Luminant

Dynegy Midwest Generation, LLC
1500 Eastport Plaza Dr.
Collinsville, IL 62234

July 31, 2023

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, IL 62794-9276

Re: Baldwin Power Plant Bottom Ash Pond; IEPA ID W1578510001-06

Dear Mr. LeCrone:

In accordance with 35 I.A.C. § 845.200, Dynegy Midwest Generation, LLC (DMG) is submitting a closure construction permit application for the Baldwin Power Plant Bottom Ash Pond (IEPA ID W1578510001-06). One hardcopy is provided with this submittal.

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

In accordance with 35 I.A.C. § 845.220(a)(7) the enclosed closure construction application includes modifications to the groundwater monitoring program originally submitted with the operating permit application on October 25, 2021. The modifications include updates to the following documents submitted with the operating permit application:

- Hydrogeologic Site Characterization Report (Operating Permit Attachment H)
- Groundwater Monitoring Plan (Operating Permit Attachment I)

Sincerely,

Cynthia Vodopivec
SVP-Environmental Health and Safety

Enclosures

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

Bureau of Water ID Number: W1578510001-06 **CCR Permit Number:** N/A **Facility Name:** Baldwin Power Plant	For IEPA Use Only Type text here

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

Facility, Operator, and Owner Information

1.1	Facility Name		
	Dynegy Midwest Generation, LLC - Baldwin Power Plant		
1.2	Illinois EPA CCR Permit Number (if applicable)		
	N/A		
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 10901 Baldwin Road		
	County name Randolph	County code (if known)	
	City or town Baldwin	State IL	Zip Code 62217
1.6	Name of Owner/Operator		
	Dynegy Midwest Generation, 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/illinois-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.		
	W1578510001-06 (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	**Date Signed**
Cynthia E. Vodopivec	7/20/2023

Form 2CC

Illinois Environmental Protection Agency

CCR Surface Impoundment Permit Application

Form CCR 2CC – Closure Construction

Bureau of Water ID Number: W1578510001-06 **CCR Permit Number:** N/A **Facility Name:** Baldwin Power Plant	For IEPA Use Only

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

Design and Construction Plans (Construction History)

1.1	CCR surface impoundment name.
	Bottom Ash Pond
1.2	Identification number of the CCR surface impoundment (if one has been assigned by the Agency).
	N/A
1.3	Describe the boundaries of the CCR surface impoundment (35 Ill. Adm. Code 845.210 (c)).
	Attachment A
1.4	State the purpose for which the CCR surface impoundment is being used.
	Attachment C
1.5	How long has the CCR surface impoundment been in operation?
	Attachment C
1.6	List the types of CCR that have been placed in the CCR surface impoundment.
	Section 2.2

Design and Construction Plans (Continued)

1.7	List the name of the watershed within which the CCR surface impoundment is located.	
	Attachment C	
1.8	What is the size in acres of the watershed within which the CCR surface impoundment is located?	
	Attachment C	
1.9	Check the corresponding boxes to indicate that you have attached the following:	
	☑	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, range, 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 surface impoundment.
	☑	A statement of the approximate dates of construction of each successive stage of construction of the CCR surface impoundment.
	☑	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.
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.	
	Attachment D	
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.	
	Section 2.2	
2.4	The rate at which CCR and non-CCR waste streams currently enter the CCR impoundment in gallons per day and dry tons.	
	Section 2.2 GPD	Section 2.2 dTn
2.5	Estimate length of time the CCR surface impoundment will receive CCR and non-CCR waste streams.	
	Section 2.2	
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.

Attachments (Continued)		✓	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.
		✓	A list of interested persons in attendance who would like to be added to the Agency's listserv for the facility.
		✓	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: CLOSURE (35 Ill. Adm. Code 845.220(d))			
Closure	6.1	What is the closure prioritization category under 35 Ill. Adm. Code 845.700(g), if applicable?	
		Attachment I	
	6.2	Indicate that you have attached the following by checking the corresponding boxes:	
		✓	The final closure plan, as specified in 35 Ill. Adm. Code 845.720(b), which includes the closure alternatives analysis required by 35 Ill. Adm. Code 845.710.
		✓	Proposed schedule to complete closure.
		✓	Post-closure care plan as specified in 35 Ill. Adm. Code 845.780(d).
SECTION 7: GROUNDWATER MODELING (35 Ill. Adm. Code 845.220(d)(3))			
Groundwater	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 closure 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 model.

Prepared for

Dynegy Midwest Generation, LLC
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

CONSTRUCTION PERMIT APPLICATION

BALDWIN POWER PLANT BOTTOM ASH POND (IEPA ID W1578510001-06) Baldwin, Illinois

Prepared by

Geosyntec consultants
engineers | scientists | innovators

1 McBride and Son Center Drive
Suite 202
Chesterfield, Missouri 63005

Project Number GLP8050

Revision 0

July 31, 2023

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ATTACHMENTS

1. INTRODUCTION

Dynegy Midwest Generation, LLC (DMG) is the owner of the active coal-fired Baldwin Power Plant (BPP) in Baldwin, Illinois. According to the Illinois Environmental Protection Agency (IEPA), this power plant has four CCR surface impoundments, as listed in **Table 1**. This construction permit application is for only the Bottom Ash Pond (BAP). As of the date of this report, the BPP is an active power plant because electricity is being produced, and the BAP is an active CCR surface impoundment because CCR is actively being placed in the BAP. DMG intends to cease the burning of coal and generation of electricity of BPP by December 31, 2025, after which the BAP will no longer receive CCR.

Table 1 – CCR Surface Impoundments at Baldwin Power Plant

Impoundment Name	Status	Acronym	IEPA ID Number	DMG CCR Unit ID	National Inventory of Dams Number
Bottom Ash Pond	**Active**	**BAP**	**W1578510001-06**	**601**	**IL50721**
Old East Fly Ash Pond	Closed	FAPS (Fly Ash Pond System)	W1578510001-01	605	IL50721
East Fly Ash Pond			W1578510001-02		
West Fly Ash Pond			W1578510001-03		

This construction permit application was developed in accordance with 35 Ill. Admin. Code 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845) [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 **Attachment A**.

1.2. Previous Assessments

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

The BAP is also regulated by 40 C.F.R. Part 257, herein referred to as the CCR Rule [2] and subsequently became regulated by Part 845 [1]. Multiple previous initial and periodic assessments, investigation plans, and programs were completed for the BAP to satisfy the requirements of both the CCR Rule and Part 845; some of which are referred to within this report.

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.*

The hydrogeologic site investigation and characterization, groundwater monitoring well system, and groundwater monitoring plan are provided for the BAP in **Attachment 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 and Floodplains were included in the Part 845 Initial Operating Permit Application for the BAP [3]. The Initial Operating Permit Application was submitted to IEPA in October 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 performed in 2016 and updated and included in the Part 845 Initial Operating Permit Application for the BAP dated October 2021 [3]. The Initial Operating Permit Application was submitted to IEPA in October 2021.

2. CONSTRUCTION PERMIT

2.1. History of Construction

<u>Section 845.220(a)(1):</u> *Design and Construction Plans (Construction History)*

The History of Construction report for the BAP was submitted to DMG by AECOM in October 2016 and is provided in **Attachment C.1**. A subsequent update letter was later submitted to DMG by Geosyntec in October 2021 to reflect the closure of the Fly Ash Pond system and is provided in **Attachment C.2**.

2.2. Narrative Description of Facility

<u>Section 845.220(a)(2):</u> *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.

<u>Section 845.220(a)(2)(A):</u> *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 BAP and analysis of the chemical constituents found within the CCR in the BAP is provided in **Attachment D.**

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

The BAP currently is estimated to contain approximately 3.8 million cubic yards (CY) of CCR. The BPP is expected to cease the burning of coal and production of electricity by December 2025. An estimated 500,000 CY of additional CCR is projected to be placed in the BAP between the time of the survey and the closure.

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

The BAP currently receives multiple CCR and non-CCR waste streams at an approximate total average rate of 443 tons per day and 7.56 million gallons of sluiced water per day before waste is excavated for beneficial reuse. Approximately 240 tons per day of waste is excavated for beneficial reuse, and 203 tons of waste remains in the BAP daily on average. These waste streams, and the approximate daily volumes, are described below.

- CCR Waste Streams
    - Process flow from two units with two pumps each is estimated to be approximately 7.56 million gallons of sluice water entering the system daily.
    - Economizer ash is projected to be generated at a rate of approximately 30 dry tons per day on average.
    - Fly ash is projected to be generated at a rate of approximately 158 dry tons per day on average after adjusted for planned beneficial reuse.
    - Bottom ash is projected to be generated at a rate of approximately 15 dry tons per day on average after adjusted for planned beneficial reuse.

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

The BAP is expected to receive CCR waste streams until the BPP ceases the burning of coal and generation of electricity by December 31, 2025. Minimal placement of CCR waste streams associated with plant decommissioning will continue through July 17, 2027.

The BAP is expected to continue to receive the existing non-CCR waste stream throughout the closure of the BAP. The specific non-CCR waste stream and estimated length of time over which the BAP will receive them is still being evaluated.

<u>Section 845.220(a)(2)(E):</u> *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.*

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

2.3. Site Maps

<u>Section 845.220(a)(3):</u> *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 showing the information required in Section 845.220(a)(3) is provided for the BAP in **Attachment F**. The Site Location Map consists of the most recent USGS topographic map (June 2022) which contains the facility and at least 1,000 meters outside of the facility 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 [4] for natural and protected areas within 1,000 meters of the BAP. The Cooling Pond at the BPP is split between two counties – Randolph County and St. Clair County. Both counties were analyzed for the required information. Within Randolph County, a total of 13 of these sites were identified from the Illinois Natural Areas Inventory (INAI) and 7 were identified from the Illinois Nature Preserves Commission (INPC). Within St. Clair County, a total of 21 of these sites were identified from the INAI and 18 were identified from the INPC. The BPP Cooling Pond is reserved as a State Fish and Wildlife Area, leased to the IDNR for public recreational use. The Kaskaskia River State Fish and Wildlife Area is adjacent to the site to the West. None of the other natural areas or preserves fall within 1,000 meters of the BAP.

The IDNR natural heritage database also includes a list of endangered species by county [5] and notes that a total of 37 threatened and endangered species as located within Randolph County, including 28 endangered and 9 threatened species. Within St. Clair County, a total of 19 threatened and endangered species were noted, including 13 endangered and 6 threatened species. A review of the U.S. Fish and Wildlife Service (USFWS) Threatened & Endangered Species Active Critical Habitat Report [6] did not identify critical habitat for any species within the Kaskaskia River, located within 1,000 meters of the BAP.

A search of the IDNR Historic and Architectural Resources Geographic Information System (HARGIS database) [7] for historical sites within the 1,000 meters of the Site located no results.

The 100-year flood plain limits were obtained from the Federal Emergency Management Area (FEMA) Flood Map Service Center [8]. Portions of the BPP site are within the 100-year flood plain of the Kaskaskia River, with approximately five (5) acres of the western portion of the BAP being within the 100-year floodplain limits.

<u>*Section 845.220(a)(4):*</u> *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 showing the information required in Section 845.220(a)(4) is provided for the BAP in **Attachment F**.

2.4. Narrative Description of Proposed Construction

<u>*Section 845.220(a)(5):*</u> *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.*

The proposed modification to the BAP will include closing the BAP through a hybrid consolidate-and-cap approach with a final cover system. The consolidate-and-cap approach will involve reducing the footprint of the BAP from approximately 177 acres to approximately 76 acres. This will include removing all CCR from a closure-by-removal area inside the BAP into a consolidated footprint within the existing BAP. The consolidated footprint will then be covered with a final cover system.

During the closure process, DMG will continue to assess off-site CCR beneficial use opportunities. Ash consolidation and closure-in-place with a combination of offsite beneficial use may result in a smaller footprint for the ultimate cap design along with a reduced construction schedule.

Specific areas and volumes that will be relocated into the closure-in-place area are described below.

- All CCR, and up to an estimated depth of one foot of the underlying subgrade soils, which are approximately 1.5 million CY in volume, will be removed from a 101-acre area inside the BAP (the closure-by-removal area) and placed into the closure-in-place area.

- The BAP dam will be removed from the closure-by-removal area and will no longer be retaining CCR during post closure conditions. This will include removing approximately

35,000 CY of dam soils, all CCR, and, where the CCR is present, to an estimated depth of one foot of underlying subgrade soils.

CCR removal will include excavating all of the CCR and approximately one foot of native underlying subgrade materials beneath the CCR. The excavation of CCR will be verified via visual observations performed during construction, and excavation depths will be adjusted, as needed to remove all of the CCR. The removed CCR and native subgrade soils will be placed within the closure-in-place area, also referred to as "consolidated-and-capped", over existing impounded CCR that will remain in-place, as compacted fill to achieve final cover system subgrades. Dike soils that are observed as not containing CCR may be utilized as cover soil for the final cover system. Dike soils that contain CCR will be utilized as subgrade fill beneath the final cover system.

As part of consolidation, a final cover system will be constructed within the closure-in-place area, as described below.

- An approximately 76-acre final cover system will be installed completely over the extent of consolidated CCR. The final cover system will consist of a geomembrane, geotextile cushion, protective cover soil, and vegetated topsoil. The final cover system will be keyed into the perimeter dikes, native foundation soils, or the existing FAPS cover with an anchor trench.

- During consolidation and capping, the BPP will be generating power and CCR materials to be placed into the BAP. An interim slope of 3 horizontal to 1 vertical (3H:1V) with temporary cover will be constructed to act as an interface during construction while the BPP is operating between the closure area and the area reserved for process flow and excavation of CCR for beneficial reuse or placement. Once the BPP is no longer generating power, the consolidation and cover system will be completed.

CCR in the consolidated closure-in-place footprint will be physically separated from the underlying uppermost aquifer by the low-permeability clay upper unit, which underlies the CCR and overlies the uppermost aquifer. Prior to installation of the final cover, free liquids will be removed from the CCR. The upper unit is a native clay with some silt and minor sand, silt layers, and occasional sand lenses with overall horizontal and vertical hydraulic conductivities of 2.9×10^{-5} to 3.5×10^{-7} cm/sec [9], respectively. The upper unit directly underlies the CCR, overlies the uppermost aquifer, and provides physical separation between the CCR and uppermost aquifer. The upper unit will provide 8 to 35 feet, and approximately 21 feet on average, of vertical separation between the base of CCR and the top of the uppermost aquifer.

The CCR will be laterally separated from surrounding areas by the following:

- To the north and south by the existing perimeter dike;

- To the east by the existing CCR divider dike where the cover will tie into the FAPS cover; and

- To the west by the cover system that will be anchored into the native soils.

Therefore, consolidate-and-cap closure of the BAP with a final cover system will result in the CCR retained within the BAP being encapsulated within a continuous cover system that ties into native soils, existing clay dikes, or the capped FAPS on the sides and bottom (e.g., the upper unit), and on top by a geosynthetic and soil barrier (e.g., the final cover system). This continuous encapsulation, along with the removal of free liquids from the CCR prior to final cover installation, will reduce the potential for groundwater liquids, and/or leachate to migrate into or out of the BAP under post-closure conditions due to low-permeability barriers being present along the outer berms of the FAPS. Furthermore, the final cover system will reduce post-closure infiltration into the CCR.

A post-closure stormwater management system including channels, diversion berms, culverts, and riprap energy dissipation will direct non-contact stormwater off of the BAP final cover system and into surrounding areas. Stormwater will then be routed to other areas of the site and ultimately to the Kaskaskia River using existing site stormwater channels.

The closure-by-removal areas, including the area inside the current BAP footprint and the southwest area outside of the BAP, will be graded to drain surface water and restored. This will include re-establishing the general pre-construction stream and drainage channels and establishing suitable vegetation on native soils within the restored area. Stormwater detention basis may also be used, if necessary, and will be based on site post-closure topography. Suitable vegetation will include upland species (i.e., grasses), where appropriate. Trees, grasses, and/or wetland species will be planted along stormwater channels and within low areas near the Kaskaskia River, as appropriate in barren or disturbed areas.

The CCR volume within the BAP will increase by approximately 500,000 CY until December 31, 2025, as part of power generation. This will include excavating all CCR known to be present outside the limits of the BAP not previously closed. The CCR was generated onsite and will be placed in the final footprint of the BAP as compacted subgrade fill.

Changes in waste streams will include the cessation of CCR placement before July 17, 2027. Other non-CCR waste streams may continue for some time after BPP retirement but will cease by the time the early stages of closure construction begin.

All areas affected by releases of CCR from the CCR surface impoundment, including, but not limited to, CCR found outside of the BAP footprint not previously closed, will be decontaminated in accordance with 845.740(a). This will include removing all of the CCR and an estimated depth of one foot of underlying subgrade materials beneath the CCR that is to be removed for final closure.

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 Closure Plan provided for the BAP in **Attachment G** and were prepared in accordance with Section 845.220(a)(6). The permit-level design plans are consistent with the narrative description provided in Section 845.220(a)(5).

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:

The Groundwater Monitoring Program details are described within this section and the referenced attachments.

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

Hydrogeologic site investigations for BAP are provided in **Attachment B**.

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 groundwater monitoring system as required by Section 845.630 are provided in **Attachment B**.

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 **Attachment B**.

2.7. Certification

<u>Section 845.220(a)(8):</u> The signature and seal of a qualified professional engineer.

I, Thomas W. Ward, 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.

Thomas W. Ward
Printed Name

07/31/23

Signature Date

Registration Number	State	Expiration Date
062-069043	IL	November 30, 2023

Affix Seal

2.8. Public Meeting Information

<u>Section 845.220(a)(9):</u> *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 the public notification and public meetings have been completed as required by Section 845.240 is provided in **Attachment H**.

2.9. Closure Construction

<u>Section 845.220(d):</u> *Closure Construction. In addition to the requirements in subsection (a), all construction permit applications for closure of the CCR surface impoundment under Subpart G must contain the following information and documents:*

The Closure Construction details are described in the following sections.

<u>Section 845.220(d)(1):</u> *Closure prioritization category, if applicable (see Section 845.700(g));*

A CCR Surface Impoundment Category Designation and Justification letter was submitted to the IEPA on May 19, 2021. The BAP was designated as Category 7 existing CCR surface impoundment in compliance with groundwater protection standards in Section 845.600. This letter is provided in **Attachment I**.

<u>Section 845.220(d)(2):</u> *Final closure plan (see Section 845.720(b)), including the closure alternatives analysis required by Section 845.710;*

The Final Closure Plan as required by Section 845.720(b) and the Alternatives Analysis as required by Section 845.210 are provided in **Attachment G**.

<u>Section 845.220(d)(3):</u> *Groundwater modeling, including:*

- *A. The results of groundwater contaminant transport modeling and calculations showing how the closure 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 closure over time;*
- *D. Capture zone modeling, if applicable; and*

E. *Any necessary licenses and software needed to review and access both the model and the data contained within the model.*

Groundwater modeling as required by Section 845.220(d)(3) is provided in **Attachment B**.

<u>Section 845.220(d)(4):</u> *Proposed schedule to complete closure; and*

The proposed schedule to completed closure is included within the Final Closure Plan, provided in **Attachment G.**

<u>Section 845.220(d)(5):</u> *Post-closure care plan specified in Section 845.780(d), if applicable.*

The Post Closure Care Plan required by Section 845.220(d)(5) is provided in **Attachment J**.

3. ADDITIONAL INFORMATION

Certification that DMG will utilize contractors, subcontractors, and installers who are participants in an approved training program, in accordance with 45 Illinois Complied Statutes (ILCS) 5/22.59(b)(4), is provided in **Attachment K**.

4. REFERENCES

[1] Illinois Environmental Protection Agency, "35 Ill. Adm. Code Part 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments," Springfield, IL, 2021.

[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] Burns & McDonnell, "Initial Operating Permit Application, Baldwin Power Plant Bottom Ash Pond," St. Louis, MO, October 25, 2021.

[4] Illinois Department of Natural Resrouces, "IDNR Natural Heritage Database," [Online]. Available: https://www2.illinois.gov/sites/naturalheritage/DataResearch/Pages/Access-Our-Data.aspx. [Accessed September 2022].

[5] Illinois Department of Natural Resources, "Illinois Threatened and Endangered Species by County," September 2022. [Online]. Available: https://www2.illinois.gov/sites/naturalheritage/DataResearch/Documents/ETCountyList_sept2021.pdf. [Accessed September 2022].

[6] U.S. Fish & Wildlife Service, "USFWS Threatened & Endangered Species Active Critical Habitat Report," [Online]. Available: https://ecos.fws.gov/ecp/report/table/critical-habitat.html. [Accessed September 2022].

[7] Illinois Department of Natural Resources, "IDNR Historic Preservation Devision HARGIS," [Online]. Available: https://www2.illinois.gov/dnrhistoric/Preserve/Pages/HARGIS.aspx. [Accessed September 2022].

[8] Federal Emergency Management Agency, "FEMA Flood Map Service Center: Welcome!," [Online]. Available: https://msc.fema.gov/portal/home. [Accessed September 2022].

[9] Ramboll, "Hydrogeologic Site Characterization Report, Bottom Ash Pond, Baldwin Power Plant, Baldwin, Illinois," 2023.

[10] Ramboll, "Groundwater Model Report, Bottom Ash Pond, Baldwin Power Plant, Baldwin, Illinois," 2023.

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ATTACHMENT A

Legal Description

845.210(c)

July 2023

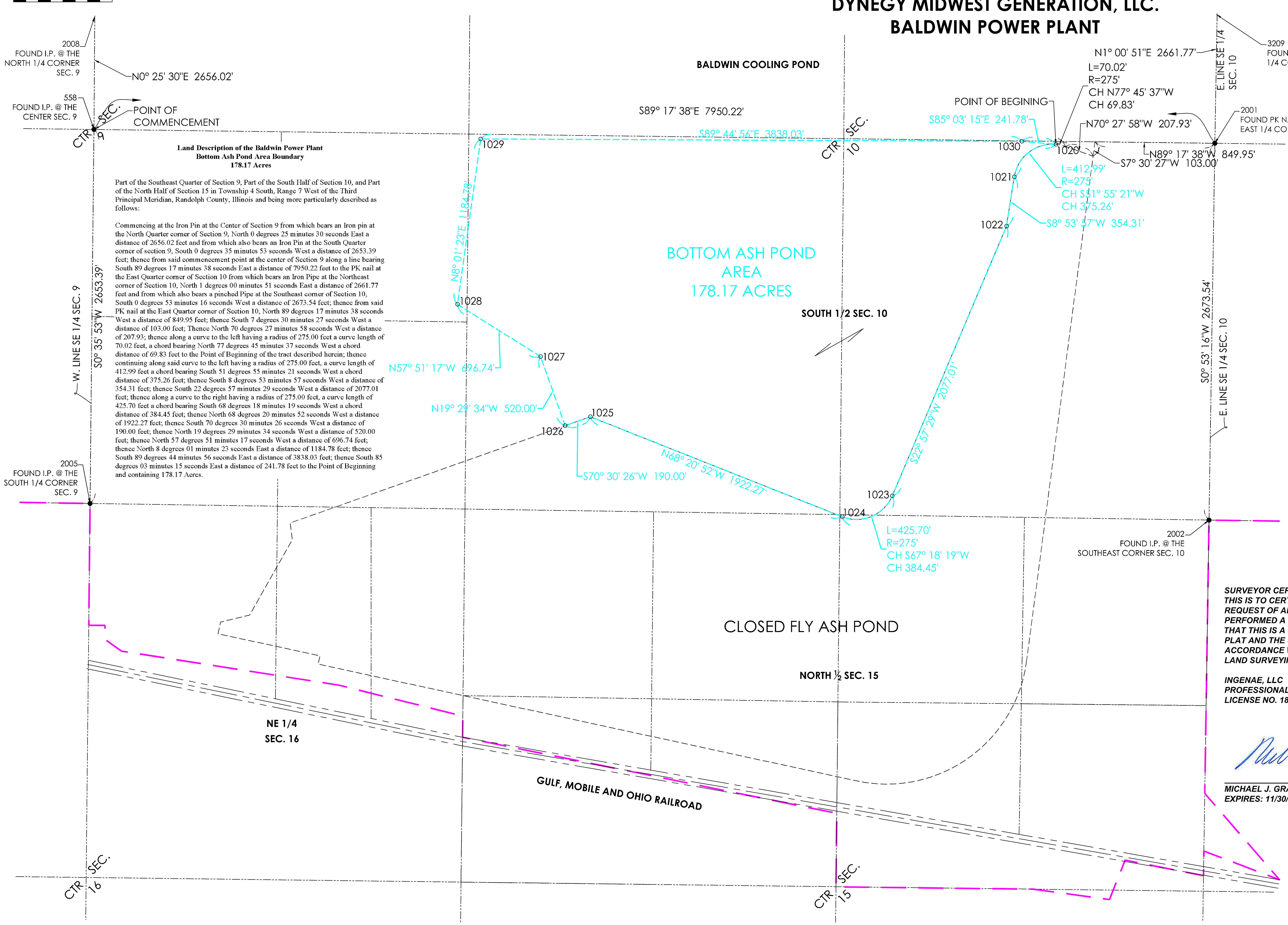
Luminant

DYNEGY MIDWEST GENERATION, LLC.
BALDWIN POWER PLANT

LEGEND

- SECTION LINE
- RESTRICTED USE BOUNDARY
- FACILITY BOUNDARY
- FOUND SURVEY MARKER AS NOTED
- APPROXIMATE PROPERTY LINE PER PREVIOUS SURVEYS BY OTHERS

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 JUNE 17, 2021. SURVEY COORDINATES, BEARINGS & DISTANCES ARE REFERENCED TO ILLINOIS WEST 1202 STATE PLANE COORDINATE SYSTEM NAD 1983.



Land Description of the Baldwin Power Plant
Bottom Ash Pond Area Boundary
178.17 Acres

Part of the Southeast Quarter of Section 9, Part of the South Half of Section 10, and Part of the North Half of Section 15 in Township 4 South, Range 7 West of the Third Principal Meridian, Randolph County, Illinois and being more particularly described as follows:

Commencing at the Iron Pin at the Center of Section 9 from which bears an Iron pin at the North Quarter corner of Section 9, North 0 degrees 25 minutes 30 seconds East a distance of 2656.02 feet and from which also bears an Iron Pin at the South Quarter corner of section 9, South 0 degrees 35 minutes 53 seconds West a distance of 2653.39 feet; thence from said commencement point at the center of Section 9 along a line bearing South 89 degrees 17 minutes 38 seconds East a distance of 7950.22 feet to the PK nail at the East Quarter corner of Section 10 from which bears an Iron Pipe at the Northeast corner of Section 10, North 1 degrees 00 minutes 51 seconds East a distance of 2661.77 feet and from which also bears a pinched Pipe at the Southeast corner of Section 10, South 0 degrees 53 minutes 16 seconds West a distance of 2673.54 feet; thence from said PK nail at the East Quarter corner of Section 10, North 89 degrees 17 minutes 38 seconds West a distance of 849.95 feet; thence South 7 degrees 30 minutes 27 seconds West a distance of 103.00 feet; Thence North 70 degrees 27 minutes 58 seconds West a distance of 207.93; thence along a curve to the left having a radius of 275.00 feet a curve length of 70.02 feet, a chord bearing North 77 degrees 45 minutes 37 seconds West a chord distance of 69.83 feet to the Point of Beginning of the tract described herein; thence continuing along said curve to the left having a radius of 275.00 feet, a curve length of 412.99 feet a chord bearing South 51 degrees 55 minutes 21 seconds West a chord distance of 375.26 feet; thence South 8 degrees 53 minutes 57 seconds West a distance of 354.31 feet; thence South 22 degrees 57 minutes 29 seconds West a distance of 2077.01 feet; thence along a curve to the right having a radius of 275.00 feet, a curve length of 425.70 feet a chord bearing South 68 degrees 18 minutes 19 seconds West a chord distance of 384.45 feet; thence North 68 degrees 20 minutes 52 seconds West a distance of 1922.27 feet; thence South 70 degrees 30 minutes 26 seconds West a distance of 190.00 feet; thence North 19 degrees 29 minutes 34 seconds West a distance of 520.00 feet; thence North 57 degrees 51 minutes 17 seconds West a distance of 696.74 feet; thence North 8 degrees 01 minutes 23 seconds East a distance of 1184.78 feet; thence South 89 degrees 44 minutes 56 seconds East a distance of 3838.03 feet; thence South 85 degrees 03 minutes 15 seconds East a distance of 241.78 feet to the Point of Beginning and containing 178.17 Acres.

CCR FACILITY BOUNDARY CORNERS				
Point #	Elevation	Northing	Easting	Description
1020	0.00	558081.48	2385975.21	SET POINT
1021	0.00	557850.04	2385679.81	SET POINT
1022	0.00	557500.00	2385625.00	SET POINT
1023	0.00	555587.51	2384814.85	SET POINT
1024	0.00	555439.18	2384460.16	SET POINT
1025	0.00	556148.45	2382673.53	SET POINT
1026	0.00	556085.05	2382494.42	SET POINT
1027	0.00	556575.24	2382320.90	SET POINT
1028	0.00	556945.96	2381730.97	SET POINT
1029	0.00	558119.14	2381896.33	SET POINT
1030	0.00	558102.32	2385734.32	SET POINT

CONTROL MONUMENTATION				
Point #	Northing	Easting	Elevation	Description
558	558186.76	2379153.13	427.99	FOUND I.P.
2001	558088.80	2387102.75	441.46	FOUND PK NAIL
2002	555415.58	2387061.32	454.17	FOUND I.P.
2005	555533.52	2379125.44	422.82	FOUND I.P.
2008	560842.70	2379172.83	424.09	FOUND I.P.
3209	560750.15	2387149.86	435.66	FOUND PIPE

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 GRAMINSKI 035-2901 — PROFESSIONAL LAND SURVEYOR

Sept 20, 2021

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

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

Submissions / Revisions:	Date:
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Luminant

Project Name & Location:

BALDWIN
POWER PLANT

10901 BALDWIN ROAD
BALDWIN, IL 62217

DO NOT SCALE PLANS
Copying, Printing, Software and other processes required to produce these prints can stretch or shrink the actual paper or layout. Therefore, scaling of this drawing may be inaccurate. Contact IngenAE with any need for additional dimensions or clarifications.

Drawing Name:
CCR FACILITIES BOUNDARY EXHIBIT

Date: 7/14/2021	Project No.
Type: SITE	Drawing No. 1
Drawn By: CB	
Approved By: MG	
Scale: AS NOTED	

Luminant

DYNEGY MIDWEST GENERATION, LLC.
BALDWIN POWER PLANT

LEGEND

- SECTION LINE
- RESTRICTED USE BOUNDARY
- FACILITY BOUNDARY
- FOUND SURVEY MARKER AS NOTED
- APPROXIMATE PROPERTY LINE PER PREVIOUS SURVEYS BY OTHERS

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0' 350' 700'

SURVEY NOTE:
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3209	560750.15	2387149.86	435.66	FOUND PIPE

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502 Earth City Plaza, Suite 120
Earth City, MO 63045
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Submissions / Revisions:	Date:
1	
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Luminant

Project Name & Location:

BALDWIN
POWER PLANT

10901 BALDWIN ROAD
BALDWIN, IL 62217

Drawing Name:
CCR FACILITIES BOUNDARY EXHIBIT

Date: 7/14/2021	Project No.
Type: SITE	Drawing No. 2
Drawn By: CB	
Approved By: MG	
Scale: AS NOTED	

ATTACHMENT B

Groundwater Information

845.210(d)(1), 845.220(a)(7)(A-C), 845.220(c)(2), and 845.220(d)(3)

Attachment B.1

Groundwater Modeling Report

July 2023

Intended for
Dynegy Midwest Generation, LLC

Date
August 1, 2023

Project No.
1940102653

GROUNDWATER MODELING REPORT REVISION 1

BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

GROUNDWATER MODELING REPORT REVISION 1
BALDWIN POWER PLANT BOTTOM ASH POND

Project Name	**Baldwin Power Plant Bottom Ash Pond**
Project No.	**1940102653**
Recipient	**Dynegy Midwest Generation, LLC**
Document Type	**Groundwater Modeling Report**
Revision	**Revision 1**
Date	**August 1, 2023**

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Jake J. Walczak, PG
Senior Hydrogeologist

Brian G. Hennings, PG
Senior Managing Hydrogeologist

CONTENTS

TABLES (IN TEXT)

TABLES (ATTACHED)

FIGURES (ATTACHED)

APPENDICES

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
ASD	Alternate Source Demonstration
BAP	Bottom Ash Pond
BPP	Baldwin Power Plant
CCR	coal combustion residuals
CIP	closure in place
cm/s	centimeters per second
Cooling Pond	Baldwin Lake
CSM	conceptual site model
DMG	Dynegy Midwest Generation, LLC
FAPS	Fly Ash Pond System
ft/day	feet/foot per day
ft/ft	feet per foot/feet
Geosyntec	Geosyntec Consultants, Inc.
GMP	Groundwater Monitoring Plan
GMR	Groundwater Modeling Report
gpm	gallons per minute
GWPS	Groundwater Protection Standard
HCR	Hydrogeologic Site Characterization Report
HELP	Hydrologic Evaluation of Landfill Performance
HUC	Hydrologic Unit Code
ID	Identification
IEPA	Illinois Environmental Protection Agency
Kd	distribution coefficient
Kh/Kv	vertical anisotropy
mg/L	milligrams per liter
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.
Phase II	Groundwater Quality Assessment and Phase II Hydrogeologic Investigation
PMP	potential migration pathway
Ramboll	Ramboll Americas Engineering Solutions, Inc.
SI	surface impoundment
Site	combined area including the BAP, FAPS, Secondary Pond, Tertiary Pond, and Cooling Pond
SDA	spray dry absorption
SSR	sum of squared residuals

S_y	specific yield
TDS	Total Dissolved Solids
TVD	total-variation-diminishing
UA	uppermost aquifer
UGU	Upper Groundwater Unit
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UU	Upper Unit

EXECUTIVE SUMMARY

Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this Groundwater Modeling Report (GMR) on behalf of the Baldwin Power Plant (BPP), operated by Dynegy Midwest Generation, LLC (DMG), 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. This document presents the results of predictive groundwater modeling simulations for the proposed closure scenario for the Bottom Ash Pond (BAP). The BAP (coal combustion residuals [CCR] unit Identification [ID] number [No.] 601, Illinois Environmental Protection Agency [IEPA] ID No. W1578510001-06, and National Inventory of Dams [NID] No. IL50721) is the only active CCR unit present on the BPP property. The Fly Ash Pond System (FAPS) is a closed CCR unit on the BPP property (CCR unit ID 605; IEPA ID Nos. W1578510001-01, W1578510001-02, and W1578510001-03; and NID No. IL50721).

The BPP is located in Baldwin, Illinois (**Figure 1-1**). The BPP property is situated in an agricultural area. The BPP property is bordered to the west by the Kaskaskia River; to the east by Baldwin Road, farmland, and strip-mining areas; to the southeast by the Village of Baldwin; to the south by the Illinois Central Gulf railroad tracks, scattered residences, and State Route 154; and to the north by farmland (**Figure 1-2**).

A detailed summary of site conditions was provided in the revision to the Hydrogeologic Site Characterization Report (HCR; Ramboll, 2023d). The revision to the HCR includes hydrogeologic data collected after submittal of the initial HCR in 2021 (Ramboll, 2021c) as part of the 2022 Hydrogeologic Site Investigation were also used to establish a conceptual site model (CSM) for this GMR and is summarized herein. Three distinct water-bearing units have been identified in the vicinity of the BAP based on stratigraphic relationships and common hydrogeologic characteristics. The units are described as follows from the surface downward:

- **CCR**: CCR, consisting primarily of fly ash, bottom ash, and boiler slag. Also includes earthen fill deposits of predominantly clay and silt materials from on-site excavations that were used to construct berms and roads surrounding the various impoundments across the Site.
- **Upper Unit (UU)**: Predominantly clay with some silt and minor sand, silt layers, and occasional sand lenses. Includes the lithologic layers identified as the Cahokia Formation, Peoria Loess, Equality Formation, and Vandalia Till. This unit is composed of unlithified natural geologic materials and extends from the upper saturated materials to the bedrock. Thin sand seams and the interface (contact) between the UU and bedrock have been identified as potential migration pathways (PMPs). No continuous sand seams were observed within or immediately adjacent to the BAP; however, the sand seams may act as a PMP due to relatively higher hydraulic conductivities. The acronym UU and the materials it contains is synonymous with Upper Groundwater Unit (UGU) used in previous documents.
- **Bedrock Unit**: This unit is considered the uppermost aquifer (UA). Pennsylvanian and Mississippian-aged bedrock is composed of interbedded shale and limestone bedrock, which underlies and is continuous across the entire Site.

The extent of sand and gravel aquifers in the region are primarily found along the Kaskaskia River Valley where sand and gravel deposits are highly permeable, thick, and extensive. Outside of the Kaskaskia River Valley, the unlithified materials in upland areas are predominantly clay, which generally provide a low probability of encountering sand and gravel layers for dependable groundwater supply. Although some thin sand seams and layers occur intermittently within the

Vandalia Till in localized areas around the BPP, most groundwater supplies in upland areas are obtained from large diameter shallow bored wells. Typical water wells in the vicinity of the BPP are between 25 and 55 feet deep, 36 to 48 inches in diameter, and collect groundwater through slow percolation into the wells, which are large diameter to allow for greater water storage to compensate for the low rate of groundwater infiltration (Ramboll, 2023d).

The shallow bedrock is the only water-bearing unit that is continuous across the Site. Groundwater in the bedrock mainly occurs under semi-confined to confined conditions with the overlying unlithified unit behaving as the upper confining unit to the UA. Shallow sandstone and creviced limestone may yield small supplies in some areas, but water quality becomes poorer (*i.e.*, highly mineralized) with increasing depth.

Data collected from previous field investigations, as well as the lithologic contact and groundwater elevation data from the 2022 Hydrogeologic Site Investigation reported in the revised HCR (Ramboll, 2023d), were used to develop a groundwater model for the BAP. The MODFLOW model was used to evaluate a closure scenario: CCR consolidation and closure in place (CIP) using information provided in the CCR Surface Impoundment Final Closure Plan (Geosyntec Consultants, Inc. [Geosyntec], 2022a).

The CIP closure scenario was predicted to reduce total flux in and out of the BAP CCR by greater than 90 percent within 30 days following implementation of the CIP closure scenario. This was determined by comparing the post-construction movement of water in and out of the consolidated BAP CCR to pre-construction conditions. The reduction in total flux in and out of the consolidated BAP CCR is predicted to exceed 90 percent reduction for the remaining model timeframe. In general, the greatest predicted reduction in heads among the proposed BAP compliance monitoring wells takes place within approximately 93 years following implementation of the CIP closure scenario, at which time total flux in and out are predicted to reduce by 95 and 93 percent respectively. Due to the low hydraulic conductivity of the UU and UA materials, heads are not predicted to stabilize at all proposed BAP compliance monitoring wells until approximately 482 years following implementation of the CIP closure scenario, at which time total flux in and out are predicted to reduce by approximately 96 percent.

A monitoring well network was included in a proposed BAP Groundwater Monitoring Plan (GMP) (Ramboll 2021a) to satisfy requirements of 35 I.A.C. § 845 and was submitted as part of the operating permit application for the BAP in 2021. Additional wells completed in 2022 are included in a revision to the proposed GMP (Ramboll, 2023b) that will be included as part of the final construction permit application for submittal to IEPA no later than August 1, 2023. A review and summary of data collected from 2015 through May 2023 are included in the revised HCR (Ramboll, 2023d).

Quarterly monitoring under 35 I.A.C. § 845.650(b) will commence no later than the second quarter of 2023. As such, comparisons of groundwater contaminant concentrations to the Groundwater Protection Standard (GWPS) in this report are considered potential exceedances. Potential exceedances of the GWPS are presented in the attached revision to the History of Potential Exceedances (**Appendix A**, Ramboll, 2023c) and discussed in **Section 3** of this report. Based on statistical analysis, evaluation of subsequent potential exceedances of the GWPS, and intention to pursue Alternate Source Demonstrations (ASDs), it has been determined there are no potential exceedances of applicable groundwater standards attributable to the BAP.

Groundwater contaminant transport modeling was completed to demonstrate how the proposed CIP closure plan will maintain compliance with the applicable GWPS. Boron is commonly used as an indicator parameter for contaminant transport modeling for CCR because it is commonly present in coal ash leachate and it is mobile (*i.e.*, has low rates of sorption or degradation) in groundwater. The revised History of Potential Exceedances did not identify boron as a potential exceedance of the GWPS; however, boron has been detected in BAP porewater and groundwater; therefore, groundwater transport modeling was completed using boron.

The model domain for evaluating boron transport following closure of the BAP includes the closed FAPS which is present along the eastern and southern boundaries of the BAP. The FAPS completed IEPA approved closure activities in November of 2020, and it is another potential source of boron within the model domain. The closure plan for the FAPS also included groundwater modeling of boron transport. Boron transport within the current BAP model was compared to the results from the previous FAPS closure plan modeling and found that simulated flow and transport associated with the FAPS are consistent between the two models. As described in this report, proposed BAP compliance wells PZ-182, OW-257, and MW-382 are located in the direction of groundwater flow from the north central area of the FAPS between the FAPS (East Fly Ash Pond) and the surface water drainage feature near the west end of the BAP. Because these wells are downgradient of the FAPS which is an alternate source of boron, and groundwater quality at these wells is not attributable to the BAP, these wells were not included in the evaluation of BAP compliance with the GWPS following implementation of the CIP scenario.

Additionally, a BAP closure by removal (CBR) closure scenario prediction model was completed to evaluate the difference in post-construction boron concentrations simulated at PZ-182, OW-257, and MW-382 under both CIP and CBR conditions. Concentrations are predicted to increase above the GWPS for boron (2 milligrams per liter [mg/L]) following implementation of both BAP CIP and CBR closure scenarios in these three wells. Maximum concentrations within the modeling timeframes at these wells are predicted to be on the same order of magnitude for both BAP CIP and CBR closure scenarios. Since concentrations at proposed BAP compliance monitoring wells PZ-182, OW-257, and MW-382 increase to concentrations above the GWPS following implementation of the CBR closure scenario, after BAP source concentrations have been removed, the source for predicted post-construction concentrations within the model domain can only be attributable to the closed FAPS. These results support the conclusion that wells PZ-182, OW-257, and MW-382 should not be included in the evaluation of BAP compliance with the GWPS following implementation of the CIP scenario.

Results of groundwater fate and transport modeling conservatively estimate that groundwater boron concentrations at the proposed BAP compliance wells that are not influenced by the FAPS will remain below the GWPS following implementation of the CIP scenario at the BAP.

1. INTRODUCTION

1.1 Overview

In accordance with requirements of 35 I.A.C. § 845, Ramboll has prepared this GMR on behalf of the BPP, operated by DMG. This report applies specifically to the CCR unit referred to as the BAP (**Figure 1-1**). The BAP is a 177-acre unlined CCR surface impoundment (SI) used to manage CCR and non-CCR waste streams at the BPP. This GMR presents and evaluates the results of predictive groundwater modeling simulations for a proposed CIP closure scenario which includes: CCR removal from the western areas of the BAP, consolidation to the southeast, and eventually northeastern portions of the BAP, and construction of a cover system over the remaining CCR following initial corrective action measures (removal of free liquids from the BAP).

1.2 Site Location and Background

The BPP is located in southwest Illinois in Randolph and St. Clair Counties. The Randolph County portion of the BPP is located within Sections 2, 3, 4, 9, 10, 11, 14, 15, and 16 of Township 4 South and Range 7 West. The St. Clair County portion of the property is located within Sections 33, 34, and 35 of Township 3 South and Range 7 West. The BAP is approximately one-half mile west-northwest of the Village of Baldwin (**Figure 1-1**).

The BPP property is bordered to the west by the Kaskaskia River; to the east by Baldwin Road, farmland, and strip-mining areas; to the southeast by the Village of Baldwin; to the south by the Illinois Central Gulf railroad tracks, scattered residences, and State Route 154; and to the north by farmland. The St. Clair/Randolph County Line crosses east-west at approximately the midpoint of Baldwin Lake (*i.e.,* Cooling Pond). **Figure 1-1** shows the location of the BPP; **Figure 1-2** is a site map showing the location of the BAP (a 35 I.A.C. § 845 regulated CCR unit and the subject of this GMR), FAPS (an IEPA closed CCR unit), Secondary Pond, Tertiary Pond, and Cooling Pond. The combined area including the BAP, FAPS, Secondary Pond, Tertiary Pond, and Cooling Pond will hereinafter be referred to as the Site.

1.3 Site History and Unit Description

The BPP is a coal-fired electrical generating plant that began operation of its first unit in 1970; two additional generating units were put into service in 1973 and 1975. The plant initially burned bituminous coal from Illinois and switched to subbituminous coal in 1999. Total plant generating capacity is approximately 1,892 megawatts.

The BAP is classified as an existing, unlined CCR SI and covers an area of approximately 177 acres in the southern portion of the BPP property (**Figure 1-2**). The BAP is surrounded by a perimeter road and is bounded to the north by the Cooling Pond, and to the east and south by the closed FAPS CCR Multi-Unit. The BAP is also bounded to the west by the easternmost wooded area that surrounds the Secondary and Tertiary Ponds. The BAP is being used to store and dispose of sluiced bottom ash, some of which is mined for beneficial use, to temporarily store spray dry absorption (SDA) waste, and to clarify plant process water, including other non-CCR station process wastewaters, prior to discharge in accordance with the BPP's National Pollutant Discharge Elimination System (NPDES) permit (AECOM, 2016b; IEPA, 2016).

The FAPS at the BPP is a closed CCR Multi-Unit consisting of three unlined SIs: Old East Fly Ash Pond (IEPA Unit ID W1578510001-01), the East Fly Ash Pond (IEPA Unit ID W1578510001-02), and West Fly Ash Pond (IEPA Unit ID W1578510001-03), with a combined surface area of approximately 232 acres (**Figure 1-2**). During operation, the FAPS discharged water to the BAP. The receiving water bodies for the BAP were the Secondary Pond, and in turn the Tertiary Pond, which ultimately discharges towards a tributary of the Kaskaskia River, south of the Cooling Pond intake structure. A Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (Phase II; Natural Resource Technology, Inc. [NRT], 2014a) was followed by a Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan dated March 31, 2016 (NRT, 2016a) with revised pages included in the response to IEPA July 13, 2016 comments in the technical memorandum dated August 8, 2016 (NRT, 2016b) to define the hydrogeology and to assess the groundwater impacts related to the FAPS. Groundwater models were also completed to assess the groundwater impacts associated with closure of the FAPS and predict the fate and transport of CCR leachate components, as well as estimate the time required for hydrostatic equilibrium of groundwater beneath the FAPS (NRT, 2014b; NRT, 2014c; NRT, 2016c). Based on these assessments, a Closure and Post-Closure Care Plan (AECOM, 2016a), which included a groundwater monitoring program sufficient for long-term, post-closure monitoring, was developed and approved by IEPA in a letter to the Dynegy Operating Company dated August 16, 2016. Closure activities, which included constructing a final cover system to control the potential for water infiltration into the closed CCR unit, were completed, and FAPS closure was completed November 17, 2020. The approximate dates of construction of each successive stage of the BAP and FAPS are summarized in **Table A** below (AECOM, 2016b).

Table A. History of Construction

Date	Event
1969	Construction of Old East Fly Ash Pond, East Fly Ash Pond, and West Fly Ash Pond external perimeter embankment
1979	Construction of East Fly Ash Pond and West Fly Ash Pond northern embankment
1989	Raise inboard perimeter of the entire East Fly Ash Pond and West Fly Ash Pond
1995	Construction of interior dike between the East Fly Ash Pond and West Fly Ash Pond
1999	Raise of interior dike between the East Fly Ash Pond and West Fly Ash Pond; replacement of outlet pipe from the West Fly Ash Pond to the Secondary Pond
2012	Modification of BAP embankment (original construction date unknown)
2016	Closure Plan completed for the FAPS and approved by IEPA
2020	FAPS closure activities, including construction of a final cover system, and FAPS closure completed

2. SITE GEOLOGY AND HYDROGEOLOGY

BAP hydrogeologic data presented in the initial HCR (Ramboll, 2021c) and BAP hydrogeologic data collected after submittal of the initial HCR in 2021 as part of the 2022 Hydrogeologic Site Investigation and included in the revision to the HCR (Ramboll, 2023d) were used to establish a CSM for this GMR and is summarized below. Refer to the revision to the HCR (Ramboll, 2023d) for more details of regional and local site characteristics. BAP hydrogeologic data collected as part of the 2022 Hydrogeologic Site Investigation are presented in a revised HCR (Ramboll, 2023d) to be included in a construction permit application for submittal to IEPA no later than August 1, 2023. Surface elevations range from approximately 415 feet North American Vertical Datum of 1988 (NAVD88) in the east side of the BAP to 450 feet NAVD88 in the west side of the BAP. Topographic maps drawn prior to construction indicate the areas of the BAP were generally between 400 and 430 feet National Geodetic Vertical Datum of 1929 (NGVD29), which included a drainage feature near the west end of the BAP (Figure 2-2 of the revised HCR). Topography in the vicinity of the Site (**Figure 1-1**) ranges from approximately 370 feet NAVD88 along the Kaskaskia River southwest of the Site to 450 feet NAVD88 towards the south and east. The principal surface drainage for the region is the Kaskaskia River.

There are five principal types of unlithified materials above the bedrock in the vicinity of the BAP, these include the following in descending order:

- Fill, predominantly coal ash (fly ash, bottom ash, and slag) within the CCR units, but also including general fill within constructed levees around the Cooling Pond, constructed berms around the Site, and constructed railroad embankments south of the Site;
- Alluvial clay, sandy clay, and clayey sand of the Cahokia Formation (ranging in thickness at the BAP from 13 to 27 feet);
- Silt and silty clay of the Peoria Loess (ranging in thickness at the BAP from 2 to 23 feet);
- Clay and sandy clay of the Equality Formation (ranging in thickness at the BAP from 8 to 37 feet), with occasional sand seams and lenses; and
- Clay and sandy clay diamictons of the Vandalia Till (ranging in thickness at the BAP from 11 to 37 feet) with intermittent and discontinuous sand lenses.

Depth to bedrock ranges from approximately 28.4 feet towards the west end of the BAP (MW-370) to approximately 57 feet immediately north of the BAP (MW-393).

Three distinct water-bearing units have been identified in the vicinity of the BAP based on stratigraphic relationships and common hydrogeologic characteristics. The units are described as follows from the surface downward:

- **CCR**: CCR, consisting primarily of fly ash, bottom ash, and boiler slag. Also includes earthen fill deposits of predominantly clay and silt materials from on-site excavations that were used to construct berms and roads surrounding the various impoundments across the Site. The overall (geometric mean) horizontal and vertical hydraulic conductivity for the CCR determined during the Phase II and 2022 Hydrogeologic Site Investigations are 1.5 x 10^{-2} centimeters per second (cm/s) and 4.1 x 10^{-5} cm/s, respectively. Horizontal and vertical hydraulic conductivities for this unit determined during the Phase II and 2022 Hydrogeologic

Site Investigations ranged from 8.1 x 10^{-4} to 1.1 x 10^{-1} cm/s and 5.6 x 10^{-7} to 6.5 x 10^{-4} cm/s, respectively.

- **UU**: Predominantly clay with some silt and minor sand, silt layers, and occasional sand lenses. Includes the lithologic layers identified as the Cahokia Formation, Peoria Loess, Equality Formation, and Vandalia Till. This unit is composed of unlithified natural geologic materials and extends from the upper saturated materials to the bedrock. As observed in the field, one or more of these four lithologic units may be present at a particular soil boring location; and, the observed lithologic unit(s) may or may not be saturated depending on location at the Site. Given that these units are not consistently in contact with groundwater, this unit was renamed from UGU used in previous reports to UU. The term UU is synonymous with UGU used in previous documents. The overall (geometric mean) horizontal and vertical hydraulic conductivities for this unit determined during the Phase II and 2022 Hydrogeologic Site Investigations are 2.9 x 10^{-5} cm/s and 3.5 x 10^{-7} cm/s, respectively. Horizontal and vertical hydraulic conductivities for this unit determined during the Phase II and 2022 Hydrogeologic Site Investigations ranged from 3.5 x 10^{-7} to 6.8 x 10^{-4} cm/s and 6.3 x 10^{-9} to 4.2 x 10^{-4} cm/s, respectively. Thin sand seams and the interface (contact) between the UU and bedrock have been identified as PMPs. No continuous sand seams were observed within or immediately adjacent to the BAP; however, the sand seams may act as a PMP due to relatively higher hydraulic conductivities (on the order of 10^{-4} cm/s) than the surrounding clays (on the order of 10^{-5} cm/s). The contacts between the unlithified material and bedrock have also been identified as PMPs where horizontal hydraulic conductivity data in Site monitoring wells with screens and/or filter packs across or immediately above the bedrock range from 3 x 10^{-7} to 6 x 10^{-4} cm/s and have a geometric mean horizontal hydraulic conductivity of 2 x 10^{-5} cm/s.
- **Bedrock Unit**: This unit is composed of interbedded shale and limestone bedrock, which underlies and is continuous across the entire Site and has been identified as the UA. The horizontal hydraulic conductivity for this unit determined during the Phase II and 2022 Hydrogeologic Site Investigations ranges from 2.4 x 10^{-7} to 3.5 x 10^{-5} cm/s with a geometric mean of 1.9 x 10^{-6} cm/s (Ramboll, 2023d).

In general, the UU consists of low permeability clays and silts. Within the UU, only thin and intermittent sand lenses are present within predominantly clay deposits; thus, the unlithified materials do not represent a continuous aquifer unit. Thin, non-continuous sandy deposits (*i.e.,* PMPs) that exist across the Site do not appear to extend to the FAPS and BAP as evidenced by soil borings adjacent to the CCR units in which no sand was observed.

The extent of sand and gravel aquifers in the region are primarily found along the Kaskaskia River Valley where sand and gravel deposits are highly permeable, thick, and extensive. Outside of the Kaskaskia River Valley, the unlithified materials in upland areas are predominantly clay, which generally provide a low probability of encountering sand and gravel layers for dependable groundwater supply. Although some thin sand seams and layers occur intermittently within the Vandalia Till in localized areas around the BPP, most groundwater supplies in upland areas are obtained from large diameter shallow bored wells. Typical water wells in the vicinity of the BPP are between 25 and 55 feet deep, 36 to 48 inches in diameter, and collect groundwater through slow percolation into the wells, which are large diameter to allow for greater water storage to compensate for the low rate of groundwater infiltration (Ramboll, 2023d).

The underlying bedrock at the Site is Pennsylvanian and Mississippian bedrock, mainly limestone and shale. A bedrock low is present at the southwest corner of the Site and extends northeastward. The Tertiary Pond in the southwest corner of the Site corresponds to the lowest observed bedrock surface elevation (372.6 feet NAVD88). Higher bedrock elevations are present east of the BPP and FAPS as observed at MW-358 (428.6 feet NAVD88). The bedrock in the vicinity of the BAP yields small amounts of water from interconnected pores, cracks, fractures, crevices, joints, and bedding planes. The shallow bedrock is the only water-bearing unit that is continuous across the Site. Shallow sandstone and creviced limestone may yield small supplies in some areas, but water quality becomes poorer (*i.e.,* highly mineralized) with increasing depth. The Pennsylvanian and Mississippian rocks generally have low porosities and permeabilities, are not a reliable source of groundwater, and the quality varies considerably (Pryor, 1956). Limestones intercepted at the Site are generally light to dark gray, fine-grained, thin bedded, banded, argillaceous, and competent except where weathered. Weathering of the limestone produces a calcareous clay. Limestone layers are often interbedded with thin shale layers and are sometimes fossiliferous or sandy. The shale layers are generally weathered, competent, silty, slightly micaceous, fissile, and dark gray. Where highly weathered shale (*i.e.,* decomposed bedrock) was encountered, the shale was non-fissile and resembled an unlithified stiff clay with medium to high plasticity.

The locations of groundwater monitoring wells are provided on **Figure 2-1**. Based on elevation measurements, lateral groundwater flow in the shallow unlithified materials and bedrock is generally to the west and southwest across the Site (**Figure 2-2**) toward the Kaskaskia River. Groundwater flow in bedrock is toward the northwest in the east and central areas of the BAP, and southwest to northwest on the east area of the FAPS until groundwater reaches the bedrock valley feature underlying the Secondary and Tertiary Ponds west of the BAP and FAPS, at which point the flow direction veers towards this bedrock surface low. Groundwater elevations across the Site vary seasonally, generally less than 7 feet, and range between approximately 370 and 450 feet NAVD88, although flow directions are generally consistent. Additional potentiometric surface maps are located in Figures 3-2 to 3-5 and Appendix E of the revised HCR (Ramboll, 2023d).

In the western area of the FAPS, average horizontal hydraulic gradients in the shallow unlithified materials and bedrock were 0.015 feet per foot/feet (ft/ft) and 0.016 ft/ft, respectively, as groundwater flowed from east to west across the FAPS. Average groundwater velocities in the shallow unlithified materials and bedrock in the western area of the FAPS were 0.0082 and 0.0003 feet per day (ft/day), respectively. In general, flow velocities in the vicinity of the FAPS are consistent, varying only 0.0019 ft/day in the shallow unlithified materials and 0.0002 ft/day in the bedrock.

Between monitoring wells in the northeastern portion of the BAP, average horizontal hydraulic gradients in the shallow unlithified materials and bedrock were 0.004 and 0.003 ft/ft, respectively, as groundwater flowed southeast to northwest across the BAP. Average groundwater velocities in the shallow unlithified materials and bedrock in the northeast portion of the BAP were 0.0023 and 0.0001 ft/day, respectively. Between monitoring wells in the western portion of the BAP average horizontal hydraulic gradients in the shallow unlithified materials and bedrock were 0.011 and 0.017 ft/ft, respectively, as groundwater flowed northeast to southwest across the BAP. Average groundwater velocities in the west area of the BAP in shallow unlithified materials and bedrock were 0.0058 and 0.0003 ft/day, respectively. In general, flow velocities are consistent, varying only 0.001 ft/day in shallow unlithified materials and 0.0001 ft/day in bedrock in the vicinity of the BAP.

Groundwater in the Pennsylvanian and Mississippian-aged bedrock mainly occurs under semi confined to confined conditions as demonstrated with vertical hydraulic gradient calculations presented in the revised HCR (Ramboll, 2023d), with the overlying unlithified unit behaving as the upper confining unit to the UA (Bedrock Unit). The relatively flat horizontal groundwater gradient beneath the Site, and the mostly upward vertical gradients, inconsistent upward/downward vertical gradients or flowing artesian conditions observed in the UU and UA, suggests the BAP and neighboring ponds are not areas of increased recharge or infiltration (Ramboll, 2023d).

In 2022, additional wells were installed as part of the 2022 Hydrogeologic Site Investigation, after the initial HCR was completed (Ramboll, 2021c), for further hydrogeologic investigation and water quality evaluation. The results of the 2022 Hydrogeologic Site Investigation and water quality evaluation are included in a revised HCR (Ramboll, 2023d). A summary of monitoring well locations and construction details for wells used in this GMR are included in **Table 2-1** and the locations are depicted on **Figure 2-1**. Groundwater elevation readings and lithologic contact information from the wells completed in 2022 have been incorporated into this GMR. Groundwater elevation data from 48 of the 78 total monitoring wells included in **Table 2-1** and depicted on **Figure 2-1**, were utilized as groundwater model flow calibration targets as summarized in **Table 2-2** and described in **Sections 5.2 and 5.2.2**. Boron concentration data from 50 of the 78 total monitoring wells included in **Table 2-1** and depicted on **Figure 2-1**, were utilized as transport model calibration targets as summarized in **Table 2-2** and described in **Sections 5.2 and 5.2.3**. Complete documentation of the 2022 Hydrogeologic Site Investigation activities at the BAP including boring logs, monitoring well and piezometer construction forms, and summary tables of testing results (*e.g.,* groundwater analytical results, horizontal and vertical gradient calculations, and single well aquifer test results), are provided in a revised HCR (Ramboll, 2023d).

3. GROUNDWATER QUALITY

The classification of groundwater at the Site was addressed in the Phase II investigation (NRT, 2014a). Field hydraulic conductivity tests performed on the UU materials (*i.e.,* Cahokia Formation, Equality Formation, and Vandalia Till) and Bedrock Unit materials (*i.e.,* Mississippian and Pennsylvanian bedrock) as part of the Phase II and 2022 Hydrogeologic Site Investigations had geometric mean hydraulic conductivities of 2.9×10^{-5} cm/s and 1.9×10^{-6} cm/s, respectively.

Geologic material with a hydraulic conductivity of less than 1×10^{-4} cm/s which does not meet the provisions of 35 I.A.C. § 620.210 (Class I), 35 I.A.C. § 620.230 (Class III), or 35 I.A.C. § 620.240 (Class IV), meets the definition of a Class II – General Resource Groundwater (35 I.A.C. § 620.220). Based on the detailed geologic information provided for the unlithified materials and bedrock at BPP, along with the hydrogeologic data, the groundwater in both the unlithified deposits and underlying bedrock at the Site is classified as Class II - General Resource Groundwater.

Bedrock was intercepted at 42 borings/well locations installed during the Phase II Investigation, the investigation for Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan, and the 2022 Hydrogeologic Site Investigation (Ramboll, 2023d). The UA at the Site is the shallow Pennsylvanian and Mississippian-aged bedrock that immediately underlies the unlithified deposits. The shallow bedrock yields water through interconnected secondary porosity features (*e.g.,* cracks, fractures, crevices, joints, bedding planes, and other secondary openings). The shallow bedrock is the only water-bearing unit that is continuous across the Site. Groundwater in the Pennsylvanian and Mississippian-aged bedrock mainly occurs under semi-confined to confined conditions with the overlying unlithified unit behaving as the upper confining unit to the UA. Off-site, immediately upgradient and downgradient of the BPP property boundaries, both the shallow glacial deposits and the shallow bedrock have served as a source of water supply (see water well survey in Section 5.1 of the revised HCR; Ramboll, 2023d). The shallow unlithified deposits off-site have yielded water through intermittent, discontinuous sand lenses and, in the bedrock, through fractured sandstone and limestone. However, within the boundaries of the Site, only thin and intermittent sand lenses are present within predominantly clay deposits; thus, the unlithified materials do not represent a continuous aquifer unit. Based on the above, the Bedrock Unit is the only viable aquifer in the vicinity of the Site and was designated as the UA in the Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan (NRT, 2016b), consistent with the United States Environmental Protection Agency (USEPA) definition in Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.53.

Water quality in the UA (*i.e.,* Pennsylvanian and Mississippian-aged bedrock) decreases with increasing depth as water becomes increasingly mineralized. Further, the ability of the unit to store and transmit water is dependent on the density of bedrock features that contribute to secondary porosities and whether those features are interconnected enough to yield water. Therefore, the lower limit of the UA is the depth at which either the groundwater is mineralized to a point that it is no longer a useable water source, or the secondary porosities do not yield a sufficient volume of groundwater to produce a useable water supply.

A monitoring well network was included in a proposed BAP GMP (Ramboll 2021a) to satisfy requirements of 35 I.A.C. § 845 and was submitted as part of the operating permit application for the BAP in 2021. Additional wells completed in 2022 are included in a revision to the proposed GMP (Ramboll, 2023b) that will be included as part of the construction permit application for submittal to IEPA no later than August 1, 2023. A review and summary of data collected from 2015 through May 2023 are included in the revised HCR (Ramboll, 2023d). Groundwater data collected from the 40 C.F.R. § 257 network monitoring wells and proposed 35 I.A.C. § 845 monitoring wells between 2015 and 2023 were evaluated with respect to standards included in 35 I.A.C § 845.600(a)(1) in the revised HPE (**Appendix A**, Ramboll, 2023c). This data set was selected because it includes parameters (total metals) consistent with the parameter list in 35 I.A.C. § 845.600(a)(1). Based on this data set, there were no consistent and/or significant concentrations of antimony, barium, boron, cadmium, calcium, mercury, molybdenum, pH, selenium, sulfate, and total dissolved solids (TDS) greater than the GWPSs. A summary of groundwater statistical analysis is provided in the revised HPE (Ramboll, 2023c). The Determination of Potential Exceedances (Table 1 of **Appendix A**) and Summary of Potential Exceedances (Table 2 of **Appendix A**) indicate the parameter well pairs listed below were detected at concentrations greater than the applicable 35 I.A.C. § 845.600(a)(1) standards and are considered potential exceedances:

- Arsenic at well OW-257
- Beryllium at well OW-257
- Chromium at well OW-257
- Chloride at well MW-370
- Cobalt at well OW-257
- Fluoride at well MW-393
- Lead at well OW-257
- Lithium at well OW-257
- Radium 226 and 228 combined at well OW-257
- Thallium at well OW-257

An ASD (**Appendix B**) was prepared by Ramboll (2023a) to further evaluate previously identified potential GWPS exceedances at UU compliance well MW-370. The results of the evaluation demonstrated that the potential GWPS exceedance of lithium in well MW-370 was not related to the BAP based on several lines of evidence presented in the ASD. Additional data is being collected to support multiple lines of evidence demonstrating the CCR unit is also not the source of observed detections of lithium at OW-257. Since an ASD is being pursued, and potential GWPS exceedances for lithium are not related to the BAP, lithium will not be discussed further in this GMR.

ASDs will be pursued for potential exceedances of chloride and fluoride at wells MW-370 and MW-393, respectively. ASDs will also be pursued for potential exceedances at proposed UU compliance well OW-257. Additional data is being collected to support multiple lines of evidence demonstrating the CCR unit is not the source of observed detections. Since ASDs are being pursued, arsenic, beryllium, chromium, chloride, cobalt, fluoride, lead, lithium, radium 226 and 228 combined, and thallium will not be discussed further in this GMR.

Quarterly monitoring under 35 I.A.C. § 845.650(b) will commence no later than the second quarter of 2023. As such, comparisons of groundwater contaminant concentrations to the GWPS in this report are considered potential exceedances. Potential exceedances of the GWPS are presented in the attached revision to the History of Potential Exceedances (**Appendix A**). Based on statistical analysis, evaluation of subsequent potential exceedances of the GWPS, and intention to pursue ASDs, it has been determined there are no potential exceedances of applicable groundwater standards attributable to the BAP.

4. GROUNDWATER MODEL

4.1 Overview

Data collected from previous field investigations, as well as the lithologic contact, groundwater elevation, and boron concentration data from 2022 Hydrogeologic Site Investigation and subsequent groundwater sampling events included in the revised HCR (Ramboll, 2023d), were used to develop a groundwater flow and transport model for the BAP. The MODFLOW (flow) and MT3DMS (transport) models were used to evaluate one closure scenario: CCR consolidation and CIP using information provided in the CCR Surface Impoundment Final Closure Plan (Geosyntec, 2022a). The results of the MODFLOW and MT3DMS modeling of the CIP closure scenario are summarized in this GMR. Associated model files are included as **Appendix C.** Contaminant transport modeling was completed in 2023 following the collection of additional groundwater samples from the monitoring wells installed in 2022. Transport modeling results are provided in this revised GMR and will be included in a construction permit application for submittal to IEPA no later than August 1, 2023.

4.2 Conceptual Site Model

The revised HCR (Ramboll, 2023d) is the foundation document for the site setting and CSM that describes groundwater flow at the Site. Additional hydrogeologic data was collected after submittal of the initial in 2021 HCR (Ramboll, 2021c) during the 2022 Hydrogeologic Site Investigation and included in this GMR to support the CSM and develop the model. The BAP overlies the recharge area for the underlying geologic media (*i.e.,* low permeability clays of the UU). Groundwater enters the model domain vertically via recharge. Groundwater may also enter or exit the model through the Cooling Pond, Secondary and Tertiary Ponds, the Kaskaskia River, or the many tributary streams located within the model domain. Groundwater may also exit the model through surface water management features within the BAP. Groundwater in the unlithified materials consistently flows east to west towards the Kaskaskia River. Groundwater flow in bedrock is northwest in the east and central areas of the BAP, and southwest to northwest on the east area of the FAPS until groundwater reaches the bedrock valley feature underlying the Secondary and Tertiary Ponds west of the BAP and FAPS, at which point the flow direction veers towards this bedrock surface low at the southwestern corner of the Site.

Groundwater contaminant transport modeling was completed to demonstrate how the proposed CIP closure scenario will maintain compliance with the applicable GWPS. Boron is commonly used as an indicator parameter for contaminant transport modeling for CCR because it is commonly present in coal ash leachate and it is mobile (*i.e.*, has low rates of sorption or degradation) in groundwater. The revision to the History of Potential Exceedances (**Appendix A**, Ramboll, 2023c) did not identify boron as a potential exceedance of the GWPS; however, boron has been detected in BAP porewater and groundwater. Therefore, groundwater transport modeling was completed using boron. The BAP and FAPS were modeled as sources of boron within the model domain. The BAP and FAPS are constructed over low permeability clays of the UU. 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. Boron mass flows with groundwater (onsite groundwater flow directions described above). The primary transport pathway is the UA which underlies the BAP and is continuous across the entire Site. The UU also contains PMPs in the form of thin discontinuous sand seams within the UU or at the interface (contact) between the UU and bedrock where hydraulic conductivities are relatively higher.

4.3 Model Approach

A three-dimensional groundwater flow and transport model was calibrated to represent the conceptual flow system described above. Initial steady state flow modeling was performed to represent current Site conditions in 2022 following closure of the FAPS in 2020. This flow model was calibrated to match median groundwater elevations for recent groundwater elevation data. The calibrated steady state flow model was used to develop a calibrated transient flow and transport model to match recent boron concentrations observed at each monitoring well. The calibrated model was then used to evaluate the effectiveness of the CIP closure scenario. The start of the transient flow and transport model was initiated in 1970 (model year 0) when the BPP began operation and the BAP and FAPS were active (initial conditions model) through 2020 (51 model years) when closure at the FAPS was complete. Three models were included for the closure prediction simulation. The first model simulated an extended period of current conditions, 2021 to 2024 (4 model years). The second model simulated a period for the removal of free liquids, 2025 to 2027 (3 model years). The third model simulated the final closure conditions, 2028 to 3027 (1,000 model years). The prediction modeling timeline for the CIP closure scenario is 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 8 software for model pre- and post- processing tasks (Environmental Simulations, Inc., 2018).

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 BAP. 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 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 consolidation areas.

5.2 Flow and Transport Model Setup

The modeled area was approximately 11,125 feet (445 rows) by 16,375 feet (655 columns) with the BAP located in the east-central portion of the model. The western edge of the model is bounded by the Kaskaskia River. The north, east, and south edges of the model were selected to maintain sufficient distance from the BAP to reduce boundary interference with model calculations, while not extending too far past the extent of available calibration data. The model area is displayed in **Figure 5-1**.

The MODFLOW model was calibrated to median groundwater elevation collected from December 2015 to June 2022. The flow model calibration targets are 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 December 2015 to December 2022 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 BAP, the calibrated flow and transport models were used in predictive modeling to evaluate the CIP closure scenario by consolidating CCR and using HELP modeled recharge values to simulate changes proposed in the closure scenario.

5.2.1 Grid and Boundary Conditions

A six-layer, 445 x 655 node grid was established with 25-foot grid spacing in the vicinity of the BAP and BPP property. The grid increases gradually to a maximum 450-foot row spacing and 225-foot column spacing near the edges of the model. The model grid and boundary conditions are illustrated in **Figures 5-2 through 5-7**. All edges of the model are no-flow (*i.e.,* Neumann) boundaries in all layers of the model with the exceptions of the western edge in layer 4, where a river (mixed) boundary was placed to simulate the mean flow conditions of the Kaskaskia River, and vary between no-flow (*i.e.,* Neumann) and river (*i.e.,* mixed) boundaries on the northern edge in layers 2 through 4, where a river (*i.e.,* mixed) boundary was placed to simulate the Cooling Pond, and the southern edge in layers 2 through 4, where river (*i.e.,* mixed) boundary was placed to simulate the southernmost tributary. The limits of the model domain approximate the limits of the Kaskaskia River subwatershed (Hydrologic Unit Code [HUC] boundary) in which the BPP and BAP reside. The top of the model was a time-dependent specified flux (*i.e.,* Neumann) boundary, with specified flux rates equal to the recharge rate. Surface water features within the active BAP were simulated in the model as constant head boundaries.

5.2.2 Flow Model Input Values and Sensitivity

Flow model input values and sensitivity analysis results are presented in **Table 5-1** and described below.

The modeled well location layers and flow model calibration targets (*i.e.*, median groundwater elevations from December 2015 to June 2022 [or November 2022 groundwater elevations for wells constructed or reoccupied in 2022] and target well locations) are summarized in **Table 2-2**. Anomalous groundwater elevations (*e.g.,* groundwater elevations that do not represent static groundwater conditions, groundwater elevation outliers, or groundwater elevations measured in error) monitored between December 2015 and June 2022 were removed from the median groundwater elevation calculations used as flow calibration targets. UU wells MW-151, MW-154, MW-252, and MW-253 are screened just above or at the interface between the UU and decomposed bedrock of the UA and may be hydraulically connected to multiple hydrostratigraphic units (*i.e.,* multiple modeled layers). In the flow calibration model, flow calibration targets for UU wells MW-151, MW-154, MW-252, and MW-253 were placed in the decomposed bedrock model layer, which 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 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 0 (*i.e.,* Cooling Pond) and river reach 1 (*i.e.,* Kaskaskia River) were varied between 98.5 and 101.5 percent of calibrated values. River stage for river reaches 2 through 8 and constant head reaches 0 and 1 were varied between 99.5 and 100.5 percent of calibrated values. When the calibrated model was tested, SSR was 1,210.53. 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

All available boring log data included in the revised HCR (Ramboll, 2023d) and lithologic contacts from the 2022 Hydrogeologic Site Investigation activities were used to develop surfaces utilizing Surfer® software for each of the three distinct water-bearing units described in **Section 2**. Layer 1 (**Figure 5-8**) modeled only CCR material within the limits of the BAP and FAPS; no flow cells were used outside the limits of the CCR units. The approximate base of ash surface in the BAP was provided by Geosyntec, which was developed using historic pre-construction topographic maps and incorporated base of ash data collected by Ramboll from borings within the BAP completed in 2022. The approximate base of ash surface in the FAPS was developed using historic pre-construction topographic maps. The modeled UU was split into three modeled layers, where model layer 2 (**Figure 5-9**) represented the upper silty clay of the UU, model layer 3 (**Figure 5-10**) represented a discontinuous transmissive zone within the UU (this unit is considered a PMP) or represented the approximate top of Vandalia Till/lower silty clay of UU in absence of a transmissive zone, and model layer 4 (**Figure 5-11**) represented the lower silty clay of the UU. Model layer 5 (**Figure 5-12**) represented the decomposed bedrock of the UA near the contact between the UU and UA. Model layer 6 (**Figure 5-13**) represented the deeper more competent bedrock of the UA. The bottom elevation of the UA (*i.e.,* bedrock) in layer 6 was flat lying and assumed to be an elevation of 200 feet NAVD88. 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 revised HCR (Ramboll, 2023d) and collected during the 2022 Hydrogeologic Site Investigation, 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 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 the UU and UA.

The spatial distribution of the hydraulic conductivity zones in each layer (**Figures 5-14 through 5-19**) simulates the distribution of hydraulic conductivity as reported in the revised HCR (Ramboll, 2023d) and determined from hydrogeologic data collected during the 2022 Hydrogeologic Site Investigation. All hydraulic conductivity zones were laterally continuous within the model with the exception of the CCR hydraulic conductivity zones Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Cell, and BAP (zones 2, 3, 4, and 7); the fill at the BAP and FAPS boundary (zone 16), the river alluvium hydraulic conductivity zone (zone 12); and the PMP hydraulic conductivity zone (zone 14). The limits of the ash fill were determined from data presented in the revised HCR (Ramboll, 2023d) and determined from hydrogeologic data collected during the 2022 Hydrogeologic Site Investigation. The ash fill extent was propagated through all related ash fill property zones (*i.e.*, recharge, storage, specific yield [S_y], and effective porosity). Conductivity zone 100 (identified on figures as “Above River BC”) was placed above river cells to improve communication between the river and the groundwater in layers above the layer in which the river boundary condition was placed.

The model had a high sensitivity to changes in horizontal conductivity in zone 9 (*i.e.,* UA), and a moderate sensitivity in zone 1 (*i.e.,* UU), zone 7 (*i.e.,* BAP), and zone 14 (*i.e.,* PMP); the model had a low or negligible sensitivity to changes in horizontal conductivity in the remaining hydraulic conductivity zones. The model had a moderate sensitivity to changes in vertical conductivity in zone 1 (*i.e.,* UU) and zone 9 (*i.e.,* UA), while the model exhibited a negligible sensitivity in the remaining hydraulic conductivity zones.

5.2.2.3 Recharge

Recharge rates (**Table 5-1**) were determined through calibration of the model to median groundwater elevation collected from December 2015 to June 2022, as presented in **Table 2-2**. The spatial distribution of recharge zones was based on the location and type of material present at land surface (**Figure 5-20**). Seven different zones were created to simulate recharge in the model area. A single silty clay zone (zone 1) was used to simulate ambient recharge over the upper silty clay of the UU outside the limits of the CCR units. Zones 5 and 6 were used to simulate recharge over the upper silty clay of the UU in the area of the Secondary Pond and Tertiary Pond, respectively. The recharge occurring through the ash fill placed in the FAPS and BAP was split into four different values, where recharge was varied based upon the historical use of each ash fill area and the response of flow calibration target heads. Post-closure FAPS recharge rates for the Old East Ash Pond, East Fly Ash Pond, and West Fly Ash Cell (zones 2, 3, and 4) were consistent with previous prediction modeling values used for the proposed cover system at the FAPS (NRT, 2014b). The BAP was simulated with a single zone (zone 7) which also had the greatest recharge value within the model domain.

The model had low sensitivity to changes in recharge in all zones, with the exception of zones 5 (Secondary Pond) and 6 (Tertiary Pond), where sensitivity was negligible.

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). S_y was set to equal effective porosity values described in **Section 5.2.3.3**. The spatial distribution of the storage and S_y 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

River reaches are illustrated in **Figure 5-1**. The Kaskaskia 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. The calibrated hydraulic conductivity value was set at 5.17 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 Kaskaskia River stage data at Red Bud, Illinois (USGS 05595240) and at New Athens, Illinois (USGS 05595000) gaging stations in 2021 and 2022. No slope was applied to the upstream and downstream modeled river stage as calculated gradients between the two gaging stations were determined to be negligible across the length of the model domain. The river boundary was placed in layer 4 corresponding with simulated river elevation (**Figure 5-5**).

The Cooling Pond was simulated using head-dependent flux nodes in modeled river reach 0 (**Table 5-1**). The conductance term was determined by adjusting hydraulic conductivity during model calibration. The calibrated hydraulic conductivity value was set at 3.8 ft/day. The river stage in the calibration model approximated the elevation at which the Cooling Pond is maintained (Ramboll, 2023d). The river boundary was placed in layers 2 through 4 corresponding with simulated river elevation (**Figures 5-3 through 5-5**).

The Secondary and Tertiary ponds were simulated using head-dependent flux nodes in modeled river reach 8 (**Table 5-1**). The conductance term was determined by adjusting hydraulic conductivity during model calibration. The calibrated hydraulic conductivity value was set at 0.26 ft/day. The river stage in the calibration model approximated historic groundwater elevations measured in monitoring well TPZ-165 placed within the limits of the Secondary Pond (**Figure 2-1**) (NRT, 2014a). The bottom of the river boundary was estimated using historic topographic maps and placed in layers 2 through 6 corresponding with simulated river elevation (**Figures 5-3 through 5-7**).

The remaining tributaries were simulated using head-dependent flux nodes in modeled river reaches 2 through 5 and reach 7 (**Table 5-1**). The conductance terms were determined by adjusting hydraulic conductivity during model calibration. Calibrated hydraulic conductivity values by tributary river reach are shown in **Table 5-1**. The river stage in the calibration model approximated local topography for each reach. The river boundaries were placed in layers 2 through 5 corresponding with simulated river elevation (**Figures 5-3 through 5-6**).

The model had moderate and high sensitivity to changes in river stage at reach 0 (Cooling Pond) and reach 1 (Kaskaskia River), respectively. The model had high sensitivity at reach 7 (northeast stream [east of Cooling Pond]) and moderate to moderately high sensitivity at reach 3 (south stream [between reach 2 and reach 4]) and reach 4 (south stream [adjacent to FAPS]) (**Table 5-1**). The remaining river reaches had low to negligible sensitivity to changes in river stage. The model had negligible sensitivity to changes in river conductance.

5.2.2.6 Constant Head Boundary Parameters

Surface water features within the active BAP were simulated in the model as constant head boundaries. The constant head boundaries required inputs for head at the boundaries (elevation).

These constant head boundary features act as discharge features within the BAP, which is consistent with stormwater management practices within the active BAP (AECOM, 2016b). The head at the boundaries for reaches 0 and 1 estimated water surface elevation within the BAP. The constant head boundaries were placed in layer 1 within the BAP (**Figure 5-2**).

The model had negligible sensitivity to changes in head in reach 0 (BAP constant head west) and reach 1 (BAP constant head central).

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 December 2015 and December 2022. 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 S_y by a factor of 2. High S_y sensitivity was not analyzed for zone 100 (identified on figures as “Above River BC”) since the calibration value was already near upper limits of acceptable values for S_y (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 the flow simulation. Two models (Calibration Model 1 and Calibration Model 2) run in series were used to calibrate concentrations to current observations and simulate changes in CCR unit operations at the Site from construction (1970) to present day (2022 [*i.e.,* current conditions]). The first model (Calibration Model 1) started at the time of BAP and FAPS construction (1970) and ended in 2020 (51-year calibration model period) when the FAPS was closed. The second model (Calibration Model 2) started in 2021 and ended in 2022 (2-year calibration model period) following the FAPS closure and included reduced recharge in the FAPS consistent with estimated closed FAPS recharge values in the 2014 FAPS groundwater modeling report (NRT, 2014b; NRT, 2014c), and removal of constant head cells in the West Ash Pond that were used to simulate stormwater management operations in the active FAPS in Calibration Model 1 to simulate the reduced activity in this area of the pond. 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 zones) through CCR were simulated in layer 1 for calibration (**Figure 5-20 and Table 5-2**) (recharge zones in order of greatest to least simulated recharge): (i) percolation through CCR in the active BAP (zone 7, BAP [West]; zone 8, BAP [East]), and (ii) percolation through CCR in the FAPS (zone 2, Old East Fly Ash Pond; zone 3, East Fly Ash Pond; zone 4, West Fly Ash Pond) active 1970 to 2020 (Calibration Model 1) and closed 2020 to 2022 (Calibration Model 2). All five sources were simulated by assigning concentration to the recharge input. Recharge rates in the active BAP were consistent across zone 7 (BAP [West]) and zone 8 (BAP [East]) which approximately bisect the active BAP; however, concentrations applied to recharge zones 7 and 8 were 4 and 1.5 mg/L, respectively, to reflect concentrations of boron observed at CCR porewater wells in each side of the active BAP.

The CCR sources were also simulated with constant concentration cells placed in layer 1 to simulate saturated ash conditions (see constant concentration cell reaches described in **Table 5-2**). 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. The spatial distributions of source concentrations applied to constant concentration cell reaches (saturated ash cells) are consistent with the spatial distributions of concentrations applied to the recharge zones. All source concentrations were calibrated in the transport model to the boron concentration data collected from December 2015 to December 2022.

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 zone 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 (Fetter, 1988; Morris and Johnson, 1967; Heath, 1983), for each material modeled then adjusted during model calibration and presented in **Table 5-2**. The spatial distribution of the effective porosity zones was consistent with those of the hydraulic conductivity zones.

Sensitivity testing was completed on all wells and the results are provided in **Table 5-3**. Monitoring locations where the calibrated and tested concentrations were below 0.1 mg/L boron are not included in the following discussion of model sensitivity to boron transport. The model had a negligible to moderately high sensitivity to decreases in porosity values, with exception of MW-382 where sensitivity was high. The model had a negligible to moderate sensitivity to increases in porosity values, with exception of three monitoring locations where sensitivity was moderately high (*i.e.,* MW-382, MW-385, and MW-390).

5.2.3.4 Storage and Specific Yield Sensitivity

Sensitivity testing was completed on all wells and the results are provided in **Table 5-3**. Monitoring locations where the calibrated and tested concentrations were below 0.1 mg/L boron are not included in the following discussion of model sensitivity to boron transport. The transport model had a negligible to moderate sensitivity to decreases in storage and S_y, with exception of seven monitoring locations where sensitivity was moderately high (i.e., MW-151, MW-366, MW-375, MW-382, MW-384, MW-385, and MW-390). The transport model had a negligible to moderately high sensitivity to increases in storage and S_y, with exception of three monitoring locations where sensitivity was high (i.e., MW-382, MW-385, and MW-390).

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 [immobile water]. 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 5 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 milliliters per gram [mL/g]) which is a conservative estimate for estimating contaminant transport times. 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). Further assessment of these processes and how they affect boron transport at the Site will be completed as part of future remedy selection evaluations. 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:

- Following closure of the FAPS in 2020, the groundwater flow system can be simulated as steady state for calibration to current conditions.
- Natural recharge is constant over the long term.
- Fluctuations in river stage do not affect groundwater flow over the long term.
- Hydraulic conductivity is consistent within each material (hydraulic conductivity zone) modeled.
- The approximate base of ash surface in the BAP was provided by Geosyntec, which was developed using historic pre-construction topographic maps and incorporated base of ash data collected by Ramboll from borings within the BAP completed in 2022. The approximate base of ash surface in the FAPS was developed using historic pre-construction topographic maps.
- Constant head cells were used to simulate surface water management features during operation of the CCR units.
- Recharge rates were modified, and constant head cells were removed after 2020 in the area of the FAPS to simulate closure.
- Source concentrations are assumed to remain constant over time. Only recharge rate was modified after 2020 to simulate FAPS closure.
- Boron is not adsorbed and does not decay; 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 BAP and FAPS, 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 2022.

5.4 Calibration Flow and Transport Model Results

Results of the MODFLOW 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 5-21 through Figure 5-28**. The mass balance error for the flow model was 0.02 percent and the ratio of the residual standard deviation to the range was 5.4 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 within the 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 and identified by layer in **Figure 5-21**. The near-linear relationship between observed and simulated values indicates that the model adequately represents the calibration dataset. The residual mean was -1.33 feet; in general, the simulated values were evenly distributed above and below the observed values. This is also illustrated by layer in the observed versus residuals plot **Figure 5-22**. Some simulated values were overpredicted (negative values on **Figure 5-22**), where the most significant overpredicted values (exceeding 10 feet) were primarily within the UA (bedrock) of layer 6, largely at lower groundwater elevations near the Secondary and Tertiary Ponds, near the southwest boundary of the West Ash Pond of the FAPS, or in bedrock wells screened below the decomposed bedrock. These residuals plot in the lower left quadrant of **Figure 5-22**.

The range of observed boron concentrations between December 2015 and December 2022 for the fifty (50) 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. Twenty (20) transport calibration locations had observed boron concentrations that ranged above and below the GWPS for boron (2 mg/L); for these locations the goal of transport model calibration was to have predicted concentrations above and below the GWPS for boron match observed median concentrations above or below the standard at each well (for example, if the median observed concentration for a well was above the GWPS, the goal is to have predicted concentrations above the GWPS at the well). One or more of these goals were achieved at all but five of the transport calibration location wells, specifically MW-150, MW-151, MW-356, MW-385, and MW-394, where concentrations were underpredicted with the exception of MW-151, where concentrations were overpredicted (**Figure 5-29**). Deviations from the observed boron concentrations are discussed below.

- MW-150, MW-356, and MW-394 were underpredicted transport calibration locations and had observed boron concentrations that ranged above and below the GWPS for boron (2 mg/L) with median observed concentrations only slightly above the GWPS for boron at 2.12, 2.01, and 2.02 mg/L, respectively.

- UU well MW-150 is nested with MW-350 at the southwest corner of the Site near the Tertiary Pond. The MW-150/MW-350 well nest was observed to have generally downward vertical gradients in the revised HCR (Ramboll, 2023d); however, other nested wells near the Secondary and Tertiary ponds indicate the presence of upward gradients between the UA and UU. The model calibration resulted in upward vertical gradients in these areas including the MW-150/MW-350 wells nest. The modeled gradients at this well nest likely inhibit the downward migration of simulated boron concentrations to MW-150. Nested well MW-350 has low observed boron concentrations and met the model calibration criteria discussed above.
- In general, the model under-predicts boron concentrations in bedrock locations like MW-356 and MW-394 where the range of concentrations observed (1.79 to 2.92 mg/L and 1.87 to 2.23 mg/L, respectively) are near the range of observed boron concentrations in upgradient bedrock wells like MW-304, where concentrations range from 1.27 to 2.16 mg/L. Since no initial concentrations were placed in the calibration model to represent the presence of boron observed in background wells, it is expected that the model may under-predict boron concentrations within the range of observed background.
- MW-385 is an under-predicted bedrock well identified as a UA well in the revised HCR (Ramboll, 2023d). MW-385 was installed in December 2015 on the former berm that was located between the active FAPS East Ash Pond and West Ash Pond. MW-385 was abandoned shortly after installation in February 2016, after collection of only one boron concentration data point. Since the data available for this well is limited, the usefulness of this location as a transport calibration point is also limited as the single data point may not be representative of current conditions. Like MW-385, MW-386 was abandoned shortly after installation, after collection of only one boron concentration data point, and was also located on the berm between the active FAPS East Ash Pond and West Ash Pond. Simulated boron concentrations at MW-386 met the calibration criteria discussed above; however, since the data available for this well is limited, like MW-385, the usefulness of this location as a transport calibration point is also limited as the single data point may not be representative of current conditions.
- MW-151 is identified as a UU well in the revised HCR (Ramboll, 2023d). MW-151 was constructed with a filter pack that extends from the UU into the weathered bedrock. This well was modeled in layer 5 which represents the decomposed bedrock rather than UU layers 2 through 4. Boron concentrations are over-predicted by the model at this location which may be associated with the well being screened across multiple model layers.

The remaining calibration locations had predicted concentrations that met one or more of the following goals of the transport model calibration: to have predicted concentrations fall within the range of observed concentrations; to have predicted concentrations above and below the GWPS for boron (2 mg/L) match observed concentrations observed above or below the standard at each well; and/or to have predicted concentrations above and below the GWPS for boron match observed median 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. For example, UA well MW-391, located west of the FAPS, where the highest UA bedrock boron concentrations were observed, was calibrated near the median concentration of the observed values from December 2015 to December 2022. Similarly, UU well OW-157 located north of the East Ash Pond of the FAPS, where the highest concentrations in the UU were observed, had the highest predicted boron concentrations on Site. The calibration result for wells MW-391 and OW-157 indicate the transport calibration model was able to simulate the highest observed concentrations in both the UA and UU, respectively. The simulated boron concentrations at porewater wells within the BAP also approximated the median of the observed boron concentrations, with the exception of XPW01 which was simulated as dry, indicating the simulated BAP boron source concentrations were representative. The distribution of boron concentrations in the calibrated model are presented on **Figure 5-30 through Figure 5-35**.

6. SIMULATION OF CIP CLOSURE SCENARIO

6.1 Overview and Prediction Model Development

Prediction simulations were performed to evaluate the effects of closure (source control) measures (CCR consolidation and CIP closure scenario) for the BAP on the groundwater quality following initial corrective action measures, which includes removal of free liquids from the BAP. 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 the closure scenario 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 closure scenario:

- Extend the modeled existing conditions (calibration conditions) approximately 2 years prior to applying initial corrective action measures to allow time for IEPA coordination, approvals, and permitting; as well as the final design and bid process according to the schedule in the CCR Surface Impoundment Final Closure Plan (Geosyntec, 2022a).
- Define CCR removal and consolidation areas based on designs provided in the CCR Surface Impoundment Final Closure Plan (Geosyntec, 2022a).
- Apply several constant head cell areas to the BAP for the dewatering period (approximately 3 years) to remove free liquids within the BAP (initial corrective action measures).
- Apply drains (drain input parameters approximated designs provided in the CCR Surface Impoundment Final Closure Plan [Geosyntec, 2022a]) to simulate storm water management within CCR removal areas following closure.
- Apply no flow cells and remove recharge in the CCR removal areas to simulate the absence of material in model layer 1 following consolidation and cover system construction.
- Remove source concentrations within the CCR removal areas (source concentrations associated with recharge zones and saturated ash cells [constant concentration cells]).
- Apply reduced recharge in the consolidated CIP areas to simulate the effects of the cover system on the groundwater flow system (HELP calculated percolation rates were developed based on cover system construction materials and designs provided in the CCR Surface Impoundment Final Closure Plan (Geosyntec, 2022a).

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 the groundwater flow system from the CIP closure scenario. The following simplifying assumptions were made during the simulations:

- In the CIP closure scenario, 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 run following closure.
- Changes in recharge resulting from dewatering, CCR removal, consolidation, construction of the cover system, 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.

- 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 CCR Surface Impoundment Final Closure Plan (Geosyntec, 2022a).
- CCR removal areas were assumed to have the same topography as the former approximated base of ash surface in the BAP.

6.2 HELP Model Setup and Results

HELP (Version 4.0; Tolaymat and Krause, 2020) was used to estimate percolation through the top and slopes of the BAP CIP Consolidation area. HELP files are included electronically (**Appendix C**), and outputs are attached to this report (**Appendix D**).

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 Belleville Scott Air Force Base, Illinois (the closest weather station included in the HELP database). Precipitation, temperature, and solar radiation was simulated based on the latitude of the BAP. Thickness and type of the geosynthetic drainage layer, geotextile protective cushion layer, geomembrane liner, soil backfill, and soil runoff input parameters were developed for the ash consolidation scenario using data provided the CCR Surface Impoundment Final Closure Plan (Geosyntec, 2022a).

HELP model results (**Table 6-1**) indicated 0.000239 inches of percolation per year through the top of the BAP CIP consolidation and cover system area, and 0.000007 inches of percolation per year through the slopes of the BAP consolidation and cover system areas. The differences in HELP model runs for each area included the type of lateral drainage layer or cushion, soil runoff slope, and the 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, 2022b) which is an appendix to the Construction Permit Application to which this report is also attached. Results of these two additional HELP simulations were not incorporated in the MODFLOW simulations for closure. Simulation inputs and output results are presented in **Appendix D**.

6.3 Simulation of CIP Closure Scenario

The calibrated model was used to evaluate the effectiveness of the CIP closure scenario by defining CCR removal and consolidation areas, reducing head to simulate a dewatering period (approximately 3 years), removing source concentrations within the removal areas, applying drains to simulate storm water management within CCR removal areas following closure, applying no flow cells and removing recharge in the CCR removal areas to simulate the absence of material in model layer 1 following closure, and applying reduced recharge in the consolidation and CIP areas to simulate the effects of the cover system on transport.

As discussed in the model approach **Section 4.3** and illustrated on **Figure 4-1**, the start of the transient flow and transport model was initiated in 1970 (model year 0), when the BPP began operation and the BAP and FAPS were active (initial conditions model), through 2020 (51 model years) when closure at the FAPS was complete. Three models were included for the closure prediction simulation. The first model simulated an extended period of current conditions, 2021 to 2024 (4 model years). The second model simulated a period for the removal of free liquids, 2025 to 2027 (3 model years). The third model simulated the final closure conditions, 2028 to 3027 (1,000 model years). The prediction model input values are summarized in **Table 6-2**.

6.3.1 CIP Closure Scenario Groundwater Flow System and Predicted Boron Concentrations

The design for CIP includes an initial 3-year dewatering period to remove free liquids followed by CCR removal from the western areas of the BAP, consolidation to the southeast, and eventually northeastern portions of the BAP, and construction of a cover system over the remaining CCR (**Figure 6-1**).

Post-construction heads decrease at monitoring wells surrounding the CCR removal and consolidated CIP areas of the BAP following dewatering and implementation of CIP. In general, the greatest predicted reduction in heads among the proposed BAP compliance monitoring wells (MW-192, MW-193, MW-356, MW-369, MW-370, MW-382, MW-392, MW393, MW-394, OW-256, OW-257, PZ-170, and PZ-182) takes place within approximately 93 years following implementation of the CIP closure scenario. The heads at these wells continue to decrease until they are predicted to stabilize (approximate hydraulic steady state); however, due to the low hydraulic conductivity of the UU and UA materials, heads are not predicted to stabilize at all proposed BAP compliance monitoring wells until approximately 482 years following implementation of the CIP closure scenario. Groundwater flow directions are predicted to remain consistent with current flow directions.

Evaluations of post-construction water flux through the consolidated and covered BAP CCR were completed using data obtained from the CIP closure scenario prediction model when simulated post-construction heads in the proposed BAP compliance monitoring wells reached their most significant reduction in heads at approximately 93 years following implementation of the CIP closure scenario. The pre-construction (calibration model) and post-construction CIP closure scenario prediction model simulated water flux values are summarized in **Appendix E** and discussed below. Data export files used for flux evaluations are found along with model files in **Appendix C**.

Figure 6-2 is a plot showing the changes in flux reduction (shown as negative percentage) over time, starting from implementation of the CIP closure scenario through approximately 100 years following implementation. The CIP closure scenario was predicted to reduce total flux in and out of the BAP CCR by greater than 90 percent within 30 days following implementation of the CIP closure scenario. This was determined by comparing the post-construction movement of water in and out of the consolidated BAP CCR to pre-construction conditions. The reduction in total flux in and out of the consolidated BAP CCR is predicted to exceed 90 percent reduction for the remaining model timeframe. In general, the greatest predicted reduction in heads among the proposed BAP compliance monitoring wells takes place within approximately 93 years following implementation of the CIP closure scenario, at which time total flux in and out are predicted to reduce by 95 and 93 percent, respectively (**Figure 6-3**). Flux in and out are predicted to reduce by approximately 96 percent after approximately 482 years following implementation of the CIP closure scenario when heads are predicted to stabilize at the BAP compliance wells. Prior to construction (*i.e.*, current existing conditions) the total groundwater flux into the CCR is 10.90 gallons per minute (gpm) versus a total flux out of 10.77 gpm (**Appendix E**). Total flux out includes flux through the CCR (3.39 gpm) and the modeled constant head cells (7.38 gpm) used to simulate surface water management within the active BAP. Approximately 93 years following implementation of the CIP closure scenario, the groundwater flux into and out of the CCR is equal at approximately 0.56 and 0.70 gpm, respectively, with no surface water management within the CIP area.

An evaluation of simulated boron plumes greater than the GWPS (2 mg/L for boron) in both pre-construction calibration models and post-construction prediction models indicated several proposed BAP compliance monitoring wells (PZ-182, OW-257, MW-382) to be potentially influenced by boron concentrations associated with the closed FAPS. The model domain for evaluating boron transport following closure of the BAP includes the closed FAPS, which is present along the eastern and southern boundaries of the BAP. The FAPS completed IEPA approved closure activities in November of 2020, and it is another potential source of boron within the model domain. The closure plan for the FAPS also included groundwater modeling of boron transport. The evaluation included a review of maximum plume extents associated with the FAPS presented in the 2014 FAPS groundwater modeling reports (NRT, 2014b; NRT, 2014c) (completed as part of the FAPS Closure Plan Report [AECOM, 2016a]), as well as a review of simulated groundwater flow directions and simulated boron concentrations in both the BAP pre-construction calibration and BAP post-construction prediction models. Groundwater elevations and boron concentrations at FAPS closure monitoring wells were calibrated during development of the current BAP flow and transport model and the simulation period was extended to 1,000 years to verify consistent results with the 2014 FAPS groundwater modeling reports. Changes in FAPS operations were incorporated into the current BAP modeling (utilizing similar changes in recharge used to simulate closure in the previous 2014 model). Boron transport within the current BAP model was compared to the results from the previous FAPS closure plan modeling and found that simulated flow and transport associated with the FAPS are consistent between the two models. Proposed BAP compliance wells PZ-182, OW-257, and MW-382 are located in the direction of groundwater flow from the north central area of the FAPS between the FAPS (East Ash Pond) and the surface water drainage feature near the west end of the BAP. Because these wells are downgradient of the FAPS, which is an alternate source of boron, these wells were not included in the evaluation of BAP compliance with the GWPS following implementation of the CIP closure scenario.

Simulated boron concentrations at the remaining proposed BAP compliance monitoring wells (PZ-170, OW-256, MW-192, MW-193, MW-370, MW-369, MW-392, MW-393, and MW-394) were below the GWPS (2 mg/L for boron) during the pre-construction period (calibration model), and prediction modeling results indicated these proposed BAP compliance monitoring wells would continue to remain below the GWPS for the post-construction modeling timeframe following dewatering and consolidation (**Figure 6-4**). The maximum extent of the plume above the GWPS for boron (2 mg/L) at 93 years following implementation of the CIP closure scenario, when simulated post-construction heads in the proposed BAP compliance monitoring wells reached their most significant reduction in heads, is illustrated in **Figure 6-5,** where boron exceedances are within the footprint of the former BAP except where source concentrations are potentially associated with the closed FAPS.

Additionally, a BAP CBR closure scenario prediction model was completed to evaluate the difference in post-construction boron concentrations simulated at PZ-182, OW-257, and MW-382 under both CIP and CBR conditions. The CBR closure scenario was simulated by: (i) extending the initial 3-year dewatering period to remove free liquids used in the CIP prediction model to an initial 9-year dewatering period, as the CBR construction timeframe is longer than CIP (see information provided in the CCR Surface Impoundment Final Closure Plan [Geosyntec, 2022a] which is an appendix to the Construction Permit Application to which this report is also attached); (ii) applying no flow cells and removing recharge in the entire BAP footprint to simulate the absence of material in model layer 1 following CBR; and, (iii) removing all source concentrations within the BAP footprint following CBR (source concentrations associated with recharge zones and saturated ash cells [constant concentration cells]). A timeseries plot of predicted boron concentrations following implementation of the BAP CIP and CBR closure scenarios at proposed BAP compliance monitoring wells PZ-182, OW-257, and MW-382 is provided in **Figure 6-6**. As illustrated in **Figure 6-6**, concentrations are predicted to increase above the GWPS for boron (2 mg/L) following implementation of both BAP CIP and CBR closure scenarios in these three wells. Maximum concentrations within the modeling timeframes at these wells are predicted to be on the same order of magnitude for both BAP CIP and CBR closure scenarios.

The differences in predicted concentrations between CIP and CBR illustrated on **Figure 6-6** are likely due to slightly lower heads simulated at PZ-182, OW-257, and MW-382 in the CBR scenario, which increases the hydraulic gradient beneath the BAP which drives more rapid predicted arrival of boron in these wells from the FAPS. Since concentrations at proposed BAP compliance monitoring wells PZ-182, OW-257, and MW-382 increase to concentrations above the GWPS following implementation of the CBR closure scenario when BAP source concentrations have been removed, the source for predicted post-construction concentrations within the model domain must be the closed FAPS. These results support the conclusion that wells PZ-182, OW-257, and MW-382 should not be included in the evaluation of BAP compliance with the GWPS following implementation of the CIP closure scenario.

Although predicted boron concentrations at proposed BAP compliance wells PZ-182 and MW-382 are influenced by the FAPS, simulated boron concentrations at these wells started below the GWPS during the pre-construction period (calibration model) and an initial decrease in predicted concentrations was observed immediately following implementation of the BAP CIP closure scenario (**Figure 6-4**). The initial decrease in predicted boron concentrations is followed by a predicted increase in concentrations at approximately 14 and 80 years in wells PZ-182 and MW-382, respectively, following implementation of the CIP closure scenario as simulated concentrations associated with the FAPS begin to influence predicted boron concentrations in wells further along the flow path between the FAPS (East Ash Pond) and the drainage feature near the west end of the BAP.

Results of groundwater fate and transport modeling conservatively estimate that groundwater boron concentrations at the proposed BAP compliance wells that are not influenced by the FAPS will remain below the GWPS following implementation of the CIP closure scenario at the BAP. 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 BAP and FAPS, 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 2022.

7. CONCLUSIONS

This GMR has been prepared to evaluate the groundwater flow system and transport of boron concentrations at the BAP and how the proposed CIP closure scenario will reduce total flux in and out of the CCR and maintain compliance with the GWPS for boron (2 mg/L) in the post-construction BAP. Groundwater elevation data collected from sampling events from December 2015 to June 2022 (or November 2022 groundwater elevations for wells constructed or reoccupied in 2022) and boron concentration data collected from sampling events from December 2015 to December 2022 were used to develop a groundwater flow and transport model for the BPP BAP and surrounding area. The MODFLOW and MT3DMS models were then used to evaluate the CIP closure scenario which includes: CCR removal from the western areas of the BAP, consolidation to the southeast, and eventually northeastern portions of the BAP, and construction of a cover system over the remaining CCR following initial corrective action measures (removal of free liquids from the BAP) using information provided in the CCR Surface Impoundment Final Closure Plan (Geosyntec, 2022a).

The CIP closure scenario was predicted to reduce total flux in and out of the BAP CCR by greater than 90 percent within 30 days following implementation of the CIP closure scenario. This was determined by comparing the post-construction movement of water in and out of the consolidated BAP CCR to pre-construction conditions. The reduction in total flux in and out of the consolidated BAP CCR is predicted to exceed 90 percent reduction for the remaining model timeframe. In general, the greatest predicted reduction in heads among the proposed BAP compliance monitoring wells takes place within approximately 93 years following implementation of the CIP closure scenario, at which time total flux in and out are predicted to reduce by 95 and 93 percent, respectively. Due to the low hydraulic conductivity of the UU and UA materials, heads are not predicted to stabilize at all proposed BAP compliance monitoring wells until approximately 482 years following implementation of the CIP closure scenario, at which time total flux in and out are predicted to reduce by approximately 96 percent.

The model domain for evaluating boron transport following closure of the BAP includes the closed FAPS which is present along the eastern and southern boundaries of the BAP. The FAPS completed IEPA approved closure activities in November of 2020, and it is another potential source of boron within the model domain. The closure plan for the FAPS also included groundwater modeling of boron transport. Boron transport within the current BAP model was compared to the results from the previous FAPS closure plan modeling and found that simulated flow and transport associated with the FAPS are consistent between the two models. As described in this report, proposed BAP compliance wells PZ-182, OW-257, and MW-382 are located in the direction of groundwater flow from the north central area of the FAPS between the FAPS (East Ash Pond) and the surface water drainage feature near the west end of the BAP. Because these wells are downgradient of the FAPS which is an alternate source of boron, and groundwater quality at these wells is not attributable to the BAP, these wells were not included in the evaluation of BAP compliance with the GWPS following implementation of the CIP closure scenario.

Additionally, a BAP CBR closure scenario prediction model was completed to evaluate the difference in post-construction boron concentrations simulated at PZ-182, OW-257, and MW-382 under both CIP and CBR conditions. Concentrations are predicted to increase above the GWPS for boron (2 mg/L) following implementation of both BAP CIP and CBR closure scenarios in these three wells. Maximum concentrations within the modeling timeframes at these wells are predicted to be on the same order of magnitude for both BAP CIP and CBR closure scenarios. Since concentrations at proposed BAP compliance monitoring wells PZ-182, OW-257, and MW-382 increase to concentrations above the GWPS following implementation of the CBR closure scenario, after BAP source concentrations have been removed, the source for predicted post-construction concentrations within the model domain can only be attributable to the closed FAPS. These results support the conclusion that wells PZ-182, OW-257, and MW-382 should not be included in the evaluation of BAP compliance with the GWPS following implementation of the CIP closure scenario.

Results of groundwater fate and transport modeling conservatively estimate that groundwater boron concentrations at the proposed BAP compliance wells that are not influenced by the FAPS will remain below the GWPS following implementation of the CIP closure scenario at the BAP.

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TABLES

TABLE 2-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
GROUNDWATER MODELING REPORT
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)
MW-104SR	UU	2011-08-01	455.54	455.54	Top of PVC	452.52	4.80	14.80	447.80	437.70	15.00	437.50	10	2	38.188355	-89.853434
MW-104DR	UU	2011-08-01	455.62	455.62	Top of PVC	452.62	23.20	28.20	429.40	424.40	28.50	417.60	5.1	2	38.188344	-89.853434
MW-116	UU	1991-09-30	457.97	547.97	Top of PVC	454.90	15.00	25.00	439.90	429.90	25.00	429.90	10	2	--	--
MW-126	UU	2009-06-19	469.84	469.84	Top of PVC	466.84	9.95	19.31	456.89	447.53	19.31	446.87	9.36	2	--	--
MW-150	UU	2010-09-01	396.54	396.54	Top of PVC	393.84	15.00	24.70	378.80	369.20	25.20	368.70	9.6	2	38.189401	-89.878468
MW-151	UU	2010-09-01	399.96	399.96	Top of PVC	397.22	6.10	15.80	391.10	381.40	16.30	380.90	9.6	2	38.188449	-89.872354
MW-152	UU	2010-09-01	424.99	424.99	Top of PVC	422.18	7.50	16.70	414.70	405.50	17.20	405.00	9.3	2	38.187569	-89.866764
MW-153	UU	2010-09-01	445.67	445.67	Top of PVC	442.77	10.40	20.00	432.40	422.80	20.50	422.30	9.6	2	38.185884	-89.86101
MW-154	UU	2010-09-01	387.76	387.76	Top of PVC	384.99	7.50	12.20	377.50	372.80	12.70	372.30	4.6	2	38.196555	-89.883732
MW-155	UU	2010-09-01	393.55	393.55	Top of PVC	390.62	10.30	19.90	380.30	370.70	20.50	370.20	9.6	2	38.193312	-89.882878
MW-158R	UU	2022-10-08	456.24	456.24	Top of PVC	453.56	8.00	18.00	445.56	435.56	18.00	435.56	10	2	38.195275	-89.849411
MW-161	UU	2013-08-01	431.27	431.27	Top of PVC	428.74	23.30	32.80	405.40	396.00	33.40	384.00	9.5	2	38.19631	-89.879159
MW-162	UU	2013-08-01	433.20	433.20	Top of PVC	430.83	15.90	25.30	415.00	405.50	25.90	404.90	9.5	2	38.192595	-89.879221
MW-192	UU	2022-09-27	436.94	436.94	Top of PVC	434.04	20.00	30.00	414.04	404.04	30.00	400.04	10	2	38.199203	-89.866927
MW-193	UU	2022-10-04	438.06	438.06	Top of PVC	434.51	22.00	32.00	412.51	402.51	32.00	402.51	10	2	38.199173	-89.862658
MW-194	UU	2022-10-05	438.20	438.20	Top of PVC	435.43	18.00	28.00	407.43	397.43	28.00	405.43	10	2	38.199138	-89.858653
MW-203	UA	--	457.53	457.53	Top of PVC	455.66	67.00	77.00	388.66	378.66	78.00	377.67	10	2	--	--
MW-204	UA	1991-09-30	456.02	456.02	Top of PVC	453.30	68.00	78.00	385.30	375.30	79.00	79.00	10	2	--	--
MW-252	UU	2010-09-01	425.07	425.07	Top of PVC	422.27	44.40	49.00	377.90	373.20	49.50	372.70	4.6	2	38.187563	-89.866745
MW-253	UU	2010-09-01	445.84	445.84	Top of PVC	442.70	29.90	34.50	412.80	408.20	35.00	407.70	4.6	2	38.185885	-89.861026
MW-258	UA	2022-10-07	456.12	456.12	Top of PVC	453.50	40.00	50.00	413.59	403.59	50.00	390.50	10	2	38.195276	-89.849429
MW-262	UU	2013-08-01	433.21	433.21	Top of PVC	430.86	42.10	46.60	388.70	384.20	47.20	379.90	4.5	2	38.192605	-89.87922
MW-304	UA	2015-10-20	455.49	455.49	Top of PVC	453.03	45.00	55.00	408.00	398.00	55.00	317.60	10	2	38.188332	-89.853441

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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)
MW-306	UA	1991-09-25	453.17	453.17	Top of PVC	450.91	72.70	87.70	378.20	363.20	87.70	361.20	15	2	38.20114	-89.846756
MW-307	UA	1991-09-16	436.66	436.66	Top of PVC	434.00	57.00	72.00	377.00	362.00	74.00	333.00	15	2	--	--
MW-350	UA	2010-09-01	396.80	396.80	Top of PVC	394.11	41.60	46.20	352.50	347.90	46.60	347.40	4.6	2	38.189416	-89.878477
MW-352	UA	2010-09-01	425.04	425.04	Top of PVC	422.36	67.90	72.50	354.50	349.80	73.00	348.60	4.6	2	38.187554	-89.866729
MW-355	UA	2010-09-01	393.69	393.69	Top of PVC	390.82	27.40	32.00	363.40	358.80	32.50	358.20	4.6	2	38.193305	-89.882865
MW-356	UA	2015-10-01	427.60	427.60	Top of PVC	425.18	56.00	66.00	369.20	359.20	66.00	290.20	10	2	38.198963	-89.869578
MW-358	UA	2022-10-08	455.73	455.73	Top of PVC	453.59	80.00	90.00	373.73	363.73	90.00	363.59	10	2	38.195275	-89.849417
MW-366	UA	2015-12-04	425.08	425.08	Top of PVC	422.54	42.00	52.00	380.50	370.50	52.00	368.20	10	2	38.192191	-89.872345
MW-369	UA	2015-11-19	422.71	422.71	Top of PVC	420.49	56.00	66.00	364.50	354.50	66.00	349.80	10	2	38.196986	-89.870258
MW-370	UA	2015-11-25	420.85	420.85	Top of PVC	418.67	53.00	63.00	365.70	355.70	63.00	352.70	10	2	38.195603	-89.869669
MW-373	UA	2015-10-28	391.32	391.32	Top of PVC	388.80	20.00	30.00	368.80	358.80	30.00	293.70	10	2	38.190726	-89.879258
MW-374	UA	2015-11-10	400.91	400.91	Top of PVC	398.41	30.00	40.00	368.40	358.40	40.00	356.10	10	2	38.189682	-89.877242
MW-375	UA	2015-11-06	423.05	423.05	Top of PVC	420.50	57.00	67.00	363.50	353.50	67.00	335.80	10	2	38.189045	-89.873514
MW-377	UA	2015-11-02	421.36	421.36	Top of PVC	418.75	46.00	56.00	372.80	362.80	56.00	360.50	10	2	38.188386	-89.869742
MW-382	UA	2015-11-23	431.19	431.19	Top of PVC	428.67	56.00	66.00	372.70	362.70	66.00	358.10	10	2	38.19454	-89.868044
MW-383	UA	2015-12-21	459.49	459.49	Top of PVC	457.18	58.00	68.00	399.20	389.20	68.00	384.20	10	2	38.194913	-89.858286
MW-384	UA	2015-12-18	458.95	458.95	Top of PVC	456.70	60.50	70.50	396.20	386.20	70.50	362.60	10	2	38.191789	-89.860699
MW-385	UA	2015-12-16	454.56	454.56	Top of PVC	454.82	80.00	90.00	374.80	364.80	90.00	361.80	10	2	38.191729	-89.86847
MW-386	UA	2015-12-11	454.17	454.17	Top of PVC	454.67	76.00	86.00	378.70	368.70	86.00	365.70	10	2	38.189441	-89.866991
MW-387	UA	2015-11-18	426.63	426.63	Top of PVC	424.01	48.00	58.00	376.00	366.00	58.00	362.70	10	2	38.190905	-89.874773
MW-388	UA	2015-12-12	408.92	408.92	Top of PVC	406.28	33.00	43.00	373.30	363.30	43.00	361.10	10	2	38.191785	-89.87773
MW-389	UA	2015-12-01	419.90	419.90	Top of PVC	417.30	42.00	52.00	375.30	365.30	52.00	361.60	10	2	38.193679	-89.877076
MW-390	UA	2016-03-04	428.06	428.06	Top of PVC	425.98	50.00	65.00	376.00	361.00	65.00	358.00	15	2	38.192956	-89.869793
MW-391	UA	2016-03-10	426.63	426.63	Top of PVC	424.24	55.00	70.00	369.20	354.20	70.00	349.80	15	2	38.190869	-89.874759

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TABLE 2-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
GROUNDWATER MODELING REPORT
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)
MW-392	UA	2022-09-26	437.02	437.02	Top of PVC	434.07	74.00	84.00	360.07	350.07	84.00	350.07	10	2	38.199203	-89.866934
MW-393	UA	2022-10-04	437.86	437.86	Top of PVC	434.59	75.00	85.00	359.59	349.59	85.00	349.59	10	2	38.199174	-89.862666
MW-394	UA	2022-10-05	438.29	438.29	Top of PVC	435.51	73.00	83.00	362.51	352.51	83.00	350.51	10	2	38.199136	-89.85866
OW-156	UU	2010-09-01	427.87	427.87	Top of PVC	425.14	7.90	17.20	417.30	407.90	17.70	407.40	9.3	2	38.198969	-89.869592
OW-157	UU	2010-09-01	432.64	432.64	Top of PVC	429.90	7.80	17.10	422.10	412.80	17.60	412.30	9.3	2	38.19384	-89.867384
OW-256	UU	2013-08-01	427.70	427.70	Top of PVC	425.20	28.00	32.50	397.20	392.70	33.10	389.20	4.5	2	38.198966	-89.86961
OW-257	UU	2013-08-01	431.02	431.02	Top of PVC	428.17	34.00	38.50	394.20	389.70	39.10	388.60	4.5	2	38.193865	-89.867456
PZ-169	UU	2015-07-28	422.60	422.60	Top of PVC	420.01	31.50	41.50	388.50	378.50	41.50	378.00	10	2	38.196962	-89.870253
PZ-170	UU	2015-07-29	421.43	421.43	Top of PVC	418.58	21.10	31.10	397.50	387.50	31.10	387.50	10	2	38.195585	-89.869632
PZ-171	UU	2015-07-31	434.15	434.15	Top of PVC	431.54	28.00	38.00	403.50	393.50	38.00	393.50	10	2	38.194595	-89.879189
PZ-172	UU	2015-08-03	412.95	412.95	Top of PVC	410.22	16.00	26.00	394.20	384.20	26.00	384.00	10	2	38.191491	-89.879283
PZ-173	UU	2015-08-03	391.46	391.46	Top of PVC	388.43	3.50	13.50	384.90	374.90	13.50	374.30	10	2	38.1907	-89.879247
PZ-174	UU	2015-08-04	401.92	401.92	Top of PVC	398.97	14.50	24.50	384.50	374.50	24.50	374.30	10	2	38.189682	-89.877209
PZ-175	UU	2015-08-07	423.01	423.01	Top of PVC	419.87	40.00	50.00	379.90	369.90	50.00	369.70	10	2	38.189032	-89.873481
PZ-176	UU	2015-08-06	406.44	406.44	Top of PVC	403.46	18.10	28.10	385.40	375.40	28.60	374.90	10	2	38.188565	-89.871623
PZ-177	UU	2015-08-06	420.90	420.90	Top of PVC	417.93	20.50	30.50	397.40	387.40	30.50	387.20	10	2	38.188361	-89.869736
PZ-178	UU	2015-08-05	431.26	431.26	Top of PVC	428.45	33.00	43.00	395.50	385.50	43.00	385.00	10	2	38.188076	-89.867868
PZ-182	UU	2015-07-30	431.61	431.61	Top of PVC	428.47	24.00	34.00	404.50	394.50	34.00	394.50	10	2	38.194512	-89.86801
TPZ-158	UU	2013-08-01	456.26	456.26	Top of PVC	453.26	9.20	18.30	444.00	435.00	18.90	434.30	9.1	1.3	38.195308	-89.849428
TPZ-159	UU	2013-08-01	447.64	447.64	Top of PVC	444.69	20.00	29.00	424.70	415.70	29.60	394.70	9.1	1.3	38.199022	-89.862558
TPZ-160	UU	2013-08-01	431.49	431.49	Top of PVC	428.59	9.80	18.80	418.80	409.80	19.40	393.60	9.1	1.3	38.19896	-89.875586
TPZ-163	CCR	2013-08-01	458.41	458.41	Top of PVC	455.51	8.60	18.10	446.90	437.40	18.70	410.50	9.5	2	38.19274	-89.857249
TPZ-164	CCR	2013-08-01	435.10	435.10	Top of PVC	432.50	5.20	9.70	427.30	422.80	10.30	422.20	4.5	2	38.195586	-89.862797
TPZ-165	UU	2013-08-01	398.85	398.85	Top of PVC	396.10	7.80	16.80	388.30	379.30	17.40	378.70	9.1	1.3	38.193174	-89.874746

TABLE 2-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
GROUNDWATER MODELING REPORT
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)
TPZ-166	UU	2013-08-01	425.18	425.18	Top of PVC	422.33	15.30	24.70	407.10	397.60	25.30	396.80	9.5	2	38.1922	-89.872297
TPZ-167	CCR	2013-08-01	441.38	441.38	Top of PVC	438.63	21.40	30.90	417.20	407.70	31.50	389.90	9.5	2	38.190478	-89.869723
TPZ-168	CCR	2013-08-01	457.53	457.53	Top of PVC	454.93	15.80	25.30	439.20	429.70	25.80	384.90	9.5	2	38.188681	-89.863954
XPW01	CCR	2022-09-23	437.66	437.66	Top of PVC	435.12	7.00	12.00	428.12	423.12	12.00	421.12	5	2	38.197522	-89.864474
XPW02	CCR	2022-09-24	437.92	437.92	Top of PVC	434.86	6.00	11.00	428.86	423.86	11.00	420.86	5	2	38.197894	-89.86188
XPW04	CCR	2022-09-24	434.58	434.58	Top of PVC	430.59	6.50	16.50	424.09	414.09	16.50	410.59	10	2	38.194698	-89.863819
XPW05	CCR	2022-09-24	437.27	437.27	Top of PVC	434.12	18.00	28.00	416.12	406.12	28.00	404.12	10	2	38.196233	-89.862366
XPW06	CCR	2022-09-22	417.72	417.72	Top of PVC	418.06	5.00	10.00	412.99	407.99	10.00	402.06	5	2	38.196967	-89.868954

Notes:
All elevation data are presented relative to the North American Vertical Datum 1988 (NAVD88), GEOID 12A
-- = data not available
BGS = below ground surface
CCR = coal combustion residuals
ft = foot or feet
HSU = Hydrostratigraphic Unit
PVC = polyvinyl chloride
UA = uppermost aquifer
UU = upper unit
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TABLE 2-2. FLOW AND TRANSPORT MODEL CALIBRATION TARGETS
GROUNDWATER MODELING REPORT
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, IL

Well ID	Monitored Hydrogeologic Unit	Modeled Target Location (Layer Number)	Flow Model Target Groundwater Elevation (Modified Median Value December 2015 to June 2022 [feet NAVD88][1])	Transport Model Target Total Boron Concentrations December 2015 to December 2022 (mg/L)		
				Minimum	Median	Maximum
MW-104DR	UU	3	445.01	0.0191	0.02	0.05
MW-104SR	UU	2	446.42	0.04	0.128	0.237
MW-116	UU	4	449.61 [2]	0.023	0.024	0.025
MW-126	UU	2	459.57 [2]	0.0092	0.0106	0.012
MW-150	UU	3	377.70	0.31[3]	2.12[3]	4.29[3]
MW-151	UU	5	395.62	0.217[3]	0.267[3]	0.507[3]
MW-152	UU	3	419.87	0.015[3]	9.92[3]	29[3]
MW-153	UU	2	432.69	0.009[3]	0.02[3]	21.5[3]
MW-154	UU	5	379.61	0.018[3]	0.02[3]	0.056[3]
MW-155	UU	3	373.98	0.0114[3]	0.02[3]	0.05[3]
MW-158R	UU	2	442.63 [2]	0.0254	0.0347	0.061
MW-192	UU	2	428.57 [2]	0.0525	0.0537	0.0686
MW-193	UU	3	429.02 [2]	0.0473	0.059	0.0645
MW-194	UU	3	431.32 [2]	0.019	0.022	0.023
MW-203	UA	6	No Target	0.907	0.907	0.907
MW-204	UA	6	442.82 [2]	1.02	1.03	1.35
MW-252	UU	5	424.93	0.12[3]	0.144[3]	1.47[3]
MW-253	UU	5	434.66	0.0333[3]	0.0604[3]	0.24[3]
MW-258	UA	5	441.95 [2]	1.03	1.27	1.35
MW-304	UA	6	445.93	1.27	1.685	2.16
MW-306	UA	6	435.63	0.025	0.2	0.634
MW-307	UA	6	431.10 [2]	1.2	1.47	1.63
MW-350	UA	6	374.27	0.541	0.652	0.9
MW-352	UA	6	423.42	0.76[3]	1.82[3]	2.09[3]
MW-355	UA	6	370.39	0.02[3]	0.024[3]	0.05[3]
MW-356	UA	6	424.92	1.79	2.01	2.92
MW-358	UA	6	No Target	1.1	1.25	1.67
MW-366	UA	6	409.99	1.19	1.66	2.7
MW-369	UA	6	413.31	0.592	1.55	2.4
MW-370	UA	6	402.35	1.56	1.82	2.67
MW-374	UA	6	388.62	No Target		
MW-375	UA	6	392.00	0.979	1.37	2.06
MW-377	UA	6	416.56	1.54	1.74	2.01
MW-382	UA	5	414.96	1.6	1.75	2.57
MW-383	UA	6	441.03	1.26	1.42	2.05
MW-384	UA	6	445.34	1.26	1.48	2.26
MW-385	UA	6	No Target	2.45	2.45	2.45
MW-386	UA	6	No Target	1.34	1.34	1.34
MW-388	UA	6	393.34	No Target		
MW-389	UA	6	400.58	No Target		
MW-390	UA	6	423.44	0.175	0.546	2.3
MW-391	UA	6	No Target	1.3	3.25	8.91
MW-392	UA	6	428.08 [2]	1.57	1.72	2.33
MW-393	UA	6	429.29 [2]	1.53	1.83	2.04
MW-394	UA	6	432.69 [2]	1.87	2.02	2.23
OW-156	UU	2	421.74	0.02[3]	0.024[3]	0.03[3]
OW-157	UU	2	426.61	44.6[3]	45.2[3]	45.3[3]
TPZ-164	CCR	1	431.14	1.09	1.47	2.04
XPW01	CCR	1	426.15 [2]	0.93	0.942	1.03
XPW02	CCR	1	433.52 [2]	1.18	1.2	1.52
XPW04	CCR	1	426.56 [2]	1.15	1.28	1.38
XPW05	CCR	1	432.43 [2]	1.02	1.16	1.25
XPW06	CCR	1	415.07 [2]	2.29	3.86	4.64

[O: EGP 1/3/23, C: JJW 1/4/23, U: JJW 5/2/23, C: EGP 5/16/23]

Notes:

[1] Target groundwater elevations represent modified median groundwater elevations from December 2015 to June 2022. Anomalous groundwater elevations (e.g., groundwater elevations that do not represent static groundwater conditions, groundwater elevation outliers, or groundwater elevations measured in error) monitored between December 2015 and June 2022 were removed from the median groundwater elevation calculations used as flow calibration targets.

[2] Target groundwater elevation used most recent measurement (November 2022) for wells constructed or reoccupied in 2022
[3] Target boron concentration used dissolved boron data from November 2010 to December 2022
ID = identification
mg/L = milligrams per liter
NAVD88 = North American Vertical Datum of 1988

Hydrogeologic Unit:
CCR = coal combustion residuals
UA = uppermost aquifer
UU = upper unit

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TABLE 5-1. FLOW MODEL INPUT AND SENSITIVITY ANALYSIS RESULTS
GROUNDWATER MODELING REPORT
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Zone	Zone Description	Materials	ft/d	cm/s	Kh/Kv	Value Source	Sensitivity[1]
Horizontal Hydraulic Conductivity			**Calibration Model**				
1	UU	silty clay	0.07	2.47E-05	NA	Calibrated - Near Geomean Hydraulic Conductivity Field Test Results for Wells Screened in the Upper Unit (Ramboll, 2023d)	Moderate
2	Old East Fly Ash Pond	CCR	0.5	1.76E-04	NA	Calibrated - Near Geomean of Vertical Hydraulic Conductivity Laboratory Test Results from FAPS Wells (Ramboll, 2023d)	Negligible
3	East Fly Ash Pond	CCR	0.5	1.76E-04	NA	Calibrated - Near Geomean of Vertical Hydraulic Conductivity Laboratory Test Results from FAPS Wells (Ramboll, 2023d)	Low
4	West Fly Ash Pond	CCR	0.5	1.76E-04	NA	Calibrated - Near Geomean of Vertical Hydraulic Conductivity Laboratory Test Results from FAPS Wells (Ramboll, 2023d)	Low
7	Bottom Ash Pond	CCR	1.5	5.29E-04	NA	Calibrated - Near Minimum Hydraulic Conductivity Field Test Results for Wells Screened in BAP (Ramboll, 2023d)	Moderate
8	UA (Decomposed Bedrock)	bedrock	0.05	1.76E-05	NA	Calibrated - Within Range of Hydraulic Conductivity Field Test Results for Wells Screened in Bedrock (Ramboll, 2023d)	Low
9	UA	bedrock	0.05	1.76E-05	NA	Calibrated - Within Range of Hydraulic Conductivity Field Test Results for Wells Screened in Bedrock (Ramboll, 2023d)	High
10	UU (Top of Vandalia)	silty clay	0.07	2.47E-05	NA	Calibrated - Near Geomean Hydraulic Conductivity Field Test Results for Wells Screened in the Upper Unit (Ramboll, 2023d)	Low
12	River Alluvium	silty clay	0.6	2.12E-04	NA	Calibrated	Low
14	PMP	sand seams	0.3	1.06E-04	NA	Calibrated - Near Geomean Hydraulic Conductivity Field Test Results for Wells Screened Across Upper Unit Sands (Ramboll, 2023d)	Moderate
16	Fill at BAP & FAPS Boundary	fill	0.5	1.76E-04	NA	Calibrated	Negligible
100	Above River Boundary Condition	NA	500	1.76E-01	NA	Calibrated - Conductivity Value to Allow Groundwater Flow to River Boundary Conditions	Negligible
Vertical Hydraulic Conductivity			**Calibration Model**				
1	UU	silty clay	0.007	2.47E-06	10	Calibrated - Within Range of Upper Unit Vertical Hydraulic Conductivity Laboratory Test Results (Ramboll, 2023d)	Moderate
2	Old East Fly Ash Pond	CCR	0.5	1.76E-04	1	Calibrated - Near Geomean of Vertical Hydraulic Conductivity Laboratory Test Results from FAPS Wells (Ramboll, 2023d)	Negligible
3	East Fly Ash Pond	CCR	0.5	1.76E-04	1	Calibrated - Near Geomean of Vertical Hydraulic Conductivity Laboratory Test Results from FAPS Wells (Ramboll, 2023d)	Negligible
4	West Fly Ash Pond	CCR	0.5	1.76E-04	1	Calibrated - Near Geomean of Vertical Hydraulic Conductivity Laboratory Test Results from FAPS Wells (Ramboll, 2023d)	Negligible
7	Bottom Ash Pond	CCR	1.5	5.29E-04	1	Calibrated - Near BAP Well TPZ-164 Vertical Hydraulic Conductivity Laboratory Test Results (Ramboll, 2023d)	Negligible
8	UA (Decomposed Bedrock)	bedrock	0.01	3.53E-06	5	Calibrated	Low

TABLE 5-1. FLOW MODEL INPUT AND SENSITIVITY ANALYSIS RESULTS
GROUNDWATER MODELING REPORT
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Zone	Zone Description	Materials	ft/d	cm/s	Kh/Kv	Value Source	Sensitivity[1]
Vertical Hydraulic Conductivity			**Calibration Model**				
9	UA	bedrock	0.005	1.76E-06	10	Calibrated	Moderate
10	UU (Top of Vandalia)	silty clay	0.007	2.47E-06	10	Calibrated - Within Range of Upper Unit Vertical Hydraulic Conductivity Laboratory Test Results (Ramboll, 2023d)	Low
12	River Alluvium	silty clay	0.6	2.12E-04	1	Calibrated	Negligible
14	PMP	sand seams	0.3	1.06E-04	1	Calibrated - Near Geomean Hydraulic Conductivity Field Test Results for Wells Screened Across Upper Unit Sands (Ramboll, 2023d)	Negligible
16	Fill at BAP & FAPS Boundary	fill	0.5	1.76E-04	NA	Calibrated	Negligible
100	Above River Boundary Condition	NA	500	1.76E-01	1	Calibrated - Conductivity Value to Allow Groundwater Flow to River Boundary Conditions	Negligible
Recharge			**Calibration Model**				
1	Silty Clay	silty clay	1.00E-05	0.04	NA	Calibrated	Low
2	Old East Fly Ash Pond	CCR	6.80E-05	0.30	NA	calibrated - 2021-2022 recharge at FAPS consistent with estimated closed FAPS recharge values in 2014 FAPS groundwater modeling report (NRT, 2014b; NRT, 2014c)	Low
3	East Fly Ash Pond	CCR	6.80E-05	0.30	NA	calibrated - 2021-2022 recharge at FAPS consistent with estimated closed FAPS recharge values in 2014 FAPS groundwater modeling report (NRT, 2014b; NRT, 2014c)	Low
4	West Fly Ash Pond	CCR	6.80E-05	0.30	NA	calibrated - 2021-2022 recharge at FAPS consistent with estimated closed FAPS recharge values in 2014 FAPS groundwater modeling report (NRT, 2014b; NRT, 2014c)	Low
5	Secondary Pond	silty clay	1.00E-05	0.04	NA	Calibrated	Negligible
6	Tertiary Pond	silty clay	1.00E-05	0.04	NA	Calibrated	Negligible
7	Bottom Ash Pond	CCR	1.80E-04	0.79	NA	Calibrated	Low
Storage							
1	UU	silty clay	*Not used in steady-state calibration model*				
2	Old East Fly Ash Pond	CCR					
3	East Fly Ash Pond	CCR					
4	West Fly Ash Pond	CCR					
7	Bottom Ash Pond	CCR					
8	UA (Decomposed Bedrock)	bedrock					
9	UA	bedrock					
10	UU (Top of Vandalia)	silty clay					
12	River Alluvium	silty clay					
14	PMP	sand seams					
16	Fill at BAP & FAPS Boundary	fill					
100	Above River Boundary Condition	NA					

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TABLE 5-1. FLOW MODEL INPUT AND SENSITIVITY ANALYSIS RESULTS
GROUNDWATER MODELING REPORT
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

River Parameters							
	Relative Location	**Stage of River (feet)**	**Sensitivity**	**River Bottom Elevation (feet)**	**Hydraulic Conductivity (ft / d)**	**Average River Conductance (ft^2 / d)**	**Sensitivity**
Reach 0	Cooling Pond	429	Moderate	410	3.80	3.80E+04	Negligible
Reach 1	Kaskaskia River	370	High	365	5.17	5.17E+04	Negligible
Reach 2	South Stream (Southern Limit of Model Domain)	456.03-370	Negligible	452.03-365.54	2.08	2.08E+04	Negligible
Reach 3	South Stream (Between Reach 2 and Reach 4)	449.98-370.06	Moderate	447.98-368.06	2.05	2.05E+04	Negligible
Reach 4	South Stream (Adjacent to FAPS)	445-368	Moderately High	443-366	0.36	3.60E+03	Negligible
Reach 5	Northwest Stream (West of Cooling Pond)	410.66-370	Negligible	408.66-368	3.89	3.89E+04	Negligible
Reach 7	Northeast Stream (East of Cooling Pond)	454.75-427	High	452.75-425	2.60	2.60E+04	Negligible
Reach 8	Secondary and Tertiary Pond	396	Low	394.99-376.17	0.26	2.60E+03	Negligible

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TABLE 5-1. FLOW MODEL INPUT AND SENSITIVITY ANALYSIS RESULTS
GROUNDWATER MODELING REPORT
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

River Parameters							
Value Source	NA	Calibrated - Cooling Pond Stage (Reach 0) Approximates Elevation at which Pond is Maintained; Kaskasia River Stage (Reach 1) at Baldwin Power Plant Based on Interpolated Stage Data Provided at New Athens, Illinois (USGS 5595000) and Red Bud (USGS 5595240); River Stage at Reaches 2 through 7 Approximate Topography; River Stage at Reach 8 Based on Historic Groundwater Elevation within Secondary and Tertiary Ponds at TPZ-165	NA	Calibrated	Calibrated	Calibrated	NA

Constant Head Parameters			
	Relative Location	**Head at Boundary (feet)**	**Sensitivity**
Reach 0	BAP Constant Head West	415	Negligible
Reach 1	BAP Constand Head Central	425	Negligible
Value Source	NA	Calibrated - Head at Boundary Based on Estimated Water Surface Elevation within BAP	NA

[O: JJW 2/17/2023 ; C: EGP 5/18/23]

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
BAP = bottom ash pond
FAPS = fly ash pond system
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:
CCR = coal combustion residuals
PMP = potential migration pathway
UA = uppermost aquifer
UU = upper unit

References:

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TABLE 5-2. TRANSPORT MODEL INPUT VALUES (CALIBRATION)
GROUNDWATER MODELING REPORT
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

	Hydrostratigraphic Unit	Materials	Calibration Model						
			Calibration Model 1 Dates: 1970-2020 Recharge (ft/d)	Calibration Model 2 Dates: 2021-2022 Recharge (ft/d)	Boron Concentration (mg/L)	Calibration Model 1 Dates: 1970-2020 Constant Head (feet)	Calibration Model 2 Dates: 2021-2022 Constant Head (feet)	Value Source	Sensitivity
Initial Concentration									
Entire Domain	NA	NA	NA	NA	0	NA	NA	NA	- - -
Source Concentration (recharge)									
Zone 2	Old East Fly Ash Pond	CCR	4.00E-04	6.80E-05	38	NA	NA	calibrated - 2021-2022 recharge at FAPS consistent with estimated closed FAPS recharge values in 2014 FAPS groundwater modeling report (NRT, 2014b; NRT, 2014c)	- - -
Zone 3	East Fly Ash Pond	CCR	8.00E-04	6.80E-05	79	NA	NA	calibrated - 2021-2022 recharge at FAPS consistent with estimated closed FAPS recharge values in 2014 FAPS groundwater modeling report (NRT, 2014b; NRT, 2014c)	- - -
Zone 4	West Fly Ash Pond	CCR	6.00E-04	6.80E-05	47	NA	NA	calibrated - 2021-2022 recharge at FAPS consistent with estimated closed FAPS recharge values in 2014 FAPS groundwater modeling report (NRT, 2014b; NRT, 2014c)	- - -
Zone 7	Bottom Ash Pond (West)	CCR	1.80E-04	1.80E-04	4	NA	NA	calibrated	- - -
Zone 8	Bottom Ash Pond (East)	CCR	1.80E-04	1.80E-04	1.5	NA	NA	calibrated	- - -
Source Concentration (constant concentration cells) and Stormwater Management (constant head cells)									
Reach 2	Old East Fly Ash Pond	CCR	NA	NA	38	NA	NA	calibrated	- - -
Reach 3	East Fly Ash Pond	CCR	NA	NA	79	NA	NA	calibrated	- - -
Reach 4	West Fly Ash Pond Constant Head	CCR	NA	NA	47	424.3	NA	calibrated - head at boundary consistent with stormwater management practices within the active FAPS (AECOM, 2016b)	- - -
Reach 14	West Fly Ash Pond (Berm)	CCR	NA	NA	47	NA	NA	calibrated	- - -
Reach 0	BAP Constant Head West	CCR	NA	NA	4	415	415	calibrated - head at boundary based on estimated water surface elevation within BAP	- - -
Reach 1	BAP Constand Head Central	CCR	NA	NA	4	425	425	calibrated - head at boundary based on estimated water surface elevation within BAP	- - -
Reach 7	Bottom Ash Pond (West)	CCR	NA	NA	4	NA	NA	calibrated	- - -
Reach 8	Bottom Ash Pond (East)	CCR	NA	NA	1.5	NA	NA	calibrated	- - -

TABLE 5-2. TRANSPORT MODEL INPUT VALUES (CALIBRATION)
GROUNDWATER MODELING REPORT
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Storage, Specific Yield and Effective Porosity

Zone	Hydrostratigraphic Unit	Materials	Storage	Specific Yield	Effective Porosity	Value Source	Sensitivity
1	UU	silty clay	0.003	0.15	0.15	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Calibrated - Effective Porosity Estimated from Literature (Fetter, 1988; Morris and Johnson, 1967; Heath, 1983; Walton, 1988)	see Table 5-3
2	Old East Fly Ash Pond	CCR	0.003	0.2	0.2	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Calibrated - Effective Porosity Estimated from Literature (Fetter, 1988; Morris and Johnson, 1967; Heath, 1983; Walton, 1988)	see Table 5-3
3	East Fly Ash Pond	CCR	0.003	0.2	0.2	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Calibrated - Effective Porosity Estimated from Literature (Fetter, 1988; Morris and Johnson, 1967; Heath, 1983; Walton, 1988)	see Table 5-3
4	West Fly Ash Pond	CCR	0.003	0.2	0.2	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Calibrated - Effective Porosity Estimated from Literature (Fetter, 1988; Morris and Johnson, 1967; Heath, 1983; Walton, 1988)	see Table 5-3
7	Bottom Ash Pond	CCR	0.003	0.25	0.25	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Calibrated - Effective Porosity Estimated from Literature (Fetter, 1988; Morris and Johnson, 1967; Heath, 1983; Walton, 1988)	see Table 5-3
8	UA (Decomposed Bedrock)	bedrock	0.003	0.15	0.15	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Calibrated - Effective Porosity Estimated from Literature (Fetter, 1988; Morris and Johnson, 1967; Heath, 1983; Walton, 1988)	see Table 5-3
9	UA	bedrock	0.003	0.3	0.3	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Calibrated - Effective Porosity Estimated from Literature (Fetter, 1988; Morris and Johnson, 1967; Heath, 1983; Walton, 1988)	see Table 5-3
10	UU (Top of Vandalia)	silty clay	0.003	0.15	0.15	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Calibrated - Effective Porosity Estimated from Literature (Fetter, 1988; Morris and Johnson, 1967; Heath, 1983; Walton, 1988)	see Table 5-3
12	River Alluvium	silty clay	0.003	0.15	0.15	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Calibrated - Effective Porosity Estimated from Literature (Fetter, 1988; Morris and Johnson, 1967; Heath, 1983; Walton, 1988)	see Table 5-3
14	PMP	sand seams	0.003	0.25	0.25	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Calibrated - Effective Porosity Estimated from Literature (Fetter, 1988; Morris and Johnson, 1967; Heath, 1983; Walton, 1988)	see Table 5-3
16	Fill at BAP & FAPS Boundary	fill	0.003	0.2	0.2	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Calibrated - Effective Porosity Estimated from Literature (Fetter, 1988; Morris and Johnson, 1967; Heath, 1983; Walton, 1988)	see Table 5-3
100	Above River Boundary Condition	NA	0.003	0.5	0.5	Storage Estimated from Literature (Fetter, 1988); Specific Yield Set Equal to Effective Porosity; Calibrated - Effective Porosity Estimated from Literature (Fetter, 1988; Morris and Johnson, 1967; Heath, 1983; Walton, 1988)	see Table 5-3

TABLE 5-2. TRANSPORT MODEL INPUT VALUES (CALIBRATION)
GROUNDWATER MODELING REPORT
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Dispersivity						
Applicable Region	**Hydrostratigraphic Unit**	**Materials**	**Longitudinal (feet)**	**Transverse (feet)**	**Vertical (feet)**	**Sensitivity**
Entire Domain	NA	NA	5	0.5	0.05	- - -

[O: JJW 5/5/2023, C:EGP 5/22/23]

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

Hydrogeologic Unit:
CCR = coal combustion residuals
PMP = potential migration pathway
UA = uppermost aquifer
UU = upper unit

References:

AECOM, 2016b. RE: History of Construction, USEPA Final Rule, 40 C.F.R. § 257.73 (c), Baldwin Energy Complex, Baldwin, Illinois. October.
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Walton, W.C., 1988. Practical Aspects of Groundwater Modeling. National Water Well Association, Worthington, Ohio.
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Natural Resource Technology, Inc. (NRT), 2014c. Groundwater Model and Simulation of Closure Alternatives, Model Report Addendum Baldwin Ash Pond System. September 30.

TABLE 5-3. TRANSPORT MODEL INPUT VALUES (SENSITIVITY)
GROUNDWATER MODELING REPORT
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Well ID	Calibration Concentration (mg/L)	Storage and Specific Yield				Effective Porosity			
		File Name		File Name		File Name		File Name	
		BAL_Conc_324_T_A _s_sy_low.gwv BAL_Conc_324_T_B_2_s_sy_low.gwv		BAL_Conc_324_T_A _s_sy_high.gwv BAL_Conc_324_T_B_2_s_sy_high.gwv		BAL_Conc_324_T_A_por_low.gwv BAL_Conc_324_T_B_2_por_low.gwv		BAL_Conc_324_T_A_por_high.gwv BAL_Conc_324_T_B_2_por_high.gwv	
		Concentration (mg/L)	Sensitivity [1]	Concentration (mg/L)	Sensitivity [1]	Concentration (mg/L)	Sensitivity [1]	Concentration (mg/L)	Sensitivity [1]
MW-116	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-126	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-158R	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-192	2.3E-02	2.2E-02	low	2.3E-02	low	2.5E-02	moderate	2.0E-02	moderate
MW-193	0.2	0.3	moderate	0.2	low	0.3	moderate	0.2	moderate
MW-194	1.3	1.2	low	1.3	negligible	1.4	low	1.2	low
MW-203	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-204	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-258	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-304	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-306	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-307	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-350	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-356	5.0E-06	3.0E-06	moderate	6.0E-06	moderate	9.0E-06	moderately high	3.0E-06	moderate
MW-358	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-366	1.5	0.6	moderately high	2.4	moderately high	2.0	moderate	1.1	moderate
MW-369	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-370	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-375	1.3	0.5	moderately high	1.9	moderate	1.8	moderate	0.9	moderate
MW-377	4.9E-03	0.0	high	3.0E-02	high	1.2E-02	high	1.4E-03	moderately high
MW-382	0.3	4.44E-03	moderately high	1.5	high	0.7	high	0.2	moderately high
MW-383	4.6E-02	1.2E-02	moderately high	4.2E-02	low	9.0E-02	moderately high	2.4E-02	moderate
MW-384	0.2	0.1	moderately high	0.1	moderately high	0.3	moderately high	0.1	moderate
MW-385	0.2	2.62E-03	moderately high	0.7	high	0.3	moderately high	0.1	moderately high
MW-386	4.0E-02	0.0	high	1.3E-01	high	9.1E-02	high	1.5E-02	moderately high
MW-390	0.2	4.48E-03	moderately high	0.5	high	0.3	moderately high	0.1	moderately high
MW-391	3.5	2.7	moderate	3.8	low	4.1	moderate	2.9	moderate
MW-392	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-393	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-394	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
TPZ-164	1.5	1.5	negligible	1.5	negligible	1.5	negligible	1.5	negligible
XPW01	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
XPW02	1.5	1.5	negligible	1.5	negligible	1.5	negligible	1.5	negligible
XPW04	1.5	1.5	negligible	1.5	negligible	1.5	negligible	1.5	negligible
XPW05	1.5	1.5	negligible	1.5	negligible	1.5	negligible	1.5	negligible
XPW06	4.0	4.0	negligible	4.0	negligible	4.0	negligible	4.0	negligible

RAMBOLL

TABLE 5-3. TRANSPORT MODEL INPUT VALUES (SENSITIVITY)
GROUNDWATER MODELING REPORT
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Well ID	Calibration Concentration (mg/L)	Storage and Specific Yield				Effective Porosity			
		File Name		File Name		File Name		File Name	
		BAL_Conc_324_T_A _s_sy_low.gwv BAL_Conc_324_T_B_2_s_sy_low.gwv		BAL_Conc_324_T_A _s_sy_high.gwv BAL_Conc_324_T_B_2_s_sy_high.gwv		BAL_Conc_324_T_A_por_low.gwv BAL_Conc_324_T_B_2_por_low.gwv		BAL_Conc_324_T_A_por_high.gwv BAL_Conc_324_T_B_2_por_high.gwv	
		Concentration (mg/L)	Sensitivity [1]	Concentration (mg/L)	Sensitivity [1]	Concentration (mg/L)	Sensitivity [1]	Concentration (mg/L)	Sensitivity [1]
MW-104SR	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-104DR	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-150	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-151	6.1	2.8	moderately high	10.3	moderately high	9.7	moderately high	3.1	moderate
MW-152	2.5	2.9	moderate	1.1	moderately high	3.7	moderate	1.6	moderate
MW-153	9.0E-06	0.0	high	3.0E-06	moderately high	1.0E-04	high	1.0E-06	moderately high
MW-154	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-155	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-252	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
MW-253	0.0	0.0	negligible	0.0	negligible	6.00E-06	negligible	0.0	negligible
MW-352	1.0E-06	2.1E-05	high	0.0	high	0.0	high	1.0E-06	negligible
MW-355	0.0	0.0	negligible	0.0	negligible	0.0	negligible	0.0	negligible
OW-156	0.7	0.7	negligible	0.7	low	0.7	low	0.6	low
OW-157	14.8	19.4	moderate	7.3	moderately high	20.0	moderate	11.3	moderate
		S*0.1 Sy*0.5		S*10 Sy*2[2]		Porosity-0.05		Porosity+0.05	

[O: JJW 5/22/23; C: EGP 5/23/23]

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 100 (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
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Closure Scenario Number (Drainage Length)	BAP CIP - Consolidation Area (Top)	BAP CIP - Consolidation Area (Slopes)	Notes
Input Parameter			
Climate-General			
City	Baldwin, IL	Baldwin, IL	Nearby city to the Site within HELP database
Latitude	38.18	38.18	Site latitude
Evaporative Zone Depth	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	Maximum for geographic location (Illinois) (Tolaymat, T. and Krause, M, 2020)
Growing Season Period, Average Wind Speed, and Quarterly Relative Humidity	Belleville Scott Air Force Base, IL	Belleville Scott Air Force Base, IL	Nearby city to the Baldwin Ash Pond within HELP database
Number of Years for Synthetic Data Generation	30	30	
Temperature, Evapotranspiration, and Precipitation	Precipitation, temperature, and solar radiation was simulated based on HELP V4 weather simulation for: Lat/Long: 38.18/ -89.85	Precipitation, temperature, and solar radiation was simulated based on HELP V4 weather simulation for: Lat/Long: 38.18/ -89.85	
Soils-General			
% where runoff possible	100	100	
Area (acres)	53.73	21.39	CIP - Consolidation and Cover System Area based on construction drawing for Baldwin Ash Pond
Specify Initial Moisture Content	No	No	
Surface Water/Snow	Model Calculated	Model Calculated	
Soils-Layers			
1	Vegetative Soil Layer (HELP Final Cover Soil [topmost layer])	Vegetative Soil Layer (HELP Final Cover Soil [topmost layer])	Layers details for CIP areas based on grading plans, construction drawings, and cover system design for Baldwin BAP
2	Protective Soil Layer (HELP Vertical Percolation Layer)	Protective Soil Layer (HELP Vertical Percolation Layer)	
3	Geotextile Protective Layer (Custom)	Geocomposite Drainage Layer (HELP Geosynthetic Drainage Net)	
4	Geomembrane Liner	Geomembrane Liner	
5	Unsaturated CCR Material (HELP Waste)	Unsaturated CCR Material (HELP Waste)	
Soil Parameters--Layer 1			
Type	1	1	Vertical Percolation Layer (Cover Soil)
Thickness (in)	6	6	Layer 1 thickness is the average thickness of unsaturated backfill material
Texture	26	26	Default used for CIP Consolidation area
Description	Silty Clay Loam (Moderate)	Silty Clay Loam (Moderate)	
Saturated Hydraulic Conductivity (cm/s)	1.90E-06	1.90E-06	Default used for CIP Consolidation area
Soil Parameters--Layer 2			
Type	1	1	Vertical Percolation Layer (BAP)
Thickness (in)	18	18	design thickness

TABLE 6-1. HELP MODEL INPUT AND OUTPUT VALUES
GROUNDWATER MODELING REPORT
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Closure Scenario Number (Drainage Length)	BAP CIP - Consolidation Area (Top)	BAP CIP - Consolidation Area (Slopes)	Notes
Texture	28	28	Defaults used
Description	Silty Clay (Moderate)	Silty Clay (Moderate)	
Saturated Hydraulic Conductivity (cm/s)	1.20E-06	1.20E-06	Defaults used
Soil Parameters--Layer 3			
Type	2	2	Lateral Drainage Layer
Thickness (in)	0.175	0.2	design thickness
Texture	43	20	Custom used for the top area of the CIP and a Default used for the slopes
Description	16 oz Nonwoven Geotextile	Geosynthetic Drainage Net	
Saturated Hydraulic Conductivity (cm/s)	3.00E-01	1.00E+01	Custom used for the top area of the CIP and a Defaults used for the slopes
Soil Parameters--Layer 4			
Type	4	4	Flexible Membrane Liner
Thickness (in)	0.04	0.04	design thickness
Texture	36	36	Defaults used
Description	LDPE Membrane	LDPE Membrane	
Saturated Hydraulic Conductivity (cm/s)	4.00E -13	4.00E -13	Defaults used
Soil Parameters--Layer 5			
Type	1	1	Vertical Percolation Layer (Waste)
Thickness (in)	545.28	231.72	design thickness
Texture	83	83	Custom used for CCR material
Description	Unsaturated CCR Material (HELP Waste)	Unsaturated CCR Material (HELP Waste)	
Saturated Hydraulic Conductivity (cm/s)	5.29E-04	5.29E-04	Custom used for CCR material from HCR average
Soils--Runoff			
Runoff Curve Number	89.8	91.1	HELP-computed curve number
Slope	2.00%	25.00%	Estimated from construction design drawings
Length (ft)	600	150	estimated maximum flow path
Vegetation	fair	fair	fair indicating fair stand of grass on surface of soil backfill
Execution Parameters			
Years	30	30	
Report Daily	No	No	
Report Monthly	No	No	
Report Annual	Yes	Yes	
Output Parameter			
Unsaturated Percolation Rate (in/yr)	**0.000239**	**0.000007**	

Notes:
[O: EGP 12/15/22, C: LCA 12/16/22]

% = percent
ft = feet
HELP = Hydrologic Evaluation of Landfill Performance
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), 2021. Hydrogeologic Site Characterization Report. Newton Primary Ash Pond. Newton Power Plant. Newton, Illinois.

TABLE 6-2. PREDICTION MODEL INPUT VALUES
GROUNDWATER MODELING REPORT
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Scenario: CIP (CCR removal from the western areas of the Bottom Ash Pond, consolidation to the eastern areas of the Bottom Ash Pond, and construction of a cover system over the remaining CCR)

Prediction Model	Model Years	Zone Description	Recharge Zone	Boron Recharge Concentration (mg/L)	Recharge (ft/day)	Recharge (in/yr)	Source Concentration (constant concentration cells) and Stormwater Management (constant head cells) Description	Reach Number	Constant Head (feet)	Constant Concentration (mg/L)
Initial Conditions	51	Old East Fly Ash Pond	2	38	4.00E-04	1.75	Old East Fly Ash Pond	2	--	38
Initial Conditions	51	East Fly Ash Pond	3	79	8.00E-04	3.50	East Fly Ash Pond	3	--	79
Initial Conditions	51	West Fly Ash Cell	4	47	6.00E-04	2.63	--	--	--	--
Initial Conditions	51	--	--	--	--	--	West Fly Ash Pond Constant Head	4	424.3	47
Initial Conditions	51	--	--	--	--	--	West Fly Ash Pond (Berm)	14	--	47
Initial Conditions	51	--	--	--	--	--	BAP Constant Head West	0	415.0	4
Initial Conditions	51	--	--	--	--	--	BAP Constand Head Central	1	425.0	4
Initial Conditions	51	Bottom Ash Pond (West)	7	4	1.80E-04	0.79	Bottom Ash Pond (West)	7	--	4
Initial Conditions	51	Bottom Ash Pond (East)	8	1.5	1.80E-04	0.79	Bottom Ash Pond (East)	8	--	1.5
Exisiting Conditions	4	Old East Fly Ash Pond (Post-Closure)	2	38	6.80E-05	0.30	Old East Fly Ash Pond	2	--	38
Exisiting Conditions	4	East Fly Ash Pond (Post-Closure)	3	79	6.80E-05	0.30	East Fly Ash Pond	3	--	79
Exisiting Conditions	4	West Fly Ash Cell (Post-Closure)	4	47	6.80E-05	0.30	--	--	--	--
Exisiting Conditions	4	--	--	--	--	--	West Fly Ash Pond Constant Head	4	--	47
Exisiting Conditions	4	--	--	--	--	--	West Fly Ash Pond (Berm)	14	--	47
Exisiting Conditions	4	--	--	--	--	--	BAP Constant Head West	0	415.0	4
Exisiting Conditions	4	--	--	--	--	--	BAP Constand Head Central	1	425.0	4
Exisiting Conditions	4	Bottom Ash Pond (West)	7	4	1.80E-04	0.79	Bottom Ash Pond (West)	7	--	4
Exisiting Conditions	4	Bottom Ash Pond (East)	8	1.5	1.80E-04	0.79	Bottom Ash Pond (East)	8	--	1.5
Dewatering	3	Old East Fly Ash Pond (Post-Closure)	2	38	6.80E-05	0.30	Old East Fly Ash Pond	2	--	38
Dewatering	3	East Fly Ash Pond (Post-Closure)	3	79	6.80E-05	0.30	East Fly Ash Pond	3	--	79
Dewatering	3	West Fly Ash Cell (Post-Closure)	4	47	6.80E-05	0.30	--	--	--	--
Dewatering	3	--	--	--	--	--	West Fly Ash Pond Constant Head	4	--	47
Dewatering	3	--	--	--	--	--	West Fly Ash Pond (Berm)	14	--	47
Dewatering	3	--	--	--	--	--	BAP Constant Head West	0	415.0	4
Dewatering	3	--	--	--	--	--	BAP Constand Head Central	1	425.0	4
Dewatering	3	Bottom Ash Pond (West)	7	4	1.80E-04	0.79	Bottom Ash Pond (West)	7	--	4
Dewatering	3	Bottom Ash Pond (East)	8	1.5	1.80E-04	0.79	Bottom Ash Pond (East)	8	--	1.5
Dewatering	3	--	--	--	--	--	CIP Area Dewater Constant Head (Northeast)	26	433	1.5
Dewatering	3	--	--	--	--	--	CIP Area Dewater Constant Head (West Central)	23	420	1.5
Dewatering	3	--	--	--	--	--	CIP Area Dewater Constant Head (Southeast)	24	433	1.5
CIP	1000	Old East Fly Ash Pond (Post-Closure)	2	38	6.80E-05	0.30	Old East Fly Ash Pond	2	--	38
CIP	1000	East Fly Ash Pond (Post-Closure)	3	79	6.80E-05	0.30	East Fly Ash Pond	3	--	79
CIP	1000	West Fly Ash Cell (Post-Closure)	4	47	6.80E-05	0.30	--	--	--	--

TABLE 6-2. PREDICTION MODEL INPUT VALUES
GROUNDWATER MODELING REPORT
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Scenario: CIP (CCR removal from the western areas of the Bottom Ash Pond, consolidation to the eastern areas of the Bottom Ash Pond, and construction of a cover system over the remaining CCR)

Prediction Model	Model Years	Zone Description	Recharge Zone	Boron Recharge Concentration (mg/L)	Recharge (ft/day)	Recharge (in/yr)	Source Concentration (constant concentration cells) and Stormwater Management (constant head cells) Description	Reach Number	Constant Head (feet)	Constant Concentration (mg/L)
CIP	1000	--	--	--	--	--	West Fly Ash Pond Constant Head	4	--	47
CIP	1000	--	--	--	--	--	West Fly Ash Pond (Berm)	14	--	47
CIP	1000	--	--	--	--	--	BAP Constant Head West	0	415.0	4
CIP	1000	--	--	--	--	--	BAP Constand Head Central	1	425.0	4
CIP	1000	Removal Area - Bottom Ash Pond (Post-Closure)	7	--	0	0	--	--	--	--
CIP	1000	CIP Top - Bottom Ash Pond (Post-Closure)	8	4	5.46E-08	2.39E-04			--	--
CIP	1000	CIP Slopes - Bottom Ash Pond (Post-Closure)	9	4	1.60E-09	7.01E-06			--	--
CIP	1000	--	--	--	--	--	CIP Area - Bottom Ash Pond (Post-Closure)	20	--	4

Prediction Model	Construction Period (years)	Zone Description	Hydraulic Conductivity Zone	Horizontal Hydraulic Conductivity (ft/d)	Horizontal Hydraulic Conductivity (cm/s)	Vertical Hydraulic Conductivity (ft/d)	Vertical Hydraulic Conductivity (cm/s)
Initial Conditions	51	Bottom Ash Pond	7	1.5	5.29E-04	1.5	5.29E-04
Exisiting Conditions	4	Bottom Ash Pond	7	1.5	5.29E-04	1.5	5.29E-04
Dewatering	3	Bottom Ash Pond	7	1.5	5.29E-04	1.5	5.29E-04
CIP	1000	CIP Top - Bottom Ash Pond (Post-Closure)	18	1.5	5.29E-04	1.5	5.29E-04
CIP	1000	CIP Slopes - Bottom Ash Pond (Post-Closure)	19	1.5	5.29E-04	1.5	5.29E-04

Prediction Model	Construction Period (years)	Drain Reach	Relative Location	Stage of Drain (feet)	Thickness of Drain Bed (feet)	Hydraulic Conductivity (ft/d)	Drain Conductance (ft^2/d)
CIP	1000	10	BAP Drain West	410	1	6.00	6.00E+04

[O: JJW 1/6/23; EGP 5/22/23]

Notes:
-- = boundary condition or property zone not included in prediction model
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
cm/s = centimeters per second

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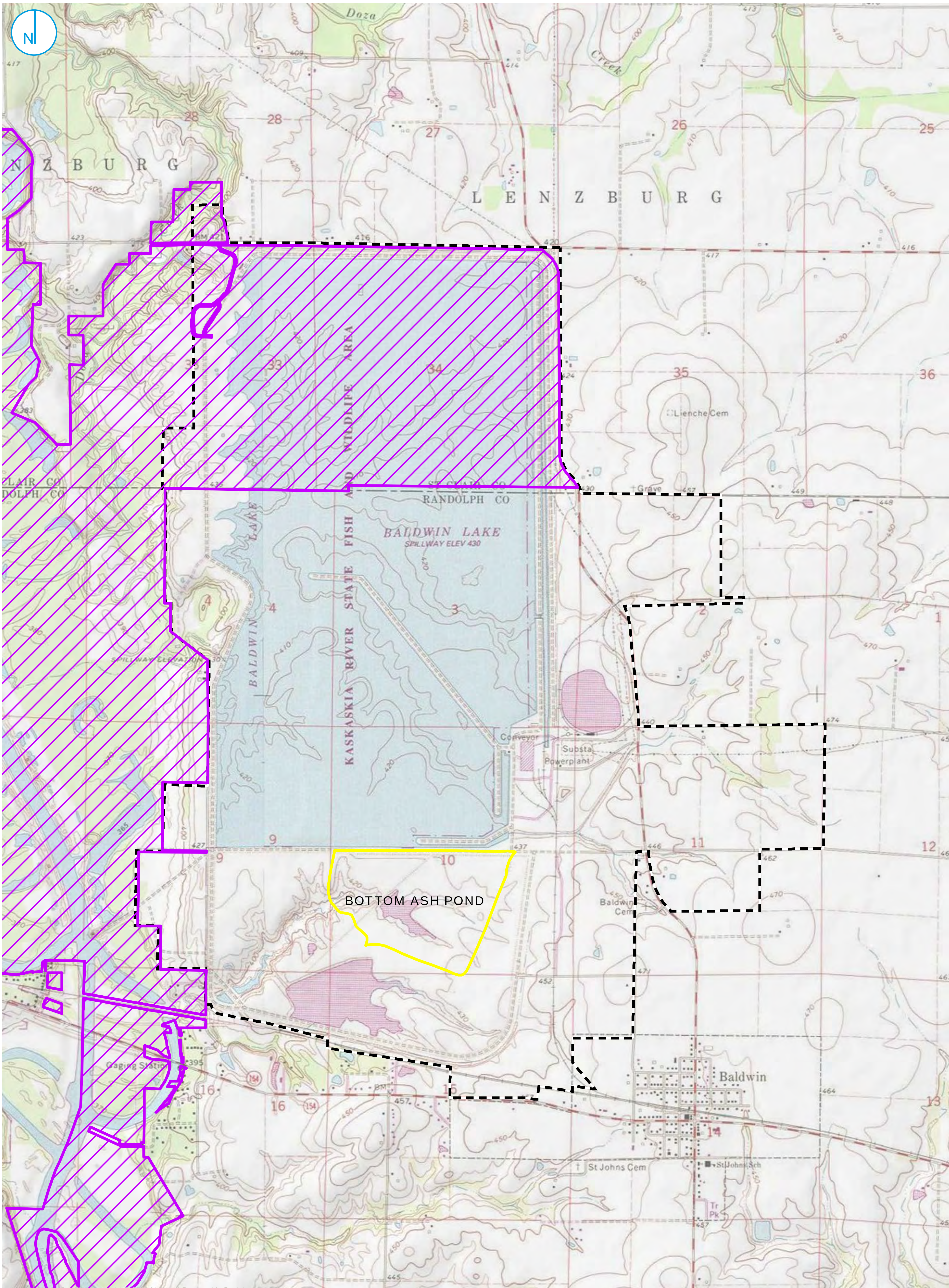
FIGURES



BOTTOM ASH POND BOUNDARY
PROPERTY BOUNDARY
KASKASKIA RIVER STATE FISH AND WILDLIFE AREA

SOURCE NOTE
I-View, Prairie State Conservation Coalition accessed via Illinois Department of Natural Resources Division of Natural Heritage Website
https://www2.illinois.gov/sites/naturalheritage/DataResearch/Pages/Access-Our-Data.aspx

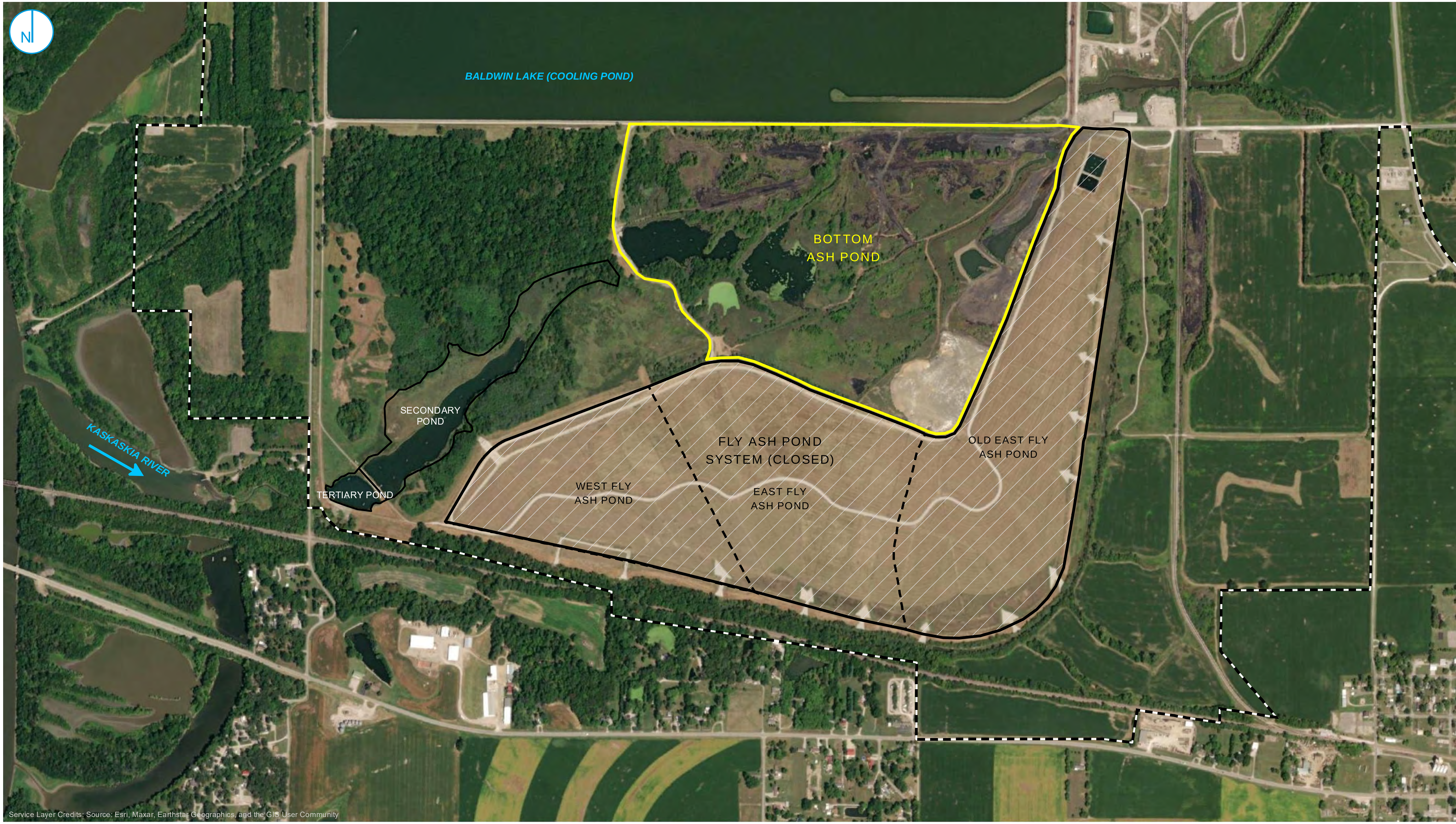
0 1,000 2,000 Feet

SITE LOCATION MAP

FIGURE 1-1

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.



Y:\Mapping\Projects\22\2285\MXD\Model_Figures\Baldwin\Figure 1-2_Base Map.mxd

PROJECT: 169000XXXX | DATED: 5/23/2023 | DESIGNER: GALARNMC

35 I.A.C. § 845 REGULATED UNIT (SUBJECT UNIT)
LIMITS OF FINAL COVER
SITE FEATURE
FLY ASH POND SYSTEM (CLOSED)
PROPERTY BOUNDARY

0 400 800 Feet

SITE MAP

FIGURE 1-2

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\Groundwater_Modeling_Report\Figure 2-1_Monitoring Well Location Map.mxd

PROJECT: 169000XXXX | DATED: 5/3/2023 | DESIGNER: GALARNMC

35 I.A.C. § 845 REGULATED UNIT (SUBJECT UNIT)
LIMITS OF FINAL COVER
SITE FEATURE
FLY ASH POND SYSTEM (CLOSED)
PROPERTY BOUNDARY
MONITORING WELL
PORE WATER WELL

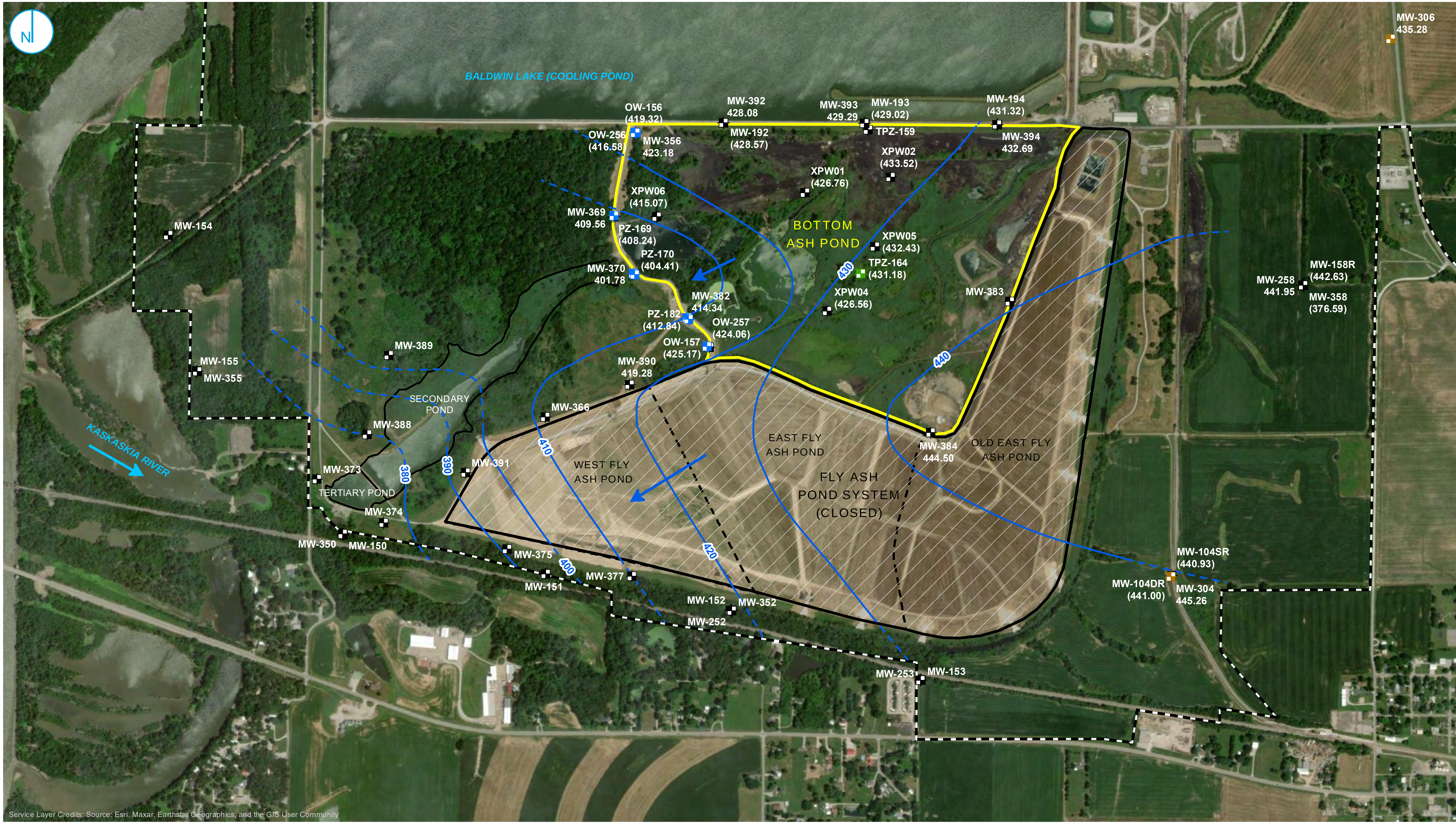
0 500 1,000 Feet

MONITORING WELL LOCATION MAP

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 2-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.



Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\Groundwater_Modeling_Report\Figure 2-2_Pot Surface 20221114.mxd

PROJECT: 169000XXXX | DATED: 1/6/2023 | DESIGNER: galarnmc

- BACKGROUND WELL
- COMPLIANCE WELL
- PORE WATER WELL
- MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- 35 I.A.C. § 845 REGULATED UNIT (SUBJECT UNIT)
- FLY ASH POND SYSTEM (CLOSED)
- SITE FEATURE
- CAPPED AREA
- PROPERTY BOUNDARY

0 400 800 Feet

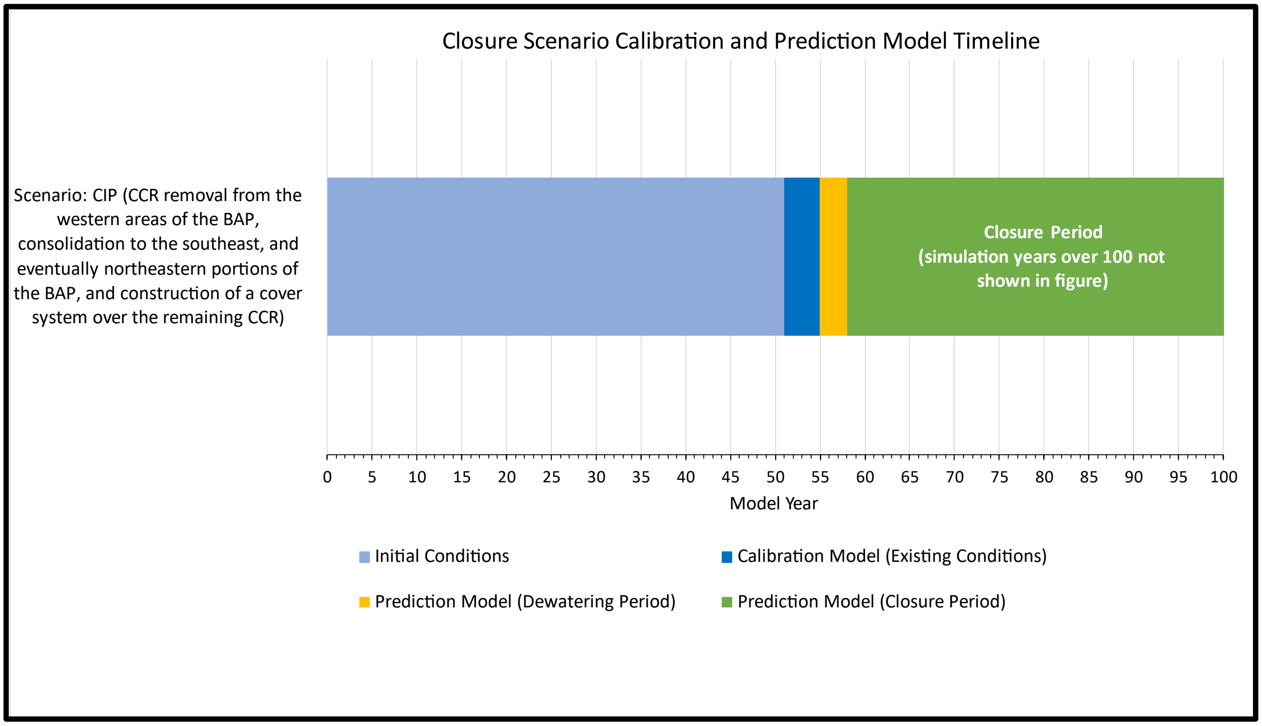
NOTES:
1. ELEVATIONS IN PARENTHESES WERE NOT USED FOR CONTOURING.
2. ELEVATION CONTOURS SHOWN IN FEET, NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

BEDROCK POTENTIOMETRIC SURFACE MAP
NOVEMBER 14, 2022

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 2-2

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.



CLOSURE SCENARIO CALIBRATION AND PREDICTION MODEL TIMELINE

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL

35 I.A.C. § 845 REGULATED UNIT (SUBJECT UNIT)
FLY ASH POND SYSTEM (CLOSED)
LIMITS OF FINAL COVER
SITE FEATURE
MODEL DOMAIN
NO FLOW AREA
RIVER
WATERBODY

0 1,250 2,500
Feet

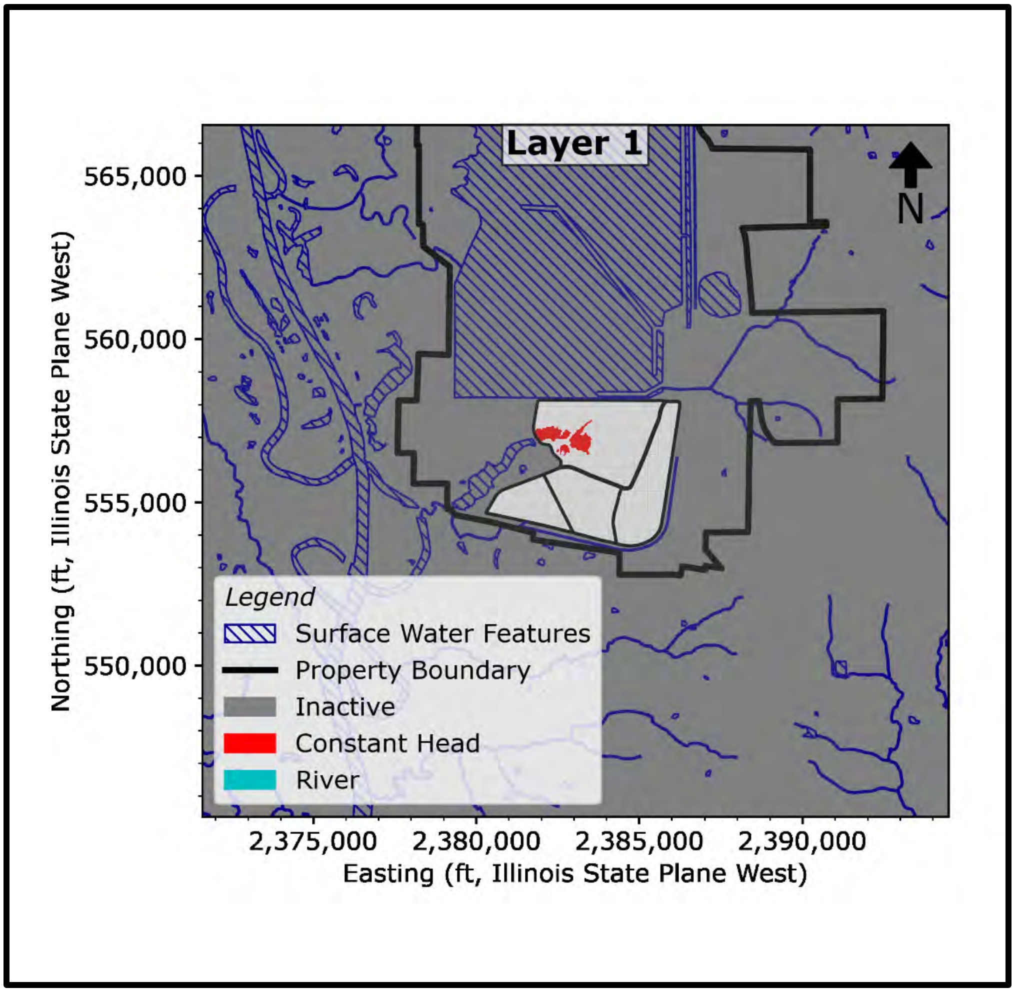
MODEL AREA MAP

FIGURE 5-1

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

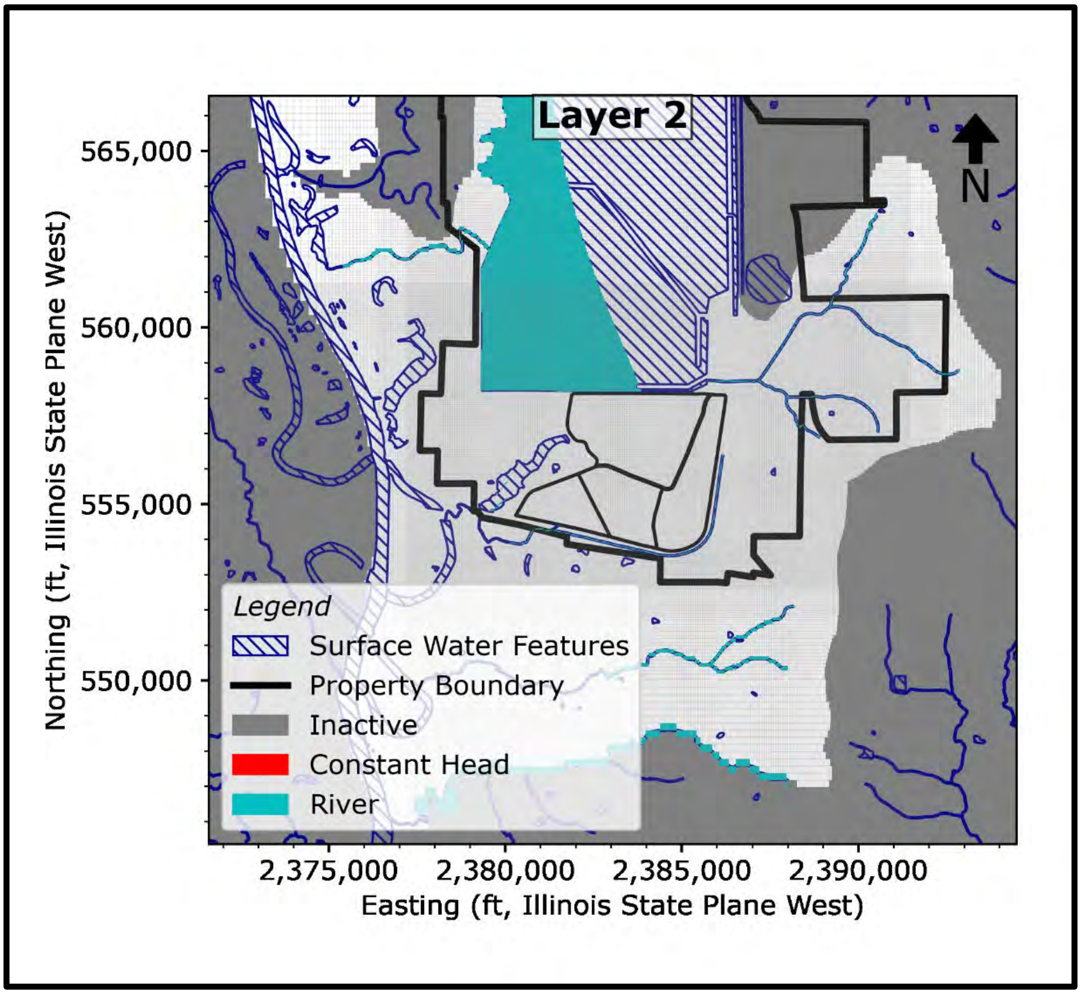


BOUNDARY CONDITIONS FOR LAYER 1 OF THE CALIBRATED NUMERICAL MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL

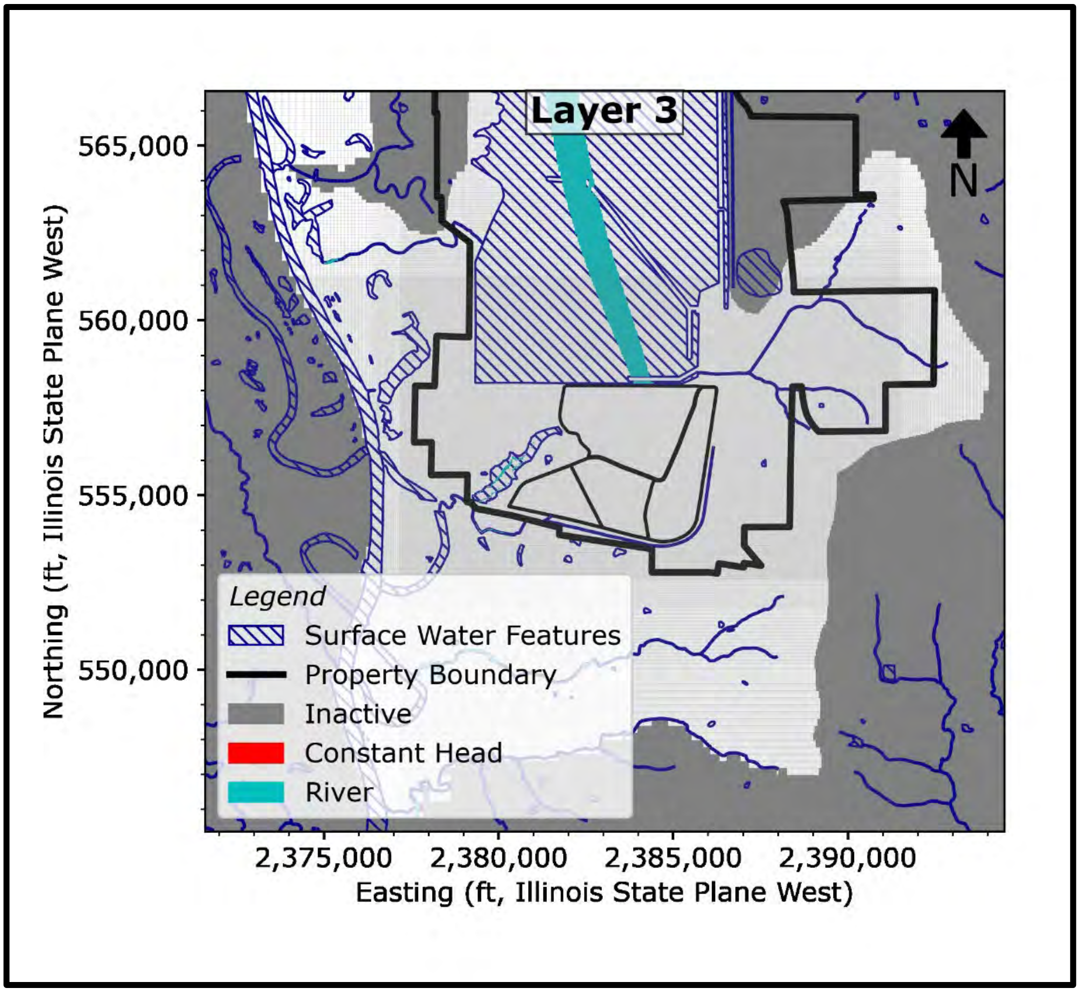
FIGURE 5-3



BOUNDARY CONDITIONS FOR LAYER 2 OF THE CALIBRATED NUMERICAL MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

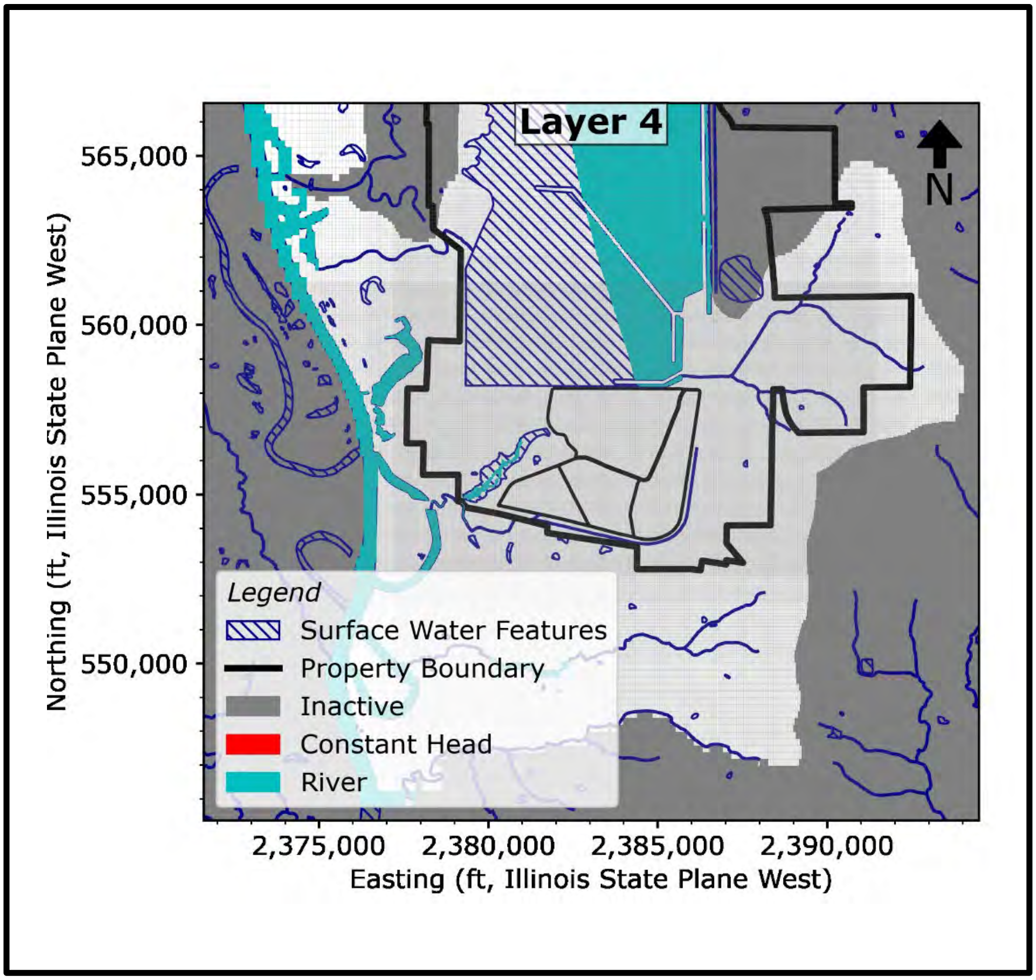
RAMBOLL



BOUNDARY CONDITIONS FOR LAYER 3 OF THE CALIBRATED NUMERICAL MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

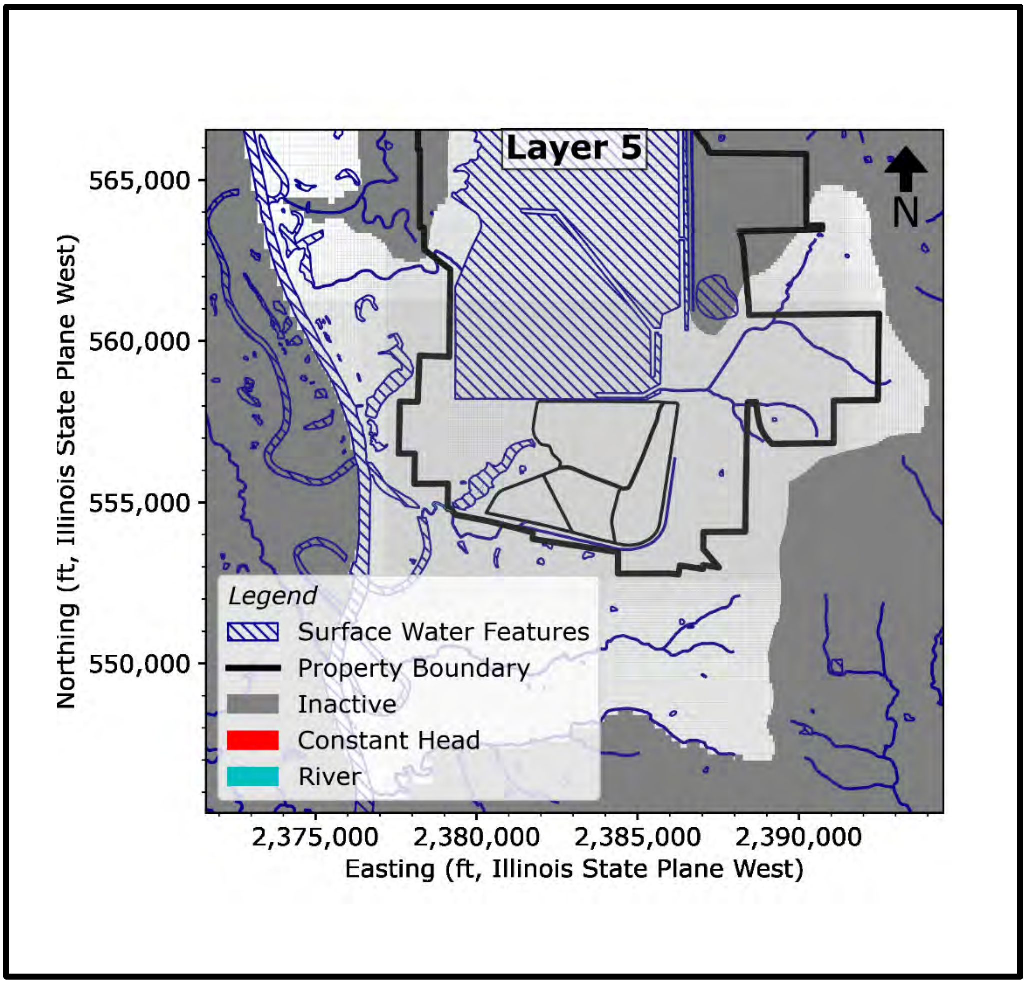
RAMBOLL



BOUNDARY CONDITIONS FOR LAYER 4 OF THE CALIBRATED NUMERICAL MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

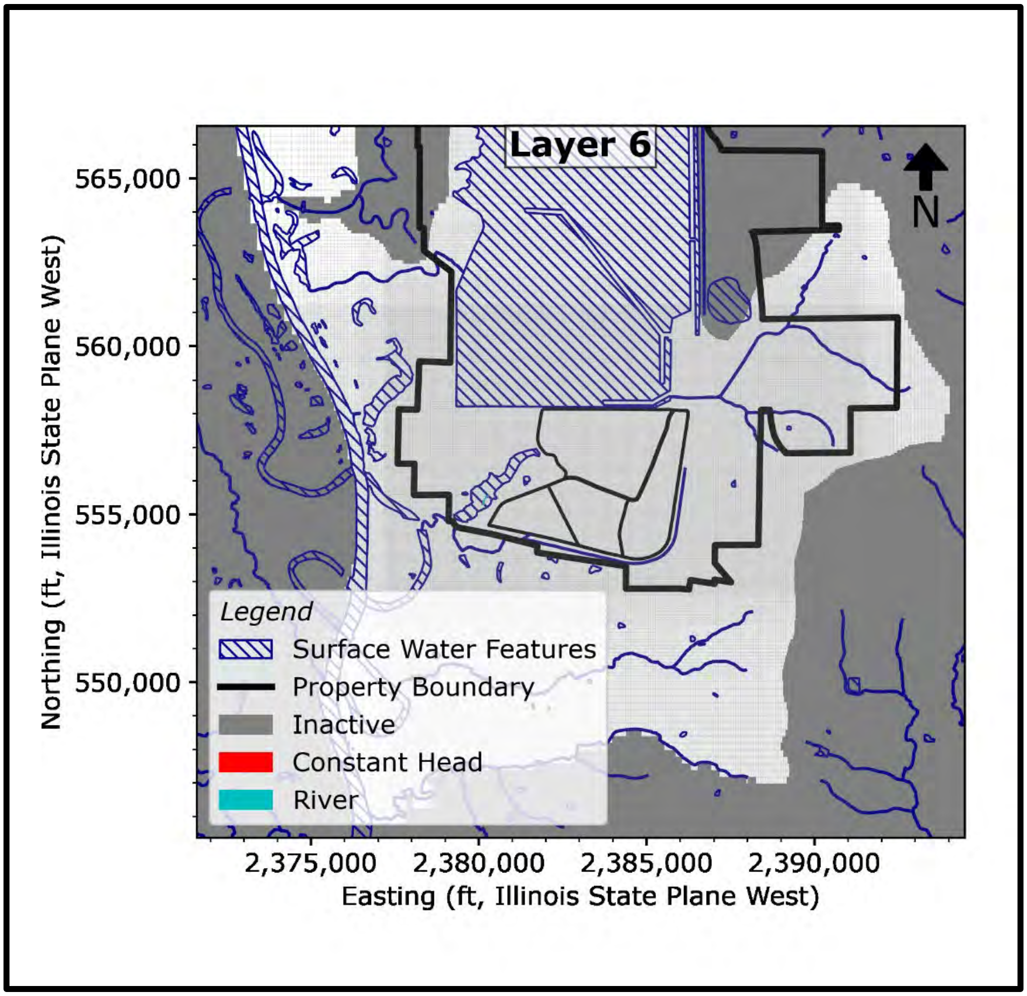
RAMBOLL



BOUNDARY CONDITIONS FOR LAYER 5 OF THE CALIBRATED NUMERICAL MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

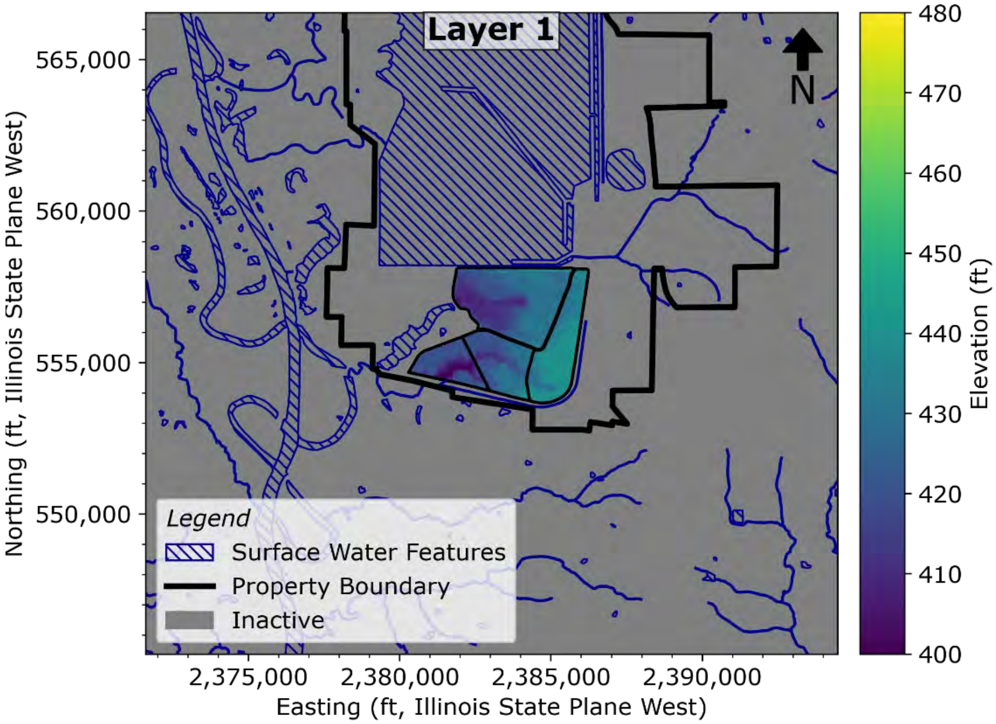
RAMBOLL



BOUNDARY CONDITIONS FOR LAYER 6 OF THE CALIBRATED NUMERICAL MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

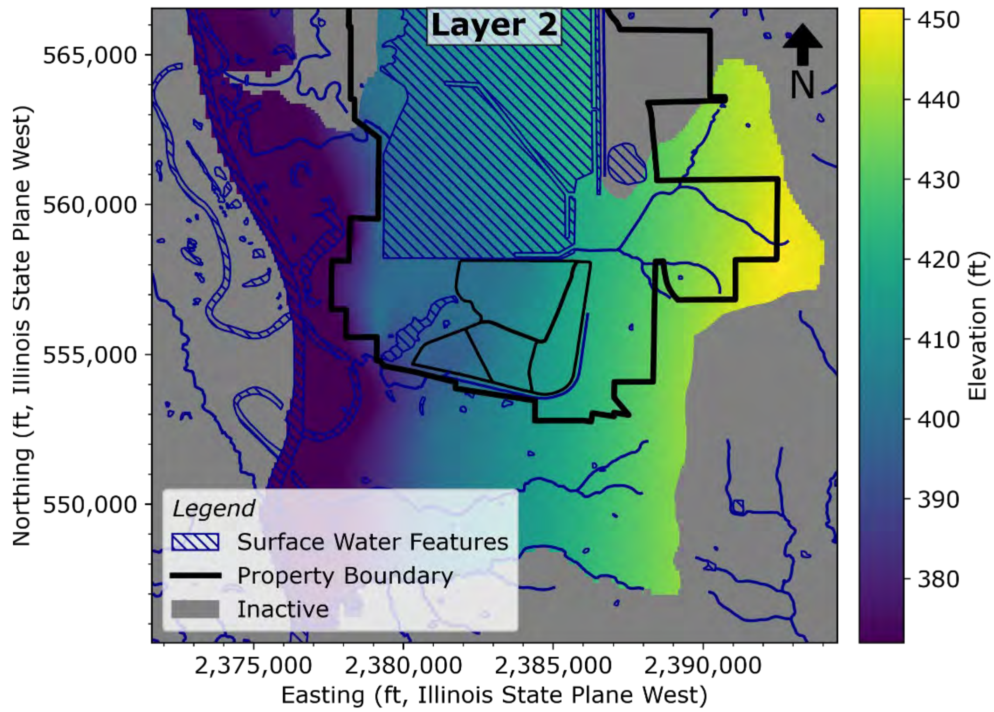
RAMBOLL



BOTTOM ELEVATION OF MODEL LAYER 1

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

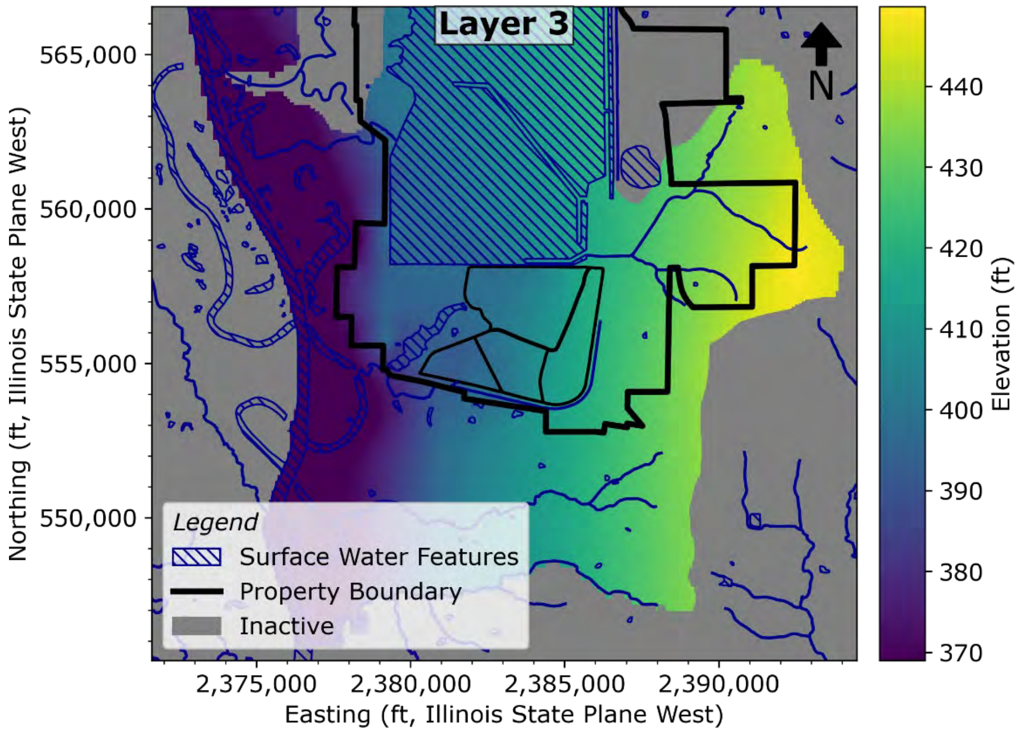
RAMBOLL



BOTTOM ELEVATION OF MODEL LAYER 2

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

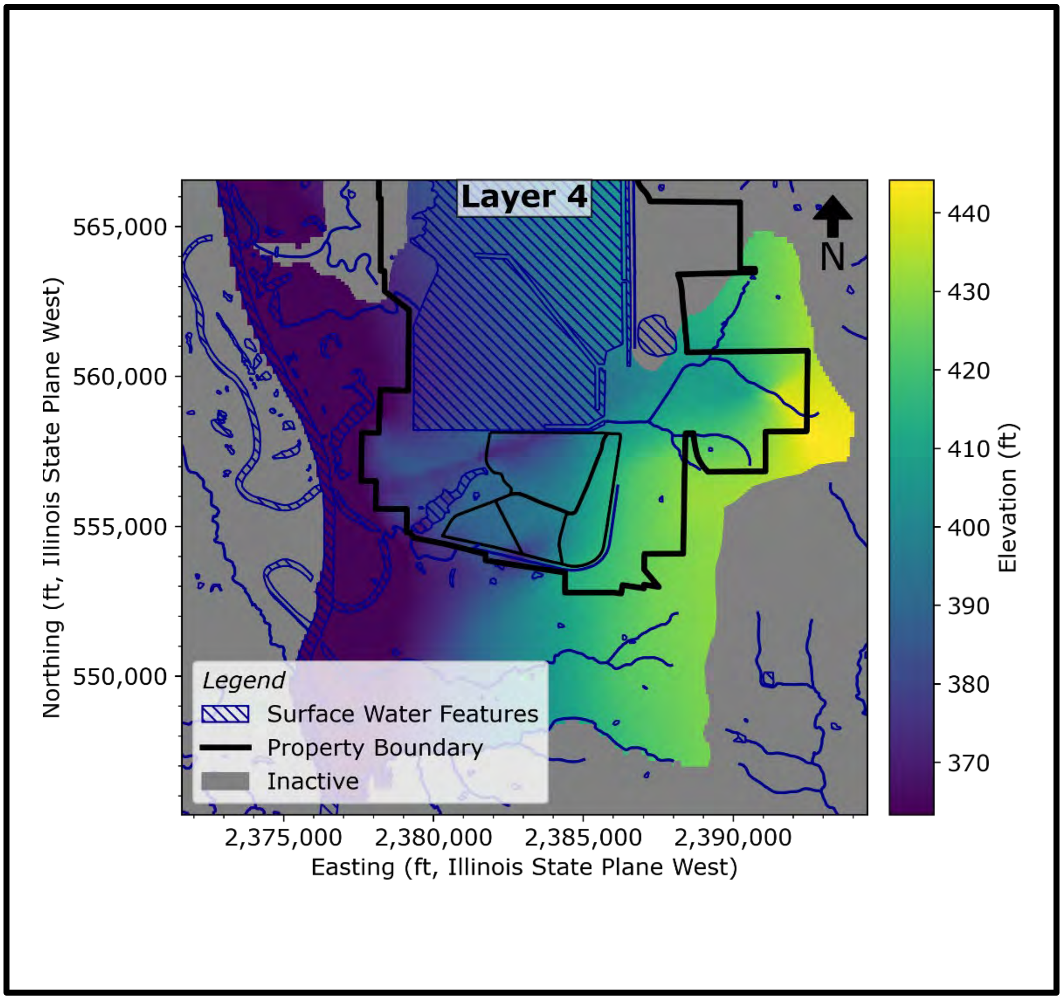
RAMBOLL



BOTTOM ELEVATION OF MODEL LAYER 3

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

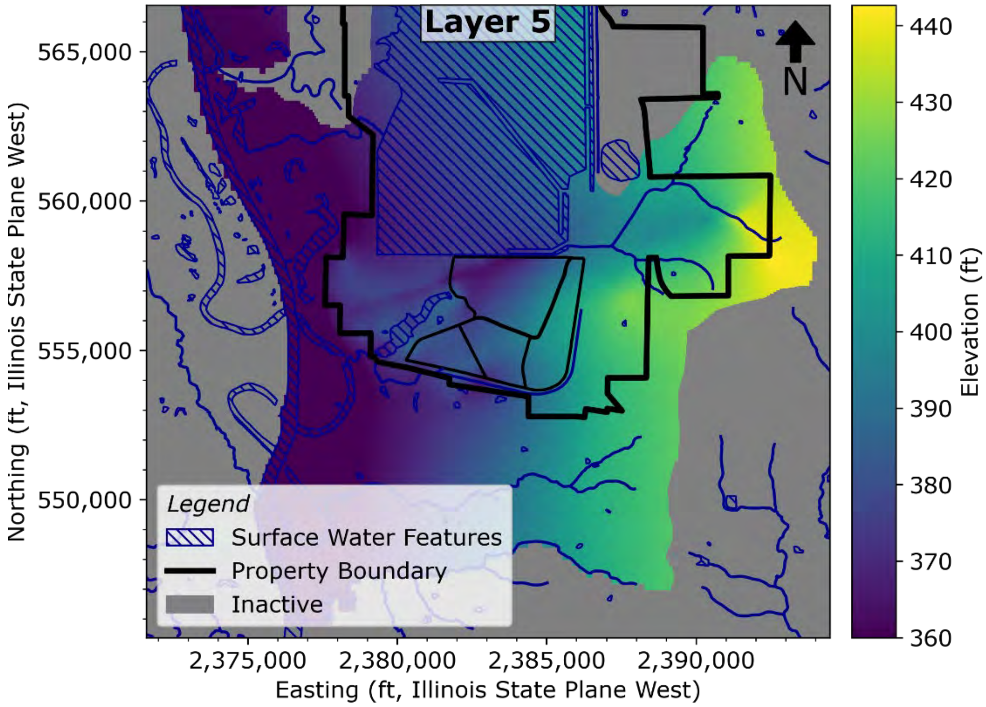
RAMBOLL



BOTTOM ELEVATION OF MODEL LAYER 4

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

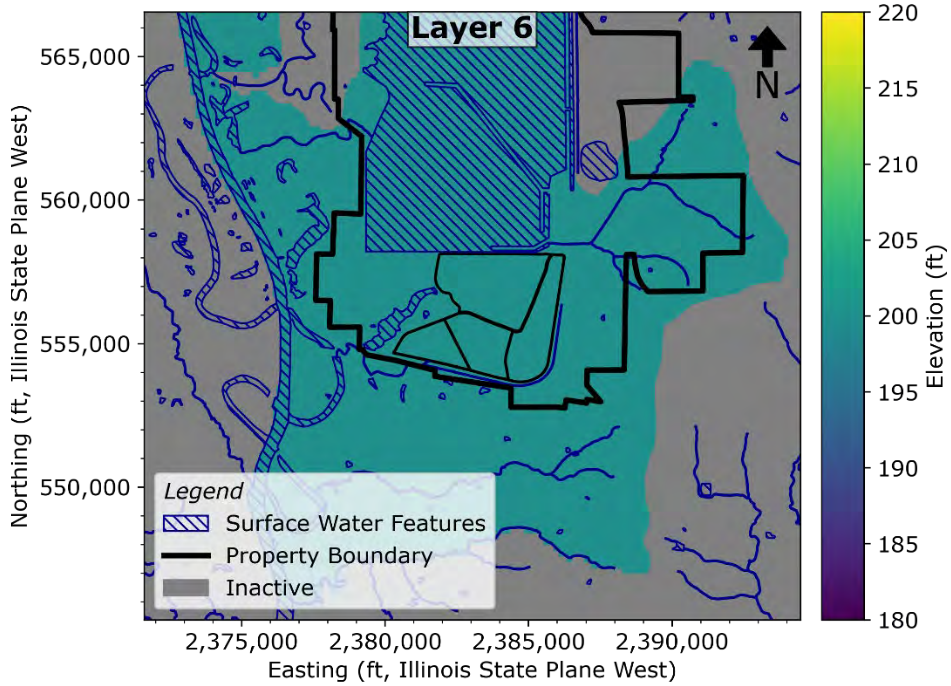
RAMBOLL



BOTTOM ELEVATION OF MODEL LAYER 5

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

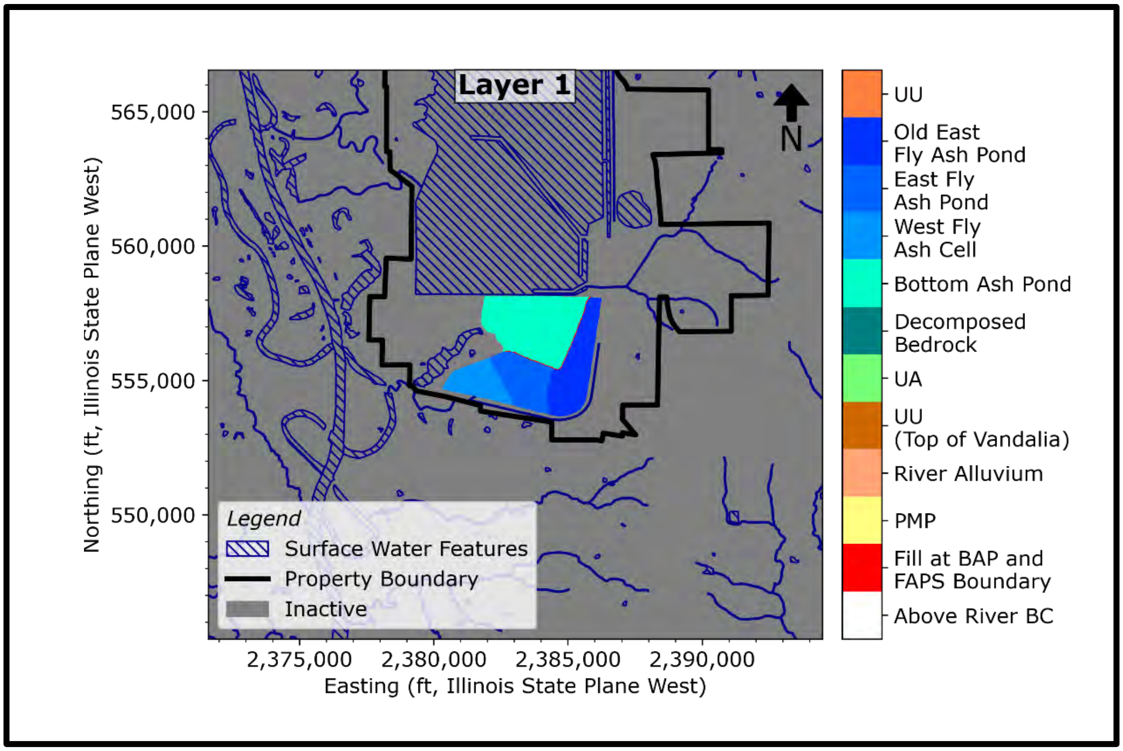
RAMBOLL



BOTTOM ELEVATION OF MODEL LAYER 6

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

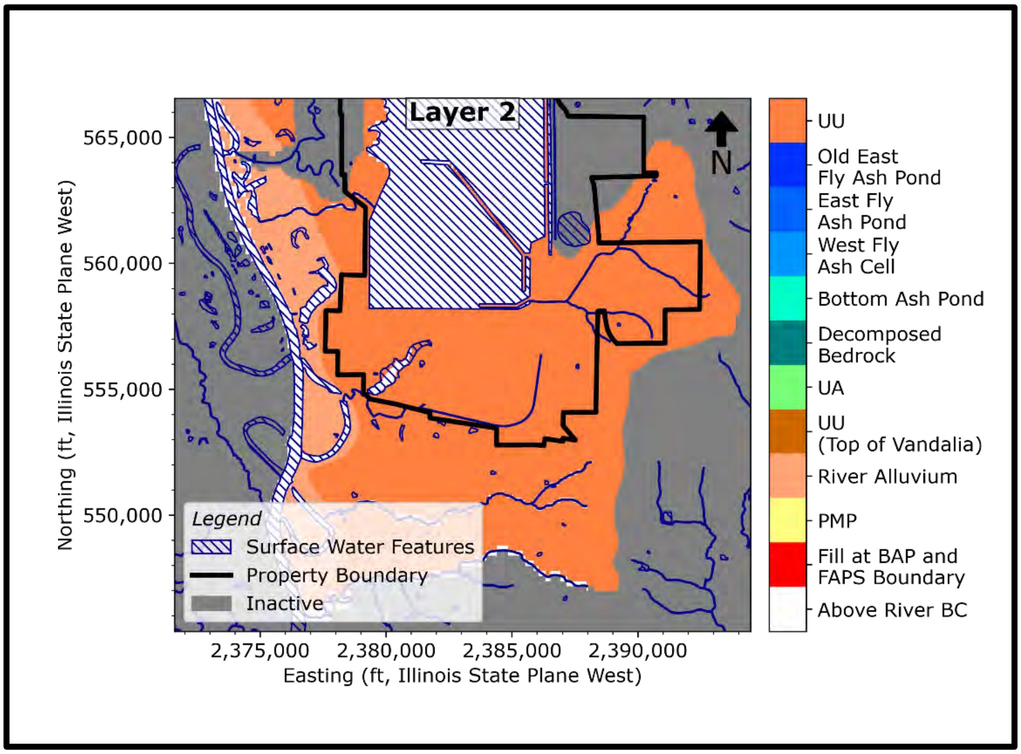
RAMBOLL



SPATIAL DISTRIBUTION OF HYDRAULIC CONDUCTIVITY ZONES FOR LAYER 1 IN THE NUMERICAL MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

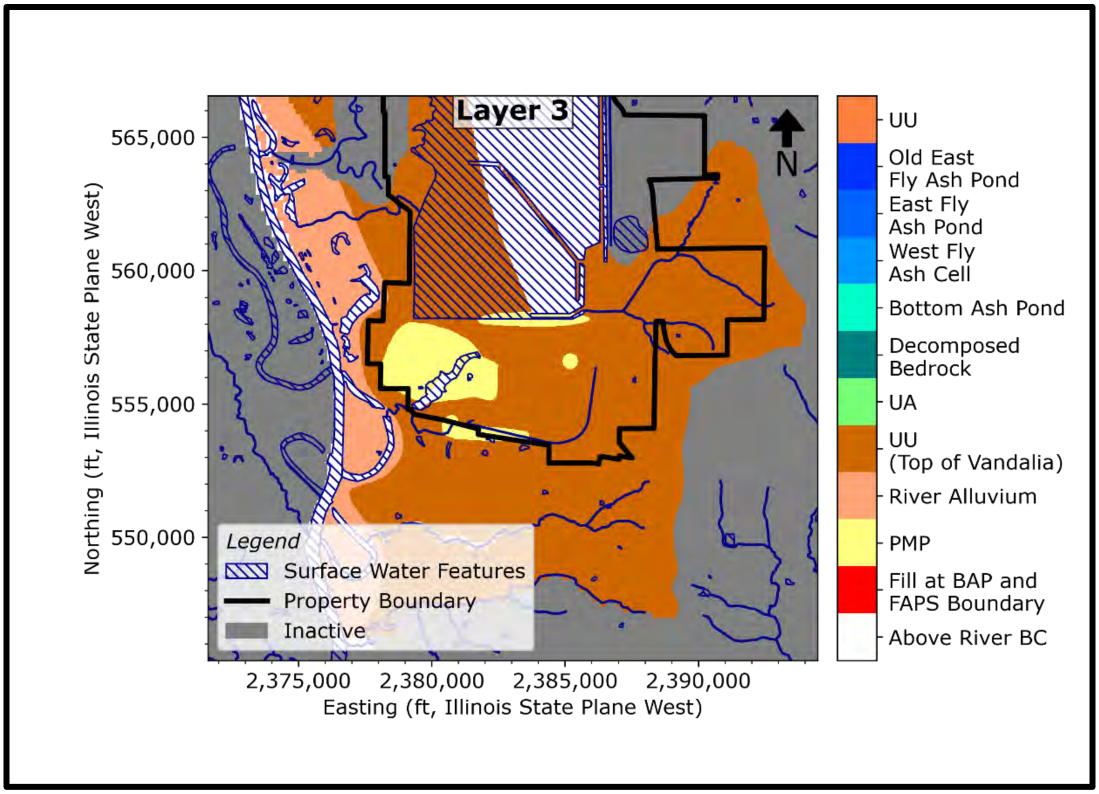
RAMBOLL



SPATIAL DISTRIBUTION OF HYDRAULIC CONDUCTIVITY ZONES FOR LAYER 2 IN THE NUMERICAL MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

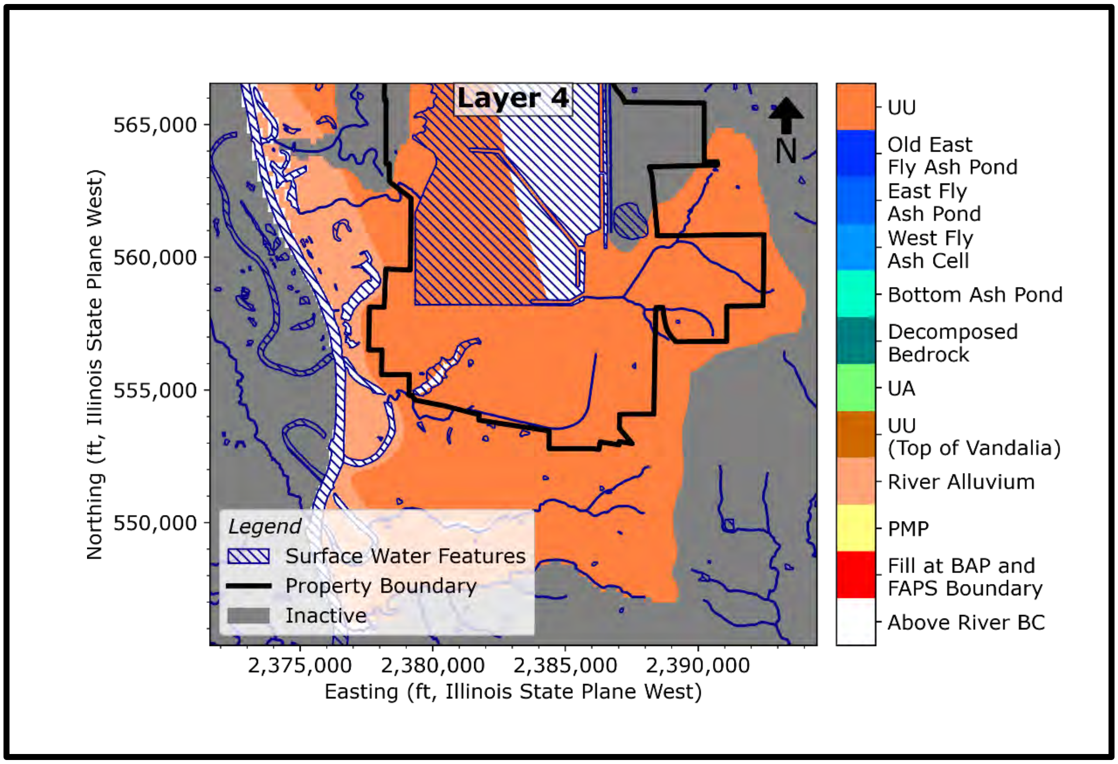
RAMBOLL



SPATIAL DISTRIBUTION OF HYDRAULIC CONDUCTIVITY ZONES FOR LAYER 3 IN THE NUMERICAL MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

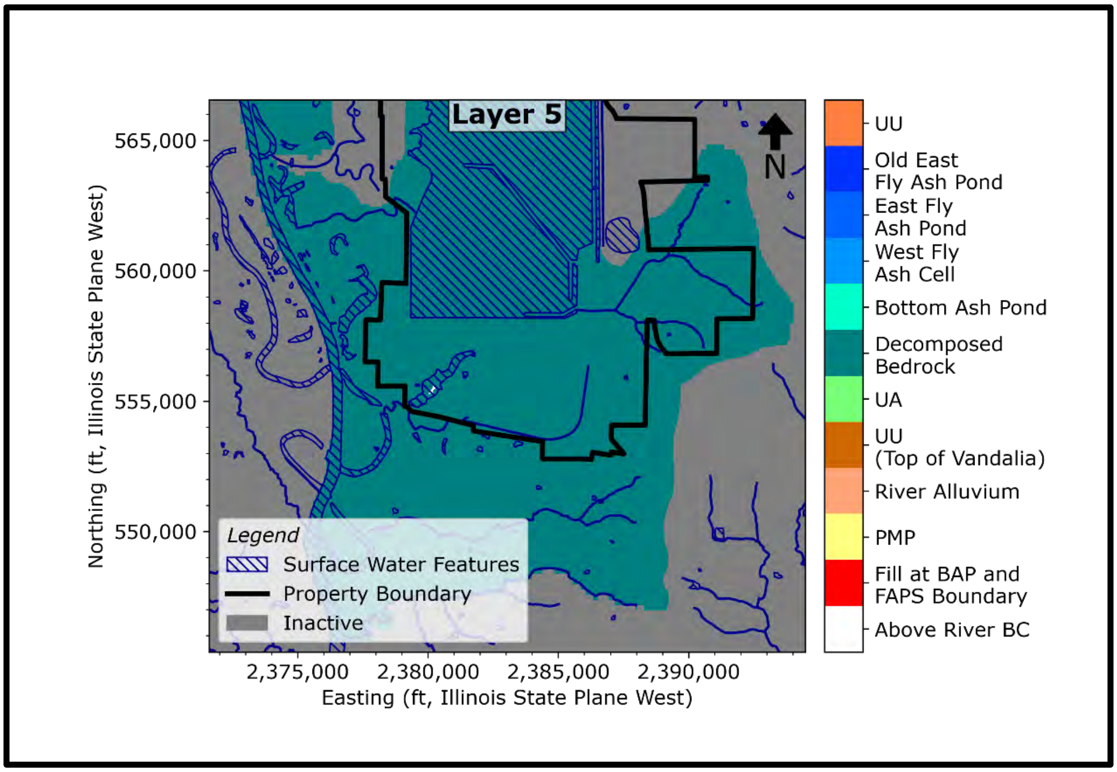
RAMBOLL



SPATIAL DISTRIBUTION OF HYDRAULIC CONDUCTIVITY ZONES FOR LAYER 4 IN THE NUMERICAL MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

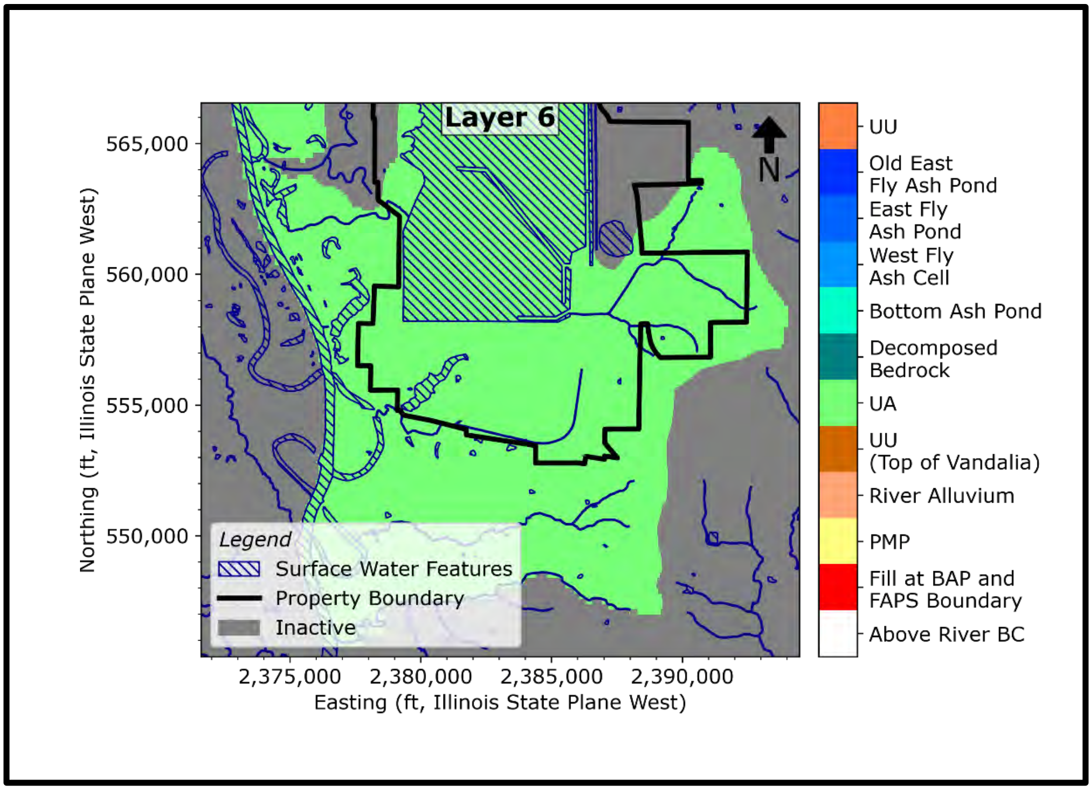
RAMBOLL



SPATIAL DISTRIBUTION OF HYDRAULIC CONDUCTIVITY ZONES FOR LAYER 5 IN THE NUMERICAL MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

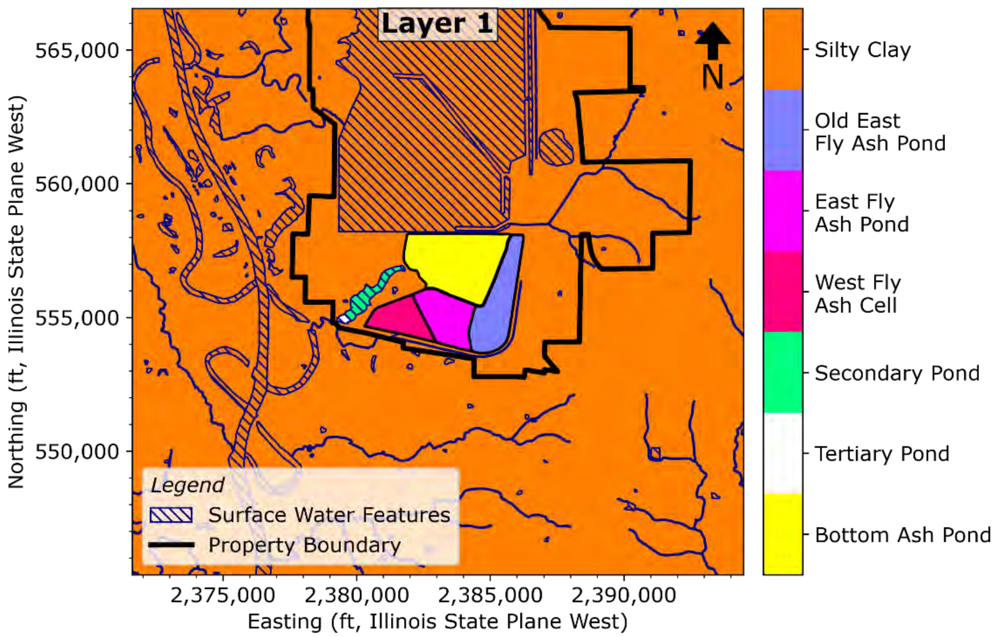
RAMBOLL



SPATIAL DISTRIBUTION OF HYDRAULIC CONDUCTIVITY ZONES FOR LAYER 6 IN THE NUMERICAL MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

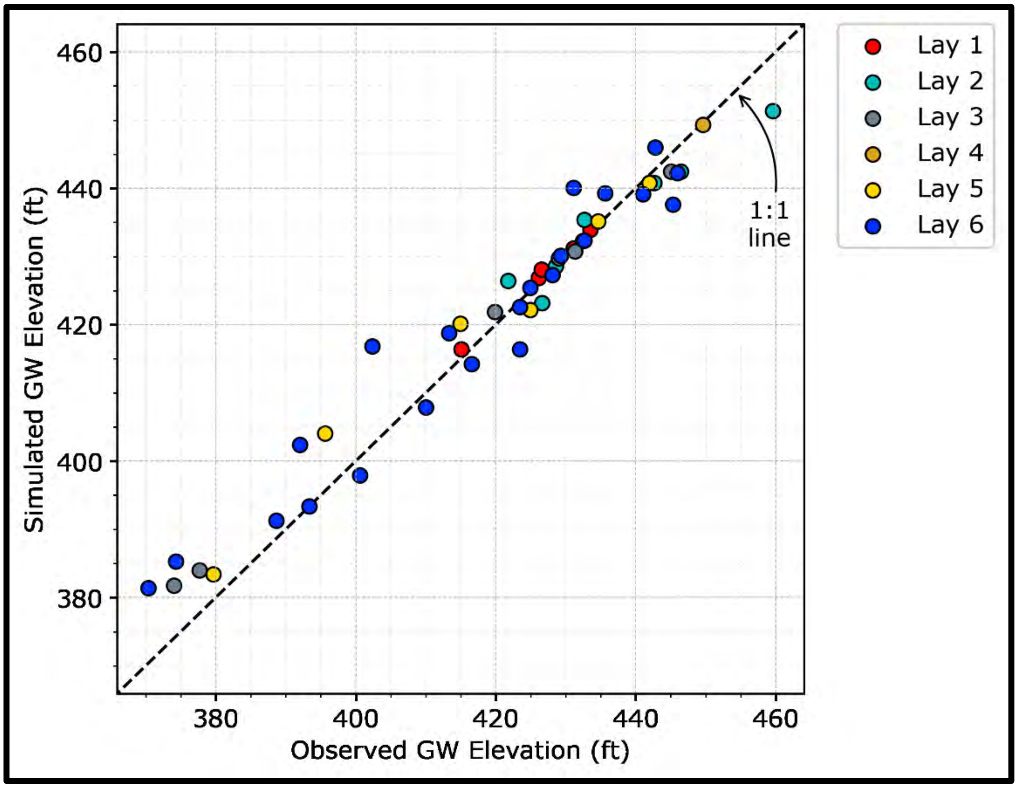
RAMBOLL



MODEL RECHARGE DISTRIBUTION (STEADY STATE CALIBRATION MODEL)

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

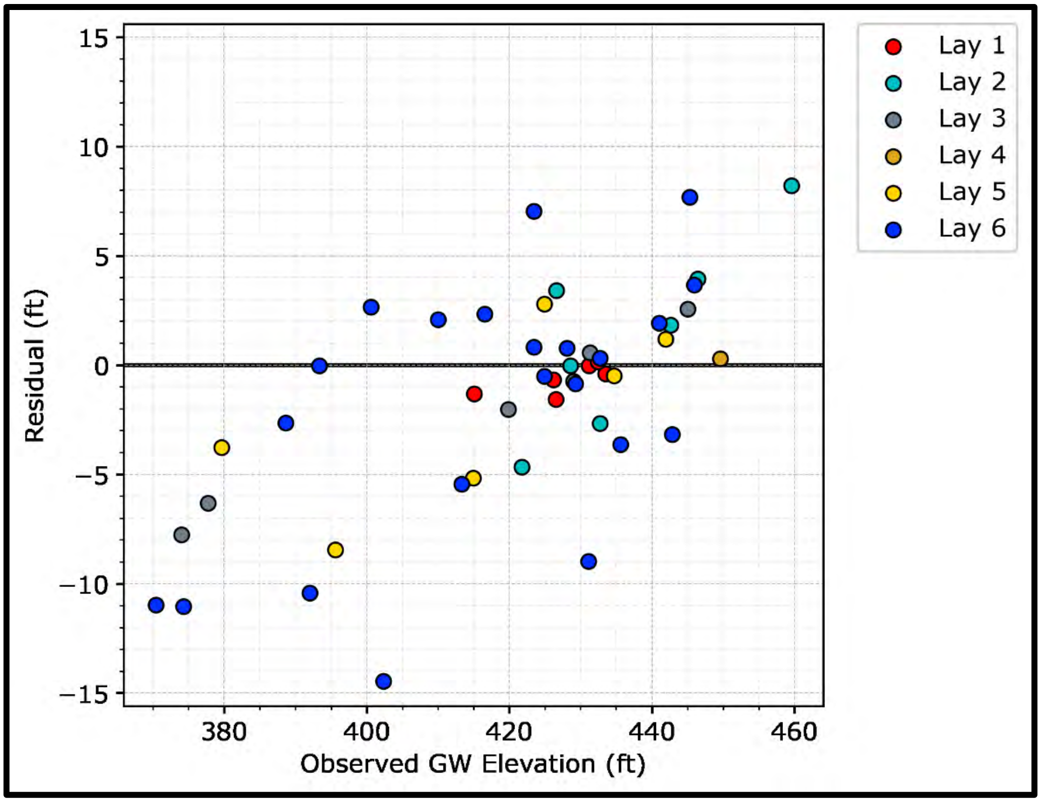
RAMBOLL



OBSERVED VERSUS SIMULATED STEADY STATE GROUNDWATER LEVELS FROM THE CALIBRATION MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

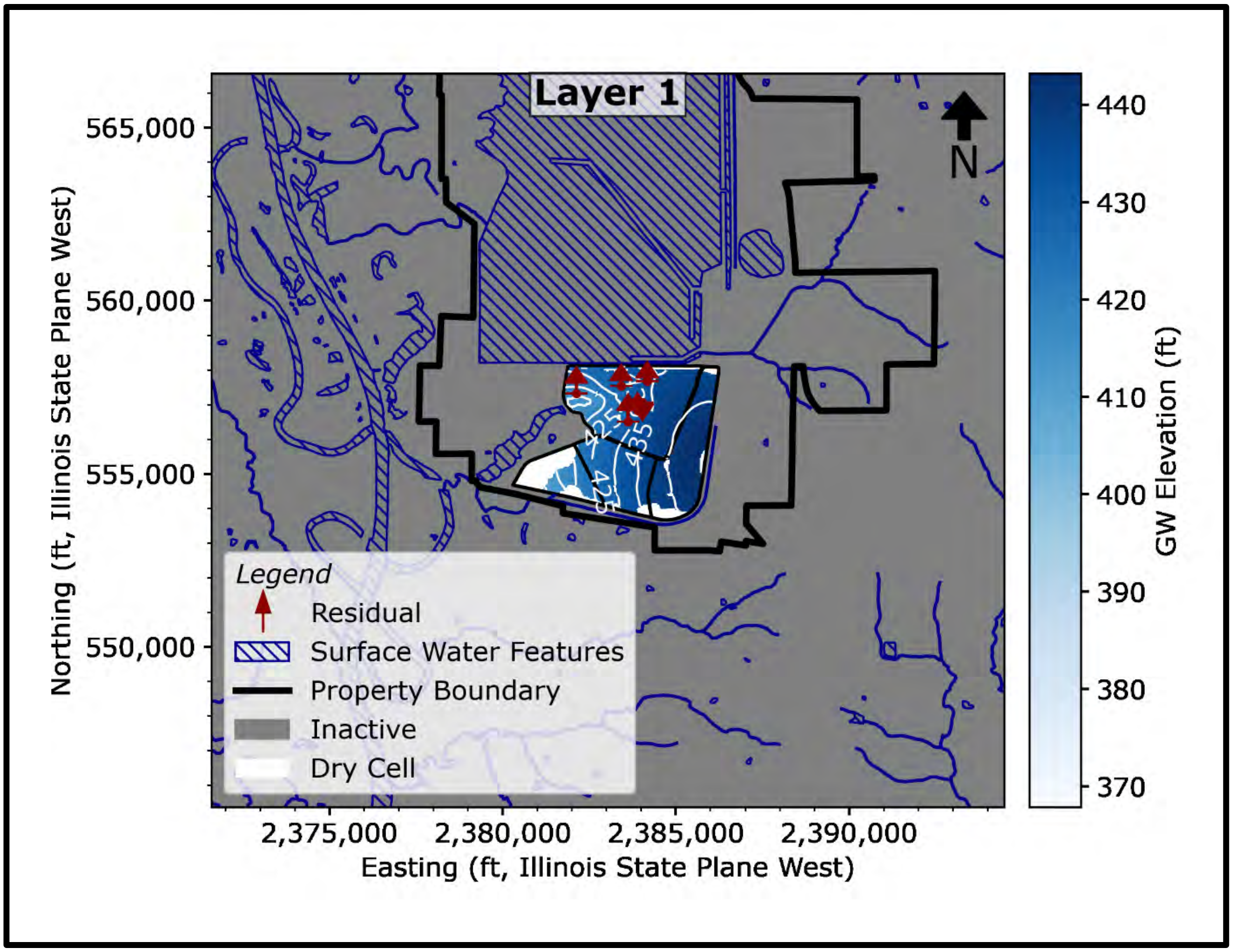
RAMBOLL



SIMULATED GROUNDWATER LEVEL RESIDUALS FROM THE CALIBRATED MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL

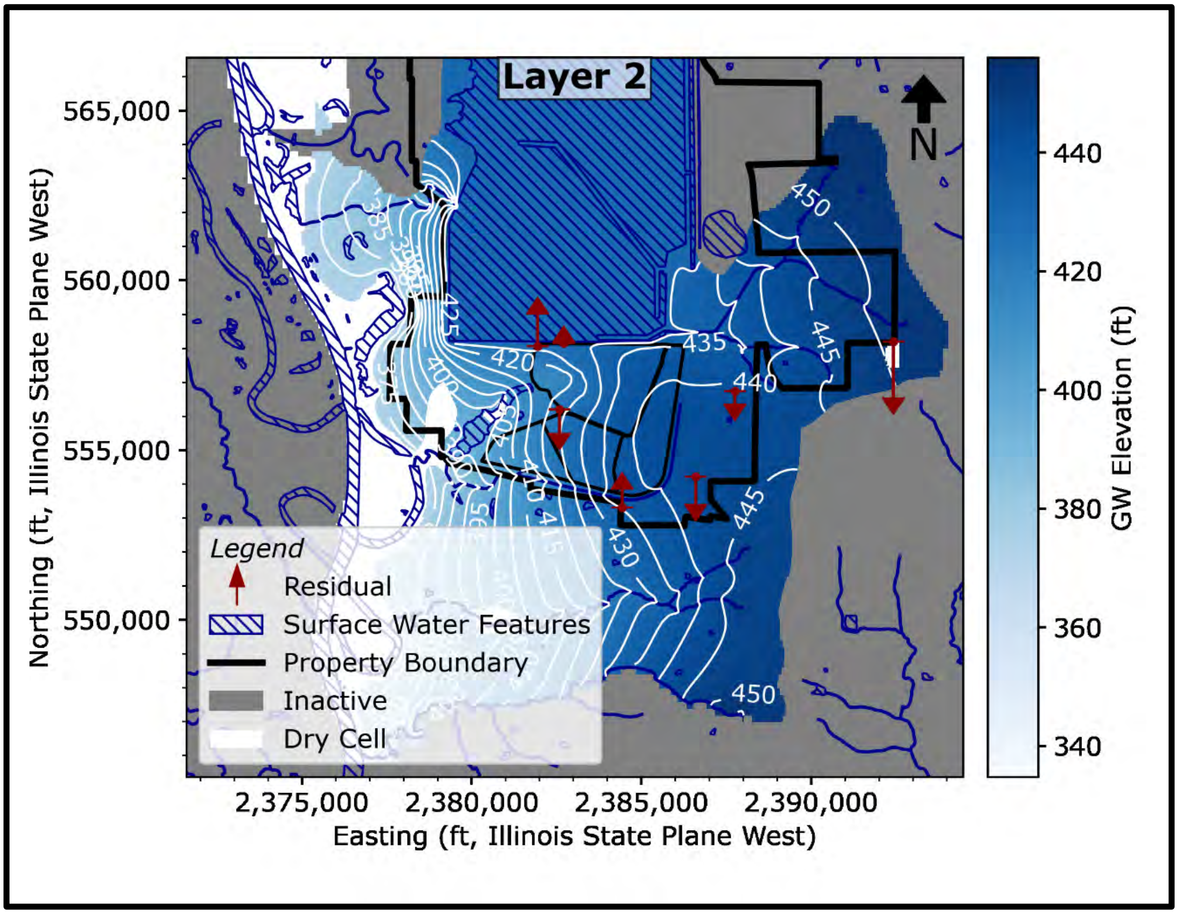


NOTE: RED DOTS INDICATE WELLS AND ARROW DIRECTION INDICATES BIAS IN SIMULATED GROUNDWATER LEVEL (NORTH ARROW = OVERESTIMATION, SOUTH ARROW = UNDERESTIMATION)

SIMULATED STEADY STATE GROUNDWATER LEVEL CONTOURS FROM LAYER 1 OF THE CALIBRATED MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL

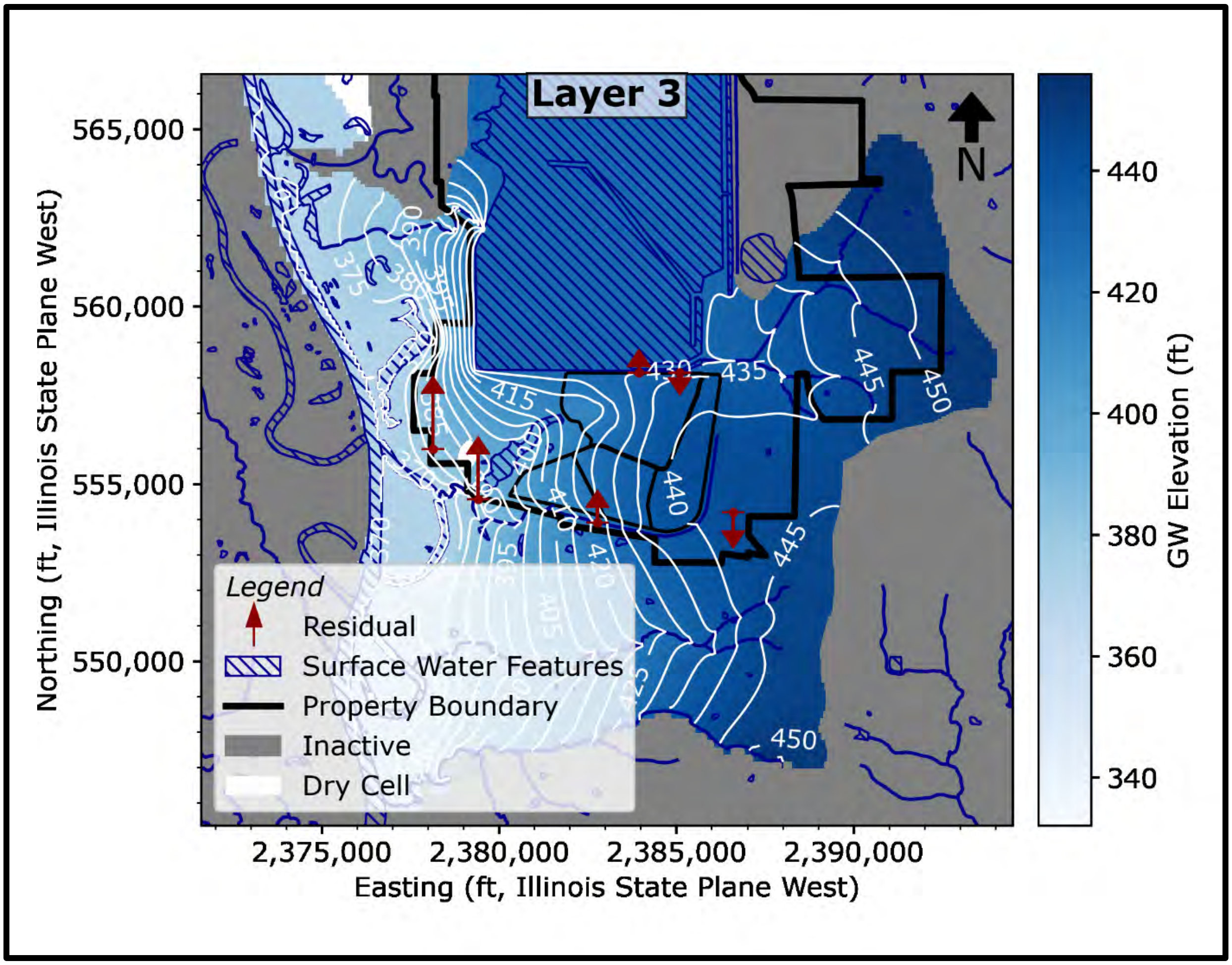


NOTE: RED DOTS INDICATE WELLS AND ARROW DIRECTION INDICATES BIAS IN SIMULATED GROUNDWATER LEVEL (NORTH ARROW = OVERESTIMATION, SOUTH ARROW = UNDERESTIMATION)

SIMULATED STEADY STATE GROUNDWATER LEVEL CONTOURS FROM LAYER 2 OF THE CALIBRATED MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL

