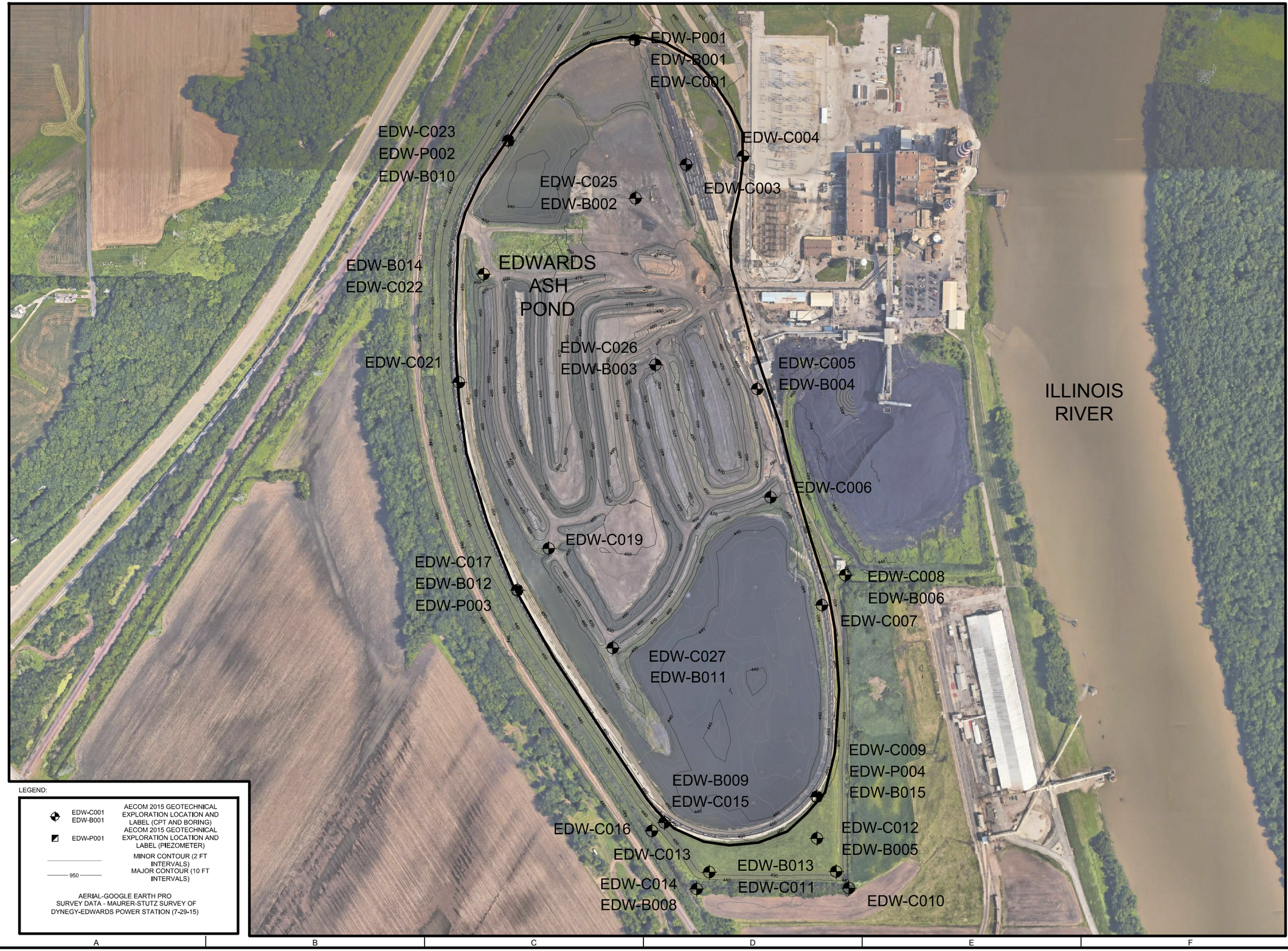
LOCATION MAP AND
SITE VICINITY MAP

Figure 1

AECOM DRAWING PATH: K:\Projects\60427894--Dynegy\900--WORKING DOCS--CAD\902--SHEETS\30% Design Sheets_Edwards\EDW 1 LOCATION PLAN.dwg



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EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

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OVERALL
GEOTECHNICAL
SITE PLAN

Figure 2

AECOM DRAWING PATH: K:\Projects\60427894-Dynegy\900-WORKING DOCS-CAD\902-SHEETS\30% Design Sheets_Edwards\EDW 2-1 OVERALL GEOTECHNICAL SITE PLAN.dwg

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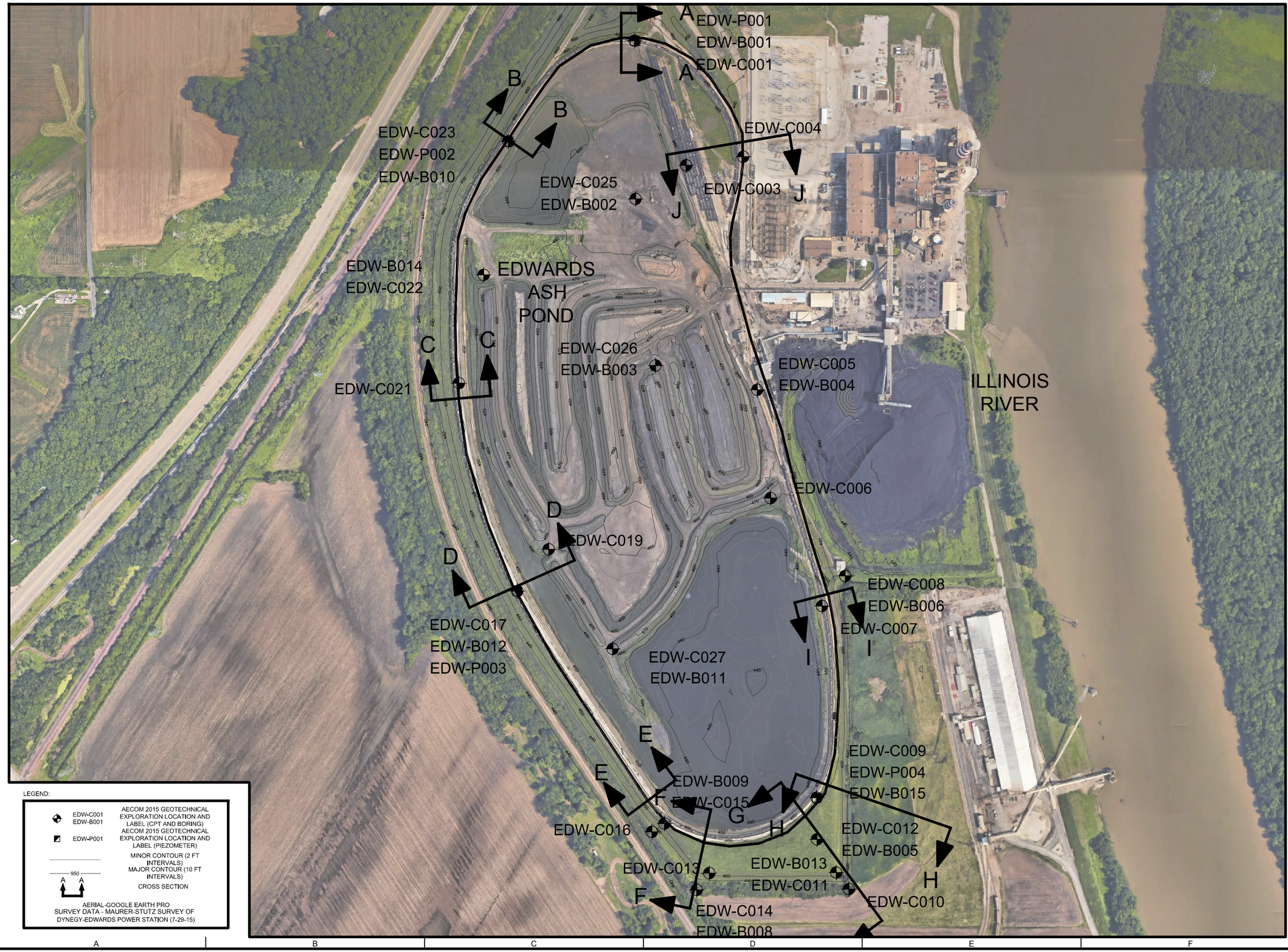

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EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

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SCALE:	AS SHOWN
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SHEET TITLE

ASH POND
GEOTECHNICAL
SITE PLAN

Figure 3

AECOM DRAWING PATH: K:\Projects\60427894-Dynegy\900-WORKING DOCS-CAD\902-SHEETS\30% Design Sheets_Edwards\EDW 2-2 ASH POND GEOTECHNICAL SITE PLAN.dwg
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Attachment B. Boring Logs

Project:	EDWARDS POWER STATION
Project Location:	BARTONVILLE, ILLINOIS
Project Number:	60440202

Key to Soil Boring Logs

Sheet 1 of 1

	Graphic Symbol	Description	USCS Classification
SAND AND GRAVEL		SAND poorly graded	SP
		SAND well graded	SW
		Silty SAND	SM
		Clayey SAND	SC
		GRAVEL poorly graded	GP
LOW PLASTIC SILTS AND CLAYS		Inorganic low plastic SILT	ML
		Inorganic low plastic CLAY	CL
		Inorganic low plastic SILTY–CLAY	CL–ML
HIGH PLASTIC SILT AND CLAYS		Inorganic high plastic CLAY	CH
		Sandy Inorganic high plastic CLAY	CH
		Inorganic elastic SILT	MH
SURFACE MATERIALS		Asphalt, Pavement	
		Topsoil	
		Gravel Limestone	
		Fly Ash	
		Bottom Ash	
		Fill	

TERMS DESCRIBING DENSITY OR CONSISTENCY

Coarse grained soils (major portion retained on No. 200 sieve) include gravels and sands. Density is based on the Standard Penetration Test (SPT).

Density	SPT Number per foot
Very loose	0 – 5
Loose	5 – 10
Medium dense	10 – 30
Dense	30 – 50
Very dense	Greater than 50

Fine grained soils (major portion passing No. 200 sieve) include clays and silts. Consistency is rated according to shearing strength, as indicated by uncorrected SPT blows per foot.

Descriptive Term	SPT Number per foot	Estimated undrained Shear Strength (tsf)	Hand Test
Very soft	0–2	< 0.25	Extrudes between fingers
Soft	2–4	0.25–0.5	Molded by light pressure
Medium stiff	4–8	0.5–1.0	Molded by strong pressure
Stiff	8–15	1.0–2.0	Indented by thumb
Very stiff	15–30	2.0–4.0	Indented by thumbnail
Hard	> 30	> 4.0	Difficult to indent

LEGEND AND NOMENCLATURE

Standard penetration split spoon test sample

Undisturbed shelby tube sample

PP qu	Pocket penetrometer unconfined compressive strength
NMC	Natural Moisture Content, %
LL	Liquid Limit
PL	Plastic Limit
PI	Plasticity Index
NP	Non–plastic
▽	Depth Groundwater enters at time of drilling.
▼	Groundwater Level at some specified time after drilling
Su	Undrained Shear Strength
TXUU	Triaxial Unconsolidated Undrained
DTW	Depth to water
N/A	Not Applicable

SAMPLING RESISTANCE

P	Sample pushed by hydraulic rig action.
3 6 9	Numbers indicate blows per 6 in. of sampler penetration. Standard penetration test sampler, (2–in O.D.) and oversize penetration sample (3–in O.D.) are driven by a 140 lb hammer falling freely 30–in
50/2	Number of blows (50) used to drive a penetration sampler a certain number of inches (2)
WOH	Weight of hammer
WOR	Weight of rods

ABBREVIATIONS USED UNDER "REMARKS"

HSA	Hollow Stem Auger	No.	Number
ATD	At Time of Drilling	CIU	Isotropically Consolidated Undrained
AD	After Drilling	ST	Shelby Tube
ID	Inside Diameter	SS	Split Spoon
OD	Outside Diameter		
RQD	Rock Quality Designation		
-200	% Passing 200 Sieve		
Sa %	Sieve Analysis % Passing #200		

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Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B001

Sheet 1 of 2

Date(s) Drilled	11/05/2015 to 11/05/2015	Logged By	Robert Weseljak	Checked By	NDS
Drilling Method	Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	51.0 ft
Drill Rig Type	Mobile B-57 Truck Mounted	Drilling Contractor	Strata Earth Services	Surface Elevation	461.0 ft
Borehole Backfill	Portland Cement and Bentonite	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
						Elevation (feet) / Depth (feet)								
	0					461.0 / 0.0								
460		SS-1	2 6 8	61		Stiff, dry, gray mottled with brown, lean CLAY (CL).					3.0			
						458.5 / 2.5								
		SS-2	3 4 5	94		Stiff, moist, brown mottled with gray and black, lean CLAY (CL), trace shell fragments.					3.0			
	5													
455		SS-3	3 3 3	75		Becomes medium stiff.					1.0			
		ST-4	200 psi	100										*Pushed shelby tube from 7.0 to 9.0 feet*
	10					451.0 / 10.0								
450		SS-5	3 3 6	83		Stiff, moist, grayish black, lean CLAY (CL), trace organics.					1.0 1.5			
	15													
445		SS-6	1 3 5	78							1.25			
	20					441.0 / 20.0								
440		SS-7	1 6 7	100		Stiff, moist, very dark gray to grayish black with some brown, lean CLAY (CL).					1.5 2.5			
	25					436.0 / 25.0								
435		SS-8	WOH WOH 2	100		Very soft, wet, brown mottled with gray, sandy lean CLAY (CL).					1.0 0.5			
	30					431.0 / 30.0								

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Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B001

Sheet 2 of 2

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
430	30	ST-9	150 psi	100		Soft, wet, gray, silty lean CLAY (CL-ML).					1.25			*Pushed shelby tube from 30.0 to 32.0 feet*
						426.0 / 35.0								
425	35	SS-10	2 2 4	100		Loose, wet, gray, silty SAND (SM), trace wood fragments. 425.2 / 35.8					0.5 1.0			
						Medium stiff, moist, gray, lean CLAY (CL).								
420	40	SS-11	50/3"	100		421.0 / 40.0 CLAYSTONE: Brown and gray, weathered, hard.								
415	45	SS-12	50/2"			415.0 / 46.0 SILTSTONE: Thin to medium bedding, fresh, argillaceous.								*Run 1 - Start 13:46, End 14:00*
		Run 1	16.7	36.7										
410	50					410.0 / 51.0 End of Boring at 51 ft								*Boring backfilled with Portland Cement and bentonite*
405	55													
400	60													
	65													

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Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B002

Date(s) Drilled	09/03/2015 to 09/03/2015	Logged By	Norm Seiler	Checked By	NDS
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	52.5 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	454.9 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	7.5 ft on 9/3/2015		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0	SS-1	7 6 8	89		454.9 / 0.0 Medium dense, moist, dark brown, FLY ASH [Fill].	38.4							
						452.4 / 2.5								
		SS-1	3 2 2	100		Loose, moist, dark gray, FLY ASH [Fill].	62.4							
450	5	ST-3	150 psi	62.5			66.6		65	29				*Pushed shelby tube from 5.0 to 7.0 feet*
						447.4 / ▽ 7.5								
		SS-4	WOR	100		Very loose, wet, black, FLY ASH [Fill].	79.0							
445	10	ST-5		55			76.9	90.8 94.3 91.2	17	NP				*10.0 feet switch to mud rotary* *Pushed shelby tube from 10.0 to 12.0 feet*
						Becomes dark gray.								
						Hard layer at tip of tube.								
440	15	SS-6	1 2 3	100		Becomes loose.	52.5							
435	20	SS-7	12 17 2	37		434.9 / 20.0 Medium dense, wet, dark gray, FLY ASH [Fill], with cementous layers.	67.8							
430	25					429.9 / 25.0								
		SS-8	1 WOH WOH	100		Very loose, wet, dark gray, FLY ASH [Fill].	63.9							
425	30													

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Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B002

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30	SS-9	WOR WOH WOH	100		424.4 / 30.5 With clay. Very soft, wet, brown, lean CLAY (CL), with sand.	126.1 31.1				0.5			
420	35	ST-10	100 psi	100		419.9 / 35.0 Very soft, gray, lean CLAY (CL), with sand, trace shells.	31.6		36	18	0.25			
415	40	SS-11	WOH WOH WOH	100			42.9				0.75			
410	45	SS-12	WOH WOH 2	100		Grades with trace organics.	57.7				0.25			
						407.9 / 47.0 SHALE: Light gray, silt sized.								
405	50	SS-13	50/3"	100			11.1							
						402.4 / 52.5 End of Boring at 52.5 ft								*Boring backfilled with bentonite and cement fluid*
400	55													
395	60													
390	65													

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Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B003

Date(s) Drilled	09/03/2015 to 09/03/2015	Logged By	Norm Seiler	Checked By	NDS
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	60.5 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	460.0 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	7 ft on 9/3/2015		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
460	0	SS-1	7 7 7	83		460.0 / 0.0 Medium dense, moist, dark gray, FLY ASH [Fill].	44.4							
		SS-2	3 2 2	100		Becomes loose.	27.3							
455	5	SS-3	1 WOH 2			455.0 / 5.0 Very soft, moist, lean CLAY (CL) with ash, sand, and organics.	37.2							
						▽ 452.5 / 7.5								
		ST-4	<100 psi	100		Ash, dark gray [Fill].	55.5							*Pushed shelby tube from 7.5 to 9.5 feet*
450	10	SS-5	WOR WOR WOR	67			50.6							*10.0 feet: Switch to mud rotary*
						447.0 / 13.0 Very dense, dark gray, moist, fine to coarse ASH with sand and gravel, slightly cemented [Fill].								*13.0 feet: Hard drilling*
445	15	SS-6	26 37 29	100			29.7							
						Becomes very loose, dark gray, fine.								
440	20	SS-7	1 1 1	100			42.1							
435	25	ST-8	100 psi	100		Grades with sand.	54.9							*Pushed shelby tube from 25.0 to 27.0 feet*
430	30													

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Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B003

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
430	30	ST-9	100 psi	100		Varved FLY ASH [Fill].	71.7	91.2 92.9 92.0						*Pushed shelby tube from 30.0 to 32.0 feet*
425	35	SS-10	WOR WOR WOR	100		423.5 / 36.5	51.9 43.0							
						Very soft, moist, brown to gray, silty CLAY (CL), trace sand, shells, and organics.								
420	40	SS-11	WOH WOH WOR	100			31.6				.75			
415	45	ST-12	100 psi	100		415.0 / 45.0 Soft, moist, dark gray, fat CLAY (CH) with sand.	46.0				1.0			*Pushed shelby tube from 45.0 to 47.0 feet*
410	50	SS-13	1 2 3	100		410.0 / 50.0 Medium stiff, moist, brownish to greenish, gray, lean CLAY (CL), with sand.	55.4				1.0			
						406.0 / 54.0 SHALE, gray, weathered, silt sized.								
405	55	SS-14	11 50/5"	100			23.3 9.8							
400	60	SS-15	50/3"	100		399.5 / 60.5 End of Boring at 60.5 ft	7.1							*Boring backfilled with bentonite and cement fluid*
395	65													

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Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B003A

Sheet 1 of 1

Date(s) Drilled	09/03/2015 to 09/03/2015	Logged By	Norm Seiler	Checked By	NDS
Drilling Method	Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	9.5 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	460.0 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
Boring Location	5' East of EDW-B003 (ft NAD83)	Groundwater Level(s)	7 ft on 9/3/2015		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	SAMPLES Sampling Resist. OR Core RQD (%)	SAMPLES Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
460	0					Elevation (feet) 460.0 / Depth (feet) 0.0 Offset boring to attempt shelby tube at 7.5 feet								
455	5													
		ST-1		0										*Pushed shelby tube from 7.5 to 9.5 feet*
						450.5 / 9.5 End of Boring at 9.5 ft								*Boring backfilled with bentonite and cement fluid*
450	10													
445	15													
440	20													
435	25													
430	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:21:54 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B004

Date(s) Drilled	09/11/2015 to 09/11/2015	Logged By	Norm Seiler	Checked By	NDS
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	60.3 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	460.5 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
						Elevation (feet) / Depth (feet)								
	0					460.5 / 0.0								
460		SS-1	16 12 15	83		460.0 6" stone at surface [Fill]. 0.5 Medium dense, moist, dark gray, ASH [Fill].	18.9							
		SS-2	3 2 2	100		457.0 3.5 Becomes dark gray to dark brown, trace silty clay, sand and gravel [Fill].	28.5 20.1							
	5													
455		SS-3	2 2 4	77							1.25			
		SS-4	2 3 4	100			21.6				2.0			
	10													
450		SS-5	2 2 2	67			21.5				2.0			*10.0 feet: Switch to mud rotary*
		SS-6	2 2 2	100		448.0 12.5 Soft, wet, brown mottled, silty CLAY (CL), trace sand and gravel.	25.4				1.25			
	15													
445		SS-7	2 3 3	77			25.8				1.25			
	20													
440		SS-8	WOH 2 3	89		Grades brown, with sand.	31.3				.75			
	25													
435		SS-9	2 2 3	89		434.5 26.0 434.0 Medium stiff, wet, brown, clayey SAND (SC). 26.5 Medium stiff, wet, dark gray to gray, silty CLAY (CL), trace sand.	23.0 19.5							
	30					430.5 30.0								

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:21:57 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B004

Elevation (feet)	Depth (feet)	SAMPLES Type Number	SAMPLES Sampling Resist. OR Core RQD (%)	SAMPLES Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
430	30	SS-10	2 7 6	89		Stiff, gray, wet, lean CLAY (CL), with sand, and organics.	19.7				4.0			
						425.5 / 35.0								
425	35	ST-11		100		Stiff, wet, gray mottled, lean CLAY (CL) with sand.	20.1				1.25			*Pushed shelby tube from 36.0 to 38.0 feet*
						420.5 / 40.0								
420	40	SS-12	2 3 3	89		Stiff, wet, brown mottled, lean CLAY (CL), trace sand.	30.0				1.75			
						415.5 / 45.0								
415	45	SS-13	2 3 5	83		Medium stiff, wet, dark gray, lean CLAY (CL).	39.5 35.1				1.25			
						410.5 / 50.0								
410	50	SS-14	2 2 3	100		Medium, stiff, wet, gray, lean CLAY (CL) with sand, trace shells and organics.	65.2				1.25			
405	55	SS-15	3 8 23			404.5 / 56.0 SHALE: Light gray, weathered.	33.4 13.2							*56.5 to 60.0 feet: Solid drilling*
						400.5 / 60.0								
400	60	SS-16	50/3"	100		End of Boring at 60.3 ft	8.8							*Boring backfilled with bentonite and cement fluid*
	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:21:57 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B005

Date(s) Drilled	09/10/2015 to 09/10/2015	Logged By	Norm Seiler	Checked By	NDS
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	53.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	459.0 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	8 ft on 9/10/2015		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0	SS-1	4 4 5	95		459.0 / 0.0 Medium, stiff, moist, brown, clayey SAND (SC), trace gravel, topsoil, roots and fill.	45.8				2.0			
						456.5 / 2.5								
		SS-2	9 15 11	100		Medium dense, moist, brown, sandy SILT (ML) with gravel.	26.0							
455														
	5	SS-3	2 2 2	100		454.0 / 5.0 Loose, moist, brown, sandy elastic SILT (MH) with clay.	50.9				1.8			
						451.0 / ▽ 8.0								
		SS-4		100		Loose, wet, brown, sandy SILT (ML) with gravel.	37.4							
450														
	10	SS-5	1 2 5	100		449.0 / 10.0 Medium stiff, wet, light brown and gray, clayey SAND (SC) with gravel.	44.3							*10.0 feet: Switch to mud rotary*
445														
	15	SS-6	2 8 10	100		444.0 / 15.0 Very stiff, wet, brown, sand SILT (ML) with gravel.	41.4							
440														
	20	SS-7	1 1 1	100		439.0 / 20.0 Soft, wet, brown, gravelly CLAY (CL), trace sand.	51.1							
435														
	25	SS-8	2"	100		432.5 / 26.5 Very loose, wet, dark brown ASH [Fill].	55.3 47.6							
430														
	30	SS-9		100			69.3							

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:03 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B005

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30	SS-9		100			69.3							
425														
	35	SS-10	WOR WOH WOH	67		424.0 / 35.0 Very loose, wet, black, ASH, with organic clay [Fill].	37.3							
						421.0 / 38.0 Soft, wet, gray, fat CLAY (CH), trace sand, shells, and organics.								
420	40	ST-11	150 psi	100			44.8		57	35				*Pushed shelby tube from 41.0 to 43.0 feet*
415														
	45	SS-12	WOH 2 2	100		414.0 / 45.0 Soft, wet, dark gray and greenish gray, lean CLAY (CL), with sand, organics and shale.	88.7							
410						409.5 / 49.5 SHALE: light gray, weathered.								
	50	SS-13	11 18 44	89			15.9 12.8							
405						406.0 / 53.0 End of Boring at 53 ft								*Boring backfilled with bentonite and cement fluid*
	55													
400														
	60													
395														
	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:03 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B006

Date(s) Drilled	09/08/2015 to 09/08/2015	Logged By	Norm Seiler	Checked By	NDS
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	37.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	436.0 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0	SS-1	3 4 6	94		436.0 / 0.0 Stiff, moist, dark brown, lean CLAY (CL) with sand and glass.	26.4				3.0			
435						433.5 / 2.5								
		SS-2	3 3 3	67		Medium stiff, brown to dark brown lean CLAY (CL), trace sand.	30.1				1.25			
	5					431.0 / 5.0								
430		SS-3	2 3 4	100		Medium stiff, moist, gray and mottled brown, lean CLAY (CL), trace sand.	24.8		48	29	2.0			
		SS-4	3 4 4	100			26.0				1.5			
	10	SS-5	1 2 1	100		Becomes soft.	34.2				1.0			*10.0 feet: Switch to mud rotary*
425						423.0 / 13.0								*Pushed shelby tube from 12.0 to 14.0 feet*
		ST-6		100		Soft, moist, gray fat CLAY (CH) with sand and shells.	31.1		62	42	1.25			
	15	SS-7	1 1 1	100		421.0 / 15.0 Soft, moist, brownish gray, lean CLAY (CL).	40.8				1.0			
420														
	20	SS-8	WOH WOH 1	100		Becomes very soft, brown and gray, with sand.	43.4				0.75			
415														
	25													
410		ST-9		100		410.0 / 26.0 Very soft, moist, dark gray, organic SILT (OH).	76.0		72	35	0.75			*Pushed shelby tube from 26.0 to 28.0 feet*
	30					406.0 / 30.0								

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:09 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B006

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
405	30	SS-10		89		Very soft, moist, gray lean CLAY (CL) with sand, pockets of organics. 405.0 / 31.0	43.4 19.6				0.75			
						Very soft, moist, grayish brown, lean CLAY (CL) with sand, silt, and organics. 403.0 / 33.0								
						SHALE: light gray, weathered.								
400	35	SS-11		84			14.2							
						399.0 / 37.0 End of Boring at 37 ft								*Boring backfilled with bentonite and cement fluid*
395	40													
390	45													
385	50													
380	55													
375	60													
	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:09 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B008

Date(s) Drilled	09/13/2015 to 09/13/2015	Logged By	Norm Seiler	Checked By	NDS
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	42.5 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	438.8 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0	SS-1	3 4 4	100		438.8 / 0.0 Stiff, moist, brown, lean CLAY (CL) with sand and gravel, trace roots.	13.2				4.0			
		SS-2	3 4 6	100			19.5		42	20	4.25			
435	5	SS-3	2 3 5	67		Becomes medium stiff.	42.3				2.0			
		SS-4	1 3 2	89		431.3 / 7.5 Medium stiff, moist, gray and mottled brown, lean CLAY (CL), trace sand.	22.8				2.5			
430	10	ST-5	150 psi	85		427.8 / 11.0 Medium stiff, moist, brown and gray fat CLAY (CH), trace sand.	33.6		52	33	0.75			*10.0 feet: Switch to mud rotary*
425	15	SS-6	WOH 1 1	100		423.8 / 15.0 Soft, moist, dark brown, lean CLAY (CL), trace shells.	64.6				0.75			
420	20	SS-7	WOH WOH WOH	100		Becomes very soft.	44.4				0.75			
415	25	ST-8	150 psi			414.8 / 24.0 Very soft, moist, dark gray, fat CLAY (CL), trace organics.	68.9		67	36	1.0			
410	30					408.8 / 30.0								

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:15 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B008

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30	SS-9	WOH WOH WOH	100		Very soft, moist, gray and brownish gray, lean CLAY (CL), trace sand.	71.4				0.5			
405	35	SS-10	WOH WOH WOH	100		Trace wood, organics, and shells.	56.9				0.75			
400						399.8 / 39.0 SHALE: Light gray, slightly weathered.								
	40	SS-11	66/4"	100			12.6							*40.0 to 42.5 feet: Solid drilling*
395	45					396.3 / 42.5 End of Boring at 42.5 ft								*Boring backfilled with bentonite and cement fluid*
390	50													
385	55													
380	60													
375	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:15 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B009

Date(s) Drilled	11/05/2015 to 11/05/2015	Logged By	Robert Weseljak	Checked By	NDS
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	66.5 ft
Drill Rig Type	Mobile B-57 Truck Mounted	Drilling Contractor	Strata Earth Services	Surface Elevation	460.1 ft
Borehole Backfill	Portland Cement and Bentonite	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
460	0	SS-1	11 13 15	100		460.1 / 0.0 459.6 / 0.5 Medium dense, moist, brown silty SAND (SM).					1.0 1.25			
						Very stiff, moist, gray and brown, sandy SILT (ML).								
		SS-2	2 1 1	67		457.6 / 2.5 Soft, dry, gray and brown sandy SILT (ML)					0.25			
455	5					455.6 / 4.5 Concrete from 4.5 to 5.5 [Fill].								
		SS-3	5 2 5	11		454.6 / 5.5 Light brown, well graded GRAVEL (GW).								*5.5 feet: Limestone cobbles*
		SS-4	5 4 4	89		452.6 / 7.5 Stiff, dry, brownish gray, silty SAND with GRAVEL (SM). 451.6 / 8.5					1.0			
450	10					Medium dense, moist, black, sandy SILT (ML).								
		ST-5	250 psi	75		449.1 / 11.0 Medium stiff, moist, brownish gray, lean CLAY (CL).					1.5			*Pushed shelby tube from 11.0 to 13.0 feet* *Trace gravel in top of tube*
445	15	SS-6	1 5 5	89		445.1 / 15.0 Medium dense, moist, brown mottled with reddish brown, lean CLAY (CL).					2.0			
440	20	SS-7	WOH 2 4	94		440.1 / 20.0 Very soft to medium dense, moist to wet, gray, lean CLAY (CL) with shell and wood fragments.					1.0			
435	25	SS-8	WOH WOH 3	100		435.1 / 25.0 Very soft to soft, wet, gray, lean CLAY (CL) with shell fragments.					0.5 1.0			
	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:20 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B009

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
430	30	SS-9	WOH 7 7	100		429.6 / 30.5 Stiff, dry, black, lean CLAY (CL), low plasticity.					1.0 1.25			
425	35	ST-10	125 psi	100		Becomes gray.					1.0			*Pushed shelby tube from 35.0 to 37.0 feet*
420	40	SS-11	WOH WOH 4	100		420.1 / 40.0 Soft, moist to wet, gray, lean CLAY (CL) with shell fragments, low to medium plasticity.					0.5			
415	45	SS-12	WOH 1 4	100							1.0			
410	50	SS-13	WOH WOH WOH	100		410.1 / 50.0 Very soft, wet, gray, SILT (ML) with shell fragments, low plasticity.					1.0			
405	55	SS-14	WOH WOH 17	100		404.1 / 56.0 Medium dense, wet, gray, fine to coarse clayey GRAVEL (GC), trace fine to coarse sand, reddish brown gravel.					3.0			
400	60	SS-15	50/3"	17		400.1 / 60.0 CLAYSTONE: Gray.								*61.5 feet: Run 1 - Start 7:57, End 8:10*
		Run 1	0	0										
	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:20 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B009

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
395		Run 1	0	0		Elevation (feet) 393.6 / Depth (feet) 66.5: End of Boring at 66.5 ft								
390	70													
385	75													
380	80													
375	85													
370	90													
365	95													
	100													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:21 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B010

Date(s) Drilled	09/04/2015 to 09/04/2015	Logged By	Norm Seiler	Checked By	NDS
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	45.3 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	459.0 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
459.0	0					459.0 / 0.0								
		SS-1	10 6 10	56		458.5 / 0.5 Medium dense, moist, brown, SAND (SP) with gravel and clay.	7.2							
						Medium dense, moist, dark gray, fine to coarse ASH [Fill].	17.4 27.9							
		SS-2	9 8 8	83			20.9 30.7							
455	5	SS-3	3 6 4	100			14.8							
						451.5 / 7.5								
		SS-4	3 3 6	78		Stiff, moist, brown lean CLAY (CL), trace sand and gravel.	22.0							
450	10					449.0 / 10.0								
		SS-5	2 3 4	78		Medium stiff, moist, brown and mottled gray, lean CLAY (CL), trace sand.	24.0							
		SS-6	2 2 3	78			28.0							*12.0 feet: Switch to mud rotary*
445	15	ST-7	250 psi	83			30.5		48	30				*Pushed shelby tube from 15.0 to 17.0 feet*
						440.0 / 19.0								
440	20					Soft, wet, gray, lean CLAY (CL), trace sand and shells.								
		SS-8	1 1 1	83			32.9							
435	25	SS-6	WOH WOH 3	89			21.4							
430	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:29 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B010

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30	ST-10		72			30.0	117.6 118.9 118.6	40	25				*Pushed shelby tube from 30.0 to 32.0 feet*
425														
	35	SS-11	1 2 3	94		Becomes medium stiff.	28.2							
420														
	40	SS-12	6 7 50/3.5"	83		419.0 / 40.0 Medium dense, wet, brown, fine to coarse silty SAND (SP) with gravel. 418.0 / 41.0 SHALE: Light gray, weathered.	17.0							*41.0 to 43.0 feet: Hard drilling*
415														
	45	SS-13	50/3"	35		413.8 / 45.3 End of Boring at 45.25 ft	16.4							*Boring backfilled with bentonite and cement fluid*
410														
	50													
405														
	55													
400														
	60													
395														
	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:29 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B011

Date(s) Drilled	09/12/2015 to 09/12/2015	Logged By	Norm Seiler	Checked By	NDS
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	62.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	456.4 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	7.5 ft on 9/12/2015		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
						Elevation (feet) 456.4 / Depth (feet) 0.0								
	0	SS-1	9 12 12	89		Medium dense, moist, dark gray, ASH [Fill].	27.7							
455		SS-2	8 9 14	100			16.3							
	5	SS-3	6 9 9	94			29.4							
450		SS-4	2 1 1	100		Becomes loose, wet. ▽	45.3							
	10	SS-5		84			70.0							*10.0 feet: Switch to mud rotary*
445														
	15	SS-6	WOR WOR WOR WOR	100		Becomes very loose.	63.2							
440														
	20	SS-7		56			84.9							
435														
	25	SS-8	WOR WOR WOR WOR	89			74.7							
430														
	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:35 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B011

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
425	30	SS-9	WOR WOR WOR WOR	100			73.7							
420	35	SS-10	WOR WOR WOR WOR	84			93.9							
415	40	SS-11	WOH 1 2	100		416.4 / 40.0 Soft, wet, gray, silty CLAY (CL), trace sand, shells, and organics.	47.9							
410	45	SS-12	WOR WOR WOH	94		411.4 / 45.0 Very soft, wet, gray, fat CLAY (CH), trace sand, shells, and wood.	63.3		63	42				
405	50	SS-13	WOR WOR WOH	89		406.4 / 50.0 Very soft, wet, dark gray and grayish brown, lean CLAY (CL).	62.5							
400	55	SS-14	WOR WOR WOH	100		Grades gray.	52.9							
395	60	SS-15	50/3"	100		398.4 / 58.0 SHALE: Light gray, soft.	9.1							*58.0 to 62.0 feet: Solid drilling*
	65					394.4 / 62.0 End of Boring at 62 ft								*Boring backfilled with bentonite and cement fluid*

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:35 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B012

Date(s) Drilled	09/09/2015 to 09/09/2015	Logged By	Norm Seiler	Checked By	NDS
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	60.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	459.0 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
						Elevation (feet) / Depth (feet)								
	0					459.0 / 0.0								
		SS-1	6 6 4	94		458.6 / 0.4 Limestone gravel [Fill]. Stiff, moist, brown sandy SILT (ML), trace clay, gravel, and topsoil.	23.0							
						456.5 / 2.5								
455		SS-2	5 4 3	78		Loose, moist, dark brown ASH [Fill].	23.8		28	2				
	5	SS-3	3 4 11	56			26.5							
		SS-4	10 10 7	89			26.5							
450														
	10	SS-5	2 3 4	89		With clay. 448.0 / 11.0 Stiff, moist, brown to gray, silty CLAY (CL), trace sand, shells, and roots.	24.7 24.9							
		SS-6	3 3 6	94			22.0							
445														
	15	SS-7	2 3 4	61		Becomes medium stiff.	24.3		48	29				*15.0 feet: Switch to mud rotary*
440														
	20	ST-8	100 psi	75			23.8							*Pushed shelby tube from 20.0 to 22.0 feet*
435														
	25	SS-9	3 3 3	100			23.2							
430														
	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:41 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B012

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30	SS-10	2 2 4	61			24.8							
425														
	35	SS-11	2 2 2	100		Becomes soft, trace sand.	28.3							
420						Becomes soft, trace sand, shells, and organics.								
	40	SS-12	WOH 2 2	100			32.2							
415														
	45	SS-13	1 2 3	100			50.2							
						412.0 / 47.0								
		ST-14		100		Medium stiff, moist, dark gray, fat CLAY (CH).	50.8	104.4 104.9 104.0	54	34				*Pushed shelby tube from 47.0 to 49.0 feet*
410						410.0 / 49.0								
	50	SS-15	3 2 4	100		Medium stiff, moist, gray and brownish gray, lean CLAY (CL), trace sand.	67.4							
405														
	55	SS-16	11 21 23	100		403.5 / 55.5 Gray broken rock, weathered.	50.5 15.3							
						402.0 / 57.0 Light gray rock, weathered.								
400														
	60	SS-17	50/2.5"	75		398.8 / 60.2 End of Boring at 60 ft	17.9							*Boring backfilled with bentonite and cement fluid*
395														
	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:41 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B013

Date(s) Drilled	09/11/2015 to 09/11/2015	Logged By	Norm Seiler	Checked By	NDS
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	53.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	457.0 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
						Elevation (feet) 457.0 / Depth (feet) 0.0								
	0	SS-1	4 4 7	44		Medium stiff, moist, dark gray to brown, CLAY (CL) with ASH [Fill].	13.6							
455						454.5 / 2.5								
		SS-2	1 3 4	83		Medium stiff, moist, brown, silty CLAY (CL), trace sand, gravel, and roots.	17.4				2.0			
	5													
450		SS-3		46			24.3 20.0		49	28				
						449.0 / 8.0								
		SS-4	3 4 6	72		Stiff, moist, dark gray, silty CLAY (CL), trace sand.	24.3				2.0			
	10	SS-5	2 4 7	83			25.4				2.0			*10.0 feet: Switch to mud rotary*
445						Gray and mottled brown silty CLAY (CL), trace sand.								
	15	SS-6	2 2 4	100		Becomes medium stiff, gray and mottled brown.	25.5		41	29	1.0			
440														
	20	SS-7	2 3 3	67			23.5				1.0			
435														
	25	SS-8	3 3 4	67		Becomes gray, trace organics.	27.7				1.25			
430														
	30					427.0 / 30.0								

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:46 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B013

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30	SS-9	1 2 2	94		Medium stiff, moist, brown mottled gray, sandy CLAY (CL), trace silt and shells.	20.2				1.5			
425						425.0 / 32.0								
		ST-10		100		Medium stiff, moist, gray and brown lean CLAY (CL) with sand.	33.3		42	19	1.25			*Pushed shelby tube from 32.0 to 34.0 feet*
	35	SS-11	2 2 2	89		Becomes dark gray, trace organics.	58.0				1.0			
420														
	40	SS-12	2 2 3	100			54.5				1.25			
415														
	45	SS-13	2 2 4	100		Grades with calcium carbonate seams and shells.	66.2				1.75			
410						Gravel layer 47.5 feet to 49.0 feet								
	50													
405						404.0 / 53.0								
						End of Boring at 53 ft								*Boring backfilled with bentonite and cement fluid*
	55													
400														
	60													
395														
	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:46 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B014

Date(s) Drilled	09/12/2015 to 09/12/2015	Logged By	Norm Seiler	Checked By	NDS
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	45.5 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	457.7 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	5 ft on 9/12/2015		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
						Elevation (feet) 457.7 / Depth (feet) 0.0								
	0	SS-1	1 4 10	89		Medium dense, moist, dark gray, ASH [Fill].	28.2							
455		SS-2	7 2 1	100		Becomes wet, gray.	40.8							
	5	ST-3		35		▽								*Pushed shelby tube from 5.0 to 7.0 feet*
450		SS-4	1 1 1	100		Becomes light gray.	60.2							
	10	SS-5		100		Becomes dark gray.	78.7							*10.0 feet: Switch to mud rotary* *Pushed shelby tube from 10.0 to 12.0 feet*
445														
	15	ST-6	1/12" 1/12"	100		Becomes light gray.	86.5							
440														
	20	SS-7	1/12" 1/12"	100			73.1							
435														
	25	SS-8	WOR WOR WOR	100			48.7							
430														
	30					427.7 / 30.0								

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:52 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B014

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30	SS-9	WOR WOR WOR	67		Very loose, wet, black to gray, ASH with clay [Fill].	31.6							
425														
	35	SS-10	WOH 1 2	100		422.7 / 35.0 Soft, wet, gray, silty CLAY (CL), trace shells and wood.								
420														
	40	SS-11	2 18 34	100		417.2 / 40.5 SHALE: Light gray, weathered.	27.3 19.6 10.2							*42.0 to 45.0 feet: Solid drilling*
415														
	45	SS-12	56	100		412.2 / 45.5 End of Boring at 45.5 ft	14.2							*Boring backfilled with bentonite and cement fluid*
410														
	50													
405														
	55													
400														
	60													
395														
	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:52 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B015

Date(s) Drilled	09/10/2015 to 09/10/2015	Logged By	Norm Seiler	Checked By	NDS
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	57.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	460.0 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
		Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
						Elevation (feet) / Depth (feet)								
460	0					460.0 / 0.0								
		SS-1	5 4 1	72		459.6 / 0.4 Brown gravel.	54.7							
						Medium stiff, moist, gray to brown, sandy CLAY (CL), trace silt.								
						457.5 / 2.5								
		SS-2	5 9 13	50		Medium dense, moist, light brown to white, fine to coarse GRAVEL (GP) with sand, trace silt and limestone.	4.5							
455	5	SS-3	6 10 13	39			5.4							
		SS-4	6 9 7	39			7.2							
450	10	SS-5	4 5 6	39			6.5							*10.0 feet: Switch to mud rotary; borehole collapsed*
		SS-6	10 3 2	11			3.6							
445	15	SS-7	4 4 4	39		Some coarse limestone.	8.2							
440	20	SS-8	10 7 9	39			7.8							
435	25	SS-9	7 4 11	33			8.1							*23.0 to 25.0 feet: Drove casing with hammer* *23.0 to 29.0 feet: Hard drilling*
430	30													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:58 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B015

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
430	30					429.0 / 31.0 Medium stiff, wet, gray, sandy CLAY (CL), trace silt, shells, and organics.		122.2						
		ST-10	300 psi	100			20.2	121.0 119.8	24	11	2.5			*Pushed shelby tube from 31.0 to 33.0 feet*
425	35					425.0 / 35.0 Medium stiff, wet, gray and dark gray lean CLAY (CL)								
		SS-11	WOH 2 3	94			33.8				1.25			
						423.0 / 37.0 Soft, wet, dark gray, fat CLAY (CH).								
		ST-12	175 psi				41.0		66	43	1.0			*Pushed shelby tube from 37.0 to 39.0 feet*
						421.0 / 39.0 Soft, wet, brown and gray, lean CLAY (CL).								
420	40	SS-13	WOH 2 2	100			36.2				1.0			
415	45	SS-14	WOH 2 2	83		Grades with sand.	49.4				1.0			
410	50	SS-15	3 5 14	22		Grades without sand.	30.9				0.5			
						408.0 / 52.0 SHALE: Light gray, silt sized, weathered.								*52.0 feet: Solid drilling*
405	55	SS-16	71/6"	oK			11.0							
						403.0 / 57.0 End of Boring at 57 ft								*Boring backfilled with bentonite and cement fluid*
400	60													
395	65													

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:22:58 PM

Project: Edwards Power Station

Project Location: Bartonville, Illinois

Project Number: 60440202

Log of Boring EDW-B015A

Sheet 1 of 1

Date(s) Drilled	09/10/2015 to 09/10/2015	Logged By	Norm Seiler	Checked By	NDS
Drilling Method	Power Auger/ Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone Roller Bit	Borehole Depth	30.0 ft
Drill Rig Type	Diedrich D-120 Rubber Tired ATV	Drilling Contractor	Strata Earth Services	Surface Elevation	460.0 ft
Borehole Backfill	Bentonite and Cement Fluid	Sampling Method(s)	Split Spoon/3" Thin Walled Tube	Hammer Data	Automatic, 140 lbs, 30" drop
Boring Location	5' SW of EDW-B015 (ft NAD83)	Groundwater Level(s)	ft on		

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
460	0					Elevation (feet) 460.0 / Depth (feet) 0.0 Blank power auger to 30.0 feet to confirm 29.0 feet of gravel.								*Offset 5.0 feet west of EDW-B015*
455	5													*5.0 to 30.0 feet: No cuttings*
														7.0 feet: Borehole collapsed; created a 14" diameter hole with no cuttings
450	10													
445	15													
440	20													*20.0 feet: Groundwater encountered*
435	25													*Auger hole collapsed and auger removed. No clay on auger.*
430	30					430.0 / 30.0								

End of Boring at 30 ft

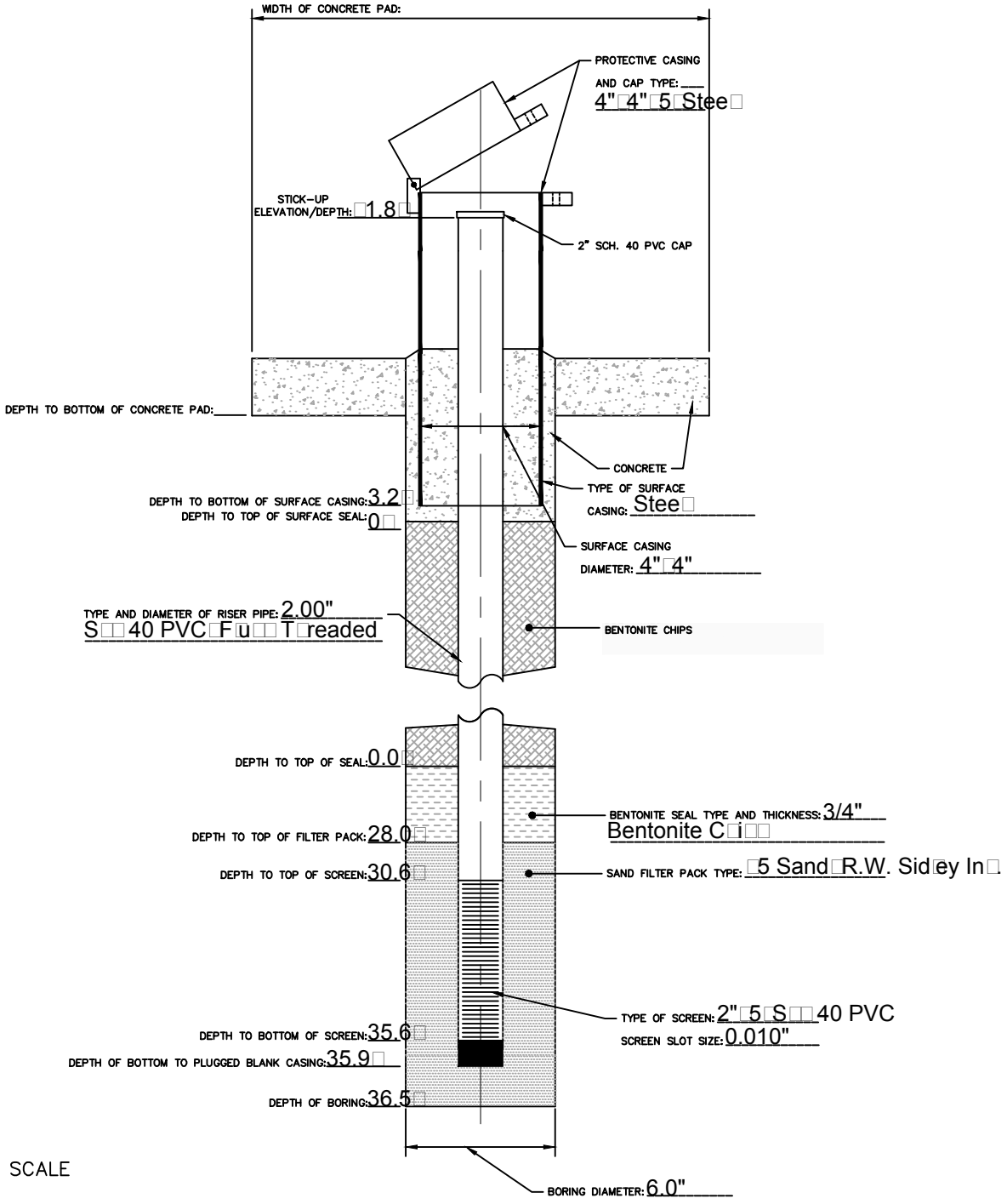
AECOM

Report: GEO_SOIL; File K:\PROJECTS\60440202_DYNEGY CCR EDWARDS\400-TECHNICAL\BORING LOGS\60440202_DYNEGYEDWARDSBORINGLOGS.GPJ; 2/24/2016 7:23:03 PM

Attachment C. Piezometer Logs

Project: Dynegy Project Location: Barton□i□e, IL Project Number: 60440202	Log of Piezometer Sheet 1 of 1

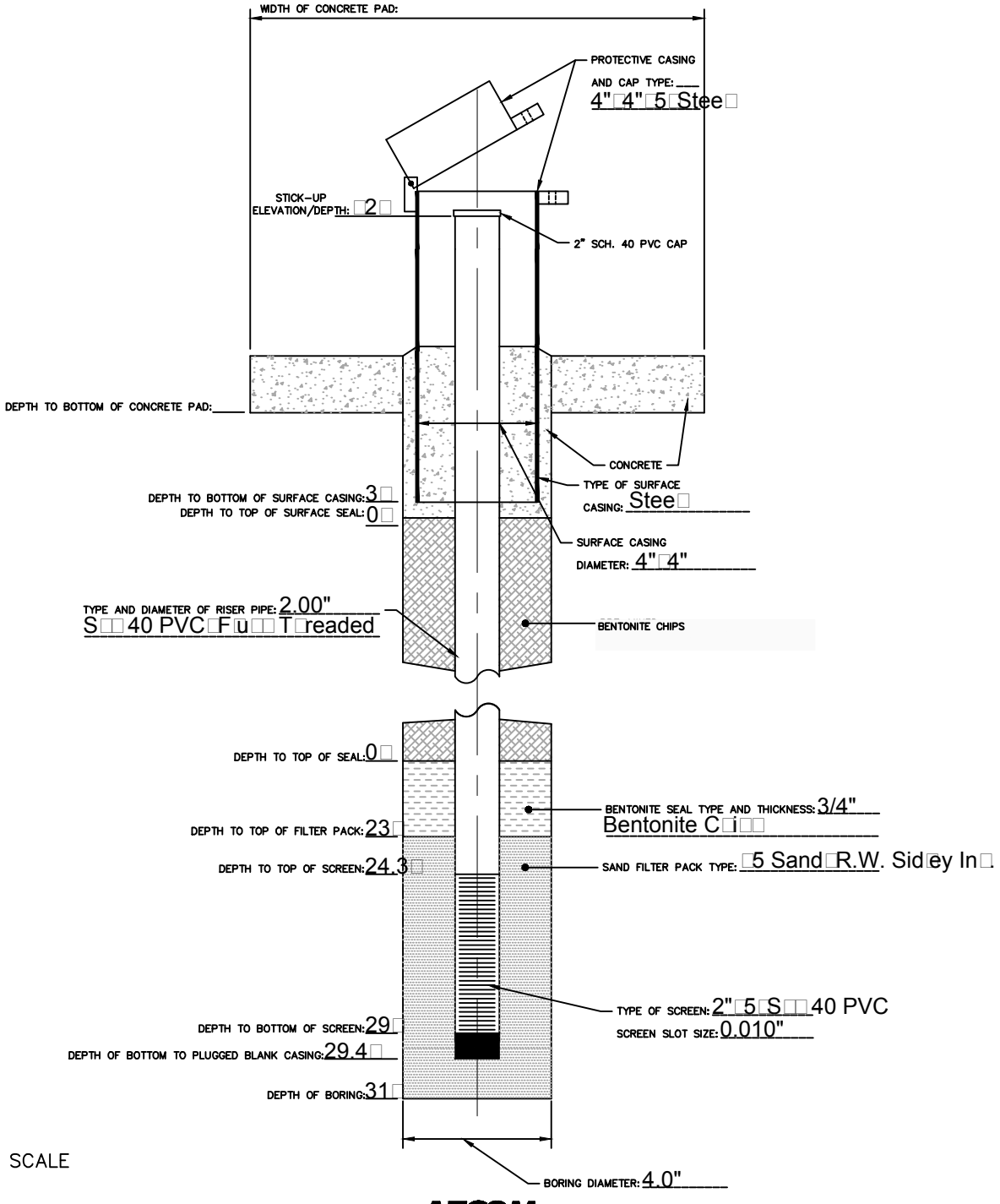
Piezometer Location	EDW-P001	Date Installed	11/05/15	Time	5:30 P.M.
Installed By	Jo□□ Ko□n	Observed By	R. We□e□a□	Total Depth	36.5□
Method of Installation	6" Mud Rotary	Drilling Contractor	Strata	Surface Elevation	461.0 □NAVD88□
Screened Interval	30.6-35.6□				
		Groundwater Level(s)	24.64□ro□ to□o□□a□in□		



AECOM

Project: Dynegy Project Location: Barton□i□e, IL Project Number: 60440202	Log of Piezometer Sheet 1 of 1

Piezometer Location	EDW-P002	Date Installed	09/04/15	Time	11:00-12:00 P.M.
Installed By	S□ott Ko□en	Observed By	N. Sei□er	Total Depth	31□
Method of Installation	4" Po□er Au□er	Drilling Contractor	Strata	Surface Elevation	459.0 □NAVD88□
Screened Interval	24-29□				
		Groundwater Level(s)	29□A□ter Dri□in□		



AECOM

Project: Dynegy

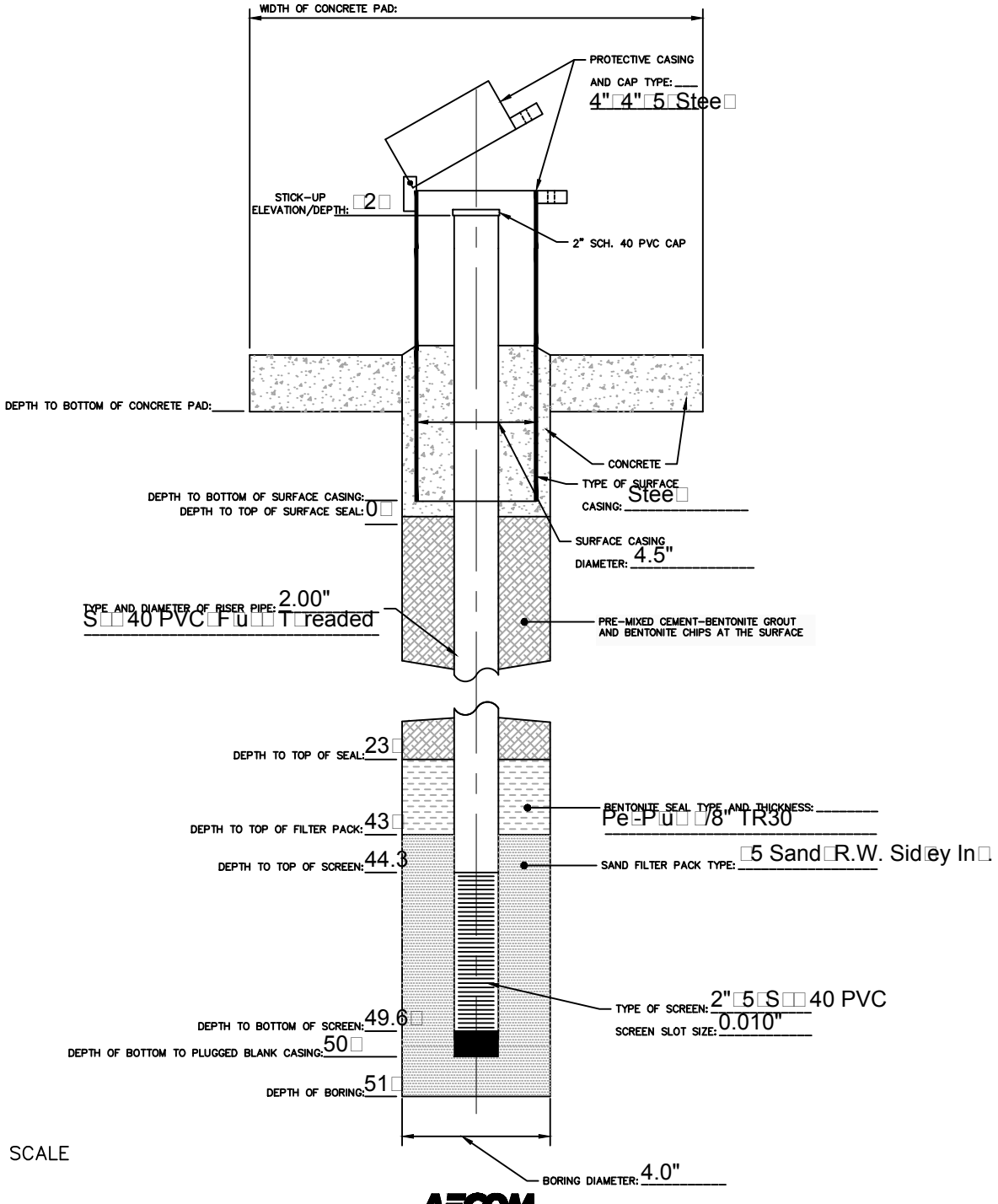
Project Location: Barton□i□e, IL

Project Number: 60440202

Log of Piezometer

Sheet 1 of 1

Piezometer Location	EDW-P003	Date Installed	09/04/15	Time	3:30-6:00 P.M.
Installed By	S□ott Ko□en	Observed By	N. Sei□er	Total Depth	51□
Method of Installation	3 7/8" Ro□□ Bit	Drilling Contractor	Strata	Surface Elevation	459.6 □NAVD88□
Screened Interval	44.3-49.6□				



AECOM

Project: Dynegy

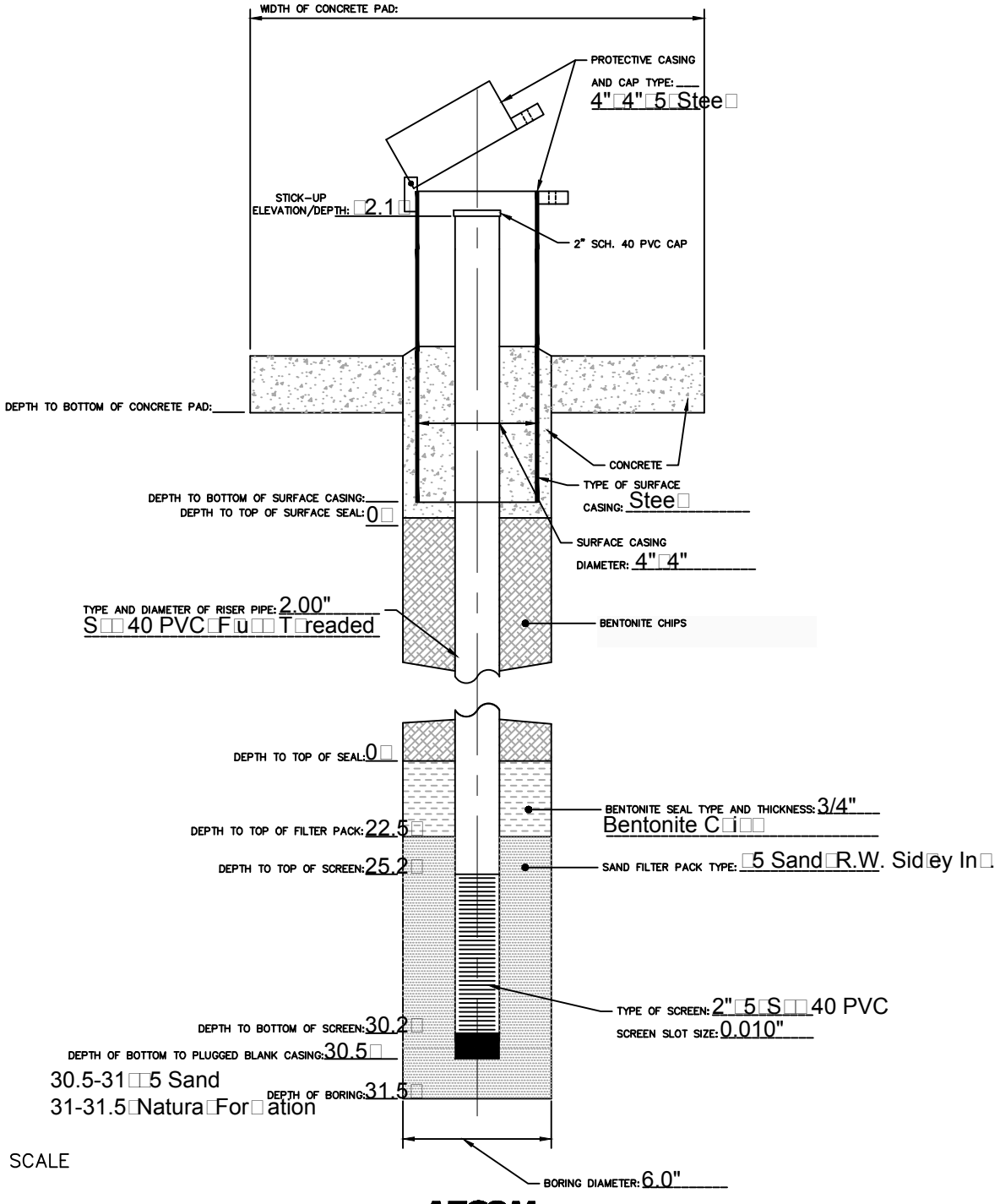
Project Location: Barton□i□e, IL

Project Number: 60440202

Log of Piezometer

Sheet 1 of 1

Piezometer Location	EDW-P004	Date Installed	11/04/15	Time	12:00
Installed By	Jo□□ Ko□n	Observed By	R. We□e□a□	Total Depth	31.5□
Method of Installation	6" Mud Rotary	Drilling Contractor	Strata	Surface Elevation	455.6 □NAVD88□
Screened Interval	25.2-30.2□				
		Groundwater Level(s)	14.85 Fro□ To□o□Ca□in□		



AECOM

Attachment D. CPT Data Report

PRESENTATION OF SITE INVESTIGATION RESULTS

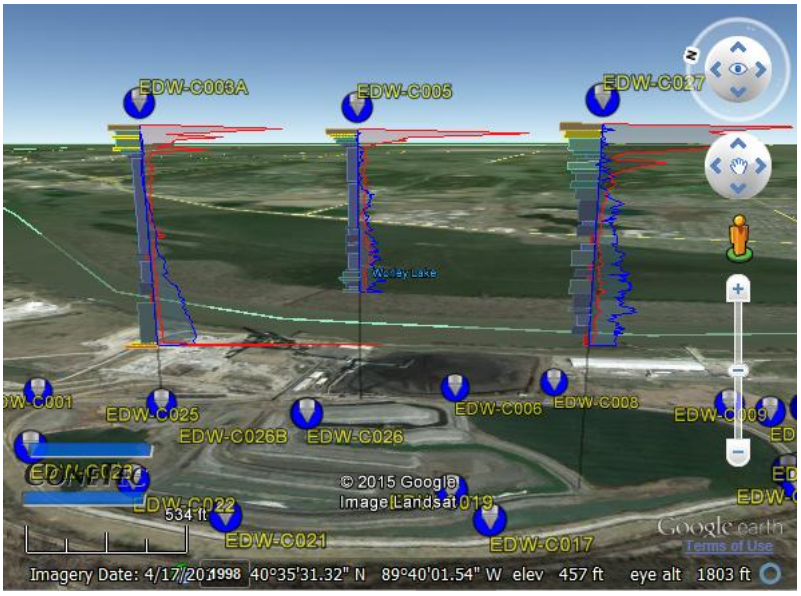
Edwards Power Station
Peoria, Illinois

Prepared for:

AECOM

ConeTec Job No: 15-53073

Project Start Date: 19-Aug-2015
Project End Date: 29-Aug-2015
Report Date: 31-Aug-2015



Prepared by:

ConeTec Inc.
436 Commerce Lane, Unit C
West Berlin, NJ 08091

Tel: (856) 767-8600
Fax: (856) 767-4008
Toll Free: (800) 504-1116

Email: conetecNJ@conetec.com
www.conetec.com
www.conetecdataservices.com

Introduction

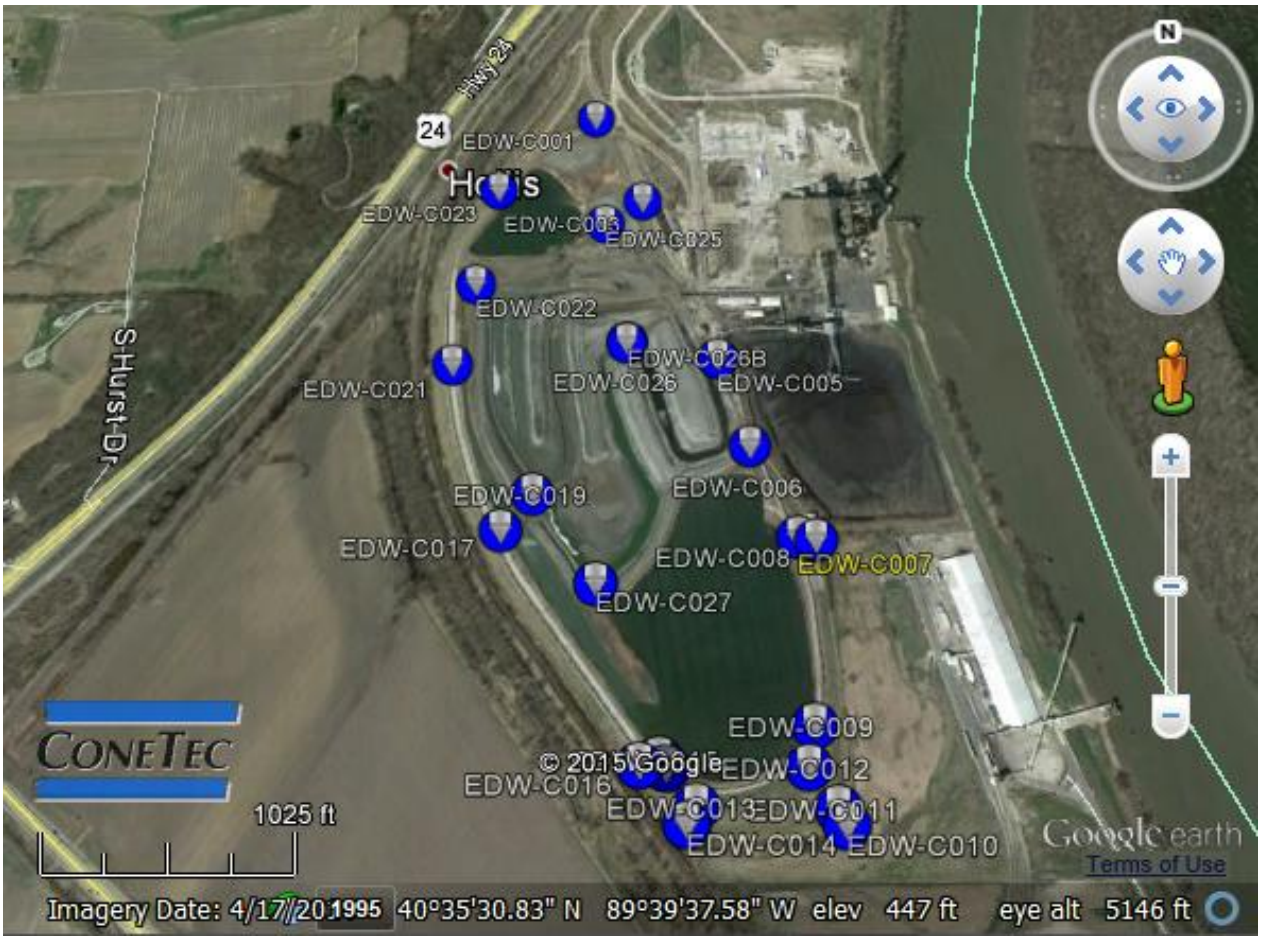
The enclosed report presents the results of a piezocone penetration testing (CPTu or CPT) and seismic piezocone penetration testing (SCPTu or SCPT) program carried out at the Edwards Power Station site located in Peoria, Illinois. The site investigation program was conducted by ConeTec Inc., under contract to AECOM of Chicago, Illinois.

A total of fourteen cone penetration tests and ten seismic cone penetration tests were completed at twenty two locations (There were two shallow refusals). The CPT and SCPT program was performed to evaluate the subsurface soil conditions. CPT and SCPT sounding locations were selected and numbered under the supervision of AECOM personnel (Mr. Daryle Harrison and Mr. Adam Grossman).

Project Information

Project	
Client	AECOM
Project	Edwards Power Station, Peoria, IL
ConeTec project number	15-53073

A map from Google earth including the CPT test locations is presented below.



Rig Description	Deployment System	Test Type
CPT Truck Rig	25 ton truck mounted (twin cylinders)	CPT and SCPT
CPT Track Rig	20 ton track mounted (twin cylinders)	CPT and SCPT

Coordinates		
Test Type	Collection Method	EPSG Number
CPT and SCPT	GPS (Handheld)	32616 (WGS 84 / UTM North)

Cone Penetration Test (CPT)	
Depth reference	Ground surface at the time of the investigation.
Tip and sleeve data offset	0.1 meter. This has been accounted for in the CPT data files.
Pore pressure dissipation (PPD) tests	Fifty seven pore pressure dissipation tests were completed primarily to determine the phreatic surface.
Additional Comments	Shear wave velocity tests were conducted at five foot intervals at ten locations.

Cone Description	Cone Number	Cross Sectional Area (cm^2)	Sleeve Area (cm^2)	Tip Capacity (bar)	Sleeve Capacity (bar)	Pore Pressure Capacity (psi)
335:T1500F15U500	335	15	225	1500	15	500
340:T1500F15U500	340	15	225	1500	15	500
374:T1500F15U500	374	15	225	1500	15	500

Limitations

This report has been prepared for the exclusive use of AECOM (Client) for the project titled “Edwards Power Station, Peoria, IL”. The report’s contents may not be relied upon by any other party without the express written permission of ConeTec, Inc. (ConeTec). ConeTec has provided site investigation services, prepared the factual data reporting, and provided geotechnical parameter calculations consistent with current best practices. No other warranty, expressed or implied, is made.

The information presented in the report document and the accompanying data set pertain to the specific project, site conditions and objectives described to ConeTec by the Client. In order to properly understand the factual data, assumptions and calculations, reference must be made to the documents provided and their accompanying data sets, in their entirety.

The cone penetration tests (CPTu) are conducted using an integrated electronic piezocone penetrometer and data acquisition system manufactured by Adara Systems Ltd. of Richmond, British Columbia, Canada.

ConeTec's piezocone penetrometers are compression type designs in which the tip and friction sleeve load cells are independent and have separate load capacities. The piezocones use strain gauged load cells for tip and sleeve friction and a strain gauged diaphragm type transducer for recording pore pressure. The piezocones also have a platinum resistive temperature device (RTD) for monitoring the temperature of the sensors, an accelerometer type dual axis inclinometer and a geophone sensor for recording seismic signals. All signals are amplified down hole within the cone body and the analog signals are sent to the surface through a shielded cable.

ConeTec penetrometers are manufactured with various tip, friction and pore pressure capacities in both 10 cm^2 and 15 cm^2 tip base area configurations in order to maximize signal resolution for various soil conditions. The 15 cm^2 penetrometers do not require friction reducers as they have a diameter larger than the deployment rods. The 10 cm^2 piezocones use a friction reducer consisting of a rod adapter extension behind the main cone body with an enlarged cross sectional area (typically 44 mm diameter over a length of 32 mm with tapered leading and trailing edges) located at a distance of 585 mm above the cone tip.

The penetrometers are designed with equal end area friction sleeves, a net end area ratio of 0.8 and cone tips with a 60 degree apex angle.

All ConeTec piezocones can record pore pressure at various locations. Unless otherwise noted, the pore pressure filter is located directly behind the cone tip in the "u_2" position (ASTM Type 2). The filter is 6 mm thick, made of porous plastic (polyethylene) having an average pore size of 125 microns (90-160 microns). The function of the filter is to allow rapid movements of extremely small volumes of water needed to activate the pressure transducer while preventing soil ingress or blockage.

The piezocone penetrometers are manufactured with dimensions, tolerances and sensor characteristics that are in general accordance with the current ASTM D5778 standard. ConeTec's calibration criteria also meet or exceed those of the current ASTM D5778 standard. An illustration of the piezocone penetrometer is presented in Figure CPTu.

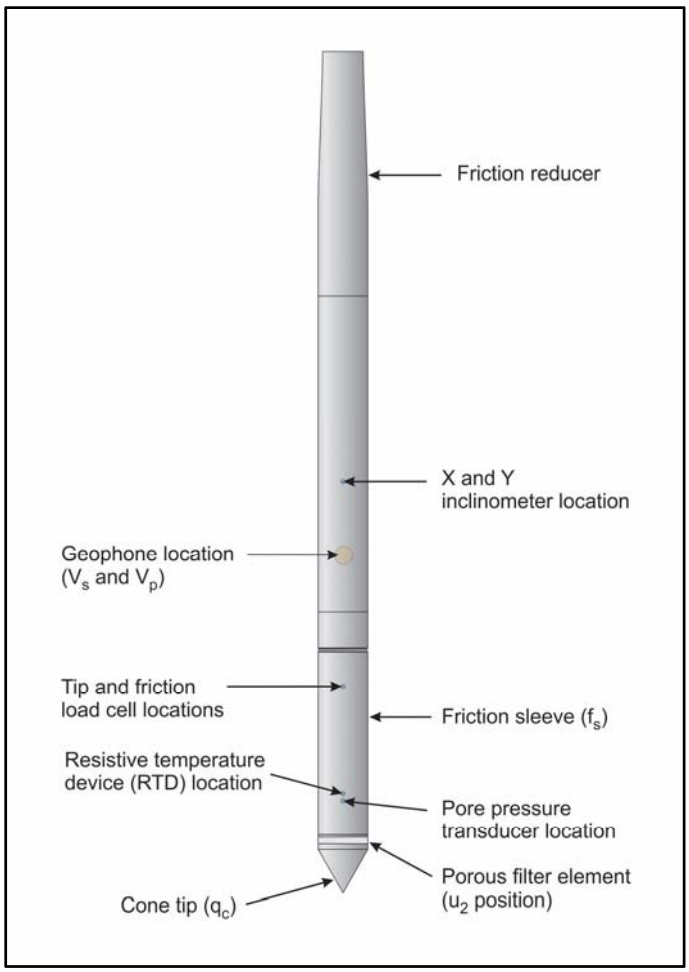


Figure CPTu. Piezocone Penetrometer (15 cm^2)

The ConeTec data acquisition systems consist of a Windows based computer and a signal conditioner and power supply interface box with a 16 bit (or greater) analog to digital (A/D) converter. The data is recorded at fixed depth increments using a depth wheel attached to the push cylinders or by using a spring loaded rubber depth wheel that is held against the cone rods. The typical recording intervals are either 2.5 cm or 5.0 cm depending on project requirements; custom recording intervals are possible. The system displays the CPTu data in real time and records the following parameters to a storage media during penetration:

- Depth
- Uncorrected tip resistance (q_c)
- Sleeve friction (f_s)
- Dynamic pore pressure (u)
- Additional sensors such as resistivity, passive gamma, ultra violet induced fluorescence, if applicable

All testing is performed in accordance to ConeTec's CPT operating procedures which are in general accordance with the current ASTM D5778 standard.

Prior to the start of a CPTu sounding a suitable cone is selected, the cone and data acquisition system are powered on, the pore pressure system is saturated with either glycerin or silicone oil and the baseline readings are recorded with the cone hanging freely in a vertical position.

The CPTu is conducted at a steady rate of 2 cm/s, within acceptable tolerances. Typically one meter length rods with an outer diameter of 1.5 inches are added to advance the cone to the sounding termination depth. After cone retraction final baselines are recorded.

Additional information pertaining to ConeTec's cone penetration testing procedures:

- Each filter is saturated in silicone oil or glycerin under vacuum pressure prior to use
- Recorded baselines are checked with an independent multi-meter
- Baseline readings are compared to previous readings
- Soundings are terminated at the client's target depth or at a depth where an obstruction is encountered, excessive rod flex occurs, excessive inclination occurs, equipment damage is likely to take place, or a dangerous working environment arises
- Differences between initial and final baselines are calculated to ensure zero load offsets have not occurred and to ensure compliance with ASTM standards

The interpretation of piezocone data for this report is based on the corrected tip resistance (q_t), sleeve friction (f_s) and pore water pressure (u). The interpretation of soil type is based on the correlations developed by Robertson (1990) and Robertson (2009). It should be noted that it is not always possible to accurately identify a soil type based on these parameters. In these situations, experience, judgment and an assessment of other parameters may be used to infer soil behavior type.

The recorded tip resistance (q_c) is the total force acting on the piezocone tip divided by its base area. The tip resistance is corrected for pore pressure effects and termed corrected tip resistance (q_t) according to the following expression presented in Robertson et al, 1986:

$$q_t = q_c + (1\text{-}a) \bullet u_2$$

where: q_t is the corrected tip resistance
q_c is the recorded tip resistance
u_2 is the recorded dynamic pore pressure behind the tip (u_2 position)
a is the Net Area Ratio for the piezocone (0.8 for ConeTec probes)

The sleeve friction (f_s) is the frictional force on the sleeve divided by its surface area. As all ConeTec piezocones have equal end area friction sleeves, pore pressure corrections to the sleeve data are not required.

The dynamic pore pressure (u) is a measure of the pore pressures generated during cone penetration. To record equilibrium pore pressure, the penetration must be stopped to allow the dynamic pore pressures to stabilize. The rate at which this occurs is predominantly a function of the permeability of the soil and the diameter of the cone.

The friction ratio (Rf) is a calculated parameter. It is defined as the ratio of sleeve friction to the tip resistance expressed as a percentage. Generally, saturated cohesive soils have low tip resistance, high

friction ratios and generate large excess pore water pressures. Cohesionless soils have higher tip resistances, lower friction ratios and do not generate significant excess pore water pressure.

A summary of the CPTu soundings along with test details and individual plots are provided in the appendices. A set of interpretation files were generated for each sounding based on published correlations and are provided in Excel format in the data release folder. Information regarding the interpretation methods used is included in an appendix.

For additional information on CPTu interpretations, refer to Robertson et al. (1986), Lunne et al. (1997), Robertson (2009), Mayne (2013, 2014) and Mayne and Peuchen (2012).

References

ASTM D5778-12, 2012, "Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils", ASTM, West Conshohocken, US.

Lunne, T., Robertson, P.K. and Powell, J. J. M., 1997, “Cone Penetration Testing in Geotechnical Practice”, Blackie Academic and Professional.

Mayne, P.W., 2013, “Evaluating yield stress of soils from laboratory consolidation and in-situ cone penetration tests”, Sound Geotechnical Research to Practice (Holtz Volume) GSP 230, ASCE, Reston/VA: 406-420.

Mayne, P.W. and Peuchen, J., 2012, “Unit weight trends with cone resistance in soft to firm clays”, Geotechnical and Geophysical Site Characterization *4,* Vol. 1 (Proc. ISC-4, Pernambuco), CRC Press, London: 903-910.

Mayne, P.W., 2014, “Interpretation of geotechnical parameters from seismic piezocone tests”, CPT’14 Keynote Address, Las Vegas, NV, May 2014.

Robertson, P.K., Campanella, R.G., Gillespie, D. and Greig, J., 1986, “Use of Piezometer Cone Data”, Proceedings of InSitu 86, ASCE Specialty Conference, Blacksburg, Virginia.

Robertson, P.K., 1990, “Soil Classification Using the Cone Penetration Test”, Canadian Geotechnical Journal, Volume 27: 151-158.

Robertson, P.K., 2009, “Interpretation of cone penetration tests – a unified approach”, Canadian Geotechnical Journal, Volume 46: 1337-1355.

Shear wave velocity testing is performed in conjunction with the piezocone penetration test (SCPTu) in order to collect interval velocities. For some projects seismic compression wave (Vp) velocity is also determined.

ConeTec's piezocone penetrometers are manufactured with a horizontally active geophone (28 hertz) that is rigidly mounted in the body of the cone penetrometer, 0.2 meters behind the cone tip.

Shear waves are typically generated by using an impact hammer horizontally striking a beam that is held in place by a normal load. In some instances an auger source or an imbedded impulsive source maybe used for both shear waves and compression waves. The hammer and beam act as a contact trigger that triggers the recording of the seismic wave traces. For impulsive devices an accelerometer trigger may be used. The traces are recorded using an up-hole integrated digital oscilloscope which is part of the SCPTu data acquisition system. An illustration of the shear wave testing configuration is presented in Figure SCPTu-1.

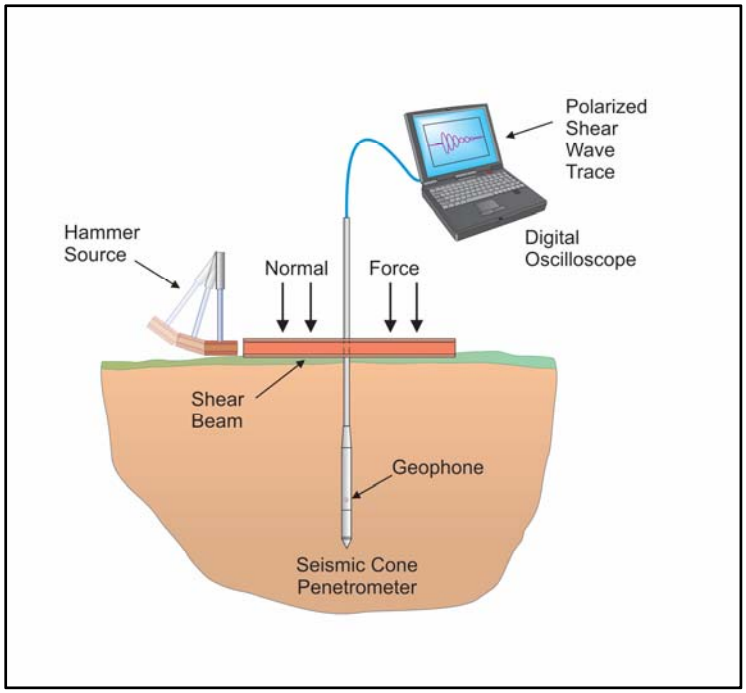


Figure SCPTu-1. Illustration of the SCPTu system

All testing is performed in accordance to ConeTec's SCPTu operating procedures.

Prior to the start of a SCPTu sounding, the procedures described in the Cone Penetration Test section are followed. In addition, the active axis of the geophone is aligned parallel to the beam (or source) and the horizontal offset between the cone and the source is measured and recorded.

Prior to recording seismic waves at each test depth, cone penetration is stopped and the rods are decoupled from the rig to avoid transmission of rig energy down the rods. Multiple wave traces are recorded for quality control purposes. After reviewing wave traces for consistency the cone is pushed to the next test depth (typically one meter intervals or as requested by the client). Figure SCPTu-2 presents an illustration of a SCPTu test.

For additional information on seismic cone penetration testing refer to Robertson et.al. (1986).

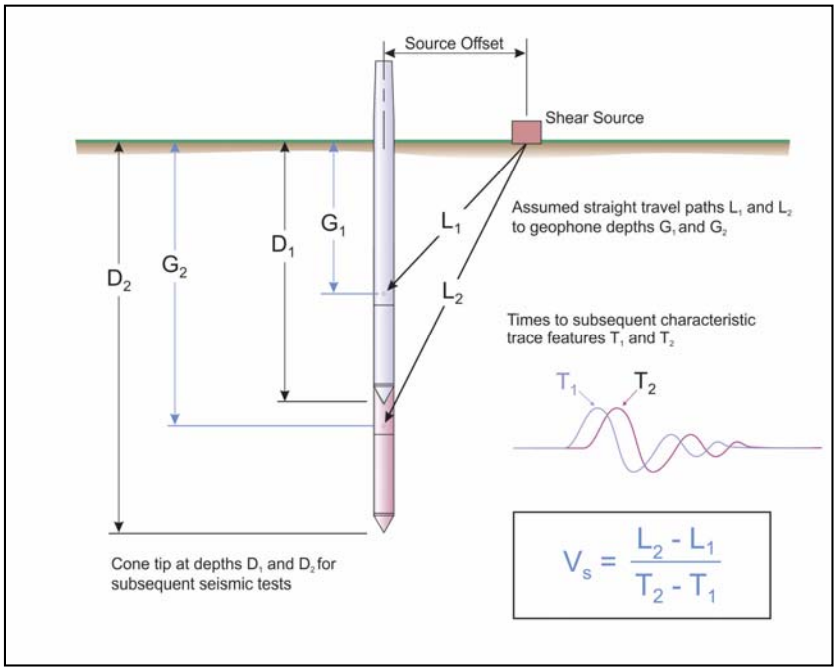


Figure SCPTu-2. Illustration of a seismic cone penetration test

Calculation of the interval velocities are performed by visually picking a common feature (e.g. the first characteristic peak, trough, or crossover) on all of the recorded wave sets and taking the difference in ray path divided by the time difference between subsequent features. Ray path is defined as the straight line distance from the seismic source to the geophone, accounting for beam offset, source depth and geophone offset from the cone tip.

The average shear wave velocity to a depth of 100 feet (30 meters) ($\bar{v}_s$) has been calculated and provided for all applicable soundings using the following equation presented in ASCE, 2010.

$$\bar{v}_s = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{v_{si}}}$$

where: $\bar{v}_s$ = average shear wave velocity ft/s (m/s)
d_i = the thickness of any layer between 0 and 100 ft (30 m)
v_{si} = the shear wave velocity in ft/s (m/s)
$\sum_{i=1}^{n} d_i$ = 100 ft (30 m)

Average shear wave velocity, $\bar{v}_s$ is also referenced to V_{s100} or V_{s30}.

The layer travel times refers to the travel times propagating in the vertical direction, not the measured travel times from an offset source.

Tabular results and SCPTu plots are presented in the relevant appendix.

References

American Society of Civil Engineers (ASCE), 2010, “Minimum Design Loads for Buildings and Other Structures”, Standard ASCE/SEI 7-10, American Society of Civil Engineers, ISBN 978-0-7844-1085-1, Reston, Virginia.

Robertson, P.K., Campanella, R.G., Gillespie D and Rice, A., 1986, “Seismic CPT to Measure In-Situ Shear Wave Velocity”, Journal of Geotechnical Engineering ASCE, Vol. 112, No. 8: 791-803.

The cone penetration test is halted at specific depths to carry out pore pressure dissipation (PPD) tests, shown in Figure PPD-1. For each dissipation test the cone and rods are decoupled from the rig and the data acquisition system measures and records the variation of the pore pressure (u) with time (t).

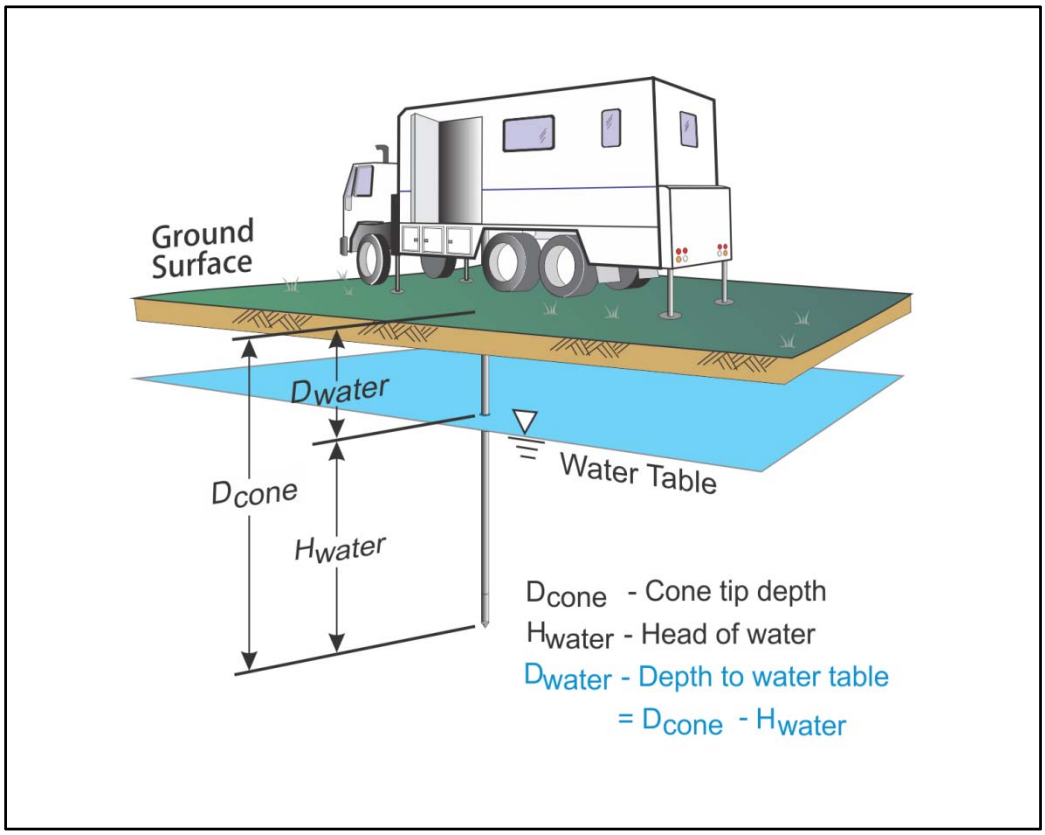


Figure PPD-1. Pore pressure dissipation test setup

Pore pressure dissipation data can be interpreted to provide estimates of ground water conditions, permeability, consolidation characteristics and soil behavior.

The typical shapes of dissipation curves shown in Figure PPD-2 are very useful in assessing soil type, drainage, in situ pore pressure and soil properties. A flat curve that stabilizes quickly is typical of a freely draining sand. Undrained soils such as clays will typically show positive excess pore pressure and have long dissipation times. Dilative soils will often exhibit dynamic pore pressures below equilibrium that then rise over time. Overconsolidated fine-grained soils will often exhibit an initial dilatory response where there is an initial rise in pore pressure before reaching a peak and dissipating.

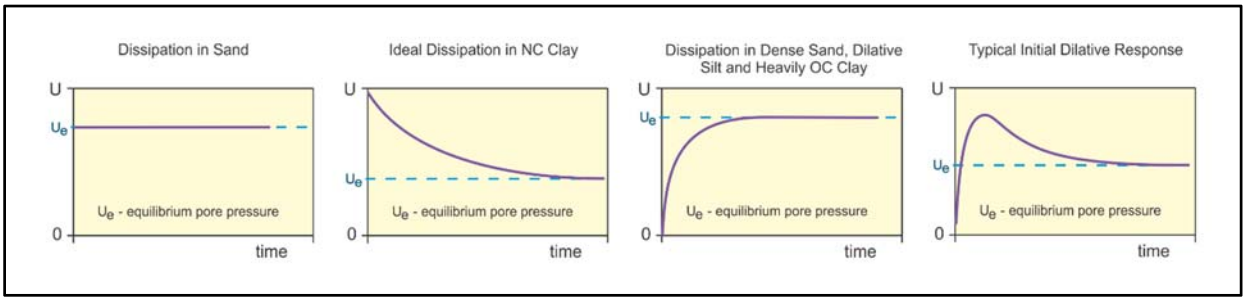


Figure PPD-2. Pore pressure dissipation curve examples

In order to interpret the equilibrium pore pressure (u_{eq}) and the apparent phreatic surface, the pore pressure should be monitored until such time as there is no variation in pore pressure with time as shown for each curve of Figure PPD-2.

In fine grained deposits the point at which 100% of the excess pore pressure has dissipated is known as t_{100}. In some cases this can take an excessive amount of time and it may be impractical to take the dissipation to t_{100}. A theoretical analysis of pore pressure dissipations by Teh and Houlsby (1991) showed that a single curve relating degree of dissipation versus theoretical time factor (T*) may be used to calculate the coefficient of consolidation (c_h) at various degrees of dissipation resulting in the expression for c_h shown below.

$$c_h = \frac{T^* \cdot a^2 \cdot \sqrt{I_r}}{t}$$

Where:

T* is the dimensionless time factor (Table Time Factor)
a is the radius of the cone
I_r is the rigidity index
t is the time at the degree of consolidation

Table Time Factor. T* versus degree of dissipation (Teh and Houlsby, 1991)

Degree of Dissipation (%)	20	30	40	50	60	70	80
T* (u_2)	0.038	0.078	0.142	0.245	0.439	0.804	1.60

The coefficient of consolidation is typically analyzed using the time (t_{50}) corresponding to a degree of dissipation of 50% (u_{50}). In order to determine t_{50}, dissipation tests must be taken to a pressure less than u_{50}. The u_{50} value is half way between the initial maximum pore pressure and the equilibrium pore pressure value, known as u_{100}. To estimate u_{50}, both the initial maximum pore pressure and u_{100} must be known or estimated. Other degrees of dissipations may be considered, particularly for extremely long dissipations.

At any specific degree of dissipation the equilibrium pore pressure (u at t_{100}) must be estimated at the depth of interest. The equilibrium value may be determined from one or more sources such as measuring the value directly (u_{100}), estimating it from other dissipations in the same profile, estimating the phreatic surface and assuming hydrostatic conditions, from nearby soundings, from client provided information, from site observations and/or past experience, or from other site instrumentation.

For calculations of c_h (Teh and Houlsby, 1991), t_{50} values are estimated from the corresponding pore pressure dissipation curve and a rigidity index (I_r) is assumed. For curves having an initial dilatory response in which an initial rise in pore pressure occurs before reaching a peak, the relative time from the peak value is used in determining t_{50}. In cases where the time to peak is excessive, t_{50} values are not calculated.

Due to possible inherent uncertainties in estimating I_r, the equilibrium pore pressure and the effect of an initial dilatory response on calculating t_{50}, other methods should be applied to confirm the results for c_h.

Additional published methods for estimating the coefficient of consolidation from a piezocone test are described in Burns and Mayne (1998, 2002), Jones and Van Zyl (1981), Robertson et al. (1992) and Sully et al. (1999).

A summary of the pore pressure dissipation tests and dissipation plots are presented in the relevant appendix.

References

Burns, S.E. and Mayne, P.W., 1998, "Monotonic and dilatory pore pressure decay during piezocone tests", Canadian Geotechnical Journal 26 (4): 1063-1073.

Burns, S.E. and Mayne, P.W., 2002, "Analytical cavity expansion-critical state model cone dissipation in fine-grained soils", Soils & Foundations, Vol. 42(2): 131-137.

Jones, G.A. and Van Zyl, D.J.A., 1981, "The piezometer probe: a useful investigation tool", Proceedings, 10th International Conference on Soil Mechanics and Foundation Engineering, Vol. 3, Stockholm: 489-495.

Robertson, P.K., Sully, J.P., Woeller, D.J., Lunne, T., Powell, J.J.M. and Gillespie, D.G., 1992, "Estimating coefficient of consolidation from piezocone tests", Canadian Geotechnical Journal, 29(4): 551-557.

Sully, J.P., Robertson, P.K., Campanella, R.G. and Woeller, D.J., 1999, "An approach to evaluation of field CPTU dissipation data in overconsolidated fine-grained soils", Canadian Geotechnical Journal, 36(2): 369-381.

Teh, C.I., and Houlsby, G.T., 1991, "An analytical study of the cone penetration test in clay", Geotechnique, 41(1): 17-34.

The appendices listed below are included in the report:

- Cone Penetration Test Summary and Standard Cone Penetration Test Plots
- Seismic Cone Penetration Test Plots
- Seismic Cone Penetration Test Tabular Results
- Pore Pressure Dissipation Summary and Pore Pressure Dissipation Plots

Cone Penetration Test Summary and Standard Cone Penetration Test Plots

CONETEC

Job No: 15-53073
Client: AECOM
Project: Edwards Power Station, Peoria, IL
Start Date: 19-Aug-2015
End Date: 29-Aug-2015

CONE PENETRATION TEST SUMMARY

Sounding ID	File Name	Date	Cone	Assumed Phreatic Surface[1] (ft)	Final Depth (ft)	Shear Wave Velocity Tests	Northing[2] (m)	Easting (m)	Refer to Notation Number
EDW-C001	15-53073_SP01	19-Aug-2015	374:T1500F15U500	9.4	38.88	8	4497502	274312	
EDW-C003	15-53073_SP03	27-Aug-2015	340:T1500F15U500	9.0	54.63	8	4497325	274377	
EDW-C005	15-53073_CP05	26-Aug-2015	374:T1500F15U500	7.0	40.03		4497026	274468	3
EDW-C006	15-53073_CP06	25-Aug-2015	374:T1500F15U500	11.5	40.03		4496880	274500	
EDW-C007	15-53073_CP07	29-Aug-2015	340:T1500F15U500	8.9	54.79		4496737	274551	
EDW-C008	15-53073_CP08	27-Aug-2015	374:T1500F15U500	10.0	33.63		4496731	274576	3
EDW-C009	15-53073_CP09	28-Aug-2015	340:T1500F15U500	19.9	52.17		4496476	274538	
EDW-C010	15-53073_CP10	27-Aug-2015	374:T1500F15U500	2.2	30.02		4496351	274562	
EDW-C011	15-53073_CP11	28-Aug-2015	340:T1500F15U500	22.5	47.08		4496372	274553	
EDW-C012	15-53073_SP12	28-Aug-2015	340:T1500F15U500	23.3	50.20	10	4496424	274524	
EDW-C013	15-53073_SP13	28-Aug-2015	340:T1500F15U500	22.7	56.27	11	4496386	274376	
EDW-C014	15-53073_CP14	27-Aug-2015	374:T1500F15U500	4.9	38.22		4496366	274362	
EDW-C015	15-53073_SP15	19-Aug-2015	335:T1500F15U500		8.04	2	4496447	274334	4
EDW-C015A	15-53073_SP15A	19-Aug-2015	335:T1500F15U500	12.0	40.03	8	4496435	274342	3
EDW-C016	15-53073_CP16	28-Aug-2015	374:T1500F15U500	3.8	36.91		4496442	274308	
EDW-C017	15-53073_SP17	27-Aug-2015	340:T1500F15U500	24.2	55.94	12	4496775	274137	
EDW-C019	15-53073_CP19	27-Aug-2015	340:T1500F15U500	6.5	53.31		4496825	274184	
EDW-C021	15-53073_CP21	27-Aug-2015	340:T1500F15U500	13.0	49.38		4497046	274071	3
EDW-C022	15-53073_SP22	26-Aug-2015	374:T1500F15U500	6.7	20.01	4	4497185	274108	
EDW-C023	15-53073_CP23	27-Aug-2015	340:T1500F15U500	15.1	40.68		4497364	274147	
EDW-C025	15-53073_CP25	25-Aug-2015	374:T1500F15U500	6.0	20.01		4497285	274315	
EDW-C026	15-53073_SP26	26-Aug-2015	374:T1500F15U500	7.2	14.27	3	4497062	274334	
EDW-C026B	15-53073_SP26B	26-Aug-2015	374:T1500F15U500	6.8	14.60	2	4497064	274335	
EDW-C027	15-53073_CP27	25-Aug-2015	374:T1500F15U500	7.4	40.03		4496687	274266	
Totals	24 soundings				929.12	68			

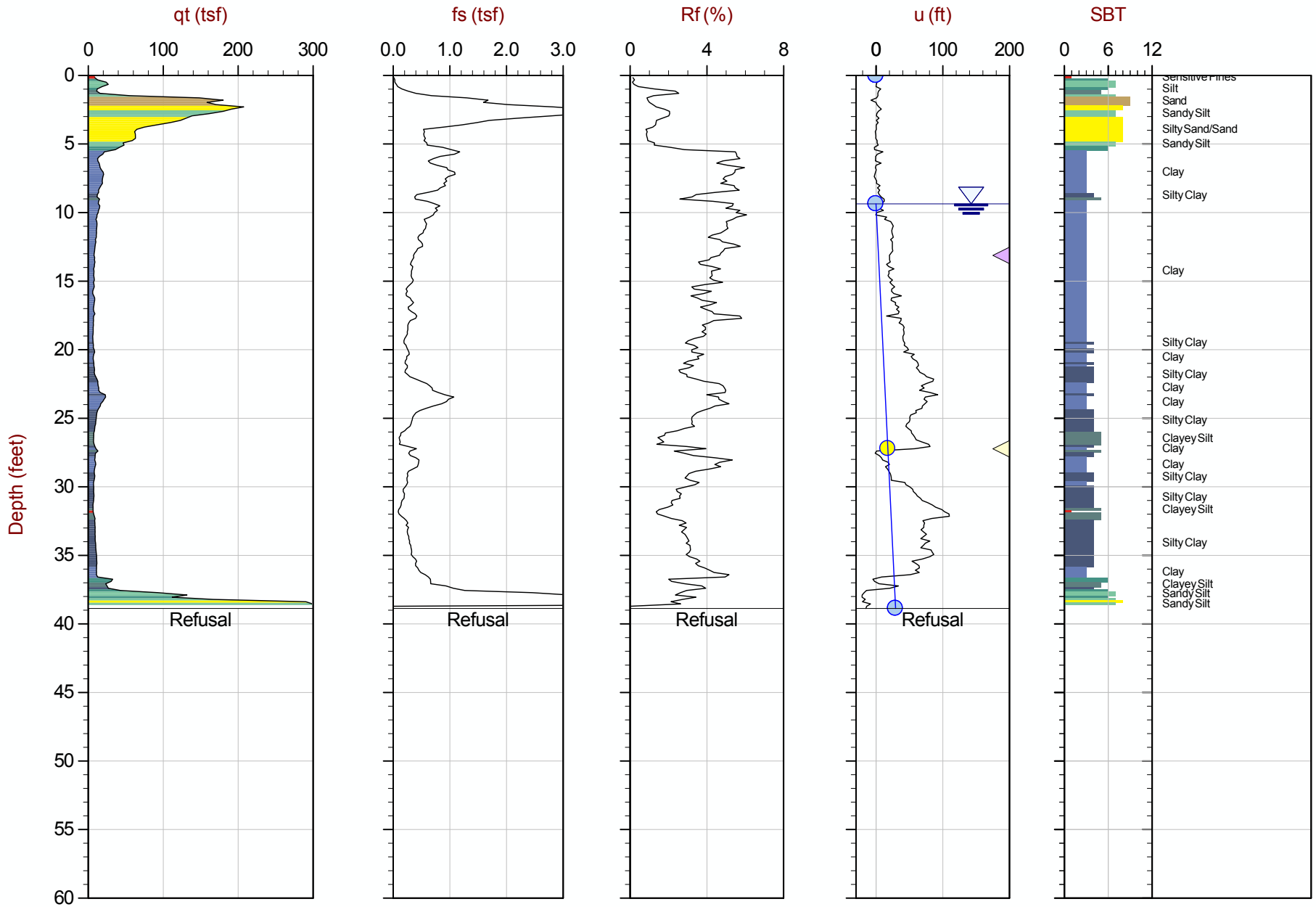
1. Assumed phreatic surface depths were determined from the pore pressure data unless otherwise noted. Hydrostatic data were used for calculated parameters.
2. Coordinates are WGS 84 / UTM Zone 16 and were collected using a handheld GPS Receiver.
3. Assumed phreatic surface estimated from dynamic pore pressure response.
4. No phreatic surface detected

CONETEC

AECOM

Job No: 15-53073
Date: 08:19:15 13:46
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C001
Cone: 374:T1500F15U500



Max Depth: 11.850 m / 38.88 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP01.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497502m E: 274312m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

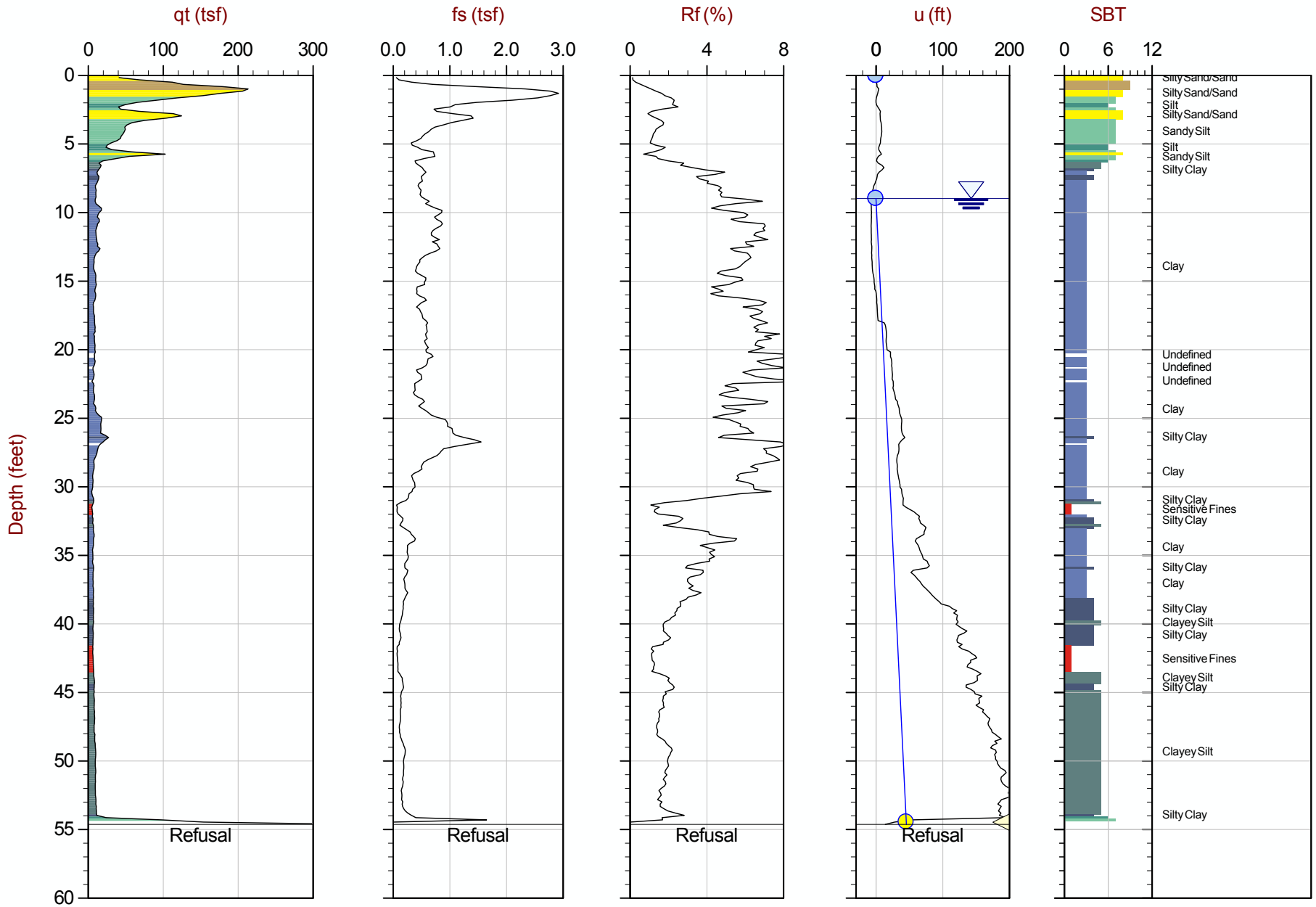
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 15:22
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C003
Cone: 340:T1500F15U500



Max Depth: 16.650 m / 54.63 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP03.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497325m E: 274377m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

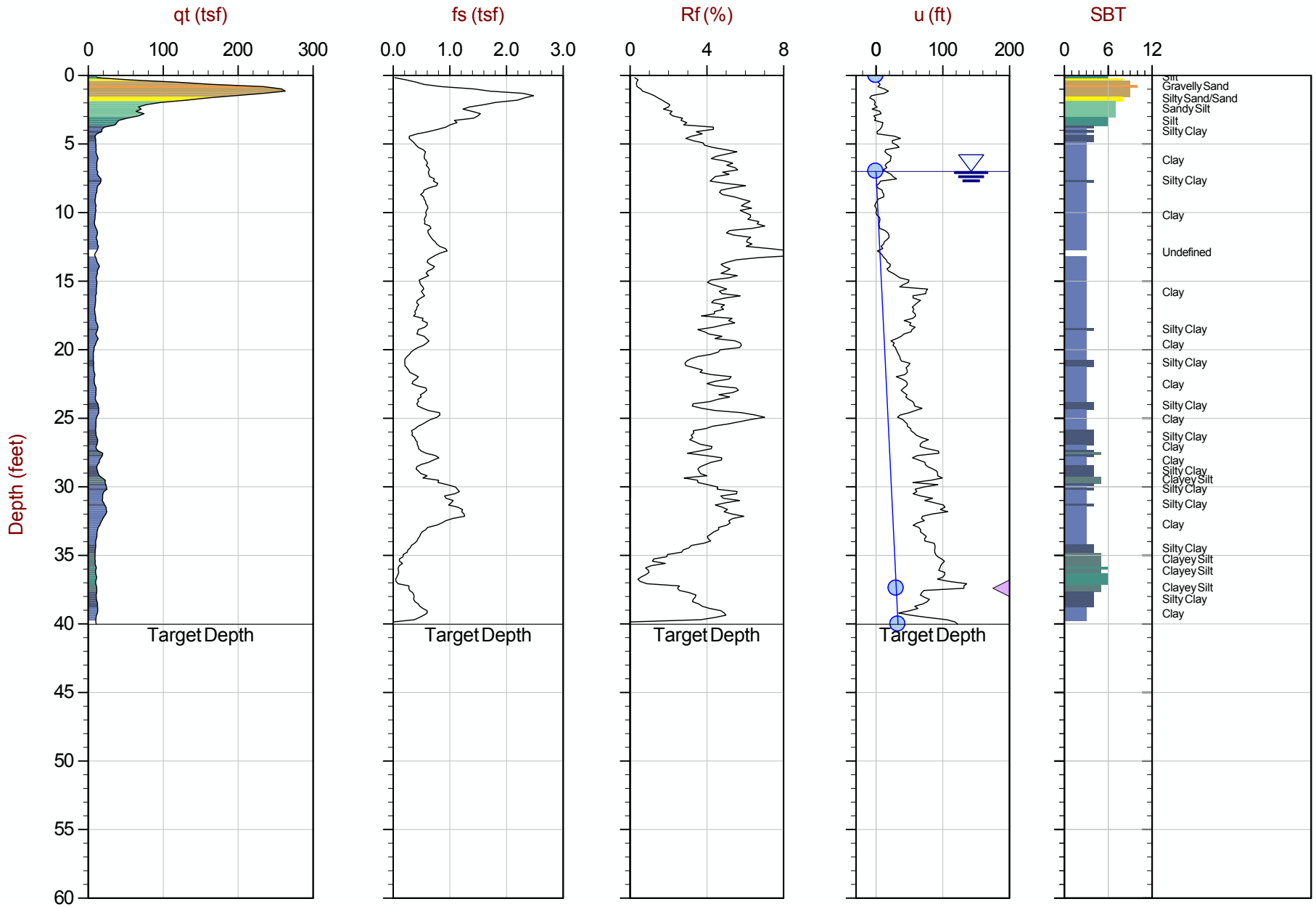
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:26:15 15:05
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C005
Cone: 374:T1500F15U500



Max Depth: 12.200 m / 40.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP05.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497026m E: 274468m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

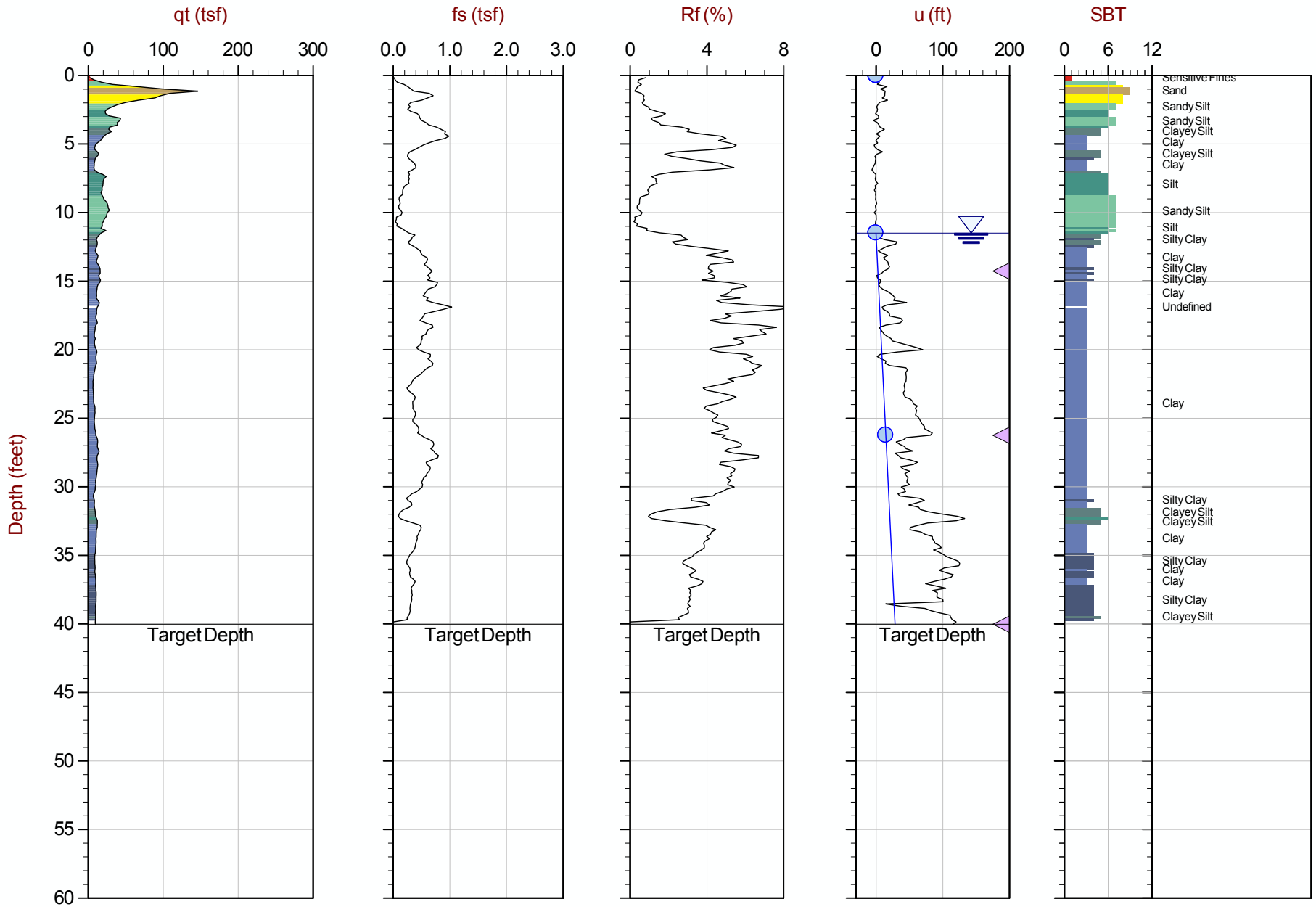
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:25:15 15:52
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C006
Cone: 374:T1500F15U500



Max Depth: 12.200 m / 40.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP06.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496880m E: 274500m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

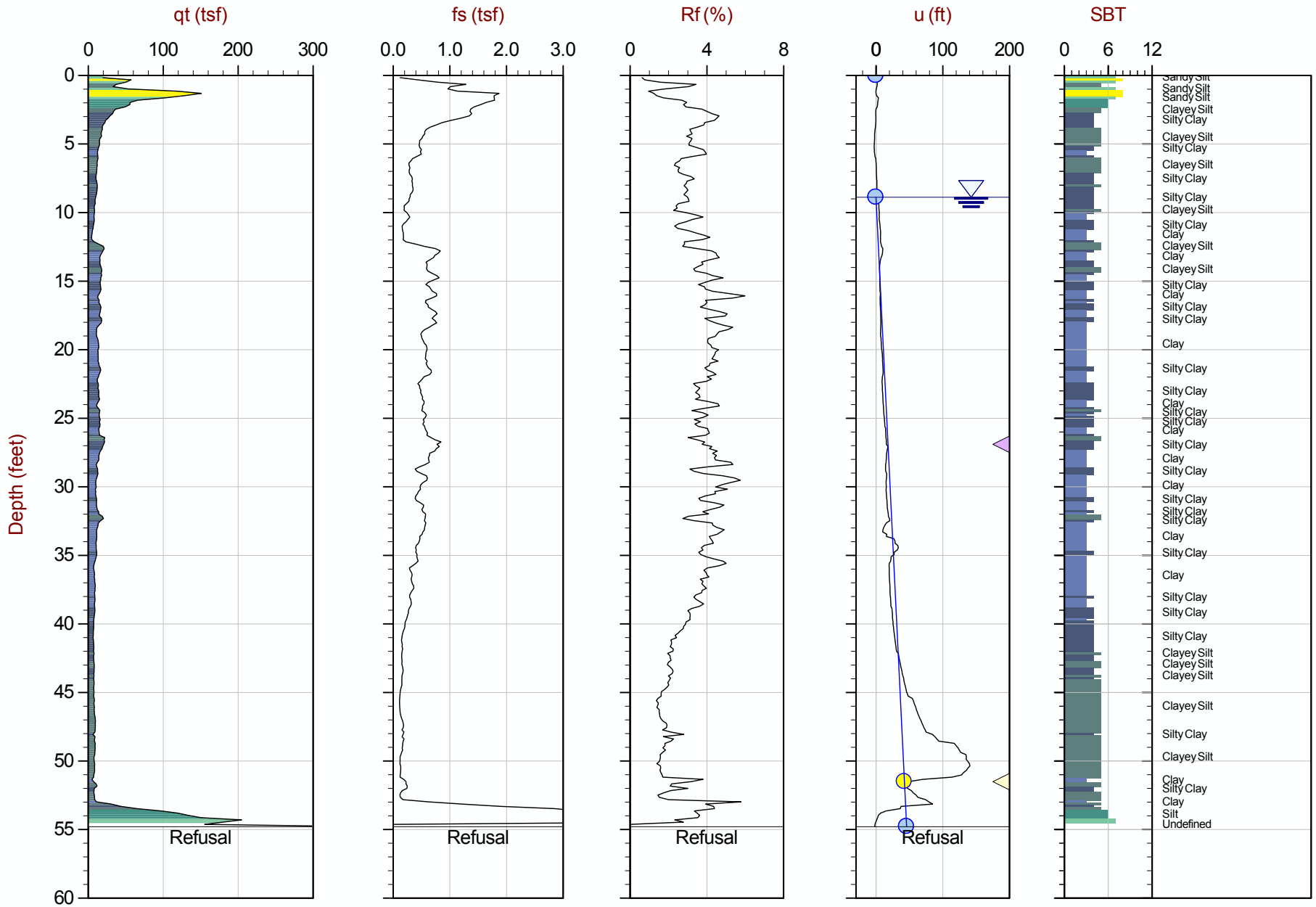
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:29:15 09:19
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C007
Cone: 340:T1500F15U500



Max Depth: 16.700 m / 54.79 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP07.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496736m E: 274551m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

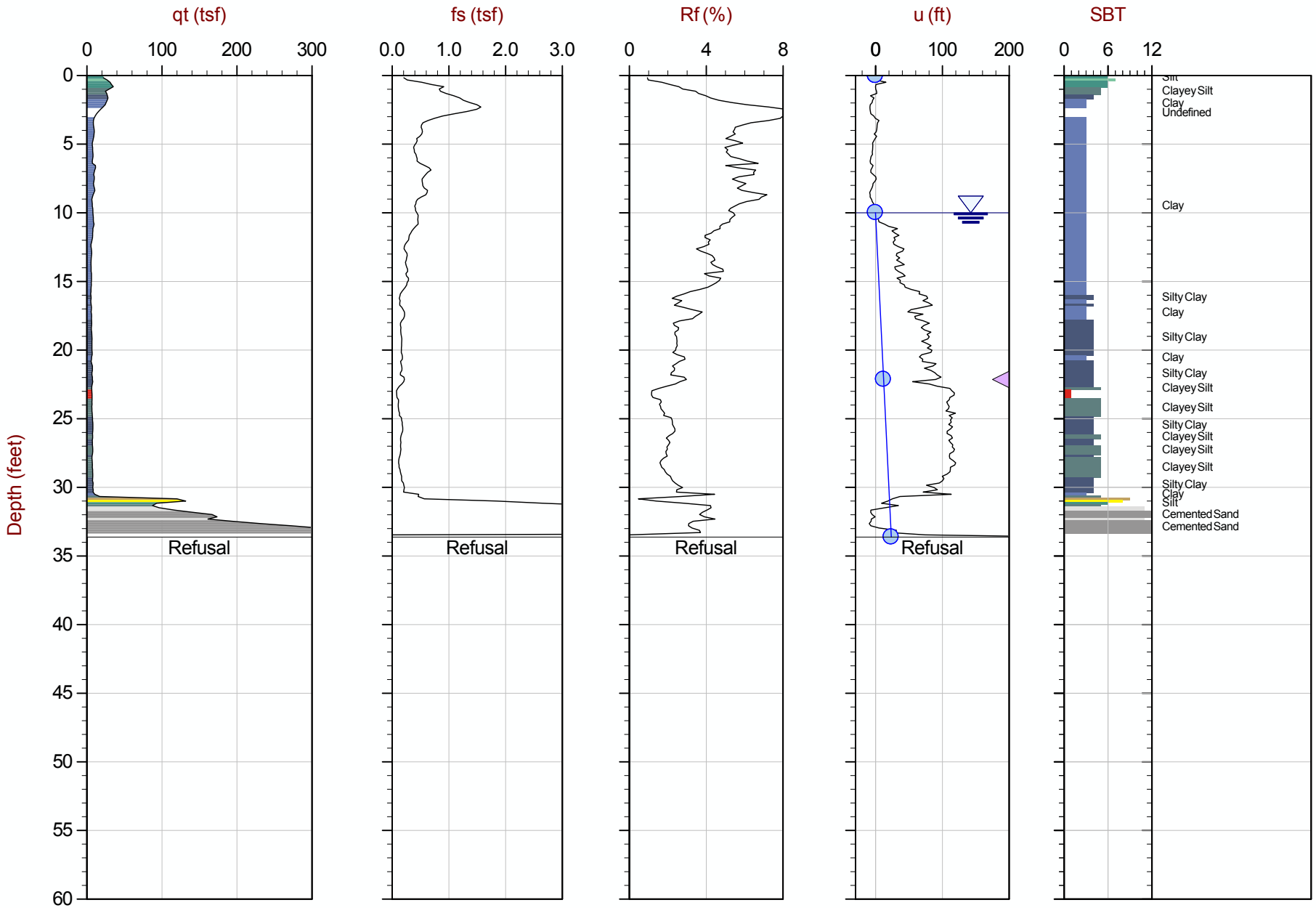
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 08:50
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C008
Cone: 374:T1500F15U500



Max Depth: 10.250 m / 33.63 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP08.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496731m E: 274576m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

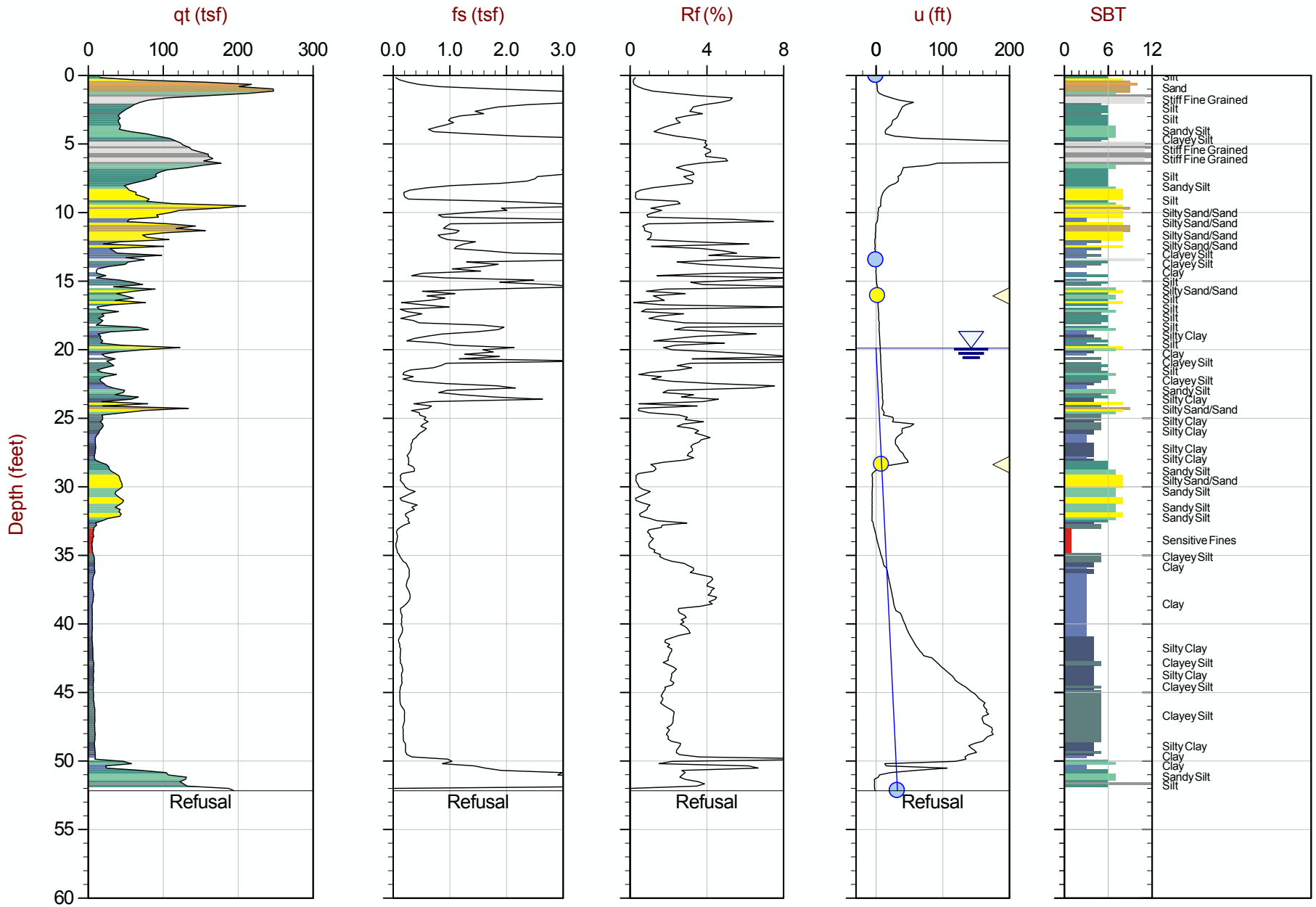
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:28:15 16:08
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C009
Cone: 340:T1500F15U500



Max Depth: 15.900 m / 52.16 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP09.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496476m E: 274538m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

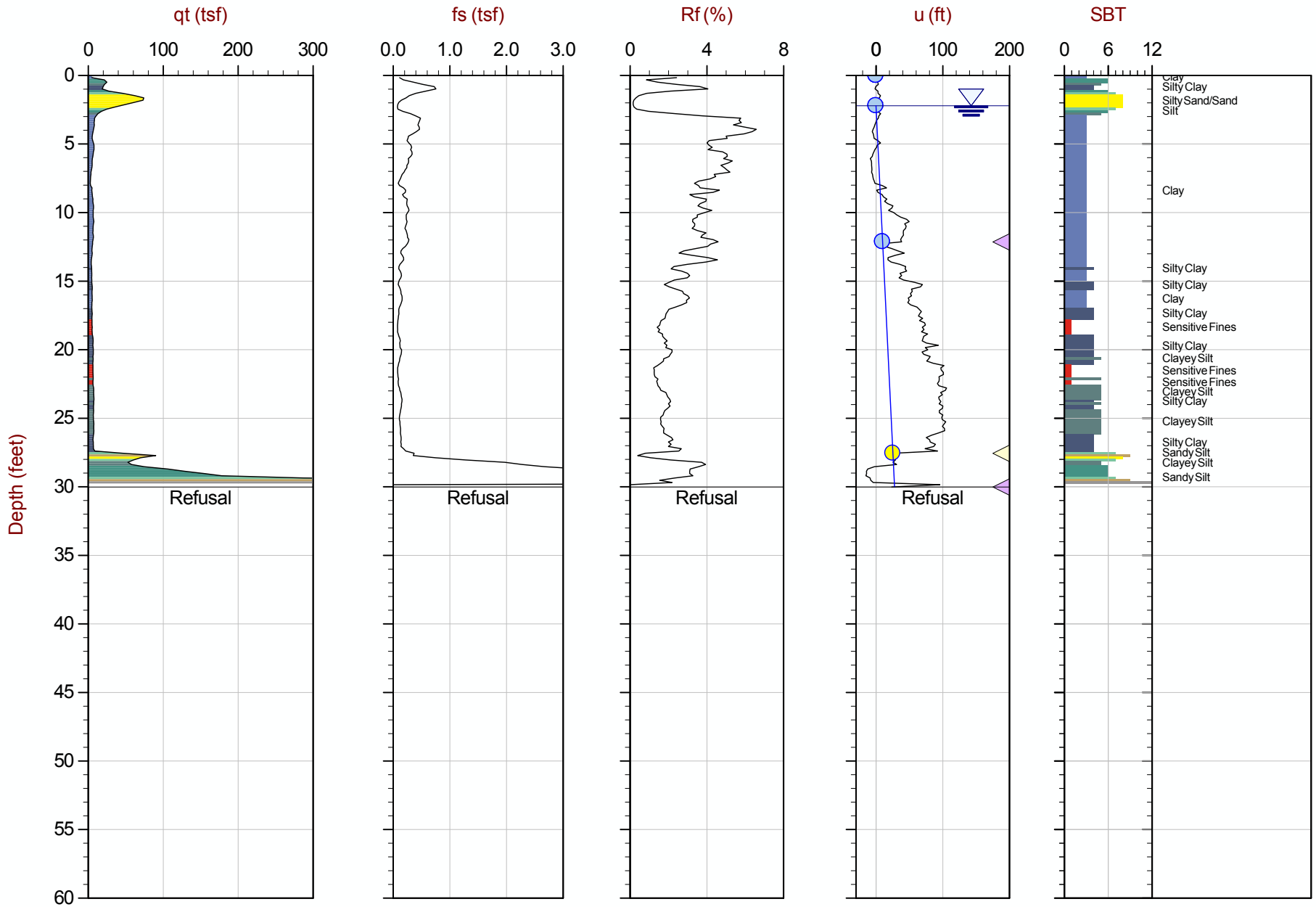
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 12:10
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C010
Cone: 374:T1500F15U500



Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP10.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496351m E: 274562m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

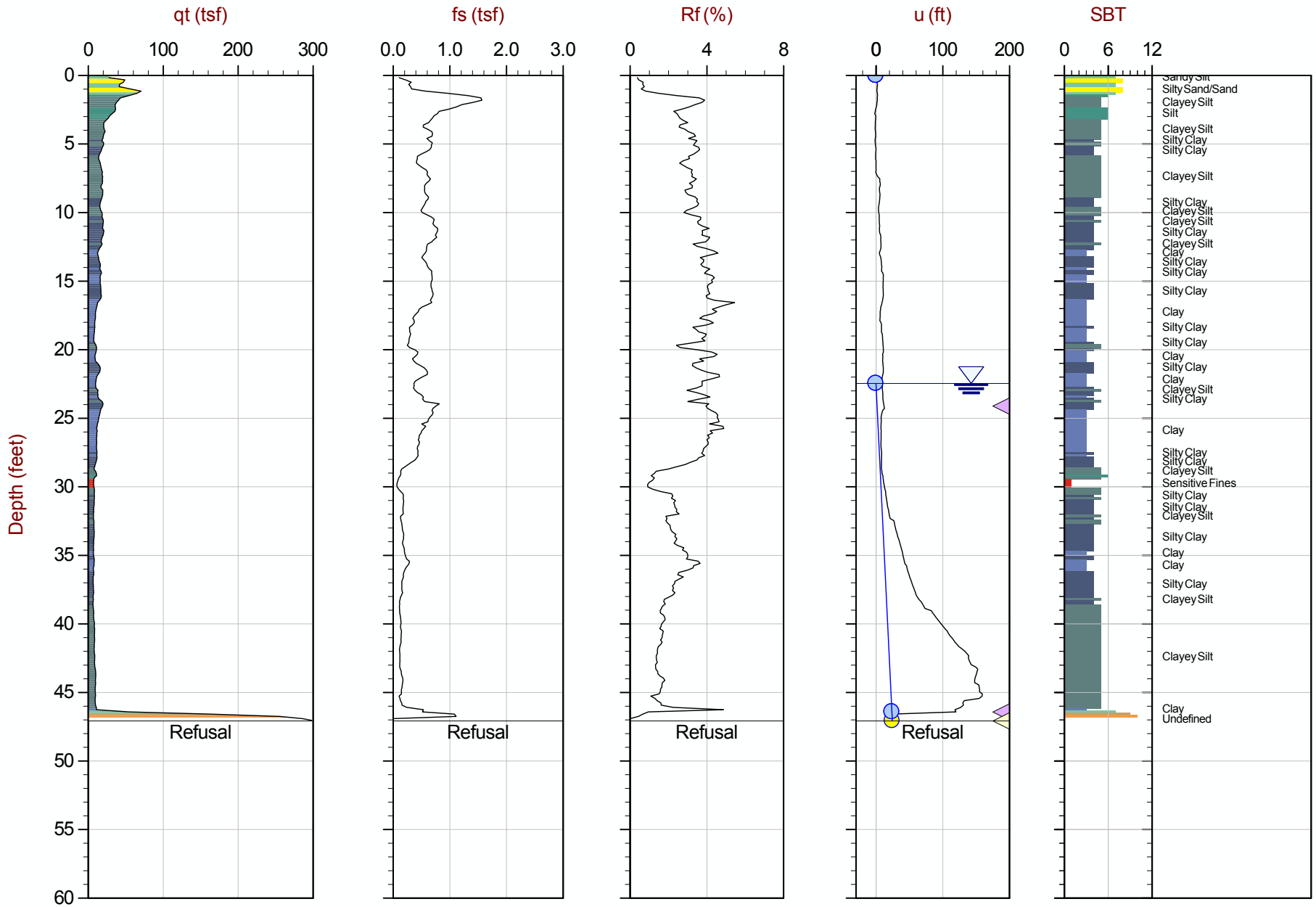
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:28:15 10:19
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C011
Cone: 340:T1500F15U500



Max Depth: 14.350 m / 47.08 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP11.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496372m E: 274553m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

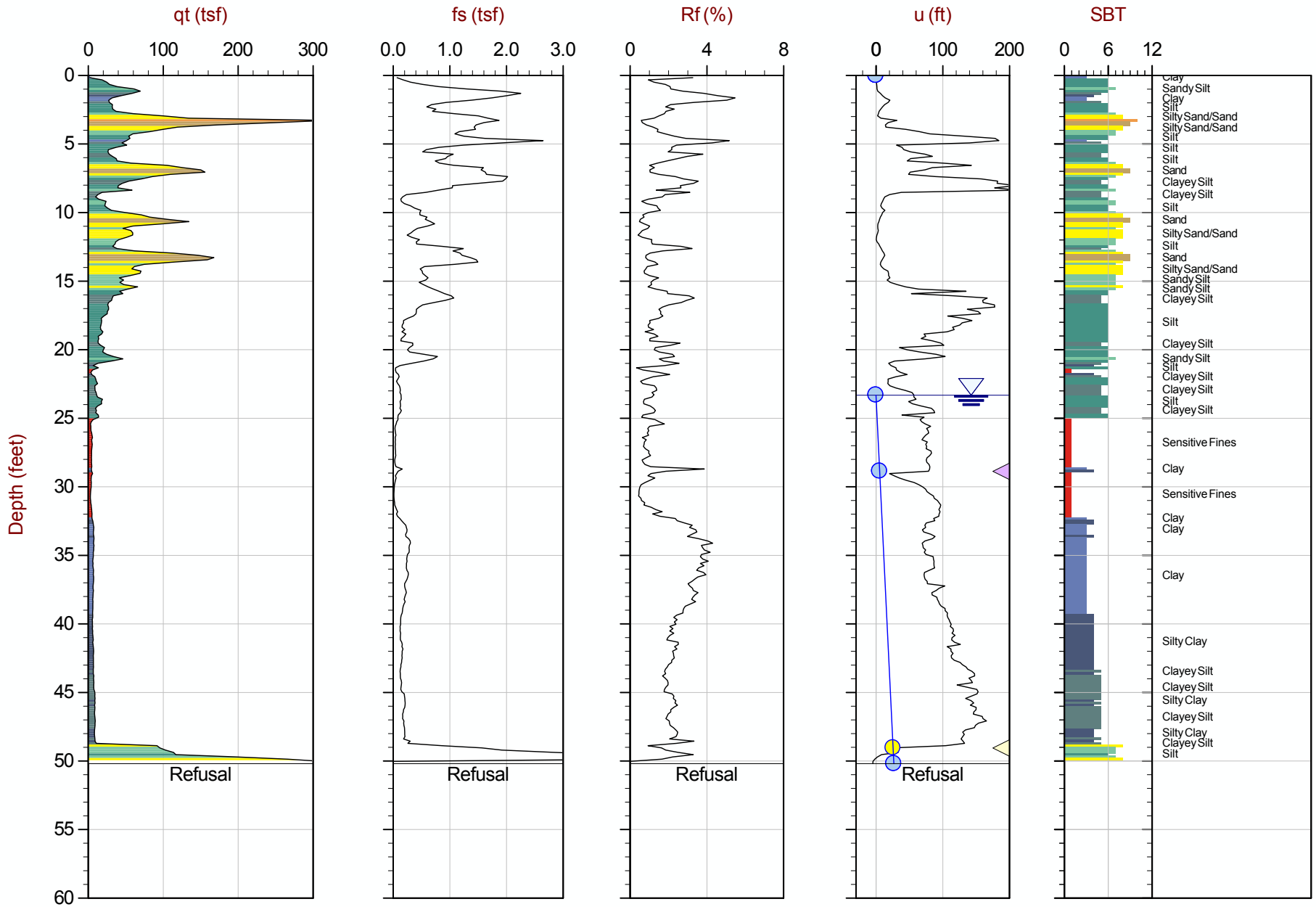
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:28:15 14:27
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C012
Cone: 340:T1500F15U500



Max Depth: 15.300 m / 50.20 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP12.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496424m E: 274524m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

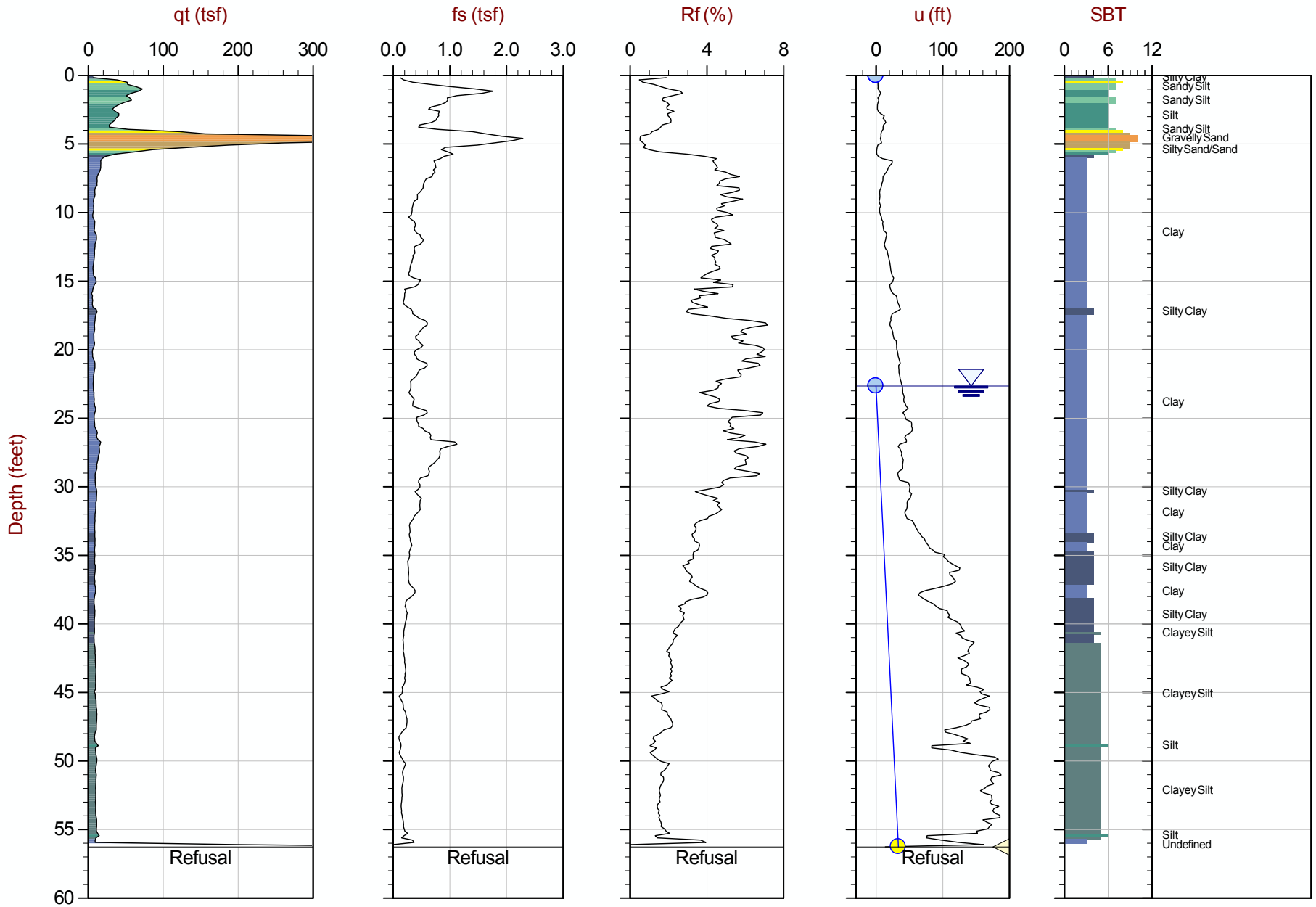
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:28:15 08:45
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C013
Cone: 340:T1500F15U500



Max Depth: 17.150 m / 56.27 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP13.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496386m E: 274376m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

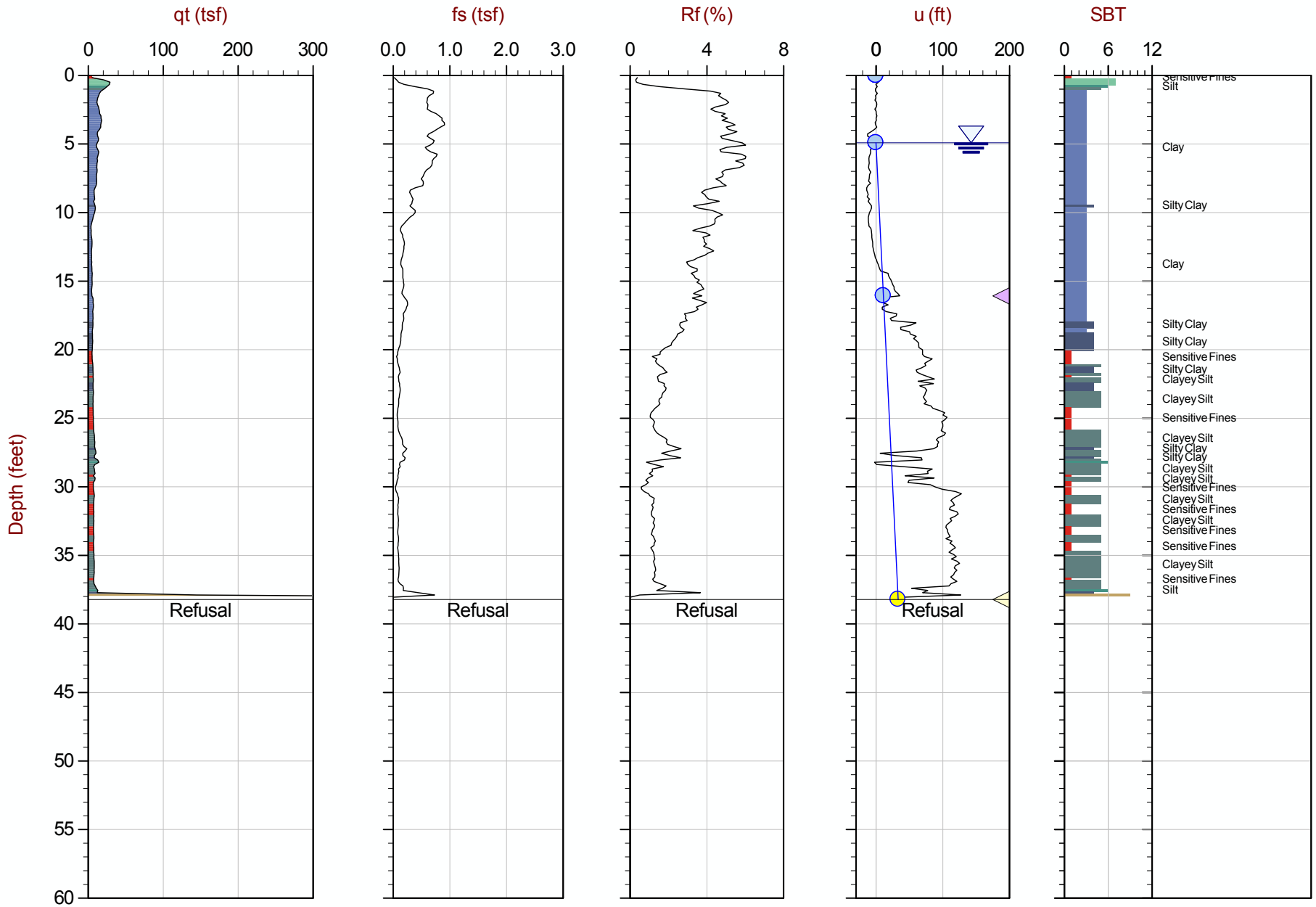
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 14:29
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C014
Cone: 374:T1500F15U500



Max Depth: 11.650 m / 38.22 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP14.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496366m E: 274362m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

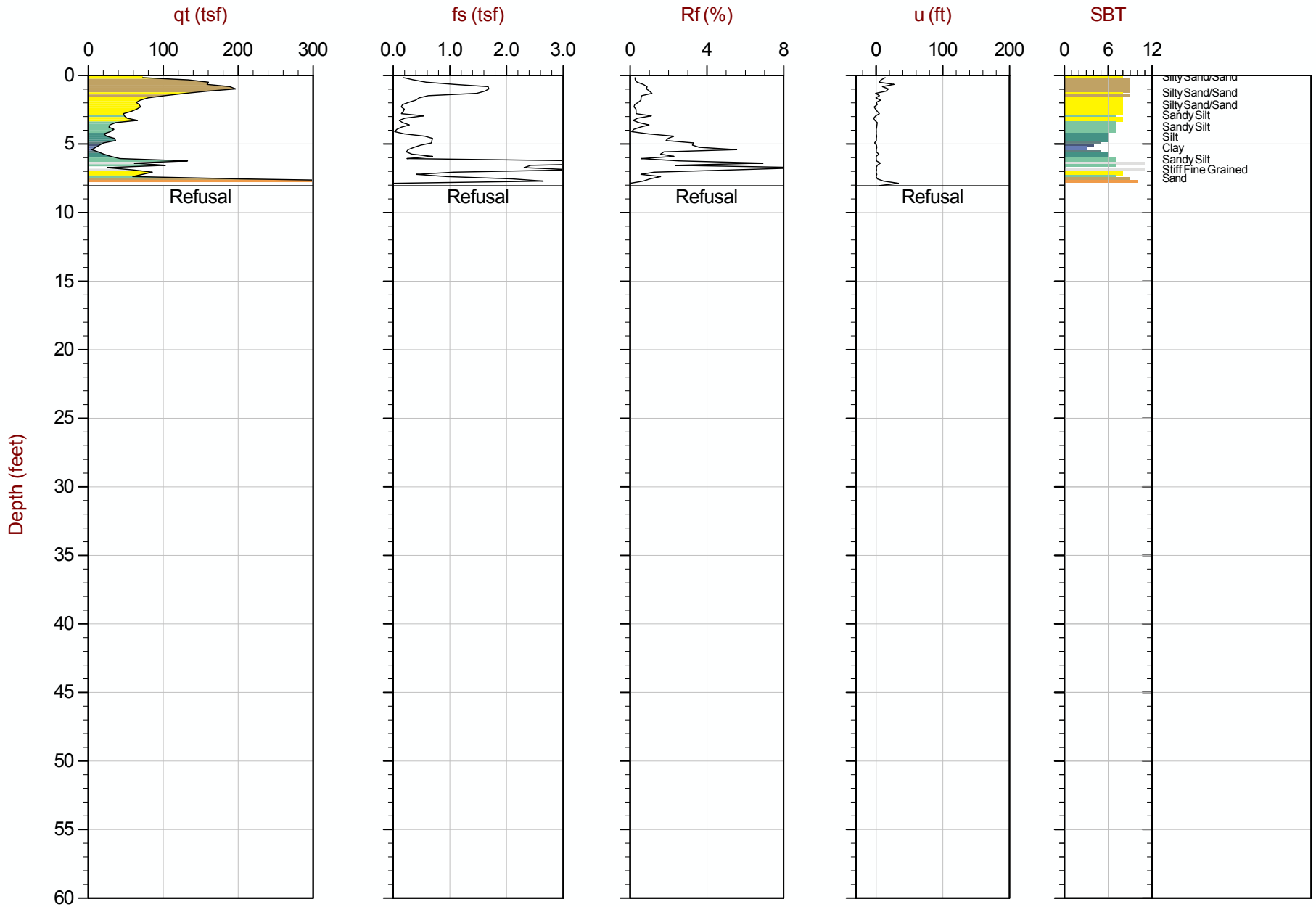
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:19:15 13:31
Site: Edwards Power Station

Sounding: EDW-C015
Cone: 335:T1500F15U500



Max Depth: 2.450 m / 8.04 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP15.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496447m E: 274334m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

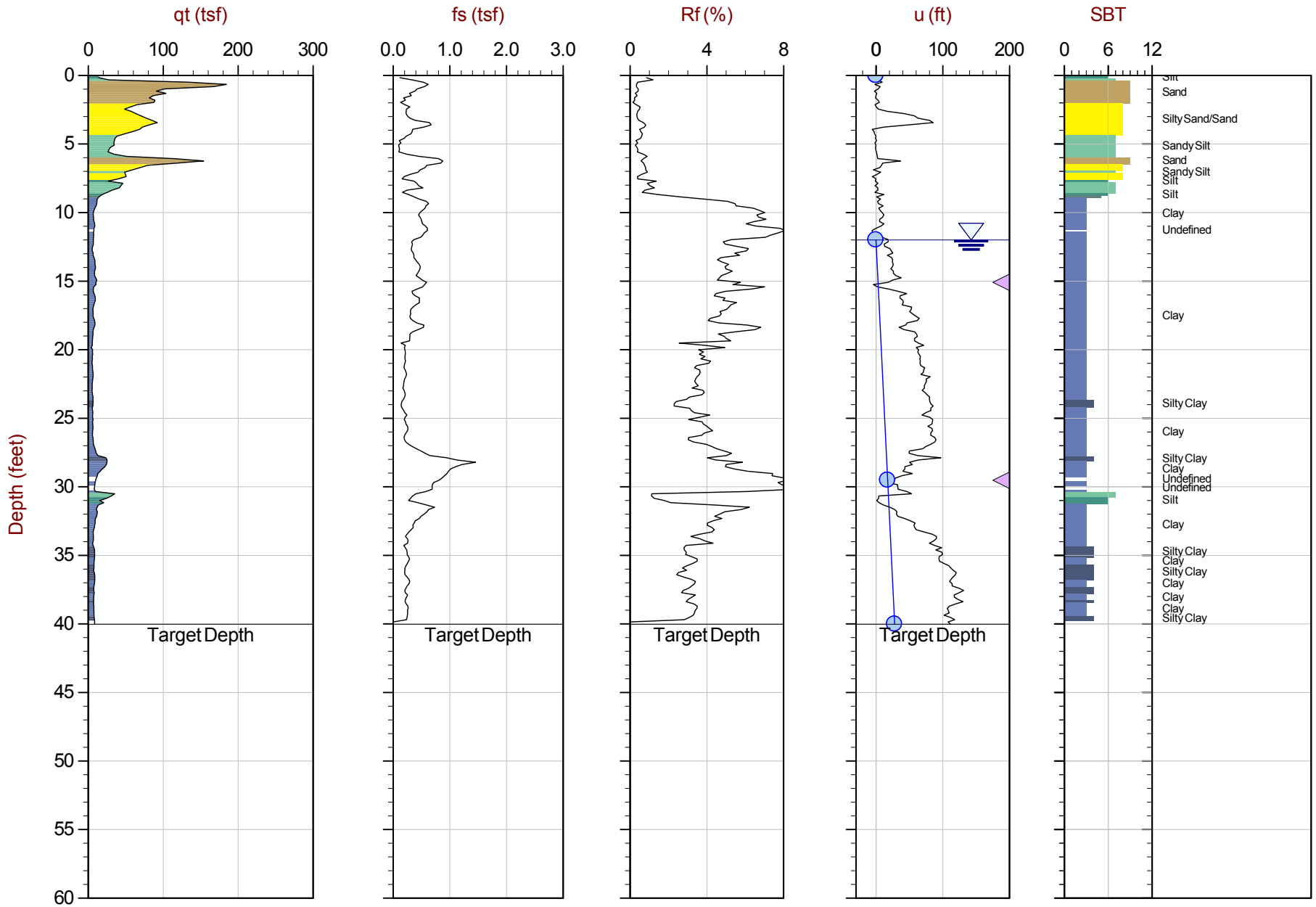
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:19:15 14:12
Site: Edwards Power Station

Sounding: EDW-C015A
Cone: 335:T1500F15U500



Max Depth: 12.200 m / 40.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP15A.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496435m E: 274342m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

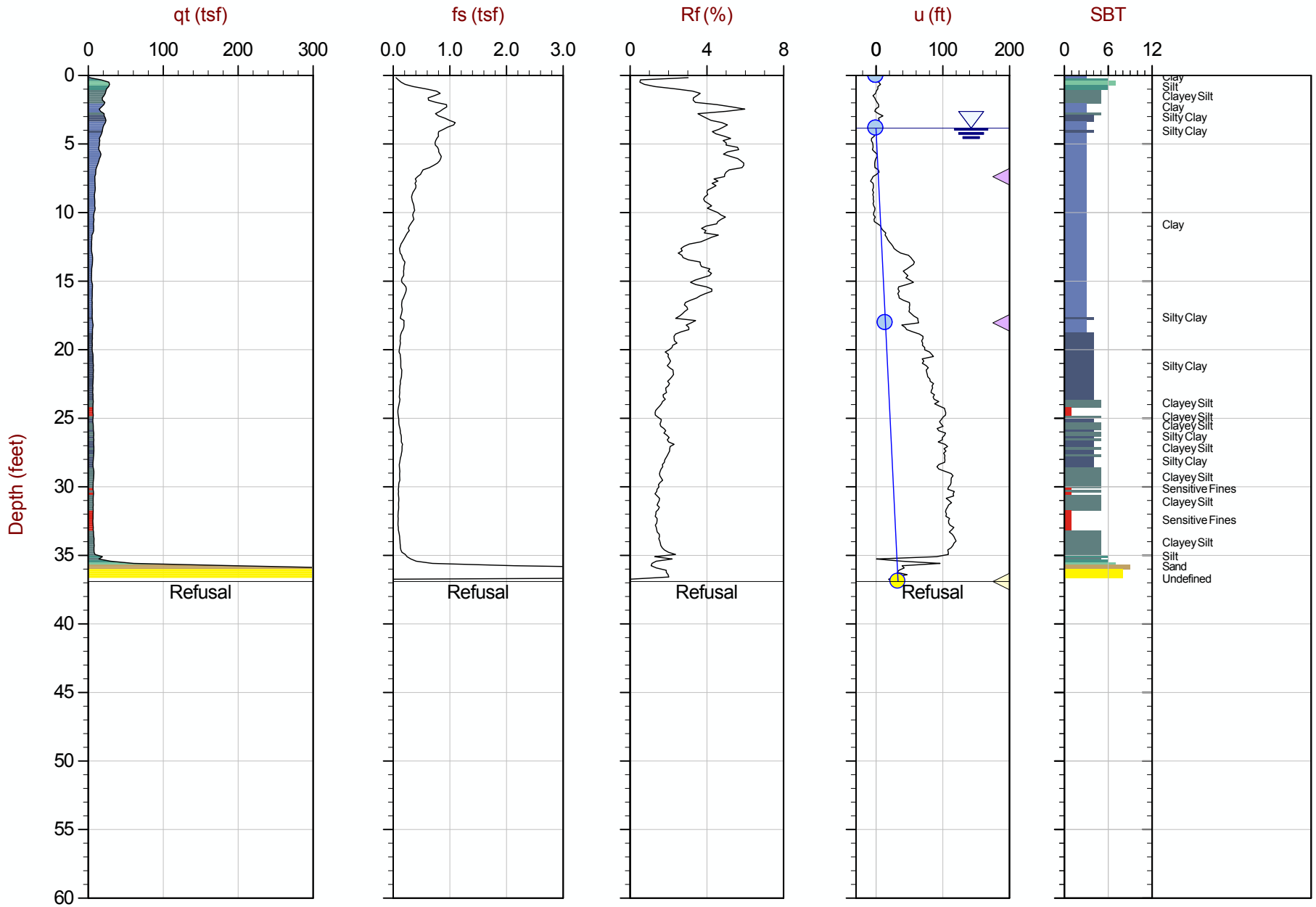
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:28:15 08:46
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C016
Cone: 374:T1500F15U500



Max Depth: 11.250 m / 36.91 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP16.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496442m E: 274308m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

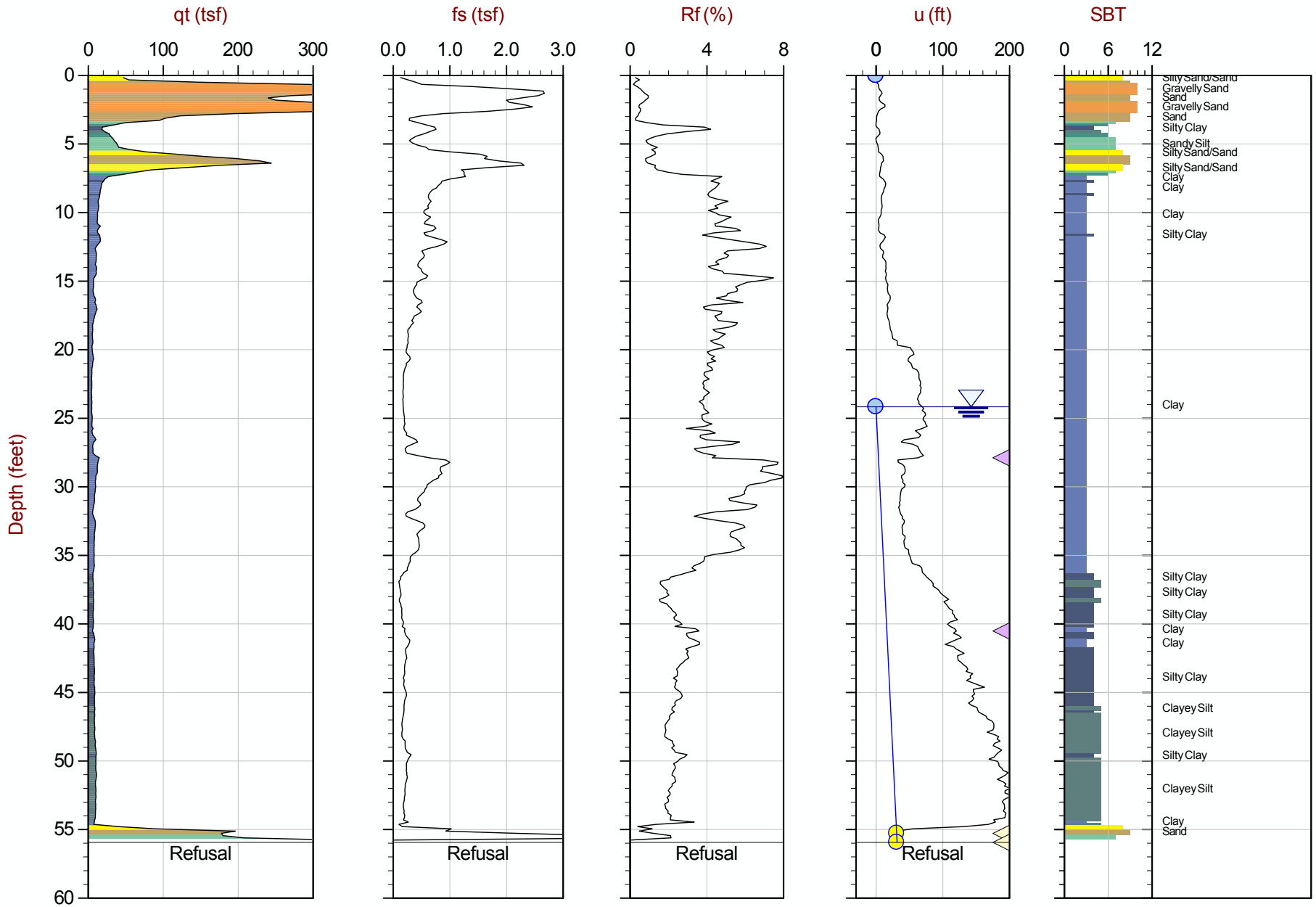
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 11:13
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C017
Cone: 340:T1500F15U500



Max Depth: 17.050 m / 55.94 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP17.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496775m E: 274137m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

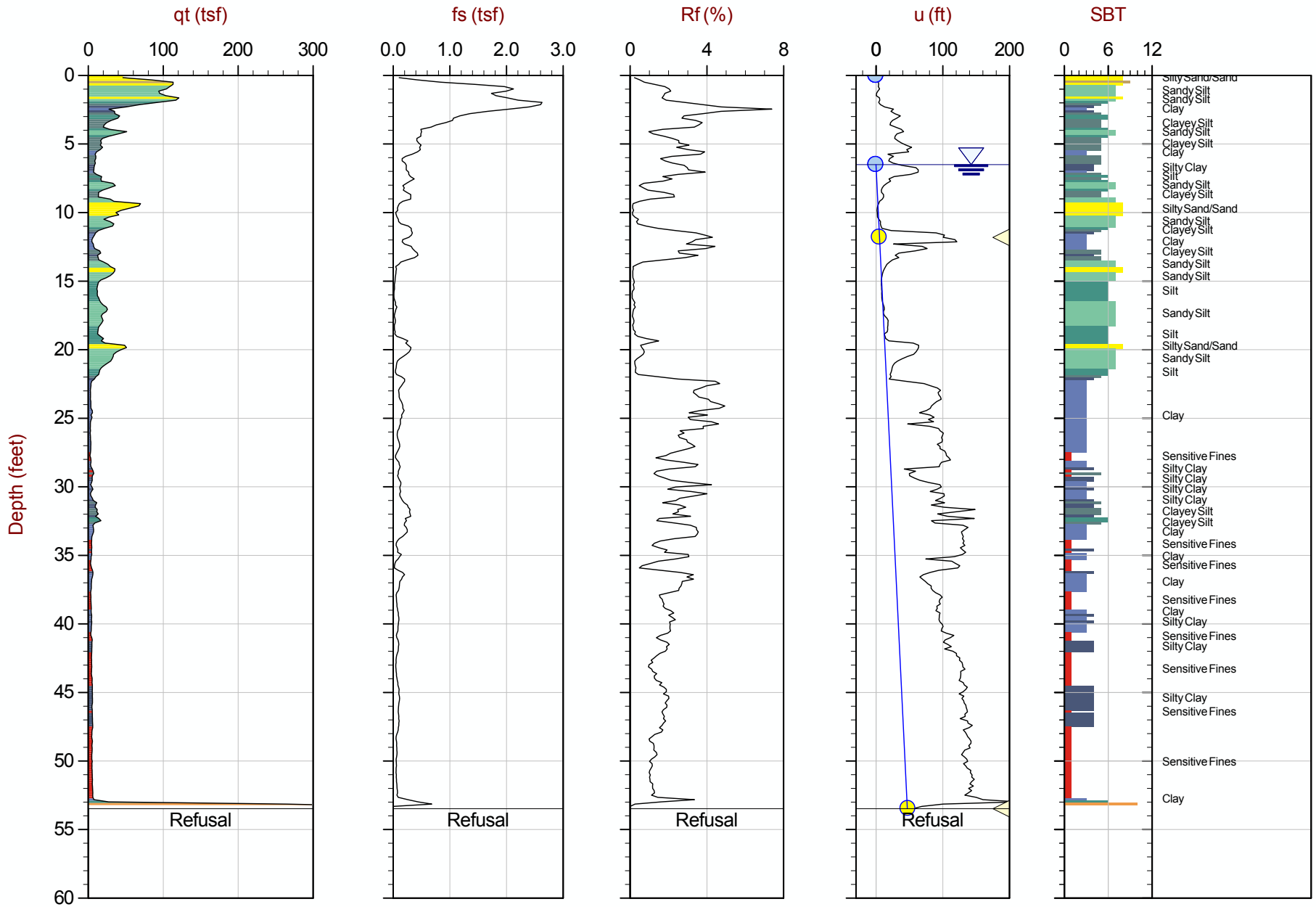
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 15:23
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C019
Cone: 340:T1500F15U500



Max Depth: 16.300 m / 53.48 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP19.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496825m E: 274184m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

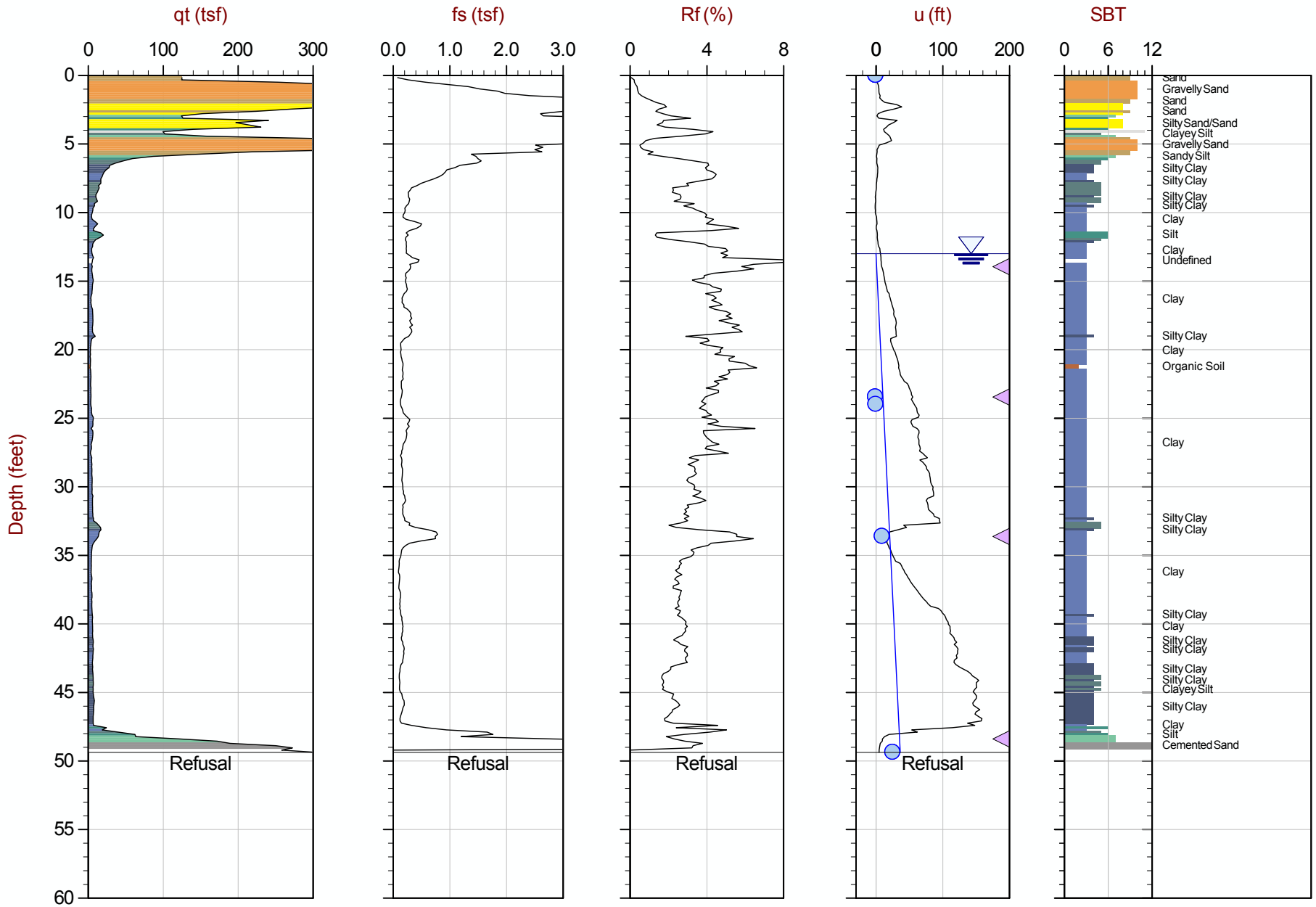
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 13:27
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C021
Cone: 340:T1500F15U500



Max Depth: 15.050 m / 49.38 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP21.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497046m E: 274071m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

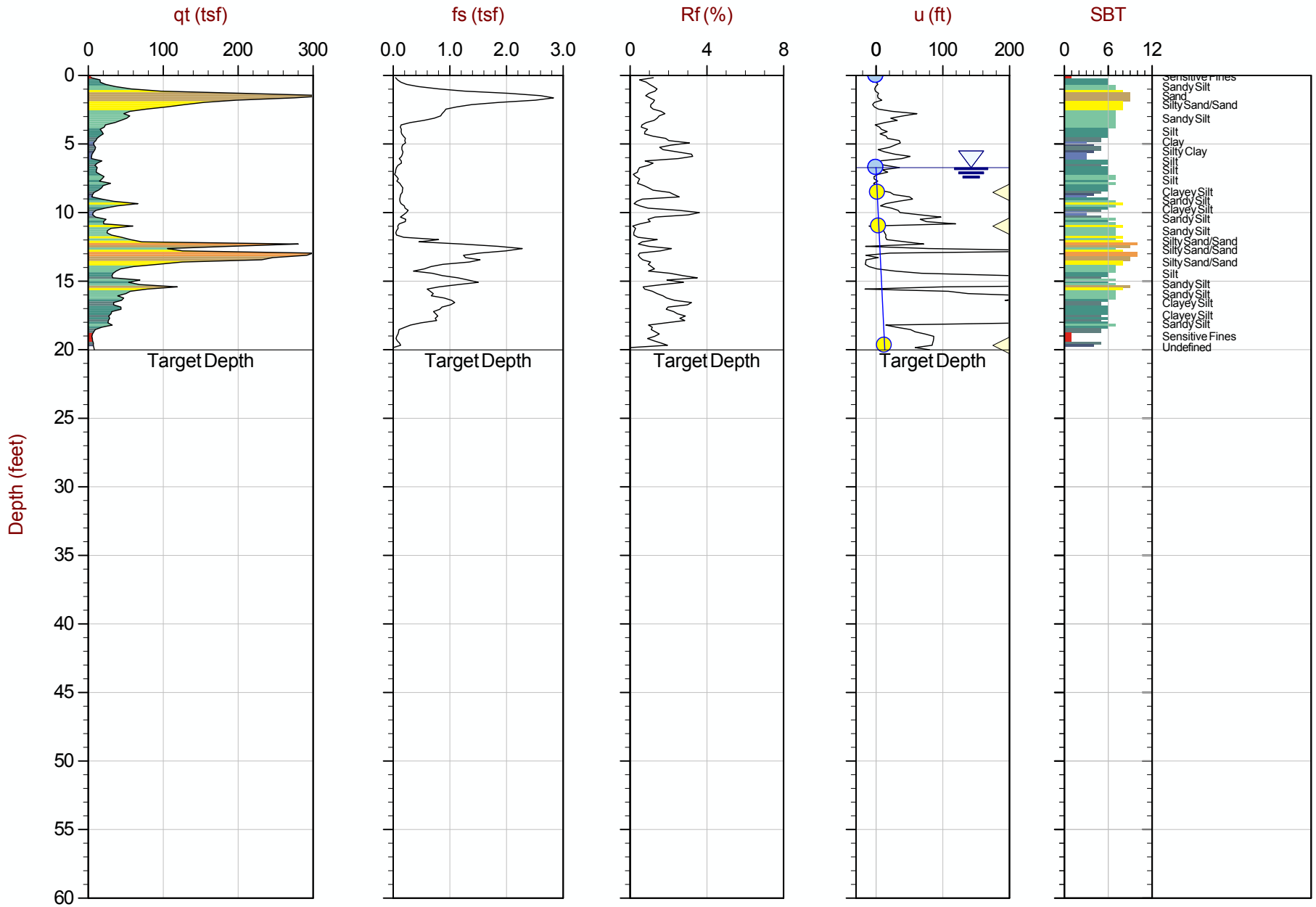
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:26:15 10:35
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C022
Cone: 374:T1500F15U500



Max Depth: 6.100 m / 20.01 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP22.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497185m E: 274108m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

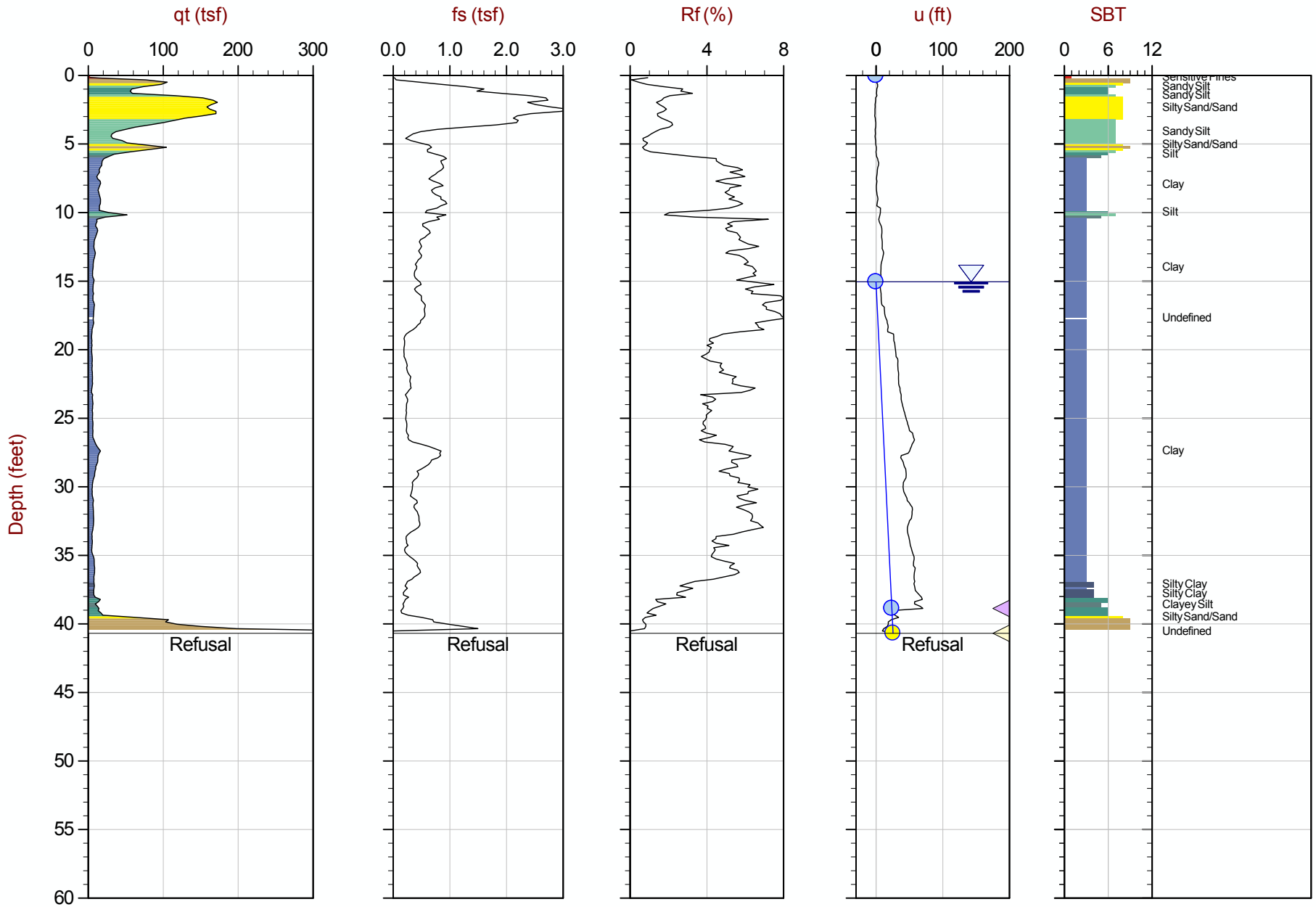
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 08:52
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C023
Cone: 340:T1500F15U500



Max Depth: 12.400 m / 40.68 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP23.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497364m E: 274147m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

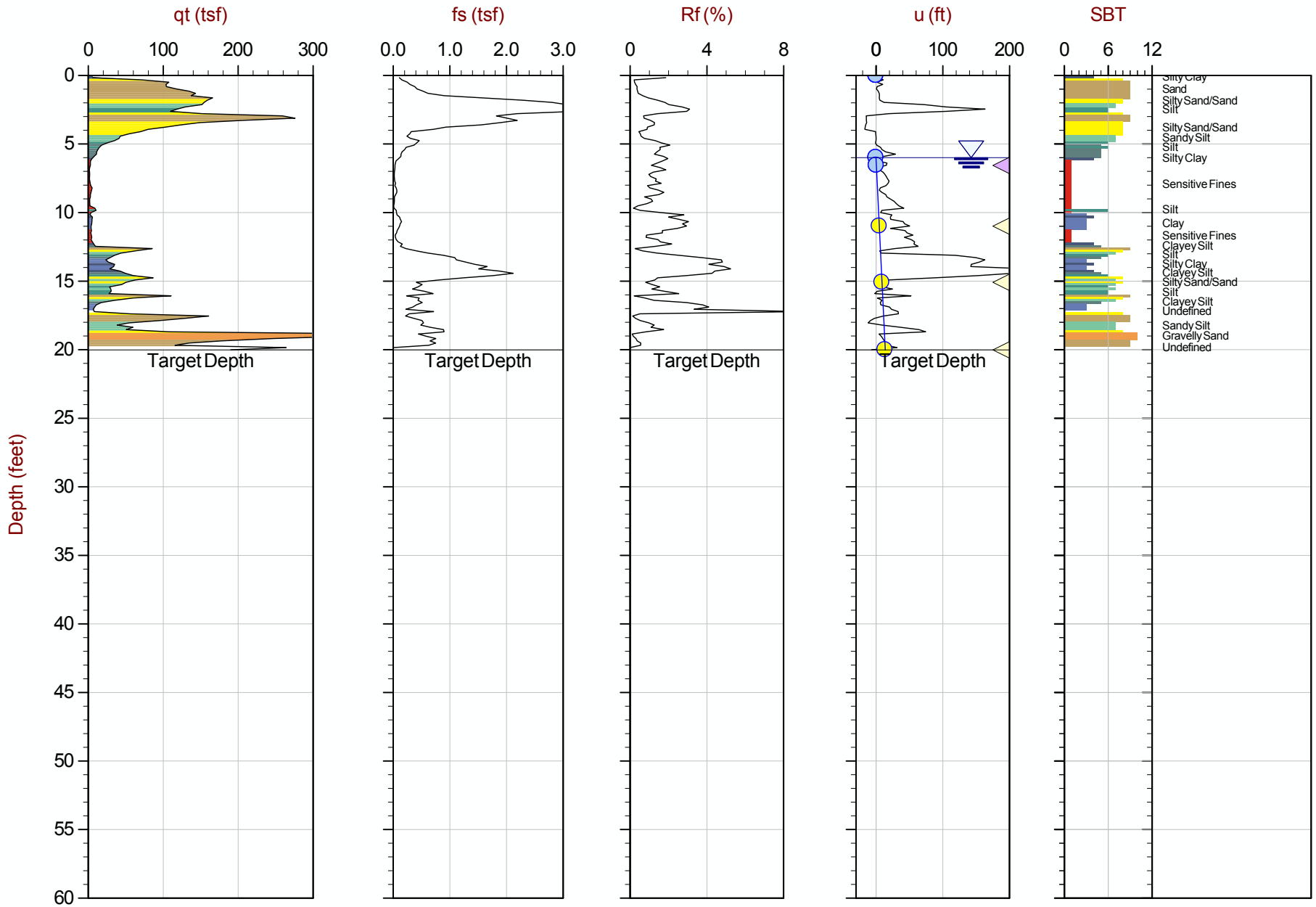
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:25:15 13:44
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C025
Cone: 374:T1500F15U500



Max Depth: 6.100 m / 20.01 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP25.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497285m E: 274315m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

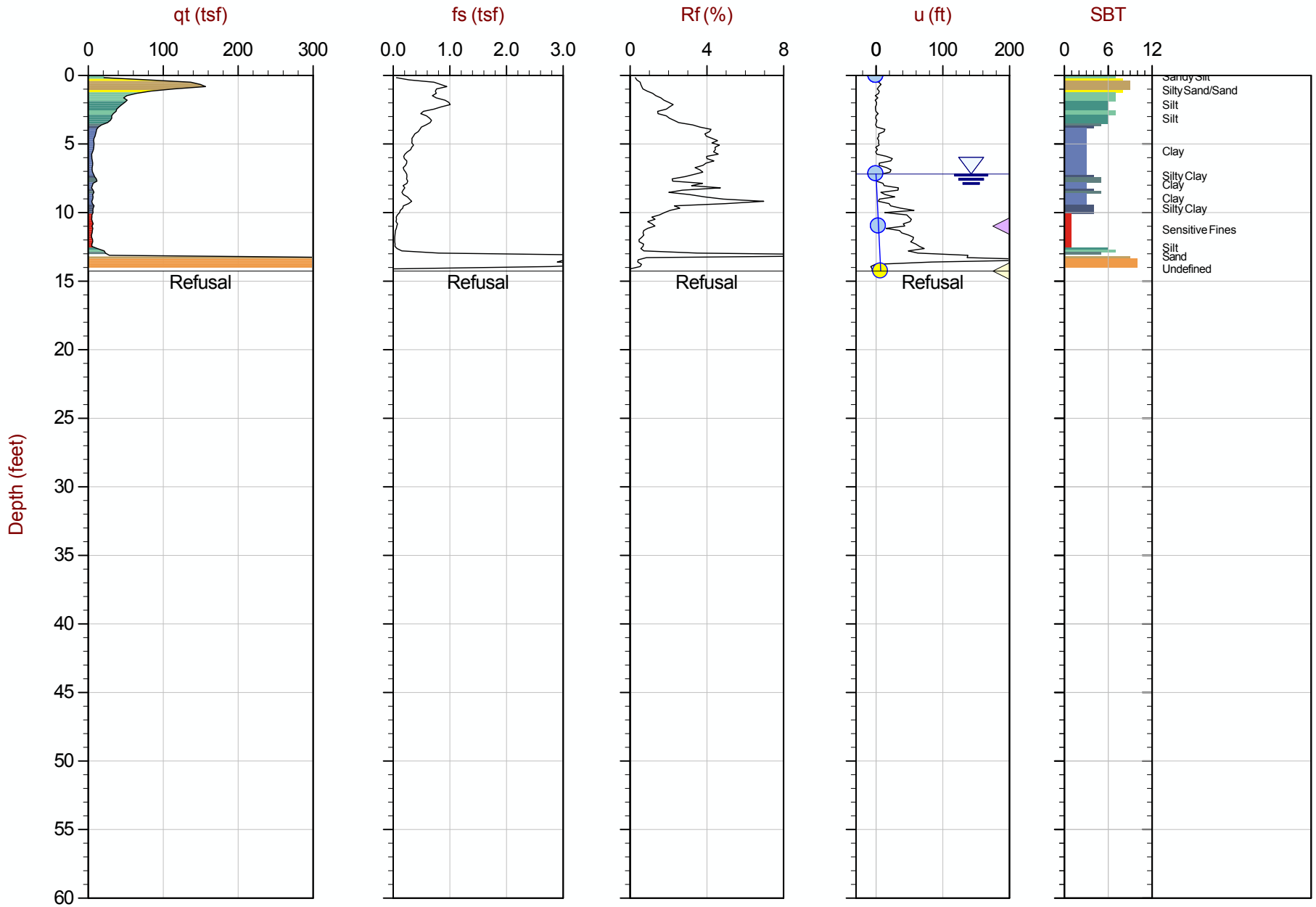
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:26:15 12:20
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C026
Cone: 374:T1500F15U500



Max Depth: 4.350 m / 14.27 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP26.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497062m E: 274334m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

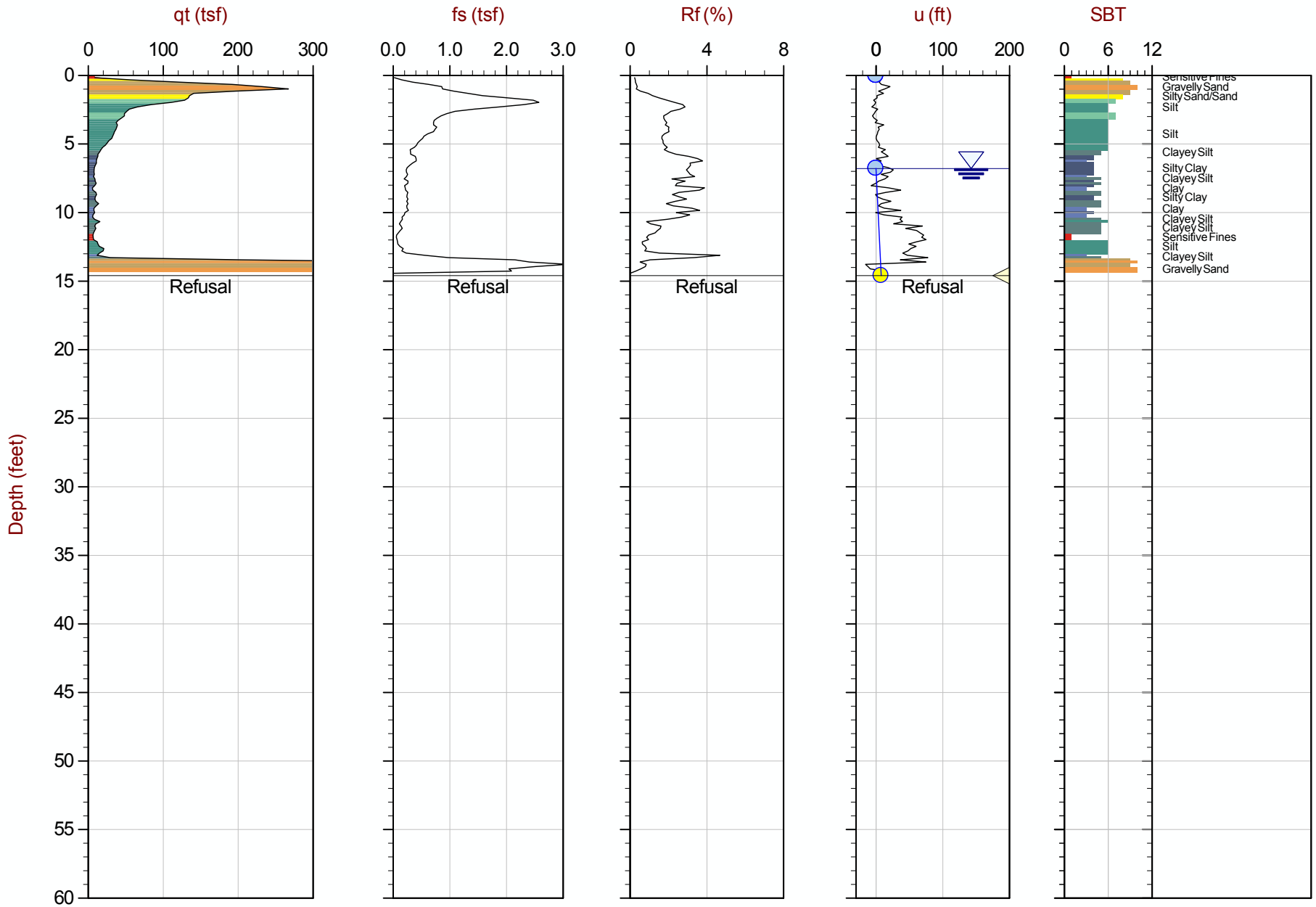
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:26:15 14:00
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C026B
Cone: 374:T1500F15U500



Max Depth: 4.450 m / 14.60 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP26B.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497064m E: 274335m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

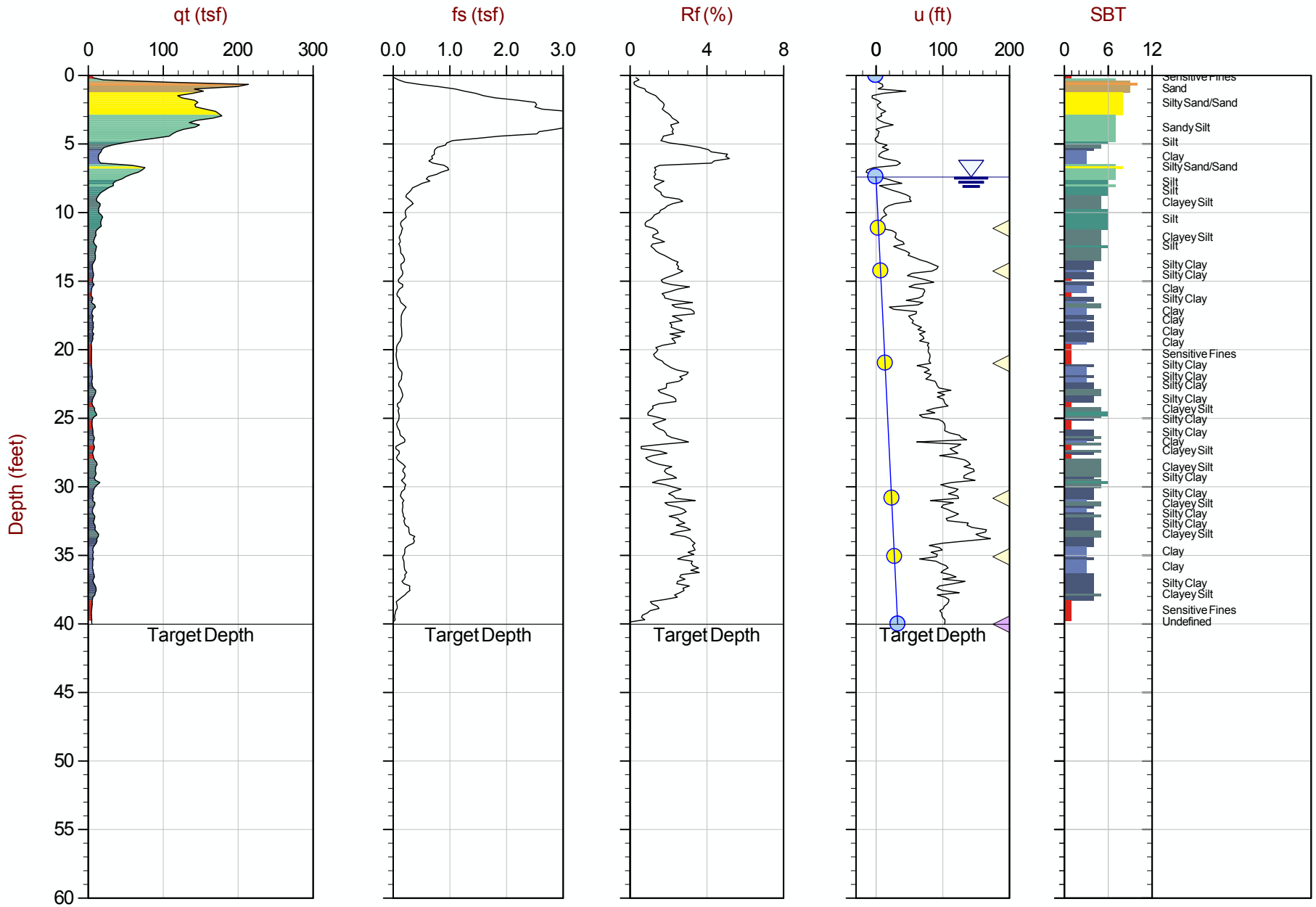
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:25:15 11:00
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C027
Cone: 374:T1500F15U500



Max Depth: 12.200 m / 40.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_CP27.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496687m E: 274266m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Seismic Cone Penetration Test Plots

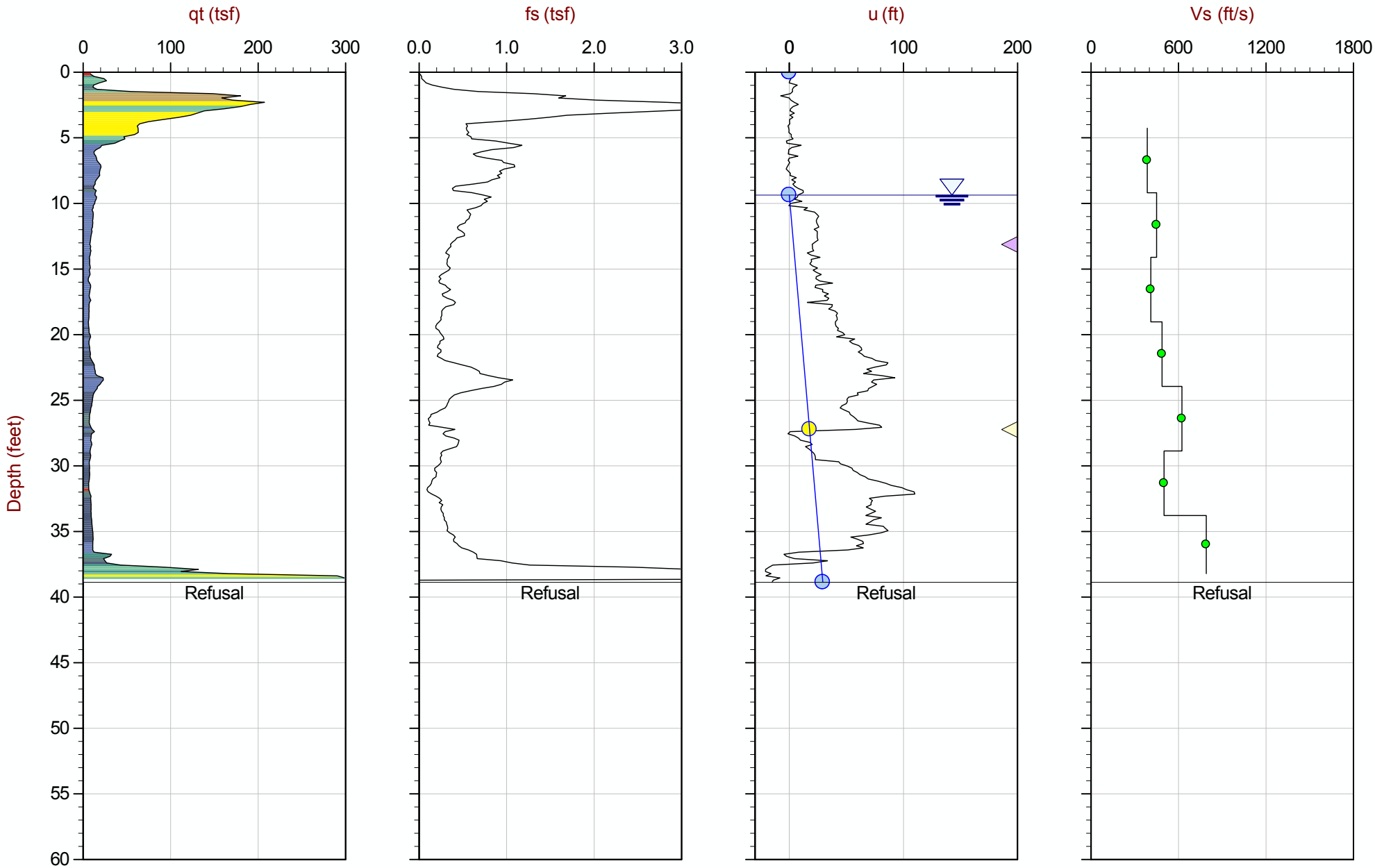
CONETEC

CONETEC

AECOM

Job No: 15-53073
Date: 08:19:15 13:46
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C001
Cone: 374:T1500F15U500



Max Depth: 11.850 m / 38.88 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP01.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497502m E: 274312m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

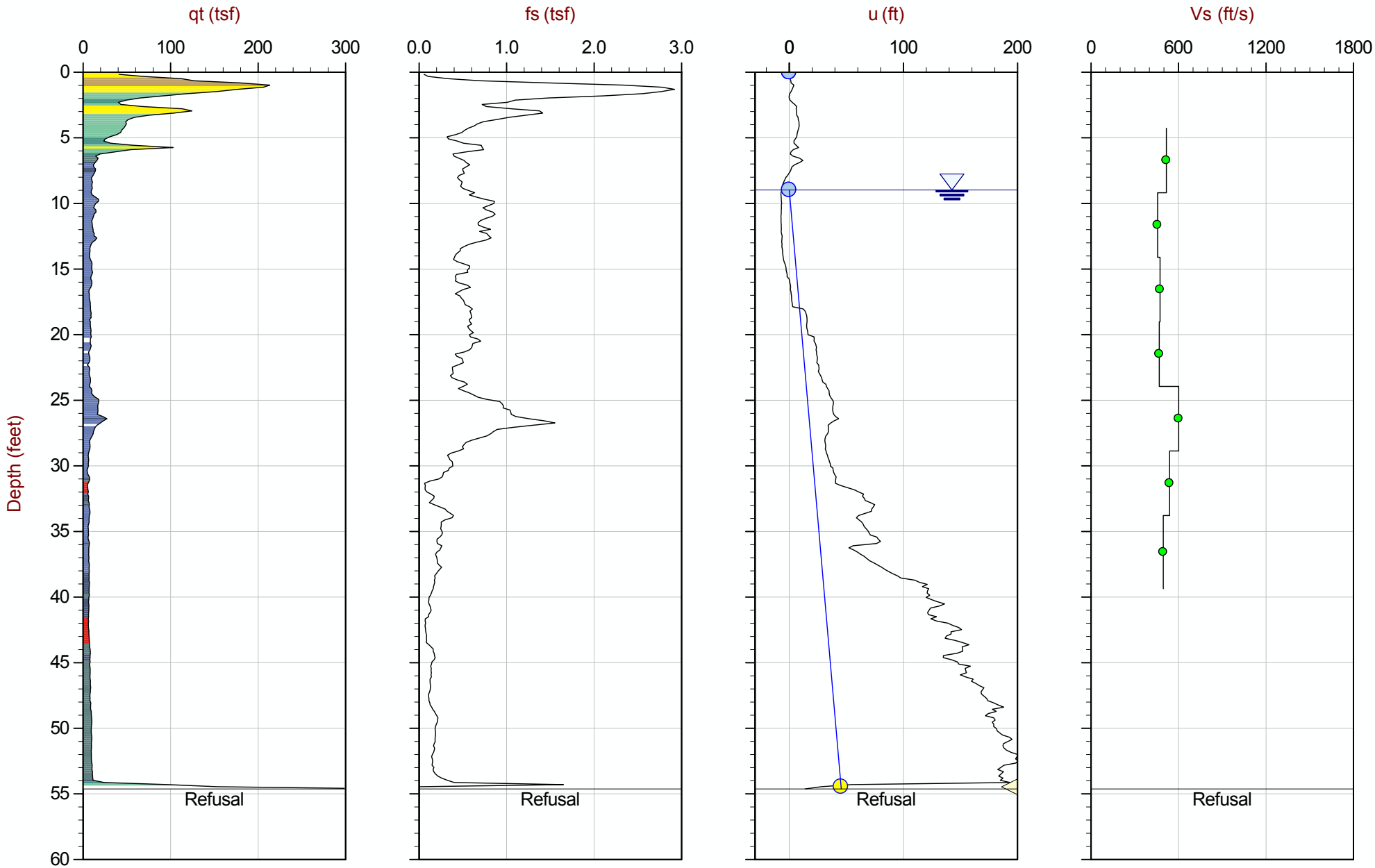
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 15:22
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C003
Cone: 340:T1500F15U500



Max Depth: 16.650 m / 54.63 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP03.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497325m E: 274377m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

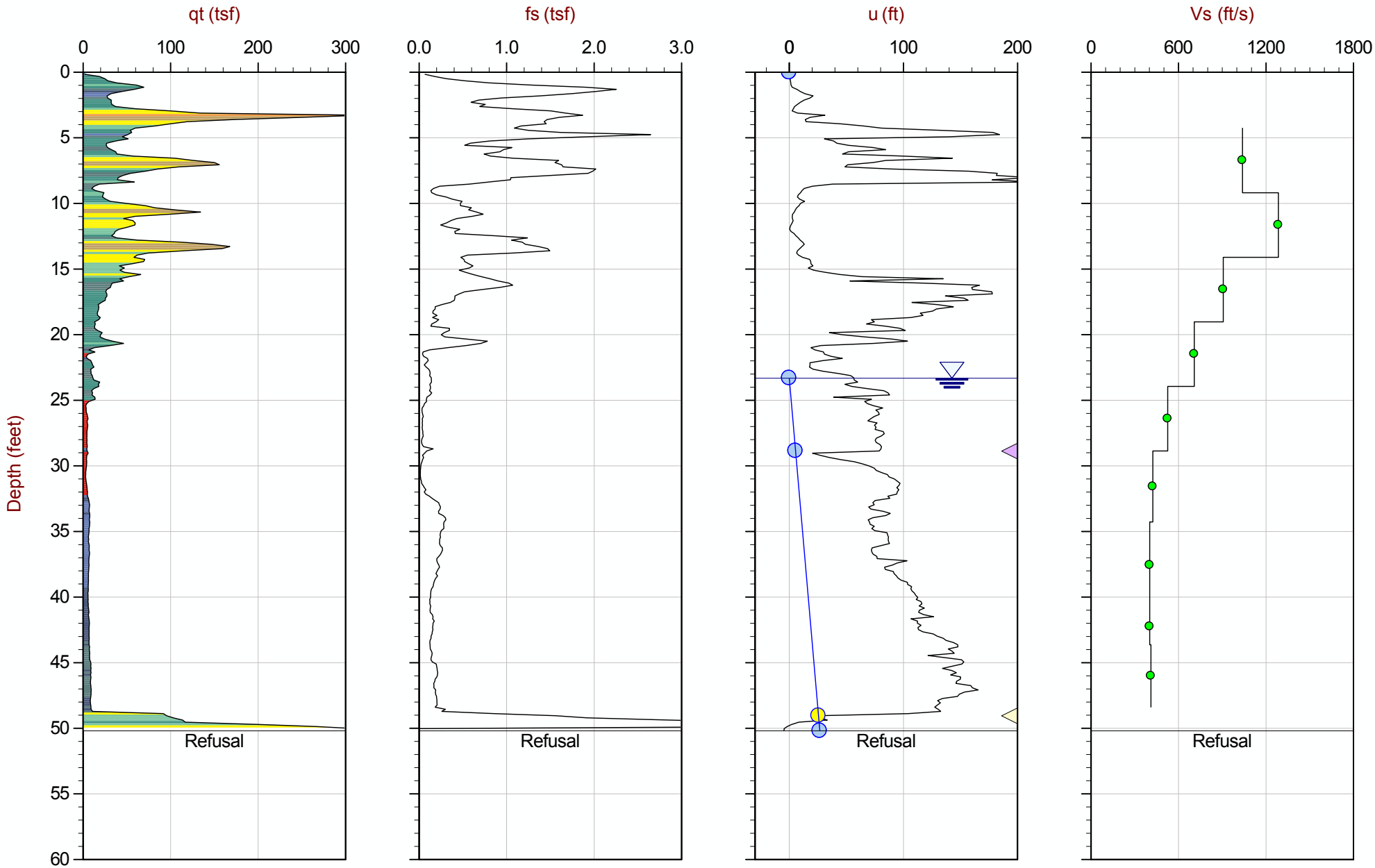
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:28:15 14:27
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C012
Cone: 340:T1500F15U500



Max Depth: 15.300 m / 50.20 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP12.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496424m E: 274524m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

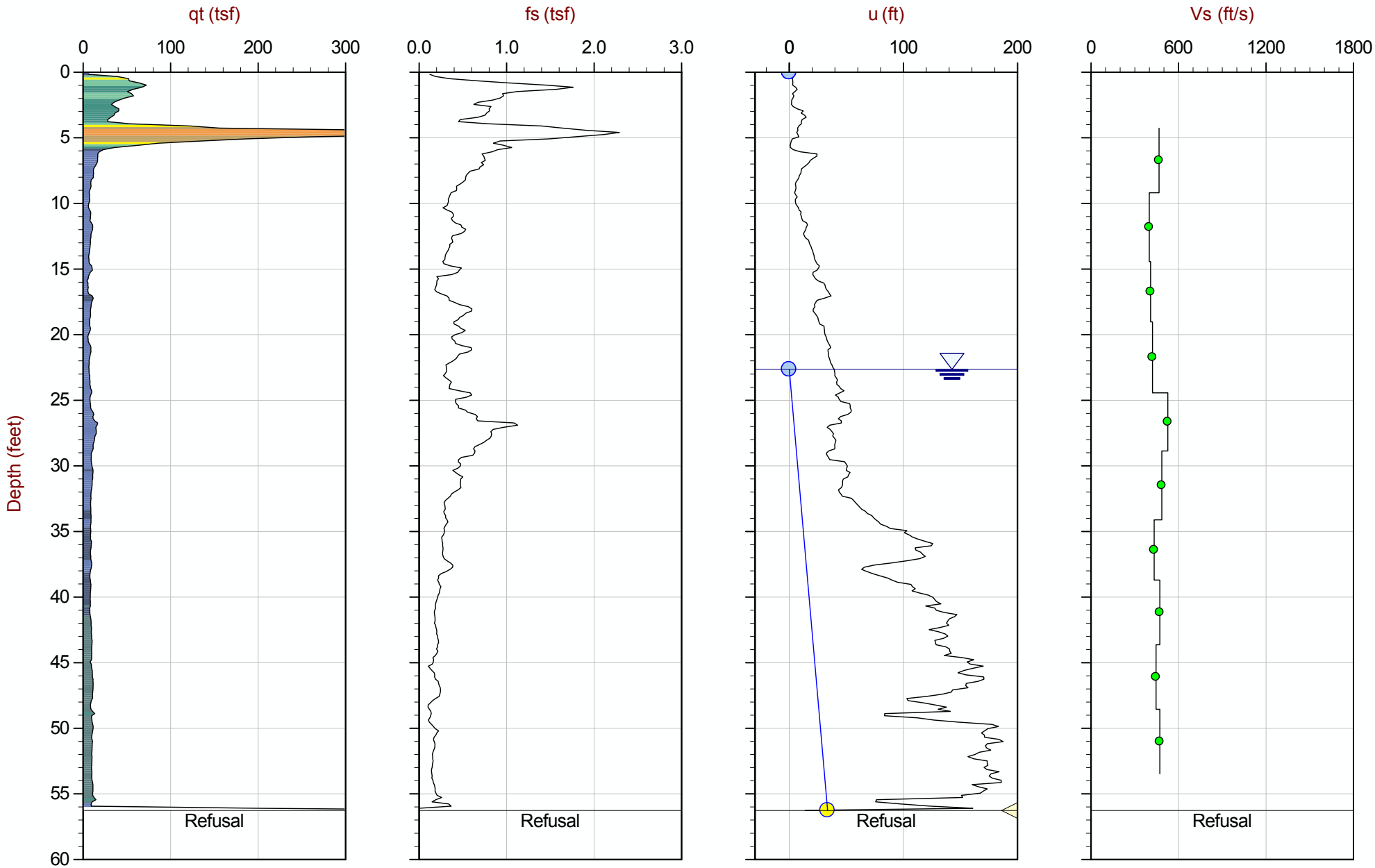
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:28:15 08:45
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C013
Cone: 340:T1500F15U500



Max Depth: 17.150 m / 56.27 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP13.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496386m E: 274376m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

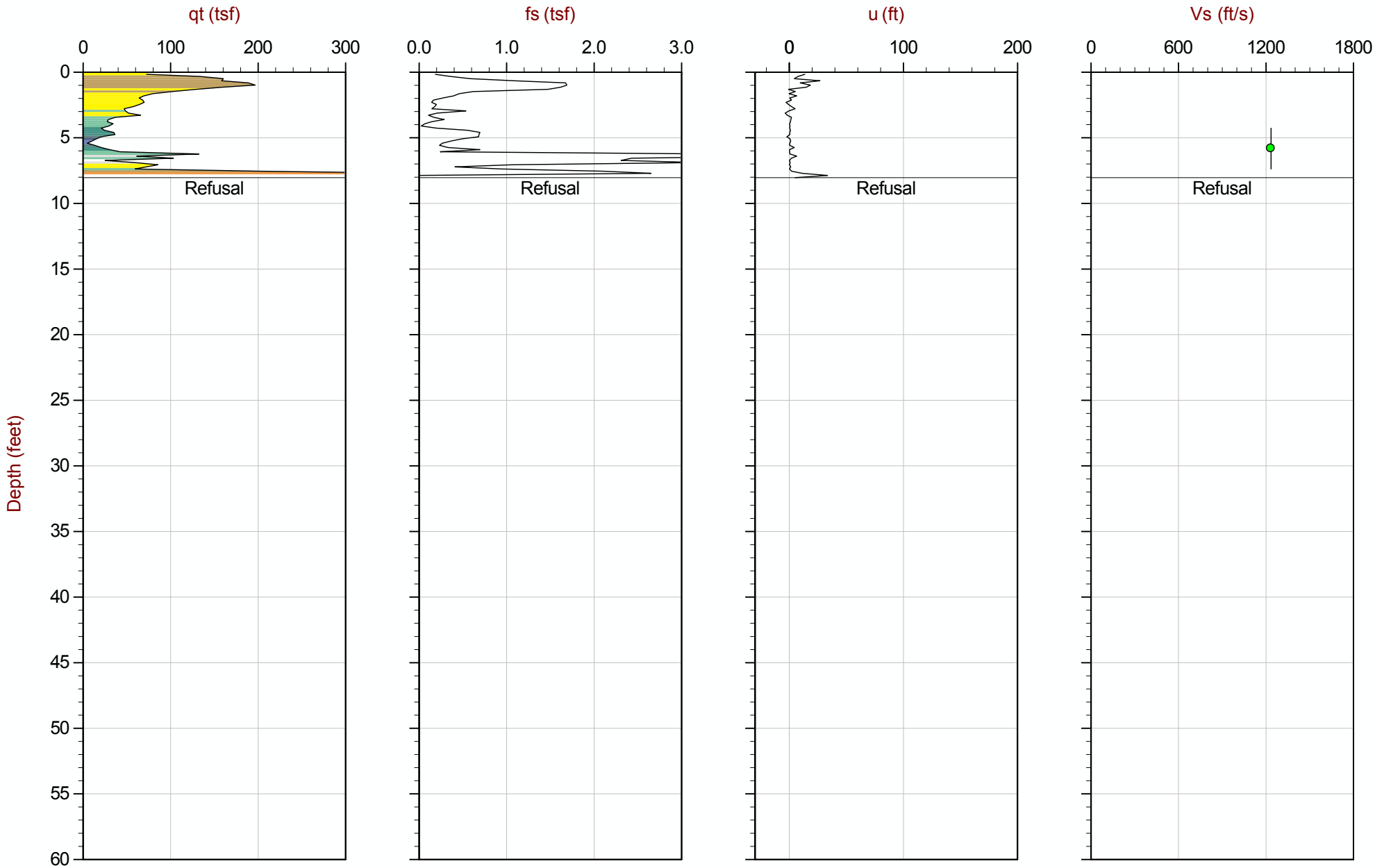
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:19:15 13:31
Site: Edwards Power Station

Sounding: EDW-C015
Cone: 335:T1500F15U500



Max Depth: 2.450 m / 8.04 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP15.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496447m E: 274334m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

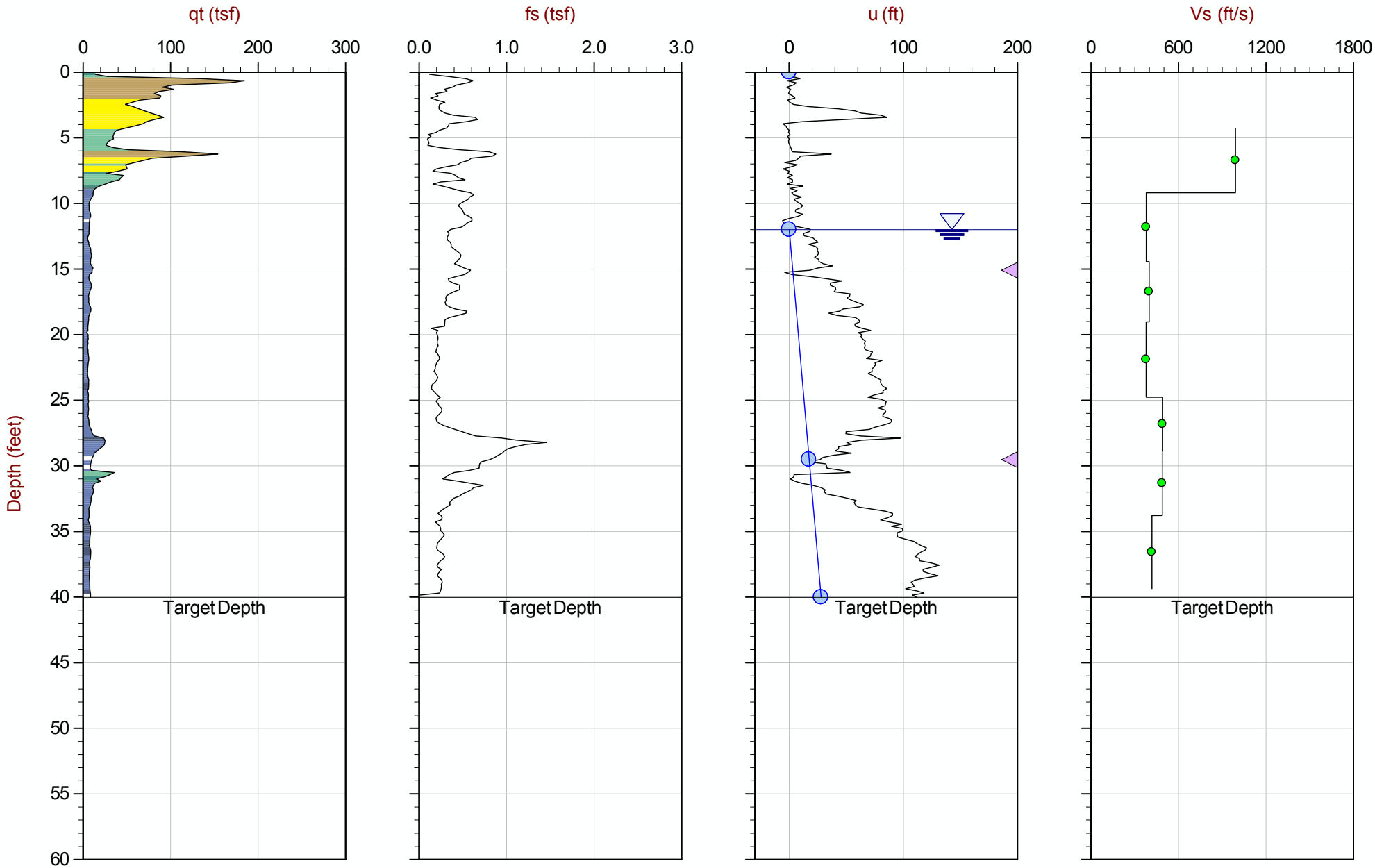
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:19:15 14:12
Site: Edwards Power Station