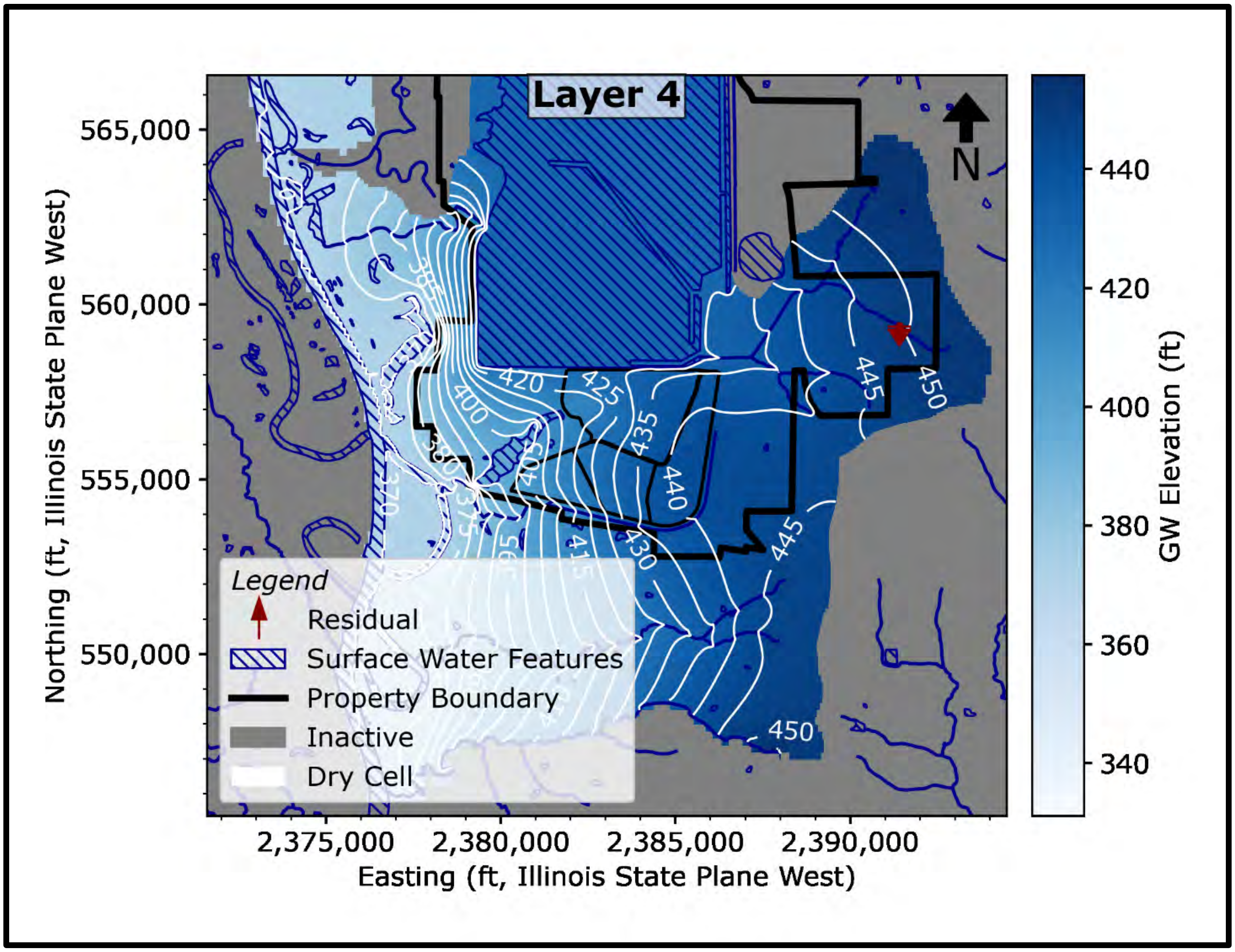


NOTE: RED DOTS INDICATE WELLS AND ARROW DIRECTION INDICATES BIAS IN SIMULATED GROUNDWATER LEVEL (NORTH ARROW = OVERESTIMATION, SOUTH ARROW = UNDERESTIMATION)

SIMULATED STEADY STATE GROUNDWATER LEVEL CONTOURS FROM LAYER 3 OF THE CALIBRATED MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL

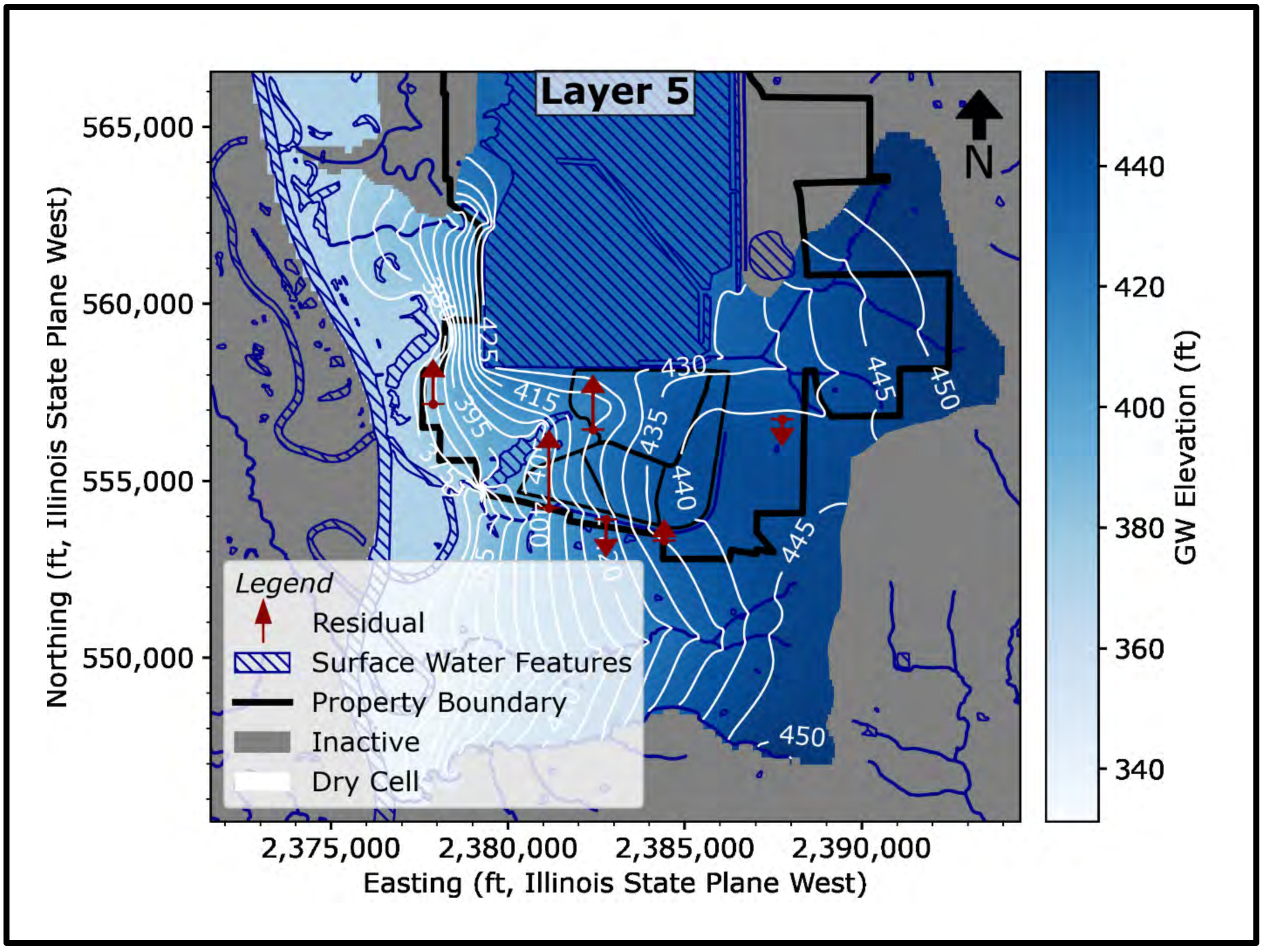


NOTE: RED DOTS INDICATE WELLS AND ARROW DIRECTION INDICATES BIAS IN SIMULATED GROUNDWATER LEVEL (NORTH ARROW = OVERESTIMATION, SOUTH ARROW = UNDERESTIMATION)

SIMULATED STEADY STATE GROUNDWATER LEVEL CONTOURS FROM LAYER 4 OF THE CALIBRATED MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL



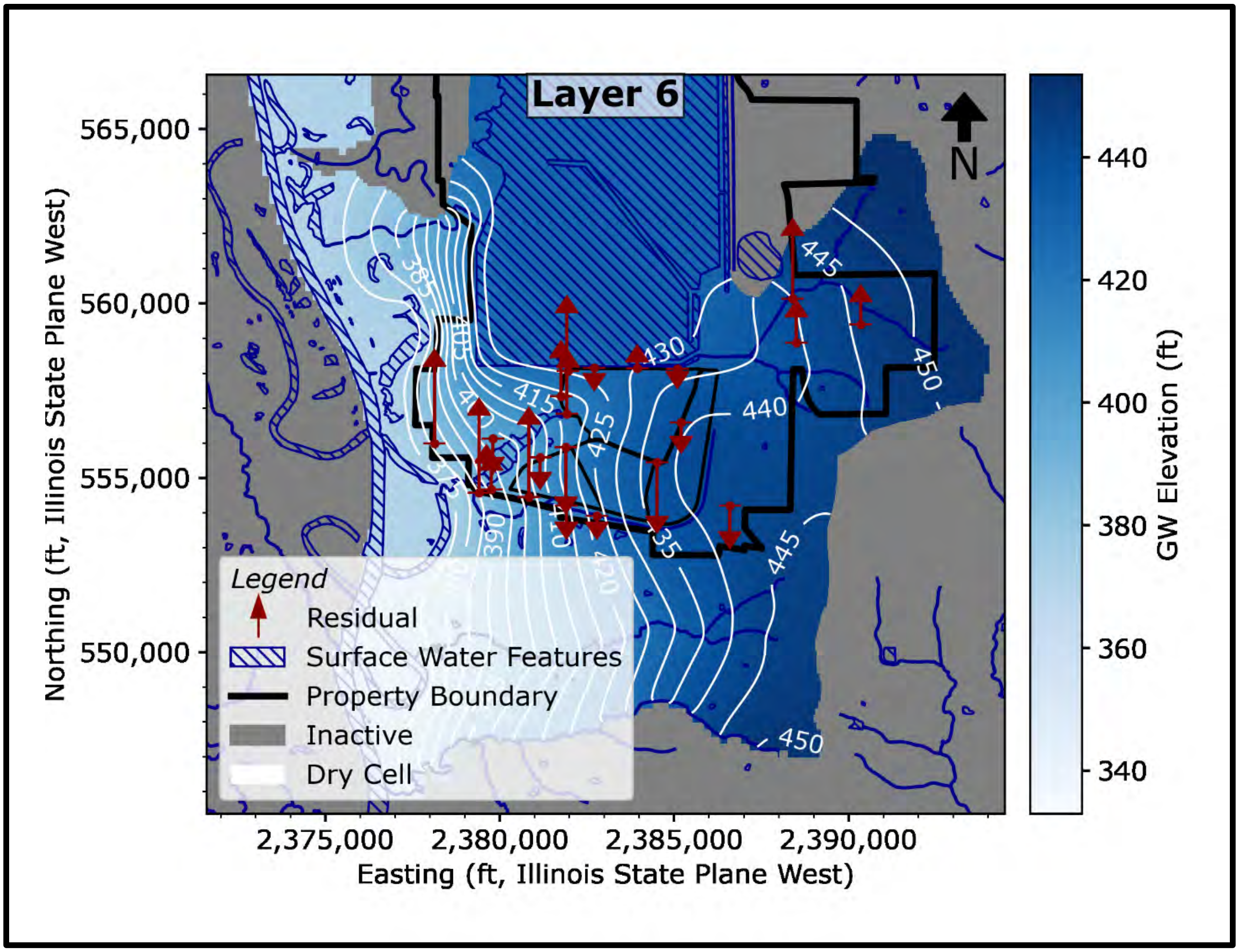
NOTE: RED DOTS INDICATE WELLS AND ARROW DIRECTION INDICATES BIAS IN SIMULATED GROUNDWATER LEVEL (NORTH ARROW = OVERESTIMATION, SOUTH ARROW = UNDERESTIMATION)

SIMULATED STEADY STATE GROUNDWATER LEVEL CONTOURS FROM LAYER 5 OF THE CALIBRATED MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL

FIGURE 5-28

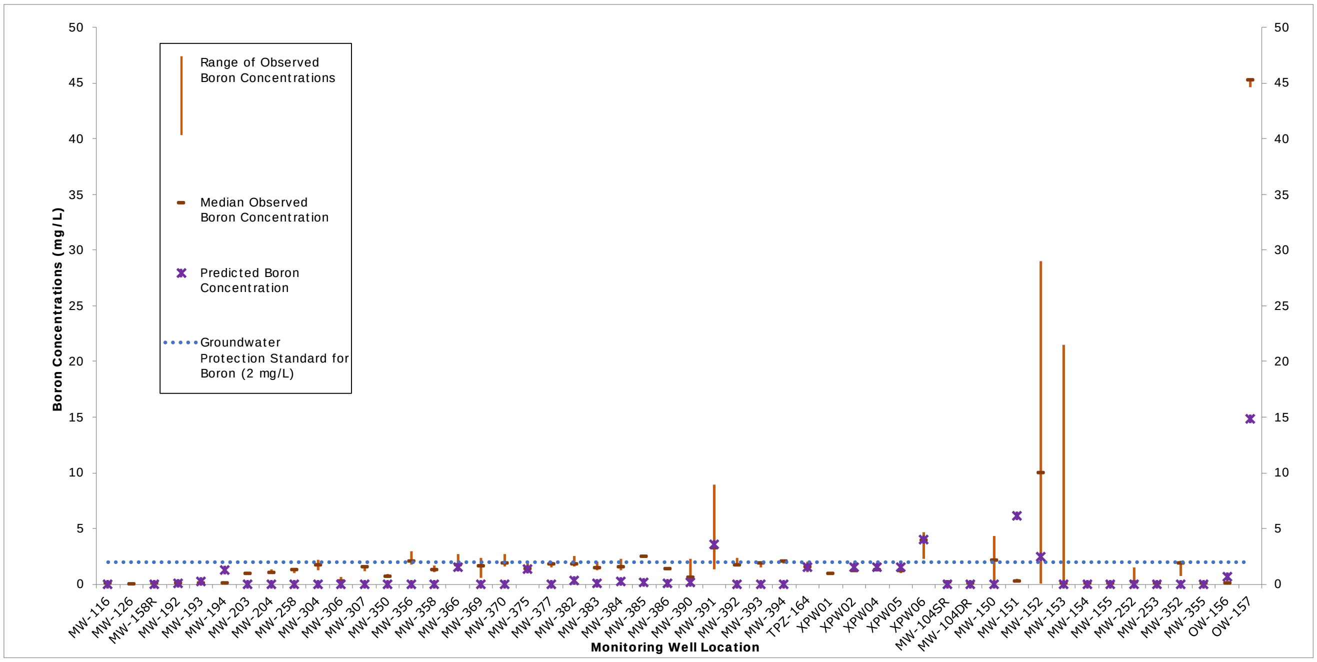


NOTE: RED DOTS INDICATE WELLS AND ARROW DIRECTION INDICATES BIAS IN SIMULATED GROUNDWATER LEVEL (NORTH ARROW = OVERESTIMATION, SOUTH ARROW = UNDERESTIMATION)

SIMULATED STEADY STATE GROUNDWATER LEVEL CONTOURS FROM LAYER 6 OF THE CALIBRATED MODEL

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

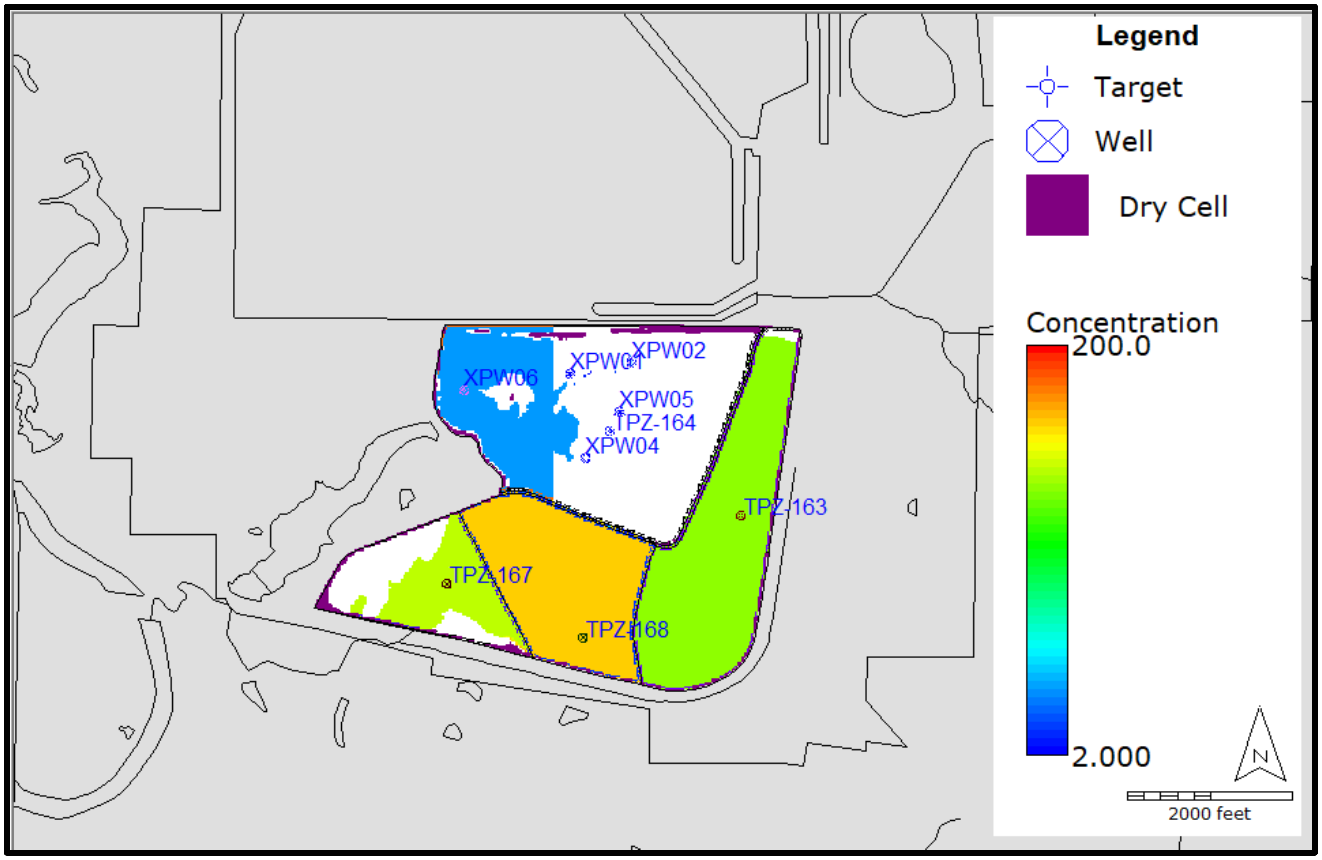
RAMBOLL



OBSERVED AND SIMULATED BORON CONCENTRATIONS (mg/L)

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

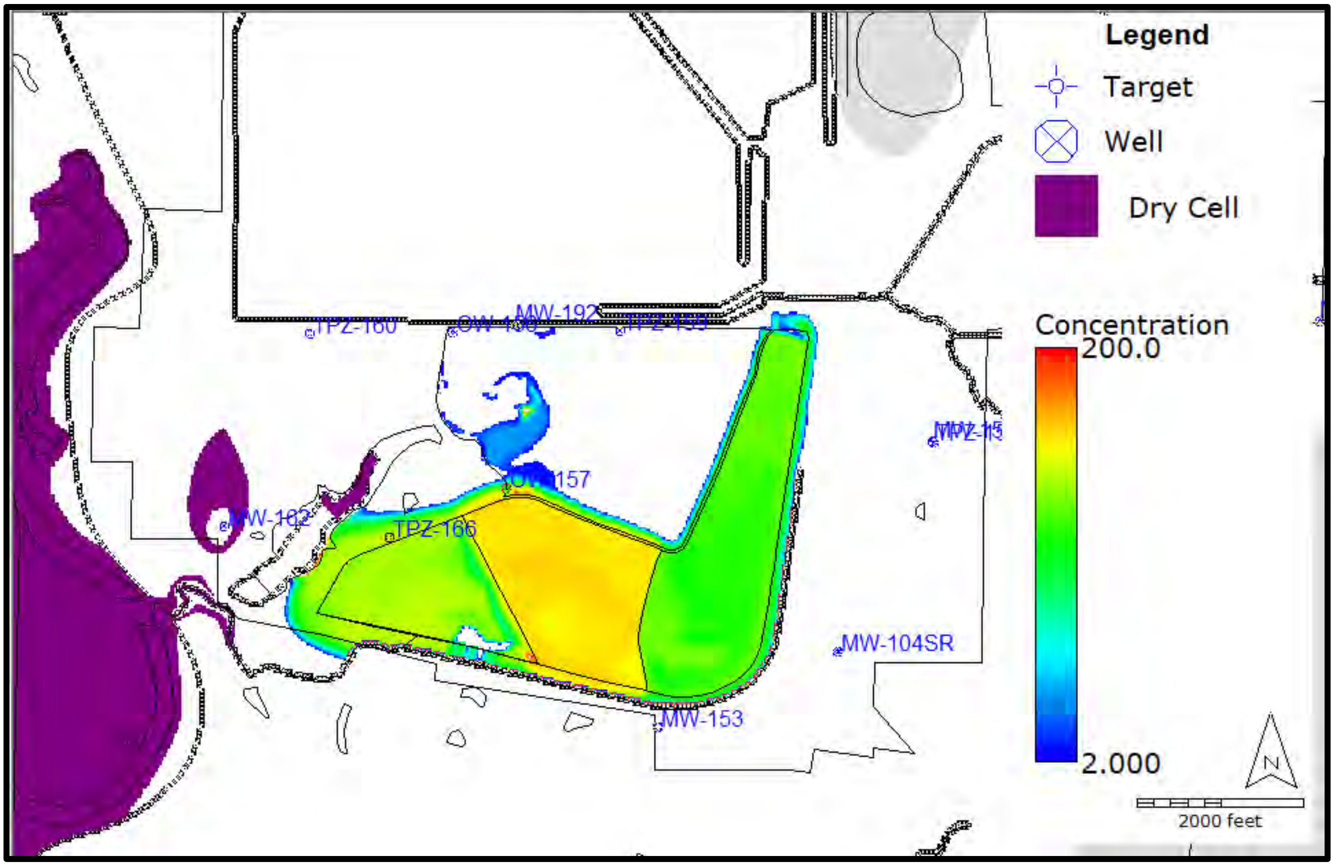
RAMBOLL



LAYER 1 DISTRIBUTION OF BORON CONCENTRATIONS (mg/L) IN THE CALIBRATED MODEL (CCR)

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

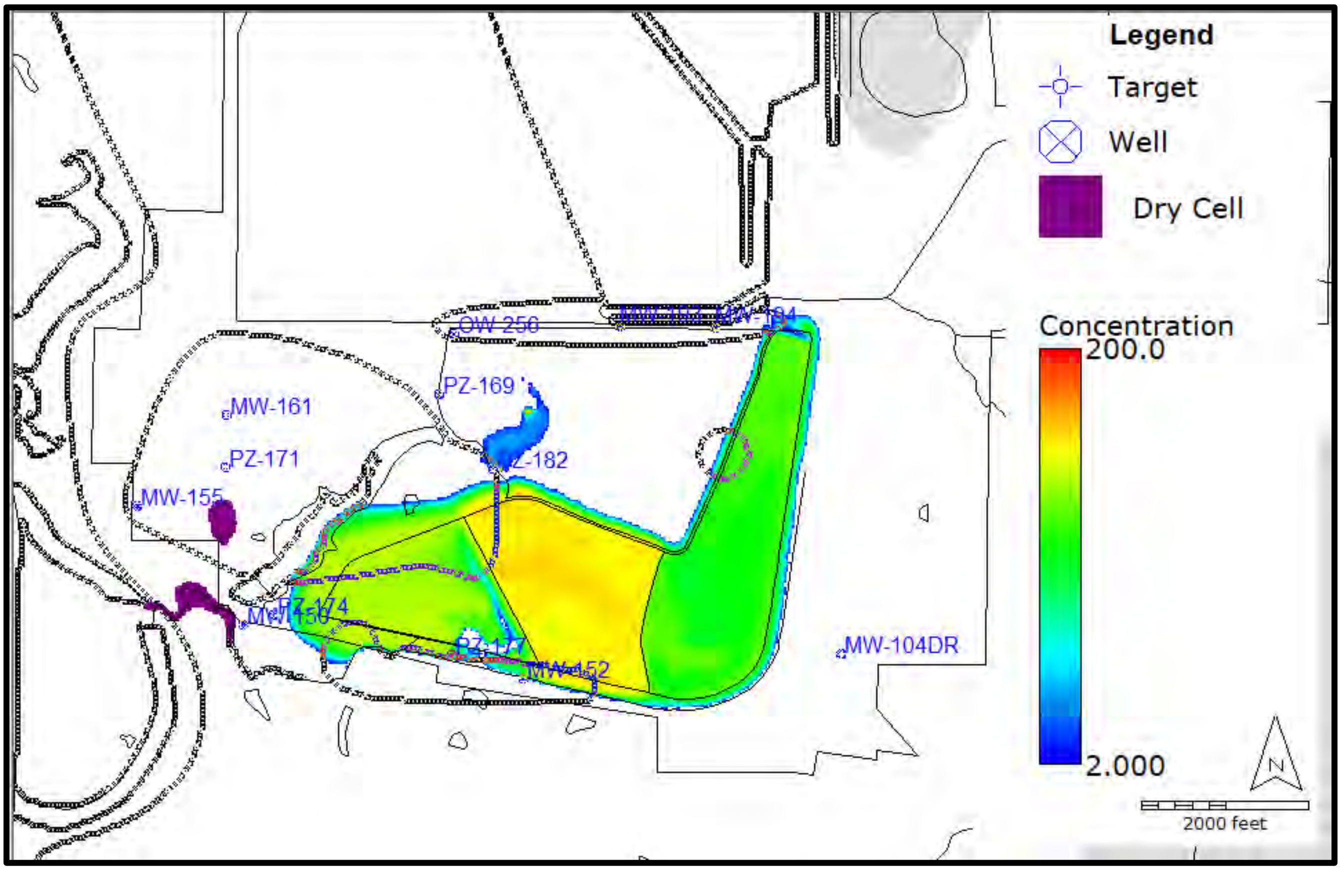
RAMBOLL



LAYER 2 DISTRIBUTION OF BORON CONCENTRATIONS (mg/L) IN THE CALIBRATED MODEL
(UU [UPPER SILTY CLAY])

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

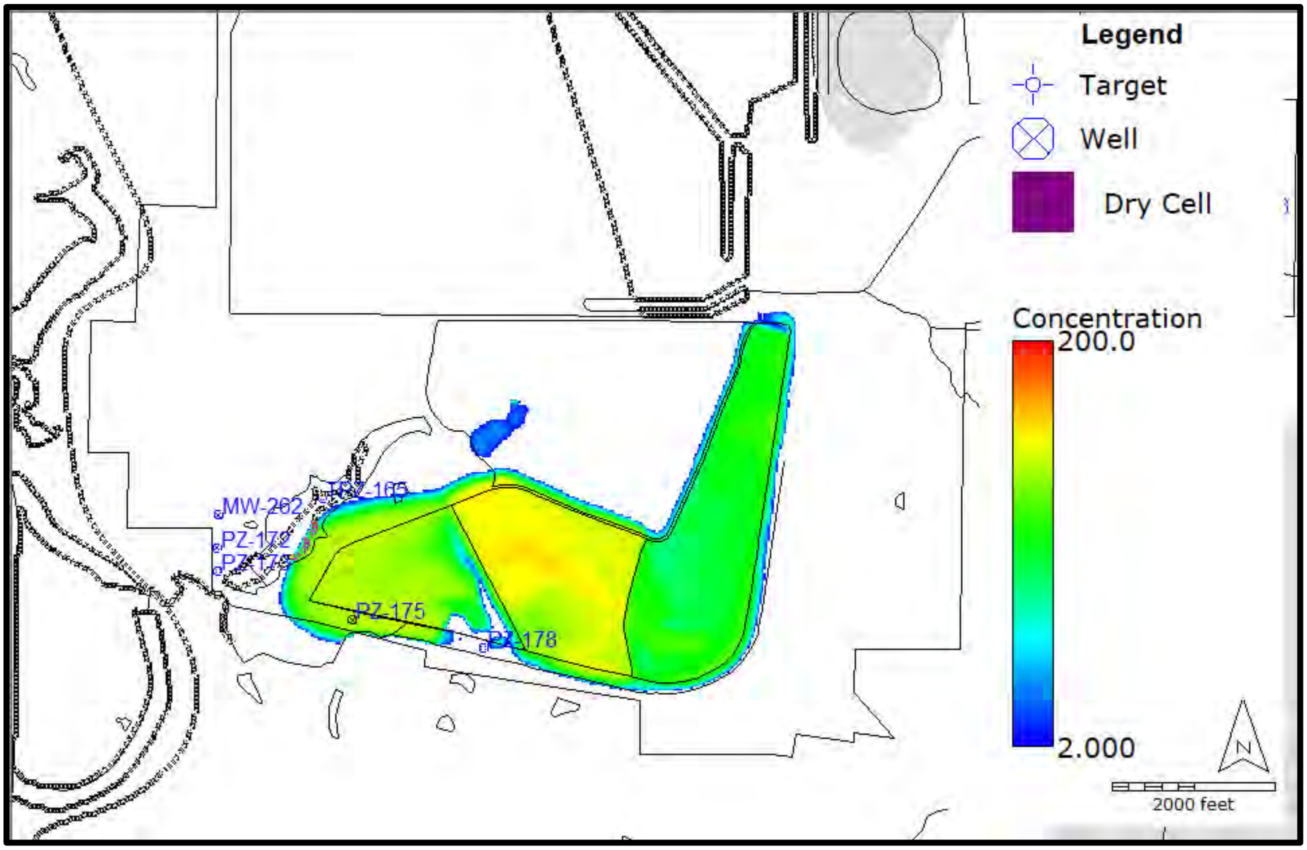
RAMBOLL



LAYER 3 DISTRIBUTION OF BORON CONCENTRATIONS (mg/L) IN THE CALIBRATED MODEL (UU [PMP/TOP OF VANDALIA])

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL

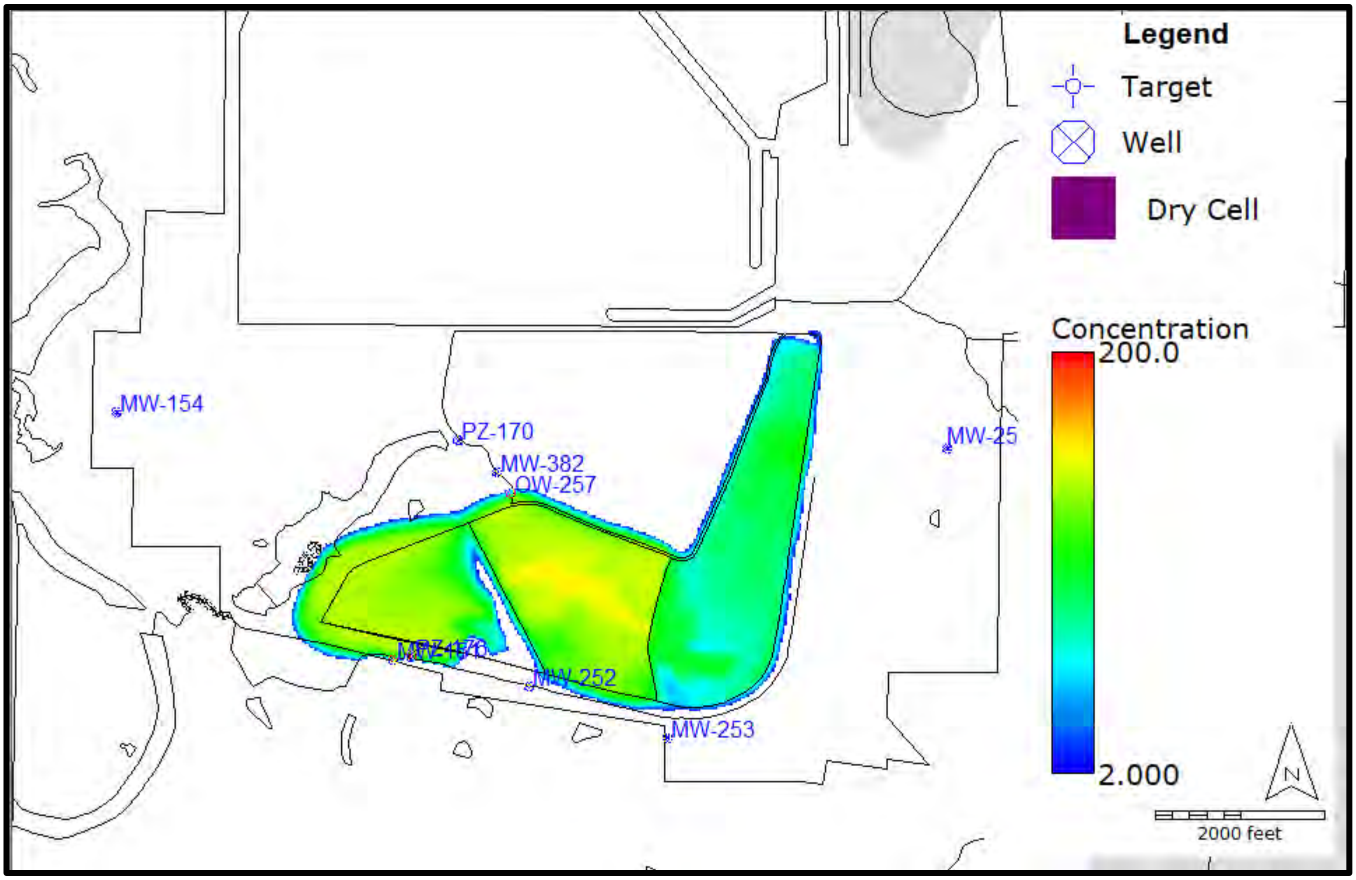


LAYER 4 DISTRIBUTION OF BORON CONCENTRATIONS (mg/L) IN THE CALIBRATED MODEL
(UU [LOWER SILTY CLAY])

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL

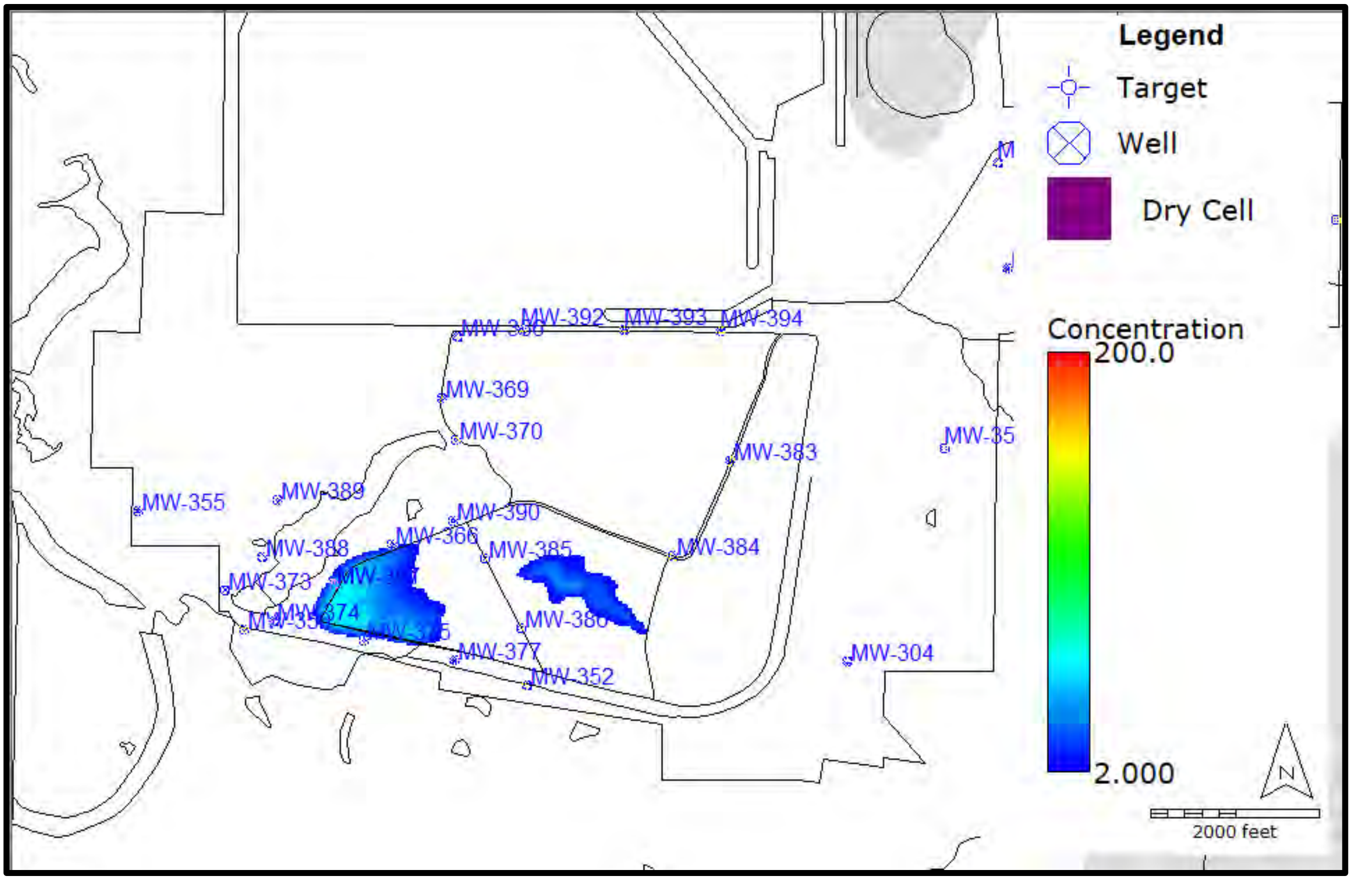
FIGURE 5-34



LAYER 5 DISTRIBUTION OF BORON CONCENTRATIONS (mg/L) IN THE CALIBRATED MODEL (UA [DECOMPOSED BEDROCK])

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

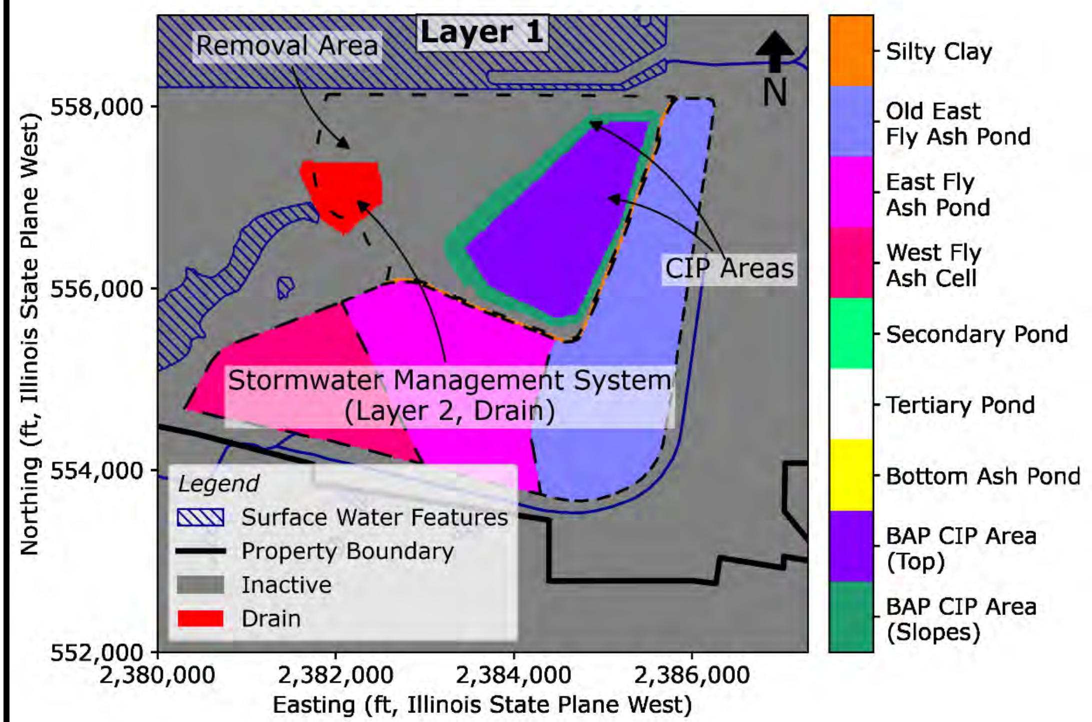
RAMBOLL



LAYER 6 DISTRIBUTION OF BORON CONCENTRATIONS (mg/L) IN THE CALIBRATED MODEL (UA)

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

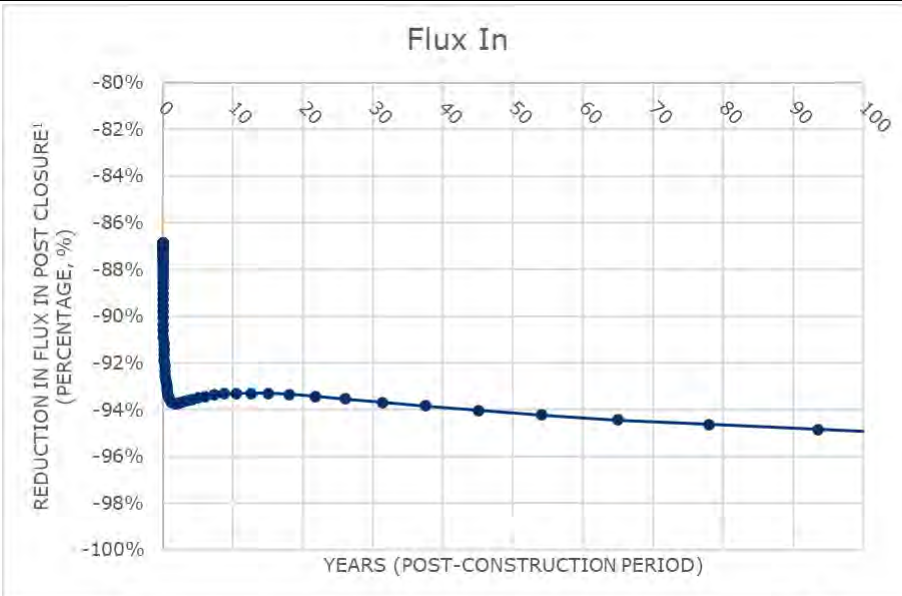
RAMBOLL



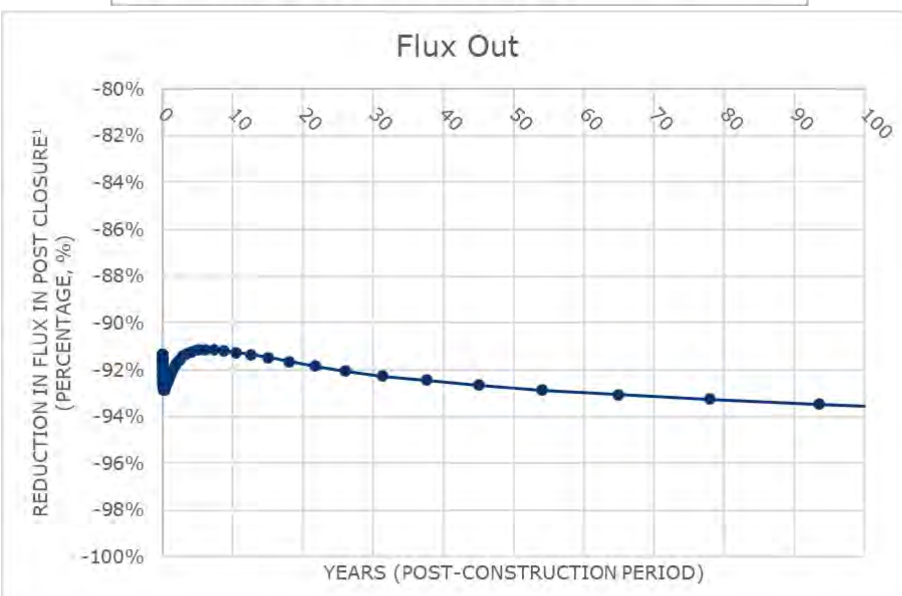
RECHARGE AND STORMWATER MANAGEMENT MODIFICATIONS FOR CLOSURE IN PLACE

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL



Notes:
1. Reduction in flux in as compared to flux in at the end of calibration model (model period of 53 years). Reduction in flux in are expressed as negative percentages to illustrate decreases in flux over time

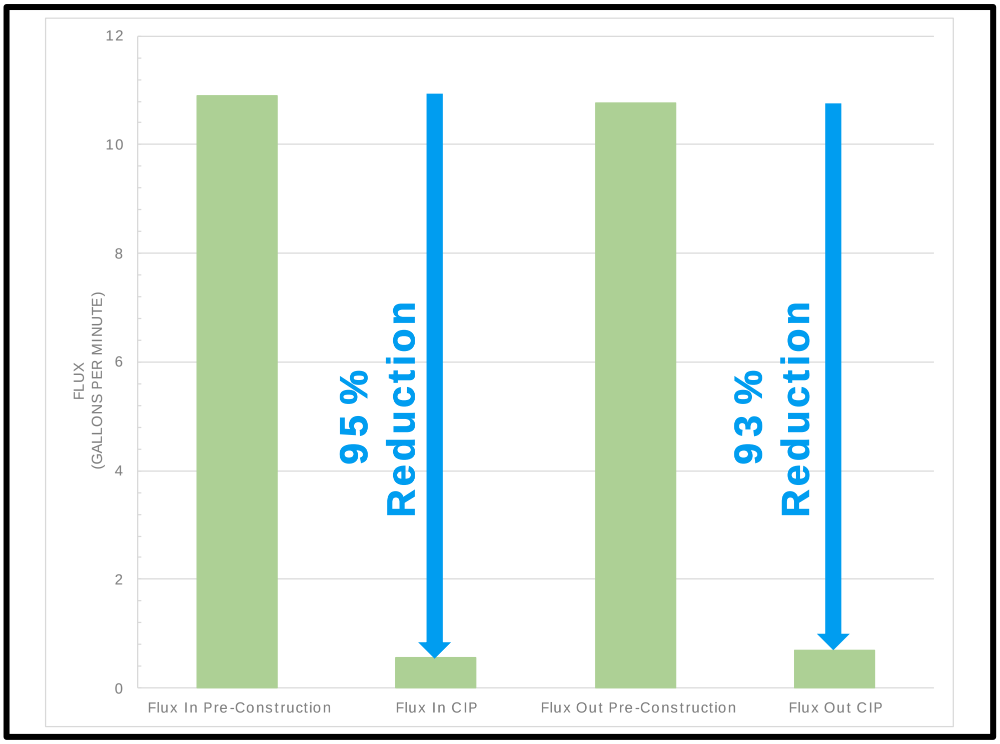


Notes:
1. Reduction in flux in as compared to flux out at the end of calibration model (model period of 53 years). Reduction in flux out are expressed as negative percentages to illustrate decreases in flux over time

REDUCTIONS IN TOTAL FLUX IN AND OUT OF CCR FOLLOWING IMPLEMENTATION OF THE CIP CLOSURE SCENARIO

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

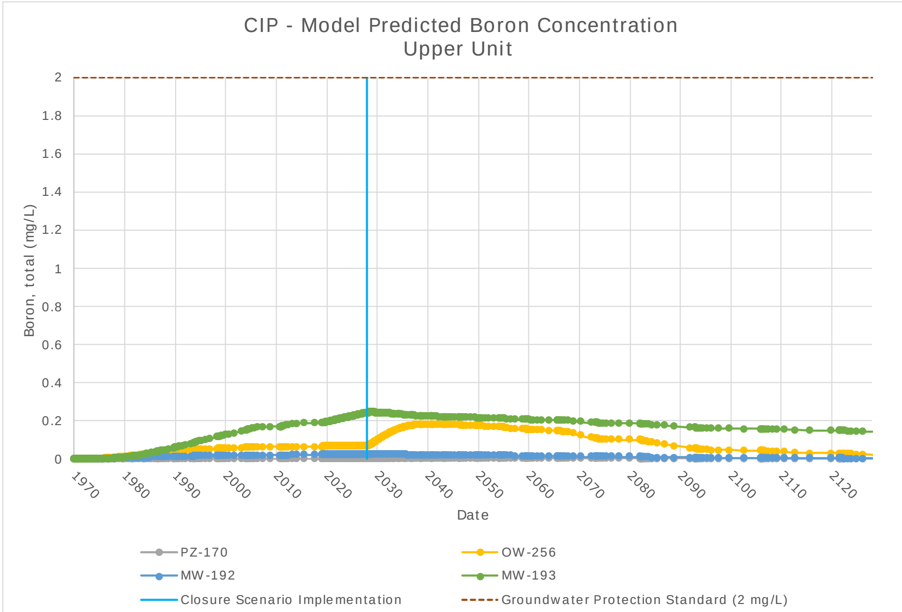
RAMBOLL

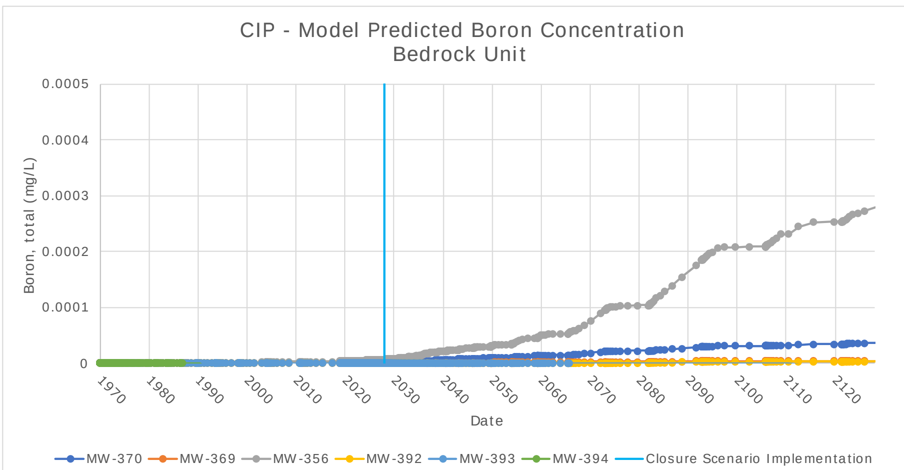


REDUCTIONS IN TOTAL FLUX IN AND OUT OF CCR 93 YEARS FOLLOWING IMPLEMENTATION OF THE CIP CLOSURE SCENARIO

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL

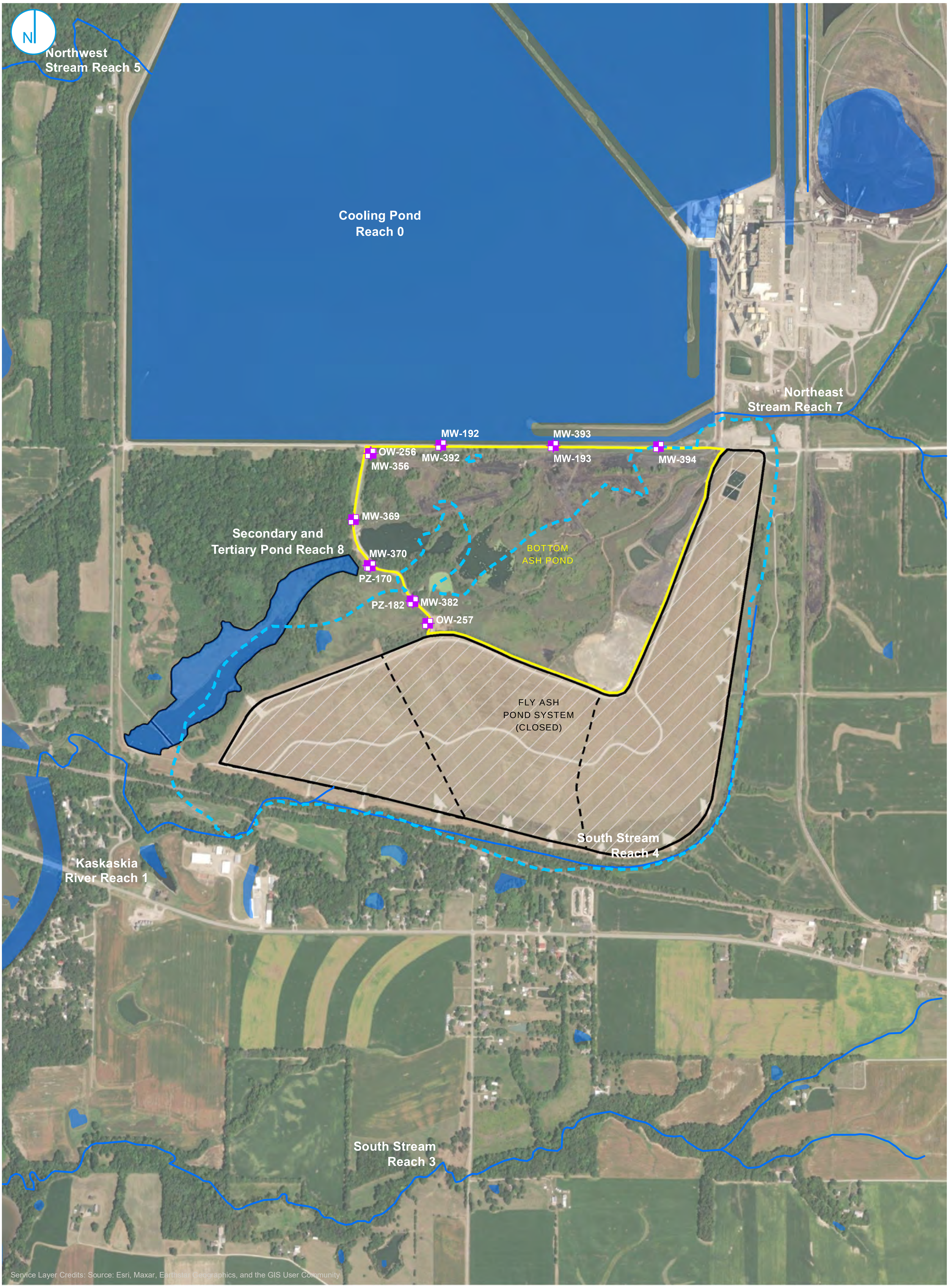




CIP - MODEL PREDICTED BORON CONCENTRATION

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL



35 I.A.C. § 845 REGULATED UNIT (SUBJECT UNIT)
FLY ASH POND SYSTEM
LIMITS OF FINAL COVER
SITE FEATURE
RIVER
WATERBODY

MAXIMUM EXTENT OF THE BORON PLUME ABOVE THE STANDARD GWPS FOR BORON (2 mg/L) AT 93 YEARS FOLLOWING IMPLEMENTATION OF THE CIP CLOSURE SCENARIO
PROPOSED BAP COMPLIANCE WELLS

0 500 1,000 Feet

CIP - MODEL PREDICTED MAXIMUM BORON PLUME IN ALL LAYERS APPROXIMATELY 93 YEARS AFTER IMPLEMENTATION

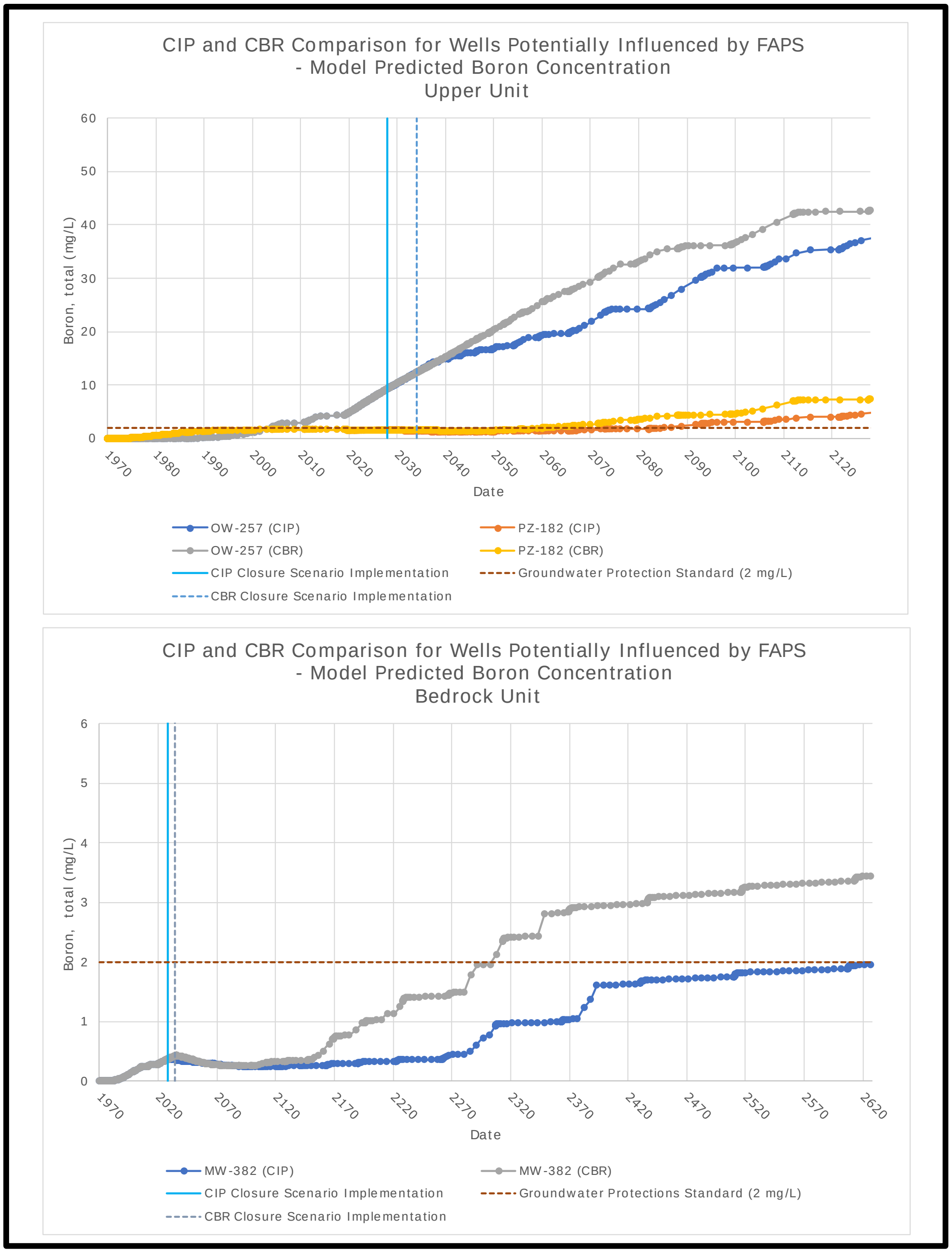
FIGURE 6-5

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

FIGURE 6-6



CIP AND CBR - MODEL PREDICTED BORON CONCENTRATION AT PROPOSED BAP COMPLIANCE MONITORING WELLS PZ-182, OW-257, AND MW-382

GROUNDWATER MODELING REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL

APPENDICES

APPENDIX A
HISTORY OF POTENTIAL EXCEEDANCES REVISION 1 (RAMBOLL, 2023c)

HISTORY OF POTENTIAL EXCEEDANCES REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

This revision of the History of Potential Exceedances, and any corrective action taken to remediate groundwater, is provided to meet the requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845.230(d)(2)(M) for the Baldwin Power Plant Bottom Ash Pond (BAP), Illinois Environmental Protection Agency (IEPA) ID No. W1578510001-06.

Note

Groundwater concentrations from 2015 to 2023 presented in the revised Hydrogeologic Site Characterization Report Revision 1 (HCR) Table 4-1, and evaluated and summarized in the following tables, are considered potential exceedances. DMG entered into a compliance commitment agreement (CCA) with IEPA on December 28, 2022. Groundwater monitoring in accordance with the CCA will follow the proposed groundwater monitoring plan and sampling methodologies provided in the operating permit application for the BAP and is scheduled to commence no later than the second quarter of 2023. After the BAP has been issued an approved operating permit, groundwater monitoring shall be conducted in accordance with that operating permit.

Alternate sources for potential exceedances as allowed by 35 I.A.C. § 845.650(e) have not yet been evaluated. These will be evaluated and presented in future submittals to IEPA as appropriate.

Table 1 summarizes how the potential exceedances were determined. Table 2 is a summary of all potential exceedances.

Background Concentrations

Background monitoring wells used to calculate background concentrations at the BAP include MW-304, MW-306, and MW-358.

For all monitoring wells presented in Tables 1 and 2, background concentrations calculated from sampling events in 2022 to 2023 were compared to the standards identified in 35 I.A.C. § 845.600(a)(1). For constituents with calculated background concentrations in greater than the standards in 35 I.A.C. § 845.600(a)(1), those calculated background concentrations were used as GWPSs for comparing to statistical calculation results for each well to determine potential exceedances. Statistical result calculations consider concentrations from all sampling events in 2015 through May of 2023.

Corrective Action

No corrective actions have been taken to remediate the groundwater.

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-192	UU	845	Antimony, total	mg/L	10/27/2022 - 05/16/2023	CI around median	0.00100	0.006	0.0023	0.006	Standard
MW-192	UU	845	Arsenic, total	mg/L	10/27/2022 - 05/16/2023	CI around geomean	0.00146	0.010	0.010	0.01	Background
MW-192	UU	845	Barium, total	mg/L	10/27/2022 - 05/16/2023	CI around mean	0.0825	2.0	0.26	2	Standard
MW-192	UU	845	Beryllium, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.0005	0.004	0.0005	0.004	Standard
MW-192	UU	845	Boron, total	mg/L	10/27/2022 - 05/16/2023	CI around mean	0.0241	2.2	2.2	2	Background
MW-192	UU	845	Cadmium, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard
MW-192	UU	845	Chloride, total	mg/L	10/27/2022 - 05/16/2023	CB around linear reg	18.9	1370	1370	200	Background
MW-192	UU	845	Chromium, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.005	0.10	0.013	0.1	Standard
MW-192	UU	845	Cobalt, total	mg/L	10/27/2022 - 05/16/2023	CI around mean	0.000910	0.006	0.0022	0.006	Standard
MW-192	UU	845	Fluoride, total	mg/L	10/27/2022 - 05/16/2023	CI around mean	0.403	4.0	3.8	4	Standard
MW-192	UU	845	Lead, total	mg/L	10/27/2022 - 05/16/2023	CI around median	0.00100	0.0075	0.0022	0.0075	Standard
MW-192	UU	845	Lithium, total	mg/L	10/27/2022 - 05/16/2023	CI around mean	0.00725	0.14	0.14	0.04	Background
MW-192	UU	845	Mercury, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-192	UU	845	Molybdenum, total	mg/L	10/27/2022 - 05/16/2023	CI around mean	0.00248	0.10	0.078	0.1	Standard
MW-192	UU	845	pH (field)	SU	10/27/2022 - 05/16/2023	CI around median	6.5/7.0	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-192	UU	845	Radium 226 + Radium 228, total	pCi/L	10/27/2022 - 05/16/2023	CI around mean	0.244	5.0	3.8	5	Standard
MW-192	UU	845	Selenium, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.001	0.050	0.0032	0.05	Standard
MW-192	UU	845	Sulfate, total	mg/L	10/27/2022 - 05/16/2023	CB around linear reg	11.0	762	762	400	Background
MW-192	UU	845	Thallium, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-192	UU	845	Total Dissolved Solids	mg/L	10/27/2022 - 05/16/2023	CI around mean	432	3260	3260	1200	Background
MW-193	UU	845	Antimony, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.001	0.006	0.0023	0.006	Standard
MW-193	UU	845	Arsenic, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.00124	0.010	0.010	0.01	Background
MW-193	UU	845	Barium, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.0703	2.0	0.26	2	Standard
MW-193	UU	845	Beryllium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.0005	0.004	0.0005	0.004	Standard
MW-193	UU	845	Boron, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.0287	2.2	2.2	2	Background
MW-193	UU	845	Cadmium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard
MW-193	UU	845	Chloride, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	34.8	1370	1370	200	Background

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-193	UU	845	Chromium, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00150	0.10	0.013	0.1	Standard
MW-193	UU	845	Cobalt, total	mg/L	10/27/2022 - 05/15/2023	Most recent sample	0.00100	0.006	0.0022	0.006	Standard
MW-193	UU	845	Fluoride, total	mg/L	10/27/2022 - 05/15/2023	CB around linear reg	0.191	4.0	3.8	4	Standard
MW-193	UU	845	Lead, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.008	0.0075	0.0022	0.0075	Standard
MW-193	UU	845	Lithium, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.00474	0.14	0.14	0.04	Background
MW-193	UU	845	Mercury, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-193	UU	845	Molybdenum, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00150	0.10	0.078	0.1	Standard
MW-193	UU	845	pH (field)	SU	10/27/2022 - 05/15/2023	CI around mean	6.7/7.2	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-193	UU	845	Radium 226 + Radium 228, total	pCi/L	10/27/2022 - 05/15/2023	CI around mean	0.376	5.0	3.8	5	Standard
MW-193	UU	845	Selenium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.001	0.050	0.0032	0.05	Standard
MW-193	UU	845	Sulfate, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	152	762	762	400	Background
MW-193	UU	845	Thallium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-193	UU	845	Total Dissolved Solids	mg/L	10/27/2022 - 05/15/2023	CI around mean	523	3260	3260	1200	Background
MW-194	UU	845	Antimony, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00100	0.006	0.0023	0.006	Standard
MW-194	UU	845	Arsenic, total	mg/L	10/27/2022 - 05/15/2023	CB around linear reg	-0.000853	0.010	0.010	0.01	Background
MW-194	UU	845	Barium, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.0844	2.0	0.26	2	Standard
MW-194	UU	845	Beryllium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.0005	0.004	0.0005	0.004	Standard
MW-194	UU	845	Boron, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.0200	2.2	2.2	2	Background
MW-194	UU	845	Cadmium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard
MW-194	UU	845	Chloride, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	28.0	1370	1370	200	Background
MW-194	UU	845	Chromium, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00150	0.10	0.013	0.1	Standard
MW-194	UU	845	Cobalt, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.000487	0.006	0.0022	0.006	Standard
MW-194	UU	845	Fluoride, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.272	4.0	3.8	4	Standard
MW-194	UU	845	Lead, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00100	0.0075	0.0022	0.0075	Standard
MW-194	UU	845	Lithium, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.00580	0.14	0.14	0.04	Background
MW-194	UU	845	Mercury, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-194	UU	845	Molybdenum, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.00200	0.10	0.078	0.1	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-194	UU	845	pH (field)	SU	10/27/2022 - 05/15/2023	CB around linear reg	6.3/6.9	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-194	UU	845	Radium 226 + Radium 228, total	pCi/L	10/27/2022 - 05/15/2023	CI around mean	0.160	5.0	3.8	5	Standard
MW-194	UU	845	Selenium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.001	0.050	0.0032	0.05	Standard
MW-194	UU	845	Sulfate, total	mg/L	10/27/2022 - 05/15/2023	CB around linear reg	80.9	762	762	400	Background
MW-194	UU	845	Thallium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-194	UU	845	Total Dissolved Solids	mg/L	10/27/2022 - 05/15/2023	CI around mean	440	3260	3260	1200	Background
MW-356	UA	257	Antimony, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.00100	0.006	0.0023	0.006	Standard
MW-356	UA	257	Arsenic, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.00100	0.010	0.010	0.01	Background
MW-356	UA	257	Barium, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.0297	2.0	0.26	2	Standard
MW-356	UA	257	Beryllium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.0005	0.004	0.0005	0.004	Standard
MW-356	UA	257	Boron, total	mg/L	12/29/2015 - 05/16/2023	CI around median	1.94	2.2	2.2	2	Background
MW-356	UA	257	Cadmium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard
MW-356	UA	257	Chloride, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	28.6	1370	1370	200	Background
MW-356	UA	257	Chromium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.005	0.10	0.013	0.1	Standard
MW-356	UA	257	Cobalt, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.001	0.006	0.0022	0.006	Standard
MW-356	UA	257	Fluoride, total	mg/L	12/29/2015 - 05/16/2023	CI around mean	1.92	4.0	3.8	4	Standard
MW-356	UA	257	Fluoride, total	mg/L	12/29/2015 - 05/16/2023	CI around mean	1.92	4.0	3.8	4	Standard
MW-356	UA	257	Lead, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.00100	0.0075	0.0022	0.0075	Standard
MW-356	UA	257	Lithium, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	0.0551	0.14	0.14	0.04	Background
MW-356	UA	257	Mercury, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-356	UA	257	Molybdenum, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.00150	0.10	0.078	0.1	Standard
MW-356	UA	257	pH (field)	SU	12/29/2015 - 05/16/2023	CI around median	7.7/7.8	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-356	UA	257	Radium 226 + Radium 228, total	pCi/L	12/29/2015 - 05/16/2023	CI around median	0.100	5.0	3.8	5	Standard
MW-356	UA	257	Selenium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.001	0.050	0.0032	0.05	Standard
MW-356	UA	257	Sulfate, total	mg/L	12/29/2015 - 05/16/2023	CI around mean	44.4	758	758	400	Background
MW-356	UA	257	Thallium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-356	UA	257	Total Dissolved Solids	mg/L	12/29/2015 - 05/16/2023	CI around mean	663	3260	3260	1200	Background

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-369	UA	257	Antimony, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	-0.00196	0.006	0.0023	0.006	Standard
MW-369	UA	257	Arsenic, total	mg/L	12/29/2015 - 05/16/2023	CI around geomean	0.00151	0.010	0.010	0.01	Background
MW-369	UA	257	Barium, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	0.0730	2.0	0.26	2	Standard
MW-369	UA	257	Beryllium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.0005	0.004	0.0005	0.004	Standard
MW-369	UA	257	Boron, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	-0.171	2.2	2.2	2	Background
MW-369	UA	257	Cadmium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard
MW-369	UA	257	Chloride, total	mg/L	12/29/2015 - 05/16/2023	CI around geomean	84.1	1370	1370	200	Background
MW-369	UA	257	Chromium, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	0.00145	0.10	0.013	0.1	Standard
MW-369	UA	257	Cobalt, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.00100	0.006	0.0022	0.006	Standard
MW-369	UA	257	Fluoride, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	-0.139	4.0	3.8	4	Standard
MW-369	UA	257	Fluoride, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	-0.139	4.0	3.8	4	Standard
MW-369	UA	257	Lead, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.00100	0.0075	0.0022	0.0075	Standard
MW-369	UA	257	Lithium, total	mg/L	12/29/2015 - 05/16/2023	CI around mean	0.0212	0.14	0.14	0.04	Background
MW-369	UA	257	Mercury, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-369	UA	257	Molybdenum, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	-0.00666	0.10	0.078	0.1	Standard
MW-369	UA	257	pH (field)	SU	12/29/2015 - 05/16/2023	CB around linear reg	6.5/8.1	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-369	UA	257	Radium 226 + Radium 228, total	pCi/L	12/29/2015 - 05/16/2023	CI around mean	0.376	5.0	3.8	5	Standard
MW-369	UA	257	Selenium, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	-0.0273	0.050	0.0032	0.05	Standard
MW-369	UA	257	Sulfate, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	-73.6	758	758	400	Background
MW-369	UA	257	Thallium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-369	UA	257	Total Dissolved Solids	mg/L	12/29/2015 - 05/16/2023	CI around median	726	3260	3260	1200	Background
MW-370	UA	257	Antimony, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	-0.000389	0.006	0.0023	0.006	Standard
MW-370	UA	257	Arsenic, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	0.000139	0.010	0.010	0.01	Background
MW-370	UA	257	Barium, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	0.0241	2.0	0.26	2	Standard
MW-370	UA	257	Beryllium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.0005	0.004	0.0005	0.004	Standard
MW-370	UA	257	Boron, total	mg/L	12/29/2015 - 05/16/2023	CI around median	1.79	2.2	2.2	2	Background
MW-370	UA	257	Cadmium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-370	UA	257	Chloride, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	1380	1370	1370	200	Background
MW-370	UA	257	Chromium, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	0.00142	0.10	0.013	0.1	Standard
MW-370	UA	257	Cobalt, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.00100	0.006	0.0022	0.006	Standard
MW-370	UA	257	Fluoride, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	3.02	4.0	3.8	4	Standard
MW-370	UA	257	Fluoride, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	3.02	4.0	3.8	4	Standard
MW-370	UA	257	Lead, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.008	0.0075	0.0022	0.0075	Standard
MW-370	UA	257	Lithium, total	mg/L	12/29/2015 - 05/16/2023	CI around mean	0.130	0.14	0.14	0.04	Background
MW-370	UA	257	Mercury, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-370	UA	257	Molybdenum, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	0.00644	0.10	0.078	0.1	Standard
MW-370	UA	257	pH (field)	SU	12/29/2015 - 05/16/2023	CB around linear reg	7.3/7.6	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-370	UA	257	Radium 226 + Radium 228, total	pCi/L	12/29/2015 - 05/16/2023	CI around geomean	0.517	5.0	3.8	5	Standard
MW-370	UA	257	Selenium, total	mg/L	12/29/2015 - 05/16/2023	Most recent sample	0.00100	0.050	0.0032	0.05	Standard
MW-370	UA	257	Sulfate, total	mg/L	12/29/2015 - 05/16/2023	CI around mean	248	758	758	400	Background
MW-370	UA	257	Thallium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-370	UA	257	Total Dissolved Solids	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	2940	3260	3260	1200	Background
MW-382	UA	257	Antimony, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.001	0.006	0.0023	0.006	Standard
MW-382	UA	257	Arsenic, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.00110	0.010	0.010	0.01	Background
MW-382	UA	257	Barium, total	mg/L	12/29/2015 - 05/16/2023	CI around mean	0.0172	2.0	0.26	2	Standard
MW-382	UA	257	Beryllium, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.00100	0.004	0.0005	0.004	Standard
MW-382	UA	257	Boron, total	mg/L	12/29/2015 - 05/16/2023	CI around median	1.72	2.2	2.2	2	Background
MW-382	UA	257	Cadmium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard
MW-382	UA	257	Chloride, total	mg/L	12/29/2015 - 05/16/2023	CI around mean	34.9	1370	1370	200	Background
MW-382	UA	257	Chromium, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	0.00577	0.10	0.013	0.1	Standard
MW-382	UA	257	Cobalt, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	0.00100	0.006	0.0022	0.006	Standard
MW-382	UA	257	Fluoride, total	mg/L	12/29/2015 - 05/16/2023	CI around geomean	2.80	4.0	3.8	4	Standard
MW-382	UA	257	Fluoride, total	mg/L	12/29/2015 - 05/16/2023	CI around geomean	2.80	4.0	3.8	4	Standard
MW-382	UA	257	Lead, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	0.00100	0.0075	0.0022	0.0075	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-382	UA	257	Lithium, total	mg/L	12/29/2015 - 05/16/2023	CI around mean	0.0580	0.14	0.14	0.04	Background
MW-382	UA	257	Mercury, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-382	UA	257	Molybdenum, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	0.00222	0.10	0.078	0.1	Standard
MW-382	UA	257	pH (field)	SU	12/29/2015 - 05/16/2023	CI around mean	7.7/7.9	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-382	UA	257	Radium 226 + Radium 228, total	pCi/L	12/29/2015 - 05/16/2023	CI around geomean	0.289	5.0	3.8	5	Standard
MW-382	UA	257	Selenium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.001	0.050	0.0032	0.05	Standard
MW-382	UA	257	Sulfate, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	354	758	758	400	Background
MW-382	UA	257	Thallium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-382	UA	257	Total Dissolved Solids	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	1060	3260	3260	1200	Background
MW-392	UA	845	Antimony, total	mg/L	10/27/2022 - 05/16/2023	CI around median	0.00100	0.006	0.0023	0.006	Standard
MW-392	UA	845	Arsenic, total	mg/L	10/27/2022 - 05/16/2023	CI around geomean	0.000901	0.010	0.010	0.01	Background
MW-392	UA	845	Barium, total	mg/L	10/27/2022 - 05/16/2023	CI around mean	0.0345	2.0	0.26	2	Standard
MW-392	UA	845	Beryllium, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.0005	0.004	0.0005	0.004	Standard
MW-392	UA	845	Boron, total	mg/L	10/27/2022 - 05/16/2023	CI around mean	1.58	2.2	2.2	2	Background
MW-392	UA	845	Cadmium, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard
MW-392	UA	845	Chloride, total	mg/L	10/27/2022 - 05/16/2023	CI around median	334	1370	1370	200	Background
MW-392	UA	845	Chromium, total	mg/L	10/27/2022 - 05/16/2023	CI around median	0.00150	0.10	0.013	0.1	Standard
MW-392	UA	845	Cobalt, total	mg/L	10/27/2022 - 05/16/2023	CI around median	0.00100	0.006	0.0022	0.006	Standard
MW-392	UA	845	Fluoride, total	mg/L	10/27/2022 - 05/16/2023	CB around linear reg	3.63	4.0	3.8	4	Standard
MW-392	UA	845	Lead, total	mg/L	10/27/2022 - 05/16/2023	CI around median	0.00100	0.0075	0.0022	0.0075	Standard
MW-392	UA	845	Lithium, total	mg/L	10/27/2022 - 05/16/2023	CI around mean	0.0497	0.14	0.14	0.04	Background
MW-392	UA	845	Mercury, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-392	UA	845	Molybdenum, total	mg/L	10/27/2022 - 05/16/2023	CI around median	0.00150	0.10	0.078	0.1	Standard
MW-392	UA	845	pH (field)	SU	10/27/2022 - 05/16/2023	CI around mean	7.3/7.9	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-392	UA	845	Radium 226 + Radium 228, total	pCi/L	10/27/2022 - 05/16/2023	CI around mean	0.237	5.0	3.8	5	Standard
MW-392	UA	845	Selenium, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.001	0.050	0.0032	0.05	Standard
MW-392	UA	845	Sulfate, total	mg/L	10/27/2022 - 05/16/2023	CI around geomean	45.9	762	762	400	Background

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-392	UA	845	Thallium, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-392	UA	845	Total Dissolved Solids	mg/L	10/27/2022 - 05/16/2023	CI around mean	1410	3260	3260	1200	Background
MW-393	UA	845	Antimony, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00100	0.006	0.0023	0.006	Standard
MW-393	UA	845	Arsenic, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00100	0.010	0.010	0.01	Background
MW-393	UA	845	Barium, total	mg/L	10/27/2022 - 05/15/2023	CI around geomean	0.0224	2.0	0.26	2	Standard
MW-393	UA	845	Beryllium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.0005	0.004	0.0005	0.004	Standard
MW-393	UA	845	Boron, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	1.47	2.2	2.2	2	Background
MW-393	UA	845	Cadmium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard
MW-393	UA	845	Chloride, total	mg/L	10/27/2022 - 05/15/2023	CB around linear reg	617	1370	1370	200	Background
MW-393	UA	845	Chromium, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00150	0.10	0.013	0.1	Standard
MW-393	UA	845	Cobalt, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00100	0.006	0.0022	0.006	Standard
MW-393	UA	845	Fluoride, total	mg/L	10/27/2022 - 05/15/2023	CB around linear reg	7.49	4.0	3.8	4	Standard
MW-393	UA	845	Lead, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.008	0.0075	0.0022	0.0075	Standard
MW-393	UA	845	Lithium, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.0519	0.14	0.14	0.04	Background
MW-393	UA	845	Mercury, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-393	UA	845	Molybdenum, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	-0.000199	0.10	0.078	0.1	Standard
MW-393	UA	845	pH (field)	SU	10/27/2022 - 05/15/2023	CI around mean	7.7/8.4	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-393	UA	845	Radium 226 + Radium 228, total	pCi/L	10/27/2022 - 05/15/2023	CI around mean	0.0868	5.0	3.8	5	Standard
MW-393	UA	845	Selenium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.001	0.050	0.0032	0.05	Standard
MW-393	UA	845	Sulfate, total	mg/L	10/27/2022 - 05/15/2023	CB around linear reg	104	762	762	400	Background
MW-393	UA	845	Thallium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-393	UA	845	Total Dissolved Solids	mg/L	10/27/2022 - 05/15/2023	CI around median	826	3260	3260	1200	Background
MW-394	UA	845	Antimony, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.000850	0.006	0.0023	0.006	Standard
MW-394	UA	845	Arsenic, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00100	0.010	0.010	0.01	Background
MW-394	UA	845	Barium, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.0258	2.0	0.26	2	Standard
MW-394	UA	845	Beryllium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.0005	0.004	0.0005	0.004	Standard
MW-394	UA	845	Boron, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	1.53	2.2	2.2	2	Background

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-394	UA	845	Cadmium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard
MW-394	UA	845	Chloride, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	490	1370	1370	200	Background
MW-394	UA	845	Chromium, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	-0.00000691	0.10	0.013	0.1	Standard
MW-394	UA	845	Cobalt, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00100	0.006	0.0022	0.006	Standard
MW-394	UA	845	Fluoride, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	3.25	4.0	3.8	4	Standard
MW-394	UA	845	Lead, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00100	0.0075	0.0022	0.0075	Standard
MW-394	UA	845	Lithium, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.0438	0.14	0.14	0.04	Background
MW-394	UA	845	Mercury, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-394	UA	845	Molybdenum, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.00443	0.10	0.078	0.1	Standard
MW-394	UA	845	pH (field)	SU	10/27/2022 - 05/15/2023	CI around mean	7.6/8.1	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-394	UA	845	Radium 226 + Radium 228, total	pCi/L	10/27/2022 - 05/15/2023	CI around mean	0.301	5.0	3.8	5	Standard
MW-394	UA	845	Selenium, total	mg/L	10/27/2022 - 05/15/2023	Most recent sample	0.00100	0.050	0.0032	0.05	Standard
MW-394	UA	845	Sulfate, total	mg/L	10/27/2022 - 05/15/2023	CB around linear reg	77.3	762	762	400	Background
MW-394	UA	845	Thallium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-394	UA	845	Total Dissolved Solids	mg/L	10/27/2022 - 05/15/2023	CI around mean	1770	3260	3260	1200	Background
OW-256	UU	257	Antimony, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.001	0.006	0.0023	0.006	Standard
OW-256	UU	257	Arsenic, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0100	0.010	0.010	0.01	Background
OW-256	UU	257	Barium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.102	2.0	0.26	2	Standard
OW-256	UU	257	Beryllium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0005	0.004	0.0005	0.004	Standard
OW-256	UU	257	Boron, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.187	2.2	2.2	2	Background
OW-256	UU	257	Cadmium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.002	0.005	0.002	0.005	Standard
OW-256	UU	257	Chloride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	54.0	1370	1370	200	Background
OW-256	UU	257	Chromium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.005	0.10	0.013	0.1	Standard
OW-256	UU	257	Cobalt, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00150	0.006	0.0022	0.006	Standard
OW-256	UU	257	Fluoride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.250	4.0	3.8	4	Standard
OW-256	UU	257	Fluoride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.250	4.0	3.8	4	Standard
OW-256	UU	257	Lead, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.008	0.0075	0.0022	0.0075	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
OW-256	UU	257	Lithium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00500	0.14	0.14	0.04	Background
OW-256	UU	257	Mercury, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0002	0.002	0.0002	0.002	Standard
OW-256	UU	257	Molybdenum, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.01	0.10	0.078	0.1	Standard
OW-256	UU	257	pH (field)	SU	03/14/2023 - 05/17/2023	Most recent sample	6.7/6.7	6.5/11	7.5/11.1	6.5/9	Standard/Background
OW-256	UU	257	Radium 226 + Radium 228, total	pCi/L	03/14/2023 - 05/17/2023	Most recent sample	0.717	5.0	3.8	5	Standard
OW-256	UU	257	Selenium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.001	0.050	0.0032	0.05	Standard
OW-256	UU	257	Sulfate, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	64.0	758	758	400	Background
OW-256	UU	257	Thallium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.002	0.002	0.002	0.002	Standard
OW-256	UU	257	Total Dissolved Solids	mg/L	03/14/2023 - 05/17/2023	Most recent sample	514	3260	3260	1200	Background
OW-257	UU	257	Antimony, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00500	0.006	0.0023	0.006	Standard
OW-257	UU	257	Arsenic, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.103	0.010	0.010	0.01	Background
OW-257	UU	257	Barium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.975	2.0	0.26	2	Standard
OW-257	UU	257	Beryllium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00970	0.004	0.0005	0.004	Standard
OW-257	UU	257	Boron, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.490	2.2	2.2	2	Background
OW-257	UU	257	Cadmium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00450	0.005	0.002	0.005	Standard
OW-257	UU	257	Chloride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	7.00	1370	1370	200	Background
OW-257	UU	257	Chromium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.214	0.10	0.013	0.1	Standard
OW-257	UU	257	Cobalt, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.203	0.006	0.0022	0.006	Standard
OW-257	UU	257	Fluoride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.370	4.0	3.8	4	Standard
OW-257	UU	257	Fluoride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.370	4.0	3.8	4	Standard
OW-257	UU	257	Lead, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.214	0.0075	0.0022	0.0075	Standard
OW-257	UU	257	Lithium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.207	0.14	0.14	0.04	Background
OW-257	UU	257	Mercury, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0002	0.002	0.0002	0.002	Standard
OW-257	UU	257	Molybdenum, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0100	0.10	0.078	0.1	Standard
OW-257	UU	257	pH (field)	SU	03/14/2023 - 05/17/2023	Most recent sample	6.8/6.8	6.5/11	7.5/11.1	6.5/9	Standard/Background
OW-257	UU	257	Radium 226 + Radium 228, total	pCi/L	03/14/2023 - 05/17/2023	Most recent sample	25.3	5.0	3.8	5	Standard
OW-257	UU	257	Selenium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.001	0.050	0.0032	0.05	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
OW-257	UU	257	Sulfate, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	118	758	758	400	Background
OW-257	UU	257	Thallium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.01	0.002	0.002	0.002	Standard
OW-257	UU	257	Total Dissolved Solids	mg/L	03/14/2023 - 05/17/2023	Most recent sample	1270	3260	3260	1200	Background
PZ-170	UU	257	Antimony, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00100	0.006	0.0023	0.006	Standard
PZ-170	UU	257	Arsenic, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.01	0.010	0.010	0.01	Background
PZ-170	UU	257	Barium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0975	2.0	0.26	2	Standard
PZ-170	UU	257	Beryllium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0005	0.004	0.0005	0.004	Standard
PZ-170	UU	257	Boron, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.267	2.2	2.2	2	Background
PZ-170	UU	257	Cadmium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.002	0.005	0.002	0.005	Standard
PZ-170	UU	257	Chloride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	35.0	1370	1370	200	Background
PZ-170	UU	257	Chromium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00500	0.10	0.013	0.1	Standard
PZ-170	UU	257	Cobalt, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00460	0.006	0.0022	0.006	Standard
PZ-170	UU	257	Fluoride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.180	4.0	3.8	4	Standard
PZ-170	UU	257	Fluoride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.180	4.0	3.8	4	Standard
PZ-170	UU	257	Lead, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.008	0.0075	0.0022	0.0075	Standard
PZ-170	UU	257	Lithium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0291	0.14	0.14	0.04	Background
PZ-170	UU	257	Mercury, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0002	0.002	0.0002	0.002	Standard
PZ-170	UU	257	Molybdenum, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.01	0.10	0.078	0.1	Standard
PZ-170	UU	257	pH (field)	SU	03/14/2023 - 05/17/2023	Most recent sample	6.5/6.5	6.5/11	7.5/11.1	6.5/9	Standard/Background
PZ-170	UU	257	Radium 226 + Radium 228, total	pCi/L	03/14/2023 - 05/17/2023	Most recent sample	0.181	5.0	3.8	5	Standard
PZ-170	UU	257	Selenium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.001	0.050	0.0032	0.05	Standard
PZ-170	UU	257	Sulfate, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	170	758	758	400	Background
PZ-170	UU	257	Thallium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.002	0.002	0.002	0.002	Standard
PZ-170	UU	257	Total Dissolved Solids	mg/L	03/14/2023 - 05/17/2023	Most recent sample	730	3260	3260	1200	Background
PZ-182	UU	257	Antimony, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.001	0.006	0.0023	0.006	Standard
PZ-182	UU	257	Arsenic, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0100	0.010	0.010	0.01	Background
PZ-182	UU	257	Barium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0692	2.0	0.26	2	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
PZ-182	UU	257	Beryllium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0005	0.004	0.0005	0.004	Standard
PZ-182	UU	257	Boron, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.484	2.2	2.2	2	Background
PZ-182	UU	257	Cadmium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.002	0.005	0.002	0.005	Standard
PZ-182	UU	257	Chloride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	88.0	1370	1370	200	Background
PZ-182	UU	257	Chromium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.005	0.10	0.013	0.1	Standard
PZ-182	UU	257	Cobalt, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00100	0.006	0.0022	0.006	Standard
PZ-182	UU	257	Fluoride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.190	4.0	3.8	4	Standard
PZ-182	UU	257	Fluoride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.190	4.0	3.8	4	Standard
PZ-182	UU	257	Lead, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00750	0.0075	0.0022	0.0075	Standard
PZ-182	UU	257	Lithium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00690	0.14	0.14	0.04	Background
PZ-182	UU	257	Mercury, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0002	0.002	0.0002	0.002	Standard
PZ-182	UU	257	Molybdenum, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.01	0.10	0.078	0.1	Standard
PZ-182	UU	257	pH (field)	SU	03/14/2023 - 05/17/2023	Most recent sample	6.6/6.6	6.5/11	7.5/11.1	6.5/9	Standard/Background
PZ-182	UU	257	Radium 226 + Radium 228, total	pCi/L	03/14/2023 - 05/17/2023	Most recent sample	0.925	5.0	3.8	5	Standard
PZ-182	UU	257	Selenium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.001	0.050	0.0032	0.05	Standard
PZ-182	UU	257	Sulfate, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	254	758	758	400	Background
PZ-182	UU	257	Thallium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.002	0.002	0.002	0.002	Standard
PZ-182	UU	257	Total Dissolved Solids	mg/L	03/14/2023 - 05/17/2023	Most recent sample	1120	3260	3260	1200	Background

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Notes:

Potential exceedance of GWPS

HSU = hydrostratigraphic unit:
  UA = Uppermost Aquifer
  UU = Upper Unit
Program = regulatory program data were collected under:
  257 = 40 C.F.R. Part 257 Subpart D (Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments)
  845 = 35 I.A.C. Part 845 (Sampling events completed to assess well locations for inclusion in the Part 845 monitoring well network)
mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = standard units
Sample Count = number of samples from Sampled Date Range used to calculate the Statistical Result
Statistical Calculation = method used to calculate the statistical result:
Statistical Result = calculated in accordance with Statistical Analysis Plan using constituent concentrations observed at monitoring well during all sampling events within the specified date range
For pH, the values presented are the lower / upper limits
GWPS = Groundwater Protection Standard
GWPS Source:
  Standard = standard specified in 35 I.A.C. § 845.600(a)(1)
  Background = background concentration (see cover page for additional information)

TABLE 2. SUMMARY OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-370	UA	257	Chloride, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	1380	1370	1370	200	Background
MW-393	UA	845	Fluoride, total	mg/L	10/27/2022 - 05/15/2023	CB around linear reg	7.49	4.0	3.8	4	Standard
OW-257	UU	257	Arsenic, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.103	0.010	0.010	0.01	Background
OW-257	UU	257	Beryllium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00970	0.004	0.0005	0.004	Standard
OW-257	UU	257	Chromium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.214	0.10	0.013	0.1	Standard
OW-257	UU	257	Cobalt, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.203	0.006	0.0022	0.006	Standard
OW-257	UU	257	Lead, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.214	0.0075	0.0022	0.0075	Standard
OW-257	UU	257	Lithium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.207	0.14	0.14	0.04	Background
OW-257	UU	257	Radium 226 + Radium 228, total	pCi/L	03/14/2023 - 05/17/2023	Most recent sample	25.3	5.0	3.8	5	Standard
OW-257	UU	257	Thallium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.01	0.002	0.002	0.002	Standard

Notes:
HSU = hydrostratigraphic unit:
UA = Uppermost Aquifer
UU = Upper Unit
Program = regulatory program data were collected under:
257 = 40 C.F.R. Part 257 Subpart D (Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments)
845 = 35 I.A.C. Part 845 (Sampling events completed to assess well locations for inclusion in the Part 845 monitoring well network)
mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = standard units
Sample Count = number of samples from Sampled Date Range used to calculate the Statistical Result
Statistical Calculation = method used to calculate the statistical result:
Statistical Result = calculated in accordance with Statistical Analysis Plan using constituent concentrations observed at monitoring well during all sampling events within the specified date range
For pH, the values presented are the lower / upper limits
GWPS = Groundwater Protection Standard
GWPS Source:
Standard = standard specified in 35 I.A.C. § 845.600(a)(1)
Background = background concentration (see cover page for additional information)

APPENDIX B
ALTERNATE SOURCE DEMONSTRATION BALDWIN POWER PLANT, BOTTOM ASH POND, CCR UNIT 601 (RAMBOLL, 2023a)

Intended for
Dynegy Midwest Generation, LLC

Date
April 30, 2023

Project No.
1940102203-001

40 C.F.R. § 257.95(g)(3)(ii): ALTERNATE SOURCE DEMONSTRATION

BALDWIN POWER PLANT

BOTTOM ASH POND

CCR UNIT 601

Bright ideas. Sustainable change.

CERTIFICATIONS

I, Brian G. Hennings, a professional geologist in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used other than for its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

____
Brian G. Hennings
Professional Geologist
196.001482
Illinois
Ramboll Americas Engineering Solutions, Inc.
Date: April 30, 2023

I, Anne Frances Ackerman, a qualified professional engineer in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used other than for its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

____
Anne Frances Ackerman
Qualified Professional Engineer
062-060586
Illinois
Ramboll Americas Engineering Solutions, Inc.
Date: April 30, 2023

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APPENDICES

ACRONYMS AND ABBREVIATIONS

40 C.F.R.	Title 40 of the Code of Federal Regulations
35 I.A.C.	Title 35 of the Illinois Administrative Code
A5D	Assessment Monitoring Sampling Event A5D
ASD	Alternate Source Demonstration
BAP	Bottom Ash Pond
bgs	below ground surface
BPP	Baldwin Power Plant
CCR	coal combustion residuals
cm/s	centimeters per second
FAPS	Fly Ash Pond System
GWPS	groundwater protection standard
IEPA	Illinois Environmental Protection Agency
LOE(s)	line(s) of evidence
mg/L	milligrams per liter
NAVD88	North American Vertical Datum of 1988
NRT	Natural Resource Technology, Inc.
NRT/OBG	Natural Resource Technology, an OBG Company
PMP	potential migration pathways
Ramboll	Ramboll Americas Engineering Solutions, Inc.
SEP	Sequential extraction procedure
SSI	statistically significant increase
SSL	statistically significant level
XRD	X-ray diffraction

1. INTRODUCTION

Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.95(g)(3)(ii) allows the owner or operator of a coal combustion residuals (CCR) unit 90 days from the date of determination of statistically significant levels (SSLs) over groundwater protection standards (GWPS) of groundwater constituents listed in Appendix IV of 40 C.F.R. § 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSL(s) (Alternate Source Demonstration [ASD]), or that the SSL(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

This ASD has been prepared on behalf of Dynegy Midwest Generation, LLC, by Ramboll Americas Engineering Solutions, Inc. (Ramboll), to provide pertinent information pursuant to 40 C.F.R. § 257.95(g)(3)(ii) for the Baldwin Power Plant (BPP) Bottom Ash Pond (BAP) located near Baldwin, Illinois.

The most recent Assessment Monitoring sampling event (A5D) was completed on September 30, 2022, and analytical data was received on November 15, 2022. Additional background and compliance monitoring wells were installed around the BAP in September and October of 2022. Following the well installations, eight monthly rounds of groundwater sampling were initiated per 35 I.A.C. § 845. Analytical data from all monitoring events, from December 2015 through A5D, were evaluated in accordance with the Statistical Analysis Plan (Natural Resource Technology, an OBG Company [NRT/OBG], 2017a) to determine any statistically significant increases (SSIs) of Appendix III parameters over background concentrations or SSLs of Appendix IV parameters over GWPSs. That evaluation identified one SSL at a compliance monitoring well as follows:

- Lithium at well MW-370

Pursuant to 40 C.F.R. § 257.95(g)(3)(ii), the lines of evidence (LOEs) presented in **Section 3** demonstrate that sources other than the BAP were the cause of the lithium SSL listed above. This ASD was completed by April 30, 2023, within 90 days of determination of the SSLs (January 30, 2023), as required by 40 C.F.R. § 257.95(g)(3)(ii).

2. BACKGROUND

2.1 Site Location and Description

The BPP is located in southwest Illinois in Randolph and St. Clair Counties. The Randolph County portion of the BPP is located within Sections 2, 3, 4, 9, 10, 11, 14, 15, and 16 of Township 4 South and Range 7 West. The St. Clair County portion of the property is located within Sections 33, 34, and 35 of Township 3 South and Range 7 West. The BAP is approximately one-half mile west-northwest of the Village of Baldwin.

The BPP property is bordered to the west by the Kaskaskia River; to the east by Baldwin Road, farmland, and strip-mining areas; to the southeast by the Village of Baldwin; to the south by the Illinois Central Gulf railroad tracks, scattered residences, and State Route 154; and to the north by farmland. The St. Clair/Randolph County Line crosses east-west at approximately the midpoint of Baldwin Lake (Cooling Pond). **Figure 1** shows the location of the BAP, as well as the Fly Ash Pond System (FAPS), Secondary Pond, Tertiary Pond, and Baldwin Lake (Cooling Pond). The BAP is adjacent to the FAPS, which was approved for closure by Illinois Environmental Protection Agency (IEPA) on August 16, 2016.

2.2 Groundwater Monitoring

The BAP groundwater monitoring system for compliance with 40 C.F.R. § 257 consists of two background monitoring wells (MW-304 and MW-306) and four compliance monitoring wells (MW-356, MW-369, MW-370, and MW-382). A map showing the groundwater monitoring system, including the CCR unit and all background and compliance monitoring wells, is presented in **Figure 1**. **Figure 1** also shows porewater location TPZ-164, as well as the monitoring wells that were installed in 2022. New monitoring well MW-358 was installed in 2022 upgradient of the BAP and compliance monitoring well MW-370 (compliance monitoring well with identified lithium SSL) with a well screen (363.7 to 373.7 feet North American Vertical Datum of 1988 [NAVD88]) that overlaps with MW-370 well screen elevations (355.6 to 365.6 feet NAVD88).

Groundwater samples are collected and analyzed in accordance with the Sampling and Analysis Plan prepared for the BAP (NRT/OBG, 2017b). Statistical evaluation of analytical data is performed in accordance with the Statistical Analysis Plan (NRT/OBG, 2017a).

2.3 Site Hydrogeology and Stratigraphy

Three hydrostratigraphic units are present at the Site, including CCR, an upper unit, and a bedrock unit. These units are described in detail in the Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan (Natural Resources Technology, Inc. [NRT], 2016) and the Hydrogeologic Site Characterization Report (Ramboll, 2021); and are summarized below.

- **CCR:** CCR, consisting primarily of fly ash, bottom ash, and boiler slag. Also includes earthen fill deposits of predominantly clay and silt materials from on-site excavations that were used to construct berms and roads surrounding the various impoundments across the Site. The 2022 Site Investigation observed up to 28.2 feet of bottom ash towards the center of the BAP (XPW05).
- **Upper Unit:** Predominantly clay with some silt and minor sand, silt layers, and occasional sand lenses. Includes the lithologic layers identified as the Cahokia Alluvium, Peoria Loess,

Equality Formation, and Vandalia Till Member. This unit is composed of unlithified natural geologic materials and extends from the water table to the bedrock. Thin sand seams and the interface (contact) between the Upper Unit and bedrock have been identified as potential migration pathways (PMPs). No continuous sand seams were observed in the Upper Unit within or immediately adjacent to the BAP; however, the sand seams may act as a PMP due to relatively higher hydraulic conductivities (on the order of 10^{-4} centimeters per second [cm/s]) than the surrounding clays (on the order of 10^{-5} cm/s).

- **Bedrock Unit:** Shallow bedrock beneath the BAP yields small amounts of water from interconnected pores, cracks, fractures, crevices, joints, and bedding planes and is the only water-bearing unit that is continuous across the Site; this unit is considered the Uppermost Aquifer (UA) and is composed of Pennsylvanian and Mississippian-aged interbedded shale and limestone bedrock having a regional strike that is generally north to northeast with a dip of 2 to 3 degrees to the east into the Illinois Basin (Breeden et. al, 2018; Bristol and Howard, 1971). The surface elevation varies across the site, generally sloping downward from east to west, and the unlithified Upper Unit thins from east to west. The top of bedrock depth ranges between 12.5 feet below ground surface (bgs) near the Kaskaskia River and 70 feet bgs within the East Fly Ash Pond (part of the FAPS). Limestone layers intercepted at the Site are generally light to dark gray, fine-grained, thin bedded, banded, argillaceous, and competent except where weathered. Weathering of the limestone produces a calcareous clay. The limestone layers are interbedded with thin shale layers and are sometimes fossiliferous or sandy. The shale layers are generally weathered, competent, silty, slightly micaceous, fissile, and dark gray. Where highly weathered shale (*i.e.,* decomposed bedrock) was encountered, the shale was non-fissile and resembled an unlithified stiff clay with medium to high plasticity. Bedrock in the vicinity of

Water quality in the Uppermost Aquifer (*i.e.,* Pennsylvanian and Mississippian-aged bedrock) degrades with increasing depth as water becomes increasingly mineralized. Therefore, water quality at monitoring wells with screens placed in deeper bedrock layers (*e.g.,* MW-358 and MW-370) would be expected to demonstrate more influence from the naturally increased mineralization than wells screened shallower in the bedrock. Groundwater flow in bedrock is toward the northwest in the east and central areas of the BAP, and southwest in the east area of the FAPS. The Secondary and Tertiary ponds were created in a former drainage channel and bedrock groundwater flows toward these ponds as illustrated in **Figure 2**. Groundwater elevations vary seasonally, generally less than 7 feet, although flow directions are generally consistent. Groundwater elevations across the Site range between approximately 370 and 450 feet NAVD88.

3. ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

This ASD is based on the following LOEs:

1. The lithium concentration in the BAP porewater is lower than the concentrations observed in compliance monitoring well location MW-370.
2. Compliance monitoring well MW-370 has a similar ionic composition to upgradient monitoring well MW-358.
3. An aquifer solids evaluation identified naturally occurring lithium associated with the shale bedrock as a source for lithium in the Uppermost Aquifer.

These LOEs are described and supported in greater detail below. Monitoring wells and the BAP porewater sample locations are shown in **Figure 1**.

3.1 LOE #1: The lithium concentration in the BAP porewater is lower than the concentrations observed in compliance monitoring well location MW-370.

Table A below provides summary statistics for lithium in background wells, MW-370 and BAP porewater collected from TPZ-164, and the five new porewater wells installed in 2022.

Table A. Summary Statistics for Lithium in MW-370 and BAP Porewater (December 2015 to March 2023).

Sample Location	Lithium (milligrams per liter [mg/L])		
	Minimum	Maximum	Median
Background Groundwater[1]	0.010	0.096	0.055
Exceedance Groundwater (MW-370)	0.098	0.22	0.14
BAP Porewater[2]	<0.005	0.035	0.013

Notes:

[1]Background groundwater was collected at monitoring wells MW-304 and MW-306.

[2]BAP porewater was collected at TPZ-164 (September 2018 through November 2022), XPW01, XPW02, XPW04, XPW05, and XPW06 (October 2022 through January 2023).

The following observations can be made from **Table A** above:

- Concentrations of lithium in background wells ranged from 0.010 to 0.096 mg/L, with a median concentration of 0.055 mg/L.
- Concentrations of lithium in downgradient compliance monitoring well MW-370 ranged from 0.098 to 0.22 mg/L, with a median concentration of 0.14 mg/L.
- Concentrations of lithium in BAP porewater ranged from non-detect (<0.005 mg/L) to 0.035 mg/L, with a median concentration of 0.013 mg/L.
- The median lithium concentration observed in porewater is an order of magnitude lower than the median lithium concentrations observed in compliance monitoring well MW-370.
- The highest observed lithium concentration in porewater is approximately six times lower than the maximum concentration observed in compliance monitoring well MW-370.

If the BAP was the source of lithium in downgradient groundwater, BAP porewater concentrations of lithium would be expected to be higher than the groundwater concentrations. The median lithium concentration observed in porewater is below the median lithium concentrations observed in both background and compliance groundwater monitoring wells, indicating that lithium concentrations are not related to the BAP.

3.2 LOE #2: Compliance monitoring well MW-370 has a similar ionic composition to upgradient monitoring well MW-358.

Stiff diagrams graphically represent ionic composition of aqueous solutions. **Figure A** on the following page shows a series of Stiff diagrams that display the ionic compositions of groundwater from background monitoring wells (brown); compliance monitoring wells (blue); and upgradient monitoring well MW-358 (tan). Polygons with similar shapes on Stiff diagrams indicate solutions with similar ionic compositions, whereas polygons with different shapes indicate solutions with dissimilar ionic compositions. The larger the area of the polygon, the greater the concentration of the various ions. A Stiff diagram was included in **Figure A** for one out-of-network, upgradient, monitoring well, MW-358, due to similarities with MW-370 with respect to ionic composition, well screen elevation, and the composition of the bedrock material.

Compliance monitoring well MW-370 has chloride as the dominant anion and a substantially higher proportion of Na+K, similar to upgradient well MW-358. Upgradient monitoring well MW-358 is screened in a similar shaley bedrock material and at a similar elevation to MW-370 (**Figures 3 and 4**). The similarity in ionic composition in compliance well MW-370 and upgradient well MW-358 suggests that groundwater at these locations and depths is from a similar lithologic material that has undergone a similar amount of naturally occurring dissolution, and supports the conclusion that natural variability of groundwater in the Uppermost Aquifer is responsible for the lithium SSL at MW-370.

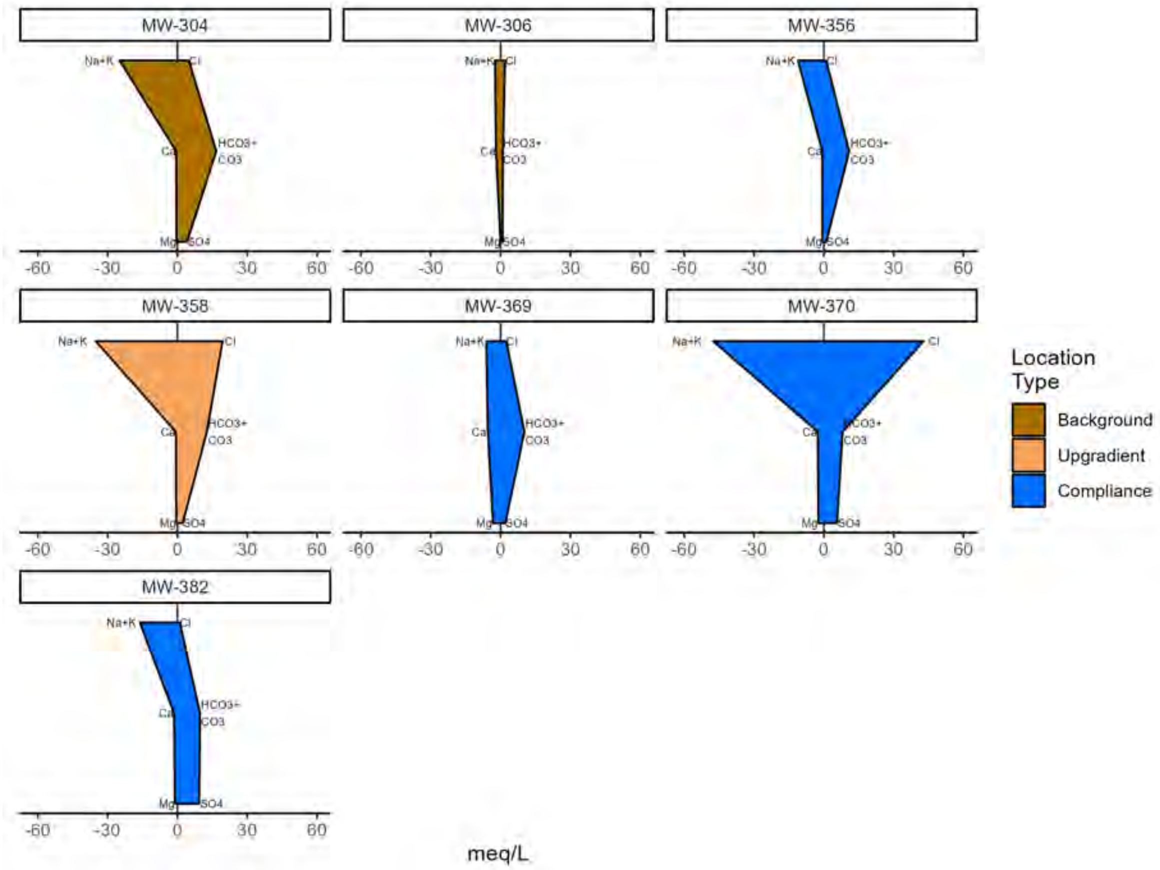

Figure A. Stiff Diagram Showing Ionic Composition of Samples of BAP Background (Brown), Compliance Groundwater (Blue), and Upgradient Groundwater (Tan).

3.3 LOE #3: An aquifer solids evaluation identified naturally occurring lithium associated with the shale bedrock as a source of lithium in the Uppermost Aquifer

Solid phase analyses were completed on samples collected from the Site to support the conclusion that lithium concentrations in groundwater at MW-370 are associated with naturally occurring lithium in the Uppermost Aquifer materials (limestone and shale bedrock formation). A review of the geochemical and site conditions was completed by Geosyntec Consultants, Inc. and is included as **Appendix A**. The following conclusions were made based on the results of the aquifer solids evaluation:

- Lithium host-minerals occur in the UA throughout the Site and constitute natural sources of lithium in BAP soils.
- Lithium is present in both upgradient and downgradient shale samples at the Site, with the largest concentrations observed in upgradient solids samples.
- Natural lithium occurrence in aquifer material from the Site is associated with multiple phases and therefore interacts with groundwater through different mechanisms at different locations and depths.

- Naturally occurring lithium associated with the shale bedrock comprising the UA at the Site was identified as a source of lithium in Site groundwater.

4. CONCLUSIONS

Based on the following three LOEs, it has been demonstrated that the lithium SSL at MW-370 is not due to the BAP:

1. The lithium concentration in the BAP porewater is lower than the concentrations observed in compliance monitoring well location MW-370.
2. Compliance monitoring well MW-370 has a similar ionic composition to upgradient monitoring well MW-358.
3. An aquifer solids evaluation identified naturally occurring lithium associated with the shale bedrock as a source for lithium in the Uppermost Aquifer.

This information serves as the written ASD prepared in accordance with 40 C.F.R. § 257.95(g)(3)(ii) that the SSL observed during the A5D sampling event was not due to the BAP. Therefore, a corrective measures assessment is not required, and the BAP will remain in assessment monitoring. Additional data is being collected to identify the source of the SSLs.

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FIGURES

Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Baldwin_AP\2023\Figure 1_Sampling Location Map.mxd

PROJECT: 169000XXXX | DATED: 4/25/2023 | DESIGNER: GALARNMC

- BACKGROUND WELL
- COMPLIANCE WELL
- MONITORING WELL
- PORE WATER WELL
- REGULATED UNIT (SUBJECT UNIT)
- FLY ASH POND SYSTEM (CLOSED)
- SITE FEATURE
- CAPPED AREA
- PROPERTY BOUNDARY

0 400 800 Feet

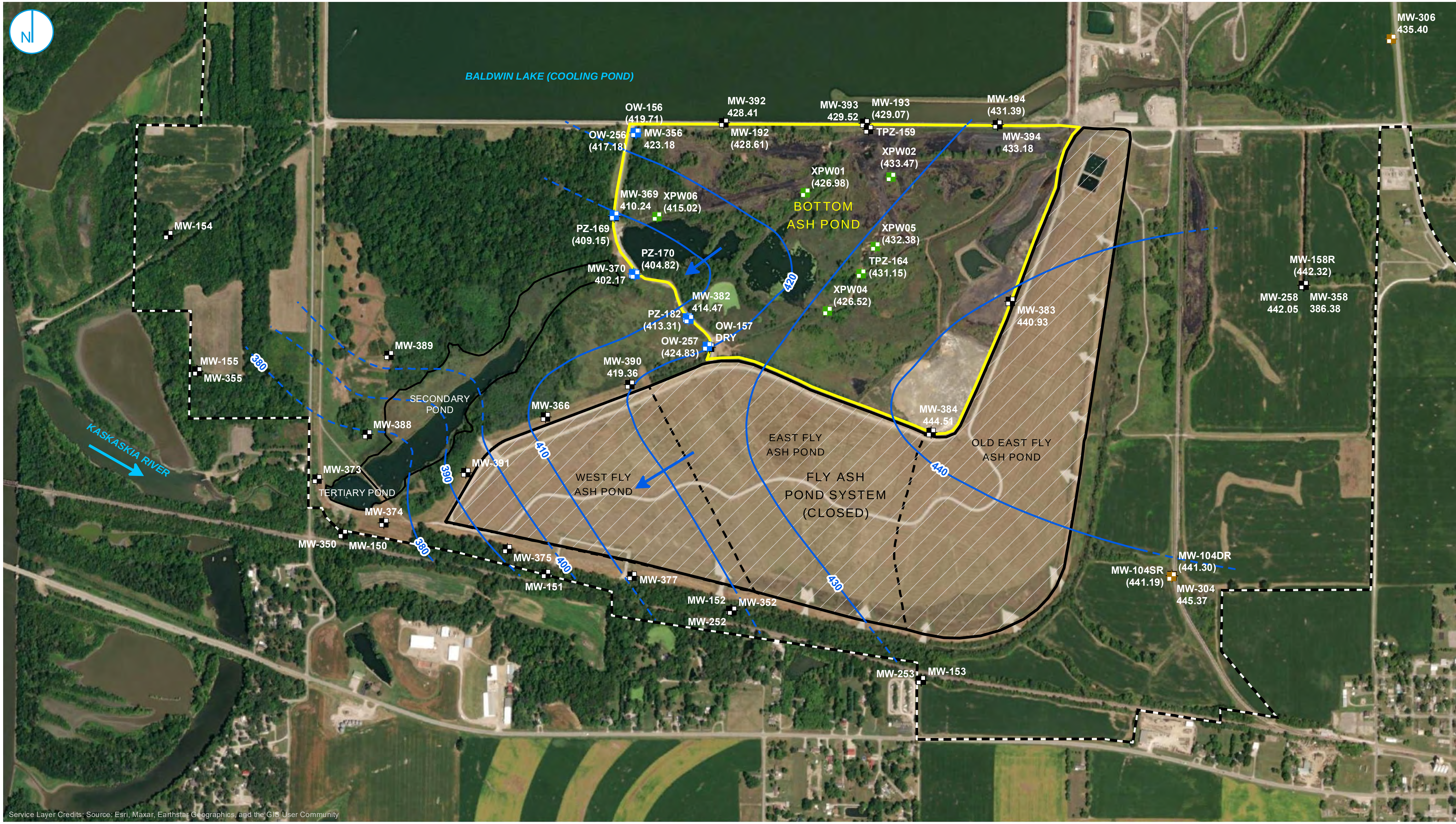
SAMPLING LOCATION MAP

ALTERNATE SOURCE DEMONSTRATION
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



COMPLIANCE WELL
BACKGROUND WELL
PORE WATER WELL
MONITORING WELL

GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION

PART 845 REGULATED UNIT (SUBJECT UNIT)
FLY ASH POND SYSTEM (CLOSED)
SITE FEATURE
CAPPED AREA
PROPERTY BOUNDARY

0 400 800 Feet

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

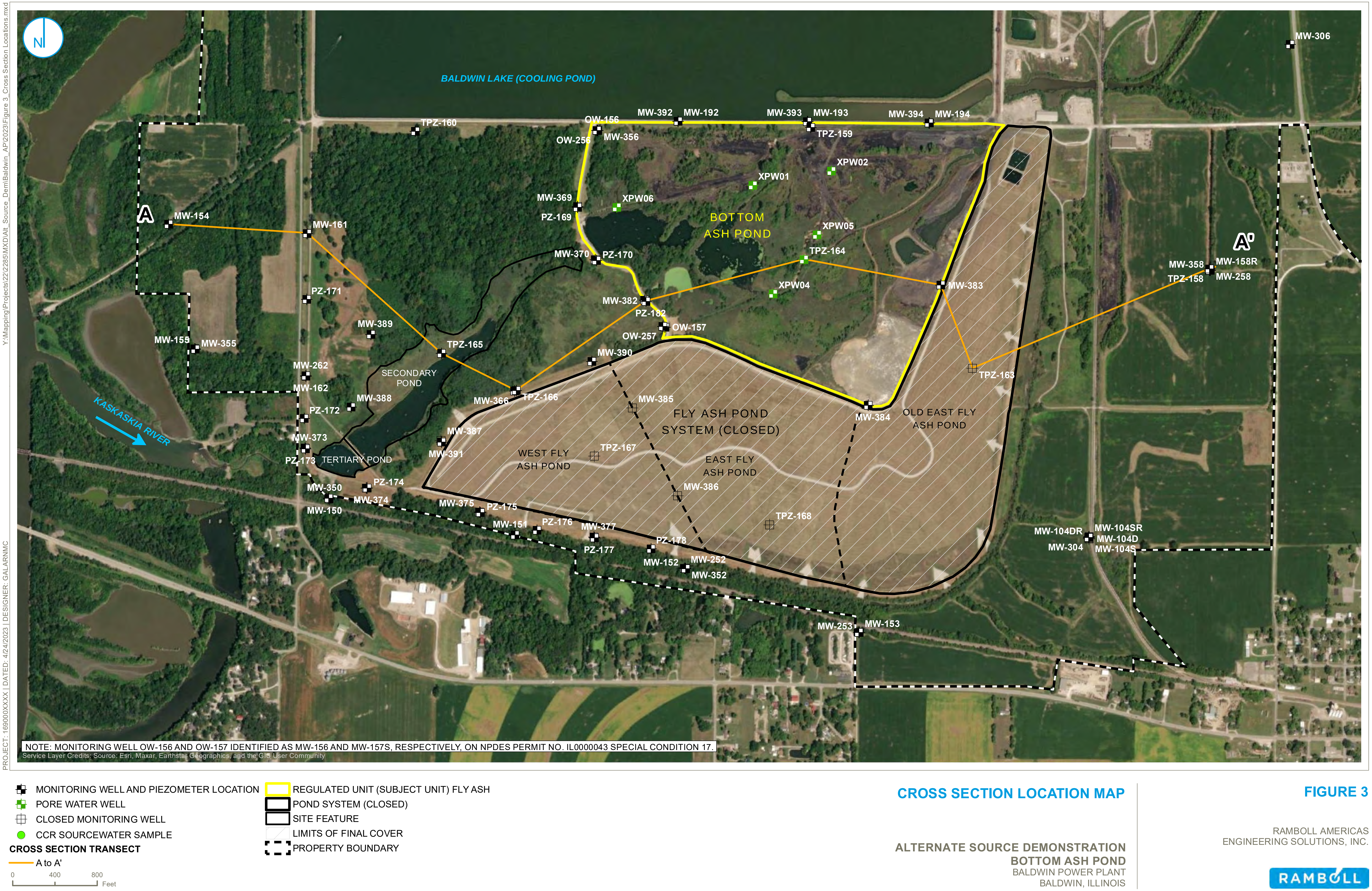
UPPERMOST AQUIFER POTENTIOMETRIC SURFACE MAP DECEMBER 12, 2022

ALTERNATE SOURCE DEMONSTRATION
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 2

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL



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Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Baldwin_AP\2023\Figure 3_Cross Section Locations.mxd

CROSS SECTION LOCATION MAP

ALTERNATE SOURCE DEMONSTRATION
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

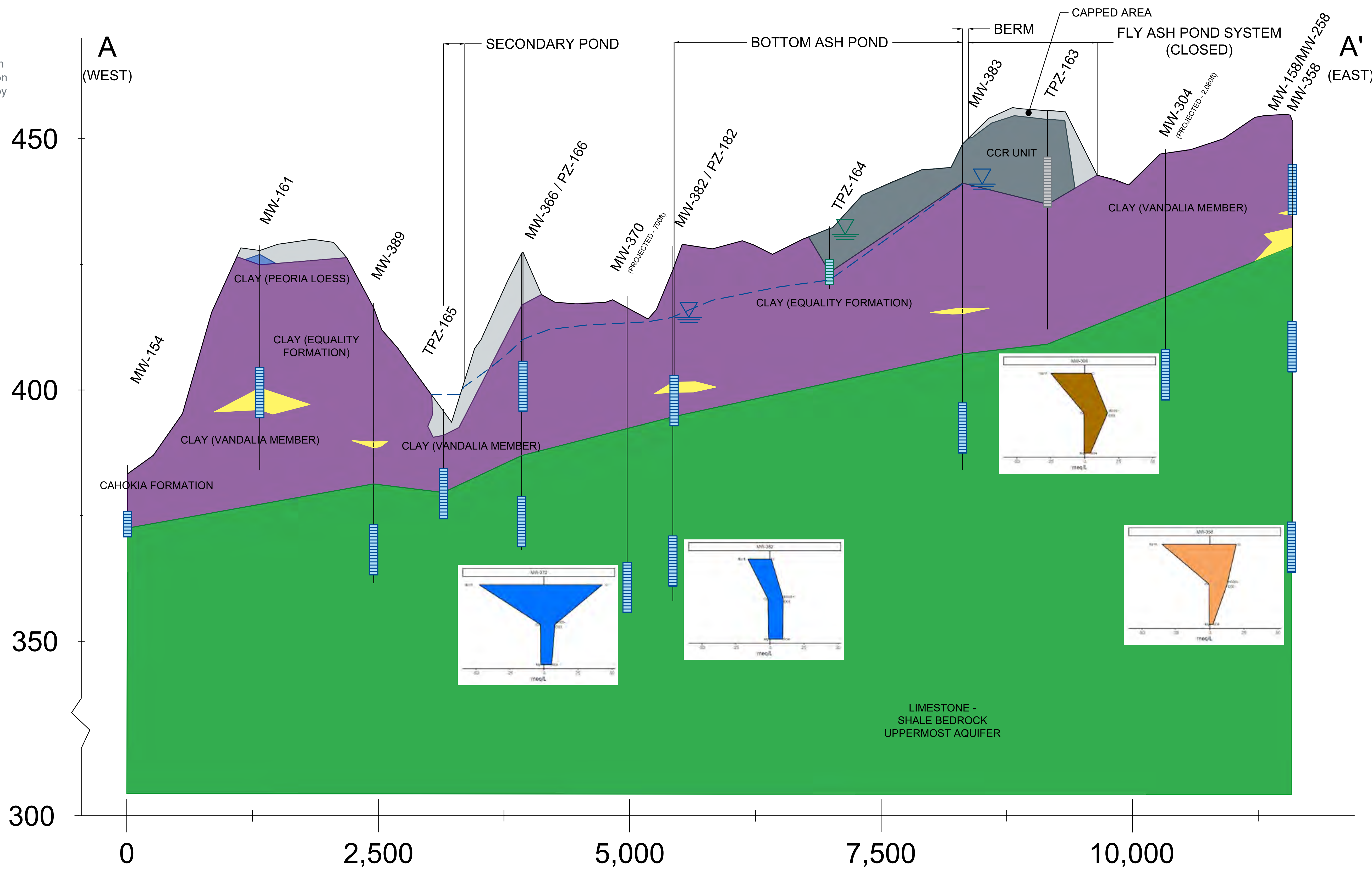
FIGURE 3

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 50X.
4. Groundwater elevations measured on December 12, 2022.



STIFF DIAGRAM LOCATION TYPE:

- BACKGROUND
- UPGRADIENT
- COMPLIANCE

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
- UPPERMOST AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)

20'
0
1,000'

CROSS SECTION A-A'

ALTERNATE SOURCE DEMONSTRATION BOTTOM ASH POND

BALDWIN POWER PLANT
BALDWIN, ILINOIS

FIGURE 4

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

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APPENDICES

APPENDIX A
TECHNICAL MEMORANDUM - EVALUATION OF LITHIUM SOURCES WITHIN AQUIFER SOLIDS, BALDWIN POWER STATION - BOTTOM ASH POND (GEOSYNTEC CONSULTANTS, INC., 2023)

Geosyntec consultants

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www.geosyntec.com

TECHNICAL MEMORANDUM

Date:	April 24, 2023
To:	Brian Voelker - Vistra
Copies to:	Stu Cravens and Phil Morris - Vistra
From:	Allison Kreinberg and Ryan Fimmen, Ph.D. - Geosyntec Consultants
Subject:	Evaluation of Lithium Sources within Aquifer Solids Baldwin Power Station – Bottom Ash Pond

Geosyntec Consultants, Inc. (Geosyntec) has completed a review of geochemical and site conditions at the Baldwin Power Plant Bottom Ash Pond (BAP; the Site) to evaluate the influence of the bedrock lithology on groundwater composition at downgradient monitoring well MW-370.

Alternate source demonstrations (ASDs) prepared by Ramboll Americas Engineering Solutions, Inc. (Ramboll) concluded that sources other than the BAP were the cause of statistically significant levels (SSL) of lithium at MW-370. This technical review has identified naturally occurring lithium associated with the shale bedrock as a source of elevated lithium in Site groundwater.

SITE CONDITIONS

The groundwater monitoring network for the BAP consists of four downgradient compliance wells (MW-356, MW-369, MW-370, and MW-382) and two upgradient background wells (MW-304 and MW-306). These monitoring locations are shown in the map provided as **Attachment 1**. Site geology consists of glacial drift deposits comprised of clastic material overlying Pennsylvanian and Mississippian-age bedrock (Ramboll, 2021). The geologic units comprising subsurface lithologies at the Site are listed in descending order:

- Equality Formation: predominantly clay and sandy clay, with intermittent sand lenses and some secondary carbonate concretions
- Pearl Formation: predominantly fine-medium grained sand with intermittent gravel
- Vandalia Till: clay and sandy clay diamicton with intermittent silt, sand, and gravel lenses
- Bedrock: Mississippian-age limestone and shale which underlies unconsolidated material beneath the western portion of the Site, and Pennsylvanian-age limestone and shale which underlies unconsolidated material beneath the eastern portion of the Site. The gradual

change from Mississippian bedrock to Pennsylvanian bedrock is believed to occur approximately beneath the central portion of the Site (Willman et al., 1967).

Limestone bedrock at the Site is generally thinly bedded, argillaceous, and competent, with localized areas of increased weathering (Ramboll, 2021). The result of this limestone weathering is a calcareous clay lithology. Layers of limestone bedrock are interbedded with thin shale layers which are sometimes calcareous and sometimes siliciclastic. The shale layers are generally more weathered than the limestone bedrock but are generally still competent. Locations of highly weathered, non-fissile, clay-like shale with medium to high plasticity have been observed.

The Uppermost Aquifer (UA) in the vicinity of the BAP is the shallow limestone/shale bedrock. Although sand lenses are present within the unconsolidated material overlying bedrock, these lenses have not been found to be laterally continuous. Groundwater in the vicinity of the BAP flows through bedrock from east to west primarily through secondary porosity features, predominantly joints and fractures, which are present at variable frequencies within the UA.

Geologic cross-sections of the lithology underlying the BAP are provided as **Attachment 2**. The fracture network within the deeper portions of the UA bedrock is overlain by unconsolidated, predominantly low permeability clay with some silt, resulting in confined to semi-confined groundwater conditions with mostly upward vertical gradients and or flowing artesian conditions observed in the unconsolidated and UA bedrock units across the Site. The observed upward vertical gradients (upwelling) result in deeper groundwater characteristic of older lithologies mixing with shallow formation water in the UA. The flat horizontal groundwater gradient beneath the Site and the mostly upward vertical gradients also suggests the BAP is not an area of significantly increased recharge or infiltration to the UA. Groundwater quality in the UA has observed to decrease with increasing depths as confined formation water is increasingly mineralized (Ramboll, 2021).

GROUNDWATER CONDITIONS

The observed lithium SSL was identified by comparing the reported groundwater concentrations at downgradient monitoring well MW-370 to the site-specific groundwater protection standard (GWPS). The site-specific GWPS for lithium was established at 0.0958 mg/L, as the Site background concentrations were greater than the health-based level of 0.040 mg/L established in 40 CFR § 257.95(h)(2). Groundwater samples collected from recently installed upgradient monitoring well MW-358, which is screened in the Mississippian-age limestone and shale bedrock strata, contained lithium concentrations ranging from 0.0592 to 0.0957 mg/L. These upgradient concentrations, as well as previously observed results from background well MW-304, are elevated with respect to the health-based GWPS. This observation indicates that lithium is present at concentrations across the Site which suggest that a naturally occurring geogenic source of lithium to groundwater is present in these strata.

AQUIFER SOLIDS EVALUATION

Geosyntec reviewed the results of analyses completed on solid phase samples collected from the Site to support the conclusion that the lithium concentrations in groundwater at MW-370 in excess of the site-specific GWPS are associated with the limestone and shale bedrock formation.

Samples were collected from soil borings advanced in September and October 2022 at one location upgradient of the BAP (MW-358) and three locations downgradient of the BAP (MW-392, MW-393, and MW-394). These boring logs, plus the boring log for monitoring well MW-370, are provided as **Attachment 3**. Additional information regarding monitoring well construction and lithology depths of these locations and MW-370 is provided in **Table 1**. Three samples each were collected from various depth intervals/lithologies at MW-358 and MW-392, and one sample each was collected from the unconsolidated overburden at MW-393 and MW-394[1]. The samples were submitted for analysis of mineralogy via X-ray diffraction (XRD), total lithium, and lithium distribution within the aquifer solids using sequential extraction procedure (SEP). SEP uses progressively stronger reagents to solubilize metals from increasingly recalcitrant phases. Although these procedures do not identify the specific metal phases in a soil/aquifer matrix, they do provide a means to evaluate association of constituents with different classes of solids (Tessier et al, 1979).

Results for total and SEP analyses of lithium in these samples are presented in **Table 2** and the analytical laboratory reports are provided as **Attachment 4**. As a first step to evaluate data quality in an SEP analysis, the sum of individual extraction steps from the SEP was compared to the total lithium concentration. The sum of the SEP procedure is not expected to be exactly equal to the total metals analysis but should generally be consistent with the total metals analysis. As can be seen in **Table 2**, the total lithium concentrations ranged from 6.0 micrograms per gram of material (μg/g) to 20 μg/g in the shale samples. The summed concentrations of lithium from the SEP analyses ranged from 7 to 73 μg/g. The results were generally consistent between the total metals analyses and the summed SEP steps, indicating good metals recovery and data quality. One notable exception is the sample collected from 86-88 feet (ft.) below ground surface (bgs) at upgradient location MW-358, which had a total lithium concentration of 20.0 μg/g and a summed SEP total of 73 μg/g. While a difference was observed, both results indicate lithium is present within shale materials upgradient of the Site.

These results indicate that lithium is present in both upgradient and downgradient shale samples at the Site, with the largest concentrations observed in upgradient samples. Most lithium in these samples was found to be associated with the residual metals fraction, which is typically considered to be immobile and not readily soluble. The abundance of lithium within the residual fraction

---

[1] Select samples, including those collected from MW-393 and MW-394, are excluded from subsequent results tables and discussion to emphasize findings associated with the bedrock lithologies.

indicates association with inseparable primary mineral phases such as clay minerals (Tessier et al., 1979). Lithium was also found to be associated with iron/manganese oxides in multiple samples (maximum of 25% associated with iron/manganese oxides in the sample collected from the 47-49 ft. bgs samples from MW-358), and a small component of lithium was found to be associated with organic material in the 86-88 ft. bgs sample collected from MW-358. These results indicate that natural lithium occurrence in aquifer material from the Site is associated with multiple phases and therefore interacts with groundwater through different mechanisms at different locations and depths.

Clay minerals are known to be common geosorbents for naturally occurring lithium (Starkey, 1982). Lithium is known to leach from lithium-hosting igneous rocks and micas through weathering processes. Mineral alteration reactions occurring in micas may result in lithium-rich micas transforming directly to illitic clays, and then to mixed-layer and smectite clays. The lithium within these primary minerals either becomes incorporated directly into the crystal structures of these clay minerals or is transported in solution and later concentrated in brines through evaporation (Ronov et al., 1970). Lithium-enriched brines constitute a common source of lithium in clay minerals, as eroded fine-grained materials deposited in these brines are capable of housing aqueous lithium within vacant sites in octahedral layers comprising their crystal structures (Schultz, 1969). SEP results from **Table 2** support the conclusion that naturally occurring lithium is observed in soils around the BAP, and that the majority of this lithium is associated with the residual solids fraction which consists of primary minerals. Field lithologic descriptions of samples indicate that nearly all of the samples collected and analyzed consist of clay or shale, both of which are comprised primarily of mica and clay minerals which are known to be hosts of natural lithium. Based on SEP results and lithologic observations, the data suggests that lithium in BAP soils is naturally occurring and primarily associated with micas and clays, with a smaller component associated with leachable oxides and organic material.

Mineralogical analyses were completed using X-ray diffraction (XRD) to evaluate whole rock mineralogy and evaluate the abundance of clays and micas within the aquifer solids. Whole rock mineralogy results are provided in **Table 3**. Sample mineralogy consists predominantly of quartz, mica (muscovite), feldspars (albite and microcline), and clay minerals (chlorite, kaolinite) (**Table 3**). Of these minerals, muscovite and clays are known hosts of natural lithium within their crystal structures (Zawidzki, 1976; Starkey, 1982). The combined abundances of muscovite or clay minerals account for between 30 to 49% of samples within the bedrock shale samples, with an average value of 43%. As indicated on **Table 3**, these minerals are present at sizeable abundances both upgradient and downgradient of the BAP, indicating that these lithium-host minerals occur in the UA throughout the Site and constitute natural sources of lithium.

MW-370 is screened from 53-63 ft. bgs within an interval of shaley limestone, with additional shale and clay directly overlying this material, as indicated by the boring log included in **Attachment 3**. It is likely that lithium-hosting micas and clay minerals are present within the screened interval of this monitoring well, the leachable component of which may act as a geogenic source of lithium in groundwater. Additionally, groundwater downgradient of the BAP may be mixing with deeper groundwater in contact with lithium-bearing micas and clay minerals within the deep shale lithologies observed upgradient of the Site due to the observed upward vertical gradient within the bedrock unit.

CONCLUSION

Naturally occurring lithium associated with the shale bedrock comprising the UA at the Site was identified as a source for lithium in Site groundwater. Solid phase samples collected from upgradient and downgradient locations around the BAP contained variable lithium, with the highest total lithium concentration observed in the background deep shale sample. SEP analyses of the solid phase samples determined that the majority of lithium in the solid phase is associated with the residual metals fraction. The residual metals fraction corresponds to primary minerals such as micas and clay minerals, which are known to host natural lithium in their crystal structures, either as a result of mineral formation (micas) or depositional/alteration processes (clays). XRD confirmed the presence of micas and clay minerals in the aquifer solids at an average of 43% of the bedrock total mineralogy, suggesting an abundance of common lithium-hosting minerals which may release lithium to groundwater. This solid phase assessment supports the determination that MW-370 groundwater geochemistry appears to be related to shaley aquifer solid material.

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TABLES

Table 1 - Relevant Monitoring Well Information
Baldwin Power Plant

Monitoring Well	Well Classification	Screened Interval	Depth of Well	Geologic Material Within Screened Interval	Interval of Observed Alluvial Clay	Interval of Observed Bedrock
MW-370	Downgradient	53-63	66	Shaley limestone, Limestone	0-28.5	28.5-66
MW-358	Upgradient	80-90	90	Limestone, Shale	4-21	21-90
MW-392	Downgradient	74-84	84	Shale, Limestone	1-33	52-84
MW-393	Downgradient	75-85	85	Shale	1-27, 31-40	57-85
MW-394	Downgradient	73-83	85	Shale, Limestone	3-20, 22-37	37-85

Notes:
Depths provided in units of feet below ground surface
Observed clay and bedrock intervals are based on the boring logs provided in Attachment 3.

Table 2 - Lithium SEP Results Summary
Baldwin Power Plant

Well ID	**MW-358**		**MW-358**		**MW-392**		**MW-392**	
Depth (ft)	**(47-49)**		**(86-88)**		**(66-68)**		**(80-82)**	
Location	**Upgradient**		**Upgradient**		**Downgradient**		**Downgradient**	
Boring Log Description	**Shallow Shale**		**Deeper Shale Body**		**Shale**		**Shale transitioning to limestone**	
Total Lithium	6.0		20.0		15.0		8.0	
SEP Results								
	Concentration	% of Total	Concentration	% of Total	Concentration	% of Total	Concentration	% of Total
Water Soluble Fraction	<2	--	<2	--	<2	--	<2	--
Exchangeable Metals Fraction	<2	--	<2	--	<2	--	<2	--
Metals Bound to Carbonates Fraction	<2	--	<2	--	<2	--	<2	--
Metals Bound to Fe/Mn Oxides Fraction	3.0	25%	5.0	7%	2.0	10%	<2	--
Bound to Organic Material Fraction	<2	--	3.0	4%	<2	--	<2	--
Residual Metals Fraction	9.0	75%	65.0	89%	19.0	90%	7.0	100%
SEP Total	12.0	100%	73.0	100%	21.0	100%	7.0	100%

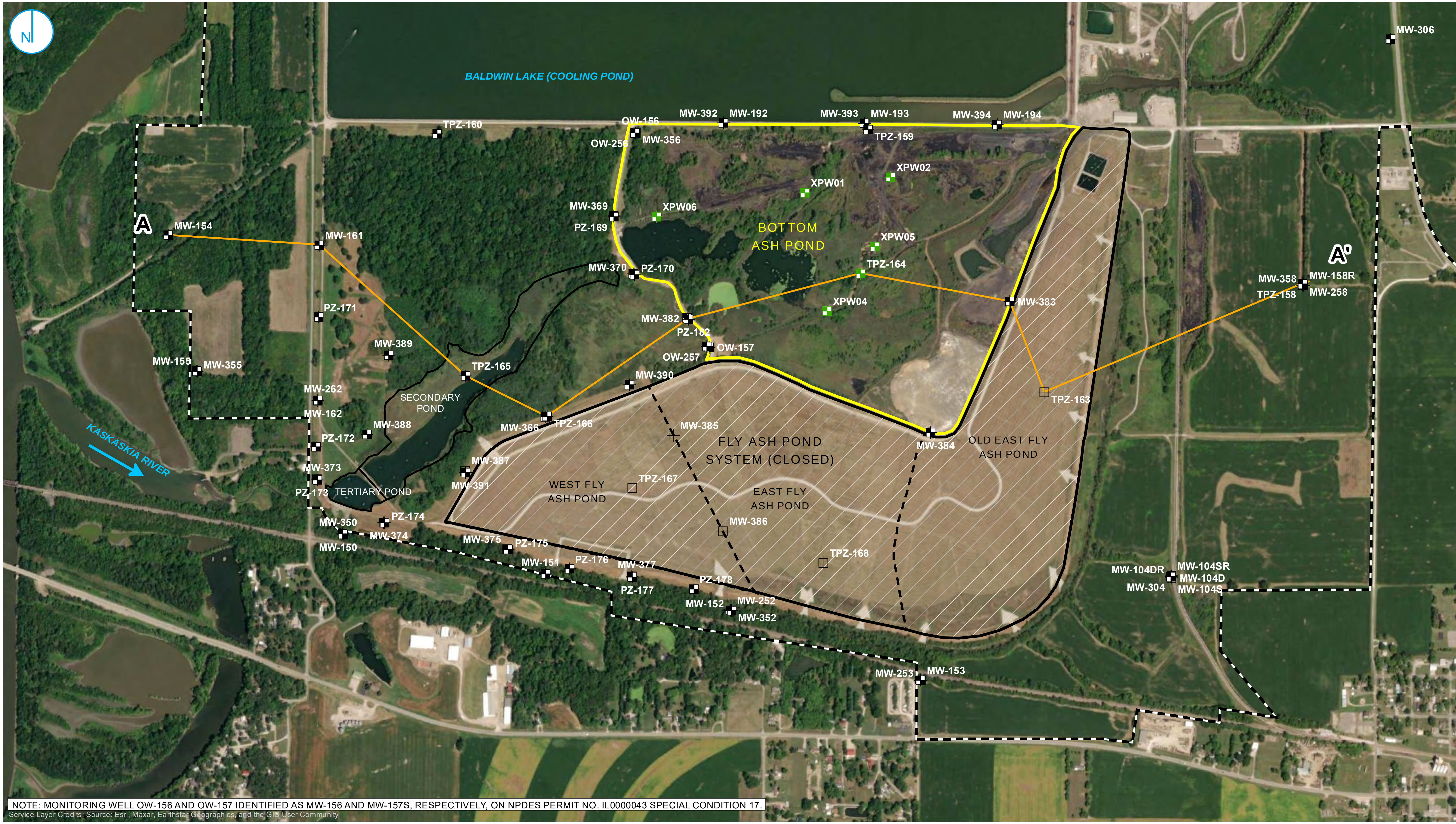
Notes:
SEP - sequential extraction procedure
All results shown in microgram of lithium per gram of soil (µg/g).
Total lithium was analyzed using aqua regia digest, ICP-MS
Non-detect values are shown as less than the detection limit.
The lithium fraction associated with each SEP phase is shown.
% of total lithium is calculated from the sum of the SEP fractions.

Table 3 - Summary of Rietveld Quantitative Analysis
X-Ray Diffraction Results
Baldwin Power Plant

Well ID			**MW-358**	**MW-358**	**MW-392**	**MW-392**
Depth (ft bgs)			**(47-49)**	**(86-88)**	**(66-68)**	**(80-82)**
Location			**Upgradient**	**Upgradient**	**Downgradient**	**Downgradient**
Boring Log Description			**Shallow Shale**	**Deeper Shale Body**	**Shale**	**Shale transitioning to limestone**
Mineral/Compound	**Formula**	**Mineral Type**	(wt %)	(wt %)	(wt %)	(wt %)
Quartz	SiO_2	Silicate	33.0	34.9	27.2	29.1
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	Mica	37.6	30.5	29.7	14.5
Albite	$NaAlSi_3O_8$	Feldspar	8.2	3.4	4.5	1.0
Microcline	$KAlSi_3O_8$	Feldspar	9.4	8.1	6.9	2.9
Chlorite	$(Fe,(Mg,Mn)_5,Al)(Si_3Al)O_{10}(OH)_8$	Clay	-	-	16.3	6.8
Diaspore	aAlO.OH	Oxyhydroxide	-	-	-	-
Pyrite	FeS_2	Sulfide	1.0	0.8	-	1.2
Kaolinite	$Al_2Si_2O_5(OH)_4$	Clay	9.0	18.4	-	8.2
Calcite	$CaCO_3$	Carbonate	1.8	1.7	14.8	31.5
Anatase	TiO_2	Oxide	-	2.1	0.7	0.4
Leucite	$KAlSi_2O_6$	Zeolite	-	-	-	2.4
Siderite	$FeCO_3$	Carbonate	-	-	-	1.9
Dolomite	$CaMg(CO_3)_2$	Carbonate	-	-	-	-
Gypsum	$CaSO_4 \cdot 2H_2O$	Sulfate	-	-	-	-
Diopside	$CaMgSi_2O_6$	Pyroxene	-	-	-	-
Clay Minerals Total			9	18	16	15
Clays + Muscovite Total			47	49	46	30

Notes
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.
Sample depths are shown in feet below ground surface (ft bgs).

ATTACHMENT 1
Cross Section Location Map



PROJECT: 169000XXXX | DATED: 4/24/2023 | DESIGNER: GALARNMC
Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Demo\Baldwin_AP\2023\Figure 3_Cross Section Locations.mxd

- MONITORING WELL AND PIEZOMETER LOCATION
- PORE WATER WELL
- CLOSED MONITORING WELL
- CCR SOURCEWATER SAMPLE

CROSS SECTION TRANSECT

- A to A'

- REGULATED UNIT (SUBJECT UNIT) FLY ASH
- POND SYSTEM (CLOSED)
- SITE FEATURE
- LIMITS OF FINAL COVER
- PROPERTY BOUNDARY

0 400 800 Feet

CROSS SECTION LOCATION MAP

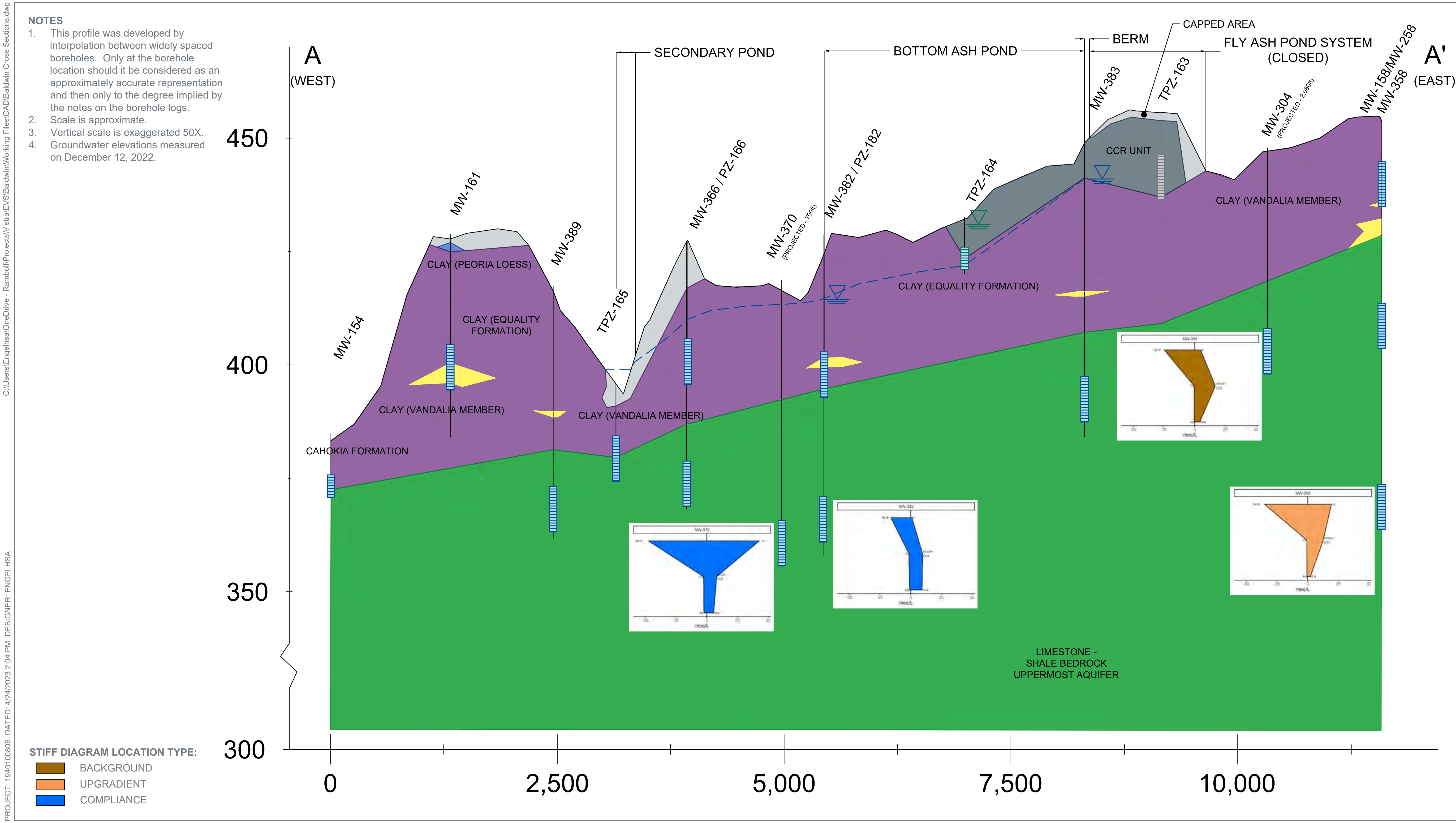
ALTERNATE SOURCE DEMONSTRATION
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

ATTACHMENT 2
Cross Section A-A'



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
- UPPERMOST AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)

20'
0
1,000'

CROSS SECTION A-A'

ALTERNATE SOURCE DEMONSTRATION BOTTOM ASH POND

BALDWIN POWER PLANT
BALDWIN, ILINOIS

FIGURE 4

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

ATTACHMENT 3
Boring Logs

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-370

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mark Baetje Bulldog Drilling	11/20/2015	11/24/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-370	Feet (NAVD88)	418.67 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,826.50 N, 2,381,936.14 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 44.1702"
Long -89° 52' 10.8084"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–2	0 - 2' **SILTY CLAY** CL/ML.	CL/ML								0-28' Blind Drilled. See log PZ-170 for soil description.
			2–4	2 - 4' Shelby Tube Sample.									
			4–8	4 - 8' **SILTY CLAY** CL/ML.	CL/ML								
			8–10	8 - 10' **SILTY CLAY** to **LEAN CLAY:** CL/ML.	CL/ML								
			10–12	10 - 12' **LEAN CLAY:** CL.	CL								

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

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-370

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
			12–14	12 - 14' Shelby Tube Sample.									
			14–24	14 - 24' **SILTY CLAY** CL/ML.	CL/ML								
			24–26	24 - 26' Shelby Tube Sample.									
			26–28	26 - 28' **SILTY CLAY** CL/ML.	CL/ML								
1 SS	10 / 10	23 50/4"	28	28 - 28.4' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace angular limestone gravel, soft, medium plasticity, moist.	CL								
1 CORE	60 / 18.5		28.4	28.4 - 28.9' **SHALE:** BDX (SH), gray, highly decomposed, very weak.	BDX (SH)								Core 1, RQD=51%
			28.9	28.9 - 38.1' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (extremely narrow to moderately narrow apertures), medium to thickly bedded, microcrystalline, moderately decomposed, very strong.	BDX (LS/SH)								

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-370

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
			33	28.9 - 38.1' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (extremely narrow to moderately narrow apertures), medium to thickly bedded, microcrystalline, moderately decomposed, very strong. *(continued)*										
2 CORE	51.5 12		34	33.9' - 38.1' gray, greenish gray in fractures, trace fossils, moderately to highly decomposed, slightly to moderately disintegrated, clay in shoe with a hard, reddish brown inclusion.	BDX (LS/SH)									Core 2, RQD=0%
			36	36' - 37.9' vertical fracture.										
3 CORE	24 25		38	38.1 - 44' **SHALE:** BDX (SH), bluish gray, intensely fractured (extremely narrow to narrow apertures), highly decomposed, weak.										Core 3, RQD=40%
4 CORE	24 11		40											Core 4, RQD=0%
5 CORE	36 32		41	40.6' - 40.8 shaley limestone layer, light gray to gray, microcrystalline, moderately decomposed, very strong. 41.1' - 43.2 gray, moderately to highly decomposed.	BDX (SH)									Core 5, RQD=78%
6 CORE	12 28		44	44 - 45.7' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (extremely narrow to narrow apertures), thin to medium bedded, microcrystalline, slightly decomposed, clay cement in apertures, very strong.	BDX (LS/SH)									Core 6, RQD=29%
7 CORE	45 27		45	45' shale layer, bluish gray, moderately fractured (extremely narrow to narrow apertures), highly decomposed, weak.										Core 7, RQD=65%
			46	45.7 - 52.2' **SHALE:** BDX (SH), bluish gray, moderately fractured (tight to narrow), highly decomposed, weak.										
8 CORE	24 30		49		BDX (SH)									Core 8, RQD=78%
9 CORE	24 24		51											Core 9, RQD=0%
			52											

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
				52' clay cement.										
10 CORE	24 36		53, 54, 55	52.2 - 61.7' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (very narrow to narrow), thin to medium bedded, microcrystalline, slightly decomposed, cemented clay in apertures, very strong. 52.7' - 53' clayey sand in aperture. 53' - 53.1 shale bed, bluish gray, fossiliferous, moderately fractured (very narrow to narrow), highly decomposed, weak. 53.1' white to bluish gray, gray in the fractures (extremely narrow to moderately narrow apertures), thinly to medium bedded, slightly to moderately disintegrated.	BDX (LS/SH)									Core 10, RQD=0%
11 CORE	24 30		56, 57	55.7' moderately disintegrated.										Core 11, RQD=18%
12 CORE	30 27		58, 59, 60	58.1' highly decomposed.										Core 12, RQD=39%
13 CORE	36 53		61											Core 13, RQD=89%
			62, 63, 64, 65	61.7 - 65.3' **LIMESTONE:** BDX (LS).	BDX (LS)									
			66	65.3 - 66' Overdrilled for Well Installation.										
				66' End of Boring.										Bedrock corehole reamed 6" in diameter to 66' for well installation.

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		MW358

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Blake Weller Cascade Drilling	10/5/2022	10/8/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW358	Feet (NAVD88)	453.59 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,726.26 N, 2,387,756.63 E E/W(circled)
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 42.9882"
Long -89° 50' 57.9018"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	180 97		0–12	0 - 3.8' **SILT:** ML, very dark grayish brown (10YR 3/2), organic material (0-10%), moist to wet. 2.1' dry.	ML									CS= Core Sample Measured Rock Quality Designation (RQD) was modified due to drilling methods, modified RQD equals the sum of recovered core sections greater than 4 inches in length divided by total core recovery.
				3.8 - 8.9' **CLAYEY SILT:** ML/CL, light gray (10YR 7/2), very dark grayish brown (10YR 3/2) and yellowish brown (10YR 5/8) mottling (20-30%), dry.	ML/CL									
				8.9 - 13' **SILTY CLAY WITH SAND:** (CL/ML)S, grayish brown (10YR 5/2), strong brown (7.5YR 5/6) and very dark brown (10YR 2/2) mottling (20-30%), organic material (0-10%), low toughness, low to medium plasticity, stiff.	(CL/ML)S									

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

Signature	Firm	
(signature)	Ramboll 234 W Florida Street, 5th Floor, Milwaukee, WI 53204	Tel: (414)837-3607 Fax: (414)837-3608

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			12–13		(CL/ML)S									
2 CS	60 60		13–17.8	13 - 17.8' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), strong brown (7.5YR 5/6) and very dark brown (10YR 2/2) mottling (20-30%), low toughness, medium to high plasticity, stiff to very stiff. 16.1' mottling discontinues.	CL/ML									
3 CS	48 36		17.8–21	17.8 - 21' **SILTY CLAY WITH SAND:** (CL/ML)S, brown (10YR 5/3), strong brown (7.5YR 5/6) and gray (10YR 6/1) mottling (20-30%), gravel (5-15%), no dilatancy, high toughness, low to medium plasticity, hard, moist.	(CL/ML)S									
4 CORE	36 32		21–26.5	21 - 26.5' **SHALE:** BDX (SH), dark gray (GLEY 1 4/N), weathered, thin bedding, moderately fractured. 24' -25.2' wet.	BDX (SH)									RUN #4: Modified RQD = (21/32) = 66%
5 CORE	36 29		26.5–27.5	26.5 - 27.5' **LIMESTONE:** BDX (LS), dark gray (5Y 4/1), shaley, fossiliferous, very strong.	BDX (LS)									RUN #5: Modified RQD = (0/29) = 0%
6 CORE	72 60		27.5–31.3	27.5 - 31.3' **SHALE:** BDX (SH), grayish black (N2), weathered, highly decomposed to residual soil, wet to moist. 29.3' thinly bedded, moderately decomposed. 30' slightly decomposed to competent, moderately fractured.	BDX (SH)									RUN #6: Modified RQD = (45/60) = 75%
			31.3–32	31.3 - 32' **COAL:** COAL, black (N1).	COAL									

Boring Number MW358

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33	32 - 33' **SHALE:** BDX (SH), grayish black (N2), slightly decomposed to competent, moderately fractured, wet to moist.	BDX (SH)									
			34, 35	33 - 36' **SHALEY LIMESTONE:** BDX (LS/SH), medium gray (N5), weathered, shaley, higly decomposed, slightly fractured.	BDX (LS/SH)									
7 CORE	72 71		36, 37, 38, 39, 40	36 - 40.8' **SHALEY LIMESTONE:** to **SHALE:** BDX (LS/SH), interbedded shale.	BDX (LS/SH)									RUN #7: Modified RQD = (67/71) = 94%
			41	40.8 - 42' **LIMESTONE:** BDX (LS), medium light gray (N6), strong to moderately fractured, slightly decomposed, narrow apertures.	BDX (LS)									
8 CORE	96 85		42, 43, 44, 45, 46, 47, 48, 49	42 - 58.9' **SHALE:** BDX (SH), medium gray (N5) to medium dark gray (N4), weathered, weak, thinly bedded, moderately to highly fractured. 47.5' dark grayish brown (10YR 4/2), pale olive (5Y 6/4) discoloration, more competent.	BDX (SH)									RUN #8: Modified RQD = (81/85) = 94%
9 CORE	60 60		50, 51, 52	50.2' weak to moderate. 50.8' olive gray (5Y 5/2).										RUN #9: Modified RQD = (52/60) = 87%

RAMBOLL

Boring Number MW358

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
			53	42 - 58.9' **SHALE:** BDX (SH), medium gray (N5) to medium dark gray (N4), weathered, weak, thinly bedded, moderately to highly fractured. *(continued)* 52.2' dark grayish green (5GY 4/2).										
			54	54.1' medium dark gray (N4) to medium gray (N5), weak, highly decomposed, no visible bedding, dry.										
10 CORE	60 58		55		BDX (SH)									RUN #10: Modified RQD = (42/58) = 72%
			56	55.7' dark grayish green (5GY 4/2).										
			57	57.2' light brownish gray (10YR 6/2), thinly bedded, laminated.										
			58	58.2' medium dark gray (N4), strong, intensely fractured, thinly bedded.										
			59	58.9 - 64' **LIMESTONE:** BDX (LS), medium gray (N5), very strong, moderately fractured, visible laminations.										
11 CORE	36 31		60											RUN #11: Modified RQD = (8/31) = 26%
			61											
			62		BDX (LS)									
12 CORE	36 36		63											RUN #12: Modified RQD = (31/36) = 86%
			64	64 - 75.3' **SHALE:** BDX (SH), medium dark gray (N4) to medium gray (N5), strong, thinly bedded to laminated, moderately fractured.										
			65	64.3' grayish green (5GY 5/2), weathered, weak, decomposed.										
13 CORE	48 48		66											RUN #13: Modified RQD = (43/48) = 90%
			67											
			68		BDX (SH)									
			69	69.3' medium dark gray (N4), weathered, moderate strength.										
14 CORE	60 58		70											RUN# 14: Modified RQD = (57/58) = 99%
			71											
			72											

RAMBOLL

Boring Number MW358

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			73, 74, 75	64 - 75.3' **SHALE:** BDX (SH), medium dark gray (N4) to medium gray (N5), strong, thinly bedded to laminated, moderately fractured. *(continued)*	BDX (SH)									
15 CORE	60 56		76, 77	75.3 - 77.1' **LIMESTONE:** BDX (LS), gray (5Y 6/1), fossiliferous, very strong.	BDX (LS)									RUN #15: Modified RQD = Not Recorded
			78	77.1 - 78.2' **SHALE:** BDX (SH), medium dark gray (N4), weathered, weak to moderate strength, moderately decomposed.	BDX (SH)									
16 CORE	60 51		79, 80, 81, 82, 83, 84	78.2 - 84.8' **LIMESTONE:** BDX (LS), medium dark gray (N4) to medium gray (N5), shaley, fossiliferous, very strong, moderately fractured, laminations (0-5%).	BDX (LS)									RUN #16: Modified RQD = (23/51) = 45%
17 CORE	60 60		85, 86, 87, 88, 89, 90	84.8 - 90' **SHALE:** BDX (SH), dark gray (N3), weathered, weak to moderate strength, moderately decomposed, moderately fractured, thin bedding.	BDX (SH)									RUN #17: Modified RQD = (28/60) = 47%
				90' End of Boring.										

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		MW392

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Blake Weller Cascade Drilling	9/9/2022	9/26/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW392	Feet (NAVD88)	434.07 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 558,140.20 N, 2,382,717.92 E E/W
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 57.132"
Long -89° 52' 0.9632"
Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	120 46		0–1	0 - 1.2' **FILL, WELL-GRADED GRAVEL WITH CLAY:** GW-GC, pinkish gray (7.5YR 6/2), angular, moist.	(FILL) GW-GC									CS= Core Sample Measured Rock Quality Designation (RQD) was modified due to drilling methods, modified RQD equals the sum of recovered core sections greater than 4 inches in length divided by total core recovery.
			1–10	1.2 - 16' **FILL, LEAN CLAY:** CL, light brown (7.5YR 6/4), sand (0-5%), no dilatancy, low to medium plasticity, moist.	(FILL) CL									
2 CS	120 62		10–12											

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, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

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
			13–16	1.2 - 16' **FILL, LEAN CLAY:** CL, light brown (7.5YR 6/4), sand (0-5%), no dilatancy, low to medium plasticity, moist. *(continued)*	(FILL) CL									
			16–20	16 - 20' **LEAN CLAY:** CL, light brown (7.5YR 6/4), sand (0-5%), no dilatancy, low to medium plasticity, moist.	CL									
3 CS	120 33		20	20 - 33' **LEAN CLAY:** CL, pinkish gray (7.5YR 6/2), sand (0-5%), medium to high plasticity, stiff, moist.	CL									
4 CS	120 104		30	30' increasing sand and gravel content.										

RAMBOLL

Boring Number MW392

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
			33	20 - 33' **LEAN CLAY:** CL, pinkish gray (7.5YR 6/2), sand (0-5%), medium to high plasticity, stiff, moist. *(continued)*	CL									
			34, 35	33 - 35' **WELL-GRADED SAND WITH SILT AND GRAVEL:** (SW-SM)g, fine to medium sand, dry.	(SW-SM)g									
			36	35 - 36.5' **SANDY SILT WITH GRAVEL:** s(ML)g, light yellowish brown (10YR 6/4), dry.	s(ML)g									
			37, 38, 39	36.5 - 39' **CLAYEY SILT:** ML/CL, gray (7.5YR 5/1), sand (5-10%), coal (0-5%), gravel (0-5%), dry.	ML/CL									
			40	39 - 40' **SILTY CLAY:** CL/ML, sand (0-5%), low to medium plasticity, stiff.	CL/ML									
5 CS	120 108		41, 42, 43, 44, 45, 46, 47, 48	40 - 48' **SILT WITH SAND:** (ML)s, light brownish gray (10YR 6/2), dry. 44' increasing clay content. 45' (2.5Y 6/2).	(ML)s									
6 CS	84 81		49, 50, 51, 52	48 - 52' **SILT:** ML, gray (2.5Y 5/1), sand (0-5%), dry.	ML									

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			52–57	52 - 57' **SHALE:** BDX (SH), dark gray (5Y 4/1), highly weathered, hard, dry. 53' very dark gray (7.5YR 3/1).	BDX (SH)									
7 CORE	60 4		57–57.5	57 - 57.5' **LIMESTONE:** BDX (LS), gray (5Y 6/1), slightly fractured.	BDX (LS)									RUN #7: Modified RQD = 0% (No Solid Recovery > 4")
			57.5–70	57.5 - 70' **SHALE:** BDX (SH), dark gray (5Y 4/1), weathered, soft, moderately fractured to highly fractured limestone beds (0-5%).	BDX (SH)									
8 CORE	96 78		62											RUN #8: Modified RQD = (28/78) = 36%
			66.3–67.2	66.3' - 67.2' highly fractured, very soft, wet.										
9 CORE	120 62		70–72	70 - 74.4' **LIMESTONE:** BDX (LS), gray (5Y 6/1), moderately to intensely fractured, moderately wide apertures.	BDX (LS)									RUN #9: Modified RQD = (28/78) = 36%

RAMBOLL

Boring Number MW392

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			73, 74	70 - 74.4' **LIMESTONE:** BDX (LS), gray (5Y 6/1), moderately to intensely fractured, moderately wide apertures. *(continued)*	BDX (LS)									
10 CORE	48 48		75, 76, 77, 78, 79, 80, 81	74.4 - 81.8' **SHALE:** BDX (SH), medium dark gray (N4) to dark gray (N3), slightly weathered, moderately fractured, thinly bedded.	BDX (SH)									RUN #10: Modified RQD = (28/48) = 58%
			82, 83, 84	81.8 - 84' **LIMESTONE:** BDX (LS), medium light gray (N6), shaley, fossiliferous, moderately fractured, thinly bedded. 83.2' medium gray (N5).	BDX (LS)									
				84' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Baldwin Power Plant		MW393	
Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Blake Weller Cascade Drilling	9/9/2022	10/4/2022	Sonic
Common Well Name: MW393	Final Static Water Level: Feet (NAVD88)	Surface Elevation: 434.59 Feet (NAVD88)	Borehole Diameter: 6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 558,133.57 N, 2,383,944.49 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 57.027"
Long -89° 51' 45.5976"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	120 86			0 - 1' **FILL, WELL-GRADED GRAVEL:** GW, pinkish gray (7.5YR 6/2), angular, moist.	(FILL) GW									CS= Core Sample
			1	1 - 20' **FILL, LEAN CLAY:** CL, brown (7.5YR 6/4), sand (0-5%), no dilatancy, low to medium plasticity, moist.	(FILL) CL									Measured Rock Quality Designation (RQD) was modified due to drilling methods, modified RQD equals the sum of recovered core sections greater than 4 inches in length divided by total core recovery.
			2											
			3											
			4											
			5											
			6											
			7											
			8											
			9											
2 CS	120 120		10	10' sand (0-5%), iron concretions (0-5%).										
			11											
			12											

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

Signature	Firm	
[signature]	Ramboll 234 W Florida Street, 5th Floor, Milwaukee, WI 53204	Tel: (414)837-3607 Fax: (414)837-3608

Boring Number MW393

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
			13–20	1 - 20' **FILL, LEAN CLAY:** CL, brown (7.5YR 6/4), sand (0-5%), no dilatancy, low to medium plasticity, moist. *(continued)* 18' medium to high plasticity.	(FILL) CL									
3 CS	120 120		20–24	20 - 24' **LEAN CLAY:** CL, light brown (7.5YR 6/4), mottling, sand (0-5%), medium to high plasticity, cohesive, moist.	CL									
			24–27	24 - 27' **CLAYEY SAND:** SC, gray (10YR 6/1), fine to medium sand, wet.	SC									
			27–31	27 - 31' **SILT WITH SAND:** (ML)s, dark gray (7.5YR 4/1), sand (0-5%), moist. 30' coal fragments (0-5%).	(ML)s									
4 CS	120 105		31–32	31 - 40' **SILTY CLAY:** CL/ML, dark gray (7.5Y 4/1), organic material (0-5%), gravel (0-5%), stiff to very stiff, moist.	CL/ML									

RAMBOLL

Boring Number MW393

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
			33–39	31 - 40' **SILTY CLAY:** CL/ML, dark gray (7.5Y 4/1), organic material (0-5%), gravel (0-5%), stiff to very stiff, moist. *(continued)*	CL/ML									
5 CS	120 120		40–49	40 - 50' **SILT:** ML, grayish brown (2.5Y 5/2), very stiff to hard, platy, dry.	ML									
6 CS	120 92		50–52	50 - 55' **SILT:** ML, dark gray (7.5YR 4/1), sand (0-5%), very stiff to hard, dry.	ML									

Boring Number MW393

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
			50–55	50 - 55' **SILT:** ML, dark gray (7.5YR 4/1), sand (0-5%), very stiff to hard, dry. *(continued)*	ML									
			55–57	55 - 57' **CLAYEY SILT:** ML/CL, gray (10YR 6/1), sand (0-5%), gravel (0-5%), medium plasticity, moist.	ML/CL									
			57–60	57 - 60' **LIMESTONE:** BDX (LS), gray (10YR 6/1), rock flour and angular chips (<2").	BDX (LS)									
7 CORE	120 60		60–70	60 - 70' **SHALE:** BDX (SH), medium gray (N5), weathered, very weak, residual soil, soft, slightly fractured.	BDX (SH)									RUN #7: Modified RQD = (31/60) = 52%
8 CORE	42 40		70–72	70 - 73.5' **LIMESTONE:** BDX (LS), medium dark gray (N4), weathered, shaley, thinly bedded, moderately fractured.	BDX (LS)									RUN #8: Modified RQD = (32/40) = 80%

RAMBOLL

Boring Number MW393

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
			73	70 - 73.5' **LIMESTONE:** BDX (LS), medium dark gray (N4), weathered, shaley, thinly bedded, moderately fractured. *(continued)* 72' medium gray (N5).	BDX (LS)									
9 CORE	78 40		74	73.5 - 85' **SHALE:** BDX (SH), medium gray (N5), weathered, moderately to slightly fractured, thinly laminated.										RUN #9: Modified RQD = (30/40) = 75%
			75–79		BDX (SH)									
10 CORE	60 45		80											RUN #10: Modified RQD = (34/45) = 76%
			81–83											
			84	83.5' more competent.										
			85	85' End of Boring.										

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name: Baldwin Power Plant	License/Permit/Monitoring Number:	Boring Number: MW394

Boring Drilled By: Name of crew chief (first, last) and Firm: Blake Weller, Cascade Drilling	Date Drilling Started: 9/25/2022	Date Drilling Completed: 10/5/2022	Drilling Method: Sonic
Common Well Name: MW394	Final Static Water Level: Feet (NAVD88)	Surface Elevation: 435.51 Feet (NAVD88)	Borehole Diameter: 6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 558,123.63 N, 2,385,095.76 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 56.8911"
Long -89° 51' 31.1756"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	72 67		0–2.6	0 - 2.6' **FILL, WELL-GRADED GRAVEL WITH CLAY:** GW-GC, brown (10YR 4/3), angular, moist.	(FILL) GW-GC									CS= Core Sample Measured Rock Quality Designation (RQD) was modified due to drilling methods, modified RQD equals the sum of recovered core sections greater than 4 inches in length divided by total core recovery.
			2.6–20	2.6 - 20' **LEAN CLAY:** CL, brown (10YR 5/3), reddish brown bottling (20%), sand (0-5%), low to medium plasticity, very stiff to hard, moist.	CL				4 (3.2), 4 (5.2)					
2 CS	120 120		6						2.5 (6.7), 3.5 (7.7), 2 (8.7)					
			9.2	9.2' brown (7.5YR 5/3), medium to high plasticity.					2 (9.7), 3 (10.7), 2.25 (11.7)					

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, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

RAMBOLL

Boring Number MW394

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
			13	2.6 - 20' **LEAN CLAY:** CL, brown (10YR 5/3), reddish brown bottling (20%), sand (0-5%), low to medium plasticity, very stiff to hard, moist. *(continued)*					2.25					
			14	14' low to medium plasticity.										
			15						2.5					
3 CS	120 120		16		CL									
			17	16.5' increasing sand and gravel content, gray (GLEY 1 5/1) iron concretions (50%).										
			18											
			19											
			20	20 - 22.1' **SILTY SAND:** SM, yellowish brown (10YR 5/6), fine sand, clay (0-5%), moist.										
			21		SM									
			22	22.1 - 36.8' **LEAN CLAY:** CL, dark yellowish brown (10YR 4/4), greenish gray (GLEY 1 5/10Y) and yellowish brown (10YR 5/6) mottling, sand (0-5%), medium to high plasticity, hard, moist.										
			23						4.5					
			24						4.5					
			25						4.5					
4 CS	120 112		26						4.5					
			27		CL				4.5					
			28						4.5					
			29						4.5					
			30						4.5					
			31						4.5					
			32											

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33	22.1 - 36.8' **LEAN CLAY:** CL, dark yellowish brown (10YR 4/4), greenish gray (GLEY 1 5/10Y) and yellowish brown (10YR 5/6) mottling, sand (0-5%), medium to high plasticity, hard, moist. *(continued)*					3.75					
			34						4.25					
			35	34.4' olive yellow (5Y 6/6), low to medium plasticity.	CL				4.5					
5 CS	120 113		36											
			37	36.8 - 48' **Weathered SHALE Bedrock:** BDX (SH), pale olive (5Y 6/3), weathered, argillaceous, fissile, moist.										
			38											
			39											
			40	40' olive gray (5Y 5/2).										
			41											
			42											
			43		BDX (SH)									
			44											
			45											
6 CS	96 96		46											
			47											
			48	48 - 58' **LIMESTONE:** to **SHALE:** BDX (LS), olive gray (5Y 4/2), interbedded limestone and shale, fissile.										
			49											
			50	50' - 50.2' limestone, very strong.	BDX (LS)									
			51											
			52											

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Boring Number MW394

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
				48 - 58' **LIMESTONE:** to **SHALE:** BDX (LS), olive gray (5Y 4/2), interbedded limestone and shale, fissile. *(continued)*										
			53											
			54	53.7' - 53.9' limestone, very strong. 54' - 55.6' dark gray (10YR 4/1) to gray (10YR 5/1), more competent.										
7 CS	48 48													
			55		BDX (LS)									
			56	55.6' gray (10YR 6/1) to dark gray (10YR 4/1), more competent.										
			57											
8 CORE	18 14		58	58 - 59.7' **LIMESTONE:** BDX (LS), medium gray (N5), shaley, laminated, moderately fractured.	BDX (LS)									RUN #8: Modified RQD = (4/14) = 29%
			59											
9 CORE	60 60		60	59.7 - 68' **SHALE:** BDX (SH), medium dark gray (N4), weathered, very weak to weak, thinly bedded, moderately fractured.										RUN #9: Modified RQD = (48/60) = 80%
			61											
			62											
			63											
			64		BDX (SH)									
10 CORE	57 56		65	64.5 - 67.2' highly decomposed, weathered, wet.										RUN #10: Modified RQD = Not Recorded
			66											
			67											
			68	68 - 68.4' **LIMESTONE:** BDX (LS), light olive gray (5Y 6/2) to olive gray (5/2).	BDX (LS)									
			69	68.4 - 70.8' **SHALE:** BDX (SH), medium dark gray (N4), weathered, very weak to weak, thinly bedded, moderately fractured.	BDX (SH)									
11 CORE	68 68		70											RUN #11: Modified RQD = (42/68) = 62%
			71	70.8 - 71' **LIMESTONE:** BDX (LS), dark gray (N3), shaley.	BDX (LS)									
			72	71 - 77.6' **SHALE:** BDX (SH), dark gray (N3),										

Boring Number MW394

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
			73, 74	strong, thinly bedded, moderately fractured. 71 - 77.6' **SHALE:** BDX (SH), dark gray (N3), strong, thinly bedded, moderately fractured. *(continued)*										
12 CORE	60 59		75, 76, 77		BDX (SH)									RUN #12: Modified RQD = (44/59) = 75%
			78, 79	77.6 - 80' **LIMESTONE:** BDX (LS), medium gray (N5), shaley, weak, moderately fractured.	BDX (LS)									
13 CORE	60 48		80, 81, 82, 83, 84	80 - 85' **SHALE:** BDX (SH), medium dark gray (N4), weathered, weak, thinly bedded, moderately fractured, moist to wet.	BDX (SH)									RUN #13: Modified RQD = (40/48) = 83%
			85	85' End of Boring.										

ATTACHMENT 4

Analytical Laboratory Reports

Tessier Leach Fraction 1 - Water Soluble

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

28-February-2023

Ramboll Americas Engineering Solutions, Inc.
Attn : Evvan Plank

P.O# Box 4873
Syrascuse, New York
13221-7873, USA

Phone: 315-463-7554
Fax:

Date Rec. : 24 November 2022
LR Report: **CA19218-NOV22**
Reference: Baldwin Power Plant Drilling

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: MW-358 (13-15)	6: MW-358 (47-49)	7: MW-358 (86-88)	8: MW-392 (80-82)
Sample Date & Time					05-Oct-22 14:05	06-Oct-22 15:00	08-Oct-22 18:00	26-Sep-22 16:00
Ag [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.05	< 0.05	< 0.05	< 0.05
Al [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	30	540	380	18
As [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.5	< 0.5	< 0.5	< 0.5
Ba [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	0.4	11	4.2	< 0.1
Be [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.02	0.06	0.05	< 0.02
B [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 1	8	10	3
Bi [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.09	< 0.09	< 0.09	< 0.09
Ca [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	21	300	140	75
Cd [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.05	< 0.05	< 0.05	< 0.05
Co [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.01	0.04	0.86	0.02
Cr [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.5	< 0.5	< 0.5	< 0.5
Cu [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.1	< 0.1	0.1	< 0.1
Fe [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	17	240	190	< 1
K [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	7	250	190	41
Li [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 2	< 2	< 2	< 2
Mg [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	9	210	150	19
Mn [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.5	0.6	0.9	< 0.5
Mo [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.1	< 0.1	< 0.1	< 0.1
Na [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	65	1800	1600	850
Ni [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.5	< 0.5	1.2	< 0.5
P [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 3	6	< 3	< 3
Pb [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.1	< 0.1	0.2	< 0.1
Si [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	100	950	750	59
Sb [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.8	< 0.8	< 0.8	< 0.8
Se [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.7	< 0.7	< 0.7	< 0.7
Sr [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	0.1	13	5.9	1.4
Sn [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.5	< 0.5	< 0.5	< 0.5
Ti [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	1.1	0.6	0.5	0.6
Tl [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.02	< 0.02	< 0.02	< 0.02
U [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.002	0.006	0.029	< 0.002
V [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 3	< 3	< 3	< 3
Zn [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.7	< 0.7	< 0.7	< 0.7

OnLine LIMS

0003245943

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
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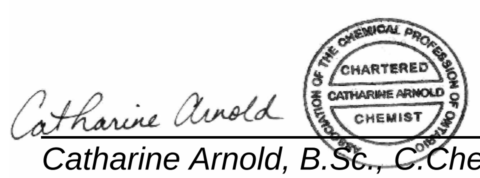
LR Report : **CA19218-NOV22**

Analysis	9: MW-392 (32-33.5)	10: MW-393 (24-25.5)	11: MW-394 (20.5-22)	12: MW-392 (66-68)
Sample Date & Time	27-Sep-22 09:00	04-Oct-22 16:00	25-Sep-22 16:00	26-Sep-22 12:00
Ag [µg/g]	< 0.05	< 0.05	< 0.05	< 0.05
Al [µg/g]	33	26	24	59
As [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Ba [µg/g]	0.5	0.3	0.3	0.3
Be [µg/g]	< 0.02	< 0.02	< 0.02	< 0.02
B [µg/g]	< 1	< 1	< 1	5
Bi [µg/g]	< 0.09	< 0.09	< 0.09	< 0.09
Ca [µg/g]	130	28	25	89
Cd [µg/g]	< 0.05	< 0.05	< 0.05	< 0.05
Co [µg/g]	0.02	< 0.01	0.01	0.02
Cr [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Cu [µg/g]	< 0.1	< 0.1	< 0.1	< 0.1
Fe [µg/g]	27	14	20	28
K [µg/g]	16	9	12	92
Li [µg/g]	< 2	< 2	< 2	< 2
Mg [µg/g]	40	12	12	44
Mn [µg/g]	1.4	0.7	0.6	< 0.5
Mo [µg/g]	< 0.1	< 0.1	< 0.1	< 0.1
Na [µg/g]	44	49	43	720
Ni [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
P [µg/g]	< 3	< 3	< 3	< 3
Pb [µg/g]	< 0.1	< 0.1	< 0.1	< 0.1
Si [µg/g]	100	80	91	140
Sb [µg/g]	< 0.8	< 0.8	< 0.8	< 0.8
Se [µg/g]	< 0.7	< 0.7	< 0.7	< 0.7
Sr [µg/g]	0.3	< 0.1	< 0.1	1.8
Sn [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Ti [µg/g]	0.6	0.6	0.9	0.5
Tl [µg/g]	< 0.02	< 0.02	< 0.02	< 0.02
U [µg/g]	< 0.002	< 0.002	< 0.002	< 0.002
V [µg/g]	< 3	< 3	< 3	< 3
Zn [µg/g]	< 0.7	< 0.7	< 0.7	< 0.7

Water Soluble Fraction



Catharine Arnold, B.Sc., C.Chem
Project Specialist,
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OnLine LIMS

0003245943

Tessier Leach Fraction 2 - Exchangeable Metals

SGS Canada Inc.
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28-February-2023

Ramboll Americas Engineering Solutions, Inc.
Attn : Evvan Plank

P.O# Box 4873
Syrascuse, New York
13221-7873, USA

Phone: 315-463-7554
Fax:

Date Rec. : 24 November 2022
LR Report: **CA19219-NOV22**
Reference: Baldwin Power Plant Drilling

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-358 (13-15)	6: MW-358 (47-49)	7: MW-358 (86-88)	8: MW-392 (80-82)
Sample Date & Time					05-Oct-22 14:05	06-Oct-22 15:00	08-Oct-22 18:00	26-Sep-22 16:00
Ag [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.05	< 0.05	< 0.05	< 0.05
Al [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	9	17	8	9
As [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.5	< 0.5	< 0.5	< 0.5
Ba [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	48	55	15	3.0
Be [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.02	< 0.02	< 0.02	< 0.02
B [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 1	< 1	1	< 1
Bi [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.09	< 0.09	< 0.09	< 0.09
Ca [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	2000	2500	1300	3500
Cd [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.05	< 0.05	< 0.05	< 0.05
Co [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.01	< 0.01	0.58	0.24
Cr [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.5	< 0.5	< 0.5	< 0.5
Cu [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.1	< 0.1	< 0.1	< 0.1
Fe [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	2	21	< 1	12
K [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	37	430	300	160
Li [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 2	< 2	< 2	< 2
Mn [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	6.5	0.7	1.8	3.6
Mo [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 0.1	< 0.1	< 0.1	< 0.1
Na [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	45	3200	2600	420
Ni [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 0.5	< 0.5	< 0.5	0.7
Pb [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 0.1	< 0.1	< 0.1	< 0.1
P [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 3	4	< 3	43
Sb [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 0.8	< 0.8	< 0.8	< 0.8
Se [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 0.7	< 0.7	< 0.7	< 0.7
Sn [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 0.5	< 0.5	< 0.5	< 0.5
Sr [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	11	100	52	76
Ti [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	0.9	0.3	0.2	0.1
Tl [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 0.02	< 0.02	< 0.02	< 0.02
U [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 0.002	0.009	0.006	0.043
V [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 3	< 3	< 3	< 3
Zn [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 0.7	< 0.7	< 0.7	< 0.7

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LR Report : **CA19219-NOV22**

Analysis	**9: MW-392 (32-33.5)**	**10: MW-393 (24-25.5)**	**11: MW-394 (20.5-22)**	**12: MW-392 (66-68)**
Sample Date & Time	27-Sep-22 09:00	04-Oct-22 16:00	25-Sep-22 16:00	26-Sep-22 12:00
Ag [µg/g]	< 0.05	< 0.05	< 0.05	< 0.05
Al [µg/g]	10	12	12	10
As [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Ba [µg/g]	16	16	10	4.3
Be [µg/g]	< 0.02	< 0.02	< 0.02	< 0.02
B [µg/g]	< 1	< 1	< 1	2
Bi [µg/g]	< 0.09	< 0.09	< 0.09	< 0.09
Ca [µg/g]	2500	1400	2100	3700
Cd [µg/g]	< 0.05	< 0.05	< 0.05	< 0.05
Co [µg/g]	0.02	< 0.01	< 0.01	0.02
Cr [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Cu [µg/g]	< 0.1	< 0.1	< 0.1	< 0.1
Fe [µg/g]	8	9	8	10
K [µg/g]	44	35	60	360
Li [µg/g]	< 2	< 2	< 2	< 2
Mn [µg/g]	3.5	1.7	3.2	2.5
Mo [µg/g]	< 0.1	< 0.1	< 0.1	< 0.1
Na [µg/g]	17	22	30	480
Ni [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Pb [µg/g]	< 0.1	< 0.1	< 0.1	< 0.1
P [µg/g]	< 3	< 3	4	< 3
Sb [µg/g]	< 0.8	< 0.8	< 0.8	< 0.8
Se [µg/g]	< 0.7	< 0.7	< 0.7	< 0.7
Sn [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Sr [µg/g]	6.5	4.3	7.4	75
Ti [µg/g]	0.1	0.6	0.3	< 0.1
Tl [µg/g]	< 0.02	< 0.02	< 0.02	< 0.02
U [µg/g]	< 0.002	< 0.002	< 0.002	0.004
V [µg/g]	< 3	< 3	< 3	< 3
Zn [µg/g]	< 0.7	< 0.7	< 0.7	< 0.7

Fraction 2 Exchangeable Metals

CHARTERED CATHARINE ARNOLD CHEMIST

Catharine Arnold, B.Sc., C.Chem
Project Specialist,
Environment, Health & Safety

SGS

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Tessier Leach Fraction 3 - Metals Bound to Carbonates

28-February-2023

Ramboll Americas Engineering Solutions, Inc.
Attn : Evvan Plank

P.O# Box 4873
Syrascuse, New York
13221-7873, USA

Phone: 315-463-7554
Fax:

Date Rec. : 24 November 2022
LR Report: **CA19220-NOV22**
Reference: Ramboll Power Plant Drilling

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: MW-358 (13-15)	6: MW-358 (47-49)	7: MW-358 (86-88)	8: MW-392 (80-82)
Sample Date & Time					05-Oct-22 14:05	06-Oct-22 15:00	08-Oct-22 18:00	26-Sep-22 16:00
Ag [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	< 0.05	< 0.05	< 0.05	< 0.05
Al [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	30	55	56	25
As [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	< 0.5	< 0.5	< 0.5	< 0.5
Ba [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	25	23	6.9	2.8
Be [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	0.09	0.10	0.07	0.03
B [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	< 1	2	3	4
Bi [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	< 0.09	< 0.09	< 0.09	< 0.09
Ca [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	110	1300	770	52000
Cd [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	< 0.05	< 0.05	< 0.05	< 0.05
Co [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	0.04	0.02	2.3	1.0
Cr [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	< 0.5	< 0.5	< 0.5	< 0.5
Cu [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	0.6	0.2	0.6	0.2
Fe [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	40	45	42	25
K [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	15	180	120	90
Li [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	< 2	< 2	< 2	< 2
Mn [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	13	7.0	4.3	77
Mo [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	< 0.1	< 0.1	< 0.1	< 0.1
Ni [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	< 0.5	< 0.5	1.9	2.7
Pb [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	0.2	0.1	0.9	1.9
P [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	< 3	13	< 3	100
Sb [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	< 0.8	< 0.8	< 0.8	< 0.8
Se [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	< 0.7	< 0.7	< 0.7	< 0.7
Si [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	96	160	150	33
Sn [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	< 0.5	< 0.5	< 0.5	< 0.5
Sr [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	0.5	10	7.3	99
Ti [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	0.8	0.6	0.5	1.0
Tl [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	< 0.02	< 0.02	< 0.02	< 0.02
U [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	0.19	0.094	0.13	0.31
V [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	< 3	< 3	< 3	< 3
Zn [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	< 0.7	< 0.7	< 0.7	3.7

OnLine LIMS

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LR Report : **CA19220-NOV22**

Analysis	9: MW-392 (32-33.5)	10: MW-393 (24-25.5)	11: MW-394 (20.5-22)	12: MW-392 (66-68)
Sample Date & Time	27-Sep-22 09:00	04-Oct-22 16:00	25-Sep-22 16:00	26-Sep-22 12:00
Ag [µg/g]	< 0.05	< 0.05	< 0.05	< 0.05
Al [µg/g]	30	28	23	28
As [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Ba [µg/g]	19	15	12	5.0
Be [µg/g]	0.06	0.04	0.04	0.07
B [µg/g]	< 1	< 1	< 1	3
Bi [µg/g]	< 0.09	< 0.09	< 0.09	< 0.09
Ca [µg/g]	1500	56	140	35000
Cd [µg/g]	< 0.05	< 0.05	< 0.05	< 0.05
Co [µg/g]	0.05	0.02	0.03	0.27
Cr [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Cu [µg/g]	0.8	0.2	0.2	0.6
Fe [µg/g]	9	14	10	300
K [µg/g]	16	10	15	130
Li [µg/g]	< 2	< 2	< 2	< 2
Mn [µg/g]	20	4.4	7.0	144
Mo [µg/g]	< 0.1	< 0.1	< 0.1	< 0.1
Ni [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Pb [µg/g]	0.2	0.1	0.1	0.4
P [µg/g]	< 3	< 3	4	< 3
Sb [µg/g]	< 0.8	< 0.8	< 0.8	< 0.8
Se [µg/g]	< 0.7	< 0.7	< 0.7	< 0.7
Si [µg/g]	130	90	99	96
Sn [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Sr [µg/g]	1.5	0.3	0.8	59
Ti [µg/g]	0.1	1.9	0.6	< 0.1
Tl [µg/g]	< 0.02	< 0.02	< 0.02	< 0.02
U [µg/g]	0.12	0.14	0.17	0.100
V [µg/g]	< 3	< 3	< 3	< 3
Zn [µg/g]	< 0.7	< 0.7	< 0.7	1.0

Fraction 3 Metals Bound to Carbonates

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SGS

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Tessier Leach Fraction 4 - Metals Bound to Fe and Mn Oxides

28-February-2023

Ramboll Americas Engineering Solutions, Inc.
Attn : Evvan Plank

P.O# Box 4873
Syrascuse, New York
13221-7873, USA

Phone: 315-463-7554
Fax:

Date Rec. : 24 November 2022
LR Report: **CA19221-NOV22**
Reference: Baldwin Power Plant Drilling

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-358 (13-15)	6: MW-358 (47-49)	7: MW-358 (86-88)	8: MW-392 (80-82)	9: MW-392 (32-33.5)
Sample Date & Time			05-Oct-22 14:05	06-Oct-22 15:00	08-Oct-22 18:00	26-Sep-22 16:00	27-Sep-22 09:00
Ag [µg/g]	31-Jan-23	09:47	< 0.01	< 0.01	< 0.01	< 0.01	0.01
Al [µg/g]	31-Jan-23	09:47	290	310	340	220	220
As [µg/g]	31-Jan-23	09:47	< 0.5	< 0.5	< 0.5	1.3	< 0.5
Ba [µg/g]	31-Jan-23	09:47	16	6.4	1.6	4.1	56
Be [µg/g]	31-Jan-23	09:47	0.26	0.16	0.15	0.15	0.21
B [µg/g]	31-Jan-23	09:47	< 1	5	6	6	< 1
Bi [µg/g]	31-Jan-23	09:47	< 0.09	< 0.09	< 0.09	0.14	< 0.09
Ca [µg/g]	31-Jan-23	09:47	71	320	250	130000	2300
Cd [µg/g]	31-Jan-23	09:47	< 0.05	< 0.05	< 0.05	0.13	0.18
Co [µg/g]	31-Jan-23	09:47	3.8	0.33	3.0	2.3	5.1
Cr [µg/g]	31-Jan-23	09:47	2.3	1.2	1.3	1.0	0.9
Cu [µg/g]	31-Jan-23	09:47	1.6	0.4	0.7	0.1	2.9
Fe [µg/g]	31-Jan-23	09:47	1600	1600	1200	1800	1100
K [µg/g]	31-Jan-23	09:47	16	140	110	43	19
Li [µg/g]	31-Jan-23	09:47	< 2	3	5	< 2	< 2
Mn [µg/g]	31-Jan-23	09:47	240	3.1	2.9	190	500
Mo [µg/g]	31-Jan-23	09:47	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ni [µg/g]	31-Jan-23	09:47	3.1	2.7	4.5	6.5	3.1
Pb [µg/g]	31-Jan-23	09:47	3.3	0.2	1.2	8.4	3.7
P [µg/g]	31-Jan-23	09:47	19	110	77	400	31
Sb [µg/g]	31-Jan-23	09:47	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Se [µg/g]	31-Jan-23	09:47	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Si [µg/g]	31-Jan-23	09:47	920	910	710	270	600
Sn [µg/g]	31-Jan-23	09:47	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Sr [µg/g]	31-Jan-23	09:47	0.4	3.1	2.8	237	1.7
Ti [µg/g]	31-Jan-23	09:47	0.4	0.1	0.3	< 0.1	< 0.1
Tl [µg/g]	31-Jan-23	09:47	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
U [µg/g]	31-Jan-23	09:47	0.26	0.068	0.17	0.62	0.15
V [µg/g]	31-Jan-23	09:47	5	< 3	< 3	< 3	3
Zn [µg/g]	31-Jan-23	09:47	2.9	1.9	1.9	13	3.8

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Tessier Leach Fraction 4 - Metals Bound to Fe and Mn Oxides

LR Report : CA19221-NOV22

Analysis	**10: MW-393 (24-25.5)**	**11: MW-394 (20.5-22)**	**12: MW-392 (66-68)**
Sample Date & Time	04-Oct-22 16:00	25-Sep-22 16:00	26-Sep-22 12:00
Ag [µg/g]	< 0.01	0.02	< 0.01
Al [µg/g]	290	270	490
As [µg/g]	< 0.5	< 0.5	< 0.5
Ba [µg/g]	45	35	1.5
Be [µg/g]	0.16	0.18	0.18
B [µg/g]	< 1	< 1	4
Bi [µg/g]	< 0.09	< 0.09	0.14
Ca [µg/g]	100	350	7600
Cd [µg/g]	0.06	0.14	< 0.05
Co [µg/g]	4.3	3.5	0.62
Cr [µg/g]	1.2	1.2	2.0
Cu [µg/g]	1.5	2.0	0.9
Fe [µg/g]	1500	1200	2700
K [µg/g]	15	22	120
Li [µg/g]	< 2	< 2	2
Mn [µg/g]	380	260	63
Mo [µg/g]	< 0.1	< 0.1	< 0.1
Ni [µg/g]	3.2	3.7	2.5
Pb [µg/g]	3.5	2.1	0.9
P [µg/g]	17	91	110
Sb [µg/g]	< 0.8	< 0.8	< 0.8
Se [µg/g]	< 0.7	< 0.7	< 0.7
Si [µg/g]	660	850	650
Sn [µg/g]	< 0.5	< 0.5	< 0.5
Sr [µg/g]	0.5	1.3	26
Ti [µg/g]	0.3	0.2	0.2
Tl [µg/g]	< 0.02	< 0.02	< 0.02
U [µg/g]	0.12	0.18	0.082
V [µg/g]	< 3	5	< 3
Zn [µg/g]	4.3	7.8	2.8

Fraction 4 Metals Bound to Fe and Mn Oxides

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
CATHARINE ARNOLD
CHEMIST

Catharine Arnold, B.Sc., C.Chem
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OnLine LIMS

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SGS

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Tessier Leach Fraction 5 - Bound to Organic Material

28-February-2023

Ramboll Americas Engineering Solutions, Inc.
Attn : Evvan Plank

P.O# Box 4873
Syrascuse, New York
13221-7873, USA

Phone: 315-463-7554
Fax:

Date Rec. : 24 November 2022
LR Report: **CA19222-NOV22**
Reference: Baldwin Power plant Drilling

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-358 (13-15)	6: MW-358 (47-49)	7: MW-358 (86-88)	8: MW-392 (80-82)	9: MW-392 (32-33.5)
Sample Date & Time			05-Oct-22 14:05	06-Oct-22 15:00	08-Oct-22 18:00	26-Sep-22 16:00	27-Sep-22 09:00
Ag [µg/g]	31-Jan-23	09:48	0.14	0.15	0.08	0.07	0.06
Al [µg/g]	31-Jan-23	09:48	980	1300	1100	130	610
As [µg/g]	31-Jan-23	09:48	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba [µg/g]	31-Jan-23	09:48	15	11	1.8	3.6	36
Be [µg/g]	31-Jan-23	09:48	0.13	0.32	0.16	0.07	0.12
B [µg/g]	31-Jan-23	09:48	< 1	2	2	2	< 1
Bi [µg/g]	31-Jan-23	09:48	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09
Ca [µg/g]	31-Jan-23	09:48	160	490	220	8600	840
Cd [µg/g]	31-Jan-23	09:48	< 0.05	< 0.05	< 0.05	0.20	< 0.05
Co [µg/g]	31-Jan-23	09:48	1.4	0.45	9.7	3.3	1.3
Cr [µg/g]	31-Jan-23	09:48	2.1	1.0	1.2	< 0.5	1.6
Cu [µg/g]	31-Jan-23	09:48	0.5	1.0	1.8	1.9	0.4
Fe [µg/g]	31-Jan-23	09:48	150	610	1800	220	83
K [µg/g]	31-Jan-23	09:48	15	104	79	25	15
Li [µg/g]	31-Jan-23	09:48	< 2	< 2	3	< 2	< 2
Mg [µg/g]	31-Jan-23	09:48	170	1100	870	200	500
Mn [µg/g]	31-Jan-23	09:48	85	3.6	15	16	92
Mo [µg/g]	31-Jan-23	09:48	< 0.1	< 0.1	< 0.1	0.2	0.4
Na [µg/g]	31-Jan-23	09:48	110	180	150	90	75
Ni [µg/g]	31-Jan-23	09:48	1.9	4.3	13	15	2.1
Pb [µg/g]	31-Jan-23	09:48	1.6	0.1	1.6	3.8	1.3
P [µg/g]	31-Jan-23	09:48	< 3	< 3	< 3	290	5
Sb [µg/g]	31-Jan-23	09:48	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Se [µg/g]	31-Jan-23	09:48	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Si [µg/g]	31-Jan-23	09:48	590	480	420	130	530
Sn [µg/g]	31-Jan-23	09:48	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Sr [µg/g]	31-Jan-23	09:48	0.5	5.1	2.8	48	0.9
Ti [µg/g]	31-Jan-23	09:48	0.7	< 0.1	< 0.1	< 0.1	2.9
Tl [µg/g]	31-Jan-23	09:48	< 0.02	< 0.02	0.02	0.05	< 0.02
U [µg/g]	31-Jan-23	09:48	0.17	0.13	0.19	0.25	0.060
V [µg/g]	31-Jan-23	09:48	< 3	< 3	< 3	< 3	3
Zn [µg/g]	31-Jan-23	09:48	1.4	< 0.7	1.8	41	1.7

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Tessier Leach Fraction 5 - Bound to Organic Material

LR Report : CA19222-NOV22

Analysis	10: MW-393 (24-25.5)	11: MW-394 (20.5-22)	12: MW-392 (66-68)
Sample Date & Time	04-Oct-22 16:00	25-Sep-22 16:00	26-Sep-22 12:00
Ag [µg/g]	< 0.05	< 0.05	< 0.05
Al [µg/g]	660	870	820
As [µg/g]	< 0.5	< 0.5	< 0.5
Ba [µg/g]	33	45	1.5
Be [µg/g]	0.08	0.15	0.18
B [µg/g]	< 1	< 1	2
Bi [µg/g]	< 0.09	< 0.09	< 0.09
Ca [µg/g]	88	300	2400
Cd [µg/g]	< 0.05	< 0.05	< 0.05
Co [µg/g]	1.2	2.3	0.68
Cr [µg/g]	1.2	1.5	1.1
Cu [µg/g]	0.3	0.8	1.4
Fe [µg/g]	93	120	680
K [µg/g]	14	21	70
Li [µg/g]	< 2	< 2	< 2
Mg [µg/g]	150	280	730
Mn [µg/g]	100	164	15
Mo [µg/g]	0.1	0.3	< 0.1
Na [µg/g]	48	170	95
Ni [µg/g]	1.6	3.5	2.9
Pb [µg/g]	1.7	1.3	0.9
P [µg/g]	4	8	< 3
Sb [µg/g]	< 0.8	< 0.8	< 0.8
Se [µg/g]	< 0.7	< 0.7	< 0.7
Si [µg/g]	470	650	470
Sn [µg/g]	< 0.5	< 0.5	< 0.5
Sr [µg/g]	0.3	1.2	9.8
Ti [µg/g]	2.1	2.5	< 0.1
Tl [µg/g]	< 0.02	< 0.02	< 0.02
U [µg/g]	0.065	0.16	0.080
V [µg/g]	< 3	4	< 3
Zn [µg/g]	1.6	4.0	0.9

Fraction 5 Bound to Organic Material

CHARTERED CATHARINE ARNOLD CHEMIST — ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO

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28-February-2023

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Date Rec. : 24 November 2022
LR Report: **CA19223-NOV22**
Reference: Baldwin Power Plant Drilling

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-358 (13-15)	6: MW-358 (47-49)	7: MW-358 (86-88)	8: MW-392 (80-82)	9: MW-392 (32-33.5)
Sample Date & Time			05-Oct-22 14:05	06-Oct-22 15:00	08-Oct-22 18:00	26-Sep-22 16:00	27-Sep-22 09:00
Ag [µg/g]	31-Jan-23	09:48	0.09	< 0.05	< 0.05	< 0.05	0.07
Al [µg/g]	31-Jan-23	09:48	44000	63000	71000	27000	45000
As [µg/g]	31-Jan-23	09:48	5.8	2.3	9.8	10	8.6
Ba [µg/g]	31-Jan-23	09:48	390	150	140	56	320
Be [µg/g]	31-Jan-23	09:48	0.65	1.4	1.5	0.68	0.87
B [µg/g]	31-Jan-23	09:48	13	60	62	26	21
Bi [µg/g]	31-Jan-23	09:48	0.25	0.26	0.18	0.14	0.25
Ca [µg/g]	31-Jan-23	09:48	2500	150	120	20000	1400
Cd [µg/g]	31-Jan-23	09:48	0.06	< 0.05	< 0.05	0.11	0.08
Co [µg/g]	31-Jan-23	09:48	3.3	7.2	6.4	2.0	6.4
Cr [µg/g]	31-Jan-23	09:48	34	69	75	37	40
Cu [µg/g]	31-Jan-23	09:48	10	9.9	5.7	7.2	15
Fe [µg/g]	31-Jan-23	09:48	22000	42000	22000	14000	28000
K [µg/g]	31-Jan-23	09:48	11000	18000	16000	5100	13000
Li [µg/g]	31-Jan-23	09:48	18	9	65	7	20
Mg [µg/g]	31-Jan-23	09:48	2700	7800	7600	4100	3300
Mn [µg/g]	31-Jan-23	09:48	110	70	51	50	130
Mo [µg/g]	31-Jan-23	09:48	0.9	0.3	0.1	0.1	0.9
Na [µg/g]	31-Jan-23	09:48	6700	560	830	550	5200
Ni [µg/g]	31-Jan-23	09:48	14	32	29	13	21
Pb [µg/g]	31-Jan-23	09:48	10	8.0	7.0	17	12
P [µg/g]	31-Jan-23	09:48	260	240	160	7200	300
Sb [µg/g]	31-Jan-23	09:48	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Se [µg/g]	31-Jan-23	09:48	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Si [µg/g]	31-Jan-23	09:48	160000	66000	51000	73000	65000
Sn [µg/g]	31-Jan-23	09:48	5.4	5.8	5.8	4.9	5.2
Sr [µg/g]	31-Jan-23	09:48	89	30	25	130	79
Ti [µg/g]	31-Jan-23	09:48	2400	670	570	520	980
Tl [µg/g]	31-Jan-23	09:48	0.47	0.42	0.42	0.17	0.51
U [µg/g]	31-Jan-23	09:48	1.3	0.30	0.99	2.7	1.1
V [µg/g]	31-Jan-23	09:48	54	73	86	95	57
Zn [µg/g]	31-Jan-23	09:48	37	47	32	43	53

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LR Report : CA19223-NOV22

Analysis	10: MW-393 (24-25.5)	11: MW-394 (20.5-22)	12: MW-392 (66-68)
Sample Date & Time	04-Oct-22 16:00	25-Sep-22 16:00	26-Sep-22 12:00
Ag [µg/g]	< 0.05	< 0.05	< 0.05
Al [µg/g]	33000	45000	59000
As [µg/g]	10	9.8	0.9
Ba [µg/g]	300	410	93
Be [µg/g]	0.56	0.83	1.2
B [µg/g]	15	16	53
Bi [µg/g]	0.18	0.27	0.20
Ca [µg/g]	1700	3000	170
Cd [µg/g]	< 0.05	0.11	< 0.05
Co [µg/g]	3.2	5.0	6.4
Cr [µg/g]	24	35	71
Cu [µg/g]	9.9	13	12
Fe [µg/g]	19000	27000	43000
K [µg/g]	12000	14000	17000
Li [µg/g]	13	16	19
Mg [µg/g]	2200	3400	9500
Mn [µg/g]	80	140	47
Mo [µg/g]	0.7	2.7	0.2
Na [µg/g]	5100	7700	490
Ni [µg/g]	13	18	31
Pb [µg/g]	9.1	13	4.1
P [µg/g]	230	460	170
Sb [µg/g]	< 0.8	< 0.8	< 0.8
Se [µg/g]	< 0.7	< 0.7	< 0.7
Si [µg/g]	61000	43000	62000
Sn [µg/g]	4.6	5.2	5.6
Sr [µg/g]	70	110	22
Ti [µg/g]	780	1100	560
Tl [µg/g]	0.35	0.50	0.36
U [µg/g]	0.61	1.1	0.097
V [µg/g]	35	57	70
Zn [µg/g]	37	54	48

Fraction 6 Residual metals

Catharine Arnold

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Trace Metals - Aqua Regia Digest, ICP-MS

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28-February-2023

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Date Rec. : 24 November 2022
LR Report: **CA19224-NOV22**
Reference: Baldwon Power Plant Drilling

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	6: MW-358 (47-49)	7: MW-358 (86-88)	8: MW-392 (80-82)	12: MW-392 (66-68)
Sample Date & Time					06-Oct-22 15:00	08-Oct-22 18:00	26-Sep-22 16:00	26-Sep-22 12:00
Hg MS [ug/g]	09-Dec-22	16:29	12-Dec-22	15:05	< 0.05	< 0.05	< 0.05	< 0.05
As [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	2.1	11	17	1.0
B [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	11	16	16	13
Ba [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	140	45	40	21
Be [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	0.85	0.67	0.85	0.70
Cd [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	< 0.02	< 0.02	0.36	0.09
Co [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	4.4	23	12	6.2
Cr [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	9.5	12	17	16
Li [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	6	20	8	15
Mo [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	0.3	0.3	0.3	0.3
Pb [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	5.7	9.6	17	4.9
Se [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	< 0.7	< 0.7	1.4	< 0.7
Tl [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	0.05	0.06	0.04	0.03

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LR Report : **CA19224-NOV22**

OnLine LIMS

0003246025

Quantitative X-Ray Diffraction by Rietveld Refinement

Report Prepared for:	*Environmental Services*
Project Number/ LIMS No.	*Custom XRD/MI4508-DEC22*
Sample Receipt:	*December 7, 2022*
Sample Analysis:	*December 15, 2022*
Reporting Date:	*December 21, 2022*

Instrument:	BRUKER AXS D8 Advance Diffractometer
Test Conditions:	Co radiation, 35 kV, 40 mA; Detector: LYNXEYE Regular Scanning: Step: 0.02°, Step time: 0.75s, 2θ range: 6-80°
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.

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Member of the SGS Group (SGS SA)

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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Environmental Services
Custom XRD/MI4508-DEC22
21-Dec-22

Summary of Rietveld Quantitative Analysis X-Ray Diffraction Results

Mineral/Compound	MW-358 (13-15) DEC4508-01 (wt %)	MW-358 (47-49) DEC4508-02 (wt %)	MW-358 (86-88) DEC4508-03 (wt %)	MW-392 (80-82) DEC4508-04 (wt %)
Quartz	58.9	33.0	34.9	29.1
Muscovite	11.2	37.6	30.5	14.5
Albite	13.3	8.2	3.4	1.0
Microcline	5.3	9.4	8.1	2.9
Chlorite	10.8	-	-	6.8
Diaspore	0.5	-	-	-
Pyrite	-	1.0	0.8	1.2
Kaolinite	-	9.0	18.4	8.2
Calcite	-	1.8	1.7	31.5
Anatase	-	-	2.1	0.4
Leucite	-	-	-	2.4
Siderite	-	-	-	1.9
Dolomite	-	-	-	-
Gypsum	-	-	-	-
Diopside	-	-	-	-
TOTAL	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/Compound	Formula
Quartz	SiO_2
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$
Albite	$NaAlSi_3O_8$
Microcline	$KAlSi_3O_8$
Chlorite	$(Fe,(Mg,Mn)_5,Al)(Si_3Al)O_{10}(OH)_8$
Diaspore	aAlO.OH
Pyrite	FeS_2
Kaolinite	$Al_2Si_2O_5(OH)_4$
Calcite	$CaCO_3$
Anatase	TiO_2
Leucite	$KAlSi_2O_6$
Siderite	$FeCO_3$
Dolomite	$CaMg(CO_3)_2$
Gypsum	$CaSO_4 \cdot 2H_2O$
Diopside	$CaMgSi_2O_6$

Summary of Rietveld Quantitative Analysis X-Ray Diffraction Results

Mineral/Compound	MW-392 (32-33.5) DEC4508-05 (wt %)	MW-393 (24-25.5) DEC4508-06 (wt %)	MW-394 (20.5-22) DEC4508-07 (wt %)	MW-392 (66-68) DEC4508-08 (wt %)
Quartz	53.5	68.2	54.9	27.2
Muscovite	13.1	13.0	11.7	29.7
Albite	8.5	7.4	13.1	4.5
Microcline	6.8	9.5	6.7	6.9
Chlorite	7.0	-	7.0	16.3
Diaspore	-	-	-	-
Pyrite	-	0.3	0.3	-
Kaolinite	7.5	-	5.0	-
Calcite	-	-	-	14.8
Anatase	-	-	-	0.7
Leucite	-	-	-	-
Siderite	-	-	-	-
Dolomite	1.2	-	-	-
Gypsum	0.4	-	-	-
Diopside	1.7	1.6	1.4	-
TOTAL	100	100	100	100

Zero values indicate that the mineral was included in the refinement, but the calculated concentration is below a measurable value.

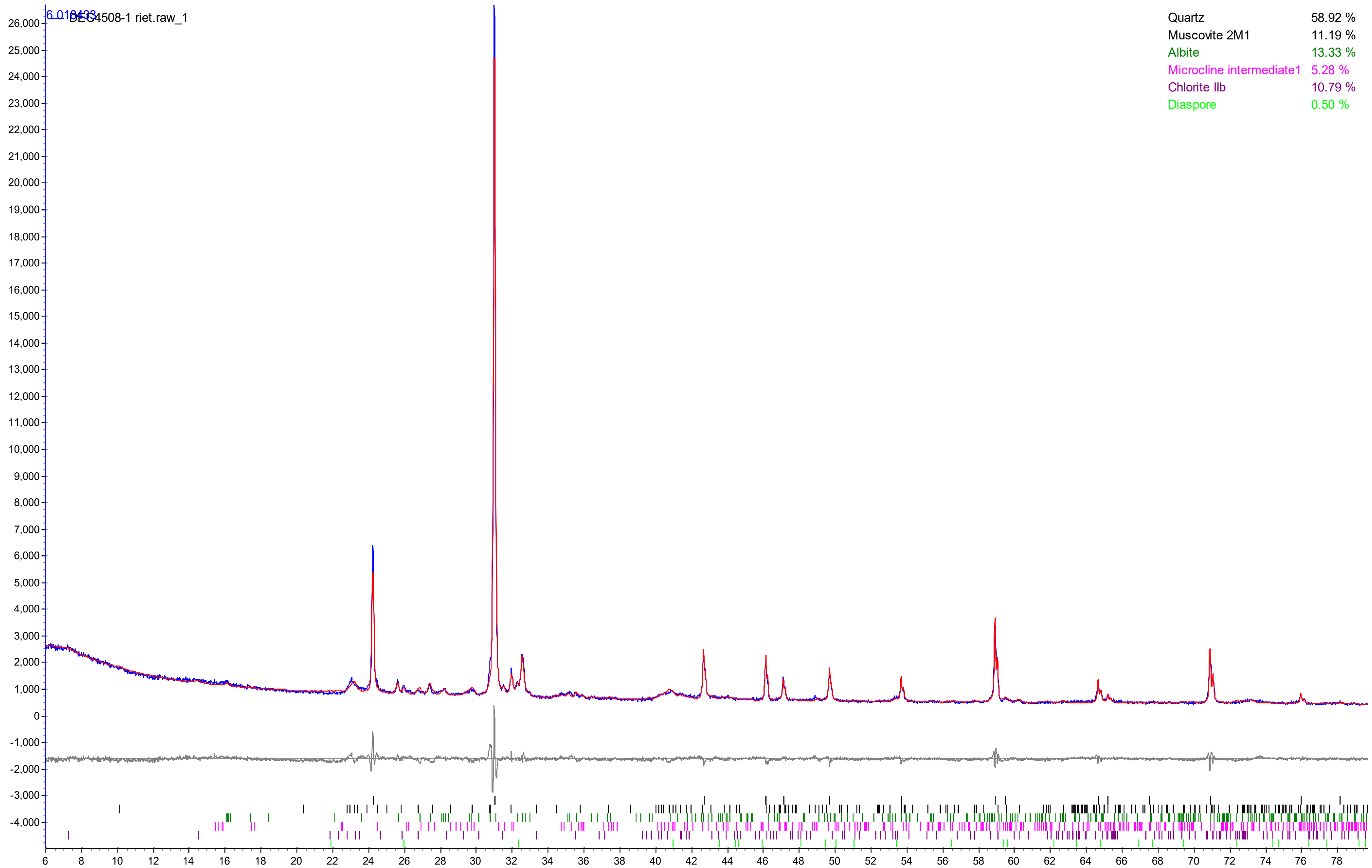
Dashes indicate that the mineral was not identified by the analyst and not included in the refinement calculation for the sample.

The weight percent quantities indicated have been normalized to a sum of 100%. The quantity of amorphous material has not been determined.

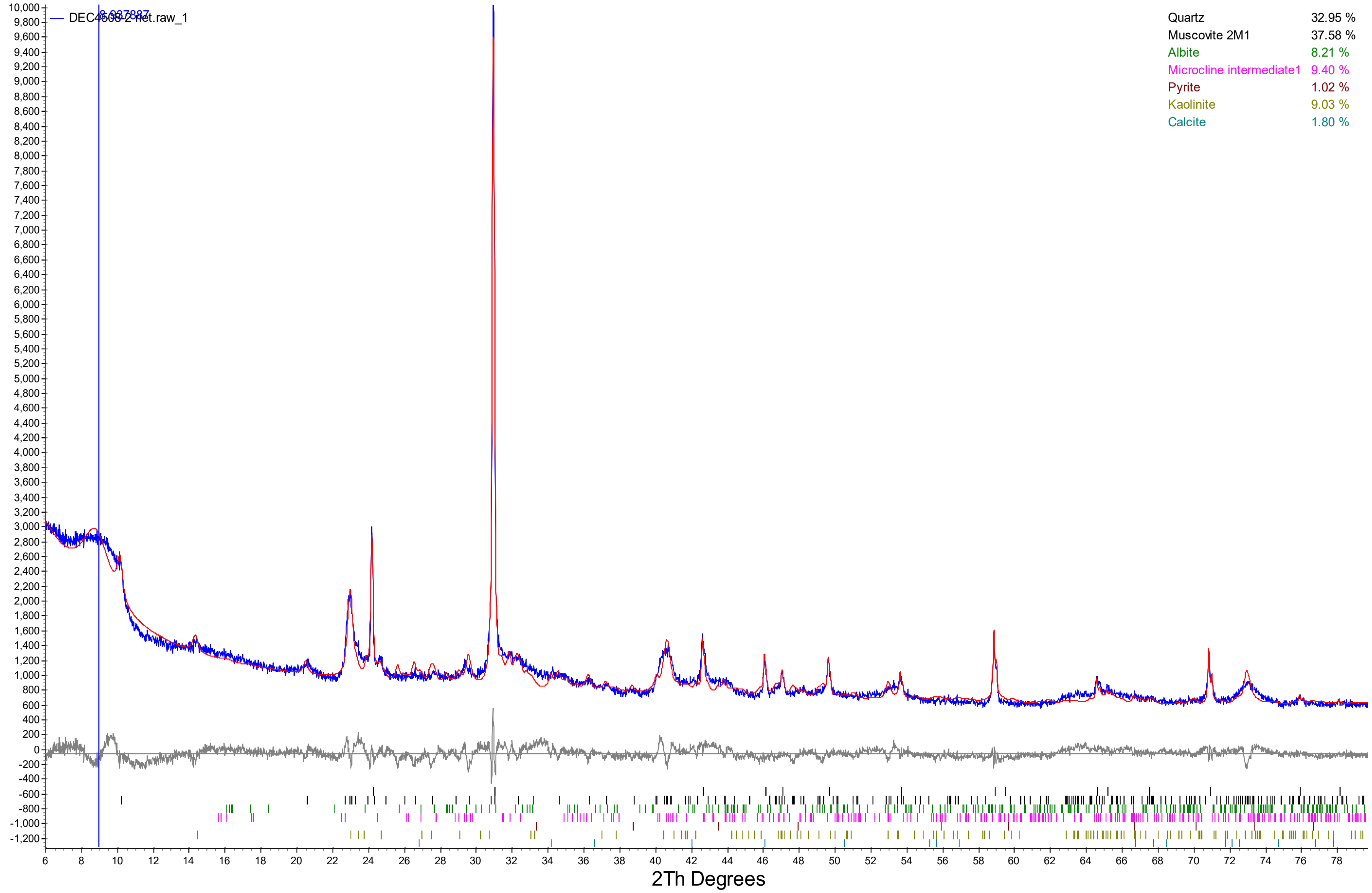
Mineral/Compound	Formula
Quartz	SiO_2
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$
Albite	$NaAlSi_3O_8$
Microcline	$KAlSi_3O_8$
Chlorite	$(Fe,(Mg,Mn)_5,Al)(Si_3Al)O_{10}(OH)_8$
Diaspore	aAlO.OH
Pyrite	FeS_2
Kaolinite	$Al_2Si_2O_5(OH)_4$
Calcite	$CaCO_3$
Anatase	TiO_2
Leucite	$KAlSi_2O_6$
Siderite	$FeCO_3$
Dolomite	$CaMg(CO_3)_2$
Gypsum	$CaSO_4 \cdot 2H_2O$
Diopside	$CaMgSi_2O_6$

Environmental Services
Custom XRD/MI4508-DEC22
21-Dec-22

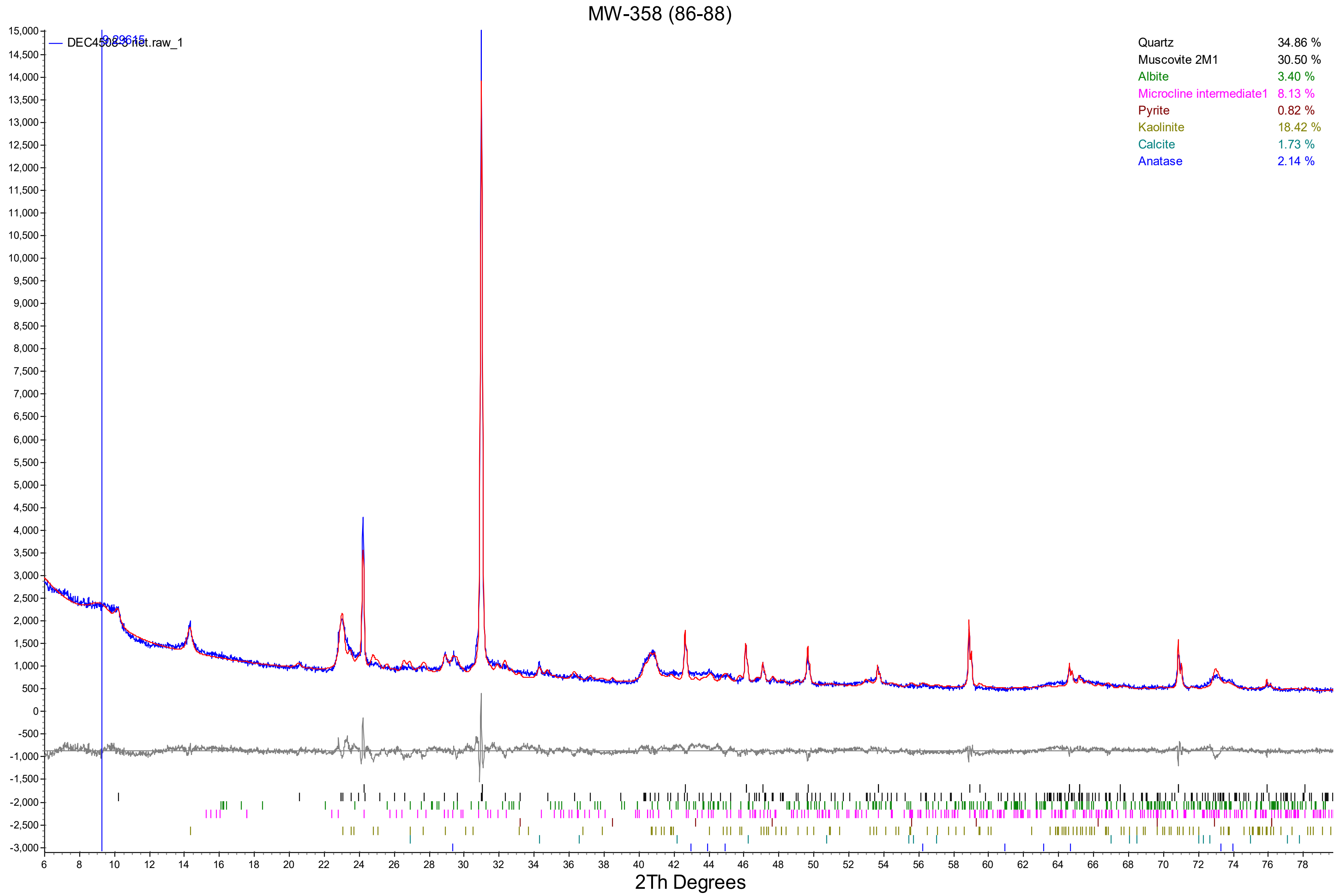
MW-358 (13-15)



MW-358 (47-49)

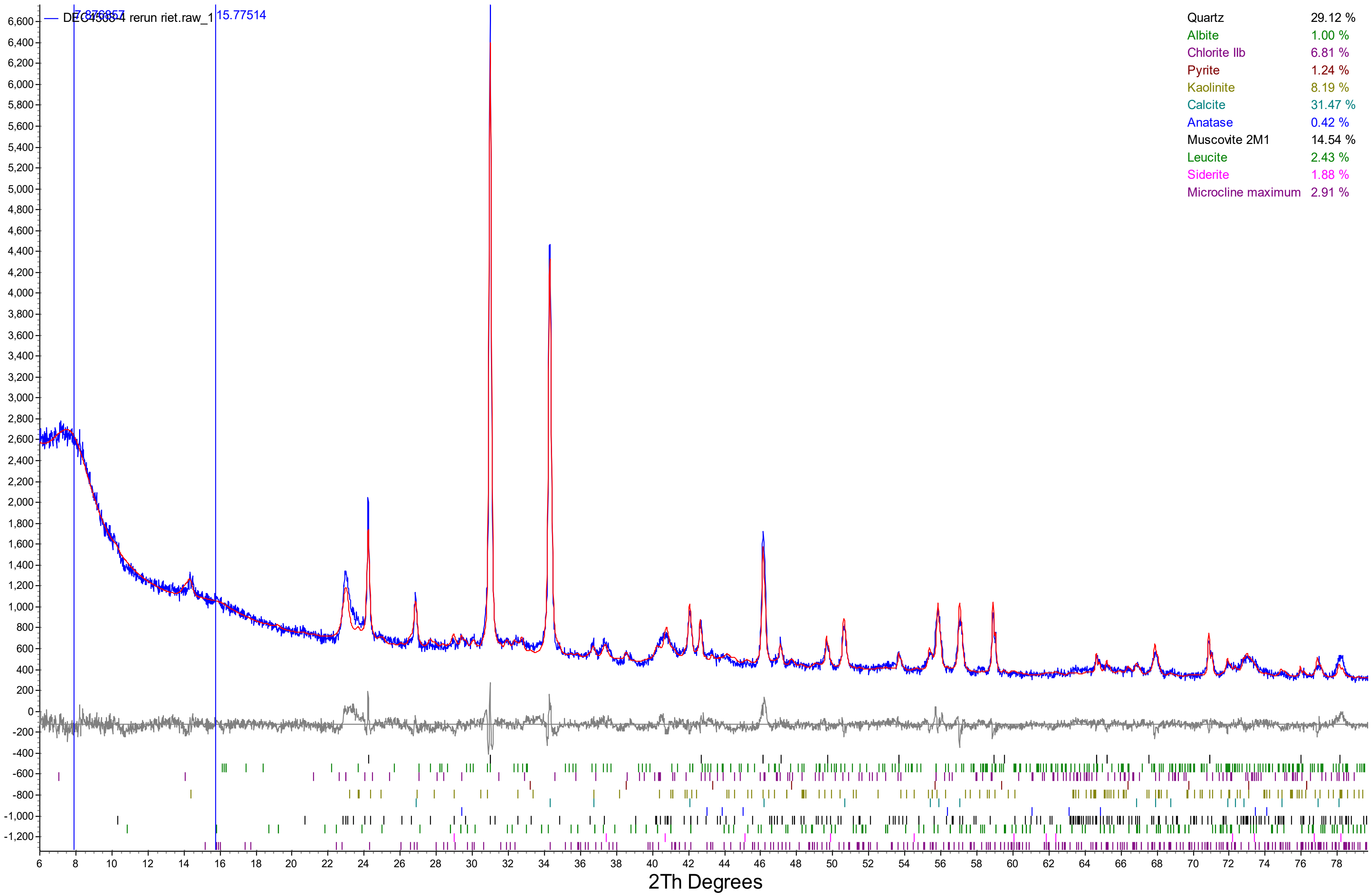

DEC4508-2-net.raw_1
Quartz 32.95 %
Muscovite 2M1 37.58 %
Albite 8.21 %
Microcline intermediate1 9.40 %
Pyrite 1.02 %
Kaolinite 9.03 %
Calcite 1.80 %
2Th Degrees

Environmental Services
Custom XRD/MI4508-DEC22
21-Dec-22



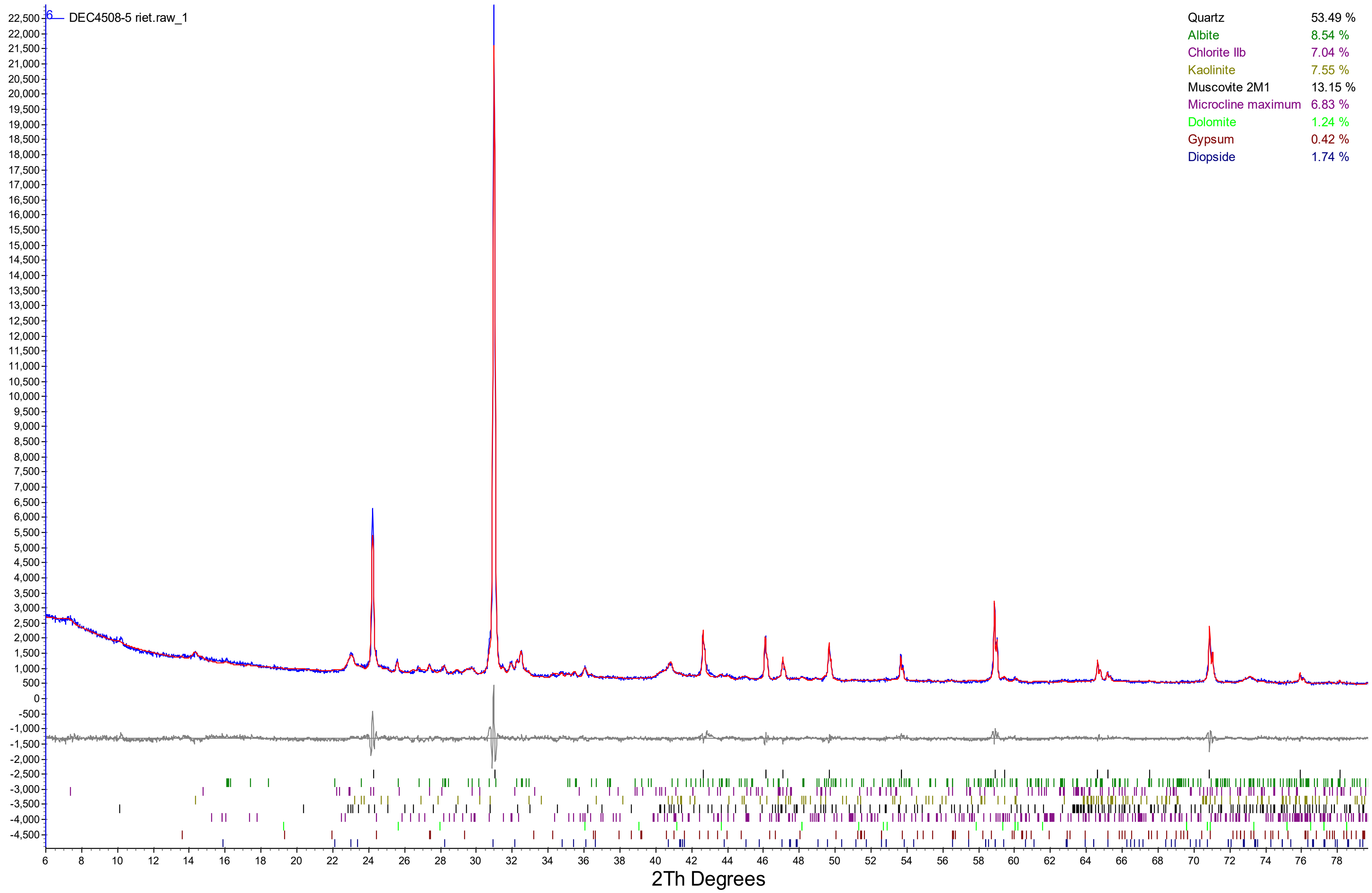
Environmental Services
Custom XRD/MI4508-DEC22
21-Dec-22

MW-392 (80-82)

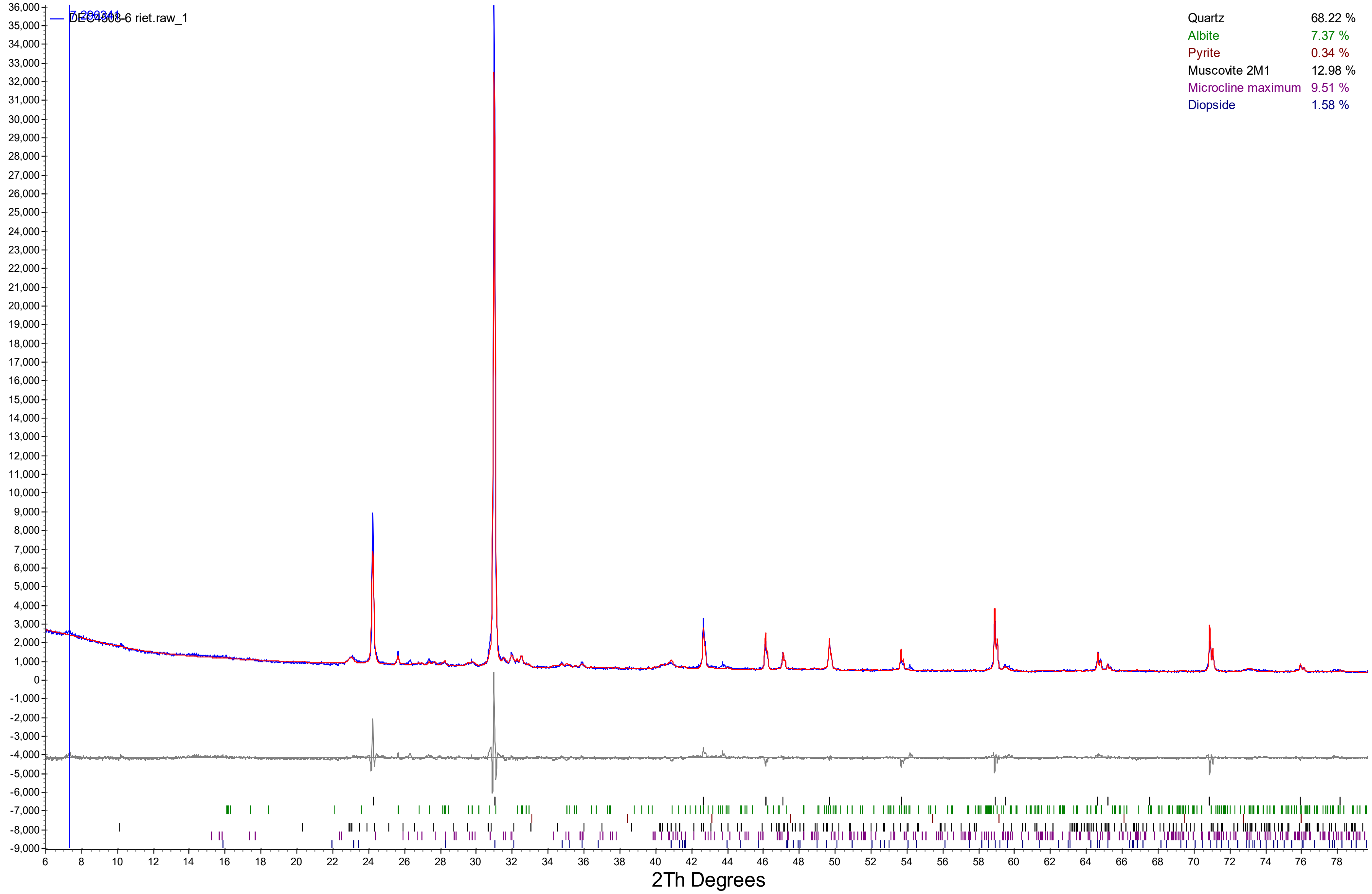


Environmental Services
Custom XRD/MI4508-DEC22
21-Dec-22

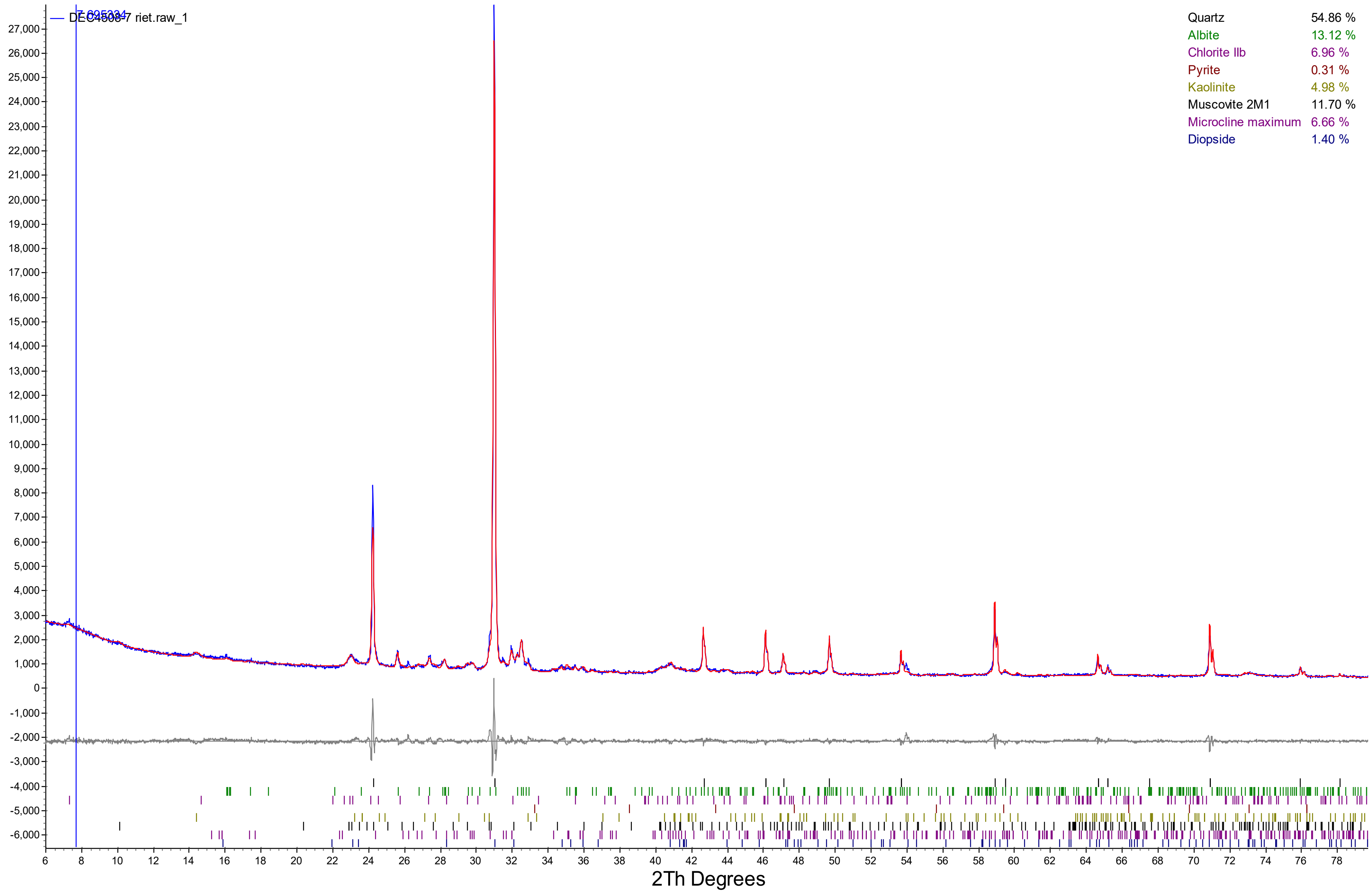
MW-392 (32-33.5)



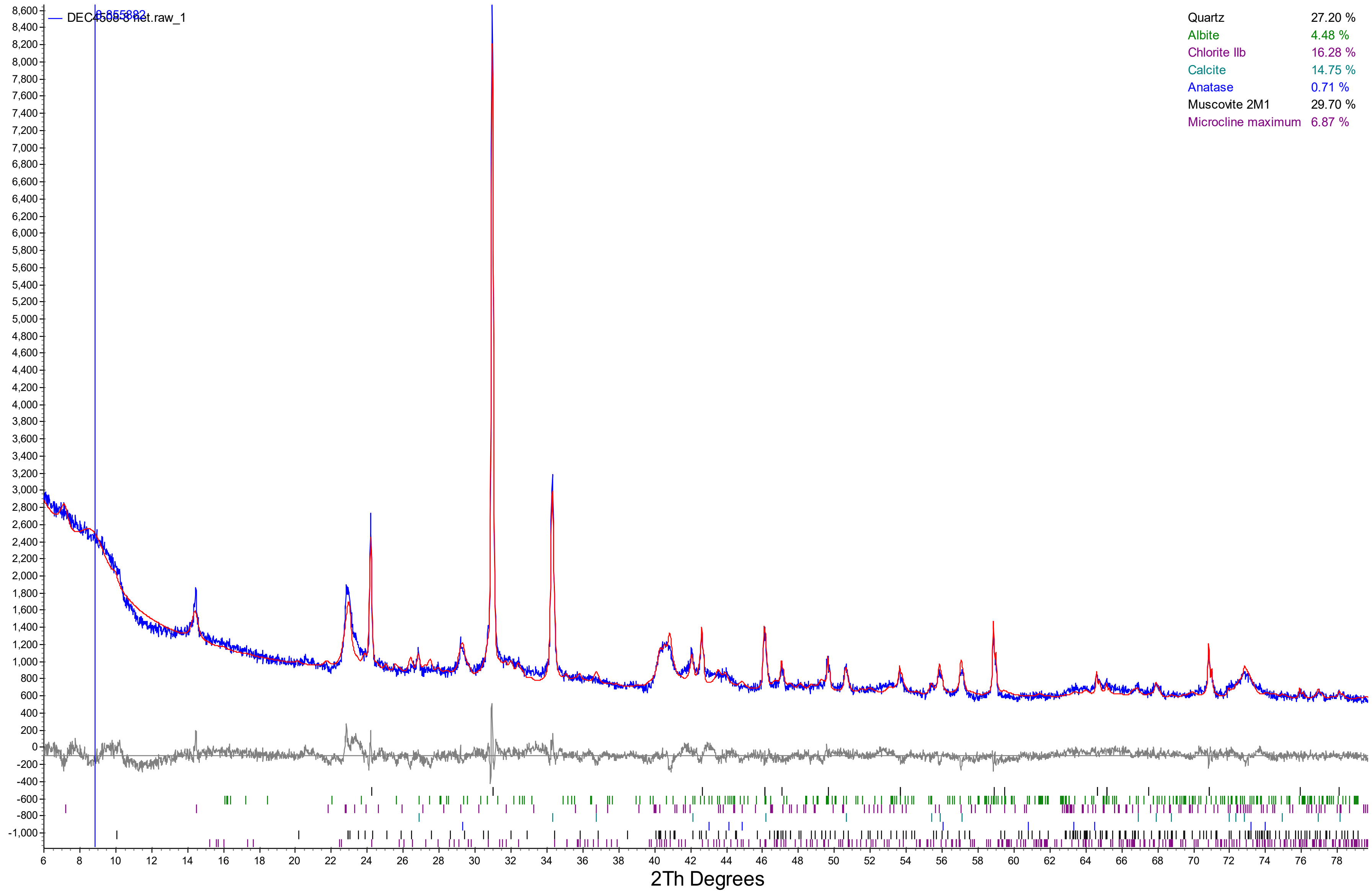
MW-393 (24-25.5)


DEC4508-6 riet.raw_1
Quartz 68.22 %
Albite 7.37 %
Pyrite 0.34 %
Muscovite 2M1 12.98 %
Microcline maximum 9.51 %
Diopside 1.58 %
2Th Degrees

MW-394 (20.5-22)


7.695334
DEC4508-7 riet.raw_1
Quartz 54.86 %
Albite 13.12 %
Chlorite IIb 6.96 %
Pyrite 0.31 %
Kaolinite 4.98 %
Muscovite 2M1 11.70 %
Microcline maximum 6.66 %
Diopside 1.40 %
2Th Degrees

MW-392 (66-68)


DEC4508-3 net.raw_1
Quartz 27.20 %
Albite 4.48 %
Chlorite IIb 16.28 %
Calcite 14.75 %
Anatase 0.71 %
Muscovite 2M1 29.70 %
Microcline maximum 6.87 %
2Th Degrees

APPENDIX C
MODFLOW, HELP MODEL, AND FLUX EVALUATION DATA EXPORT FILES (ELECTRONIC ONLY)

APPENDIX D
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: BAL BAP CIP Cons Slopes **Simulated On:** 1/6/2023 7:23

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
SiCL - Silty Clay Loam (Moderate)
Material Texture Number 26

Thickness	=	6	inches
Porosity	=	0.445	vol/vol
Field Capacity	=	0.393	vol/vol
Wilting Point	=	0.277	vol/vol
Initial Soil Water Content	=	0.3673	vol/vol
Effective Sat. Hyd. Conductivity	=	1.90E-06	cm/sec

Layer 2

Type 1 - Vertical Percolation Layer
SiC - Silty Clay (Moderate)
Material Texture Number 28

Thickness	=	18	inches
Porosity	=	0.452	vol/vol
Field Capacity	=	0.411	vol/vol
Wilting Point	=	0.311	vol/vol
Initial Soil Water Content	=	0.3948	vol/vol
Effective Sat. Hyd. Conductivity	=	1.20E-06	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	=	0.01	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E+01	cm/sec
Slope	=	25	%
Drainage Length	=	150	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)
Electric Plant Coal Bottom Ash
Material Texture Number 83

Thickness	=	231.72	inches
Porosity	=	0.578	vol/vol
Field Capacity	=	0.076	vol/vol
Wilting Point	=	0.025	vol/vol
Initial Soil Water Content	=	0.076	vol/vol
Effective Sat. Hyd. Conductivity	=	5.29E-04	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	=	91.1	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	21.39	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	6.845	inches
Upper Limit of Evaporative Storage	=	8.094	inches
Lower Limit of Evaporative Storage	=	5.394	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	26.923	inches
Total Initial Water	=	26.923	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	38.18	Degrees
Maximum Leaf Area Index	=	4.5	
Start of Growing Season (Julian Date)	=	104	days

End of Growing Season (Julian Date)	=	285	days
Average Wind Speed	=	8	mph
Average 1st Quarter Relative Humidity	=	72	%
Average 2nd Quarter Relative Humidity	=	64	%
Average 3rd Quarter Relative Humidity	=	71	%
Average 4th Quarter Relative Humidity	=	72	%

Note: Evapotranspiration data was obtained for Baldwin, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
2.421014	2.032335	4.330912	4.401604	4.511846	4.068128
4.023992	2.88724	2.952714	2.941943	4.289265	2.800511

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
35	44.8	49.4	61.2	72.7	82.1
84.9	81.7	72.6	59.4	50.1	43.9

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85

Average Annual Totals Summary

Title: BAL BAP CIP Cons Slopes
Simulated on: 1/6/2023 7:24

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	41.66	[4.8]	3,234,836.6	100.00
Runoff	16.562	[3.613]	1,285,952.1	39.75
Evapotranspiration	24.541	[2.705]	1,905,475.7	58.90
Subprofile1				
Lateral drainage collected from Layer 3	0.5339	[0.485]	41,451.4	1.28
Percolation/leakage through Layer 4	0.000007	[0.000006]	0.5720	0.00
Average Head on Top of Layer 4	0.0002	[0.0002]	---	---
Subprofile2				
Percolation/leakage through Layer 5	0.000007	[0.000007]	0.5716	0.00
Water storage				
Change in water storage	0.0252	[0.7492]	1,956.9	0.06

* 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:	BAL BAP CIP Cons Top	**Simulated On:**	1/6/2023 7:18

Layer 1
Type 1 - Vertical Percolation Layer (Cover Soil)
SiCL - Silty Clay Loam (Moderate)
Material Texture Number 26

Thickness	=	6	inches
Porosity	=	0.445	vol/vol
Field Capacity	=	0.393	vol/vol
Wilting Point	=	0.277	vol/vol
Initial Soil Water Content	=	0.3673	vol/vol
Effective Sat. Hyd. Conductivity	=	1.90E-06	cm/sec

Layer 2
Type 1 - Vertical Percolation Layer
SiC - Silty Clay (Moderate)
Material Texture Number 28

Thickness	=	18	inches
Porosity	=	0.452	vol/vol
Field Capacity	=	0.411	vol/vol
Wilting Point	=	0.311	vol/vol
Initial Soil Water Content	=	0.3951	vol/vol
Effective Sat. Hyd. Conductivity	=	1.20E-06	cm/sec

Layer 3
Type 2 - Lateral Drainage Layer
16 oz Nonwoven Geotextile
Material Texture Number 43

Thickness	=	0.11	inches
Porosity	=	0.85	vol/vol
Field Capacity	=	0.01	vol/vol
Wilting Point	=	0.005	vol/vol
Initial Soil Water Content	=	0.01	vol/vol
Effective Sat. Hyd. Conductivity	=	3.00E-01	cm/sec
Slope	=	2	%
Drainage Length	=	600	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)
Electric Plant Coal Bottom Ash
Material Texture Number 83

Thickness	=	545.28	inches
Porosity	=	0.578	vol/vol
Field Capacity	=	0.076	vol/vol
Wilting Point	=	0.025	vol/vol
Initial Soil Water Content	=	0.076	vol/vol
Effective Sat. Hyd. Conductivity	=	5.29E-04	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	=	89.8	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	53.73	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	6.849	inches
Upper Limit of Evaporative Storage	=	8.094	inches
Lower Limit of Evaporative Storage	=	5.394	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	50.759	inches
Total Initial Water	=	50.759	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	38.18	Degrees
Maximum Leaf Area Index	=	4.5	
Start of Growing Season (Julian Date)	=	104	days

End of Growing Season (Julian Date)	=	285	days
Average Wind Speed	=	8	mph
Average 1st Quarter Relative Humidity	=	72	%
Average 2nd Quarter Relative Humidity	=	64	%
Average 3rd Quarter Relative Humidity	=	71	%
Average 4th Quarter Relative Humidity	=	72	%

Note: Evapotranspiration data was obtained for Baldwin, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
2.421014	2.032335	4.330912	4.401604	4.511846	4.068128
4.023992	2.88724	2.952714	2.941943	4.289265	2.800511

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
35	44.8	49.4	61.2	72.7	82.1
84.9	81.7	72.6	59.4	50.1	43.9

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85

Average Annual Totals Summary

Title: BAL BAP CIP Cons Top
Simulated on: 1/6/2023 7:19

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	41.66	[4.8]	8,125,655.5	100.00
Runoff	16.544	[3.658]	3,226,692.1	39.71
Evapotranspiration	24.605	[2.679]	4,798,963.4	59.06
Subprofile1				
Lateral drainage collected from Layer 3	0.4260	[0.3581]	83,079.3	1.02
Percolation/leakage through Layer 4	0.061216	[0.074113]	11,939.6	0.15
Average Head on Top of Layer 4	0.7474	[0.9614]	---	---
Subprofile2				
Percolation/leakage through Layer 5	0.000239	[0.000259]	46.6	0.00
Water storage				
Change in water storage	0.0865	[0.7368]	16,874.2	0.21

* Note: Average inches are converted to volume based on the user-specified area.

APPENDIX E
FLUX EVALUATION DATA

APPENDIX E. FLUX EVALUATION DATA
GROUNDWATER MODELING REPORT
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Calibration Model

Model	Years (Model Period)	HSU	Total Flux In[1] (ft^3/d)	Total Flux In (gpm)
Calibration Model	53	CCR	2098.27	10.90
Model	**Years (Model Period)**	**HSU**	**Total Flux Out[1] (ft^3/d)**	**Total Flux Out (gpm)**
Calibration Model	53	CCR	-652.13	-3.39
Model	**Model Period**	**Boundary Condition**	**Total Flux Out[1] (ft^3/d)**	**Total Flux Out (gpm)**
Calibration Model	53	Constant Head (Stormwater Management within Active BAP)	-1420.44	-7.38

Scenario: CIP (CCR removal from the western areas of the BAP, consolidation to the southeast, and eventually northeastern portions of the BAP, 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	93	CCR	108.27	0.56	95%
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	93	CCR	-135.25	-0.70	93%

[O: JJW 1/5/23; C: EGP 1/6/23; C: BGH 1/19/23; U: JJW 5/17/23 C: EGP 5/23/23]

Notes:
1. Reduction in flux as compared to flux at the end of calibration model (model period of 53 years) including flux through constant head boundary conditions in the calibration model when applicable (flux out).
2. Total flux in and out source data provided in flux calculation data files included in Appendix C.

BAP = Bottom Ash Pond
CCR = coal combustion residuals
CIP = closure in place
HSU = Hydrostratigraphic Unit
% = percentage
ft^3/d = cubic feet per day
gpm = gallons per minute

Attachment B.2

Groundwater Monitoring Plan

July 2023

Intended for
Dynegy Midwest Generation, LLC

Date
August 1, 2023

Project No.
1940102653

GROUNDWATER MONITORING PLAN REVISION 1

BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL Bright ideas. Sustainable change.

GROUNDWATER MONITORING PLAN REVISION 1
BALDWIN POWER PLANT BOTTOM ASH POND

Project Name	**Baldwin Power Plant Bottom Ash Pond**
Project No.	**1940102653**
Recipient	**Dynegy Midwest Generation, LLC**
Document Type	**Groundwater Monitoring Plan**
Revision	**Revision 1**
Date	**August 1, 2023**

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Senior Managing Hydrogeologist

Eric J. Tlachac, PE
Senior Managing Engineer

Jake J. Walczak
Senior Hydrogeologist

Evvan G. Plank
Hydrogeologist

LICENSED PROFESSIONAL CERTIFICATIONS

35 I.A.C. § 845.630 Groundwater Monitoring Systems (PE)

I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the groundwater monitoring system described in this document (Groundwater Monitoring Plan Revision 1, Baldwin Power Plant Bottom Ash Pond), meets the intent of 35 I.A.C. § 845.630. The monitoring system was developed based on information included in the Hydrogeologic Site Characterization Report (Ramboll, 2023a; included in the Construction Permit application to which this Groundwater Monitoring Plan is attached).

____
Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
Date: August 1, 2023

35 I.A.C. § 845.630 Groundwater Monitoring Systems (PG)

I, Brian G. Hennings, a qualified professional geologist in good standing in the State of Illinois, certify that the groundwater monitoring system described in this document (Groundwater Monitoring Plan Revision 1, Baldwin Power Plant Bottom Ash Pond), meets the intent of 35 I.A.C. § 845.630. The monitoring system was developed based on information included in the Hydrogeologic Site Characterization Report (Ramboll, 2023a; included in the Construction Permit application to which this Groundwater Monitoring Plan is attached).

____
Brian G. Hennings
Professional Geologist
196.001482
Illinois
Date: August 1, 2023

CONTENTS

TABLES (IN TEXT)

TABLES (ATTACHED)

FIGURES (ATTACHED)

APPENDICES

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
ASD	Alternate Source Demonstration
BAP	Bottom Ash Pond
BPP	Baldwin Power Plant
bgs	below ground surface
CCA	Compliance Commitment Agreement
CCR	coal combustion residuals
cm/s	centimeters per second
Cooling Pond	Baldwin Lake
DMG	Dynegy Midwest Generation, LLC
FAPS	Fly Ash Pond System
GMP	Groundwater Monitoring Plan Revision 1
GWPS	groundwater protection standard
HCR	Hydrogeologic Site Characterization Report Revision 1
ID	identification
IEPA	Illinois Environmental Protection Agency
NID	National Inventory of Dams
No.	number
NPDES	National Pollutant Discharge Elimination System
NRT	Natural Resources Technology, Inc.
PMP	potential migration pathway
QA/QC	quality assurance/quality control
QAPP	Multi-Site Quality Assurance Project Plan
Ramboll	Ramboll Americas Engineering Solutions, Inc.
RL	reporting limit
SAP	Multi-Site Sampling and Analysis Plan
SI	surface impoundment
Site	BAP, FAPS, Secondary Pond, and Tertiary Pond
TDS	total dissolved solids
UA	uppermost aquifer
UGU	Upper Groundwater Unit
UU	upper unit
USEPA	United States Environmental Protection Agency
WLO	water level only

REVISION SUMMARY

Revision Date	**Description of Changes** (Section title or number – description)
08/01/2023	The 35 I.A.C. § 845 groundwater monitoring network has been changed. This document has been revised as necessary to reflect these changes.

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 Groundwater Monitoring Plan Revision 1 (GMP) on behalf of Baldwin Power Plant (BPP) (**Figure 1-1**), operated by Dynegy Midwest Generation, LLC (DMG). This report will apply specifically to the coal combustion residuals (CCR) Unit referred to as the Bottom Ash Pond (BAP) (CCR unit identification [ID] Number [No.] 601, Illinois Environmental Protection Agency [IEPA] ID No. W1578510001-06, and National Inventory of Dams (NID) ID No. IL50721. The BAP is a 177-acre unlined CCR surface impoundment (SI) used to manage CCR and non-CCR waste streams at the BPP. This GMP includes 35 I.A.C. § 845 content requirements specific to 35 I.A.C. § 845.630 (Groundwater Monitoring System), 35 I.A.C. § 845.640 (Groundwater Sampling and Analysis), and 35 I.A.C. § 845.650 (Groundwater Monitoring Program) for the BAP at BPP.

A checklist which identifies the specific requirements of 35 I.A.C. § 845.630, 35 I.A.C. § 845.640, and 35 I.A.C. § 845.650 is included in **Table 1-1**. 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. § 845.630, 35 I.A.C. § 845.640, and 35 I.A.C. § 845.650.

1.2 Site Location and Background

The BPP is located in southwest Illinois in Randolph and St. Clair Counties. The Randolph County portion of the BPP is located within Sections 2, 3, 4, 9, 10, 11, 14, 15, and 16 of Township 4 South and Range 7 West. The St. Clair County portion of the property is located within Sections 33, 34, and 35 of Township 3 South and Range 7 West. The BAP is approximately one-half mile west-northwest of the Village of Baldwin (**Figure 1-1**).

The BPP property is bordered to the west by the Kaskaskia River; to the east by Baldwin Road, farmland, and strip-mining areas; to the southeast by the village of Baldwin; to the south by the Illinois Central Gulf railroad tracks, scattered residences, and State Route 154; and to the north by farmland. The St. Clair/Randolph County Line crosses east-west at approximately the midpoint of Baldwin Lake (Cooling Pond). **Figure 1-1** shows the location of the BPP; **Figure 1-2** is a site map showing the location of the BAP (a 35 I.A.C. § 845 regulated CCR Unit and the subject of this GMP), as well as the Fly Ash Pond System (FAPS; an IEPA closed CCR Unit), Secondary Pond, Tertiary Pond, and Cooling Pond. The combined area including the BAP, FAPS, Secondary Pond, and Tertiary Pond will hereinafter be referred to as the Site. The BAP is adjacent to the FAPS, which was closed on November 17, 2020.

1.3 Conceptual Model

Significant site investigation has been completed at the BPP to characterize the geology, hydrogeology, and groundwater quality. Based on extensive investigation and monitoring, the BAP has been well characterized and detailed in the Hydrogeologic Site Characterization Report Revision 1 (HCR [Ramboll, 2023a); included in the Construction Permit to which this GMP is attached). A site conceptual model has been developed and is discussed below.

Three hydrostratigraphic units are present at the Site:

- **CCR:** CCR, consisting primarily of fly ash, bottom ash, and boiler slag. Also includes earthen fill deposits of predominantly clay and silt materials from on-site excavations that were used to construct berms and roads surrounding the various impoundments across the Site.
- **Upper Unit (UU):** Predominantly clay with some silt and minor sand, silt layers, and occasional sand lenses. Includes the lithologic layers identified as the Cahokia Alluvium, Peoria Loess, Equality Formation, and Vandalia Till Member. This unit is composed of unlithified natural geologic materials and extends from the upper saturated materials to the bedrock. Thin sand seams and the interface (contact) between the UU and bedrock have been identified as potential migration pathways (PMPs). No continuous sand seams were observed within or immediately adjacent to the BAP; however, the sand seams may act as a PMP due to relatively higher hydraulic conductivities. The acronym UU and the materials it contains is synonymous with Upper Groundwater Unit (UGU) used in previous documents.
- **Bedrock Unit:** This unit is considered the uppermost aquifer (UA). Pennsylvanian and Mississippian-aged bedrock is composed of interbedded shale and limestone bedrock, which underlies and is continuous across the entire Site.

Lateral groundwater flow in the shallow unlithified materials and bedrock is generally to the west and southwest across the Site toward the Kaskaskia River. Groundwater flow in bedrock is toward the northwest in the east and central areas of the BAP, and southwest to northwest on the east area of the FAPS until groundwater reaches the bedrock valley feature underlying the Secondary and Tertiary Ponds west of the BAP and FAPS, at which point the flow direction veers towards this bedrock surface low (**Figure 1-3** and **Figure 1-4**).

Immediately upgradient and downgradient of the BPP property boundaries, both the shallow glacial deposits and the shallow bedrock have served as a source of water supply. The shallow unlithified deposits off-site have yielded water through intermittent, discontinuous sand lenses and, in the bedrock, through fractured sandstone and limestone. However, within the area of the Site, investigations have indicated only thin and intermittent sand lenses are present within predominantly clay deposits; thus, the unlithified materials do not represent a continuous aquifer unit. Based on these details, the bedrock unit was designated as the UA in the *Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan* (Natural Resources Technology, Inc. [NRT], 2016), consistent with the United States Environmental Protection Agency (USEPA) definition in Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.53.

The shallow bedrock is the only water-bearing unit that is continuous across the Site. Shallow sandstone and creviced limestone may yield small supplies in some areas, but water quality becomes poorer (*i.e.,* highly mineralized) with increasing depth. The Pennsylvanian and Mississippian rocks generally have low porosities and permeabilities, are not a reliable source of groundwater, and the quality varies considerably (Pryor, 1956). Therefore, the lower limit of the UA is the depth at which either the groundwater is mineralized to a point that it is no longer a useable water source, or the secondary porosities do not yield a sufficient volume of groundwater to produce a useable water supply.

The parameters listed in 35 I.A.C. § 845 have been monitored in the UA monitoring wells as part of 40 C.F.R. § 257 from 2015 to present. These data were supplemented with installation and sampling of additional locations in both the UA and UU installed in 2022. The results indicate that the following parameters were detected at concentrations greater than the applicable 35 I.A.C. § 845.600 groundwater protection standards (GWPSs) and are considered potential exceedances (Ramboll, 2023b):

- Arsenic in OW-257
- Beryllium in OW-257
- Chloride in MW-370
- Chromium in OW-257
- Cobalt in OW-257
- Fluoride in MW-393
- Lead in OW-257
- Lithium in OW-257
- Radium 226 + Radium 228 in OW-257
- Thallium in OW-257

Evaluation of background groundwater quality has been completed as part of this GMP, and compliance with 35 I.A.C. § 845 will be determined following the first round of groundwater sampling. The first round of groundwater sampling for compliance was completed in the second quarter of 2023 in accordance with the Compliance Commitment Agreement (CCA) entered on December 28, 2022, for the BPP.

2. GROUNDWATER MONITORING SYSTEMS

2.1 Existing Monitoring Well Network and Analysis

This GMP is being provided to propose an updated groundwater monitoring network and monitoring program specific to the BAP that will comply with 35 I.A.C. § 845. The remaining discussion in this document will include only these networks and monitoring programs that are applicable and specific to the BAP, specifically National Pollutant Discharge Elimination System (NPDES) monitoring network, the 40 C.F.R. § 257 monitoring network, and the proposed 35 I.A.C. § 845 monitoring network. DMG entered into a CCA with the IEPA on December 28, 2022. Groundwater monitoring in accordance with the CCA and the 35 I.A.C. § 845 proposed GMP and sampling methodologies provided in the operating permit application for the BAP commenced in the second quarter of 2023. After the BAP has been issued an approved operating permit, groundwater monitoring shall be conducted in accordance with that operating permit. As specified in the CCA, groundwater sampling requirements that apply to the CCR SI under other existing state permit programs will become void upon issuance of an approved operating permit pursuant to 35 I.A.C § 845.

2.1.1 NPDES Monitoring Program

Effective November 1, 2022, Special Condition No. 17 requiring groundwater monitoring and reporting was removed from NPDES Permit IL0000043.

2.1.2 40 C.F.R. § 257 Monitoring Program

The 40 C.F.R. § 257 well network for the BAP is being revised and expanded in July of 2023 concurrent with the revisions to the 35 I.A.C. § 845 monitoring well network provided in this document. As described in Revision 1 of the 40 C.F.R. § 257 groundwater monitoring plan (Ramboll, 2023c), the revised well network consists of the same 16 monitoring wells (three background and 13 compliance) used to monitor and evaluate groundwater quality in the 35 I.A.C. § 845 monitoring well network described in **Section 2.2**.

The boring logs, well construction forms, and other related monitoring well forms are available in the Operating Records as required by 40 C.F.R. § 257.91 for each monitored CCR Unit or CCR Multi-Unit and are included in Appendix C of the HCR (included in the Construction Permit application to which this GMP is attached).

Assessment monitoring in accordance with 40 C.F.R. § 257.95 was initiated on April 9, 2018. Details of the procedures and techniques used to fulfill the groundwater sampling and analysis program requirements are found in the Multi-Site Sampling and Analysis Plan (SAP) (Ramboll, 2022a).

Groundwater samples are collected semiannually and analyzed for the following laboratory and field parameters from Appendix III and Appendix IV of 40 C.F.R. § 257, summarized in **Table A** on the following page.

Table A. 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	Mercury	Radium 226 and 228 combined
Beryllium	Fluoride	Molybdenum	

[1]Dissolved oxygen, temperature, specific conductance, oxidation/reduction potential, and turbidity are recorded during sample collection.

Results and analysis of groundwater sampling are reported annually by January 31 the following year and made available on the CCR public website as required by 40 C.F.R. § 257.

2.1.3 35 I.A.C. § 845 Well Installation and Monitoring

In 2022, 9 additional monitoring wells (MW-158R, MW- 258, MW-358, MW-192, MW-392, MW-193, MW-393, MW-194, MW-394) and five additional pore water wells (XPW01, XPW02, XPW04, XPW05, and XPW06) were installed at the BAP to assess the vertical and horizontal lithology, stratigraphy, chemical properties, and physical properties of geologic layers as specified in 35 I.A.C. § 845.620(b).

Prospective 35 I.A.C. § 845 monitoring wells were sampled for eight rounds from October 2022 through May 2023 and the results were used for selection of the BAP 35 I.A.C. § 845 monitoring well network. Groundwater samples were collected and analyzed for 35 I.A.C. § 845.600 parameters as summarized in **Table B** on the following page.

Table B. 35 I.A.C. § 845 Groundwater Monitoring Program Parameters

Field Parameters[1]			
Groundwater Elevation	pH	Turbidity	
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.

2.2 Proposed 35 I.A.C. § 845 Monitoring Well Network

The groundwater monitoring well network proposed in this GMP will include ten monitoring wells (MW-304, MW-306, MW-356, MW-358, MW-369, MW-370, MW-382, MW-392, MW-393, and MW-394) screened in the bedrock (*i.e.,* UA), six monitoring wells (MW-192, MW-193, OW-256, OW-257, PZ-170, and PZ-182) screened in the UU, and four temporary (pending implementation of impoundment closure) water level only (WLO) pore water wells (TPZ-164, XPW01, XPW05, and XPW06) screened within the CCR unit. The proposed network is summarized in **Table C** on the following page and displayed on **Figure 2-1**. Sixteen monitoring wells (three background and 13 compliance) will be used to monitor groundwater concentrations within the hydrostratigraphic units.

The groundwater samples collected from the 16 wells will be 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 will 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)). Monitoring well depths and construction details are listed in **Table 2-1** and summarized in **Table C** on the following page.

Table C. Proposed 35 I.A.C. § 845 Monitoring Well Network

Well ID	Monitored Unit	Well Screen Interval (feet bgs)	Well Type[1]
MW-192	UU	20.0 – 30.0	Compliance
MW-193	UU	22.0 – 32.0	Compliance
MW-304	UA	45.0 – 55.0	Background
MW-306	UA	72.7 – 82.7	Background
MW-356	UA	56.0 – 66.0	Compliance
MW-358	UA	80.0 – 90.0	Background
MW-369	UA	56.0 – 66.0	Compliance
MW-370	UA	53.0 – 63.0	Compliance
MW-382	UA	56.0 – 66.0	Compliance
MW-392	UA	74.0 – 84.0	Compliance
MW-393	UA	75.0 – 85.0	Compliance
MW-394	UA	73.0 – 83.0	Compliance
OW-256	UU	28.0 – 32.5	Compliance
OW-257	UU	34.0 – 38.5	Compliance
PZ-170	UU	21.1 – 31.1	Compliance
PZ-182	UU	24.0 – 34.0	Compliance
TPZ-164[2]	CCR	5.2 – 9.7	WLO
XPW01[2]	CCR	7.0 – 12.0	WLO
XPW05[2]	CCR	18.0 – 28.0	WLO
XPW06[2]	CCR	5.0 – 10.0	WLO

[1] Well type refers to the role of the well in the monitoring network.
[2] Location is temporary pending implementation of impoundment closure per an approved Construction Permit Application.
bgs = below ground surface
UU = UU
UA = uppermost aquifer
WLO = water level only

2.3 Well Abandonment

No wells are currently proposed for abandonment.

3. APPLICABLE GROUNDWATER QUALITY STANDARDS

3.1 Groundwater Classification

The classification of groundwater at the Site was addressed in the Phase II investigation (NRT, 2014a). Field hydraulic conductivity tests performed on the UU materials (*i.e.,* Cahokia Formation, Equality Formation, and Vandalia Till) and Bedrock Unit materials (*i.e.,* Mississippian and Pennsylvanian bedrock) as part of the Phase II and 2022 HSI had geometric mean hydraulic conductivities of 2.9 x 10^{-5} centimeters per second (cm/s) and 1.9 x 10^{-6} cm/s, respectively.

Geologic material with a hydraulic conductivity of less than 1 x 10^{-4} cm/s which does not meet the provisions of 35 I.A.C. § 620.210 (Class I), 35 I.A.C. § 620.230 (Class III), or 35 I.A.C. § 620.240 (Class IV), meets the definition of a Class II – General Resource Groundwater (35 I.A.C. § 620.220). Based on the detailed geologic information provided for the unlithified materials and bedrock at BPP, along with the hydrogeologic data, the groundwater in both the unlithified deposits and underlying bedrock at the Site is classified as Class II - General Resource Groundwater.

3.2 Statistical Evaluation of Background Groundwater Data

A Statistical Analysis Plan (**Appendix A**) has been developed to describe procedures that will be used to establish background conditions and implement compliance monitoring as necessary and required by 35 I.A.C. § 845.640 and 35 I.A.C. § 845.650. The 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 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 will be either the tolerance interval or the prediction 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). A comparison of the statistical background concentrations and groundwater quality standards listed in 35 I.A.C. § 845.600(a)(1) and the resulting GWPSs are summarized in **Table 3-1**.

3.3 Applicable Groundwater Protection Standards

The applicable GWPSs will be established in accordance with 35 I.A.C. § 845.600(a)(1) (greater of the background concentration or numerical limit specified in 35 I.A.C. § 845.600(a)(1)). The results of the statistical analysis of background groundwater data (**Table 3-1**) indicate that most background concentrations in the UA are less than the groundwater quality standards listed in 35 I.A.C. § 845.600(a)(1). Therefore, for these parameters, the groundwater quality standards listed in 35 I.A.C. § 845.600(a)(1) will be applied to the results from the proposed groundwater monitoring network. The exceptions are for boron, chloride, lithium, pH (upper limit), sulfate, and TDS, where the background concentrations or measurements are greater than the 35 I.A.C. § 845.600(a)(1) standards. In these instances, the GWPS will be the background concentration or measurement.

Under most circumstances, the GWPS will be compared to the lower confidence limit for the observed concentrations for each constituent in each compliance well. Exceptions are when there are high percentages (greater than 50 percent) of non-detects in compliance well data, for which a future mean (for 50 to 70 percent non-detects) or median (for greater than 70 percent non-detects) will be compared to the GWPS. 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.

Evaluation of the applicable standards will occur in conjunction with the analysis of groundwater quality results. Background calculations and the resulting concentrations may be updated as appropriate, in accordance with the Statistical Analysis Plan included in **Appendix A**.

4. GROUNDWATER MONITORING PLAN

The GMP will monitor and evaluate groundwater quality to demonstrate compliance with the groundwater quality standards included in 40 C.F.R. § 257.94(e), 40 C.F.R. § 257.95(h), and 35 I.A.C. § 845.600(a)(1). The groundwater monitoring program will include sampling and analysis procedures that are consistent and that provide an accurate representation of groundwater quality at the background and downgradient wells as required by 35 I.A.C. § 845.630.

As discussed in **Section 2**, two active monitoring networks specific to the BAP exist, the 40 C.F.R. § 257 network and the proposed 35 I.A.C. § 845 network. It is expected that upon USEPA approval of 35 I.A.C. § 845, the 40 C.F.R. § 257 network monitoring and reporting will be eliminated, and the proposed 35 I.A.C. § 845 monitoring and reporting included in this GMP will continue until requirements of 35 I.A.C. § 845 have been achieved. As specified in the CCA, groundwater sampling requirements that apply to the CCR SI under other existing IEPA permit programs will become void upon issuance of an approved operating permit pursuant to 35 I.A.C § 845.

4.1 Monitoring Networks and Parameters

4.1.1 NPDES Groundwater Monitoring

As discussed in **Section 2.1.1**, the NPDES Permit was amended on November 1, 2022, to remove groundwater monitoring and reporting specific to the BAP.

4.1.2 40 C.F.R. § 257 Groundwater Monitoring

The existing 40 C.F.R. § 257 monitoring program was discussed in detail in **Section 2.1.2**. Well locations and parameters will continue to be monitored and reported as required by 40 C.F.R. § 257 until USEPA approves 35 I.A.C. § 845. The 40 C.F.R. § 257 monitoring network will be expanded to include the 35 I.A.C. § 845 network proposed in this GMP (Ramboll, 2023c).

4.1.3 35 I.A.C. § 845 Groundwater Monitoring

The 35 I.A.C. § 845 well network will consist of three background wells (MW-304, MW-306, and MW-358), thirteen compliance wells (MW-192, MW-193, MW-356, MW-369, MW-370, MW-382, MW-392, MW-393, MW-394, OW-256, OW-257, PZ-170, and PZ-182), and four temporary water level only piezometers (TPZ-164, XPW01, XPW05, and XPW06) to monitor potential impacts from the BAP (**Figure 2-1**). The monitoring wells are installed within the UU (OW-256, OW-257, PZ-170, and PZ-182), and the UA (MW-304, MW-306, MW-356, MW-358, MW-369, MW-370, MW-382, MW-392, MW-393, and MW-394) along the perimeter of the BAP.

Groundwater samples will be collected and analyzed for the laboratory and field parameters as shown on **Table 4-1** and summarized in **Table D** on the following page.

Table D. 35 I.A.C. § 845 Groundwater Monitoring Program Parameters

Field Parameters[1]			
Groundwater Elevation	pH	Turbidity	
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 will be recorded during sample collection.

4.2 35 I.A.C. § 845 Sampling Schedule

Groundwater sampling for the 35 I.A.C. § 845 monitoring well network will initially be performed quarterly according to the schedule in **Table E** below.

Table E. 35 I.A.C. § 845 Sampling Schedule

Frequency	Duration
Monthly (groundwater elevations only)	Began: Second quarter of 2023.
	Ends: Following the 30-year post closure care period and following IEPA approval of documentation that groundwater concentrations are below standards in 35 I.A.C. § 845.600 and concentrations exceeding background are not increasing and meet requirements in 35 I.A.C. § 845.780 (c)(2)(B)(i) and (ii).
Quarterly (groundwater quality)	Begins: the quarter following approval of this plan and issuance of the Operating Permit.
	Ends: Following the 30-year post closure care period and following IEPA approval of documentation that groundwater concentrations are below standards in 35 I.A.C. § 845.600 and concentrations exceeding background are not increasing and meet requirements in 35 I.A.C. § 845.780 (c)(2)(B)(i) and (ii), or upon IEPA approval of an alternate schedule as allowed by 35 I.A.C. § 845.650(b)(4).
Semi-annual (groundwater quality)	Begins: Following 5 years of quarterly groundwater monitoring and IEPA approval of a demonstration that groundwater concentrations are below standards in 35 I.A.C. § 845.600 and not exhibiting statistically significant increasing trends, monitoring effectiveness is not compromised by a semi-annual schedule, and sufficient data has been collected to characterize groundwater.
	Ends: Following detection of a statistically-significant increasing trend in groundwater concentrations or an exceedance of the standards in 35 I.A.C. § 845.600 (quarterly monitoring shall be resumed in these circumstances), or following the 30-year post closure care period and following IEPA approval of documentation that groundwater concentrations are below standards in 35 I.A.C. § 845.600 and concentrations exceeding background are not increasing and meet requirements in 35 I.A.C. § 845.780 (c)(2)(B)(i) and (ii).

4.3 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 the Multi-Site Quality Assurance Project Plan (QAPP) (Ramboll, 2022b).

4.4 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. RLs for the applicable parameters are summarized in **Table 4-2**. Concentrations lower than the RL will be reported as less than the RL. Data reporting requirements and workflow are provided in the Multi-Site Data Management Plan (Ramboll, 2022c).

4.5 Quality Assurance Program

Consistent with the requirements of 35 I.A.C. § 845.640(a)(5), the QAPP includes procedures and techniques for laboratory quality assurance/quality control (QA/QC) and the SAP includes requirements for field data collection QA/QC.

4.6 Groundwater Monitoring System Maintenance Plan

Consistent with the requirements of 35 I.A.C. § 845.630(e)(2), the SAP includes procedures for maintenance to be performed as needed to assure that the monitoring wells provide representative groundwater samples.

4.7 Statistical Analysis

Statistical analysis will be consistent with the procedures listed in 35 I.A.C. § 845.640(f). A Statistical Analysis Plan, provided in **Appendix A**, has been developed to summarize the statistical procedures that will be used to evaluate the groundwater results.

4.8 Data Reporting

Data reporting for the 40 C.F.R. § 257 monitoring well network will be consistent with record keeping, notification, and internet posting requirements described in 40 C.F.R. § 257.105 through 257.107.

Groundwater monitoring and analysis completed in accordance with the 35 I.A.C. § 845 monitoring under an approved monitoring program will be reported to IEPA within 60 days after completion of sampling and the data placed in the facility's operating record as required by 35 I.A.C. § 845.610(b)(3)(D). Within 14 days of posting to the operating record, information will be posted to the publicly accessible internet site "Illinois CCR Rule Compliance Data and Information" as required by 35 I.A.C. § 845.810(d). Information will also be submitted to IEPA annually by January 31 as required by 35 I.A.C. § 845.550, for data collected the preceding year. The report will include the status of the groundwater monitoring and corrective action plan for the BAP in addition to other requirements detailed in 35 I.A.C. § 845.610(e).

4.9 Compliance with Applicable On-site Groundwater Protection Standards

In accordance with 35 I.A.C. § 845.600(a)(1), the GWPS at the waste boundary will be the higher of either the 35 I.A.C. § 845.600 standard or the concentration determined by background groundwater monitoring.

As provided in 35 I.A.C. § 845.780(c)(2), at the end of the 30-year post-closure care period, groundwater monitoring will continue to be conducted in post-closure care until the groundwater results show the concentrations are:

- Below the GWPS in 35 I.A.C. § 845.600; and
- Not increasing for those constituents over background, using the statistical procedures and performance standards in 35 I.A.C. §§ 845.640(f) and (g), provided that:
  - Concentrations have been reduced to the maximum extent feasible; and
  - Concentrations are protective of human health and the environment.

If one or more constituents are detected and confirmed by an immediate resample, to greater than the GWPS in any sampling event, an Alternate Source Demonstration (ASD) will be evaluated as described in **Section 4.10**.

4.10 Alternate Source Demonstrations

As allowed in 35 I.A.C. § 845.650(e), following detection of an exceedance of the GWPS, an ASD will be evaluated and, if completed, submitted to IEPA within 60 days. The ASD will provide lines of evidence that a source other than the BAP caused the contamination and the BAP did not contribute to the contamination, 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.

The ASD will include information and analysis that supports the conclusions and a certification of accuracy by a qualified professional engineer. Once the ASD is approved by IEPA, the 35 I.A.C. § 845 groundwater monitoring will continue as defined in **Section 4.1.3**.

If an ASD is not completed and submitted, or IEPA does not approve the ASD, a notification of the exceedance will be provided to IEPA and placed in the operating record. Additional actions will also be completed as required by 35 I.A.C § 845.650(d)(1) through (3), including initiation of an assessment of corrective measures under 35 I.A.C § 845.660. As allowed in 35 I.A.C § 845.650(e)(7) a petition for review of IEPA's non-concurrence under 35 I.A.C. § 105 may also be filed

4.11 Assessment of Corrective Measures and Corrective Action

As described in 35 I.A.C. § 845.660, if the ASD summarized in **Section 4.10** has not been approved by IEPA, an assessment of corrective measures will be initiated within 90 days of the detection of a result exceeding 35 I.A.C. § 845.600 standards (*i.e.,* receipt of laboratory data). The assessment of corrective measures will include at least the following (35 I.A.C. § 845.660 (c)):

- The 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.

- The time required to begin and complete the corrective action plan; and
- The institutional requirements, such as State or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the corrective action plan.

Within one year of completing the assessment of corrective measures, a corrective action plan will be developed to identify the selected remedy in accordance with 35 I.A.C. § 845.670. If closure of the CCR unit is required, a closure alternatives analysis will be completed as specified in 35 I.A.C. § 845.710. The analysis and selected alternative will be submitted to IEPA in a Closure Plan as specified by 35 I.A.C. § 845.720. Groundwater monitoring proposed in this GMP will continue as specified until the post closure care period has expired and IEPA has approved termination of post-closure care.

5. REFERENCES

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 G, Chapter I, Subchapter J, Part 845: Standards for The Disposal of Coal Combustion Residuals in Surface Impoundments, effective April 21, 2021.

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Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2023c. *40 C.F.R. § 257 Groundwater Monitoring Plan Revision 1. Baldwin Bottom Ash Pond. Baldwin Power Plant. Baldwin, Illinois*. July 2023

United States Environmental Protection Agency (USEPA), March 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance*. Office of Resource Conservation and Recovery, Program Implementation and Information Division, United States Environmental Protection Agency, Washington D.C. EPA/530/R-09/007.

TABLES

TABLE 1-1. 35 I.A.C. § 845 REQUIREMENTS CHECKLIST
GROUNDWATER MONITORING PLAN REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

35 I.A.C. § 845 Reference	35 I.A.C. § 845 Components	Location of Information in GMP
845.630	**Groundwater Monitoring Systems**	
845.630(a)(2)	Potential contaminant pathways must be monitored.	Sections 1.3, 2.2, & 4.1.3 Table 2-1
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)	Sections 2.2 & 4.1.3 Table 2-1 Figure 2-1
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 4 Tables 4-1 & 4-2
845.640(b)	Methods are appropriate	Section 4 Tables 4-1 & 4-2
845.640(c)	Groundwater elevations must be measured in each well prior to purging, each time groundwater is sampled.	Section 4.3
845.640 (d)(e)(f)(g)(h)	Establishment of background and application of statistical methods	Sections 3 & 4.7 Appendix A
845.640(i)	Analyze total recoverable metals	Sections 4.1.3 & 4.2
845.640(j)	Analyze groundwater samples using a certified laboratory	Section 4.4

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TABLE 1-1. 35 I.A.C. § 845 REQUIREMENTS CHECKLIST
GROUNDWATER MONITORING PLAN REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

35 I.A.C. § 845 Reference	35 I.A.C. § 845 Components	Location of Information in GMP
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 4.1.3
845.650(b)(c)	Groundwater Monitoring Frequency	Sections 4.1.3 & 4.2
845.650(d)(e)	Exceedances of the groundwater protection standard	Sections 4.9, 4.10 & 4.11
845.650(b)(2) and (3)	Staff gauge/ piezometer to monitor head in impoundment	Sections 2.2 & 4.1.3 Figure 2-1 (TPZ-164, XPW01, XPW05, and XPW06)
NA	Staff gauge/ piezometer to monitor head of neighboring surface water body	NA

[O: CJC 10/11/21; U: EGP 05/25/23; C: CJC 06/09/23]

Notes:
GMP = Groundwater Monitoring Plan
NA = Not Applicable

TABLE 2-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
GROUNDWATER MONITORING PLAN REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Well Number	Type	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)
MW-192	C	UU	09/27/2022	436.94	436.94	Top of PVC	434.04	20.00	30.00	414.04	404.04	30.00	400.04	10	2	38.199203	-89.866927
MW-193	C	UU	10/04/2022	438.06	438.06	Top of PVC	434.52	22.00	32.00	412.52	402.52	32.00	402.52	10	2	38.199173	-89.862658
MW-304	B	UA	10/20/2015	455.49	455.49	Top of PVC	453.03	45.00	55.00	408.00	398.00	55.00	317.60	10	2	38.188332	-89.853441
MW-306	B	UA	09/25/1991	453.17	453.17	Top of PVC	450.91	72.70	87.70	378.20	363.20	87.70	361.20	15	2	38.20114	-89.846756
MW-356	C	UA	10/01/2015	427.60	427.60	Top of PVC	425.18	56.00	66.00	369.20	359.20	66.00	290.20	10	2	38.198963	-89.869578
MW-358	B	UA	10/08/2022	455.73	455.73	Top of PVC	453.59	80.00	90.00	373.73	363.73	90.00	363.59	10	2	38.195275	-89.849417
MW-369	C	UA	11/19/2015	422.71	422.71	Top of PVC	420.49	56.00	66.00	364.50	354.50	66.00	349.80	10	2	38.196986	-89.870258
MW-370	C	UA	11/25/2015	420.85	420.85	Top of PVC	418.67	53.00	63.00	365.70	355.70	63.00	352.70	10	2	38.195603	-89.869669
MW-382	C	UA	11/23/2015	431.19	431.19	Top of PVC	428.67	56.00	66.00	372.70	362.70	66.00	358.10	10	2	38.19454	-89.868044
MW-392	C	UA	09/26/2022	437.02	437.02	Top of PVC	434.07	74.00	84.00	360.07	350.07	84.00	350.07	10	2	38.199203	-89.866934
MW-393	C	UA	10/04/2022	437.86	437.86	Top of PVC	434.59	75.00	85.00	359.59	349.59	85.00	349.59	10	2	38.199174	-89.862666
MW-394	C	UA	10/05/2022	438.29	438.29	Top of PVC	435.51	73.00	83.00	362.51	352.51	83.00	350.51	10	2	38.199136	-89.85866
OW-256	C	PMP	08/01/2013	427.70	427.70	Top of PVC	425.20	28.00	32.50	397.20	392.70	33.10	389.20	4.5	2	38.198966	-89.86961
OW-257	C	PMP	08/01/2013	431.02	431.02	Top of PVC	428.17	34.00	38.50	394.20	389.70	39.10	388.60	4.5	2	38.193865	-89.867456
PZ-170	C	PMP	07/29/2015	421.43	421.43	Top of PVC	418.58	21.10	31.10	397.50	387.50	31.10	387.50	10	2	38.195585	-89.869632
PZ-182	C	PMP	07/30/2015	431.61	431.61	Top of PVC	428.47	24.00	34.00	404.50	394.50	34.00	394.50	10	2	38.194512	-89.86801
TPZ-164	WLO	CCR	08/01/2013	435.10	435.10	Top of PVC	432.50	5.20	9.70	427.30	422.80	10.30	422.20	4.5	2	38.195586	-89.862797
XPW01	WLO	CCR	09/23/2022	437.66	437.66	Top of PVC	435.12	7.00	12.00	428.12	423.12	12.00	421.12	5	2	38.197522	-89.864474
XPW05	WLO	CCR	09/24/2022	437.27	437.27	Top of PVC	434.12	18.00	28.00	416.12	406.12	28.00	404.12	10	2	38.196233	-89.862366
XPW06	WLO	CCR	09/22/2022	417.72	417.72	Top of PVC	418.06	5.00	10.00	412.99	407.99	10.00	402.06	5	2	38.196967	-89.868954

TABLE 2-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
GROUNDWATER MONITORING PLAN REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Notes:
All elevation data are presented relative to the North American Vertical Datum 1988 (NAVD88), GEOID 12A
Type refers to the role of the well in the monitoring network: background (B), compliance (C), or water level measurements only (WLO)
WLO wells are temporary pending implementation of impoundment closure per an approved Construction Permit application
BGS = below ground surface
CCR = Coal Combustion Residual
ft = foot or feet
HSU = Hydrostratigraphic Unit
PMP = potential migration pathway
PVC = polyvinyl chloride
UA = uppermost aquifer
UU = upper unit
generated 07/18/2023, 9:49:24 AM CDT

TABLE 3-1. BACKGROUND GROUNDWATER QUALITY AND STANDARDS
GROUNDWATER MONITORING PLAN REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Parameter	Background Concentration	845 Limit	Groundwater Protection Standard	Unit
Antimony, total	0.0023	0.006	0.006	mg/L
Arsenic, total	0.0104	0.010	0.010	mg/L
Barium, total	0.261	2.0	2.0	mg/L
Beryllium, total	0.0005	0.004	0.004	mg/L
Boron, total	2.16	2	2.16	mg/L
Cadmium, total	0.002	0.005	0.005	mg/L
Chloride, total	1370	200	1370	mg/L
Chromium, total	0.0125	0.1	0.1	mg/L
Cobalt, total	0.0022	0.006	0.006	mg/L
Fluoride, total	3.84	4.0	4.0	mg/L
Lead, total	0.0022	0.0075	0.0075	mg/L
Lithium, total	0.14	0.04	0.14	mg/L
Mercury, total	0.0002	0.002	0.002	mg/L
Molybdenum, total	0.0782	0.1	0.1	mg/L
pH (field)	11.1 / 7.5	9.0 / 6.5	11.1 / 6.5	SU
Radium 226 and 228 combined	3.76	5	5	pCi/L
Selenium, total	0.0032	0.05	0.05	mg/L
Sulfate, total	762	400	762	mg/L
Thallium, total	0.002	0.002	0.002	mg/L
Total Dissolved Solids	3260	1200	3260	mg/L

Notes:
For pH, the values presented are the upper / lower limits
Groundwater protection standards for calcium and turbidity do not apply per 35 I.A.C. § 845.600(b)
mg/L = milligrams per liter
SU = standard units
pCi/L = picocuries per liter

TABLE 4-1. SAMPLING AND ANALYSIS SUMMARY
GROUNDWATER MONITORING PLAN REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

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
Metals											
Metals [6]	6020, Li - EPA 200.7	10	1	0	0	1	12	plastic	600 mL	HNO_3 to pH<2	6 months
Mercury	7470A or 6020	10	1	0	0	1	12	plastic	400 mL	HNO_3 to pH<2	28 days
Inorganic Parameters											
Fluoride	9214 or EPA 300	10	1	0	0	1	12	plastic	300 mL	Cool to 4 °C	28 days
Chloride	9251 or EPA 300	10	1	0	0	1	12	plastic	100 mL	Cool to 4 °C	28 days
Sulfate	9036 or EPA 300	10	1	0	0	1	12	plastic	50 mL	Cool to 4 °C	28 days
Total Dissolved Solids	SM 2540 C	10	1	0	0	1	12	plastic	200 mL	Cool to 4 °C	7 days
Radium											
Radium 226	9315 or EPA 903	10	0	0	0	0	10	plastic	1000 mL	HNO_3 to pH<2	6 months
Radium 228	9320 or EPA 904	10	0	0	0	0	10	plastic	1000 mL	HNO_3 to pH<2	6 months
Field Parameters											
pH	SM 4500-H+ B	10	NA	NA	NA	NA	10	flow-through cell	NA	none	immediately
Dissolved Oxygen [8]	SM 4500-O/405.1	10	NA	NA	NA	NA	10	flow-through cell	NA	none	immediately
Temperature [8]	SM 2550	10	NA	NA	NA	NA	10	flow-through cell	NA	none	immediately
Oxidation/Reduction Potential [8]	SM 2580 B	10	NA	NA	NA	NA	10	flow-through cell	NA	none	immediately
Specific Conductance [8]	SM 2510 B	10	NA	NA	NA	NA	10	flow-through cell	NA	none	immediately
Turbidity [7]	SM 2130 B	10	NA	NA	NA	NA	10	flow-through cell or hand-held turbidity meter	NA	none	immediately

[O: CJC 10/11/21; U: EGP 06/01/23; C: CJC 06/14/23]

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] Metals = antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, lead, lithium, molybdenum, selenium, thallium. Metals may be analyzed via ICP/ ICP-MS USEPA methods 6010 or 6020 depending on laboratory instrument availability.
[7] If turbidity exceeds 10 NTUs, a duplicate sample filtered through a .45 micron filter may be collected for metals analysis in addition to the unfiltered sample. Both samples would be submitted for analysis.
[8] Parameter collected for quality assurance and quality control for field sampling purposes only; not required to be collected or reported under Part 845; collection of parameter may be discontinued without notification.
< = less than
°C = degrees Celsius
HNO_3 = nitric acid
mL = milliliter
NA = not applicable
NTU = nephelometric turbidity unit

TABLE 4-2. DETECTION AND REPORTING LIMITS FOR 35 I.A.C. § 845 PARAMETERS

GROUNDWATER MONITORING PLAN REVISION 1

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

Constituent	CAS	Unit	Analytical Methods [1]	USEPA MCL [2]	35 I.A.C. § 845.600	RL [4, 5]	MDL [5]
Metals							
Antimony	7440-36-0	mg/L	6020	0.006	0.006	0.003	0.00036
Arsenic	7440-38-2	mg/L	6020	0.01	0.01	0.001	0.00013
Barium	7440-39-3	mg/L	6020	2	2	0.001	0.00028
Beryllium	7440-41-7	mg/L	6020	0.004	0.004	0.001	0.000017
Boron	7440-42-8	mg/L	6020	NS	2	0.01	0.0023
Cadmium	7440-43-9	mg/L	6020	0.005	0.005	0.001	0.000042
Calcium	7440-70-2	mg/L	6020	NS	NS	0.15	0.15
Chromium	7440-47-3	mg/L	6020	0.1	0.1	0.004	0.00027
Cobalt	7440-48-4	mg/L	6020	0.006	0.006	0.002	0.000017
Lead	7439-92-1	mg/L	6020	0.015	0.0075	0.001	0.000025
Lithium	7439-93-2	mg/L	6020 or EPA 200.7	0.04	0.04	0.02	0.0001
Mercury	7439-97-6	mg/L	6020 or 7470A	0.002	0.002	0.0002	0.000078
Molybdenum	7439-98-7	mg/L	6020	0.1	0.1	0.001	0.000063
Selenium	7782-49-2	mg/L	6020	0.05	0.05	0.001	0.00032
Thallium	7440-28-0	mg/L	6020	0.002	0.002	0.001	0.000062
Inorganics							
Fluoride	7681	mg/L	9214 or EPA 300	4	4	0.25	0.065
Chloride	16887-00-6	mg/L	9251 or EPA 300	250 [3]	200	1	0.15
Sulfate	18785-72-3	mg/L	9036 or EPA 300	250 [3]	400	1	0.24
Total Dissolved Solids	10052	mg/L	SM 2540C	500 [3]	1200	17	--
Other							
Radium 226 and 226 combined	7440-14-4	pCi/L	9315/9320 or EPA 903/904	5	5	-- [6]	-- [7]

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TABLE 4-2. DETECTION AND REPORTING LIMITS FOR 35 I.A.C. § 845 PARAMETERS

GROUNDWATER MONITORING PLAN REVISION 1

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

Constituent	CAS	Unit	Analytical Methods [1]	USEPA MCL [2]	35 I.A.C. § 845.600	RL [4, 5]	MDL [5]
Field							
pH	NA	SU	SM 4500-H+ B	NS	6.5-9.0	NA	NA
Oxidation/Reduction Potential	NA	mV	SM 2580 B	NS	NS	NA	NA
Dissolved Oxygen	NA	mg/L	SM 4500-O/405.1	NS	NS	NA	NA
Temperature	NA	°C	SM 2550	NS	NS	NA	NA
Specific Conductance	NA	μS/cm	SM 2510 B	NS	NS	NA	NA
Turbidity	NA	NTU	SM 2130 B	NS	NS	NA	NA

[O: CJC 10/11/21; U: EGP 06/01/23 C: CJC 06/14/23]

Notes:

[1] Analytical method numbers are from SW-846 unless otherwise indicated. Metals will be analyzed via Method 6020 or 6010 depending on laboratory equipment availability. Selected method will ensure reporting limits (RL) are below Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845.600 groundwater protection standards.

[2] USEPA MCL = United States Environmental Protection Agency Maximum Contaminant Level.

[3] USEPA SMCL = United States Environmental Protection Agency Secondary Maximum Contaminant Level.

[4] RLs will be less than the 35 I.A.C. § 845.600 groundwater protection standards.

[5] RLs and method detection limits (MDL) will vary depending on the laboratory performing the work.

[6] All radium results will be reported (values may be positive or negative) and will include uncertainty and the calculated MDC.

[7] Laboratories calculate a minimum detectable concentration (MDC) based on the sample.

°C = degrees Celsius

μS/cm = microSiemens per centimeter

CAS = Chemical Abstract Number

MDL = Method detection limit as established by the laboratory

mg/L = milligrams per liter

mV = millivolts

NA = Not applicable

NS = No standard

NTU = nephelometric turbidity unit

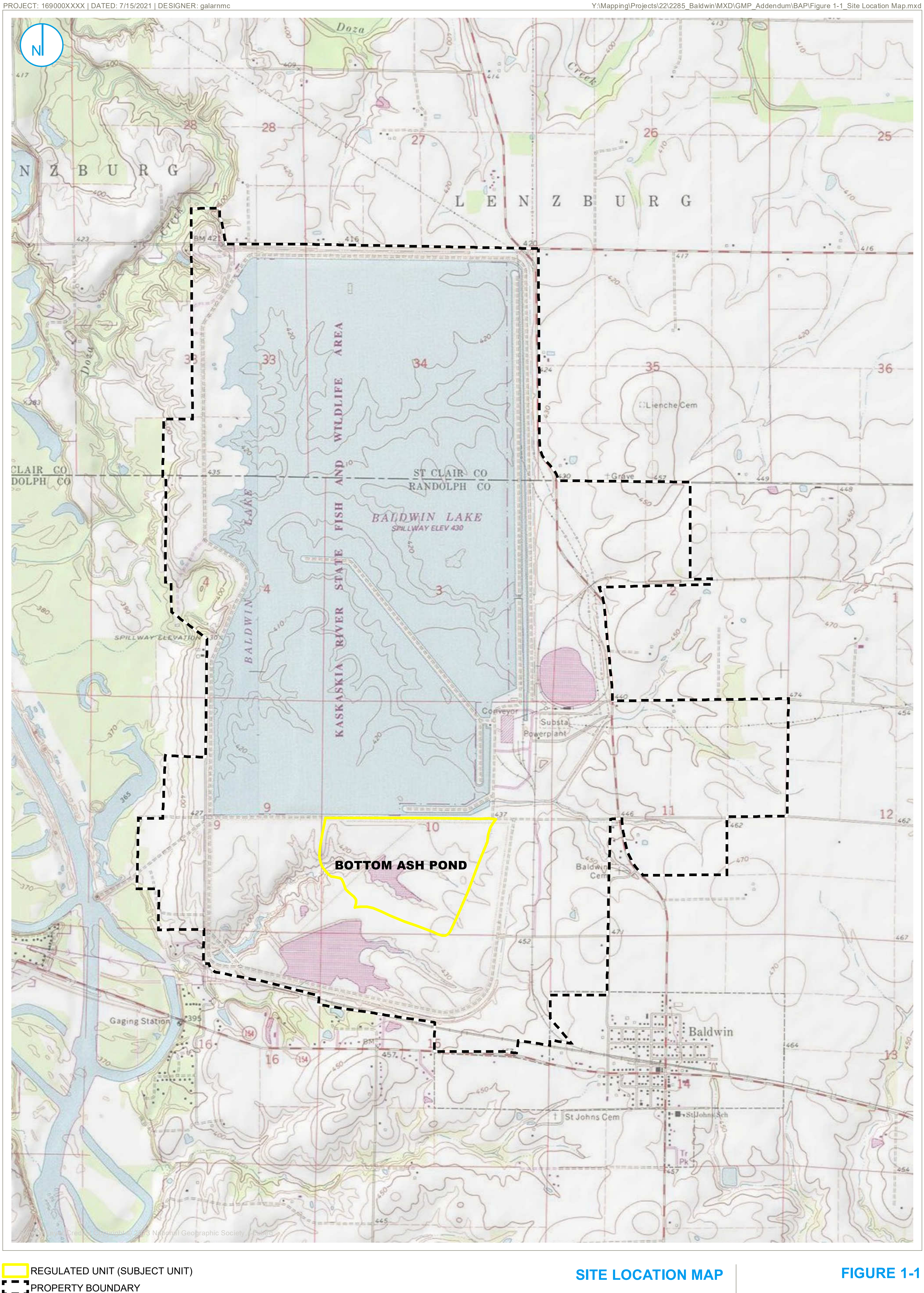
pCi/L = picoCuries per liter

RL = Reporting limit as established by the laboratory

SM = Standard Methods for the Examination of Water and Wastewater

SU = standard units

FIGURES



SITE LOCATION MAP

FIGURE 1-1

GROUNDWATER MONITORING PLAN REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\Figure 1-2_Base Map.mxd

PROJECT: 169000XXXX | DATED: 7/15/2021 | DESIGNER: galarnmc

REGULATED UNIT (SUBJECT UNIT)
FLY ASH POND SYSTEM (CLOSED)
CAPPED AREA
SITE FEATURE
PROPERTY BOUNDARY

0 400 800 Feet

SITE MAP

GROUNDWATER MONITORING PLAN REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 1-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

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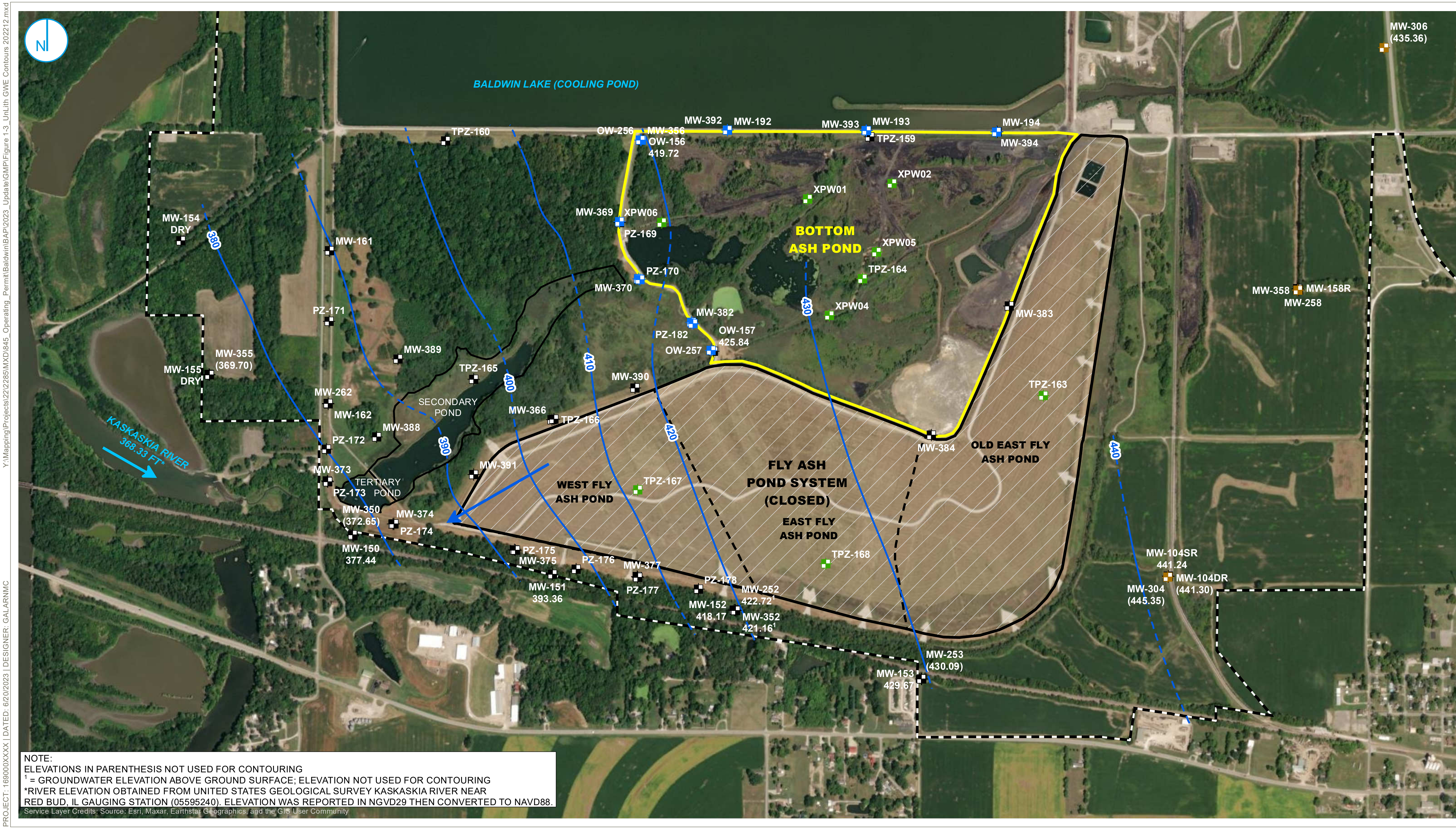

COMPLIANCE WELL
BACKGROUND WELL
MONITORING WELL
PORE WATER WELL
GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
REGULATED UNIT (SUBJECT UNIT)
FLY ASH POND SYSTEM (CLOSED)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

UPPER UNIT POTENTIOMETRIC SURFACE MAP
DECEMBER 5-6, 2022

GROUNDWATER MONITORING PLAN REVISION 1

BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 1-3

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

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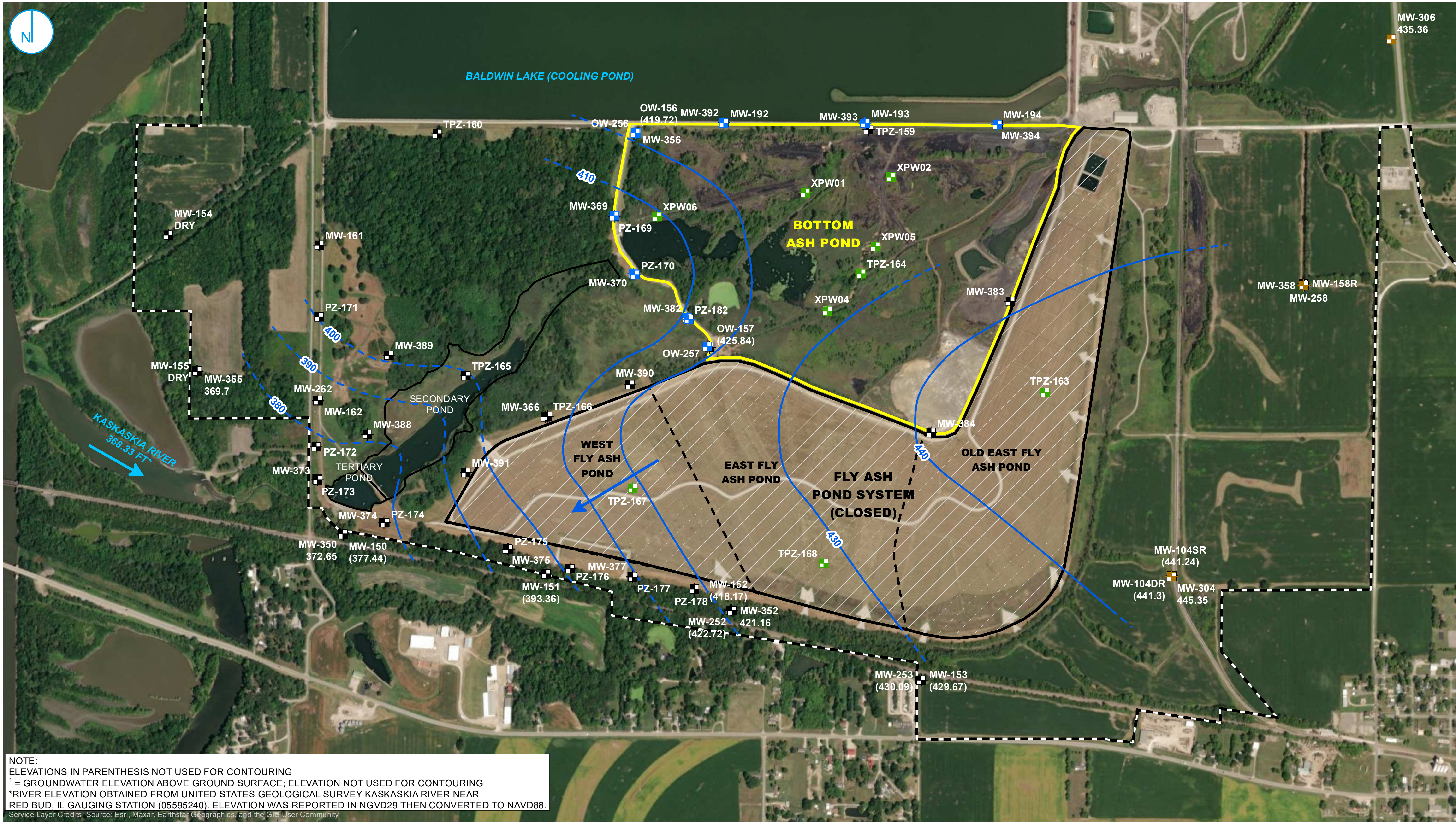

COMPLIANCE WELL
BACKGROUND WELL
MONITORING WELL
PORE WATER WELL
GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

0 400 800 Feet

BEDROCK POTENTIOMETRIC SURFACE MAP
DECEMBER 5, 2022

GROUNDWATER MONITORING PLAN REVISION 1

BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 1-4

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

PROJECT: 169000XXXX | DATED: 6/20/2023 | DESIGNER: GALARNMC

BACKGROUND WELL
COMPLIANCE WELL
PORE WATER WELL

REGULATED UNIT (SUBJECT UNIT)
FLY ASH POND SYSTEM (CLOSED)
SITE FEATURE
CAPPED AREA
PROPERTY BOUNDARY

0 400 800 Feet

PROPOSED 35 I.A.C. § 845 GROUNDWATER MONITORING NETWORK

GROUNDWATER MONITORING PLAN REVISION 1

BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 2-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

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APPENDIX A
STATISTICAL ANALYSIS PLAN

Prepared for
Dynegy Midwest Generation, LLC

Date
August 1, 2023

Project No.
1940100806-001

STATISTICAL ANALYSIS PLAN

BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL Bright ideas. Sustainable change.

STATISTICAL ANALYSIS PLAN
BALDWIN POWER PLANT BOTTOM ASH POND

Project name	**Baldwin Power Plant Bottom Ash Pond**
Project no.	**1940100806-001**
Recipient	**Dynegy Midwest Generation, LLC**
Document type	**Statistical Analysis Plan**
Version	**FINAL**
Date	**August 1, 2023**

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Brian G. Hennings, PG
Senior Managing Hydrogeologist

Eric J. Tlachac, PE
Senior Managing Engineer

Rachel A. Banoff, EIT
Project Statistician

LICENSED PROFESSIONAL CERTIFICATIONS

This certification is based on the description of the statistical methods selected to evaluate groundwater as presented in the following Statistical Analysis Plan; Baldwin Power Plant Bottom Ash Pond. The procedures described in the plan will be used to establish background conditions and implement compliance monitoring as necessary and required by 35 I.A.C. § 845.640 and 35 I.A.C. § 845.650. The 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,* March 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 will be either the tolerance interval or the prediction 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 lower confidence limit 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 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 (Statistical Analysis Plan; Baldwin Power Plant Bottom Ash Pond) 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: October 25, 2021

LICENSED PROFESSIONAL ENGINEER
ERIC J. TLACHAC
062-063091
STATE OF ILLINOIS

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 (Statistical Analysis Plan; Baldwin Power Plant Bottom Ash Pond) 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: October 25, 2021

LICENSED PROFESSIONAL GEOLOGIST
BRIAN G. HENNINGS
196.001482
ILLINOIS

35 I.A.C. § 845.640 Statistical Analysis

I, Rachel A. Banoff, a qualified professional, certify that the statistical methods described in this document (Statistical Analysis Plan; Baldwin Power Plant Bottom Ash Pond), 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: October 25, 2021

CONTENTS

TABLES (IN TEXT)

ACRONYMS AND ABBREVIATIONS

§	Section
35 I.A.C.	Title 35 of the Illinois Administrative Code
ANOVA	analysis of variance
CCR	coal combustion residuals
COC	constituents of concern
GWPS	groundwater protection standard
IEPA	Illinois Environmental Protection Agency
LCL	lower confidence limit
LTL	lower tolerance limit
MSE	mean squared error
P	probability
Part 845	Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845
RCRA	Resource Conservation and Recovery Act
RL	reporting limit
ROS	regression on order statistics
SI	surface impoundment
SSI	statistically significant increase
SWFPR	site-wide false positive rate
Unified Guidance	*Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (USEPA, 2009)
UPL	upper prediction limit
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 (Part 845). Facilities regulated under Part 845 are required to develop and sample a groundwater monitoring well network to evaluate whether impounded CCR materials are impacting downgradient groundwater quality. The groundwater quality evaluation must include selection and certification by a qualified professional engineer of the statistical procedures to be used. 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 and 35 I.A.C. § 845.650. 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*) (March 2009).

This Statistical Analysis Plan does not include procedures for groundwater sample collection and analysis, as these activities are conducted in accordance with the Sampling and Analysis Plan prepared for each CCR unit in accordance with 35 I.A.C. § 845.640. This Statistical Analysis Plan will be used as the primary reference for evaluating groundwater quality during operation and post-closure care.

1.1 Statistical Analysis Objectives

This Statistical Analysis Plan is intended to provide a logical process and framework for conducting the statistical analyses of data obtained during groundwater monitoring conducted in accordance with the Sampling and Analysis Plan for each CCR unit. The Statistical Analysis Plan will enable a qualified professional engineer to certify that the selected statistical methods are appropriate for evaluating the groundwater monitoring data for the applicable CCR unit(s).

1.2 Statistical Analysis Plan Approach

The main sections of this Statistical Analysis Plan should be viewed as a "generic" outline of statistical methods utilized for each CCR unit and constituent required to be monitored. The statistical analysis of the groundwater monitoring data, however, will be conducted on an individual-constituent or well basis, and may involve the use of appropriate statistical procedures depending on multiple factors such as detection frequency and normality distributions.

The CCR Rule outlines two phases of groundwater monitoring:

- Background Monitoring in accordance with 35 I.A.C. § 845.650(b)(1)
- Compliance Monitoring in accordance with 35 I.A.C. § 845.650

Each phase of the groundwater monitoring program requires specific statistical procedures to accomplish the intended purpose. During the background monitoring phase, background groundwater quality will be established utilizing upgradient and background wells and downgradient groundwater quality data will be collected to facilitate statistics in subsequent phases. Compliance Monitoring is then initiated through the evaluation of the downgradient groundwater monitoring data for exceedances of the groundwater protection standard (GWPS) established by Part 845 (concentration specified in 35 I.A.C. § 845.600 or an IEPA-approved background concentration). The developed statistical analysis plan will be implemented for each monitoring phase and in accordance with the statistical procedures.

2. BACKGROUND MONITORING AND DATA PREPARATION

At least one upgradient or background monitoring well and three compliance monitoring wells were sampled and analyzed for constituents, as listed in Part 845 (antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chloride, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, pH, radium 226 and 228 combined, selenium, sulfate, thallium, total dissolved solids, and turbidity), during the baseline phase of the groundwater monitoring program.

The upgradient or background monitoring well(s) were placed upgradient of the CCR unit, or at an alternative background location, where they are not affected by potential leakage from the CCR unit. Compliance monitoring wells were placed at the waste boundary of the CCR unit, along the same groundwater flow path. As 35 I.A.C. § 845.630(a) specifies, the location of these wells ensures that background accurately represents the quality of unaffected groundwater, while compliance wells accurately represent groundwater quality at the waste boundary and monitor all potential contaminant pathways.

As required by 35 I.A.C. § 845.650(a)(1), eight independent sampling events will be completed on at least a quarterly frequency upon approval of the groundwater monitoring plan by the IEPA. As outlined, groundwater sampling procedures included sampling of the upgradient, background, and compliance wells using low-flow sampling methods, collection of one field quality control sample per event, and groundwater samples were not field filtered before laboratory analysis of total recoverable metals.

Following completion of the eight baseline sampling events, background groundwater quality was established for Part 845 constituents. Groundwater monitoring will be conducted quarterly for at least the first five years. In accordance with 35 I.A.C. § 845.650(b)(4), after the first five years, a request to reduce the monitoring frequency to semiannual may be submitted to IEPA if all of the following can be demonstrated:

- Groundwater monitoring effectiveness will not be compromised by the reduced frequency
- Sufficient data has been collected to characterize groundwater
- Monitoring to date does not show any statistically significant increasing trends
- The concentrations of monitored constituents at the compliance monitoring wells are below the applicable GWPSs established in 35 I.A.C. § 845.600

The following subsections outline the statistical tests and procedures (methods) that will be utilized to evaluate data collected for each constituent in both background and compliance wells for Background and Compliance Monitoring. When necessary and contingent upon equivalent statistical power, an alternative test not included in this Statistical Analysis Plan may be chosen due to site-specific data requirements.

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. The sampling schedules for both the baseline and compliance monitoring periods are specified in 35 I.A.C. § 845.650(b) and may conflict with the statistical assumption of independence of sample results.

2.2 Non-Detect Data Processing

The reporting limit (RL) will be used as the lower level for the reporting of non-detected groundwater quality data. For all summary statistics (box plots, timeseries, etc.), the RL will be substituted for concentrations reported below the RL, including non-detects. With professional judgement, analytical results between the RL and the method detection limit, *i.e.,* estimated values, typically identified with a "J" flag, may be utilized if provided by the laboratory.

For all statistical test procedures:

- 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 between 15 percent and 50 percent, either the Kaplan-Meier or robust regression on order statistics (ROS) 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 percent, a non-parametric test will be used
- If only one background result is detected that value will be used as the non-parametric upper prediction limit (UPL)

2.3 Testing for Normality

Many statistical analyses assume that sample data are normally distributed (parametric). However, environmental data are frequently not normally distributed (nonparametric). 35 I.A.C. § 845.640(g) requires the knowledge of the background data distribution for comparison to compliance results. 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.

When possible, transformation of datasets to achieve normal distributions is preferred.

2.4 Testing for Outliers

Part 845 constituents will be screened for the existence of outliers using a method 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.
- Time series, box-whisker plots, and probability plots provide visual tools to identify potential outliers, and evaluation of seasonal, spatial, or temporal variability for both normally and non-normally distributed data.

Data quality control, groundwater geochemistry, and sampling procedures will be evaluated as potential sources of error leading to an outlier result. The outlier tests cannot be used alone to determine whether a value is a true outlier that should be excluded from future statistical analysis. Corroborating evidence needed to exclude values includes a discrete data reporting or analytical error, or potential laboratory bias. Absent corroborating evidence, the flagged values are considered true, but extreme, values in the data set. Professional judgement will be used to exclude extreme outliers from further statistical analyses. Outliers will be retained in the database.

With professional judgement, a confirmatory sample may be collected to allow for the distinction between an outlier and a true representation of groundwater quality at the monitoring point. If re-sampling is conducted, this sample will be collected within 90 days following outlier identification. If the confirmatory sample indicates the original result as an outlier, it will be reported as such.

2.5 Trend Analysis

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

A linear regression, coupled with a t-test for slope significance at a 95 percent confidence level (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 percent confidence level (0.05 significance level), will 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 unit being monitored was 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. 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 as 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.

Hydrologic factors such as drought, recharge patterns or regular (*e.g.,* seasonal) water table fluctuations may be responsible for the temporal variation. In these cases, it may be useful to test for the presence of a significant temporal effect by first constructing a parallel time series plot and then running a formal one-way analysis of variance (ANOVA) ($\alpha = 0.05$) for temporal effects. A one-way ANOVA for temporal effects considers multiple well data sets for individual sampling events or seasons as the relevant statistical factor. If event-specific analytical differences or seasonality appear to be an important temporal factor, the one-way ANOVA for temporal effects can be used to formally identify seasonality, parallel trends, or changes in lab performance that affect other temporal effects. The one-way ANOVA for temporal effects assumes that the data groups are normally distributed with constant variance. It is also assumed that for each of a series of background wells, measurements are collected at each well on sampling events or dates common to all the wells. Results of the ANOVA can also be used to create temporally stationary residuals, where the temporal effect has been 'subtracted from' the original measurements. These stationary residuals may be used to replace the original data in subsequent statistical testing.

If the data cannot be normalized, a similar test for a temporal or seasonal effect can be performed using the Kruskal-Wallis test ($\alpha = 0.05$). Each sampling event should be treated as a separate 'well,' while each well is treated as a separate 'sampling event.' In this case, no residuals can be computed since the Kruskal-Wallis test employs ranks of the data rather than the measurements themselves.

Where both spatial and temporal variation occur, two-way ANOVA can be considered where both well location and sampling event/season are treated as statistical factors. This procedure is described in Davis (1994).

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 1 to 2 years under a quarterly monitoring program), are available for comparison to historical data. Professional judgement will be used to evaluate whether any background data appear to be affected by a release and need to be excluded from a background update. A t-test for equal means (if normal data distribution) or appropriate non-parametric test (if non-normal data distribution) such as a Mann-Whitney (or Wilcoxon) rank-sum or box-whisker plots, will be conducted to evaluate whether 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 they are equivalent. In addition, time series graphs or other trend evaluation statistics 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 (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. In accordance with the *Unified Guidance*, continual background updates will not be conducted due to the lack of sufficient samples for a statistical comparison.

3. COMPLIANCE MONITORING

Compliance monitoring is designed to monitor groundwater for evidence of a release by comparing Part 845 constituents in compliance wells to both background concentrations and the GWPS. Concurrent with baseline monitoring to evaluate background groundwater quality, Compliance Monitoring began with the collection of eight independent samples from each background and compliance well and analysis for Part 845 constituents. Thereafter, samples will be collected and evaluated quarterly. The selected Compliance Monitoring statistical method used to compare compliance groundwater quality data for each constituent to the GWPS will provide for adequate statistical power, error levels and individual test false positive rates, and be appropriate for the distribution and detection frequency of the background dataset. Statistical power is the ability of a statistical test to detect a true exceedance.

In accordance with 35 I.A.C. § 845.610(b)(3)(D), compliance monitoring statistical analyses will be completed and submitted to IEPA within 60 days after completion of sampling.

3.1 GWPS Establishment and Exceedance Determination

In accordance with 35 I.A.C. § 845.600(a), the GWPS will be the constituent concentrations specified in 35 I.A.C. § 845.600(a)(1) except for when the background concentration is greater, or no concentration is specified (*i.e.,* for calcium and turbidity), in which case the GWPS will be the background concentration. The GWPS based on background concentration will be calculated using a parametric upper tolerance limit (UTL), a parametric UPL for a future mean, or a non-parametric UPL for a future median.

Statistical calculations that will be utilized in Compliance Monitoring procedures are summarized in **Table A** below and listed in **Sections 3.1.1** through **3.1.7**. Depending on the distribution of the data and the percentage of non-detects, it may be more appropriate to use a parametric model over a non-parametric model. As necessary, other techniques as mentioned in the *Unified Guidance* and/or new methods will be implemented.

Table A. Statistical Calculations Used in Compliance Monitoring Procedures

Compliance Monitoring						
Significant Trend?	Background Data			Compliance Data		
	Percent Non-Detects	Distribution	GWPS Determination	Percent Non-Detects	Distribution	Method to Determine Exceedance
No	0 ≤ 50	Normal	35 I.A.C § 845.600(a)(1) constituent concentration or The Upper Tolerance Limit	≤75	Normal	Parametric Lower Confidence Limit around a Normal Mean
				≤75	Log-Normal	Parametric Lower Confidence Limit around a Lognormal Geometric Mean
				NA	Non-Normal	Non-Parametric Lower Confidence Limit around a Median
				>75	Unknown/ Cannot be determined	
	50 ≤ 70	Normal	The Upper Prediction Limit for a Future Mean	NA	NA	Future mean
	>70	Non-Normal	Upper Prediction Limit for a Future Median	NA	NA	Future median
	100	Non-Normal	Double Quantification Rule	NA	NA	Individual Retesting Values
Yes	0 ≤ 50	Normal	UCL of Confidence Band around Linear Regression	≤75	Residuals after subtracting trend are normal, equal variance	Lower Limit from Confidence Band around Linear Regression
	50 ≤ 100	Non-Normal	UCL of Confidence Band around Thiel-Sen trend line	≤75	Residuals not normal	Lower Limit from Confidence Band around Thiel-Sen

3.1.1 The Upper Tolerance Limit

The UTL will be used to calculate the GWPS when pooled background data are normally distributed, with a non-detect frequency of 50 percent or less. When non-detect frequency is 15 percent or less, half the RL will be substituted for non-detects. The *Unified Guidance* recommends 95 percent confidence level and 95 percent coverage (95/95 tolerance interval).

- When non-detect frequency is 15 percent 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 or the ROS method will be used when the detection frequency is between 15 percent and 50 percent. 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 or ROS estimate of the mean and standard deviation will be substituted for the sample mean and standard deviation.
- If background normality cannot be achieved, non-parametric UTLs will not be calculated until a minimum of 60 background samples have been collected (to achieve 95 percent coverage).

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 are tabulated in Table 17-3 in Appendix D of the *Unified Guidance*. If exact values are not provided, then κ values can be estimated by linear interpolation.

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

When the GWPS is based on the 35 I.A.C. § 845.600(a)(1) constituent concentrations or a UTL derived from the background dataset, an exceedance in compliance wells relative to the GWPS will be evaluated using confidence intervals. A confidence interval defines the upper and lower bound of the true mean of a constituent concentration in groundwater within a specified confidence range.

- Non-detects in compliance data will be handled similarly to upgradient analyses, with half the RL substituted for non-detects when the frequency is 15 percent or less.
- The Kaplan-Meier, or the ROS method, will be used when the detection frequency is between 15 percent and 50 percent to compute estimates of the mean and standard deviation adjusted for the presence of left-censored values. These estimates will then be substituted for the sample mean and standard deviation.

Once the GWPS is established for background data using the UTL, either parametric or non-parametric confidence intervals will be computed for each constituent in compliance wells to identify GWPS exceedances.

3.1.2 Parametric Confidence Intervals around a Mean

If compliance data are approximately normal, one-sided parametric confidence intervals around a sample mean will be constructed for each constituent and well pair. The lower confidence limit (LCL) will be calculated as:

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

$\overline{x}$ = 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 (Table 16-1 in Appendix D of the *Unified Guidance*)

The chosen t value will aim to achieve both a low false-positive rate, and high statistical power. Minimum α values are tabulated in Table 22-2 of Appendix D of the *Unified Guidance*. The selected minimum α value, from which the t value will be derived, will have at least 80 percent power (1-β = 0.8) when the underlying mean concentration is twice the GWPS.

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

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

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

s_y = compliance sample log-standard deviation

3.1.3 Non-Parametric Confidence Intervals around a Median

Non-parametric confidence intervals around the median will be computed if the compliance data contain greater than 50 percent non-detects or are not normally distributed. The mathematical algorithm used to construct non-parametric confidence intervals 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.

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 close to the product of (n+1) x 0.50. If the result of (n+1) x 0.50 is a fraction (for even-numbered sample sizes), the rank values immediately above and below will be selected as possible candidate endpoints. If the result of (n+1) x 0.50 is an integer (for odd-numbered sample sizes), one will be added to and subtracted from the result to get the upper and lower candidate endpoints. The ranks of the endpoints will be denoted L* and U*. For a one-sided LCL, the confidence level associated with endpoint L* will be computed as:

$$1 - \alpha = Bin(L^* - 1; n, .50) = \sum_{x=L^*}^{n} \binom{n}{x} \left(\frac{1}{2}\right)^n$$

If the candidate endpoint(s) do not achieve the desired confidence level, new candidate endpoints (L*–1) and (U*+1) and achieved confidence levels will be calculated. If one candidate endpoint equals the data minimum or maximum, only the rank of the other endpoint will be changed. Achievable confidence levels are tabulated using these equations in Table 21-11 in Appendix D of the *Unified Guidance*.

Both parametric and non-parametric confidence limits will then be compared to the GWPS. The CCR unit is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected constituents at all compliance monitoring wells. A GWPS exceedance is determined if the LCL exceeds the GWPS.

3.1.4 The Upper Prediction Limit for a Future Mean

The parametric UPL for a future mean will be used to calculate the GWPS if the pooled background data contain 50 to 70 percent non-detects and normality can be achieved. The Kaplan-Meier or ROS methods will be used to estimate the mean and standard deviation. The non-parametric UPL for a future median will be calculated as the GWPS if background samples cannot be normalized or contain greater than 70 percent non-detects. The parametric UPL for a future mean will be calculated from the background dataset at follows:

$$UPL_{1-\alpha} = \overline{x} + \kappa s$$

$\overline{x}$ = background sample mean

s = background standard deviation

κ = multiplier based on the order (p) of the future mean to be predicted, the number of compliance wells to be tested (w), the background sample size (n) the number (c) of constituents of concern (COCs), the "1-of-m" retesting scheme, and the evaluation schedule (annual, semi-annual, quarterly). Values are tabulated in 19-5 to 19-9 in Appendix D of the *Unified Guidance*.

The mean of order p will be computed for each well and compared against the UPL. For any compliance point mean that exceeds the limit, p additional resamples may be collected at that well for a 1-of-2 retesting scheme. Resample means will then be compared to the UPL. A GWPS exceedance has been deemed to occur at a compliance well when the initial mean and all resample means exceed the UPL.

3.1.5 The Non-Parametric Upper Prediction Limit for a Future Median

The non-parametric UPL for a future median will be used to calculate the GWPS if the pooled background data contain greater than 70 percent non-detects and normality cannot be achieved. Non-parametric methods assume that the data does not have an underlying distribution. To calculate the non-parametric UPL on a future value, the target per-constituent false positive rate (α_{const}) will be determined as follows:

$$\alpha_{const} = 1 - (1 - \alpha)^{1/c}$$

α = the site-wide false positive rate (SWFPR) of 0.10 recommended by the *Unified Guidance*

c = the number of monitoring constituents

The number of yearly statistical evaluation (nE) will be multiplied by the number of compliance wells (w) to determine the look-up table entry, w*. The background sample size (n) and w* will be used to select an achievable per-constituent false positive rate value in Table 19-24 of Appendix D in the *Unified Guidance*. The chosen achievable per-constituent false positive rate value will determine the type of non-parametric prediction limit (maximum or 2nd highest value in background) and a retesting scheme for a future median. The background data will be sorted in ascending order, and the upper prediction limit will be set to the appropriate order statistic previously determined by the achievable per-constituent false positive rate value in Table 19-24. If all constituent measurements in a background sample are non-detect, the Double Quantification rule will be used. The use of the Double Quantification rule in Compliance Monitoring will only be applicable if the RL is above the 35 I.A.C. § 845.600(a)(1) constituent concentration or a constituent concentration is not specified in § 845.600(a)(1). This scenario is highly unlikely. The constituent will also be removed from calculations identifying the target false positive rate.

Two initial measurements per compliance well will be collected. If both do not exceed the upper prediction limit, a third initial measurement will not be collected since the median of order 3 will also not exceed the limit. If both exceed the prediction limit, a third initial measurement will not be collected since the median will also exceed the limit. If one initial measurement is above and one below the limit, a third initial observation may be collected to determine the position of the median relative to the UPL. Up to three resamples will be collected in order to assess the resample median. In all cases, if two or more of the compliance point observations are non-detect, the median will be set equal to the RL. The median value for each compliance well will be compared to the UPL. For the 1-of-2 retesting scheme, if any compliance point median exceeds the limit, up to three additional resamples will may be collected from that well. The resample median will be computed and compared to the UPL. A GWPS exceedance has been deemed to occur at a compliance well when either the initial median, or both the initial median and resample median exceed the UPL.

If the concentrations of detected constituents are below the established GWPS, Compliance Monitoring will continue.

3.1.6 Parametric Linear Regression and Confidence Band

If the t-test detects a significant trend in the parametric linear regression line using either background or compliance data for a particular constituent, confidence bands accounting for trends will be constructed to account for the trend-induced variation. If this is not accounted for, a wider confidence interval will inevitably be calculated for a given confidence level and sample size (n). A wider confidence interval 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 confidence intervals 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 does also to reflect this change at that point in time.

Linear regression will be used when background or compliance data are approximately normally distributed, with a constant sample variance around the mean, and the frequency of non-detects is low. The linear regression of concentration against sampling date (time) will be computed as follows:

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

xi = i^{th} concentration value and

ti = i^{th} sampling date

$\bar{t}$ = sampling mean date

s_t^2 = variance of the sampling dates

This estimate leads to the following regression equation:

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

$\bar{x}$ = 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 (MSE) will be computed as follows:

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

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

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

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

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

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

For background data, the UCL around the linear regression line will be used as the GWPS for the trending constituent. For compliance data, confidence bands around the linear regression line will be compared to the GWPS. The CCR unit is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected constituents at all compliance wells. A GWPS exceedance is determined when the LCL based on the trend line first exceeds the GWPS.

3.1.7 Non-Parametric Thiel-Sen Trend Line and Confidence Band

If the Mann-Kendall test detects a significant trend in the non-parametric Thiel-Sen line using either background or compliance data for a particular constituent, confidence bands accounting for trends will be constructed to account for the trend-induced variation. The Thiel-Sen trend line will be used as a non-parametric alternative to linear regression when trend residuals cannot be normalized or if there are a higher percentage of non-detects in either background or compliance data. 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 x1, x2, xn. All possible distinct pairs of measurements (xi, xj) 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-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:

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

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:

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

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 (ti, xi) will be formed with a sample date (ti) and the concentration measurement from that date (xi). 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 time points (tj) 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 ($\hat{x}_j^B$). An LCL will be constructed for the lower α^{th} percentile $\hat{x}_j^{[\alpha]}$ from the distribution of estimated concentrations at each time point (tj). For a UCL, compute the upper $(1-\alpha)^{th}$ percentile, $\hat{x}_j^{[1-\alpha]}$ at each time point (tj).

For background data, the UCL around the Thiel-Sen trend line will be used as the GWPS for the trending constituent. For compliance data, confidence bands around the Thiel-Sen trend line will be compared to the GWPS. The CCR unit is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected constituents at all compliance wells. A GWPS exceedance is confirmed when the LCL based on the trend line first exceeds the GWPS.

3.2 Determination of Statistically Significant Increases over Background

In accordance with 35 I.A.C. §§ 845.610(b)(3)(B) and 845.640(h), individual monitoring event concentrations for each constituent detected in the compliance monitoring wells during compliance monitoring sampling events will be compared to the background concentration as determined by the methods described above. An exceedance of the background concentration for any constituent measured at any compliance monitoring well, or constituent detection if not detected in the background samples, constitutes a Statistically Significant Increase (SSI). An exception to this method is pH, where two-sided (upper and lower) tolerance limits are established from the distribution of the background groundwater quality data. An exceedance of either the UTL or lower tolerance limit (LTL) would constitute an SSI for pH.

4. REFERENCES

Davis, C.B., 1994. *Environmental Regulatory Statistics.* In GP Patil & CR Rao (Eds.) *Handbook of Statistics, Volume 12: Environmental Statistics*, Chapter 26. New York: Elsevier Science B.V.

United States Environmental Protection Agency (USEPA), 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance*. EPA 530-R-09-007. March 2009.

Attachment B.3

Hydrogeologic Site Characterization Report

July 2023

Intended for
Dynegy Midwest Generation, LLC

Date
August 1, 2023

Project No.
1940102653

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1

BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1 BALDWIN POWER PLANT BOTTOM ASH POND

Project Name	**Baldwin Power Plant Bottom Ash Pond**
Project No.	**1940102653**
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Document Type	**Hydrogeologic Site Characterization Report**
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TABLES (IN TEXT)

FIGURES (IN TEXT)

TABLES (ATTACHED)

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APPENDICES

ACRONYMS AND ABBREVIATIONS

%	percent
°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
2022 HSI	2022 Hydrogeologic Site Investigation
ASD	Alternate Source Demonstrations
BAP	Bottom Ash Pond
BPP	Baldwin Power Plant
bgs	below ground surface
B.P.	before present
CCR	coal combustion residuals
CH	fat clay
CL	lean clay
cm/s	centimeters per second
Cooling Pond	Baldwin Lake
CPT	cone penetrometer test
DMG	Dynegy Midwest Generation, LLC
ESRI	Environmental Systems Research Institute
FAPS	Fly Ash Pond System
Federal CCR Rule	40 C.F.R. § 257 Subpart D
FEMA	Federal Emergency Management Agency
ft/d	feet/day
ft/ft	feet per feet
ft/mi	foot per mile
g	horizontal acceleration
GIS	Geographic Information System
GMP	Groundwater Monitoring Plan
GWPS	Groundwater Protection Standard
HCR	Hydrogeologic Site Characterization Report
HPE	History of Potential Exceedances
ID	identification
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
ISAS	Illinois State Archaeological Survey
ISGS	Illinois State Geological Survey
ISWS	Illinois State Water Survey
mg/L	milligrams per liter
NAD27	North American Datum of 1927
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.
pcf	pounds per cubic foot

Phase II	Groundwater Quality Assessment and Phase II Hydrogeologic Investigation
PMP	potential migration pathways
Ramboll	Ramboll Americas Engineering Solutions, Inc.
SDA	spray dry absorption
SI	surface impoundment
Site	BAP, FAPS, Secondary Pond, and Tertiary Pond
SSL	statistically significant level
SSURGO	Soil Survey Geographic
TDS	total dissolved solids
UA	uppermost aquifer
UGU	Upper Groundwater Unit
USCS	Unified Soil Classification System
USDI	United States Department of the Interior
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UU	Upper Groundwater Unit
Vandalia Till	Vandalia Till Member of the Glasford Formation

REVISION SUMMARY

Revision Date	**Description of Changes** (Section title or number – description)
08/01/2023	This document has been substantially revised based on new information obtained since the previous version and includes results of field work performed in 2022 through May 2023.

EXECUTIVE SUMMARY

Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this revised Hydrogeologic Site Characterization Report (HCR) for the Bottom Ash Pond (BAP) which expands on the previous HCR to include results of the 2022 Hydrogeologic Site Investigation (2022 HSI). This HCR also expands upon the hydrogeology and groundwater quality data presented in previous hydrogeologic investigation reports prepared for the BAP and also the Baldwin Fly Ash Pond System (FAPS) which were most recently submitted as part of Closure and Post Closure Care Plan (AECOM, 2016a). This report has been assembled to satisfy the information and analysis requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845.620 as summarized in (**Table ES-1**). The conceptual site model includes hydrogeologic and groundwater quality data specific to the BAP, which has been collected between 2015 and May 2023. The BAP is part of the Baldwin Power Plant (BPP) which is located in southwest Illinois in Randolph and St. Clair Counties. The BAP is approximately one-half mile west-northwest of the Village of Baldwin (**Figure 1-1**).

The BPP property is bordered to the west by the Kaskaskia River; to the east by Baldwin Road, farmland, and strip mining areas; to the southeast by the Village of Baldwin; to the south by the Illinois Central Gulf railroad tracks, scattered residences, and State Route 154; and to the north by farmland. The St. Clair/Randolph County Line crosses east-west at approximately the midpoint of Baldwin Lake (Cooling Pond). **Figure 1-1** shows the location of the BPP. **Figure 1-2** is a site map showing the location of the BAP (coal combustion residuals [CCR] Unit identification [ID] number [No.] 601, Illinois Environmental Protection Agency [IEPA] ID No. W1578510001-06, and National Inventory of Dams (NID) No. IL50721), a 35 I.A.C. § 845 regulated CCR Unit and the subject of this HCR; the FAPS, a Vistra-identified multi-unit and IEPA closed CCR Unit (CCR Unit ID No. 605; IEPA ID Nos. W1578510001-01, W1578510001-02, and W1578510001-03; and NID No. IL50721); and the Secondary Pond, Tertiary Pond, and Cooling Pond. The BAP is adjacent to the FAPS, which was approved for closure by IEPA on August 16, 2016. Construction of the final cover system for the FAPS was initiated in 2018 and completed on November 17, 2020.

Three distinct water-bearing units have been identified in the vicinity of the BAP based on stratigraphic relationships and common hydrogeologic characteristics. The units are described as follows from the surface downward:

- **CCR**: CCR, consisting primarily of fly ash, bottom ash, and boiler slag. Also includes earthen fill deposits of predominantly clay and silt materials from on-site excavations that were used to construct berms and roads surrounding the various impoundments across the Site.
- **Upper Unit (UU)**: Predominantly clay with some silt and minor sand, silt layers, and occasional sand lenses. Includes the lithologic layers identified as the Cahokia Alluvium, Peoria Loess, Equality Formation, and Vandalia Till Member of the Glasford Formation (Vandalia Till). This unit is composed of unlithified natural geologic materials and extends from the upper saturated materials to the bedrock. Thin sand seams and the interface (contact) between the UU and bedrock have been identified as potential migration pathways (PMPs). No continuous sand seams were observed within or immediately adjacent to the BAP; however, the sand seams may act as a PMP due to relatively higher hydraulic conductivities. The acronym UU and the materials it contains is synonymous with Upper Groundwater Unit (UGU) used in previous documents.

- **Bedrock Unit**: This unit is considered the uppermost aquifer (UA). Pennsylvanian and Mississippian-aged bedrock is composed of interbedded shale and limestone bedrock, which underlies and is continuous across the entire Site.

The extent of sand and gravel aquifers in the region are primarily found along the Kaskaskia River Valley where sand and gravel deposits are highly permeable, thick, and extensive. Outside of the Kaskaskia River Valley, the unlithified materials in upland areas are predominantly clay, which generally provide a low probability of encountering sand and gravel layers for dependable groundwater supply. Although some thin sand seams and layers occur intermittently within the Vandalia Till in localized areas around the BPP, most groundwater supplies in upland areas are obtained from large diameter shallow bored wells. Typical water wells in the vicinity of the BPP are between 25 and 55 feet deep, 36 to 48 inches in diameter, and collect groundwater through slow percolation into the wells, which are large diameter to allow for greater water storage to compensate for the low rate of groundwater infiltration.

The shallow bedrock is the only water-bearing unit that is continuous across the Site. Groundwater in the bedrock mainly occurs under semi-confined to confined conditions with the overlying unlithified unit behaving as the upper confining unit to the UA. Shallow sandstone and creviced limestone may yield small supplies in some areas, but water quality becomes poorer (*i.e.*, highly mineralized) with increasing depth.

Groundwater flow direction and gradients have not changed significantly since the hydrogeologic characterization report completed in 2016, and the more recent data support the established conceptual site model. The Baldwin BAP overlies low permeability clay and silt, with thin and discontinuous sand lenses occurring in the unlithified materials. Groundwater flow in both the UU and the Bedrock Unit are to the west and southwest toward the historic drainage feature and bedrock valley. The receiving surface water bodies for groundwater in the UU are assumed to be the Secondary and Tertiary ponds, while the receiving surface water body for groundwater in the Bedrock Unit is the Kaskaskia River.

Dynegy Midwest Generation, LLC (DMG), entered into a compliance commitment agreement (CCA) with IEPA on December 28, 2022. Groundwater monitoring in accordance with the CCA will follow the proposed groundwater monitoring plan and sampling methodologies provided in the operating permit application for the BAP and is scheduled to commence no later than the second quarter of 2023. After the BAP has been issued an approved operating permit, groundwater monitoring shall be conducted in accordance with that operating permit. Potential exceedances of the Groundwater Protection Standard (GWPS) are presented in the attached revision to the History of Potential Exceedances (HPE) (**Appendix A**; Ramboll, 2023b) and discussed in **Section 4** of this report. Based on statistical analysis, evaluation of subsequent potential exceedances of the GWPS, and intention to pursue Alternate Source Demonstrations (ASDs), it has been determined there are no potential exceedances of applicable groundwater standards attributable to the BAP.

TABLE ES-1. 35 I.A.C. § 845 REQUIREMENTS CHECKLIST
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

35 I.A.C. § 845 Reference	Individual 35 I.A.C. § 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 2-1 Figure 2-5 Appendix C
845.620(b)(2)	Climatic aspects of the site, including seasonal and temporal fluctuations in groundwater flow;	Sections 3.2.2 & 3.2.5.1 Tables 3-2 & 3-4, Tables F, G, & H Figures 3-2 to 3-5 Appendix D
845.620(b)(3)	Identification of nearby surface water bodies and drinking water intakes;	Sections 3.2.5.2 & 5.2 Figure A Appendices B-4
845.620(b)(4)	Identification of nearby pumping wells and associated uses of the groundwater;	Section 5.1 Appendix B-5
845.620(b)(5)	Identification of nearby dedicated nature preserves;	Section 5.3 Appendix B-6
845.620(b)(6)	Geologic setting;	Sections 2.4 & 2.5
845.620(b)(7)	Structural characteristics;	Section 2.4.4 Figure 2-4
845.620(b)(8)	Geologic cross-sections;	Figures 2-6 to 2-9 Appendix C
845.620(b)(9)	Soil characteristics;	Section 2.3 Appendix B-1

TABLE ES-1. 35 I.A.C. § 845 REQUIREMENTS CHECKLIST
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

35 I.A.C. § 845 Reference	Individual 35 I.A.C. § 845 Components Reviewed for Completeness	Location of Information in HCR
845.620(b)(10)	Identification of confining layers;	Section 3.2.2.1 Table 3-2
845.620(b)(11)	Identification of potential migration pathways;	Section 3.2.1.3 Figure 3-1
845.620(b)(12)	Groundwater quality data;	Section 4.2 Tables 4-1 and 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;	Table 2-2 Figures 2-6 to 2-9 Appendix B-3
845.620(b)(14)	A map displaying any known underground mines beneath a CCR surface impoundment;	Section 2.4.6 Appendix B-2
845.620(b)(15)	Chemical and physical properties of the geologic layers to a minimum depth of 100 feet below land surface;	Sections 2.5 & 3.2.3 Tables 2-3 & 3-1, Tables C through F Appendix D
845.620(b)(16)	Hydraulic characteristics of the geologic layers identified as migration pathways and geologic layers that limit migration, including:	Sections 3.2.2 & 3.2.3 Tables 3-1, 3-2, & 3-4, Table F Appendices C
845.620(b)(16)(A)	water table depth;	Section 3.2.2 Figures 3-2 to 3-5
845.620(b)(16)(B)	hydraulic conductivities;	Section 3.2.3 Table 3-1, Table H Appendices C
845.620(b)(16)(C)	effective and total porosities;	Sections 2.5 & 3.1

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TABLE ES-1. 35 I.A.C. § 845 REQUIREMENTS CHECKLIST
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

35 I.A.C. § 845 Reference	Individual 35 I.A.C. § 845 Components Reviewed for Completeness	Location of Information in HCR
845.620(b)(16)(D)	direction and velocity of groundwater flow; and	Sections 3.2.2.1, 3.2.2.2, 3.2.2.4, & 3.2.2.5 Tables 3-2 & 3-4 Figures 3-2 to 3-5
845.620(b)(16)(E)	map of the potentiometric surface;	Figures 3-2 to 3-5
845.620(b)(17)	Groundwater classification pursuant to 35 I.A.C. § 620	Section 3.2.4

[O: EGP 04/11/23; U: JJW 06/27/23; C: LDC 07/03/23]

Notes:
-- = 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 of35 I.A.C. § 845, Ramboll has prepared this HCR on behalf of BPP, operated by Dynegy Midwest Generation, LLC (DMG). This report will apply specifically to the CCR Unit referred to as the BAP (**Figure 1-1**). The BAP is a 177-acre unlined CCR surface impoundment (SI) used to manage CCR and non-CCR waste streams at the BPP. This HCR includes 35 I.A.C. § 845 content requirements specific to 35 I.A.C. § 845.620(b) (Hydrogeologic Site Characterization) for the BAP at the BPP.

1.2 35 I.A.C. § 845 Description

35 I.A.C. § 845 contains comprehensive rules for the design, construction, operation, corrective action, closure, and post closure care of these SIs. 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 rules also include financial assurance requirements for CCR SIs.

A checklist summarizing 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 to evaluate the CCR Units or Multi-Units located at the BPP. 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:

Ramboll, 2022. 2022 Hydrogeologic Site Investigation (2022 HSI) – Baldwin Bottom Ash Pond (data collected during the 2022 Hydrogeologic Site Investigation is presented as part of this revised HCR).
Additional data was collected for evaluation of the geology, hydrogeology, and groundwater quality in the vicinity of the BAP in this revised HCR. Nine monitoring wells, five porewater wells, and six soil borings were installed in and around the perimeter of the BAP. Installation of the monitoring wells was followed by eight independent monthly groundwater sampling events to assess upgradient and downgradient groundwater quality. Geotechnical analysis was performed on CCR and unlithified material solid samples collected during drilling to assess physical characteristics of the subsurface materials. Chemical analysis of solid samples was performed on unlithified materials and bedrock to assess geochemical conditions.

- ***Ramboll, November 30, 2020. Corrective Measures Assessment, Revision 2 (Revision 1, November 15, 2019; Revision 0, September 5, 2019) – Baldwin Fly Ash Pond System.***
  An assessment of potential corrective measures to address the requirements of Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.96 in response to statistically significant levels (SSLs) of Appendix IV parameters where it was unable to be demonstrated that a source other than the CCR unit caused the SSLs. Four alternatives were evaluated for their long- and short-term effectiveness, protectiveness, and certainty; source control; and implementability.

- ***Natural Resource Technology, Inc. (NRT), March 31, 2016. Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan - Baldwin Fly Ash Pond System.***
  A supplemental hydrogeologic investigation and groundwater monitoring plan to support a Closure and Post-Closure Care Plan (AECOM, 2016a) for fly ash ponds located at BPP.

- ***AECOM, December 17, 2015. 30% Design Data Report for the Dynegy Baldwin Energy Complex; West Fly Ash Pond, East Fly Ash Pond, and Old East Fly Ash Pond CCR Units.***
  A geotechnical program consisting of installation of auger borings, cone penetrometer test (CPT) soundings and piezometers to obtain information for compliance with requirements of 40 C.F.R. § 257 Subpart D (Federal CCR Rule).

- ***NRT, June 11, 2014. Groundwater Quality Assessment and Phase II Hydrogeologic Investigation, Baldwin Ash Pond System.***
  A Phase II assessment to further assess the hydrogeology and groundwater quality in the vicinity of the ash pond system at BPP, following the proposed scope of work (March 22, 2013) approved, with clarifications, by IEPA on June 18, 2013.

- ***DMG, March 22, 2013. Proposed Scope of Work – Baldwin Ash Impoundment System.***
  A plan for conducting a more comprehensive hydrogeologic investigation along with development of a groundwater model to evaluate various pond closure scenarios on groundwater quality in the vicinity of the ash pond system; accepted, with clarifications, by IEPA on August 31, 2011.

- ***Kelron Environmental (Kelron), June 30, 2012. Groundwater Quality Assessment and Initial Hydrogeologic Investigation – Baldwin Ash Pond System.***
  Assessed the hydrogeology and groundwater quality in the vicinity of the ash pond system. Thirteen monitoring wells were installed around the perimeter of the ash pond system and sampled quarterly to assess upgradient and downgradient groundwater quality (full inorganic parameter list in 35 I.A.C. § 620.410). Submitted to IEPA.

- ***Kelron, April 16, 2012. Off-Site Groundwater Quality Results – Baldwin Energy Complex.***
  Off-site groundwater quality investigation, south and southwest of the ash pond system, to assess shallow off-site groundwater quality for the presence of inorganic parameters related to CCR. Submitted to IEPA.

- ***Kelron and NRT, June 7, 2010. Water Well Survey – Baldwin Ash Pond System.***
  A survey identifying water wells located within 2,500 feet of the BPP's ash pond system. The water well survey was prepared in accordance with the "Right to Know" Potable Water Well Survey procedures of 35 IAC § 1600.210(b)(1) and § 1600.210(b)(2). Submitted to IEPA.
- ***Kelron and NRT, May 26, 2010. Hydrogeologic Assessment and Groundwater Monitoring Plan – Baldwin Ash Pond System.***
  A plan for initial evaluation of groundwater quality in the vicinity of the ash pond system along with an initial hydrogeologic characterization; accepted, with clarifications, by IEPA August 31, 2011.

The 2022 HSI results are provided in this revised HCR and will be included in a construction permit application for submittal to the IEPA no later than August 1, 2023 in conjunction with a revised GMP for the BAP.

1.4 Site Location and Background

The BPP is located in southwest Illinois in Randolph and St. Clair Counties. The Randolph County portion of the BPP is located within Sections 2, 3, 4, 9, 10, 11, 14, 15, and 16 of Township 4 South and Range 7 West. The St. Clair County portion of the property is located within Sections 33, 34, and 35 of Township 3 South and Range 7 West. The BAP is approximately one-half mile west-northwest of the Village of Baldwin (**Figure 1-1**).

The BPP property is bordered to the west by the Kaskaskia River; to the east by Baldwin Road, farmland, and strip mining areas; to the southeast by the Village of Baldwin; to the south by the Illinois Central Gulf railroad tracks, scattered residences, and State Route 154; and to the north by farmland. The St. Clair/Randolph County Line crosses east-west at approximately the midpoint of Baldwin Lake (Cooling Pond). **Figure 1-1** shows the location of the BPP; **Figure 1-2** is a site map showing the location of the BAP (a 35 I.A.C. § 845 regulated CCR Unit and the subject of this HCR), FAPS (an IEPA closed CCR Unit), Secondary Pond, Tertiary Pond, and Cooling Pond. The combined area including the BAP, FAPS, Secondary Pond, and Tertiary Pond will hereinafter be referred to as the Site.

1.5 Site History and CCR Units

The BPP is a coal-fired electrical generating plant that began operation of its first unit in 1970; two additional generating units were put into service in 1973 and 1975. The plant initially burned bituminous coal from Illinois and switched to subbituminous coal in 1999. Total plant generating capacity is approximately 1,892 megawatts. The following CCR Unit/CCR Multi-Units are present at the BPP:

BAP: The BAP is classified as an existing, unlined CCR SI and covers an area of approximately 177 acres located in the southern portion of the BPP property (**Figure 1-2**). The BAP is surrounded by a perimeter road and is bounded to the north by the Cooling Pond, and to the east and south by the closed FAPS CCR Multi-Unit. The BAP is also bounded to the west by the easternmost wooded area that surrounds the Secondary and Tertiary Ponds. The BAP is being used to store and dispose of sluiced bottom ash, some of which is mined for beneficial use, to temporarily store spray dry absorption (SDA) waste, and to clarify plant process water, including other non-CCR station process wastewaters, prior to discharge in accordance with the station's National Pollutant Discharge Elimination System (NPDES) permit (AECOM, 2016b; IEPA, 2016).

FAPS: The FAPS at the BPP is a closed CCR Multi-Unit consisting of three unlined SIs: Old East Fly Ash Pond (IEPA Unit ID W1578510001-01), the East Fly Ash Pond (IEPA Unit ID W1578510001-02), and West Fly Ash Pond (IEPA Unit ID W1578510001-03), with a combined surface area of approximately 232 acres (**Figure 1-2**). During operation, the FAPS discharged water to the BAP. The receiving water bodies for the BAP were the Secondary Pond, and in turn the Tertiary Pond, which ultimately discharges towards a tributary of the Kaskaskia River, south of the Cooling Pond intake structure. A Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (Phase II; NRT, 2014a) was followed by a Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan dated March 31, 2016 (NRT, 2016b) with revised pages included in the response to IEPA's July 13, 2016 comments in the technical memorandum dated August 8, 2016 (NRT, 2016c) to define the hydrogeology and to assess the groundwater impacts related to the FAPS. Groundwater models were also completed to assess the groundwater impacts associated with closure and predict the fate and transport of CCR leachate components, as well as estimate the time required for hydrostatic equilibrium of groundwater beneath the FAPS (NRT, 2014b; NRT, 2014c; NRT, 2016a). Based on these assessments, a Closure and Post-Closure Care Plan (AECOM, 2016a), which included a groundwater monitoring program sufficient for long-term, post-closure monitoring, was developed and approved by IEPA in a letter to the Dynegy Operating Company dated August 16, 2016. Closure activities, which included constructing a final cover system to control the potential for water infiltration into the closed CCR unit, were completed, and FAPS closure was completed November 17, 2020.

The approximate dates of construction of each successive stage of the BAP and FAPS are summarized in **Table A** below (AECOM, 2016b).

Table A. History of Construction

Date	Event
1969	Construction of Old East Fly Ash Pond, East Fly Ash Pond, and West Fly Ash Pond external perimeter embankment
1979	Construction of East Fly Ash Pond and West Fly Ash Pond northern embankment
1989	Raise inboard perimeter raise of the entire East Fly Ash Pond and West Fly Ash Pond
1995	Construction of interior dike between the East Fly Ash Pond and West Fly Ash Pond
1999	Raise of interior dike between the East Fly Ash Pond and West Fly Ash Pond; replacement of outlet pipe from the West Fly Ash Pond to the Secondary Pond
2012	Modification of BAP embankment (original construction date unknown)
2016	Closure Plan completed for the FAPS and approved by IEPA
2020	FAPS closure activities, including construction of a final cover system, and FAPS closure completed

2. REGIONAL AND LOCAL GEOLOGY

A detailed investigation of the regional and local geology of the Site was completed and reported as part of the Phase II investigation (NRT, 2014a). Significant portions of the results of the Phase II investigation are included in this revised HCR, along with supplemental information (including information sourced from previous investigations and reports identified in **Section 1.3** of this HCR, including the 2022 HSI) and updates as needed to satisfy the content requirements specific to 35 I.A.C. § 845.620(b) (Hydrogeologic Site Characterization) for the BAP at BPP.

2.1 Topography

Topography in the vicinity of the Site (**Figure 2-1**) ranges from approximately 370 feet North American Vertical Datum of 1988 (NAVD88) along the Kaskaskia River southwest of the Site to 450 feet NAVD88 towards the south and east. The principal surface drainage for the region is the Kaskaskia River, located west of the Site. A United States Geological Survey (USGS) stream gage (05595240) (Latitude 38°11'39", Longitude 89°53'17" North American Datum of 1927 [NAD27]) is located on the Kaskaskia River to the west of the Site. As seen on the historic topographic map (**Figure 2-2**), which represents the site topography in 1968 prior to construction, the natural drainage at the site was east to west in the area where the current BAP is located, with elevations ranging from approximately 400 to 430 feet National Geodetic Vertical Datum of 1929 (NGVD29). The drainage merged near the west end of the future BAP, becoming a defined intermittent stream running southwest through what is now the Secondary Pond toward the southwest corner of the Site at the current location of the Tertiary Pond.

Table B below is a comparison of the 1968 topography to the current site topography, and approximate land surface elevation changes observed at the Site:

Table B. Site Topography

CCR Unit / Multi-Unit or Pond Location	Approximate Range in Current Topographic Elevations (feet NAVD88)	Approximate Range in 1968 Topographic Elevations (feet NGVD29)	Approximate Change (increase) in Land Surface Elevation [1968 to Present] (feet)
BAP (CCR Unit)	415 – 450	400 – 430	10 – 20
Old East Fly Ash Pond (FAPS CCR Multi-Unit)	450 – 470	420 – 440	15 – 45
East Fly Ash Pond (FAPS CCR Multi-Unit)	440 – 470	420 – 435	20 – 45
West Fly Ash Pond (FAPS CCR Multi-Unit)	425 – 450	410 – 415	10 – 35
Secondary Pond	380 – 410	390 -425	5 - 10

The overall change in topography from pre-construction to current land surface ranges from 5 to 45 feet, with the greatest elevation changes (10 to 45 feet) occurring at the FAPS CCR Multi-Unit following construction of a final cover system and the smallest elevation changes (5 to 10 feet) occurring in the area now occupied by the Secondary Pond. The current drainage pattern at the Site is similar to that present prior to construction.

2.2 Regional Geomorphology

Randolph County has an area of about 387,840 acres or 604 square miles. The county has about 41,800 acres of woodland, much of it along the Mississippi and Kaskaskia Rivers. Surface water features in the form of streams and lakes greater than 40 acres in size occupy approximately 7,800 acres, of which 2,018 acres are occupied by the Cooling Pond.

The physiographic division in the region of the site is the Mt. Vernon Hill Country of the Till Plains Section, Central Lowland Province. Within the Mt. Vernon Hill Country, the topography is controlled largely by the underlying bedrock, which has been extensively eroded in some areas, resulting in a surface expression of gently rolling hills and valleys. Most streams have broad valleys with low gradients. Topographic relief seldom exceeds 30 feet. Ground surface slopes in the area range from 0 to 10 percent and lie on broad drainage divides, ridges, and side slopes.

The geomorphology of the area has been shaped by periods of glaciations and erosion. The glaciers that advanced into the region carried abundant rock debris, which was deposited as the ice melted, forming an irregular layer that thinly covers much of the bedrock north of the glacial boundary. Outwash and finer deposits were carried by the meltwater from the glaciers and deposited in valleys. Exposed glacial deposits were subject to wind erosion, and silts and fine-grained sands were deposited on the uplands adjacent to the valleys as loess. Erosion of these loess deposits overlying glacial till has been one of the processes that developed the gently rolling hills and ridges in the southern Illinois uplands.

Approximately 2.5 miles east of the Site, the topography has been altered through reclamation of strip-mined (*i.e.,* surface mined) land. This reclaimed mining area is hummocky and has numerous man-made ponds and lakes with linear to irregular shapes.

2.3 Soils

Surficial soils at the Site and vicinity are shown in **Appendix B** and based on Randolph 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)'s web hosted layer. Former soils underlying the Site, not including the fill and CCR within the limits of the BAP and FAPS, are identified as: Orthents (loamy, hilly/undulating) along the FAPS boundaries and west of the Secondary and Tertiary Ponds; Redbud silty clay loam (10 to 18 percent slopes, severely eroded) west of the BAP and FAPS along the northern and eastern boundaries of the Secondary Pond, and southeast of the FAPS; Redbud silt loam (2 to 5 percent slopes) south of the FAPS, southeast of the FAPS and west of the Site along Conservation Road; and Millstadt silt loam (0 to 2 percent slopes) west of the BAP and northwest of the Secondary Pond, with minor areas southeast of the FAPS.

Other surficial soils present along the south and east BPP property boundaries are: Okaw silt loam (0 to 2 percent slopes); Martinsville fine sandy loam (10 to 18 percent slopes, eroded); Marine silt loam (0 to 2 percent slopes), Homen silt loam (2 to 5 percent slopes), Bunkum-Coulterville silty clay loams (5 to 10 percent slopes, severely eroded), and Coulterville-Oconee silt loams (2 to 5 percent slopes). Additional information sourced from the SSURGO describing surficial soils at the Site and vicinity listed above is available in **Appendix B**.

2.4 Regional Geology

Based on regional and local information available from the Illinois State Geological Survey (ISGS), the geology in the vicinity of the Site consists of less than 25 to 75 feet of glacial drift deposits resting on top of Pennsylvanian and Mississippian age bedrock. There are three general geologic sequences found in the vicinity of the BPP, depending on proximity relative to the Kaskaskia River. The general sequences of geologic materials at the BPP based on stack-unit mapping by the ISGS and geologic quadrangle maps (Berg and Kempton, 1988; Devera, 2004; and Grimley and Webb, 2010) are presented for the following areas: Site and Cooling Pond; Kaskaskia River Bottomlands; and Southern and Eastern Upland Areas.

2.4.1 Site and Cooling Pond

From the surficial deposits downward, there are four primary geologic materials in the vicinity of the Site and Cooling Pond (**Figure 2-3**), consisting of:

- Equality Formation of the Wisconsinan Episode of glaciation of the Pleistocene Epoch (approximately 75,000 to 12,000 years before present (B.P.): consist of lake deposits and/or fine-grained alluvium (silt loam to silty clay loam to silty clay) deposited as slackwater sediment during peak glacial sedimentation periods of the Mississippi River; terraces generally occur at 400 to 425 feet NGVD29; this formation may include some interbeds of fine sand or coarse silt, is generally light olive-brown to grayish brown to dark gray, stratified, secondary carbonate concretions may occur along bedding planes, may contain small (less than 1 centimeter) aquatic gastropod shells, bivalves, or conifer wood in unoxidized portions, soft to medium stiffness when moist; up to 50 feet thick; may include approximately 3 feet of loess cover and is underlain by any of the following: Henry Formation, Pearl Formation, or Petersburg Silt. Note the equality formation was not specifically identified on **Figure 2-3**; however, soil borings from the site indicate most of the surficial deposits in the area identified as Pearl Formation on **Figure 2-3** is comprised of finer grained silts and clays associated with the Equality Formation.
- Pearl Formation (Mascoutah Facies) of the Illinois Episode of glaciations (approximately 200,000 to 130,000 years B.P.), which consists of outwash sand and some gravel deposited from glacial meltwater rivers; generally greater than 20 feet and increasing in thickness up to 55 feet towards the west as the Kaskaskia Valley is approached; the sand is predominantly fine to medium, yellowish brown, stratified below the weathered zone, typically more weathered or more clayey in upper portions, moderately to well sorted; may be overlain by the Berry Clay Member (silty clay to clay loam) in some areas. As mentioned above, most of the area identified as Pearl Formation on **Figure 2-3** was observed to be Equality Formation.
- Vandalia Till, of the Illinois Episode, is the predominant till unit in the region. It is a loamy and sandy compact diamicton deposited as till and ice-marginal sediment with the following lithologic description: pebbles mainly less than 2-inches in diameter, includes silt, sand, and gravel lenses up to several feet thick, massive to crudely stratified; yellowish brown, olive brown, grayish brown to dark gray with iron and manganese oxide staining along fracture faces; leached to calcareous; stiff to very stiff; and, up to 120 feet thick (Willman and Frye, 1970; Berg and Kempton, 1988; Philips, 2008). The Vandalia Till has been mapped by ISGS with thicknesses between 20 and 50 feet in the area surrounding the Site. The Vandalia Till has a lower and upper portion, with the lower portion a dense basal till layer, stiff to very hard, low moisture content, and calcareous. The upper portion is a weaker and moister

supraglacial till, deposited off the surface of an inactive melting glacier (*i.e.,* ablation till), and may include lenses of silt, sand or gravel up to 10 feet thick and tens of feet wide, is weathered brown, softer, more clay rich, and relatively moist (Philips, 2008).

- Pennsylvanian and Mississippian bedrock, mainly limestone and shale with some sandstone occurs within 50 feet of the ground surface; the uppermost Pennsylvanian bedrock is the Tradewater Formation of the Desmoinesian Series and ranges from 0 to 40 feet in thickness; the uppermost Mississippian bedrock is the Upper Okaw Formation, which includes the Tar Springs, Vienna, and Waltersburg units of the Chesterian Series and is generally 20 to 30 feet thick; the Upper Okaw consists of shale, limestone, and sandstone; the Tradewater Formation predominates under the Site and Cooling Pond, as the Carbondale Formation pinches out to the east and the Tradewater pinches out to the west towards the Kaskaskia River.

2.4.2 Kaskaskia River Bottomlands

From the surficial deposits downward, there are three primary geologic materials along the Kaskaskia River Bottomlands (**Figure 2-3**), consisting of:

- Cahokia Formation: alluvium (river deposits) in floodplains of tributaries to the Kaskaskia River from the Hudson Episode (approximately 12,000 years B.P. to today); consists of silt loam to silty clay loam which may contain thin sandy, gravelly or loamy zones. There are three principal facies of the Cahokia Formation in the Kaskaskia River Bottomlands west of the Site:
  - Clayey facies: silt loam, silty clay loam, and silty clay deposits within abandoned channel fills and backswamps; within frequent flood areas and only differentiated within the modern floodplain of the Kaskaskia River; olive-gray to grayish brown to gray, massive to stratified, noncalcareous, contains weak soil development without a B horizon; up to 20 feet thick.
  - Sandy facies: fine to medium sand within point bar and channel deposits of the modern floodplain of the Kaskaskia River (near surface) as well as in early to middle Holocene terraces (subsurface); interstratified with the clayey facies; may include beds of sandy loam and silty clay loam, dark yellowish brown to brownish gray, moderately to well sorted, stratified, noncalcareous, soft; up to 25 feet thick.
  - Clayey facies (high level): occurs within the early to middle Holocene terrace at elevations of approximately 395 to 400 feet above mean sea level (NGVD29); a silty clay loam to silt loam of river overbank alluvial deposit that is generally less than 20 feet in thickness but may be up to 30 feet thick; brown to yellowish brown to grayish brown, noncalcareous, upper 5 feet may exhibit a relatively weak modern soil profile.
- Henry Formation of the Wisconsinan Episode of glaciation, consisting of glacial outwash deposits (glacial meltwater river deposits) or nonglacial alluvium up to 20 feet in thickness; the outwash is dominated by fine to medium sand, moderately to well sorted, stratified, and tan to grayish brown; may contain interbeds of fine-grained silty deposits; can be intertongued with the Equality Formation.
- Pennsylvanian and Mississippian bedrock, mainly limestone and shale with some sandstone occurs within 50 feet of the ground surface; the uppermost Pennsylvanian bedrock is the Tradewater Formation of the Desmoinesian Series and ranges from 0 to 40 feet in thickness;

the uppermost Mississippian bedrock is the Upper Okaw Formation, which includes the Tar Springs, Vienna, and Waltersburg units of the Chesterian Series and is generally 20 to 30 feet thick; the Upper Okaw consists of shale, limestone, and sandstone; the Mississippian bedrock predominates in the Kaskaskia River Bottomlands as the Tradewater Formation pinches out towards the west end of the Site.

2.4.3 Southern and Eastern Upland Areas

Areas south and east of the BPP, where higher topographic elevations occur, are characterized by unlithified glacial deposits above shallow to medium depth bedrock. The three principal materials found to the south and east of the BPP, from the surface downward, are:

- Peoria Loess and Roxana Silt consists of loess (windblown silt) of the Wisconsinan Episode; the loess is a silt loam to silty clay loam that is up to 12 feet thick and typically underlain by the Vandalia Till at surface elevations greater than 440 feet NGVD29; generally brown to yellowish brown to grayish brown to slightly pinkish brown, leached of carbonates, massive but with strong soil structure in the upper 5 feet, and soft to moderately stiff.
- Vandalia Till (see earlier description in **Section 2.4.1**).
- Pennsylvanian bedrock, mainly undifferentiated shale and limestone of either the Tradewater Formation or the Carbondale Formation of the Desmoinesian Series, generally occurs within 30 feet of the ground surface; areas to the east of the Site are immediately underlain by the Carbondale Formation, which pinches out towards the west.

2.4.4 Structure

The major geological structural features of Illinois are shown on **Figure 2-4**. The Site lies on the Sparta Shelf of the Illinois Basin, which is bound to the south by the Cottage Grove Fault System and Ste. Genevieve Fault Zone, and to the east by the Du Quoin Monocline (Nelson, 1995). The Cottage Grove Fault Zone is composed of right-lateral strike-slip faulting and is a principal tectonic feature of southern Illinois. The western and northern limits of the Sparta Shelf are undefined (Nelson, 1995). To the west and east of the Site are the Waterloo-Dupo Anticline (where the east limb of the anticline dips 2 to 4 degrees) and Du Quoin Monocline (east side downwarped), respectively (Nelson, 1995). The Mississippian bedrock has a regional strike that is generally north to northeast with a dip of 2 to 3 degrees to the east into the Illinois Basin (Breeden et. al, 2018; Bristol and Howard, 1971). Pennsylvanian bedrock unconformably overlap these Mississippian units and slightly change strike to the north-northwest (Breeden et. al, 2018).

2.4.5 Seismic Setting

A review of available data from the USGS, ISGS, and other available information was completed by Haley & Aldrich, Inc. (2018) for the BAP as part of the Location Restriction Demonstration to address the requirements of 40 C.F.R. § 257.62 (Fault Areas) of the USEPA rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities* (Haley & Aldrich, Inc., 2018). The review found that the nearest known mapped fault is the Cottage Grove Fault System, which is located approximately 24 miles southeast and the timeframe of the most recent activity on this fault is not known. Based on available geologic data and information reviewed, there are no active faults or fault damage zones that have had displacement in the Holocene time reported or indicated within 200 feet of the BAP.

An evaluation was completed by Haley & Aldrich, Inc. (2018) for the BAP as part of the Location Restriction Demonstration to address the requirements of 40 C.F.R. § 257.63 (Seismic Impact Zones) of the USEPA's rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities* (Haley & Aldrich, Inc., 2018). A Seismic Impact Zone is defined in the Federal CCR Rule (40 C.F.R. § 257.63) as "an area having a 2 percent or greater probability that the maximum expected horizontal acceleration (g), expressed as a percentage of the earth's gravitational pull, will exceed 0.10 g in 50 years". The 2014 USGS Hazard Map raw data for the BAP indicates that the maximum expected horizontal acceleration for 2 percent probability of exceedance in 50 years is 0.34 g.

The results of the evaluation completed by Haley & Aldrich, Inc. (2018) indicate that the BAP is in compliance with 40 C.F.R. § 257.63(a). Although the BAP is located in a seismic impact zone, it satisfies the demonstration requirements of 40 C.F.R. § 257.63(a). The AECOM report entitled "CCR Certification Report: Initial Structural Stability Assessment, Initial Safety Factor Assessment, and Initial Inflow Design Flood Control System Plan for the Bottom Ash Pond at Baldwin Energy Complex" dated October 2016, includes engineering analysis, calculations, and findings that support the requirements of 40 C.F.R. § 257.63(a), and provides documentation that those requirements have been evaluated by AECOM for the subject CCR Unit.

2.4.6 Mining Activities

A survey to identify historic mining activities was conducted for a 1,000-meter radius around the BAP as shown in **Appendix B.** Based on records obtained from the ISGS, no historic mining activities were identified. Historic strip-mined (*i.e.,* surface mined) land is found approximately 2.5 miles east of the Site.

2.5 Site Geology

Two types of materials are present at the Site, consisting of unlithified deposits (alluvium and glacial deposits) and bedrock. Each of these materials is discussed in detail to establish a framework with which to understand the hydrogeology, and in later sections the groundwater quality, at the Site. **Figure 2-5** shows the locations of all the monitoring wells and piezometers installed as part of previous hydrogeologic investigations at the Site. Boring logs, monitoring well, and piezometer construction forms are provided in **Appendix C**. A summary of well construction details is found in **Table 2-1**. Summaries of the geotechnical laboratory test results and geotechnical testing data on the soil samples collected as part of Phase II investigation (NRT, 2014a) and the 2022 HSI are provided in **Appendix D**. **Figure 2-6** shows the locations of the east-west (**Figures 2-7, 2-8, and 2-9**) and north-south (**Figure 2-9**) BAP geologic cross-sections. Additional Site geologic cross-sections from the Phase II investigation are included in **Appendix C**.

The following is a presentation of the results of the Phase II investigation (NRT, 2014a) and 2022 HSI as they relate to Site geology. **Table 2-2** summarizes the data collected during both investigations. Supplemental information and updates are included as necessary.

The five principal types of unlithified materials present above the bedrock in the vicinity of the Site consist of the following in descending order:

- Fill, predominantly coal ash (fly ash, bottom ash, and slag) within the CCR units, but also including constructed levees around the Cooling Pond, constructed berms around the Site, and constructed railroad embankment south of the Site;

- Alluvial clay, sandy clay, and clayey sand of the Cahokia Formation;
- Silt and silty clay of the Peoria Loess;
- Clay and sandy clay of the Equality Formation, with occasional sand seams and lenses; and
- Clay and sandy clay diamictons of the Vandalia Till with intermittent and discontinuous sand lenses.

2.5.1 Fill and CCR

Approximately 9 feet of bottom ash was intercepted towards the center of the BAP (TPZ-164). Additional porewater wells were installed in 2022 to further delineate the vertical extent of bottom ash within the BAP. XPW04 and XPW05 were installed towards the center of the BAP in a historic drainage channel and 16.5 feet and 28.2 feet of bottom ash were encountered, respectively. XPW01 and XPW02 were installed in the northern portion of the BAP and encountered 11.9 and 11 feet of ash, respectively. XPW06 was installed in the western portion of the BAP and 9.9 feet of bottom ash was encountered. The approximate base of ash surface in the BAP was provided by Geosyntec as illustrated in **Figure 2-10**, which was developed using historic pre-construction topographic maps and incorporated base of ash data collected by Ramboll from borings within the BAP completed in 2022. Based on the approximate elevation of the as-built final cover system for the FAPS as shown in **Figure 2-1** and the approximate base of fill and CCR elevations observed at borings TPZ-163, TPZ-167, and TPZ-168, fill and CCR in the FAPS are estimated to range in thickness from 19 to 43 feet.

Geotechnical analysis results of seven fill and CCR samples provided Unified Soil Classification System (USCS) soil classifications of sand, silty sand, silty clayey sand, sandy silt, and silt. The results are as summarized below and in **Table 2-3** and the laboratory reports are included in **Appendix D**.

- The three shallow samples, collected at depths between 1.5 and 5 feet below ground surface (bgs) had moisture contents of 22 to 56 percent, dry bulk densities ranging from 63 to 92 pounds per cubic foot (pcf), specific gravities of 2.6 to 2.9, and calculated total porosities of 45 to 65 percent.
- The three BAP samples collected in 2022 ranging from 5.5 to 16 feet bgs had moisture contents ranging from 9.8 to 16.4 percent, dry bulk densities ranging from 110.5 to 111.5 pcf, and specific gravities ranging from 2.65 to 2.7.
- The deepest sample, collected at 29 to 30 feet bgs from boring TPZ-167 at the West Fly Ash Pond within the FAPS, had a moisture content of 18.8 percent, dry bulk density of 99.9 pcf, specific gravity of 2.6, and calculated total porosity of 38 percent.

2.5.2 Cahokia Formation

The Cahokia Formation is the uppermost unlithified unit between the Site and the Kaskaskia River and along the south side of the western third of the Site. The Cahokia Formation was identified at four boring/well locations during the Phase II investigation. The Cahokia Formation, an alluvial deposit of the Kaskaskia River and its tributaries, consists of predominantly clay with some clayey sand and sandy clay intervals. The color of the Cahokia Formation was described for different intervals as black, dark gray to very dark gray-brown, brown, light olive-brown, and dark yellow-brown. At the four boring/well locations at the Site, the Cahokia Formation ranged in thickness from 13 to 27 feet with average and median thicknesses of 20 and 22 feet, respectively. The lowermost and uppermost observed elevations of the Cahokia Formation ranged from 368 to 394 feet NAVD88, with the lowermost elevation observed at boring/well location MW-154, which is located just east of the Kaskaskia River and lies within 13 feet of bedrock.

Although the lithology of the Cahokia Formation is described as a lean to fat clay under the USCS, the percent clay for nine samples that underwent physical testing (**Appendix D**) ranged from 18 to 76 percent, silt ranged from 18 to 47 percent, and sand/gravel ranged from 1 to 54 percent. Average and median percentages of sand/gravel, silt, and clay for the Cahokia Formation samples are summarized in **Table C** below.

Table C. Grain Size Analysis in the Cahokia Formation (*n = 9*)

Grain Size	Sand/Gravel (%)	Silt (%)	Clay (%)
Range	1 – 54	18 – 47	18 – 76
Average	21	32	49
Median	8	29	52

Note: The summary above is based on a total of nine samples collected from the Cahokia Formation materials during the Phase II investigation (NRT, 2014a).
% - percent

2.5.3 Peoria Loess

The Peoria Loess occurs in topographically higher areas and bedrock upland areas and is typically underlain by the Vandalia Till at surface elevations greater than 440 feet NGVD29. The Peoria Loess was identified at seven boring/well locations during the Phase II investigation and one boring/well location during the 2022 HSI. It was categorized as silt and silty clay with a light brown to light gray color and ranged from 5 to 22 feet in thickness with lowermost and uppermost elevations ranging from 406 to 453 feet NAVD88. Based on locations where it was encountered, the average and median thicknesses of the Peoria Loess were 10 and 9 feet, respectively. No physical testing was conducted on this lithologic layer as part of the Phase II investigation (NRT, 2014a).

2.5.4 Equality Formation

The Equality Formation occupies different stratigraphic positions relative to the other lithologic units based on a real location within the Site. Generally, it is the lowermost unlithified geologic layer along the southwestern portion of the Site, where it lies between the Cahokia Formation and bedrock; the uppermost layer at the south-central portion of the Site where the Cahokia Formation pinches out; or, the middle or uppermost unlithified layer in the central portion of the Site, where it is either the uppermost unit above the Vandalia Till or lies between the Vandalia Till and either the Peoria Loess or CCR and fill material.

The Equality Formation was deposited in a slackwater lake formed as a result of backflooding of the Kaskaskia River during flooding events of the Mississippi River. Based on its identification at 11 boring/well locations during the Phase II investigation and three boring/well locations during the 2022 HSI, the Equality Formation consists of predominantly clay with silt and sand, and occasional sand lenses. The color of the Equality Formation was typically described as dark yellow-brown, dark gray-brown, dark brown, and gray. At the locations where it was identified at the Site, the Equality Formation ranged in thickness from 8 to 37 feet with average and median thicknesses of 19 and 18 feet, respectively. The lowermost and uppermost observed elevations of the Equality Formation ranged from 396 to 443 feet NAVD88, with the lowermost elevation observed at boring/well locations MW-150/MW-350, which is located near the southeast corner of the Site, and the highest elevation observed at boring/well locations MW-153/MW-253.

The lithology of the Equality Formation is described as a lean to fat clay and sandy clay under the USCS. The percent clay for five samples that underwent physical testing ranged from 26 to 40 percent, silt ranged from 29 to 62 percent, and sand/gravel ranged from 6 to 37 percent. Average and median percentages of sand/gravel, silty, and clay for the samples are summarized in **Table D** below.

Table D. Grain Size Analysis in the Equality Formation *(n = 5)*

Grain Size	Sand/Gravel (%)	Silt (%)	Clay (%)
Range	6 – 37	29 – 62	26 – 40
Average	24	44	32
Median	30	37	32

Note: The summary above is based on a total of two samples collected from the Equality Formation materials during the Phase II investigation (NRT, 2014a) and three samples collected during the 2022 HSI.
% - percent

2.5.5 Vandalia Till

The Vandalia Till is the lowermost and oldest unlithified geologic material in the vicinity of the Site. The Vandalia Till is a diamicton and occurs beneath the Equality Formation in the central portion of the Site as the Cahokia Formation pinches out and as the topographic and bedrock uplands are approached. At the higher topographic elevations (*i.e.,* bedrock uplands) to the east of the Site and southeast of the Site, the Vandalia Till is the principal unlithified geologic material but may be mantled in some areas by four to six feet of the Peoria Loess.

The Vandalia Till was identified at 15 boring/well locations during the Phase II investigation and four boring/well locations during the 2022 HSI. The Vandalia Till consists of predominantly clay and silty clay with sand and trace gravel. However, in the vicinity of the Site there are some intermittent and discontinuous sand lenses at depths below 20 feet bgs, as observed at boring MW-104DR, where approximately four feet of a fine to medium sand was intercepted at approximately 25 feet bgs. The lowermost portion of the Vandalia Till may become shaley within a few feet of the top of bedrock.

The color of the Vandalia Till has been variously described in the boring logs as light to dark yellow brown, light to dark gray-brown, olive-brown, light to dark gray, and greenish gray. At the 24 locations where it was identified at the Site, the Vandalia Till ranged in thickness from 11 to 37 feet with average and median thicknesses of 19 and 16 feet, respectively. The lowermost and uppermost observed elevations of the Vandalia Till ranged from 369 to 445 feet NAVD88, with the lowermost elevation observed at boring/well locations MW-152/MW-252/MW-352 southeast of the Site, and the highest elevation observed at MW-358 to the east of the Site.

Although the lithology of the Vandalia Till is typically described under the USCS as a lean to fat clay with sand, the percent clay for 11 samples that underwent physical testing ranged from 30 to 87 percent, silt ranged from 38 to 42 percent, and sand/gravel ranged from 0.3 to 44 percent. Average and median percentages of sand/gravel, silty, and clay for the samples are summarized in **Table E** on the following page.

Table E. Grain Size Analysis in the Vandalia Till *(n = 11)*

Grain Size	Sand/Gravel (%)	Silt (%)	Clay (%)
Range	0.3 – 44	38 – 42	30 – 87
Average	15	38	47
Median	13	40	40

Note: The summary above is based on a total of seven samples collected from the Vandalia Till materials during the Phase II investigation (NRT, 2014a) and four from the 2022 HSI.
% - percent

The amount of clay observed and analyzed in the Vandalia Till samples is greater than in the Equality Formation samples and the amount of silt is lower.

2.5.6 Bedrock

The uppermost bedrock at the Site consists of Pennsylvanian and Mississippian bedrock, mainly limestone and shale. Bedrock was intercepted at 37 boring/well locations during the Phase II investigation and the investigation for the Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan dated March 31, 2016 (NRT, 2016b), and 5 locations from the 2022 HSI, the data from which was used to create a bedrock topographic map (**Figure 2-11**). Depth to bedrock at the Site ranges from 12.5 feet at well MW-154 near the Kaskaskia River to approximately 70 feet at piezometer TPZ-168 within East Fly Ash Pond (depth observed prior to completion of cover system within the FAPS).

The bedrock surface reflects the pre-development site topography as shown on the historic topographic map from 1968 (**Figure 2-2**). As evident on **Figure 2-11**, a bedrock low is present at the southwest corner of the Site and extends northeastward. Similarly, the historic topographic map has a stream channel which overlays this bedrock valley. The locations of the Secondary and Tertiary Pond, as shown on the modern topographic map from 2012 (**Figure 2-1**), overlay the former stream channel and the bedrock valley. The Tertiary Pond in the southwest corner of the Site corresponds to the lowest observed bedrock surface elevation (372.6 feet NAVD88). Higher bedrock elevations are present east of the BPP and FAPS as observed at MW-358 (428.6 feet NAVD88). The topographic relief of the bedrock (change in bedrock elevation beneath the Site) is approximately 67 feet. The average westward slope of the bedrock surface across the entire Site, from the bedrock high at MW-358 to the westernmost borings along the Kaskaskia River (MW 154 and MW-355), is approximately 0.006 feet per feet (ft/ft) (32 feet per mile [ft/mi]).

The eastern area of higher bedrock elevations is a bedrock and topographic upland area which borders the lower topography and lower bedrock elevations of the Kaskaskia River valley. The Site lies above this transition zone from the river valley to the upland, which is characterized by a distinct change in topographic elevation, bedrock elevation, unlithified geology, and bedrock geology.

The shallow bedrock transitions from Mississippian-age limestone and shale beneath the western portion of the Site to Pennsylvanian-age limestone and shale beneath the eastern portion of the Site (Willman et al., 1967). The change from Mississippian bedrock to Pennsylvanian bedrock occurs beneath the central portion of the Site, although the two formations were not distinguished based on the samples collected. The shallow bedrock is composed of interbedded and undifferentiated limestone and shale.

Limestones intercepted at the Site are generally light to dark gray, fine-grained, thin bedded, banded, argillaceous, and competent except where weathered. Weathering of the limestone produces a calcareous clay. Limestone layers are often interbedded with thin shale layers and are sometimes fossiliferous or sandy. The shale layers are generally weathered, competent, silty, slightly micaceous, fissile, and dark gray. Where highly weathered shale (*i.e.,* decomposed bedrock) was encountered the shale was non-fissile and resembled an unlithified stiff clay with medium to high plasticity.

2.5.7 Additional Geotechnical Investigations

AECOM (2015) completed a geotechnical investigation that included additional borings that were reported in the 30% Design data package for the ash ponds. The geotechnical exploratory program included the following:

- 26 auger borings and hand auger borings at the BAP and FAPS.
- 82 CPT soundings at the BAP, FAPS, Secondary and Tertiary Ponds.
- 13 vibrating wire piezometers installed at selected boring locations.

The geotechnical exploration locations are shown in **Appendix D** (Figure D-01, AECOM, 2015). Available AECOM (2015) boring, piezometer, and CPT logs are also provided in **Appendix C**.

Representative samples from the borings were submitted to AECOM of Conshohocken, Pennsylvania and Terrasense of Totowa, New Jersey for laboratory testing of the soil samples for geotechnical properties. The AECOM geotechnical laboratory reports are provided in **Appendix D**. No interpretations were made to identify specific formations from which the data was collected as part of the AECOM (2015) geotechnical investigation. However, the majority of the USCS classifications determined in the unlithified materials through AECOM geotechnical laboratory testing were fat clays (CH) or lean clays (CL) (**Appendix D**) consistent with the majority of USCS classifications determined for the unlithified materials from Phase II investigation geotechnical laboratory testing (**Appendix D**).

3. REGIONAL AND LOCAL HYDROGEOLOGY

A detailed investigation of the regional and local hydrogeology of the Site was completed and reported as part of the Phase II investigation (NRT, 2014a). Significant portions of the results of the Phase II investigation, along with the 2022 HSI, are included in this HCR, along with supplemental information (including information sourced from previous investigations and reports identified in **Section 1.3** of this HCR) and updates as needed to satisfy the content requirements specific to 35 I.A.C. § 845.620(b) (Hydrogeologic Site Characterization) for the BAP at BPP.

3.1 Regional Hydrogeology

3.1.1 Unlithified Deposits Hydrogeology

The extent of sand and gravel aquifers in the region are primarily found along the Kaskaskia River Valley where sand and gravel deposits are highly permeable, thick, and extensive. Outside of the Kaskaskia River Valley, the unlithified materials in upland areas are predominantly clay deposits associated with the Equality Formation or the Vandalia Till, which generally provide a low probability of encountering sand and gravel layers for dependable groundwater supply. Although some thin sand seams and layers occur intermittently within the Vandalia Till in localized areas around the BPP, most groundwater supplies in upland areas are obtained from large diameter shallow bored wells. Typical water wells in the vicinity of the BPP are between 25 and 55 feet deep, 36 to 48 inches in diameter, and collect groundwater through slow percolation into the wells, which are large diameter to allow for greater water storage to compensate for the low rate of groundwater infiltration. Some of these bored wells do not intercept sand and gravel seams but rely on obtaining groundwater from sandy clay deposits.

The effective porosities for the types of sediments (diamictons) found in the vicinity of the Site range from 10 to 20 percent (Fetter, 1988). Effective porosity, which is a measure of the pore space thorough which saturated flow can occur, typically ranges from 5 to 20 percent for diamictons (Walton, 1988). Horizontal hydraulic conductivity for silt, clay, and mixtures of sand, silt, and clay typically have horizontal permeability ranging from 10^{-4} to 10^{-7} centimeters per second (cm/s) (United States Department of the Interior [USDI], 1981; Fetter, 1988).

3.1.2 Bedrock Hydrogeology

The Pennsylvanian and Mississippian-aged bedrock in the vicinity of the BPP yield small amounts of water from interconnected pores, cracks, fractures, crevices, joints, and bedding planes. The shallow bedrock is the only water-bearing unit that is continuous across the Site. Shallow sandstone and creviced limestone may yield small supplies in some areas, but water quality becomes poorer (*i.e.,* highly mineralized) with increasing depth. The Pennsylvanian and Mississippian rocks generally have low porosities and permeabilities, are not a reliable source of groundwater, and the quality varies considerably (Pryor, 1956).

Groundwater in the Pennsylvanian and Mississippian-aged bedrock mainly occurs under semi-confined to confined conditions, with the overlying unlithified unit behaving as the upper confining unit to the bedrock. Water moves primarily through secondary openings such as fractures and joints or secondary solution channels in limestones. Recharge takes place through the overlying Quaternary deposits (Student et al., 1981; Lloyd and Lyke, 1995). The regional direction of groundwater flow in these rocks is not known directly, but is assumed to be towards the Kaskaskia River Valley, with groundwater moving upward from the Pennsylvanian and Mississippian rocks to the surficial unlithified deposits and the Kaskaskia River.

The porosity of shale typically ranges from 1 to 20 percent (Walton, 1988). Representative horizontal field hydraulic conductivity (permeability) for shale typically ranges from 5 x 10^{-10} to 5 x 10^{-6} cm/s. Representative aquitard field permeability ranges for shale, which is defined as the rate of vertical flow of water through a unit horizontal cross-sectional area of the aquitard, are 5 x 10^{-12} to 5 x 10^{-8} cm/s. The porosity of limestone is much more variable than shale, ranging from 5 to 55 percent. Representative horizontal field hydraulic conductivity for limestone also has a wide range as a result of secondary openings, with values from 9 x 10^{-7} to 9 x 10^{-1} cm/s (Walton, 1988).

3.2 Site Hydrogeology

The following is a presentation of the results of the Phase II investigation (NRT, 2014a) and 2022 HSI as they relate to Site hydrogeology, including tables which summarize the data collected during the investigations. Supplemental information and updates are included as necessary.

3.2.1.1 Hydrostratigraphic Units

Three distinct water-bearing units have been identified in the vicinity of the BAP based on stratigraphic relationships and common hydrogeologic characteristics. The units are described as follows from the surface downward:

- **CCR**: CCR, consisting primarily of fly ash, bottom ash, and boiler slag. Also includes earthen fill deposits of predominantly clay and silt materials from on-site excavations that were used to construct berms and roads surrounding the various impoundments across the Site. The overall (geometric mean) horizontal and vertical hydraulic conductivity for the CCR determined during the Phase II and 2022 HSIs are 1.5 x 10^{-2} cm/s and 4.1 x 10^{-5} cm/s, respectively (**Table 3-1**). Horizontal and vertical hydraulic conductivities for this unit determined during the Phase II and 2022 HSIs ranged from 8.1 x 10^{-4} to 1.1 x 10^{-1} cm/s and 5.6 x 10^{-7} to 6.5 x 10^{-4} cm/s, respectively.
- **UU**: Predominantly clay with some silt and minor sand, silt layers, and occasional sand lenses. Includes the lithologic layers identified as the Cahokia Formation, Peoria Loess, Equality Formation, and Vandalia Till. This unit is composed of unlithified natural geologic materials and extends from the upper saturated materials to the bedrock. As observed in the field, one or more of these four lithologic units may be present at a particular soil boring location; and the observed lithologic unit(s) may or may not be saturated depending on the location at the Site. Given that these units are not consistently in contact with groundwater, this unit was renamed from UGU used in previous reports to UU. The term UU is synonymous with UGU used in previous documents. The overall (geometric mean) horizontal and vertical hydraulic conductivities for this unit determined during the Phase II and 2022 HSIs are 2.9 x 10^{-5} cm/s and 3.5 x 10^{-7} cm/s, respectively (**Table 3-1**). Horizontal and vertical hydraulic conductivities for this unit determined during the Phase II and 2022 HSIs ranged from 3.5 x 10^{-7} to 6.8 x 10^{-4} cm/s and 6.3 x 10^{-9} to 4.2 x 10^{-4} cm/s, respectively. Thin sand seams and the interface (contact) between the UU and bedrock have been identified as PMPs. The sand seams may act as a PMP due to relatively higher hydraulic conductivities (on the order of 10^{-4} cm/s) than the surrounding clays (on the order of 10^{-5} cm/s). The contacts between the unlithified material and bedrock have also been identified as PMPs where

horizontal hydraulic conductivity data in Site monitoring wells with screens and/or filter packs across or immediately above the bedrock range from 3 x 10^{-7} to 6 x 10^{-4} cm/s and have a geometric mean horizontal hydraulic conductivity of 2 x 10^{-5} cm/s.

- **Bedrock Unit**: This unit is composed of interbedded shale and limestone bedrock, which underlies and is continuous across the entire Site and has been identified as the UA. The horizontal hydraulic conductivity for this unit determined during the Phase II and 2022 HSIs ranges from 2.4 x 10^{-7} to 3.5 x 10^{-5} cm/s with a geometric mean of 1.9 x 10^{-6} cm/s (**Table 3-1**).

3.2.1.2 Uppermost Aquifer

Off-site, immediately upgradient and downgradient of the BPP property boundaries, both the shallow glacial deposits and the shallow bedrock have served as a source of water supply; see water well survey results in **Section 5.1** of this HCR. The shallow unlithified deposits off-site have yielded water through intermittent, discontinuous sand lenses and, in the bedrock, through fractured sandstone and limestone. In general, within the boundaries of the Site, the UU (shallow unlithified deposits) consists of low permeability clays and silts. Within the UU, only thin and intermittent sand lenses are present within predominantly clay deposits; thus, the unlithified materials do not represent a continuous aquifer unit. Thin, non-continuous sandy deposits (*i.e.,* PMPs) that exist across the Site do not appear to extend to the FAPS and BAP as evidenced by soil borings adjacent to the CCR units in which no sand was observed.

Based on the above, the Bedrock Unit is the only viable aquifer in the vicinity of the Site and was designated as the UA in the Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan (NRT, 2016b), consistent with the USEPA definition in 40 C.F.R. § 257.53 (USEPA, 2015).

The UA at the Site is the shallow Pennsylvanian and Mississippian-aged bedrock that immediately underlies the unlithified deposits. The shallow bedrock yields water through interconnected secondary porosity features (*e.g.,* cracks, fractures, crevices, joints, bedding planes, and other secondary openings). The shallow bedrock is the only water-bearing unit that is continuous across the Site. Groundwater in the Pennsylvanian and Mississippian-aged bedrock mainly occurs under semi-confined to confined conditions with the overlying unlithified unit behaving as the upper confining unit to the UA.

Water quality in the UA (*i.e.,* Pennsylvanian and Mississippian-aged bedrock) decreases with increasing depth as water becomes increasingly mineralized (Pryor, 1956). Further, the ability of the unit to store and transmit water is dependent on the density of bedrock features that contribute to secondary porosities and whether those features are interconnected enough to yield water. Therefore, the lower limit of the UA is the depth at which either the groundwater is mineralized to a point that it is no longer a useable water source, or the secondary porosities do not yield a sufficient volume of groundwater to produce a useable water supply.

3.2.1.3 Potential Migration Pathways

As part of the Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan (NRT, 2016b), an investigation within the unlithified materials was performed to further evaluate the potential presence of sand layers that could represent PMPs. Eleven borings (PZ-169 through PZ-178, and PZ-182) were completed during July and August 2015 as shown on **Figure 2-5**. Borings typically extended to bedrock where monitoring wells with 10-foot screens were installed. Boring depths ranged from 14 to 50 feet bgs. Three additional borings (MW-192, MW-193, and MW-194) from the 2022 HSI were used to further delineate potential PMP's along the north side of the BAP during the 2022 HSI. These borings were converted into monitoring wells across the PMP layers with 10 foot screens, where screened depths range from 18 to 32 feet bgs. The boring logs and piezometer installation details are provided in **Appendix C**.

The location of sand seams observed, as well as their thickness and base elevation based on all borings performed within the unlithified materials, are shown on **Figure 3-1**. Thin sand seams (less than 2.1 feet thick) adjacent to the BAP were identified at locations MW-383, OW-256, PZ-182, and TPZ-159. New locations MW-192, MW-193, and MW-194 (adjacent to the BAP) contained thin sand seems ranging from 2.1 to 3.5 feet thick. Based on available field hydraulic conductivity testing results from monitoring wells OW-256, MW-192, and MW-193 located downgradient of the BAP and screened across a thin sand seam, the horizontal hydraulic conductivity of the sand seams may be on the order of 10^{-4} cm/s and represent PMPs adjacent to the BAP.

Sand seams appear randomly disseminated across the Site and range from a single locally continuous unsaturated sand seam up to 7.9 feet in thickness to isolated, discontinuous thin seams of 0.2 to 1 feet in thickness. Two overlapping sand seams that appear to be continuous between adjacent borings occur to the west of the Secondary Pond (**Figure 3-1**) and are vertically separated by at least 6 feet of clay. The shallower sand seam at elevations between 395 to 403 feet NAVD88 is not saturated. These sand seams do not extend to the FAPS and BAP as evidenced by several borings in which no sand was observed. The sand seams may act as a PMP due to relatively higher hydraulic conductivities (on the order of 10^{-4} cm/s) than the surrounding clays (on the order of 10^{-5} cm/s).

In addition to the sand seams identified adjacent to the BAP, the contacts between the unlithified material and bedrock have been identified as PMPs, where horizontal hydraulic conductivity data in Site monitoring wells with screens and/or filter packs across or immediately above the bedrock range from 3 x 10^{-7} to 6 x 10^{-4} cm/s and have a geometric mean horizontal hydraulic conductivity of 2 x 10^{-5} cm/s.

3.2.2 Water Table Elevation and Groundwater Flow

Based on elevation measurements which include measurements collected from wells installed as part of the 2022 HSI, lateral groundwater flow in the shallow unlithified materials is generally to the west and southwest across the Site in 2023 as illustrated in the January and March UU potentiometric maps (**Figures 3-2 and 3-3**). General groundwater flow direction is west toward the Kaskaskia River (*i.e.,* regional receiving body). Similar to groundwater flow in the shallow unlithified materials, flow direction in the bedrock is generally to the west and southwest across the Site in 2023 as illustrated in the January and March UA potentiometric surface maps (**Figures 3-4 and 3-5**). Groundwater flow in bedrock is northwest in the east and central areas of the BAP, and southwest to northwest on the east area of the FAPS (Old East Fly Ash Pond) until groundwater reaches the bedrock valley feature underlying the Secondary and Tertiary Ponds west of the BAP and FAPS, at which point the flow direction veers toward this bedrock surface low. Additional potentiometric surface maps are located in Figures 3-2 to 3-9 of the initial HCR (Ramboll, 2021) and included in **Appendix E** of this HCR. The minimum piezometric heads in the unlithified and bedrock wells occurred most frequently in the September 2020 event. The maximum piezometric heads in the unlithified and bedrock wells occurred most frequently in the

March 2020 event. Seasonal variation in piezometric heads, illustrated in the groundwater elevation hydrograph (**Figure 3-6**), at each monitoring location was generally within a range of less than 7 feet during 2020 with the exception of three monitoring locations where seasonal variation among piezometric heads was between 9 and 12 feet. The piezometric head at locations MW-252 and MW-352 were above the ground surface during all monitoring events. Piezometric head measured at shallow unlithified location MW-152 was above ground surface during the first quarter of the 2020 monitoring event. Piezometric heads in 2020 ranged between approximately 370 and 450 feet NAVD88, although flow directions are generally consistent.

3.2.2.1 Vertical Hydraulic Gradient

Vertical hydraulic gradients were calculated based on available groundwater elevation data during the March 2017 to February 2023 monitoring period at nested well pairs both within the unlithified deposits (shallow and deep) and between the unlithified deposits and bedrock (**Table 3-2**). Vertical gradients within the UU vary from confined with strong upward gradients (including artesian conditions) to semi-confined conditions with both upward and downward gradients. Vertical gradients between the bedrock and the UU also vary in direction and strength. Detailed results of the vertical hydraulic gradient calculations used to evaluate confining conditions across the Site are presented below:

- UU:
  - Groundwater within Vandalia Till upgradient of the Site is under confined to semi-confined conditions based on mostly upward vertical gradients observed at nested wells MW-104SR/MW-104DR, with the exception of two events which had downward vertical gradients and two events which had flat vertical gradients. The average vertical gradient for all events, including the two events where downward vertical gradients and two events where flat vertical gradients were observed, was 0.003 ft/ft. The average for only the events where upward vertical gradients were observed was also -0.003 ft/ft.
  - Groundwater within Vandalia Till southeast of the Site is under semi-confined conditions based on variable upward and downward vertical gradients observed at nested wells MW-153/MW-253.
  - Groundwater within the Equality Formation and Vandalia Till south of the central portion of the Site is under confined conditions based on consistent upward vertical gradients observed between MW-152 and MW-252, with the exception of December 2021 and September 2022 where vertical gradients were downward. The average vertical gradient for all events, including the two events where downward vertical gradients were observed, was -0.125 ft/ft. The average for only the events where upward vertical gradients were observed was -0.138 ft/ft.
  - Flowing artesian conditions (*i.e.,* groundwater elevations above ground surface) were observed at MW-152 in March 2022, and MW-252 during the March 2017 to December 2023 monitoring period, with the exception of December 2021 and September 2022.
- Bedrock and UU:
  - Groundwater within Vandalia Till and bedrock upgradient of the Site is under confined to semi-confined conditions based on variable upward and downward vertical gradients observed at nested wells MW-104DR/MW-304 and downward vertical gradients observed at MW-158R/MW-258.

- Groundwater within Vandalia Till and bedrock south of the central portion of the Site (MW-252 and MW-352) had consistent downward vertical gradients (with the exception of March and December 2021).
- Flowing artesian conditions were observed at MW-252 from March 2017 to December 2022 (with the exception of December 2021 and September 2022) and at MW-352 intermittently from March 2017 to December 2022.
- Groundwater within the Cahokia Formation and bedrock to the far southwest or far west (off-site) at nested wells MW-150/MW-350 and MW 155/MW-355, respectively, had mostly downward vertical gradients with some observations of upward gradients. The nested well pairs MW-150/MW-350 and MW-155/MW-355 are located in areas where semi-confined conditions may occur near receiving surface water bodies adjacent to the Site (*i.e.,* southwest of the Tertiary Pond) or the Kaskaskia River, respectively.
- Groundwater within the Equality Formation and bedrock located in the northwest area of the BAP (nested wells OW-156/MW-356) at the downgradient end of the CCR unit is under confined to semi-confined conditions based on consistent upward vertical gradients, with the exception of slight downward gradient (0.010 ft/ft) observed during March 2020, 2021, and 2022.
- Groundwater within the Equality Formation and bedrock located immediately north of the BAP (well nests MW-192/MW-392, MW-193/MW-393, MW-194/MW-394) transitions from confined to semi-confined conditions from west to east on the north boundary of the BAP based on upward vertical gradients west (well nest MW-194/MW 394) and variable upward and downward vertical gradients east (well nests MW-192/MW-392, and MW-193/MW-393).
- Groundwater within the Equality Formation and bedrock immediately adjacent to the central portion of the BAP (well nests PZ-170/MW-370 and PZ-182/MW-382,) is under semi-confined conditions due to slightly downward vertical gradients (with the exception of the March 2023 upward event at the PZ-182/MW-382 nest).

3.2.2.2 Groundwater Flow and Existing Ponds

The existing ponds, including the FAPS, BAP, Secondary Pond, and Tertiary Pond, do not appear to be altering groundwater flow direction in the UU or Bedrock Unit (*i.e.,* UA). The Site ponds are underlain by low vertical permeability materials, predominantly clay with some silt and minor sand, silt layers, and occasional sand lenses (vertical permeability geometric mean on the order of 10^{-7} cm/s, which is near the typical maximum specified hydraulic conductivity for compacted soil liners (*i.e.,* hydraulic conductivity no more than 1×10^{-7} cm/s) followed by lower permeability bedrock (representative vertical permeabilities for shale range from 5×10^{-12} to 5×10^{-8} cm/s). The flat horizontal groundwater gradient beneath the Site, described in **Section 3.2.2.4**, and the mostly upward vertical gradients (with some inconsistent upward/downward vertical gradients or flowing artesian conditions observed in the UU and Bedrock Unit, described in **Section 3.2.2.1**) suggests the BAP and neighboring ponds are not areas of increased recharge or infiltration. The primary influence of groundwater flow direction in the UU and Bedrock Unit is flow toward the receiving surface water bodies and localized bedrock topographic lows.

3.2.2.3 Fill and CCR Saturation

The extent of saturated fill and CCR is variable both laterally and temporally within the BAP and FAPS. Recent water levels collected from BAP piezometer TPZ-164 indicate a saturated fill and CCR thickness ranging from 7.75 feet in November 2022 to 1.61 feet in January 2023. Five additional porewater wells were installed in the BAP as part of the 2022 HSI, of which XPW05 (located in the center of the BAP) had the largest saturated thickness of fill and CCR which was approximately 26.5 feet in November 2022. XPW02 (located on the north side of the BAP) had the smallest saturated fill and CCR thickness, which was approximately 1.6 feet in January 2023. Additional saturated fill and CCR thicknesses for the other porewater wells in the BAP are provided in **Table F** below. Analytical results of porewater samples collected from within the BAP at the five additional porewater wells installed as part of the 2022 HSI are also found in **Table 3-3**. Supplemental porewater quality monitoring at TPZ-164, XPW01, XPW02, XPW04, XPW05, and XPW06, located within the BAP, was completed in support of the 40 C.F.R. § 257 ASD (Ramboll, 2023c).

Table F. Fill and CCR Saturation in the BAP CCR Unit (2022-2023)

Piezometer	CCR Unit / Multi-Unit or Pond Location	Fill and CCR Thickness (feet)	Water Level above Base of CCR Unit / Multi-Unit or Pond Location (feet)			
			October 25, 2022	November 14, 2022	December 12, 2022	January 10, 2023
TPZ-164	BAP (CCR Unit)	9.1	7.7	7.8	7.7	1.6
XPW01	BAP (CCR Unit)	11.9	2.9	3.5	3.8	4.4
XPW02	BAP (CCR Unit)	11	9.0	9.7	9.6	1.6
XPW04	BAP (CCR Unit)	16.5	12.7	12.5	12.4	12.7
XPW05	BAP (CCR Unit)	28.2	26.5	26.5	26.5	--
XPW06	BAP (CCR Unit)	9.9	7.0	6.9	6.9	7.1

3.2.2.4 Horizontal Groundwater Hydraulic Gradients

Horizontal groundwater hydraulic gradients were calculated using available groundwater elevation data at well pairs located along groundwater flow paths and groundwater elevation contour maps (including **Figures 3-2 through 3-5** and those found in **Appendix E**) between March 2020 and March 2023 and presented in **Table 3-4**. Horizontal hydraulic gradients vary temporally and spatially across the Site, where average values in the shallow unlithified materials (*i.e.,* UU) in several areas across the Site ranged from 0.004 to 0.015 feet per foot/feet (ft/ft), and average values in the Bedrock Unit (*i.e.,* UA) in several areas across the Site ranged from 0.003 to 0.017 ft/ft.

- In the western area of the FAPS, average horizontal hydraulic gradients in the shallow unlithified materials and bedrock were 0.015 and 0.016 ft/ft, respectively, and ranged from 0.013 to 0.017 ft/ft and 0.010 to 0.021 ft/ft, respectively, as groundwater flowed from east to west across the FAPS.
- Between monitoring wells in the northeastern portion of the BAP, average horizontal hydraulic gradients in the shallow unlithified materials and bedrock were 0.004 and 0.003

ft/ft, respectively, and ranged from 0.004 to 0.005 ft/ft and were 0.003 ft/ft, respectively, as groundwater flowed southeast to northwest across the BAP.

- In the east and central portions of the BAP average horizontal gradient was 0.012 ft/ft in the bedrock unit and ranged from 0.009 to 0.016 ft/ft, as groundwater flowed from east to west across the BAP.
- Between monitoring wells in the western portion of the BAP, average horizontal hydraulic gradients in the shallow unlithified materials and bedrock were 0.011 and 0.017 ft/ft, respectively, and ranged from 0.010 to 0.011 ft/ft and 0.017 to 0.018 ft/ft, respectively, as groundwater flowed northeast to southwest across the BAP.

3.2.2.5 Horizontal Groundwater Velocity

Horizontal groundwater velocities were calculated between March 2020 and March 2023 and presented in **Table 3-4** using horizontal hydraulic gradients described in **Section 3.2.2.4**. Groundwater velocities vary temporally and spatially across the Site, where average values in the shallow unlithified materials (*i.e.,* UU) in several areas across the Site ranged from 0.0023 to 0.0082 feet per day (ft/d), and average values in the Bedrock Unit (*i.e.,* UA) in several areas across the Site ranged from 0.0001 ft/d to 0.0003 ft/d. In general, groundwater velocities were an order of magnitude less in the bedrock than in the shallow unlithified materials, and less variable spatially and temporally.

- In the western area of the FAPS, average groundwater velocities in the shallow unlithified materials and bedrock were 0.0082 and 0.0003 ft/d, respectively, and ranged from 0.0074 to 0.0093 ft/d and 0.0002 to 0.0004 ft/d, respectively, as groundwater flowed from east to west across the FAPS.
- Between monitoring wells in the northeastern portion of the BAP, average groundwater velocities in the shallow unlithified materials and bedrock were 0.0023 and 0.0001 ft/d, respectively, and ranged from 0.0020 to 0.0030 ft/d and were 0.0001 ft/d, respectively, as groundwater flowed southeast to northwest across the BAP.
- In the east and central portions of the BAP average groundwater velocity was 0.0002 ft/d in the bedrock unit and ranged from 0.0002 to 0.0003 ft/d, as groundwater flowed from east to west across the BAP.
- Between monitoring wells in the western portion of the BAP, average groundwater velocities in the shallow unlithified materials and bedrock were 0.0058 and 0.0003 ft/d, respectively, and ranged from 0.0056 to 0.0062 ft/d and were 0.0003 ft/d, respectively, as groundwater flowed northeast to southwest across the BAP.

3.2.3 Hydraulic Conductivity

3.2.3.1 Field Hydraulic Conductivity

Field hydraulic conductivity tests performed on the UU materials (*i.e.,* Cahokia Formation, Equality Formation, and Vandalia Till) and UA materials (*i.e.,* Mississippian and Pennsylvanian bedrock) at the Site were presented in the Phase II investigation (NRT, 2014a). Additional field hydraulic conductivity tests were performed as part of the 2022 HSI (**Appendix F**), and the results from both of these investigations are summarized in **Table 3-1**. Field measurements indicated that the horizontal hydraulic conductivity for the UU ranged from 3.5×10^{-7} to 6.8×10^{-4} cm/s, with a geometric mean of 2.9×10^{-5} cm/s. Based on field testing, the horizontal hydraulic conductivity for the UA (*i.e.,* Bedrock Unit) ranged from 2.4×10^{-7} to 3.5×10^{-5} cm/s, with a geometric mean of 1.9×10^{-6} cm/s.

3.2.3.2 Laboratory Hydraulic Conductivity

Laboratory vertical hydraulic conductivity tests (ASTM D 5084) performed on the Fill Unit materials (three fly ash and one bottom ash) and UU (*i.e.,* Cahokia Formation, Equality Formation, and Vandalia Till) materials at the Site were presented in the Phase II investigation (NRT, 2014a). Additional laboratory vertical hydraulic conductivity tests were performed on the Fill Unit (three bottom ash) and UU (one Vandalia and three Equality Formation) as part of the 2022 HSI. Laboratory test results are found in **Appendix D**. The vertical hydraulic conductivity test results from these investigations are summarized in **Table 3-1**. Laboratory measurements indicated that the vertical hydraulic conductivity for the Fill Unit ranged from 5.6×10^{-7} to 6.5×10^{-4} cm/s, with a geometric mean for all seven samples of 4.1×10^{-5} cm/s. TPZ-167 at 29 to 30 feet bgs, which was remolded in the laboratory, had the lowest hydraulic conductivity measurement in the samples collected during the Phase II investigation with a value of 9.7×10^{-6} cm/s. Excluding the one deeper fly ash sample that was remolded, the remaining ash samples (two fly ash and four bottom ash) had a median permeability of 1.5×10^{-4} cm/s. The ash samples had particle sizes equivalent to silty clayey sand, silt, sandy silt, silty sand, and sand. The ash sample from TPZ-167 was the only deeper sample and had the smallest particle size range, which would correlate to the lower hydraulic conductivity value. Laboratory measurements indicated that the vertical hydraulic conductivity for the UU ranged from 6.3×10^{-9} to 4.2×10^{-4} cm/s, with a geometric mean of 3.5×10^{-7} cm/s for all twelve samples.

Six falling head permeability tests (ASTM D5084 Method F) were performed in the laboratory on undisturbed soil samples collected from the AECOM (2015) geotechnical borings BAL-B001, BAL-B008, BAL-B010, BAL-B011, BAL-B017 and BAL-B027. Sample locations are shown in **Appendix C** (AECOM Figure D-01). Available AECOM (2015) boring, piezometer, and CPT logs are also provided in **Appendix C**. Test methods and details are provided in **Appendix D** and the results are summarized in **Table H** below.

Table H. AECOM (2015) Laboratory Vertical Hydraulic Conductivity Results

Boring Number	Sample Description	Sample Depth (feet)	Hydraulic Conductivity (cm/s)
BAL-B001	Medium stiff, moist, pale gray with orange mottling, medium plasticity Lean CLAY (CL), trace fine gravel. [TILL]	35.6	1.3×10^{-8}
BAL-B008	Very stiff, moist, light brown with orange and gray mottling, low plasticity Silty CLAY (CL). [FILL/FLY ASH]	10.8	5.5×10^{-9}
BAL-B010	Stiff, moist to wet, gray, Silty CLAY (CL), iron staining, trace sand and clay. [LOESS]	21.3	2.4×10^{-6}
BAL-B011	Stiff, moist, gray with faint orange mottling, low plasticity Silty CLAY (CL). [FILL/FLY ASH]	15.2	1.8×10^{-9}
BAL-B017	Stiff, gray, medium plasticity CLAY (CL). [RESIDUAL]	26.7	1.7×10^{-8}
BAL-B027	Stiff, moist to wet, gray, Lean CLAY (CL), with silt and fine sand, trace gravel, iron staining. [TILL]	26.9	5.0×10^{-9}

3.2.4 Groundwater Classification

The classification of groundwater at the Site was addressed in the Phase II investigation (NRT, 2014a). Field hydraulic conductivity tests performed on the UU materials (*i.e.,* Cahokia Formation, Equality Formation, and Vandalia Till) and Bedrock Unit materials (*i.e.,* Mississippian and Pennsylvanian bedrock) as part of the Phase II and 2022 HSI had geometric mean hydraulic conductivities of 2.9 x 10^{-5} cm/s and 1.9 x 10^{-6} cm/s, respectively.

Geologic material with a hydraulic conductivity of less than 1 x 10^{-4} cm/s which does not meet the provisions of 35 I.A.C. § 620.210 (Class I), 35 I.A.C. § 620.230 (Class III), or 35 I.A.C. § 620.240 (Class IV), meets the definition of a Class II – General Resource Groundwater (35 I.A.C. § 620.220). Based on the detailed geologic information provided for the unlithified materials and bedrock at BPP, along with the hydrogeologic data, the groundwater in both the unlithified deposits and underlying bedrock at the Site is classified as Class II - General Resource Groundwater.

3.2.5 Surface Water Hydrology

3.2.5.1 Climate

Average climatic data was obtained from the Illinois State Water Survey (ISWS). The data was recorded between 1981 and 2010 from Belleville, Illinois, which is located approximately twenty-five miles northwest of the BPP. The data includes monthly maximum and monthly minimum daily temperatures (degrees Fahrenheit [°F]) and average rainfall for each month calculated from daily values collected over the 29-year period. The data is summarized in **Table I** below.

Table I. Average Monthly Temperature Extremes and Precipitation for Belleville, Illinois

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual
Maximum Temperature (°F)	42.7	47.6	58.6	69.6	78.4	87.1	90.7	89.8	83.0	72.2	58.5	45.1	68.7
Minimum Temperature (°F)	23.0	26.5	35.5	45.9	55.7	64.4	58.0	65.5	56.3	45.7	36.5	26.5	45.9
Precipitation (inches)	2.29	2.24	3.20	3.86	4.90	4.26	4.05	3.30	3.28	3.44	3.92	2.91	41.65
https://www.isws.illinois.edu/statecli/newnormals/normals.USW00013802.txt													

3.2.5.2 Surface Waters

A survey to identify surface water features was conducted for a 1,000-meter radius around the BAP as shown in **Appendix B**. Based on an ESRI Geographic Information System (GIS) database layer which presents the detailed water bodies (*e.g.,* lakes, reservoirs, large rivers, and swamps) in the United States provided by the United States Fish and Wildlife Service (USFWS) there are approximately 28 surface water features within a 1,000-meter radius around the BAP, where 14 of the features are located hydraulically downgradient of the BAP. The identified surface water features within a 1,000-meter radius around the BAP are shown and tabulated along with their distance from the unit, physical orientation to the unit, and approximate hydraulic orientation to the unit in **Appendix B**. The predominant surface water bodies in the regional study area include the Mississippi River, Kaskaskia River, and Cooling Pond. The Mississippi River is located approximately 25 miles west of the Site. The Kaskaskia River borders the BPP property to the west, and the Cooling Pond borders the Site to the north (**Figure 1-2**). The regional drainage features of the Kaskaskia River exhibit a predominantly dendritic drainage pattern.

The Cooling Pond is 2,018 acres and was constructed with an 8-mile levee within the Kaskaskia River bottomland. The Cooling Pond began use in 1967 and was completed and filled in 1970. It is a perched cooling pond in that it is semi-isolated hydrologically from the natural drainage features, surface water and groundwater, of the area. The average depth of the Cooling Pond is approximately 8 feet; however, old creek channels and ponds provide areas of 20 to 50 feet in depth. The lake is filled by water pumped from the Kaskaskia River, supplemented by natural precipitation onto the surface of the lake. The pond level is generally maintained at approximately 429 to 430 feet NGVD29. Excess water from the Cooling Pond flows via a 3,250-foot-long man-made channel from its southwest corner to the Kaskaskia River. Discharge from the Cooling Pond to the Kaskaskia River is regulated as part of the BPP's NPDES discharge permit (No. IL0000043).

A USGS stream gage (USGS 05595240) is located on the Kaskaskia River to the west of the Site (Latitude 38°11'39", Longitude 89°53'17" NAD27). Daily gage heights (Datum of gage: 300.00 feet above NGVD29) for the period of January 1, 2017 through June 1, 2023 are provided in **Figure A** below.

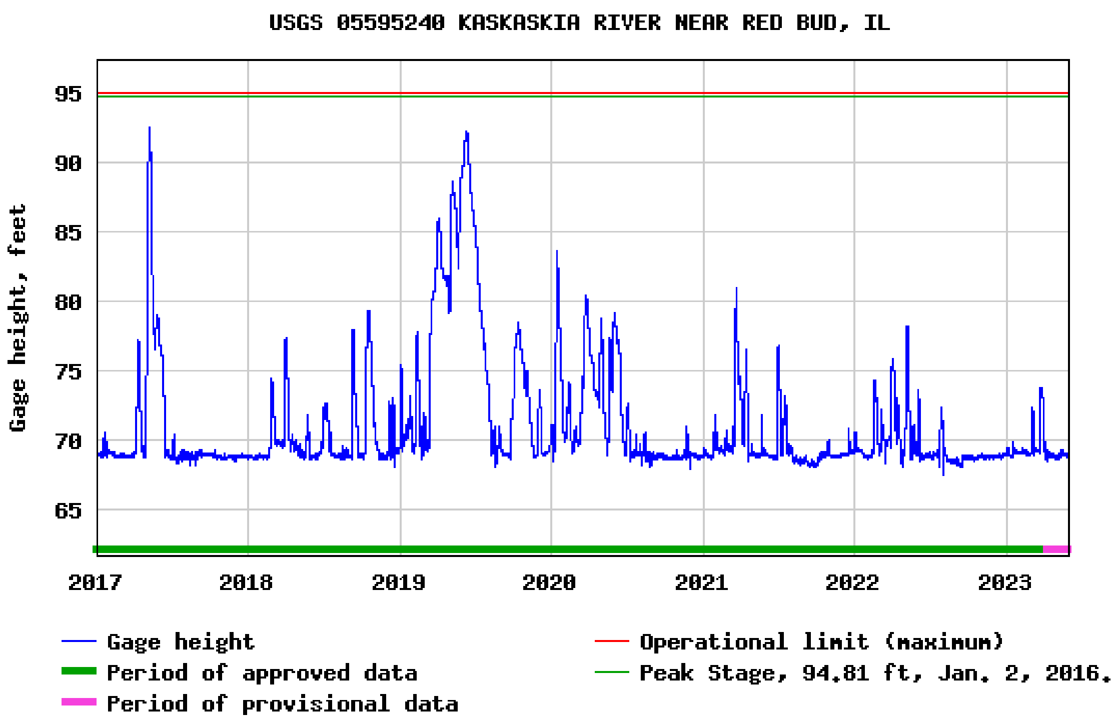

Figure A. Daily Gage Height (feet) January 1, 2017 to June 1, 2023 for USGS Gaging Station 05595240 at the Kaskaskia River Near Red Bud, Illinois

A Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map for Randolph County (Map number 17157C0075D date effective 11/15/2008) is attached in **Appendix G** and can also be viewed online at: https://www.illinoisfloodmaps.org/dfirm.aspx. A portion in the west area of the BAP impoundment is located within Zone A. The flood hazard areas shown on the map are defined as those areas subject to inundation by the 1 percent annual chance flood (*i.e.,* 100-year flood), also known as the base flood, which has a 1 percent chance of being equaled or exceeded in any given year. No base flood elevation has been established for this area.

4. GROUNDWATER QUALITY

4.1 Summary of Groundwater Monitoring Activities

4.1.1 IEPA Program Monitoring

Historically, the NPDES Permit No. IL0000043 (effective January 1, 2015) required quarterly sampling from 14 Site monitoring wells for laboratory and/or field parameters listed in Special Condition No. 17 of the NPDES Permit. Effective November 1, 2022, the NPDES permit no longer requires sampling of groundwater monitoring wells. Groundwater monitoring results, through December 2022, from sampling of the 14 wells were reported to IEPA annually in accordance with the NPDES Permit. Of the 14 wells monitored as part of the NPDES Permit monitoring, only MW-156 and MW-157S are located downgradient of the BAP. The results of NPDES Permit monitoring at wells MW-156 and MW-157S are not included in the discussion below (**Section 4.2**) as the required NPDES Permit monitoring parameters at these wells (specific conductance, temperature, depth to water, elevation of monitoring point, and elevation of groundwater surface) are not included in the list of 35 I.A.C. § 845.600 parameters with groundwater GWPSs.

Closure Plan groundwater monitoring was also initiated for the FAPS in the third quarter of 2016 following the approval of the FAPS Closure Plan by IEPA in a letter to the Dynegy Operating Company dated August 16, 2016. Seventeen monitoring wells are monitored in accordance with the approved GMP. In accordance with the CCA, once quarterly groundwater monitoring commences (Second quarter of 2023), the groundwater monitoring and reporting performed under Section 6 of the Supplemental Hydrogeologic Site Characterization Report and the FAPS Groundwater Monitoring Plan contained in the approved Closure Plan will cease.

Groundwater quality data was not collected from piezometers (PZ-169 through PZ-178 and PZ-182) installed as part of the 2015 investigation to evaluate the potential presence of sand layers that could represent PMPs described in **Section 3.2.1.3**. As described in **Section 3.2.1.3**, sand seams observed in the unlithified materials (**Figure 3-1**) appear randomly disseminated across the Site, and no continuous sand seams were observed within or immediately adjacent to the Site.

4.1.2 40 C.F.R. § 257 Program Monitoring

The 40 C.F.R. § 257 well network for the BAP is being revised and expanded in July of 2023, concurrent with the revisions to the 35 I.A.C. § 845 monitoring well network provided in this document. As described in Revision 1 of the 40 C.F.R. § 257 groundwater monitoring plan (Ramboll, 2023c), the well network consists of the same 16 monitoring wells (three background and 13 compliance) used to monitor and evaluate groundwater quality in the 35 I.A.C. § 845 monitoring well network described in **Section 4.1.3**.

The boring logs, well construction forms, and other related monitoring well forms are available in the Operating Records as required by 40 C.F.R. § 257.91 for each monitored CCR Unit or CCR Multi-Unit and are included in **Appendix C** of the HCR.

Assessment monitoring in accordance with 40 C.F.R. § 257.95 was initiated on April 9, 2018. Details of the procedures and techniques used to fulfill the groundwater sampling and analysis program requirements are found in the Multi-Site Sampling and Analysis Plan (SAP) (Ramboll, 2022a).

Groundwater samples are collected semiannually and analyzed for the following laboratory and field parameters from Appendix III and Appendix IV of 40 C.F.R. § 257, summarized in **Table J** below.

Table J. 40 C.F.R. § 257 Groundwater Monitoring Program Parameters

Field Parameters[1]			
Groundwater Elevation	pH		
Appendix III Parameters (Total, except total dissolved solids **[TDS])**			
Boron	Chloride	Sulfate	
Calcium	Fluoride	TDS	
Appendix IV Parameters (Total)			
Antimony	Cadmium	Lithium	Selenium
Arsenic	Chromium	Mercury	Thallium
Barium	Cobalt	Molybdenum	Radium 226 and 228 combined
Beryllium	Lead		

[1] Dissolved oxygen, temperature, specific conductance, oxidation/reduction potential, and turbidity are recorded during sample collection.

4.1.2.1 BAP 40 C.F.R. § 257 Monitoring and Corrective Action Program Status

Groundwater is being monitored at the BAP in accordance with the Assessment Monitoring Program requirements specified in 40 C.F.R. § 257.95. Assessment Monitoring was initiated at the BAP on April 9, 2018. The BAP remains in Assessment Monitoring as of August 1, 2023.

4.1.3 35 I.A.C. § 845 Well Installation and Monitoring`

The proposed 35 I.A.C. § 845 monitoring well network consists of ten monitoring wells (MW-304, MW-306, MW-356, MW-358, MW-369, MW-370, MW-382, MW-392, MW-393, and MW-394) screened in the bedrock (*i.e.,* UA), six monitoring wells (MW-192, MW-193, OW-256, OW-257, PZ-170, and PZ-182) screened in the unlithified materials (*i.e.,* UU), and four temporary (pending implementation of impoundment closure) water level only pore water locations (TPZ-164, XPW01, XPW05, and XPW06). Sixteen wells (three background and thirteen compliance) are used to monitor groundwater concentrations within the bedrock (*i.e.,* UA) and unlithified materials (*i.e.,* UU).

Beginning in second quarter of 2023, groundwater samples will be collected quarterly and analyzed for the laboratory and field parameters from 35 I.A.C. § 845.600 as summarized in **Table K** on the following page. The groundwater samples collected from the sixteen 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).

In 2022, 14 monitoring wells (MW158R, MW192, MW193, MW194, MW258, MW358, MW392, MW393, MW394, XPW01, XPW02, XPW04, XPW05, and XPW06) were installed, and groundwater samples were collected from the monitoring wells at the BAP. These monitoring wells were installed for further hydrogeologic investigation and water quality evaluation. Following investigation activities and collection of background groundwater quality, six of these wells were included in the proposed network described in the revised GMP for the BAP, which will be included in a construction permit application for submittal to the IEPA no later than August 1, 2023 in conjunction with this revised HCR.

Table K. 35 I.A.C. § 845 Groundwater Monitoring Program Parameters

Field Parameters[1]			
Groundwater Elevation	pH	Turbidity	
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 BAP Groundwater Monitoring Results and Analysis

Groundwater data collected from the 40 C.F.R. § 257 network monitoring wells and proposed 35 I.A.C. § 845 monitoring wells between 2015 and 2023 were evaluated with respect to standards included in 35 I.A.C § 845.600(a)(1) in the revised HPE (Ramboll, 2023b). This data set was selected because it includes parameters (total metals) consistent with the parameter list in 35 I.A.C. § 845.600(a)(1). Based on this data set, there were no consistent and/or significant concentrations of antimony, barium, boron, cadmium, calcium, mercury, molybdenum, pH, selenium, sulfate, and TDS greater than the GWPSs. Results indicate that the parameters discussed in the following sections were detected at concentrations greater than the applicable 35 I.A.C. § 845.600(a)(1) standards and are considered potential exceedances. A summary of groundwater analytical data is provided in **Table 4-1** and the HPE (Ramboll, 2023b). Groundwater field parameter results are included in **Table 4-2**.

4.2.1 Arsenic

Arsenic was detected at concentrations greater than the GWPS (0.01 milligrams per liter [mg/L]) in proposed UU compliance well OW-257. ASDs will be pursued for potential exceedances at proposed UU compliance well OW-257. Additional data is being collected to support multiple lines of evidence demonstrating the CCR unit is not the source of observed detections. Since ASDs are being pursued for potential exceedances at OW-257, arsenic will not be discussed further in this HCR. No other BAP well locations reported concentrations greater than the 35 I.A.C. § 845 GWPS for arsenic.

4.2.2 Beryllium

Beryllium was detected at concentrations greater than the GWPS (0.004 mg/L) at proposed UU compliance well OW-257. ASDs will be pursued for potential exceedances at proposed UU compliance well OW-257. Additional data is being collected to support multiple lines of evidence demonstrating the CCR unit is not the source of observed detections. Since ASDs are being pursued for potential exceedances at OW-257, beryllium will not be discussed further in this HCR. No other BAP well locations reported concentrations greater than the 35 I.A.C. § 845 GWPS for beryllium.

4.2.3 Chloride

Chloride was detected at concentrations greater than the GWPS (200 mg/L) at proposed UA compliance well MW-370. ASDs will be pursued for potential exceedances of chloride. Additional data is being collected to support multiple lines of evidence for demonstrating the CCR unit is not the source of observed detections. Since ASDs are being pursued chloride will not be discussed further in this HCR. No other BAP well locations exceeded the 35 I.A.C. § 845 GWPS for chloride.

4.2.4 Chromium

Chromium was detected at concentrations greater than the GWPS (0.10 mg/L) at proposed UU compliance well OW-257. ASDs will be pursued for potential exceedances at proposed UU compliance well OW-257. Additional data is being collected to support multiple lines of evidence for demonstrating the CCR unit is not the source of observed detections. Since ASDs are being pursued for potential exceedances at OW-257, chromium will not be discussed further in this HCR. No other BAP well locations reported concentrations greater than the 35 I.A.C. § 845 GWPS for chromium.

4.2.5 Cobalt

Cobalt was detected at concentrations greater than the GWPS (0.006 mg/L) at proposed UU compliance well OW-257. ASDs will be pursued for potential exceedances at proposed UU compliance well OW-257. Additional data is being collected to support multiple lines of evidence demonstrating the CCR unit is not the source of observed detections. Since ASDs are being pursued for potential exceedances at OW-257, cobalt will not be discussed further in this HCR. No other BAP well locations reported concentrations greater than the 35 I.A.C. § 845 GWPS for cobalt.

4.3 Fluoride

Fluoride was detected at concentrations greater than the GWPS (4.0 mg/L) at proposed UA compliance well MW-393. An ASD will be pursued for potential exceedances of fluoride. Additional data is being collected to support multiple lines of evidence demonstrating the CCR unit is not the source of observed detections. Since ASDs are being pursued fluoride will not be discussed further in this HCR. No other BAP well locations reported concentrations greater than the 35 I.A.C. § 845 GWPS for fluoride.

4.4 Lead

Lead was detected at concentrations greater than the GWPS (0.0075 mg/L) at proposed UU compliance well OW-257. ASDs will be pursued for potential exceedances at proposed UU compliance well OW-257. Additional data is being collected to support multiple lines of evidence for demonstrating the CCR unit is not the source of observed detections. Since ASDs are being pursued for potential exceedances at OW-257, lead will not be discussed further in this HCR. No other BAP well locations reported concentrations greater than the 35 I.A.C. § 845 GWPS for lead.

4.5 Lithium

Lithium was detected at concentrations greater than the GWPS (0.14 mg/L) at proposed UU compliance well OW-257. An ASD was prepared by Ramboll (2023c; **Appendix H**) to further evaluate potential GWPS exceedances at UA compliance well MW-370. The results of the evaluation demonstrated that the potential GWPS exceedance of lithium in well MW-370 was not related to the BAP based on several lines of evidence presented in the ASD. ASDs will be pursued for potential exceedances at proposed UU compliance well OW-257. Additional data is being collected to support multiple lines of evidence for demonstrating the CCR unit is not the source of observed detections. Since potential GWPS exceedances for lithium are not related to the BAP at well MW-370, and ASDs are being pursued for potential exceedances at OW-257, lithium will not be discussed further in this HCR. No other BAP well locations reported concentrations greater than the 35 I.A.C. § 845 GWPS for lithium.

4.6 Radium 226 + Radium 228

Radium 226 + radium 228 was detected at concentrations greater than the GWPS (5.0 picocuries per liter) at proposed UU compliance well OW-257. ASDs will be pursued for potential exceedances at proposed UU compliance well OW-257. Additional data is being collected to support multiple lines of evidence for demonstrating the CCR unit is not the source of observed detections. Since ASDs are being pursued for potential exceedances at OW-257, radium 226 + radium 228 will not be discussed further in this HCR. No other BAP well locations reported concentrations greater than the 35 I.A.C. § 845 GWPS for radium.

4.7 Thallium

Thallium was detected at concentrations greater than the GWPS (0.002 mg/L) at proposed UU compliance well OW-257. ASDs will be pursued for potential exceedances at proposed UU compliance well OW-257. Additional data is being collected to support multiple lines of evidence for demonstrating the CCR unit is not the source of observed detections. Since ASDs are being pursued for potential exceedances at OW-257, thallium will not be discussed further in this HCR. No other BAP well locations reported concentrations greater than the 35 I.A.C. § 845 GWPS for thallium.

5. EVALUATION OF POTENTIAL RECEPTORS

5.1 Water Well Survey

A water well survey was conducted for a 1,000-meter radius around the BAP as shown in **Appendix B**. Based on records obtained from IEPA, ISGS, and ISWS, there are nine wells located within 1,000-meter of the BAP. These included four private water wells, as well as four monitoring wells and one temporary piezometer for Illinois Power. The identified wells within a 1,000-meter radius around the BAP are shown and tabulated in **Appendix B** along with available well construction information from the well forms, also provided in **Appendix B**. Groundwater generally flows from the northeast to the southwest in the vicinity of the Site. The four identified private water wells are downgradient of the Site or in the prevailing direction of groundwater flow. The four monitoring wells are located upgradient of the Site (not in the prevailing direction of groundwater flow) and the identified temporary piezometer is located downgradient of the BAP within the FAPS. As shown in **Appendix B**, seven plugged or engineering test locations were also identified in the water well survey for a 1,000-meter radius around the BAP.

5.2 Surface Water

As discussed previously in **Section 3.2.2** of this HCR, lateral groundwater flow in the shallow unlithified materials is generally to the west and southwest across the Site. General groundwater flow direction is west toward the Kaskaskia River (*i.e.,* regional receiving body) and there is little seasonal variation in groundwater flow direction in the shallow unlithified materials. Similar to groundwater flow in the shallow unlithified materials, flow direction in the bedrock is generally to the west and southwest across the Site. Groundwater flow in bedrock is northwest in the east and central areas of the BAP until groundwater reaches the bedrock valley feature underlying the Secondary and Tertiary Ponds west of the BAP, at which point the flow direction veers toward this bedrock surface low. The predominant surface water bodies in the regional study area include the Mississippi River (25 miles west of the Site), Kaskaskia River (borders the BPP property to the west), and Cooling Pond (borders the Site to the north). Since the Kaskaskia River is a regional receiving body immediately adjacent to the western BPP property boundary (**Figure 1-2**), the groundwater flowing toward the Kaskaskia River has the potential to influence the river.

The Cooling Pond is located to the north of the BAP, upgradient of general groundwater flow, and semi-isolated hydrologically from the natural drainage features, surface water and groundwater, of the area (perched cooling pond). In addition to its use as a cooling pond for BPP, the Cooling Pond is located within the Kaskaskia River State Fish & Wildlife Area and is used for public recreational use (including, fishing, boating, waterfowl viewing, picnicking, and other recreational activities). The Cooling Pond is filled by water pumped from the Kaskaskia River (the river-intake pump house for BPP is located near USGS stream gage [USGS 05595240, Latitude 38°11'39", Longitude 89°53'17" NAD27] on the Kaskaskia River to the west of the Site), supplemented by natural precipitation onto the surface of the lake.

In addition to its use as cooling water for BPP, the Kaskaskia River is designated as a public body of water as listed in listed in Appendix B of I.A.C. CH. I, SEC. 3704 and is used for commercial barge traffic, recreational boating, commercial and recreational fishing, and waterfowl hunting (ISWS, 1995). The Kaskaskia River adjacent to the BPP property was improved for navigation in the 1960's by channelizing and cutting off the natural meandering channel (ISWS, 1995). The Kaskaskia River also serves as domestic water supply with an intake located on the cutoff meander just south of the intersection of the river and Highway 154 (on the river near the southwest corner of the BPP property boundary) for nearby City of Sparta, Illinois, and an intake located approximately 6.5 miles downstream of the Site for Village of Evansville, Illinois (ISWS, 1995). These domestic water supply intakes located downstream of the Site may represent potential receptors to impacts associated with groundwater flowing toward the Kaskaskia River. The receiving surface water bodies for groundwater in the UU are assumed to be the Secondary and Tertiary Ponds prior to intercepting the Kaskaskia River. Discharge from the Secondary and Tertiary Ponds to the Kaskaskia River is regulated as part of the BPP's NPDES discharge permit (NPDES Permit No. IL0000043).

A review of the USFWS National Wetland Inventory mapping, 0.5-meter resolution aerial imagery (2015) and the results of on-site field assessments were completed by Haley & Aldrich, Inc. (2018) for the BAP as part of the Location Restriction Demonstration to address the requirements of 40 C.F.R. § 257.61 (Wetlands) of the USEPA's rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities* (Haley & Aldrich, Inc., 2018). Based on the review completed by Haley & Aldrich, Inc. (2018), the BAP is not located in wetlands as defined by 40 C.F.R. § 232.2. One freshwater emergent wetland and one freshwater forested/shrub wetland was identified as part of the survey to identify surface water features conducted for a 1,000-meter radius around the BAP as shown in **Appendix B** and discussed in **Section 3.2.5.2** of this HCR.

5.3 Nature Preserves, Historic Sites, Endangered/Threatened Species

A survey to identify nature preserves and historic sites was conducted for a 1,000-meter radius of the BAP as shown and tabulated in **Appendix B**. Based on an ESRI GIS database layers which present the national register of historic places, national forests, state parks, national parks, and national heritage areas (as designated by the National Park Service) in the United States, no historic places, national forests, state parks, national parks, and national heritage areas were identified for a 1,000-meter radius of the BAP. However, based on data available from the Illinois Department of Natural Resources (IDNR) Illinois Nature Preserves Commission (IDNR, 2021), there are four nature preserves within a 1,000-meter radius of the BAP, including Piney Creek Ravine, Prairie of the Rock, Rockcastle Creek, and Swayne Hollow, in Randolph County. None of the four nature preserves identified are within the BPP property boundary. Based on data available from the IDNR's Illinois Natural Heritage Database there are 13 natural areas in Randolph County (IDNR, 2020b) and the IDNR Illinois Nature Preserves Commission identified six protected areas in Randolph County (IDNR, 2019) as tabulated in **Appendix B**. As shown in **Appendix B**, the Kaskaskia River Fish and Wildlife Management Area, a state conservation area, was also identified in the survey. The Kaskaskia River Fish and Wildlife Management Area includes the entire area of the Site, as well as the Cooling Pond and areas adjacent to the Kaskaskia River.

A survey to identify endangered/threatened species was conducted for Randolph County and tabulated in **Appendix B**. Based on data available from the IDNR Illinois Natural Heritage Database (IDNR, 2020a), as of December 2020 there are 32 endangered or threatened species reported in Randolph County. Twenty-five species are listed as endangered and seven are listed as threatened.

Additionally, a search of the IDNR Historic Preservation Division database for historic sites in the vicinity of the Site yielded no results within 1,000 meters of the BAP. The Illinois State

Archaeological Survey (ISAS) databases that do not require credentials to access were also searched and yielded no results within 1,000 meters of the BAP.

6. CONCLUSIONS

Hydrogeologic characterization of the Site was originally developed as part of the Phase II investigation (NRT, 2014a) and updated for the Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan dated March 31, 2016 (NRT, 2016b) in support of the Closure Plan for the FAPS. Results of these hydrogeologic characterization studies were reintroduced in this revised HCR and updated to include hydrogeologic and groundwater quality data collected since approval of the Closure Plan for the FAPS, Federal CCR Rule monitoring data, and data collected in the 2022 HSI with a focus on the BAP (35 I.A.C. § 845 regulated CCR Unit and subject of this HCR).

The data was summarized and evaluated for changes in groundwater conditions since the previous reports, and available groundwater quality data downgradient of the BAP was compared to the 35 I.A.C. § 845 GWPSs.

The results of the hydrogeologic and groundwater quality evaluation are:

- There are five principal types of unlithified materials present above the bedrock in the vicinity of the Site, including the following in descending order: fill, predominantly coal ash within the Site (approximately 28 feet of bottom ash was observed towards the center of the BAP, and fill and CCR in the FAPS are estimated to range in thickness from 19 to 43 feet); Cahokia Formation (alluvial clay, sandy clay, and clayey sand which ranged in thickness from 13 to 27 feet); Peoria Loess (silt and silty clay which ranged in thickness from 2 to 23 feet); Equality Formation (clay and sandy clay with occasional sand seams and lenses, which ranged in thickness from 8 to 37 feet); and the Vandalia Till (clay and sandy clay diamictons with intermittent and discontinuous sand lenses, the Vandalia Till ranged in thickness from 11 to 37 feet). The uppermost bedrock at the Site consists of Pennsylvanian and Mississippian bedrock, mainly limestone and shale. Depth to bedrock at the Site ranges from 12.5 feet at well MW-154 near the Kaskaskia River to approximately 70 feet at piezometer TPZ-168 within the East Fly Ash Pond (depth observed prior to completion of cover system within the FAPS).
- Three distinct water-bearing layers have been identified at the Site based on stratigraphic relationships and common hydrogeologic characteristics including the following in descending order: Fill Unit (CCR, consisting primarily of fly ash, bottom ash, and boiler slag with a geometric mean vertical hydraulic conductivity of 4.1×10^{-5} cm/s); UU (unlithified natural geologic materials extending down to the bedrock, predominantly clay with some silt and minor sand, silt layers, and occasional sand lenses with a geometric mean horizontal hydraulic conductivity of 2.9×10^{-5} cm/s); and Bedrock Unit (composed of interbedded shale and limestone bedrock with a geometric mean horizontal hydraulic conductivity of 1.9×10^{-6}). The shallow bedrock is the only water-bearing unit that is continuous across the Site and is the designated UA.
- As part of the Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan (NRT, 2016b), an investigation within the unlithified materials was performed to further evaluate the potential presence of sand layers that could represent PMPs. Additional borings from the 2022 HSI were used to further delineate potential PMP's along the north side of the BAP. The sand seams may act as a PMP due to relatively higher hydraulic conductivities (on the order of 10^{-4} cm/s) than the surrounding clays (on the order of 10^{-5} cm/s). In addition to

the sand seams identified adjacent to the BAP, the contacts between the unlithified material and bedrock have been identified as PMPs, where horizontal hydraulic conductivity data in Site monitoring wells with screens and/or filter packs across or immediately above the bedrock range from 3 x 10^{-7} to 6 x 10^{-4} cm/s, and a geometric mean of 2 x 10^{-5} cm/s.

- Based on elevation measurements which include measurements collected from wells installed as part of the 2022 HSI, lateral groundwater flow in the shallow unlithified materials is generally to the west and southwest across the Site in 2023. General groundwater flow direction is west toward the Kaskaskia River (*i.e.,* regional receiving body). Similar to groundwater flow in the shallow unlithified materials, flow direction in the bedrock is generally to the west and southwest across the Site in 2023. Groundwater flow in bedrock is northwest in the east and central areas of the BAP, and southwest to northwest on the east area of the FAPS (Old East Fly Ash Pond) until groundwater reaches the bedrock valley feature underlying the Secondary and Tertiary Ponds west of the BAP and FAPS, at which point the flow direction veers toward this bedrock surface low. Groundwater elevations in the shallow unlithified materials (*i.e.,* UU) and Bedrock Unit (*i.e.,* UA) vary seasonally, generally less than 7 feet, while across the Site they range between 370 feet NAVD88 in the east, and 450 feet NAVD88 in the west, although flow directions are generally consistent. The piezometric head at locations MW-252 and MW-352 are typically under flowing artesian conditions (*i.e.,* groundwater elevations above ground surface).
- Between monitoring wells in the northeastern portion of the BAP, average horizontal hydraulic gradients in the shallow unlithified materials and bedrock were 0.004 and 0.003 ft/ft, respectively, as groundwater flowed southeast to northwest across the BAP. Average groundwater velocities in the shallow unlithified materials and bedrock in the northeast portion of the BAP were 0.0023 and 0.0001 ft/day, respectively. Between monitoring wells in the western portion of the BAP average horizontal hydraulic gradients in the shallow unlithified materials and bedrock were 0.011 and 0.017 ft/ft, respectively, as groundwater flowed northeast to southwest across the BAP. Average groundwater velocities in the west area of the BAP in shallow unlithified materials and bedrock were 0.0058 and 0.0003 ft/day, respectively. In general, flow velocities are consistent, varying only 0.001 ft/day in shallow unlithified materials and 0.0001 ft/day in bedrock in the vicinity of the BAP. Groundwater in the Pennsylvanian and Mississippian-aged bedrock mainly occurs under semi-confined to confined conditions as demonstrated with vertical hydraulic gradient calculations presented in this HCR, with the overlying unlithified unit behaving as the upper confining unit to the UA (*i.e.,* Bedrock Unit).The relatively flat horizontal groundwater gradient beneath the Site, and the mostly upward vertical gradients, inconsistent upward/downward vertical gradients or flowing artesian conditions observed in the UU and UA, suggests the BAP and neighboring ponds are not areas of increased recharge or infiltration. The amount of saturated fill and CCR is variable both laterally and temporally within the BAP and FAPS. Recent water levels collected from BAP piezometer TPZ-164 indicate a saturated fill and CCR thickness of approximately 7.75 and 1.61 feet in November 2022 and January 2023, respectively, and are consistent with previously measured saturated thicknesses in the BAP between September 2013 and June 2014. Five additional porewater wells were installed in the BAP as part of the 2022 HSI, of which XPW05 (located in the center of the BAP) had the largest saturated thickness of fill and CCR which was approximately 26.5 feet in November 2022. XPW02 (located on the north side of the BAP) had the smallest saturated fill and CCR thickness, which was approximately 1.6 feet in January 2023. During FAPS closure activities, which

began in 2018, surface and subsurface drainage was performed to lower the phreatic surface (dewatering) for the FAPS, and completion of the final cover system to reduce infiltration for the FAPS was completed in 2020.

- Based on the detailed geologic information provided for the unlithified materials and bedrock at BPP, along with the hydrogeologic data, the groundwater in both the unlithified deposits and underlying bedrock at the Site can be classified as Class II - General Resource Groundwater.
- Arsenic, beryllium, chloride, chromium, cobalt, fluoride, lead, lithium, radium 226 + radium 228, and thallium concentrations in groundwater collected from proposed compliance wells at the BAP were detected above 35 I.A.C. § 845 GWPSs in the UU and UA as provided in the revised HPE. ASDs will be pursued for potential exceedances at proposed UU and UA compliance wells.

This HCR satisfies 35 I.A.C. § 845 content requirements specific to 35 I.A.C. § 845.620(b) (Hydrogeologic Site Characterization) for the BAP at BPP.

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TABLES

TABLE 2-1. MONITORING WELL AND PIEZOMETER CONSTRUCTION DETAILS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1

BOTTOM ASH POND

BALDWIN POWER PLANT

BALDWIN, ILLINOIS

Well Number	Date Constructed	Date Abandoned	Elevation Last Survey Date	Driller	Measuring Point Elevation (Top of PVC, feet NAVD88)	Ground Elevation (feet NAVD88)	Screen Top Depth (feet bgs)	Screen Bottom Depth (feet bgs)	Well Depth (feet bgs)	Well Depth from Measuring Point (feet below Top of PVC)	Total Boring Depth (feet bgs)	Screen Top Elevation (feet NAVD88)	Screen Bottom Elevation (feet NAVD88)	Bottom of Boring Elevation (feet NAVD88)	Stickup of Measuring Point Above Ground Surface (feet above ground surface)
MW-104D	11/01/90	07/26/11	10/27/10	Burlington Env	455.29	452.85	19.4	29.4	29.4	31.8	35.0	433.5	423.5	417.9	2.44
MW-104DR	08/01/11		09/05/13	Terra Drill	455.62	452.62	23.2	28.2	28.5	31.5	35.0	429.4	424.4	417.6	3.00
MW-104S	11/01/90	07/26/11	10/27/10	Burlington Env	455.27	452.69	4.9	14.9	14.9	17.4	15.0	447.8	437.8	437.7	2.58
MW-104SR	08/01/11		09/05/13	Terra Drill	455.54	452.52	4.8	14.8	15.0	18.0	15.0	447.8	437.7	437.5	3.02
MW-150	09/01/10		10/27/10	Terra Drill	396.54	393.84	15.0	24.7	25.2	27.9	25.2	378.8	369.2	368.7	2.70
MW-151	09/01/10		10/27/10	Terra Drill	399.96	397.22	6.1	15.8	16.3	19.0	16.3	391.1	381.4	380.9	2.74
MW-152	09/01/10		10/27/10	Terra Drill	424.99	422.18	7.5	16.7	17.2	20.0	17.2	414.7	405.5	405.0	2.81
MW-153	09/01/10		10/27/10	Terra Drill	445.67	442.77	10.4	20.0	20.5	23.4	20.5	432.4	422.8	422.3	2.90
MW-154	09/01/10		10/27/10	Terra Drill	387.76	384.99	7.5	12.2	12.7	15.4	12.7	377.5	372.8	372.3	2.77
MW-155	09/01/10		10/27/10	Terra Drill	393.55	390.62	10.3	19.9	20.5	23.4	20.5	380.3	370.7	370.2	2.93
MW-156*	09/01/10		10/27/10	Terra Drill	427.87	425.14	7.9	17.2	17.7	20.4	17.7	417.3	407.9	407.4	2.73
MW-157S*	09/01/10		10/27/10	Terra Drill	432.64	429.90	7.8	17.1	17.6	20.4	17.6	422.1	412.8	412.3	2.74
MW-158R	10/08/22		10/26/22	Cascade	456.24	453.56	8.0	18.0	18.0	21.1	18.0	445.6	435.6	435.6	3.09
MW-161	8/1/2013		9/5/2013	Bulldog Drilling	431.27	428.74	23.3	32.8	33.4	35.9	44.7	405.4	396.0	384.0	2.53
MW-162	8/1/2013		9/5/2013	Bulldog Drilling	433.20	430.83	15.9	25.3	25.9	28.3	25.9	415.0	405.5	404.9	2.37
MW-192	9/27/2022		10/26/2022	Cascade	436.94	434.04	20.0	30.0	30.0	33.3	34.0	414.0	404.0	400.0	3.29
MW-193	10/4/2022		10/26/2022	Cascade	438.06	434.52	22.0	32.0	32.0	35.9	32.0	412.5	402.5	402.5	3.92
MW-194	10/5/2022		10/26/2022	Cascade	438.20	435.43	18.0	28.0	28.0	30.8	30.0	417.4	407.4	405.4	3.20
MW-252	09/01/10		10/27/10	Terra Drill	425.07	422.27	44.4	49.0	49.5	52.3	49.5	377.9	373.2	372.7	2.80
MW-253	09/01/10		10/27/10	Terra Drill	445.84	442.70	29.9	34.5	35.0	38.2	35.0	412.8	408.2	407.7	3.14
MW-258	10/07/22		10/26/22	Cascade	456.12	453.50	40.0	50.0	50.0	52.9	63.0	413.6	403.6	390.5	2.91
MW-262	8/1/2013		9/5/2013	Bulldog Drilling	433.21	430.86	42.1	46.6	47.2	49.6	51.0	388.7	384.2	379.9	2.35
MW-304	10/20/2015		1/15/2016	Bulldog Drilling	455.49	453.03	45.0	55.0	55.0	57.5	135.4	408.0	398.0	317.6	2.46
MW-306	9/25/1991		3/24/2016	Bulldog Drilling	453.17	450.91	72.7	87.7	87.7	90.0	89.7	378.2	363.2	361.2	2.26
MW-350	09/01/10		10/27/10	Terra Drill	396.80	394.11	41.6	46.2	46.6	49.3	46.7	352.5	347.9	347.4	2.69
MW-352	09/01/10		10/27/10	Terra Drill	425.04	422.36	67.9	72.5	73.0	75.7	73.8	354.5	349.8	348.6	2.68
MW-355	09/01/10		10/27/10	Terra Drill	393.69	390.82	27.4	32.0	32.5	35.4	32.6	363.4	358.8	358.2	2.87
MW-356	10/1/2015		1/15/2016	Bulldog Drilling	427.60	425.18	56.0	66.0	66.0	68.4	135.0	369.2	359.2	290.2	2.42
MW-358	10/8/2022		10/26/22	Cascade	455.73	453.59	80.0	90.0	90.0	92.3	90.0	373.7	363.7	363.6	2.31
MW-366	12/4/2015		1/15/2016	Bulldog Drilling	425.08	422.54	42.0	52.0	52.0	54.5	54.3	380.5	370.5	368.2	2.54
MW-369	11/19/2015		1/15/2016	Bulldog Drilling	422.71	420.49	56.0	66.0	66.0	68.2	70.7	364.5	354.5	349.8	2.23
MW-370	11/25/2015		1/15/2016	Bulldog Drilling	420.85	418.67	53.0	63.0	63.0	65.2	66.0	365.7	355.7	352.7	2.18
MW-373	10/28/2015		1/15/2016	Bulldog Drilling	391.32	388.80	20.0	30.0	30.0	32.5	95.1	368.8	358.8	293.7	2.51
MW-374	11/10/2015		1/15/2016	Bulldog Drilling	400.91	398.41	30.0	40.0	40.0	42.5	42.3	368.4	358.4	356.1	2.50

RAMBOLL

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MW-375	11/6/2015		1/15/2016	Bulldog Drilling	423.05	420.50	57.0	67.0	67.0	69.5	84.7	363.5	353.5	335.8	2.54
MW-377	11/2/2015		1/15/2016	Bulldog Drilling	421.36	418.75	46.0	56.0	56.0	58.6	58.2	372.8	362.8	360.5	2.61
MW-382	11/23/2015		1/15/2016	Bulldog Drilling	431.19	428.67	56.0	66.0	66.0	68.5	70.6	372.7	362.7	358.1	2.52
MW-383	12/21/2015		1/15/2016	Bulldog Drilling	459.49	457.18	58.0	68.0	68.0	70.3	73.0	399.2	389.2	384.2	2.31
MW-384	12/18/2015		1/15/2016	Bulldog Drilling	458.95	456.70	60.5	70.5	70.5	72.7	94.1	396.2	386.2	362.6	2.24
MW-385	12/16/2015	2/29/2016	1/15/2016	Bulldog Drilling	454.56	454.82	80.0	90.0	90.0	89.7	93.0	374.8	364.8	361.8	-0.26
MW-386	12/11/2015	2/29/2016	1/15/2016	Bulldog Drilling	454.17	454.67	76.0	86.0	86.0	85.5	89.0	378.7	368.7	365.7	-0.51
MW-387	11/18/2015	3/11/2016	1/15/2016	Bulldog Drilling	426.63	424.01	48.0	58.0	58.0	60.6	61.3	376.0	366.0	362.7	2.62
MW-388	12/12/2015		1/15/2016	Bulldog Drilling	408.92	406.28	33.0	43.0	43.0	45.6	45.2	373.3	363.3	361.1	2.63
MW-389	12/1/2015		1/15/2016	Bulldog Drilling	419.90	417.30	42.0	52.0	52.0	54.6	55.7	375.3	365.3	361.6	2.60
MW-390	3/4/2016		3/24/2016	Bulldog Drilling	428.06	425.98	50.0	65.0	65.0	67.1	68.0	376.0	361.0	358.0	2.08
MW-391	3/10/2016		3/24/2016	Bulldog Drilling	426.63	424.24	55.0	70.0	70.0	72.4	74.4	369.2	354.2	349.8	2.40
MW-392	9/26/2022		10/26/22	Cascade	437.02	434.07	74.0	84.0	84.0	87.3	84.0	360.1	350.1	350.1	3.29
MW-393	10/4/2022		10/26/22	Cascade	437.86	434.59	75.0	85.0	85.0	88.3	85.0	359.6	349.6	349.6	3.85
MW-394	10/5/2022		10/26/22	Cascade	438.29	435.51	73.0	83.0	83.0	85.8	85.0	362.5	352.5	350.5	3.16
OW-256	8/1/2013		9/5/2013	Bulldog Drilling	427.70	425.20	28.0	32.5	33.1	35.6	36.0	397.2	392.7	389.2	2.50
OW-257	8/1/2013		9/5/2013	Bulldog Drilling	431.02	428.17	34.0	38.5	39.1	41.9	39.6	394.2	389.7	388.6	2.85
PZ-169	7/28/2015		9/25/2015	Bulldog Drilling	422.60	420.01	31.5	41.5	41.5	44.1	42.0	388.5	378.5	378.0	2.59
PZ-170	7/29/2015		9/25/2015	Bulldog Drilling	421.43	418.58	21.1	31.1	31.1	34.0	31.1	397.5	387.5	387.5	2.85
PZ-171	7/31/2015		9/25/2015	Bulldog Drilling	434.15	431.54	28.0	38.0	38.0	40.6	38.0	403.5	393.5	393.5	2.61
PZ-172	8/3/2015		9/25/2015	Bulldog Drilling	412.95	410.22	16.0	26.0	26.0	28.7	26.2	394.2	384.2	384.0	2.73
PZ-173	8/3/2015		9/25/2015	Bulldog Drilling	391.46	388.43	3.5	13.5	13.5	16.5	14.1	384.9	374.9	374.3	3.03
PZ-174	8/4/2015		9/25/2015	Bulldog Drilling	401.92	398.97	14.5	24.5	24.5	27.5	24.7	384.5	374.5	374.3	2.95
PZ-175	8/7/2015		9/25/2015	Bulldog Drilling	423.01	419.87	40.0	50.0	50.0	53.1	50.2	379.9	369.9	369.7	3.14
PZ-176	8/6/2015		9/25/2015	Bulldog Drilling	406.44	403.46	18.1	28.1	28.6	31.6	28.6	385.4	375.4	374.9	2.98
PZ-177	8/6/2015		9/25/2015	Bulldog Drilling	420.90	417.93	20.5	30.5	30.5	33.5	30.7	397.4	387.4	387.2	2.97
PZ-178	8/5/2015		9/25/2015	Bulldog Drilling	431.26	428.45	33.0	43.0	43.0	45.8	43.5	395.5	385.5	385.0	2.81
PZ-182	7/30/2015		9/25/2015	Bulldog Drilling	431.61	428.47	24.0	34.0	34.0	37.1	34.0	404.5	394.5	394.5	3.14
TPZ-158	8/1/2013	2018	9/5/2013	Bulldog Drilling	456.26	453.26	9.2	18.3	18.9	21.9	19.0	444.0	435.0	434.3	3.00
TPZ-159	8/1/2013		9/5/2013	Bulldog Drilling	447.64	444.69	20.0	29.0	29.6	32.5	50.0	424.7	415.7	394.7	2.95
TPZ-160	8/1/2013		9/5/2013	Bulldog Drilling	431.49	428.59	9.8	18.8	19.4	22.3	35.0	418.8	409.8	393.6	2.90
TPZ-163	8/1/2013	2018	9/5/2013	Bulldog Drilling	458.41	455.51	8.6	18.1	18.7	21.6	45.0	446.9	437.4	410.5	2.90
TPZ-164	8/1/2013		9/5/2013	Bulldog Drilling	435.10	432.50	5.2	9.7	10.3	12.9	10.3	427.3	422.8	422.2	2.60
TPZ-165	8/1/2013		9/5/2013	Bulldog Drilling	398.85	396.10	7.8	16.8	17.4	20.2	17.4	388.3	379.3	378.7	2.75

TABLE 2-1. MONITORING WELL AND PIEZOMETER CONSTRUCTION DETAILS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

Well Number	Date Constructed	Date Abandoned	Elevation Last Survey Date	Driller	Measuring Point Elevation (Top of PVC, feet NAVD88)	Ground Elevation (feet NAVD88)	Screen Top Depth (feet bgs)	Screen Bottom Depth (feet bgs)	Well Depth (feet bgs)	Well Depth from Measuring Point (feet below Top of PVC)	Total Boring Depth (feet bgs)	Screen Top Elevation (feet NAVD88)	Screen Bottom Elevation (feet NAVD88)	Bottom of Boring Elevation (feet NAVD88)	Stickup of Measuring Point Above Ground Surface (feet above ground surface)
TPZ-166	8/1/2013		9/5/2013	Bulldog Drilling	425.18	422.33	15.3	24.7	25.3	28.1	25.5	407.1	397.6	396.8	2.85
TPZ-167	8/1/2013	2018	9/5/2013	Bulldog Drilling	441.38	438.63	21.4	30.9	31.5	34.3	48.8	417.2	407.7	389.9	2.75
TPZ-168	8/1/2013	2018	9/5/2013	Bulldog Drilling	457.53	454.93	15.8	25.3	25.8	28.4	70.0	439.2	429.7	384.9	2.60
XPW01	9/23/2022		10/26/2022	Cascade	437.66	435.12	7.0	12.0	12.0	14.5	14.0	428.1	423.1	421.1	3.33
XPW02	9/24/2022		10/26/2022	Cascade	437.92	434.86	6.0	11.0	11.0	14.1	14.0	428.9	423.9	420.9	3.74
XPW04	9/24/2022		10/26/2022	Cascade	434.58	430.59	6.5	16.5	16.5	20.5	20.0	424.1	414.1	410.6	4.32
XPW05	9/24/2022		10/26/2022	Cascade	437.27	434.12	18.0	28.0	28.0	31.1	30.0	416.1	406.1	404.1	3.45
XPW06	9/22/2022		10/26/2022	Cascade	417.72	418.06	5.0	10.0	10.0	9.7	16.0	413.0	408.0	402.1	0.00

TABLE 2-1. MONITORING WELL AND PIEZOMETER CONSTRUCTION DETAILS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1

BOTTOM ASH POND

BALDWIN POWER PLANT

BALDWIN, ILLINOIS

Well Number	Screen Length (feet)	Screen Diameter (inches)	State Planar Northing - Y (NAD83 / West Zone)	State Planar Easting - X (NAD 83 / West Zone)	Latitude (decimal degrees)	Longitude (decimal degrees)	Hydrostratigraphic Unit
MW-104D	10.0	2.0	554,185.82	2,386,608.62	38.188302	-89.853436	Upper Unit
MW-104DR	5.1	2.0	554,201.00	2,386,609.00	38.188344	-89.853434	Upper Unit
MW-104S	10.0	2.0	554,178.94	2,386,609.49	38.188283	-89.853433	Upper Unit
MW-104SR	10.0	2.0	554,205.00	2,386,609.00	38.188355	-89.853434	Upper Unit
MW-150	9.6	2.0	554,562.89	2,379,412.75	38.189401	-89.878468	Upper Unit
MW-151	9.6	2.0	554,221.42	2,381,171.22	38.188449	-89.872354	Upper Unit
MW-152	9.3	2.0	553,906.39	2,382,778.77	38.187569	-89.866764	Upper Unit
MW-153	9.6	2.0	553,298.21	2,384,434.50	38.185884	-89.861010	Upper Unit
MW-154	4.6	2.0	557,163.07	2,377,892.05	38.196555	-89.883732	Upper Unit
MW-155	9.6	2.0	555,983.13	2,378,140.93	38.193312	-89.882878	Upper Unit
MW-156*	9.3	2.0	558,055.12	2,381,952.60	38.198969	-89.869592	Upper Unit
MW-157S*	9.3	2.0	556,189.22	2,382,593.37	38.193840	-89.867384	Upper Unit
MW-158R	10.0	2.0	556,726.33	2,387,758.42	38.195275	-89.849411	Upper Unit
MW-161	9.5	2.0	557,077.95	2,379,206.36	38.196310	-89.879159	Upper Unit
MW-162	9.5	2.0	555,725.07	2,379,192.90	38.192595	-89.879221	Upper Unit
MW-192	10.0	2.0	558,140.06	2,382,719.93	38.199203	-89.866927	Upper Unit
MW-193	10.0	2.0	558,133.33	2,383,946.80	38.199173	-89.862658	Upper Unit
MW-194	10.0	2.0	558,124.34	2,385,097.85	38.199138	-89.858653	Upper Unit
MW-252	4.6	2.0	553,904.16	2,382,784.17	38.187563	-89.866745	Upper Unit
MW-253	4.6	2.0	553,298.31	2,384,429.98	38.185885	-89.861026	Upper Unit
MW-258	10.0	2.0	556,726.72	2,387,753.37	38.195276	-89.849429	Bedrock
MW-262	4.5	2.0	555,728.67	2,379,193.08	38.192605	-89.879220	Upper Unit
MW-304	10.0	2.0	554,194.03	2,386,608.77	38.188324	-89.853435	Bedrock
MW-306	15.0	2.0	558,867.35	2,388,512.34	38.201140	-89.846756	Bedrock
MW-350	4.6	2.0	554,568.19	2,379,410.18	38.189416	-89.878477	Bedrock
MW-352	4.6	2.0	553,900.67	2,382,788.82	38.187554	-89.866729	Bedrock
MW-355	4.6	2.0	555,980.43	2,378,144.89	38.193305	-89.882865	Bedrock
MW-356	10.0	2.0	558,050.37	2,381,958.49	38.198956	-89.869572	Bedrock
MW-358	10.0	2.0	556,726.26	2,387,756.63	38.195275	-89.849417	Bedrock
MW-366	10.0	2.0	555,581.80	2,381,171.15	38.192184	-89.872339	Bedrock
MW-369	10.0	2.0	557,329.71	2,381,765.41	38.196979	-89.870252	Bedrock
MW-370	10.0	2.0	556,826.50	2,381,936.14	38.195596	-89.869663	Bedrock
MW-373	10.0	2.0	555,041.91	2,379,186.06	38.190719	-89.879252	Bedrock
MW-374	10.0	2.0	554,663.65	2,379,766.63	38.189675	-89.877236	Bedrock

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TABLE 2-1. MONITORING WELL AND PIEZOMETER CONSTRUCTION DETAILS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1

BOTTOM ASH POND

BALDWIN POWER PLANT

BALDWIN, ILLINOIS

Well Number	Screen Length (feet)	Screen Diameter (inches)	State Planar Northing - Y (NAD83 / West Zone)	State Planar Easting - X (NAD 83 / West Zone)	Latitude (decimal degrees)	Longitude (decimal degrees)	Hydrostratigraphic Unit
MW-375	10.0	2.0	554,434.97	2,380,838.70	38.189038	-89.873508	Bedrock
MW-377	10.0	2.0	554,198.46	2,381,923.68	38.188379	-89.869736	Bedrock
MW-382	10.0	2.0	556,440.86	2,382,404.51	38.194533	-89.868038	Bedrock
MW-383	10.0	2.0	556,586.04	2,385,208.26	38.194906	-89.858280	Bedrock
MW-384	10.0	2.0	555,446.11	2,384,518.72	38.191782	-89.860693	Bedrock
MW-385	10.0	2.0	555,417.12	2,382,285.24	38.191722	-89.868464	Bedrock
MW-386	10.0	2.0	554,585.18	2,382,713.22	38.189434	-89.866985	Bedrock
MW-387	10.0	2.0	555,111.17	2,380,474.78	38.190898	-89.874767	Bedrock
MW-388	10.0	2.0	555,429.08	2,379,624.09	38.191778	-89.877724	Bedrock
MW-389	10.0	2.0	556,119.33	2,379,809.87	38.193672	-89.877070	Bedrock
MW-390	15.0	2.0	555,865.00	2,381,902.09	38.192956	-89.869793	Bedrock
MW-391	15.0	2.0	555,100.72	2,380,477.00	38.190869	-89.874760	Bedrock
MW-392	10.0	2.0	558,140.20	2,382,717.92	38.199203	-89.866934	Bedrock
MW-393	10.0	2.0	558,133.57	2,383,944.49	38.199174	-89.862666	Bedrock
MW-394	10.0	2.0	558,123.63	2,385,095.76	38.199136	-89.858660	Bedrock
OW-256	4.5	2.0	558,053.81	2,381,947.41	38.198966	-89.869610	Upper Unit
OW-257	4.5	2.0	556,198.26	2,382,572.46	38.193865	-89.867456	Upper Unit
PZ-169	10.0	2.0	557,323.57	2,381,764.94	38.196962	-89.870254	Upper Unit
PZ-170	10.0	2.0	556,822.69	2,381,944.92	38.195585	-89.869633	Upper Unit
PZ-171	10.0	2.0	556,453.57	2,379,199.67	38.194595	-89.879189	Upper Unit
PZ-172	10.0	2.0	555,323.28	2,379,176.11	38.191492	-89.879284	Upper Unit
PZ-173	10.0	2.0	555,035.38	2,379,187.28	38.190701	-89.879248	Upper Unit
PZ-174	10.0	2.0	554,666.23	2,379,774.23	38.189682	-89.877210	Upper Unit
PZ-175	10.0	2.0	554,433.02	2,380,846.31	38.189033	-89.873482	Upper Unit
PZ-176	10.0	2.0	554,264.76	2,381,381.02	38.188566	-89.871623	Upper Unit
PZ-177	10.0	2.0	554,192.18	2,381,923.59	38.188362	-89.869736	Upper Unit
PZ-178	10.0	2.0	554,089.94	2,382,460.67	38.188076	-89.867869	Upper Unit
PZ-182	10.0	2.0	556,433.70	2,382,412.47	38.194513	-89.868010	Upper Unit
TPZ-158	9.1	1.3	556,740.90	2,387,751.70	38.195308	-89.849428	Upper Unit
TPZ-159	9.1	1.3	558,080.95	2,383,974.09	38.199022	-89.862558	Upper Unit
TPZ-160	9.1	1.3	558,046.40	2,380,230.15	38.198960	-89.875586	Upper Unit
TPZ-163	9.5	2.0	555,798.16	2,385,507.39	38.192740	-89.857249	Fill
TPZ-164	4.5	2.0	556,829.32	2,383,909.42	38.195586	-89.862797	Fill
TPZ-165	9.1	1.3	555,940.02	2,380,478.23	38.193174	-89.874746	Upper Unit

TABLE 2-1. MONITORING WELL AND PIEZOMETER CONSTRUCTION DETAILS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

Well Number	Screen Length (feet)	Screen Diameter (inches)	State Planar Northing - Y (NAD83 / West Zone)	State Planar Easting - X (NAD 83 / West Zone)	Latitude (decimal degrees)	Longitude (decimal degrees)	Hydrostratigraphic Unit
TPZ-166	9.5	2.0	555,587.43	2,381,183.25	38.192200	-89.872297	Upper Unit
TPZ-167	9.5	2.0	554,962.94	2,381,925.00	38.190478	-89.869723	Fill
TPZ-168	9.5	2.0	554,313.78	2,383,585.00	38.188681	-89.863954	Fill
XPW01	5.0	2.0	557,530.38	2,383,427.03	38.197522	-89.864474	Fill
XPW02	5.0	2.0	557,667.96	2,384,171.76	38.197894	-89.861880	Fill
XPW04	10.0	2.0	556,502.51	2,383,618.45	38.194698	-89.863819	Fill
XPW05	10.0	2.0	557,062.95	2,384,034.20	38.196233	-89.862366	Fill
XPW06	5.0	2.0	557,323.97	2,382,140.04	38.196967	-89.868954	Fill

[O: JJW 4/2021, C: KLT 5/7/21, U: EDP 9/28/21, U: EGP 6/5/23]

Notes:
* MW-156 also known as OW-156, MW-157S also known as OW-157.
bgs = below ground surface
NAD83 = North American Datum of 1983
NAVD88 = North American Vertical Datum of 1988
PVC = polyvinyl chloride
TPZ-158, TPZ-163, TPZ-167, TPZ-168 abandoned prior to construction in 2016

TABLE 2-2. GEOLOGIC LAYERS AND HYDROGEOLOGIC UNIT DESIGNATIONS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

Lithologic Layers							Hydrogeologic Unit Designations		
ID	**General Description**	**Borings where Layer Identified**	**Top Elevation (feet NAVD88)**	**Lowest Elevation (feet NAVD88)**	**Thickness Range (feet)**	**Thickness Average and Median (feet)**	**ID**	**Name**	**Description: Materials**
1	Fill and CCR Predominantly coal ash (fly ash, bottom ash, and slag) within BAP and FAPS.	TPZ-163[2], TPZ-164[1], TPZ-167[2], TPZ-168[2], XPW01[1], XPW02[1], XPW04[1], XPW05[1], XPW06[1], XCM01[1], XCM02[1], XCM03[1], XCM04[1] (notes: [1] Borings were used to approximate the elevations and thickness of Fill and CCR within the BAP. [2] Borings were used to approximate the elevations and thickness of Fill and CCR within the FAPS; TPZ-165 intercepted Fill and CCR within the Secondary Pond, data from TPZ-165 was not included in calculating elevations or thicknesses of Fill and CCR)	456	406	4 - 43	Avg = 15.2 Median = 11.9	**1**	Fill Unit	CCR: fly ash, bottom ash, minor slag. Fill deposits - clay and silt
2	Cahokia Alluvium Alluvial clay, sandy clay, and clayey sand	MW-151, MW-154, MW-155, MW-350	394	368	13 - 27	Avg = 20.6 Median = 21.6	**2**	Upper Unit	Predominantly Clay with Silt and Sand; Silt Layers; Occasional Sand Lenses
3	Peoria Loess Silt and silty clay, minor fine sand	MW-104SR, MW-154, MW-156/OW-256, MW-157S, MW-158R/MW-258/MW-358, MW-161, MW-162/MW-262	453	406	2 - 23	Avg = 10.7 Median = 8.9			
4	Equality Formation Clay, sandy clay, and occasional sand seams and lenses	MW-153/MW-253, MW-157S/OW-257, TPZ-159, TPZ-160, MW-161, MW-162/MW-262, TPZ-163, TPZ-166, TPZ-168, OW-256, MW-352, MW-192/MW-392, MW-193/MW-393, MW-194/MW-394	443	396	8 - 37	Avg = 18.9 Median = 17.8			
5	Vandalia Till Member of Glasford Formation Clay, clay with sand, and occasional sand seams and lenses	MW-104DR, TPZ-158, TPZ-159, TPZ-160, MW-161, TPZ-163, TPZ-165, TPZ-166, TPZ-167, TPZ-168, MW-253, OW-256, OW-257, MW-262, MW-352, MW-392, MW-393, MW-394, MW-258, MW-358	445	369	11 - 37	Avg = 19.0 Median = 16.0			
6	Pennsylvanian and Mississippian Bedrock Interbedded and undifferentiated limestone and shale	MW-151, MW-154, MW-161, MW-253, MW-257, MW-262, MW-104DR/MW-304, MW-306, MW-350, MW-352, MW-355, MW-256/MW-356, MW-166/MW-366, MW-369, PZ-170/MW-370, PZ-173/MW-373, PZ-174/MW-374, PZ-175/MW-375, MW-377, MW-382, MW-383, MW-384, MW-385, MW-386, MW-387, MW-388, MW-389, PZ-172, TPZ-158, TPZ-163, TPZ-165, TPZ-167, TPZ-168, B-13-1, B-13-2, SP-1, SP-1, MW-258, MW-358, MW-392, MW-393, MW-394	433	366	- -	- -	**3**	Bedrock Unit	Shale and Limestone

[U: EGP 4/26/23; C: SSW 5/2/23]

Notes:
- - = not applicable/unknown
Avg = average
BAP = Bottom Ash Pond
CCR = coal combustion residuals
FAPS = Fly Ash Pond System
NAVD88 = National Geodetic Vertical Datum of 1988

TABLE 2-3. GEOTECHNICAL ANALYSIS ASH POND DEPOSITS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Boring Number	Sample Depth (feet bgs)	USCS Soil Classification	Moisture Content (%)		Dry Bulk Density (pcf)	Hydraulic Conductivity (cm/s)	Range of Hydraulic Gradient	Specific Gravity	Calculation from Soil-Mass Relationships: Total Porosity (%)	Water Filled Porosity (%)	Air Filled Porosity (%)
TPZ-163	1.5 - 3.5	ASH - Silty SAND (SM), fine grained, very dark brown	49.3		63.7	2.5E-04	0.4 - 3.5	2.66	61.7	50.2	11.5
TPZ-164	3.0 - 5.0	ASH - Sandy SILT (ML), fine grained sand, very dark brown	22.5		91.7	6.5E-04	0.1 - 1.6	2.68	45.2	33.0	12.2
TPZ-167	29.0 - 30.0	ASH - SILT (ML), very dark gray-brown	18.8	**	99.9	9.7E-06	0.3 - 2.9	2.59	38.2	30.2	8.0
TPZ-168	3.0 - 5.0	ASH - Sandy SILT (ML), fine-medium grained sand, olive-brown	56.0		63.0	4.2E-04	0.1 - 2.3	2.88	64.9	56.5	8.4
XPW02B	5.5 - 6.5	ASH - Poorly Graded Sand with Cinders and Ash (SP-SC), Very Dark Gray and Black	11.3		110.5	4.1E-05	*10.45*	2.65	--	--	--
XPW04A	15 - 16	ASH - Poorly Graded Sand with Cinders (SP)	9.8		111.5	1.4E-05	*15.87*	2.66	--	--	--
XPW06A	7.5 - 8.5	ASH - Silty Clayey Sand with Cinders and Ash (SC-SM)	16.4		110.5	5.6E-07	*22.485*	2.69	--	--	--
		Average Value*	**26.3**		**93.0**	**4.1E-05**	**- -**	**2.69**	**52.5**	**42.5**	**10.0**

[U: EGP 4/27/23, C: SSW 5/2/23]

Notes:
All geotechnical data obtained from Geotechnology, Inc. report dated October 18, 2013 (Appendix C).
USCS Soil Classification based on both visual, and particle size analysis with sieve and hydrometer.
- - = not calculated
% = percent
* = Hydraulic conductivity is calculated as geometric mean and not an average.
** = Sample remolded in laboratory. As received moisture content = 31.1%
bgs = below ground surface
cm/s = centimeters per second
pcf = pounds per cubic foot
maximum hydraulic gradient

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TABLE 3-1. HORIZONTAL AND VERTICAL PERMEABILITY TEST RESULTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

Horizontal Hydraulic Conductivity: Field Test Results					
Monitoring Well Number	**Depth Interval Tested (feet)**	**Analysis Method**	**Lithologic Layer**	**Primary Lithologies within Screened Well Interval**	**Horizontal Hydraulic Conductivity (cm/s)**
Hydrostratigraphic Unit: Upper Unit					
MW-104DR	23.2 - 28.2	Bouwer-Rice	Vandalia Till Member	Sand (fine-medium), Sandy Clay, and Silty Clay	6.8E-04
MW-151	6.1 - 15.8	Bouwer-Rice	Cahokia Formation	Sandy Clay, Silty Clay, and Clay	1.1E-05
MW-152	7.5 - 16.7	Bouwer-Rice	Equality Formation	Clay, Sand, and Sandy Clay	7.0E-05
MW-161	23.3 - 32.8	Bouwer-Rice	Equality Formation	Silty Clay, Sand with Silt	8.1E-05
MW-252	44.4 - 49.0	Bouwer-Rice	Vandalia Till Member	Clay	1.9E-06
MW-253	29.9 - 34.5	Bouwer-Rice	Vandalia Till Member	Clay, shaley	3.5E-07
MW-262	42.1 - 46.6	Bouwer-Rice	Vandalia Till Member	Sand with Silt, Sandy Silt, Silty Clay, and Sand (fine-coarse)	6.0E-04
OW-156	7.9 - 17.2	Bouwer-Rice	Equality Formation	Clay and Silty Clay	4.3E-05
OW-157	7.8 - 17.1	Bouwer-Rice	Equality Formation	Clay with Silt, Clay with Sand, and Clay	1.3E-04
OW-256	28.0 - 32.5	Bouwer-Rice	Vandalia Till Member	Silty Clay, Sand (fine-medium)	2.2E-04
OW-257	34.0 - 38.5	Bouwer-Rice / KGS Model	Vandalia Till Member	Silty Clay, Shale and Clay	3.3E-06
TPZ-166	15.3 - 24.7	Bouwer-Rice	Vandalia Till Member	Silty Clay	1.9E-05
MW-158R	8.0 - 18.0	Bouwer-Rice	Vandalia Till Member	Sandy Clay	2.2E-05
MW-192	20.0 - 30.0	Bouwer-Rice	Equality Formation	Sandy Clay	1.1E-06
MW-193	22.0 - 32.0	Bouwer-Rice	Equality Formation	Sandy Clay	3.2E-04
				Geometric Mean Hydraulic Conductivity	**2.9E-05**
Hydrostratigraphic Unit: Bedrock Unit					
MW-350	41.6 - 46.2	Bouwer-Rice	Mississippian Bedrock	Limestone, massive, hard to very hard; RQD = 96% (Excellent)	2.1E-06
MW-352	67.9 - 72.5	Bouwer-Rice	Pennsylvanian or Mississippian Bedrock	Limestone, medium hard to hard; RQD = 57% (Fair)	1.7E-06
MW-355	27.4 - 32.0	Bouwer-Rice	Mississippian Bedrock	Limestone, medium soft, fossiliferous; RQD = 57% (Fair)	3.5E-05
MW-258	40.0 - 50.0	Bouwer-Rice	Pennsylvanian or Mississippian Bedrock	Shale, weathered	1.4E-06
MW-392	74.0 - 84.0	Bouwer-Rice	Mississippian Bedrock	Shaley Limestone, slightly weathered, fossiliferous; RQD = 58% (Fair)	9.8E-07
MW-393	75.0 - 85.0	Bouwer-Rice	Mississippian Bedrock	Shaley, weathered; RQD = 76% (Good)	2.2E-06
MW-394	73.0 - 83.0	Bouwer-Rice	Mississippian Bedrock	Shaley Limestone, weathered; RQD = 75% (Good)	2.4E-07
				Geometric Mean Hydraulic Conductivity	**1.9E-06**
Hydrostratigraphic Unit : CCR Unit					
XPW01	7.0 - 12.0	Bouwer-Rice	Ash Pond System: Bottom Ash	Ash (USCS classification: Poorly Graded Sand with Cinders and Ash)	8.7E-02
XPW02	6.0 - 11.0	Bouwer-Rice	Ash Pond System: Bottom Ash	Ash (USCS classification: Poorly Graded Sand with Cinders and Ash)	6.1E-03
XPW04	6.5 - 16.5	Springer-Gelhar	Ash Pond System: Bottom Ash	Ash (USCS classification: Poorly Graded Sand with Cinders)	1.1E-01
XPW06	5.0 - 10.0	Bouwer-Rice	Ash Pond System: Bottom Ash	Ash (USCS classification: Silty Clayey Sand with Cinders and Ash)	8.1E-04
				Geometric Mean Hydraulic Conductivity	**1.5E-02**

TABLE 3-1. HORIZONTAL AND VERTICAL PERMEABILITY TEST RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Vertical Hydraulic Conductivity: Laboratory Test Results					
Monitoring Well Number	**Depth Interval Tested (feet)**	**Analysis Method**	**Lithologic Layer**	**Primary Lithologies within Sample Interval**	**Vertical Hydraulic Conductivity (cm/s)**
Hydrostratigraphic Unit: Fill Unit					
TPZ-163	1.5 - 3.5	Geotechnology (2013)	Ash Pond System: Fly Ash / Bottom Ash	Ash (USCS classification: Silty Sand, fine grained)	2.5E-04
TPZ-164	3.0 - 5.0	Geotechnology (2013)	Ash Pond System: Bottom Ash	Ash (USCS classification: Sandy Silt, fine grained sand)	6.5E-04
TPZ-167	29.0 - 30.0	Geotechnology (2013)	Ash Pond System: Fly Ash	Ash (USCS classification: Silt)	9.7E-06
TPZ-168	3.0 - 5.0	Geotechnology (2013)	Ash Pond System: Fly Ash	Ash (USCS classification: Sandy Silt, fine-medium grained sand)	4.2E-04
XPW02B	5.5 - 6.5	Terracon (2022)	Ash Pond System: Bottom Ash	Ash (USCS classification: Poorly Graded Sand with Cinders and Ash)	4.1E-05
XPW04A	15 - 16	Terracon (2022)	Ash Pond System: Bottom Ash	Ash (USCS classification: Poorly Graded Sand with Cinders)	1.4E-05
XPW06A	7.5 - 8.5	Terracon (2022)	Ash Pond System: Bottom Ash	Ash (USCS classification: Silty Clayey Sand with Cinders and Ash)	5.6E-07
				Geometric Mean Hydraulic Conductivity	**4.1E-05**
Hydrostratigraphic Unit: Upper Unit					
MW-154	8.0 - 9.2	Shively Geotechnical (2010)	Cahokia Formation	Sandy Clay with Gravel	7.8E-06
MW-252	44.0 - 46.0	Shively Geotechnical (2010)	Vandalia Member	Clay	6.3E-09
MW-262	33.5 - 35.5	Geotechnology (2013)	Vandalia Member	Clay	9.9E-09
MW-350	18.0 - 20.0	Shively Geotechnical (2010)	Cahokia Formation	Clay	3.4E-07
TPZ-163	28.0 - 30.0	Geotechnology (2013)	Vandalia Member	Clay, trace fine sand	4.2E-04
TPZ-164	10.0 - 12.0	Geotechnology (2013)	Equality Formation	Clay	1.3E-06
TPZ-165	8.0 - 10.0	Geotechnology (2013)	Vandalia Member	Clay, trace sand	5.3E-06
TPZ-167	32.0 - 34.0	Geotechnology (2013)	Vandalia Member	Clay with sand	6.2E-07
MW-358	15.5 - 16.5	Terracon (2022)	Vandalia Member	Clay with sand	6.5E-08
MW-392	30.5 - 31.5	Terracon (2022)	Equality Formation	Clay with sand	6.3E-08
MW-393	20.5 - 21.5	Terracon (2022)	Equality Formation	Clay	4.8E-08
MW-394	18.5 - 19.5	Terracon (2022)	Equality Formation	Sandy Clay with Gravel	5.2E-08
				Geometric Mean Hydraulic Conductivity	**3.5E-07**

[O: EGP 4/27/23, C: SSW 5/2/23]

Notes:
cm/s = centimeters per second

Reference:
Bouwer-Rice = Bouwer and Rice Analytical Method for Unconfined Aquifers, 1976. (note: also used for Confined Aquifers)
KGS Model = KGS overdamped slug test analysis model (Hyder et al., 1994)
Shively Geotechnical (2010): see Appendix C
Geotechnology (2013): see Appendix C
Terracon (2022): see Appendix C
Data source was the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014)

TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

Date	MW-104SR Groundwater Elevation (ft NAVD88)	MW-104DR Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UU (Vandalia)	UU (Vandalia)				
3/21/2016	447.33	447.39	-0.06	20.41	-0.003	up
6/21/2016	445.22	445.27	-0.05	18.30	-0.003	up
9/19/2016	447.05	447.12	-0.07	20.13	-0.003	up
12/21/2016	444.45	444.52	-0.07	17.53	-0.004	up
3/14/2017	446.42	446.48	-0.06	19.50	-0.003	up
6/19/2017	443.95	444.02	-0.07	17.03	-0.004	up
7/25/2017	442.66	442.72	-0.06	15.74	-0.004	up
11/27/2017	441.54	441.60	-0.06	14.62	-0.004	up
3/15/2018	447.34	447.42	-0.08	20.42	-0.004	up
6/25/2018	444.68	444.75	-0.07	17.76	-0.004	up
9/25/2018	445.24	445.31	-0.07	18.32	-0.004	up
12/18/2018	447.91	448.01	-0.10	15.83	-0.006	up
3/19/2019	447.54	447.59	-0.05	20.62	-0.002	up
9/24/2019	443.29	443.30	-0.01	16.37	-0.001	flat
3/24/2020	448.20	448.26	-0.06	15.83	-0.004	up
9/15/2020	444.29	444.32	-0.03	17.37	-0.002	up
12/16/2020	447.46	447.50	-0.04	20.54	-0.002	up
3/8/2021	447.54	447.60	-0.06	20.62	-0.003	up
6/21/2021	445.24	445.01	0.23	18.32	0.013	down
9/14/2021	442.91	442.97	-0.06	15.99	-0.004	up
12/14/2021	444.15	444.20	-0.05	17.23	-0.003	up
3/28/2022	447.51	447.52	-0.01	20.59	0.000	flat
6/14/2022	444.99	445.02	-0.03	18.07	-0.002	up
9/29/2022	444.09	441.62	2.47	17.17	0.144	down
12/5/2022	441.24	441.30	-0.06	14.32	-0.004	up

Middle of screen elevation MW-104SR	442.8
Middle of screen elevation MW-104DR	426.9
Top of screen elevation MW-104SR	447.8
Top of screen elevation MW-104DR	429.4

TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

Date	MW-104DR Groundwater Elevation (ft NAVD88)	MW-304 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UU (Vandalia)	BU				
3/21/2016	447.39	445.08	2.31	23.89	0.097	down
6/21/2016	445.27	445.08	0.19	23.89	0.008	down
9/19/2016	447.12	444.97	2.15	23.89	0.090	down
12/21/2016	444.52	444.97	-0.45	23.89	-0.019	up
3/14/2017	446.48	445.64	0.84	23.89	0.035	down
6/19/2017	444.02	445.64	-1.62	23.89	-0.068	up
7/25/2017	442.72	445.48	-2.76	23.89	-0.116	up
11/27/2017	441.60	445.44	-3.84	23.89	-0.161	up
3/15/2018	447.42	446.02	1.40	23.89	0.059	down
6/25/2018	444.75	445.98	-1.23	23.89	-0.051	up
9/25/2018	445.31	445.60	-0.29	23.89	-0.012	up
12/18/2018	448.01	445.78	2.23	23.89	0.093	down
3/19/2019	447.59	446.16	1.43	23.89	0.060	down
9/24/2019	443.30	446.19	-2.89	23.89	-0.121	up
3/24/2020	448.26	445.93	2.33	23.89	0.098	down
9/15/2020	444.32	445.52	-1.20	23.89	-0.050	up
12/16/2020	447.50	445.67	1.83	23.89	0.077	down
3/8/2021	447.60	445.99	1.61	23.89	0.067	down
6/21/2021	445.01	446.02	-1.01	23.89	-0.042	up
9/14/2021	442.97	445.40	-2.43	23.89	-0.102	up
12/14/2021	444.20	445.47	-1.27	23.89	-0.053	up
3/28/2022	447.52	445.99	1.53	23.89	0.064	down
6/14/2022	445.02	445.86	-0.84	23.89	-0.035	up
9/29/2022	441.62	434.04	7.58	23.89	0.317	down
12/5/2022	441.30	445.35	-4.05	23.89	-0.170	up
			Middle of screen elevation MW-104DR			426.9
			Middle of screen elevation MW-304			403.0
			Top of screen elevation MW-104DR			429.4
			Top of screen elevation MW-304			408.0

TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

Date	MW-153 Groundwater Elevation (ft NAVD88)	MW-253 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UU (Vandalia)	UU (Vandalia)				
3/21/2016	435.58	435.89	-0.31	17.07	-0.018	up
6/21/2016	432.92	434.66	-1.74	17.07	-0.102	up
9/19/2016	436.69	435.27	1.42	17.07	0.083	down
12/21/2016	432.55	434.51	-1.96	17.07	-0.115	up
3/14/2017	434.19	435.09	-0.90	17.07	-0.053	up
6/22/2017	431.88	432.76	-0.88	21.35	-0.041	up
7/25/2017	430.10	432.76	-2.66	19.57	-0.136	up
11/27/2017	430.37	431.33	-0.96	19.84	-0.048	up
3/15/2018	434.62	434.74	-0.12	17.07	-0.007	up
6/25/2018	432.15	432.89	-0.74	21.62	-0.034	up
9/25/2018	432.69	433.73	-1.04	17.07	-0.061	up
12/18/2018	437.62	436.55	1.07	17.07	0.063	down
3/19/2019	439.02	437.82	1.20	17.07	0.070	down
9/24/2019	429.90	431.38	-1.48	19.37	-0.076	up
3/24/2020	439.75	438.73	1.02	17.07	0.060	down
9/15/2020	431.37	431.93	-0.56	20.84	-0.027	up
12/17/2020	434.36	433.57	0.79	17.07	0.046	down
3/8/2021	436.65	435.69	0.96	17.07	0.056	down
6/22/2021	432.07	432.56	-0.49	21.54	-0.023	up
9/16/2021	430.47	431.19	-0.72	19.94	-0.036	up
12/15/2021	431.60	431.62	-0.02	21.07	-0.001	flat
3/29/2022	436.77	435.11	1.66	17.07	0.097	down
6/15/2022	432.49	432.86	-0.37	17.07	-0.022	up
9/29/2022	428.82	429.86	-1.04	18.29	-0.057	up
12/6/2022	429.67	430.09	-0.42	19.14	-0.022	up

Middle of screen elevation MW-153	427.6
Middle of screen elevation MW-253	410.5
Top of screen elevation MW-153	432.4
Top of screen elevation MW-253	412.8

TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

Date	MW-152 Groundwater Elevation (ft NAVD88)	MW-252 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UU (Equality)	UU (Vandalia)				
3/21/2016	421.10	424.93	-3.83	34.54	-0.111	up
6/21/2016	420.09	424.57	-4.48	34.54	-0.130	up
12/21/2016	419.67	425.06	-5.39	34.54	-0.156	up
3/14/2017	420.14	425.07	-4.93	34.54	-0.143	up
6/19/2017	419.59	425.05	-5.46	34.54	-0.158	up
7/25/2017	417.90	425.05	-7.15	34.54	-0.207	up
11/27/2017	418.76	424.53	-5.77	34.54	-0.167	up
3/15/2018	419.89	424.97	-5.08	34.54	-0.147	up
6/25/2018	419.15	425.07	-5.92	34.54	-0.171	up
9/25/2018	420.44	424.97	-4.53	34.54	-0.131	up
12/18/2018	420.35	425.02	-4.67	34.54	-0.135	up
3/19/2019	420.35	424.97	-4.62	34.54	-0.134	up
9/24/2019	417.40	422.88	-5.48	34.54	-0.159	up
3/24/2020	423.84	424.92	-1.08	34.54	-0.031	up
9/15/2020	418.47	424.37	-5.90	34.54	-0.171	up
12/16/2020	419.84	424.57	-4.73	34.54	-0.137	up
3/8/2021	420.48	423.59	-3.11	34.54	-0.090	up
7/19/2021	419.74	422.39	-2.65	34.54	-0.077	up
9/14/2021	417.26	423.50	-6.24	34.54	-0.181	up
12/14/2021	418.78	418.11	0.67	34.54	0.019	down
3/28/2022	419.79	423.79	-4.00	34.54	-0.116	up
6/14/2022	418.31	423.77	-5.46	34.54	-0.158	up
9/29/2022	418.00	416.88	1.12	34.54	0.032	down
12/6/2022	418.17	422.72	-4.55	34.54	-0.132	up
			Middle of screen elevation MW-152			410.1
			Middle of screen elevation MW-252			375.6
			Top of screen elevation MW-152			414.7
			Top of screen elevation MW-252			377.9

TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Date	MW-252 Groundwater Elevation (ft NAVD88)	MW-352 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UU (Vandalia)	BU				
3/21/2016	424.93	423.88	1.05	23.41	0.045	down
6/21/2016	424.57	424.34	0.23	23.41	0.010	down
12/21/2016	425.06	422.54	2.52	23.41	0.108	down
3/14/2017	425.07	418.40	6.67	23.41	0.285	down
6/19/2017	425.05	419.86	5.19	23.41	0.222	down
7/25/2017	425.05	418.77	6.28	23.41	0.268	down
11/27/2017	424.53	419.33	5.20	23.41	0.222	down
3/15/2018	424.97	422.29	2.68	23.41	0.114	down
6/25/2018	425.07	421.73	3.34	23.41	0.143	down
9/25/2018	424.97	421.46	3.51	23.41	0.150	down
12/18/2018	425.02	422.26	2.76	23.41	0.118	down
3/19/2019	424.97	423.42	1.55	23.41	0.066	down
9/24/2019	422.88	422.20	0.68	23.41	0.029	down
3/24/2020	424.92	423.82	1.10	23.41	0.047	down
9/15/2020	424.37	423.66	0.71	23.41	0.030	down
12/16/2020	424.57	423.85	0.72	23.41	0.031	down
3/8/2021	423.59	423.95	-0.36	23.41	-0.015	up
7/19/2021	423.95	423.50	0.45	23.41	0.019	down
9/14/2021	419.48	418.11	1.37	23.41	0.059	down
12/14/2021	421.31	423.79	-2.48	23.41	-0.106	up
3/28/2022	424.19	423.77	0.42	23.41	0.018	down
6/14/2022	424.64	416.88	7.76	23.41	0.331	down
9/29/2022	424.44	422.72	1.72	23.41	0.073	down
12/6/2022	425.00	421.16	3.84	23.41	0.164	down
			Middle of screen elevation MW-252			375.6
			Middle of screen elevation MW-352			352.2
			Top of screen elevation MW-252			377.9
			Top of screen elevation MW-352			354.5

RAMBOLL

TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

Date	MW-150 Groundwater Elevation (ft NAVD88)	MW-350 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UU (Cahokia)	BU				
3/21/2016	379.22	374.57	4.65	23.79	0.195	down
6/21/2016	377.59	375.26	2.33	27.38	0.085	down
12/21/2016	377.70	374.66	3.04	27.49	0.111	down
3/14/2017	378.32	374.35	3.97	28.11	0.141	down
6/19/2017	377.35	375.52	1.83	27.14	0.067	down
7/25/2017	376.04	374.23	1.81	25.83	0.070	down
11/27/2017	376.66	374.15	2.51	26.45	0.095	down
3/15/2018	377.93	374.94	2.99	27.72	0.108	down
6/25/2018	376.82	374.92	1.90	26.61	0.071	down
9/25/2018	377.62	375.53	2.09	27.41	0.076	down
12/18/2018	379.03	373.63	5.40	23.79	0.227	down
3/19/2019	382.04	377.15	4.89	23.79	0.206	down
9/24/2019	375.67	373.45	2.22	25.46	0.087	down
3/24/2020	382.70	377.51	5.19	23.79	0.218	down
9/15/2020	376.58	373.39	3.19	26.37	0.121	down
12/17/2020	377.79	374.44	3.35	27.58	0.121	down
3/8/2021	379.17	374.80	4.37	23.79	0.184	down
6/21/2021	377.03	--	--	--	--	--
9/14/2021	376.15	373.42	2.73	25.94	0.105	down
12/14/2021	377.26	373.11	4.15	27.05	0.153	down
3/28/2022	379.39	373.70	5.69	23.79	0.239	down
6/14/2022	377.74	--	--	--	--	--
9/29/2022	375.89	372.85	3.04	25.68	0.118	down
12/6/2022	377.44	372.65	4.79	27.23	0.176	down
			Middle of screen elevation MW-150			374.0
			Middle of screen elevation MW-350			350.2
			Top of screen elevation MW-150			378.8
			Top of screen elevation MW-350			352.5

TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

Date	MW-155 Groundwater Elevation (ft NAVD88)	MW-355 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UU (Cahokia)	BU				
3/21/2016	376.85	373.83	3.02	15.74	0.192	down
6/21/2016	375.80	371.14	4.66	14.69	0.317	down
9/19/2016	373.85	372.22	1.63	12.74	0.128	down
12/21/2016	373.39	370.23	3.16	12.28	0.257	down
3/14/2017	374.20	370.39	3.81	13.09	0.291	down
6/19/2017	376.60	372.39	4.21	15.49	0.272	down
7/25/2017	373.86	369.99	3.87	12.75	0.304	down
3/15/2018	372.51	370.34	2.17	11.40	0.190	down
6/25/2018	369.49	369.82	-0.33	8.38	-0.039	up
9/25/2018	372.90	370.38	2.52	11.79	0.214	down
12/18/2018	373.77	370.94	2.83	12.66	0.224	down
3/19/2019	378.26	378.44	-0.18	17.15	-0.010	up
9/24/2019	374.22	370.54	3.68	13.11	0.281	down
3/24/2020	380.45	379.34	1.11	14.39	0.077	down
9/15/2020	374.20	370.19	4.01	13.09	0.306	down
12/17/2020	374.10	370.31	3.79	12.99	0.292	down
3/8/2021	376.63	371.34	5.29	15.52	0.341	down
6/22/2021	375.86	370.85	5.01	14.75	0.340	down
9/16/2021	373.76	369.36	4.40	12.65	0.348	down
12/14/2021	373.59	370.00	3.59	12.48	0.288	down
3/29/2022	375.90	372.06	3.84	14.79	0.260	down
6/15/2022	376.46	371.54	4.92	15.35	0.321	down
			Middle of screen elevation MW-155			375.5
			Middle of screen elevation MW-355			361.1
			Top of screen elevation MW-155			380.3
			Top of screen elevation MW-355			363.4

TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

Date	OW-156 Groundwater Elevation (ft NAVD88)	MW-356 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UU (Equality)	BU				
3/21/2016	420.78	424.77	-3.99	48.42	-0.082	up
6/21/2016	421.10	424.89	-3.79	48.42	-0.078	up
9/19/2016	423.33	425.03	-1.70	48.42	-0.035	up
12/21/2016	422.10	424.82	-2.72	48.42	-0.056	up
3/14/2017	423.45	425.06	-1.61	48.42	-0.033	up
6/19/2017	423.70	425.20	-1.50	48.42	-0.031	up
7/25/2017	419.17	425.05	-5.88	48.42	-0.121	up
11/27/2017	419.82	424.88	-5.06	48.42	-0.105	up
6/25/2018	420.06	425.06	-5.00	48.42	-0.103	up
9/25/2018	421.74	425.03	-3.29	48.42	-0.068	up
3/19/2019	424.35	424.95	-0.60	48.42	-0.012	up
9/24/2019	418.48	424.58	-6.10	48.42	-0.126	up
3/24/2020	424.87	424.37	0.50	48.42	0.010	down
9/15/2020	419.68	423.98	-4.30	48.42	-0.089	up
12/17/2020	422.85	--	--	--	--	--
3/8/2021	424.22	423.66	0.56	48.42	0.012	down
6/22/2021	420.04	--	--	--	--	--
9/15/2021	418.49	423.61	-5.12	48.42	-0.106	up
3/29/2022	424.27	423.40	0.87	48.42	0.018	down
9/30/2022	420.85	423.28	-2.43	48.42	-0.050	up

Middle of screen elevation OW-156	412.6
Middle of screen elevation MW-356	364.2
Top of screen elevation OW-156	380.3
Top of screen elevation MW-356	363.4

RAMBOLL

TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

Date	MW-158R Groundwater Elevation (ft NAVD88)	MW-258 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UU (Equality)	BU				
10/27/2022	442.74	441.74	1.00	34.15	0.029	down
11/17/2022	442.63	441.95	0.68	34.04	0.020	down
12/13/2022	442.32	442.05	0.27	33.73	0.008	down
1/11/2023	447.87	442.52	5.35	31.97	0.167	down
2/20/2023	--	442.92	--	31.97	--	--
			Middle of screen elevation MW-158R			440.6
			Middle of screen elevation MW-258			408.6
			Top of screen elevation MW-158R			445.6
			Top of screen elevation MW-258			413.6

Date	PZ-170 Groundwater Elevation (ft NAVD88)	MW-370 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UU (Equality)	BU				
10/27/2022	404.21	401.72	2.49	31.80	0.078	down
11/16/2022	404.41	401.78	2.63	31.80	0.083	down
12/13/2022	404.82	402.17	2.65	31.80	0.083	down
1/12/2023	406.02	402.60	3.42	31.80	0.108	down
2/20/2023	--	402.75	--	31.80	--	--
			Middle of screen elevation PZ-170			392.5
			Middle of screen elevation MW-370			360.7
			Top of screen elevation PZ-170			397.5
			Top of screen elevation MW-370			365.7

Date	PZ-182 Groundwater Elevation (ft NAVD88)	MW-382 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UU (Equality)	BU				
10/25/2022	411.69	414.01	-2.32	-31.80	0.073	down
11/14/2022	412.84	414.34	-1.50	-31.80	0.047	down
12/12/2022	413.31	414.47	-1.16	-31.80	0.036	down
1/10/2023	414.31	414.69	-0.38	-31.80	0.012	down
3/14/2023	415.44	415.07	0.37	-31.80	-0.012	up
			Middle of screen elevation PZ-182			367.7
			Middle of screen elevation MW-382			399.5
			Top of screen elevation PZ-182			372.7
			Top of screen elevation MW-382			404.5

TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

Date	MW-192 Groundwater Elevation (ft NAVD88)	MW-392 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UU (Equality)	BU				
10/27/2022	428.41	427.68	0.73	53.97	0.014	down
11/16/2022	428.57	428.08	0.49	53.97	0.009	down
12/13/2022	428.61	428.41	0.20	53.97	0.004	down
1/12/2023	428.91	428.61	0.30	53.97	0.006	down
2/20/2023	428.94	428.97	-0.03	53.97	-0.001	flat
			Middle of screen elevation MW-192			409.0
			Middle of screen elevation MW-392			355.1
			Top of screen elevation MW-192			414.0
			Top of screen elevation MW-392			360.1

Date	MW-193 Groundwater Elevation (ft NAVD88)	MW-393 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UU (Equality)	BU				
10/27/2022	428.95	427.06	1.89	52.93	0.036	down
11/16/2022	429.02	429.29	-0.27	52.93	-0.005	up
12/13/2022	429.07	429.52	-0.45	52.93	-0.009	up
1/12/2023	429.30	429.51	-0.21	52.93	-0.004	up
2/20/2023	431.24	429.35	1.89	52.93	0.036	down
			Middle of screen elevation MW-193			407.5
			Middle of screen elevation MW-393			354.6
			Top of screen elevation MW-193			412.5
			Top of screen elevation MW-393			359.6

TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Date	MW-194 Groundwater Elevation (ft NAVD88)	MW-394 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UU (Equality)	BU				
10/27/2022	430.43	431.52	-1.09	44.72	-0.024	up
11/16/2022	431.32	432.69	-1.37	44.72	-0.031	up
12/13/2022	431.39	433.18	-1.79	44.72	-0.040	up
1/12/2023	431.60	432.99	-1.39	44.72	-0.031	up
2/20/2023	431.69	432.91	-1.22	44.72	-0.027	up
			Middle of screen elevation MW-194			407.2
			Middle of screen elevation MW-394			362.5
			Middle of screen elevation MW-194			402.4
			Middle of screen elevation MW-394			357.5

[O: EGP 4/27/23, C: SSW 5/2/23]

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.