Sounding: EDW-C015A
Cone: 335:T1500F15U500



Max Depth: 12.200 m / 40.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP15A.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496435m E: 274342m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

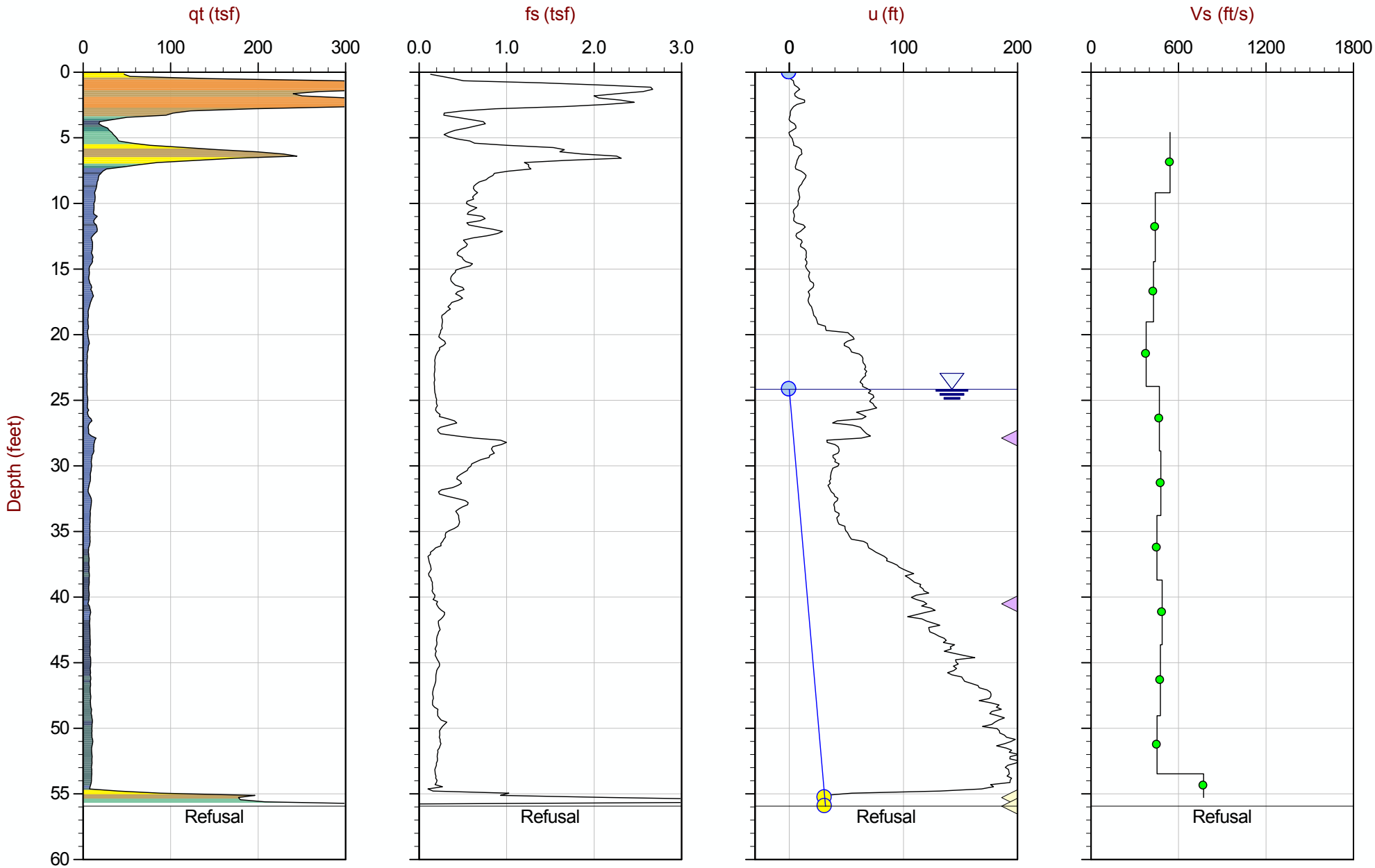
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:27:15 11:13
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C017
Cone: 340:T1500F15U500



Max Depth: 17.050 m / 55.94 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP17.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4496775m E: 274137m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

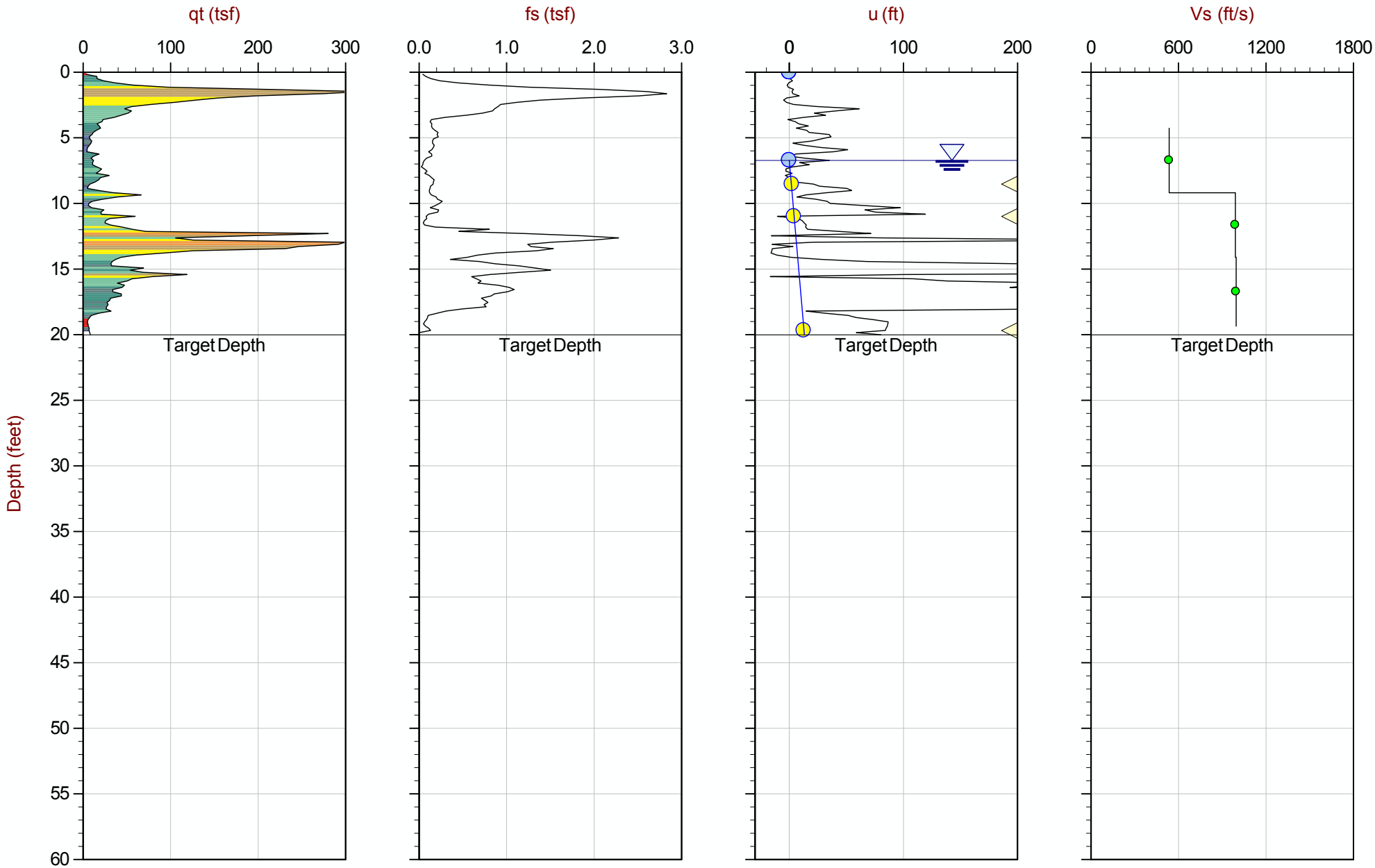
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:26:15 10:35
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C022
Cone: 374:T1500F15U500



Max Depth: 6.100 m / 20.01 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP22.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497185m E: 274108m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

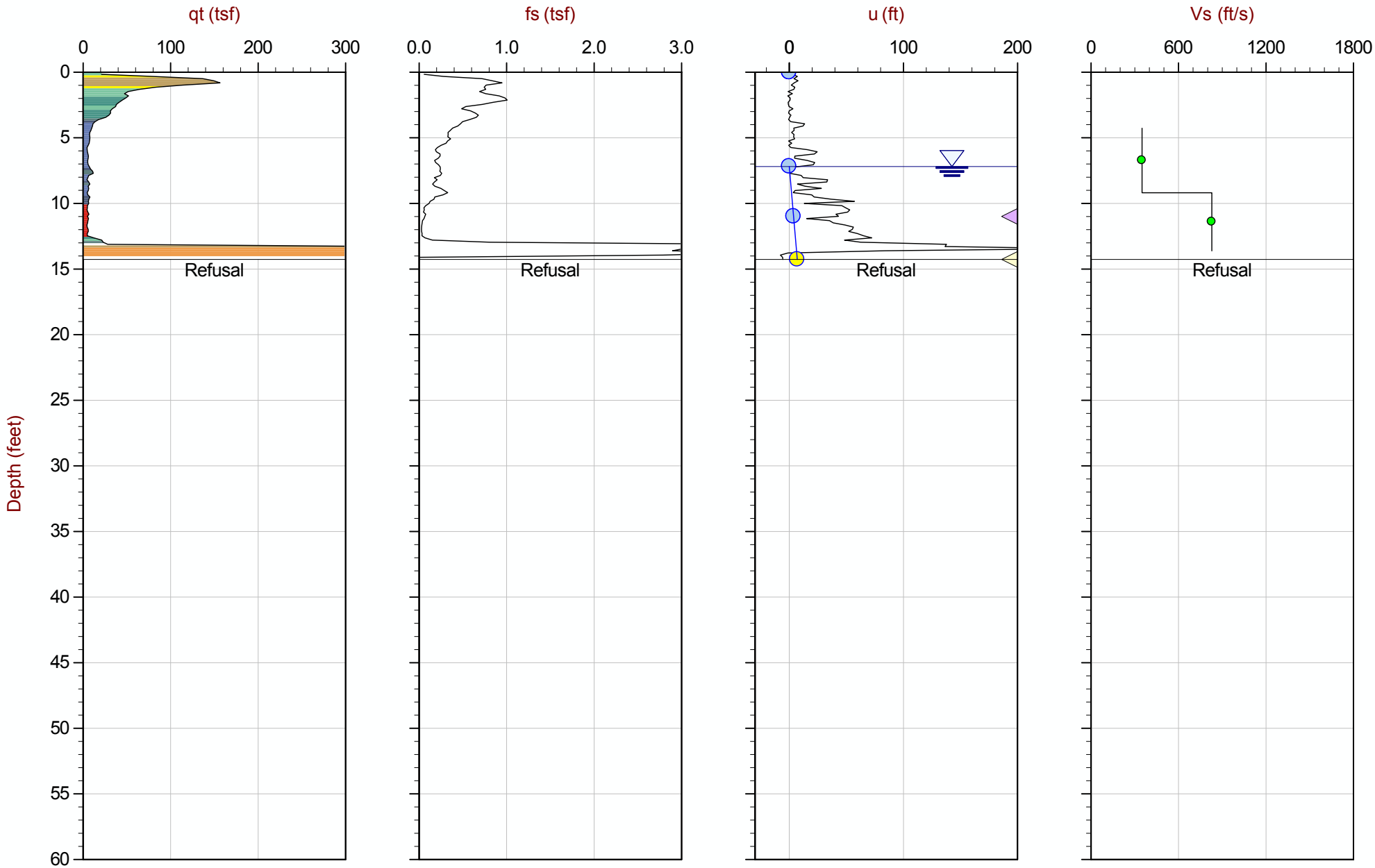
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:26:15 12:20
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C026
Cone: 374:T1500F15U500



Max Depth: 4.350 m / 14.27 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP26.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497062m E: 274334m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

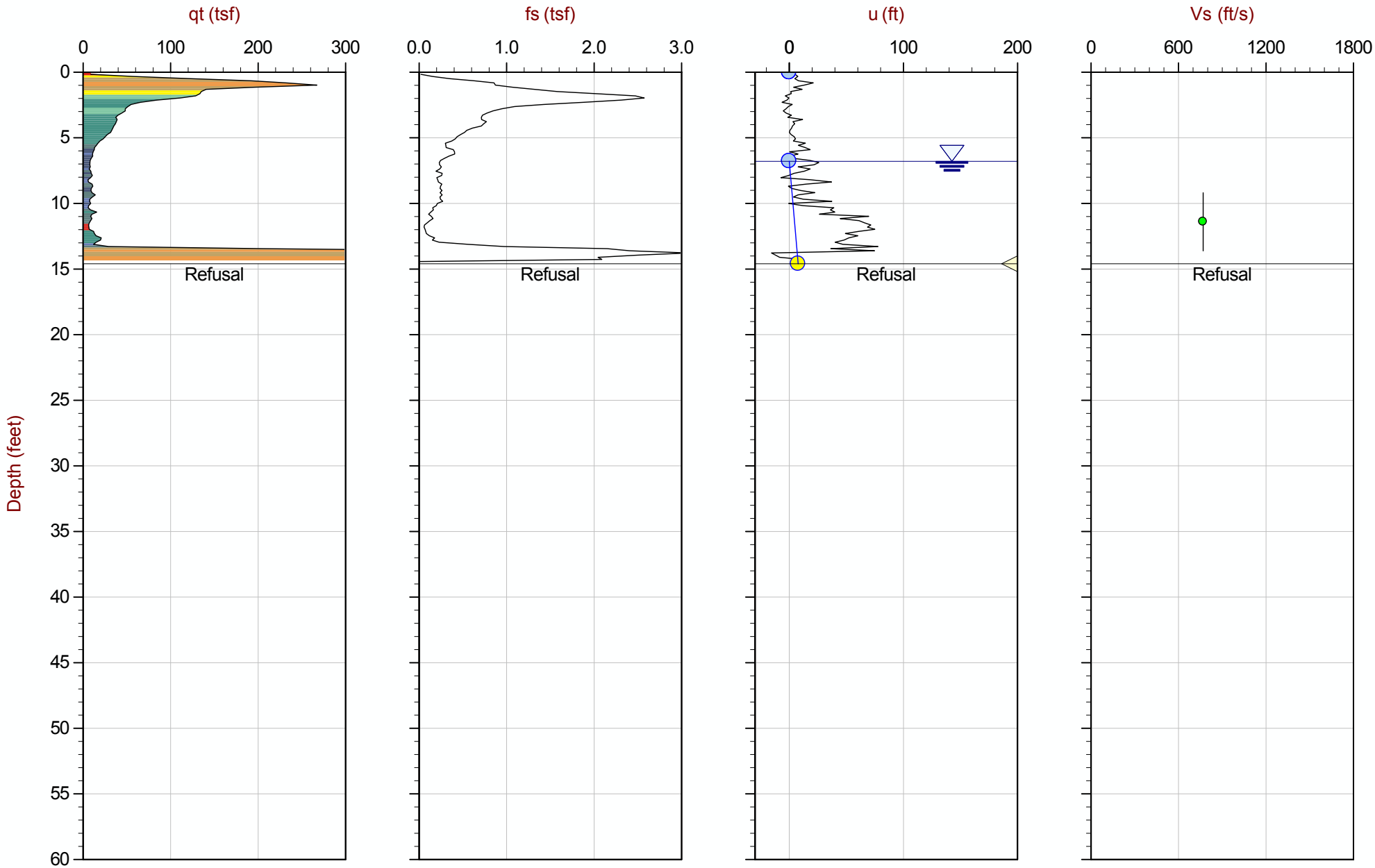
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53073
Date: 08:26:15 14:00
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C026B
Cone: 374:T1500F15U500



Max Depth: 4.450 m / 14.60 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53073_SP26B.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4497064m E: 274335m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Seismic Cone Penetration Test Tabular Results (Vs)

CONETEC

Job No:	15-53073
Client:	AECOM
Project:	Edwards Power Station
Sounding ID:	EDW-C001
Date:	19-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	8.38			
9.84	9.19	11.68	3.30	8.55	386
14.76	14.11	15.84	4.17	9.25	450
19.69	19.03	20.35	4.51	10.98	410
24.61	23.95	25.01	4.66	9.57	487
29.53	28.87	29.76	4.75	7.61	624
34.45	33.79	34.55	4.80	9.57	501
38.88	38.22	38.90	4.34	5.49	791

Job No:	15-53073
Client:	AECOM
Project:	Edwards Power Station
Sounding ID:	EDW-C003
Date:	25-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.97
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.70			
9.84	9.19	9.40	4.70	9.08	517
14.76	14.11	14.24	4.85	10.62	457
19.69	19.03	19.13	4.89	10.30	474
24.61	23.95	24.03	4.90	10.48	468
29.53	28.87	28.94	4.91	8.15	602
34.45	33.79	33.85	4.91	9.12	539
40.03	39.37	39.42	5.57	11.23	496

Job No:	15-53073
Client:	AECOM
Project:	Edwards Power Station
Sounding ID:	EDW-C012
Date:	28-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.97
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.70			
9.84	9.19	9.40	4.70	4.52	1039
14.76	14.11	14.24	4.85	3.77	1285
19.69	19.03	19.13	4.89	5.39	907
24.61	23.95	24.03	4.90	6.92	708
29.53	28.87	28.94	4.91	9.33	526
34.94	34.28	34.34	5.40	12.74	424
41.50	40.85	40.89	6.55	16.28	403
44.29	43.64	43.68	2.79	6.92	403
49.05	48.39	48.43	4.75	11.55	411

Job No:	15-53073
Client:	AECOM
Project:	Edwards Power Station
Sounding ID:	EDW-C013
Date:	28-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.97
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.70			
9.84	9.19	9.40	4.70	10.06	467
15.09	14.44	14.57	5.17	12.94	400
19.69	19.03	19.13	4.56	11.16	409
25.10	24.44	24.52	5.39	12.78	422
29.53	28.87	28.94	4.42	8.39	527
34.78	34.12	34.18	5.24	10.79	486
39.37	38.71	38.76	4.59	10.58	433
44.29	43.64	43.68	4.92	10.42	472
49.21	48.56	48.60	4.92	11.04	446
54.13	53.48	53.51	4.92	10.42	472

Job No:	15-53073
Client:	AECOM
Project:	Edwards Power Station
Sounding ID:	EDW-C015
Date:	19-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.50
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.52			
8.04	7.38	7.53	3.01	2.44	1235

Job No:	15-53073
Client:	AECOM
Project:	Edwards Power Station
Sounding ID:	EDW-C015A
Date:	19-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.50
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.52			
9.84	9.19	9.31	4.79	4.83	991
15.09	14.44	14.51	5.21	13.73	379
19.69	19.03	19.09	4.57	11.46	399
25.43	24.77	24.82	5.73	15.15	378
29.53	28.87	28.91	4.09	8.34	491
34.45	33.79	33.83	4.92	10.05	489
40.03	39.37	39.40	5.57	13.34	418

Job No:	15-53073
Client:	AECOM
Project:	Edwards Power Station
Sounding ID:	EDW-C017
Date:	27-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.97
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
5.25	4.59	5.00			
9.84	9.19	9.40	4.40	8.11	542
15.09	14.44	14.57	5.17	11.73	441
19.69	19.03	19.13	4.56	10.62	429
24.61	23.95	24.03	4.90	12.96	378
29.53	28.87	28.94	4.91	10.47	469
34.45	33.79	33.85	4.91	10.26	479
39.37	38.71	38.76	4.91	10.87	452
44.29	43.64	43.68	4.92	10.08	488
49.70	49.05	49.09	5.41	11.37	476
54.13	53.48	53.51	4.43	9.77	453
55.94	55.28	55.32	1.80	2.33	772

Job No:	15-53073
Client:	AECOM
Project:	Edwards Power Station
Sounding ID:	EDW-C022
Date:	26-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	8.38			
9.84	9.19	11.68	3.30	6.16	536
14.76	14.11	15.84	4.17	4.21	990
20.01	19.36	20.66	4.81	4.83	996

Job No:	15-53073
Client:	AECOM
Project:	Edwards Power Station
Sounding ID:	EDW-C026
Date:	26-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	8.38			
9.84	9.19	11.68	3.30	9.43	350
14.27	13.62	15.41	3.73	4.50	829

Job No:	15-53073
Client:	AECOM
Project:	Edwards Power Station
Sounding ID:	EDW-C026B
Date:	26-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
9.84	9.19	11.68			
14.27	13.62	15.41	3.73	4.85	769

Pore Pressure Dissipation Summary and

Pore Pressure Dissipation Plots

CONETEC

CONETEC

Job No: 15-53073
Client: AECOM
Project: Edwards Power Station, Peoria, IL
Start Date: 19-Aug-2015
End Date: 29-Aug-2015

CPTu PORE PRESSURE DISSIPATION SUMMARY

Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (ft)	Estimated Equilibrium Pore Pressure U_{eq} (ft)	Calculated Phreatic Surface (ft)	Estimated Phreatic Surface (ft)	t_{50} [a] (s)	Assumed Rigidity Index (I_r)	c_h [b] (cm^2/min)
EDW-C001	15-53073_SP01	15	200	13.12						
EDW-C001	15-53073_SP01	15	9000	27.23	17.86	9.37		81	100	8.69
EDW-C003	15-53073_SP03	15	1020	54.46	45.49	8.98				
EDW-C005	15-53073_CP05	15	6000	37.40	30.40		7.00	3717	100	0.19
EDW-C006	15-53073_CP06	15	360	14.27						
EDW-C006	15-53073_CP06	15	7200	26.25	14.75		11.50	7114	100	0.10
EDW-C006	15-53073_CP06	15	1200	40.03						
EDW-C007	15-53073_CP07	15	600	26.90						
EDW-C007	15-53073_CP07	15	4000	51.51	42.62	8.89				
EDW-C008	15-53073_CP08	15	4800	22.15	12.15		10.00	2835	100	0.25
EDW-C008	15-53073_CP08	15	1800	33.63						
EDW-C009	15-53073_CP09	15	800	16.08	2.61	13.46				
EDW-C009	15-53073_CP09	15	600	28.38	8.49	19.89				
EDW-C010	15-53073_CP10	15	3000	12.14	9.93		2.21	1239	100	0.57
EDW-C010	15-53073_CP10	15	300	27.56	25.35	2.21				
EDW-C010	15-53073_CP10	15	600	30.02	0.00					
EDW-C011	15-53073_CP11	15	3800	24.11						
EDW-C011	15-53073_CP11	15	7500	46.42	23.96		22.47	1082	100	0.65
EDW-C011	15-53073_CP11	15	400	47.08	24.61	22.47				
EDW-C012	15-53073_SP12	15	1500	28.87	5.55		23.32	120	100	5.86
EDW-C012	15-53073_SP12	15	1000	49.05	25.73	23.32				
EDW-C013	15-53073_SP13	15	1205	56.27	33.61	22.65				
EDW-C014	15-53073_CP14	15	4000	16.08	11.16		4.91	2190	100	0.32
EDW-C014	15-53073_CP14	15	500	38.22	33.31	4.91				
EDW-C015A	15-53073_SP15A	15	2000	15.09						
EDW-C015A	15-53073_SP15A	15	10800	29.53	17.53		12.00	6095	100	0.12
EDW-C016	15-53073_CP16	15	900	7.38						
EDW-C016	15-53073_CP16	15	3600	18.04	14.20		3.85	1538	100	0.46
EDW-C016	15-53073_CP16	15	500	36.91	33.06	3.85				
EDW-C017	15-53073_SP17	15	500	27.89						
EDW-C017	15-53073_SP17	15	525	40.52						
EDW-C017	15-53073_SP17	15	600	55.28	31.11	24.17				
EDW-C017	15-53073_SP17	15	85	55.94	31.25	24.69				
EDW-C019	15-53073_CP19	15	600	11.81	5.31	6.51				
EDW-C019	15-53073_CP19	15	1500	53.48	48.16	5.31				
EDW-C021	15-53073_CP21	15	550	13.94						
EDW-C021	15-53073_CP21	15	8000	23.46	10.46		13.00	2190	100	0.32
EDW-C021	15-53073_CP21	15	12070	33.63	20.63		13.00	1449	100	0.48
EDW-C021	15-53073_CP21	15	1600	48.39						
EDW-C022	15-53073_SP22	15	300	8.53	2.39	6.14				
EDW-C022	15-53073_SP22	15	300	10.99	4.27	6.72				
EDW-C022	15-53073_SP22	15	1200	19.68	12.85	6.84				
EDW-C023	15-53073_CP23	15	4000	38.88	23.82		15.06	78	100	9.01
EDW-C023	15-53073_CP23	15	400	40.68	25.63	15.06				
EDW-C025	15-53073_CP25	15	1500	6.56	0.57		5.99	36	100	19.34

Job No:	15-53073
Client:	AECOM
Project:	Edwards Power Station, Peoria, IL
Start Date:	19-Aug-2015
End Date:	29-Aug-2015

CPTu PORE PRESSURE DISSIPATION SUMMARY

Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (ft)	Estimated Equilibrium Pore Pressure U_{eq} (ft)	Calculated Phreatic Surface (ft)	Estimated Phreatic Surface (ft)	t_{50} [a] (s)	Assumed Rigidity Index (I_r)	c_h [b] (cm^2/min)
EDW-C025	15-53073_CP25	15	500	10.99	5.00	5.99				
EDW-C025	15-53073_CP25	15	500	15.09	9.03	6.06				
EDW-C025	15-53073_CP25	15	500	20.01	13.58	6.44				
EDW-C026	15-53073_SP26	15	2700	10.99	3.80		7.19	31	100	22.51
EDW-C026	15-53073_SP26	15	1100	14.27	7.08	7.19				
EDW-C026B	15-53073_SP26B	15	800	14.60	7.81	6.79				
EDW-C027	15-53073_CP27	15	500	11.15	3.75	7.40				
EDW-C027	15-53073_CP27	15	300	14.27	7.50	6.77				
EDW-C027	15-53073_CP27	15	360	21.00	14.24	6.76				
EDW-C027	15-53073_CP27	15	500	30.84	24.17	6.67				
EDW-C027	15-53073_CP27	15	500	35.10	28.47	6.63				
EDW-C027	15-53073_CP27	15	1800	40.03	33.25		6.77	1185	100	0.59
Totals	54 dissipations		1879.3 min							

a. Time is relative to where umax occurred

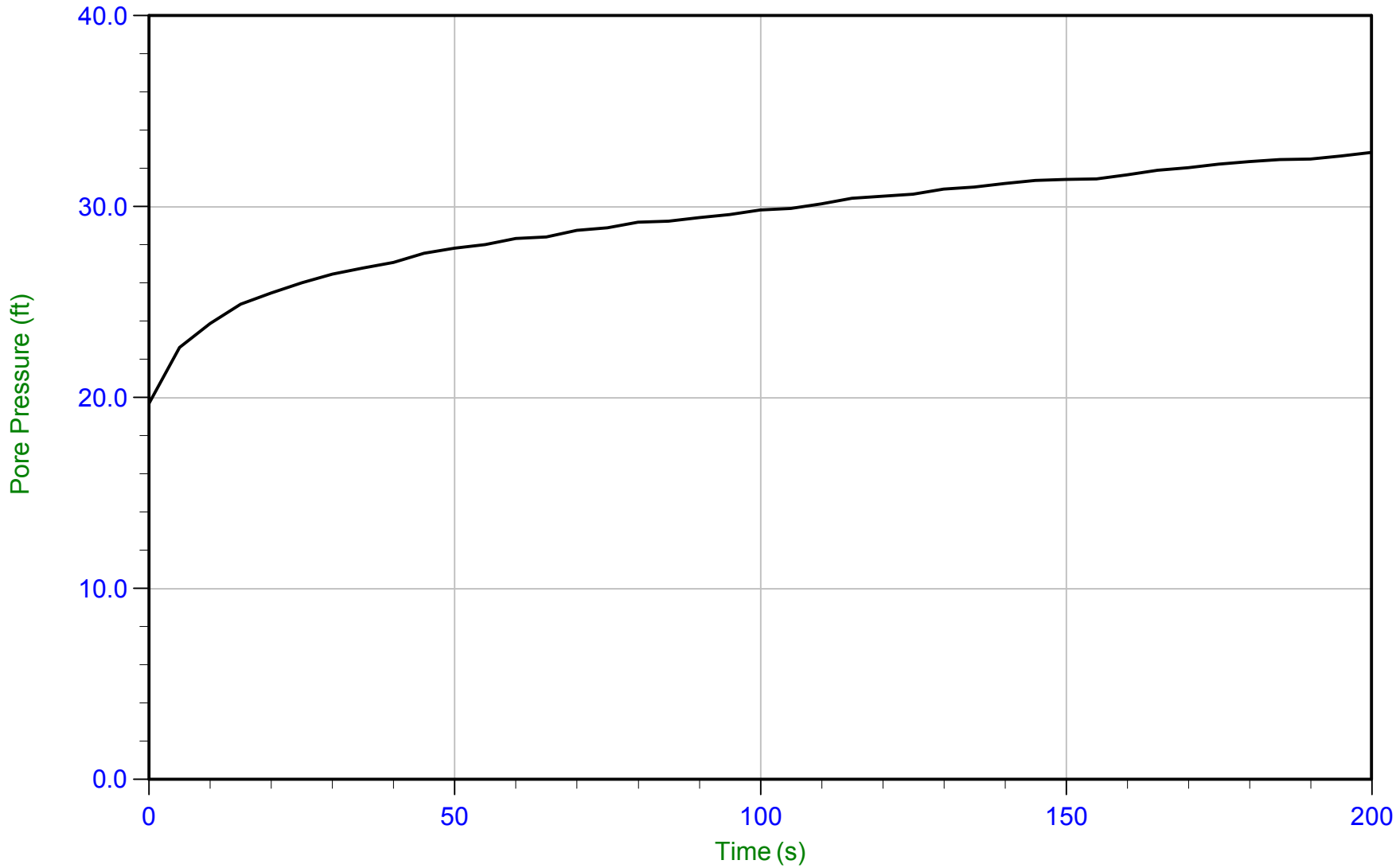
b. Houlsby and Teh, 1991

CONETEC

AECOM

Job No: 15-53073
Date: 19-Aug-2015 13:46:01
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C001
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP01.PPD
Depth: 4.000 m / 13.123 ft
Duration: 200.0 s

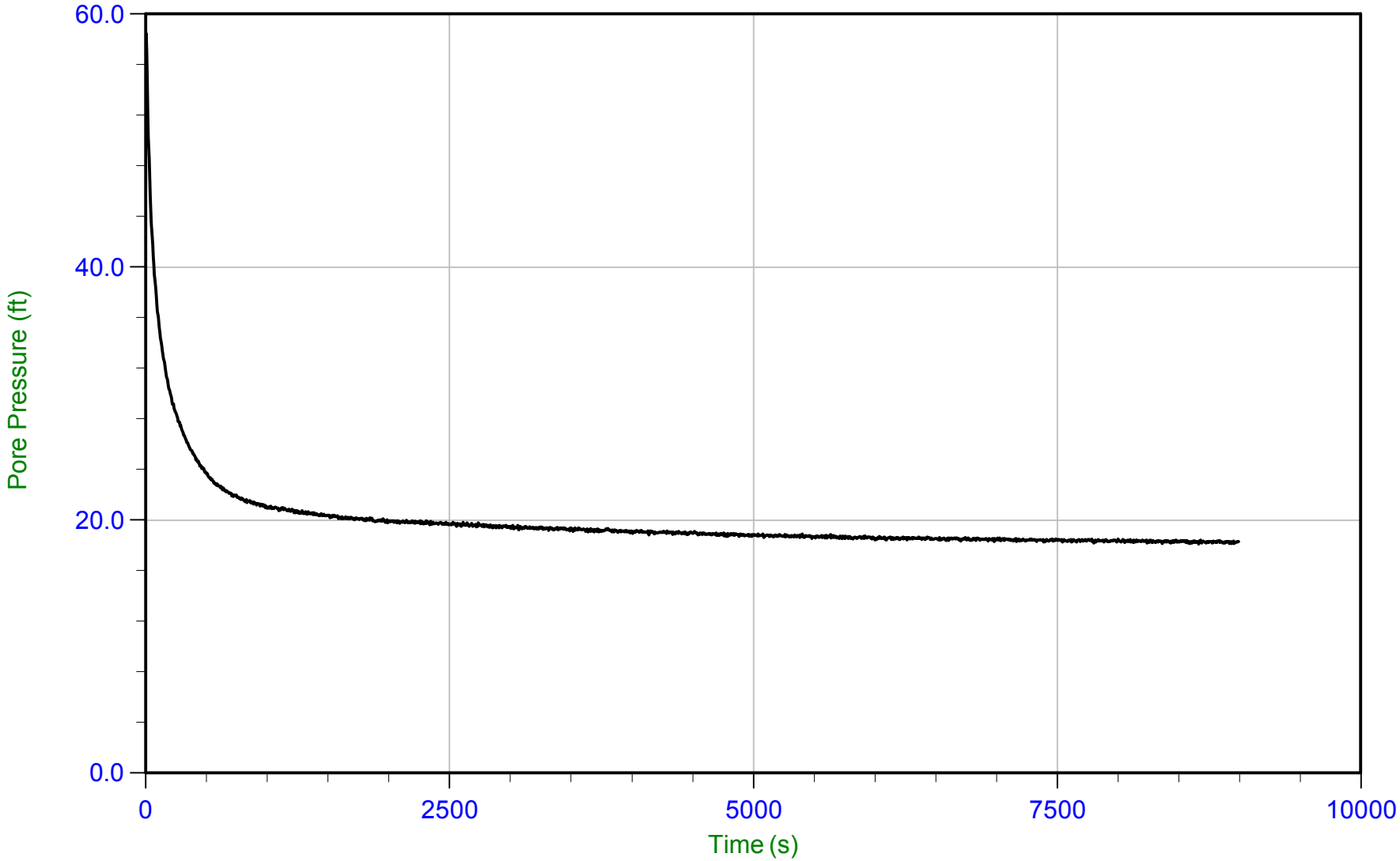
U Min: 19.7 ft
U Max: 32.8 ft

CONETEC

AECOM

Job No: 15-53073
Date: 19-Aug-2015 13:46:01
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C001
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP01.PPD
Depth: 8.300 m / 27.231 ft
Duration: 9000.0 s

U Min: 18.1 ft
U Max: 58.5 ft

WT: 2.855 m / 9.367 ft
Ueq: 17.9 ft
U(50): 38.16 ft

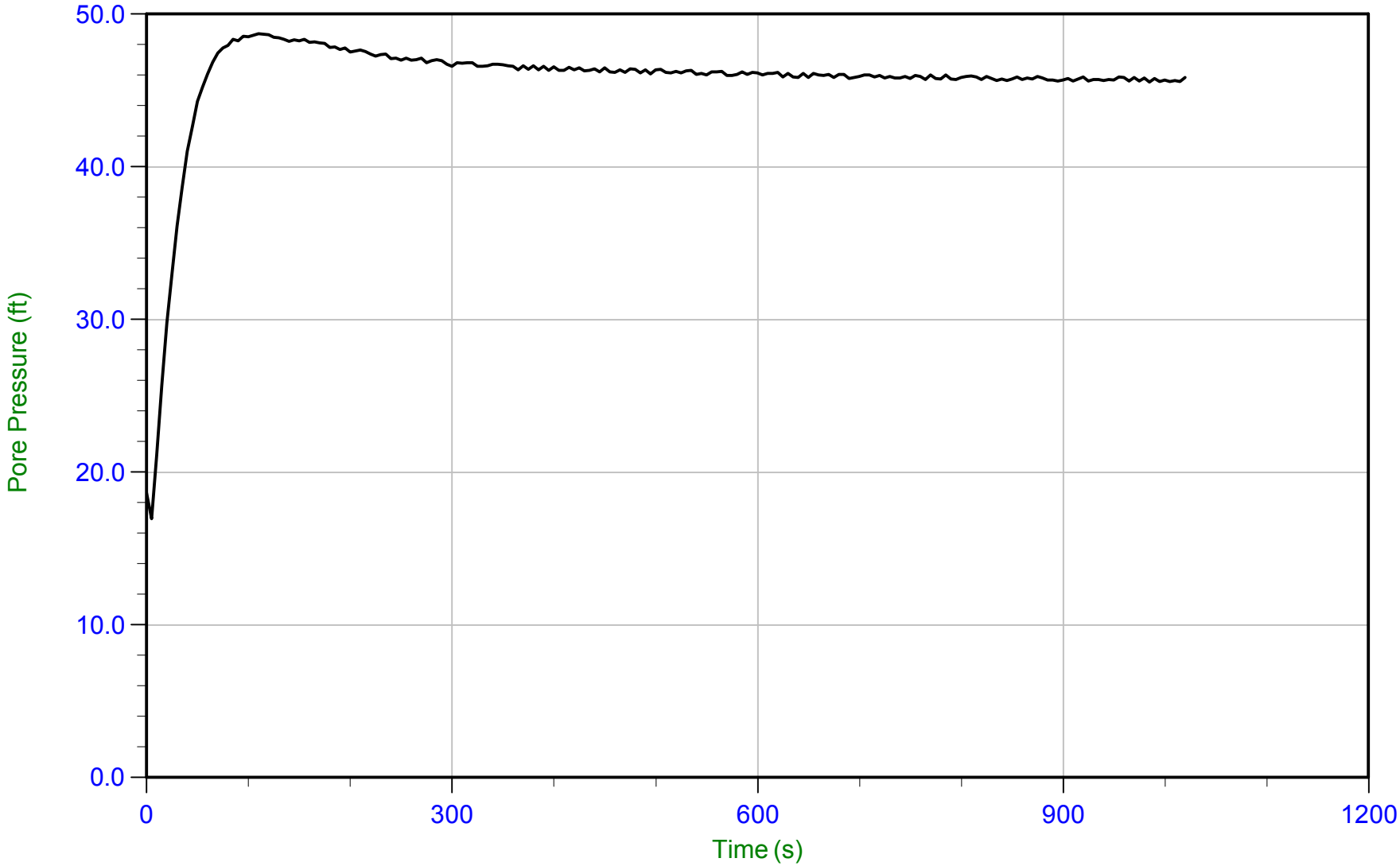
T(50): 80.8 s
Ir: 100
Ch: 8.7 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 14:27:54
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C003
Cone: AD419
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP03.PPD
Depth: 16.600 m / 54.461 ft
Duration: 1020.0 s

U Min: 16.9 ft
U Max: 48.7 ft

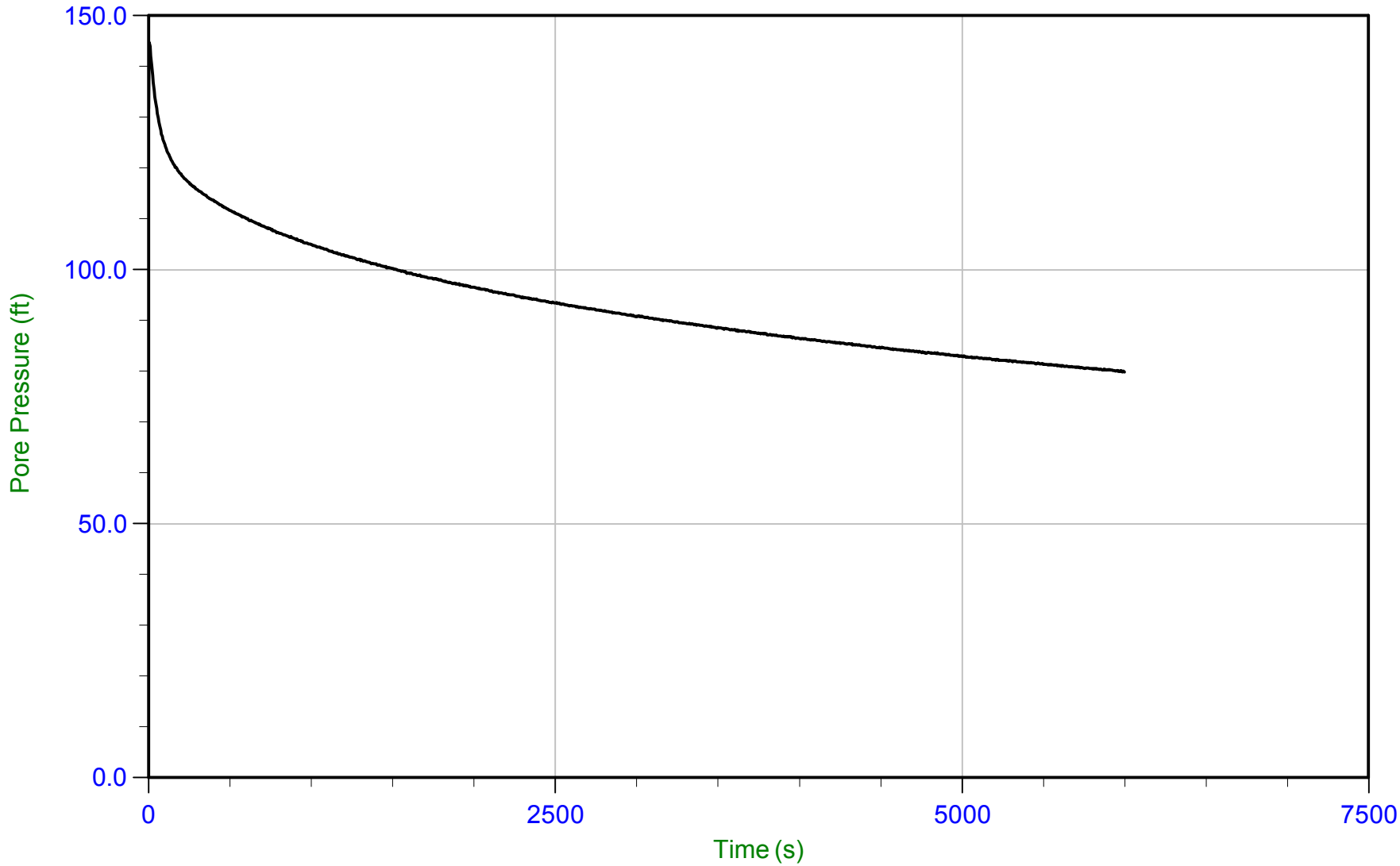
WT: 2.736 m / 8.976 ft
Ueq: 45.5 ft

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 15:05:24
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C005
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP05.PPD
Depth: 11.400 m / 37.401 ft
Duration: 6000.0 s

U Min: 79.9 ft
U Max: 144.8 ft

WT: 2.134 m / 7.001 ft
Ueq: 30.4 ft
U(50): 87.59 ft

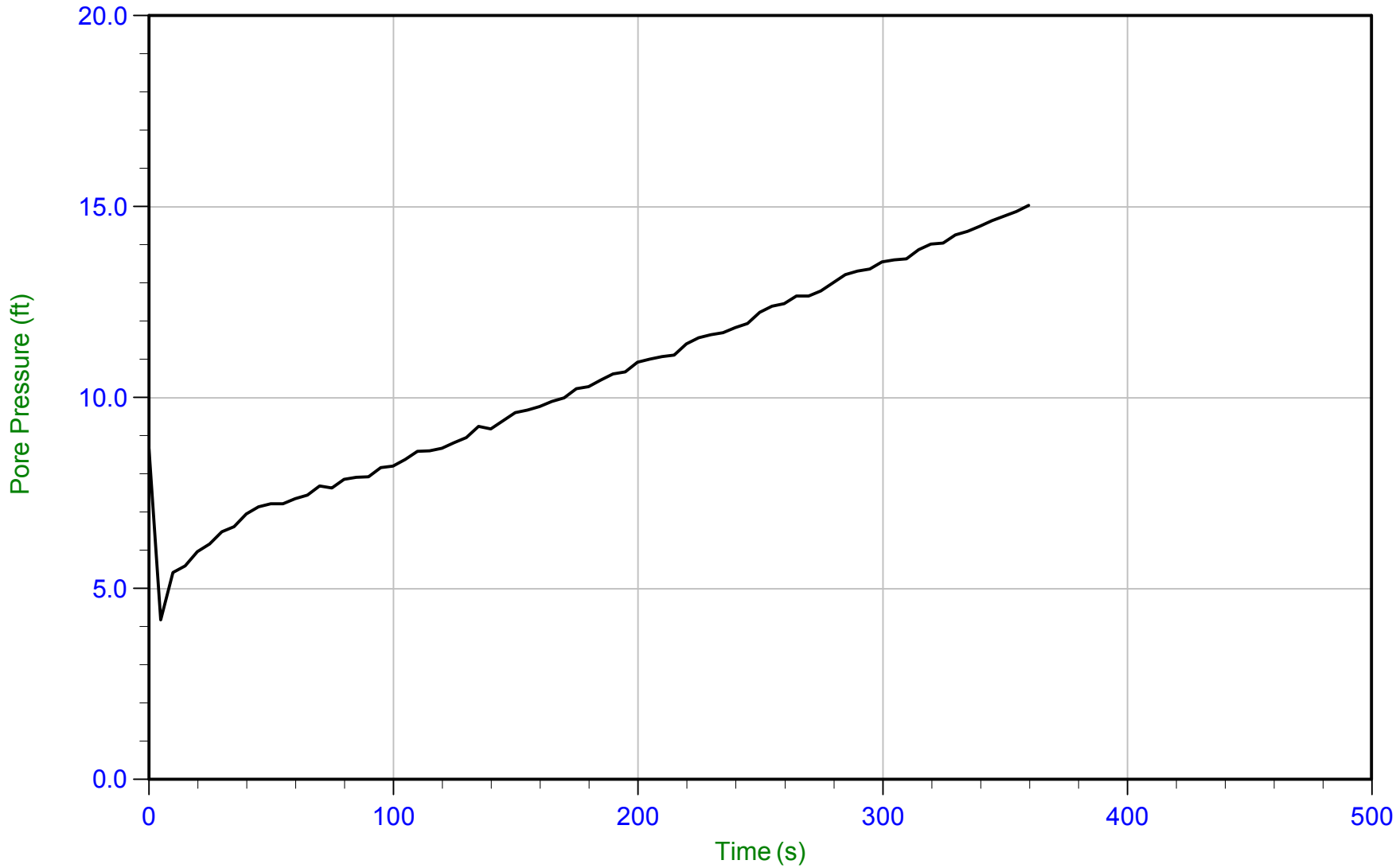
T(50): 3717.5 s
Ir: 100
Ch: 0.2 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 15:52:43
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C006
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP06.PPD
Depth: 4.350 m / 14.271 ft
Duration: 360.0 s

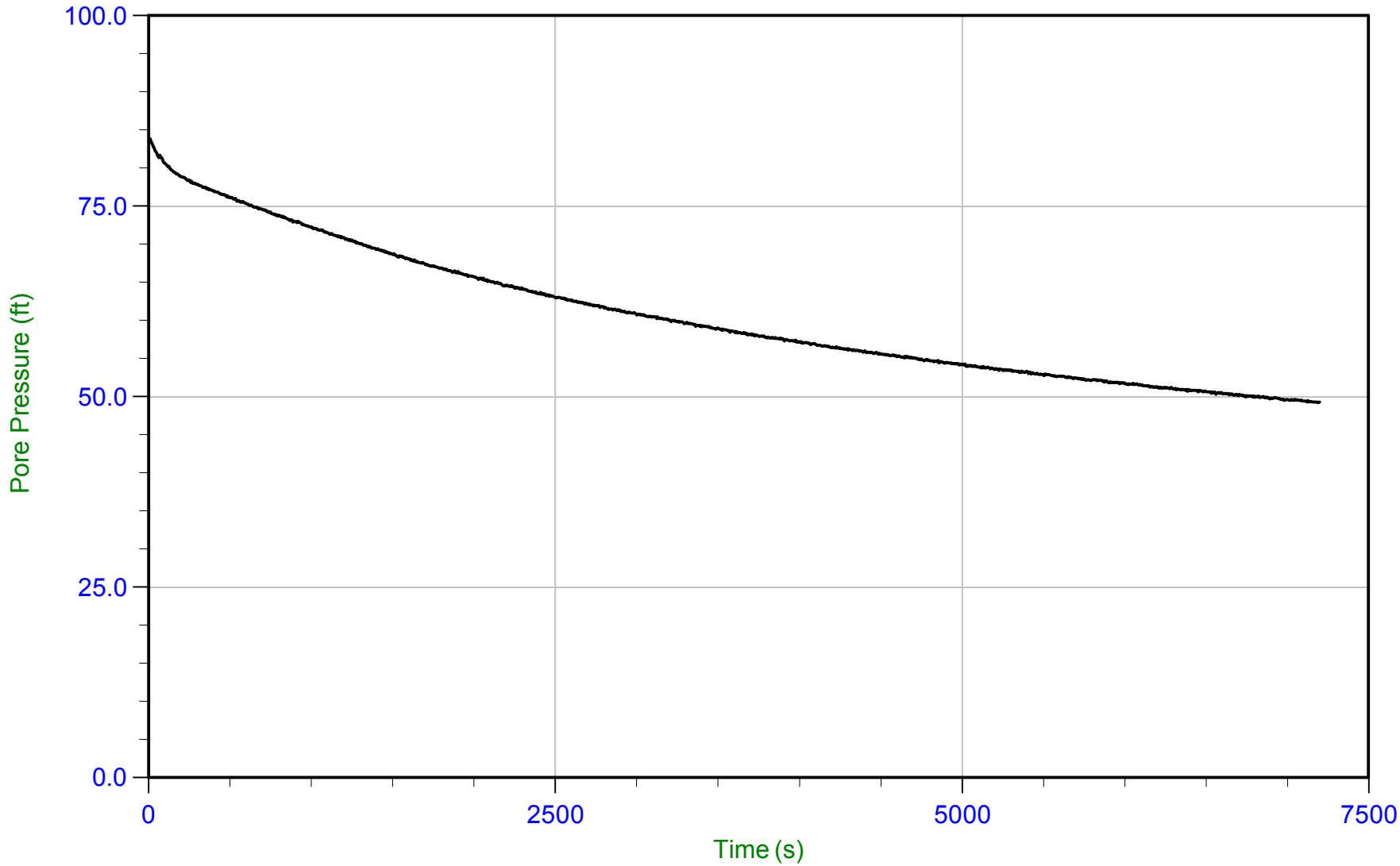
U Min: 4.2 ft
U Max: 15.0 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 15:52:43
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C006
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP06.PPD
Depth: 8.000 m / 26.246 ft
Duration: 7200.0 s

U Min: 49.2 ft
U Max: 83.8 ft

WT: 3.505 m / 11.499 ft
Ueq: 14.7 ft
U(50): 49.29 ft

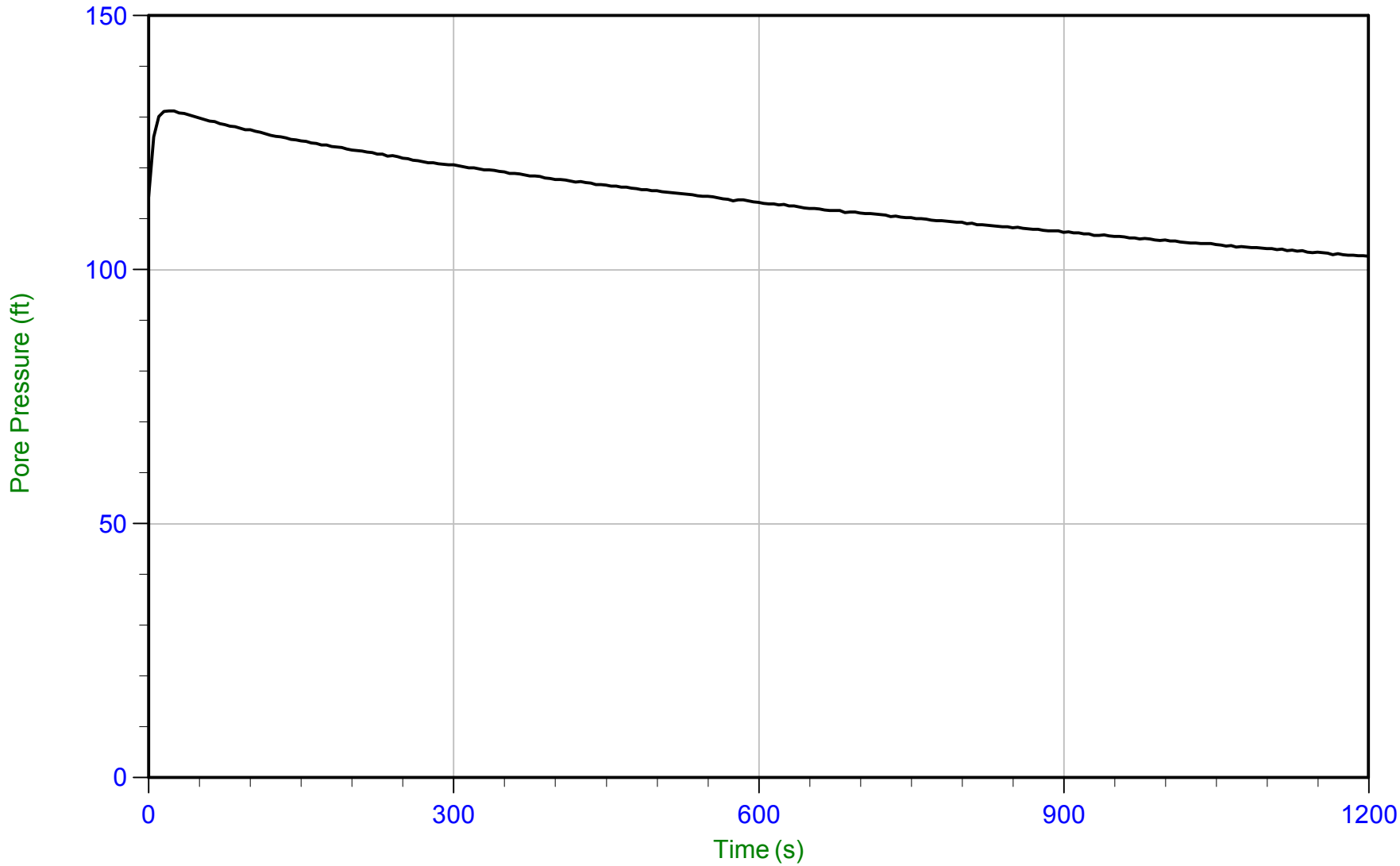
T(50): 7113.9 s
Ir: 100
Ch: 0.1 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 15:52:43
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C006
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP06.PPD
Depth: 12.200 m / 40.026 ft
Duration: 1200.0 s

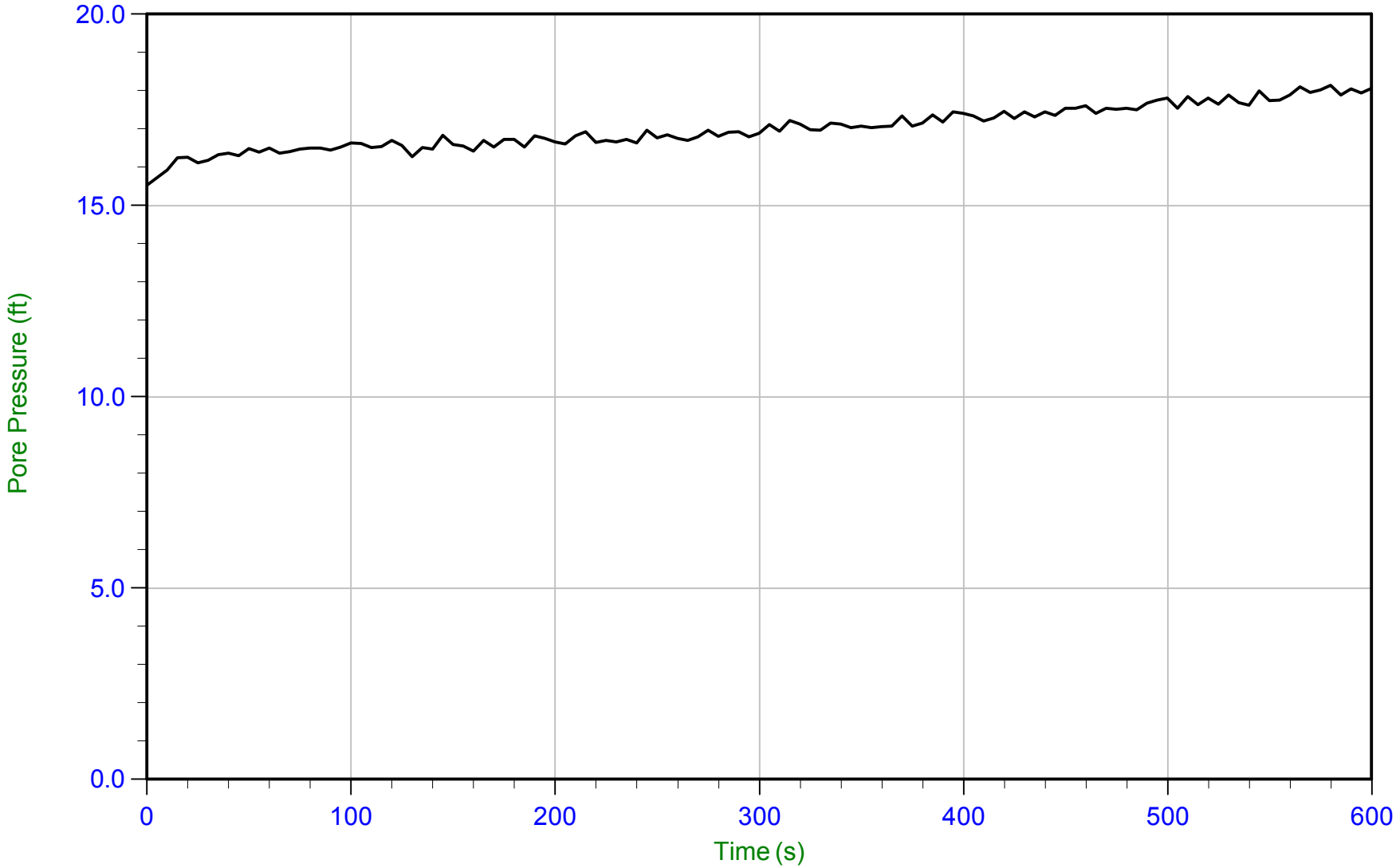
U Min: 102.7 ft
U Max: 131.3 ft

CONETEC

AECOM

Job No: 15-53073
Date: 29-Aug-2015 09:19:17
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C007
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP07.PPD
Depth: 8.200 m / 26.903 ft
Duration: 600.0 s

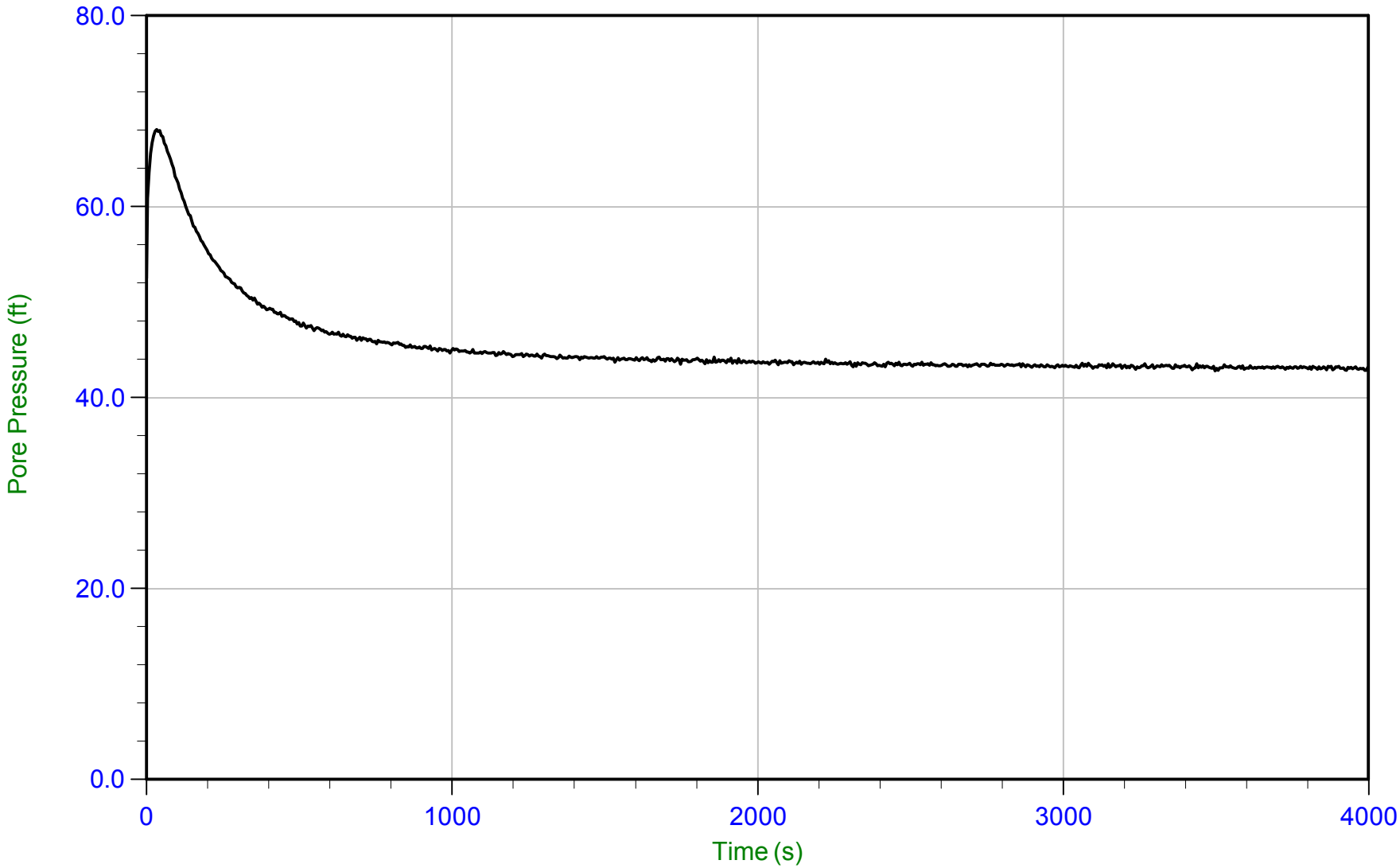
U Min: 15.5 ft
U Max: 18.1 ft

CONETEC

AECOM

Job No: 15-53073
Date: 29-Aug-2015 09:19:17
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C007
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP07.PPD
Depth: 15.700 m / 51.509 ft
Duration: 4000.0 s

U Min: 42.8 ft
U Max: 68.1 ft

WT: 2.709 m / 8.888 ft
Ueq: 42.6 ft
U(50): 55.34 ft

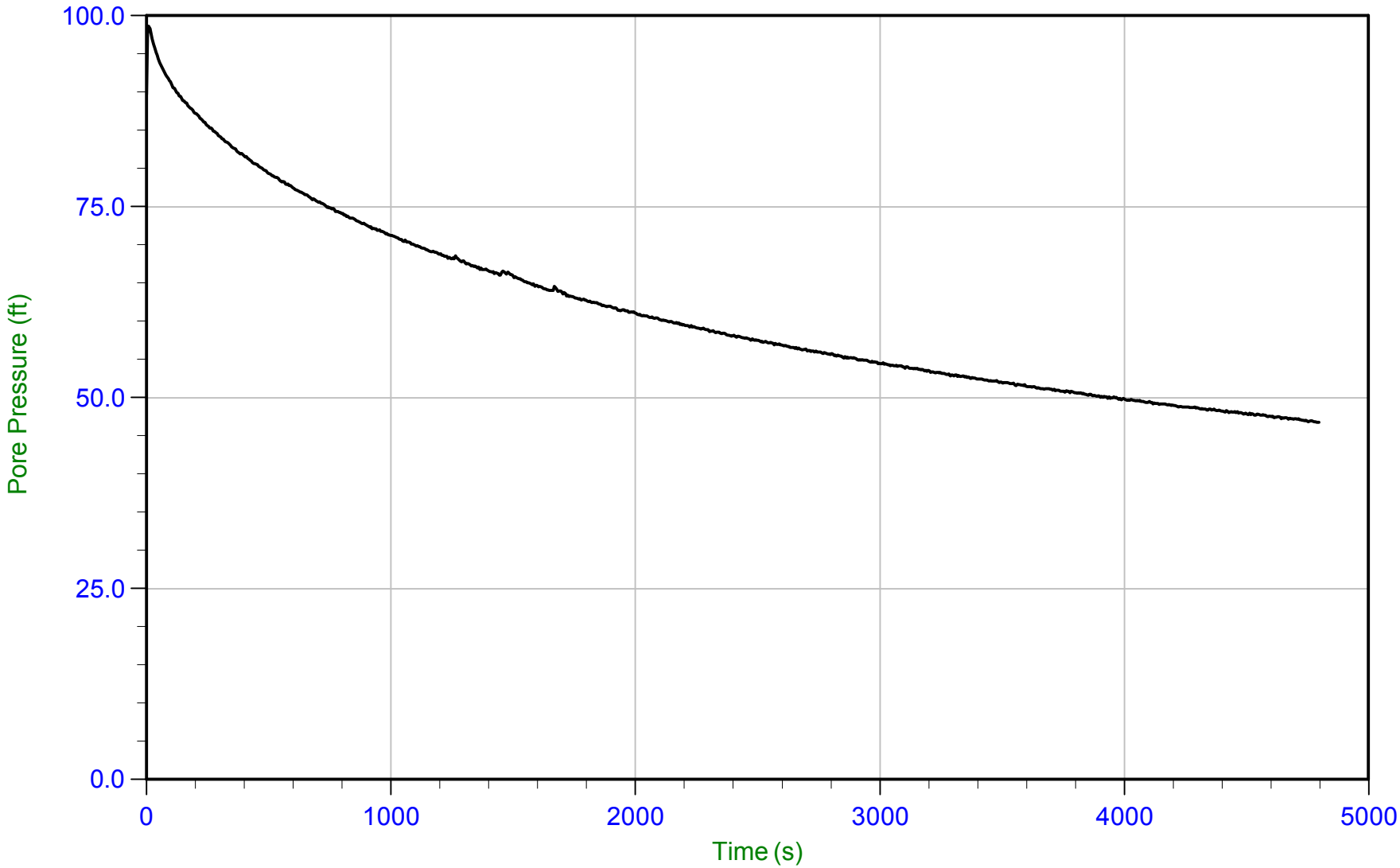
T(50): 166.2 s
Ir: 100
Ch: 4.2 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 08:50:17
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C008
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP08.PPD
Depth: 6.750 m / 22.145 ft
Duration: 4800.0 s

U Min: 46.8 ft
U Max: 98.7 ft

WT: 3.048 m / 10.000 ft
Ueq: 12.1 ft
U(50): 55.40 ft

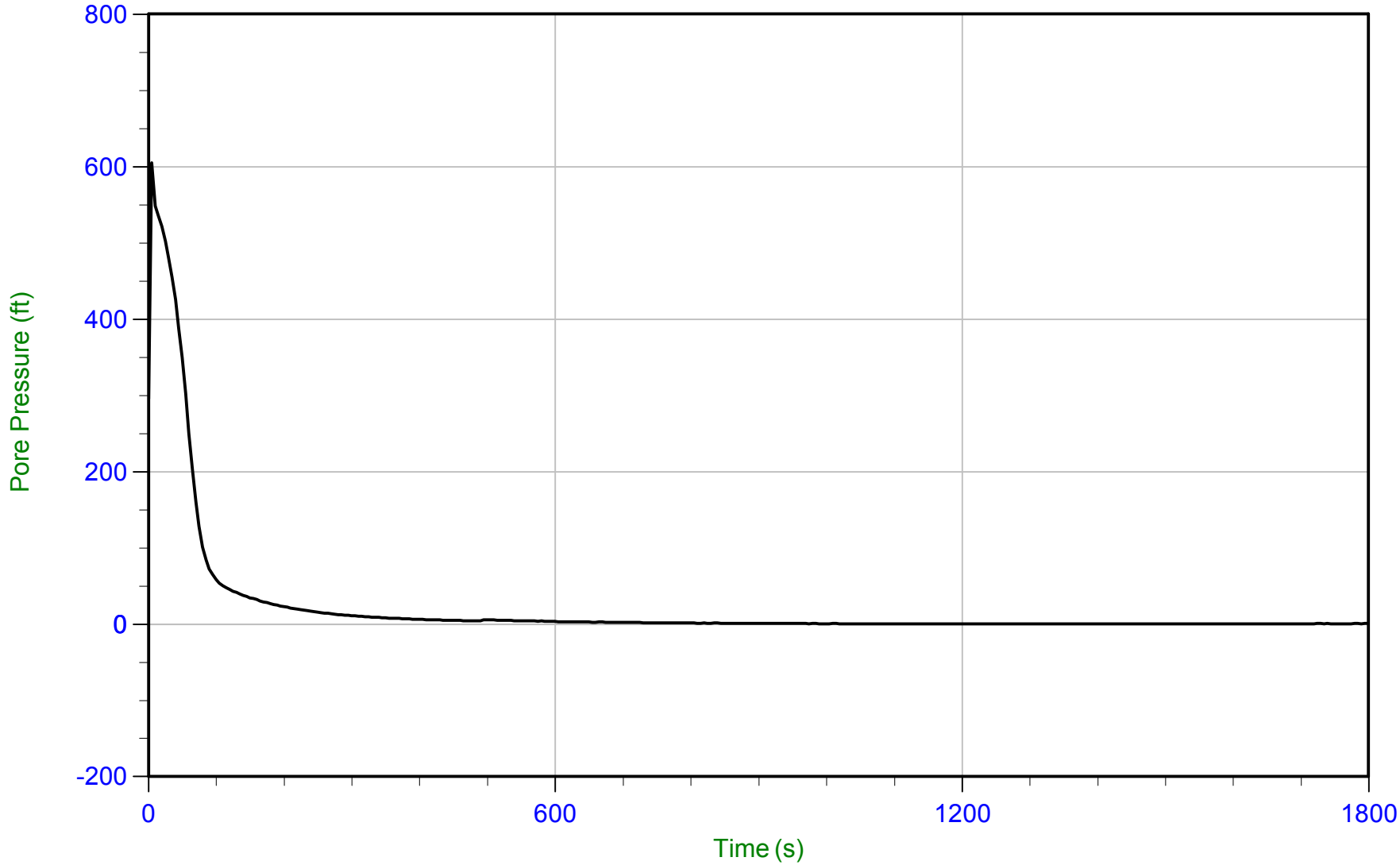
T(50): 2835.5 s
Ir: 100
Ch: 0.2 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 08:50:17
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C008
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP08.PPD
Depth: 10.250 m / 33.628 ft
Duration: 1800.0 s

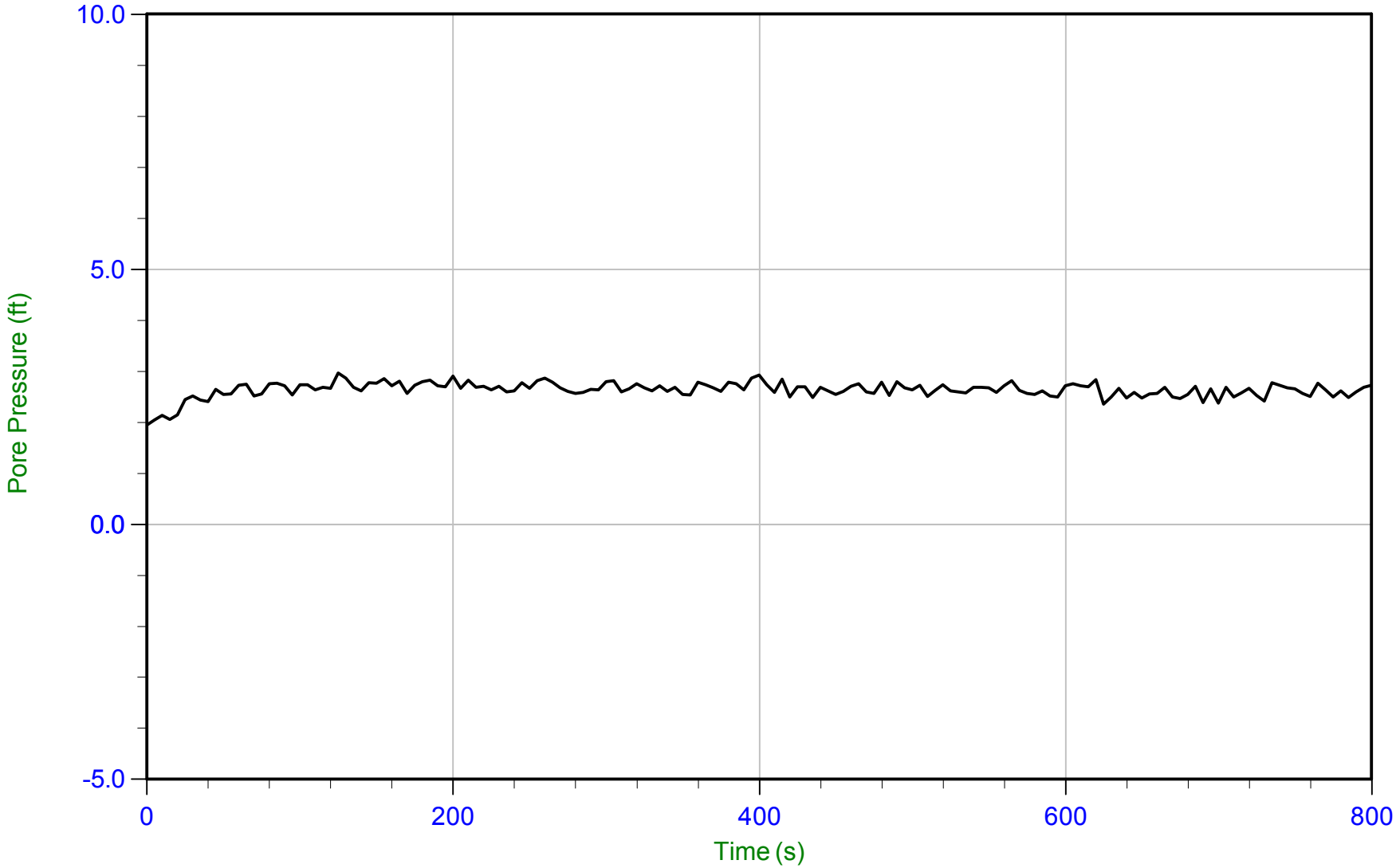
U Min: 0.1 ft
U Max: 605.2 ft

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 16:08:12
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C009
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP09.PPD
Depth: 4.900 m / 16.076 ft
Duration: 800.0 s

U Min: 1.9 ft
U Max: 3.0 ft

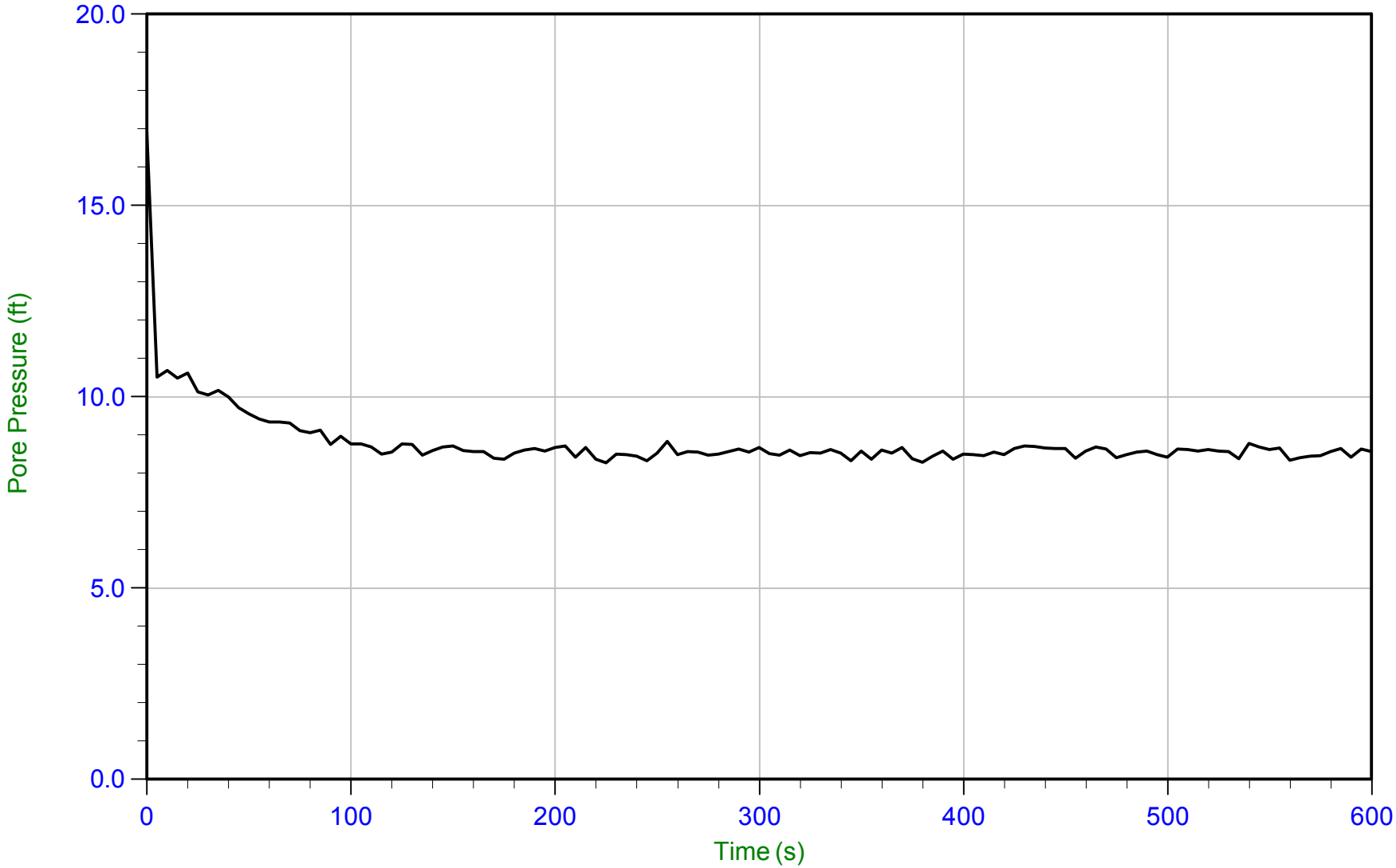
WT: 4.104 m / 13.464 ft
Ueq: 2.6 ft

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 16:08:12
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C009
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP09.PPD
Depth: 8.650 m / 28.379 ft
Duration: 600.0 s

U Min: 8.3 ft
U Max: 16.9 ft

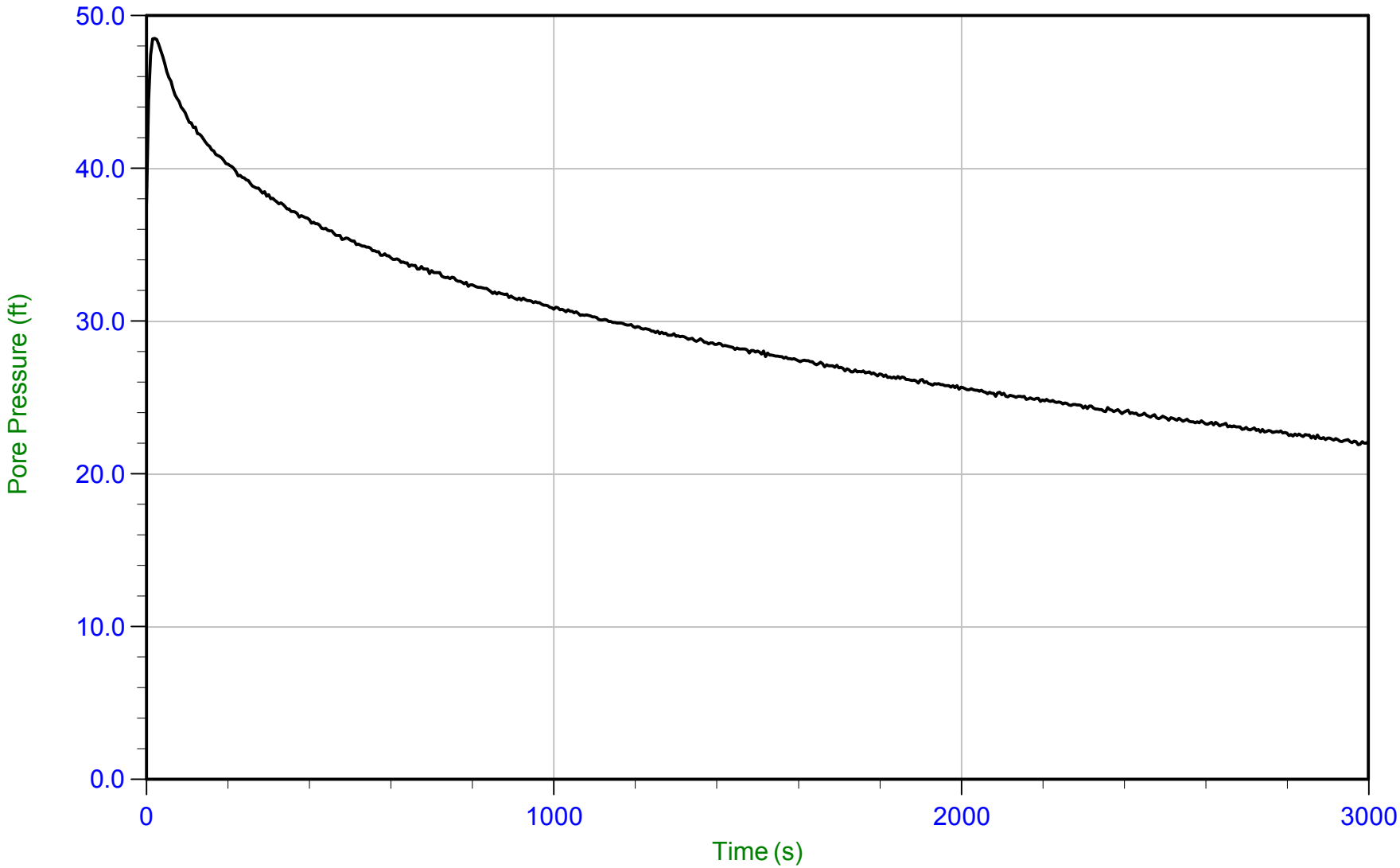
WT: 6.062 m / 19.888 ft
Ueq: 8.5 ft

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 12:10:38
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C010
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP10.PPD
Depth: 3.700 m / 12.139 ft
Duration: 3000.0 s

U Min: 21.9 ft
U Max: 48.5 ft

WT: 0.674 m / 2.211 ft
Ueq: 9.9 ft
U(50): 29.22 ft

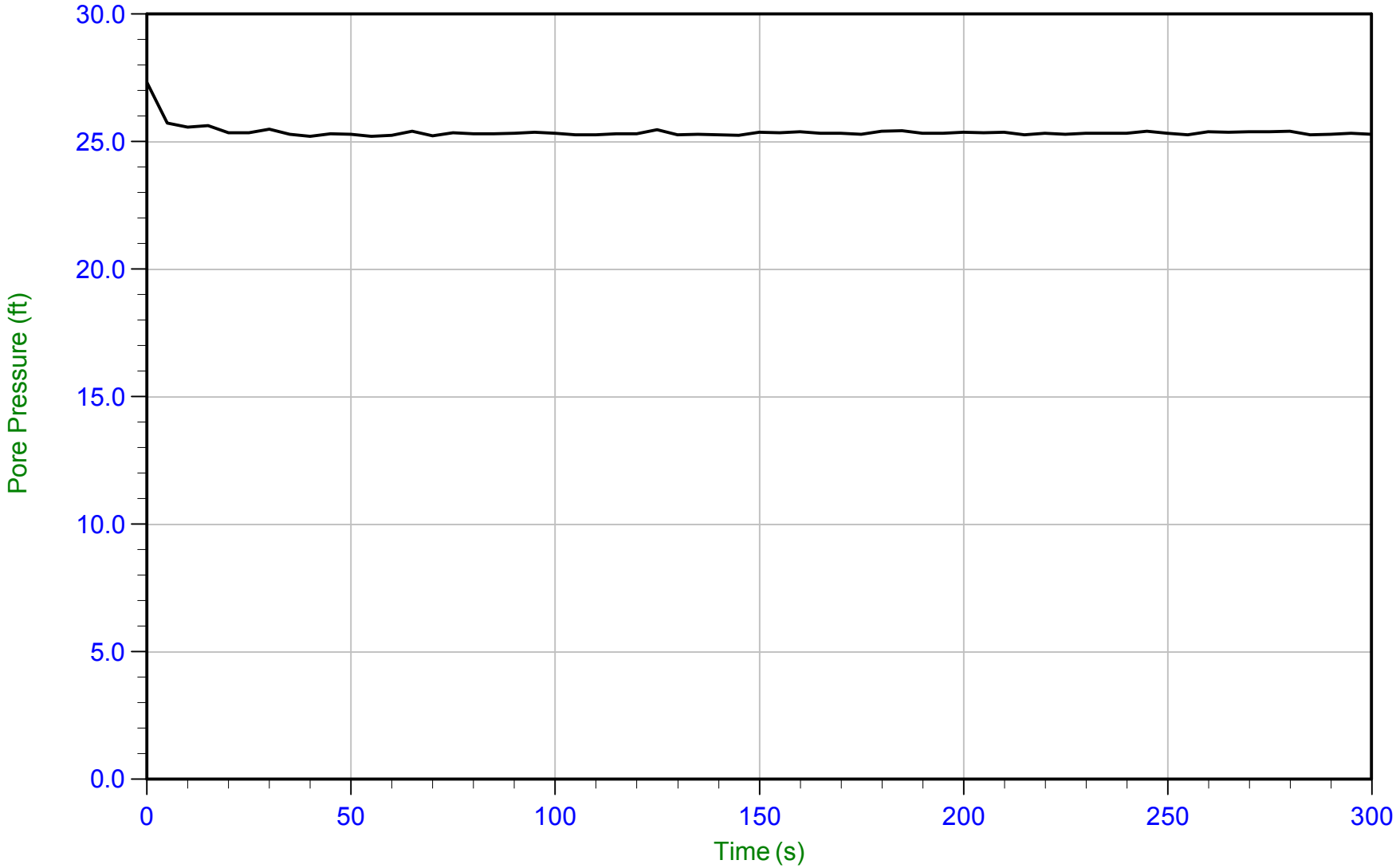
T(50): 1239.4 s
Ir: 100
Ch: 0.6 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 12:10:38
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C010
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP10.PPD
Depth: 8.400 m / 27.559 ft
Duration: 300.0 s

U Min: 25.2 ft
U Max: 27.3 ft

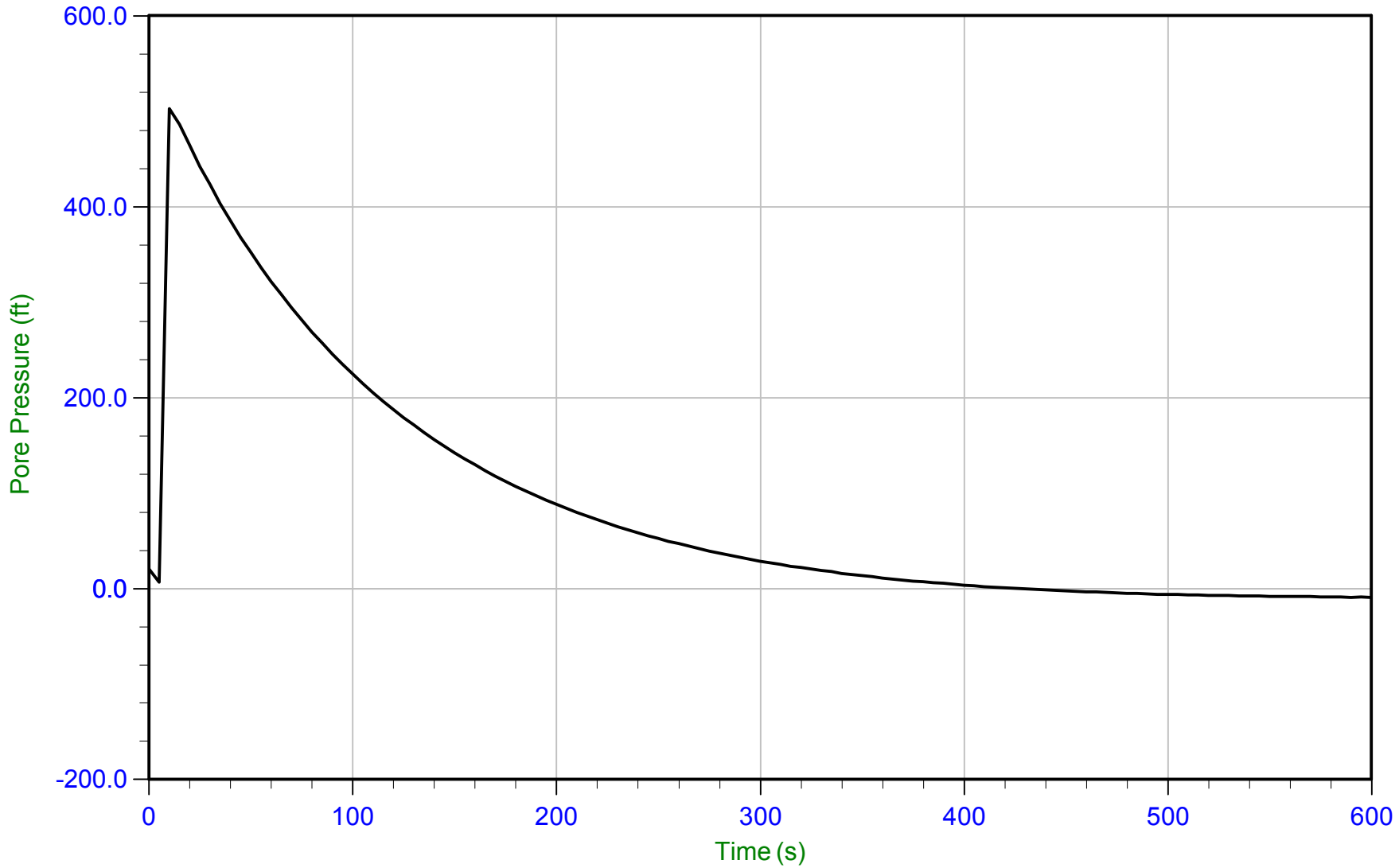
WT: 0.674 m / 2.211 ft
Ueq: 25.3 ft

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 12:10:38
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C010
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP10.PPD
Depth: 9.150 m / 30.019 ft
Duration: 600.0 s

U Min: -9.2 ft
U Max: 502.6 ft

WT: 9.150 m / 30.019 ft
Ueq: 0.0 ft
U(50): 251.28 ft

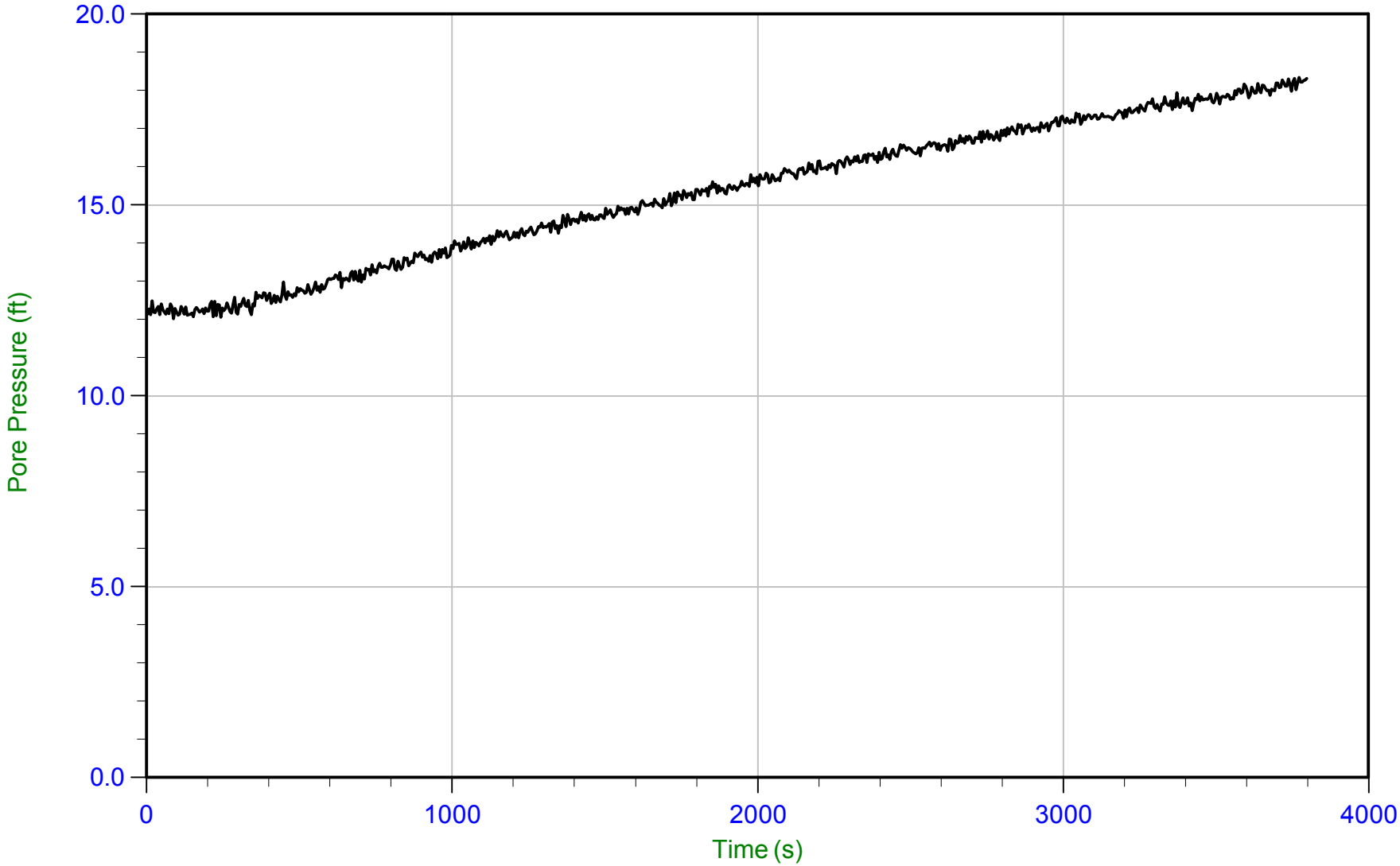
T(50): 77.5 s
Ir: 100
Ch: 9.1 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 10:19:26
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C011
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP11.PPD
Depth: 7.350 m / 24.114 ft
Duration: 3800.0 s

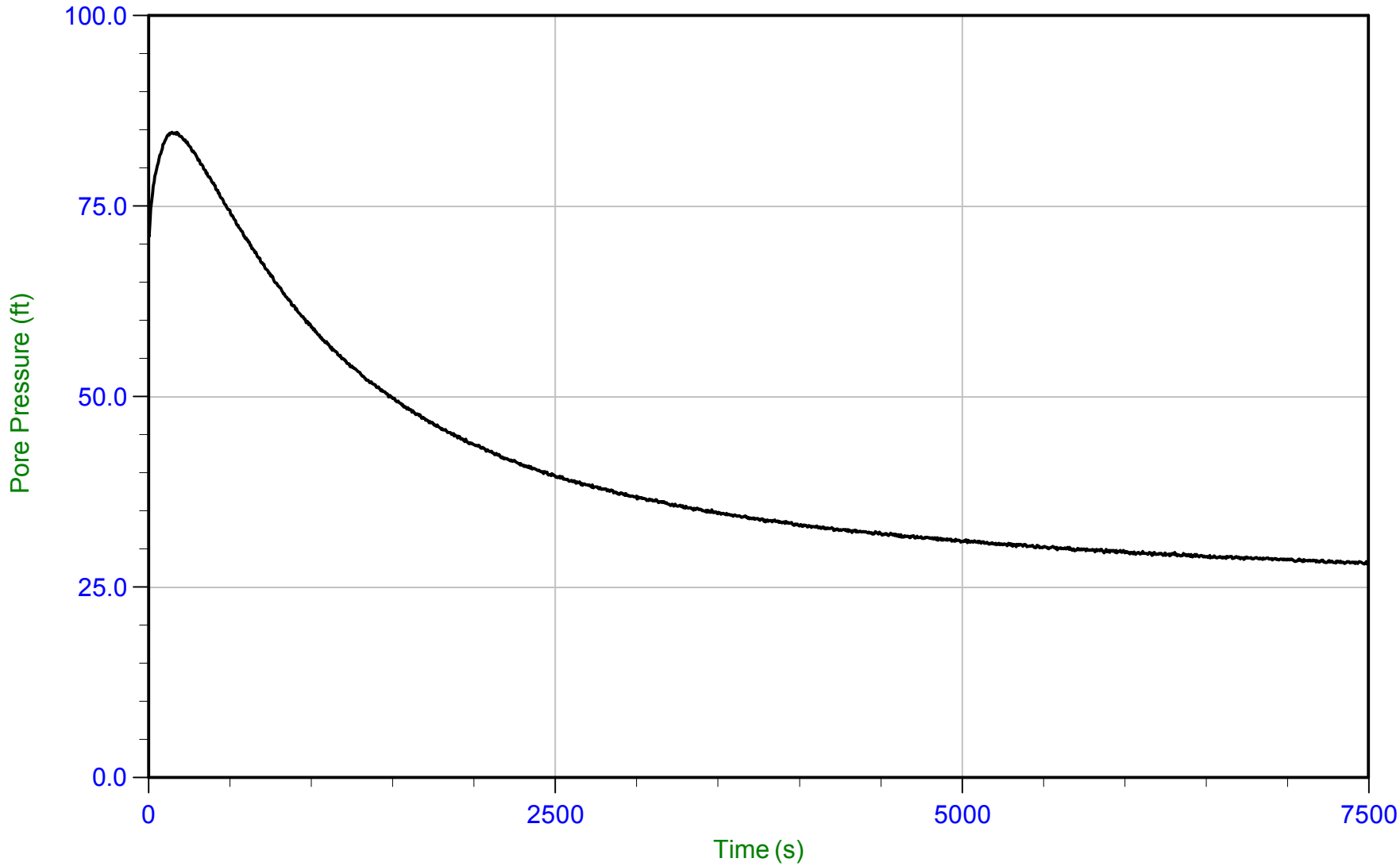
U Min: 12.0 ft
U Max: 18.3 ft

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 10:19:26
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C011
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP11.PPD
Depth: 14.150 m / 46.423 ft
Duration: 7500.0 s

U Min: 28.0 ft
U Max: 84.7 ft

WT: 6.848 m / 22.467 ft
Ueq: 24.0 ft
U(50): 54.34 ft

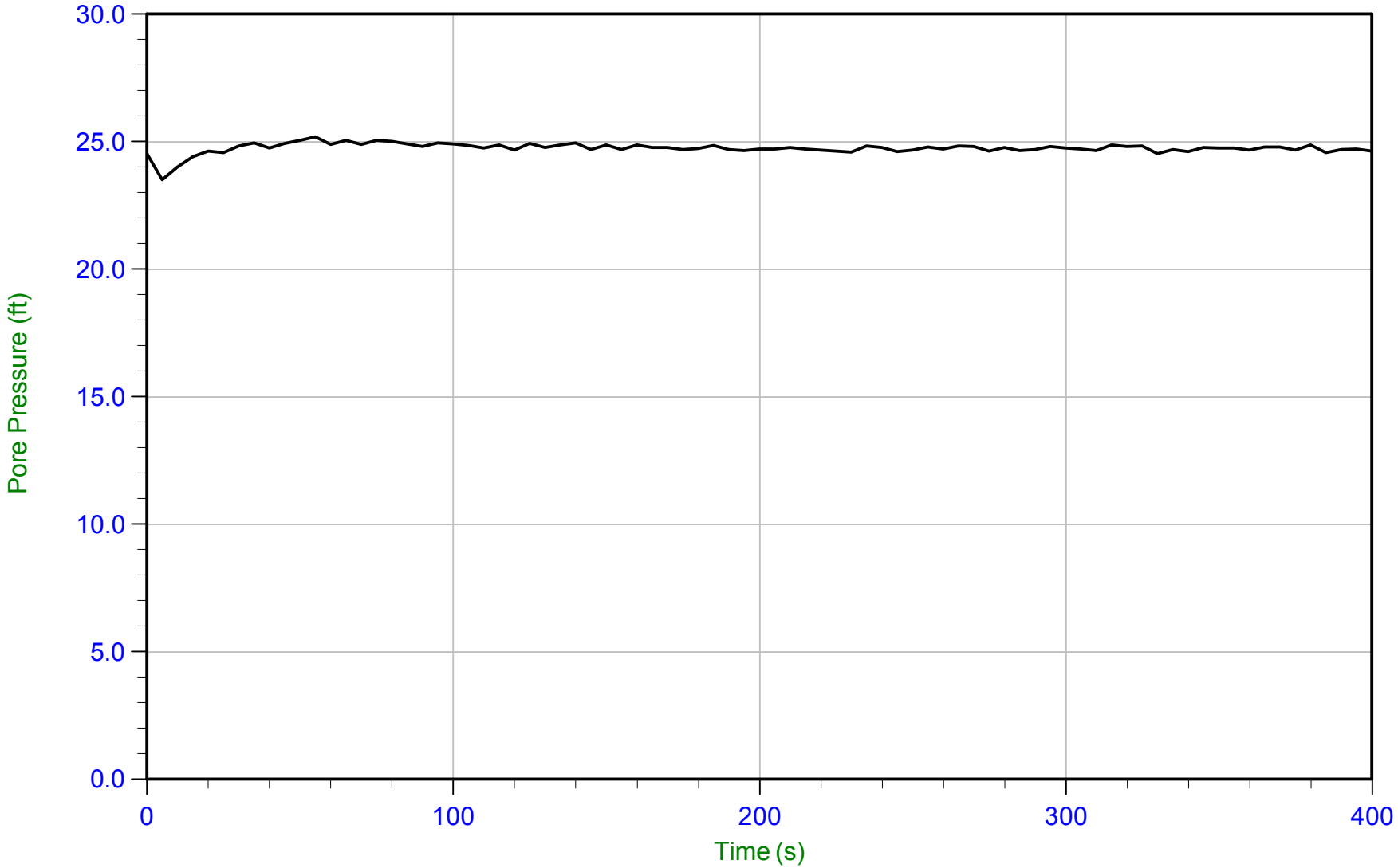
T(50): 1082.1 s
Ir: 100
Ch: 0.6 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 10:19:26
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C011
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP11.PPD
Depth: 14.350 m / 47.079 ft
Duration: 400.0 s

U Min: 23.5 ft
U Max: 25.2 ft

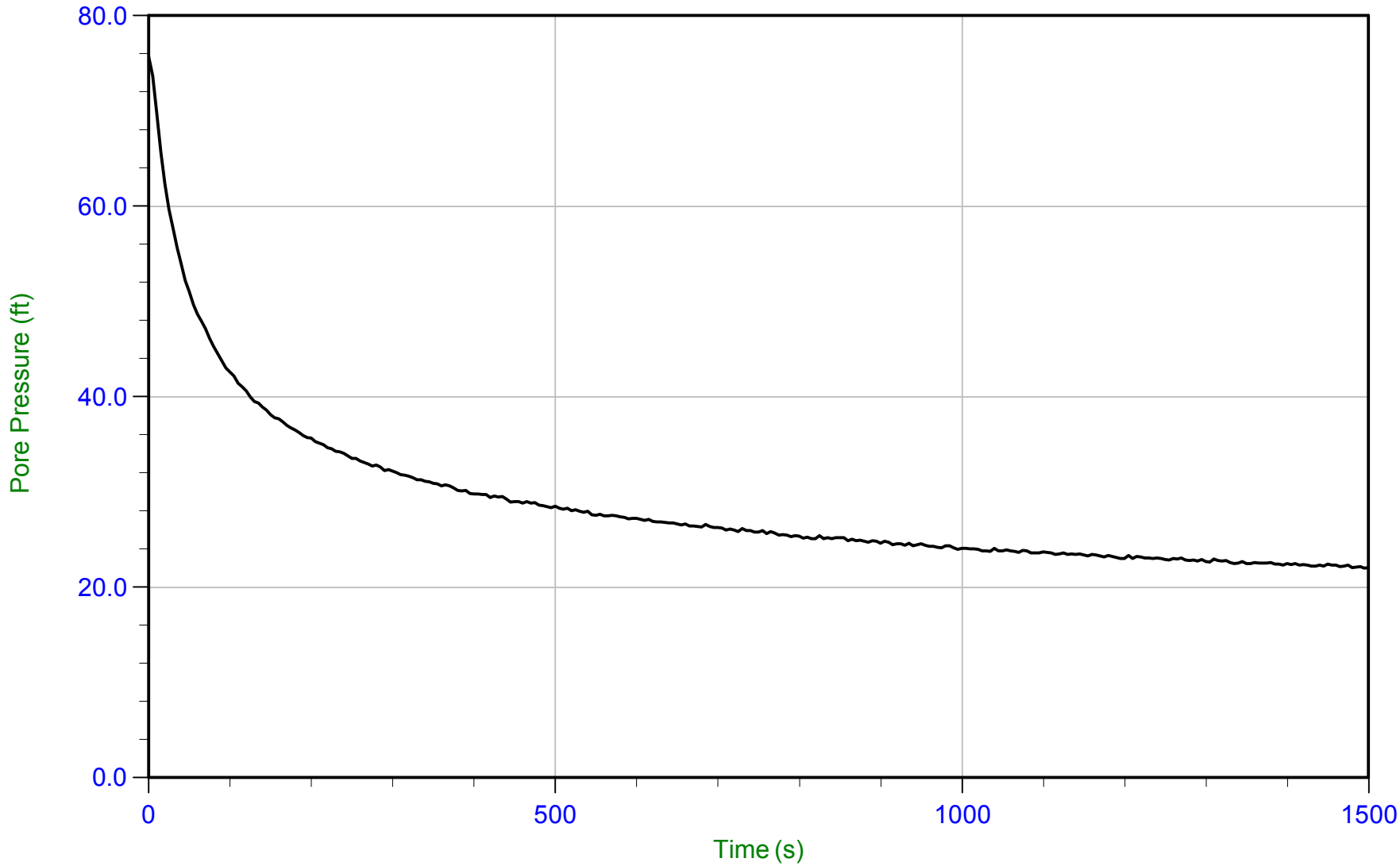
WT: 6.848 m / 22.467 ft
Ueq: 24.6 ft

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 14:27:24
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C012
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP12.PPD
Depth: 8.800 m / 28.871 ft
Duration: 1500.0 s

U Min: 22.0 ft
U Max: 75.7 ft

WT: 7.108 m / 23.320 ft
Ueq: 5.6 ft
U(50): 40.63 ft

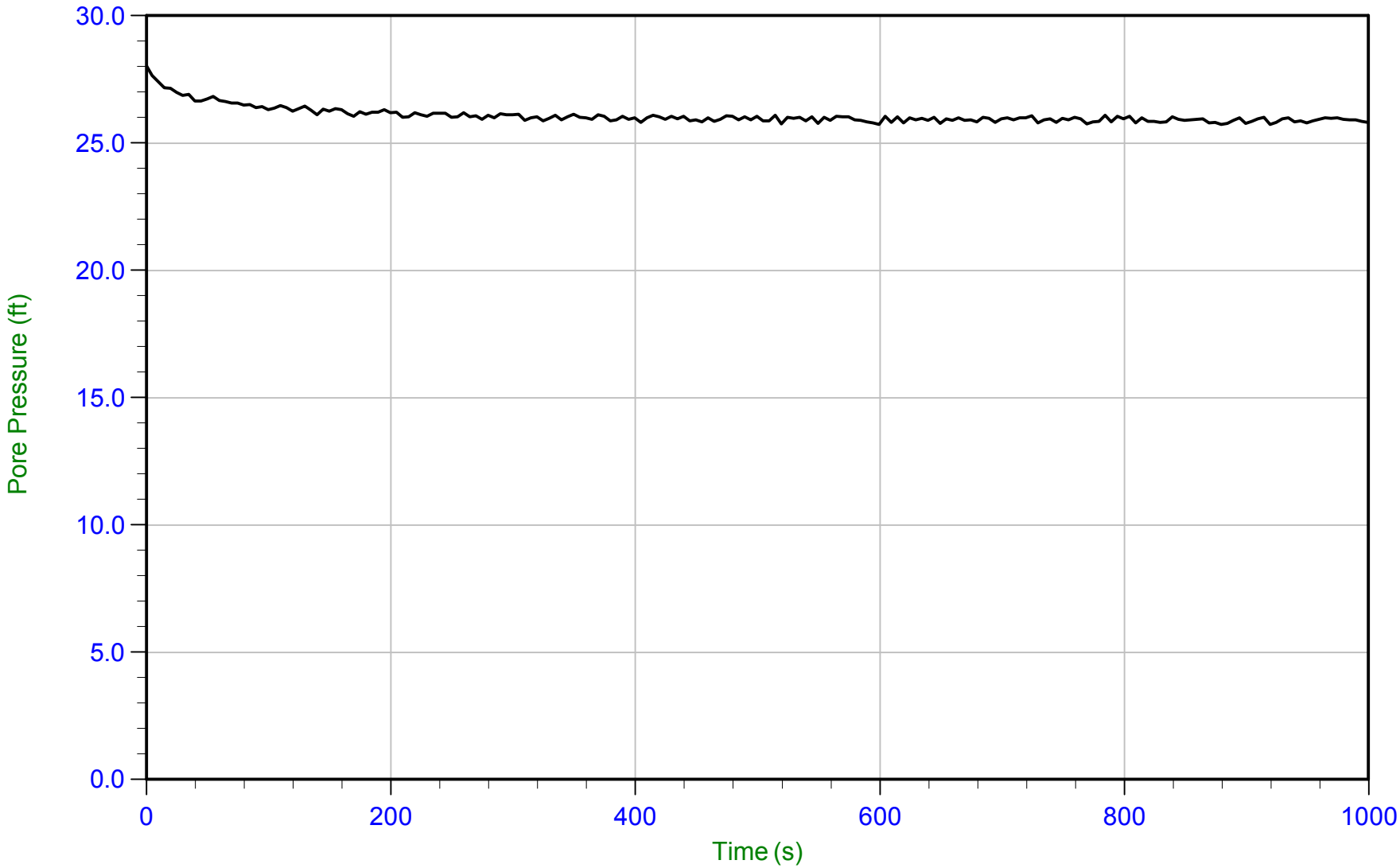
T(50): 119.8 s
Ir: 100
Ch: 5.9 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 14:27:24
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C012
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP12.PPD
Depth: 14.950 m / 49.048 ft
Duration: 1000.0 s

U Min: 25.7 ft
U Max: 28.0 ft

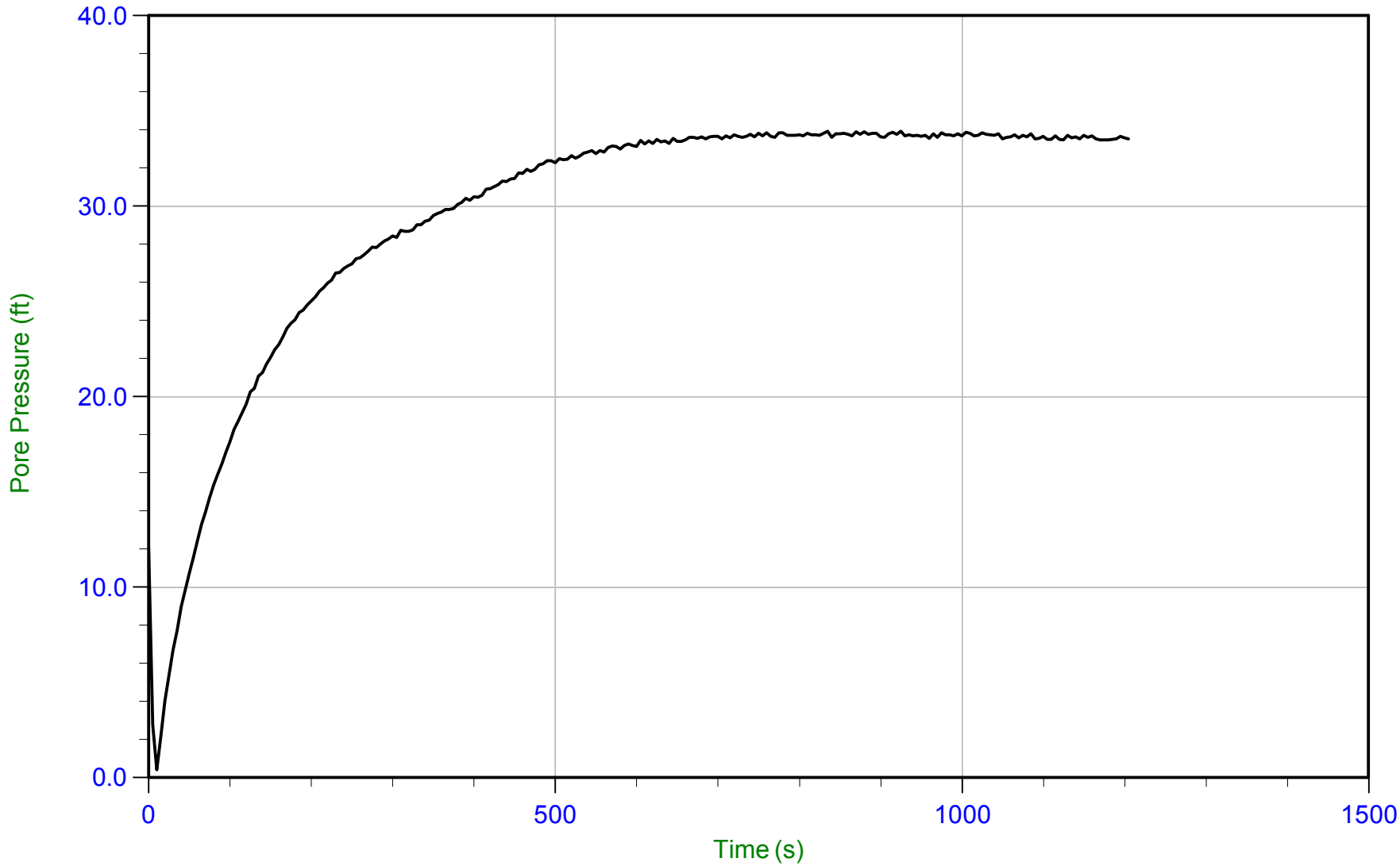
WT: 7.108 m / 23.320 ft
Ueq: 25.7 ft

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 08:45:02
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C013
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP13.PPD
Depth: 17.150 m / 56.266 ft
Duration: 1205.0 s

U Min: 0.4 ft
U Max: 33.9 ft

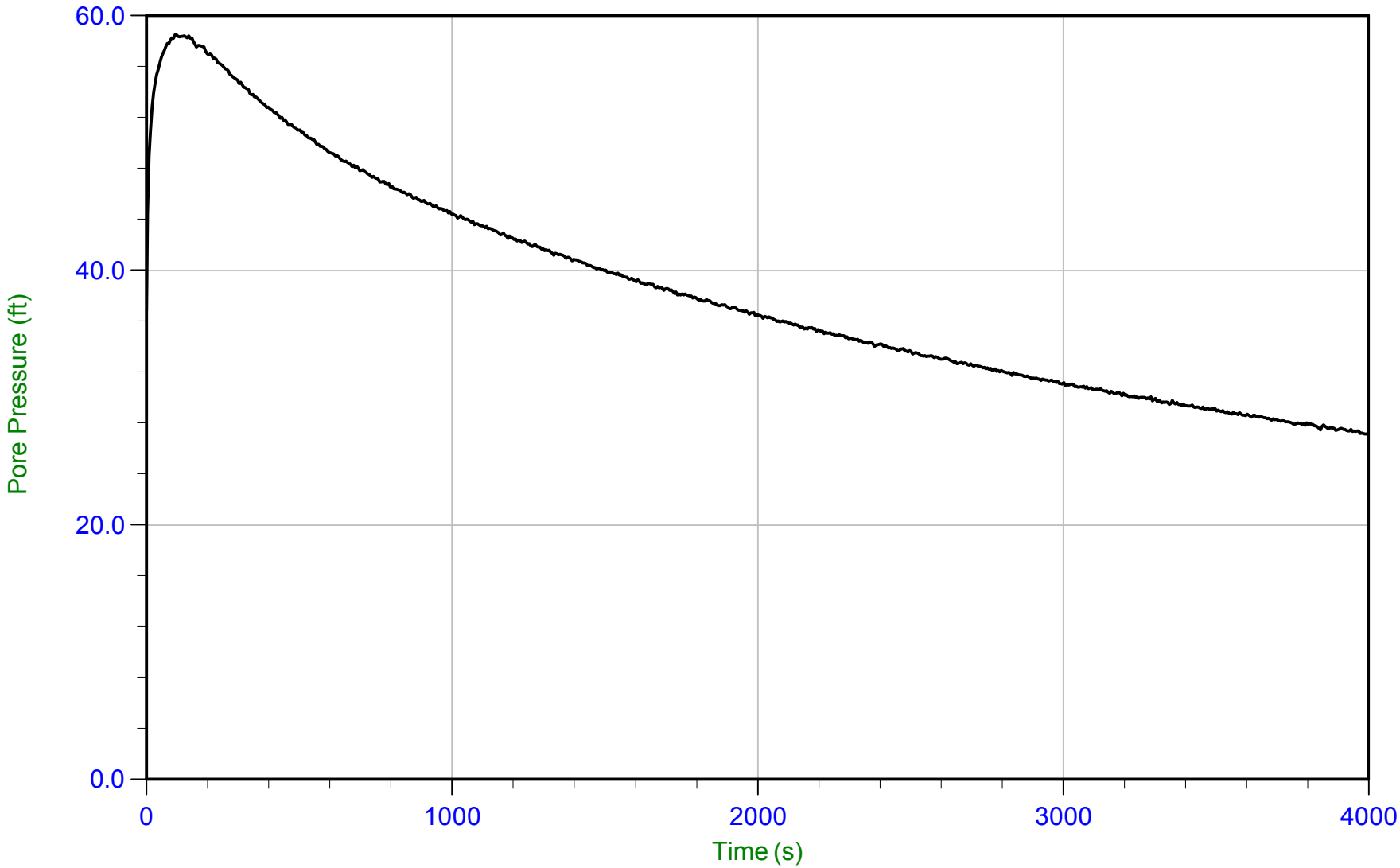
WT: 6.905 m / 22.654 ft
Ueq: 33.6 ft

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 14:29:59
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C014
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP14.PPD
Depth: 4.900 m / 16.076 ft
Duration: 4000.0 s

U Min: 27.1 ft
U Max: 58.5 ft

WT: 1.498 m / 4.915 ft
Ueq: 11.2 ft
U(50): 34.84 ft

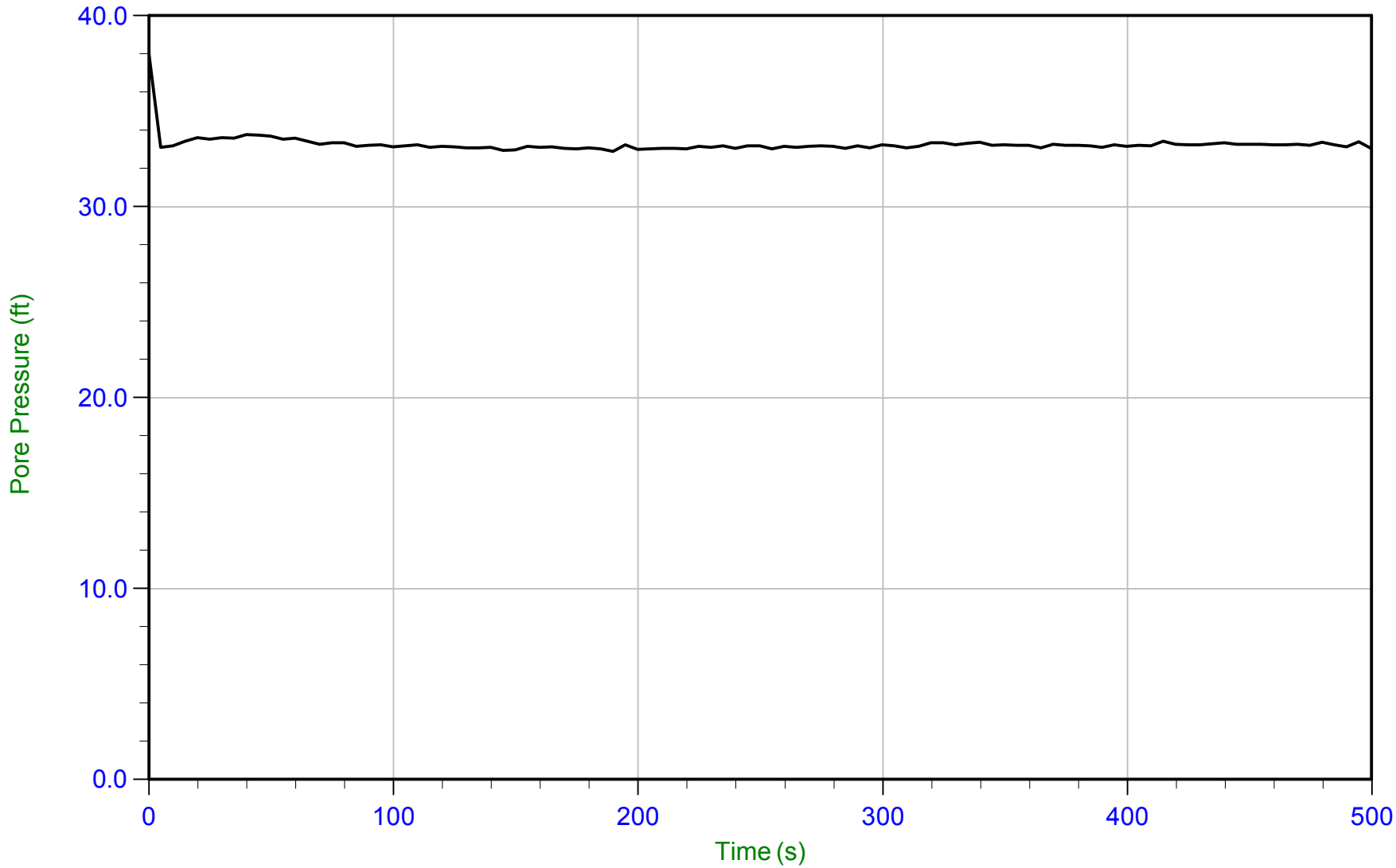
T(50): 2190.4 s
Ir: 100
Ch: 0.3 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 14:29:59
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C014
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP14.PPD
Depth: 11.650 m / 38.221 ft
Duration: 500.0 s

U Min: 32.9 ft
U Max: 38.0 ft

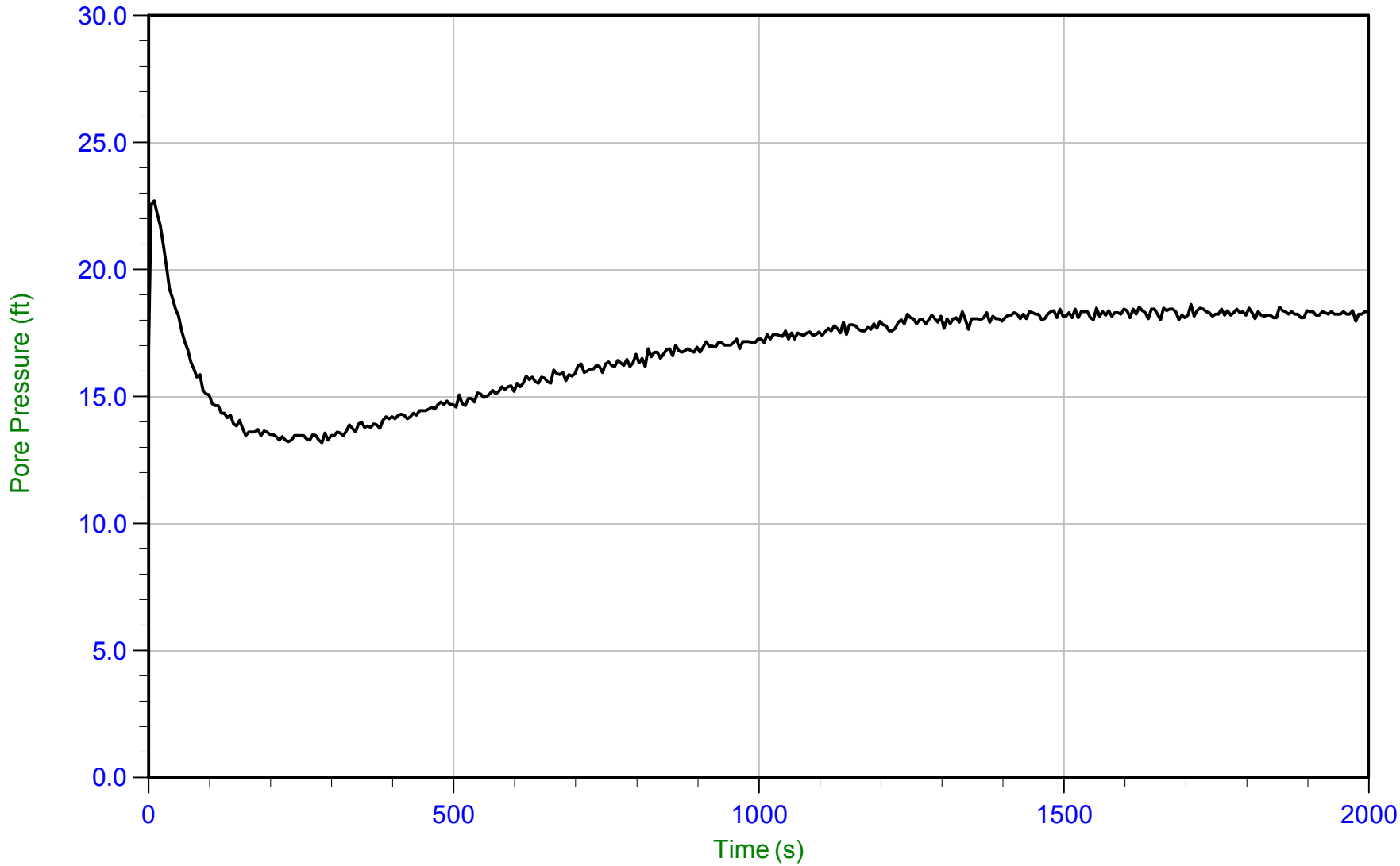
WT: 1.498 m / 4.915 ft
Ueq: 33.3 ft

CONETEC

AECOM

Job No: 15-53073
Date: 19-Aug-2015 14:12:51
Site: Edwards Power Station

Sounding: EDW-C015A
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP15A.PPD
Depth: 4.600 m / 15.092 ft
Duration: 2000.0 s

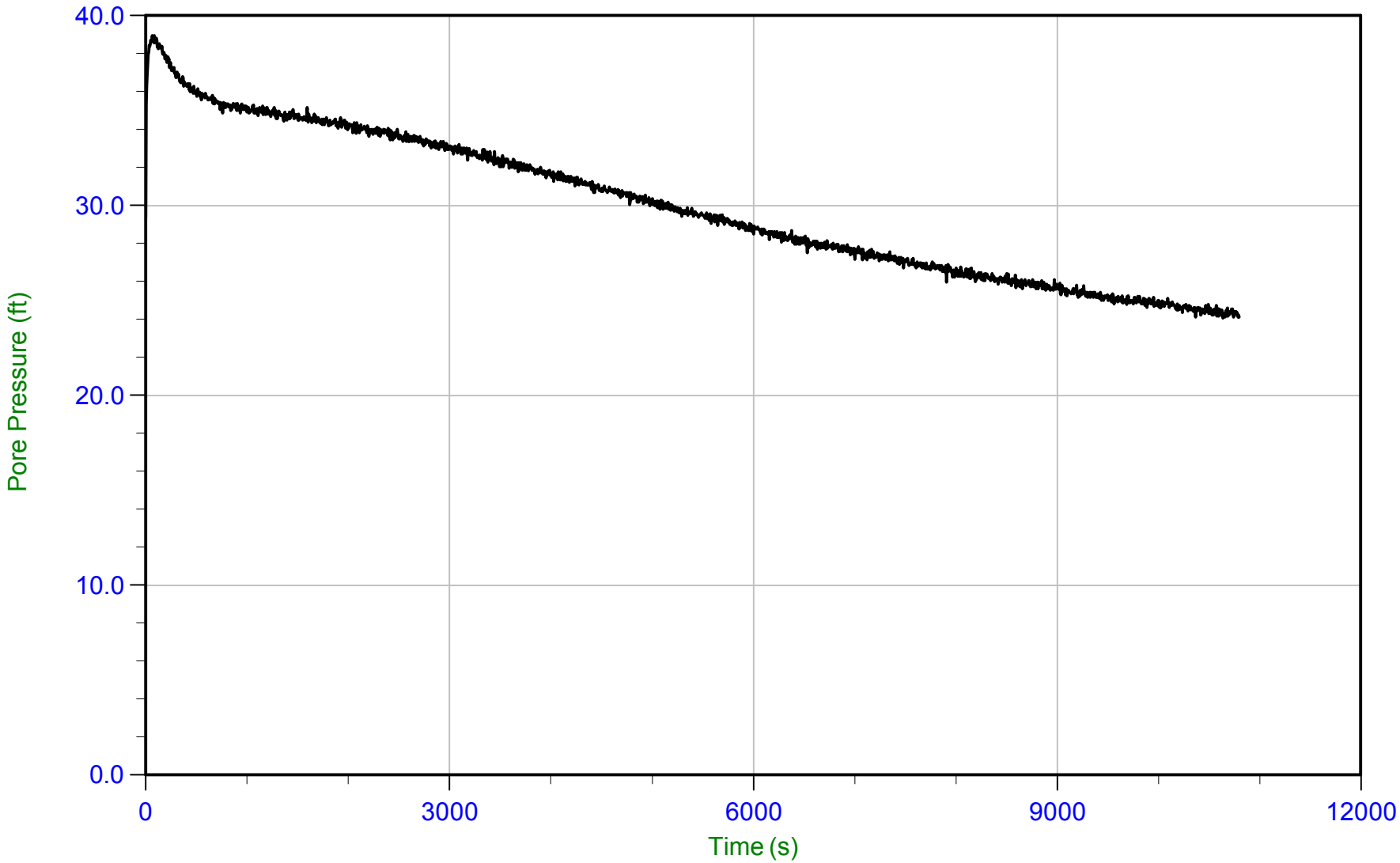
U Min: 13.2 ft
U Max: 22.7 ft

CONETEC

AECOM

Job No: 15-53073
Date: 19-Aug-2015 14:12:51
Site: Edwards Power Station

Sounding: EDW-C015A
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP15A.PPD
Depth: 9.000 m / 29.527 ft
Duration: 10800.0 s

U Min: 24.1 ft
U Max: 39.0 ft

WT: 3.658 m / 12.001 ft
Ueq: 17.5 ft
U(50): 28.24 ft

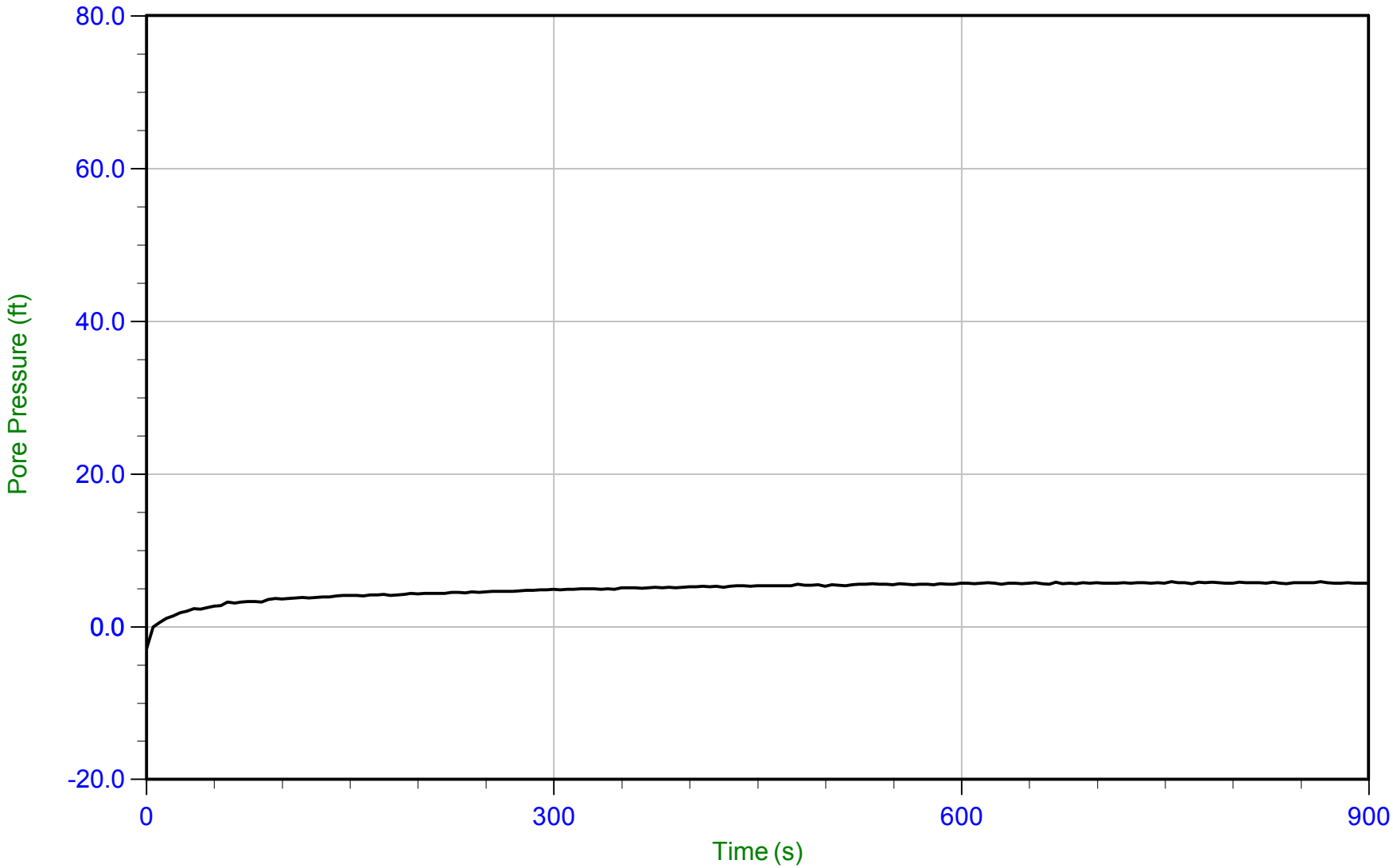
T(50): 6094.6 s
Ir: 100
Ch: 0.1 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 08:46:01
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C016
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP16.PPD
Depth: 2.250 m / 7.382 ft
Duration: 900.0 s

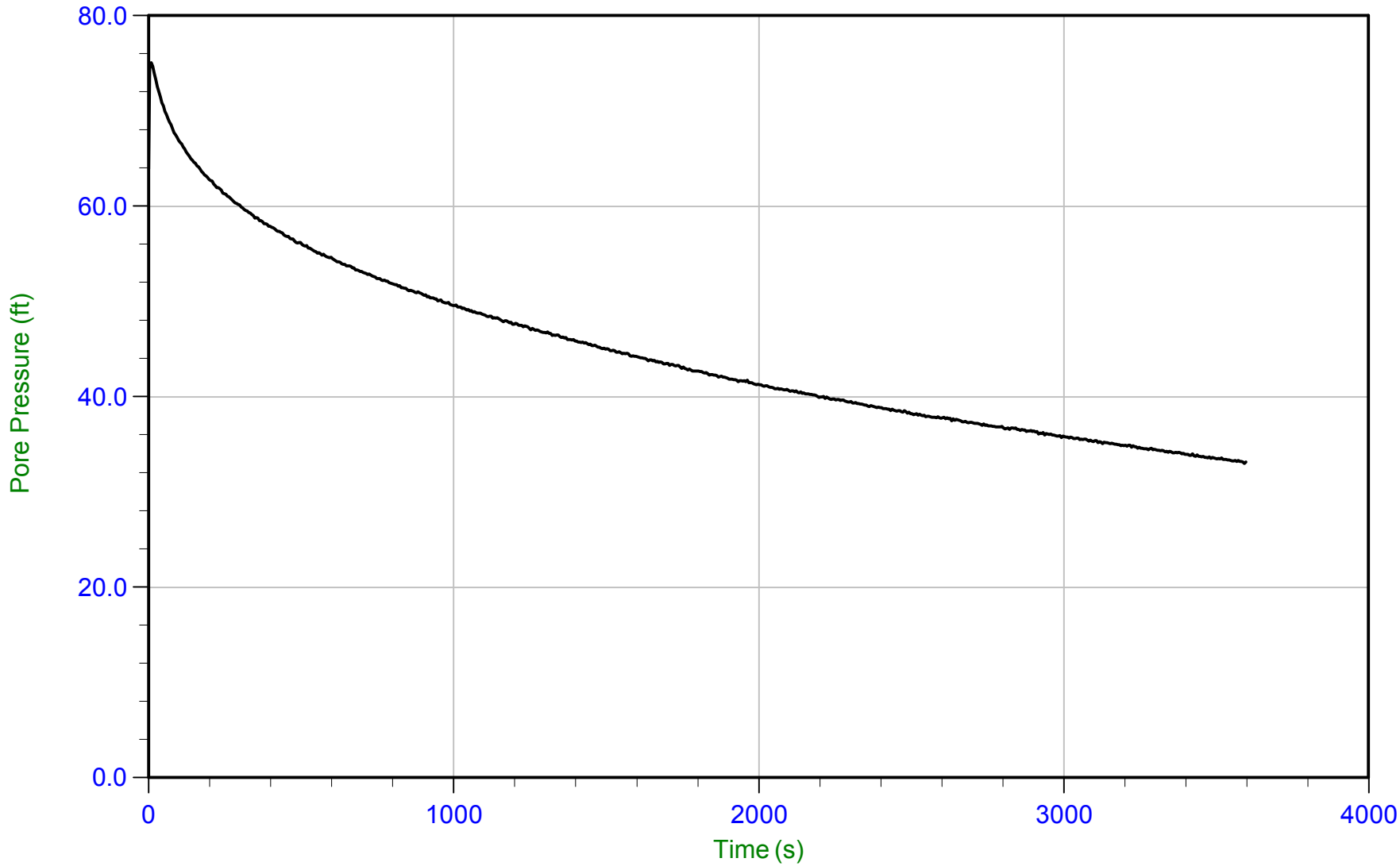
U Min: -2.9 ft
U Max: 5.9 ft

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 08:46:01
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C016
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP16.PPD
Depth: 5.500 m / 18.044 ft
Duration: 3600.0 s

U Min: 33.0 ft
U Max: 75.1 ft

WT: 1.173 m / 3.848 ft
Ueq: 14.2 ft
U(50): 44.64 ft

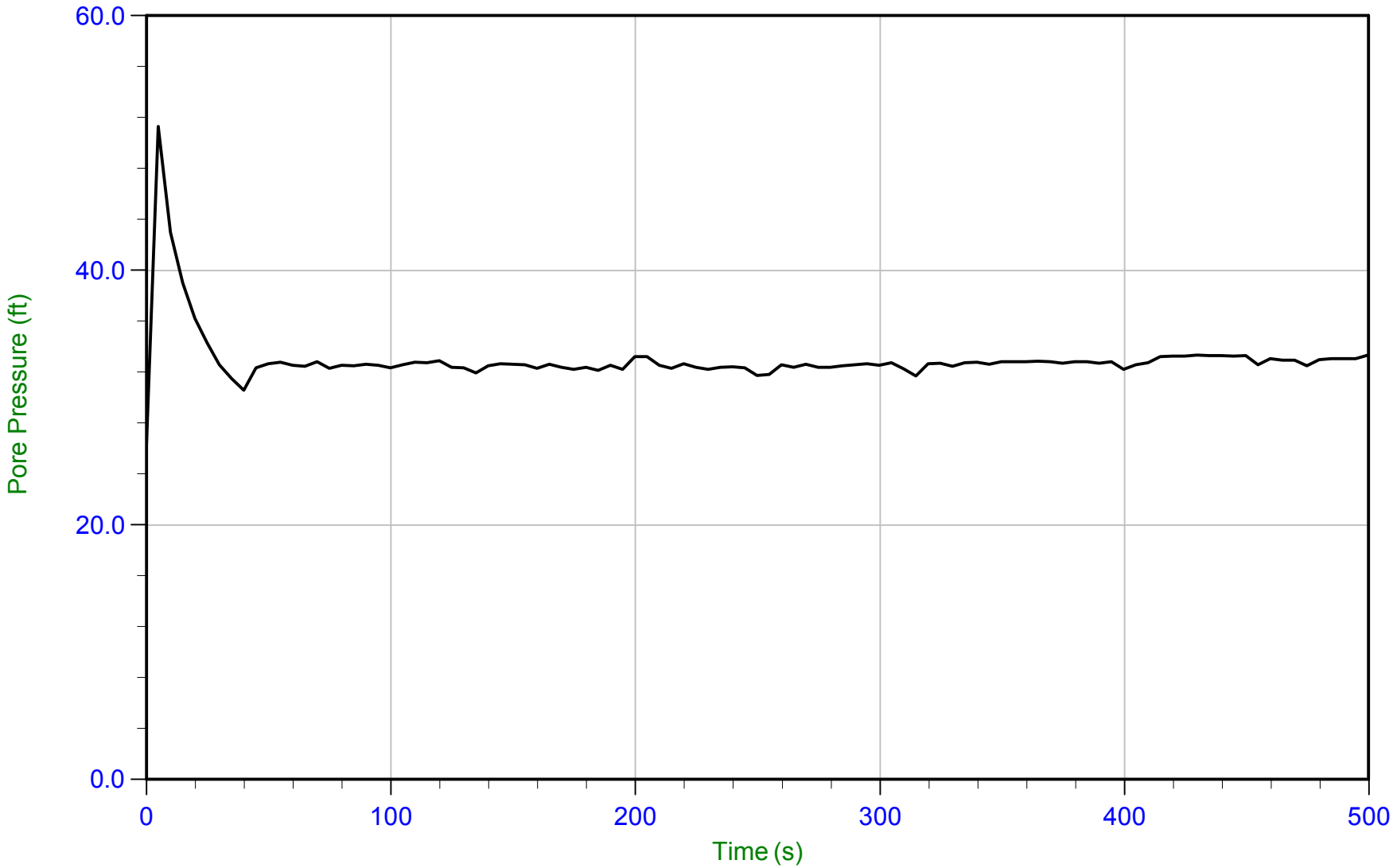
T(50): 1538.2 s
Ir: 100
Ch: 0.5 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 28-Aug-2015 08:46:01
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C016
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP16.PPD
Depth: 11.250 m / 36.909 ft
Duration: 500.0 s

U Min: 26.4 ft
U Max: 51.3 ft

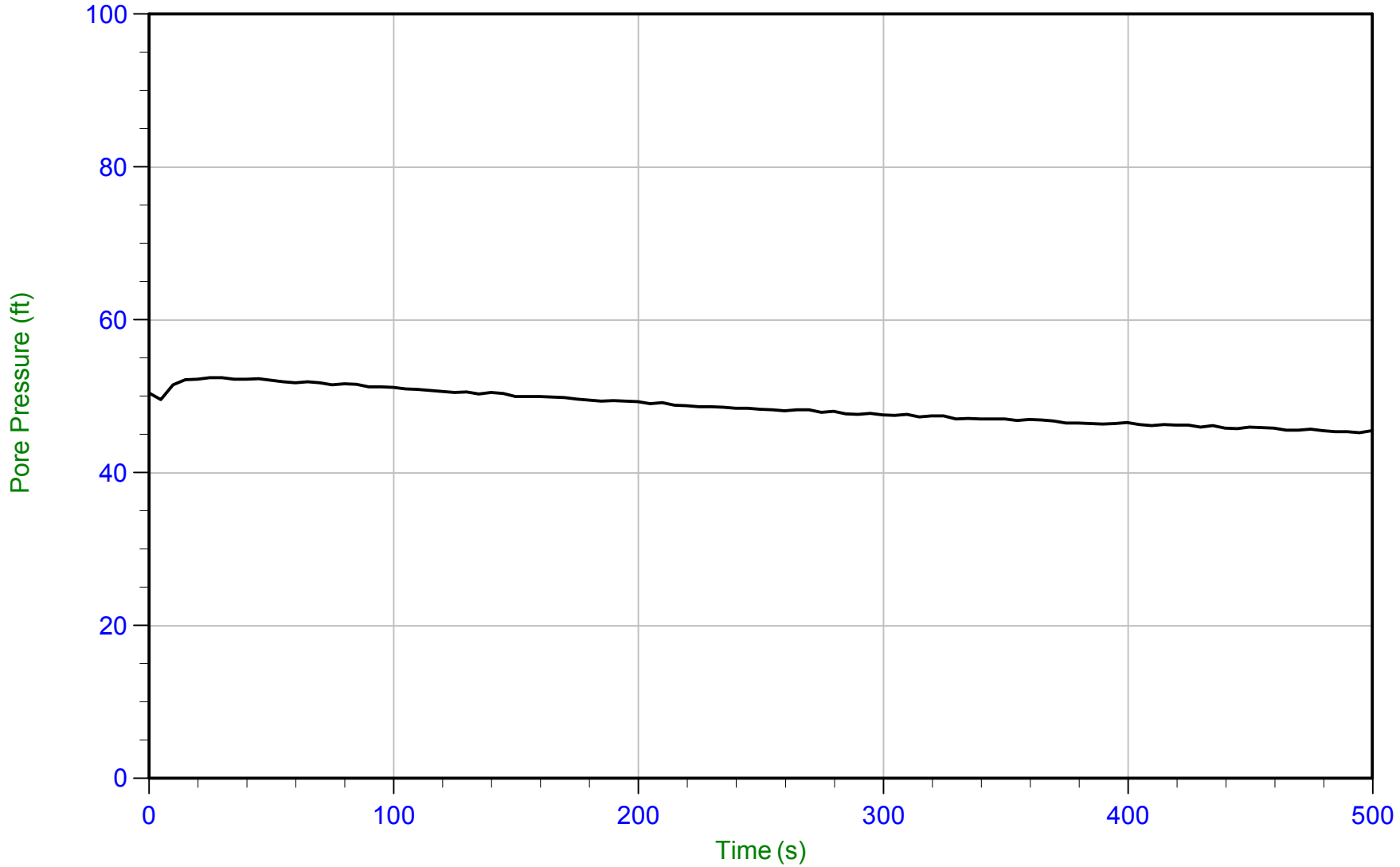
WT: 1.173 m / 3.848 ft
Ueq: 33.1 ft

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 11:13:32
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C017
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP17.PPD
Depth: 8.500 m / 27.887 ft
Duration: 500.0 s

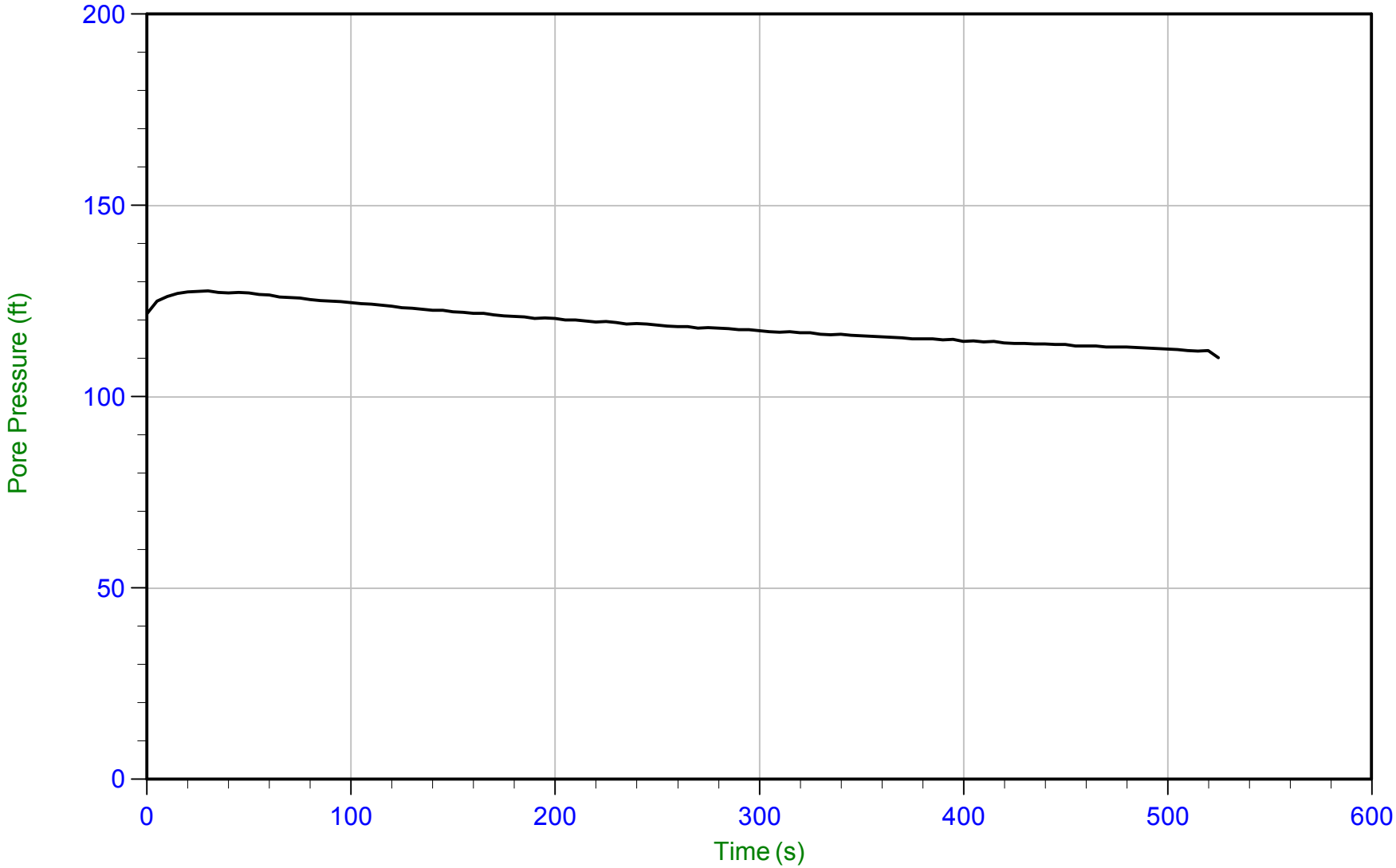
U Min: 45.3 ft
U Max: 52.5 ft

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 11:13:32
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C017
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP17.PPD
Depth: 12.350 m / 40.518 ft
Duration: 525.0 s

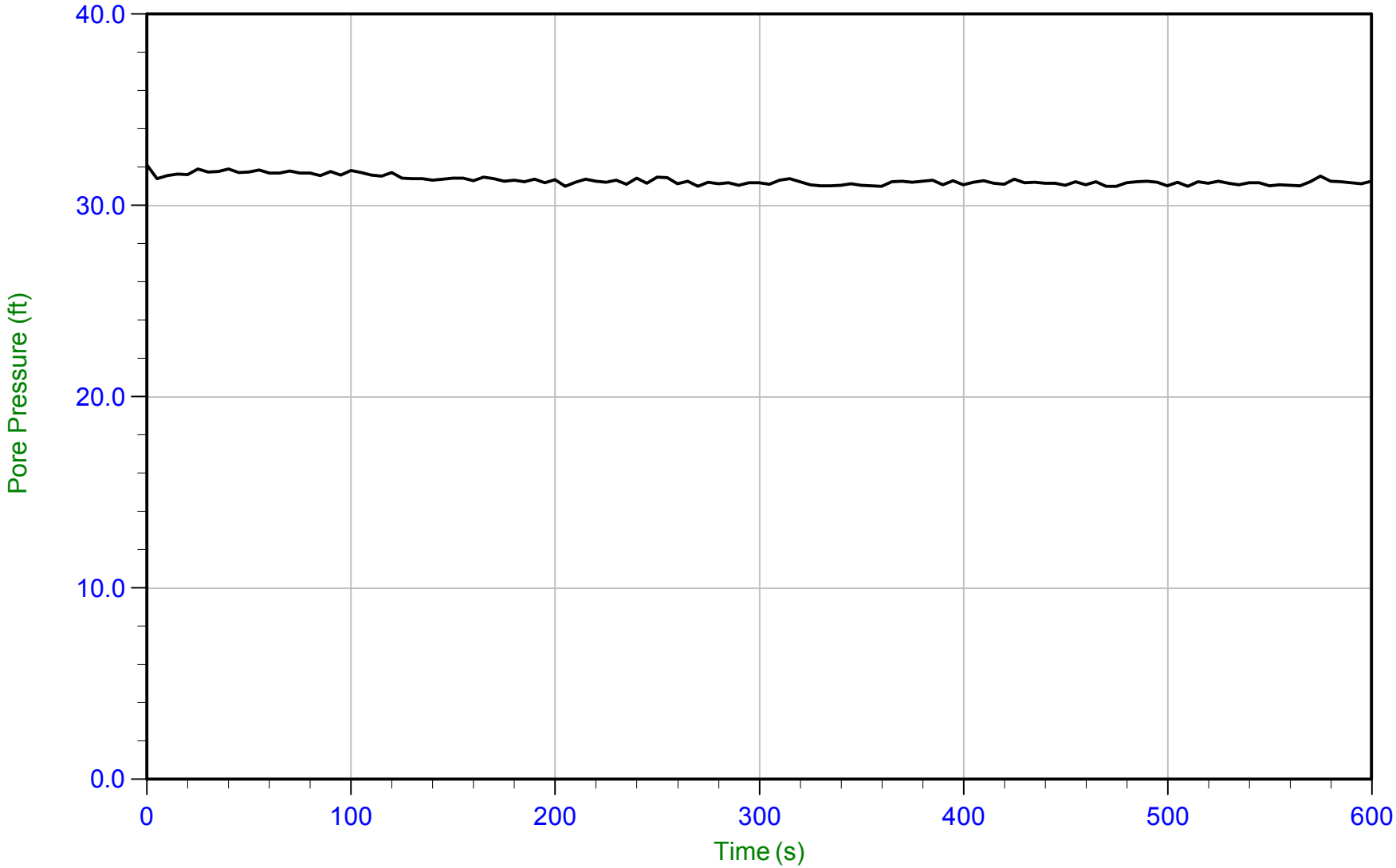
U Min: 110.3 ft
U Max: 127.7 ft

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 11:13:32
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C017
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP17.PPD
Depth: 16.850 m / 55.281 ft
Duration: 600.0 s

U Min: 31.0 ft
U Max: 32.1 ft

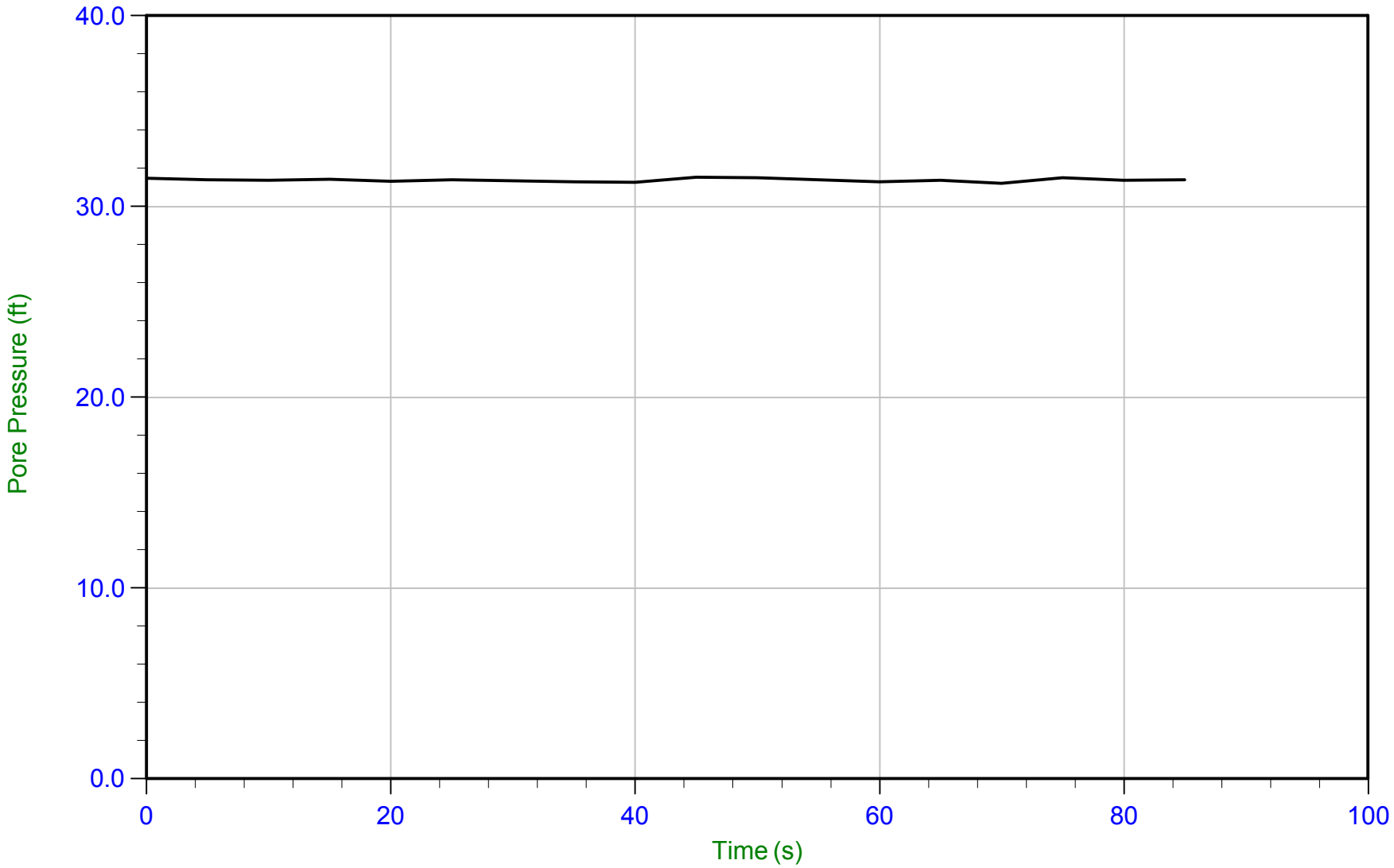
WT: 7.367 m / 24.170 ft
Ueq: 31.1 ft

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 11:13:32
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C017
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP17.PPD
Depth: 17.050 m / 55.938 ft
Duration: 85.0 s

U Min: 31.2 ft
U Max: 31.5 ft

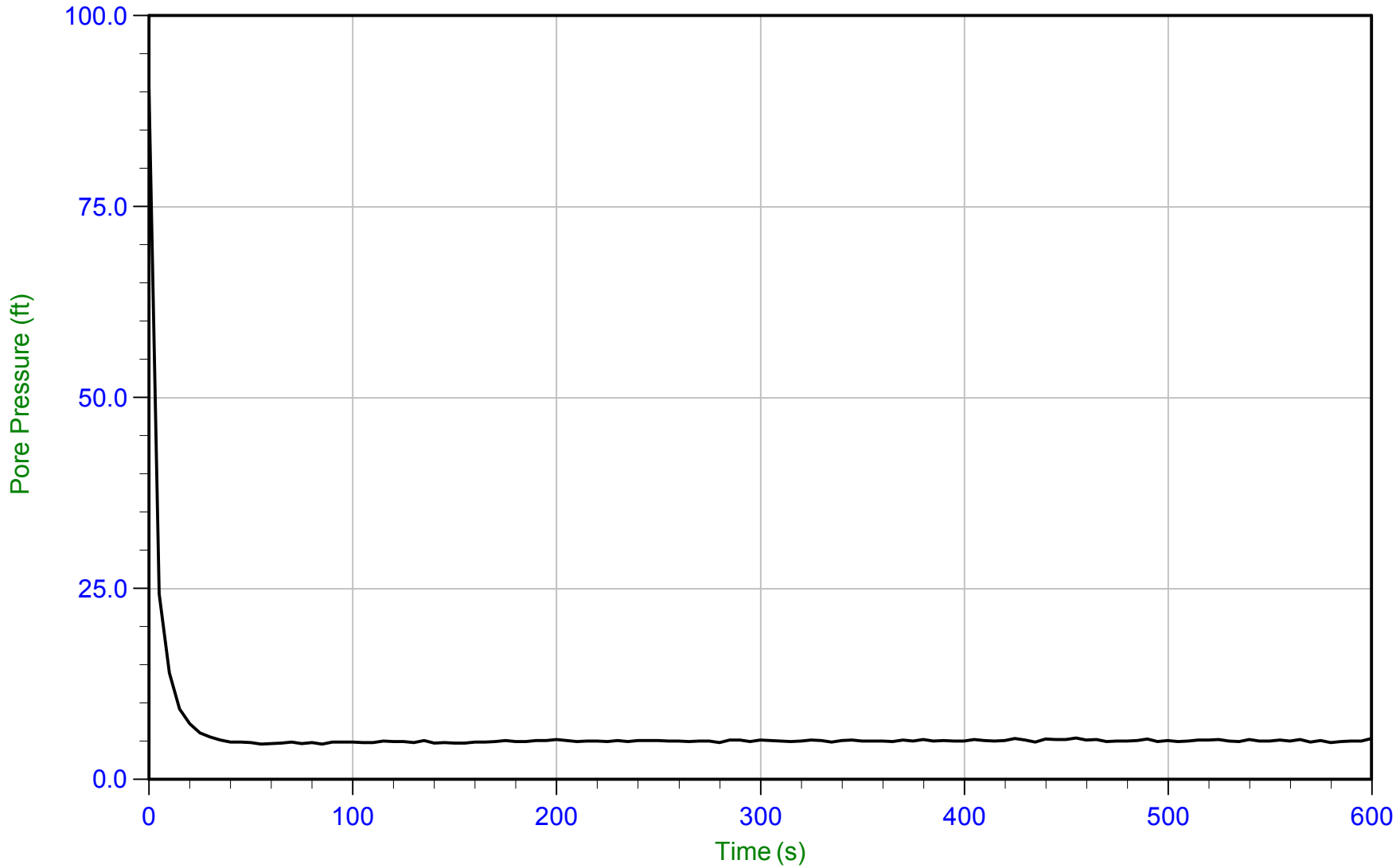
WT: 7.525 m / 24.688 ft
Ueq: 31.2 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 11:13:53
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C019
Cone: AD419
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP19.PPD
Depth: 3.600 m / 11.811 ft
Duration: 600.0 s

U Min: 4.7 ft
U Max: 90.3 ft

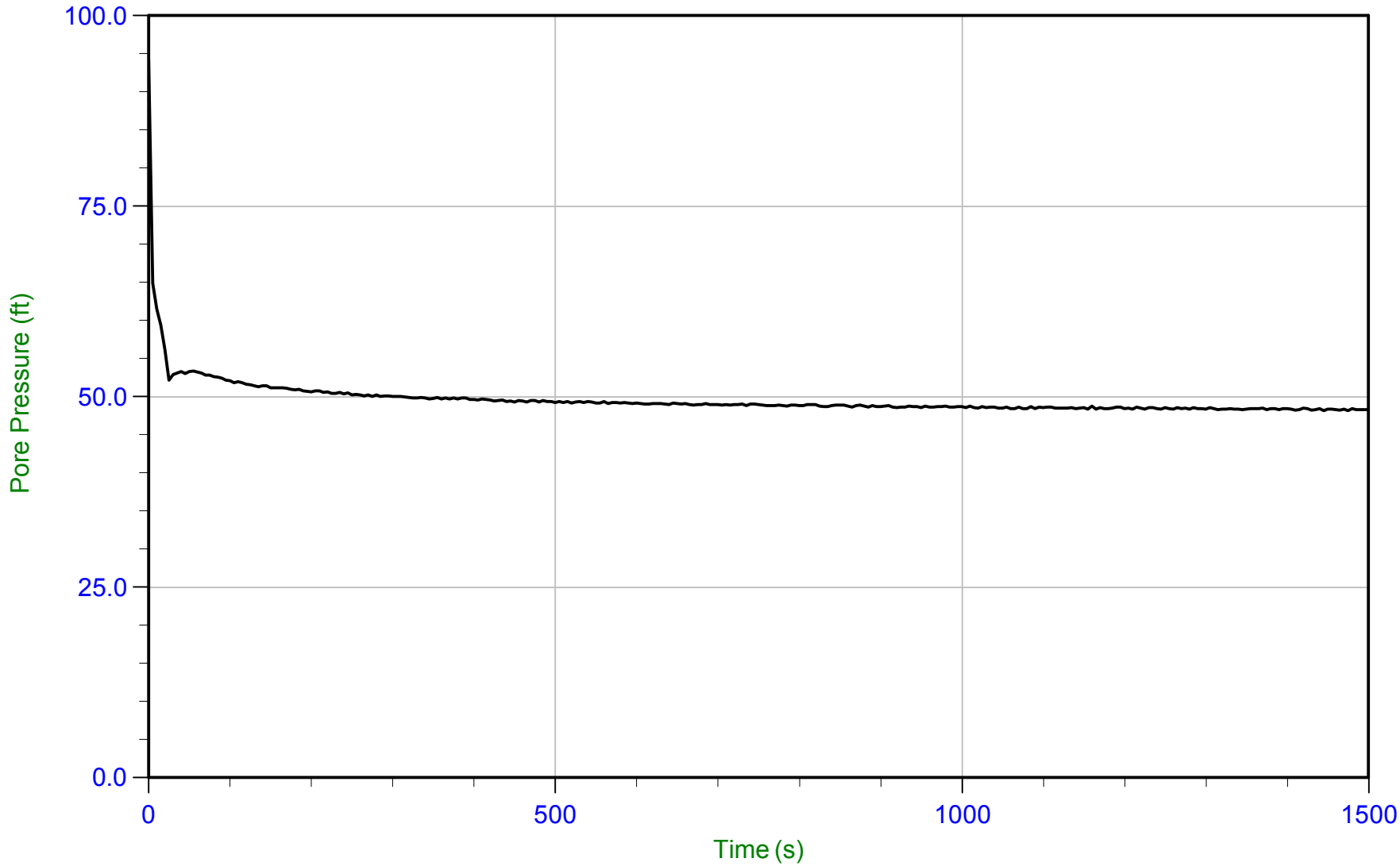
WT: 1.983 m / 6.506 ft
Ueq: 5.3 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 11:13:53
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C019
Cone: AD419
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP19.PPD
Depth: 16.300 m / 53.477 ft
Duration: 1500.0 s

U Min: 48.2 ft
U Max: 94.2 ft

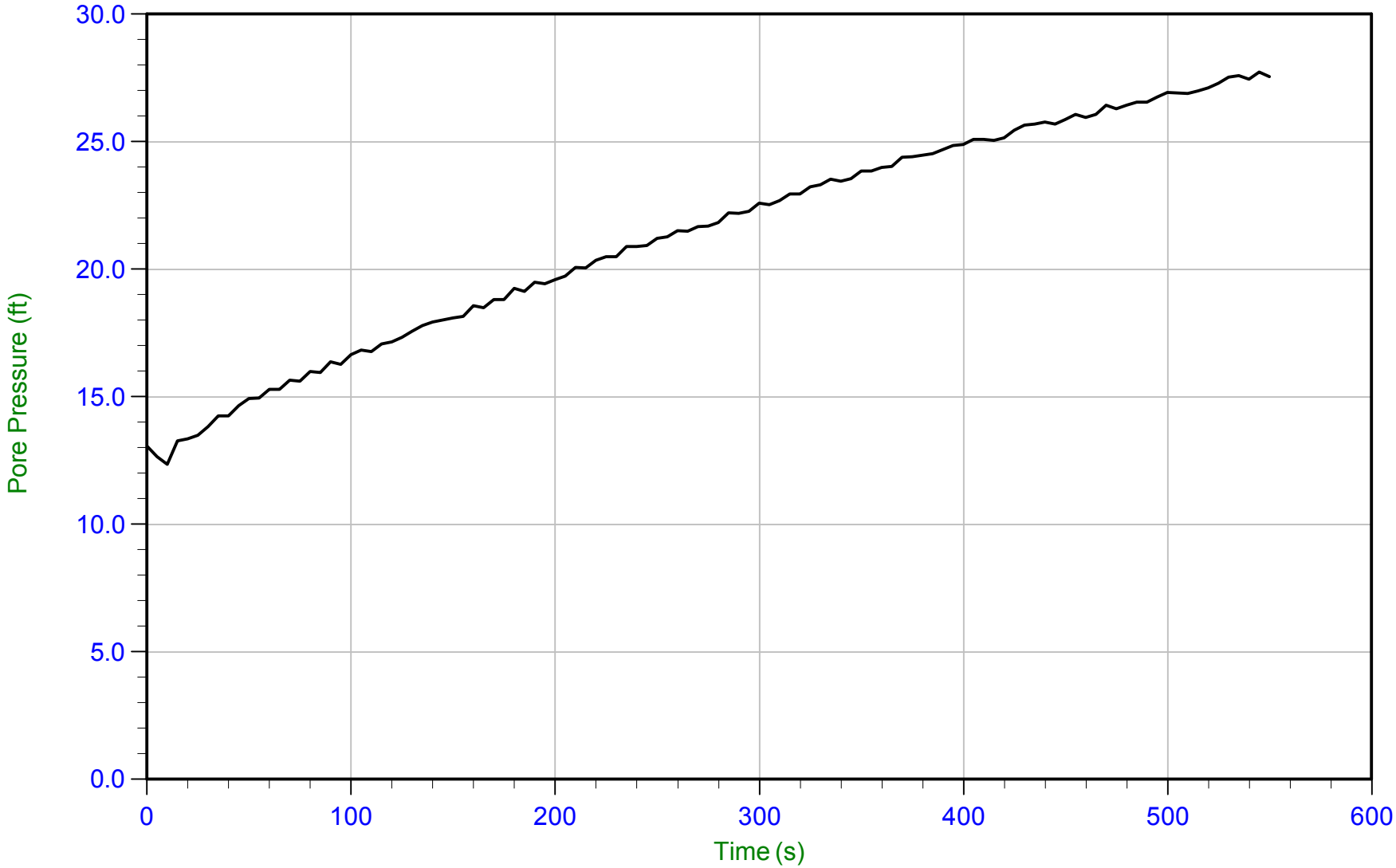
WT: 1.620 m / 5.315 ft
Ueq: 48.2 ft

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 10:21:35
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C021
Cone: AD419
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP21.PPD
Depth: 4.250 m / 13.943 ft
Duration: 550.0 s

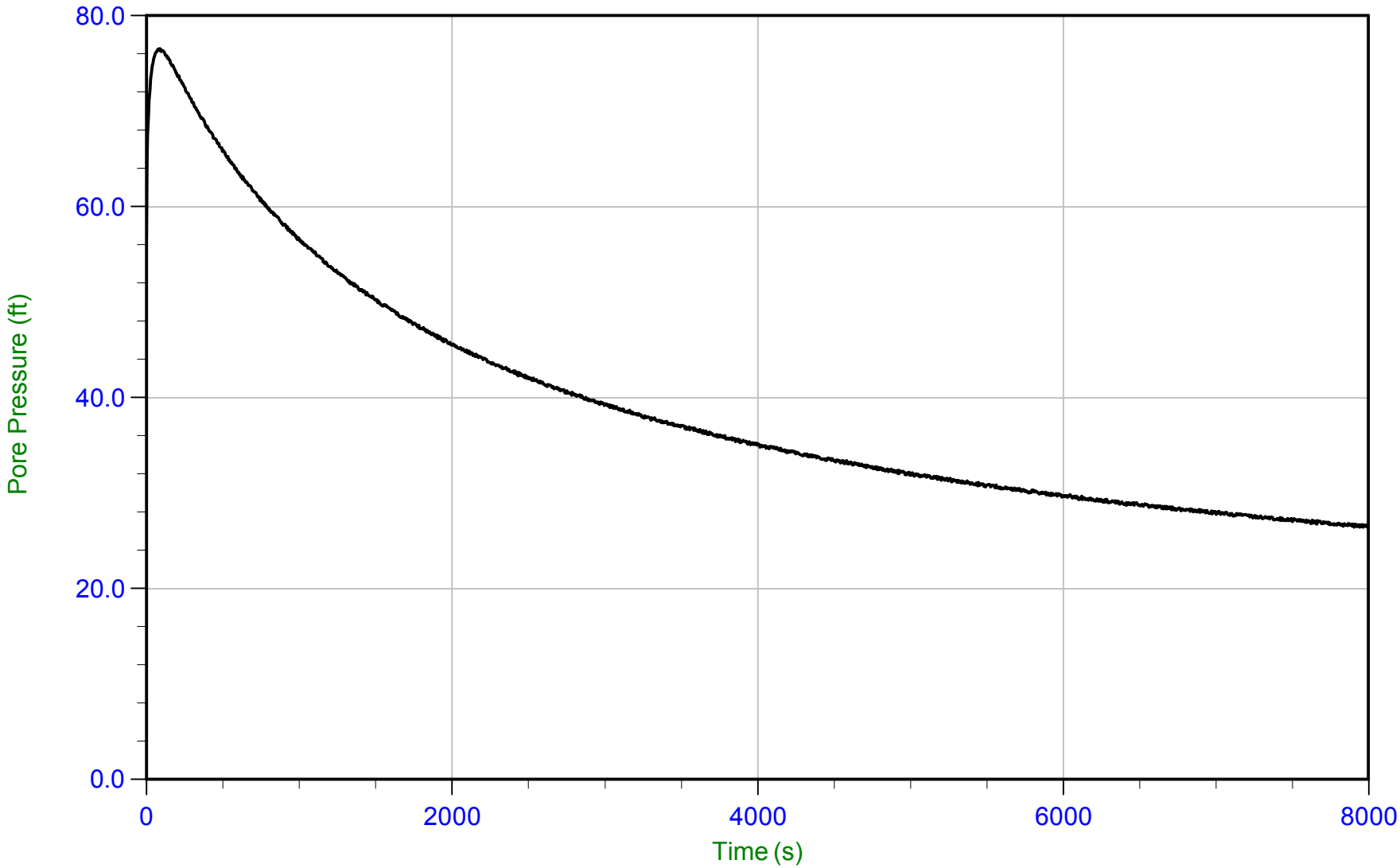
U Min: 12.4 ft
U Max: 27.7 ft

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 10:21:35
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C021
Cone: AD419
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP21.PPD
Depth: 7.150 m / 23.458 ft
Duration: 8000.0 s

U Min: 26.4 ft
U Max: 76.5 ft

WT: 3.962 m / 13.000 ft
Ueq: 10.5 ft
U(50): 43.50 ft

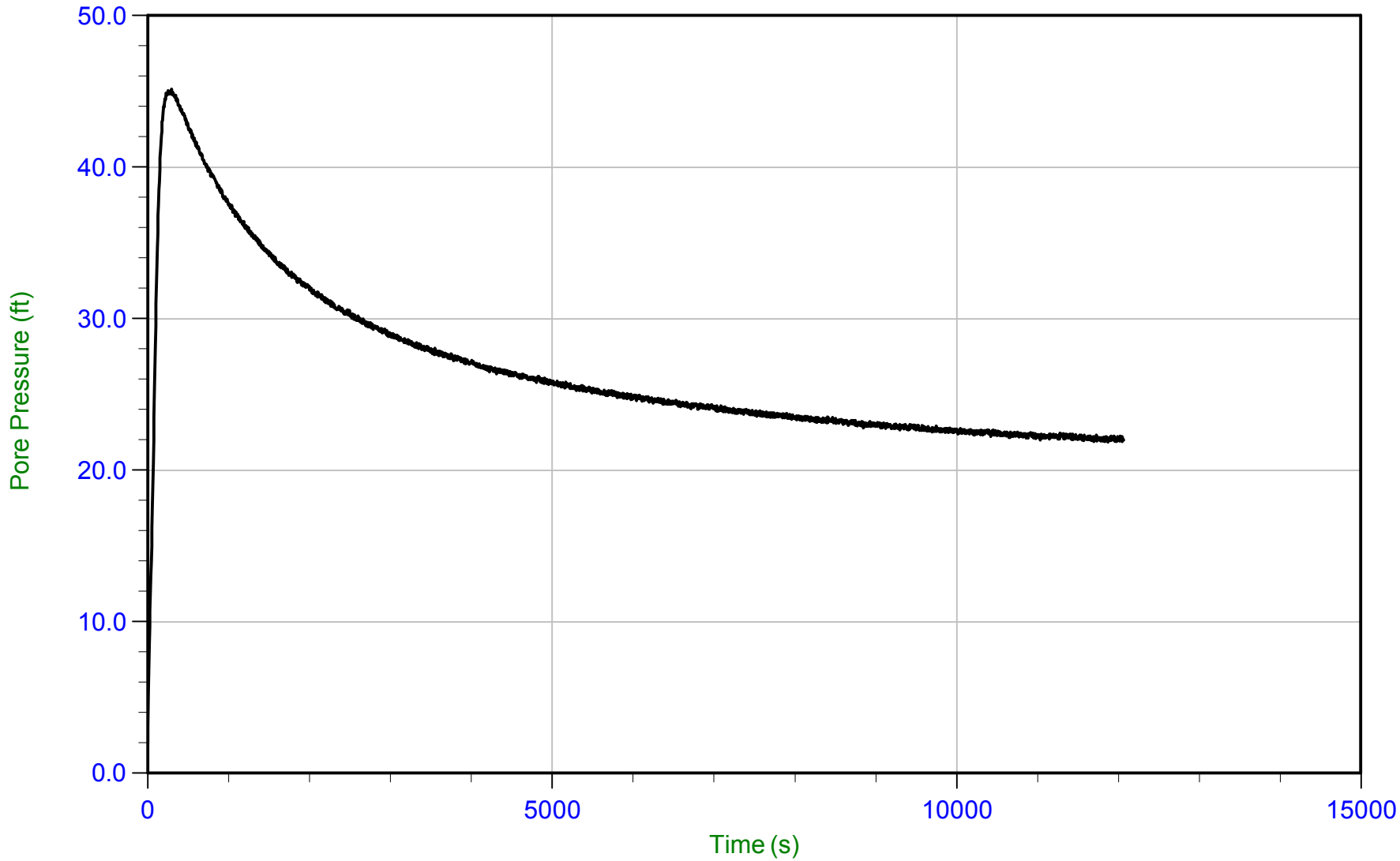
T(50): 2190.1 s
Ir: 100
Ch: 0.3 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 10:21:35
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C021
Cone: AD419
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP21.PPD
Depth: 10.250 m / 33.628 ft
Duration: 12070.0 s

U Min: 2.0 ft
U Max: 45.1 ft

WT: 3.962 m / 13.000 ft
Ueq: 20.6 ft
U(50): 32.88 ft

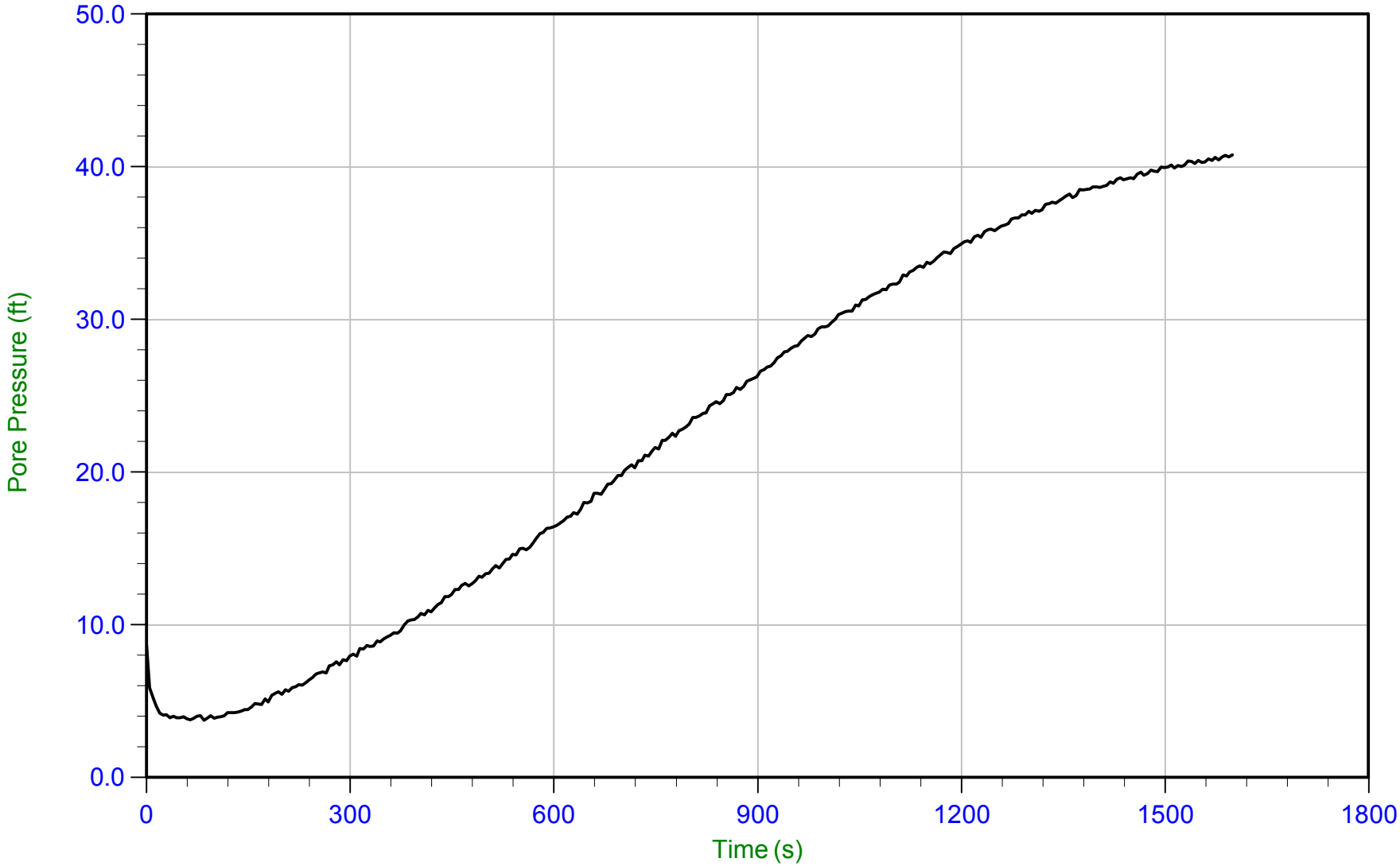
T(50): 1449.3 s
Ir: 100
Ch: 0.5 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 10:21:35
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C021
Cone: AD419
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP21.PPD
Depth: 14.750 m / 48.392 ft
Duration: 1600.0 s

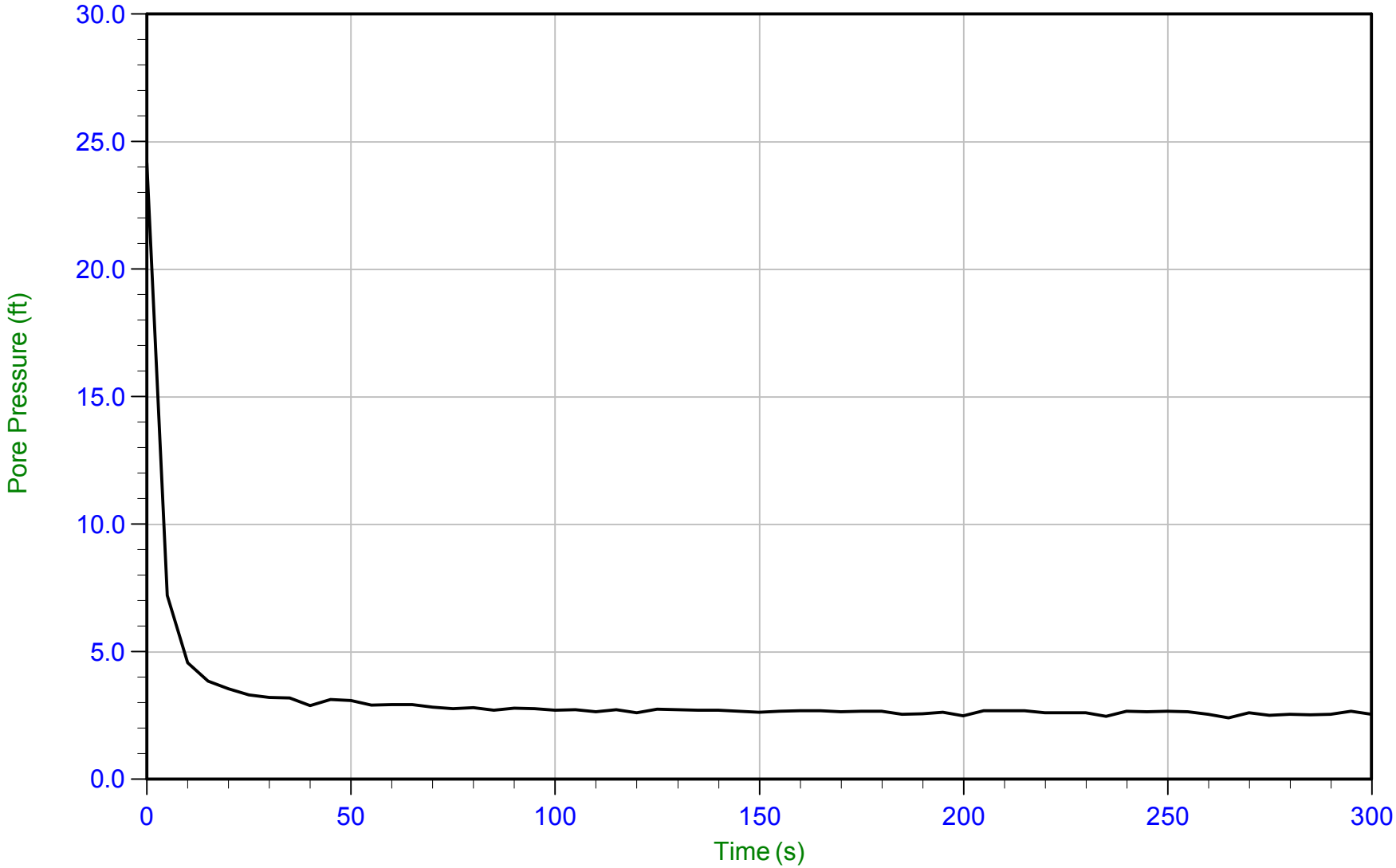
U Min: 3.8 ft
U Max: 40.8 ft

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 10:35:11
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C022
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP22.PPD
Depth: 2.600 m / 8.530 ft
Duration: 300.0 s

U Min: 2.4 ft
U Max: 24.2 ft

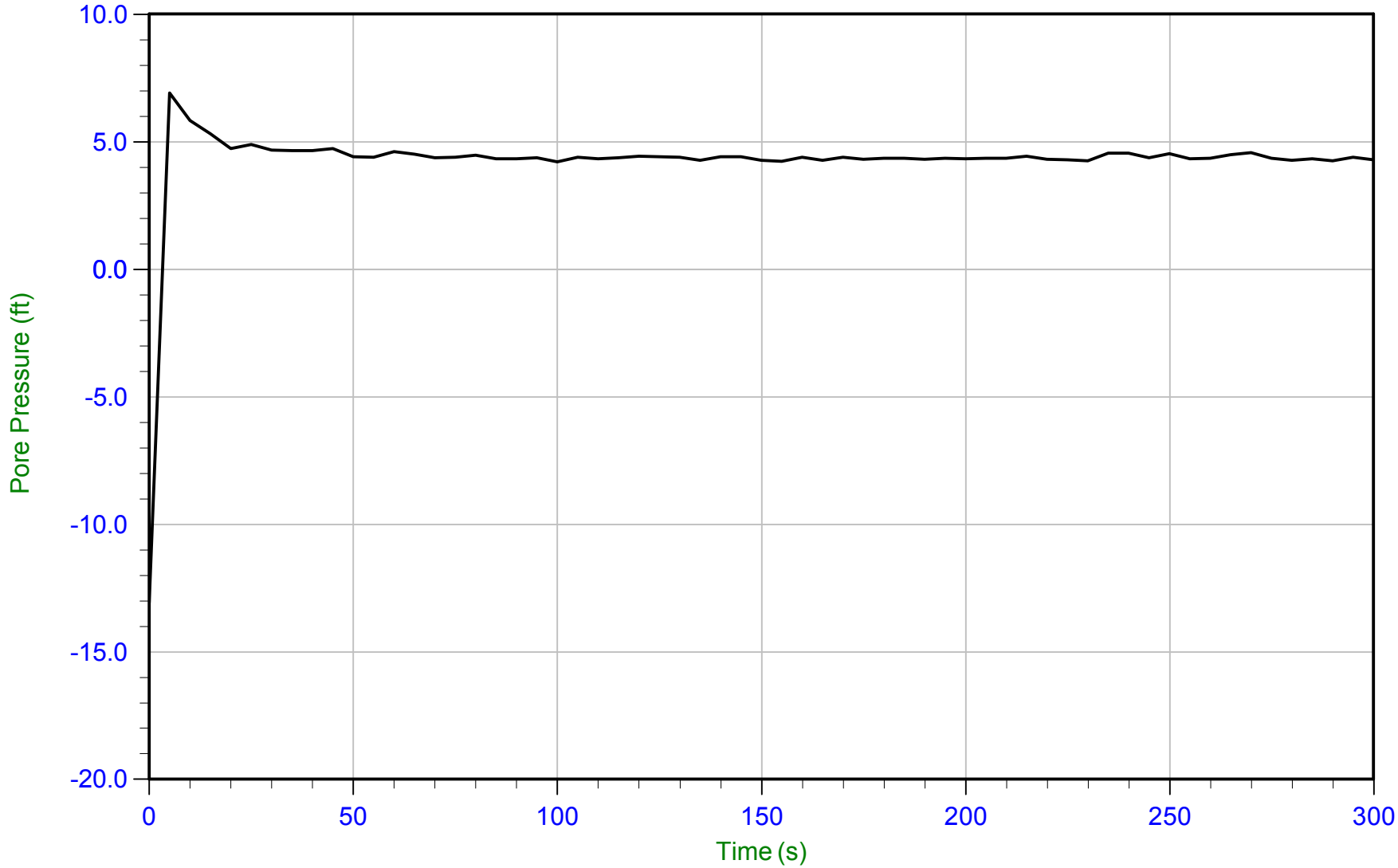
WT: 1.870 m / 6.135 ft
Ueq: 2.4 ft

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 10:35:11
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C022
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP22.PPD
Depth: 3.350 m / 10.991 ft
Duration: 300.0 s

U Min: -13.1 ft
U Max: 6.9 ft

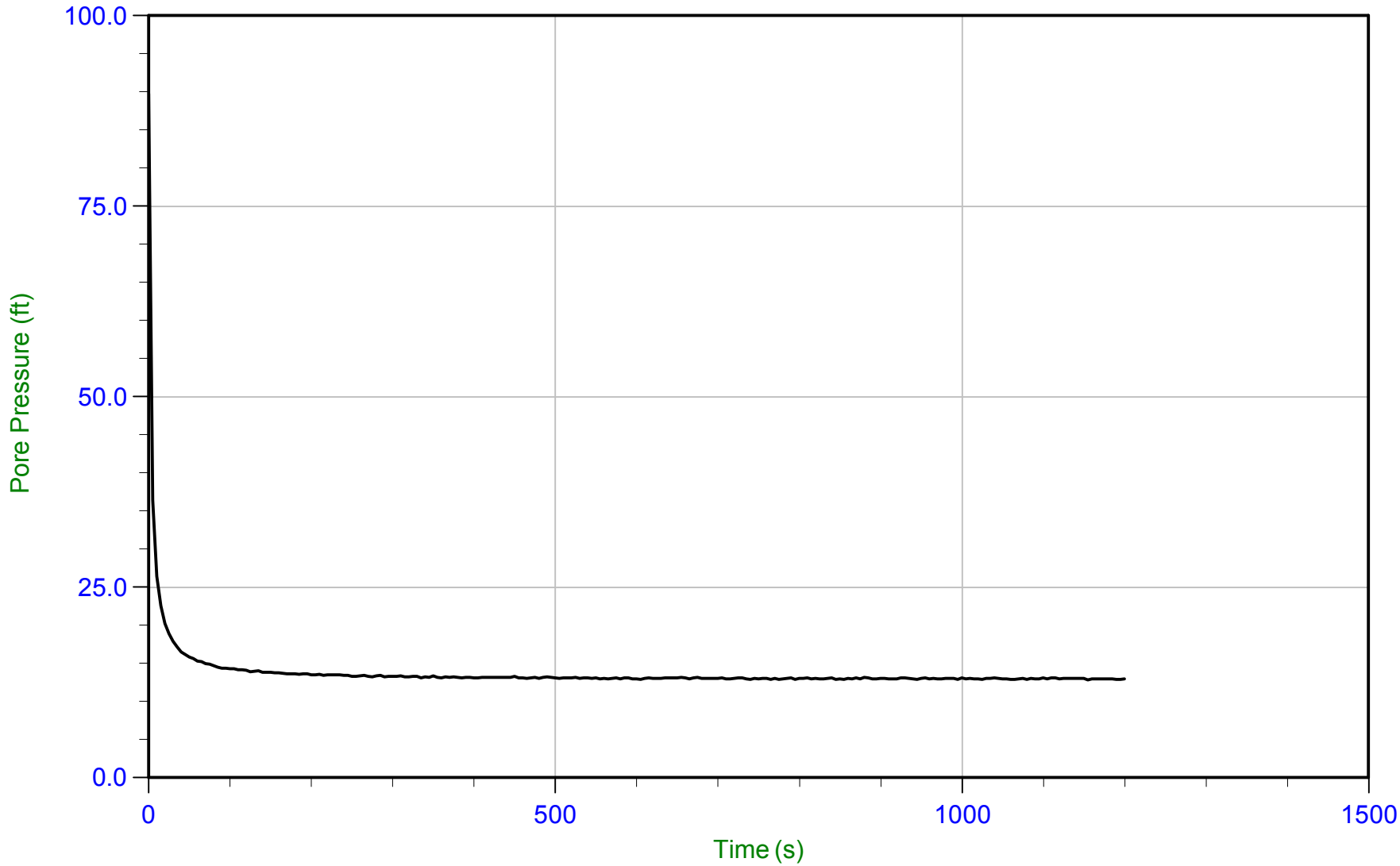
WT: 2.048 m / 6.719 ft
Ueq: 4.3 ft

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 10:35:11
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C022
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP22.PPD
Depth: 6.000 m / 19.685 ft
Duration: 1200.0 s

U Min: 12.8 ft
U Max: 89.8 ft

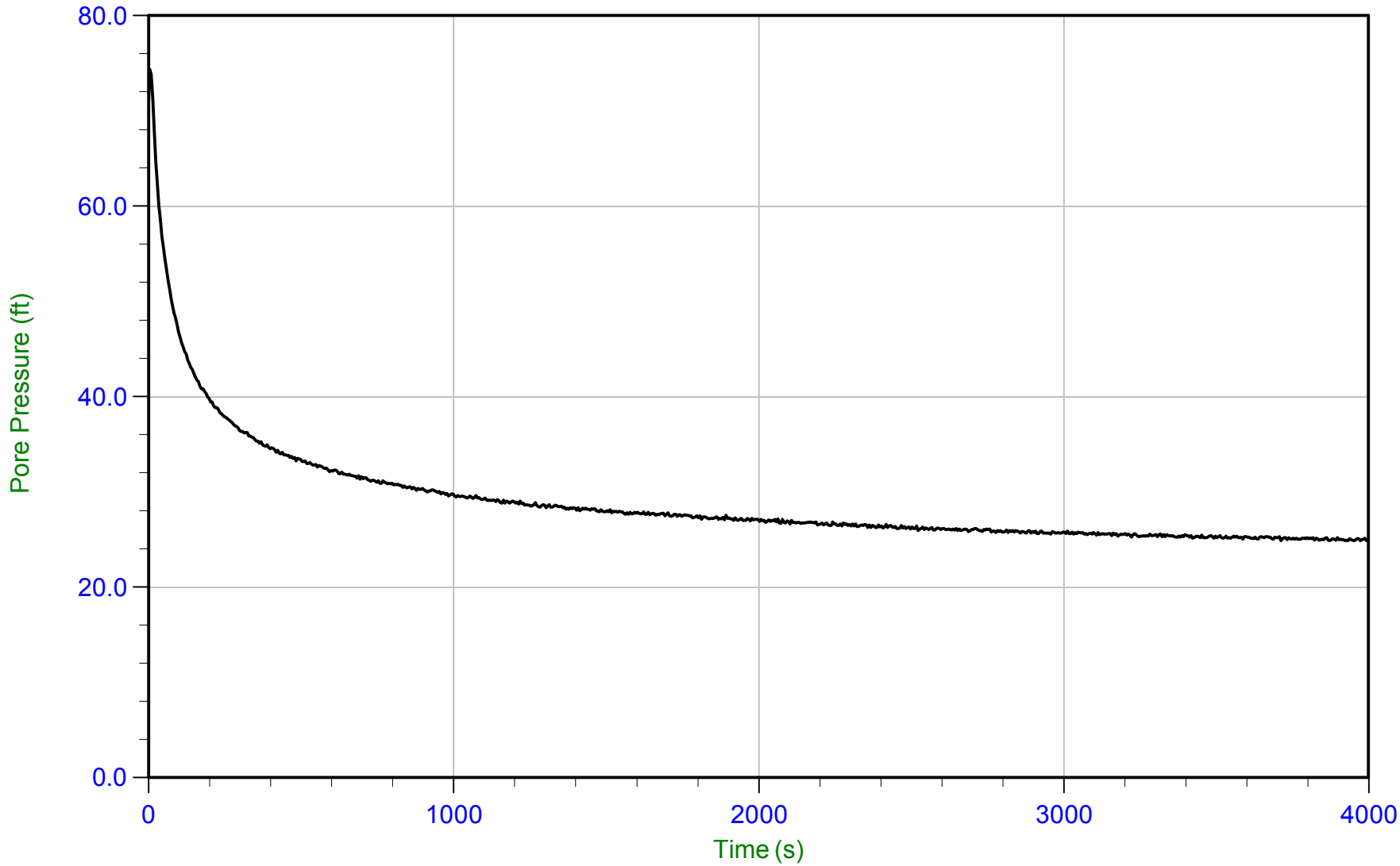
WT: 2.084 m / 6.837 ft
Ueq: 12.8 ft

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 08:52:49
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C023
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP23.PPD
Depth: 11.850 m / 38.877 ft
Duration: 4000.0 s

U Min: 24.9 ft
U Max: 74.4 ft

WT: 4.589 m / 15.056 ft
Ueq: 23.8 ft
U(50): 49.09 ft

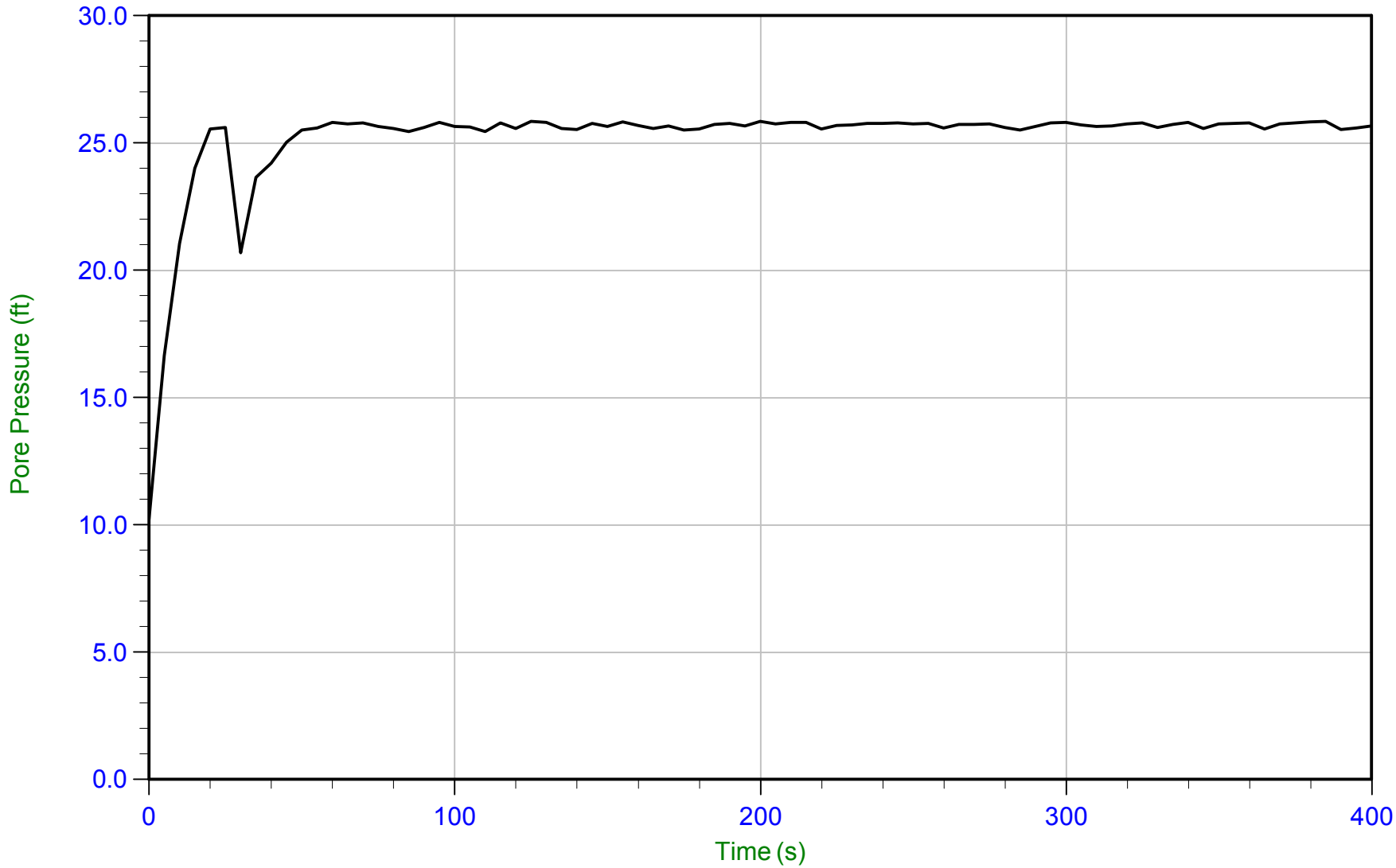
T(50): 77.9 s
Ir: 100
Ch: 9.0 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 27-Aug-2015 08:52:49
Site: Edwards Power Station, Peoria, Il

Sounding: EDW-C023
Cone: AD340
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP23.PPD
Depth: 12.400 m / 40.682 ft
Duration: 400.0 s

U Min: 10.2 ft
U Max: 25.9 ft

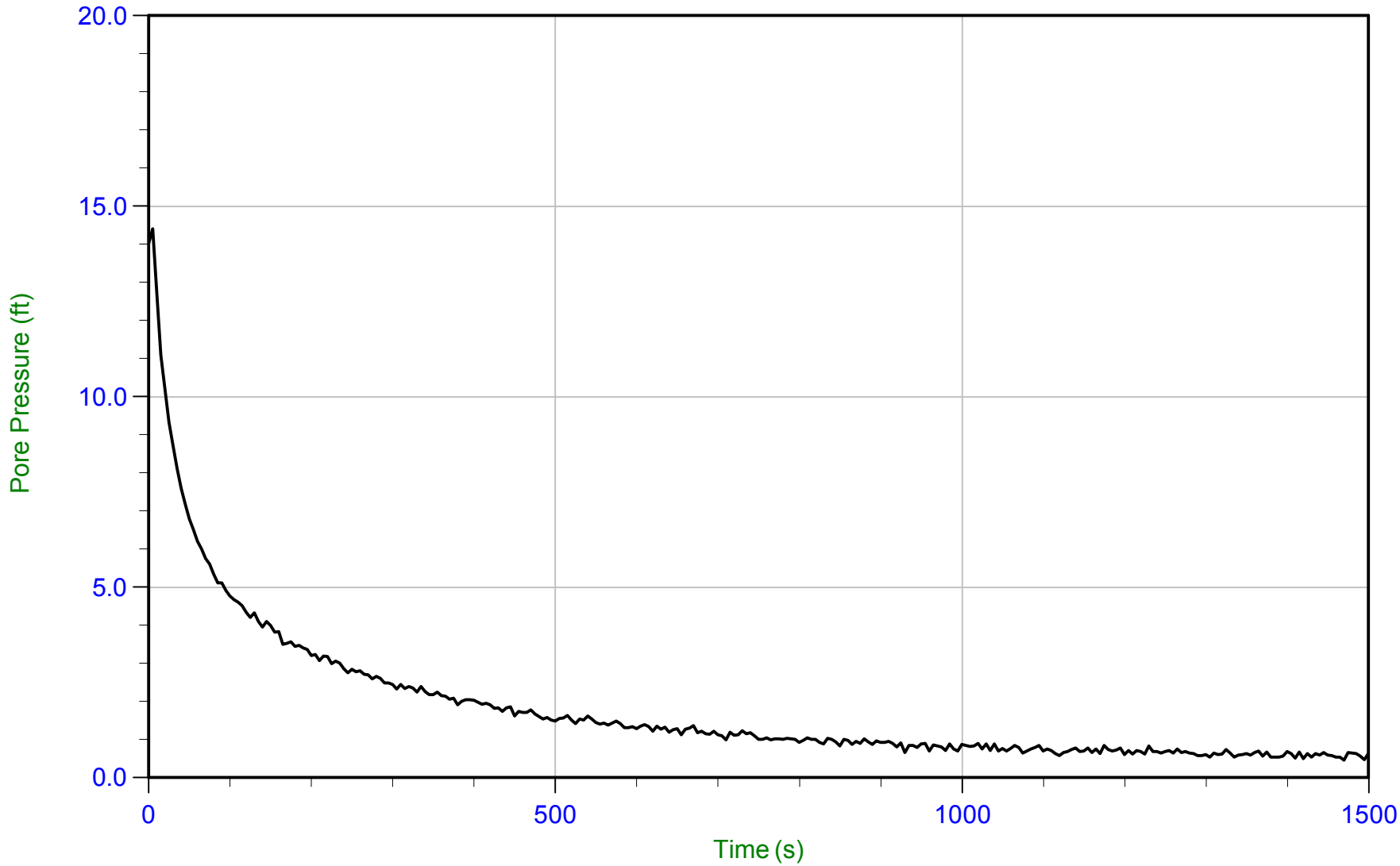
WT: 4.589 m / 15.056 ft
Ueq: 25.6 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 13:44:56
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C025
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP25.PPD
Depth: 2.000 m / 6.562 ft
Duration: 1500.0 s

U Min: 0.5 ft
U Max: 14.4 ft

WT: 1.826 m / 5.991 ft
Ueq: 0.6 ft
U(50): 7.49 ft

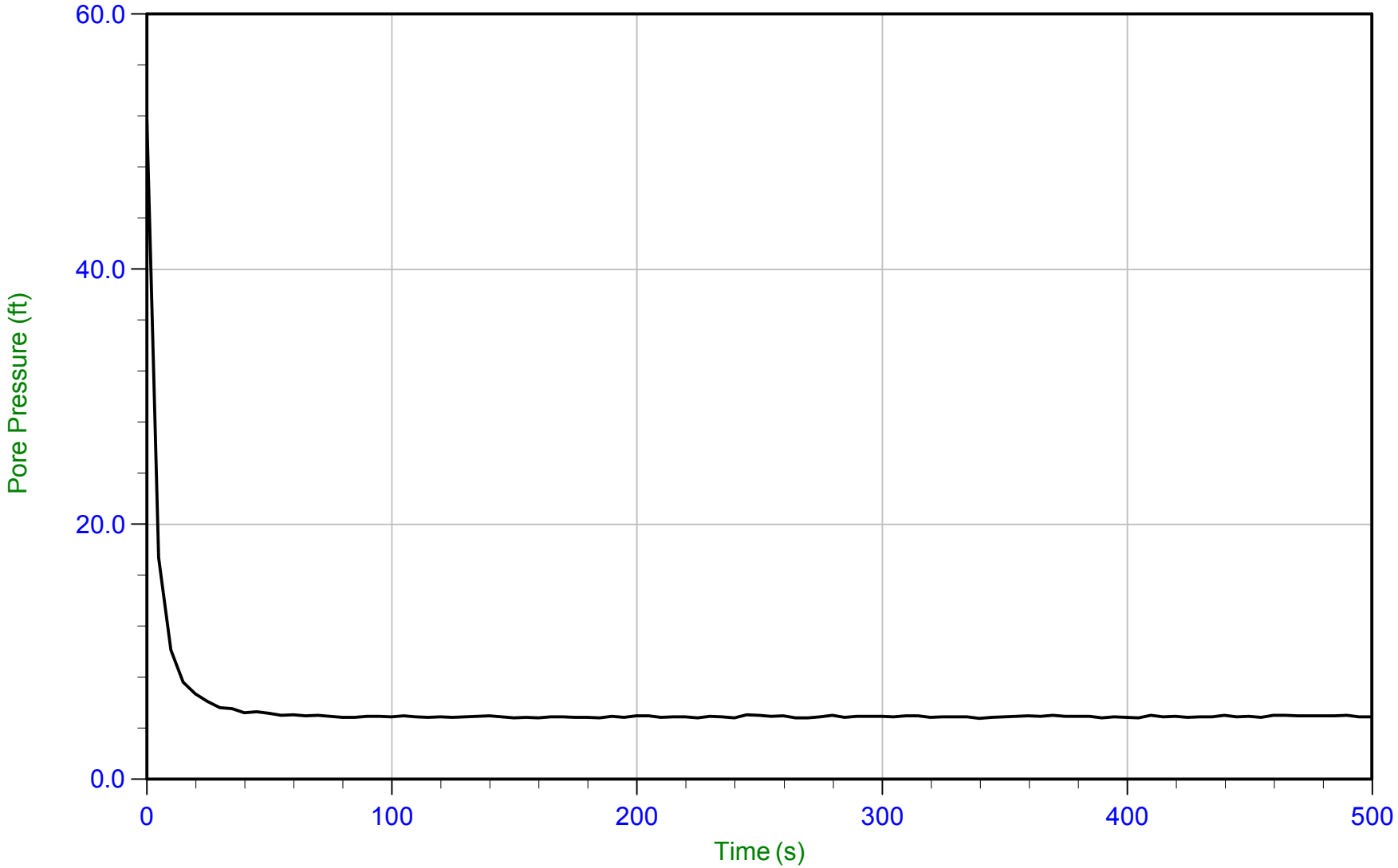
T(50): 36.3 s
Ir: 100
Ch: 19.3 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 13:44:56
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C025
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP25.PPD
Depth: 3.350 m / 10.991 ft
Duration: 500.0 s

U Min: 4.8 ft
U Max: 51.7 ft

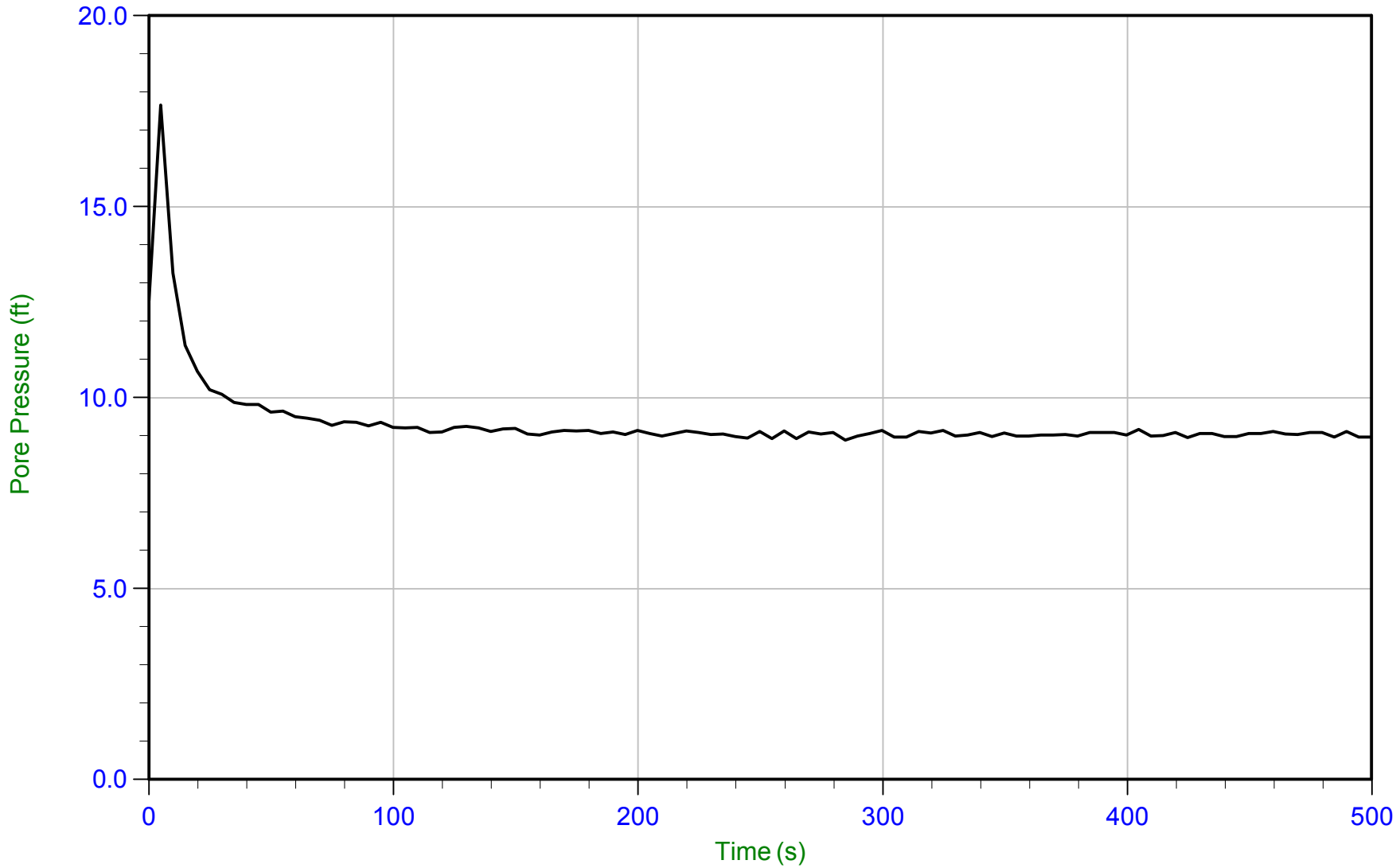
WT: 1.826 m / 5.991 ft
Ueq: 5.0 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 13:44:56
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C025
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP25.PPD
Depth: 4.600 m / 15.092 ft
Duration: 500.0 s

U Min: 8.9 ft
U Max: 17.7 ft

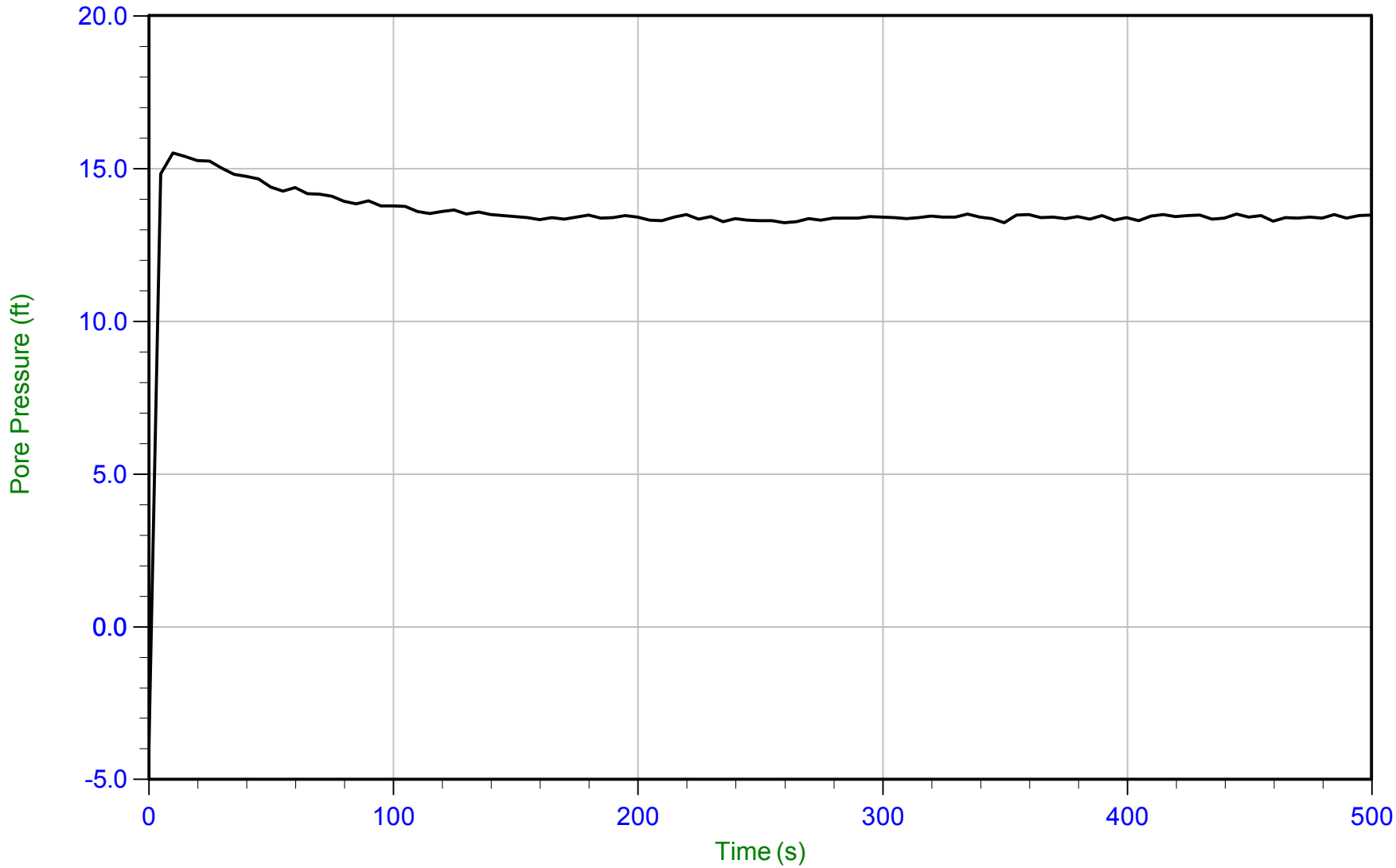
WT: 1.848 m / 6.063 ft
Ueq: 9.0 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 13:44:56
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C025
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP25.PPD
Depth: 6.100 m / 20.013 ft
Duration: 500.0 s