BU = bedrock unit
dh = head change
dl = distance change
ft = foot/feet
NAVD88 = North American Vertical Datum of 1988
PMP = potential migration pathway
UU = upper unit

TABLE 3-3. POREWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)	Total Dissolved Solids (mg/L)
TPZ-164	09/26/2018	--	--	--	--	--	--	--	--	--	--	--	--	0.0182	--	--	7.3	--	--	--	--	--
TPZ-164	06/25/2019	--	--	--	--	--	--	81.2	43	--	--	--	--	0.0142	--	--	7.3	--	--	123	--	--
TPZ-164	03/25/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1.8 U	--	--	--	--
TPZ-164	03/26/2020	0.001 U	0.00330	0.0753	0.001 U	1.23	0.001 U	63.1	58	0.00170	0.00110	0.26	0.001 U	0.0129	0.0002 U	0.0388	7.5	--	0.001 U	167	0.002 U	506
TPZ-164	09/16/2020	0.001 U	0.00120	0.0783	--	1.47	--	72.6	56	0.0015 U	0.001 U	0.22	0.001 U	0.0161	--	0.0256	7.0	--	0.001 U	187	--	555
TPZ-164	03/12/2021	0.001 U	0.001 U	0.0635	0.001 U	1.09	0.001 U	67.4	49	0.0015 U	0.001 U	0.22	0.001 U	0.0100	0.0002 U	0.0230	7.4	0.281	0.001 U	157	0.002 U	554
TPZ-164	09/21/2021	0.001 U	0.00150	0.0681	--	1.77	--	70.8	52	0.0015 U	0.001 U	0.20	0.001 U	0.0174	--	0.0219	7.1	0.865	0.001 U	--	--	--
TPZ-164	09/29/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.2	--	--	167	--	544
TPZ-164	03/29/2022	0.001 U	0.00660	0.113	0.001 U	1.56	0.001 U	55.4	50	0.00430	0.00160	0.26	0.00160	0.0167	0.0002 U	0.0337	7.3	0.694 J	0.001 U	227	0.002 U	472
TPZ-164	09/30/2022	--	0.00320	0.166	--	2.04	--	68.5	52	0.00290	0.00170	0.24	0.00220	0.0243	--	0.0316	7.1	0.161	--	150	--	465
TPZ-164	10/28/2022	0.0004 U	0.0008 J	0.0610	0.0002 U	1.47	0.0002 U	67.6	57	0.0007 U	0.0001 U	0.26	0.0006 U	0.0140	0.00006 U	0.0155	7.3	1.35	0.0006 U	127	0.001 U	615
TPZ-164	11/16/2022	0.0004 U	0.0007 J	0.0560	0.0002 U	1.38	0.0002 U	61.8	46	0.0007 U	0.0002 U	0.26	0.0006 U	0.00850	0.00006 U	0.0176	7.6	0.194	0.0006 U	123	0.001 U	515
TPZ-164	12/14/2022	0.0004 U	0.0009 J	0.0548	0.0002 U	1.54	0.0002 U	60.9	55	0.0007 U	0.0001 U	0.27	0.0006 U	0.0114	0.00008 U	0.0166	7.3	0.590 B	0.0006 U	120	0.001 U	310
TPZ-164	03/14/2023	0.0004 U	0.0008 J	0.0640	0.0002 U	1.30	0.0002 U	70.0	43	0.0007 U	0.0001 U	0.22	0.0006 U	0.0101	0.00006 U	0.0131	7.2	0	0.0006 U	113	0.001 U	550
XPW01	10/26/2022	0.0004 U	0.0005 J	0.104	0.0002 U	0.930	0.0002 U	65.4	21	0.0007 U	0.0008 U	0.61	0.0006 U	0.0142	0.00006 U	0.0464 B	7.0	0.905 J	0.0006 U	98	0.001 U	406
XPW01	11/15/2022	0.0004 U	0.0007 J	0.108	0.0002 U	1.03	0.0002 U	72.5	22	0.0013 J	0.0002 J	0.50	0.0006 U	0.0127	0.00006 U	0.0575	7.0	0.123	0.0006 U	105	0.001 U	410
XPW01	12/13/2022	0.00120	0.00930 J	0.272 J	0.00130	0.942	0.0005 J	81.5	25	0.0761 J	0.0143 J	0.50	0.0171	0.0354 J	0.00006 U	0.0660	6.6	1.86 J	0.0192	120	0.0011 J	385
XPW01	01/12/2023	0.0004 U	0.00100	0.105	0.0002 U	0.881	0.0002 U	67.5	26	0.00390	0.0007 J	0.51	0.00130	0.0132	0.00006 U	0.0467	6.9	0.284 B	0.0006 U	119	0.001 U	384
XPW01	05/23/2023	0.0004 U	0.0087 U	0.0743	0.0002 U	0.649 J+	0.0005 U	55.1	21	0.0028 U	0.0003 J	0.62	0.004 U	0.00830	0.00006 U	0.0342	7.0	1.07 J+	0.0006 U	62 J+	0.001 U	316
XPW02	10/26/2022	0.0004 U	0.00240	0.205	0.0002 U	1.18	0.0002 U	121	33	0.0007 U	0.0001 J	0.61	0.0006 U	0.0233	0.00006 U	0.0338	7.6	0.992	0.0007 J	22	0.001 U	500
XPW02	11/15/2022	0.0004 U	0.00260	0.194	0.0002 U	1.20	0.0002 U	115	30	0.001 J	0.0002 J	0.55	0.0006 U	0.0194	0.00006 U	0.0350	7.6	0.349	0.0006 U	20	0.001 U	485
XPW02	12/12/2022	0.0004 U	0.00360	0.257	0.0002 U	1.52	0.0002 U	110	32	0.0008 J	0.0003 J	0.63	0.0006 U	0.0230	0.00006 U	0.0334	7.5	1.41 B	0.0006 U	37	0.001 U	390
XPW02	01/12/2023	0.0004 U	0.00230	0.125	0.0002 U	0.870	0.0002 U	88.5	29	0.0007 U	0.0003 J	0.46	0.0006 U	0.0108	0.00006 U	0.0236	7.3	0.314 B	0.0008 J	43	0.001 U	446
XPW02	05/23/2023	0.0004 U	0.0100	0.185	0.0002 U	1.08 J+	0.0005 U	101	36	0.0028 U	0.0003 J	0.50	0.004 U	0.0147	0.00006 U	0.0328	7.0	1.07 J+	0.0006 U	41 J+	0.001 U	525
XPW04	10/28/2022	0.0004 U	0.0005 J	0.161	0.0002 U	1.28	0.0002 U	47.9	55	0.0007 U	0.0001 U	0.44	0.0006 U	0.0108	0.00006 U	0.0174	8.3	1.69	0.0006 U	119	0.001 U	484

TABLE 3-3. POREWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)	Total Dissolved Solids (mg/L)
XPW04	11/15/2022	0.0004 U	0.0005 J	0.171	0.0002 U	1.15	0.0002 U	53.2	56	0.0007 U	0.0002 U	0.40	0.0006 U	0.00660	0.00006 U	0.0184	8.4	0.134	0.0006 U	124	0.001 U	472
XPW04	12/12/2022	0.0004 U	0.0007 J	0.196	0.0002 U	1.38	0.0002 U	51.1	55	0.0007 U	0.0001 U	0.42	0.0006 U	0.0136	0.00006 U	0.0169	8.0	1.13 J	0.0006 U	120	0.001 U	428
XPW04	01/12/2023	0.0004 U	0.0005 J	0.156	0.0002 U	0.835	0.0002 U	49.6	54	0.0009 J	0.0003 J	0.40	0.0006 U	0.00900	0.00006 U	0.0144	8.0	0.178 B	0.0006 U	119	0.001 U	438
XPW04	05/23/2023	0.0004 U	0.0087 U	0.172	0.0002 U	0.921 J+	0.0005 U	56.2	45	0.0028 U	0.0006 J	0.33	0.004 U	0.00560	0.00006 U	0.0259	8.2	1.07 J+	0.0006 U	173	0.001 U	488
XPW05	10/26/2022	0.0004 U	0.0004 U	0.104	0.0002 U	1.02	0.0002 U	43.9	46	0.0007 U	0.0001 U	0.57	0.0006 U	0.00530	0.00006 U	0.0156	7.8	0.491	0.0006 U	123	0.001 U	458
XPW05	11/15/2022	0.0004 U	0.00140	0.120	0.0002 U	1.16	0.0002 U	43.5	46	0.0009 J	0.0002 J	0.58	0.0006 U	0.0039 J	0.00006 U	0.0169	7.7	0.419	0.0006 U	132	0.001 U	450
XPW05	12/12/2022	0.0004 U	0.00310	0.190	0.0002 U	1.25 J+	0.0002 U	43.6	48	0.0007 U	0.0001 J	0.62	0.0006 U	0.00930	0.00006 U	0.0228	7.2	0.956 B	0.0006 U	137	0.001 U	432
XPW05	01/24/2023	0.0004 U	0.00340	0.208	0.0002 U	1.57	0.0002 U	40.2	48	0.00560	0.0009 J	0.60	0.00230	0.00800	0.00006 U	0.0221	7.3	0.0650	0.0006 U	125	0.001 U	412
XPW05	05/23/2023	0.0004 U	0.0093 J	0.212	0.0002 U	1.08 J+	0.0005 U	45.8	47	0.0028 U	0.0004 J	0.54	0.004 U	0.0027 J	0.00006 U	0.0152	7.2	1.21 J+	0.0006 U	110	0.001 U	428
XPW06	10/26/2022	0.0004 U	0.00250	0.274	0.0002 U	2.29	0.0002 U	130	25	0.0007 U	0.0008 U	0.58	0.0006 U	0.0118	0.00006 J	0.0718 B	7.2	1.69	0.00420	575	0.001 U	855
XPW06	11/15/2022	0.0004 U	0.00200	0.198	0.0002 U	4.64	0.0002 U	164	18	0.0007 U	0.0007 J	0.61	0.0006 U	0.0019 U	0.00006 U	0.150	7.3	0.702	0.00470	475	0.001 U	1,120
XPW06	12/13/2022	0.0004 U	0.00230	0.246	0.0002 U	3.86	0.0002 U	174	18	0.0007 U	0.0005 J	0.59	0.0006 U	0.00750	0.00006 U	0.114	7.0	0.854 B	0.00210	508	0.001 U	975
XPW06	01/12/2023	0.0004 U	0.00100	0.100	0.0002 U	3.38	0.0002 U	112	10	0.0008 J	0.0002 J	0.50	0.0006 U	0.00310	0.00006 U	0.117	7.2	0.0799	0.00660	391	0.001 U	848
XPW06	05/23/2023	0.0004 U	0.0087 U	0.161	0.0002 U	2.11 J+	0.0005 U	75.9	6	0.0028 U	0.0006 J	0.32	0.004 U	0.0019 U	0.00006 U	0.0521	7.2	0.728 J+	0.0006 U	171	0.001 U	525

Notes:
Field readings are reported with as many significant figures as provided by analytical laboratory.
-- = data not available
mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = standard units
U = The analyte was analyzed for, but was not detected above the level of the adjusted detection limit or quantitation limit, as appropriate.
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.
B = The analyte was found in sample and in associated method blank.

TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

$V = K i \ / \ n_e$

V = Groundwater Velocity

K = Hydraulic Conductivity [1]

i = hydraulic gradient

n_e = Effective Porosity [2]

BAP - Downgradient, North of Secondary Pond: Upper Unit

Hydraulic Conductivity (cm/s): 2.9E-05

Effective Porosity (%): 0.15 Assumes: clay

Date	Approximate Flow Direction	Distance Between Measuring Points (ft)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/d)
3/24/2020	SW	4336	44.42	0.010	0.0056
6/23/2020	SW	4336	44.26	0.010	0.0056
9/15/2020	SW	4336	45.48	0.010	0.0057
12/16/2020	SW	4336	48.75	0.011	0.0062
3/8/2021	SW	4336	47.59	0.011	0.0060
6/21/2021	SW	4336	44.18	0.010	0.0056
9/13/2021	SW	4336	44.73	0.010	0.0057
12/14/2021	SW	4336	47.40	0.011	0.0060
3/28/2022	SW	4336	48.37	0.011	0.0061
6/14/2022	SW	4336	44.51	0.010	0.0056
9/29/2022	SW	3829.00	40.85	0.011	0.0058
12/5/2022	SW	3812.00	39.72	0.010	0.0057
			Average	**0.011**	**0.0058**

TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

FAPS - West: Upper Unit

Hydraulic Conductivity (cm/s): 2.9E-05

Effective Porosity (%): 0.15 Assumes: clay

Date	Approximate Flow Direction	Distance Between Measuring Points (ft)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/d)
3/24/2020	W	660	10	0.015	0.0082
6/23/2020	W	572	10	0.015	0.0082
9/15/2020	W	580	10	0.017	0.0093
12/16/2020	W	680	10	0.015	0.0082
3/8/2021	W	680	10	0.015	0.0081
6/21/2021	W	702	10	0.014	0.0078
9/13/2021	W	682	10	0.015	0.0080
12/14/2021	W	681	10	0.015	0.0080
3/28/2022	W	745	10	0.013	0.0074
6/14/2022	W	640	10	0.016	0.0086
9/29/2022	W	660	10	0.015	0.0083
12/5/2022	W	660	10	0.015	0.0083
1/10/2023	W	682	10	0.015	0.0080
3/13/2023	W	690	10	0.014	0.0079
			Average	**0.015**	**0.0082**

TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

BAP - NE (MW-158R/MW-194): Upper Unit

Hydraulic Conductivity (cm/s): 2.9E-05

Effective Porosity (%): 0.15 Assumes: clay

Date	Approximate Flow Direction	Distance Between Measuring Points (ft)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/d)
10/27/2022	NW	2982	12.31	0.004	0.0023
11/16/2022	NW	2982	11.31	0.004	0.0021
12/13/2022	NW	2982	10.93	0.004	0.0020
1/12/2023	NW	2982	16.27	0.005	0.0030
			Average	**0.004**	**0.0023**

BAP - East and Central: Bedrock Unit

Hydraulic Conductivity (cm/s): 1.9E-06

Effective Porosity (%): 0.3 Assumes: shale/limestone

Date	Approximate Flow Direction	Distance Between Measuring Points (ft)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/d)
3/24/2020	NW	657	10	0.015	0.0003
9/15/2020	NW	746	10	0.013	0.0002
3/8/2021	NW	830	10	0.012	0.0002
9/13/2021	NW	640	10	0.016	0.0003
12/14/2021	NW	1120	10	0.009	0.0002
3/28/2022	NW	909	10	0.011	0.0002
6/14/2022	NW	840	10	0.012	0.0002
9/29/2022	NW	769	10	0.013	0.0002
12/5/2022	NW	1000	10	0.010	0.0002
1/10/2023	NW	890	10	0.011	0.0002
3/13/2023	NW	880	10	0.011	0.0002
			Average	**0.012**	**0.0002**

TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

BAP - West (MW-392/MW-370): Bedrock Unit

Hydraulic Conductivity (cm/s): 1.9E-06

Effective Porosity (%): 0.3 Assumes: shale/limestone

Date	Approximate Flow Direction	Distance Between Measuring Points (ft)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/d)
10/27/2022	SW	1500	25.96	0.017	0.0003
11/16/2022	SW	1500	26.30	0.018	0.0003
12/13/2022	SW	1500	26.24	0.017	0.0003
1/12/2023	SW	1500	26.01	0.017	0.0003
2/20/2023	SW	1500	26.22	0.017	0.0003
			Average	**0.017**	**0.0003**

FAPS - West: Bedrock Unit

Hydraulic Conductivity (cm/s): 1.9E-06

Effective Porosity (%): 0.3 Assumes: shale/limestone

Date	Approximate Flow Direction	Distance Between Measuring Points (ft)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/d)
3/24/2020	W	1000	10	0.010	0.0002
6/23/2020	W	476	10	0.021	0.0004
9/15/2020	W	667	10	0.015	0.0003
12/16/2020	W	588	10	0.017	0.0003
3/8/2021	W	550	10	0.018	0.0003
9/13/2021	W	650	10	0.015	0.0003
12/14/2021	W	645	10	0.016	0.0003
3/28/2022	W	600	10	0.017	0.0003
6/14/2022	W	555	10	0.018	0.0003
9/29/2022	W	600	10	0.017	0.0003
12/5/2022	W	480	10	0.021	0.0004
1/10/2023	W	850	10	0.012	0.0002
3/13/2023	W	688	10	0.015	0.0003
			Average	**0.016**	**0.0003**

TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

BAP - NE (MW-258/MW-394): Bedrock Unit

Hydraulic Conductivity (cm/s): 1.9E-06

Effective Porosity (%): 0.3 Assumes: shale/limestone

Date	Approximate Flow Direction	Distance Between Measuring Points (ft)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/d)
10/27/2022	NW	2982	10.22	0.003	0.0001
11/16/2022	NW	2982	9.26	0.003	0.0001
12/13/2022	NW	2982	8.87	0.003	0.0001
1/12/2023	NW	2982	9.53	0.003	0.0001
2/20/2023	NW	2982	10.01	0.003	0.0001
			Average	**0.003**	**0.0001**

[O: EGP 5/4/23, C: SSW 5/5/23]

Notes:

cm/s = centimeters per second
ft/ft = feet per feet
ft/day = feet per day
BAP = Bottom Ash Pond
FAPS = Fly Ash Pond System
NW = northwest
SW = southwest
W = west
1) cm/s x 2,835 = ft/day
2) Source of hydraulic conductivity values was the Groundwater Quality Assessment and Phase II Hydrogeologic Investigation (NRT, June 11, 2014)
3) Effective porosity values estimated from literature, sources included:

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.
Walton, W.C., 1988. Practical Aspects of Groundwater Modeling. National Water Well Association, Worthington, Ohio.

4) Velocity (ft/d) = $\frac{\text{((Average Hydraulic Conductivity (cm/s) x 2835 ((ft/d)/(cm/s))) x (Horizontal Hydraulic Gradient (ft/ft)))}}{\text{Effective Porosity}}$

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)	Total Dissolved Solids (mg/L)
MW-116	10/25/2022	0.0004 U	0.0004 U	0.0576	0.0002 U	0.0250 J	0.0002 U	113	40	0.0009 J	0.0001 U	--	0.0009 J	0.00980	0.00006 U	0.0006 U	7.1	--	0.0006 U	150	0.001 U	--
MW-116	11/16/2022	0.0004 U	0.0004 U	0.0685	0.0002 U	0.023 J	0.0002 U	116	40	0.0007 U	0.0002 U	0.36	0.00160	0.0046 J	0.00006 J	0.0009 J	7.3	--	0.0006 U	180	0.001 U	--
MW-126	10/25/2022	0.0004 U	0.0004 U	0.110	0.0002 U	0.012 J	0.0002 U	88.2	97	0.0011 BJ	0.0001 J	--	0.0006 U	0.00690	0.00012 J	0.0006 U	6.8	--	0.0006 U	102	0.001 U	--
MW-126	11/16/2022	0.0004 U	0.0004 U	0.146	0.0002 U	0.0092 U	0.0002 U	91.0	111	0.0007 U	0.0002 U	0.28	0.0006 U	0.0027 J	0.00006 U	0.0006 U	6.8	--	0.0006 U	95	0.001 U	--
MW-158R	10/27/2022	0.0005 J	0.00100	0.131	0.0005 J	0.0610	0.0002 U	75.7	80	0.0008 J	0.0008 J	0.42	0.00330	0.0158	0.00011 J	0.00940	7.2	0.954	0.0008 J	75	0.001 U	496
MW-158R	11/17/2022	0.0004 U	0.00170	0.133	0.0002 U	0.0347	0.0002 U	76.7	85	0.0164	0.00210	0.39	0.00330	0.00600	0.00007 U	0.00700	--	0.449	0.0006 U	48	0.001 U	470 J
MW-158R	12/13/2022	0.0004 U	0.00120	0.118	0.0002 U	0.0254	0.0002 U	77.6	86 J	0.00560	0.00130	0.40 J	0.0006 J	0.0105	0.00006 U	0.00450	7.6	0.573 B	0.0006 U	47 J	0.001 U	500 J
MW-158R	01/11/2023	0.00640	0.00810	0.167	0.00110	0.0614	0.0006 J	71.6	118	0.0117	0.00650	1.39	0.00710	0.0109	0.00006 U	0.0189	6.7	0.633 B	0.00640	230	0.0019 J	665
MW-158R	05/19/2023	0.0004 U	0.0087 U	1.28	0.00150	0.0666 J+	0.0005 U	70.6	58	0.0319	0.00590	0.60	0.0145	0.0244 J+	0.00009 U	0.0044 J	6.6	2.84 J+	0.0006 U	120	0.001 U	505
MW-192	10/27/2022	0.00250	0.0006 J	0.0739	0.0002 U	0.0537	0.0002 U	56.8	36	0.0008 BJ	0.0008 U	0.46	0.0006 U	0.0225	0.00006 U	0.00470	6.9	0.255	0.0006 U	57	0.001 U	534
MW-192	11/16/2022	0.0007 J	0.00340	0.120	0.0002 U	0.0525	0.0002 U	65.4	34	0.0007 U	0.00210	0.40	0.0006 U	0.0492	0.00006 J	0.00430	7.0	1.06	0.0006 U	48	0.001 U	525
MW-192	12/13/2022	0.00210	0.00320	0.125	0.0002 U	0.0686	0.0002 U	67.5	37 J	0.0014 J	0.00210	0.45 J	0.00170	0.0396	0.00006 U	0.00680	7.0	1.07 B	0.0006 U	50 J	0.001 U	490 J
MW-192	01/12/2023	0.0004 U	0.00400	0.0921	0.0002 U	0.0376	0.0002 U	67.0	32	0.0007 U	0.00190	0.43	0.0006 U	0.0244	0.00006 U	0.00290	6.8	0.979 B	0.0006 U	40	0.001 U	440
MW-192	02/20/2023	0.0004 U	0.00180	0.0981	0.0002 U	0.02 J	0.0002 U	70.3	29	0.0007 U	0.0005 J	0.41	0.0006 U	0.0156	0.00007 U	0.00320	6.9	0.490	0.0006 U	30	0.001 U	476
MW-192	03/13/2023	0.0004 U	0.00210	0.0911	0.0002 U	0.01 U	0.0002 U	67.0	26	0.0007 U	0.0004 J	0.42	0.0006 U	0.0144	0.00006 U	0.00220	6.9	0.131	0.0006 U	27	0.001 U	424
MW-192	04/03/2023	0.0004 U	0.00220	0.154	0.0002 U	0.0527	0.0002 U	68.2	25	0.0011 J	0.00120	0.41	0.0007 J	0.0163	0.00006 U	0.00320	6.9	1.81 J+	0.0006 U	31	0.001 U	456
MW-192	05/16/2023	0.0004 U	0.0087 U	0.120	0.0002 U	0.0227 J+	0.0005 U	69.7	26	0.0028 U	0.00230	0.42	0.004 U	0.005 U	0.00006 U	0.0037 U	6.5	0.732 J+	0.0006 U	25 J+	0.001 U	450
MW-193	10/27/2022	0.0004 U	0.00210	0.0765	0.0002 U	0.0473	0.0002 U	83.9	38	0.0007 U	0.0008 J	0.32	0.0006 U	0.00610	0.00006 U	0.00150 J	7.0	0.186	0.0006 U	148	0.001 U	602
MW-193	11/16/2022	0.0004 U	0.00360	0.115	0.0002 U	0.0590	0.0002 U	92.0	37	0.0007 U	0.00100	0.26	0.0006 U	0.0019 J	0.00006 U	0.00160	7.0	0.407	0.0006 U	154	0.001 U	590
MW-193	12/14/2022	0.0004 U	0.00290	0.0822	0.0002 U	0.0645	0.0002 U	96.5	37	0.00250	0.0009 J	0.27	0.0006 U	0.00570	0.00008 U	0.0014 J	7.4	1.30 B	0.0006 U	165	0.001 U	584
MW-193	01/12/2023	0.0004 U	0.00180	0.0743	0.0002 U	0.0480	0.0002 U	85.5	37	0.0007 U	0.0008 J	0.26	0.0006 U	0.00510	0.00006 U	0.00230	6.7	0.538 B	0.0006 U	165	0.001 U	546
MW-193	02/20/2023	0.0004 U	0.00210	0.0764	0.0002 U	0.0398	0.0002 U	89.2	35	0.00400	0.0007 J	0.25	0.0006 U	0.00490	0.00007 U	0.0013 J	6.8	1.01	0.0006 U	161	0.001 U	554
MW-193	03/13/2023	0.0004 U	0.00150	0.0785	0.0002 U	0.01 U	0.0002 U	91.0	35	0.0007 U	0.0006 J	0.25	0.0006 U	0.00600	0.00006 U	0.0011 J	7.0	0.739	0.0006 U	160	0.001 U	484
MW-193	04/03/2023	0.0004 U	0.00140	0.106	0.0002 U	0.0642	0.0002 U	83.7	34	0.0007 J	0.0009 J	0.25	0.0006 U	0.00750	0.00006 U	0.0011 J	6.9	0.931 J+	0.0006 U	162	0.001 U	556
MW-193	05/15/2023	0.0004 U	0.0087 U	0.0832	0.0002 U	0.0395 J+	0.0005 U	92.3	37	0.0028 U	0.0005 J	0.24	0.004 U	0.0019 U	0.00006 U	0.0037 U	6.8	1.06 J+	0.0006 U	153	0.001 U	582

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)	Total Dissolved Solids (mg/L)
MW-194	10/27/2022	0.00110	0.0004 U	0.0642	0.0002 U	0.022 J	0.0002 J	83.5	30	0.0008 BJ	0.0008 U	0.31	0.0006 U	0.0109	0.00006 U	0.00270	6.8	0.822	0.0006 U	125	0.001 U	550
MW-194	11/17/2022	0.0004 U	0.0004 U	0.0755	0.0002 U	0.023 J	0.0002 U	83.9	29	0.0007 U	0.0006 J	0.26	0.0006 U	0.0038 J	0.00007 U	0.00220	7.1	0.203	0.0006 U	121	0.001 U	530 J
MW-194	12/14/2022	0.0007 J	0.00120	0.141	0.0002 U	0.019 J	0.0002 U	88.6	31	0.00260	0.00150	0.30	0.0006 U	0.0103	0.00008 U	0.00310	6.8	0.705 B	0.0006 U	112	0.001 U	482
MW-194	01/11/2023	0.0004 U	0.00130	0.139	0.0002 U	0.02 J	0.0002 U	79.0	29	0.0009 J	0.00100 J	0.29	0.0006 U	0.00810	0.00006 U	0.0012 J	6.8	0.218	0.0006 U	106	0.001 U	478
MW-194	02/20/2023	0.0004 U	0.00140	0.138	0.0002 U	0.011 J	0.0002 U	82.6	29	0.0013 J	0.0004 J	0.29	0.0006 U	0.00750	0.0001 J	0.00320	6.8	0.144	0.0006 U	105	0.001 U	432
MW-194	03/13/2023	0.0004 U	0.0009 J	0.128	0.0002 U	0.01 UJ	0.0002 U	78.9	27	0.0007 U	0.0003 J	0.29	0.0006 U	0.00790	0.00006 U	0.00290	6.8	0.779	0.0006 U	94	0.001 U	430
MW-194	04/03/2023	0.0004 U	0.00190	0.200	0.0002 U	0.0326	0.0002 U	77.4	29	0.00270	0.00160	0.28	0.00110	0.0115	0.00006 U	0.00420	6.6	0.291	0.0006 U	103	0.001 U	472
MW-194	05/15/2023	0.0004 U	0.0087 U	0.162	0.0002 U	0.2 UJ	0.0005 U	83.5	30	0.0028 U	0.00390	0.28	0.004 U	0.0019 U	0.00006 U	0.0045 J	6.5	0.484 <0	0.0006 U	102	0.001 U	520
MW-203	12/14/2022	0.0004 U	0.00150	0.0911	0.0002 U	0.907	0.0002 U	12.2	178	0.00380	0.0007 J	2.54	0.0009 J	0.0353	0.00008 U	0.00900	9.8	--	0.0006 U	71	0.001 U	1,750
MW-203	01/24/2023	0.0004 U	0.00270	0.115	0.0002 U	0.813	0.0002 U	19.2	142	0.0012 J	0.0004 J	1.92	0.0006 U	0.0436	0.00006 U	0.0134	8.4	0.250	0.0006 U	87	0.001 U	690
MW-203	05/23/2023	0.0004 U	0.0087 U	0.122	0.0002 U	0.510 J+	0.0005 U	43.4	103	0.0028 U	0.0004 J	1.36	0.004 U	0.0256	0.00006 U	0.0142	7.6	0.663 J+	0.0006 U	132	0.001 U	688
MW-204	10/26/2022	0.0004 U	0.00120	0.0886	0.0002 U	1.02	0.0002 U	18.2	50	0.00200	0.0003 J	--	0.0006 U	0.0652	0.00006 U	0.00680	8.0	--	0.0006 U	28	0.001 U	--
MW-204	11/17/2022	0.0006 J	0.00150	0.122	0.0002 U	1.35	0.0002 U	18.2	51	0.00150	0.0002 J	1.36	0.00290	0.0569	0.00007 U	0.00840	7.8	--	0.0006 U	30	0.001 U	--
MW-204	12/13/2022	0.0004 U	0.00100 J	0.0933	0.0002 U	1.03	0.0002 U	17.4	57 J	0.0007 U	0.0001 U	1.47 J	0.0006 U	0.0656	0.00006 U	0.00510	7.9	--	0.0006 U	26 J	0.001 U	712 J
MW-204	01/24/2023	0.00280	0.00170	0.0718	0.0002 U	0.911	0.0002 U	24.3	54	0.00150	0.0002 J	1.49	0.00200	0.0704	0.00006 U	0.0183	7.6	1.09 B	0.0006 U	32	0.001 U	648
MW-204	05/23/2023	0.00360	0.0087 U	0.0922	0.0002 U	0.754 J+	0.0005 U	43.4	63	0.0028 U	0.0004 J	1.32	0.004 U	0.0447	0.00006 U	0.0075 J	7.7	0.314 <0	0.0006 U	48 J+	0.001 U	740
MW-258	10/27/2022	0.00160	0.00150	0.0562	0.0004 J	1.27	0.0002 U	4.94	55	0.0108	0.00120	2.51	0.00130 J	0.0594	0.00007 J	0.0277	8.7	0.515	0.0006 U	16	0.001 U	920
MW-258	11/17/2022	0.00100 J	0.00150	0.0621	0.0002 U	1.35	0.0002 U	4.27	54	0.00620	0.0007 J	2.69	0.0008 J	0.0497	0.00007 U	0.0494	8.7	0.218	0.0006 U	12	0.001 U	760 J
MW-258	12/13/2022	0.0004 U	0.0005 J	0.0476	0.0002 U	1.03	0.0002 U	3.76	56 J	0.0007 U	0.0001 U	2.96 J	0.0006 U	0.0566	0.00006 U	0.0393	9.3	0.125	0.0006 U	8 J	0.001 U	738 J
MW-258	01/11/2023	0.0004 U	0.00130	0.0744	0.0003 J	1.04	0.0002 U	8.00	62	0.00920	0.00160	2.89	0.00230	0.0532	0.00006 U	0.0425	8.5	0.701	0.0006 U	13	0.001 U	800
MW-258	02/20/2023	0.0007 J	0.00200	0.0858	0.0003 J	1.22	0.0002 U	6.06	56	0.0135	0.00190	2.51	0.00250	0.0461	0.00014 J	0.0227	7.6	0.541	0.0007 J	12	0.001 U	910
MW-258	03/13/2023	0.0004 U	0.0008 J	0.0545	0.0002 U	1.28	0.0002 U	3.87	48	0.00400	0.0004 J	2.54	0.0006 U	0.0406	0.00006 U	0.0260	8.5	0.809	0.0006 U	7 J	0.001 U	772
MW-258	04/04/2023	0.0004 U	0.0007 J	0.0576	0.0002 U	1.21 J-	0.0002 U	4.90 J-	47	0.00230	0.0006 J	2.73	0.00440	0.0438	0.00006 U	0.0209	8.3	1.04 J+	0.0006 U	9 J	0.001 U	798
MW-258	05/19/2023	0.0004 U	0.0087 U	0.0644	0.0002 U	1.23 J+	0.0005 U	4.65	47	0.0028 U	0.0002 J	2.88	0.004 U	0.0320 J+	0.00009 U	0.0283	8.3	0.499 <0	0.0006 U	6 U	0.001 U	788
MW-304	12/29/2015	0.001 U	0.00190	0.0191	0.001 U	1.28	0.001 U	9.64	124	0.001 U	0.001 U	1.98	0.001 U	0.0568	0.0002 U	0.00520	8.0	0	0.001 U	157	0.001 U	1,090

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)	Total Dissolved Solids (mg/L)
MW-304	03/21/2016	0.001 U	0.00160	0.0195	0.001 U	1.27	0.001 U	9.86	131	0.001 U	0.001 U	1.86	0.001 U	0.0541	0.0002 U	0.00760	8.2	0	0.001 U	163	0.001 U	1,200 H
MW-304	06/21/2016	0.001 U	0.00160	0.0199	0.001 U	1.33	0.001 U	14.3	140	0.001 U	0.001 U	1.59	0.001 U	0.0552	0.0002 U	0.00580	8.1	0.490	0.001 U	200	0.001 U	1,220
MW-304	09/19/2016	0.001 U	0.00250	0.0238	0.001 U	1.95	0.001 U	16.5	138	0.001 U	0.001 U	1.66	0.001 U	0.0693	0.0002 U	0.00690	7.9	0.490	0.001 U	176	0.001 U	1,220
MW-304	12/27/2016	0.001 U	0.00190	0.0199	0.001 U	1.51	0.001 U	15.4	141	0.001 U	0.001 U	1.61	0.001 U	0.0646	0.0002 U	0.00530	7.9	0.11 U	0.001 U	177 S	0.001 U	1,230
MW-304	03/16/2017	0.001 U	0.00160	0.0171	0.001 U	1.49	0.001 U	6.91	144	0.001 U	0.001 U	1.66	0.001 U	0.0685	0.0002 U	0.00810	7.9	1.18 U	0.001 U	166	0.001 U	1,280
MW-304	06/21/2017	0.001 U	0.00170	0.0206	0.001 U	1.55	0.001 U	17.8	152	0.001 U	0.001 U	1.84	0.001 U	0.0650	0.0002 U	0.00390	7.9	1.16 U	0.001 U	177	0.001 U	1,360
MW-304	07/28/2017	0.001 U	0.00210	0.0193	0.001 U	1.42 S	0.001 U	13.2 S	155	0.001 U	0.001 U	1.75	0.001 U	0.0650	0.0002 U	0.00340	7.8	0.99 U	0.001 U	187	0.001 U	1,330
MW-304	09/21/2017	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.9	--	--	--	--	1,350
MW-304	11/28/2017	--	--	--	--	1.45	--	11.4	138	--	--	1.72	--	--	--	--	8.0	--	--	178	--	1,330
MW-304	03/19/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.9	--	--	--	--	1,360
MW-304	06/27/2018	0.001 U	0.00210	0.0210	0.001 U	1.75	0.001 U	12.9	151	0.0015 U	0.001 U	1.67	0.001 U	0.0874	0.0002 U	0.00220	7.4	1.23 U	0.001 U	208	0.002 U	1,360
MW-304	09/26/2018	0.001 U	0.00250	0.0229	--	1.74	--	13.1	151	0.0015 U	--	1.64	--	0.0958	--	0.00190	7.9	0.26 U	0.001 U	201	--	1,420
MW-304	12/19/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.9	--	--	--	--	1,440
MW-304	03/20/2019	0.001 U	0.00290	0.0214	0.001 U	1.82	0.001 U	13.7	148	0.0015 U	0.001 U	1.88	0.001 U	0.0833	0.0002 U	0.00190	7.7	0.55 U	0.001 U	177	0.002 U	1,390
MW-304	06/25/2019	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.9	--	--	--	--	1,420
MW-304	09/25/2019	0.001 U	0.00170	0.0211	0.001 U	1.84	0.001 U	18.4	152	0.0015 U	0.001 U	1.74	0.001 U	0.0836	0.0002 U	0.00170	7.9	0.42 U	0.001 U	169	0.002 U	1,350
MW-304	12/19/2019	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.9	--	--	--	--	1,450
MW-304	03/26/2020	0.001 U	0.00160	0.0212	0.001 U	1.66	0.001 U	17.2	153	0.0015 U	0.001 U	1.81	0.001 U	0.0782	0.0002 U	0.00150	7.9	0.95 U	0.001 U	177	0.002 U	1,320
MW-304	06/23/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	8.0	--	--	--	--	1,410
MW-304	09/17/2020	0.001 U	0.00240	0.0192	--	1.89	--	15.3	161	0.0015 U	0.001 U	1.79	0.001 U	0.0910	--	0.00190	8.0	0.37 U	0.001 U	196	--	1,320
MW-304	12/16/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.9	--	--	--	--	1,440
MW-304	03/09/2021	0.001 U	0.00240	0.0200	0.001 U	1.57	0.001 U	12.7	159	0.0015 U	0.001 U	1.64	0.001 U	0.0737	0.0002 U	0.0015 U	7.9	0.265	0.001 U	194	0.002 U	1,350
MW-304	06/21/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.8	--	--	--	--	1,440
MW-304	09/14/2021	0.001 U	0.00210	0.0189	--	1.61	--	13.3	168	0.0015 U	0.001 U	1.60	0.001 U	0.0777	--	0.00210	7.7	0.744	0.001 U	231	0.002 U	1,290
MW-304	12/14/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.8	--	--	--	--	1,400

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)	Total Dissolved Solids (mg/L)
MW-304	03/28/2022	0.001 U	0.00210	0.0194	0.001 U	1.71	0.001 U	14.5	161	0.0015 U	0.001 U	1.76	0.001 U	0.0829	0.0002 U	0.0015 U	7.8	0.968 B	0.001 U	198	0.002 U	1,410
MW-304	06/14/2022	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.8	--	--	--	--	1,430
MW-304	09/29/2022	0.0004 U	0.00270 J	0.0183 J	--	1.75 J	--	10.2	174	0.0013 J	0.0001 U	1.70	0.0006 U	0.0861 J	--	0.0008 J	7.7	0.616	0.0006 U	199	0.001 U	1,470
MW-304	10/26/2022	0.0004 U	0.00270	0.0186	0.0002 U	1.76	0.0002 U	10.8	175	0.0007 U	0.0001 U	1.72	0.0006 U	0.0869	0.00006 U	0.0013 J	7.9	0.693	0.0006 U	193	0.001 U	1,450
MW-304	11/17/2022	0.0004 U	0.00330	0.0209	0.0002 U	1.91	0.0002 U	9.48	175	0.0007 U	0.0001 U	1.70	0.0006 U	0.0635	0.00007 U	0.0011 J	7.9	0.217	0.0006 U	218	0.001 U	1,490 J
MW-304	12/05/2022	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	7.8	--	--	--	--	1,480
MW-304	12/14/2022	0.0004 U	0.00300	0.0191	0.0002 U	2.16	0.0002 U	10.0	181	0.0007 U	0.0001 U	1.82	0.0006 U	0.0756	0.00008 U	0.0009 J	7.8	0.632 B	0.0006 U	216	0.001 U	1,300
MW-304	01/11/2023	0.0004 U	0.00270	0.0173	0.0002 U	1.68	0.0002 U	8.50	185	0.0007 U	0.0001 U	1.68	0.0006 U	0.0819	0.00006 U	0.0007 J	7.8	0.213	0.0006 U	209	0.001 U	1,450
MW-304	02/20/2023	0.0004 U	0.00300	0.0216	0.0002 U	1.75	0.0002 U	10.7	186	0.0007 U	0.0001 U	1.67	0.0006 U	0.0818	0.00006 U	0.001 J	7.8	0.294	0.0006 U	228	0.001 U	1,470
MW-304	03/15/2023	0.0004 U	0.00340	0.0206	0.0002 U	1.89	0.0002 U	10.6	173	0.0007 U	0.0001 U	1.67	0.0006 U	0.0940	0.00006 U	0.0008 J	7.8	0.265 U	0.0006 U	208	0.001 U	1,230
MW-304	04/04/2023	0.0004 U	0.00510	0.0324	0.0002 U	1.69	0.0002 U	8.91	168	0.0007 U	0.0001 U	1.81	0.0006 U	0.0808	0.00006 U	0.001 J	7.8	0.932 J+	0.0006 U	210	0.001 U	1,460
MW-304	05/22/2023	0.0006 J	0.0087 U	0.0199	0.0002 U	1.68 J+	0.0005 U	9.63	162	0.0028 U	0.0001 U	1.72	0.004 U	0.0603	0.0001 J	0.0037 U	7.5	0.381 <0	0.0006 U	208	0.001 U	1,420
MW-306	03/22/2016	0.001 U	0.0101	0.0113	0.001 U	0.634	0.001 U	6.10	34	0.00110	0.001 U	0.83	0.001 U	0.0378	0.0002 U	0.00670	9.9	0.350	0.001 U	19	0.001 U	482
MW-306	06/21/2016	0.001 U	0.0140	0.00970	0.001 U	0.478	0.001 U	5.37	33	0.00110	0.001 U	0.69	0.001 U	0.0273	0.0002 U	0.00720	10.3	1.14	0.001 U	21	0.001 U	408
MW-306	08/18/2016	0.001 U	0.0121	0.0125	0.001 U	0.322	0.001 U	22.4 S	41	0.001 U	0.001 U	0.54	0.001 U	0.0202	0.0002 U	0.0126	10.3	0.490	0.001 U	25	0.001 U	314
MW-306	09/19/2016	0.001 U	0.00450	0.0157	0.001 U	0.240	0.001 U	35.3 S	47	0.001 U	0.001 U	0.55	0.001 U	0.0201	0.0002 U	0.0198	11.0	0.120	0.001 U	28	0.001 U	235
MW-306	12/27/2016	0.001 U	0.00440	0.0131	0.001 U	0.220	0.001 U	30.7 S	47	0.001 U	0.001 U	0.58	0.001 U	0.0160	0.0002 U	0.0201	10.8	0.21 U	0.001 U	26	0.001 U	360
MW-306	03/16/2017	0.001 U	0.0153	0.00960	0.001 U	0.306	0.001 U	19.7 S	51	0.001 U	0.001 U	0.61	0.001 U	0.0170	0.0002 U	0.0182	11.2	0.9 U	0.001 U	27	0.001 U	328
MW-306	06/21/2017	0.001 U	0.00460	0.0127	0.001 U	0.225	0.001 U	26.3	53	0.001 U	0.001 U	0.62	0.001 U	0.0157	0.0002 U	0.0224	11.1	0.89 U	0.001 U	30	0.001 U	335
MW-306	07/28/2017	0.001 U	0.00570	0.00850	0.001 U	0.259	0.001 U	15.3	54	0.00150	0.001 U	0.60	0.001 U	0.0159	0.0002 U	0.0237	10.9	0.14 U	0.001 U	31 S	0.001 U	256
MW-306	09/21/2017	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10.8	--	--	--	--	298
MW-306	11/28/2017	--	--	--	--	0.407	--	3.40	55	--	--	0.65	--	--	--	--	10.7	--	--	39	--	328
MW-306	03/20/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10.6	--	--	--	--	242
MW-306	06/27/2018	0.001 U	0.00240	0.0205	0.001 U	0.139	0.001 U	45.9	64	0.0015 U	0.001 U	0.64	0.001 U	0.0136	0.0002 U	0.0281	10.5	0.55 U	0.001 U	42	0.002 U	376
MW-306	09/26/2018	0.001 U	0.00190	0.0155	--	0.159	--	36.9	61	0.0015 U	--	0.54	--	0.0132	--	0.0252	11.1	0.49 U	0.001 U	34	--	325

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)	Total Dissolved Solids (mg/L)
MW-306	12/19/2018	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	11.3	--	--	--	--	310
MW-306	03/20/2019	0.001 U	0.00300	0.0192	0.001 U	0.174	0.001 U	50.4	62	0.0015 U	0.001 U	0.65	0.001 U	0.0143	0.0002 U	0.0299	11.4	0.74 U	0.001 U	32	0.002 U	330
MW-306	06/25/2019	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	11.2	--	--	--	--	310
MW-306	09/25/2019	0.001 U	0.00210	0.0150	0.001 U	0.166	0.001 U	46.0	62	0.0015 U	0.001 U	0.59	0.001 U	0.0133	0.0002 U	0.0267	11.0	0.36 U	0.001 U	37	0.002 U	318
MW-306	12/19/2019	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	11.3	--	--	--	--	304
MW-306	03/26/2020	0.001 U	0.00230	0.0163	0.001 U	0.180	0.001 U	43.1	63	0.0015 U	0.001 U	0.60	0.001 U	0.0132	0.0002 U	0.0269	11.5	1.08 U	0.001 U	37	0.002 U	288
MW-306	06/23/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10.4	--	--	--	--	278
MW-306	09/17/2020	0.001 U	0.00200	0.0124	--	0.174	--	26.9	58	0.0015 U	0.001 U	0.56	0.001 U	0.0143	--	0.0262	10.5	1.59 U	0.001 U	37	--	224
MW-306	12/17/2020	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10.9	--	--	--	--	324
MW-306	03/10/2021	0.001 U	0.00180	0.0176	0.001 U	0.120	0.001 U	43.4	61	0.0015 U	0.001 U	0.52	0.001 U	0.0114	0.0002 U	0.0275	11.0	0.0281	0.001 U	37	0.002 U	294
MW-306	06/22/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	11.1	--	--	--	--	298
MW-306	09/16/2021	0.001 U	0.001 U	1.04	--	0.025 U	--	594	96	0.0271	0.00350	0.13	0.00520	0.0584	--	0.00860	12.0	8.20	0.001 U	20 U	0.002 U	934
MW-306	12/14/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10.7	--	--	--	--	308
MW-306	03/29/2022	0.001 U	0.00230	0.0157	0.001 U	0.120	0.001 U	47.3	63	0.0015 U	0.001 U	0.55	0.001 U	0.0122	0.0002 U	0.0278	10.9	0.566 B	0.001 U	41	0.002 U	298
MW-306	06/15/2022	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10.8	--	--	--	--	305
MW-306	09/29/2022	0.0004 U	0.00140	0.0121	--	0.110	--	39.8	68	0.0007 U	0.0001 U	0.49	0.0006 U	0.0113	--	0.0224	11.3	0.241	0.0006 U	41	0.001 U	300
MW-306	10/26/2022	0.0004 U	0.00230	0.0108	0.0002 U	0.125	0.0002 U	32.4	73	0.0007 U	0.0008 U	0.59	0.0006 U	0.0105	0.00006 U	0.0209	11.1	0.262	0.0006 U	53 J-	0.001 U	292
MW-306	11/16/2022	0.0004 U	0.0103	0.00510	0.0002 U	0.334	0.0002 U	1.80	49	0.0007 U	0.0002 J	0.64	0.0006 U	0.0169	0.00006 J	0.0162	10.3	0.103	0.0006 U	46	0.001 U	266
MW-306	12/06/2022	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	10.1	--	--	--	--	306
MW-306	12/14/2022	0.00110	0.00530	0.00830	0.0002 U	0.309	0.0002 U	17.0	61	0.0007 U	0.0001 J	0.60	0.0006 U	0.0187	0.00008 U	0.0215	10.2	0.747 B	0.0006 J	41	0.001 U	272
MW-306	01/13/2023	0.0006 J	0.00640	0.00580	0.0002 U	0.365	0.0002 U	4.30	48	0.0007 U	0.0001 U	0.61	0.0006 U	0.0209	0.00006 U	0.0159	9.8	0.532 B	0.0006 U	40	0.001 U	292
MW-306	02/21/2023	0.00160	0.00470	0.0115	0.0002 U	0.218	0.0002 U	17.7	45	0.0007 U	0.0001 U	0.62	0.0006 U	0.0159	0.00016 J	0.0265	9.9	0.284	0.0007 J	42	0.001 U	342
MW-306	03/15/2023	0.0008 J	0.00670	0.00710	0.0002 U	0.328	0.0002 U	8.59	56	0.0007 U	0.0001 U	0.55	0.0006 U	0.0220	0.00006 U	0.0191	10.7	0.999	0.0006 J	41	0.001 U	288
MW-306	04/04/2023	0.00230	0.00460	0.0194	0.0002 U	0.186	0.0002 U	28.7	57	0.0007 U	0.0001 U	0.57	0.0006 U	0.0133	0.00006 U	0.0342	10.9	0.975 J+	0.0009 J	42	0.001 U	206
MW-306	05/23/2023	0.00140	0.0087 U	0.0139	0.0002 U	0.190 J+	0.0005 U	34.6	53	0.0028 U	0.0004 J	0.54	0.004 U	0.0118	0.00006 U	0.0233	11.1	0.133	0.0007 J	46 J+	0.001 U	300

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)	Total Dissolved Solids (mg/L)
MW-307	10/26/2022	0.0004 U	0.00240	0.0323	0.0002 U	1.20	0.0002 U	38.2	195	0.00210	0.0001 U	--	0.0006 U	0.0604	0.00008 U	0.00840	9.2	--	0.0006 U	73	0.001 U	--
MW-307	11/17/2022	0.0007 J	0.00150	0.0195	0.0002 U	1.47 J	0.0002 U	16.7	206	0.00210	0.0002 J	0.68	0.0006 U	0.0502	0.00007 U	0.00570	9.4	--	0.0006 U	81	0.001 U	--
MW-307	12/14/2022	0.00110	0.00370	0.0498	0.0002 U	1.63	0.0002 U	28.5	226 J	0.00190	0.0001 U	0.89 J	0.0006 J	0.0609	0.00006 U	0.00610	9.4	--	0.0006 U	88 J	0.001 U	958 J
MW-307	01/13/2023	0.00210	0.00110	0.0189	0.0002 U	0.872	0.0002 U	18.4	209	0.0007 U	0.0001 J	0.65	0.0006 U	0.0539	0.00006 U	0.00720	9.4	0.160	0.0006 U	78	0.001 U	688
MW-307	05/23/2023	0.00300	0.0087 U	0.0911	0.0002 U	0.690 J+	0.0005 U	134	191	0.0107	0.0002 J	0.43	0.004 U	0.0592	0.00006 U	0.0069 J	12.0	0.530 <0	0.0006 U	45 J	0.001 U	870
MW-356	12/29/2015	0.001 U	0.001 U	0.0297	0.001 U	1.93	0.001 U	12.7	42	0.001 U	0.001 U	1.91	0.001 U	0.0484	0.0002 U	0.00230	7.5	0.120	0.001 U	47	0.001 U	674
MW-356	03/28/2016	0.00110	0.00120	0.0288	0.001 U	1.83	0.001 U	11.7	41	0.001 U	0.001 U	1.89	0.001 U	0.0408	0.0002 U	0.00270	7.8	0.146	0.001 U	50 S	0.001 U	666
MW-356	06/23/2016	0.001 U	0.001 U	0.0315	0.001 U	2.04	0.001 U	12.0	40	0.001 U	0.001 U	1.78	0.001 U	0.0484	0.0002 U	0.00240	7.6	0.770	0.001 U	49	0.001 U	670
MW-356	09/22/2016	0.001 U	0.00130	0.0334	0.001 U	2.58	0.001 U	13.7	41	0.001 U	0.001 U	1.78	0.001 U	0.0563	0.0002 U	0.00240	7.7	0.06 U	0.001 U	51	0.001 U	670
MW-356	12/27/2016	0.001 U	0.00120	0.0301	0.001 U	2.06	0.001 U	11.4	40	0.001 U	0.001 U	1.80	0.001 U	0.0523	0.0002 U	0.00200	7.7	0.04 U	0.001 U	44 S	0.001 U	678
MW-356	03/15/2017	0.001 U	0.00100	0.0301	0.001 U	1.99	0.001 U	11.7	34	0.001 U	0.001 U	1.85	0.001 U	0.0521	0.0002 U	0.00180	7.8	0.39 U	0.001 U	47	0.001 U	696 R
MW-356	06/20/2017	0.001 U	0.001 U	0.0297	0.001 U	1.97	0.001 U	10.6	34	0.001 U	0.001 U	1.88	0.001 U	0.0533	0.0002 U	0.00140	7.8	1.21 U	0.001 U	45	0.001 U	642
MW-356	07/26/2017	0.001 U	0.001 U	0.0299	0.001 U	1.93	0.001 U	11.2	34	0.001 U	0.001 U	1.88	0.001 U	0.0544	0.0002 U	0.00140	7.9	0.83 U	0.001 U	46	0.001 U	670
MW-356	11/27/2017	--	--	--	--	1.98	--	12.2	33	--	--	1.99	--	--	--	--	7.6	--	--	44	--	744
MW-356	06/26/2018	0.001 U	0.001 U	0.0309	0.001 U	2.14	0.001 U	11.4	31	0.0015 U	0.001 U	1.96	0.001 U	0.0580	0.0002 U	0.0015 U	7.4	0.56 U	0.001 U	46	0.002 U	696
MW-356	09/26/2018	--	0.001 U	0.0317	--	2.29	--	12.0	36	--	--	1.88	--	0.0595	--	0.0015 U	7.8	0.08 U	--	46	--	718
MW-356	03/19/2019	0.001 U	0.00110	0.0322	0.001 U	2.12	0.001 U	11.7	31	0.0015 U	0.001 U	2.18	0.001 U	0.0578	0.0002 U	0.0015 U	7.8	0.19 U	0.001 U	43	0.002 U	678
MW-356	09/24/2019	--	0.001 U	0.0307	--	2.04	--	11.6	29	0.0015 U	--	2.00	--	0.0580	--	0.0015 U	7.7	0.1 U	--	38	--	644
MW-356	03/25/2020	0.001 U	0.001 U	0.0303	0.001 U	1.94	0.001 U	12.2	29	0.0015 U	0.001 U	2.01	0.001 U	0.0529	0.0002 U	0.0015 U	7.9	2.18	0.001 U	43	0.002 U	654
MW-356	09/15/2020	0.001 U	0.001 U	0.0291	--	2.09	--	11.4	32	0.0015 U	0.001 U	2.02	0.001 U	0.0579	--	0.0015 U	7.8	1.08 U	0.001 U	45	--	660
MW-356	03/09/2021	0.001 U	0.001 U	0.0299	0.001 U	1.87	0.001 U	11.4	29	0.0015 U	0.001 U	1.96	0.001 U	0.0537	0.0002 U	0.0015 U	7.7	0.0883	0.001 U	41	0.002 U	636
MW-356	09/15/2021	0.001 U	0.001 U	0.0299	--	2.03	--	11.6	37	0.0015 U	0.001 U	2.14	0.001 U	0.0583	--	0.00160	7.7	0.336	0.001 U	53	--	690
MW-356	03/29/2022	0.001 U	0.001 U	0.0290	0.001 U	1.85	0.001 U	11.7	41	0.0015 U	0.001 U	2.30	0.00100	0.0717	0.0002 U	0.0015 U	7.7	0.422 B	0.001 U	51	0.002 U	710
MW-356	09/30/2022	--	0.0006 J	0.0450	--	2.92	--	12.6	36	0.0007 U	0.0001 U	2.06	0.0006 U	0.0840	--	0.00190	7.8	0.350	--	50	--	698
MW-356	10/27/2022	0.0004 U	0.0004 U	0.0260	0.0002 U	1.79	0.0002 U	11.0	31	0.0007 U	0.0008 U	2.09	0.0006 U	0.0508	0.00009 J	0.00170	7.1	0	0.0006 U	44	0.001 U	700

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)	Total Dissolved Solids (mg/L)
MW-356	11/17/2022	0.0004 U	0.0004 U	0.0284	0.0002 U	1.98	0.0002 U	11.7	31	0.0007 U	0.0001 U	1.92	0.0006 U	0.0497	0.00007 U	0.0008 J	7.8	0.651 B	0.0006 U	45	0.001 U	682 J
MW-356	12/13/2022	0.0006 J	0.0005 J	0.0393	0.0002 U	2.71	0.0002 U	12.3	33	0.0007 U	0.0001 U	2.02	0.0006 U	0.0575	0.00006 U	0.0008 J	7.7	0.746 B	0.0006 U	47	0.001 U	652
MW-356	01/12/2023	0.0004 U	0.0004 U	0.0288	0.0002 U	1.86	0.0002 U	11.8	35	0.0007 U	0.0001 U	2.00	0.0006 U	0.0523	0.00006 U	0.0007 J	7.7	1.01 B	0.0006 U	46	0.001 U	676
MW-356	02/21/2023	0.00120	0.0005 J	0.0300	0.0002 U	2.10	0.0002 U	12.2	33	0.0007 U	0.0001 U	1.87	0.0006 U	0.0579	0.0001 J	0.001 J	7.7	0.0851	0.0006 U	48	0.001 U	642
MW-356	03/13/2023	0.0004 U	0.0005 J	0.0326	0.0002 U	2.22	0.0002 U	12.4	30	0.0007 U	0.0001 U	1.87	0.0006 U	0.0605	0.00006 U	0.0007 J	7.7	1.68 J+	0.0006 U	43 J+	0.001 U	642
MW-356	04/03/2023	0.0004 U	0.0004 U	0.0393	0.0002 U	2.61	0.0002 U	11.6	32	0.0007 U	0.0001 U	1.93	0.0006 U	0.0742	0.00006 U	0.0006 J	7.7	0.481	0.0006 U	46	0.001 U	676
MW-356	05/16/2023	0.0004 U	0.0087 U	0.0326	0.0002 U	2.01 J+	0.0005 U	11.5	31	0.0028 U	0.0003 U	1.97	0.004 U	0.0548	0.00006 U	0.0037 U	7.7	0.0477	0.0006 U	44 J+	0.001 U	688
MW-358	10/27/2022	0.00220	0.00300	0.0933	0.0003 J	1.10	0.0002 U	12.8	688	0.0125	0.00220	2.43	0.00220	0.0621	0.00013 J	0.0782	7.9	3.57	0.00320	108	0.001 U	1,990
MW-358	11/17/2022	0.00230	0.00210	0.172	0.0002 U	1.25	0.0002 U	15.8	992	0.00540	0.00140	2.36	0.0006 U	0.0592	0.00007 U	0.0475	7.8	1.28 B	0.0006 U	101	0.001 U	2,620 J
MW-358	12/13/2022	0.00150	0.00340	0.168	0.0002 U	1.67	0.0002 U	18.6	1120	0.00440	0.0008 J	2.10	0.0008 J	0.0696	0.00008 U	0.0388	8.4	1.86 B	0.0006 U	71	0.001 U	3,260
MW-358	01/11/2023	0.0004 U	0.00140	0.165	0.0002 U	1.38	0.0002 U	14.0	1200	0.0007 U	0.0001 J	2.73	0.0006 U	0.0957	0.00006 U	0.0165	7.6	0.793 B	0.0006 U	34	0.001 U	2,690
MW-358	02/20/2023	0.0008 J	0.00220	0.201	0.0002 U	1.42	0.0002 U	13.2	1330	0.0007 U	0.0001 U	2.87	0.0006 U	0.102	0.00006 U	0.0199	8.4	0.731	0.0006 U	16	0.001 U	3,080
MW-358	03/13/2023	0.0004 U	0.00210	0.166	0.0002 U	1.51	0.0002 U	10.9	1340	0.0007 U	0.0001 U	3.07	0.0006 U	0.115	0.00006 J	0.0137	7.7	0.624 J+	0.0006 U	8 J	0.001 U	2,880
MW-358	04/04/2023	0.0004 U	0.00380	0.261	0.0002 U	1.45	0.0002 U	11.4	1370	0.0007 U	0.0002 J	3.13	0.0006 U	0.105	0.00006 U	0.0217	7.7	0.873 J+	0.0006 U	31 U	0.001 U	2,990
MW-358	05/19/2023	0.0004 U	0.0087 U	0.192	0.0002 U	1.60 J+	0.0005 U	12.5	1300	0.0028 U	0.0003 J	3.31	0.004 U	0.0778 J+	0.00009 U	0.0139	7.6	0.816 J+	0.0006 U	10 U	0.001 U	3,040
MW-369	12/29/2015	0.00380	0.0139	0.00800	0.001 U	0.729	0.001 U	4.12	154	0.00290	0.001 U	3.60	0.001 U	0.0260	0.0002 U	0.0761	8.8	0.0100	0.0275	338	0.001 U	1,070
MW-369	03/28/2016	0.00210	0.00340	0.0208	0.001 U	1.42	0.001 U	20.4	126	0.001 U	0.001 U	2.69	0.001 U	0.0234	0.0002 U	0.0300	8.4	0.0400	0.00960	220	0.001 U	1,280
MW-369	06/23/2016	0.00160	0.00380	0.0228	0.001 U	1.91	0.001 U	27.9 S	176	0.001 U	0.001 U	2.90	0.001 U	0.0308	0.0002 U	0.0264	8.5	0.890	0.00640	234	0.001 U	1,230
MW-369	09/22/2016	0.001 U	0.00200	0.0539	0.001 U	2.40	0.001 U	80.3	89	0.001 U	0.001 U	1.31	0.001 U	0.0379	0.0002 U	0.0227	8.3	0.027 U	0.00300	157	0.001 U	784
MW-369	12/27/2016	0.001 U	0.00240	0.0395	0.001 U	1.90	0.001 U	54.6	127	0.001 U	0.001 U	1.75	0.001 U	0.0311	0.0002 U	0.0256	8.5	0.02 U	0.00230	170	0.001 U	964
MW-369	03/14/2017	0.001 U	0.00150	0.0482	0.001 U	1.98	0.001 U	68.5	94	0.001 U	0.001 U	1.31	0.001 U	0.0321	0.0002 U	0.0230	7.8	1.01 U	0.00120	142	0.001 U	784
MW-369	06/20/2017	0.00210	0.00220	0.0503	0.001 U	1.92	0.001 U	64.1	117	0.001 U	0.001 U	1.54	0.001 U	0.0349	0.0002 U	0.0313	7.4	0.84 U	0.00100	154	0.001 U	836
MW-369	07/26/2017	0.001 U	0.00160	0.0480	0.001 U	1.92	0.001 U	68.2	89	0.00120	0.001 U	1.32	0.001 U	0.0354	0.0002 U	0.0235	7.4	0.75 U	0.001 U	125	0.001 U	700
MW-369	11/27/2017	--	--	--	--	2.10	--	74.8 S	95	--	--	1.46	--	--	--	--	7.5	--	--	104	--	780
MW-369	06/26/2018	0.001 U	0.00150	0.0567	0.001 U	1.55	0.001 U	69.3	70	0.0015 U	0.001 U	1.09	0.001 U	0.0280	0.0002 U	0.0207	7.0	0.23 U	0.001 U	107	0.002 U	720

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)	Total Dissolved Solids (mg/L)
MW-369	09/26/2018	--	0.00120	0.0562	--	2.14	--	77.8	71	--	--	1.10	--	0.0376	--	0.0213	7.3	1.05 U	--	100	--	704
MW-369	03/19/2019	0.001 U	0.00210	0.0562	0.001 U	1.96	0.001 U	70.7	92	0.0015 U	0.001 U	1.48	0.001 U	0.0382	0.0002 U	0.0263	7.3	0.34 U	0.001 U	98	0.002 U	732
MW-369	09/24/2019	--	0.00590	0.0849	--	0.948	--	85.0	101	0.0015 U	--	1.08	--	0.0259	--	0.0186	6.7	0.84 U	--	90	--	788
MW-369	03/25/2020	0.001 U	0.00280	0.0918	0.001 U	0.714	0.001 U	92.3	94	0.0015 U	0.001 U	0.95	0.001 U	0.0182	0.0002 U	0.0113	7.1	1.72 U	0.001 U	92	0.002 U	726
MW-369	09/15/2020	0.001 U	0.00180	0.0894	--	0.683	--	88.5	105	0.0015 U	0.00330	0.97	0.001 U	0.0212	--	0.00920	7.1	1.2 U	0.001 U	91	--	756
MW-369	03/08/2021	0.001 U	0.00110	0.0917	0.001 U	0.621	0.001 U	91.4	94	0.0015 U	0.00130	0.94	0.00190	0.0177	0.0002 U	0.00490	7.0	0.509	0.001 U	76	0.002 U	774
MW-369	09/15/2021	0.001 U	0.00190	0.0691	--	0.647	--	79.5	289	0.0015 U	0.001 U	3.83	0.001 U	0.0247	--	0.00600	8.2	1.28	0.001 U	134	--	1,450
MW-369	03/29/2022	0.001 U	0.00710	0.0102	0.001 U	1.07	0.001 U	8.86	222	0.0015 U	0.001 U	3.10	0.001 U	0.0592	0.0002 U	0.00950	8.4	0.323 JB	0.001 U	112	0.002 U	1,340
MW-369	09/30/2022	--	0.00110	0.123	--	0.592	--	110	87	0.0007 U	0.0003 J	0.68	0.0006 U	0.0232	--	0.00660	8.5	0.393	--	96	--	754
MW-369	03/13/2023	0.0004 U	0.0007 J	0.116	0.0002 U	0.263	0.0002 U	120	51	0.0007 U	0.0001 J	0.46	0.0006 U	0.0104	0.00006 U	0.00420	7.0	0.613 J+	0.0006 U	102	0.001 U	650
MW-369	05/16/2023	0.0004 U	0.0087 U	0.132	0.0002 U	0.232 J+	0.0005 U	124	66	0.0028 U	0.00210	0.54	0.004 U	0.0024 J	0.00006 U	0.0054 J	7.0	0.871 J+	0.0006 U	111	0.001 U	720
MW-370	12/29/2015	0.00310	0.00130	0.0443	0.001 U	1.77	0.001 U	31.6	1120	0.001 U	0.001 U	2.80	0.001 U	0.115	0.0002 U	0.00750	7.7	0.140	0.00100	234	0.001 U	2,510
MW-370	03/28/2016	0.00220	0.00270	0.0445	0.001 U	1.56	0.001 U	25.8	1140	0.001 U	0.00140	2.53	0.001 U	0.0983	0.0002 U	0.0296	7.9	0.510	0.001 U	281	0.001 U	2,710
MW-370	06/23/2016	0.00240	0.00300	0.0582	0.001 U	2.43	0.001 U	42.1	1100	0.001 U	0.001 U	2.63	0.001 U	0.154	0.0002 U	0.0171	8.0	0.730	0.001 U	247	0.001 U	2,730
MW-370	09/22/2016	0.00230	0.00190	0.0431	0.001 U	1.81	0.001 U	35.4 S	1120	0.001 U	0.001 U	2.70	0.001 U	0.178	0.0002 U	0.0181	7.7	0.35 U	0.001 U	241	0.001 U	2,620
MW-370	12/27/2016	0.001 U	0.00230	0.0378	0.001 U	1.82	0.001 U	33.6	1140	0.001 U	0.001 U	2.77	0.001 U	0.131	0.0002 U	0.0236	7.3	0.43 U	0.001 U	230	0.001 U	2,780
MW-370	03/14/2017	0.00150	0.00190	0.0390	0.001 U	1.81	0.001 U	38.1	1120	0.001 U	0.001 U	2.58	0.001 U	0.126	0.0002 U	0.0151	7.9	4.84	0.001 U	240	0.001 U	2,730
MW-370	06/20/2017	0.001 U	0.00190	0.0379	0.001 U	1.82	0.001 U	35.1 S	1240	0.001 U	0.001 U	2.94	0.001 U	0.134	0.0002 U	0.0223	7.6	1.41 U	0.001 U	249	0.001 U	2,850
MW-370	07/25/2017	0.001 U	0.00170	0.0370	0.001 U	1.84	0.001 U	38.2 S	1280	0.001 U	0.001 U	3.00	0.001 U	0.137	0.0002 U	0.0207	7.6	0.84 U	0.001 U	247	0.001 U	2,830
MW-370	11/27/2017	--	--	--	--	1.81	--	45.9	1290	--	--	2.99	--	--	--	--	7.9	--	--	268	--	2,960
MW-370	06/26/2018	0.001 U	0.00120	0.0423	0.001 U	1.75	0.001 U	43.1	1390	0.0015 U	0.001 U	2.94	0.001 U	0.125	0.0002 U	0.0279	7.4	0.23 U	0.001 U	282	0.002 U	3,130
MW-370	09/26/2018	--	0.00100	0.0403	--	2.05	--	45.5	1530	--	--	3.06	--	0.142	--	0.0214	7.7	0.73 U	--	287	--	3,280
MW-370	03/19/2019	0.001 U	0.00150	0.0449	0.001 U	2.01	0.001 U	46.7	1280	0.0015 U	0.001 U	3.45	0.001 U	0.147	0.0002 U	0.0238	7.7	0.61 U	0.001 U	224	0.002 U	2,950
MW-370	09/24/2019	--	0.001 U	0.0424	--	1.95	--	47.0	1290	0.0015 U	--	3.00	--	0.149	--	0.0188	7.5	0.75 U	--	237	--	2,830
MW-370	03/25/2020	0.001 U	0.001 U	0.0421	0.001 U	1.79	0.001 U	44.5	1340	0.0015 U	0.001 U	3.19	0.001 U	0.132	0.0002 U	0.0180	7.7	2.01	0.001 U	251	0.002 U	2,880

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)	Total Dissolved Solids (mg/L)
MW-370	09/15/2020	0.001 U	0.001 U	0.0377	--	1.97	--	43.4	1470	0.0015 U	0.001 U	3.05	0.001 U	0.151	--	0.0157	7.5	0.95 U	0.001 U	263	--	3,040
MW-370	03/09/2021	0.001 U	0.001 U	0.0274	0.001 U	1.72	0.001 U	29.4	1370	0.0015 U	0.001 U	2.94	0.001 U	0.140	0.0002 U	0.0167	7.5	0.418	0.001 U	244	0.002 U	2,950
MW-370	09/15/2021	0.001 U	0.001 U	0.0407	--	1.91	--	45.0	1560	0.0015 U	0.001 U	3.05	0.001 U	0.156	--	0.0149	7.5	0.248	0.001 U	266	--	3,240
MW-370	03/29/2022	0.001 U	0.001 U	0.0240	0.001 U	1.61	0.001 U	34.2	1470	0.0015 U	0.001 U	3.15	0.001 U	0.223	0.0002 U	0.0178	7.6	0.883 JB	0.001 U	270	0.002 U	3,240
MW-370	09/30/2022	--	0.0009 J	0.0589	--	2.67	--	51.4	1520	0.001 J	0.0003 J	2.98	0.0006 U	0.210	--	0.0165	7.6	1.07	--	273	--	3,320
MW-370	10/27/2022	0.00150	0.0007 J	0.0380	0.0002 U	1.84	0.0002 U	39.6	1320	0.0012 BJ	0.0008 U	3.11	0.0006 U	0.137	0.00006 U	0.00810	6.9	1.16	0.0006 U	250	0.001 U	2,980
MW-370	11/17/2022	0.0006 J	0.00100 J	0.0292	0.0002 U	1.74	0.0002 U	36.8	1450 J-	0.00150	0.0004 J	3.06	0.0006 J	0.110	0.00007 U	0.0356	7.8	1.31 B	0.0006 U	278	0.001 U	3,200 J
MW-370	12/14/2022	0.0005 J	0.0008 J	0.0325	0.0002 U	2.34	0.0002 U	44.7	1430	0.0007 U	0.0001 J	3.12	0.0006 U	0.118	0.00008 U	0.00970	7.5	1.58 B	0.0006 U	263	0.001 U	2,680
MW-370	01/12/2023	0.0004 U	0.0004 J	0.0272	0.0002 U	1.75	0.0002 U	38.4	1470	0.0007 U	0.0001 U	3.07	0.0006 U	0.133	0.00006 U	0.00700	7.5	0.505 B	0.0006 U	253	0.001 U	3,060
MW-370	02/21/2023	0.0004 U	0.0007 J	0.0303	0.0002 U	1.95	0.0002 U	40.6	1570	0.0007 U	0.0002 J	2.86	0.0006 U	0.146	0.00006 U	0.00810	7.5	0.658	0.0006 U	273	0.001 U	3,250
MW-370	03/14/2023	0.0004 U	0.0008 J	0.0291	0.0002 U	1.90	0.0002 U	39.5	1340	0.0007 U	0.0002 J	2.96	0.0006 U	0.160	0.00006 U	0.00820	7.4	0.689 J+	0.0006 U	251	0.001 U	2,940
MW-370	04/03/2023	0.0004 U	0.0006 J	0.0308	0.0002 U	2.06	0.0002 U	37.4	1280	0.0009 J	0.0003 J	3.16	0.0006 U	0.158 J+	0.00006 U	0.00730	7.5	0.854 J+	0.0006 U	253	0.001 U	2,850
MW-370	05/16/2023	0.0004 U	0.0087 U	0.0321	0.0002 U	1.85 J+	0.0005 U	37.0	1360	0.0028 U	0.0004 J	3.07	0.004 U	0.120	0.00006 U	0.0062 J	7.5	1.25 J+	0.0006 U	253	0.001 U	2,940
MW-382	12/29/2015	0.001 U	0.00270	0.0204	0.001 U	1.61	0.001 U	19.3	46 S	0.00300	0.001 U	2.77	0.001 U	0.0517	0.0002 U	0.00340	7.8	0.150	0.001 U	457	0.001 U	1,120
MW-382	03/28/2016	0.001 U	0.00300	0.0160	0.001 U	1.60	0.001 U	17.9	37	0.001 U	0.001 U	2.87	0.001 U	0.0522	0.0002 U	0.00100	7.9	0.0600	0.001 U	509	0.001 U	1,250
MW-382	06/23/2016	0.001 U	0.00300	0.0221	0.001 U	2.17	0.001 U	24.8	39	0.00300	0.001 U	2.83	0.001 U	0.0705	0.0002 U	0.00130	8.0	0.450	0.001 U	447	0.001 U	1,200
MW-382	09/22/2016	0.001 U	0.00230	0.0243	0.001 U	2.57	0.001 U	27.3	35	0.00500	0.001 U	2.78	0.00100	0.0723	0.0002 U	0.00160	7.8	0.65 U	0.001 U	481	0.001 U	1,170
MW-382	12/27/2016	0.001 U	0.00120	0.0157	0.001 U	1.78	0.001 U	18.4	35	0.00250	0.001 U	2.76	0.001 U	0.0603	0.0002 U	0.00110	7.7	0.23 U	0.001 U	428	0.001 U	1,200
MW-382	03/14/2017	0.001 U	0.00140	0.0176	0.001 U	1.74	0.001 U	20.6	34	0.00210	0.001 U	2.76	0.00130	0.0575	0.0002 U	0.00180	8.1	0.43 U	0.001 U	451	0.001 U	1,200
MW-382	06/20/2017	0.001 U	0.001 U	0.0155	0.001 U	1.71	0.001 U	19.4	39	0.00180	0.001 U	2.89	0.001 U	0.0647	0.0002 U	0.001 U	7.8	2.62	0.001 U	445	0.001 U	1,160
MW-382	07/25/2017	0.001 U	0.00110	0.0155	0.001 U	1.75	0.001 U	19.0	38	0.00300	0.001 U	2.88	0.001 U	0.0610	0.0002 U	0.00170	7.7	0.97 U	0.001 U	450	0.001 U	1,180
MW-382	11/27/2017	--	--	--	--	1.86	--	20.3	35	--	--	2.91	--	--	--	--	7.9	--	--	443	--	1,240
MW-382	06/26/2018	0.001 U	0.001 U	0.0141	0.001 U	2.02	0.001 U	17.7	36	0.0015 U	0.001 U	2.79	0.001 U	0.0678	0.0002 U	0.0015 U	7.4	0.54 U	0.001 U	482	0.002 U	1,220
MW-382	09/26/2018	--	0.001 U	0.0140	--	1.77	--	16.8	40	--	--	2.92	--	0.0588	--	0.0015 U	7.8	0.63 U	--	434	--	1,240
MW-382	03/19/2019	0.001 U	0.00120	0.0170	0.001 U	1.86	0.001 U	21.5	36	0.00210	0.001 U	3.30	0.001 U	0.0625	0.0002 U	0.00190	7.6	0.16 U	0.001 U	426	0.002 U	1,180

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)	Total Dissolved Solids (mg/L)
MW-382	09/24/2019	--	0.00120	0.0221	--	1.78	--	20.5	34	0.00440	--	2.85	--	0.0623	--	0.00250	7.7	0.51 U	--	388	--	1,150
MW-382	03/25/2020	0.001 U	0.00140	0.0196	0.001 U	1.75	0.001 U	19.7	34	0.00280	0.001 U	3.04	0.001 U	0.0561	0.0002 U	0.00210	7.9	2.33	0.001 U	415	0.002 U	1,100
MW-382	09/15/2020	0.001 U	0.001 U	0.0158	--	1.75	--	18.8	32	0.00320	0.001 U	2.80	0.001 U	0.0640	--	0.00330	7.8	0.23 U	0.001 U	415	--	1,090
MW-382	03/09/2021	0.001 U	0.00230	0.0331	0.001 U	1.61	0.001 U	27.6	41	0.0130	0.00390	2.77	0.00490	0.0588	0.0002 U	0.00340	7.7	0.361	0.001 U	389	0.002 U	1,120
MW-382	09/15/2021	0.001 U	0.00220	0.0279	--	1.75	--	25.7	36	0.0124	0.00330	2.90	0.00430	0.0650	--	0.00270	7.7	0.921	0.001 U	459	--	1,120
MW-382	03/29/2022	0.001 U	0.00270	0.0320	0.001 U	2.22	0.001 U	27.9	43	0.0123	0.00360	3.01	0.00400	0.0638	0.0002 U	0.00230	7.8	0.274	0.001 U	395	0.002 U	1,120
MW-382	09/30/2022	--	0.00230	0.0271	--	1.69	--	29.1	37	0.0131	0.00330	2.70	0.00390	0.0621	--	0.00280	7.8	1.07	--	449	--	1,080
MW-382	03/14/2023	0.0004 U	0.00130	0.0159	0.0002 U	1.72	0.0002 U	18.4	29	0.00330	0.0007 J	2.66	0.0006 U	0.0539	0.00006 U	0.00210	7.7	0.689	0.0006 U	346	0.001 U	1,120
MW-382	05/16/2023	0.0004 U	0.0087 U	0.0268	0.000500	1.75 J+	0.0005 U	27.0	42	0.00930	0.00450	2.75	0.004 U	0.0573	0.00006 U	0.0037 U	7.7	0.832 J+	0.0006 U	391	0.001 U	1,170
MW-392	10/27/2022	0.00170	0.0009 J	0.0294	0.0002 U	1.57	0.0002 U	22.1	334	0.0013 BJ	0.0008 U	3.19	0.0006 U	0.0474	0.00006 U	0.00540	7.0	0.700	0.0008 J	149	0.001 U	1,270
MW-392	11/16/2022	0.00100 J	0.00420	0.0460	0.0002 U	1.72	0.0002 U	27.2	648	0.0007 U	0.0007 J	3.36	0.0006 U	0.0512	0.00006 J	0.00430	8.0	0.362	0.0006 U	83	0.001 U	1,620
MW-392	12/13/2022	0.0007 J	0.00240	0.0462	0.0002 U	2.33	0.0002 U	30.2	918 J	0.0007 U	0.0003 J	3.98 J	0.0006 U	0.0646	0.00006 U	0.00190	7.7	1.15 B	0.0006 U	50 J	0.001 U	1,710 J
MW-392	01/12/2023	0.0009 J	0.00180	0.0422	0.0002 U	1.66	0.0002 U	47.1	888	0.00670	0.00150	3.96	0.00170	0.0760	0.00006 U	0.0009 J	7.6	0.544 B	0.0006 U	47	0.001 U	1,730
MW-392	02/20/2023	0.0004 U	0.0009 J	0.0399	0.0002 U	1.97	0.0002 U	30.4	909	0.00190	0.0003 J	3.69	0.0006 U	0.0799	0.00006 U	0.0007 J	7.6	0.375	0.0006 U	68	0.001 U	1,870
MW-392	03/13/2023	0.0004 U	0.0006 J	0.0397	0.0002 U	1.92	0.0002 U	28.1	896	0.0007 U	0.0001 U	4.01	0.0006 U	0.0767	0.00006 U	0.0006 U	7.7	0.0974	0.0006 U	57	0.001 U	1,340
MW-392	04/03/2023	0.0005 J	0.00120	0.0568	0.0002 U	2.70	0.0002 U	30.5	834	0.00430	0.0005 J	4.18	0.0006 J	0.117	0.00006 U	0.0011 J	7.7	1.28 J+	0.0006 U	61	0.001 U	1,850
MW-392	05/16/2023	0.0004 U	0.0087 U	0.0414	0.0002 U	1.92 J+	0.0005 U	25.6	827	0.0028 U	0.0003 J	4.07	0.004 U	0.0675	0.00006 U	0.0037 U	7.5	0.836 J+	0.0006 U	63 J+	0.001 U	1,830
MW-393	10/27/2022	0.00200	0.00120	0.0218	0.0002 U	1.83	0.0002 U	8.54	436	0.0008 BJ	0.0008 U	5.86	0.0006 U	0.0767	0.00014 J	0.00910	7.4	0.377	0.0006 U	285	0.001 U	1,870
MW-393	11/16/2022	0.0008 J	0.00150	0.0284	0.0002 U	1.53	0.0002 U	11.3	475	0.0007 J	0.0002 U	5.95	0.0006 U	0.0722	0.00006 J	0.00750	8.1	0.495	0.0006 U	280	0.001 U	1,950
MW-393	12/14/2022	0.00240	0.00190	0.0246	0.0002 U	2.04	0.0002 U	10.9	445	0.0009 J	0.0002 J	5.79	0.0006 U	0.0603	0.00008 U	0.0135	8.6	1.40 B	0.0006 U	263	0.001 U	826
MW-393	01/12/2023	0.0004 U	0.0005 J	0.0288	0.0002 U	1.61	0.0002 U	14.7	633	0.00650	0.00110	8.02	0.0009 J	0.0807	0.00006 U	0.00240	7.9	1.02 B	0.0006 U	232	0.001 U	2,290
MW-393	02/20/2023	0.0004 U	0.0004 U	0.0304	0.0002 U	1.74	0.0002 U	10.8	640	0.00160	0.0002 J	7.66	0.0006 U	0.0853	0.00006 U	0.00150 J	8.0	0.275	0.0006 U	214	0.001 U	2,260
MW-393	03/13/2023	0.0004 U	0.0004 U	0.0273	0.0002 U	1.79	0.0002 U	7.94	606	0.0007 U	0.0001 U	8.21	0.0006 U	0.0668	0.00011 J	0.0008 J	8.0	0.294	0.0006 U	186	0.001 U	2,170
MW-393	04/03/2023	0.0005 J	0.0004 U	0.0481	0.0002 U	2.76	0.0002 U	8.59	648	0.00190	0.0002 J	9.27	0.0006 U	0.123	0.00006 U	0.001 J	8.1	0.304	0.0006 U	209	0.001 U	2,350
MW-393	05/15/2023	0.0005 J	0.0087 U	0.0261	0.0002 U	1.72 J+	0.0005 U	8.41	745	0.0028 U	0.0001 U	8.42	0.004 U	0.0442 J+	0.00014 J	0.0037 U	8.3	0.192	0.0006 U	123	0.001 U	2,290

TABLE 4-1. GROUNDWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)	Total Dissolved Solids (mg/L)
MW-394	10/27/2022	0.00210	0.00150	0.0243	0.0002 U	2.23	0.0002 U	11.6	656	0.0007 J	0.0005 J	4.42	0.0006 U	0.109	0.00008 J	0.00880	7.4	0.204	0.0006 U	348	0.001 U	2,240
MW-394	11/17/2022	0.00260	0.00100 J	0.0285	0.0002 U	1.87	0.0002 U	23.5	576	0.0007 U	0.0001 U	3.89	0.0006 U	0.0571	0.00007 U	0.0113	7.9	0.599 B	0.0006 U	336	0.001 U	1,990 J
MW-394	12/14/2022	0.00140	0.00100	0.0312	0.0002 U	2.02	0.0002 U	26.1	554	0.00310	0.0004 J	3.86	0.0006 U	0.0619	0.00008 U	0.0116	7.8	1.51 B	0.0006 U	299	0.001 U	1,950
MW-394	01/11/2023	0.0009 J	0.00150	0.0285	0.0003 J	1.55	0.0002 U	21.4	662	0.0136	0.00150	4.23	0.00210	0.0664	0.00011 U	0.00610	7.9	0.757 B	0.00100	235	0.001 U	2,130
MW-394	02/20/2023	0.00150	0.00150	0.0463	0.0002 U	1.54	0.0002 U	36.8	414	0.00670	0.00110	2.66	0.00110	0.0579	0.00006 U	0.0119	7.7	0.731 J	0.0006 U	236	0.001 U	1,680
MW-394	03/13/2023	0.0006 J	0.00110	0.0371	0.0002 U	2.89	0.0002 U	25.0	528	0.00320	0.00100 J	3.43	0.00160	0.0623	0.00006 U	0.00560	7.9	0.889	0.0006 U	162	0.001 U	1,750
MW-394	04/03/2023	0.0005 J	0.0005 J	0.0411	0.0002 U	2.50	0.0002 U	15.7	587	0.0007 U	0.0002 J	4.40	0.0006 U	0.101	0.00006 U	0.00350	8.0	0.681 J+	0.0006 U	197	0.001 U	2,010
MW-394	05/15/2023	0.0005 J	0.0087 U	0.0315	0.0002 U	1.72 J+	0.0005 U	20.8	614	0.0028 U	0.0002 J	4.13	0.004 U	0.0373 J+	0.00006 U	0.0037 U	8.1	0.353 <0	0.0006 U	215	0.001 U	1,970
OW-256	03/14/2023	0.0004 U	0.00110	0.0898	0.0002 U	0.216	0.0002 U	80.9	54	0.0007 U	0.0006 J	0.23	0.0006 U	0.00590	0.00006 U	0.0008 J	6.7	1.26	0.0006 U	77	0.001 U	538
OW-256	05/17/2023	0.0004 U	0.0087 U	0.102	0.0002 U	0.187 J+	0.0005 U	86.9	54	0.0028 U	0.00150	0.25	0.004 U	0.005 U	0.00006 U	0.0037 U	6.7	0.717 J+	0.0006 U	64 J+	0.001 U	514
OW-257	03/14/2023	0.00230	0.00400	0.114	0.0002 U	0.693	0.0002 U	116	9	0.00170	0.00260	0.39	0.00150	0.0268	0.00006 U	0.00300	7.2	1.72	0.0006 U	140	0.001 U	840
OW-257	05/17/2023	0.0022 U	0.103	0.975	0.00970	0.490 J+	0.00450	366	7	0.214	0.203	0.37	0.214	0.207 J+	0.00014 J	0.0065 J	6.8	25.3	0.0006 U	118	0.0048 U	1,270
PZ-170	03/14/2023	0.00230	0.0006 J	0.0950	0.0002 U	0.363	0.0003 J	200	86	0.00280	0.00850	0.19	0.0007 J	0.0294	0.00006 U	0.0009 J	6.6	1.31	0.0006 U	288	0.001 U	1,300
PZ-170	05/17/2023	0.0007 J	0.0087 U	0.0975	0.0002 U	0.267 J+	0.0005 U	200	35	0.0028 U	0.00460	0.18	0.004 U	0.0291	0.00006 U	0.0037 U	6.5	0.181	0.0006 U	170	0.001 U	730
PZ-182	03/14/2023	0.0005 J	0.00100 J	0.0670	0.0002 U	0.464	0.0002 J	137	35	0.0007 U	0.00100 J	0.16	0.00360	0.0143	0.00008 J	0.0008 J	6.6	1.39 J	0.0006 U	155	0.001 U	746
PZ-182	05/17/2023	0.0004 U	0.0087 U	0.0692	0.0002 U	0.484 J+	0.0005 U	143	88	0.0028 U	0.0008 J	0.19	0.004 U	0.00690 J+	0.00006 U	0.0037 U	6.6	0.925 J+	0.0006 U	254	0.001 U	1,120

Notes:
-- = data not available
mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = standard units
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 low.
J+ = The result is an estimated quantity, but the result may be biased high.
JB = The result is an estimated quantity, and the analyte was found in both the sample and in the associated method blank.
R = The data are unusable. The sample results are rejected due to serious deficiencies in meeting QC criteria. The analyte may or may not be present in the sample.
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.

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)
MW-116	10/25/2022	--	76.4	7.1	1,062	--	8.85
MW-116	11/16/2022	7.05	170.4	7.3	563.2	14.31	0
MW-126	10/25/2022	3.79	161.2	6.8	1,140	16.86	94.26
MW-126	11/16/2022	2.41	176.3	6.8	1,311	14.65	3.32
MW-158R	10/27/2022	1.66	92.5	7.2	859.2	17.55	2.96
MW-158R	12/13/2022	5.43	-106.2	7.6	916.3	10.53	424.2
MW-158R	01/11/2023	2.85	153.4	6.7	1,360	14.2	92.15
MW-158R	05/19/2023	1.74	175	6.6	903	14.8	43
MW-192	10/27/2022	0.26	76.7	6.9	549.6	16.21	221.3
MW-192	11/16/2022	0.19	-88.5	7.0	844.8	10.81	7.44
MW-192	12/13/2022	0.46	-109.3	7.0	840.1	16.56	1,689
MW-192	01/12/2023	0.1	-182.5	6.8	1,100	16	6.85
MW-192	02/20/2023	0.93	-1.3	6.9	960	15.4	8.15
MW-192	03/13/2023	1.32	-119.4	6.9	984	14.6	16.8
MW-192	04/03/2023	0.76	-125	6.9	987	16.1	25
MW-192	05/16/2023	1.09	-72	6.5	809	16.1	9.2
MW-193	10/27/2022	0.15	-56.7	7.0	894.7	18.57	594
MW-193	11/16/2022	0.1	-71.5	7.0	984.5	13.42	0
MW-193	12/14/2022	0.57	-164.3	7.4	1,062	15.78	8.83
MW-193	01/12/2023	0.61	-74	6.7	1,240	15.1	3.04
MW-193	02/20/2023	1.32	-23.1	6.8	1,130	15.6	9.21
MW-193	03/13/2023	2.72	-155.9	7.0	1,156	14	2.7
MW-193	04/03/2023	1.2	-159	6.9	1,160	16.1	9.1
MW-193	05/15/2023	1.61	-28	6.8	974	17.2	2
MW-194	10/27/2022	2.52	80	6.8	869.6	19.27	898.4
MW-194	11/17/2022	4.04	4.7	7.1	908.4	12.19	14.35
MW-194	12/14/2022	3.71	-27.4	6.8	915.9	15.43	39.05
MW-194	01/11/2023	1.78	22	6.8	908	16.1	11.07
MW-194	02/20/2023	3.31	179.8	6.8	996	14.7	22.67
MW-194	03/13/2023	2.51	18.2	6.8	1,024	12.6	22.7
MW-194	04/03/2023	1.36	116	6.6	1,030	14.8	19
MW-194	05/15/2023	1.82	98	6.5	876	16.9	5
MW-203	12/14/2022	0.7	-210.9	9.8	1,680	14.46	72.54
MW-203	01/24/2023	0.22	-123	8.4	1,590	13.9	9.3
MW-203	05/23/2023	0.78	-25	7.6	920	14.5	1 U
MW-204	10/26/2022	0.34	-136.1	8.0	1,227	13.76	130.3
MW-204	11/17/2022	0.35	116.4	7.8	1,337	13.7	44.6
MW-204	12/13/2022	1.19	-142.9	7.9	--	7.71	7.7
MW-204	01/24/2023	1.41	45	7.6	1,440	14.5	8.6
MW-204	05/23/2023	0.85	-113	7.7	970	14.7	2.8
MW-258	10/27/2022	9.68	27.4	8.7	1.1	15.29	19.75
MW-258	11/17/2022	0.17	-111.6	8.7	1,411	11.52	496.7
MW-258	12/13/2022	0.8	-285.5	9.3	1,463	11.85	7.3
MW-258	01/11/2023	0.05	-220.6	8.5	1,350	14.7	240.6
MW-258	02/20/2023	1.1	-153.4	7.6	6,440	14.1	6.18

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)
MW-258	03/13/2023	1.51	-190.9	8.5	1,607	11.1	42.5
MW-258	04/04/2023	0.57	-259	8.3	1,330	15.3	77
MW-258	05/19/2023	1.42	-157	8.3	1,340	15.9	5.4
MW-304	12/29/2015	1 U	214	8.0	1,840	14.77	1 U
MW-304	03/21/2016	1 U	47	8.2	1,660	15.61	2.8
MW-304	06/21/2016	1 U	-15	8.1	1,900	17.92	1 U
MW-304	09/19/2016	1 U	-64	7.9	1,550	25.2	1 U
MW-304	12/27/2016	1 U	-51	7.9	2,030	13.37	1 U
MW-304	03/16/2017	1 U	-39	7.9	2,200	12.51	1 U
MW-304	06/21/2017	1 U	-65	7.9	2,250	23.86	1 U
MW-304	07/28/2017	1 U	-67	7.8	2,380	19.69	1.1
MW-304	09/21/2017	--	--	7.9	2,340	16.8	--
MW-304	11/28/2017	1 U	47	8.0	1,990	15.9	1 U
MW-304	03/19/2018	--	--	7.9	2,770	14.61	--
MW-304	06/27/2018	1 U	57	7.4	2,430	20.52	1 U
MW-304	09/26/2018	1 U	-165	7.9	2,460	20.3	2.1
MW-304	12/19/2018	--	--	7.9	2,450	14.4	--
MW-304	03/20/2019	1 U	0	7.7	3,460	13.4	1 U
MW-304	06/25/2019	--	--	7.9	2,450	16.5	--
MW-304	09/25/2019	1 U	-15	7.9	2,380	17.6	1 U
MW-304	12/19/2019	--	--	7.9	2,240	13.6	--
MW-304	03/26/2020	1 U	-14	7.9	2,260	14	1.3
MW-304	06/23/2020	--	--	8.0	1,970	15.5	--
MW-304	09/17/2020	1	-48	8.0	1,910	16.5	1.3
MW-304	12/16/2020	--	--	7.9	1,800	13.9	--
MW-304	03/09/2021	1.25	-6	7.9	2,190	15.2	1 U
MW-304	06/21/2021	0.87	-78	7.8	2,540	16.2	1 U
MW-304	09/14/2021	0.38	-24	7.7	2,730	17.2	3.4
MW-304	12/14/2021	1.25	56	7.8	3,050	15	1
MW-304	03/28/2022	0.55	-21	7.8	3,180	13.4	1
MW-304	06/14/2022	1.15	105	7.8	1,960	18.3	1 U
MW-304	09/29/2022	0.66	86	7.7	3,070	16.5	1 U
MW-304	10/26/2022	0.58	30.9	7.9	2,426	16.75	0.13
MW-304	11/17/2022	0.15	159.9	7.9	2,468	15.4	0
MW-304	12/05/2022	0.4	48	7.8	2,960	14.5	61
MW-304	12/14/2022	0.22	190.8	7.8	2,826	15.41	4.07
MW-304	01/11/2023	0.2	52	7.8	2,600	15.5	1
MW-304	02/20/2023	0.76	53.2	7.8	2,880	14.4	1 U
MW-304	03/15/2023	1.64	31.9	7.8	3,422	13.2	1
MW-304	04/04/2023	0.76	-95	7.8	2,380	15.8	2
MW-304	05/22/2023	0.81	116	7.5	1,690	15.2	1 U
MW-306	03/22/2016	1.8	20	9.9	635	14.36	14.1
MW-306	06/21/2016	1 U	-33	10.3	553	17.45	3.6
MW-306	08/18/2016	1 U	-50	10.3	427	17.08	9.5
MW-306	09/19/2016	1 U	-50	11.0	512	18.61	2.9

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)
MW-306	12/27/2016	1.93	-54	10.8	616	14.28	1.8
MW-306	03/16/2017	1 U	-116	11.2	719	12.76	1.9
MW-306	06/21/2017	1 U	-133	11.1	581	19.82	1 U
MW-306	07/28/2017	1 U	-103	10.9	519	20.71	8.8
MW-306	09/21/2017	--	--	10.8	747	16.5	--
MW-306	11/28/2017	1 U	111	10.7	463	15.35	1 U
MW-306	03/20/2018	--	--	10.6	583	14.29	--
MW-306	06/27/2018	1 U	45	10.5	575	21.64	1 U
MW-306	09/26/2018	1 U	-281	11.1	607	17.8	1.5
MW-306	12/19/2018	--	--	11.3	779	14.4	--
MW-306	03/20/2019	2.37	-116	11.4	1,090	13.6	1 U
MW-306	06/25/2019	--	--	11.2	784	16.8	--
MW-306	09/25/2019	1.88	-90	11.0	773	17.1	1.3
MW-306	12/19/2019	--	--	11.3	690	13.3	--
MW-306	03/26/2020	2.39	-59	11.5	752	14.5	1.4
MW-306	06/23/2020	--	--	10.4	466	15.2	--
MW-306	09/17/2020	1	-116	10.5	450	16.3	1
MW-306	12/17/2020	--	--	10.9	538	12.8	--
MW-306	03/10/2021	0.65	-184	11.0	453	14.7	1 U
MW-306	06/22/2021	1.72	-103	11.1	789	16.7	1 U
MW-306	09/16/2021	7.45	-57	12.0	6,540	18.4	13
MW-306	12/14/2021	0.47	-138	10.7	815	15.2	1
MW-306	03/29/2022	0.14	-146	10.9	984	15.3	1
MW-306	06/15/2022	0.77	-3	10.8	693	17.2	1 U
MW-306	09/29/2022	1.47	4	11.3	675	14.9	1 U
MW-306	10/26/2022	1.97	-55.9	11.1	652.1	15.06	9.18
MW-306	11/16/2022	0.57	121.6	10.3	592.2	10.5	0
MW-306	12/06/2022	0.6	2	10.1	725	14	2.59
MW-306	12/14/2022	0.81	-80.3	10.2	637.1	14.84	33.38
MW-306	01/13/2023	0.35	48	9.8	828	11.8	2.48
MW-306	02/21/2023	0.35	-55.5	9.9	688	14.4	1 U
MW-306	03/15/2023	2.12	-120	10.7	903	14.1	3.4
MW-306	04/04/2023	2.31	-33	10.9	636	15.4	12
MW-306	05/23/2023	2.3	-30	11.1	490	15.4	1 U
MW-307	10/26/2022	0.23	-16.1	9.2	1,434	16.57	114.5
MW-307	11/17/2022	10.49	198	9.4	1,562	13.82	49.28
MW-307	12/14/2022	0.82	-96.4	9.4	1,458	15.1	442.2
MW-307	01/13/2023	3.38	66	9.4	1,930	12.9	15.44
MW-307	05/23/2023	0.87	-63	12.0	2,430	15	5.1
MW-356	12/29/2015	1 U	133	7.5	939	12.22	1 U
MW-356	03/28/2016	1 U	-71	7.8	785	14.06	1 U
MW-356	06/23/2016	1 U	-28	7.6	799	23.3	1 U
MW-356	09/22/2016	1 U	-37	7.7	789	20.74	1 U
MW-356	12/27/2016	1 U	-80	7.7	1,060	12.87	1 U
MW-356	03/15/2017	1 U	-71	7.8	937	8.96	1 U

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)
MW-356	06/20/2017	1 U	-119	7.8	1,150	23.36	1 U
MW-356	07/26/2017	1 U	-127	7.9	1,030	23.62	2.1
MW-356	11/27/2017	1 U	77	7.6	871	15.7	1 U
MW-356	06/26/2018	1 U	31	7.4	996	19.53	1 U
MW-356	09/26/2018	5.73	-76	7.8	1,010	17	1.8
MW-356	03/19/2019	1 U	-64	7.8	1,520	12.8	1 U
MW-356	09/24/2019	1 U	-69	7.7	1,230	18.1	5.2
MW-356	03/25/2020	1 U	-48	7.9	1,200	12.7	1.9
MW-356	09/15/2020	1	-78	7.8	1,020	17.5	1.8
MW-356	03/09/2021	0.36	-2	7.7	1,230	13.6	1 U
MW-356	09/15/2021	0.55	-68	7.7	1,500	19.3	6.5
MW-356	03/29/2022	0.59	-71	7.7	1,700	13.9	3.1
MW-356	09/30/2022	0.58	90	7.8	1,260	17.8	1 U
MW-356	10/27/2022	0.84	74.2	7.1	1,148	15.12	0
MW-356	11/17/2022	0.36	137.9	7.8	1,248	13.76	0
MW-356	12/13/2022	0.71	-35.5	7.7	1,314	14.5	0.35
MW-356	01/12/2023	0.22	-100	7.7	1,550	13.7	1
MW-356	02/21/2023	0.76	33.7	7.7	1,450	12.9	1 U
MW-356	03/13/2023	1.57	-106.2	7.7	1,431	13	1 U
MW-356	04/03/2023	0.97	-105	7.7	1,420	15	8.8
MW-356	05/16/2023	1.6	5	7.7	1,170	15.3	9.6
MW-358	10/27/2022	0.73	-166.9	7.9	3,454	14.46	253.7
MW-358	11/17/2022	0.26	199.5	7.8	4,360	13.28	286.1
MW-358	12/13/2022	0.65	-265.7	8.4	5,367	11.65	84.68
MW-358	01/11/2023	1.24	179.8	7.6	5,690	14.9	9.95
MW-358	02/20/2023	0.49	-131.9	8.4	1,600	14	125.1
MW-358	03/13/2023	2.31	-188.1	7.7	6,304	12.2	7.8
MW-358	04/04/2023	1.2	-207	7.7	5,460	16.7	9.4
MW-358	05/19/2023	1.2	-91	7.6	5,640	18.2	2.8
MW-369	12/29/2015	1.12	96	8.8	1,770	11.76	1.7
MW-369	03/28/2016	1 U	6	8.4	1,920	15.33	1.6
MW-369	06/23/2016	1 U	17	8.5	2,180	25.72	1 U
MW-369	09/22/2016	1 U	24	8.3	1,840	24.28	1.6
MW-369	12/27/2016	1 U	-63	8.5	2,370	13.8	1 U
MW-369	03/14/2017	1 U	2	7.8	1,440	10.85	1 U
MW-369	06/20/2017	1 U	156	7.4	1,320	24.38	1 U
MW-369	07/26/2017	3.66	106	7.4	1,160	21.14	1 U
MW-369	11/27/2017	1.06	54	7.5	934	16.25	1 U
MW-369	06/26/2018	1 U	111	7.0	1,170	17.91	1 U
MW-369	09/26/2018	1.47	143	7.3	1,110	15.9	2.2
MW-369	03/19/2019	1 U	46	7.3	1,790	12.3	15.1
MW-369	09/24/2019	1 U	-60	6.7	1,430	16.5	2.4
MW-369	03/25/2020	1 U	-22	7.1	1,310	13.4	7.1
MW-369	09/15/2020	1	-139	7.1	1,230	16.9	3.8
MW-369	03/08/2021	0.19	-110	7.0	1,410	15.5	1 U

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

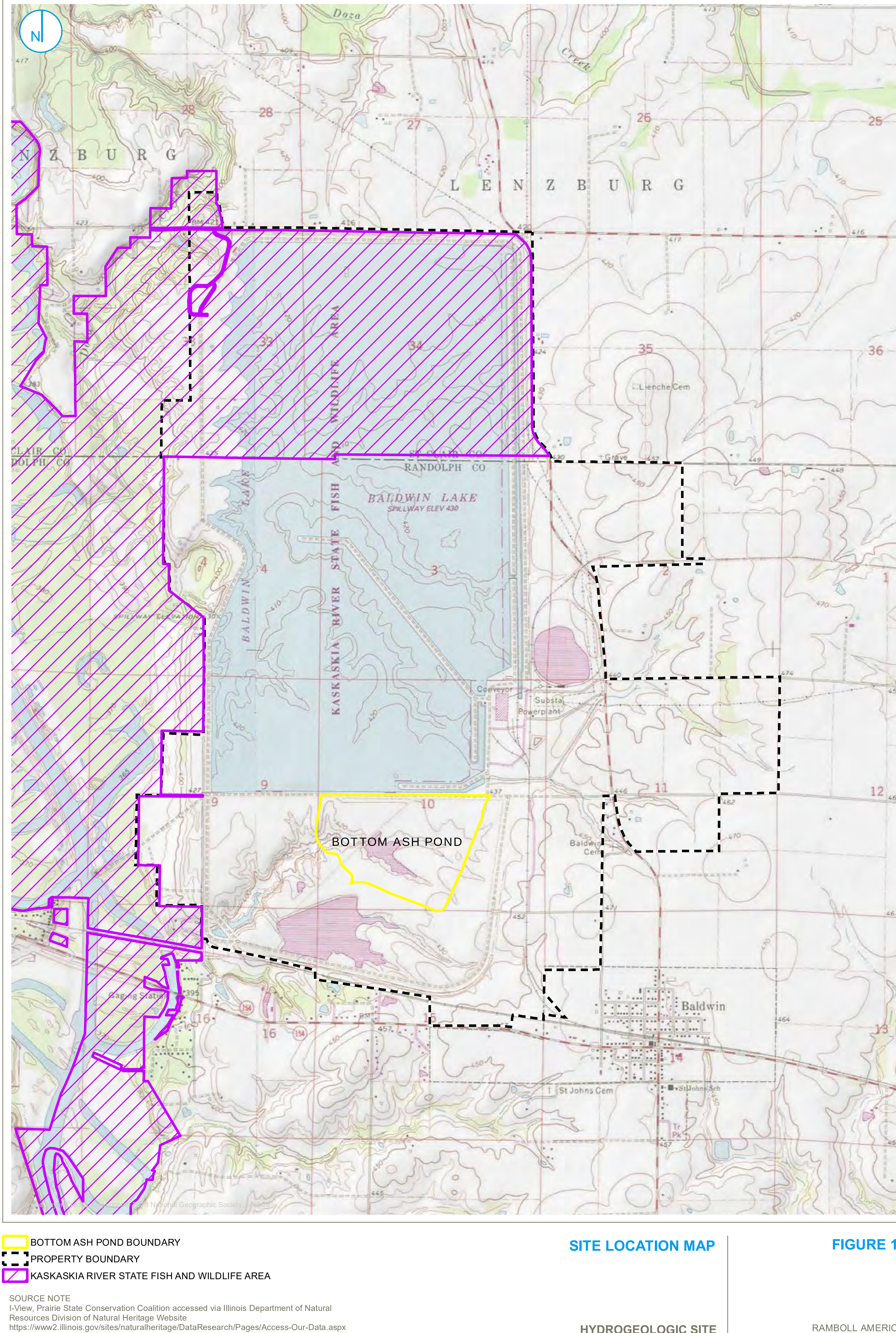
Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
MW-369	09/15/2021	0.32	-216	8.2	3,640	20	9.1
MW-369	03/29/2022	0.6	-162	8.4	3,540	13.7	4.1
MW-369	09/30/2022	0.4	88	8.5	2,310	15.1	5.5
MW-369	03/13/2023	2.68	-102.5	7.0	1,465	13.5	5.3
MW-369	05/16/2023	1.61	-21	7.0	1,210	15.2	3.3
MW-370	12/29/2015	1 U	273	7.7	5,020	13.5	1 U
MW-370	03/28/2016	1 U	-19	7.9	3,640	16.4	7.8
MW-370	06/23/2016	1 U	-23	8.0	4,050	22.44	1.7
MW-370	09/22/2016	1 U	-61	7.7	4,180	20.67	1 U
MW-370	12/27/2016	1 U	115	7.3	4,440	12.09	1 U
MW-370	03/14/2017	1 U	-20	7.9	5,030	12.71	1 U
MW-370	06/20/2017	1 U	38	7.6	6,070	22.05	1 U
MW-370	07/25/2017	1 U	1	7.6	5,970	23.61	1 U
MW-370	11/27/2017	7.3	101	7.9	5,170	16.79	1 U
MW-370	06/26/2018	1 U	52	7.4	7,050	18.35	1 U
MW-370	09/26/2018	1 U	-19	7.7	7,160	17.9	1 U
MW-370	03/19/2019	1 U	10	7.7	9,680	14.6	1 U
MW-370	09/24/2019	1 U	35	7.5	6,220	16.5	1
MW-370	03/25/2020	1 U	-8	7.7	6,110	14.2	1.1
MW-370	09/15/2020	1	-3	7.5	5,180	16	1.1
MW-370	03/09/2021	0.44	47	7.5	5,480	14.8	1 U
MW-370	09/15/2021	1.09	52	7.5	7,400	18.7	3.3
MW-370	03/29/2022	0.96	-10	7.6	8,300	14.2	1
MW-370	09/30/2022	1.03	138	7.6	6,210	15.1	1 U
MW-370	10/27/2022	0.3	176.8	6.9	5,610	14.95	0
MW-370	11/17/2022	0.74	54.4	7.8	6,561	10.55	5.45
MW-370	12/14/2022	0.1	2.6	7.5	6,044	15.4	0.86
MW-370	01/12/2023	0.29	-31	7.5	7,700	14.5	1
MW-370	02/21/2023	0.87	122.2	7.5	7,280	14	3.68
MW-370	03/14/2023	1.26	31.4	7.4	7,050	14.2	1 U
MW-370	04/03/2023	0.99	-75	7.5	6,950	16.1	11
MW-370	05/16/2023	0.81	36	7.5	5,460	15.7	1.5
MW-382	12/29/2015	1 U	240	7.8	1,700	13.02	36.5
MW-382	03/28/2016	1 U	-67	7.9	1,360	17.08	18.5
MW-382	06/23/2016	1 U	-136	8.0	1,400	23.15	6.4
MW-382	09/22/2016	1 U	-128	7.8	1,210	26.78	8.6
MW-382	12/27/2016	1 U	-62	7.7	1,760	13.61	15.6
MW-382	03/14/2017	1 U	-112	8.1	1,840	11.43	42.7
MW-382	06/20/2017	1 U	-91	7.8	1,980	22.23	1 U
MW-382	07/25/2017	3.65	-66	7.7	1,610	22.4	9.6
MW-382	11/27/2017	7.46	167	7.9	1,680	17.35	9.5
MW-382	06/26/2018	5.65	-34	7.4	1,960	18.16	14
MW-382	09/26/2018	5.95	-102	7.8	2,060	16.6	7.1
MW-382	03/19/2019	1 U	-81	7.6	2,650	15.6	57.6
MW-382	09/24/2019	1.74	-18	7.7	1,860	16.4	53

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, 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)
MW-382	03/25/2020	1 U	-56	7.9	1,920	14.3	25
MW-382	09/15/2020	2.07	-8	7.8	1,520	16.2	61
MW-382	03/09/2021	0.75	10	7.7	1,600	17.3	180
MW-382	09/15/2021	1.34	10	7.7	2,150	18.1	77
MW-382	03/29/2022	1.45	-28	7.8	2,360	14.1	130
MW-382	09/30/2022	1.18	67	7.8	1,790	15.9	120
MW-382	03/14/2023	1.16	-64.9	7.7	2,446	14.2	7.3
MW-382	05/16/2023	1.12	49	7.7	1,840	15.4	44
MW-392	10/27/2022	3.76	108.3	7.0	2,256	18.7	45.3
MW-392	11/16/2022	0.19	-100.9	8.0	3,333	7.18	5.08
MW-392	12/13/2022	0.21	-157.3	7.7	3,819	14.71	55.57
MW-392	01/12/2023	1.03	-211.1	7.6	4,600	14.8	315.8
MW-392	02/20/2023	0.39	-210	7.6	4,240	15.9	19.25
MW-392	03/13/2023	1.04	-249.1	7.7	4,239	15.1	14
MW-392	04/03/2023	0.89	-246	7.7	4,330	16.9	22
MW-392	05/16/2023	1.67	-121	7.5	3,560	16.5	6
MW-393	10/27/2022	0.14	-95.3	7.4	3,237	18.59	9.75
MW-393	11/16/2022	0.1	-235.5	8.1	3,620	10.82	7.52
MW-393	12/14/2022	0.48	-263	8.6	3,428	15.44	21.05
MW-393	01/12/2023	0.04	-292.4	7.9	5,040	15.4	234.3
MW-393	02/20/2023	0.28	-268.3	8.0	4,760	16	19.41
MW-393	03/13/2023	1.06	-296.2	8.0	4,828	13.6	8
MW-393	04/03/2023	0.55	-300 U	8.1	5,200	16.2	8.2
MW-393	05/15/2023	1.12	-300 U	8.3	4,210	17.7	1 U
MW-394	10/27/2022	0.16	-120.8	7.4	3,894	17.79	8.52
MW-394	11/17/2022	0.19	-172.6	7.9	3,344	9.12	82.93
MW-394	12/14/2022	0.1	-329.4	7.8	3,493	14.38	283.7
MW-394	01/11/2023	0.04	-300	7.9	4,060	16.2	225.5
MW-394	02/20/2023	0.4	-281.4	7.7	3,720	14.9	64.34
MW-394	03/13/2023	0.76	-300	7.9	4,068	13.4	33.6
MW-394	04/03/2023	0.8	-300 U	8.0	4,640	15.3	1.3
MW-394	05/15/2023	1.6	-286	8.1	4,090	17.7	1 U
OW-256	03/14/2023	0.96	-19.2	6.7	1,164	14.6	9.2
OW-256	05/17/2023	0.77	0	6.7	901	15.5	5.4
OW-257	03/14/2023	5.64	-31.9	7.2	1,524	13.9	40.2
OW-257	05/17/2023	0.9	-66	6.8	1,210	14.7	110
PZ-170	03/14/2023	1.5	0.9	6.6	2,321	15.2	12.4
PZ-170	05/17/2023	0.93	-67	6.5	1,750	15.9	3.7
PZ-182	03/14/2023	0.86	15.3	6.6	1,464	15.3	8.8
PZ-182	05/17/2023	0.73	-67	6.6	1,160	15.4	36

Notes:
Field readings are reported with as many significant figures as provided by analytical laboratory.
-- = data not available
cm = centimeter
deg. C = degrees Celsius
mg/L = milligrams per liter
mV = millivolts
NTU = nephelometric turbidity units
SU = standard units
U = The analyte was analyzed for, but was not detected above the level of the adjusted detection limit or quantitation limit, as appropriate.

FIGURES



BOTTOM ASH POND BOUNDARY
PROPERTY BOUNDARY
KASKASKIA RIVER STATE FISH AND WILDLIFE AREA

SOURCE NOTE
I-View, Prairie State Conservation Coalition accessed via Illinois Department of Natural Resources Division of Natural Heritage Website
https://www2.illinois.gov/sites/naturalheritage/DataResearch/Pages/Access-Our-Data.aspx

0 1,000 2,000 Feet

SITE LOCATION MAP

FIGURE 1-1

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\Figure 1-2_Base Map.mxd

PROJECT: 169000XXXX | DATED: 10/13/2021 | DESIGNER: HOTCALD

REGULATED UNIT (SUBJECT UNIT)
CAPPED AREA
SITE FEATURE
FLY ASH POND SYSTEM (CLOSED)
PROPERTY BOUNDARY

0 400 800
Feet

SITE MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 1-2

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\Figure 2-1_Site Topographic Map.mxd

PROJECT: 169000XXXX | DATED: 10/14/2021 | DESIGNER: STOLZSD

REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
FLY ASH POND SYSTEM
CAPPED AREA
PROPERTY BOUNDARY

0 400 800 Feet

SURFACE ELEVATION CONTOUR

MAJOR CONTOUR (25 FT, NAVD88)
MINOR CONTOUR (5 FT, NAVD88)

AS-BUILT COVER SYSTEM SURFACE ELEVATION CONTOUR (AS-BUILT VEGETATIVE SOIL LAYER)

MAJOR CONTOUR (10 FT, NAVD88)
MINOR CONTOUR (2 FT, NAVD88)

NOTES
NAVD88 = NORTH AMERICAN VERTICAL DATUM 1988.
CONTOUR (AS-BUILT VEGETATIVE SOUL LAYER) DATA FROM INGENAE 10/23/2020.

SITE TOPOGRAPHIC MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 2-1

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

REGULATED UNIT (SUBJECT UNIT)
FLY ASH POND SYSTEM (CLOSED)
SITE FEATURE
CAPPED AREA
PROPERTY BOUNDARY

0 400 800 Feet

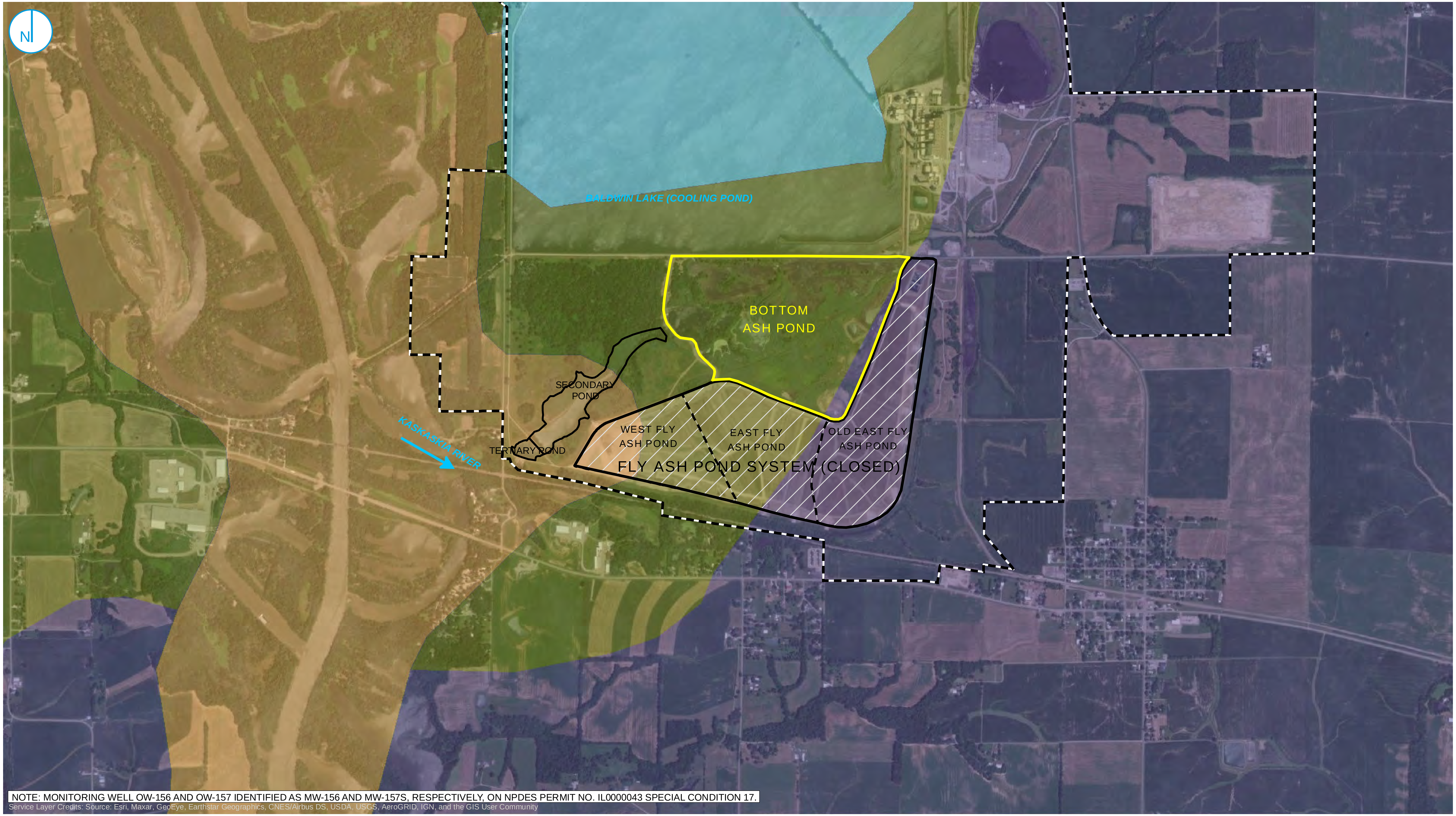
SURFACE ELEVATION CONTOUR
MAJOR CONTOUR (25 FT, NGVD29)
MINOR CONTOUR (5 FT, NGVD29)

HISTORIC TOPOGRAPHIC MAP (1968)

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 2-2

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.



PROJECT: 169000XXXX | DATED: 10/14/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\BaldwinBAP\Figure 2-3_Surficial Geologic Deposits.mxd

- CAHOKIA ALLUVIUM (INCLUDES ALLUVIAL FAN FACIES)
- PEARL FORMATION [1]
- VANDALIA TILL MEMBER
- WATER
- REGULATED UNIT (SUBJECT UNIT)
- FLY ASH POND SYSTEM (CLOSED)
- CAPPED AREA
- SITE FEATURE
- PROPERTY BOUNDARY

0 750 1,500 Feet

[1] Extents of the surficial Pearl Formation are not consistent with 2022 HSI findings

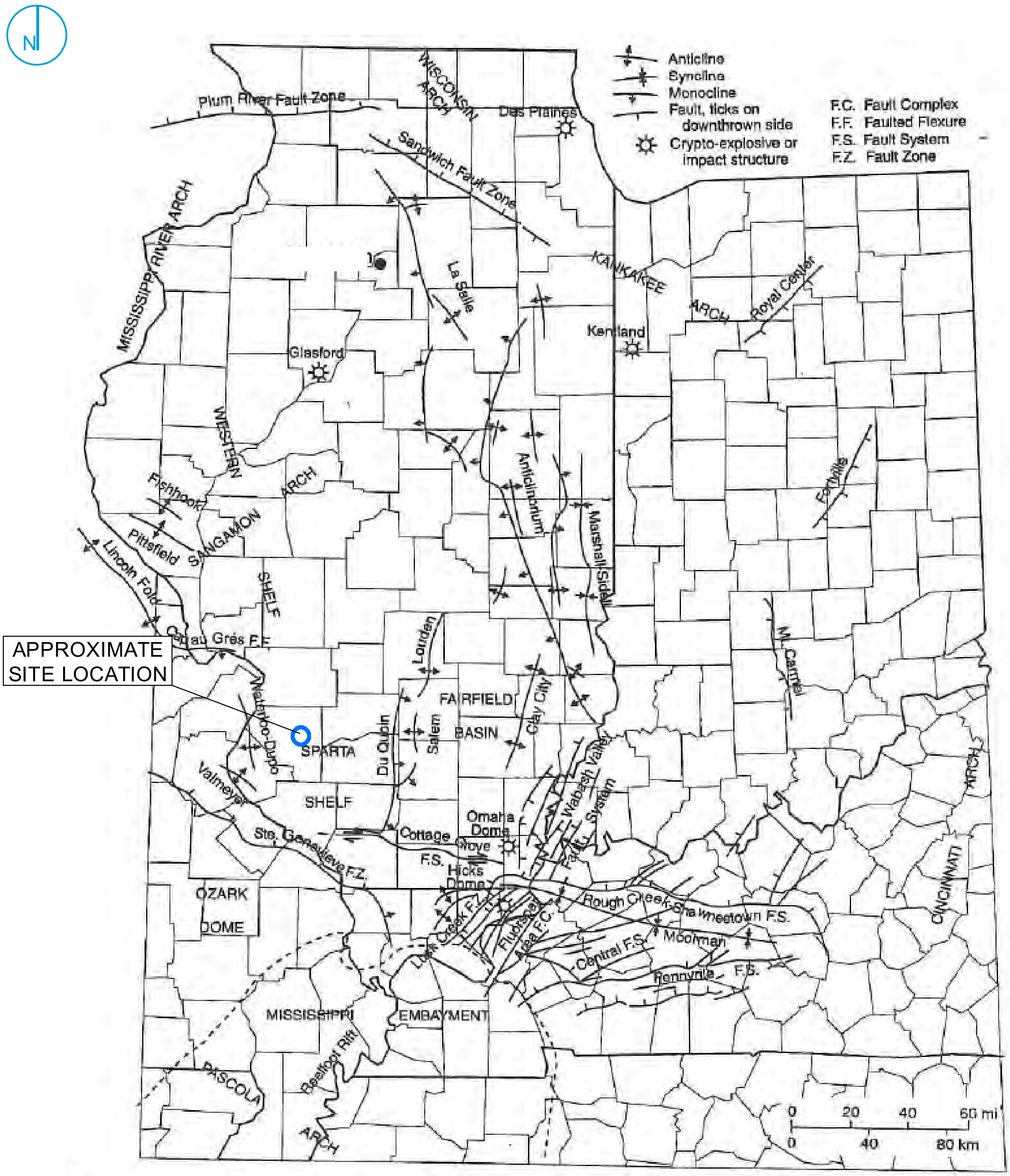
SURFICIAL GEOLOGIC DEPOSITS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 2-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



SOURCE NOTE: MODIFIED FROM "NELSON, W.J. 1995, STRUCTURAL FEATURES IN ILLINOIS, ILLINOIS STATE GEOLOGICAL SURVEY, BULLETIN 100, CHAMPAIGN, ILLINOIS."

Service Layer Credits:

PROJECT: 169000XXXX | DATED: 10/13/2021 | DESIGNER: HOTCALD
Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\Figure 2-4_Major Structural Features of Illinois.m

MAJOR STRUCTURAL FEATURES OF ILLINOIS

FIGURE 2-4

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\2023_Update\Figure 2-5_Monitoring Well Location Map.mxd

PROJECT: 169000XXXX | DATED: 6/27/2023 | DESIGNER: GALARNMC

COMPLIANCE MONITORING WELL
BACKGROUND MONITORING WELL
MONITORING WELL
PORE WATER WELL
CLOSED MONITORING WELL
CLOSED PORE WATER WELL [1]
REGULATED UNIT (SUBJECT UNIT)
FLY ASH POND SYSTEM (CLOSED)
SITE FEATURE
CAPPED AREA
PROPERTY BOUNDARY

0 400 800 Feet

NOTES:
1. Pore water wells planned to be abandoned during construction of the FAPS cover system which commenced in 2018 and was completed in 2020

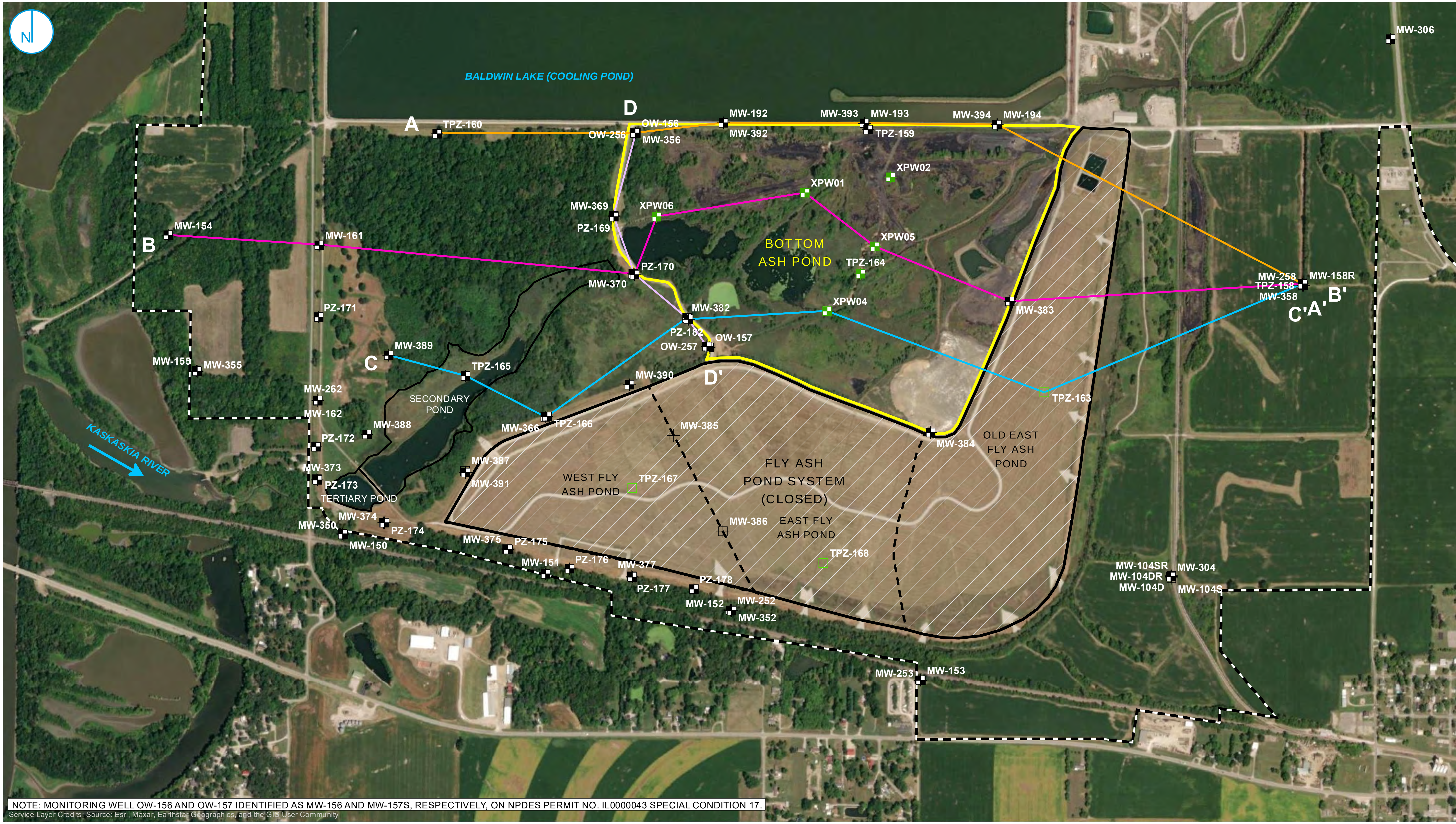
MONITORING WELL LOCATION MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 2-5

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL



Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\2023_Update\Figure 2-6_Cross Section Locations.mxd

PROJECT: 169000XXXX | DATED: 5/9/2023 | DESIGNER: GALARNMC

MONITORING WELL AND PIEZOMETER LOCATION
PORE WATER WELL
CLOSED MONITORING WELL
CLOSED PORE WATER WELL

CROSS SECTION TRANSECT
A to A'
B to B'
C to C'
D to D'

REGULATED UNIT (SUBJECT UNIT)
FLY ASH POND SYSTEM (CLOSED)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

0 400 800
Feet

CROSS SECTION LOCATION MAP

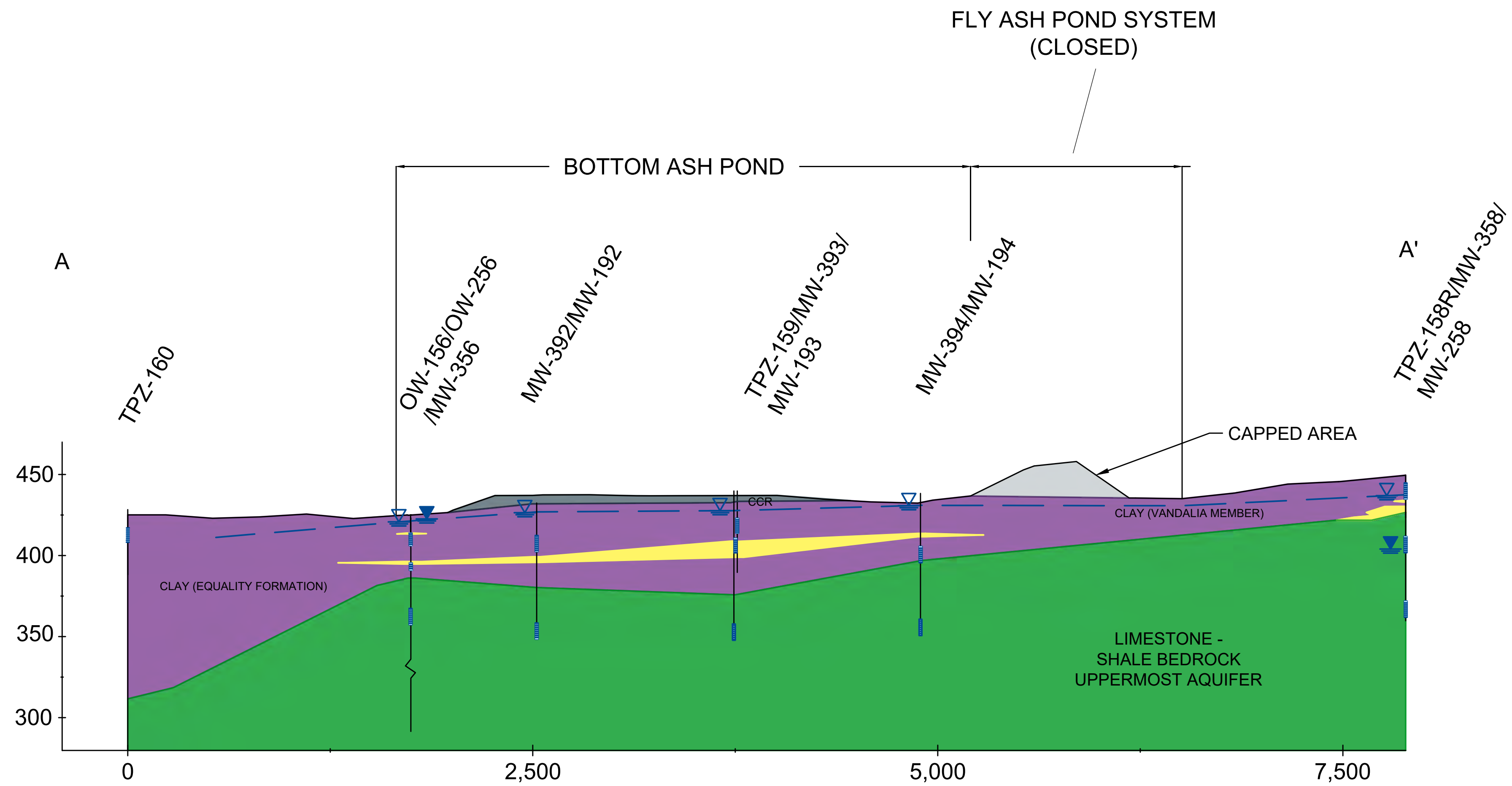
HYDROGEOLOGIC SITE
CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

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 on March 15, 2023.



LEGEND

- COAL COMBUSTION RESIDUALS (CCR)
- FILL
- CLAY
- SILT
- SAND
- BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPERMOST AQUIFER GROUNDWATER ELEVATION
- OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)

100'
0
1,000'

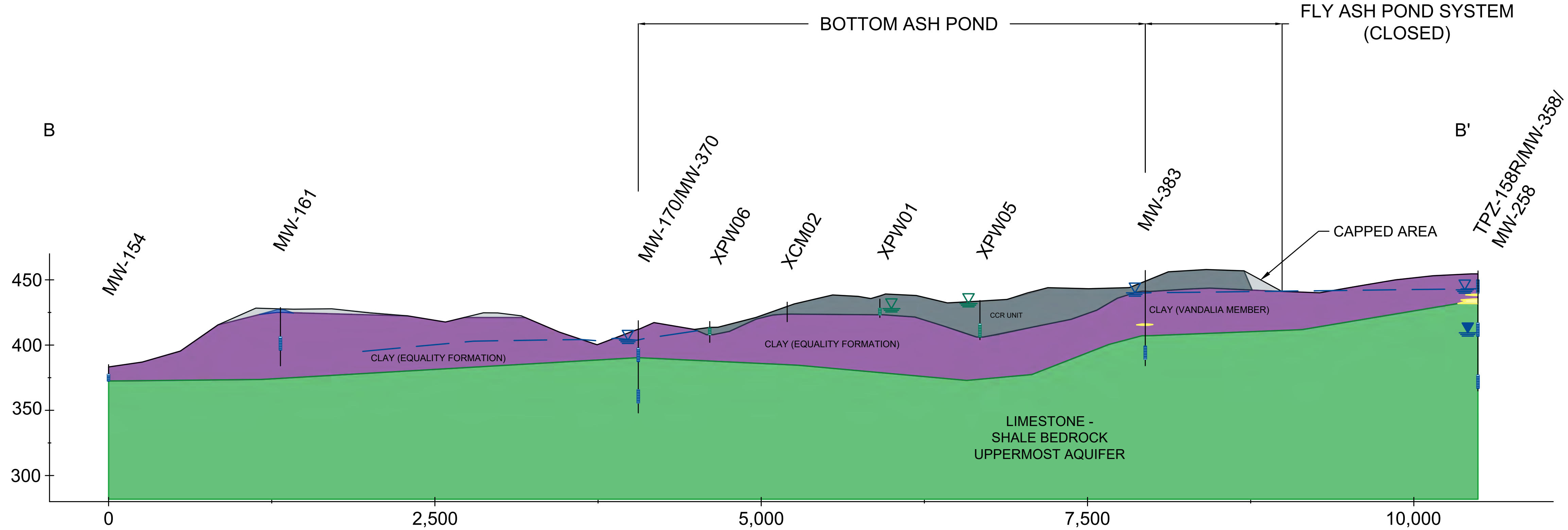
CROSS SECTIONS A-A'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILINNOIS

FIGURE 2-7

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL



NOTES

1. These profiles were 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 on March 15, 2023.

LEGEND

- COAL COMBUSTION RESIDUALS (CCR)
- FILL
- CLAY
- SILT
- SAND
- BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPERMOST AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)

100'
0
1,000'

CROSS SECTIONS B-B'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILINOIS

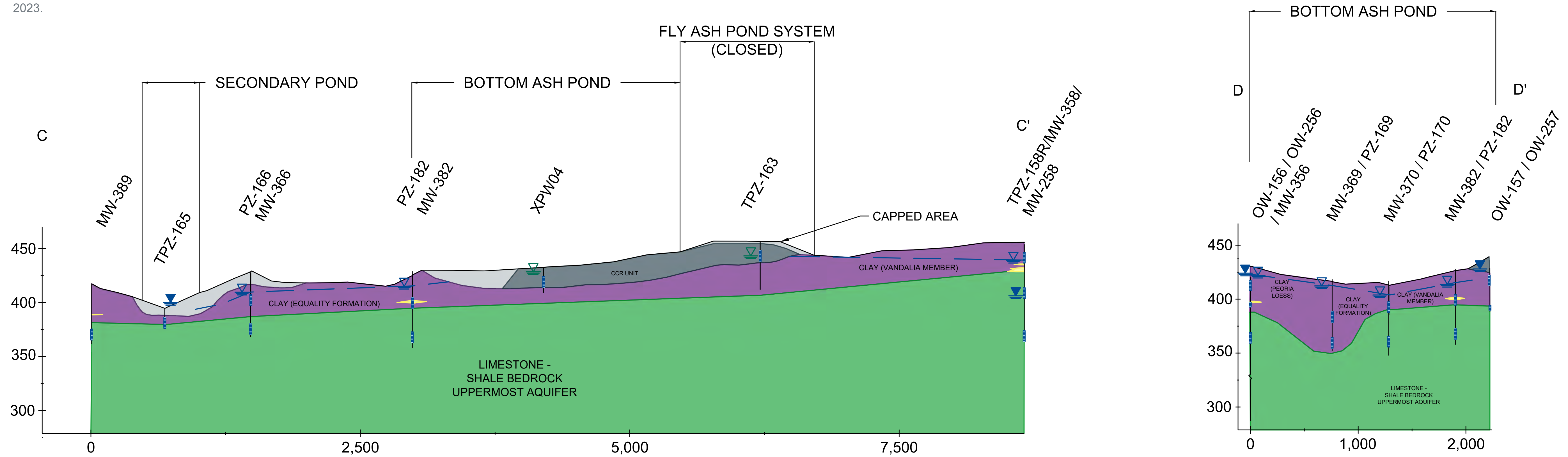
FIGURE 2-8

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 on March 15, 2023.



C:\Users\Engelhsa\OneDrive - Ramboll\Projects\Vistra\Modeling & Calcs\BAL\CAD\2023_CrossSections\Baldwin Cross Sections.dwg

PROJECT: 1940100806 DATED: 6/26/2023 11:34 PM DESIGNER: ENGELHSA

LEGEND

- COAL COMBUSTION RESIDUALS (CCR)
- FILL
- CLAY
- SILT
- SAND
- BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPERMOST AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)

100'
0
1,000'

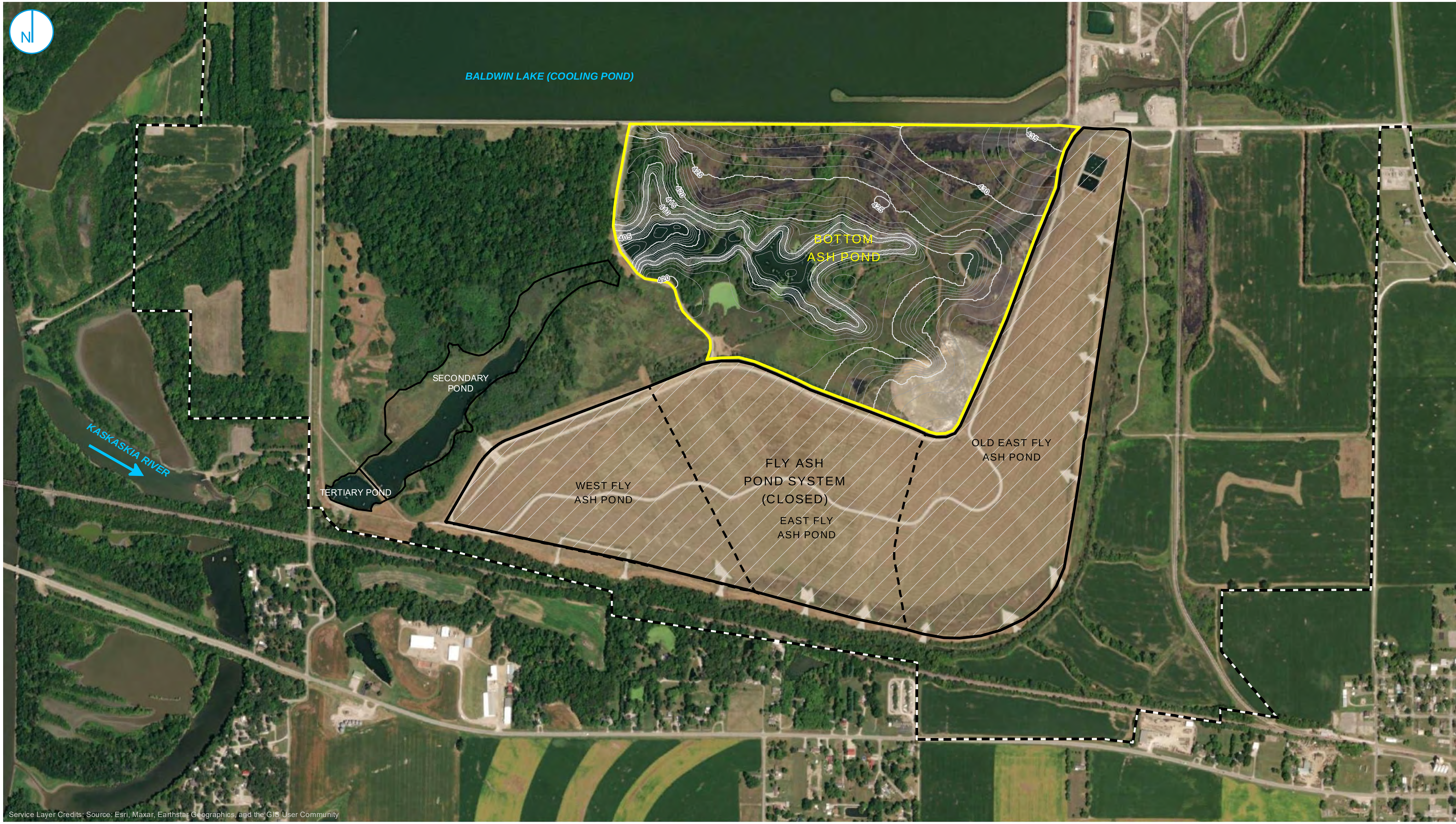
CROSS SECTIONS C-C' AND D-D'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILINNOIS

FIGURE 2-9

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL



Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\2023_Update\Figure 2-12_Bottom of Aquifer.mxd

PROJECT: 169000XXXX | DATED: 4/25/2023 | DESIGNER: GALARNMC

5-FT BOTTOM OF ASH ELEVATION CONTOUR
1-FT BOTTOM OF ASH ELEVATION CONTOUR
REGULATED UNIT (SUBJECT UNIT)
FLY ASH POND SYSTEM (CLOSED)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

0 400 800 Feet

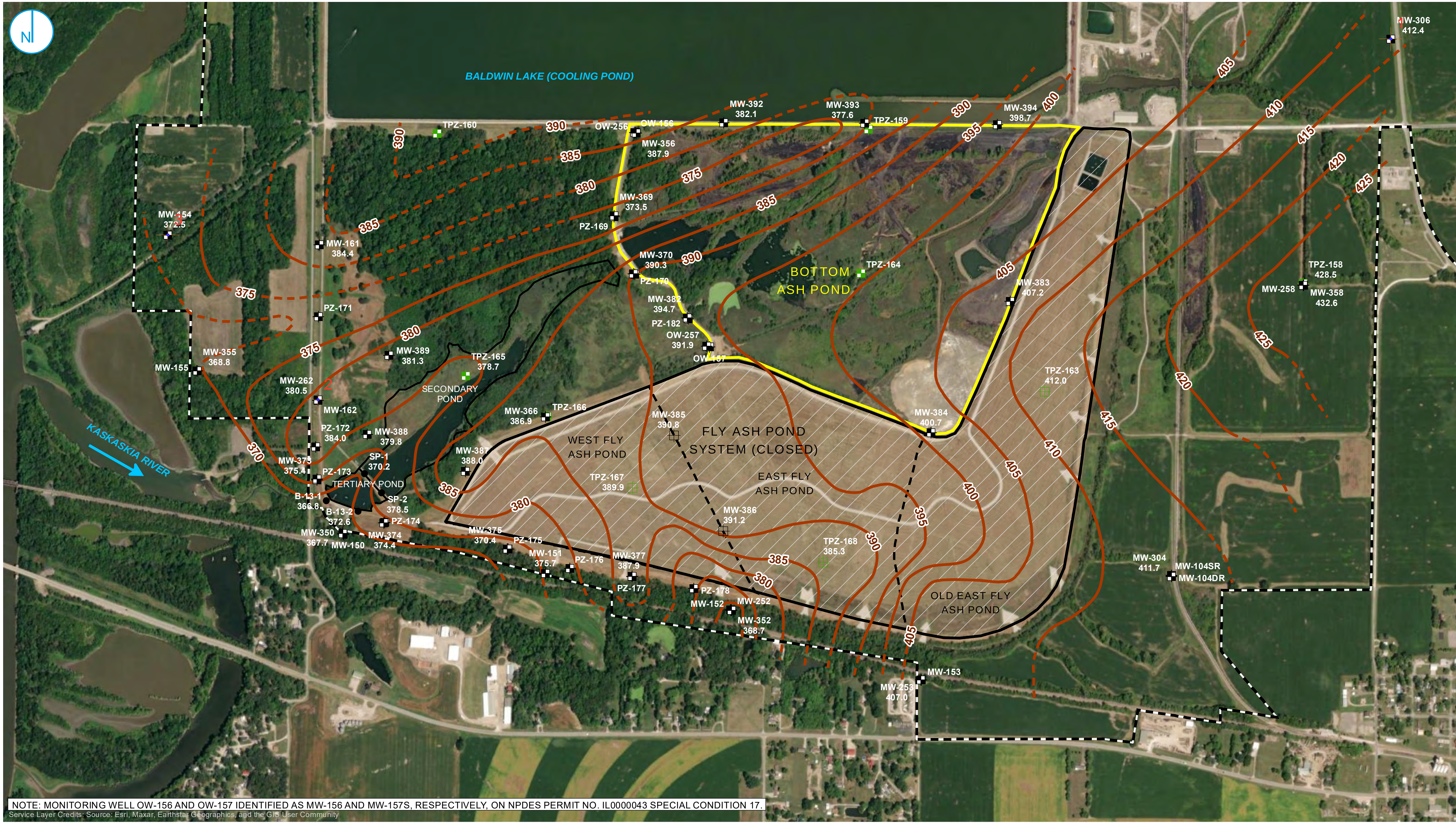
BOTTOM OF ASH

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 2-10

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL



Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\2023_Update\Figure 2-10_Bedrock Topography.mxd

PROJECT: 169000XXXX | DATED: 6/28/2023 | DESIGNER: GALARNMC

- MONITORING WELL
- PORE WATER WELL
- CLOSED MONITORING WELL
- CLOSED PORE WATER WELL
- AECOM BORING LOCATION
- BEDROCK ELEVATION CONTOUR
- INFERRED BEDROCK ELEVATION CONTOUR
- REGULATED UNIT (SUBJECT UNIT)
- FLY ASH POND SYSTEM (CLOSED)
- SITE FEATURE
- LIMITS OF FINAL COVER
- PROPERTY BOUNDARY

0 400 800 Feet

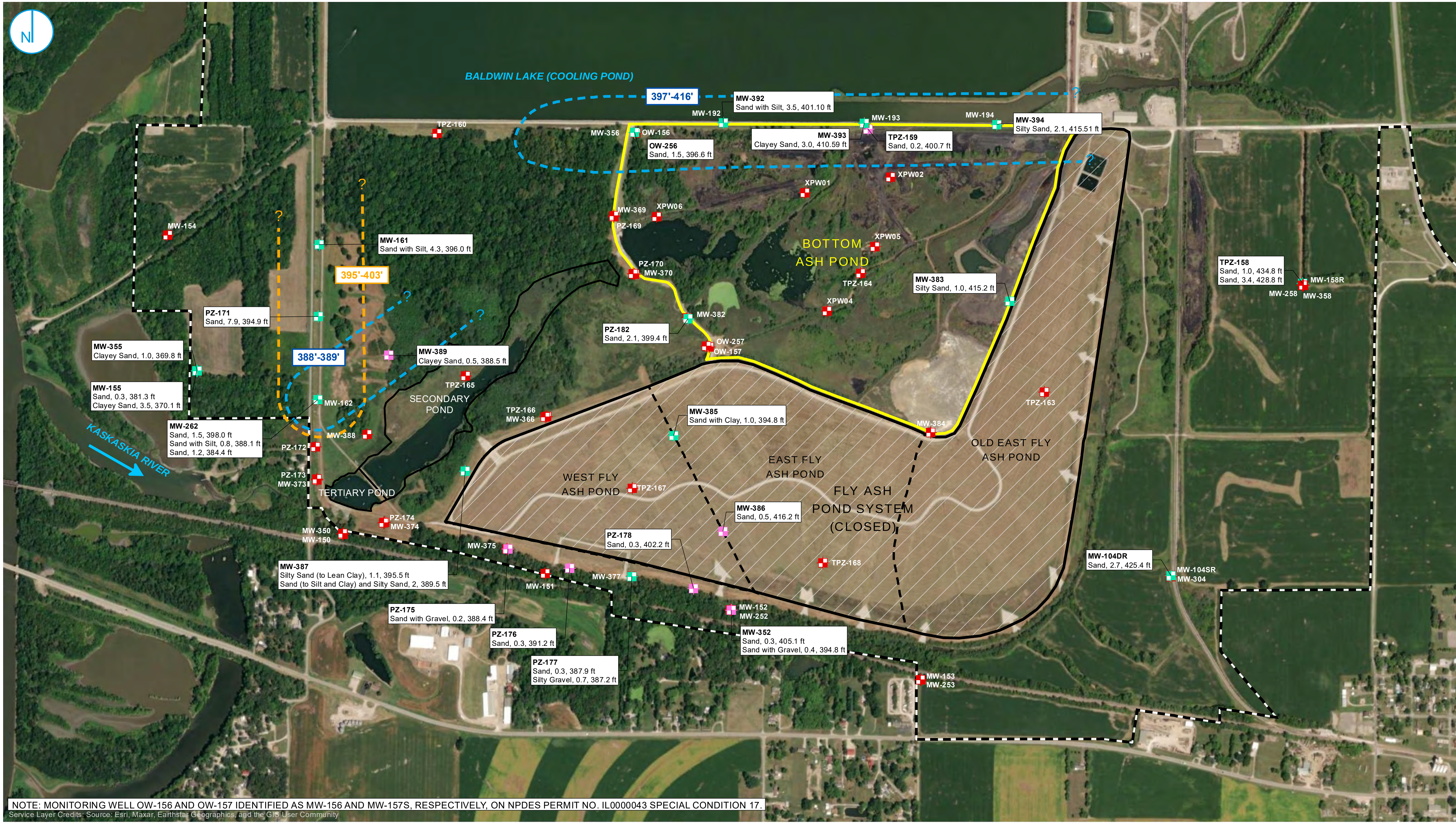
BEDROCK TOPOGRAPHY

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 2-11

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL



PROJECT: 169000XXXX | DATED: 6/27/2023 | DESIGNER: GALARNMC

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\2023_Update\Figure 3-1_Sand Seam Observations Thickness and Elevations.mxd

BORING LOCATION WITH OBSERVED SAND SEAM > 0.5 FT

BORING LOCATION WITH OBSERVED SAND SEAM =< 0.5 FT

BORING LOCATION WITH NO OBSERVED SAND SEAM

BORING/WELL NUMBER
SEAM DESCRIPTION, SEAM THICKNESS (FT), SEAM BASE ELEVATION

0 400 800 Feet

AREAS OF POTENTIALLY INTERCONNECTED SAND SEAMS AND SEAM ELEVATION INTERVAL

UNSATURATED SAND SEAM

SATURATED SAND SEAM

35 I.A.C. § 845 REGULATED UNIT (SUBJECT UNIT)

FLY ASH POND SYSTEM (CLOSED)

SITE FEATURE

LIMITS OF FINAL COVER

PROPERTY BOUNDARY

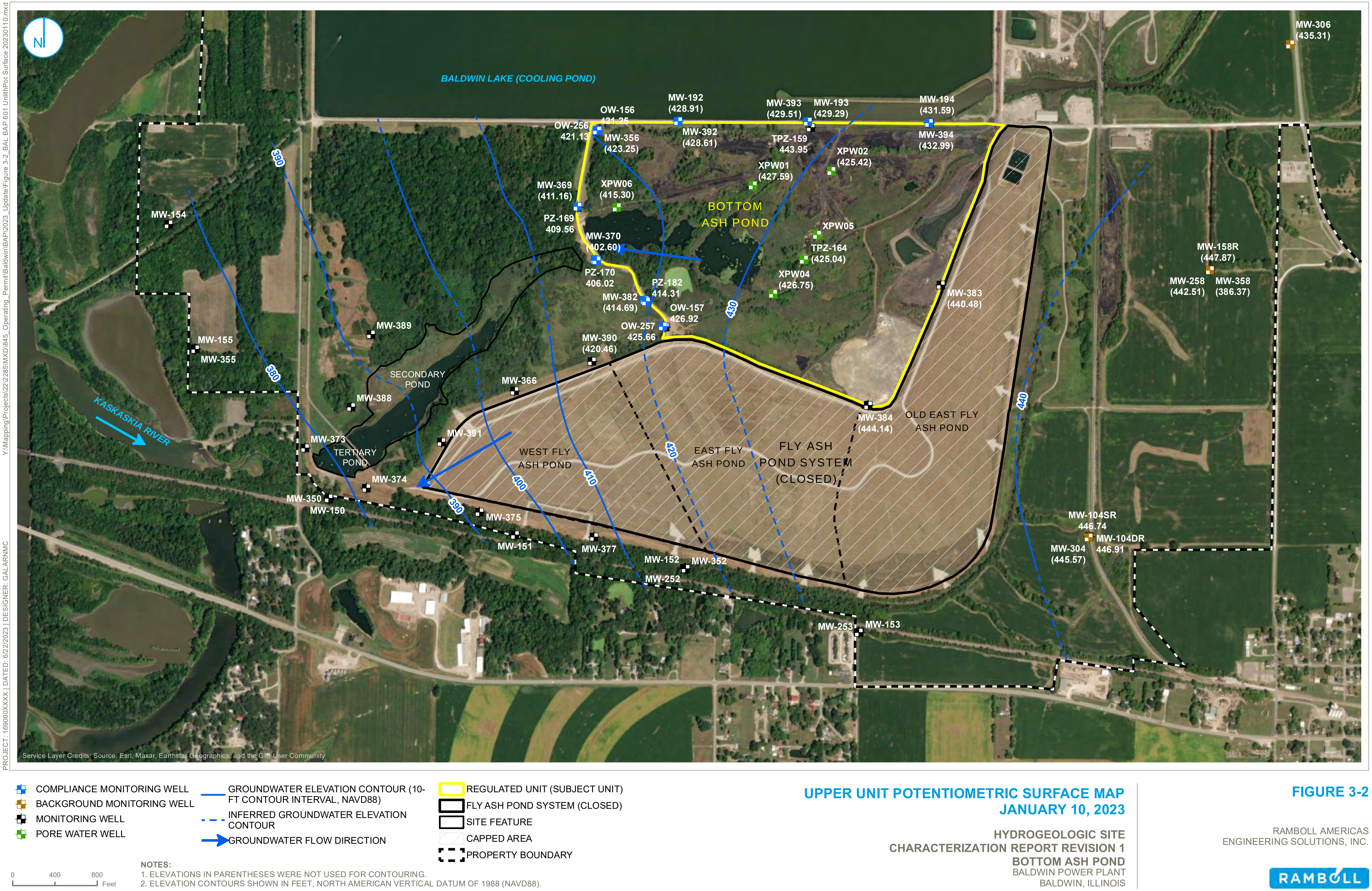
SAND SEAM OBSERVATIONS, THICKNESS AND ELEVATIONS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 3-1

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL



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

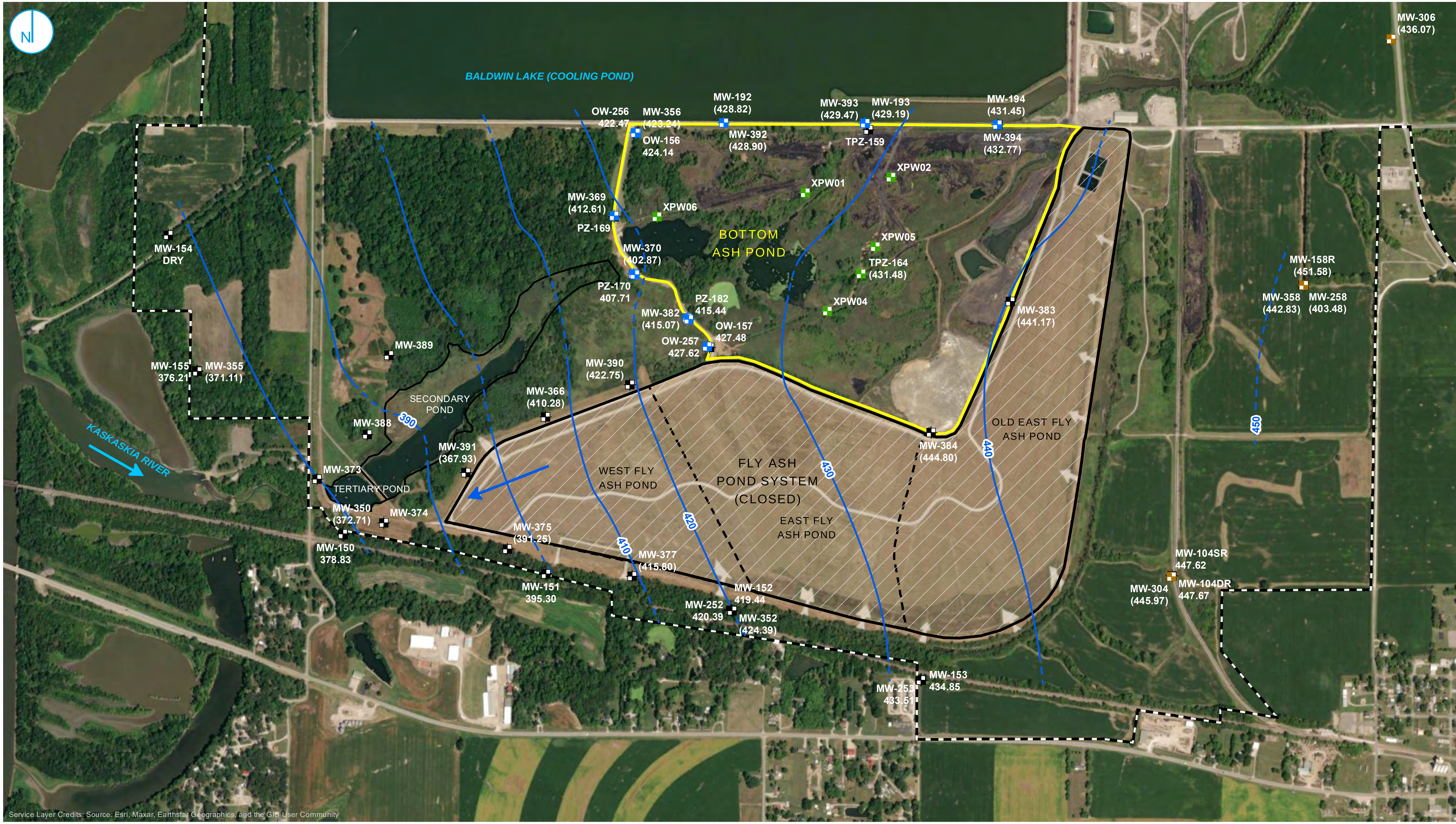
UPPER UNIT POTENTIOMETRIC SURFACE MAP
JANUARY 10, 2023

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 3-2

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL



Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\2023_Update\Figure 3-3_BAL BAP 601 UnlithPot Surface 20230313.mxd

PROJECT: 169000XXXX | DATED: 6/22/2023 | DESIGNER: GALARNMC

- COMPLIANCE MONITORING WELL
- BACKGROUND MONITORING WELL
- MONITORING WELL
- PORE WATER WELL
- GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- REGULATED UNIT (SUBJECT UNIT)
- FLY ASH POND SYSTEM (CLOSED)
- SITE FEATURE
- CAPPED AREA
- PROPERTY BOUNDARY

0 400 800 Feet

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

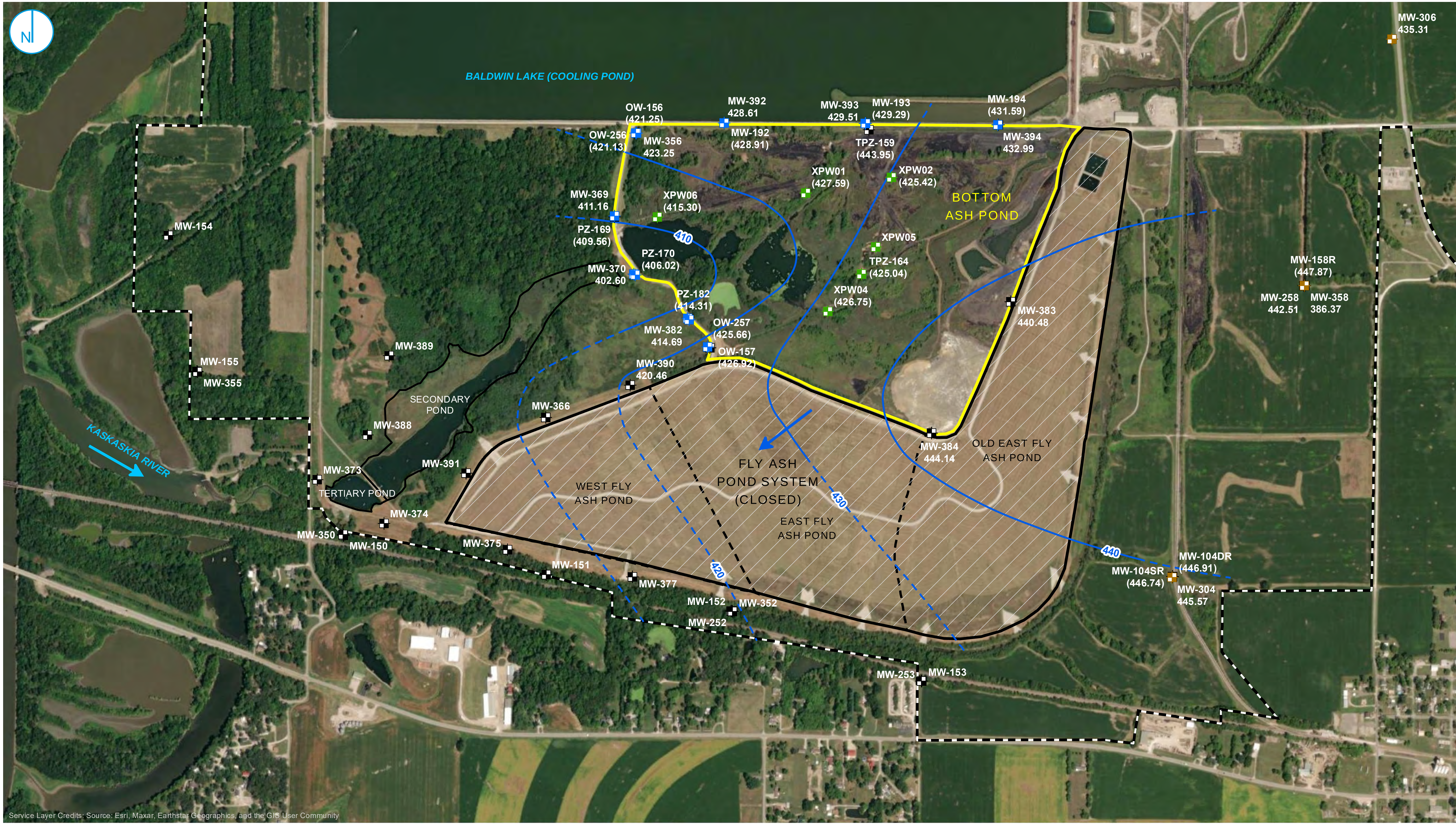
UPPER UNIT POTENTIOMETRIC SURFACE MAP
MARCH 13-15, 2023

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 3-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\2023_Update\Figure 3-4_BAL BAP 601 Pot Surface 20230110.mxd

PROJECT: 169000XXXX | DATED: 6/22/2023 | DESIGNER: GALARNMC

- COMPLIANCE MONITORING WELL
- BACKGROUND MONITORING WELL
- MONITORING WELL
- PORE WATER WELL
- GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- REGULATED UNIT (SUBJECT UNIT)
- FLY ASH POND SYSTEM (CLOSED)
- SITE FEATURE
- CAPPED AREA
- PROPERTY BOUNDARY

0 400 800 Feet

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

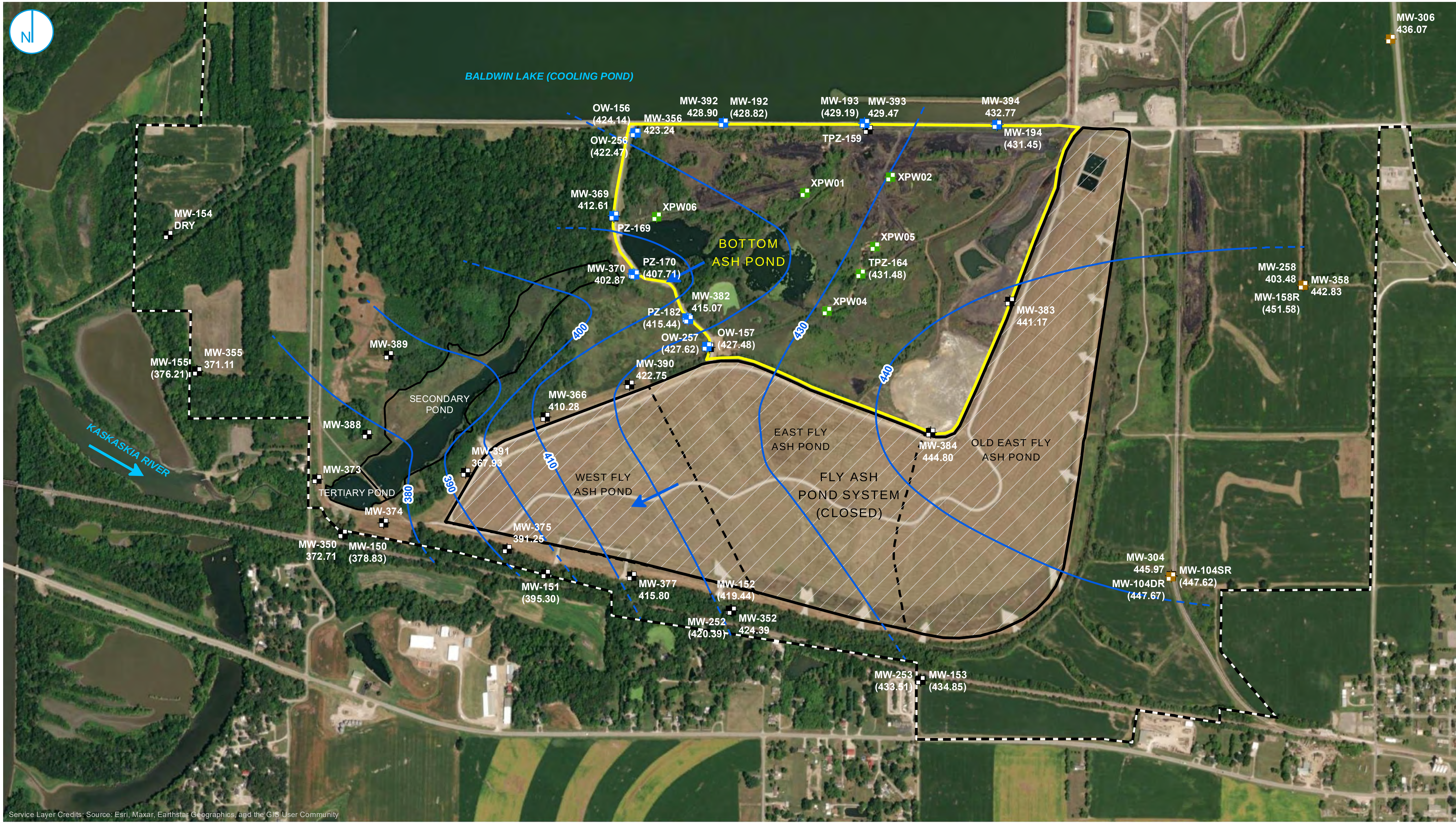
UPPERMOST AQUIFER POTENTIOMETRIC SURFACE MAP
JANUARY 10, 2023

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 3-4

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL



Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\2023_Update\Figure 3-5_BAL BAP 601 Pot Surface 20230313.mxd

PROJECT: 169000XXXX | DATED: 6/22/2023 | DESIGNER: GALARNMC

- COMPLIANCE MONITORING WELL
- BACKGROUND MONITORING WELL
- MONITORING WELL
- PORE WATER WELL
- GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- REGULATED UNIT (SUBJECT UNIT)
- FLY ASH POND SYSTEM (CLOSED)
- SITE FEATURE
- CAPPED AREA
- PROPERTY BOUNDARY

0 400 800 Feet

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

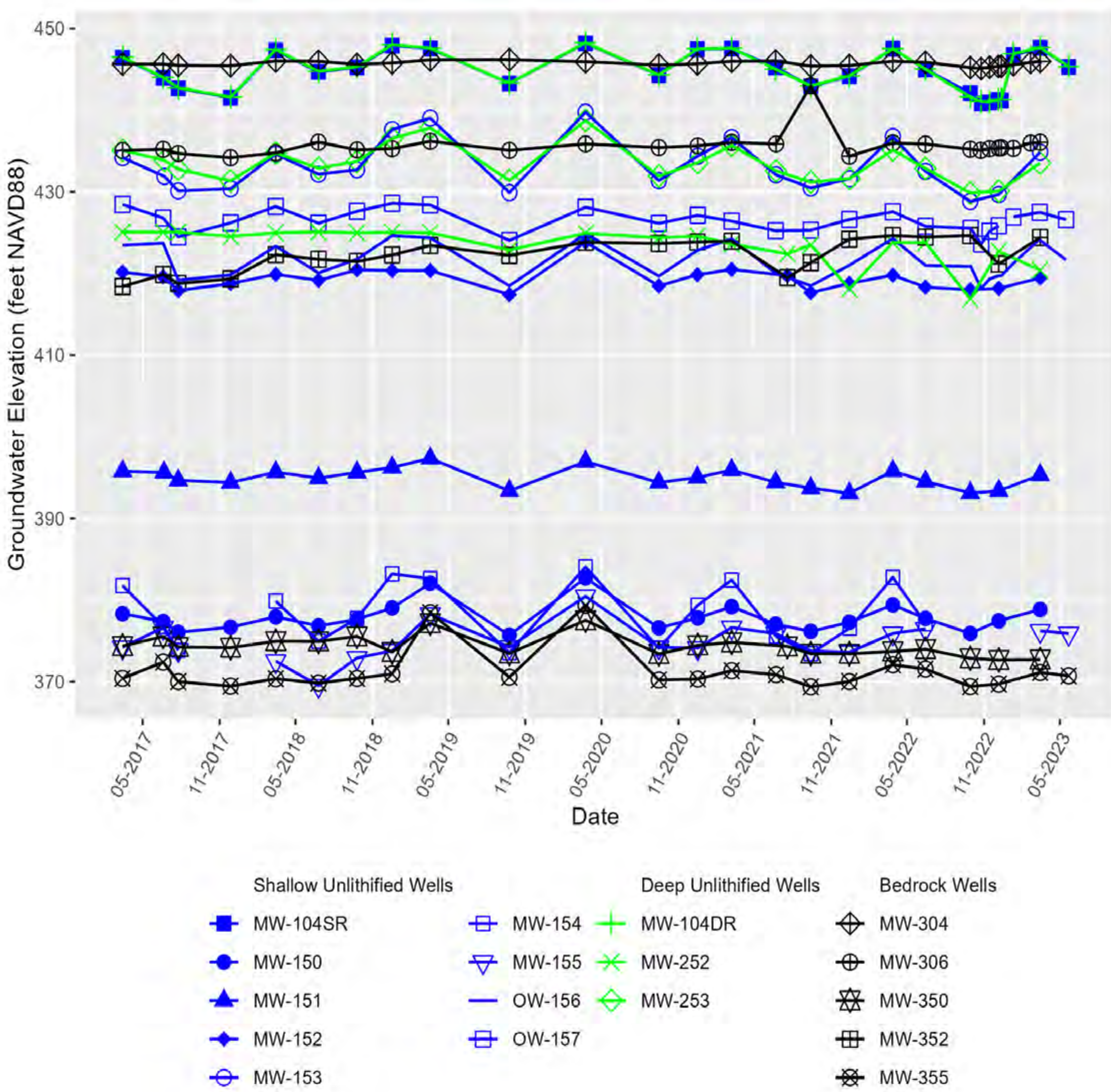
UPPERMOST AQUIFER POTENTIOMETRIC SURFACE MAP
MARCH 13-15, 2023

HYDROGEOLOGIC SITE
CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 3-5

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



GROUNDWATER ELEVATION HYDROGRAPH (2017-2023)

FIGURE 3-6

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
REVISION 1
BALDWIN BOTTOM ASH POND

BALDWIN POWER PLANT
BALDWIN, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

APPENDICES

APPENDIX A
HISTORY OF POTENTIAL EXCEEDANCES

HISTORY OF POTENTIAL EXCEEDANCES REVISION 1
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

This revision of the History of Potential Exceedances, and any corrective action taken to remediate groundwater, is provided to meet the requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845.230(d)(2)(M) for the Baldwin Power Plant Bottom Ash Pond (BAP), Illinois Environmental Protection Agency (IEPA) ID No. W1578510001-06.

<u>Note</u>

Groundwater concentrations from 2015 to 2023 presented in the revised Hydrogeologic Site Characterization Report Revision 1 (HCR) Table 4-1, and evaluated and summarized in the following tables, are considered potential exceedances. DMG entered into a compliance commitment agreement (CCA) with IEPA on December 28, 2022. Groundwater monitoring in accordance with the CCA will follow the proposed groundwater monitoring plan and sampling methodologies provided in the operating permit application for the BAP and is scheduled to commence no later than the second quarter of 2023. After the BAP has been issued an approved operating permit, groundwater monitoring shall be conducted in accordance with that operating permit.

Alternate sources for potential exceedances as allowed by 35 I.A.C. § 845.650(e) have not yet been evaluated. These will be evaluated and presented in future submittals to IEPA as appropriate.

Table 1 summarizes how the potential exceedances were determined. Table 2 is a summary of all potential exceedances.

<u>Background Concentrations</u>

Background monitoring wells used to calculate background concentrations at the BAP include MW-304, MW-306, and MW-358.

For all monitoring wells presented in Tables 1 and 2, background concentrations calculated from sampling events in 2022 to 2023 were compared to the standards identified in 35 I.A.C. § 845.600(a)(1). For constituents with calculated background concentrations in greater than the standards in 35 I.A.C. § 845.600(a)(1), those calculated background concentrations were used as GWPSs for comparing to statistical calculation results for each well to determine potential exceedances. Statistical result calculations consider concentrations from all sampling events in 2015 through May of 2023.

<u>Corrective Action</u>

No corrective actions have been taken to remediate the groundwater.

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-192	UU	845	Antimony, total	mg/L	10/27/2022 - 05/16/2023	CI around median	0.00100	0.006	0.0023	0.006	Standard
MW-192	UU	845	Arsenic, total	mg/L	10/27/2022 - 05/16/2023	CI around geomean	0.00146	0.010	0.010	0.01	Background
MW-192	UU	845	Barium, total	mg/L	10/27/2022 - 05/16/2023	CI around mean	0.0825	2.0	0.26	2	Standard
MW-192	UU	845	Beryllium, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.0005	0.004	0.0005	0.004	Standard
MW-192	UU	845	Boron, total	mg/L	10/27/2022 - 05/16/2023	CI around mean	0.0241	2.2	2.2	2	Background
MW-192	UU	845	Cadmium, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard
MW-192	UU	845	Chloride, total	mg/L	10/27/2022 - 05/16/2023	CB around linear reg	18.9	1370	1370	200	Background
MW-192	UU	845	Chromium, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.005	0.10	0.013	0.1	Standard
MW-192	UU	845	Cobalt, total	mg/L	10/27/2022 - 05/16/2023	CI around mean	0.000910	0.006	0.0022	0.006	Standard
MW-192	UU	845	Fluoride, total	mg/L	10/27/2022 - 05/16/2023	CI around mean	0.403	4.0	3.8	4	Standard
MW-192	UU	845	Lead, total	mg/L	10/27/2022 - 05/16/2023	CI around median	0.00100	0.0075	0.0022	0.0075	Standard
MW-192	UU	845	Lithium, total	mg/L	10/27/2022 - 05/16/2023	CI around mean	0.00725	0.14	0.14	0.04	Background
MW-192	UU	845	Mercury, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-192	UU	845	Molybdenum, total	mg/L	10/27/2022 - 05/16/2023	CI around mean	0.00248	0.10	0.078	0.1	Standard
MW-192	UU	845	pH (field)	SU	10/27/2022 - 05/16/2023	CI around median	6.5/7.0	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-192	UU	845	Radium 226 + Radium 228, total	pCi/L	10/27/2022 - 05/16/2023	CI around mean	0.244	5.0	3.8	5	Standard
MW-192	UU	845	Selenium, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.001	0.050	0.0032	0.05	Standard
MW-192	UU	845	Sulfate, total	mg/L	10/27/2022 - 05/16/2023	CB around linear reg	11.0	762	762	400	Background
MW-192	UU	845	Thallium, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-192	UU	845	Total Dissolved Solids	mg/L	10/27/2022 - 05/16/2023	CI around mean	432	3260	3260	1200	Background
MW-193	UU	845	Antimony, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.001	0.006	0.0023	0.006	Standard
MW-193	UU	845	Arsenic, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.00124	0.010	0.010	0.01	Background
MW-193	UU	845	Barium, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.0703	2.0	0.26	2	Standard
MW-193	UU	845	Beryllium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.0005	0.004	0.0005	0.004	Standard
MW-193	UU	845	Boron, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.0287	2.2	2.2	2	Background
MW-193	UU	845	Cadmium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard
MW-193	UU	845	Chloride, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	34.8	1370	1370	200	Background

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-193	UU	845	Chromium, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00150	0.10	0.013	0.1	Standard
MW-193	UU	845	Cobalt, total	mg/L	10/27/2022 - 05/15/2023	Most recent sample	0.00100	0.006	0.0022	0.006	Standard
MW-193	UU	845	Fluoride, total	mg/L	10/27/2022 - 05/15/2023	CB around linear reg	0.191	4.0	3.8	4	Standard
MW-193	UU	845	Lead, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.008	0.0075	0.0022	0.0075	Standard
MW-193	UU	845	Lithium, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.00474	0.14	0.14	0.04	Background
MW-193	UU	845	Mercury, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-193	UU	845	Molybdenum, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00150	0.10	0.078	0.1	Standard
MW-193	UU	845	pH (field)	SU	10/27/2022 - 05/15/2023	CI around mean	6.7/7.2	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-193	UU	845	Radium 226 + Radium 228, total	pCi/L	10/27/2022 - 05/15/2023	CI around mean	0.376	5.0	3.8	5	Standard
MW-193	UU	845	Selenium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.001	0.050	0.0032	0.05	Standard
MW-193	UU	845	Sulfate, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	152	762	762	400	Background
MW-193	UU	845	Thallium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-193	UU	845	Total Dissolved Solids	mg/L	10/27/2022 - 05/15/2023	CI around mean	523	3260	3260	1200	Background
MW-194	UU	845	Antimony, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00100	0.006	0.0023	0.006	Standard
MW-194	UU	845	Arsenic, total	mg/L	10/27/2022 - 05/15/2023	CB around linear reg	-0.000853	0.010	0.010	0.01	Background
MW-194	UU	845	Barium, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.0844	2.0	0.26	2	Standard
MW-194	UU	845	Beryllium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.0005	0.004	0.0005	0.004	Standard
MW-194	UU	845	Boron, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.0200	2.2	2.2	2	Background
MW-194	UU	845	Cadmium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard
MW-194	UU	845	Chloride, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	28.0	1370	1370	200	Background
MW-194	UU	845	Chromium, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00150	0.10	0.013	0.1	Standard
MW-194	UU	845	Cobalt, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.000487	0.006	0.0022	0.006	Standard
MW-194	UU	845	Fluoride, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.272	4.0	3.8	4	Standard
MW-194	UU	845	Lead, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00100	0.0075	0.0022	0.0075	Standard
MW-194	UU	845	Lithium, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.00580	0.14	0.14	0.04	Background
MW-194	UU	845	Mercury, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-194	UU	845	Molybdenum, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.00200	0.10	0.078	0.1	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-194	UU	845	pH (field)	SU	10/27/2022 - 05/15/2023	CB around linear reg	6.3/6.9	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-194	UU	845	Radium 226 + Radium 228, total	pCi/L	10/27/2022 - 05/15/2023	CI around mean	0.160	5.0	3.8	5	Standard
MW-194	UU	845	Selenium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.001	0.050	0.0032	0.05	Standard
MW-194	UU	845	Sulfate, total	mg/L	10/27/2022 - 05/15/2023	CB around linear reg	80.9	762	762	400	Background
MW-194	UU	845	Thallium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-194	UU	845	Total Dissolved Solids	mg/L	10/27/2022 - 05/15/2023	CI around mean	440	3260	3260	1200	Background
MW-356	UA	257	Antimony, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.00100	0.006	0.0023	0.006	Standard
MW-356	UA	257	Arsenic, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.00100	0.010	0.010	0.01	Background
MW-356	UA	257	Barium, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.0297	2.0	0.26	2	Standard
MW-356	UA	257	Beryllium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.0005	0.004	0.0005	0.004	Standard
MW-356	UA	257	Boron, total	mg/L	12/29/2015 - 05/16/2023	CI around median	1.94	2.2	2.2	2	Background
MW-356	UA	257	Cadmium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard
MW-356	UA	257	Chloride, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	28.6	1370	1370	200	Background
MW-356	UA	257	Chromium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.005	0.10	0.013	0.1	Standard
MW-356	UA	257	Cobalt, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.001	0.006	0.0022	0.006	Standard
MW-356	UA	257	Fluoride, total	mg/L	12/29/2015 - 05/16/2023	CI around mean	1.92	4.0	3.8	4	Standard
MW-356	UA	257	Fluoride, total	mg/L	12/29/2015 - 05/16/2023	CI around mean	1.92	4.0	3.8	4	Standard
MW-356	UA	257	Lead, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.00100	0.0075	0.0022	0.0075	Standard
MW-356	UA	257	Lithium, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	0.0551	0.14	0.14	0.04	Background
MW-356	UA	257	Mercury, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-356	UA	257	Molybdenum, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.00150	0.10	0.078	0.1	Standard
MW-356	UA	257	pH (field)	SU	12/29/2015 - 05/16/2023	CI around median	7.7/7.8	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-356	UA	257	Radium 226 + Radium 228, total	pCi/L	12/29/2015 - 05/16/2023	CI around median	0.100	5.0	3.8	5	Standard
MW-356	UA	257	Selenium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.001	0.050	0.0032	0.05	Standard
MW-356	UA	257	Sulfate, total	mg/L	12/29/2015 - 05/16/2023	CI around mean	44.4	758	758	400	Background
MW-356	UA	257	Thallium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-356	UA	257	Total Dissolved Solids	mg/L	12/29/2015 - 05/16/2023	CI around mean	663	3260	3260	1200	Background

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-369	UA	257	Antimony, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	-0.00196	0.006	0.0023	0.006	Standard
MW-369	UA	257	Arsenic, total	mg/L	12/29/2015 - 05/16/2023	CI around geomean	0.00151	0.010	0.010	0.01	Background
MW-369	UA	257	Barium, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	0.0730	2.0	0.26	2	Standard
MW-369	UA	257	Beryllium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.0005	0.004	0.0005	0.004	Standard
MW-369	UA	257	Boron, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	-0.171	2.2	2.2	2	Background
MW-369	UA	257	Cadmium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard
MW-369	UA	257	Chloride, total	mg/L	12/29/2015 - 05/16/2023	CI around geomean	84.1	1370	1370	200	Background
MW-369	UA	257	Chromium, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	0.00145	0.10	0.013	0.1	Standard
MW-369	UA	257	Cobalt, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.00100	0.006	0.0022	0.006	Standard
MW-369	UA	257	Fluoride, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	-0.139	4.0	3.8	4	Standard
MW-369	UA	257	Fluoride, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	-0.139	4.0	3.8	4	Standard
MW-369	UA	257	Lead, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.00100	0.0075	0.0022	0.0075	Standard
MW-369	UA	257	Lithium, total	mg/L	12/29/2015 - 05/16/2023	CI around mean	0.0212	0.14	0.14	0.04	Background
MW-369	UA	257	Mercury, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-369	UA	257	Molybdenum, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	-0.00666	0.10	0.078	0.1	Standard
MW-369	UA	257	pH (field)	SU	12/29/2015 - 05/16/2023	CB around linear reg	6.5/8.1	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-369	UA	257	Radium 226 + Radium 228, total	pCi/L	12/29/2015 - 05/16/2023	CI around mean	0.376	5.0	3.8	5	Standard
MW-369	UA	257	Selenium, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	-0.0273	0.050	0.0032	0.05	Standard
MW-369	UA	257	Sulfate, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	-73.6	758	758	400	Background
MW-369	UA	257	Thallium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-369	UA	257	Total Dissolved Solids	mg/L	12/29/2015 - 05/16/2023	CI around median	726	3260	3260	1200	Background
MW-370	UA	257	Antimony, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	-0.000389	0.006	0.0023	0.006	Standard
MW-370	UA	257	Arsenic, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	0.000139	0.010	0.010	0.01	Background
MW-370	UA	257	Barium, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	0.0241	2.0	0.26	2	Standard
MW-370	UA	257	Beryllium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.0005	0.004	0.0005	0.004	Standard
MW-370	UA	257	Boron, total	mg/L	12/29/2015 - 05/16/2023	CI around median	1.79	2.2	2.2	2	Background
MW-370	UA	257	Cadmium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-370	UA	257	Chloride, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	1380	1370	1370	200	Background
MW-370	UA	257	Chromium, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	0.00142	0.10	0.013	0.1	Standard
MW-370	UA	257	Cobalt, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.00100	0.006	0.0022	0.006	Standard
MW-370	UA	257	Fluoride, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	3.02	4.0	3.8	4	Standard
MW-370	UA	257	Fluoride, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	3.02	4.0	3.8	4	Standard
MW-370	UA	257	Lead, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.008	0.0075	0.0022	0.0075	Standard
MW-370	UA	257	Lithium, total	mg/L	12/29/2015 - 05/16/2023	CI around mean	0.130	0.14	0.14	0.04	Background
MW-370	UA	257	Mercury, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-370	UA	257	Molybdenum, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	0.00644	0.10	0.078	0.1	Standard
MW-370	UA	257	pH (field)	SU	12/29/2015 - 05/16/2023	CB around linear reg	7.3/7.6	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-370	UA	257	Radium 226 + Radium 228, total	pCi/L	12/29/2015 - 05/16/2023	CI around geomean	0.517	5.0	3.8	5	Standard
MW-370	UA	257	Selenium, total	mg/L	12/29/2015 - 05/16/2023	Most recent sample	0.00100	0.050	0.0032	0.05	Standard
MW-370	UA	257	Sulfate, total	mg/L	12/29/2015 - 05/16/2023	CI around mean	248	758	758	400	Background
MW-370	UA	257	Thallium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-370	UA	257	Total Dissolved Solids	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	2940	3260	3260	1200	Background
MW-382	UA	257	Antimony, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.001	0.006	0.0023	0.006	Standard
MW-382	UA	257	Arsenic, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.00110	0.010	0.010	0.01	Background
MW-382	UA	257	Barium, total	mg/L	12/29/2015 - 05/16/2023	CI around mean	0.0172	2.0	0.26	2	Standard
MW-382	UA	257	Beryllium, total	mg/L	12/29/2015 - 05/16/2023	CI around median	0.00100	0.004	0.0005	0.004	Standard
MW-382	UA	257	Boron, total	mg/L	12/29/2015 - 05/16/2023	CI around median	1.72	2.2	2.2	2	Background
MW-382	UA	257	Cadmium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard
MW-382	UA	257	Chloride, total	mg/L	12/29/2015 - 05/16/2023	CI around mean	34.9	1370	1370	200	Background
MW-382	UA	257	Chromium, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	0.00577	0.10	0.013	0.1	Standard
MW-382	UA	257	Cobalt, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	0.00100	0.006	0.0022	0.006	Standard
MW-382	UA	257	Fluoride, total	mg/L	12/29/2015 - 05/16/2023	CI around geomean	2.80	4.0	3.8	4	Standard
MW-382	UA	257	Fluoride, total	mg/L	12/29/2015 - 05/16/2023	CI around geomean	2.80	4.0	3.8	4	Standard
MW-382	UA	257	Lead, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	0.00100	0.0075	0.0022	0.0075	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-382	UA	257	Lithium, total	mg/L	12/29/2015 - 05/16/2023	CI around mean	0.0580	0.14	0.14	0.04	Background
MW-382	UA	257	Mercury, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-382	UA	257	Molybdenum, total	mg/L	12/29/2015 - 05/16/2023	CB around T-S line	0.00222	0.10	0.078	0.1	Standard
MW-382	UA	257	pH (field)	SU	12/29/2015 - 05/16/2023	CI around mean	7.7/7.9	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-382	UA	257	Radium 226 + Radium 228, total	pCi/L	12/29/2015 - 05/16/2023	CI around geomean	0.289	5.0	3.8	5	Standard
MW-382	UA	257	Selenium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.001	0.050	0.0032	0.05	Standard
MW-382	UA	257	Sulfate, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	354	758	758	400	Background
MW-382	UA	257	Thallium, total	mg/L	12/29/2015 - 05/16/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-382	UA	257	Total Dissolved Solids	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	1060	3260	3260	1200	Background
MW-392	UA	845	Antimony, total	mg/L	10/27/2022 - 05/16/2023	CI around median	0.00100	0.006	0.0023	0.006	Standard
MW-392	UA	845	Arsenic, total	mg/L	10/27/2022 - 05/16/2023	CI around geomean	0.000901	0.010	0.010	0.01	Background
MW-392	UA	845	Barium, total	mg/L	10/27/2022 - 05/16/2023	CI around mean	0.0345	2.0	0.26	2	Standard
MW-392	UA	845	Beryllium, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.0005	0.004	0.0005	0.004	Standard
MW-392	UA	845	Boron, total	mg/L	10/27/2022 - 05/16/2023	CI around mean	1.58	2.2	2.2	2	Background
MW-392	UA	845	Cadmium, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard
MW-392	UA	845	Chloride, total	mg/L	10/27/2022 - 05/16/2023	CI around median	334	1370	1370	200	Background
MW-392	UA	845	Chromium, total	mg/L	10/27/2022 - 05/16/2023	CI around median	0.00150	0.10	0.013	0.1	Standard
MW-392	UA	845	Cobalt, total	mg/L	10/27/2022 - 05/16/2023	CI around median	0.00100	0.006	0.0022	0.006	Standard
MW-392	UA	845	Fluoride, total	mg/L	10/27/2022 - 05/16/2023	CB around linear reg	3.63	4.0	3.8	4	Standard
MW-392	UA	845	Lead, total	mg/L	10/27/2022 - 05/16/2023	CI around median	0.00100	0.0075	0.0022	0.0075	Standard
MW-392	UA	845	Lithium, total	mg/L	10/27/2022 - 05/16/2023	CI around mean	0.0497	0.14	0.14	0.04	Background
MW-392	UA	845	Mercury, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-392	UA	845	Molybdenum, total	mg/L	10/27/2022 - 05/16/2023	CI around median	0.00150	0.10	0.078	0.1	Standard
MW-392	UA	845	pH (field)	SU	10/27/2022 - 05/16/2023	CI around mean	7.3/7.9	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-392	UA	845	Radium 226 + Radium 228, total	pCi/L	10/27/2022 - 05/16/2023	CI around mean	0.237	5.0	3.8	5	Standard
MW-392	UA	845	Selenium, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.001	0.050	0.0032	0.05	Standard
MW-392	UA	845	Sulfate, total	mg/L	10/27/2022 - 05/16/2023	CI around geomean	45.9	762	762	400	Background

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-392	UA	845	Thallium, total	mg/L	10/27/2022 - 05/16/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-392	UA	845	Total Dissolved Solids	mg/L	10/27/2022 - 05/16/2023	CI around mean	1410	3260	3260	1200	Background
MW-393	UA	845	Antimony, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00100	0.006	0.0023	0.006	Standard
MW-393	UA	845	Arsenic, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00100	0.010	0.010	0.01	Background
MW-393	UA	845	Barium, total	mg/L	10/27/2022 - 05/15/2023	CI around geomean	0.0224	2.0	0.26	2	Standard
MW-393	UA	845	Beryllium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.0005	0.004	0.0005	0.004	Standard
MW-393	UA	845	Boron, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	1.47	2.2	2.2	2	Background
MW-393	UA	845	Cadmium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard
MW-393	UA	845	Chloride, total	mg/L	10/27/2022 - 05/15/2023	CB around linear reg	617	1370	1370	200	Background
MW-393	UA	845	Chromium, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00150	0.10	0.013	0.1	Standard
MW-393	UA	845	Cobalt, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00100	0.006	0.0022	0.006	Standard
MW-393	UA	845	Fluoride, total	mg/L	10/27/2022 - 05/15/2023	CB around linear reg	7.49	4.0	3.8	4	Standard
MW-393	UA	845	Lead, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.008	0.0075	0.0022	0.0075	Standard
MW-393	UA	845	Lithium, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.0519	0.14	0.14	0.04	Background
MW-393	UA	845	Mercury, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-393	UA	845	Molybdenum, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	-0.000199	0.10	0.078	0.1	Standard
MW-393	UA	845	pH (field)	SU	10/27/2022 - 05/15/2023	CI around mean	7.7/8.4	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-393	UA	845	Radium 226 + Radium 228, total	pCi/L	10/27/2022 - 05/15/2023	CI around mean	0.0868	5.0	3.8	5	Standard
MW-393	UA	845	Selenium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.001	0.050	0.0032	0.05	Standard
MW-393	UA	845	Sulfate, total	mg/L	10/27/2022 - 05/15/2023	CB around linear reg	104	762	762	400	Background
MW-393	UA	845	Thallium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-393	UA	845	Total Dissolved Solids	mg/L	10/27/2022 - 05/15/2023	CI around median	826	3260	3260	1200	Background
MW-394	UA	845	Antimony, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.000850	0.006	0.0023	0.006	Standard
MW-394	UA	845	Arsenic, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00100	0.010	0.010	0.01	Background
MW-394	UA	845	Barium, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.0258	2.0	0.26	2	Standard
MW-394	UA	845	Beryllium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.0005	0.004	0.0005	0.004	Standard
MW-394	UA	845	Boron, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	1.53	2.2	2.2	2	Background

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-394	UA	845	Cadmium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.002	0.005	0.002	0.005	Standard
MW-394	UA	845	Chloride, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	490	1370	1370	200	Background
MW-394	UA	845	Chromium, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	-0.00000691	0.10	0.013	0.1	Standard
MW-394	UA	845	Cobalt, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00100	0.006	0.0022	0.006	Standard
MW-394	UA	845	Fluoride, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	3.25	4.0	3.8	4	Standard
MW-394	UA	845	Lead, total	mg/L	10/27/2022 - 05/15/2023	CI around median	0.00100	0.0075	0.0022	0.0075	Standard
MW-394	UA	845	Lithium, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.0438	0.14	0.14	0.04	Background
MW-394	UA	845	Mercury, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-394	UA	845	Molybdenum, total	mg/L	10/27/2022 - 05/15/2023	CI around mean	0.00443	0.10	0.078	0.1	Standard
MW-394	UA	845	pH (field)	SU	10/27/2022 - 05/15/2023	CI around mean	7.6/8.1	6.5/11	7.5/11.1	6.5/9	Standard/Background
MW-394	UA	845	Radium 226 + Radium 228, total	pCi/L	10/27/2022 - 05/15/2023	CI around mean	0.301	5.0	3.8	5	Standard
MW-394	UA	845	Selenium, total	mg/L	10/27/2022 - 05/15/2023	Most recent sample	0.00100	0.050	0.0032	0.05	Standard
MW-394	UA	845	Sulfate, total	mg/L	10/27/2022 - 05/15/2023	CB around linear reg	77.3	762	762	400	Background
MW-394	UA	845	Thallium, total	mg/L	10/27/2022 - 05/15/2023	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-394	UA	845	Total Dissolved Solids	mg/L	10/27/2022 - 05/15/2023	CI around mean	1770	3260	3260	1200	Background
OW-256	UU	257	Antimony, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.001	0.006	0.0023	0.006	Standard
OW-256	UU	257	Arsenic, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0100	0.010	0.010	0.01	Background
OW-256	UU	257	Barium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.102	2.0	0.26	2	Standard
OW-256	UU	257	Beryllium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0005	0.004	0.0005	0.004	Standard
OW-256	UU	257	Boron, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.187	2.2	2.2	2	Background
OW-256	UU	257	Cadmium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.002	0.005	0.002	0.005	Standard
OW-256	UU	257	Chloride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	54.0	1370	1370	200	Background
OW-256	UU	257	Chromium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.005	0.10	0.013	0.1	Standard
OW-256	UU	257	Cobalt, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00150	0.006	0.0022	0.006	Standard
OW-256	UU	257	Fluoride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.250	4.0	3.8	4	Standard
OW-256	UU	257	Fluoride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.250	4.0	3.8	4	Standard
OW-256	UU	257	Lead, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.008	0.0075	0.0022	0.0075	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
OW-256	UU	257	Lithium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00500	0.14	0.14	0.04	Background
OW-256	UU	257	Mercury, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0002	0.002	0.0002	0.002	Standard
OW-256	UU	257	Molybdenum, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.01	0.10	0.078	0.1	Standard
OW-256	UU	257	pH (field)	SU	03/14/2023 - 05/17/2023	Most recent sample	6.7/6.7	6.5/11	7.5/11.1	6.5/9	Standard/Background
OW-256	UU	257	Radium 226 + Radium 228, total	pCi/L	03/14/2023 - 05/17/2023	Most recent sample	0.717	5.0	3.8	5	Standard
OW-256	UU	257	Selenium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.001	0.050	0.0032	0.05	Standard
OW-256	UU	257	Sulfate, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	64.0	758	758	400	Background
OW-256	UU	257	Thallium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.002	0.002	0.002	0.002	Standard
OW-256	UU	257	Total Dissolved Solids	mg/L	03/14/2023 - 05/17/2023	Most recent sample	514	3260	3260	1200	Background
OW-257	UU	257	Antimony, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00500	0.006	0.0023	0.006	Standard
OW-257	UU	257	Arsenic, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.103	0.010	0.010	0.01	Background
OW-257	UU	257	Barium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.975	2.0	0.26	2	Standard
OW-257	UU	257	Beryllium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00970	0.004	0.0005	0.004	Standard
OW-257	UU	257	Boron, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.490	2.2	2.2	2	Background
OW-257	UU	257	Cadmium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00450	0.005	0.002	0.005	Standard
OW-257	UU	257	Chloride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	7.00	1370	1370	200	Background
OW-257	UU	257	Chromium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.214	0.10	0.013	0.1	Standard
OW-257	UU	257	Cobalt, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.203	0.006	0.0022	0.006	Standard
OW-257	UU	257	Fluoride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.370	4.0	3.8	4	Standard
OW-257	UU	257	Fluoride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.370	4.0	3.8	4	Standard
OW-257	UU	257	Lead, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.214	0.0075	0.0022	0.0075	Standard
OW-257	UU	257	Lithium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.207	0.14	0.14	0.04	Background
OW-257	UU	257	Mercury, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0002	0.002	0.0002	0.002	Standard
OW-257	UU	257	Molybdenum, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0100	0.10	0.078	0.1	Standard
OW-257	UU	257	pH (field)	SU	03/14/2023 - 05/17/2023	Most recent sample	6.8/6.8	6.5/11	7.5/11.1	6.5/9	Standard/Background
OW-257	UU	257	Radium 226 + Radium 228, total	pCi/L	03/14/2023 - 05/17/2023	Most recent sample	25.3	5.0	3.8	5	Standard
OW-257	UU	257	Selenium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.001	0.050	0.0032	0.05	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
OW-257	UU	257	Sulfate, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	118	758	758	400	Background
OW-257	UU	257	Thallium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.01	0.002	0.002	0.002	Standard
OW-257	UU	257	Total Dissolved Solids	mg/L	03/14/2023 - 05/17/2023	Most recent sample	1270	3260	3260	1200	Background
PZ-170	UU	257	Antimony, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00100	0.006	0.0023	0.006	Standard
PZ-170	UU	257	Arsenic, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.01	0.010	0.010	0.01	Background
PZ-170	UU	257	Barium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0975	2.0	0.26	2	Standard
PZ-170	UU	257	Beryllium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0005	0.004	0.0005	0.004	Standard
PZ-170	UU	257	Boron, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.267	2.2	2.2	2	Background
PZ-170	UU	257	Cadmium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.002	0.005	0.002	0.005	Standard
PZ-170	UU	257	Chloride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	35.0	1370	1370	200	Background
PZ-170	UU	257	Chromium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00500	0.10	0.013	0.1	Standard
PZ-170	UU	257	Cobalt, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00460	0.006	0.0022	0.006	Standard
PZ-170	UU	257	Fluoride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.180	4.0	3.8	4	Standard
PZ-170	UU	257	Fluoride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.180	4.0	3.8	4	Standard
PZ-170	UU	257	Lead, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.008	0.0075	0.0022	0.0075	Standard
PZ-170	UU	257	Lithium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0291	0.14	0.14	0.04	Background
PZ-170	UU	257	Mercury, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0002	0.002	0.0002	0.002	Standard
PZ-170	UU	257	Molybdenum, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.01	0.10	0.078	0.1	Standard
PZ-170	UU	257	pH (field)	SU	03/14/2023 - 05/17/2023	Most recent sample	6.5/6.5	6.5/11	7.5/11.1	6.5/9	Standard/Background
PZ-170	UU	257	Radium 226 + Radium 228, total	pCi/L	03/14/2023 - 05/17/2023	Most recent sample	0.181	5.0	3.8	5	Standard
PZ-170	UU	257	Selenium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.001	0.050	0.0032	0.05	Standard
PZ-170	UU	257	Sulfate, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	170	758	758	400	Background
PZ-170	UU	257	Thallium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.002	0.002	0.002	0.002	Standard
PZ-170	UU	257	Total Dissolved Solids	mg/L	03/14/2023 - 05/17/2023	Most recent sample	730	3260	3260	1200	Background
PZ-182	UU	257	Antimony, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.001	0.006	0.0023	0.006	Standard
PZ-182	UU	257	Arsenic, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0100	0.010	0.010	0.01	Background
PZ-182	UU	257	Barium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0692	2.0	0.26	2	Standard

TABLE 1. DETERMINATION OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
PZ-182	UU	257	Beryllium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0005	0.004	0.0005	0.004	Standard
PZ-182	UU	257	Boron, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.484	2.2	2.2	2	Background
PZ-182	UU	257	Cadmium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.002	0.005	0.002	0.005	Standard
PZ-182	UU	257	Chloride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	88.0	1370	1370	200	Background
PZ-182	UU	257	Chromium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.005	0.10	0.013	0.1	Standard
PZ-182	UU	257	Cobalt, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00100	0.006	0.0022	0.006	Standard
PZ-182	UU	257	Fluoride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.190	4.0	3.8	4	Standard
PZ-182	UU	257	Fluoride, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.190	4.0	3.8	4	Standard
PZ-182	UU	257	Lead, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00750	0.0075	0.0022	0.0075	Standard
PZ-182	UU	257	Lithium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00690	0.14	0.14	0.04	Background
PZ-182	UU	257	Mercury, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.0002	0.002	0.0002	0.002	Standard
PZ-182	UU	257	Molybdenum, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.01	0.10	0.078	0.1	Standard
PZ-182	UU	257	pH (field)	SU	03/14/2023 - 05/17/2023	Most recent sample	6.6/6.6	6.5/11	7.5/11.1	6.5/9	Standard/Background
PZ-182	UU	257	Radium 226 + Radium 228, total	pCi/L	03/14/2023 - 05/17/2023	Most recent sample	0.925	5.0	3.8	5	Standard
PZ-182	UU	257	Selenium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.001	0.050	0.0032	0.05	Standard
PZ-182	UU	257	Sulfate, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	254	758	758	400	Background
PZ-182	UU	257	Thallium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.002	0.002	0.002	0.002	Standard
PZ-182	UU	257	Total Dissolved Solids	mg/L	03/14/2023 - 05/17/2023	Most recent sample	1120	3260	3260	1200	Background

Notes:

Potential exceedance of GWPS

HSU = hydrostratigraphic unit:
- UA = Uppermost Aquifer
- UU = Upper Unit

Program = regulatory program data were collected under:
- 257 = 40 C.F.R. Part 257 Subpart D (Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments)
- 845 = 35 I.A.C. Part 845 (Sampling events completed to assess well locations for inclusion in the Part 845 monitoring well network)

mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = standard units
Sample Count = number of samples from Sampled Date Range used to calculate the Statistical Result
Statistical Calculation = method used to calculate the statistical result:
Statistical Result = calculated in accordance with Statistical Analysis Plan using constituent concentrations observed at monitoring well during all sampling events within the specified date range
For pH, the values presented are the lower / upper limits
GWPS = Groundwater Protection Standard
GWPS Source:
- Standard = standard specified in 35 I.A.C. § 845.600(a)(1)
- Background = background concentration (see cover page for additional information)

TABLE 2. SUMMARY OF POTENTIAL EXCEEDANCES
HISTORY OF POTENTIAL EXCEEDANCES REVISION 1
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-370	UA	257	Chloride, total	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	1380	200	153	200	Standard
MW-370	UA	257	Lithium, total	mg/L	12/29/2015 - 05/16/2023	CI around mean	0.130	0.096	0.096	0.04	Background
MW-370	UA	257	Total Dissolved Solids	mg/L	12/29/2015 - 05/16/2023	CB around linear reg	2940	1420	1420	1200	Background
MW-393	UA	845	Fluoride, total	mg/L	10/27/2022 - 05/15/2023	CB around linear reg	7.49	4.0	3.8	4	Standard
OW-257	UU	257	Arsenic, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.103	0.010	0.0036	0.01	Standard
OW-257	UU	257	Beryllium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.00970	0.004	0.001	0.004	Standard
OW-257	UU	257	Chromium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.214	0.10	0.0015	0.1	Standard
OW-257	UU	257	Cobalt, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.203	0.006	0.001	0.006	Standard
OW-257	UU	257	Lead, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.214	0.0075	0.001	0.0075	Standard
OW-257	UU	257	Lithium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.207	0.096	0.096	0.04	Background
OW-257	UU	257	Radium 226 + Radium 228, total	pCi/L	03/14/2023 - 05/17/2023	Most recent sample	25.3	5.0	1.6	5	Standard
OW-257	UU	257	Thallium, total	mg/L	03/14/2023 - 05/17/2023	Most recent sample	0.01	0.002	0.002	0.002	Standard

Notes:
HSU = hydrostratigraphic unit:
UA = Uppermost Aquifer
UU = Upper Unit
Program = regulatory program data were collected under:
257 = 40 C.F.R. Part 257 Subpart D (Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments)
845 = 35 I.A.C. Part 845 (Sampling events completed to assess well locations for inclusion in the Part 845 monitoring well network)
mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = standard units
Sample Count = number of samples from Sampled Date Range used to calculate the Statistical Result
Statistical Calculation = method used to calculate the statistical result:
Statistical Result = calculated in accordance with Statistical Analysis Plan using constituent concentrations observed at monitoring well during all sampling events within the specified date range
For pH, the values presented are the lower / upper limits
GWPS = Groundwater Protection Standard
GWPS Source:
Standard = standard specified in 35 I.A.C. § 845.600(a)(1)
Background = background concentration (see cover page for additional information)

APPENDIX B
INFORMATION PERTINENT TO 35 I.A.C. 845.220(a)(3) AND HISTORIC REPORT INFORMATION

MAP UNIT SYMBOL	MAP UNIT NAME
536	Dumps, mine
866	Dumps, slurry
1288L	Petrolia silty clay loam, undrained, 0 to 2 percent slopes, frequently flooded, long duration
423A	Millstadt silt loam, 0 to 2 percent slopes
437B	Redbud silt loam, 2 to 5 percent slopes
437D3	Redbud silty clay loam, 10 to 18 percent slopes, severely eroded
468A	Lakaskia silty clay loam, 0 to 2 percent slopes
517A	Marine silt loam, 0 to 2 percent slopes
570B	Martinsville silt loam, 2 to 5 percent slopes
570D2	Martinsville fine sandy loam, 10 to 18 percent slopes, eroded
571B	Whitaker silt loam, 2 to 5 percent slopes
582B	Homen silt loam, 2 to 5 percent slopes
802B	Orthents, loamy, undulating
802D	Orthents, loamy, hilly
84A	Okaw silt loam, 0 to 2 percent slopes
884B2	Bunkum-Coulterville silt loams, 2 to 5 percent slopes, eroded
884C3	Bunkum-Coulterville silty clay loams, 5 to 10 percent slopes, severely eroded
909A	Coulterville-Oconee silt loams, 0 to 2 percent slopes
909B	Coulterville-Oconee silt loams, 2 to 5 percent slopes
W	Water

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\Figure A-1_Soil Survey Map.mxd

PROJECT: 169000XXXX | DATED: 10/14/2021 | DESIGNER: STOLZSD

PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
FLY ASH POND SYSTEM (CLOSED)
CAPPED AREA
PROPERTY BOUNDARY
NRCS SOIL SURVEY MAP UNIT BOUNDARY

0 400 800 Feet

SOURCE
USDA NATURAL RESOURCES CONSERVATION SERVICE (NRCS)

SOIL SURVEY MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

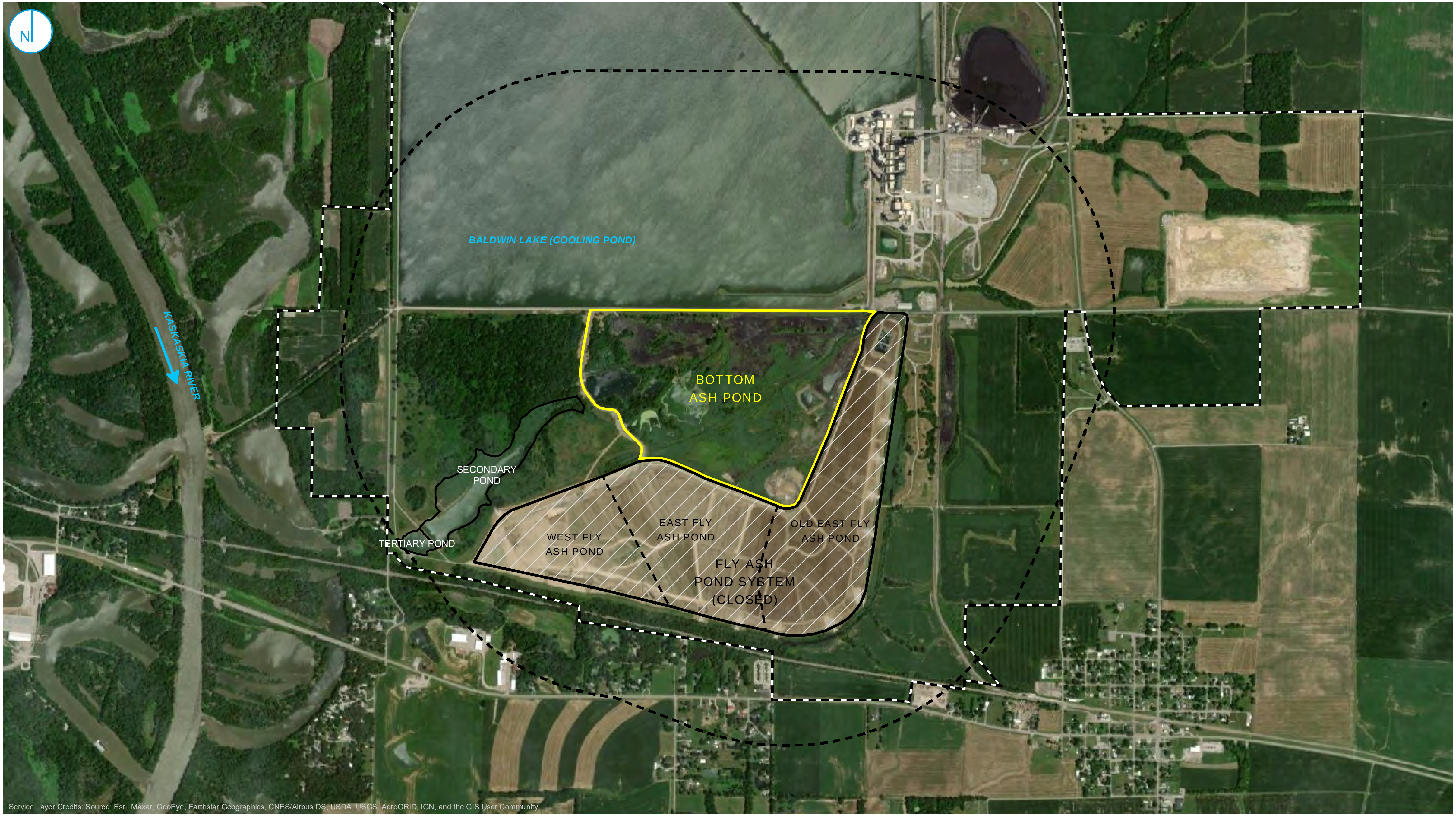
FIGURE B-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\Figure A-2_Historic Mining Activities.mxd

PROJECT: 169000XXXX | DATED: 10/18/2021 | DESIGNER: STOLZSD



COAL MINE SHAFT*
UNDERGROUND COAL MINE*
UNDERGROUND MINE BUFFER REGION*

PART 845 REGULATED UNIT (SUBJECT UNIT)
1000 METER UNIT BUFFER
SITE FEATURE
FLY ASH POND SYSTEM (CLOSED)
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

0 625 1,250 Feet

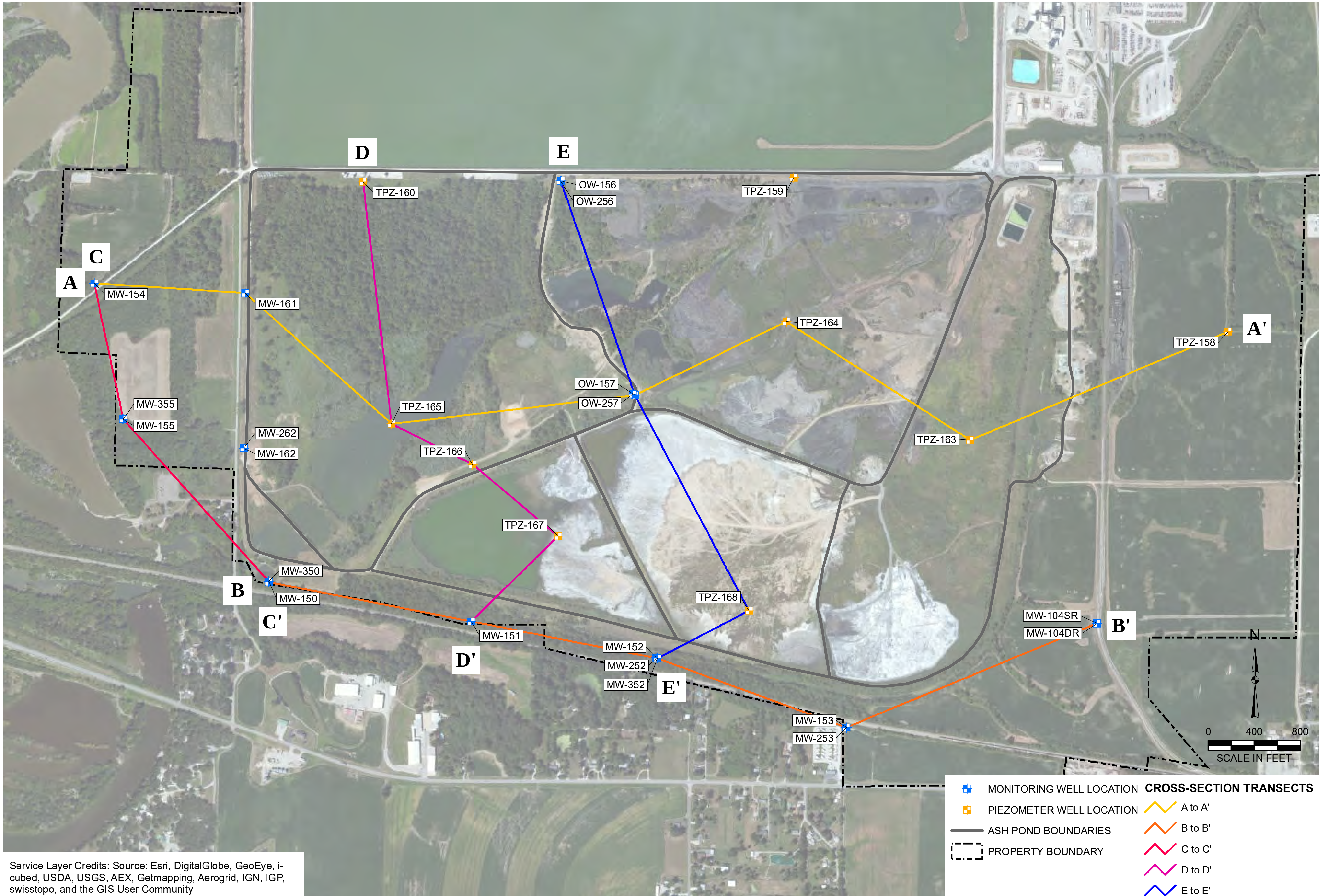
*NO FEATURES IN MAP FRAME
SOURCE
ISGS - ILMINES

HISTORIC MINING ACTIVITIES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE B-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.



DRAWN BY/DATE: TDC 4/30/14
REVIEWED BY/DATE: SJC 4/27/14
APPROVED BY/DATE: SJC 6/9/14

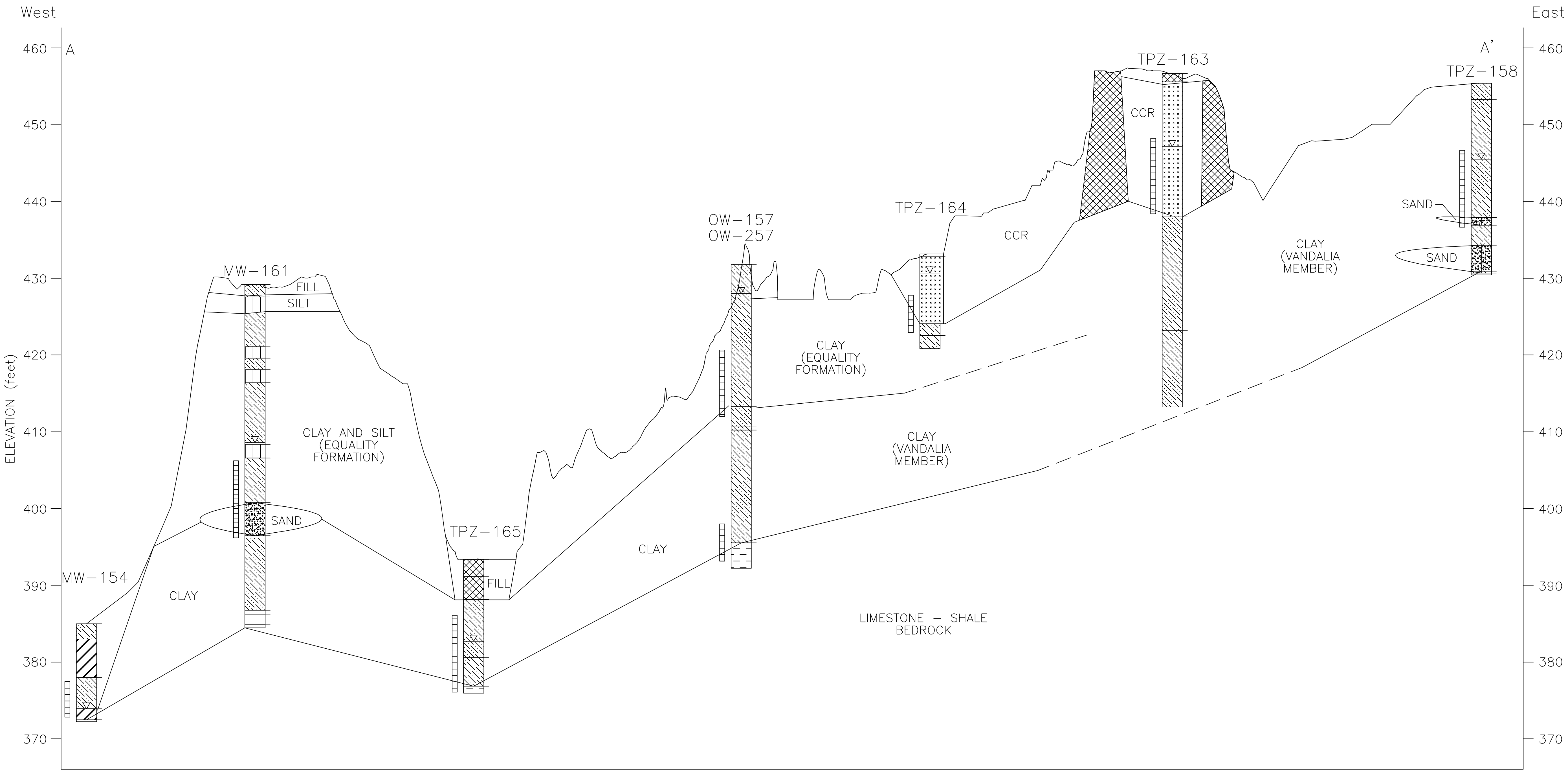
CROSS SECTION LOCATION MAP

GROUNDWATER QUALITY ASSESSMENT AND PHASE II HYDROGEOLOGIC INVESTIGATION
BALDWIN ASH POND SYSTEM, BALDWIN ENERGY COMPLEX
10901 BALDWIN ROAD BALDWIN, ILLINOIS 62217

PROJECT NO: 2189

FIGURE NO: 7

NATURAL RESOURCE TECHNOLOGY



LEGEND

- WELL SCREEN INTERVAL
- FILL
- CLAY, CL
- CLAY, CH
- SAND, SP/SM/SW
- SHALE
- SILT, ML
- COAL COMBUSTION RESIDUALS, CCRs

NOTE: 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.

0 400 800
FEET
(HORIZONTAL SCALE IS APPROXIMATE)

DRAWN BY/DATE: TDC 5/15/14
REVIEWED BY/DATE: SJC 5/16/14
APPROVED BY/DATE: SJC 6/9/14

GEOLOGIC CROSS SECTION A-A'

GROUNDWATER QUALITY ASSESSMENT AND PHASE II HYDROGEOLOGIC INVESTIGATION
BALDWIN ASH POND SYSTEM, BALDWIN ENERGY COMPLEX
10901 BALDWIN ROAD BALDWIN, ILLINOIS 62217

PROJECT NO: 2189

FIGURE NO: 8A

NATURAL RESOURCE TECHNOLOGY

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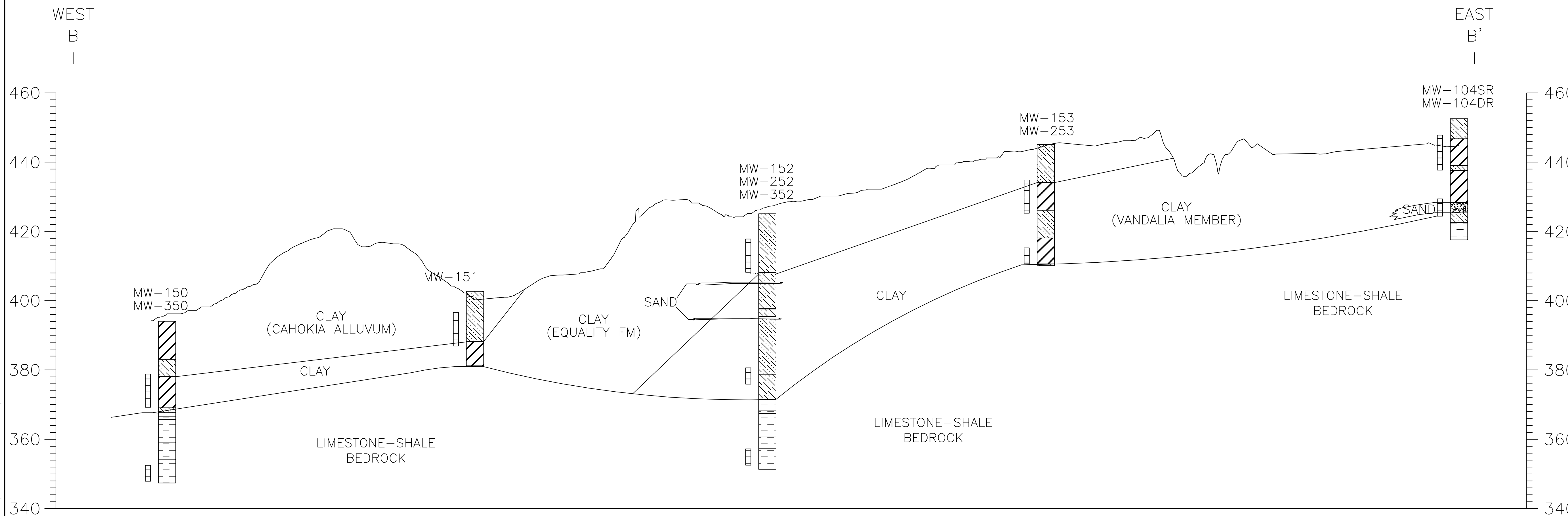

LEGEND

- WELL SCREEN INTERVAL
- FILL
- CLAY, CL
- CLAY, CH
- SAND, SP/SM/SW
- SHALE
- SILT, ML
- COAL COMBUSTION RESIDUALS, CCRs

NOTE: 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.

0 300 600
FEET
(HORIZONTAL SCALE IS APPROXIMATE)

DRAWN BY/DATE: TDC 5/15/14
REVIEWED BY/DATE: SJC 5/16/14
APPROVED BY/DATE: SJC 6/9/14

GEOLOGIC CROSS SECTION B-B'

GROUNDWATER QUALITY ASSESSMENT AND PHASE II HYDROGEOLOGIC INVESTIGATION
BALDWIN ASH POND SYSTEM, BALDWIN ENERGY COMPLEX
10901 BALDWIN ROAD BALDWIN, ILLINOIS 62217

PROJECT NO: 2189

FIGURE NO: 8B

NATURAL RESOURCE TECHNOLOGY

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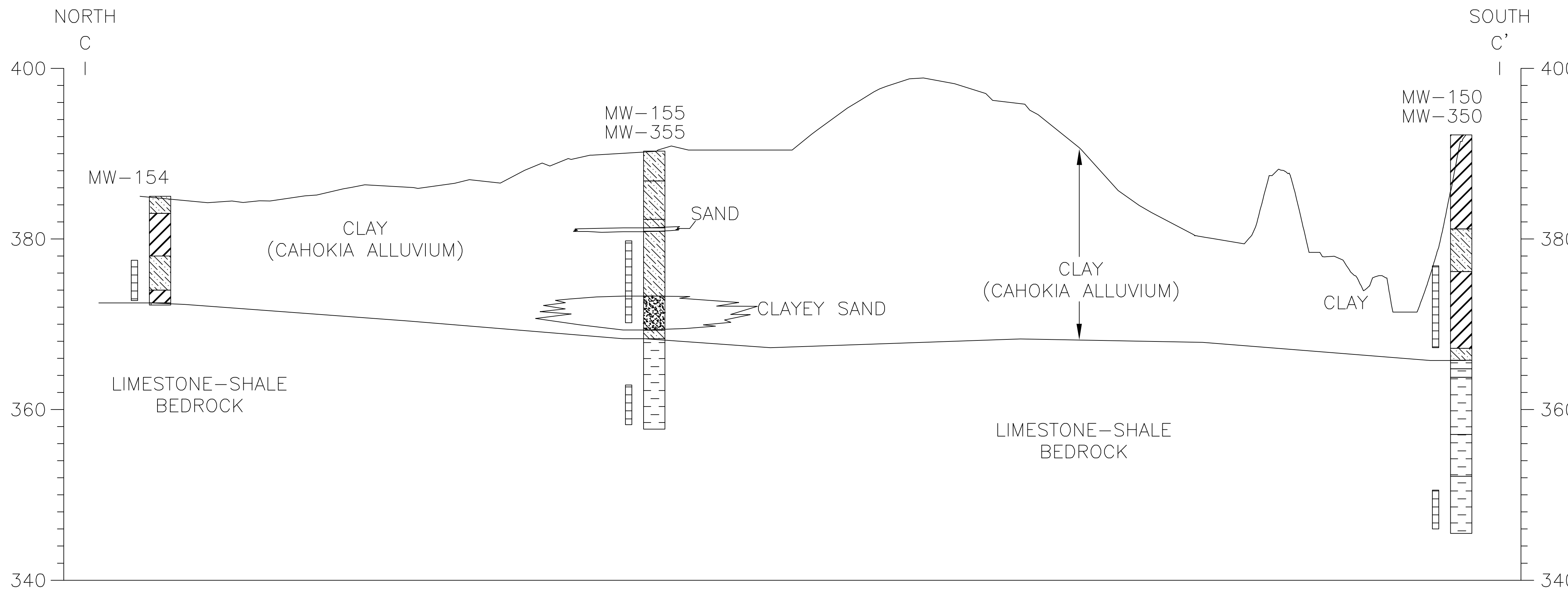


LEGEND

- WELL SCREEN INTERVAL
- FILL
- CLAY, CL
- CLAY, CH
- SAND, SP/SM/SW
- SHALE
- SILT, ML
- COAL COMBUSTION RESIDUALS, CCRs

NOTE: 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.

0 150 300
FEET
(HORIZONTAL SCALE IS APPROXIMATE)

DRAWN BY/DATE:
TDC 5/15/14
REVIEWED BY/DATE:
SJC 5/16/14
APPROVED BY/DATE:
SJC 6/9/14

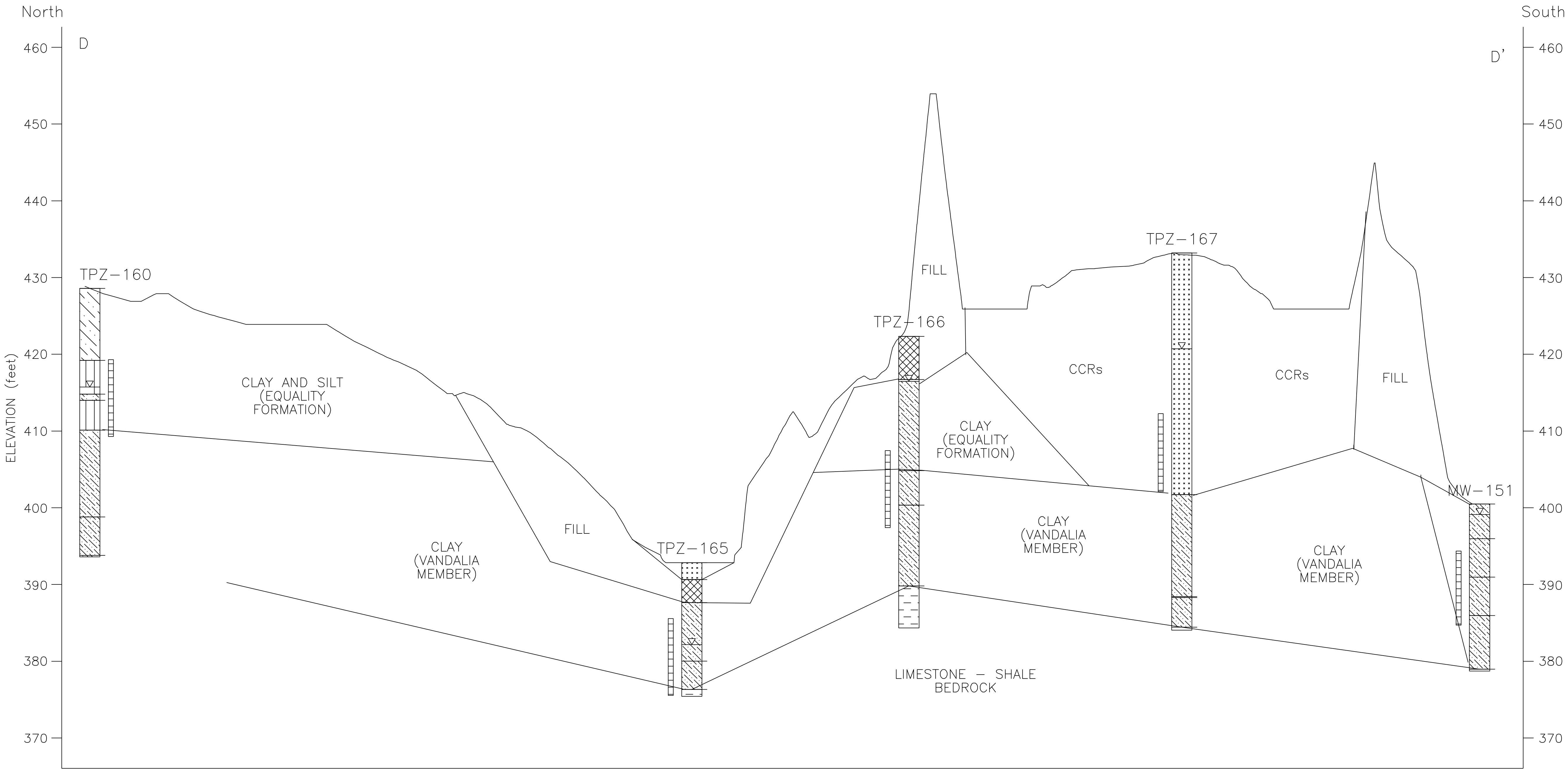
GEOLOGIC CROSS SECTION C-C'

GROUNDWATER QUALITY ASSESSMENT AND PHASE II HYDROGEOLOGIC INVESTIGATION
BALDWIN ASH POND SYSTEM, BALDWIN ENERGY COMPLEX
10901 BALDWIN ROAD BALDWIN, ILLINOIS 62217

PROJECT NO: 2189

FIGURE NO: 8C

NATURAL RESOURCE TECHNOLOGY



LEGEND

- WELL SCREEN INTERVAL
- FILL
- CLAY, CL
- CLAY, CH
- SAND, SP/SM/SW
- SHALE
- SILT, ML
- COAL COMBUSTION RESIDUALS, CCRs

NOTE: 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.

0 200 400
FEET
(HORIZONTAL SCALE IS APPROXIMATE)

DRAWN BY/DATE: TDC 5/15/14
REVIEWED BY/DATE: SJC 5/16/14
APPROVED BY/DATE: SJC 6/9/14

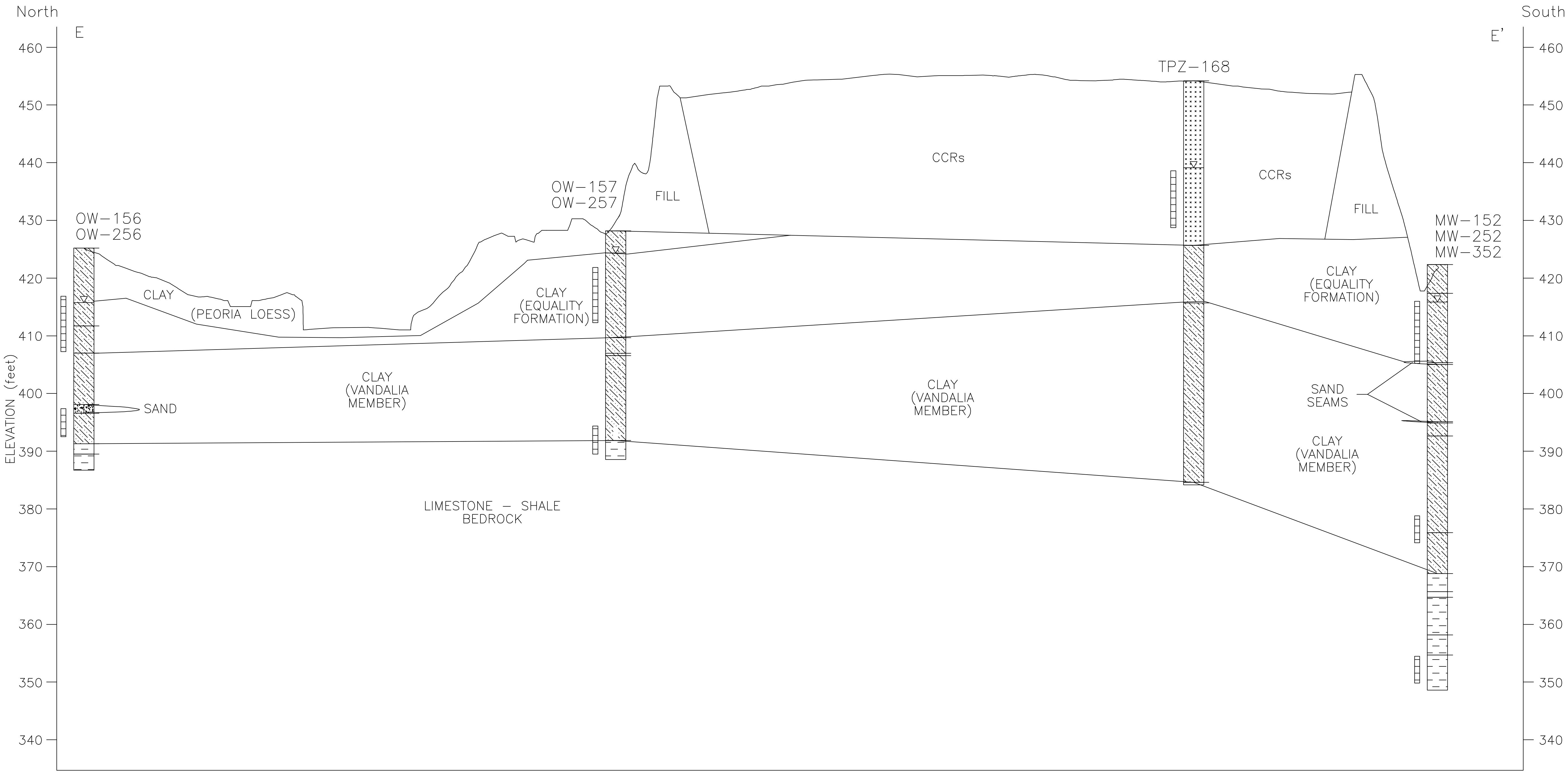
GEOLOGIC CROSS SECTION D-D'

GROUNDWATER QUALITY ASSESSMENT AND PHASE II HYDROGEOLOGIC INVESTIGATION
BALDWIN ASH POND SYSTEM, BALDWIN ENERGY COMPLEX
10901 BALDWIN ROAD BALDWIN, ILLINOIS 62217

PROJECT NO: 2189

FIGURE NO: 8D

NATURAL RESOURCE TECHNOLOGY



LEGEND

- WELL SCREEN INTERVAL
- FILL
- CLAY, CL
- CLAY, CH
- SAND, SP/SM/SW
- SHALE
- SILT, ML
- COAL COMBUSTION RESIDUALS, CCRs

NOTE: 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.