U Min: -3.8 ft
U Max: 15.5 ft

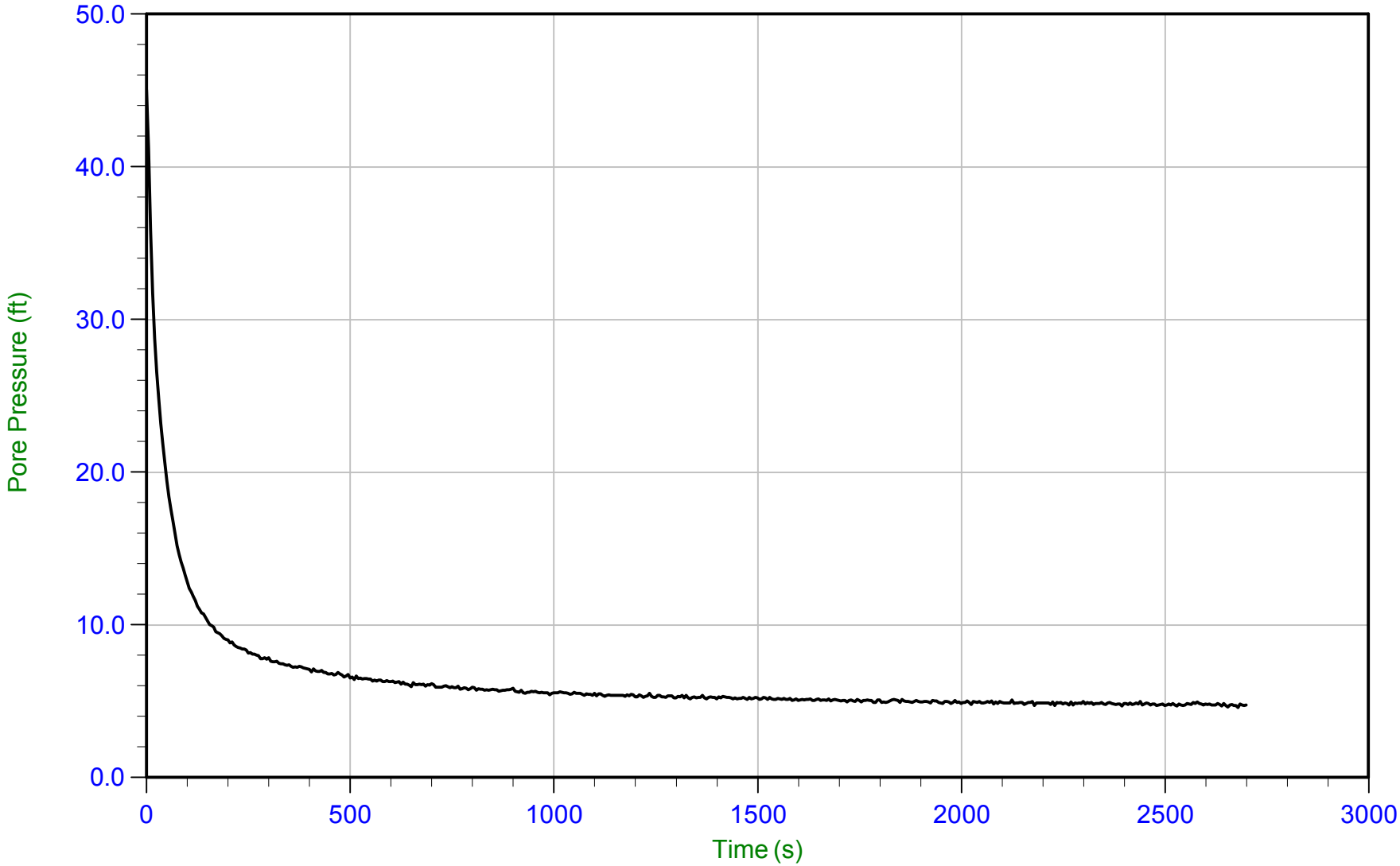
WT: 1.962 m / 6.437 ft
Ueq: 13.6 ft

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 12:20:07
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C026
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP26.PPD
Depth: 3.350 m / 10.991 ft
Duration: 2700.0 s

U Min: 4.6 ft
U Max: 45.1 ft

WT: 2.191 m / 7.188 ft
Ueq: 3.8 ft
U(50): 24.43 ft

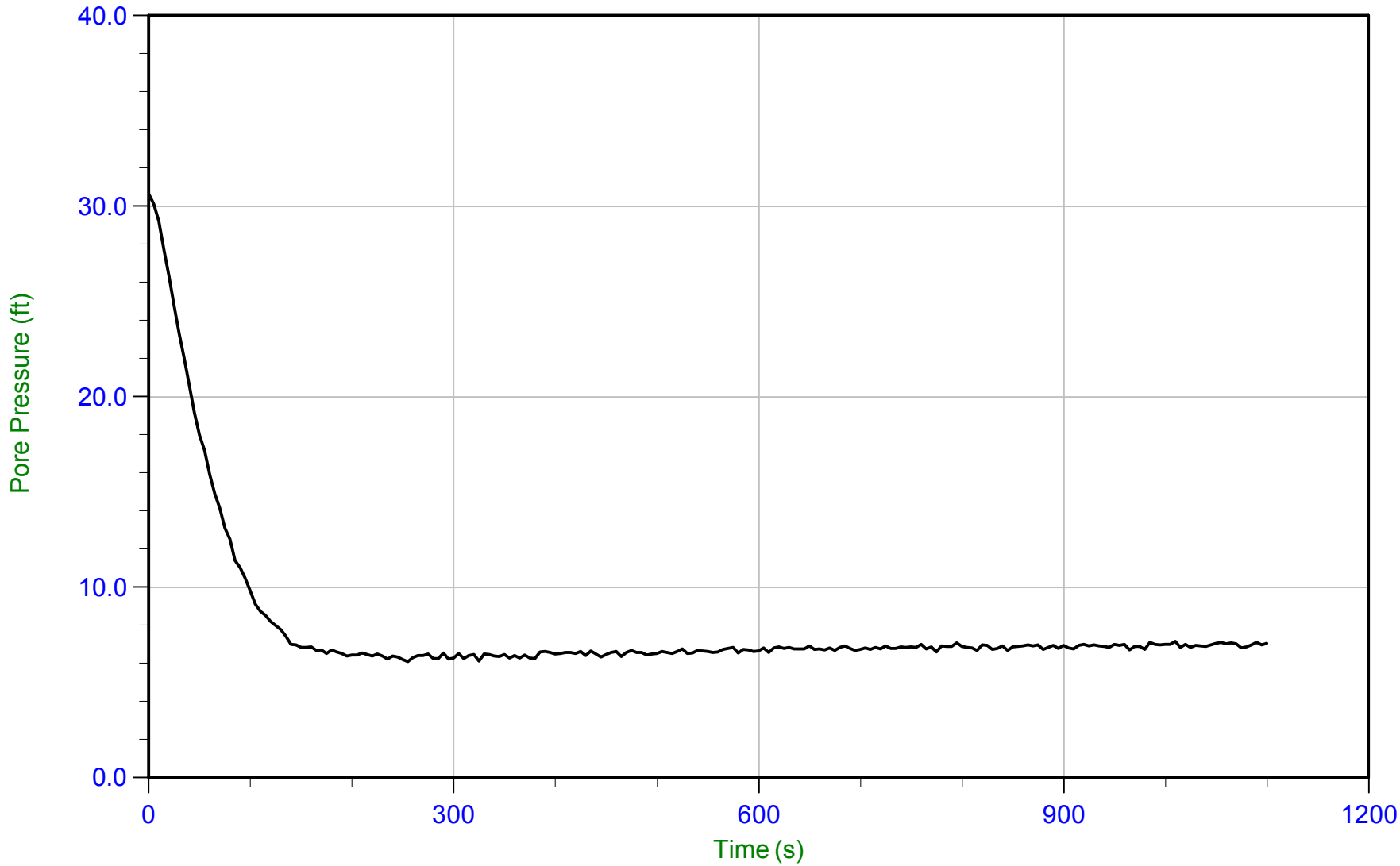
T(50): 31.2 s
Ir: 100
Ch: 22.5 sq cm/min

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 12:20:07
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C026
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP26.PPD
Depth: 4.350 m / 14.271 ft
Duration: 1100.0 s

U Min: 6.1 ft
U Max: 30.7 ft

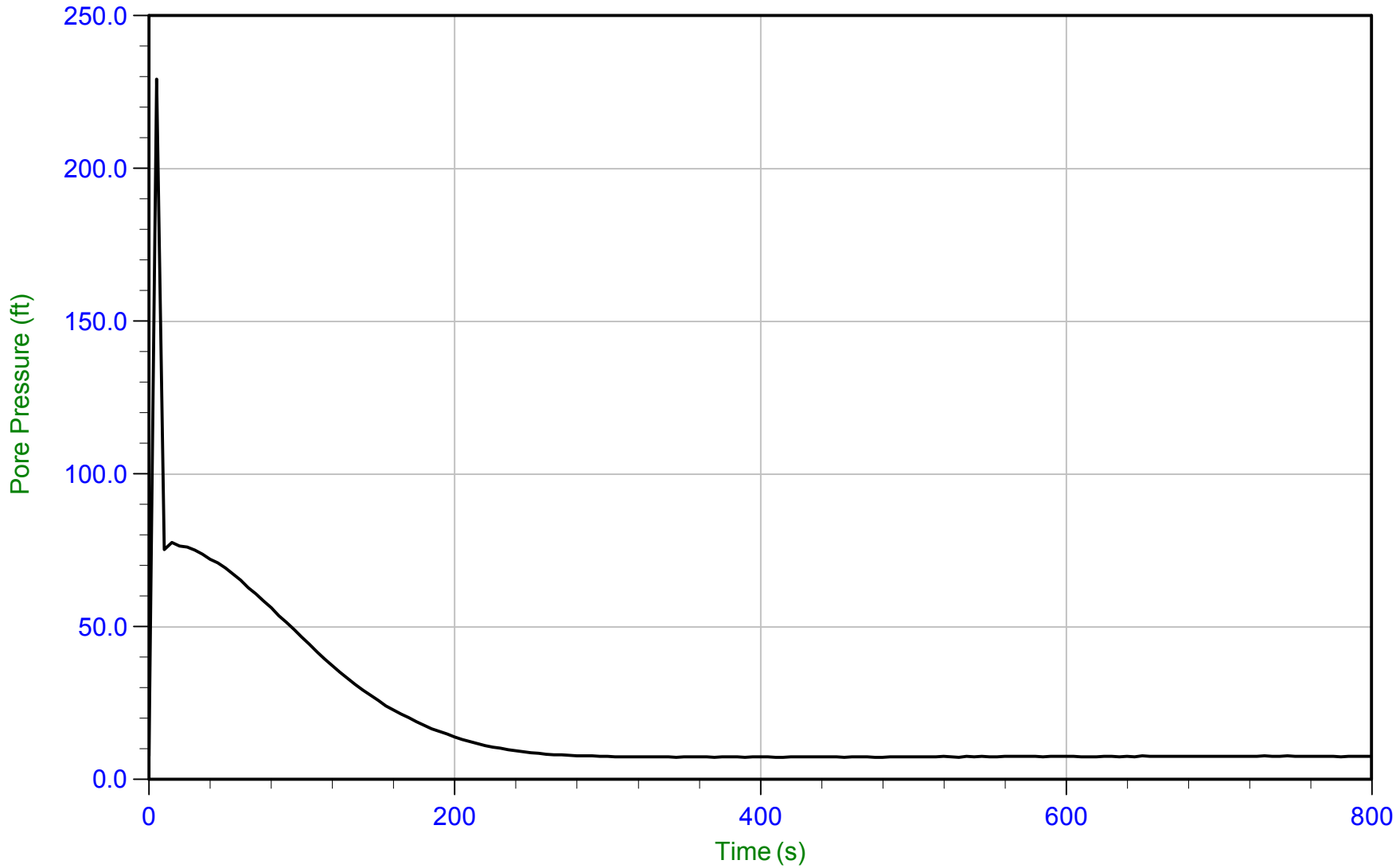
WT: 2.191 m / 7.188 ft
Ueq: 7.1 ft

CONETEC

AECOM

Job No: 15-53073
Date: 26-Aug-2015 14:00:29
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C026B
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_SP26B.PPD
Depth: 4.450 m / 14.600 ft
Duration: 800.0 s

U Min: 7.3 ft
U Max: 229.3 ft

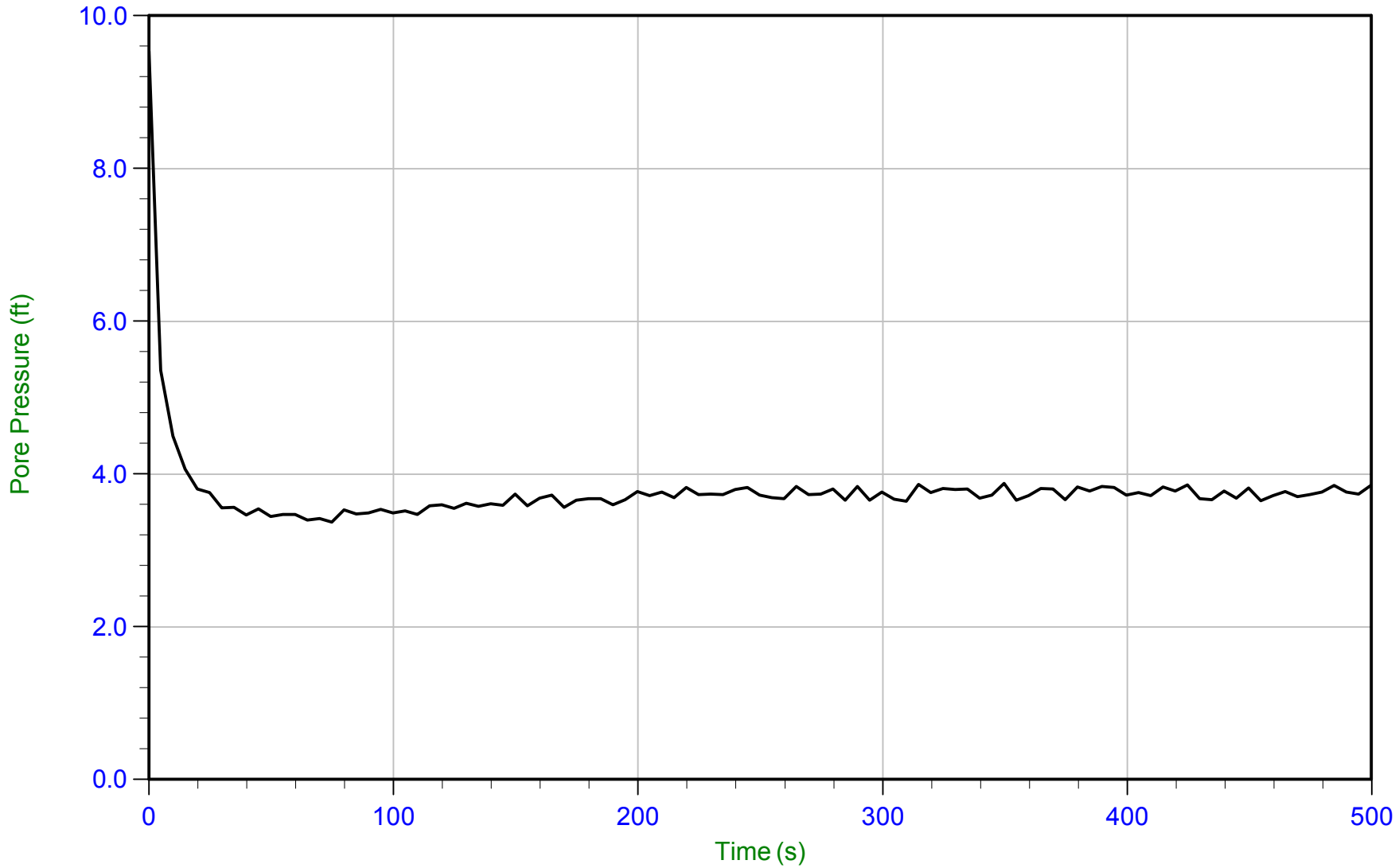
WT: 2.069 m / 6.788 ft
Ueq: 7.8 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 11:00:21
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C027
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP27.PPD
Depth: 3.400 m / 11.155 ft
Duration: 500.0 s

U Min: 3.4 ft
U Max: 9.5 ft

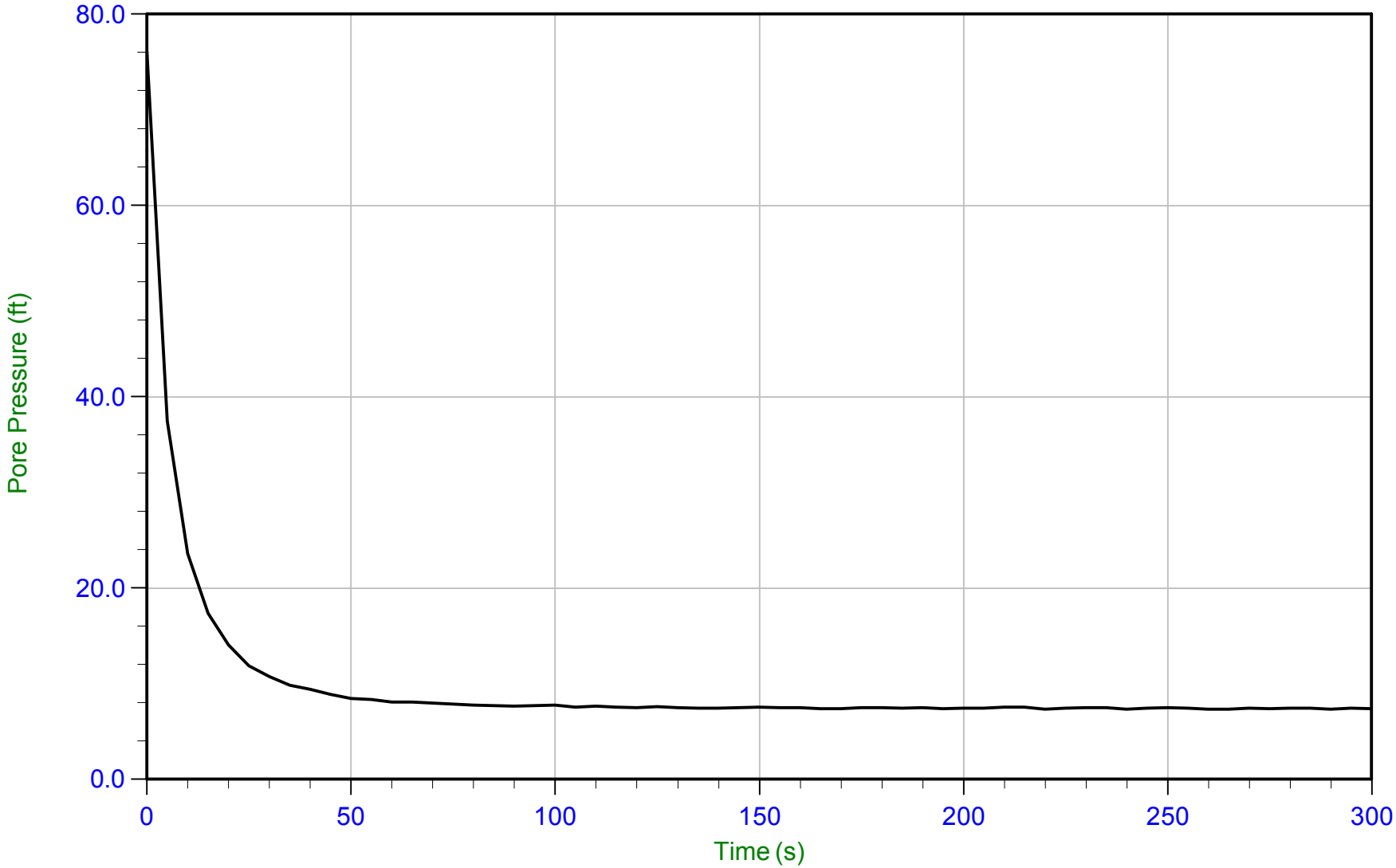
WT: 2.257 m / 7.405 ft
Ueq: 3.7 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 11:00:21
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C027
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP27.PPD
Depth: 4.350 m / 14.271 ft
Duration: 300.0 s

U Min: 7.3 ft
U Max: 76.2 ft

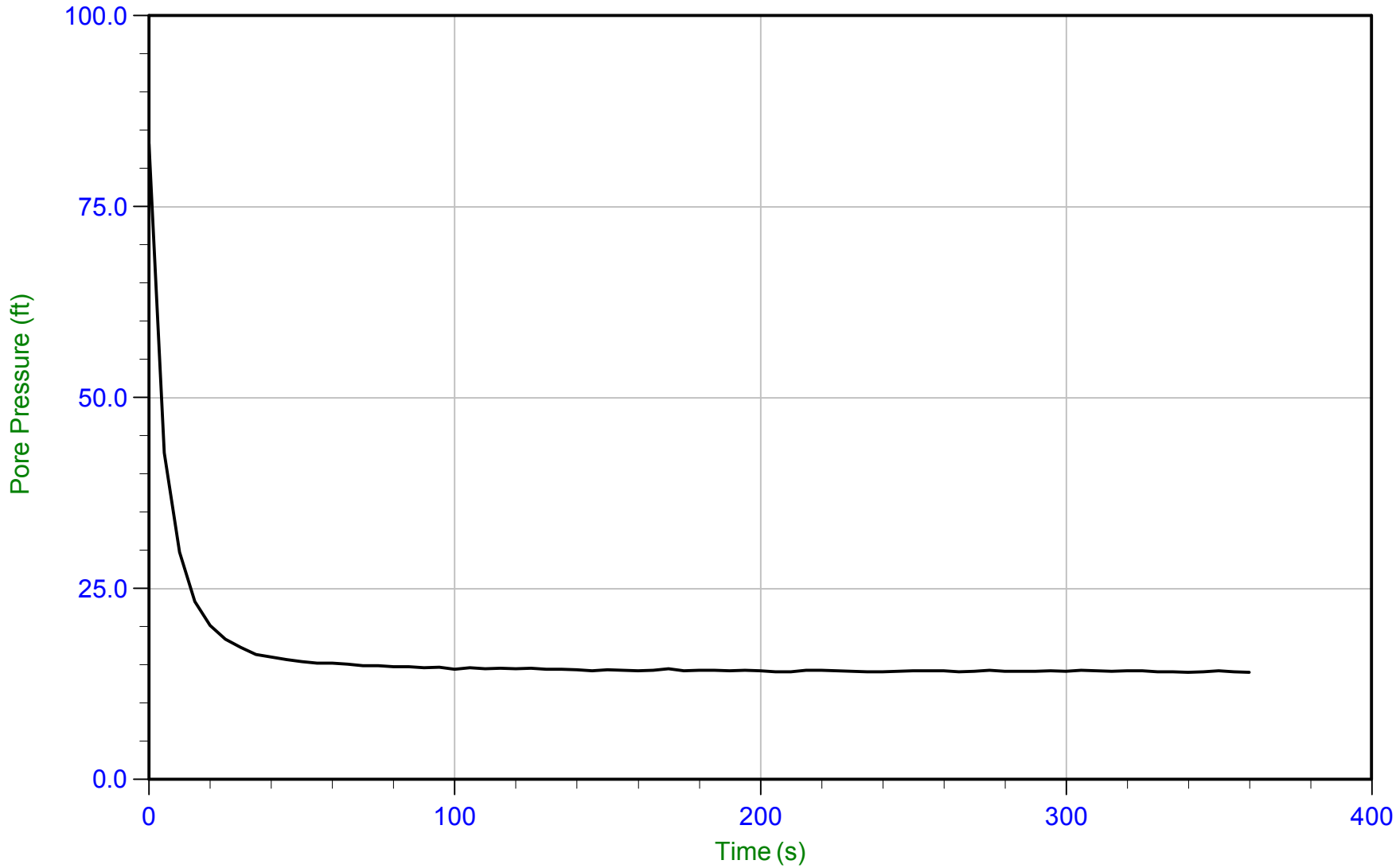
WT: 2.064 m / 6.772 ft
Ueq: 7.5 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 11:00:21
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C027
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP27.PPD
Depth: 6.400 m / 20.997 ft
Duration: 360.0 s

U Min: 14.0 ft
U Max: 83.3 ft

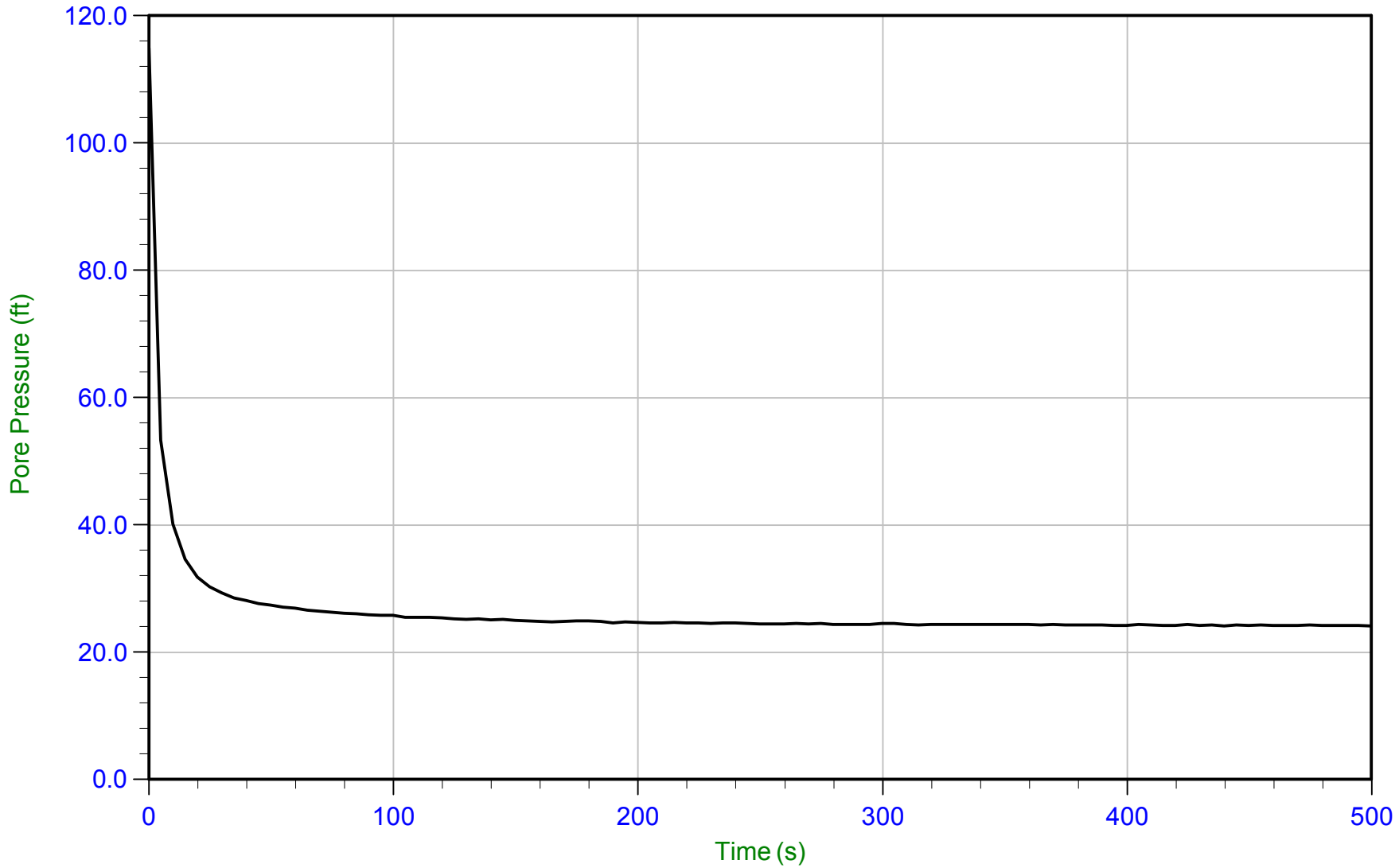
WT: 2.061 m / 6.762 ft
Ueq: 14.2 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 11:00:21
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C027
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP27.PPD
Depth: 9.400 m / 30.840 ft
Duration: 500.0 s

U Min: 24.1 ft
U Max: 114.9 ft

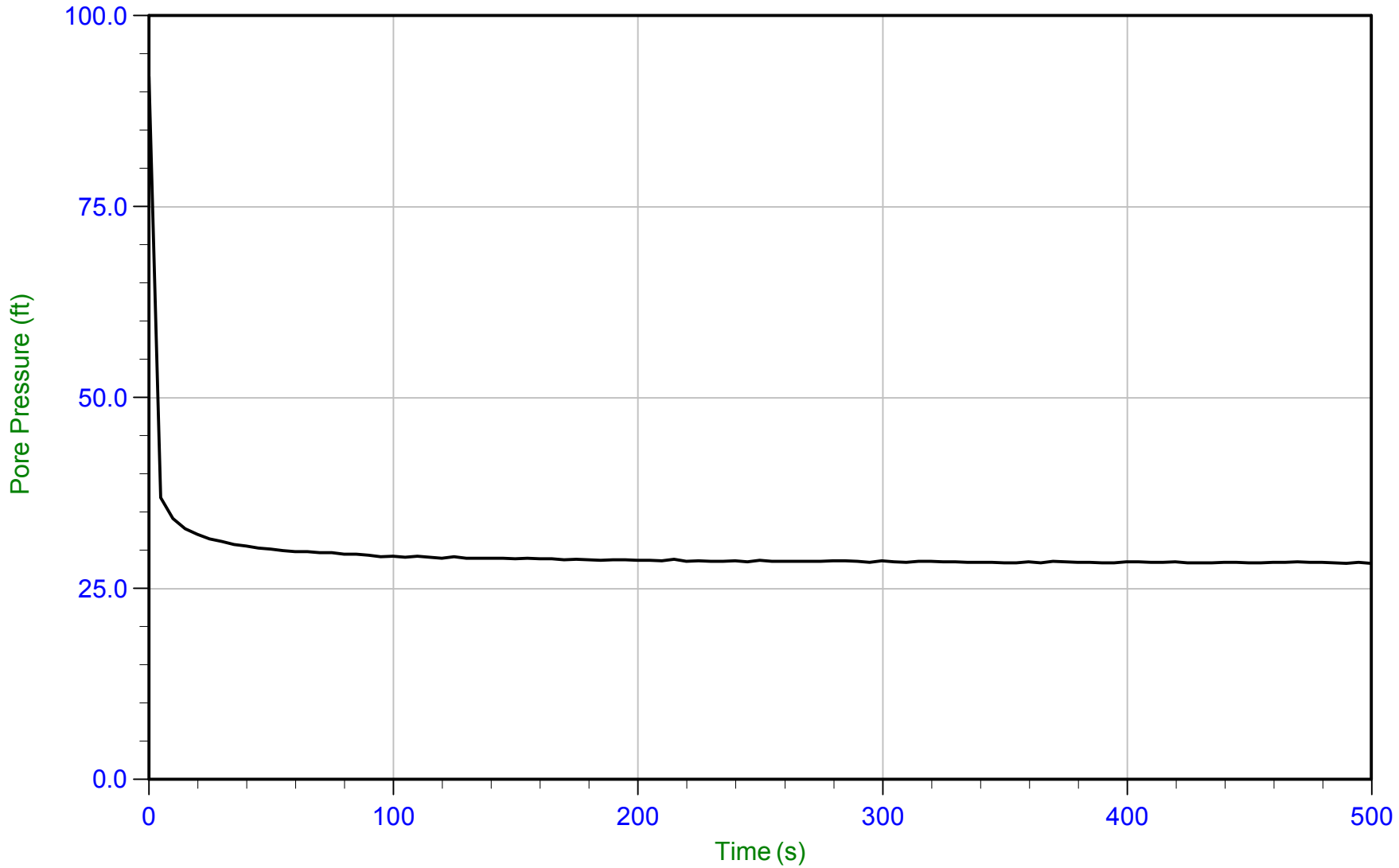
WT: 2.034 m / 6.673 ft
Ueq: 24.2 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 11:00:21
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C027
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP27.PPD
Depth: 10.700 m / 35.105 ft
Duration: 500.0 s

U Min: 28.3 ft
U Max: 92.0 ft

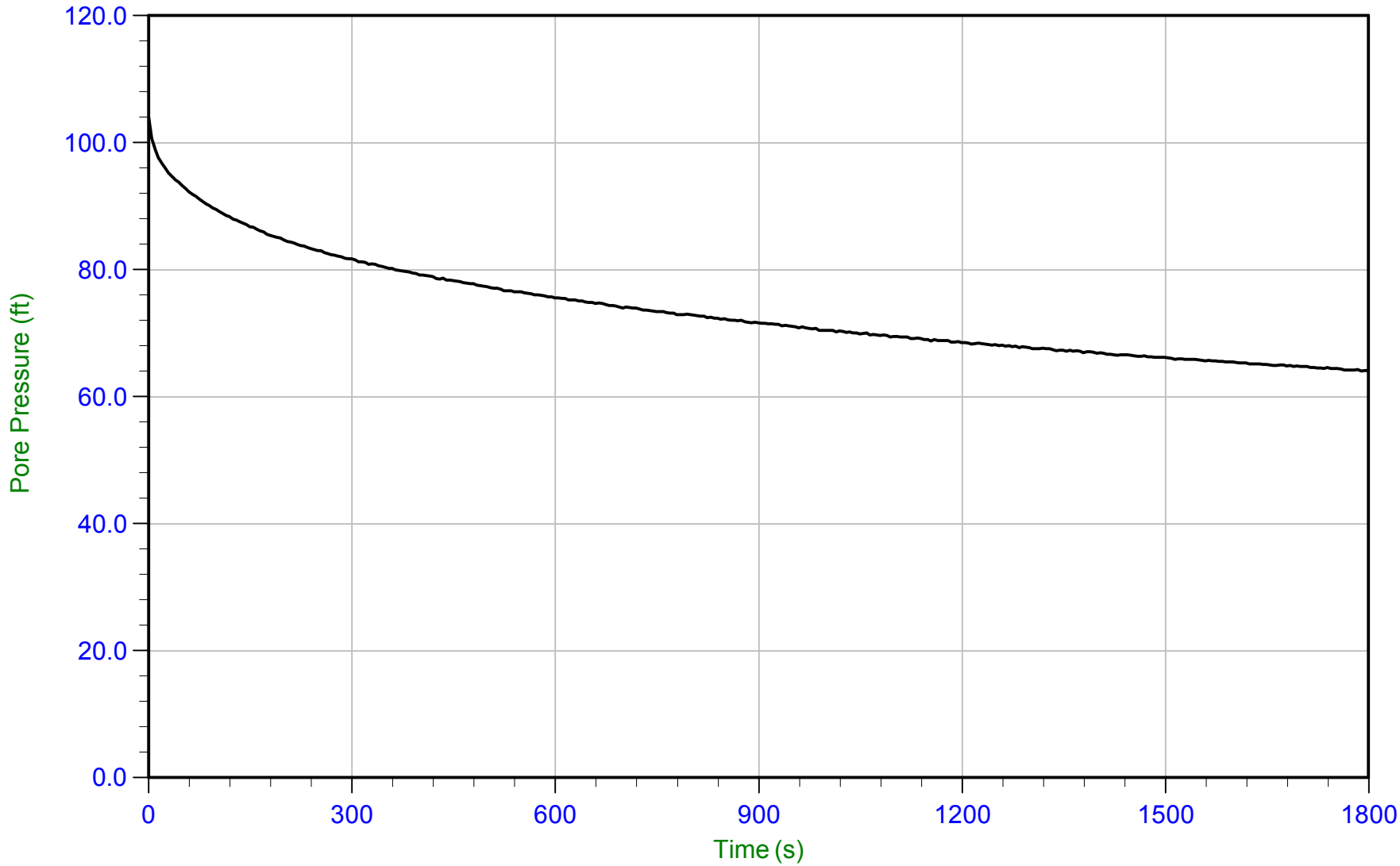
WT: 2.022 m / 6.634 ft
Ueq: 28.5 ft

CONETEC

AECOM

Job No: 15-53073
Date: 25-Aug-2015 11:00:21
Site: Edwards Power Station, Peoria, IL

Sounding: EDW-C027
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53073_CP27.PPD
Depth: 12.200 m / 40.026 ft
Duration: 1800.0 s

U Min: 64.1 ft
U Max: 104.0 ft

WT: 2.064 m / 6.772 ft
Ueq: 33.3 ft
U(50): 68.65 ft

T(50): 1184.7 s
Ir: 100
Ch: 0.6 sq cm/min

Attachment E. Laboratory Test Data

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynegy - Edwards Site **PROJECT NUMBER:** MR155218 **CLIENT:** AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	LL	PL	PI	Specific Gravity
EDW-B002	S-1	0.0'-1.5'	FILL: OLIVE BROWN TRACE BROWN SILTY SAND WITH GRAVEL		38.4	4.50+								
EDW-B002	S-2	2.5'-4.0'	GRAY SANDY SILT		62.4	3.50								
EDW-B002	S-3	5.0'-7.0'	GREENISH GRAY SANDY SILT	MH	66.6						65	36	29	
EDW-B002	S-4	7.5'-10.0'	DARK GRAY FLY ASH		79.0		0.0	7.4	73.1	19.5				
EDW-B002	S-5	10.0'-12.0'	GRAY TO DARK GRAY VARVED FLY ASH		76.9						17	27	NP	
EDW-B002	S-6	15.0'-16.5'	DARK GRAY FLY ASH		52.5									
EDW-B002	S-7	20.0'-21.5'	DARK GRAY FLY ASH WITH SAND AND GRAVEL		67.8									
EDW-B002	S-8	25.0'-27.0'	DARK GRAY FLY ASH		63.9									2.471
EDW-B002	S-9	30.0'-30.5'	LIGHT GRAY LEAN CLAY WITH ORGANIC POCKETS		126.1	<.25								
EDW-B002	S-9A	30.5'-31.5'	BROWN TO RUST BROWN LEAN CLAY WITH SAND		31.1	0.50								
EDW-B002	S-10	35.0'-37.0'	GRAY LEAN CLAY WITH SAND	CL	31.6						36	18	18	
EDW-B002	S-11	40.0'-41.5'	GRAY LEAN CLAY		42.9	1.00								2.592
EDW-B002	S-12	45.0'-46.5'	GRAY TO DARK GRAY LEAN CLAY WITH SAND		57.7	0.75								
EDW-B002	S-13	50.0'-50.25'	GRAY SILT WITH SAND	ML	11.1	4.50+								
EDW-B003	S-1	0.0'-1.5'	FILL: DARK GRAY FLY ASH WITH SAND		44.4									2.469
EDW-B003	S-2	2.5'-4.0'	FILL: DARK GRAY FLY ASH WITH SAND		27.3	2.00								
EDW-B003	S-3	5.0'-6.5'	FILL: BROWN AND BLACK LEAN CLAY WITH SAND AND ORGANICS		37.2	1.00								
EDW-B003	S-4	7.5'-9.5'	FILL: DARK GRAY FLY ASH		55.5									
EDW-B003	S-5	10.0'-11.5'	FILL: DARK GRAY FLY ASH		50.6		2.3	19.8	56.3	21.6				
EDW-B003	S-6	15.0'-16.5'	FILL: DARK GRAY FLY ASH WITH SAND AND GRAVEL		29.7									2.772
EDW-B003	S-7	20.0'-21.5'	FILL: DARK GRAY FLY ASH WITH SAND AND GRAVEL		42.1									
EDW-B003	S-8	25.0'-27.0'	FILL: DARK GRAY FLY ASH WITH SAND		54.9									
EDW-B003	S-9	30.0'-32.0'	FILL: VERY DARK GRAY VARVED FLY ASH		71.7		0.0	20.6	66.4	13.0				
EDW-B003	S-10	35.0'-36.5'	FILL: DARK GRAY FLY ASH WITH SAND		51.9									
EDW-B003	S-10A	36.5'-37.0'	GRAY LEAN CLAY WITH ORGANIC POCKETS		43.0	2.25								
EDW-B003	S-11	40.0'-41.5'	GRAY TO BROWNISH GRAY LEAN CLAY WITH SAND		31.6	1.25								
EDW-B003	S-12	45.0'-47.0'	DARK GRAY FAT CLAY WITH SAND	CH	46.0						51	17	34	
EDW-B003	S-13	50.0'-51.5'	BROWNISH GRAY TO GREENISH GRAY LEAN CLAY WITH SAND		55.4	0.50								
EDW-B003	S-14	55.0'-55.5'	BLUISH GRAY CLAYEY SILT		23.3	3.50								
EDW-B003	S-14A	55.5'-55.92'	BLUISH GRAY SILT		9.8									
EDW-B003	S-15	60.0'-60.25'	BLUISH GRAY SILT		7.1									

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynegy - Edwards Site **PROJECT NUMBER:** MR155218 **CLIENT:** AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	LL	PL	PI	Specific Gravity
EDW-B004	S-1	0.0'-1.5'	FILL: DARK GRAY FLY ASH		18.9	4.50+								
EDW-B004	S-2	2.5'-3.5'	FILL: DARK GRAY FLY ASH WITH SAND		28.5	4.00								
EDW-B004	S-2A	3.5'-4.0'	BROWN TO GRAY LEAN CLAY WITH SAND - FLY ASH NOTED		20.1	3.25								
EDW-B004	S-3	5.0'-6.5'	BROWN AND GRAY LEAN CLAY		21.6	1.75								
EDW-B004	S-4	7.5'-9.0'	GRAY AND DARK GRAY LEAN CLAY WITH ORGANICS	CL	23.4	4.00	0.0	9.3	43.3	47.4	37	16	21	
EDW-B004	S-5	10.0'-11.5'	BROWN AND DARK GRAY LEAN CLAY		21.5	2.25								
EDW-B004	S-6	12.5'-14.0'	BROWN AND GRAY LEAN CLAY WITH SAND		25.4	1.25								
EDW-B004	S-7	15.0'-16.5'	DARK GRAY LEAN CLAY		25.8	2.50								
EDW-B004	S-8	20.0'-21.5'	BROWN AND GRAY LEAN CLAY WITH SAND		31.3	1.00								
EDW-B004	S-9	25.0'-26.0'	BROWN AND GRAY LEAN CLAY WITH SAND AND SAND POCKETS		23.0	1.25								
EDW-B004	S-9A	26.0'-26.5'	GRAY AND BROWN CLAYEY SAND		19.5	0.75								
EDW-B004	S-10	30.0'-31.5'	GRAYISH BROWN AND DARK GRAY LEAN CLAY WITH SAND - ORGANIC		19.7	3.75								
EDW-B004	S-11	36.0'-38.0'	BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND	CL	20.1						35	17	18	
EDW-B004	S-12	40.0'-41.5'	BROWN, RUST BROWN AND GRAY LEAN CLAY		30.0	1.25								
EDW-B004	S-13	45.0'-46.0'	GRAY LEAN CLAY		39.5	1.00								
EDW-B004	S-13A	46.0'-46.5'	BROWNISH GRAY LEAN CLAY WITH SAND		35.1									
EDW-B004	S-14	50.0'-51.5'	GRAY LEAN CLAY WITH SAND		65.2	1.75								2.617
EDW-B004	S-15	55.0'-56.5'	BROWN AND BLUISH GRAY LEAN CLAY WITH SAND		33.4	1.25								
EDW-B004	S-15A	56.0'-56.5'	BLUISH GRAY SILT		13.2									
EDW-B004	S-16	60.0'-60.25'	BLUISH GRAY SOFT SHALE		8.8									
EDW-B005	S-1	0.0'-1.5'	FILL: BROWN AND DARK BROWN CLAYEY SAND WITH GRAVEL AND SILT		45.8	4.50								
EDW-B005	S-2	2.5'-4.0'	FILL: BROWN SANDY SILT WITH GRAVEL		26.0									
EDW-B005	S-3	5.0'-6.5'	FILL: BROWN SANDY SILT WITH CLAY CHUNKS	MH	50.9	3.25					61	54	7	
EDW-B005	S-4	8.5'-10.0'	FILL: BROWN SANDY SILT WITH GRAVEL		37.4	4.50+								
EDW-B005	S-5	10.0'-11.5'	FILL: LIGHT BROWN AND GRAY CLAYEY SAND WITH GRAVEL		44.3									
EDW-B005	S-6	15.0'-16.5'	FILL: BROWN SANDY SILT WITH GRAVEL		41.4									
EDW-B005	S-7	20.0'-21.5'	FILL: GRAY FLY ASH		51.1	1.75	3.1	21.3	51.7	23.9				
EDW-B005	S-8	25.0'-26.0'	FILL: BROWNISH GRAY CLAYEY SILT WITH SAND AND GRAVEL		55.3									
EDW-B005	S-8A	26.0'-27.0'	FILL: GRAY AND BLACK ORGANIC SILT	OL	47.6						44	29	15	
EDW-B005	S-9	29.0'-31.0'	FILL: DARK GRAY FLY ASH		69.3									
EDW-B005	S-10	35.0'-36.5'	GRAY AND GRAYISH BLACK LEAN CLAY WITH SAND AND ORGANICS		37.3	1.00								
EDW-B005	S-11	41.0'-43.0'	GRAY FAT CLAY SHELL - ORGANICS NOTED	CH	44.8						57	22	35	
EDW-B005	S-12	45.0'-46.5'	DARK GRAY AND GREENISH GRAY LEAN CLAY WITH SAND - ORGANICS AND SHALE NOTED		88.7	1.00								2.521
EDW-B005	S-13	50.0'-51.0'	BLUISH GRAY CLAYEY SILT		15.9	4.50+								
EDW-B005	S-14	51.0'-51.5'	BLUISH GRAY SOFT SHALE		12.8									

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynergy - Edwards Site **PROJECT NUMBER:** MR155218 **CLIENT:** AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	LL	PL	PI	Specific Gravity
EDW-B006	S-1	0.0'-1.5'	FILL: DARK BROWN AND DARK GRAY LEAN CLAY WITH SAND AND BRICK		26.4	2.25								
EDW-B006	S-2	2.5'-5.0'	RUST BROWN AND GRAY MOTTLED LEAN CLAY		30.1	1.25								
EDW-B006	S-3	5.0'-6.5'	GRAY AND DARK GRAY LEAN CLAY TRACE SAND	CL	24.8	2.25					48	19	29	
EDW-B006	S-4	7.5'-10.0'	GRAY AND RUST BROWN MOTTLED LEAN CLAY		26.0	2.50								
EDW-B006	S-5	10.0'-11.5'	BROWNISH GRAY LEAN CLAY		34.2	1.25								
EDW-B006	S-6	13.0'-15.0'	GRAY FAT CLAY WITH SAND	CH	31.1						62	20	42	
EDW-B006	S-7	15.0'-16.5'	BROWNISH GRAY LEAN CLAY		40.8	1.00								
EDW-B006	S-8	20.0'-21.5'	BROWN AND GRAY LEAN CLAY WITH SAND		43.4	0.75								
EDW-B006	S-9	26.0'-28.0'	DARK GRAY ORGANIC SILT	OH	76.0						72	37	35	
EDW-B006	S-10	30.0'-31.0'	GRAY LEAN CLAY WITH SAND - ORGANIC POCKETS NOTED		43.4	0.50								
EDW-B006	S-10A	31.0'-31.5'	BLUISH GRAY LEAN CLAY WITH SAND AND SILT		19.6									
EDW-B006	S-11	35.0'-35.42'	BLUISH GRAY SILT WITH SAND		14.2	3.50								
EDW-B008	S-1	0.0'-1.5'	BROWN LEAN CLAY WITH SAND AND GRAVEL		13.2	4.50+								
EDW-B008	S-2	2.5'-4.0'	DARK BROWN LEAN CLAY WITH SAND	CL	19.5	3.75					42	22	20	
EDW-B008	S-3	5.0'-6.5'	DARK GRAY AND RUST BROWN MOTTLED LEAN CLAY WITH SAND		42.3	2.00								
EDW-B008	S-4	7.5'-9.0'	BROWN AND LIGHT GRAY LEAN CLAY WITH SAND		22.8	2.00								
EDW-B008	S-5	11.0'-13.0'	BROWN AND GRAY FAT CLAY WITH SAND	CH	33.6						52	19	33	
EDW-B008	S-6	15.0'-16.5'	GRAY LEAN CLAY WITH SAND		64.6	0.50								
EDW-B008	S-7	20.0'-21.5'	BROWN AND GRAY LEAN CLAY - SHELL NOTED		44.4	0.50								
EDW-B008	S-8	24.0'-26.5'	DARK GRAY FAT CLAY SHELL - ORGANICS NOTED	CH	68.9						67	31	36	
EDW-B008	S-9	30.0'-31.5'	GRAY AND BROWNISH GRAY LEAN CLAY WITH SAND		71.4	0.50								
EDW-B008	S-10	35.0'-36.5'	GRAY LEAN CLAY WITH SAND - WOODCHIPS, ORGANICS AND SHELL NOTED		56.9	0.25								
EDW-B008	S-11	40.0'-40.33'	BLUISH GRAY SILT WITH SOFT SHALE		12.6	3.00								

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynegy - Edwards Site **PROJECT NUMBER:** MR155218 **CLIENT:** AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	LL	PL	PI	Specific Gravity
EDW-B010	S-1 TOP	0.0'-0.5'	FILL: BROWN SAND WITH GRAVEL		7.2									
EDW-B010	BOTTOM	0.0'-0.5'	FILL: BROWN LEAN CLAY WITH SAND AND GRAVEL		17.4	4.50+								
EDW-B010	S-1A	0.5'-1.5'	FILL: DARK GRAY FLY ASH		27.9									
EDW-B010	S-2	2.5'-3.0'	FILL: DARK GRAY FLY ASH		20.9									
EDW-B010	S-2A	3.0'-4.0'	FILL: DARK GRAY FLY ASH		30.7	4.50								
EDW-B010	S-3	5.0'-6.5'	FILL: DARK BROWN AND DARK GRAY SAND WITH GRAVEL - FLY ASH NOTED	SP	14.8		12.6	54.8	26.0	6.6				
EDW-B010	S-4	7.5'-9.0'	BROWN WITH RUST BROWN STAINS LEAN CLAY WITH SAND		22.0	3.75								
EDW-B010	S-5	10.0'-11.5'	BROWN AND RUST BROWN LEAN CLAY WITH SAND		24.0	2.00								
EDW-B010	S-6	12.5'-14.0'	BROWN LEAN CLAY		28.0	1.25								
EDW-B010	S-7	15.0'-17.0'	BROWN AND GRAY MOTTLED LEAN CLAY	CL	30.5						48	18	30	
EDW-B010	S-8	20.0'-21.5'	GRAY LEAN CLAY		32.9	0.75								
EDW-B010	S-9	25.0'-26.5'	GRAY LEAN CLAY WITH SAND		21.4	0.50								
EDW-B010	S-10	30.0'-32.0'	BLUISH GRAY LEAN CLAY	CL	30.0						40	15	25	
EDW-B010	S-11	35.0'-36.5'	BROWNISH GRAY LEAN CLAY		28.2	1.50								
EDW-B010	S-12	40.0'-41.0'	BROWN, RUST BROWN AND GRAY SILTY SAND WITH GRAVEL		17.0									
EDW-B010	S-13	45.0'-45.25'	BLUISH GRAY CLAYEY SILT - SHALE NOTED		16.4	4.50								
EDW-B011	S-1	0.0'-1.5'	FILL: DARK GRAY FLY ASH		27.7	4.50+								
EDW-B011	S-2	2.5'-4.0'	FILL: DARK GRAY AND BLACK FLY ASH - ASPHALT NOTED		16.3	4.50+								
EDW-B011	S-3	5.0'-6.5'	FILL: GRAY FLY ASH		29.4	4.50+								
EDW-B011	S-4	7.5'-9.0'	FILL: DARK GRAY FLY ASH		45.3	3.00								
EDW-B011	S-5	9.0'-11.0'	FILL: VERY DARK GRAY FLY ASH		70.0		15.5	21.3	46.0	17.2				
EDW-B011	S-6	15.0'-17.0'	FILL: DARK GRAY FLY ASH		63.2									
EDW-B011	S-7	19.5'-21.5'	FILL: GRAY FLY ASH		84.9		0.2	16.7	58.0	25.1				
EDW-B011	S-8	25.0'-27.0'	FILL: DARK GRAY FLY ASH - CLAY NOTED		74.7									2.691
EDW-B011	S-9	30.0'-32.0'	FILL: DARK GRAY FLY ASH		73.7									
EDW-B011	S-10	35.0'-37.0'	FILL: DARK GRAY FLY ASH		93.9									
EDW-B011	S-13	40.0'-41.5'	BROWN AND GRAY LEAN CLAY		47.9	1.00								
EDW-B011	S-14	45.0'-46.5'	GRAYISH BROWN FAT CLAY WITH SAND	CH	63.3	0.50					63	21	42	
EDW-B011	S-15	50.0'-51.5'	DARK GRAY AND GRAYISH BROWN LEAN CLAY		62.5	0.50								
EDW-B011	S-16	55.0'-56.5'	GRAY LEAN CLAY		52.9	0.75								
EDW-B011	S-17	60.0'-60.25'	BLUISH GRAY SOFT SHALE		9.1									

LABORATORY TESTING SUMMARY

PROJECT NAME: Dynegy - Edwards Site **PROJECT NUMBER:** MR155218 **CLIENT:** AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	LL	PL	PI	Specific Gravity
EDW-B012	S-1	0.0'-1.5'	FILL: BROWN SANDY SILT WITH GRAVEL		23.0									
EDW-B012	S-2	2.5'-4.0'	FILL: DARK GRAY FLY ASH		23.8	4.50+					28	26	2	
EDW-B012	S-3	5.0'-6.5'	FILL: DARK GRAY FLY ASH		26.5		0.0	9.6	73.7	16.7				
EDW-B012	S-4	7.5'-9.0'	FILL: DARK GRAY FLY ASH		26.5	4.50								
EDW-B012	S-5	10.0'-11.0'	FILL: DARK BROWN LEAN CLAY WITH SAND - FLY ASH NOTED		24.7	3.75								
EDW-B012	S-5A	11.0'-11.5'	BROWN AND GRAYISH BROWN LEAN CLAY		24.9	2.00								
EDW-B012	S-6	12.5'-14.0'	BROWN LEAN CLAY		22.0	3.50								
EDW-B012	S-7	15.0'-16.5'	BROWN AND RUST BROWN MOTTLED LEAN CLAY	CL	24.3	3.25					48	19	29	
EDW-B012	S-8	20.0'-22.0'	BROWNISH GRAY MOTTHED LEAN CLAY WITH SAND		23.8									
EDW-B012	S-9	25.0'-26.5'	BROWNISH GRAY LEAN CLAY WITH SAND		23.2	1.25								
EDW-B012	S-10	30.0'-31.5'	BROWN AND GRAY LEAN CLAY		24.8	1.50								
EDW-B012	S-11	35.0'-36.5'	RUST BROWN AND GRAY LEAN CLAY WITH SAND		28.3	1.50								
EDW-B012	S-12	40.0'-41.5'	BLUISH GRAY AND BROWNISH GRAY LEAN CLAY		32.2	1.00								
EDW-B012	S-13	45.0'-46.5'	BROWNISH GRAY LEAN CLAY		50.2	1.25								
EDW-B012	S-14	47.0'-49.0'	DARK GRAY FAT CLAY	CH	50.8						54	20	34	
EDW-B012	S-15	49.0'-50.5'	GRAY AND BROWNISH GRAY LEAN CLAY WITH SAND		67.4	1.00								
EDW-B012	S-16	55.0'-55.5'	GRAY LEAN CLAY WITH SAND		50.5	1.75								
EDW-B012	S-16A	55.5'-56.5'	BLUISH GRAY CLAYEY SILT		15.3	4.50								
EDW-B012	S-17	60.0'-60.21'	BLUISH GRAY CLAYEY SILT		17.9	1.50								
EDW-B013	S-1	0.0'-1.5'	FILL: BROWN AND DARK BROWN LEAN CLAY WITH SAND AND GRAVEL		13.6	4.50+								
EDW-B013	S-2	2.5'-4.0'	BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND		17.4	4.50+								
EDW-B013	S-3	6.0'-8.0'	BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL	CL	24.3						49	21	28	
EDW-B013	S-4	8.0'-9.5'	DARK GRAY AND RUST BROWN MOTTLED LEAN CLAY		24.3	3.00								
EDW-B013	S-5	10.0'-11.5'	DARK GRAY LEAN CLAY		25.4	2.25								
EDW-B013	S-6	15.0'-16.5'	DARK GRAY AND BROWNISH GRAY LEAN CLAY	CL	25.5	1.50					41	17	24	
EDW-B013	S-7	20.0'-21.5'	BROWN AND DARK GRAY LEAN CLAY		23.5	1.75								
EDW-B013	S-8	25.0'-26.5'	DARK BROWNISH GRAY LEAN CLAY		27.7									
EDW-B013	S-9	30.0'-31.5'	GRAY AND RUST BROWN MOTTLED SANDY LEAN CLAY		20.2	0.50								
EDW-B013	S-10	32.0'-34.0'	GRAY AND BROWN LEAN CLAY WITH SAND	CL	33.3						42	23	19	
EDW-B013	S-11	34.0'-35.5'	DARK GRAY LEAN CLAY		58.0	0.50								
EDW-B013	S-12	40.0'-41.5'	GRAY LEAN CLAY WITH SAND		54.5	1.75								
EDW-B013	S-13	45.0'-46.5'	GRAY LEAN CLAY - CALCIUM CABONATE SEAMS AND SHELL NOTED		66.2	1.25								
EDW-B013	S-3	6.0'-8.0'	BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL		20.0									

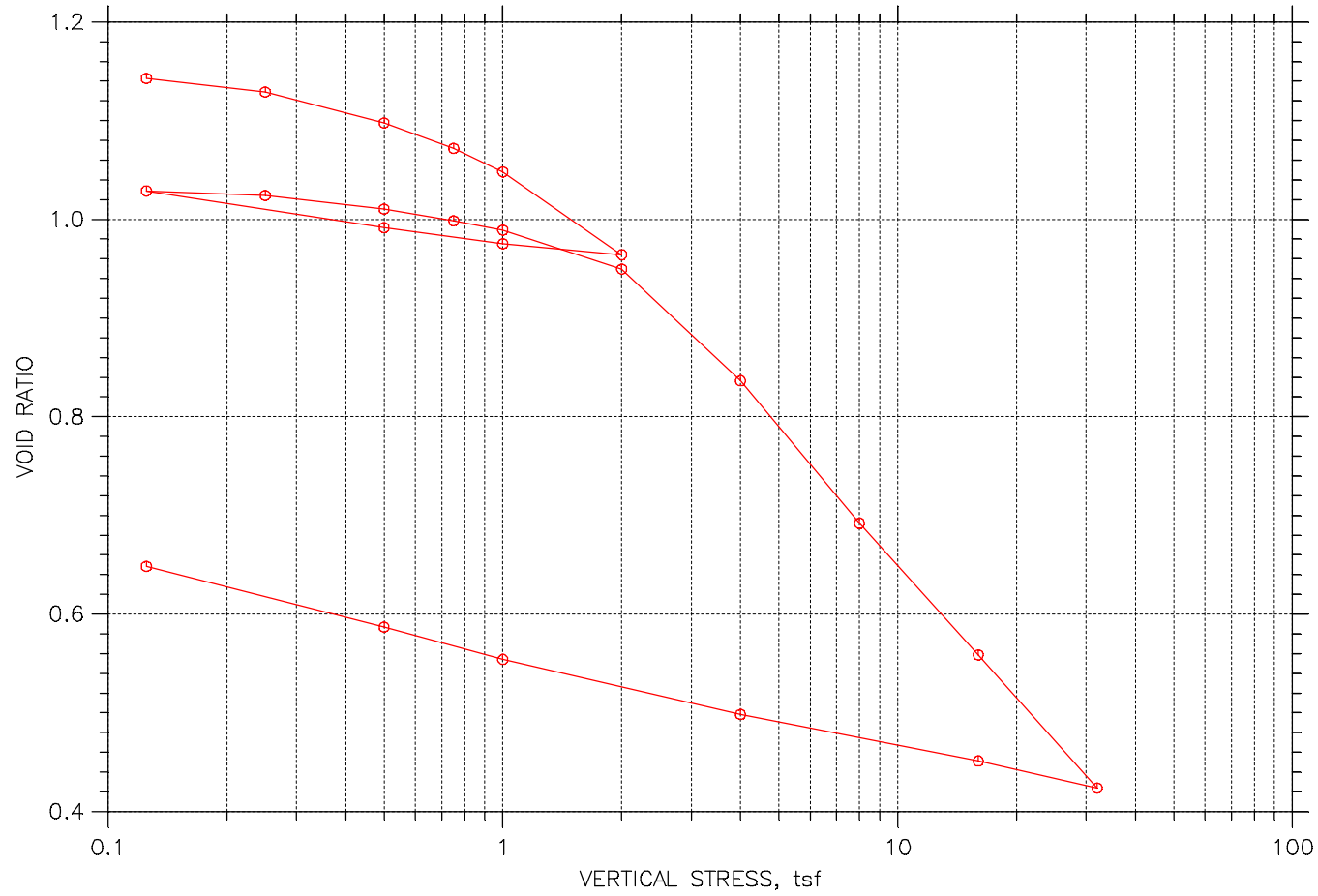
LABORATORY TESTING SUMMARY

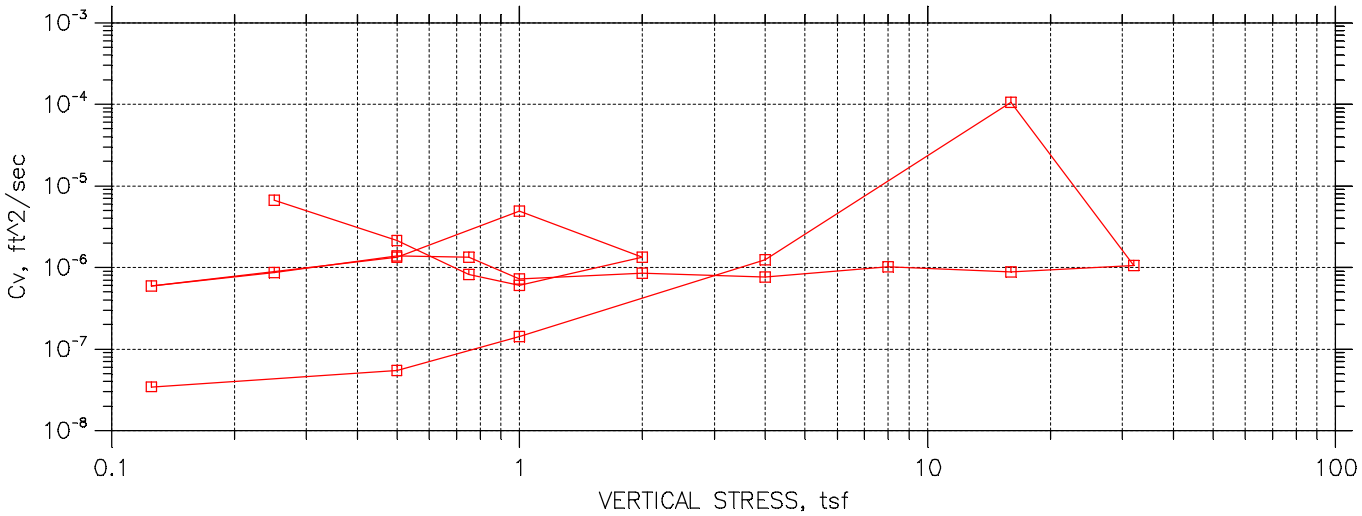
PROJECT NAME: Dynegy - Edwards Site **PROJECT NUMBER:** MR155218 **CLIENT:** AECOM

Boring Number	Sample Number	Depth	Description	USCS	WC %	Qp (tsf)	% Gravel	% Sand	% Silt	% Clay	LL	PL	PI	Specific Gravity
EDW-B014	S-1	0.0'-1.5'	FILL: DARK GRAY FLY ASH		28.2	4.00								
EDW-B014	S-2	2.5'-3.5'	FILL: DARK GRAY CLAYEY SILT - FLY ASH NOTED		40.8	1.50								
EDW-B014	S-2A	3.5'-4.0'	FILL: GRAY CLAYEY SILT WITH SAND - FLY ASH NOTED		50.0									
EDW-B014	S-4	7.0'-8.5'	FILL: GRAY SILTY SAND WITH GRAVEL - FLY ASH NOTED	SM	60.2		0.0	35.1	45.4	19.5				
EDW-B014	S-6	15.0'-17.0'	FILL: GRAY AND DARK GRAY FLY ASH		78.7	3.50								
EDW-B014	S-7	20.0'-22.5'	FILL: DARK GRAY FLY ASH		86.5	1.50								2.524
EDW-B014	S-8	25.0'-26.7'	FILL: DARK GRAY FLY ASH - CLAY NOTED		73.1									
EDW-B014	S-9	30.0'-31.5'	GRAY AND DARK GRAY LEAN CLAY - ORGANIC POCKETS NOTED		48.7									
EDW-B014	S-10	35.0'-36.7'	GRAY LEAN CLAY		31.6	0.75								
EDW-B014	S-11	40.0'-40.5'	BLUISH GRAY LEAN CLAY WITH SAND AND GRAVEL		27.3	4.00								2.719
EDW-B014	S-11A	40.5'-41.0'	BLUISH GRAY AND GREENISH GRAY SILT WITH SOFT SHALE		19.6	4.50+								
EDW-B014	S-11B	41.0'-41.5'	GRAY SOFT SHALE		10.2									
EDW-B014	S-12	45.0'-45.5'	GRAY SILT WITH SAND		14.5	4.50								
EDW-B015	S-1	0.0'-1.5'	FILL: GRAYISH BROWN SANDY SILT		54.7									
EDW-B015	S-2	2.5'-4.0'	BROWN SAND WITH GRAVEL		4.5									
EDW-B015	S-3	5.0'-6.5'	BROWN SAND WITH GRAVEL		5.4									
EDW-B015	S-4	7.5'-9.0'	BROWN SAND WITH GRAVEL		7.2									
EDW-B015	S-5	10.0'-11.5'	BROWN SAND WITH GRAVEL		6.5									
EDW-B015	S-6	13.0'-14.25'	BROWN AND GRAY GRAVEL		3.6									
EDW-B015	S-7	15.0'-16.5'	LIGHT GRAY GRAVEL WITH SAND - LIMESTONE FRAGMENTS NOTED		8.2									
EDW-B015	S-8	20.0'-21.5'	GRAY GRAVEL WITH SAND		7.8									
EDW-B015	S-9	25.0'-26.5'	LIGHT GRAY GRAVEL WITH SAND AND SILT		8.1									
EDW-B015	S-10	31.0'-33.0'	BROWN AND GRAY MOTTLED SANDY LEAN CLAY WITH GRAVEL	CL	20.2						24	13	11	
EDW-B015	S-11	35.0'-36.5'	GRAY AND DARK GRAY LEAN CLAY		33.8	1.50								
EDW-B015	S-12	37.0'-39.0'	DARK GRAY FAT CLAY	CH	41.0						66	23	43	
EDW-B015	S-13	39.0'-40.5'	BROWN AND GRAY LEAN CLAY		36.2	0.50								
EDW-B015	S-14	45.0'-46.5'	BROWN AND GRAY LEAN CLAY WITH SAND		49.4	1.00								
EDW-B015	S-15	50.0'-51.0'	GRAY LEAN CLAY		30.9	1.50								
EDW-B015	S-16	55.0'-55.5'	BLUISH GRAY SILT - SHALE NOTED		11.0	4.25								

CONSOLIDATION TEST DATA

SUMMARY REPORT





Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

CONSOLIDATION TEST DATA

Project: DYNEGY EDWARDS
Boring No.: EDW-B003
Sample No.: S-12
Test No.: EDW003S12

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 10/26/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 45.0'-47.0'
Elevation: ----

Soil Description: DARK GRAY FAT CLAY WITH SAND CH
Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435

Estimated Specific Gravity: 2.72
Initial Void Ratio: 1.15
Final Void Ratio: 0.65

Liquid Limit: 51
Plastic Limit: 24
Plasticity Index: 27

Initial Height: 1.00 in
Specimen Diameter: 2.50 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	X-14	RING	RING	X-19
Wt. Container + Wet Soil, gm	165.03	249.08	236.35	164.81
Wt. Container + Dry Soil, gm	127.13	213.35	213.35	142.68
Wt. Container, gm	44.81	111.54	111.54	44.72
Wt. Dry Soil, gm	82.32	101.81	101.81	97.96
Water Content, %	46.04	35.09	22.59	22.59
Void Ratio	---	1.15	0.65	---
Degree of Saturation, %	---	83.18	94.86	---
Dry Unit Weight, pcf	---	79.069	103.05	---

CONSOLIDATION TEST DATA

Project: DYNEGY EDWARDS
Boring No.: EDW-B003
Sample No.: S-12
Test No.: EDW003S12

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 10/26/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 45.0'-47.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: DARK GRAY FAT CLAY WITH SAND CH
Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435

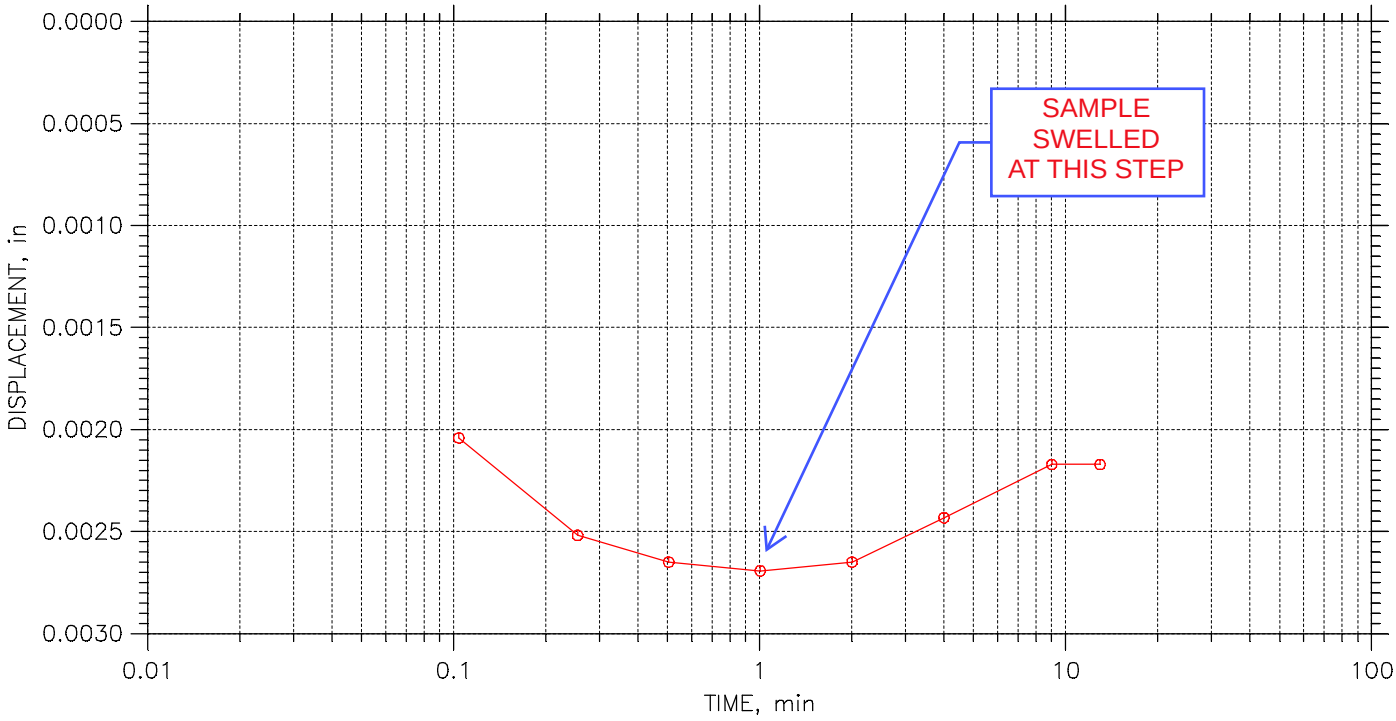
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	T50 Fitting Sq.Rt. min	T50 Fitting Log min	Coefficient of Consolidation Sq.Rt. ft^2/sec	Coefficient of Consolidation Log ft^2/sec	Coefficient of Consolidation Ave. ft^2/sec
1	0.125	0.002172	1.143	0.22	0.0	0.0	0.00e+000	0.00e+000	0.00e+000
2	0.25	0.008644	1.129	0.87	1.0	0.6	5.41e-006	8.79e-006	6.69e-006
3	0.5	0.02315	1.098	2.32	3.9	1.2	1.42e-006	4.45e-006	2.15e-006
4	0.75	0.03518	1.072	3.53	6.5	4.7	8.27e-007	1.15e-006	9.61e-007
5	1	0.04617	1.048	4.63	8.6	0.0	6.06e-007	0.00e+000	6.06e-007
6	2	0.08522	0.964	8.54	3.7	0.0	1.33e-006	0.00e+000	1.33e-006
7	1	0.08005	0.975	8.02	1.0	0.0	4.94e-006	0.00e+000	4.94e-006
8	0.5	0.07245	0.992	7.26	3.7	0.0	1.33e-006	0.00e+000	1.33e-006
9	0.125	0.05516	1.029	5.53	8.4	0.0	5.93e-007	0.00e+000	5.93e-007
10	0.25	0.05733	1.024	5.74	5.8	0.0	8.68e-007	0.00e+000	8.68e-007
11	0.5	0.06376	1.010	6.39	3.6	0.0	1.38e-006	0.00e+000	1.38e-006
12	0.75	0.06924	0.999	6.94	3.7	0.0	1.33e-006	0.00e+000	1.33e-006
13	1	0.07358	0.989	7.37	11.4	2.0	4.29e-007	2.42e-006	7.28e-007
14	2	0.09195	0.950	9.21	8.7	2.5	5.48e-007	1.92e-006	8.53e-007
15	4	0.1446	0.836	14.49	5.8	5.7	7.57e-007	7.69e-007	7.63e-007
16	8	0.2117	0.692	21.21	3.8	3.7	1.02e-006	1.04e-006	1.03e-006
17	16	0.2736	0.559	27.42	3.8	3.6	8.62e-007	9.02e-007	8.81e-007
18	32	0.3363	0.424	33.70	2.1	3.1	1.30e-006	8.96e-007	1.06e-006
19	16	0.3237	0.451	32.43	0.0	0.0	1.05e-004	0.00e+000	1.05e-004
20	4	0.3017	0.498	30.23	2.1	0.0	1.25e-006	0.00e+000	1.25e-006
21	1	0.2758	0.554	27.64	20.3	0.0	1.42e-007	0.00e+000	1.42e-007
22	0.5	0.2611	0.586	26.16	78.7	39.4	3.86e-008	7.70e-008	5.14e-008
23	0.125	0.2322	0.648	23.27	93.5	0.0	3.45e-008	0.00e+000	3.45e-008

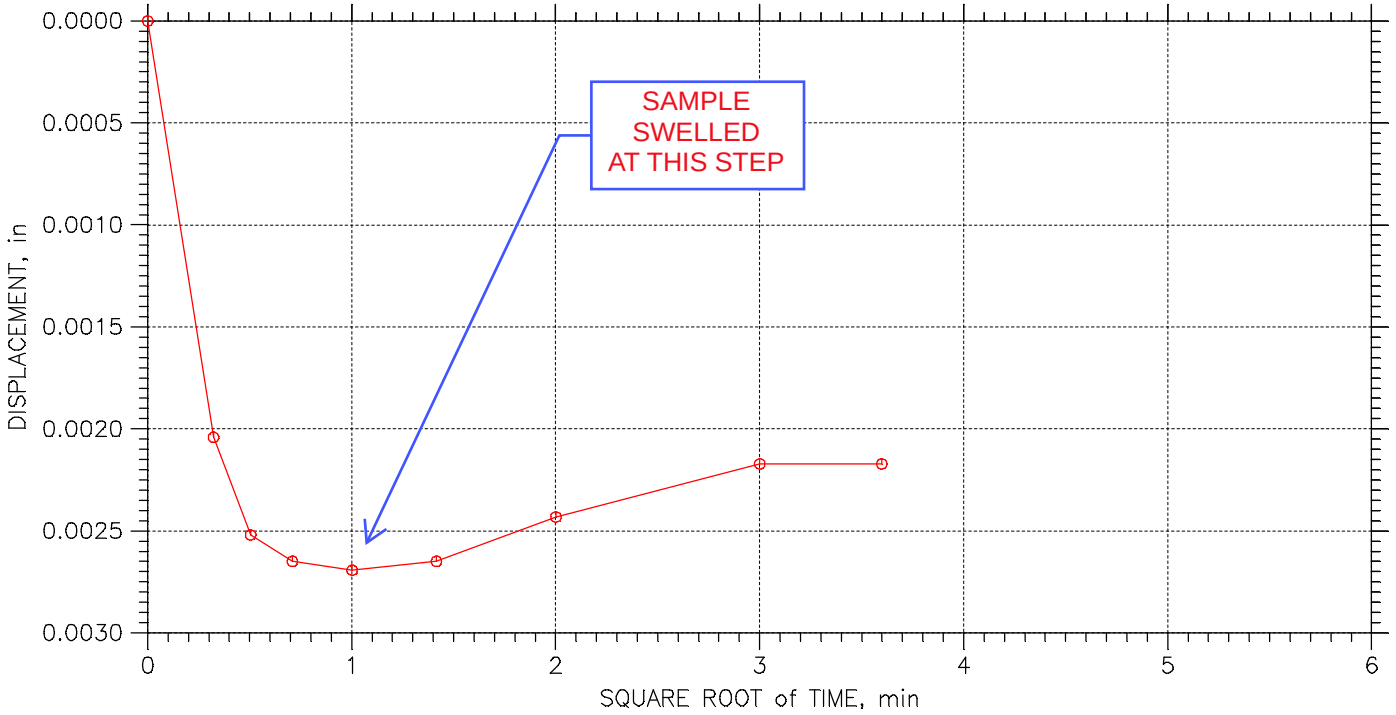
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 1 of 23

Stress: 0.125 tsf





Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

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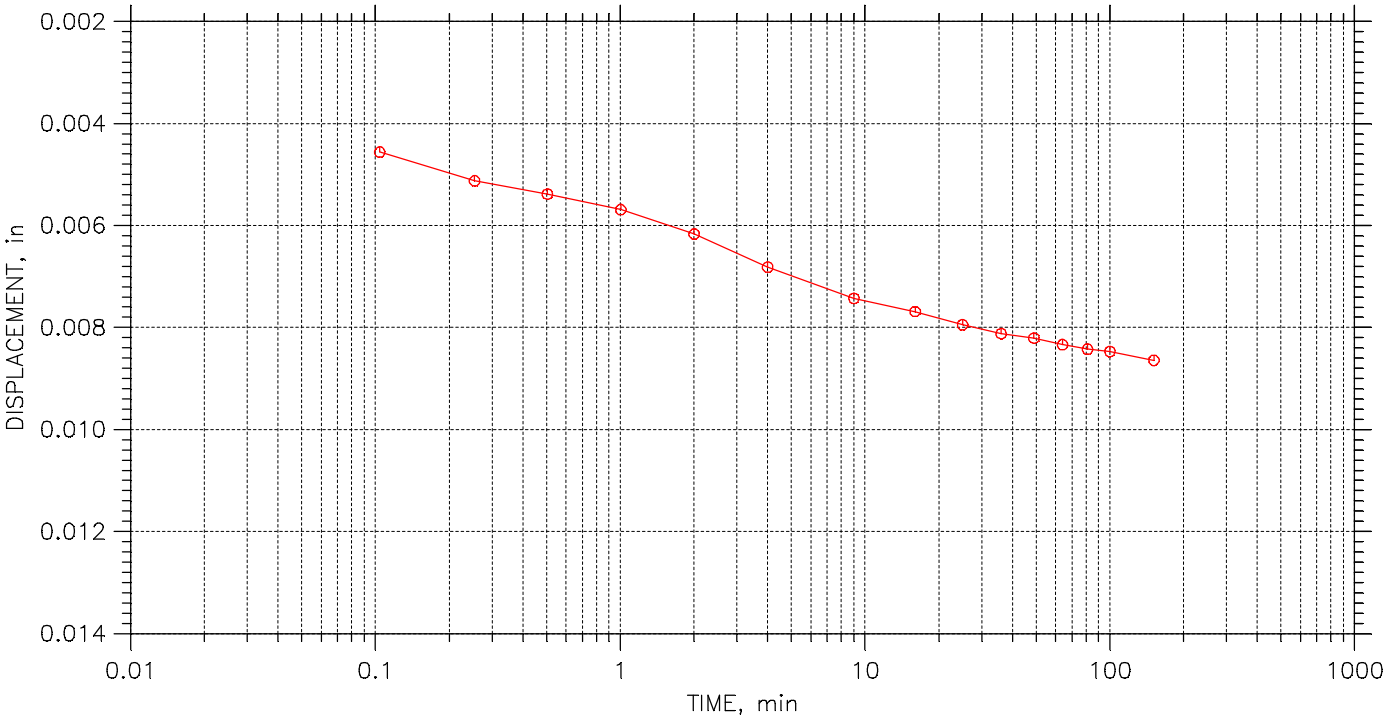
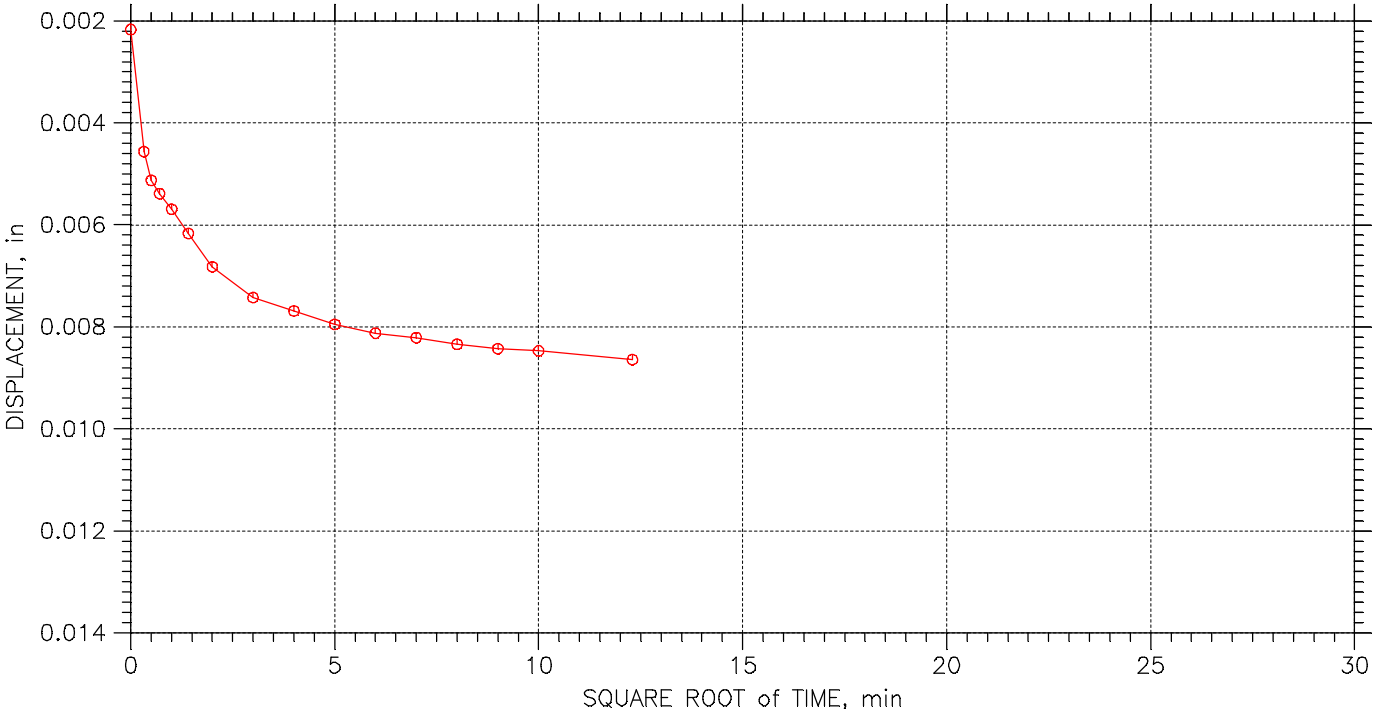
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 2 of 23

Stress: 0.25 tsf





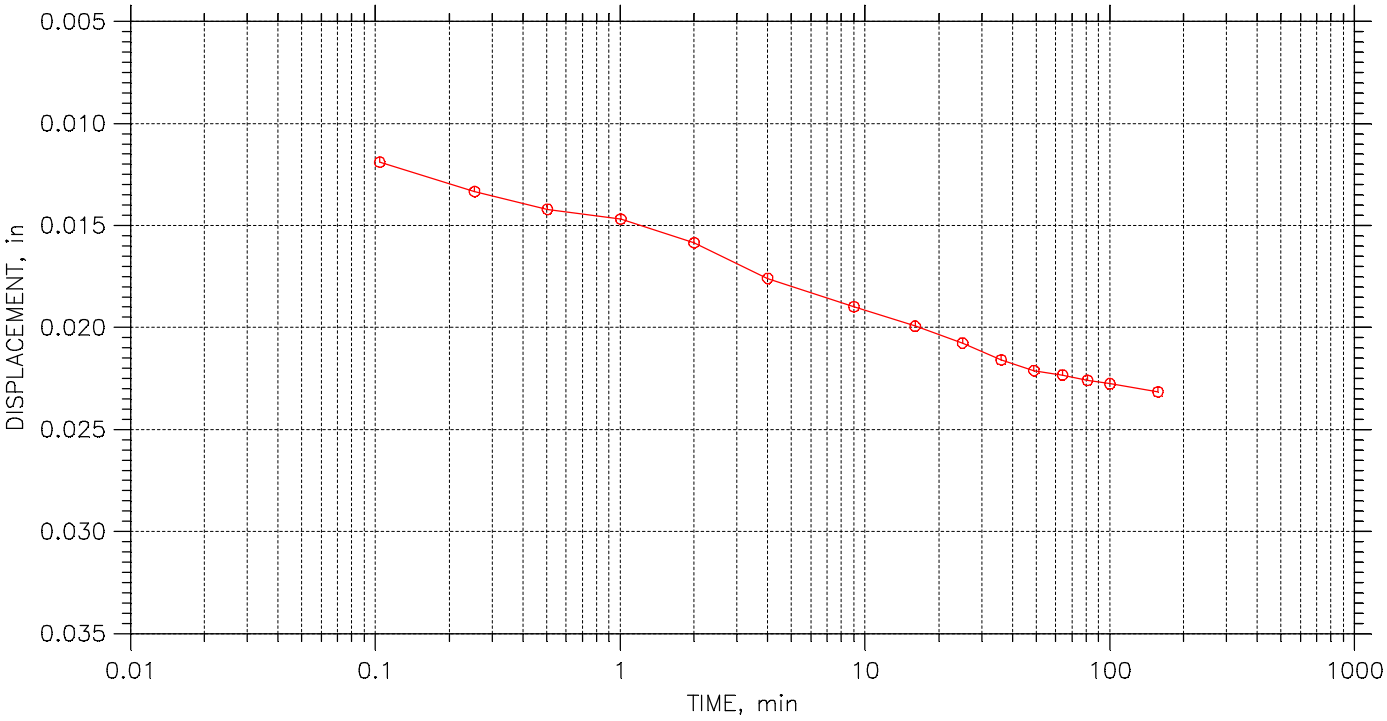
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

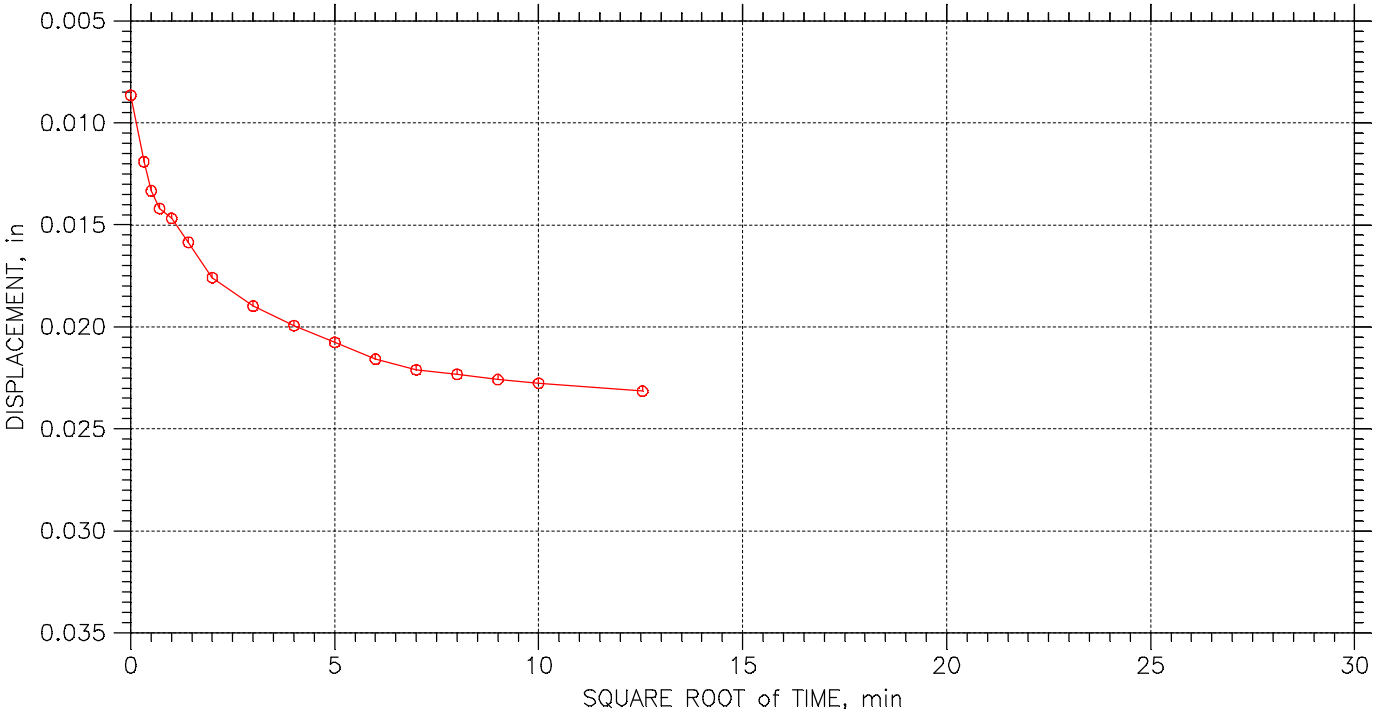
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 3 of 23

Stress: 0.5 tsf





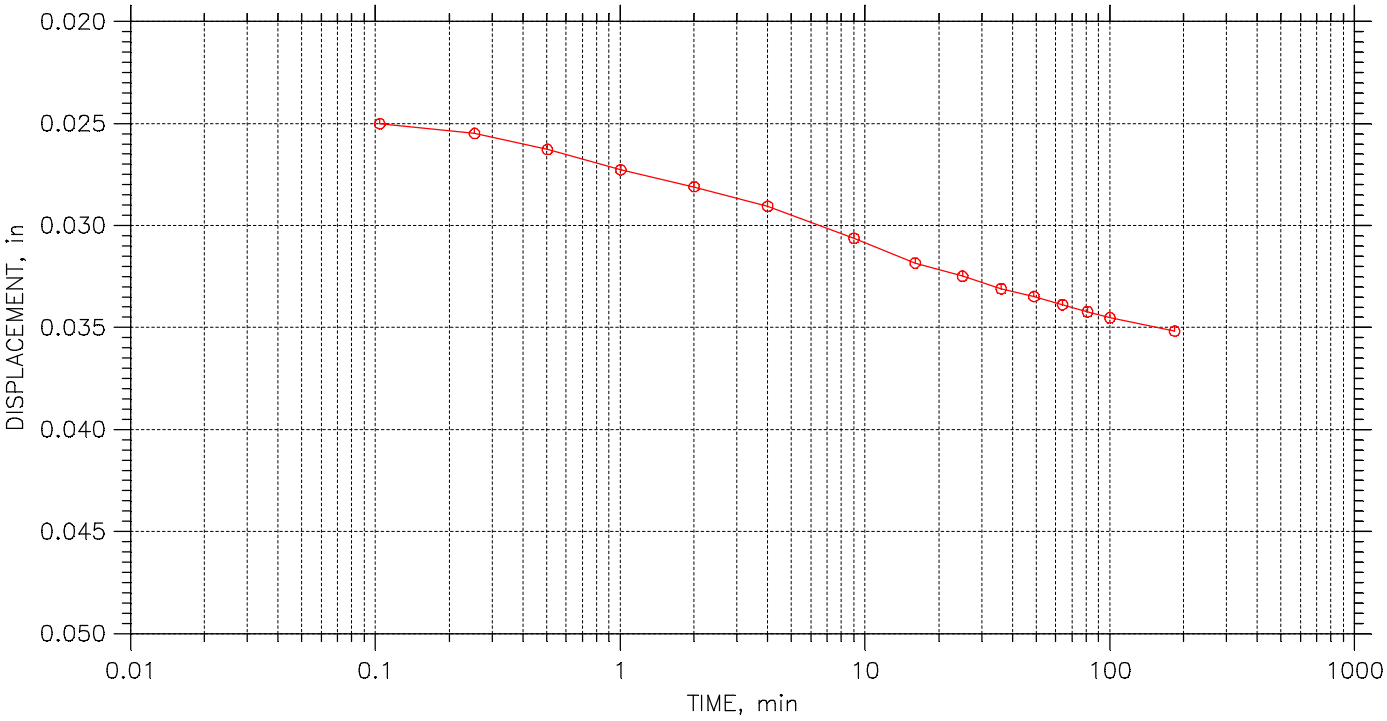
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

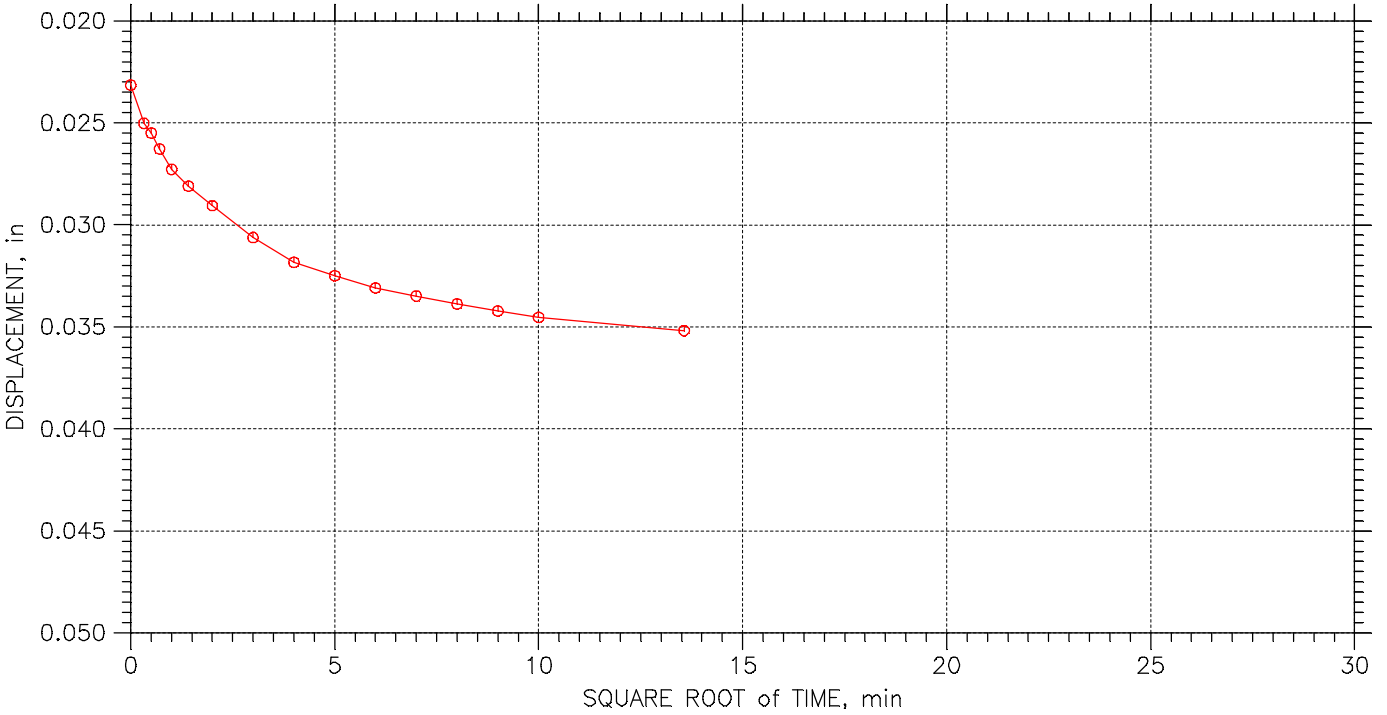
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 4 of 23

Stress: 0.75 tsf





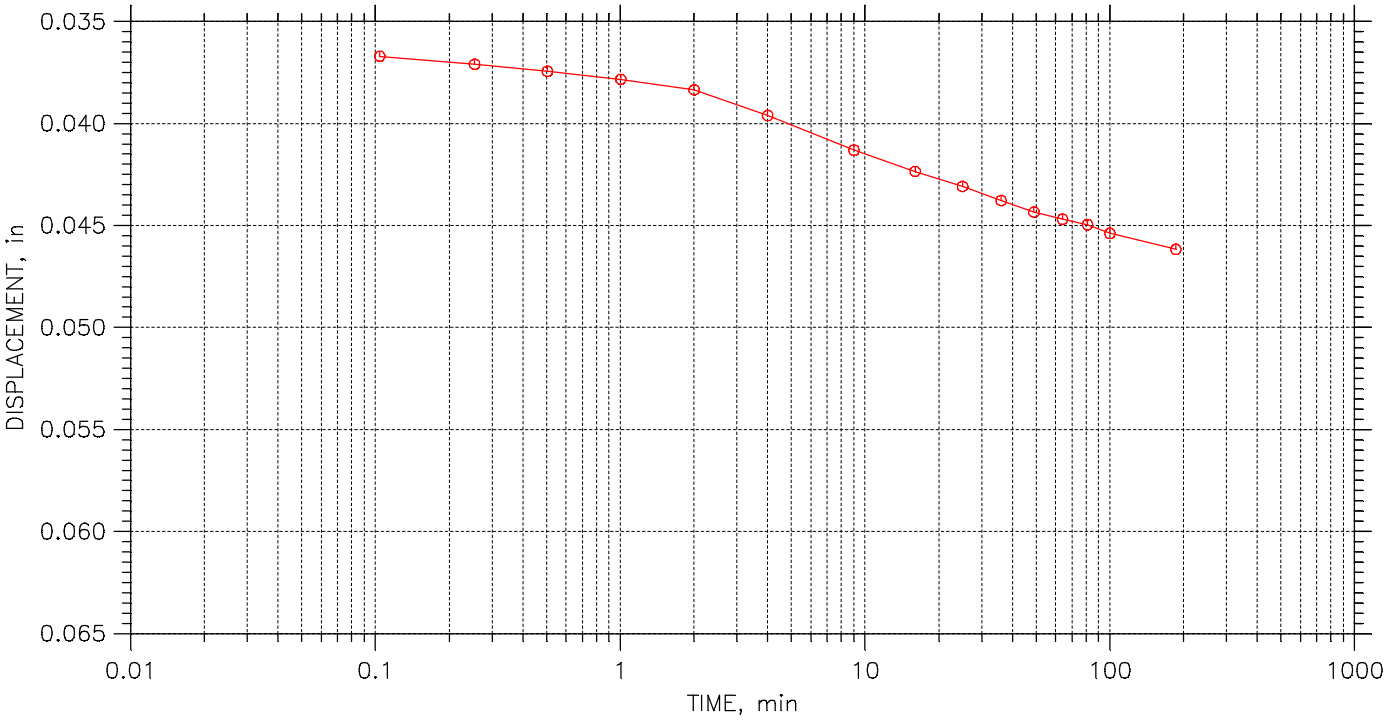
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

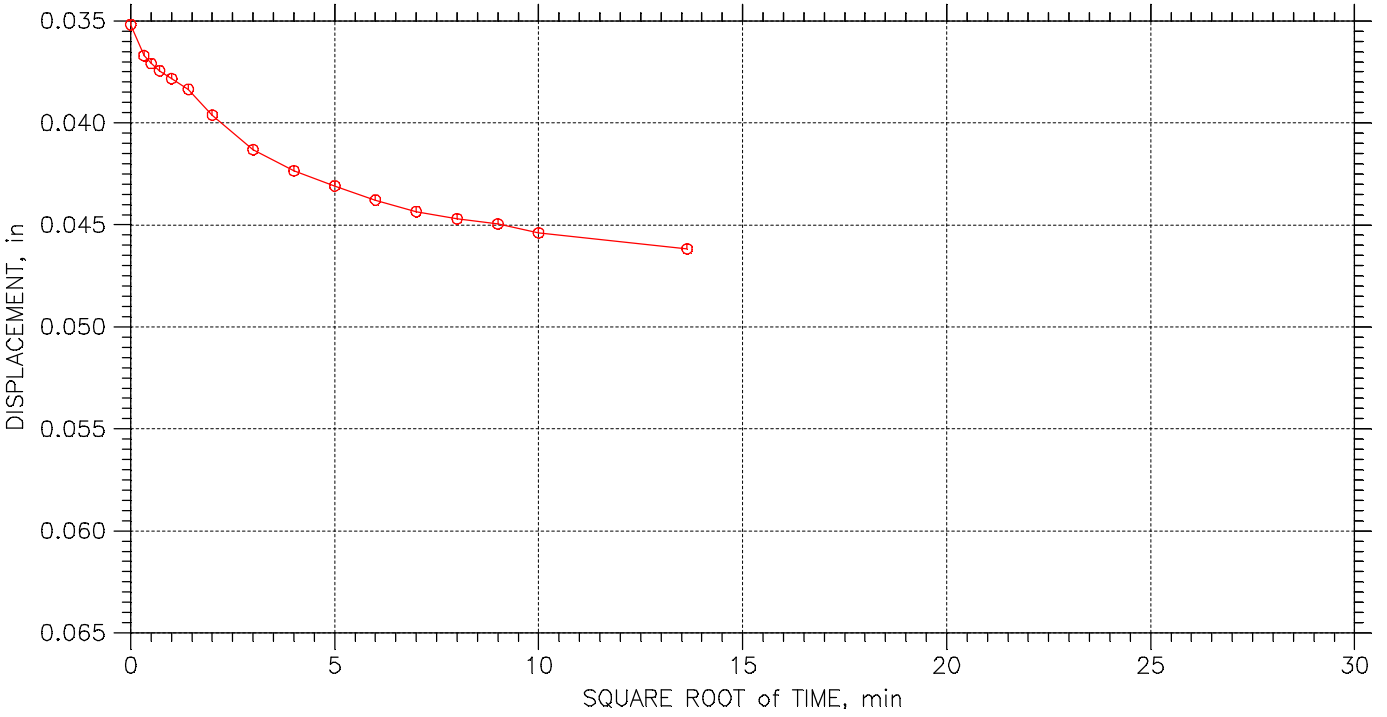
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 5 of 23

Stress: 1. tsf





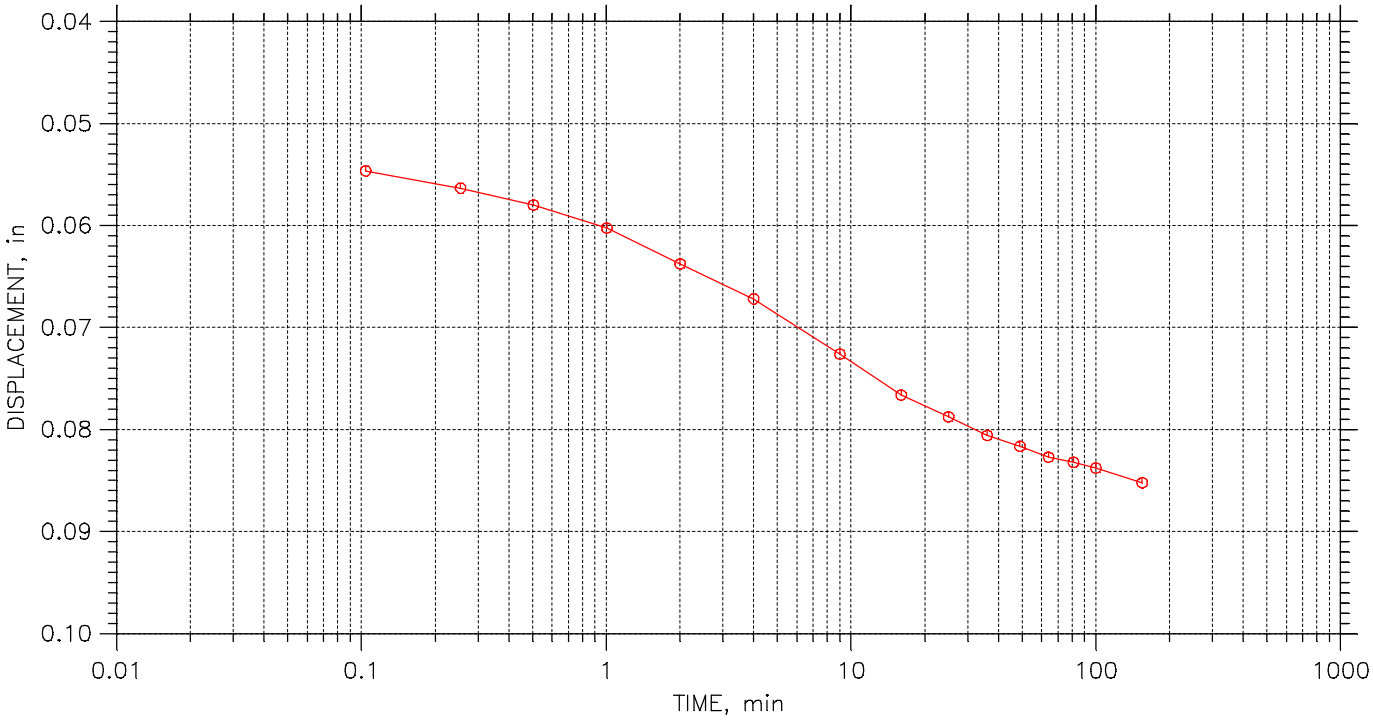
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

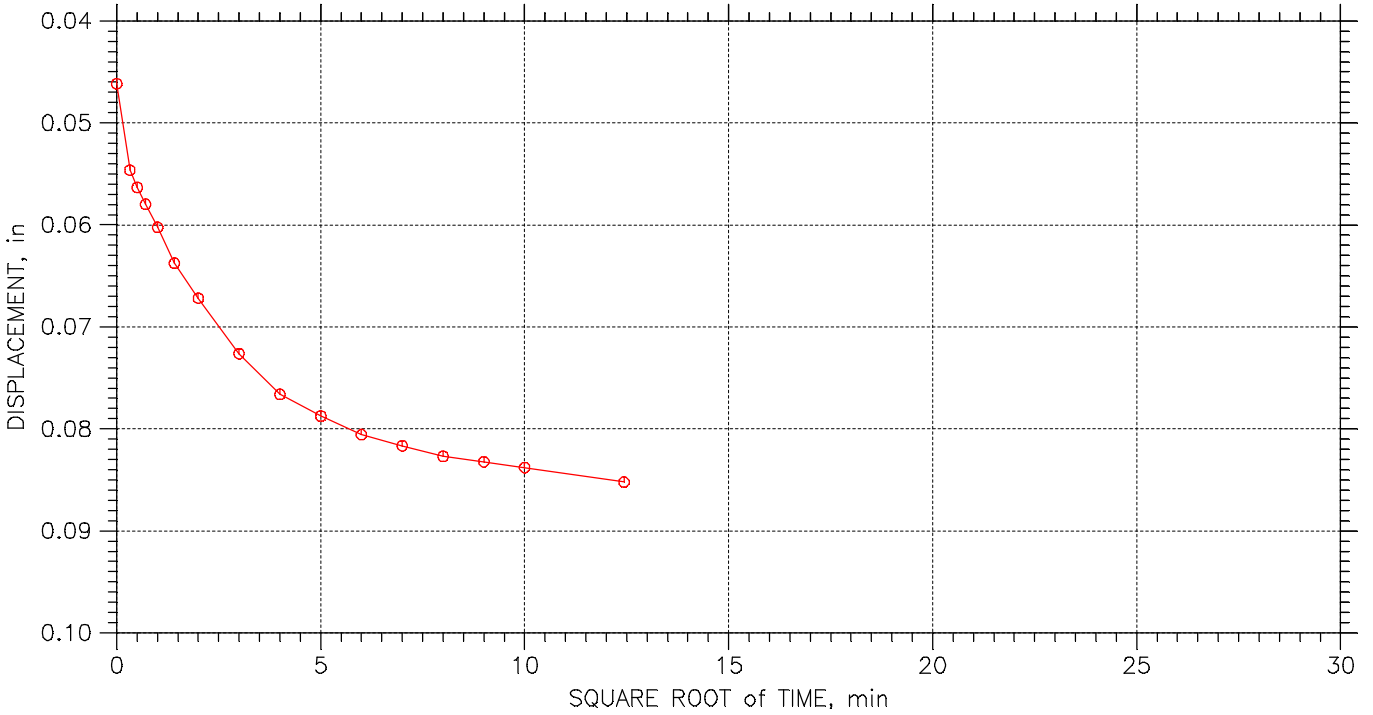
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 6 of 23

Stress: 2. tsf





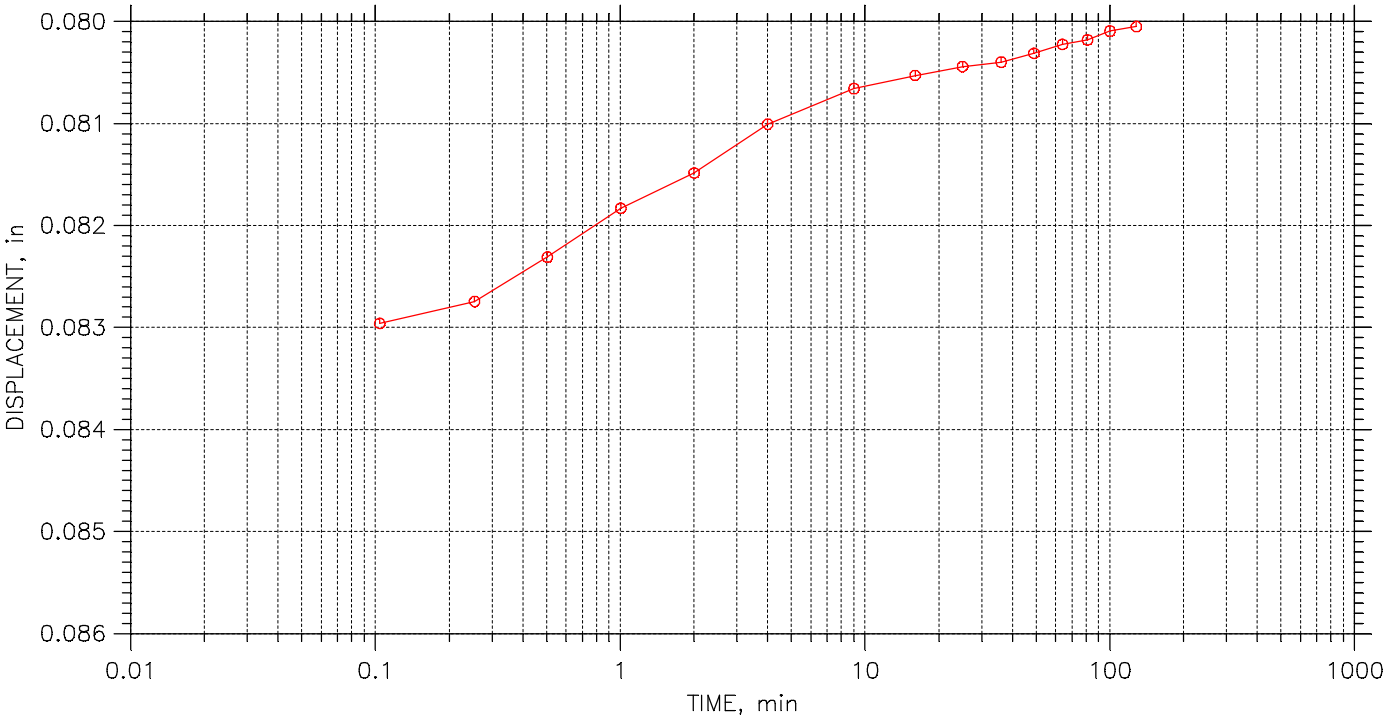
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

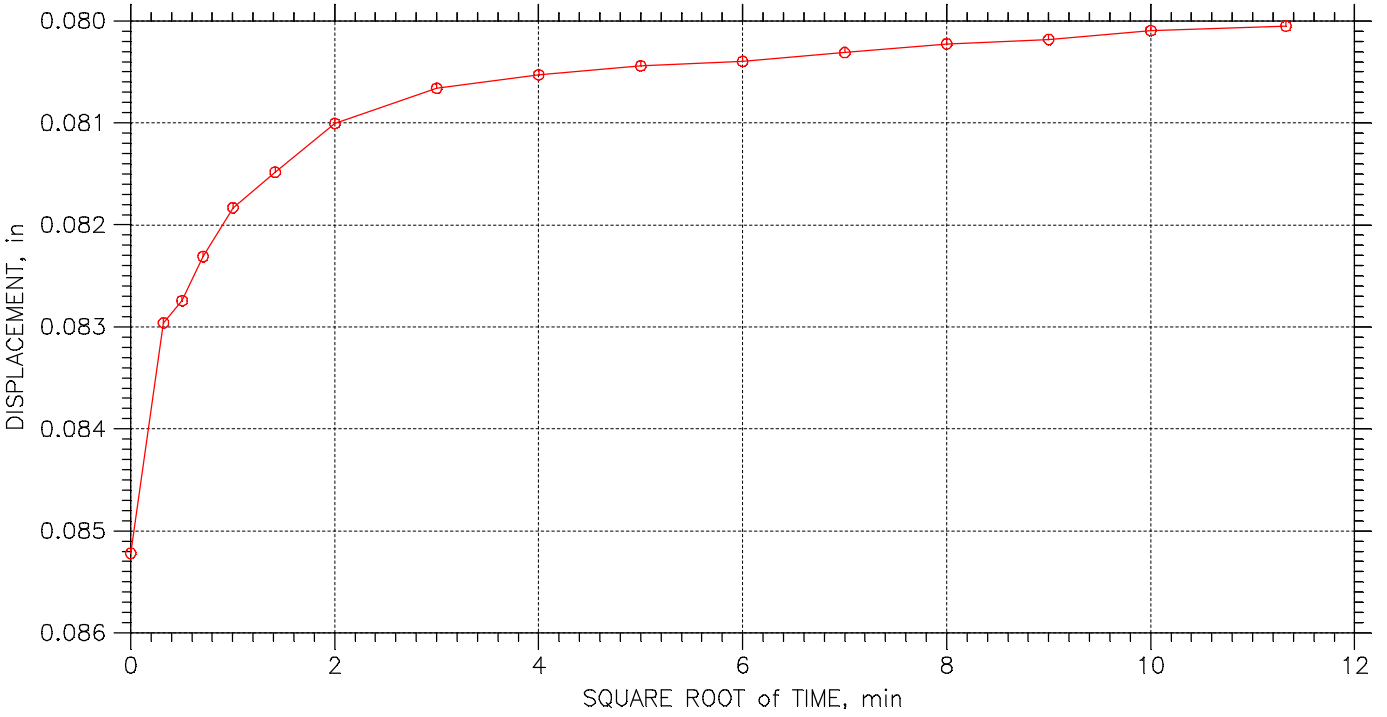
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 7 of 23

Stress: 1. tsf





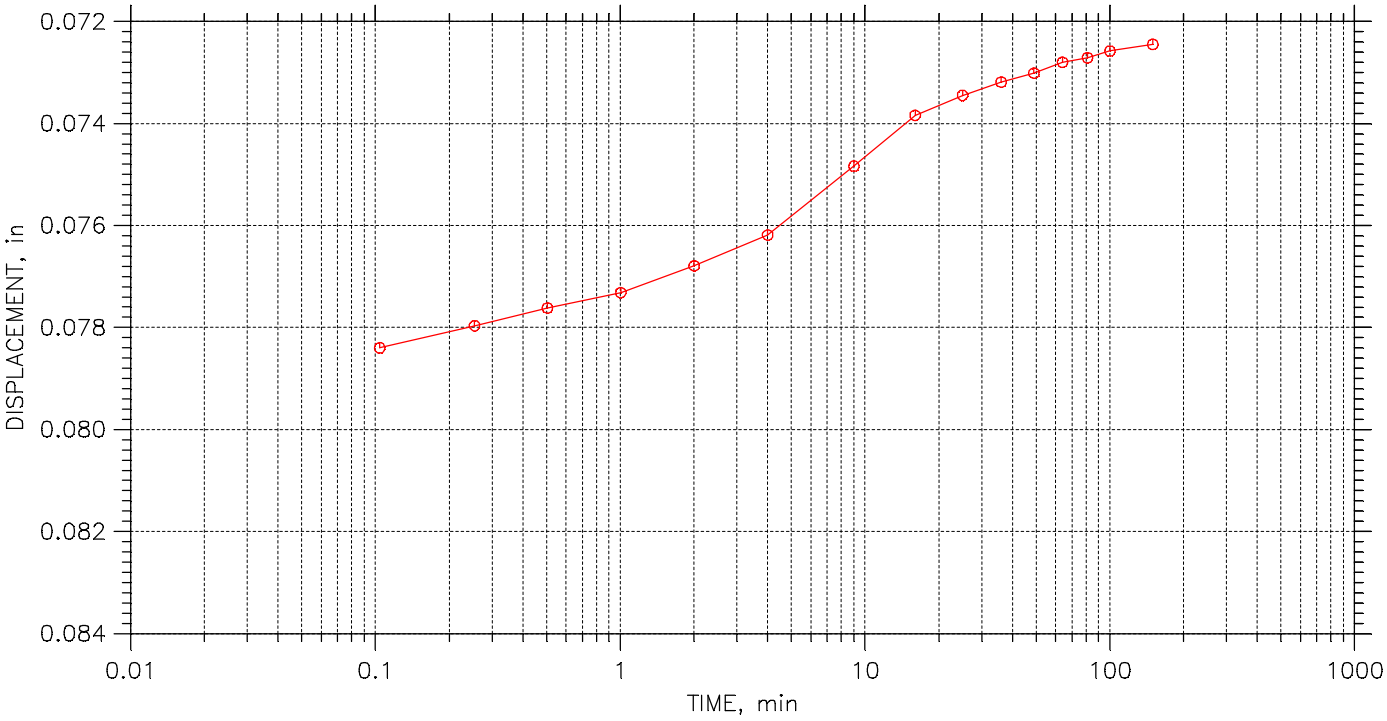
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

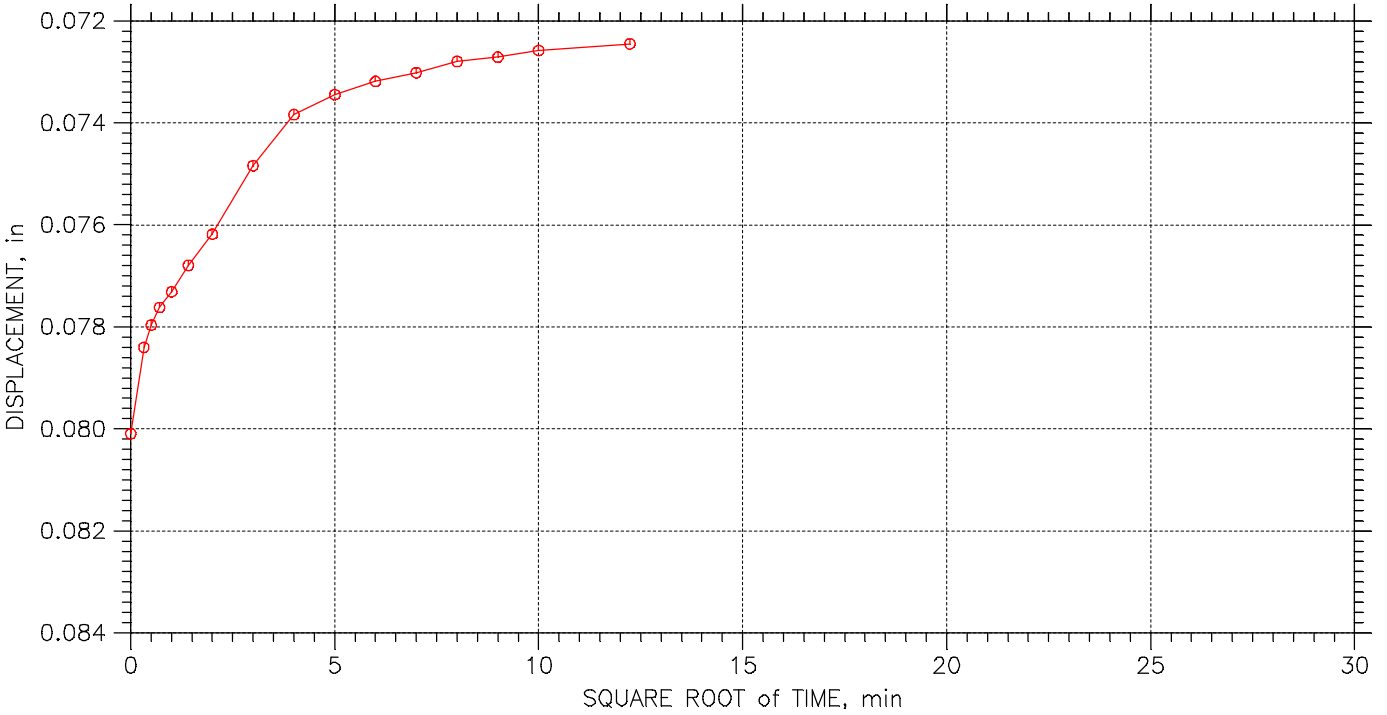
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 8 of 23

Stress: 0.5 tsf





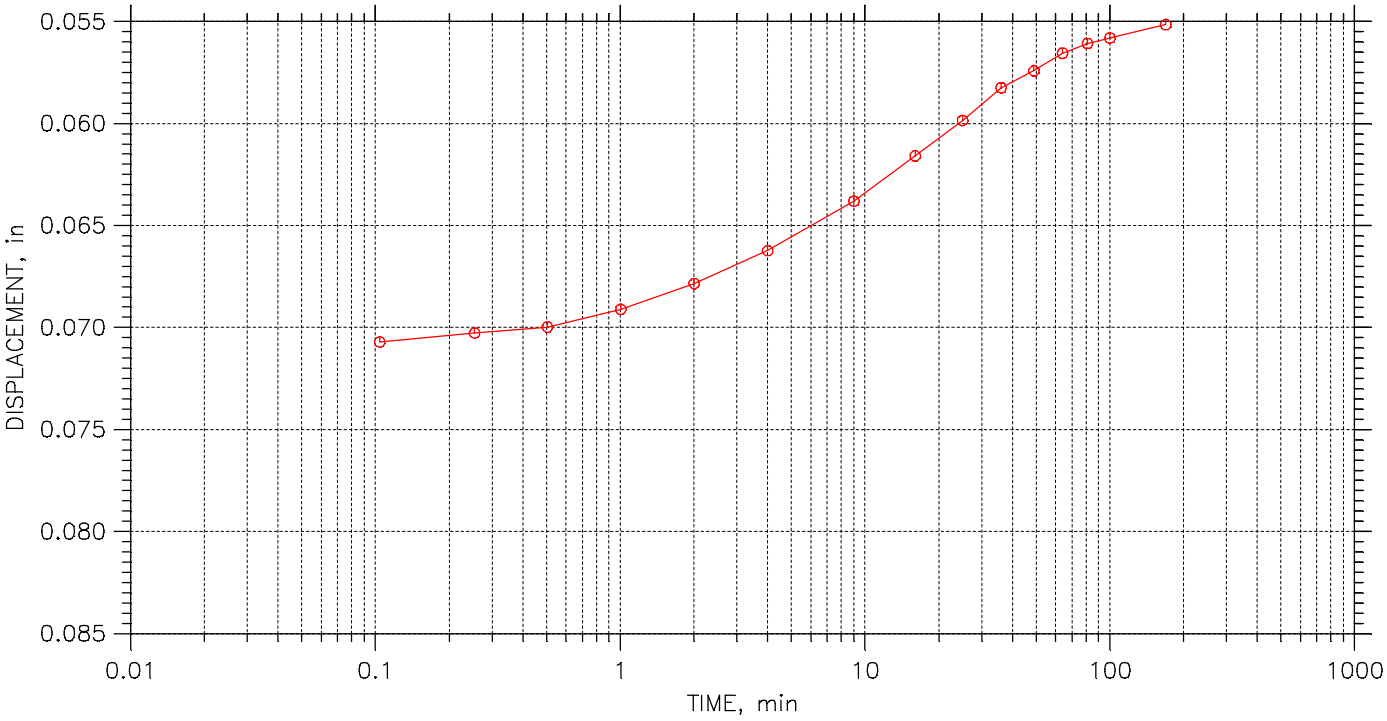
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

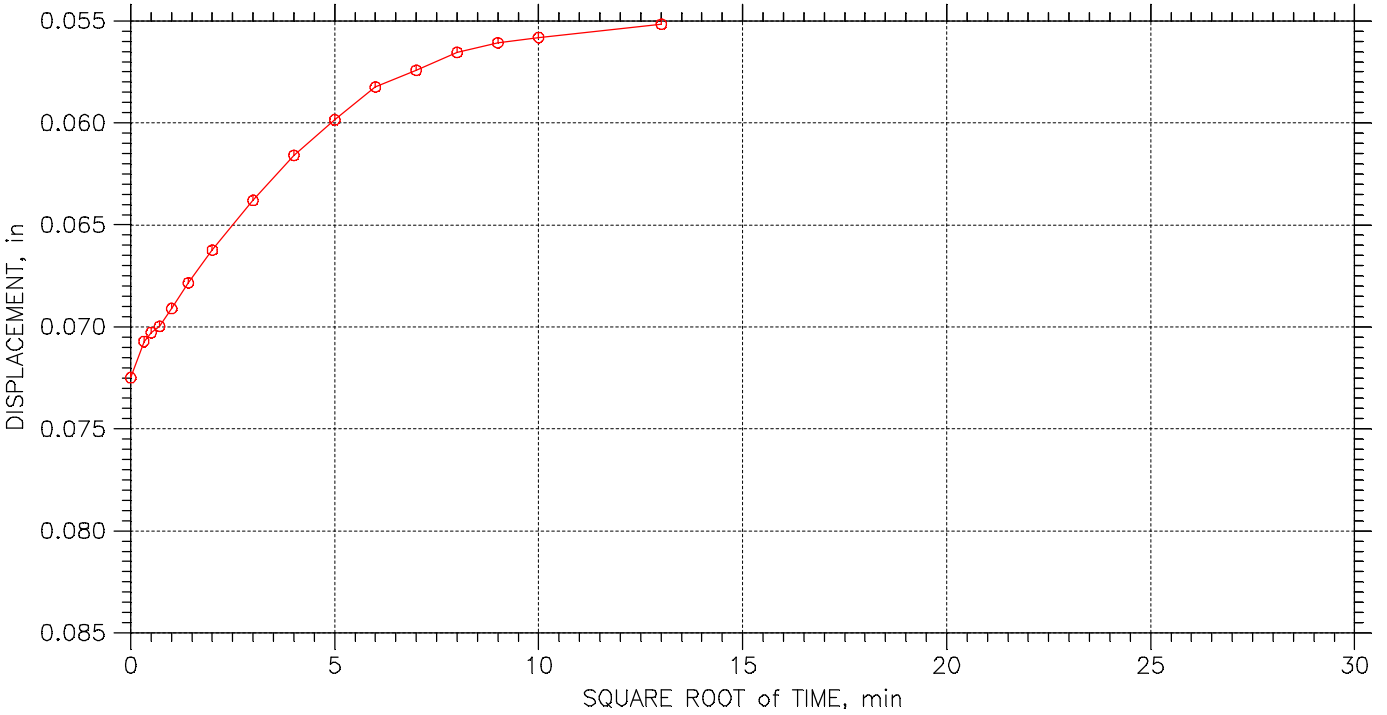
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 9 of 23

Stress: 0.125 tsf





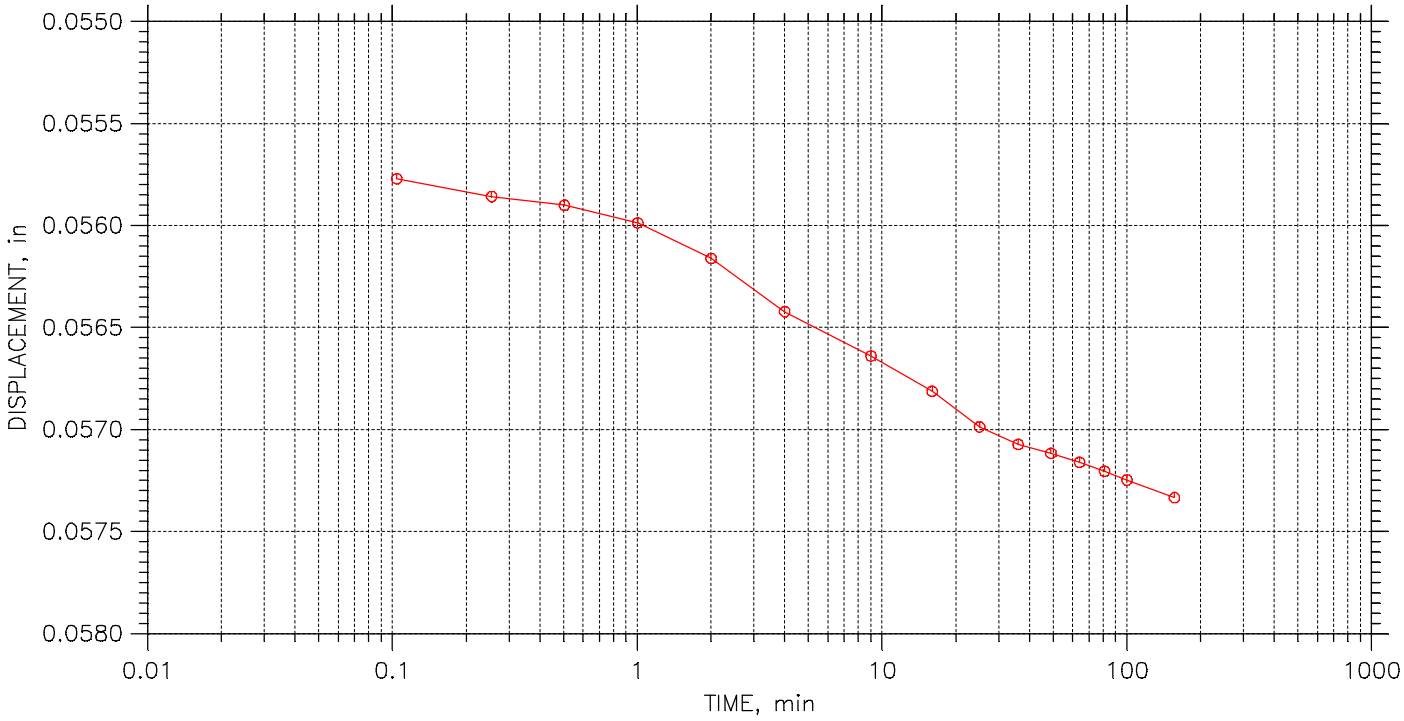
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

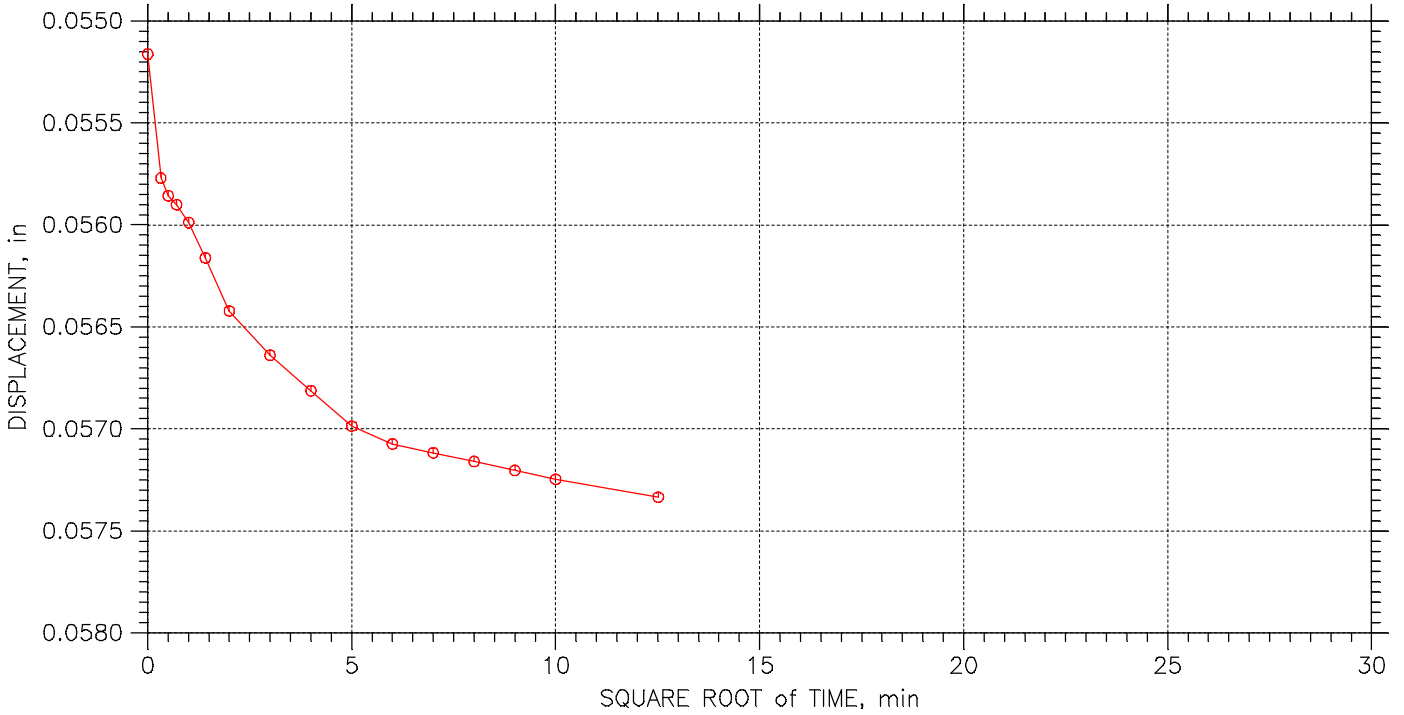
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 10 of 23

Stress: 0.25 tsf





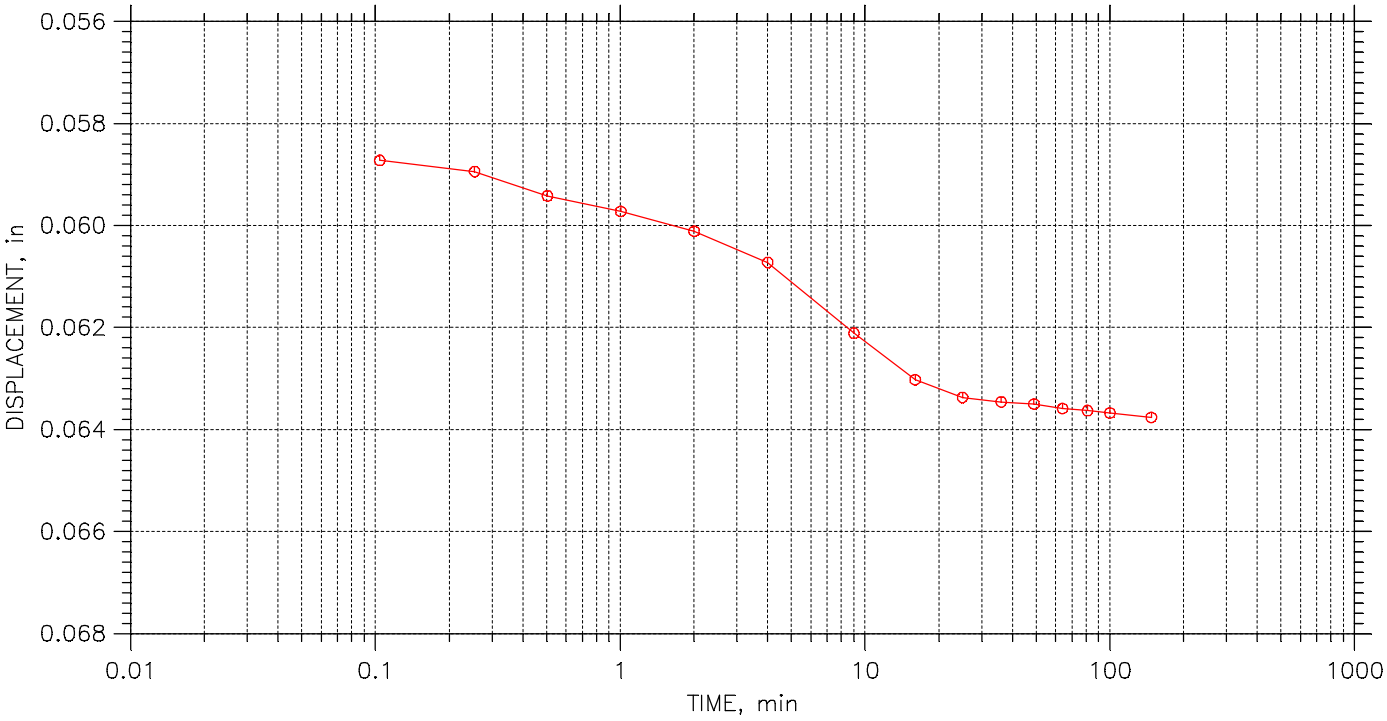
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

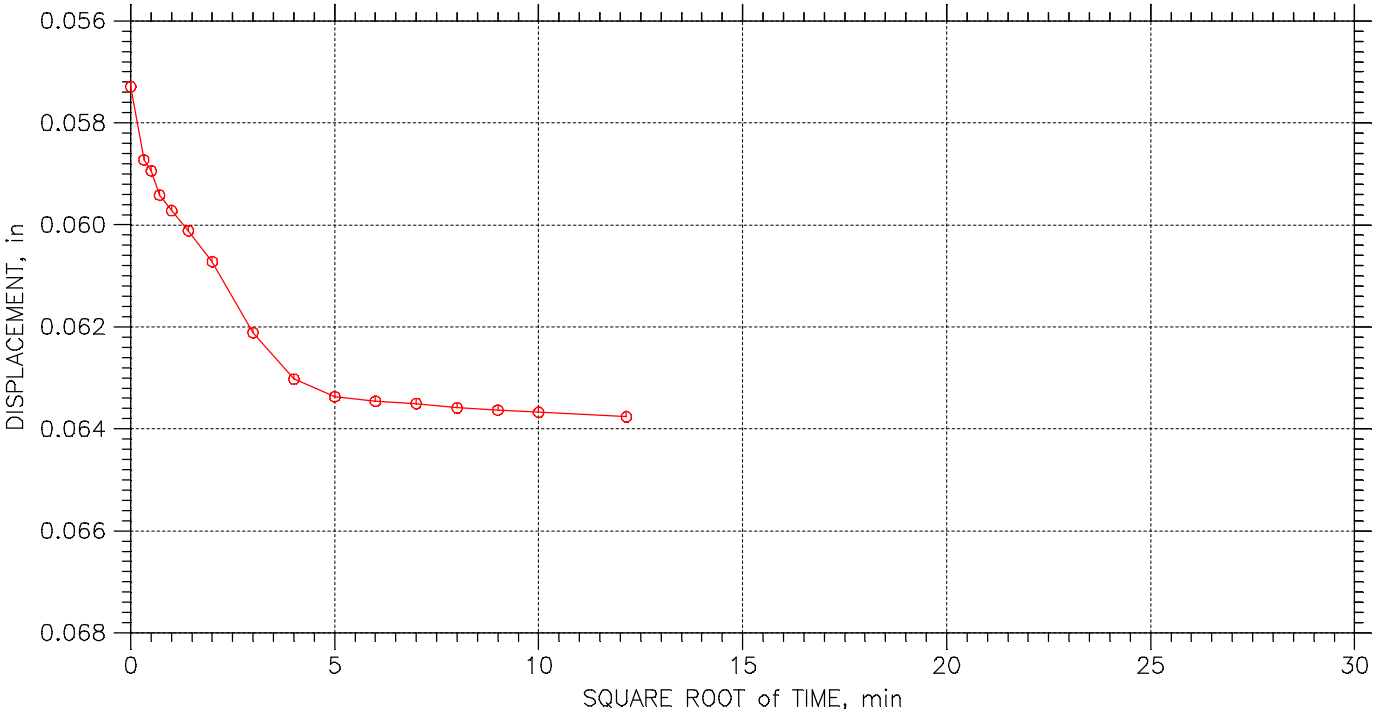
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 11 of 23

Stress: 0.5 tsf





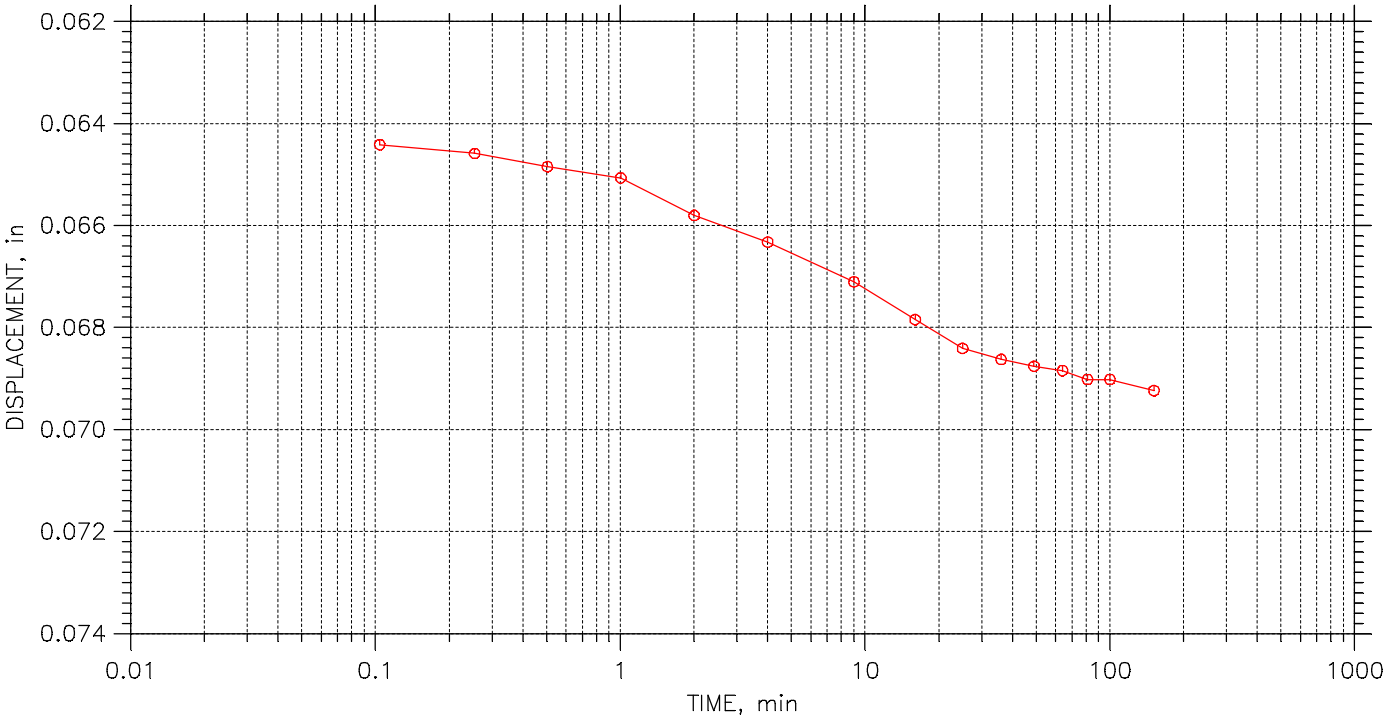
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

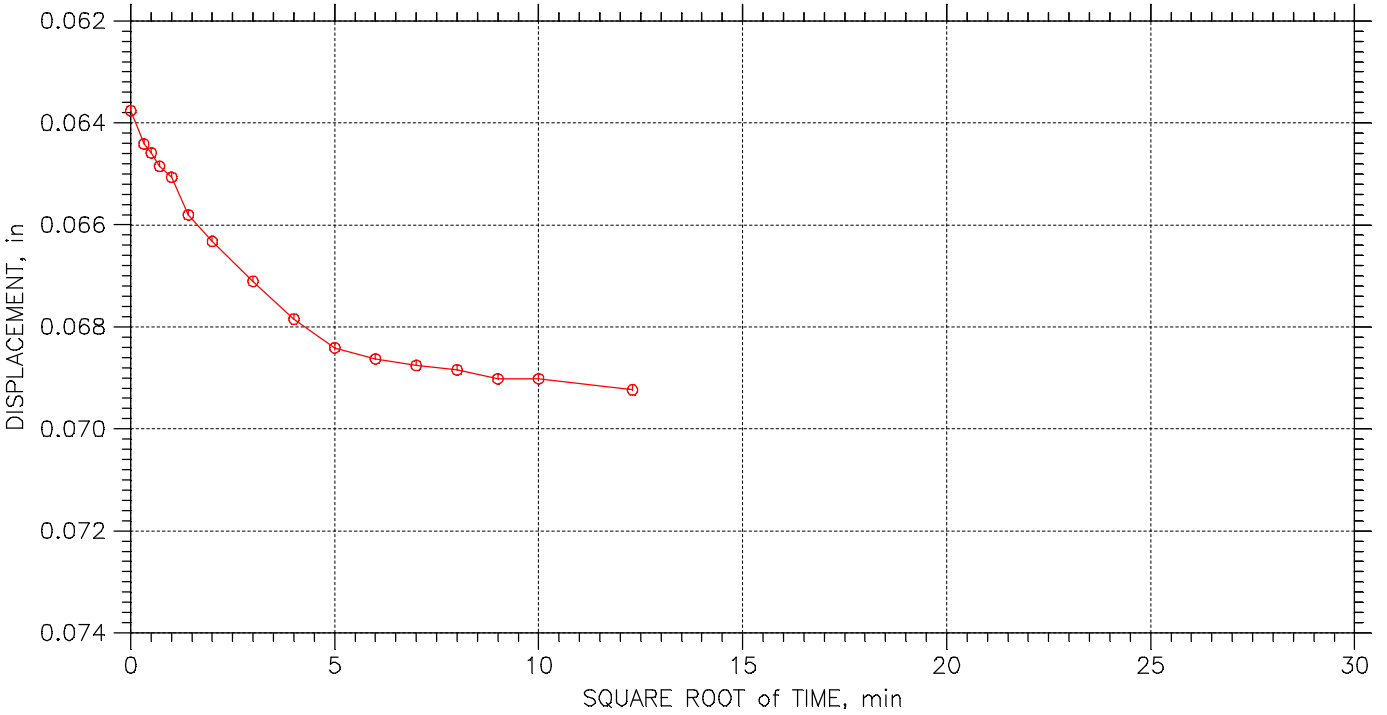
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 12 of 23

Stress: 0.75 tsf





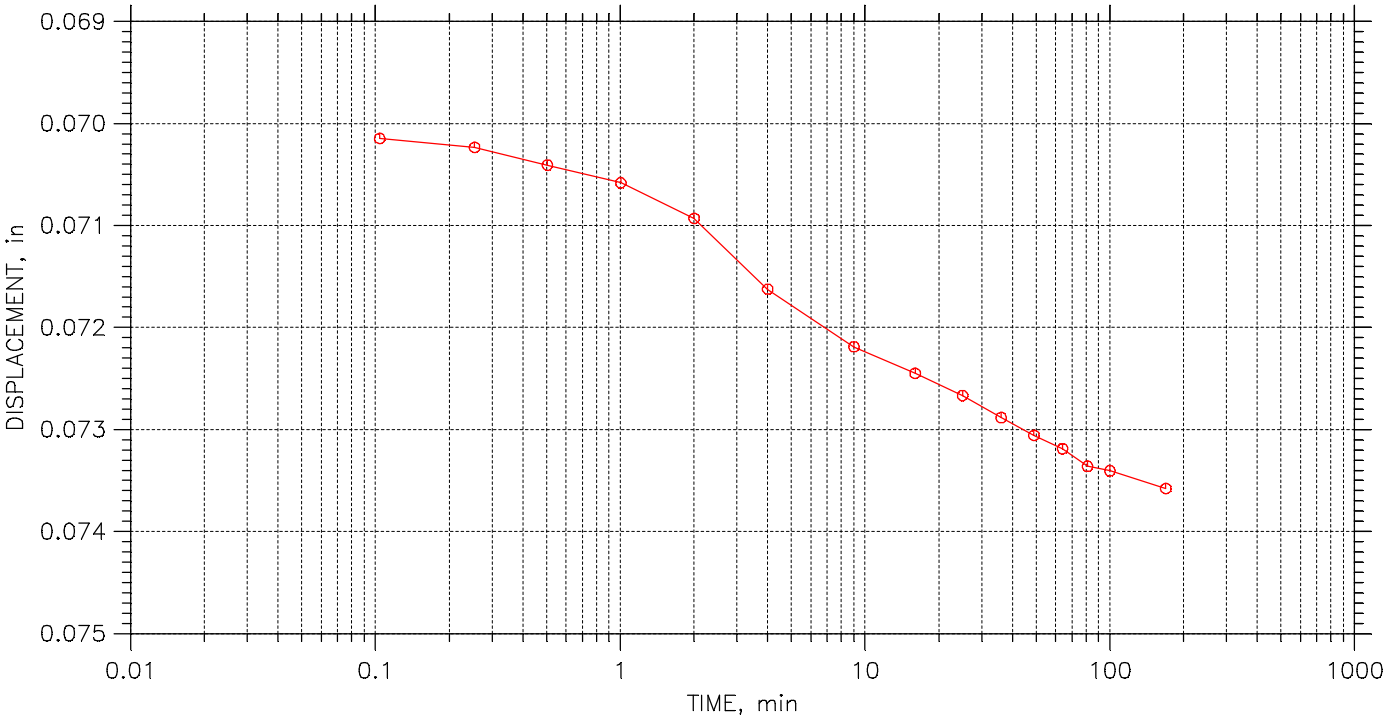
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

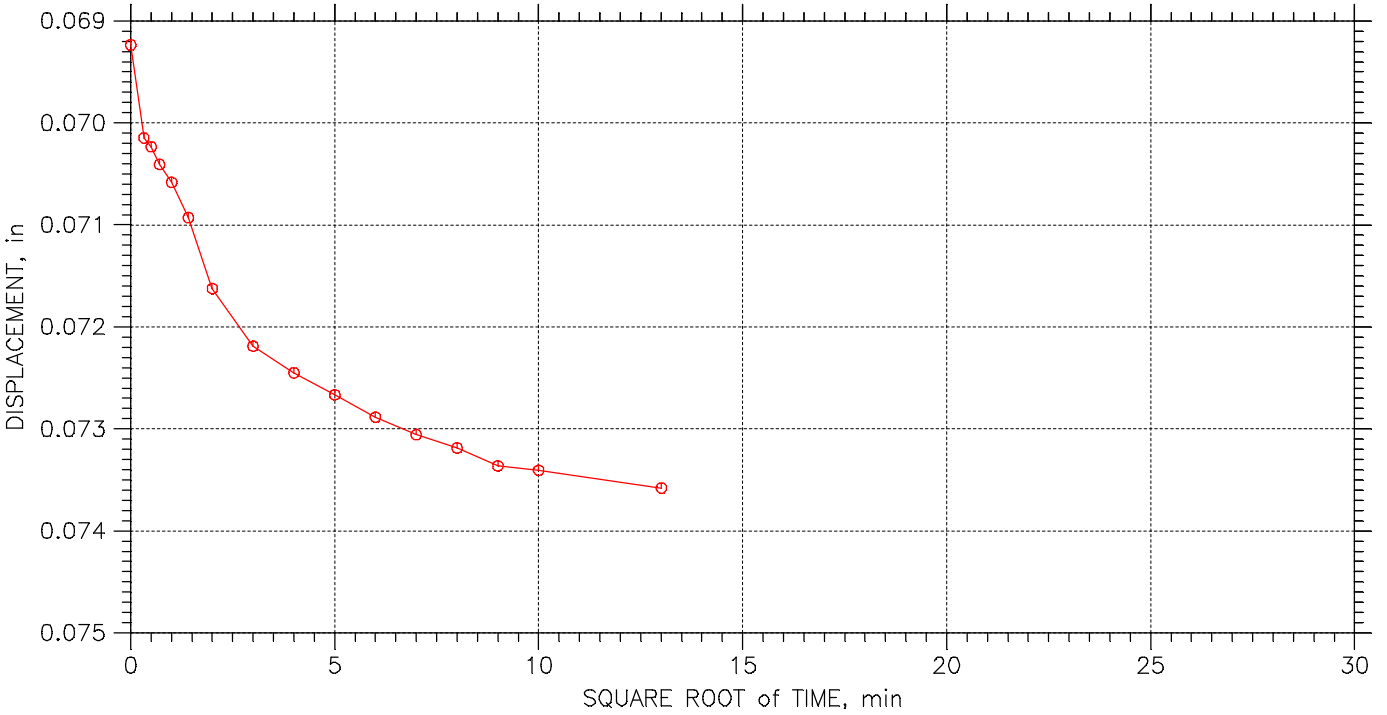
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 13 of 23

Stress: 1. tsf





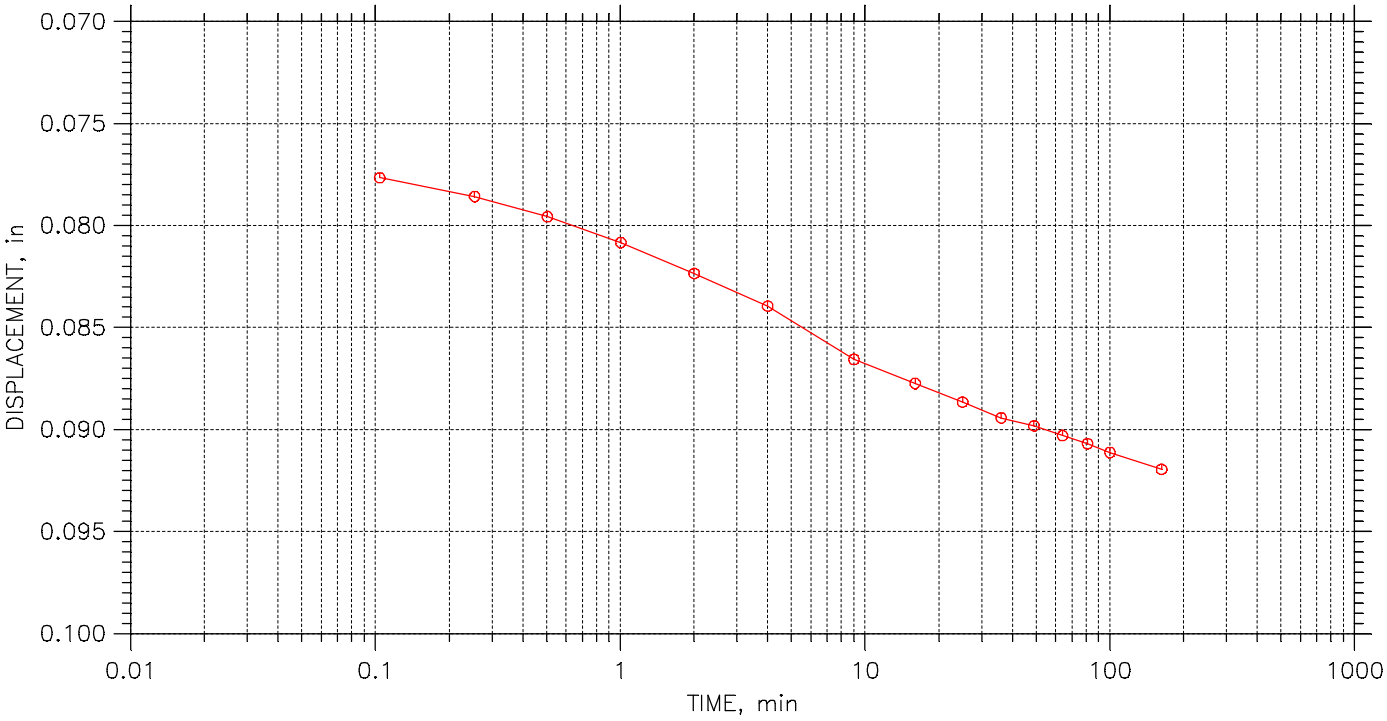
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

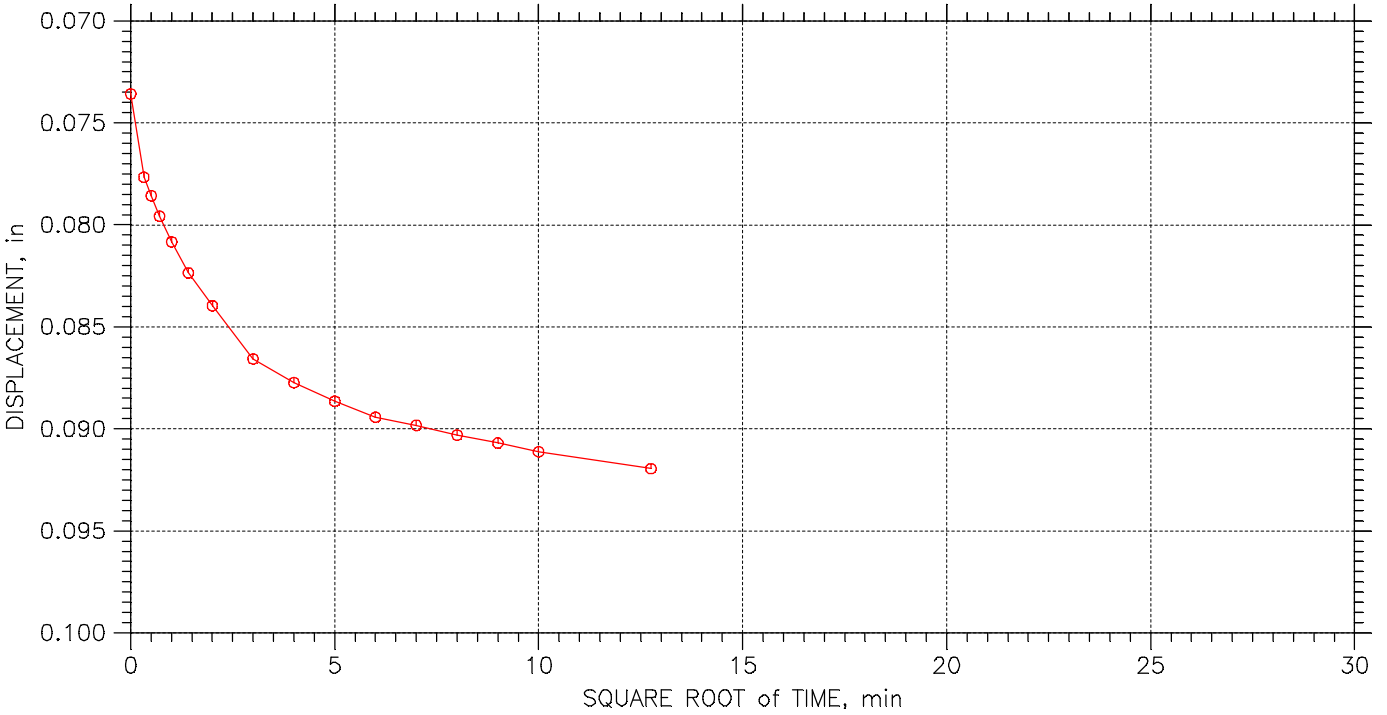
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 14 of 23

Stress: 2. tsf





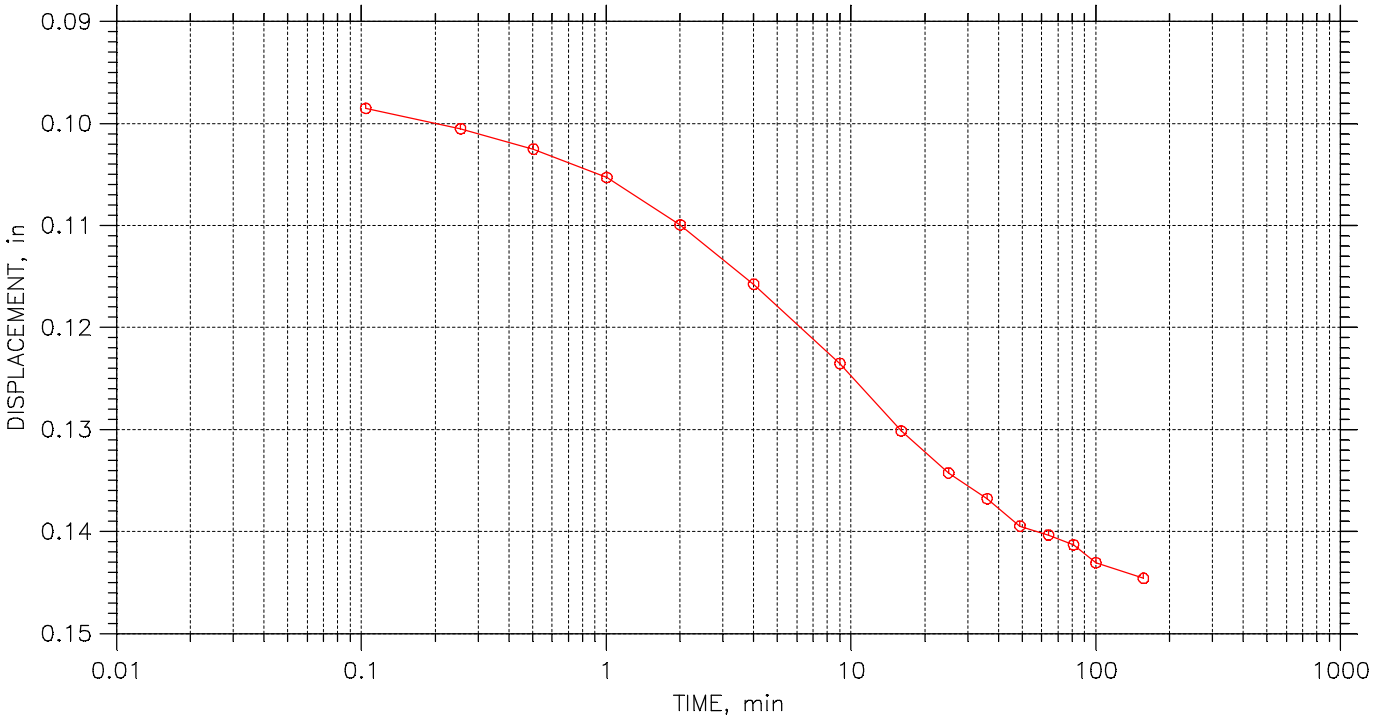
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

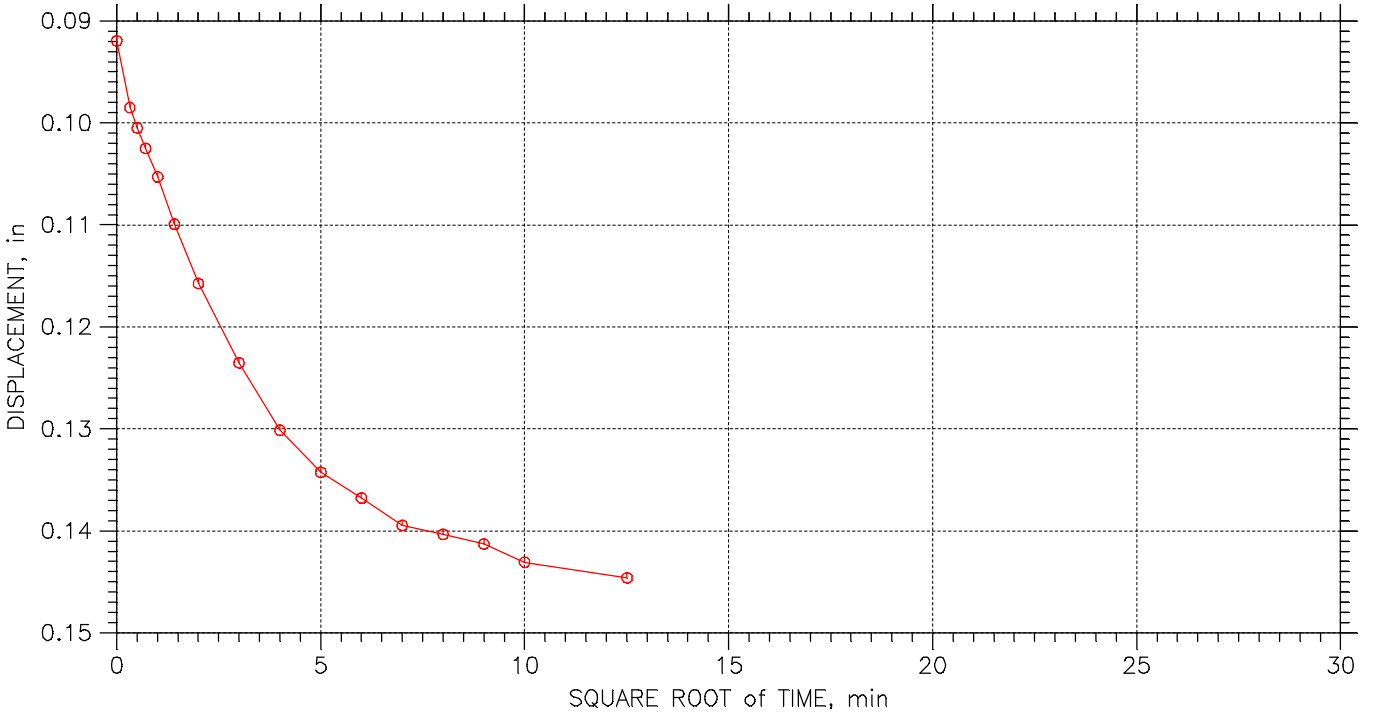
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 15 of 23

Stress: 4. tsf





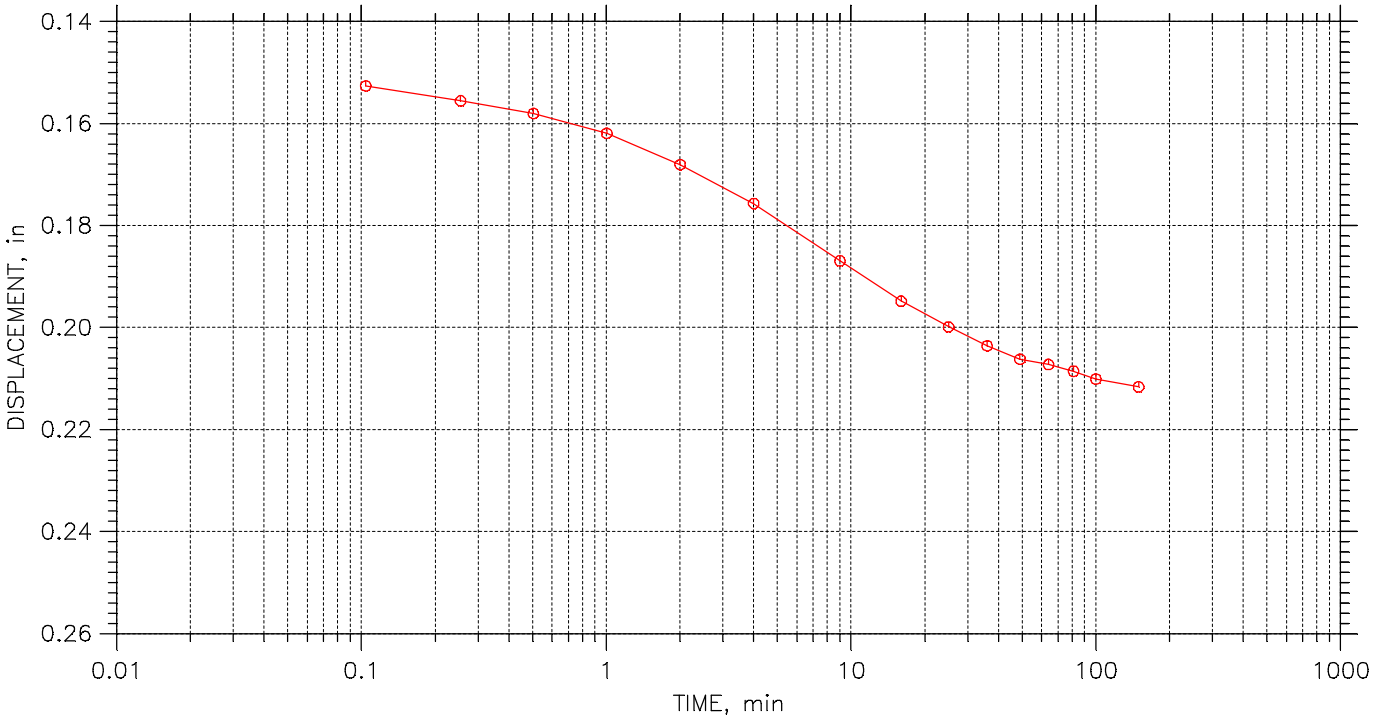
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

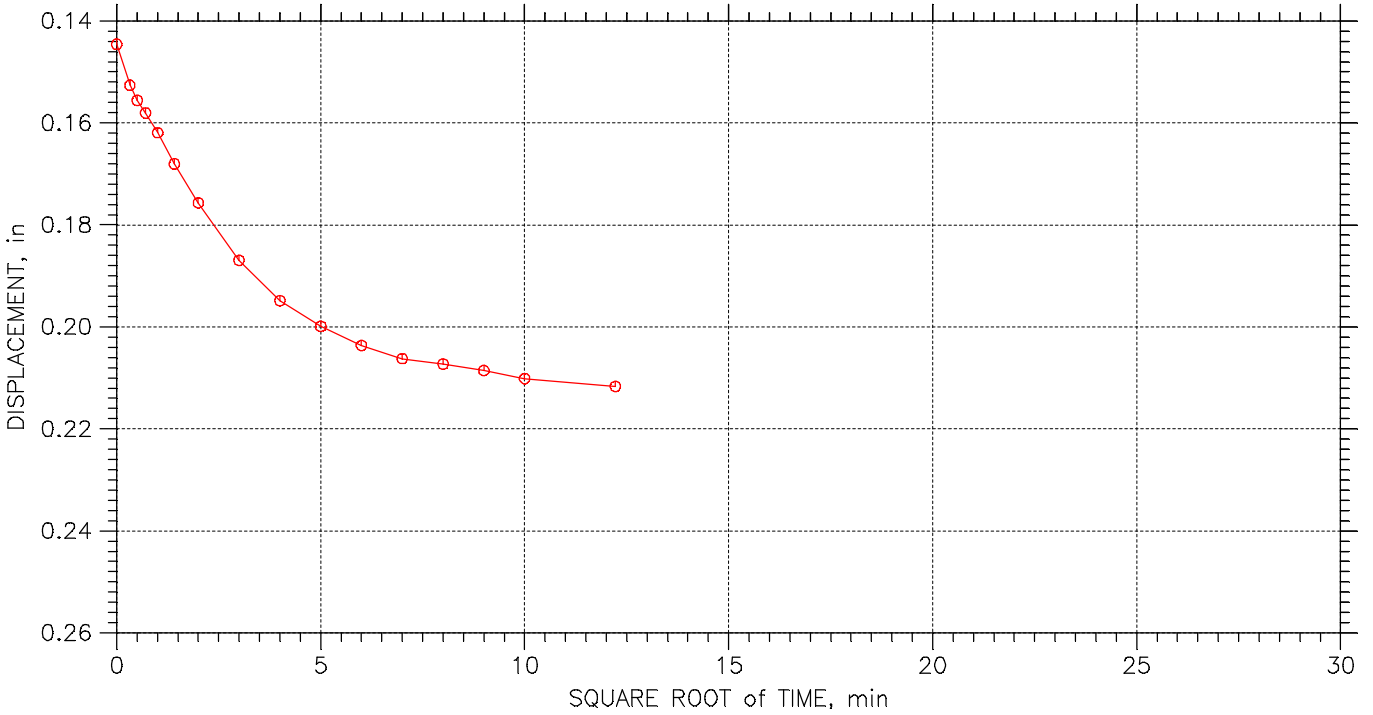
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 16 of 23

Stress: 8. tsf





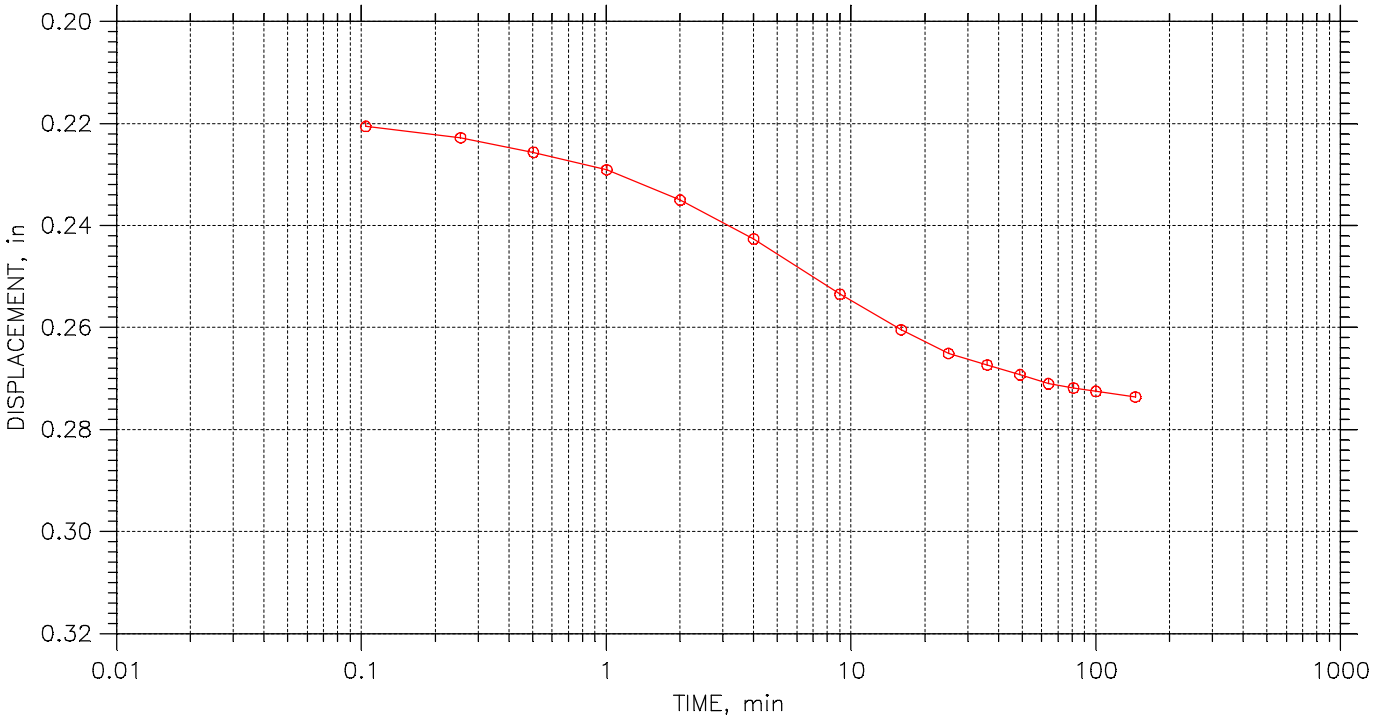
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

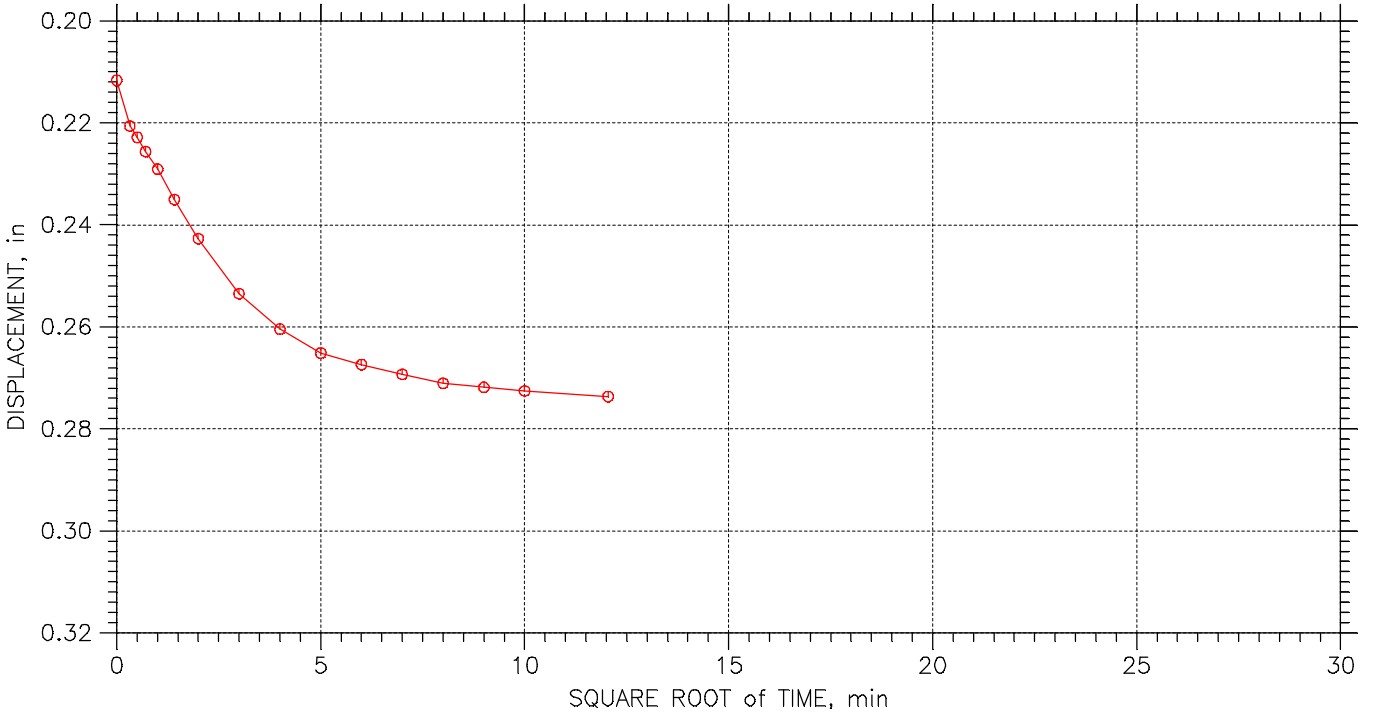
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 17 of 23

Stress: 16. tsf





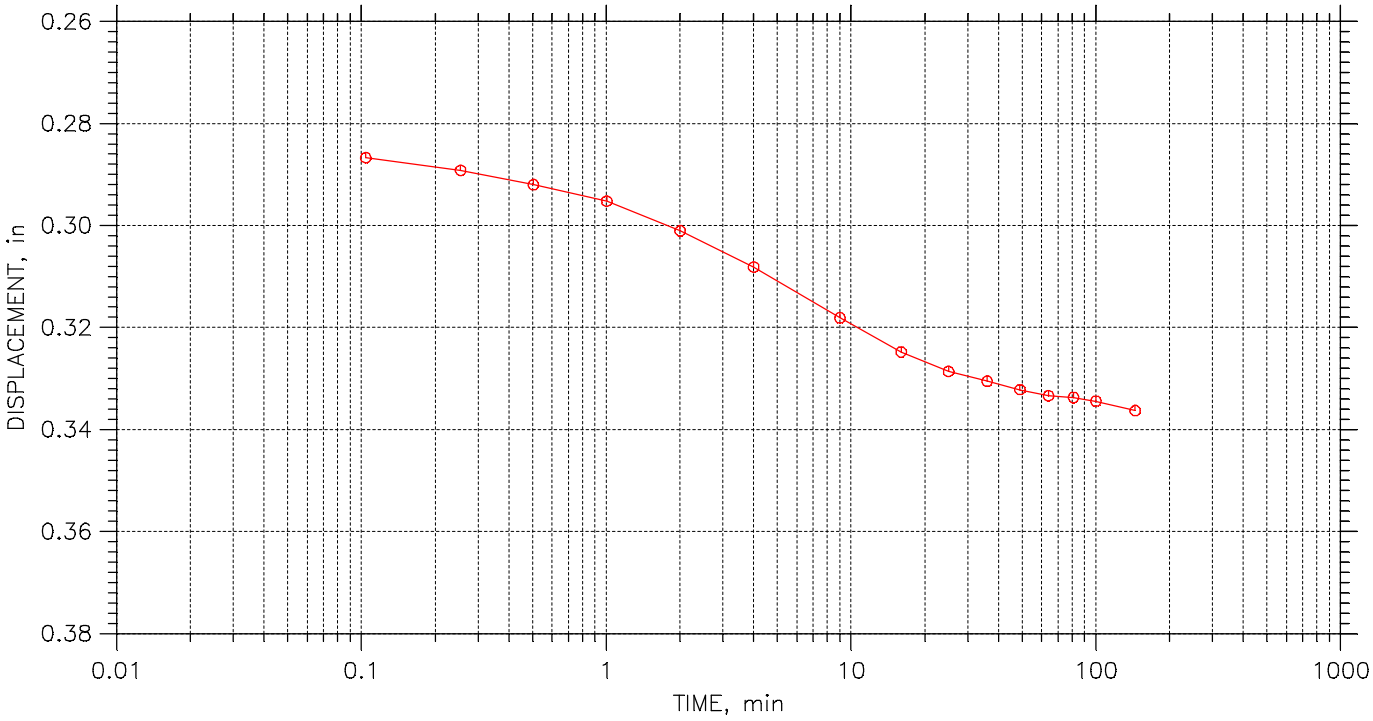
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

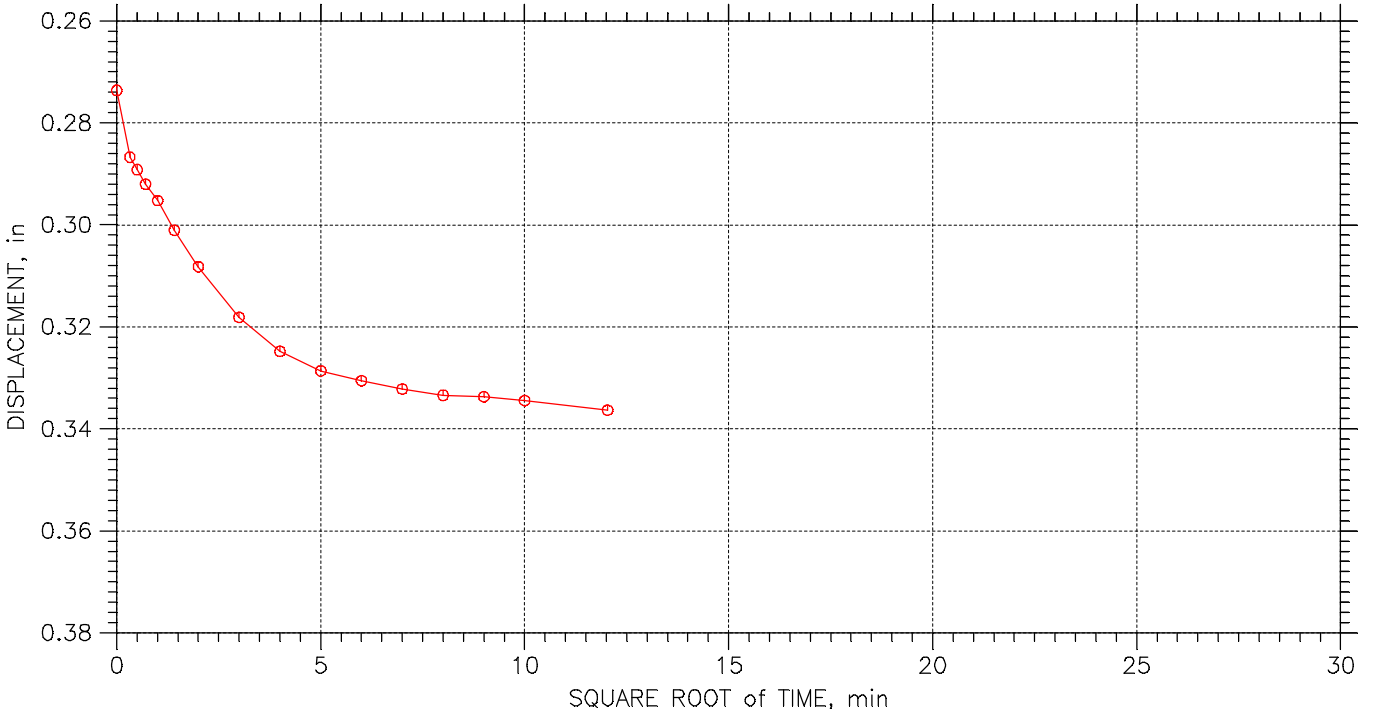
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 18 of 23

Stress: 32. tsf





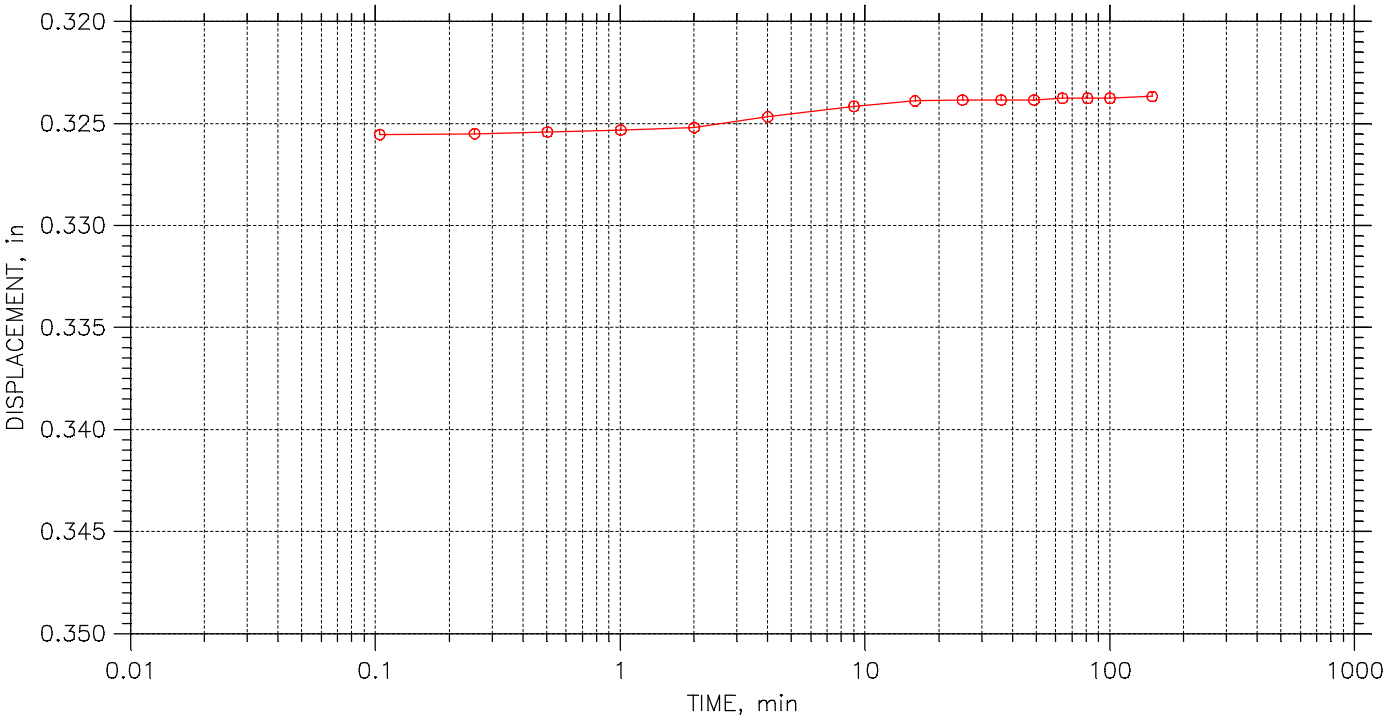
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

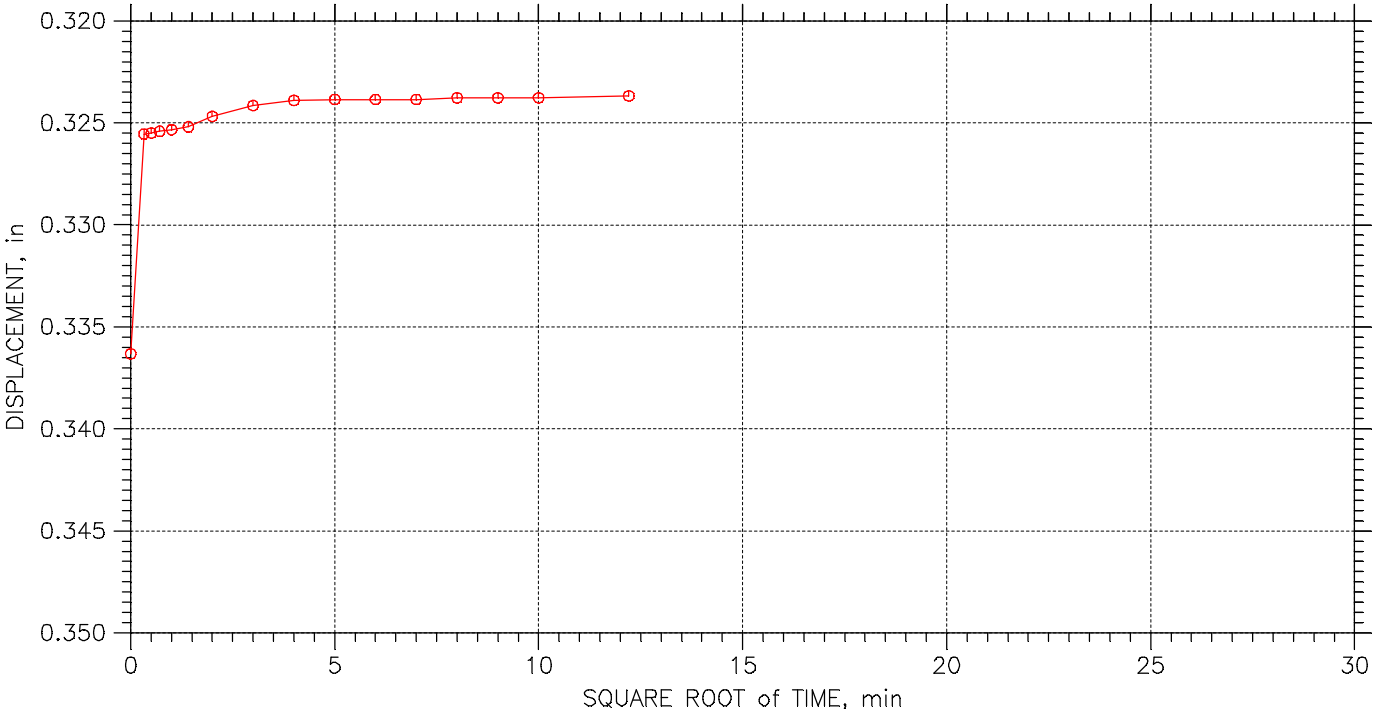
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 19 of 23

Stress: 16. tsf





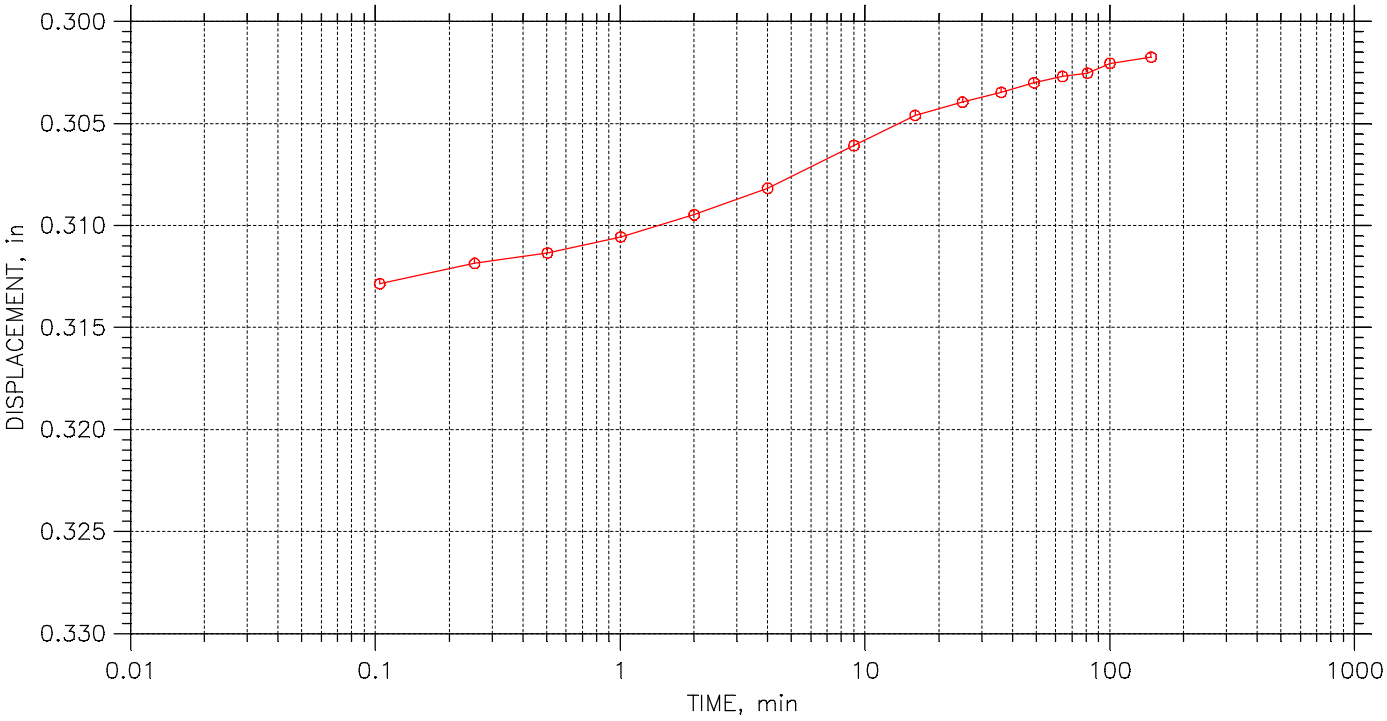
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

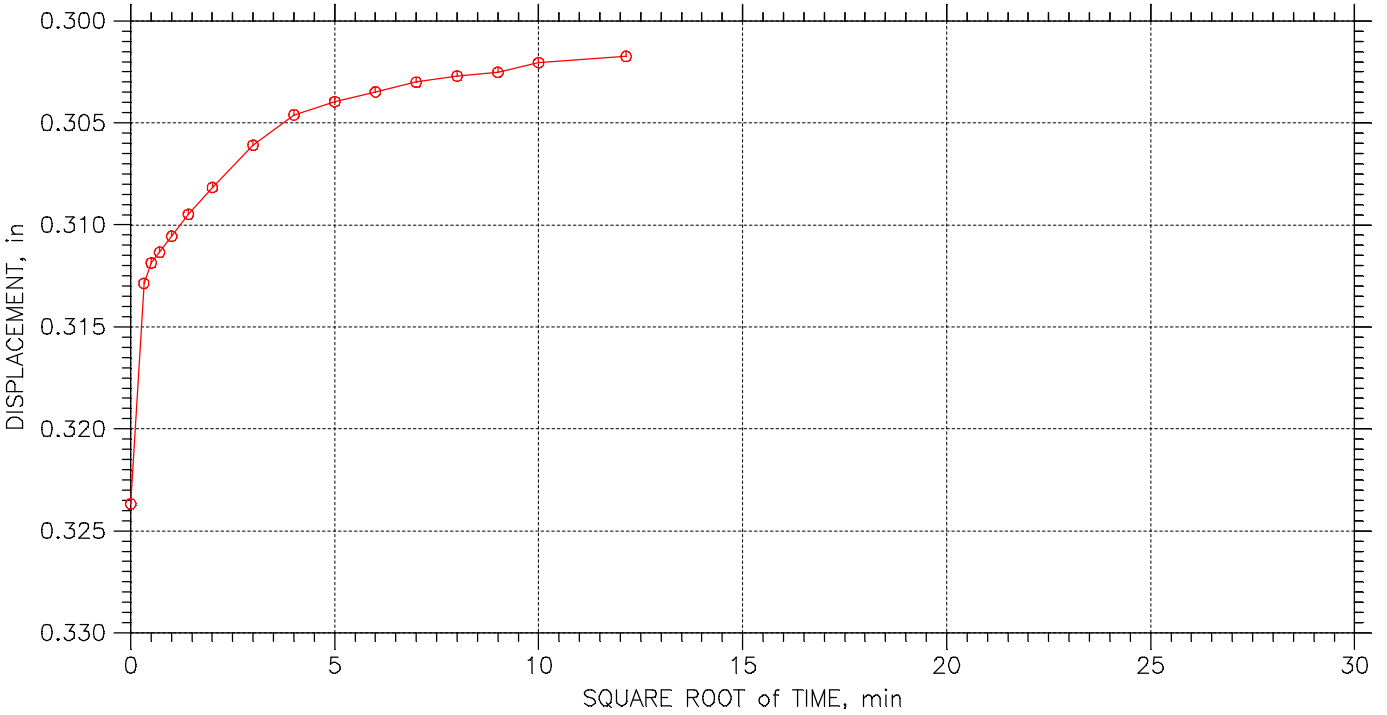
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 20 of 23

Stress: 4. tsf





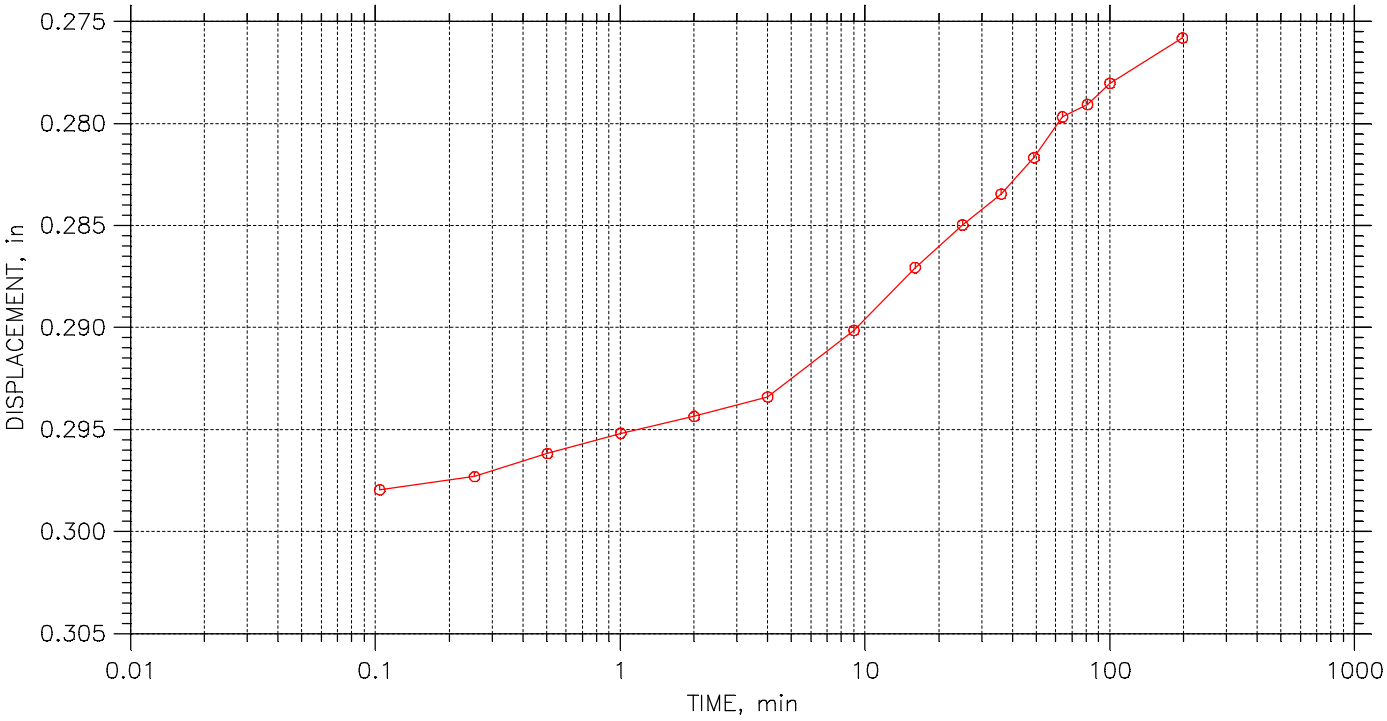
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

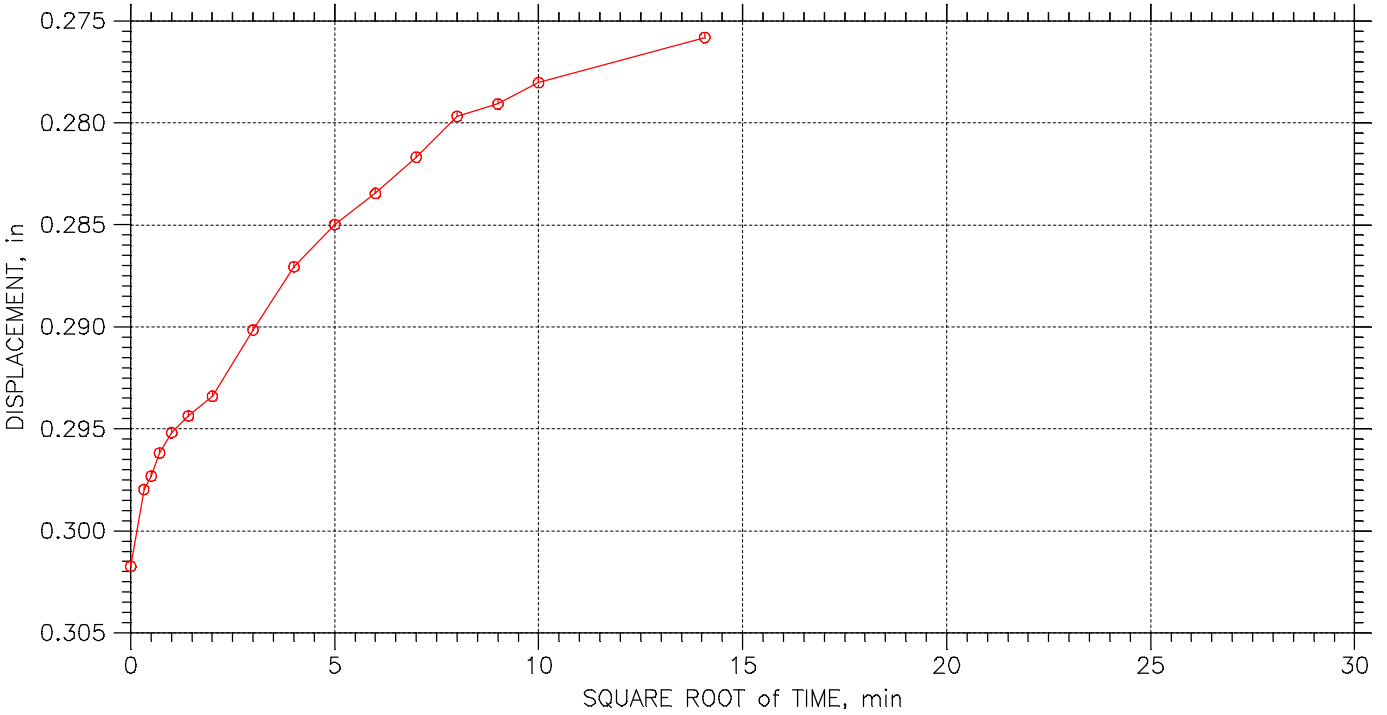
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 21 of 23

Stress: 1. tsf





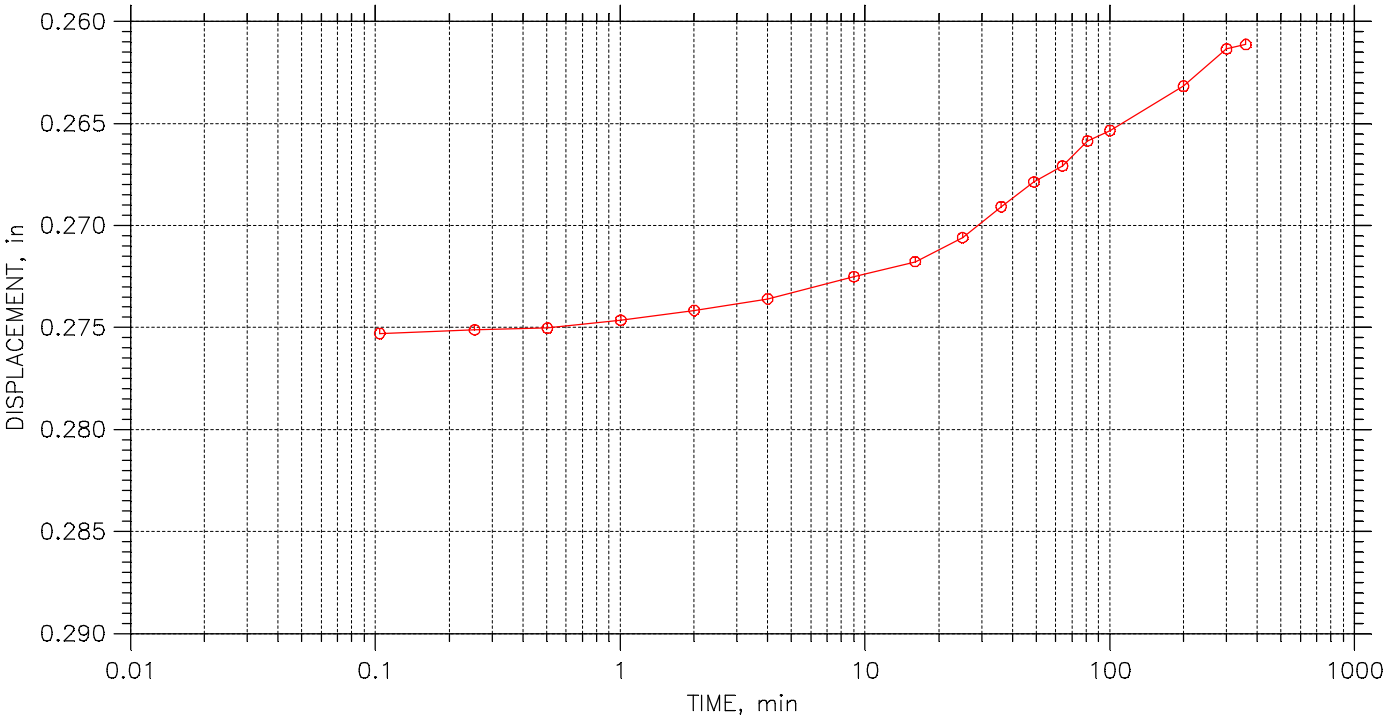
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

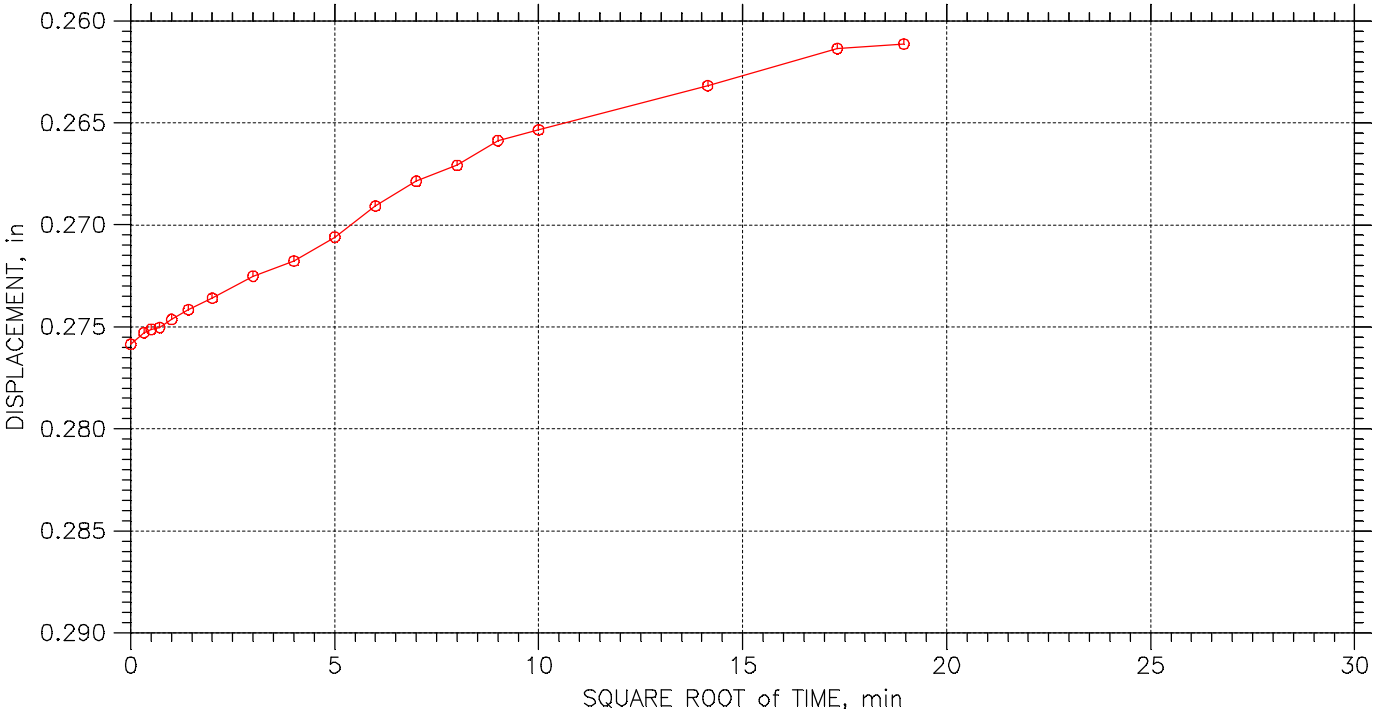
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 22 of 23

Stress: 0.5 tsf





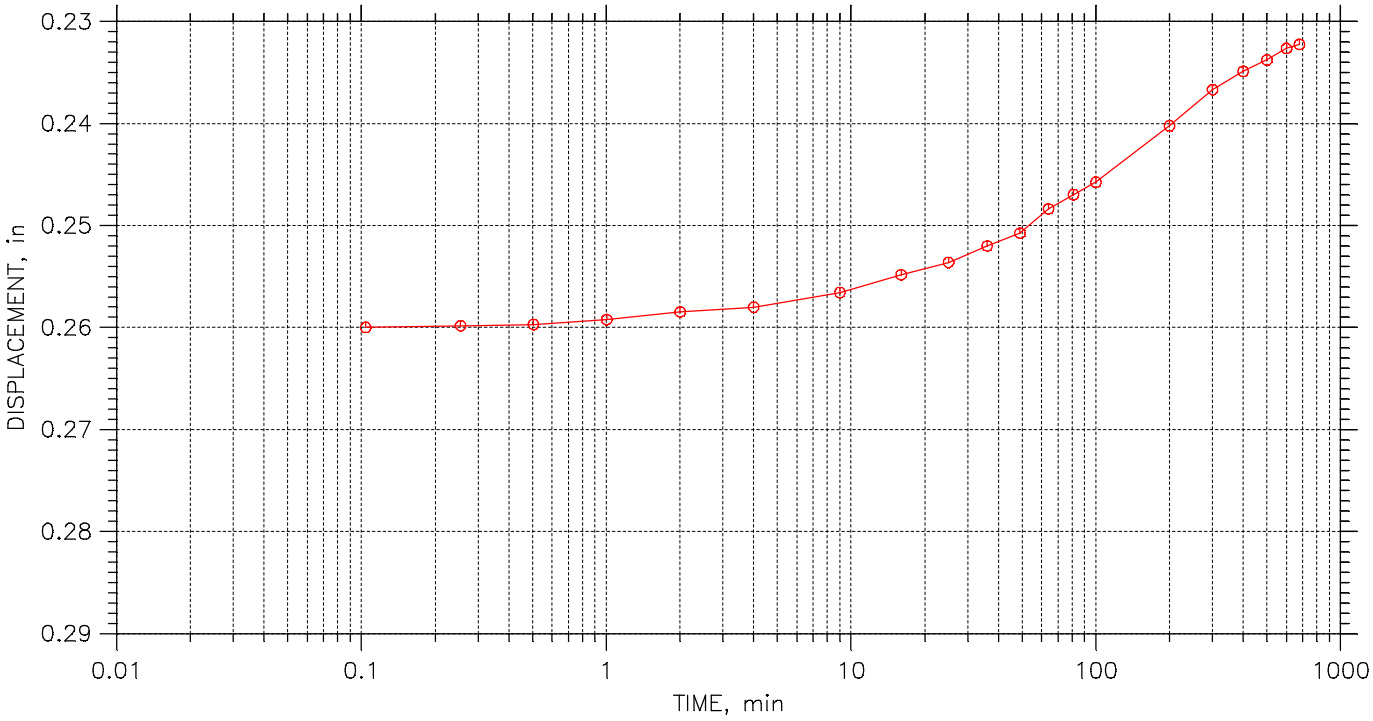
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

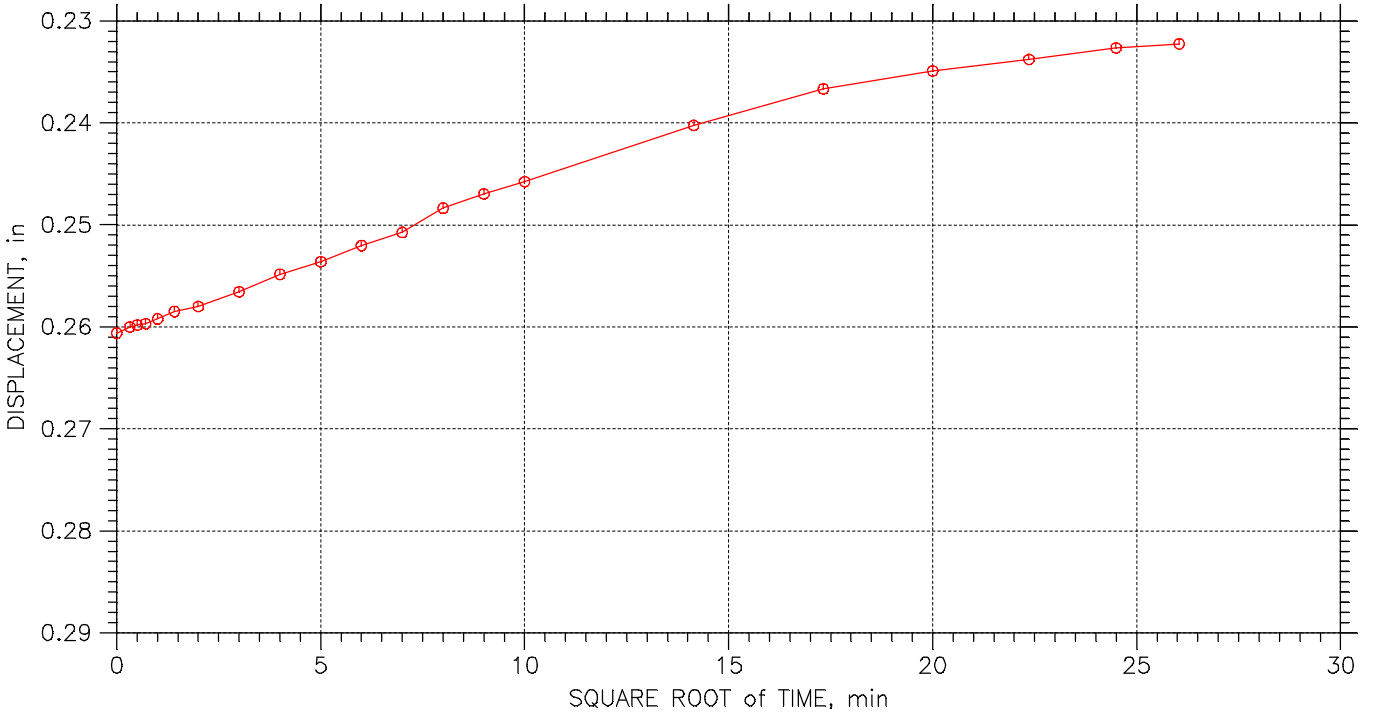
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 23 of 23

Stress: 0.125 tsf

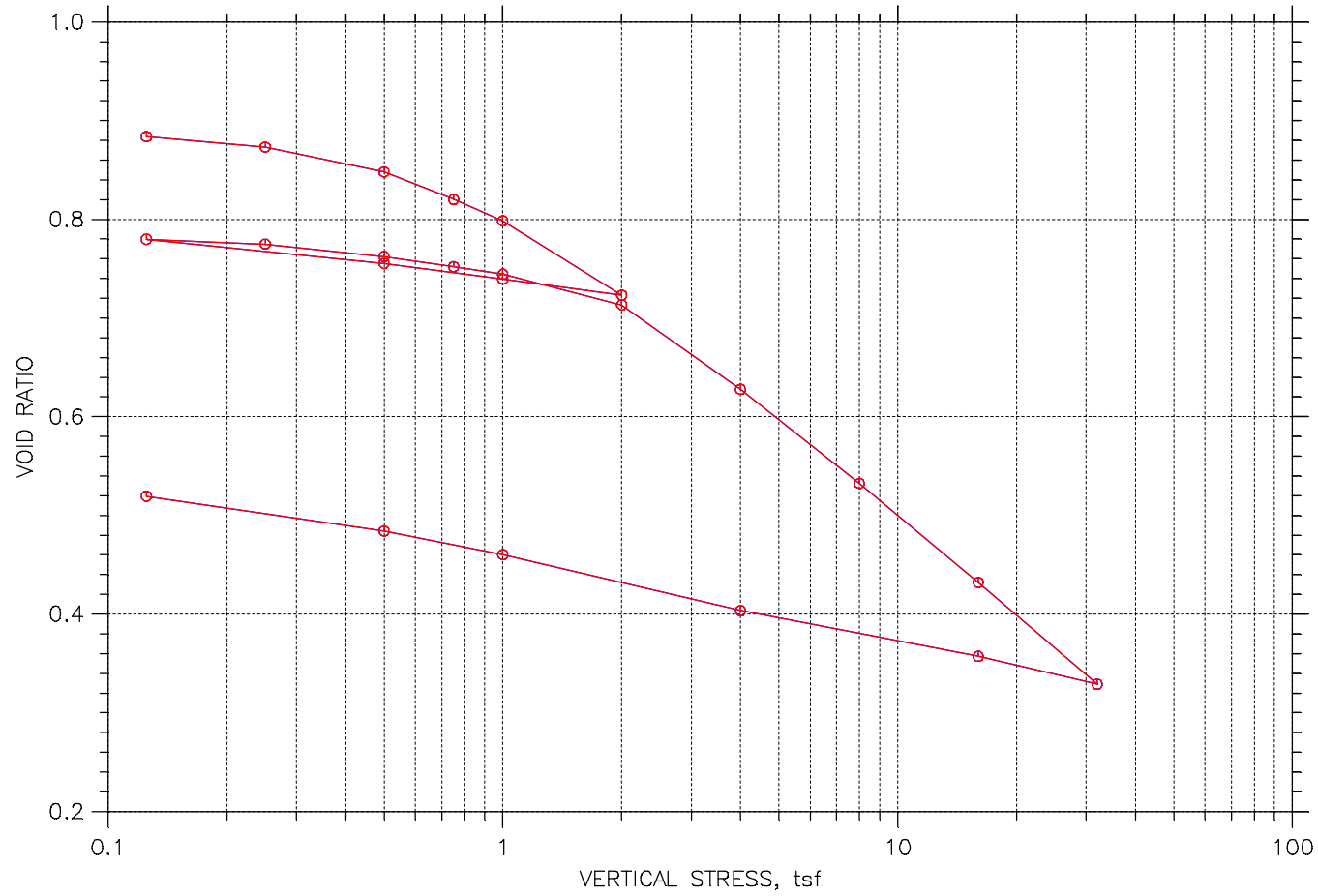


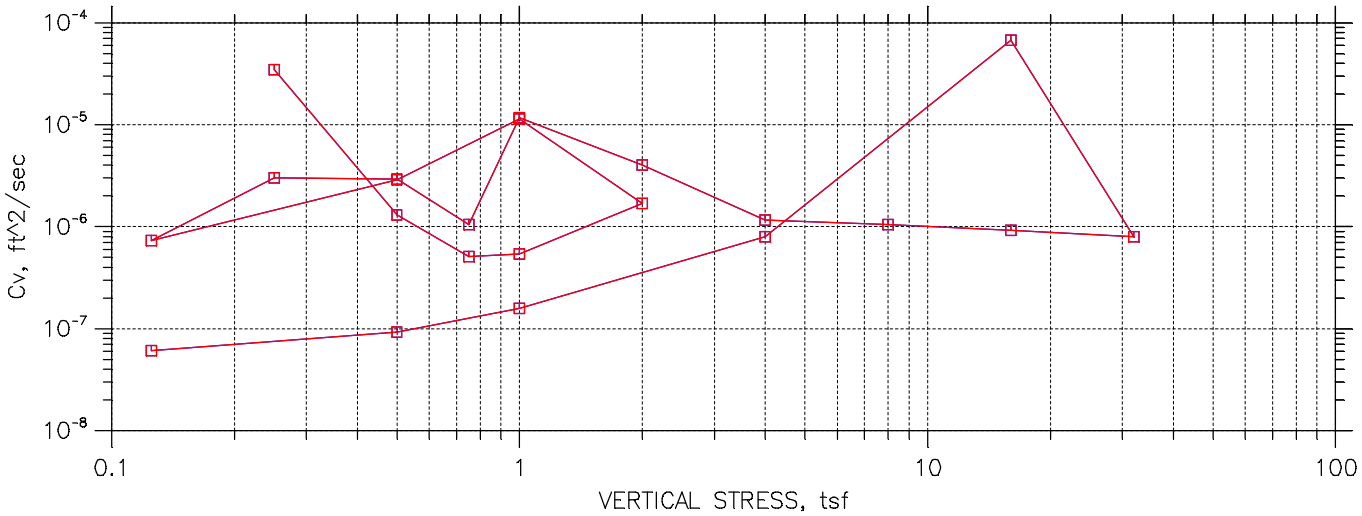


Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B003	Tested By: HP	Checked By: BCM
	Sample No.: S-12	Test Date: 10/26/15	Depth: 45.0'-47.0'
	Test No.: EDW003S12	Sample Type: 3.0" ST	Elevation: ----
	Description: DARK GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 1.1 tsf Cc = 0.445 Ccr = 0.054 TEST PERFORMED AS PER ASTM D2435		

CONSOLIDATION TEST DATA

SUMMARY REPORT





Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

CONSOLIDATION TEST DATA

Project: DYNEGY EDWARDS
Boring No.: EDW-B008 S5
Sample No.: S-5
Test No.: EDWB008S5

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 10/26/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 11.0'-13.0'
Elevation: -----

Soil Description: BROWN AND GRAY FAT CLAY WITH SAND CH
Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435

Estimated Specific Gravity: 2.72
Initial Void Ratio: 0.91
Final Void Ratio: 0.52

Liquid Limit: 52
Plastic Limit: 19
Plasticity Index: 33

Initial Height: 0.75 in
Specimen Diameter: 2.49 in

	Before Consolidation		After Consolidation	
	Trimmings	Specimen+Ring	Specimen+Ring	Trimmings
Container ID	X19	RING	RING	A-8
Wt. Container + Wet Soil, gm	194.52	185.3	175.79	131.94
Wt. Container + Dry Soil, gm	156.81	159.5	159.5	115.76
Wt. Container, gm	44.78	74.3	74.3	31.14
Wt. Dry Soil, gm	112.03	85.199	85.199	84.62
Water Content, %	33.66	30.28	19.12	19.12
Void Ratio	---	0.91	0.52	---
Degree of Saturation, %	---	90.87	100.68	---
Dry Unit Weight, pcf	---	89.066	111.96	---

CONSOLIDATION TEST DATA

Project: DYNEGY EDWARDS
Boring No.: EDW-B008 S5
Sample No.: S-5
Test No.: EDWB008S5

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 10/26/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 11.0'-13.0'
Elevation: -----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWN AND GRAY FAT CLAY WITH SAND CH
Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435

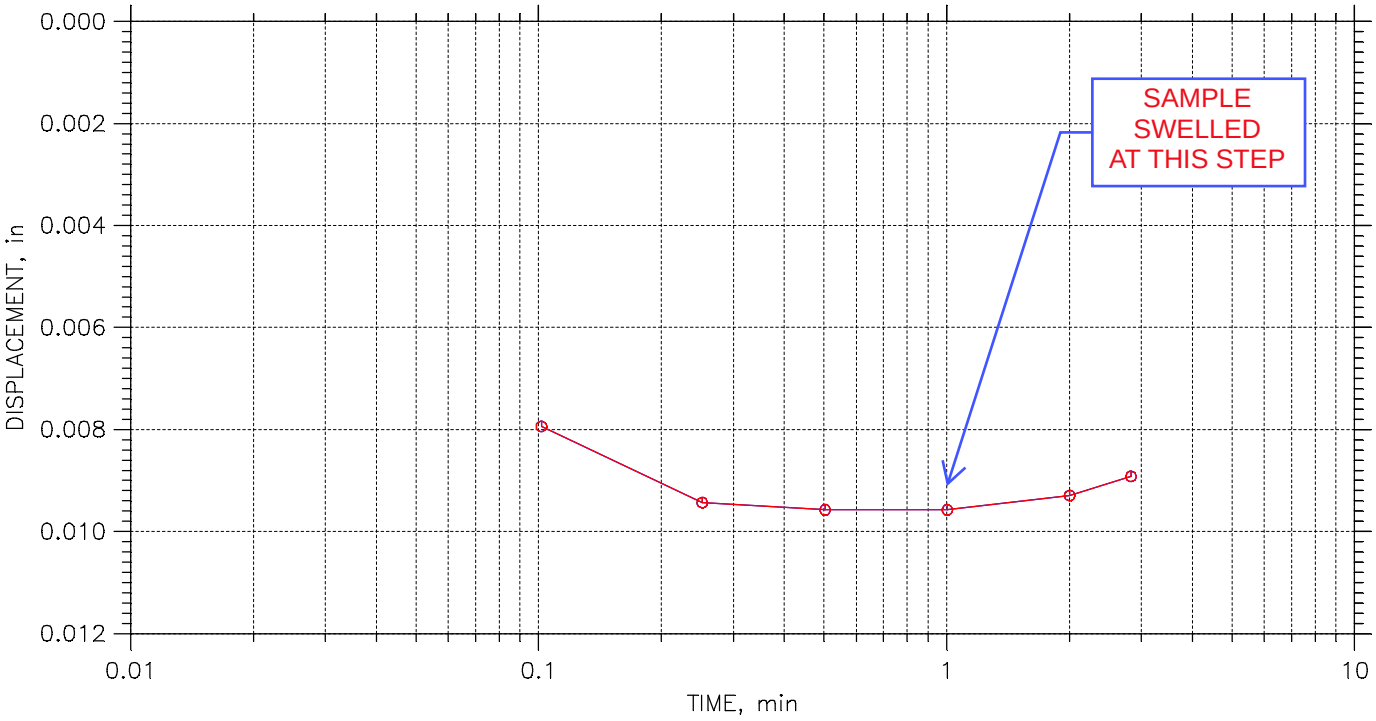
	Applied Stress tsf	Final Displacement in	Void Ratio	Strain at End %	T50 Fitting Sq.Rt. min	T50 Fitting Log min	Coefficient of Consolidation Sq.Rt. ft^2/sec	Coefficient of Consolidation Log ft^2/sec	Coefficient of Consolidation Ave. ft^2/sec
1	0.125	0.008922	0.884	1.19	0.0	0.0	0.00e+000	0.00e+000	0.00e+000
2	0.25	0.01289	0.874	1.72	0.1	0.0	3.48e-005	0.00e+000	3.48e-005
3	0.5	0.02294	0.848	3.07	1.5	0.5	2.05e-006	5.95e-006	3.05e-006
4	0.75	0.03373	0.821	4.51	5.8	0.0	5.07e-007	0.00e+000	5.07e-007
5	1	0.04241	0.798	5.67	3.8	3.2	7.58e-007	8.96e-007	8.21e-007
6	2	0.07189	0.723	9.61	2.1	1.1	1.30e-006	2.41e-006	1.69e-006
7	1	0.06554	0.739	8.76	0.2	0.0	1.15e-005	0.00e+000	1.15e-005
8	0.5	0.05914	0.756	7.91	0.9	0.0	2.88e-006	0.00e+000	2.88e-006
9	0.125	0.0497	0.780	6.64	3.7	0.0	7.35e-007	0.00e+000	7.35e-007
10	0.25	0.05157	0.775	6.89	0.9	0.0	3.01e-006	0.00e+000	3.01e-006
11	0.5	0.05657	0.762	7.56	0.9	0.0	2.94e-006	0.00e+000	2.94e-006
12	0.75	0.06059	0.752	8.10	3.9	1.3	6.94e-007	2.10e-006	1.04e-006
13	1	0.06357	0.744	8.50	0.2	0.0	1.18e-005	0.00e+000	1.18e-005
14	2	0.07577	0.713	10.13	0.9	0.4	2.80e-006	7.14e-006	4.02e-006
15	4	0.1094	0.628	14.62	2.1	0.0	1.17e-006	0.00e+000	1.17e-006
16	8	0.1468	0.532	19.63	2.1	0.0	1.04e-006	0.00e+000	1.04e-006
17	16	0.1861	0.432	24.88	2.1	0.0	9.17e-007	0.00e+000	9.17e-007
18	32	0.2266	0.329	30.29	2.1	0.0	7.97e-007	0.00e+000	7.97e-007
19	16	0.2155	0.357	28.81	0.0	0.0	6.68e-005	0.00e+000	6.68e-005
20	4	0.1974	0.403	26.38	2.1	0.0	7.97e-007	0.00e+000	7.97e-007
21	1	0.1751	0.460	23.40	11.4	0.0	1.58e-007	0.00e+000	1.58e-007
22	0.5	0.1661	0.483	22.21	8.8	0.0	2.16e-007	0.00e+000	2.16e-007
23	0.125	0.153	0.517	20.45	32.0	0.0	6.18e-008	0.00e+000	6.18e-008

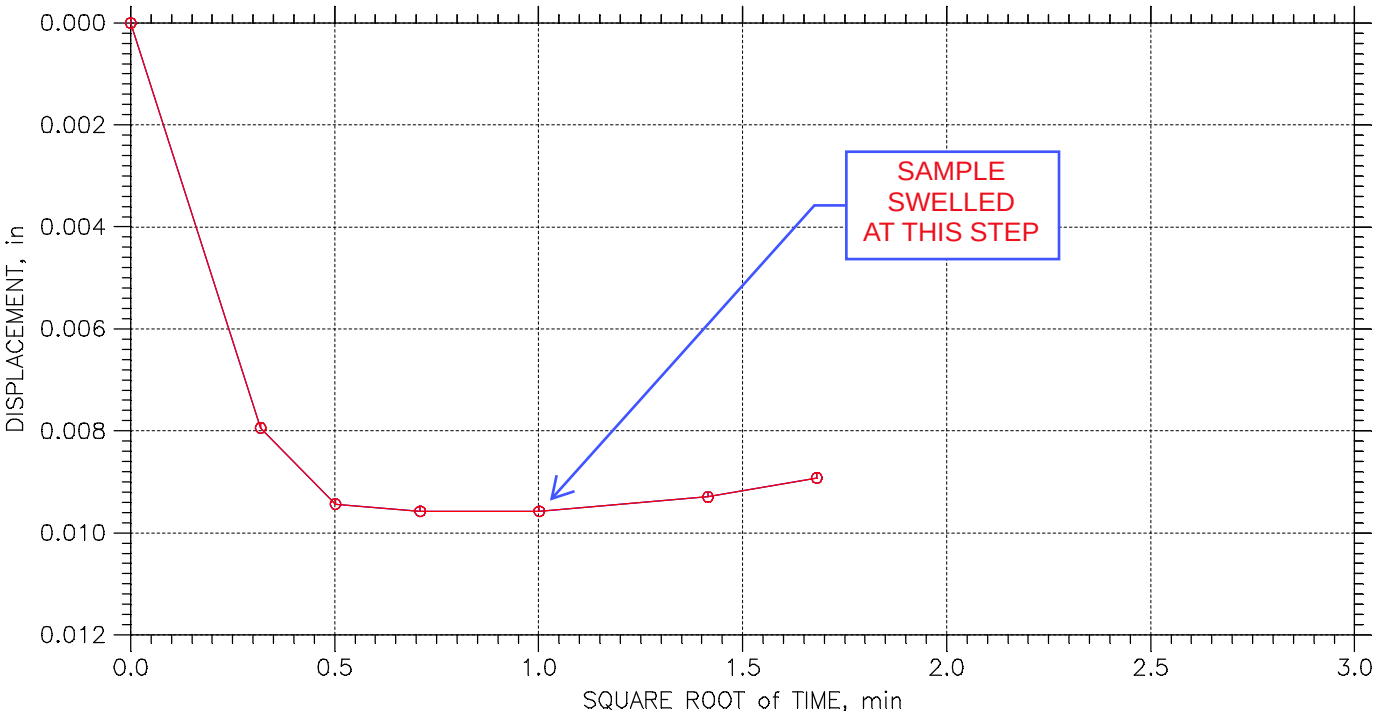
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 1 of 23

Stress: 0.125 tsf





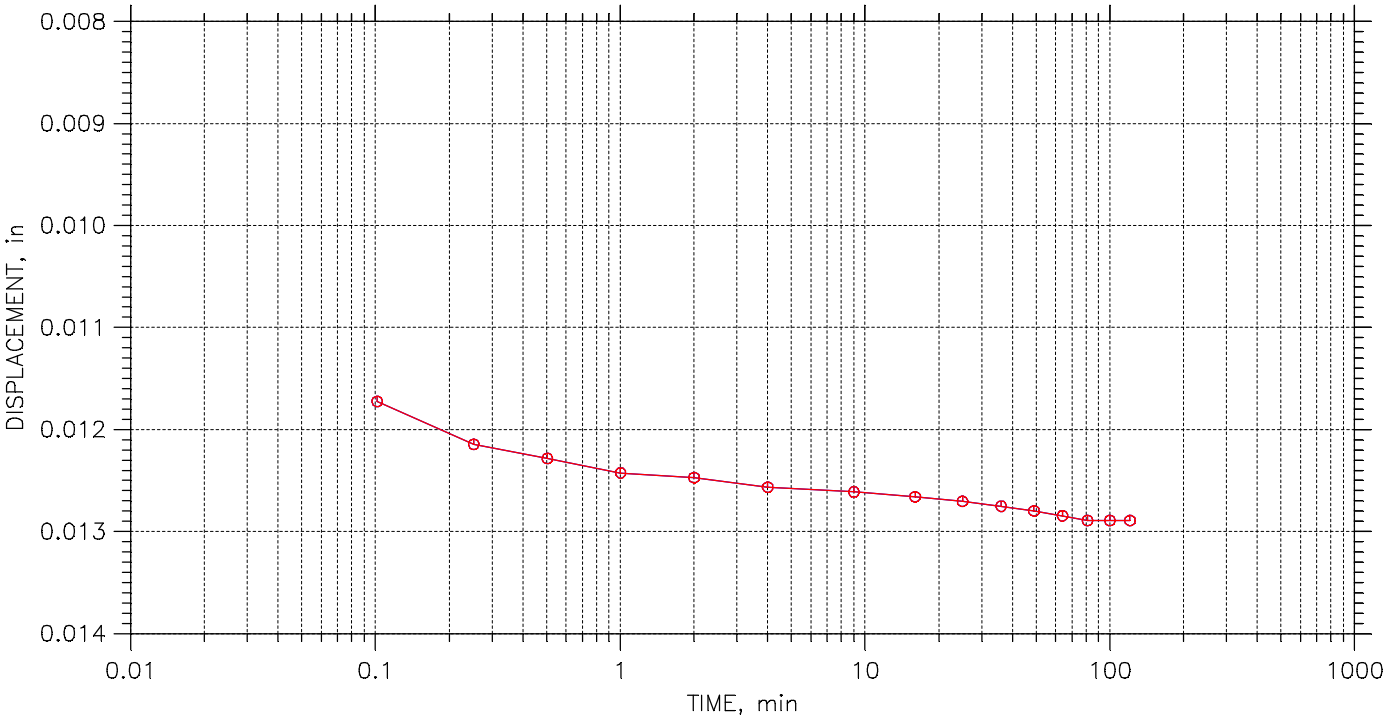
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

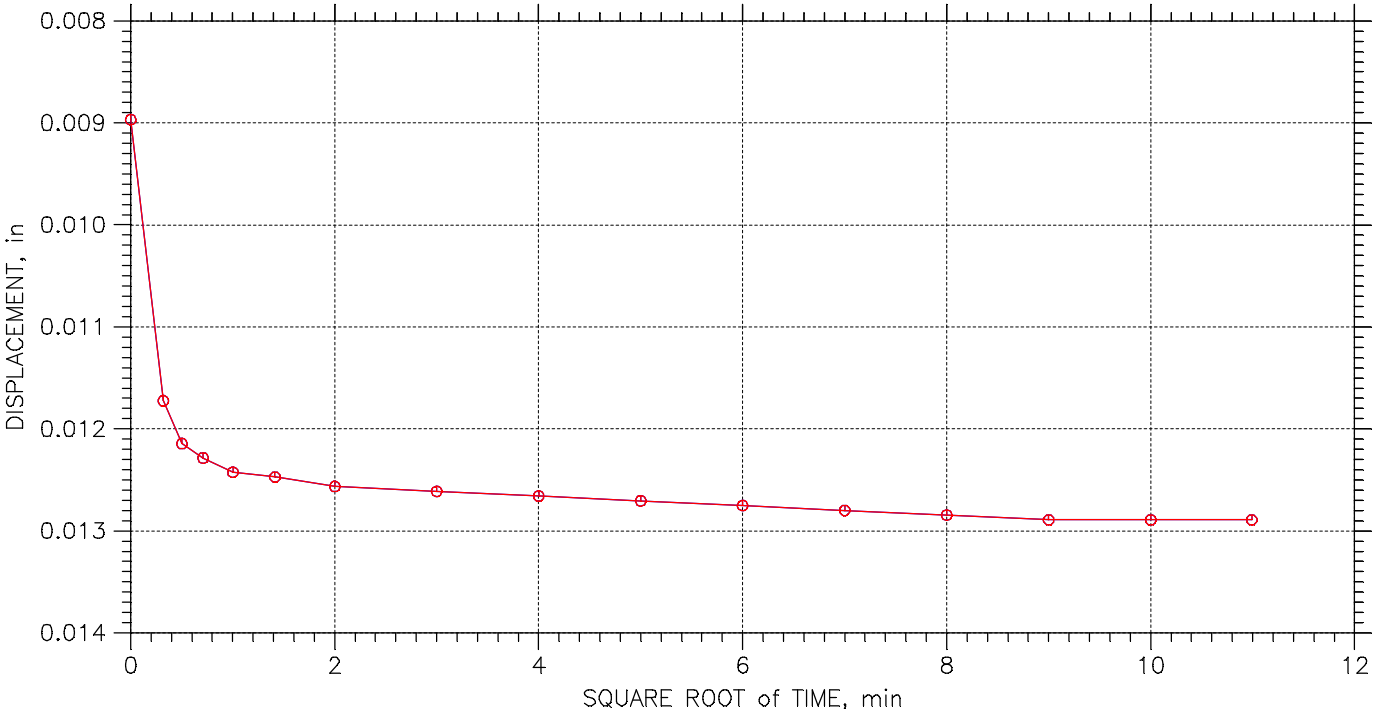
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 2 of 23

Stress: 0.25 tsf





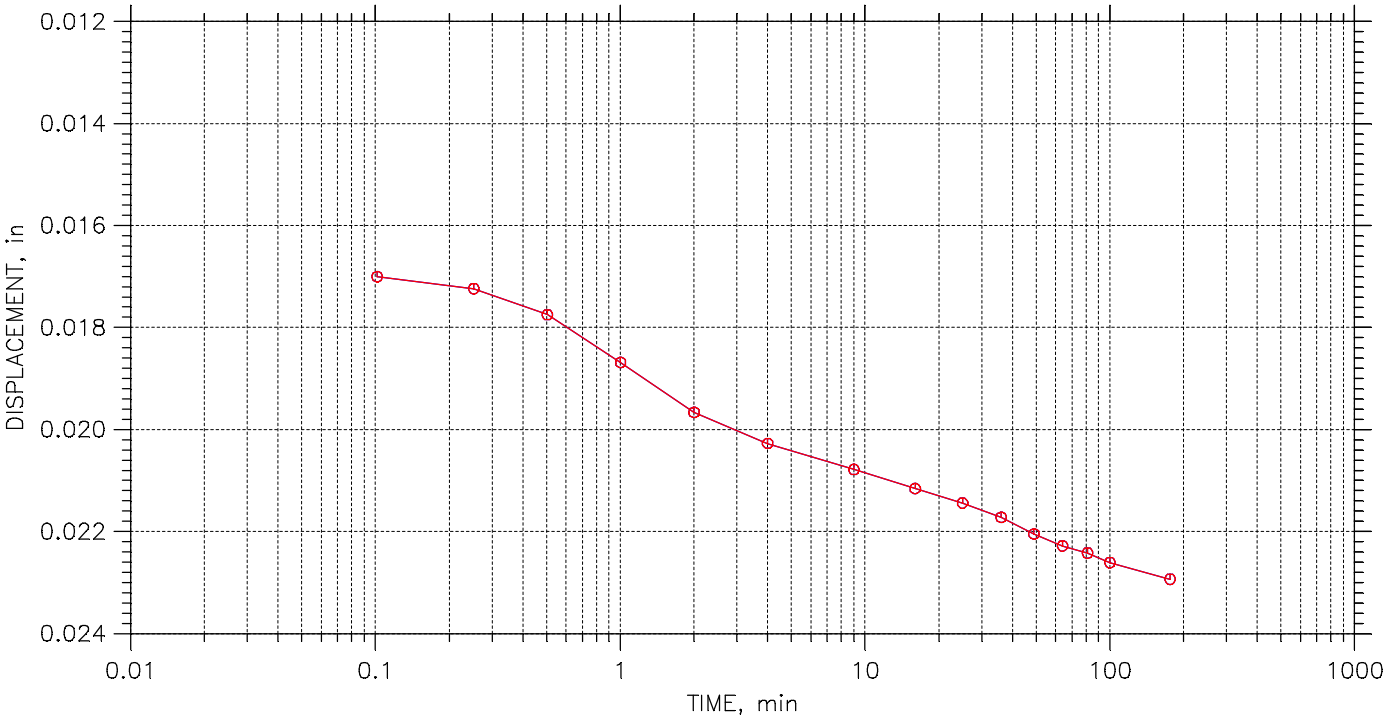
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

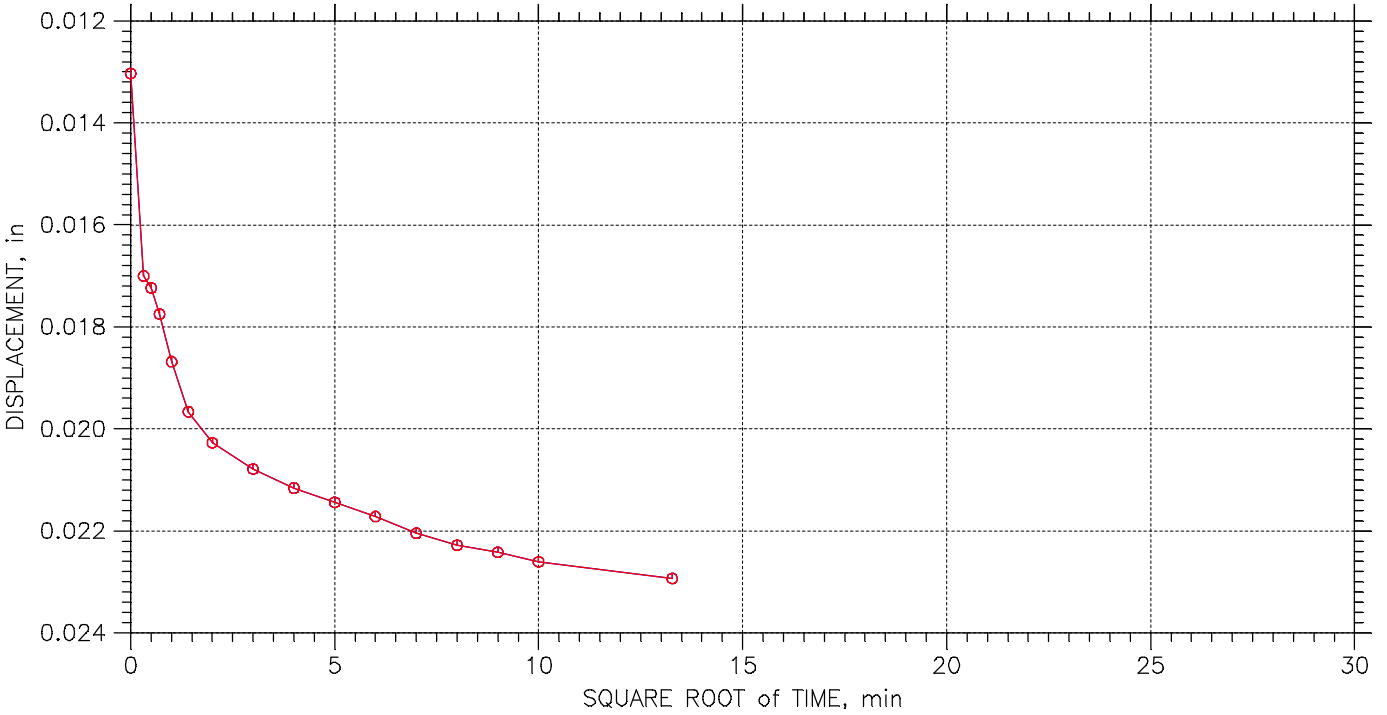
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 3 of 23

Stress: 0.5 tsf





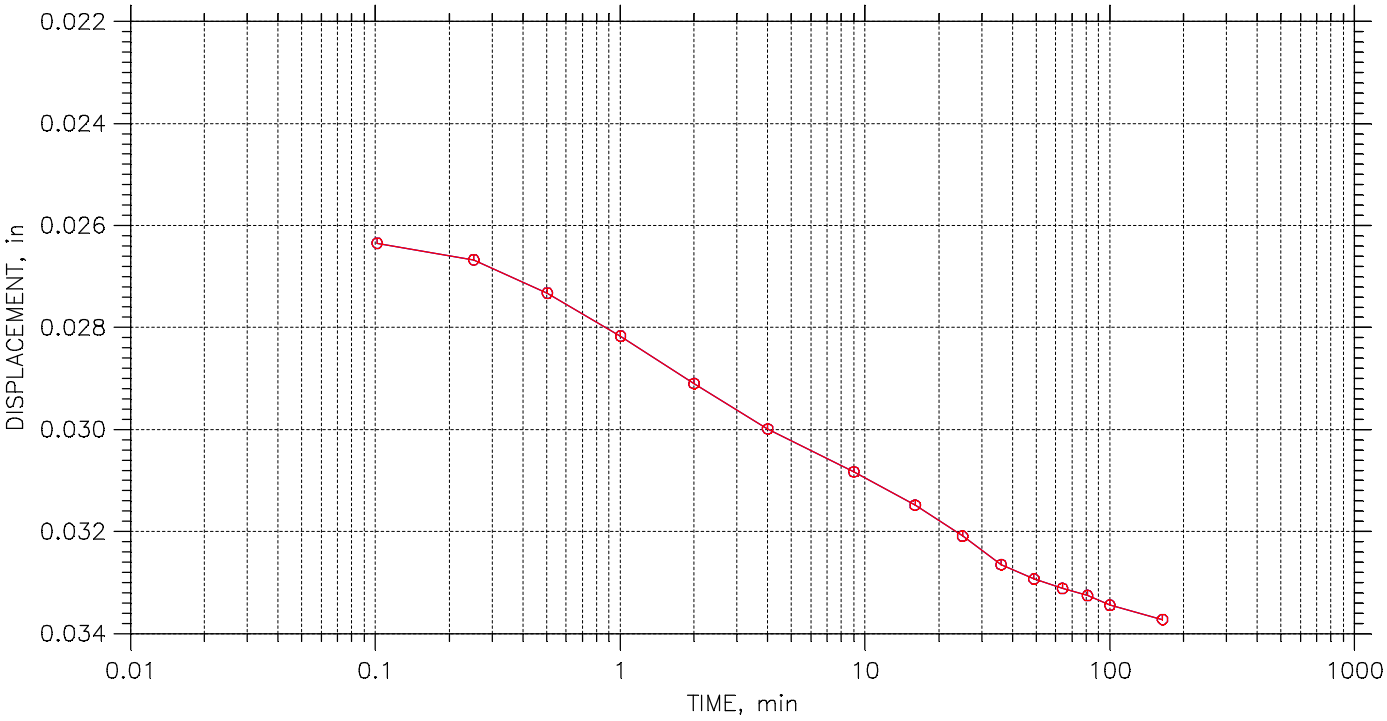
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

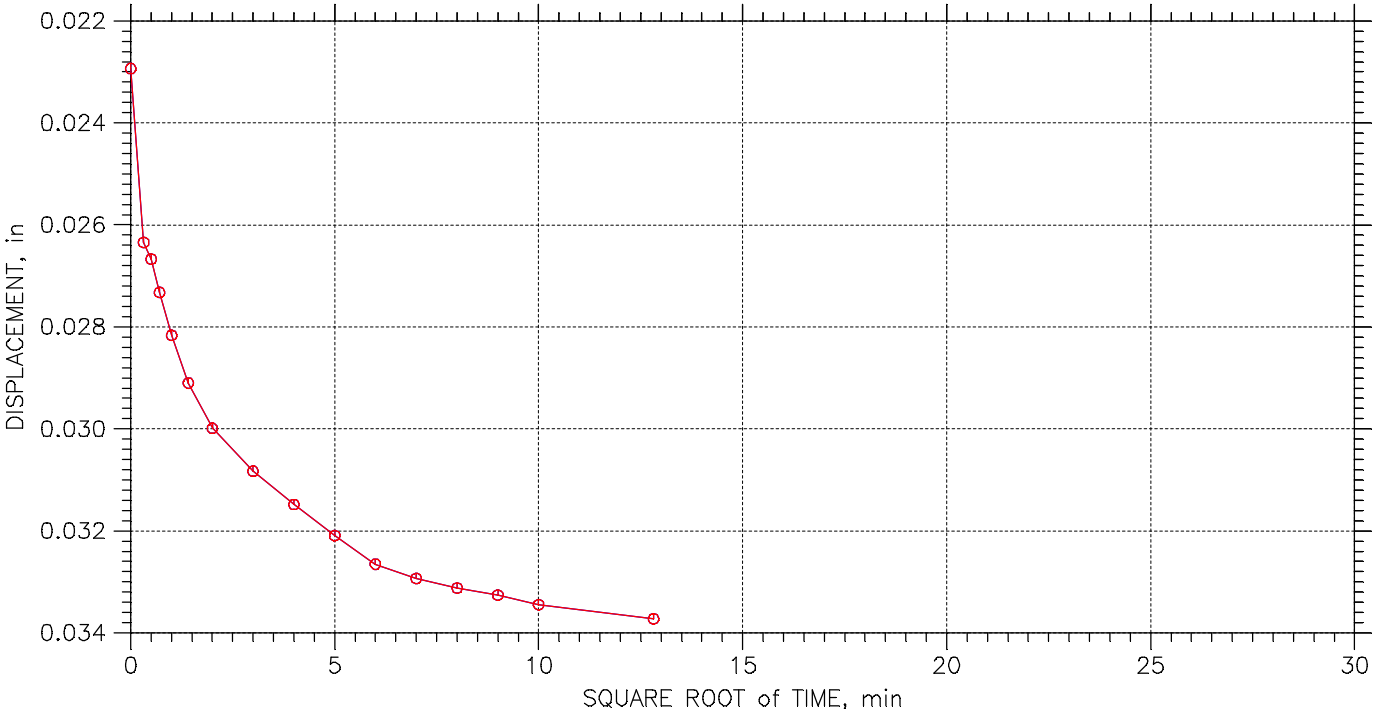
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 4 of 23

Stress: 0.75 tsf





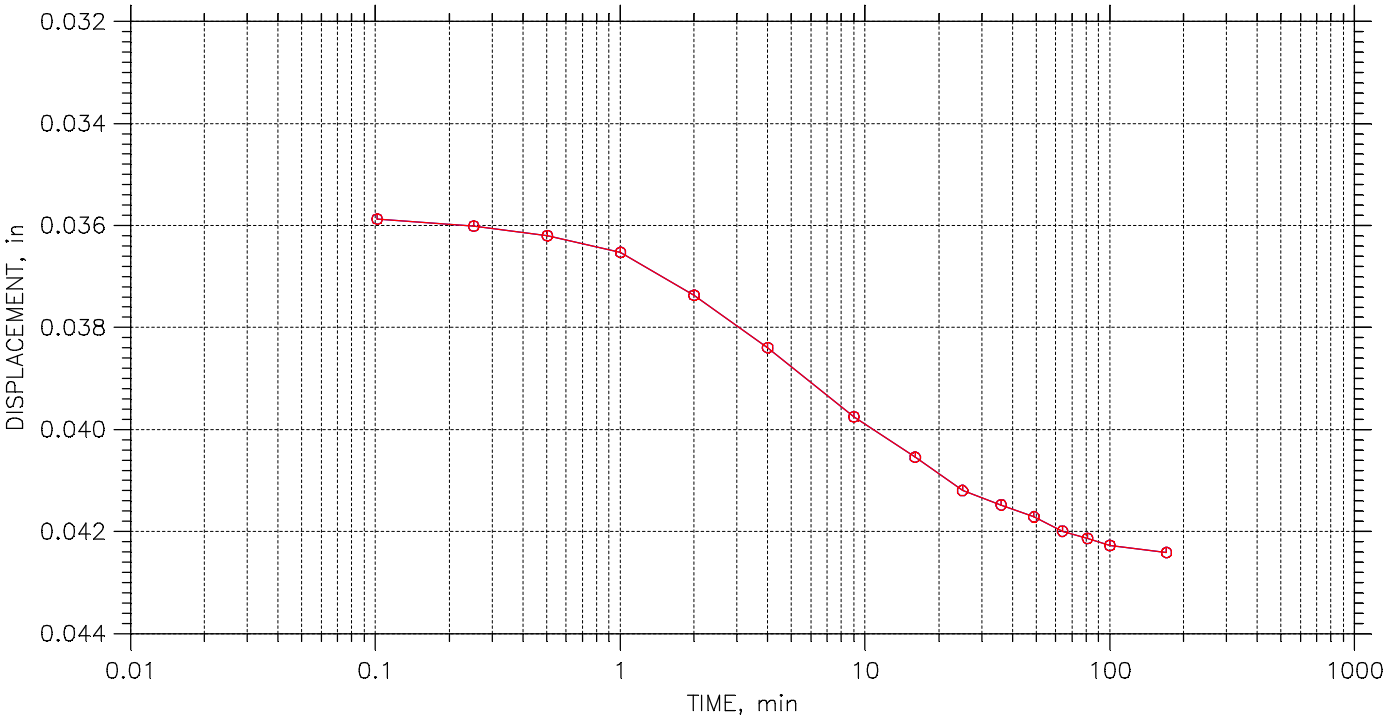
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

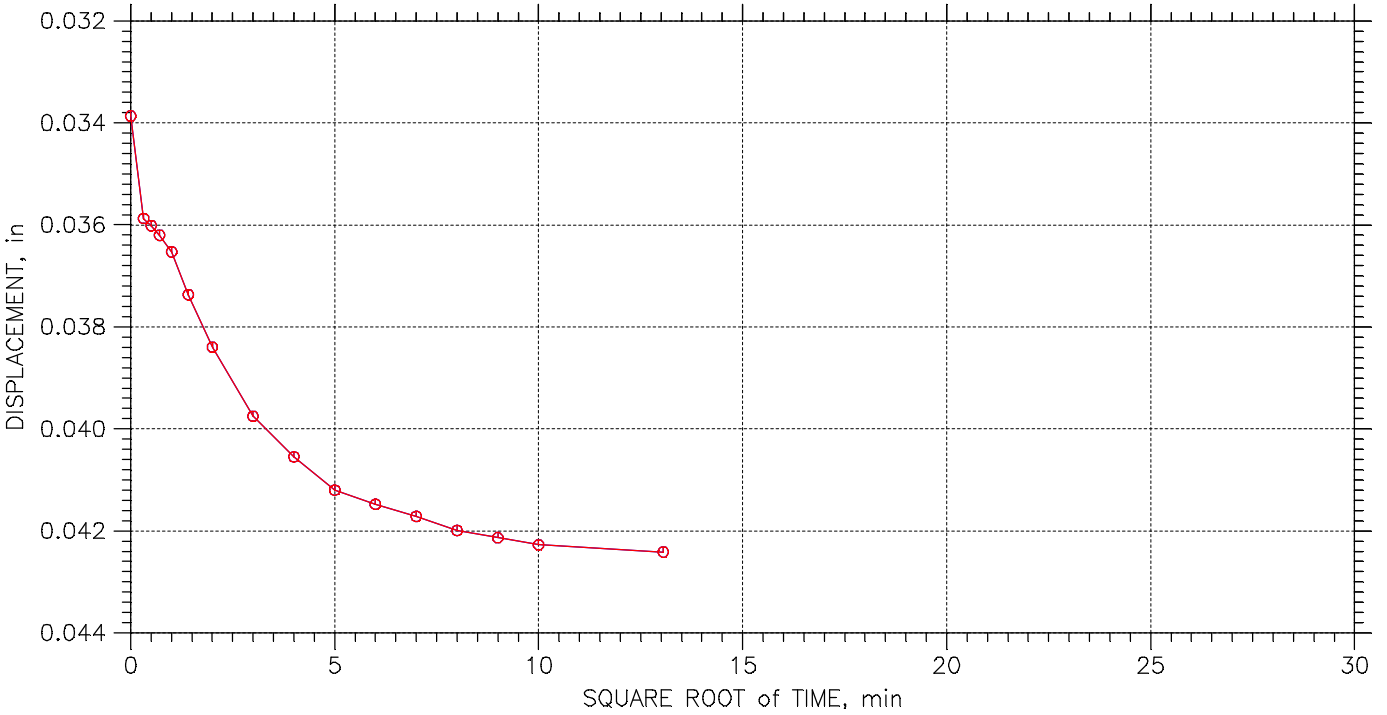
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 5 of 23

Stress: 1. tsf





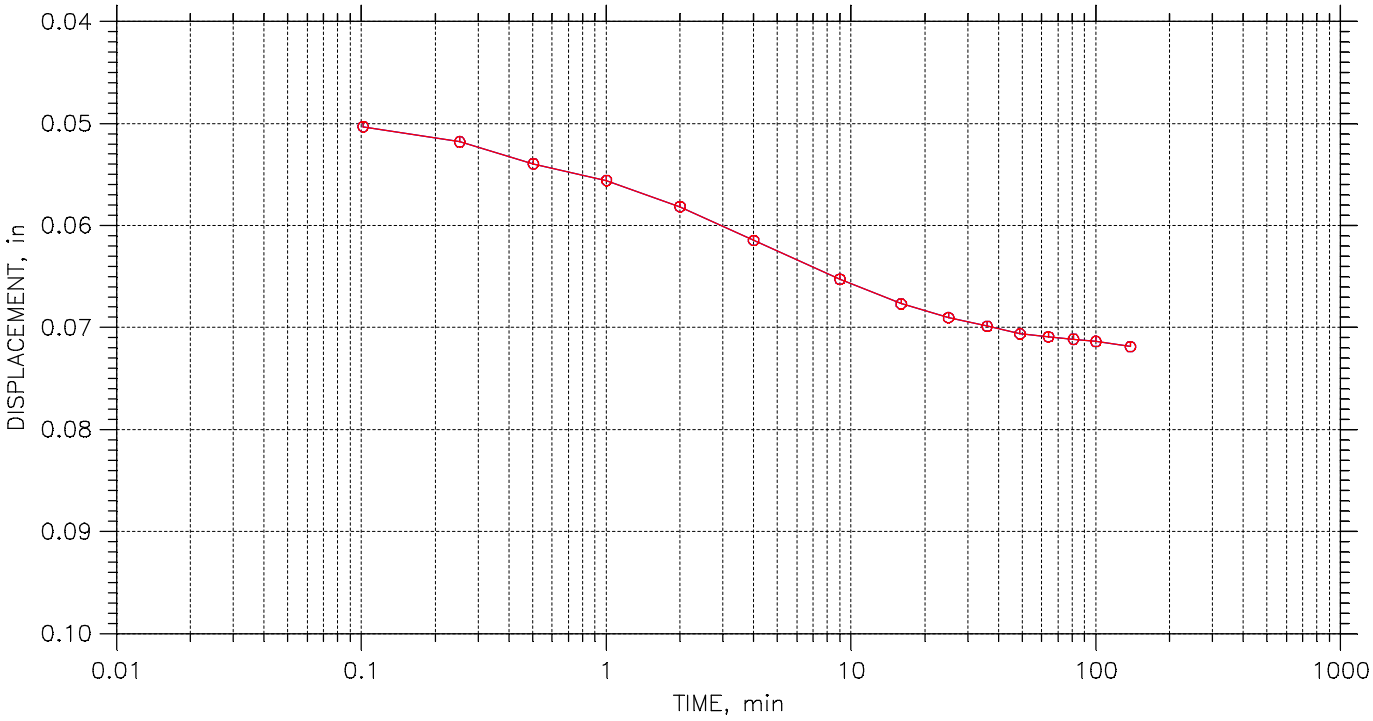
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

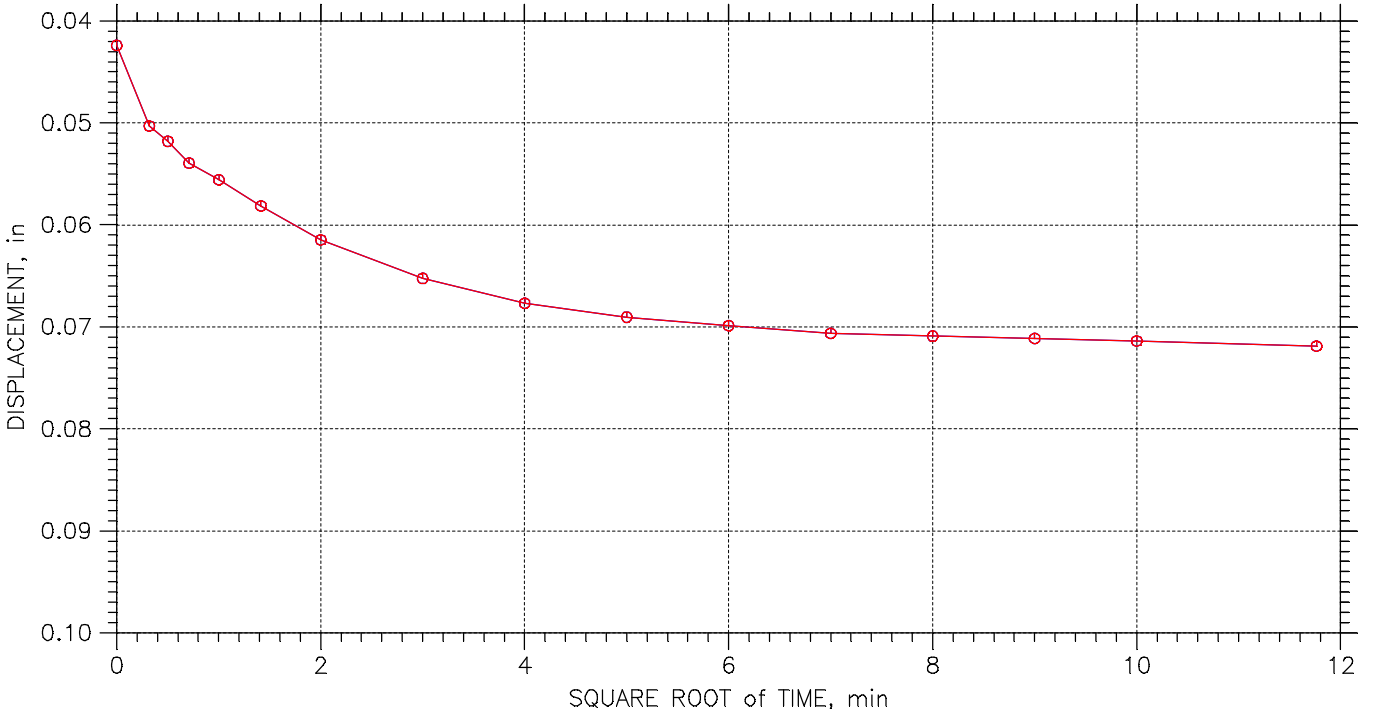
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 6 of 23

Stress: 2. tsf





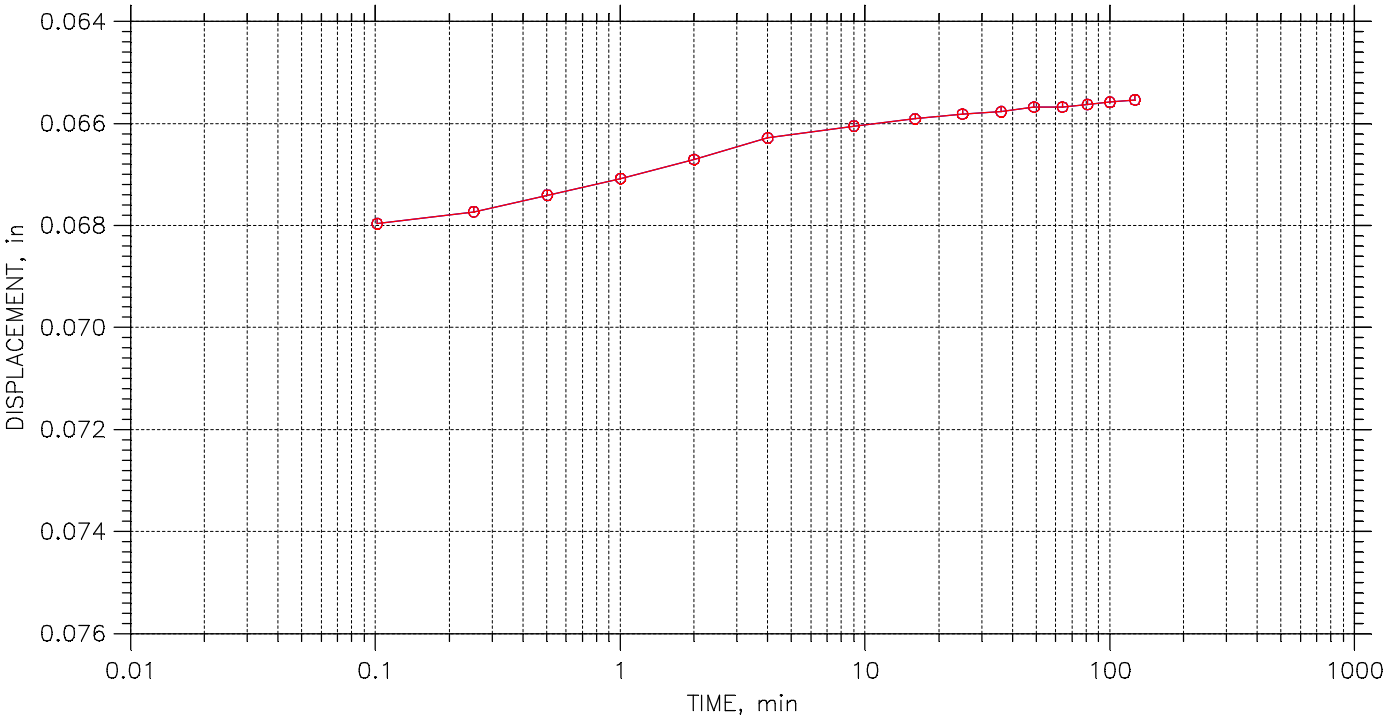
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

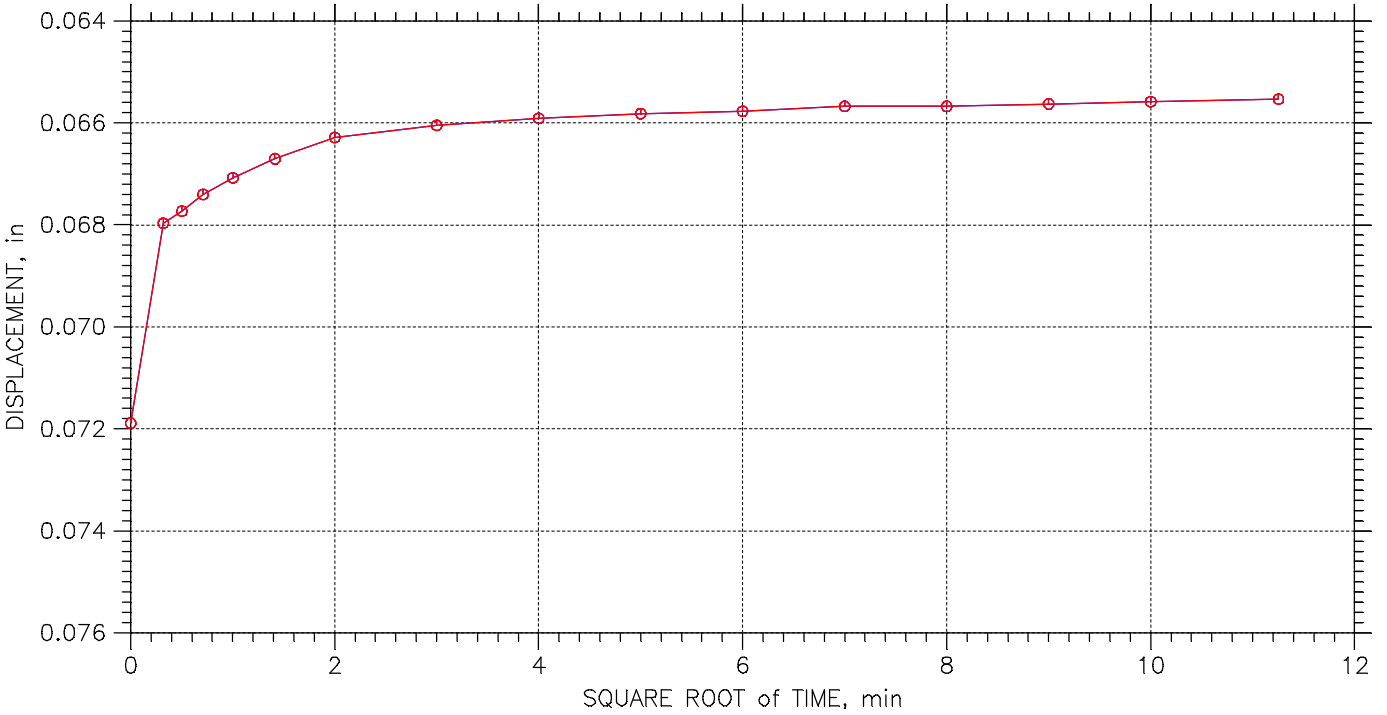
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 7 of 23

Stress: 1. tsf





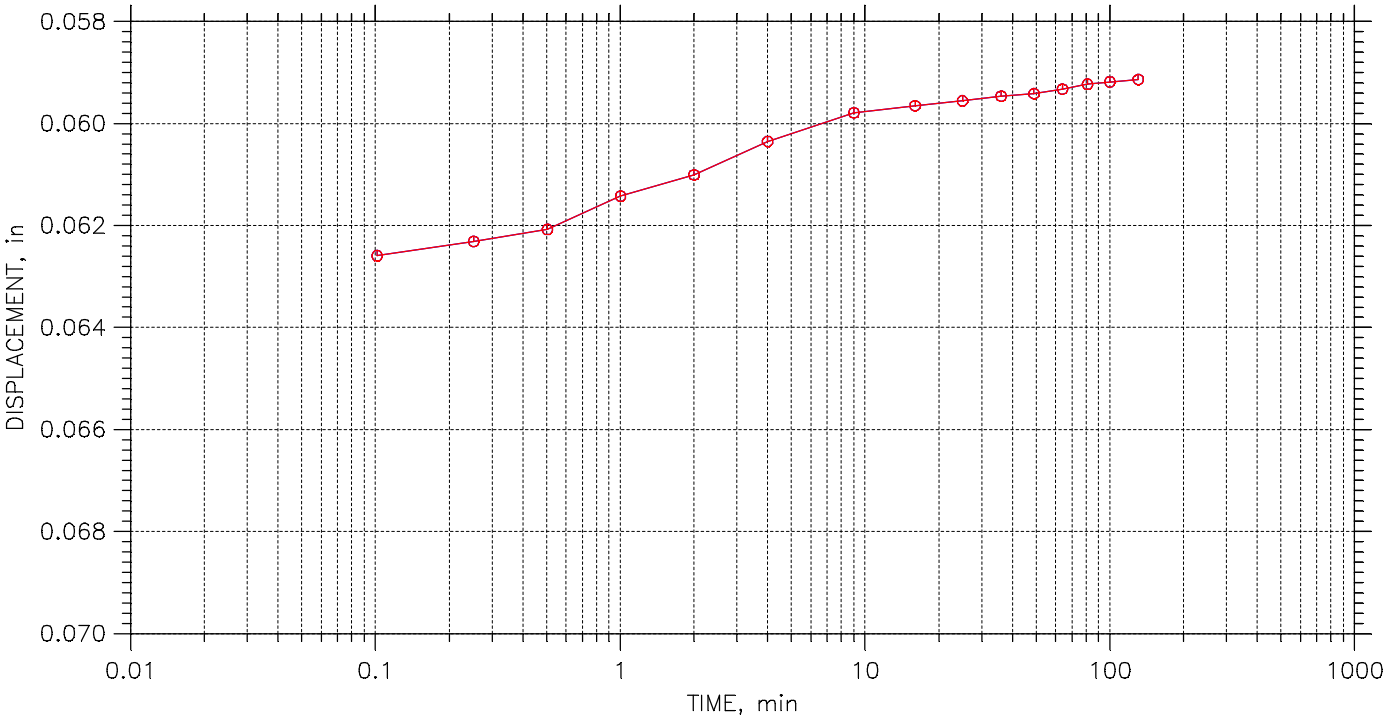
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

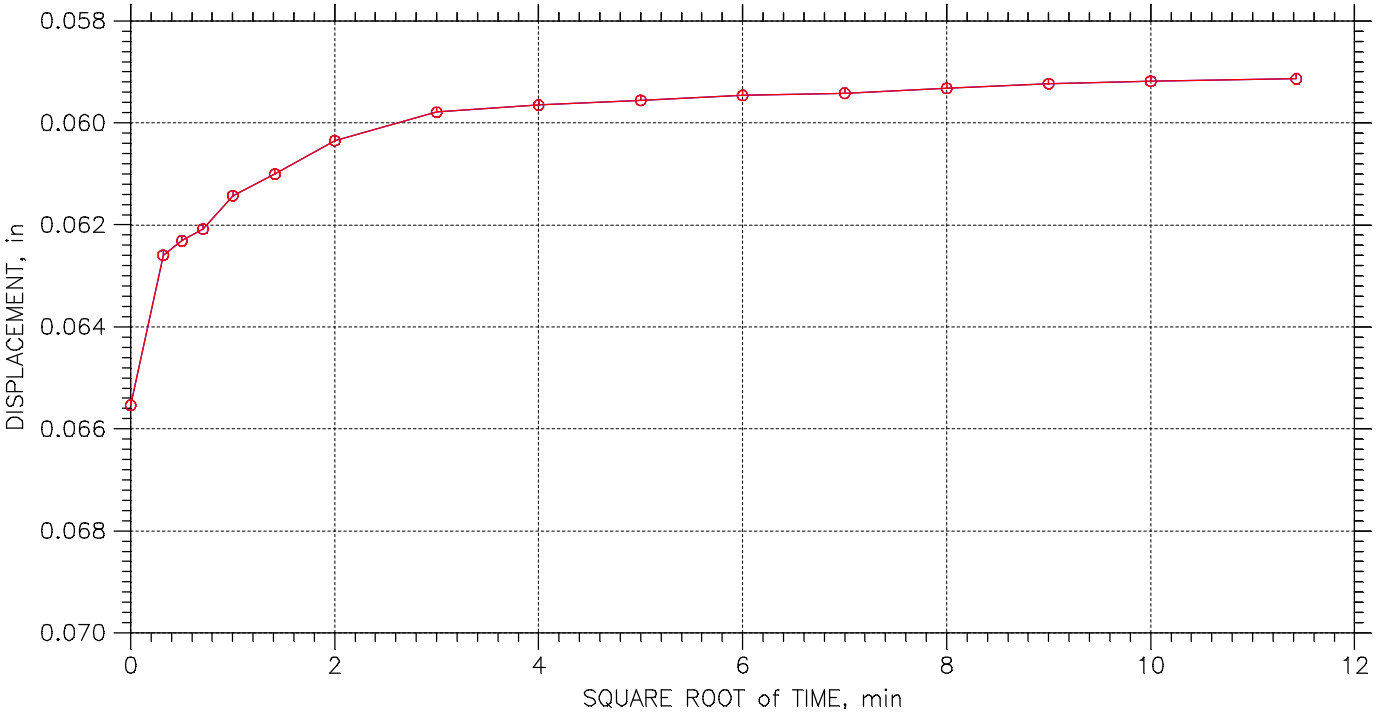
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 8 of 23

Stress: 0.5 tsf





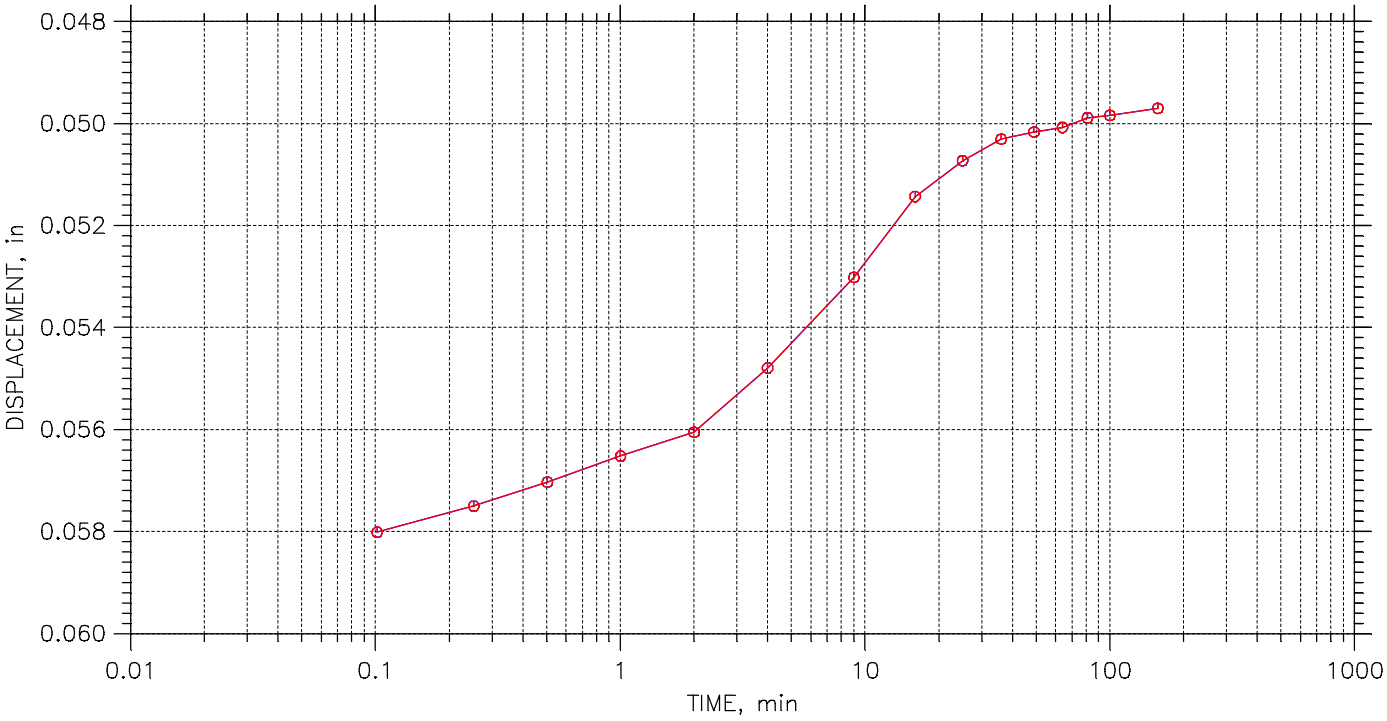
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

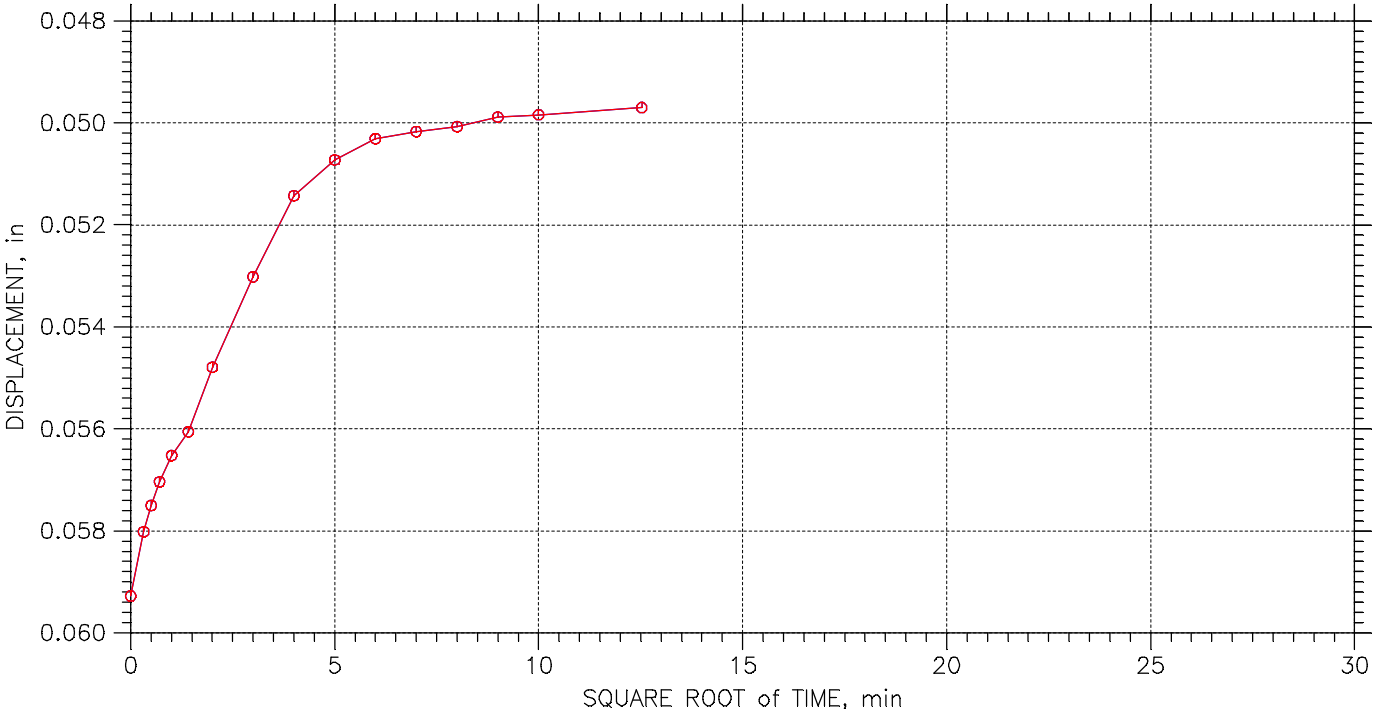
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 9 of 23

Stress: 0.125 tsf





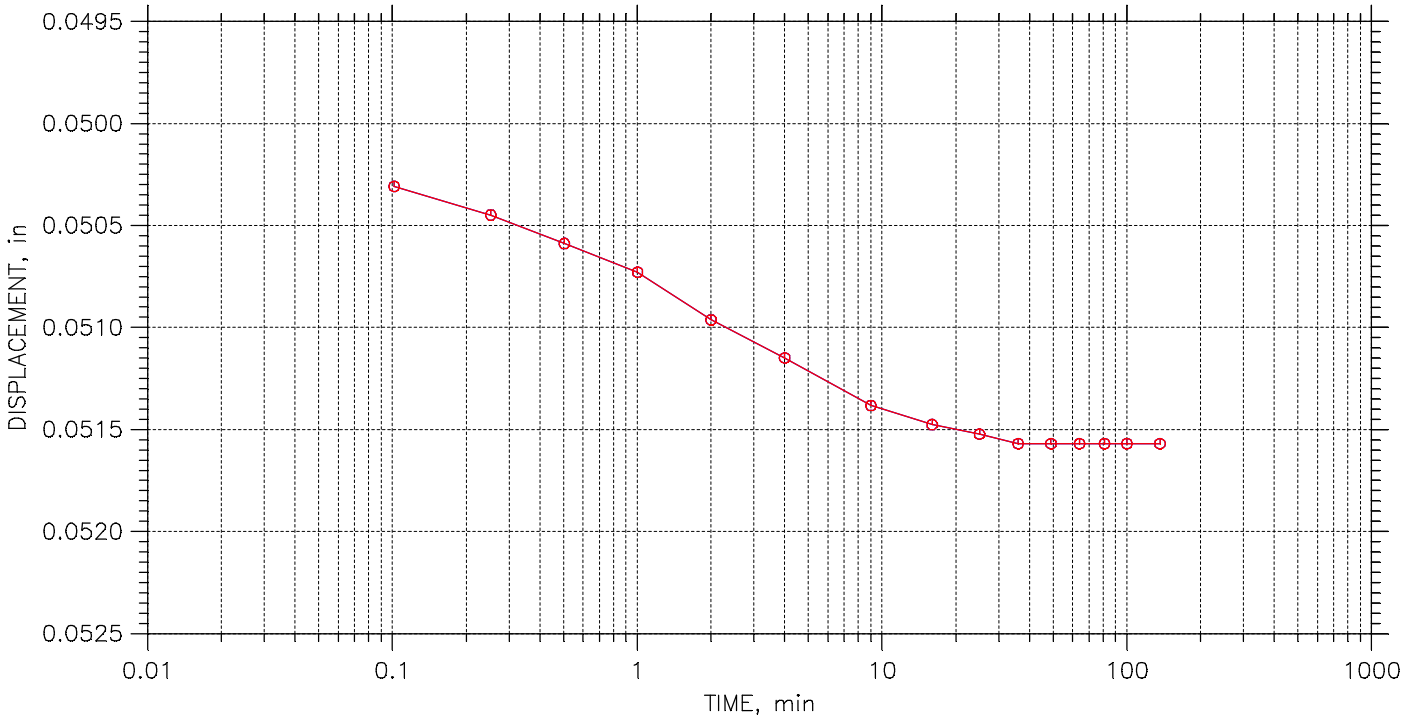
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

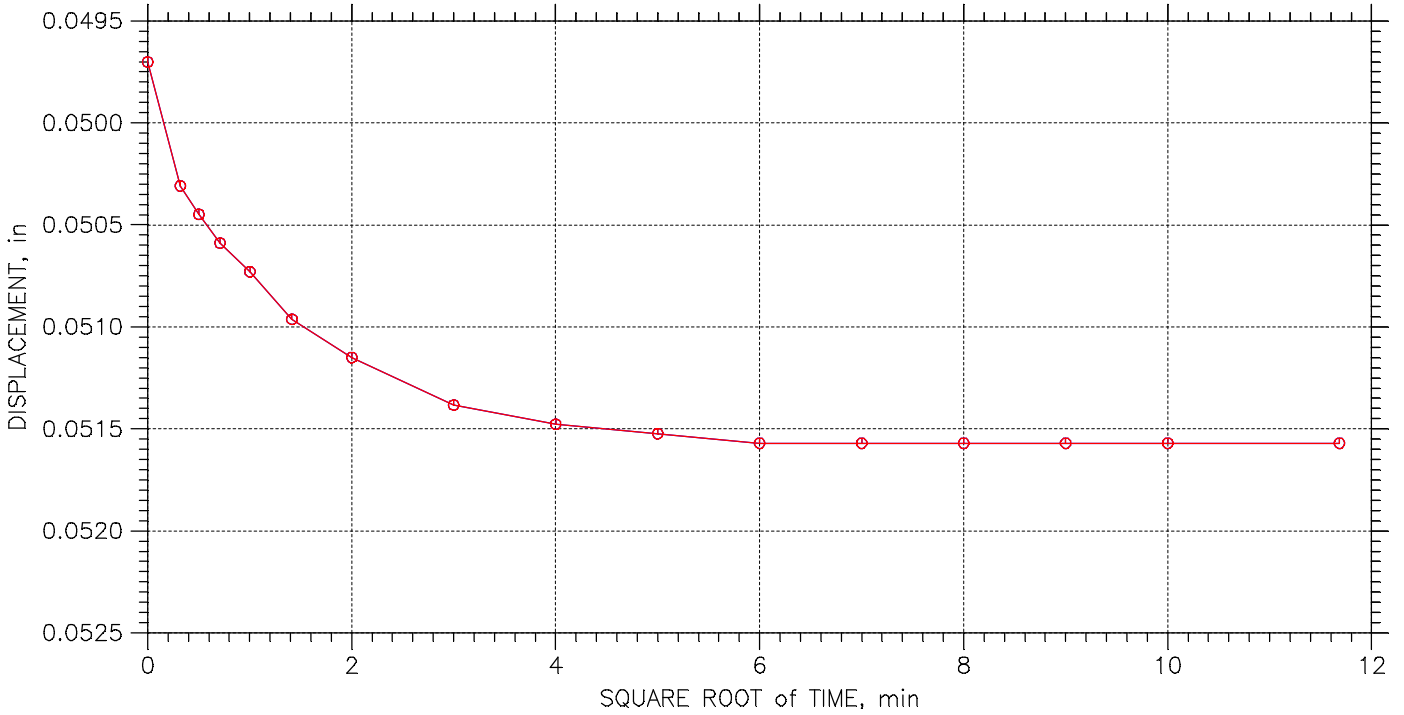
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 10 of 23

Stress: 0.25 tsf





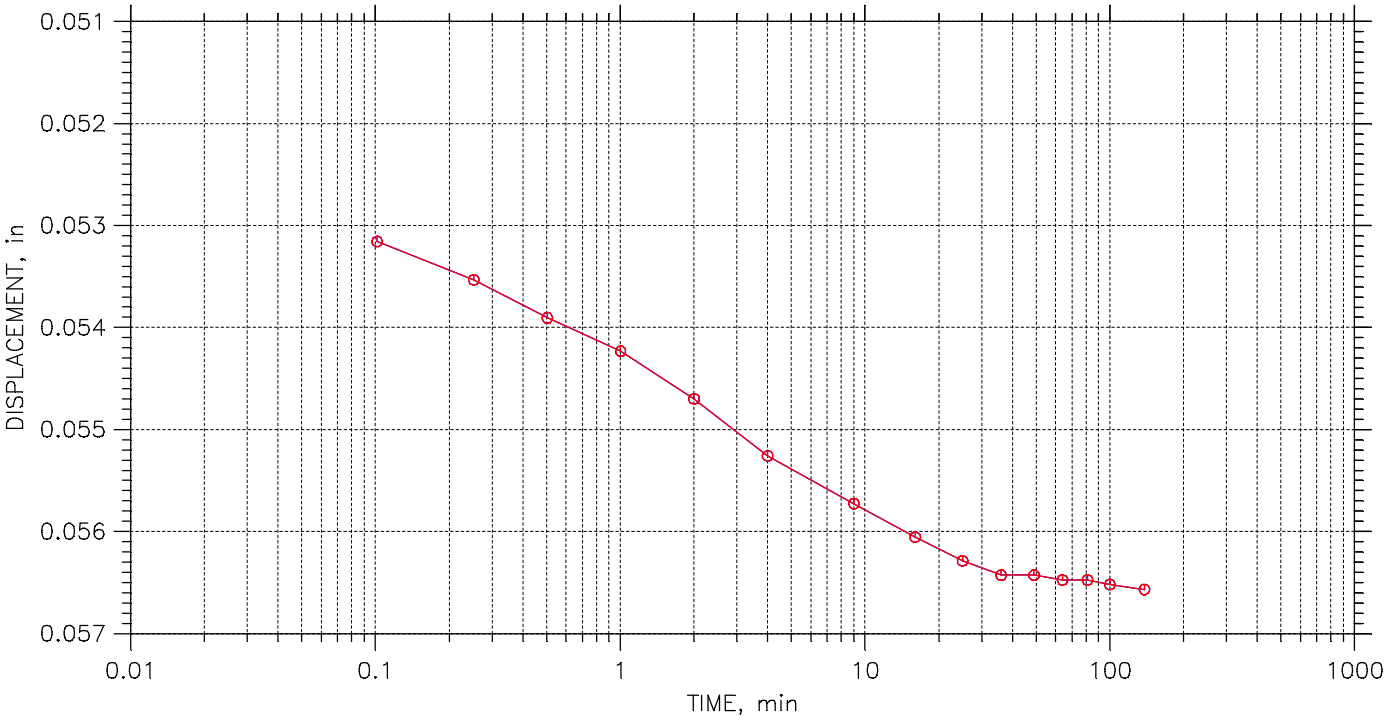
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

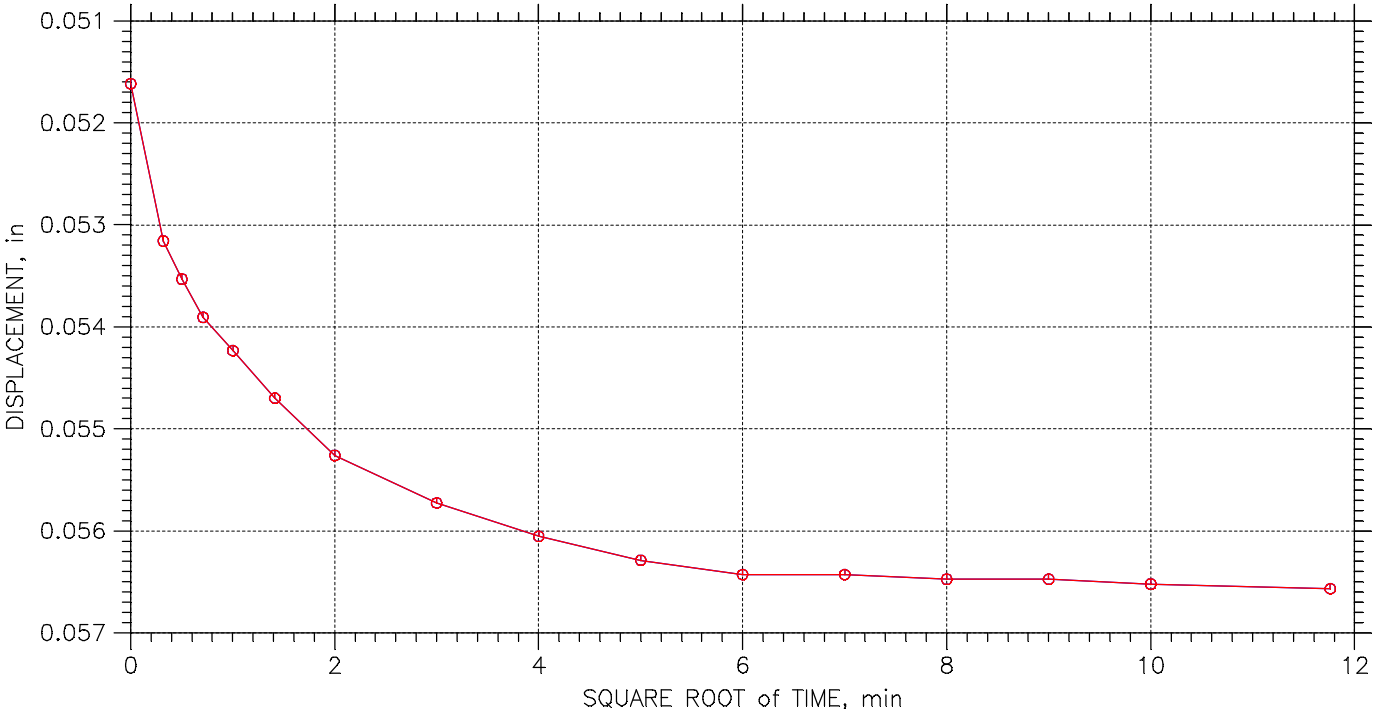
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 11 of 23

Stress: 0.5 tsf





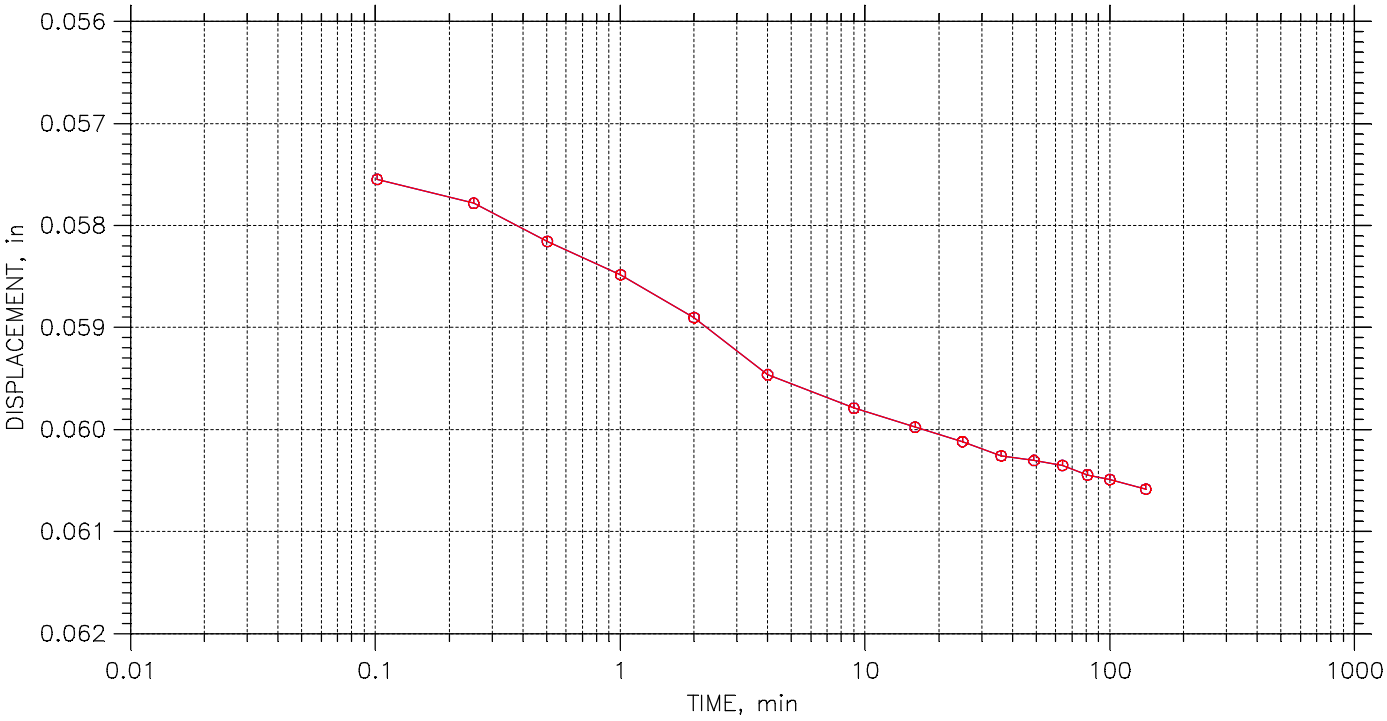
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

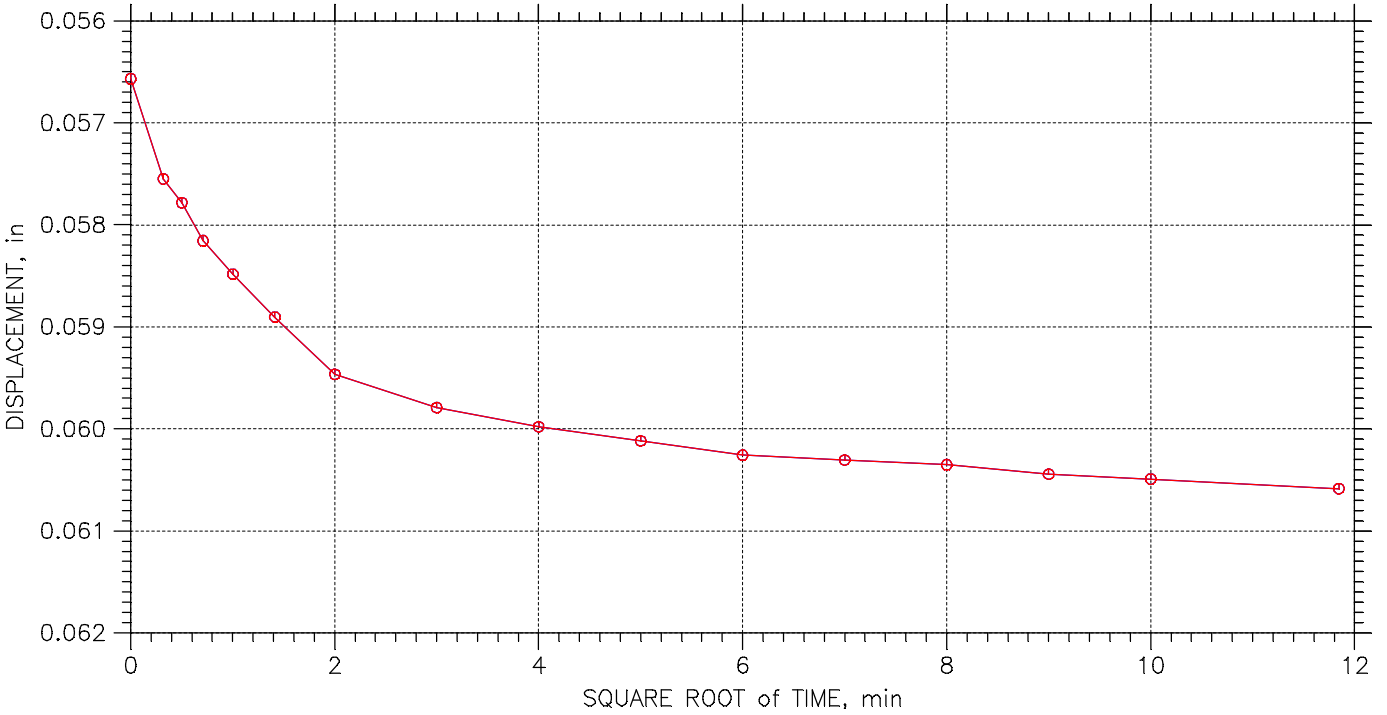
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 12 of 23

Stress: 0.75 tsf





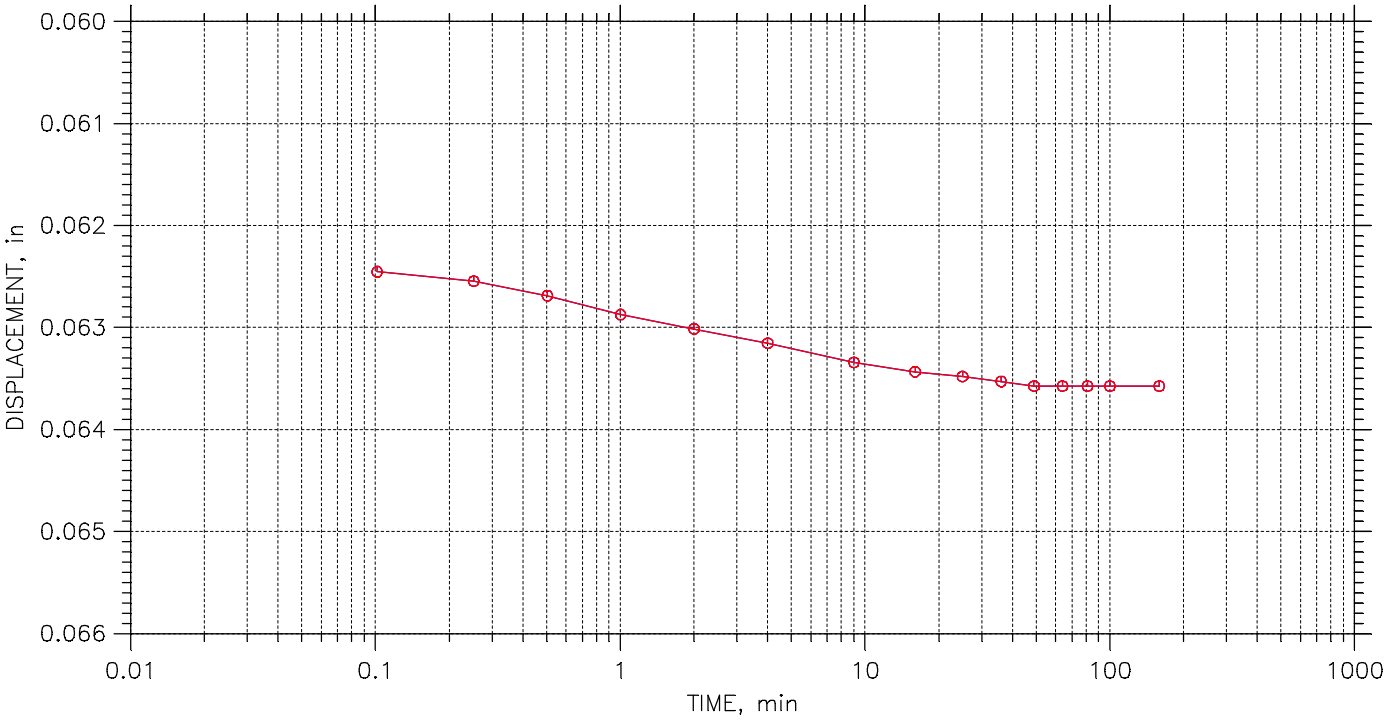
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

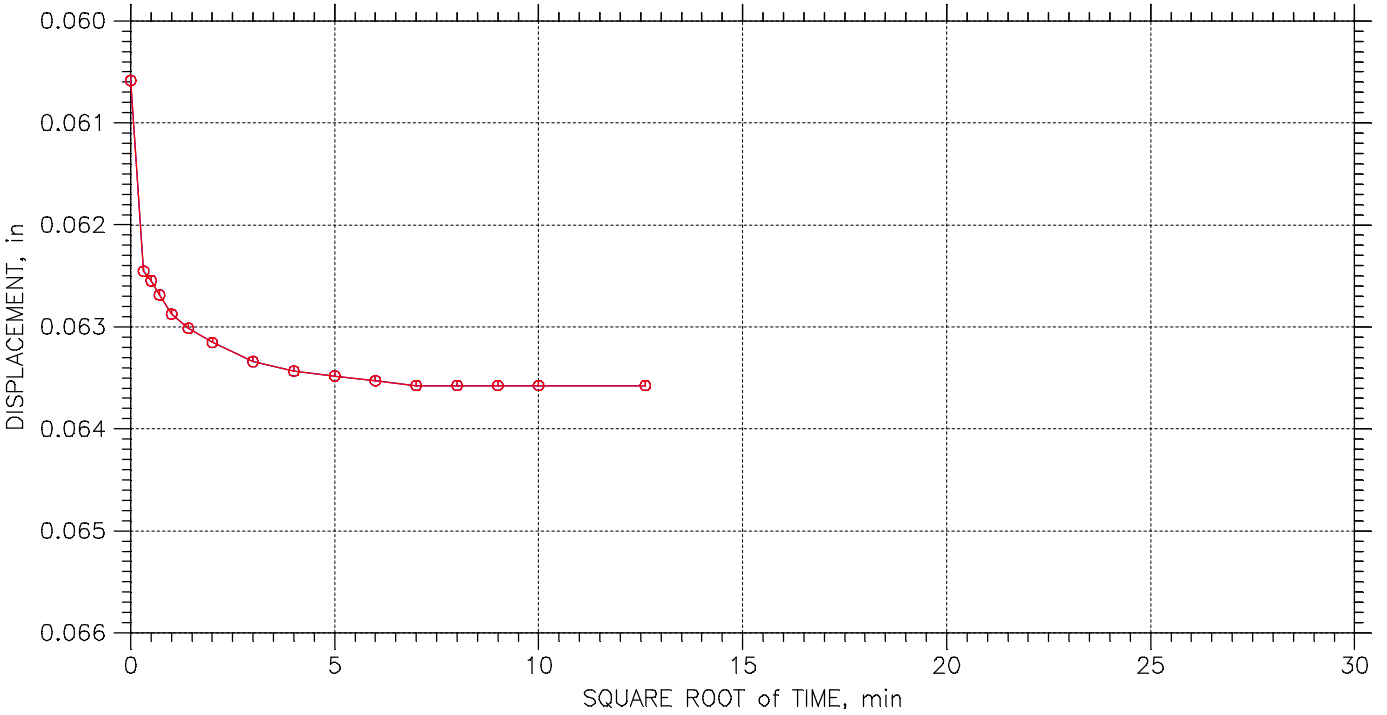
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 13 of 23

Stress: 1. tsf





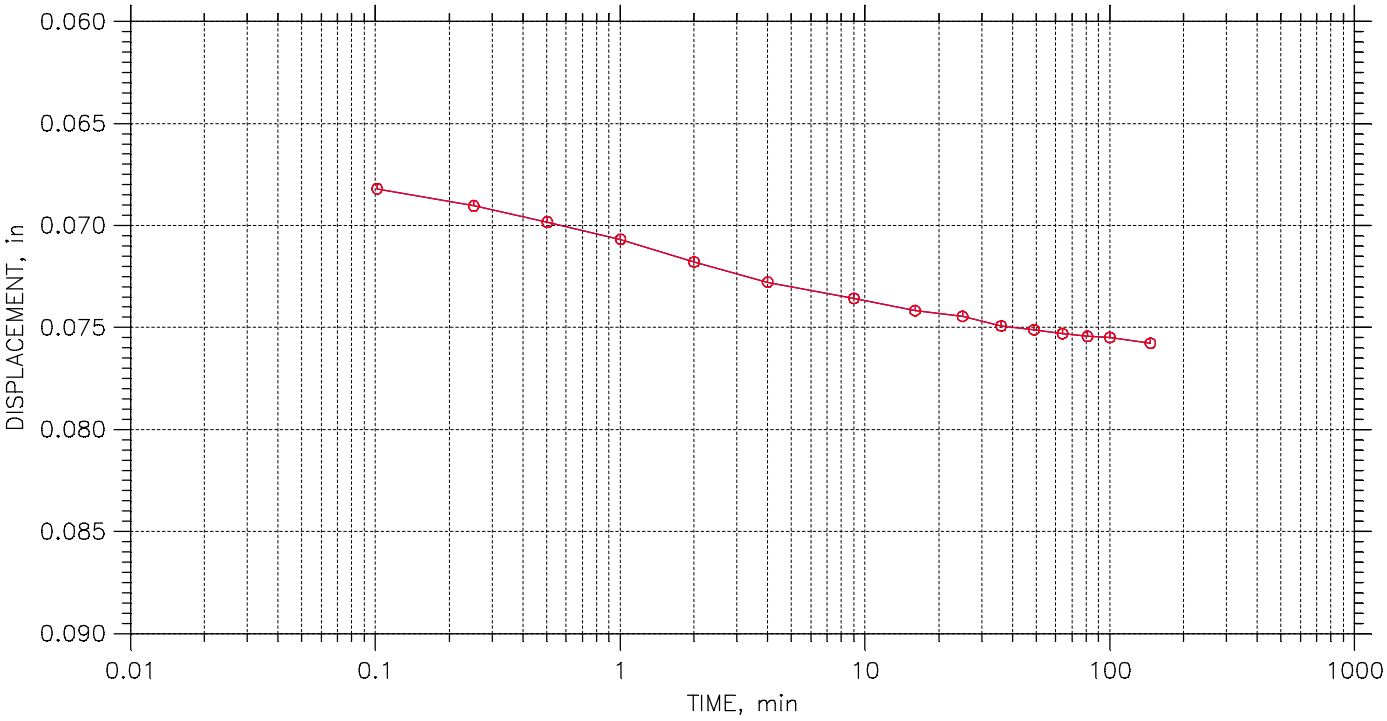
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

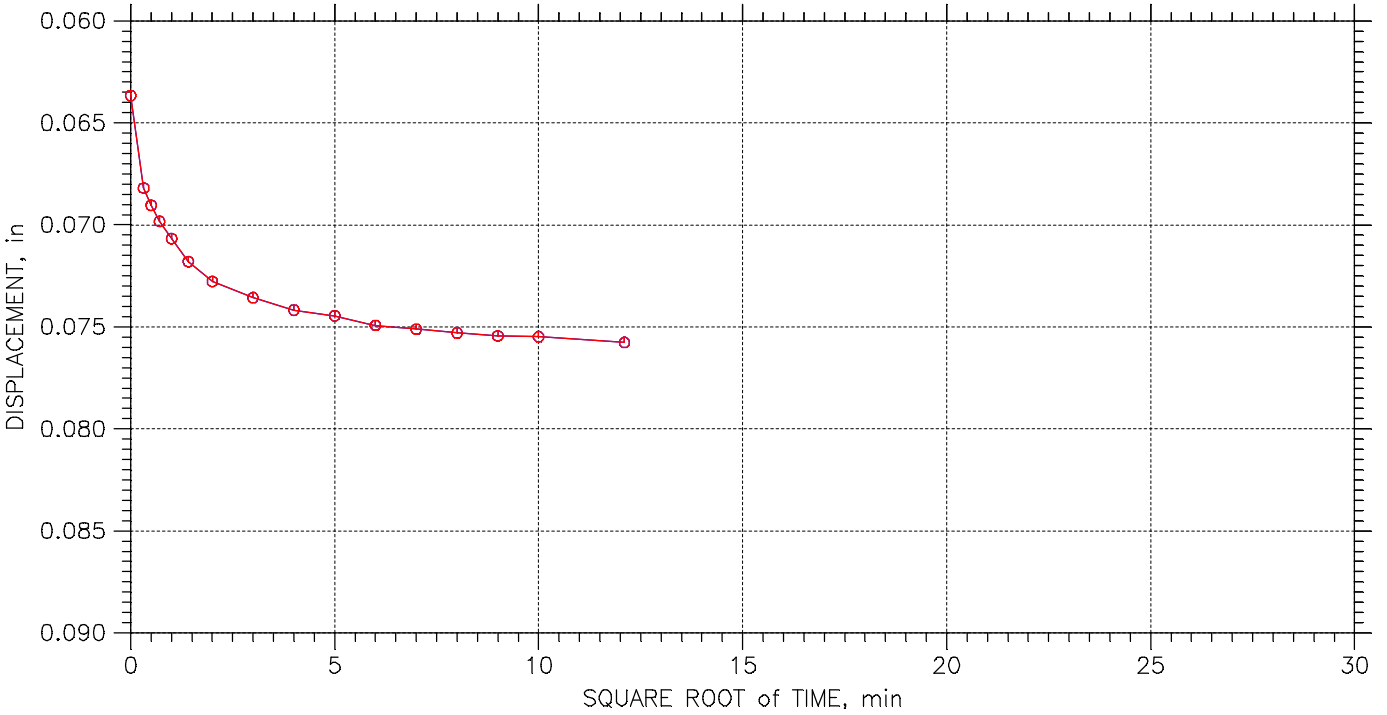
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 14 of 23

Stress: 2. tsf





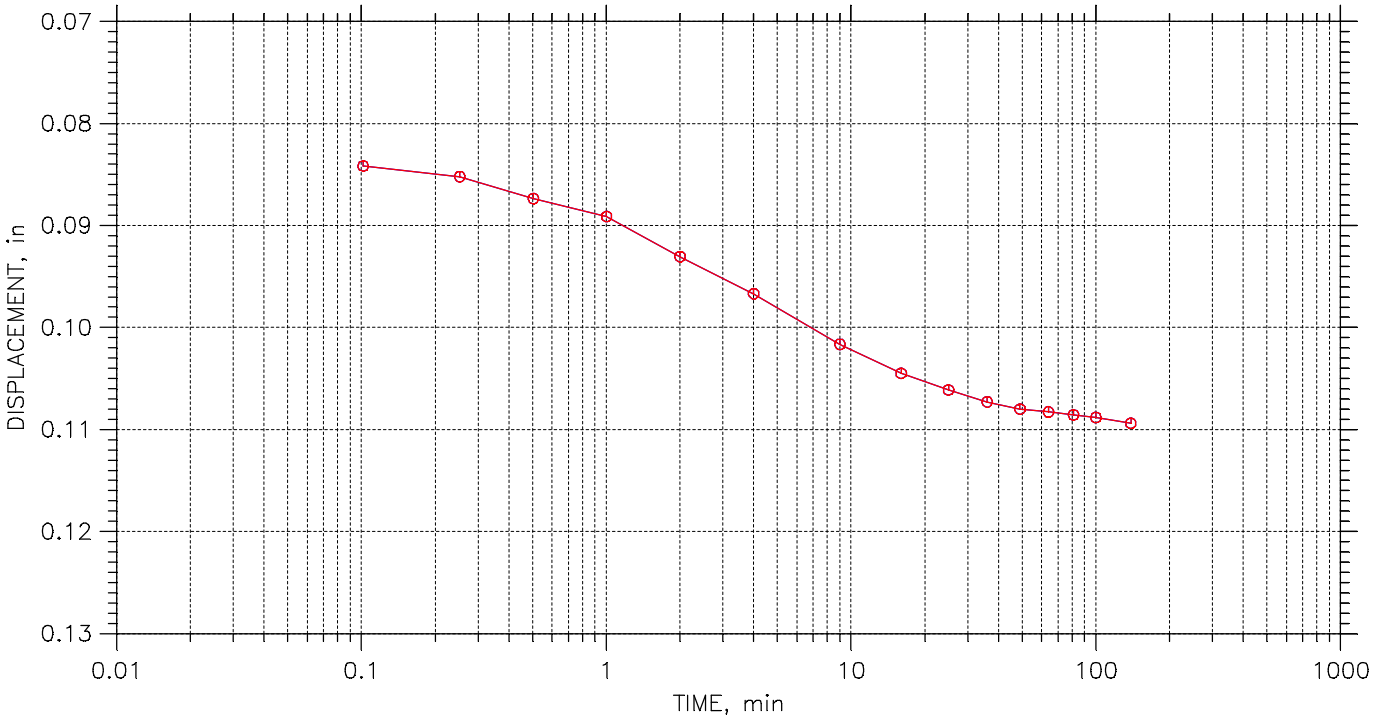
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

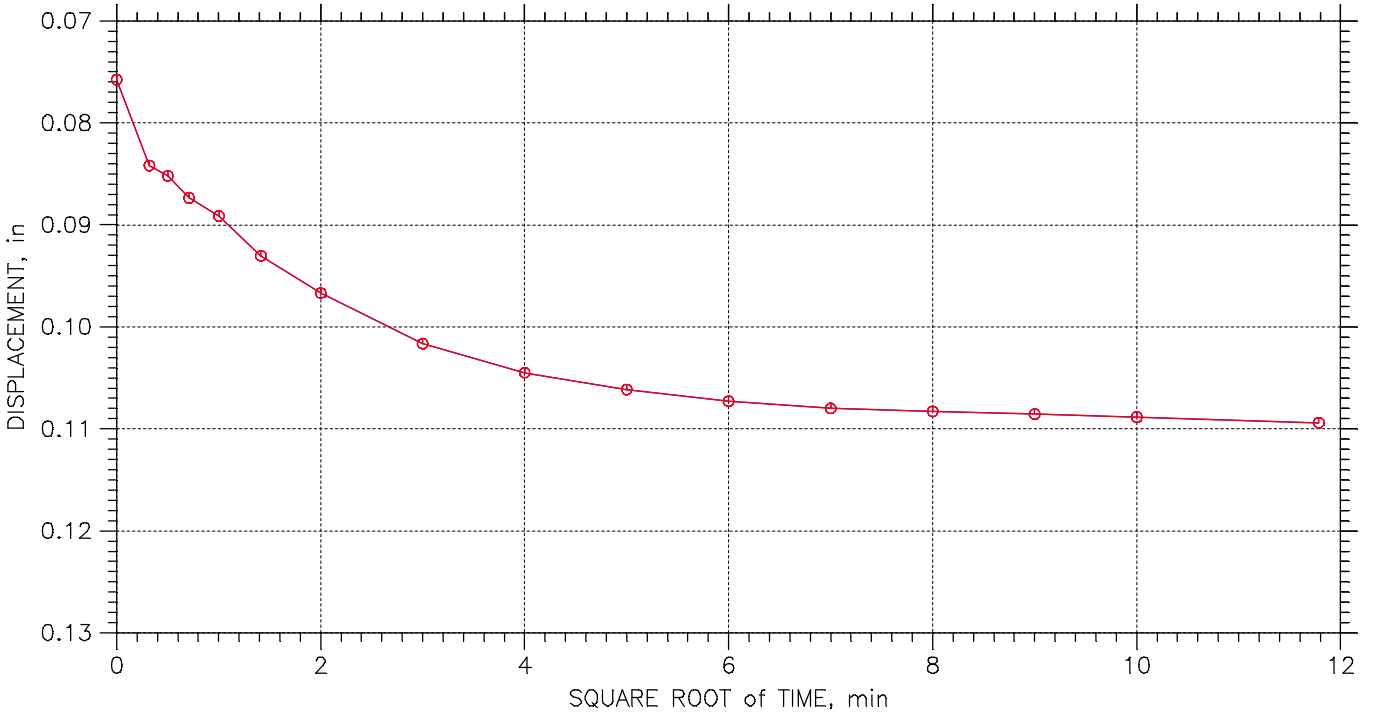
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 15 of 23

Stress: 4. tsf





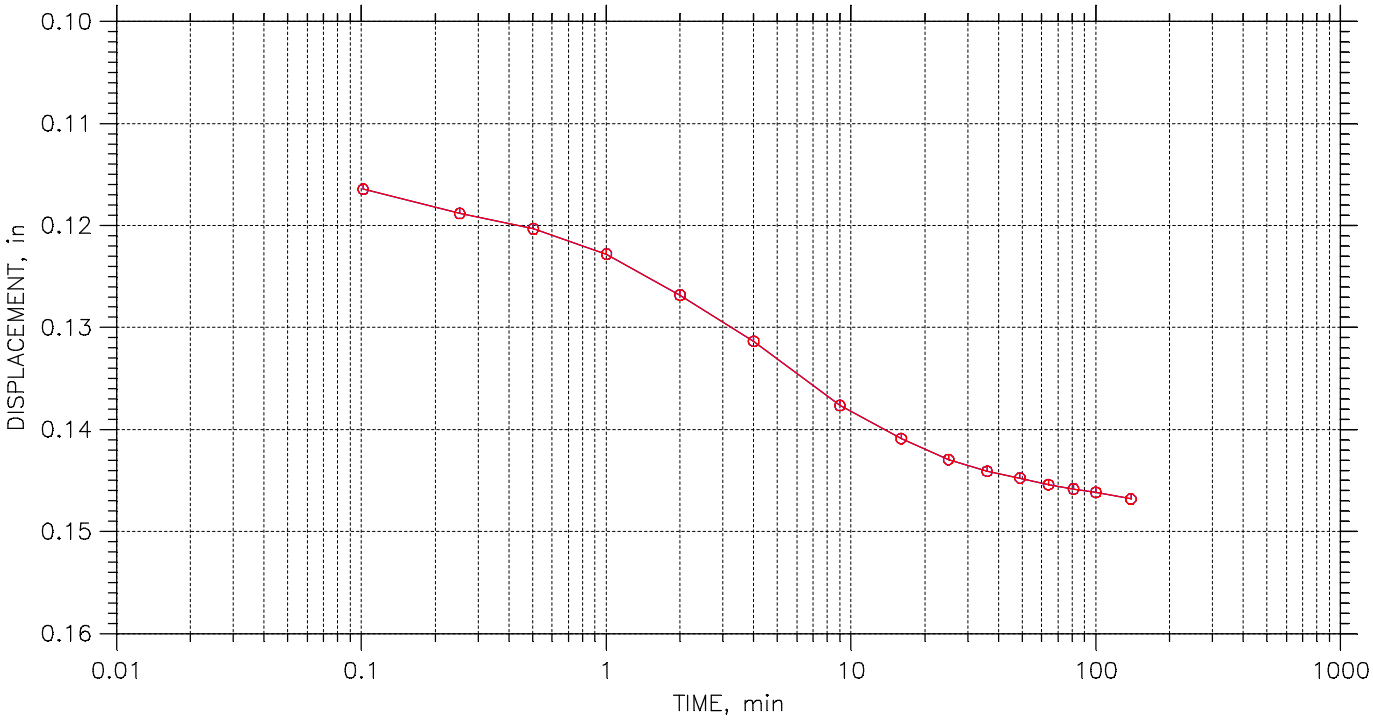
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

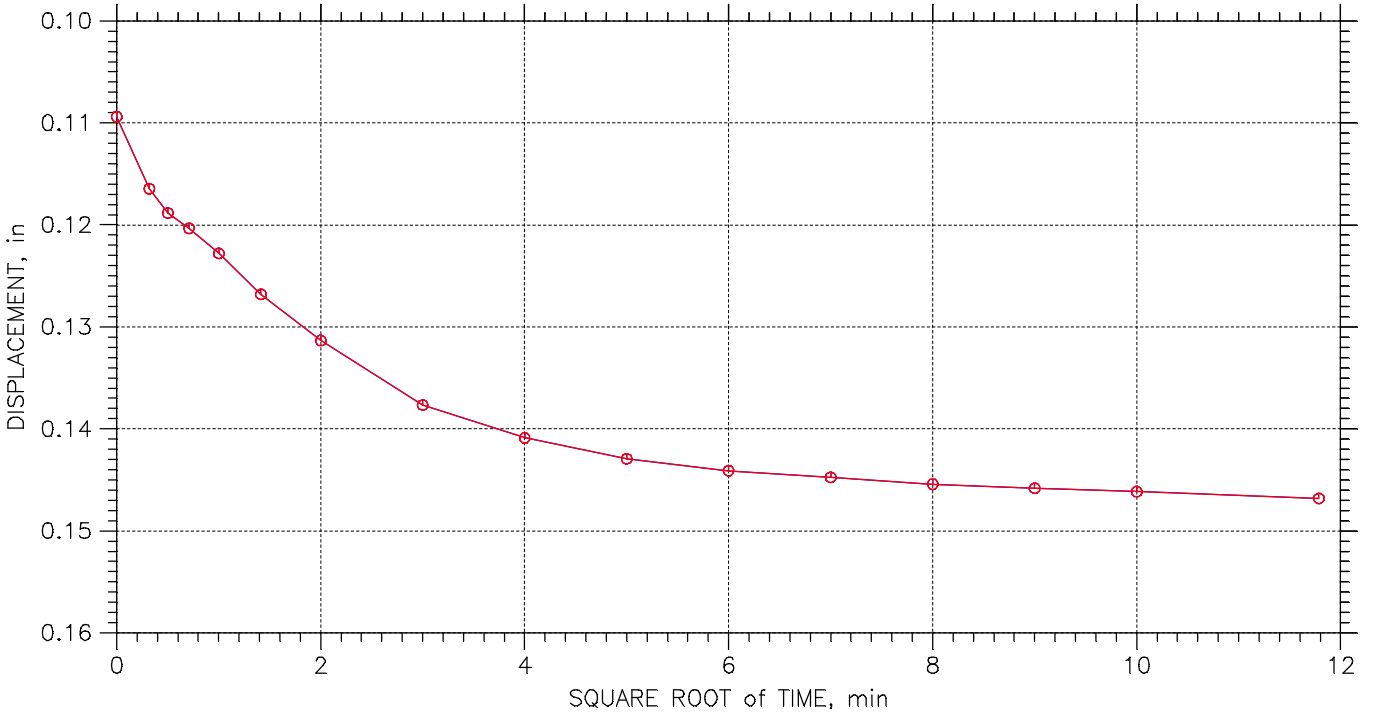
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 16 of 23

Stress: 8. tsf





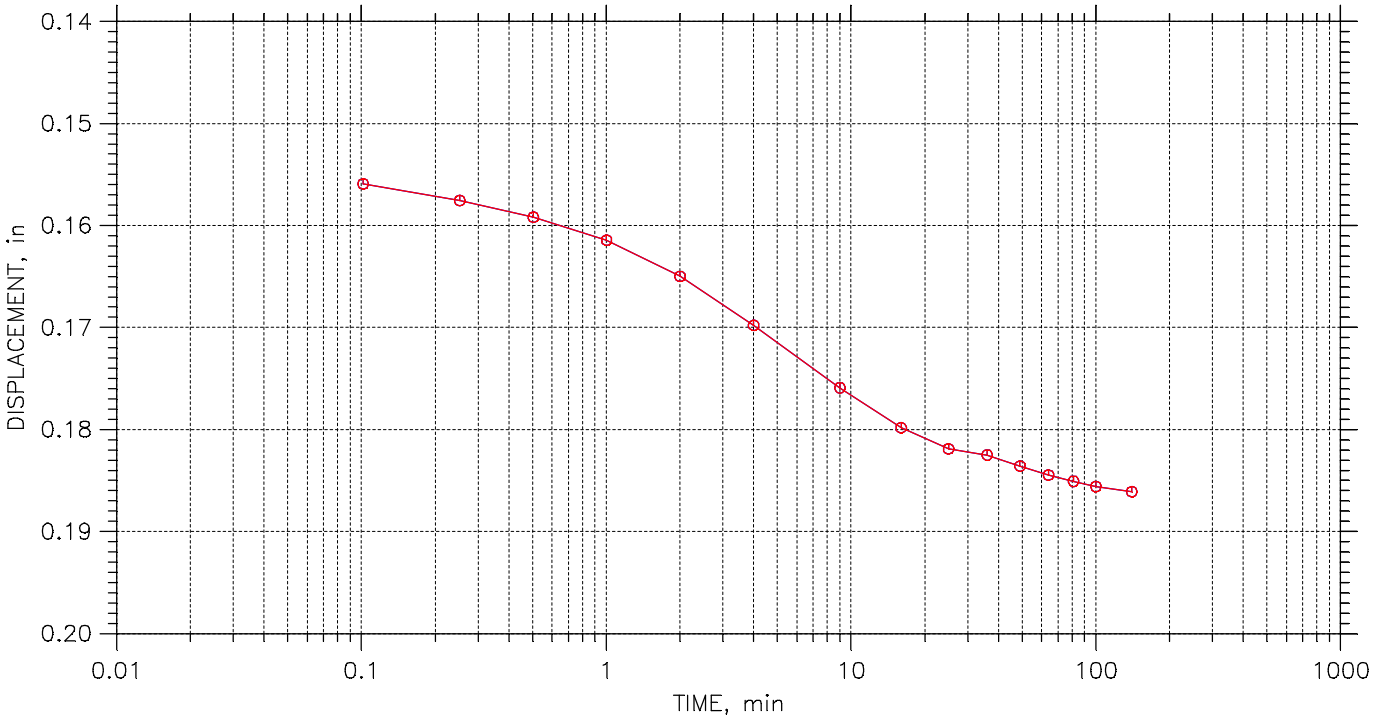
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

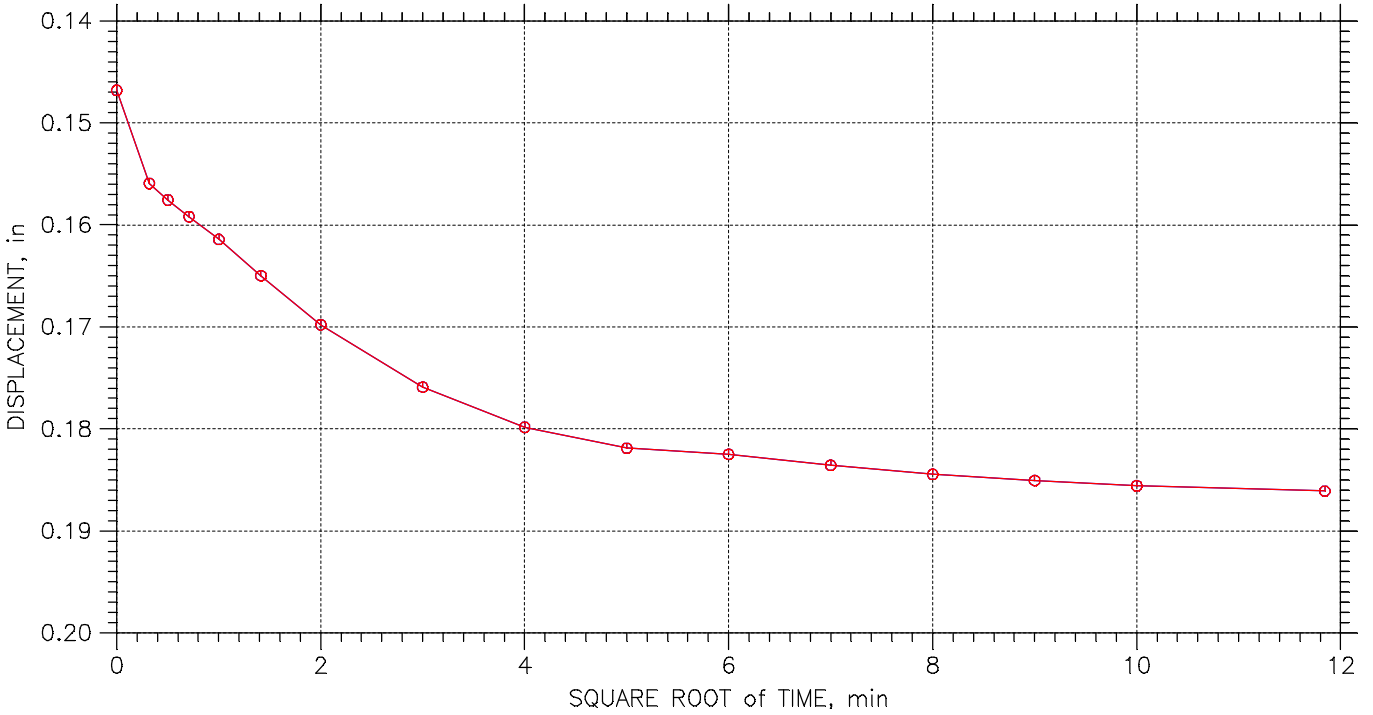
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 17 of 23

Stress: 16. tsf





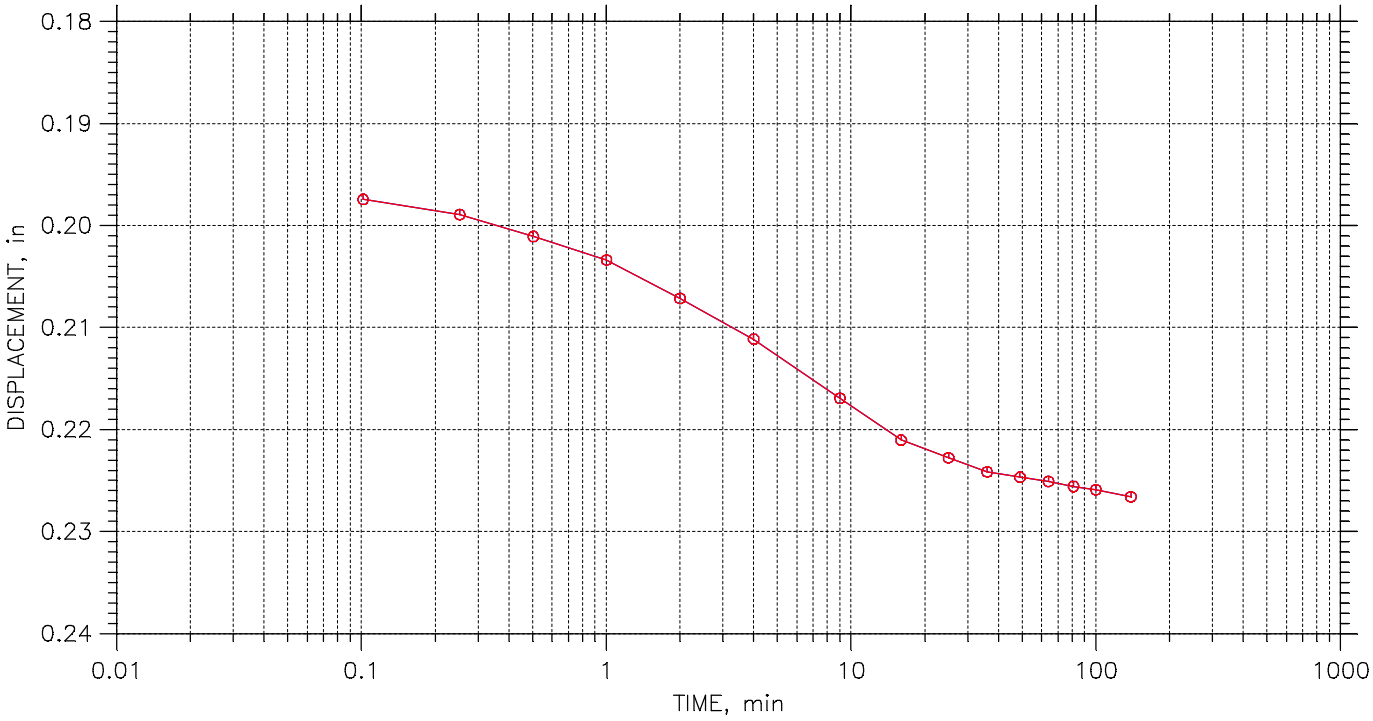
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

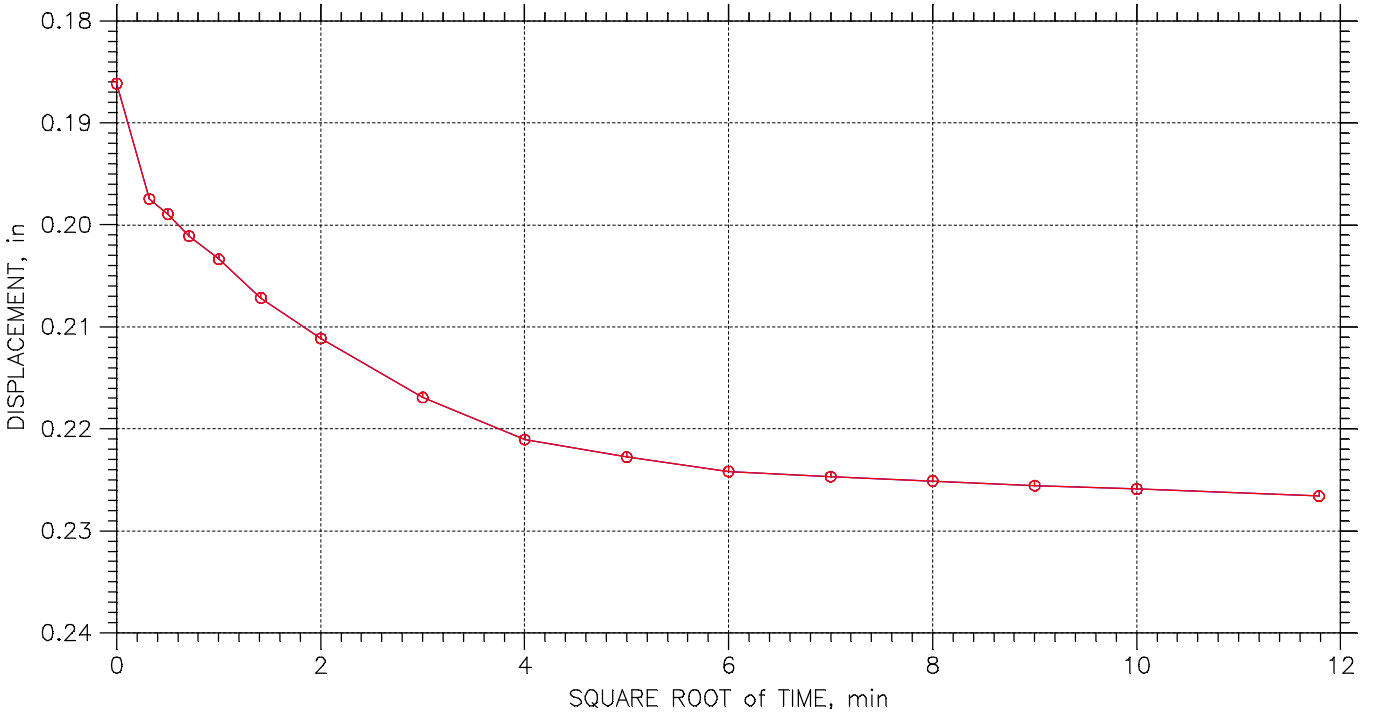
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 18 of 23

Stress: 32. tsf





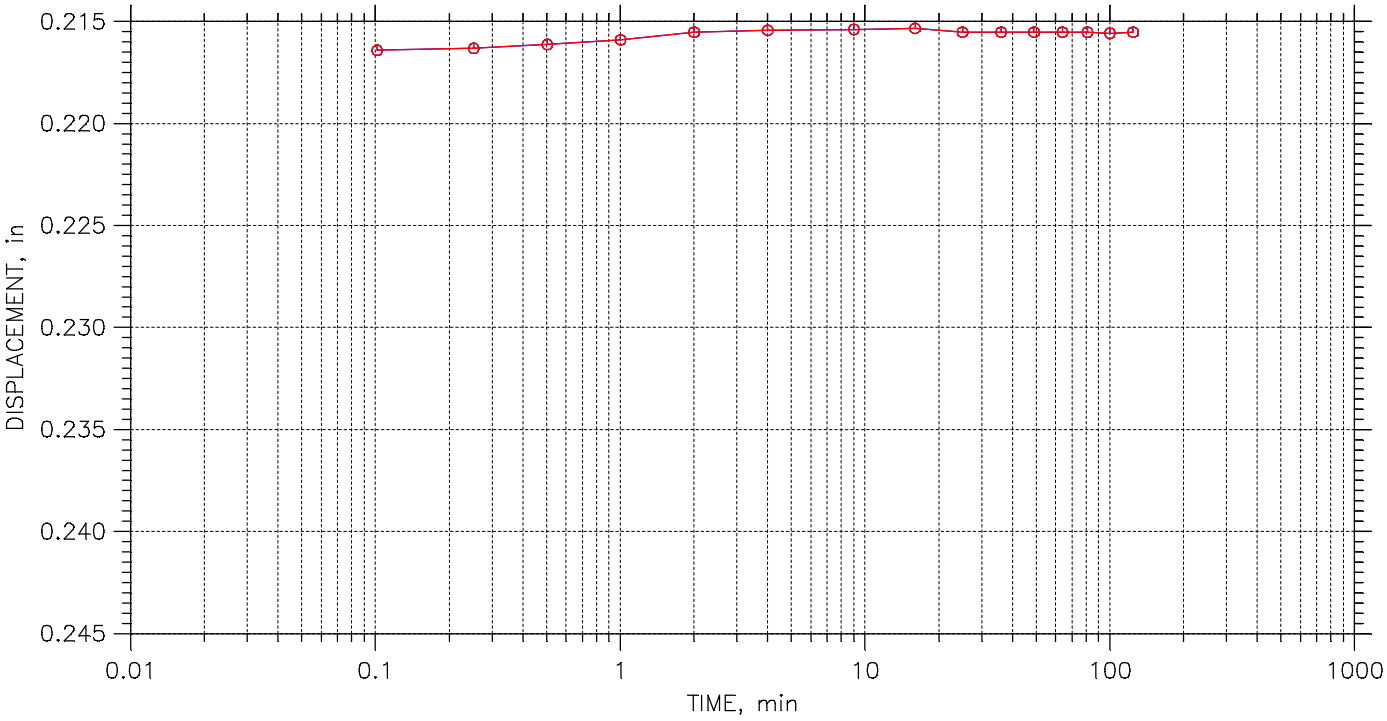
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

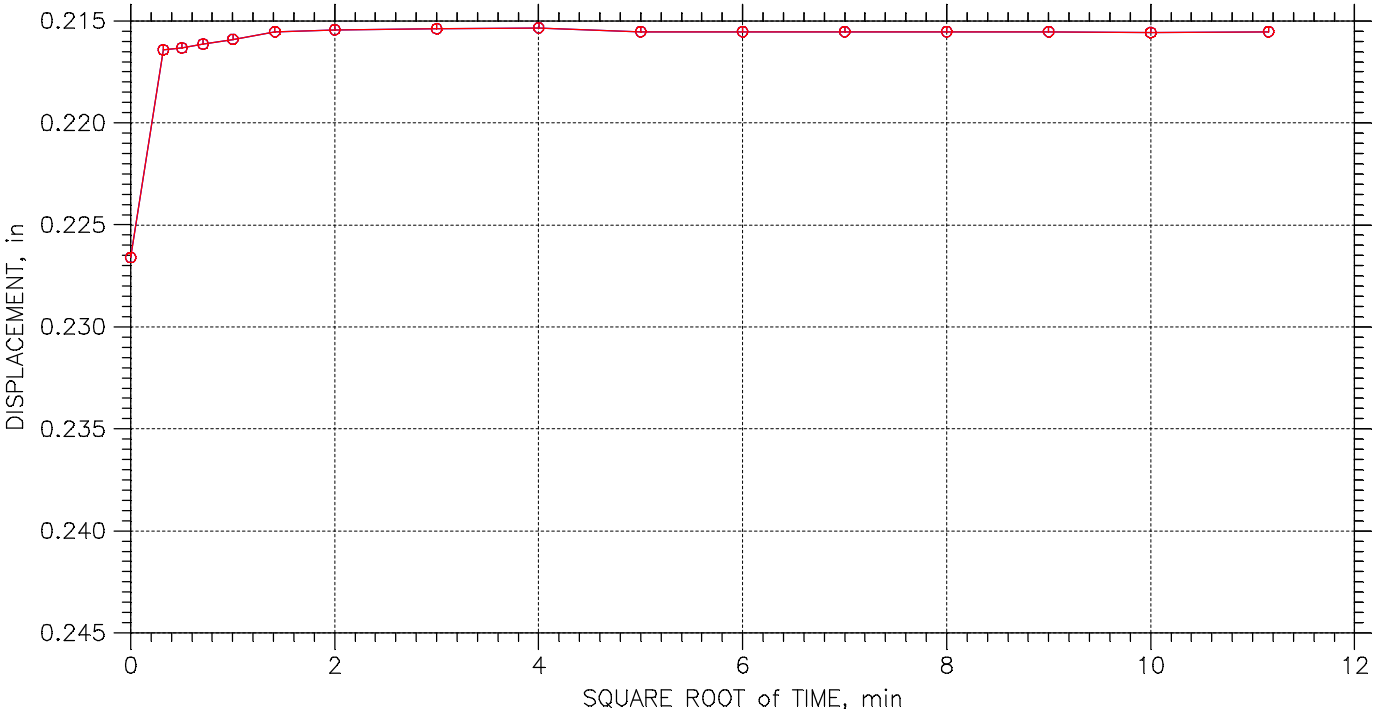
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 19 of 23

Stress: 16. tsf





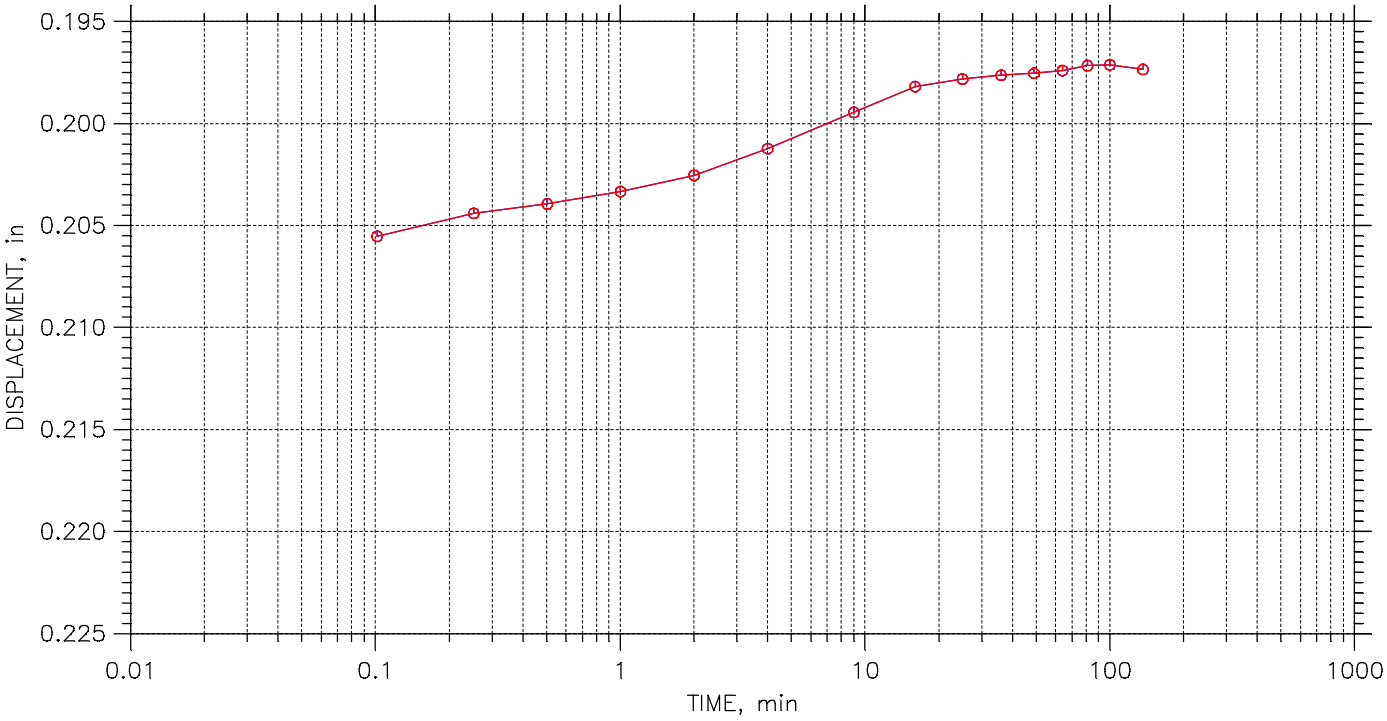
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

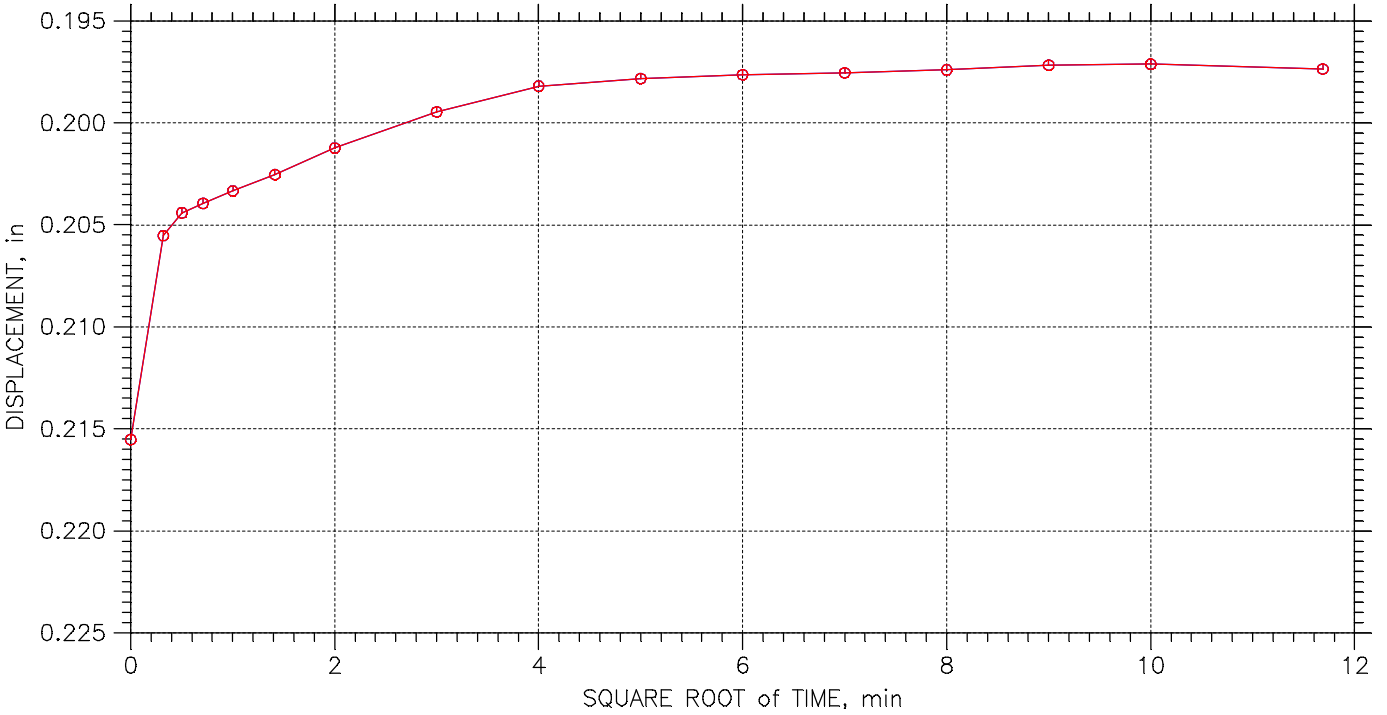
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 20 of 23

Stress: 4. tsf





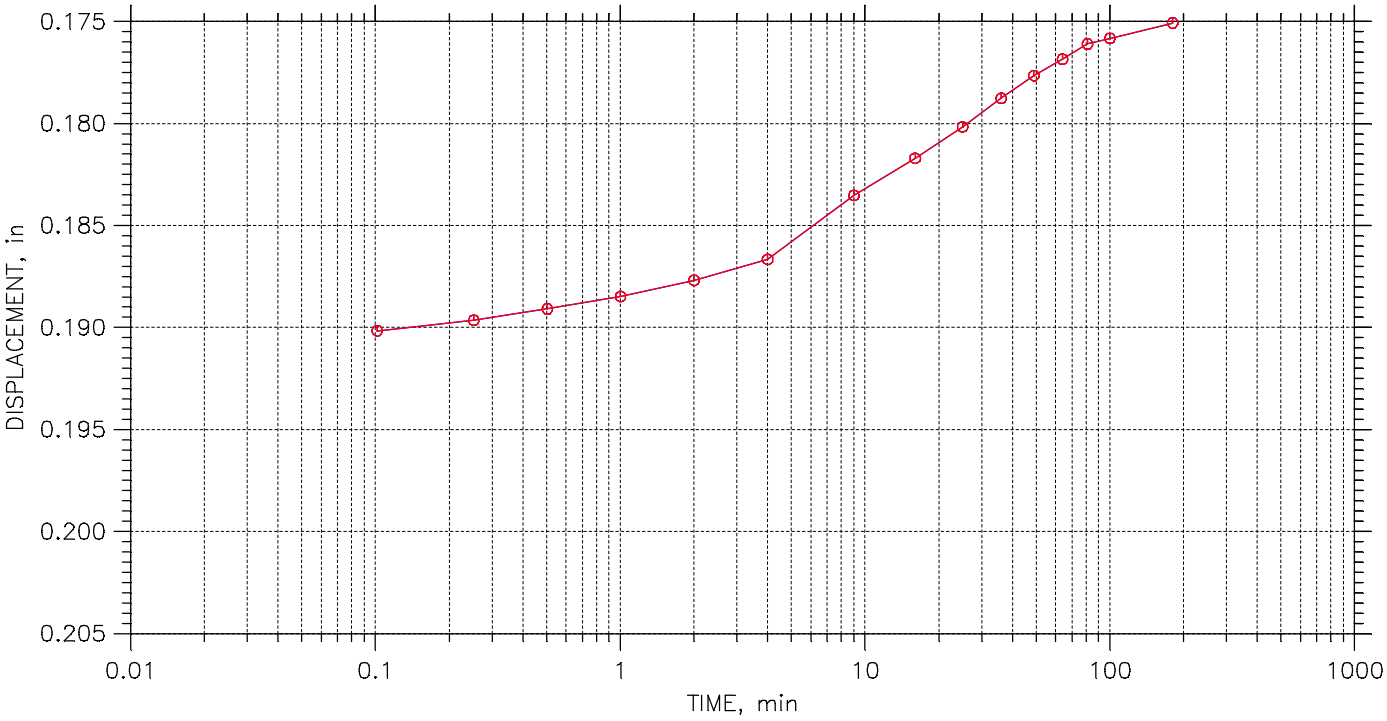
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

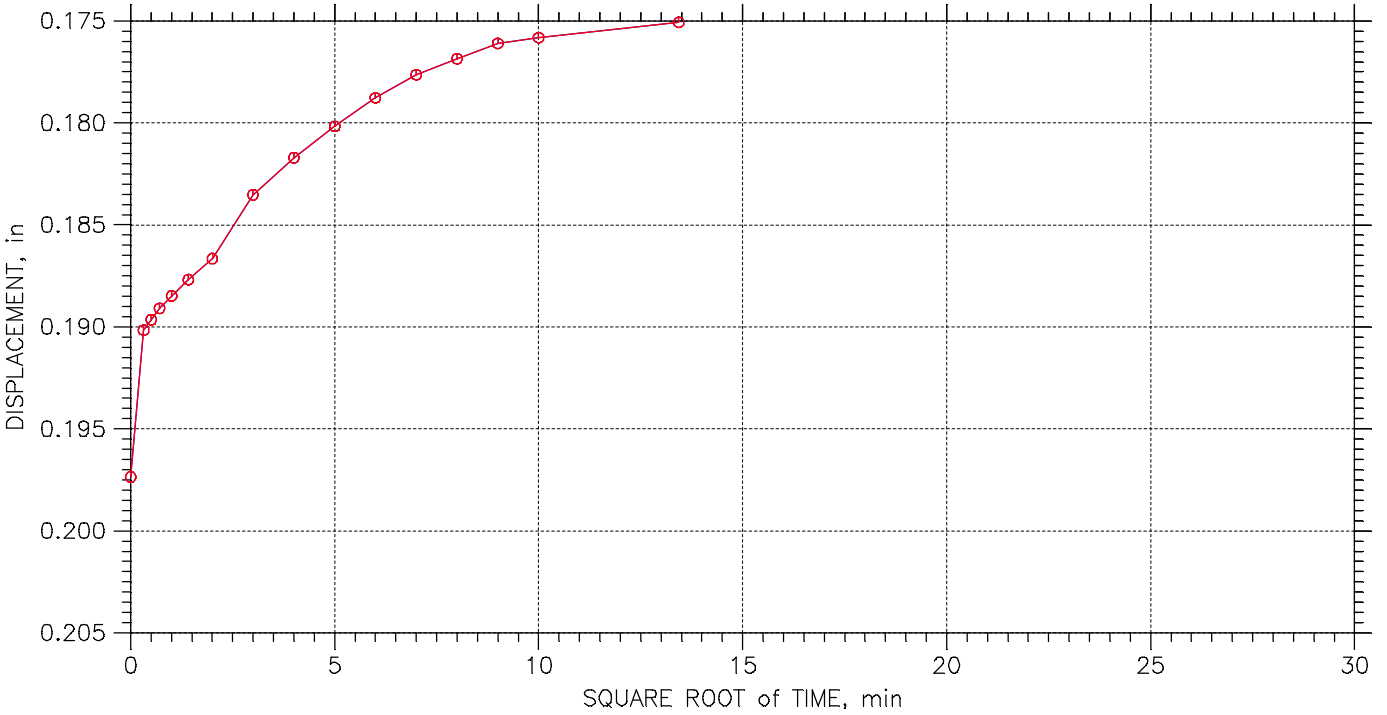
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 21 of 23

Stress: 1. tsf





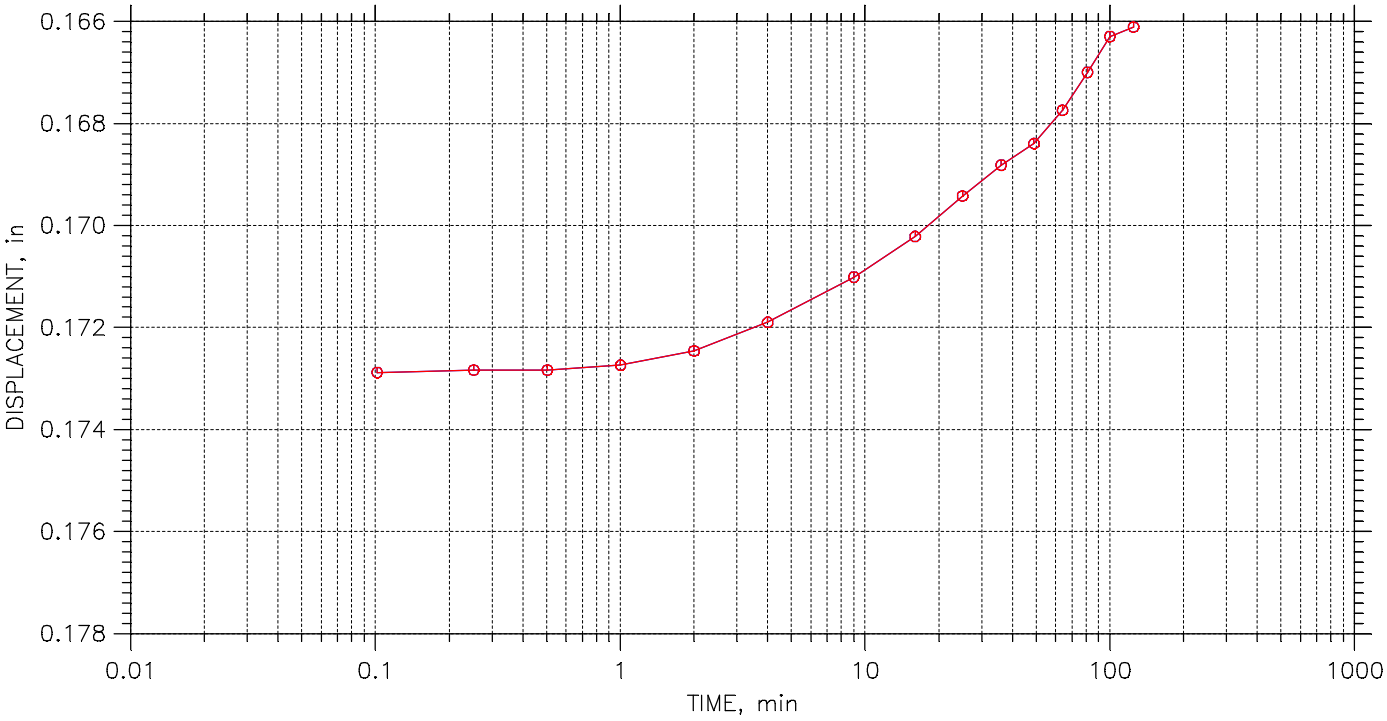
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

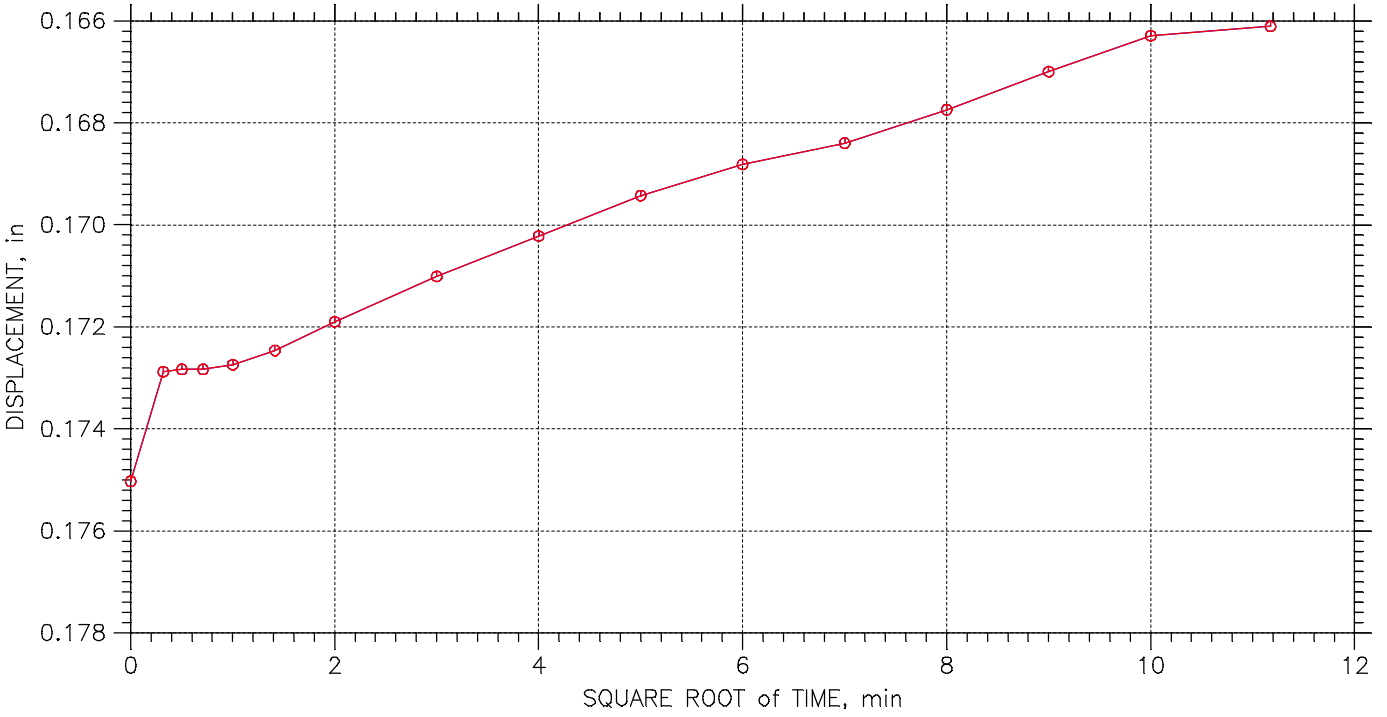
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 22 of 23

Stress: 0.5 tsf





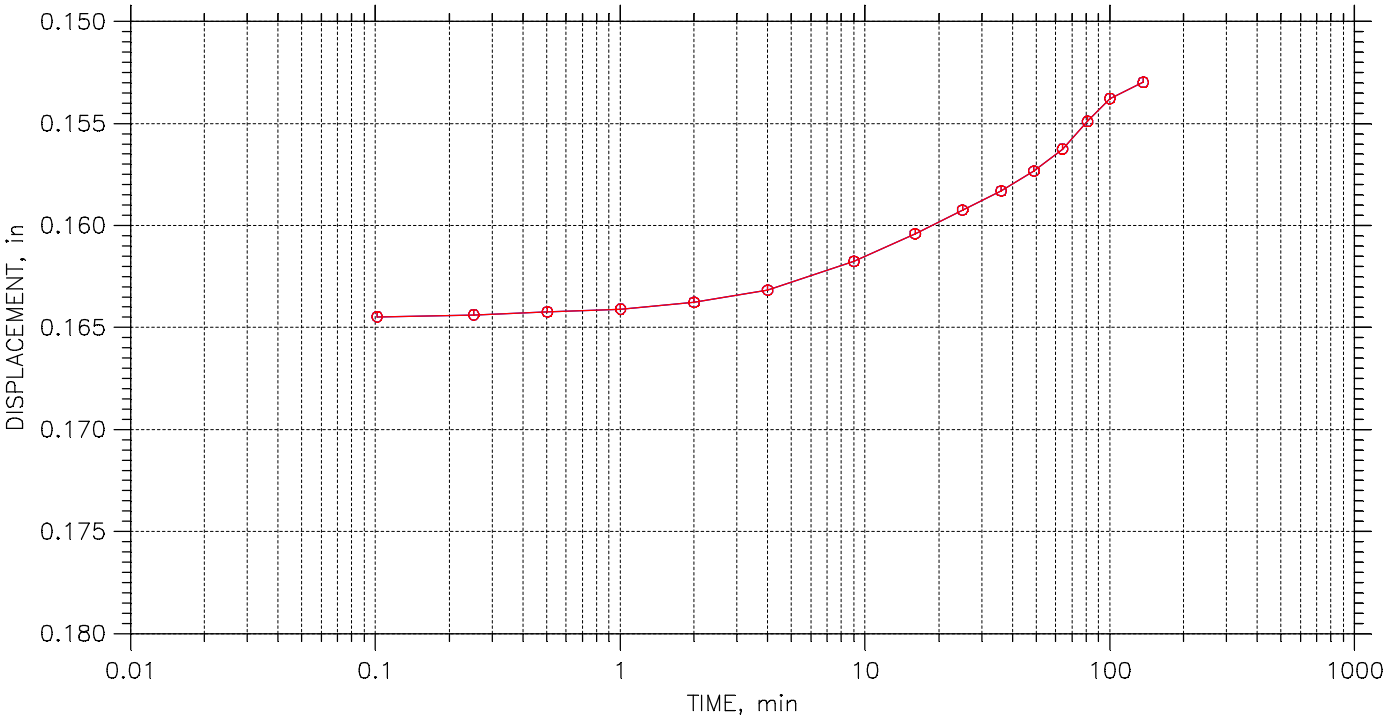
Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

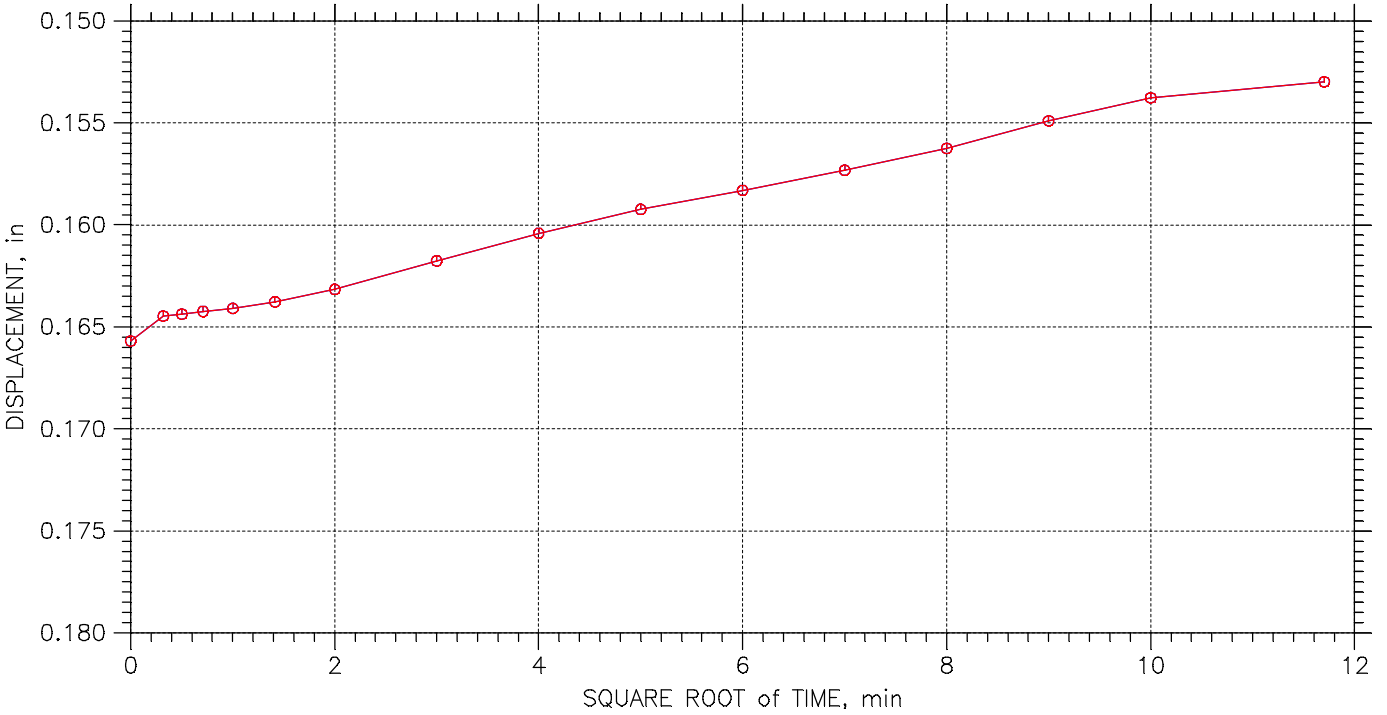
CONSOLIDATION TEST DATA

TIME CURVES

Constant Load Step: 23 of 23

Stress: 0.125 tsf

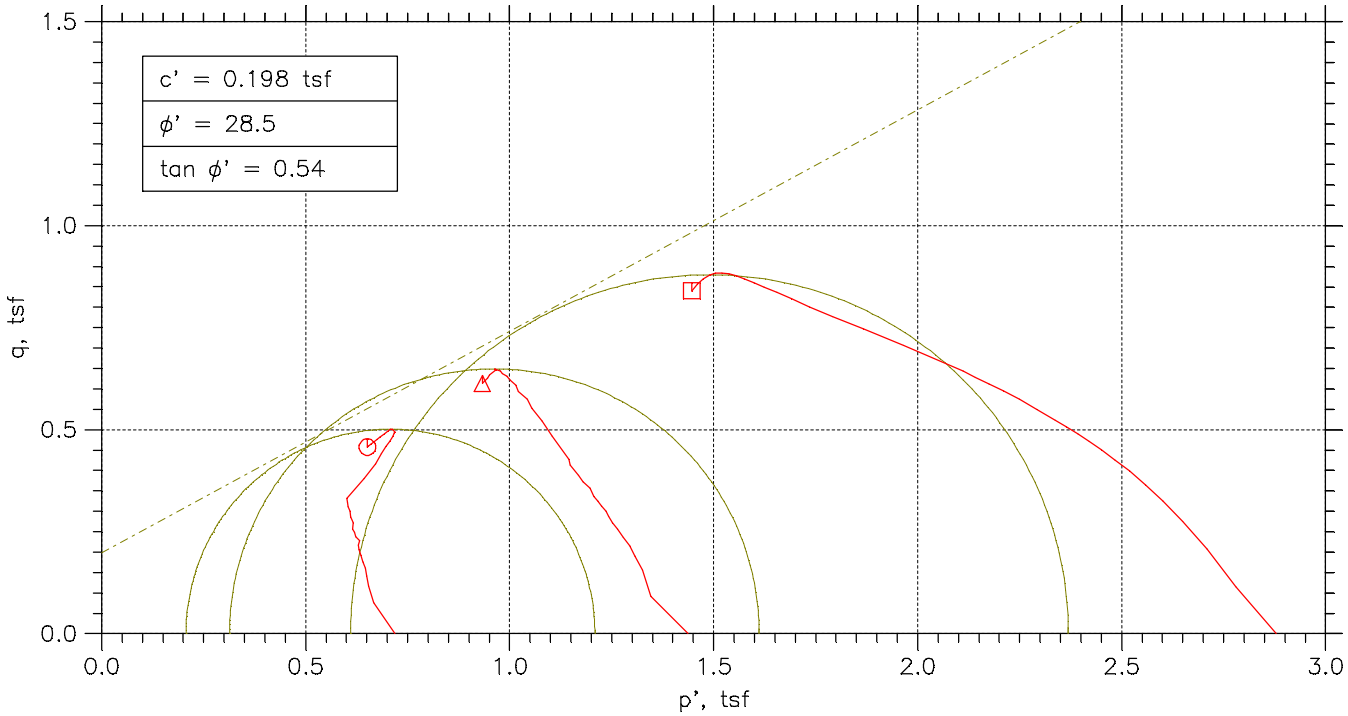


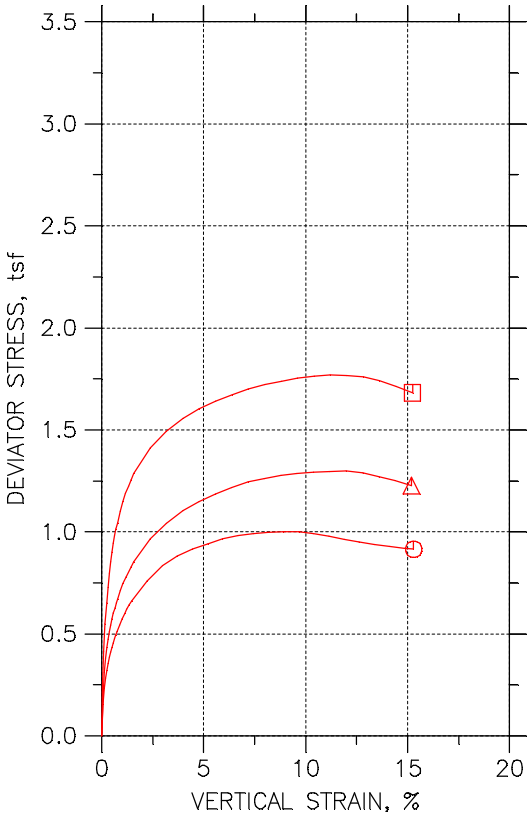


Terracon Consulting Engineers & Scientists	Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
	Boring No.: EDW-B008 S5	Tested By: HP	Checked By: BCM
	Sample No.: S-5	Test Date: 10/26/15	Depth: 11.0'-13.0'
	Test No.: EDWB008S5	Sample Type: 3.0" ST	Elevation: -----
	Description: BROWN AND GRAY FAT CLAY WITH SAND CH		
	Remarks: Pc = 0.93 tsf Cc = 0.292 Ccr = 0.037 TEST PERFORMED AS PER ASTM D2435		

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

Terracon
Consulting Engineers & Scientists





Symbol		⏲	△	⊡	
Test No.		10.0 PSI	20.0 PSI	40.0 PSI	
Initial	Diameter, in	2.8213	2.8323	2.8173	
	Height, in	6.3035	6.2161	6.1913	
	Water Content, %	75.11	79.41	77.79	
	Dry Density, pcf	54.95	52.86	53.58	
	Saturation, %	99.96	99.73	99.68	
	Void Ratio	1.9536	2.0704	2.0291	
Before Shear	Water Content, %	68.95	65.19	53.75	
	Dry Density, pcf	58.12	60.23	67.7	
	Saturation, %	100.00	100.00	100.00	
	Void Ratio	1.7926	1.6948	1.3974	
	Back Press., tsf	5.0417	5.0434	5.0421	
Minor Prin. Stress, tsf		0.71831	1.4366	2.8779	
Max. Dev. Stress, tsf		1.0023	1.2984	1.7688	
Time to Failure, min		780	900	840	
Strain Rate, %/min		0.02	0.02	0.02	
B-Value		0.96	0.99	0.95	
Estimated Specific Gravity		2.60	2.60	2.60	
Liquid Limit		72	72	72	
Plastic Limit		37	37	37	
Plasticity Index		35	35	35	

Project: DYNEGY EDWARDS
Location: BARTONVILLE, IL
Project No.: MR155218
Boring No.: EDW006 S9
Sample Type: 3.0" ST

Failure Sketch



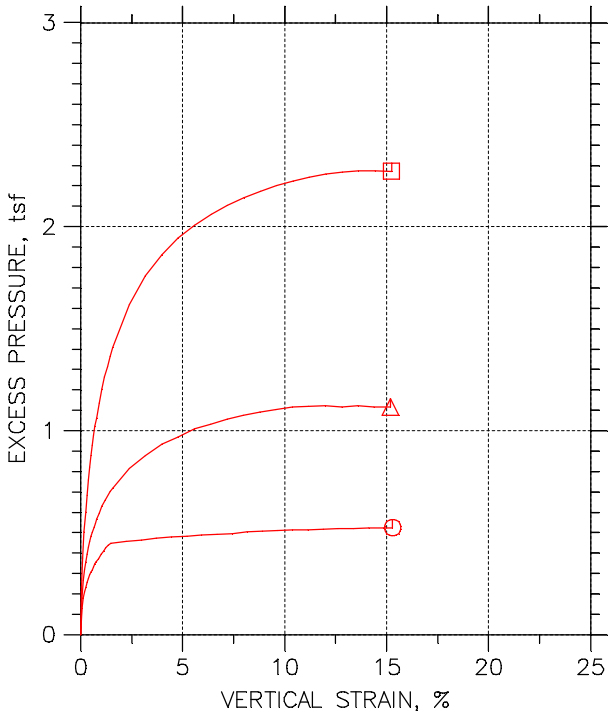
Description: DARK GRAY ORGANIC SILT OH SHELL NOTED

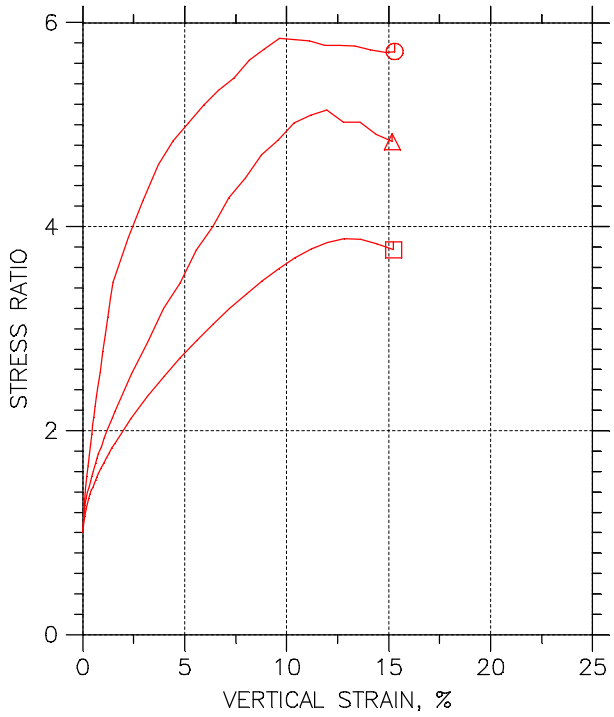
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

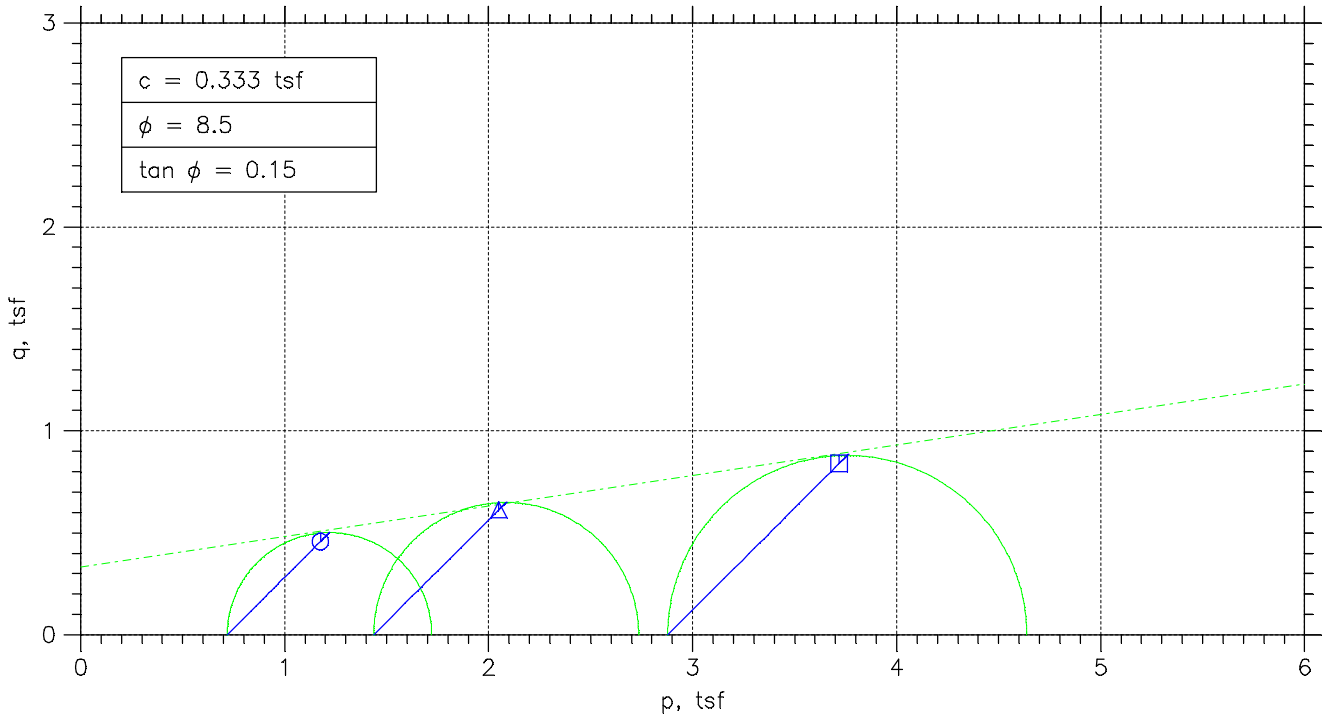
Mon, 16-NOV-2015 19:59:37

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

Terracon
Consulting Engineers & Scientists







Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
Boring No.: EDW006 S9	Tested By: BCM	Checked By: WPQ
Sample No.: S-9	Test Date: 10/29/15	Depth: 26.0'-28.0'
Test No.: EDW006 S9	Sample Type: 3.0" ST	Elevation: ----
Description: DARK GRAY ORGANIC SILT OH SHELL NOTED		
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.		

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW006 S9
Sample No.: S-9
Test No.: 10.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: DARK GRAY ORGANIC SILT OH SHELL NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.30 in
Specimen Area: 6.25 in^2
Specimen Volume: 39.41 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 72

Plastic Limit: 37

Estimated Specific Gravity: 2.60

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.2514	0	0	5.0417	5.76	5.76
2	5.0001	0.062925	6.2553	13.244	0.15244	5.17	5.76	5.9124
3	10	0.12448	6.2592	20.256	0.233	5.2217	5.76	5.993
4	15	0.18877	6.2632	24.54	0.28211	5.2513	5.76	6.0421
5	20	0.2517	6.2672	27.823	0.31965	5.2728	5.76	6.0796
6	25	0.31326	6.271	30.773	0.35331	5.2966	5.76	6.1133
7	30	0.37618	6.275	33.555	0.38502	5.3169	5.76	6.145
8	35	0.43911	6.279	35.892	0.41157	5.3355	5.76	6.1716
9	40	0.4993	6.2828	37.896	0.43428	5.3483	5.76	6.1943
10	45	0.56085	6.2866	39.843	0.45632	5.3564	5.76	6.2163
11	50	0.62241	6.2905	41.568	0.47578	5.375	5.76	6.2358
12	55	0.68534	6.2945	43.405	0.49649	5.3878	5.76	6.2565
13	60	0.74689	6.2984	44.74	0.51144	5.4	5.76	6.2714
14	70	0.87137	6.3063	47.578	0.5432	5.4145	5.76	6.3032
15	80.001	0.99586	6.3143	50.305	0.57361	5.4371	5.76	6.3336
16	90.001	1.119	6.3221	52.698	0.60015	5.4511	5.76	6.3602
17	100	1.2393	6.3298	54.645	0.62158	5.4662	5.76	6.3816
18	110	1.3625	6.3377	56.704	0.64419	5.4795	5.76	6.4042
19	120	1.4856	6.3457	58.429	0.66296	5.49	5.76	6.423
20	180	2.2256	6.3937	67.5	0.76012	5.4975	5.76	6.5201
21	240	2.9766	6.4432	74.567	0.83326	5.5045	5.76	6.5933
22	300	3.7112	6.4923	79.52	0.88187	5.5155	5.76	6.6419
23	360	4.4485	6.5424	83.304	0.91676	5.5214	5.76	6.6768
24	420	5.2009	6.5943	86.308	0.94235	5.5254	5.76	6.7024
25	480	5.9368	6.6459	89.202	0.96639	5.5295	5.76	6.7264
26	540	6.6769	6.6986	91.372	0.98211	5.5335	5.76	6.7421
27	600	7.4293	6.7531	92.93	0.99081	5.5376	5.76	6.7508
28	660	8.1638	6.8071	94.322	0.99766	5.5446	5.76	6.7577
29	720	8.9039	6.8624	95.435	1.0013	5.5486	5.76	6.7613
30	780	9.6562	6.9196	96.325	1.0023	5.5533	5.76	6.7623
31	840	10.394	6.9765	96.047	0.99124	5.555	5.76	6.7512
32	900	11.131	7.0344	95.768	0.98023	5.5568	5.76	6.7402
33	960	11.883	7.0944	94.878	0.9629	5.5585	5.76	6.7229
34	1020	12.607	7.1532	94.489	0.95107	5.5608	5.76	6.7111
35	1080	13.351	7.2146	94.043	0.93853	5.5632	5.76	6.6985
36	1140	14.11	7.2784	93.876	0.92866	5.5637	5.76	6.6887
37	1200	14.841	7.3408	93.71	0.91912	5.5649	5.76	6.6791
38	1236.6	15.291	7.3798	93.765	0.91481	5.5661	5.76	6.6748

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW006 S9
Sample No.: S-9
Test No.: 10.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: DARK GRAY ORGANIC SILT OH SHELL NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.30 in
Specimen Area: 6.25 in^2
Specimen Volume: 39.41 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 72

Plastic Limit: 37

Estimated Specific Gravity: 2.60

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	5.76	5.76	0	0.000	0.71831	0.71831	1.000	0.71831	0
2	0.06	5.9124	5.76	0.12834	0.842	0.74242	0.58998	1.258	0.6662	0.07622
3	0.12	5.993	5.76	0.18002	0.773	0.77129	0.53829	1.433	0.65479	0.1165
4	0.19	6.0421	5.76	0.20963	0.743	0.79079	0.50868	1.555	0.64973	0.14105
5	0.25	6.0796	5.76	0.23112	0.723	0.80684	0.48719	1.656	0.64702	0.15982
6	0.31	6.1133	5.76	0.25493	0.722	0.8167	0.46338	1.762	0.64004	0.17666
7	0.38	6.145	5.76	0.27525	0.715	0.82807	0.44306	1.869	0.63556	0.19251
8	0.44	6.1716	5.76	0.29384	0.714	0.83605	0.42447	1.970	0.63026	0.20579
9	0.50	6.1943	5.76	0.30661	0.706	0.84598	0.4117	2.055	0.62884	0.21714
10	0.56	6.2163	5.76	0.31474	0.690	0.85989	0.40357	2.131	0.63173	0.22816
11	0.62	6.2358	5.76	0.33333	0.701	0.86077	0.38499	2.236	0.62288	0.23789
12	0.69	6.2565	5.76	0.3461	0.697	0.8687	0.37221	2.334	0.62045	0.24824
13	0.75	6.2714	5.76	0.3583	0.701	0.87146	0.36002	2.421	0.61574	0.25572
14	0.87	6.3032	5.76	0.37281	0.686	0.8887	0.3455	2.572	0.6171	0.2716
15	1.00	6.3336	5.76	0.39546	0.689	0.89647	0.32285	2.777	0.60966	0.28681
16	1.12	6.3602	5.76	0.4094	0.682	0.90907	0.30891	2.943	0.60899	0.30008
17	1.24	6.3816	5.76	0.4245	0.683	0.91539	0.29382	3.116	0.6046	0.31079
18	1.36	6.4042	5.76	0.43785	0.680	0.92465	0.28046	3.297	0.60255	0.3221
19	1.49	6.423	5.76	0.4483	0.676	0.93297	0.27001	3.455	0.60149	0.33148
20	2.23	6.5201	5.76	0.45585	0.600	1.0226	0.26246	3.896	0.64252	0.38006
21	2.98	6.5933	5.76	0.46282	0.555	1.0887	0.25549	4.261	0.67212	0.41663
22	3.71	6.6419	5.76	0.47386	0.537	1.1263	0.24446	4.608	0.68539	0.44094
23	4.45	6.6768	5.76	0.47966	0.523	1.1554	0.23865	4.841	0.69703	0.45838
24	5.20	6.7024	5.76	0.48373	0.513	1.1769	0.23458	5.017	0.70576	0.47118
25	5.94	6.7264	5.76	0.48779	0.505	1.1969	0.23052	5.192	0.71371	0.48319
26	6.68	6.7421	5.76	0.49186	0.501	1.2086	0.22645	5.337	0.71751	0.49106
27	7.43	6.7508	5.76	0.49592	0.501	1.2132	0.22239	5.455	0.71779	0.4954
28	8.16	6.7577	5.76	0.50289	0.504	1.2131	0.21542	5.631	0.71425	0.49883
29	8.90	6.7613	5.76	0.50696	0.506	1.2127	0.21136	5.738	0.712	0.50065
30	9.66	6.7623	5.76	0.5116	0.510	1.209	0.20671	5.849	0.70785	0.50114
31	10.39	6.7512	5.76	0.51334	0.518	1.1962	0.20497	5.836	0.70059	0.49562
32	11.13	6.7402	5.76	0.51509	0.525	1.1835	0.20323	5.823	0.69334	0.49012
33	11.88	6.7229	5.76	0.51683	0.537	1.1644	0.20148	5.779	0.68293	0.48145
34	12.61	6.7111	5.76	0.51915	0.546	1.1502	0.19916	5.775	0.6747	0.47554
35	13.35	6.6985	5.76	0.52147	0.556	1.1354	0.19684	5.768	0.6661	0.46927
36	14.11	6.6887	5.76	0.52205	0.562	1.1249	0.19626	5.732	0.66058	0.46433
37	14.84	6.6791	5.76	0.52322	0.569	1.1142	0.1951	5.711	0.65466	0.45956
38	15.29	6.6748	5.76	0.52438	0.573	1.1087	0.19393	5.717	0.65134	0.4574

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW006 S9
Sample No.: S-9
Test No.: 20.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: DARK GRAY ORGANIC SILT OH SHELL NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.22 in
Specimen Area: 6.30 in^2
Specimen Volume: 39.16 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 72

Plastic Limit: 37

Estimated Specific Gravity: 2.60

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.3003	0	0	5.0434	6.48	6.48
2	5.0002	0.053874	6.3037	16.056	0.18339	5.2253	6.48	6.6634
3	10	0.11698	6.3077	27.272	0.3113	5.3105	6.48	6.7913
4	15	0.18163	6.3118	33.307	0.37994	5.363	6.48	6.8599
5	20	0.24782	6.316	37.862	0.43162	5.4014	6.48	6.9116
6	25	0.31247	6.3201	41.506	0.47285	5.4382	6.48	6.9528
7	30	0.3802	6.3244	44.922	0.51142	5.4714	6.48	6.9914
8	35	0.44639	6.3286	47.826	0.54411	5.5006	6.48	7.0241
9	40	0.51412	6.3329	50.502	0.57417	5.5245	6.48	7.0542
10	45	0.57876	6.337	52.95	0.60161	5.5449	6.48	7.0816
11	50	0.64649	6.3413	55.228	0.62706	5.5682	6.48	7.1071
12	55	0.71268	6.3456	57.391	0.65119	5.5898	6.48	7.1312
13	60	0.77887	6.3498	59.327	0.67271	5.6102	6.48	7.1527
14	70	0.91279	6.3584	62.857	0.71177	5.6382	6.48	7.1918
15	80.001	1.0467	6.367	65.988	0.74622	5.6732	6.48	7.2262
16	90.001	1.1791	6.3755	68.778	0.77673	5.7	6.48	7.2567
17	110	1.4485	6.3929	73.504	0.82783	5.7449	6.48	7.3078
18	120	1.5824	6.4016	75.895	0.8536	5.7619	6.48	7.3336
19	180	2.3828	6.4541	86.713	0.96734	5.8598	6.48	7.4473
20	240	3.1817	6.5074	94.171	1.0419	5.9216	6.48	7.5219
21	300	3.9805	6.5615	100.66	1.1046	5.9782	6.48	7.5846
22	360	4.7763	6.6164	105.5	1.1481	6.0115	6.48	7.6281
23	420	5.5721	6.6721	109.89	1.1858	6.0517	6.48	7.6658
24	480	6.371	6.729	113.87	1.2184	6.0739	6.48	7.6984
25	540	7.1745	6.7873	117.29	1.2442	6.1013	6.48	7.7242
26	600	7.978	6.8465	119.96	1.2616	6.1176	6.48	7.7416
27	660	8.7738	6.9063	122.35	1.2756	6.1357	6.48	7.7556
28	720	9.5758	6.9675	124.58	1.2873	6.1456	6.48	7.7673
29	780	10.378	7.0299	126.17	1.2922	6.1584	6.48	7.7722
30	840	11.177	7.0931	127.76	1.2969	6.1631	6.48	7.7769
31	900	11.976	7.1575	129.07	1.2984	6.1666	6.48	7.7784
32	960	12.787	7.224	129.36	1.2893	6.1596	6.48	7.7693
33	1020	13.584	7.2907	128.62	1.2702	6.1643	6.48	7.7502
34	1080	14.381	7.3586	127.93	1.2518	6.1596	6.48	7.7318
35	1140	15.18	7.4279	126.51	1.2263	6.1602	6.48	7.7063

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW006 S9
Sample No.: S-9
Test No.: 20.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: DARK GRAY ORGANIC SILT OH SHELL NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.22 in
Specimen Area: 6.30 in^2
Specimen Volume: 39.16 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 72

Plastic Limit: 37

Estimated Specific Gravity: 2.60

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	6.48	6.48	0	0.000	1.4366	1.4366	1.000	1.4366	0
2	0.05	6.6634	6.48	0.18195	0.992	1.4381	1.2547	1.146	1.3464	0.091693
3	0.12	6.7913	6.48	0.2671	0.858	1.4808	1.1695	1.266	1.3252	0.15565
4	0.18	6.8599	6.48	0.31958	0.841	1.497	1.117	1.340	1.307	0.18997
5	0.25	6.9116	6.48	0.35807	0.830	1.5102	1.0786	1.400	1.2944	0.21581
6	0.31	6.9528	6.48	0.39482	0.835	1.5147	1.0418	1.454	1.2782	0.23642
7	0.38	6.9914	6.48	0.42806	0.837	1.52	1.0086	1.507	1.2643	0.25571
8	0.45	7.0241	6.48	0.45722	0.840	1.5235	0.97941	1.556	1.2515	0.27206
9	0.51	7.0542	6.48	0.48113	0.838	1.5297	0.9555	1.601	1.2426	0.28708
10	0.58	7.0816	6.48	0.50154	0.834	1.5367	0.93509	1.643	1.2359	0.30081
11	0.65	7.1071	6.48	0.52487	0.837	1.5388	0.91176	1.688	1.2253	0.31353
12	0.71	7.1312	6.48	0.54644	0.839	1.5414	0.89018	1.732	1.2158	0.32559
13	0.78	7.1527	6.48	0.56685	0.843	1.5425	0.86977	1.773	1.2061	0.33635
14	0.91	7.1918	6.48	0.59485	0.836	1.5535	0.84178	1.846	1.1977	0.35589
15	1.05	7.2262	6.48	0.62984	0.844	1.553	0.80679	1.925	1.1799	0.37311
16	1.18	7.2567	6.48	0.65666	0.845	1.5567	0.77996	1.996	1.1683	0.38836
17	1.45	7.3078	6.48	0.70157	0.847	1.5629	0.73506	2.126	1.149	0.41392
18	1.58	7.3336	6.48	0.71848	0.842	1.5717	0.71814	2.189	1.1449	0.4268
19	2.38	7.4473	6.48	0.81646	0.844	1.5875	0.62017	2.560	1.1038	0.48367
20	3.18	7.5219	6.48	0.87827	0.843	1.6003	0.55835	2.866	1.0793	0.52097
21	3.98	7.5846	6.48	0.93484	0.846	1.6064	0.50178	3.201	1.0541	0.55229
22	4.78	7.6281	6.48	0.96809	0.843	1.6166	0.46854	3.450	1.0426	0.57404
23	5.57	7.6658	6.48	1.0083	0.850	1.6141	0.4283	3.769	1.0212	0.5929
24	6.37	7.6984	6.48	1.0305	0.846	1.6246	0.40614	4.000	1.0153	0.6092
25	7.17	7.7242	6.48	1.0579	0.850	1.6229	0.37873	4.285	1.0008	0.6221
26	7.98	7.7416	6.48	1.0742	0.852	1.624	0.3624	4.481	0.99318	0.63078
27	8.77	7.7556	6.48	1.0923	0.856	1.6199	0.34432	4.705	0.98212	0.63779
28	9.58	7.7673	6.48	1.1022	0.856	1.6217	0.33441	4.850	0.97807	0.64366
29	10.38	7.7722	6.48	1.115	0.863	1.6138	0.32158	5.018	0.96769	0.64611
30	11.18	7.7769	6.48	1.1197	0.863	1.6138	0.31691	5.092	0.96536	0.64845
31	11.98	7.7784	6.48	1.1232	0.865	1.6118	0.31341	5.143	0.96261	0.6492
32	12.79	7.7693	6.48	1.1162	0.866	1.6097	0.32041	5.024	0.96505	0.64464
33	13.58	7.7502	6.48	1.1209	0.882	1.5859	0.31575	5.023	0.95083	0.63509
34	14.38	7.7318	6.48	1.1162	0.892	1.5722	0.32041	4.907	0.9463	0.62588
35	15.18	7.7063	6.48	1.1168	0.911	1.5461	0.31983	4.834	0.93298	0.61315

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-006 S9
Sample No.: S-9
Test No.: 40.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: DARK GRAY ORGANIC SILT OH SHELL NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767.

Specimen Height: 6.19 in
Specimen Area: 6.23 in^2
Specimen Volume: 38.60 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 72

Plastic Limit: 37

Estimated Specific Gravity: 2.60

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.2339	0	0	5.0421	7.92	7.92
2	5.0041	0.048386	6.237	20.074	0.23173	5.2556	7.92	8.1517
3	10.004	0.10997	6.2408	35.922	0.41443	5.4179	7.92	8.3344
4	15	0.17448	6.2448	47.727	0.55027	5.5452	7.92	8.4703
5	20	0.239	6.2489	56.501	0.65101	5.6441	7.92	8.571
6	25	0.30498	6.253	63.345	0.72938	5.7261	7.92	8.6494
7	30	0.37096	6.2572	69.271	0.79709	5.7994	7.92	8.7171
8	35	0.43547	6.2612	74.094	0.85204	5.8628	7.92	8.772
9	40	0.50292	6.2655	78.366	0.90055	5.9192	7.92	8.8206
10	45	0.57036	6.2697	82.179	0.94372	5.971	7.92	8.8637
11	50	0.63781	6.274	85.44	0.98051	6.0187	7.92	8.9005
12	55	0.70379	6.2781	88.426	1.0141	6.0629	7.92	8.9341
13	60	0.77124	6.2824	91.274	1.0461	6.1059	7.92	8.9661
14	70	0.90613	6.291	96.097	1.0998	6.1781	7.92	9.0198
15	80	1.0381	6.2993	100.51	1.1488	6.2449	7.92	9.0688
16	90	1.173	6.3079	104.27	1.1902	6.3054	7.92	9.1102
17	100	1.3079	6.3166	107.4	1.2242	6.3572	7.92	9.1442
18	110	1.4398	6.325	110.34	1.256	6.4072	7.92	9.176
19	120	1.5747	6.3337	113.19	1.2867	6.4514	7.92	9.2067
20	180	2.3709	6.3853	125.22	1.412	6.6602	7.92	9.332
21	240	3.1832	6.4389	133.67	1.4947	6.801	7.92	9.4147
22	300	3.9838	6.4926	140.24	1.5552	6.9063	7.92	9.4752
23	360	4.7858	6.5473	145.66	1.6018	6.9854	7.92	9.5218
24	420	5.5951	6.6034	150.49	1.6408	7.0493	7.92	9.5608
25	480	6.3957	6.6599	154.71	1.6726	7.1017	7.92	9.5926
26	540	7.1948	6.7172	158.57	1.6997	7.1459	7.92	9.6197
27	600	8.0027	6.7762	162.01	1.7215	7.1825	7.92	9.6415
28	660	8.8047	6.8358	165.09	1.7389	7.2151	7.92	9.6589
29	720	9.6009	6.896	167.99	1.7539	7.2424	7.92	9.6739
30	780	10.406	6.958	170.42	1.7635	7.2651	7.92	9.6835
31	840	11.211	7.0211	172.49	1.7688	7.2843	7.92	9.6888
32	900	12.013	7.0851	173.91	1.7673	7.2989	7.92	9.6873
33	960	12.824	7.151	174.74	1.7594	7.3099	7.92	9.6794
34	1020	13.618	7.2167	174.37	1.7397	7.3151	7.92	9.6597
35	1080	14.419	7.2843	173.27	1.7126	7.3157	7.92	9.6326
36	1140	15.24	7.3548	171.71	1.6809	7.314	7.92	9.6009

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-006 S9
Sample No.: S-9
Test No.: 40.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 26.0'-28.0'
Elevation: ----

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Soil Description: DARK GRAY ORGANIC SILT OH SHELL NOTED
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767.

Specimen Height: 6.19 in
Specimen Area: 6.23 in^2
Specimen Volume: 38.60 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 72

Plastic Limit: 37

Estimated Specific Gravity: 2.60

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	7.92	7.92	0	0.000	2.8779	2.8779	1.000	2.8779	0
2	0.05	8.1517	7.92	0.21346	0.921	2.8961	2.6644	1.087	2.7803	0.11587
3	0.11	8.3344	7.92	0.37573	0.907	2.9166	2.5021	1.166	2.7093	0.20721
4	0.17	8.4703	7.92	0.50311	0.914	2.925	2.3748	1.232	2.6499	0.27514
5	0.24	8.571	7.92	0.60199	0.925	2.9269	2.2759	1.286	2.6014	0.3255
6	0.30	8.6494	7.92	0.68399	0.938	2.9233	2.1939	1.332	2.5586	0.36469
7	0.37	8.7171	7.92	0.75728	0.950	2.9177	2.1206	1.376	2.5191	0.39854
8	0.44	8.772	7.92	0.82068	0.963	2.9092	2.0572	1.414	2.4832	0.42602
9	0.50	8.8206	7.92	0.8771	0.974	2.9013	2.0008	1.450	2.451	0.45028
10	0.57	8.8637	7.92	0.92886	0.984	2.8927	1.949	1.484	2.4209	0.47186
11	0.64	8.9005	7.92	0.97655	0.996	2.8818	1.9013	1.516	2.3916	0.49026
12	0.70	8.9341	7.92	1.0208	1.007	2.8712	1.8571	1.546	2.3642	0.50705
13	0.77	8.9661	7.92	1.0638	1.017	2.8601	1.8141	1.577	2.3371	0.52303
14	0.91	9.0198	7.92	1.1359	1.033	2.8418	1.7419	1.631	2.2919	0.54992
15	1.04	9.0688	7.92	1.2028	1.047	2.8238	1.6751	1.686	2.2494	0.57439
16	1.17	9.1102	7.92	1.2633	1.061	2.8048	1.6146	1.737	2.2097	0.5951
17	1.31	9.1442	7.92	1.3151	1.074	2.787	1.5628	1.783	2.1749	0.61209
18	1.44	9.176	7.92	1.3651	1.087	2.7688	1.5128	1.830	2.1408	0.62801
19	1.57	9.2067	7.92	1.4093	1.095	2.7552	1.4686	1.876	2.1119	0.64333
20	2.37	9.332	7.92	1.6181	1.146	2.6717	1.2598	2.121	1.9658	0.70598
21	3.18	9.4147	7.92	1.7588	1.177	2.6137	1.119	2.336	1.8664	0.74736
22	3.98	9.4752	7.92	1.8641	1.199	2.569	1.0137	2.534	1.7914	0.77761
23	4.79	9.5218	7.92	1.9432	1.213	2.5365	0.93464	2.714	1.7356	0.80092
24	5.60	9.5608	7.92	2.0072	1.223	2.5115	0.87066	2.885	1.6911	0.8204
25	6.40	9.5926	7.92	2.0595	1.231	2.4909	0.81832	3.044	1.6546	0.83629
26	7.19	9.6197	7.92	2.1037	1.238	2.4738	0.77411	3.196	1.6239	0.84983
27	8.00	9.6415	7.92	2.1404	1.243	2.4589	0.73747	3.334	1.5982	0.86073
28	8.80	9.6589	7.92	2.173	1.250	2.4438	0.7049	3.467	1.5743	0.86944
29	9.60	9.6739	7.92	2.2003	1.255	2.4315	0.67756	3.589	1.5545	0.87696
30	10.41	9.6835	7.92	2.223	1.261	2.4184	0.65488	3.693	1.5366	0.88174
31	11.21	9.6888	7.92	2.2422	1.268	2.4045	0.63569	3.783	1.5201	0.88442
32	12.01	9.6873	7.92	2.2567	1.277	2.3885	0.62115	3.845	1.5048	0.88367
33	12.82	9.6794	7.92	2.2678	1.289	2.3695	0.61009	3.884	1.4898	0.87969
34	13.62	9.6597	7.92	2.273	1.307	2.3445	0.60486	3.876	1.4747	0.86983
35	14.42	9.6326	7.92	2.2736	1.328	2.3169	0.60428	3.834	1.4606	0.85632
36	15.24	9.6009	7.92	2.2718	1.352	2.287	0.60602	3.774	1.4465	0.84046

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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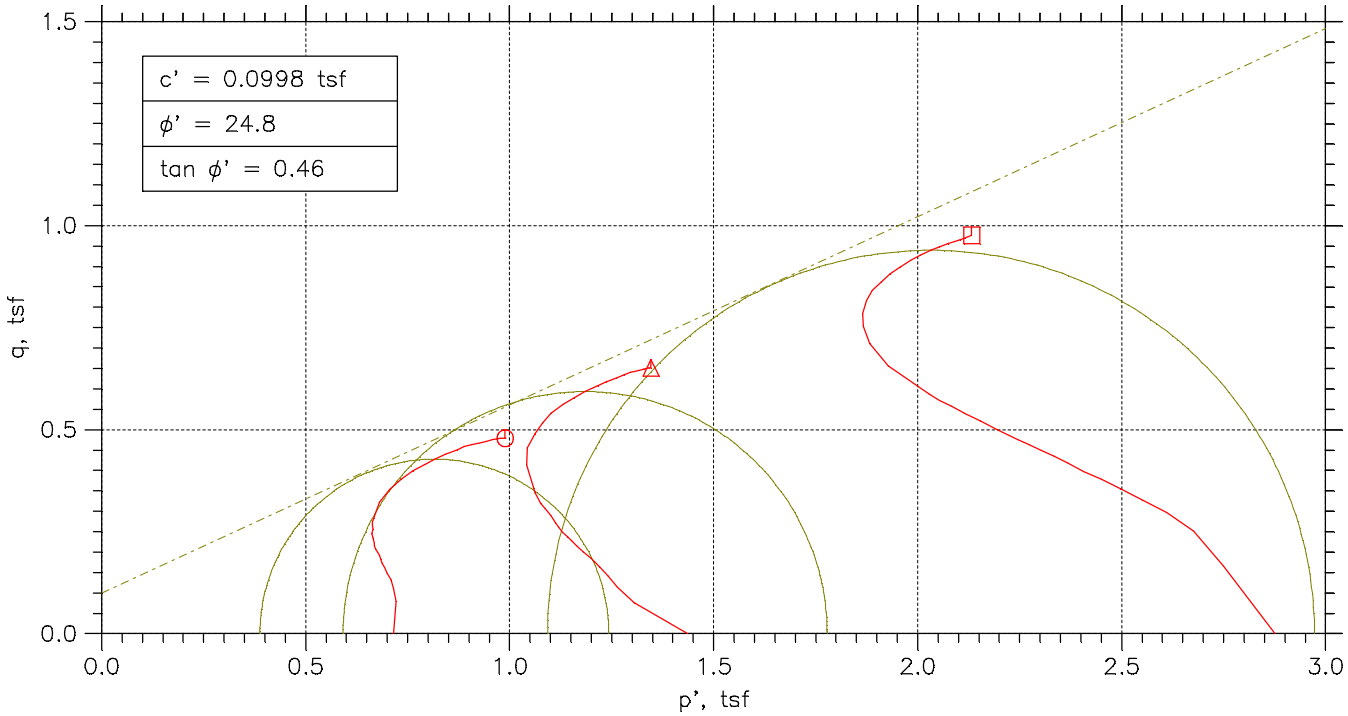

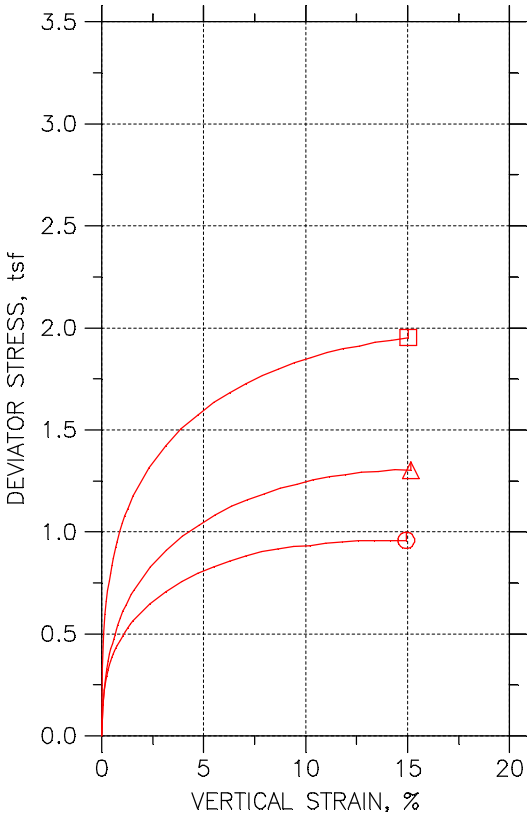

Symbol		⏲	△	⊡	
Test No.		10.0 PSI	20.0 PSI	40.0 PSI	
Initial	Diameter, in	2.8094	2.8291	2.8406	
	Height, in	5.9575	6.2256	6.276	
	Water Content, %	27.95	28.58	25.69	
	Dry Density, pcf	95.83	93.77	96.62	
	Saturation, %	98.51	95.87	92.26	
	Void Ratio	0.77188	0.81092	0.75748	
Before Shear	Water Content, %	27.39	26.71	23.87	
	Dry Density, pcf	97.31	98.35	103.	
	Saturation, %	100.00	100.00	100.00	
	Void Ratio	0.74495	0.72649	0.64936	
	Back Press., tsf	5.0452	5.044	5.045	
Minor Prin. Stress, tsf		0.71483	1.436	2.875	
Max. Dev. Stress, tsf		0.95795	1.304	1.9522	
Time to Failure, min		1140	1080	1140	
Strain Rate, %/min		0.02	0.02	0.02	
B-Value		0.95	0.97	0.95	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		48	48	48	
Plastic Limit		18	18	18	
Plasticity Index		30	30	30	

Project: DYNEGY EDWARDS
Location: BARTONVILLE, IL
Project No.: MR155218
Boring No.: EDW010 S-7
Sample Type: 3.0" ST

Failure Sketch



Description: BROWN AND GRAY MOTTLED LEAN CLAY CL

Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

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CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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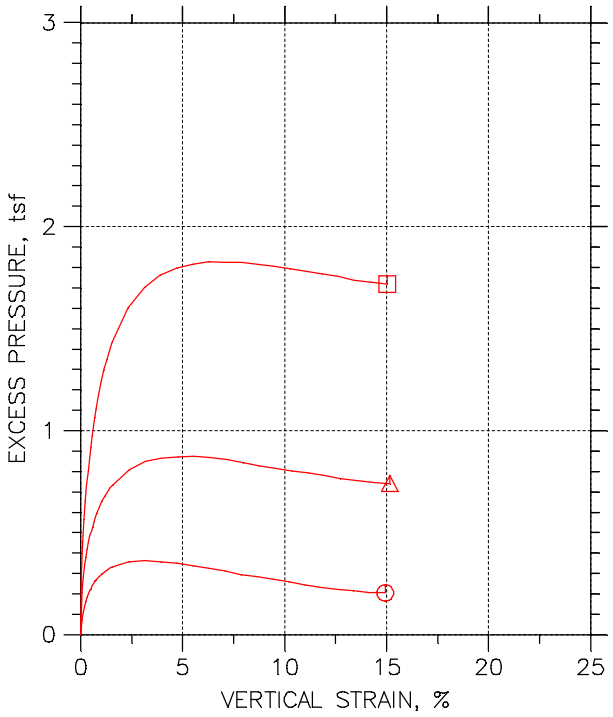

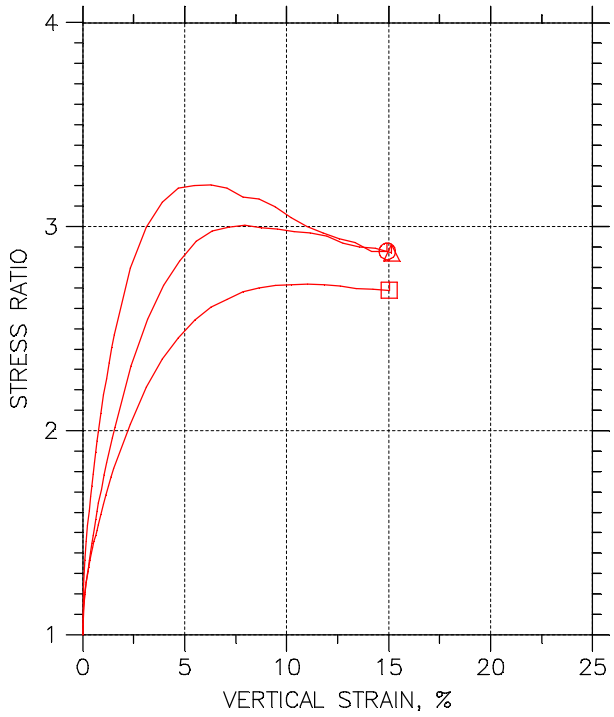

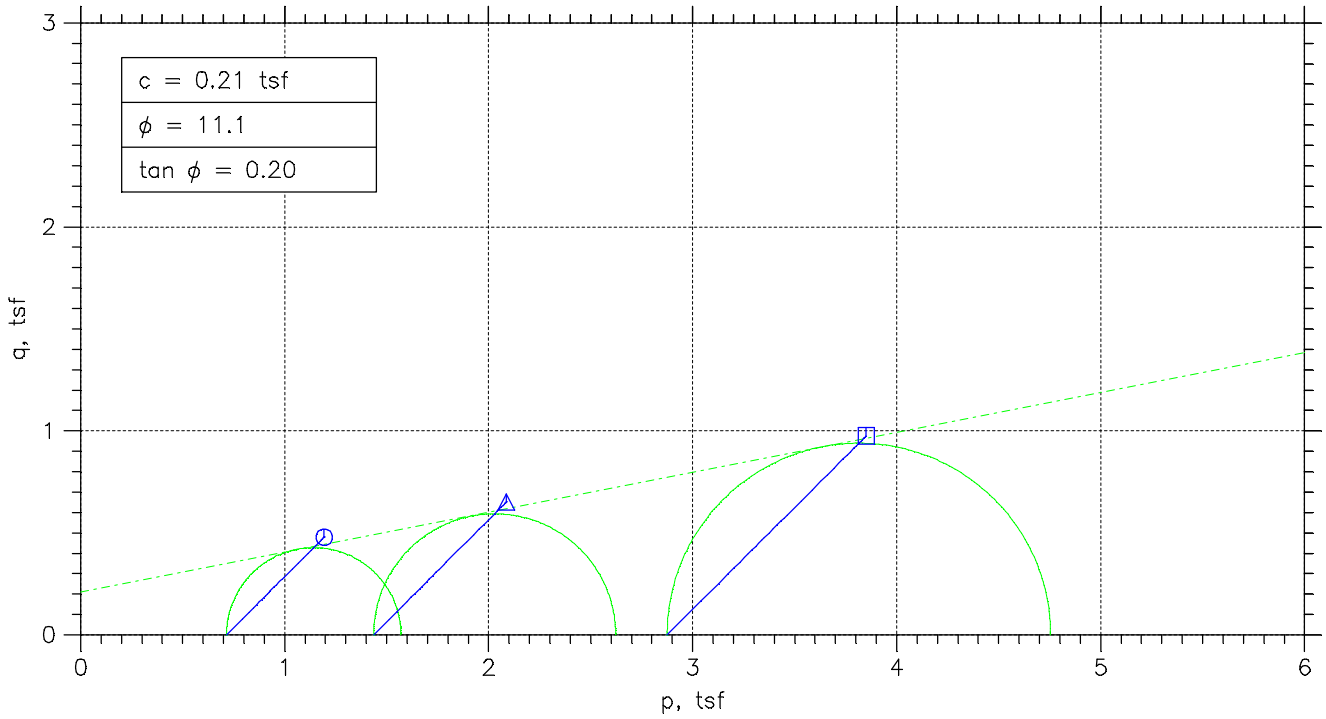

Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
Boring No.: EDW-010 S-7	Tested By: BCM	Checked By: WPQ
Sample No.: S-7	Test Date: 10/29/15	Depth: 15.0'-17.0'
Test No.: EDW-010 S-7	Sample Type: 3.0" ST	Elevation: ----
Description: BROWN AND GRAY MOTTLED LEAN CLAY CL		
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.		