0 200 400
FEET
(HORIZONTAL SCALE IS APPROXIMATE)

DRAWN BY/DATE: TDC 5/15/14
REVIEWED BY/DATE: SJC 5/16/14
APPROVED BY/DATE: SJC 6/9/14

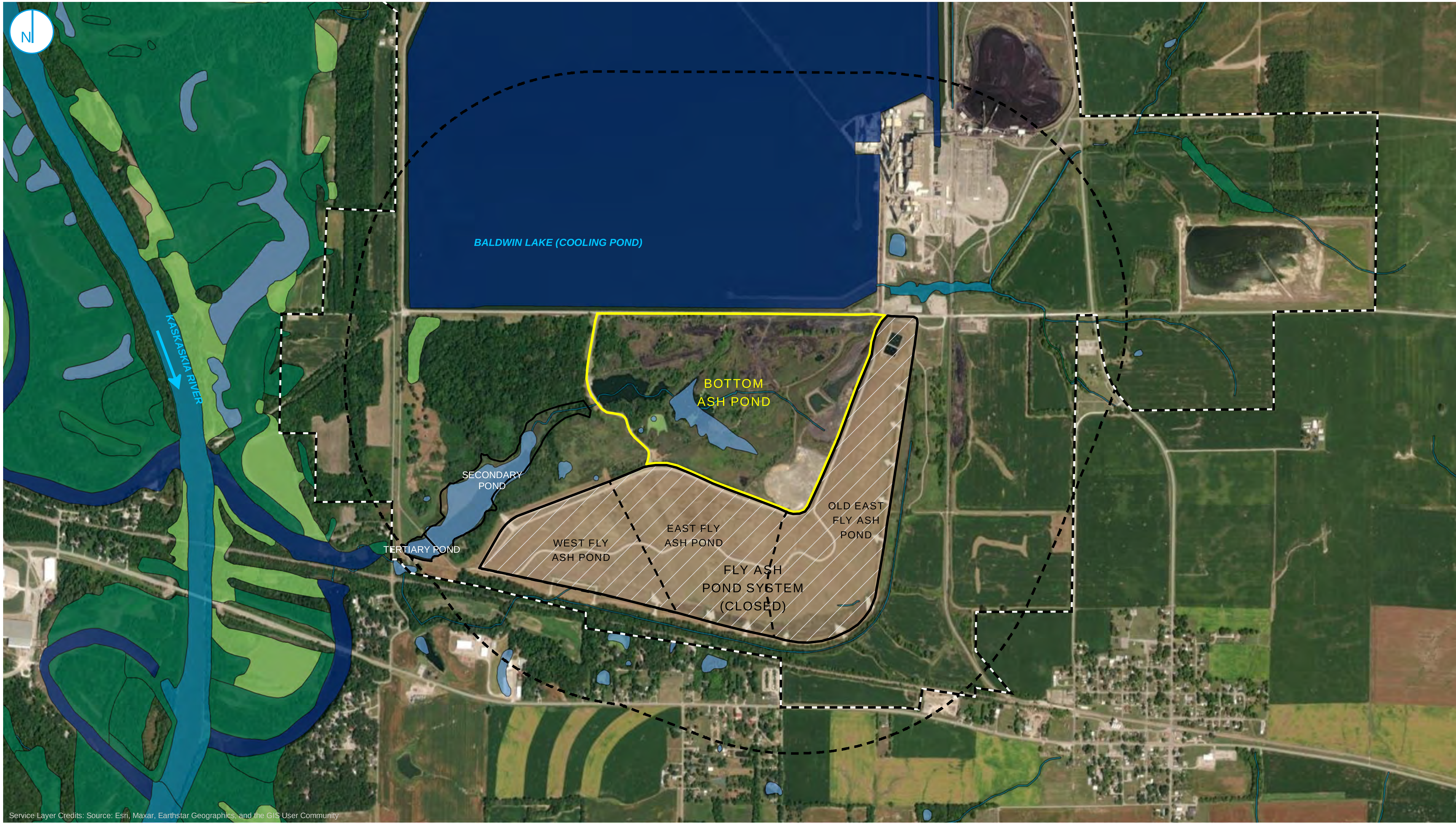
GEOLOGIC CROSS SECTION E-E'

GROUNDWATER QUALITY ASSESSMENT AND PHASE II HYDROGEOLOGIC INVESTIGATION
BALDWIN ASH POND SYSTEM, BALDWIN ENERGY COMPLEX
10901 BALDWIN ROAD BALDWIN, ILLINOIS 62217

PROJECT NO: 2189

FIGURE NO: 8E

NATURAL RESOURCE TECHNOLOGY



FRESHWATER EMERGENT WETLAND
FRESHWATER FORESTED/SHRUB WETLAND
FRESHWATER POND
LAKE
RIVERINE

PART 845 REGULATED UNIT (SUBJECT UNIT)
1000 METER UNIT BUFFER
SITE FEATURE
FLY ASH POND SYSTEM (CLOSED)
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

0 625 1,250 Feet

SOURCE
USFWS

SURFACE WATER FEATURES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE B-4

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\BaldwinBAP\Figure B-4_Surface Water Features.mxd

PROJECT: 169000XXXX | DATED: 7/14/2023 | DESIGNER: STOLZSD

SURFACE WATER FEATURES WITHIN 1,000 METERS

DESKTOP STUDY

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

HUC	Surface Water ID	Distance from BAP (meters)	Physical Orientation to Unit	Hydraulic Orientation to Unit	Classification Code	Size (acres)
--	Lake 1 (Fly Ash Pond System)	41	SW	Downgradient	L1UBHh	50.15
7140204	Lake 2 (Baldwin Lake)	7	N	Upgradient	L1UBHh	1949
--	Lake 3 (Fly Ash Pond System)	12	S	Downgradient	L2USCh	44.27
--	Freshwater Pond 1	Within	--	--	PABGh	8.01
--	Freshwater Emergent Wetland 1	190	W	Downgradient	PEM1F	4.53
--	Freshwater Forested/Shrub Wetland 1	198	E	Upgradient	PFO1A	0.61
--	Freshwater Pond 1	Within	--	--	PUBFh	0.10
--	Freshwater Pond 2	Within	--	--	PUBFh	0.10
--	Freshwater Pond 3	266	S	Downgradient	PUBGh	0.71
--	Freshwater Pond 4	251	S	Downgradient	PUBGh	0.10
--	Freshwater Pond 5	289	SW	Downgradient	PUBGh	1.81
--	Freshwater Pond 6	206	S	Downgradient	PUBGh	1.31
--	Freshwater Pond 7	208	S	Downgradient	PUBGh	0.18
--	Freshwater Pond 8	216	S	Downgradient	PUBGh	1.03
--	Freshwater Pond 9	62	SW	Downgradient	PUBGh	0.10
--	Freshwater Pond 10	79	SW	Downgradient	PUBGh	0.78
--	Freshwater Pond 11 (Secondary and Tertiary Pond)	86	SW	Downgradient	PUBGh	19.25
--	Freshwater Pond 12	239	SW	Downgradient	PUBGx	0.14
--	Freshwater Pond 13	77	NE	Upgradient	PUBGx	1.35
--	Riverine 1	28	NE	Upgradient	R2UBH	6.44
--	Riverine 2	128	S	Upgradient	R4SBC	0.13
--	Riverine 3	88	E, S, SW	Upgradient, Downgradient	R4SBC	4.59
--	Riverine 4	Within	--	--	R4SBC	1.08
--	Riverine 5	Within	--	--	R4SBC	0.62
--	Riverine 6	246	E	Upgradient	R4SBC	0.34
--	Riverine 7	200	E	Upgradient	R4SBC	1.44
--	Riverine 8	276	NE	Upgradient	R4SBC	8.21
--	Riverine 9	Within	--	--	R5UBH	0.35

[O: JJW 6/11/2021; C: LTA 6/25/2021]

SURFACE WATER FEATURES WITHIN 1,000 METERS

DESKTOP STUDY

BALDWIN POWER PLANT

BOTTOM ASH POND

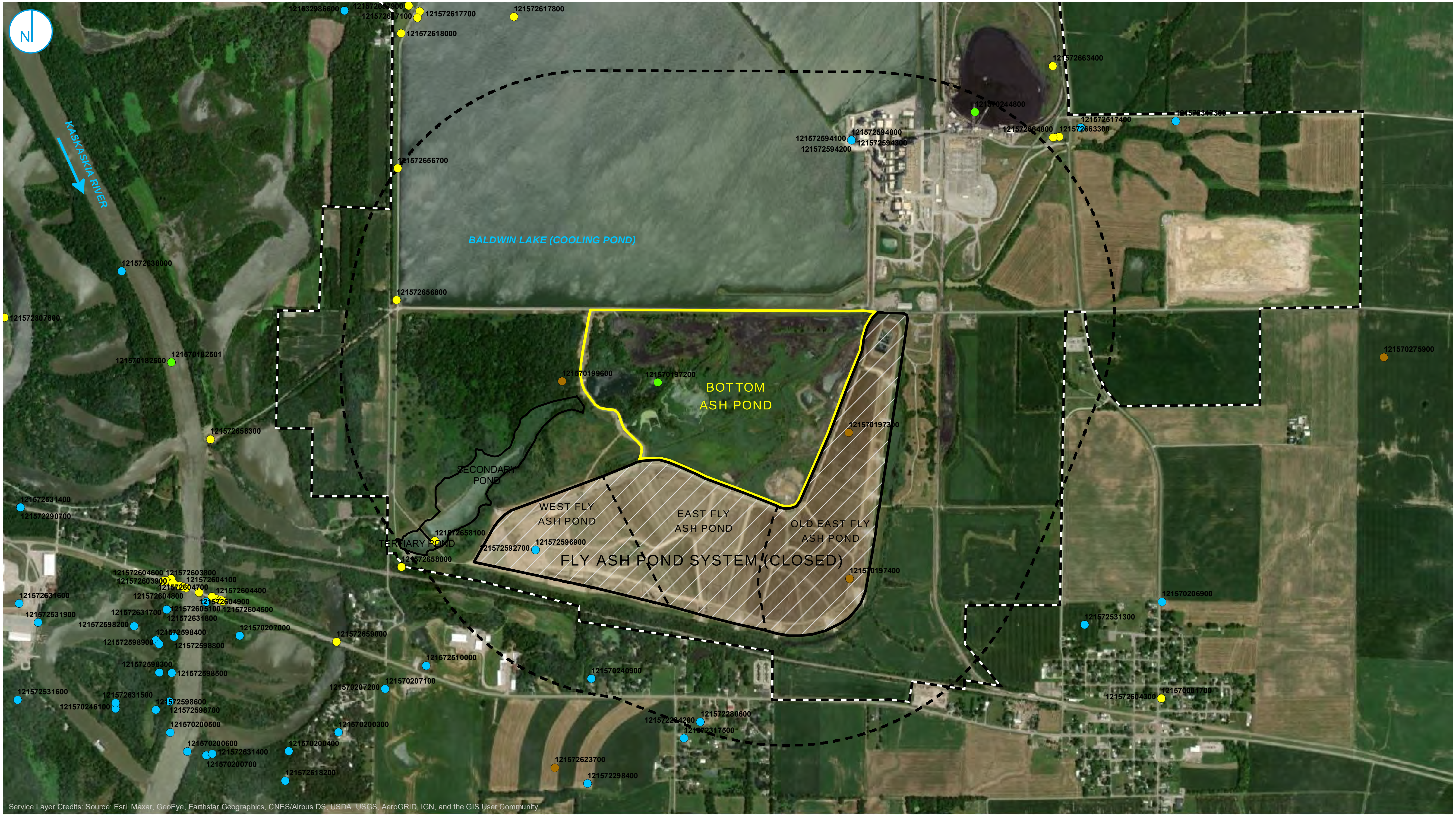
BALDWIN, ILLINOIS

HUC	Surface Water ID	Distance from BAP (meters)	Physical Orientation to Unit	Hydraulic Orientation to Unit	Classification Code	Size (acres)

Notes:

-- = not applicable
HUC = Hydrologic Unit Code
N = north
NW = northwest
NE = northeast
E = east
S = south
SW = southwest
SE = southeast
W = west

RAMBOLL



Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\Figure A-5_Water Well Survey.mxd

PROJECT: 169000XXXX | DATED: 10/14/2021 | DESIGNER: STOLZSD

WELL TYPE
- DRY
- ENGINEERING
- WATER
- N/A

- REGULATED UNIT (SUBJECT UNIT) 1000
- METER UNIT BUFFER
- SITE FEATURE
- FLY ASH POND SYSTEM (CLOSED)
- CAPPED AREA
- PROPERTY BOUNDARY

0 625 1,250 Feet

SOURCE
ISGS - IL WELLS

WATER WELL SURVEY

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE B-5

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

ILLINOIS STATE GEOLOGICAL SURVEY

Engineering Test	Top	Bottom
gray-brown, firm, moist, sandy clayey silt	0	3
gray-brown, yelllow, firm-soft, moist, sandy silty clay	3	23
dark gray, firm, moist, sandy silty clay	23	27
light gray, firm, moist, sandy clay	27	36
gray, dense, wet, sand, fine	36	39
stiff, till, weathered	39	40
Total Depth		**40**

Permit Date: **Permit #:**

COMPANY Harza Engineering
FARM Baldwin Damsite
DATE DRILLED January 1, 1967 **NO.** B-126
ELEVATION 423GL **COUNTY NO.** 26568
LOCATION 2571'S 2645'W NE/c
LATITUDE 38.199561 **LONGITUDE** -89.879029
COUNTY Randolph **API 121572656800** **9 - 4S - 7W**

ILLINOIS STATE GEOLOGICAL SURVEY

Engineering Test	Top	Bottom
brown-gray, stiff, moist, sandy clayey silt with broken rock	0	8
gray, soft, moist, sandy silty clay	8	14
gray, hard, sandy shale	14	18
laminated limestone and shale	18	23
Total Depth		**23**

Permit Date: **Permit #:**

COMPANY Harza Engineering
FARM Baldwin Damsite
DATE DRILLED January 1, 1967 **NO.** B-146
ELEVATION 373GL **COUNTY NO.** 26581
LOCATION 575'S 2050'W NE/c
LATITUDE 38.190492 **LONGITUDE** -89.877227
COUNTY Randolph **API 121572658100** **16 - 4S - 7W**

ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	Top	Bottom
brown topsoil	0	1
brown clay	1	6
red clay	6	11
yellow clay	11	28
brown sand & gravel	28	32
Total Depth		**32**

Casing: 35" CONCRETE from 0' to 32'

Water from sand & gravel at 28' to 32'.

Driller's Log filed

Owner Address: Baldwin, IL

Location source: Location from permit

Permit Date: April 8, 1970 **Permit #:** NF 0800

COMPANY Kohnen, Clarence

FARM Feltmann, Elmo

DATE DRILLED April 17, 1970 **NO.**

ELEVATION **COUNTY NO.** 02409

LOCATION 241'S line, 135'W line of NW

LATITUDE 38.185276 **LONGITUDE** -89.869794

COUNTY Randolph **API 121570240900** **15 - 4S - 7W**

ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	Top	Bottom
topsoil	0	1
red clay	1	17
red sand & gravel	17	24
Total Depth		**24**

Casing: 6" PVC from -1' to 10'
36" CONCRETE from 10' to 22'

Size hole below casing: 33"

Water from red sand & gravel at 17' to 24'.
Static level 6' below casing top which is 1' above GL

Permanent pump installed at 22'
on , with a capacity of gpm

Driller's Log filed

Owner Address: Red Bud, IL

Location source: Location from permit

Permit Date: June 28, 1974 **Permit #:** 30882

COMPANY Gwin Drilling Co.

FARM Deterding, Walter

DATE DRILLED July 1, 1974 **NO.** 1

ELEVATION **COUNTY NO.** 22806

LOCATION NW NE SW

LATITUDE 38.183638 **LONGITUDE** -89.864585

COUNTY Randolph **API 121572280600** **15 - 4S - 7W**

ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	Top	Bottom
topsoil	0	1
red clay	1	15
red sandy clay	15	25
sand & gravel	25	26
red & gray clay	26	33
Total Depth		**33**

Casing: 36" CONCRET from -1' to 30'

Size hole below casing: 33"

Water from sand & gravel at ' to '.

Driller's Log filed

Owner Address: Red Bud, IL

Location source: Location from permit

Permit Date: October 1, 1974 **Permit #:** 33530

COMPANY Gwin Drilling Co.

FARM Dennison, Mark

DATE DRILLED October 2, 1974 **NO.**

ELEVATION 0 **COUNTY NO.** 22842

LOCATION NW NE SW

LATITUDE 38.183638 **LONGITUDE** -89.864585

COUNTY Randolph **API 121572284200** **15 - 4S - 7W**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	Top	Bottom
brown - gray silty clay	0	23
Total Depth		**23**

Casing: 2" SS 304 SCREEN .010 from 13' to 23'
Screen: 10' of 2" diameter .01 slot
Grout: BENT/CEMENT from 1 to 9.
Water from silty - clay at 3' to 23'.
Static level 3' below casing top which is 0' above GL

Owner Address: Baldwin, IL
Location source: Location from the driller

Permit Date: **Permit #:** none

COMPANY Roberts, Charles Wayne
FARM Illinois Power
DATE DRILLED August 24, 1992 **NO.** BAMW-101
ELEVATION 0 **COUNTY NO.** 25940
LOCATION NE NW NE
LATITUDE 38.205526 **LONGITUDE** -89.857289
COUNTY Randolph **API 121572594000** **10 - 4S - 7W**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	Top	Bottom
fill - gravel	0	1
brown silty clay	1	18
Total Depth		**18**

Casing: 2" SS 304 SCREEN from 8' to 18'
Screen: 10' of 2" diameter .01 slot
Grout: BENT/CEMENT from 1 to 5.

Water from brown silty clay at 3' to 18'.
Static level 3' below casing top which is 0' above GL

Owner Address: Baldwin, IL
Location source: Location from the driller

Permit Date: **Permit #:** none

COMPANY Roberts, Charles Wayne
FARM Illinois Power
DATE DRILLED August 26, 1992 **NO.** BAMW102
ELEVATION 0 **COUNTY NO.** 25941
LOCATION NE NW NE
LATITUDE 38.205526 **LONGITUDE** -89.857289
COUNTY Randolph **API 121572594100** **10 - 4S - 7W**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	Top	Bottom
gravel fill	0	1
silty clay	1	18
Total Depth		**18**

Casing: 2" SS 304 SCREEN from 8' to 18'
Screen: 10' of 2" diameter .01 slot
Grout: BENT/CEMENT from 1 to 5.

Water from silty clay at 5' to 18'.
Static level 5' below casing top which is 0' above GL

Owner Address: Baldwin, IL
Location source: Location from the driller

Permit Date: **Permit #:** none

COMPANY Roberts, Charles Wayne
FARM Illinois Power
DATE DRILLED August 26, 1992 **NO.** BAMW103
ELEVATION 0 **COUNTY NO.** 25942
LOCATION NE NW NE
LATITUDE 38.205526 **LONGITUDE** -89.857289
COUNTY Randolph **API 121572594200** **10 - 4S - 7W**

ILLINOIS STATE GEOLOGICAL SURVEY

Monitoring	Top	Bottom
brown silty clay	0	17
medium - fine brown sand	17	18
Total Depth		**18**

Casing: 2" SS 304 SCREEN from 8' to 18'

Screen: 10' of 2" diameter .01 slot

Grout: BENT/CEMENT from 1 to 5.

Water from silty clay, med sand at 17' to 18'.
Static level 3' below casing top which is 0' above GL

Owner Address: Baldwin, IL
Location source: Location from the driller

Permit Date: **Permit #:** none

COMPANY Roberts, Charles Wayne
FARM Illinois Power
DATE DRILLED August 26, 1992 **NO.** BAMW104
ELEVATION 0 **COUNTY NO.** 25943
LOCATION NE NW NE
LATITUDE 38.205526 **LONGITUDE** -89.857289
COUNTY **Randolph** **API** **121572594300** **10 - 4S - 7W**

ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	Top	Bottom
gray clay firm sandy	0	4
brown clay very sandy soft	4	8
gray & white lime	8	12
shale dark gray & lime in sheets	12	14
dk gry hd shale layered w/soft gry shale	14	19
lime & shale in fine sheets H-M	19	21
gray shale sandy - medium	21	26
gray & lt gray lime w/strk dk gray lime	26	38
gray & dull gray lime	38	46
gray shale F-M dark gray	46	55
reddish brown shale M-S	55	70
gray & lt gray shale M-S	70	80
brn & white lime w/fine strk gray shale	80	91
brn & white & gray lime, shale in sheets	91	120
blue green shale soft	120	125
brown soft shale	125	131
brown & gray soft shale	131	134
off white & gray lime H	134	136
gray shale M-F	136	153
off white & gray lime	153	157
gray shale M	157	160
Total Depth		**160**
Water from lime at 19' to 22'.		

Permit Date: August 27, 1992 **Permit #:**

COMPANY Kohnen, Clarence
FARM Harbaugh, Gene
DATE DRILLED **NO.**
ELEVATION 0 **COUNTY NO.** 25927
LOCATION NE NE
LATITUDE 38.190134 **LONGITUDE** -89.872439
COUNTY **Randolph** **API** **121572592700** **16 - 4S - 7W**

Remarks: dry hole

Owner Address: % Wood Duck Marina R.R. #1 Box #480 Baldwin, IL

Location source: Location from permit

ILLINOIS STATE GEOLOGICAL SURVEY

Piezometer	Top	Bottom
no record	0	27
Total Depth		**27**

Casing: 2" SCH 40 PVC from 0' to 26'
Screen: 5' of 2" diameter .01 slot
Grout: ENVIROPLUG from 18 to 21.
Grout: BENT/CEMENT from 0 to 18.

Size hole below casing: 4.3"

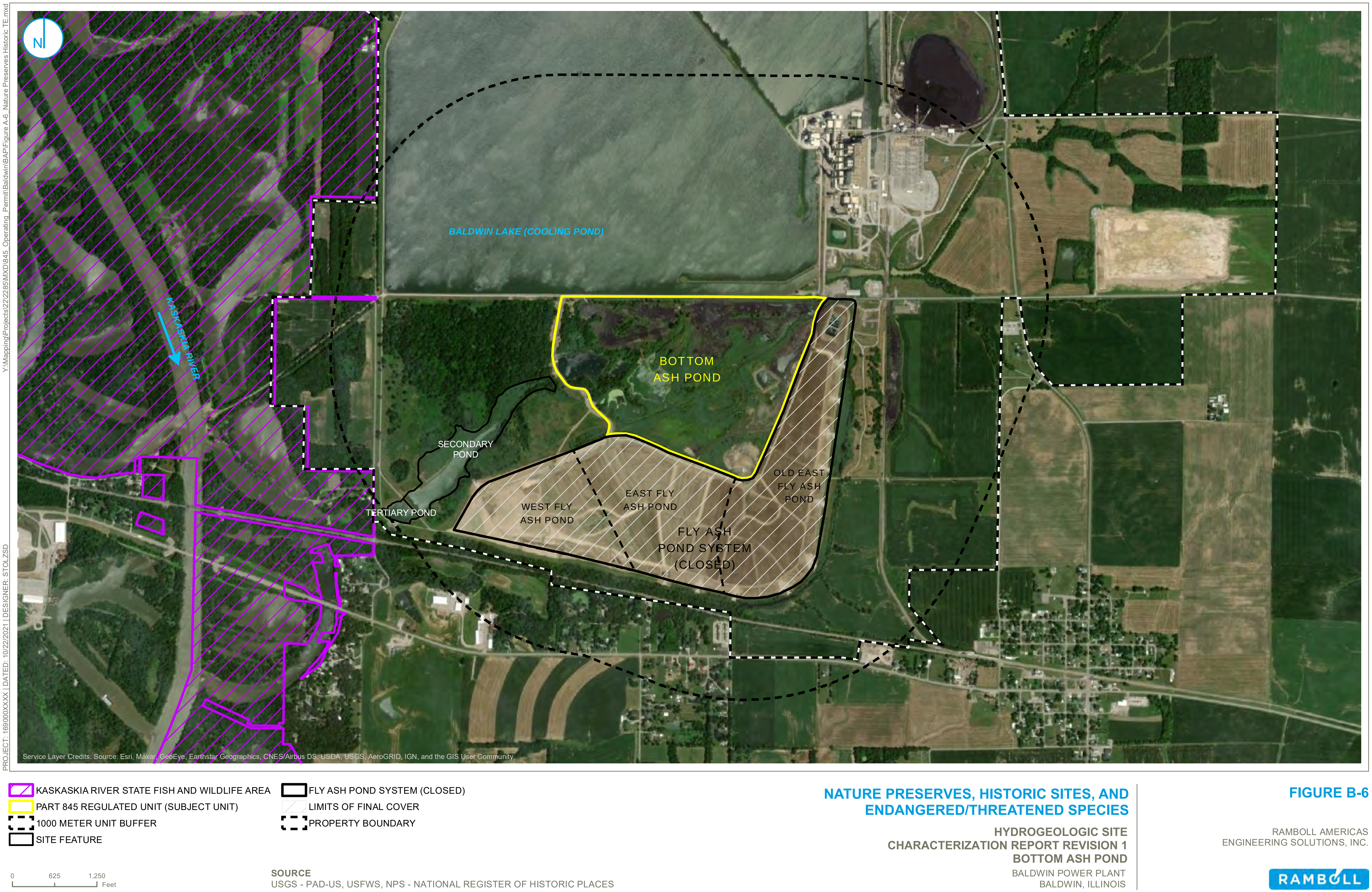
Water from at 22' to '.
Static level 22' below casing top which is 1' above GL

Remarks: temporary piezometer

Owner Address: 10901 Baldwin Rd. Baldwin, IL
Add'l loc. info: FALSE
on top of levee
Location source: Location from the driller

Permit Date: **Permit #:** none

COMPANY Meyer, David
FARM Illinois Power
DATE DRILLED March 20, 1995 **NO.** P-1
ELEVATION 0 **COUNTY NO.** 25969
LOCATION NE NE
LATITUDE 38.190134 **LONGITUDE** -89.872439
COUNTY Randolph **API 121572596900** **16 - 4S - 7W**



PROJECT: 169000XXXX | DATED: 10/22/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\Figure A-6_Nature Preserves Historic TE.mxd

SOURCE
USGS - PAD-US, USFWS, NPS - NATIONAL REGISTER OF HISTORIC PLACES

NATURE PRESERVES, HISTORIC SITES, AND ENDANGERED/THREATENED SPECIES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT REVISION 1
BOTTOM ASH POND

BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE B-6

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

NATURE PRESERVES AND HISTORIC SITES WITHIN RANDOLPH COUNTY

DESKTOP STUDY

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

INAI / INPC Number	INAI / INPC Name	Category / Categories	Size (acres)	Notes
--	Piney Creek Ravine	--	195	IDNR Owned, Nature Preserve Area
--	Prairie of the Rock	--	--	Privately Owned, Nature Preserve Area
--	Rockcastle Creek	--	79.1	Privately Owned,Nature Preserve Area
--	Swayne Hollow	--	--	Privately Owned, Nature Preserve Area
0827	Swayne Hollow	II	--	Natural Area
0826	Castle Rock - Randolph County	II	--	Natural Area
0488	Coles Mill Geological Area	IV	--	Natural Area
1307	Mississippi River - Mudds Landing	II	--	Natural Area
0099	Prairie Du Rocher - South	I, II, III	--	Natural Area
0489	Chester South Geological Area	IV	--	Natural Area
1731	Degognia Canyon	II, III, VI	--	Natural Area
0347	Piney Creek Ravine	II, III	--	Natural Area
1311	Sparta Site	II	--	Natural Area
1310	Reily Lake Area	II	--	Natural Area
0828	Rockcastle Creek Area	I, II, III	--	Natural Area
0938	Demint Prairie/Prairie Du Rocher Herpetological	I, II, III, IV	--	Natural Area
0830	Modoc Northwest Geological Area	IV	--	Natural Area
LWR130	Degognia Canyon Land and Water Reserve	--	--	Protected Area, Land and Water Reserve
NP323	Prairie of the Rock Nature Preserve	--	--	Protected Area, Nature Preserve
LWR113	Blufftop Acres Land and Water Reserve	--	--	Protected Area, Land and Water Reserve
LWR119	Prairie of the Rock Overlook Land and Water Reserve	--	--	Protected Area, Land and Water Reserve
NP332	Swayne Hollow Nature Preserve	--	--	Protected Area, Nature Preserve
NP065	Piney Creek Ravine Nature Preserve	--	--	Protected Area, Nature Preserve
--	Kaskaskia River State Fish and Wildlife Management Area	--	19,907	State Conservation Area

[O: JJW; C: YMD 6/22/21]

Notes:
- I = High quality natural community and natural community restorations
- II = Specific suitable habitat for state-listed species or state-listed species relocations
- III = State dedicated Nature Preserves, Land and Water Reserves, & Natural Heritage Landmarks
- IV = Outstanding geological features
- V = Not used at this time
- VI = Unusual concentrations of flora or fauna and high quality streams

NATURE PRESERVES AND HISTORIC SITES WITHIN RANDOLPH COUNTY

DESKTOP STUDY

BALDWIN POWER PLANT

BOTTOM ASH POND

BALDWIN, ILLINOIS

INAI / INPC Number	INAI / INPC Name	Category / Categories	Size (acres)	Notes

-- = not applicable, no data

IDNR = Illinois Department of Natural Resources

INAI = Illinois Natural Areas Inventory

INPC = Illinois Nature Preserves Commission

RAMBOLL

ENDANGERED / THREATENED SPECIES WITHIN RANDOLPH COUNTY
DESKTOP STUDY
BALDWIN POWER PLANT
BOTTOM ASH POND
BALDWIN, ILLINOIS

Scientific Name	Common Name	Status	Number of Occurances	Last Observed
Acipenser fulvescens	Lake Sturgeon	LE	1	2015-05-14
Ammocrypta clara	Western Sand Darter	LE	1	1989-08-13
Asio flammeus	Short-eared Owl	LE	1	2015-02-20
Aspelnium bradleyi	Bradley's Spleenwort	LE	2	2018-10-04
Carex physorhyncha	Bellows Beak Sedge	LE	1	1998-06-17
Centruroides vittatus	Common Striped Scorpion	LE	2	2013-10-11
Circus hudsonius	Nothern Harrier	LE	2	2015-02-07
Coluber flagellum	Coachwhip	LE	1	1978
Crotalus horridus	Timber Rattlesnake	LT	4	2018-09-29
Draba cuneifolia	Whitlow Grass	LE	1	2008-04-16
Faxonius placidus	Bigclaw Crayfish	LE	2	1981-03
Gallinula galeata	Common Gallinule	LE	1	1986-05-09
Gastrophryne carolinensis	Eastern Narrowmouth Toad	LT	4	2016-07-06
Hexalectris spicata	Crested Coralroot Orchid	LE	1	2019-07-12
Isotria medeoloides	Small Whorled Pogonia	LE	1	1991-05-21
Lanius ludovicianus	Loggerhead Shrike	LE	1	1983-06-30
Lonicera flava	Yellow Honeysuckle	LE	1	2006-05-18
Mentzelia oligosperma	Stickleaf	LE	1	2008
Myotis septentrionalis	Northern Long-eared Myotis	LT	1	2002-07-30
Myotis sodalis	Indiana Bat	LE	2	2019-07-16
Notropis boops	Bigeye Shiner	LE	1	1964-06-11
Pantherophis emoryi	Great Plains Ratsnake	LE	1	2020-05-25
Phemeranthus calycinus	Fameflower	LE	1	2009-07-05
Pinus echinata	Shortleaf Pine	LE	1	2017-08-15
Ptilimnium nuttallii	Mock Bishop's Weed	LE	1	1987-07-15
Ranunculus harveyi	Harvey's Buttercup	LT	2	2013-05-14
Rudbeckia missouriensis	Missouri Orange Coneflower	LT	1	2011-07-06
Scaphirhynchus albus	Pallid Sturgeon	LE	2	2015-05-14
Scleria pauciflora	Carolina Whipgrass	LE	1	2010-07-13
Sternula antillarum	Least Tern	LE	1	2010-06-25
Tantilla gracilis	Flat-headed Snake	LT	1	1958-04-19
Terrapene ornata	Ornate Box Turtle	LT	2	2013-04-30

[OB: LTA; CB: YMD 6/22/21]

Notes:
LE = listed endangered
LT = listed threatened

APPENDIX C
BORING LOGS, WELL CONSTRUCTION LOGS, PIEZOMETER CONSTRUCTION FORMS, AND GEOLOGIC CROSS SECTIONS

RECORD OF SUBSURFACE EXPLORATION

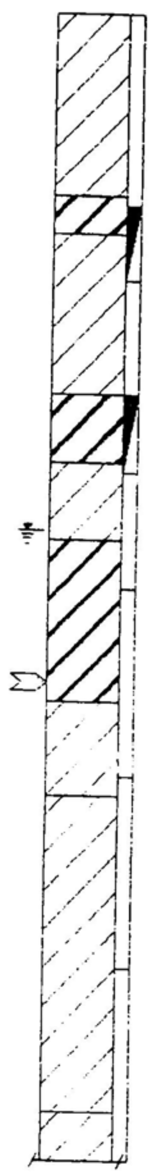
MONITORING WELL BAMW-104D

PROJECT: IP BALDWIN
PHASE II

JOB NO.: 122487
DATE DRILLED: 11/26/90

DRILLING METHOD: H.S.A.
DRILLED BY: Brotcke
LOGGED BY: Duncan
MONITORING WELL INSTALLED: Yes

GROUNDWATER: During Drilling - 17.5 Feet
At completion - 11.3 Feet
0.3 Hours after completion - 13.5 Feet

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA
0, 5, 10, 15, 20, 25, 30	

Boring Continues

USCS	DESCRIPTION	REMARKS	RECOVERY RATIO in/in	PENETROMETER, HAND, tsf
CL	Gray-Brown Silty CLAY Trace Sand		53/60	
CH	Gray-Brown CLAY w/Silt Trace Sand		22/24	
CL	Gray-Brown Silty CLAY Trace Sand			
	-Trace Gravel 7.5-9.0'		36/36	
	-Dark Gray-Brown below 9.0'			
CH	Gray-Brown CLAY w/Silt Trace Sand		12/24	
CL	Gray-Brown Silty CLAY Trace Sand		41/36	
CH	Gray-Brown CLAY w/Silt Trace Sand		62/60	
CL	Gray-Brown Silty CLAY Trace Sand			
SC	Gray-Brown Clayey SAND Trace Gravel		60/60	
		Particle Size Curve No. 9 Liquid Limit = 26 Plastic Limit = 15 Natural Moisture = 23.5% Organic Content = 6.4% Specific Gravity = 2.66 Note: Above analysis run on sample from 23.5-24.0'	62/60	
CL	Gray-Brown Silty CLAY Trace Sand			

RECORD OF SUBSURFACE EXPLORATION

MONITORING WELL BAMW-104D

PROJECT: IP BALDWIN
PHASE II

JOB NO.: 122487

DRILLING METHOD: H.S.A.

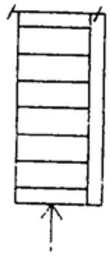
DATE DRILLED: 11/26/90

DRILLED BY: Brotcke

LOGGED BY: Duncan

GROUNDWATER: During Drilling - 17.5 Feet
At completion - 11.3 Feet
0.3 Hours after completion - 13.5 Feet

MONITORING WELL INSTALLED: Yes

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	DESCRIPTION	REMARKS	RECOVERY RATIO in/in	PENETROMETER, HAND, tsf
30			Gray-Brown Highly Weathered Clayey SHALE		60/60	
35						

KELRON
ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-104DR

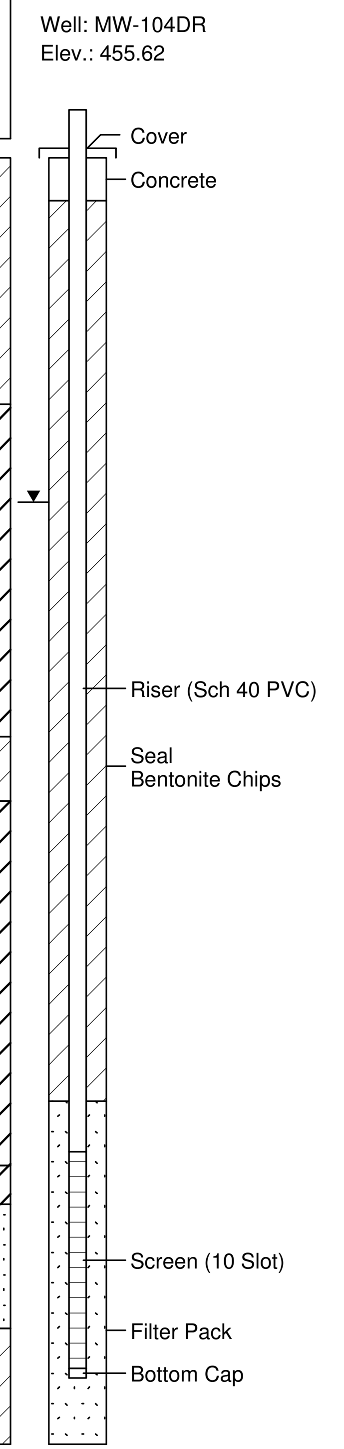
Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SE, SE

Date Completed	: 07/25/11	Driller	: Matt Cooper
Hole Diameter	: 7 3/4"OD; 3 3/4" ID	Geologist	: Stu Cravens (Kelron)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 452.62
Sampling Method	: MacroCore (60")	Top of Casing Elevation	455.62
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2386609, 554201

Depth in Feet: 0 – 30

DESCRIPTION	USCS
SILTY CLAY, trace sand, med plasticity, organics and roots, dry hard, light gray (Gley1-7/1) with brown mottling (Fe-oxidation) (10YR 3/1), dry - moist	CL
CLAY (Fat) with Silt, high plasticity, soft to very soft, high organics and roots, dark gray grading to gray with brown mottling, moist - groundwater level at completion = 8.03' bls - medium hardness - light gray (GLEY1-7/1) with yellow-brown Fe-oxid mottling (10%)	CH
CLAY (lean) with Silt, medium plasticity, light gray with yellow-brown mottling (10%)	CL
CLAY with Silt, trace sand and fine gravel, high plasticity, medium to stiff, light gray with brown mottling (20%) - trace sand and gravel, medium to high plasticity, medium to stiff hardness, mottling 25 to 50%	CH
SANDY FAT CLAY, fine sand, trace fine gravel, high plasticity, greenish gray (GLEY-6/1), moist	CH
SAND (fine to medium), trace gravel, poorly graded, light gray, wet - brown (Slotted screen interval = 4.52 ft)	SP
SILTY CLAY, trace sand and gravel (angular), medium plasticity, very stiff, olive brown (2.5Y 4/4) with light gray mottling <20%, moist (TILL)	CL

Surf. Elev. 452.62	Samples	Recovery inches	Qp TSF
	1		>4.5
	2		>4.5
450	3	60/60	3.5
	4		2.5
	5		2.5
	6		2.5
	7		2.5
445	8	60/60	1
	9		1
	10		1
	11		1.75
	12		2.25
440	13	60/60	2.25
	14		3.0
	15		2.5
	16		3.75
	17		2.75
435	18	60/60	3.5
	19		3.5
	20		3
	21		3
	22		2.5
430	23	60/60	2.5
	24		2.5
	25		2.5
	26		
	27		2.5
425	28	60/60	
	29		4.0
	30		4.5



KELRON ENVIRONMENTAL INCORPORATED

LOG OF BORING MW-104DR

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SE, SE

Date Completed	: 07/25/11	Driller	: Matt Cooper
Hole Diameter	: 7 3/4"OD; 3 3/4" ID	Geologist	: Stu Cravens (Kelron)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 452.62
Sampling Method	: MacroCore (60")	Top of Casing Elevation	455.62
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2386609, 554201

Well: MW-104DR
Elev.: 455.62

Depth in Feet	DESCRIPTION	Surf. Elev. 452.62	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
30	SHALE, highly weathered; Clay with Silt, platy /laminated, medium to high plasticity, very stiff, moist		31		3.0	~~CL~~	
			32				
		420	33	60/60		SH	
			34		3.5		
	- unweathered, light gray, fissile, dry		35				
35	END BOREHOLE AT 35 FEET BLS						
		415					
40							
		410					
45							
		405					
50							
		400					
55							
		395					
60							

NOTE: Monitoring Well MW-104S nested with MW-104D

RECORD OF SUBSURFACE EXPLORATION

MONITORING WELL BAMW-104D

PROJECT: IP BALDWIN
PHASE II

JOB NO.: 122487

DATE DRILLED: 11/26/90

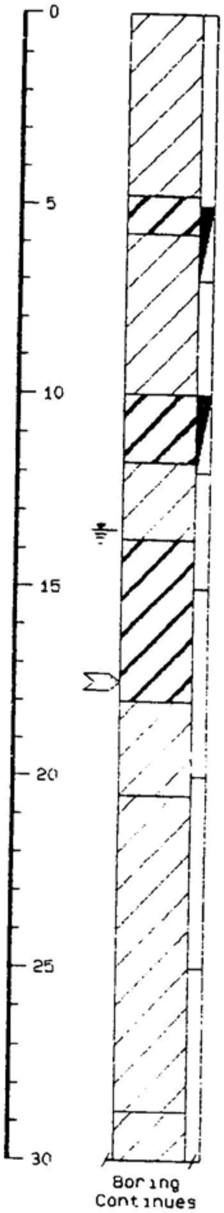
DRILLING METHOD: H.S.A.

DRILLED BY: Brotcke

LOGGED BY: Duncan

MONITORING WELL INSTALLED: Yes

GROUNDWATER: During Drilling - 17.5 Feet
At completion - 11.3 Feet
0.3 Hours after completion - 13.5 Feet



ELEVATION / DEPTH	USCS	DESCRIPTION	REMARKS	RECOVERY RATIO in/in	PENETROMETER, HAND, tsf
0	CL	Gray-Brown Silty CLAY Trace Sand		53/60	
5	CH	Gray-Brown CLAY w/Silt Trace Sand		22/24	
	CL	Gray-Brown Silty CLAY Trace Sand			
		-Trace Gravel 7.5-9.0'		36/36	
		-Dark Gray-Brown below 9.0'			
10	CH	Gray-Brown CLAY w/Silt Trace Sand		12/24	
	CL	Gray-Brown Silty CLAY Trace Sand		41/36	
	CH	Gray-Brown CLAY w/Silt Trace Sand			
15				62/60	
	CL	Gray-Brown Silty CLAY Trace Sand			
20	SC	Gray-Brown Clayey SAND Trace Gravel		60/60	
25			Particle Size Curve No. 9 Liquid Limit - 26 Plastic Limit = 15 Natural Moisture = 23.5% Organic Content - 6.4% Specific Gravity = 2.66 Note: Above analysis run on sample from 23.5-24.0'	62/60	
	CL	Gray-Brown Silty CLAY Trace Sand			
30					

RECORD OF SUBSURFACE EXPLORATION

MONITORING WELL BAMW-104D

PROJECT: IP BALDWIN
PHASE II

JOB NO.: 122487

DATE DRILLED: 11/26/90

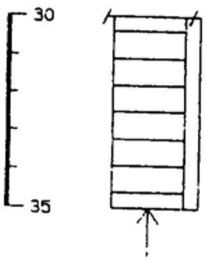
DRILLING METHOD: H.S.A.

DRILLED BY: Brotcke

LOGGED BY: Duncan

MONITORING WELL INSTALLED: Yes

GROUNDWATER: During Drilling - 17.5 Feet
At completion - 11.3 Feet
0.3 Hours after completion - 13.5 Feet

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	DESCRIPTION	REMARKS	RECOVERY RATIO in/in	PENETROMETER, HAND, tsf
30–35			Gray-Brown Highly Weathered Clayey SHALE		60/60	

KELRON ENVIRONMENTAL
INCORPORATED

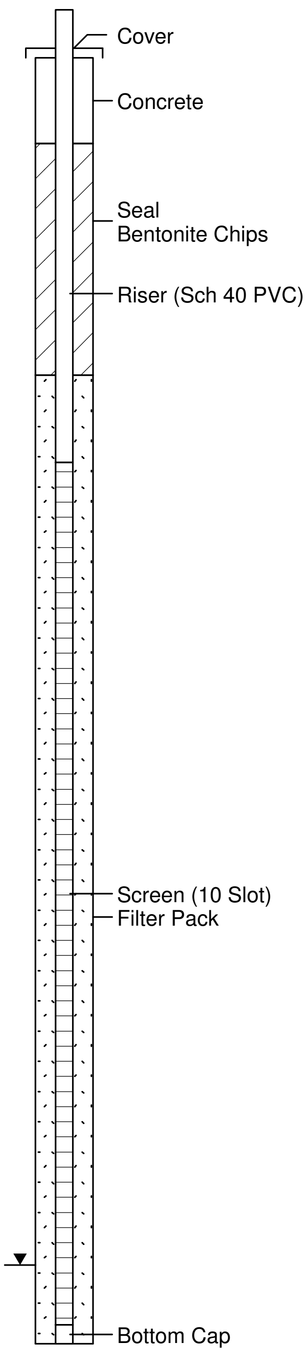
LOG OF BORING MW-104SR

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SE, SE

Date Completed	: 07/26/11	Driller	: Matt Cooper
Hole Diameter	: 7 3/4"OD; 3 3/4" ID	Geologist	: Stu Cravens (Kelron)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 452.52
Sampling Method	: MacroCore (60")	Top of Casing Elevation	455.54
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2386609, 554205

Depth in Feet	DESCRIPTION	Surf. Elev. 452.52	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring - no soil sampling conducted Refer to boring log for adjacent nested well MW-104DR for a descriptionof subsurface materials						
		450					
5							
		445					
10	(Slotted screen interval = 9.40 ft)						
		440					
	- groundwater level at completion = 14.06' bls						
15	END BOREHOLE AT 15 FEET BLS						

Well: MW-104SR
Elev.: 455.54



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KELRON
ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-104DR

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SE, SE

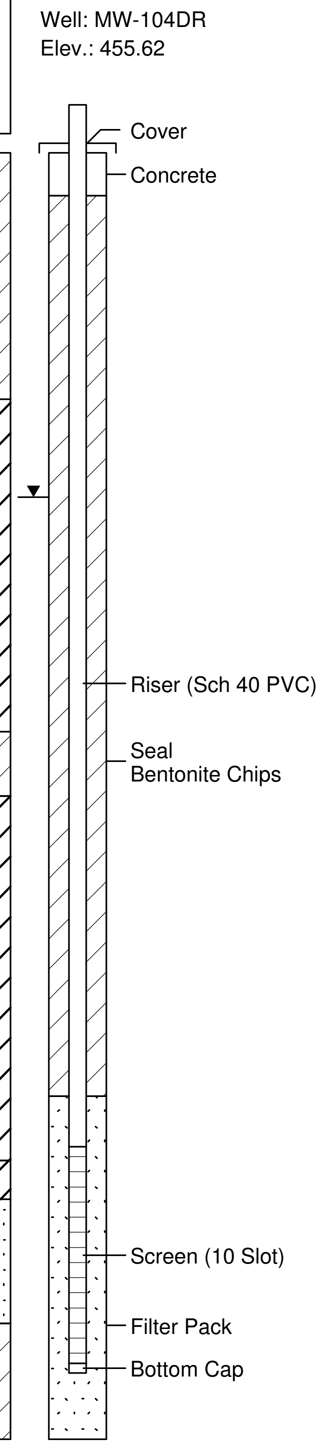
Date Completed	: 07/25/11	Driller	: Matt Cooper
Hole Diameter	: 7 3/4"OD; 3 3/4" ID	Geologist	: Stu Cravens (Kelron)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 452.62
Sampling Method	: MacroCore (60")	Top of Casing Elevation	455.62
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2386609, 554201

Depth in Feet	DESCRIPTION	USCS
0 – 5.75	SILTY CLAY, trace sand, med plasticity, organics and roots, dry hard, light gray (Gley1-7/1) with brown mottling (Fe-oxidation) (10YR 3/1), dry - moist	CL
5.75 – 13.5	CLAY (Fat) with Silt, high plasticity, soft to very soft, high organics and roots, dark gray grading to gray with brown mottling, moist - groundwater level at completion = 8.03' bls - medium hardness - light gray (GLEY1-7/1) with yellow-brown Fe-oxid mottling (10%)	CH
13.5 – 15	CLAY (lean) with Silt, medium plasticity, light gray with yellow-brown mottling (10%)	CL
15 – 23.5	CLAY with Silt, trace sand and fine gravel, high plasticity, medium to stiff, light gray with brown mottling (20%) - trace sand and gravel, medium to high plasticity, medium to stiff hardness, mottling 25 to 50%	CH
23.5 – 24.5	SANDY FAT CLAY, fine sand, trace fine gravel, high plasticity, greenish gray (GLEY-6/1), moist	CH
24.5 – 27.5	SAND (fine to medium), trace gravel, poorly graded, light gray, wet - brown (Slotted screen interval = 4.52 ft)	SP
27.5 – 30	SILTY CLAY, trace sand and gravel (angular), medium plasticity, very stiff, olive brown (2.5Y 4/4) with light gray mottling <20%, moist (TILL)	CL

Surf. Elev. 452.62: 450, 445, 440, 435, 430, 425

Samples	Recovery inches	Qp TSF
1		>4.5
2		>4.5
3	60/60	3.5
4		2.5
5		2.5
6		2.5
7		2.5
8	60/60	1
9		1
10		1
11		1.75
12		2.25
13	60/60	2.25
14		3.0
15		2.5
16		3.75
17		2.75
18	60/60	3.5
19		3.5
20		3
21		3
22		2.5
23	60/60	2.5
24		2.5
25		2.5
26		
27		2.5
28	60/60	
29		4.0
30		4.5

GRAPHIC



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KELRON ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-104DR

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SE, SE

Date Completed	: 07/25/11	Driller	: Matt Cooper
Hole Diameter	: 7 3/4"OD; 3 3/4" ID	Geologist	: Stu Cravens (Kelron)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 452.62
Sampling Method	: MacroCore (60")	Top of Casing Elevation	455.62
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2386609, 554201

Depth in Feet	DESCRIPTION	Surf. Elev. 452.62	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
30	SHALE, highly weathered; Clay with Silt, platy /laminated, medium to high plasticity, very stiff, moist		31	60/60	3.0	~~CL~~ SH	
			32				
		420	33				
			34		3.5		
	- unweathered, light gray, fissile, dry		35				
35	END BOREHOLE AT 35 FEET BLS						
		415					
40							
		410					
45							
		405					
50							
		400					
55							
		395					
60							

Well: MW-104DR
Elev.: 455.62

KELRON ENVIRONMENTAL
INCORPORATED

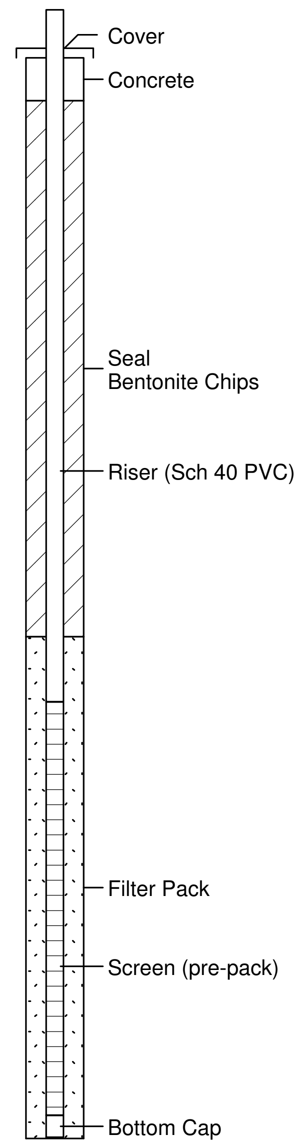
LOG OF BORING MW-150

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NW, NE

Date Completed	: 09/08/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 393.84
Sampling Method	: MacroCore (60")	Top of Casing Elevation	396.54
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2379413, 554563

Depth in Feet	DESCRIPTION	Surf. Elev. 393.84	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continous boring - no soil sampling conducted. Refer to boring log for adjacent nested well MW-350 for a description of subsurface materials	393					
5		388					
10		383					
15		378					
20		373					
25	END BOREHOLE AT 25.2 FEET BLS	368					
30							

Well: MW-150
Elev.: 396.54



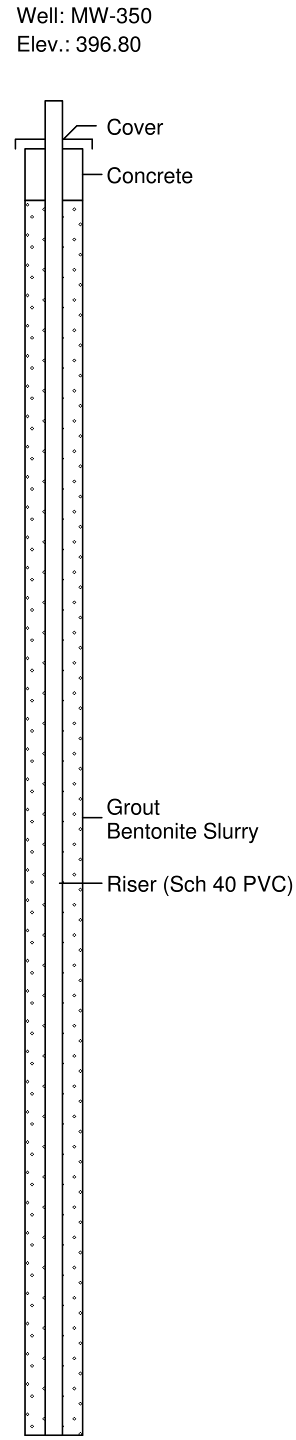
KELRON ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-350

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NW, NE

Date Completed	: 09/07/2010
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock
Drilling Method	: Hollow-Stem/Rotary (CME-550)
Sampling Method	: MacroCore (60")/NX Core
Drilling Company	: PSC
Driller	: Matt Cooper
Geologist	: Brendon Wilder (PSC)
Land Surface Elevation	: 394.11
Top of Casing Elevation	396.80
X,Y Coordinates	: 2379410, 554568

Depth in Feet	DESCRIPTION	Surf. Elev. 394.11	Samples	Recovery inches	Qp TSF	USCS
0	CLAY, very stiff to hard, brown, grayish-brown (10YR 5/2) mottled yellowish brown (10YR 5/8), dry	394	1	19/54	4.5	CH
			2		2.25	
			3			
5	- grain size analysis @ 5 - 6 ft: 2.3% sand, 42.4% silt, 55.3% clay	389	4	47/60	4.5	
			5		3.5	
			6		3.25	
			7		4.0	
10		384	8	60/60	2.75	
			9		2.75	
	CLAY, brown to olive brown, moist - grain size analysis @ 11 - 12 ft: 8.4% sand, 39.3% silt, 52.3% clay		10		2.75	CL/CH
			11		1.75	
			12		2.0	
15		379				
	CLAY, soft, high plasticity, dark yellow brown, moist; 1-2" sand seams at 17' and 19' - grain size analysis @ 18 - 20 ft: 1.8% sand, 21.9% silt, 76.3% clay - very stiff to hard, high plasticity		13	45/60		CH
20		374				
			14	60/60		
25			15	23/23		



KELRON ENVIRONMENTAL
INCORPORATED

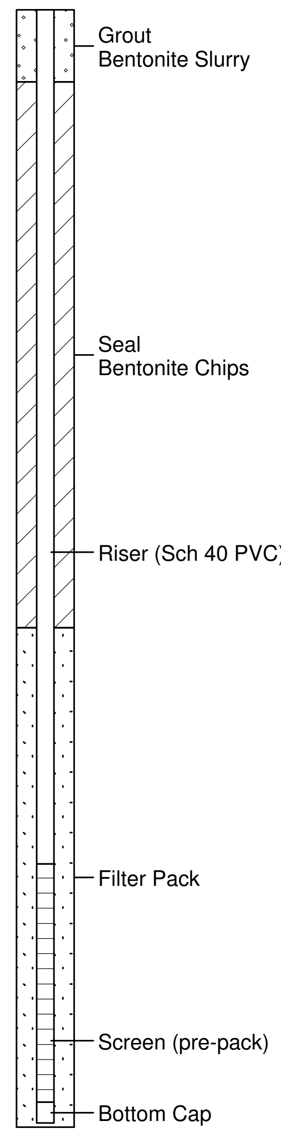
LOG OF BORING MW-350

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NW, NE

Date Completed	: 09/07/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 394.11
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	396.80
Drilling Company	: PSC	X,Y Coordinates	: 2379410, 554568

Well: MW-350
Elev.: 396.80

Depth in Feet	DESCRIPTION	Surf. Elev. 394.11	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
25	- Auger refusal at 26.4 feet bgs	369	15	23/23		CL	
	LIMESTONE and SHALE, interbedded, banded, solid, very soft, light to dark gray; slightly weathered					LS/SH	
	LIMESTONE, banded, medium bedded, solid, hard, medium gray; unweathered					LS	
30	LIMESTONE and SHALE, interbedded; limestone is banded, medium bedded, hard, medium gray; shale is very soft to medium soft, dark gray Borehole diameter from 26.4 to 46.7 feet bgs = 3 7/8" RQD for 26.4 - 36.4' = 72% (Fair) Recovery = 116/120"	364	16	116/120		LS/SH	
35	SHALE, banded, medium bedded, solid, soft to medium soft, dark gray	359				SH	
40	LIMESTONE, banded, massive, solid, hard to very hard, light to medium gray	354	17	118/120		LS	
45	RQD for 36.4 - 46.4' = 96% (Excellent) Recovery = 118/120"	349					
	END BOREHOLE AT 46.7 FEET BLS						
50							



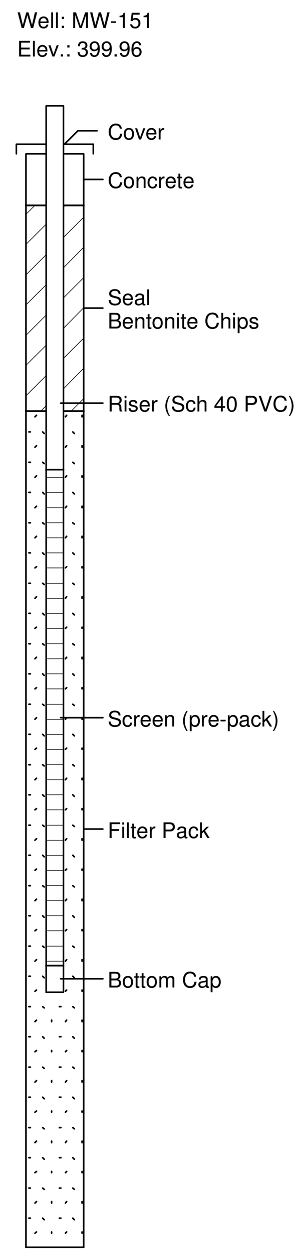
KELRON ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-151

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/21/2010
Hole Diameter	: 8 1/2"OD; 4 1/4" ID
Drilling Method	: Hollow-Stem (CME-550)
Sampling Method	: MacroCore (60")
Drilling Company	: Terra Drill, Inc.
Driller	: Matt Cooper
Geologist	: Brendon Wilder (PSC)
Land Surface Elevation	: 397.22
Top of Casing Elevation	399.96
X,Y Coordinates	: 2381171, 554221

Depth in Feet	DESCRIPTION	Surf. Elev. 397.22	Samples	Recovery inches	Qp TSF	USCS
0	SILTY CLAY, light brown, dry	397	1	31/48		CL
			2		1.5	
			3		1.0	
			4		1.5	
			5	32/60		
5	SANDY CLAY, dark gray (10YR 4/1)	392	6		1.0	CL
	- moist		7		0.5	
	- moist to wet		8		1.0	
	- very dark gray-brown; grain size analysis @7.5-8 ft: 39% sand, 41.8% silt, 19.2% clay		9		2.5	
			10	46/60	2.5	
10	SILTY CLAY, yellowish-brown (10YR 5/1)	387	11		3.0	CL
			12		2.75	
	- two small light gray sandy seams		13		2.5	
	- 2-inch layer of dusky red CLAY (10R 3/2)		14		2.75	
			15	58/60	2.5	
15	CLAY, low plasticity, medium soft	382	16		2.5	CH
	- shaley, light olive brown (2.5Y 5/4) grading to olive gray; grain size analysis @16-17 ft:: 1%sand, 28.5% silt, 70.5% clay		17		3.5	
	- platy/laminated		18		2.75	
			19		2.75	
			20	24/27	2.5	
20	Refusal in bedrock at 21.5 feet BLS END BOREHOLE AT 21.5 FEET BLS	377	21		4.5+	
			22			
	LIMESTONE, no recovery					LS
	Drove split-spoon to 21.75 feet BLS - no recovery					
25						



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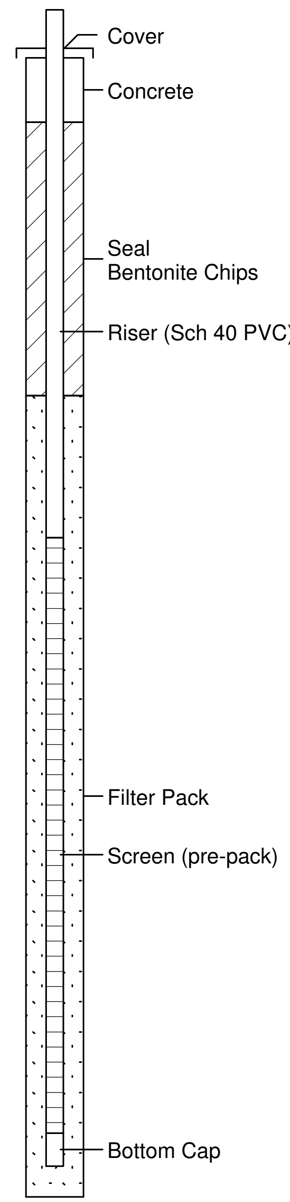
KELRON ENVIRONMENTAL INCORPORATED	LOG OF BORING MW-152 (Page 1 of 1)

Ash Pond System Monitoring Well Network Baldwin Energy Complex Dynegy Midwest Generation, Inc. Location: Twp 04S, Rng 07W, 16 SE, NE, NE	Date Completed : 09/22/10 Hole Diameter : 8 1/2"OD / 4 1/4" ID Drilling Method : Hollow-Stem/Rotary (CME-550) Sampling Method : MacroCore (60") Drilling Company : PSC	Driller : Matt Cooper Geologist : Brendon Wilder (PSC) Land Surface Elevation: 422.18 Top of Casing Elevation 424.99 X,Y Coordinates : 2382779, 553906	

Depth in Feet	DESCRIPTION	Surf. Elev. 422.18	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring - no soil sampling conducted. Refer to boring log for adjacent nested well MW-352 for a description of subsurface materials.	422					
5		417					
10		412					
15		407					
	END BOREHOLE AT 17.7 FEET BLS						
20							

Well: MW-152
Elev.: 424.99



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KELRON ENVIRONMENTAL INCORPORATED

LOG OF BORING MW-352

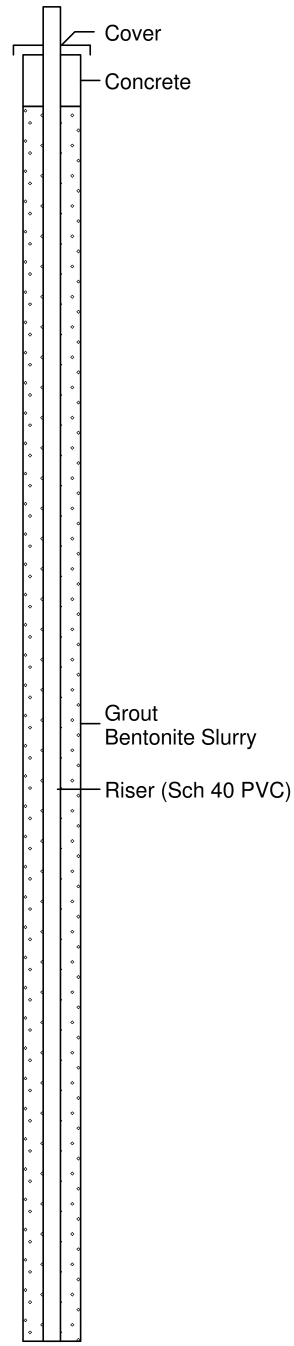
Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/16/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 422.36
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	425.04
Drilling Company	: PSC	X,Y Coordinates	: 2382789, 553901

Depth in Feet	DESCRIPTION	Surf. Elev. 422.36	USCS
0	SILTY CLAY, very stiff to hard, yellow brown (10YR 5/6), dry	422	CL
5	CLAY, trace sand and fine gravel, very stiff, high plasticity, few black organic material	417	CL
10	- medium hard	412	
	- soft		
15		407	
	- medium hard		
	SAND, poorly graded, loose, wet (4-inch thick)		SP
	SANDY CLAY, trace fine gravel, yellow brown to olive brown (2.5Y 5/3)		CL
20		402	
25			

Samples	Recovery inches	Qp TSF
1	46/48	4.5+
2	60/60	3.5
3		4.0
4		2.75
5		3.0
6	60/60	2.75
7		2.0
8		1.0
9		1.25
10	60/60	1.5
11		2.5
12		2.75
13		3.5
14	60/60	4.5+
15		2.5
16		2.5
17		2.75
18	48/60	2.5

Well: MW-352
Elev.: 425.04



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KELRON ENVIRONMENTAL
INCORPORATED

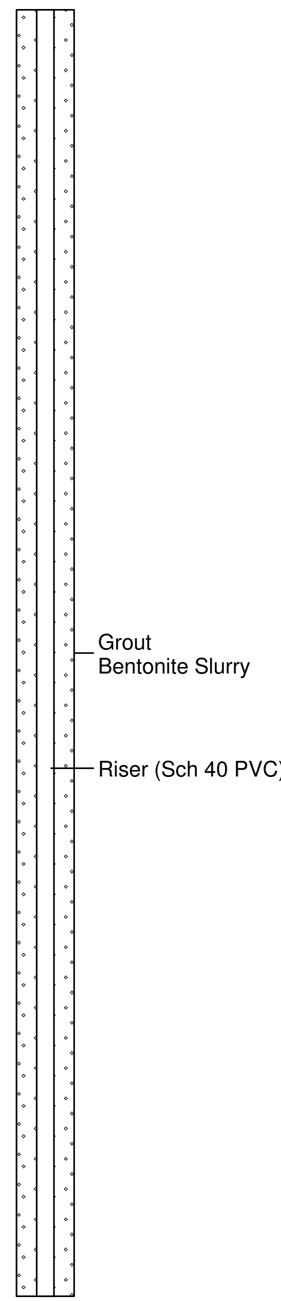
LOG OF BORING MW-352

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/16/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 422.36
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	425.04
Drilling Company	: PSC	X,Y Coordinates	: 2382789, 553901

Depth in Feet	DESCRIPTION	Surf. Elev. 422.36	Samples	Recovery inches	Qp TSF	USCS
25		397				CL
	- grain size analysis @ 26.5 - 27.5 ft: 33.7% sand, 27.1% silt, 39.2% clay		18	48/60	2.5	
	SAND with few gravel, yellow brown					SP
	CLAY, some sand and fine gravel, hard to very hard, high plasticity, dark yellow brown (10YR 4/6)					CL
			19	60/60	3.0	
30	CLAY, lean to fat	392	20		3.0	CL/CH
	- grain size analysis @ 32 - 33 ft: 13.2% sand, 43.9% silt, 42.8% clay		21		3.5	
			22		3.0	
35		387	23	48/60	1.5	
	- medium hard, high plasticity, gray brown to light olive brown (2.5Y 5/2-5/3)		24		1.5	
	- trace silt, dark yellow brown (10YR 4/4)		25		1.75	
			26		1.5	
40		382	27	54/60	1.75	
			28		2.0	
			29		2.5	
			30		2.5	
			31	57/60	2.0	
45		377	32		1.75	
			33		1.75	
	CLAY, medium hard, low plasticity, olive brown (2.5Y 5/4)		34		2.5	CL
			35		1.75	
			36	3/3		
50						

Well: MW-352
Elev.: 425.04



KELRON
ENVIRONMENTAL
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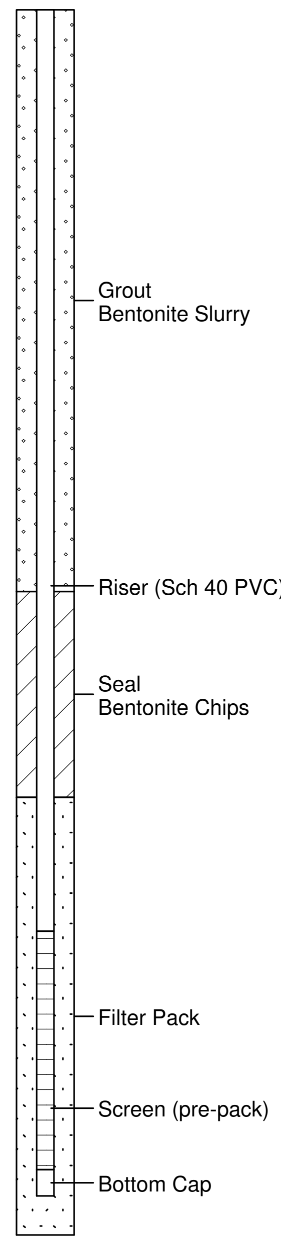
LOG OF BORING MW-352

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/16/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 422.36
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	425.04
Drilling Company	: PSC	X,Y Coordinates	: 2382789, 553901

Depth in Feet	DESCRIPTION	Surf. Elev. 422.36	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
50	- Auger refusal at 53.7 feet bgs	372				CL	
	LIMESTONE, weathered, thinly laminated, medium hard to hard, gray		37	5/5		LS	
55		367	38	8/27			
	SHALE, clayey, gray					SH	
	LIMESTONE, occasional shale partings		39	19/60		LS	
60	- laminated, fossiliferous, medium gray	362	40	54/60			
	SHALE, soft, dark gray					SH	
65		357					
	LIMESTONE, medium hard to hard, light gray		41	59/60		LS	
70	Borehole diameter from 53.7 to 73.8 feet bgs = 3 7/8" RQD for 53.8 - 73.8' = 57% (Fair) Recovery = 173/240"	352	42	33/34			
	END BOREHOLE AT 73.8 FEET BLS						
75							

Well: MW-352
Elev.: 425.04



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KELRON
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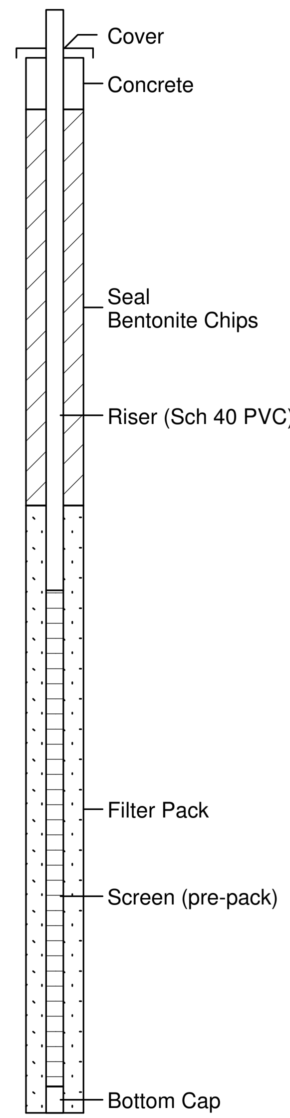
LOG OF BORING MW-153

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 15 SW, SW, NE

Date Completed	: 09/22/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 442.77
Sampling Method	: MacroCore (60")	Top of Casing Elevation	445.67
Drilling Company	: PSC	X,Y Coordinates	: 2384435, 553298

Depth in Feet	DESCRIPTION	Surf. Elev. 442.77	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring - no soil sampling conducted Refer to boring log for adjacent nested well MW-253 for a description of subsurface materials	442					
5		437					
10		432					
15		427					
20	END BOREHOLE AT 20.5 FEET BLS	422					
25							

Well: MW-153
Elev.: 445.67



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KELRON ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-253

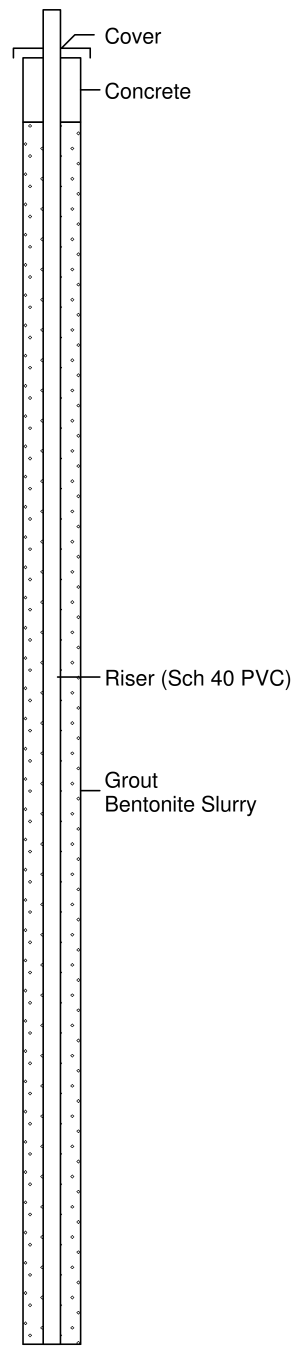
Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 15 SW, SW, NE

Date Completed	: 09/20/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 442.70
Sampling Method	: MacroCore (60")	Top of Casing Elevation	445.84
Drilling Company	: PSC	X,Y Coordinates	: 2384430, 553298

Depth in Feet	DESCRIPTION	Surf. Elev. 442.70	USCS
0 – 11	SILTY CLAY, trace gravel, hard, light brown, dry - hard, medium plasticity, gray (2.5Y 6/1) with yellow-brown mottling (10YR 5/6), moist	442, 437, 432	CL
11 – 19	CLAY (fat) with SAND, trace gravel, dark yellow brown with light gray mottling, mottling decreases with depth - grain size analysis @ 11 - 12 ft: 0.7% gravel, 16.4% sand, 41.4% silt, 41.4% clay - soft	427	CH
19 – 20	CLAY (lean) with SAND, trace gravel, stiff to hard, medium plasticity, dark yellow brown		CL

Samples	Recovery inches	Qp TSF
1	25/48	4.5+
2		4.5+
3	47/60	4.5
4		4.5
5		4.5
6	53/60	4.5
7		4.0
8		4.0
9		3.0
10	52/60	4.5
11		3.5
12		3.5
13		2.0
14	60/60	

Well: MW-253
Elev.: 445.84



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KELRON ENVIRONMENTAL
INCORPORATED

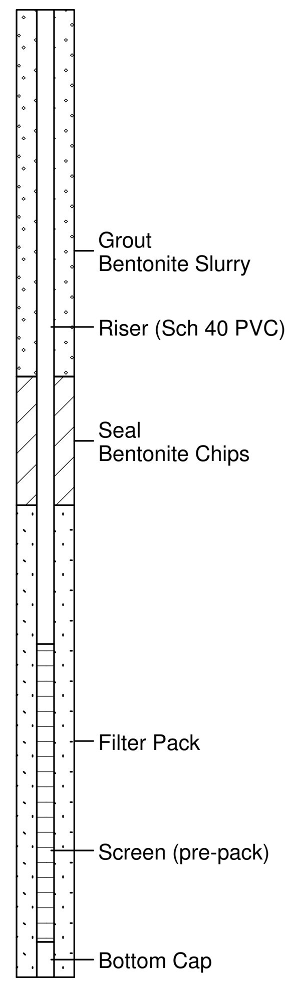
LOG OF BORING MW-253

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 15 SW, SW, NE

Date Completed	: 09/20/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 442.70
Sampling Method	: MacroCore (60")	Top of Casing Elevation	445.84
Drilling Company	: PSC	X,Y Coordinates	: 2384430, 553298

Depth in Feet	DESCRIPTION	Surf. Elev. 442.70	Samples	Recovery inches	Qp TSF	USCS
20	- grain size analysis @ 19 - 19.5 ft: 0.7% gravel, 26.9% sand, 38.1% silt, 34.3% clay	422				
			14	60/60		CL
25	- small fine sand seams from 25 to 27 feet	417	15	60/60		
	CLAY (fat), shaley, platy/laminated, soft, low plasticity, light yellow brown (10YR 6/4)		16		3.5	
	- stiff to very stiff, light olive brown (2.5Y 5/4)		17		3.0	
30	- grain size analysis @ 29 - 30 ft: 6.7% sand, 21.6% silt, 71.7% clay	412	18	60/60	4.5	CH
			19		3.5	
	- Drove split-spoon 2-inches into bedrock: 34.5 to 34.7 feet bls		20		3.0	
	LIMESTONE with SHALE		21	2/2		LS/SH
35	Auger refusal at 35.0 feet END BOREHOLE AT 35.0 FEET BLS	407				
40						

Well: MW-253
Elev.: 445.84



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KELRON ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-154

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 09 SW, NE, SW

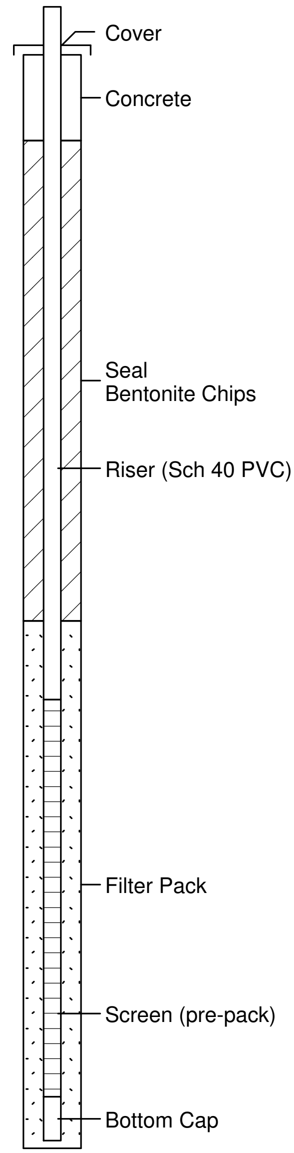
Date Completed	: 09/20/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 384.99
Sampling Method	: MacroCore (60")	Top of Casing Elevation	387.76
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2377892, 557163

Depth in Feet	DESCRIPTION	Surf. Elev. 384.99	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	SILTY CLAY, hard, very dark gray (10YR 3/1), dry	384	1	35/48		CL	
2	CLAY, black, moist	379	2	44/60		CH	
7	SANDY CLAY with gravel, very stiff to hard, low plasticity, dark gray with yellow-brown mottling, dry - grain size analysis @ 8-9.2 ft: 17.4% gravel, 30.5 %sand, 18.8% silt, 33.4% clay		3	24/42		CL	
11	CLAY, shaley, gray with light olive-brown mottling - grain size analysis @ 11-12 ft: 12.5% sand, 23% silt, 64.5% clay Refusal in bedrock at 12.5 feet BLS	374				CH	
12.5	LIMESTONE		4	1/6		LS	

Drove split-spoon to 12.75 feet BLS - 1-inch recovery
END BOREHOLE AT 12.75 FEET BLS

Depth scale: 0, 5, 10, 15

Well: MW-154
Elev.: 387.76



KELRON ENVIRONMENTAL
INCORPORATED

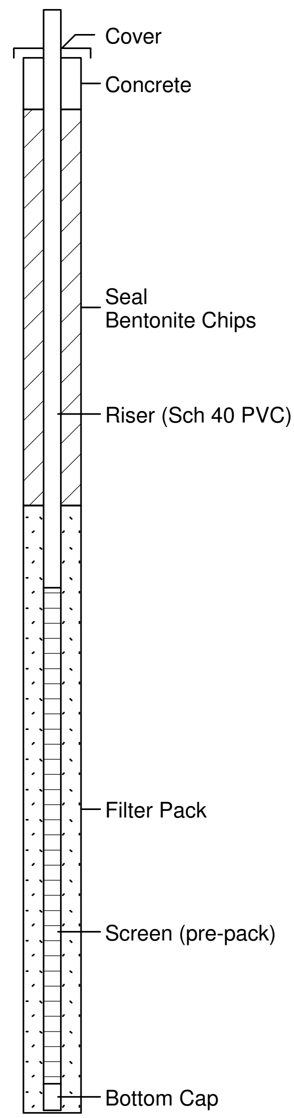
LOG OF BORING MW-155

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 09 SW, SE, SW

Date Completed	: 09/10/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 390.62
Sampling Method	: MacroCore (60")	Top of Casing Elevation	393.55
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2378141, 555983

Depth in Feet	DESCRIPTION	Surf. Elev. 390.62	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	SILTY CLAY, hard, reddish brown, dry	390	1	40/48		CL	
			2				
			3				
	CLAY (lean), hard, low plasticity, pale brown (10YR 6/3), grading to Fat CLAY		4		4.5	CL/CH	
5		385	5	53/60			
			6				
	- grain size analysis @ 7 - 8 ft: 2.5% sand, 47.2% silt, 50.3% clay		7		4.5+		
			8				
	SANDY CLAY, dry		9		0.75	CL	
	SAND, 4-inch seam, poorly graded, loose		10	44/60		SP	
10	CLAY with sand grading to SANDY CLAY, very soft, moist	380	11			CL	
			12		1.5		
			13				
			14		1.5		
15		375	15	50/60			
			16		0.5		
			17				
	CLAYEY SAND, poorly graded, dark yellow brown		18		1.5	SC	
	- grain size analysis @ 18.5 - 19.5 ft: 53.9 %sand, 28.1% silt, 18.0% clay		19				
20			20				
	END BOREHOLE AT 20.5 FEET BLS	370					
25							

Well: MW-155
Elev.: 393.55



KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE MW-161

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

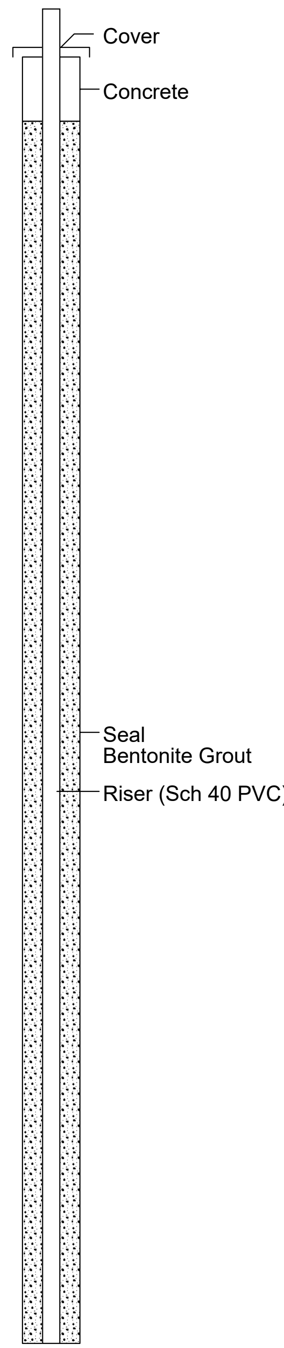
Date Completed	: 08/21/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 428.74
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.27
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379206, 557078

Depth in Feet: 0 – 20

DESCRIPTION	USCS
FILL - Silt with clay, organics (roots), stiff, non-plastic, light yellowish brown (10YR 6/4), dry	FL/CL
SILT with clay, roots, hard, brownish yellow (10YR 6/6)	ML
Silty CLAY with roots, very stiff, medium plasticity, with reddish-brown mottling and manganese staining, moist - medium hardness, medium to high plasticity, light brownish gray (10YR 6/2) with mottling and manganese staining	CL
SILT, stiff, non-plastic, brownish yellow (10YR 6/6) - with clay, very soft, medium plasticity, wet	ML
Silty CLAY, stiff to very stiff, high plasticity, light brownish gray (10YR 6/2) with reddish brown and black mottling grading to light gray, moist	CL
SILT, very soft, non-plastic, light brownish gray (10YR 6/2) - wet	ML
Silty CLAY, stiff, medium plasticity, gray (10YR 6/1), moist - soft to medium hardness, high plasticity, yellowish brown (10YR 5/6) - <25% mottling	CL

Surf. Elev. 428.74	Samples	Recovery inches	Qp TSF
	1	38/42	2.75
	2		>4.5
	3		3.0
425	4	60/60	2.0
	5		2.0
	6		2.25
	7		2.5
	8		1.75
420	9	60/60	1.0
	10		2.5
	11		1.0
	12		0.75
	13		2.0
415	14	60/60	1.5
	15		1.25
	16		1.5
	17		1.25
	18		2.25
410	19	60/60	2.0
	20		1.0

Well: MW-161
Elev.: 431.27



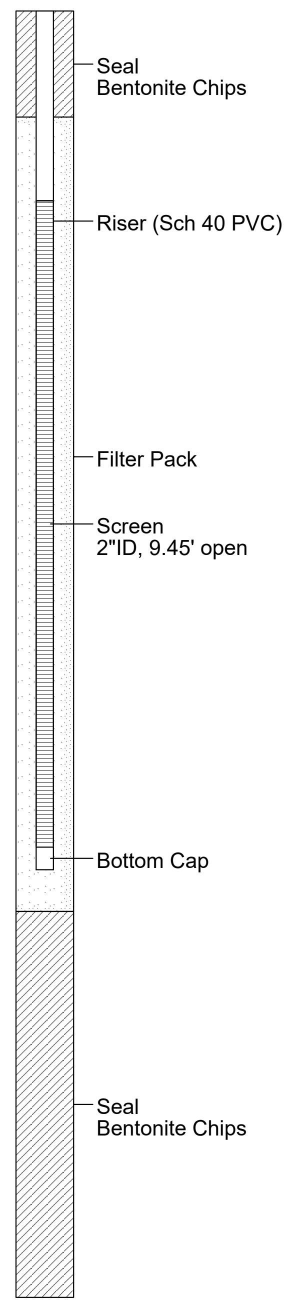
KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE MW-161 (Page 2 of 3)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/21/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 428.74
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.27
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379206, 557078

Depth in Feet	DESCRIPTION	Surf. Elev. 428.74	Samples	Recovery inches	Qp TSF	USCS
20			20		1.0	CL
	SILT with clay, stiff, low plasticity, brownish yellow (10YR 6/8)		21		2.0	ML
	- soft, yellowish brown (10YR 5/4), wet		22		2.0	
	Silty CLAY, stiff, low to medium plasticity, pale brown (10YR 6/3) with reddish-brown mottling, moist		23		1.0	CL
	- soft to very soft, high plasticity, light yellowish brown - brown (10YR 5/3) with <10% reddish brown mottling	405	24	60/60	0.75	
25			25			
			26			
	- with fine sand		27		1.0	
			28			
	SAND with Silt, fine grained, gray-brown, wet	400	29	53/60		SP/SM
30			30			
	<Sample MC161-32 @ 31.5-32.5'> grain size analysis: 89.8% Sand, 10.2% Silt		31			
	- pale green (Gley1 5G 6/2)		32			
	CLAY (lean), trace fine-medium sand, hard, low plasticity, greenish-gray (10GY 5/1), moist [TILL]		33		3.0	CL
	- medium to stiff, medium to high plasticity	395	34	60/60	2.5	
35			35		1.25	
			36		1.5	
			37		1.75	
			38		3.0	
	- trace sand, stiff to hard	390	39	44/60	2.0	
40			40		1.5	

Well: MW-161
Elev.: 431.27



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KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE MW-161

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/21/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 428.74
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.27
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379206, 557078

Well: MW-161
Elev.: 431.27

Depth in Feet	DESCRIPTION	Surf. Elev. 428.74	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
40			40		1.5	CL	
			41		2.0	CL	
			42		1.5	CL	
	Sandy SILT, medium hardness, non-plastic					ML	
	Silty CLAY with shale and fine-coarse limestone gravel (rounded to sub-rounded up to 1.5"), stiff to very stiff, greenish gray (Gley1 10Y 5/1)	385	43		2.0	CL	
			44	14/14	>4.5		
45	SHALE, laminated, hard, weathered (top of bedrock = 44.3' bls)					SH	
	END BOREHOLE AT 44.7 FEET BLS Refusal of Macrocore and Auger on top of competent bedrock						
		380					
50							
		375					
55							
		370					
60							

Seal
Bentonite Chips

KELRON ENVIRONMENTAL
Incorporated

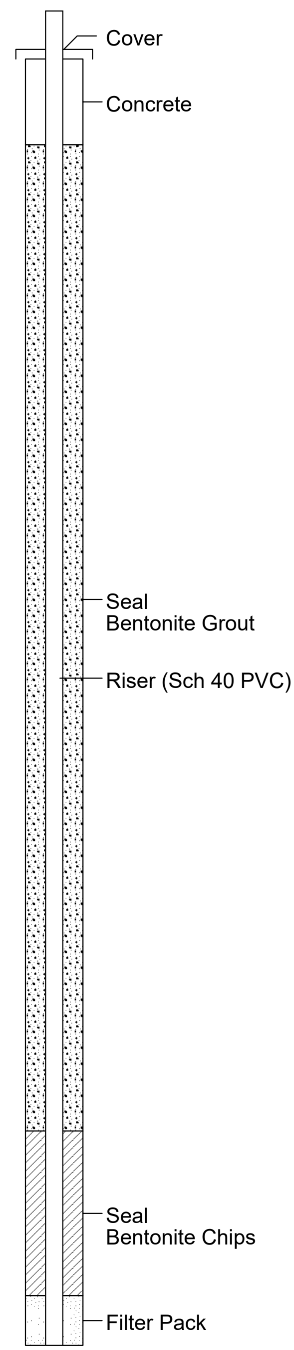
LOG OF PROBEHOLE MW-162

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/20/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.83
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.20
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555725

Depth in Feet	DESCRIPTION	Surf. Elev. 430.83	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continous Boring - no soil sampling conducted. Descriptions of subsurface materials on this log are from adjacent boring log for well MW-262.						
	Silty Clay with gravel, roots, stiff, non-plastic, pale brown (10YR 6/3), dry	430				CL	
	- brownish yellow (10YR 6/6), moist						
5	- medium stiff, high plasticity	425					
	SILT, very soft, non-plastic, light yellowish brown (10YR 6/4), moist [LOESS]					ML	
10	- clayey, soft to medium hardness, low to medium plasticity	420					
	- soft, yellowish brown (10YR 5/4)						
15	- non-plastic						

Well: MW-162
Elev.: 433.20



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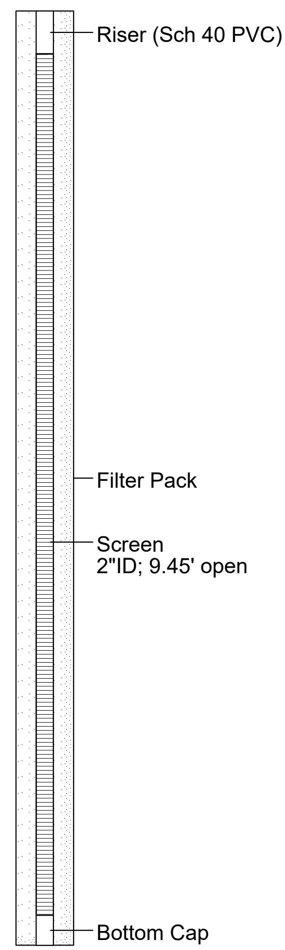
LOG OF PROBEHOLE MW-162

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/20/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.83
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.20
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555725

Depth in Feet	DESCRIPTION	Surf. Elev. 430.83	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
15		415				ML	
	Sandy CLAY (lean), medium hardness, low to medium plasticity, yellowish brown, moist					CL	
20	SILT, very soft, non-plastic, brownish yellow (10YR 6/6), moist	410				ML	
25	Silty CLAY, very soft, low plasticity - medium plasticity, wet	405				CL	
	END BOREHOLE AT 25.9 feet BLS						
30							

Well: MW-162
Elev.: 433.20



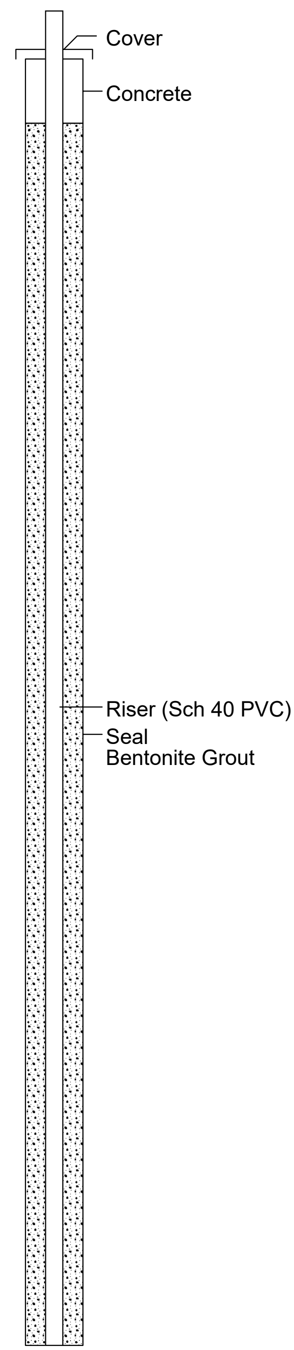
KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE MW-262
	(Page 1 of 3)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.86
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.21
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555729

Depth in Feet	DESCRIPTION	Surf. Elev. 430.86	Samples	Recovery inches	Qp TSF	USCS
0	Silty Clay with gravel, roots, stiff, non-plastic, pale brown (10YR 6/3), dry	430	1	60/60	2.5	CL
			2		>4.5	
	- brownish yellow (10YR 6/6), moist		3		3.25	
			4		2.5	
			5		2.25	
5	- medium stiff, high plasticity	425	6	42/42	1.5	
			7		1.75	
			8		2.0	
	SILT, very soft, non-plastic, light yellowish brown (10YR 6/4), moist [LOESS]		9	60/60	1.0	ML
10	- clayey, soft to medium hardness, low to medium plasticity		10		1.5	
		420	11		1.25	
			12		1.5	
			13		1.5	
	- soft, yellowish brown (10YR 5/4)		14	60/60	1.0	
15	- non-plastic		15		1.25	
		415	16		1.25	
			17		1.5	
	Sandy CLAY (lean), medium hardness, low to medium plasticity, yellowish brown, moist		18		2.0	CL
	SILT, very soft, non-plastic, brownish yellow (10YR 6/6), moist		19	60/60	2.0	ML
20			20			

Well: MW-262
Elev.: 433.21



KELRON ENVIRONMENTAL
Incorporated

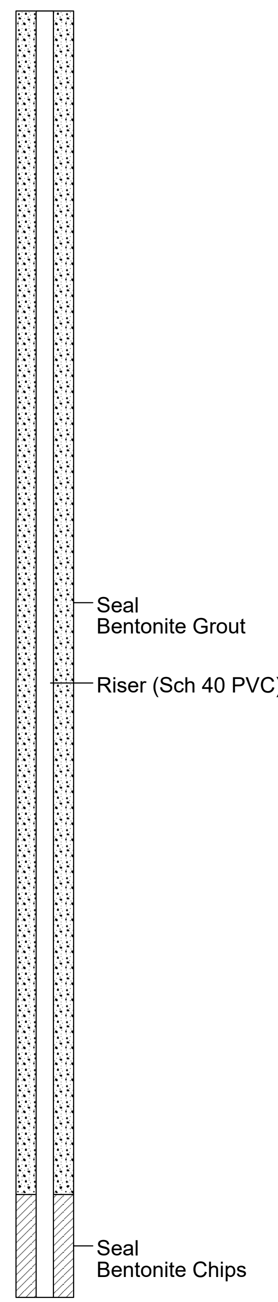
LOG OF PROBEHOLE MW-262

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.86
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.21
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555729

Depth in Feet	DESCRIPTION	Surf. Elev. 430.86	Samples	Recovery inches	Qp TSF	USCS
20			20			ML
		410	21			
			22			
	Silty CLAY, very soft, low plasticity - medium plasticity, wet		23		0.75	CL
			24	60/60	0.75	
25			25		0.75	
	- high plasticity, yellowish brown (10YR 5/4)	405	26		0.75	
			27		0.5	
	- moist		28		1.25	
			29	53/60	1.0	
30	- with fine sand		30		0.75	
		400	31			
	SAND, fine to medium grained, with clay, yellowish brown (10YR 5/6), wet - light brownish gray		32			SW/SC
	CLAY (fat), trace fine to medium sand, high plasticity, light brownish gray <Sample ST262-35 @ 33.5 - 35.5'> grain size analysis: 13.1% Sand, 33.2% Silt, 53.7% Clay		33			CH
			34	24/24		
35			35			
	- very stiff, greenish gray (Gley1 10Y 6/1)	395	36	16/36	2.75	
			37			
	- medium plasticity		38		2.75	
			39	56/60	1.0	
40			40		0.75	

Well: MW-262
Elev.: 433.21



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KELRON ENVIRONMENTAL Incorporated

LOG OF PROBEHOLE MW-262

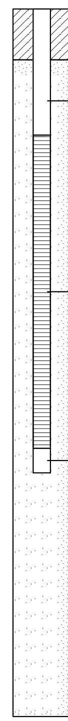
Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.86
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.21
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555729

Depth in Feet	DESCRIPTION	Surf. Elev. 430.86	Samples	Recovery inches	Qp TSF	USCS
40	- with <10% reddish-brown mottling	390	40, 41		0.75, 1.25	CH
	SAND with Silt, fine grained, poorly graded, light brown (10YR 6/4), wet		42		1.5	SP/SM
	Sandy SILT		43			ML
	Silty CLAY with fine sand, very soft, brownish yellow (10YR 6/6)		44, 45	60/60	0.75, 0.75	CL
45	SAND, fine grained, poorly graded	385	46		1.25	SP
	SAND, fine to coarse grained, well graded, trace gravel					SW
	Silty CLAY with trace and and gravel, stiff, high plasticity, light yellowish brown (10YR 6/4), moist [TILL] - trace reddish-brown mottling		47, 48, 49, 50	30/30	3.0, 2.25, 2.25, 2.25	CL
50	SHALE, clay partings, laminated, gray, weathered, dry (top of bedrock = 50.4' bls)	380	51		3.5	SH
	END BOREHOLE AT 51 feet BLS					
55		375				
60						

GRAPHIC

Well: MW-262
Elev.: 433.21



KELRON ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-252

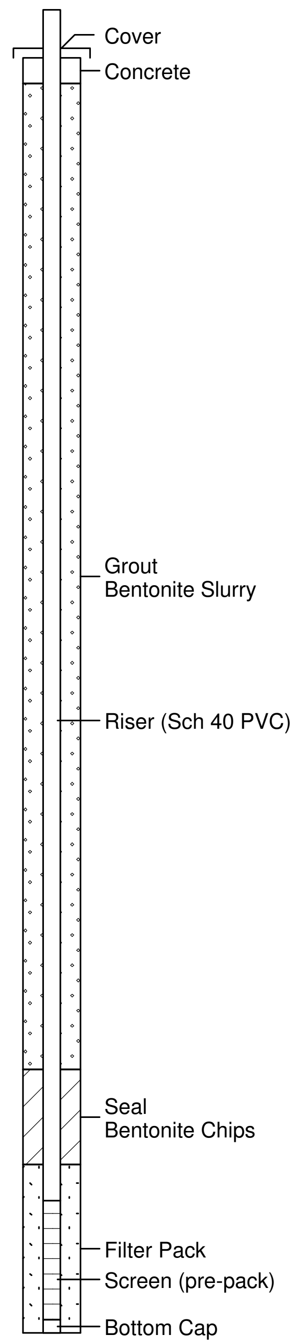
(Page 1 of 1)

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/22/10	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 422.27
Sampling Method	: MacroCore (60")	Top of Casing Elevation	425.07
Drilling Company	: PSC	X,Y Coordinates	: 2382784, 553904

Depth in Feet	DESCRIPTION	Surf. Elev. 422.27	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring - no soil sampling conducted. Refer to boring log for adjacent nested well MW-352 for a description of subsurface materials.	422					
5		417					
10		412					
15		407					
20		402					
25		397					
30		392					
35		387					
40		382					
45		377					
50	END BOREHOLE AT 49.54 FEET BLS						

Well: MW-252
Elev.: 425.07



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KELRON
ENVIRONMENTAL
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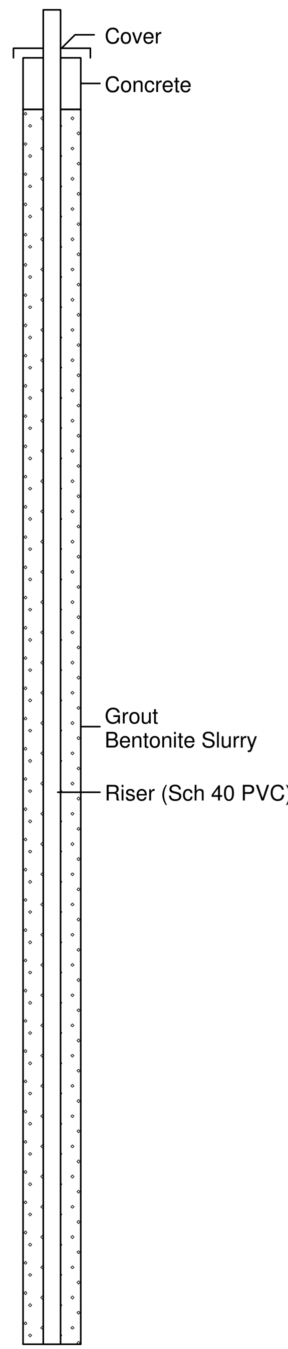
LOG OF BORING MW-352

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/16/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 422.36
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	425.04
Drilling Company	: PSC	X,Y Coordinates	: 2382789, 553901

Depth in Feet	DESCRIPTION	Surf. Elev. 422.36	Samples	Recovery inches	Qp TSF	USCS
0	SILTY CLAY, very stiff to hard, yellow brown (10YR 5/6), dry	422				CL
			1	46/48	4.5+	
			2	60/60	3.5	
5	CLAY, trace sand and fine gravel, very stiff, high plasticity, few black organic material	417	3		4.0	CL
			4		2.75	
			5		3.0	
10	- medium hard	412	6	60/60	2.75	
			7		2.0	
	- soft		8		1.0	
			9		1.25	
15		407	10	60/60	1.5	
	- medium hard		11		2.5	
	SAND, poorly graded, loose, wet (4-inch thick)					SP
	SANDY CLAY, trace fine gravel, yellow brown to olive brown (2.5Y 5/3)		12		2.75	CL
			13		3.5	
20		402	14	60/60	4.5+	
			15		2.5	
			16		2.5	
			17		2.75	
			18	48/60	2.5	
25						

Well: MW-352
Elev.: 425.04



KELRON ENVIRONMENTAL INCORPORATED

LOG OF BORING MW-352

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/16/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 422.36
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	425.04
Drilling Company	: PSC	X,Y Coordinates	: 2382789, 553901

Well: MW-352
Elev.: 425.04

Depth in Feet	DESCRIPTION	Surf. Elev. 422.36	Samples	Recovery inches	Qp TSF	USCS
25	- grain size analysis @ 26.5 - 27.5 ft: 33.7% sand, 27.1% silt, 39.2% clay	397	18	48/60	2.5	CL
	SAND with few gravel, yellow brown					SP
	CLAY, some sand and fine gravel, hard to very hard, high plasticity, dark yellow brown (10YR 4/6)		19	60/60	3.0	CL
30	CLAY, lean to fat	392	20		3.0	CL/CH
	- grain size analysis @ 32 - 33 ft: 13.2% sand, 43.9% silt, 42.8% clay		21		3.5	
			22		3.0	
35		387	23	48/60	1.5	
	- medium hard, high plasticity, gray brown to light olive brown (2.5Y 5/2-5/3)		24		1.5	
	- trace silt, dark yellow brown (10YR 4/4)		25		1.75	
			26		1.5	
40		382	27	54/60	1.75	
			28		2.0	
			29		2.5	
			30		2.5	
			31	57/60	2.0	
45		377	32		1.75	
	CLAY, medium hard, low plasticity, olive brown (2.5Y 5/4)		33		1.75	CL
			34		2.5	
			35		1.75	
			36	3/3		
50						

Well construction: Grout Bentonite Slurry; Riser (Sch 40 PVC)

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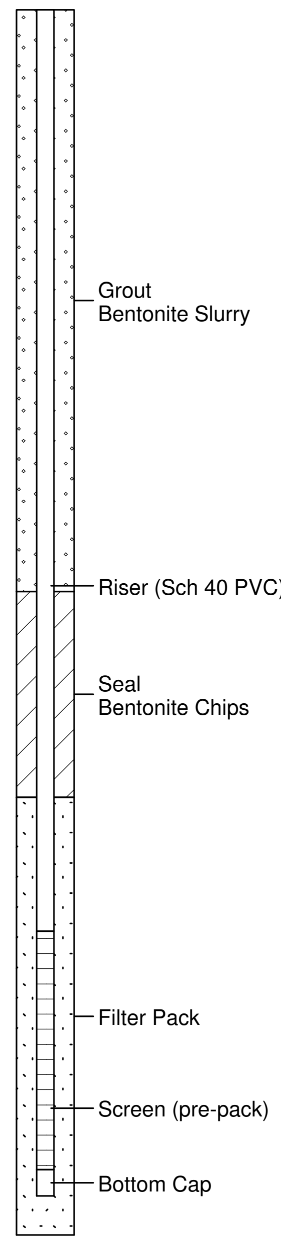
KELRON ENVIRONMENTAL INCORPORATED	LOG OF BORING MW-352
	(Page 3 of 3)

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/16/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 422.36
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	425.04
Drilling Company	: PSC	X,Y Coordinates	: 2382789, 553901

Depth in Feet	DESCRIPTION	Surf. Elev. 422.36	Samples	Recovery inches	Qp TSF	USCS
50	- Auger refusal at 53.7 feet bgs	372				CL
	LIMESTONE, weathered, thinly laminated, medium hard to hard, gray		37	5/5		LS
55		367	38	8/27		
	SHALE, clayey, gray					SH
	LIMESTONE, occasional shale partings		39	19/60		LS
60	- laminated, fossiliferous, medium gray	362	40	54/60		
	SHALE, soft, dark gray					SH
65		357				
	LIMESTONE, medium hard to hard, light gray		41	59/60		LS
70	Borehole diameter from 53.7 to 73.8 feet bgs = 3 7/8"	352				
	RQD for 53.8 - 73.8' = 57% (Fair) Recovery = 173/240"		42	33/34		
	END BOREHOLE AT 73.8 FEET BLS					
75						

Well: MW-352
Elev.: 425.04



KELRON ENVIRONMENTAL
INCORPORATED

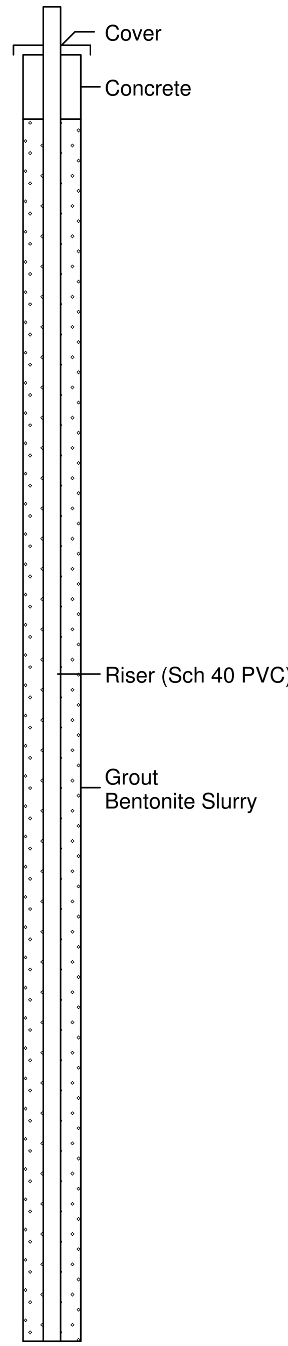
LOG OF BORING MW-253

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 15 SW, SW, NE

Date Completed	: 09/20/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 442.70
Sampling Method	: MacroCore (60")	Top of Casing Elevation	445.84
Drilling Company	: PSC	X,Y Coordinates	: 2384430, 553298

Depth in Feet	DESCRIPTION	Surf. Elev. 442.70	Samples	Recovery inches	Qp TSF	USCS
0	SILTY CLAY, trace gravel, hard, light brown, dry	442	1	25/48	4.5+	CL
			2		4.5+	
5	- hard, medium plasticity, gray (2.5Y 6/1) with yellow-brown mottling (10YR 5/6), moist	437	3	47/60	4.5	
			4		4.5	
			5		4.5	
10		432	6	53/60	4.5	
	CLAY (fat) with SAND, trace gravel, dark yellow brown with light gray mottling, mottling decreases with depth - grain size analysis @ 11 - 12 ft: 0.7% gravel, 16.4% sand, 41.4% silt, 41.4% clay		7		4.0	CH
			8		4.0	
			9		3.0	
15		427	10	52/60	4.5	
			11		3.5	
			12		3.5	
	- soft		13		2.0	
	CLAY (lean) with SAND, trace gravel, stiff to hard, medium plasticity, dark yellow brown		14	60/60		CL
20						

Well: MW-253
Elev.: 445.84



KELRON ENVIRONMENTAL
INCORPORATED

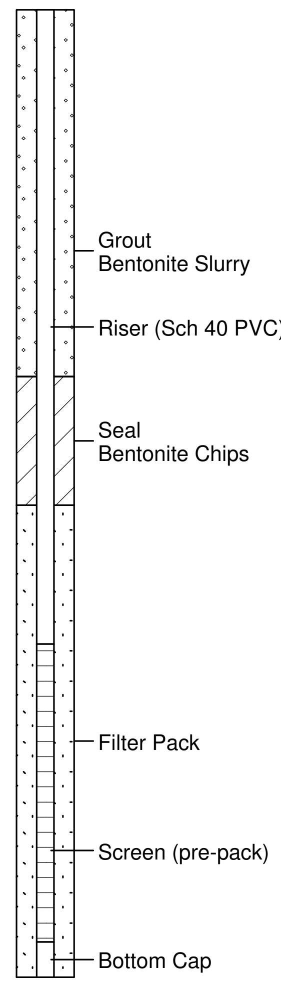
LOG OF BORING MW-253

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 15 SW, SW, NE

Date Completed	: 09/20/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 442.70
Sampling Method	: MacroCore (60")	Top of Casing Elevation	445.84
Drilling Company	: PSC	X,Y Coordinates	: 2384430, 553298

Depth in Feet	DESCRIPTION	Surf. Elev. 442.70	Samples	Recovery inches	Qp TSF	USCS
20	- grain size analysis @ 19 - 19.5 ft: 0.7% gravel, 26.9% sand, 38.1% silt, 34.3% clay	422	14	60/60		CL
25	- small fine sand seams from 25 to 27 feet	417	15	60/60		CL
	CLAY (fat), shaley, platy/laminated, soft, low plasticity, light yellow brown (10YR 6/4)		16		3.5	CH
	- stiff to very stiff, light olive brown (2.5Y 5/4) - grain size analysis @ 29 - 30 ft: 6.7% sand, 21.6% silt, 71.7% clay		17		3.0	CH
30		412	18	60/60	4.5	CH
			19		3.5	CH
	- Drove split-spoon 2-inches into bedrock: 34.5 to 34.7 feet bls		20		3.0	CH
	LIMESTONE with SHALE		21	2/2		LS/SH
35	Auger refusal at 35.0 feet END BOREHOLE AT 35.0 FEET BLS	407				
40						

Well: MW-253
Elev.: 445.84



KELRON ENVIRONMENTAL
Incorporated

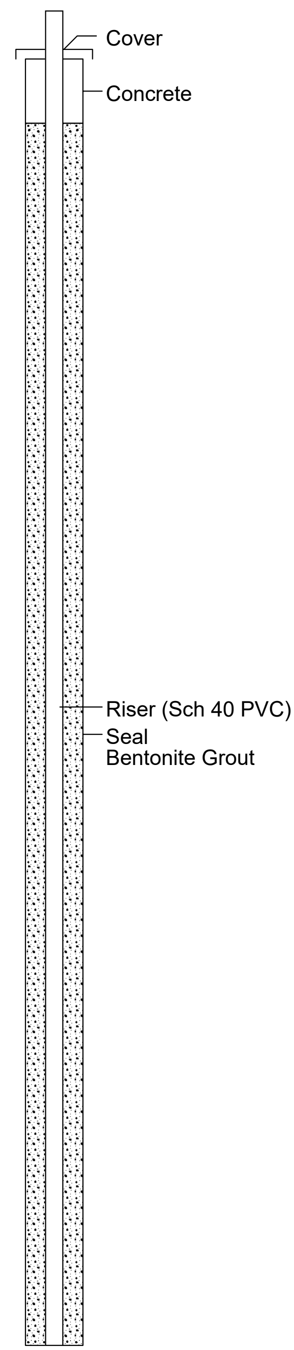
LOG OF PROBEHOLE MW-262

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.86
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.21
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555729

Depth in Feet	DESCRIPTION	Surf. Elev. 430.86	Samples	Recovery inches	Qp TSF	USCS
0	Silty Clay with gravel, roots, stiff, non-plastic, pale brown (10YR 6/3), dry		1	60/60	2.5	CL
		430	2		>4.5	
	- brownish yellow (10YR 6/6), moist		3		3.25	
			4		2.5	
			5		2.25	
5	- medium stiff, high plasticity		6	42/42	1.5	
		425	7		1.75	
			8		2.0	
	SILT, very soft, non-plastic, light yellowish brown (10YR 6/4), moist [LOESS]		9	60/60	1.0	ML
10	- clayey, soft to medium hardness, low to medium plasticity		10		1.5	
		420	11		1.25	
			12		1.5	
			13		1.5	
	- soft, yellowish brown (10YR 5/4) - non-plastic		14	60/60	1.0	
15			15		1.25	
		415	16		1.25	
			17		1.5	
	Sandy CLAY (lean), medium hardness, low to medium plasticity, yellowish brown, moist		18		2.0	CL
	SILT, very soft, non-plastic, brownish yellow (10YR 6/6), moist		19	60/60	2.0	ML
20			20			

Well: MW-262
Elev.: 433.21



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KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE MW-262

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.86
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.21
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555729

Well: MW-262
Elev.: 433.21

Depth in Feet	DESCRIPTION	Surf. Elev. 430.86	Samples	Recovery inches	Qp TSF	USCS
20			20			ML
		410	21			ML
			22			ML
	Silty CLAY, very soft, low plasticity - medium plasticity, wet		23		0.75	CL
			24	60/60	0.75	CL
25			25		0.75	CL
	- high plasticity, yellowish brown (10YR 5/4)	405	26		0.75	CL
	- moist		27		0.5	CL
			28		1.25	CL
			29	53/60	1.0	CL
30	- with fine sand		30		0.75	CL
		400	31			CL
	SAND, fine to medium grained, with clay, yellowish brown (10YR 5/6), wet - light brownish gray		32			SW/SC
	CLAY (fat), trace fine to medium sand, high plasticity, light brownish gray <Sample ST262-35 @ 33.5 - 35.5'> grain size analysis: 13.1% Sand, 33.2% Silt, 53.7% Clay		33			CH
			34	24/24		CH
35			35			CH
	- very stiff, greenish gray (Gley1 10Y 6/1)	395	36	16/36	2.75	CH
			37			CH
	- medium plasticity		38		2.75	CH
			39	56/60	1.0	CH
40			40		0.75	CH

Seal
Bentonite Grout

Riser (Sch 40 PVC)

Seal
Bentonite Chips

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KELRON ENVIRONMENTAL
Incorporated

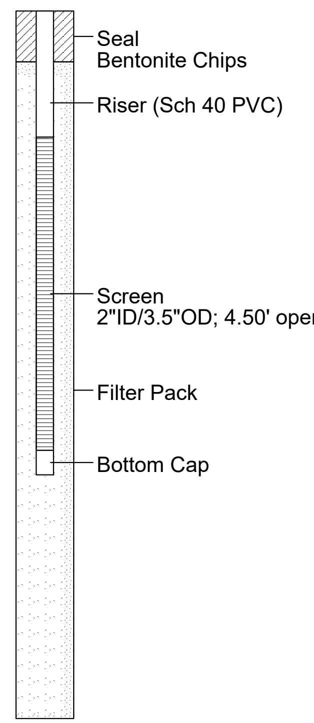
LOG OF PROBEHOLE MW-262

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.86
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.21
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555729

Well: MW-262
Elev.: 433.21

Depth in Feet	DESCRIPTION	Surf. Elev. 430.86	Samples	Recovery inches	Qp TSF	USCS
40			40		0.75	
	- with <10% reddish-brown mottling	390	41		1.25	CH
			42		1.5	
	SAND with Silt, fine grained, poorly graded, light brown (10YR 6/4), wet					SP/SM
	Sandy SILT		43			ML
	Silty CLAY with fine sand, very soft, brownish yellow (10YR 6/6)		44	60/60	0.75	CL
45			45		0.75	
	SAND, fine grained, poorly graded	385	46		1.25	SP
	SAND, fine to coarse grained, well graded, trace gravel					SW
	Silty CLAY with trace and and gravel, stiff, high plasticity, light yellowish brown (10YR 6/4), moist [TILL]		47		3.0	
	- trace reddish-brown mottling		48		2.25	CL
			49	30/30	2.25	
50			50		2.25	
	SHALE, clay partings, laminated, gray, weathered, dry (top of bedrock = 50.4' bls)	380	51		3.5	SH
	END BOREHOLE AT 51 feet BLS					
55		375				
60						



SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-304

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	10/9/2015	10/20/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-304	Feet (NAVD88)	453.03 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,194.03 N, 2,386,608.77 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 17.9952"
Long -89° 51' 12.39"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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
			0–5.8	0 - 5.8' **SILTY CLAY** CL/ML.	CL/ML								0-35.4' Blind Drilled. See log MW-104DR for soil description details.
			5.8–12	5.8 - 13.5' **FAT CLAY:** CH.	CH								

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

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

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
			13	5.8 - 13.5' **FAT CLAY:** CH. *(continued)*	CH									
			14–15	13.5 - 15' **LEAN CLAY:** CL.	CL									
			15–23	15 - 23.5' **SILTY CLAY** CL/ML.	CL/ML									
			24	23.5 - 24.5' **SANDY FAT CLAY:** s(CH).	s(CH)									
			25–27	24.5 - 27.3' **POORLY-GRADED SAND:** SP.	SP									
			28–30	27.3 - 30' **SILTY CLAY** CL/ML.	CL/ML									
			30–32	30 - 35.4' **SHALE:** BDX (SH).	BDX (SH)									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

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
			33–35	30 - 35.4' **SHALE:** BDX (SH). *(continued)*	BDX (SH)									
1 CORE	60 31		36–41	35.4 - 41.3' **LEAN CLAY:** CL, gray, 2" of wood on top of unit, stiff, dry. 36.3' stiff to very hard, dry. 36.7' trace chert gravel.	CL									
2 CORE	60 59.5			40.2' dry.										
			42–46	41.3 - 46.8' **SHALEY LIMESTONE:** BDX (LS/SH), thinly to medium bedded with shale, intensely to moderately fractured (extremely narrow apertures). 41.6' - 42' vertical fracture.	BDX (LS/SH)									
3 CORE	60 63			45.4' intensely fractured.										Core 3, RQD=75%
			47–52	46.8 - 55.6' **SHALE:** BDX (SH), gray, trace chert gravel, thickly bedded, highly to moderately decomposed, intensely fractured.	BDX (SH)									
4 CORE	60 65			50.4' moderately fractured.										Core 4, RQD=95%

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

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
			53, 54, 55	46.8 - 55.6' **SHALE:** BDX (SH), gray, trace chert gravel, thickly bedded, highly to moderately decomposed, intensely fractured. *(continued)* 54.4' intensely fractured.	BDX (SH)									
5 CORE	60 57		56, 57, 58, 59, 60	55.6 - 60.2' **LIMESTONE:** BDX (LS), shaley, thickly bedded, fossiliferous, unfractured to slightly fractured.	BDX (LS)									Core 5, RQD=95% Bedrock corehole reamed 6" in diameter to 59' for well installation.
6 CORE	60 64		61, 62, 63, 64	60.2 - 81.6' **SHALEY LIMESTONE:** BDX (LS/SH), medium bedded, mostly fossiliferous limestone, highly decomposed dark gray shale beds, intensely to moderately fractured.										Core 6, RQD=73%
7 CORE	60 66		65, 66, 67, 68, 69, 70		BDX (LS/SH)									Core 7, RQD=64%
8 CORE	60 63		71, 72	70.3' thickly bedded with dark gray shale.										Core 8, RQD=88%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

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		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			73	60.2 - 81.6' **SHALEY LIMESTONE:** BDX (LS/SH), medium bedded, mostly fossiliferous limestone, highly decomposed dark gray shale beds, intensely to moderately fractured. *(continued)*	BDX (LS/SH)									
			74											
9 CORE	60 60		75	75' diagonal fracture (narrow aperture). 75.3' intensely fractured.										Core 9, RQD=50%
			76–79											
10 CORE	60 72		80	80.3' moderately fractured.										Core 10, RQD=43%
			81											
			82	81.6 - 91.9' **SHALE:** BDX (SH), gray, highly decomposed, intensely fractured.	BDX (SH)									
			83–84											
11 CORE	60 65		85	85.4' moderately to highly decomposed, intensely to moderately fractured.										Core 11, RQD=57%
			86–89											
12 CORE	60 61.5		90	90.5' extremely narrow to very narrow apertures.										Core 12, RQD=50%
			91–92											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

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
			93	91.9 - 115.3' **SHALEY LIMESTONE:** BDX (LS/SH), thinly to medium bedded with shale, slightly to moderately decomposed shale, intensely to moderately fractured (extremely narrow to narrow apertures). *(continued)*										
13 CORE	60 62		95	95.3' tight to very narrow apertures.										Core 13, RQD=48%
14 CORE	60 65		100	100.4' thickly bedded, moderately fractured.										Core 14, RQD=65%
			102		BDX (LS/SH)									
15 CORE	60 60		105	105.3' medium bedded, slightly fractured (very narrow apertures).										Core 15, RQD=98%
16 CORE	60 72		110	110.3' moderately fractured.										Core 16, RQD=91%
			112											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

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
			113–115	91.9 - 115.3' **SHALEY LIMESTONE:** BDX (LS/SH), thinly to medium bedded with shale, slightly to moderately decomposed shale, intensely to moderately fractured (extremely narrow to narrow apertures). *(continued)*	BDX (LS/SH)									
17 CORE	60 60.5		116–120	115.3 - 135.4' **LIMESTONE:** BDX (LS), fossiliferous, thinly to medium bedded, slightly fractured (narrow apertures).										Core 17, RQD=100%
18 CORE	60 59		121–125	120.4' trace cherty limestone, slightly to moderately fractured (extremely narrow to very narrow apertures).	BDX (LS)									Core 18, RQD=97%
19 CORE	60 60.5		126–130	125.3' slightly fractured (very narrow to narrow apertures).										Core 19, RQD=98%
20 CORE	60 60		131–132	130.4' very narrow apertures.										Core 20, RQD=98%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-304

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
			133 134 135	115.3 - 135.4' **LIMESTONE:** BDX (LS), fossiliferous, thinly to medium bedded, slightly fractured (narrow apertures). *(continued)*	BDX (LS)									
				135.4' End of Boring.										

KELRON ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-104DR

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SE, SE

Date Completed	: 07/25/11	Driller	: Matt Cooper
Hole Diameter	: 7 3/4"OD; 3 3/4" ID	Geologist	: Stu Cravens (Kelron)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 452.62
Sampling Method	: MacroCore (60")	Top of Casing Elevation	455.62
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2386609, 554201

Depth in Feet | DESCRIPTION | Surf. Elev. 452.62

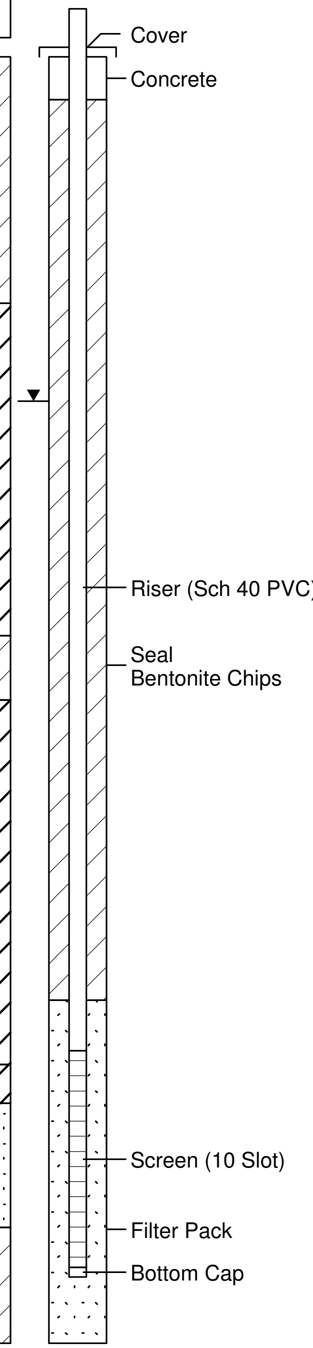
Depth in Feet	DESCRIPTION	USCS
0	SILTY CLAY, trace sand, med plasticity, organics and roots, dry hard, light gray (Gley1-7/1) with brown mottling (Fe-oxidation) (10YR 3/1), dry - moist	CL
5	CLAY (Fat) with Silt, high plasticity, soft to very soft, high organics and roots, dark gray grading to gray with brown mottling, moist - groundwater level at completion = 8.03' bls - medium hardness - light gray (GLEY1-7/1) with yellow-brown Fe-oxid mottling (10%)	CH
	CLAY (lean) with Silt, medium plasticity, light gray with yellow-brown mottling (10%)	CL
15	CLAY with Silt, trace sand and fine gravel, high plasticity, medium to stiff, light gray with brown mottling (20%) - trace sand and gravel, medium to high plasticity, medium to stiff hardness, mottling 25 to 50%	CH
	SANDY FAT CLAY, fine sand, trace fine gravel, high plasticity, greenish gray (GLEY-6/1), moist	CH
25	SAND (fine to medium), trace gravel, poorly graded, light gray, wet - brown (Slotted screen interval = 4.52 ft)	SP
	SILTY CLAY, trace sand and gravel (angular), medium plasticity, very stiff, olive brown (2.5Y 4/4) with light gray mottling <20%, moist (TILL)	CL
30		

Surf. Elev. markers: 450, 445, 440, 435, 430, 425

Samples	Recovery inches	Qp TSF
1		>4.5
2		>4.5
3	60/60	3.5
4		2.5
5		2.5
6		2.5
7		2.5
8	60/60	1
9		1
10		1
11		1.75
12		2.25
13	60/60	2.25
14		3.0
15		2.5
16		3.75
17		2.75
18	60/60	3.5
19		3.5
20		3
21		3
22		2.5
23	60/60	2.5
24		2.5
25		2.5
26		
27		2.5
28	60/60	
29		4.0
30		4.5

GRAPHIC

Well: MW-104DR
Elev.: 455.62



KELRON ENVIRONMENTAL INCORPORATED	LOG OF BORING MW-104DR

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SE, SE

Date Completed	: 07/25/11	Driller	: Matt Cooper
Hole Diameter	: 7 3/4"OD; 3 3/4" ID	Geologist	: Stu Cravens (Kelron)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 452.62
Sampling Method	: MacroCore (60")	Top of Casing Elevation	455.62
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2386609, 554201

Well: MW-104DR
Elev.: 455.62

Depth in Feet	DESCRIPTION	Surf. Elev. 452.62	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
30	SHALE, highly weathered; Clay with Silt, platy /laminated, medium to high plasticity, very stiff, moist		31		3.0	~~CL~~	
			32				
		420	33	60/60		SH	
			34		3.5		
	- unweathered, light gray, fissile, dry		35				
35	END BOREHOLE AT 35 FEET BLS						
		415					
40							
		410					
45							
		405					
50							
		400					
55							
		395					
60							

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RECORD OF SUBSURFACE EXPLORATION

MONITORING WELL BAMW-306 Renamed MW-306

PROJECT: IP BALDWIN
PHASE III. AREA 1

JOB NO.: 124081
DATE DRILLED: 09/25/91

DRILLING METHOD: H.S.A. & NX Rock Core
DRILLED BY: Crank
LOGGED BY: Brooks
BOREHOLE NUMBER: BTB-38

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	DESCRIPTION	REMARKS	RECOVERY RATIO in/in	PENETROMETER, HAND, tsf
0 – 30	Boring Continues			Augered to 53.2'. No Samples Taken. See BAMW-124; BTB-39 for sample descriptions from 0-53.5'		

RECORD OF SUBSURFACE EXPLORATION

MONITORING WELL BAMW-306 Renamed MW-306

PROJECT: IP BALDWIN — JOB NO.: 124081

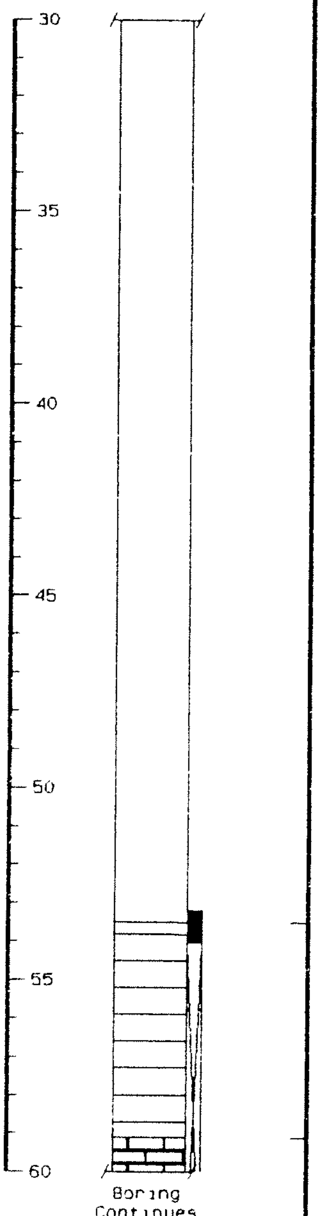
PHASE III, AREA 1 — DATE DRILLED: 09/25/91

DRILLING METHOD: H.S.A. & NX Rock Core

DRILLED BY: Crank

LOGGED BY: Brooks

BOREHOLE NUMBER: BTB-38



ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	DESCRIPTION	REMARKS	RECOVERY RATIO in/in	PENETROMETER, HAND, tsf
30				Augered to 53.2'. No Samples Taken. See BAMW-124; BTB-39 sample descriptions from 0-53.5'		
~53.5			Gray Clayey SHALE		4/10 62/108	
~59			Light Gray LIMESTONE			

BURLINGTON ENVIRONMENTAL INC.

00074

RECORD OF SUBSURFACE EXPLORATION

MONITORING WELL BAMW-306 Renamed MW-306

PROJECT: IP BALDWIN — JOB NO.: 124081

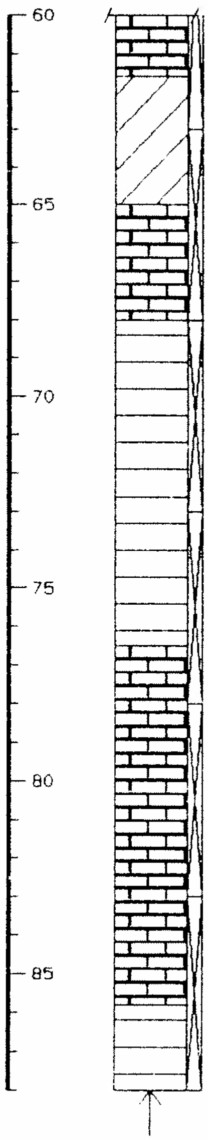
PHASE III, AREA 1 — DATE DRILLED: 09/25/91

DRILLING METHOD: H.S.A. & NX Rock Core

DRILLED BY: Crank

LOGGED BY: Brooks

BOREHOLE NUMBER: BTB-38



ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	DESCRIPTION	REMARKS	RECOVERY RATIO in/in	PENETROMETER, HAND, tsf
60			Light Gray LIMESTONE			
		CL	Gray Shaley CLAY			
					60/60	
65			Light Gray LIMESTONE			
			Olive Clayey SHALE		37/60	
70			-Dark Gray, Calcareous below 70.3'			
					60/60	
75			Light Gray LIMESTONE			
					60/60	
					59/60	
85			Dark Gray Clayey SHALE			

RECORD OF SUBSURFACE EXPLORATION

MONITORING WELL BAMW-124

PROJECT: IP BALDWIN
PHASE III, AREA 1

JOB NO.: 124081

DATE DRILLED: 09/19/91

DRILLING METHOD: H.S.A.

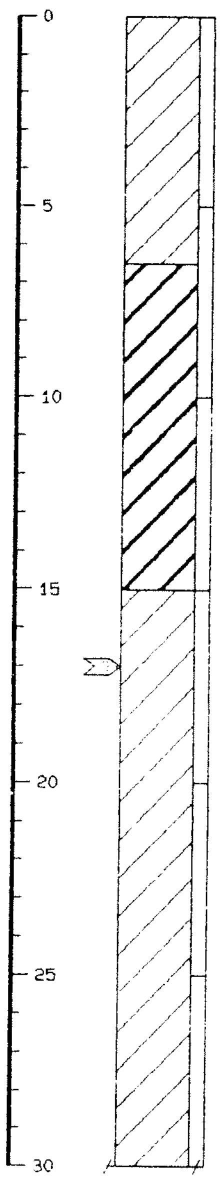
DRILLED BY: Bunselmeyer

GROUNDWATER: During Drilling - 17.0 Feet

LOGGED BY: Brooks

BOREHOLE NUMBER: BTB-39

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	DESCRIPTION	REMARKS	RECOVERY RATIO in/in	PENETROMETER, HAND, tsf
0		CL	Dark Brown Silty CLAY -2" Silt Seam @ 0.2' -Gray-Brown below 0.5'		47/60	
5					60/60	
		CH	Gray-Brown CLAY w/Silt, Sand			
10					60/60	
15		CL	Brown Silty CLAY		50/60	
				Hit Water @ 17.0'		
20			-Gray-Brown 19.5-20.0 -Dark Gray-Brown, w/Sand, Trace Gravel below 20.0' -1" Sand Seam @ 21.3'		60/60	
25			-2" Gravel Seam @ 26.7'		60/60	
30						



Boring Continues

RECORD OF SUBSURFACE EXPLORATION

MONITORING WELL BAMW-124

PROJECT: IP BALDWIN
PHASE III, AREA 1

JOB NO.: 124081
DATE DRILLED: 09/19/91

DRILLING METHOD: H.S.A.

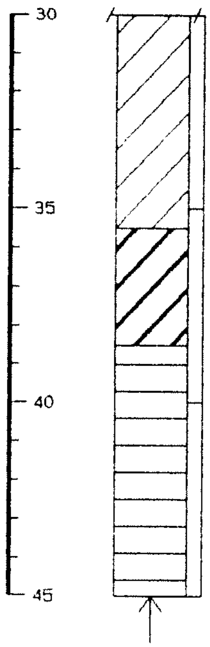
DRILLED BY: Bunselmeyer

GROUNDWATER: During Drilling - 17.0 Feet

LOGGED BY: Brooks

BOREHOLE NUMBER: BTB-39

ELEVATION / DEPTH	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	DESCRIPTION	REMARKS	RECOVERY RATIO in/in	PENETROMETER, HAND, tsf
30		CL	Dark Gray-Brown Silty CLAY w/Sand Trace Gravel		60/60	
35		CH	Dark Gray-Brown CLAY w/Silt, Sand		60/60	
			Dark Gray-Brown Weathered SHALE -Gray-Brown below 39.0'			
40					60/60	
45						



KELRON ENVIRONMENTAL
INCORPORATED

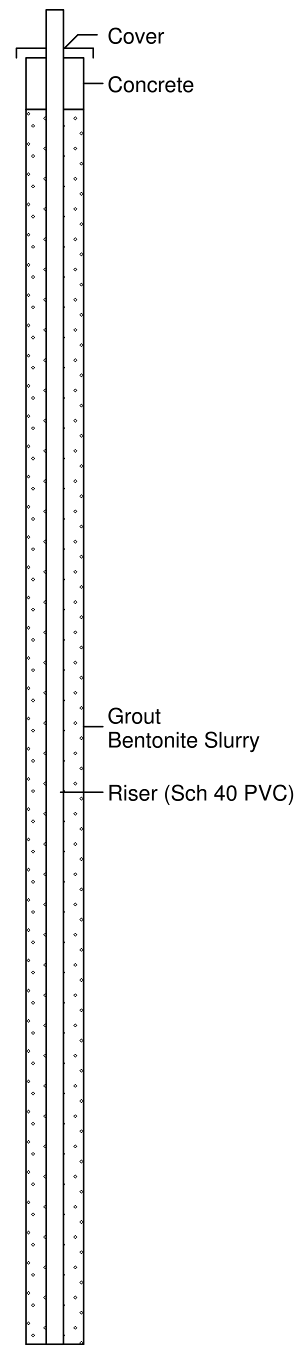
LOG OF BORING MW-350

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NW, NE

Date Completed	: 09/07/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 394.11
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	396.80
Drilling Company	: PSC	X,Y Coordinates	: 2379410, 554568

Depth in Feet	DESCRIPTION	Surf. Elev. 394.11	Samples	Recovery inches	Qp TSF	USCS
0	CLAY, very stiff to hard, brown, grayish-brown (10YR 5/2) mottled yellowish brown (10YR 5/8), dry	394	1	19/54	4.5	CH
			2		2.25	
			3			
5		389	4	47/60	4.5	
	- grain size analysis @ 5 - 6 ft: 2.3% sand, 42.4% silt, 55.3% clay		5		3.5	
			6		3.25	
			7		4.0	
10		384	8	60/60	2.75	
	CLAY, brown to olive brown, moist		9		2.75	CL/CH
	- grain size analysis @ 11 - 12 ft: 8.4% sand, 39.3% silt, 52.3% clay		10		2.75	
			11		1.75	
			12		2.0	
15		379				
	CLAY, soft, high plasticity, dark yellow brown, moist; 1-2" sand seams at 17' and 19'		13	45/60		CH
	- grain size analysis @ 18 - 20 ft: 1.8% sand, 21.9% silt, 76.3% clay					
	- very stiff to hard, high plasticity					
20		374	14	60/60		
25			15	23/23		

Well: MW-350
Elev.: 396.80



KELRON ENVIRONMENTAL INCORPORATED

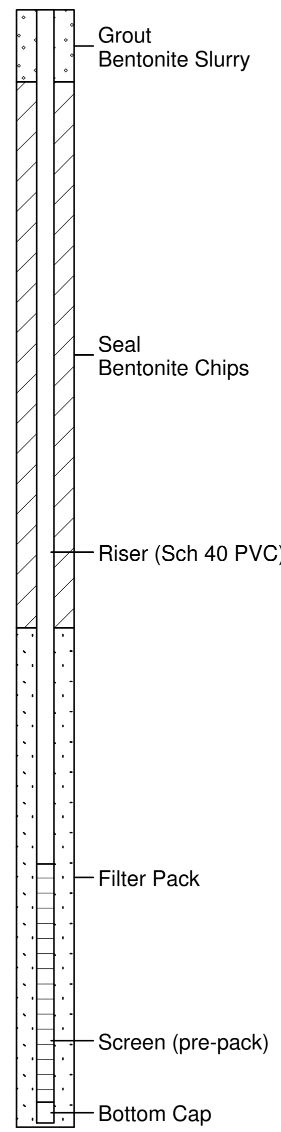
LOG OF BORING MW-350

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NW, NE

Date Completed	: 09/07/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 394.11
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	396.80
Drilling Company	: PSC	X,Y Coordinates	: 2379410, 554568

Depth in Feet	DESCRIPTION	Surf. Elev. 394.11	Samples	Recovery inches	Qp TSF	USCS
25	- Auger refusal at 26.4 feet bgs	369	15	23/23		CL
	LIMESTONE and SHALE, interbedded, banded, solid, very soft, light to dark gray; slightly weathered					LS/SH
	LIMESTONE, banded, medium bedded, solid, hard, medium gray; unweathered					LS
30	LIMESTONE and SHALE, interbedded; limestone is banded, medium bedded, hard, medium gray; shale is very soft to medium soft, dark gray Borehole diameter from 26.4 to 46.7 feet bgs = 3 7/8" RQD for 26.4 - 36.4' = 72% (Fair) Recovery = 116/120"	364	16	116/120		LS/SH
35	SHALE, banded, medium bedded, solid, soft to medium soft, dark gray	359				SH
40	LIMESTONE, banded, massive, solid, hard to very hard, light to medium gray RQD for 36.4 - 46.4' = 96% (Excellent) Recovery = 118/120"	354	17	118/120		LS
45		349				
	END BOREHOLE AT 46.7 FEET BLS					
50						

Well: MW-350
Elev.: 396.80



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KELRON ENVIRONMENTAL
INCORPORATED

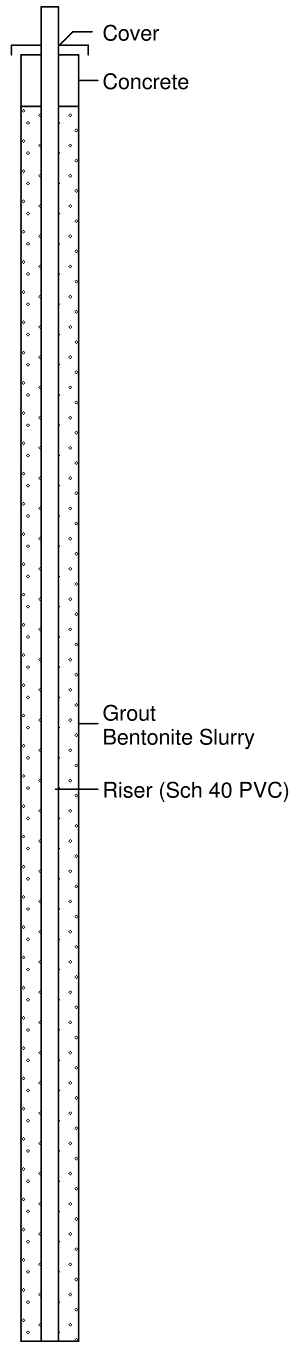
LOG OF BORING MW-352

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/16/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 422.36
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	425.04
Drilling Company	: PSC	X,Y Coordinates	: 2382789, 553901

Depth in Feet	DESCRIPTION	Surf. Elev. 422.36	Samples	Recovery inches	Qp TSF	USCS
0	SILTY CLAY, very stiff to hard, yellow brown (10YR 5/6), dry	422				
			1	46/48	4.5+	CL
			2	60/60	3.5	
5	CLAY, trace sand and fine gravel, very stiff, high plasticity, few black organic material	417	3		4.0	
			4		2.75	
			5		3.0	
10	- medium hard	412	6	60/60	2.75	
			7		2.0	CL
	- soft		8		1.0	
			9		1.25	
15		407	10	60/60	1.5	
	- medium hard		11		2.5	
	SAND, poorly graded, loose, wet (4-inch thick)					SP
	SANDY CLAY, trace fine gravel, yellow brown to olive brown (2.5Y 5/3)		12		2.75	
			13		3.5	
20		402	14	60/60	4.5+	
			15		2.5	CL
			16		2.5	
			17		2.75	
			18	48/60	2.5	
25						

Well: MW-352
Elev.: 425.04



KELRON ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-352

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/16/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 422.36
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	425.04
Drilling Company	: PSC	X,Y Coordinates	: 2382789, 553901

Well: MW-352
Elev.: 425.04

Depth in Feet	DESCRIPTION	Surf. Elev. 422.36	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
25		397				CL	
	- grain size analysis @ 26.5 - 27.5 ft: 33.7% sand, 27.1% silt, 39.2% clay		18	48/60	2.5		
	SAND with few gravel, yellow brown					SP	
	CLAY, some sand and fine gravel, hard to very hard, high plasticity, dark yellow brown (10YR 4/6)		19	60/60	3.0	CL	
30	CLAY, lean to fat	392	20		3.0		
	- grain size analysis @ 32 - 33 ft: 13.2% sand, 43.9% silt, 42.8% clay		21		3.5		
			22		3.0		
35		387	23	48/60	1.5		
	- medium hard, high plasticity, gray brown to light olive brown (2.5Y 5/2-5/3)		24		1.5		
	- trace silt, dark yellow brown (10YR 4/4)		25		1.75		
			26		1.5	CL/CH	
40		382	27	54/60	1.75		
			28		2.0		
			29		2.5		
			30		2.5		
			31	57/60	2.0		
45		377	32		1.75		
			33		1.75		
	CLAY, medium hard, low plasticity, olive brown (2.5Y 5/4)		34		2.5		
			35		1.75	CL	
			36	3/3			
50							

Grout
Bentonite Slurry

Riser (Sch 40 PVC)

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KELRON ENVIRONMENTAL INCORPORATED

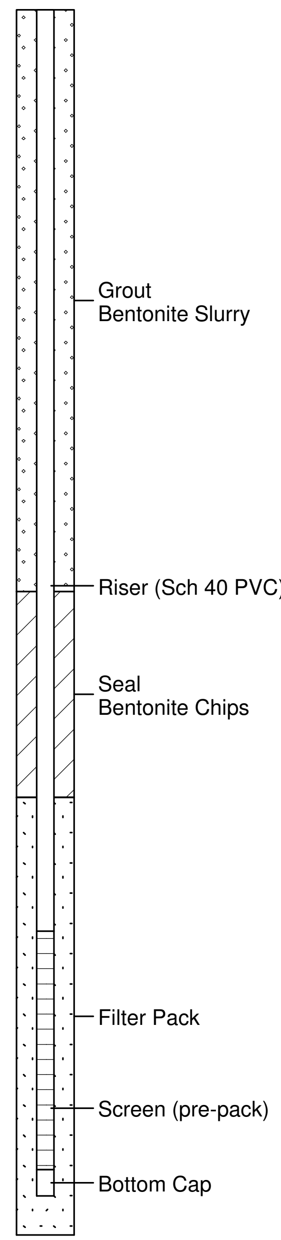
LOG OF BORING MW-352

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 16 SE, NE, NE

Date Completed	: 09/16/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID: 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 422.36
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	425.04
Drilling Company	: PSC	X,Y Coordinates	: 2382789, 553901

Depth in Feet	DESCRIPTION	Surf. Elev. 422.36	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
50	- Auger refusal at 53.7 feet bgs	372				CL	
	LIMESTONE, weathered, thinly laminated, medium hard to hard, gray		37	5/5		LS	
55		367	38	8/27			
	SHALE, clayey, gray					SH	
	LIMESTONE, occasional shale partings		39	19/60		LS	
60	- laminated, fossiliferous, medium gray	362	40	54/60			
	SHALE, soft, dark gray					SH	
65		357					
	LIMESTONE, medium hard to hard, light gray		41	59/60		LS	
70	Borehole diameter from 53.7 to 73.8 feet bgs = 3 7/8" RQD for 53.8 - 73.8' = 57% (Fair) Recovery = 173/240"	352	42	33/34			
	END BOREHOLE AT 73.8 FEET BLS						
75							

Well: MW-352
Elev.: 425.04



KELRON ENVIRONMENTAL
INCORPORATED

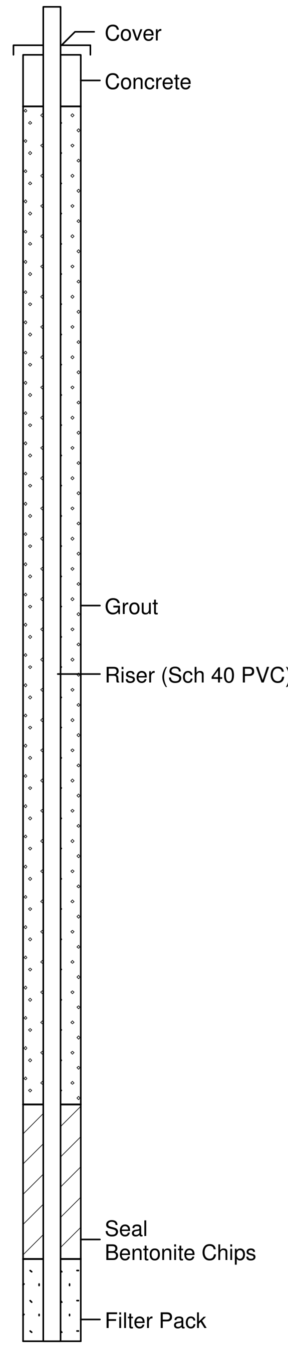
LOG OF BORING MW-355

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 09 SW, SE, SW

Date Completed	: 09/14/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID; 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 390.82
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	393.69
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2378145, 555980

Depth in Feet	DESCRIPTION	Surf. Elev. 390.82	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring to 20 feet below ground surface. Refer to boring log for adjacent well MW-155 for description of subsurface materials to 20 feet.	390					
5		385					
10		380					
15		375					
20	CLAYEY SAND, poorly graded, dark yellow brown, wet	370	1	23/23	3.5	SC	
	CLAY, lean, very stiff, gray with yellow-brown mottling - Auger refusal at 22.1 feet bgs					CL	
	LIMESTONE, lightly weathered, fine grained, slightly fossiliferous, medium soft, light gray banded with light red staining along horizontal fractures; three small shale lenses within 31 inch interval - coarse grained, medium soft to hard		2	108/124		LS	
25							

Well: MW-355
Elev.: 393.69



KELRON ENVIRONMENTAL
INCORPORATED

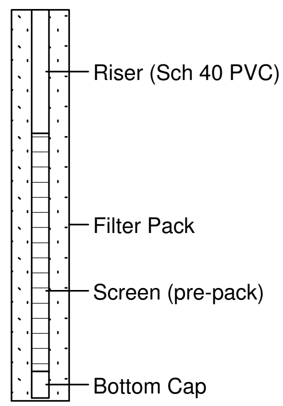
LOG OF BORING MW-355

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 09 SW, SE, SW

Date Completed	: 09/14/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD / 4 1/4" ID; 3 7/8" rock	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem/Rotary (CME-550)	Land Surface Elevation	: 390.82
Sampling Method	: MacroCore (60")/NX Core	Top of Casing Elevation	393.69
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2378145, 555980

Depth in Feet	DESCRIPTION	Surf. Elev. 390.82	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
25	- fine grained, slightly fossiliferous, light gray Borehole diameter from 22.1 to 32.6 feet bls = 3 7/8" RQD for 22.1 - 32.6' = 57% (Fair)	365	2	108/124		LS	
30		360					
	END BOREHOLE AT 32.6 FEET BLS						
35		355					
40		350					
45		345					
50							

Well: MW-355
Elev.: 393.69



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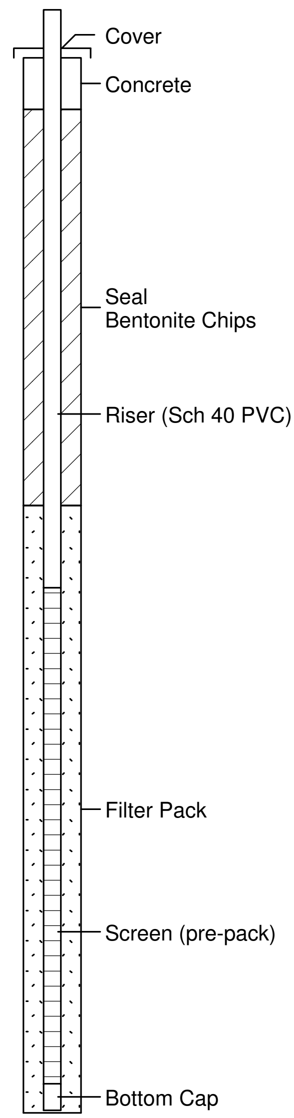
KELRON ENVIRONMENTAL INCORPORATED	LOG OF BORING MW-155

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 09 SW, SE, SW

Date Completed	: 09/10/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 390.62
Sampling Method	: MacroCore (60")	Top of Casing Elevation	393.55
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2378141, 555983

Depth in Feet	DESCRIPTION	Surf. Elev. 390.62	Samples	Recovery inches	Qp TSF	USCS
0	SILTY CLAY, hard, reddish brown, dry	390	1, 2, 3	40/48		CL
	CLAY (lean), hard, low plasticity, pale brown (10YR 6/3), grading to Fat CLAY - grain size analysis @ 7 - 8 ft: 2.5% sand, 47.2% silt, 50.3% clay	385	4, 5, 6, 7, 8	53/60	4.5, 4.5+	CL/CH
5						
	SANDY CLAY, dry		9		0.75	CL
	SAND, 4-inch seam, poorly graded, loose					SP
10	CLAY with sand grading to SANDY CLAY, very soft, moist	380	10, 11, 12, 13, 14, 15, 16, 17	44/60, 50/60	1.5, 1.5, 0.5	CL
15		375				
	CLAYEY SAND, poorly graded, dark yellow brown - grain size analysis @ 18.5 - 19.5 ft: 53.9 %sand, 28.1% silt, 18.0% clay		18, 19, 20		1.5	SC
20	END BOREHOLE AT 20.5 FEET BLS	370				
25						

Well: MW-155
Elev.: 393.55



SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-356

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	9/28/2015	10/1/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-356	Feet (NAVD88)	425.18 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 558,050.37 N, 2,381,958.49 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 56.2662"
Long -89° 52' 10.4808"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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
			0–10	0 - 10' **SILTY CLAY** CL/ML.	CL/ML									0-37.3' Blind Drilled. See logs OW-156 and OW-256 for soil description.
			10–12	10 - 17.7' **LEAN CLAY WITH SAND:** (CL)s.	(CL)s									

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

Signature	Firm
[signature]	Natural Resource Technology 234 W. Florida St., Fifth Floor, Milwaukee, WI 53204 Tel: (414) 837-3607 Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

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
			12–17.7	10 - 17.7' **LEAN CLAY WITH SAND:** (CL)s. *(continued)*	(CL)s									
			17.7–27.3	17.7 - 27.3' **SILTY CLAY** CL/ML.	CL/ML									
			27.3–28.6	27.3 - 28.6' **POORLY-GRADED SAND:** SP.	SP									
			28.6–32	28.6 - 33.9' **SILTY CLAY** CL/ML.	CL/ML									

Depth scale: 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

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
			33	28.6 - 33.9' **SILTY CLAY** CL/ML. *(continued)*	CL/ML									
			34–35	33.9 - 35.7' **LEAN CLAY:** to **SHALE:** CL.	CL									
			36–37	35.7 - 37.3' **SHALE:** BDX (SH).	BDX (SH)									
1 CORE	28 24.5		38–39	37.3 - 53.8' **SHALE:** BDX (SH), weathered shale and clay, brown to dark gray, soft, slightly fractured.	BDX (SH)									Core 1, RQD=92%
2 CORE	60 57		40–44	39.6' light to dark gray to tan. 42.3' - 43.2' limestone. 43.2' light to dark gray/tan, very weak.										Core 2, RQD = 58%
3 CORE	60 41		45–49	45' - 50' dark gray, intensely fractured.										Low recovery, possible washout. Core 3, RQD = 18%
4 CORE	36 36		50–52	50' - 53.1' thin beds of limestone, limestone is more competent, slightly fractured, wet.										Core 4, RQD=92%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

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		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				37.3 - 53.8' **SHALE:** BDX (SH), weathered shale and clay, brown to dark gray, soft, slightly fractured. *(continued)*										
			53		BDX (SH)									
5 CORE	24 21.5			53.1' - 53.8' intensely fractured.										Core 5, RQD=58%
			54	53.8 - 55.4' **LIMESTONE:** BDX (LS), white, thickly bedded, moderately fractured (moderately wide to very narrow apertures).	BDX (LS)									
6 CORE	60 60.5		55											Core 6, RQD=84%
			56	55.4 - 57.2' **SHALE:** BDX (SH), dark gray, trace limestone beds, moderately fractured.	BDX (SH)									
			57	56.8' soft, highly weathered bed, decomposed. 57.1' soft, highly weathered bed.										
			58	57.2 - 60' **LIMESTONE:** BDX (LS), trace shale beds, moderately fractured (moderately wide to very wide apertures).	BDX (LS)									
			59	59.4' - 59.7' vertical fractures with pyrite mineralization.										
7 CORE	60 61		60	60 - 65.8' **SHALE:** BDX (SH), gray, moderately fractured.										Core 7 RQD=75%
			61	61' -62' dark gray.										
			62	62' - 62.4' soft, clayey.										
			63		BDX (SH)									
			64											
8 CORE	60 61.5		65	65' dark gray, narrow to moderately wide apertures. 65.3' - 65.8' fossiliferous.										Core 8, RQD=67%
			66	65.8 - 68.8' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, slightly to moderately fractured.										
			67		BDX (LS/SH)									
			68											
			69	68.8 - 70' **SHALE:** BDX (SH), gray, fossiliferous, moderately fractured (moderately wide to narrow apertures).	BDX (SH)									Bedrock corehole reamed 6" in diameter to 69' for well installation.
9 CORE	60 61		70	70 - 75' **SHALEY LIMESTONE:** BDX (LS/SH), gray to dark gray, fossiliferous, medium bedded, moderately fractured (narrow apertures).										Core 9, RQD=87%
			71		BDX (LS/SH)									
			72											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			73	70 - 75' **SHALEY LIMESTONE:** BDX (LS/SH), gray to dark gray, fossiliferous, medium bedded, moderately fractured (narrow apertures). *(continued)*	BDX (LS/SH)						
			74								
10 CORE	60 60		75	75 - 75.9' **SHALE:** BDX (SH), dark gray, soft, moderately fractured (narrow to moderately narrow apertures).	BDX (SH)						Core 10, RQD=95%
			76	75.9 - 76.2' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, narrow to moderately narrow apertures.	BDX (LS/SH)						
			77	76.2 - 101.8' **LIMESTONE:** BDX (LS), light gray, fossiliferous, thickly bedded, narrow to moderately narrow apertures.							
			78								
			79								
11 CORE	60 60.5		80	80' light gray to gray, unfractured.							Core 11, RQD=100%
			81								
			82								
			83								
			84		BDX (LS)						
12 CORE	60 61.5		85								Core 12, RQD=100%
			86								
			87								
			88								
			89								
13 CORE	60 59.5		90								Core 13, RQD=100%
			91								
			92								

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

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		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			93	76.2 - 101.8' **LIMESTONE:** BDX (LS), light gray, fossiliferous, thickly bedded, narrow to moderately narrow apertures. *(continued)*										
14 CORE	61 61		95											Core 14, RQD=100%
			97		BDX (LS)									
15 CORE	60 59.5		100	99.7' slightly weathered, decomposed. 100' gray, no fossils.										Core 15, RQD=100%
			102	101.8 - 106.5' **SHALE:** BDX (SH), dark gray, thickly bedded, slightly fractured.										
			104		BDX (SH)									
16 CORE	60 58.5		105											Core 16, RQD=56%
			106	106.2' weathered, decomposed.										
			107	106.5 - 108.4' **LIMESTONE:** BDX (LS), light gray to green, highly decomposed, intensely fractured.	BDX (LS)									
			109	108.4 - 109.8' **SHALE:** BDX (SH), dark reddish-brown, highly decomposed.	BDX (SH)									
17 CORE	60 55		110	109.8 - 111.1' **LIMESTONE:** BDX (LS), gray, highly disintegrated (healed dissolution cracks with green highly decomposed infilling). 109.9' - 110.7' angular gravel-sized fragments. 110.7' moderately decomposed, very intensely fractured.	BDX (LS)									Core 17, RQD=49%
			112		BDX (SH)									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

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
			113	111.1 - 114' **SHALE:** BDX (SH), dark gray, moderately to highly decomposed, moderately fractured. *(continued)*	BDX (SH)									
18 CORE	60 61		114, 115, 116	114 - 116.3' **LIMESTONE:** BDX (LS), gray, moderately fractured.	BDX (LS)									Core 18, RQD=61%
				116.3 - 116.7' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured.	BDX (LS/SH)									
			117, 118, 119	116.7 - 119.7' **SHALE:** BDX (SH), gray, slightly decomposed, intensely fractured.	BDX (SH)									
19 CORE	60 64		120	119.7 - 120.9' **SHALEY LIMESTONE:** BDX (LS/SH), gray, slightly decomposed, intensely fractured.	BDX (LS/SH)									Core 19, RQD=86%
			121, 122	120.9 - 122.2' **SHALE:** BDX (SH), dark gray, moderately fractured.	BDX (SH)									
20 CORE	48 48		123, 124, 125, 126	122.2 - 126.1' **LIMESTONE:** BDX (LS), gray, moderately fractured. 123.3' - 123.4' fossiliferous. 124.1' - 124.1' fossiliferous. 124.7' - 124.8' fossiliferous.	BDX (LS)									Core 20, RQD =88%
			127	126.1 - 127.6' **SHALE:** BDX (SH), dark gray, slightly decomposed. 126.7' - 127' limestone, gray. 127' moderately decomposed.	BDX (SH)									
21 CORE	12 12		128, 129	127.6 - 129.2' **LIMESTONE:** BDX (LS), slightly decomposed.	BDX (LS)									Core 21, RQD=0%
			130	129.2 - 130' **SHALE:** BDX (SH), gray, intensely fractured.	BDX (SH)									
22 CORE	60 60			130 - 130.4' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured.	BDX (LS/SH)									Core 22, RQD=94%
			131	130.4 - 131' **LIMESTONE:** BDX (LS), gray, fossiliferous, moderately fractured.	BDX (LS)									
			132	131 - 134' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured.										

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-356

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
			133	131 - 134' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured. *(continued)*	BDX (LS/SH)									The casing dropped 3" during drilling.
			134 - 135	134 - 135' **LIMESTONE:** BDX (LS), gray, thickly bedded, moderately fractured.	BDX (LS)									
			135	135' End of Boring.										

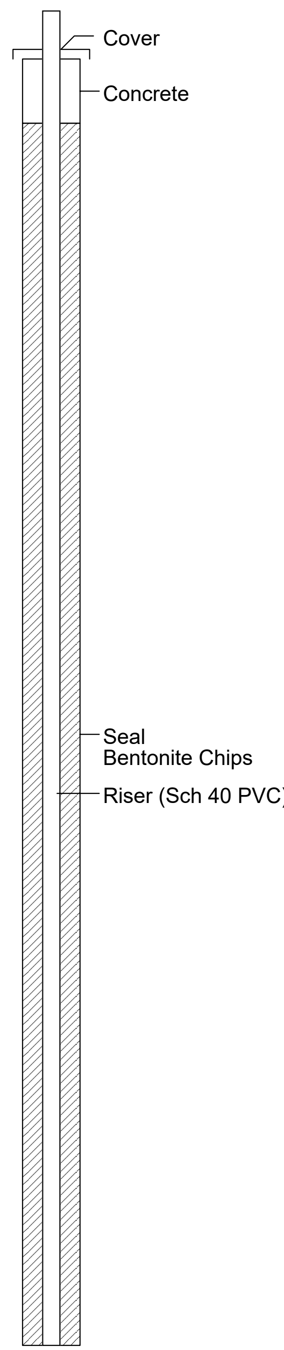
KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE OW-256

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/22/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 425.20
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 427.70
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381947, 558054

Depth in Feet	DESCRIPTION	Surf. Elev. 425.20	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring to 13.5 feet below ground surface. Refer to boring log for adjacent well OW-156.	425					
5		420				CL	
10		415					
13.5	CLAY (lean), very stiff, high plasticity, pale brown (10YR 6/3),moist - 25% reddish-brown mottling with black manganese staining - light gray (10YR 7/1) with 10-25% mottling		1	60/60	3.0	CL	
15		410	2		2.25		
			3		2.0		
			4		2.0		
			5		1.75		
18.5	Silty CLAY, trace fine to coarse sand [TILL]		6	60/60	2.5	CL	
20			7		1.0		

Well: OW-256
Elev.: 427.70



KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE OW-256 (Page 2 of 2)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/22/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 425.20
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 427.70
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381947, 558054

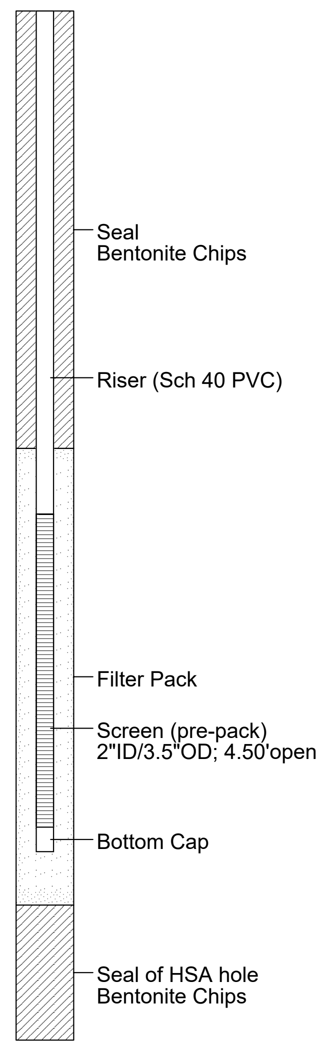
Depth in Feet	DESCRIPTION	USCS
20 – 27.8	- trace fine-coarse gravel (angular to sub-angular; granite piece of 1 1/4"), 50-75% yellowish-brown (10YR 6/8) mottling - few sand and gravel, stiff, high plasticity, gray (10YR 6/1) with 25-75% mottling - <25% mottling - with sand (fine-medium)	CL
27.8 – 29.3	SAND (fine-medium), well graded, brownish yellow (10YR 6/6), wet	SW
29.3 – 34.6	Silty CLAY (lean) with sand (fine-medium), medium plasticity, brownish yellow, wet - hard, non plastic, light brownish gray (10YR 6/2), moist [Vandalia Till @ 31.5'] - little sand (fine-coarse) and gravel (fine-coarse, sub-angular to sub-rounded), low to non-plastic, gray (10YR 5/1)	CL
34.6 – 36.4	SHALE and CLAY, semi-competent, laminated clay with up to 1/2-inch thick layers of hard shale, dry [note: top of weathered bedrock at 33.9 feet below ground surface]	SH/CL
36.4 – 38.5	SHALE with intermittent clay layers, hard, gray	SH

END Sampling at 38.5 feet BLS
END WELL BOREHOLE at 36.0 feet BLS

Surf. Elev. 425.20: 405 (20 ft), 400 (25 ft), 395 (30 ft), 390 (35 ft)

Samples	Recovery inches	Qp TSF
7		1.0
8		1.75
9		1.75
10		1.0
11	60/60	1.0
12		2.0
13		1.0
14		1.0
15		
16	35/60	
17		
18		>4.5
19		
20		
21	54/60	3.0
22		4.0
23		>4.5
24		>4.5
25		>4.5

Well: OW-256
Elev.: 427.70



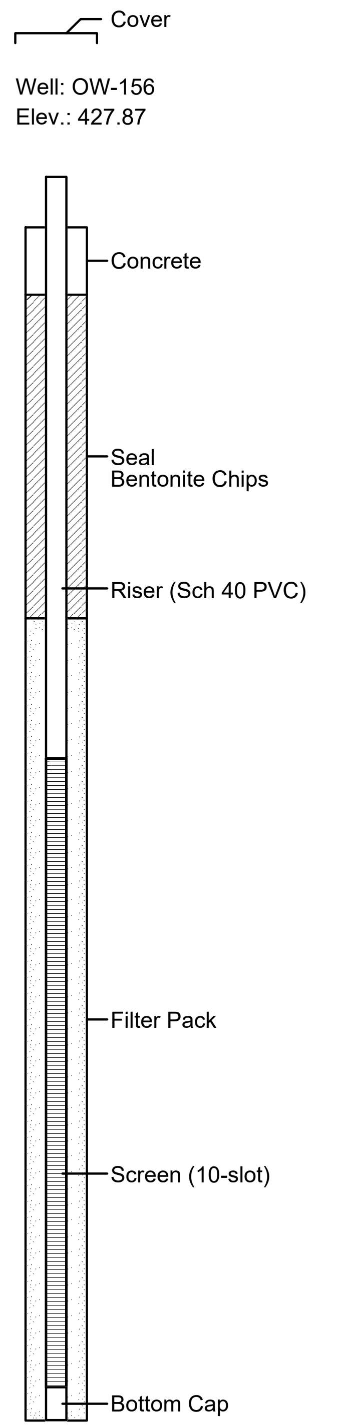
KELRON ENVIRONMENTAL Incorporated

LOG OF BORING OW-156

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 NW, NW, SW

Date Completed	: 09/10/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation:	425.14
Sampling Method	: MacroCore (60")	Top of Casing Elevation:	427.87
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2378141, 555983

Depth in Feet	DESCRIPTION	Surf. Elev.425.15	Samples	Recovery inches	Qp TSF	USCS
0	SILTY CLAY, stiff, medium brown, dry	425				
			1	32/48	2.5	
			2		1.5	
			3		3.5	
			4		1.75	
5	- stiff to very stiff, low plasticity	420	5	56/60	2.0	
			6		1.75	
	- dark gray-brown (10YR 3/3) with light brown mottling (10YR 6/3)		7		1.75	
			8		1.75	
			9		2.25	CL
10	CLAY (lean) with Sand, soft to medium, light brown (10YR 6/3) with brown-yellow mottling (10YR 6/6), moist	415	10	60/60	1.0	
			11		1.5	
			12		1.75	
			13		1.75	
			14		1.5	
15		410	15	50/60	2.25	
			16		2.0	
			17		2.5	
	END BOREHOLE AT 17.7 FEET BLS		18		1.25	
	Terminated probing with MacroCore at 19.5 feet bls		19			
20						



04-09-2014

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-366

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	12/3/2015	12/4/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-366	Feet (NAVD88)	422.54 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,581.80 N, 2,381,171.15 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 31.8876"
Long -89° 52' 20.4414"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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
			0	0 - 5.6' **FILL, SILTY CLAY** CL/ML.	(FILL) CL/ML								0-33' Blind Drilled. See logs TPZ-166 and B-13-4 for soil description.
			5.6	5.6 - 33' **SILTY CLAY** CL/ML.	CL/ML								
			12										

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

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
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Natural Resource Technology

Boring Number MW-366

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
			13–32	5.6 - 33' **SILTY CLAY** CL/ML. *(continued)*	CL/ML									

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-366

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
				5.6 - 33' **SILTY CLAY** CL/ML. *(continued)*	CL/ML									
1 SS	23 18	17 21 20 50	33	33 - 35.6' **LEAN CLAY:** to **SHALE:** CL, gray, residual soil, hard (>4.5 tsf).	CL									
1 CORE	60 54		35.6	35.6 - 39.3' **SHALE:** BDX (SH), gray, highly decomposed, moderately fractured. 38.4' limestone layer (approximately 2.5").	BDX (SH)									Core 1, RQD=54%
2 CORE	60 47		39.3	39.3 - 42.3' **LIMESTONE:** BDX (LS), cherty, intensely fractured.	BDX (LS)									Core 2, RQD=32%
			42.3	42.3 - 42.9' **SHALE:** BDX (SH), dark gray, intensely fractured.	BDX (SH)									
			42.9	42.9 - 43.7' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured.	BDX (LS/SH)									
3 CORE	60 63		43.7	43.7 - 49.8' **SHALE:** BDX (SH), dark gray, moderately fractured.	BDX (SH)									Core 3, RQD=73%
4 CORE	60 49		49.8	49.8 - 54.3' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, slightly fractured.	BDX (LS/SH)									Core 4, RQD=96%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-366

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
			53 54	49.8 - 54.3' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, slightly fractured. *(continued)* 52.8' - 53.1 shale bed. 53.1' fossiliferous.	BDX (LS/SH)									
				54.3' End of Boring.										Bedrock corehole reamed 6" in diameter to 54' for well installation.

KELRON ENVIRONMENTAL
Incorporated

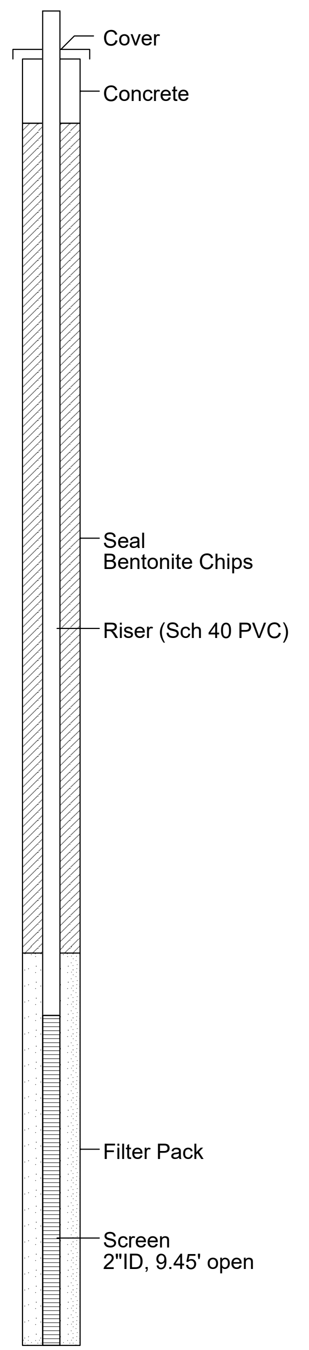
LOG OF PROBEHOLE TPZ-166

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/16/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 422.33
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 425.18
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381183, 555587

Depth in Feet	DESCRIPTION	Surf. Elev. 422.33	Samples	Recovery inches	Qp TSF	USCS
0	FILL - Silty CLAY, trace roots, very stiff, non-plastic, light brown gray (10YR 6/2), dry		1	60/60	2.75	FL/CL
	- medium plasticity, pale brown (10YR 6/3) w/ trace manganese and iron oxide staining		2		2.75	
	- very stiff, yellowish brown (10YR 5/4) with 25% reddish-brown mottling	420	3		3.75	
	- very stiff, low plasticity		4		1.5	
5	- gray mottling		5		2.75	
	- 1-inch silt lense with high organics, trace roots		6	60/60	1.5	
	Silty CLAY, very stiff, medium plasticity, gray (10YR 6/1) with reddish-brown mottling and manganese staining		7		2.75	CL
	- medium to stiff, high plasticity, 25-50% manganese staining	415	8		1.75	
	- no manganese staining		9		2.5	
10			10		2.5	
			11	60/60	1.5	
			12		1.5	
	- stiff, medium plasticity, yellowish brown (10YR 5/4) with 10-25% reddish-brown mottling, moist	410	13		2.25	
			14		2.0	
15			15		2.5	
	- very soft, high plasticity		16	60/60	1.0	
	- very stiff, medium plasticity		17		3.0	
		405	18		3.0	
	Silty CLAY with trace fine-coarse sand and fine gravel, very stiff, medium plasticity, yellowish brown (10YR 5/4) with <10% reddish-brown mottling, moist [TILL]		19		3.5	CL
	- hard, gray (10YR 6/1) with 10-25% reddish-brown mottling		20		3.25	
20						

Well: TPZ-166
Elev.: 425.18



KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE TPZ-166 (Page 2 of 2)

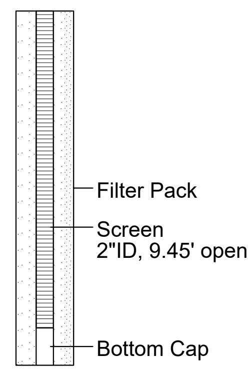
LOG OF PROBEHOLE TPZ-166

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/16/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 422.33
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 425.18
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381183, 555587

Depth in Feet	DESCRIPTION	Surf. Elev. 422.33	Samples	Recovery inches	Qp TSF	USCS
20			21	24/24	>4.5	CL
	END BOREHOLE TPZ-166 AT 22' BLS.		22		>4.5	
	CONTINUE LOG USING URS BORINGS B-13-4 and B-13-5 FROM 08/01/2013	400				CL
25						
		395				
30						
		390				
	SHALE, calcareous, fine grained, highly weathered, very weak, brown-gray to gray (top of bedrock = 32.53' bls; elevation = 389.8 ft NAVD88)					SH
35						
		385				
	END URS LOGS AT 38 FEET BLS					
40						

Well: TPZ-166
Elev.: 425.18



LOG of BORING No. B-13-4

STARTED: 8/1/01
COMPLETED: 8/1/01
LOCATION: Baldwin Energy Complex
SURFACE EL., FT: 424.4
EL. DATUM: NAVD88
NORTHING: 555572.96
EASTING: 2381189.45
N, E DATUM: NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
0				Stiff, moist, brown to light grayish brown, silty CLAY (CL), trace roots, trace fine sand, trace manganese iron oxide staining.[FILL]										HSA (3.75" ID)
		2 5 5	67				20				4.5 2.4			
		P	100				21	133	49	37	4.0			4' : UC= 3.28 ksf
5				Becomes orangish brown and grayish brown, meduim plasticity.										5.5' : Tv= 7.0 tsf
		2 3 4	89	Medium stiff, moist, grayish brown, medium plastic silty CLAY (CL), trace fine sand, iron oxide staining. [LOESS]	417.9 6.5		27							
10		2 2 4	100				25				2.5 1.75 1.5			
		P	86				22	127	40	20	2.5		2.36	
15				Becomes pinkish brown with gray. ▼										
		2 3 5	94	Medium stiff, moist, grayish brown, silty CLAY (CL), with coarse to fine sand, iron oxide staining. [TILL]	405.9 18.5		20				3.0 2.75 2.75			
20														
		3 5 6	100	Becomes stiff.			19				2.5 4.0 3.75			

Completion Depth: 40.0 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling

Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Keith Brown

Water Depth: 28.5 ft., After ATD hrs.; 15 ft., After 0.5 hrs.; ____ ft., After ____ hrs.
Logged by: Stefanie Voss

URS

LOG of BORING No. B-13-4

STARTED	8/1/01	NORTHING	555572.96
COMPLETED	8/1/01	EASTING	2381189.45
LOCATION	Baldwin Energy Complex	SURFACE EL., FT	424.4
EL. DATUM	NAVD88	N, E DATUM	NAD83

DEPTH, ft.	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
25												
	1 3 6	100	Becomes wet, trace fine sand, trace coarse gravel, trace organics.		18				1.5 2.25 2.75			
30			30.0' : Sand parting. 30.2': Occasional high oxidation staining.									
	3 6 8	100			14				2.5 2.75 3.5			
35												
	33 27 50/3.5"	55	SHALE: Gray, very fine grained, highly weathered, very weak.	385.9 38.5	8							
40			Bottom of boring at 40'	384.4 40.0								39.7' : Spoon refusal. 40.0' : Auger refusal. Borehole backfilled with bentonite/cement Grout mix: 60 gallons of water 4 bags of cement 1/3 bag bentonite gel
45												

Completion Depth: 40.0 feet	Drilling Equipment: CME 550X	Water Depth:	28.5 ft., After ATD hrs.
Project No.: 21562902	Drilling Method: HSA		15 ft., After 0.5 hrs.
Project Name: Dynergy-Baldwin	Hammer Type: Automatic		ft., After hrs.
Drilling Contractor: Bulldog Drilling	Driller's Name: Keith Brown	Logged by:	Stefanie Voss

LOG of BORING No. B-13-5

STARTED 8/1/01 | COMPLETED 8/1/01 | LOCATION Baldwin Energy Complex | SURFACE EL., FT 419.1 | EL. DATUM NAVD88

NORTHING 555614.43 | EASTING 2381169.40 | N, E DATUM NAD83

DEPTH, ft.	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
0			Medium stiff, moist, brown, silty CLAY (CL), some roots, trace fine sand. [TOPSOIL]									HSA (3.75" ID)
	2 3 4	50	Medium stiff, moist, grayish brown with orange, silty CLAY (CL), trace fine sand, iron oxide staining. [LOESS]	417.6 / 1.5	38				3.0 2.5			
5	2 3 4	83			24				2.0 1.75 2.6			
	2 2 4	100	Becomes brown, trace roots.		24				1.75 2.0 1.5			
	P	0			23				2.0			
	1 3 4	83	Trace coarse to medium sand, iron oxide staining around sand.						2.0 1.75			9.5' : Split spoon taken to collect sample
10	P	2							1.6			11' : Minimal recovery Sample slid into tube while taking penetrometer
	1 2 8	78	Stiff, moist, gray, medium plastic silty CLAY (CL), with medium to fine sand, trace silt, iron oxide staining. [TILL]	405.6 / 13.5	21				2.5 2.75 3.0			
15												
	2 4 5	100			22				2.75 3.4 1.9			
20												
	P	100	Becomes brown with gray clay pocket.		20	129	34	24	3.75 2.0 4.25			23' : UC= 0.52 ksf

Completion Depth: 34.5 feet | Project No.: 21562902 | Project Name: Dynergy-Baldwin | Drilling Contractor: Bulldog Drilling

Drilling Equipment: CME 550X | Drilling Method: HSA | Hammer Type: Automatic | Driller's Name: Keith Brown

Water Depth: Dry ft., After ATD hrs.; Dry ft., After 0.25 hrs.; ft., After hrs.

Logged by: Stefanie Voss

LOG of BORING No. B-13-5

STARTED: 8/1/01
COMPLETED: 8/1/01
LOCATION: Baldwin Energy Complex
SURFACE EL., FT: 419.1
EL. DATUM: NAVD88
NORTHING: 555614.43
EASTING: 2381169.40
N, E DATUM: NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
25														
		6 13 30	83	28.5' : Brown, medium to fine silty sand seam. 28.9' : Light pinkish gray sand parting.	389.8 29.3		13				4.5 4.5 4.5			
30				29.3' : SHALE : Brown gray, calcareous, fine grained, highly weathered, very weak.										
		10 50/5.5"	78		384.6 34.5						4.5			34.1' : Auger refusal.
35				Bottom of boring at 34.5'										Borehole backfilled with bentonite/cement Grout mix: 60 gallons of water 4 bags of cement 1/3 bag bentonite gel
40														
45														

Completion Depth: 34.5 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling

Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Keith Brown

Water Depth: Dry ft., After ATD hrs.
Dry ft., After 0.25 hrs.
ft., After hrs.
Logged by: Stefanie Voss

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-369

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mark Baetje Bulldog Drilling	11/17/2015	11/18/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-369	Feet (NAVD88)	420.49 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 557,329.71 N, 2,381,765.41 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 49.1496"
Long -89° 52' 12.9288"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0	0 - 0.2' **SILT:** ML.	ML								0-43' Blind Drilled. See log PZ-169 for soil description.
			0.2	0.2 - 2' **SILTY CLAY** CL/ML.	CL/ML								
			2	2 - 4' Shelby Tube Sample.									
			4	4 - 10' **SILTY CLAY** CL/ML.	CL/ML								
			10	10 - 12' **SILTY CLAY** to **LEAN CLAY:** CL/ML.	CL/ML								
			12										

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

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-369

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
			12	12 - 14' Shelby Tube Sample.										
			14	14 - 20' **LEAN CLAY:** CL.	CL									
			20	20 - 22' **SILTY CLAY** CL/ML.	CL/ML									
			22	22 - 24' Shelby Tube Sample.										
			24	24 - 28' **LEAN CLAY WITH SAND:** (CL)s.	(CL)s									
			28	28 - 30' **SILTY CLAY** CL/ML.	CL/ML									
			30	30 - 32' **LEAN CLAY:** to **SILTY CLAY** CL.	CL									
			32											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-369

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
			33, 34, 35, 36, 37	32 - 38' **LEAN CLAY:** CL.	CL									
			38, 39	38 - 40' No Recovery.										
			40, 41	40 - 42' **LEAN CLAY:** CL.	CL									
1 SS	24 0	10 18 30 40	42, 43, 44	42 - 45' No Recovery.										
2 SS	5 9	50/5"	45	45 - 45.3' **LEAN CLAY:** CL, dark brown (10YR 3/3), 30-50% pale brown (10YR 6/4) and brown (10YR 4/3) mottling, trace subrounded fine gravel, cohesive, low plasticity, moist.	CL									
3 SS	5 8	50/5"	46, 47, 48	45.3 - 48.7' **SHALE:** BDX (SH), dark grayish brown, highly decomposed. 47' trace clay layers (< 1" thick), highly decomposed, very weak.	BDX (SH)									
1 CORE	66 30		49, 50	48.7 - 50.8' **LIMESTONE:** BDX (LS), white, fossiliferous, intensely fractured (extremely narrow to narrow apertures), microcrystalline, slightly to moderately decomposed.	BDX (LS)									Core 1, RQD=17%
			51, 52	50.8 - 53.4' **SHALE:** BDX (SH), dark gray, intensely fractured (extremely narrow to narrow apertures), highly decomposed, very weak.	BDX (SH)									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-369

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
			53	50.8 - 53.4' **SHALE:** BDX (SH), dark gray, intensely fractured (extremely narrow to narrow apertures), highly decomposed, very weak. *(continued)*	BDX (SH)									
2 CORE	60 46		54–59	53.4 - 59.3' **LIMESTONE:** BDX (LS), white, moderately fractured (very narrow to narrow apertures), fossiliferous, microcrystalline, slightly decomposed, very strong, pitted, trace mineralization. 58.4' mud in fracture.	BDX (LS)									Core 2, RQD=83%
3 CORE	60 64		60–64	59.3 - 64.9' **SHALEY LIMESTONE:** BDX (LS/SH), dark gray, medium bedded shale, intensely fractured (extremely narrow to narrow apertures), fossiliferous, microcrystalline, decomposed, very weak to weak, weathered, highly weathered shale cementing segments together.	BDX (LS/SH)									Core 3, RQD=63%
4 CORE	60 62		64											Core 4, RQD=79%
			65–68	64.9 - 68.8' **LIMESTONE:** BDX (LS), white, slightly fractured (tight to narrow apertures), fossiliferous, microcrystalline, slightly decomposed, slightly disintegrated, pitted.	BDX (LS)									
			69–70	68.8 - 70.7' Overdrilled for Well Installation.										Bedrock corehole reamed 6" in diameter to 70.7' for well installation.
				70.7' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-169

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/27/2015	7/28/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-169	Feet (NAVD88)	420.01 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 557,323.57 N, 2,381,764.94 E E/W
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 49.0632"
Long -89° 52' 12.9108"
Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 15.5	4 9 10 11	0–2	0 - 0.2' **SILT:** ML, dark grayish brown (10YR 4/2), trace roots and clay, very soft (<0.25 tsf), dry.	ML								
				0.2 - 2' **SILTY CLAY** CL/ML, brown (10YR 5/3), cohesive, nonplastic to low plasticity, dry.	CL/ML								
2 ST	24 22		2–4	2 - 4' Shelby Tube Sample.									ST2: 24" push at 500lbs of pressure.
3 SS	24 21	2 3 6 6	4–6	4 - 10' **SILTY CLAY** CL/ML, dark yellowish brown (10YR 3/6), trace brown (10YR 5/3) and gray (10YR 6/1) mottling, cohesive, nonplastic to low plasticity, stiff to very stiff (1.0-2.5 tsf), dry to moist.	CL/ML								
4 SS	24 20	2 3 5 7	6–8										
5 SS	24 24	2 3 4 5	8–10	8' - 10' dark grayish brown (10YR 4/2), very dark brown (10YR 2/2) mottling, trace dark yellowish brown (10YR 6/3), cohesive, moist. 8.9' dark brown (10YR 3/3) mottling.									
6 SS	24 23	1 3 4 5	10–12	10 - 12' **SILTY CLAY** to **LEAN CLAY:** CL/ML, dark yellowish brown (10YR 3/6), trace yellowish brown (10YR 5/6) mottling, decreasing silt content with depth, moist. 10.3' trace wood pieces. 11.4' - 11.7' trace very dark brown (10YR 2/2) mottling.	CL/ML								
7 ST	24 24		12–14	12 - 14' Shelby Tube Sample.									ST7: 24" push at 400lbs of pressure.

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

Signature [signature]

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NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-169

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
8 SS	24 22	2 4 5 6	15	14 - 20' **LEAN CLAY:** CL, dark yellowish brown (10YR 3/6), grades to gray (10YR 6/1), yellowish brown (10YR 5/6) mottling, trace very dark brown (10YR 2/2) mottling, silt (5-30%), cohesive, low to medium plasticity, stiff to very stiff (1.5-3.5 tsf), moist.	CL								
9 SS	24 22.5	2 3 5 5	16, 17	16' - 19.9' dark yellowish brown (10YR 3/6) and yellowish brown (10YR 5/6) mottling.									
10 SS	24 23	1 4 4 4	18, 19	18' trace dark yellowish brown (10YR 6/3) mottling, trace silt, softer with depth. 18.8' trace very fine and coarse sand.									
11 SS	24 21	1 3 4 4	20, 21	20 - 22' **SILTY CLAY** CL/ML, gray (10YR 6/1), dark yellowish brown (10YR 3/6) and trace very dark brown (10YR 2/2) mottling, trace to few very fine sand seams, cohesive, nonplastic to low plasticity, stiff to very stiff (1.75-2.5 tsf), moist. 21' trace very fine sand seams.	CL/ML								
12 ST	24 25		22, 23	22 - 24' Shelby Tube Sample.									ST12: 24" push at 150lbs of pressure, wet tube (free water)
13 SS	24 24	1 2 3 5	24, 25	24 - 28' **LEAN CLAY WITH SAND:** s(CL), pale brown (10YR 6/3), trace brownish yellow (10YR 6/6) mottling, very fine sand, trace coarse sand, trace silt, cohesive, soft, moist to wet.	s(CL)								
14 SS	24 24	1 1 2 4	26, 27										
15 SS	24 21.5	4 6 8 10	28, 29	28 - 30' **SILTY CLAY** CL/ML, gray (10YR 5/1), trace strong brown (7.5YR 5/6) and very dark brown (10YR 2/2) mottling, very fine sand (10-20%), trace coarse sand and fine gravel, stiff to hard (1.25->4.5 tsf), moist to wet (on bottom).	CL/ML								
16 SS	24 21	3 7 9 14	30, 31	30 - 32' **LEAN CLAY:** to **SILTY CLAY** CL, yellowish brown (10YR 5/4), trace gray (10YR 5/1) and yellowish brown (10YR 5/6) mottling, silt (15-25%), trace very fine to fine gravel, cohesive, medium to high plasticity, very stiff (2.5-4.0 tsf), moist. 30.2' small dark brown (10YR 3/3) fragments (possible shale).	CL								
17 SS	24 20	4 6 10 13	32, 33	32 - 38' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace gray (10YR 5/1) mottling, silt (5-15%), trace fine to coarse sand, low to medium plasticity, medium to hard (0.75->4.5 tsf), dry to moist (increasing moisture content with depth).	CL								
18 SS	24 17	4 6 13 16	34, 35	33.1' - 33.3' dark gray (10YR 4/1). 34' - 35.4' no coarse sand, moist.									
19 SS	11 11	5 50 for 5"	36, 37	36' - 37' low plasticity, moist (decreasing moisture content with depth).									subangular gravel in shoe of sample SS19

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-169

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
					CL									
20 SS	24 0	13 20 23 25	38	38 - 40' No Recovery.										
21 SS	18 6	16 35 50 for 6"	40	40 - 42' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace gray (10YR 5/1) mottling, silt (0-10%), subrounded to subangular gravel (5-10%), trace fine to coarse sand, low to medium plasticity, medium to hard (0.75->4.5 tsf), moist to wet.	CL									
			42	42' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-370

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mark Baetje Bulldog Drilling	11/20/2015	11/24/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-370	Feet (NAVD88)	418.67 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,826.50 N, 2,381,936.14 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 44.1702"
Long -89° 52' 10.8084"
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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
			0-2	0 - 2' **SILTY CLAY** CL/ML.	CL/ML								0-28' Blind Drilled. See log PZ-170 for soil description.
			2-4	2 - 4' Shelby Tube Sample.									
			4-8	4 - 8' **SILTY CLAY** CL/ML.	CL/ML								
			8-10	8 - 10' **SILTY CLAY** to **LEAN CLAY:** CL/ML.	CL/ML								
			10-12	10 - 12' **LEAN CLAY:** CL.	CL								

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

Signature [signature]

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SOIL BORING LOG INFORMATION SUPPLEMENT

Natural Resource Technology

Boring Number MW-370

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
			12 - 14	12 - 14' Shelby Tube Sample.										
			14 - 24	14 - 24' **SILTY CLAY** CL/ML.	CL/ML									
			24 - 26	24 - 26' Shelby Tube Sample.										
			26 - 28	26 - 28' **SILTY CLAY** CL/ML.	CL/ML									
1 SS	10 10	23 50/4"	28 - 28.4	28 - 28.4' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace angular limestone gravel, soft, medium plasticity, moist.	CL									
1 CORE	60 18.5		28.4 - 28.9	28.4 - 28.9' **SHALE:** BDX (SH), gray, highly decomposed, very weak.	BDX (SH)									Core 1, RQD=51%
			28.9 - 38.1	28.9 - 38.1' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (extremely narrow to moderately narrow apertures), medium to thickly bedded, microcrystalline, moderately decomposed, very strong.	BDX (LS/SH)									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-370

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
			33	28.9 - 38.1' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (extremely narrow to moderately narrow apertures), medium to thickly bedded, microcrystalline, moderately decomposed, very strong. *(continued)*									
2 CORE	51.5 12		34	33.9' - 38.1' gray, greenish gray in fractures, trace fossils, moderately to highly decomposed, slightly to moderately disintegrated, clay in shoe with a hard, reddish brown inclusion.	BDX (LS/SH)								Core 2, RQD=0%
			35–37	36' - 37.9' vertical fracture.									
3 CORE	24 25		38	38.1 - 44' **SHALE:** BDX (SH), bluish gray, intensely fractured (extremely narrow to narrow apertures), highly decomposed, weak.									Core 3, RQD=40%
4 CORE	24 11		40										Core 4, RQD=0%
5 CORE	36 32		41	40.6' - 40.8 shaley limestone layer, light gray to gray, microcrystalline, moderately decomposed, very strong. 41.1' - 43.2 gray, moderately to highly decomposed.	BDX (SH)								Core 5, RQD=78%
6 CORE	12 28		44	44 - 45.7' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (extremely narrow to narrow apertures), thin to medium bedded, microcrystalline, slightly decomposed, clay cement in apertures, very strong.	BDX (LS/SH)								Core 6, RQD=29%
7 CORE	45 27		45–46	45' shale layer, bluish gray, moderately fractured (extremely narrow to narrow apertures), highly decomposed, weak. 45.7 - 52.2' **SHALE:** BDX (SH), bluish gray, moderately fractured (tight to narrow), highly decomposed, weak.									Core 7, RQD=65%
8 CORE	24 30		49		BDX (SH)								Core 8, RQD=78%
9 CORE	24 24		51–52										Core 9, RQD=0%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-370

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
			52	52' clay cement.										
			53	52.2 - 61.7' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (very narrow to narrow), thin to medium bedded, microcrystalline, slightly decomposed, cemented clay in apertures, very strong.	BDX (LS/SH)									
10 CORE	24 36		54	52.7' - 53' clayey sand in aperture. 53' - 53.1 shale bed, bluish gray, fossiliferous, moderately fractured (very narrow to narrow), highly decomposed, weak. 53.1' white to bluish gray, gray in the fractures (extremely narrow to moderately narrow apertures), thinly to medium bedded, slightly to moderately disintegrated.										Core 10, RQD=0%
11 CORE	24 30		56	55.7' moderately disintegrated.										Core 11, RQD=18%
12 CORE	30 27		58	58.1' highly decomposed.										Core 12, RQD=39%
13 CORE	36 53		61											Core 13, RQD=89%
			62	61.7 - 65.3' **LIMESTONE:** BDX (LS).	BDX (LS)									
			65	65.3 - 66' Overdrilled for Well Installation.										
			66	66' End of Boring.										Bedrock corehole reamed 6" in diameter to 66' for well installation.

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-170

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/29/2015	7/29/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-170	Feet (NAVD88)	418.58 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,822.69 N, 2,381,944.92 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 44.106"
Long -89° 52' 10.6752"
Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 8	4 5 6 9	0-2	0 - 2' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (15-25%), trace roots, grass, gravel, and coarse sand, cohesive, nonplastic to low plasticity, hard (>4.5 tsf), dry.	CL/ML								
2 ST	24 21		2-4	2 - 4' Shelby Tube Sample.									ST2: 24" push at 500lbs of pressure.
3 SS	24 15	2 3 5 7	4-8	4 - 8' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (5-15%), trace very fine sand and gravel, low plasticity, very stiff to hard (2.5->4.5 tsf), dry.	CL/ML								
4 SS	24 17	3 5 8 8		6' - 7.4' trace gray (10YR 5/1) mottling.									
5 SS	24 17	3 4 6 6	8-10	8 - 10' **SILTY CLAY** to **LEAN CLAY:** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (5-15%), trace very fine sand and gravel, silt content decreases with depth, clay content increases with depth, medium plasticity, very stiff (3.25 tsf), dry.	CL/ML								
6 SS	24 20	3 4 5 5	10-12	10 - 12' **LEAN CLAY:** CL, brown (5YR 4/3), trace very dark brown (10YR 2/2) mottling, trace silt, silt content increasing with depth, medium to high plasticity, stiff (1.75-2.0 tsf).	CL								
7 ST	24 24		12-14	12 - 14' Shelby Tube Sample.									ST7: 24" push at 250lbs of pressure.

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

Signature [signature] | Firm Natural Resource Technology, 234 W. Florida St., Fifth Floor, Milwaukee, WI 53204 | Tel: (414) 837-3607 Fax: (414) 837-3608

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				12 - 14' Shelby Tube Sample. *(continued)*									
8 SS	24 21	3 5 7 8	14	14 - 24' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (10-20%), trace gravel, cohesive, low plasticity, stiff to very stiff (1.0-3.0 tsf), dry to moist. 14.9' - 15.3' very dark brown (10YR 2/2) mottling.	CL/ML								
9 SS	24 24	2 4 4 6	16	16' - 18.5' increaed very dark brown (10YR 2/2) mottling (5-15%), very fine sand (0-10%), trace fine gravel, subangular, cohesive, low to medium plasticity, dry to moist. 16.8' - 17.1' very dark brown (10YR 2/2) mottling.									
10 SS	24 24	1 3 3 3	18	18' - 20' silt (15-25%), very fine sand (0-10%), trace fine gravel, medium plasticity, moist. 19' layer of gravel (2" thick, subangular to subrounded).									
11 SS	24 20	1 2 5 7	20	19.8' very soft (0.25 tsf). 20' - 24' subangular to subrounded gravel, low plasticity, dry to moist. 20.8' increased gravel content (10-15%). 21.2' decrease in gravel content (5-15%).									
12 SS	24 20.5	3 6 8 10	22										
13 ST	24 24		24	24 - 26' Shelby Tube Sample.									ST13: 24" push at 650lbs of pressure.
14 SS	24 22	3 6 12 14	26	26 - 28.2' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (10-30%), very fine sand (0-15%), trace fine subangular to subrounded gravel, gravel decreases with depth to no gravel, trace <1mm thick very fine sand seams, cohesive, low to medium plasticity, plasticity increasing with depth, very stiff to hard (2.0->4.5 tsf), moist, decreasing silt and sand content with depth.	CL/ML								
15 SS	24 22	9 17 24 35	28	28.2 - 30' **LEAN CLAY:** CL, very dark gray (2.5Y 3/1), trace silt, cohesive, medium to high plasticity, hard (>4.5 tsf), dry. 28.5' black (2.5Y 2.5/1). 28.9' greenish gray (GLEY 1 6/1).	CL								
16 SS	17 13	11 30 50 for 5"	30	30 - 31.1' **SHALE:** to **LEAN CLAY:** BDX (SH), greenish gray (GLEY 1 6/1), trace silt, cohesive, medium to high plasticity, dry, shale (residual soil to highly decomposed, very weak, fissile).	BDX (SH)								Hollow Stem Auger Refusal at 31.1 ft bgs on Shale Bedrock.
			31	31.1' End of Boring.									

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-373

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	10/21/2015	10/28/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-373	Feet (NAVD88)	388.80 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,041.91 N, 2,379,186.06 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 26.613"
Long -89° 52' 45.3282"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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
			0	0 - 2' No Recovery. Gravel Pad.									0-13.4' Blind Drilled. See log PZ-173 for soil description detail.
			2	2 - 10.9' **SILTY CLAY** CL/ML.	CL/ML								
			10.9	10.9 - 13.4' **SILT:** ML.	ML								

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

Signature: Brad Rhodes (signed)

Firm: Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-373

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13	10.9 - 13.4' **SILT:** ML. *(continued)*	ML						
1 CORE	23 23		14	13.4 - 14.7' **LIMESTONE:** BDX (LS), fossiliferous, extremely fractured, thickly bedded.	BDX (LS)						Core 1, RQD=65%
			15	14.7 - 15.5' **SHALE:** BDX (SH), gray, trace limestone, highly decomposed.	BDX (SH)						
2 CORE	58.2 42		16	15.5 - 16.6' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, intensely fractured.	BDX (LS/SH)						Core 2, RQD=52%
			17	16.6 - 17.3' **SHALE:** BDX (SH), gray, highly decomposed.	BDX (SH)						
			18	17.3 - 18.8' **LIMESTONE:** BDX (LS), thickly bedded.	BDX (LS)						
			19, 20	18.8 - 20.2' **SHALE:** BDX (SH), highly decomposed.	BDX (SH)						
3 CORE	60 56			20.2 - 20.8' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured, tight diagonal fracture.	BDX (LS/SH)						Core 3, RQD=57%
			21	20.8 - 21.5' **SHALE:** BDX (SH), gray, highly decomposed.	BDX (SH)						
			22, 23, 24	21.5 - 24.9' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured, extremely narrow to narrow apertures.	BDX (LS/SH)						
4 CORE	60 55		25, 26, 27, 28, 29	24.9 - 29.1' **SHALE:** BDX (SH), highly decomposed. 25.1' - 25.4' limestone, fossiliferous. 25.4' gray, fossiliferous, thickly bedded, hard.	BDX (SH)						Core 4, RQD=65%
5 CORE	60 60		30, 31, 32	29.1 - 48.3' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded. 30' - 35.1' moderately fractured, extremely narrow apertures.	BDX (LS)						Core 5, RQD=95%

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-373

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
				29.1 - 48.3' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded. *(continued)*										
			33											Bedrock corehole reamed 6" in diameter to 33.3' for well installation.
			34											
6 CORE	60 58		35	35.1' - 40' slightly fractured, narrow apertures.										Core 6, RQD=96%
			36											
			37											
			38											
			39											
7 CORE	60 60		40	40' - 45.1' moderately fractured, extremely narrow to narrow apertures.	BDX (LS)									Core 7, RQD=100%
			41	41.3' - 41.6' vuggy.										
			42											
			43											
			44											
8 CORE	60 61.5		45	45.1' - 48.3' moderately fractured.										Core 8, RQD=63%
			46											
			47											
			48	48.3 - 57' **SHALE:** BDX (SH), gray, thin limestone beds.										
			49											
9 CORE	60 63		50	49.9' moderately decomposed.	BDX (SH)									Core 9, RQD=57%
			51											
			52											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-373

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
				48.3 - 57' **SHALE:** BDX (SH), gray, thin limestone beds. *(continued)* 54.7' - 55' fossiliferous.	BDX (SH)									
10 CORE	60 46		55											Core 10, RQD=35%
			57	57 - 58.3' **LIMESTONE:** BDX (LS), intensely fractured, decomposed green infilling.	BDX (LS)									
			58.3	58.3 - 60' **LEAN CLAY:** CL, greenish gray to reddish brown. 58.7' reddish brown.	CL									
11 CORE	60 55		60	60 - 65.2' **SHALE:** BDX (SH), intensely fractured, thickly bedded, decomposed. 62.8' gray.	BDX (SH)									Core 11, RQD=51%
12 CORE	60 58		65.2	65.2 - 66.5' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured, thinly bedded.	BDX (LS/SH)									Core 12, RQD=67%
			66.5	66.5 - 68.8' **SHALE:** BDX (SH), gray.	BDX (SH)									
			68.8	68.8 - 70.7' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured, decomposed (greenish gray).	BDX (LS/SH)									
13 CORE	46 48		70											Core 13, RQD=60%
			70.7	70.7 - 80.1' **SHALE:** BDX (SH), dark gray, thickly bedded.	BDX (SH)									

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-373

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				70.7 - 80.1' **SHALE:** BDX (SH), dark gray, thickly bedded. *(continued)*	BDX (SH)						
			73								
14 CORE	12 11		74								Core 14, RQD=91%
15 CORE	60 62		75								Core 15, RQD=61%
			76	76.1' dark to light gray, intensely fractured, highly decomposed.							
			77	77.5' dark gray, moderately fractured.							
			78	78.7' highly fractured, decomposed.							
			79								
16 CORE	60 64		80	80.1 - 83.3' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured.	BDX (LS/SH)						Core 16, RQD=61%
			81								
			82								
			83	83.3 - 85.4' **SHALE:** BDX (SH), dark gray, intensely fractured.	BDX (SH)						
			84								
17 CORE	60 60		85	85.4 - 88.4' **SHALEY LIMESTONE:** BDX (LS/SH), thickly bedded, fossiliferous.	BDX (LS/SH)						Core 17, RQD=87%
			86								
			87								
			88	88.4 - 88.8' **SHALE:** BDX (SH), dark gray, intensely fractured.	BDX (SH)						
			89	88.8 - 94' **LIMESTONE:** BDX (LS), thickly bedded.	BDX (LS)						
18 CORE	60 59		90								Core 18, RQD=88%
			91								
			92								

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-373

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
			93	88.8 - 94' **LIMESTONE:** BDX (LS), thickly bedded. *(continued)*	BDX (LS)									
			94 95	94 - 95.1' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured.	BDX (LS/SH)									
				95.1' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-173

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	8/3/2015	8/3/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-173	Feet (NAVD88)	388.43 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,035.38 N, 2,379,187.28 E E/W
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 26.52"
Long -89° 52' 45.2892"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 0		0-2	0 - 2' No Recovery. Gravel Pad.	(FILL)								
2 SS	24 13	2 2 2 3	2-4	2 - 10.9' **SILTY CLAY** CL/ML, dark grayish brown (10YR 4/2), trace sand and wood, cohesive, medium plasticity, very stiff (2.5-3.5 tsf), moist.	CL/ML								
3 SS	24 7	2 5 4 5	4-6	4' yellowish red (5YR 4/6) mottling.									
4 SS	24 20	2 4 8 9	6-8	6' - 7.7' yellowish brown (10YR 5/6) with dark gray (10YR 4/1) mottling, hard, laminated, dry.									
5 SS	24 19	2 4 6 8	8-10	8.2' very dark gray (10YR 3/1), trace dark yellowish brown (10YR 4/6) mottling, small hard nodules of clay in the matrix, dry to moist.									
6 SS	24 18	2 3 6 7	10-12	10.6' olive (5Y 5/6) with bluish gray (GLEY2 5/2) mottling. 10.9 - 13.8' **SILT:** ML, dark reddish gray (5YR 4/2), cohesive, nonplastic, stiff (2.0 tsf), moist.	ML								

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

Signature: [signature]

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NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-173

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	22 16	2 5 15 50 for 4"	13	10.9 - 13.8' **SILT:** ML, dark reddish gray (5YR 4/2), cohesive, nonplastic, stiff (2.0 tsf), moist. *(continued)* 12' - 13.3' trace brown (7.5YR 4/4) mottling, trace gravel, trace sand, increasing sand and gravel with depth. 12.6' wet. 12.8' clay (0-15%).	ML									
8 SS	2 0	50 for 2"	14	13.8 - 14.1' **BEDROCK** BDX (SH), wet.	BDX (SH)									Hollow Stem Auger Refusal at 13.5 ft bgs on Bedrock. SS8: Rock chips in spoon. Split Spoon Refusal at 14.1 ft bgs on Bedrock.
9 SS	1 1	50 for 1"		14.1' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-374

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	11/6/2015	11/9/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-374	Feet (NAVD88)	398.41 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,663.65 N, 2,379,766.63 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 22.8546"
Long -89° 52' 38.0706"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	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: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			0-2	0 - 2' **TOPSOIL:** ML.	ML									0-23.6' Blind Drilled. See log PZ-174 for soil description.
			2-4	2 - 4' No Recovery.										
			4-12	4 - 23.6' **LEAN CLAY:** CL.	CL									

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

Signature: [signature]

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SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-374

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
			13–23	4 - 23.6' **LEAN CLAY:** CL. *(continued)*	CL									
1 SS	24 0.4	50/5"	24	23.6 - 24.1' **SILTY CLAY** CL/ML, brown, 3" of shale at bottom of sample.	CL/ML									
1 CORE	18 16			24.1 - 27.5' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded, moderately fractured (very narrow to moderately narrow apertures).	BDX (LS)									Core 1, RQD=89%
2 CORE	60 44		26											Core 2, RQD=61%
			28	27.5 - 37.2' **SHALEY LIMESTONE:** BDX (LS/SH), decomposed, thickly bedded.										
3 CORE	38 30		30	29.7' moderately fractured.	BDX (LS/SH)									Core 3, RQD=67%
			31–32											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-374

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
				27.5 - 37.2' **SHALEY LIMESTONE:** BDX (LS/SH), decomposed, thickly bedded. *(continued)*	BDX (LS/SH)								
4 CORE	30 27		33										Core 4, RQD=56%
			34										
			35										
5 CORE	59 59			35.4' - 36.2' fossiliferous.									Core 5, RQD=100%
			36	36.2' increase in shale content.									
			37										
				37.2 - 40.3' **SHALE:** to **LIMESTONE:** BDX (SH), gray, limestone content decreasing with depth, thickly bedded, moderately fractured.	BDX (SH)								
			38										
			39										
				39.6' dark gray, no limestone.									
			40										
6 CORE	25 25			40.3 - 42.3' **LIMESTONE:** BDX (LS), fossiliferous, slightly fractured.	BDX (LS)								Core 6, RQD=100%
			41										
			42	41.9' very narrow diagonal fracture.									Bedrock corehole reamed 6" in diameter to 42' for well installation.
				42.3' End of Boring.									

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-174

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	8/4/2015	8/4/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-174	Feet (NAVD88)	398.97 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,666.23 N, 2,379,774.23 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 22.8552"
Long -89° 52' 37.9524"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 5	2 3 5 3	0–2	0 - 2' **TOPSOIL:** ML, brown (10YR 4/3), trace grass and roots, cohesive, nonplastic, dry.	ML								
2 SS	24 0	2 2 2 4	2–4	2 - 4' No Recovery.									
3 SS	24 6	2 2 4 5	4	4 - 24.7' **LEAN CLAY:** CL, dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/4) mottling, silt (10-20%), cohesive, medium plasticity, moist.	CL								
4 SS	24 6	4 4 5 7	6										
5 SS	24 23	3 4 5 5	8	8' - 9.9' increased yellowish brown (10YR 4/4) mottling, increase in silt content with depth (50%).									
6 SS	24 20	2 4 8 6	10–12	10' - 11.7' decrease in silt content with depth (10-20%). 10.6' - 11.2' dark yellowish brown (10YR 4/4) and very dark brown (10YR 2/2) mottling (50%), dry to moist.									

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

Signature: [signature]

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SOIL BORING LOG INFORMATION SUPPLEMENT

Natural Resource Technology

Boring Number PZ-174

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	24 21	2 3 5 7	13	4 - 24.7' **LEAN CLAY:** CL, dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/4) mottling, silt (10-20%), cohesive, medium plasticity, moist. *(continued)* 12' - 13.8' trace coarse sand, dry.										
8 SS	24 21	2 4 5 8	14 15	14' - 15.8' increased sand content, trace gravel, dry.										
9 SS	24 24	2 4 5 7	16 17	16' - 18' yellowish brown (10YR 5/4), moist.										
10 SS	24 24	3 7 9 12	18 19	18' - 20' coarse sand and gravel (5-15%), moist.	CL									
11 SS	24 24	3 7 9 15	20 21											
12 SS	24 24	4 7 8 10	22 23											
13 SS	8 8	11 50 for 2"	24	24' - 24.7' decreased moisture content with depth.										Hollow Stem Auger Refusal at 24.7 ft bgs on Shale Bedrock.
				24.7' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Baldwin Energy Complex		MW-375	
Boring Drilled By: Name of crew chief (first, last) and Firm	**Date Drilling Started**	**Date Drilling Completed**	**Drilling Method**
Jim Dittmaier Bulldog Drilling	11/3/2015	11/6/2015	4 1/4 HSA and rotary
Common Well Name: MW-375	Final Static Water Level: Feet (NAVD88)	Surface Elevation: 420.50 Feet (NAVD88)	Borehole Diameter: 8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,434.97 N, 2,380,838.70 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 20.562"
Long -89° 52' 24.6504"
Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–0.9	0 - 0.9' **SILT:** ML.	ML								0- 44.8' Blind Drilled. See log PZ-175 for soil description details.
			0.9–5.4	0.9 - 5.4' **LEAN CLAY:** CL.	CL								
			5.4–13.5	5.4 - 13.5' **SILT:** ML.	ML								
			13.5–15	13.5 - 22.3' **LEAN CLAY:** CL.	CL								

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

Signature

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NATURAL RESOURCE TECHNOLOGY

Boring Number MW-375

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
			16–22.3	13.5 - 22.3' **LEAN CLAY:** CL. *(continued)*	CL									
			22.3–26	22.3 - 26' **SILT:** ML.	ML									
			26–28	26 - 28' **LEAN CLAY:** to **SILT:** CL.	CL									
			28–28.4	28 - 28.4' **SANDY SILT:** s(ML).	s(ML)									
			28.4–31.3	28.4 - 31.3' **LEAN CLAY:** CL.	CL									
			31.3–31.5	31.3 - 31.5' **WELL-GRADED SAND WITH GRAVEL:** (SW)g.	(SW)g									
			31.5–41	31.5 - 43.8' **LEAN CLAY:** CL.	CL									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-375

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
			42–43	31.5 - 43.8' **LEAN CLAY:** CL. *(continued)*	CL								
			44	43.8 - 44.8' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g.	s(CL)g								
1 CORE 1 SS	60 42 5 5	50 for 5"	45	44.8 - 45.3' **WELL-GRADED GRAVEL:** GW, gray, mostly limestone cobbles.	GW								Core 1, RQD=86% Broken limestone in split spoon at 45'.
			46–49	45.3 - 49.3' **SILTY CLAY** CL/ML, dark yellowish brown (10YR 4/6).	CL/ML								
			50	49.3 - 50.1' **LEAN CLAY:** CL, dark gray (10YR 4/1).	CL								
2 CORE	24 18		50–51	50.1 - 51.3' **SHALE:** BDX (SH), highly decomposed.	BDX (SH)								Core 2, RQD=33%
3 CORE	36 30.5		52–53	51.3 - 62.8' **SHALEY LIMESTONE:** BDX (LS/SH), gray, thickly bedded, fossiliferous, moderately fractured.	BDX (LS/SH)								Core 3, RQD=85%
4 CORE	60 55		55–59										Core 4, RQD=95%
5 CORE	60 62		60–62	59.9' very narrow to narrow apertures.									Core 5, RQD=94%
			63–64	62.8 - 84.7' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded, slightly fractured (extremely narrow to moderately narrow apertures).									
6 CORE	60 55		65–67	64.9' very narrow apertures.	BDX (LS)								Core 6, RQD=100%

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW-375

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
			68	62.8 - 84.7' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded, slightly fractured (extremely narrow to moderately narrow apertures). *(continued)*										
			69											
7 CORE	60 63		70	69.5' slightly to moderately fractured (very narrow to moderately narrow apertures).										Core 7, RQD=95% Bedrock corehole reamed 6" in diameter to 70' for well installation.
			71											
			72											
			73											
			74											
8 CORE	60 62		75	74.9' extremely narrow apertures.										Core 8, RQD=100%
			76		BDX (LS)									
			77											
			78											
			79											
9 CORE	60 56		80	80.2' unfractured, cherty.										Core 9, RQD=100%
			81											
			82											
			83											
			84											
				84.7' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-175

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	8/7/2015	8/7/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-175	Feet (NAVD88)	419.87 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,433.02 N, 2,380,846.31 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 20.5152"
Long -89° 52' 24.5316"
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 17	4 7 5 4	0–1	0 - 0.9' **SILT:** ML, brown (10YR 5/3), trace roots and grass, noncohesive, nonplastic, hard (3.0->4.5 tsf), dry.	ML								
2 SS	24 15	2 4 4 6	1–3	0.9 - 5.4' **LEAN CLAY:** CL, brownish yellow (10YR 6/6), black (10YR 2/1) mottling, silt (5-15%), dry, cohesive, low plasticity, very stiff (2.5-3.0 tsf). 2' dry, increase in moisture content with depth, trace brown (10YR 5/3) silt seams.	CL								
3 SS	24 17	2 3 4 6	3–5	4' increased brown (10YR 5/3) and black mottling (10YR 2/1), moist.									
4 SS	24 23	2 2 4 4	5–7	5.4 - 13.5' **SILT:** ML, light yellowish brown (10YR 6/4), trace dark gray (10YR 4/1) mottling, clay (5-15%), moist, cohesive, nonplastic, medium to stiff (0.5- 1.5 tsf).	ML								
5 SS	24 22	1 2 3 3	7–9	8' decreased mottling.									
6 SS	24 24	1 2 2 2	9–11	10' brown (7.5YR 4/4), no mottling.									
7 SS	24 23	1 2 3 4	11–14	12' increasing clay content with depth, low plasticity.									

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

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
8 SS	24 21	1 3 4 5	15	13.5 - 22.3' **LEAN CLAY:** CL, brown (7.5YR 4/4), silt (5-15%), moist, cohesive, low to medium plasticity, stiff to very stiff (1.5-4.0 tsf) increasing with depth. *(continued)* 14' trace black (10YR 2/1) and dark gray (10YR 4/1) mottling, trace silt.	CL								
9 SS	24 24	2 3 4 4	16, 17	16' brown (7.5YR 5/4), silt (5-15%).									
10 SS	24 23	1 4 6 6	18, 19	18' trace black (10YR 2/1) and dark gray (5-50% 10YR 4/1) mottling, trace silt, silt content decreasing with depth, wet.	CL								
11 SS	24 23	2 5 7 7	20, 21	20' no black (10YR 2/1) mottling, yellowish brown (5-15% 10YR 5/8) mottling.									
12 SS	24 24	3 3 4 4	22, 23	22.3 - 26' **SILT:** ML, clay (5-15%), trace coarse sand, decrease in clay content with depth, moist, cohesive, nonplastic, very soft to very stiff (<0.25-3.0 tsf) decreasing with depth.									
13 SS	24 24	2 2 2 3	24, 25	23.9' sandy silt seam (2" thick), wet. 24' some sandy and clayey silt seams, trace coarse sand to fine gravel, moist to wet in sandy silt seams.	ML								
14 SS	24 24	11 8 9 10	26, 27	26 - 28' **LEAN CLAY:** to **SILT:** CL, silt (40-60%), coarse sand to fine gravel (5-15%), trace fine sand seams, moist, cohesive, low plasticity, stiff (1.5-2.0 tsf).	CL								
15 SS	24 24	8 11 15 20	28, 29	28 - 28.4' **SANDY SILT:** s(ML), yellowish brown (10YR 5/4), wet, cohesive, nonplastic, stiff (1.5 tsf). 28.4 - 31.3' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), coarse sand to fine gravel (5-15%), trace fine sand seams, hard (>4.5 tsf), dry to moist.	s(ML)								
16 SS	24 24	9 19 20 23	30, 31		CL								
17 SS	24 24	6 6 8 10	32, 33	31.3 - 31.5' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, dark yellowish brown (10YR 4/6), dry. 31.5 - 43.8' **LEAN CLAY:** CL, gray (10YR 5/1), dry, very stiff to hard (2.5->4.5 tsf), cohesive, nonplastic. 32' trace yellowish brown (10YR 5/6) seams and mottling, medium to high plasticity, increasing moisture content with depth.	(SW)g								
18 SS	24 24	7 5 6 8	34, 35	34' trace mottling, moist, decreasing moisture content with depth.	CL								
19 SS	24 24	3 5 6 7	36, 37	36' dry to moist, silty clay seam (4" thick, moist).									

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-175

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
20 SS	24 24	3 4 7 7	38, 39	31.5 - 43.8' **LEAN CLAY:** CL, gray (10YR 5/1), dry, very stiff to hard (2.5->4.5 tsf), cohesive, nonplastic. *(continued)* 38' trace black (10YR 2/1) mottling. 38.3' yellowish brown (10YR 5/6) with gray (10YR 5/1) mottling.	CL								
21 SS	24 24	3 5 6 7	40, 41										
22 SS	24 24	3 5 8 20	42, 43	42' trace fine gravel.									
23 SS	24 20	3 11 12 14	44, 45	43.8 - 45.7' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g, brown (10YR 5/3), mostly broken rock, moist. 44' black (10YR 2/1) mottling, seams of wet gravel, coarse sand to coarse gravel.	s(CL)g								
24 SS	24 24	3 5 7 11	46, 47	45.7 - 50' **LEAN CLAY:** CL, light yellowish brown (10YR 6/4), brownish yellow (10YR 6/6) and dark gray (10YR 4/1) and black (10YR 2/1) mottling, trace fine gravel, some laminations, very stiff (2.5-3.5 tsf).	CL								
25 SS	24 24	4 7 12 20	48, 49	48' moist to dry. 48.7' laminated, dry.									
26 SS	1 0	50 for 1"	50	50 - 50.2' **SHALE:** BDX (SH). 50.2' End of Boring.	BDX (SH)								Hollow Stem Auger Refusal at 50.2 ft bgs on Shale Bedrock.

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-377

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	10/29/2015	11/2/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-377	Feet (NAVD88)	418.75 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,198.46 N, 2,381,923.68 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 18.1896"
Long -89° 52' 11.0712"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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
			0–4	0 - 4' **TOPSOIL:** ML.	ML								0-28.5' Blind Drilled. See log PZ-177 for soil description.
			4–13	4 - 19.3' **LEAN CLAY:** CL.	CL								

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SOIL BORING LOG INFORMATION SUPPLEMENT

Natural Resource Technology

Boring Number MW-377

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		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13–19.3	4 - 19.3' **LEAN CLAY:** CL. *(continued)*	CL									
			19.3–22	19.3 - 22' **SILT:** ML.	ML									
			22–28.5	22 - 28.5' **LEAN CLAY:** CL.	CL									
1 SS	24	3 6 9 17	28.5–30.8	28.5 - 30.8' **LEAN CLAY:** CL, brownish yellow (10YR 6/6), gray (10YR 5/4) mottling, hard (4.5 tsf).	CL									
2 SS	24 12	12 20 27 30	30.8–34.9	30.8 - 34.9' **SHALE:** BDX (SH), gray, moderately to highly decomposed.	BDX (SH)									
1 CORE	41 51			31.7' grayish brown mottling, thickly bedded.										Core 1, RQD=92%

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-377

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
2 CORE	55.8 16		35	34.9 - 35.3' **LIMESTONE:** BDX (LS), cherty, moderately decomposed, reddish gray mottling, moderately fractured.	BDX (LS)									Core 2, RQD=25%
			36	35.3 - 46.4' **SHALE:** BDX (SH), gray, moderately to highly decomposed.										
			37											
			38											
			39											
3 CORE	60 64.2		40	39.7' - 40.4' gray and brown mottling, highly decomposed, blocky structure. 40.4' - 43.1' highly decomposed, moderately fractured.	BDX (SH)									Core 3, RQD=75%
			41											
			42											
			43											
			44											
4 CORE	60 58		45											Core 4, RQD=12%
			46											
			47	46.4 - 51.1' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured (narrow apertures).										
			48											
			49		BDX (LS/SH)									
5 CORE	60 50		50	49.5 - 49.9' vertical fracture.										Core 5, RQD=58%
			51	51.1 - 55.5' **SHALE:** BDX (SH), gray, thickly bedded.										
			52											
			53		BDX (SH)									
			54											
6 CORE	60 41		55											Core 6, RQD=61%
			56	55.5 - 58.2' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured.	BDX (LS/SH)									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-377

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
			57 58	55.5 - 58.2' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, moderately fractured. *(continued)*	BDX (LS/SH)									
				58.2' End of Boring.										Bedrock corehole reamed 6" in diameter to 58' for well installation.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-382

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	11/19/2015	11/24/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-382	Feet (NAVD88)	428.67 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,440.86 N, 2,382,404.51 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 40.344"
Long -89° 52' 4.9578"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–2	0 - 2' **SILTY CLAY** CL/ML.	CL/ML								0-34' Blind Drilled. See log PZ-182 log for soil description details.
			2–4	2 - 4' Shelby Tube Sample.									
			4–12	4 - 12' **SILTY CLAY** CL/ML.	CL/ML								

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

Signatur [signature]

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NATURAL RESOURCE TECHNOLOGY

Boring Number MW-382

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
			12 - 14	12 - 14' Shelby Tube Sample.										
			14 - 22	14 - 22' **SILTY CLAY** CL/ML.	CL/ML									
			22 - 24	22 - 24' Shelby Tube Sample.										
			24 - 27	24 - 27' **SILTY CLAY** CL/ML.	CL/ML									
			27 - 29.1	27 - 29.1' **WELL-GRADED SAND:** SW.	SW									
			29.1 - 30	29.1 - 30' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g.	s(CL)g									
			30 - 32	30 - 34' **SILTY CLAY** CL/ML.	CL/ML									

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-382

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		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33	30 - 34' **SILTY CLAY** CL/ML. *(continued)*	CL/ML									
1 SS	23 20	12 20 25 50 for 5"	34–35	34 - 36' **SILTY CLAY** CL/ML, dark gray (10YR 4/1), dark yellowish brown 10YR 4/6 mottling, highly decomposed shale at bottom of spoon, hard (>4.5 tsf).	CL/ML									
1 CORE	53 48.5		36–38	36 - 38.3' **SHALE:** BDX (SH), gray, highly decomposed.	BDX (SH)									Core 1, RQD=94%
			39	38.3 - 40' **LIMESTONE:** BDX (LS), thinly laminated, intensely fractured (extremely narrow apertures).	BDX (LS)									
2 CORE	60 24.5		40–44	40 - 44.5' **SHALE:** BDX (SH), gray, highly decomposed.	BDX (SH)									Core 2, RQD=51%
			45	44.5 - 45.4' **LIMESTONE:** BDX (LS), thinly bedded.	BDX (LS)									
3 CORE	54 35		46–49	45.4 - 58.4' **SHALE:** BDX (SH), gray, highly decomposed.	BDX (SH)									Core 3, RQD=51%
4 CORE	24 23.5		50–52	50.1' - 51.2' reddish brown and dark gray mottling. 51.2' - 52.1' limestone, intensely fractured.										Core 4, RQD=19%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-382

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
5 CORE	41 41			45.4 - 58.4' **SHALE:** BDX (SH), gray, highly decomposed. *(continued)* 52.1' gray.										Core 5, RQD=63%
			53											
			54											
			55		BDX (SH)									
6 CORE	30 25		56	55.9' gray to dark gray, intensely fractured, few medium limestone beds.										Core 6, RQD=50%
			57											
7 CORE	30 30		58	58.4 - 62' **LIMESTONE:** BDX (LS), cherty, moderately fractured.										Core 7, RQD=53%
			59	59.5' - 59.9' vertical fracture.										
			60	60' shale (2" layer).	BDX (LS)									
8 CORE	60 59		61	60.4' - 61.4' shaley, intensely fractured.										Core 8, RQD=70%
			62	62 - 67.1' **SHALE:** BDX (SH), gray, hard, slightly fractured.										
			63											
			64											
			65		BDX (SH)									
9 CORE	60 59		66											Core 9, RQD=88%
			67	67.1 - 70.6' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, slightly fractured, (very narrow apertures).										
			68											
			69		BDX (LS/SH)									Bedrock corehole reamed 6" in diameter to 69' for well installation.
			70											
				70.6' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Baldwin Energy Complex		MW-383	
Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	12/7/2015	12/21/2015	4 1/4 HSA and rotary
Common Well Name: MW-383	Final Static Water Level: Feet (NAVD88)	Surface Elevation: 457.18 Feet (NAVD88)	Borehole Diameter: 8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,586.04 N, 2,385,208.26 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 41.6862"
Long -89° 51' 29.8296"
Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24	4 2 2 4		0 - 16' **FILL, ASH (Coal):** black (10YR 2/1) and dark yellowish brown (10YR 4/4), mostly sand-sized ash, 30-50% cinders, >15% silt-sized ash, very soft (0 tsf).									
			1										
2 SS	24	1 3 2 3	2										
			3										
3 SS	24 18	1 2 3 7	4										
			5										
4 SS	24 18	2 11 11 7	6		(FILL)								
			7										
5 SS	24 17	7 4 3 2	8	8' mostly black (10YR 2/1).									
			9										
6 SS	24 18	2 4 4 4	10										
			11										
			12										

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

Signature: [signature]

Firm: Natural Resource Technology
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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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24	2 3 4 1	13	0 - 16' **FILL, ASH (Coal):** black (10YR 2/1) and dark yellowish brown (10YR 4/4), mostly sand-sized ash, 30-50% cinders, >15% silt-sized ash, very soft (0 tsf). *(continued)*	(FILL)								
8 SS	24	1 2 1 2	14–15	14' clay (2" thick layer).									
9 SS	24 10	WOH WOH 2 2	16–17	16 - 18' **LEAN CLAY:** CL, gray (5Y 5/1), stiff (1.75 tsf).	CL								WOH=weight of hammer
10 SS	24 14	WOH 2 2 2	18–19	18 - 40' **SILTY CLAY** CL/ML, gray (10YR 6/1), yellowish brown (10YR 5/6) mottling, stiff to very stiff (1.0-3.0 tsf), low plasticity.	CL/ML								
11 SS	24	WOH 2 2	20–21										
			22–23										Blind drill 22-24' bgs during casing install. Permanent 6" PVC casing was installed to 22.5' bgs.
13 SS	24 13	1 1 3 3	24–25	24' gray (10YR 5/1), dark yellowish brown (10YR 4/6) mottling.									
14 SS	24 12	1 1 2 3	26–27	26' dark gray (10YR 5/6) mottling.									
15 SS	24 23	2 4 4 6	28–29										
16 SS	24 27	4 4 2 7	30–32	31' trace oxidation staining.									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-383

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 27	4 4 5 5	33	18 - 40' **SILTY CLAY** CL/ML, gray (10YR 6/1), yellowish brown (10YR 5/6) mottling, stiff to very stiff (1.0-3.0 tsf), low plasticity. *(continued)* 32' light brownish gray (10YR 6/2), yellowish brown (10YR 5/6) mottling, very stiff (3.0 tsf).									
18 SS	24 26	2 3 5 6	34, 35	34' gray (10YR 5/1), dark yellowish brown (10YR 4/6) mottling, very stiff (2.0 tsf).									
19 SS	24 14	WOH WOH 3 4	36, 37	36' very soft to stiff (0-1.75 tsf).	CL/ML								
20 SS	24 12	3 4 3 5	38, 39	38' strong brown (7.5YR 4/6), gray (10Y R5/1) mottling, trace sand, very stiff (3.5 tsf).									
21 SS	24 22	1 2 2 2	40	40 - 41' **LEAN CLAY WITH SAND:** (CL)s, gray (10YR 5/1), dark yellowish brown (10YR 4/6) mottling, moderately stiff (0.75 tsf).	(CL)s								
			41	41 - 42' **SILTY SAND:** SM, yellowish brown (10YR 5/6), mostly medium sand, trace coarse sand, soft.	SM								
22 SS	24 24	5 8 9 10	42, 43	42 - 44' **SILTY CLAY** CL/ML, brown (10YR 5/3), >15% sand, moderately stiff (0.75 tsf), nonplastic.	CL/ML								
23 SS	24 20	4 6 8 7	44, 45	44 - 50' **LEAN CLAY:** CL, yellowish brown (10YR 5/6), trace black oxidation staining, very stiff to hard (3.25-4.5+ tsf), plastic.									
24 SS	24 16	4 6 10 11	46, 47		CL								
25 SS	24 19	6 18 21 21	48, 49	48' brown (10YR 5/3), hard (4.25-4.5+), low plasticity.									
26 SS 1 CORE	24 60	8 16 22 32	50, 51, 52	50 - 53.1' **SHALE:** BDX (SH), light olive gray (5Y 6/2), hard, highly decomposed, dry.	BDX (SH)								Core 1, RQD=60%

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW-383

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
27 SS	24	8 10 15 50/4"		50 - 53.1' **SHALE:** BDX (SH), light olive gray (5Y 6/2), hard, highly decomposed, dry. *(continued)*	BDX (SH)									
			53	53.1 - 55.1' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured.	BDX (LS/SH)									
2 CORE	60		55	55.1 - 58.6' **LIMESTONE:** BDX (LS), slightly fractured.	BDX (LS)									Core 2, RQD=82%
			58	58.6 - 59.5' **SHALE:** BDX (SH), thinly bedded with limestone, moderately fractured.	BDX (SH)									
3 CORE	60		59	59.5 - 70.1' **SHALE:** BDX (SH), gray, moderately decomposed. 60' intensely to moderately fractured.	BDX (SH)									Core 3, RQD=31%
			63	63' moderately fractured.										
4 CORE	60		65											Core 4, RQD=49%
5 CORE	34		70	70.1 - 73' **LIMESTONE:** BDX (LS), unfractured.	BDX (LS)									Core 5, RQD=100%

Depth scale: 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-383

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
			73	70.1 - 73' **LIMESTONE:** BDX (LS), unfractured. *(continued)*	BDX (LS)									
				73' End of Boring.										Bedrock corehole reamed 6" in diameter to 73' for well installation.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-384

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	12/7/2015	12/16/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-384	Feet (NAVD88)	456.70 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,446.11 N, 2,384,518.72 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 30.4398"
Long -89° 51' 38.5158"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 / 8	2 3 4 6	0–2.5	0 - 2.5' **FILL, ASH (Coal):** very soft to moderately stiff (0-0.75 tsf).	(FILL)								
2 SS	24 / 19	2 4 3 6	2.5–4	2.5 - 4' **FILL, SILTY CLAY** CL/ML, strong brown (7.5YR 4/6), trace gravel, very soft to very stiff (0-3.5 tsf).	(FILL) CL/ML								
3 SS	24 / 10	1 2 3 4	4–18	4 - 18' **FILL, ASH (Coal):** yellowish red (5YR 4/6) to reddish black (10R 2.5/1), sand-sized ash and cinders, very soft to stiff (0-1.5 tsf).	(FILL)								
4 SS	24	2 2 2 2	6										
5 SS	24	1 2 1 1	8										
6 SS	24	1 2 1 1	10										

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

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24	1 5 10 10	13	4 - 18' **FILL, ASH (Coal):** yellowish red (5YR 4/6) to reddish black (10R 2.5/1), sand-sized ash and cinders, very soft to stiff (0-1.5 tsf). *(continued)*	(FILL)								
8 SS	24 14	5 10 11 11	14 – 15	14' wet.									
9 SS	24 14	5 8 14 15	16 – 17										
10 SS	24 16	2 2 3 4	18 – 19	18 - 22' **SILTY CLAY** CL/ML, gray (5Y 6/1), organic odor, stiff to very stiff (1.25-3.75 tsf), wet.	CL/ML								
11 SS	24 18	2 2 6 4	20 – 21										
12 SS	24 16	4 4 5 4	22 – 23	22 - 24' **SILT:** ML, very dark gray (10YR 3/1), dark yellowish brown (10YR 3/6) mottling, hard (4.25-4.5 tsf).	ML								
13 SS	24 22	1 2 5 7	24 – 25	24 - 42.4' **SILTY CLAY** CL/ML, gray (10YR 5/1) with yellowish brown (10YR 5/8), oxidation staining, very soft to hard (<0.25-4.5+ tsf).	CL/ML								Permanent 6" PVC casing set at 25' bgs.
14 SS	24 21	3 4 5 7	26 – 27	26' yellowish brown (10YR 5/4), trace yellowish brown (10YR 5/8) and very dark gray (10YR 3/1) mottling, 15-30% silt, 5-15% fine sand, trace fine gravel, stiff to very stiff (1.25-2.5 tsf), low to medium plasticity, moist.									
15 SS	24 21	3 4 5 6	28 – 29	28' color grades to gray (10YR 5/1), 30-50% silt, soft to stiff (0.5-1.25 tsf).									
16 SS	24 17.5	1 5 5 7	30 – 32	30' yellowish brown (10YR 5/8) mottling (15-30%), trace very dark gray (10YR 3/1) mottling, no gravel, very soft to very stiff (<0.25-2.5 tsf), medium plasticity.									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-384

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
17 SS	24 20.5	4 4 4 6	33	24 - 42.4' **SILTY CLAY** CL/ML, gray (10YR 5/1) with yellowish brown (10YR 5/8), oxidation staining, very soft to hard (<0.25-4.5+ tsf). *(continued)* 32' trace yellowish brown (10YR 5/8) and very dark gray (10YR 3/1) mottling, 15-30% silt, stiff to very stiff (1.75-3.5 tsf).										
18 SS	24 22	3 4 5 7	34 35	34' yellowish brown (10YR 5/8) mottling (15-30%), trace very dark gray (10YR 3/1) mottling, stiff to very stiff (1.5-2.5), dry to moist. 35.3' yellowish brown (10YR 5/8), trace gray (10YR 5/1) and very dark gray (10YR 3/1) mottling.										
19 SS	24 21	4 3 3 4	36 37	36' gray (10YR 5/1) mottling (15-30%), silt content increasing with depth, moderately stiff to stiff (0.75-1.25 tsf), low plasticity, moist.	CL/ML									
20 SS	24 24	2 4 7 14	38 39	38' grayish brown (10YR 5/2), trace gray (10YR 5/1), trace strong brown (7.5YR 4/6) mottling, 30-50% silt, soft to very stiff (0.5-3.75 tsf). 38.7' - 40' very dark gray (10YR 3/1) mottling (5-15%), 5-15% fine gravel.										
21 SS	24 25	3 11 21 44	40 41	40' sand (5-15%), trace gravel, very stiff to hard (3.5-4.5+ tsf). 40.3' wet. 40.8' very stiff to hard (3.5-4.5+ tsf), moist.										
22 SS	24 20	13 11 15 17	42 43	41.8' fine sand seam (1/4" thick). 42' - 42.4' fine gravel, 30-50% clay, trace sand, wet. 42.4 - 44.3' **CLAYEY SILT** ML/CL, gray (10YR 5/1) to grayish brown (10YR 5/2), 30-50% clay, 5-15% fine sand, trace subrounded gravel, very stiff to hard (3.5-4.5+), nonplastic to low plasticity, moist.	ML/CL									
23 SS	24 17	6 8 10 14	44 45	43.5' - 44.3' very dark grayish brown (10YR 3/2), brownish yellow trace (10YR 6/6) mottling, trace coal. 44.3 - 56' **LEAN CLAY:** CL, brownish yellow trace (10YR 6/6), trace light brownish gray (10YR 6/2) mottling, 15-30% silt, 5-15% gravel, trace gravel-sized oxidation-stained nodules, very stiff (2.5-3.0 tsf), low to medium plasticity, moist to dry.										
24 SS	24 16	5 10 11 15	46 47	46' decreasing silt content, trace gravel, clay becoming laminated with depth, very stiff (2.25-3.0 tsf).										
25 SS	24 13.5	6 8 12 22	48 49	48' silt (5-15%), trace shale gravel, very stiff (3.0 tsf), medium plasticity, dry. 49.2' gravel (2" diameter).	CL									
26 SS	24 16	8 9 15 19	50 51 52	50' very dark grayish brown (10YR 3/2) to dark grayish brown (10YR 4/2), trace silt, very stiff (3.5 tsf), medium to high plasticity, highly weathered shale (residual soil).										

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-384

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
27 SS	24 22	13 14 9 14	53	44.3 - 56' **LEAN CLAY:** CL, brownish yellow trace (10YR 6/6), trace light brownish gray (10YR 6/2) mottling, 15-30% silt, 5-15% gravel, trace gravel-sized oxidation-stained nodules, very stiff (2.5-3.0 tsf), low to medium plasticity, moist to dry. *(continued)*	CL								
28 SS	24 24	12 12 14 22	54, 55	52' - 54' clay is fractured, light brownish gray (10YR 6/2) to light yellowish brown (10YR 6/4) in fractures. 54' trace very dark brown (10YR 2/2) laminations, hard (>4.5 tsf).									
29 SS	23 20	11 14 20 50/5"	56, 57, 58	56 - 58.2' **SHALE:** BDX (SH), very dark gray (10YR 3/1), highly weathered, fissile, totally healed fractures, very weak, highly decomposed [light brownish gray (10YR 6/2) in fractures], very intensely fractured (closed to narrow apertures). 57' light yellowish brown (10YR 6/4) to very dark gray (10YR 3/1) layers, thinly bedded, highly decomposed to residual soil.	BDX (SH)								3" steel casing set at 57.7 ft bgs.
1 CORE	24 40												Core 1, RQD=36%
2 CORE	60 64		59, 60	58.2 - 60.8' **LIMESTONE:** BDX (LS), light greenish gray (GLEY 1 7/10Y), microcrystalline, trace fossils, moderately strong to strong, medium bedded, slightly to moderately decomposed, moderately fractured.	BDX (LS)								Core 2, RQD=73%
			61, 62, 63	60.8 - 64' **SHALEY LIMESTONE:** BDX (LS/SH), weak, thin to medium bedded, moderately decomposed, slightly to moderately disintegrated.	BDX (LS/SH)								
3 CORE	60 73		64, 65, 66, 67, 68	64 - 82.6' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, thinly bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (very narrow to moderately narrow apertures). 67.9' - 68.8' shale clasts within decomposed shale matrix.	BDX (SH)								Core 3, RQD= 58%
4 CORE	60 63		69, 70, 71, 72	68.8' - 69.2' light yellowish brown (10YR 6/4), trace dark yellowish brown (10YR 3/6) layers. 69.2' - 74' intensely fractured (extremely narrow to narrow aperture).									Core 4, RQD=46%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-384

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		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			73	64 - 82.6' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, thinly bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (very narrow to moderately narrow apertures). *(continued)*										
5 CORE	60 20		74	74' - 79' intensely to very intensely fractured.										Core 5, RQD=0%
			75–78		BDX (SH)									Bedrock corehole reamed 6" in diameter to 77' for well installation.
6 CORE	60 64		79	79' - 82.6' intensely fractured.										Core 6, RQD=64%
			83	82.6 - 83.9' **SHALEY LIMESTONE:** BDX (LS/SH), light greenish gray (GLEY 1 7/10Y), fossiliferous, intensely fractured (extremely narrow to narrow apertures), slightly decomposed.	BDX (LS/SH)									
7 CORE	60 37		84–85	83.9 - 85.6' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, medium bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (extremely narrow to narrow apertures).	BDX (SH)									Core 7, RQD=15%
			86–88	85.6 - 88.7' **SHALEY LIMESTONE:** BDX (LS/SH), light greenish gray (GLEY 1 7/10Y), shaley, fossiliferous, intensely fractured (extremely narrow to narrow apertures), slightly decomposed. 86.4' - 87' SHALE layer, greenish gray (GLEY 1 5/10Y), very weak, medium bedded.	BDX (LS/SH)									
8 CORE	60 50		89–92	88.7 - 94.1' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, medium bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (extremely narrow to narrow apertures).	BDX (SH)									Core 8, RQD=49%

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW-384

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
			93 94	88.7 - 94.1' **SHALE:** BDX (SH), greenish gray (GLEY 1 5/10Y), very weak, medium bedded, highly to moderately decomposed, slightly to moderately disintegrated, intensely fractured (extremely narrow to narrow apertures). *(continued)* 92.5' - 93.2' light greenish gray (GLEY 1 7/10Y), shaley, fossiliferous, intensely fractured, slightly decomposed.	BDX (SH)									
				94.1' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-385

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mark Baetje Bulldog Drilling	12/4/2015	12/16/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-385	Feet (NAVD88)	454.82 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,417.12 N, 2,382,285.24 E E/W(circled)
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 30.2244"
Long -89° 52' 6.492"
Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 13	2 3 3 5		0 - 0.3' **FILL, ASH (Coal):** dark yellowish brown (10YR 4/6), sand and silt-sized ash, dark gray (10YR 4/1) slag pieces, dry to moist.	(FILL)								
			1	0.3 - 19.7' **FILL, LEAN CLAY:** CL, brown (10YR 5/3) to yellowish brown (10YR 5/4) inside, 10-30% silt, cohesive, stiff to hard (1.0-4.5 tsf), medium plasticity, moist.									
2 SS	24 9	1 2 2 3	2	2' dark gray (10YR 4/1) mottling (15-30%), moist.									
			3										
3 SS	24 15	1 3 4 5	4	4' trace sand, trace dark yellowish brown (10YR 4/6) oxidation staining, moist to dry.									
			5										
4 SS	24 16	1 3 5 6	6	6' dry to moist.	(FILL) CL								
			7										
5 SS	24 9	WOH 1 3 4	8	8' increased dark gray (10YR 4/1) mottling 20-30%, dry to moist.									WOH=weight of hammer
			9										
6 SS	24 13	1 2 3 5	10	10' moist.									
			11										
7 SS	24 18	WOH 2 5 7	12	12' moist to dry. 12.3' mostly dark gray (10YR 4/1), no mottling.									
			13										

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

Signature	Firm
(signature)	Natural Resource Technology 234 W. Florida St., Fifth Floor, Milwaukee, WI 53204 Tel: (414) 837-3607 Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-385

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
				0.3 - 19.7' **FILL, LEAN CLAY:** CL, brown (10YR 5/3) to yellowish brown (10YR 5/4) inside, 10-30% silt, cohesive, stiff to hard (1.0-4.5 tsf), medium plasticity, moist. *(continued)*										
8 SS	24 12	WOH WOH 3 3	14	13' mostly brown (10YR 4/3), dark gray (10YR 4/1) mottling.										
			15	14' some dark gray (10YR 4/1) mottling, trace yellowish brown (10YR 5/6) oxidation staining, trace very dark grayish brown (10YR 3/2) mottling, moist.										
9 SS	24 16	WOH 1 3 4	16	16' moist.	(FILL) CL									
			17	16.5' dark gray (10YR 4/1) with dark yellowish brown (10YR 4/6) mottling, cohesive, medium to high plasticity.										
10 SS	24 24	WOH WOH 2 3	18	18' dark gray (10YR 4/1), dark yellowish brown (10YR 4/6) mottling, softer than above, moist to wet.										
			19											
11 SS	24 24	WOH WOH WOH 1	20	19.7 - 31.9' **FILL, ASH (Coal):** very dark grayish brown (10YR 3/2) to very dark brown (10YR 2/2), silt-sized ash, trace sand-sized ash, cohesive, very soft (0 tsf), non-plastic, wet.										
			21	20' very dark grayish brown (10YR 3/2), trace sand seams, wet.										
12 SS	48 24	WOH 1 WOH 1	22	22' trace fine-grained sand seams.										
			23											
			24											
			25											
13 SS	24 21	1 WOH 1 WOH	26	25.7' medium-grained sand seam (2" thick).	(FILL)									
			27											
14 SS	24 24	1 2 2 1	28											
			29											
15 SS	24 24	WOH WOH WOH WOH	30											
			31											
			32	31.9 - 38' **SILT:** to **LEAN CLAY:** ML, olive gray (5Y 5/2), cohesive, very soft to soft (0.25-0.5 tsf), low to medium plasticity, moist to wet.										
			33		ML									
16 SS	24 24	WOH WOH WOH	34											

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-385

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		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
		WOH	35	31.9 - 38' **SILT:** to **LEAN CLAY:** ML, olive gray (5Y 5/2), cohesive, very soft to soft (0.25-0.5 tsf), low to medium plasticity, moist to wet. *(continued)*	ML									
			36											
			37											
17 SS	24 24	2 4 6 6	38	38 - 59' **LEAN CLAY:** CL, olive gray (5Y 5/2), dark yellowish brown (10YR 4/6) mottling, moist to dry.	CL									
			39											
			40											
			41											
18 SS	24 14	WOH 2 3 4	42	42' medium plasticity, moist.										Augered with 8" plug to 42' bgs.
			43											
19 SS	24 23	1 3 4 6	44											Permanent 6"PVC casing set at 45' bgs.
			45											
20 SS	24 27	2 3 3 5	46											
			47											
21 SS	24 16	WOH 2 4 4	48	48' gray (10YR 6/1), dark yellowish brown (10YR4/6), stiff (1.5 tsf), plastic.										
			49											
22 SS	24 24	WOH 3 4 4	50											
			51	51' trace sand, very stiff (2.5 tsf).										
23 SS	24 24	3 4 4 7	52											
			53											
24 SS	24 22	WOH 2 3 4	54	54' increase in sand content, stiff (1.75 tsf).										
			55											
25	24	WOH	56	56' trace root structures, oxidation staining.										

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
SS	21	3 3 4	57	38 - 59' **LEAN CLAY:** CL, olive gray (5Y 5/2), dark yellowish brown (10YR 4/6) mottling, moist to dry. *(continued)*	CL									
26 SS	24 23	WOH 5 11 27	58											
			59	59 - 60' **POORLY-GRADED SAND WITH CLAY:** SP-SC, fine-grained, trace coarse-grained sand, and trace gravel, very stiff (2.25 tsf).	SP-SC									
27 SS	24 22	6 8 13 13	60	60 - 61' **SILTY CLAY** to **POORLY-GRADED SAND:** CL/ML, yellowish brown (10YR 5/6), gray (10YR 5/1) mottling.	CL/ML									
			61	61 - 62' **LEAN CLAY:** to **SHALE:** CL, very dark gray (10YR 3/1), weathered, hard (>4.5 tsf), dry.	CL									
28 SS	24 22	9 13 15 50/4"	62	62 - 63.8' **SILTY CLAY** to **SHALE:** CL/ML, grayish brown (10YR 5/2), dark yellowish brown (10YR 4/6) mottling, weathered.	CL/ML									
			63											
1 CORE	12 11		64	63.8 - 65' **SHALE:** BDX (SH), weathered.	BDX (SH)									Core 1, RQD=0%
2 CORE	60 48		65	65 - 65.9' **SHALEY LIMESTONE:** BDX (LS/SH).	BDX (LS/SH)									Core 2, RQD=63%
			66	65.9 - 76.3' **SHALE:** BDX (SH), gray, decomposed, intensely to moderately fractured.	BDX (SH)									
			67											
			68											
			69											
3 CORE	60 55		70											Core 3, RQD=82%
			71	71.2' - 72.5 vertical fracture (tight aperture).										
			72											
			73											
			74											
4 CORE	60 60		75											Core 4, RQD=74%
			76	76.3 - 76.9' **LIMESTONE:** BDX (LS).	BDX (LS)									
			77	76.9 - 78.9' **SHALE:** BDX (SH), dark gray, moderately fractured.	BDX (SH)									
			78											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-385

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				76.9 - 78.9' **SHALE:** BDX (SH), dark gray, moderately fractured. *(continued)*	BDX (SH)								
			79	78.9 - 81.1' **LIMESTONE:** BDX (LS), cherty, slightly fractured.	BDX (LS)								
5 CORE	60 54.5		80–81										Core 5, RQD=62%
			81	81.1 - 82.2' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured.	BDX (LS/SH)								
			82	82.2 - 82.9' **LIMESTONE:** BDX (LS), moderately fractured.	BDX (LS)								
			83	82.9 - 83.5' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured.	BDX (LS/SH)								
			84	83.5 - 87.4' **SHALE:** BDX (SH), gray.	BDX (SH)								
6 CORE	60 65		85–87										Core 6, RQD=58%
			88	87.4 - 93' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, intensely to moderately fractured.	BDX (LS/SH)								
7 CORE	30 30		89–92										Core 7, RQD=100%
			93	93' End of Boring.									Bedrock corehole reamed 6" in diameter to 93' for well installation.

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-386

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mark Baetje Bulldog Drilling	12/1/2015	12/11/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-386	Feet (NAVD88)	454.67 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,585.18 N, 2,382,713.22 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 21.9876"
Long -89° 52' 1.167"
Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 16	3 3 7 5		0 - 0.5' **FILL, WELL-GRADED SAND:** SW, dark brown (10YR 3/3) to black (10YR 2/1), fine to coarse sand-sized ash and slag, moist.	(FILL) SW								
			1	0.5 - 2.6' **FILL, SILT:** ML, dark yellowish brown (10YR 4/4), yellowish brown (10YR 5/8) mottling, 20-40% clay, cohesive, hard (4.5 tsf), nonplastic, dry.	(FILL) ML								
2 SS	24 16	2 4 4 6	2	2' - 2.6' clay content increases with depth to mostly clay at 2.6', dry.									
			3	2.6 - 24.5' **FILL, LEAN CLAY:** CL, dark yellowish brown (10YR 4/4), trace gray (10YR 5/1) mottling, 20-40% silt, cohesive, very stiff (2.0-4.0 tsf), high plasticity, moist.									
3 SS	24 17	2 4 4 5	4	4' gray (10YR 5/1), 20-30% yellowish brown (10YR 5/8) mottling, trace medium-grained sand, moist to dry.									
			5										
4 SS	24 12	3 2 3 4	6	6' trace sand, moist to dry.									
			7		(FILL) CL								
5 SS	24 14.5	2 2 4 5	8	8' moist.									
			9										
6 SS	24 12	2 2 3 4	10	10' stiff (1.75 tsf).									
			11										
			12										

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

Signature	Firm	
[signature]	Natural Resource Technology 234 W. Florida St., Fifth Floor, Milwaukee, WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-386

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		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 16	2 2 3 7	13	2.6 - 24.5' **FILL, LEAN CLAY:** CL, dark yellowish brown (10YR 4/4), trace gray (10YR 5/1) mottling, 20-40% silt, cohesive, very stiff (2.0-4.0 tsf), high plasticity, moist. *(continued)* 13.2' dark gray (10YR 4/1), trace sand, stiff to hard (1.5-4.5+ tsf), high plasticity, dry.										
8 SS	24 17	2 3 3 5	14, 15	14' dark gray (10YR 4/1), dark yellowish brown (10YR 4/6), high plasticity, dry to moist.										
9 SS	24 14	2 2 3 3	16, 17	16' dark yellowish brown (10YR 4/6), decrease to 30% dark gray (10YR 4/1), soft to very stiff (1.0-4.0 tsf), dry, increasing moisture content with depth.										
10 SS	24 15	1 1 2 2	18, 19	18' brownish yellow (10YR 6/8) mottling, silt content increases with depth to 30-50%, trace fine gravel, very soft to very stiff (0.0 to 3.0 tsf), moist to wet.	(FILL) CL									
11 SS	24 24	3 2 2 4	20, 21	20' yellowish brown (10YR 5/6), 30% dark gray (10YR 4/1) mottling, 20-40% silt, trace sand, trace fine gravel, soft to stiff (0.5-1.5 tsf), moist.										
12 SS	24 5	2 1 2 2	22, 23	22' trace yellowish red (5YR 4/6), 5-15% sand, stiff (1.5 tsf).										
13 SS	24 24	2 2 1 1	24, 25	24.5 - 26' **FILL, SILT:** ML, very dark grayish brown (10YR 3/2), low to medium plasticity, wet.	(FILL) ML									
14 SS	24 6	WOH WOH WOH WOH	26, 27	26 - 28.2' **FILL, LEAN CLAY:** CL, dark yellowish brown (10YR 4/6), 30-50% silt, cohesive, moderately stiff (0.75 tsf), medium to low plasticity, wet.	(FILL) CL									WOH=weight of hammer
15 SS	24 24	1 1 1 1	28, 29	28.2 - 44.3' **FILL, ASH (Coal):** very dark grayish brown (10YR 3/2), mostly silt-sized ash, 15-30% sand-sized ash, sand-sized ash seams, noncohesive, nonplastic.										
16 SS	24 24	2 3 1 1	30, 31, 32	30' wet.	(FILL)									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-386

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		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 24	WOH WOH WOH WOH	33	28.2 - 44.3' **FILL, ASH (Coal):** very dark grayish brown (10YR 3/2), mostly silt-sized ash, 15-30% sand-sized ash, sand-sized ash seams, noncohesive, nonplastic. *(continued)*										
18 SS	24 24	WOH WOH 2 1	34, 35	34' trace dark gray (10YR 4/1) mottling of silt-sized ash, trace black (10YR 2/1) mottling of sand-sized ash, trace dark yellowish brown (10YR 4/6) mottling of clay-sized ash, very soft (0 tsf), wet.										
19 SS	24 23	1 WOH WOH WOH	36, 37											
20 SS	24 19	2 WOH WOH WOH	38, 39	38' mostly fine to medium sand-sized ash, 15-30% silt-sized ash, wet. 38.5' very dark grayish brown (10YR 3/2), black (10YR 2/1) mottling, mostly silt-sized ash, sand-sized ash seams, cohesive, nonplastic, wet.	(FILL)									
21 SS	24 24	1 2 WOH WOH	40, 41	40' dark gray (10YR 4/1) and black (10YR 2/1) mottling, wet.										
22 SS	24 21	1 WOH WOH WOH	42, 43											
23 SS	24 18	WOH 2 3 3	44, 45	44.3 - 46' **SILT:** ML, grades from very dark gray (10YR 3/1) to dark gray (10YR 4/1) with depth, 15-30% clay, cohesive, low plasticity, moist to wet.	ML									
24 SS	24 24	WOH 2 2 5	46, 47	46 - 60' **SILTY CLAY** CL/ML, gray (10YR 5/1) with yellowish brown (10YR 4/5), 20-40% silt, cohesive, stiff (1.75 tsf), medium plasticity, moist.										
25 SS	24 24	WOH 2 4 6	48, 49	48' dry to moist.	CL/ML									Permanent 6" PVC casing set at 48.5' bgs.
26 SS	24 12	2 4 5 5	50, 51, 52	50' oxidation-stained nodules (15-30%), trace sand.										