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-010 S-7
Sample No.: S-7
Test No.: 10.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-17.0'
Elevation: ----

Terracon Consulting Engineers & Scientists

Soil Description: BROWN AND GRAY MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 5.96 in
Specimen Area: 6.20 in^2
Specimen Volume: 36.93 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 18

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.1991	0	0	5.0452	5.76	5.76
2	5.0041	0.056448	6.2027	13.621	0.15811	5.1172	5.76	5.9181
3	10.004	0.12013	6.2066	19.07	0.22122	5.1549	5.76	5.9812
4	15.004	0.18382	6.2106	22.767	0.26394	5.1834	5.76	6.0239
5	20	0.24895	6.2146	25.54	0.29589	5.2078	5.76	6.0559
6	25	0.31408	6.2187	27.923	0.3233	5.2287	5.76	6.0833
7	30	0.37922	6.2227	29.967	0.34673	5.2467	5.76	6.1067
8	35	0.4429	6.2267	31.669	0.36619	5.2595	5.76	6.1262
9	40	0.50948	6.2309	33.275	0.3845	5.2716	5.76	6.1445
10	45	0.57462	6.235	34.734	0.4011	5.285	5.76	6.1611
11	50	0.63975	6.2391	36.047	0.41599	5.296	5.76	6.176
12	55	0.70488	6.2432	37.312	0.43031	5.3065	5.76	6.1903
13	60	0.77001	6.2473	38.48	0.44348	5.314	5.76	6.2035
14	70	0.90028	6.2555	40.669	0.4681	5.3286	5.76	6.2281
15	80	1.032	6.2638	42.663	0.4904	5.3431	5.76	6.2504
16	90	1.1608	6.272	44.609	0.5121	5.3512	5.76	6.2721
17	100	1.2925	6.2803	46.263	0.53038	5.3622	5.76	6.2904
18	110	1.4213	6.2885	47.869	0.54807	5.3704	5.76	6.3081
19	120	1.5516	6.2969	49.377	0.56459	5.3762	5.76	6.3246
20	180	2.3404	6.3477	56.868	0.64504	5.4011	5.76	6.405
21	240	3.1249	6.3991	62.706	0.70554	5.407	5.76	6.4655
22	300	3.908	6.4513	67.717	0.75576	5.4035	5.76	6.5158
23	360	4.7026	6.5051	72.046	0.79743	5.3959	5.76	6.5574
24	420	5.4871	6.5591	75.549	0.82931	5.3831	5.76	6.5893
25	480	6.2774	6.6144	78.565	0.85521	5.3721	5.76	6.6152
26	540	7.0676	6.6706	81.63	0.88108	5.3576	5.76	6.6411
27	600	7.8492	6.7272	84.305	0.90231	5.3396	5.76	6.6623
28	660	8.6337	6.7849	86.446	0.91734	5.3303	5.76	6.6773
29	720	9.424	6.8441	88.197	0.92783	5.3175	5.76	6.6878
30	780	10.213	6.9043	89.462	0.93294	5.3036	5.76	6.6929
31	840	10.997	6.9651	91.213	0.94289	5.2891	5.76	6.7029
32	900	11.786	7.0274	92.818	0.95098	5.2769	5.76	6.711
33	960	12.572	7.0906	94.083	0.95535	5.2682	5.76	6.7154
34	1020	13.361	7.1551	95.105	0.95701	5.2618	5.76	6.717
35	1080	14.148	7.2208	95.981	0.95705	5.2502	5.76	6.717
36	1140	14.93	7.2871	96.953	0.95795	5.2502	5.76	6.7179

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-010 S-7
Sample No.: S-7
Test No.: 10.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-17.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWN AND GRAY MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 5.96 in
Specimen Area: 6.20 in^2
Specimen Volume: 36.93 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 18

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	5.76	5.76	0	0.000	0.71483	0.71483	1.000	0.71483	0
2	0.06	5.9181	5.76	0.072008	0.455	0.80093	0.64282	1.246	0.72188	0.079057
3	0.12	5.9812	5.76	0.10975	0.496	0.82629	0.60507	1.366	0.71568	0.11061
4	0.18	6.0239	5.76	0.13821	0.524	0.84056	0.57662	1.458	0.70859	0.13197
5	0.25	6.0559	5.76	0.1626	0.550	0.84812	0.55223	1.536	0.70018	0.14795
6	0.31	6.0833	5.76	0.1835	0.568	0.85462	0.53132	1.608	0.69297	0.16165
7	0.38	6.1067	5.76	0.2015	0.581	0.86005	0.51332	1.675	0.68669	0.17336
8	0.44	6.1262	5.76	0.21428	0.585	0.86674	0.50055	1.732	0.68364	0.1831
9	0.51	6.1445	5.76	0.22648	0.589	0.87285	0.48835	1.787	0.6806	0.19225
10	0.57	6.1611	5.76	0.23983	0.598	0.87609	0.475	1.844	0.67555	0.20055
11	0.64	6.176	5.76	0.25086	0.603	0.87996	0.46396	1.897	0.67196	0.208
12	0.70	6.1903	5.76	0.26132	0.607	0.88382	0.45351	1.949	0.66866	0.21515
13	0.77	6.2035	5.76	0.26887	0.606	0.88944	0.44596	1.994	0.6677	0.22174
14	0.90	6.2281	5.76	0.28338	0.605	0.89954	0.43144	2.085	0.66549	0.23405
15	1.03	6.2504	5.76	0.2979	0.607	0.90733	0.41693	2.176	0.66213	0.2452
16	1.16	6.2721	5.76	0.30603	0.598	0.9209	0.4088	2.253	0.66485	0.25605
17	1.29	6.2904	5.76	0.31707	0.598	0.92814	0.39776	2.333	0.66295	0.26519
18	1.42	6.3081	5.76	0.3252	0.593	0.9377	0.38963	2.407	0.66367	0.27403
19	1.55	6.3246	5.76	0.331	0.586	0.94841	0.38382	2.471	0.66612	0.28229
20	2.34	6.405	5.76	0.35597	0.552	1.0039	0.35885	2.797	0.68137	0.32252
21	3.12	6.4655	5.76	0.36178	0.513	1.0586	0.35305	2.998	0.70582	0.35277
22	3.91	6.5158	5.76	0.3583	0.474	1.1123	0.35653	3.120	0.73441	0.37788
23	4.70	6.5574	5.76	0.35075	0.440	1.1615	0.36408	3.190	0.7628	0.39872
24	5.49	6.5893	5.76	0.33797	0.408	1.2062	0.37686	3.201	0.79151	0.41466
25	6.28	6.6152	5.76	0.32694	0.382	1.2431	0.38789	3.205	0.8155	0.42761
26	7.07	6.6411	5.76	0.31242	0.355	1.2835	0.40241	3.190	0.84295	0.44054
27	7.85	6.6623	5.76	0.29442	0.326	1.3227	0.42041	3.146	0.87156	0.45115
28	8.63	6.6773	5.76	0.28513	0.311	1.347	0.4297	3.135	0.88837	0.45867
29	9.42	6.6878	5.76	0.27235	0.294	1.3703	0.44248	3.097	0.90639	0.46391
30	10.21	6.6929	5.76	0.25841	0.277	1.3894	0.45641	3.044	0.92288	0.46647
31	11.00	6.7029	5.76	0.2439	0.259	1.4138	0.47093	3.002	0.94238	0.47144
32	11.79	6.711	5.76	0.2317	0.244	1.4341	0.48313	2.968	0.95862	0.47549
33	12.57	6.7154	5.76	0.22299	0.233	1.4472	0.49184	2.942	0.96951	0.47768
34	13.36	6.717	5.76	0.2166	0.226	1.4552	0.49822	2.921	0.97673	0.47851
35	14.15	6.717	5.76	0.20499	0.214	1.4669	0.50984	2.877	0.98836	0.47852
36	14.93	6.7179	5.76	0.20499	0.214	1.4678	0.50984	2.879	0.98881	0.47897

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW010 S-7
Sample No.: S-7
Test No.: 20.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-17.0'
Elevation: ----

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Soil Description: BROWN AND GRAY MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.23 in
Specimen Area: 6.29 in^2
Specimen Volume: 39.14 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 18

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.2863	0	0	5.044	6.48	6.48
2	5.0041	0.05533	6.2898	13.126	0.15025	5.2498	6.48	6.6303
3	10.004	0.11988	6.2939	19.719	0.22558	5.328	6.48	6.7056
4	15.004	0.18597	6.298	24.693	0.2823	5.381	6.48	6.7623
5	20.004	0.25206	6.3022	28.769	0.32867	5.4242	6.48	6.8087
6	25.004	0.31968	6.3065	32.245	0.36814	5.4644	6.48	6.8481
7	30.004	0.38731	6.3108	35.122	0.40071	5.4988	6.48	6.8807
8	35.004	0.45339	6.315	37.46	0.4271	5.5286	6.48	6.9071
9	40.004	0.52256	6.3193	39.617	0.45138	5.5525	6.48	6.9314
10	45.004	0.58557	6.3234	41.595	0.47362	5.5747	6.48	6.9536
11	50.004	0.65166	6.3276	43.633	0.49649	5.5991	6.48	6.9765
12	55.004	0.71775	6.3318	45.791	0.5207	5.6207	6.48	7.0007
13	60.004	0.7823	6.3359	47.769	0.54284	5.6394	6.48	7.0228
14	70.004	0.91601	6.3444	50.885	0.57747	5.6668	6.48	7.0575
15	80	1.0497	6.353	54.002	0.61202	5.6983	6.48	7.092
16	90	1.1834	6.3616	56.459	0.639	5.7228	6.48	7.119
17	110	1.4493	6.3788	61.314	0.69208	5.7642	6.48	7.1721
18	120	1.583	6.3874	63.292	0.71343	5.7776	6.48	7.1934
19	180	2.3746	6.4392	73.961	0.82699	5.8522	6.48	7.307
20	240	3.1676	6.492	82.052	0.91001	5.8919	6.48	7.39
21	300	3.9653	6.5459	89.124	0.9803	5.9077	6.48	7.4603
22	360	4.766	6.6009	94.698	1.0329	5.9158	6.48	7.5129
23	420	5.5652	6.6568	100.03	1.082	5.9193	6.48	7.562
24	480	6.366	6.7137	104.89	1.1248	5.9117	6.48	7.6048
25	540	7.1682	6.7717	108.78	1.1566	5.9012	6.48	7.6366
26	600	7.9582	6.8299	112.56	1.1866	5.8884	6.48	7.6666
27	660	8.7559	6.8896	116.22	1.2145	5.8709	6.48	7.6945
28	720	9.5582	6.9507	119.03	1.233	5.8598	6.48	7.713
29	780	10.356	7.0125	122.09	1.2535	5.8453	6.48	7.7335
30	840	11.16	7.076	124.79	1.2697	5.8353	6.48	7.7497
31	900	11.954	7.1398	127	1.2807	5.8248	6.48	7.7607
32	960	12.753	7.2052	129.22	1.2913	5.8073	6.48	7.7713
33	1020	13.56	7.2725	130.84	1.2954	5.7986	6.48	7.7754
34	1080	14.358	7.3402	132.94	1.304	5.791	6.48	7.784
35	1140	15.15	7.4087	134.02	1.3024	5.7846	6.48	7.7824

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW010 S-7
Sample No.: S-7
Test No.: 20.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-17.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWN AND GRAY MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.23 in
Specimen Area: 6.29 in^2
Specimen Volume: 39.14 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 18

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	6.48	6.48	0	0.000	1.436	1.436	1.000	1.436	0
2	0.06	6.6303	6.48	0.20586	1.370	1.3804	1.2302	1.122	1.3053	0.075127
3	0.12	6.7056	6.48	0.28401	1.259	1.3776	1.152	1.196	1.2648	0.11279
4	0.19	6.7623	6.48	0.33708	1.194	1.3813	1.099	1.257	1.2401	0.14115
5	0.25	6.8087	6.48	0.38024	1.157	1.3845	1.0558	1.311	1.2201	0.16434
6	0.32	6.8481	6.48	0.42048	1.142	1.3837	1.0156	1.362	1.1996	0.18407
7	0.39	6.8807	6.48	0.45488	1.135	1.3819	0.98116	1.408	1.1815	0.20036
8	0.45	6.9071	6.48	0.48463	1.135	1.3785	0.95142	1.449	1.165	0.21355
9	0.52	6.9314	6.48	0.50854	1.127	1.3789	0.92751	1.487	1.1532	0.22569
10	0.59	6.9536	6.48	0.5307	1.121	1.379	0.90535	1.523	1.1422	0.23681
11	0.65	6.9765	6.48	0.55519	1.118	1.3773	0.88085	1.564	1.1291	0.24825
12	0.72	7.0007	6.48	0.57677	1.108	1.38	0.85927	1.606	1.1196	0.26035
13	0.78	7.0228	6.48	0.59543	1.097	1.3834	0.84061	1.646	1.112	0.27142
14	0.92	7.0575	6.48	0.62284	1.079	1.3907	0.8132	1.710	1.1019	0.28874
15	1.05	7.092	6.48	0.65433	1.069	1.3937	0.78171	1.783	1.0877	0.30601
16	1.18	7.119	6.48	0.67883	1.062	1.3962	0.75722	1.844	1.0767	0.3195
17	1.45	7.1721	6.48	0.72023	1.041	1.4079	0.71581	1.967	1.0619	0.34604
18	1.58	7.1934	6.48	0.73365	1.028	1.4158	0.7024	2.016	1.0591	0.35672
19	2.37	7.307	6.48	0.80829	0.977	1.4547	0.62775	2.317	1.0412	0.41349
20	3.17	7.39	6.48	0.84795	0.932	1.4981	0.58809	2.547	1.0431	0.455
21	3.97	7.4603	6.48	0.8637	0.881	1.5526	0.57235	2.713	1.0625	0.49015
22	4.77	7.5129	6.48	0.87186	0.844	1.5971	0.56418	2.831	1.0806	0.51646
23	5.57	7.562	6.48	0.87536	0.809	1.6426	0.56068	2.930	1.1017	0.54098
24	6.37	7.6048	6.48	0.86778	0.771	1.6931	0.56827	2.979	1.1307	0.56242
25	7.17	7.6366	6.48	0.85728	0.741	1.7354	0.57876	2.998	1.1571	0.57831
26	7.96	7.6666	6.48	0.84445	0.712	1.7782	0.59159	3.006	1.1849	0.5933
27	8.76	7.6945	6.48	0.82695	0.681	1.8236	0.60909	2.994	1.2163	0.60726
28	9.56	7.713	6.48	0.81587	0.662	1.8532	0.62017	2.988	1.2367	0.61651
29	10.36	7.7335	6.48	0.80129	0.639	1.8883	0.63475	2.975	1.2615	0.62676
30	11.16	7.7497	6.48	0.79138	0.623	1.9144	0.64466	2.970	1.2795	0.63487
31	11.95	7.7607	6.48	0.78088	0.610	1.9359	0.65516	2.955	1.2955	0.64037
32	12.75	7.7713	6.48	0.76339	0.591	1.9639	0.67266	2.920	1.3183	0.64564
33	13.56	7.7754	6.48	0.75464	0.583	1.9768	0.6814	2.901	1.3291	0.64768
34	14.36	7.784	6.48	0.74706	0.573	1.993	0.68899	2.893	1.341	0.65199
35	15.15	7.7824	6.48	0.74064	0.569	1.9978	0.6954	2.873	1.3466	0.6512

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-010 S7
Sample No.: S-7
Test No.: 40.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-17.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWN AND GRAY MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.28 in
Specimen Area: 6.34 in^2
Specimen Volume: 39.77 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 18

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.3372	0	0	5.045	7.92	7.92
2	5.0034	0.036161	6.3395	29.009	0.32946	5.3353	7.92	8.2495
3	10.003	0.10125	6.3436	44.36	0.50349	5.4952	7.92	8.4235
4	15.003	0.16634	6.3477	52.512	0.59563	5.6081	7.92	8.5156
5	20.003	0.23288	6.352	58.07	0.65823	5.6994	7.92	8.5782
6	25.003	0.29942	6.3562	62.835	0.71176	5.7779	7.92	8.6318
7	30.003	0.36451	6.3604	66.964	0.75804	5.8489	7.92	8.678
8	35.003	0.43104	6.3646	70.351	0.79586	5.9111	7.92	8.7159
9	40.003	0.49758	6.3689	73.792	0.83422	5.9681	7.92	8.7542
10	45.003	0.56122	6.3729	76.915	0.86897	6.0199	7.92	8.789
11	50.003	0.62632	6.3771	79.509	0.89769	6.0658	7.92	8.8177
12	55.003	0.69141	6.3813	82.103	0.92637	6.11	7.92	8.8464
13	60.003	0.7565	6.3855	84.432	0.95202	6.1513	7.92	8.872
14	70.003	0.88523	6.3938	88.826	1.0003	6.2246	7.92	8.9203
15	80.003	1.0154	6.4022	92.637	1.0418	6.2874	7.92	8.9618
16	90.003	1.1441	6.4105	96.078	1.0791	6.3444	7.92	8.9991
17	100	1.2743	6.419	99.307	1.1139	6.3944	7.92	9.0339
18	110	1.4031	6.4273	102.17	1.1445	6.4386	7.92	9.0645
19	120	1.5318	6.4357	105.08	1.1756	6.4788	7.92	9.0956
20	180	2.3245	6.488	118.31	1.313	6.648	7.92	9.233
21	240	3.1243	6.5415	129.11	1.4211	6.7475	7.92	9.3411
22	300	3.8982	6.5942	137.9	1.5057	6.8062	7.92	9.4257
23	360	4.6923	6.6492	145.04	1.5706	6.8405	7.92	9.4906
24	420	5.4951	6.7056	152.14	1.6335	6.8615	7.92	9.5535
25	480	6.2791	6.7617	157.91	1.6814	6.8719	7.92	9.6014
26	540	7.0746	6.8196	163.31	1.7241	6.8714	7.92	9.6441
27	600	7.8702	6.8785	168.65	1.7654	6.8702	7.92	9.6854
28	660	8.6498	6.9372	173.1	1.7966	6.8621	7.92	9.7166
29	720	9.454	6.9988	177.86	1.8298	6.8516	7.92	9.7498
30	780	10.257	7.0614	181.83	1.854	6.8399	7.92	9.774
31	840	11.038	7.1234	185.96	1.8796	6.8272	7.92	9.7996
32	900	11.839	7.1882	189.4	1.8971	6.8149	7.92	9.8171
33	960	12.632	7.2534	192.47	1.9106	6.8021	7.92	9.8306
34	1020	13.412	7.3187	196.23	1.9305	6.7824	7.92	9.8505
35	1080	14.223	7.388	199.09	1.9403	6.7742	7.92	9.8603
36	1140	15.029	7.458	202.21	1.9522	6.7638	7.92	9.8722

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-010 S7
Sample No.: S-7
Test No.: 40.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-17.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWN AND GRAY MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.28 in
Specimen Area: 6.34 in^2
Specimen Volume: 39.77 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 18

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	7.92	7.92	0	0.000	2.875	2.875	1.000	2.875	0
2	0.04	8.2495	7.92	0.29023	0.881	2.9142	2.5847	1.127	2.7495	0.16473
3	0.10	8.4235	7.92	0.45018	0.894	2.9283	2.4248	1.208	2.6765	0.25174
4	0.17	8.5156	7.92	0.56302	0.945	2.9076	2.3119	1.258	2.6098	0.29781
5	0.23	8.5782	7.92	0.65433	0.994	2.8789	2.2206	1.296	2.5497	0.32912
6	0.30	8.6318	7.92	0.73285	1.030	2.8539	2.1421	1.332	2.498	0.35588
7	0.36	8.678	7.92	0.80381	1.060	2.8292	2.0711	1.366	2.4502	0.37902
8	0.43	8.7159	7.92	0.86604	1.088	2.8048	2.0089	1.396	2.4068	0.39793
9	0.50	8.7542	7.92	0.92304	1.106	2.7861	1.9519	1.427	2.369	0.41711
10	0.56	8.789	7.92	0.97481	1.122	2.7691	1.9001	1.457	2.3346	0.43449
11	0.63	8.8177	7.92	1.0208	1.137	2.7519	1.8542	1.484	2.303	0.44885
12	0.69	8.8464	7.92	1.065	1.150	2.7364	1.81	1.512	2.2732	0.46318
13	0.76	8.872	7.92	1.1063	1.162	2.7207	1.7687	1.538	2.2447	0.47601
14	0.89	8.9203	7.92	1.1795	1.179	2.6957	1.6954	1.590	2.1955	0.50013
15	1.02	8.9618	7.92	1.2424	1.192	2.6744	1.6326	1.638	2.1535	0.52091
16	1.14	8.9991	7.92	1.2994	1.204	2.6547	1.5756	1.685	2.1152	0.53955
17	1.27	9.0339	7.92	1.3494	1.211	2.6395	1.5256	1.730	2.0825	0.55695
18	1.40	9.0645	7.92	1.3936	1.218	2.6258	1.4814	1.773	2.0536	0.57224
19	1.53	9.0956	7.92	1.4337	1.220	2.6168	1.4412	1.816	2.029	0.58778
20	2.32	9.233	7.92	1.603	1.221	2.5849	1.272	2.032	1.9285	0.65648
21	3.12	9.3411	7.92	1.7024	1.198	2.5936	1.1725	2.212	1.8831	0.71053
22	3.90	9.4257	7.92	1.7612	1.170	2.6194	1.1138	2.352	1.8666	0.75283
23	4.69	9.4906	7.92	1.7955	1.143	2.6501	1.0795	2.455	1.8648	0.7853
24	5.50	9.5535	7.92	1.8164	1.112	2.6921	1.0585	2.543	1.8753	0.81676
25	6.28	9.6014	7.92	1.8269	1.087	2.7295	1.0481	2.604	1.8888	0.84071
26	7.07	9.6441	7.92	1.8263	1.059	2.7728	1.0486	2.644	1.9107	0.86207
27	7.87	9.6854	7.92	1.8251	1.034	2.8152	1.0498	2.682	1.9325	0.88268
28	8.65	9.7166	7.92	1.817	1.011	2.8545	1.0579	2.698	1.9562	0.89828
29	9.45	9.7498	7.92	1.8065	0.987	2.8982	1.0684	2.713	1.9833	0.91488
30	10.26	9.774	7.92	1.7949	0.968	2.9341	1.0801	2.717	2.0071	0.92701
31	11.04	9.7996	7.92	1.7821	0.948	2.9725	1.0928	2.720	2.0327	0.93981
32	11.84	9.8171	7.92	1.7699	0.933	3.0022	1.1051	2.717	2.0536	0.94857
33	12.63	9.8306	7.92	1.7571	0.920	3.0284	1.1179	2.709	2.0731	0.95528
34	13.41	9.8505	7.92	1.7373	0.900	3.0681	1.1376	2.697	2.1029	0.96525
35	14.22	9.8603	7.92	1.7292	0.891	3.086	1.1458	2.693	2.1159	0.97013
36	15.03	9.8722	7.92	1.7187	0.880	3.1084	1.1562	2.688	2.1323	0.97609

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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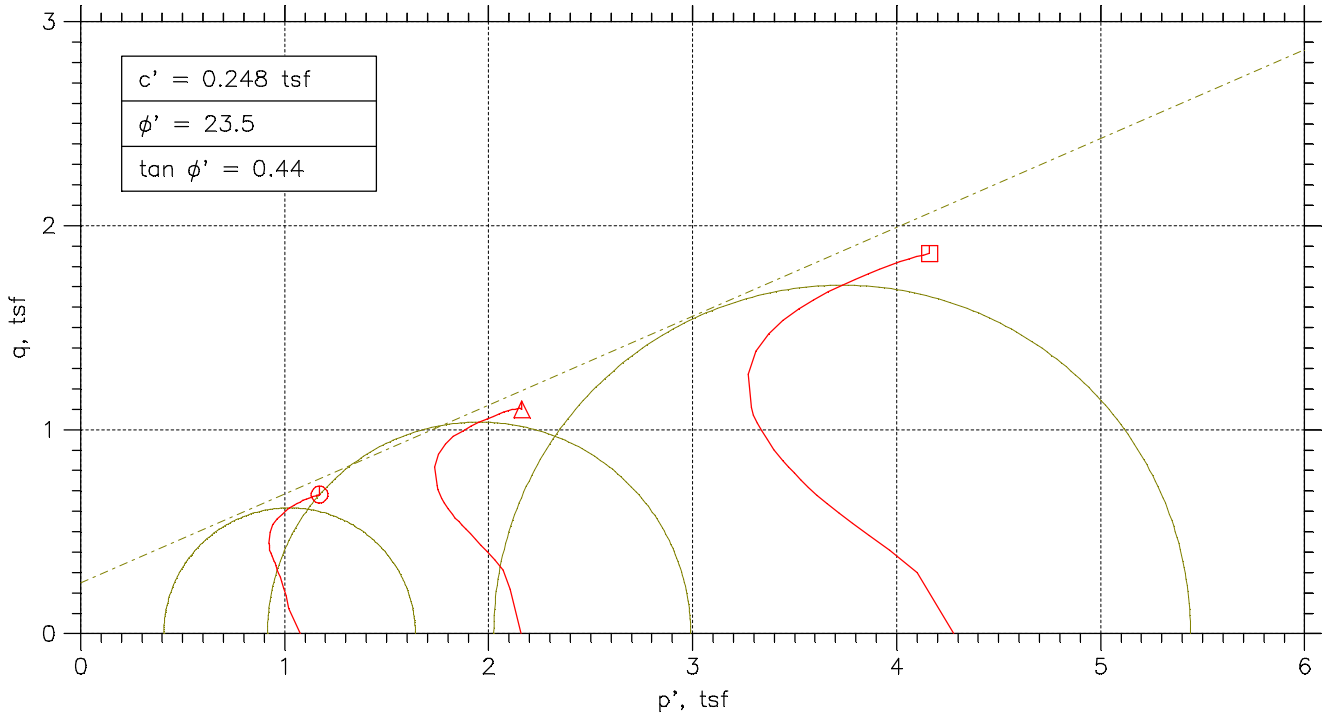

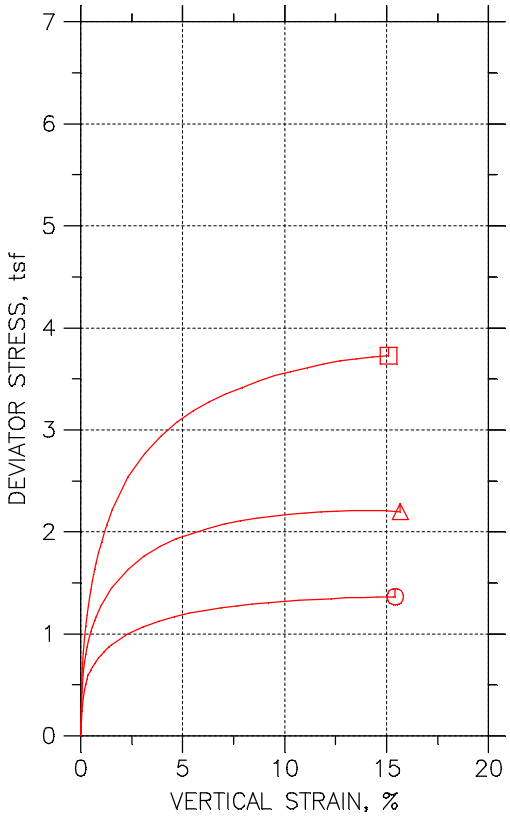

Symbol		⏲	△	⊡	
Test No.		15.0 PSI	30.0 PSI	60.0 PSI	
Initial	Diameter, in	2.8382	2.8134	2.8295	
	Height, in	6.3996	6.3425	6.2551	
	Water Content, %	31.54	29.27	28.87	
	Dry Density, pcf	87.92	91.94	94.81	
	Saturation, %	92.13	94.02	99.28	
	Void Ratio	0.93126	0.84681	0.791	
Before Shear	Water Content, %	31.86	27.59	24.62	
	Dry Density, pcf	90.97	97.01	101.7	
	Saturation, %	100.00	100.00	100.00	
	Void Ratio	0.86663	0.75044	0.66973	
	Back Press., tsf	5.0434	5.0422	5.0794	
Minor Prin. Stress, tsf		1.0766	2.1578	4.2806	
Max. Dev. Stress, tsf		1.3642	2.2082	3.7265	
Time to Failure, min		1205.9	1080	1140	
Strain Rate, %/min		0.02	0.02	0.02	
B-Value		0.97	0.98	0.96	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		48	48	48	
Plastic Limit		19	19	19	
Plasticity Index		29	29	29	

Project: DYNEGY EDWARDS
Location: BARTONVILLE, IL
Project No.: MR155218
Boring No.: EDW-012 S-7
Sample Type: 3.0" ST

Failure Sketch



Description: BROWN AND RUST BROWN MOTTLED LEAN CLAY CL

Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

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CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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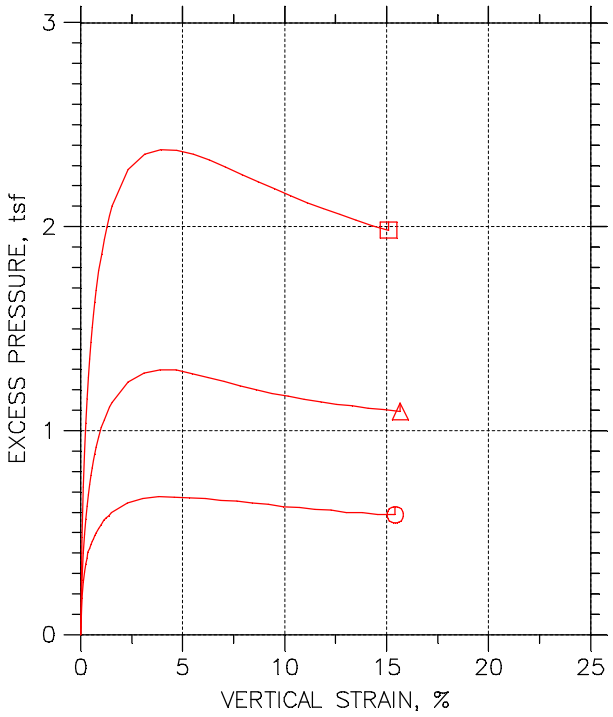

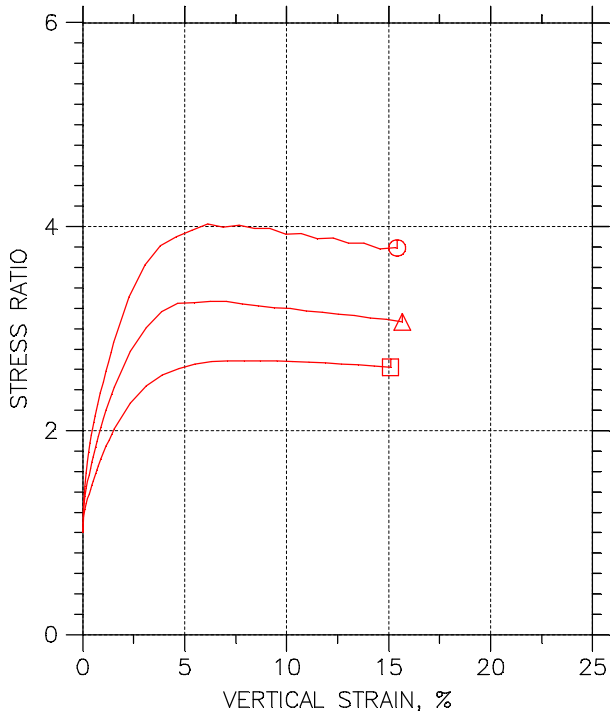

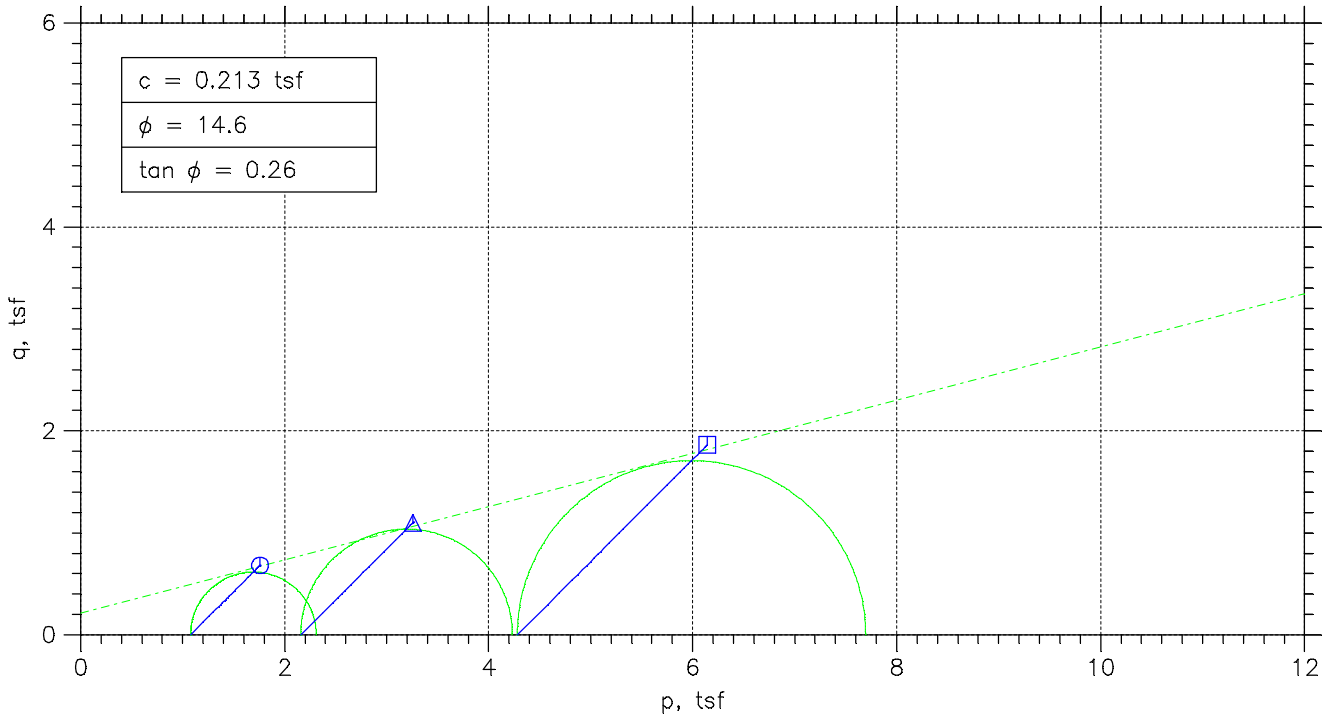

Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
Boring No.: EDW-012 S-7	Tested By: BCM	Checked By: WPQ
Sample No.: S-7	Test Date: 11/5/15	Depth: 15.0'-17.0'
Test No.: EDW-012 S-7	Sample Type: 3.0" ST	Elevation: ----
Description: BROWN AND RUST BROWN MOTTLED LEAN CLAY CL		
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.		

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-012 S-7
Sample No.: S-7
Test No.: 15.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/5/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-17.0'
Elevation: ----

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Consulting Engineers & Scientists

Soil Description: BROWN AND RUST BROWN MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.40 in
Specimen Area: 6.33 in^2
Specimen Volume: 40.49 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 19

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.3266	0	0	5.0434	6.12	6.12
2	5.0003	0.05234	6.3299	21.743	0.24732	5.2234	6.12	6.3673
3	10	0.11458	6.3339	32.694	0.37164	5.2995	6.12	6.4916
4	15	0.17541	6.3377	39.538	0.44917	5.3506	6.12	6.5692
5	20	0.23765	6.3417	44.908	0.50986	5.3907	6.12	6.6299
6	25	0.30131	6.3458	49.067	0.55672	5.4203	6.12	6.6767
7	30	0.36214	6.3496	52.331	0.5934	5.4476	6.12	6.7134
8	35	0.42579	6.3537	54.963	0.62285	5.4673	6.12	6.7428
9	40	0.48945	6.3577	57.122	0.64689	5.4848	6.12	6.7669
10	45	0.55452	6.3619	59.175	0.66971	5.4993	6.12	6.7897
11	50.001	0.61818	6.366	61.228	0.6925	5.5132	6.12	6.8125
12	55.001	0.68183	6.3701	62.966	0.71169	5.5283	6.12	6.8317
13	60.001	0.74549	6.3741	64.545	0.72908	5.5399	6.12	6.8491
14	70.001	0.87563	6.3825	67.599	0.76257	5.5632	6.12	6.8826
15	80.001	1.0029	6.3907	70.284	0.79184	5.5829	6.12	6.9118
16	90.001	1.1303	6.399	72.863	0.81985	5.6032	6.12	6.9398
17	100	1.259	6.4073	75.18	0.84481	5.6154	6.12	6.9648
18	110	1.3863	6.4156	77.444	0.86913	5.6276	6.12	6.9891
19	120	1.5136	6.4239	79.392	0.88984	5.6427	6.12	7.0098
20	180	2.2832	6.4745	89.553	0.99588	5.6886	6.12	7.1159
21	240	3.0499	6.5257	96.923	1.0694	5.7124	6.12	7.1894
22	300	3.8194	6.5779	102.87	1.126	5.7194	6.12	7.246
23	360	4.5847	6.6306	107.72	1.1697	5.7165	6.12	7.2897
24	420	5.35	6.6842	111.77	1.2039	5.7141	6.12	7.3239
25	480	6.1238	6.7393	115.4	1.2329	5.7124	6.12	7.3529
26	540	6.8848	6.7944	118.4	1.2547	5.7014	6.12	7.3747
27	600	7.6572	6.8512	121.14	1.2731	5.6973	6.12	7.3931
28	660	8.4239	6.9086	123.83	1.2905	5.6874	6.12	7.4105
29	720	9.1878	6.9667	126.25	1.3047	5.6822	6.12	7.4247
30	780	9.9587	7.0264	128.56	1.3174	5.67	6.12	7.4374
31	840	10.721	7.0864	130.72	1.3282	5.6671	6.12	7.4482
32	900	11.496	7.1484	132.83	1.3379	5.6561	6.12	7.4579
33	960	12.266	7.2111	134.78	1.3457	5.6538	6.12	7.4657
34	1020	13.031	7.2746	136.78	1.3537	5.6433	6.12	7.4737
35	1080	13.799	7.3394	138.3	1.3568	5.6416	6.12	7.4768
36	1140	14.57	7.4057	139.88	1.36	5.6317	6.12	7.48
37	1200	15.338	7.4728	141.57	1.364	5.6317	6.12	7.484
38	1205.9	15.418	7.4798	141.73	1.3642	5.6311	6.12	7.4842

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-012 S-7
Sample No.: S-7
Test No.: 15.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/5/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-17.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWN AND RUST BROWN MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.40 in
Specimen Area: 6.33 in^2
Specimen Volume: 40.49 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 19

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	6.12	6.12	0	0.000	1.0766	1.0766	1.000	1.0766	0
2	0.05	6.3673	6.12	0.18002	0.728	1.1439	0.89655	1.276	1.0202	0.12366
3	0.11	6.4916	6.12	0.25609	0.689	1.1921	0.82048	1.453	1.0063	0.18582
4	0.18	6.5692	6.12	0.30719	0.684	1.2185	0.76938	1.584	0.99396	0.22459
5	0.24	6.6299	6.12	0.34726	0.681	1.2392	0.72931	1.699	0.98424	0.25493
6	0.30	6.6767	6.12	0.37688	0.677	1.2564	0.69969	1.796	0.97805	0.27836
7	0.36	6.7134	6.12	0.40417	0.681	1.2658	0.6724	1.883	0.9691	0.2967
8	0.43	6.7428	6.12	0.42392	0.681	1.2755	0.65265	1.954	0.96408	0.31142
9	0.49	6.7669	6.12	0.44134	0.682	1.2821	0.63523	2.018	0.95868	0.32345
10	0.55	6.7897	6.12	0.45585	0.681	1.2904	0.62072	2.079	0.95557	0.33485
11	0.62	6.8125	6.12	0.46979	0.678	1.2993	0.60678	2.141	0.95303	0.34625
12	0.68	6.8317	6.12	0.48489	0.681	1.3034	0.59168	2.203	0.94753	0.35585
13	0.75	6.8491	6.12	0.4965	0.681	1.3091	0.58007	2.257	0.94461	0.36454
14	0.88	6.8826	6.12	0.51973	0.682	1.3194	0.55684	2.369	0.93812	0.38128
15	1.00	6.9118	6.12	0.53948	0.681	1.3289	0.53709	2.474	0.93301	0.39592
16	1.13	6.9398	6.12	0.5598	0.683	1.3366	0.51677	2.586	0.92669	0.40992
17	1.26	6.9648	6.12	0.572	0.677	1.3494	0.50457	2.674	0.92698	0.42241
18	1.39	6.9891	6.12	0.58419	0.672	1.3615	0.49238	2.765	0.92694	0.43456
19	1.51	7.0098	6.12	0.59929	0.673	1.3671	0.47728	2.864	0.9222	0.44492
20	2.28	7.1159	6.12	0.64516	0.648	1.4273	0.43141	3.308	0.92935	0.49794
21	3.05	7.1894	6.12	0.66897	0.626	1.477	0.4076	3.624	0.94229	0.53469
22	3.82	7.246	6.12	0.67594	0.600	1.5266	0.40063	3.811	0.96364	0.56301
23	4.58	7.2897	6.12	0.67304	0.575	1.5732	0.40353	3.899	0.98836	0.58483
24	5.35	7.3239	6.12	0.67072	0.557	1.6098	0.40585	3.966	1.0078	0.60197
25	6.12	7.3529	6.12	0.66897	0.543	1.6405	0.4076	4.025	1.024	0.61645
26	6.88	7.3747	6.12	0.65794	0.524	1.6733	0.41863	3.997	1.046	0.62736
27	7.66	7.3931	6.12	0.65387	0.514	1.6958	0.42269	4.012	1.0592	0.63654
28	8.42	7.4105	6.12	0.644	0.499	1.7231	0.43257	3.983	1.0778	0.64524
29	9.19	7.4247	6.12	0.63878	0.490	1.7425	0.43779	3.980	1.0902	0.65237
30	9.96	7.4374	6.12	0.62658	0.476	1.7674	0.44999	3.928	1.1087	0.6587
31	10.72	7.4482	6.12	0.62368	0.470	1.7811	0.45289	3.933	1.117	0.66409
32	11.50	7.4579	6.12	0.61264	0.458	1.8018	0.46392	3.884	1.1329	0.66893
33	12.27	7.4657	6.12	0.61032	0.454	1.8119	0.46625	3.886	1.1391	0.67284
34	13.03	7.4737	6.12	0.59987	0.443	1.8304	0.4767	3.840	1.1536	0.67687
35	13.80	7.4768	6.12	0.59813	0.441	1.8352	0.47844	3.836	1.1568	0.67838
36	14.57	7.48	6.12	0.58826	0.433	1.8483	0.48831	3.785	1.1683	0.67999
37	15.34	7.484	6.12	0.58826	0.431	1.8523	0.48831	3.793	1.1703	0.68199
38	15.42	7.4842	6.12	0.58767	0.431	1.8531	0.48889	3.790	1.171	0.68212

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-012 S-7
Sample No.: S-7
Test No.: 30.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/5/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-16.5'
Elevation: ----

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Soil Description: BROWN AND RUST BROWN MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.34 in
Specimen Area: 6.22 in^2
Specimen Volume: 39.43 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 19

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.2165	0	0	5.0422	7.2	7.2
2	5	0.057327	6.2201	37.373	0.4326	5.3099	7.2	7.6326
3	10	0.11918	6.224	53.994	0.62462	5.4417	7.2	7.8246
4	15	0.18405	6.228	62.676	0.72458	5.5332	7.2	7.9246
5	20	0.24892	6.232	69.557	0.80361	5.6096	7.2	8.0036
6	25	0.31228	6.236	75.327	0.86972	5.6726	7.2	8.0697
7	30	0.37564	6.24	80.356	0.92719	5.728	7.2	8.1272
8	35	0.44202	6.2441	85.068	0.9809	5.7788	7.2	8.1809
9	40	0.50689	6.2482	88.985	1.0254	5.8225	7.2	8.2254
10	45	0.57025	6.2522	92.478	1.065	5.8616	7.2	8.265
11	50	0.6321	6.2561	95.602	1.1003	5.8972	7.2	8.3003
12	55	0.69697	6.2602	98.513	1.133	5.9298	7.2	8.333
13	60	0.76033	6.2642	101.53	1.167	5.9607	7.2	8.367
14	70	0.88856	6.2723	106.72	1.225	6.0115	7.2	8.425
15	80	1.0198	6.2806	111.69	1.2804	6.0569	7.2	8.4804
16	90	1.1496	6.2888	115.93	1.3273	6.0949	7.2	8.5273
17	110	1.412	6.3056	123.92	1.415	6.1573	7.2	8.615
18	120	1.5403	6.3138	127.47	1.4536	6.1806	7.2	8.6536
19	180	2.3247	6.3645	144.14	1.6307	6.2815	7.2	8.8307
20	240	3.1062	6.4158	156.9	1.7608	6.3252	7.2	8.9608
21	300	3.8877	6.468	167.01	1.8591	6.3415	7.2	9.0591
22	360	4.6691	6.521	175.01	1.9323	6.3398	7.2	9.1323
23	420	5.4611	6.5756	181.3	1.9852	6.32	7.2	9.1852
24	480	6.2516	6.6311	187.18	2.0324	6.3025	7.2	9.2324
25	540	7.0361	6.687	192.69	2.0747	6.2844	7.2	9.2747
26	600	7.8221	6.7441	197.24	2.1057	6.2616	7.2	9.3057
27	660	8.6005	6.8015	201.31	2.1311	6.2418	7.2	9.3311
28	720	9.391	6.8608	205.13	2.1527	6.2237	7.2	9.3527
29	780	10.177	6.9209	208.78	2.172	6.2109	7.2	9.372
30	840	10.96	6.9817	211.85	2.1847	6.1957	7.2	9.3847
31	900	11.752	7.0444	214.97	2.1972	6.1841	7.2	9.3972
32	960	12.536	7.1076	217.25	2.2007	6.1713	7.2	9.4007
33	1020	13.315	7.1714	219.79	2.2067	6.1631	7.2	9.4067
34	1080	14.104	7.2373	221.96	2.2082	6.1514	7.2	9.4082
35	1140	14.884	7.3036	223.76	2.2059	6.145	7.2	9.4059
36	1200	15.665	7.3713	225.14	2.199	6.1363	7.2	9.399

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-012 S-7
Sample No.: S-7
Test No.: 30.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/5/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-16.5'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWN AND RUST BROWN MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.34 in
Specimen Area: 6.22 in^2
Specimen Volume: 39.43 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 19

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	7.2	7.2	0	0.000	2.1578	2.1578	1.000	2.1578	0
2	0.06	7.6326	7.2	0.26768	0.619	2.3227	1.8901	1.229	2.1064	0.2163
3	0.12	7.8246	7.2	0.39948	0.640	2.3829	1.7583	1.355	2.0706	0.31231
4	0.18	7.9246	7.2	0.49104	0.678	2.3913	1.6668	1.435	2.029	0.36229
5	0.25	8.0036	7.2	0.56744	0.706	2.394	1.5904	1.505	1.9922	0.4018
6	0.31	8.0697	7.2	0.63042	0.725	2.3971	1.5274	1.569	1.9622	0.43486
7	0.38	8.1272	7.2	0.68582	0.740	2.3992	1.472	1.630	1.9356	0.4636
8	0.44	8.1809	7.2	0.73656	0.751	2.4021	1.4212	1.690	1.9117	0.49045
9	0.51	8.2254	7.2	0.7803	0.761	2.4029	1.3775	1.744	1.8902	0.5127
10	0.57	8.265	7.2	0.81937	0.769	2.4034	1.3384	1.796	1.8709	0.53249
11	0.63	8.3003	7.2	0.85495	0.777	2.4031	1.3028	1.845	1.853	0.55013
12	0.70	8.333	7.2	0.88761	0.783	2.4032	1.2702	1.892	1.8367	0.56651
13	0.76	8.367	7.2	0.91851	0.787	2.4063	1.2393	1.942	1.8228	0.58349
14	0.89	8.425	7.2	0.96925	0.791	2.4136	1.1885	2.031	1.8011	0.61251
15	1.02	8.4804	7.2	1.0147	0.792	2.4235	1.1431	2.120	1.7833	0.64022
16	1.15	8.5273	7.2	1.0526	0.793	2.4324	1.1051	2.201	1.7688	0.66363
17	1.41	8.615	7.2	1.115	0.788	2.4577	1.0427	2.357	1.7502	0.7075
18	1.54	8.6536	7.2	1.1384	0.783	2.473	1.0194	2.426	1.7462	0.7268
19	2.32	8.8307	7.2	1.2393	0.760	2.5492	0.91853	2.775	1.7339	0.81533
20	3.11	8.9608	7.2	1.283	0.729	2.6356	0.87479	3.013	1.7552	0.88039
21	3.89	9.0591	7.2	1.2993	0.699	2.7176	0.85846	3.166	1.788	0.92957
22	4.67	9.1323	7.2	1.2976	0.672	2.7925	0.86021	3.246	1.8263	0.96614
23	5.46	9.1852	7.2	1.2778	0.644	2.8652	0.88004	3.256	1.8726	0.9926
24	6.25	9.2324	7.2	1.2603	0.620	2.9299	0.89753	3.264	1.9137	1.0162
25	7.04	9.2747	7.2	1.2422	0.599	2.9903	0.91561	3.266	1.9529	1.0373
26	7.82	9.3057	7.2	1.2194	0.579	3.0441	0.93836	3.244	1.9912	1.0529
27	8.60	9.3311	7.2	1.1996	0.563	3.0893	0.95818	3.224	2.0237	1.0655
28	9.39	9.3527	7.2	1.1815	0.549	3.1289	0.97626	3.205	2.0526	1.0763
29	10.18	9.372	7.2	1.1687	0.538	3.1611	0.98909	3.196	2.0751	1.086
30	10.96	9.3847	7.2	1.1535	0.528	3.189	1.0043	3.175	2.0966	1.0924
31	11.75	9.3972	7.2	1.1419	0.520	3.2131	1.0159	3.163	2.1145	1.0986
32	12.54	9.4007	7.2	1.129	0.513	3.2295	1.0287	3.139	2.1291	1.1004
33	13.31	9.4067	7.2	1.1209	0.508	3.2436	1.0369	3.128	2.1402	1.1033
34	14.10	9.4082	7.2	1.1092	0.502	3.2567	1.0486	3.106	2.1527	1.1041
35	14.88	9.4059	7.2	1.1028	0.500	3.2608	1.055	3.091	2.1579	1.1029
36	15.67	9.399	7.2	1.0941	0.498	3.2628	1.0637	3.067	2.1633	1.0995

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-012 S-7
Sample No.: S-7
Test No.: 60.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/5/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-16.5'
Elevation: ----

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Soil Description: BROWN AND RUST BROWN MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767.

Specimen Height: 6.26 in
Specimen Area: 6.29 in^2
Specimen Volume: 39.33 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 19

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.2881	0	0	5.0794	9.36	9.36
2	5	0.055149	6.2915	52.036	0.59549	5.5563	9.36	9.9555
3	10	0.11755	6.2955	71.569	0.81852	5.8035	9.36	10.179
4	15	0.18141	6.2995	84.326	0.96381	5.9774	9.36	10.324
5	20	0.24672	6.3036	94.702	1.0817	6.1181	9.36	10.442
6	25	0.31203	6.3078	103.75	1.1843	6.2356	9.36	10.544
7	30	0.37733	6.3119	111.85	1.2759	6.3392	9.36	10.636
8	35	0.44119	6.3159	119.26	1.3596	6.4305	9.36	10.72
9	40	0.5065	6.3201	125.99	1.4353	6.5113	9.36	10.795
10	45	0.5718	6.3242	132.6	1.5097	6.5858	9.36	10.87
11	50	0.63566	6.3283	138.48	1.5755	6.6503	9.36	10.936
12	55	0.70097	6.3325	143.88	1.6359	6.7091	9.36	10.996
13	60	0.76628	6.3366	149.33	1.6968	6.7667	9.36	11.057
14	70	0.89544	6.3449	158.97	1.8039	6.8626	9.36	11.164
15	80	1.0261	6.3533	167.86	1.9023	6.9446	9.36	11.262
16	90	1.1567	6.3617	176.06	1.9927	7.0185	9.36	11.353
17	100	1.2873	6.3701	183	2.0684	7.0773	9.36	11.428
18	110	1.4165	6.3784	189.56	2.1398	7.1325	9.36	11.5
19	120	1.5471	6.3869	196.55	2.2157	7.1802	9.36	11.576
20	180	2.3351	6.4384	227.25	2.5413	7.3582	9.36	11.901
21	240	3.1261	6.491	249.54	2.768	7.4332	9.36	12.128
22	300	3.9156	6.5443	267.01	2.9376	7.4565	9.36	12.298
23	360	4.7123	6.599	281.56	3.0721	7.453	9.36	12.432
24	420	5.5149	6.6551	294.48	3.1859	7.4338	9.36	12.546
25	480	6.3087	6.7115	305.17	3.2739	7.4059	9.36	12.634
26	540	7.1069	6.7692	315.07	3.3513	7.3716	9.36	12.711
27	600	7.9066	6.8279	323.91	3.4156	7.3349	9.36	12.776
28	660	8.699	6.8872	332.28	3.4737	7.2994	9.36	12.834
29	720	9.5044	6.9485	340.75	3.5308	7.2645	9.36	12.891
30	780	10.304	7.0104	347.84	3.5725	7.2302	9.36	12.932
31	840	11.102	7.0734	354.51	3.6086	7.1977	9.36	12.969
32	900	11.898	7.1372	361.34	3.6452	7.1668	9.36	13.005
33	960	12.697	7.2026	367.64	3.675	7.1383	9.36	13.035
34	1020	13.49	7.2686	373.2	3.6967	7.1104	9.36	13.057
35	1080	14.297	7.337	378.28	3.7121	7.0837	9.36	13.072
36	1140	15.095	7.406	383.31	3.7265	7.0621	9.36	13.086

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-012 S-7
Sample No.: S-7
Test No.: 60.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/5/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 15.0'-16.5'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWN AND RUST BROWN MOTTLED LEAN CLAY CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D 4767.

Specimen Height: 6.26 in
Specimen Area: 6.29 in^2
Specimen Volume: 39.33 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 48

Plastic Limit: 19

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	9.36	9.36	0	0.000	4.2806	4.2806	1.000	4.2806	0
2	0.06	9.9555	9.36	0.47694	0.801	4.3992	3.8037	1.157	4.1015	0.29775
3	0.12	10.179	9.36	0.72413	0.885	4.375	3.5565	1.230	3.9658	0.40926
4	0.18	10.324	9.36	0.89803	0.932	4.3464	3.3826	1.285	3.8645	0.4819
5	0.25	10.442	9.36	1.0388	0.960	4.3235	3.2419	1.334	3.7827	0.54084
6	0.31	10.544	9.36	1.1563	0.976	4.3087	3.1244	1.379	3.7165	0.59215
7	0.38	10.636	9.36	1.2598	0.987	4.2967	3.0208	1.422	3.6588	0.63796
8	0.44	10.72	9.36	1.3511	0.994	4.2891	2.9295	1.464	3.6093	0.67979
9	0.51	10.795	9.36	1.432	0.998	4.2839	2.8487	1.504	3.5663	0.71764
10	0.57	10.87	9.36	1.5064	0.998	4.2839	2.7742	1.544	3.5291	0.75483
11	0.64	10.936	9.36	1.571	0.997	4.2852	2.7097	1.581	3.4974	0.78777
12	0.70	10.996	9.36	1.6297	0.996	4.2868	2.6509	1.617	3.4689	0.81795
13	0.77	11.057	9.36	1.6873	0.994	4.2901	2.5933	1.654	3.4417	0.84839
14	0.90	11.164	9.36	1.7833	0.989	4.3013	2.4974	1.722	3.3993	0.90195
15	1.03	11.262	9.36	1.8653	0.981	4.3177	2.4154	1.788	3.3665	0.95115
16	1.16	11.353	9.36	1.9391	0.973	4.3341	2.3415	1.851	3.3378	0.99633
17	1.29	11.428	9.36	1.9979	0.966	4.3511	2.2827	1.906	3.3169	1.0342
18	1.42	11.5	9.36	2.0531	0.960	4.3673	2.2275	1.961	3.2974	1.0699
19	1.55	11.576	9.36	2.1008	0.948	4.3955	2.1798	2.016	3.2877	1.1079
20	2.34	11.901	9.36	2.2788	0.897	4.5432	2.0018	2.270	3.2725	1.2707
21	3.13	12.128	9.36	2.3539	0.850	4.6947	1.9268	2.437	3.3108	1.384
22	3.92	12.298	9.36	2.3771	0.809	4.8411	1.9035	2.543	3.3723	1.4688
23	4.71	12.432	9.36	2.3736	0.773	4.9791	1.907	2.611	3.443	1.536
24	5.51	12.546	9.36	2.3544	0.739	5.1121	1.9262	2.654	3.5192	1.593
25	6.31	12.634	9.36	2.3265	0.711	5.228	1.9541	2.675	3.5911	1.6369
26	7.11	12.711	9.36	2.2922	0.684	5.3397	1.9884	2.685	3.6641	1.6756
27	7.91	12.776	9.36	2.2556	0.660	5.4407	2.0251	2.687	3.7329	1.7078
28	8.70	12.834	9.36	2.2201	0.639	5.5342	2.0606	2.686	3.7974	1.7368
29	9.50	12.891	9.36	2.1852	0.619	5.6263	2.0955	2.685	3.8609	1.7654
30	10.30	12.932	9.36	2.1509	0.602	5.7022	2.1298	2.677	3.916	1.7862
31	11.10	12.969	9.36	2.1183	0.587	5.7709	2.1623	2.669	3.9666	1.8043
32	11.90	13.005	9.36	2.0875	0.573	5.8383	2.1932	2.662	4.0158	1.8226
33	12.70	13.035	9.36	2.059	0.560	5.8967	2.2217	2.654	4.0592	1.8375
34	13.49	13.057	9.36	2.031	0.549	5.9463	2.2496	2.643	4.098	1.8484
35	14.30	13.072	9.36	2.0043	0.540	5.9885	2.2763	2.631	4.1324	1.8561
36	15.09	13.086	9.36	1.9828	0.532	6.0243	2.2979	2.622	4.1611	1.8632

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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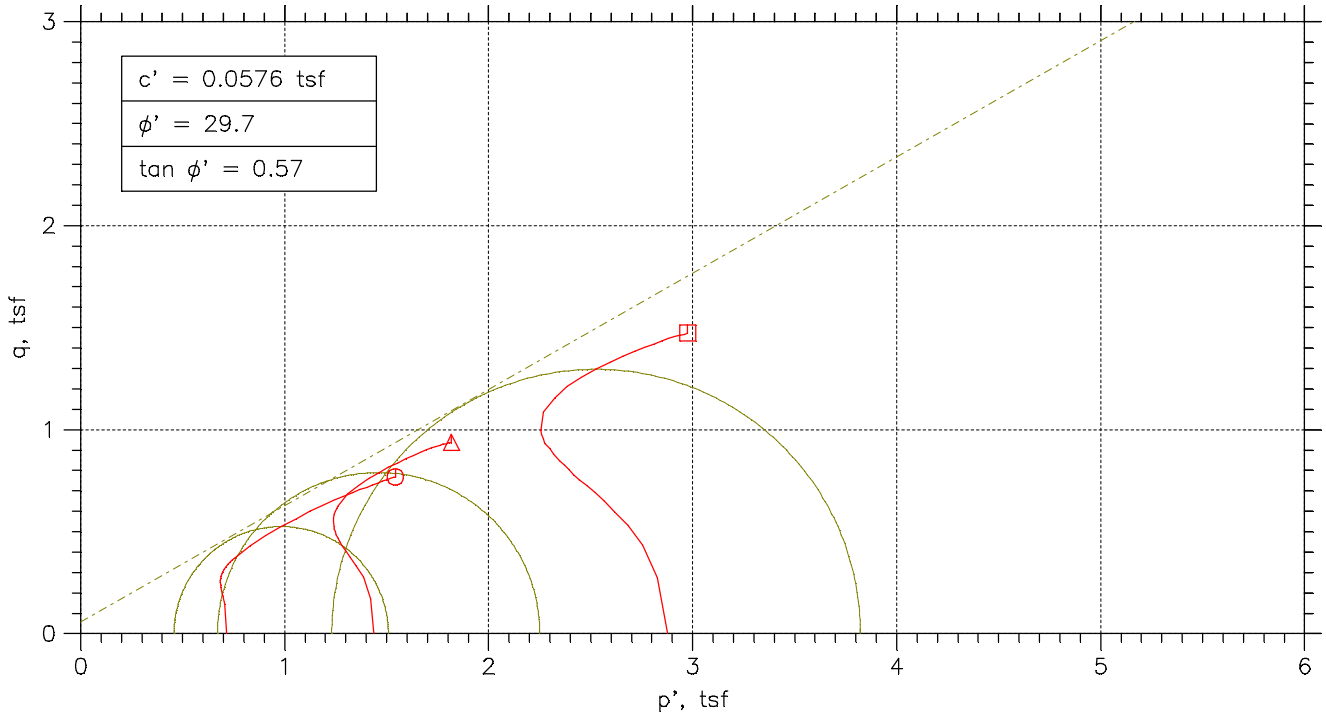

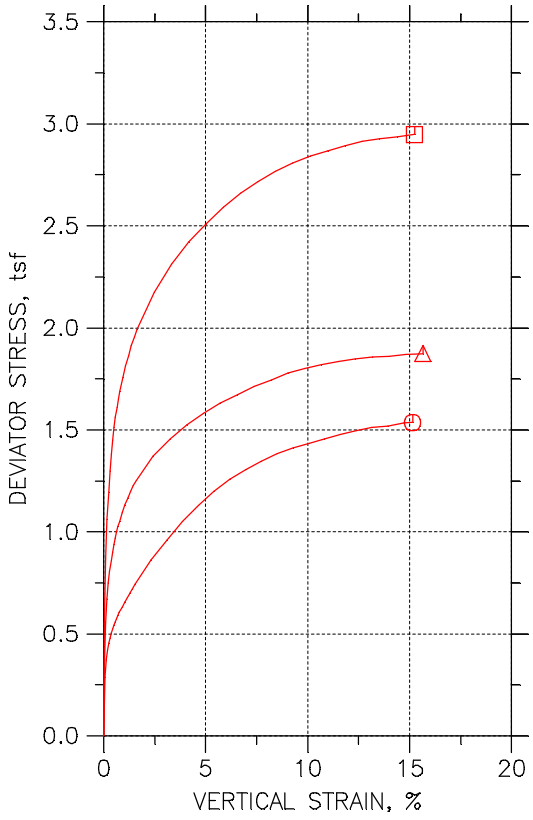

Symbol		⏲	△	⊡	
Test No.		10.0 PSI	20.0 PSI	40.0 PSI	
Initial	Diameter, in	2.8386	2.8571	2.8543	
	Height, in	6.0421	6.0181	5.878	
	Water Content, %	19.07	19.02	18.95	
	Dry Density, pcf	111.5	111.3	111.5	
	Saturation, %	99.28	98.47	98.47	
	Void Ratio	0.52245	0.52554	0.52343	
Before Shear	Water Content, %	18.80	18.40	16.50	
	Dry Density, pcf	112.4	113.2	117.2	
	Saturation, %	100.00	100.00	100.00	
	Void Ratio	0.51129	0.50044	0.4489	
	Back Press., tsf	5.0445	5.044	5.0432	
Minor Prin. Stress, tsf		0.71549	1.436	2.8768	
Max. Dev. Stress, tsf		1.536	1.8745	2.9478	
Time to Failure, min		1174.7	1140	1080	
Strain Rate, %/min		0.02	0.02	0.02	
B-Value		0.95	0.97	0.97	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		49	49	49	
Plastic Limit		21	21	21	
Plasticity Index		28	28	28	

Project: DYNEGY EDWARDS
Location: BARTONVILLE, IL
Project No.: MR155218
Boring No.: EDW-013 S3
Sample Type: 3.0" ST

Failure Sketch



Description: BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL CL

Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

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CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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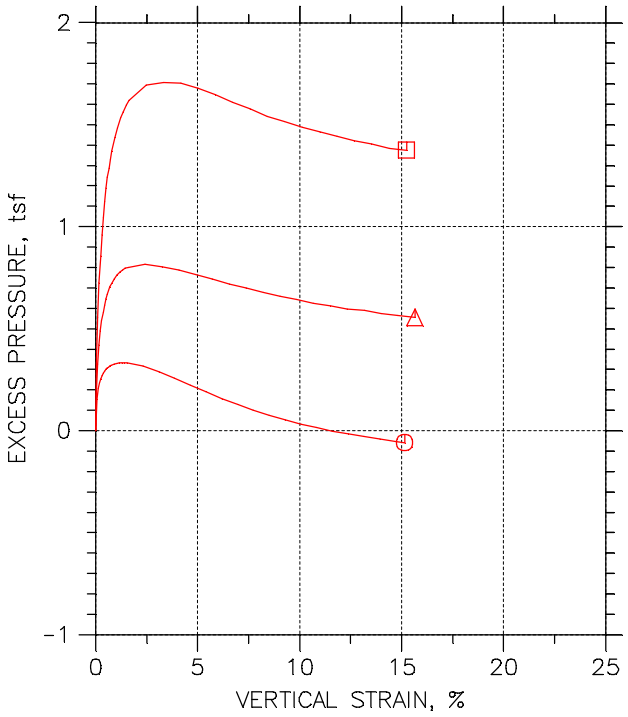

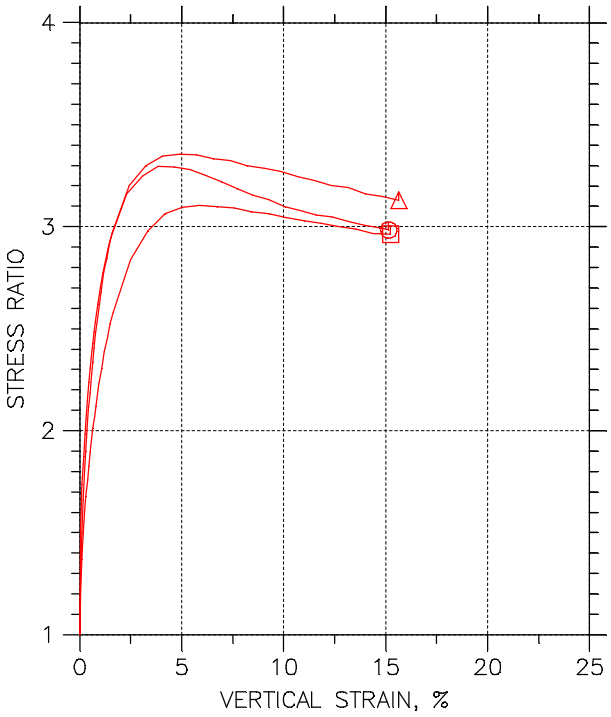

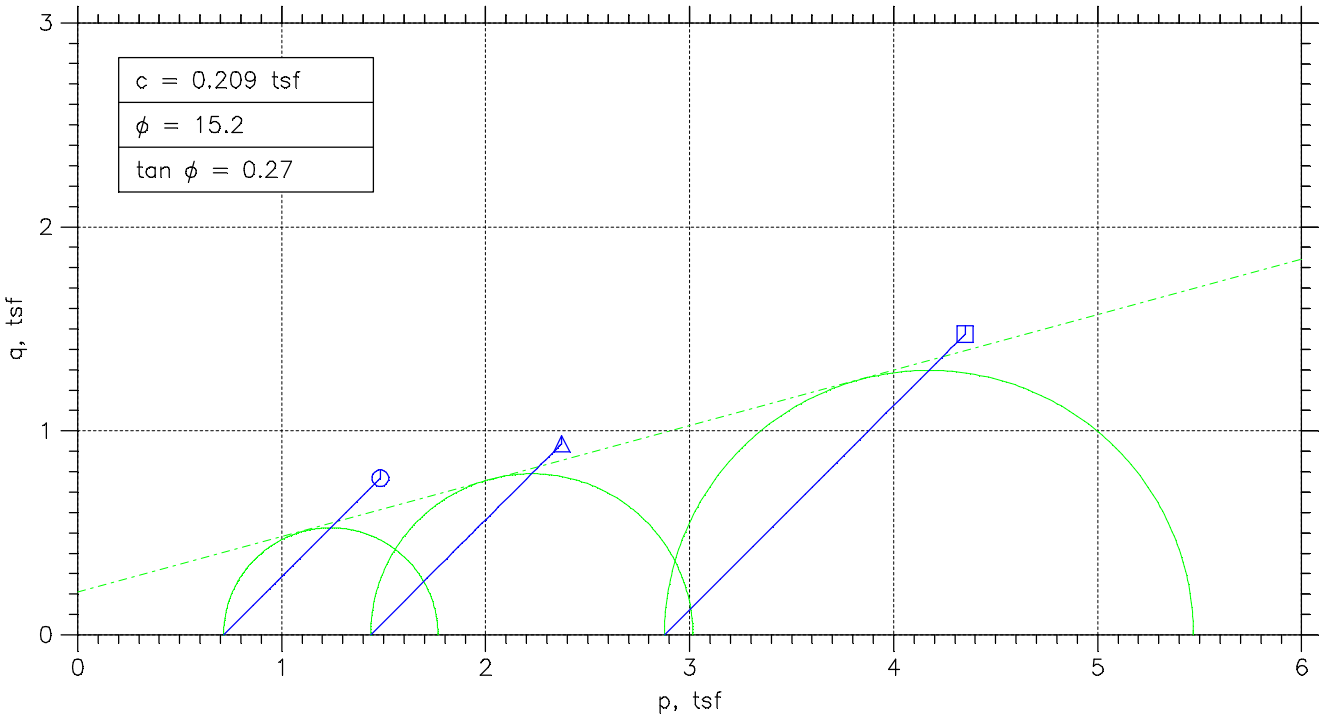

Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
Boring No.: EDW-013 S3	Tested By: BCM	Checked By: WPQ
Sample No.: S-3	Test Date: 11/4/15	Depth: 6.0'-8.0'
Test No.: EDW-013 S3	Sample Type: 3.0" ST	Elevation: -----
Description: BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL CL		
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767		

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-013 S3
Sample No.: S-3
Test No.: 10.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/4/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 6.0'-8.0'
Elevation: -----

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Soil Description: BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.04 in
Specimen Area: 6.33 in^2
Specimen Volume: 38.24 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 49

Plastic Limit: 21

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.3284	0	0	5.0445	5.76	5.76
2	5.0002	0.058512	6.3321	25.429	0.28914	5.1976	5.76	6.0491
3	10	0.12273	6.3362	32.957	0.3745	5.2511	5.76	6.1345
4	15	0.18695	6.3402	36.958	0.4197	5.2802	5.76	6.1797
5	20	0.25117	6.3443	39.959	0.45348	5.3	5.76	6.2135
6	25	0.31682	6.3485	42.381	0.48065	5.3139	5.76	6.2407
7	30	0.38104	6.3526	44.539	0.50481	5.3273	5.76	6.2648
8	35	0.44526	6.3567	46.277	0.52416	5.3372	5.76	6.2842
9	40	0.50948	6.3608	47.909	0.5423	5.3454	5.76	6.3023
10	45	0.5737	6.3649	49.488	0.55981	5.3512	5.76	6.3198
11	50	0.63935	6.3691	50.91	0.57551	5.3564	5.76	6.3355
12	55	0.70357	6.3732	52.278	0.5906	5.3617	5.76	6.3506
13	60	0.76922	6.3774	53.542	0.60448	5.3657	5.76	6.3645
14	70.001	0.89623	6.3856	55.911	0.63042	5.371	5.76	6.3904
15	80.001	1.0232	6.3938	58.175	0.6551	5.375	5.76	6.4151
16	90.001	1.1503	6.402	60.386	0.67913	5.3774	5.76	6.4391
17	100	1.2787	6.4104	62.387	0.70072	5.3779	5.76	6.4607
18	110	1.4043	6.4185	64.387	0.72227	5.3785	5.76	6.4823
19	120	1.5342	6.427	66.493	0.74491	5.3768	5.76	6.5049
20	180	2.3134	6.4783	77.602	0.86247	5.3611	5.76	6.6225
21	240	3.0926	6.5303	87.078	0.96008	5.3331	5.76	6.7201
22	300	3.8561	6.5822	96.028	1.0504	5.3023	5.76	6.8104
23	360	4.6339	6.6359	103.98	1.1282	5.268	5.76	6.8882
24	420	5.4102	6.6903	111.3	1.1977	5.2348	5.76	6.9577
25	480	6.1766	6.745	117.72	1.2566	5.2016	5.76	7.0166
26	540	6.9544	6.8014	123.3	1.3053	5.172	5.76	7.0653
27	600	7.7321	6.8587	128.09	1.3446	5.1446	5.76	7.1046
28	660	8.4985	6.9162	132.78	1.3822	5.1184	5.76	7.1422
29	720	9.2777	6.9756	136.88	1.4129	5.0975	5.76	7.1729
30	780	10.057	7.036	140.2	1.4347	5.0759	5.76	7.1947
31	840	10.819	7.0961	143.62	1.4572	5.0591	5.76	7.2172
32	900	11.602	7.159	146.99	1.4783	5.0416	5.76	7.2383
33	960	12.382	7.2227	150.1	1.4963	5.0288	5.76	7.2563
34	1020	13.151	7.2866	152.89	1.5107	5.0148	5.76	7.2707
35	1080	13.932	7.3527	155.15	1.5193	5.0032	5.76	7.2793
36	1140	14.706	7.4195	157.94	1.5327	4.9921	5.76	7.2927
37	1174.7	15.146	7.458	159.1	1.536	4.9857	5.76	7.296

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-013 S3
Sample No.: S-3
Test No.: 10.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/4/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 6.0'-8.0'
Elevation: -----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 6.04 in
Specimen Area: 6.33 in^2
Specimen Volume: 38.24 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 49

Plastic Limit: 21

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	5.76	5.76	0	0.000	0.71549	0.71549	1.000	0.71549	0
2	0.06	6.0491	5.76	0.15304	0.529	0.85158	0.56245	1.514	0.70701	0.14457
3	0.12	6.1345	5.76	0.20658	0.552	0.88341	0.50891	1.736	0.69616	0.18725
4	0.19	6.1797	5.76	0.23567	0.562	0.89951	0.47981	1.875	0.68966	0.20985
5	0.25	6.2135	5.76	0.25546	0.563	0.91352	0.46003	1.986	0.68677	0.22674
6	0.32	6.2407	5.76	0.26942	0.561	0.92672	0.44606	2.078	0.68639	0.24033
7	0.38	6.2648	5.76	0.2828	0.560	0.93749	0.43268	2.167	0.68508	0.2524
8	0.45	6.2842	5.76	0.2927	0.558	0.94695	0.42279	2.240	0.68487	0.26208
9	0.51	6.3023	5.76	0.30084	0.555	0.95694	0.41464	2.308	0.68579	0.27115
10	0.57	6.3198	5.76	0.30666	0.548	0.96863	0.40882	2.369	0.68873	0.27991
11	0.64	6.3355	5.76	0.3119	0.542	0.9791	0.40359	2.426	0.69134	0.28776
12	0.70	6.3506	5.76	0.31714	0.537	0.98895	0.39835	2.483	0.69365	0.2953
13	0.77	6.3645	5.76	0.32121	0.531	0.99875	0.39428	2.533	0.69651	0.30224
14	0.90	6.3904	5.76	0.32645	0.518	1.0195	0.38904	2.620	0.70425	0.31521
15	1.02	6.4151	5.76	0.33052	0.505	1.0401	0.38496	2.702	0.71252	0.32755
16	1.15	6.4391	5.76	0.33285	0.490	1.0618	0.38264	2.775	0.7222	0.33956
17	1.28	6.4607	5.76	0.33343	0.476	1.0828	0.38206	2.834	0.73241	0.35036
18	1.40	6.4823	5.76	0.33401	0.462	1.1037	0.38147	2.893	0.74261	0.36113
19	1.53	6.5049	5.76	0.33227	0.446	1.1281	0.38322	2.944	0.75567	0.37245
20	2.31	6.6225	5.76	0.31656	0.367	1.2614	0.39893	3.162	0.83017	0.43124
21	3.09	6.7201	5.76	0.28862	0.301	1.3869	0.42686	3.249	0.9069	0.48004
22	3.86	6.8104	5.76	0.25778	0.245	1.5081	0.4577	3.295	0.98291	0.52521
23	4.63	6.8882	5.76	0.22345	0.198	1.6202	0.49203	3.293	1.0561	0.56408
24	5.41	6.9577	5.76	0.19028	0.159	1.7229	0.5252	3.281	1.1241	0.59887
25	6.18	7.0166	5.76	0.15711	0.125	1.815	0.55837	3.250	1.1867	0.6283
26	6.95	7.0653	5.76	0.12744	0.098	1.8933	0.58805	3.220	1.2407	0.65263
27	7.73	7.1046	5.76	0.10009	0.074	1.96	0.6154	3.185	1.2877	0.67232
28	8.50	7.1422	5.76	0.073902	0.053	2.0238	0.64158	3.154	1.3327	0.69112
29	9.28	7.1729	5.76	0.052953	0.037	2.0754	0.66253	3.133	1.369	0.70643
30	10.06	7.1947	5.76	0.031423	0.022	2.1187	0.68406	3.097	1.4014	0.71734
31	10.82	7.2172	5.76	0.014548	0.010	2.1582	0.70094	3.079	1.4296	0.72862
32	11.60	7.2383	5.76	-0.0029095	-0.002	2.1967	0.7184	3.058	1.4576	0.73916
33	12.38	7.2563	5.76	-0.015711	-0.011	2.2275	0.7312	3.046	1.4793	0.74813
34	13.15	7.2707	5.76	-0.029677	-0.020	2.2559	0.74516	3.027	1.5005	0.75534
35	13.93	7.2793	5.76	-0.041315	-0.027	2.2761	0.7568	3.008	1.5164	0.75964
36	14.71	7.2927	5.76	-0.052371	-0.034	2.3005	0.76786	2.996	1.5342	0.76634
37	15.15	7.296	5.76	-0.058772	-0.038	2.3102	0.77426	2.984	1.5422	0.76798

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-013 S3
Sample No.: ----
Test No.: 20.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/4/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 6.0'-8.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.02 in
Specimen Area: 6.41 in^2
Specimen Volume: 38.58 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 49

Plastic Limit: 21

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.4112	0	0	5.044	6.48	6.48
2	5.0001	0.036568	6.4135	30.226	0.33933	5.2282	6.48	6.8193
3	10	0.095395	6.4173	49.495	0.55532	5.3711	6.48	7.0353
4	15	0.16217	6.4216	59.764	0.67009	5.4644	6.48	7.1501
5	20	0.22895	6.4259	66.858	0.74912	5.5321	6.48	7.2291
6	25	0.29572	6.4302	72.098	0.8073	5.5828	6.48	7.2873
7	30	0.36409	6.4346	76.704	0.85828	5.6254	6.48	7.3383
8	35	0.43405	6.4391	80.568	0.90088	5.6604	6.48	7.3809
9	40	0.50082	6.4434	83.903	0.93755	5.689	6.48	7.4175
10	45	0.57078	6.448	86.92	0.97058	5.7129	6.48	7.4506
11	50	0.63756	6.4523	89.62	1.0001	5.7309	6.48	7.4801
12	55	0.70433	6.4566	92.002	1.0259	5.7496	6.48	7.5059
13	60	0.77429	6.4612	94.384	1.0518	5.7642	6.48	7.5318
14	70	0.91261	6.4702	98.513	1.0962	5.7881	6.48	7.5762
15	80.001	1.0478	6.479	101.9	1.1324	5.8068	6.48	7.6124
16	90.001	1.1861	6.4881	105.29	1.1684	5.8219	6.48	7.6484
17	100	1.3212	6.497	108.15	1.1985	5.8301	6.48	7.6785
18	110	1.4595	6.5061	110.79	1.2261	5.8394	6.48	7.7061
19	120	1.5947	6.5151	113.28	1.2519	5.8435	6.48	7.7319
20	180	2.423	6.5704	125.03	1.3702	5.8581	6.48	7.8502
21	240	3.2498	6.6265	133.87	1.4546	5.847	6.48	7.9346
22	300	4.0702	6.6832	141.44	1.5238	5.8307	6.48	8.0038
23	360	4.8969	6.7413	147.9	1.5797	5.8091	6.48	8.0597
24	420	5.7253	6.8005	154.2	1.6326	5.7863	6.48	8.1126
25	480	6.5521	6.8607	159.44	1.6733	5.763	6.48	8.1533
26	540	7.3804	6.922	164.79	1.7141	5.742	6.48	8.1941
27	600	8.2072	6.9844	169.34	1.7457	5.7204	6.48	8.2257
28	660	9.0339	7.0479	174.05	1.7781	5.7024	6.48	8.2581
29	720	9.8591	7.1124	177.97	1.8016	5.686	6.48	8.2816
30	780	10.684	7.1781	181.41	1.8196	5.6697	6.48	8.2996
31	840	11.508	7.2449	184.64	1.835	5.6563	6.48	8.315
32	900	12.335	7.3132	187.76	1.8486	5.6406	6.48	8.3286
33	960	13.166	7.3832	190.52	1.8579	5.633	6.48	8.3379
34	1020	13.991	7.4541	192.74	1.8617	5.619	6.48	8.3417
35	1080	14.821	7.5267	195.44	1.8695	5.6096	6.48	8.3495
36	1140	15.646	7.6003	197.87	1.8745	5.5997	6.48	8.3545

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-013 S3
Sample No.: ----
Test No.: 20.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/4/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 6.0'-8.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.02 in
Specimen Area: 6.41 in^2
Specimen Volume: 38.58 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 49

Plastic Limit: 21

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	6.48	6.48	0	0.000	1.436	1.436	1.000	1.436	0
2	0.04	6.8193	6.48	0.18429	0.543	1.5911	1.2518	1.271	1.4214	0.16966
3	0.10	7.0353	6.48	0.32717	0.589	1.6642	1.1089	1.501	1.3865	0.27766
4	0.16	7.1501	6.48	0.42048	0.627	1.6857	1.0156	1.660	1.3506	0.33504
5	0.23	7.2291	6.48	0.48812	0.652	1.697	0.94792	1.790	1.3225	0.37456
6	0.30	7.2873	6.48	0.53886	0.667	1.7045	0.89718	1.900	1.3008	0.40365
7	0.36	7.3383	6.48	0.58143	0.677	1.7129	0.85461	2.004	1.2837	0.42914
8	0.43	7.3809	6.48	0.61643	0.684	1.7205	0.81962	2.099	1.2701	0.45044
9	0.50	7.4175	6.48	0.645	0.688	1.7286	0.79104	2.185	1.2598	0.46877
10	0.57	7.4506	6.48	0.66891	0.689	1.7377	0.76713	2.265	1.2524	0.48529
11	0.64	7.4801	6.48	0.68699	0.687	1.7491	0.74905	2.335	1.2491	0.50003
12	0.70	7.5059	6.48	0.70565	0.688	1.7563	0.73039	2.405	1.2434	0.51297
13	0.77	7.5318	6.48	0.72023	0.685	1.7676	0.71581	2.469	1.2417	0.52588
14	0.91	7.5762	6.48	0.74414	0.679	1.7881	0.6919	2.584	1.24	0.54812
15	1.05	7.6124	6.48	0.7628	0.674	1.8056	0.67324	2.682	1.2394	0.5662
16	1.19	7.6484	6.48	0.77797	0.666	1.8265	0.65808	2.775	1.2423	0.58421
17	1.32	7.6785	6.48	0.78613	0.656	1.8484	0.64991	2.844	1.2492	0.59925
18	1.46	7.7061	6.48	0.79546	0.649	1.8667	0.64058	2.914	1.2536	0.61305
19	1.59	7.7319	6.48	0.79954	0.639	1.8884	0.6365	2.967	1.2625	0.62596
20	2.42	7.8502	6.48	0.81412	0.594	1.9921	0.62192	3.203	1.307	0.68508
21	3.25	7.9346	6.48	0.80304	0.552	2.0876	0.633	3.298	1.3603	0.7273
22	4.07	8.0038	6.48	0.78671	0.516	2.1731	0.64933	3.347	1.4112	0.76191
23	4.90	8.0597	6.48	0.76514	0.484	2.2506	0.67091	3.355	1.4607	0.78983
24	5.73	8.1126	6.48	0.74239	0.455	2.3262	0.69365	3.354	1.5099	0.8163
25	6.55	8.1533	6.48	0.71907	0.430	2.3903	0.71698	3.334	1.5536	0.83664
26	7.38	8.1941	6.48	0.69807	0.407	2.452	0.73797	3.323	1.595	0.85703
27	8.21	8.2257	6.48	0.67649	0.388	2.5052	0.75955	3.298	1.6324	0.87284
28	9.03	8.2581	6.48	0.65841	0.370	2.5557	0.77763	3.287	1.6667	0.88905
29	9.86	8.2816	6.48	0.64209	0.356	2.5956	0.79396	3.269	1.6948	0.90081
30	10.68	8.2996	6.48	0.62576	0.344	2.6299	0.81029	3.246	1.7201	0.90982
31	11.51	8.315	6.48	0.61234	0.334	2.6587	0.8237	3.228	1.7412	0.91748
32	12.33	8.3286	6.48	0.5966	0.323	2.688	0.83945	3.202	1.7637	0.92428
33	13.17	8.3379	6.48	0.58902	0.317	2.7049	0.84703	3.193	1.776	0.92893
34	13.99	8.3417	6.48	0.57502	0.309	2.7227	0.86102	3.162	1.7919	0.93084
35	14.82	8.3495	6.48	0.56569	0.303	2.7399	0.87036	3.148	1.8051	0.93477
36	15.65	8.3545	6.48	0.55577	0.296	2.7548	0.88027	3.129	1.8175	0.93725

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-013 S3
Sample No.: S-3
Test No.: 40.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/4/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 6.0'-8.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 5.88 in
Specimen Area: 6.40 in^2
Specimen Volume: 37.61 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 49

Plastic Limit: 21

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.3988	0	0	5.0432	7.92	7.92
2	5.0041	0.048179	6.4019	48.62	0.54682	5.3658	7.92	8.4668
3	10.004	0.10879	6.4058	77.205	0.86778	5.6	7.92	8.7878
4	15.004	0.17407	6.41	94.356	1.0599	5.7689	7.92	8.9799
5	20.004	0.23934	6.4142	106.47	1.1952	5.9005	7.92	9.1152
6	25.004	0.30772	6.4186	115.76	1.2985	6.0036	7.92	9.2185
7	30	0.37611	6.423	123.2	1.3811	6.0892	7.92	9.3011
8	35	0.44449	6.4274	129.5	1.4506	6.1649	7.92	9.3706
9	40	0.51287	6.4318	135	1.5113	6.2313	7.92	9.4313
10	45	0.58125	6.4362	139.57	1.5613	6.2855	7.92	9.4813
11	50	0.65119	6.4407	143.87	1.6083	6.3309	7.92	9.5283
12	55	0.72113	6.4453	147.8	1.6511	6.3746	7.92	9.5711
13	60	0.78951	6.4497	151.16	1.6874	6.413	7.92	9.6074
14	70	0.93094	6.4589	157.56	1.7563	6.4788	7.92	9.6763
15	80	1.0724	6.4682	162.96	1.814	6.5278	7.92	9.734
16	90	1.2138	6.4774	167.78	1.865	6.5767	7.92	9.785
17	100	1.3568	6.4868	172.3	1.9124	6.607	7.92	9.8324
18	110	1.4982	6.4961	176.23	1.9532	6.639	7.92	9.8732
19	120	1.6381	6.5054	179.9	1.9911	6.6605	7.92	9.9111
20	180	2.4804	6.5616	198.15	2.1743	6.7374	7.92	10.094
21	240	3.3274	6.619	212.42	2.3106	6.7514	7.92	10.231
22	300	4.176	6.6777	224.69	2.4227	6.7467	7.92	10.343
23	360	5.0277	6.7375	234.87	2.5099	6.7217	7.92	10.43
24	420	5.8747	6.7982	244.73	2.5919	6.6891	7.92	10.512
25	480	6.7264	6.8602	253.49	2.6604	6.6512	7.92	10.58
26	540	7.5718	6.923	261.25	2.717	6.6209	7.92	10.637
27	600	8.4204	6.9871	268.49	2.7667	6.5848	7.92	10.687
28	660	9.2674	7.0524	275.04	2.808	6.5598	7.92	10.728
29	720	10.122	7.1194	280.92	2.841	6.5301	7.92	10.761
30	780	10.979	7.1879	286.37	2.8685	6.5068	7.92	10.789
31	840	11.838	7.258	291.67	2.8934	6.4858	7.92	10.813
32	900	12.685	7.3284	296.55	2.9135	6.4643	7.92	10.834
33	960	13.532	7.4002	300.74	2.9261	6.4474	7.92	10.846
34	1020	14.391	7.4745	304.73	2.9354	6.4276	7.92	10.855
35	1080	15.24	7.5493	309.08	2.9478	6.4183	7.92	10.868

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-013 S3
Sample No.: S-3
Test No.: 40.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/4/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 6.0'-8.0'
Elevation: ----

Terracon
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Soil Description: BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 5.88 in
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Piston Area: 0.00 in^2
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Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 49

Plastic Limit: 21

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	7.92	7.92	0	0.000	2.8768	2.8768	1.000	2.8768	0
2	0.05	8.4668	7.92	0.32266	0.590	3.101	2.5542	1.214	2.8276	0.27341
3	0.11	8.7878	7.92	0.55679	0.642	3.1878	2.32	1.374	2.7539	0.43389
4	0.17	8.9799	7.92	0.72569	0.685	3.211	2.1511	1.493	2.6811	0.52993
5	0.24	9.1152	7.92	0.85732	0.717	3.2147	2.0195	1.592	2.6171	0.59758
6	0.31	9.2185	7.92	0.96041	0.740	3.2149	1.9164	1.678	2.5657	0.64924
7	0.38	9.3011	7.92	1.046	0.757	3.2119	1.8308	1.754	2.5213	0.69054
8	0.44	9.3706	7.92	1.1217	0.773	3.2057	1.7551	1.827	2.4804	0.72532
9	0.51	9.4313	7.92	1.1881	0.786	3.2	1.6887	1.895	2.4443	0.75564
10	0.58	9.4813	7.92	1.2423	0.796	3.1958	1.6345	1.955	2.4152	0.78065
11	0.65	9.5283	7.92	1.2877	0.801	3.1974	1.5891	2.012	2.3932	0.80414
12	0.72	9.5711	7.92	1.3314	0.806	3.1965	1.5454	2.068	2.371	0.82554
13	0.79	9.6074	7.92	1.3698	0.812	3.1944	1.507	2.120	2.3507	0.84371
14	0.93	9.6763	7.92	1.4357	0.817	3.1975	1.4412	2.219	2.3193	0.87817
15	1.07	9.734	7.92	1.4846	0.818	3.2062	1.3922	2.303	2.2992	0.90699
16	1.21	9.785	7.92	1.5335	0.822	3.2083	1.3433	2.388	2.2758	0.93251
17	1.36	9.8324	7.92	1.5638	0.818	3.2254	1.313	2.456	2.2692	0.95619
18	1.50	9.8732	7.92	1.5958	0.817	3.2342	1.281	2.525	2.2576	0.97662
19	1.64	9.9111	7.92	1.6174	0.812	3.2506	1.2595	2.581	2.255	0.99555
20	2.48	10.094	7.92	1.6943	0.779	3.3569	1.1826	2.839	2.2697	1.0872
21	3.33	10.231	7.92	1.7082	0.739	3.4792	1.1686	2.977	2.3239	1.1553
22	4.18	10.343	7.92	1.7036	0.703	3.5959	1.1733	3.065	2.3846	1.2113
23	5.03	10.43	7.92	1.6785	0.669	3.7082	1.1983	3.095	2.4532	1.2549
24	5.87	10.512	7.92	1.6459	0.635	3.8228	1.2309	3.106	2.5269	1.296
25	6.73	10.58	7.92	1.6081	0.604	3.9292	1.2688	3.097	2.599	1.3302
26	7.57	10.637	7.92	1.5778	0.581	4.0161	1.2991	3.092	2.6576	1.3585
27	8.42	10.687	7.92	1.5417	0.557	4.1018	1.3352	3.072	2.7185	1.3833
28	9.27	10.728	7.92	1.5166	0.540	4.1682	1.3602	3.064	2.7642	1.404
29	10.12	10.761	7.92	1.4869	0.523	4.2309	1.3899	3.044	2.8104	1.4205
30	10.98	10.789	7.92	1.4636	0.510	4.2817	1.4132	3.030	2.8475	1.4343
31	11.84	10.813	7.92	1.4427	0.499	4.3276	1.4342	3.017	2.8809	1.4467
32	12.69	10.834	7.92	1.4211	0.488	4.3692	1.4557	3.001	2.9125	1.4568
33	13.53	10.846	7.92	1.4042	0.480	4.3987	1.4726	2.987	2.9357	1.463
34	14.39	10.855	7.92	1.3844	0.472	4.4278	1.4924	2.967	2.9601	1.4677
35	15.24	10.868	7.92	1.3751	0.466	4.4495	1.5017	2.963	2.9756	1.4739

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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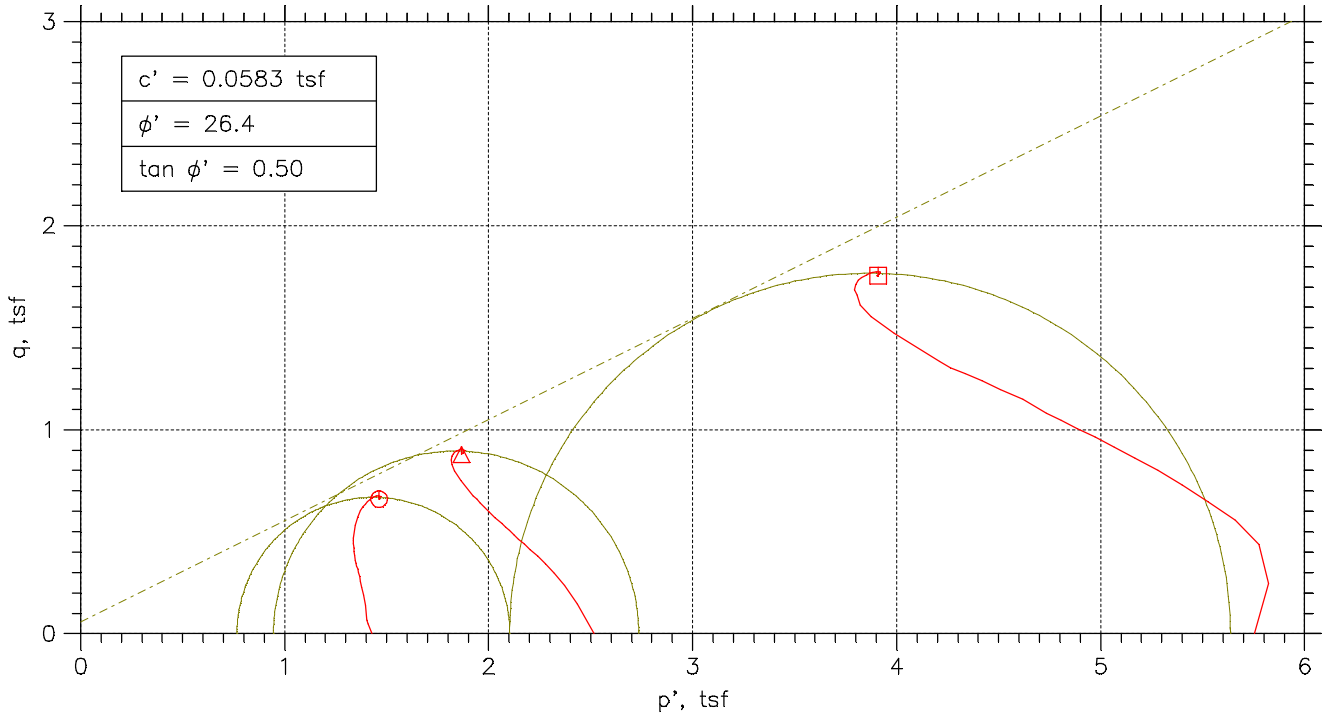

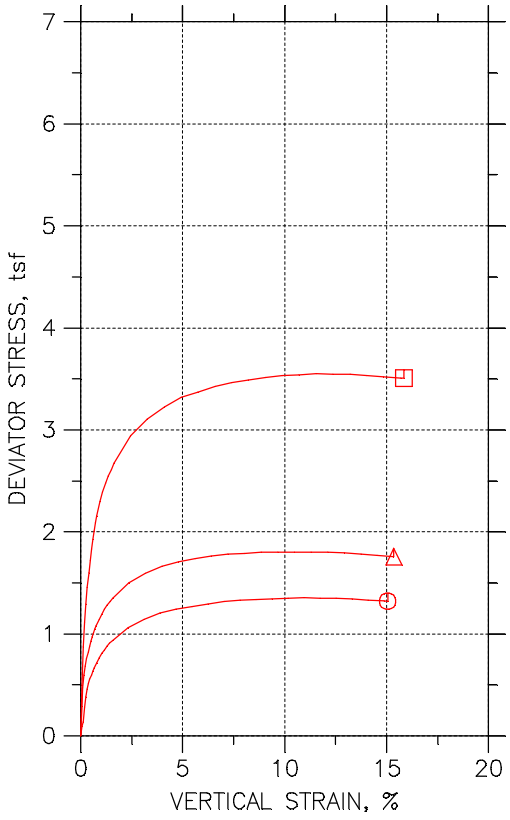

Symbol		⏲	△	◫	
Test No.		20.0 PSI	40.0 PSI	80.0 PSI	
Initial	Diameter, in	2.8323	2.8394	2.8232	
	Height, in	5.9835	6.1287	6.0461	
	Water Content, %	35.45	32.69	30.23	
	Dry Density, pcf	84.39	88.44	92.32	
	Saturation, %	95.27	96.65	97.97	
	Void Ratio	1.0122	0.91997	0.83931	
Before Shear	Water Content, %	27.91	28.32	23.10	
	Dry Density, pcf	96.52	95.92	104.3	
	Saturation, %	100.00	100.00	100.00	
	Void Ratio	0.75927	0.7702	0.62821	
	Back Press., tsf	5.0509	5.0422	1.4473	
Minor Prin. Stress, tsf		1.4291	2.5178	5.7527	
Max. Dev. Stress, tsf		1.3524	1.8029	3.5485	
Time to Failure, min		840	780	840	
Strain Rate, %/min		0.02	0.02	0.02	
B-Value		0.98	0.99	0.96	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		42	42	42	
Plastic Limit		23	23	23	
Plasticity Index		19	19	19	

Project: DYNEGY EDWARDS
Location: BARTONVILLE, IL
Project No.: MR155218
Boring No.: EDW-013 S10
Sample Type: 3.0" ST

Failure Sketch



Description: GRAY AND BROWN LEAN CLAY WITH SAND CL

Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

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CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST
ASTM D4767

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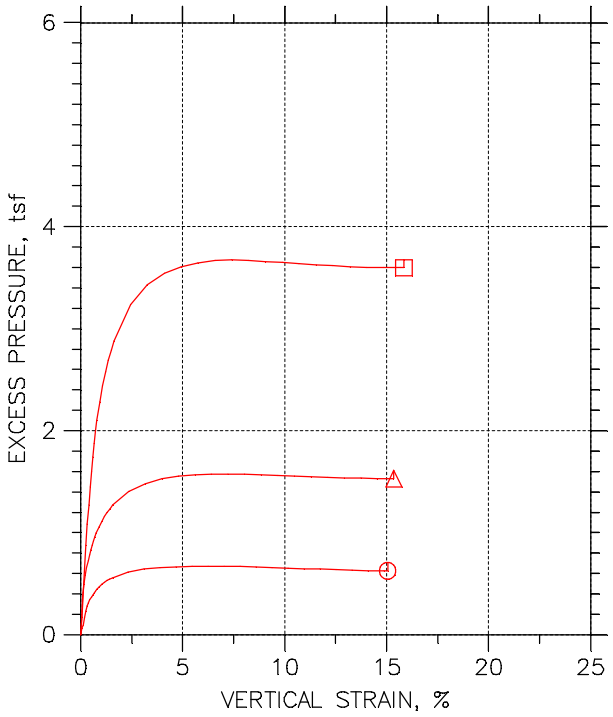

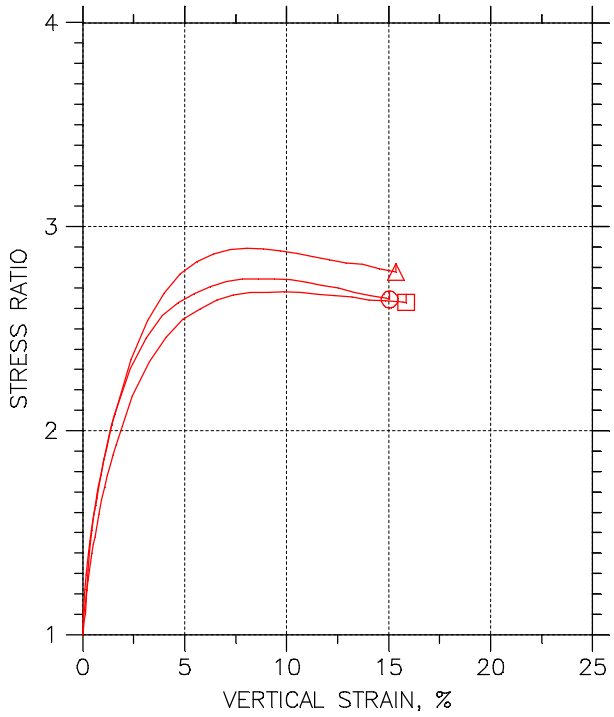

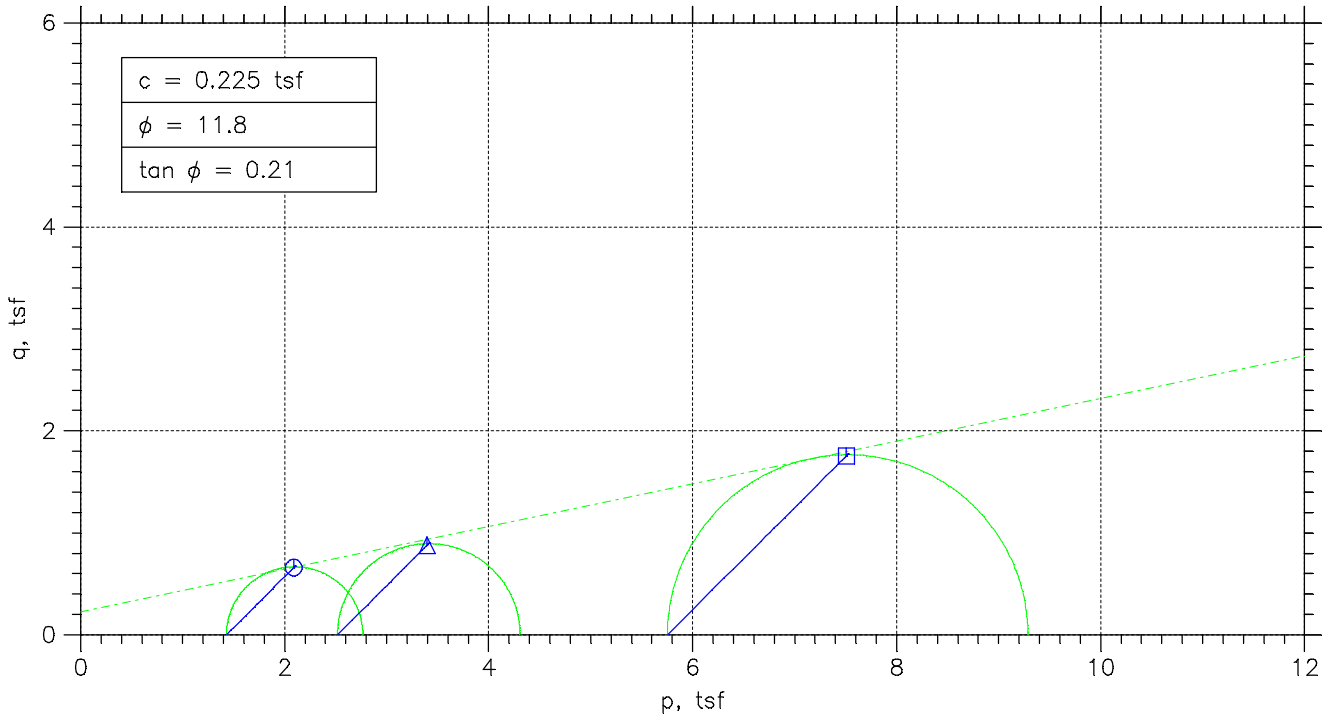

Project: DYNEGY EDWARDS	Location: BARTONVILLE, IL	Project No.: MR155218
Boring No.: EDW-013 S10	Tested By: BCM	Checked By: WPQ
Sample No.: S-10	Test Date: 10/29/15	Depth: 32.0'-34.0'
Test No.: EDW-013 S10	Sample Type: 3.0" ST	Elevation: -----
Description: GRAY AND BROWN LEAN CLAY WITH SAND CL		
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767		

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-013 S10
Sample No.: S-10
Test No.: 20.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 32.0'-34.0'
Elevation: -----

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Soil Description: GRAY AND BROWN LEAN CLAY WITH SAND CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.98 in
Specimen Area: 6.30 in^2
Specimen Volume: 37.70 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.3003	0	0	5.0509	6.48	6.48
2	5.0003	0.070614	6.3048	8.4452	0.096443	5.1202	6.48	6.5764
3	10	0.13546	6.3089	11.964	0.13654	5.1458	6.48	6.6165
4	15	0.19743	6.3128	24.163	0.27558	5.2208	6.48	6.7556
5	20	0.26228	6.3169	33.487	0.38169	5.2837	6.48	6.8617
6	25	0.32713	6.321	40.115	0.45693	5.3296	6.48	6.9369
7	30	0.39054	6.325	45.041	0.51272	5.364	6.48	6.9927
8	35	0.45539	6.3292	49.088	0.55842	5.3925	6.48	7.0384
9	40	0.52024	6.3333	52.665	0.59872	5.4169	6.48	7.0787
10	45	0.58653	6.3375	55.773	0.63364	5.4396	6.48	7.1136
11	50	0.6485	6.3415	58.412	0.66321	5.4594	6.48	7.1432
12	55	0.71335	6.3456	61.052	0.69272	5.4775	6.48	7.1727
13	60.001	0.7782	6.3497	63.339	0.7182	5.4932	6.48	7.1982
14	70.001	0.9079	6.3581	67.62	0.76574	5.5199	6.48	7.2457
15	80.001	1.039	6.3665	71.315	0.80652	5.5438	6.48	7.2865
16	90.001	1.1687	6.3748	74.716	0.84388	5.5636	6.48	7.3239
17	100	1.297	6.3831	77.825	0.87784	5.5816	6.48	7.3578
18	110	1.4281	6.3916	80.698	0.90905	5.5979	6.48	7.389
19	120	1.5593	6.4001	83.161	0.93555	5.6095	6.48	7.4155
20	180	2.3332	6.4508	95.243	1.063	5.6642	6.48	7.543
21	240	3.1229	6.5034	103.34	1.144	5.6945	6.48	7.624
22	300	3.904	6.5563	109.67	1.2044	5.7102	6.48	7.6844
23	360	4.6807	6.6097	114.07	1.2426	5.7172	6.48	7.7226
24	420	5.469	6.6648	117.59	1.2703	5.7201	6.48	7.7503
25	480	6.2544	6.7207	120.81	1.2943	5.7218	6.48	7.7743
26	540	7.0312	6.7768	123.8	1.3153	5.7207	6.48	7.7953
27	600	7.8223	6.835	126.21	1.3295	5.7178	6.48	7.8095
28	660	8.6063	6.8936	128.03	1.3372	5.7137	6.48	7.8172
29	720	9.3787	6.9524	129.79	1.3441	5.709	6.48	7.8241
30	780	10.17	7.0136	131.6	1.351	5.7044	6.48	7.831
31	840	10.952	7.0752	132.89	1.3524	5.6974	6.48	7.8324
32	900	11.731	7.1376	133.72	1.3488	5.6928	6.48	7.8288
33	960	12.525	7.2024	134.83	1.3478	5.6875	6.48	7.8278
34	1020	13.309	7.2675	135.53	1.3427	5.68	6.48	7.8227
35	1080	14.091	7.3337	135.65	1.3318	5.6794	6.48	7.8118
36	1140	14.882	7.4019	135.94	1.3224	5.6776	6.48	7.8024
37	1152.3	15.045	7.4161	135.89	1.3193	5.677	6.48	7.7993

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-013 S10
Sample No.: S-10
Test No.: 20.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 32.0'-34.0'
Elevation: -----

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Soil Description: GRAY AND BROWN LEAN CLAY WITH SAND CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767

Specimen Height: 5.98 in
Specimen Area: 6.30 in^2
Specimen Volume: 37.70 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	6.48	6.48	0	0.000	1.4291	1.4291	1.000	1.4291	0
2	0.07	6.5764	6.48	0.069246	0.718	1.4563	1.3598	1.071	1.4081	0.048221
3	0.14	6.6165	6.48	0.09485	0.695	1.4708	1.3342	1.102	1.4025	0.068269
4	0.20	6.7556	6.48	0.16992	0.617	1.5348	1.2592	1.219	1.397	0.13779
5	0.26	6.8617	6.48	0.23276	0.610	1.578	1.1963	1.319	1.3872	0.19084
6	0.33	6.9369	6.48	0.27873	0.610	1.6073	1.1504	1.397	1.3788	0.22846
7	0.39	6.9927	6.48	0.31306	0.611	1.6287	1.116	1.459	1.3724	0.25636
8	0.46	7.0384	6.48	0.34158	0.612	1.6459	1.0875	1.513	1.3667	0.27921
9	0.52	7.0787	6.48	0.36602	0.611	1.6618	1.0631	1.563	1.3624	0.29936
10	0.59	7.1136	6.48	0.38871	0.613	1.674	1.0404	1.609	1.3572	0.31682
11	0.65	7.1432	6.48	0.4085	0.616	1.6838	1.0206	1.650	1.3522	0.3316
12	0.71	7.1727	6.48	0.42653	0.616	1.6953	1.0025	1.691	1.3489	0.34636
13	0.78	7.1982	6.48	0.44225	0.616	1.705	0.98684	1.728	1.3459	0.3591
14	0.91	7.2457	6.48	0.46901	0.612	1.7258	0.96007	1.798	1.3429	0.38287
15	1.04	7.2865	6.48	0.49287	0.611	1.7427	0.93621	1.861	1.3395	0.40326
16	1.17	7.3239	6.48	0.51266	0.608	1.7603	0.91643	1.921	1.3384	0.42194
17	1.30	7.3578	6.48	0.5307	0.605	1.7762	0.89839	1.977	1.3373	0.43892
18	1.43	7.389	6.48	0.54699	0.602	1.7911	0.8821	2.031	1.3366	0.45452
19	1.56	7.4155	6.48	0.55863	0.597	1.806	0.87046	2.075	1.3382	0.46777
20	2.33	7.543	6.48	0.61333	0.577	1.8788	0.81576	2.303	1.3473	0.53152
21	3.12	7.624	6.48	0.64358	0.563	1.9295	0.7855	2.456	1.3575	0.57202
22	3.90	7.6844	6.48	0.6593	0.547	1.9742	0.76979	2.565	1.372	0.60219
23	4.68	7.7226	6.48	0.66628	0.536	2.0054	0.76281	2.629	1.3841	0.62128
24	5.47	7.7503	6.48	0.66919	0.527	2.0302	0.7599	2.672	1.395	0.63515
25	6.25	7.7743	6.48	0.67093	0.518	2.0524	0.75815	2.707	1.4053	0.64715
26	7.03	7.7953	6.48	0.66977	0.509	2.0747	0.75931	2.732	1.417	0.65767
27	7.82	7.8095	6.48	0.66686	0.502	2.0917	0.76222	2.744	1.427	0.66474
28	8.61	7.8172	6.48	0.66279	0.496	2.1035	0.7663	2.745	1.4349	0.66858
29	9.38	7.8241	6.48	0.65813	0.490	2.115	0.77095	2.743	1.443	0.67204
30	10.17	7.831	6.48	0.65348	0.484	2.1266	0.77561	2.742	1.4511	0.67551
31	10.95	7.8324	6.48	0.64649	0.478	2.135	0.78259	2.728	1.4588	0.67619
32	11.73	7.8288	6.48	0.64184	0.476	2.1361	0.78725	2.713	1.4617	0.67442
33	12.52	7.8278	6.48	0.6366	0.472	2.1403	0.79248	2.701	1.4664	0.67392
34	13.31	7.8227	6.48	0.62904	0.468	2.1428	0.80005	2.678	1.4714	0.67137
35	14.09	7.8118	6.48	0.62845	0.472	2.1324	0.80063	2.663	1.4665	0.66588
36	14.88	7.8024	6.48	0.62671	0.474	2.1247	0.80238	2.648	1.4636	0.66118
37	15.05	7.7993	6.48	0.62613	0.475	2.1222	0.80296	2.643	1.4626	0.65963

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-013 S10
Sample No.: S-10
Test No.: 40.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 32.0'-34.0'
Elevation: ----

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Soil Description: GRAY AND BROWN LEAN CLAY WITH SAND CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.13 in
Specimen Area: 6.33 in^2
Specimen Volume: 38.81 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.3319	0	0	5.0422	7.56	7.56
2	5.0001	0.049959	6.3351	25.547	0.29035	5.2708	7.56	7.8503
3	10.004	0.10929	6.3388	41.648	0.47306	5.4236	7.56	8.0331
4	15.004	0.17017	6.3427	52.381	0.59462	5.5356	7.56	8.1546
5	20.004	0.23262	6.3467	60.539	0.68679	5.6242	7.56	8.2468
6	25.004	0.29975	6.3509	67.151	0.76129	5.7006	7.56	8.3213
7	30.004	0.36533	6.3551	72.647	0.82305	5.7683	7.56	8.3831
8	35.004	0.4309	6.3593	77.585	0.87841	5.8248	7.56	8.4384
9	40.004	0.49803	6.3636	81.878	0.9264	5.8756	7.56	8.4864
10	45.004	0.56204	6.3677	85.914	0.97144	5.9211	7.56	8.5314
11	50.004	0.62761	6.3719	89.435	1.0106	5.9619	7.56	8.5706
12	55.004	0.6963	6.3763	92.698	1.0467	6.001	7.56	8.6067
13	60.004	0.76187	6.3805	95.875	1.0819	6.0371	7.56	8.6419
14	70.004	0.89614	6.3892	101.2	1.1404	6.1001	7.56	8.7004
15	80.004	1.0304	6.3978	105.97	1.1925	6.1538	7.56	8.7525
16	90.004	1.1631	6.4064	110.34	1.2401	6.201	7.56	8.8001
17	100	1.3005	6.4153	114.08	1.2803	6.2412	7.56	8.8403
18	110	1.4332	6.424	117.56	1.3176	6.2774	7.56	8.8776
19	120	1.569	6.4328	120.69	1.3509	6.3118	7.56	8.9109
20	180	2.3684	6.4855	135.2	1.501	6.4477	7.56	9.061
21	240	3.1786	6.5398	144.78	1.594	6.5241	7.56	9.154
22	300	3.9889	6.595	152.03	1.6598	6.569	7.56	9.2198
23	360	4.7976	6.651	157.53	1.7053	6.5952	7.56	9.2653
24	420	5.6095	6.7082	162	1.7387	6.6086	7.56	9.2987
25	480	6.4166	6.766	165.6	1.7622	6.6151	7.56	9.3222
26	540	7.2316	6.8255	168.65	1.779	6.6174	7.56	9.339
27	600	8.0434	6.8857	171.18	1.79	6.6145	7.56	9.35
28	660	8.8506	6.9467	173.55	1.7987	6.6092	7.56	9.3587
29	720	9.6608	7.009	175.35	1.8013	6.6022	7.56	9.3613
30	780	10.477	7.073	177.11	1.8029	6.5958	7.56	9.3629
31	840	11.286	7.1374	178.61	1.8018	6.5882	7.56	9.3618
32	900	12.099	7.2035	180.03	1.7994	6.5812	7.56	9.3594
33	960	12.914	7.2709	181.32	1.7955	6.5748	7.56	9.3555
34	1020	13.732	7.3398	181.88	1.7841	6.5766	7.56	9.3441
35	1080	14.54	7.4092	182.18	1.7703	6.5725	7.56	9.3303
36	1140	15.353	7.4804	182.61	1.7576	6.5719	7.56	9.3176

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-013 S10
Sample No.: S-10
Test No.: 40.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 32.0'-34.0'
Elevation: ----

Terracon Consulting Engineers & Scientists

Soil Description: GRAY AND BROWN LEAN CLAY WITH SAND CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.13 in
Specimen Area: 6.33 in^2
Specimen Volume: 38.81 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	7.56	7.56	0	0.000	2.5178	2.5178	1.000	2.5178	0
2	0.05	7.8503	7.56	0.22861	0.787	2.5795	2.2892	1.127	2.4344	0.14517
3	0.11	8.0331	7.56	0.3814	0.806	2.6094	2.1364	1.221	2.3729	0.23653
4	0.17	8.1546	7.56	0.49337	0.830	2.619	2.0244	1.294	2.3217	0.29731
5	0.23	8.2468	7.56	0.58202	0.847	2.6226	1.9358	1.355	2.2792	0.34339
6	0.30	8.3213	7.56	0.65841	0.865	2.6207	1.8594	1.409	2.24	0.38064
7	0.37	8.3831	7.56	0.72606	0.882	2.6148	1.7917	1.459	2.2033	0.41153
8	0.43	8.4384	7.56	0.78263	0.891	2.6136	1.7352	1.506	2.1744	0.43921
9	0.50	8.4864	7.56	0.83337	0.900	2.6108	1.6844	1.550	2.1476	0.4632
10	0.56	8.5314	7.56	0.87886	0.905	2.6104	1.6389	1.593	2.1247	0.48572
11	0.63	8.5706	7.56	0.91968	0.910	2.6087	1.5981	1.632	2.1034	0.50529
12	0.70	8.6067	7.56	0.95875	0.916	2.6058	1.559	1.671	2.0824	0.52336
13	0.76	8.6419	7.56	0.99491	0.920	2.6048	1.5229	1.710	2.0638	0.54095
14	0.90	8.7004	7.56	1.0579	0.928	2.6003	1.4599	1.781	2.0301	0.57021
15	1.03	8.7525	7.56	1.1115	0.932	2.5988	1.4062	1.848	2.0025	0.59626
16	1.16	8.8001	7.56	1.1588	0.934	2.5991	1.359	1.913	1.9791	0.62007
17	1.30	8.8403	7.56	1.199	0.936	2.5991	1.3188	1.971	1.9589	0.64017
18	1.43	8.8776	7.56	1.2352	0.937	2.6002	1.2826	2.027	1.9414	0.65879
19	1.57	8.9109	7.56	1.2696	0.940	2.5991	1.2482	2.082	1.9236	0.67543
20	2.37	9.061	7.56	1.4055	0.936	2.6133	1.1123	2.349	1.8628	0.7505
21	3.18	9.154	7.56	1.4819	0.930	2.6299	1.0359	2.539	1.8329	0.79698
22	3.99	9.2198	7.56	1.5268	0.920	2.6508	0.99102	2.675	1.8209	0.82991
23	4.80	9.2653	7.56	1.553	0.911	2.6701	0.96477	2.768	1.8174	0.85267
24	5.61	9.2987	7.56	1.5664	0.901	2.6901	0.95136	2.828	1.8207	0.86936
25	6.42	9.3222	7.56	1.5728	0.893	2.7072	0.94495	2.865	1.8261	0.88112
26	7.23	9.339	7.56	1.5752	0.885	2.7217	0.94261	2.887	1.8321	0.88952
27	8.04	9.35	7.56	1.5723	0.878	2.7355	0.94553	2.893	1.8405	0.89498
28	8.85	9.3587	7.56	1.567	0.871	2.7495	0.95078	2.892	1.8501	0.89937
29	9.66	9.3613	7.56	1.56	0.866	2.759	0.95778	2.881	1.8584	0.90063
30	10.48	9.3629	7.56	1.5536	0.862	2.7671	0.96419	2.870	1.8656	0.90145
31	11.29	9.3618	7.56	1.546	0.858	2.7736	0.97177	2.854	1.8727	0.90089
32	12.10	9.3594	7.56	1.539	0.855	2.7782	0.97877	2.838	1.8785	0.89971
33	12.91	9.3555	7.56	1.5326	0.854	2.7807	0.98519	2.822	1.8829	0.89775
34	13.73	9.3441	7.56	1.5344	0.860	2.7675	0.98344	2.814	1.8755	0.89205
35	14.54	9.3303	7.56	1.5303	0.864	2.7578	0.98752	2.793	1.8727	0.88516
36	15.35	9.3176	7.56	1.5297	0.870	2.7457	0.9881	2.779	1.8669	0.87881

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-013 S10
Sample No.: S-10
Test No.: 80.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 32.0'-34.0'
Elevation: ----

Terracon
Consulting Engineers & Scientists

Soil Description: GRAY AND BROWN LEAN CLAY WITH SAND CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.05 in
Specimen Area: 6.26 in^2
Specimen Volume: 37.85 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

Plastic Limit: 23

Estimated Specific Gravity: 2.72

	Time min	Vertical Strain %	Corrected Area in^2	Deviator Load lb	Deviator Stress tsf	Pore Pressure tsf	Horizontal Stress tsf	Vertical Stress tsf
1	0	0	6.2601	0	0	1.4473	7.2	7.2
2	5.0002	0.057416	6.2637	42.956	0.49377	1.6232	7.2	7.6938
3	10	0.12843	6.2682	75.999	0.87297	1.8591	7.2	8.073
4	15	0.19491	6.2723	96.821	1.1114	2.0973	7.2	8.3114
5	20	0.26139	6.2765	112.87	1.2948	2.3215	7.2	8.4948
6	25	0.32939	6.2808	127.24	1.4586	2.53	7.2	8.6586
7	30	0.39436	6.2849	139.93	1.6031	2.7199	7.2	8.8031
8	35	0.46084	6.2891	150.32	1.7209	2.8923	7.2	8.9209
9	40	0.52581	6.2932	159.97	1.8302	3.0478	7.2	9.0302
10	45	0.59531	6.2976	168.57	1.9273	3.1905	7.2	9.1273
11	50	0.6633	6.3019	175.7	2.0074	3.3198	7.2	9.2074
12	55	0.7313	6.3062	183.2	2.0917	3.438	7.2	9.2917
13	60	0.79929	6.3105	189.45	2.1615	3.5452	7.2	9.3615
14	70	0.9383	6.3194	201.61	2.2971	3.7298	7.2	9.4971
15	80	1.0758	6.3282	210.37	2.3936	3.8876	7.2	9.5936
16	90.001	1.2163	6.3372	218.14	2.4784	4.0228	7.2	9.6784
17	100	1.3538	6.346	224.69	2.5493	4.1375	7.2	9.7493
18	110	1.4928	6.355	230.15	2.6075	4.2388	7.2	9.8075
19	120	1.6303	6.3639	236.18	2.6721	4.3262	7.2	9.8721
20	180	2.4432	6.4169	262.25	2.9425	4.685	7.2	10.142
21	240	3.2787	6.4723	279.34	3.1075	4.8801	7.2	10.308
22	300	4.1067	6.5282	292.25	3.2232	4.9907	7.2	10.423
23	360	4.9136	6.5836	303.47	3.3188	5.0548	7.2	10.519
24	420	5.7506	6.6421	310.87	3.3698	5.0903	7.2	10.57
25	480	6.5802	6.701	318.68	3.4241	5.1136	7.2	10.624
26	540	7.4006	6.7604	325.24	3.4638	5.1206	7.2	10.664
27	600	8.2346	6.8219	330.8	3.4913	5.1171	7.2	10.691
28	660	9.0626	6.884	336.15	3.5158	5.1061	7.2	10.716
29	720	9.877	6.9462	340.92	3.5338	5.0973	7.2	10.734
30	780	10.714	7.0113	344.8	3.5408	5.088	7.2	10.741
31	840	11.542	7.0769	348.79	3.5485	5.0746	7.2	10.749
32	900	12.361	7.1431	351.99	3.5479	5.0647	7.2	10.748
33	960	13.204	7.2124	355.4	3.5478	5.0566	7.2	10.748
34	1020	14.025	7.2813	357.18	3.5319	5.0478	7.2	10.732
35	1080	14.848	7.3517	359.59	3.5217	5.0496	7.2	10.722
36	1140	15.696	7.4256	361.69	3.507	5.049	7.2	10.707
37	1151.2	15.853	7.4395	362.53	3.5086	5.0455	7.2	10.709

TRIAXIAL TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-013 S10
Sample No.: S-10
Test No.: 80.0 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/29/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 32.0'-34.0'
Elevation: ----

Terracon
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Soil Description: GRAY AND BROWN LEAN CLAY WITH SAND CL
Remarks: FAILURE CRITERIA = MAXIMUM EFFECTIVE STRESS RATIO TEST PERFORMED AS PER ASTM D4767.

Specimen Height: 6.05 in
Specimen Area: 6.26 in^2
Specimen Volume: 37.85 in^3

Piston Area: 0.00 in^2
Piston Friction: 0.00 lb
Piston Weight: 0.00 lb

Filter Strip Correction: 0.00 tsf
Membrane Correction: 0.00 lb/in
Correction Type: Uniform

Liquid Limit: 42

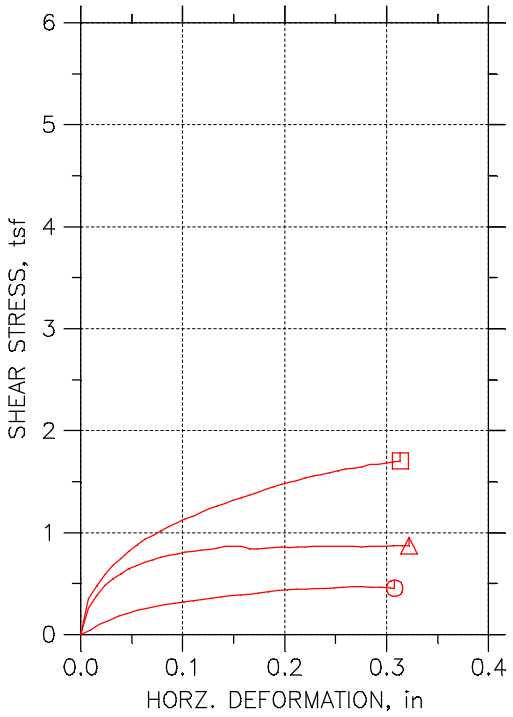
Plastic Limit: 23

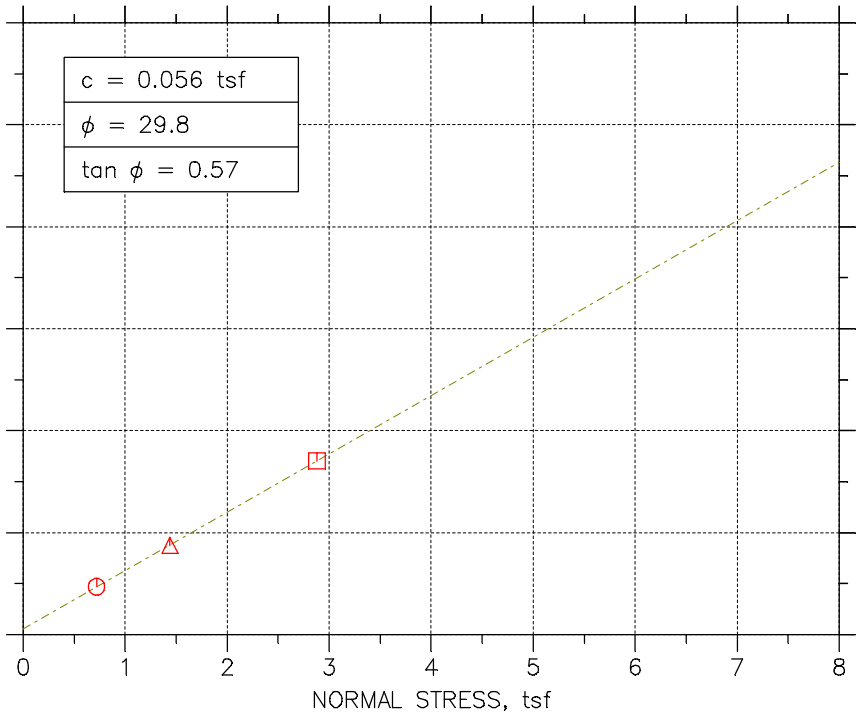
Estimated Specific Gravity: 2.72

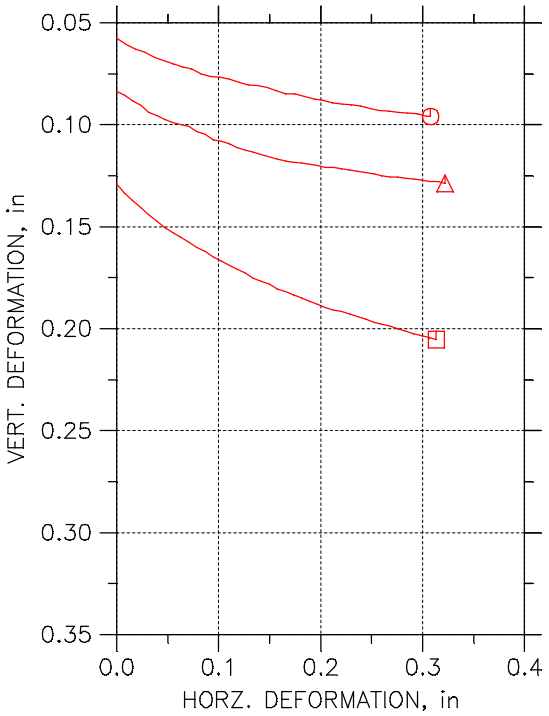
	Vertical Strain %	Total Vertical Stress tsf	Total Horizontal Stress tsf	Excess Pore Pressure tsf	A Parameter	Effective Vertical Stress tsf	Effective Horizontal Stress tsf	Stress Ratio	Effective p tsf	q tsf
1	0.00	7.2	7.2	0	0.000	5.7527	5.7527	1.000	5.7527	0
2	0.06	7.6938	7.2	0.17589	0.356	6.0706	5.5768	1.089	5.8237	0.24688
3	0.13	8.073	7.2	0.41177	0.472	6.2139	5.3409	1.163	5.7774	0.43648
4	0.19	8.3114	7.2	0.64998	0.585	6.2141	5.1027	1.218	5.6584	0.5557
5	0.26	8.4948	7.2	0.87421	0.675	6.1733	4.8785	1.265	5.5259	0.64739
6	0.33	8.6586	7.2	1.0827	0.742	6.1286	4.67	1.312	5.3993	0.72932
7	0.39	8.8031	7.2	1.2726	0.794	6.0832	4.4801	1.358	5.2816	0.80155
8	0.46	8.9209	7.2	1.445	0.840	6.0286	4.3077	1.399	5.1682	0.86046
9	0.53	9.0302	7.2	1.6005	0.874	5.9824	4.1522	1.441	5.0673	0.9151
10	0.60	9.1273	7.2	1.7432	0.904	5.9368	4.0095	1.481	4.9731	0.96363
11	0.66	9.2074	7.2	1.8725	0.933	5.8877	3.8802	1.517	4.8839	1.0037
12	0.73	9.2917	7.2	1.9907	0.952	5.8537	3.762	1.556	4.8078	1.0459
13	0.80	9.3615	7.2	2.0979	0.971	5.8163	3.6548	1.591	4.7356	1.0807
14	0.94	9.4971	7.2	2.2825	0.994	5.7673	3.4702	1.662	4.6187	1.1485
15	1.08	9.5936	7.2	2.4403	1.020	5.7059	3.3124	1.723	4.5091	1.1968
16	1.22	9.6784	7.2	2.5755	1.039	5.6556	3.1772	1.780	4.4164	1.2392
17	1.35	9.7493	7.2	2.6902	1.055	5.6118	3.0625	1.832	4.3371	1.2746
18	1.49	9.8075	7.2	2.7915	1.071	5.5686	2.9612	1.881	4.2649	1.3037
19	1.63	9.8721	7.2	2.8789	1.077	5.5459	2.8738	1.930	4.2098	1.336
20	2.44	10.142	7.2	3.2377	1.100	5.4575	2.515	2.170	3.9863	1.4712
21	3.28	10.308	7.2	3.4328	1.105	5.4274	2.3199	2.339	3.8737	1.5538
22	4.11	10.423	7.2	3.5434	1.099	5.4325	2.2093	2.459	3.8209	1.6116
23	4.91	10.519	7.2	3.6075	1.087	5.464	2.1452	2.547	3.8046	1.6594
24	5.75	10.57	7.2	3.643	1.081	5.4794	2.1097	2.597	3.7945	1.6849
25	6.58	10.624	7.2	3.6663	1.071	5.5105	2.0864	2.641	3.7984	1.712
26	7.40	10.664	7.2	3.6733	1.060	5.5432	2.0794	2.666	3.8113	1.7319
27	8.23	10.691	7.2	3.6698	1.051	5.5742	2.0829	2.676	3.8285	1.7457
28	9.06	10.716	7.2	3.6588	1.041	5.6097	2.0939	2.679	3.8518	1.7579
29	9.88	10.734	7.2	3.65	1.033	5.6364	2.1027	2.681	3.8695	1.7669
30	10.71	10.741	7.2	3.6407	1.028	5.6528	2.112	2.677	3.8824	1.7704
31	11.54	10.749	7.2	3.6273	1.022	5.6739	2.1254	2.670	3.8996	1.7743
32	12.36	10.748	7.2	3.6174	1.020	5.6832	2.1353	2.662	3.9092	1.774
33	13.20	10.748	7.2	3.6093	1.017	5.6913	2.1434	2.655	3.9173	1.7739
34	14.02	10.732	7.2	3.6005	1.019	5.6841	2.1522	2.641	3.9181	1.766
35	14.85	10.722	7.2	3.6023	1.023	5.6721	2.1504	2.638	3.9113	1.7609
36	15.70	10.707	7.2	3.6017	1.027	5.658	2.151	2.630	3.9045	1.7535
37	15.85	10.709	7.2	3.5982	1.026	5.6631	2.1545	2.628	3.9088	1.7543

DIRECT SHEAR TEST REPORT

Terracon
Consulting Engineers & Scientists







Symbol		⏲	△	⧈	
Test No.		10 PSI	20 PSI	40 PSI	
Sample No.		S-5	S-5	S-5	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.502	2.5016	2.5035	
	Area, in^2	4.9165	4.9149	4.9227	
	Height, in	1.0098	1.0087	1.0067	
	Water Content, %	75.08	66.70	67.21	
	Dry Density, pcf	51.869	56.572	54.543	
	Saturation, %	97.66	99.74	94.70	
	Void Ratio	1.7682	1.5381	1.6325	
Consol. Height, in		0.955	0.93155	0.88124	
Consol. Void Ratio		1.6179	1.344	1.3044	
Final	Water Content, %	64.90	53.10	47.20	
	Dry Density, pcf	57.319	64.848	68.523	
	Saturation, %	99.18	100.59	99.10	
	Void Ratio	1.505	1.2142	1.0954	
Normal Stress, tsf		0.71991	1.4387	2.88	
Max. Shear Stress, tsf		0.47008	0.87498	1.7039	
Ult. Shear Stress, tsf		0.45479	0.87367	1.7039	
Time to Failure, min		3678.3	1181.7	1190.6	
Disp. Rate, in/min		6.49e-005	0.000267	0.000267	
Estimated Specific Gravity		2.30	2.30	2.30	
Liquid Limit		NP	NP	NP	
Plastic Limit		NP	NP	NP	
Plasticity Index		NP	NP	NP	

Project: DYNEGY EDWARDS	
Location: BARTONVILLE, IL	
Project No.: MR155218	
Boring No.: EDW-B002 S5	
Sample Type: 3.0" ST	
Description: GRAY TO DARK GRAY VARVED FLY ASH	
Remarks: TEST PERFORMED AS PER ASTM D3080.	

DIRECT SHEAR TEST DATA

Terracon
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Project: DYNEGY EDWARDS
Boring No.: EDW-B002 S5
Sample No.: S-5
Test No.: 10 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/23/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 10.0'-12.0'
Elevation: ----

Soil Description: GRAY TO DARK GRAY VARVED FLY ASH
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	0.7191	0.05749	0	0
2	156.95	0.7199	0.06058	0.04248	0.009199
3	277.29	0.7199	0.06298	0.1019	0.0184
4	393.34	0.7199	0.06449	0.1405	0.0276
5	521.67	0.7199	0.06689	0.1795	0.03679
6	638.11	0.7191	0.06852	0.2096	0.04599
7	753.57	0.7199	0.07016	0.2362	0.05519
8	865.04	0.7199	0.07168	0.2577	0.06439
9	981.73	0.7199	0.07275	0.2764	0.07359
10	1096.66	0.7199	0.07502	0.2939	0.08279
11	1214.45	0.7199	0.07628	0.3104	0.09199
12	1328.38	0.7199	0.07678	0.3228	0.1012
13	1454.83	0.7199	0.07767	0.3353	0.1104
14	1573.59	0.7199	0.0793	0.3472	0.1196
15	1688.63	0.7199	0.08044	0.3596	0.1288
16	1817.30	0.7199	0.08094	0.3721	0.138
17	1955.96	0.7199	0.08183	0.3817	0.1472
18	2070.95	0.7199	0.08321	0.3902	0.1564
19	2203.51	0.7199	0.08473	0.3965	0.1656
20	2323.62	0.7199	0.08485	0.4072	0.1748
21	2452.80	0.7199	0.08599	0.4191	0.184
22	2580.16	0.7199	0.08731	0.431	0.1932
23	2700.75	0.7199	0.08813	0.4401	0.2024
24	2823.89	0.7199	0.08933	0.4463	0.2116
25	2950.56	0.7199	0.09002	0.4486	0.2208
26	3070.17	0.7199	0.09027	0.4491	0.23
27	3194.72	0.7199	0.09078	0.4514	0.2392
28	3328.14	0.7199	0.09217	0.4588	0.2483
29	3443.95	0.7191	0.09292	0.4655	0.2575
30	3554.17	0.7191	0.09343	0.4695	0.2667
31	3678.32	0.7199	0.09393	0.4701	0.2759
32	3812.79	0.7199	0.09443	0.4678	0.2851
33	3932.15	0.7199	0.09475	0.4633	0.2943
34	4054.51	0.7199	0.09576	0.4571	0.3035
35	4102.88	0.7199	0.09601	0.4548	0.3078

DIRECT SHEAR TEST DATA

Terracon
Consulting Engineers & Scientists

Project: DYNEGY EDWARDS
Boring No.: EDW-B002 S5
Sample No.: S-5
Test No.: 20 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/23/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 10.0'-12.0'
Elevation: ----

Soil Description: GRAY TO DARK GRAY VARVED FLY ASH
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	1.438	0.08377	0	0
2	33.66	1.439	0.08551	0.2598	0.007876
3	62.53	1.439	0.08828	0.3842	0.01575
4	94.03	1.439	0.09063	0.4817	0.02363
5	123.61	1.439	0.09391	0.5451	0.0315
6	153.40	1.439	0.09565	0.5982	0.03938
7	184.06	1.439	0.09749	0.644	0.04725
8	213.02	1.439	0.09903	0.6793	0.05513
9	241.92	1.439	0.09985	0.7094	0.06301
10	271.68	1.439	0.101	0.7362	0.07088
11	302.17	1.439	0.1033	0.7611	0.07876
12	330.34	1.439	0.1047	0.7781	0.08663
13	360.65	1.439	0.1073	0.7886	0.09451
14	392.06	1.439	0.1082	0.8089	0.1024
15	421.40	1.439	0.1095	0.818	0.1103
16	448.87	1.439	0.1113	0.8259	0.1181
17	477.79	1.439	0.1125	0.8351	0.126
18	506.84	1.439	0.1134	0.8495	0.1339
19	537.40	1.439	0.1148	0.8632	0.1418
20	593.97	1.439	0.1167	0.8652	0.1575
21	623.57	1.439	0.1179	0.8429	0.1654
22	655.08	1.439	0.1184	0.8423	0.1733
23	684.47	1.439	0.1188	0.8481	0.1811
24	712.80	1.439	0.1195	0.8521	0.189
25	740.02	1.439	0.1199	0.8573	0.1969
26	771.65	1.439	0.1208	0.8567	0.2048
27	801.16	1.439	0.121	0.858	0.2126
28	830.38	1.439	0.1215	0.8625	0.2205
29	861.82	1.439	0.1222	0.8645	0.2284
30	891.86	1.439	0.1228	0.8665	0.2362
31	920.33	1.439	0.1234	0.8678	0.2441
32	947.61	1.439	0.124	0.8645	0.252
33	978.79	1.439	0.1249	0.8645	0.2599
34	1008.02	1.439	0.1256	0.8645	0.2677
35	1036.49	1.439	0.1257	0.8625	0.2756
36	1067.92	1.439	0.1262	0.8652	0.2835
37	1095.86	1.439	0.1267	0.8652	0.2914
38	1124.42	1.439	0.1273	0.8691	0.2992
39	1152.92	1.439	0.1277	0.8704	0.3071
40	1181.69	1.439	0.128	0.875	0.315
41	1207.99	1.439	0.1287	0.8737	0.322

DIRECT SHEAR TEST DATA

Terracon
Consulting Engineers & Scientists

Project: DYNEGY EDWARDS
Boring No.: EDW-B002 S5
Sample No.: S-5
Test No.: 40 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/23/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 10.0'-12.0'
Elevation: ----

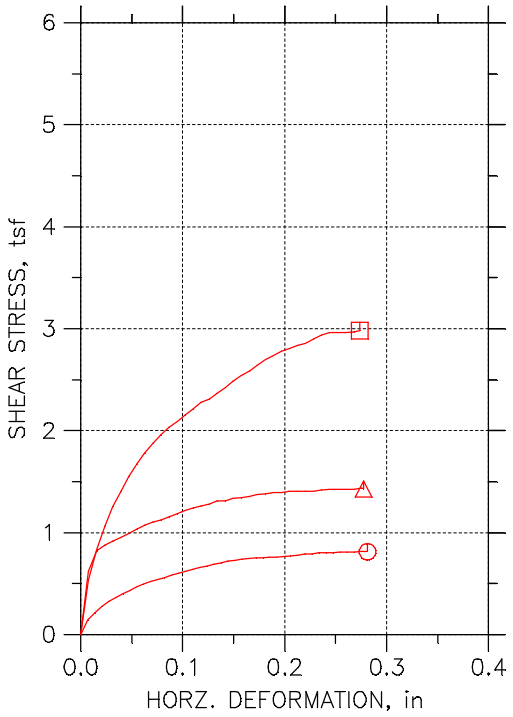
Soil Description: GRAY TO DARK GRAY VARVED FLY ASH
Remarks: TEST PERFORMED AS PER ASTM D3080.

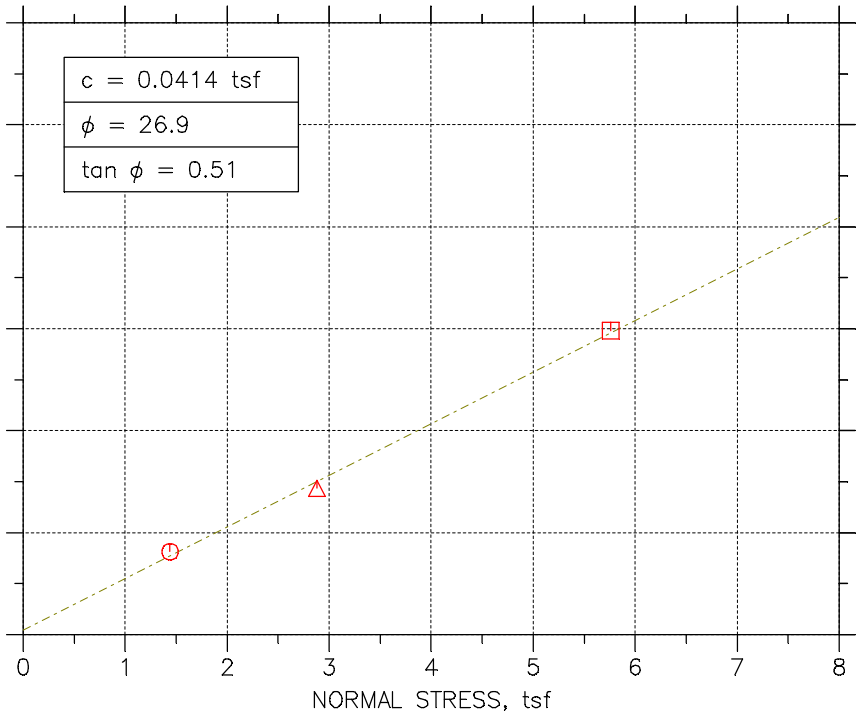


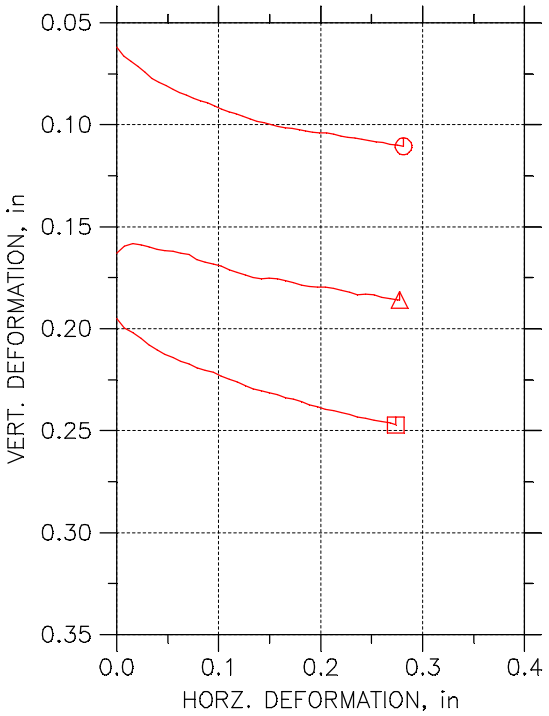
	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	2.879	0.1292	0	0
2	34.66	2.879	0.1336	0.3516	0.007876
3	65.95	2.879	0.1374	0.4772	0.01575
4	98.49	2.879	0.1406	0.5912	0.02363
5	128.04	2.879	0.1442	0.6779	0.0315
6	157.00	2.879	0.1474	0.7496	0.03938
7	188.14	2.88	0.1504	0.8151	0.04725
8	217.44	2.88	0.1529	0.8772	0.05513
9	247.88	2.879	0.1551	0.9339	0.06301
10	276.45	2.879	0.1577	0.9701	0.07088
11	306.20	2.879	0.1601	1.017	0.07876
12	336.36	2.879	0.162	1.06	0.08663
13	366.50	2.879	0.1648	1.096	0.09451
14	397.75	2.879	0.1667	1.135	0.1024
15	427.67	2.88	0.169	1.161	0.1103
16	455.53	2.88	0.171	1.197	0.1181
17	485.04	2.879	0.1726	1.234	0.126
18	515.15	2.879	0.1753	1.262	0.1339
19	546.34	2.879	0.1769	1.285	0.1418
20	576.29	2.879	0.1782	1.317	0.1496
21	605.44	2.879	0.1806	1.346	0.1575
22	631.71	2.879	0.1819	1.367	0.1654
23	663.92	2.879	0.1834	1.395	0.1733
24	693.09	2.879	0.1851	1.423	0.1811
25	722.31	2.879	0.1865	1.447	0.189
26	753.49	2.88	0.1881	1.472	0.1969
27	783.68	2.879	0.1898	1.494	0.2048
28	812.56	2.879	0.1911	1.515	0.2126
29	840.21	2.879	0.1916	1.537	0.2205
30	873.07	2.879	0.1927	1.556	0.2284
31	901.78	2.88	0.194	1.57	0.2362
32	929.62	2.88	0.1952	1.589	0.2441
33	960.88	2.88	0.1967	1.608	0.252
34	990.19	2.88	0.1979	1.625	0.2599
35	1019.61	2.88	0.1986	1.632	0.2677
36	1048.80	2.879	0.1999	1.647	0.2756
37	1076.60	2.88	0.2013	1.668	0.2835
38	1109.68	2.88	0.2026	1.67	0.2914
39	1138.55	2.88	0.2036	1.681	0.2992
40	1167.91	2.879	0.2044	1.694	0.3071
41	1190.59	2.88	0.2054	1.704	0.3133

DIRECT SHEAR TEST REPORT

Terracon
Consulting Engineers & Scientists







Symbol		⏲	△	⊡	
Test No.		20 PSI	40 PSI	80 PSI	
Sample No.		S-9	S-9	S-9	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.5035	2.4988	2.4921	
	Area, in^2	4.9227	4.9041	4.8779	
	Height, in	1.0067	0.98937	0.99213	
	Water Content, %	71.70	70.21	69.53	
	Dry Density, pcf	53.119	54.563	54.248	
	Saturation, %	96.83	98.97	97.11	
	Void Ratio	1.7031	1.6315	1.6468	
Consol. Height, in		0.95172	0.83719	0.8042	
Consol. Void Ratio		1.5555	1.2268	1.1454	
Final	Water Content, %	60.80	49.80	42.70	
	Dry Density, pcf	59.677	67.193	72.249	
	Saturation, %	99.46	100.75	99.47	
	Void Ratio	1.406	1.1369	0.98736	
Normal Stress, tsf		1.4396	2.8798	5.7593	
Max. Shear Stress, tsf		0.81396	1.4353	2.9807	
Ult. Shear Stress, tsf		0.81396	1.4289	2.9807	
Time to Failure, min		1202.3	4163.3	1353.2	
Disp. Rate, in/min		0.000267	6.69e-005	0.000207	
Estimated Specific Gravity		2.30	2.30	2.30	
Liquid Limit		NP	NP	NP	
Plastic Limit		NP	NP	NP	
Plasticity Index		NP	NP	NP	

Project: DYNEGY EDWARDS
Location: BARTONVILLE, IL
Project No.: MR155218
Boring No.: EDW-B003 S9
Sample Type: 3.0" ST
Description: VERY DARK GRAY VARVED FLY ASH
Remarks: TEST PERFORMED AS PER ASTM D3080

DIRECT SHEAR TEST DATA

Terracon
Consulting Engineers & Scientists

Project: DYNEGY EDWARDS
Boring No.: EDW-B003 S9
Sample No.: S-9
Test No.: 20 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/23/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 30.0'-32.0'
Elevation: ----

Soil Description: VERY DARK GRAY VARVED FLY ASH
Remarks: TEST PERFORMED AS PER ASTM D3080



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	1.438	0.06197	0	0
2	29.97	1.439	0.06626	0.1471	0.006868
3	57.78	1.439	0.06903	0.2144	0.01374
4	88.56	1.439	0.07142	0.2734	0.0206
5	120.00	1.439	0.0742	0.3261	0.02747
6	147.42	1.439	0.07741	0.3658	0.03434
7	177.07	1.44	0.07918	0.4002	0.04121
8	208.08	1.439	0.08094	0.4362	0.04807
9	237.87	1.439	0.08258	0.468	0.05494
10	268.15	1.44	0.08422	0.4952	0.06181
11	297.24	1.44	0.08555	0.5181	0.06868
12	327.37	1.439	0.08693	0.5374	0.07555
13	354.52	1.44	0.08832	0.5599	0.08241
14	388.81	1.439	0.08933	0.5859	0.08928
15	414.34	1.439	0.0909	0.6053	0.09615
16	443.05	1.44	0.09235	0.6214	0.103
17	475.44	1.44	0.09362	0.6428	0.1099
18	503.04	1.439	0.09456	0.6569	0.1168
19	531.73	1.44	0.09576	0.672	0.1236
20	563.76	1.44	0.09708	0.6908	0.1305
21	590.20	1.44	0.09841	0.7049	0.1374
22	620.48	1.439	0.09897	0.719	0.1442
23	648.48	1.44	0.09992	0.7268	0.1511
24	679.58	1.44	0.1007	0.7399	0.158
25	707.75	1.44	0.1014	0.7493	0.1648
26	736.66	1.44	0.1019	0.7503	0.1717
27	766.24	1.44	0.1026	0.754	0.1786
28	796.15	1.44	0.1031	0.7592	0.1854
29	823.23	1.439	0.1038	0.7618	0.1923
30	851.40	1.44	0.104	0.767	0.1991
31	883.03	1.44	0.1041	0.7727	0.206
32	911.21	1.44	0.1047	0.7764	0.2129
33	944.16	1.44	0.1056	0.7879	0.2197
34	971.55	1.44	0.1061	0.7936	0.2266
35	1000.34	1.44	0.1065	0.802	0.2335
36	1031.20	1.44	0.1073	0.803	0.2403
37	1059.90	1.439	0.1079	0.8067	0.2472
38	1088.96	1.44	0.1084	0.8113	0.2541
39	1119.26	1.44	0.1087	0.8108	0.2609
40	1145.99	1.44	0.1097	0.8098	0.2678
41	1177.16	1.44	0.1101	0.814	0.2747
42	1202.27	1.44	0.1106	0.814	0.2812

DIRECT SHEAR TEST DATA

Terracon
Consulting Engineers & Scientists

Project: DYNEGY EDWARDS
Boring No.: EDW-B003 S9
Sample No.: S-9
Test No.: 40 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/23/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 30.0'-32.0'
Elevation: ----

Soil Description: VERY DARK GRAY VARVED FLY ASH
Remarks: TEST PERFORMED AS PER ASTM D3080



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	4.541	0.1631	0	0
2	165.26	2.88	0.1594	0.623	0.007876
3	285.62	2.88	0.1584	0.8242	0.01575
4	408.00	2.88	0.1589	0.8772	0.02363
5	528.28	2.88	0.1597	0.9172	0.0315
6	644.59	2.88	0.161	0.9573	0.03938
7	763.78	2.88	0.1618	0.994	0.04725
8	884.32	2.88	0.1622	1.033	0.05513
9	993.76	2.88	0.163	1.072	0.06301
10	1117.20	2.88	0.1637	1.102	0.07088
11	1235.24	2.88	0.166	1.124	0.07876
12	1344.93	2.88	0.1672	1.154	0.08663
13	1464.24	2.88	0.1684	1.183	0.09451
14	1587.75	2.88	0.1694	1.219	0.1024
15	1704.16	2.879	0.171	1.241	0.1103
16	1806.00	2.879	0.1724	1.26	0.1181
17	1919.53	2.88	0.1737	1.281	0.126
18	2040.50	2.88	0.1748	1.31	0.1339
19	2161.06	2.88	0.1757	1.312	0.1418
20	2270.85	2.88	0.1753	1.338	0.1496
21	2391.12	2.88	0.1755	1.346	0.1575
22	2509.07	2.88	0.1764	1.356	0.1654
23	2633.81	2.88	0.1773	1.373	0.1733
24	2755.77	2.88	0.1787	1.382	0.1811
25	2871.20	2.88	0.1792	1.392	0.189
26	2977.15	2.88	0.1795	1.392	0.1969
27	3107.25	2.88	0.1796	1.405	0.2048
28	3223.67	2.88	0.1804	1.408	0.2126
29	3336.47	2.88	0.1812	1.406	0.2205
30	3458.59	2.88	0.1821	1.403	0.2284
31	3580.72	2.88	0.1833	1.418	0.2362
32	3695.22	2.879	0.1829	1.425	0.2441
33	3803.01	2.88	0.1834	1.426	0.252
34	3924.20	2.88	0.1847	1.426	0.2599
35	4048.11	2.88	0.1853	1.428	0.2677
36	4163.33	2.88	0.1858	1.435	0.2756
37	4182.96	2.88	0.186	1.429	0.2775

DIRECT SHEAR TEST DATA

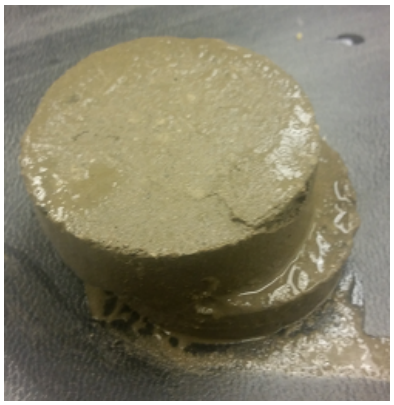
Terracon Consulting Engineers & Scientists

Project: DYNEGY EDWARDS
Boring No.: EDW-B003 S9
Sample No.: S-9
Test No.: 80 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 10/23/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 30.0'-32.0'
Elevation: ----

Soil Description: VERY DARK GRAY VARVED FLY ASH
Remarks: TEST PERFORMED AS PER ASTM D3080



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	5.757	0.195	0	0
2	58.95	5.759	0.1996	0.5335	0.007876
3	100.20	5.759	0.2019	0.8357	0.01575
4	140.38	5.759	0.2048	1.069	0.02363
5	178.98	5.759	0.2079	1.257	0.0315
6	214.75	5.759	0.2102	1.405	0.03938
7	256.36	5.759	0.2126	1.554	0.04725
8	295.19	5.759	0.2142	1.68	0.05513
9	332.54	5.759	0.216	1.784	0.06301
10	373.08	5.759	0.2174	1.879	0.07088
11	411.52	5.759	0.219	1.962	0.07876
12	450.22	5.759	0.2203	2.034	0.08663
13	487.04	5.759	0.2214	2.089	0.09451
14	524.30	5.759	0.2232	2.152	0.1024
15	562.81	5.759	0.2247	2.215	0.1103
16	600.83	5.759	0.2262	2.277	0.1181
17	638.96	5.759	0.2278	2.314	0.126
18	681.52	5.759	0.2295	2.365	0.1339
19	716.24	5.759	0.2303	2.426	0.1418
20	755.33	5.76	0.2315	2.489	0.1496
21	791.66	5.759	0.2324	2.542	0.1575
22	830.85	5.759	0.2338	2.587	0.1654
23	870.20	5.759	0.2346	2.643	0.1733
24	908.45	5.759	0.2356	2.697	0.1811
25	944.85	5.759	0.2372	2.738	0.189
26	983.52	5.759	0.2383	2.779	0.1969
27	1022.76	5.759	0.2395	2.809	0.2048
28	1059.45	5.759	0.2401	2.838	0.2126
29	1096.13	5.759	0.2411	2.858	0.2205
30	1136.62	5.759	0.2421	2.903	0.2284
31	1174.43	5.759	0.2433	2.936	0.2362
32	1210.69	5.759	0.244	2.961	0.2441
33	1248.49	5.759	0.2448	2.964	0.252
34	1288.45	5.759	0.2456	2.966	0.2599
35	1323.77	5.759	0.2462	2.967	0.2677
36	1353.20	5.759	0.2472	2.982	0.2737

DIRECT SHEAR TEST REPORT

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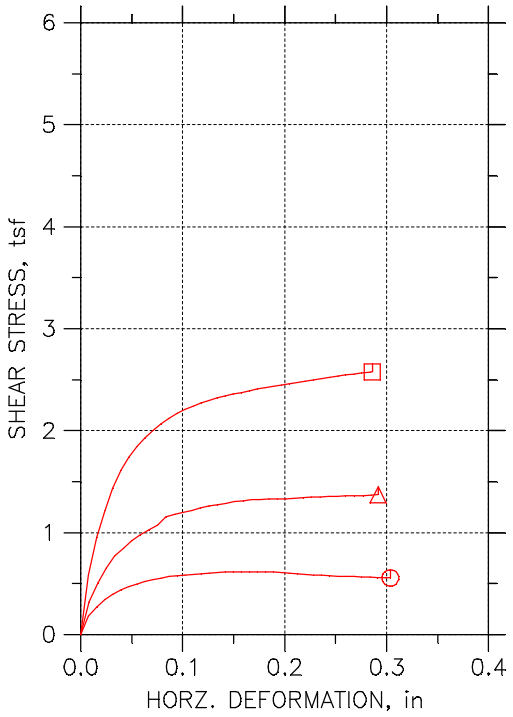

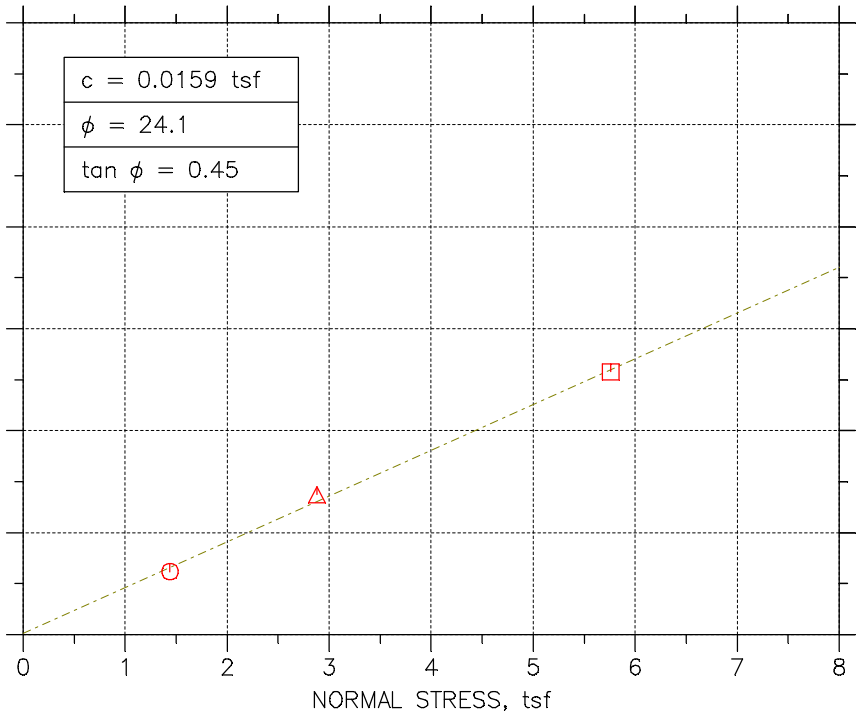

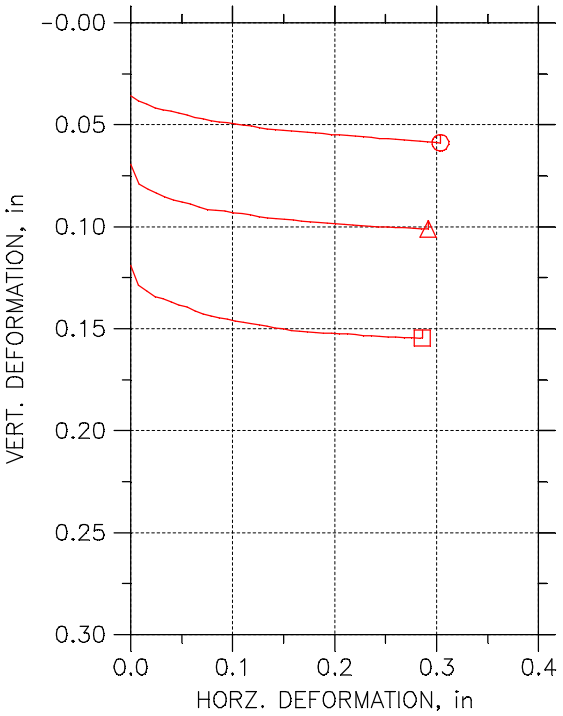

Symbol		⏲	△	⊡	
Test No.		20 PSI	40 PSI	80 PSI	
Sample No.		S-10	S-10	S-10	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.4921	2.4996	2.4976	
	Area, in^2	4.8779	4.9072	4.8995	
	Height, in	0.99606	0.98583	0.98858	
	Water Content, %	29.91	28.99	29.10	
	Dry Density, pcf	90.515	92.188	91.834	
	Saturation, %	92.88	93.65	93.21	
	Void Ratio	0.87597	0.84192	0.84903	
Consol. Height, in		0.96227	0.91945	0.88312	
Consol. Void Ratio		0.81233	0.71789	0.65176	
Final	Water Content, %	28.10	23.40	19.70	
	Dry Density, pcf	96.208	102.73	108.85	
	Saturation, %	99.92	97.47	95.68	
	Void Ratio	0.76496	0.653	0.56003	
Normal Stress, tsf		1.4392	2.8795	5.7594	
Max. Shear Stress, tsf		0.61821	1.3715	2.5767	
Ult. Shear Stress, tsf		0.55697	1.3715	2.5767	
Time to Failure, min		793.54	1341	1400	
Disp. Rate, in/min		0.000207	0.000207	0.000207	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		40	40	40	
Plastic Limit		15	15	15	
Plasticity Index		25	25	25	

Project: DYNEGY EDWARDS	
Location: BARTONVILLE, IL	
Project No.: MR155218	
Boring No.: EDW010 S10	
Sample Type: 3.0" ST	
Description: BLUISH GRAY LEAN CLAY CL	
Remarks: TEST PERFORMED AS PER ASTM D3080	

Tue, 17-NOV-2015 16:39:52

DIRECT SHEAR TEST DATA

Terracon
Consulting Engineers & Scientists

Project: DYNEGY EDWARDS
Boring No.: EDW010 S10
Sample No.: S-10
Test No.: 20 PSI

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/4/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 30.0'-32.0'
Elevation: ----

Soil Description: BLUISH GRAY LEAN CLAY CL
Remarks: TEST PERFORMED AS PER ASTM D3080



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	1.438	0.03587	0	0
2	39.39	1.439	0.03845	0.185	0.007876
3	76.42	1.439	0.0399	0.2733	0.01575
4	116.70	1.439	0.04167	0.343	0.02363
5	155.57	1.439	0.04274	0.3971	0.0315
6	194.59	1.439	0.04325	0.439	0.03938
7	231.17	1.439	0.04419	0.4699	0.04725
8	266.54	1.439	0.04514	0.4951	0.05513
9	305.27	1.439	0.0464	0.5183	0.06301
10	340.94	1.439	0.04709	0.537	0.07088
11	379.25	1.439	0.04797	0.555	0.07876
12	423.04	1.439	0.04873	0.5699	0.08663
13	457.67	1.439	0.04905	0.5782	0.09451
14	495.80	1.439	0.04968	0.586	0.1024
15	531.98	1.439	0.05012	0.5924	0.1103
16	571.20	1.439	0.05068	0.5989	0.1181
17	608.83	1.439	0.0515	0.604	0.126
18	647.29	1.439	0.05207	0.6079	0.1339
19	683.43	1.438	0.05239	0.6124	0.1418
20	721.04	1.438	0.0527	0.615	0.1496
21	758.83	1.439	0.05295	0.6169	0.1575
22	793.54	1.439	0.05327	0.6182	0.1654
23	830.97	1.439	0.05365	0.6176	0.1733
24	869.12	1.439	0.05396	0.615	0.1811
25	906.41	1.439	0.0544	0.6124	0.189
26	945.26	1.439	0.05491	0.6073	0.1969
27	982.69	1.439	0.0551	0.6021	0.2048
28	1020.06	1.439	0.05529	0.5957	0.2126
29	1059.90	1.439	0.0556	0.5905	0.2205
30	1095.28	1.439	0.05585	0.586	0.2284
31	1131.23	1.439	0.05617	0.5821	0.2362
32	1169.64	1.439	0.05674	0.5776	0.2441
33	1209.10	1.439	0.05699	0.5731	0.252
34	1244.59	1.439	0.0573	0.5718	0.2599
35	1283.36	1.439	0.05762	0.5705	0.2677
36	1319.90	1.439	0.05775	0.5679	0.2756
37	1357.90	1.439	0.05806	0.5641	0.2835
38	1393.69	1.438	0.05838	0.5615	0.2914
39	1434.20	1.44	0.05875	0.5589	0.2992
40	1455.26	1.439	0.05894	0.557	0.3036

DIRECT SHEAR TEST DATA

Terracon
Consulting Engineers & Scientists

Project: DYNEGY EDWARDS
Boring No.: EDW010 S10
Sample No.: S-10
Test No.: 40 PSI

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 11/4/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 30.0'-32.0'
Elevation: ----

Soil Description: BLUISH GRAY LEAN CLAY CL
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	2.879	0.06953	0	0
2	66.92	2.879	0.07899	0.3222	0.00838
3	104.04	2.88	0.0817	0.5099	0.01676
4	142.82	2.879	0.08347	0.6542	0.02514
5	185.18	2.88	0.08542	0.7741	0.03352
6	219.73	2.88	0.08681	0.8505	0.0419
7	257.69	2.88	0.08794	0.9202	0.05028
8	298.10	2.88	0.08882	0.982	0.05866
9	333.83	2.88	0.09046	1.029	0.06704
10	369.75	2.88	0.0916	1.072	0.07542
11	413.04	2.88	0.09204	1.152	0.0838
12	445.97	2.88	0.09229	1.18	0.09218
13	485.62	2.88	0.09317	1.197	0.1006
14	521.13	2.88	0.09368	1.22	0.1089
15	559.14	2.88	0.09418	1.241	0.1173
16	595.57	2.879	0.095	1.261	0.1257
17	634.46	2.88	0.09563	1.272	0.1341
18	671.61	2.88	0.0962	1.289	0.1425
19	707.68	2.88	0.09645	1.303	0.1508
20	746.34	2.88	0.0967	1.312	0.1592
21	785.27	2.879	0.09727	1.321	0.1676
22	821.12	2.88	0.09778	1.327	0.176
23	858.67	2.88	0.09796	1.33	0.1844
24	895.38	2.88	0.09834	1.334	0.1927
25	934.75	2.88	0.09866	1.333	0.2011
26	971.24	2.88	0.09891	1.337	0.2095
27	1007.72	2.88	0.09916	1.342	0.2179
28	1045.96	2.88	0.09941	1.346	0.2262
29	1084.53	2.88	0.09992	1.351	0.2346
30	1120.37	2.88	0.1001	1.354	0.243
31	1156.63	2.88	0.1002	1.357	0.2513
32	1197.77	2.88	0.1003	1.36	0.2597
33	1233.68	2.88	0.1004	1.362	0.2681
34	1272.09	2.88	0.1006	1.364	0.2765
35	1311.64	2.88	0.1009	1.369	0.2849
36	1340.99	2.88	0.1011	1.371	0.2916

DIRECT SHEAR TEST DATA

Terracon Consulting Engineers & Scientists

Project: DYNEGY EDWARDS
Boring No.: EDW010 S10
Sample No.: S-10
Test No.: 80 PSI

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 11/5/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 30.0'-32.0'
Elevation: ----

Soil Description: BLUISH GRAY LEAN CLAY CL
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	5.757	0.1189	0	0
2	53.81	5.759	0.1286	0.586	0.007876
3	93.90	5.759	0.1315	0.9544	0.01575
4	132.06	5.759	0.1342	1.218	0.02363
5	171.21	5.759	0.1354	1.435	0.0315
6	211.15	5.759	0.1367	1.61	0.03938
7	250.46	5.759	0.1385	1.74	0.04725
8	288.21	5.759	0.1395	1.844	0.05513
9	324.71	5.759	0.1411	1.926	0.06301
10	364.16	5.759	0.1428	2.004	0.07088
11	401.96	5.759	0.1437	2.067	0.07876
12	438.83	5.759	0.1446	2.119	0.08663
13	478.24	5.759	0.1452	2.171	0.09451
14	515.94	5.759	0.1461	2.207	0.1024
15	554.42	5.759	0.1469	2.242	0.1103
16	590.30	5.759	0.1476	2.272	0.1181
17	626.52	5.759	0.1482	2.294	0.126
18	663.24	5.759	0.1488	2.321	0.1339
19	700.05	5.759	0.1496	2.34	0.1418
20	741.31	5.759	0.15	2.362	0.1496
21	780.69	5.759	0.1509	2.374	0.1575
22	817.38	5.759	0.1512	2.393	0.1654
23	854.69	5.759	0.1515	2.407	0.1733
24	892.50	5.759	0.1519	2.423	0.1811
25	930.62	5.759	0.1523	2.434	0.189
26	969.48	5.759	0.1523	2.444	0.1969
27	1008.12	5.759	0.1525	2.457	0.2048
28	1045.34	5.759	0.1527	2.471	0.2126
29	1083.92	5.759	0.1529	2.484	0.2205
30	1123.76	5.759	0.1533	2.499	0.2284
31	1160.12	5.759	0.1535	2.512	0.2362
32	1197.88	5.759	0.1537	2.526	0.2441
33	1240.24	5.759	0.1541	2.536	0.252
34	1277.15	5.759	0.1541	2.545	0.2599
35	1312.34	5.759	0.1543	2.556	0.2677
36	1351.46	5.759	0.1543	2.566	0.2756
37	1391.74	5.759	0.1546	2.576	0.2835
38	1399.98	5.759	0.1545	2.577	0.2859

DIRECT SHEAR TEST REPORT

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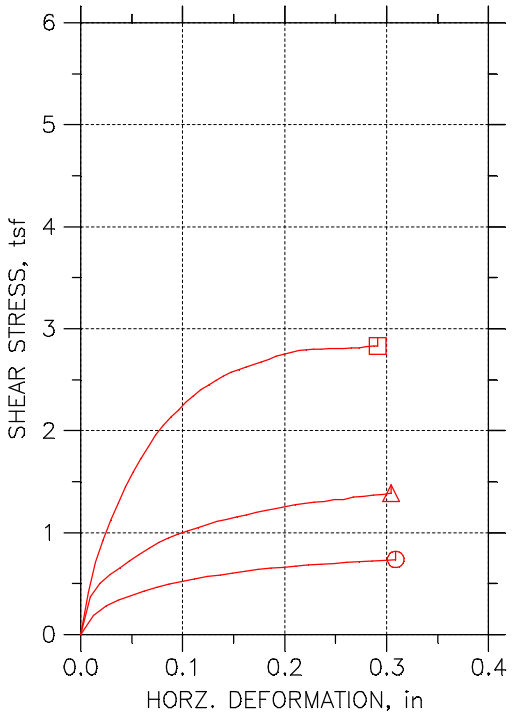

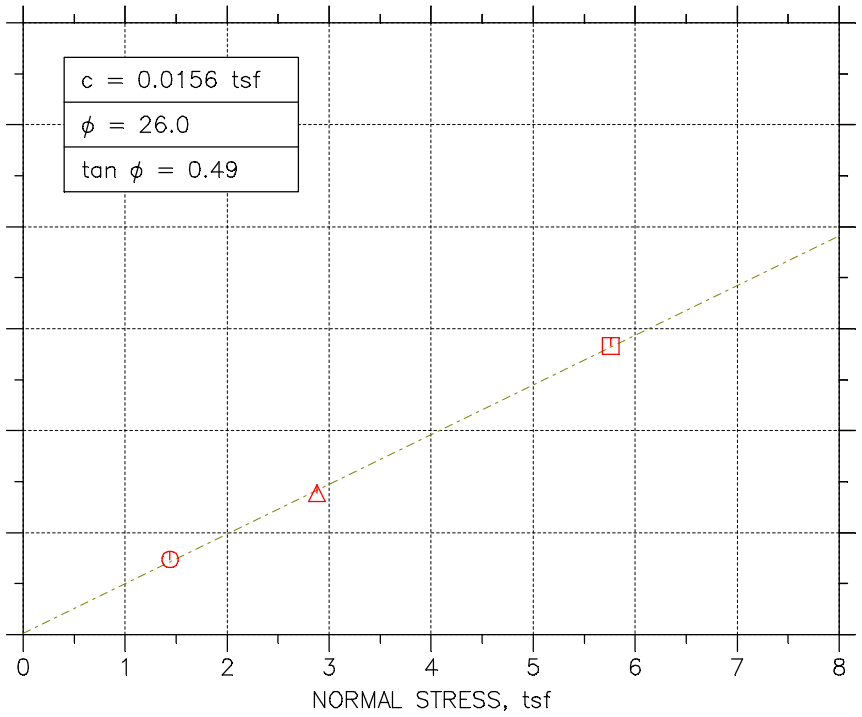

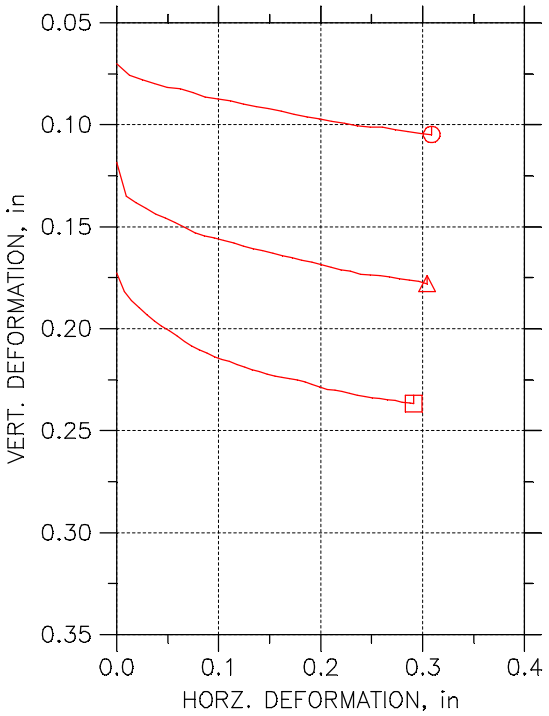

Symbol		⏲	△	◫	
Test No.		20 PSI	40 PSI	80 PSI	
Sample No.		S-14	S-14	S-14	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.5087	2.5067	2.502	
	Area, in^2	4.9428	4.9351	4.9165	
	Height, in	0.99961	1.0098	0.99646	
	Water Content, %	50.80	50.19	50.11	
	Dry Density, pcf	69.233	69.813	69.282	
	Saturation, %	95.13	95.32	93.94	
	Void Ratio	1.4527	1.4323	1.4509	
Consol. Height, in		0.93203	0.8987	0.83564	
Consol. Void Ratio		1.2868	1.1646	1.0554	
Final	Water Content, %	44.10	36.30	31.60	
	Dry Density, pcf	77.344	84.748	90.862	
	Saturation, %	100.34	98.38	98.93	
	Void Ratio	1.1954	1.0036	0.86882	
Normal Stress, tsf		1.4393	2.8799	5.7593	
Max. Shear Stress, tsf		0.73733	1.3874	2.8312	
Ult. Shear Stress, tsf		0.73733	1.3874	2.8312	
Time to Failure, min		961	3164.9	1365.2	
Disp. Rate, in/min		0.000207	8.85e-005	0.000232	
Estimated Specific Gravity		2.72	2.72	2.72	
Liquid Limit		54	54	54	
Plastic Limit		20	20	20	
Plasticity Index		34	34	34	

Project: DYNEGY EDWARDS
Location: BARTONVILLE, IL
Project No.: MR155218
Boring No.: EDW012 S14
Sample Type: 3.0" ST

Description: DARK GRAY FAT CLAY CH SHELL NOTED

Remarks: TEST PERFORMED AS PER ASTM D3080.

Tue, 17-NOV-2015 17:00:29

DIRECT SHEAR TEST DATA

Terracon
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Project: DYNEGY EDWARDS
Boring No.: EDW012 S14
Sample No.: S-14
Test No.: 20 PSI

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 11/5/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 47.0'-49.0'
Elevation: ----

Soil Description: DARK GRAY FAT CLAY CH SHELL NOTED
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	1.438	0.07004	0	0
2	47.30	1.438	0.0759	0.1909	0.01241
3	86.02	1.439	0.07811	0.2818	0.02482
4	124.31	1.439	0.07994	0.3416	0.03724
5	160.06	1.438	0.08176	0.3855	0.04965
6	200.31	1.439	0.08246	0.4281	0.06206
7	238.78	1.438	0.08441	0.4644	0.07447
8	275.86	1.439	0.08649	0.4949	0.08688
9	314.97	1.439	0.08737	0.5229	0.09929
10	355.17	1.439	0.08832	0.5477	0.1117
11	393.92	1.439	0.08977	0.5706	0.1241
12	429.38	1.439	0.09128	0.5859	0.1365
13	468.43	1.439	0.09223	0.6056	0.1489
14	506.02	1.439	0.09336	0.6215	0.1614
15	542.62	1.439	0.09481	0.6381	0.1738
16	586.75	1.439	0.09614	0.6521	0.1862
17	618.29	1.439	0.09721	0.6616	0.1986
18	656.28	1.438	0.09828	0.6718	0.211
19	696.76	1.439	0.09935	0.682	0.2234
20	732.98	1.439	0.1005	0.6915	0.2358
21	769.67	1.439	0.1012	0.6998	0.2482
22	812.59	1.439	0.1013	0.7093	0.2606
23	848.00	1.439	0.1026	0.7151	0.2731
24	887.83	1.438	0.1033	0.724	0.2855
25	924.52	1.438	0.1043	0.731	0.2979
26	961.00	1.439	0.1048	0.7373	0.3088

DIRECT SHEAR TEST DATA

Terracon Consulting Engineers & Scientists

Project: DYNEGY EDWARDS
Boring No.: EDW012 S14
Sample No.: S-14
Test No.: 40 PSI

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 11/7/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 47.0'-49.0'
Elevation: ----

Soil Description: DARK GRAY FAT CLAY CH SHELL NOTED
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	2.879	0.1185	0	0
2	372.53	2.88	0.1351	0.3735	0.009556
3	468.99	2.88	0.1381	0.5003	0.01911
4	564.01	2.88	0.141	0.5902	0.02867
5	651.75	2.88	0.144	0.656	0.03822
6	744.20	2.88	0.1459	0.7228	0.04778
7	835.68	2.879	0.1481	0.7865	0.05733
8	925.97	2.88	0.1505	0.8454	0.06689
9	1018.05	2.88	0.1529	0.9026	0.07645
10	1104.25	2.88	0.1545	0.9476	0.086
11	1195.15	2.88	0.1556	0.9882	0.09556
12	1289.11	2.88	0.1568	1.019	0.1051
13	1376.20	2.88	0.158	1.049	0.1147
14	1467.76	2.88	0.1596	1.082	0.1242
15	1560.82	2.88	0.1608	1.11	0.1338
16	1648.67	2.88	0.1618	1.132	0.1433
17	1734.35	2.88	0.1631	1.153	0.1529
18	1827.14	2.88	0.1642	1.177	0.1624
19	1925.93	2.88	0.1651	1.202	0.172
20	2006.92	2.88	0.1663	1.219	0.1816
21	2105.98	2.88	0.1673	1.236	0.1911
22	2191.37	2.88	0.1688	1.253	0.2007
23	2278.65	2.88	0.1698	1.274	0.2102
24	2368.36	2.88	0.1711	1.289	0.2198
25	2452.94	2.88	0.1719	1.301	0.2293
26	2544.63	2.88	0.1735	1.308	0.2389
27	2629.18	2.88	0.1737	1.323	0.2485
28	2720.25	2.88	0.1741	1.327	0.2579
29	2813.74	2.88	0.1747	1.347	0.2675
30	2902.90	2.88	0.1755	1.353	0.2771
31	2995.72	2.88	0.1763	1.367	0.2866
32	3085.70	2.879	0.177	1.376	0.2962
33	3164.86	2.88	0.178	1.387	0.3043

DIRECT SHEAR TEST DATA

Terracon
Consulting Engineers & Scientists

Project: DYNEGY EDWARDS
Boring No.: EDW012 S14
Sample No.: S-14
Test No.: 80 PSI

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 11/9/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 47.0'-49.0'
Elevation: ----

Soil Description: DARK GRAY FAT CLAY CH SHELL NOTED
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	5.758	0.1729	0	0
2	39.55	5.758	0.1819	0.4139	0.007372
3	77.10	5.759	0.1863	0.7122	0.01474
4	112.99	5.759	0.1897	0.9304	0.02212
5	148.81	5.759	0.193	1.122	0.02949
6	184.76	5.759	0.1961	1.293	0.03686
7	219.25	5.759	0.1988	1.448	0.04423
8	256.03	5.759	0.2008	1.596	0.0516
9	290.21	5.759	0.2034	1.726	0.05897
10	325.35	5.759	0.2062	1.846	0.06635
11	362.78	5.759	0.2083	1.96	0.07372
12	397.12	5.759	0.2103	2.054	0.08109
13	429.34	5.759	0.2121	2.132	0.08846
14	462.52	5.759	0.2137	2.205	0.09583
15	499.06	5.759	0.215	2.279	0.1032
16	532.30	5.759	0.2162	2.34	0.1106
17	569.81	5.76	0.2177	2.403	0.1179
18	598.74	5.759	0.2187	2.447	0.1253
19	633.77	5.759	0.2199	2.494	0.1327
20	670.11	5.759	0.2209	2.537	0.1401
21	703.89	5.759	0.2224	2.574	0.1474
22	737.17	5.759	0.2233	2.6	0.1548
23	771.57	5.759	0.2238	2.622	0.1622
24	805.68	5.759	0.2246	2.647	0.1696
25	841.96	5.759	0.2251	2.675	0.1769
26	874.04	5.759	0.226	2.7	0.1843
27	910.30	5.759	0.2273	2.727	0.1917
28	942.84	5.759	0.2287	2.746	0.199
29	977.11	5.759	0.2297	2.769	0.2064
30	1011.86	5.759	0.2302	2.785	0.2137
31	1046.27	5.759	0.2307	2.794	0.2211
32	1078.57	5.759	0.2316	2.801	0.2285
33	1111.99	5.759	0.2326	2.8	0.2359
34	1147.40	5.759	0.2332	2.803	0.2432
35	1179.32	5.759	0.2338	2.804	0.2506
36	1216.60	5.759	0.2341	2.806	0.258
37	1246.79	5.759	0.2347	2.809	0.2653
38	1278.72	5.759	0.2353	2.814	0.2727
39	1316.44	5.759	0.236	2.823	0.2801
40	1349.92	5.759	0.2364	2.829	0.2875
41	1365.24	5.759	0.2367	2.831	0.2913

DIRECT SHEAR TEST REPORT

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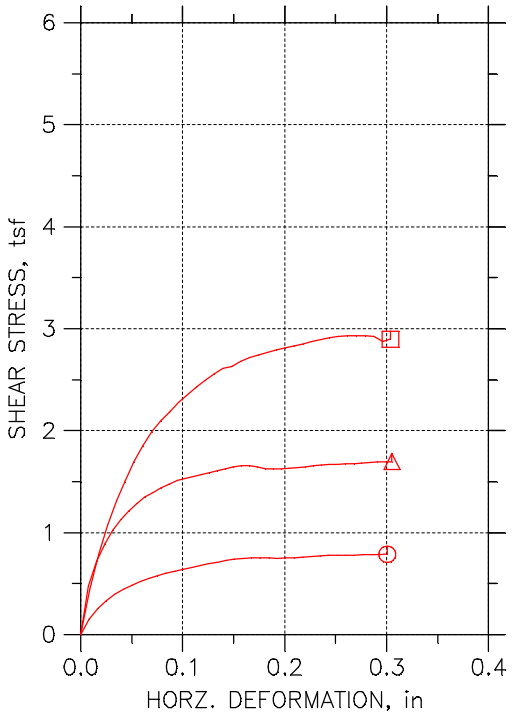

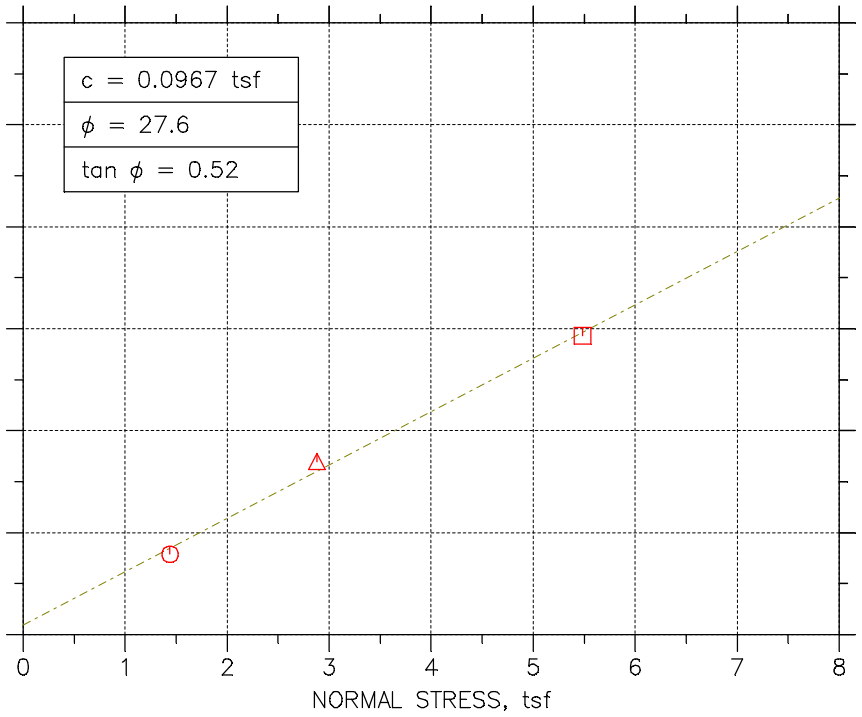

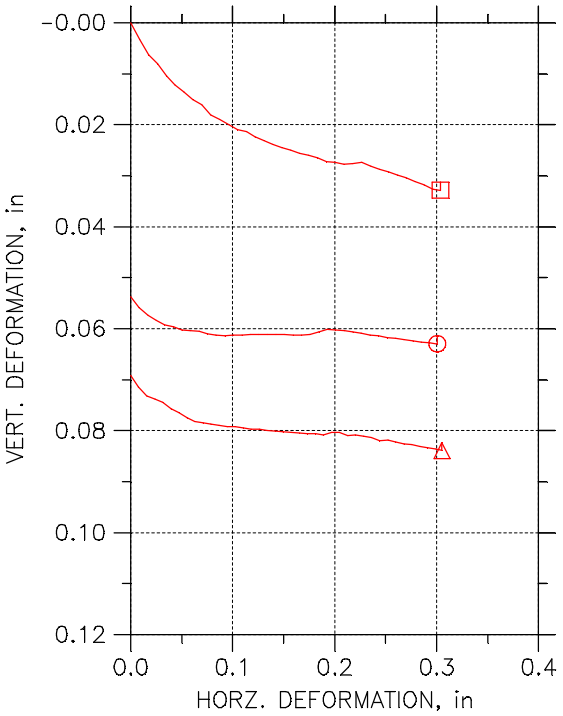

Symbol		⏲	△	⊡	
Test No.		20 PSI	40 PSI	80 PSI	
Sample No.		S-10	S-10	S-10	
Shape		Circular	Circular	Circular	
Initial	Dimension, in	2.498	2.5	2.5087	
	Area, in^2	4.901	4.9087	4.9431	
	Height, in	0.98898	0.99252	0.99606	
	Water Content, %	20.30	20.20	20.70	
	Dry Density, pcf	101.54	100.62	99.218	
	Saturation, %	85.50	83.10	82.20	
	Void Ratio	0.62921	0.64421	0.66738	
Consol. Height, in		0.94144	0.9279	0.99606	
Consol. Void Ratio		0.5509	0.53717	0.66738	
Final	Water Content, %	19.10	18.60	22.80	
	Dry Density, pcf	108.45	109.91	102.6	
	Saturation, %	96.32	97.56	98.66	
	Void Ratio	0.52546	0.50521	0.61241	
Normal Stress, tsf		1.4396	2.8794	5.4854	
Max. Shear Stress, tsf		0.78821	1.6963	2.9302	
Ult. Shear Stress, tsf		0.78821	1.6963	2.8965	
Time to Failure, min		1242.6	1357.2	1031.5	
Disp. Rate, in/min		0.000232	0.000232	0.000232	
Estimated Specific Gravity		2.65	2.65	2.65	
Liquid Limit		24	24	24	
Plastic Limit		13	13	13	
Plasticity Index		11	11	11	

Project: DYNEGY EDWARDS
Location: BARTONVILLE, IL
Project No.: MR155218
Boring No.: EDW015 S10
Sample Type: 3.0" ST
Description: BROWN AND GRAY MOTTLED SANDY LEAN CLAY WITH GRAVEL CL
Remarks: TEST PERFORMED AS PER ASTM D3080.

DIRECT SHEAR TEST DATA

Terracon
Consulting Engineers & Scientists

Project: DYNEGY EDWARDS
Boring No.: EDW015 S10
Sample No.: S-10
Test No.: 20 PSI

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 11/10/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 31.0'-33.0'
Elevation: ----

Soil Description: BROWN AND GRAY MOTTLED SANDY LEAN CLAY WITH GRAVEL CL
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	1.439	0.05371	0	0
2	53.95	1.44	0.05592	0.1498	0.00838
3	89.12	1.439	0.05743	0.2586	0.01676
4	121.56	1.439	0.05838	0.3313	0.02514
5	157.67	1.44	0.05919	0.3949	0.03352
6	194.41	1.44	0.05957	0.4472	0.0419
7	229.85	1.44	0.0602	0.4865	0.05028
8	262.66	1.44	0.06033	0.5204	0.05866
9	296.74	1.44	0.06052	0.5501	0.06704
10	331.66	1.44	0.06102	0.577	0.07542
11	364.35	1.44	0.06128	0.6007	0.0838
12	395.09	1.44	0.06134	0.6201	0.09218
13	431.13	1.44	0.06121	0.6417	0.1006
14	466.24	1.44	0.06121	0.6611	0.1089
15	499.12	1.44	0.06109	0.6772	0.1173
16	531.39	1.44	0.06109	0.6939	0.1257
17	565.38	1.44	0.06115	0.7106	0.1341
18	600.22	1.44	0.06115	0.7257	0.1425
19	633.76	1.44	0.06115	0.7381	0.1508
20	668.19	1.44	0.06121	0.7478	0.1592
21	702.22	1.44	0.06121	0.7543	0.1676
22	736.72	1.44	0.06115	0.7553	0.176
23	772.13	1.439	0.06058	0.7521	0.1844
24	804.93	1.44	0.06008	0.7494	0.1927
25	838.10	1.44	0.06027	0.751	0.2011
26	873.29	1.44	0.06033	0.7548	0.2095
27	907.96	1.44	0.06058	0.7613	0.2179
28	940.97	1.44	0.06083	0.7661	0.2262
29	974.96	1.44	0.06121	0.771	0.2346
30	1009.21	1.44	0.0614	0.7758	0.243
31	1042.51	1.44	0.06178	0.7769	0.2513
32	1073.94	1.439	0.06191	0.778	0.2597
33	1112.13	1.44	0.06216	0.7801	0.2681
34	1143.69	1.44	0.06241	0.7823	0.2765
35	1177.31	1.44	0.0626	0.785	0.2849
36	1213.76	1.44	0.06273	0.7861	0.2932
37	1242.60	1.44	0.06298	0.7882	0.3006

DIRECT SHEAR TEST DATA

Terracon
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Project: DYNEGY EDWARDS
Boring No.: EDW015 S10
Sample No.: S-10
Test No.: 40 PSI

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 11/10/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 31.0'-33.0'
Elevation: ----

Soil Description: BROWN AND GRAY MOTTLED SANDY LEAN CLAY WITH GRAVEL CL
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	2.887	0.06916	0	0
2	81.09	2.879	0.07142	0.4785	0.007876
3	117.60	2.879	0.07313	0.7219	0.01575
4	151.97	2.879	0.07376	0.8898	0.02363
5	186.66	2.879	0.07439	1.023	0.0315
6	221.15	2.879	0.07571	1.129	0.03938
7	253.83	2.879	0.07647	1.211	0.04725
8	289.37	2.879	0.07741	1.288	0.05513
9	323.30	2.879	0.07823	1.347	0.06301
10	356.53	2.879	0.07849	1.394	0.07088
11	391.02	2.879	0.07867	1.439	0.07876
12	424.56	2.879	0.07893	1.477	0.08663
13	459.98	2.879	0.07918	1.51	0.09451
14	492.86	2.879	0.07924	1.534	0.1024
15	523.80	2.879	0.07943	1.552	0.1103
16	556.72	2.879	0.07968	1.571	0.1181
17	588.93	2.879	0.07975	1.588	0.126
18	622.51	2.879	0.08	1.607	0.1339
19	657.43	2.879	0.08006	1.626	0.1418
20	692.69	2.879	0.08025	1.644	0.1496
21	724.45	2.879	0.08031	1.655	0.1575
22	759.66	2.879	0.08044	1.658	0.1654
23	791.34	2.88	0.08057	1.646	0.1733
24	825.40	2.879	0.08063	1.628	0.1811
25	858.43	2.879	0.08082	1.623	0.189
26	892.73	2.879	0.08031	1.623	0.1969
27	926.40	2.879	0.08038	1.63	0.2048
28	958.76	2.879	0.08101	1.635	0.2126
29	993.58	2.879	0.08088	1.643	0.2205
30	1027.07	2.879	0.08113	1.655	0.2284
31	1059.32	2.88	0.08132	1.662	0.2362
32	1094.50	2.879	0.08195	1.667	0.2441
33	1128.29	2.879	0.08189	1.671	0.252
34	1161.15	2.879	0.08227	1.676	0.2599
35	1194.98	2.879	0.08258	1.676	0.2677
36	1230.64	2.879	0.08271	1.684	0.2756
37	1263.56	2.879	0.08315	1.688	0.2835
38	1294.95	2.879	0.0834	1.693	0.2914
39	1331.25	2.879	0.08365	1.694	0.2992
40	1357.24	2.879	0.08391	1.696	0.3052

DIRECT SHEAR TEST DATA

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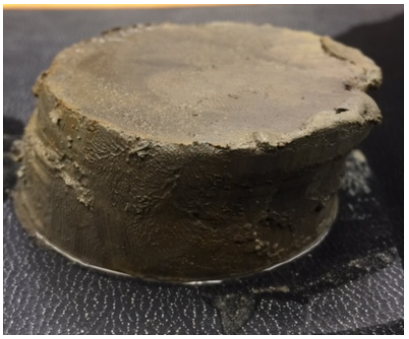
Project: DYNEGY EDWARDS
Boring No.: EDW015 S10
Sample No.: S-10
Test No.: 80 PSI

Location: BARTONVILLE, IL
Tested By: HP
Test Date: 11/12/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: BCM
Depth: 31.0'-33.0'
Elevation: ----

Soil Description: BROWN AND GRAY MOTTLED SANDY LEAN CLAY WITH GRAVEL CL
Remarks: TEST PERFORMED AS PER ASTM D3080.



	Elapsed Time min	Vertical Stress tsf	Vertical Displacement in	Horizontal Stress tsf	Horizontal Displacement in
1	0.00	5.485	0	0	0
2	36.40	5.485	0.003256	0.437	0.008716
3	71.32	5.485	0.006327	0.7826	0.01743
4	106.78	5.485	0.008001	1.076	0.02615
5	141.55	5.485	0.01042	1.313	0.03486
6	173.06	5.485	0.01219	1.499	0.04358
7	209.72	5.485	0.01358	1.693	0.05229
8	245.51	5.485	0.01507	1.854	0.06101
9	279.22	5.485	0.0161	1.987	0.06973
10	314.35	5.485	0.01805	2.098	0.07844
11	349.53	5.485	0.01898	2.187	0.08716
12	383.30	5.485	0.02	2.276	0.09587
13	415.59	5.485	0.02093	2.352	0.1046
14	449.70	5.485	0.0214	2.428	0.1133
15	485.17	5.485	0.02242	2.494	0.122
16	517.51	5.485	0.02317	2.551	0.1307
17	556.85	5.485	0.02382	2.612	0.1395
18	584.89	5.485	0.02447	2.627	0.1482
19	618.32	5.485	0.02503	2.678	0.1569
20	654.74	5.485	0.02568	2.719	0.1656
21	687.22	5.485	0.02596	2.742	0.1743
22	720.44	5.485	0.02652	2.766	0.183
23	755.56	5.485	0.02726	2.793	0.1917
24	788.89	5.485	0.02735	2.81	0.2005
25	823.96	5.485	0.02782	2.83	0.2092
26	856.37	5.485	0.02763	2.851	0.2179
27	893.08	5.485	0.02735	2.874	0.2266
28	925.58	5.485	0.02819	2.893	0.2353
29	960.00	5.485	0.02875	2.911	0.244
30	995.06	5.485	0.02931	2.924	0.2527
31	1031.53	5.485	0.02987	2.93	0.2614
32	1062.43	5.485	0.03042	2.929	0.2701
33	1097.75	5.486	0.03117	2.929	0.2789
34	1131.93	5.485	0.03182	2.926	0.2876
35	1165.06	5.485	0.03266	2.877	0.2963
36	1194.80	5.485	0.03284	2.897	0.3037

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Laboratory Services Group 750 Corporate Woods Parkway Vernon Hills, Illinois 60061 Phone:(847) 793-0306 Fax:(847) 793-0309

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO.: **MR155218** **11/17/2015**
PROJECT NAME: **DYNEGY - EDWARDS SITE**
CLIENT: **AECOM**
LOCATION : **BARTONVILLE, IL**

SUMMARY OF TEST RESULTS

BORING NO.	EDW-B002
SAMPLE NO.	S-5
DEPTH:	10.0'-12.0'
CLASSIFICATION	GRAY TO DARK GRAY VARVED FLY ASH

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	55.9	59.7
WATER CONTENT (%)	66.4	60.8
DIAMETER (cm)	7.218	7.030
LENGTH (cm)	8.678	8.558
HYDRAULIC GRADIENT (MAXIMUM)	10.87	
PERCENT SATURATION	100.0	

SAMPLE PHOTO



(Percent saturation calculation is based on final measurements and an estimated specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec): 9.19E-05

Deaired water was used as the liquid permeant.

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO.: **MR155218** **11/17/2015**
PROJECT NAME: **DYNEGY - EDWARDS SITE**
CLIENT: **AECOM**
LOCATION : **BARTONVILLE, IL**

SUMMARY OF TEST RESULTS

BORING NO.	EDW-B003
SAMPLE NO.	S-9
DEPTH:	30.0'-32.0'
CLASSIFICATION	VERY DARK GRAY VARVED FLY ASH

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	53.2	59.3
WATER CONTENT (%)	71.2	61.7
DIAMETER (cm)	7.206	6.968
LENGTH (cm)	8.429	8.091

SAMPLE PHOTO



HYDRAULIC GRADIENT (MAXIMUM)	11.19
PERCENT SATURATION	100.2

(Percent saturation calculation is based on final measurements and an estimated specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec): 6.79E-05

Deaired water was used as the liquid permeant.

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO.: **MR155218** **11/17/2015**
PROJECT NAME: **DYNEGY - EDWARDS SITE**
CLIENT: **AECOM**
LOCATION : **BARTONVILLE, IL**

SUMMARY OF TEST RESULTS

BORING NO.	EDW-B004
SAMPLE NO.	S-11
DEPTH:	36.0'-38.0'
CLASSIFICATION	BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND CL

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	111.1	113.9
WATER CONTENT (%)	19.3	18.0
DIAMETER (cm)	7.117	7.074
LENGTH (cm)	8.145	8.042

SAMPLE PHOTO



HYDRAULIC GRADIENT (MAXIMUM) 20.21

PERCENT SATURATION 100.5 (Percent saturation calculation is based on final measurements and an estimated specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec) 7.20E-07

Deaired water was used as the liquid permeant.

UNCONFINED COMPRESSION TEST REPORT

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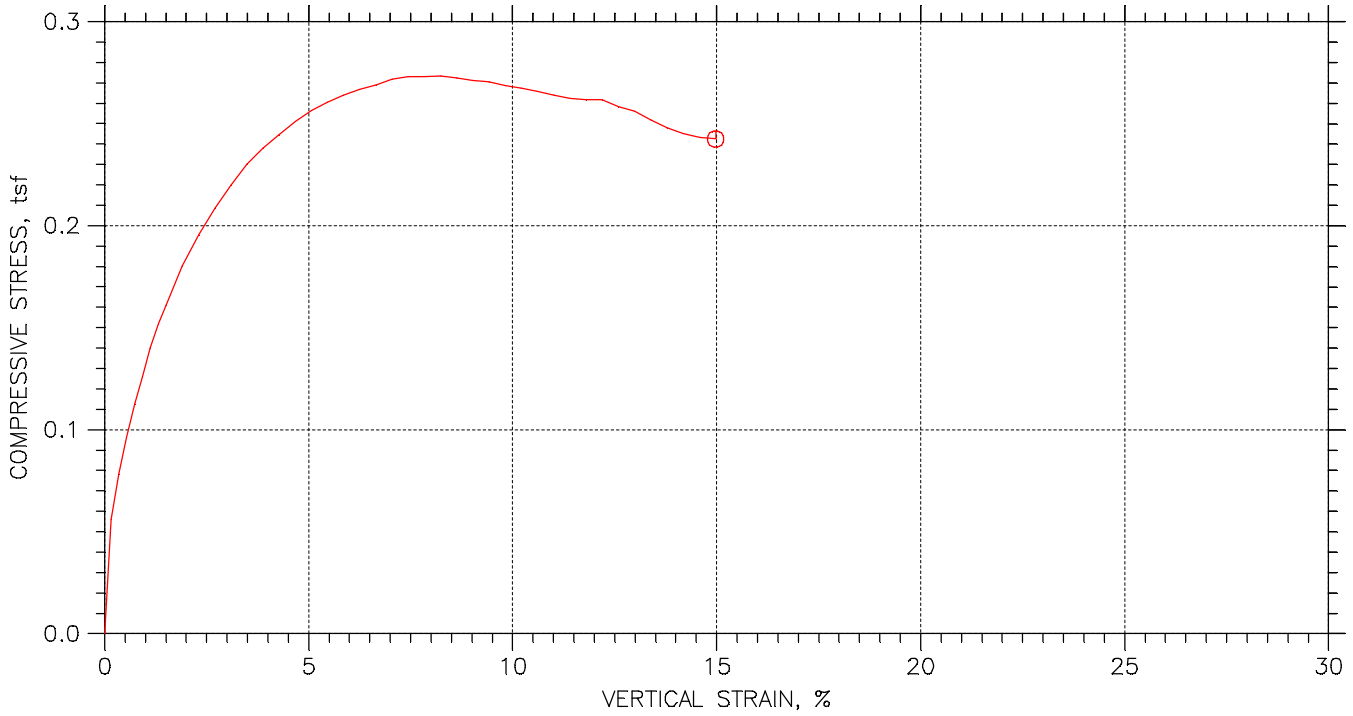

Symbol		⏲			
Test No.		EDW-002 S10			
Initial	Diameter, in	2.8118			
	Height, in	5.9587			
	Water Content, %	29.48			
	Dry Density, pcf	93.81			
	Saturation, %	98.98			
	Void Ratio	0.81002			
Unconfined Compressive Strength, tsf		0.27347			
Undrained Shear Strength, tsf		0.13673			
Time to Failure, min		10.5			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		36			
Plastic Limit		18			
Plasticity Index		18			
Failure Sketch					

Project: DYNEGY EDWARDS
Location: BARTONVILLE, IL
Project No.: MR155199
Boring No.: EDW-002 S10
Sample Type: 3.0" ST
Description: GRAY LEAN CLAY WITH SAND CL
Remarks: TEST PERFORMED AS PER ASTM D 2166.

UNCONFINED COMPRESSION TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-002 S10
Sample No.: S-10
Test No.: EDW-002 S10

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/17/15
Sample Type: 3.0" ST

Project No.: MR155199
Checked By: WPQ
Depth: 35.0'-37.0'
Elevation: -----

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Consulting Engineers & Scientists

Soil Description: GRAY LEAN CLAY WITH SAND CL
Remarks: TEST PERFORMED AS PER ASTM D 2166.

Specimen Height: 5.96 in
Specimen Area: 6.21 in^2
Specimen Volume: 37.00 in^3

Liquid Limit: 36
Plastic Limit: 18
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.2096	0	0
2	0.25007	0.0091325	0.15326	4.8253	6.2191	0.055864	0.027932
3	0.50007	0.020663	0.34678	6.7659	6.2312	0.078179	0.039089
4	0.75007	0.032286	0.54184	8.3394	6.2434	0.096171	0.048086
5	1.0001	0.043725	0.73381	9.808	6.2555	0.11289	0.056444
6	1.2501	0.055348	0.92887	10.962	6.2678	0.12592	0.062961
7	1.5001	0.066879	1.1224	12.221	6.2801	0.14011	0.070054
8	1.7501	0.078318	1.3144	13.27	6.2923	0.15184	0.075919
9	2.0001	0.089941	1.5094	14.109	6.3047	0.16112	0.080561
10	2.5001	0.11346	1.9042	15.84	6.3301	0.18016	0.090082
11	3.0001	0.13708	2.3005	17.256	6.3558	0.19548	0.097739
12	3.5001	0.1606	2.6953	18.462	6.3816	0.2083	0.10415
13	4.0001	0.18413	3.09	19.564	6.4076	0.21983	0.10991
14	4.5001	0.20756	3.4833	20.56	6.4337	0.23009	0.11504
15	5.0001	0.23108	3.878	21.347	6.4601	0.23792	0.11896
16	5.5001	0.2546	4.2728	22.029	6.4867	0.24451	0.12225
17	6.0001	0.27822	4.6691	22.71	6.5137	0.25103	0.12552
18	6.5001	0.30183	5.0654	23.287	6.5409	0.25634	0.12817
19	7.0001	0.32536	5.4602	23.759	6.5682	0.26045	0.13022
20	7.5001	0.34897	5.8565	24.179	6.5959	0.26394	0.13197
21	8.0001	0.37249	6.2513	24.546	6.6236	0.26682	0.13341
22	8.5001	0.39602	6.6461	24.861	6.6517	0.2691	0.13455
23	9.0001	0.41972	7.0439	25.228	6.6801	0.27191	0.13596
24	9.5001	0.44343	7.4418	25.438	6.7088	0.273	0.1365
25	10	0.46686	7.835	25.543	6.7375	0.27296	0.13648
26	10.5	0.49039	8.2298	25.7	6.7664	0.27347	0.13673
27	11	0.51372	8.6215	25.7	6.7954	0.2723	0.13615
28	11.5	0.53734	9.0178	25.7	6.825	0.27112	0.13556
29	12	0.56114	9.4172	25.753	6.8551	0.27048	0.13524
30	12.5	0.58503	9.8182	25.7	6.8856	0.26873	0.13437
31	13	0.60874	10.216	25.7	6.9161	0.26755	0.13377
32	13.5	0.63235	10.612	25.648	6.9468	0.26582	0.13291
33	14	0.65588	11.007	25.595	6.9776	0.26411	0.13205
34	14.5	0.67912	11.397	25.543	7.0083	0.26241	0.13121
35	15	0.70274	11.794	25.595	7.0398	0.26178	0.13089
36	15.5	0.72654	12.193	25.7	7.0718	0.26166	0.13083
37	16	0.75043	12.594	25.49	7.1043	0.25834	0.12917
38	16.5	0.77414	12.992	25.385	7.1368	0.2561	0.12805
39	17	0.79784	13.39	25.071	7.1696	0.25177	0.12589
40	17.5	0.82155	13.788	24.808	7.2026	0.24799	0.124
41	18	0.84517	14.184	24.651	7.2359	0.24529	0.12264
42	18.5	0.86887	14.582	24.546	7.2696	0.24311	0.12156
43	19	0.8924	14.976	24.599	7.3034	0.2425	0.12125

UNCONFINED COMPRESSION TEST REPORT

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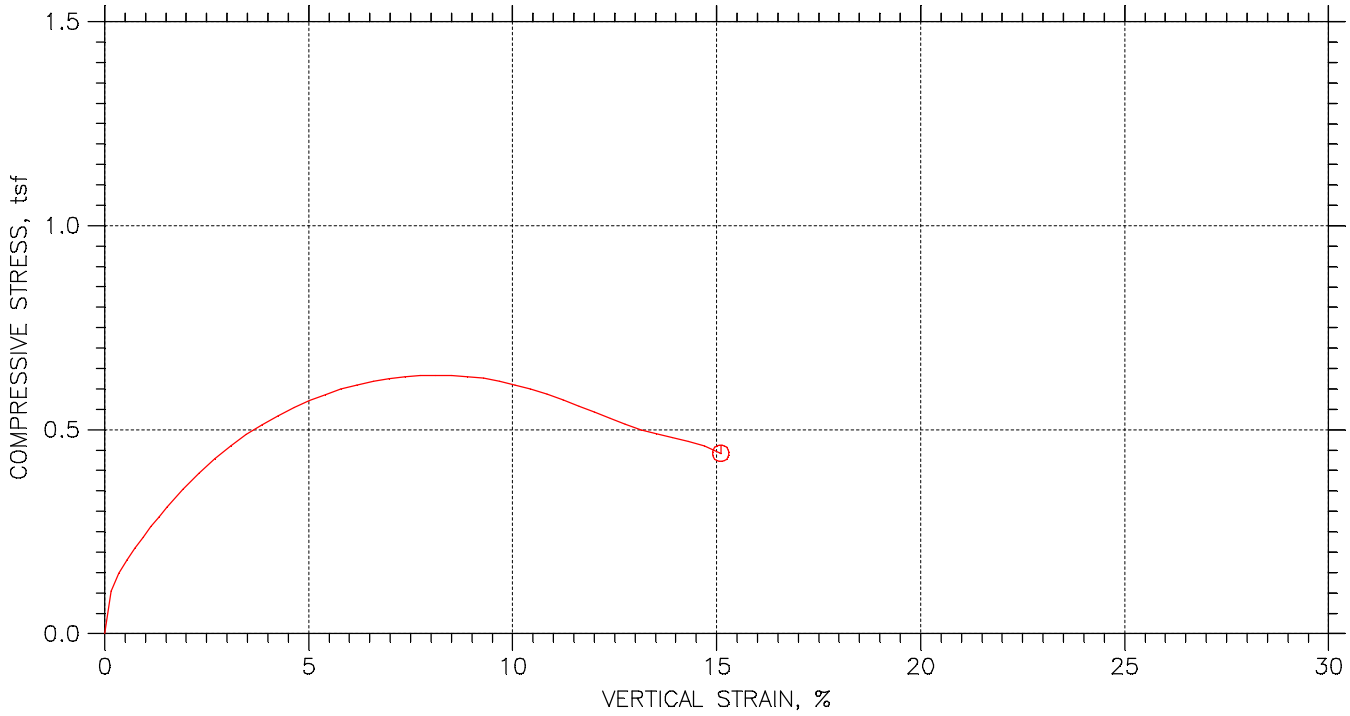

Symbol		⏲			
Test No.		EDWB003S12			
Initial	Diameter, in	2.8343			
	Height, in	6.0811			
	Water Content, %	41.57			
	Dry Density, pcf	79.31			
	Saturation, %	99.09			
	Void Ratio	1.141			
Unconfined Compressive Strength, tsf		0.63249			
Undrained Shear Strength, tsf		0.31624			
Time to Failure, min		10.504			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		51			
Plastic Limit		17			
Plasticity Index		34			
Failure Sketch					

Project: DYNEGY EDWARDS
Location: BARTONVILLE, IL
Project No.: MR155218
Boring No.: EDW-003 S12
Sample Type: 3.0" ST
Description: DARK GRAY FAT CLAY WITH SAND CH
Remarks: TEST PERFORMED AS PER ASTM D2166.

UNCONFINED COMPRESSION TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-003 S12
Sample No.: S-12
Test No.: EDWB003S12

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/13/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 45.0'-47.0'
Elevation: -----

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Soil Description: DARK GRAY FAT CLAY WITH SAND CH
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 6.08 in
Specimen Area: 6.31 in^2
Specimen Volume: 38.37 in^3

Liquid Limit: 51
Plastic Limit: 17
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.3091	0	0
2	0.25402	0.0096859	0.15928	9.0737	6.3192	0.10339	0.051693
3	0.50402	0.021401	0.35193	13.007	6.3314	0.14792	0.07396
4	0.75402	0.033117	0.54458	15.945	6.3436	0.18097	0.090485
5	1.004	0.044924	0.73875	18.515	6.356	0.20973	0.10486
6	1.254	0.056824	0.93444	20.927	6.3686	0.23659	0.1183
7	1.504	0.068816	1.1316	23.235	6.3813	0.26216	0.13108
8	1.754	0.080808	1.3288	25.385	6.3941	0.28585	0.14293
9	2.004	0.092893	1.5276	27.536	6.407	0.30944	0.15472
10	2.504	0.11678	1.9205	31.522	6.4326	0.35282	0.17641
11	3.004	0.14058	2.3118	35.246	6.4584	0.39293	0.19646
12	3.504	0.1642	2.7002	38.55	6.4842	0.42806	0.21403
13	4.004	0.18754	3.084	41.592	6.5099	0.46002	0.23001
14	4.504	0.21115	3.4723	44.319	6.536	0.48822	0.24411
15	5.004	0.23505	3.8652	46.732	6.5628	0.5127	0.25635
16	5.504	0.25885	4.2565	48.935	6.5896	0.53468	0.26734
17	6.004	0.28246	4.6449	50.981	6.6164	0.55477	0.27739
18	6.504	0.30571	5.0272	52.764	6.643	0.57188	0.28594
19	7.004	0.32905	5.4109	54.285	6.67	0.58598	0.29299
20	7.504	0.35248	5.7962	55.753	6.6973	0.59938	0.29969
21	8.0041	0.37637	6.1891	56.96	6.7253	0.6098	0.3049
22	8.5041	0.40026	6.582	58.061	6.7536	0.61899	0.30949
23	9.0041	0.42388	6.9704	58.848	6.7818	0.62477	0.31238
24	9.5041	0.44721	7.3542	59.53	6.8099	0.6294	0.3147
25	10.004	0.47018	7.7319	60.054	6.8378	0.63235	0.31618
26	10.504	0.49343	8.1141	60.316	6.8662	0.63249	0.31624
27	11.004	0.51723	8.5055	60.526	6.8956	0.63198	0.31599
28	11.504	0.54121	8.8999	60.631	6.9255	0.63035	0.31517
29	12.004	0.56511	9.2928	60.474	6.9554	0.626	0.313
30	12.504	0.58835	9.6751	60.002	6.9849	0.6185	0.30925
31	13.004	0.61151	10.056	59.372	7.0145	0.60943	0.30471
32	13.504	0.63484	10.44	58.691	7.0445	0.59986	0.29993
33	14.004	0.65874	10.833	57.746	7.0756	0.58762	0.29381
34	14.504	0.68281	11.228	56.593	7.1071	0.57332	0.28666
35	15.004	0.70689	11.624	55.334	7.1389	0.55807	0.27904
36	15.504	0.73023	12.008	54.127	7.1701	0.54353	0.27177
37	16.004	0.7532	12.386	52.816	7.201	0.52809	0.26404
38	16.504	0.77598	12.761	51.505	7.2319	0.51278	0.25639
39	17.004	0.79904	13.14	50.456	7.2635	0.50015	0.25007
40	17.504	0.82266	13.528	49.669	7.2961	0.49015	0.24507
41	18.004	0.84637	13.918	48.987	7.3292	0.48124	0.24062
42	18.504	0.86998	14.306	48.201	7.3624	0.47138	0.23569
43	19.004	0.89341	14.692	47.257	7.3956	0.46007	0.23003
44	19.504	0.91666	15.074	45.736	7.4289	0.44326	0.22163
45	19.538	0.91823	15.1	45.631	7.4312	0.44211	0.22106

UNCONFINED COMPRESSION TEST REPORT

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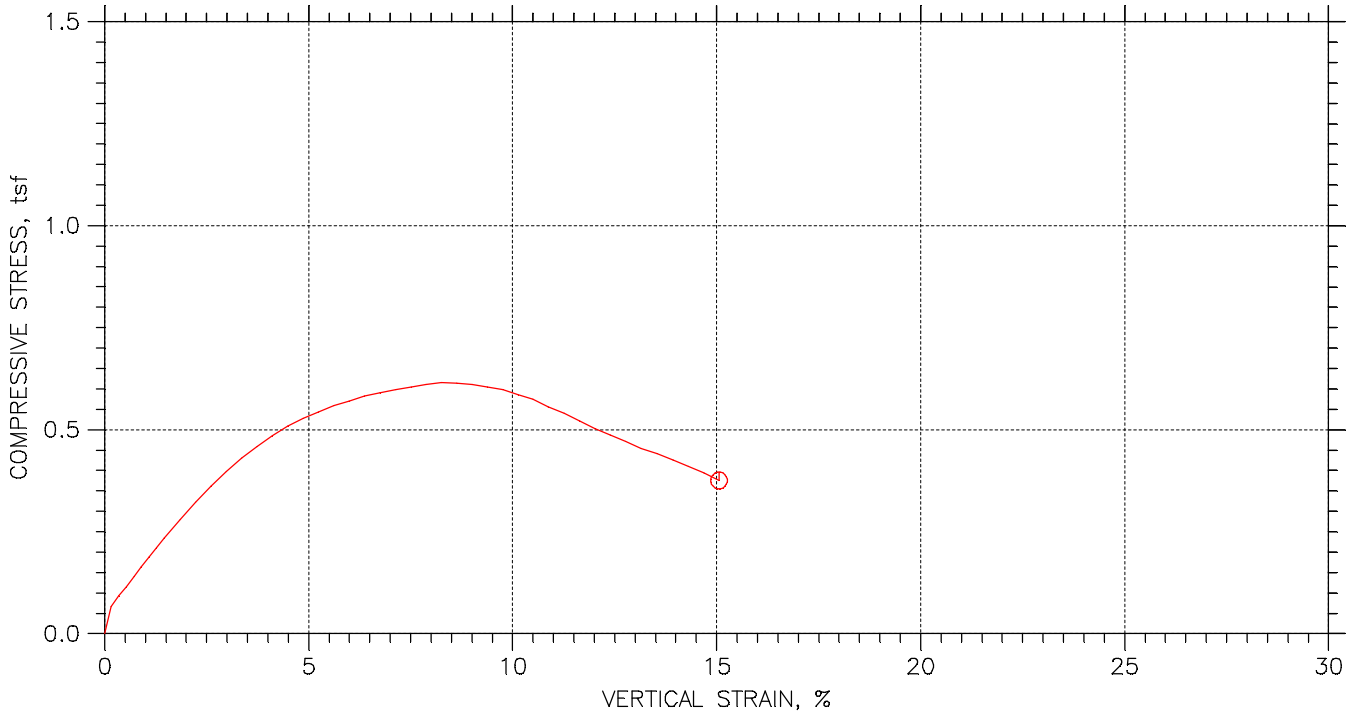

Symbol		⏲			
Test No.		EDWB004S11			
Initial	Diameter, in	2.8217			
	Height, in	6.2535			
	Water Content, %	19.25			
	Dry Density, pcf	111.4			
	Saturation, %	99.83			
	Void Ratio	0.52451			
Unconfined Compressive Strength, tsf		0.61504			
Undrained Shear Strength, tsf		0.30752			
Time to Failure, min		11.004			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		35			
Plastic Limit		17			
Plasticity Index		18			
Failure Sketch					

Project: DYNEGY EDWARDS

Location: BARTONVILLE, IL

Project No.: MR155218

Boring No.: EDW-004 S11

Sample Type: 3.0" ST

Description: BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND CL

Remarks: TEST PERFORMED AS PER ASTM D 2166.

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UNCONFINED COMPRESSION TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-004 S11
Sample No.: S-11
Test No.: EDWB004S11

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/13/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 36.0'-38.0'
Elevation: -----

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Soil Description: BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND CL
Remarks: TEST PERFORMED AS PER ASTM D 2166.

Specimen Height: 6.25 in
Specimen Area: 6.25 in^2
Specimen Volume: 39.10 in^3

Liquid Limit: 35
Plastic Limit: 17
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.2531	0	0
2	0.25398	0.0096859	0.15489	5.717	6.2628	0.065724	0.032862
3	0.50398	0.021494	0.3437	8.0772	6.2747	0.092683	0.046341
4	0.75398	0.033117	0.52957	10.07	6.2864	0.11534	0.057668
5	1.004	0.04474	0.71543	12.221	6.2982	0.1397	0.069852
6	1.254	0.056363	0.9013	14.319	6.31	0.16338	0.081691
7	1.504	0.068078	1.0886	16.469	6.322	0.18756	0.093782
8	1.754	0.079701	1.2745	18.567	6.3339	0.21106	0.10553
9	2.004	0.091601	1.4648	20.665	6.3461	0.23446	0.11723
10	2.504	0.1154	1.8454	24.808	6.3707	0.28038	0.14019
11	3.004	0.13929	2.2274	28.637	6.3956	0.32239	0.1612
12	3.504	0.16291	2.6051	32.256	6.4204	0.36173	0.18087
13	4.004	0.18652	2.9827	35.56	6.4454	0.39724	0.19862
14	4.504	0.20977	3.3544	38.707	6.4702	0.43074	0.21537
15	5.004	0.2332	3.7291	41.382	6.4953	0.45872	0.22936
16	5.504	0.257	4.1097	43.952	6.5211	0.48528	0.24264
17	6.004	0.2808	4.4903	46.313	6.5471	0.50931	0.25465
18	6.504	0.30442	4.8679	48.201	6.5731	0.52798	0.26399
19	7.004	0.32794	5.244	49.827	6.5992	0.54363	0.27182
20	7.504	0.35128	5.6172	51.4	6.6253	0.55859	0.27929
21	8.004	0.37462	5.9904	52.606	6.6516	0.56944	0.28472
22	8.504	0.39832	6.3696	53.97	6.6785	0.58184	0.29092
23	9.004	0.42221	6.7516	55.019	6.7059	0.59073	0.29537
24	9.504	0.44601	7.1322	55.911	6.7334	0.59785	0.29893
25	10.004	0.46945	7.5069	56.802	6.7606	0.60494	0.30247
26	10.504	0.4926	7.8771	57.537	6.7878	0.61031	0.30515
27	11.004	0.51594	8.2503	58.219	6.8154	0.61504	0.30752
28	11.504	0.53928	8.6235	58.323	6.8433	0.61364	0.30682
29	12.004	0.56298	9.0026	58.323	6.8718	0.61109	0.30555
30	12.504	0.58678	9.3832	58.009	6.9006	0.60525	0.30263
31	13.004	0.6104	9.7608	57.537	6.9295	0.59783	0.29891
32	13.504	0.63355	10.131	56.593	6.9581	0.5856	0.2928
33	14.004	0.65671	10.501	55.701	6.9868	0.574	0.287
34	14.504	0.68014	10.876	54.18	7.0162	0.55599	0.278
35	15.004	0.70394	11.257	52.869	7.0463	0.54022	0.27011
36	15.504	0.72783	11.639	51.295	7.0768	0.52188	0.26094
37	16.004	0.75163	12.019	49.669	7.1074	0.50317	0.25158
38	16.504	0.77515	12.395	48.306	7.1379	0.48726	0.24363
39	17.004	0.79867	12.772	46.889	7.1687	0.47094	0.23547
40	17.504	0.82229	13.149	45.368	7.1998	0.45369	0.22685
41	18.004	0.84655	13.537	44.319	7.2322	0.44122	0.22061
42	18.504	0.87081	13.925	43.008	7.2648	0.42625	0.21312
43	19.004	0.89489	14.31	41.592	7.2974	0.41037	0.20519
44	19.504	0.91832	14.685	40.071	7.3294	0.39363	0.19682
45	20.004	0.94157	15.057	38.393	7.3615	0.3755	0.18775

UNCONFINED COMPRESSION TEST REPORT

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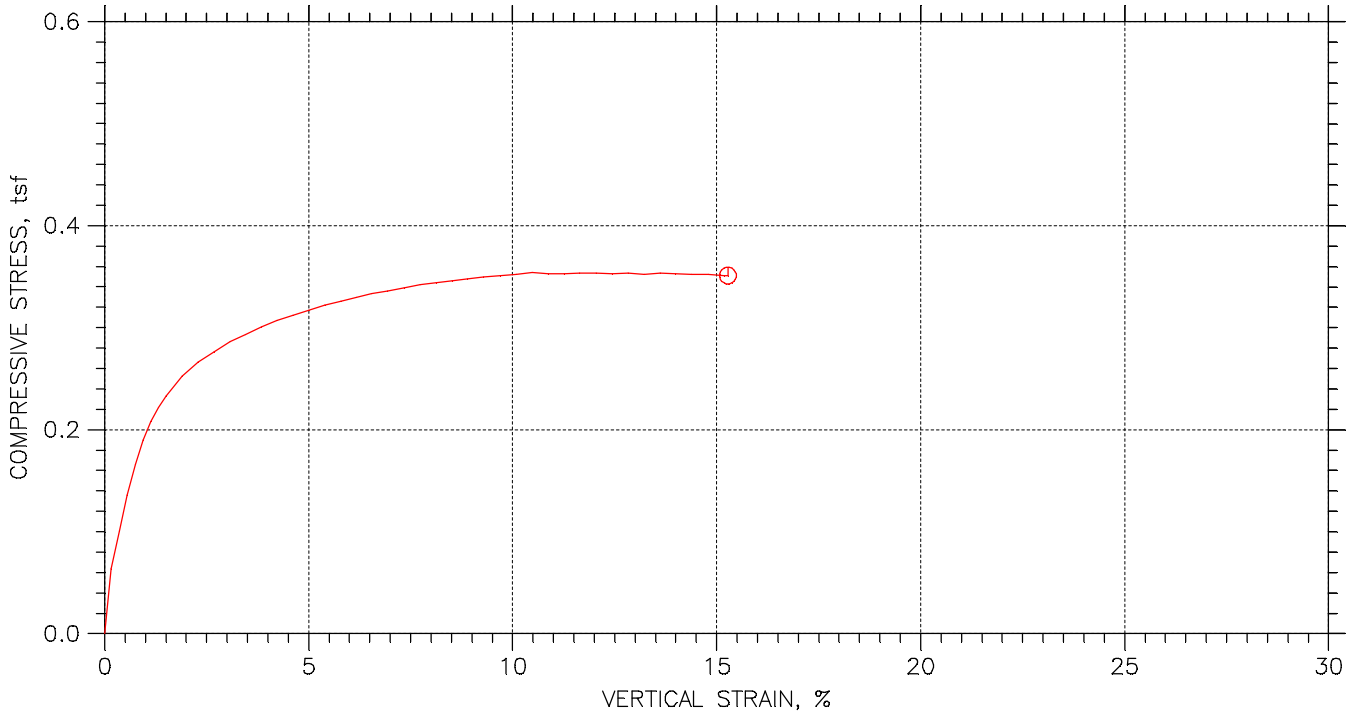

Symbol		⏲			
Test No.		EDWB008S5			
Initial	Diameter, in	2.8047			
	Height, in	6.0665			
	Water Content, %	33.59			
	Dry Density, pcf	88.9			
	Saturation, %	100.40			
	Void Ratio	0.91009			
Unconfined Compressive Strength, tsf		0.35399			
Undrained Shear Strength, tsf		0.177			
Time to Failure, min		13.504			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		52			
Plastic Limit		19			
Plasticity Index		33			
Failure Sketch					

Project: DYNEGY EDWARDS
Location: BARTONVILLE, IL
Project No.: MR155218
Boring No.: EDW-008 S5
Sample Type: 3.0" ST
Description: BROWN AND GRAY FAT CLAY WITH SAND CH
Remarks: TEST PERFORMED AS PER ASTM D2166.

UNCONFINED COMPRESSION TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-008 S5
Sample No.: S-5
Test No.: EDWB008S5

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/13/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 11.0'-13.0'
Elevation: -----

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Soil Description: BROWN AND GRAY FAT CLAY WITH SAND CH
Remarks: TEST PERFORMED AS PER ASTM D2166.

Specimen Height: 6.07 in
Specimen Area: 6.18 in^2
Specimen Volume: 37.48 in^3

Liquid Limit: 52
Plastic Limit: 19
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.1783	0	0
2	0.254	0.0097782	0.16118	5.4547	6.1883	0.063465	0.031732
3	0.504	0.021678	0.35734	8.6541	6.2005	0.10049	0.050246
4	0.754	0.033578	0.55349	11.696	6.2127	0.13555	0.067774
5	1.004	0.045293	0.74661	14.319	6.2248	0.16562	0.082809
6	1.254	0.057009	0.93972	16.417	6.2369	0.18952	0.094758
7	1.504	0.068632	1.1313	18.042	6.249	0.20788	0.10394
8	1.754	0.080255	1.3229	19.301	6.2611	0.22195	0.11098
9	2.004	0.091878	1.5145	20.298	6.2733	0.23296	0.11648
10	2.504	0.11512	1.8977	22.081	6.2978	0.25244	0.12622
11	3.004	0.13865	2.2854	23.392	6.3228	0.26638	0.13319
12	3.504	0.16245	2.6778	24.389	6.3483	0.27661	0.1383
13	4.004	0.18615	3.0685	25.333	6.3739	0.28616	0.14308
14	4.504	0.20949	3.4533	26.067	6.3993	0.29329	0.14664
15	5.004	0.23274	3.8364	26.854	6.4248	0.30094	0.15047
16	5.504	0.25608	4.2212	27.483	6.4506	0.30676	0.15338
17	6.004	0.27969	4.6104	28.06	6.4769	0.31193	0.15596
18	6.504	0.30368	5.0058	28.637	6.5039	0.31702	0.15851
19	7.004	0.32748	5.3981	29.214	6.5309	0.32207	0.16104
20	7.504	0.35091	5.7843	29.686	6.5576	0.32594	0.16297
21	8.004	0.37406	6.166	30.158	6.5843	0.32978	0.16489
22	8.504	0.39731	6.5492	30.63	6.6113	0.33358	0.16679
23	9.004	0.42092	6.9384	30.997	6.639	0.33617	0.16808
24	9.504	0.445	7.3353	31.417	6.6674	0.33927	0.16963
25	10.004	0.46917	7.7337	31.837	6.6962	0.34232	0.17116
26	10.504	0.49315	8.1291	32.151	6.725	0.34422	0.17211
27	11.004	0.51658	8.5153	32.466	6.7534	0.34613	0.17307
28	11.504	0.53992	8.9	32.781	6.7819	0.34802	0.17401
29	12.004	0.56363	9.2908	33.095	6.8111	0.34985	0.17492
30	12.504	0.5878	9.6892	33.358	6.8412	0.35107	0.17554
31	13.004	0.61206	10.089	33.62	6.8716	0.35227	0.17613
32	13.504	0.63614	10.486	33.935	6.9021	0.35399	0.177
33	14.004	0.65966	10.874	33.987	6.9321	0.35301	0.1765
34	14.504	0.68309	11.26	34.092	6.9623	0.35256	0.17628
35	15.004	0.70661	11.648	34.354	6.9928	0.35372	0.17686
36	15.504	0.7305	12.042	34.459	7.0241	0.35322	0.17661
37	16.004	0.75467	12.44	34.564	7.0561	0.35269	0.17634
38	16.504	0.77875	12.837	34.774	7.0882	0.35322	0.17661
39	17.004	0.80255	13.229	34.826	7.1203	0.35216	0.17608
40	17.504	0.8258	13.612	35.088	7.1518	0.35325	0.17662
41	18.004	0.84923	13.999	35.193	7.184	0.35272	0.17636
42	18.504	0.87293	14.389	35.298	7.2168	0.35216	0.17608
43	19.004	0.89719	14.789	35.456	7.2506	0.35208	0.17604
44	19.504	0.92127	15.186	35.508	7.2846	0.35096	0.17548
45	19.621	0.92671	15.276	35.56	7.2923	0.35111	0.17555

UNCONFINED COMPRESSION TEST REPORT

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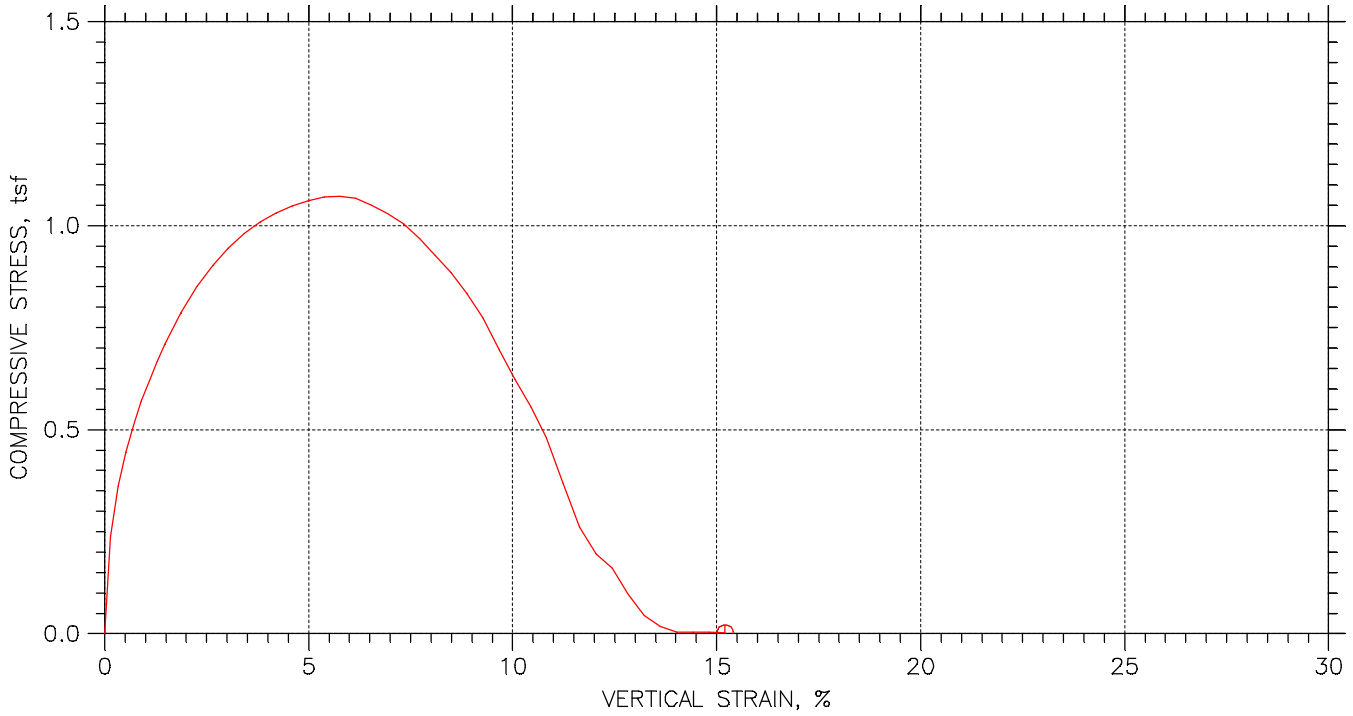

Symbol		⏲			
Test No.		EDWB015S12			
Initial	Diameter, in	2.8217			
	Height, in	6.061			
	Water Content, %	41.01			
	Dry Density, pcf	79.76			
	Saturation, %	98.82			
	Void Ratio	1.1289			
Unconfined Compressive Strength, tsf		1.0722			
Undrained Shear Strength, tsf		0.53609			
Time to Failure, min		7.5002			
Strain Rate, %/min		1			
Estimated Specific Gravity		2.72			
Liquid Limit		66			
Plastic Limit		23			
Plasticity Index		43			
Failure Sketch					

Project: DYNEGY EDWARDS
Location: BARTONVILLE, IL
Project No.: MR155218
Boring No.: EDW-015 S12
Sample Type: 3.0" ST
Description: DARK GRAY FAT CLAY CH
Remarks: TEST PERFORMED AS PER ASTM D 2166.

UNCONFINED COMPRESSION TEST

Project: DYNEGY EDWARDS
Boring No.: EDW-015 S12
Sample No.: S-12
Test No.: EDWB015S12

Location: BARTONVILLE, IL
Tested By: BCM
Test Date: 11/13/15
Sample Type: 3.0" ST

Project No.: MR155218
Checked By: WPQ
Depth: 37.0'-39.0'
Elevation: -----

Terracon
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Soil Description: DARK GRAY FAT CLAY CH
Remarks: TEST PERFORMED AS PER ASTM D 2166.

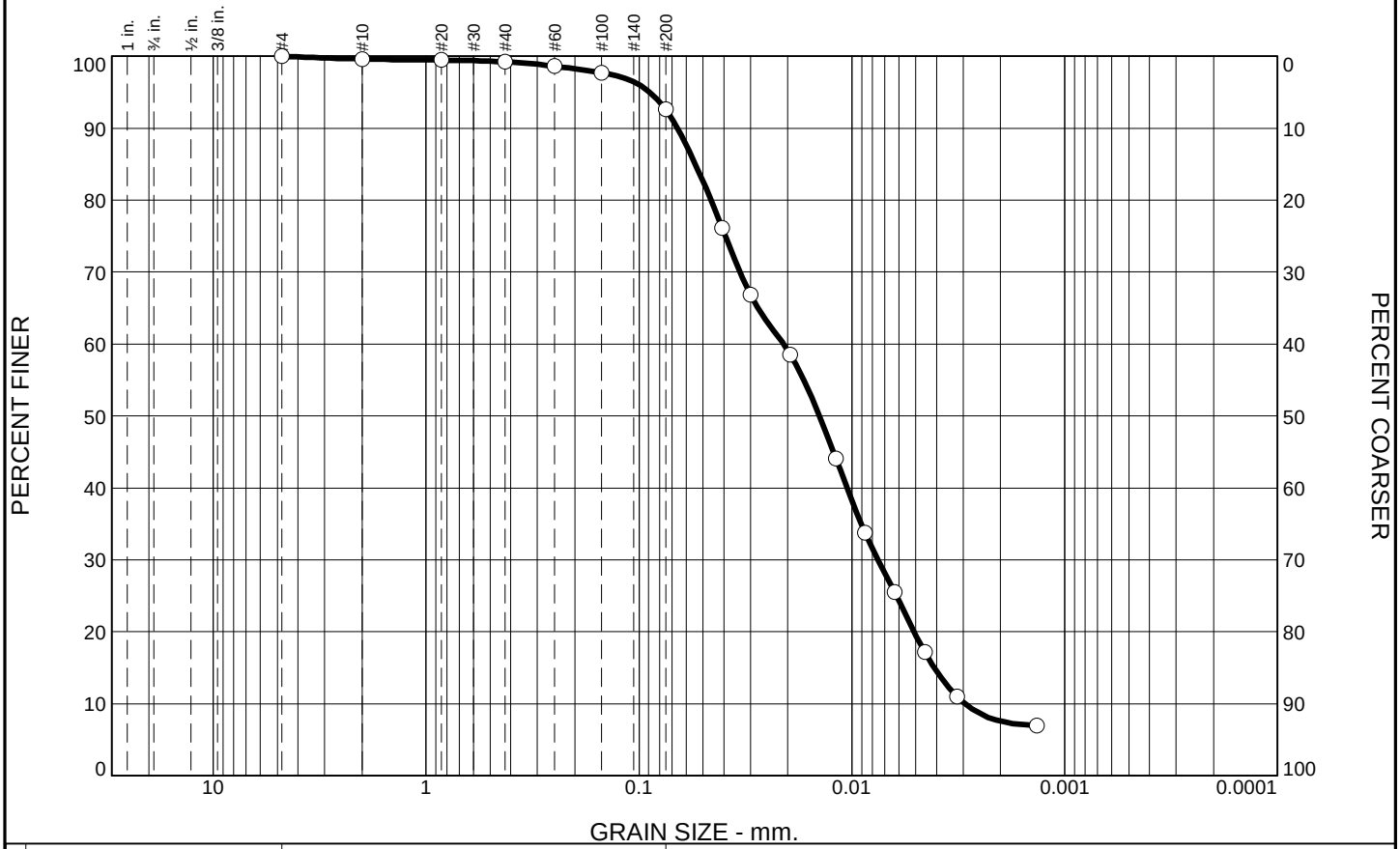
Specimen Height: 6.06 in
Specimen Area: 6.25 in^2
Specimen Volume: 37.90 in^3

Liquid Limit: 66
Plastic Limit: 23
Estimated Specific Gravity: 2.72

Cap Mass: 0 gm

	Time min	Axial Displacement in	Axial Strain %	Load lb	Corrected Area in^2	Vertical Stress tsf	Shear Stress tsf
1	0	0	0	0	6.2531	0	0
2	0.25015	0.0088557	0.14611	20.683	6.2623	0.2378	0.1189
3	0.50015	0.02011	0.33179	31.44	6.2739	0.3608	0.1804
4	0.75015	0.031548	0.52051	38.87	6.2858	0.44523	0.22261
5	1.0002	0.042987	0.70924	44.692	6.2978	0.51094	0.25547
6	1.2502	0.05461	0.90101	49.96	6.31	0.57006	0.28503
7	1.5002	0.066141	1.0913	54.506	6.3221	0.62075	0.31038
8	1.7502	0.077949	1.2861	58.665	6.3346	0.6668	0.3334
9	2.0002	0.089664	1.4794	62.547	6.347	0.70952	0.35476
10	2.5002	0.11346	1.872	69.644	6.3724	0.78689	0.39344
11	3.0002	0.13726	2.2647	75.633	6.398	0.85113	0.42556
12	3.5002	0.16069	2.6513	80.512	6.4234	0.90246	0.45123
13	4.0002	0.18385	3.0333	84.615	6.4487	0.94473	0.47236
14	4.5002	0.20728	3.4199	88.164	6.4745	0.98043	0.49021
15	5.0002	0.23089	3.8095	91.158	6.5008	1.0096	0.50482
16	5.5002	0.25497	4.2067	93.543	6.5277	1.0318	0.51588
17	6.0002	0.27905	4.604	95.428	6.5549	1.0482	0.5241
18	6.5002	0.30266	4.9936	96.98	6.5818	1.0609	0.53045
19	7.0002	0.32582	5.3756	98.2	6.6084	1.0699	0.53496
20	7.5002	0.34915	5.7607	98.81	6.6354	1.0722	0.53609
21	8.0002	0.37277	6.1503	98.755	6.6629	1.0672	0.53358
22	8.5002	0.39685	6.5475	97.535	6.6912	1.0495	0.52475
23	9.0002	0.42074	6.9417	96.149	6.7196	1.0302	0.51511
24	9.5002	0.44445	7.3329	94.097	6.7479	1.004	0.502
25	10	0.46769	7.7164	91.214	6.776	0.96922	0.48461
26	10.5	0.49085	8.0984	87.72	6.8042	0.92824	0.46412
27	11	0.51428	8.485	84.061	6.8329	0.88577	0.44289
28	11.5	0.53798	8.8761	79.514	6.8622	0.83428	0.41714
29	12	0.56215	9.2749	74.135	6.8924	0.77444	0.38722
30	12.5	0.58614	9.6706	67.093	6.9226	0.69782	0.34891
31	13	0.60966	10.059	60.162	6.9525	0.62304	0.31152
32	13.5	0.63291	10.442	53.897	6.9822	0.55578	0.27789
33	14	0.65652	10.832	46.854	7.0127	0.48106	0.24053
34	14.5	0.6806	11.229	36.153	7.0441	0.36953	0.18476
35	15	0.70532	11.637	25.617	7.0766	0.26064	0.13032
36	15.5	0.72986	12.042	19.296	7.1092	0.19543	0.097714
37	16	0.75366	12.435	15.969	7.1411	0.16101	0.080505
38	16.5	0.77773	12.832	9.5372	7.1736	0.095723	0.047862
39	17	0.80181	13.229	4.3805	7.2065	0.043765	0.021883
40	17.5	0.82543	13.619	1.7744	7.239	0.017648	0.0088241
41	18	0.8496	14.017	0.44359	7.2725	0.0043917	0.0021958
42	18.5	0.87404	14.421	0.38814	7.3068	0.0038247	0.0019123
43	19	0.89802	14.816	0.33269	7.3408	0.0032632	0.0016316
44	19.5	0.92164	15.206	0.16635	7.3745	0.0016241	0.00081206

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.4	0.4	6.6	73.1	19.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.6		
#20	99.5		
#40	99.2		
#60	98.6		
#100	97.7		
#200	92.6		

* (no specification provided)

DARK GRAY FLY ASH

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0659 D_{85}= 0.0543 D_{60}= 0.0210
D_{50}= 0.0142 D_{30}= 0.0075 D_{15}= 0.0041
D_{10}= 0.0029 C_u= 7.16 C_c= 0.92

Classification

USCS= AASHTO=

Remarks

F.M.=0.05

Source of Sample: EDW-B002 **Depth:** 7.5'-10.0'
Sample Number: S-4 **Date:** 11-5-15

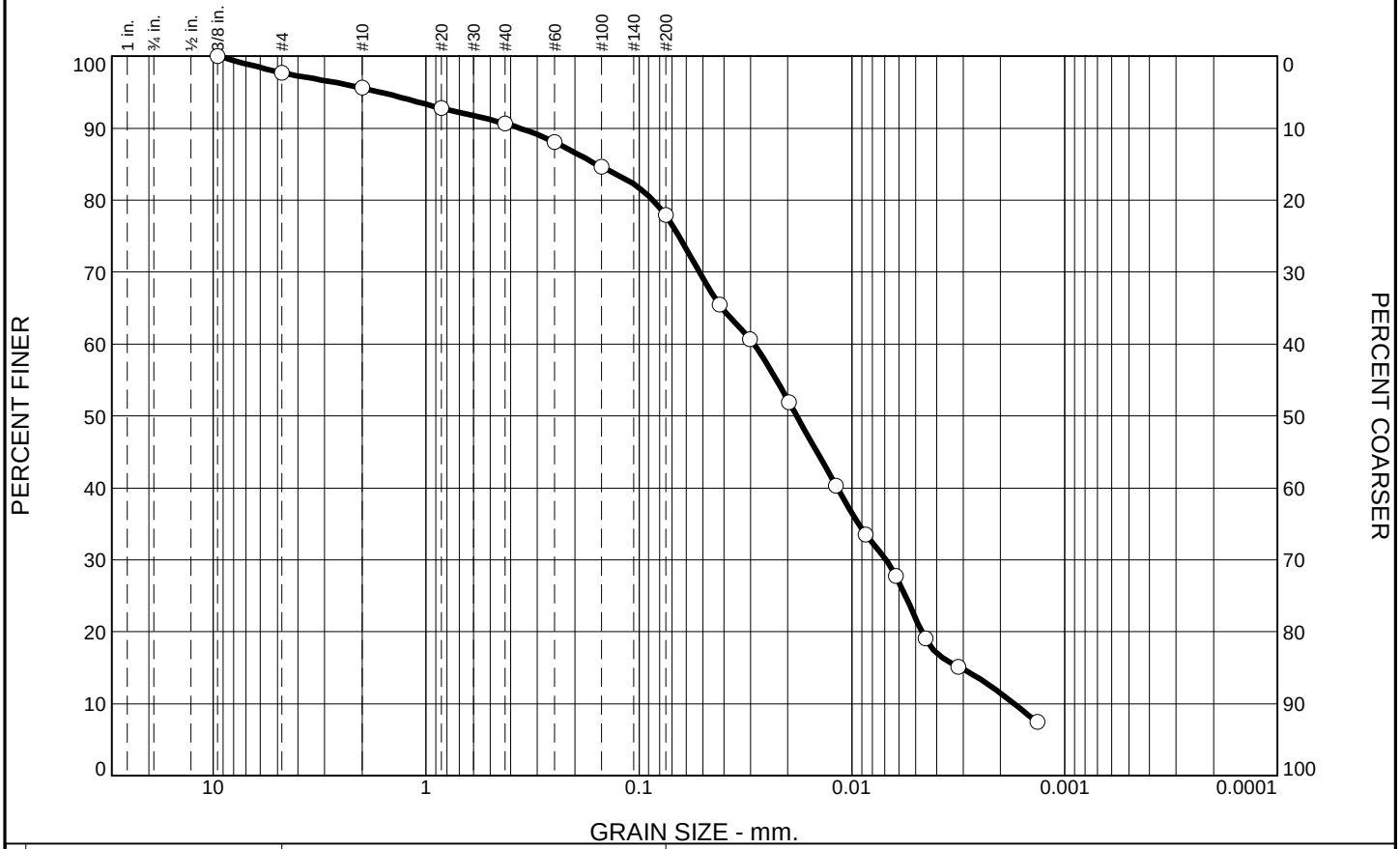
Terracon

Client: DYNEGY
Project: DYNEGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.3	2.1	5.0	12.7	56.3	21.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	97.7		
#10	95.6		
#20	92.8		
#40	90.6		
#60	88.1		
#100	84.6		
#200	77.9		

* (no specification provided)

FILL: DARK GRAY FLY ASH

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.3632 D_{85}= 0.1593 D_{60}= 0.0290
D_{50}= 0.0181 D_{30}= 0.0069 D_{15}= 0.0031
D_{10}= 0.0017 C_u= 16.81 C_c= 0.96

Classification

USCS= AASHTO=

Remarks

F.M.=0.47

Source of Sample: EDW-B003 **Depth:** 10.0'-11.5'
Sample Number: S-5 **Date:** 11-5-15

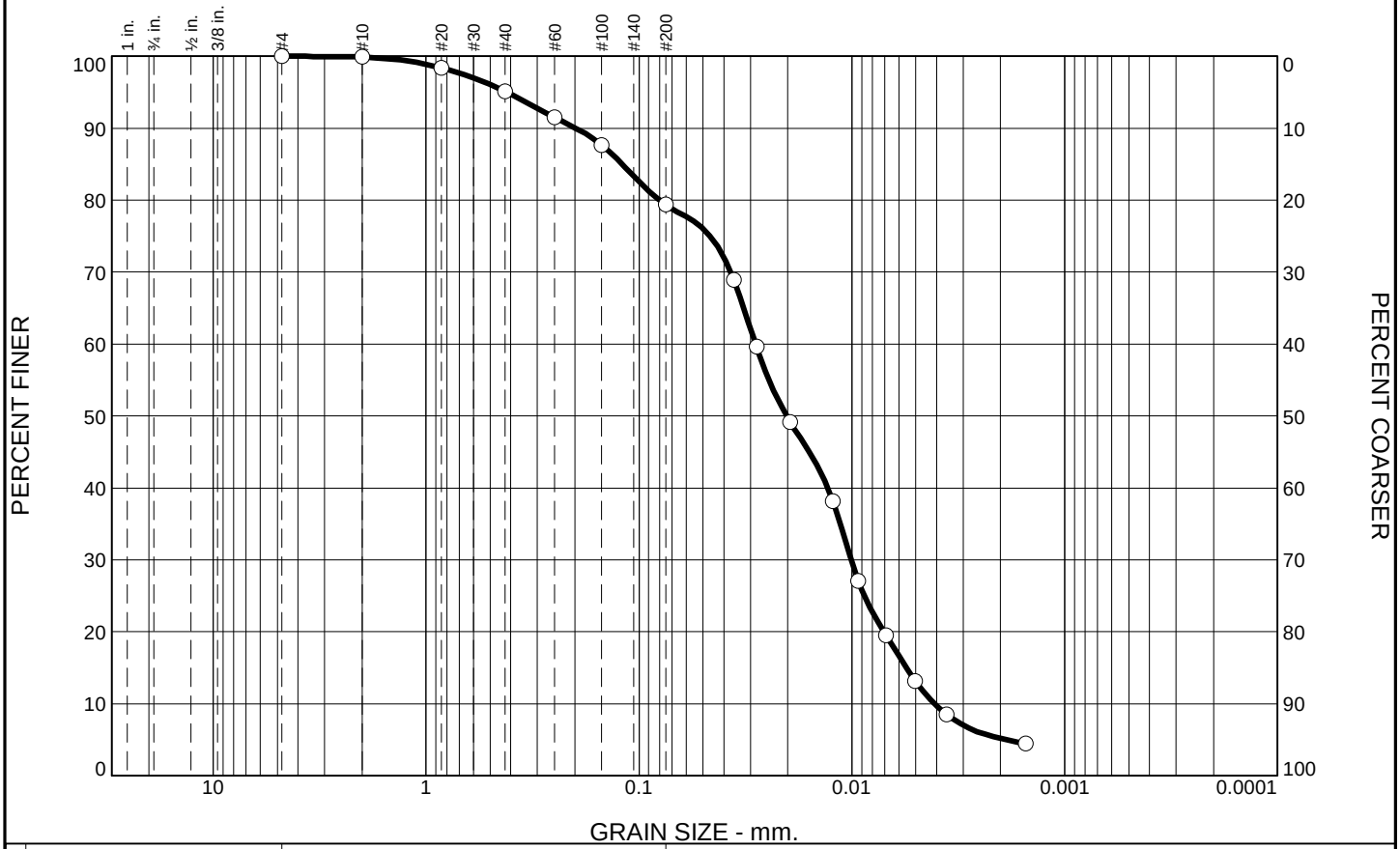
Terracon

Client: DYNEGY
Project: DYNEGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	4.8	15.7	66.4	13.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	98.4		
#40	95.1		
#60	91.5		
#100	87.6		
#200	79.4		

* (no specification provided)

FILL: VERY DARK GRAY VARVED FLY ASH

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1981 D_{85}= 0.1202 D_{60}= 0.0284
D_{50}= 0.0203 D_{30}= 0.0101 D_{15}= 0.0056
D_{10}= 0.0041 C_u= 6.92 C_c= 0.87

Classification

USCS= AASHTO=

Remarks

F.M.=0.23

Source of Sample: EDW-B003 **Depth:** 30.0'-32.0'
Sample Number: S-9 **Date:** 11-5-15

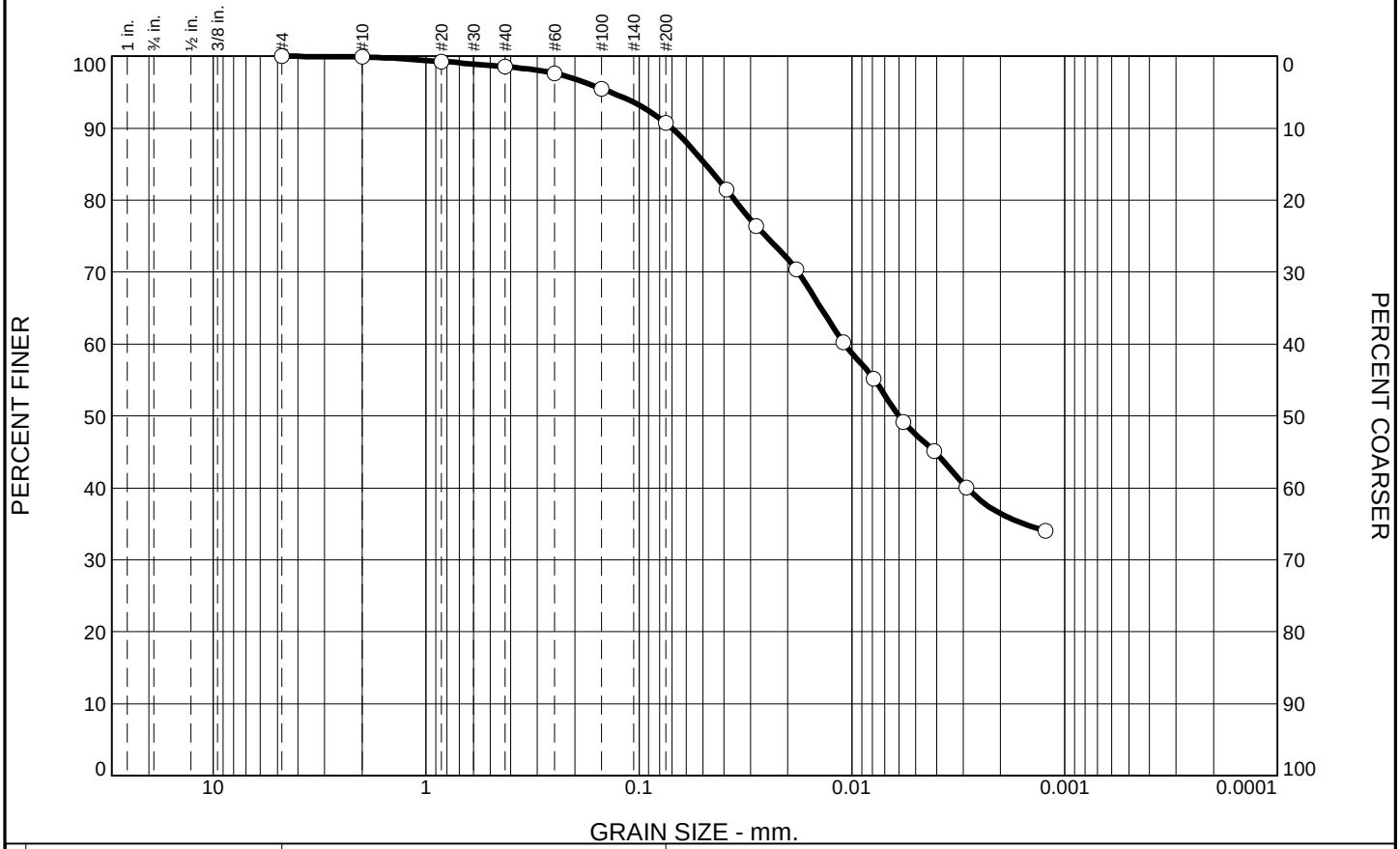
Terracon

Client: DYNEGY
Project: DYNEGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	1.4	7.8	43.3	47.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	99.3		
#40	98.5		
#60	97.6		
#100	95.5		
#200	90.7		

* (no specification provided)

GRAY AND DARK GRAY LEAN CLAY WITH ORGANICS

Atterberg Limits

PL= 16 LL= 37 PI= 21

Coefficients

D_{90}= 0.0702 D_{85}= 0.0486 D_{60}= 0.0108
D_{50}= 0.0060 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(19)

Remarks

F.M.=0.08

Source of Sample: EDW-B004 **Depth:** 7.5'-9.0'
Sample Number: S-4 **Date:** 11-5-15

Terracon

Client: DYNEGY
Project: DYNEGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.1	1.6	5.6	14.1	51.7	23.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	96.9		
#10	95.3		
#20	92.5		
#40	89.7		
#60	86.7		
#100	82.6		
#200	75.6		

* (no specification provided)

FILL: GRAY FLY ASH

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4580 D_{85}= 0.1999 D_{60}= 0.0244
D_{50}= 0.0136 D_{30}= 0.0065 D_{15}= 0.0028
D_{10}= 0.0019 C_u= 12.93 C_c= 0.91

Classification

USCS= AASHTO=

Remarks

F.M.=0.52

Source of Sample: EDW-B005 **Depth:** 20.0'-21.5'
Sample Number: S-7 **Date:** 11-13-15

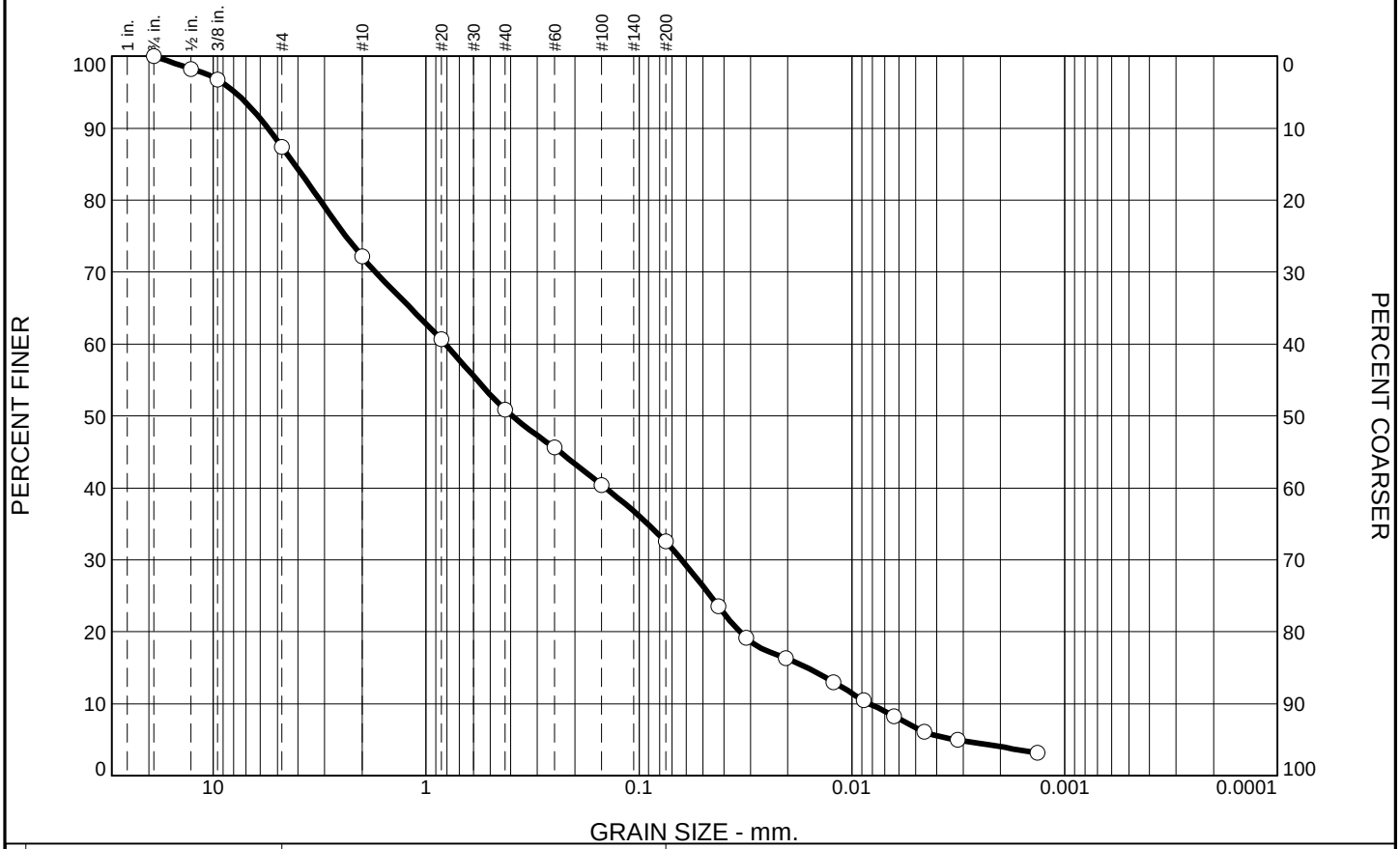
Terracon

Client: DYNEGY
Project: DYNEGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	12.6	15.3	21.2	18.3	26.0	6.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	98.2		
.375	96.7		
#4	87.4		
#10	72.1		
#20	60.6		
#40	50.9		
#60	45.6		
#100	40.4		
#200	32.6		

* (no specification provided)

FILL: DARK BROWN AND DARK GRAY SAND WITH GRAVEL - FLY ASH NOTED

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 5.5350 D_{85}= 4.1471 D_{60}= 0.8124
D_{50}= 0.3943 D_{30}= 0.0630 D_{15}= 0.0162
D_{10}= 0.0082 C_u= 98.50 C_c= 0.59

Classification

USCS= SP AASHTO=

Remarks

F.M.=2.33

Source of Sample: EDW-B010 **Depth:** 5.0'-6.5'
Sample Number: S-3 **Date:** 11-5-15

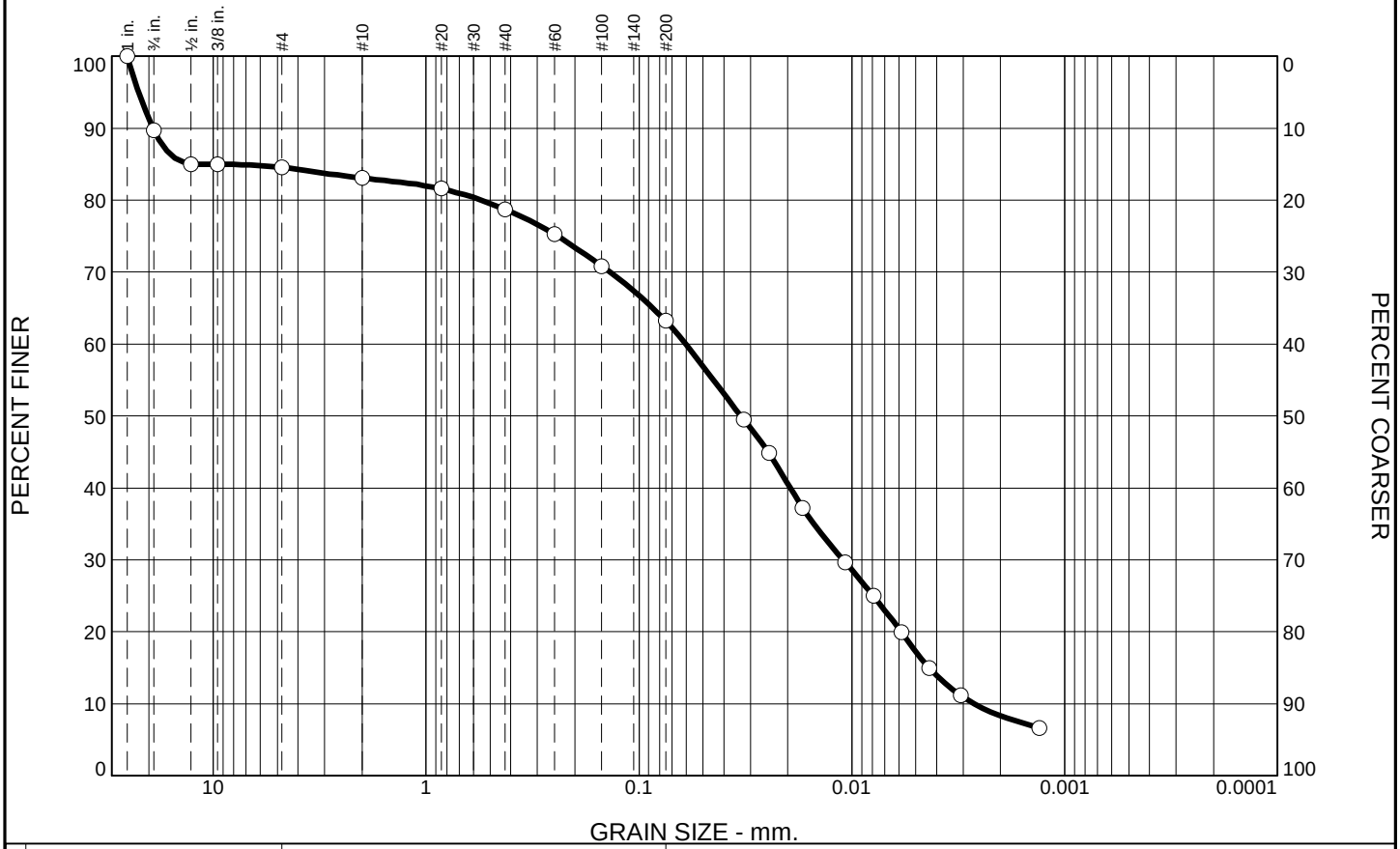
Terracon

Client: DYNEGY
Project: DYNEGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.3	5.2	1.4	4.4	15.5	46.0	17.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	89.7		
.5	85.0		
.375	85.0		
#4	84.5		
#10	83.1		
#20	81.6		
#40	78.7		
#60	75.3		
#100	70.8		
#200	63.2		

* (no specification provided)

FILL: VERY DARK GRAY FLY ASH

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 19.2789 D_{85}= 8.9744 D_{60}= 0.0604
D_{50}= 0.0333 D_{30}= 0.0110 D_{15}= 0.0043
D_{10}= 0.0027 C_u= 22.70 C_c= 0.75

Classification

USCS= AASHTO=

Remarks

F.M.=1.47

Source of Sample: EDW-B011 **Depth:** 9.0'-11.0'
Sample Number: S-5 **Date:** 11-12-15

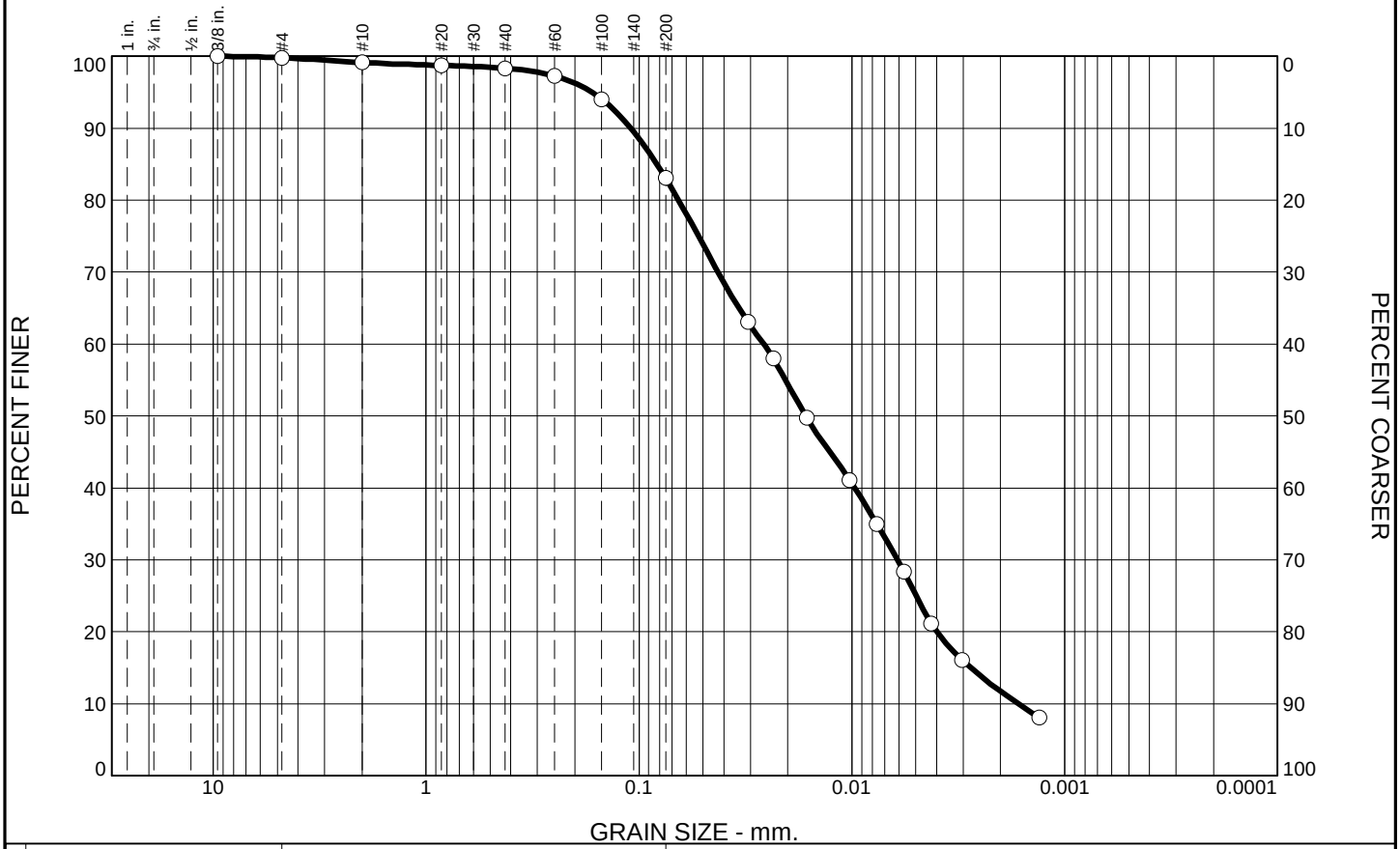
Terracon

Client: DYNEGY
Project: DYNEGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	0.7	0.8	15.2	58.0	25.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.8		
#10	99.1		
#20	98.7		
#40	98.3		
#60	97.3		
#100	94.0		
#200	83.1		

* (no specification provided)

FILL: GRAY FLY ASH

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.1094 D_{85}= 0.0823 D_{60}= 0.0260
D_{50}= 0.0165 D_{30}= 0.0061 D_{15}= 0.0028
D_{10}= 0.0017 C_u= 15.75 C_c= 0.87

Classification

USCS= AASHTO=

Remarks

F.M.=0.12

Source of Sample: EDW-B011 **Depth:** 19.5'-21.5'
Sample Number: S-7 **Date:** 11-11-15

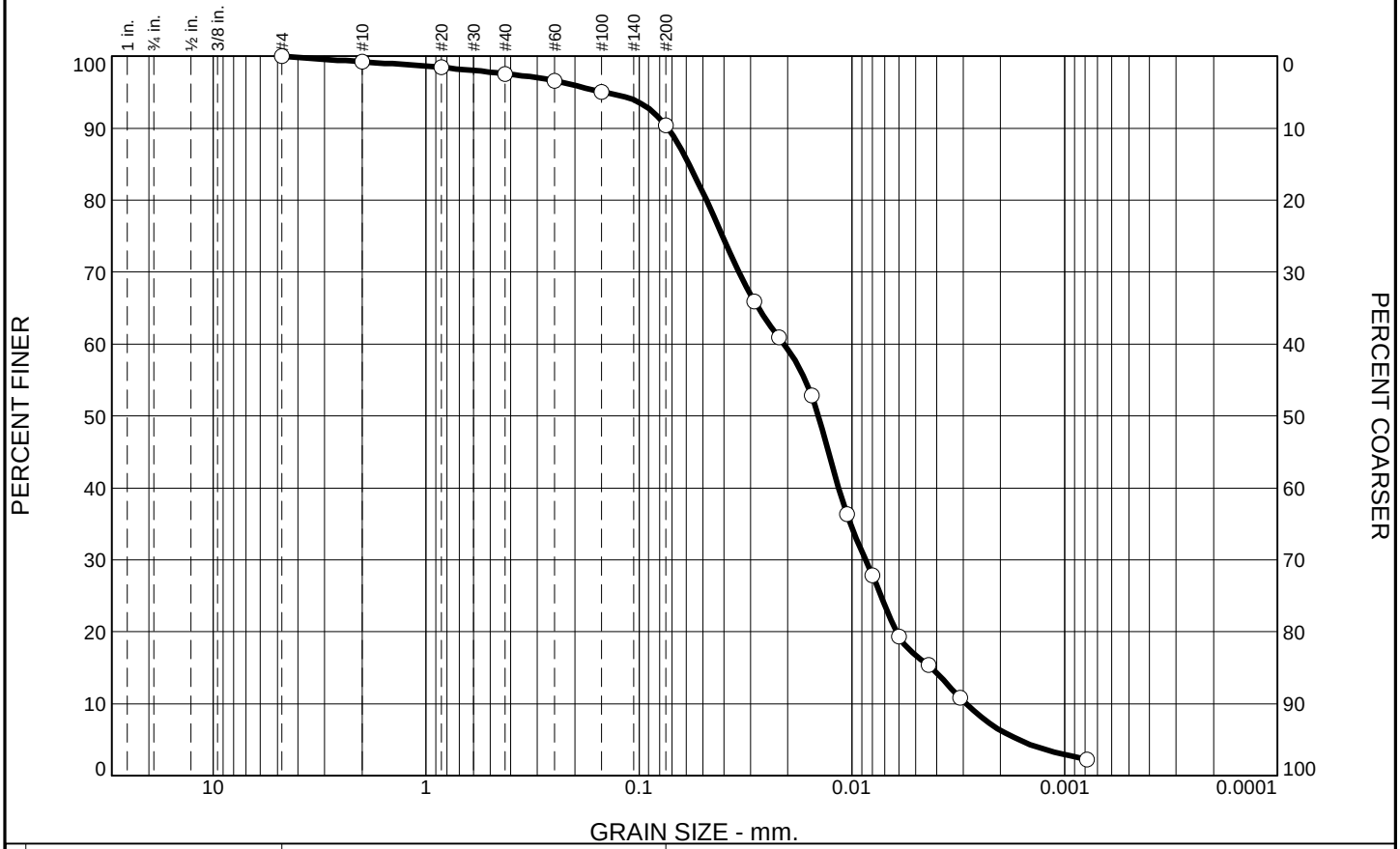
Terracon

Client: DYNEGY
Project: DYNEGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.8	1.6	7.2	73.7	16.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.2		
#20	98.4		
#40	97.6		
#60	96.6		
#100	95.1		
#200	90.4		

* (no specification provided)

FILL: DARK GRAY FLY ASH

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.0732 D_{85}= 0.0581 D_{60}= 0.0208
D_{50}= 0.0144 D_{30}= 0.0086 D_{15}= 0.0042
D_{10}= 0.0029 C_u= 7.17 C_c= 1.22

Classification

USCS= AASHTO=

Remarks

F.M.=0.12

Source of Sample: EDW-B012 **Depth:** 5.0'-6.5'
Sample Number: S-3

Date: 11-13-15

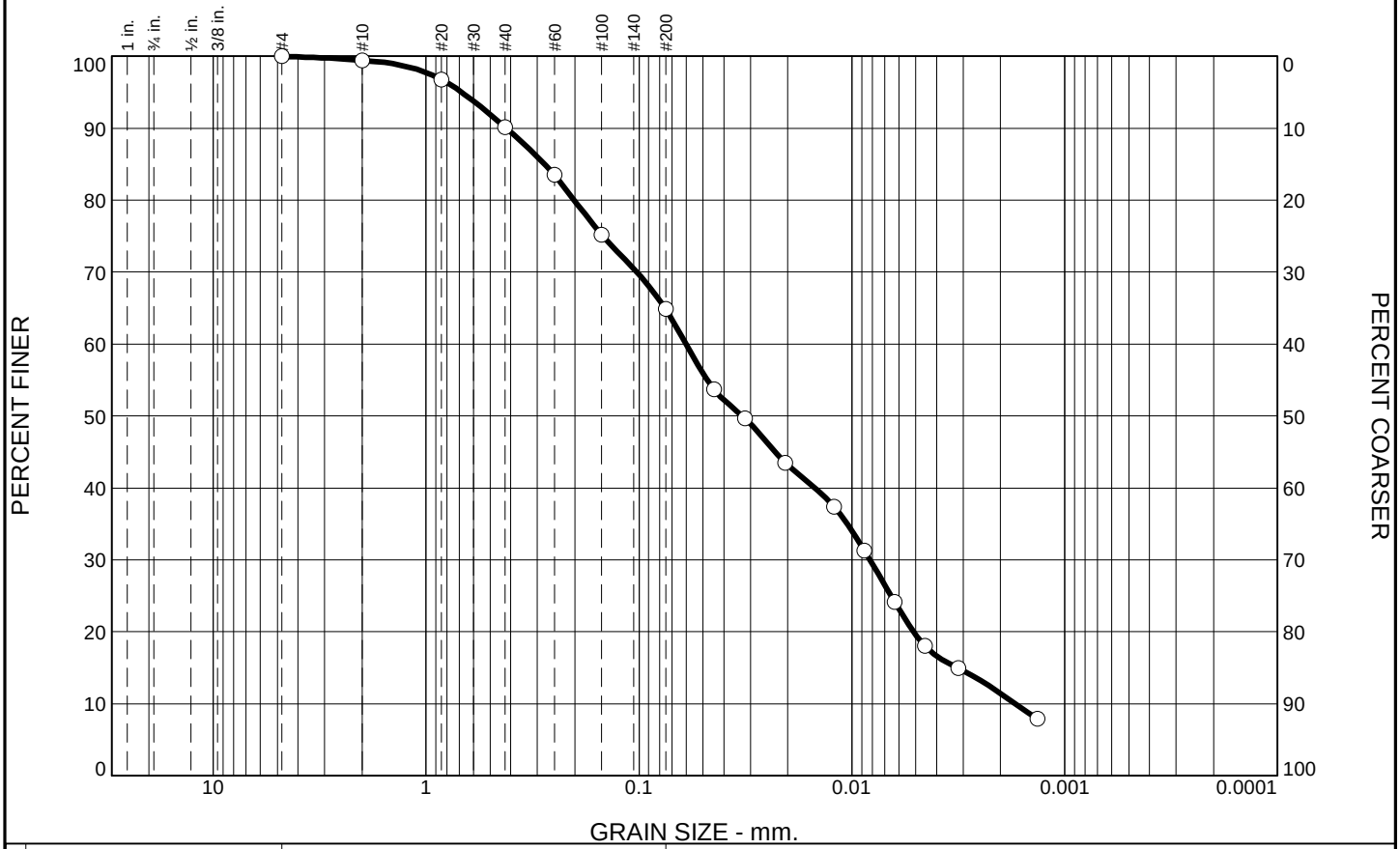
Terracon

Client: DYNEGY
Project: DYNEGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

PARTICLE SIZE ANALYSIS OF SOILS ASTM D422



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.6	9.3	25.2	45.4	19.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.4		
#20	96.8		
#40	90.1		
#60	83.5		
#100	75.2		
#200	64.9		

* (no specification provided)

FILL: GRAY SILTY SAND WITH GRAVEL - FLY ASH NOTED

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4213 D_{85}= 0.2775 D_{60}= 0.0602
D_{50}= 0.0328 D_{30}= 0.0082 D_{15}= 0.0032
D_{10}= 0.0017 C_u= 35.34 C_c= 0.66

Classification

USCS= SM AASHTO=

Remarks

F.M.=0.47

Source of Sample: EDW-B014 **Depth:** 7.0'-8.5'
Sample Number: S-4 **Date:** 11-5-15

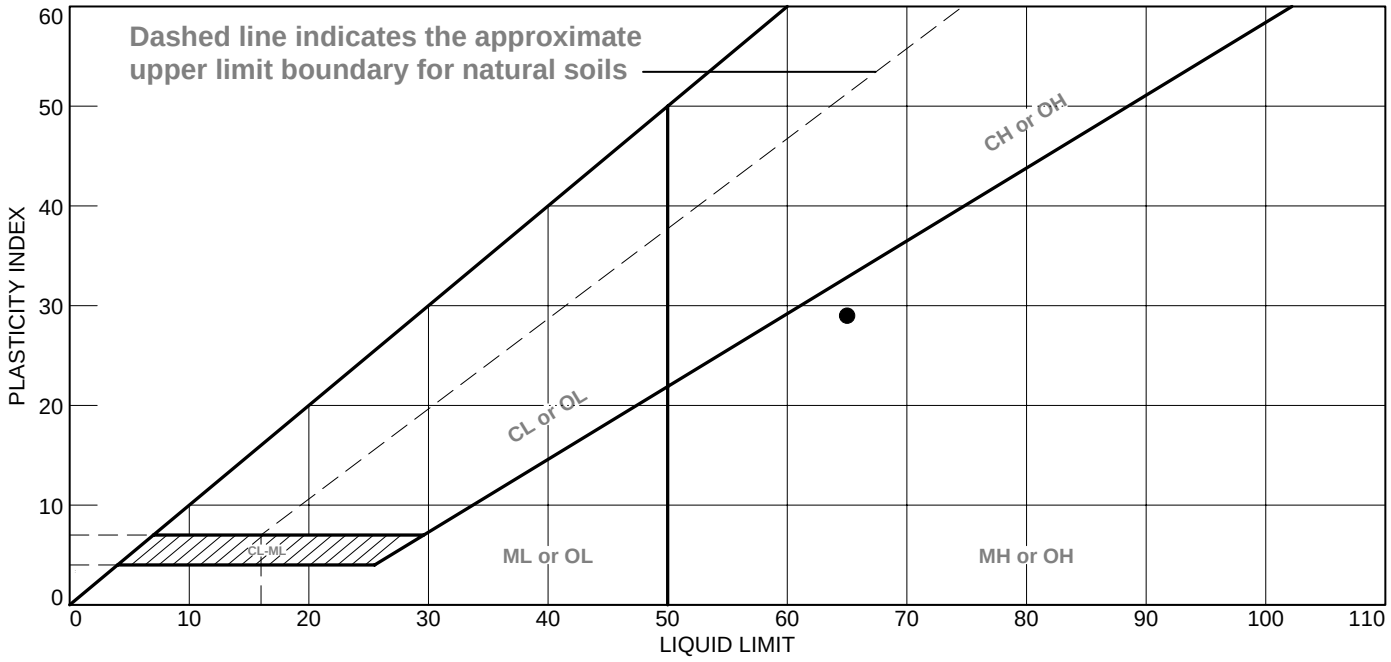
Terracon

Client: DYNEGY
Project: DYNEGY - EDWARDS SITE

Project No: MR155218 **Figure**

Tested By: SJH **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GREENISH GRAY SANDY SILT	65	36	29			MH

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

Source of Sample: EDW-B002 **Depth:** 5.0'-7.0'
Sample Number: S-3

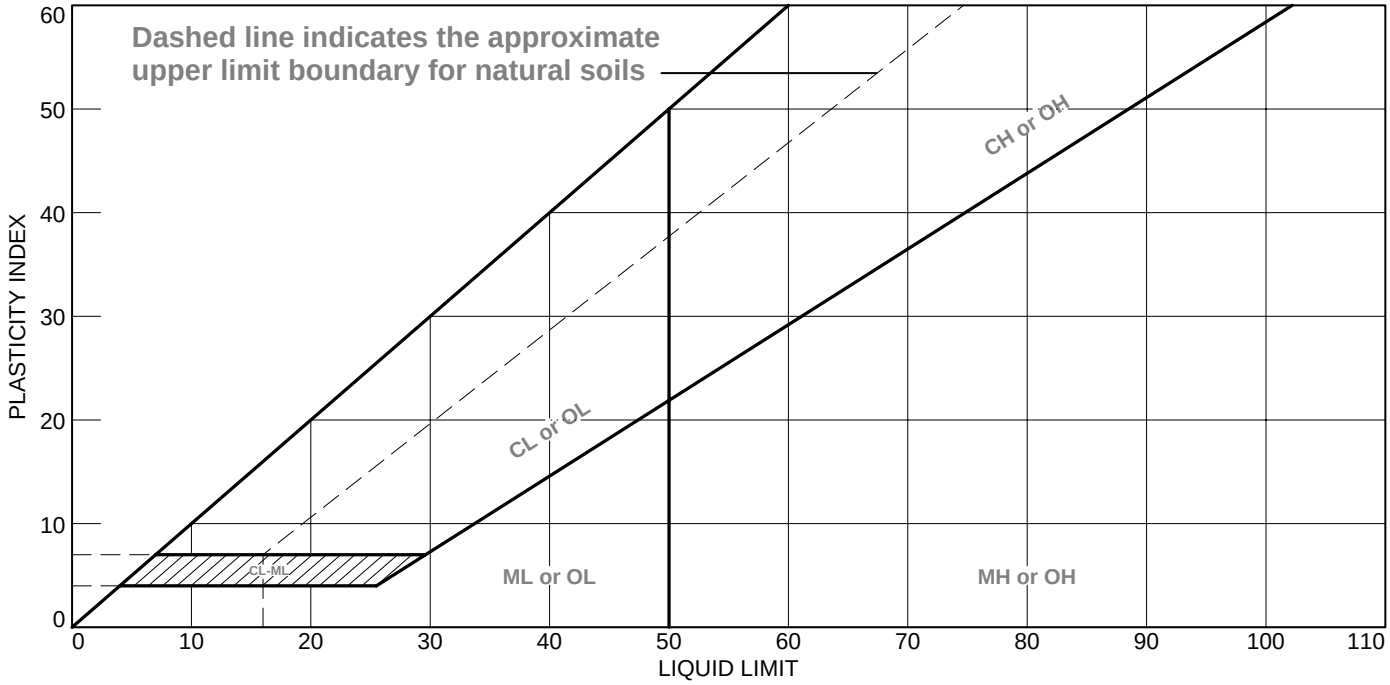
Terracon

Remarks:
● SHELL NOTED

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY TO DARK GRAY FLY ASH	17	27	NP			

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

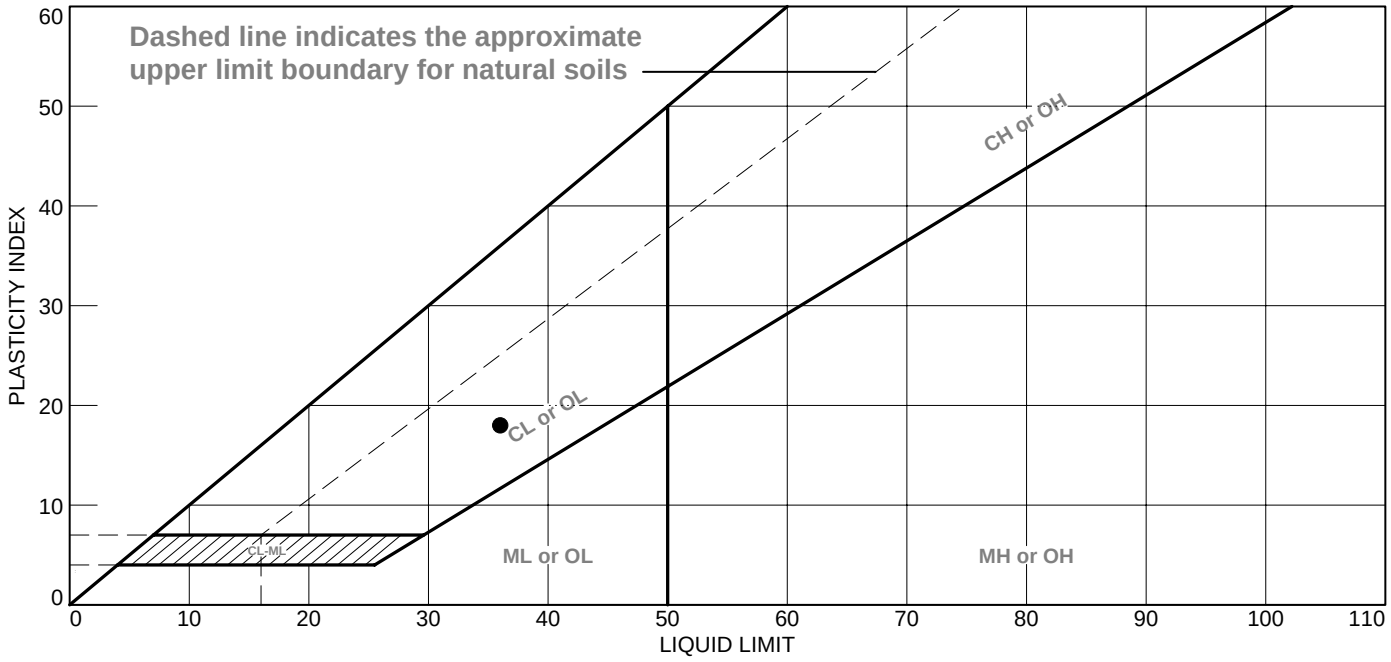
Source of Sample: EDW-B002 **Depth:** 10.0'-12.0'
Sample Number: S-5

Remarks:

Terracon

Figure

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY LEAN CLAY WITH SAND	36	18	18			CL

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

Source of Sample: EDW-B002 **Depth:** 35.0'-37.0'
Sample Number: S-10

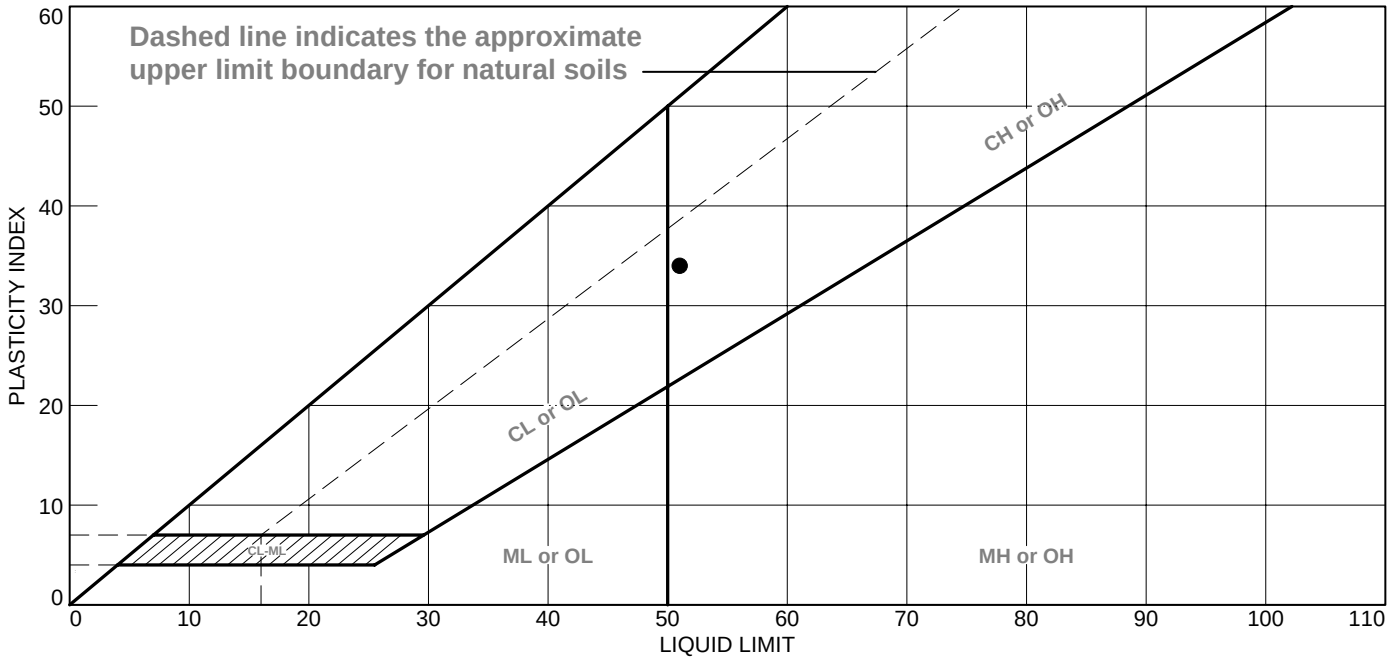
Remarks:

Terracon

Figure

Tested By: SJH **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY FAT CLAY WITH SAND	51	17	34			CH

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

Source of Sample: EDW-B003 **Depth:** 45.0'-47.0'
Sample Number: S-12

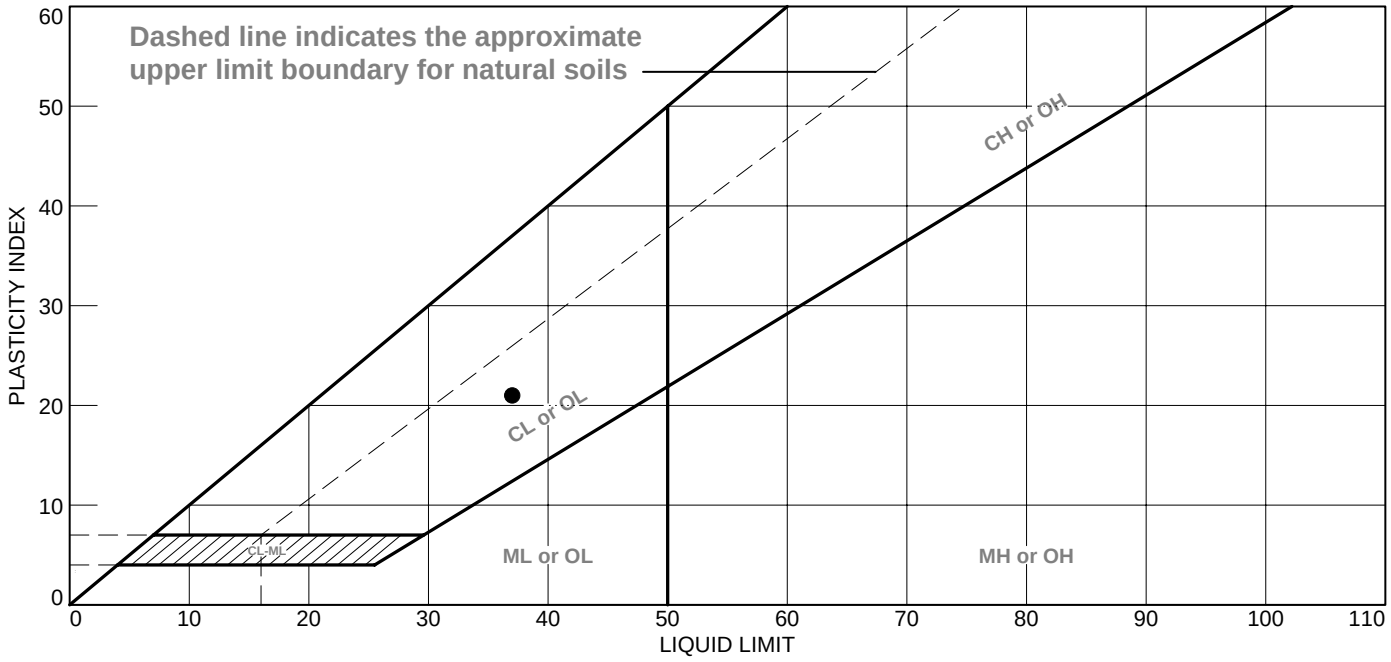
Terracon

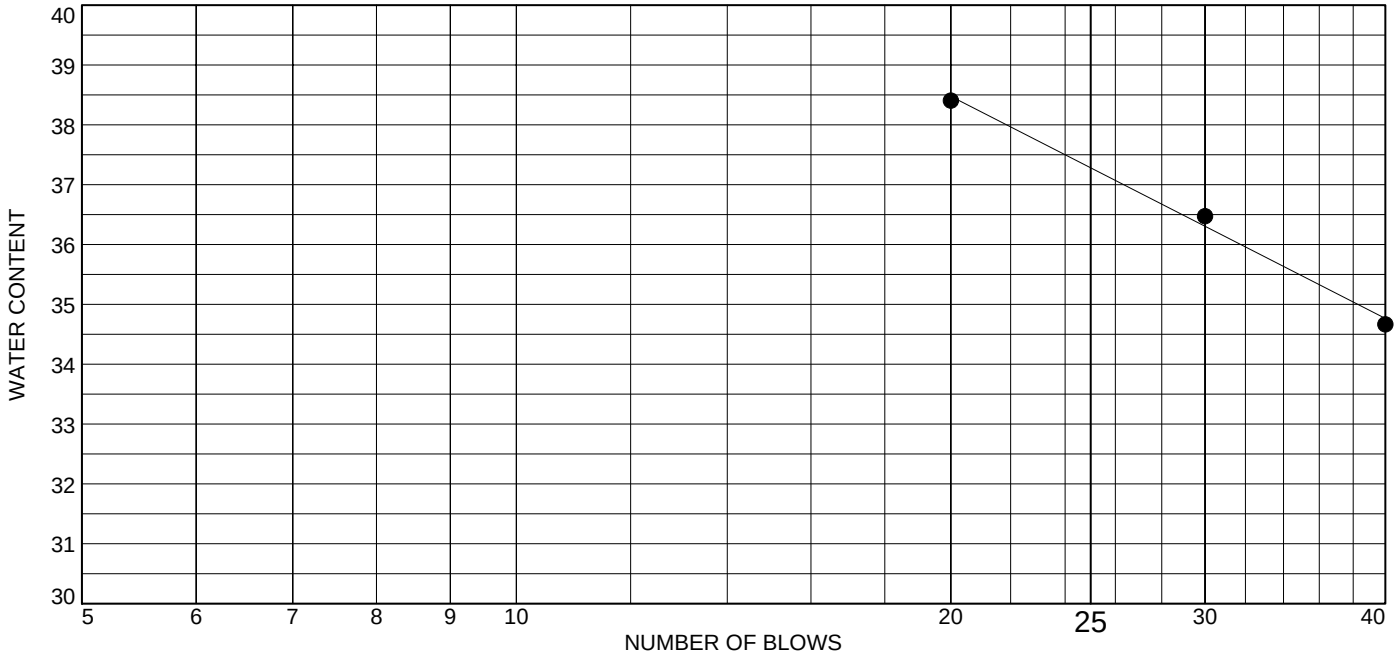
Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY AND DARK GRAY LEAN CLAY WITH ORGANICS	37	16	21	98.5	90.7	CL

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

Source of Sample: EDW-B004 **Depth:** 7.5'-9.0'
Sample Number: S-4

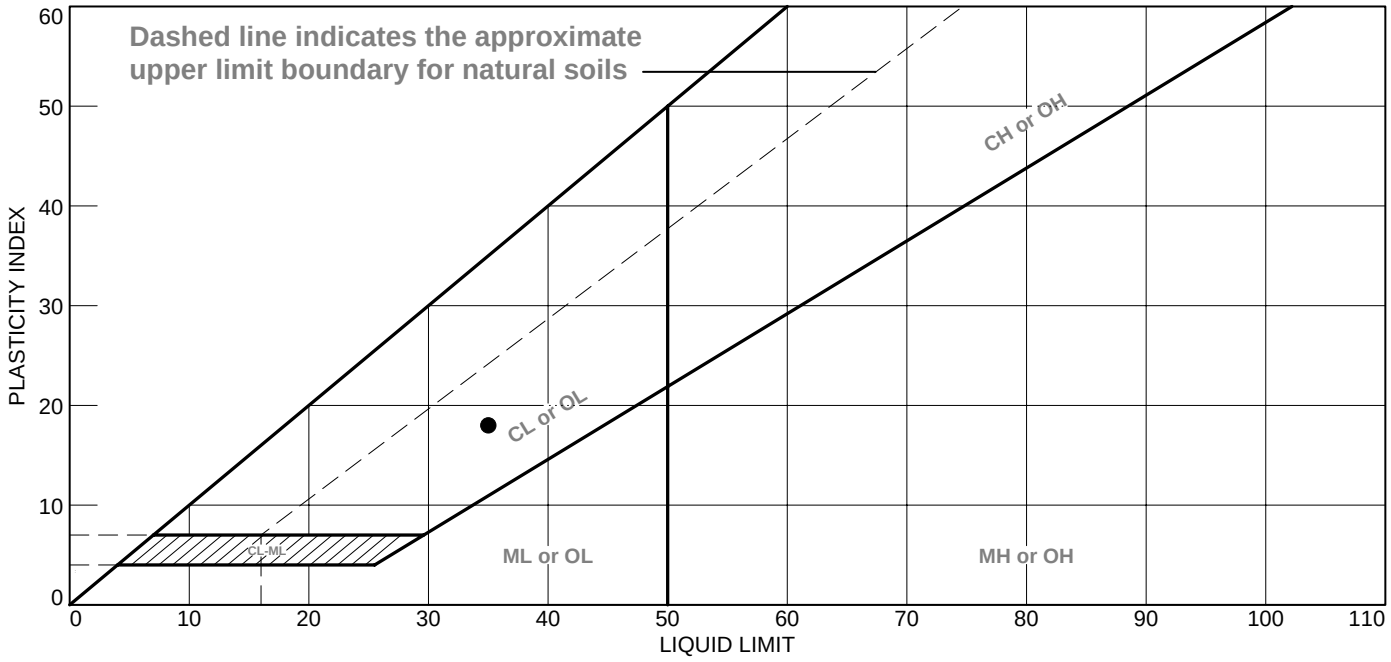
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAYISH BROWN LEAN CLAY WITH SAND	35	17	18			CL

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

Source of Sample: EDW-B004 **Depth:** 36.0'-38.0'
Sample Number: S-11

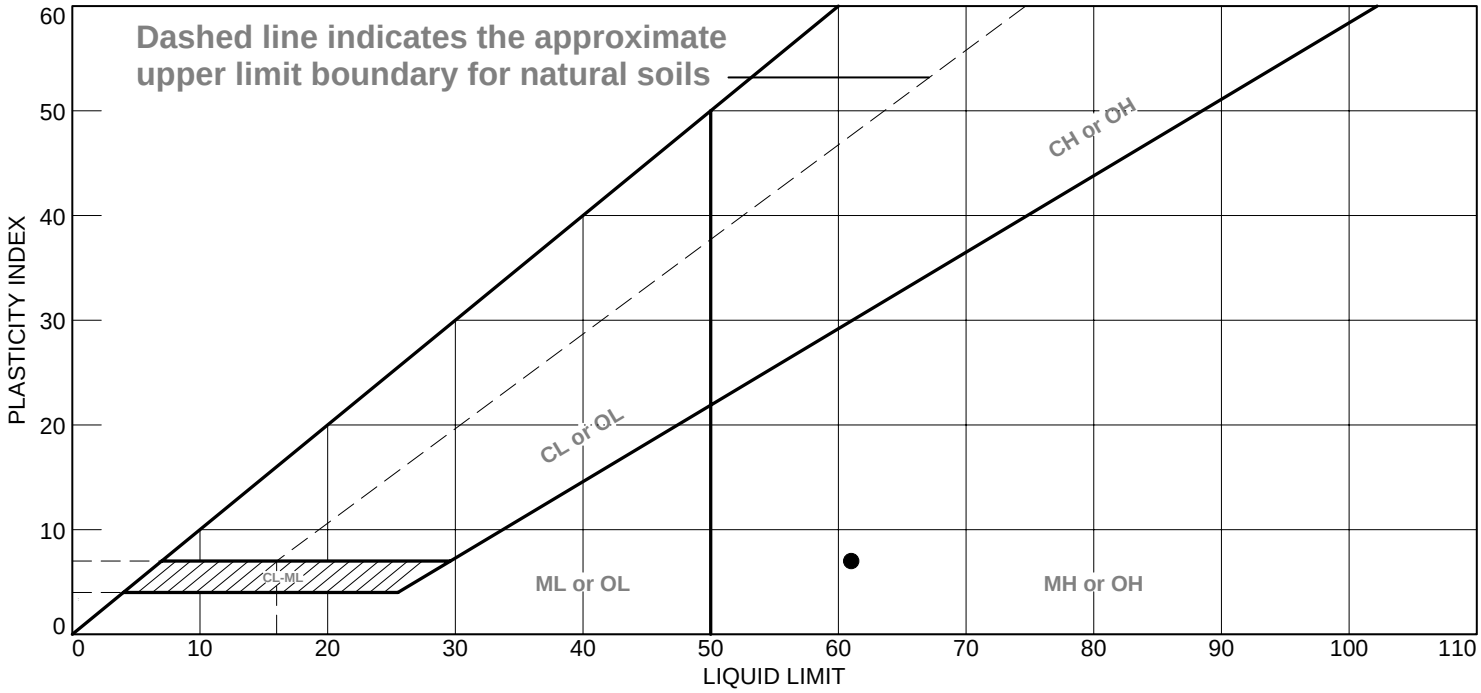
Remarks:

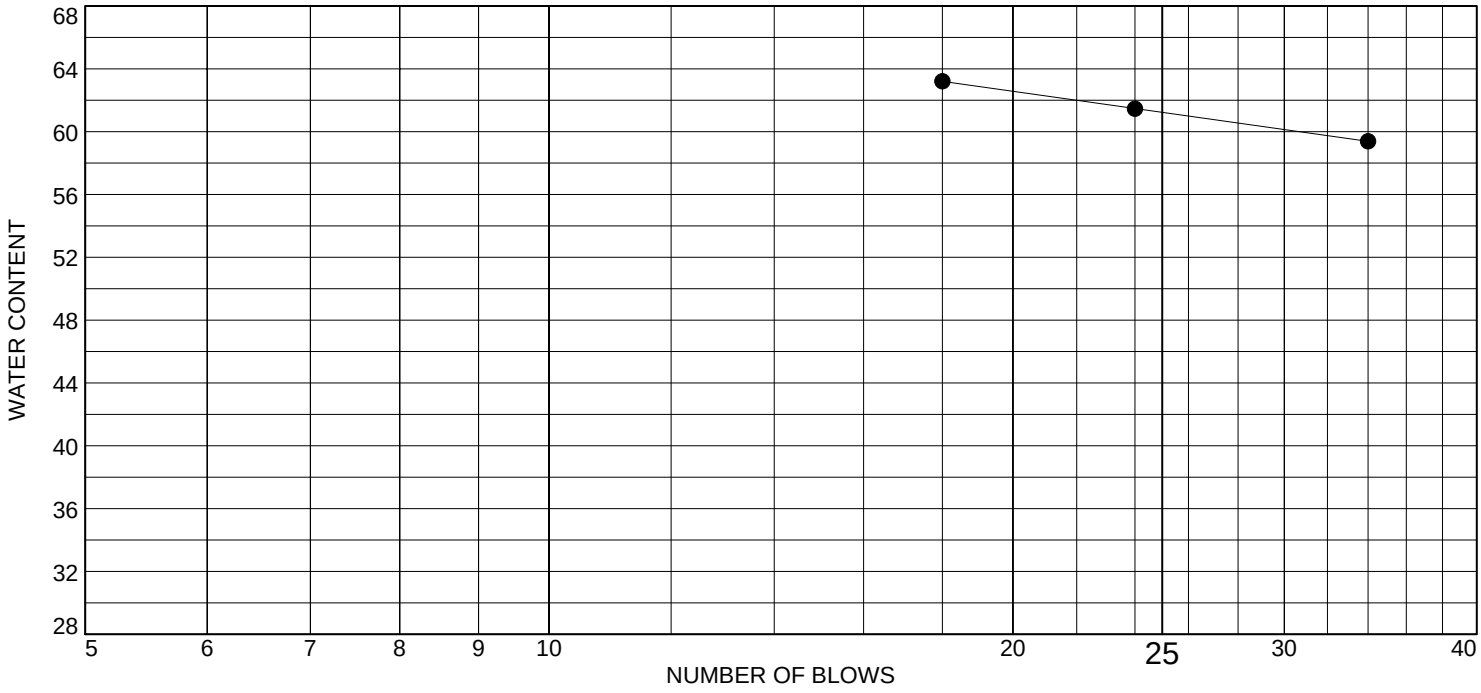
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	FILL: BROWN SANDY SILT WITH CLAY CHUNKS	61	54	7			MH

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

Source of Sample: EDW-B005 **Depth:** 5.0'-6.5'

Sample Number: S-3

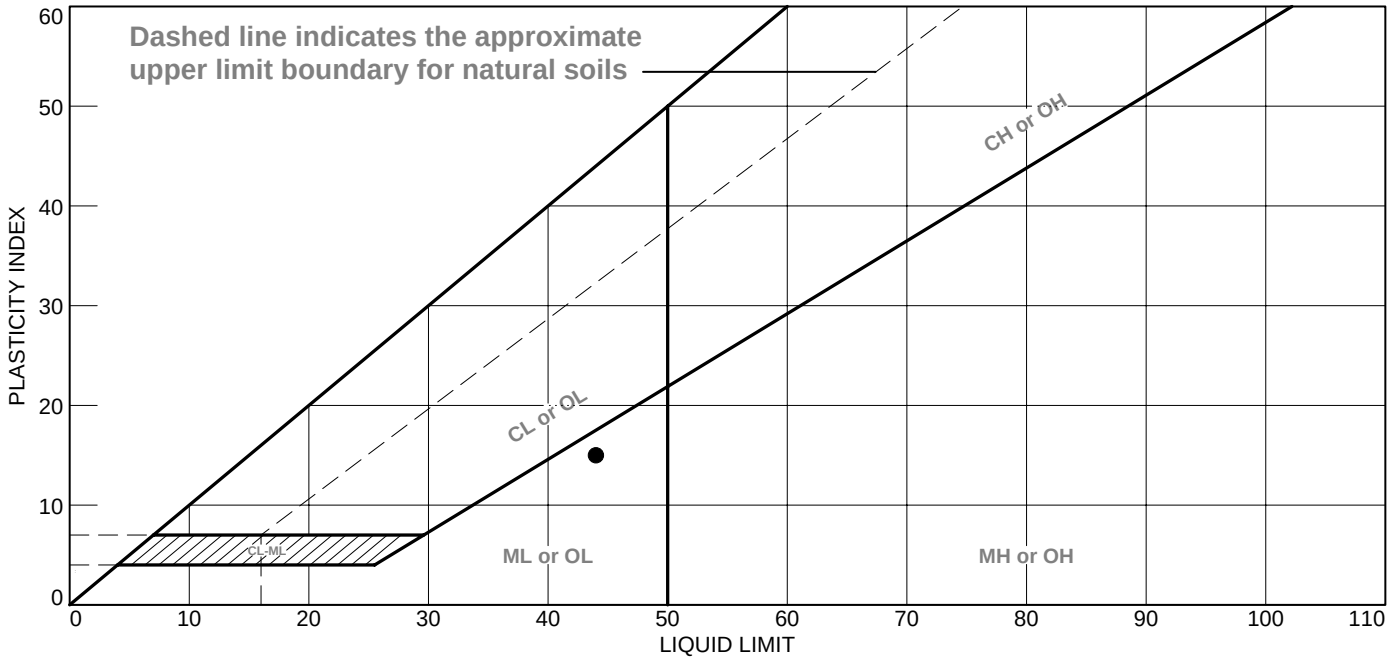
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	FILL: GRAY AND BLACK ORGANIC SILT	44	29	15			OL

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

Source of Sample: EDW-B005 **Depth:** 26.0'-27.0'
Sample Number: S-8A

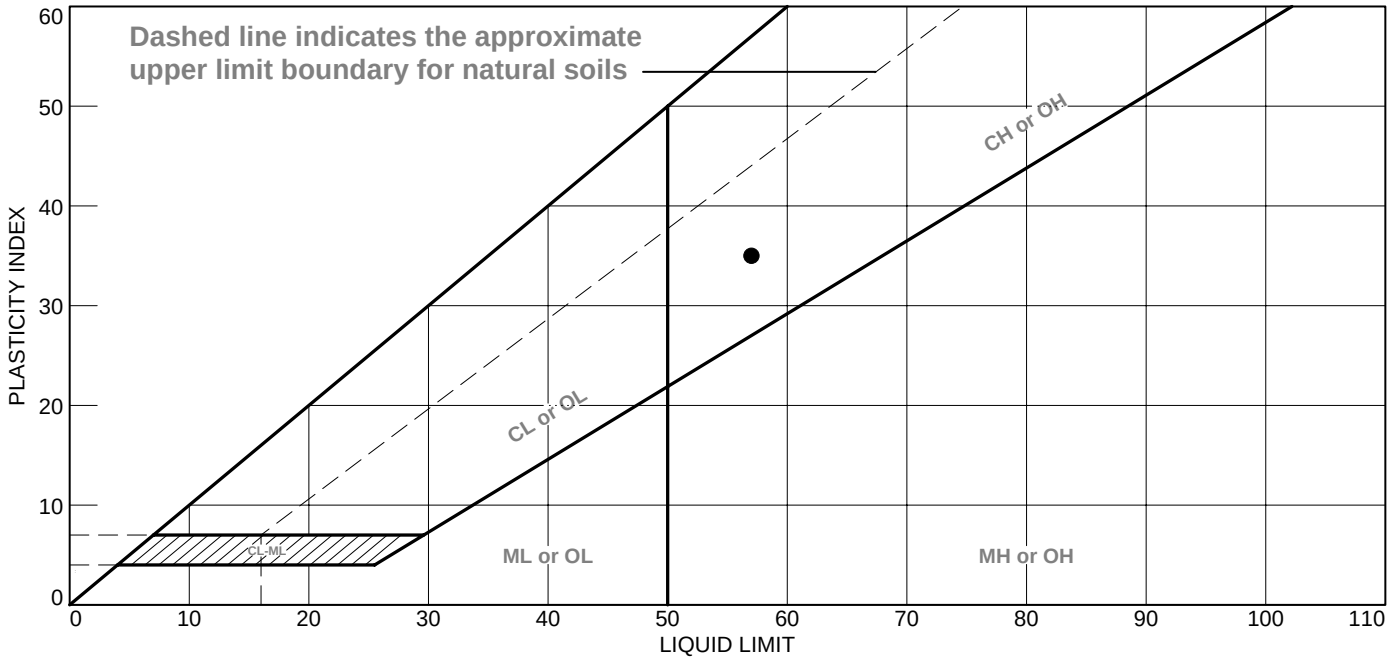
Remarks:

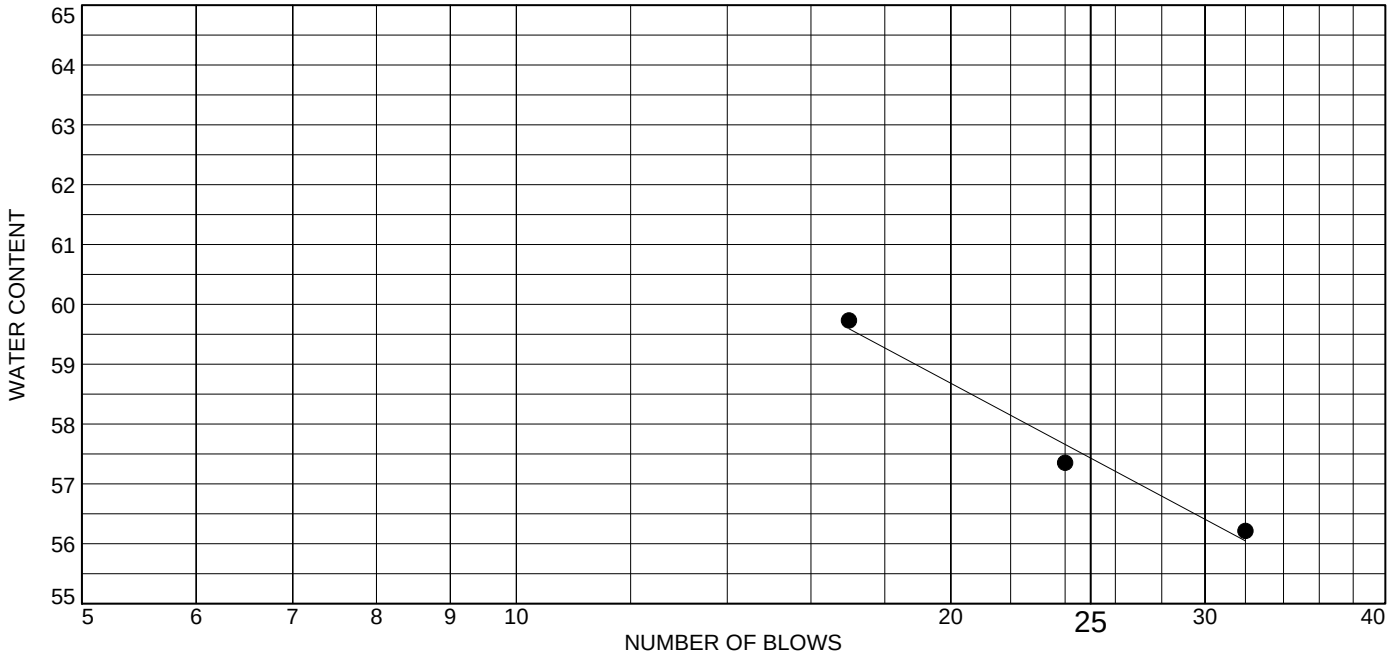
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY FAT CLAY SHELL - ORGANICS NOTED	57	22	35			CH

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

Source of Sample: EDW-B005 **Depth:** 41.0'-43.0'
Sample Number: S-11

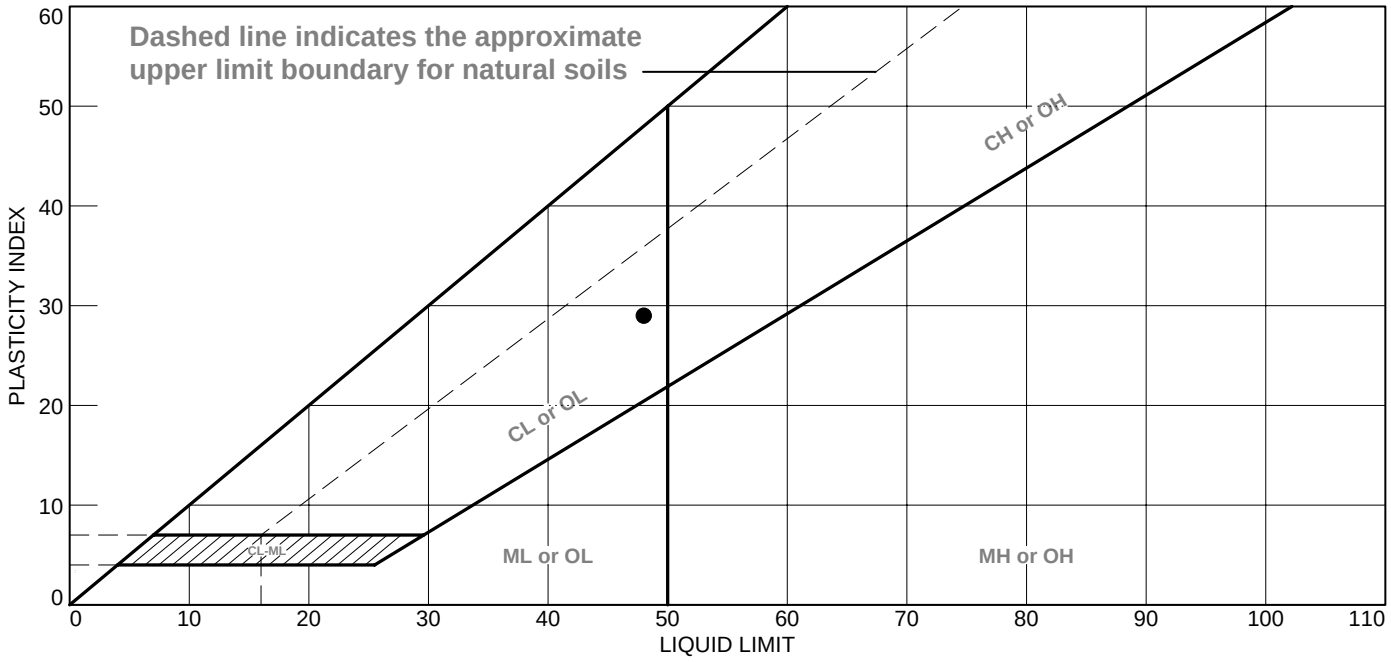
Remarks:

Terracon

Figure

Tested By: SJH **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY AND DARK GRAY LEAN CLAY TRACE SAND	48	19	29			CL

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

Source of Sample: EDW-B006 **Depth:** 5.0'-6.5'
Sample Number: S-3

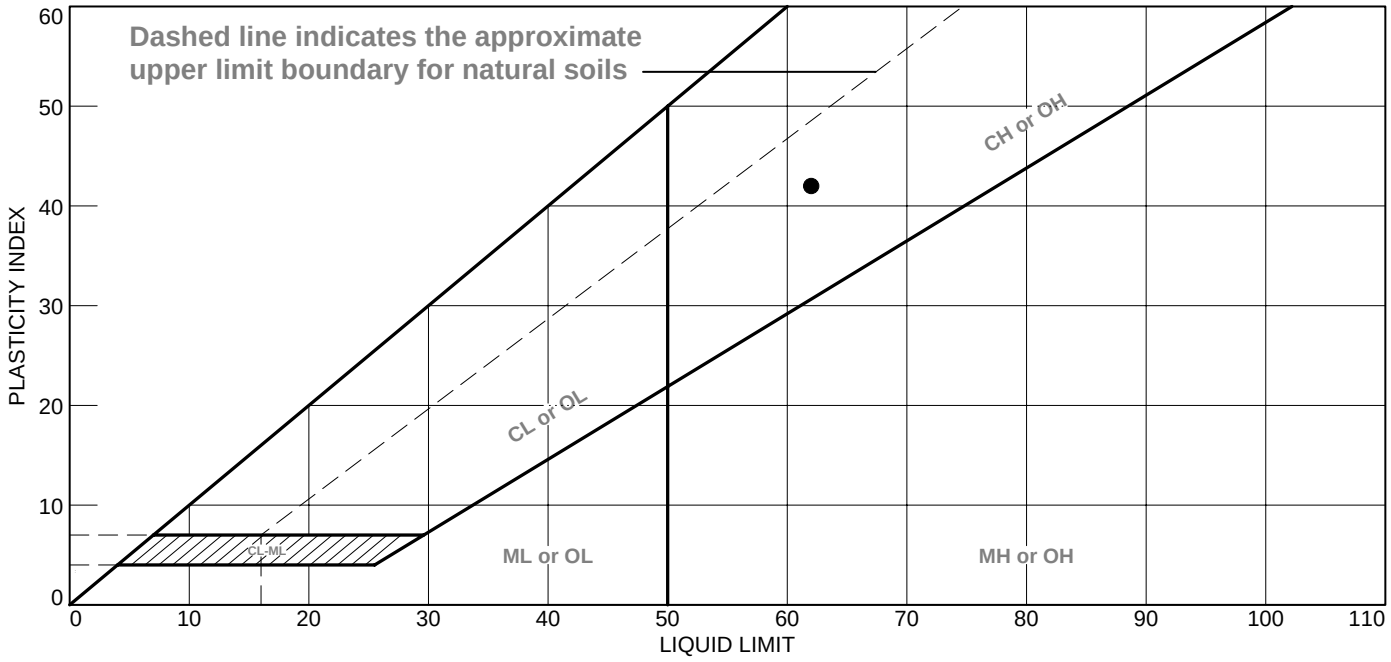
Terracon

Remarks:

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY FAT CLAY WITH SAND	62	20	42			CH

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

Source of Sample: EDW-B006 **Depth:** 13.0'-15.0'
Sample Number: S-6

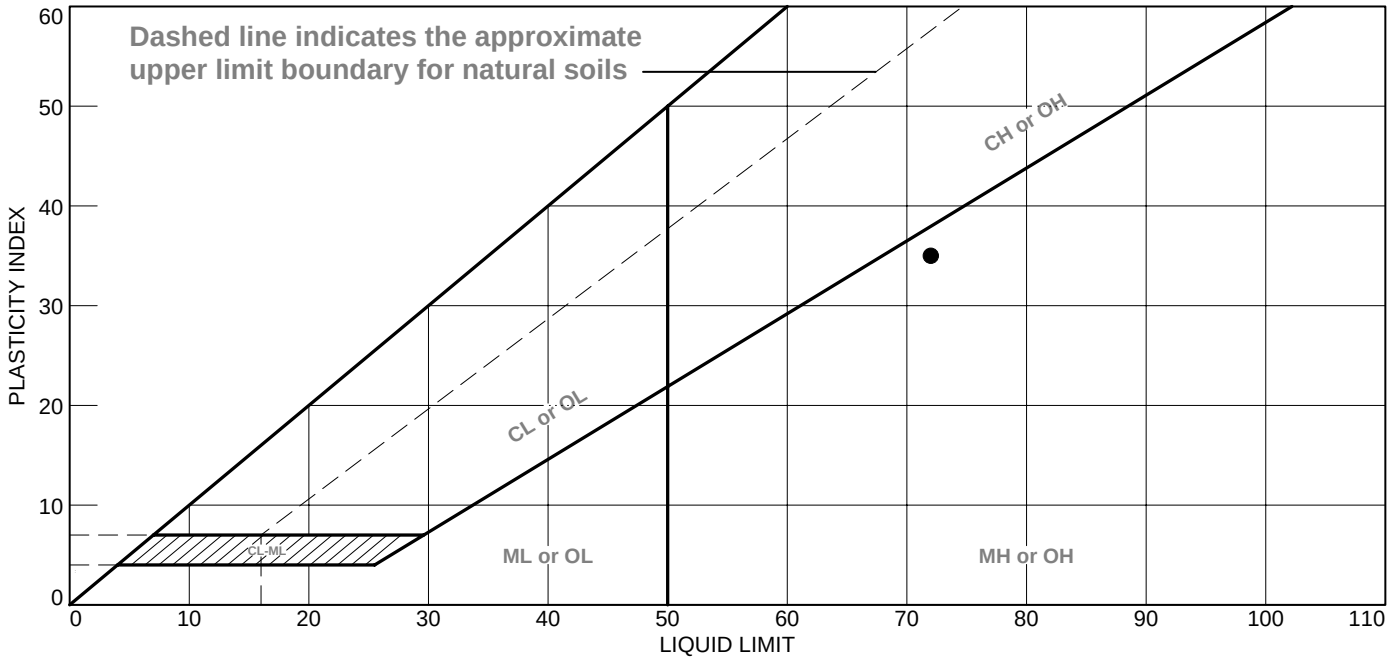
Remarks:

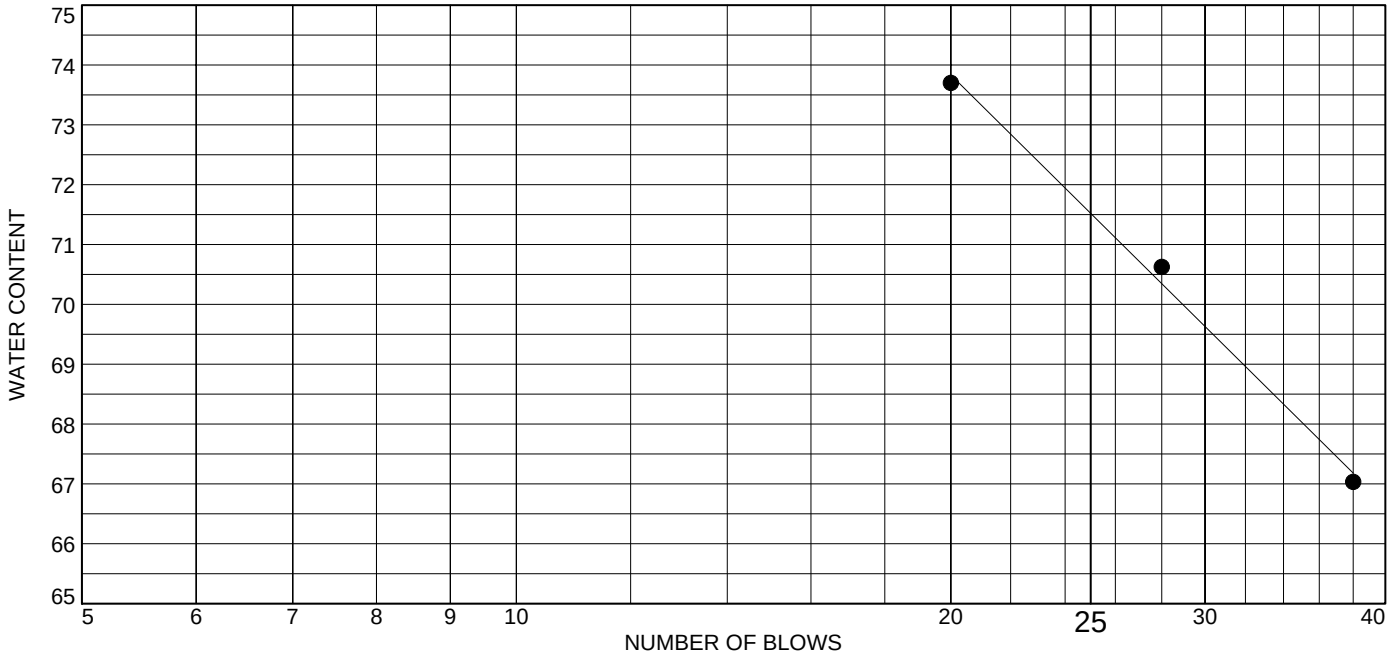
Terracon

Figure

Tested By: SJH **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY ORGANIC SILT	72	37	35			OH

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

Source of Sample: EDW-B006 **Depth:** 26.0'-28.0'
Sample Number: S-9

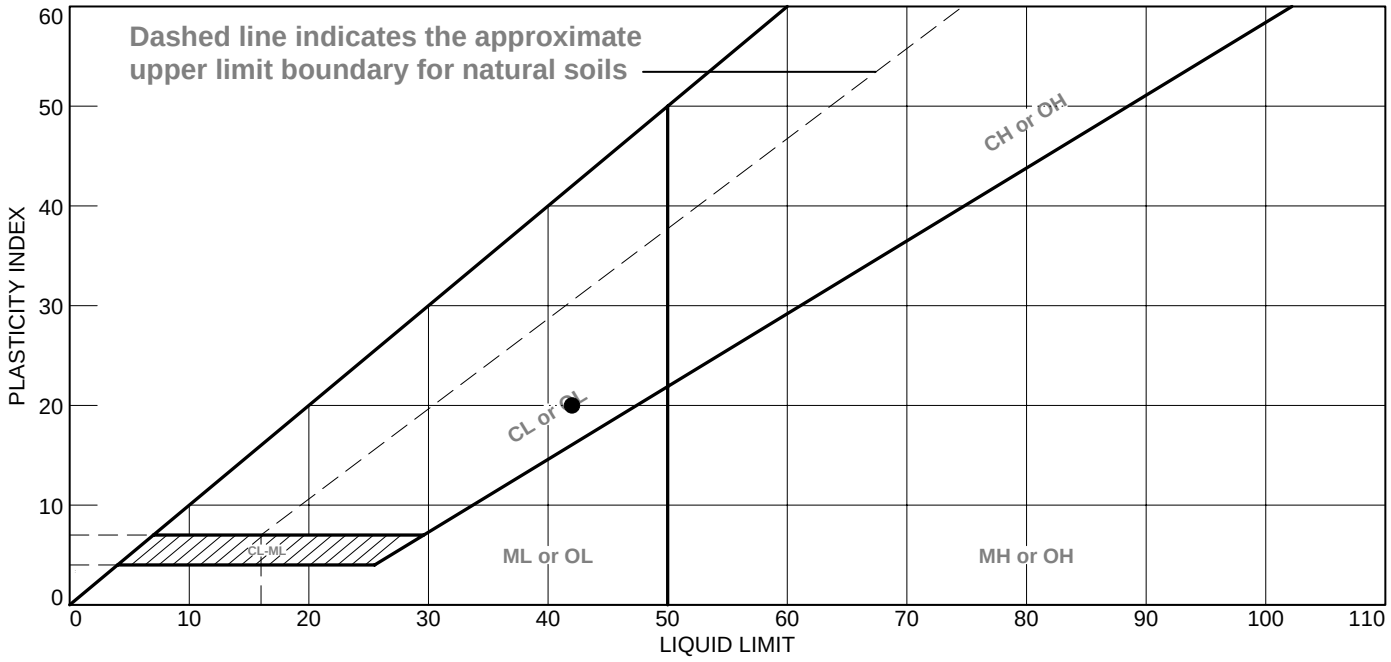
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK BROWN LEAN CLAY WITH SAND	42	22	20			CL

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

Source of Sample: EDW-B008 **Depth:** 2.5'-4.0'
Sample Number: S-2

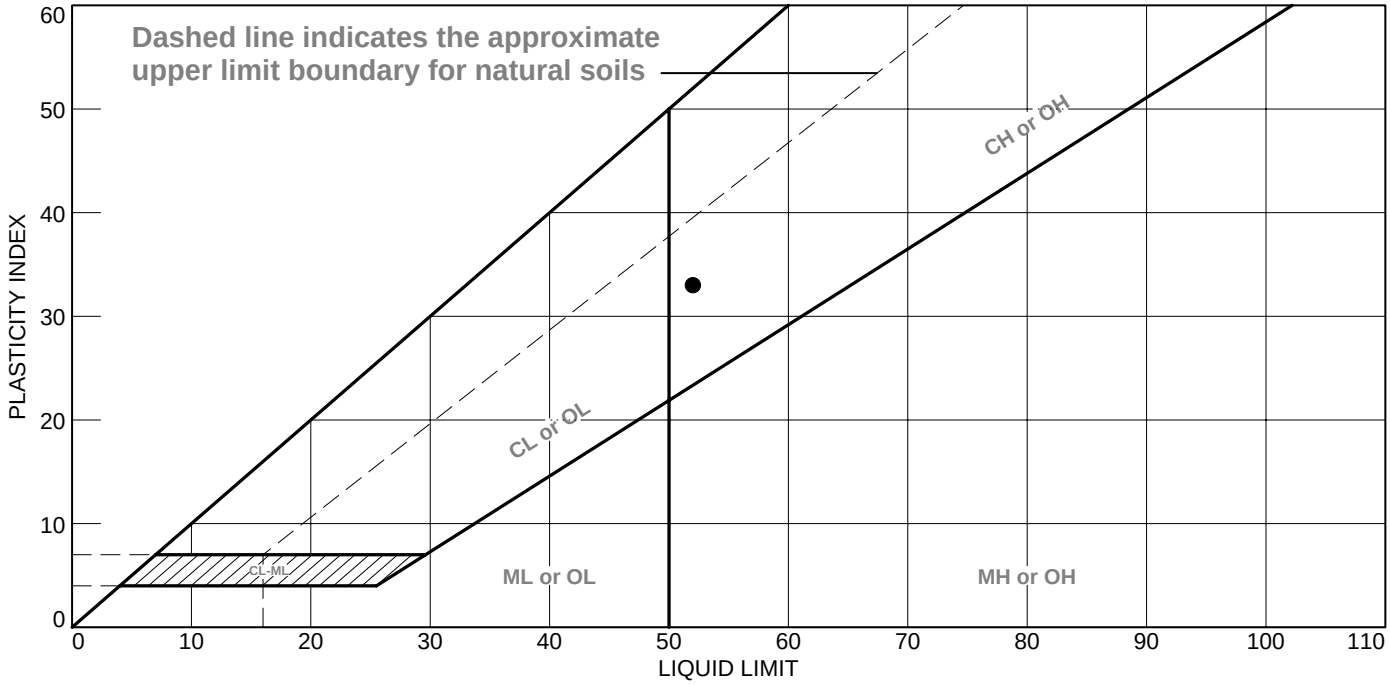
Remarks:

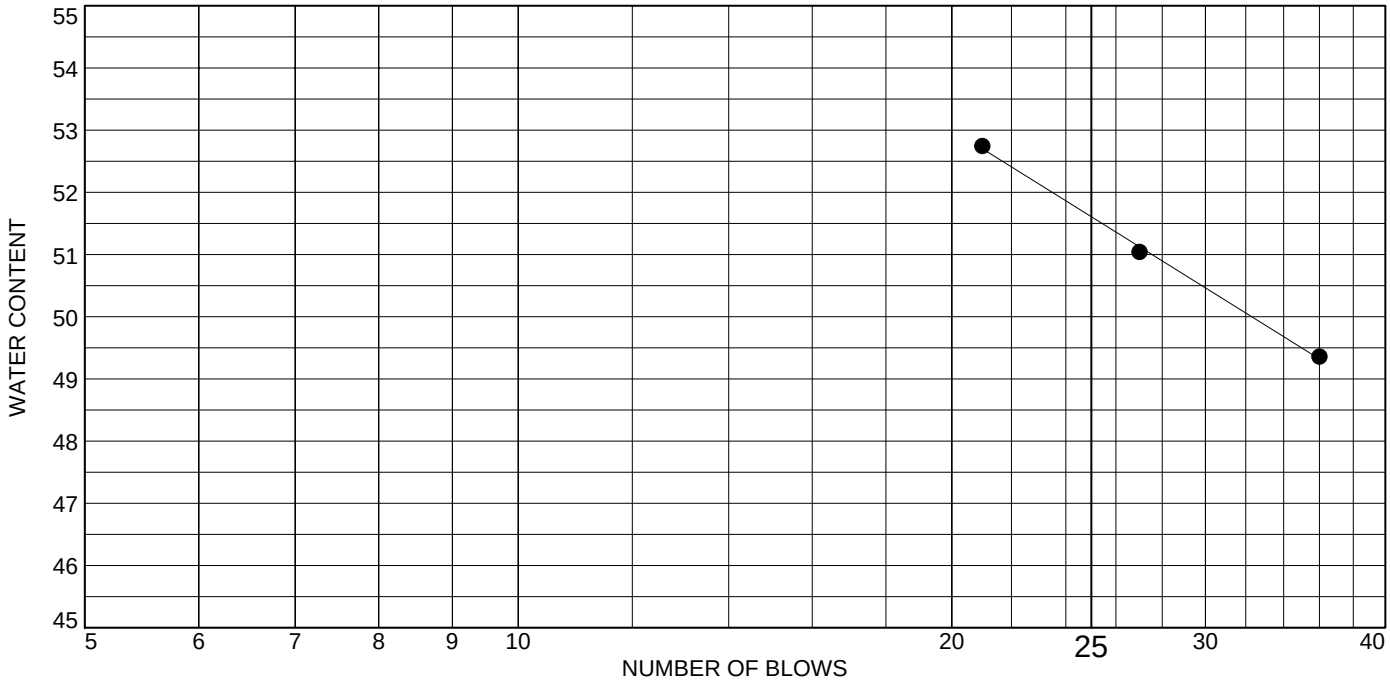
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAY FAT CLAY WITH SAND	52	19	33			CH

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

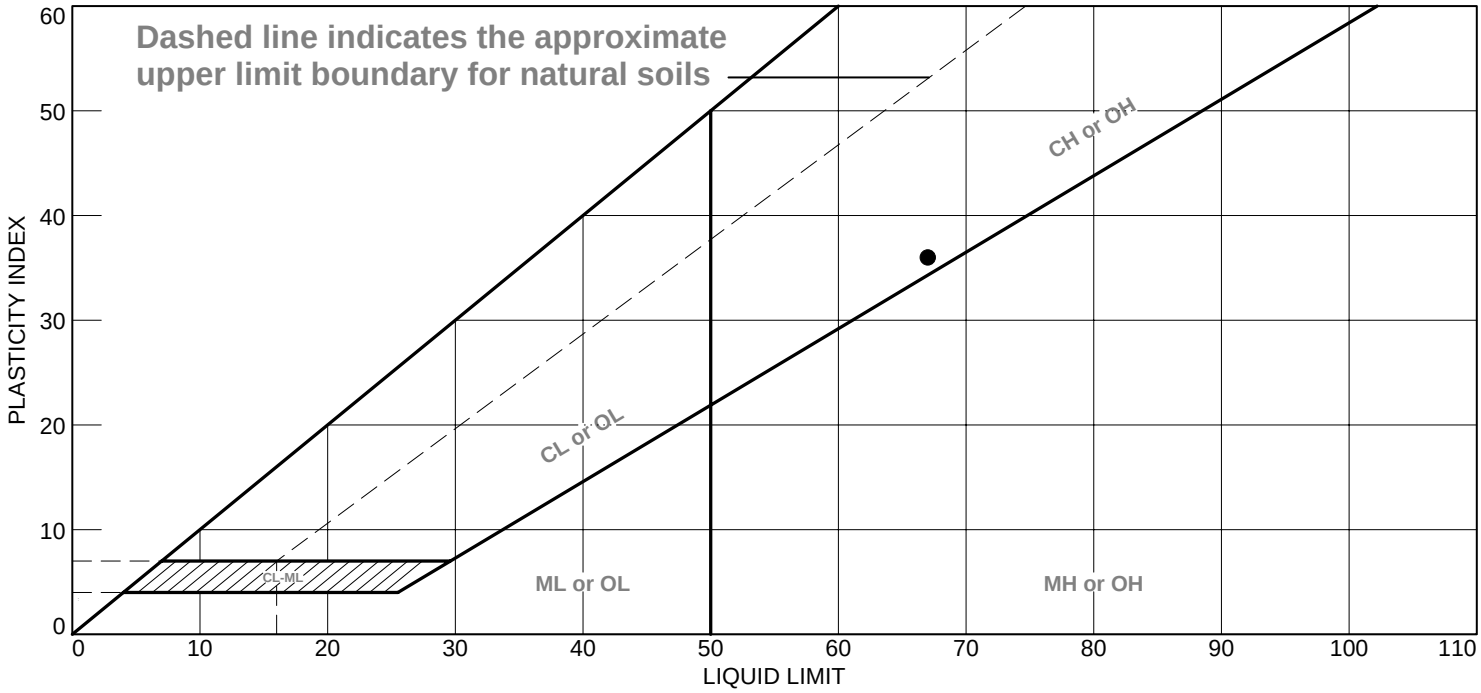
Source of Sample: EDW-B008 **Depth:** 11.0'-13.0'
Sample Number: S-5

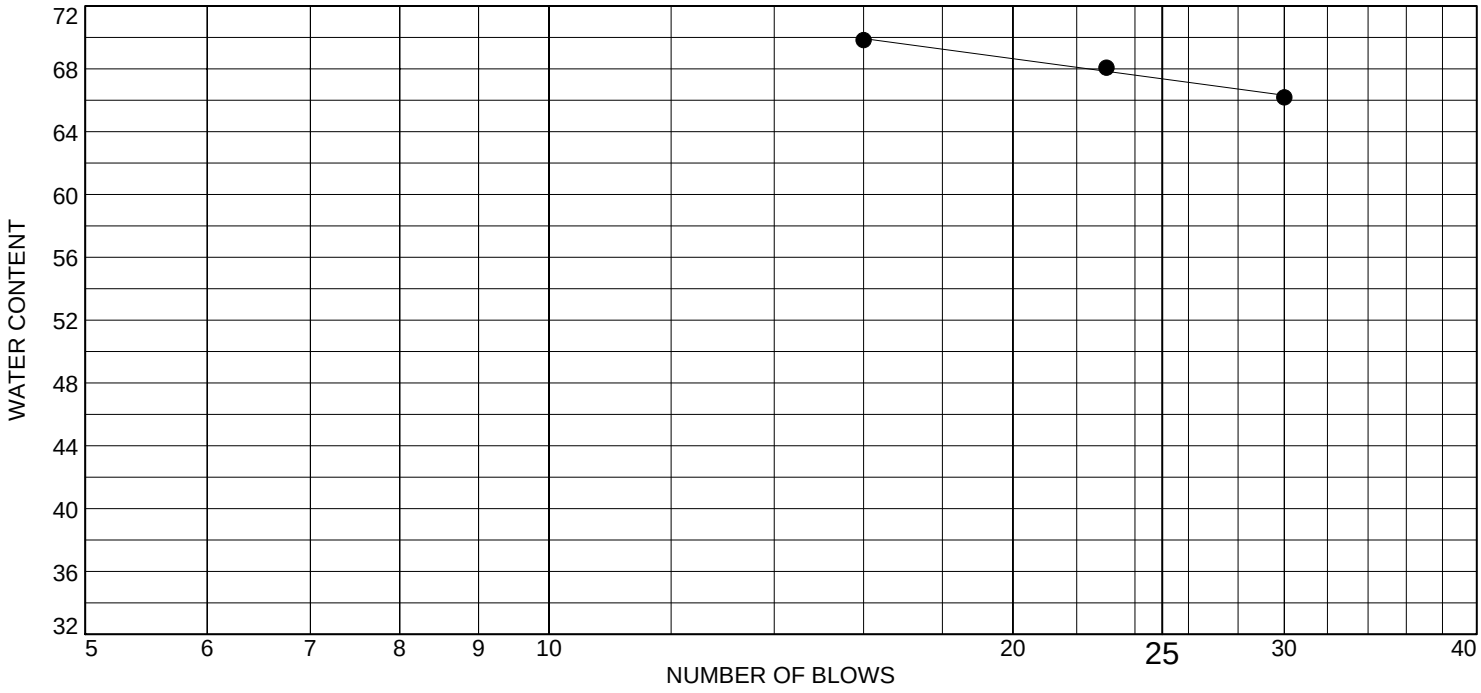
Remarks:

Terracon

Figure

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY FAT CLAY SHELL - ORGANICS NOTED	67	31	36			CH

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

Source of Sample: EDW-B008 **Depth:** 24.0'-26.5'

Sample Number: S-8

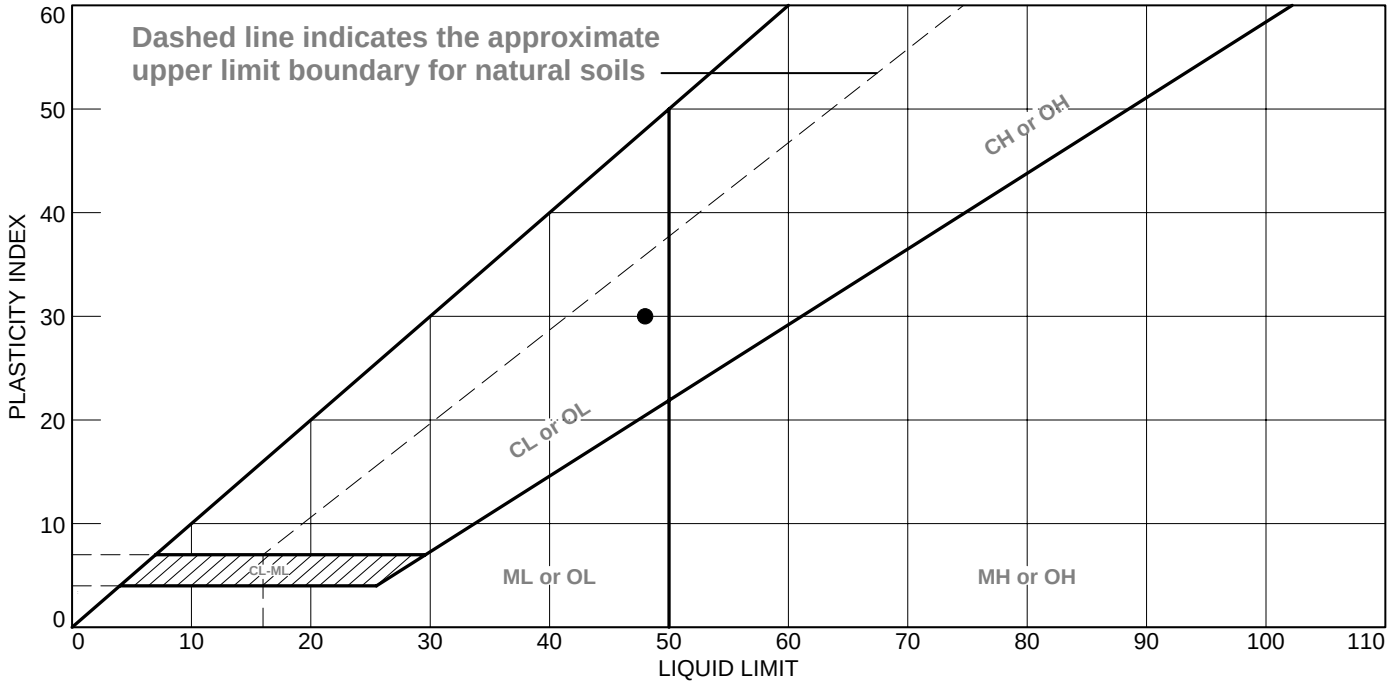
Remarks:

Terracon

Figure

Tested By: SJH **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAY MOTTLED LEAN CLAY	48	18	30			CL

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

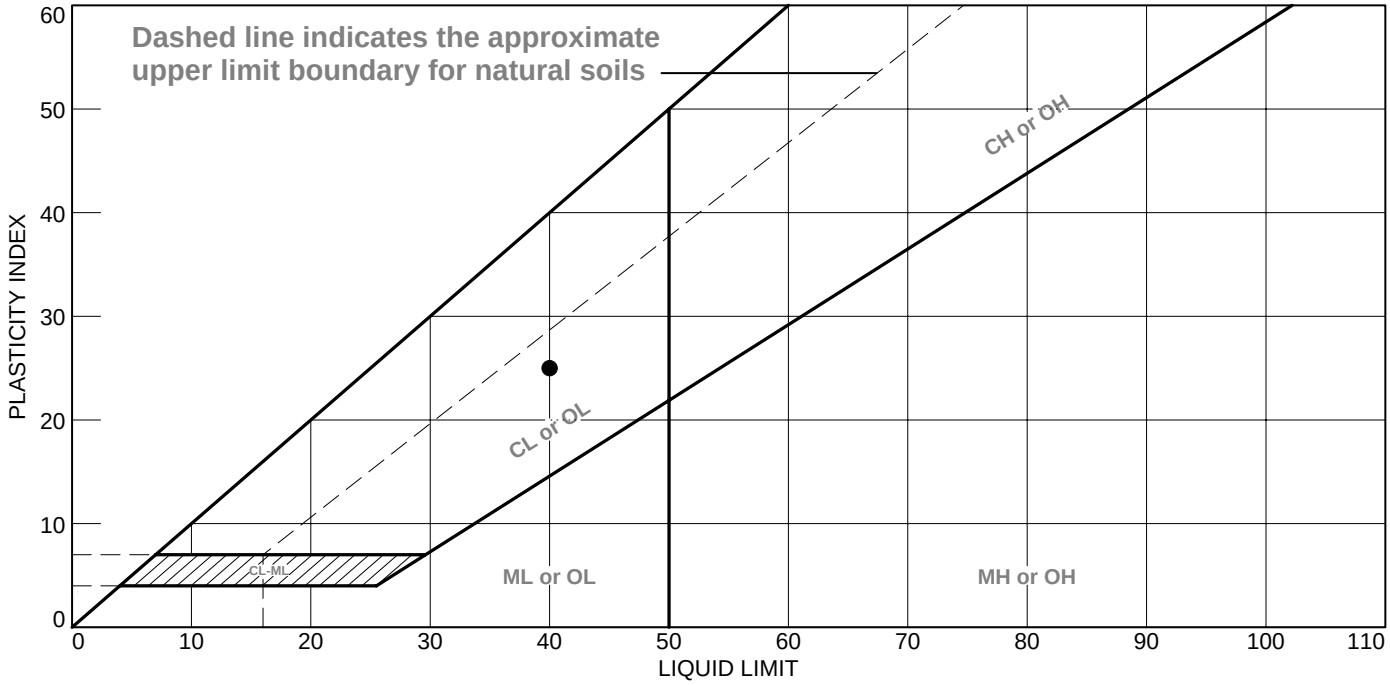
Source of Sample: EDW-B010 **Depth:** 15.0'-17.0'
Sample Number: S-7

Remarks:

Terracon

Figure

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BLUISH GRAY LEAN CLAY	40	15	25			CL

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

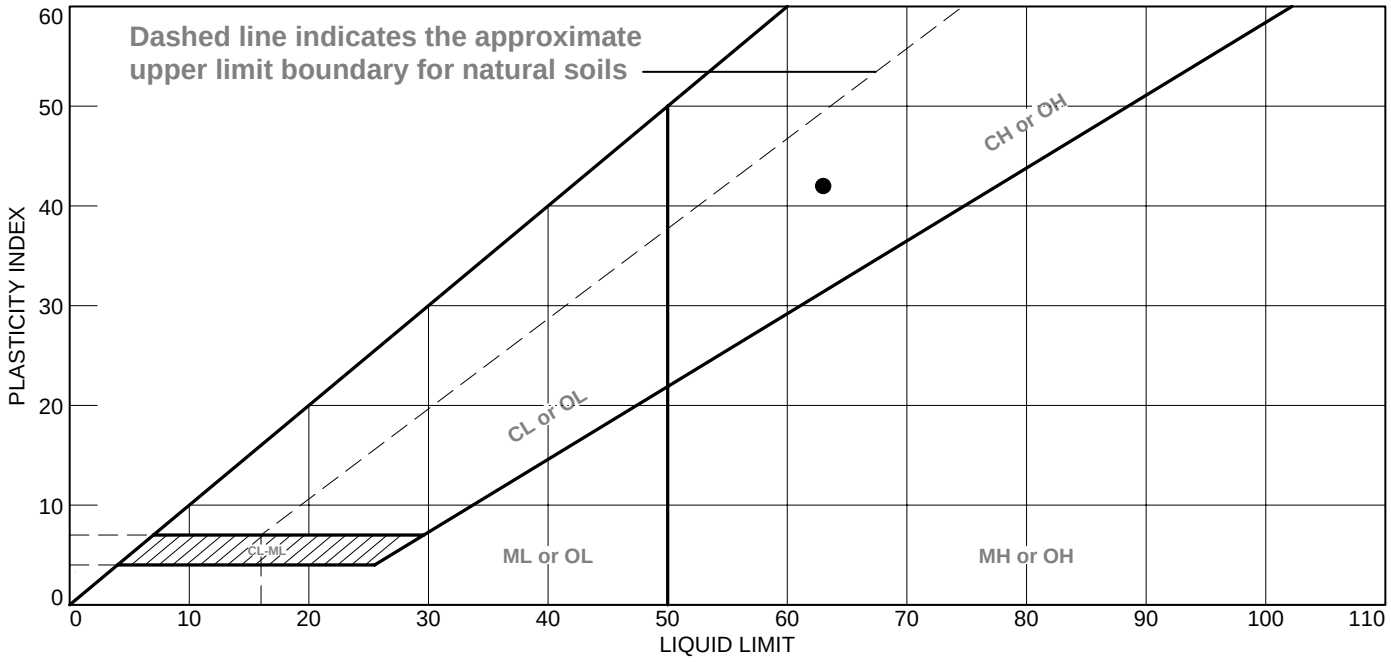
Source of Sample: EDW-B010 **Depth:** 30.0'-32.0'
Sample Number: S-10

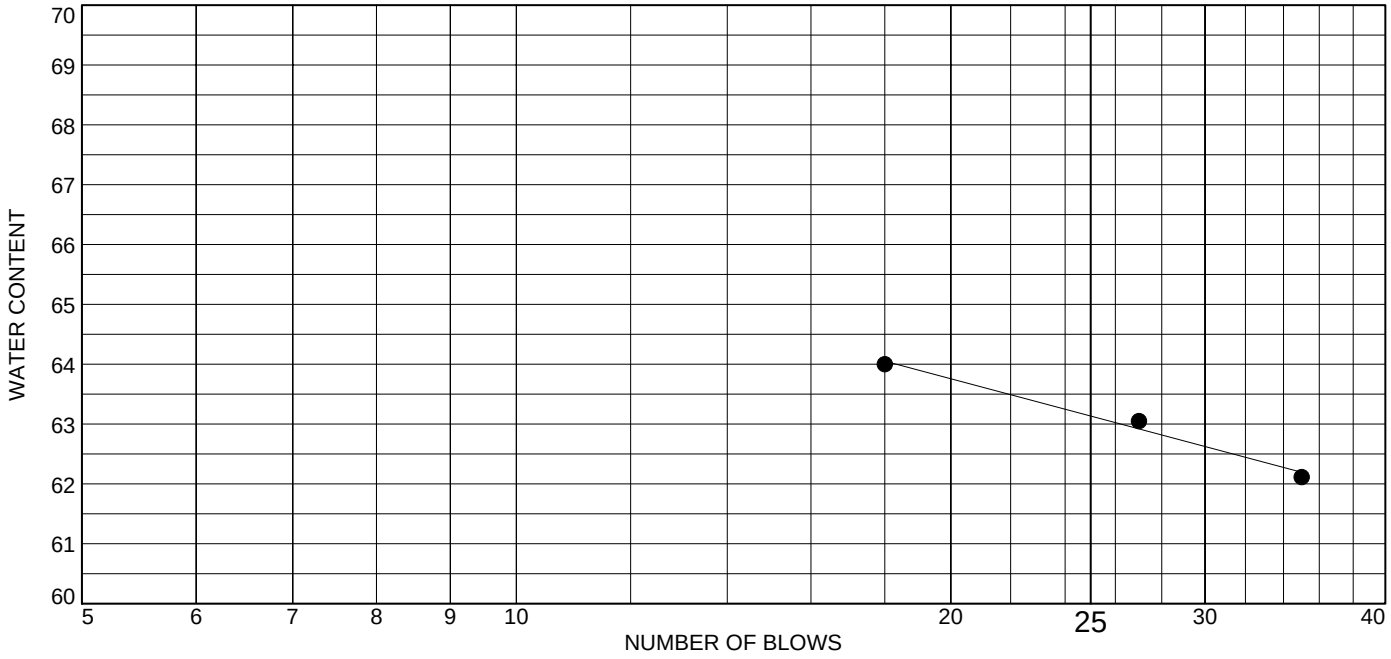
Remarks:

Terracon

Figure

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAYISH BROWN FAT CLAY WITH SAND	63	21	42			CH

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

Source of Sample: EDW-B011 **Depth:** 45.0'-46.5'
Sample Number: S-14

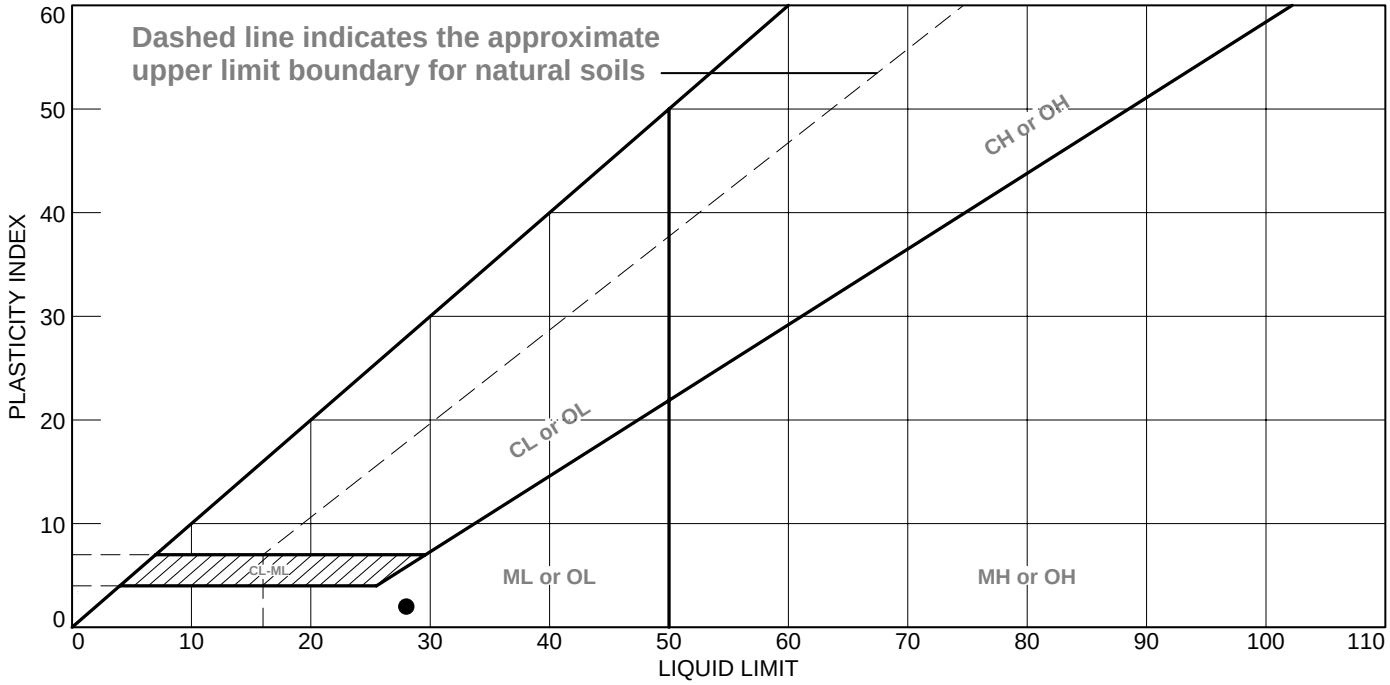
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	FILL: DARK GRAY FLY ASH	28	26	2			

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

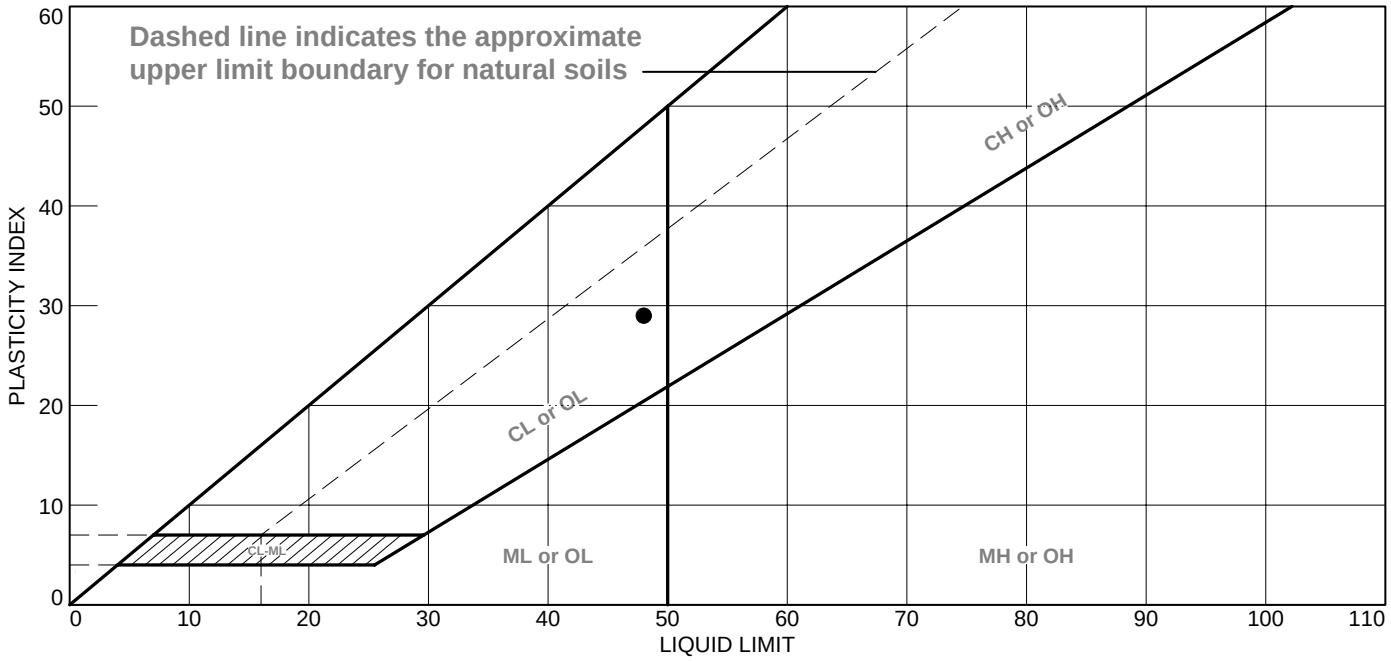
Source of Sample: EDW-B012 **Depth:** 2.5'-4.0'
Sample Number: S-2

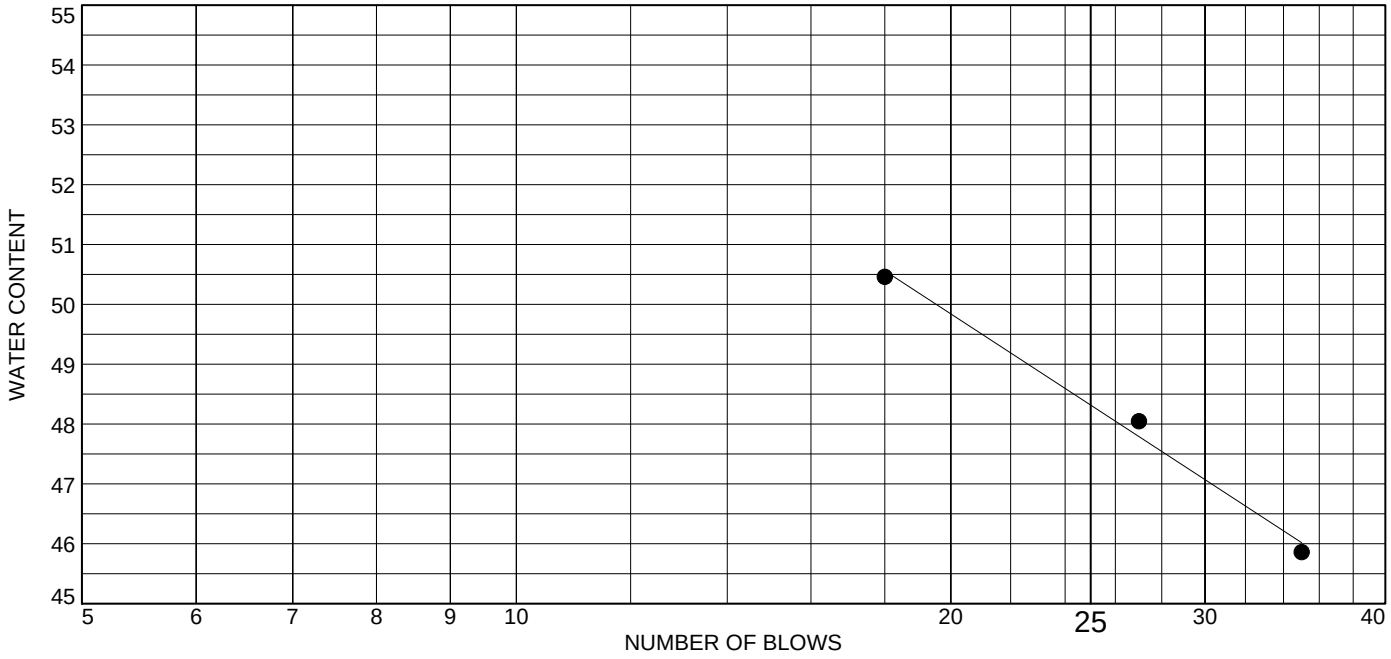
Remarks:

Terracon

Figure

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND RUST BROWN MOTTLED LEAN CLAY	48	19	29			CL

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

Source of Sample: EDW-B012 **Depth:** 15.0'-16.5'
Sample Number: S-7

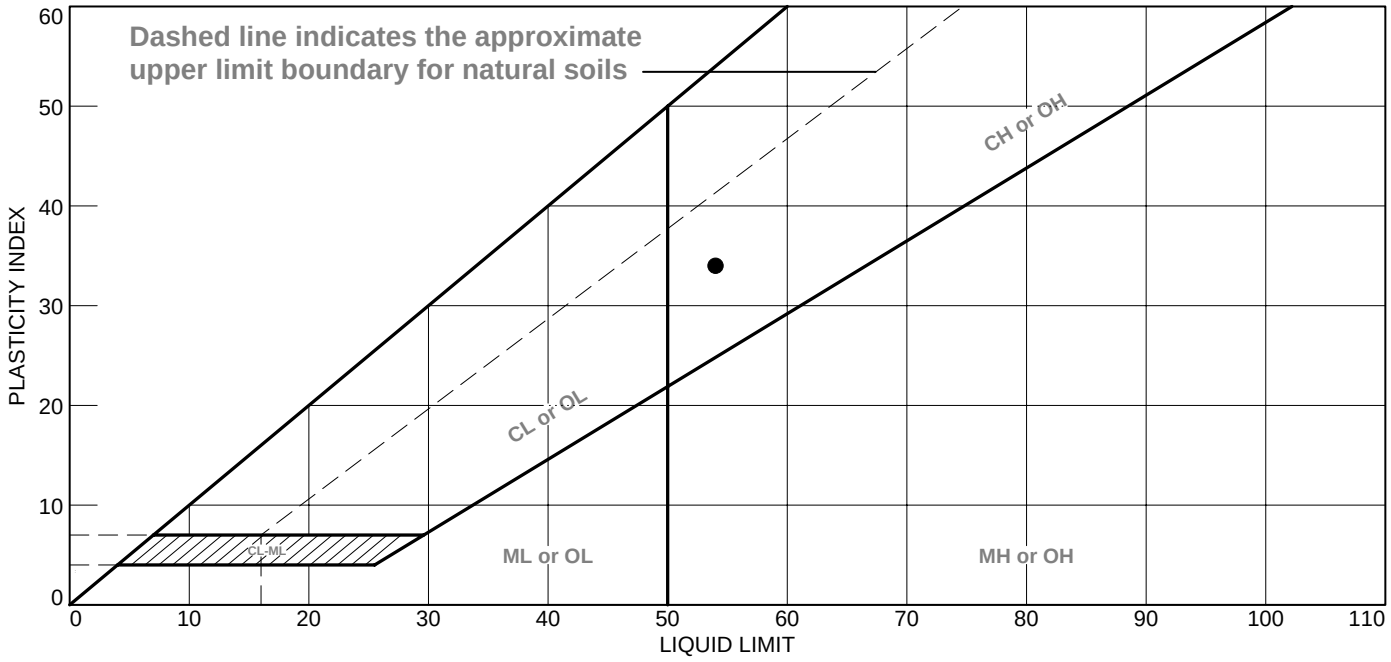
Remarks:

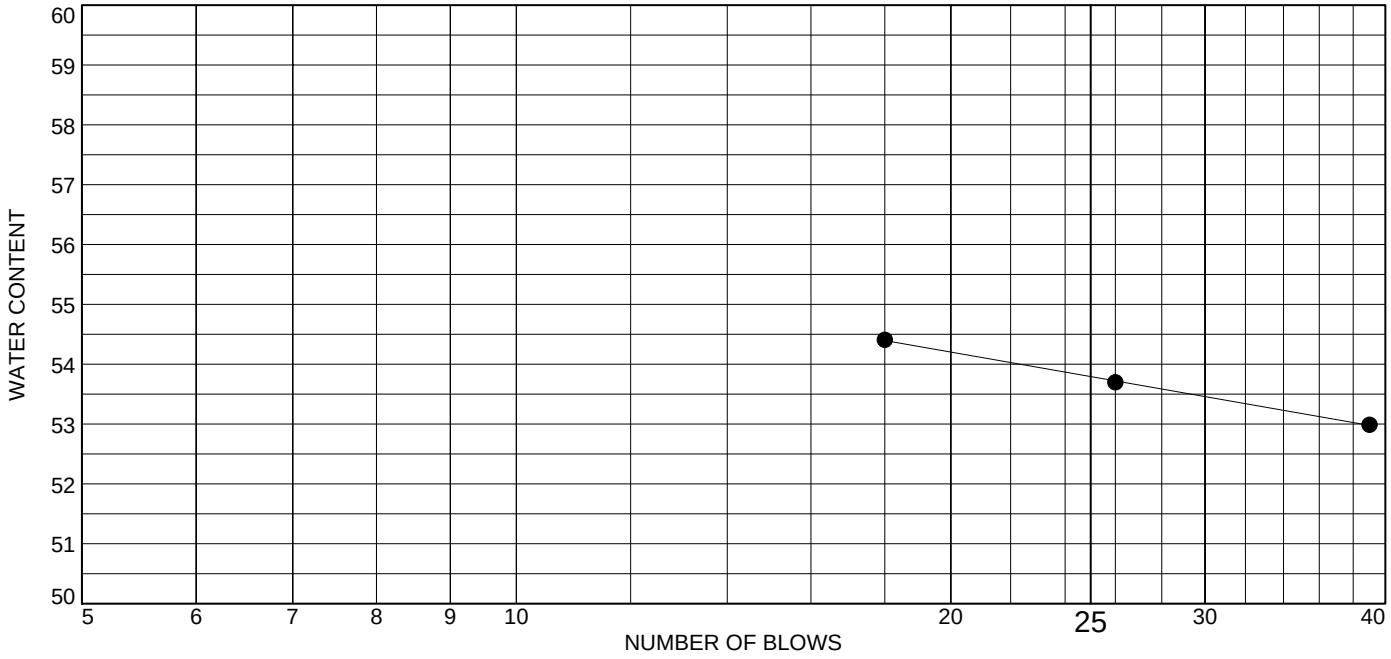
Terracon

Figure

Tested By: SJH **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY FAT CLAY	54	20	34			CH

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

Source of Sample: EDW-B012 **Depth:** 47.0'-49.0'
Sample Number: S-14

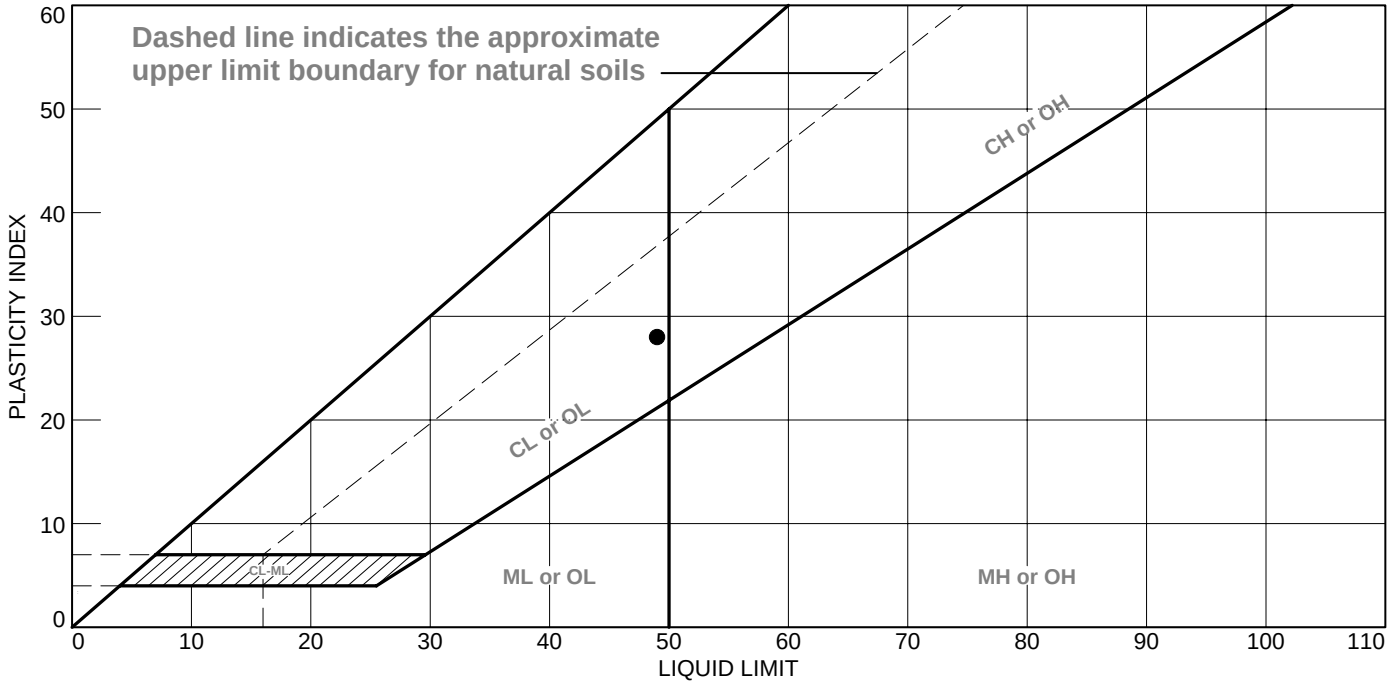
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWNISH GRAY LEAN CLAY WITH SAND AND GRAVEL	49	21	28			CL

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

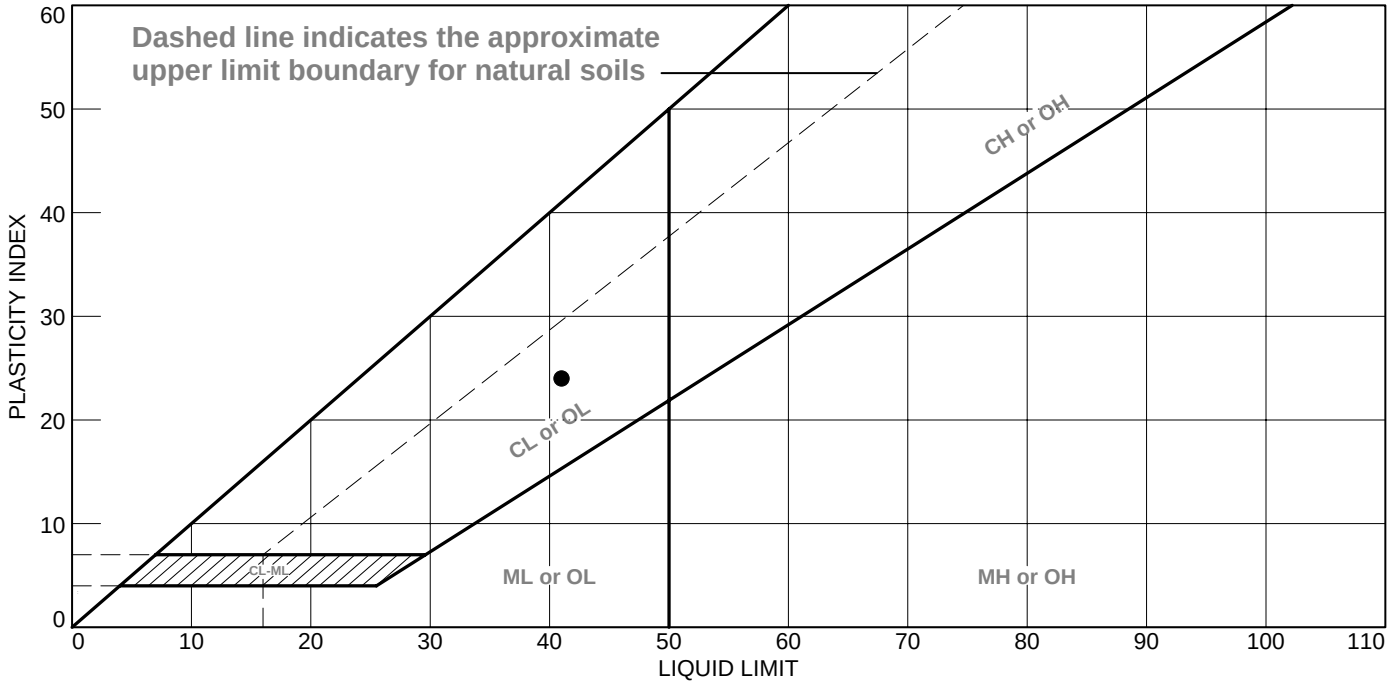
Source of Sample: EDW-B013 **Depth:** 6.0'-8.0'
Sample Number: S-3

Remarks:

Terracon

Figure

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY AND BROWNISH GRAY LEAN CLAY	41	17	24			CL

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

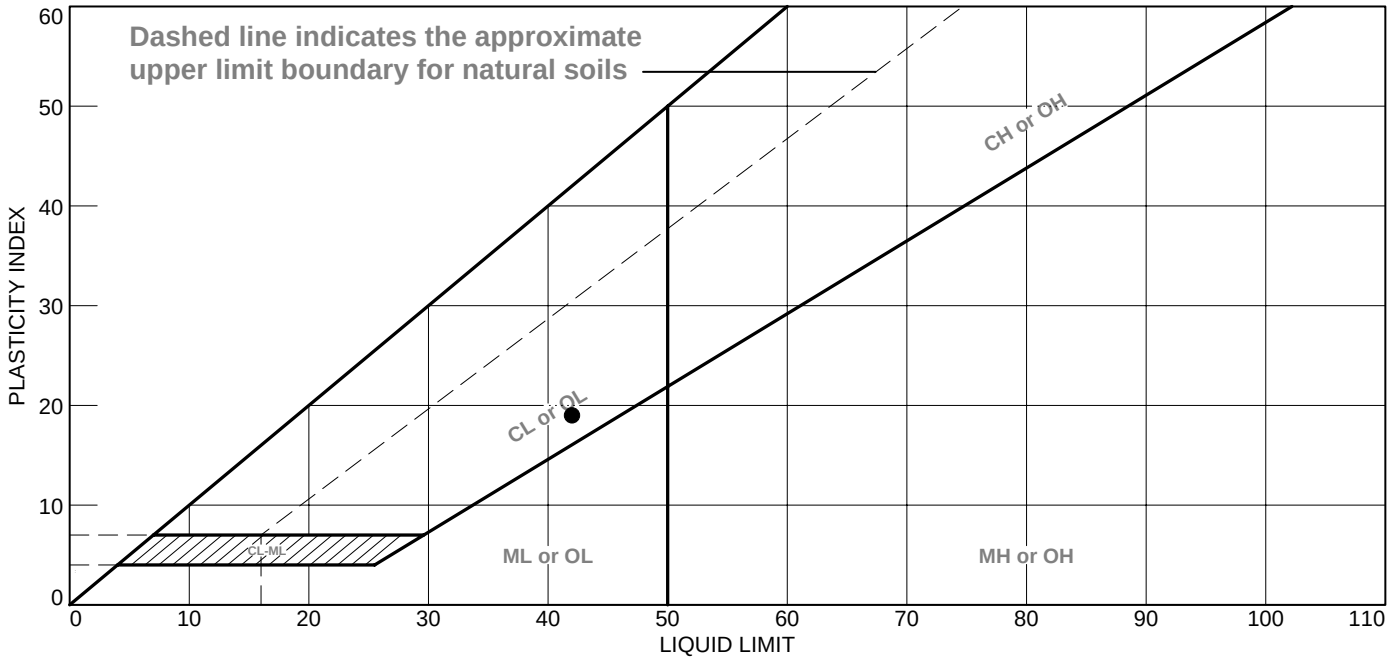
Source of Sample: EDW-B013 **Depth:** 15.0'-16.5'
Sample Number: S-6

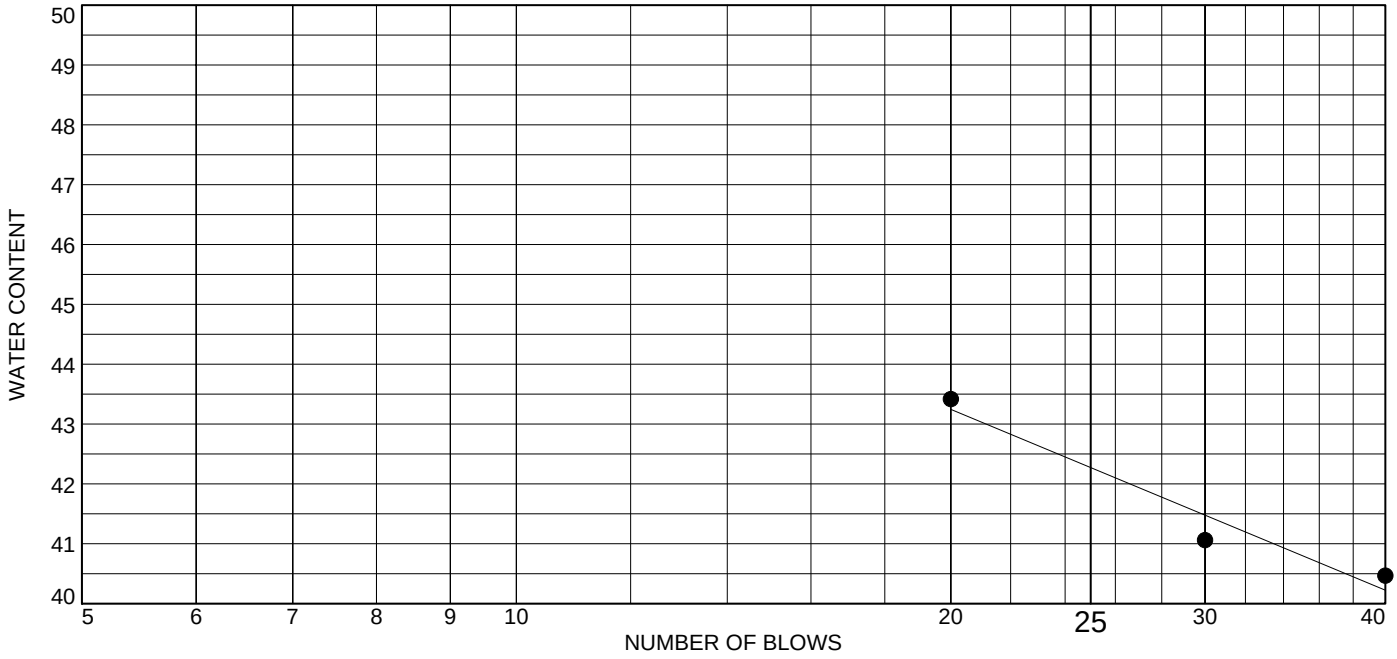
Remarks:

Terracon

Figure

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY AND BROWN LEAN CLAY WITH SAND	42	23	19			CL

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

Source of Sample: EDW-B013 **Depth:** 32.0'-34.0'
Sample Number: S-10

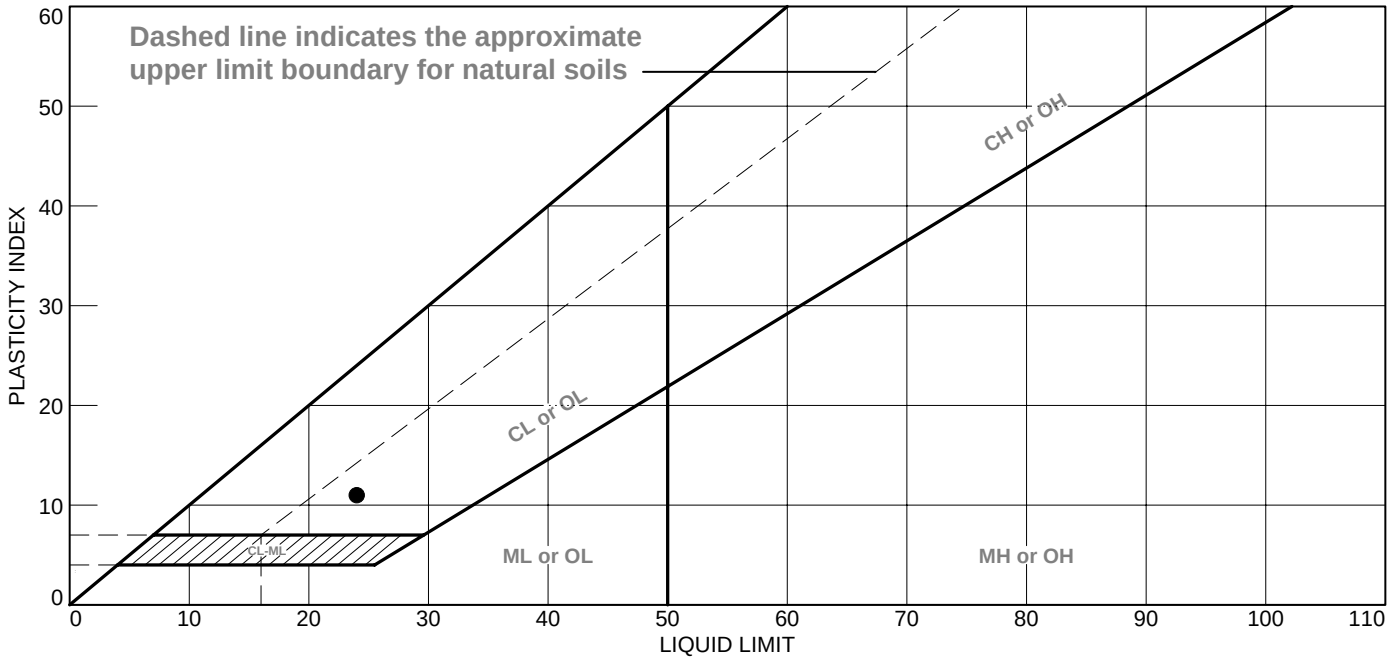
Remarks:

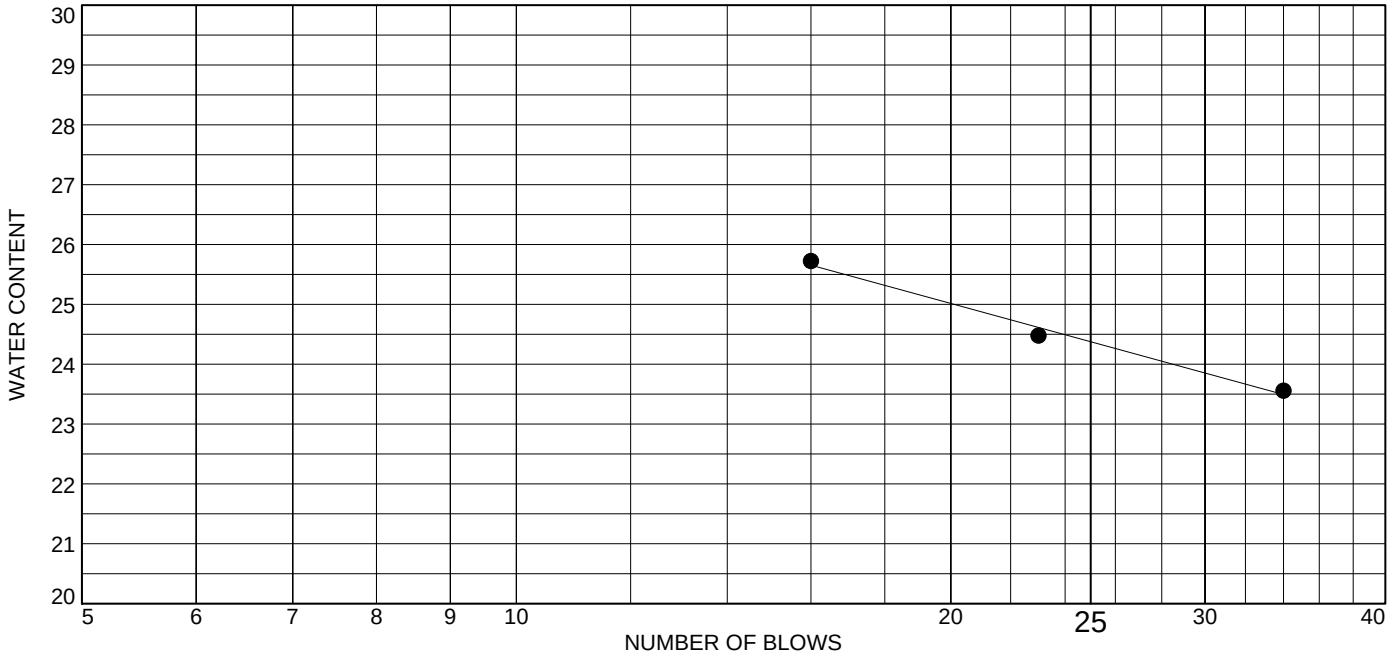
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAY MOTTLED SANDY LEAN CLAY WITH GRAVEL	24	13	11			CL

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

Source of Sample: EDW-B015 **Depth:** 31.0'-33.0'
Sample Number: S-10

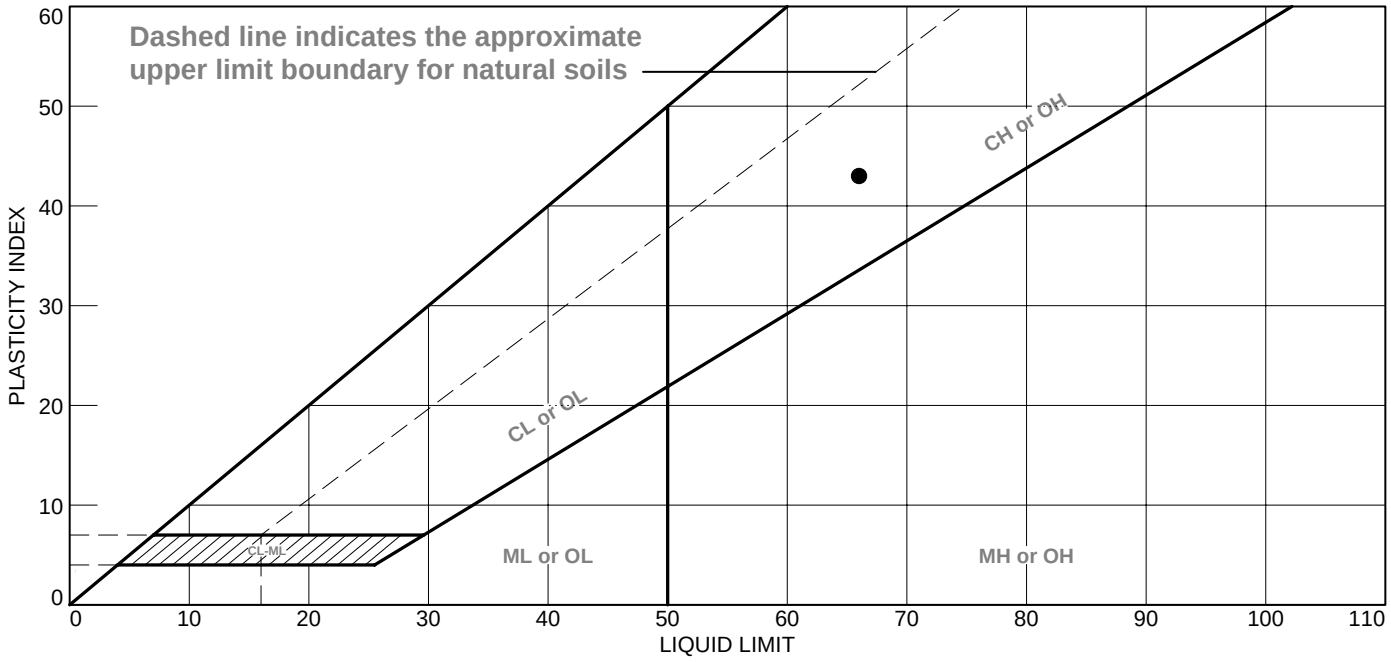
Remarks:

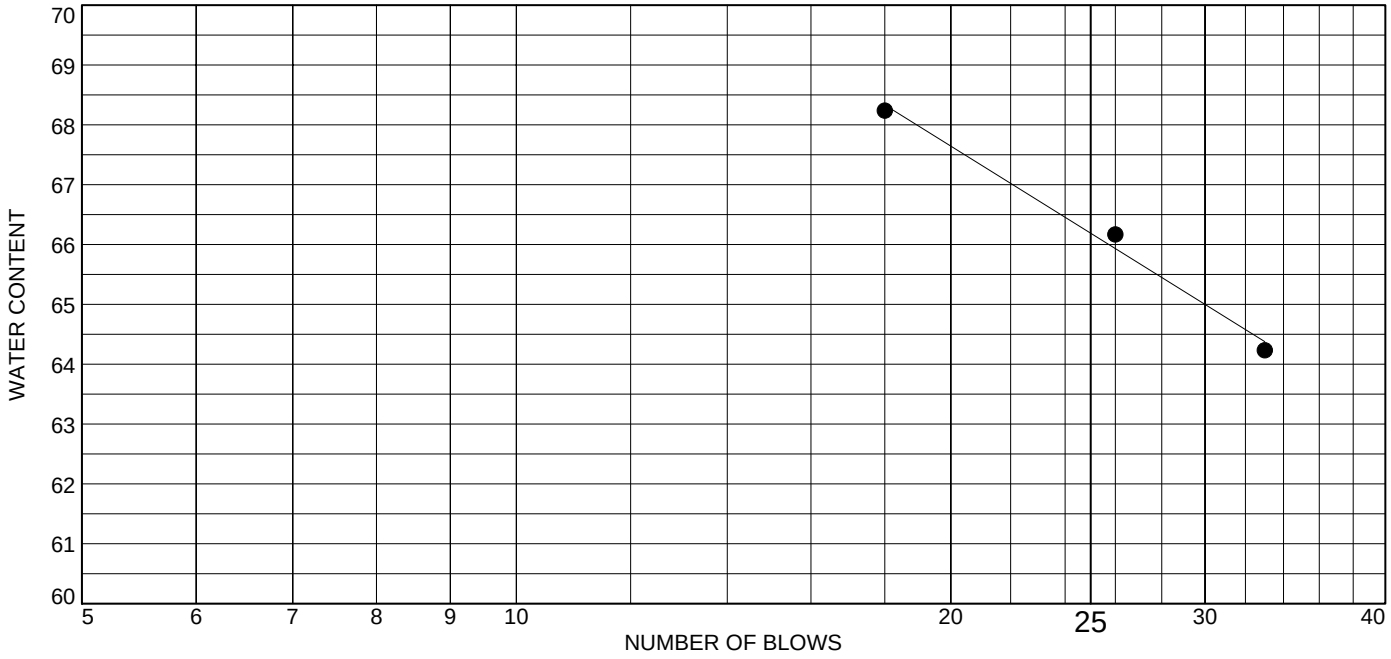
Terracon

Figure

Tested By: SJH **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY FAT CLAY	66	23	43			CH

Project No. MR155218 **Client:** DYNEGY

Project: DYNEGY - EDWARDS SITE

Source of Sample: EDW-B015 **Depth:** 37.0'-39.0'
Sample Number: S-12

Remarks:

Terracon

Figure

Tested By: SJH **Checked By:** WPQ

Terracon
Consulting Engineers & Scientists

SPECIFIC GRAVITY OF SOIL SOLIDS
ASTM D-854

Project Number: MR155218
Project Name: Dynegy Edwards
Test Date: 11/10/2015

Results Summary

Boring / Sample	Sample Description	USCS	Sample Number	Depth (ft)	Passing #4	Specific Gravity (Gs)
EDW-B002	DARK GRAY FLY ASH		S-8	25.0'-27.0'	100.00%	2.471
EDW-B002	GRAY LEAN CLAY	CL	S-11	40.0'-41.5'	100.00%	2.592
EDW-B003	FILL: DARK GRAY FLY ASH WITH SAND		S-1	0.0'-1.5'	100.00%	2.469
EDW-B003	FILL: DARK GRAY FLY ASH WITH SAND AND GRAVEL		S-6	15.0'-16.5'	100.00%	2.772
EDW-B004	GRAY LEAN CLAY WITH SAND	CL	S-14	50.0'-51.5'	100.00%	2.617
EDW-B005	DARK GRAY AND GREENISH GRAY LEAN CLAY WITH SAND - ORGANICS AND SHALE NOTED	CL	S-12	45.0'-46.5'	100.00%	2.521
EDW-B011	FILL: DARK GRAY FLY ASH - CLAY NOTED		S-8	25.0'-29.0'	100.00%	2.691
EDW-B014	FILL: DARK GRAY FLY ASH		S-7	20.0'-22.5'	100.00%	2.524
EDW-B014	BLUISH GRAY LEAN CLAY WITH SAND AND GRAVEL	CL	S-11	40.0'-40.5'	100.00%	2.719

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Soil Resistivity	**AASHTO T 288/ ASTM G 57**
Soil pH	**AASHTO T 289/ ASTM G 51**
Soil REDOX	**DIPRA**
Soil Sulfides	**DIPRA**
Water Content	**AASHTO T 93/ ASTM D 2216**

Laboratory Services Group **750 Corporate Woods Parkway** **Vernon Hills, Illinois 60061** **Ph. (224)352-7000** **Fax (224)352-7024**

Soil Corrosivity Indication Series

Project No.: MR155218
Project Name: DYNEGY EDWARDS

Client Name: AECOM
Test Date: 5/11/13/15

Summary of Test Results

Boring / Sample No.	Resistivity Natural Miller Soil Box(ohms)	Resistivity Saturated Miller Soil Box(ohms)	pH Soil Water Slurry	REDOX (mV)Soil Water Slurry	Sulfides Reaction	As Received WC%	Saturated WC%	Total Points
EDW-B002 S6	**1,720**	**1,550**	**9.77**	**65**	**NEG**	**52.3**	**77.4**	**14.5**
Points	0	8	3	3.5	0			
Description:	DARK GRAY FLY ASH							
EDW-B004 S3	**3,380**	**3,070**	**8.97**	**140**	**NEG**	**21.4**	**36.9**	**3.0**
Points	0	0	3	0	0			
Description:	BROWN AND GRAY LEAN CLAY							
EDW-B005 S12	**1,120**	**960**	**8.38**	**195**	**NEG**	**88.7**	**99.4**	**10.0**
Points	0	10	0	0	0			
Description:	DARK GRAY AND GREENISH GRAY LEAN CLAY WITH SAND							
EDW- B011 S6	**1,760**	**1,600**	**9.85**	**60**	**NEG**	**63.6**	**82.3**	**14.5**
Points	0	8	3	3.5	0			
Description:	DARK GRAY FLY ASH							
EDW-B0014 S7	**1,995**	**1,810**	**10.89**	**35**	**4**	**86.5**	**98.6**	**15.0**
Points	0	8	3	4	0			
Description:	DARK GRAY FLY ASH							

Resistivity:	Points:	pH:	Points:	Redox:	Points:	Sulfides:	Points:	†
<1500 ohms	10	0.0-2.0	5	Negative	5	Positive	3.5	
1500-1800	8	2.0-4.0	3	0 - 50mV	4	Trace	2	
1800-2100	5	4.0-6.5	0	50 - 100mV	3.5	Negative	0	
2100-2500	2	6.5-7.5	0*	100mV+	0			
2500-3000	1	7.5-8.5	0					
3000+	0	8.5 +	3					

*- If Sulfides are present and a low or neg. ReDox, add 3 points

† - THIS SYSTEM IS BASED ON A 25.5 POINT CORROSIVITY RATING SYSTEM DEVELOPED BY THE AMERICAN NATIONAL STANDARDS FOR POLYETHYLENE ENCASEMENT AND DUCTILE-IRON PIPE SYSTEMS. IT SHOULD BE NOTED THAT THESE TEST RESULTS ARE AN INDICATION OF SOIL CHEMISTRY AND SHOULD BE USED AS A INDICATION OF POSSIBLE CORROSIVE CONDITIONS. TERRACON IS NOT LIABLE FOR ANY REMEDIAL MEASURES TAKEN ON THE BASIS OF THESE RESULTS.

Tested by: BCM

Checked By: WPQ

Terracon
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ORGANIC CONTENT TEST
ASTM D-2974
Method C

Laboratory Services Group *750 Corporate Woods Parkway, Vernon Hills, Illinois 60061* *Phone: (224) 352-7000 Fax:(224)352-7*

Project No.: MR155218
Project Name: DYNEGY - EDWARDS SITE
Client: AECOM
Date Tested: 11/13/2015

Sample Information

Boring / Source:	EDW-B005
Sample No.:	S-12
Depth (ft.):	45.0-46.5'
Description:	CL

Organic Content Test Data

Tare No.:	C
Tare Wt. (gm):	20.04
Wet Wt. + Tare (gm):	49.66
Dry Wt. + Tare (gm):	36.05
Moisture Content (%):	**85.01**
Wt. of Ash + Tare (gm):	34.63
Percent Ash:	91.13
Organic Content (%):	**8.87**

** Note: Test performed by heating the sample to 440 degrees Centigrade until constant weight of ash is attained.

Attachment F. Material Characterization Calculations

1. **Objective**

This calculation package summarizes the material characteristics of the subsurface strata encountered during AECOM's geotechnical investigation of the Ash Pond at Dynegy's Edwards Power Station in Bartonville, Illinois. Selection of material properties for slope stability analyses is also developed and summarized within this package.

2. **Subsurface Conditions**

A subsurface exploration was performed at the East Ash Complex between August 19 and November 5, 2015. The subsurface exploration included the following; fourteen soil borings, installation of four piezometers to monitor phreatic conditions, and a program of twenty-two cone penetrometer test (CPT) soundings. Pore pressure dissipation testing and seismic shear wave velocity measurements were conducted on a selection of the CPT soundings. A full set of AECOM's boring logs, including soil descriptions, types of sampling, and choice laboratory test results, is provided in **Attachment B** of the report. A complete report that includes the graphical CPT logs and the results of the SCPTu and PPD tests is included in **Attachment D** of the report. The geotechnical exploration locations are shown on **Figure 2-1 – East Ash Pond Geotechnical Site Plan** in **Attachment A** of the report.

Based on the results of the investigation, five main stratigraphic materials were identified at the site. These are listed below and briefly summarized:

New Embankment Materials: The perimeter embankment / dike of the Edwards Ash Pond was constructed in two stages, with an original embankment, and a later raise constructed on top of and on the downstream slope of the existing dike, to facilitate the addition of a rail loop around the impoundment. This raise was completed in the early 2000s, raising the dike crest from an original elevation around 455 ft to the current typical elevation around 461 ft. This newer embankment fill material is comprised of fly ash from the plant (as beneficial reuse material), classified as lean silt (ML) to poorly-graded silty sand with gravel (SP). The consistency of the new embankment fill, as measured by the standard penetration test, ranged from soft to very stiff, but generally had a stiff to very stiff consistency and appeared to be well-compacted materials.

Table F-1: New Embankment Material Summary

Category	Min.	Max.	Representative Average
First Encountered (ft bgs)	<0.5	<0.5	<0.5
Thickness (feet)	7.5	11	9.6
SPT-N	2	28	11
Pocket Penetrometer (tsf)	.125	1.5	.75
Cone Resistance (tsf)	2	537	95
Sleeve Resistance (tsf)	<0.25	6.8	1.1
Cone/Sleeve Ratio (%)	<0.25	9.2	2.0
SCPTu Shear Wave Velocity (ft/sec)	400	1250	600

Historical compaction data for the new embankment fill material was not available, but field data are generally indicative of well-compacted materials.

Old Embankment Materials: As noted above, the original Ash Pond dike was constructed to approximately elevation 455 ft, but was raised in the early 2000s to facilitate the addition of the rail loop. The original perimeter embankment / dike of the Edwards Ash Pond is largely comprised of clay fill with trace sand and shells, classified as lean clay (CL). The

consistency of the old embankment fill, as measured by the standard penetration test, ranged from soft to stiff, but generally had a stiff consistency and appeared to be well-compacted materials. It was noted that the Old Embankment Fill generally had a higher measured shear strength above approximately elevation 450 ft, so this material was split into two materials (Old Embankment Fill 1 and Old Embankment Fill 2) within the slope stability models.

Table F-2: Old Embankment Fill Material Summary

Category	Min.	Max.	Representative Average
First Encountered (ft bgs)	<0.5	11	6.8
Thickness (feet)	11	24.5	16.7
SPT-N	2	13	7
Pocket Penetrometer (tsf)	.25	2.125	1
Cone Resistance (tsf)	2	444	13
Sleeve Resistance (tsf)	<0.25	2.3	<1
Cone/Sleeve Ratio (%)	<0.25	8.3	4.3
SCPTu Shear Wave Velocity (ft/sec)	400	450	400

Impounded Ash Materials: Fly ash materials were encountered in the borings drilled within the Edwards Ash Pond. The material was generally silt sized with some sand and clay, and trace gravel, and was classified as a silt (ML - fly ash). The measured consistency of the ash ranged from very loose to very dense, though generally, the consistency of ash was loose to very loose and was saturated below the residual water level in the Ash Pond.

Table F-3: Ash Material Summary

Category	Min.	Max.	Representative Average
First Encountered (ft bgs)	<0.5	<0.5	<0.5
Thickness (feet)	2.5	40	24.7
SPT-N	0	100	12
Pocket Penetrometer (tsf)	N/A	N/A	N/A
Cone Resistance (tsf)	2	969	39
Sleeve Resistance (tsf)	<0.25	3.9	<1
Cone/Sleeve Ratio (%)	<0.25	13.8	2.6
SCPTu Shear Wave Velocity (ft/sec)	450	600	600

Native Alluvial Clay Crust: The Edwards Ash Pond is underlain by a native clay of alluvial origin. This material was typically classified as lean clay (CL), with some zones of fat clay (CH) occasionally identified. (Much of the clay has a Liquid Limit near 50, denoting a borderline fat/lean clay.) The uppermost approximately 5 feet of this native alluvial clay, near the original ground surface, measured significantly higher in strength, signifying a desiccated crust layer at the original ground surface. The consistency of this clay was generally stiff.

Table F-4: Native Alluvial Clay Crust Summary

Category	Min.	Max.	Representative Average
First Encountered (ft bgs)	0	35	24.9
Thickness (feet)	2	5	4.3
SPT-N	4	14	8
Pocket Penetrometer (tsf)	.5	1.5	.75
Cone Resistance (tsf)	3	47	12
Sleeve Resistance (tsf)	<0.25	1.6	<1
Cone/Sleeve Ratio (%)	<0.25	8.5	4.1
SCPTu Shear Wave Velocity (ft/sec)	450	600	500

Native Alluvial Clay: As noted above, the Edwards Ash Pond is underlain by a native clay of alluvial origin, typically classified as lean clay (CL), with some zones of fat clay (CH) occasionally identified. (Much of the clay has a Liquid Limit near 50, denoting a borderline fat/lean clay.) Beneath the upper crust material, the clay has significantly less shear strength, and is normally consolidated or slightly over-consolidated, with strength increasing with depth. The clay consistency varied from soft to medium stiff near the top of the stratum, generally increasing in strength with depth to a consistency of medium stiff to stiff at the bedrock below. To capture this strength increase within the stability models, this material was divided into three layers (Native Clay 1, Native Clay 2, Native Clay 3).

Table F-5: Native Alluvial Clay Summary

Category	Min.	Max.	Representative Average
First Encountered (ft bgs)	5	40	30
Thickness (feet)	5.5	28	17.9
SPT-N	0	100	6
Pocket Penetrometer (tsf)	.125	1.5	.5
Cone Resistance (tsf)	2	40	7
Sleeve Resistance (tsf)	<0.25	1.7	<1
Cone/Sleeve Ratio (%)	<0.25	10.9	2.7
SCPTu Shear Wave Velocity (ft/sec)	400	800	500

Shale Bedrock: Shale bedrock was encountered below the native alluvial soils in several of the borings. The shale was found to be slightly weathered to weathered near the upper contact, and became hard with depth. The shale was cored in two locations to verify classification, but no further testing was completed on this material.

Other Materials: Other materials were encountered in relatively small quantities at the site, appearing at only one or two exploration locations, and were not considered part of the site-wide stratigraphy. These materials include old and recent fill (similar in properties to the old and new embankment fill materials), historic ash material (similar in properties to the more recent ash fill), and crushed stone embankment fill in the cut-off embankment that constructed the “Dead Pond”. The crushed stone embankment fill was observed to be medium dense, fine to coarse, crushed stone gravel with sand, classified as poorly graded gravel (GP). A final additional material, a clean crushed stone toe drain material, was noted on available historical design drawings, but not encountered in the borings performed for this project.

3. **Laboratory Testing Program**

Representative samples were collected at regular intervals from the borings and were utilized for laboratory testing. The laboratory tests were assigned to characterize the site materials including index (moisture content, unit weight, Atterberg limits, specific gravity, and particle size analysis), permeability and consolidation tests. Strength testing included isotropically consolidated-undrained triaxial tests with pore pressure measurements (CIU), Unconfined Compression (UC) tests, and direct shear tests (DS) on the native clay materials, embankment materials, and ash materials.

Table F-6: Laboratory Testing Program for Ash Pond

ASTM Designation	Test Type	Number of Tests							
		Total	Ash	New Embankment Fill	Old Embankment Fill	Other Fill Materials	Native Clay Crust	Native Clay	Bedrock
D2216	Moisture Content	181	47	15	21	19	5	56	18
D4318	Atterberg Limits	26	4	1	5	1	1	14	-
T311, D1140, D422	Gradation / Hydrometer	10	7	3	-	-	-	-	-
D854	Specific Gravity	9	5	-	-	-	4	-	-
D5084	Hydraulic Conductivity	3	2	-	-	-	-	1	-
D2435	Consolidation	2	-	-	-	-	-	2	-
D 2166	Unconfined Compression	5	-	-	-	-	-	5	-
D4767	Consolidated Undrained Triaxial (CIU)	5	-	-	3	-	-	2	-
D6528	Direct Shear (DS)	8	2	-	-	-	1	5	-
G57, G51	Corrosion Suite	5	4	-	-	-	-	1	-

Compete results of the laboratory tests are included in **Attachment E** of the report.

4. **Material Properties**

Material properties for slope stability analyses were developed using both laboratory testing data (index and strength testing) and strength correlations from SPT and CPT data.
The following specific material properties were developed for the new embankment material, old embankment material, impounded ash, native clay crust, and native clay, for use in the various stability analyses performed as part of this study:

- Unit Weight
- Drained and Undrained Shear Strength of Fine-Grained Soil Strata
- Drained and Undrained Shear Strength of Ash

Material properties for the various historic fill materials on site were conservatively estimated based on the data available, empirical correlations, and experience with similar materials.

Unit Weight

Unit weight for the old embankment, ash, native clay crust, and native clay materials were evaluated using measured results from samples collected. Values were plotted and design unit weight lines were then fit to the plotted data, and layers were divided where warranted by differences in the data. Plots of these measured values are included as Attachments F.1 through F.5 at the end of this document.

For materials that could not be directly measured for unit weight (new embankment and crushed stone, and historic fill materials), estimates of the unit weight were based on empirical correlations, and experience with similar materials.

The following total unit weights were selected for use in stability analyses:

- New embankment (compacted ash): 115 pounds per cubic foot (pcf),
- Old embankment: 125 pcf,
- Ash materials: 105 pcf,
- Native clay crust: 120 pcf, and
- Native Clay: 105-117 pcf.

Drained Shear Strength Selection

Drained shear strengths were selected for all materials for use in the Long Term and Max Pool analyses. Drained strengths were primarily based on results from DS and CIU testing. Plots of both effective friction angle and effective cohesion values were created for each material type to estimate average values across each material. To supplement the effective friction angle measured in laboratory testing, correlated values of phi' were calculated using the procedure developed by Peck, Hanson, and Thornburn, 1974, based on corrected SPT blow counts. Measured laboratory values were given precedence when selecting design values. For materials that could not be directly measured for drained shear strength (new embankment, crushed stone and historic fill materials), the above correlation was used for effective friction angles. Effective cohesion values for these materials were conservatively estimated based on experience with similar materials. Where materials existed, but were not encountered in the field investigation (gravel toe drain, GP) experience with similar materials was used. Design strength lines were then fit to the plotted data, and layers were divided where warranted by differences in the data. Plots of the measured and correlated drained shear strength values for the five primary materials are included as Attachments F.1 through F.5.

Undrained Shear Strength Selection

Undrained shear strengths were selected for the cohesive materials for use in the Pseudostatic and analyses. Undrained strengths were based on results from CIU and UC testing, and correlated values of undrained shear strength from the CPT tests. Plots of undrained shear strength were created for each material type to estimate average values across each material. To supplement the undrained shear strengths measured in laboratory testing, correlated values were calculated using the procedure developed by Aas, et al (1986), based on CPT data. An NKT factor of 17 was selected for use in this correlation based on published values. Su / σ'vo lines were also calculated and plotted for comparison purposes. Design strength lines were then fit to the plotted data, and layers were divided where warranted by differences in the data. Plots of the measured and correlated undrained shear strength values for the five primary materials are included as Attachments F.1 through F.5.

Bedrock Material Selection

Based on the field investigation, the bedrock encountered is generally hard shale. SPT samples of this material were recovered, though testing, other than water contents, was generally not possible. Therefore, conservative strength and unit weight values were selected for this material, based on experience with similar materials. Failure surfaces within the models are generally not expected to extend through this material.

5. Material Properties for Analysis

The table below summarizes the material parameters used in the stability analysis, based on the analysis and strength selection procedures and considerations presented in the preceding sections.

Table F-8: Summary of Material Parameters used in Stability Analysis

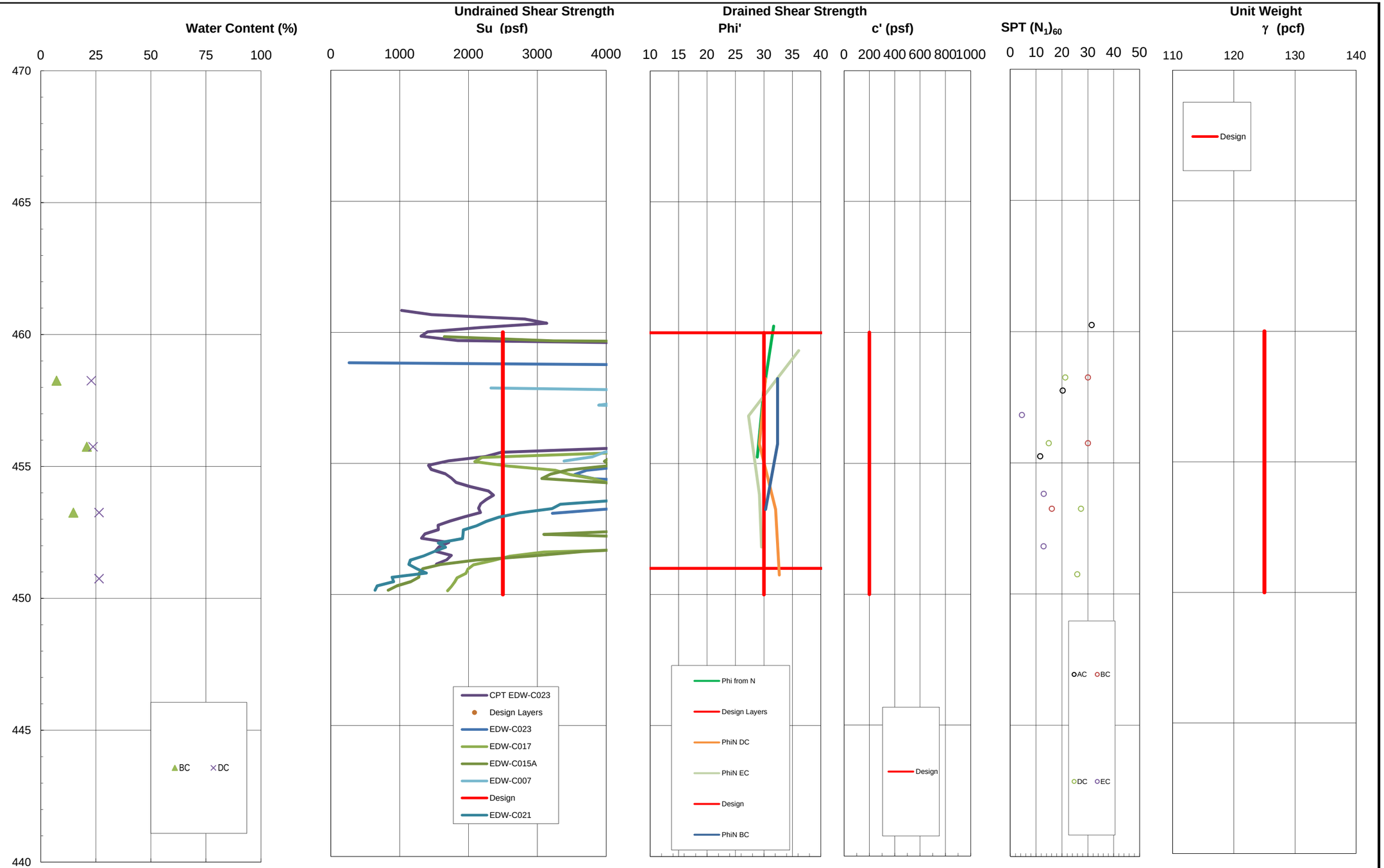
Material	Unit Weight Above WT (pcf)	Unit Weight Below WT (pcf)	Effective (drained) Shear Strength Parameters		Total (undrained) Shear Strength Parameters	
			c' (psf)	Φ' (°)	c (psf)	Φ (°)
New Embankment	115	115	200	30	2500	0
Old Embankment 1	125	125	200	28	2500	0
Old Embankment 2	125	125	100	29	1250	0
Native Clay Crust	120	120	200	27.5	1250	0
Native Clay 1	117	117	100	26	650	0
Native Clay 2	105	105	200	26	700	0
Native Clay 3	105	105	200	26	900	0
Fly Ash	105	105	100	27	600	0
Historic Ash	105	105	100	26	750	0
Historic Fill	125	125	200	28	1000	0
Recent Fill	115	115	200	30	1250	0
GP (Very Dense)	135	135	0	36	0	36
New Embankment (Crushed Stone - Sandy Gravel)	120	120	0	32	0	32
Bedrock - Shale	140	140	1000	36	1000	36

References:

Aas, G., Lacasse, S., Lunne, I., and Hoeg, K. (1986). "Use of In situ Tests for Foundation Design in Clay," Proceedings, In Situ 86, American Society of Civil Engineers, pp. 30.

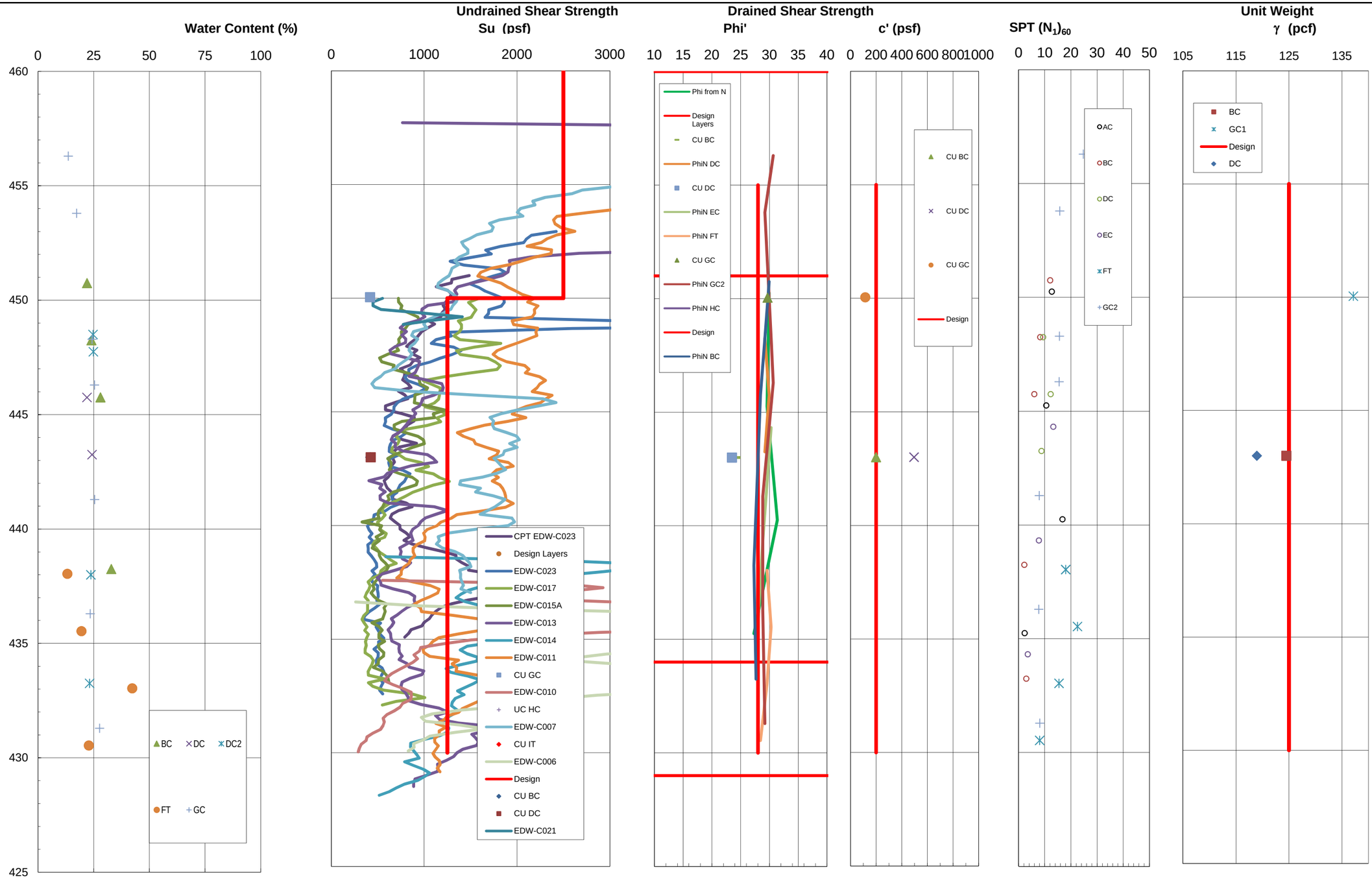
Peck, R.B., Hanson, W.E. and Thornburn, T.H., 1974. Foundation Engineering, 2nd edition, John Wiley and Sons, Inc.

Attachment F.1 Material Characterization Plot – New Embankment



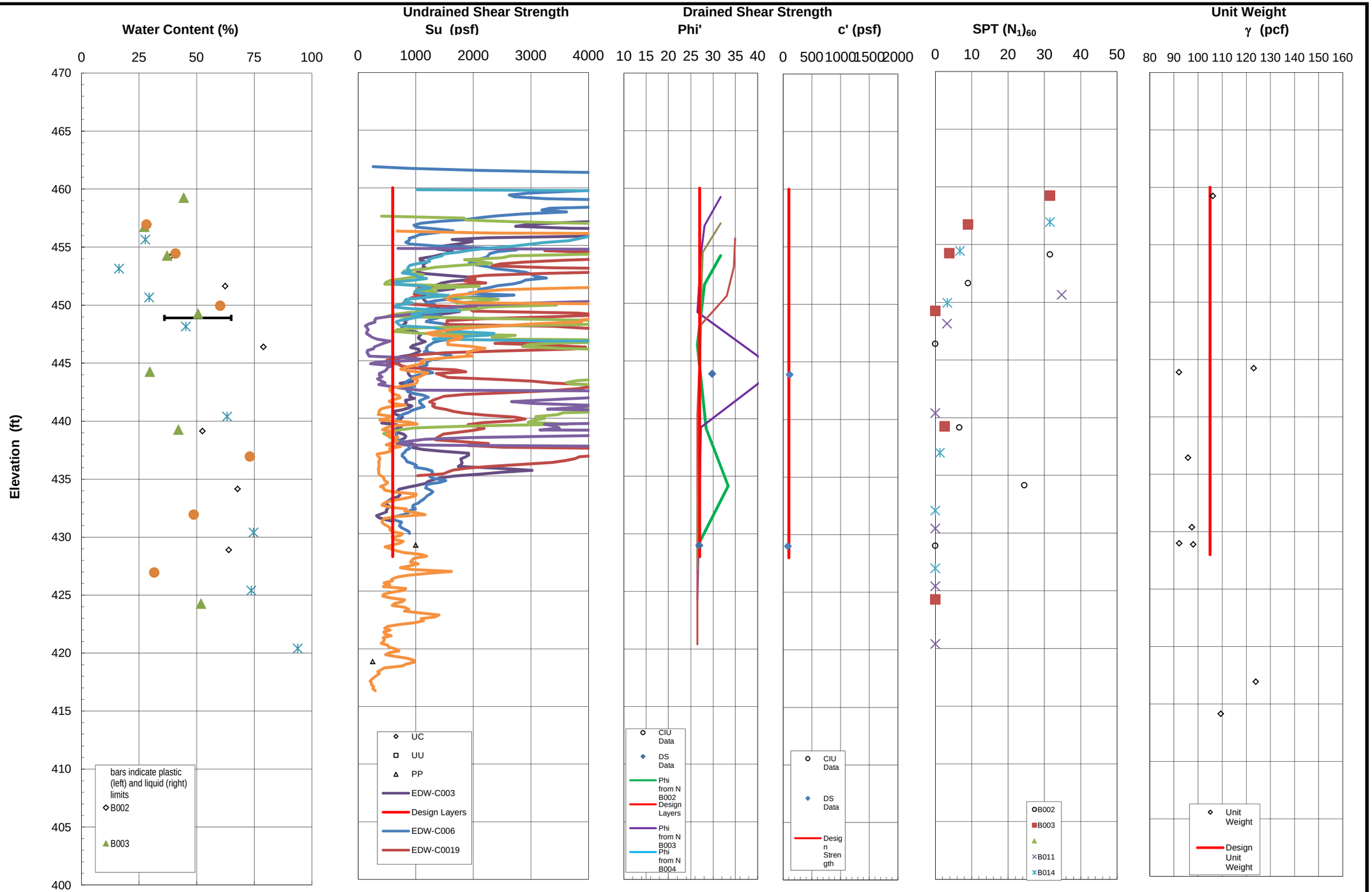
New Embankment Data	Project No. 60440202	Material Properties	AECOM		Attachment F.1

Attachment F.2 Material Characterization Plot – Original Embankment Data



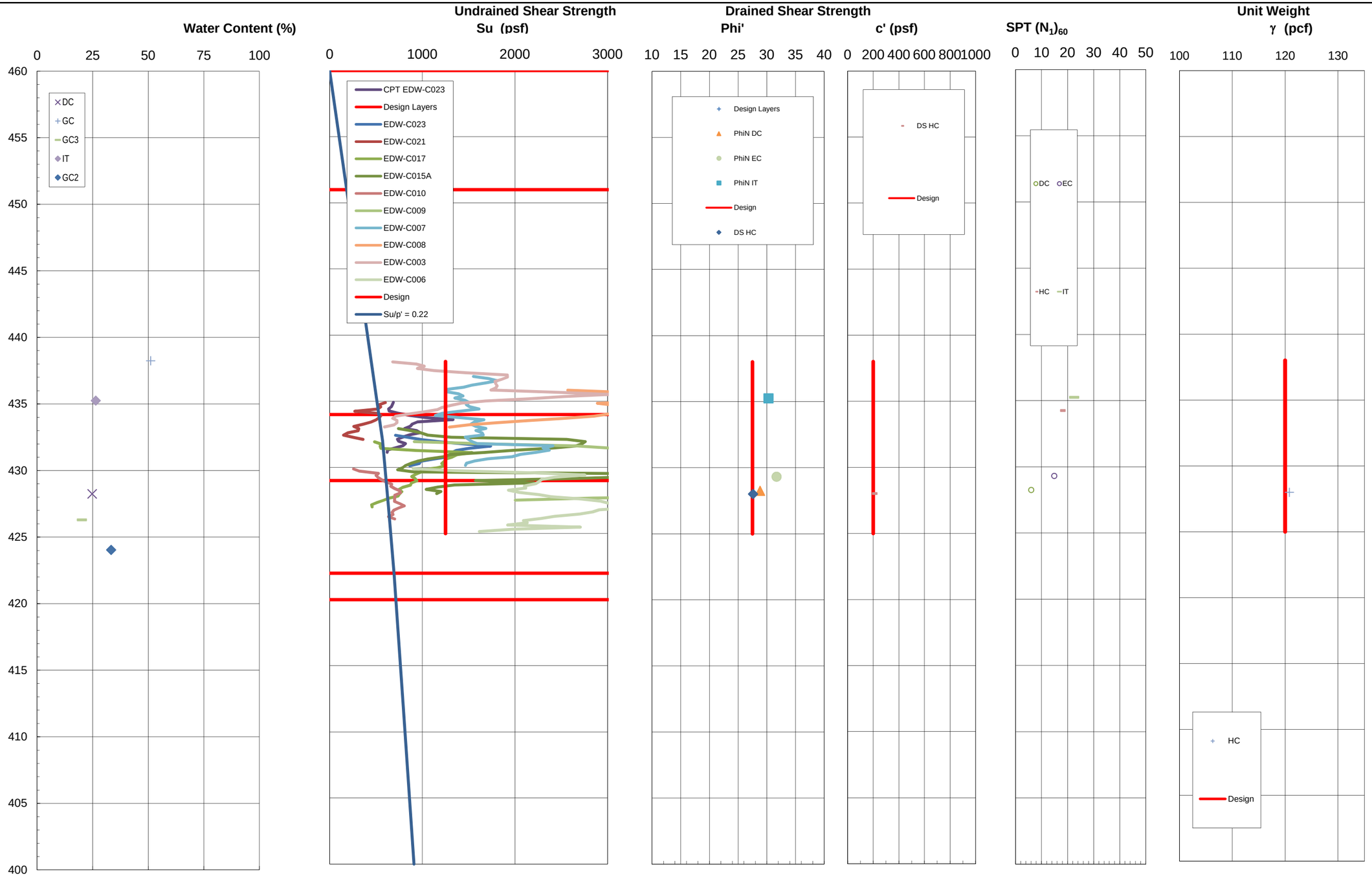
Original Embankment Data	Project No. 60440202	Material Properties	AECOM		Attachment F.2

Attachment F.3 Material Characterization Plot – Ash Data



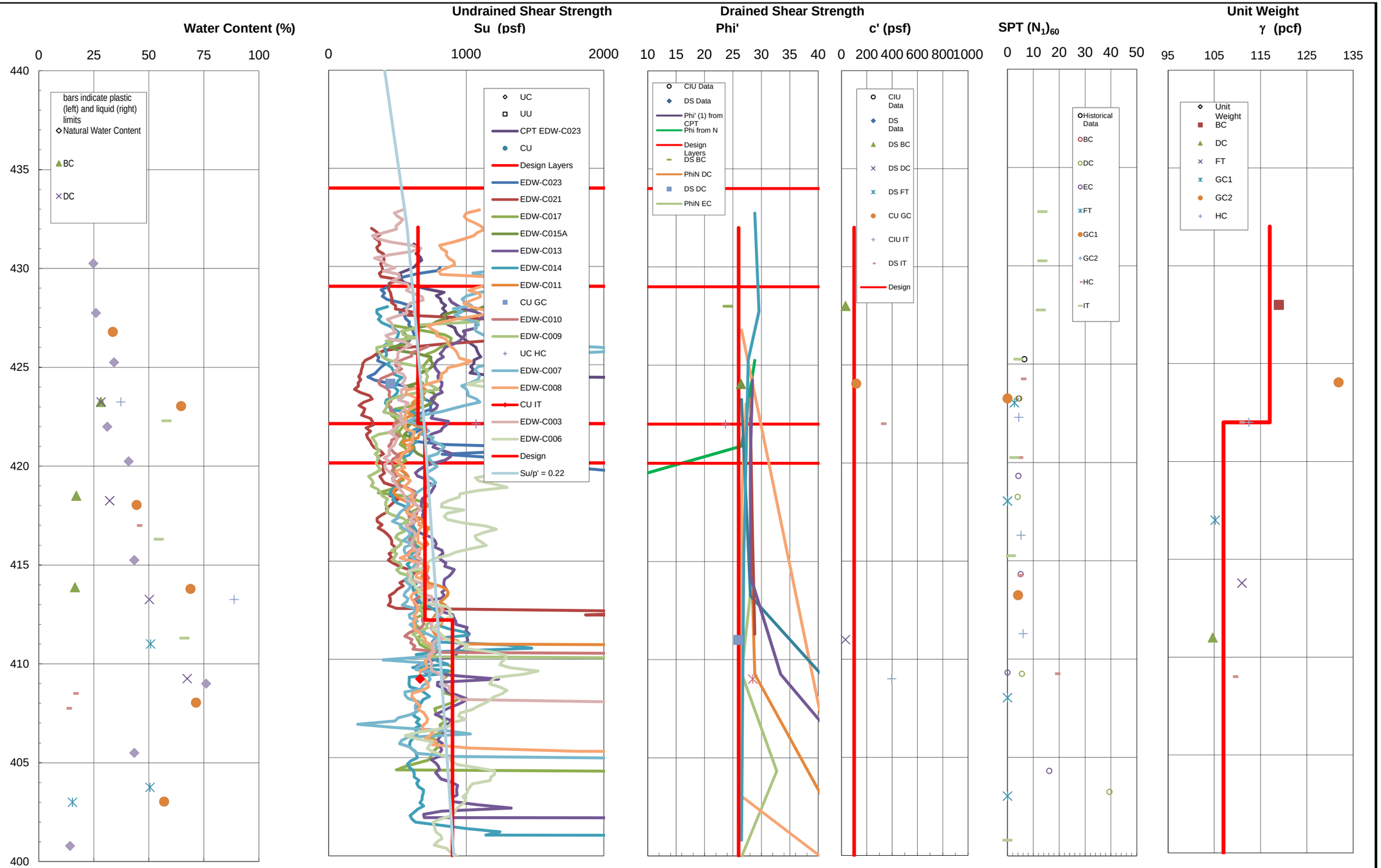
Ash Data	Project No. 60440202	Material Properties	AECOM		Attachment F.3

Attachment F.4 Material Characterization Plot – Native Clay Crust Data



Native Clay Crust Data	Project No. 60440202	Material Properties	AECOM		Attachment F.4

Attachment F.5 Material Characterization Plot – Native Clay Data



Native Clay Data	Project No. 60440202	Material Properties	AECOM		Attachment F.5

Attachment G. Slope Stability Analysis

1. Objective & Introduction

This calculation package summarizes the limit equilibrium slope stability analyses for both the static and seismic loading conditions performed in support of the Edwards Ash Pond CCR Unit Geotechnical Report for Dynegy's Edwards Power Station. Figures, calculations and computer program outputs are provided as attachments and are referenced herein. Slope stability analyses have been completed for ten cross-sections within the Edwards Ash Pond to evaluate the stability of the embankment under loading conditions required by the CCR Rule.

The objective for the slope stability analysis is to determine factors of safety (FoS) at critical cross section locations across the East Ash Pond dike complex for the following loading cases:

- Static, Steady-State, Normal Pool Conditions;
- Static, Maximum Pool Surcharge Conditions;
- Seismic Slope Stability Analysis;

The factors of safety determined from each of these loading conditions will be utilized to determine if the requirements outlined by the USEPA CCR Rule criteria are met. The methodology used to perform the slope stability analysis and the results of the analyses are summarized in the subsequent sections listed below.

2. Development of Cross-Sections for Analysis

A total of ten cross-sections (A, B, C, D, E, F, G, H, I, and J) were utilized to evaluate the perimeter embankment stability at the Ash Pond.

The section geometry for each analysis cross-section was determined based on the LiDAR ground surface topographic contours obtained from the Illinois Geospatial Data Clearinghouse.

3. Subsurface Conditions

Subsurface materials and extents (stratigraphy) at each cross section were developed by utilizing nearby subsurface explorations (CPTs and borings) from AECOM's exploration activities and historic geotechnical explorations. The subsurface strata generally encountered across the exploration locations can be generalized into five typical layers. These layers are listed below and are further described in Appendix F – Material Characterization.

- New Embankment Fill Materials
- Old Embankment Fill Materials
- Ash Material
- Native Alluvial Clay Crust
- Native Alluvial Clay

Material interfaces inferred from the subsurface explorations nearest to the cross-sections were transposed onto the profile and a reasonable interpretation of the subsurface stratigraphy between the exploration locations was developed. Table G-1 below summarizes the exploration locations utilized to construct each cross-section:

Table G-1
Cross-section Locations for Slope Stability Analyses

Cross-Section	Approximate Station	Location (Crest/Toe)	Boring/CPT Number
A	15+00	CREST	EDW-B001, EDW-C001
		TOE	
B	18+00	CREST	EDW-B010, EDW-C023
		TOE	
C	31+00	CREST	EDW-C021
		TOE	
D	41+00	CREST	EDW-B012, EDW-C017
		TOE	
E	51+00	CREST	EDW-B009, EDW-C015
		TOE	EDW-C016
F	54+00	CREST	EDW-C013
		TOE	EDW-B008, EDW-C014
G	58+00	CREST	EDW-B005, EDW-B013, EDW-C011, EDW-C012
		TOE	EDW-C010
H	60+00	CREST	EDW-B015, EDW-C009
		TOE	
I	67+00	CREST	EDW-C007
		TOE	EDW-B006, EDW-C008
J	87+00	CREST	EDW-C003
		TOE	

Additionally, design drawings from "Proposed 150 Car Loop Track For Edwards Power Plant Bartonville, Illinois" by Design Nine, Inc. (2003) were used to supplement the subsurface investigation in developing the subsurface embankment geometry. The relevant CPT soundings and test borings that were used to develop subsurface stratigraphy at the 10 analysis sections are listed in Table E-1 below.

Phreatic conditions were modeled as a piezometric line in SLOPE/W. Elevations and configuration of the lines were established based on the water levels encountered in the borings and CPTs, the piezometers installed during the 2015 AECOM exploration, and the normal pool elevation of approximately 447.2 feet for the Clarification Pond sub-basin and 449.5 feet for the Cooling Pond sub-basin, based on the 2016 AECOM hydraulics and hydrology report (AECOM, 2016).

4. Analysis Methodology

Analyses were performed using Spencer's Method which is a limit equilibrium slope stability analysis procedure. The computer program SLOPE/W 2012 by Geo-Slope International was utilized. The program analyzes a large number of potential slip surface geometries and identifies the geometry that results in a critical (i.e. lowest) factor of safety (FS). Additional information on the program is available at http://www.geo-slope.com/. Circular shaped failure surfaces, with optimization, were analyzed for the each of the loading cases considered. The optimization option within Slope/W allows the checking of non-circular failure surfaces by incrementally altering the location of the failure surface to find the lowest factor of safety. This procedure allows the failure surface to follow thin layers of lower strength, and interface boundaries to calculate a more critical factor of safety.

Each section was analyzed for the following cases:

- **Static, Steady-State, Normal Pool Condition:** This case models the conditions under static, long-term conditions, under the normal storage water level within the impoundment. Drained (effective stress) shear strength parameters were used for all materials, and phreatic conditions were estimated based on available data as described above. A target **Factor of Safety of 1.50** is needed for this loading condition. The operating water level of the Ash Pond is El. 447.2 and 449.5 ft, obtained from AECOM's Hydrologic and Hydraulic Analysis, for the Clarification Pond and Cooling Pond sub-basins, respectively. These levels were utilized in this analysis.
- **Static, Maximum Surcharge Pool Condition:** This case models the conditions under short-term surcharge pool conditions. Drained (effective stress) shear strength parameters were used for all materials, as the change in pool elevation primarily affects the upstream slope of the dike and is not anticipate to result in the development of undrained conditions within the downstream face of the dike, which is where the critical slip surface was found from the normal pool condition analysis. It was assumed that the temporary surcharge load was not of a sufficient duration to significantly alter the phreatic surface (i.e. saturation line within the embankment). Therefore, the phreatic surface was modeled equivalent to the steady state case. A target **Factor of Safety of 1.40** is needed for this loading condition. The water level of the Ash Pond was modeled at El. 457.8 and 457.4 ft for the Clarification Pond and Cooling Pond sub-basins, respectively, for this case. These values are from the 2016 Hydraulics and Hydrology report generated for this project.