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-386

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
27 SS	24 17	1 6 12 14	53	46 - 60' **SILTY CLAY** CL/ML, gray (10YR 5/1) with yellowish brown (10YR 4/5), 20-40% silt, cohesive, stiff (1.75 tsf), medium plasticity, moist. *(continued)* 52' trace oxidation staining, very stiff (>4.5 tsf).										
28 SS	24 17	25 24	54, 55											
29 SS	24 12	8 16 33 24	56, 57	56' laminated weathered shale, dry.	CL/ML									
30 SS	24 24	7 11 15 24	58, 59											
31 SS	24 21	6 10 15 18	60, 61	60 - 60.3' **GRAVELLY FAT CLAY:** g(CH), black.	g(CH)									
				60.3 - 63.5' **SILTY CLAY** CL/ML, gray (10YR 5/1), dark yellowish brown (10YR 4/6) mottling, hard (>4.5 tsf).										
32 SS	24 18	9 15 50/5"	62		CL/ML									
1 CORE	28 35		63	63' gravel (>15%).										Core 1, RQD=34%
			64	63.5 - 64.8' **SHALE:** BDX (SH), weathered.	BDX (SH)									
			65	64.8 - 65.2' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured.	BDX (LS/SH)									
2 CORE	60 45		66, 67, 68, 69, 70	65.2 - 71' **SHALE:** BDX (SH), gray, slightly to moderately fractured, highly decomposed, some material washed-out.	BDX (SH)									Core 2, RQD=93%
3 CORE	60 28		71, 72	71 - 76' **LIMESTONE:** BDX (LS), vertical fracture, intensely fractured.	BDX (LS)									Core 3, RQD=18%

![Natural Resource Technology logo]

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW-386

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		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
4 CORE	60 57		73–76	71 - 76' **LIMESTONE:** BDX (LS), vertical fracture, intensely fractured. *(continued)* 72.3' vertical fracture.	BDX (LS)									Core 4, RQD=37%
			76–77	76 - 77.2' **SHALE:** BDX (SH), dark gray, moderately fractured.	BDX (SH)									
5 CORE	60 55		77–81	77.2 - 81.3' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured. 78.2' - 78.9 vertical fracture. 79.6' - 79.8' vertical fracture. 80.3' - 80.5' vertical fracture.	BDX (LS/SH)									Core 5, RQD=69%
			81–82	81.3 - 82.2' **SHALE:** to **LIMESTONE:** BDX (SH), slightly fractured.	BDX (SH)									
6 CORE	48 48		82–86	82.2 - 86.3' **SHALE:** BDX (SH), gray, slightly to moderately fractured.	BDX (SH)									Core 6, RQD=65%
			86–89	86.3 - 89' **SHALEY LIMESTONE:** BDX (LS/SH), slightly fractured.	BDX (LS/SH)									
			89	89' End of Boring.										Bedrock corehole reamed 6" in diameter to 89' for well installation.

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-387

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	11/13/2015	11/18/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-387	Feet (NAVD88)	424.01 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,111.17 N, 2,380,474.78 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 27.258"
Long -89° 52' 29.1828"
Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 16	2 7 6 6	0–2	0 - 4' **FILL, SILTY CLAY** CL/ML, brown (10YR 5/3), trace roots, stiff to very stiff (2.5-4 tsf), low plasticity, dry.	(FILL) CL/ML								
2 SS	24 18	2 5 5 7	2–4	3' trace fine sand.									
3 SS	24 18	2 4 4 5	4–6	4 - 10.8' **SILTY CLAY** CL/ML, dark yellowish brown (10YR 4/4), stiff to hard (1.5-4.5 tsf), medium plasticity, moist.	CL/ML								
4 SS	24 21	3 4 4 5	6–8	6' dark yellowish brown (10YR 3/4), trace oxidation staining.									
5 SS	24 0		8–10										
6 SS	24 16	WOH 3 4 5	10–12	10.8 - 12' **CLAYEY SILT** ML/CL, dark yellowish brown (10YR 4/4), nonplastic.	ML/CL								WOH=weight of hammer

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

Signature Brad Rodes

Firm Natural Resource Technology
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SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-387

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 24	WOH 3 4 4	13	12 - 24' **SILTY CLAY** CL/ML, dark yellowish brown (10YR 3/4), stiff to very stiff (1.5-2.75 tsf). 12.5' - 12.6' black staining. 13' increased silt content, moist.	CL/ML								
8 SS	24 24	1 2 4 5	14, 15	14' dark yellowish brown (10YR 4/6). 15' trace oxidation staining, medium plasticity, moist.									
9 SS	24 26	2 3 5 6	16, 17										
10 SS	24 25	1 3 4 5	18, 19	18' low plasticity. 19' medium plasticity.									
11 SS	24 23	1 2 3 3	20, 21	20' dark yellowish brown (10YR 4/4), grayish brown (10YR 5/2) mottling.									
12 SS	24 24	1 4 5 7	22, 23										
13 SS	24 26	1 4 5 6	24, 25	24 - 27.4' **LEAN CLAY:** CL, gray (10YR 5/1), stiff to very stiff (1.5-2.5 tsf), high plasticity.	CL								
14 SS	24 24	1 3 6 4	26, 27	26' trace black oxidation staining. 27.4 - 28.5' **SILTY SAND:** to **LEAN CLAY:** SM, mostly fine sand, wet.	SM								
15 SS	24 24	1 2 2 3	28, 29	28.5 - 32.5' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/4), trace sand, very soft to very hard (0-4.5+ tsf).	CL/ML								
16 SS	24 20	WOH 1 4 7	30, 31, 32	30' dark yellowish brown (10YR 3/4), oxidation-stained nodules (1" layer). 31' brown (10YR 4/3).									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-387

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 16	1 1 1 2											
			33	32.5 - 34' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), mostly medium sand, sand grain size decreasing with depth, silt and clay content increasing with depth.	SP								
18 SS	24	4 10 12 14	34	34 - 34.5' **SILTY SAND:** SM, yellowish brown (10YR 5/4), mostly fine sand.	SM								
			35	34.5 - 36' **SILTY CLAY** CL/ML, brown (10YR 4/3), very stiff to hard (2.5-4.5 tsf), low plasticity.	CL/ML								
19 SS 1 CORE	3 3 39 39	50 for 3"	36, 37, 38, 39, 40	36 - 40.6' **LIMESTONE:** BDX (LS), light gray, cherty, intensely fractured (fractures partly healed with shale).	BDX (LS)								Core 1, RQD=44%
2 CORE	60 49		41, 42, 43	40.6 - 43.9' **SHALE:** BDX (SH), dark gray, intensely fractured.	BDX (SH)								Core 2, RQD=61%
			44, 45	43.9 - 45.3' **SHALEY LIMESTONE:** BDX (LS/SH), intensely fractured.	BDX (LS/SH)								
3 CORE	60 61		46, 47, 48	45.3 - 48.8' **LIMESTONE:** BDX (LS), fossiliferous, moderately fractured (fractures partly healed with shale).	BDX (LS)								Core 3, RQD=75%
4 CORE	64 64		49, 50, 51, 52	48.8 - 53.9' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured.	BDX (LS/SH)								Formation taking water during coring.

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-387

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
			53	48.8 - 53.9' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured. *(continued)*	BDX (LS/SH)								Core 4, RQD=92%
			54	53.9 - 55' **SHALE:** BDX (SH), dark gray, moderately fractured, slightly decomposed.	BDX (SH)								
5 CORE	60 59		55, 56	55 - 56.3' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured.	BDX (LS/SH)								Core 5, RQD=100%
			57, 58, 59, 60	56.3 - 60.1' **LIMESTONE:** BDX (LS), fossiliferous, slightly fractured to unfractured.	BDX (LS)								
			61	60.1 - 61.3' Overdrilled for Well Installation.									
				61.3' End of Boring.									Bedrock corehole reamed 6" in diameter to 61.3' for well installation.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-388

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	11/10/2015	11/12/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-388	Feet (NAVD88)	406.28 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,429.08 N, 2,379,624.09 E E/W
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 30.426"
Long -89° 52' 39.8274"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 11	2 5 10 8		0 - 4' **FILL, SILTY CLAY** CL/ML, dark yellowish brown (10YR 3/4), 30-50% silt, organic material at surface, very soft to very stiff (0.0-4.0 tsf), moist.	(FILL) CL/ML								
2 SS	24 18	3 6 8 9	2										
3 SS	24 15	3 4 8 9	4	4 - 18' **SILTY CLAY** CL/ML, brown (10YR 5/3), 30-50% silt, very soft to very stiff (0.0-4.0 tsf), moist.	CL/ML								
4 SS	24 18	1 4 6 4	6	6' yellowish brown (7.5YR 5/6), 30-50% fine sand.									
5 SS	24 22	1 1 2 4	8	8' yellowish brown (10YR 5/4).									
6 SS	24 21	2 2 3 3	10	10' brown (10YR 4/3), yellow (10YR 7/8) mottling.									

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

Signature

Firm Natural Resource Technology
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NATURAL RESOURCE TECHNOLOGY

Boring Number MW-388

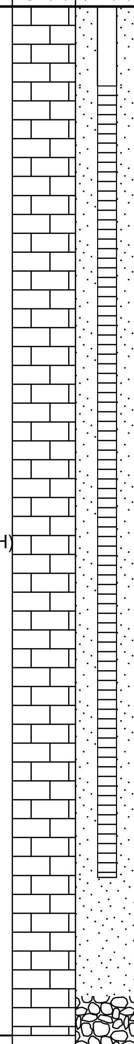
Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 25	1 2 3 3	13	4 - 18' **SILTY CLAY** CL/ML, brown (10YR 5/3), 30-50% silt, very soft to very stiff (0.0-4.0 tsf), moist. *(continued)* 13.3' brown (10YR 5/3), trace sand.										
8 SS	24 20	1 2 4 7	14, 15	14' grayish brown (10YR 5/2), increasing coarse sand content.	CL/ML									
9 SS	24 21	2 4 5 8	16, 17	16' brownish yellow (10YR 6/8) mottling, very dark brown (10YR 2/2) stringers. 17 - 18' **SILTY CLAY WITH SAND** (CL/ML)S, yellowish brown (10YR 5/8).	(CL/ML)S									
10 SS	24 22	1 2 2 3	18, 19	18 - 20' **SILTY CLAY** CL/ML, 30-50% silt, very soft to very stiff (0.0-4.0 tsf), slow dilatancy, wet.	CL/ML									
11 SS	24 14	WOH 2 4 7	20, 21	20 - 23.5' **SILT WITH SAND:** (ML)s, yellowish brown (10YR 5/6), fine sand, rapid dilatancy, very soft (0.0 tsf), wet.										WOH=weight of hammer
12 SS	24 22	3 9 12 9	22, 23	22' yellowish brown (10YR 5/4), with clay.	(ML)s									
13 SS	24 18	WOH 4 6 9	24, 25	23.5 - 26.5' **SILTY CLAY WITH SAND** (CL/ML)S, grayish brown (10YR 5/2), fine sand, very stiff (2.5-3.0 tsf), wet. 24' gray (10YR 5/1), no fine sand.	(CL/ML)S									
14 SS	8 7	4 50 for 2"	26	26.5 - 27' **SHALE:** BDX (SH), gray, decomposed.	BDX (SH)									
1 CORE	35 31		27, 28, 29	27 - 30' **LIMESTONE:** BDX (LS), fossiliferous, thickly bedded, slightly fractured (narrow to moderately narrow apertures).	BDX (LS)									Core 1, RQD = 97%
2 CORE	60 40		30, 31, 32	30 - 45' **SHALEY LIMESTONE:** BDX (LS/SH), highly decomposed, intensely fractured.	BDX (LS/SH)									Core 2, RQD = 68%

Natural Resource Technology

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW-388

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
				30 - 45' **SHALEY LIMESTONE:** BDX (LS/SH), highly decomposed, intensely fractured. *(continued)*									
			33										
			34										
3 CORE	60 57.5		35	34.9' moderately fractured.									Core 3, RQD = 93%
			36										
			37	37' - 43.5' fossiliferous.									
			38										
			39		BDX (LS/SH)								
			40	40.1' slightly fractured.									
4 CORE	60 60.5		41	40.9' fossiliferous.									Core 4, RQD = 100%
			42										
			43										
			44										
			45	45 - 45.2' Overdrilled for Well Installation.									
				45.2' End of Boring.									Bedrock corehole reamed 6" in diameter to 45.2' for well installation.



SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Baldwin Energy Complex		MW-389	
Boring Drilled By: Name of crew chief (first, last) and Firm	**Date Drilling Started**	**Date Drilling Completed**	**Drilling Method**
Tom Marlo Bulldog Drilling	11/25/2015	12/1/2015	4 1/4 HSA and rotary
Common Well Name: MW-389	Final Static Water Level: Feet (NAVD88)	Surface Elevation: 417.30 Feet (NAVD88)	Borehole Diameter: 8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,119.33 N, 2,379,809.87 E E/W
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 37.2444"
Long -89° 52' 37.4736"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 16	1 3 7 13	0	0 - 16' **SILTY CLAY** CL/ML, brown (7.5YR 4/4), stiff to very hard (1-4.5+ tsf), low plasticity.									
			1										
2 SS	24 18	2 6 9 9	2										
			3										
3 SS	24 19.5	1 3 3 3	4	4.5' moist.									
			5										
4 SS	24 17	1 2 3 1	6		CL/ML								
			7	7' trace root structures.									
5 SS	24 17	2 2 4 5	8	8' black (10YR 2/1) oxidation mottling.									
			9										
6 SS	24 20	2 2 4 4	10	10' decreasing mottling, increasing silt content.									
			11										
			12										

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

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-389

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	24 21	2 3 2 3	13	0 - 16' **SILTY CLAY** CL/ML, brown (7.5YR 4/4), stiff to very hard (1-4.5+ tsf), low plasticity. *(continued)* 12' dark yellowish brown (10YR 4/4), wet.	CL/ML									
8 SS	24 20	2 3 3 5	14 15	14' brown (10YR 5/3), dark yellowish brown (10YR4/6) mottling.										
9 SS	24 24	1 3 5 6	16 17	16 - 23' **FAT CLAY:** CH, grayish brown (10YR 5/2), yellowish brown (10YR 5/6) mottling, trace sand, stiff to very stiff (1.75-3.0 tsf), medium plasticity.	CH									
10 SS	24 24	1 3 4 4	18 19	18' black (10YR 2/1) oxidation nodules.										
11 SS	24 24	2 3 4 5	20 21											
12 SS	24 27	1 3 3 4	22											
			23	23 - 28.3' **SILTY CLAY WITH SAND** (CL/ML)S, yellowish brown (10YR 5/4), grayish brown (10YR 5/2) mottling, trace fine gravel, stiff to hard (1.5-4.5 tsf), medium plasticity.	(CL/ML)S									
13 SS	24 27	1 2 4 4	24 25											
14 SS	24 26	1 3 5 10	26 27	27' low plasticity.										
15 SS	24	1 3 8 11	28	28.3 - 28.8' **POORLY-GRADED SAND WITH CLAY:** SP-SC, yellowish brown (10YR 5/6).	SP-SC									
			29	28.8 - 36' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/4), trace sand, oxidation nodules, and fine gravel, very stiff to hard (2.5-4.5 tsf), wet.	CL/ML									
16 SS	24	1 3 5 10	30 31 32											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-389

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 23	1 3 5 8	33	28.8 - 36' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/4), trace sand, oxidation nodules, and fine gravel, very stiff to hard (2.5-4.5 tsf), wet. *(continued)*									
18 SS	24 26	1 3 8 13	34, 35	34' increasing gravel content.	CL/ML								
19 SS	4 4	50 for 4"	36	36 - 37.3' **SHALEY LIMESTONE:** BDX (LS/SH), moderately fractured.	BDX (LS/SH)								
1 CORE	46 45		37										Core 1, RQD=86%
				37.3 - 37.7' **SHALE:** BDX (SH), decomposed, moderately fractured.	BDX (SH)								
			38, 39	37.7 - 39.3' **LIMESTONE:** BDX (LS), shale at fractures, moderately fractured.	BDX (LS)								
2 CORE	13 12		40	39.3 - 46.8' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous, decomposed, moderately fractured.	BDX (LS/SH)								Core 2, RQD=67%
3 CORE	56 56		41, 42, 43, 44, 45	40.4' - 41' intensely fractured.									Core 3, RQD=65%
4 CORE	63 63		46	45.2' slightly fractured.									Core 4, RQD=89%
			47, 48, 49, 50	46.8 - 50.5' **LIMESTONE:** BDX (LS), fossiliferous, slightly fractured.	BDX (LS)								
5 CORE	60 59		51, 52	50.5 - 52.1' **SHALEY LIMESTONE:** BDX (LS/SH), fossiliferous.	BDX (LS/SH)								Core 5, RQD=100%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-389

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
			53 54 55	52.1 - 55.7' **LIMESTONE:** BDX (LS), fossiliferous, slightly fractured.	BDX (LS)									Bedrock corehole reamed 6" in diameter to 55' for well installation.
				55.7' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Baldwin Energy Complex		MW-390	
Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	2/29/2016	3/4/2016	4 1/4 HSA and rotary
Common Well Name: MW-390	Final Static Water Level: Feet (NAVD88)	Surface Elevation: 425.98 Feet (NAVD88)	Borehole Diameter: 8.3 inches
Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒ State Plane 555,865.00 N, 2,381,902.09 E E/W(W) 1/4 of 1/4 of Section , T N, R	Lat 38° 11' 34.6302" Long -89° 52' 11.2533"	Local Grid Location Feet ☐N ☐S Feet ☐E ☐W	
Facility ID	County: Randolph	State: Illinois	Civil Town/City/ or Village: Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 / 14	2 2 3 4	0–2	0 - 26.5' **FILL, LEAN CLAY:** CL, dark grayish brown (10YR 4/2) with black (10YR 2/1) and dark gray (10YR 4/1) mottling, 5-10% silt, trace roots, stiff to very stiff (1.5-3.5 tsf), nonplastic to medium plasticity, cohesive, moist to dry.	(FILL) CL								
2 SS	24 / 10	2 2 3 3	2–4	2' trace sand, no roots, moist. 2.4' dark gray (10YR 4/1) with dark grayish brown (10YR 3/2) mottling.									
3 SS	24 / 8.5	1 2 1 2	4–6	4' dark grayish brown (10YR 3/2), trace sand, silt, and roots, high plasticity, cohesive, trace black (10YR 2/1) oxidation.									
4 SS	24 / 15	1 2 3 4	6–8	6' gray (10YR 5/1) mottling, 15-20% silt, trace roots, low to medium plasticity, cohesive, black (10YR 2/1) and dark yellowish brown (10YR 4/5) oxidation.									
5 SS	24 / 19	1 1 3 5	8–10										
6 SS	24 / 17	1 2 3 4	10–12	10' moist to dry.									

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

Signature [signature]

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NATURAL RESOURCE TECHNOLOGY

Boring Number MW-390

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	24 21	1 2 3 4	13	0 - 26.5' **FILL, LEAN CLAY:** CL, dark grayish brown (10YR 4/2) with black (10YR 2/1) and dark gray (10YR 4/1) mottling, 5-10% silt, trace roots, stiff to very stiff (1.5-3.5 tsf), nonplastic to medium plasticity, cohesive, moist to dry. *(continued)* 12' moist.	(FILL) CL								
8 SS	24 19	1 3 5 7	14, 15	14' dry.									
9 SS	24 24	2 3 2 5	16, 17										
10 SS	24 20	2 2 4 5	18, 19										
11 SS	24 24	1 2 3 4	20, 21										
12 SS	24 24	1 3 4 4	22, 23	22' trace fine gravel (subrounded), dry.									
13 SS	24 24	1 2 4 6	24, 25	24' no fine gravel, dry. 24.7' dark gray (10YR 4/1) with dark yellowish brown (10YR 4/5).									
14 SS	24 24	2 2 2 3	26, 27	26' brown (10YR 4/3) with dark gray (10YR 4/1), black (10YR 2/1), and dark yellowish brown (10YR 4/5) mottling, dry to moist.									
				26.5 - 28.5' **FILL, SILT:** ML, trace gravel, nonplastic, cohesive, wet.	(FILL) ML								
15 SS	24 21	1 3 4 6	28	28' soft to stiff (0.5-1.5).									
			29	28.5 - 30.6' **FILL, LEAN CLAY:** CL, brown (10YR 4/3), trace dark gray (10YR 4/1) mottling, 15-25% silt, very stiff (3.0 tsf), dry to moist, trace dark yellowish brown (10YR 4/6) oxidation.	(FILL) CL								
16 SS	24 24	2 5 7 8	30										
			31, 32	30.6 - 36.5' **LEAN CLAY:** CL, dark gray (10YR 4/1) with blueish mottling, 15-25% silt, trace sand and fine gravel, stiff to very stiff (2.0-3.0 tsf), moist to dry, native clay.	CL								

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-390

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
17 SS	24 20	1 2 5 7	33	30.6 - 36.5' **LEAN CLAY:** CL, dark gray (10YR 4/1) with blueish mottling, 15-25% silt, trace sand and fine gravel, stiff to very stiff (2.0-3.0 tsf), moist to dry, native clay. *(continued)*	CL									
18 SS	24 20	1 1 8 28	34, 35	34' very dark gray (10YR 3/1), very stiff to hard (2.5- 4.5 tsf), consistency increasing with depth, slightly laminated, dry.										
19 SS	24 16	3 12 19 23	36	36' very dark gray (10YR 3/1), hard (4.5 tsf).										
			37	36.5 - 39.5' **SHALE:** BDX (SH), dark gray (10YR 4/1), highly decomposed, intensely fractured (tight mud-filled apertures).	BDX (SH)									
20 SS	21 16	1 6 22 50 for 3"	38											
1 CS	16 15		39	38.7' gray to greenish gray.										Core 1, RQD = 63%
				39.5 - 39.9' **LIMESTONE:** BDX (LS), intensely fractured, mostly angular gravel sized pieces of limestone.	BDX (LS)									
2 CS	54 52		40, 41, 42, 43, 44	39.9 - 47.3' **SHALE:** BDX (SH), dark gray, highly decomposed to fresh, intensely fractured (tight mud-filled apertures).	BDX (SH)									Core 2, RQD = 27%
3 CS	66 60.5		45, 46, 47	44.5' dark gray, slightly to highly decomposed, intensely fractured (extremely narrow to narrow apertures).										Core 3, RQD = 54%
			48, 49, 50	47.3 - 50.2' **LIMESTONE:** BDX (LS), gray, intensely fractured (tight to narrow apertures).	BDX (LS)									
4 CS	60 57		51, 52	50.2 - 52' **SHALEY LIMESTONE:** BDX (LS/SH), gray to dark gray, moderately to highly decomposed, intensely fractured (extremely tight to narrow apertures).	BDX (LS/SH)									Core 4, RQD = 57%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-390

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
			53, 54	52 - 56.6' **SHALE:** BDX (SH), dark gray, massive, slightly fractured (extremely narrow to narrow apertures).	BDX (SH)									
5 CS	60 55		55, 56	54.8' dark gray, fossiliferous, moderately to intensely fractured (extremely narrow to narrow apertures).										Core 5, RQD = 57%
			57, 58, 59	56.6 - 64.9' **SHALEY LIMESTONE:** BDX (LS/SH), light gray, fossiliferous, moderately fractured (extremely narrow to narrow apertures).	BDX (LS/SH)									
6 CS	60 58.5		60, 61, 62, 63, 64	59.9' moderately to intensely fractured (tight to narrow apertures).										Core 6, RQD = 74%
				64.9 - 68' Overdrilled for Well Installation.										Bedrock corehole reamed 6" in diameter to 68' bgs for well installation.
				68' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-391

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Jim Dittmaier Bulldog Drilling	3/7/2016	3/10/2016	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-391	Feet (NAVD88)	424.24 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,100.63 N, 2,380,477.06 E E/W (W circled)
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 27.1285"
Long -89° 52' 29.1339"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0 - 4	0 - 4' SILTY CLAY CL/ML.	CL/ML								0-35' Blind Drilled. See log MW-387 for soil description.
			4 - 10.8	4 - 10.8' SILTY CLAY CL/ML.	CL/ML								
			10.8 - 12	10.8 - 12' CLAYEY SILT ML/CL.	ML/CL								

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

Signature [signature]

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NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW-391

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
			12	12 - 24' **SILTY CLAY** CL/ML.	CL/ML									
			24	24 - 27.4' **LEAN CLAY:** CL.	CL									
			27.4	27.4 - 28.5' **SILTY SAND:** SM.	SM									
			28.5	28.5 - 32.5' **SILTY CLAY** CL/ML.	CL/ML									

Depth scale: 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-391

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		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				28.5 - 32.5' **SILTY CLAY** CL/ML. *(continued)*										
			33	32.5 - 34' **POORLY-GRADED SAND:** SP.	SP									
			34	34 - 34.5' **SILTY SAND:** SM.	SM									
				34.5 - 35' **SILTY CLAY** CL/ML.	CL/ML									
1 CS	60 52.5		35	35 - 35.8' **LEAN CLAY:** CL, brown, wet, possible wash out of clay.	CL									Core 1, RQD = 25%
			36	35.8 - 40.7' **LIMESTONE:** BDX (LS), brown and tan, moderately fractured (extremely narrow to narrow apertures), oxidation discoloration.	BDX (LS)									
			37	37.4' white, intensely fractured (extremely narrow to narrow apertures).										
			38											
			39											
2 CS	60 25.5		40											Core 2, RQD = 0%
			41	40.7 - 45.8' **SHALE:** BDX (SH), dark gray, highly decomposed, intensely fractured (tight to very narrow mud-filled fractures).	BDX (SH)									
			42											
			43											
			44											
3 CS	60 49.5		45											Core 3, RQD = 80%
			46	45.8 - 47.5' **SHALEY LIMESTONE:** BDX (LS/SH), light gray, moderately fractured (very narrow apertures).	BDX (LS/SH)									
			47											
			48	47.5 - 49.7' **LIMESTONE:** BDX (LS), white, massive, slightly fractured.	BDX (LS)									
			49											
4 CS	60 64		50	49.7 - 60' **SHALEY LIMESTONE:** BDX (LS/SH), light gray, medium to thinly bedded, moderately to highly decomposed, moderately fractured (tight to narrow apertures).	BDX (LS/SH)									Core 4, RQD = 55%
			51											
			52											

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-391

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		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			53	49.7 - 60' **SHALEY LIMESTONE:** BDX (LS/SH), light gray, medium to thinly bedded, moderately to highly decomposed, moderately fractured (tight to narrow apertures). *(continued)*										
5 CS	60 58.5		55	54.7' light gray, moderately decomposed, moderately fractured, decomposition and fracture density decrease with depth.	BDX (LS/SH)									Core 5, RQD = 96%
6 CS	60 52.5		60	60 - 74.4' **LIMESTONE:** BDX (LS), white, massive, slightly fractured (extremely narrow to very narrow apertures).										Core 6, RQD =99%
7 CS	60 63.25		64	64.4' slightly fractured (very narrow aperture).	BDX (LS)									Core 7, RQD = 100%
8 CS	60 55		70	69.8' unfractured.										Core 8, RQD = 100%

Depth scale: 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-391

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
			73 74	60 - 74.4' **LIMESTONE:** BDX (LS), white, massive, slightly fractured (extremely narrow to very narrow apertures). *(continued)*	BDX (LS)									
				74.4' End of Boring.										Bedrock corehole reamed to 6" in diameter to 72' bgs for well installation.

KELRON ENVIRONMENTAL Incorporated

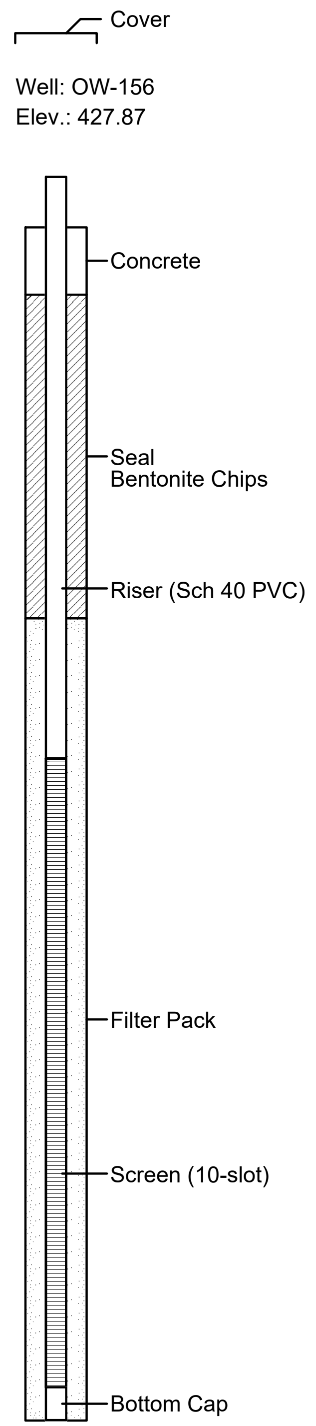
LOG OF BORING OW-156

(Page 1 of 1)

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 NW, NW, SW

Date Completed	: 09/10/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation:	425.14
Sampling Method	: MacroCore (60")	Top of Casing Elevation:	427.87
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2378141, 555983

Depth in Feet	DESCRIPTION	Surf. Elev.425.15	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	SILTY CLAY, stiff, medium brown, dry	425					
			1	32/48	2.5		
			2		1.5		
			3		3.5		
			4		1.75		
5	- stiff to very stiff, low plasticity	420	5	56/60	2.0		
			6		1.75		
	- dark gray-brown (10YR 3/3) with light brown mottling (10YR 6/3)		7		1.75		
			8		1.75		
			9		2.25		
10	CLAY (lean) with Sand, soft to medium, light brown (10YR 6/3) with brown-yellow mottling (10YR 6/6), moist	415	10	60/60	1.0	CL	
			11		1.5		
			12		1.75		
			13		1.75		
			14		1.5		
15		410	15	50/60	2.25		
			16		2.0		
			17		2.5		
	END BOREHOLE AT 17.7 FEET BLS		18		1.25		
	Terminated probing with MacroCore at 19.5 feet bls		19				
20							



04-09-2014

KELRON ENVIRONMENTAL INCORPORATED

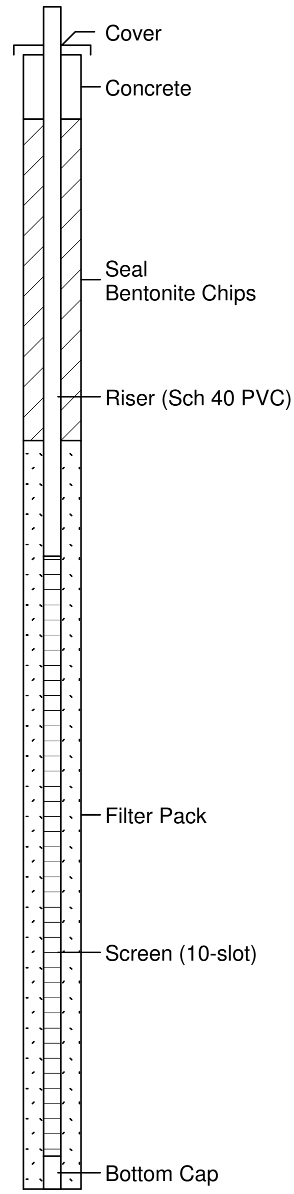
LOG OF BORING OW-157

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SW, SW

Date Completed	: 09/9/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 432.64
Sampling Method	: MacroCore (60")	Top of Casing Elevation	429.90
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2382593, 556189

Depth in Feet	DESCRIPTION	Surf. Elev. 429.90	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	SILTY CLAY with Fly Ash, dark gray-brown, dry	429	1	48/48		CL/FL	
5	CLAY with Silt, hard, medium plasticity, light olive brown, moist	424	2	60/60		CH	
10	CLAY with Sand, stiff, wet	419				CL	
	CLAY, trace to some Sand, very stiff to hard, medium to high plasticity		3	60/60		CL/CH	
15		414	4	60/60			
	END BOREHOLE AT 17.5 FEET BLS						
	Terminated probing with MacroCore at 19.5 feet bls						
20							

Well: OW-157
Elev.: 432.64



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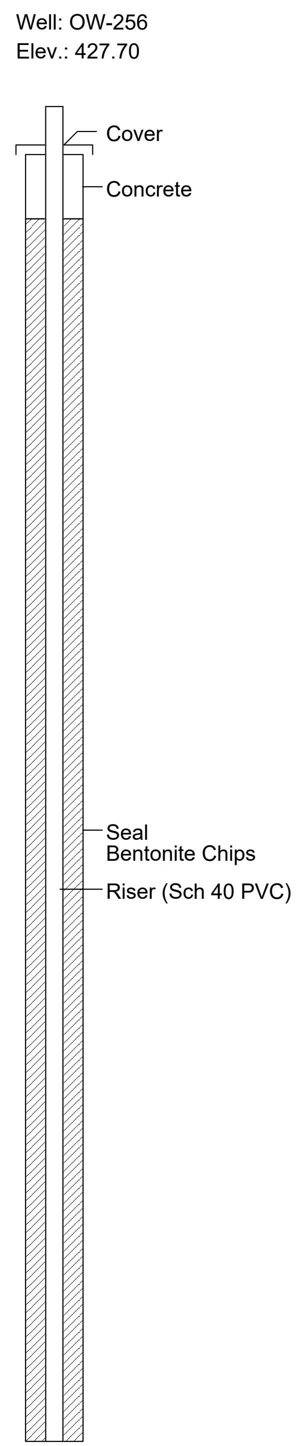
KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE OW-256 (Page 1 of 2)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/22/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 425.20
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 427.70
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381947, 558054

Depth in Feet	DESCRIPTION	Surf. Elev. 425.20	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring to 13.5 feet below ground surface. Refer to boring log for adjacent well OW-156.	425				CL	
5		420					
10		415					
13.5	CLAY (lean), very stiff, high plasticity, pale brown (10YR 6/3),moist - 25% reddish-brown mottling with black manganese staining - light gray (10YR 7/1) with 10-25% mottling		1	60/60	3.0	CL	
15		410	2		2.25		
			3		2.0		
			4		2.0		
			5		1.75		
18.2	Silty CLAY, trace fine to coarse sand [TILL]		6	60/60	2.5	CL	
			7		1.0		
20							



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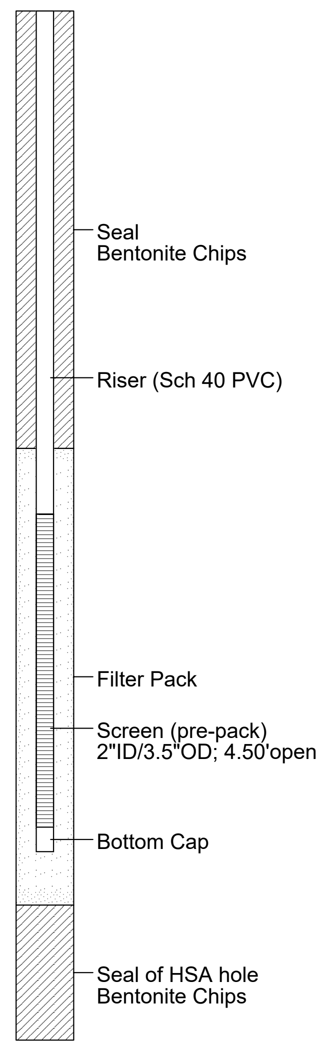
KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE OW-256

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/22/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 425.20
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 427.70
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381947, 558054

Depth in Feet	DESCRIPTION	Surf. Elev. 425.20	Samples	Recovery inches	Qp TSF	USCS
20		405	7		1.0	CL
			8		1.75	
			9		1.75	
			10		1.0	
	- trace fine-coarse gravel (angular to sub-angular; granite piece of 1 1/4"), 50-75% yellowish-brown (10YR 6/8) mottling - few sand and gravel, stiff, high plasticity, gray (10YR 6/1) with 25-75% mottling		11	60/60	1.0	
25	- <25% mottling - with sand (fine-medium)	400	12		2.0	
			13		1.0	
			14		1.0	
	SAND (fine-medium), well graded, brownish yellow (10YR 6/6), wet		15			SW
	Silty CLAY (lean) with sand (fine-medium), medium plasticity, brownish yellow, wet		16	35/60		CL
30		395	17			
	- hard, non plastic, light brownish gray (10YR 6/2), moist [Vandalia Till @ 31.5'] - little sand (fine-coarse) and gravel (fine-coarse, sub-angular to sub-rounded), low to non-plastic, gray (10YR 5/1)		18		>4.5	
			19			
			20			
	SHALE and CLAY, semi-competent, laminated clay with up to 1/2-inch thick layers of hard shale, dry [note: top of weathered bedrock at 33.9 feet below ground surface]		21	54/60	3.0	SH/CL
35		390	22		4.0	
	SHALE with intermittent clay layers, hard, gray		23		>4.5	SH
			24		>4.5	
			25		>4.5	
	END Sampling at 38.5 feet BLS END WELL BOREHOLE at 36.0 feet BLS					
40						

Well: OW-256
Elev.: 427.70



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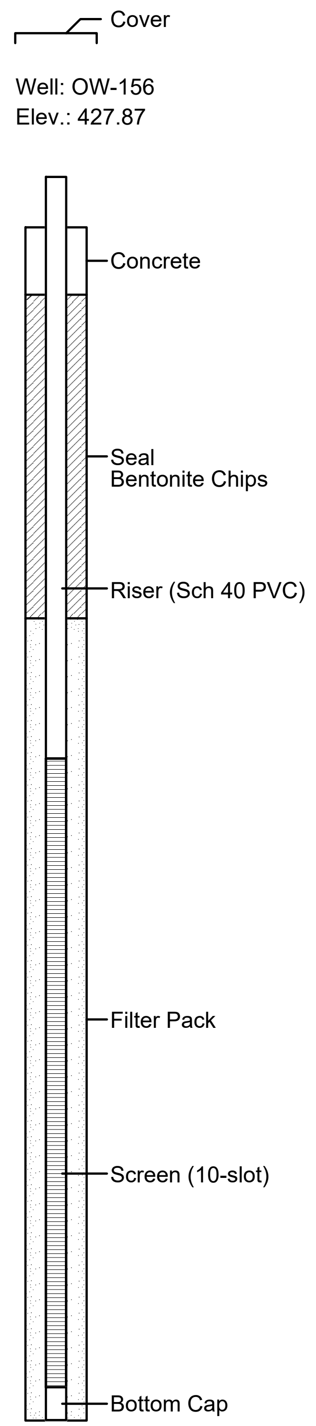
KELRON ENVIRONMENTAL Incorporated	# LOG OF BORING OW-156

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 NW, NW, SW

Date Completed	: 09/10/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation:	425.14
Sampling Method	: MacroCore (60")	Top of Casing Elevation:	427.87
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2378141, 555983

Depth in Feet	DESCRIPTION	Surf. Elev.425.15	Samples	Recovery inches	Qp TSF	USCS
0	SILTY CLAY, stiff, medium brown, dry	425				
			1	32/48	2.5	
			2		1.5	
			3		3.5	
			4		1.75	
5	- stiff to very stiff, low plasticity	420	5	56/60	2.0	
			6		1.75	
	- dark gray-brown (10YR 3/3) with light brown mottling (10YR 6/3)		7		1.75	
			8		1.75	
			9		2.25	CL
10	CLAY (lean) with Sand, soft to medium, light brown (10YR 6/3) with brown-yellow mottling (10YR 6/6), moist	415	10	60/60	1.0	
			11		1.5	
			12		1.75	
			13		1.75	
			14		1.5	
15		410	15	50/60	2.25	
			16		2.0	
			17		2.5	
	END BOREHOLE AT 17.7 FEET BLS		18		1.25	
	Terminated probing with MacroCore at 19.5 feet bls		19			
20						



KELRON ENVIRONMENTAL
Incorporated

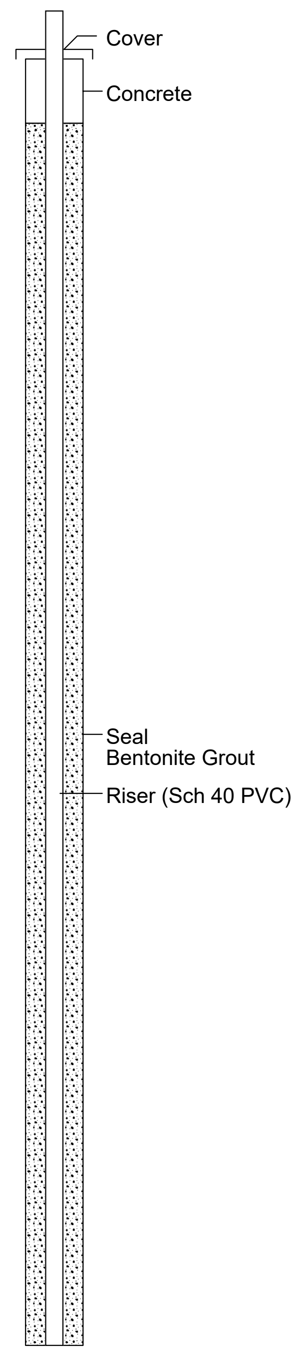
LOG OF PROBEHOLE OW-257

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/16/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 428.17
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.02
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2382572, 556198

Depth in Feet	DESCRIPTION	Surf. Elev. 428.17	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring to 18.5 feet below ground surface. Refer to boring log for adjacent well OW-157.						
		425					
5							
		420				CL	
10							
		415					
15							
		410					
	Silty CLAY, trace sand and gravel, stiff, high plasticity, gray (10YR 6/1) with 25-50% reddish-brown mottling, moist [TILL]		1	56/60	3.0	CL	
			2		2.75		
20							

Well: OW-257
Elev.: 431.02



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KELRON ENVIRONMENTAL
Incorporated

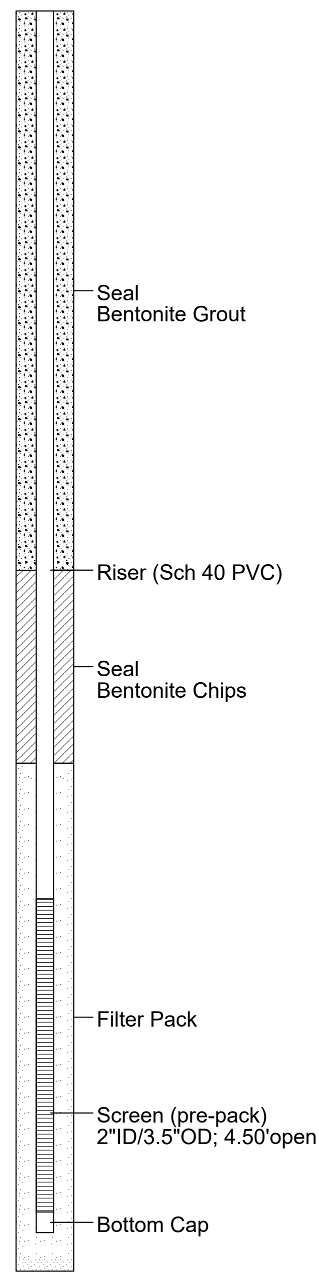
LOG OF PROBEHOLE OW-257

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/16/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 428.17
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.02
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2382572, 556198

Depth in Feet	DESCRIPTION	Surf. Elev. 428.17	Samples	Recovery inches	Qp TSF	USCS
20			2		2.75	CL
	- >50% mottling		3		2.5	
	Sandy CLAY with gravel (fine-coarse, sub-angular; granite piece of 1.5"), brownish yellow (10YR 6/6), wet					CL
	Silty CLAY, trace sand and gravel, soft, high plasticity, yellowish brown (10YR5/6) with 10-25% light gray mottling		4		1.0	
		405	5		1.5	
	- very soft, brownish yellow with <10% mottling		6	60/60	0.5	
25	- with trace pyrite crystals		7		1.0	
	- medium hardness grading to stiff		8		2.0	
			9		2.0	
		400	10		3.25	
			11	60/60	1.5	CL
30	- stiff, high plasticity, gray with <10% reddish-brown mottling, moist		12		3.5	
			13		2.75	
	- very stiff, dark gray (10YR 4/1)		14		2.0	
		395	15		3.5	
			16	60/60	2.0	
35			17		2.0	
	- low plasticity, very dark gray (10YR 3/1)		18		4.0	
	SHALE and CLAY (fat), intermittent lamination, hard, very dark gray, moist [note: top of weathered bedrock at 36.3 feet below ground surface]		19		3.0	
		390	20		>4.5	SH/CL
			21	13/13		
40	END BOREHOLE at 39.6 feet BLS					

Well: OW-257
Elev.: 431.02



KELRON ENVIRONMENTAL INCORPORATED

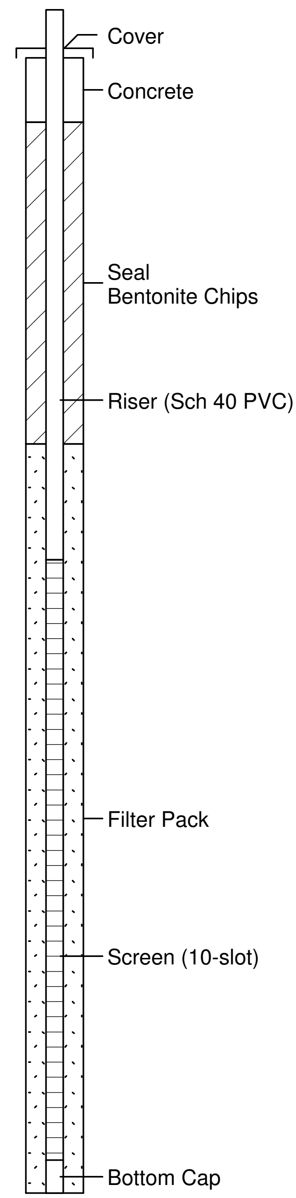
LOG OF BORING OW-157

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SW, SW

Date Completed	: 09/9/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 432.64
Sampling Method	: MacroCore (60")	Top of Casing Elevation	429.90
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2382593, 556189

Depth in Feet	DESCRIPTION	Surf. Elev. 429.90	Samples	Recovery inches	Qp TSF	USCS
0	SILTY CLAY with Fly Ash, dark gray-brown, dry	429	1	48/48		CL/FL
4	CLAY with Silt, hard, medium plasticity, light olive brown, moist	424	2	60/60		CH
10.5	CLAY with Sand, stiff, wet	419				CL
11.5	CLAY, trace to some Sand, very stiff to hard, medium to high plasticity		3	60/60		CL/CH
	END BOREHOLE AT 17.5 FEET BLS	414	4	60/60		
20	Terminated probing with MacroCore at 19.5 feet bls					

Well: OW-157
Elev.: 432.64



SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-169

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/27/2015	7/28/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-169	Feet (NAVD88)	420.01 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 557,323.57 N, 2,381,764.94 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 49.0632"
Long -89° 52' 12.9108"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 15.5	4 9 10 11	0–2	0 - 0.2' **SILT:** ML, dark grayish brown (10YR 4/2), trace roots and clay, very soft (<0.25 tsf), dry.	ML								
				0.2 - 2' **SILTY CLAY** CL/ML, brown (10YR 5/3), cohesive, nonplastic to low plasticity, dry.	CL/ML								
2 ST	24 22		2–4	2 - 4' Shelby Tube Sample.									ST2: 24" push at 500lbs of pressure.
3 SS	24 21	2 3 6 6	4–6	4 - 10' **SILTY CLAY** CL/ML, dark yellowish brown (10YR 3/6), trace brown (10YR 5/3) and gray (10YR 6/1) mottling, cohesive, nonplastic to low plasticity, stiff to very stiff (1.0-2.5 tsf), dry to moist.	CL/ML								
4 SS	24 20	2 3 5 7	6–8										
5 SS	24 24	2 3 4 5	8–10	8' - 10' dark grayish brown (10YR 4/2), very dark brown (10YR 2/2) mottling, trace dark yellowish brown (10YR 6/3), cohesive, moist. 8.9' dark brown (10YR 3/3) mottling.									
6 SS	24 23	1 3 4 5	10–12	10 - 12' **SILTY CLAY** to **LEAN CLAY:** CL/ML, dark yellowish brown (10YR 3/6), trace yellowish brown (10YR 5/6) mottling, decreasing silt content with depth, moist. 10.3' trace wood pieces. 11.4' - 11.7' trace very dark brown (10YR 2/2) mottling.	CL/ML								
7 ST	24 24		12–14	12 - 14' Shelby Tube Sample.									ST7: 24" push at 400lbs of pressure.

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

Signature [signature]

Firm Natural Resource Technology
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SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-169

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
8 SS	24 22	2 4 5 6	15	14 - 20' **LEAN CLAY:** CL, dark yellowish brown (10YR 3/6), grades to gray (10YR 6/1), yellowish brown (10YR 5/6) mottling, trace very dark brown (10YR 2/2) mottling, silt (5-30%), cohesive, low to medium plasticity, stiff to very stiff (1.5-3.5 tsf), moist.	CL								
9 SS	24 22.5	2 3 5 5	16, 17	16' - 19.9' dark yellowish brown (10YR 3/6) and yellowish brown (10YR 5/6) mottling.									
10 SS	24 23	1 4 4 4	18, 19	18' trace dark yellowish brown (10YR 6/3) mottling, trace silt, softer with depth. 18.8' trace very fine and coarse sand.									
11 SS	24 21	1 3 4 4	20, 21	20 - 22' **SILTY CLAY** CL/ML, gray (10YR 6/1), dark yellowish brown (10YR 3/6) and trace very dark brown (10YR 2/2) mottling, trace to few very fine sand seams, cohesive, nonplastic to low plasticity, stiff to very stiff (1.75-2.5 tsf), moist. 21' trace very fine sand seams.	CL/ML								
12 ST	24 25		22, 23	22 - 24' Shelby Tube Sample.									ST12: 24" push at 150lbs of pressure, wet tube (free water)
13 SS	24 24	1 2 3 5	24, 25	24 - 28' **LEAN CLAY WITH SAND:** s(CL), pale brown (10YR 6/3), trace brownish yellow (10YR 6/6) mottling, very fine sand, trace coarse sand, trace silt, cohesive, soft, moist to wet.	s(CL)								
14 SS	24 24	1 1 2 4	26, 27										
15 SS	24 21.5	4 6 8 10	28, 29	28 - 30' **SILTY CLAY** CL/ML, gray (10YR 5/1), trace strong brown (7.5YR 5/6) and very dark brown (10YR 2/2) mottling, very fine sand (10-20%), trace coarse sand and fine gravel, stiff to hard (1.25->4.5 tsf), moist to wet (on bottom).	CL/ML								
16 SS	24 21	3 7 9 14	30, 31	30 - 32' **LEAN CLAY:** to **SILTY CLAY** CL, yellowish brown (10YR 5/4), trace gray (10YR 5/1) and yellowish brown (10YR 5/6) mottling, silt (15-25%), trace very fine to fine gravel, cohesive, medium to high plasticity, very stiff (2.5-4.0 tsf), moist. 30.2' small dark brown (10YR 3/3) fragments (possible shale).	CL								
17 SS	24 20	4 6 10 13	32, 33	32 - 38' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace gray (10YR 5/1) mottling, silt (5-15%), trace fine to coarse sand, low to medium plasticity, medium to hard (0.75->4.5 tsf), dry to moist (increasing moisture content with depth).	CL								
18 SS	24 17	4 6 13 16	34, 35	33.1' - 33.3' dark gray (10YR 4/1). 34' - 35.4' no coarse sand, moist.									
19 SS	11 11	5 50 for 5"	36, 37	36' - 37' low plasticity, moist (decreasing moisture content with depth).									subangular gravel in shoe of sample SS19

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-169

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
					CL									
20 SS	24 0	13 20 23 25	38	38 - 40' No Recovery.										
			39											
21 SS	18 6	16 35 50 for 6"	40	40 - 42' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace gray (10YR 5/1) mottling, silt (0-10%), subrounded to subangular gravel (5-10%), trace fine to coarse sand, low to medium plasticity, medium to hard (0.75->4.5 tsf), moist to wet.	CL									
			41											
			42	42' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Baldwin Energy Complex		PZ-170	
Boring Drilled By: Name of crew chief (first, last) and Firm	**Date Drilling Started**	**Date Drilling Completed**	**Drilling Method**
Chad Dutton Bulldog Drilling	7/29/2015	7/29/2015	hollow stem auger
Common Well Name	**Final Static Water Level**	**Surface Elevation**	**Borehole Diameter**
PZ-170	Feet (NAVD88)	418.58 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,822.69 N, 2,381,944.92 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 44.106"
Long -89° 52' 10.6752"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 8	4 5 6 9	0–2	0 - 2' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (15-25%), trace roots, grass, gravel, and coarse sand, cohesive, nonplastic to low plasticity, hard (>4.5 tsf), dry.	CL/ML								
2 ST	24 21		2–4	2 - 4' Shelby Tube Sample.									ST2: 24" push at 500lbs of pressure.
3 SS	24 15	2 3 5 7	4–8	4 - 8' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (5-15%), trace very fine sand and gravel, low plasticity, very stiff to hard (2.5->4.5 tsf), dry.	CL/ML								
4 SS	24 17	3 5 8 8		6' - 7.4' trace gray (10YR 5/1) mottling.									
5 SS	24 17	3 4 6 6	8–10	8 - 10' **SILTY CLAY** to **LEAN CLAY:** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (5-15%), trace very fine sand and gravel, silt content decreases with depth, clay content increases with depth, medium plasticity, very stiff (3.25 tsf), dry.	CL/ML								
6 SS	24 20	3 4 5 5	10–12	10 - 12' **LEAN CLAY:** CL, brown (5YR 4/3), trace very dark brown (10YR 2/2) mottling, trace silt, silt content increasing with depth, medium to high plasticity, stiff (1.75-2.0 tsf).	CL								
7 ST	24 24		12–13	12 - 14' Shelby Tube Sample.									ST7: 24" push at 250lbs of pressure.

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

Signature [signature]

Firm Natural Resource Technology
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NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-170

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
				12 - 14' Shelby Tube Sample. *(continued)*									
8 SS	24 21	3 5 7 8	14	14 - 24' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (10-20%), trace gravel, cohesive, low plasticity, stiff to very stiff (1.0-3.0 tsf), dry to moist. 14.9' - 15.3' very dark brown (10YR 2/2) mottling.	CL/ML								
9 SS	24 24	2 4 4 6	16	16' - 18.5' increaed very dark brown (10YR 2/2) mottling (5-15%), very fine sand (0-10%), trace fine gravel, subangular, cohesive, low to medium plasticity, dry to moist. 16.8' - 17.1' very dark brown (10YR 2/2) mottling.									
10 SS	24 24	1 3 3 3	18	18' - 20' silt (15-25%), very fine sand (0-10%), trace fine gravel, medium plasticity, moist. 19' layer of gravel (2" thick, subangular to subrounded).									
11 SS	24 20	1 2 5 7	20	19.8' very soft (0.25 tsf). 20' - 24' subangular to subrounded gravel, low plasticity, dry to moist. 20.8' increased gravel content (10-15%). 21.2' decrease in gravel content (5-15%).									
12 SS	24 20.5	3 6 8 10	22										
13 ST	24 24		24	24 - 26' Shelby Tube Sample.									ST13: 24" push at 650lbs of pressure.
14 SS	24 22	3 6 12 14	26	26 - 28.2' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/6), trace brown (10YR 5/3) and very dark brown (10YR 2/2) mottling, silt (10-30%), very fine sand (0-15%), trace fine subangular to subrounded gravel, gravel decreases with depth to no gravel, trace <1mm thick very fine sand seams, cohesive, low to medium plasticity, plasticity increasing with depth, very stiff to hard (2.0->4.5 tsf), moist, decreasing silt and sand content with depth.	CL/ML								
15 SS	24 22	9 17 24 35	28	28.2 - 30' **LEAN CLAY:** CL, very dark gray (2.5Y 3/1), trace silt, cohesive, medium to high plasticity, hard (>4.5 tsf), dry. 28.5' black (2.5Y 2.5/1). 28.9' greenish gray (GLEY 1 6/1).	CL								
16 SS	17 13	11 30 50 for 5"	30	30 - 31.1' **SHALE:** to **LEAN CLAY:** BDX (SH), greenish gray (GLEY 1 6/1), trace silt, cohesive, medium to high plasticity, dry, shale (residual soil to highly decomposed, very weak, fissile). 31.1' End of Boring.	BDX (SH)								Hollow Stem Auger Refusal at 31.1 ft bgs on Shale Bedrock.

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-171

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/30/2015	7/31/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-171	Feet (NAVD88)	431.54 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,453.57 N, 2,379,199.67 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 40.542"
Long -89° 52' 45.0804"
Local Grid Location
Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 16	2 5 4 4	0–2	0 - 2' **SILT:** ML, brown (7.5YR 4/3), 5-15% clay, trace roots, cohesive, nonplastic, dry. 0.7' increase in clay content (15-25%).	ML								
2 ST	24 24		2–4	2 - 4' Shelby Tube Sample.									ST2: 24" push at 250lbs of pressure.
3 SS	24 18	1 3 3 3	4	4 - 10.8' **SILTY CLAY** CL/ML, brown (10YR 5/3), very dark brown (10YR 2/2) and dark yellowish brown (10YR 4/4) mottling, silt (10-20%), cohesive, low to medium plasticity, medium to stiff (0.5-1.75 tsf), moist.	CL/ML								
4 SS	24 24	1 3 3 5	6	6' low plasticity.									
5 SS	24 17	1 2 3 3	7.7–8	7.7' silt (25-35%), trace very fine sand, nonplastic to low plasticity. 8' silt (5-15%), medium plasticity.									
6 SS	24 24	2 2 3 4	10	10' silt (20-50%), silt content increasing with depth, moist.									
			10.8–12	10.8 - 12' **CLAYEY SILT** ML/CL, clay (30-50%), medium (0.5-0.75 tsf), moist.	ML/CL								

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

Signature [signature]

Firm Natural Resource Technology
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Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-171

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 ST	24 26		13	12 - 14' Shelby Tube Sample.									ST7: 24" push at 200lbs of pressure.
8 SS	24 24	2 3 3 5	14, 15	14 - 20' **SILTY CLAY** CL/ML, brown (10YR 5/3), very dark brown (10YR 2/2) and dark yellowish brown (10YR 4/4) mottling, silt (30-40%), cohesive, low to medium plasticity, medium to stiff (0.75-2.0 tsf), moist.	CL/ML								
9 SS	24 24	2 3 5 5	16, 17										
10 SS	24 20	1 3 5 8	18, 19	17.4' - 19.7' dark yellowish brown (10YR 4/4), brown (10YR 5/3) mottling, clay (20-30%), cohesive, nonplastic, moist.									
11 ST	24 16		20, 21	20 - 22' Shelby Tube Sample.									ST11: 24" push at 350lbs of pressure.
12 SS	24 21	1 1 2 2	22, 23	22 - 26' **SILTY CLAY** CL/ML, brown (10YR 5/3), very dark brown (10YR 2/2) and dark yellowish brown (10YR 4/4) mottling, silt (10-20%), cohesive, low to medium plasticity, very soft to medium (0.25-1.0 tsf), moist. 22.8' - 23' sandy clay layer, very fine sand, wet.	CL/ML								
13 SS	24 17	WOR 1 2 3	24, 25	24' - 26' silt (5-15%), medium to high plasticity, moist.									WOR = Weight of Rods
14 SS	24 24	1 1 2 2	26, 27	26 - 28' **SILTY CLAY** to **SANDY LEAN CLAY:** CL/ML, yellowish brown (10YR 5/4), very fine sand (30-50%), increasing sand content with depth, silt (20-40%), decreasing silt content with depth, clay content decreasing with depth, cohesive, nonplastic to low plasticity, decreasing plasticity with depth, wet.	CL/ML								
15 SS	24 21.5	1 3 7 10	28, 29	28 - 28.7' **CLAYEY SILT** to **POORLY-GRADED SAND:** ML/CL, yellowish brown (10YR 5/4), clay (10-20%), fine sand (10-20%), cohesive, nonplastic, wet. 28.7 - 36.6' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), fine sand, silt (5-15%), clay (5-15%), medium and coarse grained sand (5-10%), wet.	ML/CL								
16 SS	24 24	4 4 3 4	30, 31, 32	30' trace clay, trace medium and coarse sand.	SP								

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-171

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		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
17 SS	24 21.5	5 9 15 20	33	28.7 - 36.6' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), fine sand, silt (5-15%), clay (5-15%), medium and coarse grained sand (5-10%), wet. *(continued)* 32' - 33.8' sand grading from fine to very fine with depth.										
18 SS	24 22	5 15 19 22	34 35		SP									
19 SS	24 22	4 4 5 6	36 37	36' - 36.6' increase in silt content with depth (5-15%). 36.4' clay layer (2mm thick). 36.5' clay layer (2mm thick).										
			38	36.6 - 38' **LEAN CLAY:** CL, dark gray (2.5Y 4/1) to very dark gray (2.5Y 3/1), trace silt, trace fine sand seams, high plasticity, stiff (1.5-1.75 tsf), moist.	CL									
				38' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-172

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/31/2015	7/31/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-172	Feet (NAVD88)	410.22 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,323.28 N, 2,379,176.11 E E/W (W circled)
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 29.3676"
Long -89° 52' 45.4188"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 / 17	3 6 5 4	0–1	0 - 0.5' **FILL, TOPSOIL:** ML, dark grayish brown (10YR 4/2), trace clay, gravel, roots, and grass, noncohesive, dry. 0.4' angular gravel.	(FILL) ML								
			1–2	0.5 - 2' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/4), very dark brown (10YR 2/2) and strong brown (7.5YR 4/6) mottling, silt (5-15%), trace fine sand, cohesive, low plasticity, dry.	CL/ML								
2 ST	24 / 17		2–4	2 - 4' Shelby Tube Sample.									ST2: 24" push at 500lbs of pressure.
3 SS	24 / 19	2 3 4 6	4	4 - 9.2' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/4), increased very dark brown (10YR 2/2) and strong brown (7.5YR 4/6) mottling, silt (5-15%), trace fine sand, cohesive, medium plasticity, very soft to very stiff (0.25-2.5 tsf), moist.	CL/ML								
4 SS	24 / 22	2 2 4 8	6	6' silt (10-20%), low to medium plasticity.									
5 SS	24 / 20	1 3 5 9	8	8' decreased mottling, trace brown silt seams, silt content increasing with depth (20-50%).									
			9.2	9.2 - 10' **SILT:** ML, brown (7.5YR 4/4), clay (5-15%), cohesive, nonplastic, moist.	ML								
6 ST	24 / 16		10–12	10 - 12' Shelby Tube Sample.									ST6: 24" push at 450lbs of pressure.

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

Signature	Firm	
(signed)	Natural Resource Technology 234 W. Florida St., Fifth Floor, Milwaukee, WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-172

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 24	1 1 3 4	12–13	12 - 18' **SILTY CLAY** CL/ML, brown (7.5YR 4/4), cohesive, nonplastic to low plasticity, stiff to very stiff (1.25-2.75 tsf), moist.	CL/ML						
			13–14	13.3' soft (0.5 tsf).							
8 SS	24 24	2 3 4 7	14–16								
9 SS	24 22.5	2 4 4 6	16–18	15.8' hard (4.0 tsf). 16.6' - 16.8' increased very dark brown (10YR 2/2) mottling.							
10 ST	24 22		18–20	18 - 20' Shelby Tube Sample.							ST10: 24" push at 350lbs of pressure.
11 SS	24 23	1 3 3 3	20–21	20 - 21' **SANDY LEAN CLAY:** s(CL), dark gray (10YR 4/1), with clay seams, trace yellowish brown (10YR 5/8 mottling), cohesive, nonplastic, wet, clay seams (medium to high plasticity).	s(CL)						
			21–22	21 - 22' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g, mostly yellowish brown (10YR 5/8) with some dark gray (10YR 4/1), silt (>15%), cohesive, nonplastic.	s(CL)g						
12 SS	14 12	1 2 50 for 2"	22–24	22 - 24' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/8) with dark gray (10YR 4/1) mottling, sand (5-15%), cohesive, low plasticity.	CL/ML						
13 SS	22 18	15 14 18 50 for 4"	24–26	24 - 26' **LEAN CLAY:** CL, trace gravel, hard (4.5 tsf), cohesive, dry.	CL						
14 SS	2 2	50 for 2"	26–26.2	26 - 26.2' **SHALE:** BDX (SH), clay (5-15%). 26.2' End of Boring.	BDX (SH)						

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-173

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	8/3/2015	8/3/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-173	Feet (NAVD88)	388.43 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 555,035.38 N, 2,379,187.28 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 26.52"
Long -89° 52' 45.2892"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 0		0–1	0 - 2' No Recovery. Gravel Pad.	(FILL)									
2 SS	24 13	2 2 2 3	2	2 - 10.9' **SILTY CLAY** CL/ML, dark grayish brown (10YR 4/2), trace sand and wood, cohesive, medium plasticity, very stiff (2.5-3.5 tsf), moist.										
3 SS	24 7	2 5 4 5	4	4' yellowish red (5YR 4/6) mottling.										
4 SS	24 20	2 4 8 9	6	6' - 7.7' yellowish brown (10YR 5/6) with dark gray (10YR 4/1) mottling, hard, laminated, dry.	CL/ML									
5 SS	24 19	2 4 6 8	8	8.2' very dark gray (10YR 3/1), trace dark yellowish brown (10YR 4/6) mottling, small hard nodules of clay in the matrix, dry to moist.										
6 SS	24 18	2 3 6 7	10	10.6' olive (5Y 5/6) with bluish gray (GLEY2 5/2) mottling.										
			11–12	10.9 - 13.8' **SILT:** ML, dark reddish gray (5YR 4/2), cohesive, nonplastic, stiff (2.0 tsf), moist.	ML									

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

Signature [signature]

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SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-173

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		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	22 16	2 5 15 50 for 4"	13	10.9 - 13.8' **SILT:** ML, dark reddish gray (5YR 4/2), cohesive, nonplastic, stiff (2.0 tsf), moist. *(continued)* 12' - 13.3' trace brown (7.5YR 4/4) mottling, trace gravel, trace sand, increasing sand and gravel with depth. 12.6' wet. 12.8' clay (0-15%).	ML									Hollow Stem Auger Refusal at 13.5 ft bgs on Bedrock. SS8: Rock chips in spoon. Split Spoon Refusal at 14.1 ft bgs on Bedrock.
8 SS	2 0	50 for 2"	14	13.8 - 14.1' **BEDROCK** BDX (SH), wet.	BDX (SH)									
9 SS	1 1	50 for 1"		14.1' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-174

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	8/4/2015	8/4/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-174	Feet (NAVD88)	398.97 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,666.23 N, 2,379,774.23 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 22.8552"
Long -89° 52' 37.9524"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 5	2 3 5 3	0–2	0 - 2' **TOPSOIL:** ML, brown (10YR 4/3), trace grass and roots, cohesive, nonplastic, dry.	ML								
2 SS	24 0	2 2 2 4	2–4	2 - 4' No Recovery.									
3 SS	24 6	2 2 4 5	4–6	4 - 24.7' **LEAN CLAY:** CL, dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/4) mottling, silt (10-20%), cohesive, medium plasticity, moist.	CL								
4 SS	24 6	4 4 5 7	6–8										
5 SS	24 23	3 4 5 5	8–10	8' - 9.9' increased yellowish brown (10YR 4/4) mottling, increase in silt content with depth (50%).									
6 SS	24 20	2 4 8 6	10–12	10' - 11.7' decrease in silt content with depth (10-20%). 10.6' - 11.2' dark yellowish brown (10YR 4/4) and very dark brown (10YR 2/2) mottling (50%), dry to moist.									

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

Signature [signature]

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SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-174

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	24 21	2 3 5 7	13	4 - 24.7' **LEAN CLAY:** CL, dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/4) mottling, silt (10-20%), cohesive, medium plasticity, moist. *(continued)* 12' - 13.8' trace coarse sand, dry.										
8 SS	24 21	2 4 5 8	14, 15	14' - 15.8' increased sand content, trace gravel, dry.										
9 SS	24 24	2 4 5 7	16, 17	16' - 18' yellowish brown (10YR 5/4), moist.										
10 SS	24 24	3 7 9 12	18, 19	18' - 20' coarse sand and gravel (5-15%), moist.	CL									
11 SS	24 24	3 7 9 15	20, 21											
12 SS	24 24	4 7 8 10	22, 23											
13 SS	8 8	11 50 for 2"	24	24' - 24.7' decreased moisture content with depth.										Hollow Stem Auger Refusal at 24.7 ft bgs on Shale Bedrock.
				24.7' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-175

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	8/7/2015	8/7/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-175	Feet (NAVD88)	419.87 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,433.02 N, 2,380,846.31 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 20.5152"
Long -89° 52' 24.5316"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 17	4 7 5 4		0 - 0.9' **SILT:** ML, brown (10YR 5/3), trace roots and grass, noncohesive, nonplastic, hard (3.0->4.5 tsf), dry.	ML								
			1	0.9 - 5.4' **LEAN CLAY:** CL, brownish yellow (10YR 6/6), black (10YR 2/1) mottling, silt (5-15%), dry, cohesive, low plasticity, very stiff (2.5-3.0 tsf).	CL								
2 SS	24 15	2 4 4 6	2	2' dry, increase in moisture content with depth, trace brown (10YR 5/3) silt seams.									
			3										
3 SS	24 17	2 3 4 6	4	4' increased brown (10YR 5/3) and black mottling (10YR 2/1), moist.									
			5										
4 SS	24 23	2 2 4 4	6	5.4 - 13.5' **SILT:** ML, light yellowish brown (10YR 6/4), trace dark gray (10YR 4/1) mottling, clay (5-15%), moist, cohesive, nonplastic, medium to stiff (0.5- 1.5 tsf).	ML								
			7										
5 SS	24 22	1 2 3 3	8	8' decreased mottling.									
			9										
6 SS	24 24	1 2 2 2	10	10' brown (7.5YR 4/4), no mottling.									
			11										
7 SS	24 23	1 2 3 4	12	12' increasing clay content with depth, low plasticity.									
			13										
			14										

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

Signature [signature]

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NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-175

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
8 SS	24 21	1 3 4 5	15	13.5 - 22.3' **LEAN CLAY:** CL, brown (7.5YR 4/4), silt (5-15%), moist, cohesive, low to medium plasticity, stiff to very stiff (1.5-4.0 tsf) increasing with depth. *(continued)* 14' trace black (10YR 2/1) and dark gray (10YR 4/1) mottling, trace silt.	CL									
9 SS	24 24	2 3 4 4	16, 17	16' brown (7.5YR 5/4), silt (5-15%).										
10 SS	24 23	1 4 6 6	18, 19	18' trace black (10YR 2/1) and dark gray (5-50% 10YR 4/1) mottling, trace silt, silt content decreasing with depth, wet.	CL									
11 SS	24 23	2 5 7 7	20, 21	20' no black (10YR 2/1) mottling, yellowish brown (5-15% 10YR 5/8) mottling.										
12 SS	24 24	3 3 4 4	22, 23	22.3 - 26' **SILT:** ML, clay (5-15%), trace coarse sand, decrease in clay content with depth, moist, cohesive, nonplastic, very soft to very stiff (<0.25-3.0 tsf) decreasing with depth.										
13 SS	24 24	2 2 2 3	24, 25	23.9' sandy silt seam (2" thick), wet. 24' some sandy and clayey silt seams, trace coarse sand to fine gravel, moist to wet in sandy silt seams.	ML									
14 SS	24 24	11 8 9 10	26, 27	26 - 28' **LEAN CLAY:** to **SILT:** CL, silt (40-60%), coarse sand to fine gravel (5-15%), trace fine sand seams, moist, cohesive, low plasticity, stiff (1.5-2.0 tsf).	CL									
15 SS	24 24	8 11 15 20	28, 29	28 - 28.4' **SANDY SILT:** s(ML), yellowish brown (10YR 5/4), wet, cohesive, nonplastic, stiff (1.5 tsf). 28.4 - 31.3' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), coarse sand to fine gravel (5-15%), trace fine sand seams, hard (>4.5 tsf), dry to moist.	s(ML)									
16 SS	24 24	9 19 20 23	30, 31		CL									
17 SS	24 24	6 6 8 10	32, 33	31.3 - 31.5' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, dark yellowish brown (10YR 4/6), dry. 31.5 - 43.8' **LEAN CLAY:** CL, gray (10YR 5/1), dry, very stiff to hard (2.5->4.5 tsf), cohesive, nonplastic. 32' trace yellowish brown (10YR 5/6) seams and mottling, medium to high plasticity, increasing moisture content with depth.	(SW)g									
18 SS	24 24	7 5 6 8	34, 35	34' trace mottling, moist, decreasing moisture content with depth.	CL									
19 SS	24 24	3 5 6 7	36, 37	36' dry to moist, silty clay seam (4" thick, moist).										

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-175

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
20 SS	24 24	3 4 7 7	38	31.5 - 43.8' **LEAN CLAY:** CL, gray (10YR 5/1), dry, very stiff to hard (2.5->4.5 tsf), cohesive, nonplastic. *(continued)* 38' trace black (10YR 2/1) mottling. 38.3' yellowish brown (10YR 5/6) with gray (10YR 5/1) mottling.	CL									
21 SS	24 24	3 5 6 7	40											
22 SS	24 24	3 5 8 20	42	42' trace fine gravel.										
23 SS	24 20	3 11 12 14	44	43.8 - 45.7' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g, brown (10YR 5/3), mostly broken rock, moist. 44' black (10YR 2/1) mottling, seams of wet gravel, coarse sand to coarse gravel.	s(CL)g									
24 SS	24 24	3 5 7 11	46	45.7 - 50' **LEAN CLAY:** CL, light yellowish brown (10YR 6/4), brownish yellow (10YR 6/6) and dark gray (10YR 4/1) and black (10YR 2/1) mottling, trace fine gravel, some laminations, very stiff (2.5-3.5 tsf).	CL									
25 SS	24 24	4 7 12 20	48	48' moist to dry. 48.7' laminated, dry.										
26 SS	1 0	50 for 1"	50	50 - 50.2' **SHALE:** BDX (SH). 50.2' End of Boring.	BDX (SH)									Hollow Stem Auger Refusal at 50.2 ft bgs on Shale Bedrock.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Baldwin Energy Complex		PZ-176	

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	8/6/2015	8/6/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-176	Feet (NAVD88)	403.46 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,264.76 N, 2,381,381.02 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 18.834"
Long -89° 52' 17.8428"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 15	3 3 4 4	0 – 1	0 - 0.5' **TOPSOIL:** ML, dark grayish brown (10YR 4/2), clay (5-15%), trace grass and roots, cohesive, nonplastic, stiff (1.5 tsf), dry.	ML								
			1 – 2.4	0.5 - 2.4' **SILT:** ML, dark grayish brown (10YR 4/2), brownish yellow (10YR 6/6) and dark brown (10YR 3/3) mottling, clay (30-50%), trace roots, cohesive, low plasticity, very stiff (3.0 tsf), dry.	ML								
2 SS	24 16	3 3 5 5	2.4 – 4	2.4 - 6.3' **LEAN CLAY:** CL, dark yellowish brown (10YR 4/4), dark gray (10YR 4/1) mottling, silt (5-15%), trace roots, cohesive, medium plasticity, moist.									
3 SS	24 9	2 3 4 4	4 – 6	4' increase in silt content (40-60%), dry to moist.	CL								
4 SS	24 21	3 3 3 4	6 – 8	6.3 - 12' **SILT:** ML, dark gray (10YR 4/1), cohesive, nonplastic, moist.									
5 SS	24 12	1 1 1 2	8 – 10	8' sand (0-40%), sand content increasing with depth, moist to wet.	ML								
6 SS	24 13	1 1 1 2	10 – 12	10' increase in sand content (40-60%).									

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

Signature	Firm	
[signature]	Natural Resource Technology 234 W. Florida St., Fifth Floor, Milwaukee, WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-176

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 20	1 2 3 5		12 - 12.3' **WELL-GRADED SAND:** SW, very dark grayish brown (10YR 3/2), fine gravel (>15%), moist. /	SW								
			13	12.3 - 16' **LEAN CLAY:** CL, gray (10YR 5/1), brownish yellow (5-15% 10YR 6/6) and trace very dark brown (10YR 2/2) mottling, silt (5-15%), trace sand seams, cohesive, medium plasticity, stiff to very stiff (1.5-3.0 tsf).									
8 SS	24	2 3 3 5	14	14' increase in thickness of sand seams (1"-2" thick, moist, wet).	CL								
			15										
9 SS	24 17	2 4 7 10	16	16 - 28.6' **LEAN CLAY:** CL, dark gray (10YR 4/1), light yellowish brown (10YR 6/4) mottling, cohesive, low plasticity, very stiff to hard (3.5->4.5 tsf) dry.									
			17										
10 SS	24 18	4 6 8 12	18	18' increased mottling, mostly brown (10YR 5/3), brownish yellow (10YR 6/6), dark gray (10YR 4/1), and olive gray (5Y 5/2) mottling.									
			19										
11 SS	24 17	5 16 22 25	20	20' olive gray (5Y 5/2), brownish yellow (10YR 6/6) mottling. 20.3' dark gray (2.5Y 4/1), brownish yellow (10YR 6/6) mottling, clay becoming blocky and laminated.									
			21										
12 SS	11 7	7 50 for 5"	22	22' pale olive (5Y 6/3), dark gray (10YR 4/1) mottling, laminated.	CL								
			23										
13 SS	24 24	13 21 31 43	24	24' brownish yellow (10YR 6/6) mottling.									At 23.6' rock fragment on bottom of split spoon. Refusal of split spoon.
			25										
14 SS	24 24	14 12 17 19	26										
			27										
15 SS	8 8	9 50 for 2"	28	28' hard (4.5 tsf).									
16 SS	1 0	50 for 1"		28.6' End of Boring.									

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-177

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	8/5/2015	8/6/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-177	Feet (NAVD88)	417.93 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,192.18 N, 2,381,923.59 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 18.0996"
Long -89° 52' 11.0496"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 / 12	1 6 8 5		0 - 4' **TOPSOIL:** ML, dark yellowish brown (10YR 4/4), clay (5-15%), clay content increasing with depth, trace sand and roots, cohesive, nonplastic, dry.	ML								
2 SS	24 / 4	4 4 6 7	2										
3 SS	24 / 17	2 3 4 5	4	4 - 19.3' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace black (10YR 2/1) and dark gray (10YR 4/1) mottling, silt (5-15%), moist, cohesive, medium plasticity, stiff to very stiff (1.0-3.5 tsf).	CL								
4 SS	24 / 23	1 2 4 4	6	6' dark yellowish brown (10YR 4/4), decreased mottling.									
5 SS	24 / 20	2 2 4 4	8	8' trace black (10YR 2/1) and dark gray (10YR 4/1) mottling.									
6 SS	24 / 20	2 4 6 7	10										
7 SS	24 / 20	3 4 5 8	12	12' yellowish brown (10YR 5/4), yellowish brown (10YR 5/8) mottling, trace coarse sand to fine gravel, no black mottling.									
8 SS	24 / 23	3 3 6 7	14	14' trace black (10YR 2/1) mottling.									

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

Signature [signature]

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-177

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
9 SS	24 23	2 4 4 5	16	4 - 19.3' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace black (10YR 2/1) and dark gray (10YR 4/1) mottling, silt (5-15%), moist, cohesive, medium plasticity, stiff to very stiff (1.0-3.5 tsf). *(continued)* 16' increased gravel content.	CL									
10 SS	24 24	1 2 3 2	18											
11 SS	24	2 2 3 4	20	19.3 - 22' **SILT:** ML, yellowish brown (10YR 5/4), brownish yellow (10YR 6/8) mottling, clay (5-15%), trace sand, cohesive, nonplastic, soft (0.5 tsf), wet. 20' increase in clay content with depth (30-50%), trace gravel.	ML									
12 SS	24 16	2 4 13 11	22	22 - 29.7' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), strong brown (7.5YR 5/6) mottling, silt (5-15%), trace sand and gravel, stiff to hard (1.5->4.5 tsf) increasing with depth, moist to wet.	CL									
13 SS	24 24	3 4 7 9	24	24' sand (5-15%), moist. 24.5' - 25.3' black sand (0-15%).										
14 SS	24 24	4 6 11 13	26	26' no mottling, decreasing sand and gravel content with depth to trace, dry to moist, moisture content increases with depth, cohesive, low to medium plasticity, plasticity decreasing with depth.										
15 SS	24 22	5 7 15 50 for 5"	28	28' clay becoming laminated with depth. 28.7' brownish yellow (10YR 6/6), yellowish brown (10YR 5/4) mottling.										
16 SS	9 6	11 50 for 3"	30	29.7 - 30' **WELL-GRADED SAND:** SW, trace gravel and silt (noncohesive, nonplastic, rock flour), wet.	SW									
17 SS	1 1	50 for 1"		30 - 30.7' **SILTY GRAVEL:** GM, gravel is broken pieces of bedrock, silt is laminated, cohesive, and nonplastic. 30.7' End of Boring.	GM									Hollow Stem Auger Refusal at 30.7 ft bgs.

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-178

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	8/4/2015	8/5/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-178	Feet (NAVD88)	428.45 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 554,089.94 N, 2,382,460.67 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 17.0736"
Long -89° 52' 4.3248"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 16	2 7 5 5	0–1	0 - 6.3' **SILT:** ML, brown (10YR 5/3), clay (10-20%), noncohesive, nonplastic, stiff to hard (1.5->4.5 tsf) decreasing with depth, dry. 1' - 1.3' cohesive, moist.										
2 SS	24 19	2 7 8 6	2	2' yellowish brown (10YR 5/4), clay (0-15%), brown and gray mottling (30-50%), dry to moist.	ML									
3 SS	24 18	2 4 6 8	4	4' dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/6) mottling, increasing clay content, moist.										
4 SS	24 23	2 3 4 5	6	6.3 - 20' **LEAN CLAY:** CL, dark gray (10YR 4/1), dark brown (10YR 3/3) mottling, silt (5-15%), moist, cohesive, medium plasticity.										
5 SS	24 23	1 3 3 4	8		CL									
6 SS	24 24	2 2 3 5	10–12	10' increased silt content.										

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

Signature [signature] | Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-178

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
7 SS	24 22	1 2 4 5	13	6.3 - 20' **LEAN CLAY:** CL, dark gray (10YR 4/1), dark brown (10YR 3/3) mottling, silt (5-15%), moist, cohesive, medium plasticity. *(continued)*									
8 SS	24 22	2 4 6 8	14, 15										
9 SS	24 22	3 4 6 7	16, 17	16' trace coarse sand.	CL								
10 SS	24 20	2 4 6 9	18, 19										
11 SS	24 24	2 4 7 6	20, 21	20 - 24.3' **LEAN CLAY:** to **SILT:** CL, dark gray (10YR 4/1), dark brown (10YR 3/3) mottling, clay (40-60%), silt (40-60%), trace coarse sand, cohesive, medium plasticity, moist.									
12 SS	24 24	1 2 5 4	22, 23	21.7' - 22' sand seam (mostly sand with silt). 23' interbedded sand (mostly fine to medium sand), silt and clay layers, wet.	CL								
13 SS	24 18	1 12 17 20	24, 25	24.3 - 26' **SANDY SILT:** s(ML), medium to coarse sand, moist, cohesive, nonplastic.	s(ML)								
14 SS	24 22	8 16 18 25	26, 27	26 - 26.3' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), mostly fine sand, trace medium sand and silt, wet. 26.3 - 43.5' **LEAN CLAY:** CL, fine to coarse sand (5-15%), trace gravel, yellowish brown (10YR 5/4), very stiff to hard (2.5->4.5 tsf), moist.	SP								
15 SS	24 22	7 8 9 11	28, 29	26.6' dark gray (10YR 4/1) mottling, silt (5-15%), increase in silt content with depth, trace very thin sand seams, trace black fine gravel, cohesive, nonplastic, dry. 28' - 28.6' wet in sand seams. 28.6' trace sand and silt, cohesive, medium to high plasticity, moist.	CL								
16 SS	24 19	4 7 9 13	30, 31, 32	30' trace fine gravel, no sand.									

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-178

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
17 SS	24 17	4 5 16 22	33	26.3 - 43.5' **LEAN CLAY:** CL, fine to coarse sand (5-15%), trace gravel, yellowish brown (10YR 5/4), very stiff to hard (2.5->4.5 tsf), moist. *(continued)* 32' increased mottling, trace fine gravel, no sand. 33' brown (10YR 4/3), no mottling, no gravel, trace silt, cohesive, very stiff, dry.										
18 SS	24 20	10 21 25 37	34, 35	34' brown (10YR 5/3), yellowish brown (10YR 5/6) mottling (5-15%).										
19 SS	24 22	12 20 24 24	36, 37	36' increase to yellowish brown (10YR 5/6) mottling (30-50%), trace coarse sand, becoming laminated with depth.										
20 SS	24	5 11 14 16	38, 39	38.3' silt seam (very soft, wet), trace sand.	CL									
21 SS	24 24	5 10 13 17	40, 41	39.6' dark gray grading to black with depth, trace olive yellow (2.5Y 6/6) mottling, silt (5-15%), dry to moist. 40' trace dark gray (10YR 4/1) and brownish yellow (10YR 6/8) mottling, no laminations, silt (5-15%), moist. 40.1' black seam (<0.25" thick).										
22 SS	17 17	7 16 50 for 5"	42, 43	42' silt (30-50%), moist to dry, cohesive, nonplastic to low plasticity. 42.2' - 42.5' mostly silt seams [brownish yellow (10YR 6/6), dry]. 43.4' becoming laminated with depth.										
23 SS	1 0	50 for 1"		43.5' End of Boring.										Hollow Stem Auger Refusal at 43.5 ft bgs.

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		PZ-182

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/29/2015	7/30/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-182	Feet (NAVD88)	428.47 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,433.70 N, 2,382,412.47 E E/W
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 40.2432"
Long -89° 52' 4.836"
Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 15	5 9 10 8	0–2	0 - 2' **SILTY CLAY** CL/ML, grayish brown (10YR 5/2), gravel (5-15%), cohesive, low to medium plasticity, dry. 0.9' - 2' yellowish brown (10YR 5/4), trace gray (10YR 6/1) mottling, silt (10-20%), medium to high plasticity.	CL/ML								
2 ST	24 23		2–4	2 - 4' Shelby Tube Sample.									ST2: 24" push at 550lbs.
3 SS	24 15.5	2 3 6 7	4–6	4 - 12' **SILTY CLAY** CL/ML, grayish brown (10YR 5/2), trace very dark brown (10YR 2/2) mottling, silt (5-15%) and gravel, trace sand, medium plasticity, medium to very stiff (0.75-2.75 tsf), moist.	CL/ML								
4 SS	24 20	3 4 5 6	6–8	6' - 7.7' low to medium plasticity. 7.2' increase in silt content (20-30%), increase in very fine sand content (5-15%).									
5 SS	24 23	1 3 3 4	8–10	9.3' sandy silt seams (sand is very fine).									
6 SS	24 20.5	1 3 4 4	10–12	9.9' sandy silt seams (sand is very fine). 10' - 12' medium plasticity.									
7 ST	24 21		12–14	12 - 14' Shelby Tube Sample.									ST7: 24" push.

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

Signature	Firm
[signature]	Natural Resource Technology 234 W. Florida St., Fifth Floor, Milwaukee, WI 53204 Tel: (414) 837-3607 Fax: (414) 837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-182

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
			14	12 - 14' Shelby Tube Sample. *(continued)*									
8 SS	24 21	3 4 5 7	14–16	14 - 22' **SILTY CLAY** CL/ML, grayish brown (10YR 5/2), trace very dark brown (10YR 2/2) mottling, silt (10-20%), gravel (5-15%), trace sand, low to medium plasticity, medium to very stiff (0.75-3.0 tsf), moist.	CL/ML								
9 SS	24 22	3 4 6 7	16–18	16' color grades to grayish brown (10YR 5/2), dark yellowish brown (10YR 4/4) mottling, medium plasticity. 16.3' - 17.4' very dark brown (10YR 2/2) mottling.									
10 SS	24 24	3 4 6 7	18–20	18.4' trace coarse sand and subangular fine gravel.									
11 SS	24 17	1 4 5 7	20–22	20' 0-10% sand. 21.1' pocket of weak red (10R 5/4), medium sand (1" diameter).									
12 ST	24 20		22–24	22 - 24' Shelby Tube Sample.									ST12: 24" push at 200lbs.
13 SS	24 20	1 1 4 5	24–26	24 - 27' **SILTY CLAY** CL/ML, brown (10YR 5/3), trace very dark brown (10YR 2/2) mottling, silt (20-30%), gravel (5-15%), very fine to fine sand (10-20%), cohesive, medium to high plasticity, medium (0.5-0.75 tsf), moist to wet. 24.5' - 25.6' yellowish brown (10YR 5/6), grayish brown (10YR 5/2) mottling, trace subrounded gravel. 25.4' black (10YR 2/1) gravel (shale, 1" diameter), sand content increasing with depth.	CL/ML								
14 SS	24 24	6 10 11 12	26–28	26' decrease in very fine sand content 5-15%, medium plasticity, wet. 26.6' seam of coarse sand and fine gravel. 26.7' very stiff (3.0 tsf).									
15 SS	24 18	WOR 2 6 9	28–30	27 - 29.1' **WELL-GRADED SAND:** SW, yellowish brown (10YR 5/6), trace silt, clay, and fine gravel, wet. 28' - 28.1' increase in very fine sand content. 29.1 - 30' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g, yellowish brown (10YR 5/6), well-graded sand (10-20%), subangular fine gravel (5-15%), trace silt, wet.	SW s(CL)g								WOR = Weight of Rods.
16 SS	24 16	6 12 15 19	30–32	30 - 34' **SILTY CLAY** CL/ML, brown (10YR 5/3), very dark brown (10YR 2/2) mottling, silt (20-30%), gravel (5-15%), very fine to fine sand (10-20%), cohesive, low to medium plasticity, stiff to very stiff (1.25-4.0 tsf), moist to wet. 30.8' - 31.1' layer of coarse sand and subangular fine gravel, clay (50%).	CL/ML								
17 SS	24 10	16 15 19 26	32–34	32' - 34' silt (10-20%), subangular gravel (5-10%), very fine sand (5-10%), sand and gravel content decreasing with depth, medium to low plasticity. 32.7' - 32.9' very dark gray (2.5Y 3/1), trace silt, high plasticity, dry.									
			34	34' End of Boring.									

KELRON ENVIRONMENTAL
Incorporated

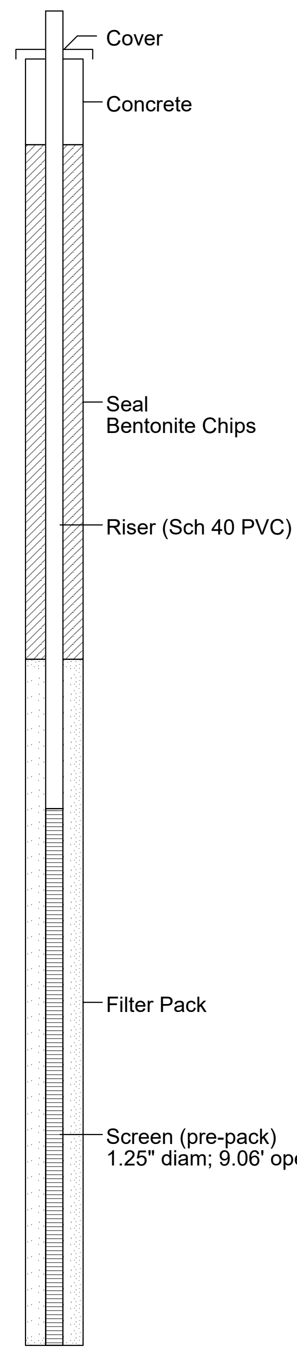
LOG OF PROBEHOLE TPZ-158

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/27/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 453.26
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 456.26
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2387752, 556741

Depth in Feet	DESCRIPTION	Surf. Elev. 453.26	Samples	Recovery inches	Qp TSF	USCS
0	Silty Loam with roots, stiff, non-plastic, pale brown (10YR 6/3), dry		1	60/60	2	CL
	- dark brown (10YR 3/3)		2		2.75	
	Silty CLAY, very stiff, low plasticity, gray (10YR 5/1) with yellowish-brown mottling, moist		3		3.75	CL
		450	4		3.5	
	- 25-50% mottling w/ black oxidation staining		5		4.5	
5	- high plasticity, <25% mottling		6	60/60	2.5	
			7		2.5	
			8		1.25	
		445	9		1.25	
			10		1.75	
10			11	60/60	1.75	
			12		3.5	
	- trace fine-medium sand, brownish yellow mottling (10YR 6/8)					
	- trace fine-coarse sand and fine gravel (angular to sub-angular)		13		2.25	
	- few to little sand and gravel, very stiff, 50-75% mottling	440	14		2.75	
			15		2.5	
15	- high plasticity					

Well: TPZ-158
Elev.: 456.26



KELRON ENVIRONMENTAL
Incorporated

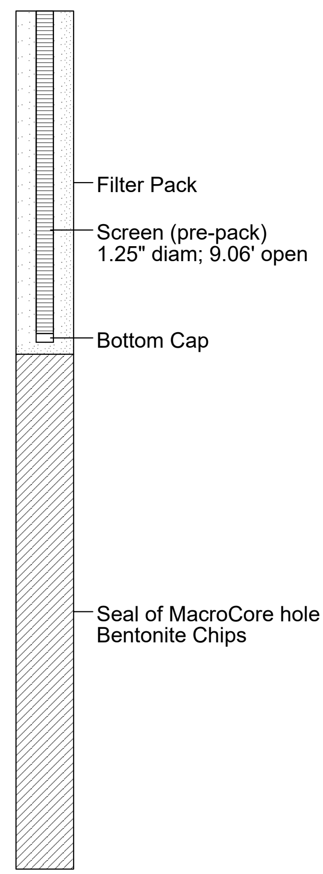
LOG OF PROBEHOLE TPZ-158

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/27/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 453.26
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 456.26
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2387752, 556741

Depth in Feet	DESCRIPTION	Surf. Elev. 453.26	Samples	Recovery inches	Qp TSF	USCS
15	- high plasticity					
			16	60/60	1.0	CL
	- trace fine to medium sand, soft, light gray (10YR 6/1) with 50-75% brownish-yellow mottling		17		0.75	CL
	Sandy CLAY (fine to medium sand) with trace fine-coarse gravel (<1"), very soft		18		- -	CL
	SAND, fine to coarse, well graded, brownish-yellow (10YR 6/8), wet	435				SW
	Sandy CLAY (fine-coarse sand) with gravel, hard, non-plastic, moist		19		>4.5	CL
	Silty CLAY with trace sand and gravel, hard, medium to high plasticity, very pale brown (10YR 7/3)		20		>4.5	CL
20	- very soft, high plasticity		21	60/60	<0.5	CL
	SAND, fine to coarse, well graded, yellowish-brown (10YR 5/8), wet		22		- -	SW
			23		- -	SW
		430	24		- -	SW
	Silty CLAY with trace fine to coarse sand, hard, brownish-yellow (10YR 6/6), moist		25		4.0	CL
25	SHALE, weathered, gray (10YR 6/1), dry at 24.75' - platy/laminated, dark gray (10YR 4/1), at 24.9' - top of bedrock = 24.75' bls					SH
	END BOREHOLE AT 25 FEET BLS					
		425				
30						

Well: TPZ-158
Elev.: 456.26



KELRON ENVIRONMENTAL
Incorporated

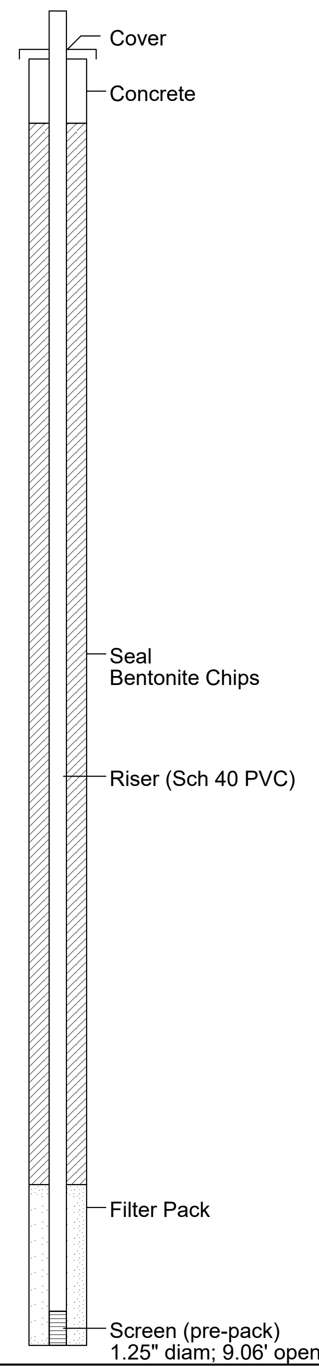
LOG OF PROBEHOLE TPZ-159

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/23/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 444.69
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 447.64
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383974, 558081

Depth in Feet	DESCRIPTION	Surf. Elev. 444.69	Samples	Recovery inches	Qp TSF	USCS
0	FILL - Bottom Ash with some clay and silt, soft, loose, dry					AR
	FILL - Silty CLAY with some bottom ash, sand, and gravel, hard, low-medium plasticity, yellowish brown (10YR 5/4) with variable brown to gray mottling		1	49/60	- -	FL/CL
5		440	2	7/42	- -	
			3	8/18	3.0	
10	- few bottom ash, very stiff, high plasticity, moist	435				
			4	0/60	- -	
15	Silty CLAY, trace fine-coarse sand, stiff, med plasticity, light yellowish brown (10YR 6/4), moist	430	5	60/60	2.5	CL
			6		3.25	
			7		1.75	
	- high plasticity, gray (10YR 5/1) with <10% yellowish-brown mottling		8		2.0	
20		425	9		3.0	

Well: TPZ-159
Elev.: 447.64



KELRON ENVIRONMENTAL
Incorporated

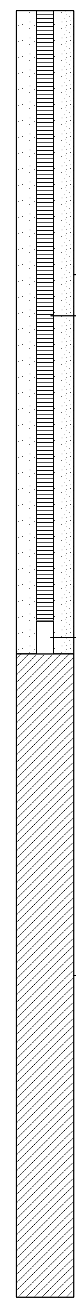
LOG OF PROBEHOLE TPZ-159

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/23/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 444.69
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 447.64
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383974, 558081

Depth in Feet	DESCRIPTION	Surf. Elev. 444.69	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
20	Silty CLAY, trace fine-coarse sand, stiff, med plasticity, light yellowish brown (10YR 6/4), moist		10	16/60	- -	CL	
	- soft to medium hardness, yellowish-brown mottling with black manganese staining	420					
25			11	32/60	1.5		
			12		- -		
	- high plasticity, brown (10YR 5/3)		13		1.25		
			14		1.25		
	- trace fine-medium sand, very stiff, gray (10YR 6/1) with 10-25% yellowish-brown mottling (10YR 5/6)	415	15		2.75		
30			16	49/60	- -		
	- no sand, brown		17		1.5		
			18		1.0		
	- trace sand, gray (10YR 6/1) with 10-25% yellowish-brown mottling		19		2.0		
	- trace fine-coarse sand and gravel (sub-angular to sub-rounded)	410	20		2.0		
35	- stiff, medium plasticity, pale brown (10YR 6/3) with <10% gray mottling		21	60/60	2.5		
			22		2.0		
			23		1.0		
			24		0.5		
	- few fine-coarse sand and fine gravel, very stiff, yellowish brown (10YR 5/8)		25		3.0		
40	- hard, non-plastic, dry	405					

Well: TPZ-159
Elev.: 447.64



KELRON ENVIRONMENTAL
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LOG OF PROBEHOLE TPZ-159

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/23/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 444.69
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 447.64
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383974, 558081

Well: TPZ-159
Elev.: 447.64

Depth in Feet	DESCRIPTION	Surf. Elev. 444.69	Samples	Recovery inches	Qp TSF	USCS
40	- trace sand and gravel, very stiff, high plasticity, brown (10YR 5/3) to pale brown (10YR 6/3)		26	50/60	2.75	CL
			27		- -	
			28		<0.5	
	SAND, fine to coarse, well graded, greenish gray (Gley1 10Y 5/1), wet (2.4 inch seam)	400	29		>4.5	SW
45	Silty CLAY, trace sand, hard grading to very stiff, low plasticity grading to high plasticity, dark gray (Gley1 4/N), moist [TILL]		30	5/60	- -	CL
		395	31		3.25	
50	END BOREHOLE AT 50 FEET BLS					
55		390				
60		385				

Seal of MacroCore hole
Bentonite Chips

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KELRON ENVIRONMENTAL
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LOG OF PROBEHOLE TPZ-160

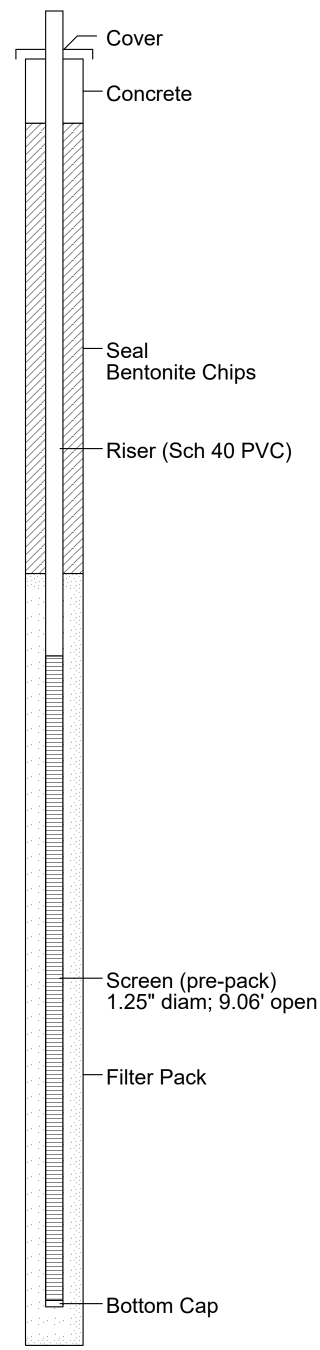
Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/21/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 428.59
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.49
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2380230, 558046

Depth in Feet	DESCRIPTION	Surf. Elev. 428.59	USCS
0	Silty CLAY with grass / roots, hard, non-plastic, pale brown (10YR 6/3), dry - gray (10YR 6/1) with reddish-brown mottling and black oxidation staining - very stiff, low plasticity, brown (10YR 4/3), moist - high plasticity, grayish brown (10YR 5/2) with 10-25% reddish-brown mottling'	425	CL
5	- gray (10YR 6/1), <10% mottling - 10-25% mottling, black organics	420	CL
10	Sandy SILT, fine sand, very soft, non-plastic, light brownish gray (10YR 6/2), wet Clayey SILT, trace fine sand, very soft, medium plasticity, gray (10YR 6/1)	415	ML
	Silty CLAY, medium to high plasticity, gray with trace reddish-brown mottling, moist - 1-inch weathered zone with 75% yellowish-brown (10YR 5/8) mottling @ 14.5'		CL
15	SILT, gray (10YR 7/1), wet @ 14.9'	410	ML
	CLAY, medium hardness,brown (10YR 5/3), moist - greenish gray (Gley1 10GY 5/1)		CL
20			

Samples	Recovery inches	Qp TSF
1	58/60	4.5
2		3.25
3		3.0
4		3.0
5		2.25
6	58/60	1.5
7		1.0
8		1.0
9		1.0
10		1.0
11	41/60	- -
12		<0.5
13		<0.5
14		<0.5
15		1.25
16	16/60	- -
17		1.25
18		1.5

Well: TPZ-160
Elev.: 431.49



KELRON ENVIRONMENTAL
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LOG OF PROBEHOLE TPZ-160

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/21/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 428.59
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.49
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2380230, 558046

Well: TPZ-160
Elev.: 431.49

Depth in Feet	DESCRIPTION	Surf. Elev. 428.59	Samples	Recovery inches	Qp TSF	USCS
20			19	24/60	- -	
	- gray (10YR 6/1)					
	- very soft, brown (10YR 5/3)	405	20		<0.5	
	- soft, greenish gray		21		1.25	
25						CL
			22	27/60	- -	
			23		0.75	
		400	24		1.0	
			25		1.5	
			26		2.5	
30	Silty CLAY with fine-coarse sand and fine gravel (sub-angular to sub-rounded), very stiff, greenish gray with reddish-brown mottling [TILL]					
			27	27/60	- -	
						CL
	- very soft, high plasticity, yellowish-brown (10YR 5/4)		28		0.5	
	- medium plasticity, greenish gray with 50-75% yellowish-brown mottling, moist	395	29		0.5	
			30		1.5	
35	Sandy CLAY, stiff, dark yellowish-brown (10YR 4/4) with <25% greenish-gray mottling, dry					CL
	END BOREHOLE AT 35 FEET BLS					
		390				
40						

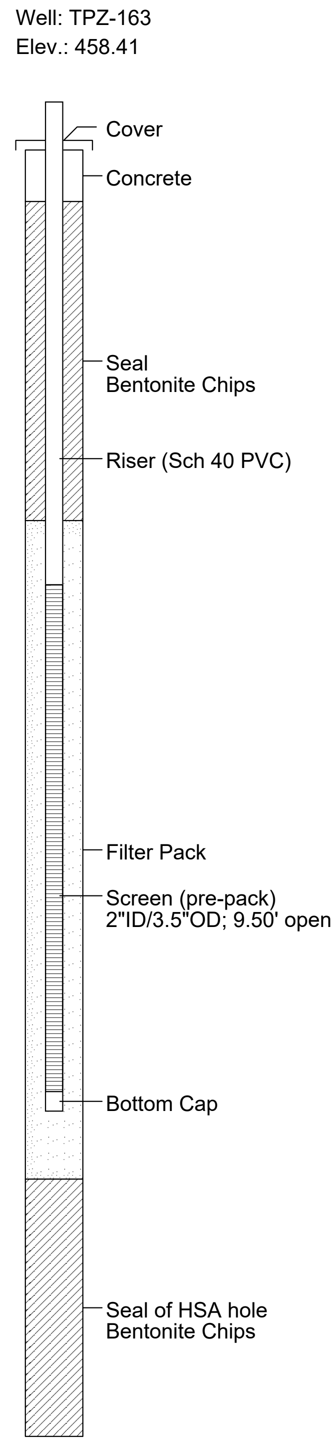
Seal of MacroCore Hole Bentonite Chips

KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE TPZ-163 (Page 1 of 2)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/27/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 455.51
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 458.41
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2385507, 555798

Depth in Feet	DESCRIPTION	Surf. Elev. 455.51	Samples	Blow Count	Recovery inches	Qp TSF	USCS
0	FILL - Silty clay loam with roots, loose, pale brown (10YR 6/3), dry (13" thick soil cover)						FL/CL
	FILL - Fly Ash, silty, loose very dark gray (10YR 3/1)						AR
	<Shelby Tube Sample ST163-3 @1.5-3.5'> grain size analysis (Ash - very dark brown): 51% Sand, 45.8% Silt, 3.2% Clay		1		9/24	- -	
5		450					
	- very soft, wet		2	1 0 1	18/18	<0.5	
10		445					
			3	1 0 1	18/18	<0.5	
15		440					
	Silty CLAY (lean to fat), trace fine sand, stiff, medium to high plasticity, gray (10YR 6/1) with 10-25% yellowish-brown mottling (10YR 6/8), moist		4	1 3 5	17/18	2.75	CL/CH
20		435					
	- very stiff		5	2 2 4	18/18	2.25	
25		430					



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KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE TPZ-163 (Page 2 of 2)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/27/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 455.51
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 458.41
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2385507, 555798

Well: TPZ-163
Elev.: 458.41

Depth in Feet	DESCRIPTION	Surf. Elev. 455.51	Samples	Blow Count	Recovery inches	Qp TSF	USCS
25							
28-30	- dark yellowish brown <Shelby Tube Sample ST163-30 @ 28-30'> grain size analysis: 10.6% Sand, 51.2% Silt, 38.2% Clay		6		24/24	- -	CL/CH
30		425					
33.5	Silty CLAY with trace fine-coarse sand and fine gravel, stiff to very stiff, high plasticity, brownish-yellow (10YR 6/6), moist [TILL]		7	2 2 5	18/18	2.5	CL
35		420					
	- medium plasticity, pale brown (10YR 6/3)		8	5 5 7	18/18	3.5	
	- brownish-yellow (10YR 6/6) with 10-25% light gray mottling (10YR 6/1)						
40		415					
43.5	SHALE, platy/laminated with weathered clay layers; hard, gray (10YR 5/1) with 25-50% olive yellow clayey layers (2.5Y 6/6) (top of bedrock = 43.5' bls)		9	5 7 8	18/18	>4.5	SH
45	END BOREHOLE AT 45 FEET BLS	410					
50		405					

Seal of HSA hole
Bentonite Chips

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KELRON ENVIRONMENTAL
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LOG OF PROBEHOLE TPZ-164

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/26/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 432.50
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 435.10
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383909, 556829

Depth in Feet	DESCRIPTION	Surf. Elev. 432.50	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC
0	FILL - Bottom Ash, coarse, black (10YR 2/1), dry							
2.5		430						
3	- moist <Shelby Tube Sample ST164-5 @ 3-5'> grain size analysis (Ash): 50% Sand, 42.9% Silt, 7.1% Clay	429						
4			1		17/24			
4.5	- wet	428					AR	
5.5		427						
6.5		426						
7.5		425						
8.5		424		3				
8.7	CLAY (lean), stiff, medium to high plasticity, dark gray (10YR 4/1), moist - @8.9' - light yellowish brown (10YR 6/4) with <10% light gray mottling - @9.3' - gray (10YR 6/1) with 25-50% brownish-yellow mottling (10YR 6/6)		2	3	18/18			
9.5		423		5			CL	
10.3	- light olive brown <Shelby Tube Sample ST164-12 @ 10-12'> grain size analysis: 7.2% Sand, 62.2% Silt, 30.6% Clay	422						
11			3		23/24		CL	
11.5	END BOREHOLE AT 10.3 FEET BLS END Split-Spoon Sampling at 12 feet BLS	421						
12								

Well: TPZ-164
Elev.: 435.10

- Cover
- Concrete
- Seal Bentonite Chips
- Riser (Sch 40 PVC)
- Filter Pack
- Screen (pre-pack) 2"ID/3.5"OD; 4.50' open
- Bottom Cap
- Seal Bentonite Chips

420

419

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LOG OF PROBEHOLE TPZ-165

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

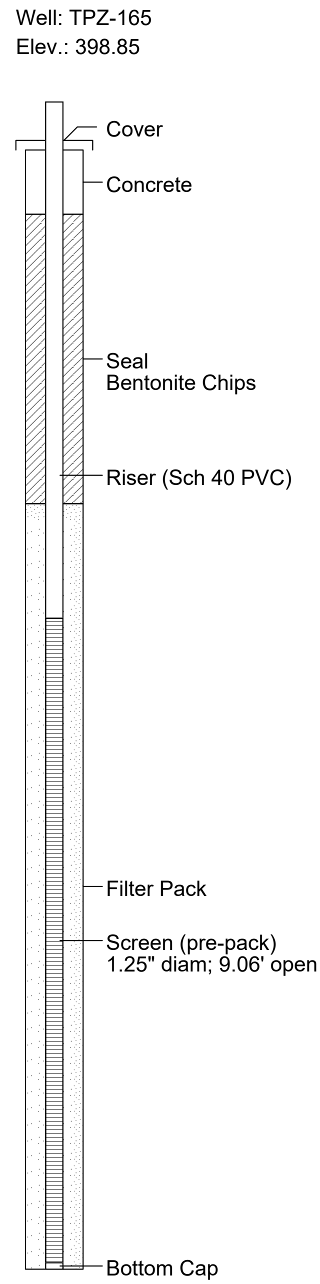
Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 396.10
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 398.85
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2380478, 555940

Depth in Feet: 0, 5, 10, 15, 20
Surf. Elev. 396.10: 395, 390, 385, 380

DESCRIPTION	USCS
FILL - Fly Ash, silty, stiff, non-plastic to low plasticity, very dark grayish-brown (10YR 3/2), moist	AR
FILL - Silty Clay with Fly Ash, very soft, dark gray (10YR 4/1)	FL/CL
Silty CLAY (lean) with organics and roots, soft, high plasticity, dark gray - gray (10YR 5/1) - trace sand, very dark gray brown <Shelby Tube Sample ST165-10 @ 8-10'> grain size analysis: 11.2% Sand, 59.2% Silt, 29.6% Clay	CL
Silty CLAY (lean) with trace fine-coarse sand and fine gravel, very soft, medium to high plasticity, dark gray (10YR 4/1), moist [TILL]	CL
LIMESTONE, hard, light gray, hammer refusal at 16.5', auger refusal at 17.4' bls (top of bedrock)	LS

END BOREHOLE AT 17.4 FEET BLS

Samples	Recovery inches	Qp TSF
1	41/60	1.75
2		0.75
3		- -
4		- -
5		- -
6	60/60	1.5
7		2.0
8		2.75
9		2.5
10		1.25
11	49/60	2.0
12		0.5
13		0.5
14		1.0
15		0.5
16	18/18	0.5
17		- -



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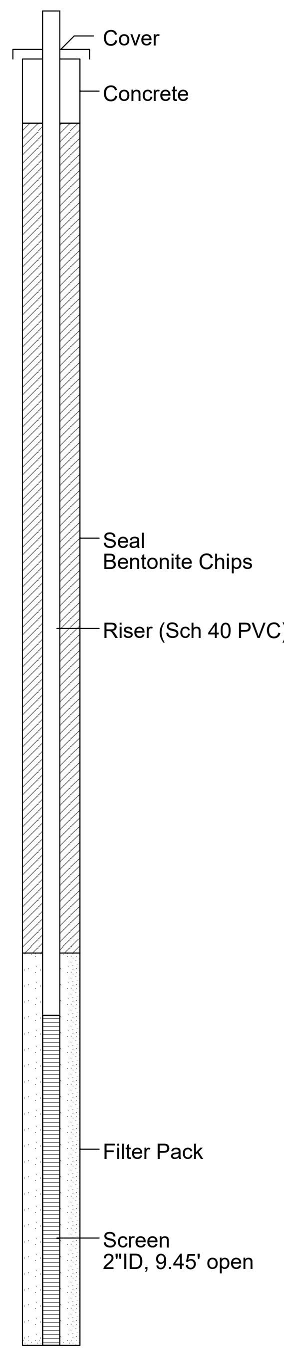
LOG OF PROBEHOLE TPZ-166

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/16/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 422.33
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 425.18
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381183, 555587

Depth in Feet	DESCRIPTION	Surf. Elev. 422.33	Samples	Recovery inches	Qp TSF	USCS
0	FILL - Silty CLAY, trace roots, very stiff, non-plastic, light brown gray (10YR 6/2), dry		1	60/60	2.75	FL/CL
	- medium plasticity, pale brown (10YR 6/3) w/ trace manganese and iron oxide staining		2		2.75	
	- very stiff, yellowish brown (10YR 5/4) with 25% reddish-brown mottling	420	3		3.75	
	- very stiff, low plasticity		4		1.5	
			5		2.75	
5	- gray mottling - 1-inch silt lense with high organics, trace roots		6	60/60	1.5	
	Silty CLAY, very stiff, medium plasticity, gray (10YR 6/1) with reddish-brown mottling and manganese staining		7		2.75	CL
	- medium to stiff, high plasticity, 25-50% manganese staining	415	8		1.75	
	- no manganese staining		9		2.5	
			10		2.5	
10			11	60/60	1.5	
			12		1.5	
	- stiff, medium plasticity, yellowish brown (10YR 5/4) with 10-25% reddish-brown mottling, moist	410	13		2.25	
			14		2.0	
			15		2.5	
15	- very soft, high plasticity		16	60/60	1.0	
	- very stiff, medium plasticity		17		3.0	
		405	18		3.0	
	Silty CLAY with trace fine-coarse sand and fine gravel, very stiff, medium plasticity, yellowish brown (10YR 5/4) with <10% reddish-brown mottling, moist [TILL]		19		3.5	CL
	- hard, gray (10YR 6/1) with 10-25% reddish-brown mottling		20		3.25	
20						

Well: TPZ-166
Elev.: 425.18



KELRON ENVIRONMENTAL
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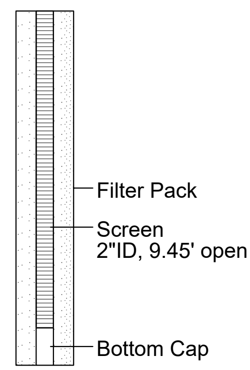
LOG OF PROBEHOLE TPZ-166

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/16/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 422.33
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 425.18
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381183, 555587

Depth in Feet	DESCRIPTION	Surf. Elev. 422.33	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
20			21	24/24	>4.5	CL	
	END BOREHOLE TPZ-166 AT 22' BLS.		22		>4.5		
	CONTINUE LOG USING URS BORINGS B-13-4 and B-13-5 FROM 08/01/2013	400					
25							
		395				CL	
30							
		390					
	SHALE, calcareous, fine grained, highly weathered, very weak, brown-gray to gray (top of bedrock = 32.53' bls; elevation = 389.8 ft NAVD88)						
35						SH	
		385					
	END URS LOGS AT 38 FEET BLS						
40							

Well: TPZ-166
Elev.: 425.18



KELRON ENVIRONMENTAL
Incorporated

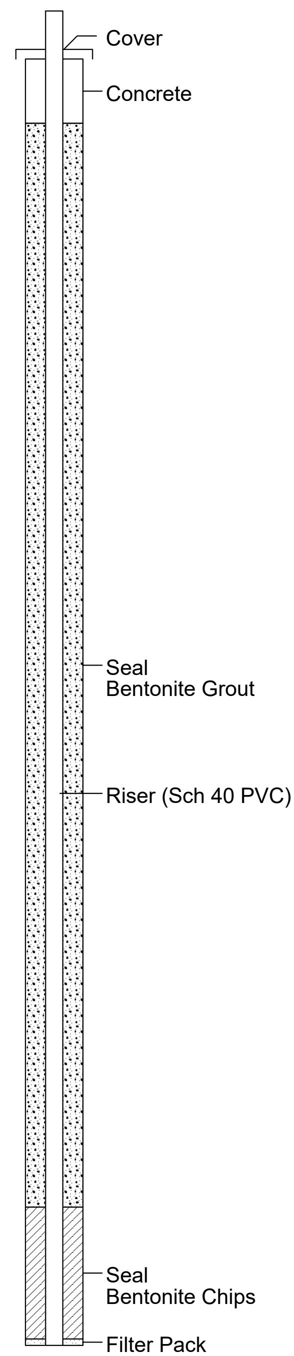
LOG OF PROBEHOLE TPZ-167

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/14/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 438.63
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 441.38
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381925, 554963

Depth in Feet	DESCRIPTION	Surf. Elev. 438.63	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC
0	FILL - Fly Ash, silty to clayey with coarse sand grain size, soft, medium to high plasticity, dark gray (Gley 1 4/N), moist							
		435						
	- very soft, non-plastic, wet		1		18/18			
5								
	- dark greenish gray (10Y 4/1)	430		2				
			2	2	18/18			
				1				
10							AR	
	- silty with sand grain size, very dark greenish gray (10Y 3/1)	425		0				
			3	0	18/18			
				1				
15								
		420						
20								

Well: TPZ-167
Elev.: 441.38



KELRON ENVIRONMENTAL Incorporated

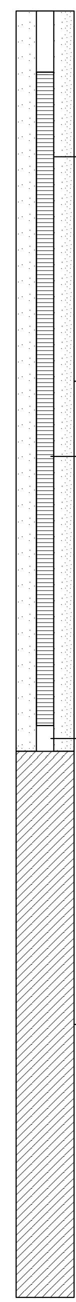
LOG OF PROBEHOLE TPZ-167

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/14/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 438.63
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 441.38
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381925, 554963

Depth in Feet	DESCRIPTION	Surf. Elev. 438.63	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC
20								
	- dark greenish gray	415	4	0 0 1	18/18		AR	
25								
	- very dark gray brown <Sample SS167-30 @ 29-30'> grain size analysis (Ash): 1.5% Sand, 77.6% Silt, 20.8% Clay	410	5	0 0 0	18/18			
30								
	Silty CLAY (lean) with sand and trace fine gravel (chert, angular to sub-angular), very stiff, medium to high plasticity, light gray (10Y 7/N) with 15-50% reddish brown mottling, dry [TILL] <Shelby Tube Sample ST167-34 @ 32-34'> grain size analysis: 15.7% Sand, 52.6% Silt, 31.7% Clay	405	6		20/24		CL	
35								
		400	7	3 4 6	16/18	3.5		
40								

Well: TPZ-167
Elev.: 441.38



KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-167

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/14/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 438.63
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 441.38
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381925, 554963

Depth in Feet	DESCRIPTION	Surf. Elev. 438.63	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC
40							CL	
	- soft, brownish-yellow (10YR 6/6), moist	395	8	2 2 2	18/18	>4.5		
45	- laminated, hard, non-plastic, black (3/4" thick organic-rich layer)						CL	
	CLAY (lean to fat) with sand, stiff to very stiff, medium to high plasticity, greenish gray (10YR 6/1), dry						CL/CH	
	- with sand and fine gravel (angular)		9	5 5 50	18/18	4.0		
		390	10	50	3/3			
	SHALE, weathered; clay (laminated) with platy and micaceous layer and limestone parting, dark gray (Gley1 4/N), dry (top of bedrock = 48.75' bls)		11	53	5/5		SH	
50	END BOREHOLE (Auger Refusal) at 48.75 feet BLS END Split-Spoon Sampling at 49.15 feet BLS							
		385						
55								
		380						
60								

Well: TPZ-167
Elev.: 441.38

Seal of HSA hole
Bentonite Chips

KELRON ENVIRONMENTAL
Incorporated

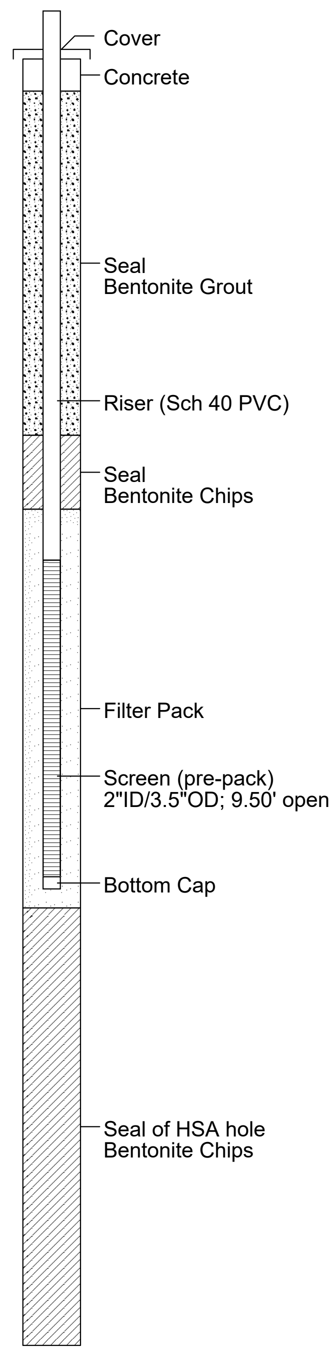
LOG OF PROBEHOLE TPZ-168

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/15/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 454.93
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 457.53
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383585, 554314

Depth in Feet	DESCRIPTION	Surf. Elev. 454.93	Samples	Blow Count	Recovery inches	Qp TSF	USCS
0	FILL - Fly Ash, silt size, greenish gray (10Y 5/1), moist						
	<Shelby Tube Sample ST168-5 @ 3-5'> grain size analysis: 29.4% Sand, 50.2% Silt, 20.4% Clay		1		21/24		
5		450					
	- wet		2	3 2 3	18/18		
10		445					
	- silty with coarse sand grain size, greenish black (10Y 2.5/1)		3	1 1 1	16/18		AR
15		440					
			4		0/24		
20		435					
			5		3/18		
25		430					
	Silty CLAY, medium to stiff, high plasticity, light gray (10YR 7/1) with 10-50% reddish-brown mottling		6	3 3 5	18/18	2.0	
30		425					
							CL
35		420					
			7	2 4 5	18/18	3.5	CL
40		415					

Well: TPZ-168
Elev.: 457.53



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KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE TPZ-168 (Page 2 of 2)

Phase II Hydrogeologic Investigation Baldwin Energy Complex Dynegy Midwest Generation, Inc.	Date Completed : 08/15/2013 Hole Diameter : 8 1/2" OD / 4 1/4" ID Drilling Method : HSA (CME-55LC) Sampling Method : Split Spoon / Shelby Tube Drilling Company : Bulldog Drilling, LLC	Driller : John Gates Geologist : Stuart Cravens (Kelron) Ground Elevation : 454.93 Casing (MP) Elevation : 457.53 X,Y Coordinates : 2383585, 554314

Well: TPZ-168
Elev.: 457.53

Depth in Feet	DESCRIPTION	Surf. Elev. 454.93	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC	Well
40	Silty CLAY, trace sand and fine gravel (angular to sub-angular), stiff to very stiff, 10-25% reddish-brown mottling, moist [TILL]								
45		410							
	- light yellowish-brown (10YR 6/4) with <10% light gray mottling		8	3 7 10	18/18	3.5			
50	Clay, black (1/2" thick organic-rich layer) surrounded by highly weathered zone with >75% reddish-brown mottling	405							
55		400					CL		Seal of HSA hole Bentonite Chips
	- medium to stiff, high plasticity, yellowish brown (10YR 5/4)		9	3 4 8	18/18	2.0			
60	- with 25-50% light gray mottling	395							
65		390							
	- with sand seams, very stiff, medium plasticity, dark gray (10YR 4/1)		10	10 16 18	18/18	>4.5			
70	SHALE, laminated, hard, dark gray (top of bedrock = 69.6' bls)	385					SH		
	END BOREHOLE AT 70 FEET BLS								
75		380							
80		375							

LOG of BORING No. SP-1

STARTED: 10/14/13
COMPLETED: 10/14/13
LOCATION: Baldwin Energy Complex
SURFACE EL., FT: 398.7
EL. DATUM: NAVD88
NORTHING: 555090.26
EASTING: 2379599.21
N, E DATUM: NAD83

DEPTH, ft.	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
0			CRUSHED LIMESTONE ROCK FILL									HSA (4.75" ID)
	7 7 6	22	Stiff, moist, brown with yellowish brown, Silty Fat CLAY (CH), trace fine to medium sand. [FILL]	397.7 / 1.0					4.5			
	5 6 5	0										3.5': Low recovery due to rock fill.
5												
	4 4 4	0	Becomes medium stiff, brown with gray.		23 21	119	51	36	3.5			6.0': After two consecutive samples with no recovery, driller pushed Shelby Tube to collect sample and knock obstruction away. Rec=14.5 inches, tube bent. 6.7': Fines content (%) = 85 8.5': No recovery due to gravel.
			7.5': Gray sandy clay pocket.									
	4 4 5	0	Becomes stiff.									
10												
	2 4 7	72	Becomes stiff, brown to gray, trace fine sand, trace roots.						2.1 3.6			
15												
			Medium stiff, moist, Clayey SILT (ML), trace fine sand, trace wood. [ALLUVIAL]	381.7 / 17.0								
	2 3 4	100	▼		25		41	26	1.5			18.5': Fines content (%) = 84
			Medium stiff, moist, pinkish brown with gray, medium plastic CLAY (CL), trace fine sand, oxidation-stained nodules. [ALLUVIAL]	379.7 / 19.0	22				2.8 1.8			
20												
	5 40 37	78	Becomes gray.	374.7 / 24.0					3.4 4.5			

Completion Depth: 30.0 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling
Drilling Equipment: CME 55 LC
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: John Gates
Water Depth: Dry ft., After ATD hrs.; 18.7 ft., After 2 hrs.; ft., After hrs.
Logged by: Stefanie Voss

LOG of BORING No. SP-1

STARTED	10/14/13	NORTHING	555090.26
COMPLETED	10/14/13	EASTING	2379599.21
LOCATION	Baldwin Energy Complex	SURFACE EL., FT	398.7
EL. DATUM	NAVD88	N, E DATUM	NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
25				Hard, moist, orangish brown, Lean CLAY (CL), with fine to coarse sand, trace coarse gravel. [TILL]										26.0': Driller indicated harder drilling. Increased down pressure to 600-700 psi.
		26 31 50/5"	100	SHALE: Gray, calcareous, very fine grained, medium hard, moderately weathered, with limestone interbedded.	370.2 28.5									
30				Bottom of boring at 30'	368.7 30.0									30.0': Auger refusal.
35														
40														
45														

Completion Depth: 30.0 feet	Drilling Equipment: CME 55 LC	Water Depth:	Dry ft., After ATD hrs.
Project No.: 21562902	Drilling Method: HSA		18.7 ft., After 2 hrs.
Project Name: Dynergy-Baldwin	Hammer Type: Automatic		ft., After hrs.
Drilling Contractor: Bulldog Drilling	Driller's Name: John Gates	Logged by:	Stefanie Voss

LOG of BORING No. SP-1A

STARTED 10/14/13
COMPLETED 10/14/13
LOCATION Baldwin Energy Complex SURFACE EL., FT 399.0 EL. DATUM NAVD88
NORTHING 555083.68
EASTING 2379603.25
N, E DATUM NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
0				CRUSHED LIMESTONE ROCK FILL	398.0 / 1.0									HSA (4.75" ID)
		6 5 6	33	Stiff, moist, brown, Silty CLAY (CL), trace fine sand, trace fine gravel. [FILL]							4.5			Due to minimal recovery in SP-1, an offset boring was drilled.
		5 5 7	0											3.5': Low recovery due to rock fill.
5														
		4 3 4	0	Medium stiff.										6.0': No recovery due to rock fill.
			64	Becomes stiff to very stiff, brown with gray, trace roots.			15 24 21	116	45	28	3.9			Down pressure = 600 psi Tube bottom bent. 9.5': Fines content (%) = 97
10				Bottom of boring at 10.5'	388.5 / 10.5									
15														
20														

Completion Depth: 10.5 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling
Drilling Equipment: CME 55 LC
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: John Gates
Water Depth: Dry ft., After ATD hrs.
ft., After hrs.
ft., After hrs.
Logged by: Stefanie Voss

LOG of BORING No. SP-2

STARTED: 10/14/13
COMPLETED: 10/14/13
LOCATION: Baldwin Energy Complex
SURFACE EL., FT: 399.1
EL. DATUM: NAVD88
NORTHING: 554922.24
EASTING: 2379747.42
N, E DATUM: NAD83

DEPTH, ft.	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
0			Stiff, moist, blackish brown, Silty CLAY (CL), with roots, trace fine sand. [TOPSOIL]									HSA (4.75" ID)
	2 4 7	89	Stiff, moist, orangish brown, Lean CLAY (CL), with fine sand, oxidation staining. [FILL]	397.9 / 1.2					4.5			
	3 4 4	0	3.5': Becomes medium stiff.									
5												5.0': Rock in shoe.
	2 3 6	67	Stiff, moist, orangish brown to gray, Silty CLAY (CL), trace fine sand, oxidation staining. [FILL] 6.8': Black oxidation staining along vertical.	393.1 / 6.0	21				3.3 2.5 2.6			6.0': Fines content (%) = 74
	2 3 3	67	8.5': Becomes medium stiff. 9.0': Trace tannish brown and gray.						4.25 2.1			
10												
			Medium stiff, moist, orangish brown, Silty CLAY (CL), trace fine sand, trace black oxidation staining. [ALLUVIAL]	387.6 / 11.5								
	2 2 5	72			25		37	19	1.8 2.3			
15												
	2 4 7	83	Stiff, moist, gray, Lean CLAY (CL), with fine to coarse sand, trace fine gravel, trace oxidation staining, trace roots. [TILL]	380.6 / 18.5	18				2.1 2.8 2.6			18.5': Fines content (%) = 72
20			20.0': Whitish gray clay with coarse sand and									
	50/1"	100	gravel fragments in shoe.	378.5 / 20.6								20.5': Auger refusal. 20.6': Spoon refusal on rock.
			Bottom of boring at 20.6'									

Completion Depth: 20.6 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling
Drilling Equipment: CME 55 LC
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: John Gates
Water Depth: Dry ft., After ATD hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.
Logged by: Stefanie Voss

LOG of BORING No. B-13-1

STARTED 7/29/13
COMPLETED 7/29/13
LOCATION Baldwin Energy Complex
SURFACE EL., FT 399.3
EL. DATUM NAVD88
NORTHING 554854.10
EASTING 2379264.64
N, E DATUM NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
0				Stiff, moist, tanish brown, silty CLAY (CL), trace roots, trace fine sand, fine gravel, oxidation staining. [FILL]										
		5 7 7	61								3.7 4.5			HSA (3.75" ID) 1.5' : Fines content (%) =96
		5 6 6	17	Trace coarse gravel.			13							3.5' : Fines content (%) = 95 3.5': Gravel in tube, possible slough
5														
		P	83	No gravel.			21	129	37	17	2.5		1.90	6' : Fines content (%) = 91
		1 2 4	78	Medium stiff, moist, light brown to brown, silty CLAY (CL), little sand. [LOESS]	390.8 / 8.5		21				0.75 2.75 1.25			9' :TV=3.75 tsf
10														
		2 4 5	89	Stiff, moist, light brown to brown, lean CLAY (CL), some fine sand. [LOESS]	385.8 / 13.5		20				1.6 2.75			
15							14							
		4 5 7	83	Becomes yellowish brown with trace gray mottling, black oxidation staining.			20				3.5 2.5			
20														
		P	100	Becomes very stiff, brown with gray mottling, medium plasticity.			19	128	45	32	4.0 4.5			23' :UC= 2.05 ksf
														24.5' :TV=3.0 tsf

Completion Depth: 32.5 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling
Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Joe Brown
Water Depth: 29.0 ft., After ATD hrs.; 29.5 ft., After 0.2 hrs.; ft., After hrs.
Logged by: Stefanie Voss

10/4/13 URS GEOTECH TEMPLATE (LAB STRENGTH-TXUU) Y:\GINT\PROJECTS\DYNERG- BALDWIN_ENERGY COMPLEX.GPJ URS_STL.GLB

LOG of BORING No. B-13-1

STARTED 7/29/13
COMPLETED 7/29/13
LOCATION Baldwin Energy Complex
SURFACE EL., FT 399.3
EL. DATUM NAVD88
NORTHING 554854.10
EASTING 2379264.64
N, E DATUM NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
25														
		4 3 5	78	29.0' : Clayey gravel seam, 3" thick.	370.1 29.2		20				2.25 2.75			
30				Medium stiff, wet, pinkish brown with gray, FAT CLAY (CH), some fine gravel, trace sand. [TILL]										
		50/0"		Bedrock. Bottom of boring at 32.5'	366.8 32.5									32.5' : Auger refusal. Borehole backfilled with bentonite/cement Grout mix: 60 gallons of water 4 bags of cement 1/3 bag bentonite gel
35														
40														
45														

Completion Depth: 32.5 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling

Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Joe Brown

Water Depth: 29.0 ft., After ATD hrs.
29.5 ft., After 0.2 hrs.
ft., After hrs.
Logged by: Stefanie Voss

URS

LOG of BORING No. B-13-2

STARTED: 7/29/13
COMPLETED: 7/29/13
LOCATION: Baldwin Energy Complex
SURFACE EL., FT: 399.7
EL. DATUM: NAVD88
NORTHING: 554761.46
EASTING: 2379540.56
N, E DATUM: NAD83

DEPTH, ft.	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
0			Medium stiff, moist, brown, silty CLAY (CL), some roots, trace fine sand. [FILL]									
	3 3 3	22			19							HSA (3.75" ID) 1.5' : Fines content (%) = 84
					18		30	16				3.5' : Fines content (%) = 84
5	3 6 9	67	Becomes stiff, yellowish brown, some oxidation, no roots.						3.9 3.3 4.0			5' : Fines content (%) = 94
	2 4 4	28	Trace gray clay.		22							
10	1 2 3	78	Medium stiff, moist, light gray with light brown, high plasticity CLAY (CH), trace coarse to fine gravel, trace wood at 9.5 feet, iron oxide staining. [LOESS]	391.2 / 8.5	28				1.6 1.75			
	P	77			29	123			2.8			13' : UC= 1.82 ksf
15							63	47				
20	1 4 5	100	Becomes stiff, wet, light brown, silty. Trace gravel at 19.4 ft.		23				1.5 3.2 3.2			
	3 4 6	94	Stiff, wet, light brown, silty CLAY (CL), trace fine sand, pinkish gray clay lens vertically through sample. [TILL]	376.2 / 23.5	26				2.5 1.9 3.9			

Completion Depth: 27.1 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling

Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Joe Brown

Water Depth: 18.5 ft., After ATD hrs.
13.4 ft., After 0.25 hrs.
10.75 ft., After 16 hrs.
Logged by: Stefanie Voss

LOG of BORING No. B-13-2

STARTED: 7/29/13
COMPLETED: 7/29/13
LOCATION: Baldwin Energy Complex
SURFACE EL., FT: 399.7
EL. DATUM: NAVD88
NORTHING: 554761.46
EASTING: 2379540.56
N, E DATUM: NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
25														
		6 50/2"		Grades coarse to fine gravel, weathered rock fragments, iron oxide staining.	372.6 27.1		23							26.6' : Auger refusal.
				Bottom of boring at 27.1'										Borehole backfilled with bentonite/cement Grout mix: 60 gallons of water 4 bags of cement 1/3 bag bentonite gel
30														
35														
40														
45														

Completion Depth: 27.1 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling
Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Joe Brown

Water Depth: 18.5 ft., After ATD hrs.
13.4 ft., After 0.25 hrs.
10.75 ft., After 16 hrs.
Logged by: Stefanie Voss

LOG of BORING No. B-13-3

STARTED 7/30/13
COMPLETED 7/30/13
LOCATION Baldwin Energy Complex
SURFACE EL., FT 454.0
EL. DATUM NAVD88
NORTHING 555507.44
EASTING 2381215.09
N, E DATUM NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
0				Stiff, moist, orangish-brown, silty CLAY (CL), trace fine sand, iron oxide staining. [FILL]										HSA (3.75" ID)
		4 4 5	56				17				4.5 3.5			
		3 4 5	44				20				4.4 3.5			
5				4.8' : Fissured										
				5.5' : trace coarse sand.										
		3 4 8	78	Some gray and black mottling.			19				2.25 2.8			
		P	85				17	130	50	30	4.5		3.48	9' : Stiff push into soil TV greater than 8 tsf
10														
				11.0' : With light gray and black mottling, very stiff, iron oxide staining, geofabric on sides.										
		3 5 5	61	Becomes stiff, medium plastic.			21				3.5 2.9			
15														
		2 4 8	89	19.0' : Gray clay pocket.			19				1.9 3.4 4.5+			
20														
		P	100				20	130	44	24	4.5		3.50	23.5' : TV= 10 tsf with small vane

Completion Depth: 63.7 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling
Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Keith Brown
Water Depth: 38.5 ft., After ATD hrs.
39.3 ft., After 0.75 hrs.
ft., After hrs.
Logged by: Stefanie Voss

LOG of BORING No. B-13-3

STARTED 7/30/13
COMPLETED 7/30/13
LOCATION Baldwin Energy Complex
SURFACE EL., FT 454.0
EL. DATUM NAVD88
NORTHING 555507.44
EASTING 2381215.09
N, E DATUM NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
25				25.5' : Grades very stiff to hard, grayish brown.										
		2 6 7	78	28.5' : Becomes stiff, pockets of gray clay.			31				2.3 2.5			
30														
		2 5 7	89	Stiff, moist,orange to pinkish brown with pockets of gray, medium plastic CLAY (CL), trace silt, trace roots, iron oxide staining.[LOESS]	420.5 / 33.5		22				3.0 3.25 2.75			
35														
		2 2 4	100	Medium stiff, moist to wet, light grayish brown, silty CLAY (CL), trace fine sand, iron oxide staining. [TILL]	415.5 / 38.5		31				1.9 1.6 1.25			
40														
		2 4 5	100	Becomes stiff, pinkish brown with orange.			24				2.25 2.25 1.9			
45														
		P	100				21	129	47	36	2.5 2.75			48' : UC= 1.34 ksf

Completion Depth: 63.7 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling
Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Keith Brown
Water Depth: 38.5 ft., After ATD hrs.
39.3 ft., After 0.75 hrs.
ft., After hrs.
Logged by: Stefanie Voss

LOG of BORING No. B-13-3

STARTED 7/30/13
COMPLETED 7/30/13
LOCATION Baldwin Energy Complex
SURFACE EL., FT 454.0
EL. DATUM NAVD88
NORTHING 555507.44
EASTING 2381215.09
N, E DATUM NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
50				50.0' : With gray clay, trace sand.										50' : TV= 2.5 tsf
		3 5 5	94	Stiff, wet, light gray with light pinkish brown, silty CLAY (CL), with coarse to fine sand, iron oxide staining, trace fine gravel. [TILL]	400.5 53.5		20				2.0 2.0 2.5			
55														
		6 17 30	100	Dense, wet, orangish brown, coarse to fine clayey SAND (SC), some silt trace, fine gravel. [OUTWASH] 59.5' : Well graded sand lens.	395.5 58.5		12							
60														
		15 17 10	67	Very stiff, wet, grayish brown, silty CLAY (CL), with coarse to fine sand, trace gravel. [WEATHERED ROCK]	391.5 62.5		24				3.9			62.2' : Auger refusal on hard till or possible boulder.
				Bottom of boring at 63.7'	390.3 63.7									Borehole backfilled with bentonite/cement Grout mix: 60 gallons of water 4 bags of cement 1/3 bag bentonite gel
65														
70														

Completion Depth: 63.7 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling
Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Keith Brown
Water Depth: 38.5 ft., After ATD hrs.
39.3 ft., After 0.75 hrs.
ft., After hrs.
Logged by: Stefanie Voss

LOG of BORING No. B-13-4

STARTED: 8/1/01
COMPLETED: 8/1/01
LOCATION: Baldwin Energy Complex
SURFACE EL., FT: 424.4
EL. DATUM: NAVD88
NORTHING: 555572.96
EASTING: 2381189.45
N, E DATUM: NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
0				Stiff, moist, brown to light grayish brown, silty CLAY (CL), trace roots, trace fine sand, trace manganese iron oxide staining.[FILL]										HSA (3.75" ID)
		2 5 5	67				20				4.5 2.4			
		P	100				21	133	49	37	4.0			4' : UC= 3.28 ksf
5														
				Becomes orangish brown and grayish brown, meduim plasticity.										5.5' : Tv= 7.0 tsf
		2 3 4	89	Medium stiff, moist, grayish brown, medium plastic silty CLAY (CL), trace fine sand, iron oxide staining. [LOESS]	417.9 6.5		27							
		2 2 4	100				25				2.5 1.75 1.5			
10														
		P	86				22	127	40	20	2.5		2.36	
15				Becomes pinkish brown with gray. ▼										
		2 3 5	94	Medium stiff, moist, grayish brown, silty CLAY (CL), with coarse to fine sand, iron oxide staining. [TILL]	405.9 18.5		20				3.0 2.75 2.75			
20														
		3 5 6	100	Becomes stiff.			19				2.5 4.0 3.75			

Completion Depth: 40.0 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling

Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Keith Brown

Water Depth: 28.5 ft., After ATD hrs.
15 ft., After 0.5 hrs.
ft., After hrs.
Logged by: Stefanie Voss

LOG of BORING No. B-13-4

STARTED: 8/1/01
COMPLETED: 8/1/01
LOCATION: Baldwin Energy Complex
SURFACE EL., FT: 424.4
EL. DATUM: NAVD88
NORTHING: 555572.96
EASTING: 2381189.45
N, E DATUM: NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
25														
28.5–30		1 3 6	100	▽ Becomes wet, trace fine sand, trace coarse gravel, trace organics. 30.0' : Sand parting. 30.2': Occasional high oxidation staining.			18				1.5 2.25 2.75			
33.5–35		3 6 8	100				14				2.5 2.75 3.5			
38.5–40		33 27 50/3.5"	55	SHALE: Gray, very fine grained, highly weathered, very weak.	385.9 38.5		8							
40				Bottom of boring at 40'	384.4 40.0									39.7' : Spoon refusal. 40.0' : Auger refusal. Borehole backfilled with bentonite/cement Grout mix: 60 gallons of water 4 bags of cement 1/3 bag bentonite gel
45														

Completion Depth: 40.0 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling
Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Keith Brown
Water Depth: 28.5 ft., After ATD hrs.; 15 ft., After 0.5 hrs.; ft., After hrs.
Logged by: Stefanie Voss

URS

LOG of BORING No. B-13-5

STARTED: 8/1/01
COMPLETED: 8/1/01
LOCATION: Baldwin Energy Complex
SURFACE EL., FT: 419.1
EL. DATUM: NAVD88
NORTHING: 555614.43
EASTING: 2381169.40
N, E DATUM: NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
0				Medium stiff, moist, brown, silty CLAY (CL), some roots, trace fine sand. [TOPSOIL]										HSA (3.75" ID)
		2 3 4	50	Medium stiff, moist, grayish brown with orange, silty CLAY (CL), trace fine sand, iron oxide staining. [LOESS]	417.6 / 1.5		38				3.0 2.5			
5		2 3 4	83				24				2.0 1.75 2.6			
		2 2 4	100	Becomes brown, trace roots.			24				1.75 2.0 1.5			
		P	0				23				2.0			
		1 3 4	83	Trace coarse to medium sand, iron oxide staining around sand.							2.0 1.75			9.5' : Split spoon taken to collect sample
10		P	2								1.6			11' : Minimal recovery Sample slid into tube while taking penetrometer
		1 2 8	78	Stiff, moist, gray, medium plastic silty CLAY (CL), with medium to fine sand, trace silt, iron oxide staining. [TILL]	405.6 / 13.5		21				2.5 2.75 3.0			
15														
20		2 4 5	100				22				2.75 3.4 1.9			
		P	100	Becomes brown with gray clay pocket.			20	129	34	24	3.75 2.0 4.25			23' : UC= 0.52 ksf

Completion Depth: 34.5 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling

Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Keith Brown

Water Depth: Dry ft., After ATD hrs.
Dry ft., After 0.25 hrs.
ft., After hrs.
Logged by: Stefanie Voss

LOG of BORING No. B-13-5

STARTED 8/1/01
COMPLETED 8/1/01
LOCATION Baldwin Energy Complex
SURFACE EL., FT 419.1
EL. DATUM NAVD88
NORTHING 555614.43
EASTING 2381169.40
N, E DATUM NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
25														
		6 13 30	83	28.5' : Brown, medium to fine silty sand seam. 28.9' : Light pinkish gray sand parting.	389.8 29.3		13				4.5 4.5 4.5			
30				29.3' : SHALE : Brown gray, calcareous, fine grained, highly weathered, very weak.										
		10 50/5.5"	78		384.6 34.5						4.5			34.1' : Auger refusal.
35				Bottom of boring at 34.5'										Borehole backfilled with bentonite/cement Grout mix: 60 gallons of water 4 bags of cement 1/3 bag bentonite gel
40														
45														

Completion Depth: 34.5 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling

Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Keith Brown

Water Depth: Dry ft., After ATD hrs.
Dry ft., After 0.25 hrs.
ft., After hrs.
Logged by: Stefanie Voss

LOG of BORING No. B-13-6

STARTED 7/30/13
COMPLETED 7/31/13
LOCATION Baldwin Energy Complex
SURFACE EL., FT 454.1
EL. DATUM NAVD88
NORTHING 555679.26
EASTING 2381674.10
N, E DATUM NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
0				Crushed Rock fill.	453.6 / 0.5									
				Medium stiff, moist, yellowish brown, silty CLAY (CL), trace fine sand, iron oxide staining. [FILL]										HSA (3.75" ID)
		3 3 3	22				19							2' : Poor recovery due to rock on sampler
5		3 3 4	67	Becomes medium plastic.			25				2.75 1.75			
		4 7 9	67	Becomes stiff with ocasional laminations of gray clay, trace roots. 6.5' - 6.8' : Fine gravel.			18				4.5			
10		3 3 7	67	Becomes orangish brown.			19				3.8 2.8			
15		2 4 7	67				19				2.3			
		P	83				19	130	42	21	4.5		4.06	
20				Becomes very stiff, grayish brown, trace roots.										19' : Down pressure = 650 psi Pushed 20 inches, tube slightly bent. 21' : TV= 8.75 tsf with stiff soil vane
		4 7 10	89	23.8' : Light gray clay parting. Becomes orangish brown and gray mottled.			19				4.0 3.75 3.5			

Completion Depth: 65.0 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling
Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Keith Brown
Water Depth: 38 ft., After ATD hrs.
30.6 ft., After 16 hrs.
ft., After hrs.
Logged by: Stefanie Voss

LOG of BORING No. B-13-6

STARTED 7/30/13
COMPLETED 7/31/13
LOCATION Baldwin Energy Complex
SURFACE EL., FT 454.1
EL. DATUM NAVD88
NORTHING 555679.26
EASTING 2381674.10
N, E DATUM NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
25														
		2 6 8	67				20				4.5 4.5			
30				Stiff, moist, gray, silty CLAY (CL), trace fine sand, trace roots.[LOESS] ▼	424.6 29.5									
		3 6 8	83	Becomes pinkish brown and orangish brown mottled, trace roots, iron oxide staining.			23				3.5 3.5 2.75			
35														
		P	24	▽ Becomes medium stiff.			24	126	36	22	2.5 2.2			38' : UC= 1.11 ksf 38.5' : Down pressure = 300 psi Water on shelby tube TV= 4.1 psi
40														
		3 4 6	100				23				4.0 3.75 2.75			
45														
		1 3 4	100				22				3.5 3.5			

Completion Depth: 65.0 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling
Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Keith Brown
Water Depth: 38 ft., After ATD hrs.; 30.6 ft., After 16 hrs.; ft., After hrs.
Logged by: Stefanie Voss

LOG of BORING No. B-13-6

STARTED 7/30/13
COMPLETED 7/31/13
LOCATION Baldwin Energy Complex
SURFACE EL., FT 454.1
EL. DATUM NAVD88
NORTHING 555679.26
EASTING 2381674.10
N, E DATUM NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
50														
					401.1 / 53.0									
		3 3 4	100	Medium stiff, wet, orangish brown, sandy CLAY (CL), some silt, coarse to fine sand. [OUTWASH]	399.8 / 54.3		24							
55				54.3' : Loose, wet, orangish brown, medium to fine silty SAND (SM), with clay. [OUTWASH]	396.1 / 58.0									55.0' : Driller noted 4 ft of sand blown in. 7-31-13: Driller filled augers with water to stop sand heave. Bentonite gel slurry was used to keep boring open.
		5 9 9	67	Medium dense, wet, orangish brown, well graded, fine to coarse SAND (SW), some silt, trace clay. [OUTWASH]	390.6 / 63.5		15							
60														
		6 11 13	67	Very stiff, moist, gray, CLAY (CL), highly weathered shale fragments, trace sand. [WEATHERED ROCK]	389.1 / 65.0		25				3.5			64.5' : Auger refusal.
65				Bottom of boring at 65'										Borehole backfilled with bentonite/cement Grout mix: 60 gallons of water 4 bags of cement 1/3 bag bentonite gel
70														

Completion Depth: 65.0 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling
Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Keith Brown
Water Depth: 38 ft., After ATD hrs.
30.6 ft., After 16 hrs.
ft., After hrs.
Logged by: Stefanie Voss

URS

LOG of BORING No. B-13-7

STARTED 7/31/13
COMPLETED 7/31/13
LOCATION Baldwin Energy Complex
SURFACE EL., FT 426.3
EL. DATUM NAVD88
NORTHING 555757.13
EASTING 2381649.31
N, E DATUM NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
0				Medium stiff, moist, brown to dark brown with light gray, silty CLAY (CL), some roots, trace wood, trace sand. [FILL]										HSA (3.75" ID)
		3 4 3	33				16							
		2 6 9	72	Becomes stiff, orangish brown, medium plastic, iron oxide staining.	421.7 / 4.6		21				4.75 2.6			
5				Stiff, moist, grayish brown, SILT (ML), trace fine sand, iron oxide staining. [LOESS]	419.8 / 6.5									
		2 3 4	83	Medium stiff, moist, light grayish brown, silty CLAY (CL), trace fine sand, iron oxide staining. [LOESS]			25				1.25 2.3 3.5			
		P	100								3.3			
							29	121						9' : UC= 1.51 ksf
10														10' : TV= 5.5 tsf
		1 3 5	94	Grades pinkish brown.			23				1.6 2.75 3.0			
15														
		P	100				21	129	46	26	4.3		2.38	
20				Becomes grayish brown with pink.										20' : TV= 6.25 tsf
		3 2 4	100	▽ Becomes medium stiff. 24' : Gray soft clay seam to 24.5' , trace coarse sand.			23				2.5 1.0 2.5			

Completion Depth: 38.1 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling
Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Keith Brown
Water Depth: 23.5 ft., After ATD hrs.
ft., After hrs.
ft., After hrs.
Logged by: Stefanie Voss

LOG of BORING No. B-13-7

STARTED 7/31/13
COMPLETED 7/31/13
LOCATION Baldwin Energy Complex
SURFACE EL., FT 426.3
EL. DATUM NAVD88
NORTHING 555757.13
EASTING 2381649.31
N, E DATUM NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
25														
		WH 3 9	72	Medium dense, wet, orangish brown, sandy SILT (ML), with coarse to fine sand, some clay, trace coarse gravel. [TILL] 29.1' - 29.3' : Orangish brown sand seam.	397.8 / 28.5		17							
30														
		2 9 15	72	Medium dense, wet, orangish brown, medium to fine poorly graded SAND (SP). [ALLUVIAL]	392.8 / 33.5		22				3.5			34' : Drill rods locking in hole due to flowing sands. Drill mud mixed and added to auger hole to maintain open hole
				Very stiff, moist, grayish brown, silty CLAY (CL), some sand, iron oxide staining. [TILL]	391.8 / 34.5									
35														
		50/3"		SHALE: Grayish brown, moderately weathered, very weak.	388.2 / 38.1		23							38.1: Auger refusal.
				Bottom of boring at 38.1'	388.0 / 38.3									Borehole backfilled with bentonite/cement Grout mix: 60 gallons of water 4 bags of cement 1/3 bag bentonite gel
40														
45														

Completion Depth: 38.1 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling
Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Keith Brown
Water Depth: 23.5 ft., After ATD hrs.
ft., After hrs.
ft., After hrs.
Logged by: Stefanie Voss

LOG of BORING No. B-13-8

STARTED 7/31/13
COMPLETED 7/31/13
LOCATION Baldwin Energy Complex
SURFACE EL., FT 423.4
EL. DATUM NAVD88
NORTHING 555805.28
EASTING 2381630.72
N, E DATUM NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
0				Very stiff, moist, brown to light grayish brown, silty CLAY (CL), trace fine sand, trace roots, iron oxide staining. [FILL]										HSA (3.75" ID)
		3 19 10	72				17				3.5			
				▼										
5		3 4 6	44	Becomes stiff, orangish brown, trace fine sand, iron oxide staining.			25				3.5 3.5			
		P	90	Very stiff, moist, light grayish brown, clayey SILT (ML), trace fine sand, iron oxide staining. [LOESS]	417.4 6.0		24	125	39	17	3.9		1.64	TV= 5 tsf
10		1 2 3	100	Medium stiff, moist, orangish to pinkish brown, silty CLAY (CL), trace fine sand, iron oxide staining. [LOESS]	413.9 9.5		24				1.5 1.5 2.0			
15		1 4 5	89	Stiff. Trace coarse sand.			21				2.25 2.75 2.75			
20		3 4 6	100	Stiff, moist, light gray, silty CLAY (CL), with medium to fine sand, iron oxide staining. [TILL]	404.9 18.5		21				4.5 4.5 2.75			
		P	0	Loose, wet, orangish brown, coarse to fine well graded SAND (SW), trace clay, particle separation in sample. [OUTWASH] ▽	400.4 23.0									24' : Split spoon taken to collect sample jar 6

Completion Depth: 37.2 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling
Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Keith Brown
Water Depth: 23.5 ft., After ATD hrs.; 3.6 ft., After 14 hrs.; ___ ft., After ___ hrs.
Logged by: Stefanie Voss

URS

LOG of BORING No. B-13-8

STARTED: 7/31/13
COMPLETED: 7/31/13
LOCATION: Baldwin Energy Complex
SURFACE EL., FT: 423.4
EL. DATUM: NAVD88
NORTHING: 555805.28
EASTING: 2381630.72
N, E DATUM: NAD83

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	NMC, %	γ_t, PCF	LL	PI	PP Su, KSF	TV Su, KSF	TXUU Su, KSF	NOTES
25														Sample separation of fine to coarse in split spoon.
		4 10 11	56	Medium dense, wet, gray, coarse to fine sandy SILT (ML). [TILL]	394.9 / 28.5		18				4.5			
30				Very stiff, moist, gray sandy CLAY (CL), coarse to fine sand. [TILL]	394.4 / 29.0									
		9 12 14	61	SHALE: Gray, calcareous, fine grained, highly weathered, very weak.	389.9 / 33.5		24				4.5			
35		44 26 16	67	35.5' - 36.8' : Interbedded shaley SANDSTONE, highly weathered.			22							35.7' : Auger refusal.
				Bottom of boring at 37.2'	386.2 / 37.2									Borehole backfilled with bentonite/cement Grout mix: 60 gallons of water 4 bags of cement 1/3 bag bentonite gel
40														
45														

Completion Depth: 37.2 feet
Project No.: 21562902
Project Name: Dynergy-Baldwin
Drilling Contractor: Bulldog Drilling
Drilling Equipment: CME 550X
Drilling Method: HSA
Hammer Type: Automatic
Driller's Name: Keith Brown
Water Depth: 23.5 ft., After ATD hrs.; 3.6 ft., After 14 hrs.; ft., After hrs.
Logged by: Stefanie Voss

URS

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		MW158R

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Blake Weller Cascade Drilling	10/8/2022	10/8/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW158R	Feet (NAVD88)	453.56 Feet (NAVD88)	6.0 inches

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

State Plane 556,726.33 N, 2,387,758.42 E E/Ⓦ

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

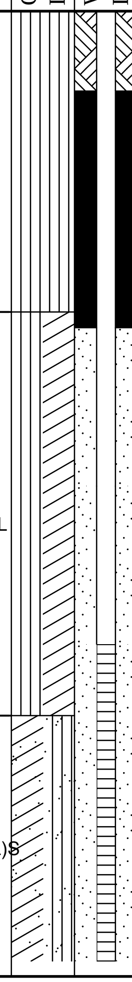
Lat 38° 11' 42.9889"

Long -89° 50' 57.8794"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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
			0–3.8	0 - 3.8' **SILT:** ML, MW158R Blind Drilled to 18 feet below ground surface. See MW358 Boring Log for Detailed Lithology.	ML									Blind Drilled to 18 feet below ground surface.
			3.8–8.9	3.8 - 8.9' **CLAYEY SILT:** ML/CL.	ML/CL									
			8.9–12	8.9 - 13' **SILTY CLAY WITH SAND:** (CL/ML)S.	(CL/ML)S									



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, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW158R

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				8.9 - 13' **SILTY CLAY WITH SAND:** (CL/ML)S. *(continued)*	(CL/ML)S									
			13	13 - 17.8' **SILTY CLAY:** CL/ML.	CL/ML									
			14											
			15											
			16											
			17											
			18	17.8 - 18' **SILTY CLAY WITH SAND:** (CL/ML)S. 18' End of Boring.	(CL/ML)S									

Facility/Project Name: Baldwin Power Plant	License/Permit/Monitoring Number:	Boring Number: MW192	
Boring Drilled By: Name of crew chief (first, last) and Firm: Blake Weller, Cascade Drilling	Date Drilling Started: 9/27/2022	Date Drilling Completed: 9/27/2022	Drilling Method: Sonic
Common Well Name: MW192	Final Static Water Level: Feet (NAVD88)	Surface Elevation: 434.04 Feet (NAVD88)	Borehole Diameter: 6.0 inches
Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒ State Plane 558,140.06 N, 2,382,719.93 E E/W; 1/4 of 1/4 of Section , T N, R	Lat 38° 11' 57.1306" Long -89° 52' 0.9379"	Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W	
Facility ID:	County: Randolph	State: IL	Civil Town/City/ or Village: Baldwin

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	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–1.2	0 - 1.2' **FILL, WELL-GRADED GRAVEL WITH CLAY:** GW-GC, MW192 Blind Drilled to 20 feet below ground surface. See MW392 Boring Log for Detailed Lithology.	(FILL) GW-GC									Blind Drilled to 20 feet below ground surface.
			1.2–12	1.2 - 16' **FILL, LEAN CLAY:** CL.	(FILL) CL									

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Signature: [signature]

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Boring Number MW192

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			12–16	1.2 - 16' **FILL, LEAN CLAY:** CL. *(continued)*	(FILL) CL									
			16–20	16 - 20' **LEAN CLAY:** CL.	CL									
1 CS	120 98		20–22.8	20 - 22.8' **SANDY LEAN CLAY WITH GRAVEL:** s(CL)g, light brown (7.5YR 6/4), fine to medium sand, medium to low plasticity, wet.	s(CL)g				1					CS= Core Sample MC= Modified California Sample
			22.8–30	22.8 - 30' **WELL-GRADED SAND WITH SILT AND GRAVEL:** (SW-SM)g.	(SW-SM)g				1 2 2.5 2.5					
2 MC	24 24		30–32	30 - 34' **SILTY CLAY:** CL/ML, brown (7.5YR 5/3), strong brown (7.5YR 5/3) and gray (7.5YR 5/1) mottling (20-30%), sand (15-30%), moist.	CL/ML					20.1 21.5	33 32	19 20	70.8 63.1	

Boring Number MW192

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
3 CS	24 24		33	30 - 34' **SILTY CLAY:** CL/ML, brown (7.5YR 5/3), strong brown (7.5YR 5/3) and gray (7.5YR 5/1) mottling (20-30%), sand (15-30%), moist. *(continued)*	CL/ML									
			34	34' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		MW193

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Blake Weller Cascade Drilling	10/4/2022	10/4/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW193	Feet (NAVD88)	434.52 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 558,133.33 N, 2,383,946.80 E E/W (W circled)
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 57.0245"
Long -89° 51' 45.5687"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Sample: 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
			0–1	0 - 1' **FILL, WELL-GRADED GRAVEL**: GW, MW193 Blind Drilled to 20 feet below ground surface. See MW393 Boring Log for Detailed Lithology.	(FILL) GW									Blind Drilled to 20 feet below ground surface.
			1–13	1 - 20' **FILL, LEAN CLAY**: CL.	(FILL) CL									

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[signature]	Ramboll 234 W Florida Street, 5th Floor, Milwaukee, WI 53204	Tel: (414)837-3607 Fax: (414)837-3608

Boring Number MW193

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
			14–19	1 - 20' **FILL, LEAN CLAY:** CL. *(continued)*	(FILL) CL									
1 MC	24 24		20–21	20 - 26.4' **LEAN CLAY WITH SAND:** (CL)s, brown (7.5YR 5/4), strong brown (7.5YR 5/8) and gray (10YR 5/1) mottling (20-30%), gravel (0-5%), moist.	(CL)s					22.6	48	33	94.1	CS= Core Sample
										20.1	44	30	95	MC= Modified California Sample
2 CS	120 120		22–26						3.5					
									3					
			26.4	26.4 - 27.3' **SANDY LEAN CLAY:** s(CL), brown (7.5YR 5/4), strong brown (7.5YR 5/8) and gray (10YR 5/1) mottling (20-30%), silt (15-30%), gravel (0-5%), wet.	s(CL)									
			27.3	27.3 - 29.5' **CLAYEY SAND:** SC, yellowish brown (10YR 5/4), gravel (0-5%), wet.	SC									
			29.5	29.5 - 32' **SANDY LEAN CLAY:** s(CL), yellowish brown (10YR 5/4), strong brown (7.5YR 5/8) mottling (10-20%), silt (30-45%), moist. 29.9' very dark gray (10YR 4/1).	s(CL)				4.5					
			32	32' End of Boring.										

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		MW194

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Blake Weller Cascade Drilling	10/5/2022	10/5/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW194	Feet (NAVD88)	435.43 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 558,124.34 N, 2,385,097.85 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 56.8982"
Long -89° 51' 31.1494"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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
			0 - 2.6	0 - 2.6' **FILL, WELL-GRADED GRAVEL WITH CLAY:** GW-GC, MW194 Blind Drilled to 18 feet below ground surface. See MW394 Boring Log for Detailed Lithology.	(FILL) GW-GC									Blind Drilled to 18 feet below ground surface.
			2.6 - 12	2.6 - 18' **LEAN CLAY:** CL.	CL									

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Signature [signature]

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Boring Number MW194

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
			13–18	2.6 - 18' **LEAN CLAY:** CL. *(continued)*	CL									
1 MC	24 24		18–20	18 - 20' **SANDY LEAN CLAY:** s(CL).	s(CL)					17.1	46	33	57.4	CS= Core Sample
										20.3	39	27	68.5	MC= Modified California Sample
2 CS	120 106		20–21.4	20 - 21.4' **SANDY LEAN CLAY:** s(CL), dark yellowish brown (10YR 4/4), gray (10YR 5/1) and yellowish brown (10YR 5/6) mottling, silt (30-45%), gravel (0-5%), medium plasticity, moist.	s(CL)				4.5					
			21.4–26.3	21.4 - 26.3' **SANDY LEAN CLAY:** s(CL), grayish brown (10YR 5/2), brownish yellow (10YR 6/6) mottling, low plasticity, moist. 22.3' gray (10YR 6/1).	s(CL)				4.5 2.5					
			26.3–30	26.3 - 30' **LEAN CLAY WITH SAND:** (CL)s, gray (10YR 5/1), yellowish brown (10YR 5/6) mottling (20-30%), silt (0-5%), moist.	(CL)s				2.5 2					
			30–32	30 - 32' Blind Drilled 30 to 32 feet below ground surface..										

SOIL BORING LOG INFORMATION SUPPLEMENT

Sample		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					RQD/ Comments
Number and Type	Length Att. & Recovered (in)								Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	
				32' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		MW258

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Blake Weller Cascade Drilling	10/5/2022	10/7/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW258	Feet (NAVD88)	453.50 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,726.72 N, 2,387,753.37 E E/W (W circled)
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 42.9929"
Long -89° 50' 57.9427"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0 - 3.8	0 - 3.8' **SILT:** ML, MW258 Blind Drilled to 63 feet below ground surface. See MW358 Boring Log for Detailed Lithology.	ML									Blind Drilled to 63 feet below ground surface.
			3.8 - 8.9	3.8 - 8.9' **CLAYEY SILT:** ML/CL.	ML/CL									
			8.9 - 13	8.9 - 13' **SILTY CLAY WITH SAND:** (CL/ML)S.	(CL/ML)S									

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

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Boring Number MW258

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
			13 - 15	13 - 15' **SILTY CLAY:** CL/ML.	CL/ML									
1 MC	24		15 - 17	15 - 17' **SILTY CLAY:** CL/ML.	CL/ML					20.8 22.1	34 35	18 20	73.7 76.7	
			17 - 17.8	17 - 17.8' **SILTY CLAY:** CL/ML.	CL/ML									
			17.8 - 21	17.8 - 21' **SILTY CLAY WITH SAND:** (CL/ML)S.	(CL/ML)S									
			21 - 26.5	21 - 26.5' **SHALE:** BDX (SH).	BDX (SH)									
			26.5 - 27.5	26.5 - 27.5' **LIMESTONE:** BDX (LS).	BDX (LS)									
			27.5 - 31.3	27.5 - 31.3' **SHALE:** BDX (SH).	BDX (SH)									
			31.3 - 32	31.3 - 32' **COAL:** COAL.	COAL									
			32 - 33	32 - 33' **SHALE:** BDX (SH).	BDX (SH)									
			33 - 36	33 - 36' **SHALEY LIMESTONE:** BDX (LS/SH).	BDX (LS/SH)									

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW258

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
			35	33 - 36' **SHALEY LIMESTONE:** BDX (LS/SH). *(continued)*	BDX (LS/SH)									
			36–40	36 - 40.8' **SHALEY LIMESTONE:** to **SHALE:** BDX (LS/SH).	BDX (LS/SH)									
			41	40.8 - 42' **LIMESTONE:** BDX (LS).	BDX (LS)									
			42–56	42 - 58.9' **SHALE:** BDX (SH).	BDX (SH)									

Boring Number MW258

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
			57 58	42 - 58.9' **SHALE:** BDX (SH). *(continued)*	BDX (SH)									
			59 60 61 62 63	58.9 - 63' **LIMESTONE:** BDX (LS).	BDX (LS)									
				63' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		MW358

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Blake Weller Cascade Drilling	10/5/2022	10/8/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW358	Feet (NAVD88)	453.59 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,726.26 N, 2,387,756.63 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 42.9882"
Long -89° 50' 57.9018"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	180 97		0–4	0 - 3.8' **SILT:** ML, very dark grayish brown (10YR 3/2), organic material (0-10%), moist to wet. 2.1' dry.	ML									CS= Core Sample Measured Rock Quality Designation (RQD) was modified due to drilling methods, modified RQD equals the sum of recovered core sections greater than 4 inches in length divided by total core recovery.
			4–9	3.8 - 8.9' **CLAYEY SILT:** ML/CL, light gray (10YR 7/2), very dark grayish brown (10YR 3/2) and yellowish brown (10YR 5/8) mottling (20-30%), dry.	ML/CL									
			9–12	8.9 - 13' **SILTY CLAY WITH SAND:** (CL/ML)S, grayish brown (10YR 5/2), strong brown (7.5YR 5/6) and very dark brown (10YR 2/2) mottling (20-30%), organic material (0-10%), low toughness, low to medium plasticity, stiff.	(CL/ML)S									

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

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Boring Number MW358

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			12–13		(CL/ML)S									
2 CS	60 60		13–17.8	13 - 17.8' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), strong brown (7.5YR 5/6) and very dark brown (10YR 2/2) mottling (20-30%), low toughness, medium to high plasticity, stiff to very stiff. 16.1' mottling discontinues.	CL/ML									
3 CS	48 36		17.8–21	17.8 - 21' **SILTY CLAY WITH SAND:** (CL/ML)S, brown (10YR 5/3), strong brown (7.5YR 5/6) and gray (10YR 6/1) mottling (20-30%), gravel (5-15%), no dilatancy, high toughness, low to medium plasticity, hard, moist.	(CL/ML)S									
4 CORE	36 32		21–26.5	21 - 26.5' **SHALE:** BDX (SH), dark gray (GLEY 1 4/N), weathered, thin bedding, moderately fractured. 24' -25.2' wet.	BDX (SH)									RUN #4: Modified RQD = (21/32) = 66%
5 CORE	36 29		26.5–27.5	26.5 - 27.5' **LIMESTONE:** BDX (LS), dark gray (5Y 4/1), shaley, fossiliferous, very strong.	BDX (LS)									RUN #5: Modified RQD = (0/29) = 0%
6 CORE	72 60		27.5–31.3	27.5 - 31.3' **SHALE:** BDX (SH), grayish black (N2), weathered, highly decomposed to residual soil, wet to moist. 29.3' thinly bedded, moderately decomposed. 30' slightly decomposed to competent, moderately fractured.	BDX (SH)									RUN #6: Modified RQD = (45/60) = 75%
			31.3–32	31.3 - 32' **COAL:** COAL, black (N1).	COAL									

Boring Number MW358

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			32–33	32 - 33' **SHALE:** BDX (SH), grayish black (N2), slightly decomposed to competent, moderately fractured, wet to moist.	BDX (SH)									
			33–36	33 - 36' **SHALEY LIMESTONE:** BDX (LS/SH), medium gray (N5), weathered, shaley, higly decomposed, slightly fractured.	BDX (LS/SH)									
7 CORE	72 71		36–40.8	36 - 40.8' **SHALEY LIMESTONE:** to **SHALE:** BDX (LS/SH), interbedded shale.	BDX (LS/SH)									RUN #7: Modified RQD = (67/71) = 94%
			40.8–42	40.8 - 42' **LIMESTONE:** BDX (LS), medium light gray (N6), strong to moderately fractured, slightly decomposed, narrow apertures.	BDX (LS)									
8 CORE	96 85		42–52	42 - 58.9' **SHALE:** BDX (SH), medium gray (N5) to medium dark gray (N4), weathered, weak, thinly bedded, moderately to highly fractured.	BDX (SH)									RUN #8: Modified RQD = (81/85) = 94%
			47.5	47.5' dark grayish brown (10YR 4/2), pale olive (5Y 6/4) discoloration, more competent.										
9 CORE	60 60		50.2	50.2' weak to moderate.										RUN #9: Modified RQD = (52/60) = 87%
			50.8	50.8' olive gray (5Y 5/2).										

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	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			53	42 - 58.9' **SHALE:** BDX (SH), medium gray (N5) to medium dark gray (N4), weathered, weak, thinly bedded, moderately to highly fractured. *(continued)* 52.2' dark grayish green (5GY 4/2).										
			54	54.1' medium dark gray (N4) to medium gray (N5), weak, highly decomposed, no visible bedding, dry.										
10 CORE	60 58		55		BDX (SH)									RUN #10: Modified RQD = (42/58) = 72%
			56	55.7' dark grayish green (5GY 4/2).										
			57	57.2' light brownish gray (10YR 6/2), thinly bedded, laminated.										
			58	58.2' medium dark gray (N4), strong, intensely fractured, thinly bedded.										
			59	58.9 - 64' **LIMESTONE:** BDX (LS), medium gray (N5), very strong, moderately fractured, visible laminations.										
11 CORE	36 31		60											RUN #11: Modified RQD = (8/31) = 26%
			61		BDX (LS)									
			62											
12 CORE	36 36		63											RUN #12: Modified RQD = (31/36) = 86%
			64	64 - 75.3' **SHALE:** BDX (SH), medium dark gray (N4) to medium gray (N5), strong, thinly bedded to laminated, moderately fractured. 64.3' grayish green (5GY 5/2), weathered, weak, decomposed.										
			65											
13 CORE	48 48		66											RUN #13: Modified RQD = (43/48) = 90%
			67											
			68		BDX (SH)									
			69	69.3' medium dark gray (N4), weathered, moderate strength.										
14 CORE	60 58		70											RUN# 14: Modified RQD = (57/58) = 99%
			71											
			72											

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Boring Number MW358

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			73, 74, 75	64 - 75.3' **SHALE:** BDX (SH), medium dark gray (N4) to medium gray (N5), strong, thinly bedded to laminated, moderately fractured. *(continued)*	BDX (SH)									
15 CORE	60 56		76, 77	75.3 - 77.1' **LIMESTONE:** BDX (LS), gray (5Y 6/1), fossiliferous, very strong.	BDX (LS)									RUN #15: Modified RQD = Not Recorded
			78	77.1 - 78.2' **SHALE:** BDX (SH), medium dark gray (N4), weathered, weak to moderate strength, moderately decomposed.	BDX (SH)									
16 CORE	60 51		79, 80, 81, 82, 83, 84	78.2 - 84.8' **LIMESTONE:** BDX (LS), medium dark gray (N4) to medium gray (N5), shaley, fossiliferous, very strong, moderately fractured, laminations (0-5%).	BDX (LS)									RUN #16: Modified RQD = (23/51) = 45%
17 CORE	60 60		85, 86, 87, 88, 89, 90	84.8 - 90' **SHALE:** BDX (SH), dark gray (N3), weathered, weak to moderate strength, moderately decomposed, moderately fractured, thin bedding.	BDX (SH)									RUN #17: Modified RQD = (28/60) = 47%
				90' End of Boring.										

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		MW392

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Blake Weller Cascade Drilling	9/9/2022	9/26/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW392	Feet (NAVD88)	434.07 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 558,140.20 N, 2,382,717.92 E E/W
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 57.132"
Long -89° 52' 0.9632"
Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	120 46		0 - 1.2	0 - 1.2' **FILL, WELL-GRADED GRAVEL WITH CLAY:** GW-GC, pinkish gray (7.5YR 6/2), angular, moist.	(FILL) GW-GC									CS= Core Sample
			1.2 - 16	1.2 - 16' **FILL, LEAN CLAY:** CL, light brown (7.5YR 6/4), sand (0-5%), no dilatancy, low to medium plasticity, moist.	(FILL) CL									Measured Rock Quality Designation (RQD) was modified due to drilling methods, modified RQD equals the sum of recovered core sections greater than 4 inches in length divided by total core recovery.
2 CS	120 62		10											

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, 5th Floor, Milwaukee, WI 53204
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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
			13–16	1.2 - 16' **FILL, LEAN CLAY:** CL, light brown (7.5YR 6/4), sand (0-5%), no dilatancy, low to medium plasticity, moist. *(continued)*	(FILL) CL									
			16–20	16 - 20' **LEAN CLAY:** CL, light brown (7.5YR 6/4), sand (0-5%), no dilatancy, low to medium plasticity, moist.	CL									
3 CS	120 33		20–32	20 - 33' **LEAN CLAY:** CL, pinkish gray (7.5YR 6/2), sand (0-5%), medium to high plasticity, stiff, moist.	CL									
4 CS	120 104		30	30' increasing sand and gravel content.										

Boring Number MW392

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				20 - 33' **LEAN CLAY:** CL, pinkish gray (7.5YR 6/2), sand (0-5%), medium to high plasticity, stiff, moist. *(continued)*	CL									
			33	33 - 35' **WELL-GRADED SAND WITH SILT AND GRAVEL:** (SW-SM)g, fine to medium sand, dry.	(SW-SM)g									
			34											
			35	35 - 36.5' **SANDY SILT WITH GRAVEL:** s(ML)g, light yellowish brown (10YR 6/4), dry.	s(ML)g									
			36											
				36.5 - 39' **CLAYEY SILT:** ML/CL, gray (7.5YR 5/1), sand (5-10%), coal (0-5%), gravel (0-5%), dry.	ML/CL									
			37											
			38											
			39	39 - 40' **SILTY CLAY:** CL/ML, sand (0-5%), low to medium plasticity, stiff.	CL/ML									
5 CS	120 108		40	40 - 48' **SILT WITH SAND:** (ML)s, light brownish gray (10YR 6/2), dry.	(ML)s									
			41											
			42											
			43											
			44	44' increasing clay content.										
			45	45' (2.5Y 6/2).										
			46											
			47											
			48	48 - 52' **SILT:** ML, gray (2.5Y 5/1), sand (0-5%), dry.	ML									
			49											
6 CS	84 81		50											
			51											
			52											

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Boring Number MW392

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				52 - 57' **SHALE:** BDX (SH), dark gray (5Y 4/1), highly weathered, hard, dry.										
			53	53' very dark gray (7.5YR 3/1).	BDX (SH)									
7 CORE	60 4		57	57 - 57.5' **LIMESTONE:** BDX (LS), gray (5Y 6/1), slightly fractured.	BDX (LS)									RUN #7: Modified RQD = 0% (No Solid Recovery > 4")
				57.5 - 70' **SHALE:** BDX (SH), dark gray (5Y 4/1), weathered, soft, moderately fractured to highly fractured limestone beds (0-5%).	BDX (SH)									
8 CORE	96 78		62											RUN #8: Modified RQD = (28/78) = 36%
			66	66.3' - 67.2' highly fractured, very soft, wet.										
9 CORE	120 62		70	70 - 74.4' **LIMESTONE:** BDX (LS), gray (5Y 6/1), moderately to intensely fractured, moderately wide apertures.	BDX (LS)									RUN #9: Modified RQD = (28/78) = 36%

Depth scale: 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72

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Boring Number MW392

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			73, 74	70 - 74.4' **LIMESTONE:** BDX (LS), gray (5Y 6/1), moderately to intensely fractured, moderately wide apertures. *(continued)*	BDX (LS)									
			75, 76, 77, 78, 79, 80, 81	74.4 - 81.8' **SHALE:** BDX (SH), medium dark gray (N4) to dark gray (N3), slightly weathered, moderately fractured, thinly bedded.	BDX (SH)									
10 CORE	48 48													RUN #10: Modified RQD = (28/48) = 58%
			82, 83, 84	81.8 - 84' **LIMESTONE:** BDX (LS), medium light gray (N6), shaley, fossiliferous, moderately fractured, thinly bedded. 83.2' medium gray (N5).	BDX (LS)									
				84' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		MW393

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Blake Weller Cascade Drilling	9/9/2022	10/4/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW393	Feet (NAVD88)	434.59 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 558,133.57 N, 2,383,944.49 E E/(W)
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 57.027"
Long -89° 51' 45.5976"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	120 86		0–1	0 - 1' **FILL, WELL-GRADED GRAVEL:** GW, pinkish gray (7.5YR 6/2), angular, moist.	(FILL) GW									CS= Core Sample
			1–10	1 - 20' **FILL, LEAN CLAY:** CL, brown (7.5YR 6/4), sand (0-5%), no dilatancy, low to medium plasticity, moist.	(FILL) CL									Measured Rock Quality Designation (RQD) was modified due to drilling methods, modified RQD equals the sum of recovered core sections greater than 4 inches in length divided by total core recovery.
2 CS	120 120		10–12	10' sand (0-5%), iron concretions (0-5%).										

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

Signature: [signature]

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Boring Number MW393

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13–20	1 - 20' **FILL, LEAN CLAY:** CL, brown (7.5YR 6/4), sand (0-5%), no dilatancy, low to medium plasticity, moist. *(continued)* 18' medium to high plasticity.	(FILL) CL									
3 CS	120 120		20–24	20 - 24' **LEAN CLAY:** CL, light brown (7.5YR 6/4), mottling, sand (0-5%), medium to high plasticity, cohesive, moist.	CL									
			24–27	24 - 27' **CLAYEY SAND:** SC, gray (10YR 6/1), fine to medium sand, wet.	SC									
			27–31	27 - 31' **SILT WITH SAND:** (ML)s, dark gray (7.5YR 4/1), sand (0-5%), moist.	(ML)s									
4 CS	120 105		30	30' coal fragments (0-5%).										
			31–32	31 - 40' **SILTY CLAY:** CL/ML, dark gray (7.5Y 4/1), organic material (0-5%), gravel (0-5%), stiff to very stiff, moist.	CL/ML									

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			32–40	31 - 40' **SILTY CLAY:** CL/ML, dark gray (7.5Y 4/1), organic material (0-5%), gravel (0-5%), stiff to very stiff, moist. *(continued)*	CL/ML									
5 CS	120 120		40–50	40 - 50' **SILT:** ML, grayish brown (2.5Y 5/2), very stiff to hard, platy, dry.	ML									
6 CS	120 92		50–52	50 - 55' **SILT:** ML, dark gray (7.5YR 4/1), sand (0-5%), very stiff to hard, dry.	ML									

Boring Number MW393

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
			50–55	50 - 55' **SILT:** ML, dark gray (7.5YR 4/1), sand (0-5%), very stiff to hard, dry. *(continued)*	ML									
			55–57	55 - 57' **CLAYEY SILT:** ML/CL, gray (10YR 6/1), sand (0-5%), gravel (0-5%), medium plasticity, moist.	ML/CL									
			57–60	57 - 60' **LIMESTONE:** BDX (LS), gray (10YR 6/1), rock flour and angular chips (<2").	BDX (LS)									
7 CORE	120 60		60–70	60 - 70' **SHALE:** BDX (SH), medium gray (N5), weathered, very weak, residual soil, soft, slightly fractured.	BDX (SH)									RUN #7: Modified RQD = (31/60) = 52%
8 CORE	42 40		70–72	70 - 73.5' **LIMESTONE:** BDX (LS), medium dark gray (N4), weathered, shaley, thinly bedded, moderately fractured.	BDX (LS)									RUN #8: Modified RQD = (32/40) = 80%

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
			73	70 - 73.5' **LIMESTONE:** BDX (LS), medium dark gray (N4), weathered, shaley, thinly bedded, moderately fractured. *(continued)* 72' medium gray (N5).	BDX (LS)									
9 CORE	78 40		74	73.5 - 85' **SHALE:** BDX (SH), medium gray (N5), weathered, moderately to slightly fractured, thinly laminated.										RUN #9: Modified RQD = (30/40) = 75%
			75											
			76											
			77											
			78											
			79		BDX (SH)									
10 CORE	60 45		80											RUN #10: Modified RQD = (34/45) = 76%
			81											
			82											
			83	83.5' more competent.										
			84											
			85	85' End of Boring.										

Facility/Project Name: Baldwin Power Plant	License/Permit/Monitoring Number:	Boring Number: MW394	
Boring Drilled By: Name of crew chief (first, last) and Firm: Blake Weller, Cascade Drilling	Date Drilling Started: 9/25/2022	Date Drilling Completed: 10/5/2022	Drilling Method: Sonic
Common Well Name: MW394	Final Static Water Level: Feet (NAVD88)	Surface Elevation: 435.51 Feet (NAVD88)	Borehole Diameter: 6.0 inches
Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒ State Plane 558,123.63 N, 2,385,095.76 E E/Ⓦ 1/4 of 1/4 of Section , T N, R	Lat 38° 11' 56.8911" Long -89° 51' 31.1756"	Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W	
Facility ID:	County: Randolph	State: IL	Civil Town/City/ or Village: Baldwin

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	72 67		0–2	0 - 2.6' **FILL, WELL-GRADED GRAVEL WITH CLAY:** GW-GC, brown (10YR 4/3), angular, moist.	(FILL) GW-GC									CS= Core Sample Measured Rock Quality Designation (RQD) was modified due to drilling methods, modified RQD equals the sum of recovered core sections greater than 4 inches in length divided by total core recovery.
			3	2.6 - 20' **LEAN CLAY:** CL, brown (10YR 5/3), reddish brown bottling (20%), sand (0-5%), low to medium plasticity, very stiff to hard, moist.					4					
			5						4					
2 CS	120 120		6–7						2.5					
			8		CL				3.5					
			9						2					
			10	9.2' brown (7.5YR 5/3), medium to high plasticity.					2					
			11						3					
			12						2.25					

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, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

Boring Number MW394

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	2.6 - 20' **LEAN CLAY:** CL, brown (10YR 5/3), reddish brown bottling (20%), sand (0-5%), low to medium plasticity, very stiff to hard, moist. *(continued)*					2.25					
			14	14' low to medium plasticity.										
			15						2.5					
3 CS	120 120		16		CL									
			17	16.5' increasing sand and gravel content, gray (GLEY 1 5/1) iron concretions (50%).										
			18											
			19											
			20	20 - 22.1' **SILTY SAND:** SM, yellowish brown (10YR 5/6), fine sand, clay (0-5%), moist.										
			21		SM									
			22	22.1 - 36.8' **LEAN CLAY:** CL, dark yellowish brown (10YR 4/4), greenish gray (GLEY 1 5/10Y) and yellowish brown (10YR 5/6) mottling, sand (0-5%), medium to high plasticity, hard, moist.										
			23						4.5					
			24						4.5					
			25						4.5					
4 CS	120 112		26						4.5					
			27		CL				4.5					
			28						4.5					
			29						4.5					
			30						4.5					
			31						4.5					
			32											

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33	22.1 - 36.8' **LEAN CLAY:** CL, dark yellowish brown (10YR 4/4), greenish gray (GLEY 1 5/10Y) and yellowish brown (10YR 5/6) mottling, sand (0-5%), medium to high plasticity, hard, moist. *(continued)*					3.75					
			34						4.25					
			35	34.4' olive yellow (5Y 6/6), low to medium plasticity.	CL				4.5					
5 CS	120 113		36											
			37	36.8 - 48' **Weathered SHALE Bedrock:** BDX (SH), pale olive (5Y 6/3), weathered, argillaceous, fissile, moist.										
			38–39											
			40	40' olive gray (5Y 5/2).										
			41–45		BDX (SH)									
6 CS	96 96		46–47											
			48	48 - 58' **LIMESTONE:** to **SHALE:** BDX (LS), olive gray (5Y 4/2), interbedded limestone and shale, fissile.										
			49											
			50	50' - 50.2' limestone, very strong.	BDX (LS)									
			51–52											

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
			53	48 - 58' **LIMESTONE:** to **SHALE:** BDX (LS), olive gray (5Y 4/2), interbedded limestone and shale, fissile. *(continued)*										
7 CS	48 48		54	53.7' - 53.9' limestone, very strong. 54' - 55.6' dark gray (10YR 4/1) to gray (10YR 5/1), more competent.										
			55		BDX (LS)									
			56	55.6' gray (10YR 6/1) to dark gray (10YR 4/1), more competent.										
			57											
8 CORE	18 14		58	58 - 59.7' **LIMESTONE:** BDX (LS), medium gray (N5), shaley, laminated, moderately fractured.	BDX (LS)									RUN #8: Modified RQD = (4/14) = 29%
			59											
9 CORE	60 60		60	59.7 - 68' **SHALE:** BDX (SH), medium dark gray (N4), weathered, very weak to weak, thinly bedded, moderately fractured.										RUN #9: Modified RQD = (48/60) = 80%
			61											
			62											
			63											
			64		BDX (SH)									
10 CORE	57 56		65	64.5 - 67.2' highly decomposed, weathered, wet.										RUN #10: Modified RQD = Not Recorded
			66											
			67											
			68	68 - 68.4' **LIMESTONE:** BDX (LS), light olive gray (5Y 6/2) to olive gray (5/2).	BDX (LS)									
			69	68.4 - 70.8' **SHALE:** BDX (SH), medium dark gray (N4), weathered, very weak to weak, thinly bedded, moderately fractured.	BDX (SH)									
11 CORE	68 68		70											RUN #11: Modified RQD = (42/68) = 62%
			71	70.8 - 71' **LIMESTONE:** BDX (LS), dark gray (N3), shaley.	BDX (LS)									
			72	71 - 77.6' **SHALE:** BDX (SH), dark gray (N3),										

Boring Number MW394

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
			73, 74	strong, thinly bedded, moderately fractured. 71 - 77.6' **SHALE:** BDX (SH), dark gray (N3), strong, thinly bedded, moderately fractured. *(continued)*	BDX (SH)									
12 CORE	60 59		75, 76, 77											RUN #12: Modified RQD = (44/59) = 75%
			78, 79	77.6 - 80' **LIMESTONE:** BDX (LS), medium gray (N5), shaley, weak, moderately fractured.	BDX (LS)									
13 CORE	60 48		80, 81, 82, 83, 84	80 - 85' **SHALE:** BDX (SH), medium dark gray (N4), weathered, weak, thinly bedded, moderately fractured, moist to wet.	BDX (SH)									RUN #13: Modified RQD = (40/48) = 83%
			85	85' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		XCM01

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Arlen Little Cascade Drilling	9/23/2022	9/23/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
	Feet (NAVD88)	428.37 Feet (NAVD88)	6.0 inches

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

State Plane 557,812.47 N, 2,382,908.89 E E/W (W)

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

Lat 38° 11' 53.886"

Long -89° 51' 58.5841"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	120 54		0	0 - 1.6' **FILL, ASH (Coal):** SM, black (10YR 2/1), silt to sand-sized ash, organic material (5-10%), clay (5-10%), wet.	(FILL) SM									CS= Core Sample
			1.6	1.6 - 2.1' **FILL, SILTY CLAY:** CL/ML, olive gray (5Y 4/2), soft, medium plasticity, moist.	(FILL) CL/ML									
			2.1	2.1 - 5.3' **FILL, ASH (Coal):** SM, black (10YR 2/1), silt to sand-sized ash, clay (5-10%), wet.	(FILL) SM									
			5.3	5.3 - 10' **SILTY CLAY:** CL/ML, olive gray (5Y 4/2), very stiff, medium to high plasticity.	CL/ML									
			6						2.5					
			7	7' - 9' iron and manganese concretions (0-5%).					2.75					
			8						2.5					
			9	9' olive brown (2.5Y 4/3), soft.					0.5					
			10	10' End of Boring.										

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

Signature: [signature]

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

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Baldwin Power Plant		XCM01A	
Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Arlen Little Cascade Drilling	9/23/2022	9/23/2022	Sonic
Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
	Feet (NAVD88)	428.26 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 557,808.89 N, 2,382,911.27 E E/W(circled)
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 52.8506"
Long -89° 51' 58.5544"
Local Grid Location: Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	96 41			0 - 1.4' **FILL, SILTY CLAY:** CL/ML, gray (10YR 4/1), very soft, moist.	(FILL) CL/ML				0.25					CS= Core Sample
			1											
			2	1.4 - 3.5' **FILL, ASH (Coal):** SM, black (10YR 2/1), silt to sand-sized ash, wet.	(FILL) SM									
			3											
			4	3.5 - 7.6' **SILTY CLAY:** CL/ML, olive gray (5Y 4/2), medium to high plasticity, stiff to very stiff.					2.75					
			5						2					
			6	6 - 7.6' iron and manganese concretions (0-5%).	CL/ML				1.75					
			7						0.5					
			8	7.6 - 8' **SANDY LEAN CLAY:** s(CL), reddish brown (2.5YR 4/3), medium to low plasticity, soft, moist.	s(CL)									
				8' End of Boring.										

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

Signature: [signature]

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		XCM02

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Blake Weller Cascade Drilling	9/23/2022	9/23/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
	Feet (NAVD88)	432.93 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 557,360.10 N, 2,382,735.40 E E/(W)
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 49.4195"
Long -89° 52' 0.7758"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	120 / 70		0–1.9	0 - 1.9' **FILL, ASH (Coal):** SM, black (10YR 2/1), silt to sand-sized ash, dry to moist.	(FILL) SM									CS= Core Sample
			1.9–3.2	1.9 - 3.2' **FILL, ASH (Coal):** (SP)g, light yellowish brown (10YR 6/4), fine sand-sized ash, dry.	(FILL) (SP)g									
			3.2–9.2	3.2 - 9.2' **FILL, ASH (Coal):** SM, very dark gray (10YR 3/1) to very dark brown (10YR 2/2), silt to sand-sized ash, moist to dry.	(FILL) SM									
			9.2–10.2	9.2 - 10.2' **FILL, ASH (Coal):** SM, black (10YR 2/1), silt to sand-sized ash, wet.	(FILL) SM									
2 CS	60 / 43		10.2–12	10.2 - 15' **SILTY CLAY:** CL/ML, light brownish gray (10YR 6/2), brownish yellow (10YR 6/8) to light gray (10YR 7/1) mottling (10%), medium to high plasticity, very stiff.	CL/ML									

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

Signature: [signature]

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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 14 15	10.2 - 15' **SILTY CLAY:** CL/ML, light brownish gray (10YR 6/2), brownish yellow (10YR 6/8) to light gray (10YR 7/1) mottling (10%), medium to high plasticity, very stiff. *(continued)*	CL/ML									
				15' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Baldwin Power Plant		XCM03	
Boring Drilled By: Name of crew chief (first, last) and Firm	**Date Drilling Started**	**Date Drilling Completed**	**Drilling Method**
Arlen Little Cascade Drilling	9/24/2022	9/24/2022	Sonic
Common Well Name	**Final Static Water Level**	**Surface Elevation**	**Borehole Diameter**
	Feet (NAVD88)	439.05 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 557,818.92 N, 2,384,677.67 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 53.8925"
Long -89° 51' 36.4258"
Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	120 101		0–2.5	0 - 2.5' **FILL, ASH (Coal):** SM, very dark gray (10YR 3/1), silt to sand-sized ash, moist.	(FILL) SM									CS= Core Sample
			2.5–4.8	2.5 - 4.8' **FILL, ASH (Coal):** SW-SM, black (10YR 2/1), silt to sand-sized ash, wet.	(FILL) SW-SM									
			4.8–10	4.8 - 10' **SILTY CLAY:** CL/ML, greenish gray (GLEY 1 6/2), medium to high plasticity, very stiff, moist.	CL/ML				2.5 (6) 2.5 (7) 3 (8) 4 (9)					
			10	10' End of Boring.										

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

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SOIL BORING LOG INFORMATION

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Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		XCM03A

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Arlen Little Cascade Drilling	9/24/2022	9/24/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
	Feet (NAVD88)	439.74 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 557,807.72 N, 2,384,670.88 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 53.782"
Long -89° 51' 36.5114"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	96 96		0–3.5	0 - 3.5' **FILL, ASH (Coal):** SM, very dark gray (10YR 3/1), silt to sand-sized ash, moist.	(FILL) SM									CS= Core Sample
			3.5–6	3.5 - 6' **FILL, ASH (Coal):** SW-SM, black (10YR 2/1), silt to sand-sized ash, wet.	(FILL) SW-SM									
			6–8	6 - 8' **SILTY CLAY:** CL/ML, greenish gray (GLEY 1 6/2), medium to high plasticity, very stiff, moist.	CL/ML				3.5 3.75					
			8	8' End of Boring.										

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

Signature: [signature]

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number	
Baldwin Power Plant		XCM04	
Boring Drilled By: Name of crew chief (first, last) and Firm	**Date Drilling Started**	**Date Drilling Completed**	**Drilling Method**
Blake Weller Cascade Drilling	9/8/2022	9/8/2022	Sonic
Common Well Name	**Final Static Water Level**	**Surface Elevation**	**Borehole Diameter**
	Feet (NAVD88)	431.82 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,142.18 N, 2,382,723.78 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 37.3797"
Long -89° 52' 0.9707"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	60 / 42		0	0 - 15' **FILL, SILTY CLAY:** CL/ML, brown (7.5YR 5/4), sand (0-5%), low to medium plasticity, cohesive.	(FILL) CL/ML									CS= Core Sample
			1						1					
			4						0.5					
2 CS	24 / 24		5											
3 CS	36 / 15		7											
4 CS	60 / 30		10											
			12											

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Boring Number XCM04

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
			13	0 - 15' **FILL, SILTY CLAY:** CL/ML, brown (7.5YR 5/4), sand (0-5%), low to medium plasticity, cohesive. *(continued)*	(FILL) CL/ML				2.75					
			14						3					
			15	15' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		XPW01

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Arlen Little Cascade Drilling	9/23/2022	9/23/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
XPW01	Feet (NAVD88)	435.12 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 557,530.38 N, 2,383,427.03 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 51.0807"
Long -89° 51' 52.1047"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	120 45			0 - 0.5' **FILL, ASH (Coal):** SM, black (10YR 2/1), silt to sand-sized ash, organic material (5-10%), loose, wet.	(FILL) SM									CS= Core Sample
			1	0.5 - 1.5' **FILL, SILTY CLAY:** CL/ML, medium to high plasticity, stiff.	(FILL) CL/ML				1					
			2	1.5 - 3.2' **FILL, ASH (Coal):** SM, black (10YR 2/1), silt to sand-sized ash, wet.	(FILL) SM									
			3	3.2 - 4.1' **FILL, SILTY CLAY:** CL/ML, gray (10YR 5/1), medium plasticity, soft, moist.	(FILL) CL/ML				0.5					
			4	4.1 - 11' **FILL, ASH (Coal):** SM, black (10YR 2/1), silt to sand-sized ash, wet. 5.4' very dark gray.	(FILL) SM									
			5											
			6											
			7											
			8											
			9											
2 CS	48 30		10											
			11	11 - 11.9' **FILL, ASH (Coal):** SW-SM, black (10YR 2/1), silt to sand-sized ash, wet.	(FILL) SW-SM									
			12											

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Boring Number XPW01

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	11.9 - 14' **SILTY CLAY:** CL/ML, dark grayish brown (10YR 4/2), yellowish brown to gray (10YR 5/1) mottling (10-20%), medium to high plasticity, very stiff, moist. *(continued)*	CL/ML				2.75 3					
			14	14' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		XPW02

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Arlen Little Cascade Drilling	9/24/2022	9/24/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
XPW02	Feet (NAVD88)	434.86 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 557,667.96 N, 2,384,171.76 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 52.4167"
Long -89° 51' 42.7697"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	120 120		0 - 9.5	0 - 9.5' **FILL, ASH (Coal):** SM, greenish black (GLEY 1 2.5/1), silt to sand-sized ash, gravel (0-5%), loose, moist.	(FILL) SM									CS=Core Sample
2 CS	48 48		9.5 - 11	9.5 - 11' **FILL, ASH (Coal):** SW-SM, reddish black (2.5YR 2.5/1), silt to sand-sized ash, silt (5-15%), moist to wet.	(FILL) SW-SM									
			11 - 14	11 - 14' **SILTY CLAY:** CL/ML, dark greenish gray (GLEY 1 4/1), medium to high plasticity, stiff to very stiff, moist.	CL/ML				1.25					

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Boring Number XPW02

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	11 - 14' **SILTY CLAY:** CL/ML, dark greenish gray (GLEY 1 4/1), medium to high plasticity, stiff to very stiff, moist. *(continued)* 13' yellowish brown (10YR 5/4).	CL/ML				2.5					
			14						2					
				14' End of Boring.										

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		XPW02B

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Arlen Little Cascade Drilling	9/24/2022	9/24/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
	Feet (NAVD88)	434.67 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 557,657.80 N, 2,384,171.29 E E/W (W circled)
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 52.3163"
Long -89° 51' 42.776"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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
			0–5	0 - 5' **FILL, ASH (Coal):** SM, XPW02B Blind Drilled to 7 feet below ground surface (ft bgs). See XPW02 Boring Log for Detailed Lithology.	(FILL) SM									
1 MC	24 24		5–7	5 - 7' **FILL, ASH (Coal):** SM.	(FILL) SM					14.3 8.3	26 24	16 9	9.6 9.1	MC=Modified California Sample
			7	7' End of Boring.										

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Signature: [signature]

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		XPW04

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Blake Weller Cascade Drilling	9/24/2022	9/24/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
XPW04	Feet (NAVD88)	430.59 Feet (NAVD88)	6.0 inches

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

State Plane 556,502.51 N, 2,383,618.45 E E/Ⓦ

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

Lat 38° 11' 40.9132"

Long -89° 51' 49.7489"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	120 85		0	0 - 6' **FILL, ASH (Coal):** SM, black (10YR 2/1) to very dark gray (10YR 3/1), silt to sand-sized ash, clay (5-15%), gravel (0-5%), wood (0-5%), moist.	(FILL) SM									CS=Core Sample
			6	6 - 16.5' **FILL, ASH (Coal):** SW, black (10YR 2/1), sand-sized ash, silt (10-20%), clay (0-5%), loose, wet.	(FILL) SW									
2 CS	60 60		10											

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

Signature: [signature]

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Boring Number XPW04

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	6 - 16.5' **FILL, ASH (Coal):** SW, black (10YR 2/1), sand-sized ash, silt (10-20%), clay (0-5%), loose, wet. *(continued)*										
			14		(FILL) SW									
3 CS	60 50.4		15	15' interbedded silty clay.										
			16											
			17	16.5 - 20' **SILTY CLAY:** CL/ML, greenish gray (GLEY 1 6/1), yellowish brown mottling (10%), sand (0-5%), medium to high plasticity, very stiff, moist.					2.75					
			18		CL/ML				3.25					
			19						3.5					
			20	20' End of Boring.										

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		XPW04A

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Blake Weller Cascade Drilling	9/25/2022	9/25/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
	Feet (NAVD88)	429.81 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,502.38 N, 2,383,607.29 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 40.9122"
Long -89° 51' 49.8886"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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
			0–6	0 - 6' **FILL, ASH (Coal):** SM, XPW04A Blind Drilled to 14.5 feet below ground surface (ft bgs). See XPW04 Boring Log for Detailed Lithology.	(FILL) SM									
			6–12	6 - 14.5' **FILL, ASH (Coal):** SW.	(FILL) SW									

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Signature	Firm	
[signature]	Ramboll 234 W Florida Street, 5th Floor, Milwaukee, WI 53204	Tel: (414)837-3607 Fax: (414)837-3608

Boring Number XPW04A

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
			13 14	6 - 14.5' **FILL, ASH (Coal):** SW. *(continued)*	(FILL) SW									
1 MC	24 24		15 16	14.5 - 16.5' **FILL, ASH (Coal):** SW.	(FILL) SW					10.7 8.8	27 25	15 9	3.4 2.9	MC=Modified California Sample
				16.5' End of Boring.										

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		XPW05

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Blake Weller Cascade Drilling	9/24/2022	9/24/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
XPW05	Feet (NAVD88)	434.12 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 557,062.95 N, 2,384,034.20 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 46.4401"
Long -89° 51' 44.5179"
Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	120 55		0–10	0 - 21.9' **ASH (Coal):** (SW)g, black (10YR 2/1) to very dark gray (10YR 3/1), sand-sized ash, silt (5-15%), clay (0-5%), organic material (0-5%), loose, moist.	(SW)g									
2 CS	120 88		10–12											

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, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

RAMBOLL

Boring Number XPW05

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
			13–21	0 - 21.9' **ASH (Coal):** (SW)g, black (10YR 2/1) to very dark gray (10YR 3/1), sand-sized ash, silt (5-15%), clay (0-5%), organic material (0-5%), loose, moist. *(continued)* 15' saturated.	(SW)g									
3 CS	120 120		22–24	21.9 - 24.5' **ASH (Coal):** ML, dark gray (10YR 4/1) to dark grayish brown (10YR 4/2), silt-sized ash, clay (5-15%), sand (0-5%), non-plastic, wet.	ML									
			25–28	24.5 - 28.2' **ASH (Coal):** (SW)g, black (10YR 2/1), sand-sized ash, silt (5-15%), loose, wet.	(SW)g									
			29–30	28.2 - 30' **SILTY CLAY:** CL/ML, gray (10YR 5/1), light yellowish brown (10YR 6/4) mottling, sand (0-5%), very stiff to hard, medium plasticity, moist.	CL/ML				3.5 4.5					
			30	30' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		XPW06

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Arlen Little Cascade Drilling	9/22/2022	9/22/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
XPW06	Feet (NAVD88)	418.06 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 557,323.97 N, 2,382,140.04 E E/W (W circled)
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 49.0814"
Long -89° 52' 8.2353"
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	72 / 72		0–5	0 - 5' **FILL, ASH (Coal):** SM, black (10YR 2/1) to very dark grayish brown (10YR 3/2), silt to sand-sized ash, angular gravel (5-15%), clay (5-15%), loose, moist.	(FILL) SM									CS=Core Sample
			5–5.4	5 - 5.4' **FILL, ASH (Coal):** CL/ML, dark greenish gray (GLEY 1 4/1), medium plasticity, soft.	(FILL) CL/ML									
2 CS	120 / 120		5.4–9.9	5.4 - 9.9' **FILL, ASH (Coal):** SM, black (10YR 2/1), silt to sand-sized ash, clay (5-15%), loose, moist. 7 - 9.9' interbedded silty clay.	(FILL) SM									
			9.9–12	9.9 - 16' **SILTY CLAY:** CL/ML, greenish gray (GLEY 1 6/1), sand (0-5%), organic material (0-5%), medium to high plasticity, very stiff, moist. 10.5' light olive brown (2.5Y 5/3), yellowish brown to reddish brown mottling (50%).	CL/ML									

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, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

Boring Number XPW06

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
			13	9.9 - 16' **SILTY CLAY:** CL/ML, greenish gray (GLEY 1 6/1), sand (0-5%), organic material (0-5%), medium to high plasticity, very stiff, moist. *(continued)*										
			14	13.7' dark greenish gray (GLEY 1 4/1), reddish brown mottling (10%).	CL/ML									
			15											
			16	16' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		XPW06A

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Arlen Little Cascade Drilling	9/22/2022	9/22/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
	Feet (NAVD88)	417.89 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 557,325.84 N, 2,382,148.08 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 49.0996"
Long -89° 52' 8.1345"

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

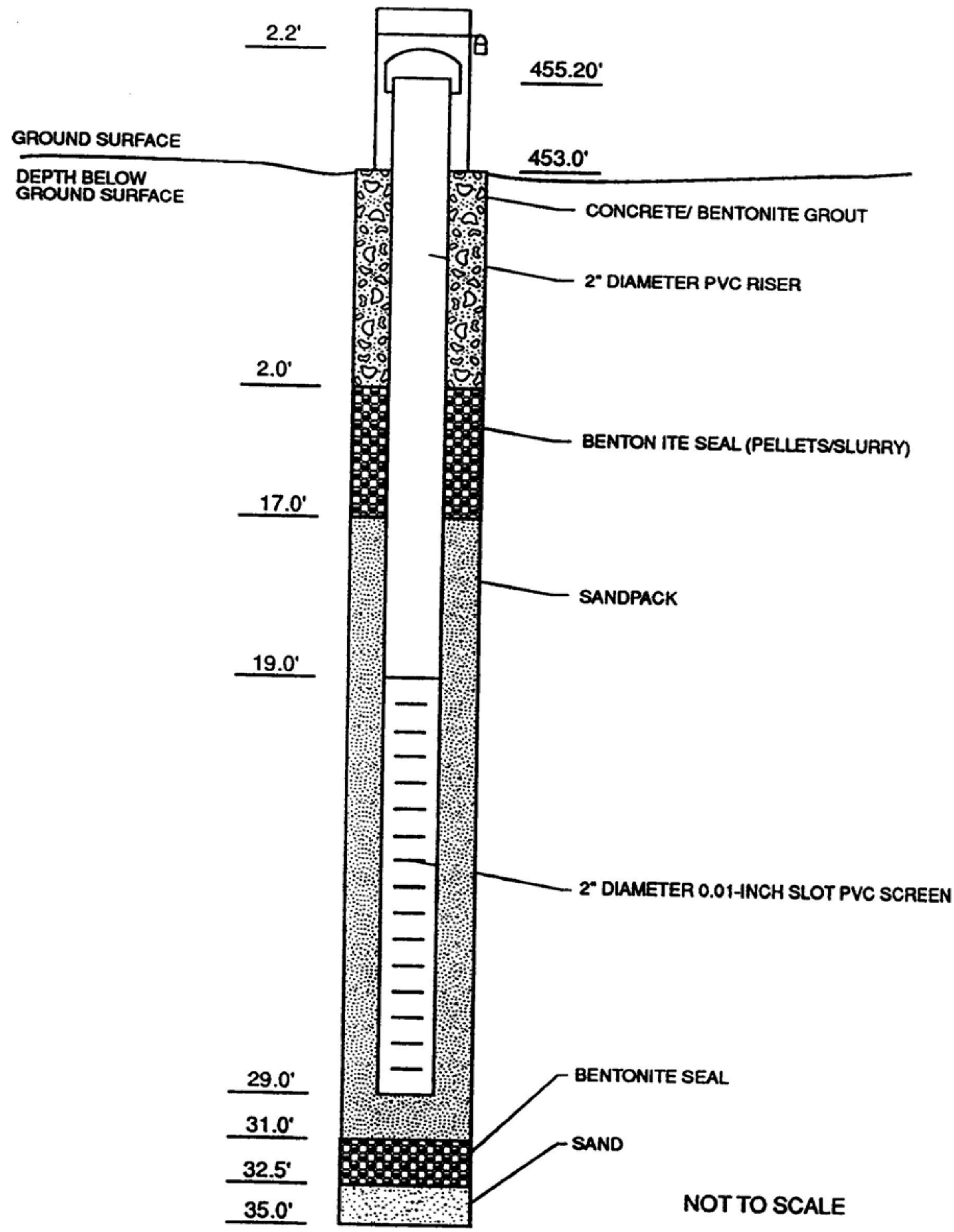
Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0–7	0 - 7' **FILL, ASH (Coal):** SM, XPW06A Blind Drilled to 7 feet below ground surface (ft bgs). See XPW06 Boring Log for Detailed Lithology.	(FILL) SM									
1 MC	24 24		7–9	7 - 9' **FILL, ASH (Coal):** SM.	(FILL) SM					17.7	19	6	29.8	MC=Modified California Sample
										15.1	19	5	47.2	
			9	9' End of Boring.										

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, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608



PROJECT MANAGER

PROJECT MANAGER

CHECKED BY

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MB REV. DATE 1/29/92

NOT TO SCALE

Burlington Environmental Inc.	
BAMW -104D MONITORING WELL CONSTRUCTION DIAGRAM	
BALDWIN FGD SOLID WASTE MANAGEMENT FACILITY 123558	BAMW-104D

KELRON ENVIRONMENTAL
INCORPORATED

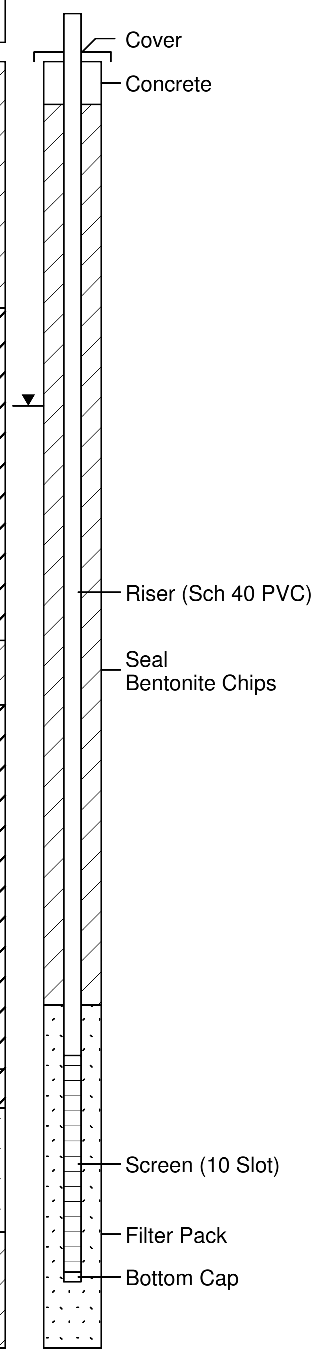
LOG OF BORING MW-104DR

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SE, SE

Date Completed	: 07/25/11	Driller	: Matt Cooper
Hole Diameter	: 7 3/4"OD; 3 3/4" ID	Geologist	: Stu Cravens (Kelron)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 452.62
Sampling Method	: MacroCore (60")	Top of Casing Elevation	455.62
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2386609, 554201

Depth in Feet	DESCRIPTION	Surf. Elev. 452.62	Samples	Recovery inches	Qp TSF	USCS
0	SILTY CLAY, trace sand, med plasticity, organics and roots, dry hard, light gray (Gley1-7/1) with brown mottling (Fe-oxidation) (10YR 3/1), dry		1		>4.5	
			2		>4.5	
	- moist	450	3	60/60	3.5	CL
			4		2.5	
5			5		2.5	
			6		2.5	
	CLAY (Fat) with Silt, high plasticity, soft to very soft, high organics and roots, dark gray grading to gray with brown mottling, moist		7		2.5	
	- groundwater level at completion = 8.03' bls	445	8	60/60	1	
			9		1	
10	- medium hardness		10		1	CH
			11		1.75	
	- light gray (GLEY1-7/1) with yellow-brown Fe-oxid mottling (10%)		12		2.25	
		440	13	60/60	2.25	
	CLAY (lean) with Silt, medium plasticity, light gray with yellow-brown mottling (10%)		14		3.0	
15			15		2.5	CL
	CLAY with Silt, trace sand and fine gravel, high plasticity, medium to stiff, light gray with brown mottling (20%)		16		3.75	
			17		2.75	
		435	18	60/60	3.5	
			19		3.5	
20	- trace sand and gravel, medium to high plasticity, medium to stiff hardness, mottling 25 to 50%		20		3	CH
			21		3	
			22		2.5	
		430	23	60/60	2.5	
	SANDY FAT CLAY, fine sand, trace fine gravel, high plasticity, greenish gray (GLEY-6/1), moist		24		2.5	CH
25	SAND (fine to medium), trace gravel, poorly graded, light gray, wet		25		2.5	
	- brown (Slotted screen interval = 4.52 ft)		26			SP
			27		2.5	
	SILTY CLAY, trace sand and gravel (angular), medium plasticity, very stiff, olive brown (2.5Y 4/4) with light gray mottling <20%, moist (TILL)	425	28	60/60		
			29		4.0	CL
30			30		4.5	

Well: MW-104DR
Elev.: 455.62



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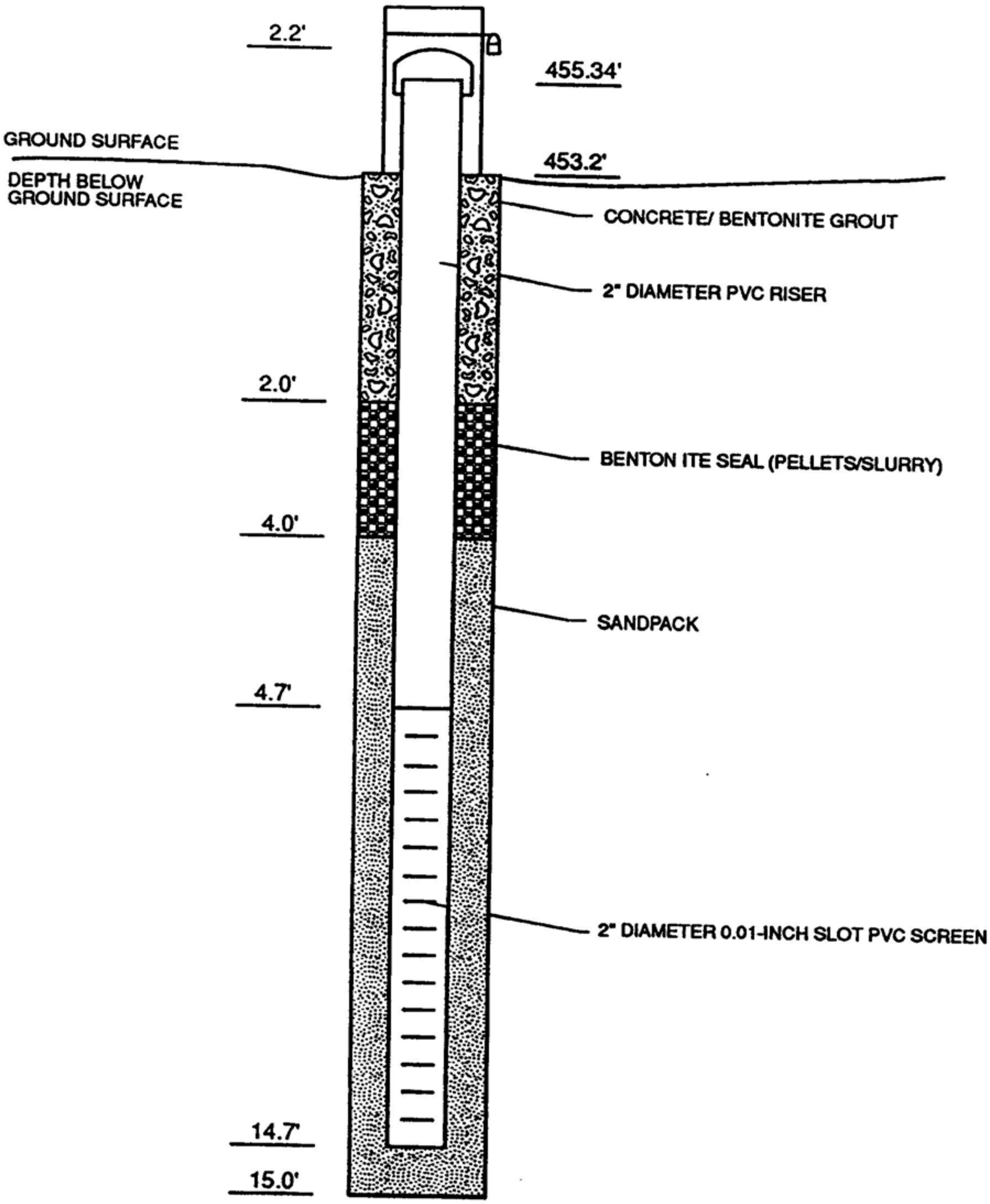
KELRON ENVIRONMENTAL INCORPORATED	LOG OF BORING MW-104DR

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SE, SE

Date Completed	: 07/25/11	Driller	: Matt Cooper
Hole Diameter	: 7 3/4"OD; 3 3/4" ID	Geologist	: Stu Cravens (Kelron)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 452.62
Sampling Method	: MacroCore (60")	Top of Casing Elevation	455.62
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2386609, 554201

Well: MW-104DR
Elev.: 455.62

Depth in Feet	DESCRIPTION	Surf. Elev. 452.62	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
30	SHALE, highly weathered; Clay with Silt, platy /laminated, medium to high plasticity, very stiff, moist		31		3.0	~~CL~~	
			32				
		420	33	60/60		SH	
			34		3.5		
	- unweathered, light gray, fissile, dry		35				
35	END BOREHOLE AT 35 FEET BLS						
		415					
40							
		410					
45							
		405					
50							
		400					
55							
		395					
60							



NOT TO SCALE

Burlington Environmental Inc.	
BAMW -104S MONITORING WELL CONSTRUCTION DIAGRAM	
BALDWIN FGD SOLID WASTE MANAGEMENT FACILITY 123558	BAMW-104S

PROJECT MANAGER

PROJECT MANAGER

CHECKED BY

DRAWN BY

MA
REV. DATE
1/28/02

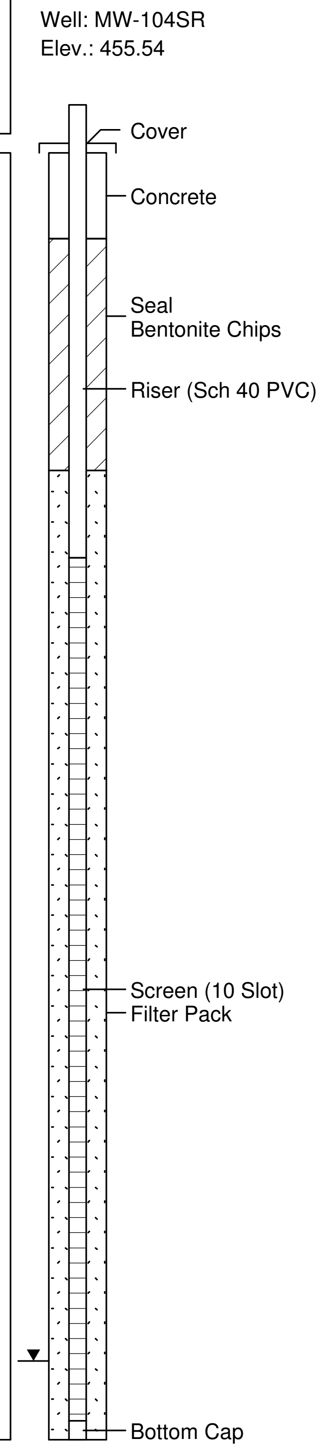
KELRON
ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-104SR

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SE, SE

Date Completed	: 07/26/11	Driller	: Matt Cooper
Hole Diameter	: 7 3/4"OD; 3 3/4" ID	Geologist	: Stu Cravens (Kelron)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 452.52
Sampling Method	: MacroCore (60")	Top of Casing Elevation	455.54
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2386609, 554205

Depth in Feet	DESCRIPTION	Surf. Elev. 452.52	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring - no soil sampling conducted Refer to boring log for adjacent nested well MW-104DR for a descriptionof subsurface materials						
		450					
5							
		445					
10	(Slotted screen interval = 9.40 ft)						
		440					
	- groundwater level at completion = 14.06' bls						
15	END BOREHOLE AT 15 FEET BLS						



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KELRON ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-104DR

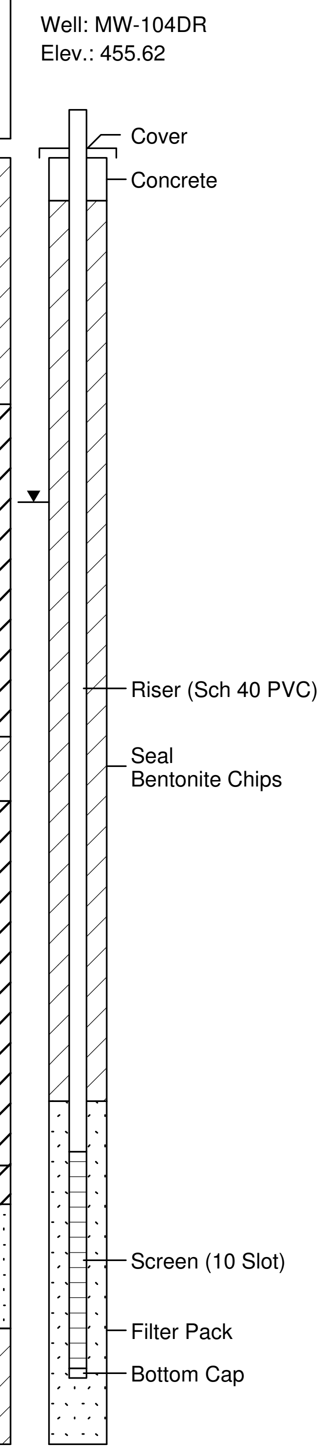
Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SE, SE

Date Completed	: 07/25/11	Driller	: Matt Cooper
Hole Diameter	: 7 3/4"OD; 3 3/4" ID	Geologist	: Stu Cravens (Kelron)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 452.62
Sampling Method	: MacroCore (60")	Top of Casing Elevation	455.62
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2386609, 554201

Depth in Feet (0–30); Surf. Elev. 452.62 (450, 445, 440, 435, 430, 425)

DESCRIPTION	USCS
SILTY CLAY, trace sand, med plasticity, organics and roots, dry hard, light gray (Gley1-7/1) with brown mottling (Fe-oxidation) (10YR 3/1), dry - moist	CL
CLAY (Fat) with Silt, high plasticity, soft to very soft, high organics and roots, dark gray grading to gray with brown mottling, moist - groundwater level at completion = 8.03' bls - medium hardness - light gray (GLEY1-7/1) with yellow-brown Fe-oxid mottling (10%)	CH
CLAY (lean) with Silt, medium plasticity, light gray with yellow-brown mottling (10%)	CL
CLAY with Silt, trace sand and fine gravel, high plasticity, medium to stiff, light gray with brown mottling (20%) - trace sand and gravel, medium to high plasticity, medium to stiff hardness, mottling 25 to 50%	CH
SANDY FAT CLAY, fine sand, trace fine gravel, high plasticity, greenish gray (GLEY-6/1), moist	CH
SAND (fine to medium), trace gravel, poorly graded, light gray, wet - brown (Slotted screen interval = 4.52 ft)	SP
SILTY CLAY, trace sand and gravel (angular), medium plasticity, very stiff, olive brown (2.5Y 4/4) with light gray mottling <20%, moist (TILL)	CL

Samples	Recovery inches	Qp TSF
1		>4.5
2		>4.5
3	60/60	3.5
4		2.5
5		2.5
6		2.5
7		2.5
8	60/60	1
9		1
10		1
11		1.75
12		2.25
13	60/60	2.25
14		3.0
15		2.5
16		3.75
17		2.75
18	60/60	3.5
19		3.5
20		3
21		3
22		2.5
23	60/60	2.5
24		2.5
25		2.5
26		
27		2.5
28	60/60	
29		4.0
30		4.5



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KELRON ENVIRONMENTAL
INCORPORATED

LOG OF BORING MW-104DR

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SE, SE

Date Completed	: 07/25/11	Driller	: Matt Cooper
Hole Diameter	: 7 3/4"OD; 3 3/4" ID	Geologist	: Stu Cravens (Kelron)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 452.62
Sampling Method	: MacroCore (60")	Top of Casing Elevation	455.62
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2386609, 554201

Well: MW-104DR
Elev.: 455.62

Depth in Feet	DESCRIPTION	Surf. Elev. 452.62	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
30	SHALE, highly weathered; Clay with Silt, platy /laminated, medium to high plasticity, very stiff, moist		31		3.0	~~CL~~	
			32				
		420	33	60/60		SH	
			34		3.5		
	- unweathered, light gray, fissile, dry		35				
35	END BOREHOLE AT 35 FEET BLS						
		415					
40							
		410					
45							
		405					
50							
		400					
55							
		395					
60							

Illinois Environmental Protection Agency

Well Completion Report

Incident No.: None

Site Name: Dynegy-Baldwin Energy Complex

Drilling Contractor: Terra Drill

Driller: Matt Cooper

Drilling Method: Hollow-Stem Auger

Well No.: MW-150

Date Drilled Start: 09/08/10

Date Completed: 09/08/10

Geologist: Brendon Wilder

Drilling Fluids (Type): None

Annular Space Details

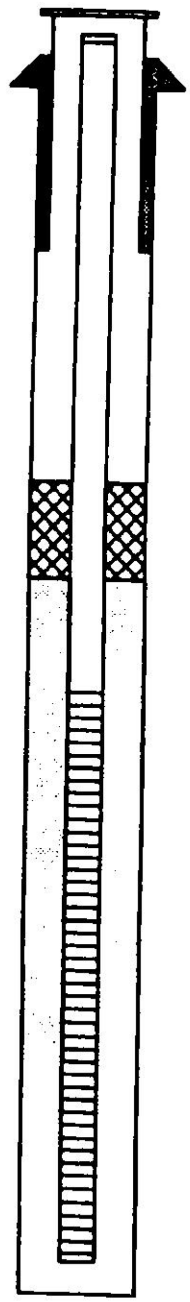
Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite Chips

Type of Bentonite Seal (Granular, Pellet): Bentonite Chips (hydrated)

Type of Sand Pack: Clean Silica Sand

Elevations - .01 ft.



____	Top of Protective Casing
396.54	Top of Riser Pipe
393.84	Ground Surface
392.84	Top of Annular sealant
____	Casing Stickup
383.34	Top of Seal
3.00	Total Seal Interval
380.34	Top of Sand
378.82	Top of Screen
9.25	Total Screen Interval
369.18	Bottom of Screen
368.67	Bottom of Borehole

Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			
Riser pipe above w.t.		Sch. 40	
Riser Pipe below w.t.		Sch. 40	
Screen		Sch. 40	
Coupling joint screen to riser			
Protective casing			

Measurements

to .01 ft (where applicable)

Riser Pipe Length	17.72
Screen Length	9.64
Screen Slot Size	0.01
Protective casing length	
Depth to water	19.58
Elevation of water	376.96
Free Product thickness	
Gallons removed (develop)	4.05
Gallons removed (purge)	
Other	

Completed by: PSC Industrial Outsourcing, LP

Illinois Environmental Protection Agency

Well Completion Report

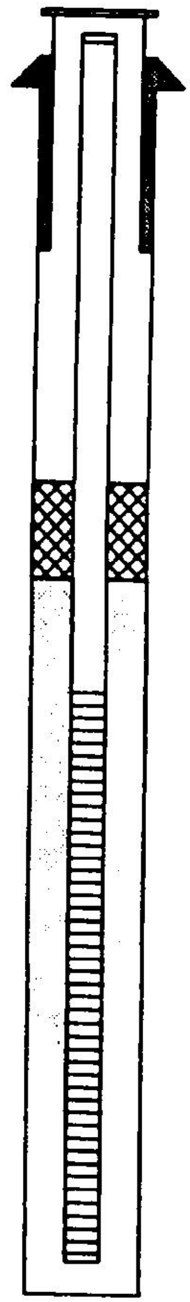
Incident No.: None
Site Name: Dynegy-Baldwin Energy Complex
Drilling Contractor: Terra Drill
Driller: Matt Cooper
Drilling Method: Hollow-Stem Auger

Well No.: MW-151
Date Drilled Start: 09/21/10
Date Completed: 09/21/10
Geologist: Brendon Wilder
Drilling Fluids (Type): None

Annular Space Details

Type of Surface Seal: Concrete
Type of Annular Sealant: Bentonite Chips
Type of Bentonite Seal (Granular, Pellet): Bentonite Chips (hydrated)
Type of Sand Pack: Clean Silica Sand

Elevations - .01 ft.



- ____ Top of Protective Casing
- 399.96 Top of Riser Pipe
- 397.22 Ground Surface
- 396.22 Top of Annular sealant
- ____ Casing Stickup
- 394.22 Top of Seal
- 2.00 Total Seal Interval
- 392.22 Top of Sand
- 391.08 Top of Screen
- 9.64 Total Screen Interval
- 381.44 Bottom of Screen
- 375.72 Bottom of Borehole

Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			
Riser pipe above w.t.		Sch. 40	
Riser Pipe below w.t.		Sch. 40	
Screen		Sch. 40	
Coupling joint screen to riser			
Protective casing			

Measurements

to .01 ft (where applicable)

Riser Pipe Length	8.88
Screen Length	9.25
Screen Slot Size	0.01
Protective casing length	
Depth to water	3.32
Elevation of water	396.64
Free Product thickness	
Gallons removed (develop)	7.70
Gallons removed (purge)	
Other	

Completed by: PSC Industrial Outsourcing, LP

Illinois Environmental Protection Agency

Well Completion Report

Incident No.: None
Site Name: Dynegy-Baldwin Energy Complex
Drilling Contractor: Terra Drill
Driller: Matt Cooper
Drilling Method: Hollow-Stem Auger

Well No.: MW-152
Date Drilled Start: 09/23/10
Date Completed: 09/23/10
Geologist: Brendon Wilder
Drilling Fluids (Type): None

Annular Space Details

Type of Surface Seal: Concrete
Type of Annular Sealant: Bentonite Chips
Type of Bentonite Seal (Granular, Pellet): Bentonite Chips (hydrated)
Type of Sand Pack: Clean Silica Sand

Well Construction Materials

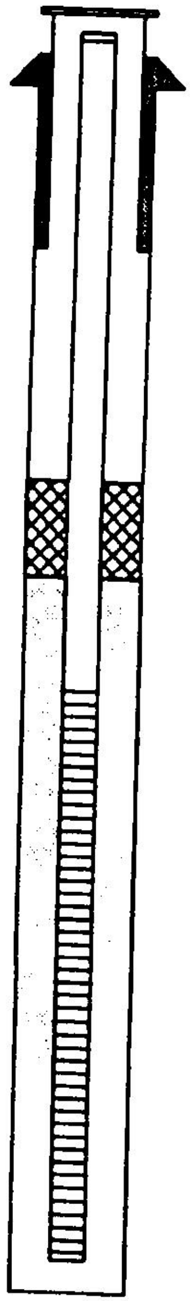
	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			
Riser pipe above w.t.		Sch. 40	
Riser Pipe below w.t.		Sch. 40	
Screen		Sch. 40	
Coupling joint screen to riser			
Protective casing			

Measurements

to .01 ft (where applicable)

Riser Pipe Length	9.88
Screen Length	9.25
Screen Slot Size	0.01
Protective casing length	
Depth to water	7.35
Elevation of water	417.64
Free Product thickness	
Gallons removed (develop)	6.20
Gallons removed (purge)	
Other	

Completed by: PSC Industrial Outsourcing, LP



Elevations - .01 ft.

____	Top of Protective Casing
424.99	Top of Riser Pipe
422.18	Ground Surface
421.18	Top of Annular sealant
____	Casing Stickup
418.68	Top of Seal
2.00	Total Seal Interval
416.68	Top of Sand
415.11	Top of Screen
9.64	Total Screen Interval
405.47	Bottom of Screen
404.48	Bottom of Borehole

Illinois Environmental Protection Agency

Well Completion Report

Incident No.: None
Site Name: Dynegy-Baldwin Energy Complex
Drilling Contractor: Terra Drill
Driller: Matt Cooper
Drilling Method: Hollow-Stem Auger

Well No.: MW-153
Date Drilled Start: 09/21/10
Date Completed: 09/21/10
Geologist: Brendon Wilder
Drilling Fluids (Type): None

Annular Space Details

Type of Surface Seal: Concrete
Type of Annular Sealant: Bentonite Chips
Type of Bentonite Seal (Granular, Pellet): ______
Bentonite Chips (hydrated)
Type of Sand Pack: Clean Silica Sand

Well Construction Materials

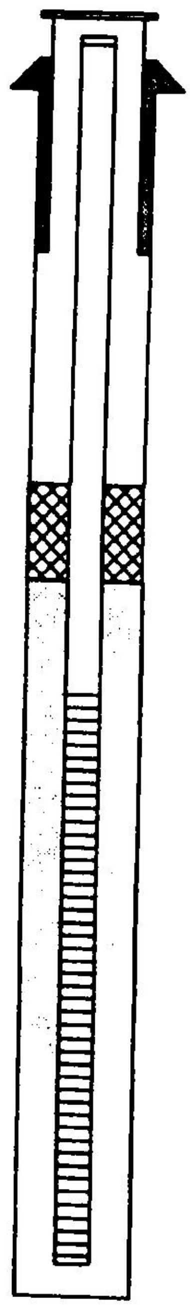
	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			
Riser pipe above w.t.		Sch. 40	
Riser Pipe below w.t.		Sch. 40	
Screen		Sch. 40	
Coupling joint screen to riser			
Protective casing			

Measurements

to .01 ft (where applicable)

Riser Pipe Length	13.25
Screen Length	9.25
Screen Slot Size	0.01
Protective casing length	
Depth to water	16.38
Elevation of water	429.29
Free Product thickness	
Gallons removed (develop)	3.44
Gallons removed (purge)	
Other	

Completed by: PSC Industrial Outsourcing, LP



Elevations - .01 ft.

____	Top of Protective Casing
445.67	Top of Riser Pipe
442.77	Ground Surface
441.77	Top of Annular sealant
____	Casing Stickup
436.07	Top of Seal
2.00	Total Seal Interval
434.07	Top of Sand
432.42	Top of Screen
9.64	Total Screen Interval
422.78	Bottom of Screen
422.27	Bottom of Borehole

Illinois Environmental Protection Agency

Well Completion Report

Incident No.: None
Site Name: Dynegy-Baldwin Energy Complex
Drilling Contractor: Terra Drill
Driller: Matt Cooper
Drilling Method: Hollow-Stem Auger

Well No.: MW-154
Date Drilled Start: 09/20/10
Date Completed: 09/20/10
Geologist: Brendon Wilder
Drilling Fluids (Type): None

Annular Space Details

Type of Surface Seal: Concrete
Type of Annular Sealant: Bentonite Chips
Type of Bentonite Seal (Granular, Pellet): Bentonite Chips (hydrated)
Type of Sand Pack: Clean Silica Sand

Well Construction Materials

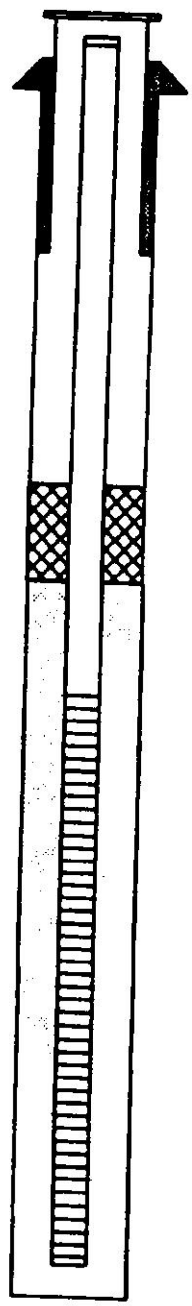
	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			
Riser pipe above w.t.		Sch. 40	
Riser Pipe below w.t.		Sch. 40	
Screen		Sch. 40	
Coupling joint screen to riser			
Protective casing			

Measurements

to .01 ft (where applicable)

Riser Pipe Length	10.30
Screen Length	4.63
Screen Slot Size	0.01
Protective casing length	
Depth to water	15.00
Elevation of water	372.76
Free Product thickness	
Gallons removed (develop)	0.00
Gallons removed (purge)	
Other	

Completed by: PSC Industrial Outsourcing, LP



Elevations - .01 ft.

____ Top of Protective Casing
387.76 Top of Riser Pipe
384.99 Ground Surface
383.99 Top of Annular sealant
____ Casing Stickup

380.49 Top of Seal
2.10 Total Seal Interval
378.39 Top of Sand
377.47 Top of Screen
4.63 Total Screen Interval
372.84 Bottom of Screen
372.24 Bottom of Borehole

Illinois Environmental Protection Agency

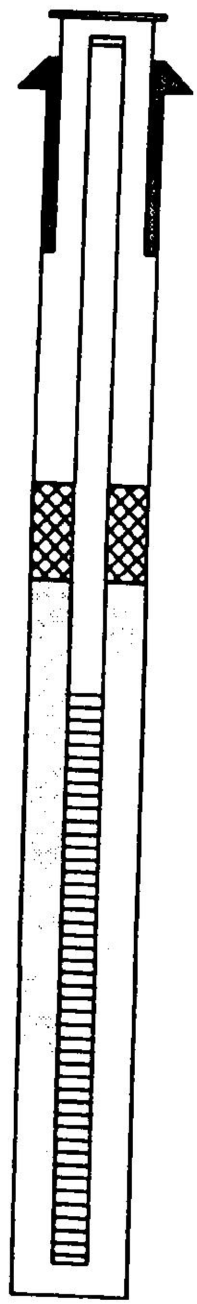
Well Completion Report

Incident No.: None
Site Name: Dynegy-Baldwin Energy Complex
Drilling Contractor: Terra Drill
Driller: Matt Cooper
Drilling Method: Hollow-Stem Auger

Well No.: MW-155
Date Drilled Start: 09/10/10
Date Completed: 09/10/10
Geologist: Brendon Wilder
Drilling Fluids (Type): None

Annular Space Details

Type of Surface Seal: Concrete
Type of Annular Sealant: Bentonite Chips
Type of Bentonite Seal (Granular, Pellet): Bentonite Chips (hydrated)
Type of Sand Pack: Clean Silica Sand



Elevations - .01 ft.

_____ Top of Protective Casing
393.55 Top of Riser Pipe
390.62 Ground Surface
389.62 Top of Annular sealant
_____ Casing Stickup

383.92 Top of Seal
2.00 Total Seal Interval
381.92 Top of Sand
380.32 Top of Screen
9.64 Total Screen Interval
370.68 Bottom of Screen
370.17 Bottom of Borehole

Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			
Riser pipe above w.t.		Sch. 40	
Riser Pipe below w.t.		Sch. 40	
Screen		Sch. 40	
Coupling joint screen to riser			
Protective casing			

Measurements

to .01 ft (where applicable)

Riser Pipe Length	13.23
Screen Length	9.25
Screen Slot Size	0.01
Protective casing length	
Depth to water	20.07
Elevation of water	372.85
Free Product thickness	
Gallons removed (develop)	1.31
Gallons removed (purge)	
Other	

Completed by: PSC Industrial Outsourcing, LP

KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE MW-161

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

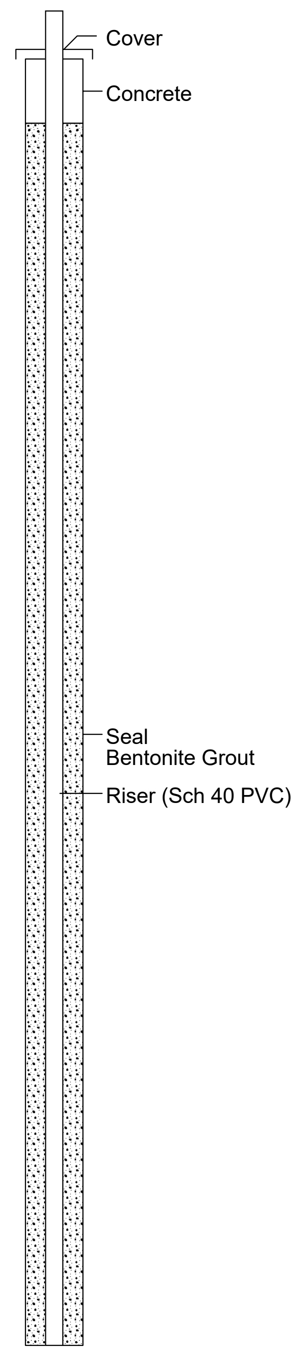
Date Completed	: 08/21/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 428.74
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.27
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379206, 557078

Depth in Feet	DESCRIPTION	USCS
0	FILL - Silt with clay, organics (roots), stiff, non-plastic, light yellowish brown (10YR 6/4), dry	FL/CL
	SILT with clay, roots, hard, brownish yellow (10YR 6/6)	ML
5	Silty CLAY with roots, very stiff, medium plasticity, with reddish-brown mottling and manganese staining, moist - medium hardness, medium to high plasticity, light brownish gray (10YR 6/2) with mottling and manganese staining	CL
	SILT, stiff, non-plastic, brownish yellow (10YR 6/6) - with clay, very soft, medium plasticity, wet	ML
10	Silty CLAY, stiff to very stiff, high plasticity, light brownish gray (10YR 6/2) with reddish brown and black mottling grading to light gray, moist	CL
	SILT, very soft, non-plastic, light brownish gray (10YR 6/2) - wet	ML
15	Silty CLAY, stiff, medium plasticity, gray (10YR 6/1), moist - soft to medium hardness, high plasticity, yellowish brown (10YR 5/6) - <25% mottling	CL
20		

Surf. Elev. 428.74 (elevation marks: 425, 420, 415, 410)

Samples	Recovery inches	Qp TSF
1	38/42	2.75
2		>4.5
3		3.0
4	60/60	2.0
5		2.0
6		2.25
7		2.5
8		1.75
9	60/60	1.0
10		2.5
11		1.0
12		0.75
13		2.0
14	60/60	1.5
15		1.25
16		1.5
17		1.25
18		2.25
19	60/60	2.0
20		1.0

Well: MW-161
Elev.: 431.27



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KELRON ENVIRONMENTAL
Incorporated

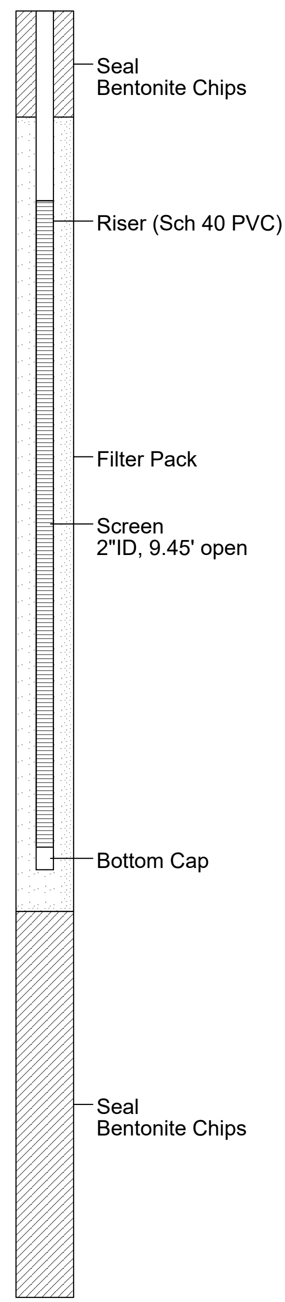
LOG OF PROBEHOLE MW-161

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/21/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 428.74
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.27
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379206, 557078

Depth in Feet	DESCRIPTION	Surf. Elev. 428.74	Samples	Recovery inches	Qp TSF	USCS
20			20		1.0	CL
	SILT with clay, stiff, low plasticity, brownish yellow (10YR 6/8)		21		2.0	ML
	- soft, yellowish brown (10YR 5/4), wet		22		2.0	
	Silty CLAY, stiff, low to medium plasticity, pale brown (10YR 6/3) with reddish-brown mottling, moist		23		1.0	CL
	- soft to very soft, high plasticity, light yellowish brown - brown (10YR 5/3) with <10% reddish brown mottling	405	24	60/60	0.75	
25			25			
			26			
	- with fine sand		27		1.0	
			28			
	SAND with Silt, fine grained, gray-brown, wet	400	29	53/60		SP/SM
30			30			
	<Sample MC161-32 @ 31.5-32.5'> grain size analysis: 89.8% Sand, 10.2% Silt		31			
	- pale green (Gley1 5G 6/2)		32			
	CLAY (lean), trace fine-medium sand, hard, low plasticity, greenish-gray (10GY 5/1), moist [TILL]		33		3.0	CL
	- medium to stiff, medium to high plasticity	395	34	60/60	2.5	
35			35		1.25	
			36		1.5	
			37		1.75	
			38		3.0	
	- trace sand, stiff to hard	390	39	44/60	2.0	
40			40		1.5	

Well: MW-161
Elev.: 431.27



KELRON ENVIRONMENTAL
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LOG OF PROBEHOLE MW-161

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/21/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 428.74
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.27
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379206, 557078

Well: MW-161
Elev.: 431.27

Depth in Feet	DESCRIPTION	Surf. Elev. 428.74	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
40			40		1.5	CL	
			41		2.0	CL	
			42		1.5	CL	
	Sandy SILT, medium hardness, non-plastic					ML	
	Silty CLAY with shale and fine-coarse limestone gravel (rounded to sub-rounded up to 1.5"), stiff to very stiff, greenish gray (Gley1 10Y 5/1)	385	43		2.0	CL	
			44	14/14	>4.5	CL	
	SHALE, laminated, hard, weathered (top of bedrock = 44.3' bls)					SH	
45	END BOREHOLE AT 44.7 FEET BLS Refusal of Macrocore and Auger on top of competent bedrock						
		380					
50							
		375					
55							
		370					
60							

Seal
Bentonite Chips

KELRON ENVIRONMENTAL
Incorporated

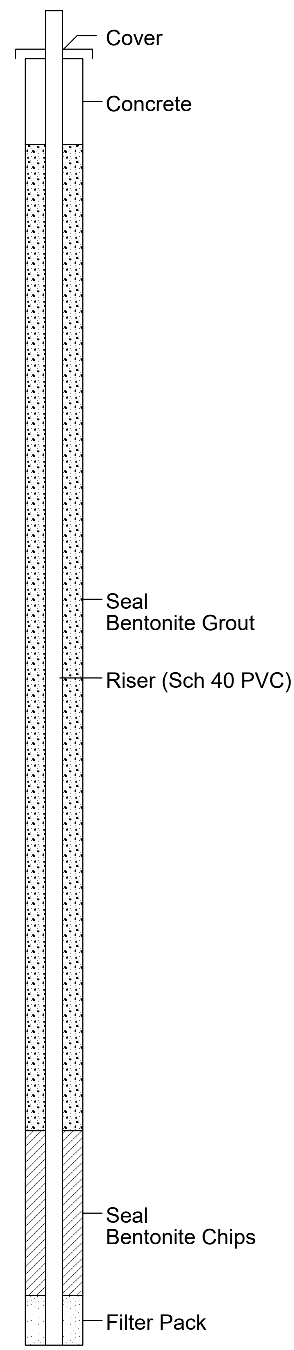
LOG OF PROBEHOLE MW-162

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/20/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.83
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.20
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555725

Depth in Feet	DESCRIPTION	Surf. Elev. 430.83	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continous Boring - no soil sampling conducted. Descriptions of subsurface materials on this log are from adjacent boring log for well MW-262.						
	Silty Clay with gravel, roots, stiff, non-plastic, pale brown (10YR 6/3), dry	430				CL	
	- brownish yellow (10YR 6/6), moist						
5	- medium stiff, high plasticity	425					
	SILT, very soft, non-plastic, light yellowish brown (10YR 6/4), moist [LOESS]					ML	
10	- clayey, soft to medium hardness, low to medium plasticity	420					
	- soft, yellowish brown (10YR 5/4)						
	- non-plastic						
15							

Well: MW-162
Elev.: 433.20



KELRON ENVIRONMENTAL
Incorporated

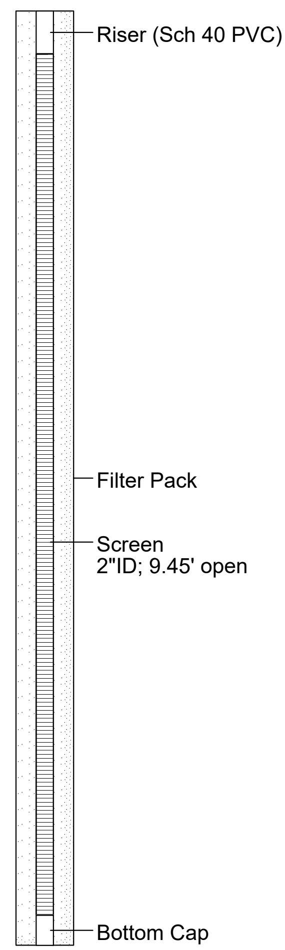
LOG OF PROBEHOLE MW-162

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/20/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.83
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.20
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555725

Well: MW-162
Elev.: 433.20

Depth in Feet	DESCRIPTION	Surf. Elev. 430.83	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
15		415				ML	
	Sandy CLAY (lean), medium hardness, low to medium plasticity, yellowish brown, moist					CL	
	SILT, very soft, non-plastic, brownish yellow (10YR 6/6), moist					ML	
20		410					
	Silty CLAY, very soft, low plasticity - medium plasticity, wet					CL	
25		405					
	END BOREHOLE AT 25.9 feet BLS						
30							



KELRON ENVIRONMENTAL
Incorporated

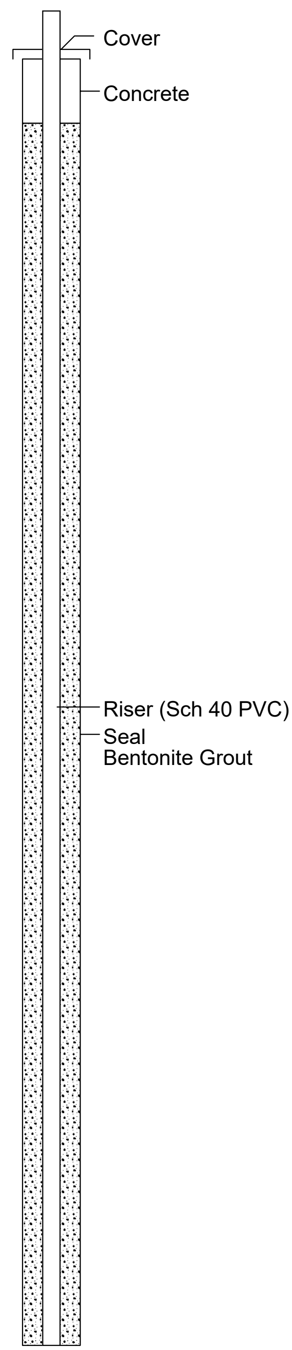
LOG OF PROBEHOLE MW-262

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.86
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.21
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555729

Depth in Feet	DESCRIPTION	Surf. Elev. 430.86	Samples	Recovery inches	Qp TSF	USCS
0	Silty Clay with gravel, roots, stiff, non-plastic, pale brown (10YR 6/3), dry	430	1	60/60	2.5	CL
			2		>4.5	
	- brownish yellow (10YR 6/6), moist		3		3.25	
			4		2.5	
			5		2.25	
5	- medium stiff, high plasticity	425	6	42/42	1.5	
			7		1.75	
			8		2.0	
	SILT, very soft, non-plastic, light yellowish brown (10YR 6/4), moist [LOESS]		9	60/60	1.0	ML
10	- clayey, soft to medium hardness, low to medium plasticity		10		1.5	
		420	11		1.25	
			12		1.5	
			13		1.5	
	- soft, yellowish brown (10YR 5/4)		14	60/60	1.0	
15	- non-plastic		15		1.25	
		415	16		1.25	
			17		1.5	
	Sandy CLAY (lean), medium hardness, low to medium plasticity, yellowish brown, moist		18		2.0	CL
	SILT, very soft, non-plastic, brownish yellow (10YR 6/6), moist		19	60/60	2.0	ML
20			20			

Well: MW-262
Elev.: 433.21



KELRON ENVIRONMENTAL
Incorporated

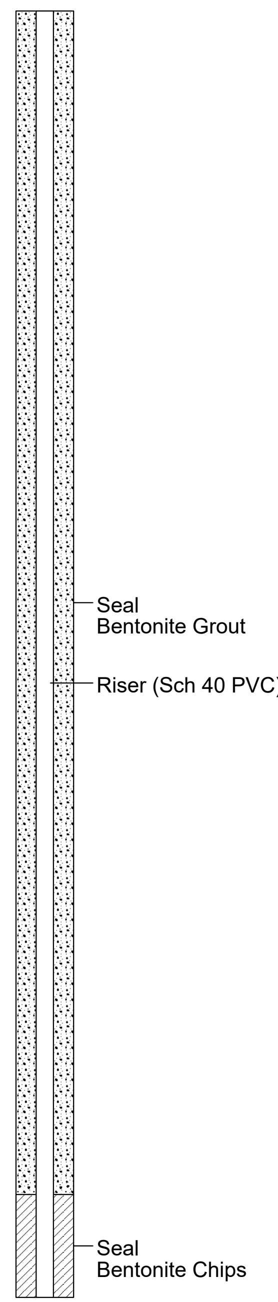
LOG OF PROBEHOLE MW-262

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.86
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.21
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555729

Depth in Feet	DESCRIPTION	Surf. Elev. 430.86	Samples	Recovery inches	Qp TSF	USCS
20			20			ML
		410	21			ML
			22			ML
	Silty CLAY, very soft, low plasticity		23		0.75	CL
	- medium plasticity, wet		24	60/60	0.75	CL
25			25		0.75	CL
	- high plasticity, yellowish brown (10YR 5/4)	405	26		0.75	CL
	- moist		27		0.5	CL
			28		1.25	CL
			29	53/60	1.0	CL
30	- with fine sand		30		0.75	CL
		400	31			CL
	SAND, fine to medium grained, with clay, yellowish brown (10YR 5/6), wet - light brownish gray		32			SW/SC
	CLAY (fat), trace fine to medium sand, high plasticity, light brownish gray <Sample ST262-35 @ 33.5 - 35.5'> grain size analysis: 13.1% Sand, 33.2% Silt, 53.7% Clay		33			CH
			34	24/24		CH
35			35			CH
	- very stiff, greenish gray (Gley1 10Y 6/1)	395	36	16/36	2.75	CH
			37			CH
	- medium plasticity		38		2.75	CH
			39	56/60	1.0	CH
40			40		0.75	CH

Well: MW-262
Elev.: 433.21



KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE MW-262

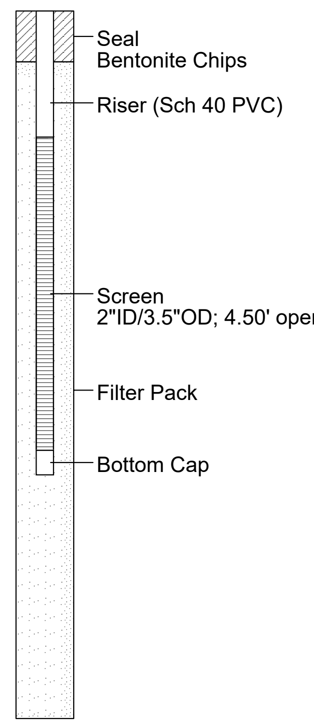
Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.86
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.21
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555729

Depth in Feet	DESCRIPTION	Surf. Elev. 430.86	USCS
40	- with <10% reddish-brown mottling	390	CH
	SAND with Silt, fine grained, poorly graded, light brown (10YR 6/4), wet		SP/SM
	Sandy SILT		ML
	Silty CLAY with fine sand, very soft, brownish yellow (10YR 6/6)		CL
45	SAND, fine grained, poorly graded	385	SP
	SAND, fine to coarse grained, well graded, trace gravel		SW
	Silty CLAY with trace and and gravel, stiff, high plasticity, light yellowish brown (10YR 6/4), moist [TILL] - trace reddish-brown mottling		CL
50	SHALE, clay partings, laminated, gray, weathered, dry (top of bedrock = 50.4' bls)	380	SH
	END BOREHOLE AT 51 feet BLS		
55		375	
60			

Samples	Recovery inches	Qp TSF
40	60/60	0.75
41		1.25
42		1.5
43		
44		0.75
45		0.75
46	30/30	1.25
47		3.0
48		2.25
49		2.25
50		2.25
51		3.5

Well: MW-262
Elev.: 433.21



Illinois Environmental Protection Agency

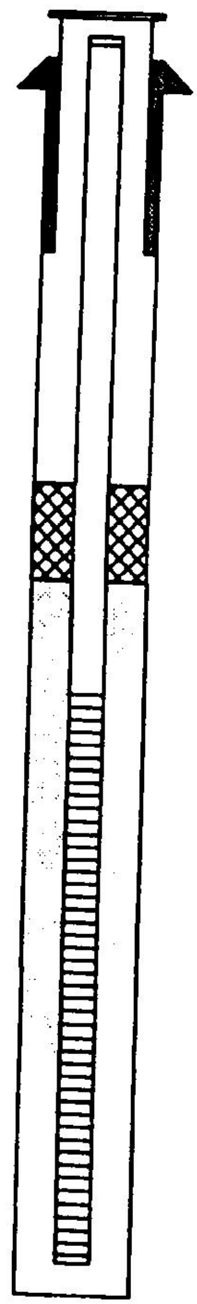
Well Completion Report

Incident No.: None
Site Name: Dynegy-Baldwin Energy Complex
Drilling Contractor: Terra Drill
Driller: Matt Cooper
Drilling Method: Hollow-Stem Aug.; Mud-Rotary

Well No.: MW-252
Date Drilled Start: 09/21/10
Date Completed: 09/22/10
Geologist: Brendon Wilder
Drilling Fluids (Type): Water w/ Polymer

Annular Space Details

Type of Surface Seal: Concrete
Type of Annular Sealant: Cement-Bentonite Grout
Type of Bentonite Seal (Granular, Pellet): Bentonite Chips (hydrated)
Type of Sand Pack: Clean Silica Sand



Elevations - .01 ft.