- **Seismic Stability Condition:** These analyses incorporate a horizontal seismic coefficient kh selected to be representative of expected loading during the design earthquake event (i.e., a "pseudostatic" analysis). The analyses utilized peak undrained strength parameters in soils that are not consider to be rapidly draining materials, and peak drained strengths in soils considered to freely drain. The phreatic surface and pore water pressures corresponding to the Steady State Normal Storage Pool case from the static analyses were utilized. Seismic loading was included in this analysis using a pseudostatic coefficient (kh). A **Factor of Safety of 1.00** is required for this loading condition.

Ground motion parameters for the pseudostatic analysis were estimated using the USGS Interactive Deaggregation tool (http:earthquake.usgs.gov/hazards/apps/). This application generates acceleration values, including peak ground acceleration (PGA), and mean and modal moment magnitudes, based on user entered values of location, exceedance probability, and spectral period. Results are computed based on the 2008 NSHMP PSHA Seismic Hazard Maps.

For the Edwards Power Station, the calculated PGA for a 2,500-year event was 0.067g for top of hard rock. To determine the free-field, ground surface horizontal acceleration, the site was classified

according to the site classes defined in IBC (2003) and amplified using the site amplification factors found in NEHRP (2009) The site class was determined based on the weighted average of the shear wave velocity of the foundation soils (600 ≤ vs ≤ 1,200 ft/s) and found to be Site Class D. This corresponds to a NEHRP amplification factor of 1.6, resulting in a ground surface acceleration of 0.107g. The Peak Transverse Acceleration at the dike crest was estimated using the ground surface acceleration and the procedure proposed by Idriss (2015), resulting in a crest acceleration of 0.32.

The pseudostatic coefficient was calculated based on the simplified procedure developed by Makdisi and Seed (1978). Specifically, the pseudostatic coefficient was taken as the parameter kmax, which represents the peak average acceleration along the failure surface. As shown in Figure 1 below (excerpted from the above reference), the ratio kmax/umax (where umax is the peak acceleration at the crest of the embankment) for a full height failure surface (y/H = 1.0) is 0.34. From the procedure noted above, the anticipated maximum peak crest acceleration is approximately 0.43g. Therefore, the pseudostatic coefficient kh was estimated as kh= 0.34*0.43g = 0.109g for these analyses.

The seismic hazard deaggregation output and calculations for the pseudostatic coefficient are provided at the back of this document.

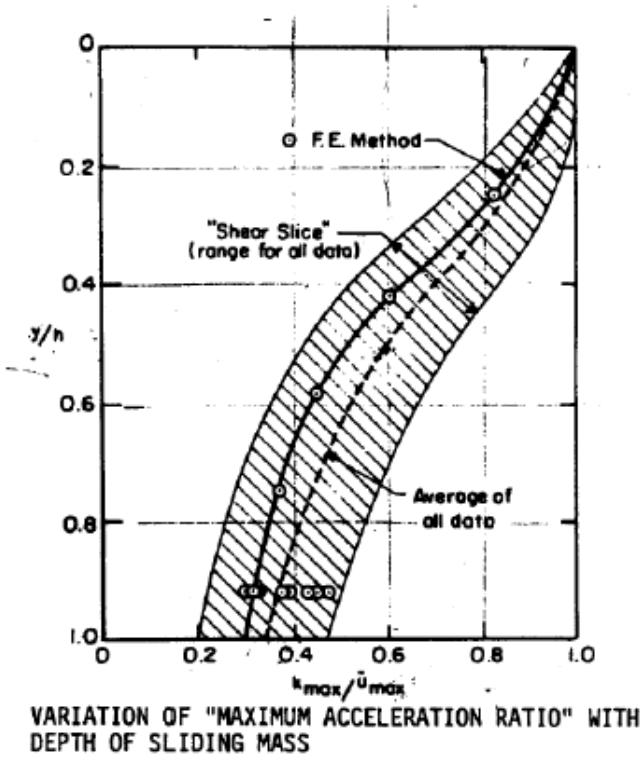


Figure 1: Determination of Maximum Average Acceleration Along Failure Surface

5. Material Properties for Analysis

Material properties for slope stability analyses were developed using both laboratory testing data (index and strength testing) and strength correlations from CPT and SPT data. Details of the material characterization and

strength parameter selection for each stratum are provided in Attachment F of this report. The properties used in the stability analysis are summarized in the table below:

Table G-2: Summary of Material Parameters used in Stability Analysis

Material	Unit Weight Above WT (pcf)	Unit Weight Below WT (pcf)	Effective (drained) Shear Strength Parameters		Total (undrained) Shear Strength Parameters	
			c' (psf)	Φ' (°)	c (psf)	Φ (°)
New Embankment	115	115	200	30	2500	0
Old Embankment 1	125	125	200	28	2500	0
Old Embankment 2	125	125	100	29	1250	0
Native Clay Crust	120	120	200	27.5	1250	0
Native Clay 1	117	117	100	26	650	0
Native Clay 2	105	105	200	26	700	0
Native Clay 3	105	105	200	26	900	0
Fly Ash	105	105	100	27	600	0
Historic Ash	105	105	100	26	750	0
Historic Fill	125	120	200	28	1000	0
Recent Fill	115	115	200	30	1250	0
GP (Very Dense)	135	135	0	36	0	36
New Embankment (Crushed Stone - Sandy Gravel)	120	120	0	32	0	32
Bedrock - Shale	140	140	1000	36	1000	36

6. Results

Table G-3 summarizes the results of the stability analyses for each section, and output figures from the SLOPE/W models are provided at the back of this document.

Table G-3: Summary of Minimum Slope Stability Factors

Cross Section	Factor of Safety		
	Drained		Undrained
	Steady State (Normal Pool)	Surcharge Pool (Flood)	Seismic (Pseudostatic)
CCR Rule Criteria	*FS ≥ 1.50*	*FS ≥ 1.40*	*FS ≥ 1.00*
A	2.02	2.02	1.37
B	1.59	1.59	1.28
C	1.83	1.82	1.09
D	1.79	1.79	1.18
E	1.54	1.54	1.11
F	2.31	2.31	1.08
G	2.12	2.12	1.13
H	2.08	2.08	1.08
I	2.26	2.26	1.30
J	2.08	2.58	2.00

7. Conclusions

Load cases analyzed for this study included static (steady-state) normal pool, maximum flood surcharge pool, and seismic (pseudo-static). The calculated factors of safety from the limit equilibrium slope stability analysis satisfy the USEPA CCR Rule § 257.73(e) requirements for all the load cases analyzed at the critical analysis sections for the perimeter of the impoundment. Load cases analyzed for this study included static (steady-state) normal pool, maximum flood surcharge pool and seismic (pseudo-static).

8. References

AECOM (2016). Hydrologic and Hydraulic Summary Report for Edwards Power Generating Station, Cooling Pond and Clarification Pond CCR Units.

GEO-SLOPE International Ltd. (2015). "GeoStudio 2012 (SLOPE/W and SEEP/W)." Calgary, Alberta, Canada.

Idriss, I. M., and Boulanger, R. W. (2008). Soil Liquefaction During Earthquakes. Earthquake Engineering Research Institute, Oakland, California, USA.
International Code Council, (2003), 2003 International Building Code.

Illinois Geospatial Data Clearinghouse [IGDC]. (2015). LiDAR data for Peoria County downloaded in August of 2015.

Makdisi, F.I. and Seed, B. H., August, 1977. "A Simplified Procedure for Estimating Earthquake-Induced Deformations in Dams and Embankments", Earthquake Engineering Research Center Report No. UCB/EERC-77/19, University of California, Berkeley, CA.

NEHRP (National Earthquake Hazards Reduction Program), (2009) Recommended Seismic Provisions for New and Other Structures, (FEMA P-750), 2009 Edition.

U.S. Environmental Protection Agency [USEPA]. (2015). Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments. 40 CFR §257. Federal Register 80, Subpart D, April 17, 2015.

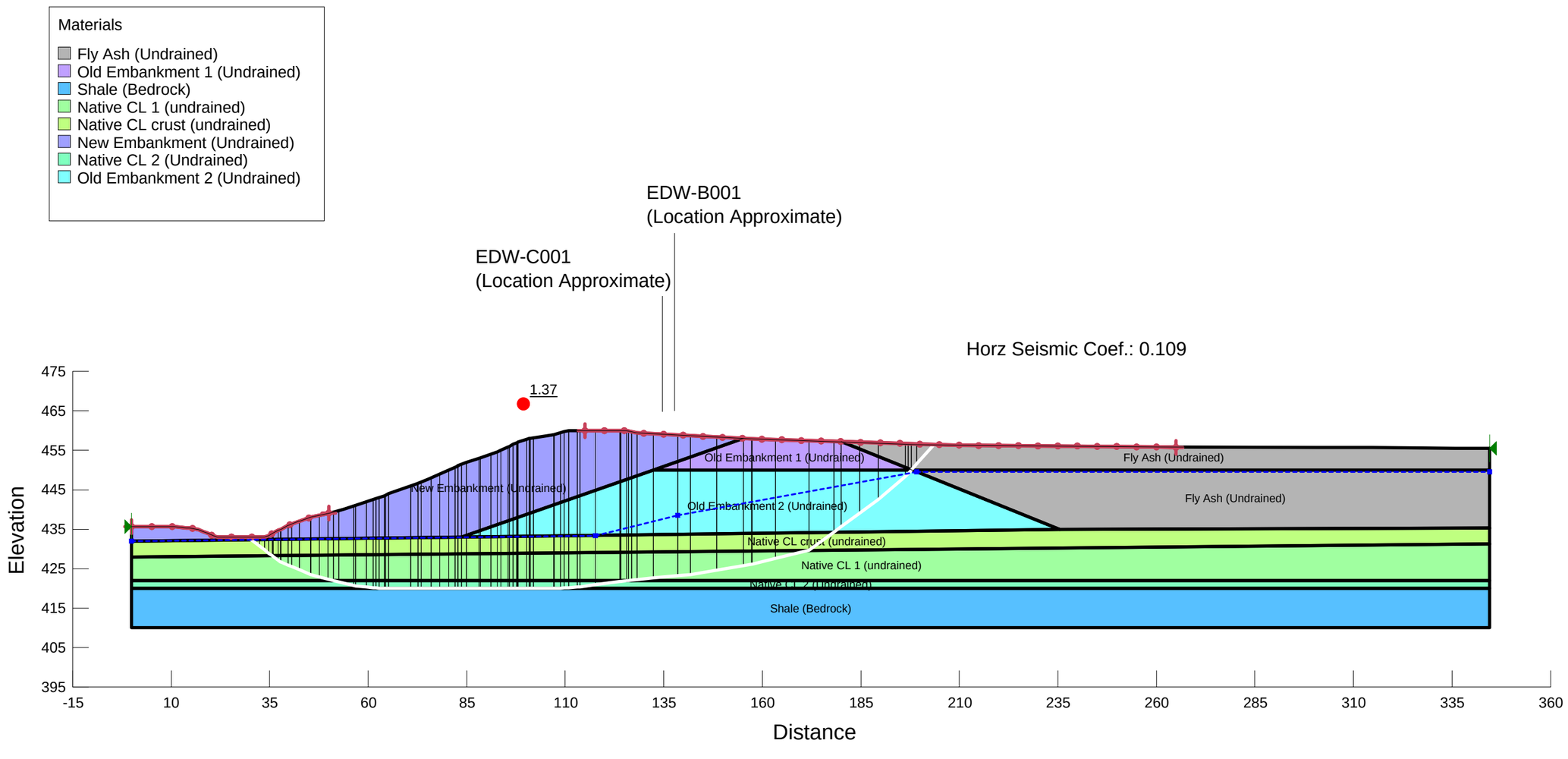
9. Attachments

G.1 Slope Stability Analysis Output Data
G.2 Seismic Parameter Calculations

Attachment G.1 Slope Stability Analysis Output Data

Name: Fly Ash (Undrained) Unit Weight: 105 pcf Cohesion': 600 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 1 (Undrained) Unit Weight: 125 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL crust (undrained) Unit Weight: 120 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: New Embankment (Undrained) Unit Weight: 115 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 105 pcf Cohesion': 700 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 2 (Undrained) Unit Weight: 125 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1

Dynegy Edwards
Cross-section A
Slope Stability - Seismic



Dynegy Edwards
Cross-section A
Slope Stability - Steady State

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
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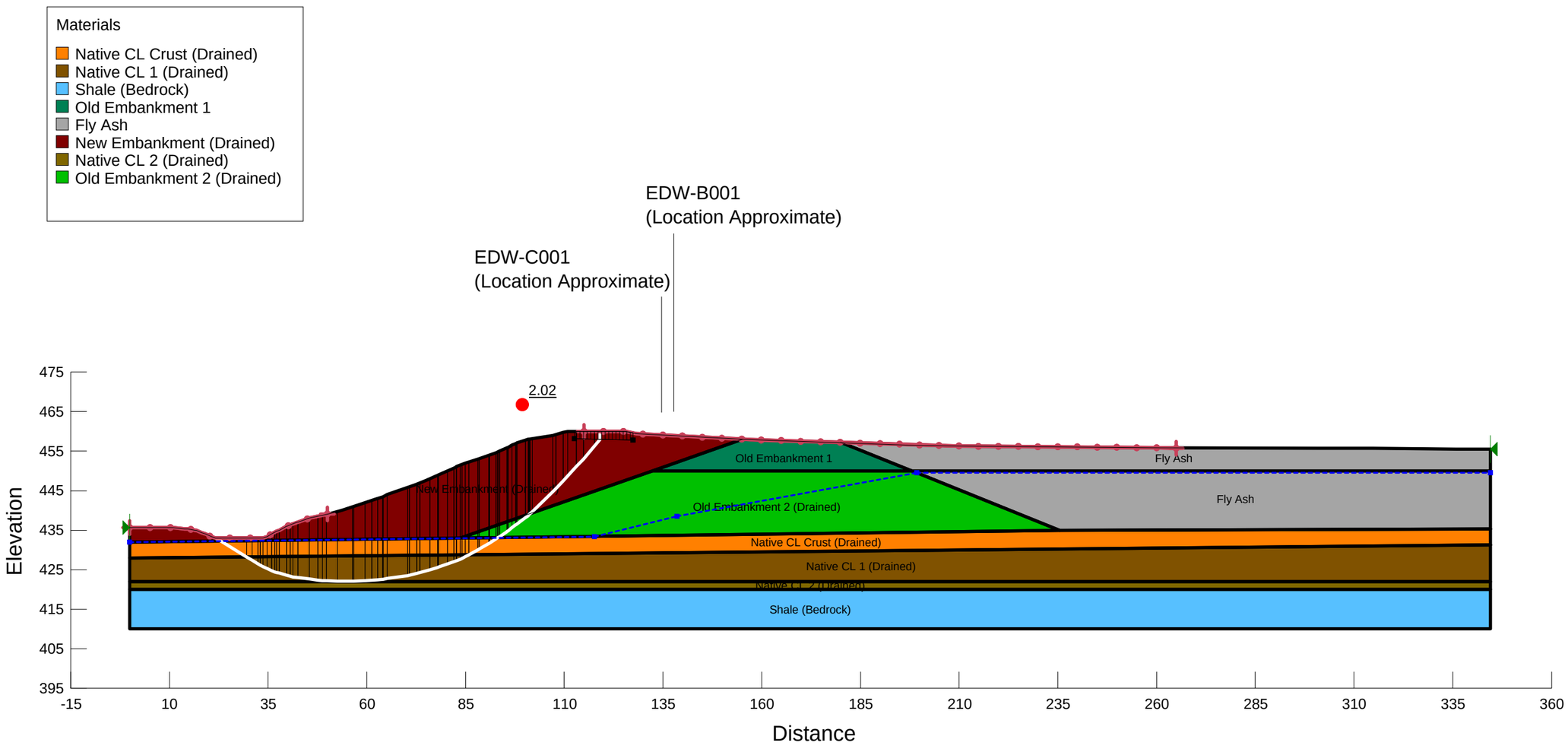

Dynegy Edwards
Cross-section A
Slope Stability - Surcharge Pool

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
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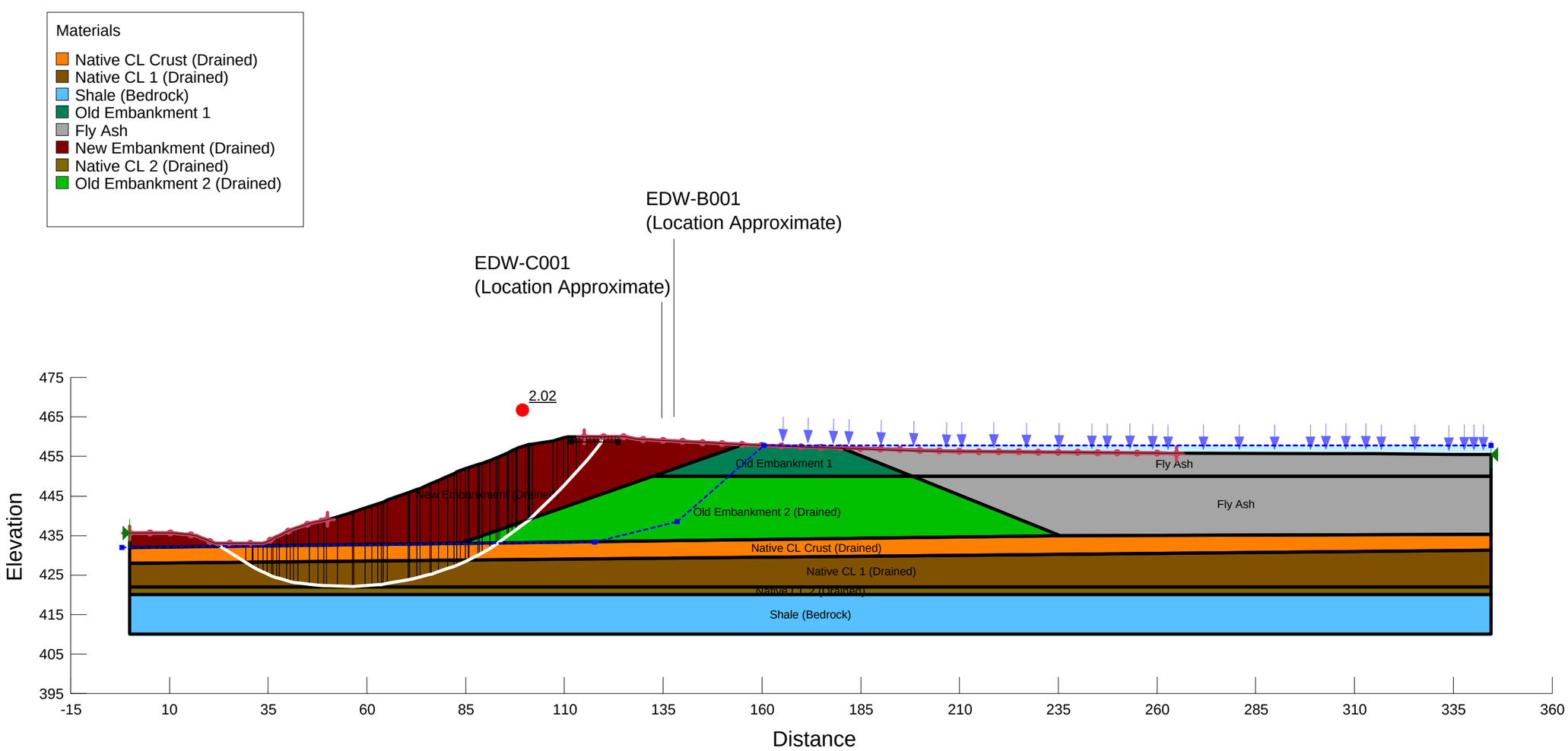

Name: Fly Ash (Undrained) Unit Weight: 105 pcf Cohesion': 600 psf Phi': 0 ° Piezometric Line: 1
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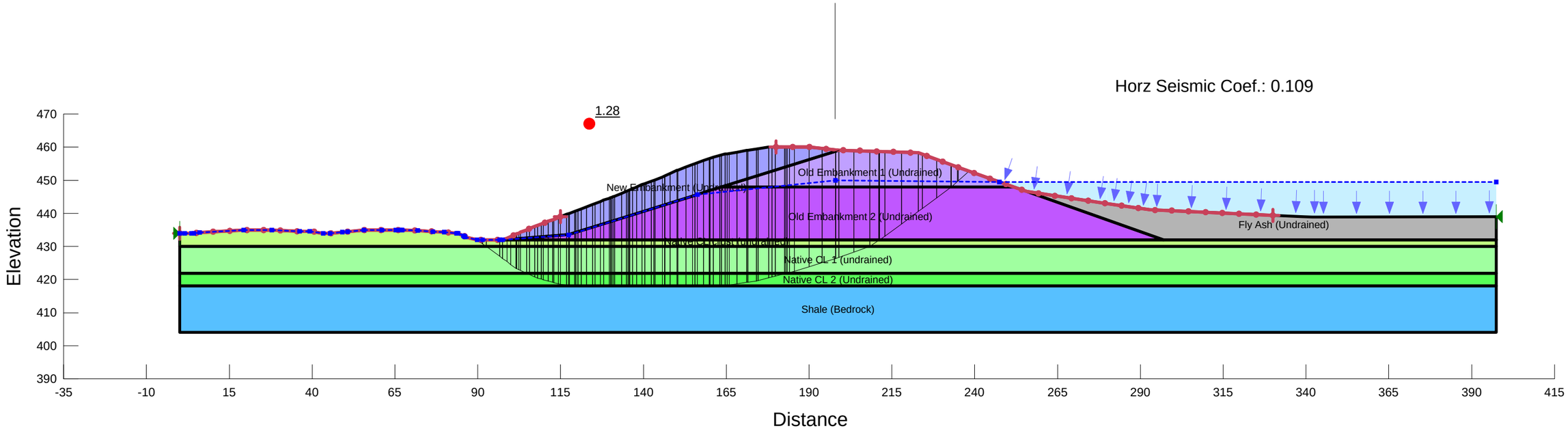
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL crust (undrained) Unit Weight: 120 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: New Embankment (Undrained) Unit Weight: 115 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 2 (Undrained) Unit Weight: 125 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 105 pcf Cohesion': 700 psf Phi': 0 ° Piezometric Line: 1

Dynegy Edwards
Cross-section B
Slope Stability - Seismic

Materials
- Fly Ash (Undrained)
- Old Embankment 1 (Undrained)
- Shale (Bedrock)
- Native CL 1 (undrained)
- Native CL crust (undrained)
- New Embankment (Undrained)
- Old Embankment 2 (Undrained)
- Native CL 2 (Undrained)

EDW-B010
EDW-C023
(Location Approximate)

Horz Seismic Coef.: 0.109



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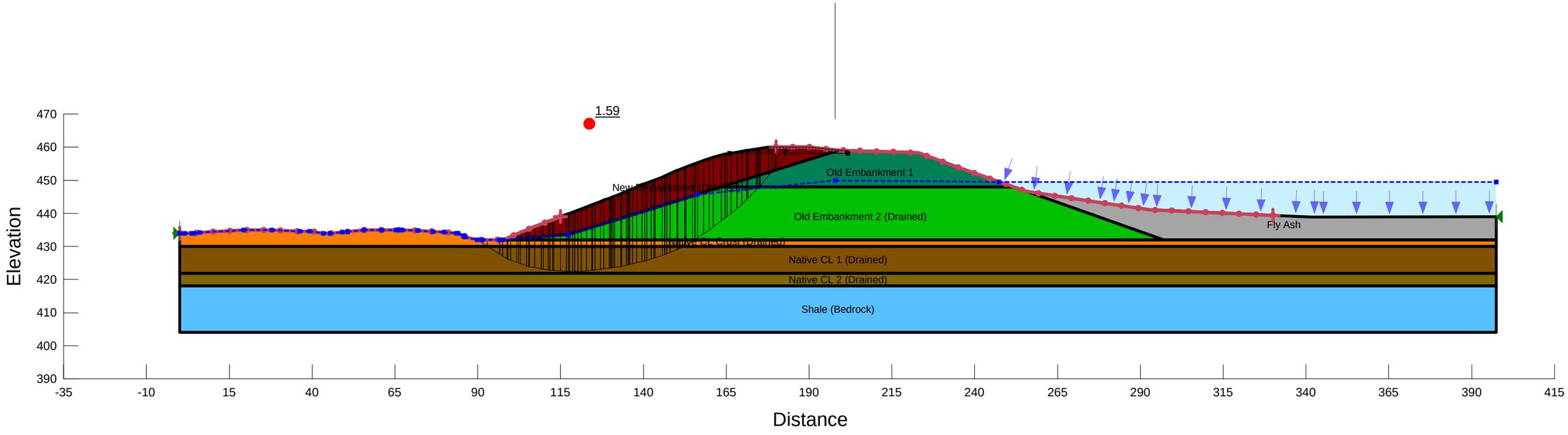
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: Old Embankment 2 (Drained) Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1

Dynegy Edwards
Cross-section B
Slope Stability - Steady State

Materials
- Native CL Crust (Drained)
- Native CL 1 (Drained)
- Shale (Bedrock)
- Old Embankment 1
- Fly Ash
- New Embankment (Drained)
- Old Embankment 2 (Drained)
- Native CL 2 (Drained)

EDW-B010
EDW-C023
(Location Approximate)



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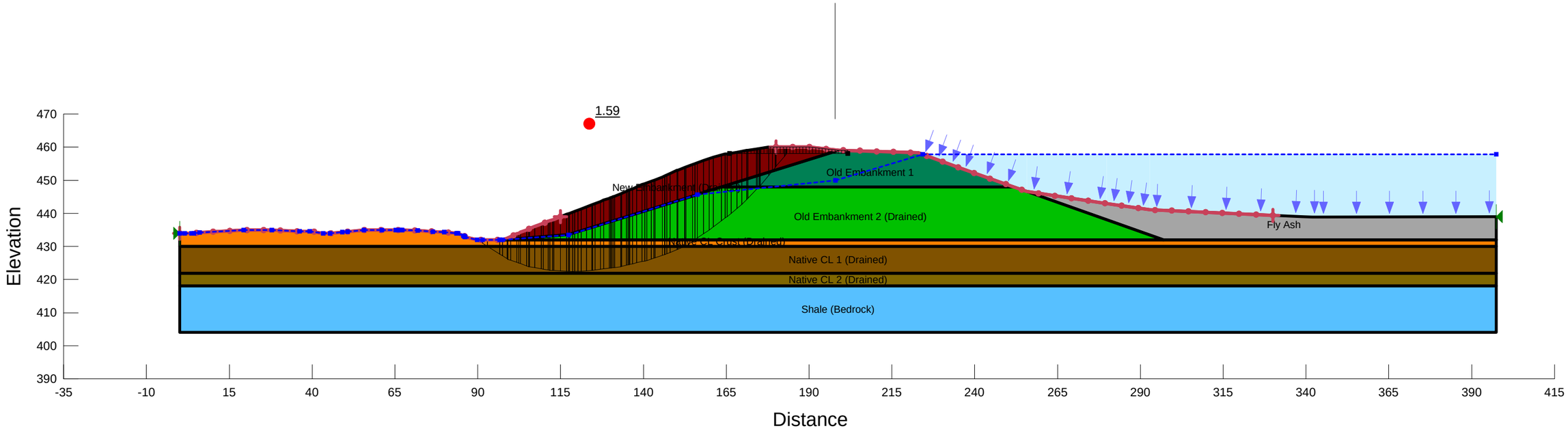
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: Old Embankment 2 (Drained) Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1

Dynegy Edwards
Cross-section B
Slope Stability - Surcharge Pool

Materials
- Native CL Crust (Drained)
- Native CL 1 (Drained)
- Shale (Bedrock)
- Old Embankment 1
- Fly Ash
- New Embankment (Drained)
- Old Embankment 2 (Drained)
- Native CL 2 (Drained)

EDW-B010
EDW-C023
(Location Approximate)



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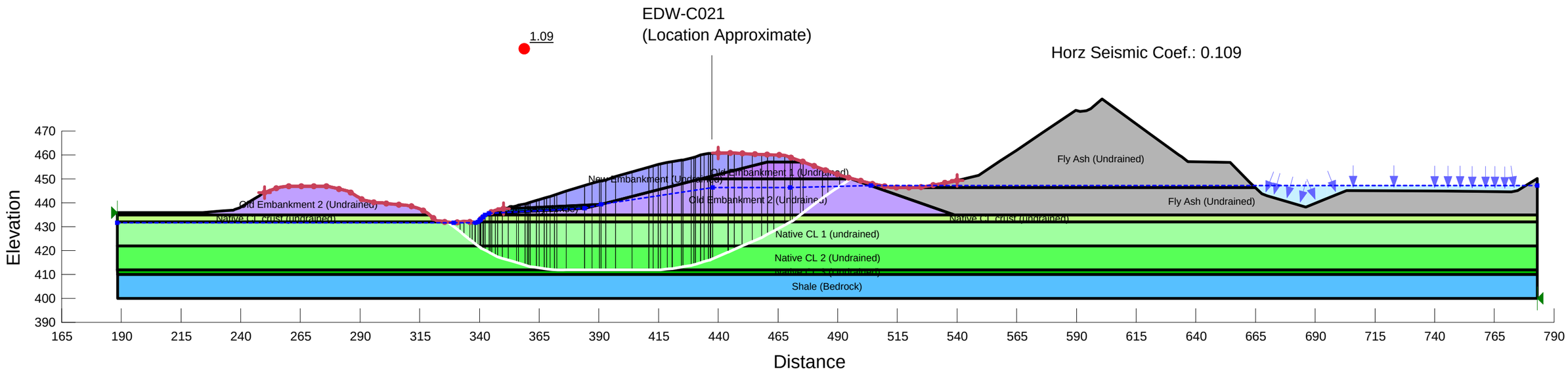
Name: Old Embankment 2 (Undrained) Unit Weight: 125 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL crust (undrained) Unit Weight: 120 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: New Embankment (Undrained) Unit Weight: 115 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: GP (very dense) Unit Weight: 135 pcf Cohesion': 0 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 105 pcf Cohesion': 700 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 3 (Undrained) Unit Weight: 105 pcf Cohesion': 900 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 1 (Undrained) Unit Weight: 125 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1

Dynegy Hennepin
Cross-section C
Slope Stability - Seismic

Materials

- Fly Ash (Undrained)
- Old Embankment 2 (Undrained)
- Shale (Bedrock)
- Native CL 1 (undrained)
- Native CL crust (undrained)
- New Embankment (Undrained)
- GP (very dense)
- Native CL 2 (Undrained)
- Native CL 3 (Undrained)
- Old Embankment 1 (Undrained)



Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
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Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: GP (very dense) Unit Weight: 135 pcf Cohesion': 0 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
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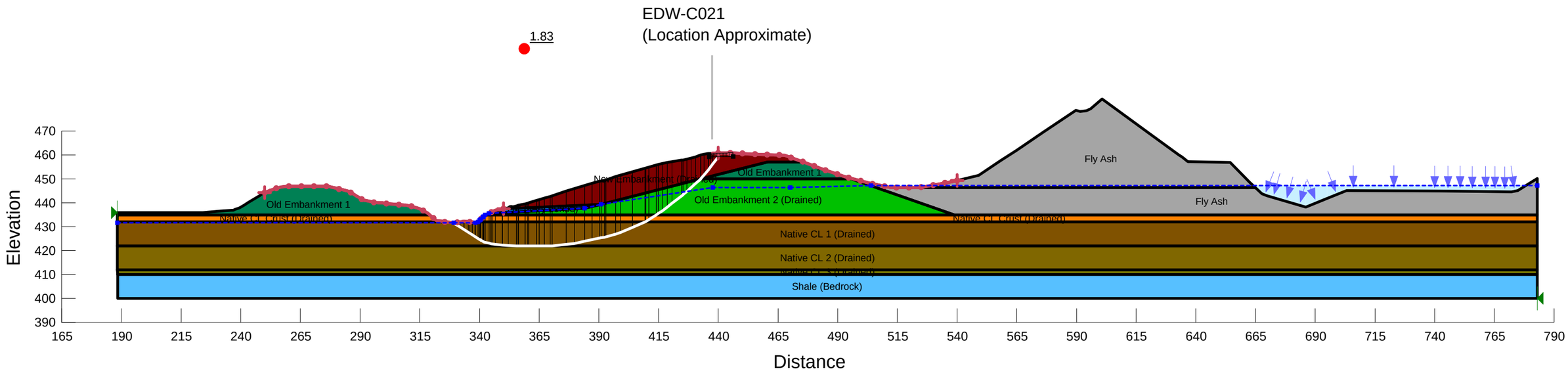
Name: Old Embankment 2 (Drained) Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1

Dynegy Hennepin
Cross-section C
Slope Stability - Steady State

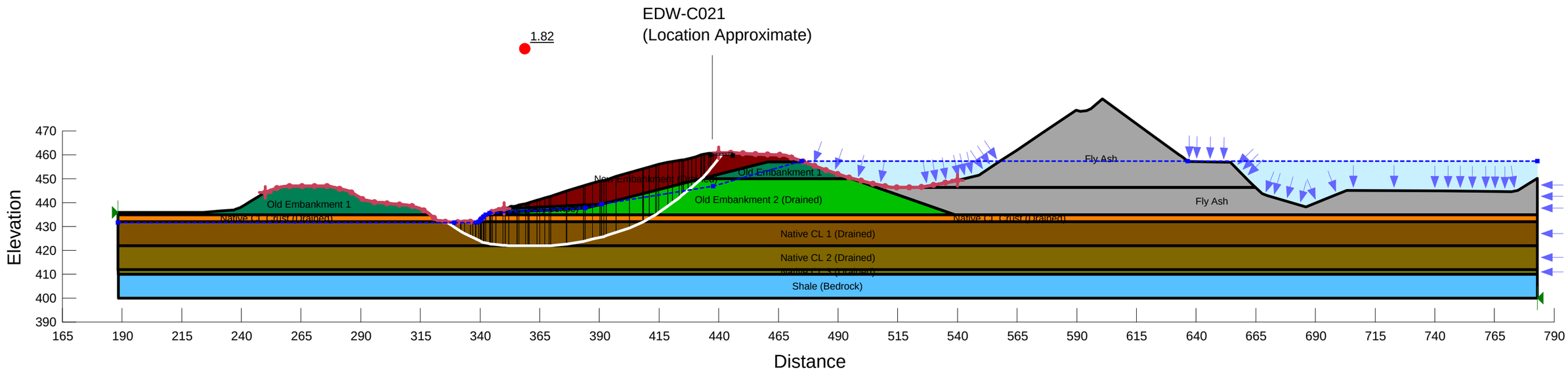
Materials
- Native CL Crust (Drained)
- Native CL 1 (Drained)
- Shale (Bedrock)
- Old Embankment 1
- Fly Ash
- New Embankment (Drained)
- GP (very dense)
- Native CL 2 (Drained)
- Native CL 3 (Drained)
- Old Embankment 2 (Drained)



Dynegy Hennepin
Cross-section C
Slope Stability - Surcharge Pool

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: GP (very dense) Unit Weight: 135 pcf Cohesion': 0 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 (Drained) Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1

Materials
- Native CL Crust (Drained)
- Native CL 1 (Drained)
- Shale (Bedrock)
- Old Embankment 1
- Fly Ash
- New Embankment (Drained)
- GP (very dense)
- Native CL 2 (Drained)
- Native CL 3 (Drained)
- Old Embankment 2 (Drained)



Name: Fly Ash (Undrained) Unit Weight: 105 pcf Cohesion': 600 psf Phi': 0 ° Piezometric Line: 1
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Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL crust (undrained) Unit Weight: 120 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: New Embankment (Undrained) Unit Weight: 115 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: GP (very dense) Unit Weight: 135 pcf Cohesion': 0 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 105 pcf Cohesion': 700 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 3 (Undrained) Unit Weight: 105 pcf Cohesion': 900 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 2 (Undrained) Unit Weight: 125 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1

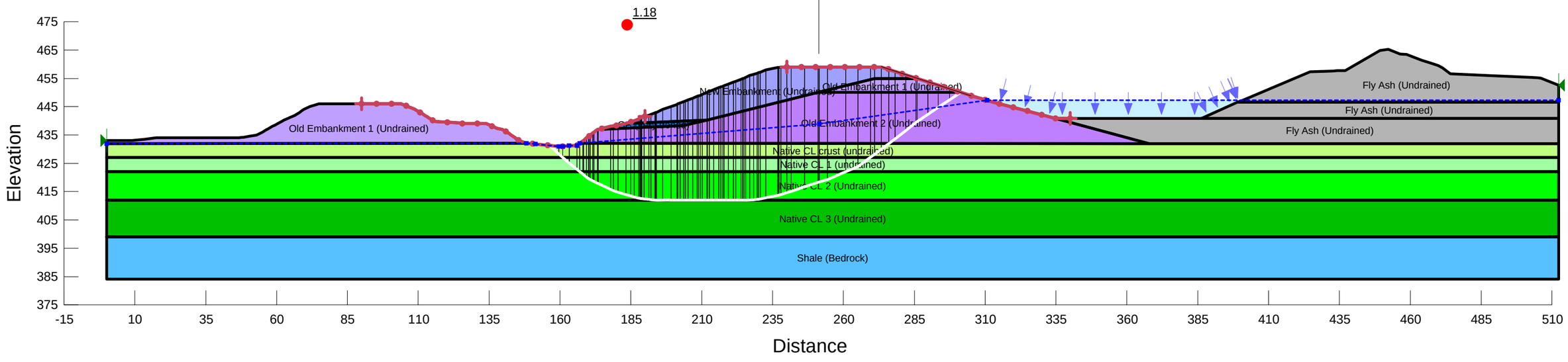
Dynegy Edwards
Cross-section D
Slope Stability - Seismic

Materials

- Fly Ash (Undrained)
- Old Embankment 1 (Undrained)
- Shale (Bedrock)
- Native CL 1 (undrained)
- Native CL crust (undrained)
- New Embankment (Undrained)
- GP (very dense)
- Native CL 2 (Undrained)
- Native CL 3 (Undrained)
- Old Embankment 2 (Undrained)

EDW-B012
EDW-C017
(Location Approximate)

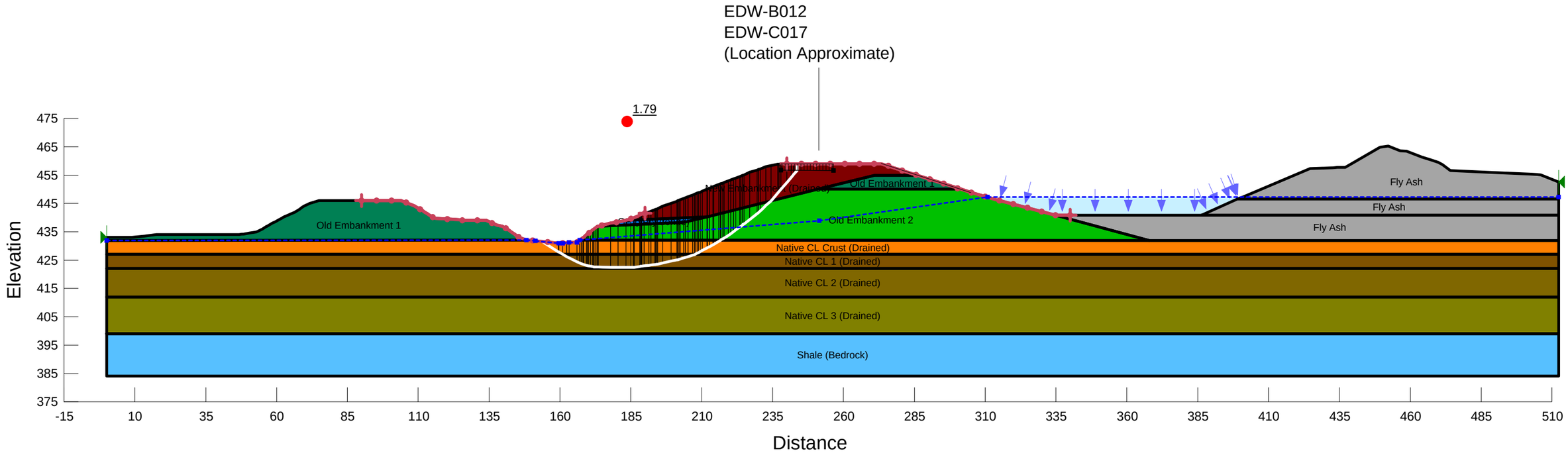
Horz Seismic Coef.: 0.109



Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: GP (very dense) Unit Weight: 135 pcf Cohesion': 0 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1

Dynegy Edwards
Cross-section D
Slope Stability - Steady State

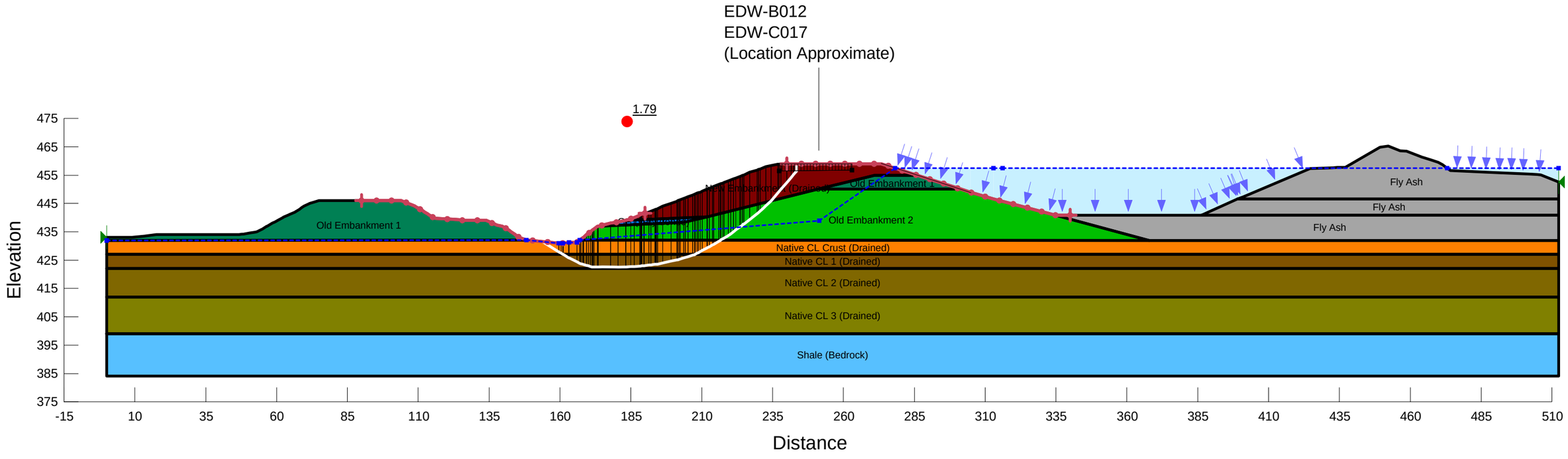
Materials
- Native CL Crust (Drained)
- Native CL 1 (Drained)
- Shale (Bedrock)
- Old Embankment 1
- Fly Ash
- New Embankment (Drained)
- GP (very dense)
- Native CL 2 (Drained)
- Native CL 3 (Drained)
- Old Embankment 2



Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: GP (very dense) Unit Weight: 135 pcf Cohesion': 0 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1

Dynegy Edwards
Cross-section D
Slope Stability - Surcharge Pool

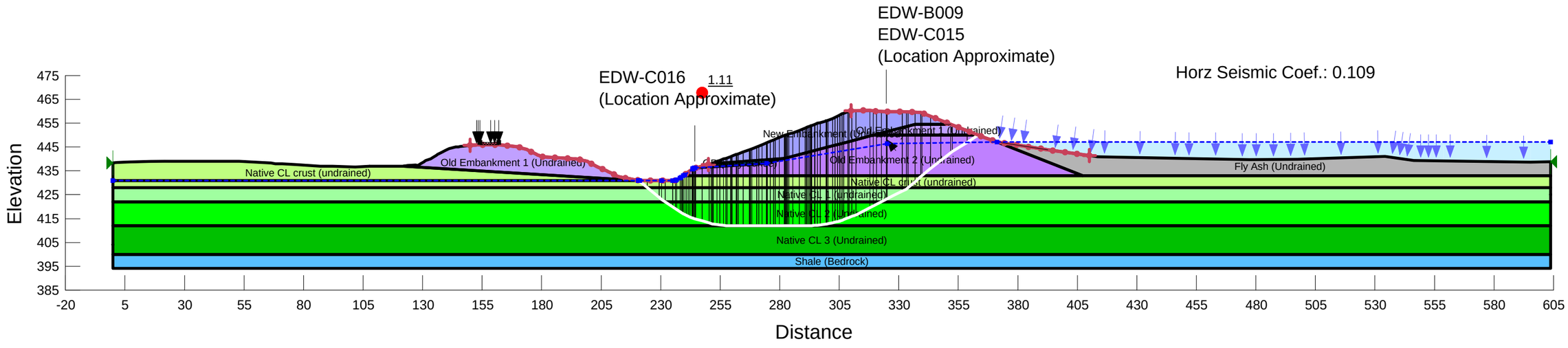
Materials
- Native CL Crust (Drained)
- Native CL 1 (Drained)
- Shale (Bedrock)
- Old Embankment 1
- Fly Ash
- New Embankment (Drained)
- GP (very dense)
- Native CL 2 (Drained)
- Native CL 3 (Drained)
- Old Embankment 2



Name: Fly Ash (Undrained) Unit Weight: 105 pcf Cohesion': 600 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 1 (Undrained) Unit Weight: 125 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL crust (undrained) Unit Weight: 120 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: New Embankment (Undrained) Unit Weight: 115 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: GP (very dense) Unit Weight: 135 pcf Cohesion': 0 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 105 pcf Cohesion': 700 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 3 (Undrained) Unit Weight: 105 pcf Cohesion': 900 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 2 (Undrained) Unit Weight: 125 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1

Dynegy Edwards
Cross-section E
Slope Stability - Seismic

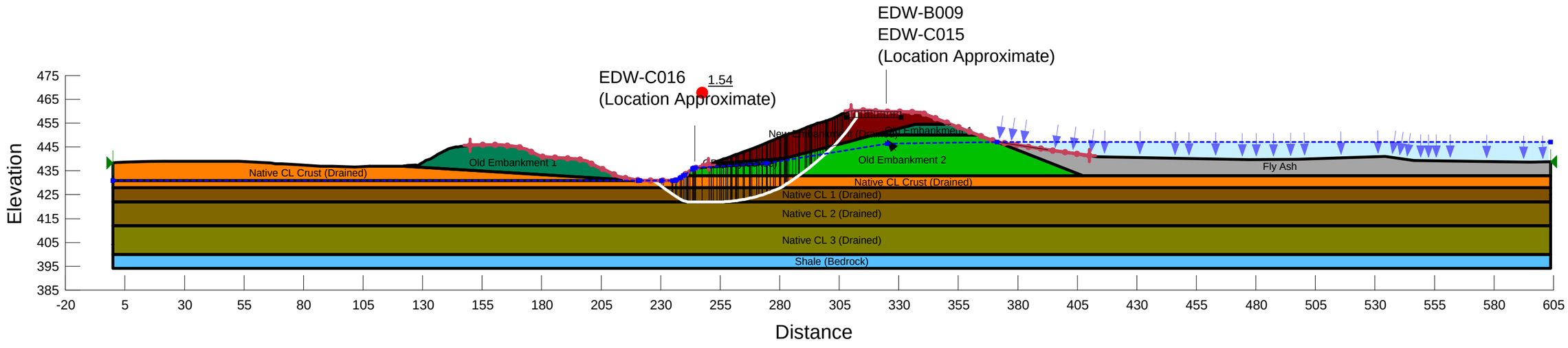
Materials
- Fly Ash (Undrained)
- Old Embankment 1 (Undrained)
- Shale (Bedrock)
- Native CL 1 (undrained)
- Native CL crust (undrained)
- New Embankment (Undrained)
- GP (very dense)
- Native CL 2 (Undrained)
- Native CL 3 (Undrained)
- Old Embankment 2 (Undrained)



Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: GP (very dense) Unit Weight: 135 pcf Cohesion': 0 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1

Dynegy Edwards
Cross-section E
Slope Stability - Steady State

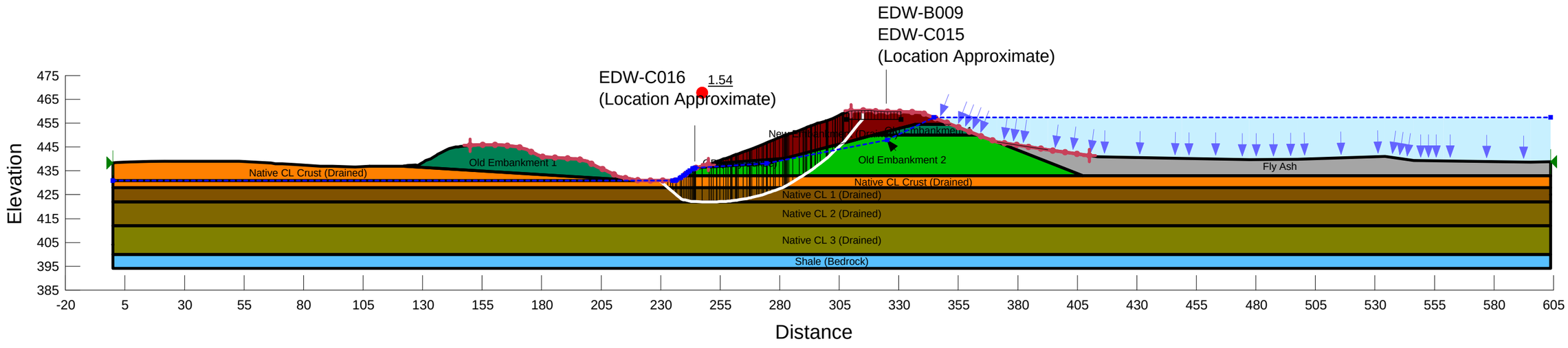
Materials
- Native CL Crust (Drained)
- Native CL 1 (Drained)
- Shale (Bedrock)
- Old Embankment 1
- Fly Ash
- New Embankment (Drained)
- GP (very dense)
- Native CL 2 (Drained)
- Native CL 3 (Drained)
- Old Embankment 2



Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: GP (very dense) Unit Weight: 135 pcf Cohesion': 0 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1

Dynegy Edwards
Cross-section E
Slope Stability - Surcharge Pool

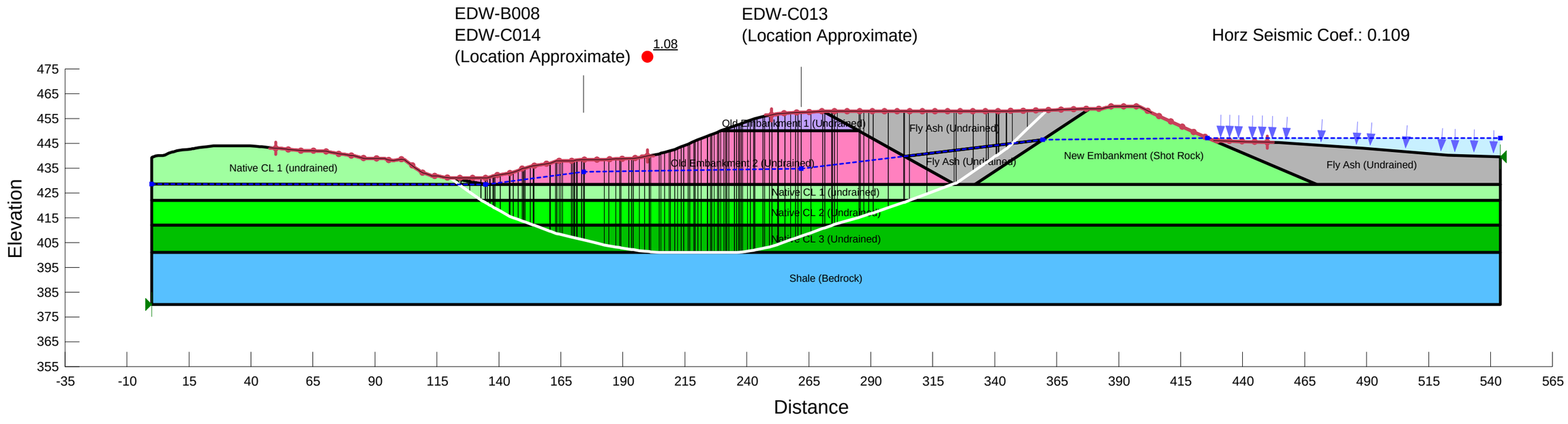
Materials
- Native CL Crust (Drained)
- Native CL 1 (Drained)
- Shale (Bedrock)
- Old Embankment 1
- Fly Ash
- New Embankment (Drained)
- GP (very dense)
- Native CL 2 (Drained)
- Native CL 3 (Drained)
- Old Embankment 2



Name: Fly Ash (Undrained) Unit Weight: 105 pcf Cohesion': 600 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 1 (Undrained) Unit Weight: 125 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: New Embankment (Shot Rock) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 32 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 105 pcf Cohesion': 700 psf Piezometric Line: 1
Name: Native CL 3 (Undrained) Unit Weight: 105 pcf Cohesion': 900 psf Piezometric Line: 1
Name: Old Embankment 2 (Undrained) Unit Weight: 125 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1

Dynegy Edwards
Cross-section F
Slope Stability - Seismic

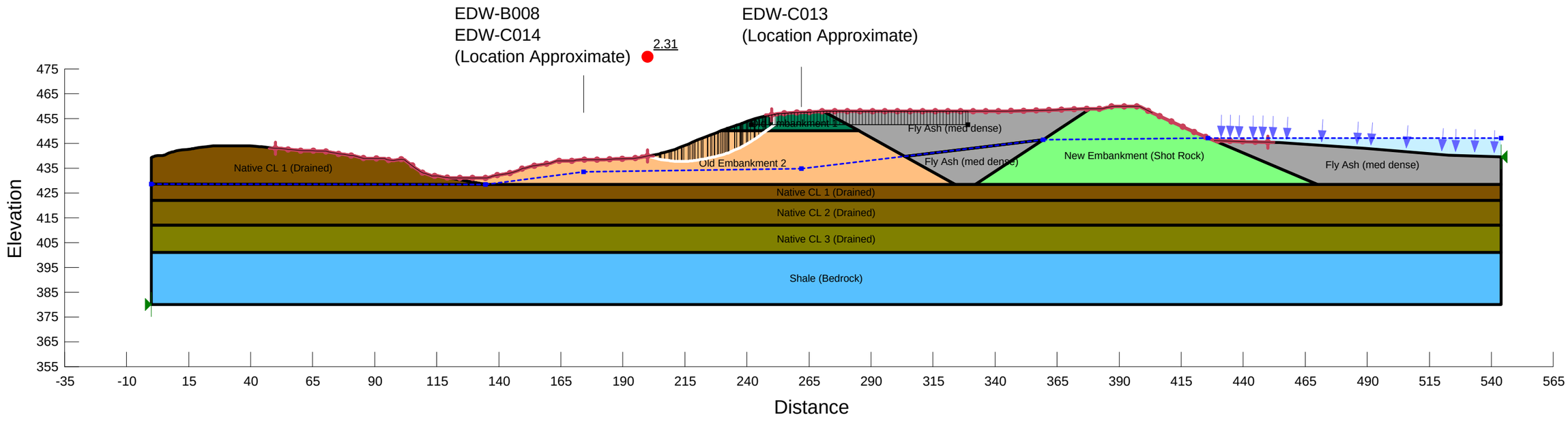
Materials
- Fly Ash (Undrained)
- Old Embankment 1 (Undrained)
- Shale (Bedrock)
- Native CL 1 (undrained)
- New Embankment (Shot Rock)
- Native CL 2 (Undrained)
- Native CL 3 (Undrained)
- Old Embankment 2 (Undrained)



Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash (med dense) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Shot Rock) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 32 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1

Dynegy Edwards
Cross-section F
Slope Stability - Steady State

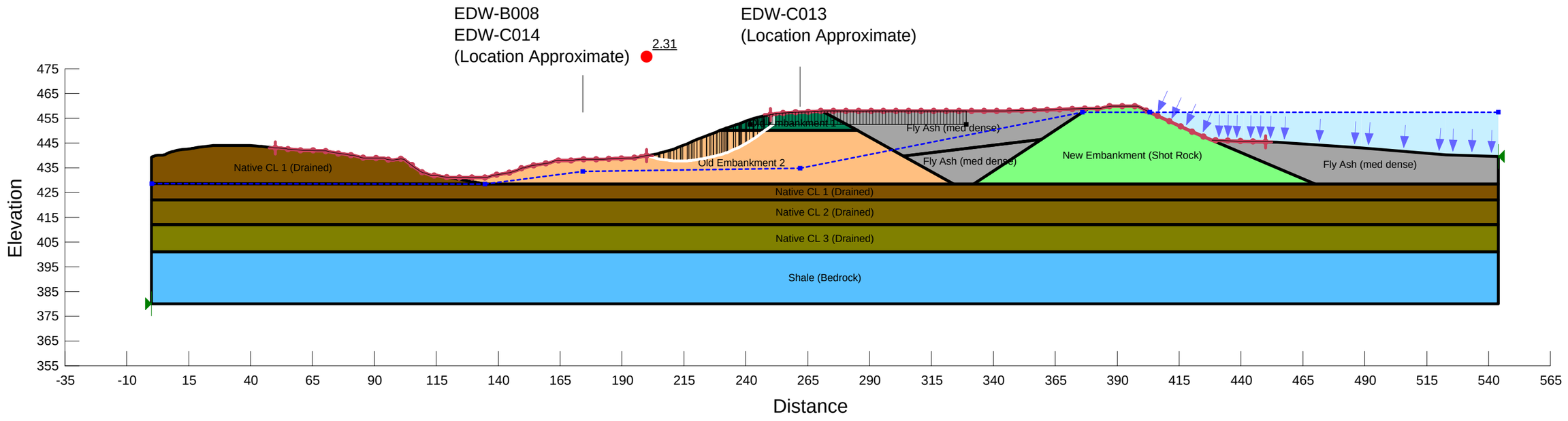
Materials
- Native CL 1 (Drained)
- Shale (Bedrock)
- Old Embankment 1
- Fly Ash (med dense)
- New Embankment (Shot Rock)
- Native CL 2 (Drained)
- Native CL 3 (Drained)
- Old Embankment 2



Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash (med dense) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Shot Rock) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 32 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1

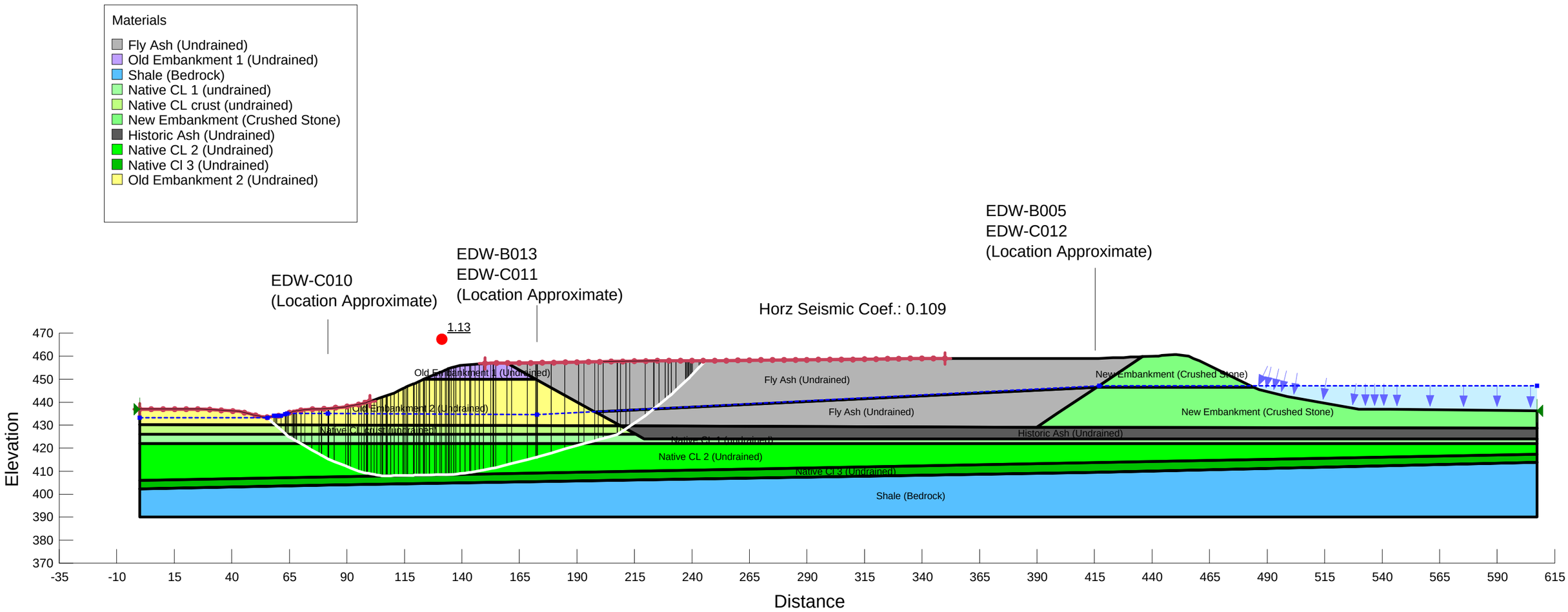
Dynegy Edwards
Cross-section F
Slope Stability - Surcharge Pool

Materials
- Native CL 1 (Drained)
- Shale (Bedrock)
- Old Embankment 1
- Fly Ash (med dense)
- New Embankment (Shot Rock)
- Native CL 2 (Drained)
- Native CL 3 (Drained)
- Old Embankment 2



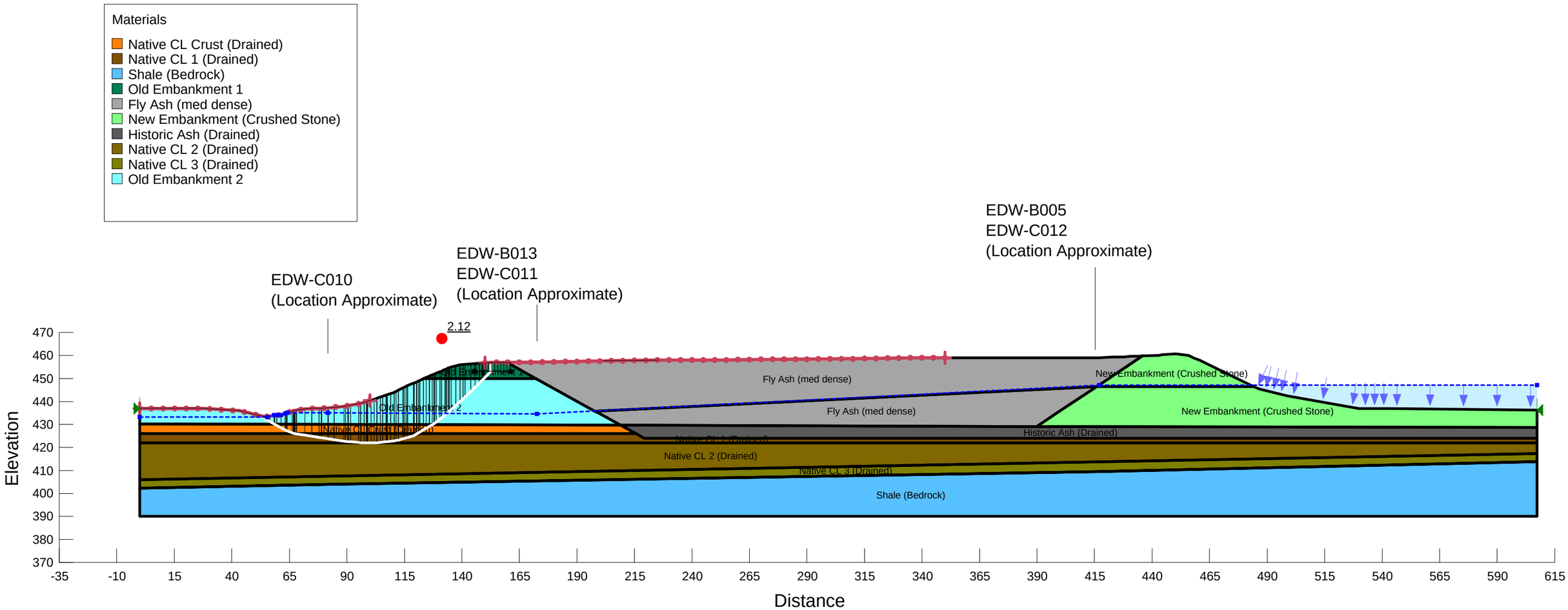
Name: Fly Ash (Undrained) Unit Weight: 105 pcf Cohesion': 600 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 1 (Undrained) Unit Weight: 125 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL crust (undrained) Unit Weight: 120 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: New Embankment (Crushed Stone) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 32 ° Piezometric Line: 1
Name: Historic Ash (Undrained) Unit Weight: 105 pcf Cohesion': 750 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 105 pcf Cohesion': 700 psf Piezometric Line: 1
Name: Native Cl 3 (Undrained) Unit Weight: 105 pcf Cohesion': 900 psf Piezometric Line: 1
Name: Old Embankment 2 (Undrained) Unit Weight: 125 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1

Dynegy Edwards
Cross-section G
Slope Stability - Seismic



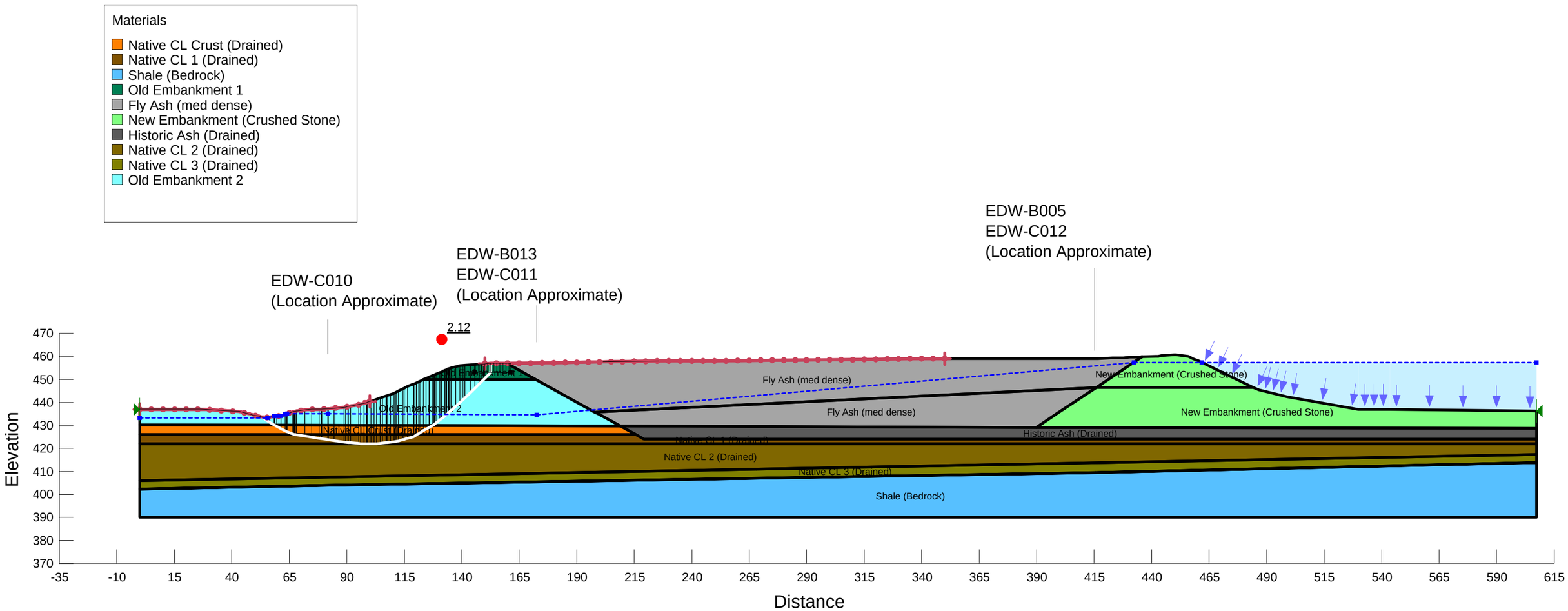
Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash (med dense) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Crushed Stone) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 32 ° Piezometric Line: 1
Name: Historic Ash (Drained) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1

Dynegy Edwards
Cross-section G
Slope Stability - Steady State



Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash (med dense) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Crushed Stone) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 32 ° Piezometric Line: 1
Name: Historic Ash (Drained) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1

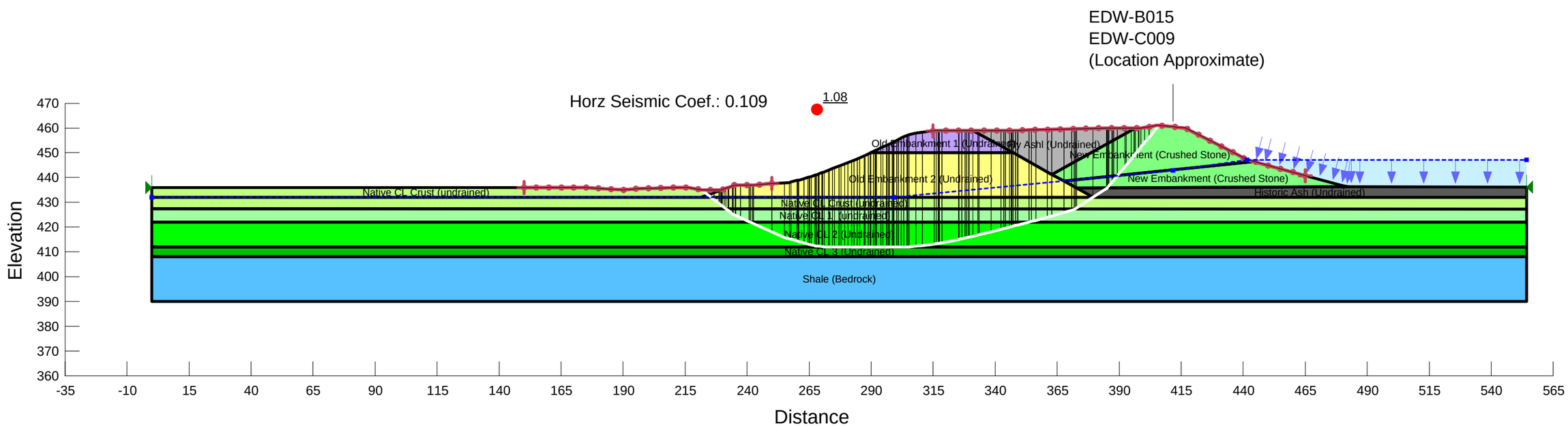
Dynegy Edwards
Cross-section G
Slope Stability - Surcharge Pool



Name: Fly Ashl (Undrained) Unit Weight: 105 pcf Cohesion': 600 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 1 (Undrained) Unit Weight: 125 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL Crust (undrained) Unit Weight: 120 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: New Embankment (Crushed Stone) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 32 ° Piezometric Line: 1
Name: Historic Ash (Undrained) Unit Weight: 105 pcf Cohesion': 750 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 117 pcf Cohesion': 700 psf Piezometric Line: 1
Name: Native CL 3 (Undrained) Unit Weight: 105 pcf Cohesion': 900 psf Piezometric Line: 1
Name: Old Embankment 2 (Undrained) Unit Weight: 125 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1

Dynegy Edwards
Cross-section H
Slope Stability - Seismic

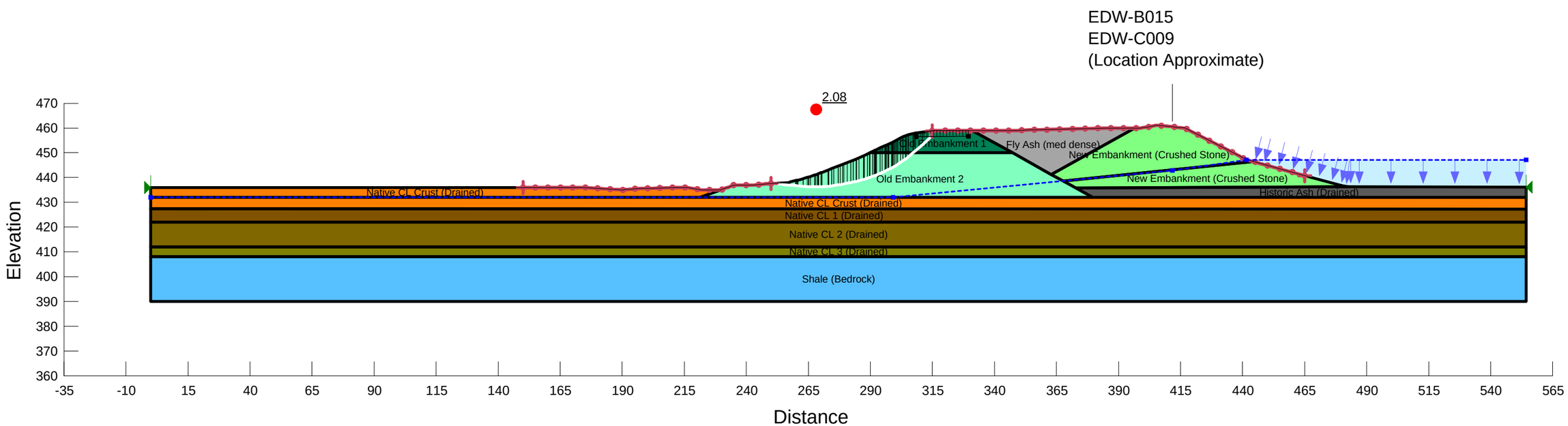
Materials
- Fly Ashl (Undrained)
- Old Embankment 1 (Undrained)
- Shale (Bedrock)
- Native CL 1 (undrained)
- Native CL Crust (undrained)
- New Embankment (Crushed Stone)
- Historic Ash (Undrained)
- Native CL 2 (Undrained)
- Native CL 3 (Undrained)
- Old Embankment 2 (Undrained)



Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash (med dense) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Crushed Stone) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 32 ° Piezometric Line: 1
Name: Historic Ash (Drained) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1

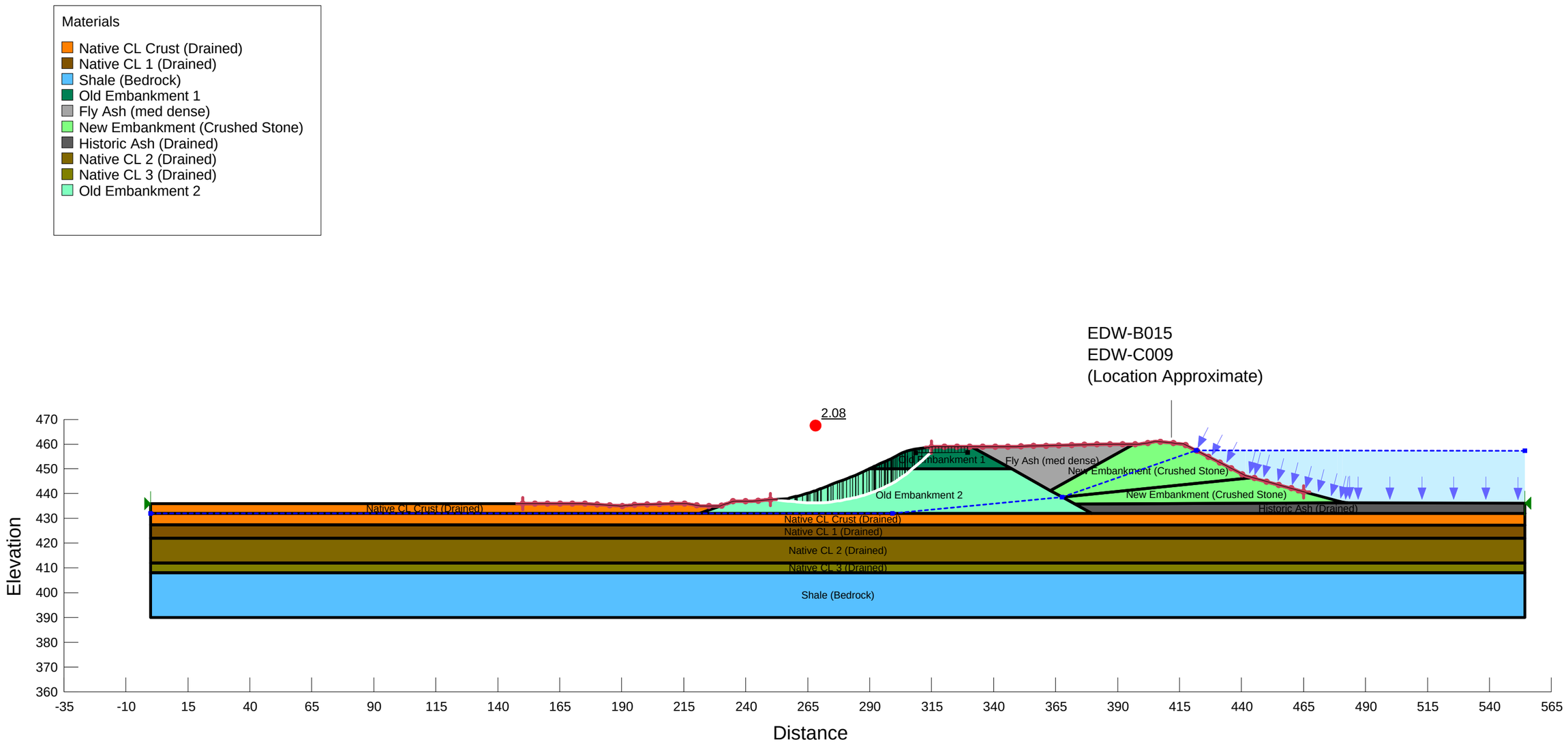
Dynegy Edwards
Cross-section H
Slope Stability - Steady State

Materials
- Native CL Crust (Drained)
- Native CL 1 (Drained)
- Shale (Bedrock)
- Old Embankment 1
- Fly Ash (med dense)
- New Embankment (Crushed Stone)
- Historic Ash (Drained)
- Native CL 2 (Drained)
- Native CL 3 (Drained)
- Old Embankment 2



Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash (med dense) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Crushed Stone) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 32 ° Piezometric Line: 1
Name: Historic Ash (Drained) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1

Dynegy Edwards
Cross-section H
Slope Stability - Surcharge Pool



Name: Old Embankment 1 (Undrained) Unit Weight: 125 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL crust (undrained) Unit Weight: 120 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: New Embankment (Undrained) Unit Weight: 115 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 105 pcf Cohesion': 700 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 2 (Undrained) Unit Weight: 125 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 3 (Undrained) Unit Weight: 105 pcf Cohesion': 900 psf Piezometric Line: 1

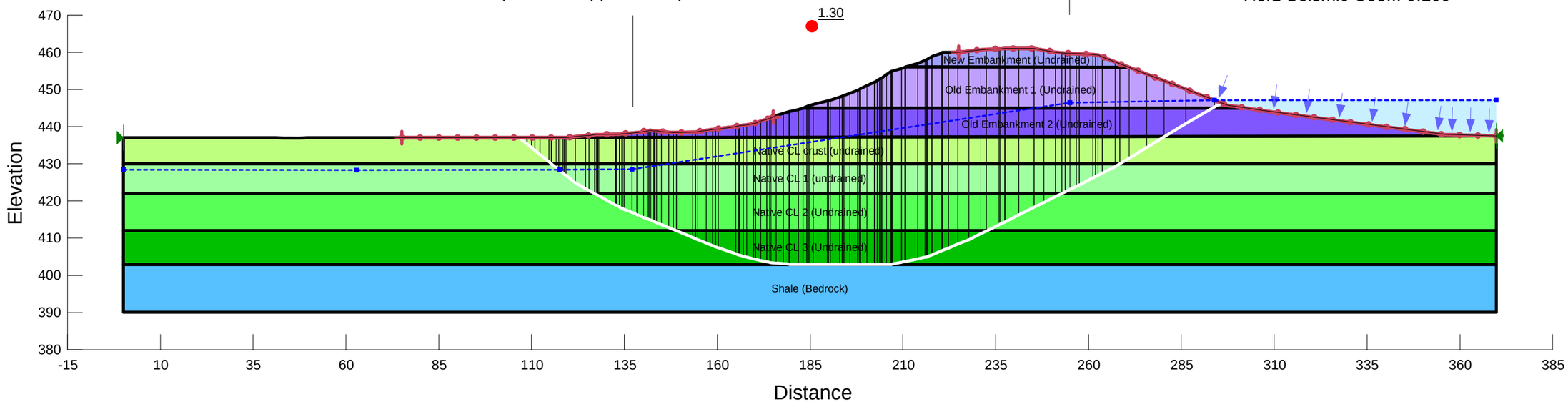
Dynegy Edwards
Cross-section I
Slope Stability - Seismic

Materials
- Old Embankment 1 (Undrained)
- Shale (Bedrock)
- Native CL 1 (undrained)
- Native CL crust (undrained)
- New Embankment (Undrained)
- Native CL 2 (Undrained)
- Old Embankment 2 (Undrained)
- Native CL 3 (Undrained)

EDW-C007
(Location Approximate)

EDW-C008
EDW-B006
(Location Approximate)

Horz Seismic Coef.: 0.109



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Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 (Drained) Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
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Name: Old Embankment 2 (Drained) Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
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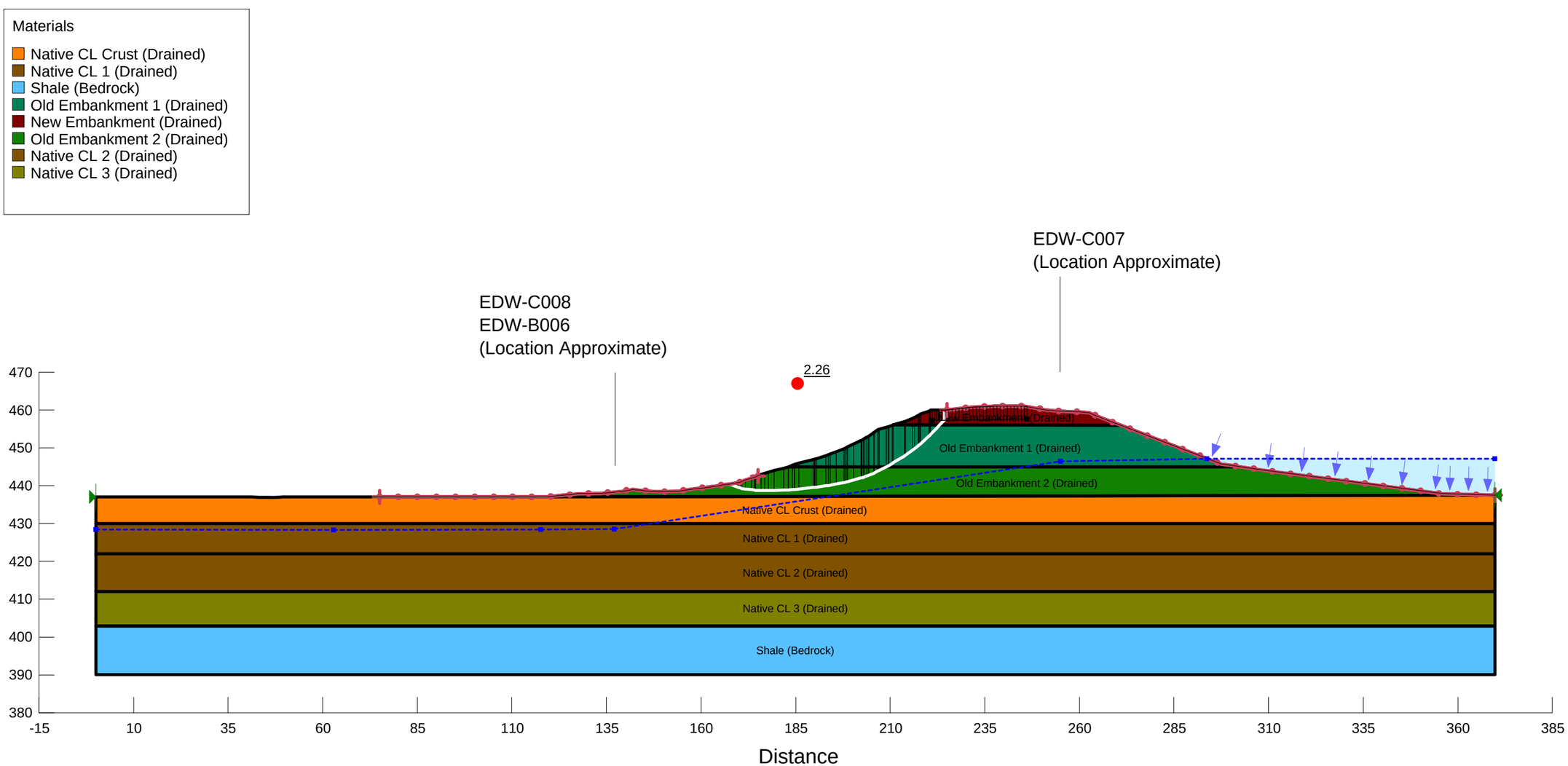
Dynegy Edwards
Cross-section I
Slope Stability - Steady State



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Name: Old Embankment 1 (Drained) Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
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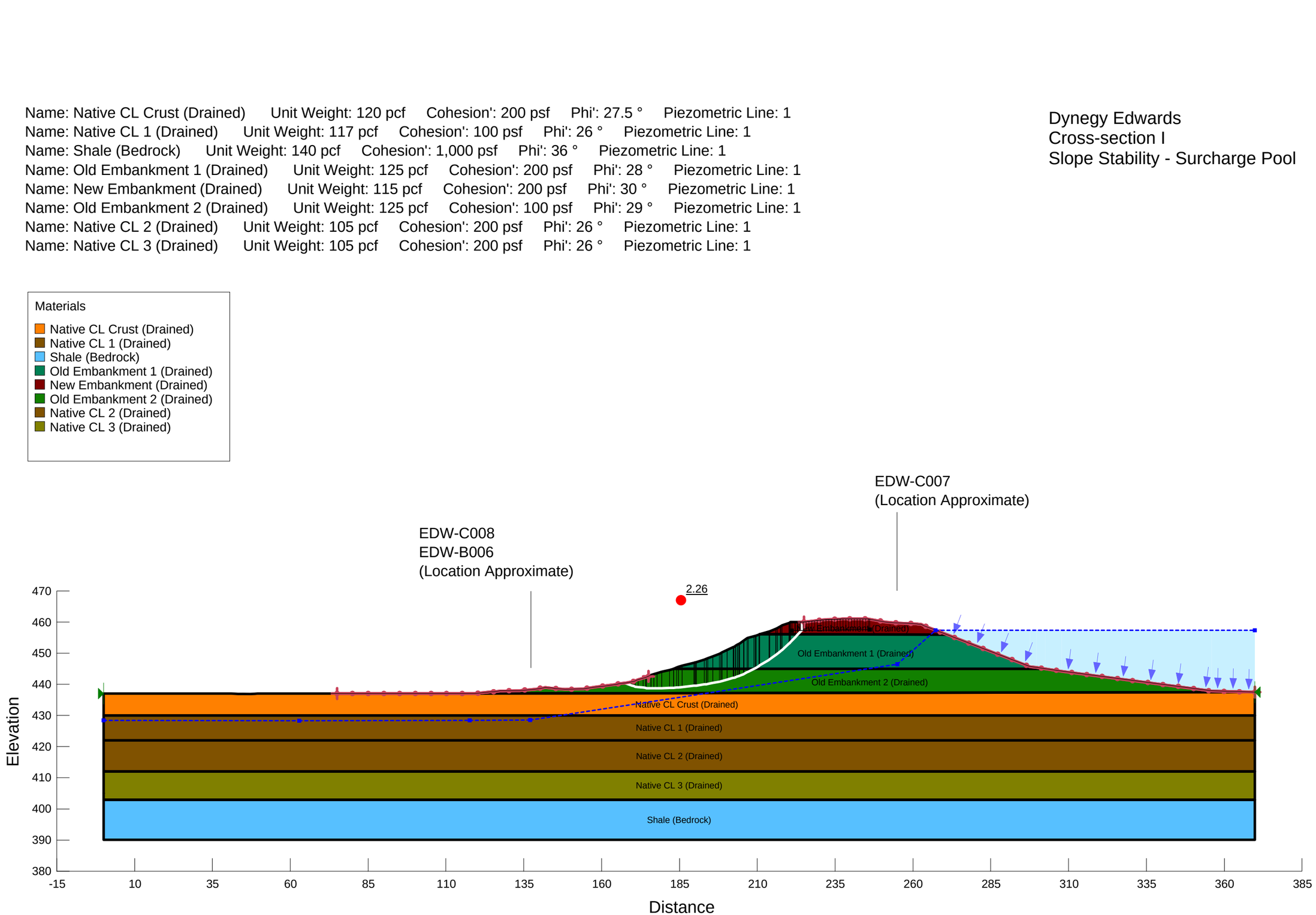
Name: Old Embankment 2 (Drained) Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1

Dynegy Edwards
Cross-section I
Slope Stability - Surcharge Pool

Materials
- Native CL Crust (Drained)
- Native CL 1 (Drained)
- Shale (Bedrock)
- Old Embankment 1 (Drained)
- New Embankment (Drained)
- Old Embankment 2 (Drained)
- Native CL 2 (Drained)
- Native CL 3 (Drained)



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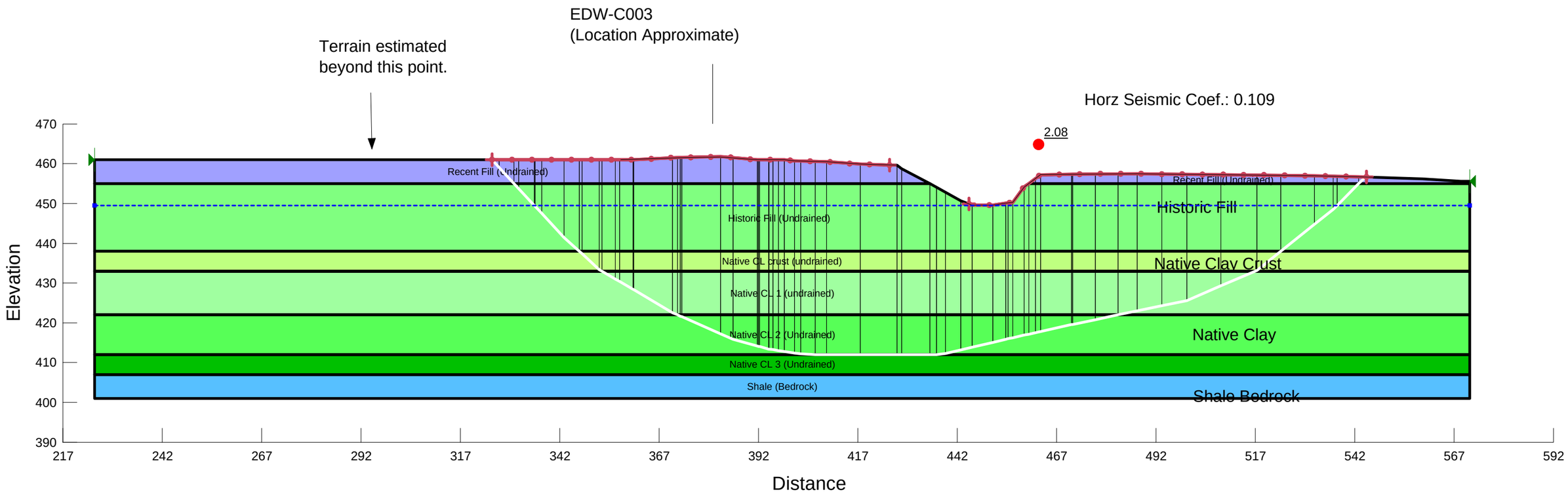
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL crust (undrained) Unit Weight: 120 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: Recent Fill (Undrained) Unit Weight: 115 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: Historic Fill (Undrained) Unit Weight: 125 pcf Cohesion': 1,000 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 105 pcf Cohesion': 700 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 3 (Undrained) Unit Weight: 105 pcf Cohesion': 900 psf Piezometric Line: 1

Dynegy Edwards
Cross-section J
Slope Stability - Seismic

Materials
- Shale (Bedrock)
- Native CL 1 (undrained)
- Native CL crust (undrained)
- Recent Fill (Undrained)
- Historic Fill (Undrained)
- Native CL 2 (Undrained)
- Native CL 3 (Undrained)



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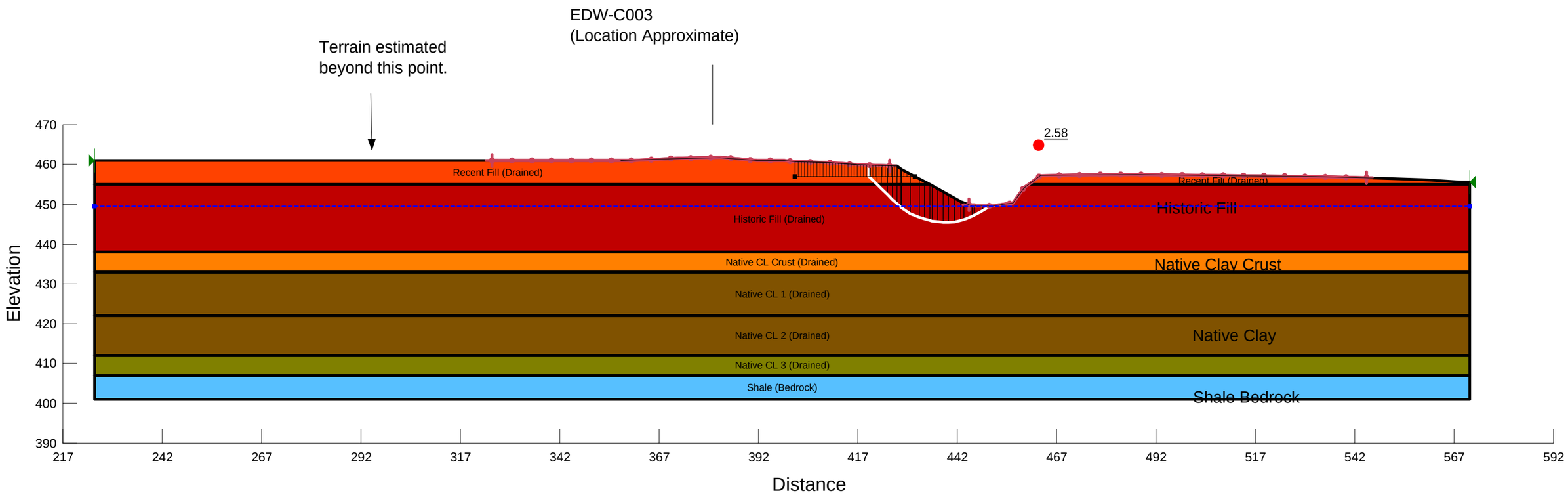
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Historic Fill (Drained) Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Recent Fill (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1

Dynegy Edwards
Cross-section J
Slope Stability - Steady-State

Materials
- Native CL Crust (Drained)
- Native CL 1 (Drained)
- Shale (Bedrock)
- Historic Fill (Drained)
- Recent Fill (Drained)
- Native CL 2 (Drained)
- Native CL 3 (Drained)



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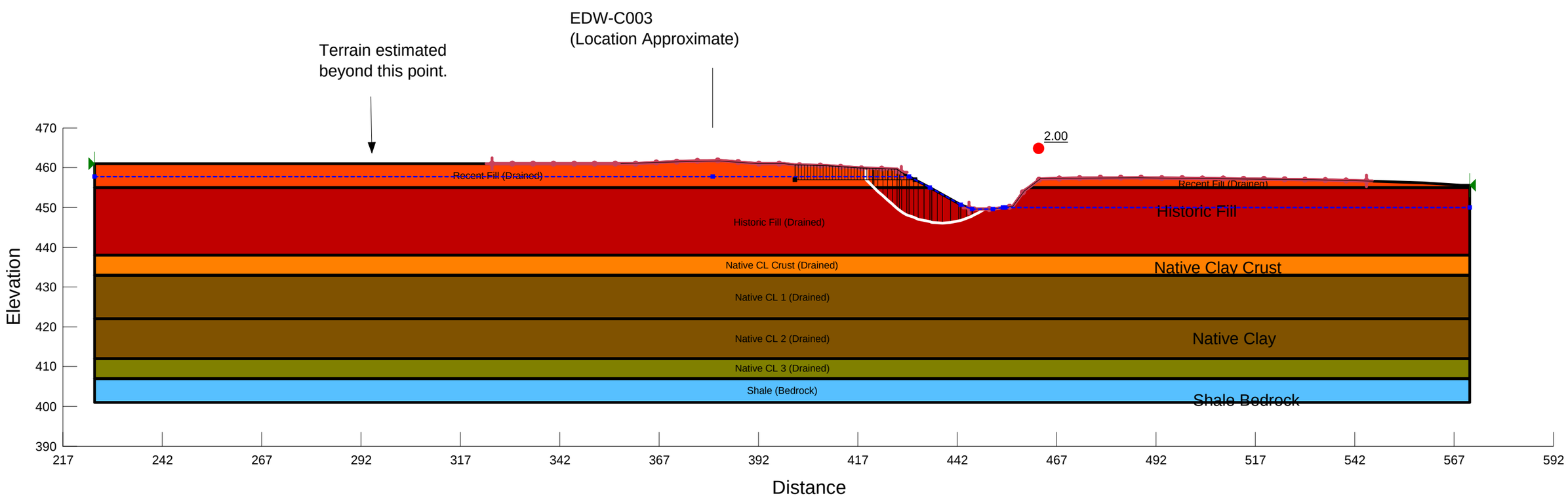
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Historic Fill (Drained) Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Recent Fill (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1

Dynegy Edwards
Cross-section J
Slope Stability - Surcharge Pool

Materials
- Native CL Crust (Drained)
- Native CL 1 (Drained)
- Shale (Bedrock)
- Historic Fill (Drained)
- Recent Fill (Drained)
- Native CL 2 (Drained)
- Native CL 3 (Drained)



Attachment G.2 Seismic Parameter Calculations

Calculation of K_h for Pseudostatic Analysis

Calc By:	AJW
Date:	2/15/2016

Objective: Estimate kh for pseudostatic analysis.

Given: Seismic Hazard Deaggregation with PGA_{BC} = 0.067, M=6.8
Site Class D, based on IBC (2008)
FPGA = 1.6, based on NEHRP (2009)
Holzer (1998) Figure for estimation of crest acceleration
Makdisi Seed (1978) Figure for Max Acc of Slide Mass

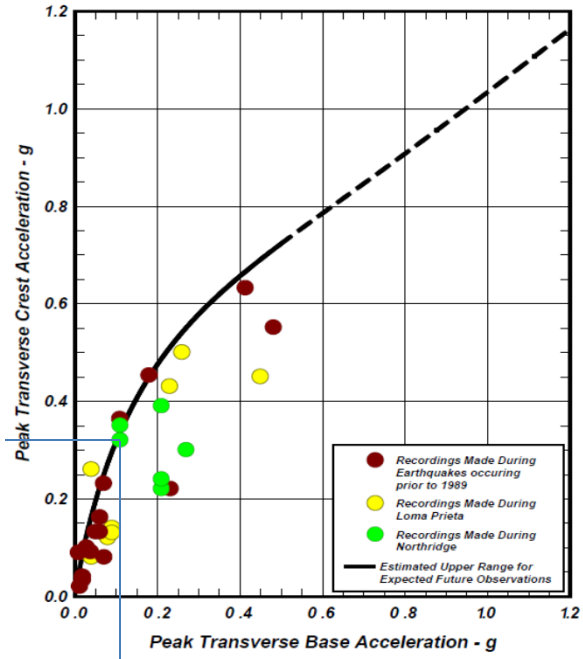


Figure 3. Variations of Recorded Peak Crest Accelerations versus those Recorded at the Base of Earth and Rock Fill Dams by Idriss (2015). Source of recorded values for Loma Prieta Earthquake and prior earthquakes: Holzer, (1998).

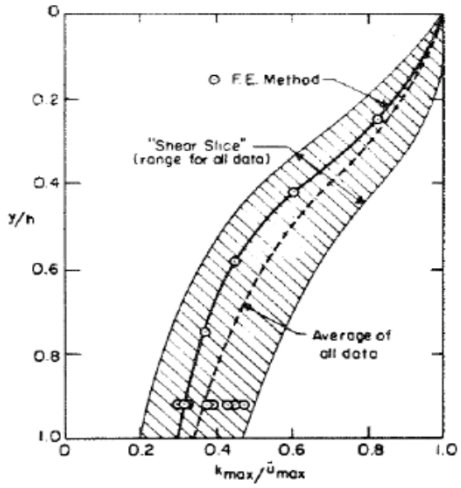


Figure 4. Variations of Maximum Acceleration Ratio with Depth of Sliding Mass (Makdisi and Seed, 1977). Maximum Acceleration Ratio is the Ratio between $(PGA)_{base\ of\ slide\ mass}$ and $(PGA)_{crest}$

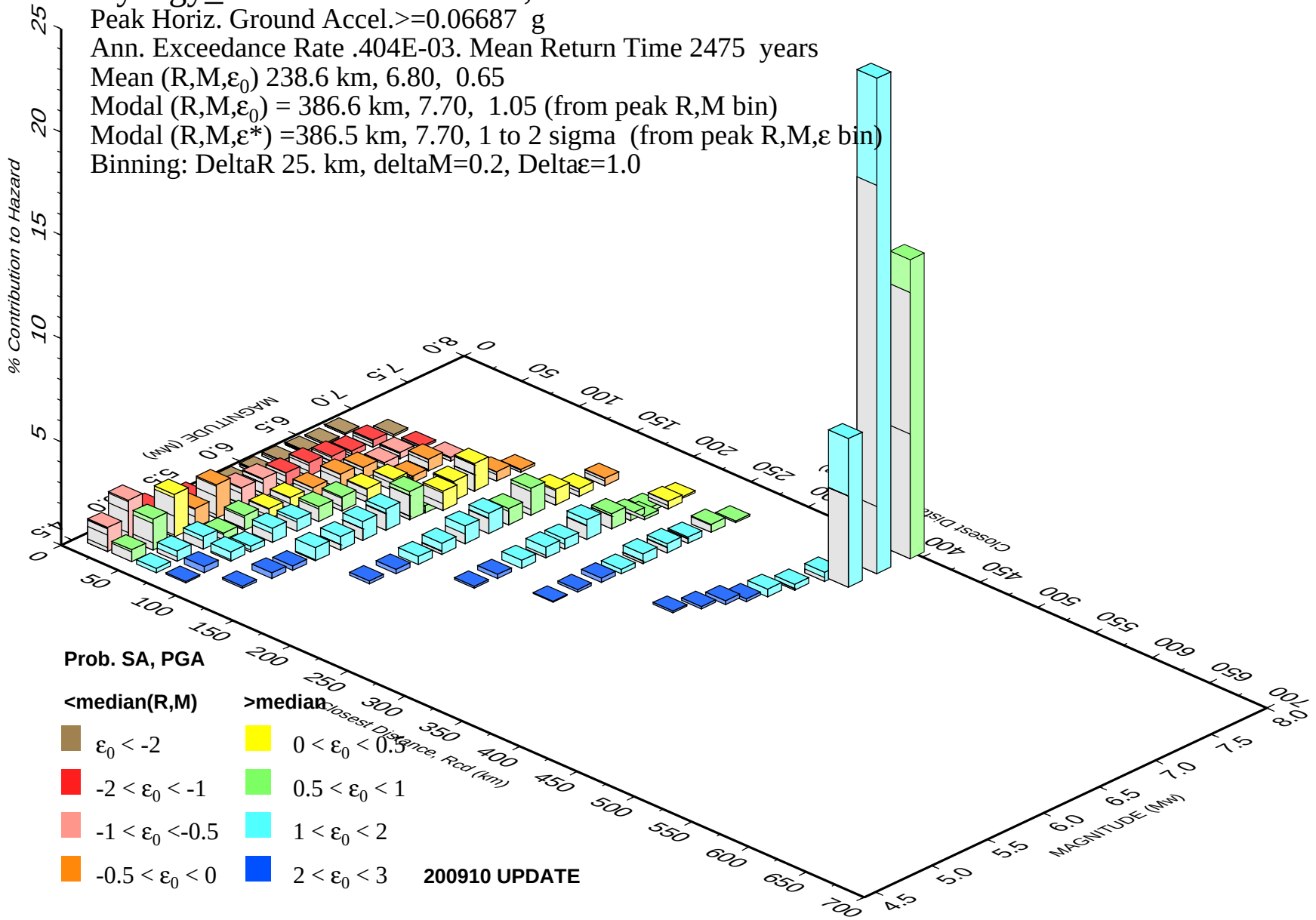
PGA_{BC}	Site class	F_{PGA}	PGA_{BASE}	PGA_{CREST}	Makdisi -Seed reduction for full height failure	k_h
0.06687	D	1.6	0.107	0.32	0.34	0.109

Results:

Use k_h = 0.109 for pseudostatic analyses.

PSH Deaggregation on NEHRP BC rock
Dynegy_Edwards 89.668º W, 40.593 N.

Peak Horiz. Ground Accel.>=0.06687 g
Ann. Exceedance Rate .404E-03. Mean Return Time 2475 years
Mean (R,M,ε_0) 238.6 km, 6.80, 0.65
Modal (R,M,ε_0) = 386.6 km, 7.70, 1.05 (from peak R,M bin)
Modal (R,M,ε*) =386.5 km, 7.70, 1 to 2 sigma (from peak R,M,ε bin)
Binning: DeltaR 25. km, deltaM=0.2, Deltaε=1.0



Appendix C. Hydrologic and Hydraulic Report

AECOM
1001 Highlands Plaza Drive West
Suite 300
St. Louis, MO 63110-1337
www.aecom.com

314.429.0100 tel
314.429.0462 fax

October 7, 2016

Mr. Matt Ballance, PE
Senior Project Engineer
Dynegy Inc.
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

RE: Hydrologic and Hydraulic Summary Report
Edwards Power Station
Ash Pond

Dear Mr. Ballance:

AECOM is pleased to provide this Summary Report of Hydrologic and Hydraulic Modeling for the Illinois Power Resources Generating, LLC (IPRG) Edwards Ash Pond Coal Combustion Residual (CCR) Unit. This analysis was performed to document that the facility meets the requirements of 40 CFR §257.82(a) with regard to the Inflow Design Flood Control Plan. Based on AECOM's analysis, the Ash Pond meets all hydraulic requirements for certification per 40 CFR §257.82(a).

AECOM looks forward to providing continued support to IPRG and working together on this important program. Please do not hesitate to call Ron Hager at 314-429-0100 (office) / 440-591-7868 (mobile), if you have any questions.

Sincerely,

AECOM

Jeremy Thomas, PE
Site Manager
jeremy.thomas@aecom.com

Ronald Hager
Program Manager
ronald.hager@aecom.com

cc: Mark Rokoff, PE – AECOM

Attachments:

A. Location Maps and Pertinent Drawings
B. Hydrologic and Hydraulic Analysis

1. INTRODUCTION

1.1. *Purpose of This Memorandum*

This report presents the results of the hydrologic and hydraulic analysis prepared by AECOM for the Illinois Power Resources Generating, LLC (IPRG)[1] Ash Pond Coal Combustion Residuals (CCR) unit at the Edwards Power Station, located near Bartonville, Illinois in Peoria County (See Attachment A for Location Map). This analysis was completed in accordance with the Environmental Protection Agency (EPA) 40 CFR Part §257, Subpart D, regulations for the disposal of CCR. As required by §257.82(a), by October 17, 2016 owners and operators of existing CCR surface impoundments must develop an Inflow Design Flood Control Plan that documents how the inflow design flood control system had been designed and constructed to meet the following requirements:

- *(40 CFR 257.82 (a)(1)* - The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood.

- *(40 CFR 257.82 (a)(2)* - The inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood.

The Ash Pond has a high hazard potential based on the initial hazard potential classification assessment performed by Stantec in 2016, in accordance with §257.73(a)(2). The “High Hazard” category indicates that the inflow design flood for risk analysis is the Probable Maximum Flood (PMF) flood event. Since the Ash Pond does not have an inflow watershed outside of precipitation that falls directly into the CCR Unit, the PMF corresponds to the probable maximum precipitation (PMP) rainfall event. This event is the basis for AECOM certification.

1.2. *Brief Description of Impoundments*

The Edwards Power Station is a coal-fired facility that sluices bottom ash, fly ash, boiler slag and plant process water into the Ash Pond. There are three separate sub-basins within the Ash Pond: the Process Water Pond (referred to the as the “Cooling Pond” in the attachments), the Fly Ash Pond, and the Clarification Pond. The first sub-basin is referred to as the Process Water Pond and is in the northwestern end of the Ash Pond. The plant operations sluice boiler slag into the Process Water Pond and flow is discharged downstream to the Clarification Pond through a 24 inch diameter corrugated metal pipe (CMP) culvert. The normal water surface elevation (WSE) in the Process Water Pond is elevation 449.5 feet which is the invert elevation of the outlet culvert pipe. The second sub-basin is the Fly Ash Pond. During normal plant operations both bottom ash and fly ash are sluiced into settling channels within the Fly Ash Pond. The settling channels discharge into the Clarification Pond through culvert pipes. However, during the design storm rainfall discharge through these channels greatly exceeds the capacity of the culvert pipes, and will likely overtop or wash out the small interior splitter

[1] Although the Edwards Power Station and Ash Pond are owned and operated by IPRG, Dynegy Administrative Services Company (*Dynegy*) contracted AECOM to develop this Hydrologic and Hydraulic Summary Report on behalf of IPRG. Therefore, “Dynegy” is references in materials attached to this hydrologic and hydraulic report.

dikes and discharge directly into the Clarification Pond. Therefore, the upstream storage potential of the channel was ignored and rainfall was modeled to discharge directly into the Clarification Pond. The third sub-basin is the Clarification Pond, which is located furthest downstream in the southern end of the Ash Pond. The clarified water is discharged from the Clarification Pond to the Illinois River through a 36 inch diameter CMP or reinforced concrete pipe (RCP) (material type has not been verified) vertical drop structure that leads to a nearly horizontal 36 inch CMP outfall pipe with a flap-gate back-flow preventer. This discharge is the site's NPDES-permitted outfall. The Clarification Pond normal WSE is 447.2 feet, which is the invert elevation of the outlet structure. The Location Map / Site Vicinity Map and Site Plan are included in Attachment A.

Elevations in this report are in feet and are referenced with respect to the North American Vertical Datum of 1988.

2. POND CAPACITY COMPUTATIONS

2.1. *Ash Pond*

Topographic and bathymetric surveys of the Ash Pond were performed by Maurer-Stutz in 2015 (Maurer-Stutz, 2015) supplemented with a 1/9 arc second Digital Elevation Model (DEM) obtained by AECOM from the U.S. Geologic Survey National Map website (http://nationalmap.gov). AECOM used this survey data to estimate storage capacity curves for the Ash Pond consisting of the Process Water Pond and the Clarification Pond impoundments using the conical basin volume equation in HydroCAD and are provided in in Attachment B. During the design storm event the peak discharge through the settling channels in the Fly Ash Pond portion of the Ash Pond greatly exceeds the hydraulic capacity of the culvert pipes connecting the channels to the Clarification Pond. The interior separation berms will likely overtop or washout, therefore, to be conservative the upstream storage capacity of the Fly Ash Pond was ignored and discharged directly into the Clarification Pond.

3. HYDROLOGIC AND HYDRAULIC ANALYSIS OF EDWARDS PONDS

3.1. *Rainfall Data*

The high hazard rainfall depths were selected using the National Weather Service – Hydrometerological Report No. 51 (HMR 51) for the 10-square mile all-season Probable Maximum Precipitation (PMP). The 24-hour PMP rainfall total is 32.8 inches. The HMR 51 figures are included in Attachment B.

3.2. *Runoff Computations*

The HydroCAD Version 10.0 computer model, by HydroCAD Software Solutions, LLC, was used to model the Ash Pond collection and control system, for the runoff calculations, and storage and discharge structure evaluations. The model evaluated pond capacities, hydraulics of the ponds considering details of the between-pond discharge structures, and the final outlet structure during peak discharges.

3.3. *Illinois River Tailwater*

The Ash Pond discharges to the Illinois River and therefore the pool level in the Illinois River may affect the corresponding pool level in the Ash Pond. The historic high water elevation in the Illinois River was obtained from NOAA website for the Illinois River

gage at Peoria Lock and Dam. The historic high water elevation in the Illinois River is 456.7 feet. It is assumed that during the design storm event that the outlet pipe into the Illinois River will be completely submerged and no flow would be discharged from the Ash Pond. This is because the flap-gate structure on the end of the pipe is not expected to be opened based on the flood in the upstream Ash Pond, which is within 3 feet of the flood elevation in the Illinois River. Therefore, it is unlikely to cause the flap gate to open significantly.

Please refer to Attachment B for further details and modeling results.

4. CONCLUSIONS

- The inflow design flood control system of the Edwards Ash Pond adequately manages flow into and out of the Ash Pond during and following the peak discharge of the PMP storm event inflow design flood. Results of the model are summarized in Table 4.1. The Edwards Ash Pond meets the §257.82(a) requirements for certification.

Table 4.1
Edwards Summary of Hydrologic and Hydraulic Analysis, 24-hour PMP Storm

CCR Unit	Beginning WSE[1] (ft)	Peak WSE (ft)	Crest Elevation (ft)
Ash Pond - Process Water Pond Area	449.5	457.8	458.8
Ash Pond - Clarification Pond Area	447.2	457.4	459.6

Notes:
[1] WSE = Water Surface Elevation

5. LIMITATIONS

Background information, design basis, and other data, which AECOM has used in preparing this report have been furnished to AECOM by IPRG. AECOM has relied on this information as furnished, and is not responsible for the accuracy of this information. Our recommendations are based on available information from previous and current investigations. These recommendations may be updated as future investigations are performed.

The conclusions presented in this report are intended only for the purpose, site location, and project indicated. The recommendations presented in this report should not be used for other projects or purposes. Conclusions or recommendations made from these data by others are their responsibility. The conclusions and recommendations are based on AECOM's understanding of current plant operations, maintenance, stormwater handling, and ash handling procedures at the station, as provided by IPRG. Changes in any of these operations or procedures may invalidate the findings in this report until AECOM has had the opportunity to review the changes, and revise the report if necessary.

This hydrologic and hydraulic analysis was performed in accordance with the standard of care commonly used as state-of-practice in our profession. Specifically, our services have been performed in accordance with accepted principles and practices of the engineering profession. The conclusions presented in this report are professional

opinions based on the indicated project criteria and data available at the time this report was prepared. Our services were provided in a manner consistent with the level of care and skill ordinarily exercised by other professional consultants under similar circumstances. No other representation is intended.

6. REFERENCES

1. Kleinfelder Engineers, 2011. Coal Ash Impoundment Site Assessment Final Report – E.D. Edwards Power Generating Station, May 10, 2011
2. Maurer-Stutz, 2015. Topographical and Bathymetric Survey, Edwards Ash Pond, Performed in June and July 2015.

Attachment A

A1 – Location Map and Site Vicinity Map
A2 – Site Map

BRAND, TRAVIS, 2/22/2016 11:05 AM
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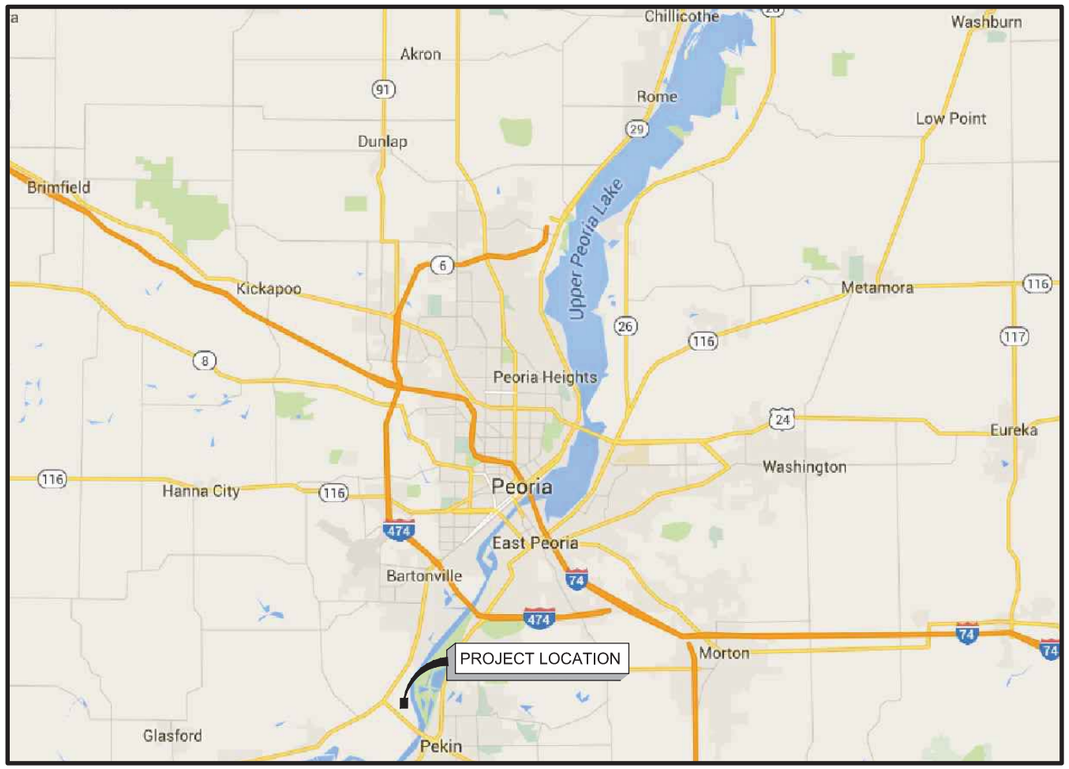

LOCATION MAP
NOT TO SCALE



VICINITY MAP
NOT TO SCALE

AERIAL FROM GOOGLE EARTH PRO
MAP FROM GOOGLE

AECOM
558 N Main Street
Oshkosh, Wisconsin
920 235-0270 (phone)
920 235-0321 (fax)

DYNEGY
Dynegy Inc.
1500 East Port Plaza Drive
Collinsville, IL 62234

CCR RULE ASSESSMENT
OF PLANTS

EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

H&H REPORT
ASH POND

ISSUED FOR BIDDING DATE BY

ISSUED FOR CONSTRUCTION DATE BY

REVISIONS

NO.	DESCRIPTION	DATE
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DRAWN BY:	TPB
DESIGNED BY:	_
CHECKED BY:	_
DATE CREATED:	2/17/2016
PLOT DATE:	2/17/2016
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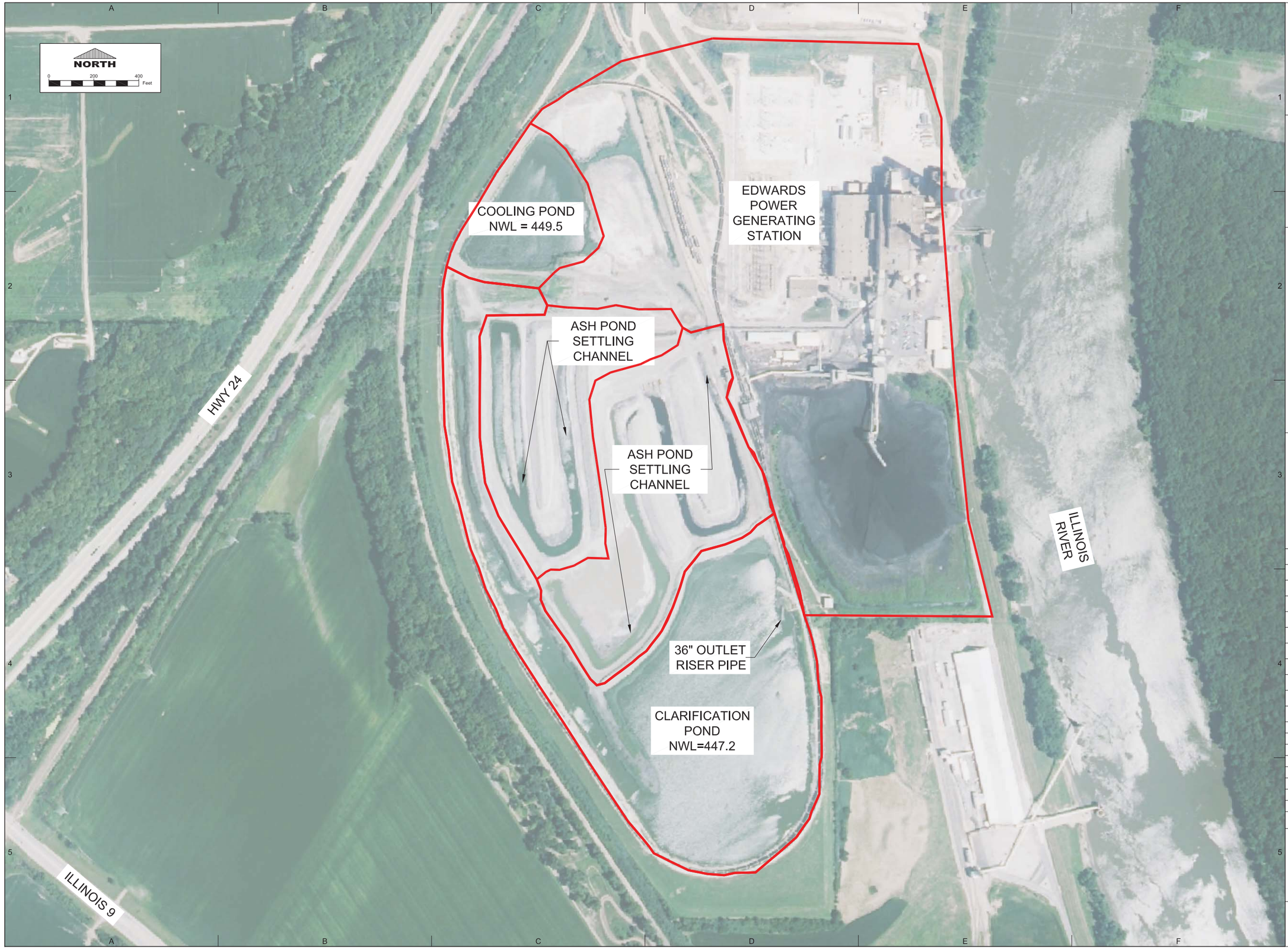
ACAD VER:	2014

SHEET TITLE

LOCATION MAP AND
SITE VICINITY MAP

ATTACHMENT A-1



AECOM
558 N Main Street
Oshkosh, Wisconsin
920 235-0270 (phone)
920 235-0321 (fax)

DYNEGY
Dynegy Inc.
1500 East Port Plaza Drive
Collinsville, IL 62234

CCR RULE ASSESSMENT
OF PLANTS

EDWARDS POWER PLANT
BARTONVILLE, ILLINOIS

H&H
REPORT
ASH POND

ISSUED FOR BIDDING — DATE BY

ISSUED FOR CONSTRUCTION — DATE BY

REVISIONS

NO.	DESCRIPTION	DATE
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DESIGNED BY:	
CHECKED BY:	
DATE CREATED:	2/25/2016
PLOT DATE:	2/25/2016
SCALE:	AS SHOWN
ACAD VER:	2014

SHEET TITLE

SITE MAP

ATTACHMENT A-2

Attachment B

Hydrologic and Hydraulic Analysis

Objective: **This analysis describes the independent investigation and design calculations and considerations of the on-site hydrology and hydraulics as required by the Environmental Protection Agency's (EPA's) Final Coal Combustion Residuals (CCR) Rule. In particular, the analysis investigates the performance of the existing spillways and outlet structures for the Edwards Ash Pond during the probable maximum precipitation (PMP) storm event as required by the EPA's CCR Rule. AECOM evaluated how the onsite hydraulics will be affected by the existing conditions of the Ash Pond. In addition, the analyses evaluate how large flows from off-site affect the station's operations.**

- **Overview**

The Ash Pond has three pond areas that collect and route water within the impoundment; the Process Water Pond located on the north end of the Ash Pond and the Clarification Pond located on the south end of the Ash Pond. In addition the central portion of the Ash Pond, known as the Fly Ash Pond, is filled with CCR material and contains two drainage channels which convey water to the Clarification Pond. During the design storm event the discharge from the channels greatly exceeds the hydraulic capacity of the culvert pipes, therefore, the potential storage area in the channels was ignored and rainfall within the Fly Ash Pond area was modeled to directly discharge into the Clarification Pond.

Process Water Pond

The Process Water Pond receives plant process water flow of 8 cubic feet per second (cfs), based on information provided by Dynegy, and discharges to the Clarification Pond through a 24-inch CMP culvert. The normal water surface elevation (WSE) of the Process Water Pond is 449.5 feet as listed in the Kleinfelder Site Assessment Final Report dated May 10, 2011.

Clarification Pond

The Clarification Pond receives flows from the Process Water Pond as well as the two channels in the central area of the Ash Pond. The Clarification Pond discharges to the Illinois River through a 36-inch corrugated metal pipe (CMP) vertical drop structure with a back-flow preventer. The normal WSE of the Clarification Pond is 447.2 feet as listed in the Kleinfelder Site Assessment Final Report dated May 10, 2011. The pool level in the Ash Pond sub-basins is not listed in the 2015 Maurer-Stutz survey.

- **Selected Methods:**

AECOM developed a hydrologic model for the ash ponds using HydroCAD-10 modeling software. Development of the model includes the most recent and available information that best represent the existing conditions at the site. 2015 survey data from Maurer-Stutz supplemented with survey data from the U.S. Geologic Survey National Map website in areas outside of the extents of the Maurer-Stutz survey was also used in developing the model. Site

soil characteristics from NRCS were used to input hydrologic parameters. Curve numbers were assigned based on soil and land use data. Times of concentrations were calculated in the model based on the longest hydraulic flow path for each sub-catchment. Additional elevations from drawings and current NPDES permitted outflows were used to generate the existing model. Flows entering the ponds were modeled according to AECOM's best estimation of current conditions in the Ash Pond and plant operations.

All storm calculations are to include the assumption that the tailwater conditions in the Illinois River during PMP flood are at elevation 456.7 feet, the historical high water elevation; the outlet pipe from the Ash Pond would be completely submerged and no flow would be discharged from the Ash Pond during the PMP storm event due to the flap-gate back-flow preventer in the outlet pipe, which is unlikely to be opened during the PMP IDF due to the nominal head difference between the pool level in the Illinois River and the East Ash Pond.

- **Data & Assumptions**

Watershed Area

The Edwards Ash Pond watershed is separated by the perimeter dike system that surrounds the site. The watershed delineation was performed using topographic survey provided by Dynegy, and supplemented with a 1/9 arc second Digital Elevation Model (DEM) obtained by AECOM from the U.S. Geologic Survey National Map website (http://nationalmap.gov). The watershed delineation is provided in **Appendix A**. The Ash Pond watershed was sub divided into four Sub-Watersheds to describe the total watershed. The watersheds include the Process Water Pond Watershed draining via overland flow and storm sewer networks, the North and South Ash Pond watersheds draining via the settling channels to the Clarification Pond, and the direct runoff into the Clarification Pond. The sub-watersheds are summarized in Table 1 below.

Table 1 Summary of Sub-Watersheds

Sub-Watershed	Area (acres)	Area (square miles)	Drainage Path Description
Process Water Pond	34.0	0.053	Site Runoff to Process Water Pond, including switch yard, warehouse, and parking areas.
North Ash Pond	14.7	0.023	Runoff to the Clarification Pond through the Settling Channel
South Ash Pond	19.4	0.030	Runoff to the Clarification Pond through the Settling Channel
Clarification Pond	35.8	0.056	Direct Runoff to Clarification Pond
Total:	**103.9**	**0.162**	-

Rainfall Depths

The 24-hour PMP storm was evaluated to meet the CCR Rule. The National Weather Service – Hydrometeorological Report No. 51 (HMR 51) was used to obtain the design storm depth of 32.8 inches for the Edwards Power Station. The data obtained from HMR 51 is presented in **Appendix B.**

Loss Rates

The runoff loss rates are dependent upon land use, hydrologic soil groups, and antecedent moisture conditions. The land use at the project site includes reservoirs, gravel roads and industrial. The underlying soil at the project site is a combination of urban land, orthents, and silty loams based on the Natural Resources Conservation Service (NRCS) Web Soil Survey with a hydrologic soil group of predominately Group C. Group C infiltration rates are estimated to be between 0 to 0.05 in. per hour. An Antecedent Moisture Condition (AMC) of II was used to describe average moisture condition before the storm events. The Web Soil Survey Report is included in **Appendix C**. These factors were combined to estimate a SCS Runoff Curve Number (RCN). A high RCN indicates low infiltration rates with greater runoff volumes, while a low RCN indicates high infiltration rates with lesser runoff volumes. For this analysis, a RCN of 96 was selected for gravel surfaces, 91 for industrial areas and 98 for water surfaces. Calculations for the weighted runoff curve numbers for each sub-watershed were performed in HydroCAD and are included in **Appendix F**.

Unit Hydrograph Methods

A NCRS TR-60 PMP, 24-hour rainfall distribution was applied to the PMP/24 hour storm of 32.8 inches.

Plant Operations and Base-Flow

Plant operation base-flows include approximately 5.16 million gallons per day (MGD). These base flows were taken from the NPDES permit Renewal Application Dated July 23, 2010. The plant base-flows were added to the inflow into the Clarification Pond during and after the IDF.

- **Results**

Flood Stage Hydraulic Analysis Results Summary

Tables 2 and 3 below give details of the maximum pond water surface elevation for the design storm, and inflow and discharge rates for the 24-hour PMP storm event.

Table 2 – Ash Pond - Process Water Pond Area Routing Summary – 24-hour PMP

Storm Event	Rainfall Depth (inches)	Peak IDF Inflow (cfs)	Inflow Design Flood Pool (feet)	Outflow (cfs)
PMP, 24-hour	32.8	149	457.8	44

Table 3 – Ash Pond - Clarification Pond Area Routing Summary – 24-hour PMP

Storm Event	Rainfall Depth (inches)	Peak IDF Inflow (cfs)	Inflow Design Flood Pool (feet)	Outflow (cfs)
PMP, 24-hour	32.8	338	457.4	0

- **Conclusions**

Based on the HydroCAD model results, the Ash Pond does not overtop its crest during the 24-hour PMP storm event. Nearby off-site drainage does not enter the Ash Pond through culverts or overtopping of the outside berms. Therefore, the Edwards Power Station Ash Pond meets the hydrologic and hydraulic requirements for certification under CCR regulations.

- **List of Appendices**

Appendix A – HydroCAD Model Schematic

Appendix B – High Hazard PMP Rainfall Depths (HMR 51)

Appendix C – NRCS Soil Survey

Appendix D – FEMA Flood Insurance Rate Map

Appendix E – NOAA Illinois River Gage at Peoria Lock and Dam

Appendix F – PMP/24-hour storm HydroCAD Output

Appendix A

HydroCAD Model Schematic



AECOM
558 N Main Street
Oshkosh, Wisconsin
920 235-0270 (phone)
920 235-0321 (fax)

DYNEGY
Dynegy Inc.
1500 East Port Plaza Drive
Collinsville, IL 62234

CCR RULE ASSESSMENT OF PLANTS

EDWARDS POWER PLANT BARTONVILLE, ILLINOIS

H&H REPORT ASH POND

ISSUED FOR BIDDING — DATE BY

ISSUED FOR CONSTRUCTION — DATE BY

REVISIONS

NO.	DESCRIPTION	DATE
△		
△		
△		
△		
△		

AECOM PROJECT NO:	60440202
DRAWN BY:	
DESIGNED BY:	
CHECKED BY:	
DATE CREATED:	2/25/2016
PLOT DATE:	2/25/2016
SCALE:	AS SHOWN
ACAD VER:	2014

SHEET TITLE

HYDROCAD MODEL SCHEMATIC

ATTACHMENT C-1

Appendix B

High Hazard PMP Rainfall Depths (HMR 51)

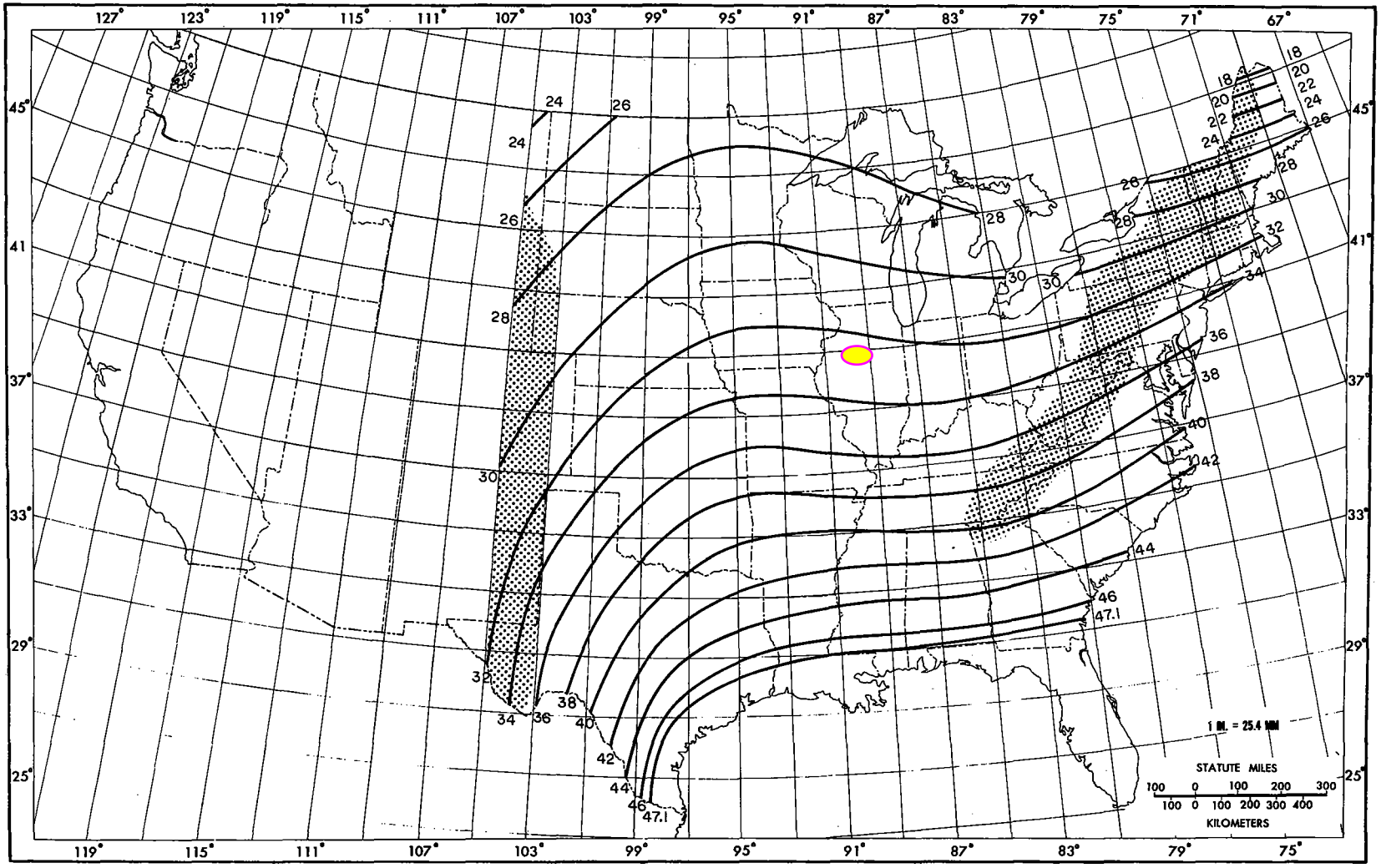
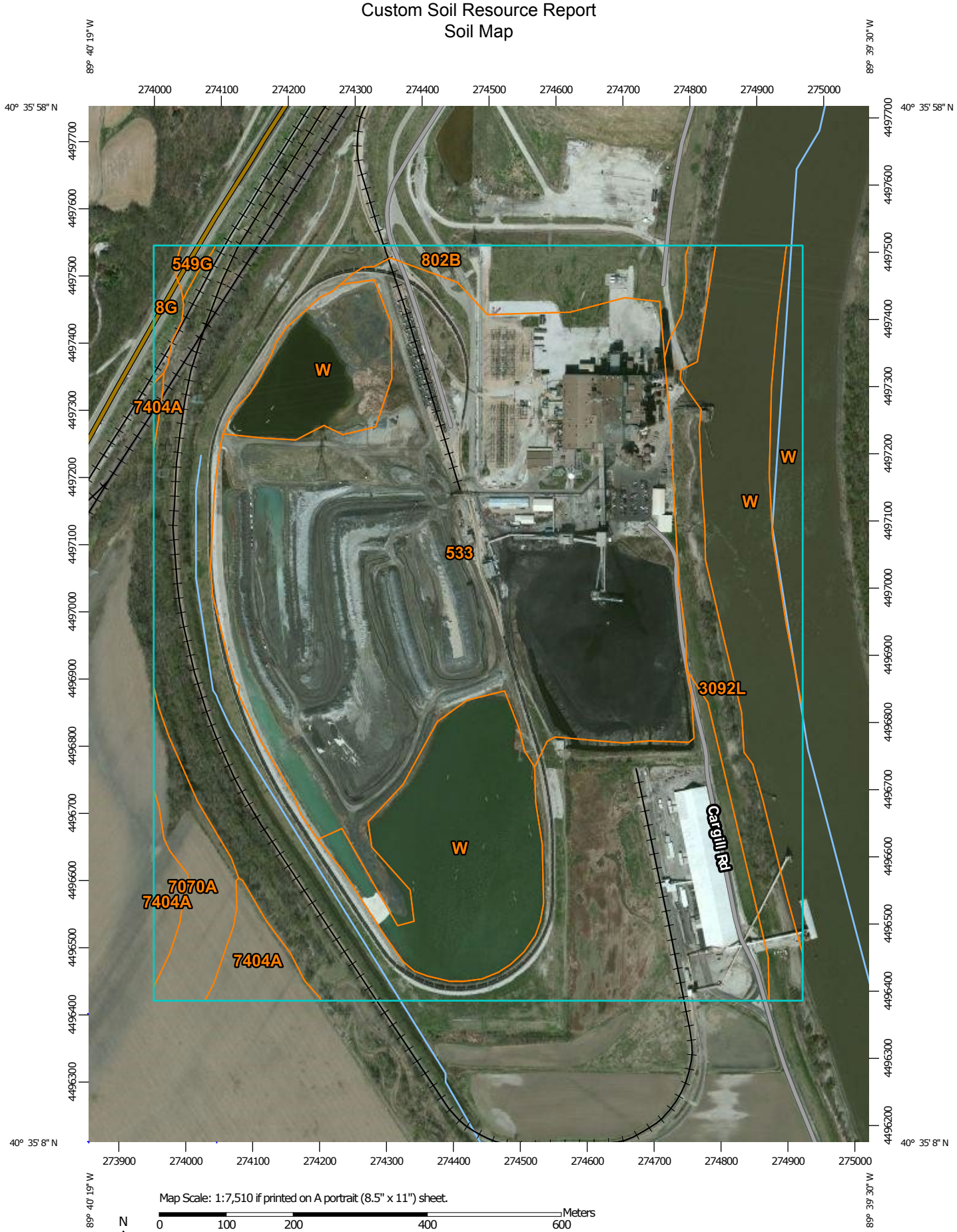


Figure 20.--All-season PMP (in.) for 24 hr 10 mi^2 (26 km^2).

Appendix C

NRCS Soil Survey

Custom Soil Resource Report
Soil Map



Map Scale: 1:7,510 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 100 200 400 600

Feet
0 350 700 1400 2100

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Peoria County, Illinois
Survey Area Data: Version 10, Sep 25, 2015

Soil Survey Area: Tazewell County, Illinois
Survey Area Data: Version 9, Sep 25, 2015

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Peoria County, Illinois (IL143)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
8G	Hickory silt loam, 35 to 60 percent slopes	1.6	0.6%
533	Urban land	104.3	38.6%
549G	Marseilles silt loam, 35 to 60 percent slopes	0.6	0.2%
802B	Orthents, loamy, undulating	79.3	29.3%
3092L	Sarpy loamy fine sand, 0 to 2 percent slopes, frequently flooded, long duration	12.8	4.7%
7070A	Beaucoup silty clay loam, 0 to 2 percent slopes, rarely flooded	7.1	2.6%
7404A	Titus silty clay, 0 to 2 percent slopes, rarely flooded	5.7	2.1%
W	Water	52.9	19.6%
Subtotals for Soil Survey Area		**264.3**	**97.8%**
Totals for Area of Interest		**270.4**	**100.0%**

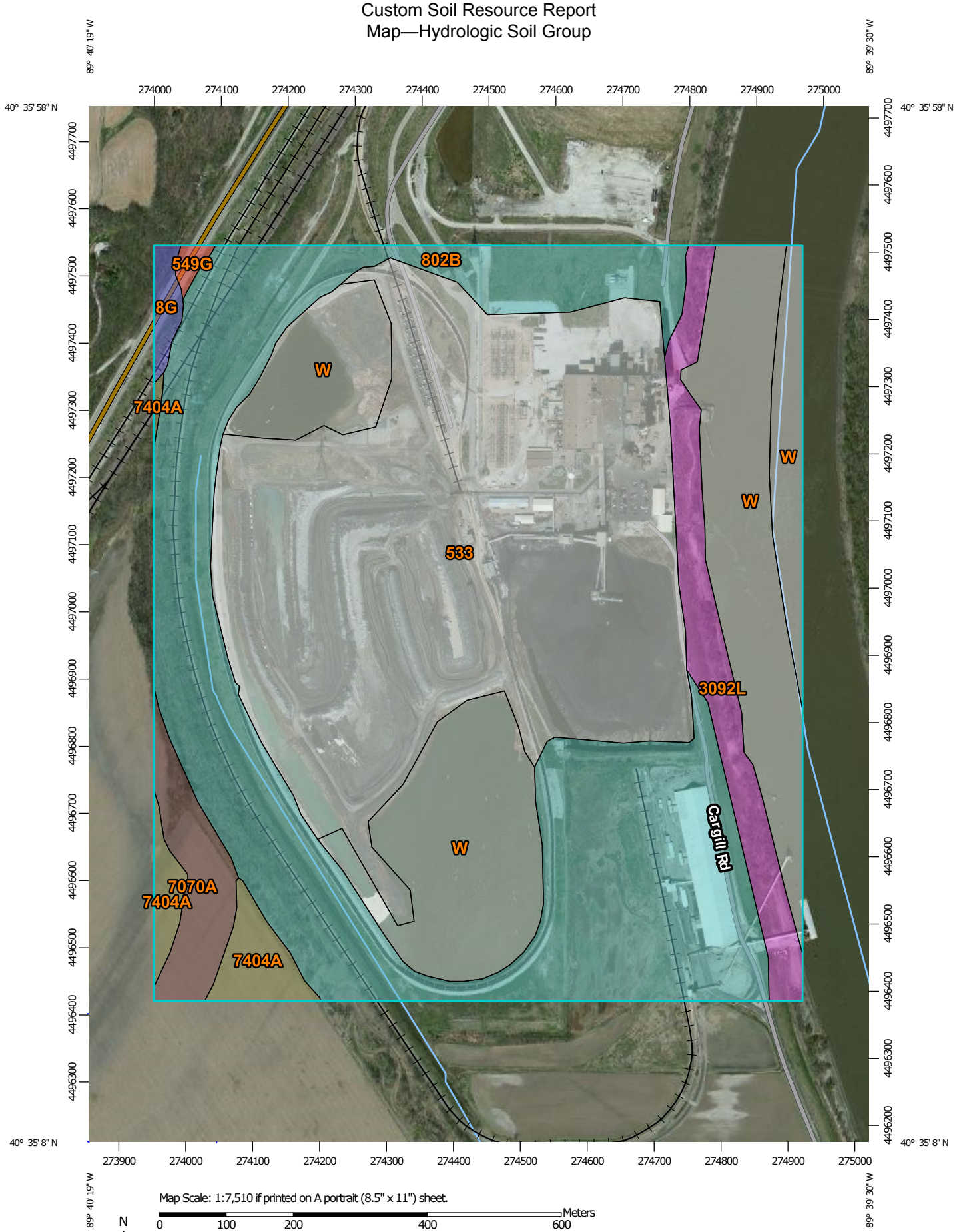
Tazewell County, Illinois (IL179)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
W	Water	6.1	2.2%
Subtotals for Soil Survey Area		**6.1**	**2.2%**
Totals for Area of Interest		**270.4**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Custom Soil Resource Report
Map—Hydrologic Soil Group



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Peoria County, Illinois
Survey Area Data: Version 10, Sep 25, 2015

Soil Survey Area: Tazewell County, Illinois
Survey Area Data: Version 9, Sep 25, 2015

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Data not available.

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Peoria County, Illinois (IL143)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
8G	Hickory silt loam, 35 to 60 percent slopes	B	1.6	0.6%
533	Urban land		104.3	38.6%
549G	Marseilles silt loam, 35 to 60 percent slopes	D	0.6	0.2%
802B	Orthents, loamy, undulating	C	79.3	29.3%
3092L	Sarpy loamy fine sand, 0 to 2 percent slopes, frequently flooded, long duration	A	12.8	4.7%
7070A	Beaucoup silty clay loam, 0 to 2 percent slopes, rarely flooded	B/D	7.1	2.6%
7404A	Titus silty clay, 0 to 2 percent slopes, rarely flooded	C/D	5.7	2.1%
W	Water		52.9	19.6%
Subtotals for Soil Survey Area			**264.3**	**97.8%**
Totals for Area of Interest			**270.4**	**100.0%**

Hydrologic Soil Group— Summary by Map Unit — Tazewell County, Illinois (IL179)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
W	Water		6.1	2.2%
Subtotals for Soil Survey Area			**6.1**	**2.2%**
Totals for Area of Interest			**270.4**	**100.0%**

Rating Options—Hydrologic Soil Group

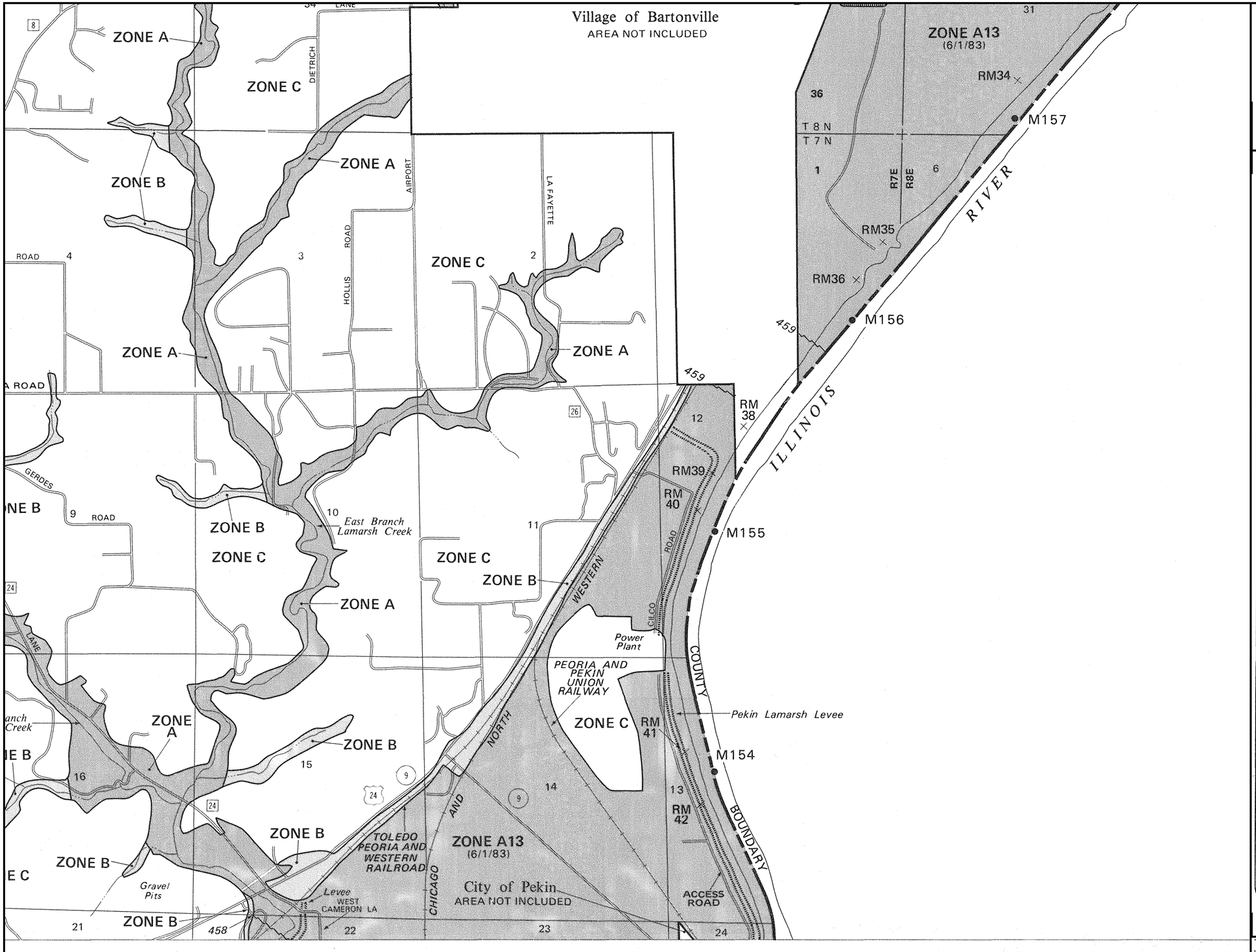
Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix D

FEMA Flood Insurance Rate Map



APPROXIMATE SCALE

2000 0 2000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

COUNTY OF
PEORIA,
ILLINOIS
(UNINCORPORATED AREAS)

PANEL 175 OF 200

COMMUNITY-PANEL NUMBER
170533 0175 B

MAP REVISED:
JUNE 1, 1983

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Appendix E

NOAA Illinois River Gage at Peoria Lock and Dam

Illinois River At Peoria Lock and Dam (PRAI2)

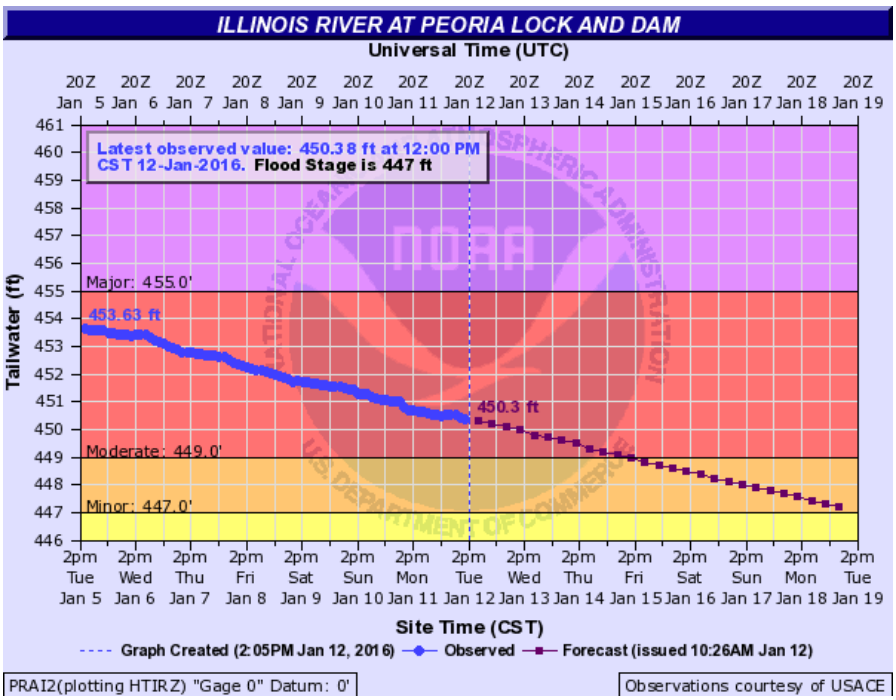
Return to Top

NOTE: River forecasts for this location take into account past precipitation and the precipitation amounts expected approximately 48 hours into the future from the forecast issuance time.

Flood Stage: 447 Feet Latest Stage: 450.38

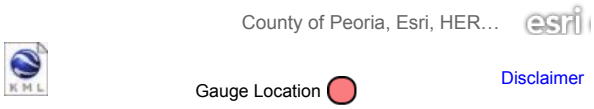
Current Warnings/Statements/Advisories: None currently.

Complete information about the Illinois River at Peoria Lock and Dam available from NWS Lincoln, IL





Switch Basemap



Disclaimer

Latitude/Longitude Disclaimer: The gauge location shown in the above map is the approximate location based on the latitude/longitude coordinates provided to the NWS by the gauge owner.

Flood Categories (in feet)	
Major Flood Stage:	455
Moderate Flood Stage:	449
Flood Stage:	447
Action Stage:	444

Historic Crests

(1) 456.57 ft on 04/24/2013
(2) 455.90 ft on 05/24/1943
(3) 455.80 ft on 03/23/1979
(4) 455.60 ft on 03/08/1985
(5) 454.65 ft on 06/30/2015 **(P)**

Show More Historic Crests

(P): Preliminary values subject to further review.

Recent Crests

(1) 454.13 ft on 01/03/2016 **(P)**
(2) 454.65 ft on 06/30/2015 **(P)**
(3) 456.57 ft on 04/24/2013
(4) 454.30 ft on 09/19/2008
(5) 454.20 ft on 03/03/1997

Show More Recent Crests

(P): Preliminary values subject to further review.

Collaborative Agencies

Collapse

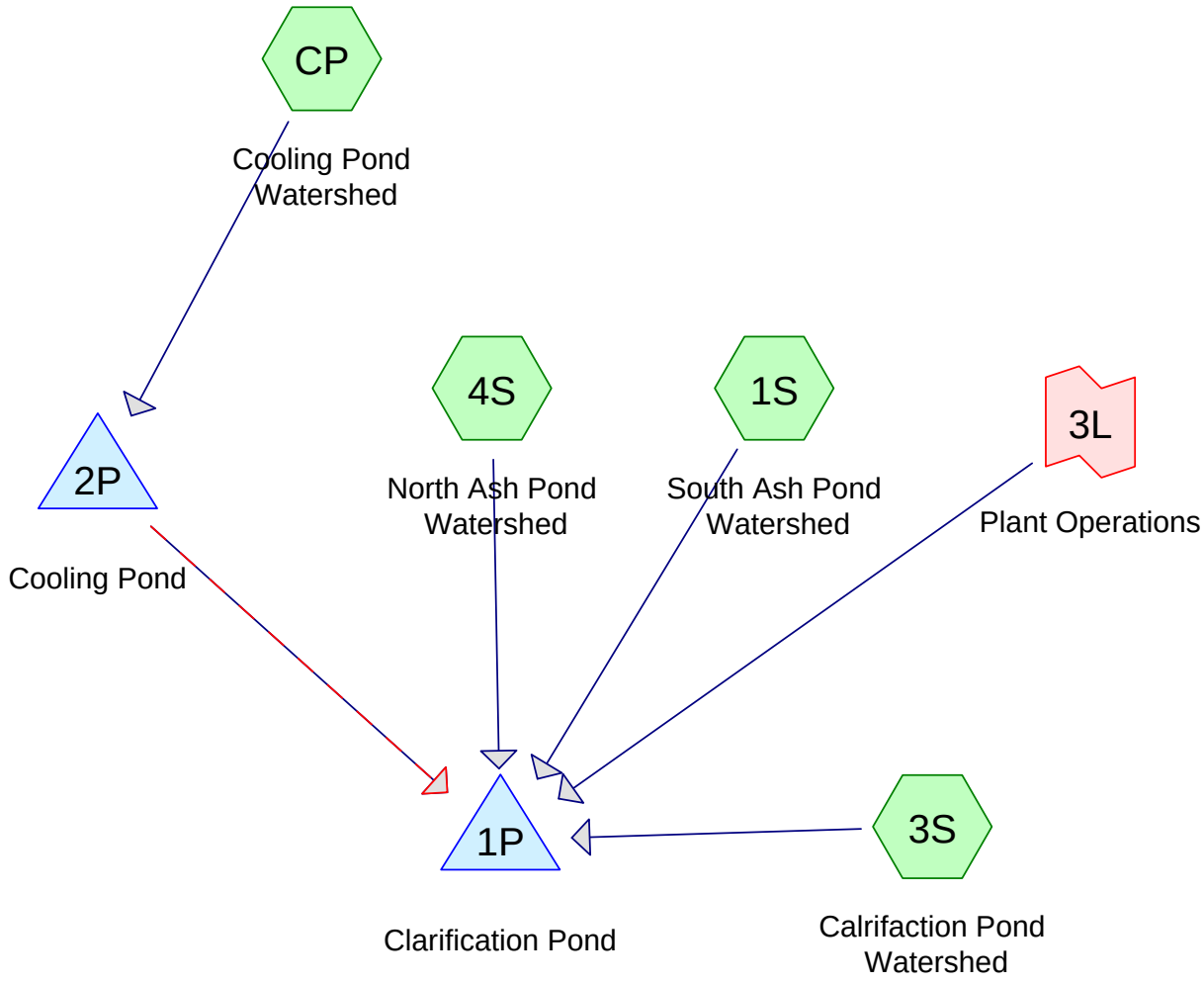
The National Weather Service prepares its forecasts and other services in collaboration with agencies like the US Geological Survey, US Bureau of Reclamation, US Army Corps of Engineers, Natural Resource Conservation Service, National Park Service, ALERT Users Group, Bureau of Indian Affairs, and many state and local emergency managers across the country. For details, please click here.

NWS Information

National Weather Service
Lincoln Weather Forecast Office
1362 State Route 10
Lincoln, IL 62656
(217) 732-3089
Ask Questions/Webmaster
Page last modified: 16-Nov-2015 1:20 PM

Appendix F

PMP/24-hour Storm HydroCAD Output



Subcat Reach Pond Link

Routing Diagram for Edwards_IDF
Prepared by AECOM, Printed 9/21/2016
HydroCAD® 10.00-14 s/n 04260 © 2015 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
15.600	96	Gravel surface, HSG C (CP)
49.300	91	Urban industrial, 72% imp, HSG C (1S, 3S, 4S, CP)
39.000	98	Water Surface, HSG C (1S, 3S, 4S, CP)

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
103.900	HSG C	1S, 3S, 4S, CP
0.000	HSG D	
0.000	Other	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1P	434.00	432.00	1,090.5	0.0018	0.011	36.0	0.0	0.0
2	2P	449.50	449.40	80.0	0.0013	0.025	24.0	0.0	0.0

Summary for Subcatchment 1S: South Ash Pond Watershed

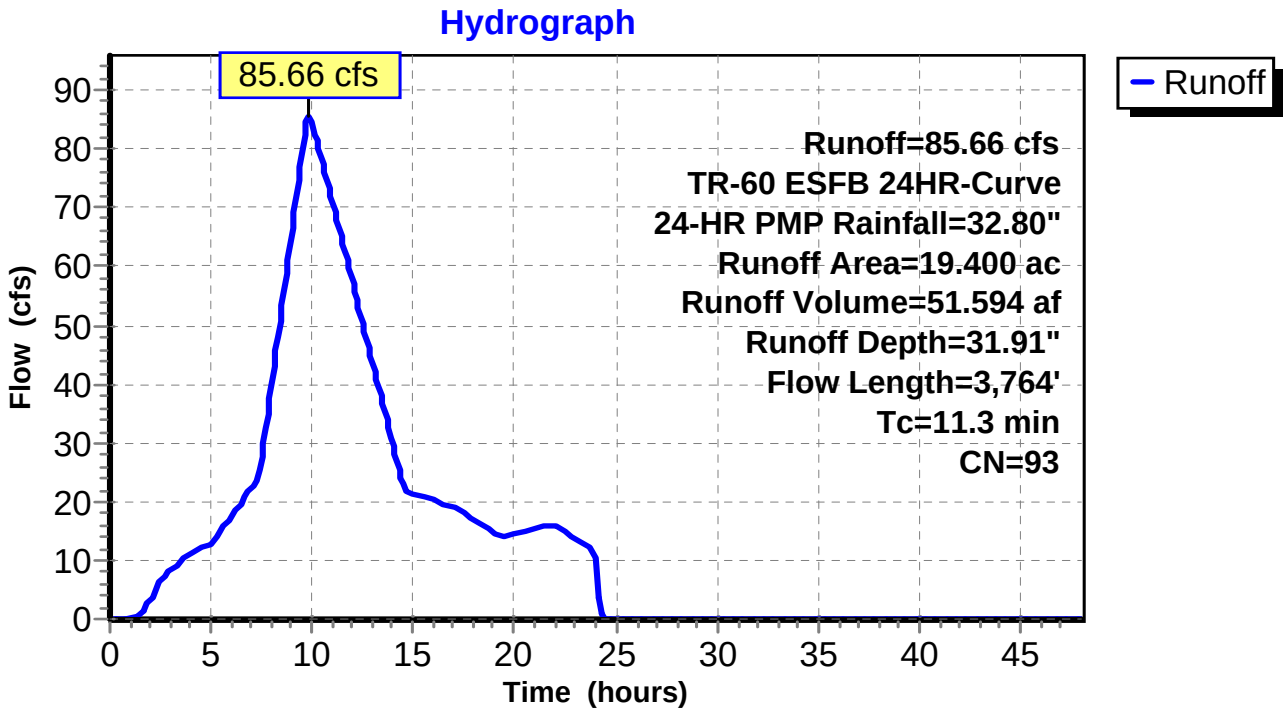
Runoff = 85.66 cfs @ 9.809 hrs, Volume= 51.594 af, Depth=31.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.000-48.000 hrs, dt= 0.100 hrs
TR-60 ESFB 24HR-Curve 24-HR PMP Rainfall=32.80"

Area (ac)	CN	Description
4.300	98	Water Surface, HSG C
15.100	91	Urban industrial, 72% imp, HSG C
19.400	93	Weighted Average
4.228		21.79% Pervious Area
15.172		78.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	64	0.0400	1.60		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.97"
10.6	3,700	0.0020	5.81	3,198.10	**Channel Flow,** Area= 550.0 sf Perim= 84.0' r= 6.55' n= 0.040 Winding stream, pools & shoals
11.3	3,764	Total			

Subcatchment 1S: South Ash Pond Watershed



Summary for Subcatchment 3S: Calrifaction Pond Watershed

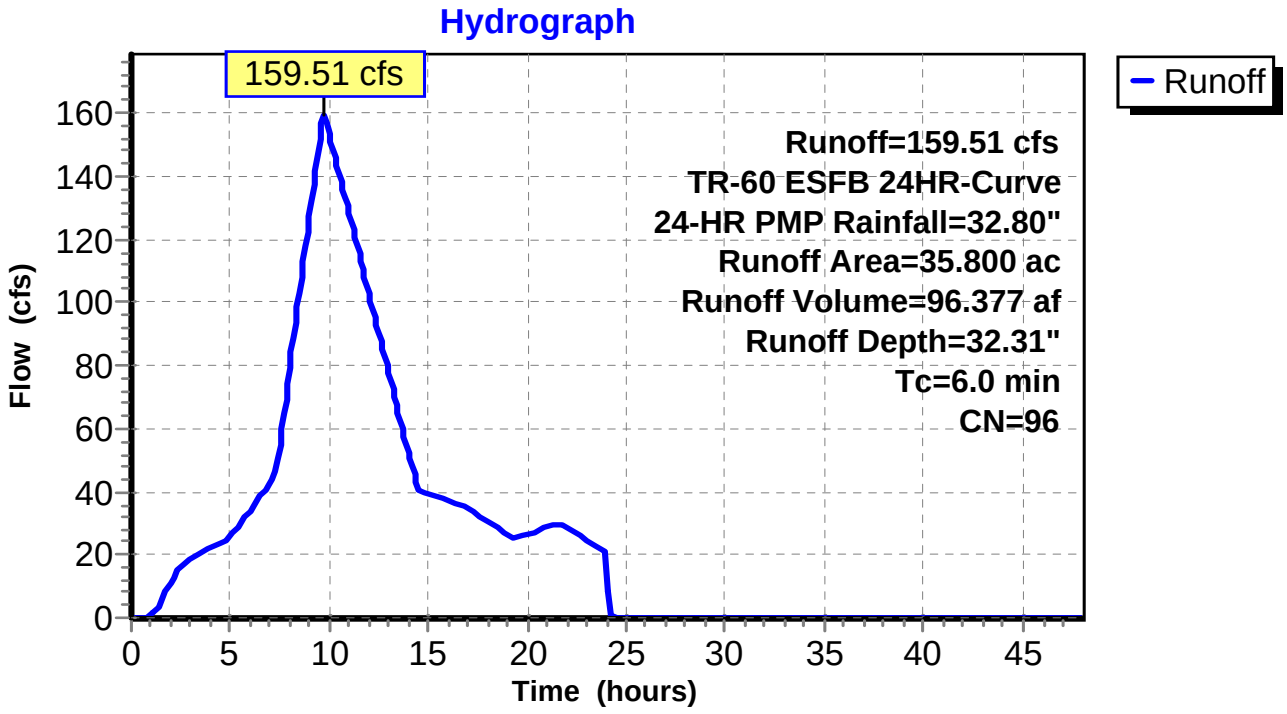
Runoff = 159.51 cfs @ 9.720 hrs, Volume= 96.377 af, Depth=32.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.000-48.000 hrs, dt= 0.100 hrs
TR-60 ESFB 24HR-Curve 24-HR PMP Rainfall=32.80"

Area (ac)	CN	Description
25.100	98	Water Surface, HSG C
10.700	91	Urban industrial, 72% imp, HSG C
35.800	96	Weighted Average
2.996		8.37% Pervious Area
32.804		91.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 3S: Calrifaction Pond Watershed



Summary for Subcatchment 4S: North Ash Pond Watershed

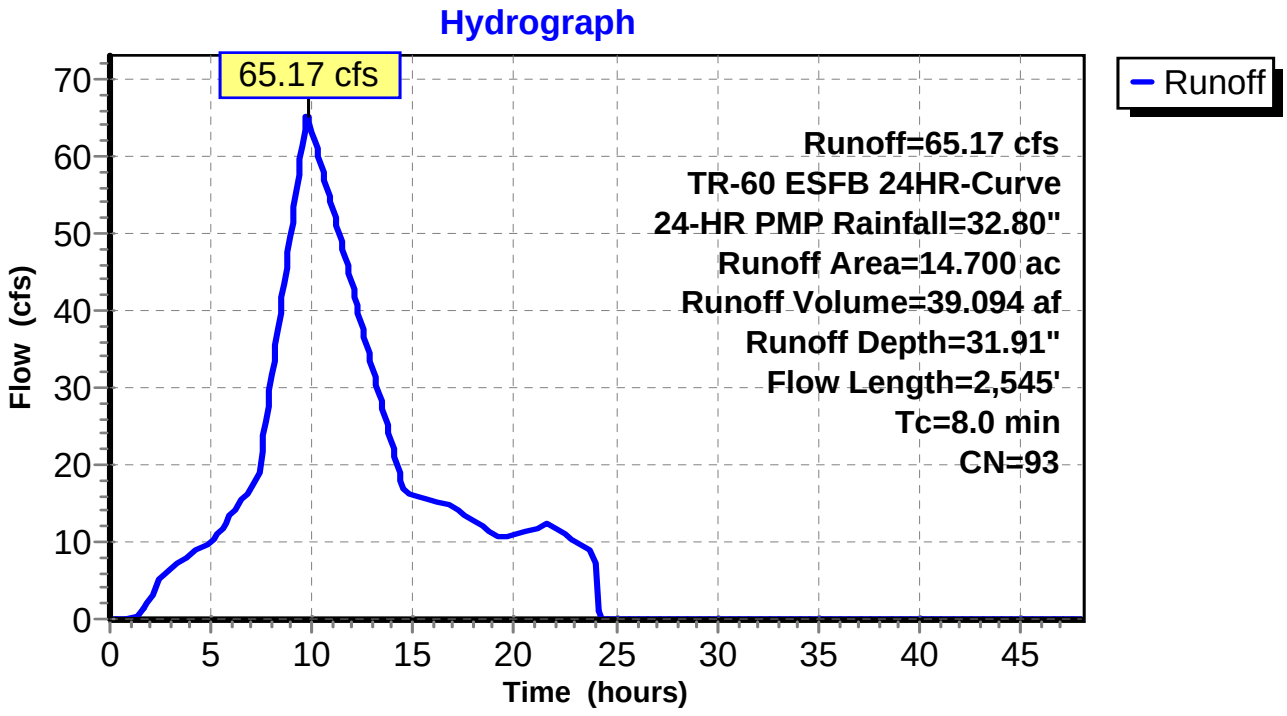
Runoff = 65.17 cfs @ 9.746 hrs, Volume= 39.094 af, Depth=31.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.000-48.000 hrs, dt= 0.100 hrs
TR-60 ESFB 24HR-Curve 24-HR PMP Rainfall=32.80"

Area (ac)	CN	Description
4.400	98	Water Surface, HSG C
10.300	91	Urban industrial, 72% imp, HSG C
14.700	93	Weighted Average
2.884		19.62% Pervious Area
11.816		80.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0400	1.75		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.97"
7.0	2,445	0.0020	5.81	3,198.10	**Channel Flow,** Area= 550.0 sf Perim= 84.0' r= 6.55' n= 0.040 Winding stream, pools & shoals
8.0	2,545	Total			

Subcatchment 4S: North Ash Pond Watershed



Summary for Subcatchment CP: Cooling Pond Watershed

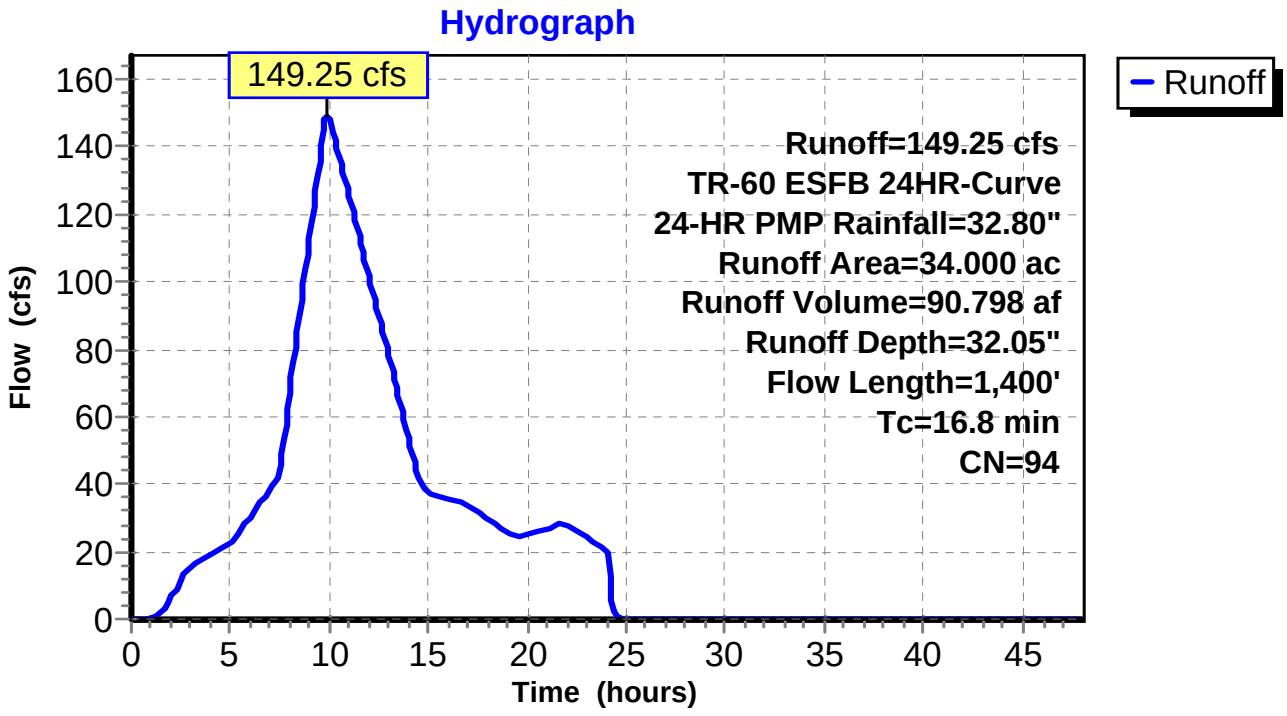
Runoff = 149.25 cfs @ 9.897 hrs, Volume= 90.798 af, Depth=32.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.000-48.000 hrs, dt= 0.100 hrs
TR-60 ESFB 24HR-Curve 24-HR PMP Rainfall=32.80"

Area (ac)	CN	Description
5.200	98	Water Surface, HSG C
15.600	96	Gravel surface, HSG C
13.200	91	Urban industrial, 72% imp, HSG C
34.000	94	Weighted Average
19.296		56.75% Pervious Area
14.704		43.25% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	100	0.0100	1.00		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.97"
15.1	1,300	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.8	1,400	Total			

Subcatchment CP: Cooling Pond Watershed



Summary for Pond 1P: Clarification Pond

Inflow Area = 103.900 ac, 71.70% Impervious, Inflow Depth > 30.61" for 24-HR PMP event
Inflow = 337.54 cfs @ 9.749 hrs, Volume= 265.009 af
Outflow = 0.00 cfs @ 0.000 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.000 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.000-48.000 hrs, dt= 0.100 hrs
Starting Elev= 447.20' Surf.Area= 22.678 ac Storage= 171.804 af
Peak Elev= 457.36' @ 48.000 hrs Surf.Area= 28.887 ac Storage= 436.780 af (264.976 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	434.00'	660.837 af	**Custom Stage Data (Conic)**Listed below

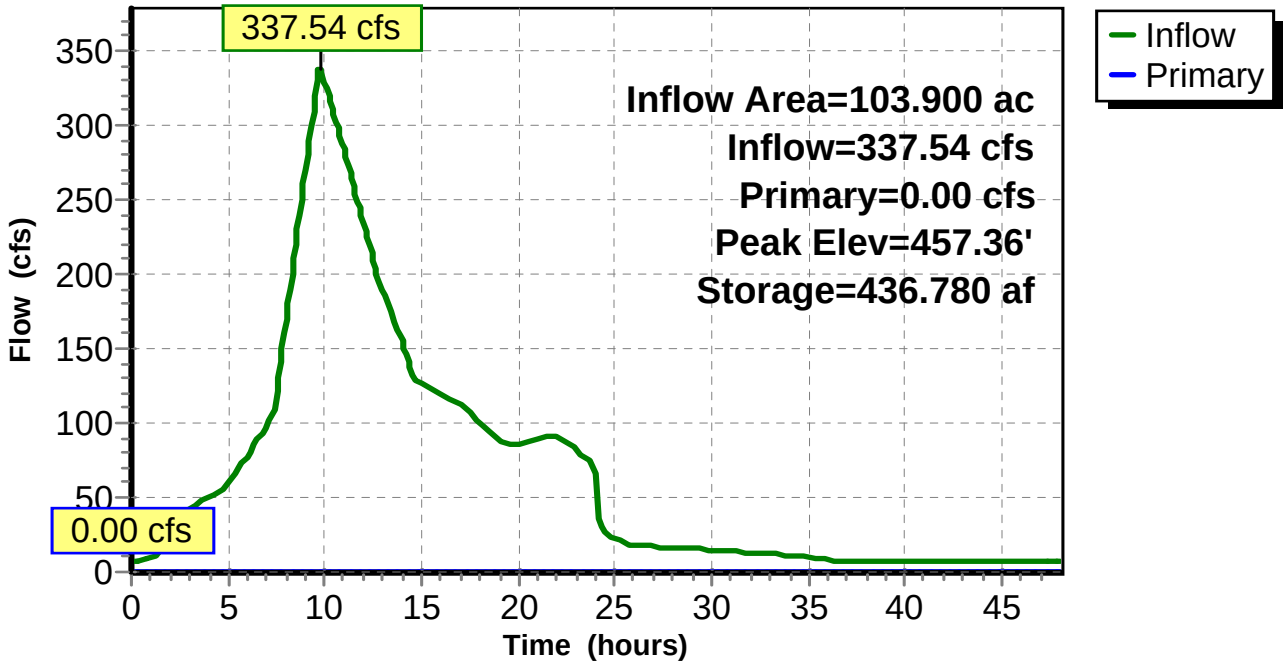
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
434.00	0.098	0.000	0.000	0.098
436.00	4.173	3.274	3.274	4.173
438.00	9.434	13.254	16.528	9.435
440.00	14.495	23.749	40.276	14.497
442.00	16.159	30.639	70.915	16.167
444.00	18.420	34.554	105.470	18.432
446.00	21.068	39.458	144.928	21.084
448.00	23.752	44.793	189.721	23.773
450.00	24.969	48.716	238.437	25.002
452.00	26.048	51.013	289.450	26.094
454.00	27.040	53.085	342.535	27.101
456.00	28.135	55.171	397.707	28.211
458.00	29.239	57.370	455.077	29.330
460.00	32.274	61.488	516.565	32.371
464.00	40.000	144.272	660.837	40.107

Device	Routing	Invert	Outlet Devices
#1	Primary	434.00'	**36.0" Round Culvert** L= 1,090.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 434.00' / 432.00' S= 0.0018 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	447.20'	**36.0" Horiz. Orifice/Grate X 0.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.000 hrs HW=447.20' (Free Discharge)
↑**1=Culvert** (Passes 0.00 cfs of 74.01 cfs potential flow)
↑**2=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: Clarification Pond

Hydrograph



Summary for Pond 2P: Cooling Pond

Inflow Area = 34.000 ac, 43.25% Impervious, Inflow Depth = 32.05" for 24-HR PMP event
Inflow = 149.25 cfs @ 9.897 hrs, Volume= 90.798 af
Outflow = 43.98 cfs @ 14.360 hrs, Volume= 46.141 af, Atten= 71%, Lag= 267.7 min
Primary = 23.47 cfs @ 11.000 hrs, Volume= 32.229 af
Secondary = 22.30 cfs @ 14.422 hrs, Volume= 13.913 af

Routing by Dyn-Stor-Ind method, Time Span= 0.000-48.000 hrs, dt= 0.100 hrs
Starting Elev= 449.50' Surf.Area= 3.551 ac Storage= 22.537 af
Peak Elev= 457.81' @ 14.422 hrs Surf.Area= 11.372 ac Storage= 75.167 af (52.630 af above start)

Plug-Flow detention time= 930.0 min calculated for 23.604 af (26% of inflow)
Center-of-Mass det. time= 331.8 min (1,064.0 - 732.2)

Volume	Invert	Avail.Storage	Storage Description
#1	438.00'	104.602 af	**Custom Stage Data (Conic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
438.00	0.107	0.000	0.000	0.107
440.00	0.681	0.706	0.706	0.681
442.00	1.525	2.150	2.856	1.526
444.00	2.182	3.687	6.543	2.184
446.00	2.755	4.926	11.468	2.760
448.00	3.234	5.982	17.451	3.243
450.00	3.660	6.889	24.340	3.673
452.00	4.051	7.708	32.048	4.070
454.00	6.031	10.016	42.064	6.051
456.00	8.858	14.798	56.862	8.880
458.00	11.647	20.441	77.303	11.671
460.00	15.755	27.299	104.602	15.781

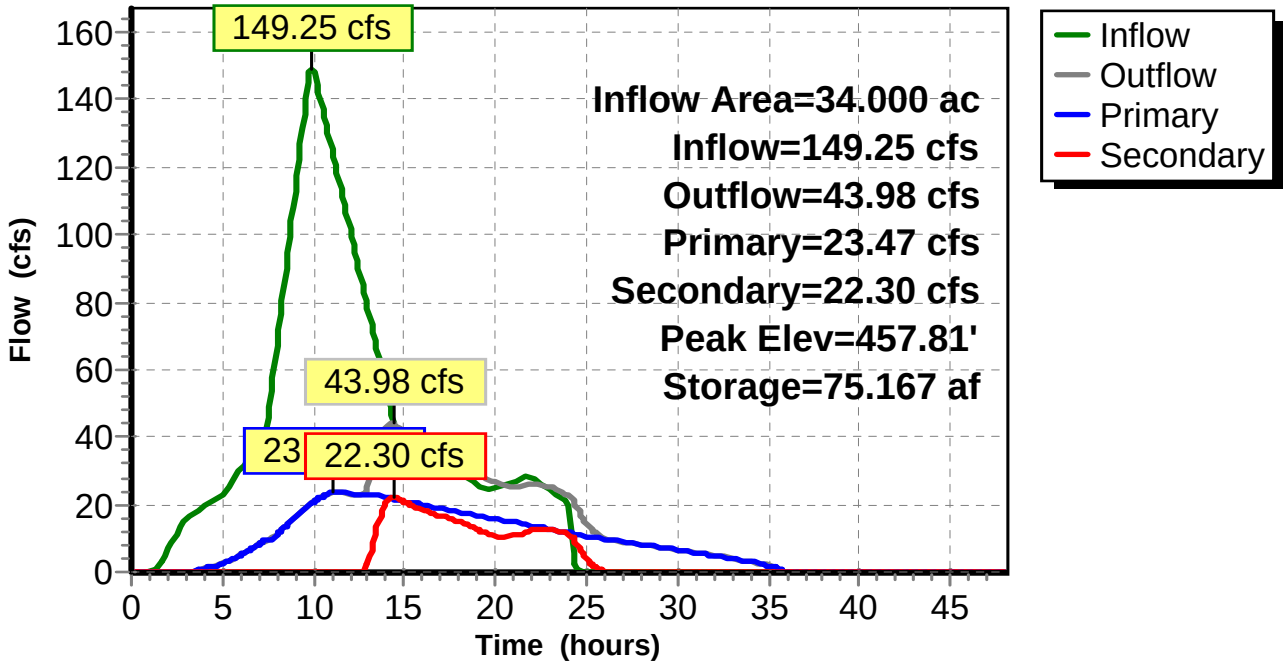
Device	Routing	Invert	Outlet Devices
#1	Primary	449.50'	**24.0" Round Culvert** L= 80.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 449.50' / 449.40' S= 0.0013 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf
#2	Secondary	457.50'	**50.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=23.25 cfs @ 11.000 hrs HW=456.29' TW=451.54' (Dynamic Tailwater)
└**1=Culvert** (Outlet Controls 23.25 cfs @ 7.40 fps)

Secondary OutFlow Max=22.29 cfs @ 14.422 hrs HW=457.81' TW=453.74' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 22.29 cfs @ 1.42 fps)

Pond 2P: Cooling Pond

Hydrograph



Summary for Link 3L: Plant Operations

Inflow = 8.00 cfs @ 0.000 hrs, Volume= 31.802 af
Primary = 8.00 cfs @ 0.000 hrs, Volume= 31.802 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.000-48.000 hrs, dt= 0.100 hrs

61 Point manual hydrograph, To= 0.000 hrs, dt= 1.000 hrs, cfs =

8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
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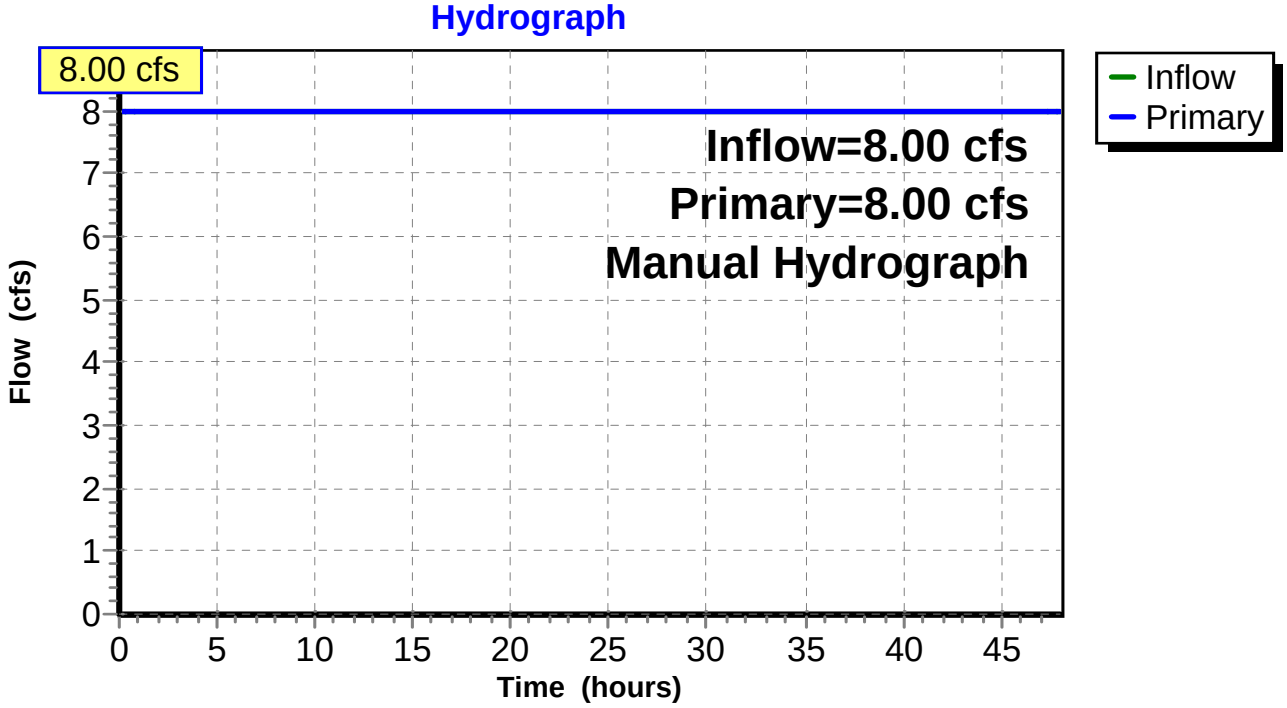
8.00									

Link 3L: Plant Operations



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1001 Highlands Plaza Drive West, Suite 300
St. Louis, MO 63110
1-314-429-0100

Geosyntec consultants

1 McBride and Son Center Drive, Suite 202
Chesterfield, MO 63005
PH 636-812-0800
www.geosyntec.com

October 11, 2021

Illinois Power Resources Generating, LLC
7800 South Cilco Lane
Bartonville, Illinois, 61607

Subject: **USEPA CCR Rule and IEPA Part 845 Rule Applicability Cross-Reference**
2021 USEPA CCR Rule Periodic Certification Report
Ash Pond, Edwards Power Plant, Bartonville, Illinois

At the request of Illinois Power Resources Generating, LLC (IPRG), Geosyntec Consultants (Geosyntec) has prepared this letter to document how the attached 2021 United States Environmental Protection Agency (USEPA) CCR Rule Periodic Certification Report (Report) was prepared in accordance with both the Federal USEPA CCR Rule[1] and the state-specific Illinois Environmental Protection Agency (IEPA) Part 845 Rule[2]. Specific sections of the report and the applicable sections of the USEPA CCR Rule and Illinois Part 845 Rule are cross-referenced in **Table 1**. A certification from a Qualified Professional Engineer for each of the CCR Rule sections listed in **Table 1** is provided in Section 9 of the attached Report. This certification statement is also applicable to each section of the Part 845 Rule listed in **Table 1.**

Table 1 – USEPA CCR Rule and Illinois Part 845 Rule Cross-Reference

Report Section	USEPA CCR Rule		Illinois Part 845 Rule	
3	§257.73 (a)(2)	Hazard Potential Classification	845.440	Hazard Potential Classification Assessment[3]
4	§257.73 (c)(1)	History of Construction	845.220(a)	Design and Construction Plans (Construction History)
5	§257.73 (d)(1)	Structural Stability Assessment	845.450 (a) and (c)	Structural Stability Assessment
6	§257.73 (e)(1)	Safety Factor Assessment	845.460 (a-b)	Safety Factor Assessment
7	§257.82 (a)(1-3)	Adequacy of Inflow Design Control System Plan	845.510(a), (c)(1), (c)(3)	Hydrologic and Hydraulic Capacity Requirements / Inflow Design Flood Control System Plan
	§257.82 (b)	Discharge from CCR Unit	845.510(b)	Discharge from CCR Surface Impoundment

[1] United Stated Environmental Protection Agency, 2015. *40 CFR Parts 257 and 261, Hazardous and Solid Waste Management System, Disposal of Coal Combustion Residuals from Electric Utilities, Final Rule.*
[2] State of Illinois, Joint Committee on Administrative Rule, Administrative Code (2021). *Title 35: Environmental Protection, Subtitle G: Waste Disposal, Chapter I: Pollution Control Board, Subchapter j: Coal Combustion Waste Surface Impoundment, Part 845 Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments.*
[3] "Significant" and "High" hazard, per the CCR Rule[1], are equivalent to Class II and Class I hazard potential, respectively, per Part 845[2].

CLOSING

This letter has been prepared to demonstrate that the content and Qualified Professional Engineer Certification of the 2021 Periodic USEPA CCR Rule Certification Report fulfills the corresponding requirements of Part 845 of Illinois Administrative Code listed in **Table 1**.

Sincerely,

John P. Seymour, P.E.
Senior Principal

Lucas P. Carr, P.E.
Senior Engineer

Edwards

2021 USEPA CCR RULE PERIODIC CERTIFICATION REPORT §257.73(a)(2), (c), (d), (e) and §257.82 ASH POND Edwards Power Plant Edwards, Illinois

Edwards

Submitted to

Illinois Power Resources Generating, LLC

7800 South Cilco Lane
Bartonville, Illinois 61607

Submitted by

Geosyntec consultants

engineers | scientists | innovators

1 McBride and Son Center Drive, Suite 202
Chesterfield, Missouri 63005

October 11, 2021

TABLE OF CONTENTS

Executive Summary 1
SECTION 1 Introduction and Background 3
1.1 AP Description 4
1.2 Report Objectives 6
SECTION 2 Comparision of Initial and Periodic Site Conditions 8
2.1 Overview 8
2.2 Review of Annual Inspection Reports 8
2.3 Review of Instrumentation Data 8
2.4 Comparison of Initial to Periodic Topographic Surveys 9
2.5 Comparison of Initial to Periodic Aerial Photography 10
2.6 Comparison of Initial to Periodic Site Visits 10
2.7 Interview with Power Plant Staff 11
SECTION 3 Hazard Potential Classification - §257.73(a)(2) 13
3.1 Overview of Initial HPC 13
3.2 Review of Initial HPC 13
3.3 Summary of Site Changes Affecting the Initial HPC 14
3.4 Periodic HPC 14
SECTION 4 History of Construction Report - §257.73(c) 15
4.1 Overview of Initial HoC 15
4.2 Summary of Site Affecting the Initial HoC 15
SECTION 5 Structural Stability Assessment - §257.73(d) 17
5.1 Overview of Initial SSA 17
5.2 Review of Initial SSA 17
5.3 Summary of Site Changes Affecting the Initial SSA 18
5.4 Periodic SSA 18
SECTION 6 Safety Factor Assessment - §257.73(e)(1) 19
6.1 Overview of Initial SFA 19
6.2 Review of Initial SFA 19
6.3 Summary of Site Changes Affecting the Initial SFA 20
6.4 Periodic SFA 20
SECTION 7 Inflow Design Flood ConTrol System Plan - §257.82 22
7.1 Overview of Initial IDF 22
7.2 Review of Initial IDF 22
7.3 Summary of Site Changes Affecting the Initial IDF 23
7.4 Periodic IDF 24

SECTION 8 Conclusions 27
SECTION 9 Certification Statement 28
SECTION 10 References 29

LIST OF FIGURES

Figure 1 Site Location Map
Figure 2 Site Plan
Figure 3 AP Pond Monitoring Well Locations

LIST OF TABLES

Table 1 Periodic Certification Summary
Table 2 Initial to Periodic Survey Comparison
Table 3 Factors of Safety from Periodic SFA
Table 4 Summary of Updated IDF Results

LIST OF DRAWINGS

Drawing 1 Initial to Periodic Survey Comparison
Drawing 2 Survey Comparison Isopach
Drawing 3 Initial to Periodic Aerial Imagery Comparison

LIST OF ATTACHMENTS

Attachment A AP Piezometer Data Plots
Attachment B AP Site Visit Photolog
Attachment C Periodic History of Construction Report Update Letter
Attachment D Periodic Structural Stability and Safety Factor Assessment Analyses
Attachment E Periodic Inflow Design Flood Control System Plan Analyses

Edwards

EXECUTIVE SUMMARY

This Periodic United States Environmental Protection Agency (USEPA) Coal Combustion Residuals (CCR) Rule [1] certification report (Periodic Certification Report) for the Ash Pond (AP) at the Edwards Power Plant (EPP)[1], also known as the Edwards Power Station (EDW), has been prepared in accordance with Rule 40, Code of Federal Regulations (CFR) §257, herein referred to as the "CCR Rule" [1]. The CCR Rule requires that initial certifications for existing CCR surface impoundment, completed in 2016 and subsequently posted originally on the Illinois Power Resource Generating LLC CCR Website; ([2], [3], [4], [5], [6]). These documents are to be updated on a five-year basis.

The initial certification reports developed in 2016 and 2017 were independently reviewed by Geosyntec ([2], [7], [3], [8], [4], [5], [6]). Additionally, field observations, interviews with plant staff, updated engineering analyses, and evaluations were performed to compare conditions in 2021 at the AP relative to those of the 2016 and 2017 initial certifications. These tasks determined that updates are not required for the Hazard Potential Classification. However due to changes at the site, updates were required and were performed for the:

- History of Construction Report,
- Initial Structural Stability Assessment,
- Initial Safety Factor Assessment, and
- Initial Inflow Design Flood Control System Plan.

Geosyntec's evaluations of the initial certification reports and updated analyses identified that the AP meets all requirements for hazard potential classification, history of construction reporting, structural stability, safety factor assessment, and inflow design flood control system planning. **Table 1** provides a summary of the initial 2016 certifications and the updated 2021 periodic certifications.

[1] The AP is also referred to as ID Number W1438050005-01, Ash Pond by the Illinois Environmental Protection Agency (IEPA); CCR unit ID 301 by IPRG; and IL50710 within the National Inventory of Dams (NID) maintained by the Illinois Department of Natural Resources (IDNR). Within this document it is referred to as the AP.

Table 1 – Periodic Certification Summary

	CCR Rule Reference	Requirement Summary	2016 Initial Certification		2021 Periodic Certification	
			Requirement Met?	Comments	Requirement Met?	Comments
Hazard Potential Classification						
3	§257.73(a)(2)	Document hazard potential classification	Yes	Impoundment was determined to have High hazard potential classification [2].	Yes	No changes were identified that may affect this requirement.
History of Construction						
4	§257.73(c)(1)	Compile a history of construction	Yes	A history of Construction report was prepared for the AP. [3].	Yes	A letter listing updates to the History of Construction Report is provided in Attachment C.
Structural Stability Assessment						
5	§257.73(d)(1)(i)	Stable foundations and abutments	Yes	Foundations and abutments were found to be stable [8].	Yes	Foundations and abutments were found to be stable after performing updated slope stability analyses.
	§257.73(d)(1)(ii)	Adequate slope protection	Yes	Slope protection was adequate [8].	Yes	No changes were identified that may affect this requirement.
	§257.73(d)(1)(iii)	Sufficiency of dike compaction	Yes	Dike compaction was sufficient for expected ranges in loading conditions [8].	Yes	Dike compaction was found to be sufficient after performing updated slope stability analyses.
	§257.73(d)(1)(iv)	Presence and condition of slope vegetation	Yes	Vegetation was present on interior and exterior slopes and is maintained. [8].	Yes	No changes were identified that may affect this requirement.
	§257.73(d)(1)(v)(A) and (B)	Adequacy of spillway design and management	Yes	Spillway was adequately designed and constructed and was expected to adequately manage flow during the calculated Probable Maximum Flood (PMF) [8].	Yes	Spillways were found to e adequately design and constructed and are expected to adequately manager flow during the PMF, after performing updated hydrologic and hydraulic analyses.
	§257.73(d)(1)(vi)	Structural integrity of hydraulic structures	No	Requirement could not be certified in 2016 due to inability to complete a CCTV inspection of all hydraulic structures.	Yes	An inspection was completed in 2020 and met all structural stability requirements. [8].
	§257.73(d)(1)(vii)	Stability of downstream slopes inundated by water body.	Not Applicable	Inundation of exterior slopes was not expected; this requirement was not applicable [8].	Not Applicable	No changes were identified that may affect this requirement.
Safety Factor Assessment						
6	§257.73(e)(1)(i)	Maximum storage pool safety factor must be at least 1.50	Yes	Safety factors were calculated to be 1.54. [5].	Yes	Safety factors from updated slope stability analyses were calculated to be 1.54 and higher.
	§257.73(e)(1)(ii)	Maximum surcharge pool safety factor must be at least 1.40	Yes	Safety factors were calculated to be 1.54 [5].	Yes	Safety factors from updated slope stability analyses were calculated to be 1.58 and higher.
	§257.73(e)(1)(iii)	Seismic safety factor must be at least 1.00	Yes	Safety factors were calculated to be 1.08 [5].	Yes	Safety factors from updated slope stability analyses were calculated to be 1.08 and higher.
	§257.73(e)(1)(iv)	For dike construction of soils that have susceptible to liquefaction, safety factor must be at least 1.20	Not Applicable	Dike soils were not susceptible to liquefaction [5].	Not Applicable	No changes were identified that may affect this requirement.
Inflow Design Flood Control System Plan						
7	§257.82(a)(1), (2), (3)	Adequacy of inflow design control system plan.	Yes	Flood control system adequately managed inflow and peak discharge during the calculated probable maximum flood (PMF) conditions [8].	Yes	The flood control system was found to adequately manage inflow and peak discharge during the PMP, 24-hour, Inflow Design Flood, after performing updated hydrologic and hydraulic analyses.
	§257.82(b)	Discharge from CCR Unit	Yes	Discharge from the CCR Unit is routed through a NPDES-permitted outfall during both normal and PMP, 24-hour Inflow Design Flood conditions [6].	Yes	Discharge from the CCR Unit is routed through a NPDES-permitted outfall during both normal and PMP, 24-hour Inflow Design Flood conditions, after performing updated hydrologic and hydraulic analyses.

SECTION 1

INTRODUCTION AND BACKGROUND

This Periodic United States Environmental Protection Agency (USEPA) Coal Combustion Residual (CCR) Rule [1] Certification Report was prepared by Geosyntec Consultants (Geosyntec) for Illinois Power Resources Generating LLC (IPRG), to document the periodic certification of the Ash Pond (AP) at the Edwards Power Plant (EPP), also known as the Edwards Power Station (EDW), located at 7800 South Cilco Lane Bartonville, Illinois 61607. The location of EPP is provided in **Figure 1**, and a site plan showing the location of the AP is provided in **Figure 2**.

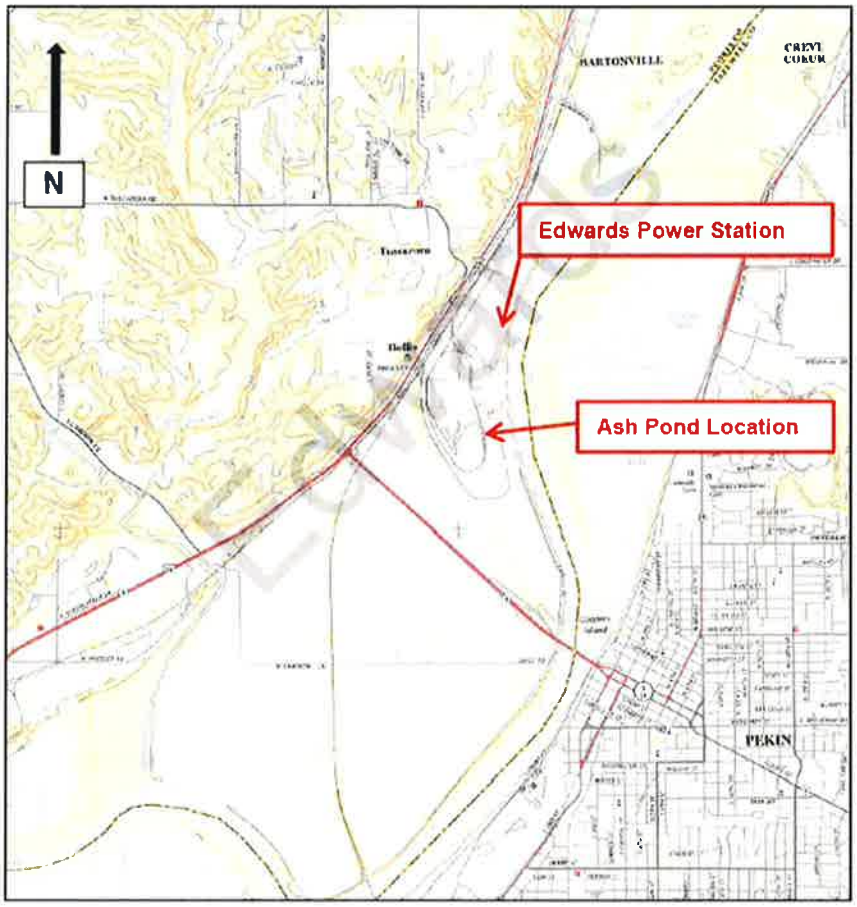

Figure 1 – Site Location Map (from AECOM, 2016)

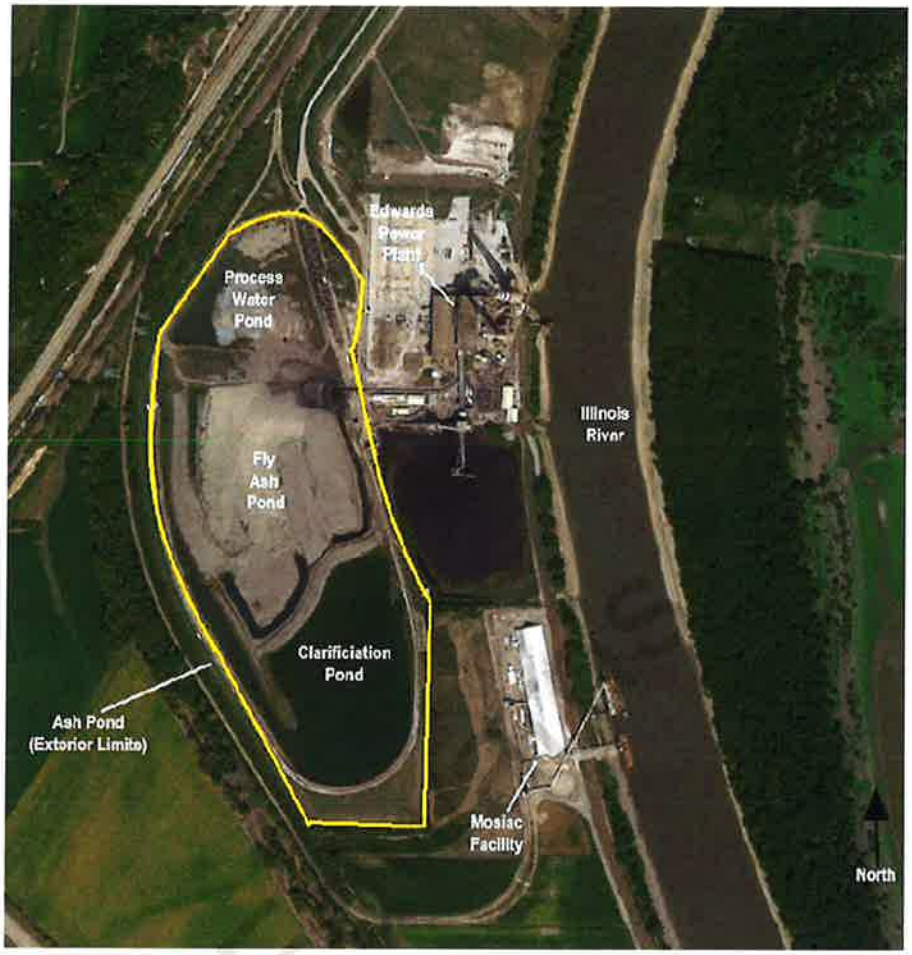

Figure 2 – Site Plan (September 2017)

1.1 AP Description

The AP receives CCR materials and plant process water from the Edwards Power Plant through sluice pipes that discharge into the eastern side of the Ash Pond, immediately west of the Edwards Power Plant. Within the AP, there are three separate sub-basins: The Process Water Pond, the Fly Ash Pond, and the Clarification Pond. The Process Water Pond is located within the northwest portions of the AP, and receives water from miscellaneous sumps, pumps, and processes at the Edwards Power Plant, as well as stormwater. The Process Water Pond transmits outflow to the Clarification Pond, which is located in the southern portion of the AP, through a 24-inch diameter corrugated metal pipe (CMP) culvert. At the time of the initial certification the Fly Ash Pond received sluiced bottom ash and fly ash from the plant and directed it into a settling channel, where ash was mechanically dipped out and stacked in windrows within the Fly Ash Pond [8].

The Fly Ash Pond discharges into the Clarification Pond through a reinforced concrete pipe (RCP) culvert. The Clarification Pond then discharges the clear water to the Illinois River through a 36-

inch diameter vertical drop inlet spillway structure (invert elevation[2] of 447.2 ft), with a skimmer/trash rack structure. Original design drawings indicate that the vertical "morning glory" spillway is a vertical CMP; however, 2004 design drawings for replacement of the skimmer/trash rack indicate that the vertical portions of the spillway may have been replaced with RCP pipe at some time. The pipe material has not been verified as it is typically submerged and high flows into the pipe have prevented inspection. Within the embankment, the spillway structure transitions to a nearly horizontal 36-inch diameter CMP that discharges to the Illinois River at the NPDES outfall. A flap gate backflow prevention device is present at the pipe's discharge [8].

A sanitary sewer force main, consisting of six-inch diameter high-density polyethylene (HDPE) pipe, crosses the Ash Pond, between the Process Water Pond and the Fly Ash Pond, and is buried at a shallow depth within the Ash Pond. However, the pipe penetrates the west dike of the Ash Pond at a depth of approximately 10 feet. The pipe was installed in 2008 and transmits sewer flow from east to west [8]. It is discharged into a sewer main along the northwest perimeter of the Edwards Power plant property.

The AP earthen embankments were constructed in the 1960s and an engineered raise of the embankment was completed in 2004 to facilitate the addition of a rail loop at the crest of the embankment. The engineered raise included increasing the dike height from its original elevation of approximately 455 feet (based on the 2015 Maurer-Stutz survey) to approximately 460 feet (Clarification Pond) and 461 feet (Process Water Pond) using fly ash as a beneficial use material. The maximum height above the exterior grade of the current embankment is approximately 29 feet. Within the southern portions of the Clarification Pond, the rail loop was constructed approximately 250 feet inside the crest of the earthen embankment out of crushed stone. This effectively cut off a portion of the AP from the Clarification Pond, creating an area which was filled with CCR and vegetated. The original embankment acts as the perimeter of the AP at the southern end of the filled and vegetated area and was also raised in 2004 to a similar elevation as the remainder of the embankment [8].

The perimeter embankment forms the exterior of the impoundment on all but the northeast side of the AP. The northeast side is bordered by the Edwards Power Plant building grounds and switch yard which are at approximately the same elevation as the top of the pond embankment. The perimeter dike was constructed to include a crest width ranging from approximately 15 to 42 feet with narrower crest widths along the northern portion of the embankment, and wider crest widths along the south, east, and west sides of the embankment. Both the rail loop and a gravel crest access road are located at the crest of the embankment.

Based on 2015 LiDAR data from the State of Illinois, the exterior slopes have orientations ranging from 2.5H:1V (southern end of AP) to 3.4H:1V (western side of AP). The interior slopes have a typical orientation of 2H:1V. Based on the 2015 Maurer-Stutz survey, minimum crest elevations range from 458.8 feet for the Process Water Pond to 459.6 feet for the Clarification Pond, although

[2] All elevations in this report are in the North American Vertical Datum of 1988 (NAVD88), unless otherwise noted.

the typical crest elevations are similar to the design crest elevations of 460 feet and 461 feet for each pond, respectively [8]. These elevations and slopes have not been altered since the initial certification.

Initial certifications for the AP for Hazard Potential Classification (§257.73(a)(2)), History of Construction (§257.73(c)), Structural Stability Assessment (§257.73(d)), Safety Factor Assessment (§257.73(e)(1)), and Inflow Design Flood Control System Plan (§257.82) were completed by Stantec and AECOM in 2016 and 2017 and subsequently posted to IPRG's CCR Website ([2], [3], [4], [5], [6]). Additional documentation for the initial certifications included a detailed operating record reports containing calculations and other information prepared for the hazard potential classification by Stantec [7] and for the structural stability assessment, safety factor assessment, and inflow design flood control system plan by AECOM [8]. These operating record reports were not required to be posted and were not posted to IPRG's CCR Website.

1.2 Report Objectives

These following objectives are associated with this report:

- Compare site conditions from 2015/2016, when the initial certifications were developed, to site conditions in 2020/2021, when data for the periodic certification was obtained, and evaluate if updates are required to the:
    - §257.73(a)(2) Hazard Potential Classification [2];
    - §257.73(c) History of Construction [3];
    - §257.73(d) Structural Stability Assessment [4];
    - §257.73(e) Safety Factor Assessment [5], and/or
    - §257.82 Inflow Design Flood Control System Plan [6].
- Independently review the Hazard Potential Classification ([2], [7]), Structural Stability Assessment ([4], [8]), Safety Factor Assessment ([5], [8]), and Inflow Design Flood Control System Plan ([6], [8]) reports to determine if updates may be required based on technical considerations.
    - The History of Construction report [3] was not independently reviewed for technical considerations, as this report contained historical information primarily developed prior to promulgation of the CCR Rule [1] for the AP CCR unit at EPP, and did not include calculations or other information used to certify performance and/or integrity of the impoundments under §257.73(a)(2), §257.73(c)-(e), or §257.82.

- Confirm whether the AP meets all of the requirements associated with §257.73(a)(2), (c), (d), (e), and §257.82, and provide recommendations for compliance with these sections of the CCR Rule [1], if necessary.

Edwards

SECTION 2

COMPARISION OF INITIAL AND PERIODIC SITE CONDITIONS

2.1 Overview

This section describes the comparison of conditions at the AP between the start of the initial CCR certification program in 2015 and 2016 (initial conditions) and subsequent collection of periodic certification site data in 2020 and 2021 (periodic conditions).

2.2 Review of Annual Inspection Reports

Annual onsite inspections for the AP were performed between 2016 and 2020 ([9], [10], [11], [12], [13]) and were certified by a licensed professional engineer in accordance with §257.83(b). Each inspection report provided the following information relative to the previous inspection:

- A statement that no changes in geometry of the impounding structure were observed since the previous inspection.
- Information on maximum recorded instrumentation readings and water levels.
- Approximate volumes of impounded water and CCR at the time of inspection.
- A statement that no appearances of actual or potential structural weakness or other disruptive conditions were observed
- A statement that no other changes which may have affected the stability or operation of the impounding structure were observed.

In summary, the reports did not indicate any significant changes to the AP between 2015 and 2020. No signs of instability, structural weakness, or changes which may have affected the operation or stability of the AP were noted in the inspection reports.

2.3 Review of Instrumentation Data

Four piezometers, P001, P002, P003 and P004, are present at the AP and were monitored monthly by IPRG between October 28, 2015 and May 13, 2021 [14]. Geosyntec reviewed the piezometer data to evaluate if significant fluctuations, partially increases in phreatic levels, may have occurred between development of the initial structural stability and factor of safety certifications ([8], [4], [5]) and May 13, 2021. Available piezometer readings are plotted in **Attachment A**. The location of the piezometers used for monitoring of phreatic level in AP is shown in **Figure 3**.



Figure 3 – AP Pond Monitoring Well Locations
(Not to Scale, adapted from AECOM, 2015)

In summary, only minor changes in phreatic conditions were observed in the available piezometric data. Phreatic levels varied by a maximum of 2.5 feet. These changes do not significantly differ from the phreatic levels utilized for the initial structural stability and factor of safety certifications ([8], [4], [5]).

2.4 Comparison of Initial to Periodic Topographic Surveys

The initial topographic survey of the AP, conducted by Maurer-Stutz, Inc. in 2015 [15], was compared to the periodic topographic survey of the AP, conducted by IngenAE, LLC (IngenAE) in 2020 [16], using AutoCAD Civil3D 2021 software. This comparison quantified changes in the volume of CCR placed within the AP and considered volumetric changes above and below the starting water surface elevation (SWSE) used for the 2016 inflow design flood control plan hydraulic analysis [8] as required by 40 CFR §257.82. Potential changes to embankment geometry were also evaluated. This comparison is presented in side-by-side views of each survey in **Drawing 1** and a plan view isopach map denoting changes in ground surface elevation in **Drawing 2**. A summary of the water elevations and changes in CCR volumes is provided in **Table 2**.

Table 2 – Initial to Periodic Survey Comparison

Initial Surveyed Pool Elevation (ft)	444.53
Periodic Surveyed Pool Elevation (ft)	447.32
Initial §257.82 Starting Water Surface Elevation (SWSE) (ft)	447.2
Total Change in CCR Volume (CY)	+126,383 (Fill)
Change in CCR Volume Above SWSE (CY)	+90,315 (Fill)
Change in CCR Volume Below SWSE (CY)	+36,069 (Fill)

The comparison indicated that approximately 126,000 CY of CCR was placed in the AP between the initial and periodic surveys. The comparison also indicated a net fill of approximately 90,000 CY of CCR above the SWSE from the IDF and a fill of approximately 36,000 CY of CCR below the SWSE. The surveys also indicated that many interior channels (i.e., serpentines) were filled in, with some fill being placed below the SWSE. Therefore, the site grading has changed significantly since the initial certifications were developed. No significant changes to embankment geometry appeared to have occurred between the initial and periodic surveys.

2.5 Comparison of Initial to Periodic Aerial Photography

Initial aerial photographs of the AP collected by Weaver in 2015 [17] were compared to periodic aerial photographs collected by IngenAE in 2020 [16] to visually evaluate if potential site changes (i.e., changes to the embankment, outlet structures, limits of CCR, other appurtenances) may have occurred. Additionally, an aerial photograph provided by ERIS in 2019 [18] was used for additional comparisons and during the periodic site visit. A comparison of these aerial photographs is provided in **Drawing 2**, and the only change that was identified was all but one of the serpentine ponds have been filled in and do not retain water.

2.6 Comparison of Initial to Periodic Site Visits

An initial site visit to the AP was conducted by AECOM in 2015 and documented with a Site Visit Summary and corresponding photographs [19]. A periodic site visit was conducted by John Seymour, P.E. of Geosyntec on June 10, 2021. The site visit was intended to evaluate potential changes at the site since the initial certifications were prepared (i.e., modification to the embankment, outlet structures or other appurtenances, limits of CCR, maintenance programs, repairs), in addition to performing visual observations of the AP to evaluate if the structural stability requirements (§257.73(d)) were still met. The site visit included walking the perimeter of the AP, visually observing conditions, recording field notes, and collecting photographs. The site visit is documented in a photographic log provided in **Attachment B**. A summary of significant findings from the periodic site visit is provided below:

- All but one of the serpentine ponds were filled in with ash as observed in the site walk and as shown by comparison of aerial photograph.

2.7 Interview with Power Plant Staff

An interview with Mark Davis, Environmental Manager of the Edwards Power Plant was conducted by Mr. John Seymour, P.E. of Geosyntec on June 10, 2021. Mr. Davis was employed at EPP between 2015 and 2021. The interview included a discussion of included a discussion of potential changes that that may have occurred at the AP since development of the initial certifications ([2], [3], [4], [5], [6]). A summary of the interview is provided below.

- Were any construction projects completed for the AP since 2015, and, if so, are design drawings and/or details available?
  - Ash placement in the North Pond that filled in all but one serpentine pond.
- Were there any changes to the purpose of the AP since 2015?
  - In 2017, one of the two serpentine settling channels in the AP was filled in with ponded ash (dewatered/dredged). Only one channel was needed, as all conditioned fly ash was being hauled to the Duck Creek Landfill. Only bottom ash is sluiced to the pond, which is then dredged, dewatered, and stored in the AP.
  - Beginning in 2019 conditioned ash was placed in the North Pond (Process Water Pond) area. Placement of ash was in accordance with the closure design developed by Hanson and Associates.
  - Currently placing unmarketable, conditioned fly ash in the South (Fly Ash) Pond.
- Were there any changes to the to the instrumentation program and/or physical instruments for the AP since 2015?
  - No.
- Have area-capacity curves for the AP been prepared since 2015?
  - No.
- Were there any changes to spillways and/or diversion features for the AP completed since 2015?
  - No.
- Were there any changes to construction specifications, surveillance, maintenance, and repair procedures for the AP since 2015?
  - The site AP O&M Manual and Emergency Action Plan was revised in 2020.

- An internal inspection of the AP discharge tunnel was completed in 2020; records were reviewed.

- Were there any instances of dike and/or structural instability for the AP since 2015?
  - No; only minor slope erosion has occurred and were addressed as needed.

Edwards

SECTION 3

HAZARD POTENTIAL CLASSIFICATION - §257.73(a)(2)

3.1 Overview of Initial HPC

The Initial Hazard Potential Classification (Initial HPC) was prepared by Stantec Consulting Services, Inc. (Stantec) in 2016 ([2], [7]), following the requirements of §257.73(a)(2). The Initial HPC included the following information:

- Performing a visual analysis to evaluate potential hazards associated with a failure of the AP perimeter dike, along the east and west embankments of the AP, as the AP is contained by natural high ground to the northeast and south.
- Evaluation of potential breach flow paths were evaluated using elevation data and aerial imagery to evaluate potential impacts to downstream structures, infrastructure, frequently occupied facilities/areas, and waterways [2].
- While a breach map is not included within the Initial HPC, it is included within the Emergency Action Plan [20].