_____ Top of Protective Casing
425.07 Top of Riser Pipe
422.27 Ground Surface
421.27 Top of Annular sealant
_____ Casing Stickup
382.97 Top of Seal
3.70 Total Seal Interval
379.27 Top of Sand
377.87 Top of Screen
4.63 Total Screen Interval
373.24 Bottom of Screen
372.73 Bottom of Borehole

Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			
Riser pipe above w.t.		Sch. 40	
Riser Pipe below w.t.		Sch. 40	
Screen		Sch. 40	
Coupling joint screen to riser			
Protective casing			

Measurements

to .01 ft (where applicable)

Riser Pipe Length	47.21
Screen Length	4.63
Screen Slot Size	0.01
Protective casing length	
Depth to water	0.40
Elevation of water	424.67
Free Product thickness	
Gallons removed (develop)	7.37
Gallons removed (purge)	
Other	

Completed by: PSC Industrial Outsourcing, LP

Illinois Environmental Protection Agency

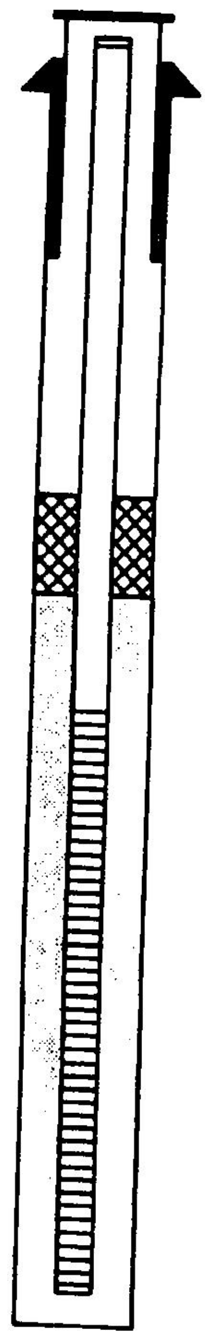
Well Completion Report

Incident No.: None
Site Name: Dynegy-Baldwin Energy Complex
Drilling Contractor: Terra Drill
Driller: Matt Cooper
Drilling Method: Hollow-Stem Aug.; Mud-Rotary

Well No.: MW-253
Date Drilled Start: 09/20/10
Date Completed: 09/20/10
Geologist: Brendon Wilder
Drilling Fluids (Type): Water w/ Polymer

Annular Space Details

Type of Surface Seal: Concrete
Type of Annular Sealant: Cement-Bentonite Grout
Type of Bentonite Seal (Granular, Pellet): Bentonite Chips (hydrated)
Type of Sand Pack: Clean Silica Sand



Elevations - .01 ft.

_____ Top of Protective Casing
445.84 Top of Riser Pipe
442.70 Ground Surface
441.70 Top of Annular sealant
_____ Casing Stickup
417.00 Top of Seal
2.00 Total Seal Interval
415.00 Top of Sand
412.84 Top of Screen
4.63 Total Screen Interval
408.21 Bottom of Screen
407.70 Bottom of Borehole

Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			
Riser pipe above w.t.		Sch. 40	
Riser Pipe below w.t.		Sch. 40	
Screen		Sch. 40	
Coupling joint screen to riser			
Protective casing			

Measurements

to .01 ft (where applicable)

Riser Pipe Length	33.01
Screen Length	4.63
Screen Slot Size	0.01
Protective casing length	
Depth to water	12.71
Elevation of water	433.13
Free Product thickness	
Gallons removed (develop)	7.89
Gallons removed (purge)	
Other	

Completed by: PSC Industrial Outsourcing, LP

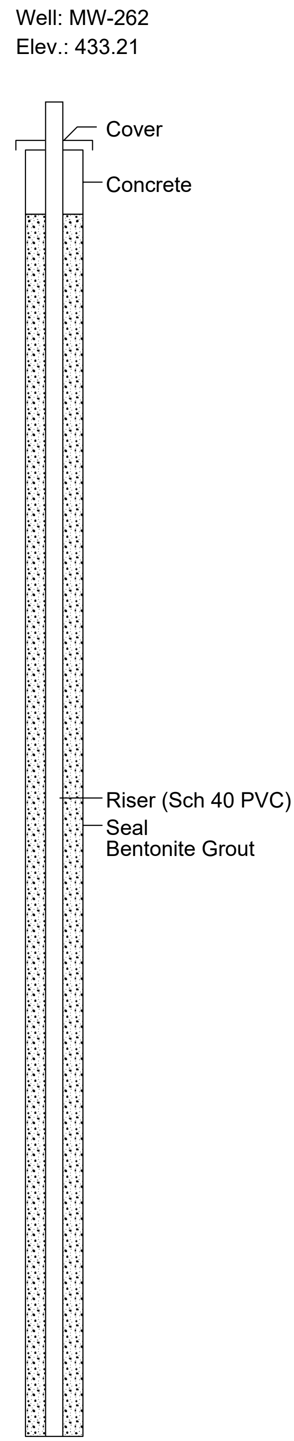
IL 532-2274
LPC 500 Rev June 2004

KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE MW-262

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.86
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.21
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555729

Depth in Feet	DESCRIPTION	Surf. Elev. 430.86	Samples	Recovery inches	Qp TSF	USCS
0	Silty Clay with gravel, roots, stiff, non-plastic, pale brown (10YR 6/3), dry	430	1	60/60	2.5	CL
			2		>4.5	
	- brownish yellow (10YR 6/6), moist		3		3.25	
			4		2.5	
			5		2.25	
5	- medium stiff, high plasticity	425	6	42/42	1.5	
			7		1.75	
			8		2.0	
	SILT, very soft, non-plastic, light yellowish brown (10YR 6/4), moist [LOESS]		9	60/60	1.0	ML
10	- clayey, soft to medium hardness, low to medium plasticity		10		1.5	
		420	11		1.25	
			12		1.5	
			13		1.5	
	- soft, yellowish brown (10YR 5/4) - non-plastic		14	60/60	1.0	
15			15		1.25	
		415	16		1.25	
	Sandy CLAY (lean), medium hardness, low to medium plasticity, yellowish brown, moist		17		1.5	CL
			18		2.0	
	SILT, very soft, non-plastic, brownish yellow (10YR 6/6), moist		19	60/60	2.0	ML
20			20			



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KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE MW-262 (Page 2 of 3)

LOG OF PROBEHOLE MW-262

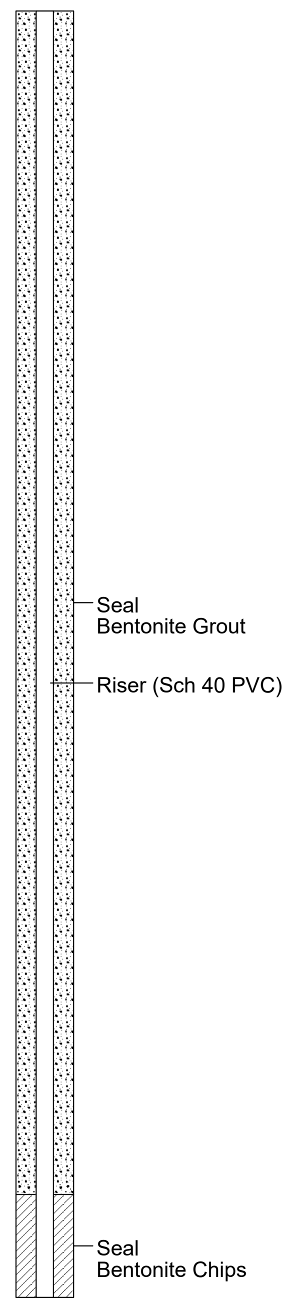
(Page 2 of 3)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.86
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.21
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555729

Depth in Feet	DESCRIPTION	Surf. Elev. 430.86	Samples	Recovery inches	Qp TSF	USCS
20			20			ML
		410	21			ML
			22			ML
	Silty CLAY, very soft, low plasticity - medium plasticity, wet		23		0.75	CL
			24	60/60	0.75	CL
25			25		0.75	CL
	- high plasticity, yellowish brown (10YR 5/4)	405	26		0.75	CL
	- moist		27		0.5	CL
			28		1.25	CL
			29	53/60	1.0	CL
30	- with fine sand		30		0.75	CL
		400	31			CL
	SAND, fine to medium grained, with clay, yellowish brown (10YR 5/6), wet - light brownish gray		32			SW/SC
	CLAY (fat), trace fine to medium sand, high plasticity, light brownish gray <Sample ST262-35 @ 33.5 - 35.5'> grain size analysis: 13.1% Sand, 33.2% Silt, 53.7% Clay		33			CH
			34	24/24		CH
35			35			CH
	- very stiff, greenish gray (Gley1 10Y 6/1)	395	36	16/36	2.75	CH
			37			CH
	- medium plasticity		38		2.75	CH
			39	56/60	1.0	CH
40			40		0.75	CH

Well: MW-262
Elev.: 433.21



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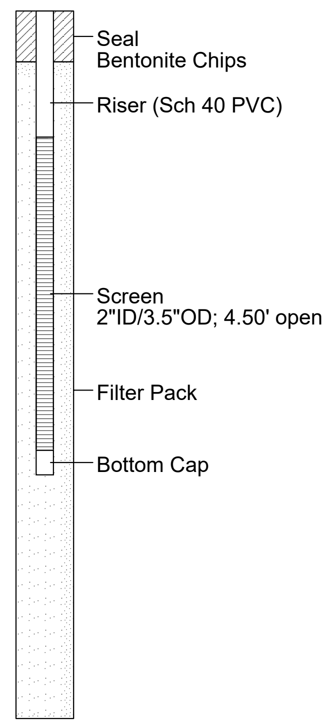
KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE MW-262 (Page 3 of 3)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 430.86
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 433.21
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2379193, 555729

Well: MW-262
Elev.: 433.21

Depth in Feet	DESCRIPTION	Surf. Elev. 430.86	Samples	Recovery inches	Qp TSF	USCS
40			40		0.75	CH
	- with <10% reddish-brown mottling	390	41		1.25	CH
			42		1.5	CH
	SAND with Silt, fine grained, poorly graded, light brown (10YR 6/4), wet					SP/SM
	Sandy SILT		43			ML
	Silty CLAY with fine sand, very soft, brownish yellow (10YR 6/6)		44	60/60	0.75	CL
45			45		0.75	CL
	SAND, fine grained, poorly graded	385	46		1.25	SP
	SAND, fine to coarse grained, well graded, trace gravel					SW
	Silty CLAY with trace and and gravel, stiff, high plasticity, light yellowish brown (10YR 6/4), moist [TILL]		47		3.0	CL
	- trace reddish-brown mottling		48		2.25	CL
			49	30/30	2.25	CL
50			50		2.25	CL
	SHALE, clay partings, laminated, gray, weathered, dry (top of bedrock = 50.4' bls)	380	51		3.5	SH
	END BOREHOLE AT 51 feet BLS					
55		375				
60						



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NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	______ft. ☐ N. ☐ S. ______ft. ☐ E. ☐ W.	MW-304
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 17.995" Long. -89° 51' 12.390" or	
Facility ID	St. Plane 554,194.03 ft. N, 2,386,608.77 ft. E. E / (W)	Date Well Installed 10/20/2015
Type of Well: mw	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) John Gates, Bulldog Drilling
Distance from Waste/Source ____ ft. / State: Illinois	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 455.49 ft. (NAVD88)

C. Land surface elevation 453.03 ft. (NAVD88)

D. Surface seal, bottom 452.0 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): Village of Baldwin

E. Bentonite seal, top 413.0 ft. (NAVD88) or 40.0 ft.

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

G. Filter pack, top 410.0 ft. (NAVD88) or 43.0 ft.

H. Screen joint, top 408.0 ft. (NAVD88) or 45.0 ft.

I. Well bottom 398.0 ft. (NAVD88) or 55.0 ft.

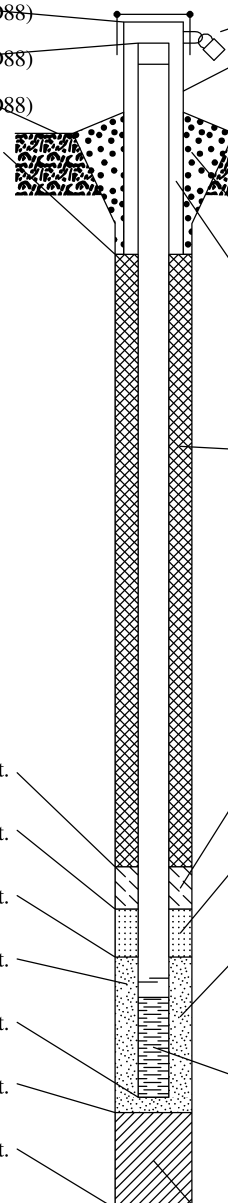
J. Filter pack, bottom 397.0 ft. (NAVD88) or 56.0 ft.

K. Borehole, bottom 394.0 ft. (NAVD88) or 59.0 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: Three 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. 30 % 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. Unimin Corporation, FILTERSIL
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 ______
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☐
1' of bentonite chips, 2' of bedrock drill cuttings Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 2/4/2016

Signature	Firm	
[signature]	Natural Resource Technology 234 W. Florida Street, Floor 5, Milwaukee, WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

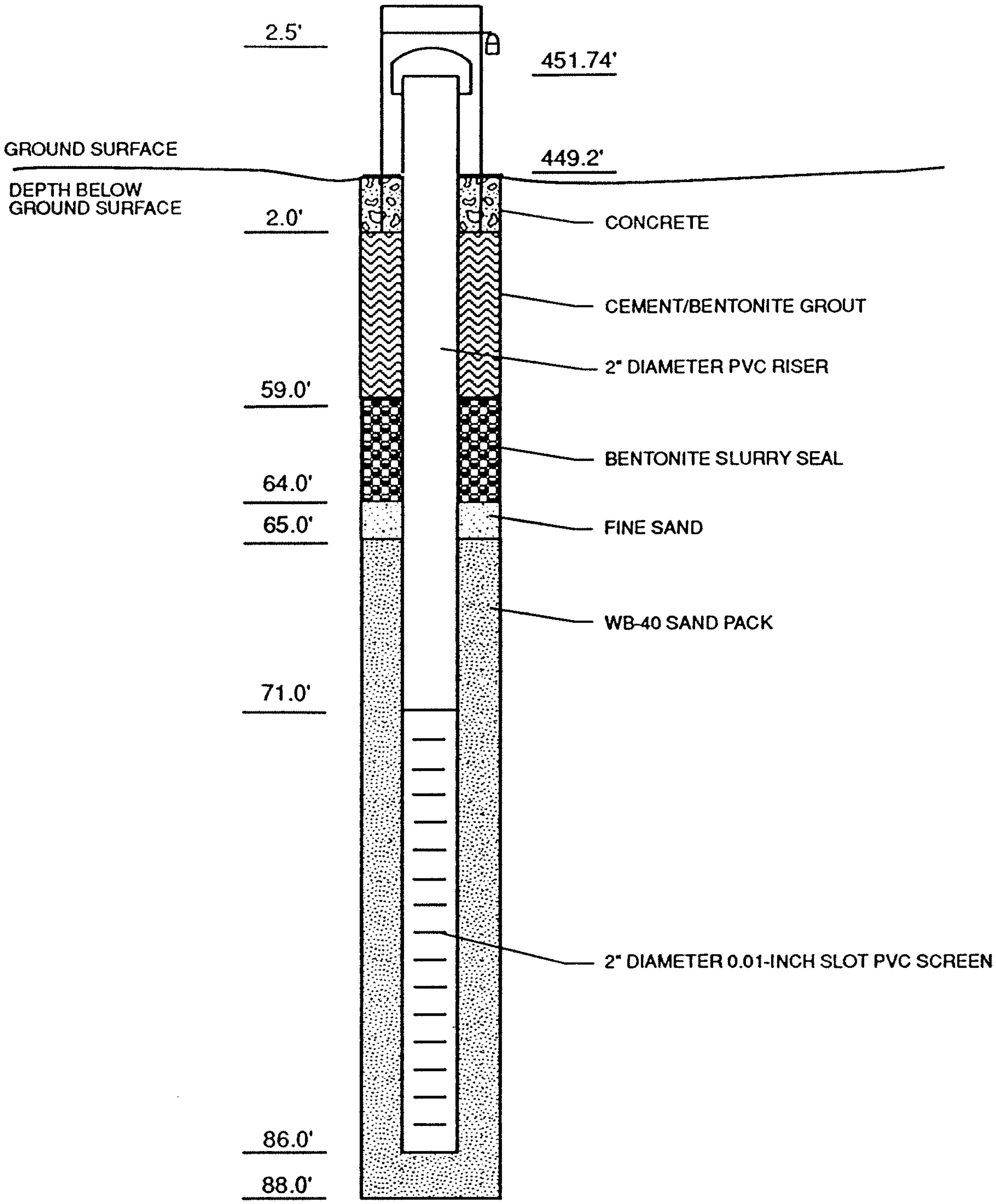
PROJECT MANAGER

PROJECT MANAGER

CHECKED BY

DRAWN BY

MH
REV. DATE
11/20/91



NOT TO SCALE

Burlington Environmental Inc.	
Renamed MW-306 BAMW - 306 MONITORING WELL CONSTRUCTION DIAGRAM	
BALDWIN FGD SOLID WASTE BALDWIN, ILLINOIS 124081	BAMW-306

Illinois Environmental Protection Agency

Well Completion Report

Incident No.: None
Site Name: Dynegy-Baldwin Energy Complex
Drilling Contractor: Terra Drill
Driller: Matt Cooper
Drilling Method: Hollow-Stem Aug.; Mud-Rotary

Well No.: MW-350
Date Drilled Start: 09/08/10
Date Completed: 09/09/10
Geologist: Brendon Wilder
Drilling Fluids (Type): Water w/ Polymer

Annular Space Details

Type of Surface Seal: Concrete
Type of Annular Sealant: Cement-Bentonite Grout
Type of Bentonite Seal (Granular, Pellet): Bentonite Chips (hydrated)
Type of Sand Pack: Clean Silica Sand

Well Construction Materials

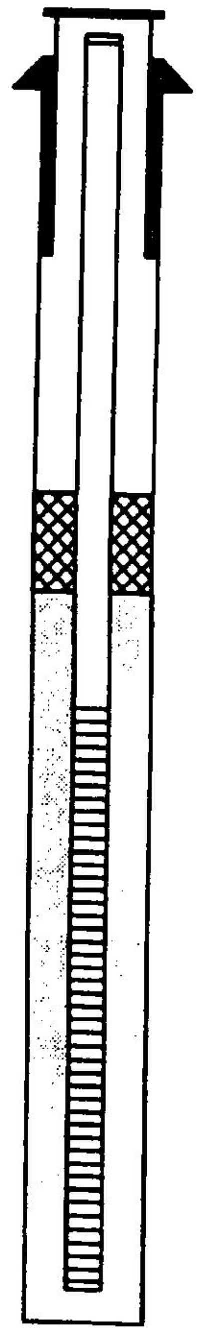
	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			
Riser pipe above w.t.		Sch. 40	
Riser Pipe below w.t.		Sch. 40	
Screen		Sch. 40	
Coupling joint screen to riser			
Protective casing			

Measurements

to .01 ft (where applicable)

Riser Pipe Length	44.29
Screen Length	4.63
Screen Slot Size	0.01
Protective casing length	
Depth to water	22.52
Elevation of water	374.28
Free Product thickness	
Gallons removed (develop)	10.00
Gallons removed (purge)	
Other	

Completed by: PSC Industrial Outsourcing, LP



Elevations - .01 ft.

____	Top of Protective Casing
396.80	Top of Riser Pipe
394.11	Ground Surface
393.11	Top of Annular sealant
____	Casing Stickup
367.71	Top of Seal
10.60	Total Seal Interval
357.11	Top of Sand
352.52	Top of Screen
4.63	Total Screen Interval
347.89	Bottom of Screen
347.38	Bottom of Borehole

Illinois Environmental Protection Agency

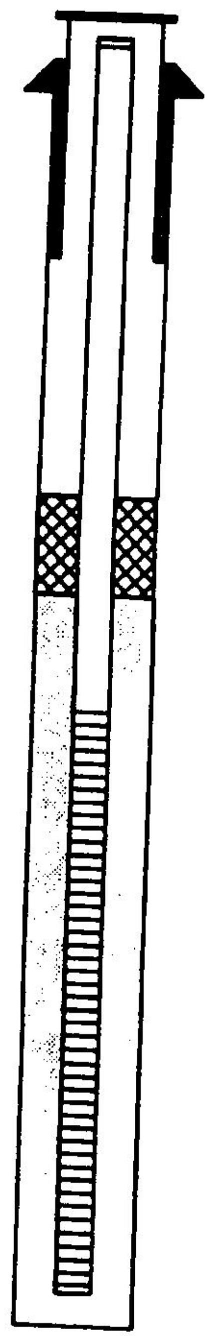
Well Completion Report

Incident No.: None
Site Name: Dynegy-Baldwin Energy Complex
Drilling Contractor: Terra Drill
Driller: Matt Cooper
Drilling Method: Hollow-Stem Aug.; Mud-Rotary

Well No.: MW-352
Date Drilled Start: 09/15/10
Date Completed: 09/17/10
Geologist: Brendon Wilder
Drilling Fluids (Type): Water w/ Polymer

Annular Space Details

Type of Surface Seal: Concrete
Type of Annular Sealant: Cement-Bentonite Grout
Type of Bentonite Seal (Granular, Pellet): Bentonite Chips (hydrated)
Type of Sand Pack: Clean Silica Sand



Elevations - .01 ft.

____ Top of Protective Casing
425.04 Top of Riser Pipe
422.36 Ground Surface
421.36 Top of Annular sealant
____ Casing Stickup

361.06 Top of Seal
4.00 Total Seal Interval
357.06 Top of Sand
354.46 Top of Screen
4.63 Total Screen Interval
349.83 Bottom of Screen
348.56 Bottom of Borehole

Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			
Riser pipe above w.t.		Sch. 40	
Riser Pipe below w.t.		Sch. 40	
Screen		Sch. 40	
Coupling joint screen to riser			
Protective casing			

Measurements

to .01 ft (where applicable)

Riser Pipe Length	70.59
Screen Length	4.63
Screen Slot Size	0.01
Protective casing length	
Depth to water	23.85
Elevation of water	401.19
Free Product thickness	
Gallons removed (develop)	13.70
Gallons removed (purge)	
Other	

Completed by: PSC Industrial Outsourcing, LP

IL 532-2274
LPC 500 Rev June 2004

Illinois Environmental Protection Agency

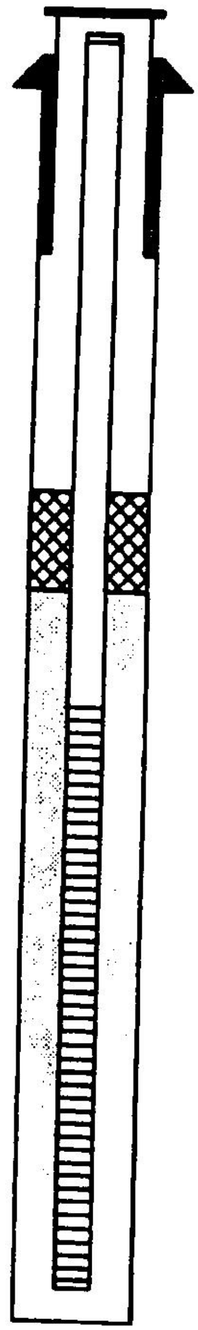
Well Completion Report

Incident No.: None
Site Name: Dynegy-Baldwin Energy Complex
Drilling Contractor: Terra Drill
Driller: Matt Cooper
Drilling Method: Hollow-Stem Aug.; Mud-Rotary

Well No.: MW-355
Date Drilled Start: 09/14/10
Date Completed: 09/14/10
Geologist: Brendon Wilder
Drilling Fluids (Type): Water w/ Polymer

Annular Space Details

Type of Surface Seal: Concrete
Type of Annular Sealant: Cement-Bentonite Grout
Type of Bentonite Seal (Granular, Pellet):
Bentonite Chips (hydrated)
Type of Sand Pack: Clean Silica Sand



Elevations - .01 ft.

Elevation	Item
	Top of Protective Casing
393.69	Top of Riser Pipe
390.82	Ground Surface
389.82	Top of Annular sealant
	Casing Stickup
370.82	Top of Seal
3.40	Total Seal Interval
367.42	Top of Sand
363.42	Top of Screen
4.63	Total Screen Interval
358.79	Bottom of Screen
358.28	Bottom of Borehole

Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			
Riser pipe above w.t.		Sch. 40	
Riser Pipe below w.t.		Sch. 40	
Screen		Sch. 40	
Coupling joint screen to riser			
Protective casing			

Measurements

to .01 ft (where applicable)

Riser Pipe Length	30.28
Screen Length	4.63
Screen Slot Size	0.01
Protective casing length	
Depth to water	23.90
Elevation of water	369.79
Free Product thickness	
Gallons removed (develop)	23.00
Gallons removed (purge)	
Other	

Completed by: PSC Industrial Outsourcing, LP

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	MW-356
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 56.266" Long. -89° 52' 10.481" or	
Facility ID	St. Plane 558,050.37 ft. N, 2,381,958.49 ft. E. E/Ⓦ	Date Well Installed: 10/01/2015
Type of Well: mw	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) John Gates, Bulldog Drilling
Distance from Waste/Source ____ ft. / State: Illinois	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 427.60 ft. (NAVD88)

C. Land surface elevation 425.18 ft. (NAVD88)

D. Surface seal, bottom 424.2 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): Village of Baldwin

E. Bentonite seal, top 376.1 ft. (NAVD88) or 49.1 ft.

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

G. Filter pack, top 371.3 ft. (NAVD88) or 53.9 ft.

H. Screen joint, top 369.2 ft. (NAVD88) or 56.0 ft.

I. Well bottom 359.2 ft. (NAVD88) or 66.0 ft.

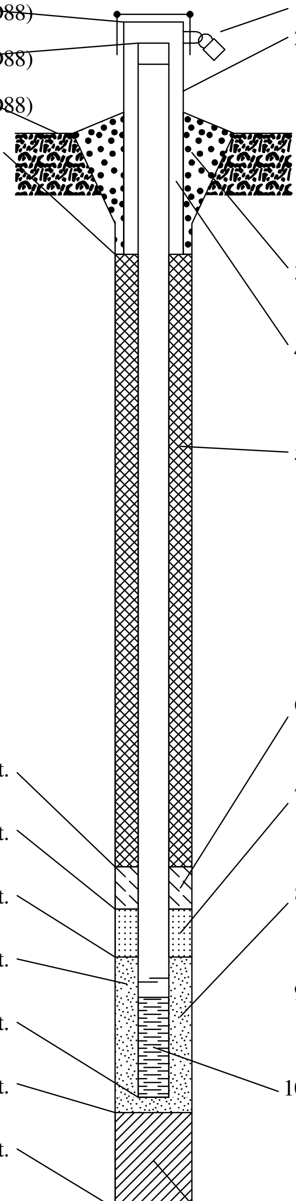
J. Filter pack, bottom 358.2 ft. (NAVD88) or 67.0 ft.

K. Borehole, bottom 356.2 ft. (NAVD88) or 69.0 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: Two 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. 30 % 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. Unimin Corporation, FILTERSIL
   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 ____
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐; 2' of bedrock drill cuttings Other ☒

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

Date Modified: 2/26/2016

Signature: Brad Roeder [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Baldwin Energy Complex	Local Grid Location of Well: ______ft. ☐ N. ☐ S. ______ft. ☐ E. ☐ W.	Well Name
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 31.888" Long. -89° 52' 20.441" or	MW-366
Facility ID	St. Plane 555,581.80 ft. N, 2,381,171.15 ft. E. E /(W)	Date Well Installed: 12/04/2015
Type of Well: mw	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) Jim Dittmaier, Bulldog Drilling
Distance from Waste/Source: ft. — State: Illinois	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 425.08 ft. (NAVD88)

C. Land surface elevation 422.54 ft. (NAVD88)

D. Surface seal, bottom 421.5 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): Village of Baldwin

E. Bentonite seal, top 387.5 ft. (NAVD88) or 35.0 ft.

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

G. Filter pack, top 382.5 ft. (NAVD88) or 40.0 ft.

H. Screen joint, top 380.5 ft. (NAVD88) or 42.0 ft.

I. Well bottom 370.5 ft. (NAVD88) or 52.0 ft.

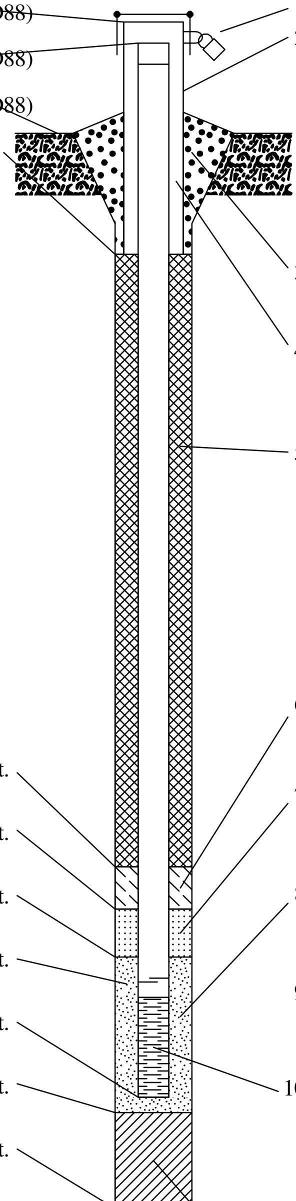
J. Filter pack, bottom 370.0 ft. (NAVD88) or 52.5 ft.

K. Borehole, bottom 368.5 ft. (NAVD88) or 54.0 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: Three steel bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ Other ☒ Sand
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % 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. Unimin Corporation, FILTERSIL
   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 ______
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐ Other ☒ 1.5' bedrock drill cuttings

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 2/4/2016

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 49.150" Long. -89° 52' 12.929" or	MW-369
Facility ID	St. Plane 557,329.71 ft. N, 2,381,765.41 ft. E. E/Ⓦ	Date Well Installed 11/19/2015
Type of Well: mw	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) Mark Baetje, Bulldog Drilling
Distance from Waste/Source ft. / State: Illinois	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 422.71 ft. (NAVD88)

C. Land surface elevation 420.49 ft. (NAVD88)

D. Surface seal, bottom 419.5 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): Village of Baldwin

E. Bentonite seal, top 373.7 ft. (NAVD88) or 46.8 ft.

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

G. Filter pack, top 368.7 ft. (NAVD88) or 51.8 ft.

H. Screen joint, top 364.5 ft. (NAVD88) or 56.0 ft.

I. Well bottom 354.5 ft. (NAVD88) or 66.0 ft.

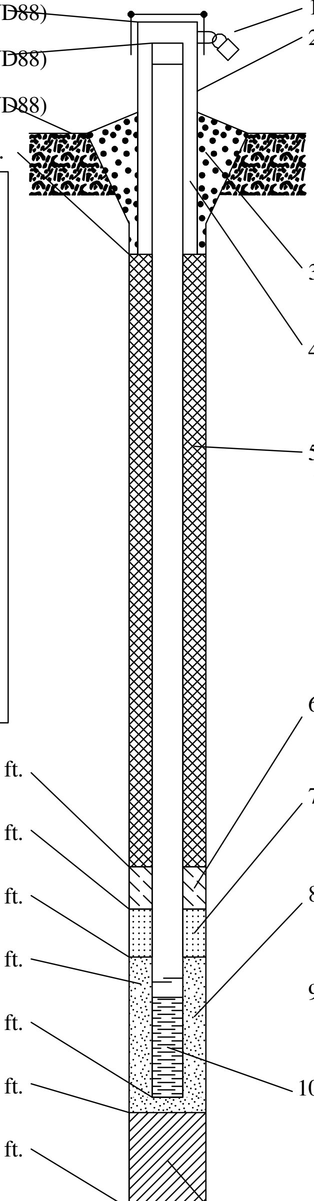
J. Filter pack, bottom 353.3 ft. (NAVD88) or 67.2 ft.

K. Borehole, bottom 349.8 ft. (NAVD88) or 70.7 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: Two steel bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ Other ☒ Sand
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % 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. Unimin Corporation, FILTERSIL
   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 ______
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐ Other ☒ 1' of bentonite chips, 2.5' of bedrock drill cuttings

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

Date Modified: 2/26/2016

Signature [signature]

Firm Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 44.170" Long. -89° 52' 10.808" or	MW-370
Facility ID	St. Plane 556,826.50 ft. N, 2,381,936.14 ft. E. E / (W)	Date Well Installed 11/25/2015
Type of Well mw	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) Mark Baetje Bulldog Drilling
Distance from Waste/Source ____ ft. / State: Illinois	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 420.85 ft. (NAVD88)

C. Land surface elevation 418.67 ft. (NAVD88)

D. Surface seal, bottom 417.7 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):
Village of Baldwin

E. Bentonite seal, top 389.7 ft. (NAVD88) or 29.0 ft.

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

G. Filter pack, top 367.7 ft. (NAVD88) or 51.0 ft.

H. Screen joint, top 365.7 ft. (NAVD88) or 53.0 ft.

I. Well bottom 355.7 ft. (NAVD88) or 63.0 ft.

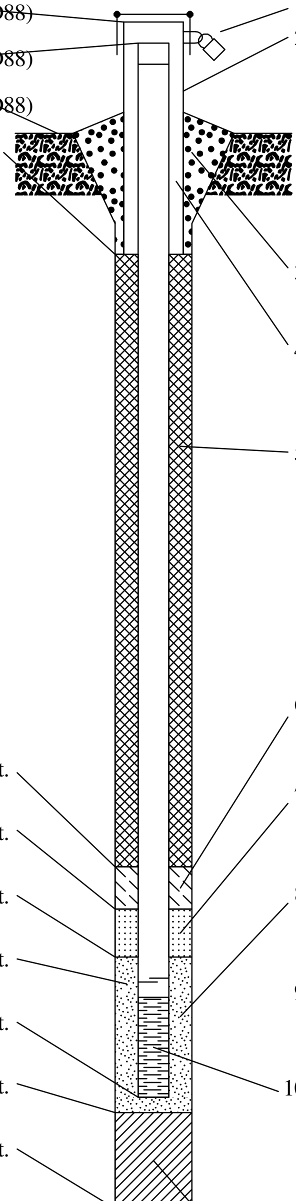
J. Filter pack, bottom 355.2 ft. (NAVD88) or 63.5 ft.

K. Borehole, bottom 352.7 ft. (NAVD88) or 66.0 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: Three 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. 30 % 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. Unimin Corporation, FILTERSIL
   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 ______
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐
    2.1' of bentonite chips, 0.4' of bedrock drill cuttings Other ☒

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

Date Modified: 2/26/2016

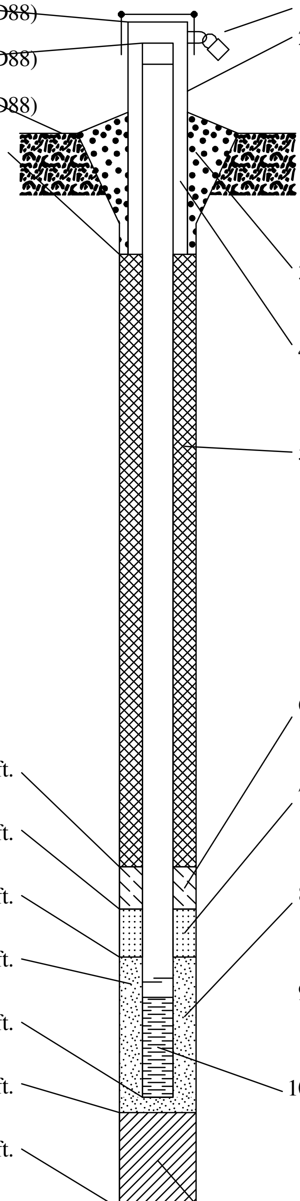
Signature [signature]

Firm Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	MW-373
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 26.613" Long. -89° 52' 45.328" or	
Facility ID	St. Plane 555,041.91 ft. N, 2,379,186.06 ft. E. E/Ⓦ	Date Well Installed: 10/28/2015
Type of Well: mw	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) John Gates, Bulldog Drilling
Distance from Waste/Source ____ ft. / State: Illinois	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 391.32 ft. (NAVD88)

C. Land surface elevation 388.80 ft. (NAVD88)

D. Surface seal, bottom 387.8 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):
Village of Baldwin

E. Bentonite seal, top 373.8 ft. (NAVD88) or 15.0 ft.

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

G. Filter pack, top 370.8 ft. (NAVD88) or 18.0 ft.

H. Screen joint, top 368.8 ft. (NAVD88) or 20.0 ft.

I. Well bottom 358.8 ft. (NAVD88) or 30.0 ft.

J. Filter pack, bottom 357.0 ft. (NAVD88) or 31.8 ft.

K. Borehole, bottom 355.6 ft. (NAVD88) or 33.3 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: Two steel bollards

3. Surface seal: Bentonite ☐; Concrete ☒; Other ☐

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

5. Annular space seal:
a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
d. 30 % 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. Unimin Corporation, FILTERSIL
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 ____
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☐; Other ☒ 1' of bentonite chips, 0.5' of bedrock drill cuttings

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

Date Modified: 2/26/2016

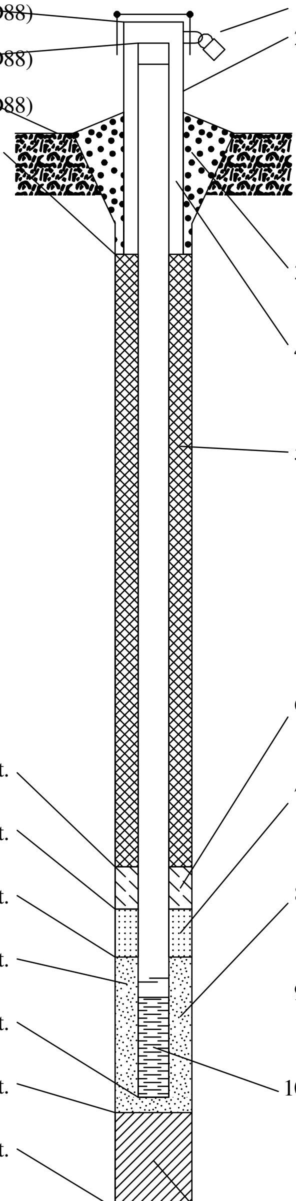
Signature [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Baldwin Energy Complex	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 22.855" Long. -89° 52' 38.071" or	MW-374
Facility ID	St. Plane 554,663.65 ft. N, 2,379,766.63 ft. E. E /Ⓦ	Date Well Installed: 11/10/2015
Type of Well: mw	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) Jim Dittmaier, Bulldog Drilling
Distance from Waste/Source: ft. — State: Illinois	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 400.91 ft. (NAVD88)

C. Land surface elevation 398.41 ft. (NAVD88)

D. Surface seal, bottom 397.4 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): Village of Baldwin

E. Bentonite seal, top 373.9 ft. (NAVD88) or 24.5 ft.

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

G. Filter pack, top 370.8 ft. (NAVD88) or 27.6 ft.

H. Screen joint, top 368.4 ft. (NAVD88) or 30.0 ft.

I. Well bottom 358.4 ft. (NAVD88) or 40.0 ft.

J. Filter pack, bottom 357.9 ft. (NAVD88) or 40.5 ft.

K. Borehole, bottom 356.4 ft. (NAVD88) or 42.0 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: Three 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. 30 % 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. Unimin Corporation, FILTERSIL
   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 ____
   c. Slot size: 0.010 in.
   d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐; 1.5' of bedrock drill cuttings — Other ☒

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

Date Modified: 2/26/2016

Signature: [signature]

Firm: Natural Resource Technology, 234 W. Florida Street, Floor 5, Milwaukee, WI 53204. Tel: (414) 837-3607 Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Baldwin Energy Complex	Local Grid Location of Well: ______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	Well Name: MW-375
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 20.562" Long. -89° 52' 24.650" or	
Facility ID	St. Plane 554,434.97 ft. N, 2,380,838.70 ft. E. E/(W)	Date Well Installed: 11/06/2015
Type of Well: mw	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) Jim Dittmaier Bulldog Drilling
Distance from Waste/Source: ft. / State: Illinois	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 423.05 ft. (NAVD88)

C. Land surface elevation 420.50 ft. (NAVD88)

D. Surface seal, bottom 419.5 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): Village of Baldwin

E. Bentonite seal, top 380.5 ft. (NAVD88) or 40.0 ft.

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

G. Filter pack, top 366.5 ft. (NAVD88) or 54.0 ft.

H. Screen joint, top 363.5 ft. (NAVD88) or 57.0 ft.

I. Well bottom 353.5 ft. (NAVD88) or 67.0 ft.

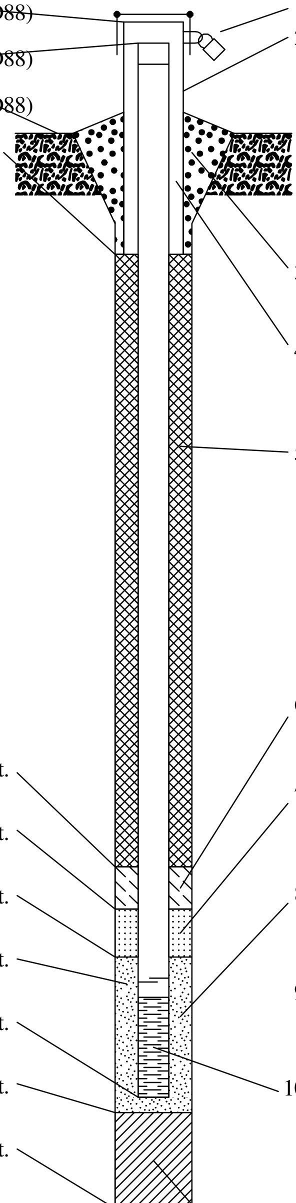
J. Filter pack, bottom 352.5 ft. (NAVD88) or 68.0 ft.

K. Borehole, bottom 350.5 ft. (NAVD88) or 70.0 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: Two 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. 30 % 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. Unimin Corporation, FILTERSIL
   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 ______
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐; 2' of bentonite chips — Other ☒

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

Date Modified: 2/4/2016

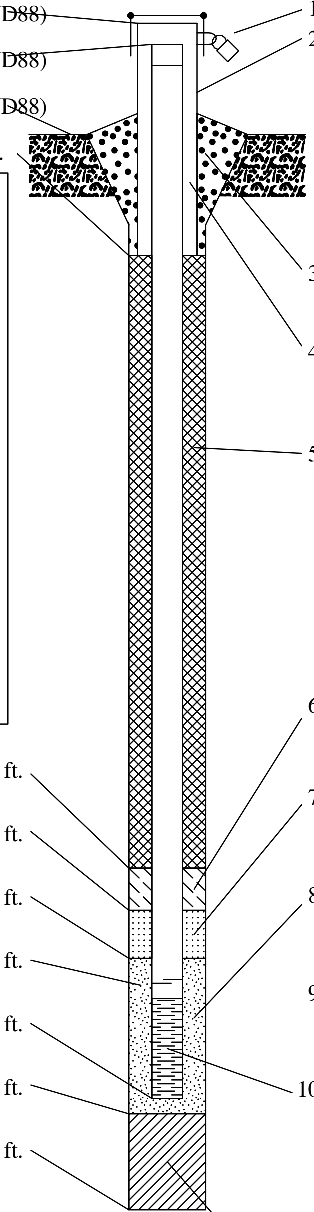
Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Baldwin Energy Complex	Local Grid Location of Well: ____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W.	Well Name
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 18.190" Long. -89° 52' 11.071" or	MW-377
Facility ID	St. Plane 554,198.46 ft. N, 2,381,923.68 ft. E. E/(W)	Date Well Installed: 11/02/2015
Type of Well: mw	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) Jim Dittmaier, Bulldog Drilling
Distance from Waste/Source ____ ft. / State: Illinois	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 421.36 ft. (NAVD88)

C. Land surface elevation 418.75 ft. (NAVD88)

D. Surface seal, bottom 417.8 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): Village of Baldwin

E. Bentonite seal, top 378.0 ft. (NAVD88) or 40.8 ft.

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

G. Filter pack, top 374.8 ft. (NAVD88) or 44.0 ft.

H. Screen joint, top 372.8 ft. (NAVD88) or 46.0 ft.

I. Well bottom 362.8 ft. (NAVD88) or 56.0 ft.

J. Filter pack, bottom 362.1 ft. (NAVD88) or 56.7 ft.

K. Borehole, bottom 360.8 ft. (NAVD88) or 58.0 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: Three 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. 30 % 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. Unimin Corporation, FILTERSIL
   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 ____
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐ 1.3' bedrock drill cuttings Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 2/4/2016

Signature: [signature]

Firm: Natural Resource Technology, 234 W. Florida Street, Floor 5, Milwaukee, WI 53204 Tel: (414) 837-3607 Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Baldwin Energy Complex	Local Grid Location of Well: ____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W.	Well Name: MW-382
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 40.344" Long. -89° 52' 4.958" or St. Plane 556,440.86 ft. N, 2,382,404.51 ft. E. E/W (W circled)	
Facility ID		Date Well Installed: 11/23/2015
Type of Well: mw	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) Jim Dittmaier Bulldog Drilling
Distance from Waste/Source ____ ft. / State: Illinois	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 431.19 ft. (NAVD88)

C. Land surface elevation 428.67 ft. (NAVD88)

D. Surface seal, bottom 427.7 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):
Village of Baldwin

E. Bentonite seal, top 392.8 ft. (NAVD88) or 35.9 ft.

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

G. Filter pack, top 375.8 ft. (NAVD88) or 52.9 ft.

H. Screen joint, top 372.7 ft. (NAVD88) or 56.0 ft.

I. Well bottom 362.7 ft. (NAVD88) or 66.0 ft.

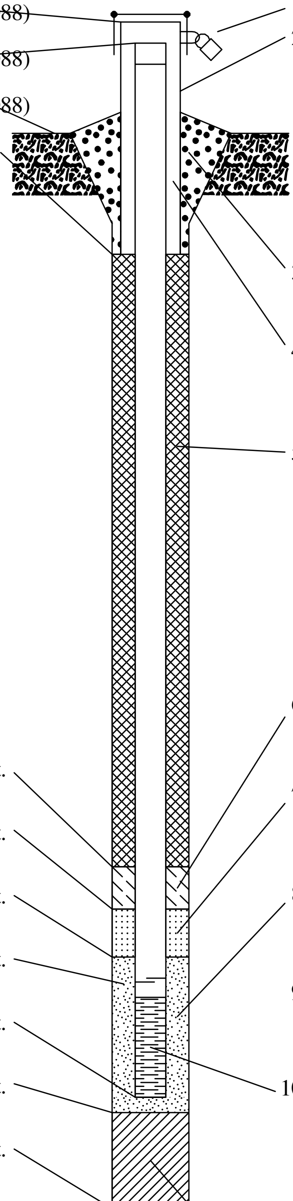
J. Filter pack, bottom 362.3 ft. (NAVD88) or 66.4 ft.

K. Borehole, bottom 359.7 ft. (NAVD88) or 69.0 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: Three 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. 30 % 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. Unimin Corporation, FILTERSIL
   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 ____
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐; 2.6' of bedrock drill cuttings Other ☒

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

Date Modified: 2/26/2016

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W.	
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 41.686" Long. -89° 51' 29.830" or	MW-383
Facility ID	St. Plane 556,586.04 ft. N, 2,385,208.26 ft. E. E/Ⓦ	Date Well Installed 12/21/2015
Type of Well mw	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) Jim Dittmaier, Bulldog Drilling
Distance from Waste/Source ft. / State Illinois	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 459.49 ft. (NAVD88)

C. Land surface elevation 457.18 ft. (NAVD88)

D. Surface seal, bottom 456.2 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): Village of Baldwin

E. Bentonite seal, top 406.7 ft. (NAVD88) or 50.5 ft.

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

G. Filter pack, top 401.5 ft. (NAVD88) or 55.7 ft.

H. Screen joint, top 399.2 ft. (NAVD88) or 58.0 ft.

I. Well bottom 389.2 ft. (NAVD88) or 68.0 ft.

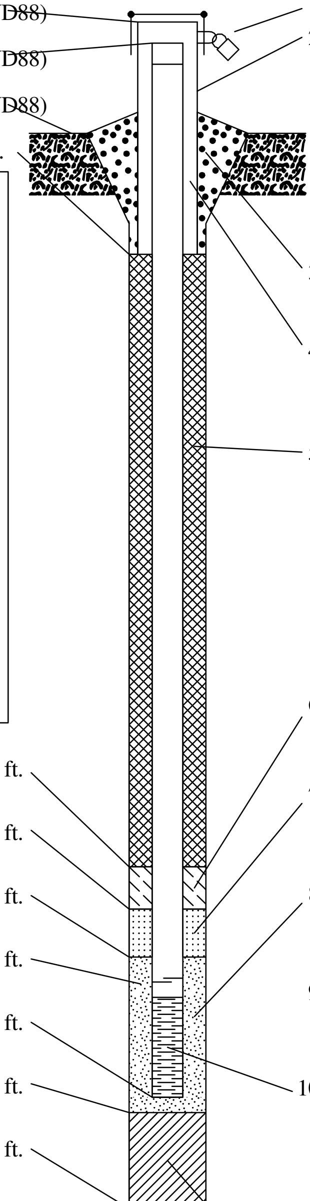
J. Filter pack, bottom 388.1 ft. (NAVD88) or 69.1 ft.

K. Borehole, bottom 384.2 ft. (NAVD88) or 73.0 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: Steel bollards (3), 6" PVC casing to 22.5' bgs
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. 30 % 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. Unimin Corporation, FILTERSIL
   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 ____
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐
    3.2' of bentonite chips, 0.7' of bedrock drill cuttings Other ☒

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

Date Modified: 2/4/2016

Signature [signature]

Firm Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Baldwin Energy Complex	Local Grid Location of Well: ______ft. ☐ N. ☐ S. ______ft. ☐ E. ☐ W.	Well Name
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 30.440" Long. -89° 51' 38.516" or	MW-384
Facility ID	St. Plane 555,446.11 ft. N, 2,384,518.72 ft. E. E/Ⓦ	Date Well Installed: 12/18/2015
Type of Well: mw	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) Chad Dutton Bulldog Drilling
Distance from Waste/Source ft. / State: Illinois	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 458.95 ft. (NAVD88)

C. Land surface elevation 456.70 ft. (NAVD88)

D. Surface seal, bottom 455.7 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):
Village of Baldwin

E. Bentonite seal, top 402.7 ft. (NAVD88) or 54.0 ft.

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

G. Filter pack, top 398.2 ft. (NAVD88) or 58.5 ft.

H. Screen joint, top 396.2 ft. (NAVD88) or 60.5 ft.

I. Well bottom 386.2 ft. (NAVD88) or 70.5 ft.

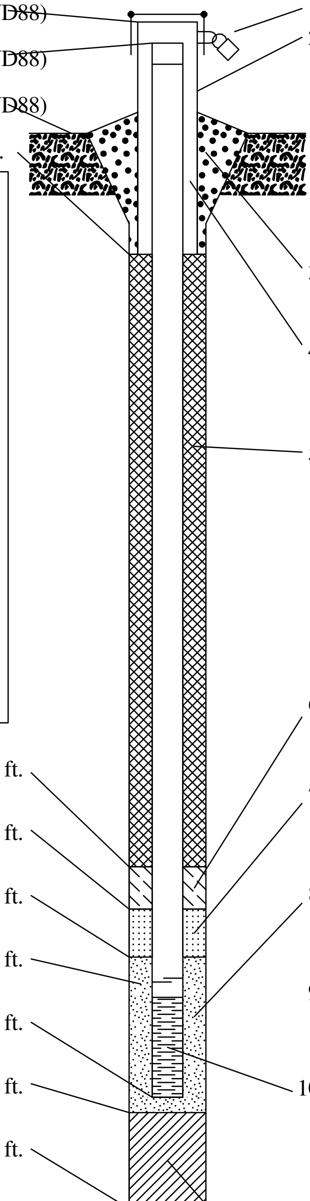
J. Filter pack, bottom 385.2 ft. (NAVD88) or 71.5 ft.

K. Borehole, bottom 379.7 ft. (NAVD88) or 77.0 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: Steel bollards (3), 6" PVC casing to 25' bgs

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. 30 % 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. Unimin Corporation, FILTERSIL
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 ______
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☐
0.5' of bentonite chips, 5' of bedrock drill cuttings Other ☒

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

Date Modified: 2/4/2016

Signature: Brad Rasher

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Baldwin Energy Complex	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-385
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 30.224" Long. -89° 52' 6.492" or	
Facility ID	St. Plane 555,417.12 ft. N, 2,382,285.24 ft. E. E /Ⓦ	Date Well Installed: 12/16/2015
Type of Well: mw	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) Mark Baetje, Bulldog Drilling
Distance from Waste/Source ____ ft. — State: Illinois	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 454.56 ft. (NAVD88)

C. Land surface elevation 454.82 ft. (NAVD88)

D. Surface seal, bottom 453.8 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): Village of Baldwin

E. Bentonite seal, top 390.8 ft. (NAVD88) or 64.0 ft.

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

G. Filter pack, top 376.8 ft. (NAVD88) or 78.0 ft.

H. Screen joint, top 374.8 ft. (NAVD88) or 80.0 ft.

I. Well bottom 364.8 ft. (NAVD88) or 90.0 ft.

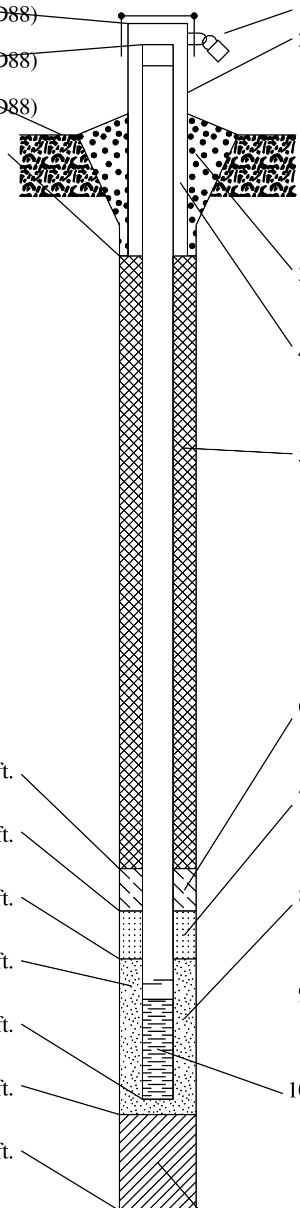
J. Filter pack, bottom 363.9 ft. (NAVD88) or 90.9 ft.

K. Borehole, bottom 361.8 ft. (NAVD88) or 93.0 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: 12.0 in.
   b. Length: 1.0 ft.
   c. Material: Steel ☒ ____ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Steel bollards (3), 6" PVC casing to 45' bgs
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. 30 % 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. Unimin Corporation, FILTERSIL
   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 ____
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐ 0.9' of bentonite chips, 1.2' of bedrock drill cuttings Other ☒

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

Date Modified: 2/4/2016

Signature: Brad Rode [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W.	MW-386
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 21.988" Long. -89° 52' 1.167" or	
Facility ID	St. Plane 554,585.18 ft. N, 2,382,713.22 ft. E. E/(W)	Date Well Installed 12/11/2015
Type of Well mw	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) Mark Baetje, Bulldog Drilling
Distance from Waste/Source ft. / State Illinois	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 454.17 ft. (NAVD88)

C. Land surface elevation 454.67 ft. (NAVD88)

D. Surface seal, bottom 453.7 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): Village of Baldwin

E. Bentonite seal, top 391.7 ft. (NAVD88) or 63.0 ft.

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

G. Filter pack, top 381.7 ft. (NAVD88) or 73.0 ft.

H. Screen joint, top 378.7 ft. (NAVD88) or 76.0 ft.

I. Well bottom 368.7 ft. (NAVD88) or 86.0 ft.

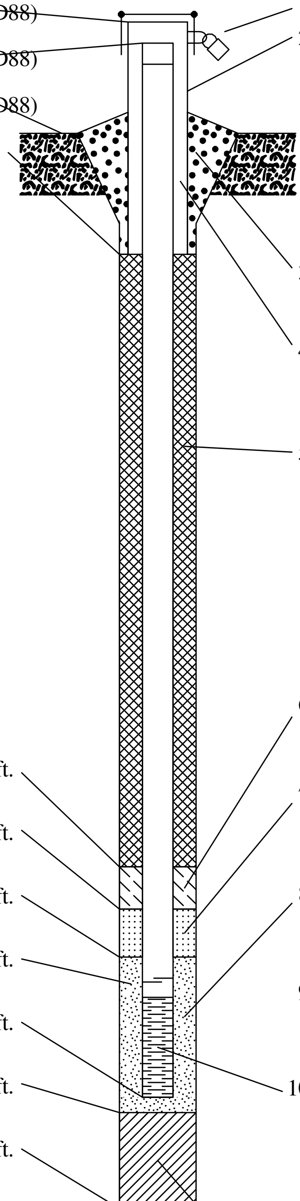
J. Filter pack, bottom 367.8 ft. (NAVD88) or 86.9 ft.

K. Borehole, bottom 365.7 ft. (NAVD88) or 89.0 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: 12.0 in.
   b. Length: 1.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Steel bollards (3), 6" PVC casing to 48.5' bgs
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. 30 % 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. Unimin Corporation, FILTERSIL
   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 ____
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐ 2.1' of bedrock drill cuttings Other ☒

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

Date Modified: 2/4/2016

Signature [signature]

Firm Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Baldwin Energy Complex	Local Grid Location of Well: ______ft. ☐ N. ☐ S. ______ft. ☐ E. ☐ W.	Well Name: MW-387
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 27.258" Long. -89° 52' 29.183" or	
Facility ID	St. Plane 555,111.17 ft. N, 2,380,474.78 ft. E. E/Ⓦ	Date Well Installed: 11/18/2015
Type of Well: mw	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) Jim Dittmaier, Bulldog Drilling
Distance from Waste/Source ft. / State: Illinois	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 426.63 ft. (NAVD88)

C. Land surface elevation 424.01 ft. (NAVD88)

D. Surface seal, bottom 423.0 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):
Village of Baldwin

E. Bentonite seal, top 382.1 ft. (NAVD88) or 41.9 ft.

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

G. Filter pack, top 378.4 ft. (NAVD88) or 45.6 ft.

H. Screen joint, top 376.0 ft. (NAVD88) or 48.0 ft.

I. Well bottom 366.0 ft. (NAVD88) or 58.0 ft.

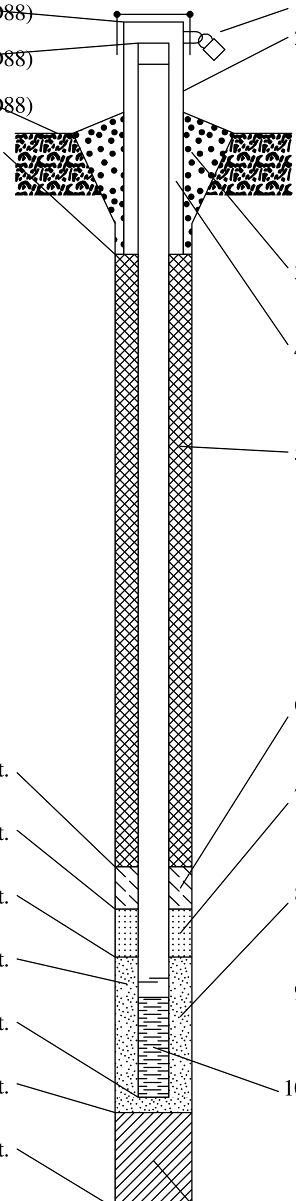
J. Filter pack, bottom 364.8 ft. (NAVD88) or 59.2 ft.

K. Borehole, bottom 362.7 ft. (NAVD88) or 61.3 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: Three 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. 30 % 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. Unimin Corporation, FILTERSIL
   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 ______
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐; 2.1' of bentonite chips Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 2/4/2016

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Baldwin Energy Complex	Local Grid Location of Well: ____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W.	Well Name
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 30.426" Long. -89° 52' 39.827" or	MW-388
Facility ID	St. Plane 555,429.08 ft. N, 2,379,624.09 ft. E. E/Ⓦ	Date Well Installed: 11/12/2015
Type of Well: mw	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) Jim Dittmaier, Bulldog Drilling
Distance from Waste/Source: ft. / State: Illinois	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 408.92 ft. (NAVD88)

C. Land surface elevation 406.28 ft. (NAVD88)

D. Surface seal, bottom 405.3 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): Village of Baldwin

E. Bentonite seal, top 380.3 ft. (NAVD88) or 26.0 ft.

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

G. Filter pack, top 375.7 ft. (NAVD88) or 30.6 ft.

H. Screen joint, top 373.3 ft. (NAVD88) or 33.0 ft.

I. Well bottom 363.3 ft. (NAVD88) or 43.0 ft.

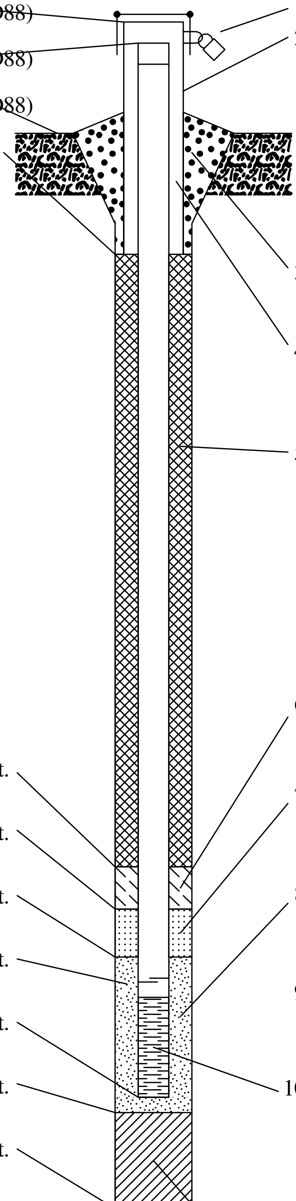
J. Filter pack, bottom 361.8 ft. (NAVD88) or 44.5 ft.

K. Borehole, bottom 361.1 ft. (NAVD88) or 45.2 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: Three steel bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ Other ☒ Sand
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % 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. Unimin Corporation, FILTERSIL
   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 ____
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐ Other ☒ 0.7' of bedrock drill cuttings

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

Date Modified: 2/26/2016

Signature: [signature]

Firm: Natural Resource Technology, 234 W. Florida Street, Floor 5, Milwaukee, WI 53204. Tel: (414) 837-3607 Fax: (414) 837-3608

MONITORING WELL CONSTRUCTION

Natural Resource Technology

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	______ft. ☐ N. ☐ S. ______ft. ☐ E. ☐ W.	MW-389
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 37.244" Long. -89° 52' 37.474" or	
Facility ID	St. Plane 556,119.33 ft. N, 2,379,809.87 ft. E. E/W (W circled)	Date Well Installed: 12/01/2015
Type of Well: mw	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) Jim Dittmaier, Bulldog Drilling
Distance from Waste/Source ___ ft. / State: Illinois	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 419.90 ft. (NAVD88)

C. Land surface elevation 417.30 ft. (NAVD88)

D. Surface seal, bottom 416.3 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): Village of Baldwin

E. Bentonite seal, top 382.3 ft. (NAVD88) or 35.0 ft.

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

G. Filter pack, top 377.3 ft. (NAVD88) or 40.0 ft.

H. Screen joint, top 375.3 ft. (NAVD88) or 42.0 ft.

I. Well bottom 365.3 ft. (NAVD88) or 52.0 ft.

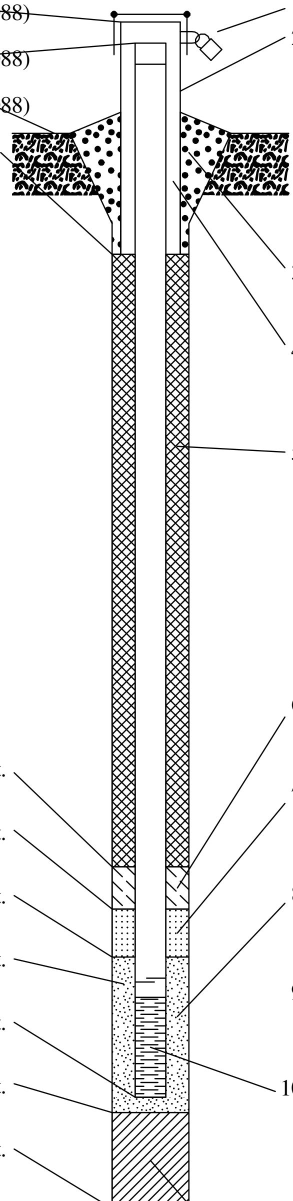
J. Filter pack, bottom 364.8 ft. (NAVD88) or 52.5 ft.

K. Borehole, bottom 362.3 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: Three 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. 30 % 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. Unimin Corporation, FILTERSIL
   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 ______
   c. Slot size: 0.010 in.
   d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐ 2.5' of bedrock drill cuttings Other ☒

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

Date Modified: 2/26/2016

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	MW-390
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 34.630" Long. -89° 52' 11.253" or	
Facility ID	St. Plane 555,865.00 ft. N, 2,381,902.09 ft. E. E/Ⓦ	Date Well Installed 03/04/2016
Type of Well: mw	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) Jim Dittmaier, Bulldog Drilling
Distance from Waste/Source ____ ft. / State: Illinois	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 428.06 ft. (NAVD88)

C. Land surface elevation 425.98 ft. (NAVD88)

D. Surface seal, bottom 425.0 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): Village of Baldwin

E. Bentonite seal, top 386.1 ft. (NAVD88) or 39.9 ft.

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

G. Filter pack, top 378.0 ft. (NAVD88) or 48.0 ft.

H. Screen joint, top 376.0 ft. (NAVD88) or 50.0 ft.

I. Well bottom 361.0 ft. (NAVD88) or 65.0 ft.

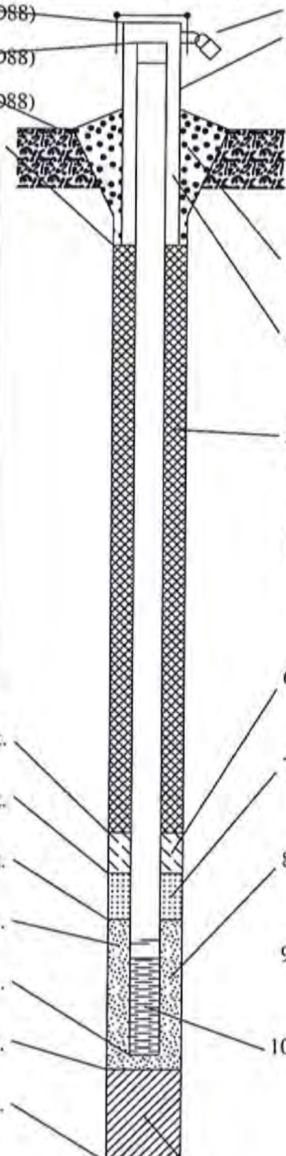
J. Filter pack, bottom 360.3 ft. (NAVD88) or 65.7 ft.

K. Borehole, bottom 358.0 ft. (NAVD88) or 68.0 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: Three 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. 30 % Bentonite . . . Bentonite-cement grout ☒
e. ____ Ft³ 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 ____ ft³

8. Filter pack material: Manufacturer, product name & mesh size
a. Unimin Corporation, FILTERSIL
b. Volume added ____ ft³

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 ____
c. Slot size: 0.010 in.
d. Slotted length: 15.0 ft.

11. Backfill material (below filter pack): None ☐ 2.3' of bedrock drill cuttings Other ☒

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

Date Modified: 3/28/2016

Signature: [signature]

Firm: Natural Resource Technology, 234 W. Florida Street, Floor 5, Milwaukee, WI 53204 — Tel: (414) 837-3607 Fax: (414) 837-3608

Natural Resource Technology

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	MW-391
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒	
	Lat. 38° 11' 27.129" Long. -89° 52' 29.134" or	
Facility ID	St. Plane 555,100.63 ft. N, 2,380,477.06 ft. E. E/W (W circled)	Date Well Installed: 03/10/2016
Type of Well: mw	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) Jim Dittmaier, Bulldog Drilling
Distance from Waste/Source ____ ft. / State: Illinois	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 426.63 ft. (NAVD88)

C. Land surface elevation 424.24 ft. (NAVD88)

D. Surface seal, bottom 423.2 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):
Village of Baldwin

E. Bentonite seal, top 377.2 ft. (NAVD88) or 47.0 ft.

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

G. Filter pack, top 371.2 ft. (NAVD88) or 53.0 ft.

H. Screen joint, top 369.2 ft. (NAVD88) or 55.0 ft.

I. Well bottom 354.2 ft. (NAVD88) or 70.0 ft.

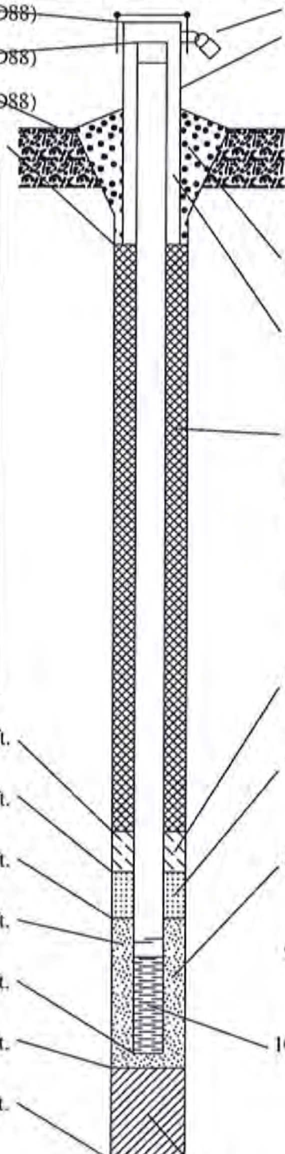
J. Filter pack, bottom 352.4 ft. (NAVD88) or 71.8 ft.

K. Borehole, bottom 352.2 ft. (NAVD88) or 72.0 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: Three 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. 30 % 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. Unimin Corporation, FILTERSIL
   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 ____
    c. Slot size: 0.010 in.
    d. Slotted length: 15.0 ft.
11. Backfill material (below filter pack): None ☐ Other ☒
    0.2' of bedrock drill cuttings

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

Date Modified: 3/28/2016

Signature: [signature]

Firm: Natural Resource Technology, 234 W. Florida Street, Floor 5, Milwaukee, WI 53204 — Tel: (414) 837-3607 Fax: (414) 837-3608

Illinois Environmental Protection Agency

Well Completion Report

Incident No.: None
Site Name: Dynegy-Baldwin Energy Complex
Drilling Contractor: Terra Drill
Driller: Matt Cooper
Drilling Method: Hollow-Stem Auger

Well No.: OW-156
Date Drilled Start: 09/10/10
Date Completed: 09/10/10
Geologist: Brendon Wilder
Drilling Fluids (Type): None

Annular Space Details

Type of Surface Seal: Concrete
Type of Annular Sealant: Bentonite Chips
Type of Bentonite Seal (Granular, Pellet): Bentonite Chips (hydrated)
Type of Sand Pack: Clean Silica Sand

Well Construction Materials

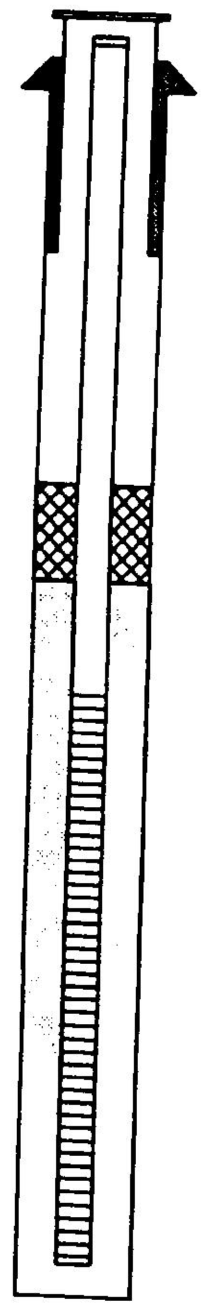
	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			
Riser pipe above w.t.		Sch. 40	
Riser Pipe below w.t.		Sch. 40	
Screen		Sch. 40	
Coupling joint screen to riser			
Protective casing			

Measurements

to .01 ft (where applicable)

Riser Pipe Length	10.61
Screen Length	9.33
Screen Slot Size	0.01
Protective casing length	
Depth to water	7.36
Elevation of water	420.51
Free Product thickness	
Gallons removed (develop)	
Gallons removed (purge)	
Other	

Completed by: PSC Industrial Outsourcing, LP



Elevations - .01 ft.

_____ Top of Protective Casing
427.87 Top of Riser Pipe
425.14 Ground Surface
424.14 Top of Annular sealant
_____ Casing Stickup
422.14 Top of Seal
3.00 Total Seal Interval
419.14 Top of Sand
417.26 Top of Screen
9.33 Total Screen Interval
407.93 Bottom of Screen
407.42 Bottom of Borehole

IL 532-2274
LPC 500 Rev June 2004

Illinois Environmental Protection Agency

Well Completion Report

Incident No.: None

Site Name: Dynegy-Baldwin Energy Complex

Drilling Contractor: Terra Drill

Driller: Matt Cooper

Drilling Method: Hollow-Stem Auger

Well No.: OW-157

Date Drilled Start: 09/09/10

Date Completed: 09/09/10

Geologist: Brendon Wilder

Drilling Fluids (Type): None

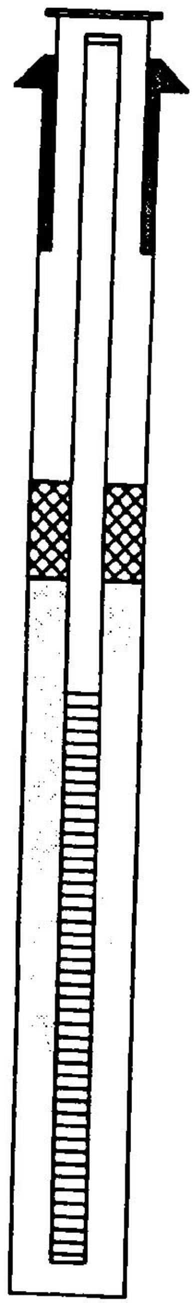
Annular Space Details

Type of Surface Seal: Concrete

Type of Annular Sealant: Bentonite Chips

Type of Bentonite Seal (Granular, Pellet): Bentonite Chips (hydrated)

Type of Sand Pack: Clean Silica Sand



Elevations - .01 ft.

- ____ Top of Protective Casing
- 432.64 Top of Riser Pipe
- 429.90 Ground Surface
- 428.90 Top of Annular sealant
- ____ Casing Stickup
- 424.90 Top of Seal
- 2.00 Total Seal Interval
- 422.90 Top of Sand
- 422.10 Top of Screen
- 9.33 Total Screen Interval
- 412.77 Bottom of Screen
- 412.26 Bottom of Borehole

Well Construction Materials

	Stainless Steel Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint			
Riser pipe above w.t.		Sch. 40	
Riser Pipe below w.t.		Sch. 40	
Screen		Sch. 40	
Coupling joint screen to riser			
Protective casing			

Measurements

to .01 ft (where applicable)

Riser Pipe Length	10.54
Screen Length	9.33
Screen Slot Size	0.01
Protective casing length	
Depth to water	5.03
Elevation of water	427.61
Free Product thickness	
Gallons removed (develop)	
Gallons removed (purge)	
Other	

Completed by: PSC Industrial Outsourcing, LP

KELRON ENVIRONMENTAL
Incorporated

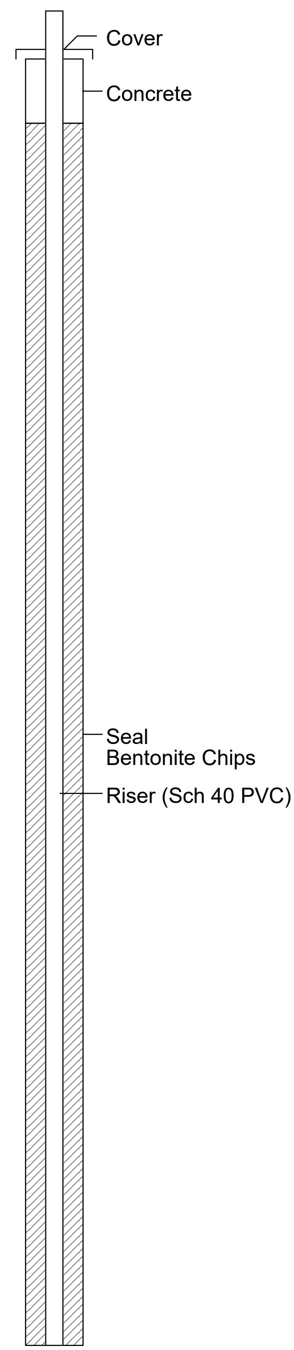
LOG OF PROBEHOLE OW-256

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/22/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 425.20
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 427.70
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381947, 558054

Depth in Feet	DESCRIPTION	Surf. Elev. 425.20	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring to 13.5 feet below ground surface. Refer to boring log for adjacent well OW-156.	425					
5		420				CL	
10		415					
	CLAY (lean), very stiff, high plasticity, pale brown (10YR 6/3),moist - 25% reddish-brown mottling with black manganese staining - light gray (10YR 7/1) with 10-25% mottling		1	60/60	3.0	CL	
15		410	2		2.25		
			3		2.0		
			4		2.0		
			5		1.75		
	Silty CLAY, trace fine to coarse sand [TILL]		6	60/60	2.5	CL	
			7		1.0		
20							

Well: OW-256
Elev.: 427.70



KELRON
ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE OW-256

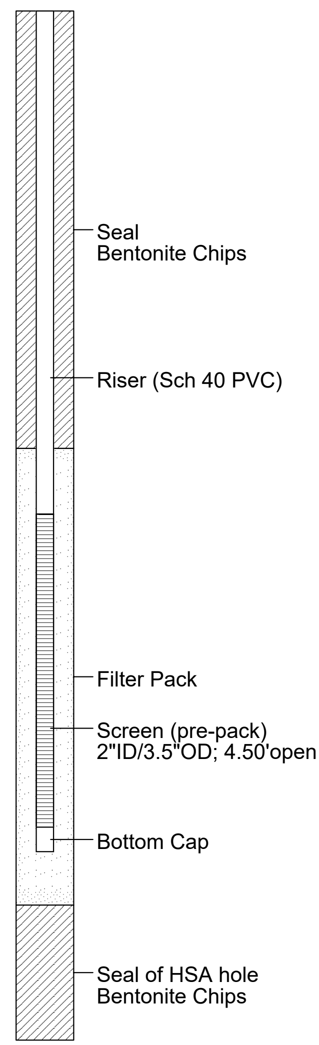
Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/22/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 425.20
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 427.70
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381947, 558054

Depth in Feet	DESCRIPTION	Surf. Elev. 425.20	USCS
20	- trace fine-coarse gravel (angular to sub-angular; granite piece of 1 1/4"), 50-75% yellowish-brown (10YR 6/8) mottling - few sand and gravel, stiff, high plasticity, gray (10YR 6/1) with 25-75% mottling - <25% mottling - with sand (fine-medium)	405 / 400	CL
	SAND (fine-medium), well graded, brownish yellow (10YR 6/6), wet		SW
30	Silty CLAY (lean) with sand (fine-medium), medium plasticity, brownish yellow, wet - hard, non plastic, light brownish gray (10YR 6/2), moist [Vandalia Till @ 31.5'] - little sand (fine-coarse) and gravel (fine-coarse, sub-angular to sub-rounded), low to non-plastic, gray (10YR 5/1)	395	CL
35	SHALE and CLAY, semi-competent, laminated clay with up to 1/2-inch thick layers of hard shale, dry [note: top of weathered bedrock at 33.9 feet below ground surface]	390	SH/CL
	SHALE with intermittent clay layers, hard, gray		SH
40	END Sampling at 38.5 feet BLS END WELL BOREHOLE at 36.0 feet BLS		

Samples	Recovery inches	Qp TSF
7		1.0
8		1.75
9		1.75
10		1.0
11	60/60	1.0
12		2.0
13		1.0
14		1.0
15		
16	35/60	
17		
18		>4.5
19		
20		
21	54/60	3.0
22		4.0
23		>4.5
24		>4.5
25		>4.5

Well: OW-256
Elev.: 427.70



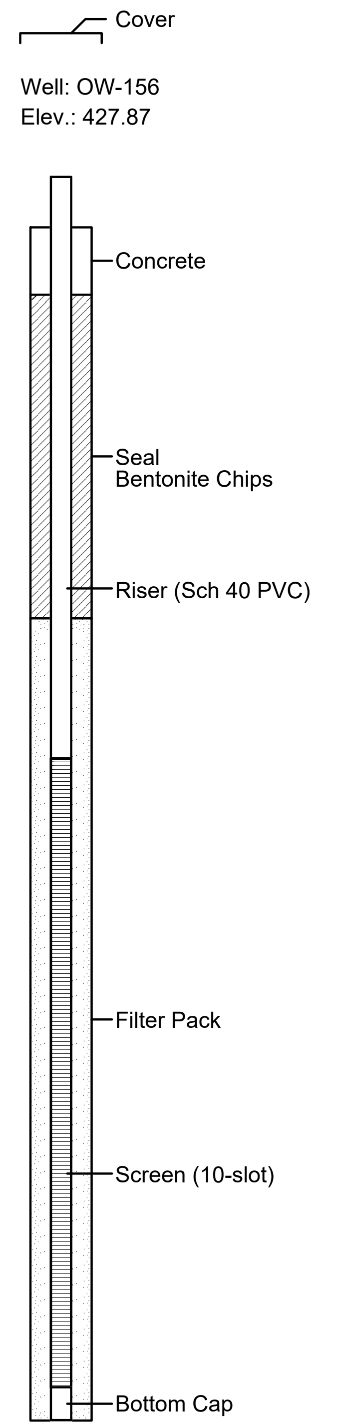
KELRON ENVIRONMENTAL Incorporated

LOG OF BORING OW-156

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 NW, NW, SW

Date Completed	: 09/10/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 425.14
Sampling Method	: MacroCore (60")	Top of Casing Elevation	: 427.87
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2378141, 555983

Depth in Feet	DESCRIPTION	Surf. Elev.425.15	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	SILTY CLAY, stiff, medium brown, dry	425					
			1	32/48	2.5		
			2		1.5		
			3		3.5		
			4		1.75		
5	- stiff to very stiff, low plasticity	420	5	56/60	2.0		
			6		1.75		
	- dark gray-brown (10YR 3/3) with light brown mottling (10YR 6/3)		7		1.75		
			8		1.75		
			9		2.25	CL	
10	CLAY (lean) with Sand, soft to medium, light brown (10YR 6/3) with brown-yellow mottling (10YR 6/6), moist	415	10	60/60	1.0		
			11		1.5		
			12		1.75		
			13		1.75		
			14		1.5		
15		410	15	50/60	2.25		
			16		2.0		
			17		2.5		
	END BOREHOLE AT 17.7 FEET BLS		18		1.25		
	Terminated probing with MacroCore at 19.5 feet bls		19				
20							



04-09-2014

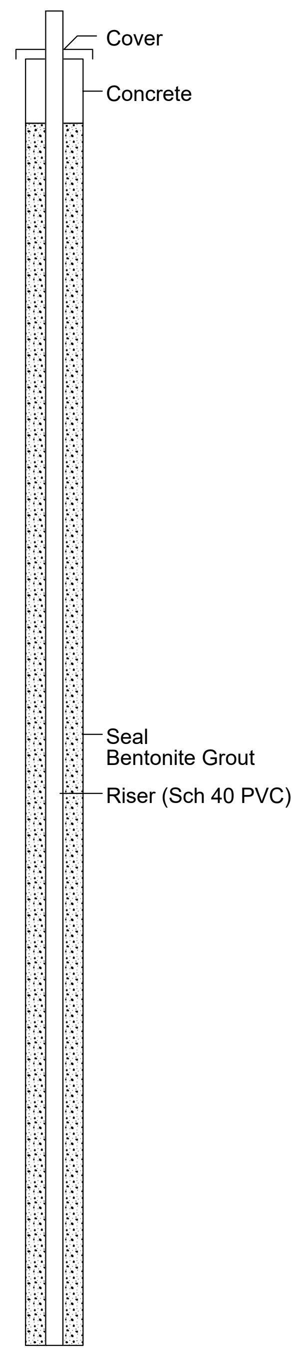
KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE OW-257

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/16/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 428.17
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.02
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2382572, 556198

Depth in Feet	DESCRIPTION	Surf. Elev. 428.17	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	Continuous boring to 18.5 feet below ground surface. Refer to boring log for adjacent well OW-157.						
		425					
5							
		420				CL	
10							
		415					
15							
		410					
	Silty CLAY, trace sand and gravel, stiff, high plasticity, gray (10YR 6/1) with 25-50% reddish-brown mottling, moist [TILL]		1	56/60	3.0	CL	
			2		2.75		
20							

Well: OW-257
Elev.: 431.02



KELRON ENVIRONMENTAL
Incorporated

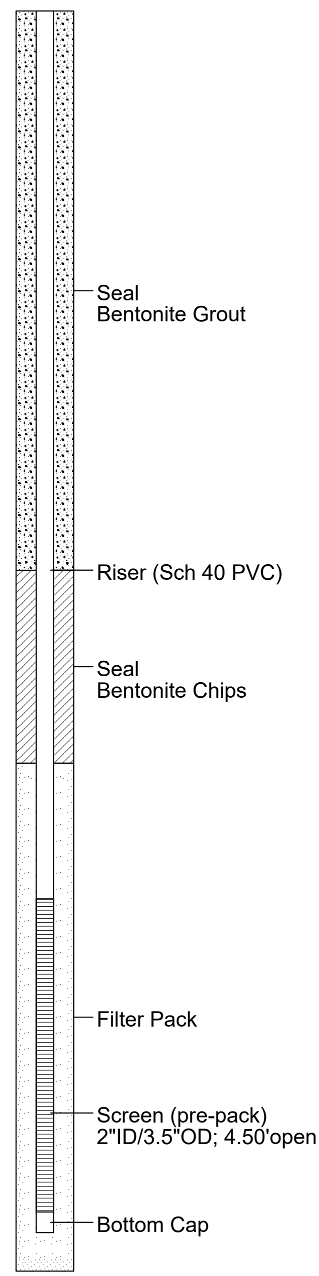
LOG OF PROBEHOLE OW-257

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/16/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 428.17
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.02
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2382572, 556198

Depth in Feet	DESCRIPTION	Surf. Elev. 428.17	Samples	Recovery inches	Qp TSF	USCS
20			2		2.75	CL
	- >50% mottling		3		2.5	
	Sandy CLAY with gravel (fine-coarse, sub-angular; granite piece of 1.5"), brownish yellow (10YR 6/6), wet					CL
	Silty CLAY, trace sand and gravel, soft, high plasticity, yellowish brown (10YR5/6) with 10-25% light gray mottling		4		1.0	
		405	5		1.5	
	- very soft, brownish yellow with <10% mottling		6	60/60	0.5	
25	- with trace pyrite crystals		7		1.0	
	- medium hardness grading to stiff		8		2.0	
			9		2.0	
		400	10		3.25	
			11	60/60	1.5	CL
30			12		3.5	
	- stiff, high plasticity, gray with <10% reddish-brown mottling, moist		13		2.75	
	- very stiff, dark gray (10YR 4/1)		14		2.0	
		395	15		3.5	
			16	60/60	2.0	
35			17		2.0	
	- low plasticity, very dark gray (10YR 3/1)		18		4.0	
	SHALE and CLAY (fat), intermittent lamination, hard, very dark gray, moist [note: top of weathered bedrock at 36.3 feet below ground surface]		19		3.0	
		390	20		>4.5	SH/CL
			21	13/13		
40	END BOREHOLE at 39.6 feet BLS					

Well: OW-257
Elev.: 431.02



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KELRON ENVIRONMENTAL INCORPORATED

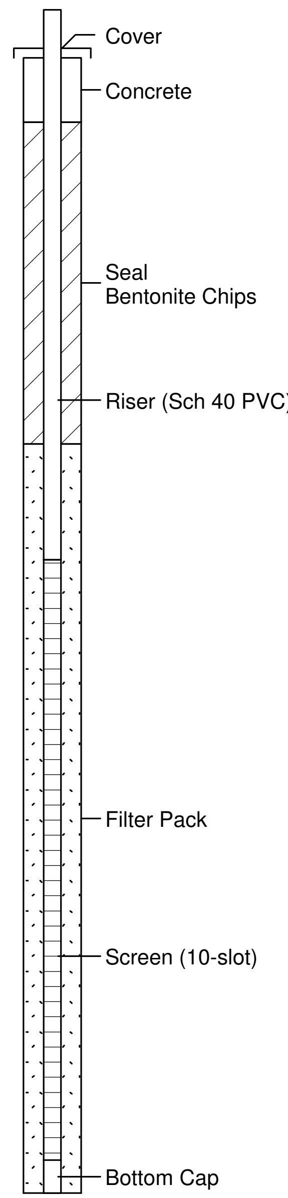
LOG OF BORING OW-157

Ash Pond System Monitoring Well Network
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.
Location: Twp 04S, Rng 07W, 10 SE, SW, SW

Date Completed	: 09/9/2010	Driller	: Matt Cooper
Hole Diameter	: 8 1/2"OD; 4 1/4" ID	Geologist	: Brendon Wilder (PSC)
Drilling Method	: Hollow-Stem (CME-550)	Land Surface Elevation	: 432.64
Sampling Method	: MacroCore (60")	Top of Casing Elevation	429.90
Drilling Company	: Terra Drill, Inc.	X,Y Coordinates	: 2382593, 556189

Depth in Feet	DESCRIPTION	Surf. Elev. 429.90	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
0	SILTY CLAY with Fly Ash, dark gray-brown, dry	429	1	48/48		CL/FL	
5	CLAY with Silt, hard, medium plasticity, light olive brown, moist	424	2	60/60		CH	
10	CLAY with Sand, stiff, wet	419				CL	
	CLAY, trace to some Sand, very stiff to hard, medium to high plasticity		3	60/60		CL/CH	
15		414	4	60/60			
	END BOREHOLE AT 17.5 FEET BLS						
20	Terminated probing with MacroCore at 19.5 feet bls						

Well: OW-157
Elev.: 432.64



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NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W.	PZ-169
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 49.063" Long. -89° 52' 12.911" or	
Facility ID	St. Plane 557,323.57 ft. N, 2,381,764.94 ft. E. E/Ⓦ	Date Well Installed: 07/28/2015
Type of Well	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) Chad Dutton, Bulldog Drilling
Distance from Waste/Source ft. / State: Illinois	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 422.60 ft. (NAVD88)

C. Land surface elevation 420.01 ft. (NAVD88)

D. Surface seal, bottom 419.0 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): Village of Baldwin

E. Bentonite seal, top 393.0 ft. (NAVD88) or 27.0 ft.

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

G. Filter pack, top 390.5 ft. (NAVD88) or 29.5 ft.

H. Screen joint, top 388.5 ft. (NAVD88) or 31.5 ft.

I. Well bottom 378.5 ft. (NAVD88) or 41.5 ft.

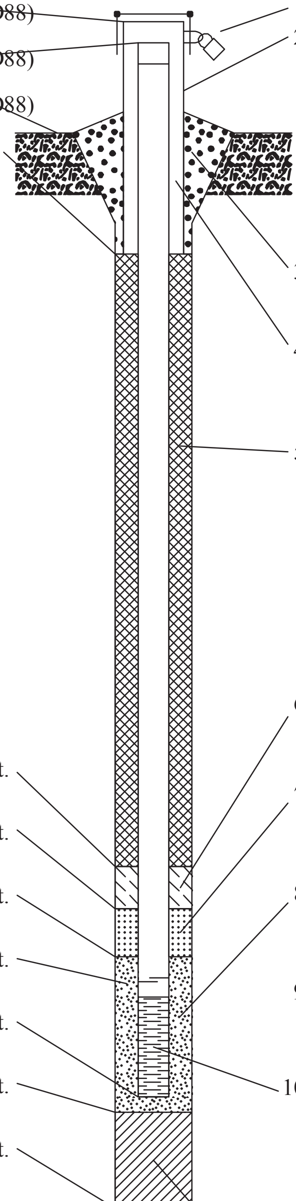
J. Filter pack, bottom 378.0 ft. (NAVD88) or 42.0 ft.

K. Borehole, bottom 378.0 ft. (NAVD88) or 42.0 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: Three 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. 30 % 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. Unimin Corporation, FILTERSIL
   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 ____
    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: 11/6/2015

Signature [signature]

Firm Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 44.106" Long. -89° 52' 10.675" or	PZ-170
Facility ID	St. Plane 556,822.69 ft. N, 2,381,944.92 ft. E. E / (W)	Date Well Installed 07/29/2015
Type of Well	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) Chad Dutton, Bulldog Drilling
Distance from Waste/Source ft. / State: Illinois	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 421.43 ft. (NAVD88)

C. Land surface elevation 418.58 ft. (NAVD88)

D. Surface seal, bottom 417.6 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): Village of Baldwin

E. Bentonite seal, top 404.7 ft. (NAVD88) or 13.9 ft.

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

G. Filter pack, top 399.7 ft. (NAVD88) or 18.9 ft.

H. Screen joint, top 397.5 ft. (NAVD88) or 21.1 ft.

I. Well bottom 387.5 ft. (NAVD88) or 31.1 ft.

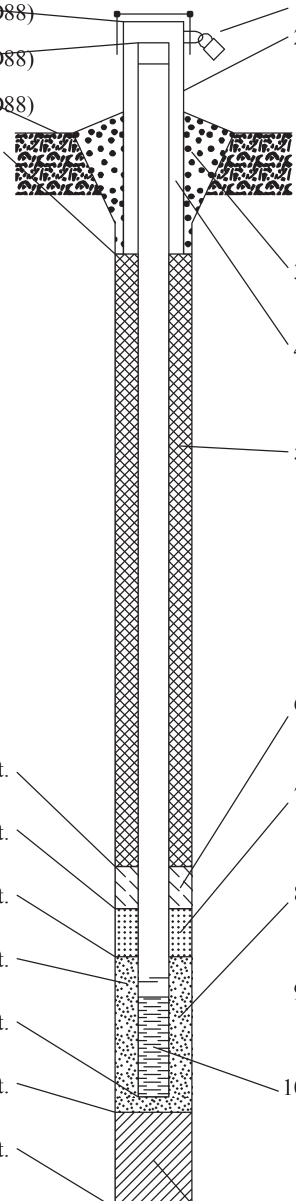
J. Filter pack, bottom 387.5 ft. (NAVD88) or 31.1 ft.

K. Borehole, bottom 387.5 ft. (NAVD88) or 31.1 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: Three additional 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. 30 % 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. Unimin Corporation, FILTERSIL
   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 ______
    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: 11/6/2015

Signature [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

Natural Resource Technology

MONITORING WELL CONSTRUCTION

Facility/Project Name: Baldwin Energy Complex	Local Grid Location of Well: ______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	Well Name: PZ-171
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 40.542" Long. -89° 52' 45.080" or	
Facility ID	St. Plane 556,453.57 ft. N, 2,379,199.67 ft. E. E /(W)	Date Well Installed: 07/31/2015
Type of Well	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) Chad Dutton, Bulldog Drilling
Distance from Waste/Source: ft. — State: Illinois	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 434.15 ft. (NAVD88)

C. Land surface elevation 431.54 ft. (NAVD88)

D. Surface seal, bottom 430.5 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): Village of Baldwin

E. Bentonite seal, top 410.5 ft. (NAVD88) or 21.0 ft.

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

G. Filter pack, top 405.5 ft. (NAVD88) or 26.0 ft.

H. Screen joint, top 403.5 ft. (NAVD88) or 28.0 ft.

I. Well bottom 393.5 ft. (NAVD88) or 38.0 ft.

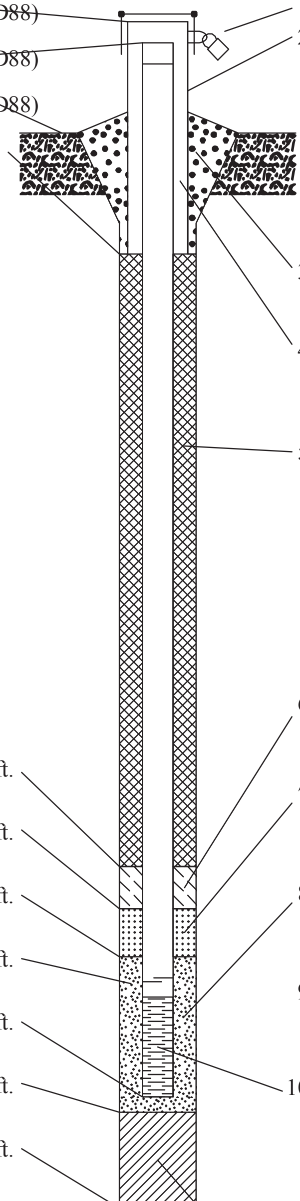
J. Filter pack, bottom 393.5 ft. (NAVD88) or 38.0 ft.

K. Borehole, bottom 393.5 ft. (NAVD88) or 38.0 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: Three 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. 30 % 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. Unimin Corporation, FILTERSIL
   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 ______
    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: 11/6/2015

Signature [signature]

Firm: Natural Resource Technology, 234 W. Florida Street, Floor 5, Milwaukee, WI 53204 — Tel: (414) 837-3607 Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

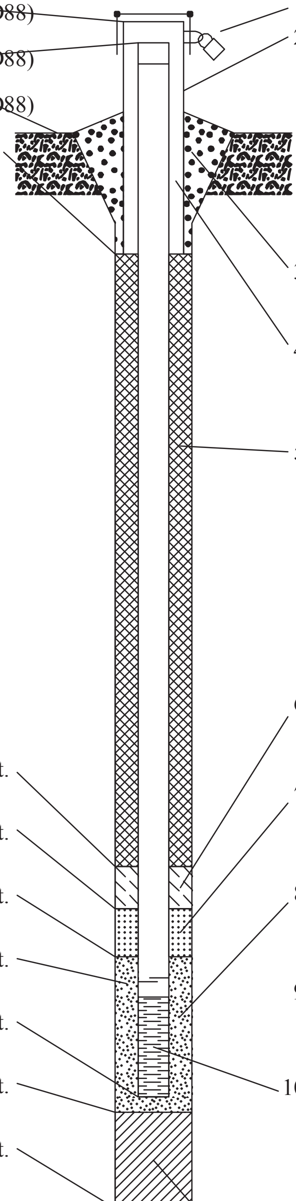
Facility/Project Name Baldwin Energy Complex	Local Grid Location of Well _____ft. ☐ N. ☐ S. _____ft. ☐ E. ☐ W.	Well Name
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 29.368" Long. -89° 52' 45.419" or	PZ-172
Facility ID	St. Plane 555,323.28 ft. N, 2,379,176.11 ft. E. E/Ⓦ	Date Well Installed 08/03/2015
Type of Well	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) Chad Dutton Bulldog Drilling
Distance from Waste/Source ft. / State Illinois	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 412.95 ft. (NAVD88)

C. Land surface elevation 410.22 ft. (NAVD88)

D. Surface seal, bottom 409.2 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):
Village of Baldwin

E. Bentonite seal, top 409.2 ft. (NAVD88) or 1.0 ft.

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

G. Filter pack, top 396.2 ft. (NAVD88) or 14.0 ft.

H. Screen joint, top 394.2 ft. (NAVD88) or 16.0 ft.

I. Well bottom 384.2 ft. (NAVD88) or 26.0 ft.

J. Filter pack, bottom 384.0 ft. (NAVD88) or 26.2 ft.

K. Borehole, bottom 384.0 ft. (NAVD88) or 26.2 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: Three 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. Unimin Corporation, FILTERSIL
   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 _____
    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: 11/6/2015

Signature	Firm
[signature]	Natural Resource Technology 234 W. Florida Street, Floor 5, Milwaukee, WI 53204 Tel: (414) 837-3607 Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 26.520" Long. -89° 52' 45.289" or	PZ-173
Facility ID	St. Plane 555,035.38 ft. N, 2,379,187.28 ft. E. E /(W)	Date Well Installed 08/03/2015
Type of Well	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) Chad Dutton Bulldog Drilling
Distance from Waste/ Source ft. | State Illinois	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 391.46 ft. (NAVD88)

C. Land surface elevation 388.43 ft. (NAVD88)

D. Surface seal, bottom 387.4 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):
Village of Baldwin

E. Bentonite seal, top 387.4 ft. (NAVD88) or 1.0 ft.

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

G. Filter pack, top 385.4 ft. (NAVD88) or 3.0 ft.

H. Screen joint, top 384.9 ft. (NAVD88) or 3.5 ft.

I. Well bottom 374.9 ft. (NAVD88) or 13.5 ft.

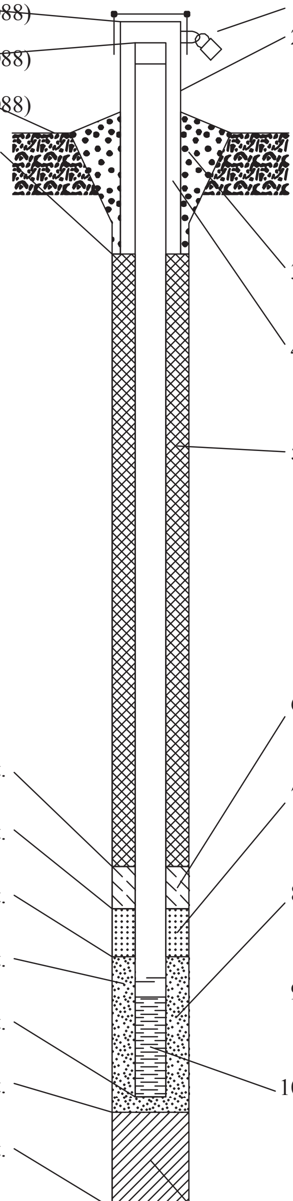
J. Filter pack, bottom 374.3 ft. (NAVD88) or 14.1 ft.

K. Borehole, bottom 374.3 ft. (NAVD88) or 14.1 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: Three 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. Unimin Corporation, FILTERSIL
   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 ______
   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.

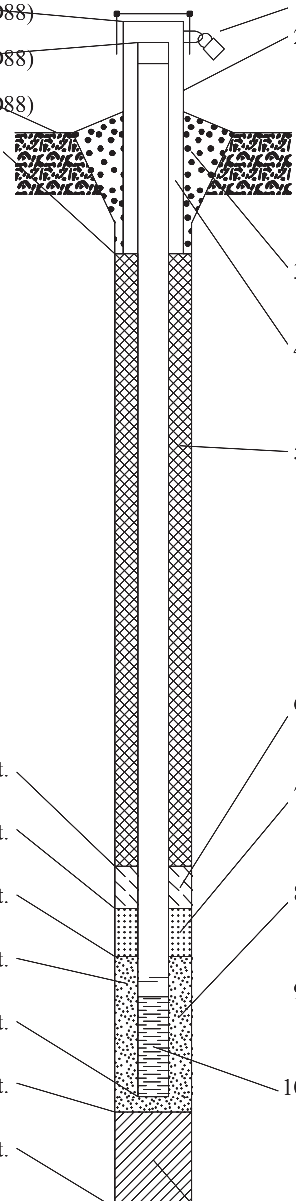
Date Modified: 11/6/2015

Signature	Firm	
[signature]	Natural Resource Technology 234 W. Florida Street, Floor 5, Milwaukee, WI 53204	Tel: (414) 837-3607 Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Baldwin Energy Complex	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: PZ-174
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 22.855" Long. -89° 52' 37.952" or	
Facility ID	St. Plane 554,666.23 ft. N, 2,379,774.23 ft. E. E /Ⓦ	Date Well Installed: 08/04/2015
Type of Well	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) Chad Dutton, Bulldog Drilling
Distance from Waste/Source ____ ft. / State: Illinois	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 401.92 ft. (NAVD88)

C. Land surface elevation 398.97 ft. (NAVD88)

D. Surface seal, bottom 398.0 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): Village of Baldwin

E. Bentonite seal, top 398.0 ft. (NAVD88) or 1.0 ft.

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

G. Filter pack, top 386.5 ft. (NAVD88) or 12.5 ft.

H. Screen joint, top 384.5 ft. (NAVD88) or 14.5 ft.

I. Well bottom 374.5 ft. (NAVD88) or 24.5 ft.

J. Filter pack, bottom 374.5 ft. (NAVD88) or 24.5 ft.

K. Borehole, bottom 374.5 ft. (NAVD88) or 24.5 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: Three 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. Unimin Corporation, FILTERSIL
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 ____
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: 11/6/2015

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 20.515" Long. -89° 52' 24.532" or	PZ-175
Facility ID	St. Plane 554,433.02 ft. N, 2,380,846.31 ft. E. E /(W)	Date Well Installed 08/07/2015
Type of Well	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) Chad Dutton Bulldog Drilling
Distance from Waste/ Source ____ ft. / State: Illinois	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 423.01 ft. (NAVD88)

C. Land surface elevation 419.87 ft. (NAVD88)

D. Surface seal, bottom 418.9 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 ☒
______ 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):
Village of Baldwin

E. Bentonite seal, top 384.9 ft. (NAVD88) or 35.0 ft.

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

G. Filter pack, top 381.9 ft. (NAVD88) or 38.0 ft.

H. Screen joint, top 379.9 ft. (NAVD88) or 40.0 ft.

I. Well bottom 369.9 ft. (NAVD88) or 50.0 ft.

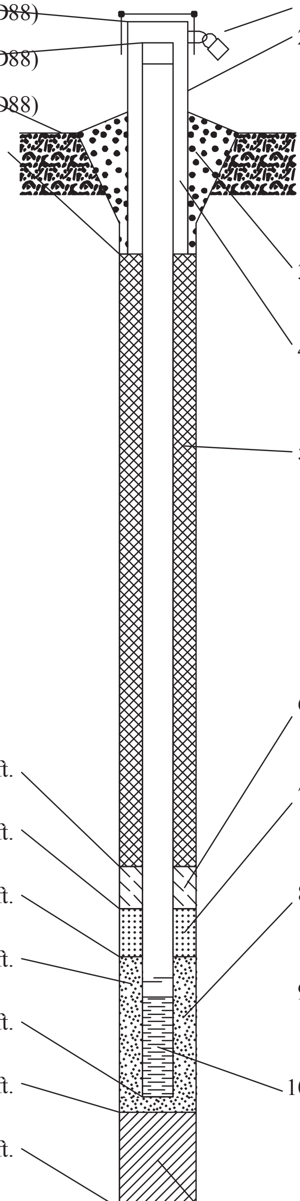
J. Filter pack, bottom 369.9 ft. (NAVD88) or 50.0 ft.

K. Borehole, bottom 369.9 ft. (NAVD88) or 50.0 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: Three 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. 30 % 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. Unimin Corporation, FILTERSIL
   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 ______
   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: 11/6/2015

Signature: Pat M. Huff

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 18.834" Long. -89° 52' 17.843" or	PZ-176
Facility ID	St. Plane 554,264.76 ft. N, 2,381,381.02 ft. E. E/Ⓦ	Date Well Installed 08/06/2015
Type of Well	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) Chad Dutton, Bulldog Drilling
Distance from Waste/Source ft. / State Illinois	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 406.44 ft. (NAVD88)

C. Land surface elevation 403.46 ft. (NAVD88)

D. Surface seal, bottom 402.5 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):
Village of Baldwin

E. Bentonite seal, top 392.5 ft. (NAVD88) or 11.0 ft.

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

G. Filter pack, top 387.5 ft. (NAVD88) or 16.0 ft.

H. Screen joint, top 385.4 ft. (NAVD88) or 18.1 ft.

I. Well bottom 375.4 ft. (NAVD88) or 28.1 ft.

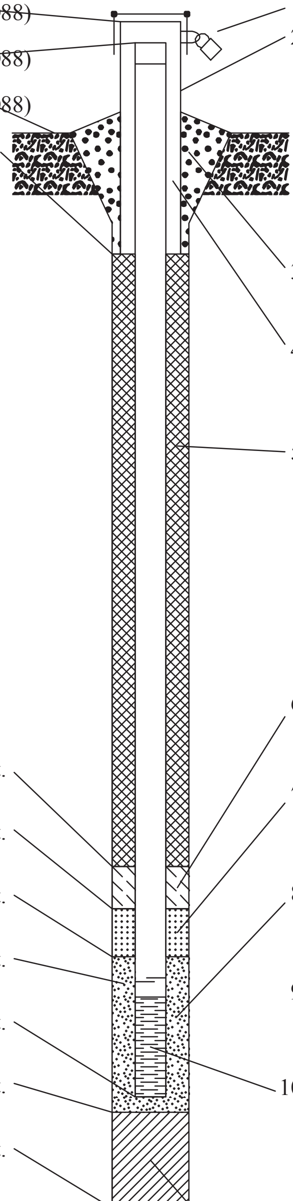
J. Filter pack, bottom 374.9 ft. (NAVD88) or 28.6 ft.

K. Borehole, bottom 374.9 ft. (NAVD88) or 28.6 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: Three 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. 30 % 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. Unimin Corporation, FILTERSIL
   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 ______
   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: 11/6/2015

Signature [signature]

Firm Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Baldwin Energy Complex	Local Grid Location of Well: ____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W.	Well Name
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 18.100" Long. -89° 52' 11.050" or	PZ-177
Facility ID	St. Plane 554,192.18 ft. N, 2,381,923.59 ft. E. E /(W)	Date Well Installed: 08/06/2015
Type of Well	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) Chad Dutton Bulldog Drilling
Distance from Waste/Source ____ ft. | State: Illinois	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 420.90 ft. (NAVD88)

C. Land surface elevation 417.93 ft. (NAVD88)

D. Surface seal, bottom 416.9 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 ☒
____ 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):
Village of Baldwin

E. Bentonite seal, top 402.4 ft. (NAVD88) or 15.5 ft.

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

G. Filter pack, top 399.4 ft. (NAVD88) or 18.5 ft.

H. Screen joint, top 397.4 ft. (NAVD88) or 20.5 ft.

I. Well bottom 387.4 ft. (NAVD88) or 30.5 ft.

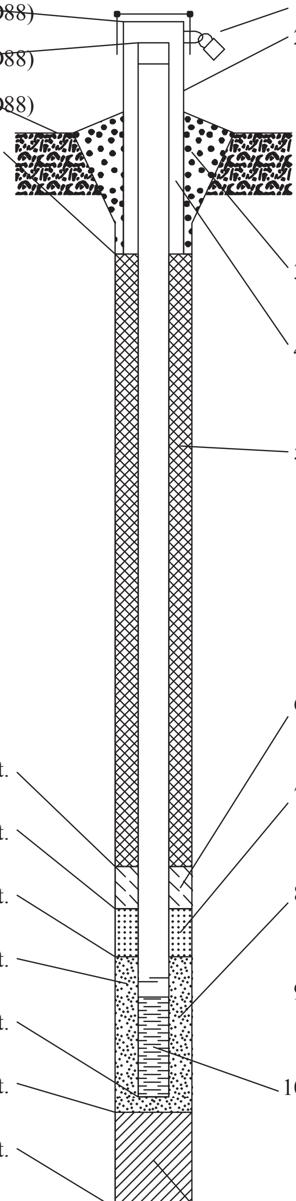
J. Filter pack, bottom 387.4 ft. (NAVD88) or 30.5 ft.

K. Borehole, bottom 387.4 ft. (NAVD88) or 30.5 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: Three 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. 30 % 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. Unimin Corporation, FILTERSIL
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 ____
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: 11/6/2015

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Baldwin Energy Complex	Local Grid Location of Well: ____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W.	Well Name: PZ-178
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 17.074" Long. -89° 52' 4.325" or	
Facility ID	St. Plane 554,089.94 ft. N, 2,382,460.67 ft. E. E /(W)	Date Well Installed: 08/05/2015
Type of Well	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) Chad Dutton, Bulldog Drilling
Distance from Waste/Source ____ ft. / State: Illinois	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 431.26 ft. (NAVD88)

C. Land surface elevation 428.45 ft. (NAVD88)

D. Surface seal, bottom 427.5 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): Village of Baldwin

E. Bentonite seal, top 401.5 ft. (NAVD88) or 27.0 ft.

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

G. Filter pack, top 397.5 ft. (NAVD88) or 31.0 ft.

H. Screen joint, top 395.5 ft. (NAVD88) or 33.0 ft.

I. Well bottom 385.5 ft. (NAVD88) or 43.0 ft.

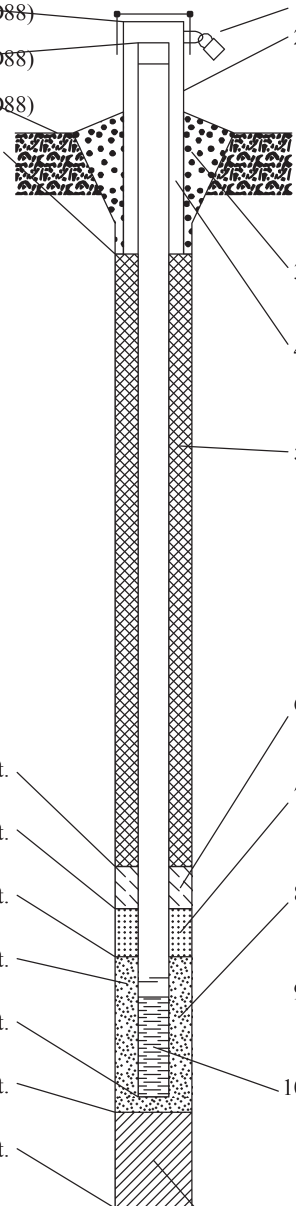
J. Filter pack, bottom 385.0 ft. (NAVD88) or 43.5 ft.

K. Borehole, bottom 385.0 ft. (NAVD88) or 43.5 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: Three 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. 30 % 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. Unimin Corporation, FILTERSIL
   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 ____
    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: 11/6/2015

Signature: [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Energy Complex	______ft. ☐ N. ☐ S. ______ft. ☐ E. ☐ W.	
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 40.243" Long. -89° 52' 4.836" or	PZ-182
Facility ID	St. Plane 556,433.70 ft. N, 2,382,412.47 ft. E. E/(W)	Date Well Installed 07/30/2015
Type of Well	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) Chad Dutton, Bulldog Drilling
Distance from Waste/Source ft. / State: Illinois	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 431.61 ft. (NAVD88)

C. Land surface elevation 428.47 ft. (NAVD88)

D. Surface seal, bottom 427.5 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):
Village of Baldwin

E. Bentonite seal, top 409.5 ft. (NAVD88) or 19.0 ft.

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

G. Filter pack, top 406.5 ft. (NAVD88) or 22.0 ft.

H. Screen joint, top 404.5 ft. (NAVD88) or 24.0 ft.

I. Well bottom 394.5 ft. (NAVD88) or 34.0 ft.

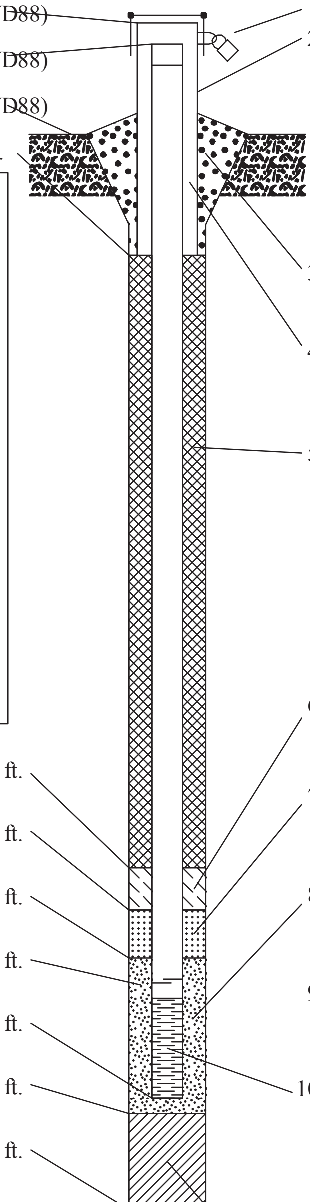
J. Filter pack, bottom 394.5 ft. (NAVD88) or 34.0 ft.

K. Borehole, bottom 394.5 ft. (NAVD88) or 34.0 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: Three 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. 30 % 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. Unimin Corporation, FILTERSIL
   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 ______
   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: 11/6/2015

Signature [signature]

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE TPZ-158 (Page 1 of 2)

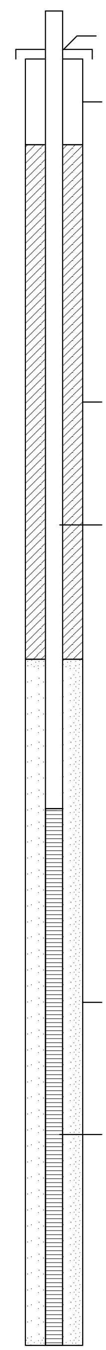
Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/27/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 453.26
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 456.26
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2387752, 556741

Depth in Feet	DESCRIPTION	Surf. Elev. 453.26	Samples	Recovery inches	Qp TSF	USCS
0	Silty Loam with roots, stiff, non-plastic, pale brown (10YR 6/3), dry		1	60/60	2	CL
	- dark brown (10YR 3/3)		2		2.75	
	Silty CLAY, very stiff, low plasticity, gray (10YR 5/1) with yellowish-brown mottling, moist		3		3.75	CL
		450	4		3.5	
	- 25-50% mottling w/ black oxidation staining		5		4.5	
5	- high plasticity, <25% mottling		6	60/60	2.5	
			7		2.5	
			8		1.25	
		445	9		1.25	
			10		1.75	
10			11	60/60	1.75	
			12		3.5	
	- trace fine-medium sand, brownish yellow mottling (10YR 6/8)		13		2.25	
	- trace fine-coarse sand and fine gravel (angular to sub-angular)	440	14		2.75	
	- few to little sand and gravel, very stiff, 50-75% mottling		15		2.5	
15	- high plasticity					

GRAPHIC

Well: TPZ-158
Elev.: 456.26



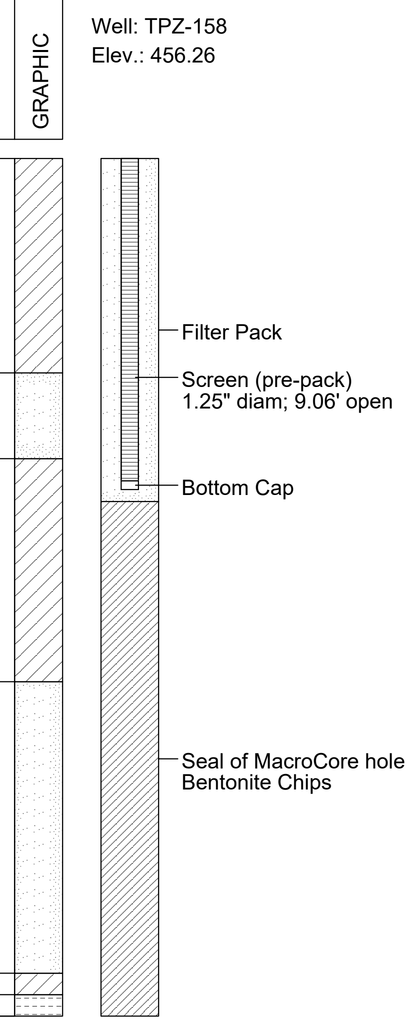
11-08-2013 C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Boring Logs\BEC158.BOR

KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE TPZ-158 (Page 2 of 2)

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/27/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 453.26
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 456.26
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2387752, 556741

Depth in Feet	DESCRIPTION	Surf. Elev. 453.26	Samples	Recovery inches	Qp TSF	USCS
15	- high plasticity					
			16	60/60	1.0	CL
	- trace fine to medium sand, soft, light gray (10YR 6/1) with 50-75% brownish-yellow mottling		17		0.75	
	Sandy CLAY (fine to medium sand) with trace fine-coarse gravel (<1"), very soft					
	SAND, fine to coarse, well graded, brownish-yellow (10YR 6/8), wet	435	18		- -	SW
	Sandy CLAY (fine-coarse sand) with gravel, hard, non-plastic, moist		19		>4.5	CL
20	Silty CLAY with trace sand and gravel, hard, medium to high plasticity, very pale brown (10YR 7/3) - very soft, high plasticity		20		>4.5	
			21	60/60	<0.5	
	SAND, fine to coarse, well graded, yellowish-brown (10YR 5/8), wet		22		- -	SW
			23		- -	
		430	24		- -	
	Silty CLAY with trace fine to coarse sand, hard, brownish-yellow (10YR 6/6), moist		25		4.0	CL
25	SHALE, weathered, gray (10YR 6/1), dry at 24.75' - platy/laminated, dark gray (10YR 4/1), at 24.9' - top of bedrock = 24.75' bls					SH
	END BOREHOLE AT 25 FEET BLS					
		425				
30						



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KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE TPZ-159 (Page 1 of 3)

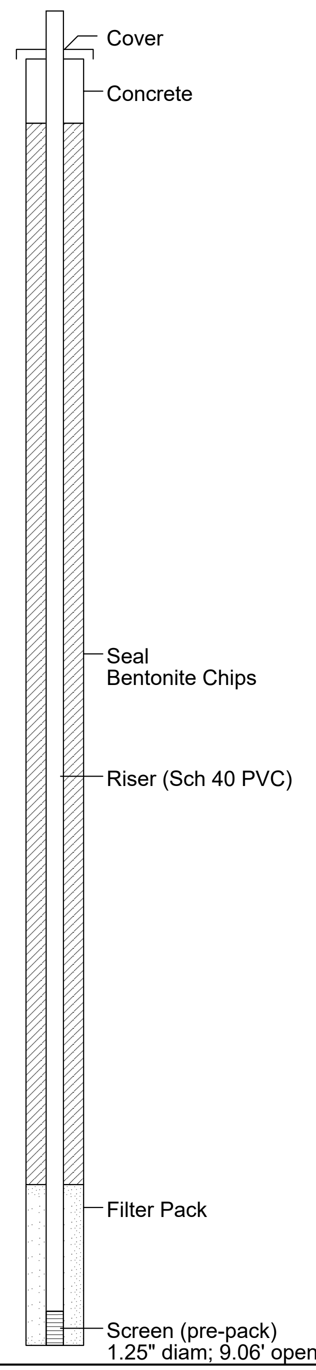
Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/23/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 444.69
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 447.64
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383974, 558081

Depth in Feet	DESCRIPTION	Surf. Elev. 444.69	Samples	Recovery inches	Qp TSF	USCS
0	FILL - Bottom Ash with some clay and silt, soft, loose, dry					AR
	FILL - Silty CLAY with some bottom ash, sand, and gravel, hard, low-medium plasticity, yellowish brown (10YR 5/4) with variable brown to gray mottling		1	49/60	- -	FL/CL
5		440	2	7/42	- -	
			3	8/18	3.0	
10	- few bottom ash, very stiff, high plasticity, moist	435				
			4	0/60	- -	
15	Silty CLAY, trace fine-coarse sand, stiff, med plasticity, light yellowish brown (10YR 6/4), moist	430	5	60/60	2.5	CL
			6		3.25	
			7		1.75	
	- high plasticity, gray (10YR 5/1) with <10% yellowish-brown mottling		8		2.0	
20		425	9		3.0	

GRAPHIC

Well: TPZ-159
Elev.: 447.64



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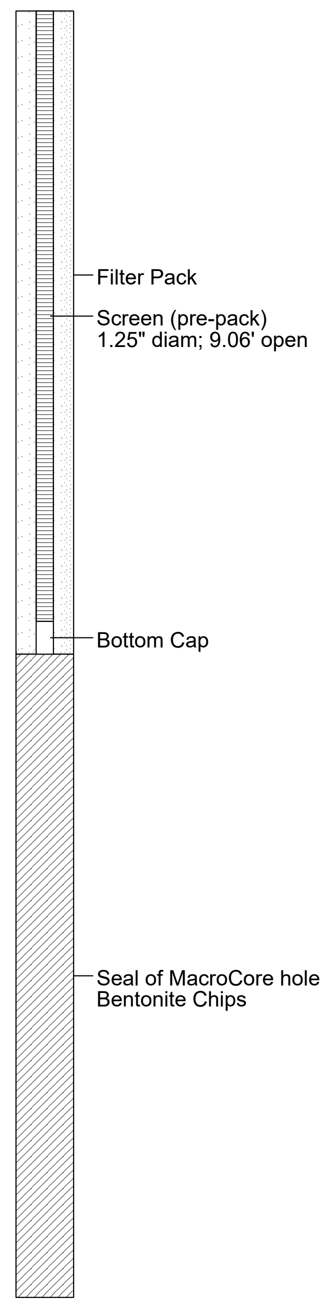
LOG OF PROBEHOLE TPZ-159

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/23/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 444.69
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 447.64
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383974, 558081

Depth in Feet	DESCRIPTION	Surf. Elev. 444.69	Samples	Recovery inches	Qp TSF	USCS
20	Silty CLAY, trace fine-coarse sand, stiff, med plasticity, light yellowish brown (10YR 6/4), moist					
			10	16/60	- -	
	- soft to medium hardness, yellowish-brown mottling with black manganese staining	420				
25						
			11	32/60	1.5	
			12		- -	
	- high plasticity, brown (10YR 5/3)		13		1.25	
			14		1.25	
	- trace fine-medium sand, very stiff, gray (10YR 6/1) with 10-25% yellowish-brown mottling (10YR 5/6)	415	15		2.75	
30						CL
			16	49/60	- -	
	- no sand, brown					
			17		1.5	
			18		1.0	
	- trace sand, gray (10YR 6/1) with 10-25% yellowish-brown mottling		19		2.0	
	- trace fine-coarse sand and gravel (sub-angular to sub-rounded)	410	20		2.0	
35	- stiff, medium plasticity, pale brown (10YR 6/3) with <10% gray mottling		21	60/60	2.5	
			22		2.0	
			23		1.0	
			24		0.5	
	- few fine-coarse sand and fine gravel, very stiff, yellowish brown (10YR 5/8)	405	25		3.0	
40	- hard, non-plastic, dry					

Well: TPZ-159
Elev.: 447.64



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KELRON ENVIRONMENTAL
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LOG OF PROBEHOLE TPZ-159

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/23/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 444.69
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 447.64
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383974, 558081

Well: TPZ-159
Elev.: 447.64

Depth in Feet	DESCRIPTION	Surf. Elev. 444.69	Samples	Recovery inches	Qp TSF	USCS	Well
40	- trace sand and gravel, very stiff, high plasticity, brown (10YR 5/3) to pale brown (10YR 6/3)		26	50/60	2.75	CL	
			27		- -		
			28		<0.5		
	SAND, fine to coarse, well graded, greenish gray (Gley1 10Y 5/1), wet (2.4 inch seam)	400	29		>4.5	SW	
45	Silty CLAY, trace sand, hard grading to very stiff, low plasticity grading to high plasticity, dark gray (Gley1 4/N), moist [TILL]		30	5/60	- -	CL	Seal of MacroCore hole Bentonite Chips
		395	31		3.25		
50	END BOREHOLE AT 50 FEET BLS						
55		390					
60		385					

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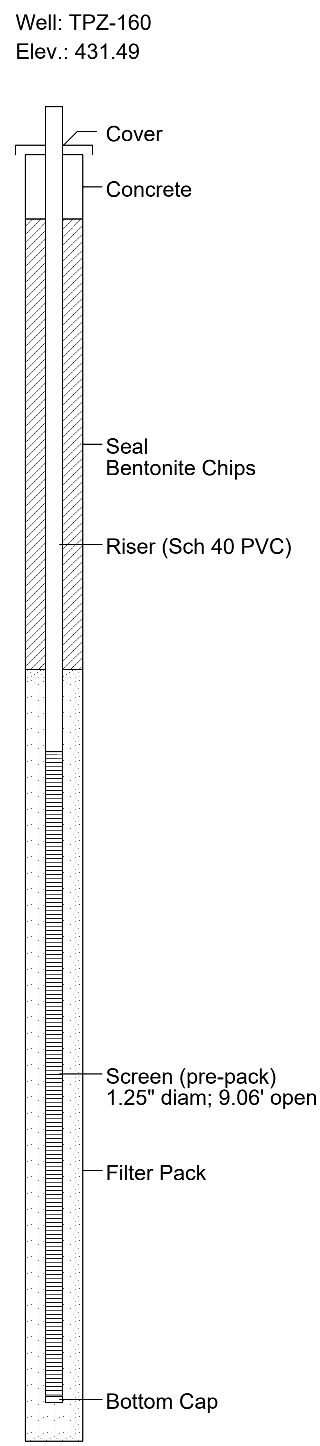
KELRON ENVIRONMENTAL Incorporated	LOG OF PROBEHOLE TPZ-160

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/21/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 428.59
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.49
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2380230, 558046

Depth in Feet	DESCRIPTION	Surf. Elev. 428.59	USCS
0	Silty CLAY with grass / roots, hard, non-plastic, pale brown (10YR 6/3), dry - gray (10YR 6/1) with reddish-brown mottling and black oxidation staining - very stiff, low plasticity, brown (10YR 4/3), moist - high plasticity, grayish brown (10YR 5/2) with 10-25% reddish-brown mottling' - gray (10YR 6/1), <10% mottling - 10-25% mottling, black organics	425	CL
5		420	
10	Sandy SILT, fine sand, very soft, non-plastic, light brownish gray (10YR 6/2), wet Clayey SILT, trace fine sand, very soft, medium plasticity, gray (10YR 6/1)	415	ML
	Silty CLAY, medium to high plasticity, gray with trace reddish-brown mottling, moist - 1-inch weathered zone with 75% yellowish-brown (10YR 5/8) mottling @ 14.5'		CL
15	SILT, gray (10YR 7/1), wet @ 14.9'	410	ML
	CLAY, medium hardness,brown (10YR 5/3), moist - greenish gray (Gley1 10GY 5/1)		CL
20			

Samples	Recovery inches	Qp TSF
1	58/60	4.5
2		3.25
3		3.0
4		3.0
5		2.25
6	58/60	1.5
7		1.0
8		1.0
9		1.0
10		1.0
11	41/60	- -
12		<0.5
13		<0.5
14		<0.5
15		1.25
16	16/60	- -
17		1.25
18		1.5



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LOG OF PROBEHOLE TPZ-160

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/21/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 428.59
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 431.49
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2380230, 558046

Well: TPZ-160
Elev.: 431.49

Depth in Feet	DESCRIPTION	Surf. Elev. 428.59	Samples	Recovery inches	Qp TSF	USCS
20			19	24/60	- -	CL
	- gray (10YR 6/1)					
	- very soft, brown (10YR 5/3)	405	20		<0.5	
	- soft, greenish gray		21		1.25	
25			22	27/60	- -	
			23		0.75	
		400	24		1.0	
			25		1.5	
			26		2.5	
30	Silty CLAY with fine-coarse sand and fine gravel (sub-angular to sub-rounded), very stiff, greenish gray with reddish-brown mottling [TILL]		27	27/60	- -	CL
	- very soft, high plasticity, yellowish-brown (10YR 5/4)		28		0.5	
	- medium plasticity, greenish gray with 50-75% yellowish-brown mottling, moist	395	29		0.5	
			30		1.5	
35	Sandy CLAY, stiff, dark yellowish-brown (10YR 4/4) with <25% greenish-gray mottling, dry					CL
	END BOREHOLE AT 35 FEET BLS					
		390				
40						

Seal of MacroCore Hole
Bentonite Chips

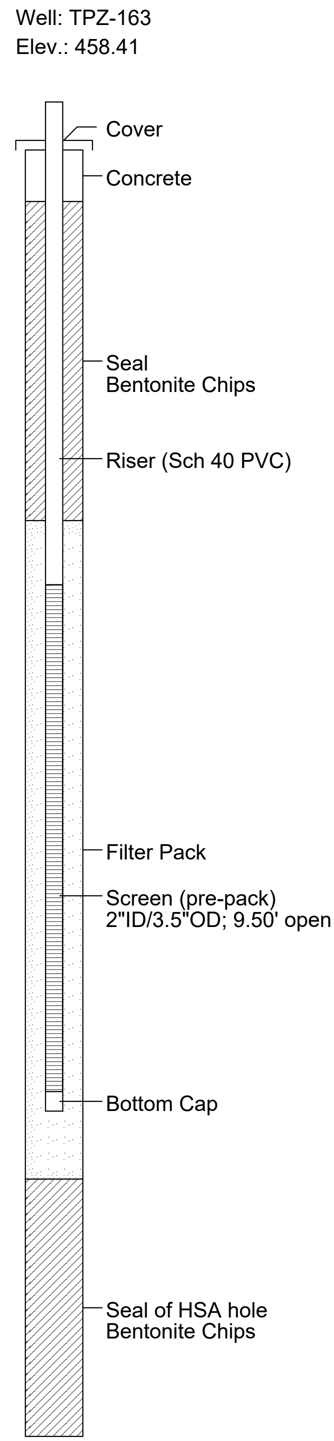
KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-163

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/27/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 455.51
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 458.41
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2385507, 555798

Depth in Feet	DESCRIPTION	Surf. Elev. 455.51	Samples	Blow Count	Recovery inches	Qp TSF	USCS
0	FILL - Silty clay loam with roots, loose, pale brown (10YR 6/3), dry (13" thick soil cover)						FL/CL
	FILL - Fly Ash, silty, loose very dark gray (10YR 3/1)						AR
	<Shelby Tube Sample ST163-3 @1.5-3.5'> grain size analysis (Ash - very dark brown): 51% Sand, 45.8% Silt, 3.2% Clay		1		9/24	- -	
5		450					
	- very soft, wet		2	1 0 1	18/18	<0.5	
10		445					
			3	1 0 1	18/18	<0.5	
15		440					
	Silty CLAY (lean to fat), trace fine sand, stiff, medium to high plasticity, gray (10YR 6/1) with 10-25% yellowish-brown mottling (10YR 6/8), moist		4	1 3 5	17/18	2.75	CL/CH
20		435					
	- very stiff		5	2 2 4	18/18	2.25	
25		430					



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KELRON ENVIRONMENTAL
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LOG OF PROBEHOLE TPZ-163

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/27/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 455.51
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 458.41
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2385507, 555798

Well: TPZ-163
Elev.: 458.41

Depth in Feet	DESCRIPTION	Surf. Elev. 455.51	Samples	Blow Count	Recovery inches	Qp TSF	USCS
25							
	- dark yellowish brown <Shelby Tube Sample ST163-30 @ 28-30'> grain size analysis: 10.6% Sand, 51.2% Silt, 38.2% Clay		6		24/24	- -	CL/CH
30		425					
	Silty CLAY with trace fine-coarse sand and fine gravel, stiff to very stiff, high plasticity, brownish-yellow (10YR 6/6), moist [TILL]		7	2 2 5	18/18	2.5	
35		420					
	- medium plasticity, pale brown (10YR 6/3)						CL
			8	5 5 7	18/18	3.5	
40	- brownish-yellow (10YR 6/6) with 10-25% light gray mottling (10YR 6/1)	415					
	SHALE, platy/laminated with weathered clay layers; hard, gray (10YR 5/1) with 25-50% olive yellow clayey layers (2.5Y 6/6) (top of bedrock = 43.5' bls)		9	5 7 8	18/18	>4.5	SH
45	END BOREHOLE AT 45 FEET BLS	410					
50		405					

Seal of HSA hole
Bentonite Chips

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KELRON ENVIRONMENTAL
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LOG OF PROBEHOLE TPZ-164

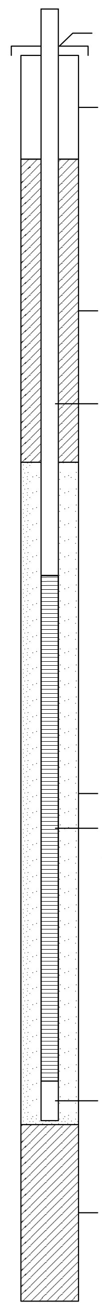
Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/26/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 432.50
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 435.10
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383909, 556829

Depth in Feet	DESCRIPTION	Surf. Elev. 432.50	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC
0	FILL - Bottom Ash, coarse, black (10YR 2/1), dry							
3	- moist <Shelby Tube Sample ST164-5 @ 3-5'> grain size analysis (Ash): 50% Sand, 42.9% Silt, 7.1% Clay	429	1		17/24		AR	
4.5	- wet	428						
8.9	CLAY (lean), stiff, medium to high plasticity, dark gray (10YR 4/1), moist - @8.9' - light yellowish brown (10YR 6/4) with <10% light gray mottling - @9.3' - gray (10YR 6/1) with 25-50% brownish-yellow mottling (10YR 6/6)	423	2	3 3 5	18/18		CL	
10.3	- light olive brown <Shelby Tube Sample ST164-12 @ 10-12'> grain size analysis: 7.2% Sand, 62.2% Silt, 30.6% Clay	422	3		23/24		CL	
12	END BOREHOLE AT 10.3 FEET BLS END Split-Spoon Sampling at 12 feet BLS							

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Elevation scale: 430, 429, 428, 427, 426, 425, 424, 423, 422, 421, 420, 419

Well: TPZ-164
Elev.: 435.10



KELRON ENVIRONMENTAL
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LOG OF PROBEHOLE TPZ-165

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

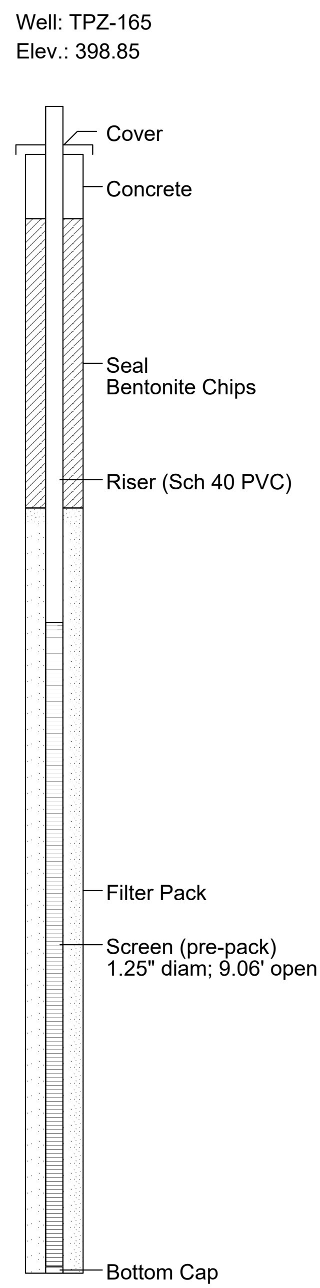
Date Completed	: 08/19/2013	Driller	: John Gates
Hole Diameter	: 4" OD	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: Solid Flight Auger (CME-55LC)	Ground Elevation	: 396.10
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 398.85
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2380478, 555940

Depth in Feet	DESCRIPTION	USCS
0	FILL - Fly Ash, silty, stiff, non-plastic to low plasticity, very dark grayish-brown (10YR 3/2), moist	AR
	FILL - Silty Clay with Fly Ash, very soft, dark gray (10YR 4/1)	FL/CL
5	Silty CLAY (lean) with organics and roots, soft, high plasticity, dark gray - gray (10YR 5/1) - trace sand, very dark gray brown <Shelby Tube Sample ST165-10 @ 8-10'> grain size analysis: 11.2% Sand, 59.2% Silt, 29.6% Clay	CL
10		
	Silty CLAY (lean) with trace fine-coarse sand and fine gravel, very soft, medium to high plasticity, dark gray (10YR 4/1), moist [TILL]	CL
15		
	LIMESTONE, hard, light gray, hammer refusal at 16.5', auger refusal at 17.4' bls (top of bedrock)	LS
	END BOREHOLE AT 17.4 FEET BLS	
20		

Surf. Elev. 396.10: 395, 390, 385, 380

Samples	Recovery inches	Qp TSF
1	41/60	1.75
2		0.75
3		- -
4		- -
5		- -
6	60/60	1.5
7		2.0
8		2.75
9		2.5
10		1.25
11	49/60	2.0
12		0.5
13		0.5
14		1.0
15		0.5
16	18/18	0.5
17		- -

GRAPHIC



KELRON ENVIRONMENTAL Incorporated

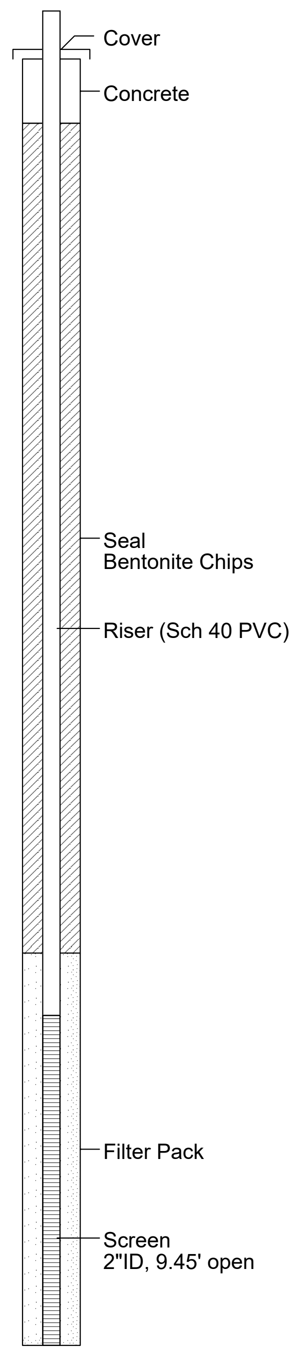
LOG OF PROBEHOLE TPZ-166

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/16/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 422.33
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 425.18
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381183, 555587

Depth in Feet	DESCRIPTION	Surf. Elev. 422.33	Samples	Recovery inches	Qp TSF	USCS
0	FILL - Silty CLAY, trace roots, very stiff, non-plastic, light brown gray (10YR 6/2), dry		1	60/60	2.75	FL/CL
	- medium plasticity, pale brown (10YR 6/3) w/ trace manganese and iron oxide staining		2		2.75	
	- very stiff, yellowish brown (10YR 5/4) with 25% reddish-brown mottling	420	3		3.75	
	- very stiff, low plasticity		4		1.5	
			5		2.75	
5	- gray mottling - 1-inch silt lense with high organics, trace roots		6	60/60	1.5	
	Silty CLAY, very stiff, medium plasticity, gray (10YR 6/1) with reddish-brown mottling and manganese staining		7		2.75	CL
	- medium to stiff, high plasticity, 25-50% manganese staining	415	8		1.75	
	- no manganese staining		9		2.5	
			10		2.5	
10			11	60/60	1.5	
			12		1.5	
	- stiff, medium plasticity, yellowish brown (10YR 5/4) with 10-25% reddish-brown mottling, moist	410	13		2.25	
			14		2.0	
			15		2.5	
15	- very soft, high plasticity		16	60/60	1.0	
	- very stiff, medium plasticity		17		3.0	
		405	18		3.0	
	Silty CLAY with trace fine-coarse sand and fine gravel, very stiff, medium plasticity, yellowish brown (10YR 5/4) with <10% reddish-brown mottling, moist [TILL]		19		3.5	CL
	- hard, gray (10YR 6/1) with 10-25% reddish-brown mottling		20		3.25	
20						

Well: TPZ-166
Elev.: 425.18



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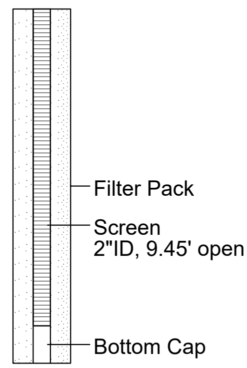
LOG OF PROBEHOLE TPZ-166

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/16/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 422.33
Sampling Method	: MacroCore (60")	Casing (MP) Elevation	: 425.18
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381183, 555587

Depth in Feet	DESCRIPTION	Surf. Elev. 422.33	Samples	Recovery inches	Qp TSF	USCS	GRAPHIC
20			21	24/24	>4.5	CL	
	END BOREHOLE TPZ-166 AT 22' BLS.		22		>4.5		
	CONTINUE LOG USING URS BORINGS B-13-4 and B-13-5 FROM 08/01/2013	400					
25							
		395				CL	
30							
		390					
	SHALE, calcareous, fine grained, highly weathered, very weak, brown-gray to gray (top of bedrock = 32.53' bls; elevation = 389.8 ft NAVD88)						
35						SH	
		385					
	END URS LOGS AT 38 FEET BLS						
40							

Well: TPZ-166
Elev.: 425.18



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KELRON ENVIRONMENTAL
Incorporated

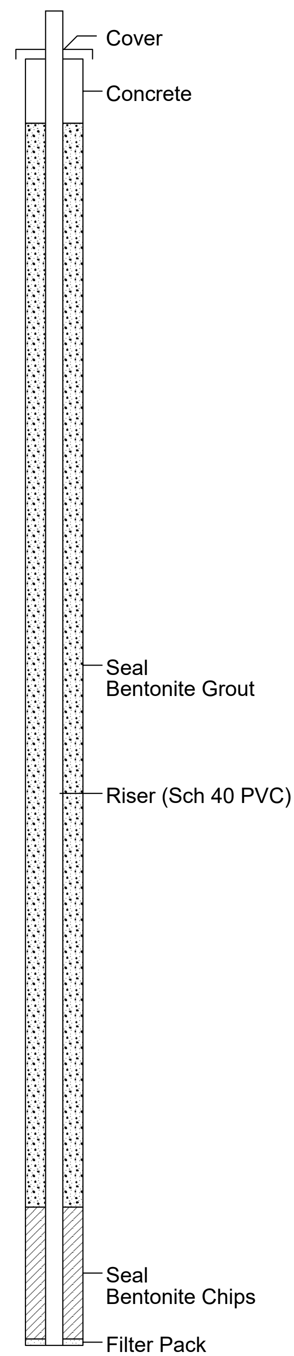
LOG OF PROBEHOLE TPZ-167

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/14/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 438.63
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 441.38
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381925, 554963

Depth in Feet	DESCRIPTION	Surf. Elev. 438.63	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC
0	FILL - Fly Ash, silty to clayey with coarse sand grain size, soft, medium to high plasticity, dark gray (Gley 1 4/N), moist							
		435						
	- very soft, non-plastic, wet		1		18/18			
5								
	- dark greenish gray (10Y 4/1)	430	2	2 2 1	18/18			
10							AR	
	- silty with sand grain size, very dark greenish gray (10Y 3/1)	425	3	0 0 1	18/18			
15								
		420						
20								

Well: TPZ-167
Elev.: 441.38



KELRON ENVIRONMENTAL
Incorporated

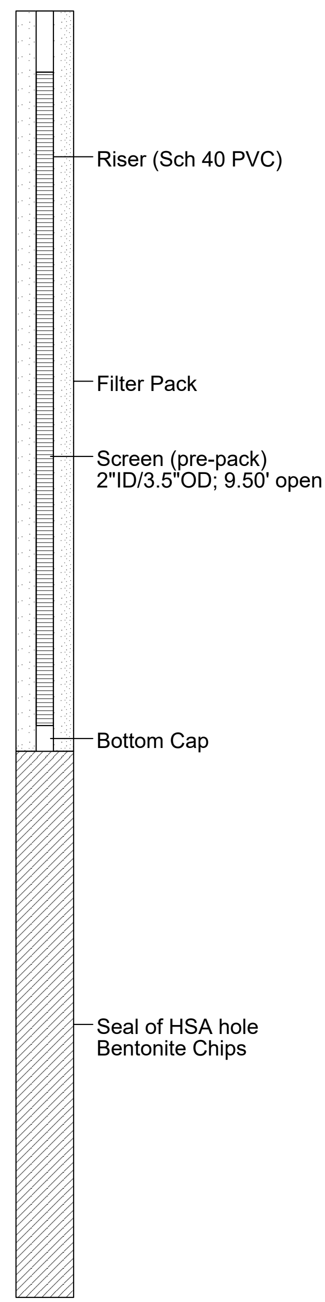
LOG OF PROBEHOLE TPZ-167

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/14/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 438.63
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 441.38
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381925, 554963

Depth in Feet	DESCRIPTION	Surf. Elev. 438.63	Samples	Blow Count	Recovery inches	Qp TSF	USCS
20							
	- dark greenish gray	415	4	0 0 1	18/18		
25							AR
	- very dark gray brown <Sample SS167-30 @ 29-30'> grain size analysis (Ash): 1.5% Sand, 77.6% Silt, 20.8% Clay	410	5	0 0 0	18/18		
30							
	Silty CLAY (lean) with sand and trace fine gravel (chert, angular to sub-angular), very stiff, medium to high plasticity, light gray (10Y 7/N) with 15-50% reddish brown mottling, dry [TILL] <Shelby Tube Sample ST167-34 @ 32-34'> grain size analysis: 15.7% Sand, 52.6% Silt, 31.7% Clay	405	6		20/24		CL
35							
		400	7	3 4 6	16/18	3.5	
40							

Well: TPZ-167
Elev.: 441.38



KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-167

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/14/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 438.63
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 441.38
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2381925, 554963

Depth in Feet	DESCRIPTION	Surf. Elev. 438.63	Samples	Blow Count	Recovery inches	Qp TSF	USCS	GRAPHIC	Well: TPZ-167 Elev.: 441.38
40							CL		
	- soft, brownish-yellow (10YR 6/6), moist	395	8	2, 2, 2	18/18	>4.5	CL		Seal of HSA hole Bentonite Chips
45	- laminated, hard, non-plastic, black (3/4" thick organic-rich layer)								
	CLAY (lean to fat) with sand, stiff to very stiff, medium to high plasticity, greenish gray (10YR 6/1), dry						CL/CH		
	- with sand and fine gravel (angular)		9	5, 5, 50	18/18	4.0			
		390	10	50	3/3				
	SHALE, weathered; clay (laminated) with platy and micaceous layer and limestone parting, dark gray (Gley1 4/N), dry (top of bedrock = 48.75' bls)		11	53	5/5		SH		
50	END BOREHOLE (Auger Refusal) at 48.75 feet BLS END Split-Spoon Sampling at 49.15 feet BLS								
		385							
55									
		380							
60									

KELRON
ENVIRONMENTAL
Incorporated

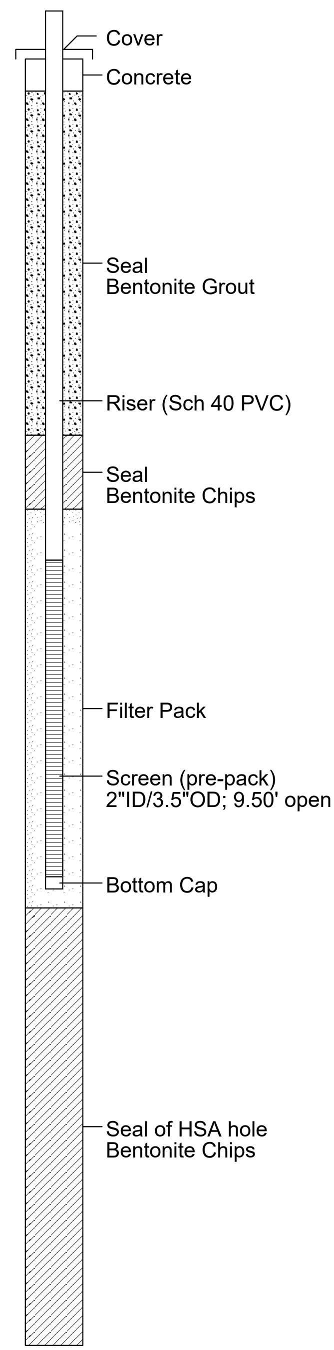
LOG OF PROBEHOLE TPZ-168

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/15/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 454.93
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 457.53
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383585, 554314

Depth in Feet	DESCRIPTION	Surf. Elev. 454.93	Samples	Blow Count	Recovery inches	Qp TSF	USCS
0	FILL - Fly Ash, silt size, greenish gray (10Y 5/1), moist						
5	<Shelby Tube Sample ST168-5 @ 3-5'> grain size analysis: 29.4% Sand, 50.2% Silt, 20.4% Clay	450	1		21/24		
10	- wet	445	2	3 2 3	18/18		
15	- silty with coarse sand grain size, greenish black (10Y 2.5/1)	440	3	1 1 1	16/18		AR
20		435	4		0/24		
25		430	5		3/18		
30	Silty CLAY, medium to stiff, high plasticity, light gray (10YR 7/1) with 10-50% reddish-brown mottling	425	6	3 3 5	18/18	2.0	CL
35		420					CL
40		415	7	2 4 5	18/18	3.5	CL

Well: TPZ-168
Elev.: 457.53



KELRON ENVIRONMENTAL
Incorporated

LOG OF PROBEHOLE TPZ-168

Phase II Hydrogeologic Investigation
Baldwin Energy Complex
Dynegy Midwest Generation, Inc.

Date Completed	: 08/15/2013	Driller	: John Gates
Hole Diameter	: 8 1/2" OD / 4 1/4" ID	Geologist	: Stuart Cravens (Kelron)
Drilling Method	: HSA (CME-55LC)	Ground Elevation	: 454.93
Sampling Method	: Split Spoon / Shelby Tube	Casing (MP) Elevation	: 457.53
Drilling Company	: Bulldog Drilling, LLC	X,Y Coordinates	: 2383585, 554314

Well: TPZ-168
Elev.: 457.53

Depth in Feet	DESCRIPTION	Surf. Elev. 454.93	Samples	Blow Count	Recovery inches	Qp TSF	USCS
40	Silty CLAY, trace sand and fine gravel (angular to sub-angular), stiff to very stiff, 10-25% reddish-brown mottling, moist [TILL]						CL
45		410					
	- light yellowish-brown (10YR 6/4) with <10% light gray mottling		8	3 7 10	18/18	3.5	
50	Clay, black (1/2" thick organic-rich layer) surrounded by highly weathered zone with >75% reddish-brown mottling	405					
55		400					
	- medium to stiff, high plasticity, yellowish brown (10YR 5/4)		9	3 4 8	18/18	2.0	
60	- with 25-50% light gray mottling	395					
65		390					
	- with sand seams, very stiff, medium plasticity, dark gray (10YR 4/1)		10	10 16 18	18/18	>4.5	
70	SHALE, laminated, hard, dark gray (top of bedrock = 69.6' bls)	385					SH
	END BOREHOLE AT 70 FEET BLS						
75		380					
80		375					

Seal of HSA hole
Bentonite Chips

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RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
Baldwin Power Plant	______ft. ☐ N. ☐ S. ______ft. ☐ E. ☐ W.	MW158R
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 43.0" Long. -89° 50' 57.9" or St. Plane 556,726 ft. N, 2,387,758 ft. E. E/(W)	
Facility ID		Date Well Installed 10/08/2022
Type of Well	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) Blake Weller 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 456.65 ft. (NAVD88)

B. Well casing, top elevation 456.24 ft. (NAVD88)

C. Land surface elevation 453.56 ft. (NAVD88)

D. Surface seal, bottom 452.6 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 ☐
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):

E. Bentonite seal, top 452.6 ft. (NAVD88) or 1.0 ft.

F. Fine sand, top 449.6 ft. (NAVD88) or 4.0 ft.

G. Filter pack, top 447.6 ft. (NAVD88) or 6.0 ft.

H. Screen joint, top 445.6 ft. (NAVD88) or 8.0 ft.

I. Well bottom 435.6 ft. (NAVD88) or 18.0 ft.

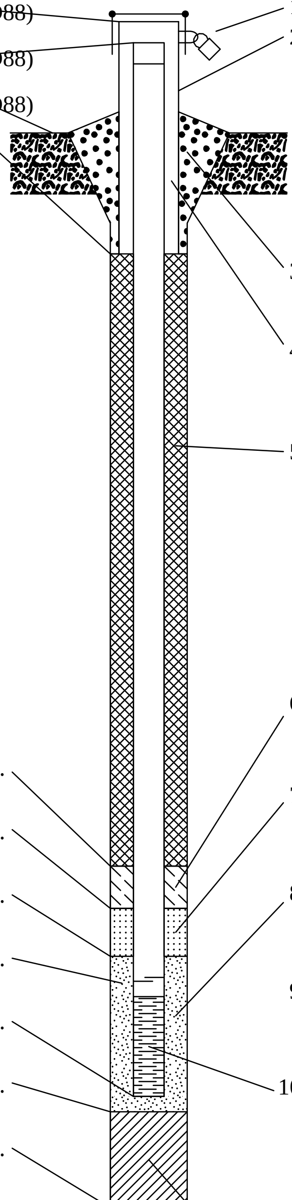
J. Filter pack, bottom 435.6 ft. (NAVD88) or 18.0 ft.

K. Borehole, bottom 435.6 ft. (NAVD88) or 18.0 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: ______

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. ____% 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. Filtersil
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 ______
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: 12/16/2022

Signature [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	Local Grid Location of Well	Well Name
Baldwin Power Plant	___ ft. ☐ N. ☐ S. ___ ft. ☐ E. ☐ W.	MW192
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 57.1" Long. -89° 52' 0.9" or	
Facility ID	St. Plane 558,140 ft. N, 2,382,720 ft. E. E/W	Date Well Installed 09/28/2022
Type of Well	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) Blake Weller, 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 437.32 ft. (NAVD88)

B. Well casing, top elevation 436.94 ft. (NAVD88)

C. Land surface elevation 434.04 ft. (NAVD88)

D. Surface seal, bottom 433.0 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 ☐
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):

___

E. Bentonite seal, top 423.0 ft. (NAVD88) or 11.0 ft.

F. Fine sand, top 418.0 ft. (NAVD88) or 16.0 ft.

G. Filter pack, top 416.0 ft. (NAVD88) or 18.0 ft.

H. Screen joint, top 414.0 ft. (NAVD88) or 20.0 ft.

I. Well bottom 404.0 ft. (NAVD88) or 30.0 ft.

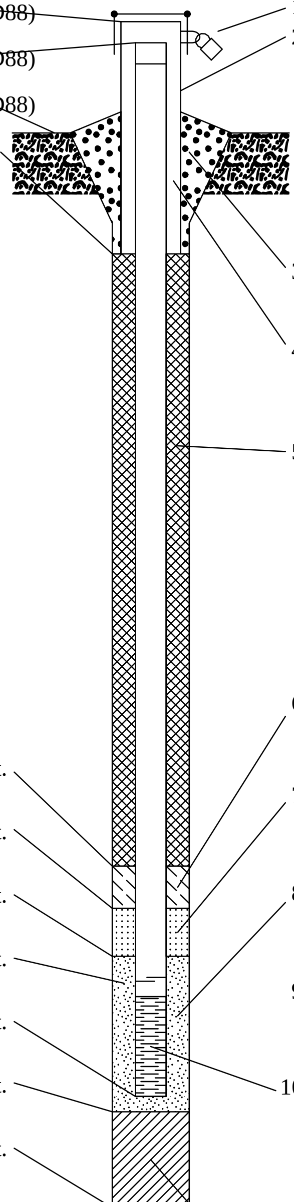
J. Filter pack, bottom 402.0 ft. (NAVD88) or 32.0 ft.

K. Borehole, bottom 400.0 ft. (NAVD88) or 34.0 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: ___

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. 5 % 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. Filtersil
   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 ___
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☐
    3/8" bentonite chips Other ☒

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

Date Modified: 1/9/2023

Signature [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: Baldwin Power Plant	Local Grid Location of Well: ______ft. ☐ N. ☐ S. ______ft. ☐ E. ☐ W.	Well Name
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 57.0" Long. -89° 51' 45.6" or	MW193
Facility ID	St. Plane 558,133 ft. N, 2,383,947 ft. E. E /(W)	Date Well Installed: 10/04/2022
Type of Well	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) Blake Weller 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 438.43 ft. (NAVD88)

B. Well casing, top elevation 438.06 ft. (NAVD88)

C. Land surface elevation 434.52 ft. (NAVD88)

D. Surface seal, bottom 433.5 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 ☐ 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): ____________

E. Bentonite seal, top 421.5 ft. (NAVD88) or 13.0 ft.

F. Fine sand, top 416.5 ft. (NAVD88) or 18.0 ft.

G. Filter pack, top 414.5 ft. (NAVD88) or 20.0 ft.

H. Screen joint, top 412.5 ft. (NAVD88) or 22.0 ft.

I. Well bottom 402.5 ft. (NAVD88) or 32.0 ft.

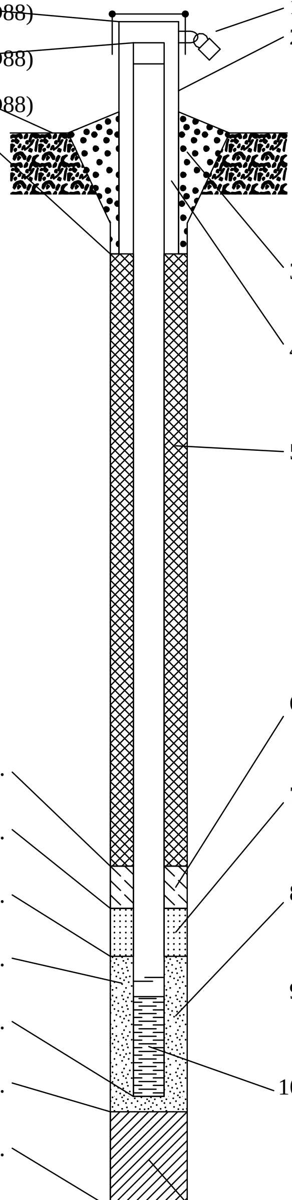
J. Filter pack, bottom 402.5 ft. (NAVD88) or 32.0 ft.

K. Borehole, bottom 402.5 ft. (NAVD88) or 32.0 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: ____________

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. 5 % 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. Filtersil
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 ____________
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: 1/9/2023

Signature [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: Baldwin Power Plant	Local Grid Location of Well: ____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W.	Well Name: MW194
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 56.9" Long. -89° 51' 31.1" or	
Facility ID	St. Plane 558,124 ft. N, 2,385,098 ft. E. E/Ⓦ	Date Well Installed: 10/05/2022
Type of Well	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) Blake Weller, 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 438.63 ft. (NAVD88)

B. Well casing, top elevation 438.20 ft. (NAVD88)

C. Land surface elevation 435.43 ft. (NAVD88)

D. Surface seal, bottom 434.4 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 ☒ Sonic

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): ____

E. Bentonite seal, top 422.4 ft. (NAVD88) or 13.0 ft.

F. Fine sand, top 421.4 ft. (NAVD88) or 14.0 ft.

G. Filter pack, top 419.4 ft. (NAVD88) or 16.0 ft.

H. Screen joint, top 417.4 ft. (NAVD88) or 18.0 ft.

I. Well bottom 407.4 ft. (NAVD88) or 28.0 ft.

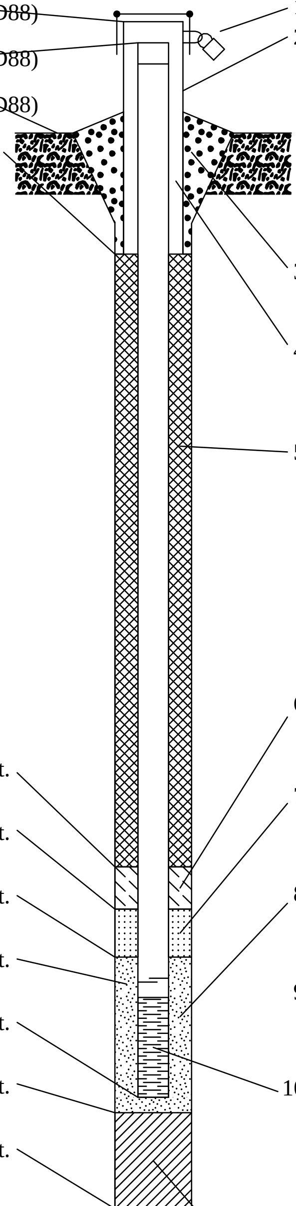
J. Filter pack, bottom 407.4 ft. (NAVD88) or 28.0 ft.

K. Borehole, bottom 405.4 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: ____
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. 5 % 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. Filtersil
   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 ____
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐ Other ☒ 3/8" bentonite chips

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 1/9/2023

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	Local Grid Location of Well	Well Name
Baldwin Power Plant	____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W.	
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 43.0" Long. -89° 50' 57.9" or	MW258
Facility ID	St. Plane 556,727 ft. N, 2,387,753 ft. E. E/Ⓦ	Date Well Installed 10/07/2022
Type of Well	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) Blake Weller 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 456.41 ft. (NAVD88)

B. Well casing, top elevation 456.12 ft. (NAVD88)

C. Land surface elevation 453.50 ft. (NAVD88)

D. Surface seal, bottom 452.5 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 ☒ Sonic

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):

E. Bentonite seal, top 418.5 ft. (NAVD88) or 35.0 ft.

F. Fine sand, top 417.5 ft. (NAVD88) or 36.0 ft.

G. Filter pack, top 415.5 ft. (NAVD88) or 38.0 ft.

H. Screen joint, top 413.5 ft. (NAVD88) or 40.0 ft.

I. Well bottom 403.5 ft. (NAVD88) or 50.0 ft.

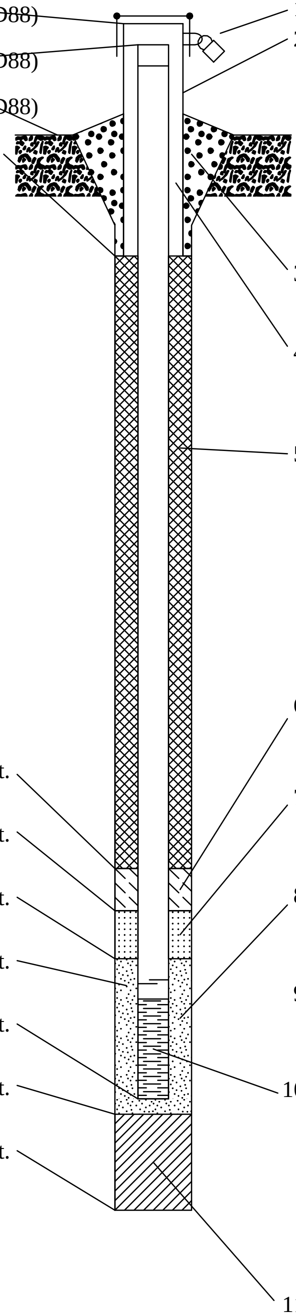
J. Filter pack, bottom 401.5 ft. (NAVD88) or 52.0 ft.

K. Borehole, bottom 390.5 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: ____
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. 5 % 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. Filtersil
   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 ____
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐ Other ☒ 3/8" bentonite chips

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

Date Modified: 1/9/2023

Signature [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	Local Grid Location of Well	Well Name
Baldwin Power Plant	______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	MW358
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 43.0" Long. -89° 50' 57.9" or St. Plane 556,726 ft. N, 2,387,757 ft. E. E/Ⓦ	
Facility ID		Date Well Installed 10/08/2022
Type of Well	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) Blake Weller, 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 455.90 ft. (NAVD88)

B. Well casing, top elevation 455.73 ft. (NAVD88)

C. Land surface elevation 453.59 ft. (NAVD88)

D. Surface seal, bottom 452.6 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 ☐ 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): ______

E. Bentonite seal, top 378.6 ft. (NAVD88) or 75.0 ft.

F. Fine sand, top 377.6 ft. (NAVD88) or 76.0 ft.

G. Filter pack, top 375.6 ft. (NAVD88) or 78.0 ft.

H. Screen joint, top 373.6 ft. (NAVD88) or 80.0 ft.

I. Well bottom 363.6 ft. (NAVD88) or 90.0 ft.

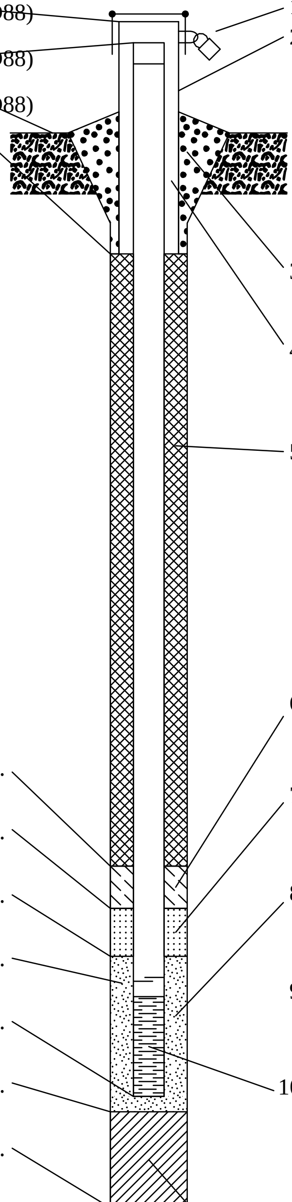
J. Filter pack, bottom 363.6 ft. (NAVD88) or 90.0 ft.

K. Borehole, bottom 363.6 ft. (NAVD88) or 90.0 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: ______
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. 5 % 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. Filtersil
   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 ______
   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: 12/16/2022

Signature [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 Baldwin Power Plant	Local Grid Location of Well ____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W.	Well Name MW392
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 57.1" Long. -89° 52' 1.0" or St. Plane 558,140 ft. N, 2,382,718 ft. E. E/(W)	
Facility ID		Date Well Installed 09/26/2022
Type of Well	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) Blake Weller 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 437.36 ft. (NAVD88)

B. Well casing, top elevation 437.02 ft. (NAVD88)

C. Land surface elevation 434.07 ft. (NAVD88)

D. Surface seal, bottom 433.1 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 ☐
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):

____

E. Bentonite seal, top 368.1 ft. (NAVD88) or 66.0 ft.

F. Fine sand, top 363.1 ft. (NAVD88) or 71.0 ft.

G. Filter pack, top 362.1 ft. (NAVD88) or 72.0 ft.

H. Screen joint, top 360.1 ft. (NAVD88) or 74.0 ft.

I. Well bottom 350.1 ft. (NAVD88) or 84.0 ft.

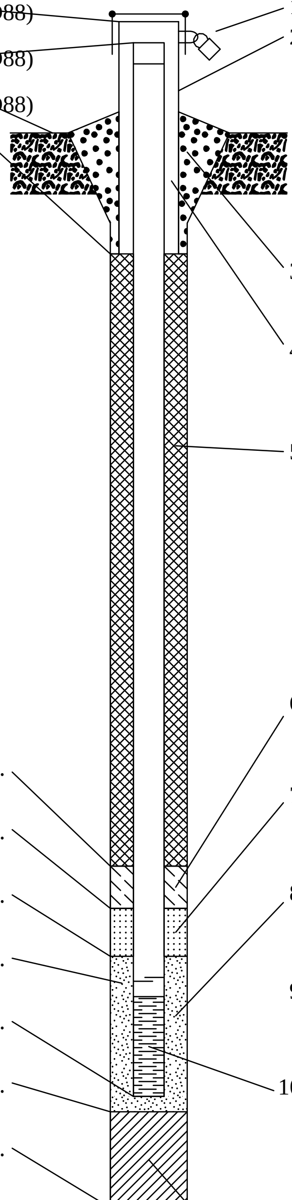
J. Filter pack, bottom 350.1 ft. (NAVD88) or 84.0 ft.

K. Borehole, bottom 350.1 ft. (NAVD88) or 84.0 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: ____

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. 5 % 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. Filtersil
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 ____
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: 12/16/2022

Signature [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: Baldwin Power Plant	Local Grid Location of Well: ______ft. ☐ N. ☐ S. ______ft. ☐ E. ☐ W.	Well Name: MW393
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 57.0" Long. -89° 51' 45.6" or	
Facility ID	St. Plane 558,134 ft. N, 2,383,944 ft. E. E /Ⓦ	Date Well Installed: 10/03/2022
Type of Well	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) Blake Weller, 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 438.44 ft. (NAVD88)

B. Well casing, top elevation 437.86 ft. (NAVD88)

C. Land surface elevation 434.59 ft. (NAVD88)

D. Surface seal, bottom 433.6 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 ☐
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): ______

E. Bentonite seal, top 368.6 ft. (NAVD88) or 66.0 ft.

F. Fine sand, top 363.6 ft. (NAVD88) or 71.0 ft.

G. Filter pack, top 361.6 ft. (NAVD88) or 73.0 ft.

H. Screen joint, top 359.6 ft. (NAVD88) or 75.0 ft.

I. Well bottom 349.6 ft. (NAVD88) or 85.0 ft.

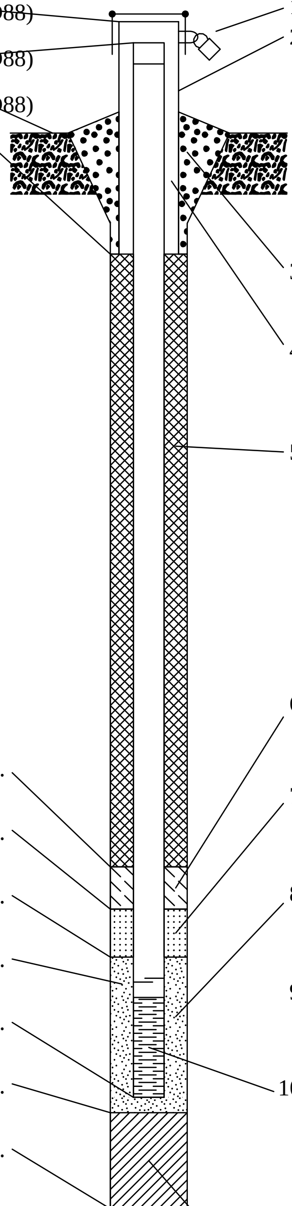
J. Filter pack, bottom 349.6 ft. (NAVD88) or 85.0 ft.

K. Borehole, bottom 349.6 ft. (NAVD88) or 85.0 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: ______

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. 5 % 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. Filtersil
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 ______
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: 12/16/2022

Signature	Firm
[signature]	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	Local Grid Location of Well	Well Name
Baldwin Power Plant	____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W.	MW394
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 56.9" Long. -89° 51' 31.2" or St. Plane 558,124 ft. N, 2,385,096 ft. E. E /W	
Facility ID		Date Well Installed 10/05/2022
Type of Well	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) Blake Weller 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 438.67 ft. (NAVD88)

B. Well casing, top elevation 438.29 ft. (NAVD88)

C. Land surface elevation 435.51 ft. (NAVD88)

D. Surface seal, bottom 434.5 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 ☐
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):

E. Bentonite seal, top 371.5 ft. (NAVD88) or 64.0 ft.

F. Fine sand, top 366.5 ft. (NAVD88) or 69.0 ft.

G. Filter pack, top 364.5 ft. (NAVD88) or 71.0 ft.

H. Screen joint, top 362.5 ft. (NAVD88) or 73.0 ft.

I. Well bottom 352.5 ft. (NAVD88) or 83.0 ft.

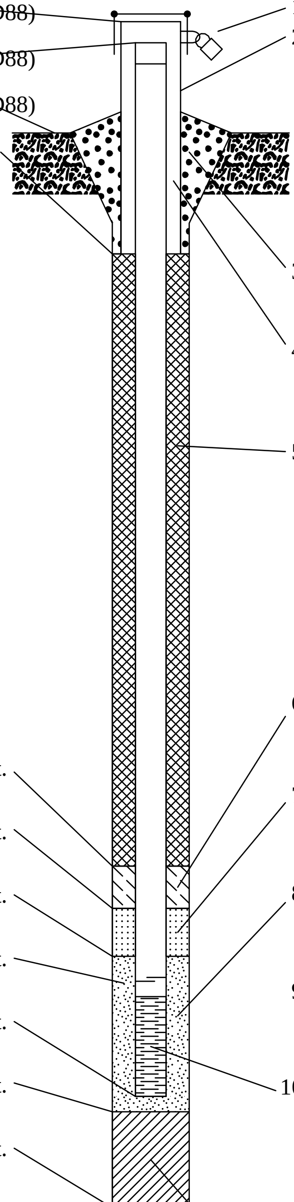
J. Filter pack, bottom 350.5 ft. (NAVD88) or 85.0 ft.

K. Borehole, bottom 350.5 ft. (NAVD88) or 85.0 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: ____
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. 5 % 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. Filtersil
   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 ____
   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: 12/16/2022

Signature [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: Baldwin Power Plant	Local Grid Location of Well: ____ft. ☐ N. ☐ S. ____ft. ☐ E. ☐ W.	Well Name
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 51.1" Long. -89° 51' 52.1" or St. Plane 557,530 ft. N, 2,383,427 ft. E. E /Ⓦ	XPW01
Facility ID	Section Location of Waste/Source: ____1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Date Well Installed: 09/23/2022
Type of Well	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known; Gov. Lot Number	Well Installed By: (Person's Name and Firm) Arlen Little, Cascade Drilling
Distance from Waste/Source ft.; State: IL		

A. Protective pipe, top elevation 438.45 ft. (NAVD88)

B. Well casing, top elevation 437.66 ft. (NAVD88)

C. Land surface elevation 435.12 ft. (NAVD88)

D. Surface seal, bottom 434.1 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 ☐ 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): ____

E. Bentonite seal, top 434.1 ft. (NAVD88) or 1.0 ft.

F. Fine sand, top 431.1 ft. (NAVD88) or 4.0 ft.

G. Filter pack, top 430.1 ft. (NAVD88) or 5.0 ft.

H. Screen joint, top 428.1 ft. (NAVD88) or 7.0 ft.

I. Well bottom 423.1 ft. (NAVD88) or 12.0 ft.

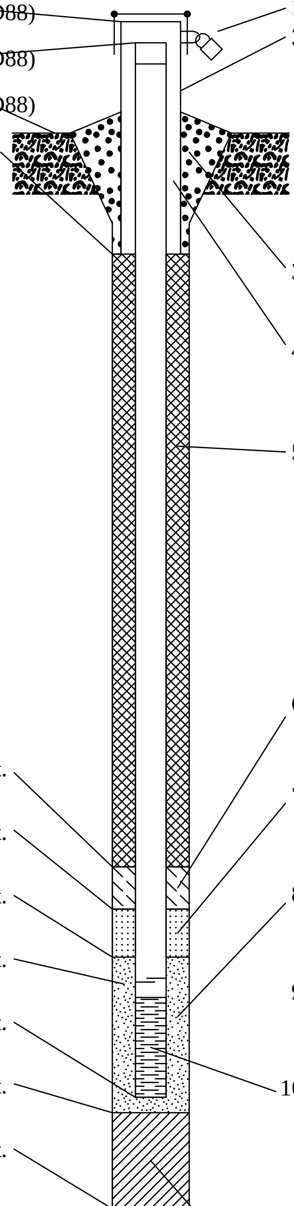
J. Filter pack, bottom 421.1 ft. (NAVD88) or 14.0 ft.

K. Borehole, bottom 421.1 ft. (NAVD88) or 14.0 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: ____

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. ____% 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. Filtersil
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 ____
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: 12/16/2022

Signature: [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	Local Grid Location of Well	Well Name
Baldwin Power Plant	______ft. ☐ N. ☐ S. ______ft. ☐ E. ☐ W.	XPW02
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 52.4" Long. -89° 51' 42.8" or	
Facility ID	St. Plane 557,668 ft. N, 2,384,172 ft. E. E /(W)	Date Well Installed 09/24/2022
Type of Well	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) Arlen Little, 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 438.60 ft. (NAVD88)

B. Well casing, top elevation 437.92 ft. (NAVD88)

C. Land surface elevation 434.86 ft. (NAVD88)

D. Surface seal, bottom 433.9 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 ☐
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):

E. Bentonite seal, top 433.9 ft. (NAVD88) or 1.0 ft.

F. Fine sand, top 430.9 ft. (NAVD88) or 4.0 ft.

G. Filter pack, top 429.9 ft. (NAVD88) or 5.0 ft.

H. Screen joint, top 428.9 ft. (NAVD88) or 6.0 ft.

I. Well bottom 423.9 ft. (NAVD88) or 11.0 ft.

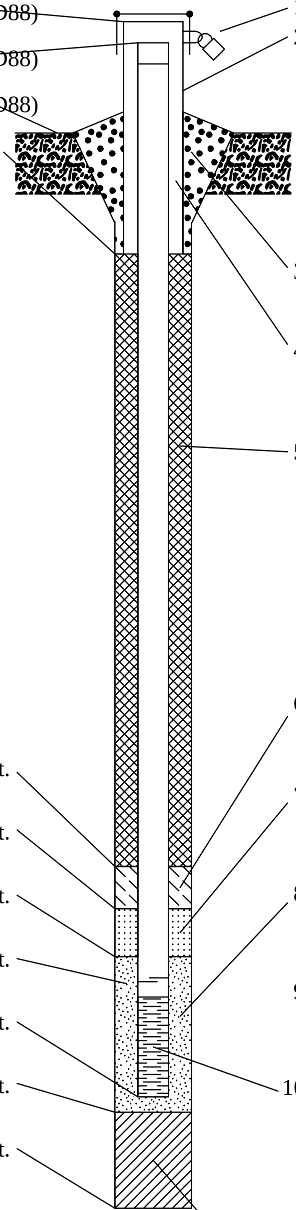
J. Filter pack, bottom 422.9 ft. (NAVD88) or 12.0 ft.

K. Borehole, bottom 420.9 ft. (NAVD88) or 14.0 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: ______

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. ____% 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. Filtersil
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 ______
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.

11. Backfill material (below filter pack): None ☐
3/8" bentonite chips Other ☒

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

Date Modified: 12/16/2022

Signature [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: Baldwin Power Plant	Local Grid Location of Well: ______ft. ☐ N. ☐ S. ______ft. ☐ E. ☐ W.	Well Name: XPW04
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 40.9" Long. -89° 51' 49.7" or	
Facility ID	St. Plane 556,503 ft. N, 2,383,618 ft. E. E/Ⓦ	Date Well Installed: 10/05/2022
Type of Well	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) Arlen Little 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 434.91 ft. (NAVD88)

B. Well casing, top elevation 434.58 ft. (NAVD88)

C. Land surface elevation 430.59 ft. (NAVD88)

D. Surface seal, bottom 429.6 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 ☐
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):

E. Bentonite seal, top 429.6 ft. (NAVD88) or 1.0 ft.

F. Fine sand, top 426.1 ft. (NAVD88) or 4.5 ft.

G. Filter pack, top 425.1 ft. (NAVD88) or 5.5 ft.

H. Screen joint, top 424.1 ft. (NAVD88) or 6.5 ft.

I. Well bottom 414.1 ft. (NAVD88) or 16.5 ft.

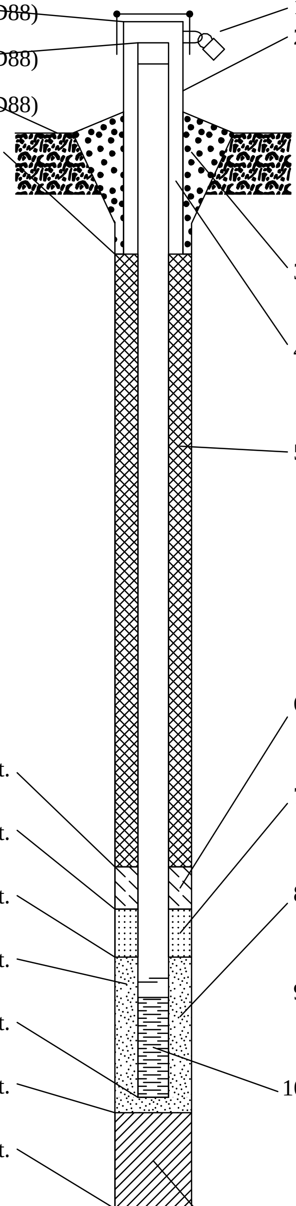
J. Filter pack, bottom 413.1 ft. (NAVD88) or 17.5 ft.

K. Borehole, bottom 410.6 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:
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. ____% 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. Filtersil
   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 ________
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐
    3/8" bentonite chips Other ☒

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

Date Modified: 12/16/2022

Signature: [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 Baldwin Power Plant	Local Grid Location of Well _____ft. ☐ N. ☐ S. _____ft. ☐ E. ☐ W.	Well Name
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 46.4" Long. -89° 51' 44.5" or	XPW05
Facility ID	St. Plane 557,063 ft. N, 2,384,034 ft. E. E /Ⓦ	Date Well Installed 09/24/2022
Type of Well	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) Arlen Little
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 437.57 ft. (NAVD88)

B. Well casing, top elevation 437.27 ft. (NAVD88)

C. Land surface elevation 434.12 ft. (NAVD88)

D. Surface seal, bottom 433.1 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 ☐
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):

E. Bentonite seal, top 433.1 ft. (NAVD88) or 1.0 ft.

F. Fine sand, top 418.1 ft. (NAVD88) or 16.0 ft.

G. Filter pack, top 417.1 ft. (NAVD88) or 17.0 ft.

H. Screen joint, top 416.1 ft. (NAVD88) or 18.0 ft.

I. Well bottom 406.1 ft. (NAVD88) or 28.0 ft.

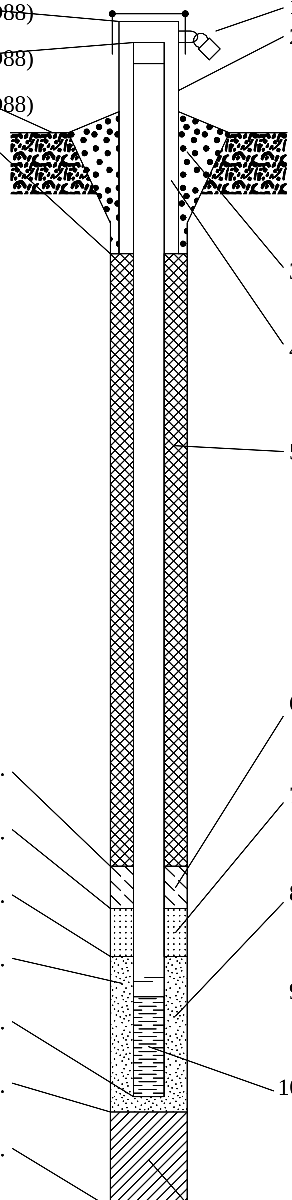
J. Filter pack, bottom 405.1 ft. (NAVD88) or 29.0 ft.

K. Borehole, bottom 404.1 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: _____

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. ____% 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. Filtersil
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 _____
c. Slot size: 0.010 in.
d. Slotted length: 10.0 ft.

11. Backfill material (below filter pack): None ☐
3/8" bentonite chips Other ☒

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

Date Modified: 12/16/2022

Signature [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: Baldwin Power Plant	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: XPW06
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 38° 11' 49.1" Long. -89° 52' 8.2" or St. Plane 557,324 ft. N, 2,382,140 ft. E. E /(W)	
Facility ID		Date Well Installed: 09/22/2022
Type of Well	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): Arlen Little, 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 418.06 ft. (NAVD88)

B. Well casing, top elevation 417.72 ft. (NAVD88)

C. Land surface elevation 418.06 ft. (NAVD88)

D. Surface seal, bottom 417.1 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 ☐; 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): ____

E. Bentonite seal, top 417.1 ft. (NAVD88) or 1.0 ft.

F. Fine sand, top 415.1 ft. (NAVD88) or 3.0 ft.

G. Filter pack, top 414.1 ft. (NAVD88) or 4.0 ft.

H. Screen joint, top 413.1 ft. (NAVD88) or 5.0 ft.

I. Well bottom 408.1 ft. (NAVD88) or 10.0 ft.

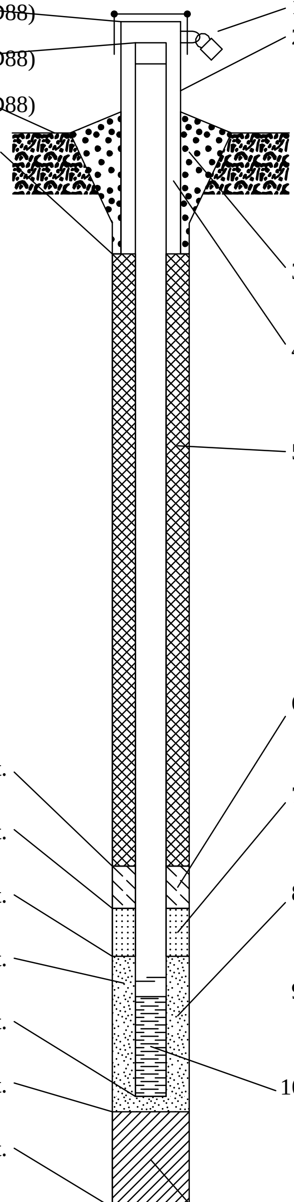
J. Filter pack, bottom 406.1 ft. (NAVD88) or 12.0 ft.

K. Borehole, bottom 402.1 ft. (NAVD88) or 16.0 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: ____

3. Surface seal: Bentonite ☐; Concrete ☒; Other ☐

4. Material between well casing and protective pipe: Bentonite ☒; bentonite chips 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. Filtersil
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 ____
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.

11. Backfill material (below filter pack): None ☐; 3/8" bentonite chips Other ☒

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

Date Modified: 12/16/2022

Signature [signature]

Firm: Ramboll
234 W Florida Street, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

APPENDIX D
GEOTECHNICAL LABORATORY REPORTS

Terracon

192 Exchnage Boulevard
Glendale Heights, IL 60139
P (630) 717-4263
F (630) 557-9489
Terracon.com

December 9, 2022

Mr. Evvan Plank
Ramboll Americas Engineering Solutions, Inc.
234 W. Florida Street, 5th Fl.
Milwaukee, WI 53204

Re: Baldwin DG/ WP / Field Investigation Project – Terracon Project No. 11225019

Dear Mr. Plank,

We are pleased to submit our laboratory report pertaining to the testing of fourteen (14) California sampler soil samples received in our Glendale Heights, Illinois laboratory. The samples were in reference to the Baldwin DG/ WP / Field Investigation Project. In accordance with your instructions, Terracon performed the following tests on each of the samples.

- Water Content of Soil and Rock – ASTM D2216
- 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
- Liquid Limit, Plastic Limit and Plasticity Index of Soils – ASTM D4318
- Laboratory Determination of Density (Unit Weight) of Soil Specimens – ASTM D7263
- Specific Gravity of Soils – ASTM D854
- Hydraulic Conductivity Using a Flexible-Wall Permeameter – ASTM D5084

The test data included in our 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 Terracon is 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.

Sincerely,
Terracon Consultants, Inc.

Brian Mays
Laboratory Manager

Attachments:

LABORATORY TESTING SUMMARY

PROJECT NAME: Baldwin DG-WP Field Investigation PROJECT NUMBER: 11225019 CLIENT: Ramboll Americas Engineering Solutions

Boring Number	Sample Number	Depth (ft)	Description	USCS	WC %	% Gravel	% Sand	% Silt	% Clay	LL	PL	PI	Specific Gravity	Density (pcf)	Hydraulic Conductivity k (cm/sec)
MW358	TOP	15.5'-16.0'	BROWN MOTTLED GRAY LEAN CLAY WITH SAND	CL	20.8%	0.5	25.8	41.0	32.7	34.0	16	18	2.681	106.8	6.39E-08
MW358	BOTTOM	16.0'-16.5'	BROWN MOTTLED GRAY LEAN CLAY WITH SAND	CL	22.1%	0.3	23.0	42.0	34.7	35	15	20	2.693	103.4	6.70E-08
MW392	TOP	30.5'-31.0'	BROWN LEAN CLAY WITH SAND	CL	20.1%	2.4	26.8	37.5	33.3	33	14	19	2.685	107.4	6.91E-08
MW392	BOTTOM	31.0'-31.5'	BROWN SANDY LEAN CLAY	CL	21.5%	9.8	27.1	37.3	25.8	32	12	20	2.702	103.8	5.77E-08
MW393	TOP	20.5'-21.0'	BROWN LEAN CLAY	CL	22.6%	0.0	5.9	53.8	40.3	48	15	33	2.688	103.0	4.12E-08
MW393	BOTTOM	21.0'-21.5'	BROWN LEAN CLAY	CL	20.1%	0.0	5.0	58.7	36.3	44	14	30	2.708	103.1	5.59E-08
MW394	TOP	18.5'-19.0'	GRAYISH BROWN SANDY LEAN CLAY WITH GRAVEL	CL	17.1%	18.4	24.2	28.5	28.9	46	13	33	2.698	109.1	4.30E-08
MW394	BOTTOM	19.0'-19.5'	BROWN AND GRAY MOTTLED SANDY LEAN CLAY	CL	20.3%	0.2	31.3	35.1	33.4	39	12	27	2.707	109.7	6.24E-08
XPW02B	TOP	5.5'-6.0'	VERY DARK GRAY AND BLACK POORLY GRADED SAND WITH CLAY, GRAVEL, CINDERS AND ASH	SP-SC	14.3%	22.4	68.0	8.5	1.1	26	10	16	2.646	102.7	5.63E-05
XPW02B	BOTTOM	6.0'-6.5'	BLACK AND VERY DARK BROWN WELL GRADED SAND WITH CINDERS	SW-SC	8.3%	21.0	69.9	8.2	0.9	24	15	9	2.652	118.2	2.61E-05
XPW04A	TOP	15.0'-15.5'	BLACK POORLY GRADED SAND WITH CINDERS	SP	10.7%	3.0	93.6	2.5	0.9	27	12	15	2.668	108.9	1.81E-05
XPW04A	BOTTOM	15.5'-16.0'	BLACK POORLY GRADED SAND WITH CINDERS	SP	8.8%	8.7	88.4	1.9	1.0	25	16	9	2.658	114.1	9.45E-06
XTPW06A	TOP	7.5'-8.0'	DARK GRAY AND BLACK SILTY CLAYEY SAND WITH CINDERS AND ASH	SC-SM	17.7%	8.1	62.1	22.3	7.5	19	13	6	2.698	107.1	4.85E-07
XTPW06A	BOTTOM	8.0'-8.5'	BLACK AND BROWN SILTY CLAYEY SAND WITH CINDERS	SC-SM	15.1%	2.4	50.4	32.4	14.8	19	14	5	2.675	113.9	6.32E-07

Terracon

HYDRAULIC CONDUCTIVITY DETERMINATION
RISING TAILWATER
METHOD C
ASTM D5084

Terracon

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

Laboratory Services Group **192 Exchange Blvd** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

TERRACON PROJECT NO.:	**11225019**	**12/8/2022**
PROJECT NAME:	**BALDWIN DG-WP-FIELD INVESTIGATION**	
CLIENT:	**RAMBOLL AMERICAS ENGINEERING SOLUTIONS**	
LOCATION :	**BALDWIN, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	MW358
SAMPLE ID.	TOP
DEPTH:	15.5'-16.0'
CLASSIFICATION	BROWN MOTTLED GRAY LEAN CLAY WITH SAND

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	106.8	113.0
WATER CONTENT (%)	20.8	17.7
DIAMETER (cm)	6.050	5.974
LENGTH (cm)	7.806	7.572
B VALUE PARAMETER:	0.98	
HYDRAULIC GRADIENT (MAXIMUM)	21.09	
PERCENT SATURATION	99.5	
HYDRAULIC CONDUCTIVITY k (cm/sec)	6.39E-08	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

Laboratory Services Group **192 Exchange Blvd** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

TERRACON PROJECT NO.:	**11225019**	**12/8/2022**
PROJECT NAME:	**BALDWIN DG-WP-FIELD INVESTIGATION**	
CLIENT:	**RAMBOLL AMERICAS ENGINEERING SOLUTIONS**	
LOCATION :	**BALDWIN, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	MW358
SAMPLE ID.	BOTTOM
DEPTH:	16.0'-16.5'
CLASSIFICATION	BROWN MOTTLED GRAY LEAN CLAY WITH SAND (CL)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	103.4	105.5
WATER CONTENT (%)	22.1	21.6
DIAMETER (cm)	5.993	5.994
LENGTH (cm)	7.703	7.551
B VALUE PARAMETER:	0.99	
HYDRAULIC GRADIENT (MAXIMUM)	21.37	
PERCENT SATURATION	98.5	
HYDRAULIC CONDUCTIVITY k (cm/sec)	6.70E-08	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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.: **11225019** **12/8/2022**
PROJECT NAME: **BALDWIN DG-WP-FIELD INVESTIGATION**
CLIENT: **RAMBOLL AMERICAS ENGINEERING SOLUTIONS**
LOCATION : **BALDWIN, IL**

SUMMARY OF TEST RESULTS

BORING NO. MW392

SAMPLE ID. TOP

DEPTH: 30.5'-31.0'

CLASSIFICATION BROWN LEAN CLAY WITH SAND (CL)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	107.4	113.5
WATER CONTENT (%)	20.1	17.4
DIAMETER (cm)	6.034	5.940
LENGTH (cm)	7.576	7.399
B VALUE PARAMETER:	0.95	
HYDRAULIC GRADIENT (MAXIMUM)	21.73	
PERCENT SATURATION	98.9	
HYDRAULIC CONDUCTIVITY k (cm/sec)	6.91E-08	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

Laboratory Services Group **192 Exchange Blvd** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

TERRACON PROJECT NO.:	**11225019**	**12/8/2022**
PROJECT NAME:	**BALDWIN DG-WP-FIELD INVESTIGATION**	
CLIENT:	**RAMBOLL AMERICAS ENGINEERING SOLUTIONS**	
LOCATION :	**BALDWIN, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	MW392
SAMPLE ID.	BOTTOM
DEPTH:	31.0'-31.5'
CLASSIFICATION	BROWN SANDY LEAN CLAY (CL)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	103.8	107.6
WATER CONTENT (%)	21.5	20.7
DIAMETER (cm)	5.986	5.964
LENGTH (cm)	7.451	7.241
B VALUE PARAMETER:	0.96	
HYDRAULIC GRADIENT (MAXIMUM)	21.82	
PERCENT SATURATION	99.2	
HYDRAULIC CONDUCTIVITY k (cm/sec)	5.77E-08	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

Terracon

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

Laboratory Services Group **192 Exchange Blvd** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

TERRACON PROJECT NO.:	**11225019**	**12/8/2022**
PROJECT NAME:	**BALDWIN DG-WP-FIELD INVESTIGATION**	
CLIENT:	**RAMBOLL AMERICAS ENGINEERING SOLUTIONS**	
LOCATION :	**BALDWIN, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	MW393
SAMPLE ID.	TOP
DEPTH:	20.5'-21.0'
CLASSIFICATION	BROWN LEAN CLAY (CL)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	103.0	107.3
WATER CONTENT (%)	22.6	20.7
DIAMETER (cm)	6.017	5.947
LENGTH (cm)	8.307	8.163
B VALUE PARAMETER:	0.99	
HYDRAULIC GRADIENT (MAXIMUM)	19.82	
PERCENT SATURATION	99.6	
HYDRAULIC CONDUCTIVITY k (cm/sec)	4.12E-08	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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.:	**11225019**	**12/8/2022**
PROJECT NAME:	**BALDWIN DG-WP-FIELD INVESTIGATION**	
CLIENT:	**RAMBOLL AMERICAS ENGINEERING SOLUTIONS**	
LOCATION :	**BALDWIN, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	MW393
SAMPLE ID.	BOTTOM
DEPTH:	21.0'-21.5'
CLASSIFICATION	BROWN LEAN CLAY (CL)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	103.1	104.0
WATER CONTENT (%)	20.1	22.7
DIAMETER (cm)	5.965	5.963
LENGTH (cm)	7.489	7.428
B VALUE PARAMETER:	0.98	
HYDRAULIC GRADIENT (MAXIMUM)	21.98	
PERCENT SATURATION	99.0	
HYDRAULIC CONDUCTIVITY k (cm/sec)	5.59E-08	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

Terracon

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

Laboratory Services Group **192 Exchange Blvd** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

TERRACON PROJECT NO.:	**11225019**	**12/8/2022**
PROJECT NAME:	**BALDWIN DG-WP-FIELD INVESTIGATION**	
CLIENT:	**RAMBOLL AMERICAS ENGINEERING SOLUTIONS**	
LOCATION :	**BALDWIN, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	MW394
SAMPLE ID.	TOP
DEPTH:	18.5'-19.0'
CLASSIFICATION	GRAYISH BROWN SANDY LEAN CLAY WITH GRAVEL (CL)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	109.1	116.9
WATER CONTENT (%)	17.1	16.1
DIAMETER (cm)	6.029	5.961
LENGTH (cm)	6.787	6.480
B VALUE PARAMETER:	0.97	
HYDRAULIC GRADIENT (MAXIMUM)	24.25	
PERCENT SATURATION	99.3	
HYDRAULIC CONDUCTIVITY k (cm/sec)	4.30E-08	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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.:	**11225019**	**12/8/2022**
PROJECT NAME:	**BALDWIN DG-WP-FIELD INVESTIGATION**	
CLIENT:	**RAMBOLL AMERICAS ENGINEERING SOLUTIONS**	
LOCATION :	**BALDWIN, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	MW394
SAMPLE ID.	BOTTOM
DEPTH:	19.0'-19.5'
CLASSIFICATION	BROWN AND GRAY MOTTLED SANDY LEAN CLAY (CL)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	109.7	113.2
WATER CONTENT (%)	20.3	17.0
DIAMETER (cm)	6.039	6.023
LENGTH (cm)	9.133	8.894
B VALUE PARAMETER:	0.95	
HYDRAULIC GRADIENT (MAXIMUM)	18.02	
PERCENT SATURATION	94.3	
HYDRAULIC CONDUCTIVITY k (cm/sec)	6.24E-08	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

Laboratory Services Group **192 Exchange Blvd** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

TERRACON PROJECT NO.:	**11225019**	**12/8/2022**
PROJECT NAME:	**BALDWIN DG-WP-FIELD INVESTIGATION**	
CLIENT:	**RAMBOLL AMERICAS ENGINEERING SOLUTIONS**	
LOCATION :	**BALDWIN, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	XPW02B
SAMPLE ID.	TOP
DEPTH:	5.5'-6.0'
CLASSIFICATION	VERY DARK GRAY AND BLACK POORLY GRADED SAND WITH CINDERS ABD ASH (SP-SC)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	102.7	104.0
WATER CONTENT (%)	14.3	21.9
DIAMETER (cm)	6.128	6.128
LENGTH (cm)	9.252	9.144
B VALUE PARAMETER:	0.95	
HYDRAULIC GRADIENT (MAXIMUM)	10.19	
PERCENT SATURATION	98.9	
HYDRAULIC CONDUCTIVITY k (cm/sec)	5.63E-05	

SPECIMEN PHOTO
N/A

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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.:	**11225019**	**12/8/2022**
PROJECT NAME:	**BALDWIN DG-WP-FIELD INVESTIGATION**	
CLIENT:	**RAMBOLL AMERICAS ENGINEERING SOLUTIONS**	
LOCATION :	**BALDWIN, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	XPW02B
SAMPLE ID.	BOTTOM
DEPTH:	6.0'-6.5'
CLASSIFICATION	BLACK AND VERY DARK BROWN WELL GRADED SAND WITH CINDERS (SW-SC)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	118.2	118.6
WATER CONTENT (%)	8.3	14.5
DIAMETER (cm)	6.074	6.074
LENGTH (cm)	8.807	8.774
B VALUE PARAMETER:	0.95	
HYDRAULIC GRADIENT (MAXIMUM)	10.71	
PERCENT SATURATION	97.9	
HYDRAULIC CONDUCTIVITY k (cm/sec)	2.61E-05	

SPECIMEN PHOTO
N/A

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

Laboratory Services Group **192 Exchange Blvd** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

TERRACON PROJECT NO.:	**11225019**	**12/8/2022**
PROJECT NAME:	**BALDWIN DG-WP-FIELD INVESTIGATION**	
CLIENT:	**RAMBOLL AMERICAS ENGINEERING SOLUTIONS**	
LOCATION :	**BALDWIN, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	XPW04A
SAMPLE ID.	TOP
DEPTH:	15.0'-15.5'
CLASSIFICATION	BLACK POORLY GRADED SAND WITH CINDERS (SP)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	108.9	109.1
WATER CONTENT (%)	10.7	19.7
DIAMETER (cm)	6.040	6.040
LENGTH (cm)	6.058	6.046
B VALUE PARAMETER:	0.95	
HYDRAULIC GRADIENT (MAXIMUM)	15.57	
PERCENT SATURATION	100.5	
HYDRAULIC CONDUCTIVITY k (cm/sec)	1.81E-05	

SPECIMEN PHOTO
N/A

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

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.: **11225019** **12/8/2022**
PROJECT NAME: **BALDWIN DG-WP-FIELD INVESTIGATION**
CLIENT: **RAMBOLL AMERICAS ENGINEERING SOLUTIONS**
LOCATION : **BALDWIN, IL**

SUMMARY OF TEST RESULTS

BORING NO. XPW04A

SAMPLE ID. BOTTOM

DEPTH: 15.5'-16.0'

CLASSIFICATION BLACK POORLY GRADED SAND WITH CINDERS (SP)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	114.1	115.0
WATER CONTENT (%)	8.8	16.5
DIAMETER (cm)	6.133	6.133
LENGTH (cm)	5.833	5.789
B VALUE PARAMETER:	0.95	
HYDRAULIC GRADIENT (MAXIMUM)	16.17	
PERCENT SATURATION	99.8	
HYDRAULIC CONDUCTIVITY k (cm/sec)	9.45E-06	

SPECIMEN PHOTO

N/A

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

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.:	**11225019**	**12/8/2022**
PROJECT NAME:	**BALDWIN DG-WP-FIELD INVESTIGATION**	
CLIENT:	**RAMBOLL AMERICAS ENGINEERING SOLUTIONS**	
LOCATION :	**BALDWIN, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	XTPW06A
SAMPLE ID.	TOP
DEPTH:	7.5'-8.0'
CLASSIFICATION	DARK GRAY AND BLACK SILTY CLAYEY SAND WITH CINDERS AND ASH (SC-SM)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	107.1	113.5
WATER CONTENT (%)	17.7	17.5
DIAMETER (cm)	6.067	5.974
LENGTH (cm)	7.464	7.268
B VALUE PARAMETER:	0.96	
HYDRAULIC GRADIENT (MAXIMUM)	22.05	
PERCENT SATURATION	98.0	
HYDRAULIC CONDUCTIVITY k (cm/sec)	4.85E-07	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

Laboratory Services Group | **192 Exchange Blvd** | **Glendale Heights, Illinois 60139** | **Ph. (630) 717-4263**

TERRACON PROJECT NO.:	**11225019**	**12/8/2022**
PROJECT NAME:	**BALDWIN DG-WP-FIELD INVESTIGATION**	
CLIENT:	**RAMBOLL AMERICAS ENGINEERING SOLUTIONS**	
LOCATION :	**BALDWIN, IL**	

SUMMARY OF TEST RESULTS

BORING NO.	XTPW06A
SAMPLE ID.	BOTTOM
DEPTH:	8.0'-8.5'
CLASSIFICATION	BLACK AND BROWN CLAYEY SAND WITH CINDERS (SC-SM)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	113.9	114.9
WATER CONTENT (%)	15.1	16.2
DIAMETER (cm)	6.136	6.132
LENGTH (cm)	7.183	7.131
B VALUE PARAMETER:	0.97	
HYDRAULIC GRADIENT (MAXIMUM)	22.92	
PERCENT SATURATION	97.9	
HYDRAULIC CONDUCTIVITY k (cm/sec)	6.32E-07	

SPECIMEN PHOTO

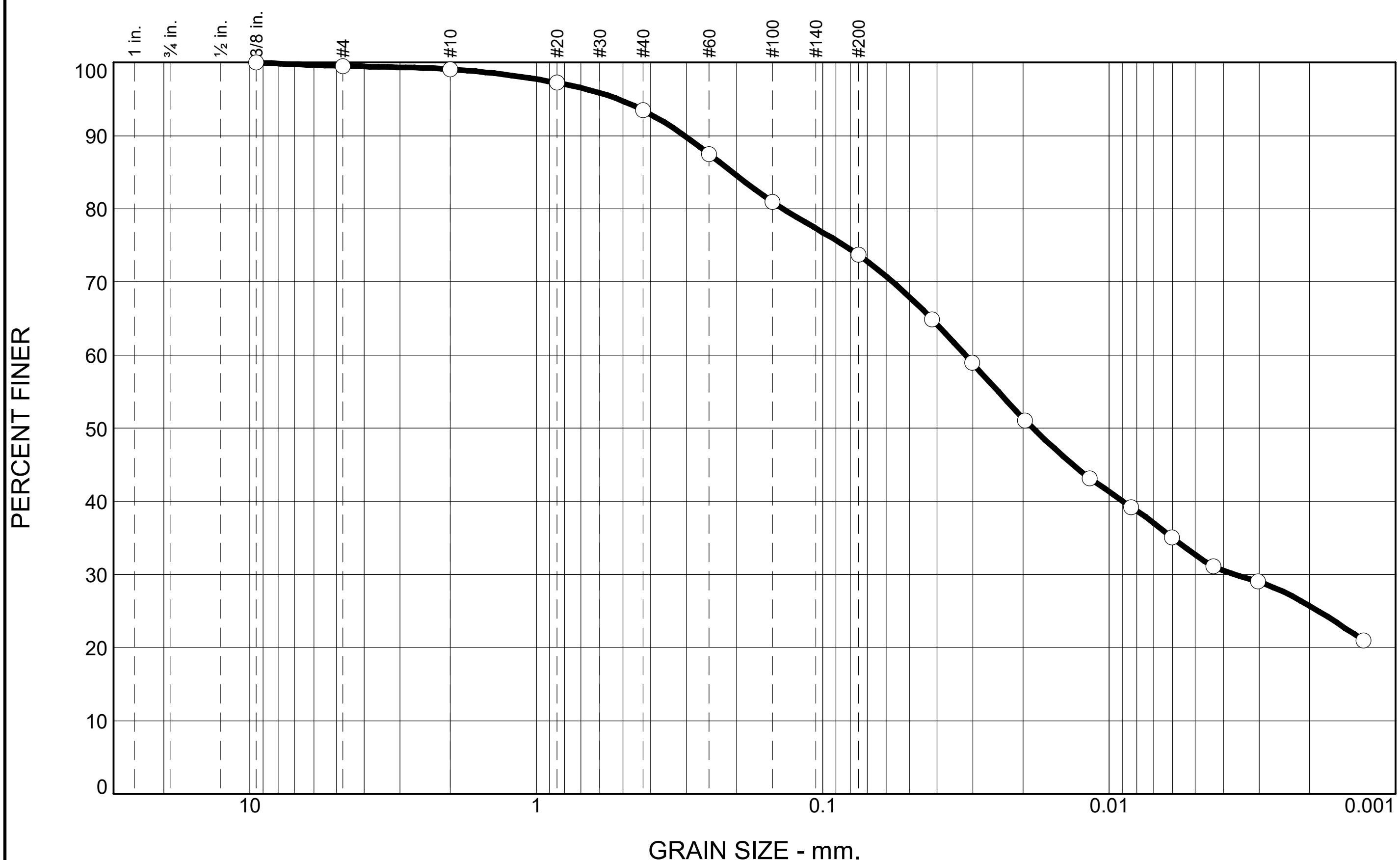
(Percent saturation calculation is based on final measurements and a measured specific gravity.)

Deaired water was used as the liquid permeant.