The volume transfer analysis indicated potential impacts to intermittently occupied structures consisting of a motocross and ATV park as well as mobile home trailers. For the motocross and ATV park, the Initial HPC concluded that neither breach would be likely to result in a probable loss of human life by federal standards, as occupancy is not constant. However, due to the probable loss of life within the trailers, the initial HPC recommended a "High" hazard potential classification for the AP [2].

3.2 Review of Initial HPC

Geosyntec performed a review of the Initial HPC ([2], [7]), in terms of technical approach, input parameters, and assessment of the results. The review included the following tasks:

- Review of all report documentation and figures
- Check that correct CCR Rule guidance is referenced and adhered to
- Review of appropriate failure mode selections
- Review for changes to the site and surrounding area
- Review that appropriate breach analysis methodology, model software, and inputs were utilized

- Check that selected HPC is appropriate per results of the breach analysis

Geosyntec performed a review of the Initial HPC ([2], [7]), in terms of technical approach, input parameters, assessment of the results, and applicable requirements of the CCR Rule [1]. No significant technical issues were noted within the technical review, although a detailed review (e.g., check) of the calculations was not performed as the Initial HPC utilized a visual assessment.

3.3 Summary of Site Changes Affecting the Initial HPC

No new structures, infrastructure, frequently occupied facilities/areas, or waterways were present in the probable breach area indicated in the Initial HPC [2].

3.4 Periodic HPC

Geosyntec recommends retaining the "High" hazard potential classification for the AP, per §257.73(a)(2), based on the lack of site changes occurring since the initial HPC was developed, as described in **Section 3.3** no updates to the Initial HPC report ([2], [7]) are recommended at this time.

Edwards

SECTION 4

HISTORY OF CONSTRUCTION REPORT - §257.73(c)

4.1 Overview of Initial HoC

The Initial History of Construction report (Initial HoC) was prepared by AECOM in 2016 [3], following the requirements of §257.73(c). The Initial HoC included the following information for each CCR surface impoundment:

- The name and address of the owner/operator,
- Location maps,
- Statements of purpose,
- The names and size of the surrounding watershed,
- A description of the foundation and abutment materials,
- A description of the dike materials,
- Approximate dates and stages of construction,
- Available design and engineering drawings,
- A summary of instrumentation and map of instrument locations,
- A statement that area-capacity curves are not available,
- Information on spillway structures,
- A statement that construction specifications are not readily available,
- Inspection and surveillance plans, and
- Information on operational and maintenance procedures.

4.2 Summary of Site Affecting the Initial HoC

Two significant changes were identified at the site that occurred after development of the initial HoC [3] report and are described below:

- A state identification number (ID) of W1438050005-01 was assigned to the AP by the Illinois Environmental Protection Agency (IEPA).

- Revised area-capacity curves and spillway design calculations for the AP were prepare das part of the periodic Inflow Design Flood Control System Plan, as described in **Section 6.3**.

A letter documenting changes to the HoC report is provided in **Attachment C**.

Edwards

SECTION 5

STRUCTURAL STABILITY ASSESSMENT - §257.73(d)

5.1 Overview of Initial SSA

The Initial Structural Stability Assessment (Initial SSA) was prepared by AECOM in 2016 ([4], [8]), following the requirements of §257.73(d)(1), and included the following evaluations:

- Stability of dike foundations, dike abutments, slope protection, dike compaction, and slope vegetation,
- Spillway stability including capacity, structural stability and integrity; and
- Downstream slope stability under sudden drawdown conditions for a downstream water body.

The Initial SSA concluded that the AP met all structural stability requirements for §257.73(d)(1)(i)-(v) and (vii). A recommended CCTV inspection was completed in 2020 after the inspection could not be completed as part of the initial 2016 certification. It covered the hydraulic structures that pass through the dike of the AP, consisting of the CMP primary spillway outlet pipe and the high-density polyethylene (HDPE) sewer force main to verify that the AP meets the stability and structural integrity criteria for hydraulic outfall structures, per §257.73(d)(1)(vi). Over 750 ft of pipe were inspected after terminating when the camera became blocked by a permanent sample probe. The pipe appeared to be intact and flowing normally.

The Initial SSA referenced the results of the Initial Structural Factor Assessment (Initial SFA) ([5] [8]) to demonstrate stability of the stability of foundations and abutments (§257.73(d)(1)(i)) and sufficiency of dike compaction (§257.73(d)(1)(iii)) portions of the SSA criteria. This included stating that slope stability analyses for slip surfaces passing through the foundation met or exceeded the criteria listed in §257.73(e)(1), for the stability of foundations and abutments. For the sufficiency of dike compaction, this included stating that slope stability analyses for slip surfaces passing through the dike also met or exceeded the §257.73(e)(1) criteria.

5.2 Review of Initial SSA

Geosyntec performed a review of the Initial SSA ([4], [8]) in terms of technical approach, calculation input parameters and methodology, recommendations, and completeness. The review included the following tasks:

- Reviewing photographs collected in 2015 and used to demonstrate compliance with §257.73(d)(1)(i)-(vii).

- Reviewing geotechnical calculations used to demonstrate the stability of foundations, per §257.73(d)(1)(i) and sufficiency of dike compaction, per §257.73(d)(1)(iii), in terms of supporting geotechnical investigation and testing data, input parameters, analysis methodology, selection of critical cross-sections, and loading conditions.

- Review of the methodology used to demonstrate that a downstream water body that could induce a sudden drawdown condition, per §257.73(d)(1)(vii), is not present.

- Completeness and technical approach of closed-circuit television (CCTV) inspections used to evaluate the stability of hydraulic structures, per §257.73(d)(1)(vi).

No significant technical issues were noted within the technical review, although a detailed review (e.g., check) of the calculations was not performed.

5.3 Summary of Site Changes Affecting the Initial SSA

Several changes at the site that occurred after development of the Initial SSA were identified. These changes will require updates to the Initial SSA. Each change and the recommended updates to the Initial SSA ([4], [8]) are described below:

- The Initial SSA utilized the results of the Initial Inflow Design Flood Control System Plan (IDF) to demonstrate compliance with the adequacy of spillway design and management (§257.73(d)(1)(v)(A)-(B)). The Initial IDF was subsequently updated to develop a Periodic IDF, based on site changes, as discussed in **Section 7**.

- The Initial SSA utilized the slope stability analysis results of the Initial Safety Factor Assessment (SFA) as part of the compliance demonstration for the stability of foundations and abutments (§257.73(d)(1)(i)) and sufficiency of dike compaction (§257.73(d)(1)(iii)) as discussed in **Section 5.1**. The Initial SFA slope stability analyses were subsequently updated to develop a Periodic SFA, based on site changes, as discussed in **Section 6**.

5.4 Periodic SSA

The Periodic SFA (**Section 6**) indicates that foundations and abutments are stable and dike compaction is sufficient for expected ranges in loading conditions, as slope stability factors of safety were found to meet or exceed the requirements of §257.73(e)(1). Therefore, the requirements of §257.73(d)(1)(i) and §257.73(d)(1)(iii) are met for the Periodic SSA.

The Periodic IDF (**Section 7**) indicates that spillways are adequately designed and constructed to adequately manage flow during the PMF flood, as the spillways can adequately manage flow during peak discharge from the PMP storm event without overtopping of the embankments. Therefore, the requirements of §257.73(d)(1)(v)(A)-(B) are met for the Periodic SSA.

SECTION 6

SAFETY FACTOR ASSESSMENT - §257.73(e)(1)

6.1 Overview of Initial SFA

The Initial Safety Factor Assessment (Initial SFA) was prepared by AECOM in 2016 ([5], [8]), following the requirements of §257.73(e)(1). The Initial SFA included the following information:

- A geotechnical investigation program with in-situ and laboratory testing;
- An assessment of the potential for liquefaction in the dike and foundation soils;
- The development of ten slope stability cross-sections for limit equilibrium stability analysis utilizing GeoStudio SLOPE/W software; and
- The analysis of all cross-sections for maximum storage pool, maximum surcharge pool, and seismic loading conditions.
    - Liquefaction loading conditions were not evaluated as liquefaction-susceptible soil layers were not identified in the either the embankments or foundation soils.

The Initial SFA concluded that the AP met all safety factor requirements, per §257.73(e), as all calculated safety factors were equal to or higher than the minimum required values.

6.2 Review of Initial SFA

Geosyntec performed a review of the Initial SFA ([5], [8]) in terms of technical approach, calculation input parameters and methodology, recommendations, and completeness. The review included the following tasks:

- Reviewing geotechnical calculations used to demonstrate the acceptable safety factors, per §257.73(e)(1), in terms of:
    - Completeness and adequacy of supporting geotechnical investigation and testing data;
    - Completeness and approach of liquefaction triggering assessments;
    - Input parameters, analysis methodology, selection of critical cross-sections, and loading conditions utilized for slope stability analyses; and
    - Reviewing the contents vs. the applicable CCR Rule requirements [1].

No significant technical issues were noted within the technical review, although a detailed review (e.g., check) of the calculations was not performed.

6.3 Summary of Site Changes Affecting the Initial SFA

Two changes at the site that occurred after development of the Initial SFA were identified. These changes required updates to the Initial SFA and are described below:

- Significant amount of CCR (up to 20 ft high) were placed below and above the SWSE in the Process Water Pond, thereby potentially applying additional load to the AP dike than was present at the time of the Initial SFA.

- The Periodic IDF (**Section 7**) found that the normal pool elevation within the Process Water Pond increased from 449.5 to 450.4 ft, and within Clarification Pond increased from 447.2 to 447.3 ft. This resulted in increases of 0.9 and 0.1 ft, respectively, adding more water loading on the embankment dikes than was considered in the Initial SFA for the maximum storage pool and seismic loading conditions (§257.73(e)(1)(i) and (iii)). Peak water surface elevations during the IDF also increased from 457.8 to 458.6 ft within the Process Water Pond, and from 457.4 to 457.5 within the Clarification Pond resulting in 0.8 and 0.1 ft, respectively. This resulted in an increase of water loading on the embankment dikes than was considered in the Initial SFA for the maximum surcharge pool loading conditions (§257.73(e)(1)(i)).

6.4 Periodic SFA

Geosyntec revised existing slope stability analyses associated with the Initial SFA ([5], [8]), for the ten cross-sections (A, B, C, D, E, F, G, H, I, and J) previously evaluated to account for site changes, as described in **Section 6.3**. The following approach and input data were used to revise the analyses:

- Ground surface geometry was revised for all the loading conditions in cross-section "B" using the 2021 site survey [16] to account for the changes that occurred to CCR grades.

- Water levels in the AP for the maximum storage pool, and seismic slope stability analysis loading conditions were increased to El. 450.4 and El. 447.3 ft for Process Water Pond cross-sections (i.e., A, B, and J) and Clarification Pond cross-sections (i.e., C, D, E, F, G, H, and I), respectively, based on the Periodic IDF.

- Water levels in the AP for the maximum surcharge pool slope stability analysis loading conditions were increased to El. 458.6 and El. 457.5 ft for Process Water Pond cross-

sections (i.e., A, B, and J) and Clarification Pond cross-sections (i.e., C, D, E, F, G, H, and I), respectively, based on the Periodic IDF.

- All other analysis input data and settings from the Initial SFA ([5], [8]), were utilized, including, but not limited to, subsurface stratigraphy and soil strengths, phreatic conditions, ground surface geometry, software package and version, slip surface search routines and methods, and input data for the seismic analyses.

Factors of safety from the Periodic SFA are summarized in Table 3 and confirm that the AP meets the requirements of §257.73(e)(1). Slope stability analysis output associated with the Periodic SFA is provided in **Attachment D**.

Table 3 – Factors of Safety from Periodic SFA

	Structural Stability Assessment (§257.73(d)) and Safety Factor Assessment (§257.73(e))			
Cross-Section	**Maximum Storage Pool §257.73(e)(1)(i) Minimum Required = 1.50**	**Maximum Surcharge Pool[1] §257.73(e)(1)(ii) Minimum Required = 1.40**	**Seismic §257.73(e)(1)(iii) Minimum Required = 1.00**	**Dike Liquefaction §257.73(e)(1)(iv) Minimum Required = 1.20**
A	2.02	2.02	1.35	N/A
B	1.59	1.59	1.22	N/A
C	1.83	1.82	1.09	N/A
D	1.79	1.79	1.18	N/A
E	1.54*	1.54*	1.11	N/A
F	2.31	2.31	1.08*	N/A
G	2.12	2.12	1.13	N/A
H	2.08	2.08	1.08*	N/A
I	2.26	2.26	1.30	N/A
J	2.55	1.97	2.08	N/A

Notes:
*Indicates critical cross-section (i.e., lowest calculated factor of safety out of the ten cross-sections analyzed)
N/A – Loading condition is not applicable.

SECTION 7

INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN - §257.82

7.1 Overview of Initial IDF

The Initial Inflow Design Flood Control System Plan (Initial IDF) was prepared by AECOM in 2016 ([6], [8]) following the requirements of §257.82. The Initial IDF included the following information:

- A hydraulic and hydrologic analysis was performed for the PMF design flood event because of the hazard potential classification of "high", which corresponded to a peak surcharge elevation of 457.8 feet in the Process Water Pond and 457.4 feet in the Fly Ash Pond and Clarification Pond.
- The Initial IDF utilized a HydroCAD Version 10 model to evaluate spillway flows and pool level increases during the design flood, with a SWSE of 449.5 ft for the Process Water Pond and 447.2 ft for the Fly Ash Pond and Clarification Pond.

The Initial IDF concluded that the AP met the requirements of §257.82, as the peak water surface elevation estimated by the HydroCAD model was 457.8 ft, relative to a minimum AP dike crest elevation of 458.8 ft in the Process Water Pond and 457.4 ft, relative to a minimum AP dike crest elevation of 459.6 ft in the Fly Ash Pond and Clarification Pond. Therefore, overtopping was not expected. The Initial IDF also evaluated the potential for discharge from the CCR unit and determined that discharge in violation of the existing NDPES for the AP was not expected, as all discharge from the AP during both normal and inflow design flood conditions was expected to be routed through the existing spillway and NDPES-permitted outfall.

7.2 Review of Initial IDF

Geosyntec performed a review of the Initial IDF ([6], [8]) in terms of technical approach, calculation input parameters and methodology, recommendations, and completeness. The review included the following tasks:

- Reviewing the return interval used vs. the hazard potential classification.
- Reviewing the rainfall depth and distribution for appropriateness.
- Performing a high-level review of the inputs to the hydrological modeling.
- Reviewing the hydrologic model parameters for spillway parameters, starting pool elevation, and storage vs. the reference data.

- Reviewing the overall Initial IDF vs. the applicable requirements of the CCR Rule [1].

Several comments were identified during review of the Initial IDF. The comments are described below:

- The initial IDF certification used the National Resource Conservation Service (NRCS) TR-60 Emergency Spillway and Freeboard (ESFB) rainfall distribution. This is a distribution NRCS utilizes in making determination and analysis of auxiliary spillway flow depth and duration. The electronic model files for the initial IDF were unavailable; therefore, the "Spillway Emergency" [21] storm type provided by HydroCAD was used for the updated IDF, which replicates the NRCS 24-hour ESFB design hydrograph rainfall distribution.
    - The ESFB rainfall distribution was found by NRCS to be an accurate representation of a 24-hour Probable Maximum Precipitation (PMP) event per a study applying different rainfall distributions to 24-hour PMP storm events for purposes of evaluating existing high-hazard dams east of the 105th meridian [22]. The following are excerpts from the NRCS study:
        - *"The dimensionless conversion of the ESFB distribution from a 6-hour to a 24-hour pattern has been used with PMP events in a number of states where 24-hour storms are required as a part of the State's dam safety criteria and approval process……Although the ESFB Distribution and the World Curve distribution were developed from entirely independent data sources, the distributions are similar when compared on a volume-duration basis. The world curve supports the ESFB."*
        - *"The World Curve Distribution is a valid basis for design of high hazard structures…It would seem logical to use the World Curve distribution for PMP size event"*
    - The NRCS study [22]found the NRCS ESFB is comparable to the World Curve. The World Curve is developed from worldwide maximum rainfall records and deemed by NRCS to be logical to use for a PMP size event and valid for design of high hazard structures.

7.3 Summary of Site Changes Affecting the Initial IDF

Two changes at the site that occurred after development of the Initial IDF were identified. These changes required updates to the Initial IDF and are described below:

- Approximately 100,030 CY of CCR were placed above the SWSE utilized for the Initial IDF certification in the Process Water Pond, thereby altering the stage-storage curve relative to the Initial IDF. Filling in of the serpentine channel system above and below the SWSE also occurred; however, the storage capacity of the serpentine channels was

disregarded in the Initial IDF for conservatism in the model and the filling of the serpentine channels did not have to be accounted for in the updated IDF.

- In 2020, the surveyed water surface elevation (WSE) was 450.4 ft within the Process Water Pond and 447.3 ft in the Clarification Pond [16]; this is higher than the SWSE used in the Initial IDF by 0.9 ft and 0.1 ft, respectively, thereby the SWSE utilized in the Initial IDF were no longer consistent with conditions observed in 2020.

7.4 Periodic IDF

Geosyntec revised the HydroCAD model associated with the Initial IDF to account for the revised rainfall distribution type and additional CCR placement, as described in **Sections 7.2** and **7.3**. The following approach and input data were used for the revised analyses and are referenced in **Attachment E** as appropriate:

- The name of the "Cooling Pond" node in the model was changed to "Process Water Pond" for consistency with the text portion of the 2016 IDF Certification.
- Stage-storage (i.e., area-capacity) curves for both the Process Water Pond and Clarification Pond were updated based on the 2020 site survey [16].
    - A revised stage-volume curve for the AP was prepared based on measuring the storage volume of the AP every two-foot increment of depth from: (i) an elevation at the bottom of the Clarification Pond (434 ft) to an elevation of 460 ft, and (ii) an elevation at the bottom of the Process Water Pond (444 ft) to an elevation of 460 ft. This analysis identified an overall increase of 810 CY (0.5 ac-ft) of storage volume at the Clarification Pond and an overall decrease of 100,030 CY (62 ac-ft) of storage volume from the Cooing Pond compared to the storage volumes used in the 2016 Initial IDF Certification.
- The SWSE within the Process Water Pond was updated from 449.5 ft to 450.4 ft to reflect the 2020 site survey [16]. The discharge structure invert elevation is 449.2 ft; however, the greater elevation of the invert structure and the surveyed WSE was used as the SWSE to provide conservatism in the model.
- The SWSE within the Clarification Pond was updated from 447.2 ft to 447.3 ft to reflect the 2020 site survey [16]. The vertical spillway elevation is 447.2 ft; however, the greater elevation of the invert structure and the surveyed WSE was used as the SWSE to provide conservatism in the model.
- The rainfall distribution type was updated to the "Spillway Emergency" storm type provided by HydroCAD [21], which replicates the NRCS 24-hour ESFB distribution.
- The initial IDF assumed that the tailwater conditions in the Illinois River during the IDF was the historic high-water elevation at Peoria Lock and Dam (NOAA Gauging Station

PRAI2) of 456.7 ft; however, the NOAA gauging station shows a historic high-water elevation of 456.57 ft. Therefore, a link was added in the updated model downstream of the Clarification Pond to represent the Illinois River historic high-water elevation of 456.57 ft at Peoria Lock and Dam [23].

- Drainage area characteristics were updated based on the 2020 site survey, as follows:
    - For the Process Water Pond Watershed, the open water surface area was updated from 5.2 acres to 1.2 acres and the CCR surface was updated from 13.2 acres to 17.2 acres.
    - For the North Ash Pond Watershed, the open water surface area was updated from 4.4 acres to 0.6 acres and the CCR surface was updated from 10.3 acres to 14.1 acres.
    - For the South Ash Pond Watershed, the open water surface area was updated from 4.3 acres to 1.2 acres and the CCR surface was updated from 15.1 acres to 18.2 acres.
    - For the Clarification Pond Watershed, the open water surface area was updated from 25.1 acres to 19.7 acres and the CCR surface was updated from 10.7 acres to 16.1 acres
- Pipes
    - The following updates were made for the 24-inch corrugated metal pipe (CMP) outlet from the Process Water Pond based on the 2020 site survey:
        - The upstream invert elevation was updated from 449.5 ft to 449.15 ft and downstream invert elevation was updated from 449.5 ft to 447.93 ft.
        - The length was updated from 80 ft to 104 ft.

All other input data and settings from the Initial IDF HydroCAD model were utilized, including, but not limited to software package and version, 24-hour PMP rainfall depth, runoff method, analysis time span and analysis time step.

The results of the Updated IDF are summarized in **Table 4** and confirm that the AP meets the requirements of §257.82(a)-(b), as the peak water surface elevation does not exceed the minimum perimeter dike crest elevations. Additionally, all discharge from the AP is routed through the existing spillway system to the NPDES-permitted outfall, during both normal and IDF conditions. Updated area-capacity curves and HydroCAD model output is provided in **Attachment E**.

Table 4 – Water Levels from updated Periodic IDF

	Process Water Pond			Clarification Pond		
Analysis	Starting WSE (ft)	Peak WSE (ft)	Min. Dike Crest Elevation (ft)	Starting WSE (ft)	Peak WSE (ft)	Min. Dike Crest Elevation (ft)
Initial IDF	449.5	457.8	458.8	447.2	457.4	459.6
Periodic IDF Update	450.4	458.6	458.8	447.3	457.5	459.6
Initial to Periodic Change[1]	+0.9	+0.8	-	+0.1	+0.1	-

Notes:
[1]Postive change indicates increase in the WSE relative to the Initial IDF, negative change indicates decrease in the WSE, relative to the Initial IDF.

Edwards

SECTION 8

CONCLUSIONS

The AP at EPP was evaluated relative to the USEPA CCR Rule periodic assessment requirements for:

- Hazard potential classification (§257.73(a)(2)),
- History of Construction reporting (§257.73(d)),
- Structural stability assessment (§257.73(d)),
- Safety factor assessment (§257.73(e)), and
- Inflow design flood control system planning (§257.82).
- Based on the evaluations presented herein, the referenced requirements are satisfied.

Based on the evaluations presented herein, the referenced requirements are satisfied for this CCR unit.

Edwards

SECTION 9

CERTIFICATION STATEMENT

CCR Unit: Illinois Power Resources Generating, LLC, Edwards Power Plant, Ash Pond

I, John P. Seymour, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this 2021 USEPA CCR Rule Periodic Certification Report, has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the periodic assessment of the hazard potential classification, history of construction report, structural stability, safety factors, and inflow design flood control system planning, dated October 2021, were conducted in accordance with the requirements of 40 CFR §257.73(a)(2), (c), (d), (e), and §257.82.

John Seymour

JOHN P. SEYMOUR
062-040562
LICENSED
PROFESSIONAL
ENGINEER
STATE OF ILLINOIS

Exp. 11/30/2021

10/11/2021
Date

Edwards

SECTION 10

REFERENCES

[1] United States Environmental Protection Agency, 40 CFR Parts 257 and 261: Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule, 2015.

[2] Stantec Consulting Services Inc., "Initial Hazard Potetnial Classification Assessment, EPA Final CCR Rule, Ash Pond,Edwards Power Plant, Peoria County, Illinois," Fenton, MO, October 12, 2016.

[3] AECOM, "History of Construction, USEPA Final CCR Rule, Edwards Power Plant, Bartonville, Illinois," October 2016.

[4] AECOM, "CCR Rule Report: Initial Structural Stability Assessment For Ash Pond At Edwards Power Plant," St. Louis, MO, October 2016.

[5] AECOM, "CCR Rule Report: Initial Safety Factor Assessment For Ash Pond At Edwards Power Plant," St. Louis, MO, October 2016.

[6] AECOM, "CCR Rule Report: Initial Inflow Design Flood Control System Plan For East Ash Pond At Edwards Power Plant," St. Louis, MO, October 2016.

[7] Stantec Consulting Services, Inc., "Documentation of Initial Hazard Potential Classification Assessment, Ash Pond, Edwards Power Plant, Bartonville, Illinois," October 12, 2016.

[8] AECOM, "CCR Certification Report: Initial Structural Stability Assessment, Initial Safety Factor Assessment, and Initial Inflow Design Flood Control System Plan for Ash Pond at Edwards Power Plant," St. Louis, MO, October 2016.

[9] J. Knutelski and J. Campbell, "Annual CCR Surface Impoundment Inspection Report (per 40 CFR 257.83(b)(2)), Edwards Power Plant, Ash Pond," August 29, 2016.

[10] J. Knutelski and J. Campbell, "Annual CCR Surface Impoundment Inspection Report (per 40 CFR 257.83(b)(2)), Edwards Power Plant, Ash Pond," August 30, 2017.

[11] S. Arends, "Annual Inspection by a Qualified Professional Engineer, 40 CFR §257.83(b), Edwards Power Plant, Ash Pond," August 29, 2018.

[12] J. Knutelski, "Annual Inspection by a Qualified Professional Engineer, 40 CFR 257.83(b), Edwards Power Plant, Ash Pond," September 05, 2019.

[13] J. Knutelski, "Annual Inspection by a Qualified Professional Engineer, 40 CFR §257.83(b), Edwards Power Plant, Ash Pond," November 06, 2020.

[14] Geosyntec Consultants, "Edwards Piezo Measurements_20160211," 2021.

[15] M.-S. Inc., "Edwards Power Plant, 2015 Topogaphy," Dynegy, Collinsville, IL, July 2015.

[16] IngenAE, "Luminant, Illinois Power Rescources Generating, LLC, Edwards Power Plant, December 2020 Topography," Earth City, Missouri, March 12, 2021.

[17] Weaver Consultants Group, "Dynegy, Collinsville, IL, 2015 - Edwards 2015 Existing Aerial Photograph Existing Site Conditions," Collinsville, IL, October 2015.

[18] Envrionmental Risk Information Services (ERIS), "Edwards Power Plant," Toronto ON, CA, 2019.

[19] AECOM, "Draft CCR Unit Initial Site Visit Summary, Dynegy CCR Compliance Program," June 24, 2015.

[20] Illinois Power Resources Generating, "Emergency Action Plan," 2017.

[21] HydroCadTM Software Solutions, LLC, "HydroCad Stormwater Modeling System, Version 10," Chocorua, New Hampshire, 2016.

[22] J. N. Riely and R. C. Moore, "Comparison of Temporal Rainfall Distributions for Near Probable Maximum Precipitation Storm Events for Dam Design," National Water Management Center, National Resources Conservation Service (NRCS), Little Rock, Arkansas.

[23] National Oceanic and Atmospheric Administration, "Advanced Hydrologic Prediction Service, Illinois River at Peoria Lock and Dam," [Online]. Available: https://water.weather.gov/ahps2/hydrograph.php?wfo=ilx&gage=prai2&prob_type=stage&source=hydrograph. [Accessed 18 August 2021].

Edwards

DRAWINGS

Edwards



INITIAL SURVEY
07-23-2015 TOPOGRAPHY



PERIODIC SURVEY
02-23-2021 TOPOGRAPHY

NOTES:

1. THE INITIAL SURVEY WAS TAKEN FROM THE DRAWING TITLED "TOPOGRAPHIC AND BATHYMETRIC SURVEY, DYNEGY - EDWARDS POWER STATION - BARTONVILLE, IL", PREPARED BY MAURER-STUTZ, INC., DATED JULY 23, 2015.
2. THE PERIODIC SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED "LUMINANT, ILLINOIS POWER RESOURCES GENERATING, LLC, EDWARDS POWER STATION, DECEMBER 2020 TOPOGRAPHY", PREPARED BY INGENAE, DATED FEBRUARY 23, 2021.
3. ALL SURVEY DATA WAS COLLECTED IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) AND NORTH AMERICAN DATUM OF 1983 (NAD83) FOR VERTICAL AND HORIZONTAL COORDINATES, RESPECTIVELY.

0 500
SCALE IN FEET

INITIAL TO PERIODIC SURVEY COMPARISON
ASH POND
EDWARDS POWER PLANT
PEORIA, ILLINOIS

Geosyntec consultants

DRAWING 1

GLP8027.04 | MAY 2021

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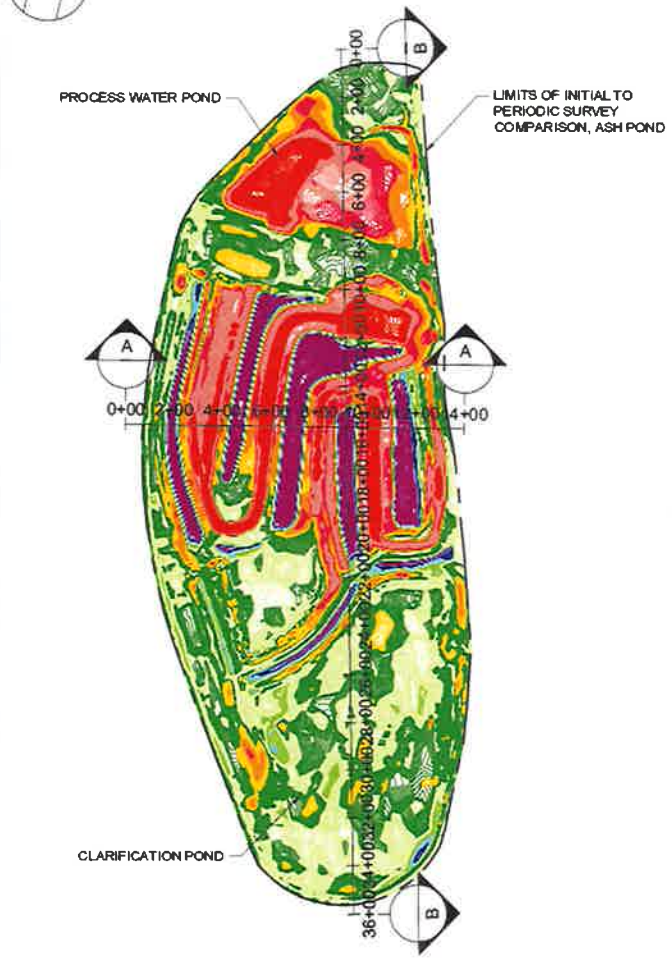

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SCALE IN FEET

ISOPACH CONTOUR KEY		
COLOR	MIN ELEV	MAX ELEV
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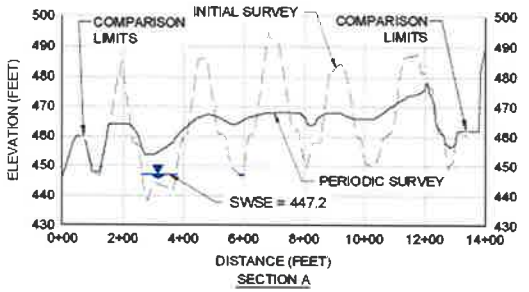
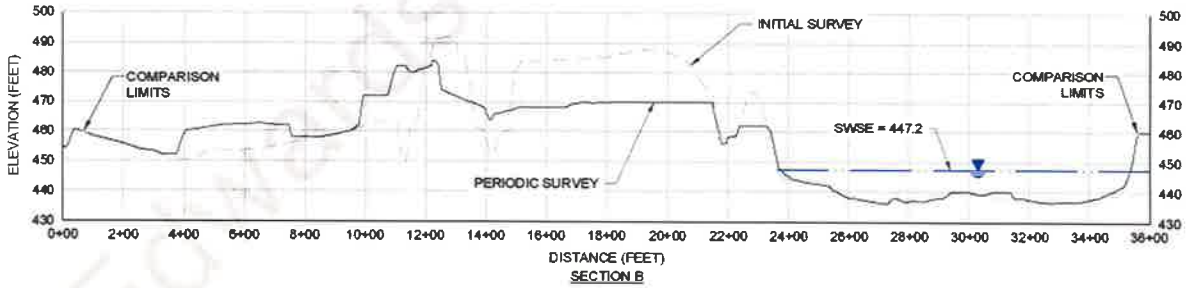
	-10	-8
	-8	-6
	-6	-4
	-4	-2
	-2	0
	0	2
	2	4
	4	6
	6	8
	8	10
	10	19



SECTION A



SECTION B

0 40
VERT: SCALE IN FEET

0 400
HORZ: SCALE IN FEET

INITIAL TO PERIODIC SURVEY COMPARISON SUMMARY			
SURFACE IMPOUNDMENT	CUT	FILL	NET (CU. YD.)
ASH POND	243,495	369,878	126,383 (FILL)
ABOVE SWSE	224,416	314,732	90,315 (FILL)
BELOW SWSE	19,080	55,149	36,069 (FILL)

NOTES:

1. THE INITIAL SURVEY WAS TAKEN FROM THE DRAWING TITLED "TOPOGRAPHIC AND BATHYMETRIC SURVEY, DYNEGY - EDWARDS POWER STATION - BARTONVILLE, IL", PREPARED BY MAURER-STUTZ, INC., DATED JULY 23, 2015.
2. THE PERIODIC SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED "LUMINANT, ILLINOIS POWER RESOURCES GENERATING, LLC, EDWARDS POWER STATION, DECEMBER 2020 TOPOGRAPHY", PREPARED BY INGENAE, DATED FEBRUARY 23, 2021.
3. ALL SURVEY DATA WAS COLLECTED IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) AND NORTH AMERICAN DATUM OF 1983 (NAD83) FOR VERTICAL AND HORIZONTAL COORDINATES, RESPECTIVELY.
4. THE STARTING WATER SURFACE ELEVATION (SWSE) OF THE ASH POND IS EL. 447.2 FT, AS NOTED IN THE REPORT TITLED "CCR CERTIFICATION REPORT: INITIAL STRUCTURAL STABILITY ASSESSMENT, INITIAL SAFETY FACTOR ASSESSMENT, AND INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN FOR ASH POND AT EDWARDS POWER STATION", PREPARED BY AECOM, DATED OCTOBER, 2016.

SURVEY CPMPARISON ISOPACH
ASH POND
EDWARDS POWER STATION
PEORIA, ILLINOIS

Geosyntec consultants

FIGURE 2

GLP8027.04 | AUGUST 2021

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INITIAL AERIAL
07-23-2015 IMAGERY



PERIODIC AERIAL
02-23-2021 IMAGERY

NOTES:

1. THE INITIAL IMAGERY WAS TAKEN FROM THE DRAWING TITLED "TOPOGRAPHIC AND BATHYMETRIC SURVEY, DYNEGY - EDWARDS POWER STATION - BARTONVILLE, IL", PREPARED BY MAURER-STUTZ, INC., DATED JULY 23, 2015.
2. THE PERIODIC IMAGERY WAS TAKEN FROM THE DRAWING PACKAGE TITLED "LUMINANT, ILLINOIS POWER RESOURCES GENERATING, LLC, EDWARDS POWER STATION, DECEMBER 2020 TOPOGRAPHY", PREPARED BY INGENAE, DATED FEBRUARY 23, 2021.

0 500
SCALE IN FEET

INITIAL TO PERIODIC AERIAL IMAGERY
COMPARISON
ASH POND
EDWARDS POWER STATION
PEORIA, ILLINOIS

Geosyntec consultants

DRAWING 3

GLP8027.04 | MAY 2021

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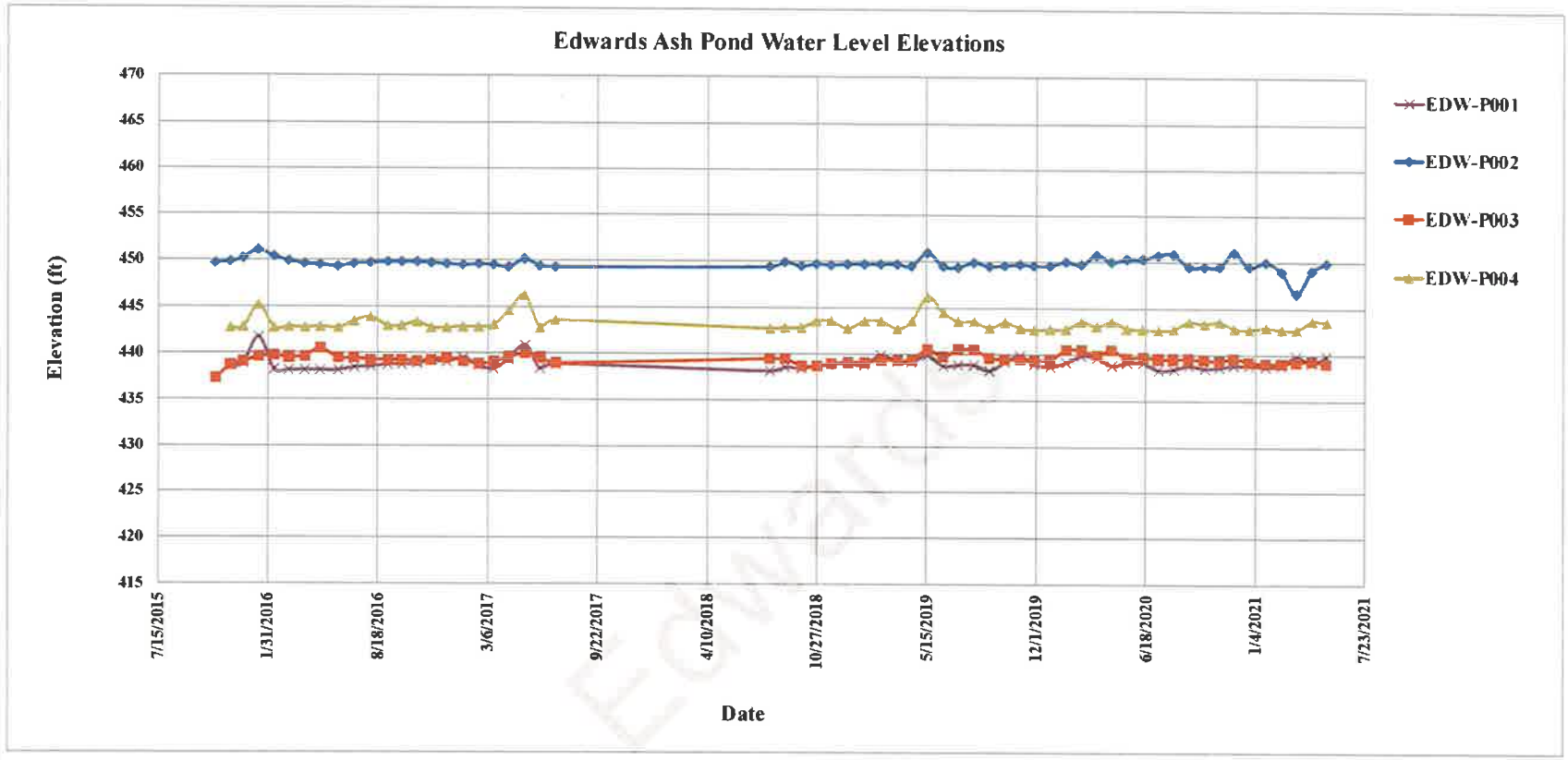
ATTACHMENTS

Edwards

Attachment A

AP Piezometer Data Plots

Edwards



NOTES:
1. Piezometer data was taken from the spreadsheet titled "Edwards Piezo Measurements_20160211", provided by the Edwards Power Plant.

PIEZOMETER DATA PERIODIC CERTIFICATION EDWARDS POWER PLANT EDWARDS, ILLINOIS		
Geosyntec consultants		Figure A-1
GLP8027	6/15/2021	

Attachment B

AP Site Visit Photolog

Edwards

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Illinois Power Generating Company **Project Number:** GLP8027

CCR Unit: Ash Pond **Site:** Edwards Power Plant

Photo: P-1

Date: 6/10/2021

Direction Facing: S

Comments: Slope along access road to former acid building. Pond is to the right beyond the train.



Photo: P-2

Date: 6/10/2021

Direction Facing: E

Comments: Rip rap placed on steeper slope in place of grass.



GEOSYNTEC CONSULTANTS Photographic Record	Geosyntec consultants
Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: Ash Pond	**Site:** Edwards Power Plant

Photo: P-3 **Date:** 6/10/2021 **Direction Facing:** S **Comments:** Crest of dam and inside of pond.	
Photo: P-4 **Date:** 6/10/2021 **Direction Facing:** SW **Comments:** Drop inlet spillway structure	

GEOSYNTEC CONSULTANTS	
Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: Ash Pond	**Site:** Edwards Power Plant

Photo: P-5 **Date:** 6/10/2021 **Direction Facing:** Down **Comments:** Drop inlet morning glory spillway structure from above.	

Photo: P-6 **Date:** 6/10/2021 **Direction Facing:** NW **Comments:** Pond divider dike.	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Illinois Power Generating Company **Project Number:** GLP8027

CCR Unit: Ash Pond **Site:** Edwards Power Plant

Photo: P-7

Date: 6/10/2021

Direction Facing: S

Comments: Crest of filled and covered area at south end of pond outside of tracks.



Photo: P-8

Date: 6/10/2021

Direction Facing: W

Comments: Slope of filled and covered area at south end of AP.



GEOSYNTEC CONSULTANTS	Geosyntec consultants
Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: Ash Pond	**Site:** Edwards Power Plant

Photo: P-9 **Date:** 6/10/2021 **Direction Facing:** W **Comments:** Water at toe of slope in ditch.	
Photo: P-10 **Date:** 6/10/2021 **Direction Facing:** NE **Comments:** Bottom ash sluiced into clean out area. Pooled bottom ash is to be drained and disposed of on site.	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Illinois Power Generating Company **Project Number:** GLP8027

CCR Unit: Ash Pond **Site:** Edwards Power Plant

Photo: P-11

Date: 6/10/2021

Direction Facing: W

Comments: Piled ash is higher than the crest of dam.



Photo: P-12

Date: 6/10/2021

Direction Facing: NNW

Comments: West end of bottom ash clean-out area.



Edwards

GEOSYNTEC CONSULTANTS	Geosyntec consultants
Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: Ash Pond	**Site:** Edwards Power Plant

Photo: P-13 **Date:** 6/10/2021 **Direction Facing:** SSE **Comments:** Piled ash and concrete debris on the left.	
Photo: P-14 **Date:** 6/10/2021 **Direction Facing:** NNW **Comments:** Filled "serpentine" and ash fill to the right placed higher than the crest.	

GEOSYNTEC CONSULTANTS **Photographic Record**	Geosyntec consultants
Site Owner: Illinois Power Generating Company	**Project Number:** GLP8027
CCR Unit: Ash Pond	**Site:** Edwards Power Plant

Photo: P-15	
Date: 6/10/2021	
Direction Facing: ENW	
Comments: Ash fill placed higher than the crest; left one remaining serpentine pond to the left.	

Attachment C

Periodic History of Construction Report Update Letter

Edwards

Geosyntec consultants

1 McBride and Son Center Drive, Suite 202
Chesterfield, MO 63005
PH 636-812-0800
www.geosyntec.com

October 11, 2021

Illinois Power Resources Generation, LLC
7800 South Cilco Lane
Bartonville, Illinois 61607

Subject: **Periodic History of Construction Report Update Letter**
USEPA Final CCR Rule, 40 CFR §257.73(c)
Edwards Power Plant
Bartonville, Illinois

Geosyntec Consultants (Geosyntec) has prepared this Letter at the request of Illinois Power Resources Generation (IPRG) to document updates to the Initial History of Construction (HoC) report for the Edwards Power Plant (EPP), also known as the Edwards Power Station (EPS). The Initial HoC report was prepared by AECOM in October of 2016 [1] in accordance with 40 Code of Federal Regulations (CFR) §257.73(c) of the United States Environmental Protection Agency (USEPA) Coal Combustion Residuals Rule, known as the CCR Rule [2]. This letter also includes information required by Section 845.220(a)(1)(B) (Design and Construction Plans) of the state-specific Illinois Environmental Protection Agency (IEPA) Part 845 CCR Rule [3] that is not expressly required by §257.73(c).

BACKGROUND

The CCR Rule required that, by October 17, 2016, Initial HoC reports to be compiled for existing CCR surface impoundments with: (1) a height of five feet or more and a storage volume of 20 acre-feet or more, or (2) a height of 20 feet or more. The Initial HoC report was required to contain, to the extent feasible, the information specified in 40 CFR §257.73(c)(1)(i)-(xii). The Initial HoC report for EPP, which included the existing CCR surface impoundment, the Ash Pond (AP), was prepared and subsequently posted to IPRG's CCR Website prior to October 17, 2016.

The CCR Rule requires that Initial HoC to be updated if there is a significant change to any information complied in the Initial HoC report, as listed below:

§ 257.73(c)(2): If there is a significant change to any information complied under paragraph (c)(1) of this section, the owner or operator of the CCR unit must update the relevant information and place it in the facility's operating record as required by § 257.105(f)(9).

IRPG retained Geosyntec to review the Initial HoC report, review reasonably and readily available information for the AP generated since the Initial HoC report was prepared, and perform a site visit to EPP to evaluate if significant changes may have occurred since the Initial HoC report was prepared. This Letter contains the results of Geosyntec's evaluation and documents significant changes that have occurred at the AP and EPP, as they pertain the requirements of §257.73(c)(1)(i)-(xii)

UPDATES TO HISTORY OF CONSTRUCTION REPORT

Geosyntec's evaluation for the EPP AP determined that no known significant changes requiring updates to the information in the Initial HoC report pertaining to pertaining to §257.73(c)(1)(ii-viii) of the CCR Rule had occurred since the Initial HoC report had been developed.

However, Geosyntec's evaluation determined that significant changes at the EPP AP pertaining to §257.73(c)(1) (i),(ix)-(x) of the CCR Rule had occurred since the Initial HoC report had been developed. Additionally, information how long the CCR surface impoundments have been operating and the types of CCR in the surface impoundments, as required by Section 845.220(a)(1)(B) of the Part 845 Rule were not included in the Initial HoC report, as this information is not required by the CCR Rule. Each change and the subsequent updates to the Initial HoC report is described within this section.

Section 845.220(a)(1)(B): A statement of ... how long the CCR surface impoundment has been in operation, and the types of CCR that have been placed in the surface impoundment.

Ash Pond

The AP is in operation since 1960. As of the date of this report, the AP has been present for approximately 61 years.

CCR placed in the AP has been used to store and dispose sluiced bottom ash and fly ash and to clarify water, including non-CCR station process wastewaters, prior to discharge in accordance with the station's NPDES permit [1].

§ 257.73(c)(1)(i): The name and address of the person(s) owning or operating the CCR unit; the name associated with the CCR unit; and the identification number of the CCR unit if one has been assigned by the state.

The state identification number (ID) for the AP have been assigned by the Illinois Environmental Protection Agency (IEPA). The ID is listed in **Table 1**.

Table 1 – IEPA ID Numbers

CCR Surface Impoundment	State ID
Ash Pond	W1438050005-01

§ 257.73(c)(1)(ix): Area-capacity curves for the CCR unit.

Updated area-capacity curves were prepared for the Process Water Pond and the Clarification Pond for the AP in 2021. These curves are provided in **Figures 1** and **2**.

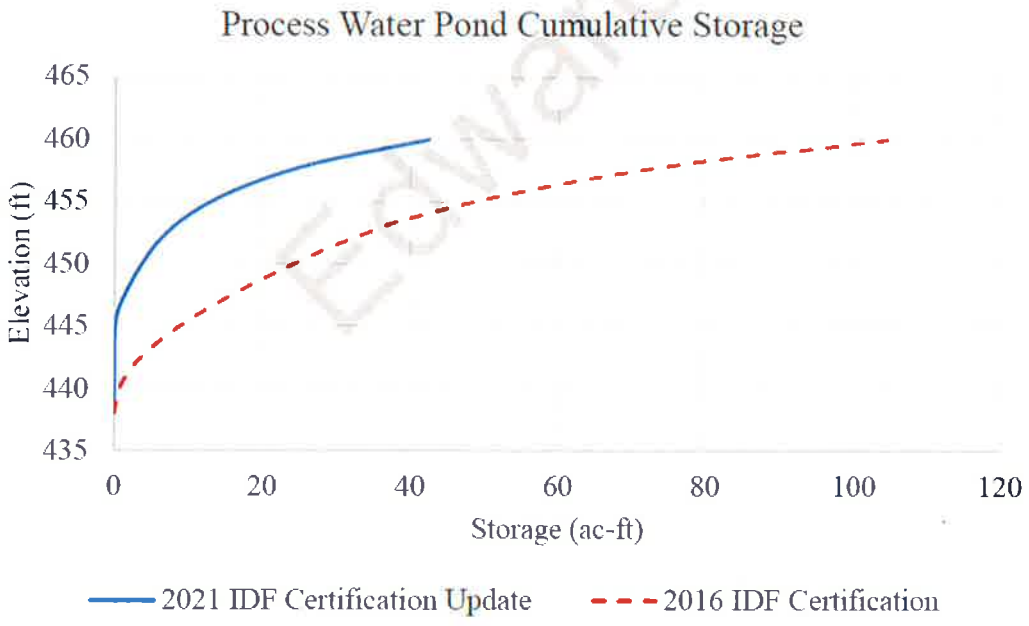


Figure 1 – Area-Capacity Curve for Ash Pond – Process Water Pond

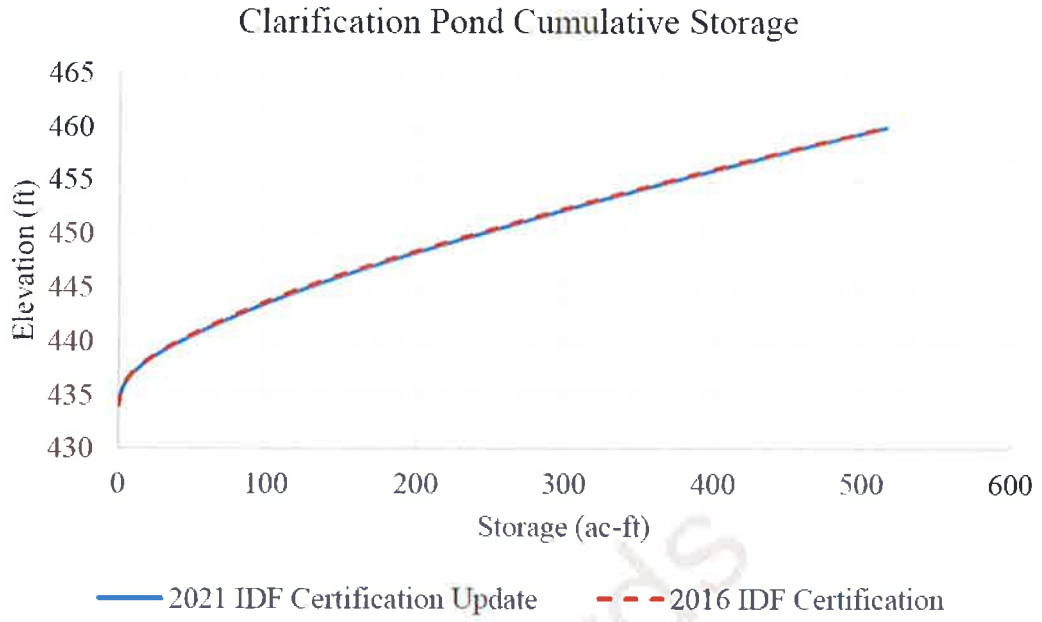


Figure 2 – Area-Capacity Curve for Ash Pond – Clarification Pond

§ 257.73(c)(1)(x): A description of each spillway and diversion design features and capacities and calculations used in their determination.

Updated discharge capacity calculations for the existing spillways were prepared in 2021 using HydroCAD 10 modeling software. The calculations indicate that the AP has sufficient storage capacity and will not overtop the embankments during the 1,000 year 24-hour rainfall event. The results of the calculations are provided in **Table 2**.

Table 2 – Results of Updated Discharge Capacity Calculations

	Process Water Pond	Clarification Pond
Approximate Berm Minimum Elevation[1], ft	458.8	459.6
Approximate Emergency Spillway Elevation[1], ft	Not Applicable	Not Applicable
Starting Water Surface Elevation[1] (SWSE), ft	450.4	447.3
Peak Water Surface Elevation[1] (PWSE), ft	458.6	457.5
Time to Peak, hr	9.3	24.6
Surface Area[2], ac	7.3	29.2
Storage[3], ac-ft	27.2	265.3
Notes:		

engineers | scientists | innovators

[1]Elevations are based on the NAVD88 datum
[2]Surface area is defined as the water surface area at the PWSE
[2]Storage is defined as the volume between the SWSE and PWSE

Edwards

engineers | scientists | innovators

CLOSING

This letter has been prepared to document Geosyntec's evaluation of changes that have occurred at the AP at the EPP since the Initial HoC was developed, based on reasonably and readily available information provided by IPRG, observed by Geosyntec during the site visit, or generated by Geosyntec as part of subsequent calculations.

Sincerely,

John Seymour, P.E.
Senior Principal

Lucas P. Carr, P.E.
Senior Engineer

Edwards

REFERENCES

[1] AECOM, "History of Construction, USEPA 40 CFR § 257.73(c), Edwards Power Station, Bartonville, IL," October 2016.

[2] United Stated Environmental Protection Agency, "40 CFR Parts 257 and 261, Hazardous and Solid Waste Management System, Disposal of Coal Combustion Residuals from Electric Utilities, Final Rule, 2015," 2015.

[3] Illinois Environmental Protection Agency, "35 Ill. Adm. Code Part 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments," Springfield, IL, 2021.

Edwards

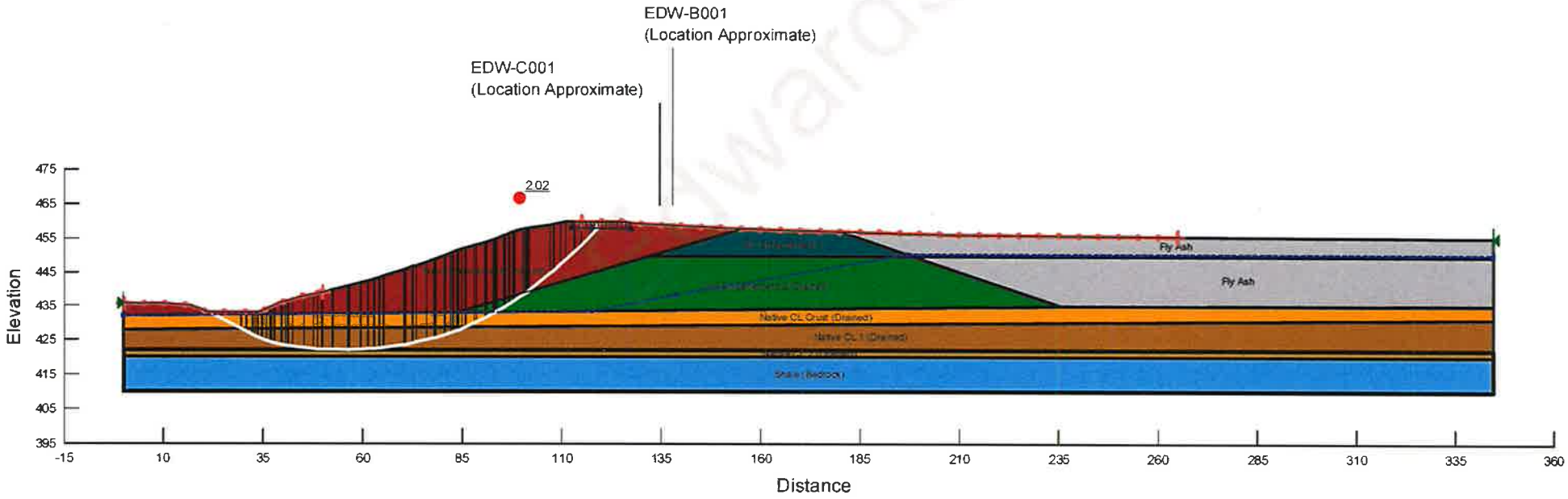
Attachment D

Periodic Structural Stability and Safety Factor Assessment Analyses

Edwards

Edwards Power Plant
Cross-section A
Slope Stability - Steady State

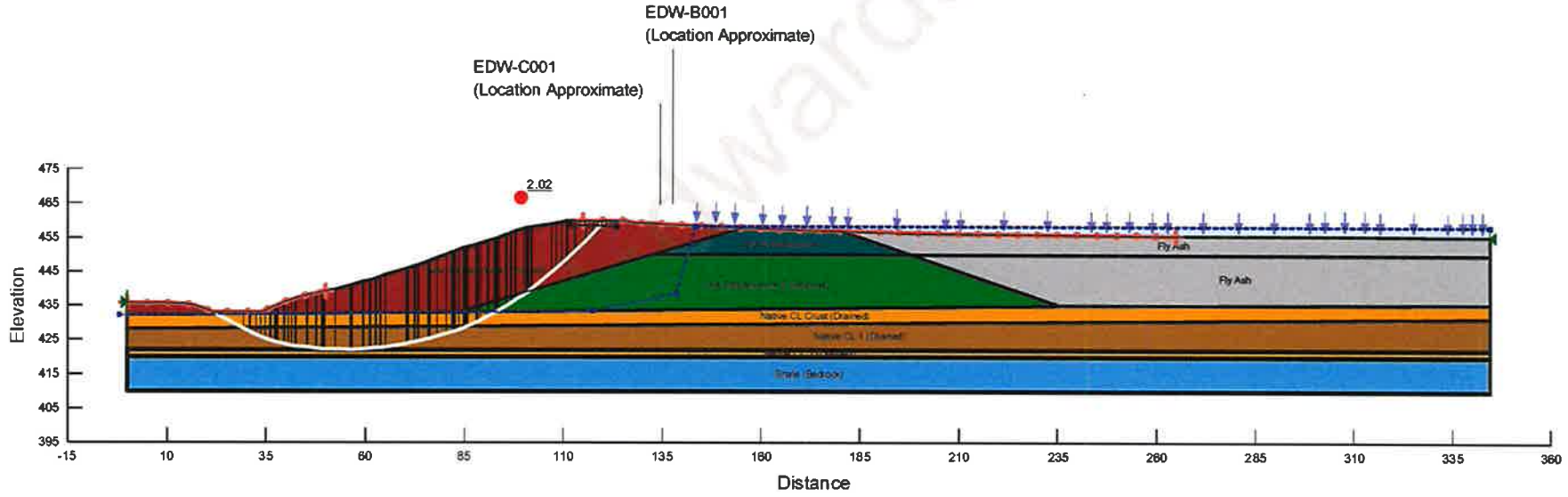
Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 (Drained) Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1



\\STLOUISMO-01\Data\Company\Projects_post_2014\GLP8027_CCR_ReCert\500_Technical\504_EDW\504h_Updated_FOS\Section A\Slope Stability-Existing-X-Sect_A_Edwards_20210830_ZJF.gsz

Edwards Power Plant
Cross-section A
Slope Stability - Surcharge Pool

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 (Drained) Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1

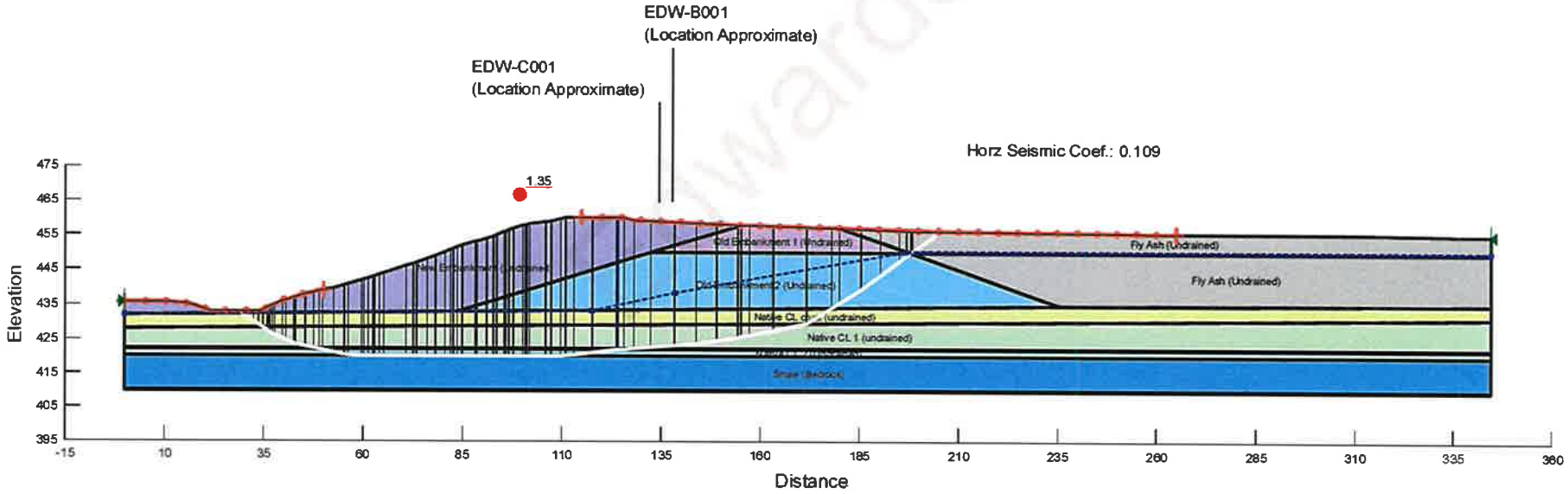


Edwards

\\STLOUISMO-01\Data\Company\Projects_post_2014\GLP8027_CCR_ReCert\500_Technical\504_EDW\504h_Updated_FOS\Section A\Slope Stability-Existing-X-Sect_A_Edwards_20210830_ZJF.gsz

Edwards Power Plant
Cross-section A
Slope Stability - Seismic

Name: Fly Ash (Undrained) Unit Weight: 105 pcf Cohesion': 600 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 1 (Undrained) Unit Weight: 125 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL crust (undrained) Unit Weight: 120 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: New Embankment (Undrained) Unit Weight: 115 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 105 pcf Cohesion': 700 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 2 (Undrained) Unit Weight: 125 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1



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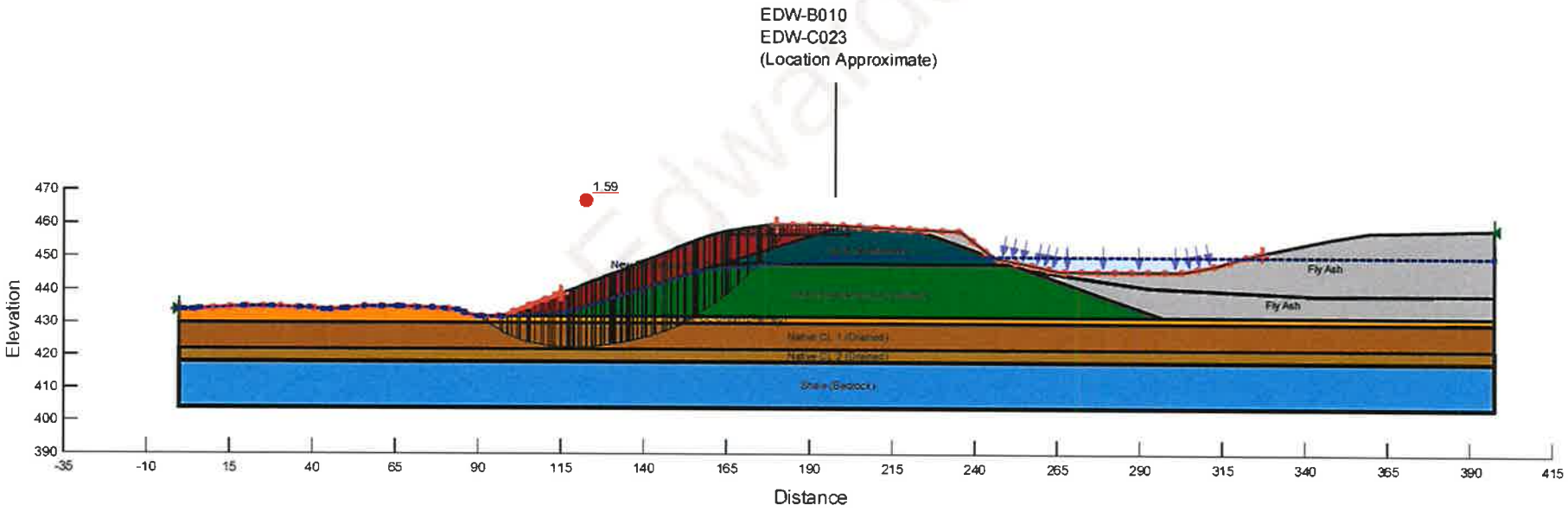
Edwards Power Plant
Cross-section B
Slope Stability - Steady State

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: Old Embankment 2 (Drained) Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1



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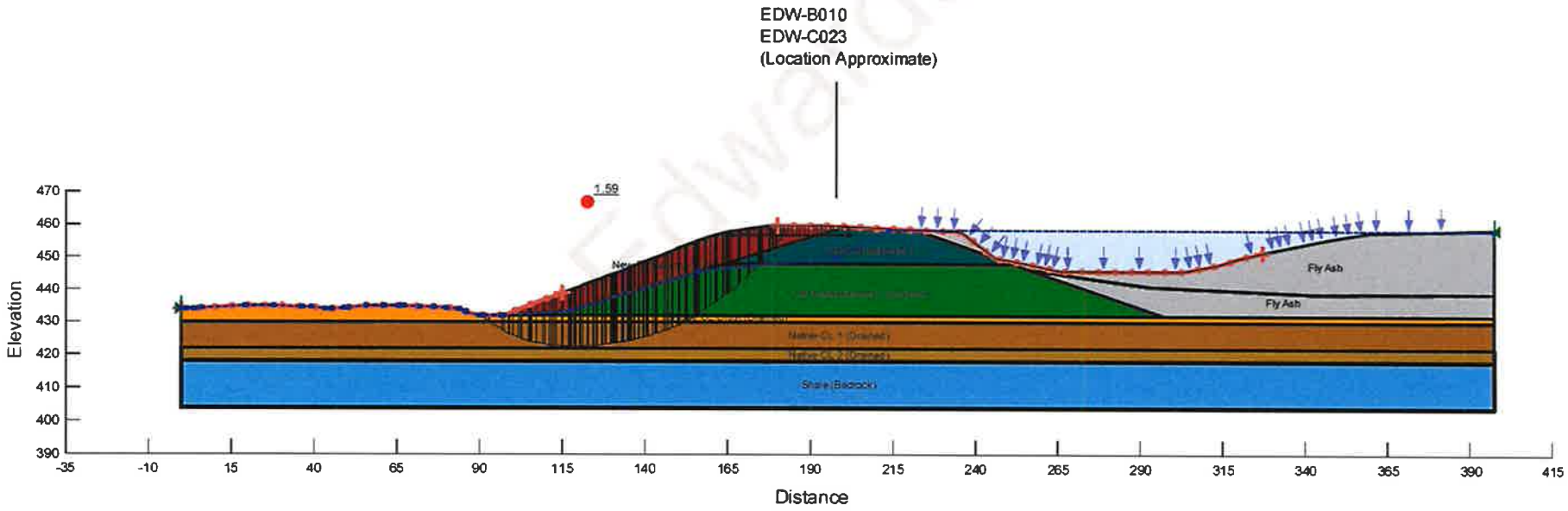
Edwards Power Plant
Cross-section B
Slope Stability - Surcharge Pool

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: Old Embankment 2 (Drained) Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1



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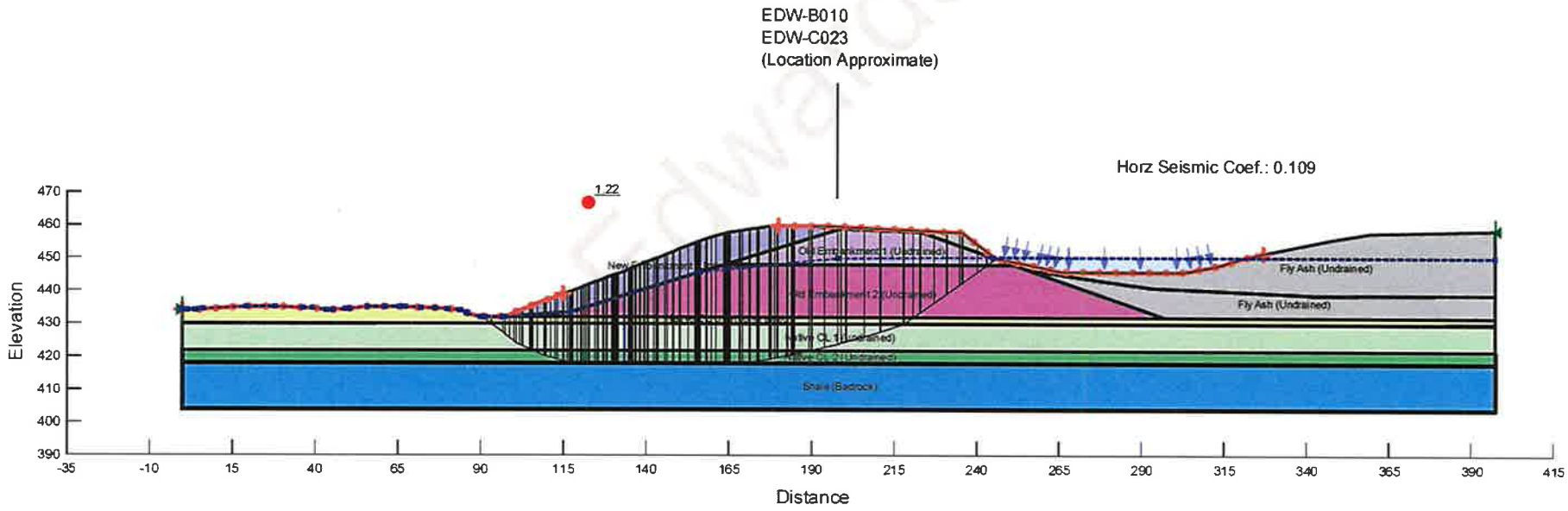
Edwards Power Plant
Cross-section B
Slope Stability - Seismic

Name: Fly Ash (Undrained) Unit Weight: 105 pcf Cohesion': 600 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 1 (Undrained) Unit Weight: 125 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL crust (undrained) Unit Weight: 120 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: New Embankment (Undrained) Unit Weight: 115 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 2 (Undrained) Unit Weight: 125 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 105 pcf Cohesion': 700 psf Phi': 0 ° Piezometric Line: 1



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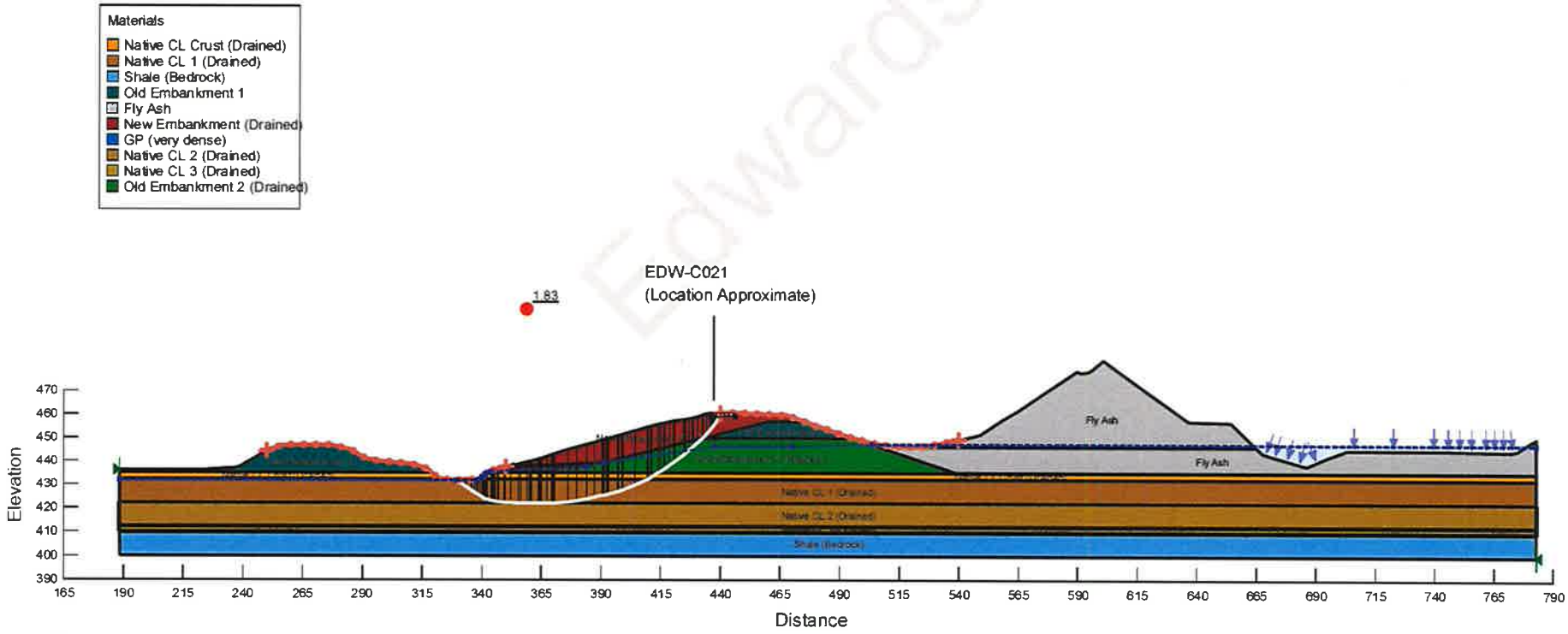
Edwards Power Plant
Cross-section C
Slope Stability - Steady State

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: GP (very dense) Unit Weight: 135 pcf Cohesion': 0 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 (Drained) Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1



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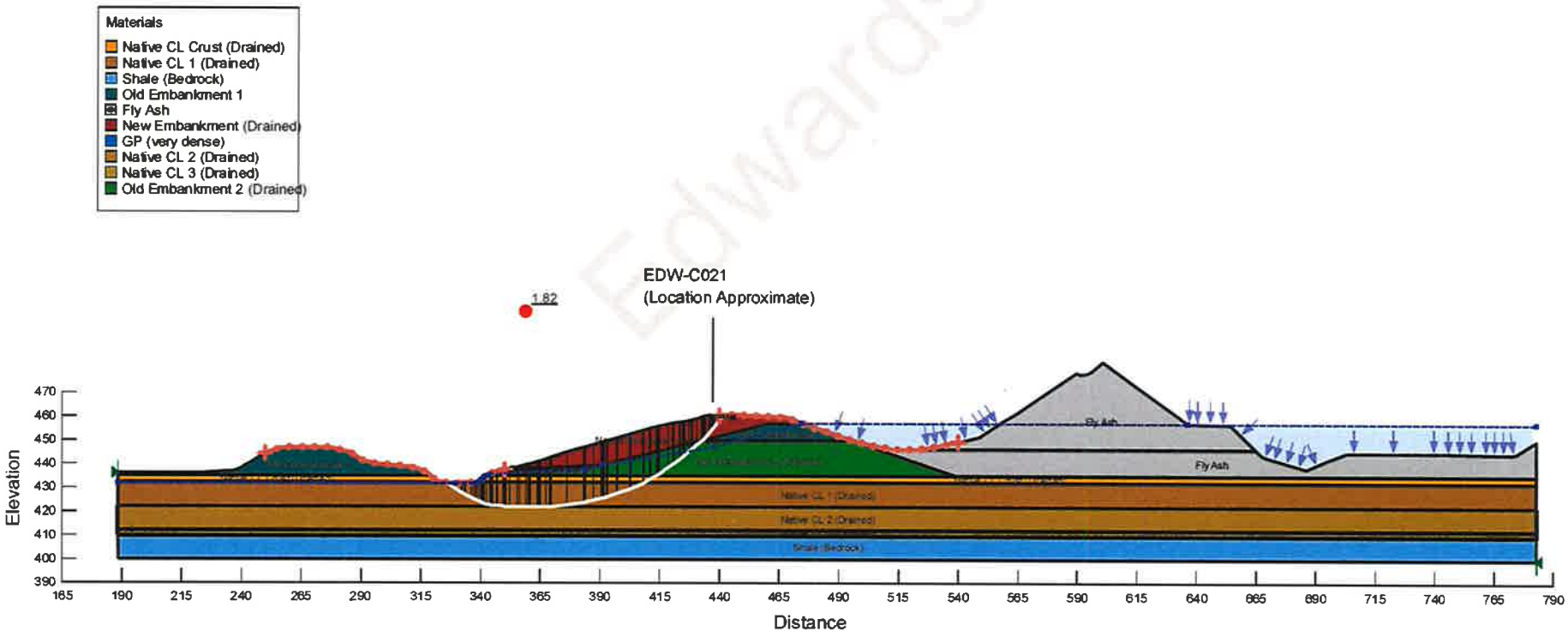
Edwards Power Plant
Cross-section C
Slope Stability - Surcharge Pool

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: GP (very dense) Unit Weight: 135 pcf Cohesion': 0 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 (Drained) Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1



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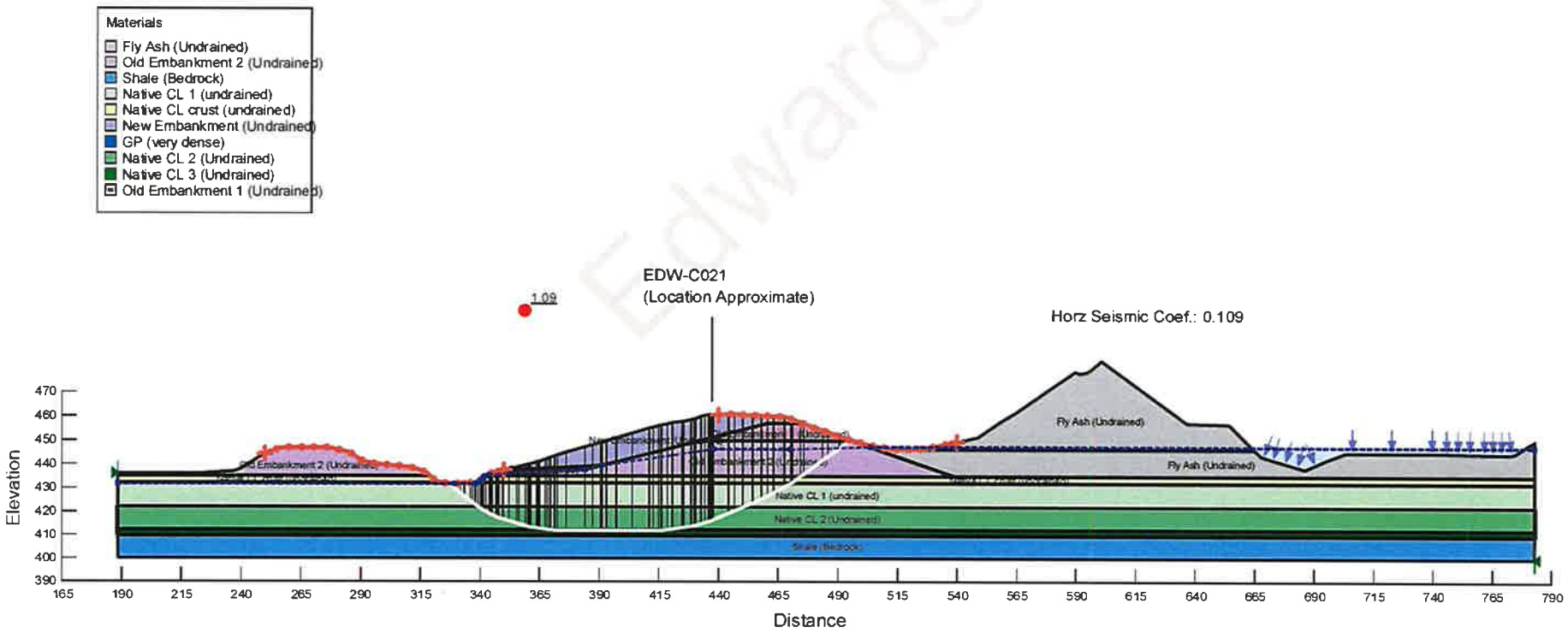
Edwards Power Plant-
section C
Slope Stability - Seismic

Name: Fly Ash (Undrained) Unit Weight: 105 pcf Cohesion': 600 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 2 (Undrained) Unit Weight: 125 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL crust (undrained) Unit Weight: 120 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: New Embankment (Undrained) Unit Weight: 115 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: GP (very dense) Unit Weight: 135 pcf Cohesion': 0 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 105 pcf Cohesion': 700 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 3 (Undrained) Unit Weight: 105 pcf Cohesion': 900 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 1 (Undrained) Unit Weight: 125 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1



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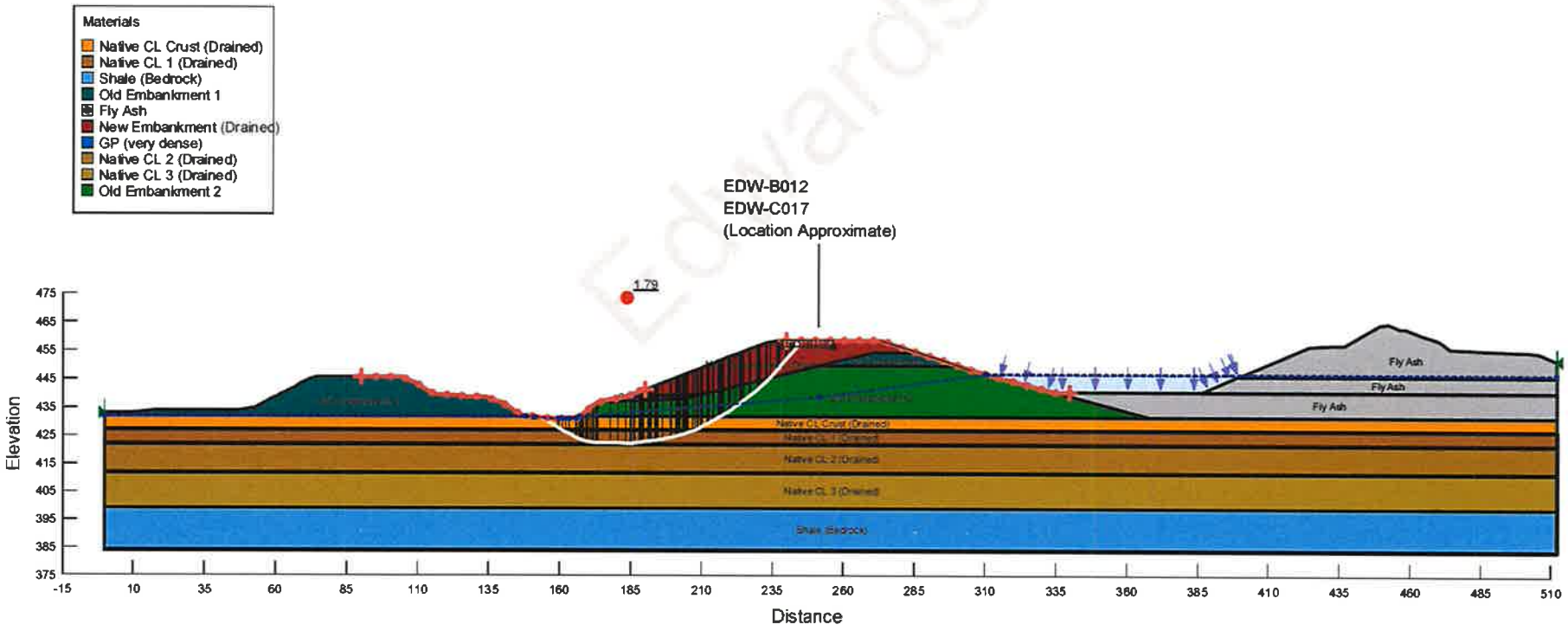
Edwards Power Plant
Cross-section D
Slope Stability - Steady State

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: GP (very dense) Unit Weight: 135 pcf Cohesion': 0 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1



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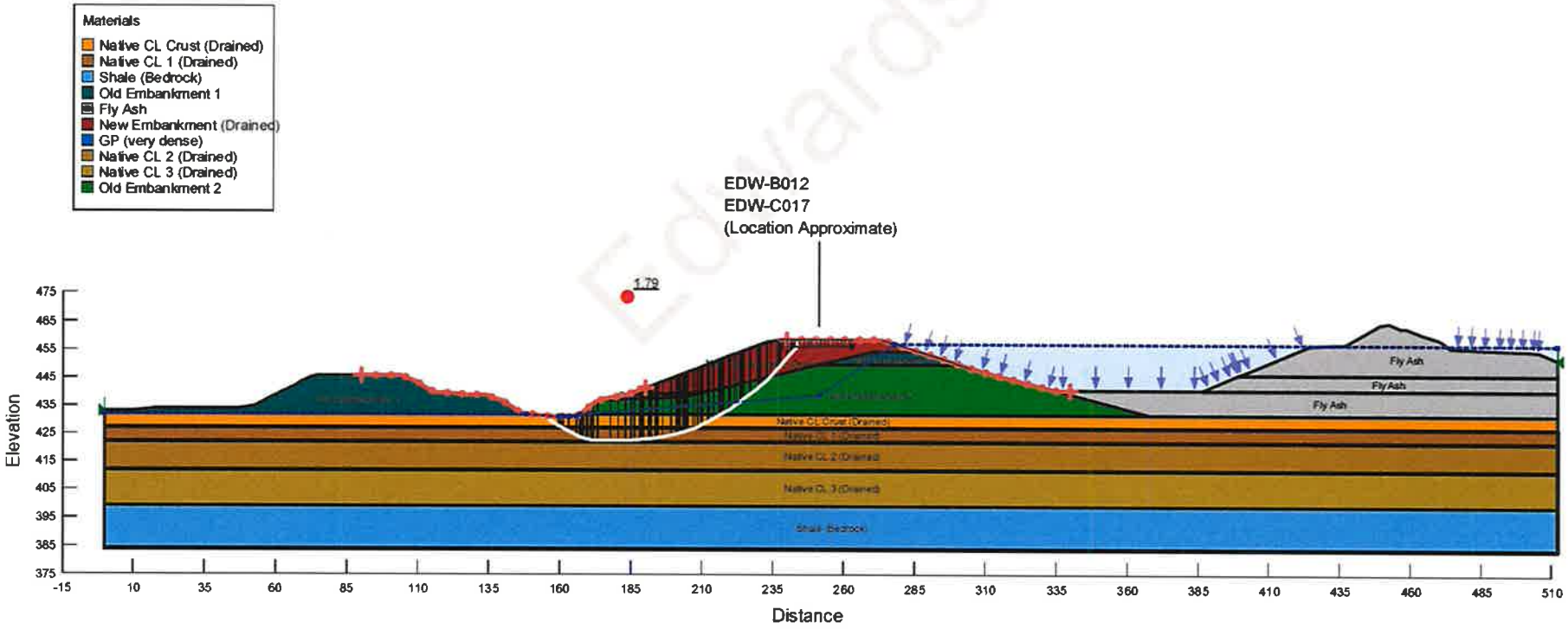
Edwards Power Plant
Cross-section D
Slope Stability - Surcharge Pool

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: GP (very dense) Unit Weight: 135 pcf Cohesion': 0 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1



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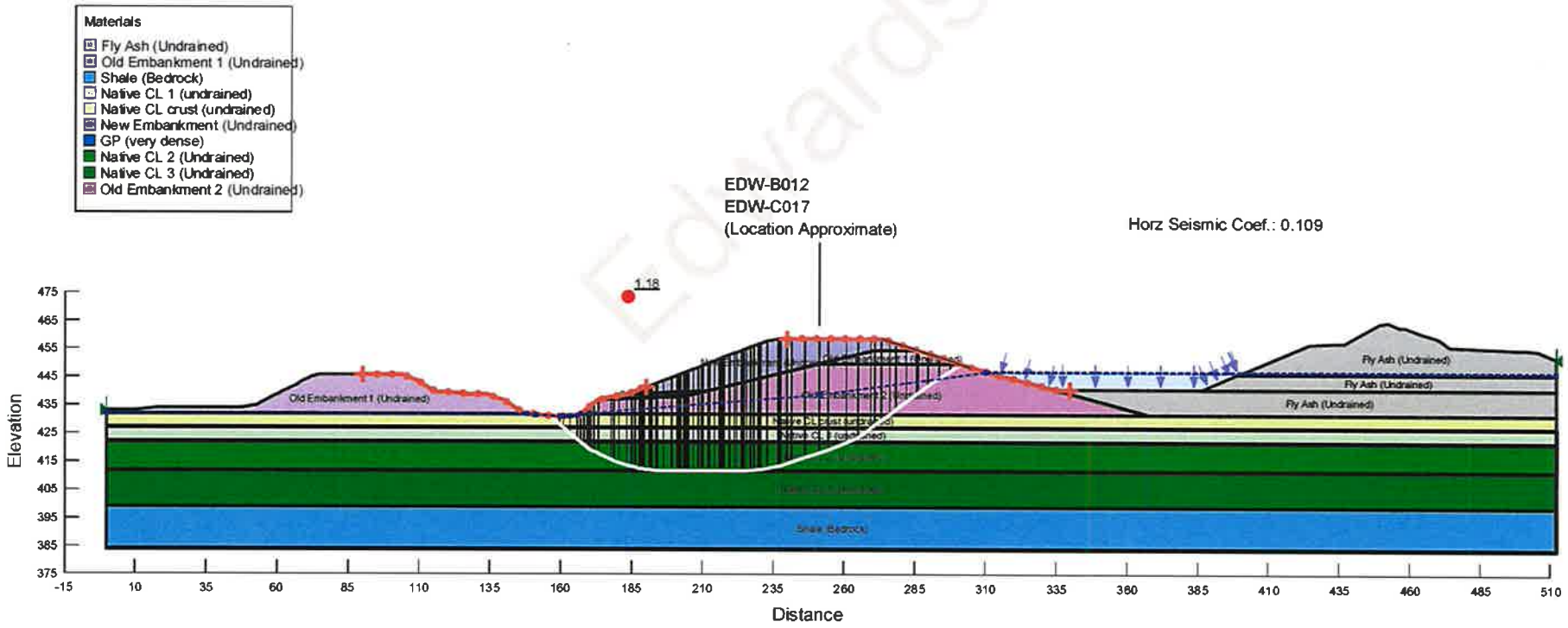
Edwards Power Plant
Cross-section D
Slope Stability - Seismic

Name: Fly Ash (Undrained) Unit Weight: 105 pcf Cohesion': 600 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 1 (Undrained) Unit Weight: 125 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL crust (undrained) Unit Weight: 120 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: New Embankment (Undrained) Unit Weight: 115 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: GP (very dense) Unit Weight: 135 pcf Cohesion': 0 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 105 pcf Cohesion': 700 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 3 (Undrained) Unit Weight: 105 pcf Cohesion': 900 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 2 (Undrained) Unit Weight: 125 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1



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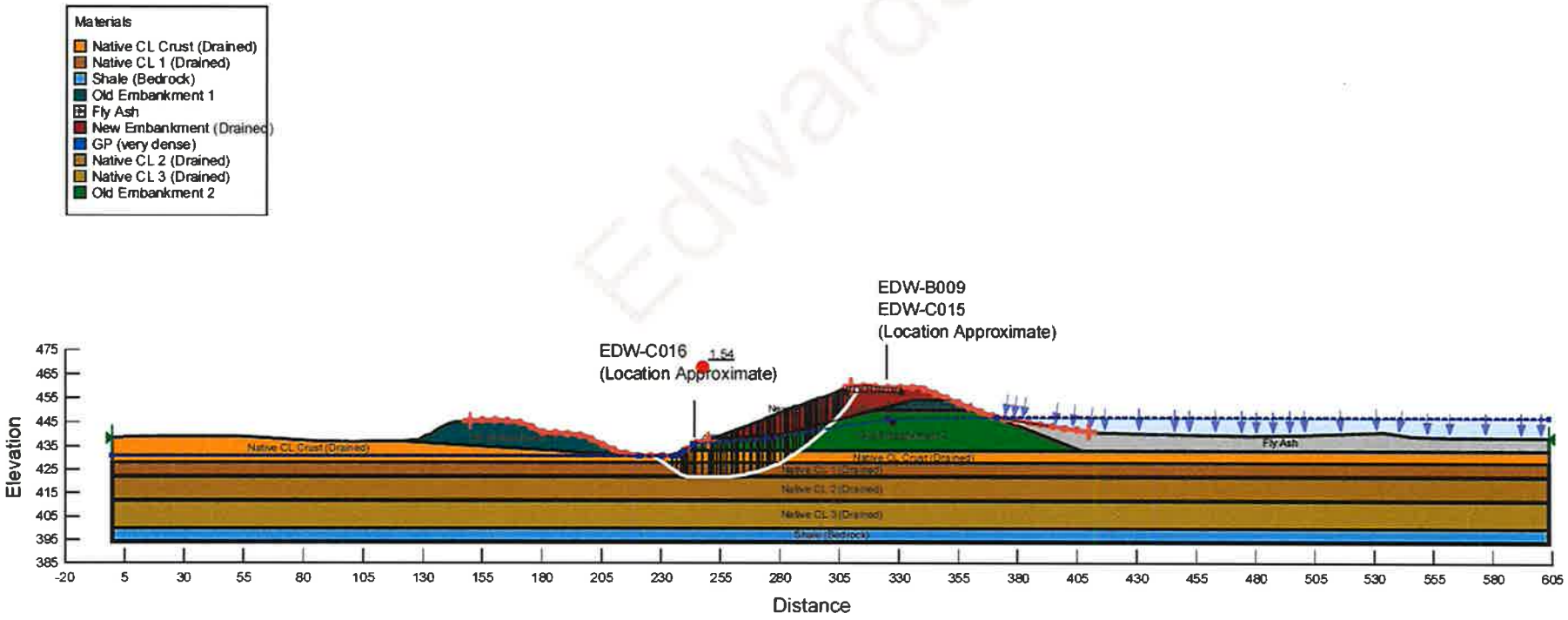
Edwards Power Plant
Cross-section E
Slope Stability - Steady State

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: GP (very dense) Unit Weight: 135 pcf Cohesion': 0 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1



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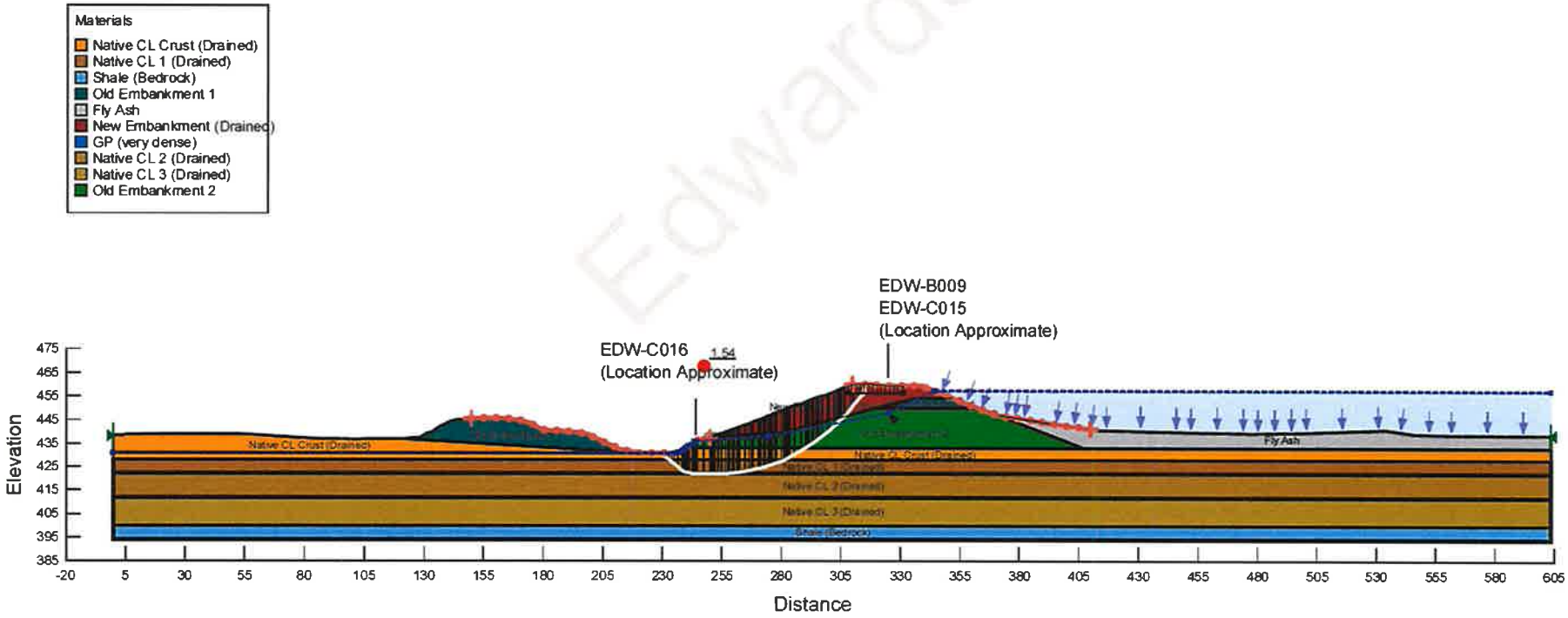
Edwards Power Plant
Cross-section E
Slope Stability - Surcharge Pool

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: GP (very dense) Unit Weight: 135 pcf Cohesion': 0 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1



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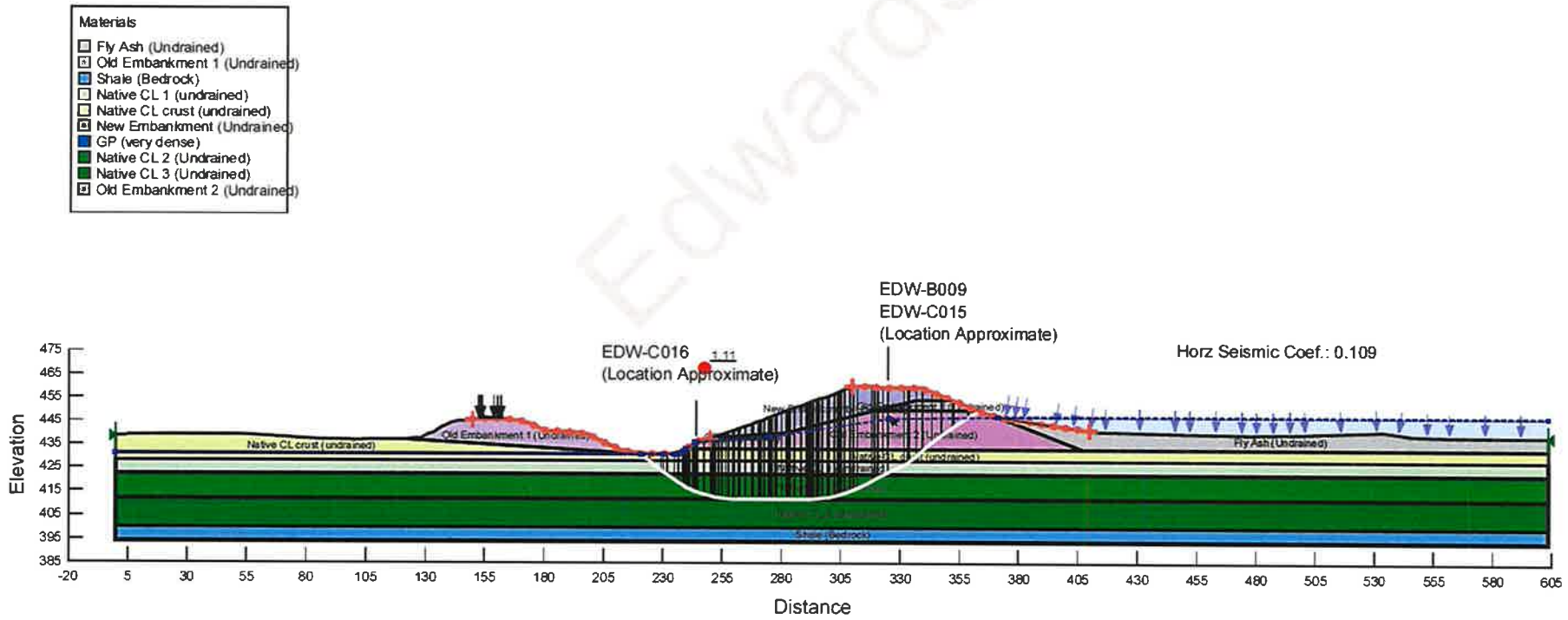
Edwards Power Plant
Cross-section E
Slope Stability - Seismic

Name: Fly Ash (Undrained) Unit Weight: 105 pcf Cohesion': 600 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 1 (Undrained) Unit Weight: 125 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL crust (undrained) Unit Weight: 120 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: New Embankment (Undrained) Unit Weight: 115 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: GP (very dense) Unit Weight: 135 pcf Cohesion': 0 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 105 pcf Cohesion': 700 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 3 (Undrained) Unit Weight: 105 pcf Cohesion': 900 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 2 (Undrained) Unit Weight: 125 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1



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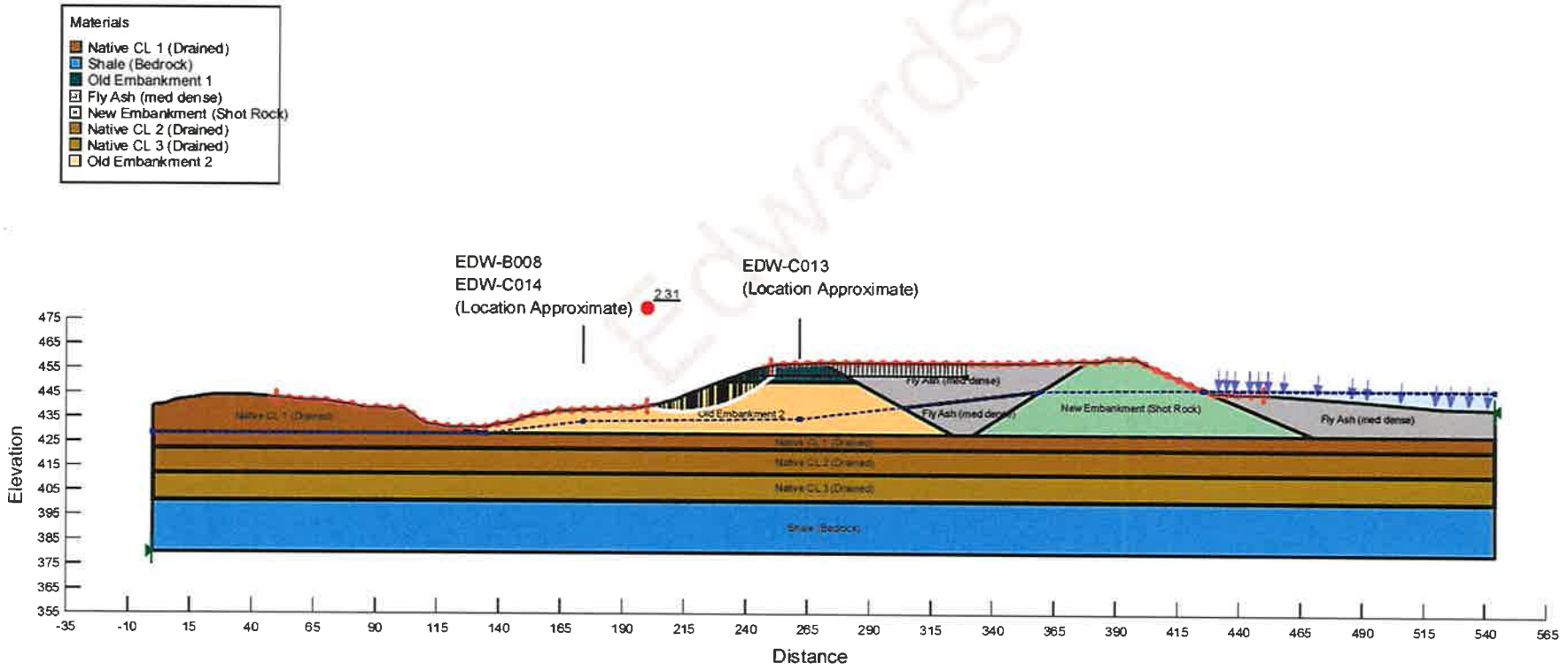
Edwards Power Plant
Cross-section F
Slope Stability - Steady State

Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash (med dense) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Shot Rock) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 32 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1



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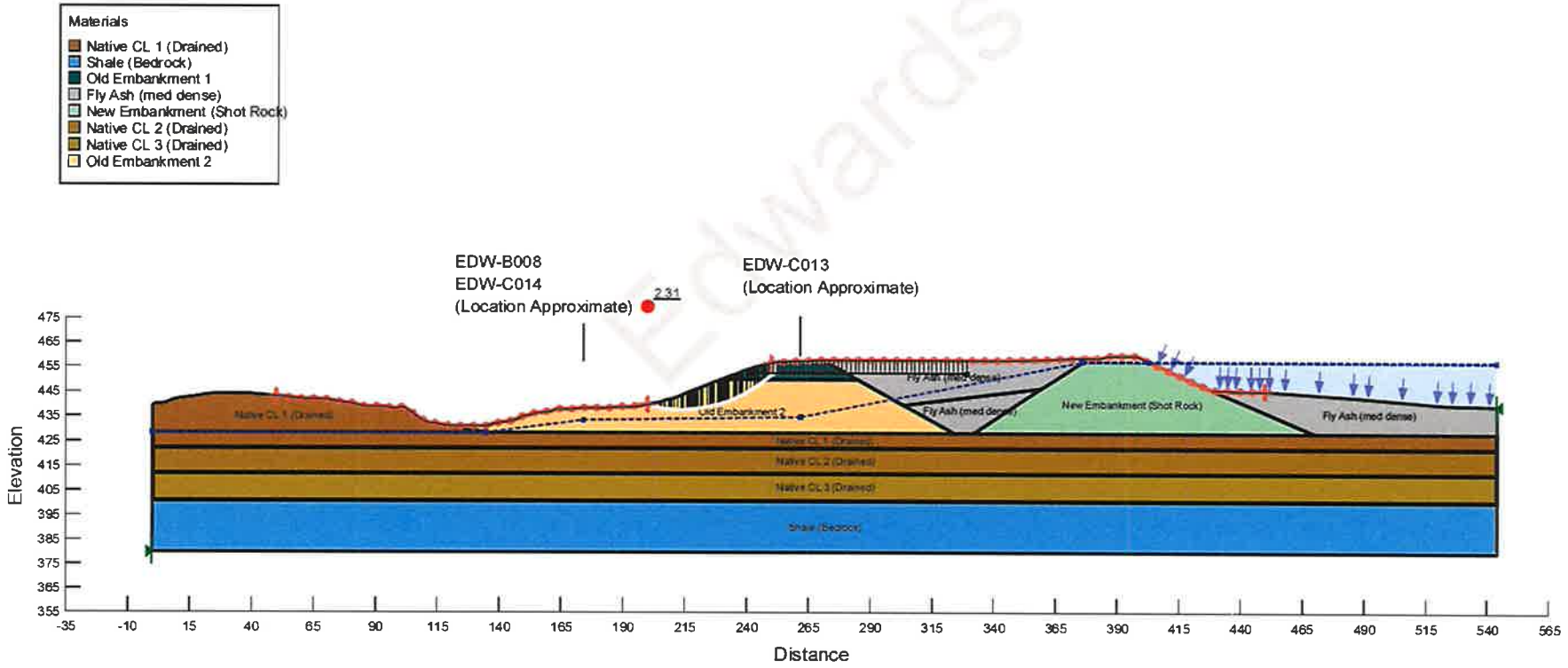
Edwards Power Plant
Cross-section F
Slope Stability - Surcharge Pool

Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash (med dense) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Shot Rock) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 32 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1



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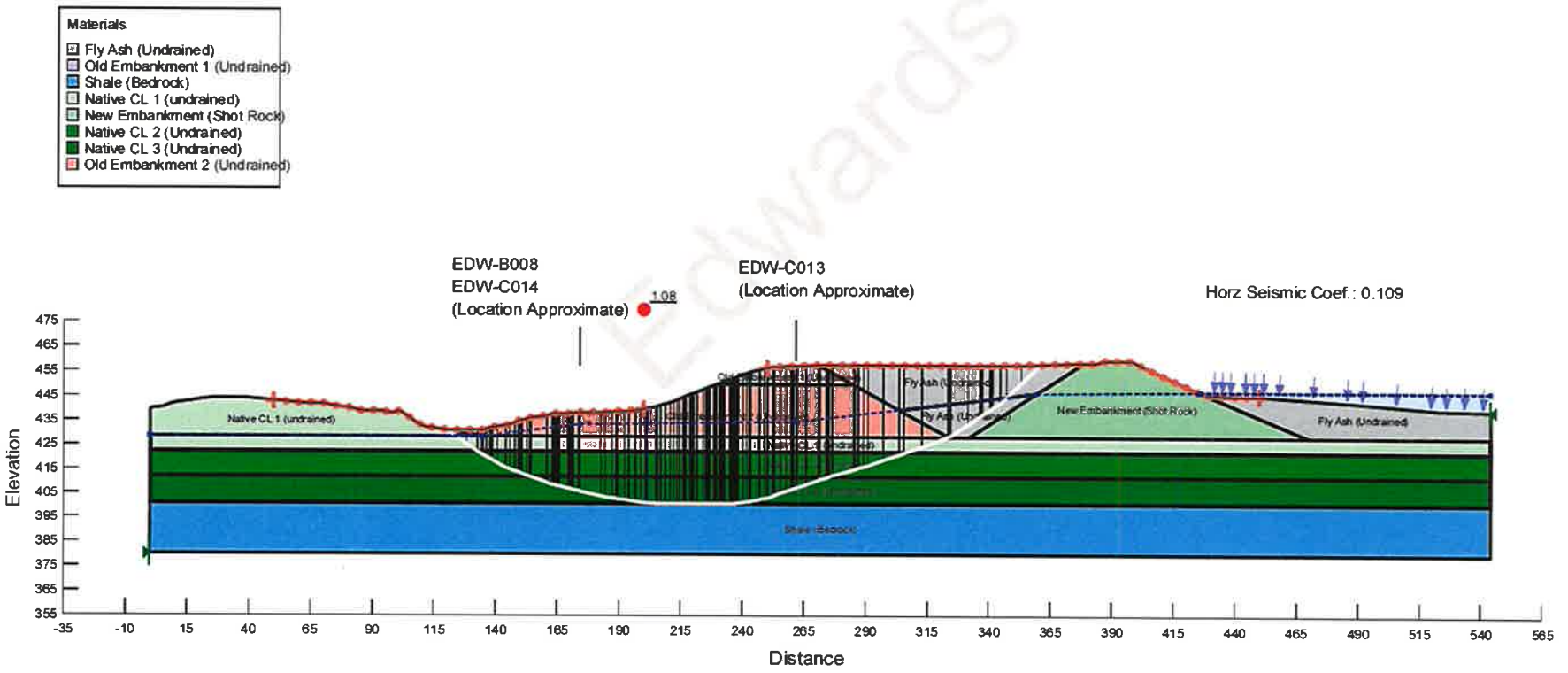
Edwards Power Plant
Cross-section F
Slope Stability - Seismic

Name: Fly Ash (Undrained) Unit Weight: 105 pcf Cohesion': 600 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 1 (Undrained) Unit Weight: 125 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: New Embankment (Shot Rock) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 32 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 105 pcf Cohesion': 700 psf Piezometric Line: 1
Name: Native CL 3 (Undrained) Unit Weight: 105 pcf Cohesion': 900 psf Piezometric Line: 1
Name: Old Embankment 2 (Undrained) Unit Weight: 125 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1



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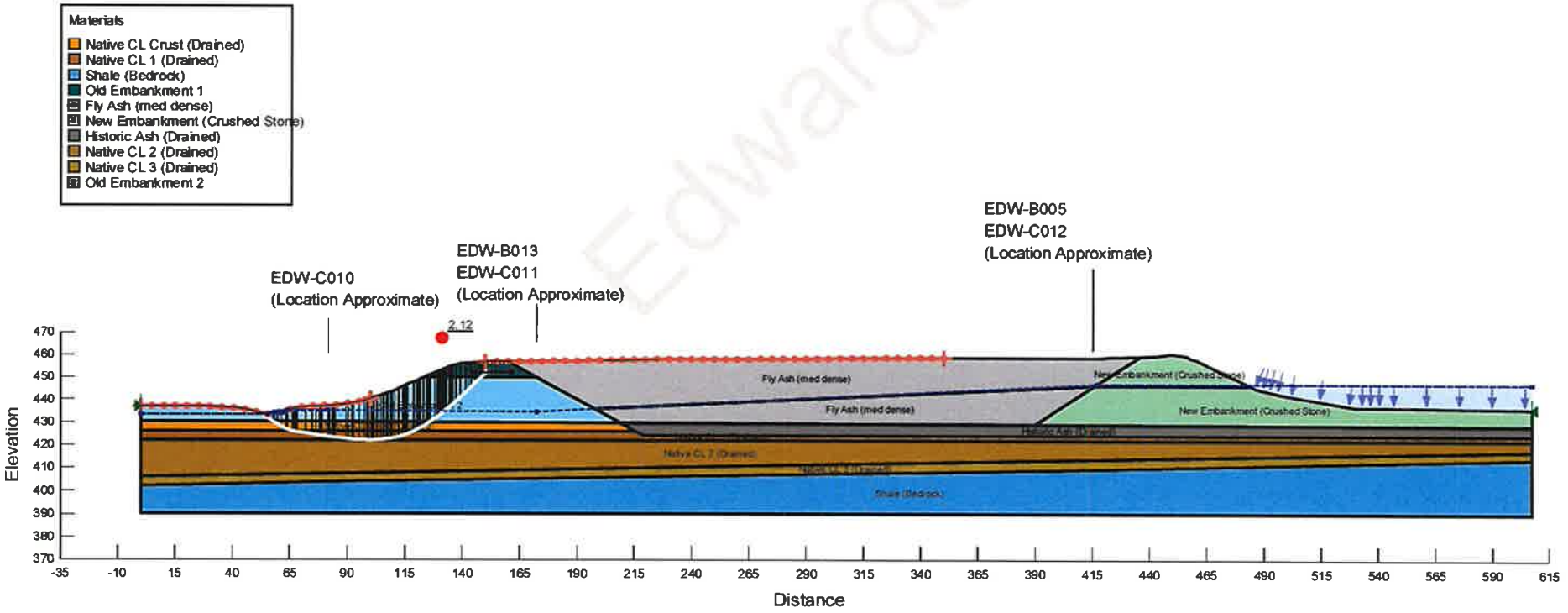
Edwards Power Plant
Cross-section G
Slope Stability - Steady State

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash (med dense) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Crushed Stone) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 32 ° Piezometric Line: 1
Name: Historic Ash (Drained) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1



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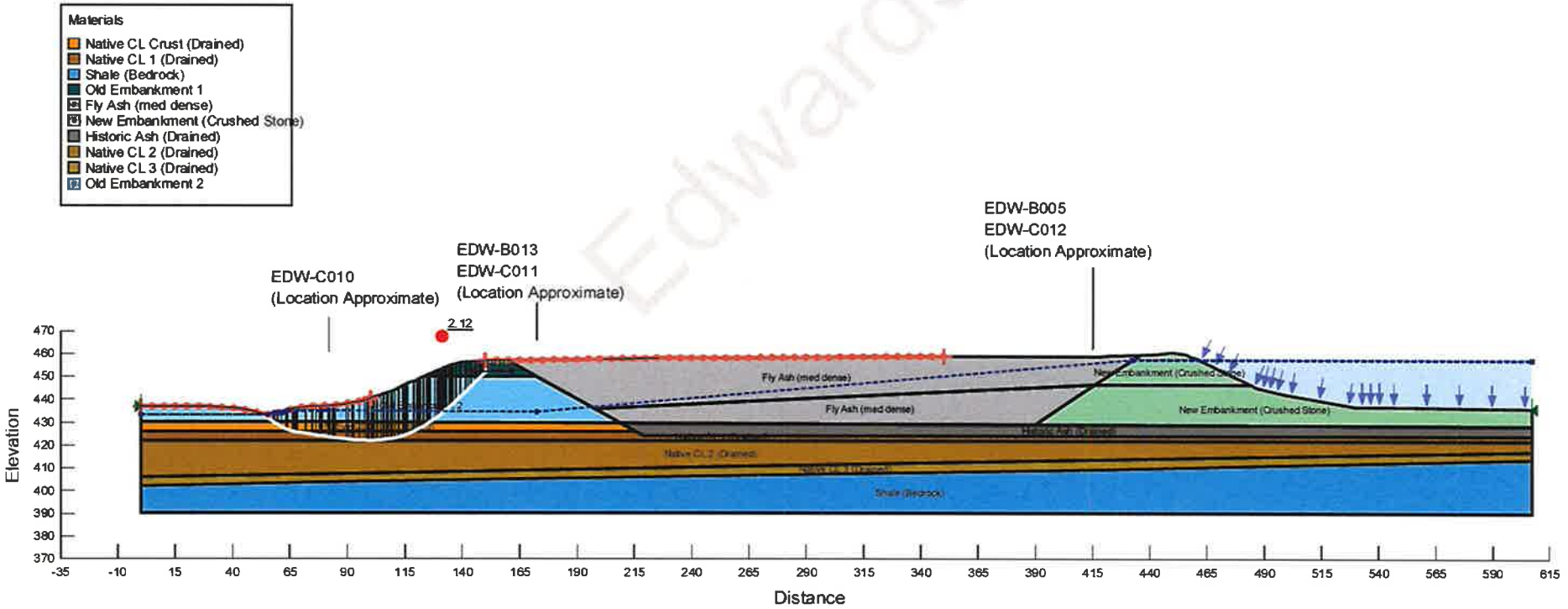
Edwards Power Plant
Cross-section G
Slope Stability - Surcharge Pool

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash (med dense) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Crushed Stone) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 32 ° Piezometric Line: 1
Name: Historic Ash (Drained) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1



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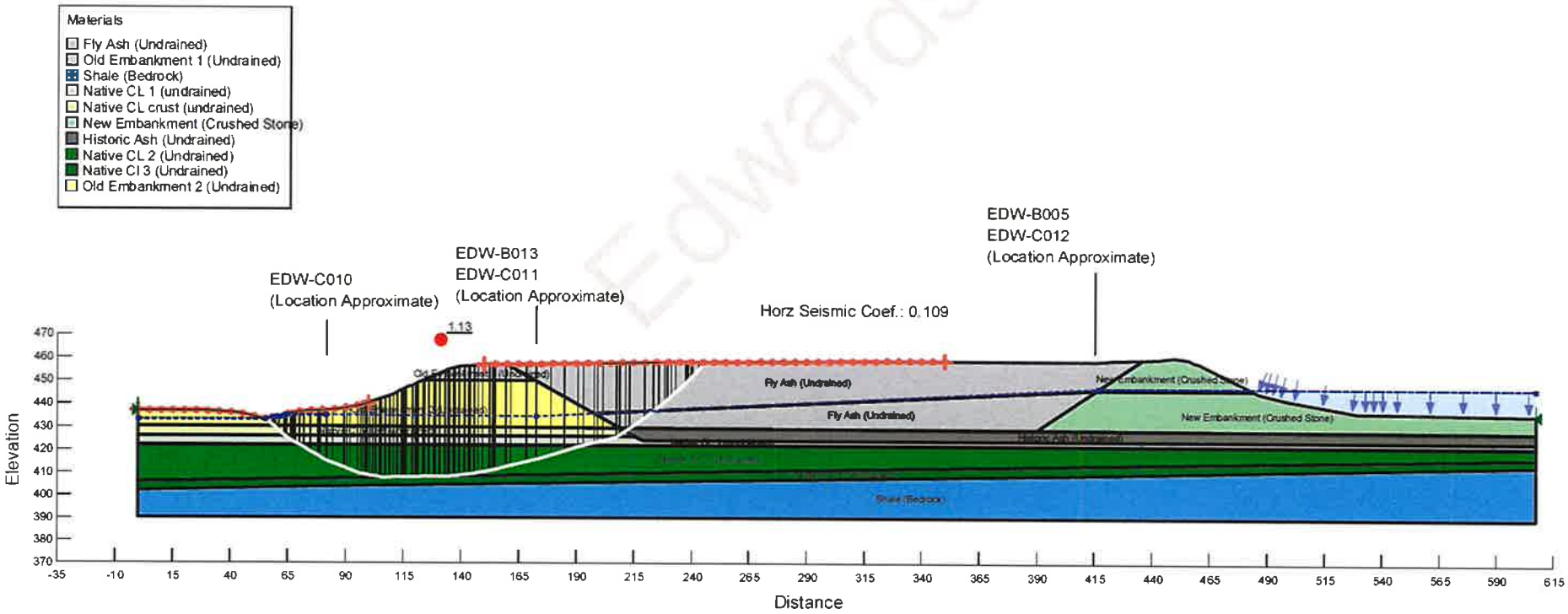
Edwards Power Plant
Cross-section G
Slope Stability - Seismic

Name: Fly Ash (Undrained) Unit Weight: 105 pcf Cohesion': 600 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 1 (Undrained) Unit Weight: 125 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL crust (undrained) Unit Weight: 120 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: New Embankment (Crushed Stone) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 32 ° Piezometric Line: 1
Name: Historic Ash (Undrained) Unit Weight: 105 pcf Cohesion': 750 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 105 pcf Cohesion': 700 psf Piezometric Line: 1
Name: Native Cl 3 (Undrained) Unit Weight: 105 pcf Cohesion': 900 psf Piezometric Line: 1
Name: Old Embankment 2 (Undrained) Unit Weight: 125 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1



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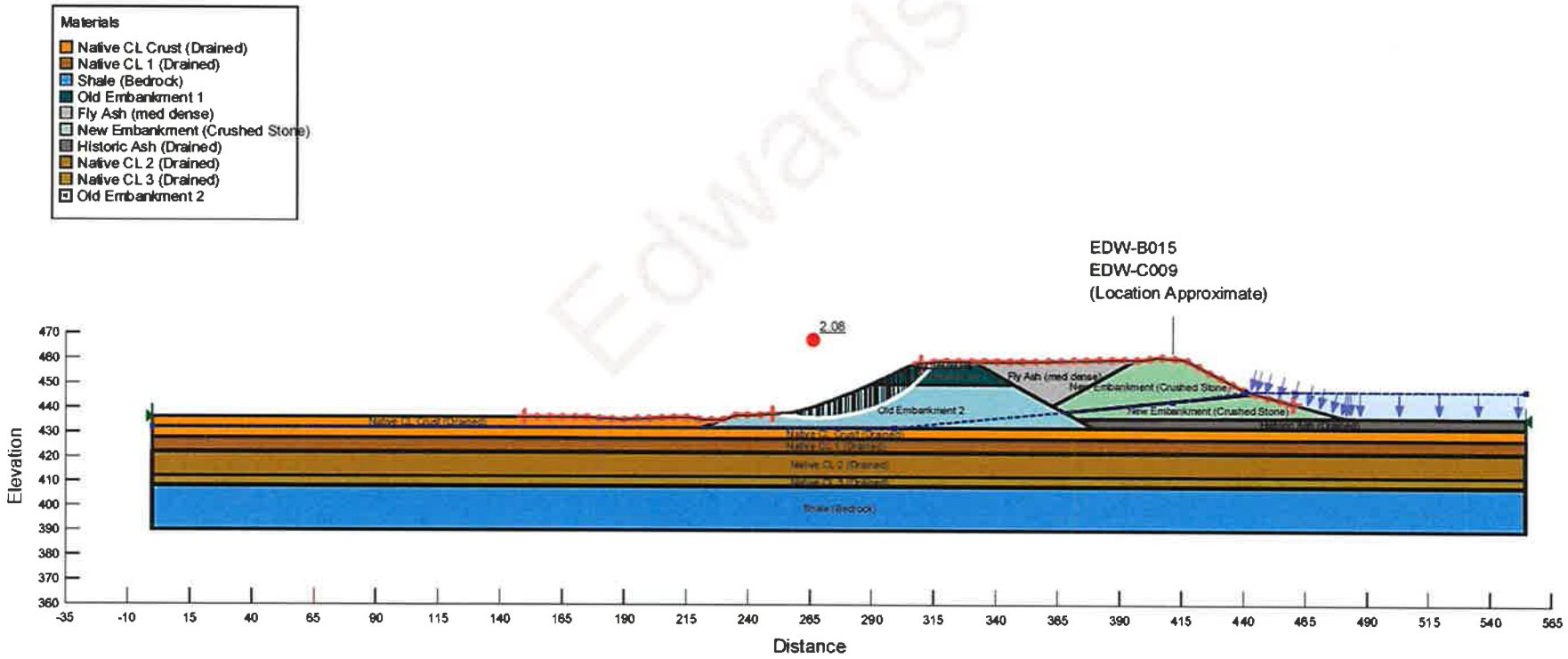
Edwards Power Plant
Cross-section H
Slope Stability - Steady State

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash (med dense) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Crushed Stone) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 32 ° Piezometric Line: 1
Name: Historic Ash (Drained) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1



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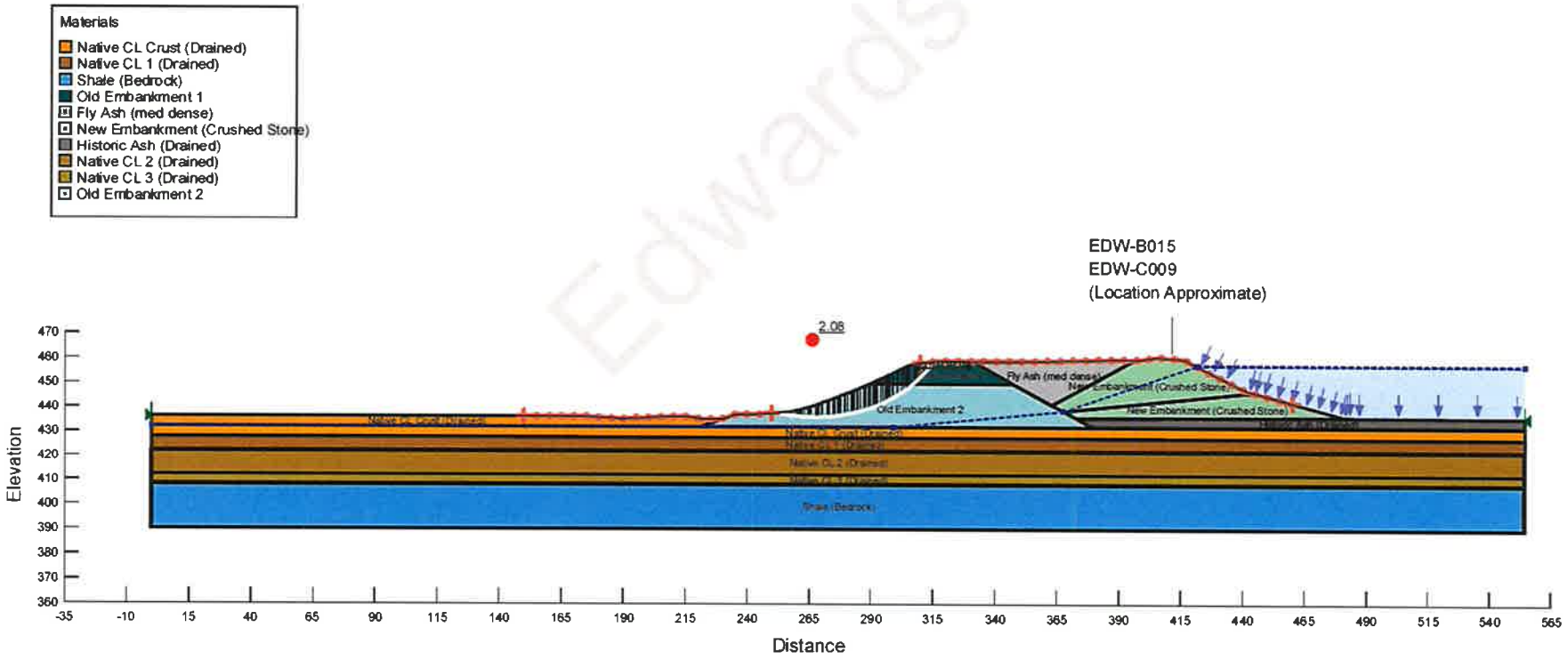
Edwards Power Plant
Cross-section H
Slope Stability - Surcharge Pool

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Fly Ash (med dense) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 27 ° Piezometric Line: 1
Name: New Embankment (Crushed Stone) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 32 ° Piezometric Line: 1
Name: Historic Ash (Drained) Unit Weight: 105 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Old Embankment 2 Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1



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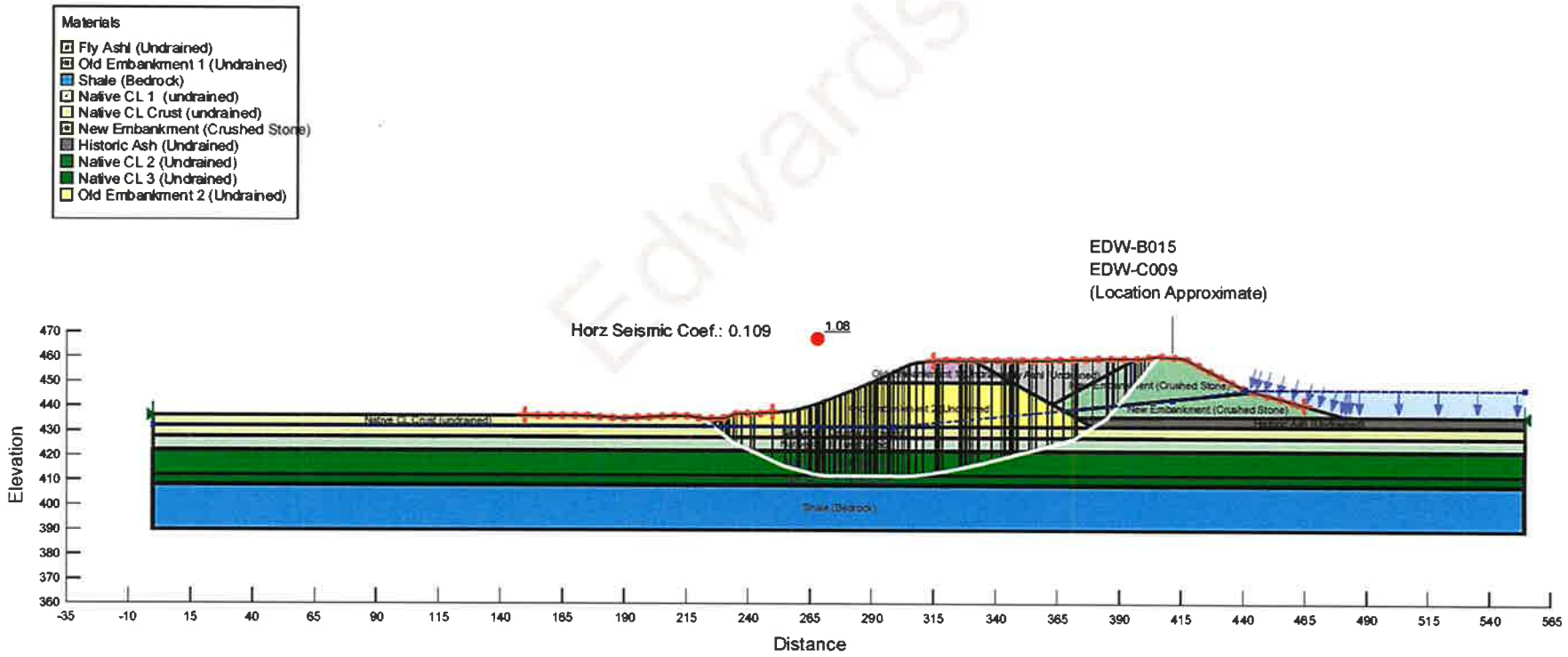
Edwards Power Plant
Cross-section H
Slope Stability - Seismic

Name: Fly Ashl (Undrained) Unit Weight: 105 pcf Cohesion': 600 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 1 (Undrained) Unit Weight: 125 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL Crust (undrained) Unit Weight: 120 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: New Embankment (Crushed Stone) Unit Weight: 120 pcf Cohesion': 0 psf Phi': 32 ° Piezometric Line: 1
Name: Historic Ash (Undrained) Unit Weight: 105 pcf Cohesion': 750 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 117 pcf Cohesion': 700 psf Piezometric Line: 1
Name: Native CL 3 (Undrained) Unit Weight: 105 pcf Cohesion': 900 psf Piezometric Line: 1
Name: Old Embankment 2 (Undrained) Unit Weight: 125 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1



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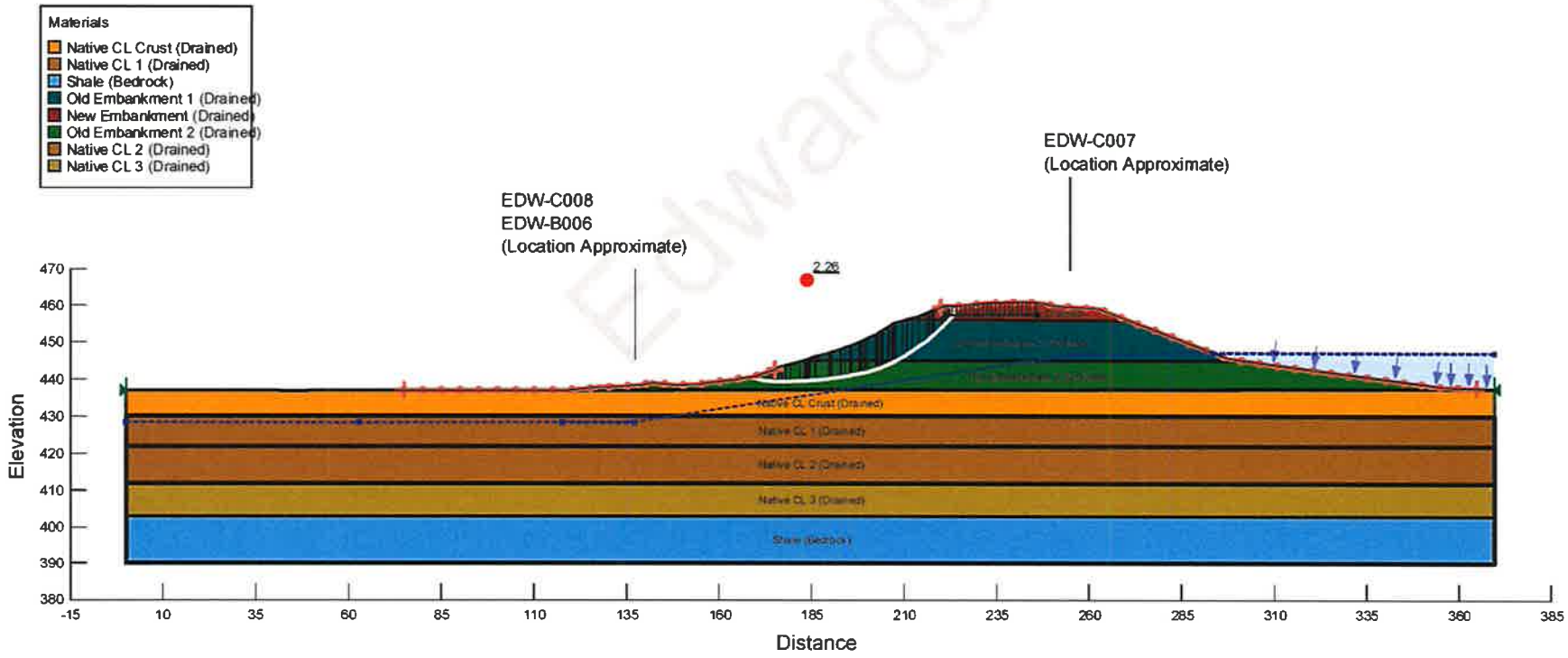
Edwards Power Plant
Cross-section I
Slope Stability - Steady State

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 (Drained) Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: Old Embankment 2 (Drained) Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1



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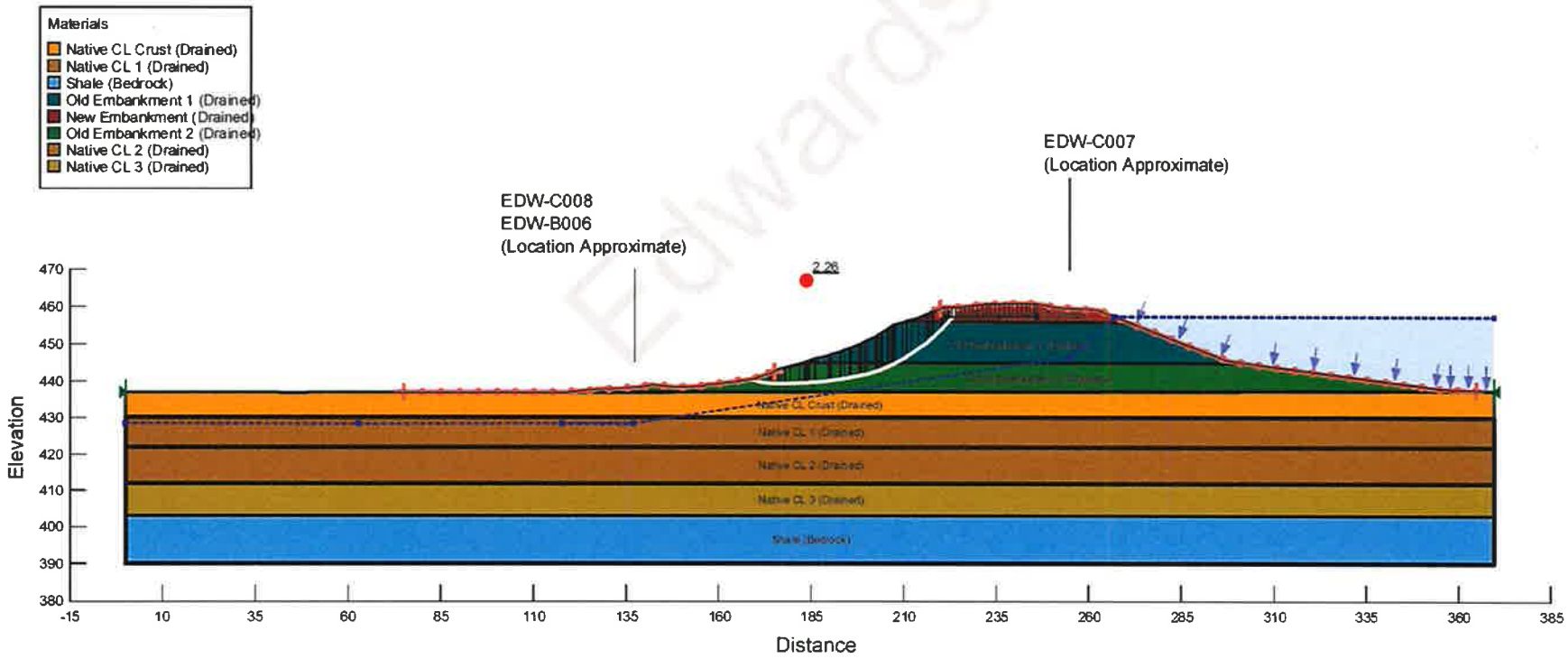
Edwards Power Plant
Cross-section I
Slope Stability - Surcharge Pool

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Old Embankment 1 (Drained) Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: New Embankment (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: Old Embankment 2 (Drained) Unit Weight: 125 pcf Cohesion': 100 psf Phi': 29 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1



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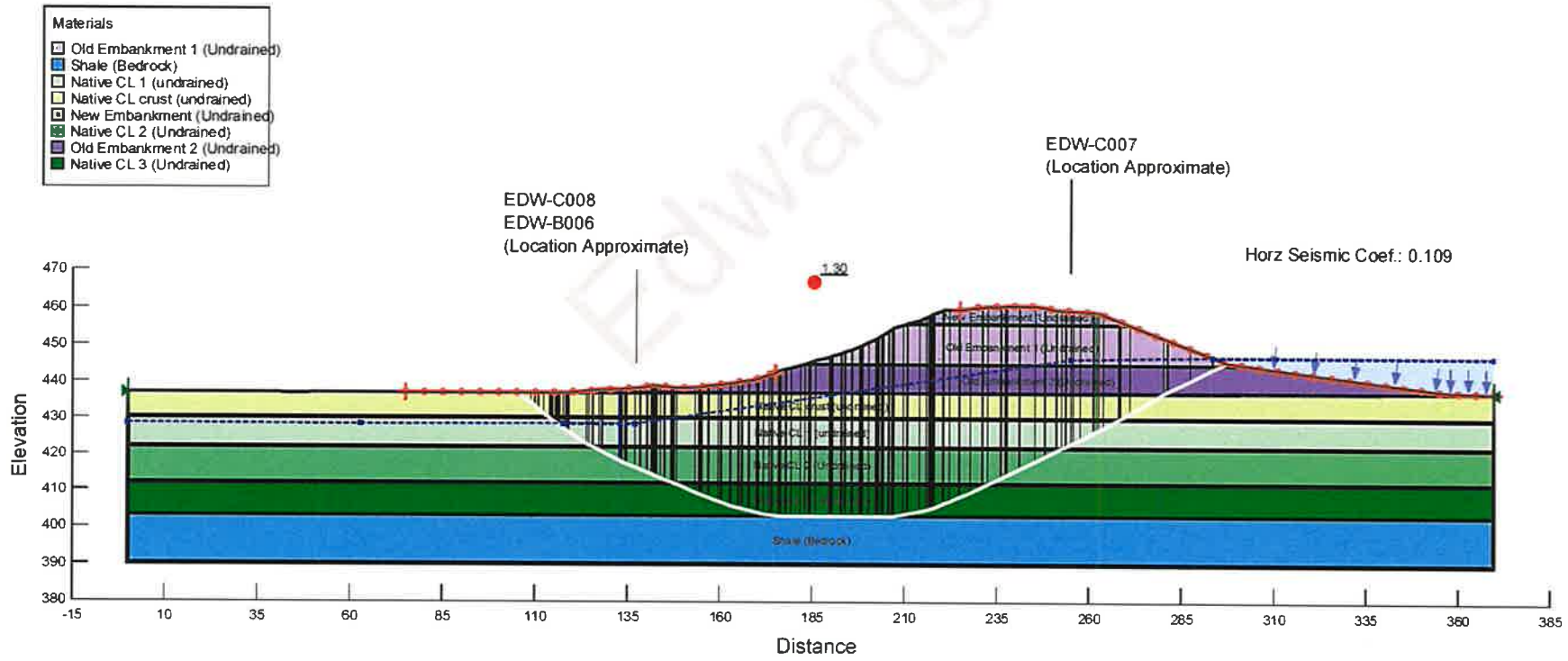
Edwards Power Plant
Cross-section I
Slope Stability - Seismic

Name: Old Embankment 1 (Undrained) Unit Weight: 125 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL crust (undrained) Unit Weight: 120 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: New Embankment (Undrained) Unit Weight: 115 pcf Cohesion': 2,500 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 105 pcf Cohesion': 700 psf Phi': 0 ° Piezometric Line: 1
Name: Old Embankment 2 (Undrained) Unit Weight: 125 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 3 (Undrained) Unit Weight: 105 pcf Cohesion': 900 psf Piezometric Line: 1



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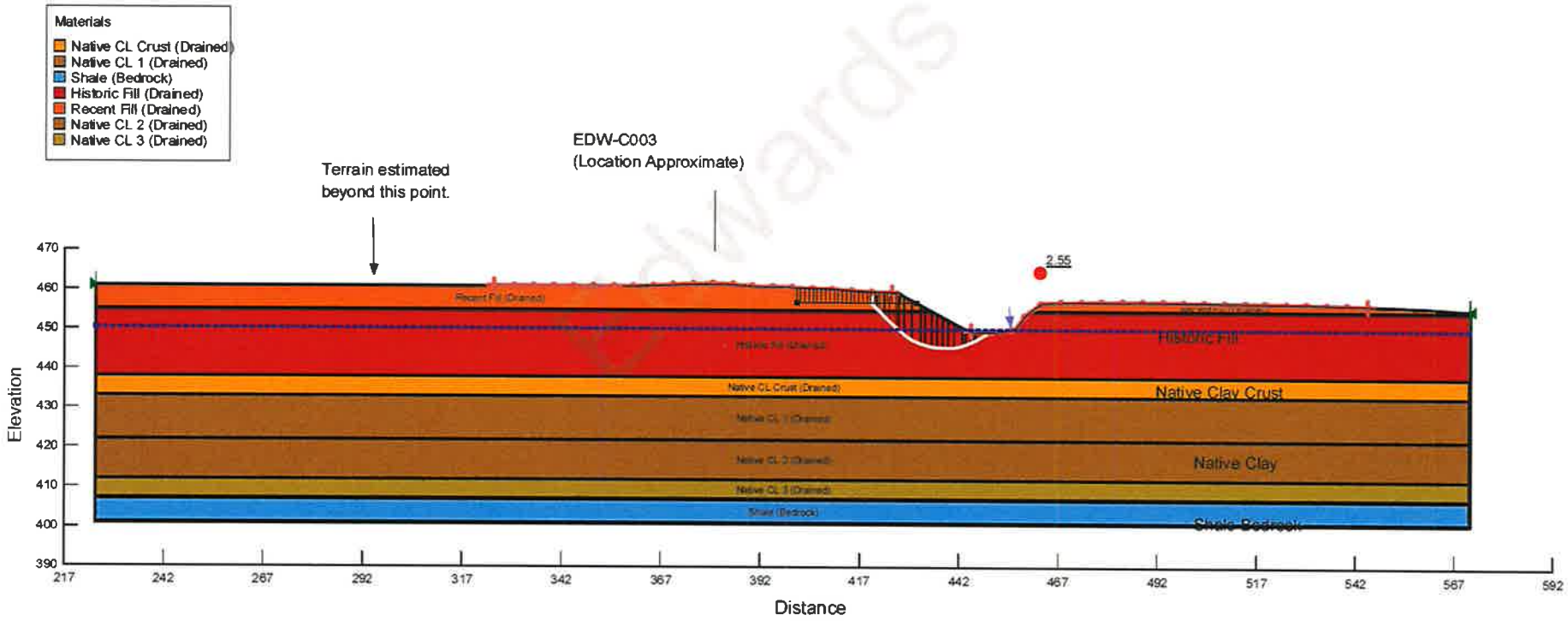
Edwards Power Plant
Cross-section J
Slope Stability - Steady-State

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Historic Fill (Drained) Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Recent Fill (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1



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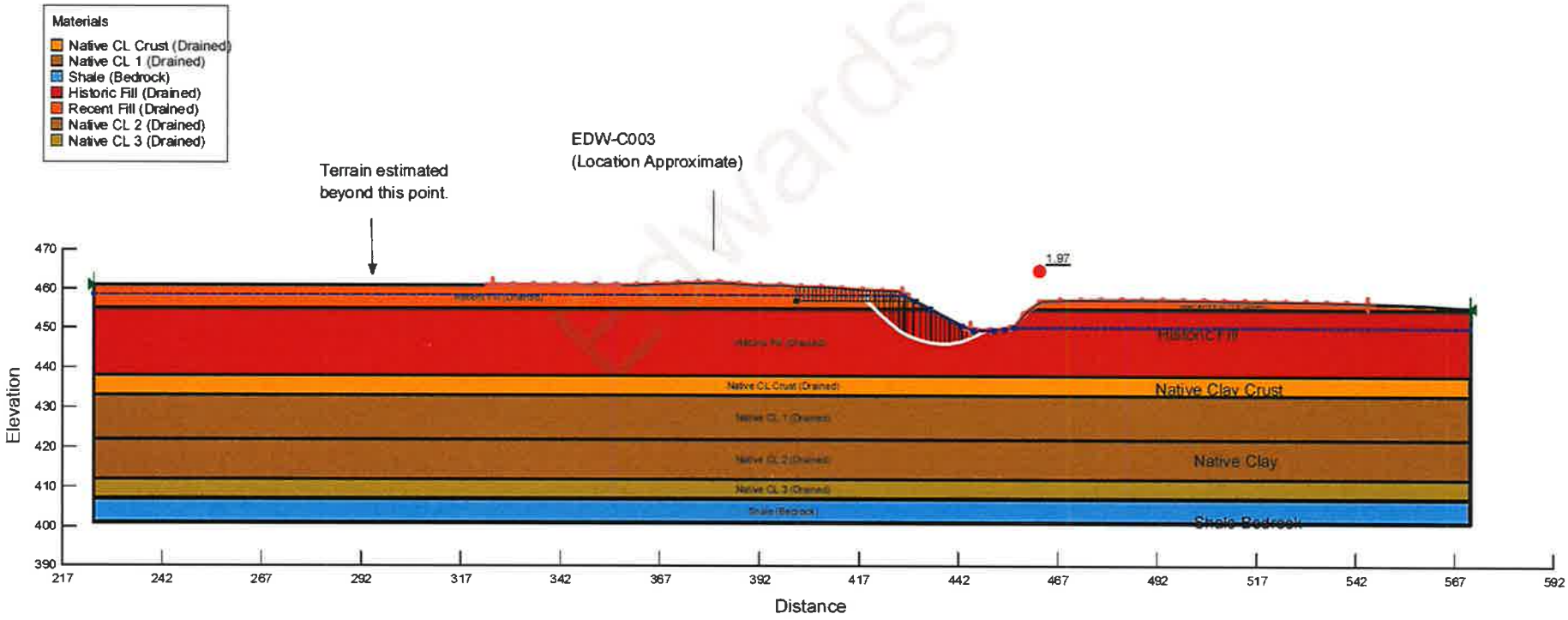
Edwards Power Plant
Cross-section J
Slope Stability - Surcharge Pool

Name: Native CL Crust (Drained) Unit Weight: 120 pcf Cohesion': 200 psf Phi': 27.5 ° Piezometric Line: 1
Name: Native CL 1 (Drained) Unit Weight: 117 pcf Cohesion': 100 psf Phi': 26 ° Piezometric Line: 1
Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Historic Fill (Drained) Unit Weight: 125 pcf Cohesion': 200 psf Phi': 28 ° Piezometric Line: 1
Name: Recent Fill (Drained) Unit Weight: 115 pcf Cohesion': 200 psf Phi': 30 ° Piezometric Line: 1
Name: Native CL 2 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1
Name: Native CL 3 (Drained) Unit Weight: 105 pcf Cohesion': 200 psf Phi': 26 ° Piezometric Line: 1



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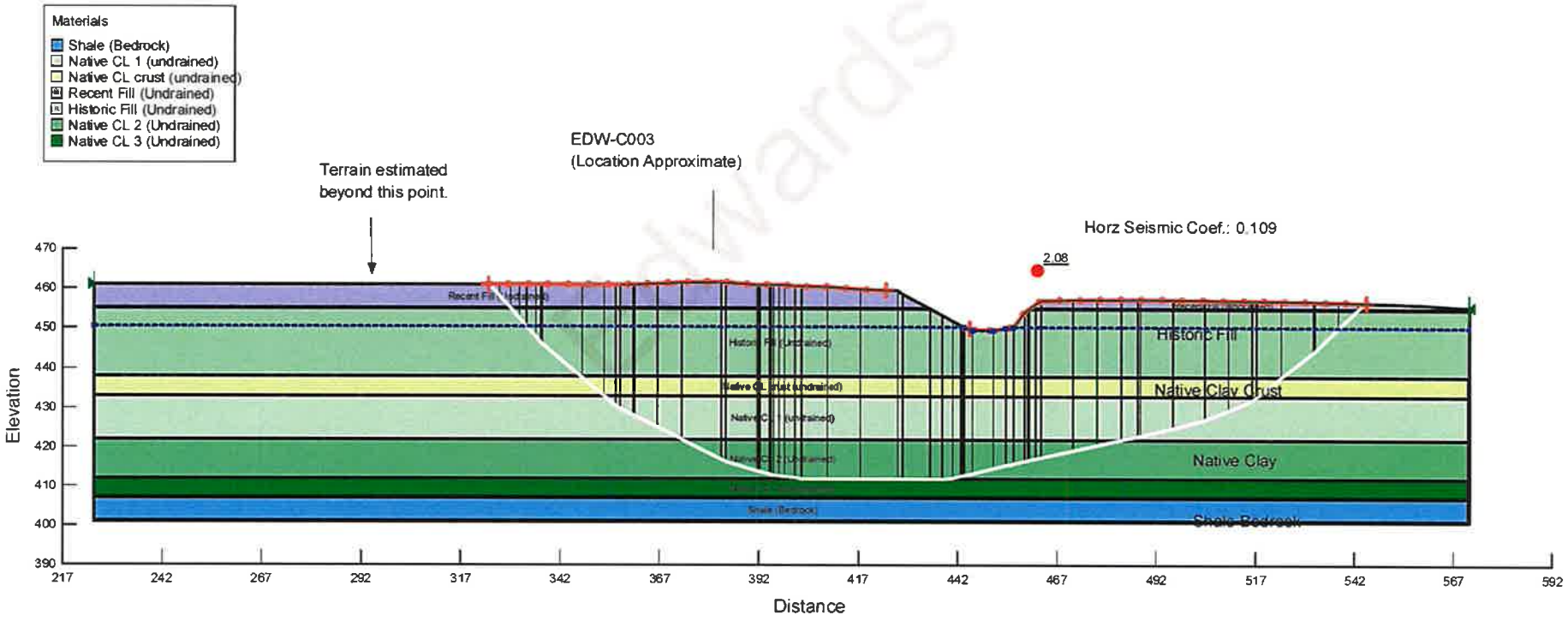
Edwards Power Plant
Cross-section J
Slope Stability - Seismic

Name: Shale (Bedrock) Unit Weight: 140 pcf Cohesion': 1,000 psf Phi': 36 ° Piezometric Line: 1
Name: Native CL 1 (undrained) Unit Weight: 117 pcf Cohesion': 650 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL crust (undrained) Unit Weight: 120 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: Recent Fill (Undrained) Unit Weight: 115 pcf Cohesion': 1,250 psf Phi': 0 ° Piezometric Line: 1
Name: Historic Fill (Undrained) Unit Weight: 125 pcf Cohesion': 1,000 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 2 (Undrained) Unit Weight: 105 pcf Cohesion': 700 psf Phi': 0 ° Piezometric Line: 1
Name: Native CL 3 (Undrained) Unit Weight: 105 pcf Cohesion': 900 psf Piezometric Line: 1



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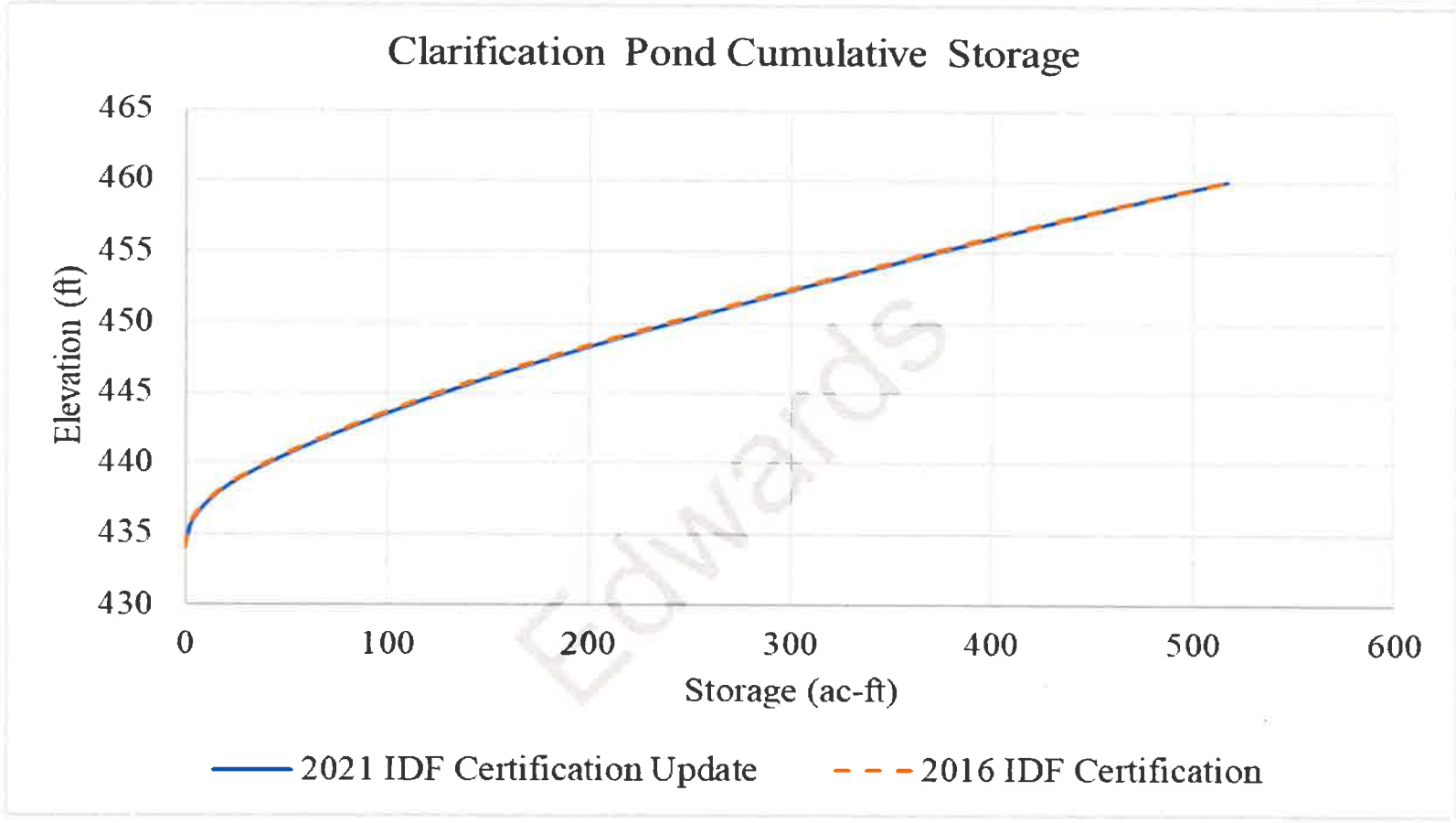
Attachment E

Periodic Inflow Design Flood Control System Plan Analyses

Edwards

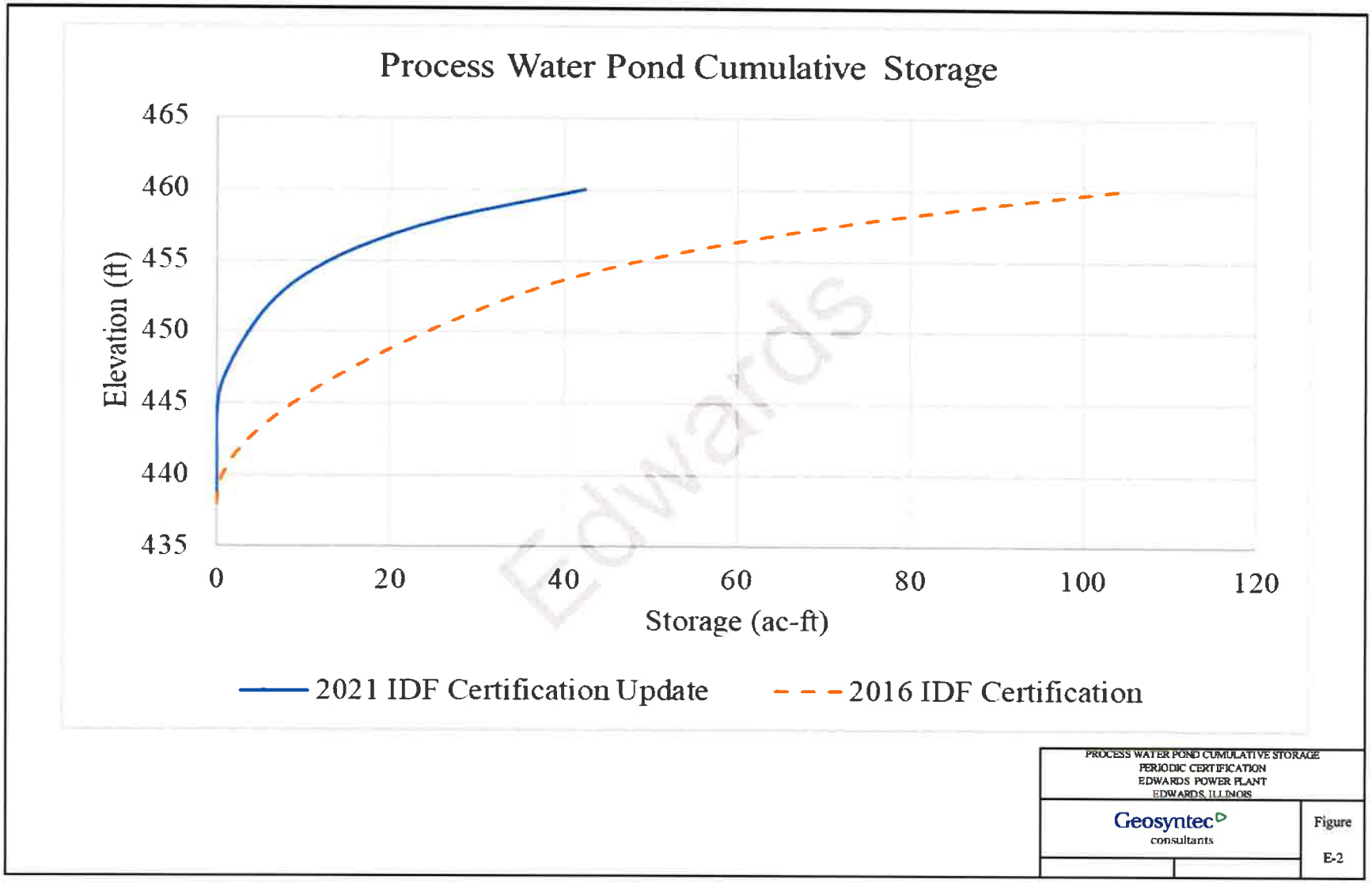


CLARIFICATION POND CUMULATIVE STORAGE
PERIODIC CERTIFICATION
EDWARDS POWER PLANT
EDWARDS, ILLINOIS

Geosyntec consultants

Figure E-1

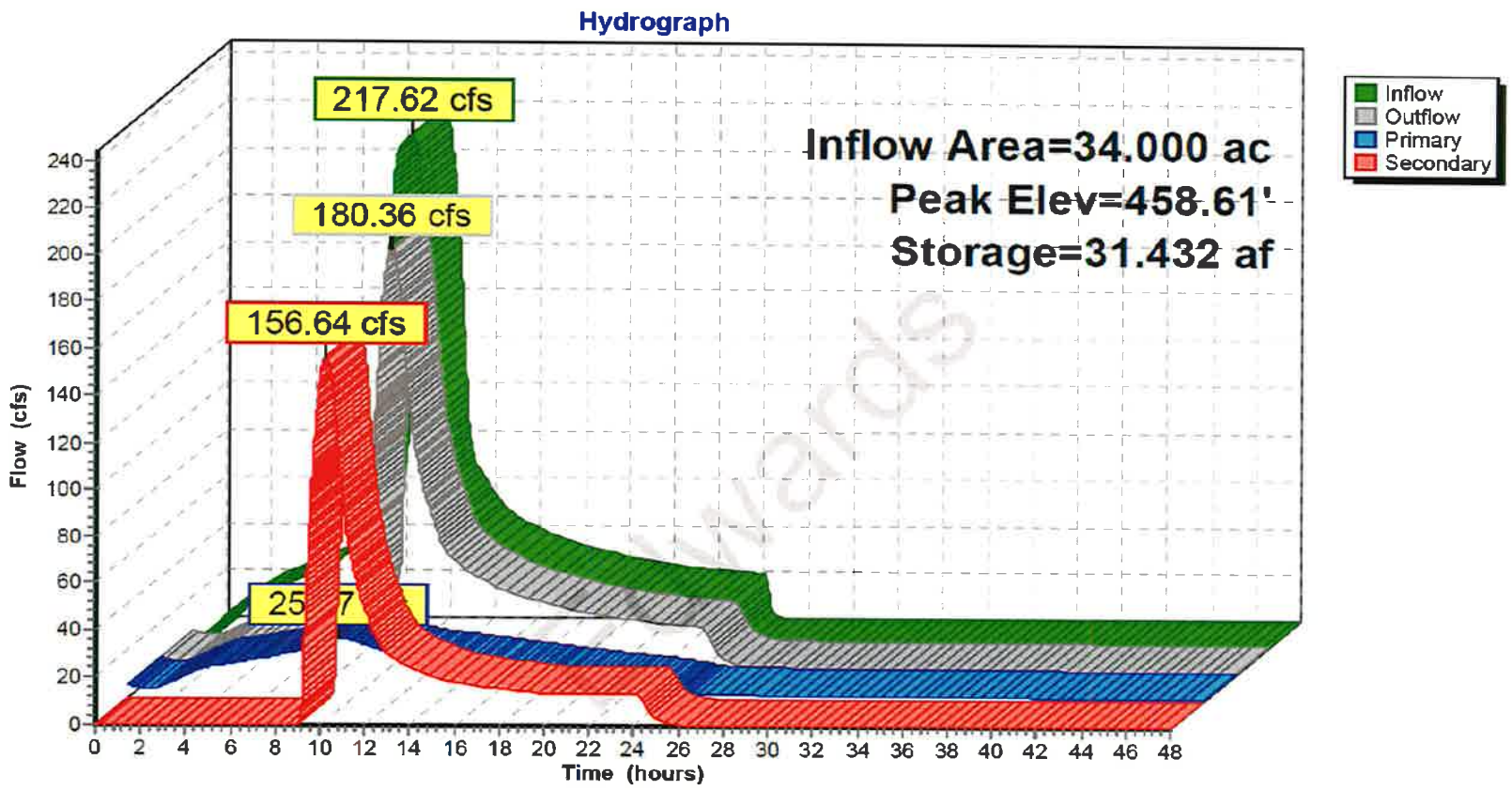
GLP8027 | 8/30/2021



PROCESS WATER POND CUMULATIVE STORAGE
PERIODIC CERTIFICATION
EDWARDS POWER PLANT
EDWARDS, ILLINOIS

Geosyntec consultants

Figure E-2

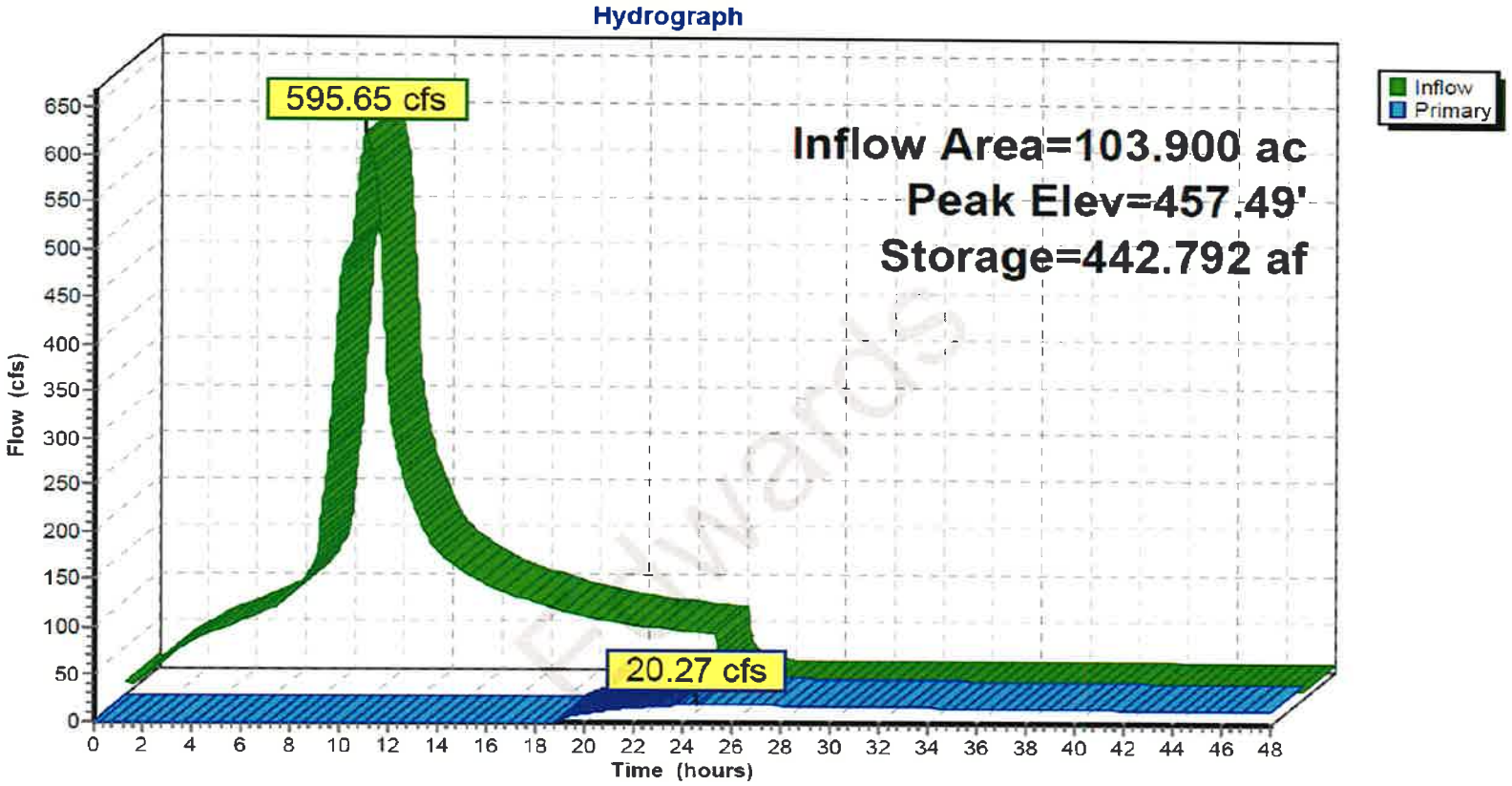


PROCESS WATER POND - HYDROGRAPH
PERIODIC CERTIFICATION
EDWARDS POWER PLANT
EDWARDS, ILLINOIS

Geosyntec consultants

Figure E-3

GLP8027 | 8/30/2021



CLARIFICATION POND - HYDROGRAPH
PERIODIC CERTIFICATION
EDWARDS POWER PLANT
EDWARDS, ILLINOIS

Geosyntec consultants

Figure E-4

GLP8027 | 8/30/2021

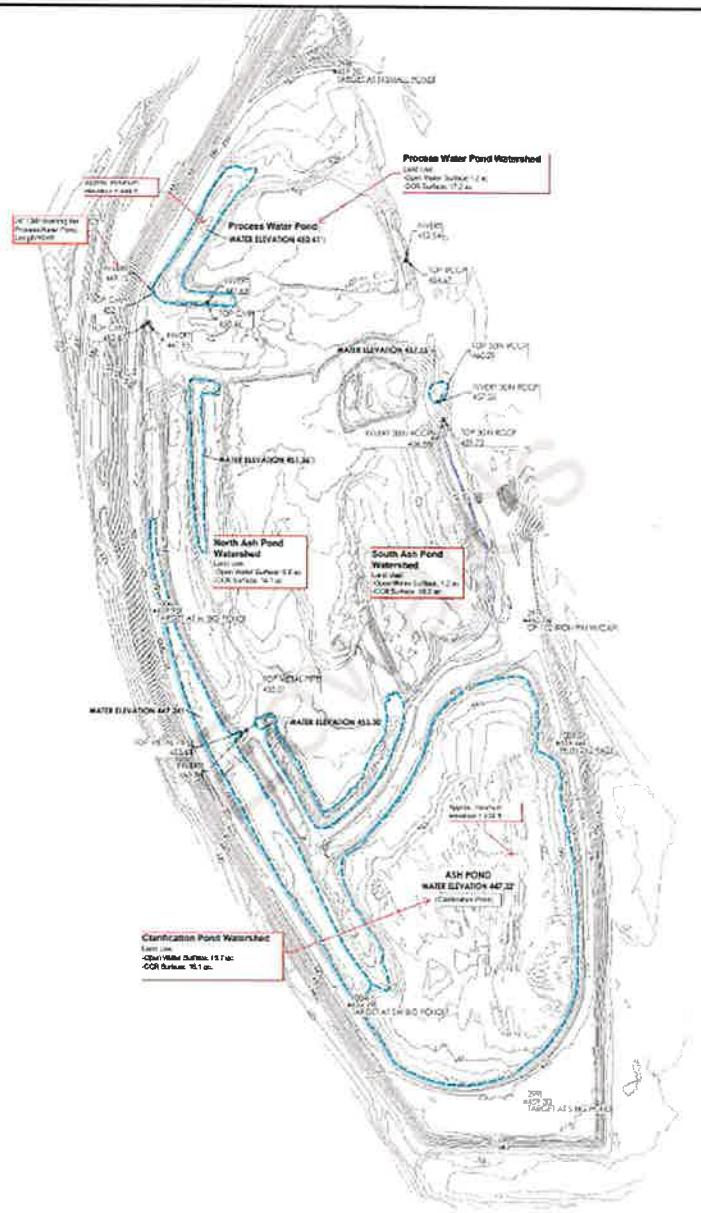


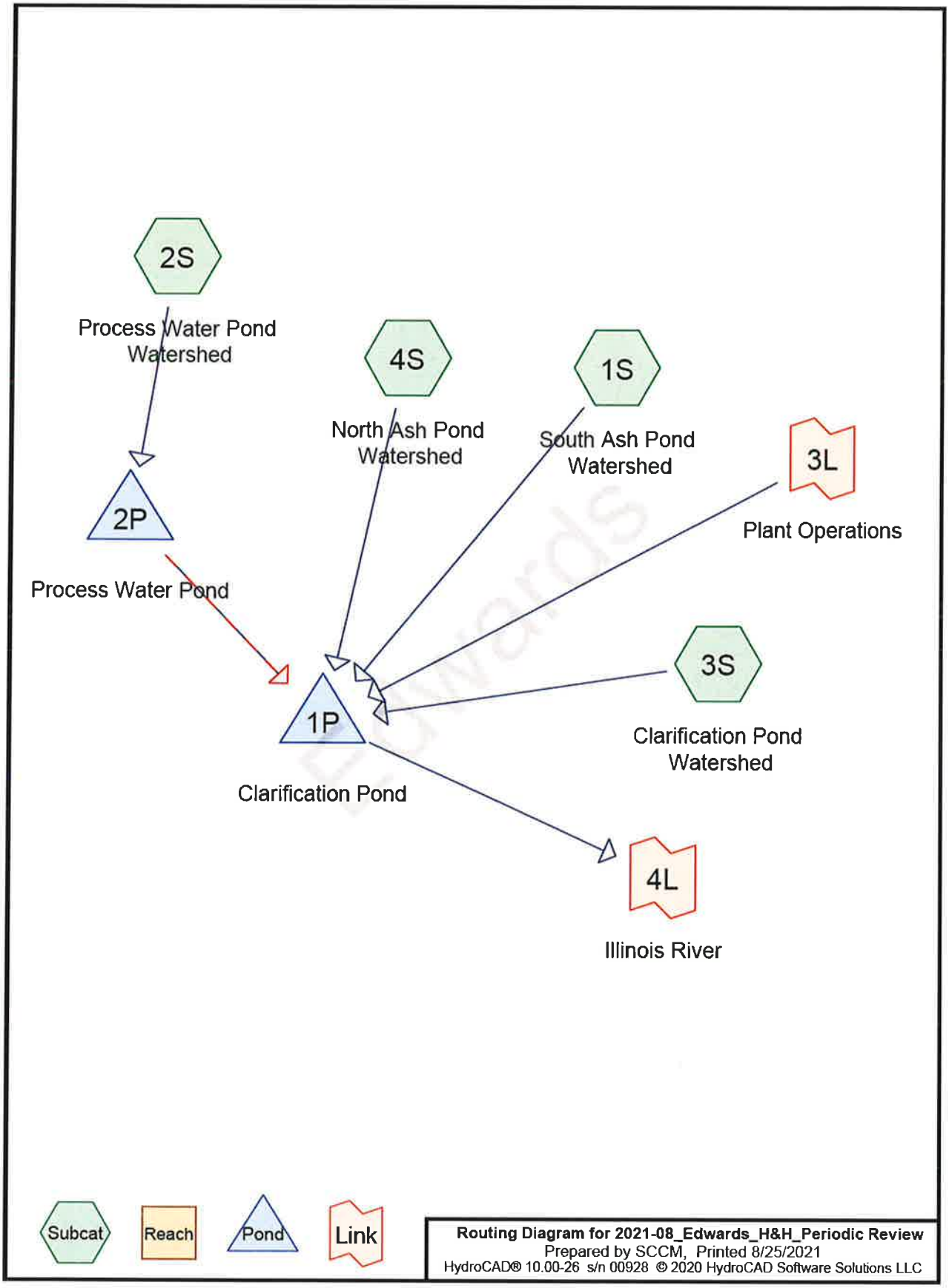
Figure based on IngenAE 2020 Site Topo

NOT TO SCALE

Edwards Power Plant
Hydrologic Workmap

Geosyntec consultants

GLP8027	September 2021	Figure E-5


2S
Process Water Pond Watershed
4S
North Ash Pond Watershed
1S
South Ash Pond Watershed
3L
Plant Operations
2P
Process Water Pond
3S
Clarification Pond Watershed
1P
Clarification Pond
4L
Illinois River
Subcat
Reach
Pond
Link
Routing Diagram for 2021-08_Edwards_H&H_Periodic Review
Prepared by SCCM, Printed 8/25/2021
HydroCAD® 10.00-26 s/n 00928 © 2020 HydroCAD Software Solutions LLC

Project Notes

Rainfall events imported from "NRCS-Rain.txt" for 1671 IL Peoria

Edwards

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
15.600	96	Gravel Surface, HSG C (2S)
65.600	91	Urban industrial, 72% imp, HSG C (1S, 2S, 3S, 4S)
22.700	98	Water Surface, HSG C (1S, 2S, 3S, 4S)
103.900	**93**	**TOTAL AREA**

Edwards

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
103.900	HSG C	1S, 2S, 3S, 4S
0.000	HSG D	
0.000	Other	
103.900		**TOTAL AREA**

Edwards

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	15.600	0.000	0.000	15.600	Gravel Surface	2S
0.000	0.000	65.600	0.000	0.000	65.600	Urban industrial, 72% imp	1S, 2S, 3S, 4S
0.000	0.000	22.700	0.000	0.000	22.700	Water Surface	1S, 2S, 3S, 4S
0.000	**0.000**	**103.900**	**0.000**	**0.000**	**103.900**	**TOTAL AREA**	

Edwards

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1P	434.00	432.00	1,090.5	0.0018	0.011	36.0	0.0	0.0
2	2P	449.15	447.93	104.0	0.0117	0.025	24.0	0.0	0.0

Edwards

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points x 3
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: South Ash Pond Runoff Area=19.400 ac 73.73% Impervious Runoff Depth=31.64"
Flow Length=3,764' Tc=11.3 min CN=91 Runoff=124.07 cfs 51.155 af

Subcatchment 2S: Process Water Pond Runoff Area=34.000 ac 39.95% Impervious Runoff Depth=32.05"
Flow Length=1,400' Tc=16.8 min CN=94 Runoff=217.62 cfs 90.798 af

Subcatchment 3S: Clarification Pond Runoff Area=35.800 ac 87.41% Impervious Runoff Depth=32.18"
Tc=6.0 min CN=95 Runoff=229.80 cfs 95.994 af

Subcatchment 4S: North Ash Pond Runoff Area=14.700 ac 73.14% Impervious Runoff Depth=31.64"
Flow Length=2,545' Tc=8.0 min CN=91 Runoff=94.08 cfs 38.762 af

Pond 1P: Clarification Pond Peak Elev=457.49' Storage=442.792 af Inflow=595.65 cfs 291.027 af
Outflow=20.27 cfs 39.676 af

Pond 2P: Process Water Pond Peak Elev=458.61' Storage=31.432 af Inflow=217.62 cfs 90.798 af
Primary=25.67 cfs 30.614 af Secondary=156.64 cfs 42.760 af Outflow=180.36 cfs 73.374 af

Link 3L: Plant Operations Manual Hydrograph Inflow=8.00 cfs 31.742 af
Primary=8.00 cfs 31.742 af

Link 4L: Illinois River Inflow=20.27 cfs 39.676 af
Primary=20.27 cfs 39.676 af

Total Runoff Area = 103.900 ac Runoff Volume = 276.709 af Average Runoff Depth = 31.96"
32.69% Pervious = 33.968 ac 67.31% Impervious = 69.932 ac

Edwards

Summary for Subcatchment 1S: South Ash Pond Watershed

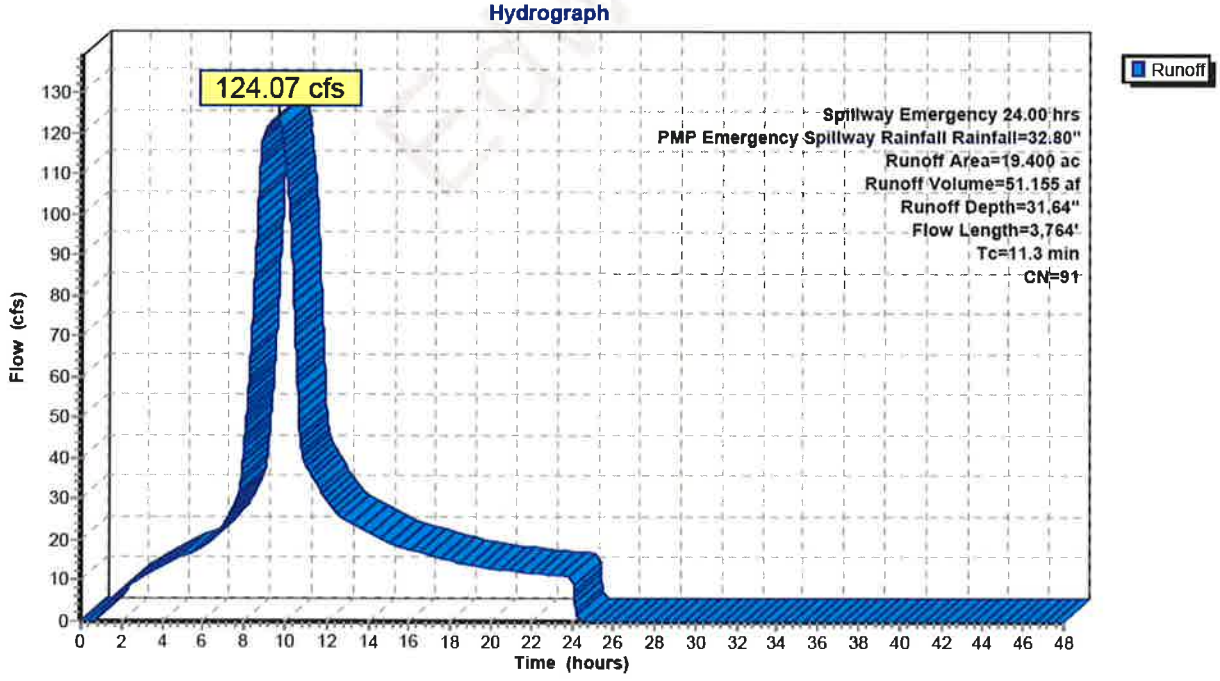
Runoff = 124.07 cfs @ 9.68 hrs, Volume= 51.155 af, Depth=31.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Spillway Emergency 24.00 hrs PMP Emergency Spillway Rainfall Rainfall=32.80"

	Area (ac)	CN	Description
*	1.200	98	Water Surface, HSG C
*	18.200	91	Urban industrial, 72% imp, HSG C
	19.400	91	Weighted Average
	5.096		26.27% Pervious Area
	14.304		73.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	64	0.0400	1.60		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 2.97"
10.6	3,700	0.0020	5.81	3,198.10	**Channel Flow, Channel Flow** Area= 550.0 sf Perim= 84.0' r= 6.55' n= 0.040 Winding stream, pools & shoals
11.3	3,764	Total			

Subcatchment 1S: South Ash Pond Watershed



Summary for Subcatchment 2S: Process Water Pond Watershed

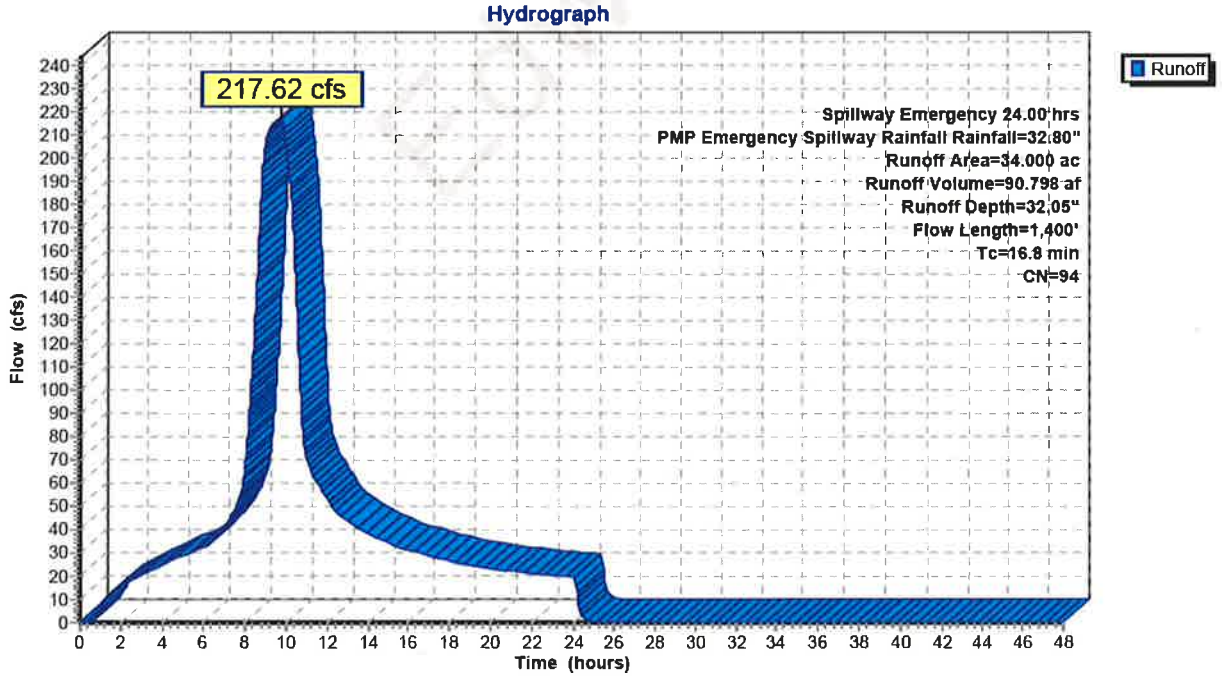
Runoff = 217.62 cfs @ 9.69 hrs, Volume= 90.798 af, Depth=32.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Spillway Emergency 24.00 hrs PMP Emergency Spillway Rainfall Rainfall=32.80"

	Area (ac)	CN	Description
	1.200	98	Water Surface, HSG C
*	15.600	96	Gravel Surface, HSG C
	17.200	91	Urban industrial, 72% imp, HSG C
	34.000	94	Weighted Average
	20.416		60.05% Pervious Area
	13.584		39.95% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.7	100	0.0100	1.00		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.97"
15.1	1,300	0.0050	1.44		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
16.8	1,400	Total			

Subcatchment 2S: Process Water Pond Watershed



Summary for Subcatchment 3S: Clarification Pond Watershed

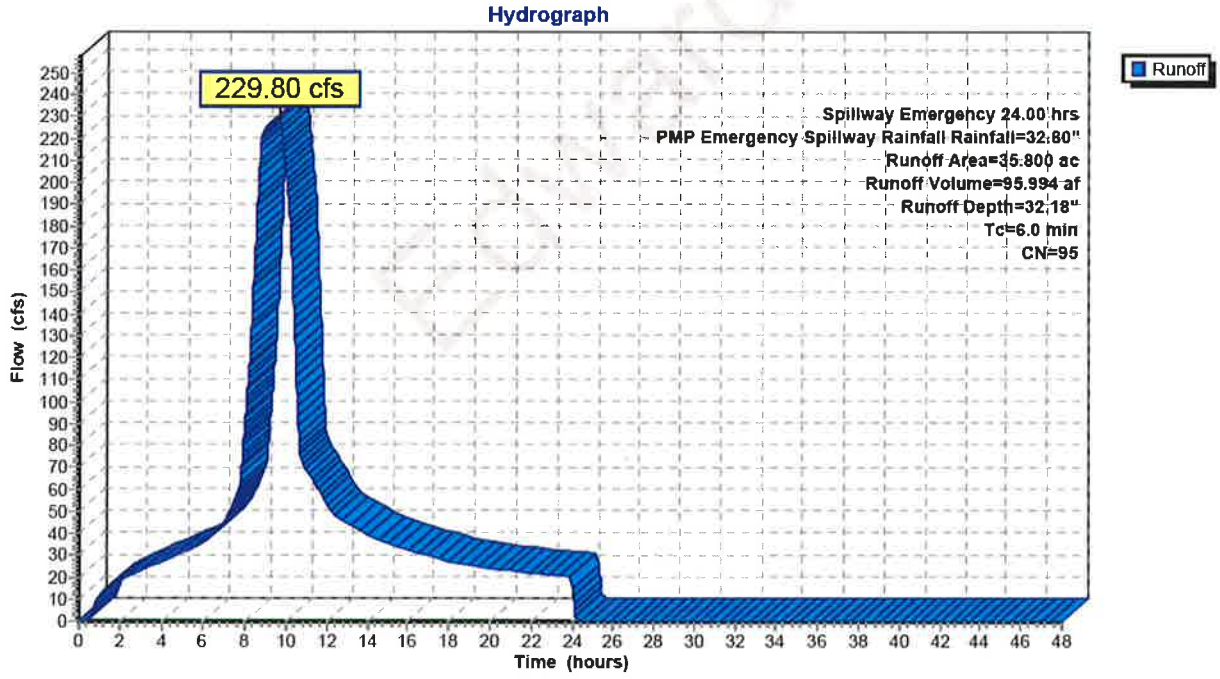
Runoff = 229.80 cfs @ 9.62 hrs, Volume= 95.994 af, Depth=32.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Spillway Emergency 24.00 hrs PMP Emergency Spillway Rainfall Rainfall=32.80"

Area (ac)	CN	Description
19.700	98	Water Surface, HSG C
16.100	91	Urban industrial, 72% imp, HSG C
35.800	95	Weighted Average
4.508		12.59% Pervious Area
31.292		87.41% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Direct Entry**

Subcatchment 3S: Clarification Pond Watershed



Summary for Subcatchment 4S: North Ash Pond Watershed

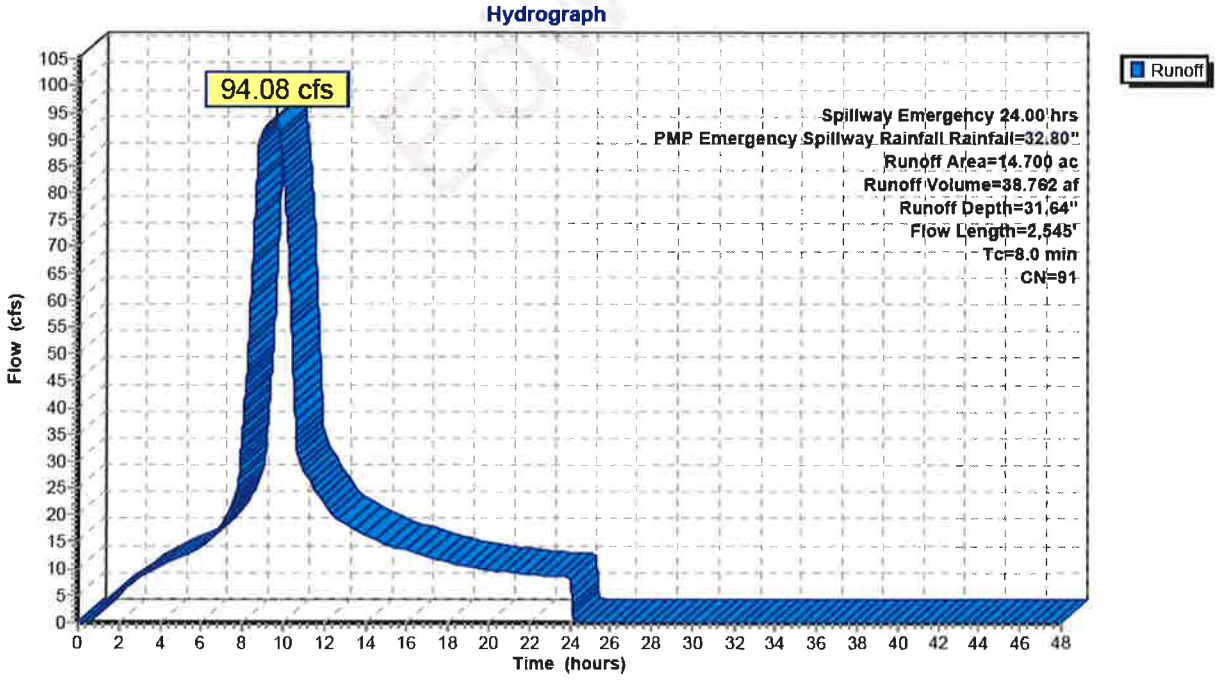
Runoff = 94.08 cfs @ 9.66 hrs, Volume= 38.762 af, Depth=31.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Spillway Emergency 24.00 hrs PMP Emergency Spillway Rainfall Rainfall=32.80"

Area (ac)	CN	Description
0.600	98	Water Surface, HSG C
14.100	91	Urban industrial, 72% imp, HSG C
14.700	91	Weighted Average
3.948		26.86% Pervious Area
10.752		73.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0	100	0.0400	1.75		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.97"
7.0	2,445	0.0020	5.81	3,198.10	**Channel Flow,** Area= 550.0 sf Perim= 84.0' r= 6.55' n= 0.040 Winding stream, pools & shoals
8.0	2,545	Total			

Subcatchment 4S: North Ash Pond Watershed



Summary for Pond 1P: Clarification Pond

Inflow Area = 103.900 ac, 67.31% Impervious, Inflow Depth > 33.61" for PMP Emergency Spillway Rainfall ev
Inflow = 595.65 cfs @ 9.75 hrs, Volume= 291.027 af
Outflow = 20.27 cfs @ 24.56 hrs, Volume= 39.676 af, Atten= 97%, Lag= 888.9 min
Primary = 20.27 cfs @ 24.56 hrs, Volume= 39.676 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Starting Elev= 447.32' Surf.Area= 0.000 ac Storage= 177.470 af
Peak Elev= 457.49' @ 24.56 hrs Surf.Area= 0.000 ac Storage= 442.792 af (265.322 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 1,199.2 min (1,991.7 - 792.4)

Volume	Invert	Avail.Storage	Storage Description
#1	434.00'	517.029 af	**Custom Stage Data**Listed below

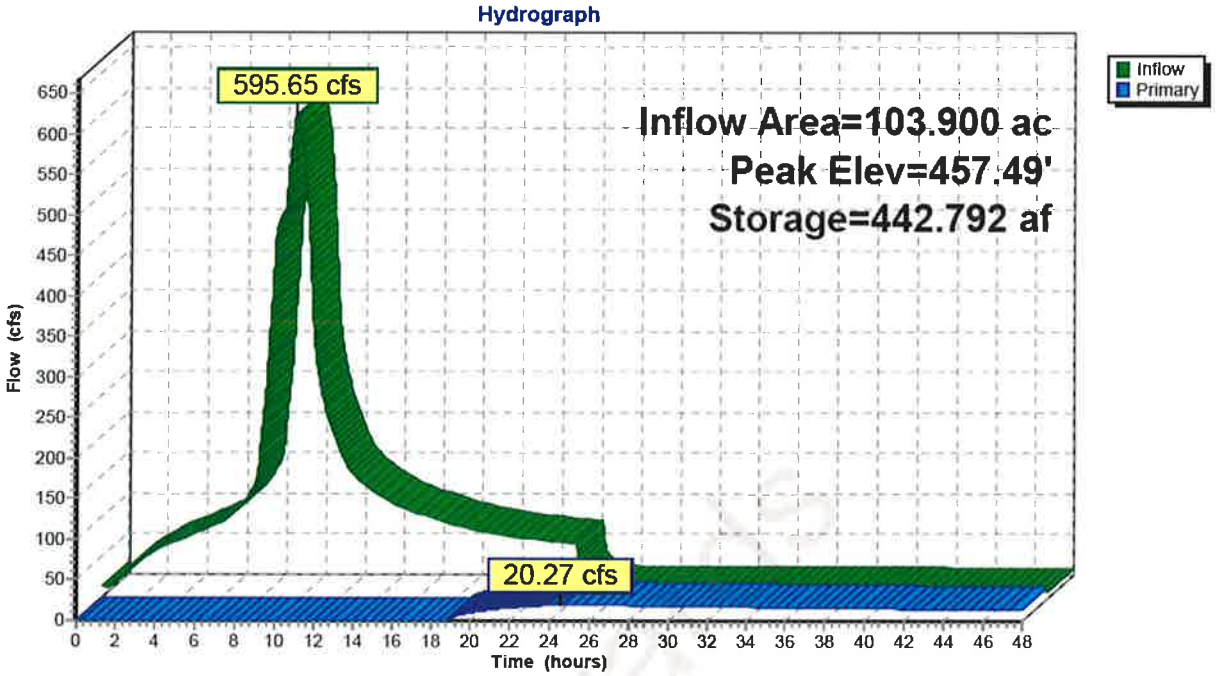
Elevation (feet)	Cum.Store (acre-feet)
434.00	0.000
436.00	4.022
438.00	17.504
440.00	41.759
442.00	72.854
444.00	108.189
446.00	148.070
448.00	192.615
450.00	241.465
452.00	292.504
454.00	345.457
456.00	400.409
458.00	457.312
460.00	517.029

Device	Routing	Invert	Outlet Devices
#1	Primary	434.00'	**36.0" Round Culvert** L= 1,090.5' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 434.00' / 432.00' S= 0.0018 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean, Flow Area= 7.07 sf
#2	Device 1	447.20'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=20.32 cfs @ 24.56 hrs HW=457.49' TW=456.57' (Dynamic Tailwater)
↑└1=**Culvert** (Outlet Controls 20.32 cfs @ 2.87 fps)
↑└2=**Orifice/Grate** (Passes 20.32 cfs of 32.64 cfs potential flow)

Edwards

Pond 1P: Clarification Pond



Summary for Pond 2P: Process Water Pond

Inflow Area = 34.000 ac, 39.95% Impervious, Inflow Depth = 32.05" for PMP Emergency Spillway Rainfall ev
Inflow = 217.62 cfs @ 9.69 hrs, Volume= 90.798 af
Outflow = 180.36 cfs @ 10.23 hrs, Volume= 73.374 af, Atten= 17%, Lag= 32.2 min
Primary = 25.67 cfs @ 9.34 hrs, Volume= 30.614 af
Secondary = 156.64 cfs @ 10.24 hrs, Volume= 42.760 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs / 3
Starting Elev= 450.41' Surf.Area= 0.000 ac Storage= 4.187 af
Peak Elev= 458.61' @ 10.24 hrs Surf.Area= 0.000 ac Storage= 31.432 af (27.245 af above start)

Plug-Flow detention time= 312.5 min calculated for 69.187 af (76% of inflow)
Center-of-Mass det. time= 138.2 min (817.0 - 678.8)

Volume	Invert	Avail.Storage	Storage Description
#1	444.00'	42.450 af	**Custom Stage Data**Listed below

Elevation (feet)	Cum.Store (acre-feet)
444.00	0.000
446.00	0.382
448.00	1.763
450.00	3.674
452.00	6.177
454.00	10.150
456.00	16.537
458.00	26.618
460.00	42.450

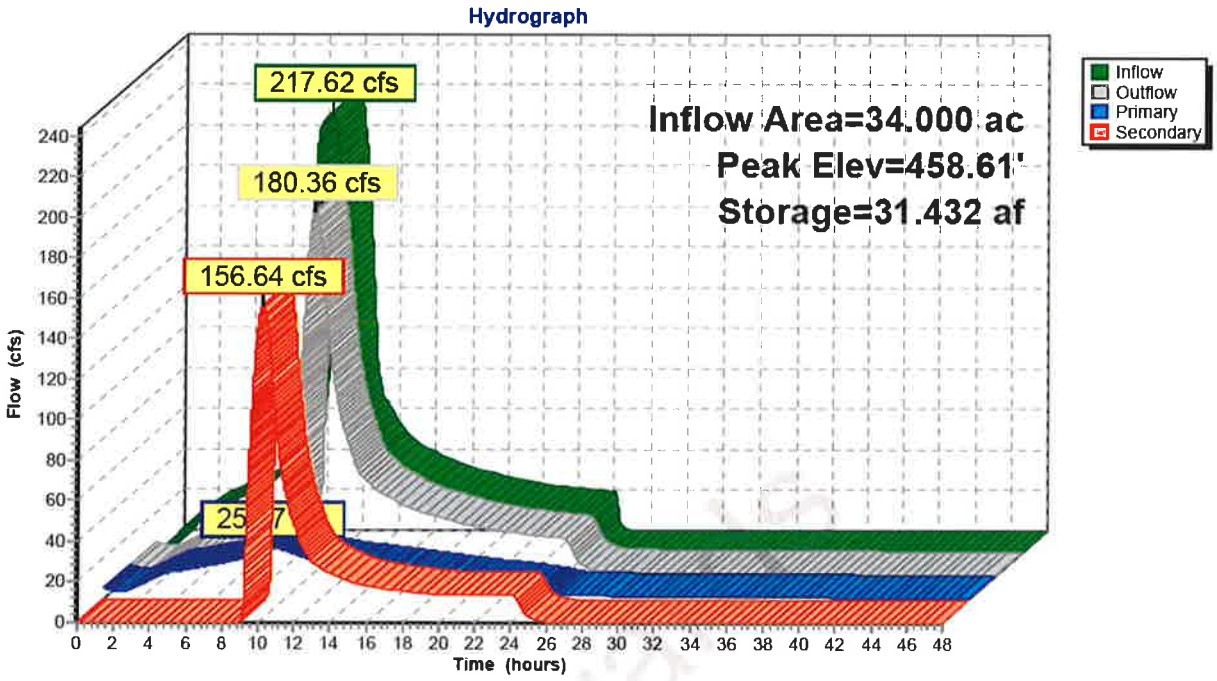
Device	Routing	Invert	Outlet Devices
#1	Primary	449.15'	**24.0" Round Culvert** L= 104.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 449.15' / 447.93' S= 0.0117 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 3.14 sf
#2	Secondary	457.50'	**50.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Primary OutFlow Max=25.67 cfs @ 9.34 hrs HW=458.00' TW=451.06' (Dynamic Tailwater)
↑—**1=Culvert** (Outlet Controls 25.67 cfs @ 8.17 fps)

Secondary OutFlow Max=156.64 cfs @ 10.24 hrs HW=458.61' TW=452.69' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 156.64 cfs @ 2.83 fps)

Edwards

Pond 2P: Process Water Pond



Summary for Link 3L: Plant Operations

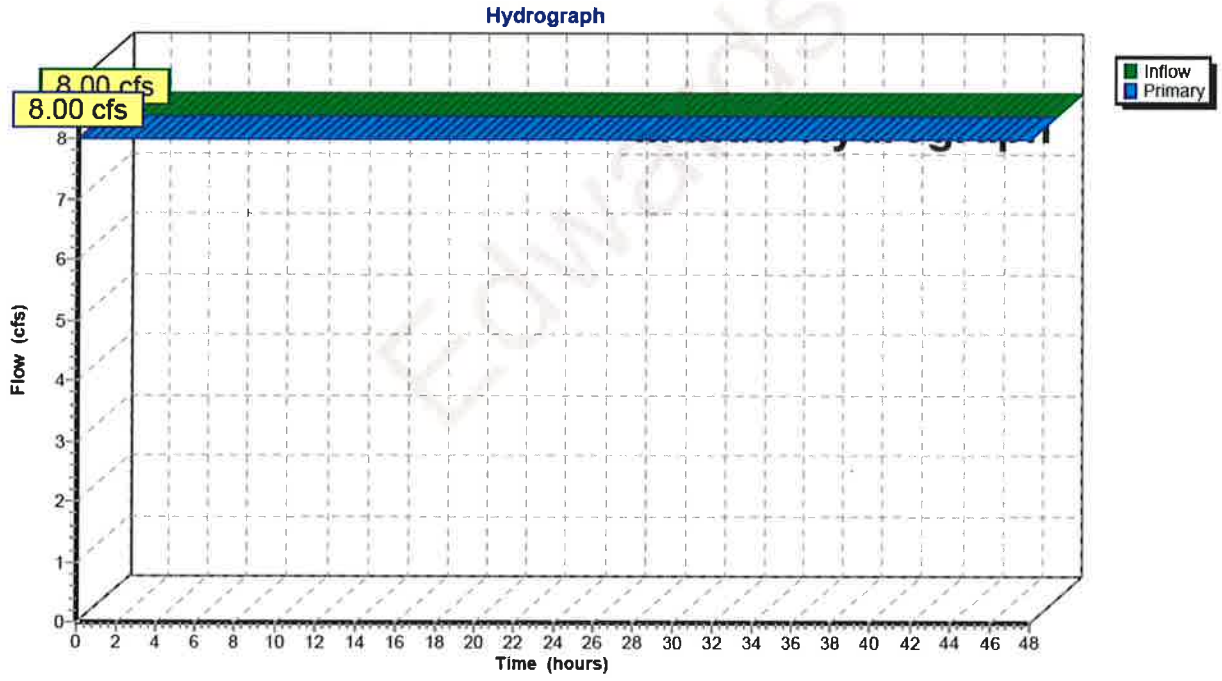
Inflow = 8.00 cfs @ 0.00 hrs, Volume= 31.742 af
Primary = 8.00 cfs @ 0.00 hrs, Volume= 31.742 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

61 Point manual hydrograph, To= 0.00 hrs, dt= 1.00 hrs, cfs =

8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
8.00									

Link 3L: Plant Operations



Summary for Link 4L: Illinois River

Historic Illinois River high water elevation

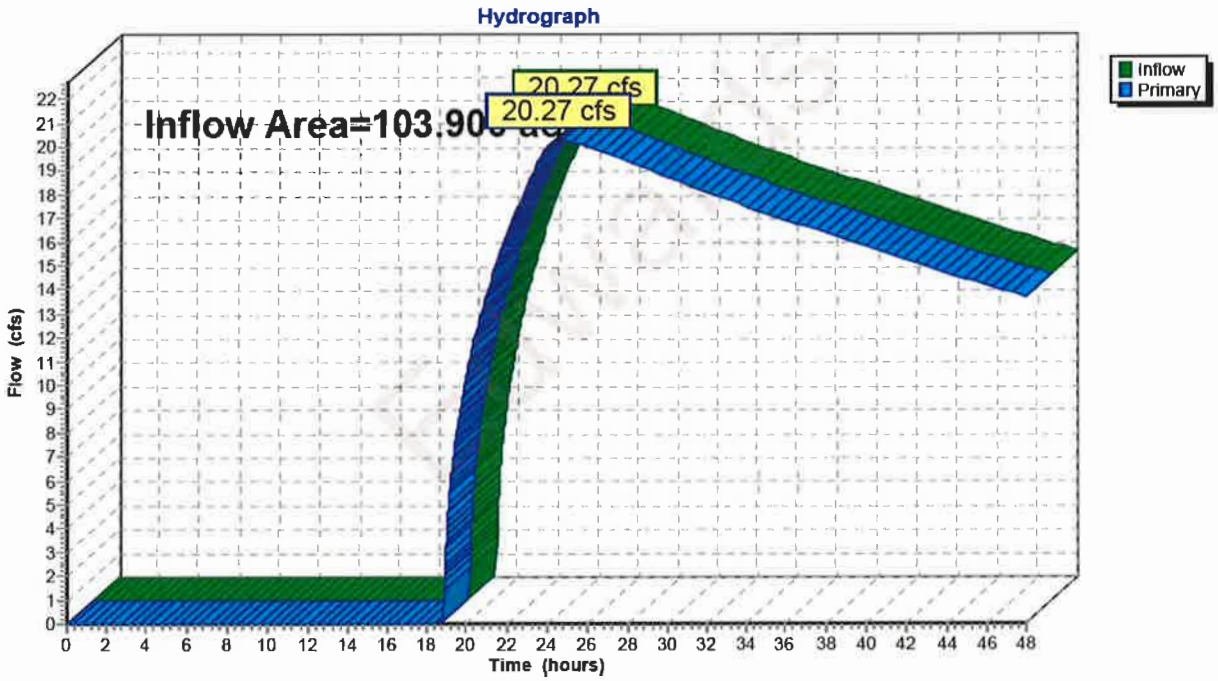
[80] Warning: Exceeded Pond 1P by 9.25' @ 0.00 hrs (64.44 cfs 66.867 af)

Inflow Area = 103.900 ac, 67.31% Impervious, Inflow Depth > 4.58" for PMP Emergency Spillway Rainfall ev
Inflow = 20.27 cfs @ 24.56 hrs, Volume= 39.676 af
Primary = 20.27 cfs @ 24.56 hrs, Volume= 39.676 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Fixed water surface Elevation= 456.57'

Link 4L: Illinois River



APPENDIX I
PUBLIC NOTIFICATION AND PUBLIC MEETING CERTIFICATION (845.220(a)(9))

Edwards Public Meeting Summary, April 30, 2025

On March 31, 2025, Illinois Power Resources Generating, LLC ("IPRG") made available to the public its proposed plans to implement corrective action at the previously closed Ash Pond located at the Edwards Power Plant. On Wednesday, April 30, 2025, IPRG held in-person public meetings at 3:00 pm and 5:00 pm at the Peoria Marriott Pere Marquette in Peoria, IL to present its decision-making process. A discussion of the corrective measures assessment and corrective action alternatives analysis, including an objective comparison of pros and cons and projected groundwater impacts for each of the alternatives, was presented at these meetings. During the question-and-answer portion of the meetings, the public asked questions relating to the proposed remedial measures which the company addressed. As required by Section 845.240(g), this document provides a general summary of the issues or comments raised by the public relating to the closure, a summary of the company's responses to those issues or comments, and a summary of any revisions or changes made to the proposed corrective action as a result of issues and comments raised by the public. This document also provides as required by 845.240(f)(3), written responses to the questions not addressed during the public meetings.

Issue/Topic		Summary of Response Provided at Meeting	Additional Written Response
1.	Closure Method	The purpose of the current public meeting is to discuss the corrective action evaluation for groundwater remediation at the Ash Pond. The final closure system, previously submitted to IEPA as a closure construction permit application in 2022, meets the cover design requirements of Part 845 and Federal Part 257. Source control, consisting of the final closure system, is the most effective means of ensuring the timely attainment of remediation objectives. The process will include removal of free liquids, relocation of 1,130,000 cubic yards of CCR, and stabilization of ash prior to installation of a designed final cover system. The proposed final closure will consist of reducing the Ash Pond footprint by 32%. The previously submitted closure method includes protecting the ash pond from flood events. The height of the Ash Pond berm is outside of the 100-year flood level. The submitted closure construction permit application included a closure alternatives analysis and proposed the most appropriate closure method for the Ash Pond, and can be found on our website (noted below).	Final design and construction of the proposed groundwater extraction trenches and infrastructure will be closely coordinated with the Ash Pond closure construction. It is anticipated that construction of the trenches will occur prior to installation of the final cover system. This sequencing is necessary to facilitate construction of the trenches without adversely impacting the closure construction. Free liquids will be removed from ash that will be consolidated.

		Groundwater protection standards will be met despite the unit having limited hydraulic connection with the clay soils of the uppermost aquifer, and there is no risk to human health and the environment. Edwards Power Plant retired in 2022 and is no longer generating ash. Naturally occurring methane at low levels that exist outside the Ash Pond will be monitored during any proposed construction to ensure proper worker safety. Health and safety issues are a top priority of IPRG. Construction activities will be managed in accordance with regulatory requirements to limit fugitive dust. Upon completion of the closure construction, a solar power generating facility is proposed to be installed on top of the cover system.	
2.	Groundwater Impacts and Monitoring	A risk assessment confirmed that the Ash Pond is not adversely impacting human health and the environment; specifically the Ash Pond is not negatively impacting the river habitat and does not present a risk to river users. The risk assessment did take into account consumption of locally caught fish. No potable water wells are impacted. Groundwater predominantly flows in a westward and southward direction with a minor and localized northern component of flow. There are no seasonal changes to groundwater direction due to the naturally surrounding soils being very low permeability. The geology at the site has been robustly characterized including the bedrock layer (with borings) and the groundwater monitoring network comprehensively monitors groundwater flow in all directions at appropriate depths. Groundwater monitoring wells are located on all sides of the Ash Pond, including to the east between the Ash Pond and the river.	A map of the groundwater well network can be found in our operating permit application in Attachment I: "Groundwater Sampling and Analysis Program" which can be found on page 959.

		Our groundwater monitoring results indicate the following constituents were above groundwater protection standards: boron, sulfate, and total dissolved solids. The corrective action will reduce, to the maximum extent feasible, further releases and minimize further migration of CCR-derived constituents in groundwater until the groundwater protection standards are achieved. Adaptive site management action will be taken if the remedy performance does not correspond with the expected performance. Groundwater is required to be monitored quarterly for a minimum of 30 years beginning after closure to ensure conditions are as anticipated. Groundwater monitoring will continue until groundwater protection standards are met.	
3.	Corrective Action Plan	To evaluate corrective action and select a remedy, Part 845 requires several factors to be analyzed, which do not include cost. Associated groundwater flow and transport modeling takes into account groundwater flow in all directions and is not limited to vertical flow. A total of five corrective measures were assessed and discussed for the Ash Pond. A cutoff wall is not a site appropriate remedy due to the low conductivity of the native surrounding soils, which have comparable permeability to an engineered cutoff wall. In addition, phytoremediation was not chosen due to the longer predicted modeled time to meet groundwater protection standards among other uncertainties as compared to the groundwater extraction trench. Corrective action will consist of supplementing the completed source control (pond closure) with groundwater extraction trenches near observed groundwater impacts. The source control proposed will result in the removal of the primary driving	Part 845 requires over 16 evaluation factors to be considered such as long- and short-term effectiveness and protectiveness, effectiveness of controlling the source, ease or difficulty of implementing, and the degree to which community concerns are addressed. There will be very little groundwater flow into or out of the Ash Pond once the corrective action plan is implemented due to the cover system, consolidation, and the native low conductivity clay surrounding the unit. The goal of a groundwater extraction trench is to increase the hydraulic gradient towards the extraction trench by collecting groundwater from the bottom of the trench and lowering the head in the

		force of the outflow from the ash and provide protective cover. Groundwater corrective action would consist of two trenches on the northwest and southwest boundary of the Ash Pond, up to three feet thick and keyed into bedrock. The trenches will be constructed to a depth of 20 and 50 feet below ground surface. A perforated groundwater collection pipe will be laid in the trench. Groundwater collected from the groundwater extraction system will be treated on-site, monitored and discharged in accordance with the site's National Pollutant Discharge Elimination System (NPDES) permit, approved and implemented through IEPA. All applicable discharge limits to ensure protection of the river will be met. Specific treatment of collected water will be designed once corrective action plans are approved. The system will continue to be in operation until monitoring data shows groundwater protection standards are met and in conjunction with IEPA approval. Additional information and drawings are provided in the draft corrective action plan previously posted on IPRG publicly accessible website (noted below).	surrounding soil, which will reduce the time to achieve groundwater protection standards. The north trench will be approximately 1,700 feet, and the south trench will be approximately 800 feet. The total estimated extraction rate ranges from 40 gpm to a long-term rate of approximately 20 gpm or less. The corrective action plan proposes to place spoils excavated from the trenches within the closure footprint prior to the construction of the final cover system. Bordering the east perimeter of the Ash Pond, the river has a normal baseflow elevation of approximately 433.6 feet. The north trench will extend from approximately 440 feet down to bedrock (elevation range of 411 to 421 feet). The south trench will extend from approximately 450 feet down to bedrock (approximate elevation of 401 feet). The trenches are located approximately 200 feet west of the river with low permeability materials in between. The visuals shown in the slide, as well as additional full drawings, can be found in the draft corrective action construction permit application appendix B: "Drawings and Materials Specifications for Selected Remedy" which can be found on page 1535 and 1537.

4.	Financial Obligation	IPRG will fully fund all closure and corrective action activities. Financial assurance has been obtained to cover the cost of closure and corrective action. As required by Part 845, the most recent cost estimate for closure, post-closure, and preliminary corrective action can be found on our website (noted below).	
5.	Working with IEPA	IPRG has submitted an operating permit application under Part 845 in 2021 and a closure construction permit application under Part 845 in 2022. No permit has been issued yet. As IEPA continues to implement Part 845, IPRG will continue to meet regulatory obligations.	
6.	More Information	Additional information about the items discussed in this Public Meeting can be found online. Data and documents for compliance with the Illinois CCR Rule: www.luminant.com/ccr/illinois-ccr/	

APPENDIX J
CONTRACTOR TRAINING CERTIFICATION
(45 ILCS 5/22.59(b)(4))

Phil Morris
Illinois Power Resources Generating, LLC
1500 Eastport Plaza Drive
Collinsville, IL 62234

June 30, 2022

Illinois Environmental Protection Agency
DWPC – Permits MC # 15
ATTN: Part 845 Coal Combustion Residual Rule Submittal
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

Re: 415 ILCS 5/22.59(b)(4) Certification Statement
Edwards Power Plant Ash Pond (IEPA ID# W1438050005)

Dear Mr. Darin LeCrone:

For the above-referenced CCR surface impoundment and in accordance with 415 ILCS 5/22.59(b)(4), Illinois Power Resources Generating, LLC certify that all contractors, subcontractors, and installers utilized to construct, install, modify, or close a CCR surface impoundment will be participants in a training program that is approved by and registered with the US Department of Labor's Employment and Training Administration and that includes instruction in the following: erosion control, environmental remediation, operation of heavy equipment and excavation.

Sincerely,
Illinois Power Resources Generating, LLC

Phil Morris, P.E.
Senior Director, Environmental