Terracon

Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis
ASTM D7928
Particle Size Analysis of Soils
ASTM D6913

PARTICLE SIZE ANALYSIS OF SOILS - ASTM D6913 AND D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.5	0.4	5.6	19.8	41.0	32.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.5		
#10	99.1		
#20	97.2		
#40	93.5		
#60	87.5		
#100	80.9		
#200	73.7		
0.0416 mm.	64.9		
0.0301 mm.	59.0		
0.0197 mm.	51.1		
0.0117 mm.	43.2		
0.0084 mm.	39.2		
0.0060 mm.	35.1		
0.0043 mm.	31.1		
0.0030 mm.	29.0		
0.0013 mm.	21.0		

* (no specification provided)

Soil Description

BROWN MOTTLED GRAY LEAN CLAY WITH SAND

Atterberg Limits

PL= 16 LL= 34 PI= 18

Coefficients

D_{90}= 0.3050 D_{85}= 0.2072 D_{60}= 0.0318
D_{50}= 0.0185 D_{30}= 0.0036 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(11)

Remarks

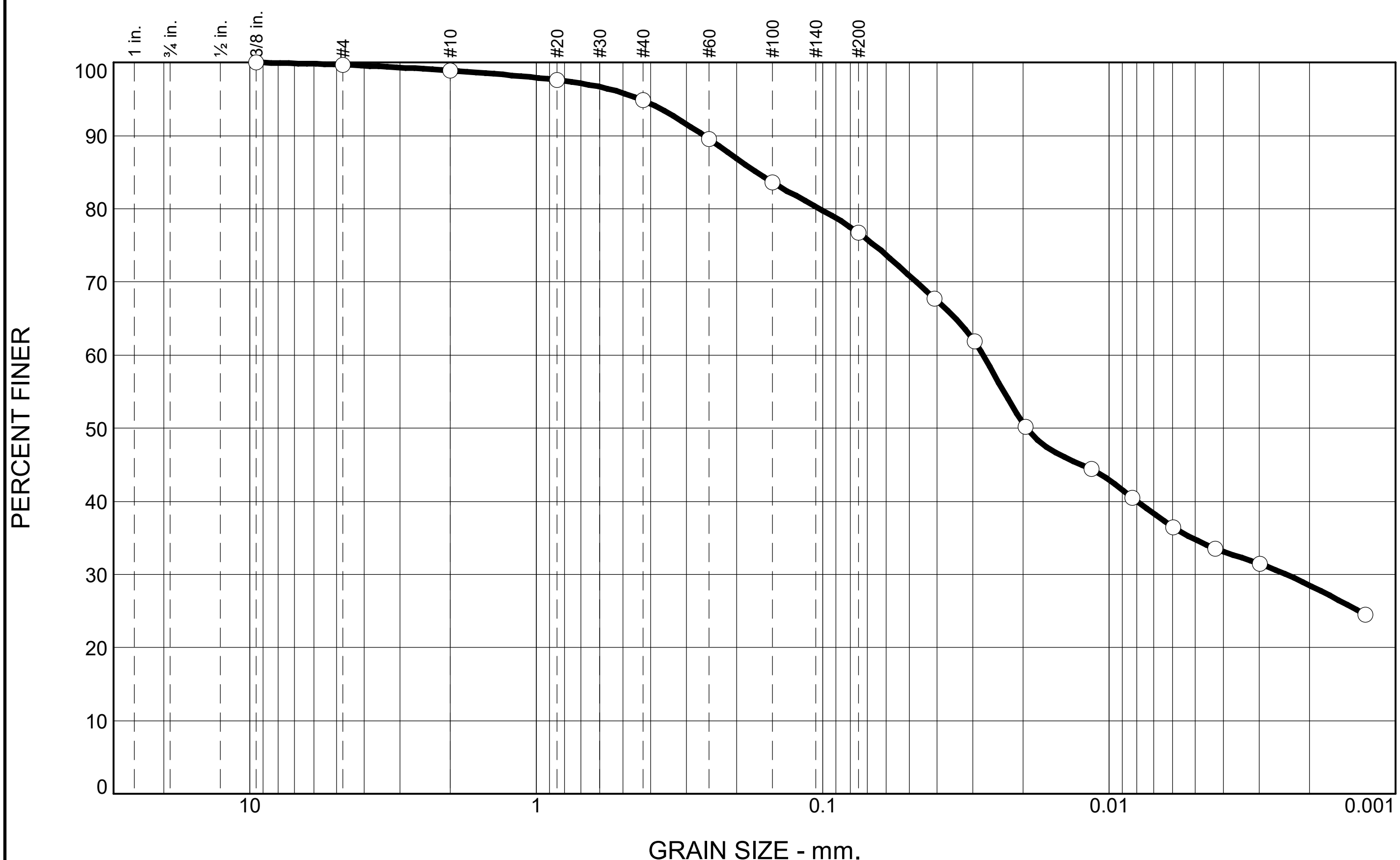
F.M.=0.37

Source of Sample: MW358 **Depth:** 15.5'-16.0'
Sample Number: TOP **Date:** 12-1-22

Client: RAMBOLL AMERICAS ENGINEERING SOLUTIONS
Project: BALDWIN DG-WP-FIELD INVESTIGATION
Project No: 11225019 **Figure**

Tested By: LV **Checked By:** BCM

PARTICLE SIZE ANALYSIS OF SOILS - ASTM D6913 AND D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.3	0.8	4.1	18.1	42.0	34.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.7		
#10	98.9		
#20	97.6		
#40	94.8		
#60	89.5		
#100	83.6		
#200	76.7		
0.0408 mm.	67.7		
0.0296 mm.	61.9		
0.0196 mm.	50.2		
0.0116 mm.	44.4		
0.0083 mm.	40.5		
0.0060 mm.	36.4		
0.0043 mm.	33.5		
0.0030 mm.	31.5		
0.0013 mm.	24.5		

* (no specification provided)

Soil Description

BROWN MOTTLED GRAY LEAN CLAY WITH SAND

Atterberg Limits

PL= 15 LL= 35 PI= 20

Coefficients

D_{90}= 0.2598 D_{85}= 0.1704 D_{60}= 0.0276
D_{50}= 0.0194 D_{30}= 0.0024 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(14)

Remarks

F.M.=0.31

Source of Sample: MW358 **Depth:** 16.0'-16.5'
Sample Number: BOTTOM **Date:** 12-1-22

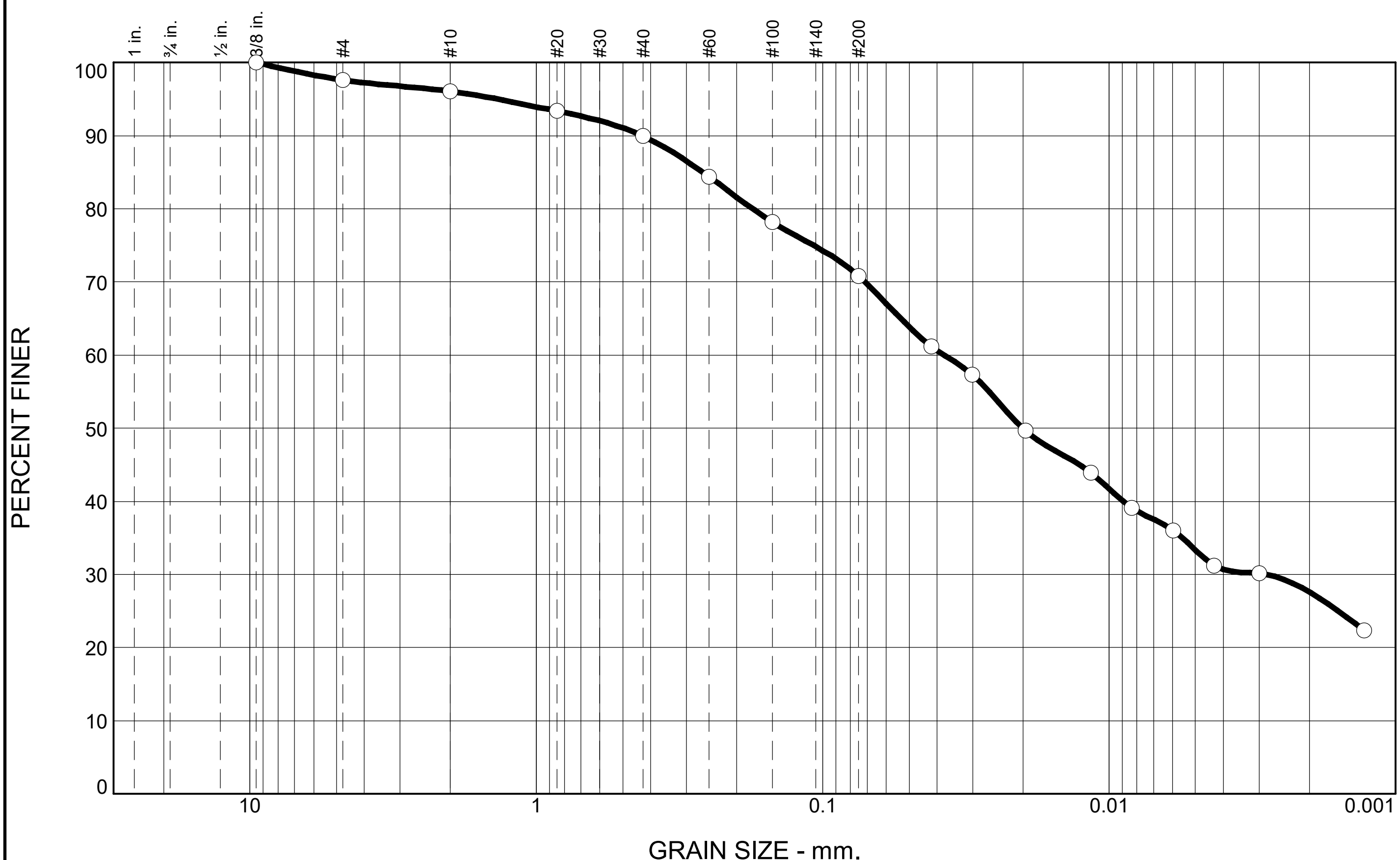
Terracon

Client: RAMBOLL AMERICAS ENGINEERING SOLUTIONS
Project: BALDWIN DG-WP-FIELD INVESTIGATION

Project No: 11225019 **Figure**

Tested By: LV **Checked By:** BCM

PARTICLE SIZE ANALYSIS OF SOILS - ASTM D6913 AND D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.4	1.5	6.1	19.2	37.5	33.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	97.6		
#10	96.1		
#20	93.4		
#40	90.0		
#60	84.4		
#100	78.2		
#200	70.8		
0.0419 mm.	61.2		
0.0301 mm.	57.3		
0.0196 mm.	49.7		
0.0116 mm.	43.9		
0.0083 mm.	39.1		
0.0060 mm.	36.0		
0.0043 mm.	31.2		
0.0030 mm.	30.1		
0.0013 mm.	22.3		

* (no specification provided)

Soil Description

BROWN LEAN CLAY WITH SAND

Atterberg Limits

PL= 14 LL= 33 PI= 19

Coefficients

D_{90}= 0.4277 D_{85}= 0.2625 D_{60}= 0.0378
D_{50}= 0.0201 D_{30}= 0.0028 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(11)

Remarks

F.M.=0.55

Source of Sample: MW392 **Depth:** 30.5'-31.0'
Sample Number: TOP **Date:** 12-1-22

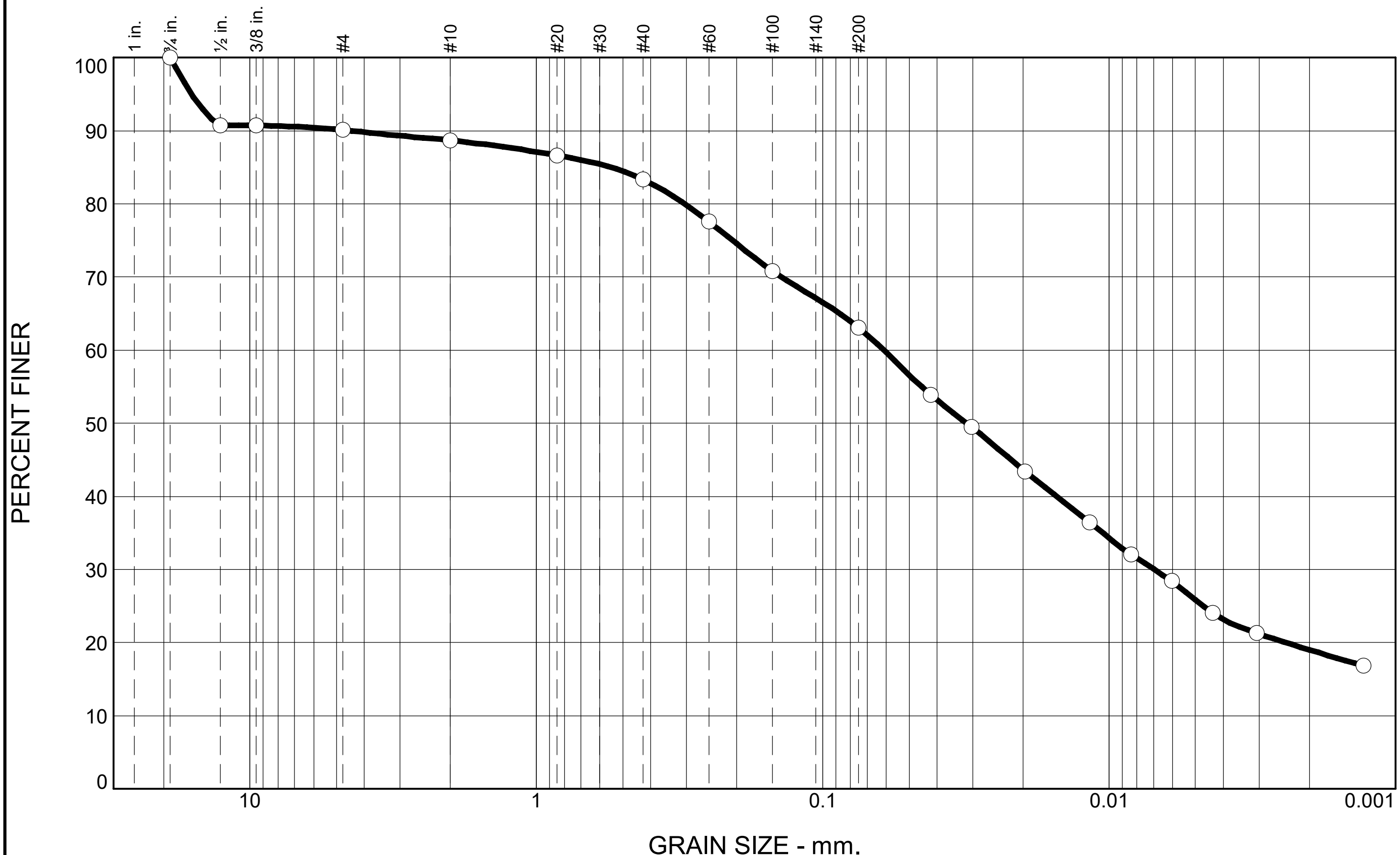
Terracon

Client: RAMBOLL AMERICAS ENGINEERING SOLUTIONS
Project: BALDWIN DG-WP-FIELD INVESTIGATION

Project No: 11225019 **Figure**

Tested By: LV **Checked By:** BCM

PARTICLE SIZE ANALYSIS OF SOILS - ASTM D6913 AND D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.8	1.5	5.4	20.2	37.3	25.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
0.50	90.7		
.375	90.7		
#4	90.2		
#10	88.7		
#20	86.6		
#40	83.3		
#60	77.6		
#100	70.8		
#200	63.1		
0.0420 mm.	53.9		
0.0303 mm.	49.5		
0.0197 mm.	43.4		
0.0117 mm.	36.4		
0.0084 mm.	32.1		
0.0061 mm.	28.4		
0.0043 mm.	24.0		
0.0031 mm.	21.3		
0.0013 mm.	16.8		

* (no specification provided)

Soil Description

BROWN SANDY LEAN CLAY

Atterberg Limits

PL= 12 LL= 32 PI= 20

Coefficients

D_{90}= 4.4350 D_{85}= 0.5510 D_{60}= 0.0614
D_{50}= 0.0314 D_{30}= 0.0070 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(9)

Remarks

F.M.=1.07

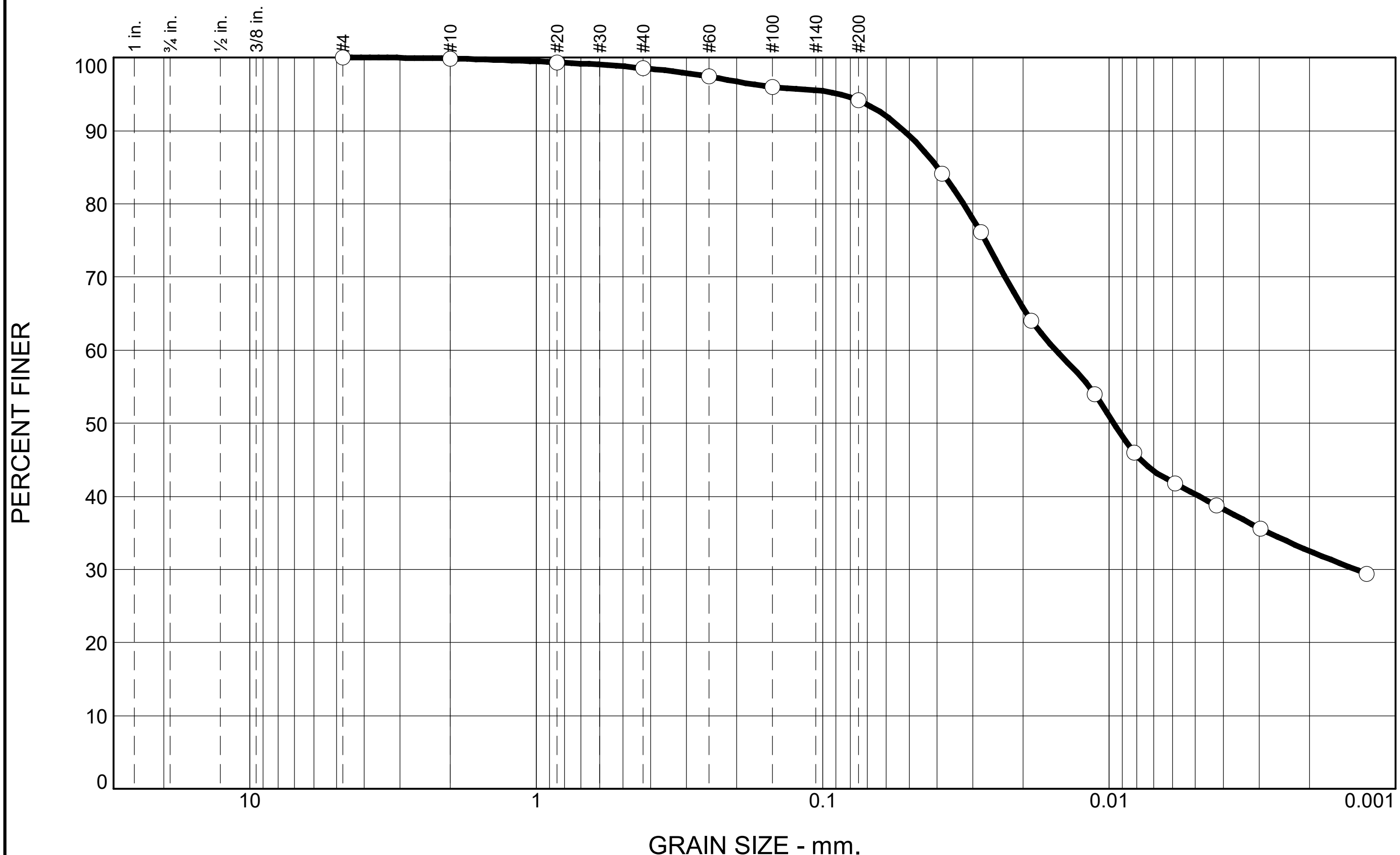
Source of Sample: MW392 **Depth:** 31.0'-31.5'
Sample Number: BOTTOM **Date:** 12-1-22

Terracon

Client: RAMBOLL AMERICAS ENGINEERING SOLUTIONS
Project: BALDWIN DG-WP-FIELD INVESTIGATION
Project No: 11225019 **Figure**

Tested By: LV **Checked By:** BCM

PARTICLE SIZE ANALYSIS OF SOILS - ASTM D6913 AND D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	1.3	4.5	53.8	40.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	99.4		
#40	98.6		
#60	97.4		
#100	96.0		
#200	94.1		
0.0383 mm.	84.2		
0.0281 mm.	76.1		
0.0187 mm.	64.1		
0.0112 mm.	54.0		
0.0082 mm.	46.0		
0.0059 mm.	41.7		
0.0042 mm.	38.7		
0.0030 mm.	35.6		
0.0013 mm.	29.4		

* (no specification provided)

Soil Description

BROWN LEAN CLAY

Atterberg Limits

PL= 15 LL= 48 PI= 33

Coefficients

D_{90}= 0.0521 D_{85}= 0.0398 D_{60}= 0.0154
D_{50}= 0.0096 D_{30}= 0.0014 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(32)

Remarks

F.M.=0.08

Source of Sample: MW393 **Depth:** 20.5'-21.0'
Sample Number: TOP

Date: 12-1-22

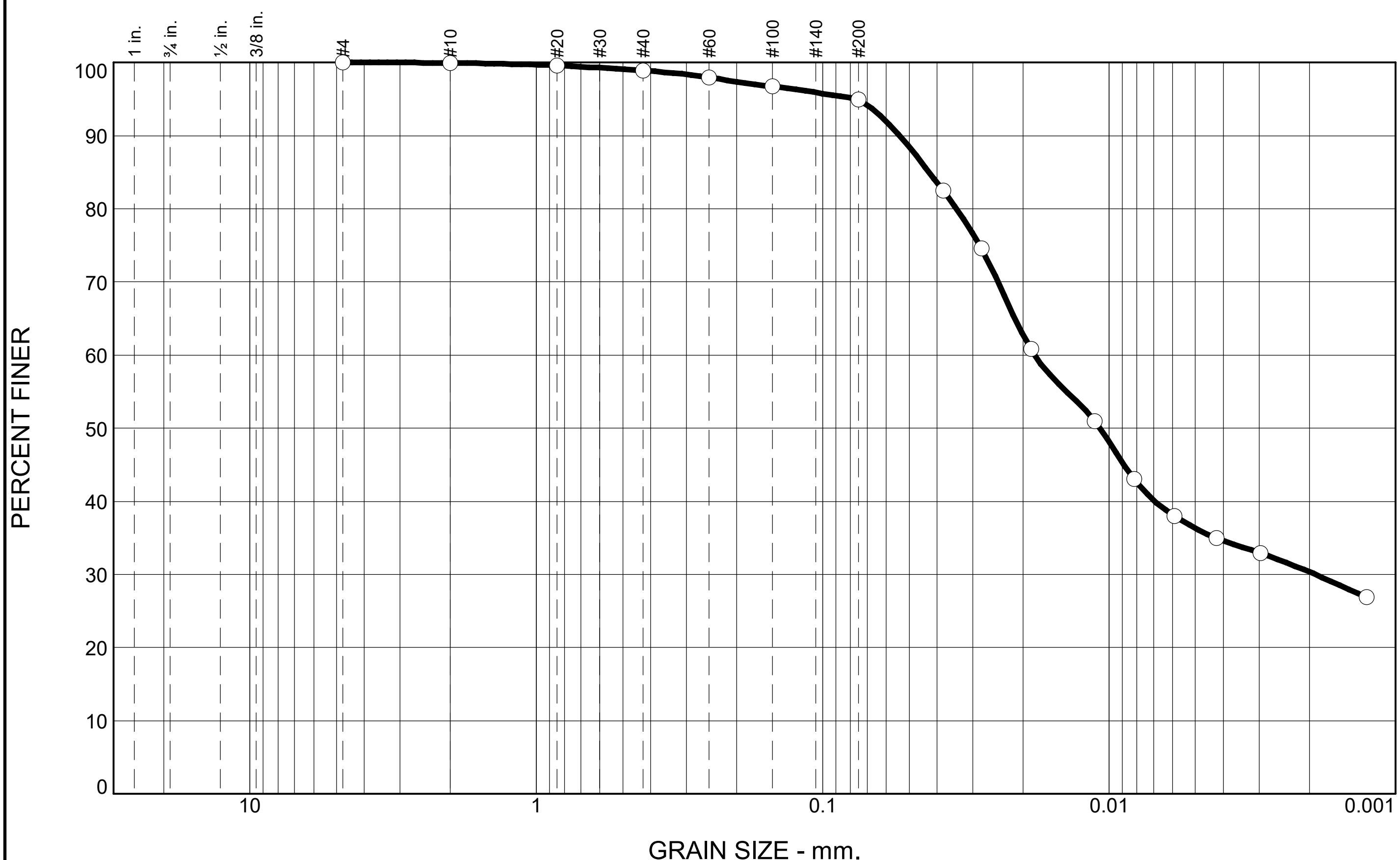
Terracon

Client: RAMBOLL AMERICAS ENGINEERING SOLUTIONS
Project: BALDWIN DG-WP-FIELD INVESTIGATION

Project No: 11225019 **Figure**

Tested By: LV **Checked By:** BCM

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	1.1	3.9	58.7	36.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	99.6		
#40	98.9		
#60	98.0		
#100	96.8		
#200	95.0		
0.0381 mm.	82.5		
0.0279 mm.	74.6		
0.0188 mm.	60.8		
0.0113 mm.	51.0		
0.0082 mm.	43.1		
0.0059 mm.	38.0		
0.0042 mm.	35.0		
0.0030 mm.	32.9		
0.0013 mm.	26.9		

* (no specification provided)

Soil Description

BROWN LEAN CLAY

Atterberg Limits

PL= 14 LL= 44 PI= 30

Coefficients

D_{90}= 0.0540 D_{85}= 0.0426 D_{60}= 0.0182
D_{50}= 0.0108 D_{30}= 0.0019 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(29)

Remarks

F.M.=0.06

Source of Sample: MW393 **Depth:** 21.0'-21.5'
Sample Number: BOTTOM

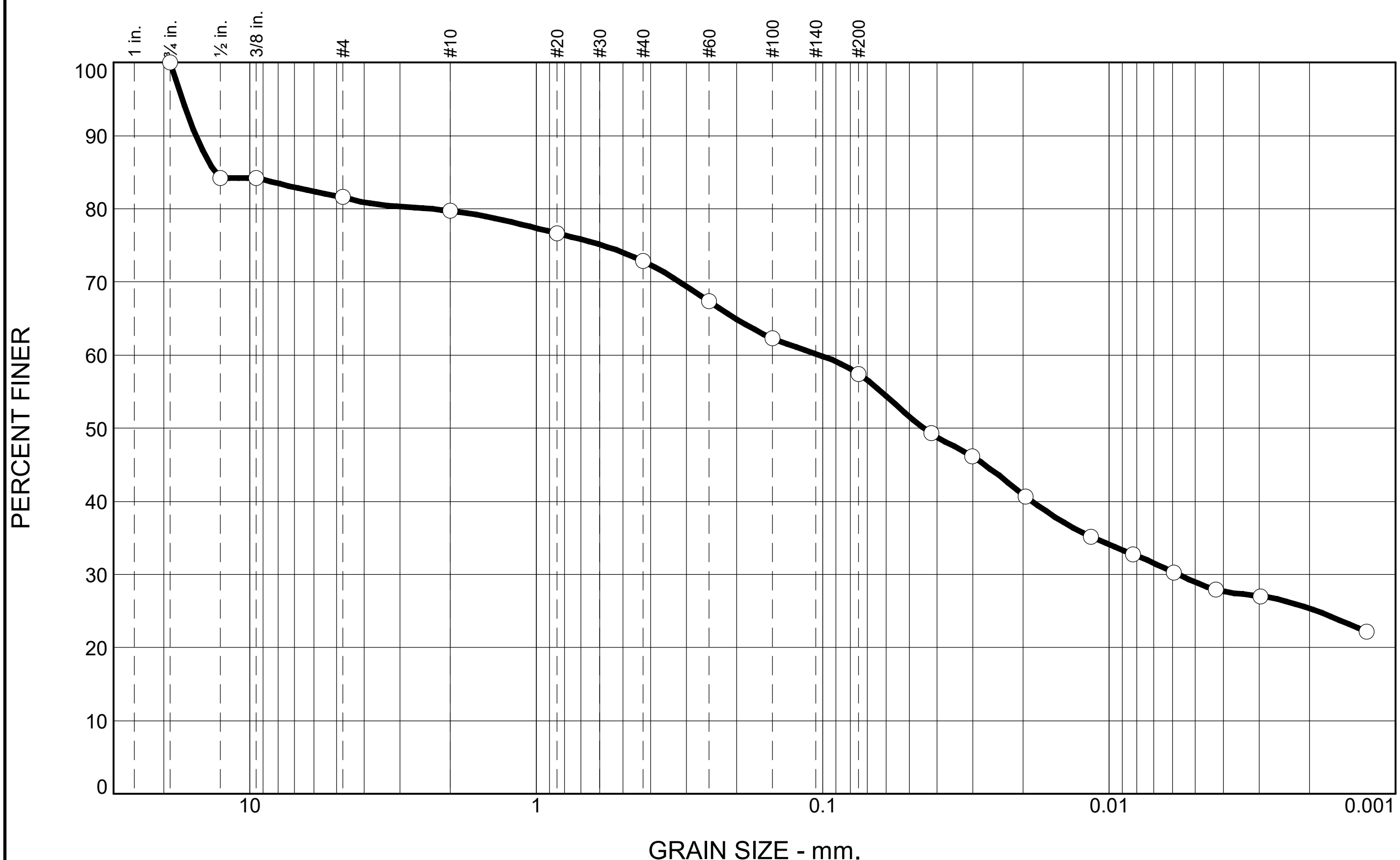
Date: 12-1-22

Terracon

Client: RAMBOLL AMERICAS ENGINEERING SOLUTIONS
Project: BALDWIN DG-WP-FIELD INVESTIGATION
Project No: 11225019 **Figure**

Tested By: LV **Checked By:** BCM

PARTICLE SIZE ANALYSIS OF SOILS - ASTM D6913 AND D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	18.4	1.9	6.8	15.5	28.5	28.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
0.50	84.2		
.375	84.2		
#4	81.6		
#10	79.7		
#20	76.7		
#40	72.9		
#60	67.3		
#100	62.3		
#200	57.4		
0.0419 mm.	49.3		
0.0301 mm.	46.1		
0.0196 mm.	40.6		
0.0116 mm.	35.1		
0.0083 mm.	32.8		
0.0059 mm.	30.3		
0.0042 mm.	27.9		
0.0030 mm.	27.0		
0.0013 mm.	22.2		

* (no specification provided)

Soil Description

GRAYISH BROWN SANDY LEAN CLAY WITH GRAVEL

Atterberg Limits

PL= 13 LL= 46 PI= 33

Coefficients

D_{90}= 15.4480 D_{85}= 13.2486 D_{60}= 0.1026
D_{50}= 0.0445 D_{30}= 0.0057 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(15)

Remarks

F.M.=1.69

Source of Sample: MW394 **Depth:** 18.5'-19.0'
Sample Number: TOP

Date: 12-1-22

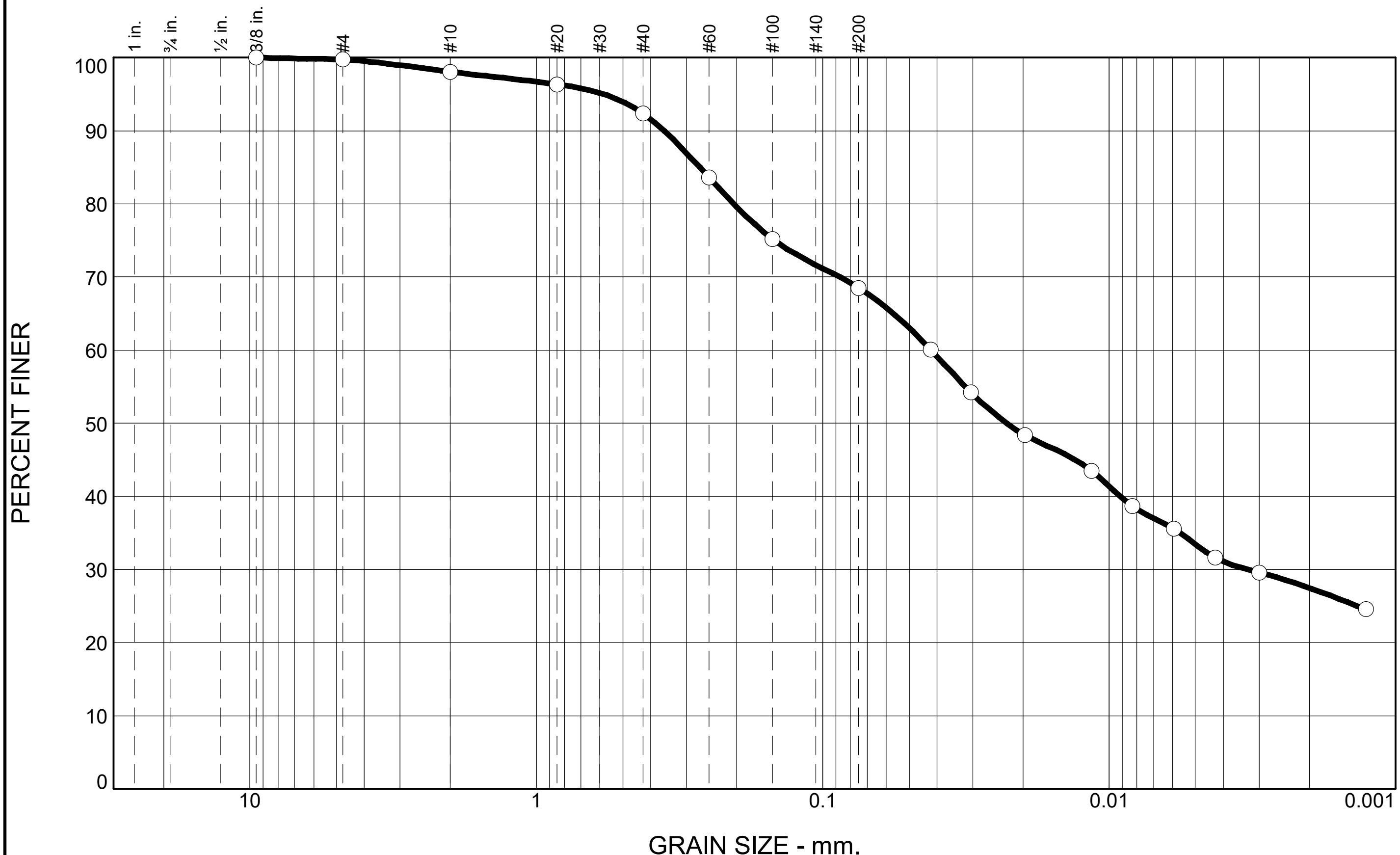
Terracon

Client: RAMBOLL AMERICAS ENGINEERING SOLUTIONS
Project: BALDWIN DG-WP-FIELD INVESTIGATION

Project No: 11225019 **Figure**

Tested By: LV **Checked By:** BCM

PARTICLE SIZE ANALYSIS OF SOILS - ASTM D6913 AND D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.2	1.7	5.7	23.9	35.1	33.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.8		
#10	98.1		
#20	96.3		
#40	92.4		
#60	83.6		
#100	75.2		
#200	68.5		
0.0420 mm.	60.0		
0.0304 mm.	54.2		
0.0196 mm.	48.4		
0.0115 mm.	43.5		
0.0083 mm.	38.6		
0.0060 mm.	35.5		
0.0043 mm.	31.7		
0.0030 mm.	29.6		
0.0013 mm.	24.6		

* (no specification provided)

Soil Description

BROWN AND GRAY MOTTLED SANDY LEAN CLAY

Atterberg Limits

PL= 12 LL= 39 PI= 27

Coefficients

D_{90}= 0.3588 D_{85}= 0.2692 D_{60}= 0.0419
D_{50}= 0.0228 D_{30}= 0.0033 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(15)

Remarks

F.M.=0.47

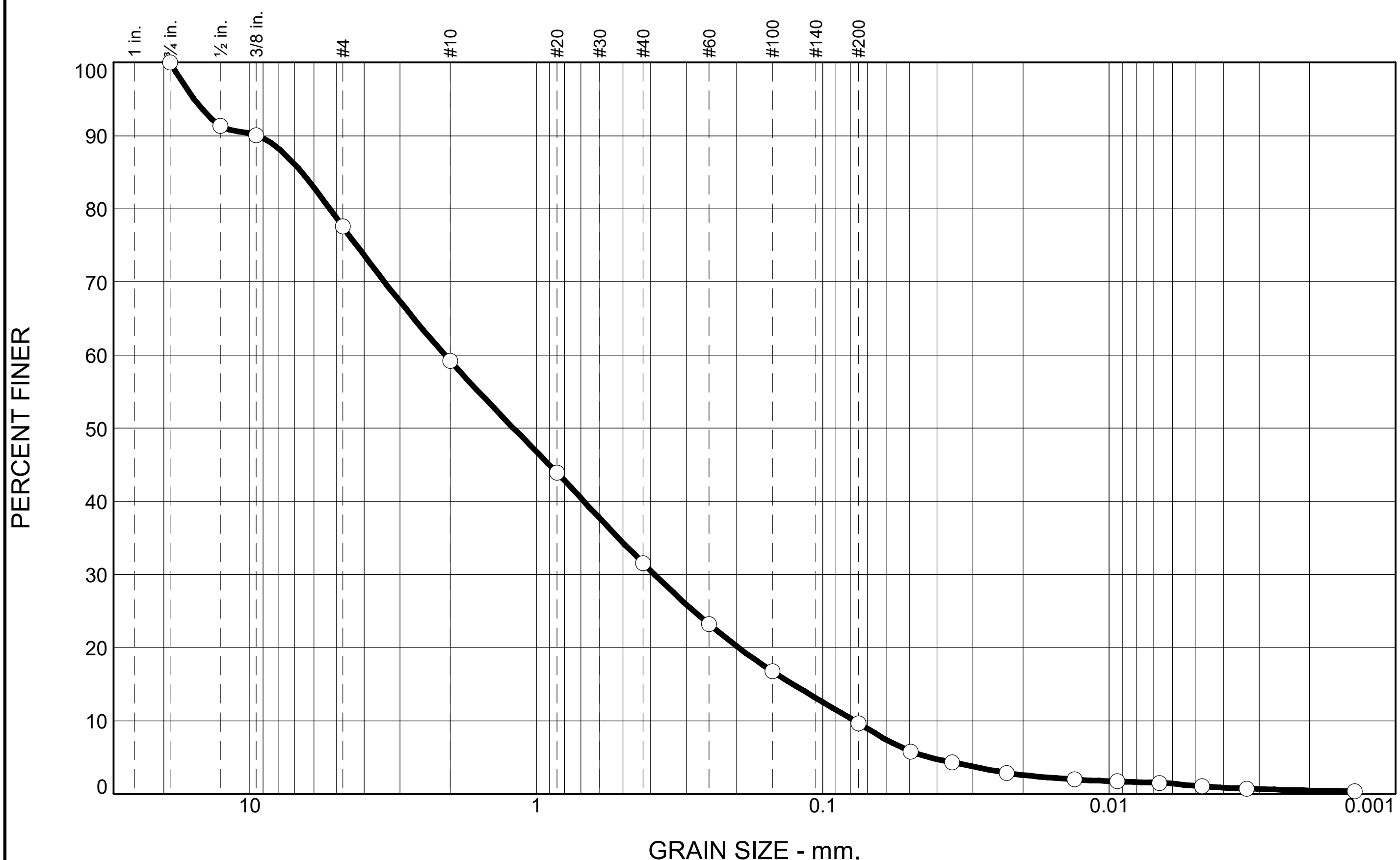
Source of Sample: MW394 **Depth:** 19.0'-19.5'
Sample Number: BOTTOM **Date:** 12-1-22

Terracon

Client: RAMBOLL AMERICAS ENGINEERING SOLUTIONS
Project: BALDWIN DG-WP-FIELD INVESTIGATION
Project No: 11225019 **Figure**

Tested By: LV **Checked By:** BCM

PARTICLE SIZE ANALYSIS OF SOILS - ASTM D6913 AND D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	22.4	18.4	27.6	22.0	8.5	1.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
0.50	91.4		
.375	90.1		
#4	77.6		
#10	59.2		
#20	43.9		
#40	31.6		
#60	23.2		
#100	16.7		
#200	9.6		
0.0494 mm.	5.8		
0.0355 mm.	4.3		
0.0227 mm.	2.9		
0.0132 mm.	2.0		
0.0094 mm.	1.7		
0.0067 mm.	1.5		
0.0047 mm.	1.0		
0.0033 mm.	0.7		
0.0014 mm.	0.4		

* (no specification provided)

Soil Description

VERY DARK GRAY AND BLACK POORLY GRADED SAND WITH CLAY, GRAVEL, CINDERS AND ASH

Atterberg Limits

PL= 10 LL= 26 PI= 16

Coefficients

D_{90}= 9.4452 D_{85}= 6.6124 D_{60}= 2.0872
D_{50}= 1.2033 D_{30}= 0.3874 D_{15}= 0.1276
D_{10}= 0.0777 C_u= 26.86 C_c= 0.93

Classification

USCS= SP-SC AASHTO= A-2-6(0)

Remarks

F.M.=3.40

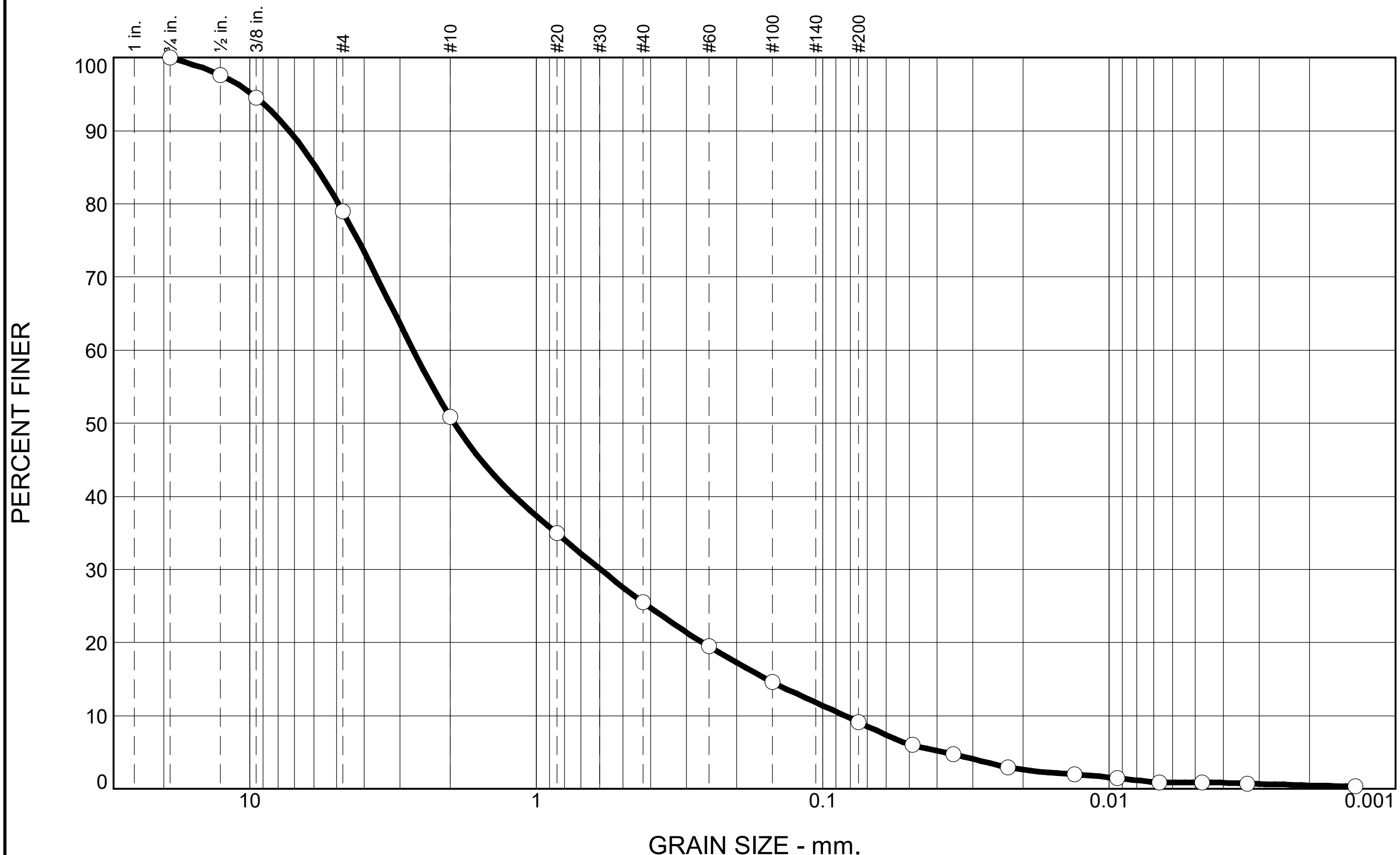
Source of Sample: XPW02B **Depth:** 5.5'-6.0'
Sample Number: TOP
Date: 12-1-22

Terracon

Client: RAMBOLL AMERICAS ENGINEERING SOLUTIONS
Project: BALDWIN DG-WP-FIELD INVESTIGATION
Project No: 11225019 **Figure**

Tested By: LV **Checked By:** BCM

PARTICLE SIZE ANALYSIS OF SOILS - ASTM D6913 AND D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	21.0	28.2	25.3	16.4	8.2	0.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
0.50	97.6		
.375	94.6		
#4	79.0		
#10	50.8		
#20	35.0		
#40	25.5		
#60	19.5		
#100	14.6		
#200	9.1		
0.0487 mm.	6.0		
0.0350 mm.	4.7		
0.0226 mm.	3.0		
0.0132 mm.	2.0		
0.0094 mm.	1.4		
0.0067 mm.	0.9		
0.0047 mm.	0.9		
0.0033 mm.	0.7		
0.0014 mm.	0.3		

* (no specification provided)

Soil Description

BLACK AND VERY DARK BROWN WELL GRADED SAND WITH CINDERS

Atterberg Limits

PL= 15 LL= 24 PI= 9

Coefficients

D_{90}= 7.3045 D_{85}= 5.8840 D_{60}= 2.6968
D_{50}= 1.9382 D_{30}= 0.5978 D_{15}= 0.1570
D_{10}= 0.0840 C_u= 32.12 C_c= 1.58

Classification

USCS= SW-SC AASHTO= A-2-4(0)

Remarks

F.M.=3.65

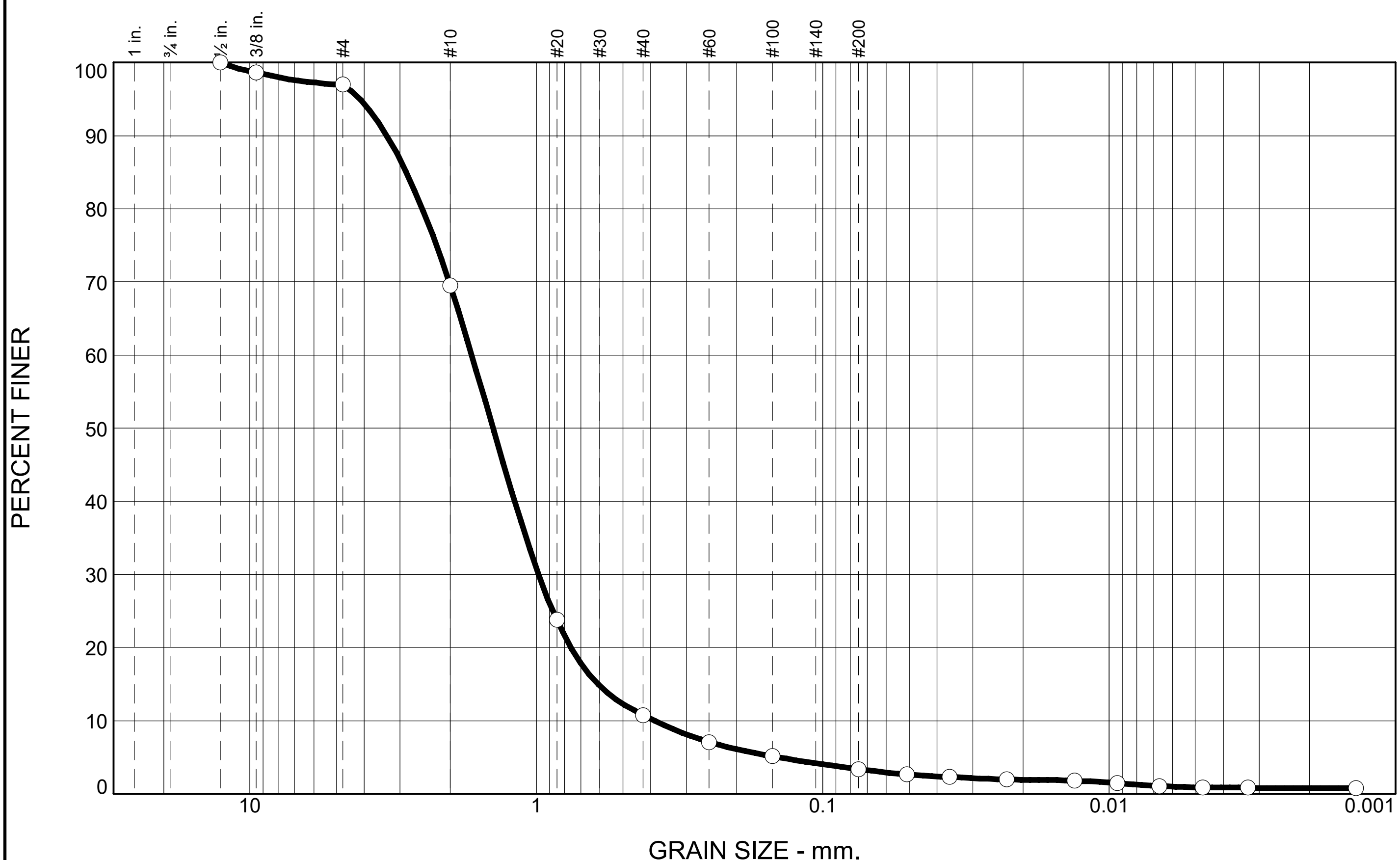
Source of Sample: XPW02B **Depth:** 6.0'-6.5'
Sample Number: BOTTOM **Date:** 12-1-22

Terracon

Client: RAMBOLL AMERICAS ENGINEERING SOLUTIONS
Project: BALDWIN DG-WP-FIELD INVESTIGATION
Project No: 11225019 **Figure**

Tested By: LV **Checked By:** BCM

PARTICLE SIZE ANALYSIS OF SOILS - ASTM D6913 AND D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.0	27.5	58.7	7.4	2.5	0.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.50	100.0		
.375	98.6		
#4	97.0		
#10	69.5		
#20	23.8		
#40	10.8		
#60	7.1		
#100	5.1		
#200	3.4		
0.0508 mm.	2.6		
0.0360 mm.	2.3		
0.0229 mm.	2.0		
0.0132 mm.	1.8		
0.0094 mm.	1.4		
0.0067 mm.	1.0		
0.0047 mm.	0.9		
0.0033 mm.	0.8		
0.0014 mm.	0.8		

* (no specification provided)

Soil Description

BLACK POORLY GRADED SAND WITH CINDERS

Atterberg Limits

PL= 12 LL= 27 PI= 15

Coefficients

D_{90}= 3.3328 D_{85}= 2.8502 D_{60}= 1.6829
D_{50}= 1.4180 D_{30}= 0.9832 D_{15}= 0.6091
D_{10}= 0.3873 C_u= 4.35 C_c= 1.48

Classification

USCS= SP AASHTO= A-2-6(0)

Remarks

F.M.=3.59

Source of Sample: XPW04A **Depth:** 15.0'-15.5'
Sample Number: TOP **Date:** 12-1-22

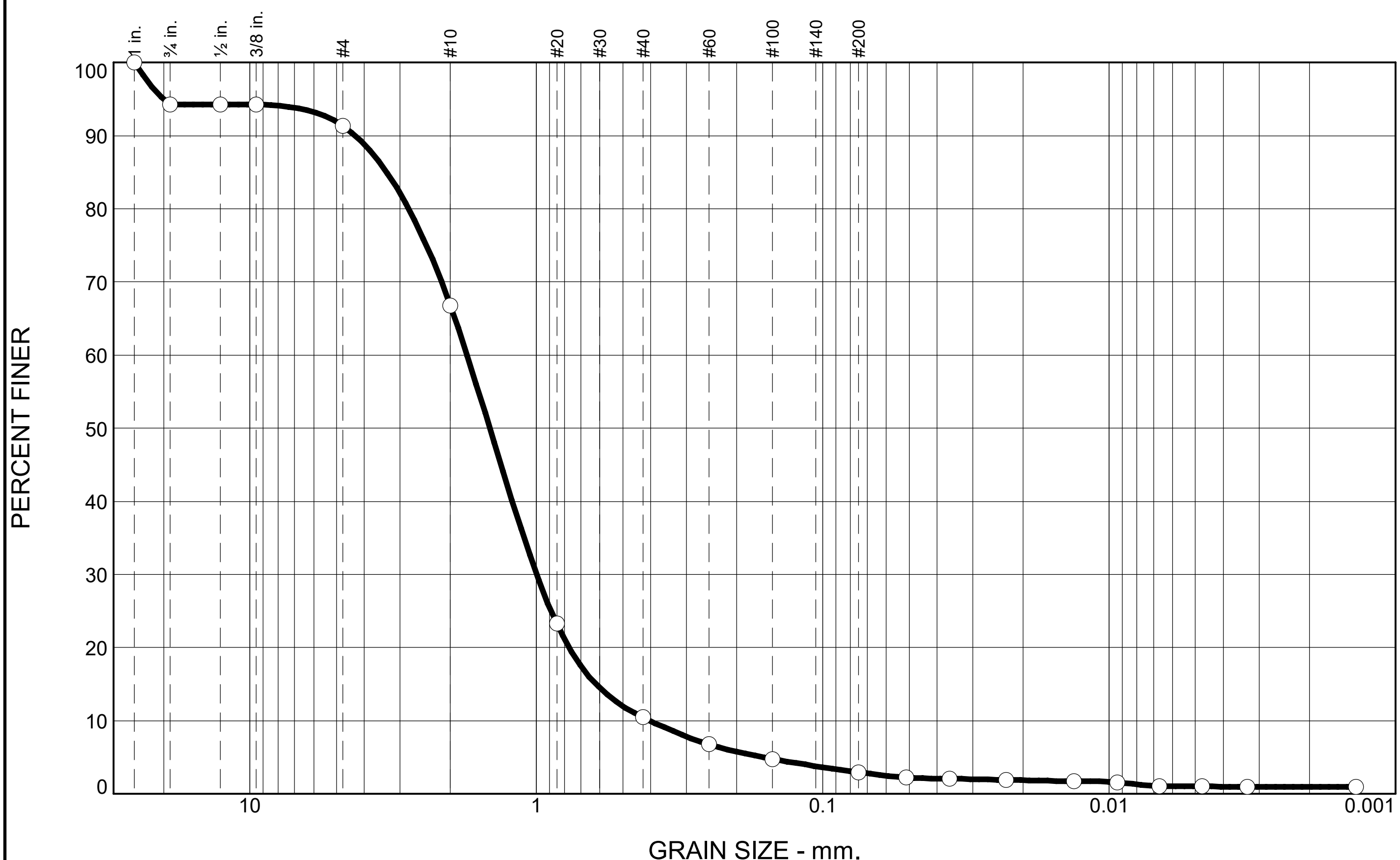
Terracon

Client: RAMBOLL AMERICAS ENGINEERING SOLUTIONS
Project: BALDWIN DG-WP-FIELD INVESTIGATION

Project No: 11225019 **Figure**

Tested By: LV **Checked By:** BCM

PARTICLE SIZE ANALYSIS OF SOILS - ASTM D6913 AND D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
5.7	3.0	24.5	56.3	7.6	1.9	1.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	94.3		
0.50	94.3		
.375	94.3		
#4	91.3		
#10	66.8		
#20	23.3		
#40	10.5		
#60	6.8		
#100	4.8		
#200	2.9		
0.0511 mm.	2.2		
0.0362 mm.	2.1		
0.0229 mm.	1.9		
0.0133 mm.	1.7		
0.0094 mm.	1.6		
0.0067 mm.	1.0		
0.0047 mm.	1.0		
0.0033 mm.	1.0		
0.0014 mm.	0.9		

* (no specification provided)

Soil Description

BLACK POORLY GRADED SAND WITH CINDERS

Atterberg Limits

PL= 16 LL= 25 PI= 9

Coefficients

D_{90}= 4.3017 D_{85}= 3.3358 D_{60}= 1.7474
D_{50}= 1.4558 D_{30}= 0.9983 D_{15}= 0.6205
D_{10}= 0.4013 C_u= 4.35 C_c= 1.42

Classification

USCS= SP AASHTO= A-2-4(0)

Remarks

F.M.=3.81

Source of Sample: XPW04A **Depth:** 15.5'-16.0'
Sample Number: BOTTOM

Date: 12-1-22

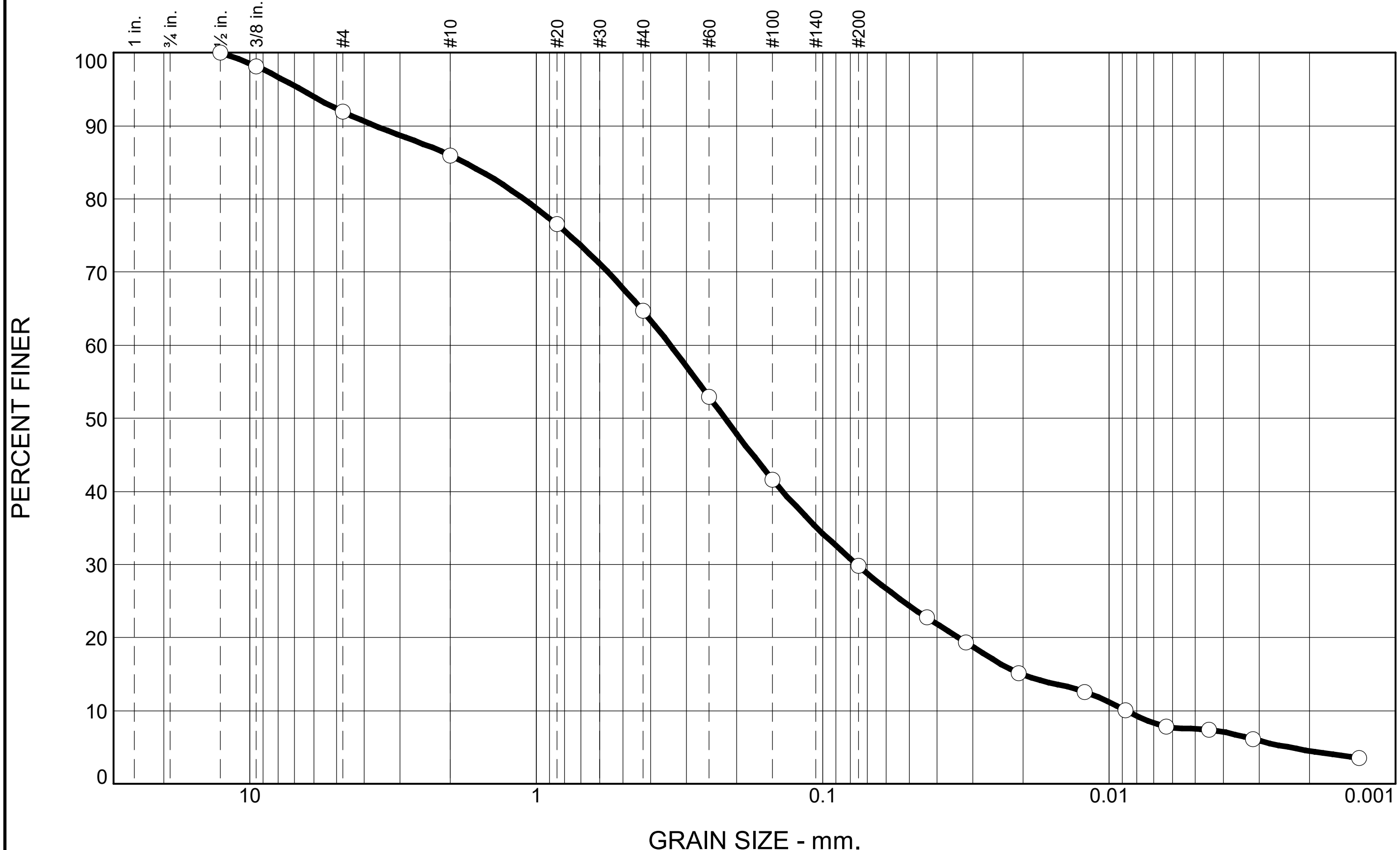
Terracon

Client: RAMBOLL AMERICAS ENGINEERING SOLUTIONS
Project: BALDWIN DG-WP-FIELD INVESTIGATION

Project No: 11225019 **Figure**

Tested By: LV **Checked By:** BCM

PARTICLE SIZE ANALYSIS OF SOILS - ASTM D6913 AND D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	8.1	6.0	21.2	34.9	22.3	7.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.50	100.0		
.375	98.1		
#4	91.9		
#10	85.9		
#20	76.5		
#40	64.7		
#60	52.9		
#100	41.6		
#200	29.8		
0.0434 mm.	22.7		
0.0316 mm.	19.4		
0.0207 mm.	15.1		
0.0122 mm.	12.6		
0.0088 mm.	10.0		
0.0063 mm.	7.8		
0.0045 mm.	7.4		
0.0031 mm.	6.1		
0.0013 mm.	3.5		

* (no specification provided)

Soil Description

DARK GRAY AND BLACK SILTY CLAYEY SAND WITH CINDERS AND ASH

Atterberg Limits

PL= 13 LL= 19 PI= 6

Coefficients

D_{90}= 3.6569 D_{85}= 1.7839 D_{60}= 0.3411
D_{50}= 0.2200 D_{30}= 0.0761 D_{15}= 0.0203
D_{10}= 0.0087 C_u= 39.06 C_c= 1.95

Classification

USCS= SC-SM AASHTO= A-2-4(0)

Remarks

F.M.=1.72

Source of Sample: XTPW06A **Depth:** 7.5'-8.0'
Sample Number: TOP

Date: 12-1-22

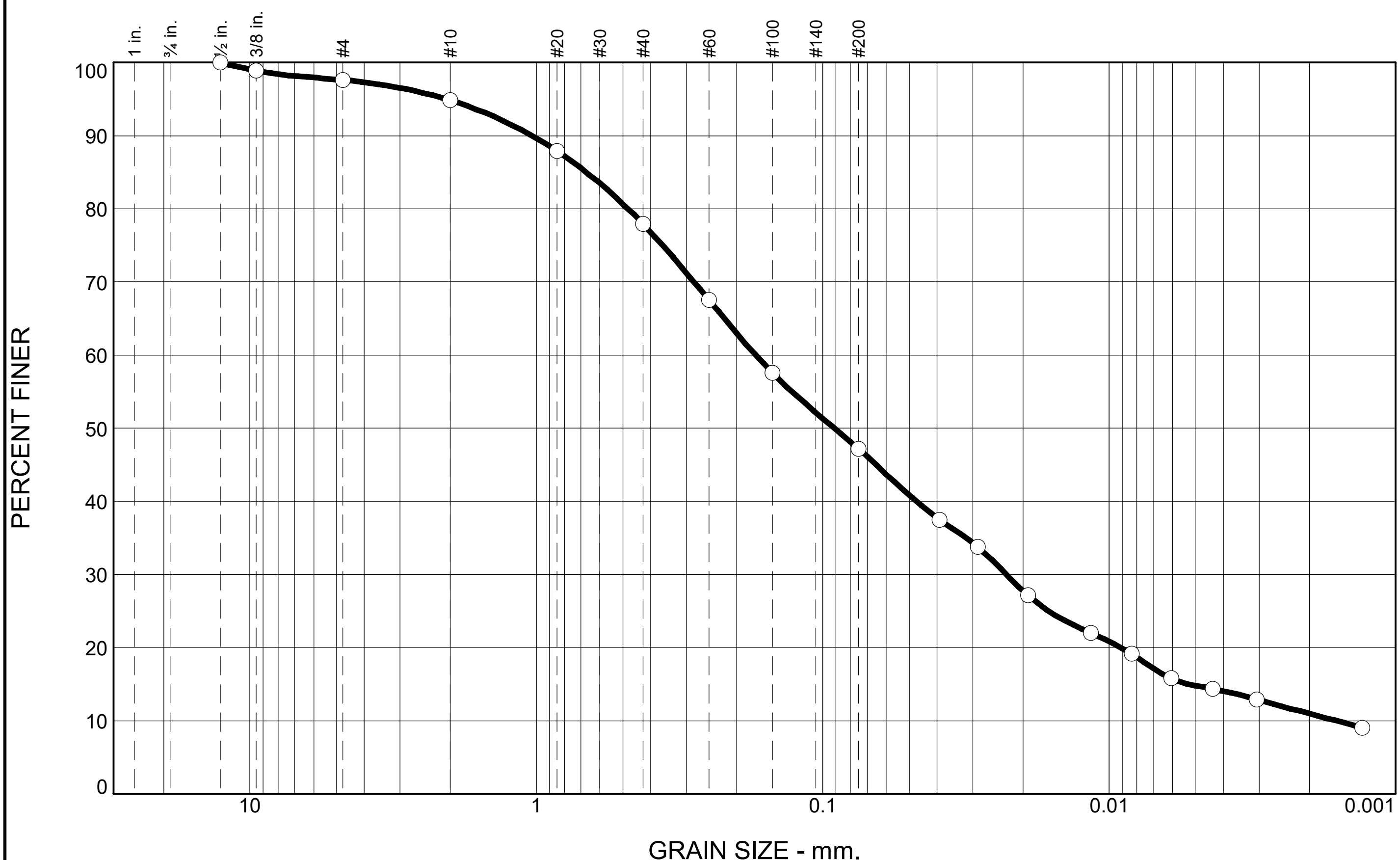
Terracon

Client: RAMBOLL AMERICAS ENGINEERING SOLUTIONS
Project: BALDWIN DG-WP-FIELD INVESTIGATION

Project No: 11225019 **Figure**

Tested By: LV **Checked By:** BCM

PARTICLE SIZE ANALYSIS OF SOILS - ASTM D6913 AND D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.4	2.8	16.9	30.7	32.4	14.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.50	100.0		
.375	98.9		
#4	97.6		
#10	94.8		
#20	87.9		
#40	77.9		
#60	67.5		
#100	57.6		
#200	47.2		
0.0392 mm.	37.5		
0.0287 mm.	33.7		
0.0192 mm.	27.1		
0.0116 mm.	22.0		
0.0084 mm.	19.2		
0.0061 mm.	15.8		
0.0043 mm.	14.4		
0.0030 mm.	12.9		
0.0013 mm.	9.1		

* (no specification provided)

Soil Description

BLACK AND BROWN SILTY CLAYEY SAND WITH CINDERS

Atterberg Limits

PL= 14 LL= 19 PI= 5

Coefficients

D_{90}= 1.0358 D_{85}= 0.6702 D_{60}= 0.1716
D_{50}= 0.0911 D_{30}= 0.0229 D_{15}= 0.0053
D_{10}= 0.0016 C_u= 106.39 C_c= 1.89

Classification

USCS= SC-SM AASHTO= A-4(0)

Remarks

F.M.=1.04

Source of Sample: XTPW06A **Depth:** 8.0'-8.5'
Sample Number: BOTTOM **Date:** 12-1-22

Terracon

Client: RAMBOLL AMERICAS ENGINEERING SOLUTIONS
Project: BALDWIN DG-WP-FIELD INVESTIGATION

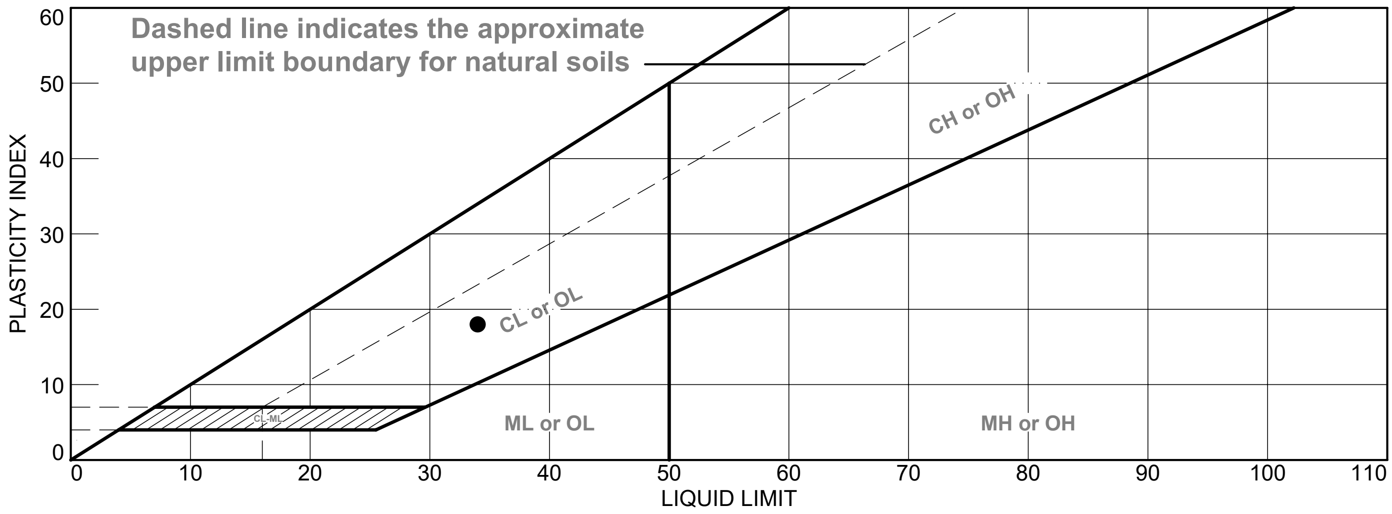
Project No: 11225019 **Figure**

Tested By: LV **Checked By:** BCM

Terracon

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
●	BROWN MOTTLED GRAY LEAN CLAY WITH SAND	34	16	18	93.5	73.7	CL

Project No. 11225019 **Client:** RAMBOLL AMERICAS ENGINEERING SOLUTIONS

Project: BALDWIN DG-WP-FIELD INVESTIGATION

● **Source of Sample:** MW358 **Depth:** 15.5'-16.0' **Sample Number:** TOP

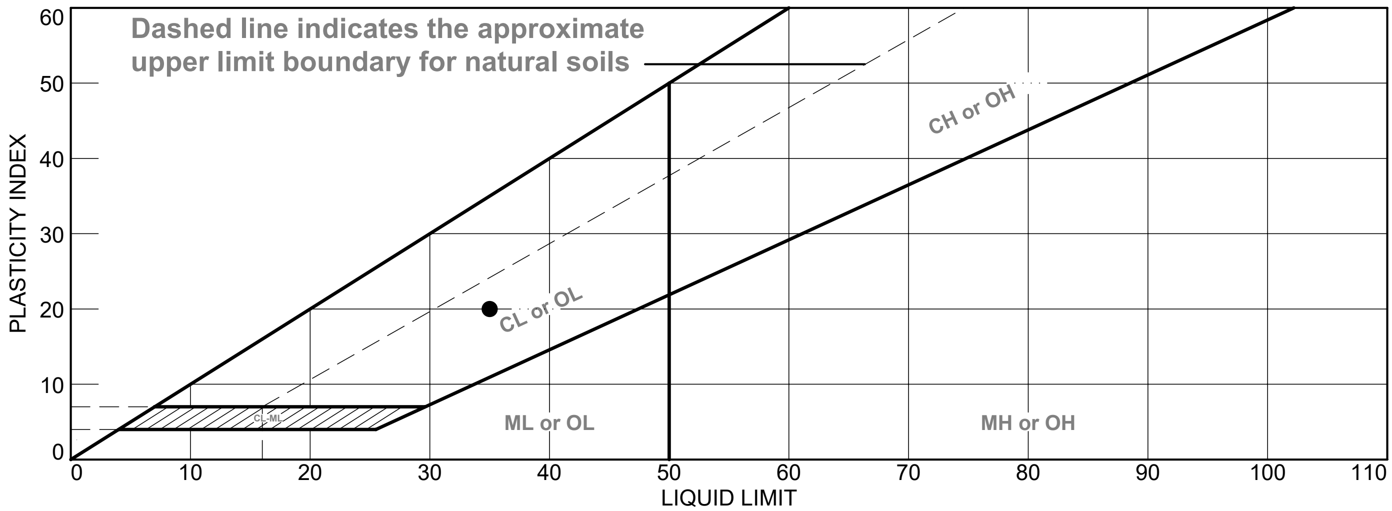
Remarks:

Terracon

Figure

Tested By: LV **Checked By:** BCM

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN MOTTLED GRAY LEAN CLAY WITH SAND	35	15	20	94.8	76.7	CL

Project No. 11225019 **Client:** RAMBOLL AMERICAS ENGINEERING SOLUTIONS

Project: BALDWIN DG-WP-FIELD INVESTIGATION

● **Source:** MW358 **Depth:** 16.0'-16.5' **Sample No.:** BOTTOM

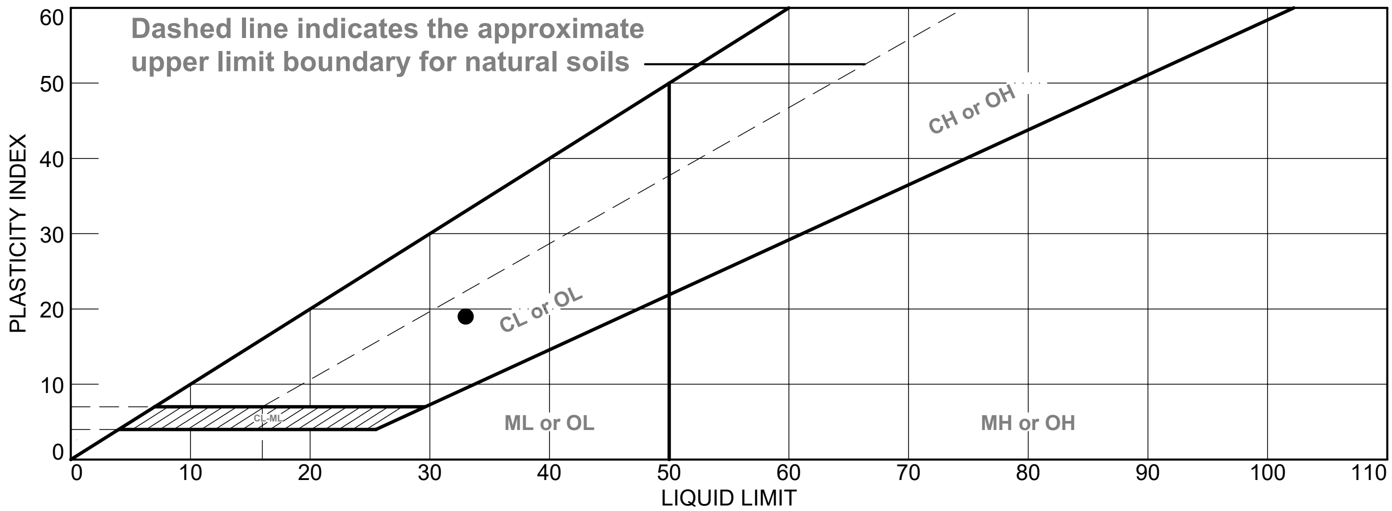
Remarks:

Terracon

Figure

Tested By: LV **Checked By:** BCM

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN LEAN CLAY WITH SAND	33	14	19	90.0	70.8	CL

Project No. 11225019 **Client:** RAMBOLL AMERICAS ENGINEERING SOLUTIONS

Project: BALDWIN DG-WP-FIELD INVESTIGATION

● **Source of Sample:** MW392 **Depth:** 30.5'-31.0' **Sample Number:** TOP

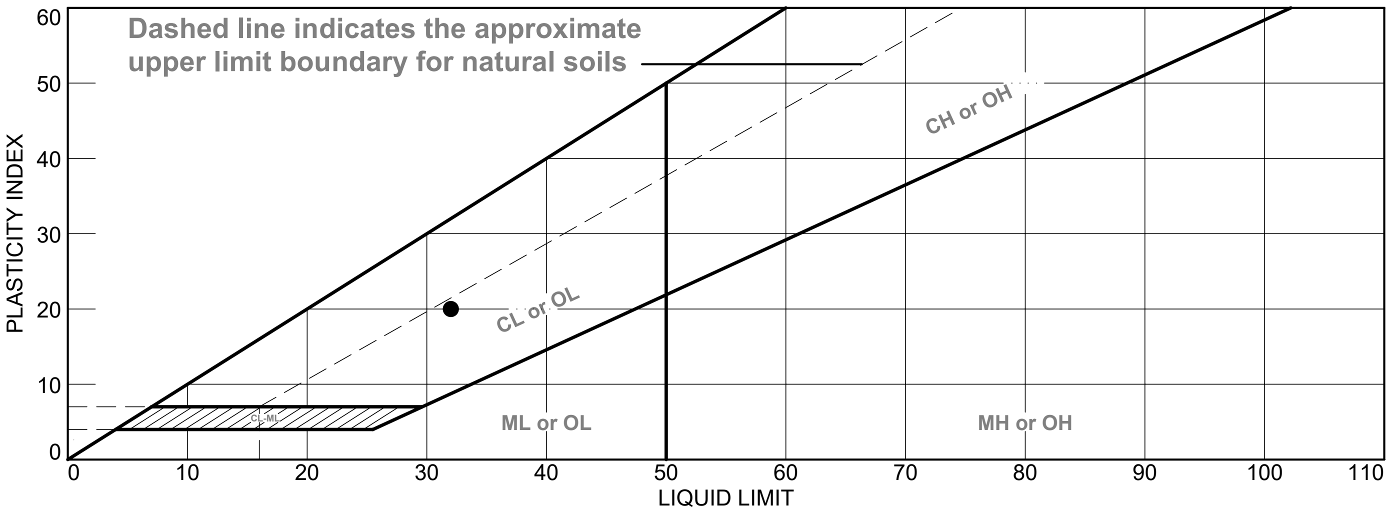
Remarks:

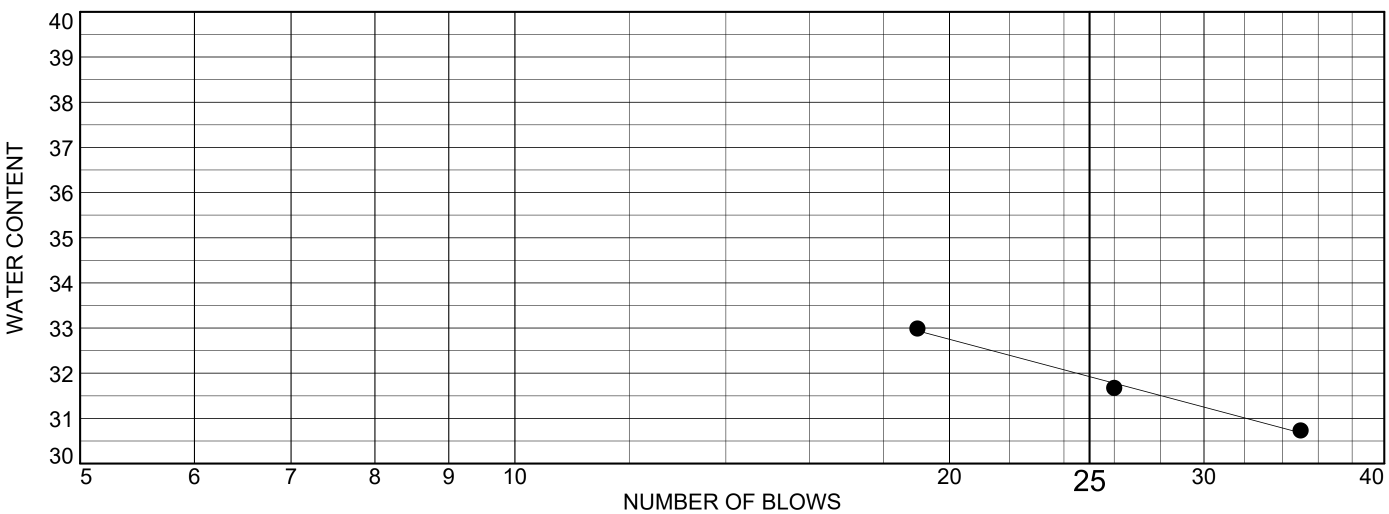
Terracon

Figure

Tested By: LV **Checked By:** BCM

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN SANDY LEAN CLAY	32	12	20	83.3	63.1	CL

Project No. 11225019 **Client:** RAMBOLL AMERICAS ENGINEERING SOLUTIONS

Project: BALDWIN DG-WP-FIELD INVESTIGATION

● **Source:** MW392 **Depth:** 31.0'-31.5' **Sample No.:** BOTTOM

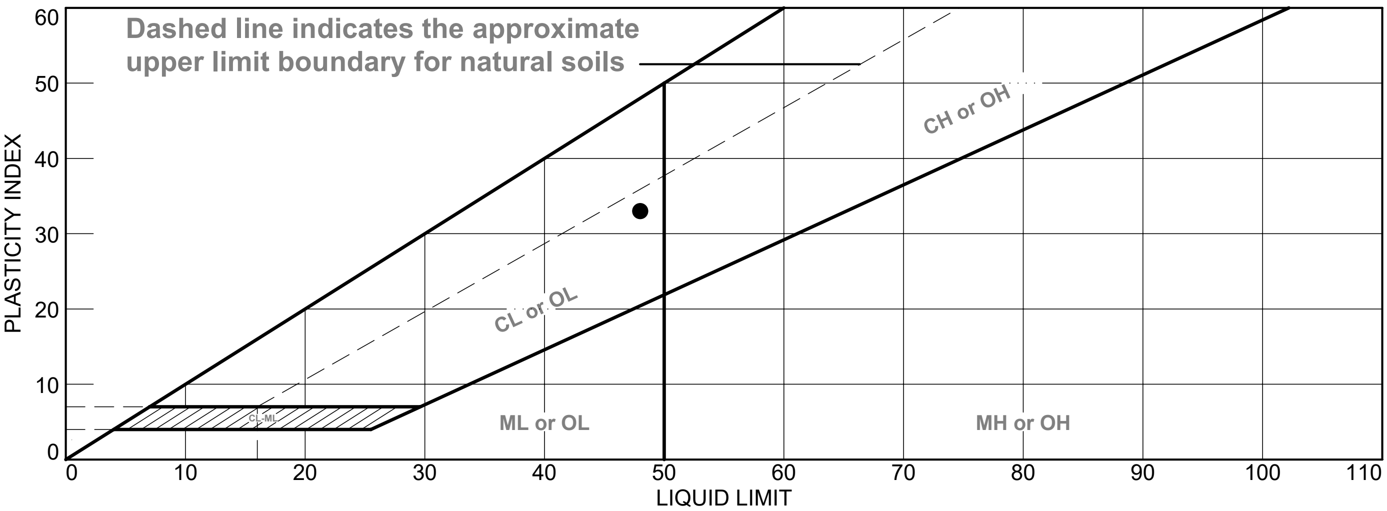
Remarks:

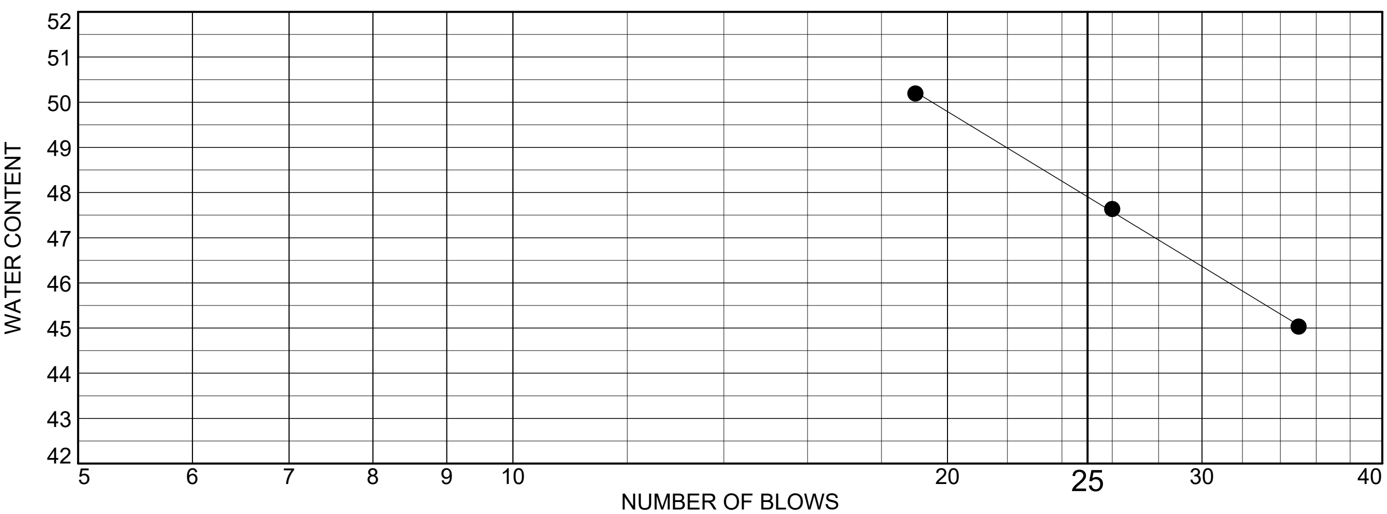
Terracon

Figure

Tested By: DT **Checked By:** BCM

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN LEAN CLAY	48	15	33	98.6	94.1	CL

Project No. 11225019 **Client:** RAMBOLL AMERICAS ENGINEERING SOLUTIONS

Project: BALDWIN DG-WP-FIELD INVESTIGATION

● **Source of Sample:** MW393 **Depth:** 20.5'-21.0' **Sample Number:** TOP

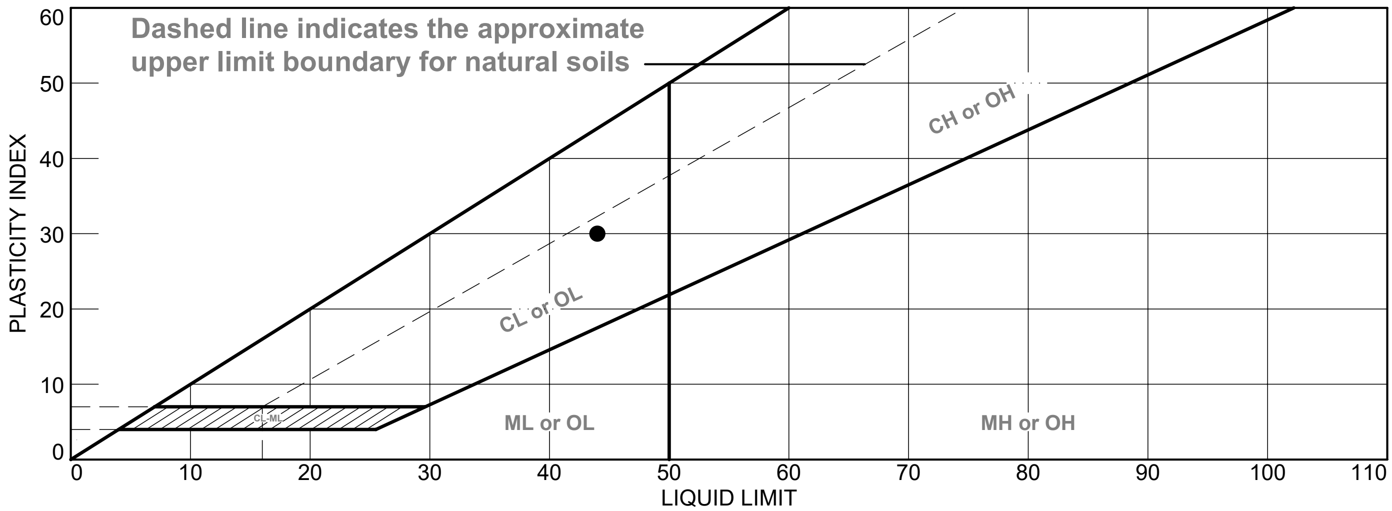
Remarks:

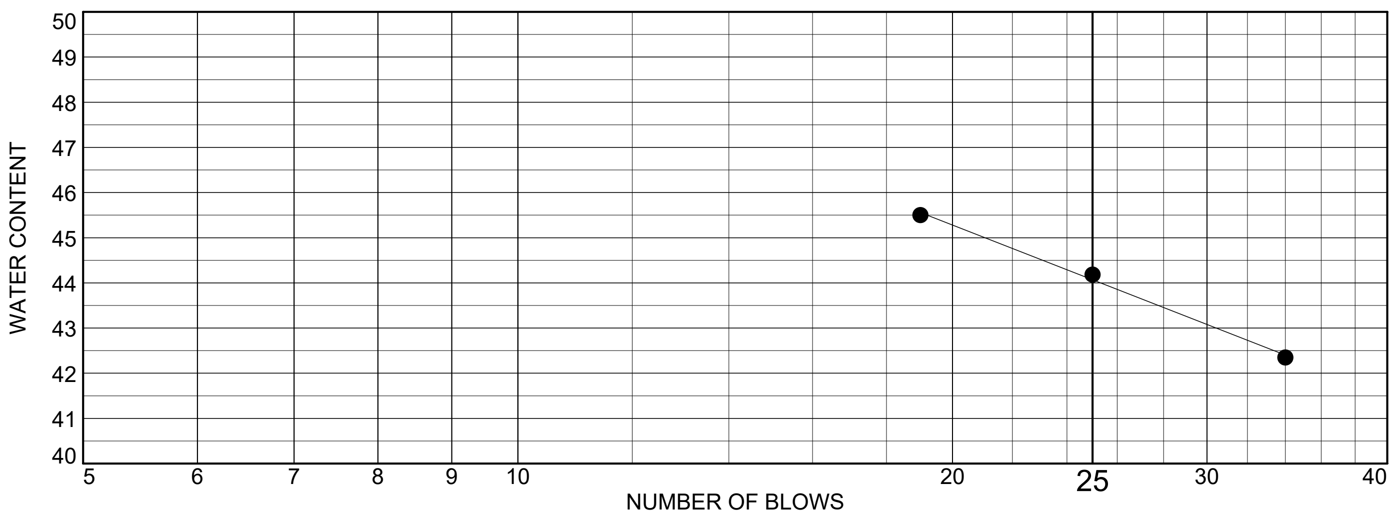
Terracon

Figure

Tested By: DT **Checked By:** BCM

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN LEAN CLAY	44	14	30	98.9	95.0	CL

Project No. 11225019 **Client:** RAMBOLL AMERICAS ENGINEERING SOLUTIONS

Project: BALDWIN DG-WP-FIELD INVESTIGATION

● **Source:** MW393 **Depth:** 21.0'-21.5' **Sample No.:** BOTTOM

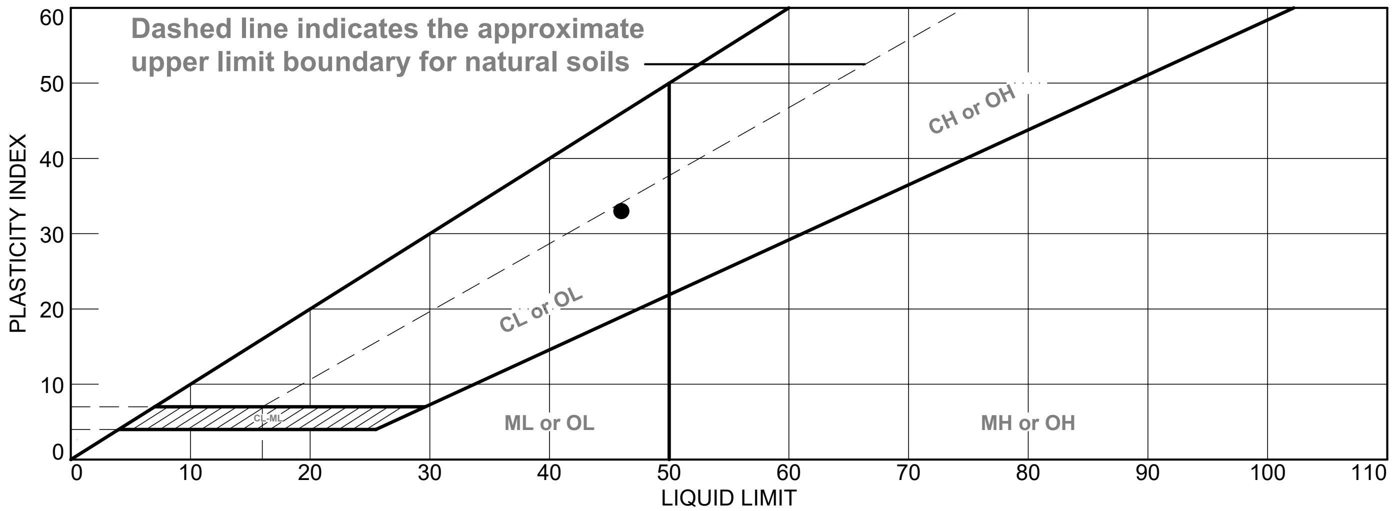
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** BCM

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAYISH BROWN SANDY LEAN CLAY WITH GRAVEL	46	13	33	72.9	57.4	CL

Project No. 11225019 **Client:** RAMBOLL AMERICAS ENGINEERING SOLUTIONS

Remarks:

Project: BALDWIN DG-WP-FIELD INVESTIGATION

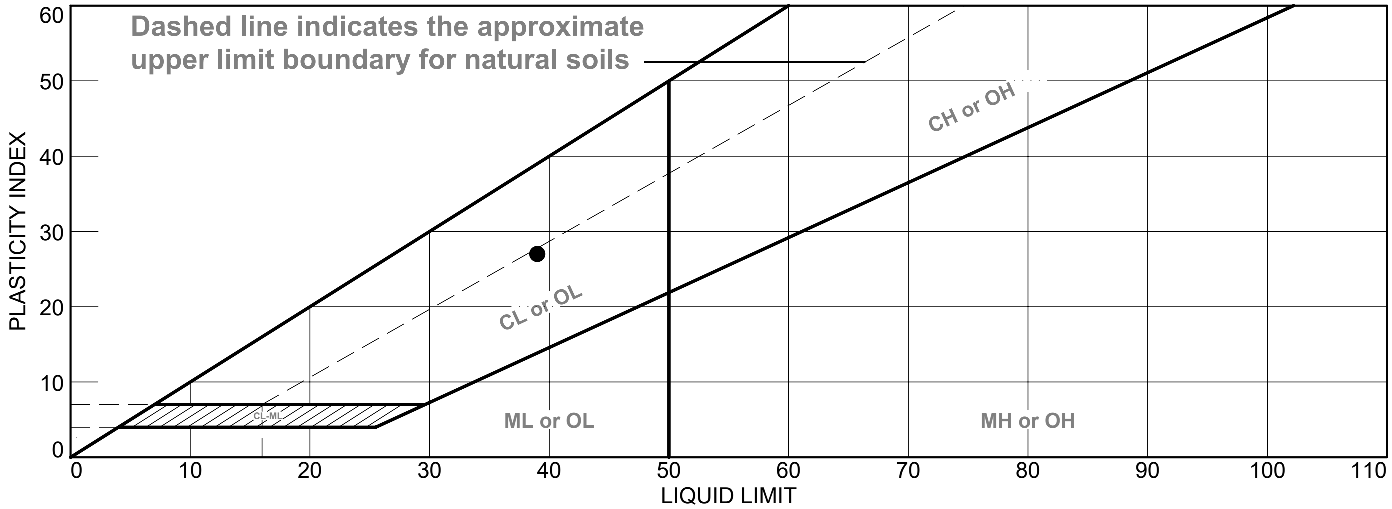
● **Source of Sample:** MW394 **Depth:** 18.5'-19.0' **Sample Number:** TOP

Terracon

Figure

Tested By: DT **Checked By:** BCM

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAY MOTTLED SANDY LEAN CLAY	39	12	27	92.4	68.5	CL

Project No. 11225019 **Client:** RAMBOLL AMERICAS ENGINEERING SOLUTIONS

Project: BALDWIN DG-WP-FIELD INVESTIGATION

● **Source:** MW394 **Depth:** 19.0'-19.5' **Sample No.:** BOTTOM

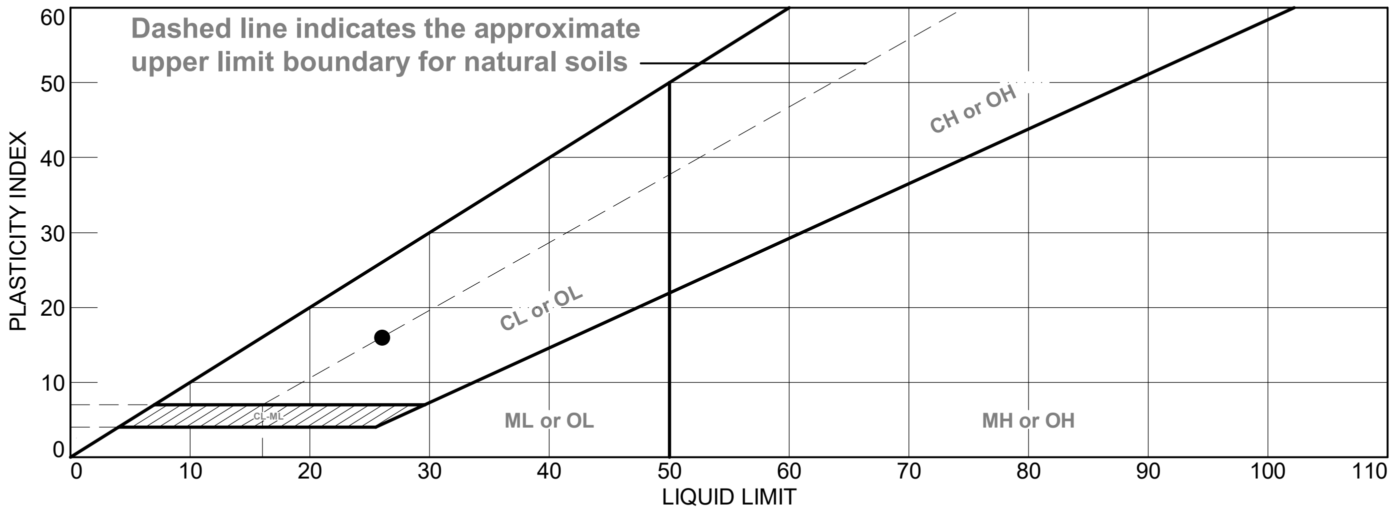
Remarks:

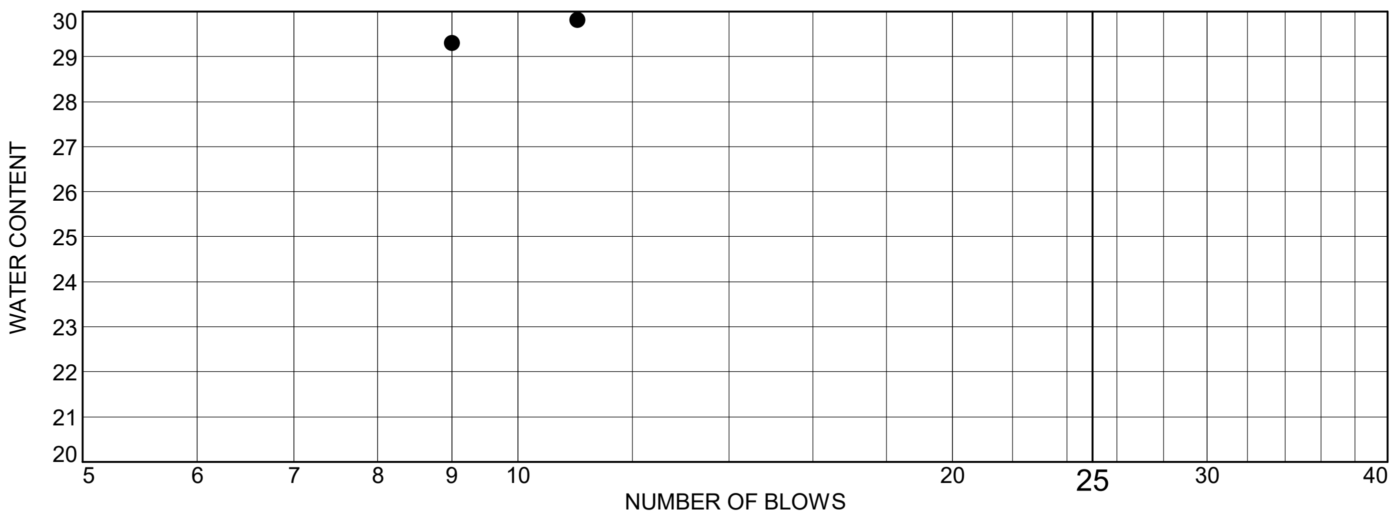
Terracon

Figure

Tested By: DT **Checked By:** BCM

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	VERY DARK GRAY AND BLACK POORLY GRADED SAND WITH CLAY, GRAVEL, CINDERS AND ASH	26	10	16	31.6	9.6	SP-SC

Project No. 11225019 **Client:** RAMBOLL AMERICAS ENGINEERING SOLUTIONS

Remarks:

Project: BALDWIN DG-WP-FIELD INVESTIGATION

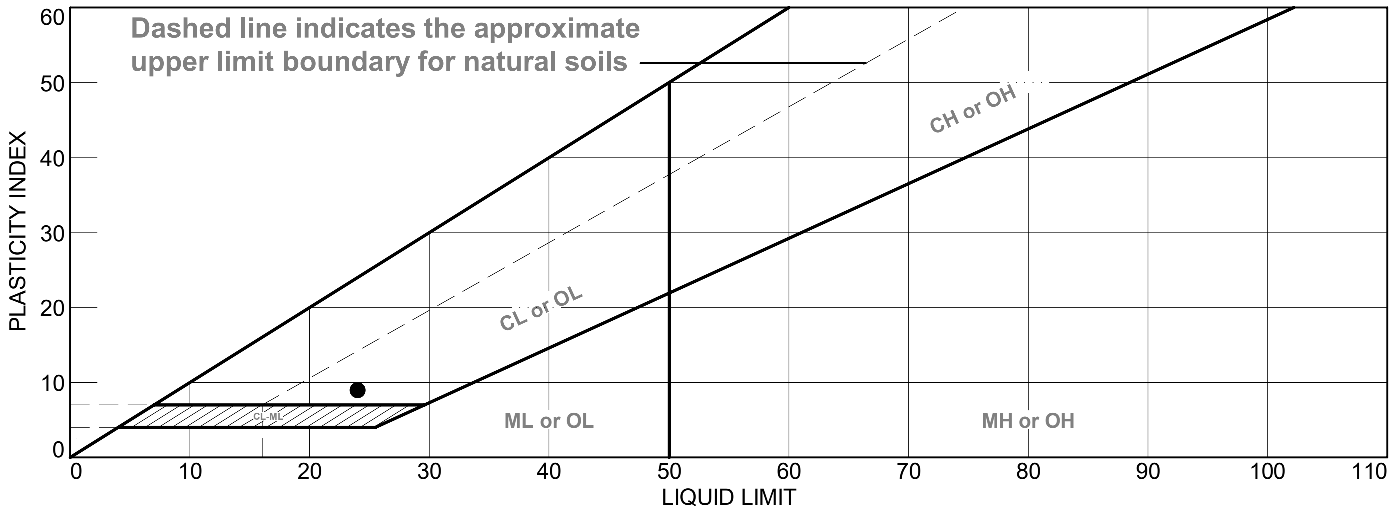
● **Source of Sample:** XPW02B **Depth:** 5.5'-6.0' **Sample Number:** TOP

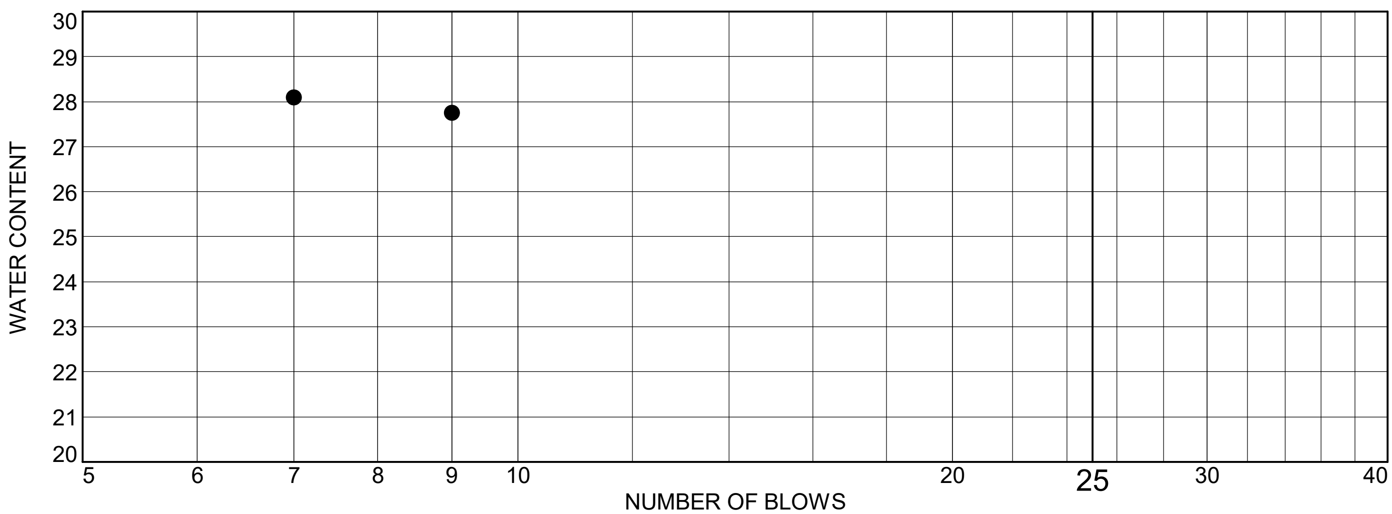
Terracon

Figure

Tested By: DT **Checked By:** BCM

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BLACK AND VERY DARK BROWN WELL GRADED SAND WITH CINDERS	24	15	9	25.5	9.1	SW-SC

Project No. 11225019 **Client:** RAMBOLL AMERICAS ENGINEERING SOLUTIONS

Project: BALDWIN DG-WP-FIELD INVESTIGATION

● **Source:** XPW02B **Depth:** 6.0'-6.5' **Sample No.:** BOTTOM

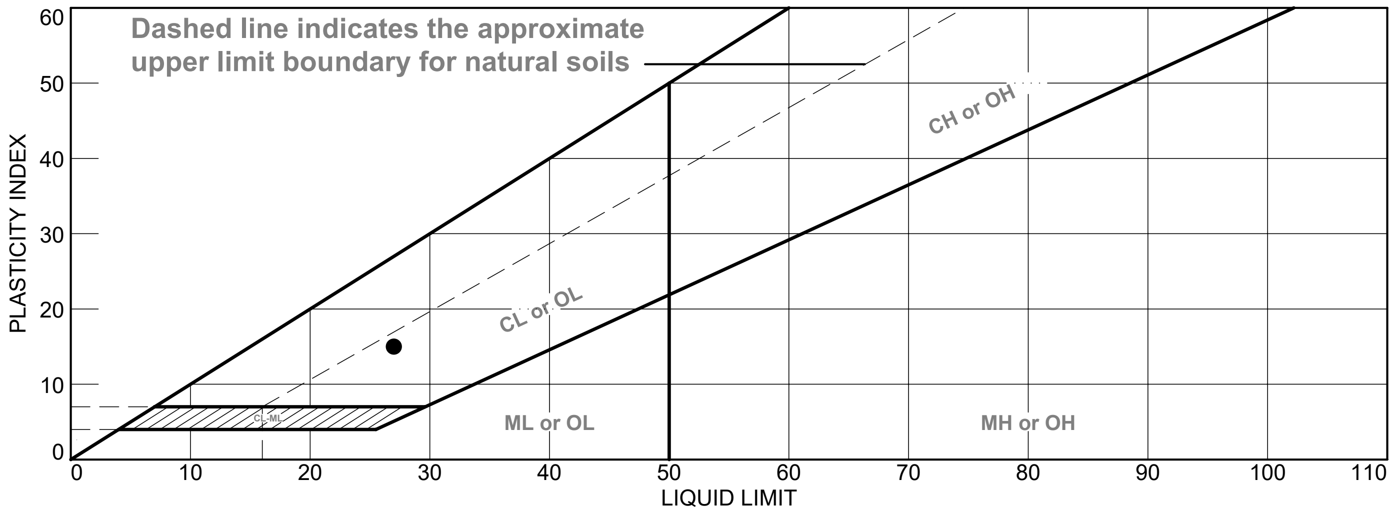
Remarks:

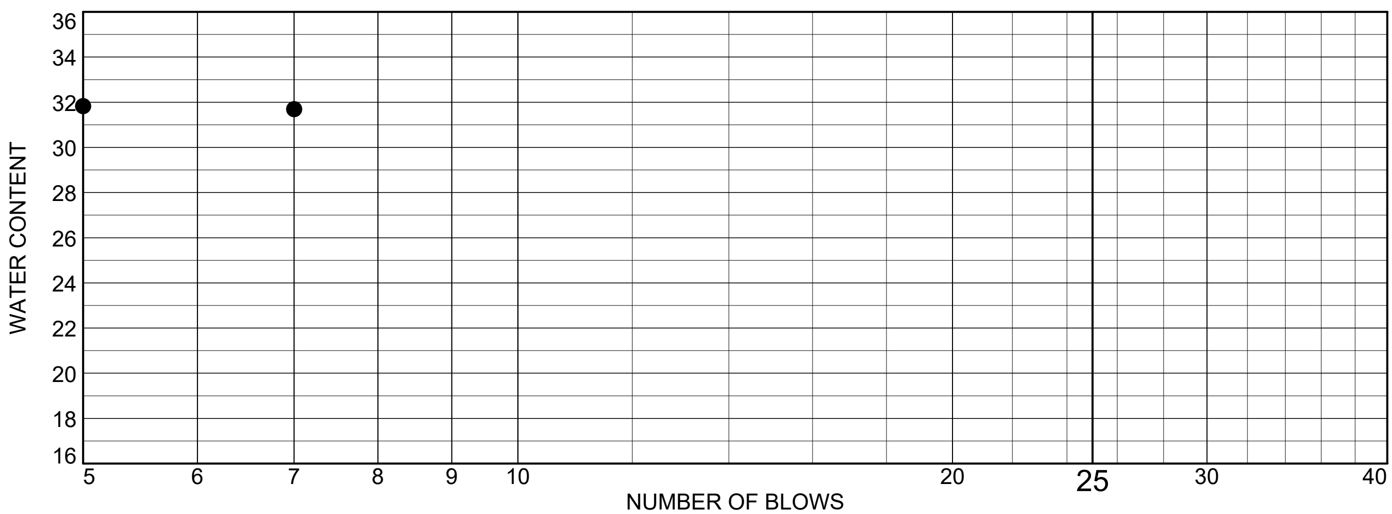
Terracon

Figure

Tested By: DT **Checked By:** BCM

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BLACK POORLY GRADED SAND WITH CINDERS	27	12	15	10.8	3.4	SP

Project No. 11225019 **Client:** RAMBOLL AMERICAS ENGINEERING SOLUTIONS

Project: BALDWIN DG-WP-FIELD INVESTIGATION

● **Source of Sample:** XPW04A **Depth:** 15.0'-15.5' **Sample Number:** TOP

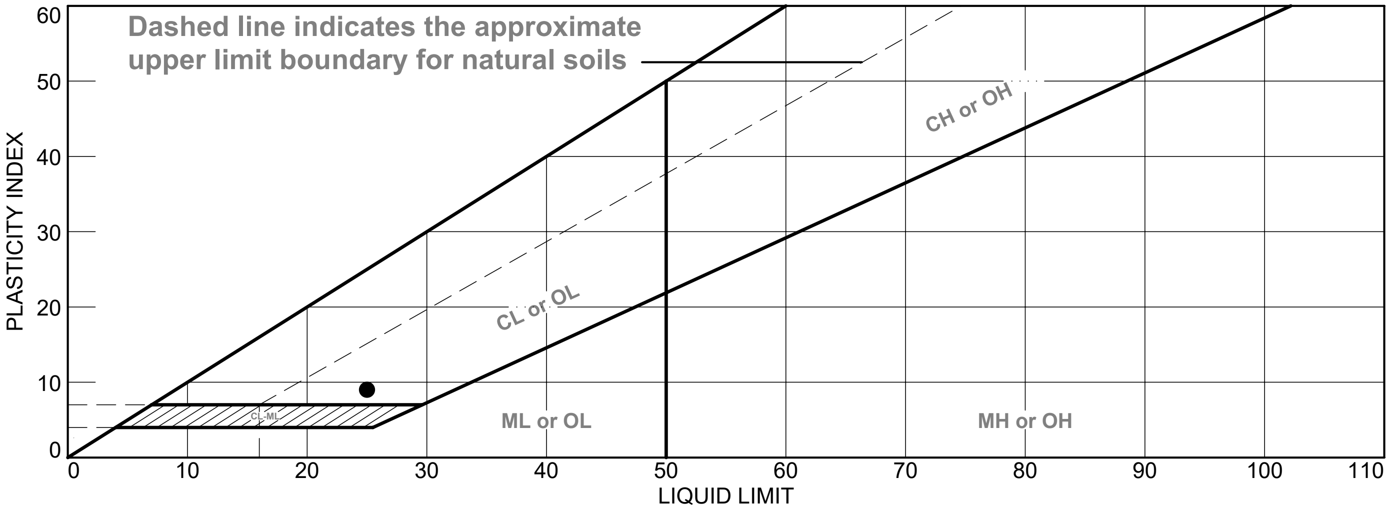
Remarks:

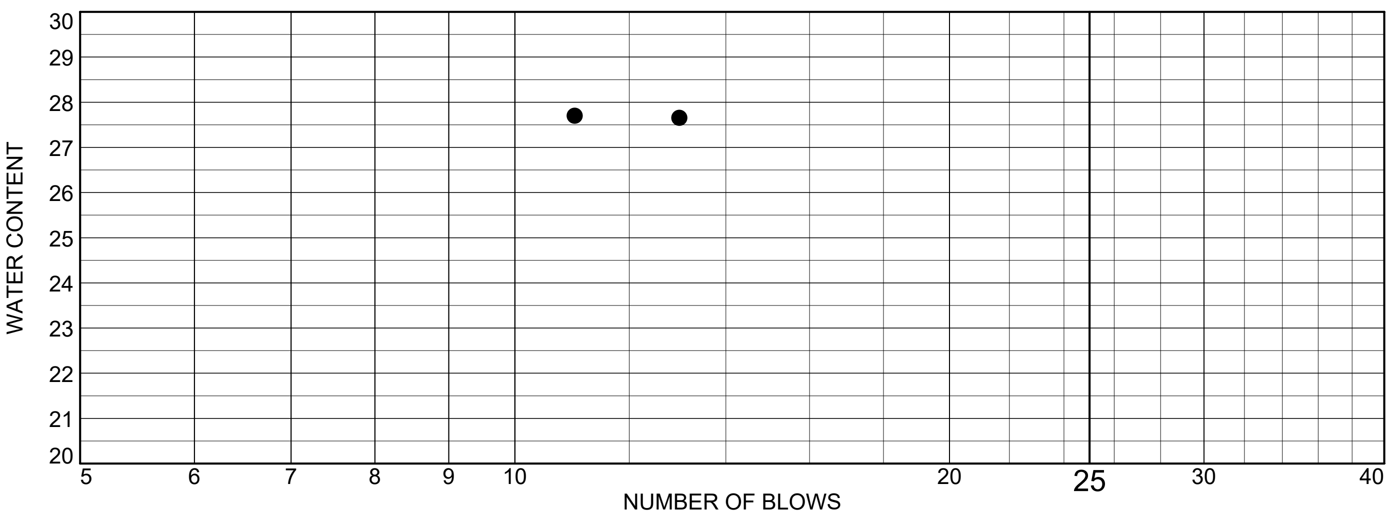
Terracon

Figure

Tested By: DT **Checked By:** BCM

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BLACK POORLY GRADED SAND WITH CINDERS	25	16	9	10.5	2.9	SP

Project No. 11225019 **Client:** RAMBOLL AMERICAS ENGINEERING SOLUTIONS

Project: BALDWIN DG-WP-FIELD INVESTIGATION

● **Source:** XPW04A **Depth:** 15.5'-16.0' **Sample No.:** BOTTOM

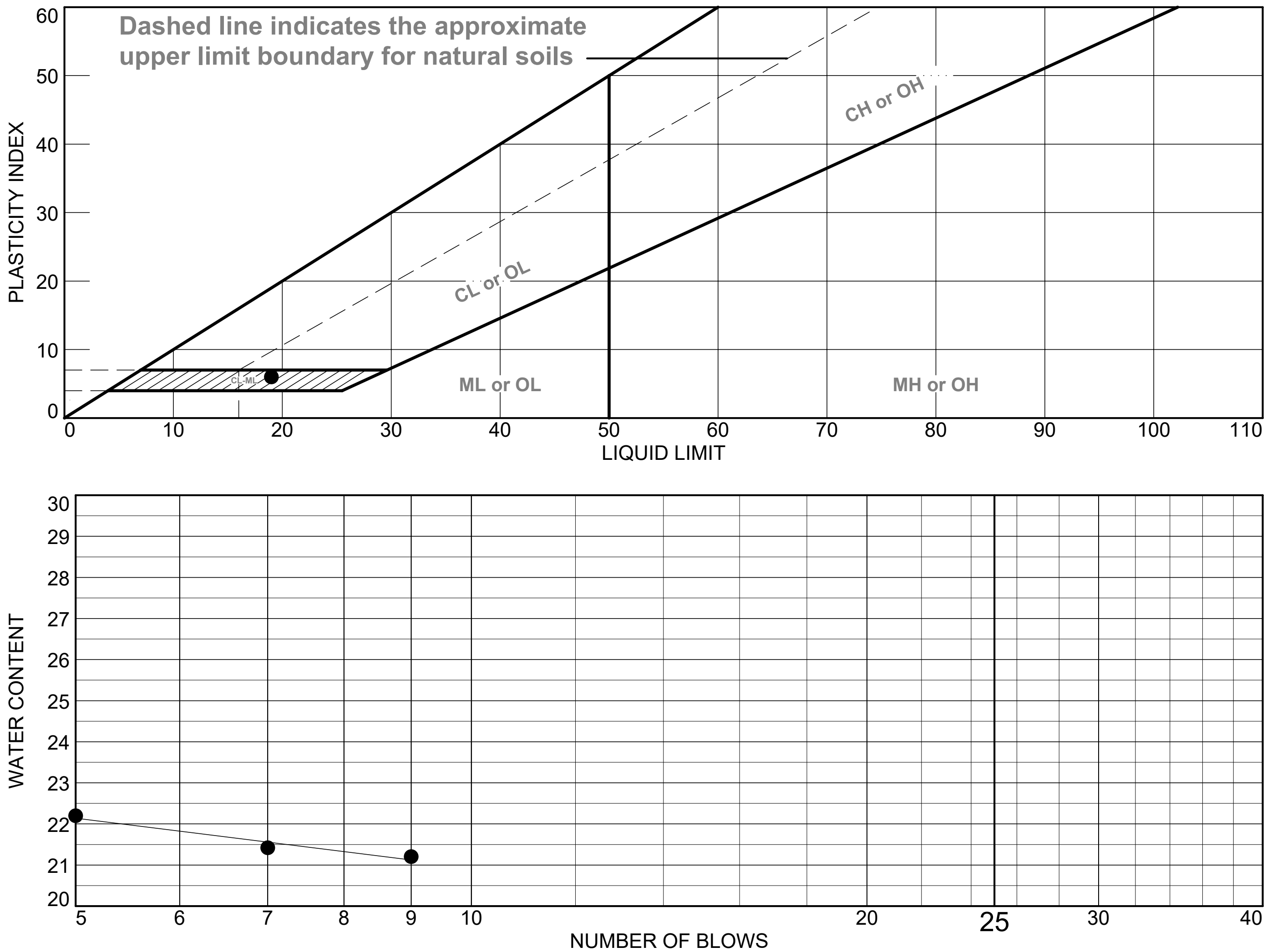
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** BCM

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK GRAY AND BLACK SILTY CLAYEY SAND WITH CINDERS AND ASH	19	13	6	64.7	29.8	SC-SM

Project No. 11225019 **Client:** RAMBOLL AMERICAS ENGINEERING SOLUTIONS

Project: BALDWIN DG-WP-FIELD INVESTIGATION

● **Source of Sample:** XTPW06A **Depth:** 7.5'-8.0' **Sample Number:** TOP

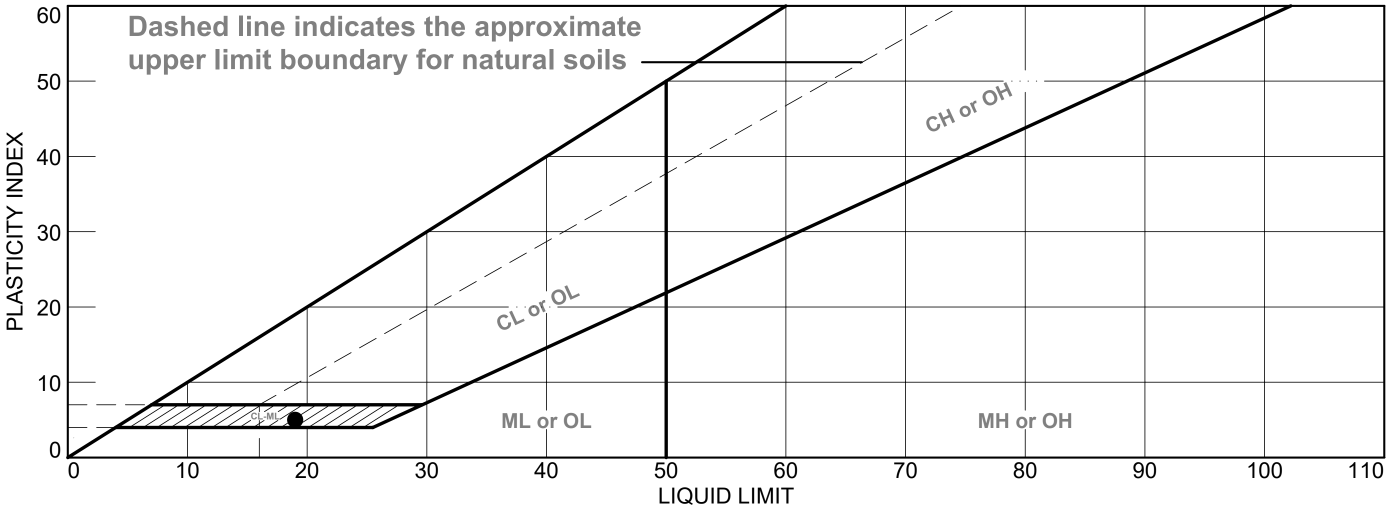
Remarks:

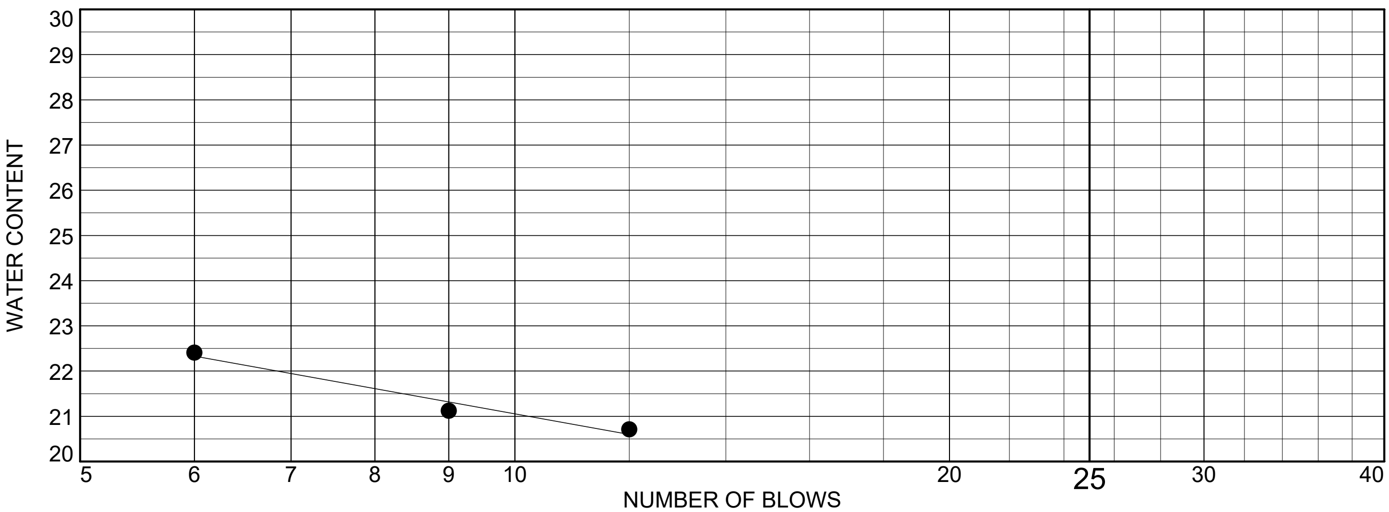
Terracon

Figure

Tested By: DT **Checked By:** BCM

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BLACK AND BROWN SILTY CLAYEY SAND WITH CINDERS	19	14	5	77.9	47.2	SC-SM

Project No. 11225019 **Client:** RAMBOLL AMERICAS ENGINEERING SOLUTIONS

Project: BALDWIN DG-WP-FIELD INVESTIGATION

● **Source:** XTPW06A **Depth:** 8.0'-8.5' **Sample No.:** BOTTOM

Remarks:

Terracon

Figure

Tested By: DT **Checked By:** BCM

Terracon

Specific Gravity of Soils
ASTM D854

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: 11225019
Project Name: BALDWIN DG-WP-FIELD INVESTIGATION
Test Date: 12/6/2022

Results Summary

Boring / Sample	Sample Number	Depth (ft)		Specific Gravity (Gs)
MW358	TOP	15.5'-16.0'		2.681
MW358	BOTTOM	16.0'-16.5'		2.693
MW392	TOP	30.5'-31.0'		2.685
MW392	BOTTOM	31.0'-31.5'		2.702
MW393	TOP	20.5'-21.0'		2.688
MW393	BOTTOM	21.0'-21.5'		2.708
MW394	TOP	18.5'-19.0'		2.698
MW394	BOTTOM	19.0'-19.5'		2.707
XPW02B	TOP	5.5'-6.0'		2.646
XPW02B	BOTTOM	6.0'-6.5'		2.652
XPW04A	TOP	15.0'-15.5'		2.668
XPW04A	BOTTOM	15.5'-16.0'		2.658
XTPW06A	TOP	7.5'-8.0'		2.698
XTPW06A	BOTTOM	8.0'-8.5'		2.675

Tested By: BCM

Checked By: WPQ

Shively Geotechnical
A Division of Environmental Operations, Inc.

October 11, 2010
Project No. 6339

Stuart Cravens
Kelron Environmental
1213 Dorchester Drive
Champaign, Illinois 61821

Subject: Geotechnical Laboratory Testing
Groundwater Investigation
BEC Ash Pond System
Baldwin, Illinois

Dear Mr. Cravens:

Please find the attached results of laboratory testing performed on samples provided to Shively Geotechnical, a Division of Environmental Operations. Samples were taken from the BEC Ash Pond System Groundwater Investigation project by others and were submitted to our laboratory for various testing. Assignments for the testing were initiated by Stuart Cravens of Kelron Environmental.

Testing was performed in accordance with the following American Society for Testing and Materials (ASTM) test procedures:

D 422	Particle-Size Analysis of Soils.
D 2216	Water (Moisture) Content of Soil and Rock by Mass
D 2487	Classification of Soils (Unified Soil Classification System)
D 5084	Hydraulic Conductivity Using a Flexible Wall Permeameter

We appreciate the opportunity to be of service to Kelron Environmental and to Dynegy, Inc. Please let us know if you have any questions or if we can be of further assistance.

Sincerely,

Shively Geotechnical,
a Division of Environmental Operations, Inc.

Janet M. May
Laboratory Services Manager

Attachments

SUMMARY OF LABORATORY TEST RESULTS

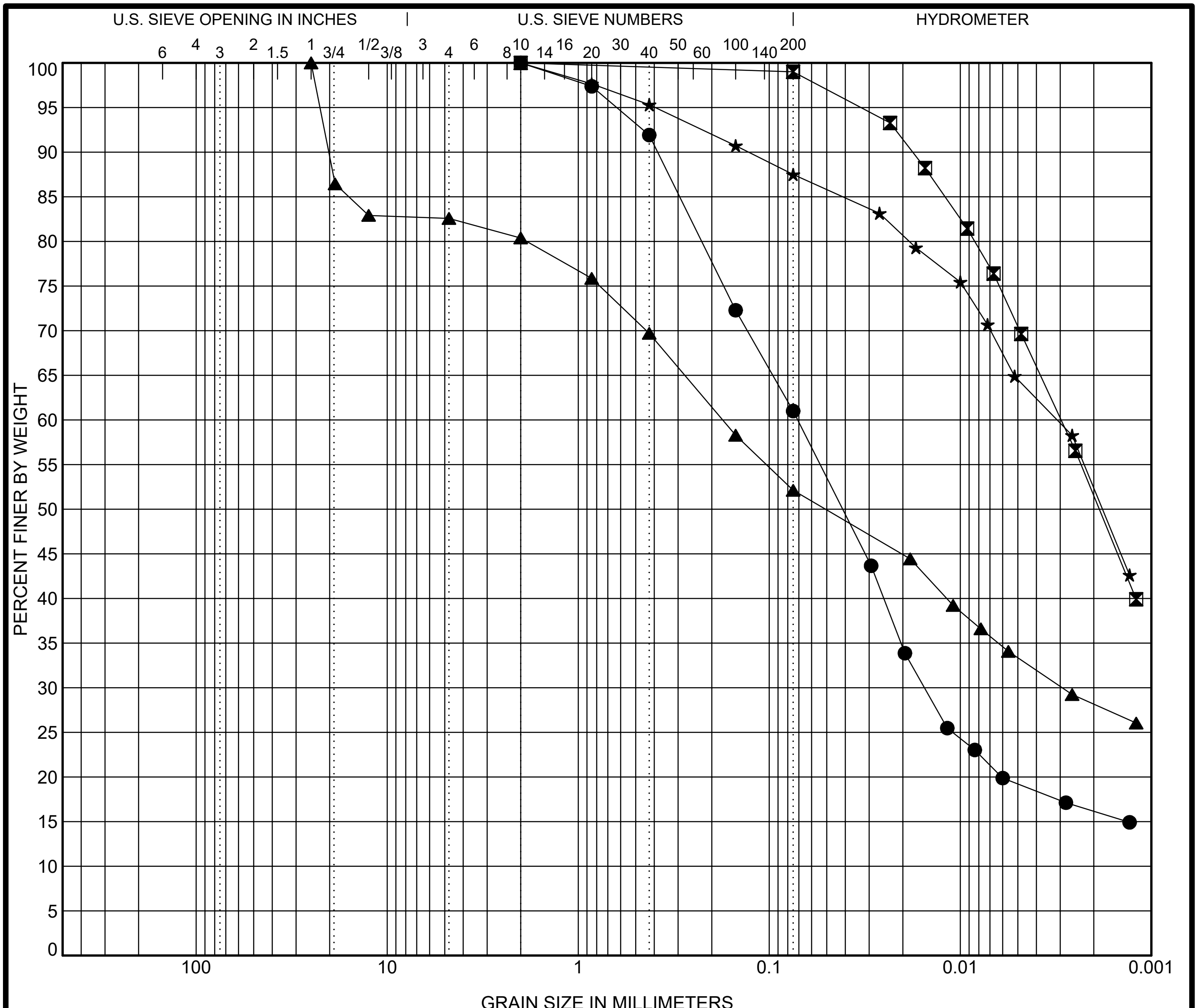
Boring Number	Sample Depth (Feet)	Moisture Content, %	USCS Classification
MW-151	7.5-8.0	20.8	Very Dark Gray-Brown Sandy CLAY (CL)
MW-151	16.0-17.0	20.0	Olive-Gray Shaley Fat CLAY (CH)
MW-154	3.0-4.0	24.4	Black Fat CLAY (CH)
MW-154	8.0-9.2	16.9	Dark Gray & Yellow-Brown Sandy CLAY with Gravel (CL)
MW-154	11.0-12.0	27.2	Gray & Light Olive-Brown Shaley Fat CLAY (CH)
MW-155	7.0-8.0	16.0	Brown Lean CLAY to Fat CLAY (CL/CH)
MW-155	18.5-19.5	15.2	Dark Yellow-Brown Clayey SAND (SC)
MW-156	10.0-11.0	27.4	Dark Brown Lean CLAY (CL)
MW-157	2.0-3.0	23.3	Dark Gray-Brown Lean CLAY (CL)
MW-157	7.0-9.0	36.6	Light Olive-Brown Fat CLAY (CH)
MW-157	17.0-18.0	25.3	Dark Yellow-Brown Lean CLAY to Fat CLAY (CL/CH)
MW-252	14.0-16.0	15.1	Dark Yellow-Brown Sandy CLAY (CL)
MW-252	44.0-46.0	31.4	Dark Yellow-Brown Fat CLAY (CH)
MW-253	11.0-12.0	18.6	Dark Yellow-Brown Fat CLAY with Sand (CH)
MW-253	19.0-19.5	19.1	Dark Yellow-Brown Lean CLAY with Sand (CL)
MW-253	29.0-30.0	23.5	Olive Shaley Fat CLAY (CH)
MW-350	5.0-6.0	52.6	Brown Fat CLAY (CH)
MW-350	11.0-12.0	55.5	Light Olive-Brown Lean CLAY to Fat CLAY (CL/CH)
MW-350	18.0-20.0	26.3	Dark Yellow-Brown Fat CLAY (CH)
MW-350	22.0-23.0	27.4	Dark Yellow-Brown Fat CLAY (CH)
MW-352	6.5-7.5	19.4	Dark Gray-Brown Lean CLAY (CL)
MW-352	16.5-17.5	19.5	Olive-Brown Sandy CLAY (CL)
MW-352	26.5-27.5	46.8	Yellow-Brown Sandy CLAY (CL)
MW-352	32.0-33.0	21.4	Yellow-Brown Lean CLAY to Fat CLAY (CL/CH)
MW-352	37.0-38.0	26.3	Yellow-Brown Lean CLAY to Fat CLAY (CL/CH)
MW-355	21.0-22.0	24.1	Gray & Yellow-Brown Lean CLAY (CL)

USCS – Unified Soil Classification System

LABORATORY HYDRAULIC CONDUCTIVITY TEST RESULTS

		ASTM D 2216	ASTM D 6023	ASTM D 5084	
Boring Number	Sample Depth (Feet)	Moisture Content, %	Dry Bulk Density, (pcf)	Hydraulic Conductivity, cm/sec	Range of Hydraulic Gradient
MW-154	8.0-9.2	16.9	105.9	7.8×10^{-6}	0.4 - 1.8
MW-252	44.0-46.0	31.4	91.5	6.3×10^{-9}	2.6 - 10.7
MW-350	18.0-20.0	26.3	97.9	3.4×10^{-7}	0.8 - 2.2

% - Percent
cm/sec - Centimeters per Second
pcf - Pounds per Cubic Foot



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	LL	PL	PI	Cc	Cu
● **MW-151 7.5-8.0 Feet**	**Very Dark Gray-Brown Sandy CLAY (CL)**					
⊠ **MW-151 16.0-17.0 Feet**	**Olive-Gray Shaley Fat CLAY (CH)**					
▲ **MW-154 8.0-9.2 Feet**	**Dark Gray & Yellow-Brown Sandy CLAY with Gravel, (CL)**					
★ **MW-154 11.0-12.0 Feet**	**Gray & Light Olive-Brown Shaley Fat CLAY (CH)**					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● **MW-151 7.5-8.0 Feet**	**2**	**0.071**	**0.015**		**0.0**	**39.0**	**41.8**	**19.2**
⊠ **MW-151 16.0-17.0 Feet**	**2**	**0.003**			**0.0**	**1.0**	**28.5**	**70.5**
▲ **MW-154 8.0-9.2 Feet**	**25**	**0.175**	**0.003**		**17.4**	**30.5**	**18.8**	**33.4**
★ **MW-154 11.0-12.0 Feet**	**2**	**0.003**			**0.0**	**12.5**	**23.0**	**64.5**

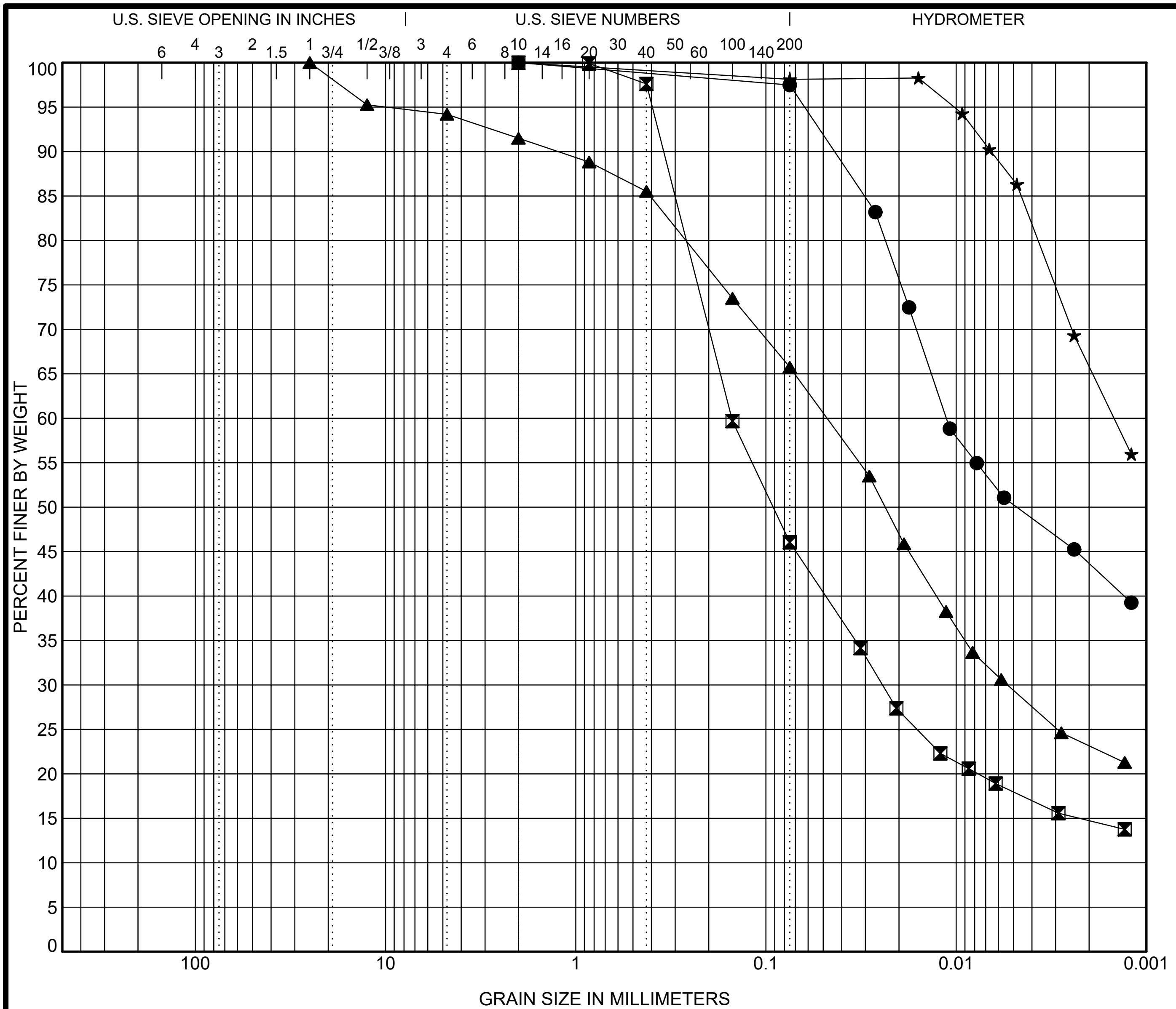
Shively Geotechnical
A Division of Environmental Operations, Inc.
Missouri (314) 241-0900
Illinois (618) 398-1414

GRAIN SIZE DISTRIBUTION

Project Number: 6339

Project: Ash Pond System

Location: Baldwin Energy Complex



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	**MW-155 7.0-8.0 Feet**	**Brown Lean to Fat CLAY (CL/CH)**					
⧗	**MW-155 18.5-19.5 Feet**	**Dark Yellow-Brown Clayey SAND (SC)**					
▲	**MW-252 14.0-16.0 Feet**	**Dark Yellow-Brown Sandy CLAY (CL)**					
★	**MW-252 44.0-46.0 Feet**	**Dark Yellow-Brown Fat CLAY (CH)**					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**MW-155 7.0-8.0 Feet**	**2**	**0.011**			**0.0**	**2.5**	**47.2**	**50.3**
⧗	**MW-155 18.5-19.5 Feet**	**2**	**0.151**	**0.024**		**0.0**	**53.9**	**28.1**	**18.0**
▲	**MW-252 14.0-16.0 Feet**	**25**	**0.048**	**0.005**		**5.8**	**28.4**	**36.3**	**29.4**
★	**MW-252 44.0-46.0 Feet**	**2**	**0.001**			**0.0**	**1.9**	**11.3**	**86.8**

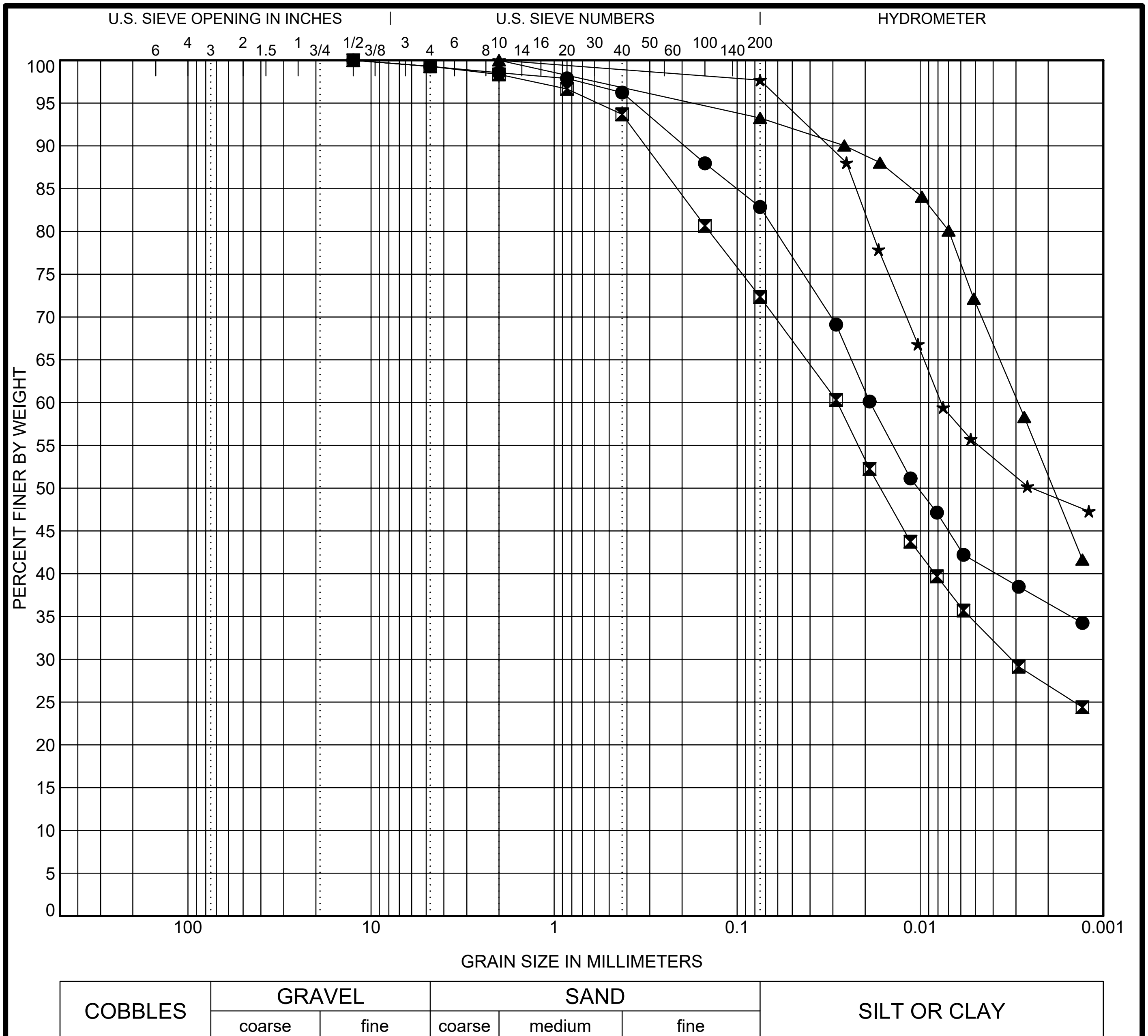
Shively Geotechnical
A Division of Environmental Operations, Inc.
Missouri (314) 241-0900
Illinois (618) 398-1414

GRAIN SIZE DISTRIBUTION

Project Number: 6339

Project: Ash Pond System

Location: Baldwin Energy Complex



	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	**MW-253 11.0-12.0 Feet**	**Dark Yellow-Brown Fat CLAY with SAND (CH)**					
⧗	**MW-253 19.0-19.5 Feet**	**Dark Yellow-Brown Lean CLAY with Sand (CL)**					
▲	**MW-253 29.0-30.0 Feet**	**Olive Shaley Fat CLAY (CH)**					
★	**MW-350 5.0-6.0 Feet**	**Brown Fat CLAY (CH)**					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**MW-253 11.0-12.0 Feet**	**12.5**	**0.019**			**0.7**	**16.4**	**41.4**	**41.4**
⧗	**MW-253 19.0-19.5 Feet**	**12.5**	**0.028**	**0.003**		**0.7**	**26.9**	**38.1**	**34.3**
▲	**MW-253 29.0-30.0 Feet**	**2**	**0.003**			**0.0**	**6.7**	**21.6**	**71.7**
★	**MW-350 5.0-6.0 Feet**	**2**	**0.008**			**0.0**	**2.3**	**42.4**	**55.3**

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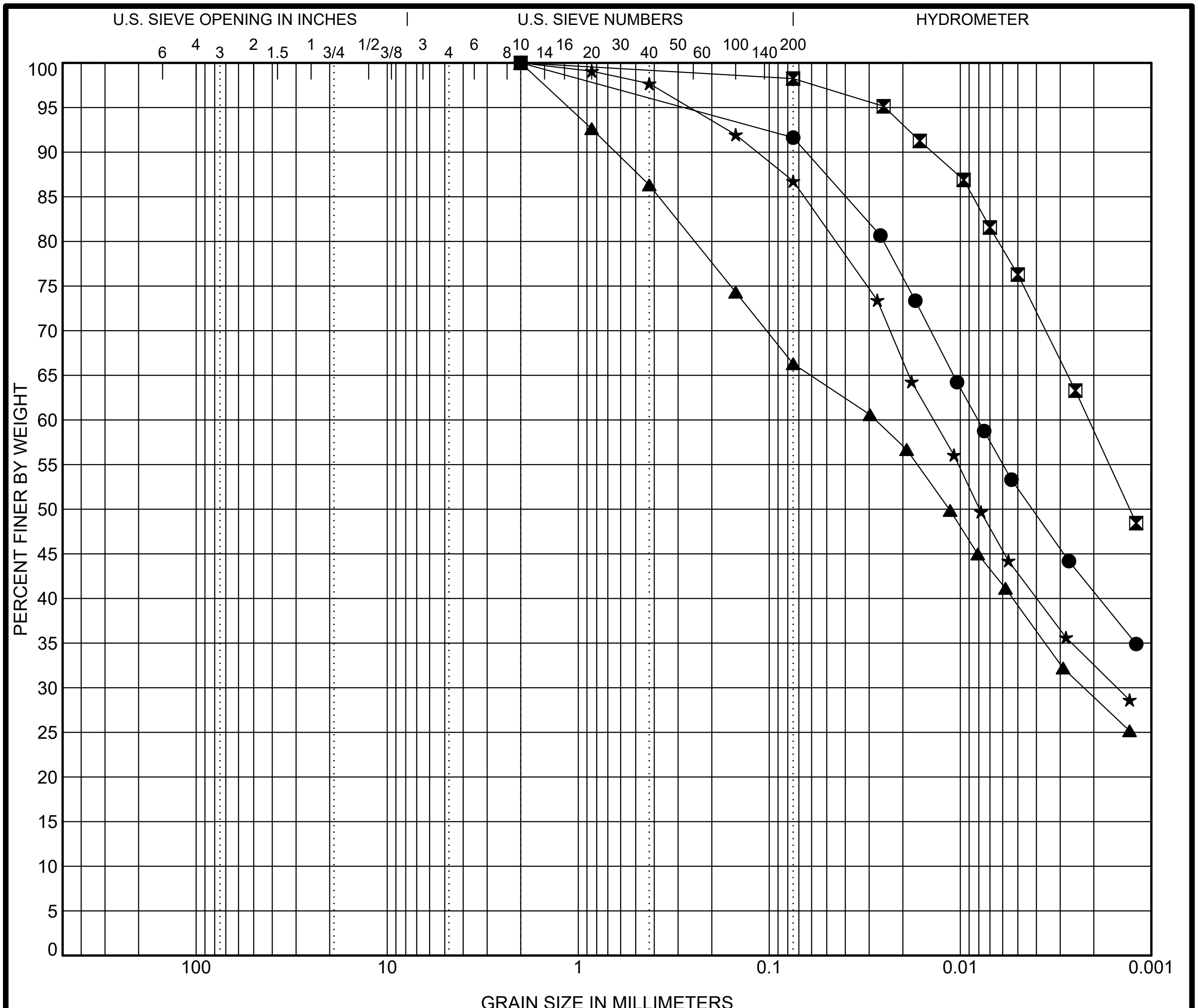
Illinois (618) 398-1414

GRAIN SIZE DISTRIBUTION

Project Number: 6339

Project: Ash Pond System

Location: Baldwin Energy Complex



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	**MW-350 11.0-12.0 Feet**	**Light Olive-Brown Lean to Fat CLAY (CL/CH)**					
⧖	**MW-350 18.0-20.0 Feet**	**Dark Yellow-Brown Fat CLAY (CH)**					
▲	**MW-352 26.5-27.5 Feet**	**Yellow Brown Sandy CLAY (CL)**					
★	**MW-352 32.0-33.0 Feet**	**Yellow-Brown Lean to Fat CLAY (CL/CH)**					

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**MW-350 11.0-12.0 Feet**	**2**	**0.008**			**0.0**	**8.4**	**39.3**	**52.3**
⧖	**MW-350 18.0-20.0 Feet**	**2**	**0.002**			**0.0**	**1.8**	**21.9**	**76.3**
▲	**MW-352 26.5-27.5 Feet**	**2**	**0.028**	**0.002**		**0.0**	**33.7**	**27.1**	**39.2**
★	**MW-352 32.0-33.0 Feet**	**2**	**0.014**	**0.002**		**0.0**	**13.2**	**43.9**	**42.8**

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GRAIN SIZE DISTRIBUTION

Project Number: 6339

Project: Ash Pond System

Location: Baldwin Energy Complex

HYDRAULIC CONDUCTIVITY TEST DATA
(ASTM D 5084)

JOB NO.:	6339			WET UNIT WEIGHT, pcf:	123.7		
LOCATION:	MW-154			**DRY UNIT WEIGHT, pcf:**	**105.9**		
DEPTH:	8' - 9'2"						
SPECIMEN:							
				INITIAL MOISTURE CONTENT		FINAL MOISTURE CONTENT	
LENGTH, in.:	3.017	LENGTH, cm:	7.663	WET WT SPLE+TARE	752.92	WET WT SPLE+TARE	781.60
DIAMETER, in.:	2.856	DIAMETER, cm	7.254	DRY WT SPLE+TARE	662.30	DRY WT SPLE+TARE	662.30
WET WT., gms.:	627.80			TARE WEIGHT	125.12	TARE WEIGHT	125.12
AREA, sq.in.:	6.406	AREA, sq cm:	41.331	**% MOISTURE**	16.9	% MOISTURE	22.2

B VALUE (before Permeation): 96% Cell / Back Pressure, psi: 53 / 50

HEAD (PSI)	DATE (YR,MO,DY)	TIME (HR,MN,SC)	TEMP ºC	ELAPSED MINUTES	BOTTOM BURET	TOP BURET	Q (CC)	K CM/SEC	HYDRAULIC GRADIENT	HYDRAULIC HEAD
0.0	01-Oct-10	08:46 AM	25.0	0	10.04	24.13			1.84	14.09
0.0	01-Oct-10	09:23 AM	25.0	37	11.80	22.85	1.76	1.1E-05	1.44	11.05
0.0	01-Oct-10	10:16 AM	25.0	53	13.25	21.41	1.45	9.3E-06	1.06	8.16
0.0	01-Oct-10	11:17 AM	25.1	61	14.30	20.34	1.05	8.0E-06	0.79	6.04
0.0	01-Oct-10	01:01 PM	25.3	104	15.66	19.02	1.36	9.1E-06	0.44	3.36

Average Temp. = 25.1

AVERAGE K = 8.8E-06

Corrected K for 20ºC = 7.8E-06

Shively Geotechnical,
A Division of Environmental Operations, Inc.

HYDRAULIC CONDUCTIVITY TEST DATA
(ASTM D 5084)

JOB NO.:	6339			WET UNIT WEIGHT, pcf:	120.2		
LOCATION:	MW-252			**DRY UNIT WEIGHT, pcf:**	**91.5**		
DEPTH:	44' - 46'						
SPECIMEN:							
				INITIAL MOISTURE CONTENT		FINAL MOISTURE CONTENT	
LENGTH, in.:	3.002	LENGTH, cm:	7.625	WET WT SPLE+TARE	735.25	WET WT SPLE+TARE	747.80
DIAMETER, in.:	2.855	DIAMETER, cm	7.252	DRY WT SPLE+TARE	590.42	DRY WT SPLE+TARE	590.42
WET WT., gms.:	606.40			TARE WEIGHT	128.85	TARE WEIGHT	128.85
AREA, sq.in.:	6.402	AREA, sq cm:	41.302	**% MOISTURE**	31.4	% MOISTURE	34.1

B VALUE (before Permeation): 97%   Cell / Back Pressure, psi: 45 / 40

HEAD (PSI)	DATE (YR,MO,DY)	TIME (HR,MN,SC)	TEMP ºC	ELAPSED MINUTES	BOTTOM BURET	TOP BURET	Q (CC)	K CM/SEC	HYDRAULIC GRADIENT	HYDRAULIC HEAD
0.0	01-Oct-10	09:23 AM	25.0	0	2.52	22.96			2.68	20.44
0.0	01-Oct-10	01:00 PM	25.4	217	2.71	22.65	0.19	1.8E-07	2.62	19.94
0.0	01-Oct-10	04:58 PM	25.2	238	2.90	22.78	0.19	2.0E-08	2.61	19.88
0.0	04-Oct-10	08:52 AM	22.9	3834	4.10	23.65	1.20	7.1E-09	2.56	19.55
1.0	05-Oct-10	09:52 AM	22.9	0	12.31	23.90			10.74	81.89
1.0	05-Oct-10	05:11 PM	23.0	439	12.40	23.83	0.09	7.2E-09	10.72	81.73
1.0	06-Oct-10	08:37 AM	23.0	926	12.67	23.81	0.27	6.2E-09	10.68	81.44

Average Temp. = 23.4

AVERAGE K = 6.8E-09
Corrected K for 20ºC = 6.3E-09

Shively Geotechnical,
A Division of Environmental Operations, Inc.

HYDRAULIC CONDUCTIVITY TEST DATA
(ASTM D 5084)

JOB NO.:	6339			WET UNIT WEIGHT, pcf:	123.6		
LOCATION:	MW-350			**DRY UNIT WEIGHT, pcf:**	**97.9**		
DEPTH:	18' - 20'						
SPECIMEN:							
				INITIAL MOISTURE CONTENT		FINAL MOISTURE CONTENT	
LENGTH, in.:	3.518	LENGTH, cm:	8.936	WET WT SPLE+TARE	849.30	WET WT SPLE+TARE	862.40
DIAMETER, in.:	2.864	DIAMETER, cm	7.275	DRY WT SPLE+TARE	696.40	DRY WT SPLE+TARE	696.40
WET WT., gms.:	735.10			TARE WEIGHT	114.20	TARE WEIGHT	114.20
AREA, sq.in.:	6.442	AREA, sq cm:	41.563	**% MOISTURE**	26.3	% MOISTURE	28.5

B VALUE (before Permeation): 96%   Cell / Back Pressure, psi: 53 / 50

HEAD (PSI)	DATE (YR,MO,DY)	TIME (HR,MN,SC)	TEMP °C	ELAPSED MINUTES	BOTTOM BURET	TOP BURET	Q (CC)	K CM/SEC	HYDRAULIC GRADIENT	HYDRAULIC HEAD
0.0	01-Oct-10	09:23 AM	25.0	0	4.57	23.92			2.17	19.35
0.0	01-Oct-10	01:03 PM	25.4	220	5.09	23.43	0.52	4.6E-07	2.05	18.34
0.0	01-Oct-10	04:58 PM	25.2	235	5.67	22.93	0.58	4.9E-07	1.93	17.26
0.0	04-Oct-10	08:52 AM	22.9	3834	10.89	18.67	5.22	3.9E-07	0.87	7.78
0.0	04-Oct-10	03:35 PM	24.7	403	11.14	18.34	0.25	3.6E-07	0.81	7.20
0.0	04-Oct-10	04:00 PM	24.5	0	5.94	24.03			2.02	18.09
0.0	05-Oct-10	08:14 AM	23.0	974	7.68	22.53	1.74	3.8E-07	1.66	14.85

Average Temp. = 24.1

AVERAGE K = 3.8E-07

Corrected K for 20°C = 3.4E-07

Shively Geotechnical,
A Division of Environmental Operations, Inc.

SOIL/SEDIMENT/SLUDGE SAMPLING DATA

Serial No. SSSSD

Project Name Groundwater Investigation – BEC Ash Pond System ✓ Project No. 2010.010

Project Manager Stuart Cravens, Kelron Environmental Phase.Task No.

Client Company Dynegy, Inc.

Site Name Baldwin Energy Complex

Site Address 10901 Baldwin Road, Baldwin, IL

Sampling Method
- [x] Shelby Tube (ST)
- [ ] Split Spoon (SS)
- [x] Macrocore (MC)
- [ ] Other

Reason For Collection
- [ ] Lab Analysis
- [ ] On-Site Headspace
- [x] Geotechnical Lab
- [ ] Other

Portable Screening Instrument Used ☒ None

Type	Manufacturer	Model
☐ PID (Lamp____eV)		
☐ FID		
☐ CGI		

Sample No.	Location	Date Collected	Sample Type ST	SS	MC	Requested Analysis 1 Visual	*Requested Analysis 2 Grain Size	Requested Analysis 3 Vert. Perm (K)
MW-154	8'-9'2"	9/20/10	✓			✓	✓	✓
MW-252	14-16'	9/22/10	✓			✓	✓	—
MW-252	44-46'	9/22/10	✓			✓	✓	✓
MW-350	18-20'	9/8/10	✓			✓	✓	✓
MW-350	5-6'				✓	✓	✓	
MW-350	11-12'				✓	✓	✓	
MW-350	22-23'				✓	✓	—	
MW-155	7-8'				✓	✓	✓	
MW-155	18.5-19.5'				✓	✓	✓	
MW-156	10-11'				✓	✓	—	
MW-157	7-9'				✓	✓	—	
MW-157	2-3'				✓	✓	—	
MW-157	17-18'				✓	✓	—	
MW-355	21-22'				✓	✓	—	

Chain-of-Custody Form Number 0924100l

Comments *Grain Size = standard sieve/hydrometer per ASTM

Signature [signature] Date 9/24/10 Reviewer ______ Date ______

Brendon Wilder (PSC)
9/27/2010 @ 1026 ext. 1557

6339

SOIL/SEDIMENT/SLUDGE SAMPLING DATA

Serial No. SSSSD

Project Name Groundwater Investigation – BEC Ash Pond System

Project No. 2010.010

Project Manager Stuart Cravens, Kelron Environmental

Phase.Task No.

Client Company Dynegy, Inc.

Site Name Baldwin Energy Complex

Site Address 10901 Baldwin Road, Baldwin, IL

Sampling Method
- ☐ Shelby Tube (ST)
- ☐ Split Spoon (SS)
- ☒ Macrocore (MC)
- ☐ Other

Reason For Collection
- ☐ Lab Analysis
- ☐ On-Site Headspace
- ☒ Geotechnical Lab
- ☐ Other

Portable Screening Instrument Used ☒ None

Type	Manufacturer	Model
☐ PID (Lamp____eV)		
☐ FID		
☐ CGI		

Sample No.	Location	Date Collected	Sample Type ST	SS	MC	Requested Analysis 1 Visual	* Requested Analysis 2 Grain Size	Requested Analysis 3
MW-151	7.5-8'				✓	✓	✓	
MW-151	16-17'				✓	✓	✓	
MW-352	6.5-7.5'				✓	✓	–	
MW-352	26.5-27.5'				✓	✓	✓	
MW-352	16.5-17.5'				✓	✓	–	
MW-352	32-33'				✓	✓	✓	
MW-352	37-38'				✓	✓	–	
MW-253	11-12'				✓	✓	✓	
MW-253	19-19.5'				✓	✓	✓	
MW-253	29-30'				✓	✓	✓	
MW-154	3-4'				✓	✓	–	
MW-154	11-12'				✓	✓	✓	

Chain-of-Custody Form Number 092410.2

Comments *Grain Size = std sieve/hydrometer per ASTM

Signature [signature] Date 9/24/10 Reviewer ______ Date ______

Total = 3 perm / 26 visual / 16 grain size

GEOTECHNOLOGY INC
FROM THE GROUND UP

Via email: kelron1@comcast.net

October 18, 2013 J022188.01

Stuart Cravens
Kelron Environmental
1213 Dorchester Drive
Champaign, Illinois 61821

Re: BEC Ash Pond System Samples – Baldwin, Illinois

Dear Mr. Cravens:

Included in this report are the test results of soil samples received in our laboratory on August 22nd and 27th, 2013. There were 18 samples, eight in Shelby tubes and the remainder in plastic baggies, submitted for testing. The samples were tested in general accordance with the test method listed below.

Test to Determine	Method of Test
Particle Size Analysis of Soils	ASTM D422
Specific Gravity of Soils	ASTM D854
Water (Moisture) Content of Soil and Rock by Mass	ASTM D2216
Classification of Soils (Unified Soil Classification System)	ASTM D2487
Hydraulic Conductivity Using a Flexible Wall Permeameter	ASTM D5084
Determination of Density (Unit Weight) of Soil Specimens	ASTM D7263

Porosity was calculated using soil-mass relationships. Tables are enclosed with test results, as well as the porosity calculation worksheets. Particle size analysis can be found on the enclosed Grain Size Distribution curves.

* * * * *

We trust this is the information you require. Please contact the undersigned if you have any questions regarding this report.

Respectfully submitted,

GEOTECHNOLOGY, INC.

Janet M. May
Illinois Laboratory Manager

JMM/LPH:jmm

Copies Submitted: (1)

Attachment: Summary Tables
Grain Size Distribution
Hydraulic Conductivity Test Data Sheets
Porosity Calculation Worksheets

Classification Using Unified Soil Classification System – ASTM D2487

Location	Sample Depth (Feet)	Moisture Content (%)	USCS Classification
MW-161	31.5 - 32.5	17.8	SAND with Silt (SP-SM) - Fine Grained, Gray-Brown
MW-161	41.0 - 42.0	25.0	Lean CLAY (CL) – Medium Plasticity, Trace Sand, Blue-Gray
MW-262	17.0 - 18.0	19.1	Sandy Lean CLAY (CL) – Low to Medium Plasticity, Red-Brown
MW-262	33.5 - 35.5	23.5	Fat CLAY (CH) – High Plasticity, Light Gray-Brown
OW-256	33.0 - 33.5	8.6	Lean CLAY with Sand (CL) –Medium Plasticity, Gray-Brown
OW-257	36.5 - 37.0	19.1	SHALE - "Fat CLAY (CH)" – High Plasticity, Very Dark Gray
TPZ-163	1.5 - 3.5	49.3	ASH – "Silty SAND (SM) – Fine Grained, Very Dark Brown
TPZ-163	28.0 - 30.0	25.1	Lean to Fat CLAY (CL/CH) - Trace Fine Sand, Medium to High Plasticity, Dark Yellow-Brown
TPZ-164	3.0 - 5.0	22.5	ASH – "Sandy SILT (ML)" – Fine Grained Sand, Very Dark Brown
TPZ-164	10.0 - 12.0	25.6	Lean CLAY (CL) - Medium Plasticity, Light Olive-Brown
TPZ-165	8.0 - 10.0	22.3	Lean CLAY (CL) - Medium Plasticity, Trace Sand, Very Dark Gray-Brown
TPZ-165	13.0 - 14.0	24.5	Lean CLAY, with Sand (CL) - Medium Plasticity, Very Dark Gray-Brown
TPZ-167	29.0 - 30.0	31.1	ASH – "SILT (ML)" - Very Dark Gray-Brown
TPZ-167	32.0 - 34.0	24.1	Lean CLAY, with Sand (CL) - Medium Plasticity, Light Gray-Brown
TPZ-167	47.0 - 48.0	28.9	Lean to Fat CLAY (CL/CH) - Medium to High Plasticity, Yellow-Brown
TPZ-168	3.0 - 5.0	56.0	ASH – "Sandy SILT (ML)" – Fine-Medium Grained Sand, Olive-Brown
TPZ-168	39.0 - 40.0	18.6	TILL - Fat CLAY (CH) – High Plasticity, Trace Sand, Gray-Brown
TPZ-168	68.5 - 69.0	17.5	Lean CLAY (CL) - Medium Plasticity, with Sand Seams, Blue-Gray

USCS – Unified Soil Classification System

Hydraulic Conductivity Summary – ASTM D5084

		ASTM D 2216	ASTM D 6023	ASTM D 5084	
Location	Sample Depth (Feet)	Moisture Content, %	Dry Bulk Density, (pcf)	Hydraulic Conductivity, cm/sec	Range of Hydraulic Gradient
MW-262	33.5 - 35.5	23.5	102.2	9.9×10^{-9}	2.0 - 17.5
TPZ-163	1.5 - 3.5	49.3	63.7	2.5×10^{-4}	0.4 - 3.5
TPZ-163	28.0 - 30.0	25.1	98.0	4.2×10^{-4}	0.2 1.7
TPZ-164	3.0 - 5.0	22.5	91.7	6.5×10^{-4}	0.1 - 1.6
TPZ-164	10.0 - 12.0	25.6	95.7	1.3×10^{-6}	0.1 - 2.2
TPZ-165	8.0 - 10.0	22.3	102.4	5.3×10^{-6}	0.3 - 2.1
TPZ-167	29.0 - 30.0	18.8*	99.9*	9.7×10^{-6}	0.3 - 2.9
TPZ-167	32.0 - 34.0	24.1	101.3	6.2×10^{-7}	0.3 - 2.0
TPZ-168	3.0 - 5.0	56.0	63.0	4.2×10^{-4}	0.1 - 2.3

% - Percent
cm/sec - Centimeters per Second
pcf - Pounds per Cubic Foot

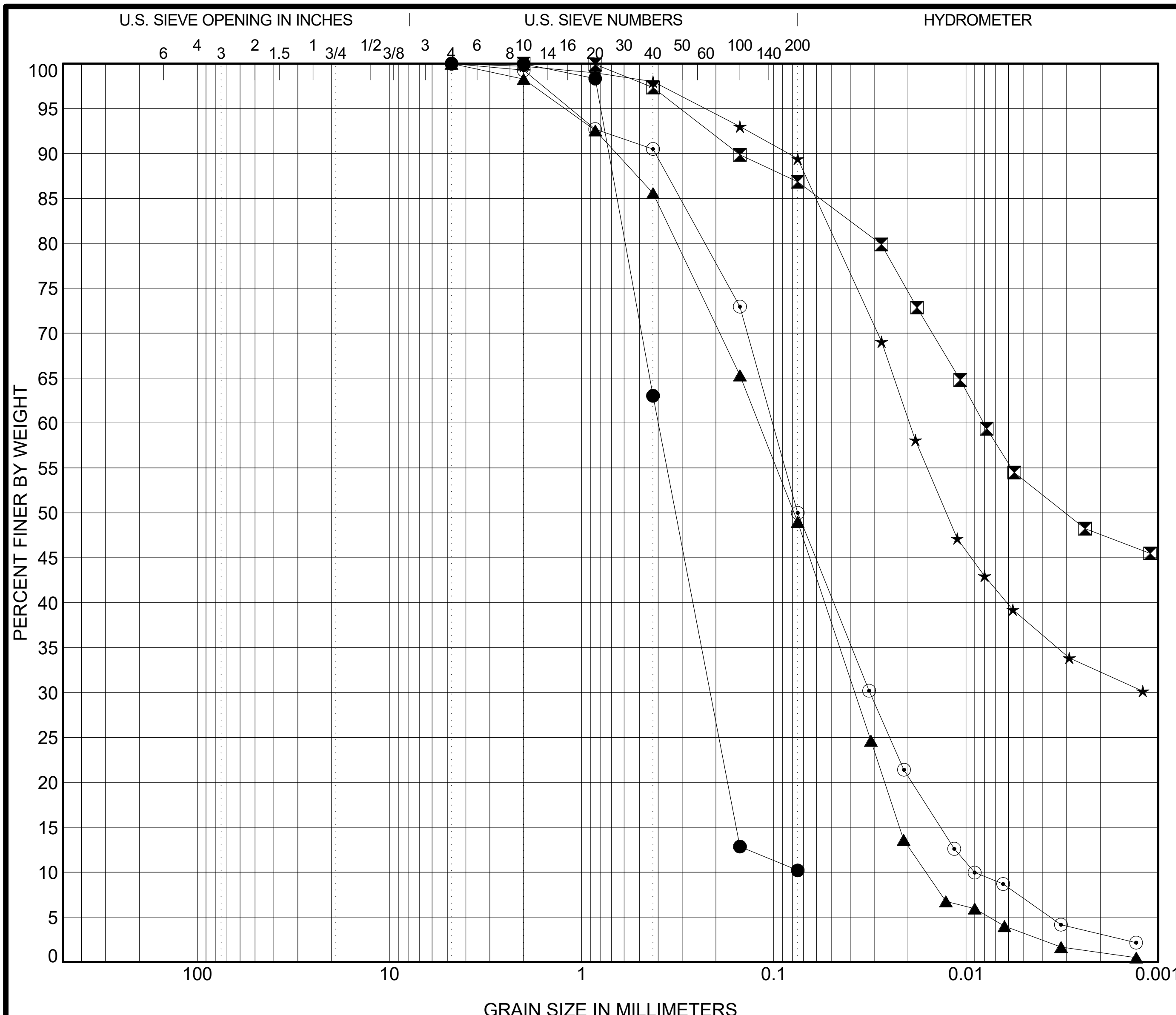
*Sample remolded in laboratory – As received moisture content = 31.1%

Porosity Using Soil-Mass Relationships*

		ASTM D 854	Calculation from Soil-Mass Relationships		
Location	Sample Depth (Feet)	Specific Gravity	Total Porosity, (%)	Water Filled Porosity, (%)	Air Filled Porosity, (%)
TPZ-163	1.5 - 3.5	2.66	61.7	50.2	11.5
TPZ-164	3.0 - 5.0	2.68	45.2	33.0	12.2
TPZ-167	29.0 - 30.0	2.59	38.2	30.2	8.0
TPZ-168	3.0 - 5.0	2.88	64.9	56.5	8.4

% - Percent

*Note: Values not representative of effective porosity.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	MW-161 31.5-32.5 Feet	**SAND, with Silt (SP-SM)**				1.61	5.60
⧗	MW-262 33.5-35.5 Feet	**Fat CLAY (CH)**					
▲	TPZ-163 1.5-3.5 Feet	**ASH - "Silty SAND (SM)"**				0.74	7.42
★	TPZ-163 28.0-30.0 Feet	**Lean to Fat CLAY (CL/CH)**					
⊙	TPZ-164 3.0-5.0 Feet	**ASH - "Sandy SILT (ML)"**				1.09	11.23

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	MW-161 31.5-32.5 Feet	4.75	0.399	0.214		0.0	89.8	10.2	
⧗	MW-262 33.5-35.5 Feet	2	0.008			0.0	13.1	33.2	53.7
▲	TPZ-163 1.5-3.5 Feet	4.75	0.12	0.038	0.016	0.0	51.0	45.8	3.2
★	TPZ-163 28.0-30.0 Feet	4.75	0.02			0.0	10.6	51.2	38.2
⊙	TPZ-164 3.0-5.0 Feet	4.75	0.101	0.032	0.009	0.0	50.0	42.9	7.1

GEOTECHNOLOGY INC
FROM THE GROUND UP

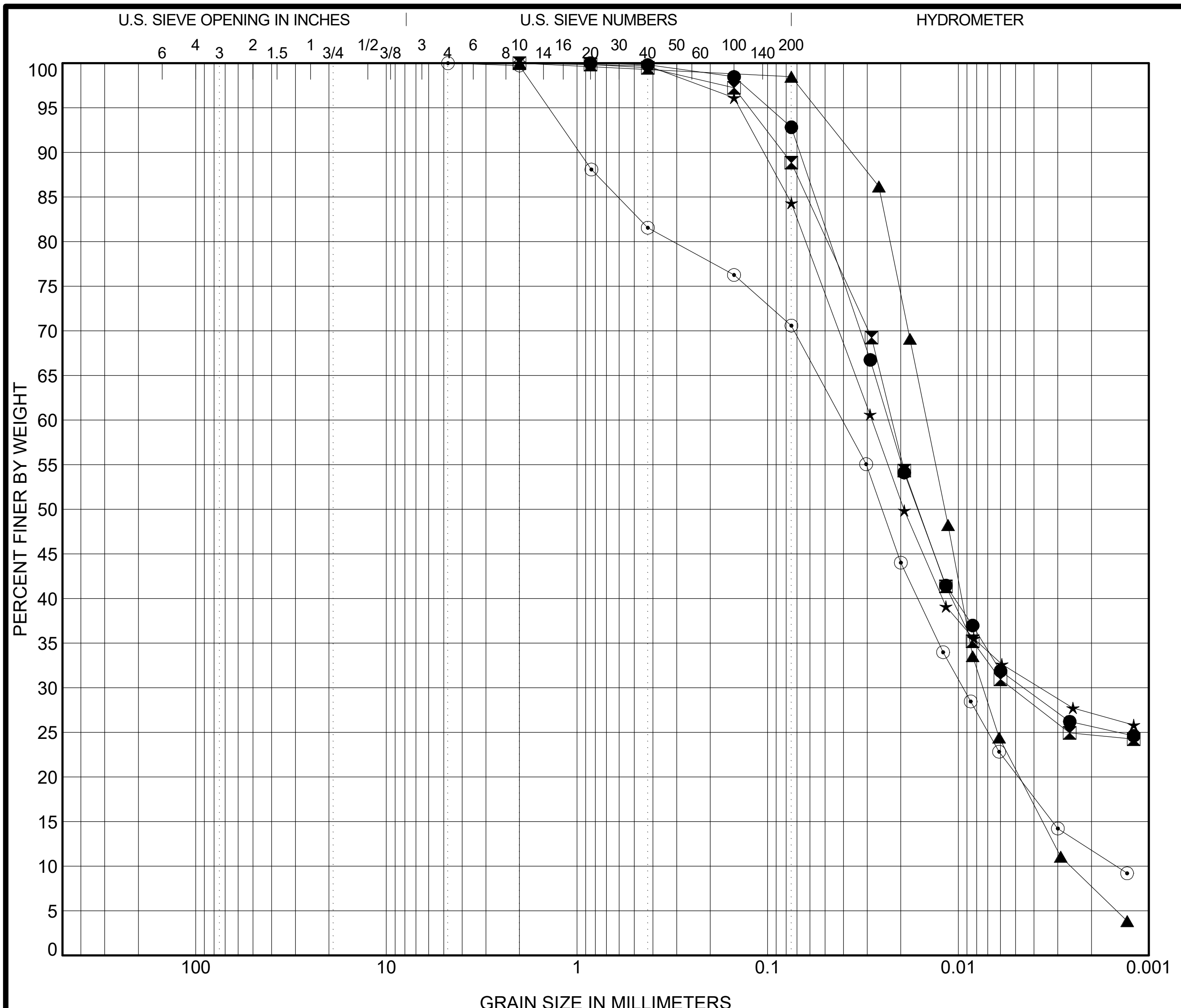
GRAIN SIZE DISTRIBUTION

Project Number: J02188.01.1300

Project: Baldwin Ash Pond System

Location: Environmental Investigation - Baldwin, Illinois

US GRAIN SIZE J022188.01.1300 LAB RESULTS.GPJ GEOTECHNOLOGY.GDT 10/16/13



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**TPZ-164 10.0-12.0 Feet**	**Lean CLAY (CL)**					
⧗	**TPZ-165 8.0-10.0 Feet**	**Lean CLAY (CL)**					
▲	**TPZ-167 29.0-30.0 Feet**	**ASH - "SILT (ML)"**				**1.46**	**5.69**
★	**TPZ-167 32.0-34.0 Feet**	**Lean CLAY, with Sand (CL)**					
⊙	**TPZ-168 3.0-5.0 Feet**	**ASH - "Sandy SILT (ML)"**				**1.48**	**27.30**

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TPZ-164 10.0-12.0 Feet**	**0.85**	**0.023**	**0.005**		**0.0**	**7.2**	**62.2**	**30.6**
⧗	**TPZ-165 8.0-10.0 Feet**	**2**	**0.022**	**0.005**		**0.0**	**11.2**	**59.2**	**29.6**
▲	**TPZ-167 29.0-30.0 Feet**	**2**	**0.015**	**0.007**	**0.003**	**0.0**	**1.5**	**77.6**	**20.8**
★	**TPZ-167 32.0-34.0 Feet**	**2**	**0.028**	**0.004**		**0.0**	**15.7**	**52.6**	**31.7**
⊙	**TPZ-168 3.0-5.0 Feet**	**4.75**	**0.041**	**0.009**	**0.001**	**0.0**	**29.4**	**50.2**	**20.4**

GEOTECHNOLOGY INC
FROM THE GROUND UP

GRAIN SIZE DISTRIBUTION

Project Number: J02188.01.1300

Project: Baldwin Ash Pond System

Location: Environmental Investigation - Baldwin, Illinois

US GRAIN SIZE J022188.01.1300 LAB RESULTS.GPJ GEOTECHNOLOGY.GDT 10/16/13

HYDRAULIC CONDUCTIVITY TEST DATA
(ASTM D 5084)

JOB NO.:	J022188.01			WET UNIT WEIGHT, pcf:	95.0
SAMPLE ID:	ST163-3			**DRY UNIT WEIGHT, pcf:**	**63.7**
LOCATION:	TPZ-163				
DEPTH:	1.5 - 3.5				

				INITIAL MOISTURE CONTENT		FINAL MOISTURE CONTENT*
LENGTH, in.:	2.464	LENGTH, cm:	6.259	WET WT SPLE+TARE	527.00	WET WT SPLE+TARE
DIAMETER, in.:	2.870	DIAMETER, cm	7.290	DRY WT SPLE+TARE	395.82	DRY WT SPLE+TARE
WET WT., gms.:	397.53			TARE WEIGHT	129.47	TARE WEIGHT
AREA, sq.in.:	6.469	AREA, sq cm:	41.737	**% MOISTURE**	49.3	% MOISTURE
						*Not Available

B VALUE (before Permeation): 97% Cell / Back Pressure, psi: 43 / 40

HEAD (PSI)	DATE (YR,MO,DY)	TIME (HR,MN,SC)	TEMP ºC	ELAPSED MINUTES	BOTTOM BURETTE	TOP BURETTE	Q (CC)	K CM/SEC	HYDRAULIC GRADIENT	HYDRAULIC HEAD	HEAD LOSS,%
0.0	08-Sep-13	11:32 AM	24.8	0	1.52	23.60			3.53	22.08	
0.0	08-Sep-13	11:37 AM	24.8	5	8.60	15.95	7.08	2.9E-04	1.17	7.35	66.71
0.0	09-Sep-13	01:35 PM	23.7	0	3.75	23.74			3.19	19.99	
0.0	09-Sep-13	01:43 PM	23.7	8	11.57	15.40	7.82	2.7E-04	0.61	3.83	80.84
0.0	09-Sep-13	05:09 PM	23.7	0	5.00	23.77			3.00	18.77	
0.0	09-Sep-13	05:18 PM	23.7	9	12.93	15.83	7.93	2.7E-04	0.46	2.90	84.55
0.0	09-Sep-13	05:20 PM	23.7	0	6.47	23.73			2.76	17.26	
0.0	09-Sep-13	05:30 PM	23.7	10	13.99	16.16	7.52	2.7E-04	0.35	2.17	87.43

Average Temp. = 23.7

AVERAGE K = 2.7E-04

Corrected K for 20ºC = 2.5E-04

HYDRAULIC CONDUCTIVITY TEST DATA
(ASTM D 5084)

JOB NO.:	J022188.01			WET UNIT WEIGHT, pcf:	122.6
SAMPLE ID:	ST163-30			**DRY UNIT WEIGHT, pcf:**	**98.0**
LOCATION:	TPZ-163				
DEPTH:	28.0 - 30.0				

				INITIAL MOISTURE CONTENT		FINAL MOISTURE CONTENT	
LENGTH, in.:	3.656	LENGTH, cm:	9.286	WET WT SPLE+TARE	901.33	WET WT SPLE+TARE	907.19
DIAMETER, in.:	2.888	DIAMETER, cm	7.336	DRY WT SPLE+TARE	746.92	DRY WT SPLE+TARE	746.92
WET WT., gms.:	770.63			TARE WEIGHT	130.70	TARE WEIGHT	130.7
AREA, sq.in.:	6.551	AREA, sq cm:	42.262	**% MOISTURE**	25.1	% MOISTURE	26.0

B VALUE (before Permeation): 98% Cell / Back Pressure, psi: 43 / 40

HEAD (PSI)	DATE (YR,MO,DY)	TIME (HR,MN,SC)	TEMP ºC	ELAPSED MINUTES	BOTTOM BURETTE	TOP BURETTE	Q (CC)	K CM/SEC	HYDRAULIC GRADIENT	HYDRAULIC HEAD	HEAD LOSS,%
0.0	20-Sep-13	11:54 AM	23.6	0	7.03	23.15			1.74	16.12	
0.0	20-Sep-13	12:02 PM	23.6	8	13.83	16.26	6.80	4.5E-04	0.26	2.43	84.93
0.0	25-Sep-13	09:00 AM	23.9	0	9.51	24.05			1.57	14.54	
0.0	25-Sep-13	09:08 AM	23.9	8	15.65	17.83	6.14	4.6E-04	0.23	2.18	85.01
0.0	25-Sep-13	09:20 AM	23.9	0	9.29	24.37			1.62	15.08	
0.0	25-Sep-13	09:28 AM	23.9	8	15.72	17.84	6.43	4.7E-04	0.23	2.12	85.94

Average Temp. = 23.8

AVERAGE K = 4.6E-04

Corrected K for 20ºC = 4.2E-04

HYDRAULIC CONDUCTIVITY TEST DATA

(ASTM D 5084)

JOB NO.:	J022188.01			WET UNIT WEIGHT, pcf:	120.1		
SAMPLE ID:	ST164-12			**DRY UNIT WEIGHT, pcf:**	**95.7**		
LOCATION:	TPZ-164						
DEPTH:	10.0 - 12.0						
				INITIAL MOISTURE CONTENT		FINAL MOISTURE CONTENT	
LENGTH, in.:	3.373	LENGTH, cm:	8.567	WET WT SPLE+TARE	793.36	WET WT SPLE+TARE	807.00
DIAMETER, in.:	2.823	DIAMETER, cm	7.170	DRY WT SPLE+TARE	657.83	DRY WT SPLE+TARE	657.83
WET WT., gms.:	665.70			TARE WEIGHT	127.66	TARE WEIGHT	127.66
AREA, sq.in.:	6.259	AREA, sq cm:	40.381	**% MOISTURE**	25.6	% MOISTURE	28.1

B VALUE (before Permeation): 97%   Cell / Back Pressure, psi: 43 / 40

HEAD (PSI)	DATE (YR,MO,DY)	TIME (HR,MN,SC)	TEMP °C	ELAPSED MINUTES	BOTTOM BURETTE	TOP BURETTE	Q (CC)	K CM/SEC	HYDRAULIC GRADIENT	HYDRAULIC HEAD	HEAD LOSS,%
0.0	30-Aug-13	10:28 AM	23.4	0	4.50	23.60			2.23	19.10	
0.0	30-Aug-13	05:44 PM	23.7	436	6.63	21.04	2.13	1.2E-06	1.68	14.41	24.55
0.0	02-Sep-13	09:06 AM	22.9	3802	13.80	14.83	7.17	1.3E-06	0.12	1.03	92.85
0.0	02-Sep-13	09:07 AM	22.9	0	6.28	23.67			2.03	17.39	
0.0	02-Sep-13	02:53 PM	22.8	346	8.47	21.50	2.19	1.5E-06	1.52	13.03	25.07
0.0	03-Sep-13	08:23 AM	23.4	1050	12.14	17.85	3.67	1.5E-06	0.67	5.71	56.18
0.0	03-Sep-13	05:36 PM	23.0	553	13.13	16.91	0.99	1.4E-06	0.44	3.78	33.80
0.0	04-Sep-13	08:10 AM	23.0	874	14.19	16.18	1.06	1.4E-06	0.23	1.99	47.35
0.0	04-Sep-13	02:25 PM	23.4	375	14.43	15.97	0.24	1.5E-06	0.18	1.54	22.61

Average Temp. = 23.1

AVERAGE K = 1.4E-06

Corrected K for 20°C = 1.3E-06

HYDRAULIC CONDUCTIVITY TEST DATA
(ASTM D 5084)

JOB NO.:	J022188.01			WET UNIT WEIGHT, pcf:	112.3		
SAMPLE ID:	ST164-5			**DRY UNIT WEIGHT, pcf:**	**91.7**		
LOCATION:	TPZ-164						
DEPTH:	3.0 - 5.0						
				INITIAL MOISTURE CONTENT		FINAL MOISTURE CONTENT*	
LENGTH, in.:	5.570	LENGTH, cm:	14.148	WET WT SPLE+TARE	1191.79	WET WT SPLE+TARE	
DIAMETER, in.:	2.869	DIAMETER, cm	7.287	DRY WT SPLE+TARE	996.94	DRY WT SPLE+TARE	
WET WT., gms.:	1061.53			TARE WEIGHT	130.26	TARE WEIGHT	
AREA, sq.in.:	6.465	AREA, sq cm:	41.708	**% MOISTURE**	22.5	% MOISTURE	
						*Not Available	

B VALUE (before Permeation): 95% Cell / Back Pressure, psi: 43 / 40

HEAD (PSI)	DATE (YR,MO,DY)	TIME (HR,MN,SC)	TEMP ºC	ELAPSED MINUTES	BOTTOM BURETTE	TOP BURETTE	Q (CC)	K CM/SEC	HYDRAULIC GRADIENT	HYDRAULIC HEAD	HEAD LOSS,%
0.0	08-Sep-13	11:32 AM	24.6	0	1.40	23.77			1.58	22.37	
0.0	08-Sep-13	11:36 AM	24.6	4	8.28	17.65	6.88	6.5E-04	0.66	9.37	58.11
0.0	09-Sep-13	01:35 PM	23.7	0	3.53	23.77			1.43	20.24	
0.0	09-Sep-13	01:43 PM	23.7	8	12.10	15.10	8.57	7.1E-04	0.21	3.00	85.18
0.0	09-Sep-13	05:09 PM	23.8	0	5.30	23.70			1.30	18.40	
0.0	09-Sep-13	05:18 PM	23.7	9	13.38	15.52	8.08	7.1E-04	0.15	2.14	88.37
0.0	09-Sep-13	05:20 PM	23.7	0	6.87	24.14			1.22	17.27	
0.0	09-Sep-13	05:30 PM	23.7	10	14.67	16.27	7.80	7.1E-04	0.11	1.60	90.74

Average Temp. = 23.7

AVERAGE K = 7.1E-04

Corrected K for 20ºC = 6.5E-04

HYDRAULIC CONDUCTIVITY TEST DATA

(ASTM D 5084)

JOB NO.:	J022188.01			WET UNIT WEIGHT, pcf:	125.2		
SAMPLE ID:	ST165-10			**DRY UNIT WEIGHT, pcf:**	**102.4**		
LOCATION:	TPZ-165						
DEPTH:	8.0 - 10.0						
				INITIAL MOISTURE CONTENT		FINAL MOISTURE CONTENT	
LENGTH, in.:	3.370	LENGTH, cm:	8.560	WET WT SPLE+TARE	804.93	WET WT SPLE+TARE	809.06
DIAMETER, in.:	2.823	DIAMETER, cm	7.170	DRY WT SPLE+TARE	678.39	DRY WT SPLE+TARE	678.39
WET WT., gms.:	693.30			TARE WEIGHT	111.63	TARE WEIGHT	111.63
AREA, sq.in.:	6.259	AREA, sq cm:	40.381	**% MOISTURE**	**22.3**	% MOISTURE	23.1

B VALUE (before Permeation): 99%   Cell / Back Pressure, psi: 43 / 40

HEAD (PSI)	DATE (YR,MO,DY)	TIME (HR,MN,SC)	TEMP ºC	ELAPSED MINUTES	BOTTOM BURETTE	TOP BURETTE	Q (CC)	K CM/SEC	HYDRAULIC GRADIENT	HYDRAULIC HEAD	HEAD LOSS,%
0.0	30-Aug-13	10:26 AM	23.4	0	5.03	23.15			2.12	18.12	
0.0	30-Aug-13	05:45 PM	23.7	439	11.30	16.83	6.27	5.0E-06	0.65	5.53	69.48
0.0	02-Sep-13	09:05 AM	23.0	0	6.77	23.53			1.96	16.76	
0.0	02-Sep-13	02:53 PM	23.1	348	12.40	17.78	5.63	6.1E-06	0.63	5.38	67.90
0.0	03-Sep-13	08:22 AM	23.1	0	8.19	23.78			1.82	15.59	
0.0	03-Sep-13	05:34 PM	22.9	552	14.70	17.27	6.51	6.1E-06	0.30	2.57	83.52

Average Temp. = 23.2

AVERAGE K = 5.7E-06

Corrected K for 20ºC = 5.3E-06

HYDRAULIC CONDUCTIVITY TEST DATA
(ASTM D 5084)

JOB NO.:	J022188.01			WET UNIT WEIGHT, pcf:	118.8	
SAMPLE ID:	ST167-30			**DRY UNIT WEIGHT, pcf:**	**99.9**	
LOCATION:	TPZ-167			**Note: Sample Remolded in Lab**		
DEPTH:	29.0 - 30.0					
				INITIAL MOISTURE CONTENT		FINAL MOISTURE CONTENT*
LENGTH, in.:	2.408	LENGTH, cm:	6.116	WET WT SPLE+TARE	586.87	WET WT SPLE+TARE
DIAMETER, in.:	2.835	DIAMETER, cm	7.201	DRY WT SPLE+TARE	511.77	DRY WT SPLE+TARE
WET WT., gms.:	473.89			TARE WEIGHT	112.98	TARE WEIGHT
AREA, sq.in.:	6.312	AREA, sq cm:	40.725	**% MOISTURE**	18.8	% MOISTURE
						*Not Available

B VALUE (before Permeation): 95% Cell / Back Pressure, psi: 63 / 60

HEAD (PSI)	DATE (YR,MO,DY)	TIME (HR,MN,SC)	TEMP ºC	ELAPSED MINUTES	BOTTOM BURETTE	TOP BURETTE	Q (CC)	K CM/SEC	HYDRAULIC GRADIENT	HYDRAULIC HEAD	HEAD LOSS,%
0.0	07-Oct-13	10:38 AM	23.1	0	6.12	23.77			2.89	17.65	
0.0	07-Oct-13	11:14 AM	23.0	36	8.31	21.53	2.19	1.1E-05	2.16	13.22	25.10
0.0	07-Oct-13	11:58 AM	23.0	44	10.25	19.60	1.94	1.0E-05	1.53	9.35	29.27
0.0	07-Oct-13	02:39 PM	22.8	161	13.60	16.23	3.35	1.0E-05	0.43	2.63	71.87
0.0	08-Oct-13	12:00 PM	23.2	0	7.42	23.43			2.62	16.01	
0.0	08-Oct-13	04:51 PM	22.3	291	14.57	16.22	7.15	1.0E-05	0.27	1.65	89.69

Average Temp. = 22.9

AVERAGE K = 1.0E-05

Corrected K for 20ºC = 9.7E-06

HYDRAULIC CONDUCTIVITY TEST DATA

(ASTM D 5084)

JOB NO.:	J022188.01			WET UNIT WEIGHT, pcf:	125.7		
SAMPLE ID:	ST167-34			**DRY UNIT WEIGHT, pcf:**	**101.3**		
LOCATION:	TPZ-167						
DEPTH:	32.0 - 34.0						
				INITIAL MOISTURE CONTENT		FINAL MOISTURE CONTENT	
LENGTH, in.:	3.900	LENGTH, cm:	9.906	WET WT SPLE+TARE	922.20	WET WT SPLE+TARE	921.52
DIAMETER, in.:	2.805	DIAMETER, cm	7.125	DRY WT SPLE+TARE	767.59	DRY WT SPLE+TARE	767.59
WET WT., gms.:	795.39			TARE WEIGHT	126.81	TARE WEIGHT	126.81
AREA, sq.in.:	6.180	AREA, sq cm:	39.868	**% MOISTURE**	**24.1**	% MOISTURE	24.0

B VALUE (before Permeation): 100%   Cell / Back Pressure, psi: 43 / 40

HEAD (PSI)	DATE (YR,MO,DY)	TIME (HR,MN,SC)	TEMP ºC	ELAPSED MINUTES	BOTTOM BURETTE	TOP BURETTE	Q (CC)	K CM/SEC	HYDRAULIC GRADIENT	HYDRAULIC HEAD	HEAD LOSS,%
0.0	30-Aug-13	10:26 AM	23.4	0	3.20	23.17			2.02	19.97	
0.0	30-Aug-13	05:46 PM	23.7	440	4.40	21.92	1.20	6.5E-07	1.77	17.52	12.27
0.0	02-Sep-13	09:03 AM	22.8	3797	10.73	16.19	6.33	6.7E-07	0.55	5.46	68.84
0.0	03-Sep-13	08:20 AM	23.0	1397	11.70	15.29	0.97	6.5E-07	0.36	3.59	34.25
0.0	03-Sep-13	05:33 PM	23.1	553	12.01	15.06	0.31	6.4E-07	0.31	3.05	15.04
0.0	03-Sep-13	05:59 PM	23.1	0	4.82	23.63			1.90	18.81	
0.0	04-Sep-13	08:08 AM	23.4	849	7.00	21.48	2.18	7.3E-07	1.46	14.48	23.02

Average Temp. = 23.2

AVERAGE K = 6.7E-07

Corrected K for 20ºC = 6.2E-07

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HYDRAULIC CONDUCTIVITY TEST DATA
(ASTM D 5084)

JOB NO.:	J022188.01			WET UNIT WEIGHT, pcf:	98.3		
SAMPLE ID:	ST168-5			**DRY UNIT WEIGHT, pcf:**	**63.0**		
LOCATION:	TPZ-168						
DEPTH:	3.0 - 5.0						
				INITIAL MOISTURE CONTENT		FINAL MOISTURE CONTENT*	
LENGTH, in.:	2.883	LENGTH, cm:	7.323	WET WT SPLE+TARE	610.66	WET WT SPLE+TARE	
DIAMETER, in.:	2.874	DIAMETER, cm	7.300	DRY WT SPLE+TARE	437.44	DRY WT SPLE+TARE	
WET WT., gms.:	482.72			TARE WEIGHT	127.94	TARE WEIGHT	
AREA, sq.in.:	6.487	AREA, sq cm:	41.853	**% MOISTURE**	56.0	% MOISTURE	
						*Not Available	

B VALUE (before Permeation): 99%   Cell / Back Pressure, psi: 43 / 40

HEAD (PSI)	DATE (YR,MO,DY)	TIME (HR,MN,SC)	TEMP ºC	ELAPSED MINUTES	BOTTOM BURETTE	TOP BURETTE	Q (CC)	K CM/SEC	HYDRAULIC GRADIENT	HYDRAULIC HEAD	HEAD LOSS,%
0.0	03-Oct-13	09:40 AM	24.2	0	6.27	23.34			2.33	17.07	
0.0	03-Oct-13	09:46 AM	24.2	6	13.43	16.13	7.16	4.7E-04	0.37	2.70	84.18
0.0	03-Oct-13	09:50 AM	24.2	4	14.39	15.16	0.96	4.8E-04	0.11	0.77	71.48
0.0	03-Oct-13	10:15 AM	24.0	0	7.57	24.18			2.27	16.61	
0.0	03-Oct-13	10:22 AM	24.0	7	14.83	16.85	7.26	4.6E-04	0.28	2.02	87.84
0.0	03-Oct-13	10:27 AM	24.0	5	15.62	16.07	0.79	4.6E-04	0.06	0.45	77.72

Average Temp. = 24.1

AVERAGE K = 4.7E-04

Corrected K for 20ºC = 4.2E-04

HYDRAULIC CONDUCTIVITY TEST DATA
(ASTM D 5084)

JOB NO.:	J022188.01	WET UNIT WEIGHT, pcf:	126.1
SAMPLE ID:	ST262-35	**DRY UNIT WEIGHT, pcf:**	**102.2**
LOCATION:	MW-262		
DEPTH:	33.5 - 35.5		

				INITIAL MOISTURE CONTENT		FINAL MOISTURE CONTENT	
LENGTH, in.:	3.545	LENGTH, cm:	9.004	WET WT SPLE+TARE	880.20	WET WT SPLE+TARE	888.98
DIAMETER, in.:	2.854	DIAMETER, cm	7.249	DRY WT SPLE+TARE	737.44	DRY WT SPLE+TARE	737.44
WET WT., gms.:	750.94			TARE WEIGHT	129.26	TARE WEIGHT	129.26
AREA, sq.in.:	6.397	AREA, sq cm:	41.273	**% MOISTURE**	23.5	% MOISTURE	24.9

B VALUE (before Permeation): 99%   Cell / Back Pressure, psi: 43 / 40

HEAD (PSI)	DATE (YR,MO,DY)	TIME (HR,MN,SC)	TEMP ºC	ELAPSED MINUTES	BOTTOM BURETTE	TOP BURETTE	Q (CC)	K CM/SEC	HYDRAULIC GRADIENT	HYDRAULIC HEAD	HEAD LOSS,%
0.0	30-Aug-13	10:28 AM	23.4	0	5.05	24.01			2.11	18.96	
0.0	30-Aug-13	05:45 PM	23.7	437	5.69	24.03	0.64	1.5E-07	2.04	18.34	3.27
0.0	02-Sep-13	09:05 AM	22.9	3800	6.48	24.41	0.79	1.1E-08	1.99	17.93	2.24
0.0	03-Sep-13	08:22 AM	23.3	1397	6.67	24.47	0.19	9.9E-09	1.98	17.80	0.73
0.0	03-Sep-13	05:35 PM	23.0	553	6.77	24.50	0.10	1.4E-08	1.97	17.73	0.39
2.0	03-Sep-13	06:02 PM	23.0	0	5.91	23.23			17.54	157.92	
2.0	04-Sep-13	08:09 AM	23.3	847	6.25	22.93	0.34	9.3E-09	17.47	157.28	0.41
2.0	04-Sep-13	02:24 PM	23.4	375	6.40	22.82	0.15	9.3E-09	17.44	157.02	0.17

Average Temp. = 23.2

AVERAGE K = 1.1E-08
Corrected K for 20ºC = 9.9E-09

Va = Volume of air
Vw = Volume of water
Vv = Volume of voids
Vd - Volume of dry soil
V = Total volume
Ma = Mass of air (=0)
Mw = Mass of water
Md = Mass of dry soil
M = Total mass

	Volume		Mass
Volume of Voids	Va	AIR	Ma=0
	Vw	WATER	Mw
	Vd	SOIL	Md
	V	Total	M

Project No.:	J022188.01	
Location:	TPZ-163	
Sample No.:	ST163-3	
Depth (Feet):	1.5 - 3.5	
Height	2.464	(in)
Diameter	2.870	(in)
Weight	397.53	(g)
Volume	261.21	(cc)
Bulk Density, Wet	1.522	(g/cc)
Bulk Density, Dry - ASTM D 2937	**1.020**	**(g/cc)**
Wet + Tare	527.00	(gms)
Dry + Tare	395.82	(gms)
Tare	129.47	(gms)
Water Content - ASTM D 2216	**49.3**	**(%)**
Gravimetric Water Content	**0.493**	**(g/g)**
Volumetric Water Content	**0.502**	**(cc/cc)**

Volume of Voids	Volume (cc)		Mass (gms)
	29.90	AIR	0.00
161.08			
	131.18	WATER	131.18
	100.13	SOIL	266.35
	261.21	Total	397.53

Specific Gravity - ASTM D 854 = 2.66 (g/cc)

Total Porosity (n) = Vv/V = 0.617 (cc/cc)

Water Filled Porosity (n) = Vw/V = 0.5022 (cc/cc)

Air Filled Porosity (n) = Va/V = 0.1145 (cc/cc)

Project No.:	J022188.01	
Location:	TPZ-164	
Sample No.:	ST164-5	
Depth (Feet):	3.0 - 5.0	
Height	5.570	(in)
Diameter	2.869	(in)
Weight	1061.5	(g)
Volume	590.08	(cc)
Bulk Density, Wet	1.799	(g/cc)
Bulk Density, Dry - ASTM D 2937	**1.469**	**(g/cc)**
Wet + Tare	1191.79	(gms)
Dry + Tare	996.94	(gms)
Tare	130.26	(gms)
Water Content - ASTM D 2216	**22.5**	**(%)**
Gravimetric Water Content	**0.225**	**(g/g)**
Volumetric Water Content	**0.330**	**(cc/cc)**

Volume of Voids	Volume (cc)		Mass (gms)
	71.84	AIR	0.00
266.69			
	194.85	WATER	194.85
	323.39	SOIL	866.68
	590.08	Total	1061.53

Specific Gravity - ASTM D 854 = 2.68 (g/cc)

Total Porosity (n) = Vv/V = 0.452 (cc/cc)

Water Filled Porosity (n) = Vw/V = 0.330 (cc/cc)

Air Filled Porosity (n) = Va/V = 0.122 (cc/cc)

NOTE: Values not representative of effective porosity.

Va = Volume of air
Vw = Volume of water
Vv = Volume of voids
Vd - Volume of dry soil
V = Total volume
Ma = Mass of air (=0)
Mw = Mass of water
Md = Mass of dry soil
M = Total mass

	Volume		Mass
Volume of Voids	Va	AIR	Ma=0
	Vw	WATER	Mw
	Vd	SOIL	Md
	V	Total	M

				Volume (cc)		Mass (gms)
Project No.:	J022188.01					
Location:	TPZ-167					
Sample No.:	SS167-30					
Depth (Feet):	29.0 - 30.0			20.02	AIR	0.00
			95.12			
Height	2.408	(in)		75.10	WATER	75.10
Diameter	2.835	(in)				
Weight	473.89	(g)		153.97	SOIL	398.79
Volume	249.09	(cc)				
				249.09	Total	473.89
Bulk Density, Wet	1.902	(g/cc)				
Bulk Density, Dry - ASTM D 2937	**1.601**	**(g/cc)**				
				Specific Gravity - ASTM D 854 =	**2.59**	**(g/cc)**
Wet + Tare	586.87	(gms)				
Dry + Tare	511.77	(gms)				
Tare	112.98	(gms)		**Total Porosity (n) = Vv/V =**	**0.382**	**(cc/cc)**
Water Content - ASTM D 2216	**18.8**	**(%)**				
				Water Filled Porosity (n) = Vw/V =	**0.3015**	**(cc/cc)**
Gravimetric Water Content	**0.188**	**(g/g)**				
Volumetric Water Content	**0.301**	**(cc/cc)**		**Air Filled Porosity (n) = Va/V =**	**0.0804**	**(cc/cc)**

Note: Sample Remolded in Laboratory

				Volume (cc)		Mass (gms)
Project No.:	J022188.01					
Location:	TPZ-168					
Sample No.:	ST168-5					
Depth (Feet):	3.0 - 5.0			25.80	AIR	0.00
			199.02			
Height	2.883	(in)		173.22	WATER	173.22
Diameter	2.874	(in)				
Weight	482.7	(g)		107.47	SOIL	309.50
Volume	306.48	(cc)				
				306.48	Total	482.72
Bulk Density, Wet	1.575	(g/cc)				
Bulk Density, Dry - ASTM D 2937	**1.010**	**(g/cc)**				
				Specific Gravity - ASTM D 854 =	**2.88**	**(g/cc)**
Wet + Tare	610.66	(gms)				
Dry + Tare	437.44	(gms)				
Tare	127.94	(gms)		**Total Porosity (n) = Vv/V =**	**0.649**	**(cc/cc)**
Water Content - ASTM D 2216	**56.0**	**(%)**				
				Water Filled Porosity (n) = Vw/V =	**0.565**	**(cc/cc)**
Gravimetric Water Content	**0.560**	**(g/g)**				
Volumetric Water Content	**0.565**	**(cc/cc)**		**Air Filled Porosity (n) = Va/V =**	**0.084**	**(cc/cc)**

NOTE: Values not representative of effective porosity.

Rec'd 8/22/13

SOIL/SEDIMENT/SLUDGE SAMPLING DATA

Serial No. SSSSD

Project Name Hydrogeologic Investigation – BEC Ash Pond System   Project No. 2013.009

Project Manager Stuart Cravens, Kelron Environmental   Phase.Task No. ______

Client Company Dynegy, Inc.

Site Name Baldwin Energy Complex

Site Address 10901 Baldwin Road, Baldwin, IL

Sampling Method
- ☒ Shelby Tube (ST)
- ☒ Split Spoon (SS)
- ☒ Macrocore (MC)
- ☐ Other ______

Reason For Collection
- ☐ Lab Analysis
- ☐ On-Site Headspace
- ☒ Geotechnical Lab
- ☐ Other ______

Portable Screening Instrument Used ☒ None

Type	Manufacturer	Model
☐ PID (Lamp____eV)		
☐ FID		
☐ CGI		

Depth	Sample No.	Location	Date Collected	Sample Type ST	SS	MC	Analysis 1 (USCS Class)	Analysis 2 (USCS w/ Sieve / Hydrometer)	Analysis 3 (Moisture, Bulk Density, Hyd Cond, SpGr)**	Analysis 4 (Moisture)	Analysis 5 (Hyd Cond)
29-30'	SS167-30	TPZ-167	8-13-13		X			⊗	⊗		
32-34'	ST167-34	↓	8-13-13	X				X		X	X
47-48'	SS167-48	↓	8-13-13		X		X				
3-5	ST168-5	TPZ-168	8-15-13	X				⊗	⊗		
39-40	SS168-40	↓	8-14-13		X		X				
68.5-69	SS168-69	↓	8-14-13		X		X				
36.5-37	MC257-37	OW-257	8-15-13			X	X				
8-10	ST165-10	TPZ-165	8-19-13	X				X		X	X
13-14	MC165-14	↓	8-19-13			X	X				
17-18	MC262-18	MW-262	8-19-13				X				
33.5-35.5	ST262-35	↓	8-19-13	X				X		X	X
31.5-32.5	MC161-32	MW-161	8-20-13			X	X	X (sieve only)			
41-42	MC161-42	↓	8-20-13			X	X				
33-33.5	MC256-33	OW-256	8-22-13			X	X				

Chain-of-Custody Form Number ______

Comments **Calculation of total, water filled, and air filled porosity.

Ash samples: Analyses 1, 2, and 3. Soil samples: Analyses 1 or Analyses 2 or Analyses 2, 3,5

Signature [signature]   Date 8/23/13 SJ   Reviewer ______ Date ______

Form A0204 Rev. 7/19/13   C:\Consulting A\Power Plants\Baldwin\Baldwin 2013 Hydrogeologic Study\Field Work Phase\Field Forms\Geotech samples.docx   7/19/13

SOIL/SEDIMENT/SLUDGE SAMPLING DATA

Rec'd 8/27/13

Serial No. SSSSD

Project Name Hydrogeologic Investigation – BEC Ash Pond System

Project No. 2013.009

Project Manager Stuart Cravens, Kelron Environmental

Phase.Task No.

Client Company Dynegy, Inc.

Site Name Baldwin Energy Complex

Site Address 10901 Baldwin Road, Baldwin, IL

Sampling Method
- ☒ Shelby Tube (ST)
- ☐ Split Spoon (SS)
- ☐ Macrocore (MC)
- ☐ Other

Reason For Collection
- ☐ Lab Analysis
- ☐ On-Site Headspace
- ☒ Geotechnical Lab
- ☐ Other

Portable Screening Instrument Used ☒ None

	Type	Manufacturer	Model
☐	PID (Lamp____eV)		
☐	FID		
☐	CGI		

Sample No.	Location	Date Collected	Sample Type ST	Sample Type SS	Sample Type MC	Analysis 1 (USCS Class)	Analysis 2 (USCS w/ Sieve / Hydrometer)	Analysis 3 (Moisture, Bulk Density, Hyd Cond, SpGr)**	Analysis 4 (Moisture)	Analysis 5 (Hyd Cond)
ST164-5	TPZ-164 @ 3-5'	8/26/13	X				⊗	⊗		
ST164-12	TPZ-164 @ 10-12'	11	X				X		X	X
ST163-3	TPZ-163 @ 1.5-3.5'	8/27/13	X				⊗	⊗		
ST163-30	TPZ-163 @ 28-30'	11	X				X		X	X

Chain-of-Custody Form Number

Comments **Calculation of total, water filled, and air filled porosity.

Ash samples: Analyses 2 and 3. Soil samples: Analyses 1 **or** Analyses 2 **or** Analyses 2, 4, 5

Signature [signature] Date 8/27/13 Reviewer ______ Date ______

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\BaldwinBAP\Figure 2-6_Cross Section Locations.mxd

PROJECT: 169000XXXX | DATED: 10/20/2021 | DESIGNER: STOLZSD

MONITORING WELL AND PIEZOMETER LOCATIONS
ABANDONED MONITORING WELL AND PIEZOMETER LOCATIONS

CROSS SECTION TRANSECTS

A to A'
B to B'
C to C'

0 400 800 Feet

PART 845 REGULATED UNIT (SUBJECT UNIT)
FLY ASH POND SYSTEM (CLOSED)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

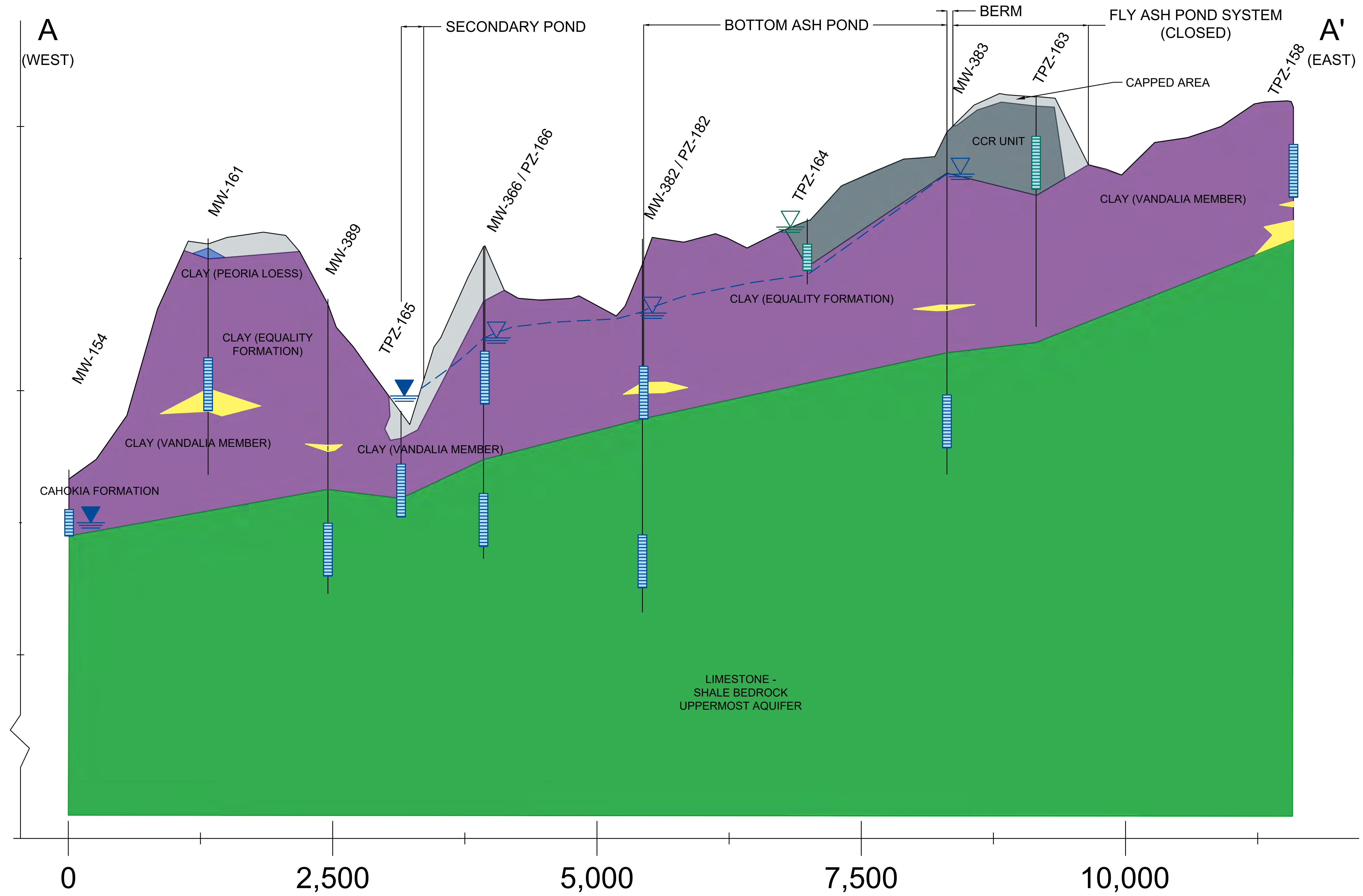
CROSS SECTION LOCATION MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, 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 50X.
4. Groundwater elevations measured on September 15, 2020.

PROJECT: 1940100806 DATED: 10/13/2021

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
- UPPERMOST AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)

20'
0
1,000'

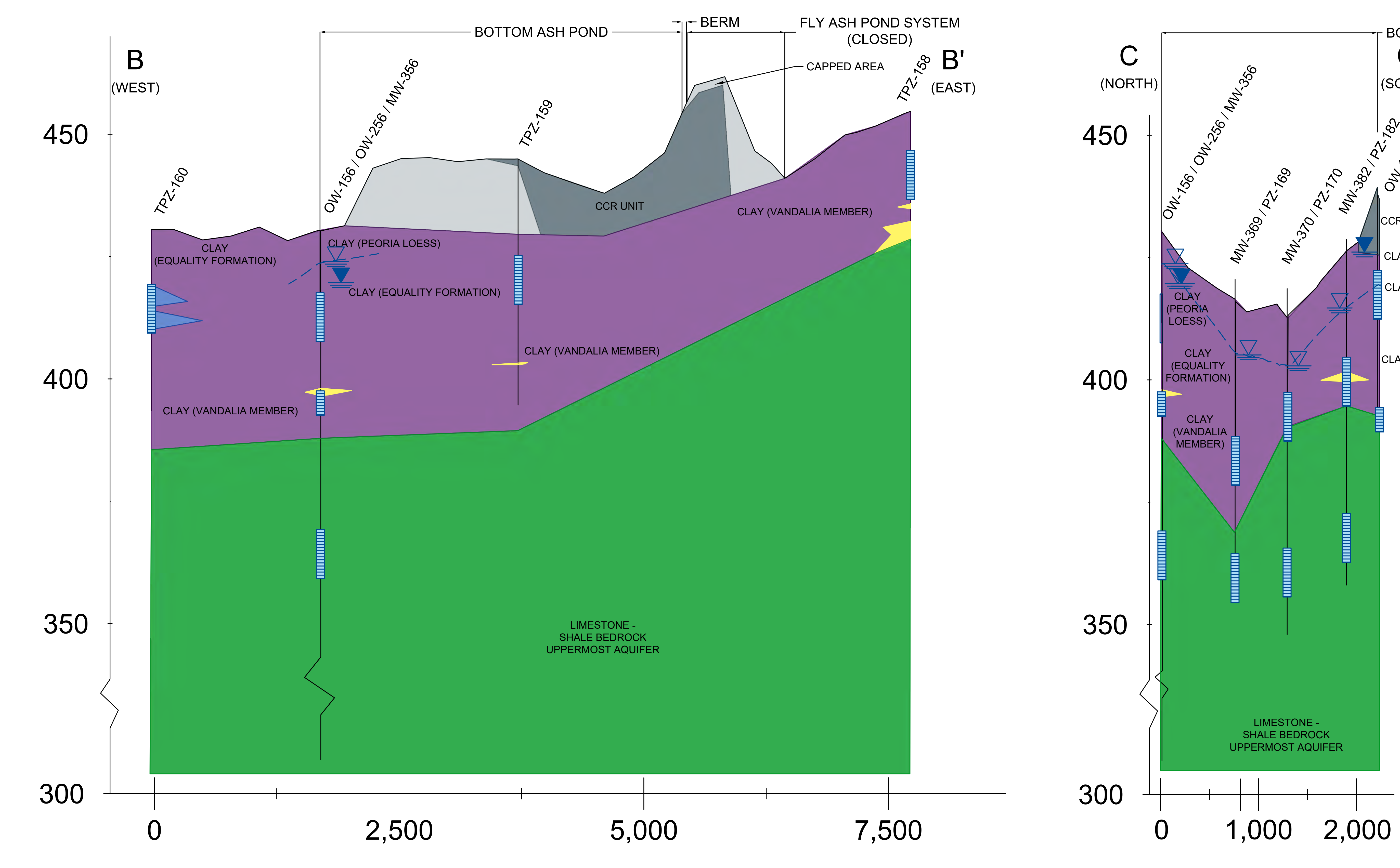
CROSS SECTIONS A-A'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILINOIS

FIGURE 2-7

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL



NOTES

1. These profiles were 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 50X.
4. Groundwater elevations measured on September 15, 2020.

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
- UPPERMOST AQUIFER GROUNDWATER ELEVATION
- OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)

20'
0
1,000'

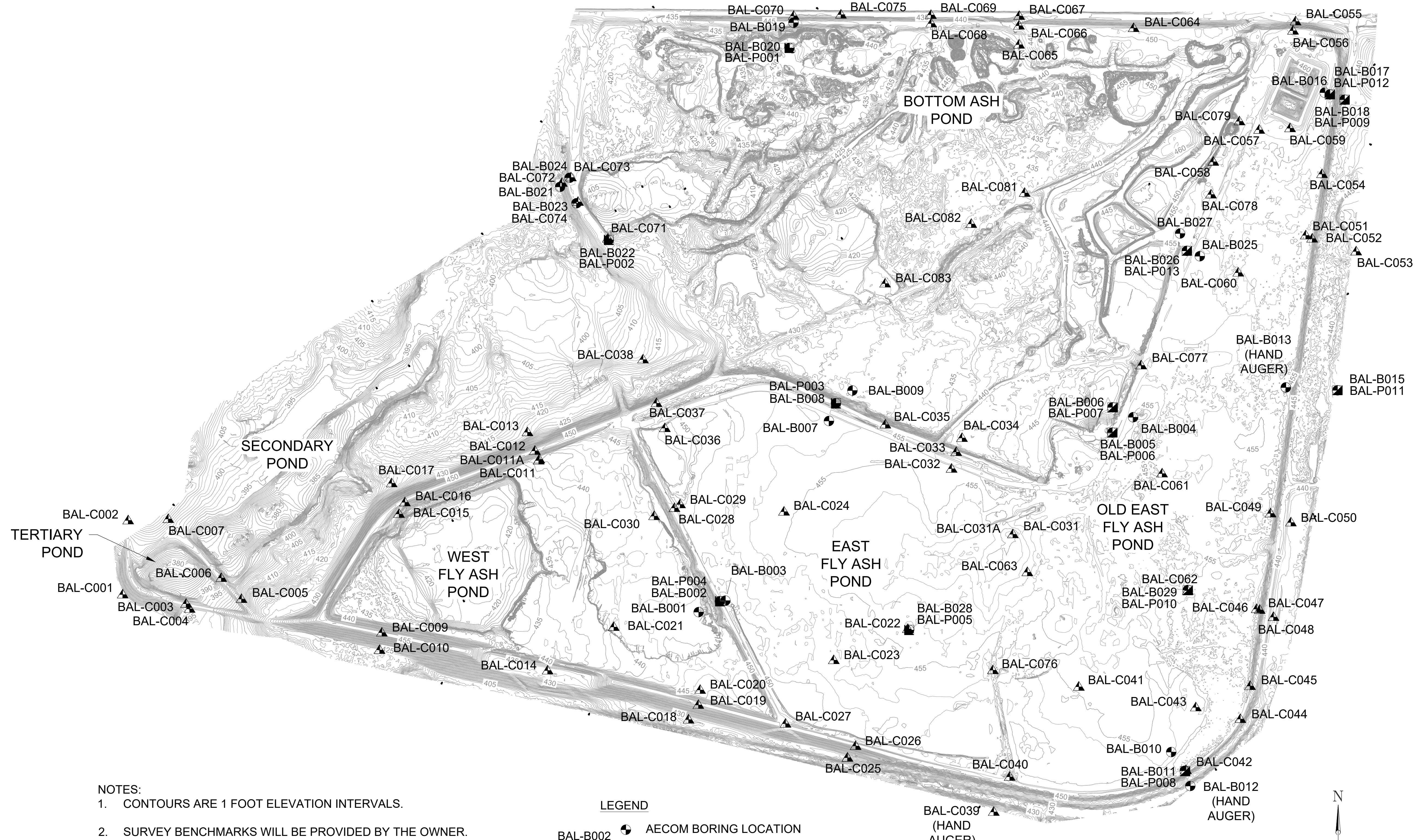
CROSS SECTIONS B-B' AND C-C'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILINNOIS

FIGURE 2-8

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



NOTES:

1. CONTOURS ARE 1 FOOT ELEVATION INTERVALS.
2. SURVEY BENCHMARKS WILL BE PROVIDED BY THE OWNER.
3. EXISTING CONTOURS SHOWN ARE FROM AERIAL SURVEY COMPLETED BY SURDEX ON AUGUST 17, 2015 AND BATHYMETRIC SURVEY COMPLETED BY WEAVER CONSULTANTS GROUP ON SEPTEMBER 22, 2015.

LEGEND

BAL-B002	AECOM BORING LOCATION
BAL-P004	AECOM PIEZOMETER LOCATION
BAL-C021	AECOM CONE PENETRATION TEST (CPT) LOCATION

AECOM
1001 Highlands Plaza Drive, Suite 300
St. Louis, Mo. 63110
314 429-0100 (phone)
314-429-0462 (fax)

DYNEGY
Dynegy Inc.
1500 EastPort Plaza Drive
Collinsville, IL 62234

CCR RULE ASSESSMENT OF PLANTS

BALDWIN POWER PLANT
BALDWIN, IL

30% DESIGN DRAWINGS FOR CLOSURE OF EAST ASH POND, OLD EAST ASH POND, AND WEST ASH POND

ISSUED FOR BIDDING DATE BY

ISSUED FOR CONSTRUCTION DATE BY

REVISIONS

NO.	DESCRIPTION	DATE
△		
△		
△		
△		
△		

AECOM PROJECT NO:	60440742
DRAWN BY:	DJD
DESIGNED BY:	DJD
CHECKED BY:	SAV
DATE CREATED:	2015-10-13
PLOT DATE:	2015-10-13
SCALE:	1" = 300'
ACAD VER:	2014

SHEET TITLE

EXPLORATION LOCATIONS

D-01

SHEET 1 OF 3

DEGUIRE, DAVID, 12/16/2015 10:15 AM

AECOM DRAWING PATH: P:\Projects\Geotech\60428794_DynegyCCR\04Tasks\00 Program Tasks\01_Templates\CADD\DYNEGY CAD STANDARDS\7.04_Plan_Sheets\D-01 EXPLORATION LOCATIONS.dwg

Project:	DYNEGY CCR RULE ASSESSMENT OF PLANTS
Project Location:	BALDWIN ENERGY COMPLEX BALDWIN, ILLINOIS
Project Number:	60428794

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
		Gravelly CLAY	CL
HIGH PLASTIC CLAYS		Organic CLAY	OH
		Inorganic high plastic CLAY	CH
		Sandy Inorganic high plastic CLAY	CH
ROCKS		LIMESTONE	
		SHALE	
SURFACE MATERIALS		Asphalt, Pavement	
		CONCRETE	
		Topsoil	
		Fly Ash	
		Fly Ash/Coal	

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 blows 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 blows per foot	Estimated undrained shear strength (ksf)	Hand Test
Very soft	0–2	< 0.25	Extrudes between fingers
Soft	2–4	0.25–0.5	Molded by slight 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	(% Pass #200 Sieve)		
Sa (%)	Sieve Analysis (% Passing #200)		

File: P:\RESOURCES\GINTDATA\GINT\GEOTECHNICAL\BORING KEY LOGS\DYNEGY GEO KEY.DWG Last edited: NOV. 13, 15 @ 3:50 p.m. by: david_deguire

AECOM

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B001

Date(s) Drilled	08/06/2015 11:15 AM to 08/07/2015 11:20 AM	Logged By	Jennifer Allen	Checked By	Stefanie Voss
Drilling Method	Hollow Stem Auger/Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	102.0 ft
Drill Rig Type	CME75	Drilling Contractor	Strata Earth	Surface Elevation	444.49 ft (NAVD88)
Borehole Backfill	Bentonite Grout	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 554704 E 2382498 (ft NAD83)	Groundwater Level(s)	3 ft on 8/6/2015	Not Encountered	

Elevation (feet)	Depth (feet)	Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	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
444.5	0		S-1	5 5 5	100	444.5 / 0.0: Medium stiff, moist, brown, low plasticity SILT (ML), some fine sand. [FILL/FLY ASH]					0.5 0.5 0.0			
442.0	2.5		S-2	2 2 16	56	442.0 / 2.5: Medium dense, wet, brown, Silty Sand (SM), with gravel, coarse, subrounded. [FILL/FLY ASH] ▽								
440	5		S-3	4 6 11	78	Becomes black, Silty, gravelly, fine subrounded gravel, some fine sand.								*5.0': Groundwater encountered.*
			S-4	1 1 1	100	Increased silt.								*7.5': SA (- #200) = 31.5%.*
435 / 434.5	10		S-5	10 2 2	78	434.5 / 10.0: Very loose, soft, wet, dark gray, Sandy, SILT (ML), fine sand, 1" layers of clean silt. [FILL/FLY ASH]					0.0 0.0 0.0			
430	15		S-6	WH WH WH	100	Becomes dark brown, with lenses of silty clay, no fly ash.					0.0 0.0 0.0			
425	20		S-7	WH WH WH	100						0.0 0.0 0.0			
420	25		S-8	WH WH WH	100						0.0 0.0 0.0			
415	30													

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Material Description	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	Remarks
414.0	30.5		S-1	P	100	Medium stiff, moist, pale gray with orange mottling, medium plasticity Lean CLAY (CL), trace fine gravel. [TILL]					1.5			
	35		S-2	P	75		23.8 23.2 22.4	126.6 125.6 128.4	63	48	2.0		1.6	
	40		S-9	3 4 5	100	Becomes stiff.								
	45		S-10	5 7 14	100	Becomes very stiff, orangish tan.					1.5 2 3			
396.5	48.0					Very stiff, moist, orangish tan, low plasticity Silty CLAY (CL). [RESIDUAL]								*48.0': Driller noted harder drilling.*
	50		S-11	27 31 42	67	51.0' - 51.2': Limestone gravel.					>4.5			
	55		S-12	15 27 50/5"	100	Becomes bluish gray.					>4.5			
	60		S-13	17 29 47	100						>4.5			
	65													

Elevation scale: 410, 405, 400, 395, 390, 385, 380

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
			S-14	24 36 49	100		Very stiff, moist, orangish tan, low plasticity Silty CLAY (CL). [RESIDUAL]					>4.5			
375	70		S-15	50/6"	100							>4.5			
370	75		S-16	100/6"	100										
365	80		S-17	100/6"	100										
360	85			100/2"											
355	90						354.5 / 90.0 LIMESTONE: Pale gray, moderately weathered, moderately bedded, strong, with very thin interbeds SHALE, (breaks horizontally along shale).								*90.0': Driller noted rock. Limestone in cuttings, drilled to 92' to confirm solid rock before switching to coring. Switch to coring utilizing a 10' long, 2 7/8" ID NV core barrel.*
350	95		C-1	92	100		96.3': 1/4" thick shale seam.								
345	100														

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
			C-1	92	100		LIMESTONE: Pale gray, moderately weathered, moderately bedded, moderately strong. (Elevation 342.5, Depth 102.0)								
							End of Boring at 102 ft								
340	105														
335	110														
330	115														
325	120														
320	125														
315	130														
310	135														

Project: Dynegy CCR Rule Assessment of Plants	**Log of Boring BAL-B002**
Project Location: Baldwin, Illinois	Sheet 1 of 3
Project Number: 60428794	

Date(s) Drilled	08/07/2015 12:00 AM to 08/08/2015 10:12 AM	Logged By	Jennifer Allen	Checked By	Stefanie Voss
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	76.0 ft
Drill Rig Type	CME75	Drilling Contractor	Strata Earth	Surface Elevation	454.70 ft (NAVD88)
Borehole Backfill	Bentonite Grout	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 554766 E 2382620 (ft NAD83)	Groundwater Level(s)	Not Encountered	Not Encountered	

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
454.7	0.0													
454.2	0.5	S-1	2 3 4	67		Loose, dry, brown, fine, Silty SAND (SM), with gravel. [FILL]					2.5			
						Medium stiff, moist, brown, low plasticity Silty CLAY (CL), trace fine gravel and orange staining. [FILL]								
		S-2	2 3 4	44							4.0			
450	5	S-3	2 3 5	100			19.1		36	17	1.0 1.5 2.0			
447.2	7.5	ST-1	P	69		Medium stiff, moist, brown, high plasticity CLAY (CH). [FILL]	25.9	120.1	54	38	2.5		1.0	
444.7	10.0	S-4	2 2 2	66		Soft, moist, brown with gray mottling, low plasticity Silty CLAY (CL). [FILL]					1.5 1.0			
440	15	ST-2	P	29			21.8	123.3 130.3	46	32	1.0		0.7	
435	20	S-5	0 0 2	83		Becomes very soft, gray with orange mottling. 21.0' - 21.1': Coal fragments.					0 0 0.5			
429.7	25.0	S-6	WH WH WH	75		Very soft, wet, dark gray, SILT (ML). [FILL/FLY ASH]					0 0 0			
		ST-3	P	100			34.8 26.4 32.1 25.5	111.5 118.5 114.9 113.5 122.0	21	NP	0		1.3 2.9 10.1	*ST-3 Collected using a LUCAS adapter due to saturated soils.*
425	30													

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
	30		S7	WH WH WH	28		Very soft, wet, dark gray, SILT (ML). [FILL/FLY ASH]								*S-7 low recovery due to saturated soils falling out of sampler.*
420	35		S-8	WH WH WH	67		35.0' - 36.5': Brown Silt and gray fly ash, alternating layers.					0 0			
415	40		S-9	WH WH WH	100		Becomes a Silt and fly ash mixture, dark brownish gray.	38.6				0 0 0			*SA (- #200)=94.3%.*
410	45		S-10	WH WH WH	100							0 0.5 0 0			
405	50		S-11	WH WH WH	100		Becomes gray.					0 0.5 0.5 0			
400	55		S-12	2 6 9	100		399.7 / 55.0 Very stiff, moist, gray with orange mottling, low plasticity Silty CLAY (CL). [RESIDUAL]	24.0		42	19	1.0 3.5 3.0			*57.5': Driller noted harder drilling conditions.*
395	60		S-13	7 10 12	100		60.5' - 61.0': Moist, black, clay SHALE.					3.5 2.0 3.0			
390	65														

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
				100/3"			Crushed limestone in shoe.								*65.2' - 65.6': Possible limestone cobble.*
385	70		S-14	39 50/3"	100		384.7 / 70.0 SHALE: Pale bluish gray, moderately weathered, very weak, clayey.								
380	75		S-15	36 50/5"	100		378.7 / 76.0	17.4		45	21				
							End of Boring at 76 ft								
375	80														
370	85														
365	90														
360	95														
355	100														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B003

Date(s) Drilled	08/05/2015 2:30 PM to 08/06/2015 10:45 AM	Logged By	Betty Tesfu	Checked By	Stefanie Voss
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	79.0 ft
Drill Rig Type	D-120 ATV	Drilling Contractor	Strata Earth	Surface Elevation	452.18 ft (NAVD88)
Borehole Backfill	Tremie Grout	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 554770 E 2382651 (ft NAD83)	Groundwater Level(s)	0.5 ft on 8/6/2015		Not Encountered

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
452.2	0.0	S-1	2 2 2	78	Very loose, moist to wet, whitish gray to dark gray, very fine SAND, with silt (SP-SM). [FILL/FLY ASH] (groundwater ▽ at 0.5 ft)								S-1A: Whitish gray fine sand with silt. S-1B: Dark gray, sand and fly ash with silt (bottom 10"). S-2A: Brown silt, with fine sand. S-2B: Light brown (bottom). ST-1: Top - silt, Bottom - silty clay.
449.7	2.5	S-2	2 3 1	100	Soft, wet, light brown and gray, SILT (ML), with fine sand. [FILL/FLY ASH]					0.75 1.5 1.25			
		ST-1	P	100									
447.2	5.0				Stiff, wet, brown and gray, Silty CLAY (CL), iron staining, traces of coal and bottom ash. [FILL/FLY ASH]								
		S-3	3 5 7	100						2.0 1.0 0.5			
	10	S-4	1 2 3	61	100': Medium stiff, with fine gravel	22.3		39	22	0.75 2.25 1.0			Switch to mud rotary drilling 4" OD.
437.2	15.0	ST-2	P	81	Medium stiff, wet, brown and gray, CLAY (CH). [FILL/FLY ASH]	24.7	125.3 124.8	58	43			0.8	Shelby tube bent.
432.2	20.0	S-5	1 2 2	89	Soft, wet, gray and whitish brown, Clayey SILT (ML). [FILL/FLY ASH]					0.5 2.0 2.0			
	25	ST-3	P	100	Becomes brown, with fine sand.								
	30												

Elevation scale: 450, 445, 440, 435, 430, 425

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	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		S-6	WH WH WH	89	Becomes very soft, brown.								SA(- #200)=97%.
420														
	35		S-7	1 WH 2	89	With very fine sand.								
415														
	40		S-8	WH WH WH	94									
410														
	45		S-9	WH WH WH	100									
405														47.0': Stratum change, becomes stiffer.
404.2	48.0					Stiff, wet, brown and gray, Silty CLAY (CL), trace gravel. [RESIDUAL]								
	50		S-10	3 5 5	100		19.3		39	22	1.5 1.25 0.75			
400														
	55		S-11	13 17 26	78	Becomes hard.								
395														
392.2	60.0		S-12	7 13 17	100	Hard, wet, orange brown with gray spots, SILT (ML). [RESIDUAL]								
390														
387.2	65.0													

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
			S-13	15 24 26	89		Hard, moist to wet, gray, SILT (ML), transition between silt and shale. [RESIDUAL].	21.6		57	27				
385															
382.2	70		S-14	33 53 50/4"			SHALE: Gray, highly to moderately weathered, very weak.								*70.0' - 79.0': Hard drilling.*
380															
	75														*75.0': Solid rock.*
375			S-15	100/2"											
372.2	80						End of Boring at 79 ft								
370															
	85														
365															
	90														
360															
	95														
355															
	100														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B004

Date(s) Drilled	08/06/2015 2:40 PM to 08/07/2015 9:05 AM	Logged By	Betty Tesfu	Checked By	Stefanie Voss
Drilling Method	4" SSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	49.0 ft
Drill Rig Type	D-120 ATV	Drilling Contractor	Strata Earth	Surface Elevation	454.95 ft (NAVD88)
Borehole Backfill	Tremie Grout	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 555520 E 2384986 (ft NAD83)	Groundwater Level(s)	Not Encountered	Not Encountered	

Elevation (feet)	Depth (feet)	Samples: Type	Samples: Number	Samples: Sampling Resist. OR Core RQD (%)	Samples: Recovery (%)	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
455.0	0.0	Split Spoon	1	1 2 4	100	Loose, dry to moist, and black coal, fine SAND (SP-SM), with silt. [FILL/FLY ASH]								
		Split Spoon	2	3 3 4	56	Becomes moist.	10.3							*SA (-#200) = 5.4%. 2.5': Sample wet.*
450	5	Split Spoon	3	1 1 1	33	Becomes very loose, wet, very fine.								
447.5	7.5	Split Spoon	4	WH WH WH	100	Very soft, moist, brown, SILT (ML), with fine sand, trace fine coal and bottom ash. [FILL/FLY ASH]								
445	10	Shelby Tube	1		0									
444.0	11.0	Split Spoon	5	1 WH 1	33	Very loose, wet, FLY ASH and COAL, with silt and very fine sand. [FILL/FLY ASH]								*12.5': Driller noted hard drilling.*
440.0	15.0	Split Spoon	6	WH 8 1	72	Very soft, wet, brown, SILT (ML), with fine sand. [FILL/FLY ASH]					0.0 0.0 0.0			
435	20	Split Spoon	7	WH WH WH	100						0.0 0.0 0.0			
430	25	Shelby Tube	2	P	85		37.1 23.6 29.9	115.8 127.0 119.2 118.1	47	33	1.0 0.5 0.75		1.4 1.4 1.8	
425	30													

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
	30		8	2 2 3	94		Becomes gray, clayey silt, with iron staining.	31.4		37	19	0.75 0.5 0.25			
420	35		9	4 5 8	100		420.0 / 35.0 Stiff, wet, gray and orangish brown, Silty CLAY (CL), trace gravel and iron staining. [RESIDUAL]	19.4		38	23	3.0 2.5 2.75			
415	40		10	4 5 8	100							0.25 0.5 0.5			
410	45		11	50/4"	100		410.0 / 45.0 SHALE: Brown and gray, highly weathered, very weak, with silt.					4.5 4.0			*45.0': Driller noted hard drilling.* *46.0'-49.0': Grinding in augers.*
							406.0 / 49.0 End of Boring at 49 ft								*49': Mud rotary refusal.*
405	50														
400	55														
395	60														
390	65														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B005

Date(s) Drilled	08/21/2015 3:30 PM to 08/20/2015 8:30 AM	Logged By	Blaine Higbee/Betty Tesfu	Checked By	Stefanie Voss
Drilling Method	4" SSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	60.4 ft
Drill Rig Type	D-120 ATV	Drilling Contractor	Strata Earth	Surface Elevation	457.00 ft (NAVD88)
Borehole Backfill	Piezometer P006	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 555732 E 2384867 (ft NAD83)	Groundwater Level(s)	11 ft on 8/19/2015	Not Encountered	

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
457.0	0						457.0 / 0.0								
456.5		Split spoon	1	8 12 12	94		Black to brown CLAY (CL). 0.5								
							Stiff, dry to moist, black to brown, high plasticity CLAY (CH). [FILL/FLY ASH]								
455		Split spoon	2	2 3 5	67		Becomes medium stiff, brown, moist.					4.5			
	5	Shelby tube	1	P	71			22.0	108.7 126.5	60	43	>4.5		1.9	
450		Split spoon	3	2 3 5	75		Becomes gray, medium plasticity.	26.2				3.5			
	10	Shelby tube	2	P	58		Becomes moist to wet. ▽	24.8	123.7 115.1	60	44	2.5		1.4	*10.0': Switch to mud rotary.*
445															
442.0	15						442.0 / 15.0								
		Split spoon	4	2 5 5	100		Stiff, wet, gray, low plasticity CLAY (CL). [FILL/FLY ASH]					4.0			
440															
	20	Split spoon	5	3 3 4	100		Becomes medium stiff, dark gray, medium plasticity.					2.5			
435															
	25	Split spoon	6	3 3 4	100		Becomes brown.					1.5			
430															
	30														

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
	30		7	2 4 5	100		Becomes stiff, low plasticity	21.2		36	22	3.0			
425															
	35		8	4 6 6	100		Becomes gray to brown, low plasticity with gravel.					3.0			0.0'-35.0': Logger, B. Higbee. 35.0'-60.4': Logger, B. Tesfu.
420															
	40		9	9 18 16	100		417.0 / 40.0 Hard, wet, brown, sandy to silty CLAY (CL), trace gravel [RESIDUAL].					3.0 3.0 3.75			
415															
	45		10A 10B	9 22 50/1.5"			412.0 / 45.0 Hard, wet, gray to orangish brown, Clayey SILT (ML) to Sandy SILT (ML), trace gravel, crushed rock at the bottom [RESIDUAL].					4.25 3.75 2.75			45.0': Driller noted strata change. S-10A: gray clayey silt. S-10B: orangish brown clayey to sandy silt. 46.0'-49.5': Looks like rock based on drilling.
410															
	50		11	18 24 36	100		Becomes gray and traces of orangish brown, non plasticity completely weathered shale, .	22.0							
405															
	55		12	23 36 59	100		402.0 / 55.0 SHALE: Gray, highly weathered, soft, very weak.	16.6		44	19				
400															
	60		13	72/5"			396.6 / 60.4 End of Boring at 60.4 ft								
395															
	65														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B006

Date(s) Drilled	08/20/2015 10:35 AM to 08/31/2015 5:15 PM	Logged By	Betty Tesfu	Checked By	Stefanie Voss
Drilling Method	4" SSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	50.1 ft
Drill Rig Type	D-120 ATV	Drilling Contractor	Strata Earth	Surface Elevation	443.32 ft (NAVD88)
Borehole Backfill	Piezometer	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 555876 E 2384868 (ft NAD83)	Groundwater Level(s)	Not Encountered	Not Encountered	

Elevation (feet)	Depth (feet)	Sample Type	Sample 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
443.3	0.0	Split spoon	S-1	WOH 3 4	72	FILL/FLY ASH	Loose, moist, dark gray, Bottom ASH, trace brown, fine sand. [FILL/FLY ASH]								*SA (-#200) = 20.9%.*
440		Split spoon	S-2	2 5 3	78		Becomes FLY ASH and Bottom ASH, with layer of silt, trace sand and gravel. [FILL/FLY ASH]								*Sample is wet. SA (-#200) = 44.4%.*
	5	Split spoon	S-3	2 2 3	89		Trace coal, gravel, and sand.								*SA (-#200) = 18.5%.*
435		Split spoon	S-4	1 0 1	83		Becomes loose, layer of coal.								*SA (-#200) = 12.8%.*
	10	Split spoon	S-5	7 23 16	100		Becomes dense, with layer of coal, clayey.					2.5 1.0 1.75			*SA (-#200) = 53.4%. 10.0': Start mud rotary.*
430															*13': Clay layer started, based on drilling.*
428.3	15.0	Shelby tube	ST-1	P	92	TILL	Medium stiff, wet, brown, Lean CLAY (CL), with fine sand and silt. [TILL]	17.9	135.0			2.0 1.75 4.25		1.7	
425		Split spoon	S-6	6 6 6	100		Becomes gray and orangish brown, silty, trace gravel and sand.					1.0 1.5 2.0			
	20	Split spoon	S-7	3 3 3	94		Trace coal.					1.75 2.25 1.75			
420															
	25	Split spoon	S-8	3 3 3	100		Orangish brown, with black and gray, mottling, with sand, trace gravel.	20.0		32	18	1.75 1.5 1.25			
415															
	30														

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
	30		ST-1	P	92		Very stiff, wet, brown with gray, Silty CLAY (CL). [RESIDUAL]	13.4 13.0 13.3 14.0	138.3 135.3 134.8 137.0	29	14 8			6.1 7.2 5.0	*Stopped drilling, hydraulics not operating.*
410															
	35		S-9	50/0.5"	100		Becomes brown, trace sand and fine gravel.								
405															
403.3	40.0		S-10	19 25 23	100		SHALE: Gray, highly weathered, very weak.								
400															
	45		S-11	39 43 70	100		Weak to moderately weak.	19.1		56	33				
395															
393.3	50.0		S-12	50/1"	100		Fragments of gravel. End of Boring at 50.1 ft								
390															
	55														
385															
	60														
380															
	65														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B007

Date(s) Drilled	08/05/2015 1:02 PM to 08/06/2015 10:20 AM	Logged By	Jennifer Allen	Checked By	Stefanie Voss
Drilling Method	4" HSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	71.5 ft
Drill Rig Type	CME 75	Drilling Contractor	Strata Earth	Surface Elevation	453.02 ft (NAVD88)
Borehole Backfill	Piezometer	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 555798 E 2383244 (ft NAD83)	Groundwater Level(s)	3.0 ft on 8/5/2015	Not Encountered	

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
453.0	0.0		1	1 3 1	100		Very soft, moist, brownish gray, SILT (ML), interlayered fly ash. [FILL/FLY ASH]					0.0 0.0 1.0			
450			2	2 1 1	67		With fly ash. ∇					1.0 1.0 1.0			*3.0': Groundwater encountered.*
	5		3	1 2 3	100		Becomes pale brownish gray, no fly ash.	65.4		NP	NP	0.5 1.0 1.0			*Attempted to collect a Shelby Tube 5'-7.5'. Shelby Tube sampler lost in borehole. Unable to retrieve sampler pushed into side of borehole.*
445			4	0 0 1	67		8.0' - 9.0': Becomes dark gray to black, saturated, with fly ash, some medium sand.					0.0 0.0 0.0			*Switched to mud rotary.*
	10		5	0 0 0	67		11.0' - 11.5': Sandy, fine.					0.0 0.0 0.0			
440			6	0 0 0	100		13.2': Becomes brown, moist, no fly ash.					0.0 0.0 0.0			
435	15		7	0 0 1	83							0.0 0.0 0.0			
	20		8	0 0 1	89		21.3': - 21.5': Fly ash.								*Set 20' of 4" casing.*
430	25		9	8 1 1	67		25.0': Saturated, fly ash.								
425															
423.0	30.0														

AECOM

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Material Description	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	Remarks
	30		1	P	100	Medium stiff, wet, pale orangish tan, Silty CLAY (CL). [LOESS]	25.0 25.8 22.8 26.0	123.0 125.8 126.6 123.0 125.8	48	31	1.5		2.2 2.9 2.5	
420														
	35		2	P	100	Becomes mottled with pale gray.					2.5			
415														
	40		10	1 2 7	100	40': Stiff. 40.5' - 41.5': Some black staining and fine sand.					1.5 2.0 2.5			
410														
408.0	45.0		11	3 6 5	100	Stiff, wet, pale orangish tan with pale gray mottling, low to medium plasticity CLAY (CL). [TILL]					1.5 1.0 1.5			
405														
403.0	50.0		12	10 50	67	Medium dense, wet, orangish tan, fine to medium grained SAND (SP). [TILL]								*Coarse gravel stuck in drill shoe.* *52.0'-54.0': Driller noted possible coarse gravel.*
400														
398.0	55.0		13	24 26 36	100	Hard, moist, blueish gray, low plasticity SILT (ML), laminated in places. [RESIDUAL]								
395														
393.0	60.0		14	45 50/4"		SHALE: Dark gray, highly weathered, weak.								
390														
	65													

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
			15	36 38 50	100		SHALE: Dark gray, moist, highly weathered, weak.								
385															
	70		16	17 34 31	100										
381.5	71.5						End of Boring at 71.5 ft								
380															
	75														
375															
	80														
370															
	85														
365															
	90														
360															
	95														
355															
	100														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B008

Date(s) Drilled	08/12/2015 8:34 AM to 08/12/2015 1:05 PM	Logged By	Jennifer Allen	Checked By	Stefanie Voss
Drilling Method	4" HSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	65.9 ft
Drill Rig Type	CME 75	Drilling Contractor	Strata Earth	Surface Elevation	454.68 ft (NAVD88)
Borehole Backfill	Bentonite Grout	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 555900 E 2383284 (ft NAD83)	Groundwater Level(s)	Not Encountered	Not Encountered	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	Material Description (Elevation / Depth, feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	Remarks
454.7	0						454.7 / 0.0								
454.4	0.3	Split spoon	1	12, 12, 6	44		Road Gravel and Sand. (454.4 / 0.3)								
							Very stiff, moist, light brown with orange and gray mottling, low plasticity Silty CLAY (CL). [FILL/FLY ASH]								
		Split spoon	2	1, 3, 6	67							3.0, 2.0			
450	5	Split spoon	3	3, 5, 7	100			21.6		48	27	2.0, 2.5, 3.0			
		Split spoon	4	2, 5, 7	100							2.5, 2.5, 3.0			
445	10	Shelby tube	1	P	54			23.1	127.5	65	48	4.0			
440	15	Split spoon	5	2, 5, 8	100		Becomes gray.					1.0, 2.5, 2.0			
435	20	Shelby tube	2	P	50		434.7 / 20.0 Medium stiff, moist, gray, high plasticity CLAY (CH). [FILL/FLY ASH]	23.4, 22.5	125.7, 119.5	58	18	3.0		0.4	
430	25	Split spoon	6	4, 7, 9	100		Faint orange mottling.					1.0, 3.0, 2.0			
425	30						424.7 / 30.0								

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
	30		7	1 2 3	100		Medium stiff, moist, gray, with orange mottling, Silty CLAY (CL). [LOESS]	26.2		38	21	0.5 0.5 0.5			
420	35		8	2 4 4	100							2.0 3.0 3.0			
415	40		9	3 4 7	100		Becomes very stiff.					2.5 2.5 2.5			
410	45		10	3 4 5	100							2.0 2.5 3.0			
405	50		11 12	8 8 9	100							3.0			
	51.0						403.7 — 51.0 Loose, wet, gray, 70% fine 20% medium 10% coarse grained SAND (SP), trace fine rounded gravel. [TILL]								*51.5-55.5: Driller noted possible gravel* *52.5': Piezometer set.*
400	55		X	100/2"	100										*Limestone gravel in shoe.* *55.5': Driller noted strata change.*
395	60		13	22 45 50/4"			394.7 — 60.0 SHALE: Gray, clayey, highly weathered, very weak.	17.8		42	17				
390	65														

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
388.8	65.9		14	48 55/5"	92		SHALE: Gray, highly weathered, soft, weak.								
							End of Boring at 65.9 ft								

Elevation scale: 385, 380, 375, 370, 365, 360, 355
Depth scale: 70, 75, 80, 85, 90, 95, 100

Date(s) Drilled	08/13/2015 1:45 PM to 08/13/2015 12:00 AM	Logged By	Betty Tesfu	Checked By	Stefanie Voss
Drilling Method	4" SSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	41.5 ft
Drill Rig Type	D-120 ATV	Drilling Contractor	Strata Earth	Surface Elevation	432.03 ft (NAVD88)
Borehole Backfill	Tremie Grout with 4" Casing	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 555973 E 2383378 (ft NAD83)	Groundwater Level(s)	1.0 ft on 8/13/2015	Not Encountered	

Elevation (feet)	Depth (feet)	Sample Type	Sample 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
432.0	0.0	Split spoon	1	1 WH 1	72	Fill/Fly ash	Very soft, moist to wet, black to dark gray, FLY ASH and coal, with trace silt and sand [FILL/FLY ASH]. ▽					0.0 0.0 0.0			1.0': Sample wet.
430		Split spoon	2	0 0 1	27		Becomes wet.								S-2: 1 blow pushed to 2.5'.
427.0	5.0	Split spoon	3	0 0 1	39		Very soft, wet, gray and reddish brown, silty, Lean, CLAY (CL), trace organics and gravel. [FILL/FLY ASH					1.0 1.0 0.75			
425		Shelby tube	1	P	0										ST-1: No recovery.
		Split spoon	4	P	54		With organics, fly ash and bottom ash.								S-4: 8.5'-10.5': Push SPT as sample is disturbed.
	10	Shelby tube	2	P	100		Stiff, trace fine sand.	25.2 26.3 26.3	124.9 122.5 124.1 123.6	40	21	1.75 1.25 1.0		1.8 1.6 2.1	10.5': Switched to mud rotary.
	15	Split spoon	5	2 4 4	100		Becomes medium stiff, reddish brown and trace gray, trace fine sand, coal, and gravel.					2.0 2.25 3.25			
	20	Split spoon	6	2 4 4	100		Becomes gray and reddish brown, trace gravel.					1.5 1.75 3.0			
407.0	25.0	Shelby tube	3	600 psi	79	Clay	Medium stiff, wet, gray, Silty CLAY (CL). [TILL]	22.1	125.9	49	35			0.7	
406.0	26.0					Silty sand	Loose, wet, yellowish brown, Silty fine to coarse SAND (SM), trace gravel. [TILL]		113.6						26': Strata changes.
402.0	30.0														

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
	30		7	50/4"	100		Very dense, wet, brown, fine to coarse GRAVEL (SP), trace silt. [TILL]								
400															
397.0	35		8	9 15 15	72		SHALE: Gray, dry to moist, completely highly to weathered, very weak.	23.2		49	24				
395															
	40		9	25 45/5"	100										*40.0': Hammer broke while retrieving SPT. S-9: Sample can easily be crushed by fingers.*
390.5	41.5						End of Boring at 41.5 ft								
390															
	45														
385															
	50														
380															
	55														
375															
	60														
370															
	65														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B010

Date(s) Drilled	08/07/2015 10:45 AM to 08/07/2015 2:00 PM	Logged By	Betty Tesfu	Checked By	Stefanie Voss
Drilling Method	4" SSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	60.0 ft
Drill Rig Type	D-120 ATV	Drilling Contractor	Strata Earth	Surface Elevation	454.78 ft (NAVD88)
Borehole Backfill	Tremie Grout	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 553903 E 2385204 (ft NAD83)	Groundwater Level(s)	1.0 ft on 8/7/2015 Not Encountered		

Elevation (feet)	Depth (feet)	Samples: Type	Samples: 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
454.8	0	Split spoon	1	27 22 14	100	Fill/fly ash	454.8 / 0.0 Dense, moist to wet, dark gray, gravelly, clayey, fine to coarse SAND (SC-SM), trace coal. [FILL/FLY ASH] ▽					0.0			1.0': Sample wet.
		Split spoon	2	7 8 5	100		Becomes wet.					0.0			SA (-#200) = 28.4%
450	5	Split spoon	3	1 1 WH	100		449.8 / 5.0 Very soft, wet, dark gray, SILT (ML), trace sand, gravel. [FILL/FLY ASH]					0.0			
		Shelby tube	1	P	0										ST-1: No recovery.
445	10	Shelby tube	4	P	100										S-4: Pushed SPT as sample was disturbed.
		Split spoon	5	WH WH WH	33										
440	15	Split spoon	6	WH WH WH	100		15': Clayey.								SA (-#200) = 98.3%
435	20	Shelby tube	2	P	100	Silty clay	434.8 / 20.0 Stiff, moist to wet, gray, Silty CLAY (CL), iron staining, trace sand and clay. [LOESS]	22.2 20.9	123.9 124.2 124.9	42	24	4.0 2.0 3.75		2.0	
430	25	Split spoon	7	5 6 9	100							3.75 4.5 4.0			
425	30														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B010

Elevation (feet)	Depth (feet)	Samples: Type	Samples: 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		8	5 5 6	100		Stiff, wet, orangish brown with gray, Silty CLAY (CL), with sand and gravel. [RESIDUAL]	18.6		30	16	2.5 2.75 3.0			
420	35		9	7 15 26	100		419.8 / 35.0 Hard, wet, gray and orangish brown, Silty CLAY (CL), with sand and gravel.	15.0		22	8	>4.5 >4.5			
															38.5': Becomes stiffer during drilling.
415	40		10	40/1"	50		40.0': - 0.5" size of shale fragments.								
410	45		11	13 27 27	100		Trace completely weathered shale.								
405	50		12	25 45 50/4"	100		404.8 / 50.0 SHALE: Gray, soft, highly weathered, very weak.								
															53.0': Strata changes. *53.0'-60.0': Solid rock.*
400	55														
395	60						394.8 / 60.0 End of Boring at 60 ft								*Mud rotary refusal at 60.0'.* *53.0'-60.0': Filtered sample out of mud rotary. Spoil collected as S-13.*
390	65														

AECOM

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B011

Date(s) Drilled	08/13/2015 9:55 AM to 08/13/2015 1:50 PM	Logged By	Jennifer Allen	Checked By	Stefanie Voss
Drilling Method	4" HSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	52.5 ft
Drill Rig Type	CME 75	Drilling Contractor	Strata Earth	Surface Elevation	455.11 ft (NAVD88)
Borehole Backfill	Bentonite Grout	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 553796 E 2385282 (ft NAD83)	Groundwater Level(s)	Not Encountered	Not Encountered	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
455	0	Split Spoon	1	6 9 7	61	(455.1, 0.0) Very stiff, moist, brown, low plasticity silt, FLY ASH and road gravel. [FILL/FLY ASH] 0.0' - 1.5': Fine coal fragments.					4.0			
		Split Spoon	2	0 1 2	67	Becomes soft, increased moisture.					0.0 1.0			
450	5	Split Spoon	3	1 2 2	67	Becomes pale brownish gray.					1.0 1.0			
		Split Spoon	4	3 3 5	83	(447.6, 7.5) Stiff, moist, gray with orange mottling, low plasticity Silty CLAY (CL). [FILL/FLY ASH]					2.0 2.0 2.0			
445	10	Shelby Tube	5	P	100	Orange mottling becomes faint.					0.0 1.5 4.5			*10.0': Attempted Shelby Tube, no recovery, pushed S-5.*
440	15	Shelby Tube	1	P	100		25.8 24.8 24.9 25.6	122.8 123.3 125.1 122.3 121.3	46	28	2.0		2.5 2.8 1.7	
						(437.6, 17.5) Stiff, moist, gray, Silty CLAY (CL), trace very thin roots. [RESIDUAL]								
435	20	Split Spoon	6	0 3 5	100						0.5 1.0 2.0			*ST-1, ST-2 collected with Lucas Adapter.*
430	25	Shelby Tube	2	P	100						2.0			
	30													*29.0': Pressure grouted to surface.*

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B011

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
425	30		7	2 4 6	100		31.0' - Becomes orange mottling sandy clay					1.0 2.0 2.0			
420	35		8	10 12 16	100		Becomes very stiff, brownish gray, Silty Sandy CLAY (CL), trace fine to coarse well rounded gravel.	8.8		19	8	3.0 4.0 4.0			*36.0': Piezometer set.*
							417.6 / 37.5 LIMESTONE.								*37.5': Driller noted hard strata change. Limestone in cuttings.*
415	40														
			10	29 42 50/5"	100		412.6 / 42.5 SHALE: Pale blueish gray, highly weathered, weak.	18.2		49	25	>4.5			*42.5': Driller noted softer strata change.*
410	45														
405	50														
			X	100/0"			402.6 / 52.5 End of Boring at 52.5 ft								
400	55														
395	60														
	65														

Project: Dynegy CCR Rule Assessment of Plants Project Location: Baldwin, Illinois Project Number: 60428794	**Log of Boring BAL-B012** Sheet 1 of 1

Date(s) Drilled	08/08/2015 12:00 AM to 08/08/2015 12:00 AM	Logged By	Blaine Higbee	Checked By	Stefanie Voss
Drilling Method	Hand Auger	Drill Bit Size/Type	2" O.D Bucket Auger	Borehole Depth	12.0 ft
Drill Rig Type	N/A	Drilling Contractor	N/A	Surface Elevation	~430.0 ft (NAVD88)
Borehole Backfill	Cuttings	Sampling Method(s)	Grab	Hammer Data	N/A
Boring Location	N 553709 E 2385313 (ft NAD83)	Groundwater Level(s)	Not Encountered	Not Encountered	

Elevation (feet)	Depth (feet)	Samples: Type	Samples: Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) ~430.0; Depth (feet) 0.0)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0	X	1				Stiff, brown, Organic CLAY (OH).								
		X	2				1.5 — Very stiff, brown, high plasticity CLAY (CH).								
		X	3					22.0		54	30				
		X	4				Increasing oxidation.								
		X	5												
	5	X	6				5.0 — Gray, medium plasticity CLAY (CL), heavy oxidation, increasing plasticity.								
		X	7				Highly plasticity.	20.7		34	16				
		X	8				Becomes stiff, brown.								
		X	9												
		X	10					21.3							
	10	X	11												
		X	12												
							12.0 — End of Boring at 12 ft								
	15														
	20														
	25														
	30														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B013

Date(s) Drilled	08/10/2015 12:00 AM to 08/10/2015 12:00 AM	Logged By	Blaine Higbee	Checked By	Stefanie Voss
Drilling Method	Hand Auger	Drill Bit Size/Type	2" O.D Bucket Auger	Borehole Depth	1.5 ft
Drill Rig Type	N/A	Drilling Contractor	N/A	Surface Elevation	~455.0 ft (NAVD88)
Borehole Backfill	Cuttings	Sampling Method(s)	Grab	Hammer Data	N/A
Boring Location	N 555990 E 2385860 (ft NAD83)	Groundwater Level(s)	Not Encountered	Not Encountered	

Elevation (feet)	Depth (feet)	SAMPLES Type	SAMPLES Number	SAMPLES Sampling Resist. OR Core RQD (%)	SAMPLES Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) ~455.0 / Depth (feet) 0.0)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0	X	1		100		Brown, medium plasticity CLAY (CL), organic matter with coarse gravel. (1.5)								
							End of Boring at 1.5 ft								*1.5': Refusal.*
	5														
	10														
	15														
	20														
	25														
	30														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B015

Date(s) Drilled	08/17/2015 3:40 PM to 08/18/2015 9:55 AM	Logged By	Betty Tesfu	Checked By	Stefanie Voss
Drilling Method	4" SSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	51.5 ft
Drill Rig Type	D-120 ATV	Drilling Contractor	Strata Earth	Surface Elevation	442.45 ft (NAVD88)
Borehole Backfill	Piezometer P011	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 555974 E 2386156 (ft NAD83)	Groundwater Level(s)	8.0 ft on 8/17/2015 3.0 ft on 8/18/2015	Not Encountered	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	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
442.5	0.0													
442.2	0.3	Split Spoon	1	4 3 3	67	0.0' - 0.25': Topsoil. Medium stiff, dry, brown, Silty CLAY (CL), with fine sand, trace organics and gravel. [TILL]								S-1: Too dry to take Pocket Penetrometer reading.
440		Split Spoon	2	2 1 1	61	Becomes very soft, moist, brown, trace sand and gravel, iron staining. ▼					0.75 1.0 1.0			
	5	Shelby Tube	1	P	96	Becomes stiff, moist, brown and gray, with fine sand.	21.3	129.1	44	27	>4.5		2.3	
435		Split Spoon	3	2 2 4	100	Becomes medium stiff, moist to wet. ▽					2.0 2.0 0.7			8.0': Groundwater encountered.
	10	Split Spoon	4	2 4 4	100						1.75 2.25 1.5			10.0': Switch to mud rotary.
431.0	11.5	Shelby Tube	2	P	100	Medium stiff to stiff, wet, brown and gray, high plasticity CLAY (CH). [TILL]	19.5 20.8 20.8 20.7 21.7	128.6 128.8 129.9	53	39	1.0 2.0 2.5		1.8 1.8 1.9	
430	15	Split Spoon	5	3 3 5	100	Becomes wet, gray and orangish brown, trace gravel and sand.					2.75 3.0 2.75			
425														
422.5	20.0	Split Spoon	6A 6B	3 3 6	100	Stiff, brown, Sandy CLAY (CL), with pockets of clayey fine sand, trace gravel.					2.0 2.5 1.0			S-6A: Sandy clay. S-6B: Pockets of clayey sand at bottom 3".
420														
417.5	25.0	Split Spoon	7	6 9 12	94	Very stiff, wet, gray and orangish brown to brown, Silty CLAY (CL), trace gravel and fine sand [RESIDUAL].	17.1		37	22	3.25 3.0 4.0			
415														
	30													

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B015

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
	30		8	6 11 16	100		Very stiff, moist, gray and orangish brown to brown, Silty CLAY (CL), trace gravel and fine sand. [RESIDUAL]					4.0 4.5 4.0			
410															
	35		9	14 17 22	100		Becomes hard.					3.0 4.5 4.0			
405															
	40		10	17 26 32	100		Becomes gray and brown.					>4.5 >4.5 >4.5			
400															*42.5': Strata change noted.*
397.5	45.0		11	50/1"	100		SHALE: gray, moderately weathered, medium strong.								
395															*47.0': Begin solid rock.*
	50		12	32 37 62	100		Becomes dark gray, highly weathered.	21.7		87	54				
391.0	51.5						End of Boring at 51.5 ft								
390															
	55														
385															
	60														
380															
	65														

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Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B016

Date(s) Drilled	08/04/2015 9:45 AM to 08/04/2015 12:00 PM	Logged By	Betty Tesfu	Checked By	Stefanie Voss
Drilling Method	4" SSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	72.0 ft
Drill Rig Type	D-120 ATV	Drilling Contractor	Strata Earth	Surface Elevation	459.02 ft (NAVD88)
Borehole Backfill	Tremie Grout	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 557678 E 2386083 (ft NAD83)	Groundwater Level(s)	7.0 ft on 8/4/2015	Not Encountered	

Elevation (feet)	Depth (feet)	Samples: Type	Samples: Number	Samples: Sampling Resist. OR Core RQD (%)	Samples: Recovery (%)	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
459.0	0.0													
458.5	0.5	Split spoon	1	5 8 13	50	0.0' - 0.5': Topsoil					>4.5 >4.5			
						Very stiff, dry, reddish brown and brown, Silty Lean CLAY (CL), trace gravel and grass [FILL/FLY ASH].								
456.5	2.5	Split spoon	2	4 3 2	50	Loose, moist, dark gray, Sandy SILT (ML), trace bottom ash [FILL/FLY ASH].					0.0 0.0			
455	5	Shelby tube	1	P	100	Some sand.	15.0 27.6 31.8	128.0 115.4 107.7 114.6	24	2			0.8 2.1 1.9	
						Becomes sandy.								
	7.0 (groundwater)	Split spoon	3A 3B	2 2 2	100	Becomes very loose, wet, silty to sandy.					0.0 0.25 0.75			*7.0': Groundwater encountered. Switched to mud rotary. SA(- #200)=96%*
450	10	Shelby tube	2	50-100 psi	100		62.1	96.8 103.4	-	NP	1.0 1.5 1.0			
445	15	Split spoon	4A 4B	13 11 10	67	Becomes medium dense, sandy.					0.0 0.0 0.0			*S-4A: Silty fly ash. S-4B: Sandy fly ash.*
440	20	Split spoon	5	WH 2 5	100	Becomes loose, with bottom ash.								*SA(- #200)=90%*
434.0	25.0	Split spoon	6	4 4 5	89	Stiff, wet, brown and gray, high plasticity CLAY (CH). [RESIDUAL]					1.75 2.75 3.25			
430	30													

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Material Description	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	Remarks
	30		7	3 3 6	100	Becomes stiff, gray with iron staining.					1.5 1.0 1.0			
425	35		8	3 3 5	100						2.0 1.75 2.7			
420	40		9	2 3 5	100						1.75 1.0 2.25			
415	45		10	8 9 16	100	Becomes very stiff.					4.0 3.25 >4.5			
410														
409.0	50		11	6 9 16	100	50.0 Very stiff, wet, reddish brown, with gray, Silty CLAY (CL). [RESIDUAL]	14.5		30	15				
405														
404.0	55		12	14 18 33	89	55.0 SHALE: Gray, completely to highly weathered, very weak.	10.3		34	20				
400														*57.5': Harder drilling noted.*
	60													*59.0'-62.5': Grinding in augers.*
			13	50/2"	100	Becomes moderately to slightly weathered, weak.								
395	65													

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
			14	30 32 54	100		Becomes greenish gray.								
390.5	68.5						LIMESTONE.								
387.0	72.0						End of Boring at 72 ft								

Elevation scale: 390, 385, 380, 375, 370, 365, 360

Depth scale: 70, 75, 80, 85, 90, 95, 100

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B017

Date(s) Drilled	09/01/2015 12:00 AM to 09/01/2015 12:00 AM	Logged By	Betty Tesfu	Checked By	Stefanie Voss
Drilling Method	4" SSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	60.0 ft
Drill Rig Type	D-120 ATV	Drilling Contractor	Strata Earth	Surface Elevation	460.71 ft (NAVD88)
Borehole Backfill	Piezometer P012	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 557668 E 2386112 (ft NAD83)	Groundwater Level(s)	Not Encountered	Not Encountered	

Elevation (feet)	Depth (feet)	Samples: Type / Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	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
460.7	0.0												
460.2	0.5				Gray fly ash with grass [FILL/FLY ASH]								
460		S-1	6 5 5	67	Stiff, dry to moist, yellowish brown and brown, Silty CLAY (CL), trace gravel, sand and organics. [FILL/FLY ASH]					4.0 >4.5 >4.5			
		S-2 A B	4 6 5	100									*SA (-#200) = 73.5%*
457.0	3.7				Dry to moist, dark gray, medium dense, sandy, SILT (ML). [FILL/FLY ASH]								
455	5	S-3	7 7 7	100									*SA (-#200) = 67%*
													SA (-#200) = 94.2%
		S-4	0 0 0	100	Becomes very loose, wet, varved fly ash and fine sand.								
450	10	ST-1	P	100									
449.7	11.0				Medium stiff, wet, yellowish brown and brown, medium plasticity lean SILT (ML), trace fine sand and fly ash. [FILL/FLY ASH]	35.0	112.2	23	NP	1.5 1.5 1.5		0.4	*Switched to mud rotary.*
445.7	15.0				Medium stiff, gray and reddish brown, Silty CLAY (CL), iron staining, trace gravel. [FILL/FLY ASH]								
445	15	S-5	2 2 6	67						2.0 1.75 1.75			
440	20	S-6	WOH 2 3	78	Becomes gray and brown, trace gravel	21.4		33	18	0.0 0.25 3.0			
435.7	25.0				Stiff, gray, medium plasticity CLAY (CL). [RESIDUAL]								
435	25	ST-2	P	100		23.5	124.5	44	29	3.75 2.75 2.75		2.0	
	30												

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B017

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
430	30		S-7	1 2 2	100		Becomes soft, gray and reddish brown, with gravel.					0.25 0.25 0.25			
425	35		S-8	4 6 7	100		Becomes stiff.	21.2		43	31	3.25 2.5 2.25			
420	40		S-9	4 6 8	83							2.75 3.25 >4.5			
415	45		S-10	7 12 16	100		Becomes very stiff.					4.25 3.75 2.25			
410	50		S-11	5 9 13	100							4.0 4.0 3.75			
405	55		S-12	15 19 50/3"	100		405.7 / 55.0 SHALE: Gray, highly weathered, weak to moderately weak, with fine brown sand.	10.3		28	19				*Strata changed.*
400	60		S-13	50/1"			400.7 / 60.0 End of Boring at 60 ft								
	65														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B018

Date(s) Drilled	08/10/2015 2:55 PM to 08/11/2015 11:27 AM	Logged By	Jennifer Allen	Checked By	Stefanie Voss
Drilling Method	4" HSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	85.0 ft
Drill Rig Type	CME 75	Drilling Contractor	Strata Earth	Surface Elevation	437.94 ft (NAVD88)
Borehole Backfill	Bentonite Grout	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 557638 E 2386197 (ft NAD83)	Groundwater Level(s)	7.5 ft on 8/10/2015	Not Encountered	

Elevation (feet)	Depth (feet)	Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Material Description	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	Remarks
437.9	0.0		1	3 16 18	44	Very stiff, moist, brown, SILT (ML), and road gravel. [FILL]								
435			X	1 2 3	0	Becomes medium stiff, gravel in shoe. [FILL/FLY ASH]								
432.9	5.0		2	1 1 2	150	Soft, moist, pale gray with trace orange staining, medium plasticity CLAY (CL). [RESIDUAL]	30.0		37	17	0.0 0.0 0.0			
430			1	P	17	∇					1.0			*7.5': Groundwater encountered.*
	10		3	2 4 5	100	Becomes very stiff.					2.5 2.5 2.5			
425														
	15		4	2 4 5	100	Becomes gray with orange mottling.					1.5 2.5 2.5			
420														
	20		5	1 5 7	100	Trace fine rounded gravel.					0.5 2.0 2.0			
415														*23.0'-24.0': Driller noted possible gravel.* *24.0': Piezometer P009 set.*
412.9	25.0		2	P	100	Medium stiff to stiff, moist, gray, high plasticity CLAY (CH).	27.4 18.1	123.3 129.7 126.1	54	41	3.0		0.9 2.2	
410	30													

AECOM

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
	30		6	4 10 14	100		Becomes very stiff, very pale gray with orange mottling.					3.0 3.0 4.0			
405															
402.9	35.0		7	9 9 27	100		Very stiff, moist, gray with orange mottling, Silty CLAY (CL), slightly laminated. [RESIDUAL]					4.0 4.0 >4.5			
400															
397.9	40.0		8	21 27 32	100		SHALE: Bluish gray, highly weathered, very weak, slight laminations, clayey.	17.7		47	22				
395															
	45		9	21 40 50/5"	100										
390.9	47.0						LIMESTONE: Pale gray, very thickly bedded, slightly weathered, moderately fractured, medium strong.								*47.0': Driller noted hard rock. Limestone in cuttings.*
390															
	50														*50.0': Switch to 10.0' long NV core barrel. Time = 11:27 DWR = 90%*
386.9	51.0						SHALE: Gray, highly weathered, very weak to weak, slight laminations, clayey.								
385															
	55		C-1	6	37										
380															
	60														
375															
	65														

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
			10	60/6"	100		SHALE: Gray, moderately to slightly weathered, weak to medium strong.								*Switched to split spoon to test strength in shale.*
370															
	70		11	60/6"	100										*70.0'-75.0': Sand in cuttings.*
365															
	75		12	56/6"	100										
360															
	80		13	48/5"	100										
355							85': Limestone in shoe.								
	85		14	100/2"			352.9 / 85.0 End of Boring at 85 ft								
350															
	90														
345															
	95														
340															
	100														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B019

Date(s) Drilled	08/04/2015 1:57 PM to 08/05/2015 10:54 AM	Logged By	Jennifer Allen	Checked By	Stefanie Voss
Drilling Method	4" HSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	80.9 ft
Drill Rig Type	CME 75	Drilling Contractor	Strata Earth	Surface Elevation	445.38 ft (NAVD88)
Borehole Backfill	Bentonite Grout	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 558079 E 2383041 (ft NAD83)	Groundwater Level(s)	11.0 ft on 8/5/2015	Not Encountered	

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
445.4	0.0	S-1	3 3 5	33		Medium stiff, dry, dark brown, Sandy SILT (ML), fine grained sand. [FILL/FLY ASH]					1.5			
442.9	2.5	S-2	4 4 5	39		Stiff, dry, brown with orange mottling, Silty CLAY (CL). [FILL/FLY ASH]					1.5			
440	5	S-3	3 7 8	61			22.4		40	21	1.5 1.5			
		S-4	7 10 14	100		Becomes very stiff, moist, brown with gray mottling.					2.5 3.0 3.0			
														9.0': Switch to mud rotary.
435	10	S-6	4 6 10	72		Trace fine gravel. ▼					2.0 2.5			
430	15	S-7	3 6 9	89		Becomes gray with orange mottling, trace black organics.					2.0 2.5 2.5			
425.4	20.0	S-8	3 4 6	83		Stiff, moist, gray, Silty CLAY (CL). [LOESS]					1.0 1.5 1.5			
420	25	ST-1	P	100			24.5	128.1 124.8	38	21	1.5		1.5	
	30													

AECOM

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B019

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
415	30		S-9	3 5 5	89		Becomes pale gray with orange mottling.					0.5 1.0 1.0			
410	35		ST-2		87		410.4 / 35.0 Stiff, moist, pale gray, high plasticity CLAY (CH). [LOESS]	22.1	118.4 126.8	55	40	2.0		2.0	
405	40		S-10	7 11 15	100		405.4 / 40.0 Very stiff, orangish brown, medium plasticity CLAY (CL), some fine gravel. [TILL]					2.5 3.0 3.0			
400	45		S-11	6 10 13	100		Light gray mottling, trace black organics.	16.7		33	21	2.5 3.5 2.5			
395	50		S-12	7 15 22	100		394.4 / 51.0 Very stiff, moist, grayish tan, low plasticity Silty CLAY (CL). [RESIDUAL]					3.0 3.5 4.0			
390	55		S-13	82/2"	100		Becomes pale gray with tan mottling, partially laminated.	18.6		40	22	>4.5			
385	60		S-14	25 28 55/5"	59		385.4 / 60.0 SHALE: Gray, highly weathered, very weak.	21.9		43	17				
	65														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B019

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
380			S-15	36 50/3"	67		SHALE: Gray, highly to slightly weathered, laminated, very weak to weak.								
375	70		S-16	40 60	83										
370	75		S-17	28 41 60	100										74.75'-76.5': Driller noted possible boulder.
365	80		S-18	36 50/3	100										
364.5	80.9						End of Boring at 80.9 ft								
360	85														
355	90														
350	95														
	100														

AECOM

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B020

Date(s) Drilled	08/11/2015 2:40 PM to 08/12/2015 3:18 PM	Logged By	Betty Tesfu	Checked By	Stefanie Voss
Drilling Method	4" SSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	100.0 ft
Drill Rig Type	D-120 ATV	Drilling Contractor	Strata Earth	Surface Elevation	430.19 ft (NAVD88)
Borehole Backfill	Piezometer P001	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 557934 E 2383018 (ft NAD83)	Groundwater Level(s)	2.5' ft on 8/11/2015 Not Encountered		

Elevation (feet)	Depth (feet)	Sample Type	Sample 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	0		1	6 8 10	83		430.2 / 0.0; 429.9 / 0.3 — 0.0'-0.25': FLY ASH. [FILL/FLY ASH] Medium dense, black, sand size coal fragments, bottom ASH. [FILL/FLY ASH]								
			2A 2B	8 6 3	72		426.9 / 3.3 — Stiff, wet, gray, Silty CLAY (CL). [FILL/FLY ASH]								*2.5': Sample wet. S-2A: Top 10" coal. S-2B: Bottom 3" clay.*
425	5		1	P	90		Layer of fine coal.								*ST-1: Top fine coal.*
												0.0			
			3A 3B	WH 1 2	56		422.7 / 7.5 — Soft, wet, gray to reddish brown with black, SILT (ML), with clay and fine sand, trace coal. [FILL/FLY ASH]								*S-3A: Top 6" gray silt. S-3B: Bottom 4" Reddish brown with dark spots.*
420	10		2	P	89		421.2 / 9.0 — Medium stiff, moist, gray to brown, high plasticity CLAY (CL), with fine sand. [LOESS]	30.8 25.6 24.7	120.4 123.5 125.8 121.1	51	34	0.5 0.25 0.25		0.9 1.2 1.3	
415	15		4	3 3 3	100		Becomes gray to reddish brown, trace fine sand and gravel.					1.25 1.0 1.25			
410	20		5	2 2 3	100		Sandy.	22.6		38	22	2.0 1.5 1.75			
405	25		6	2 2 4	83		Becomes orangish brown and gray with dark spots.					2.0 2.25 1.0			
	30						400.2 / 30.0								

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
400	30		7A 7B	6 12 18	94		Dense, wet, yellowish brown, fine to coarse SAND (SP), trace silt and gravel. [TILL] Becomes fine with silt, trace medium to coarse gravel.								
395	35		8	6 17 50/0.25"	100		395.2 — 35.0 Very stiff, wet, gray, Clayey SILT (ML), trace gravel and fine sand, limestone at the bottom. [TILL]					2.5 3.5 4.25			*36.0': Strata changes.*
390	40		9	50/1"	0		390.2 — 40.0 LIMESTONE: Boulder								*S-9: Classification based on drilling.*
							387.2 — 43.0 Hard, moist, gray, Silty CLAY (CL), trace gravel, shaley. [RESIDUAL]								*43.0': Strata changes.*
385	45		10	91	100										
380	50		11	50 39 60	89										
375	55		12	41 46 50	100		Becomes gray to dark gray.								
370	60		13	31 25 37	100		370.2 — 60.0 Hard, moist, gray, high plasticity CLAY (CH). [RESIDUAL]	21.6		73	37				
	65						365.2 — 65.0								

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
365			14	34 50/4"	100		SHALE: Highly to slightly weathered, very weak to weak.								
360	70		15	50			Becomes gray.								
355	75		16	50/2"	100										
350	80		17	34 48 50/4"	100		Becomes weak.								
345	85		18	50/1"											86.0': Hit solid rock.
340	90						339.7 / 90.5 SHALE: Gray, fine grained, highly weathered, weak to moderately weak.								90.0'-100.0': Rock core. Set casing at 90'. Core run #1: Begin at 90.0' at 1:49 PM, End at 97.5' at 2:10 PM. 100% water return, rod and core barrels clogged.
			Run 1	6	97		337.3 / 92.9 LIMESTONE: Light gray, moderately weathered, fine grained, strong.								
335	95						96.5' - 96.6': Interbedded limestone and shale.								Core run #2: Begin at 97.5' at 3:07 PM, End at 100.0' at 3:18 PM. Removal of inner and outer core was challenging, causing a delay of approximately 1 hour 40 minutes.
			Run 2		0										
	100						330.2 / 100.0								

End of Boring at 100 ft

Date(s) Drilled	08/03/2015 12:30 PM to 08/03/2015 12:00 AM	Logged By	Betty Tesfu	Checked By	Stefanie Voss
Drilling Method	4" SSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	40.0 ft
Drill Rig Type	D-120 ATV	Drilling Contractor	Strata Earth	Surface Elevation	405.02 ft (NAVD88)
Borehole Backfill	Tremie Grout	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 557139 E 2381705 (ft NAD83)	Groundwater Level(s)	Not Encountered	Not Encountered	

Elevation (feet)	Depth (feet)	Sample Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	MATERIAL DESCRIPTION (Elevation / Depth)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
405	0	1	2 2 1	44	405.0 / 0.0 404.5 0.0' - 0.5': Topsoil, grass, lean clay. 0.5 Soft, dry to moist, yellowish brown with dark spots, Silty Lean CLAY (CL), trace gravel and sand. [LOESS]								
		1	P	67	Becomes gray.	20.6 22.4	125.8 124.9 117.5	49	34	0.75 0.75 1.0		0.6 0.9	
400	5	2	1 1 2	44	Becomes brown and gray, sandy, trace iron staining.					0.25 0.5 1.0			
		3	2 3 4	100	Becomes medium stiff, gray and brown, medium plasticity, with iron staining, trace gravel.	20.8		43	26	2.5 1.0 2.5			
395	10	4	2 3 5	100						3.25 1.75 2.25			*10.0': Switched to mud rotary.*
390	15	5	4 5 6	100	Stiff, no iron staining.					4.0 3.5 2.5			
					18.5': Becomes stiffer.								
385	20	6	11 18 23	73	385.0 / 20.0 Hard, moist, gray, Silty CLAY (CL). [RESIDUAL]								
380	25	7	28 39 53	100	380.0 / 25.0 SHALE: Gray, highly weathered, very weak.								
					27.0': Becomes gravelly, moderately weathered, weak.								
					29.0': Becomes slightly weathered.								
	30												

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B021

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
375	30		8	50/0.5"	0		SHALE: Gray, slightly weathered, weak.								
370	35		9	13 16 26/4"	100			18.6		42	19				*S-9: SPT stopped at 16" due to mechanical issue with hydraulics.*
368.0	37.0						LIMESTONE								*Driller and mud rotary cuttings indicated limestone.*
365.0	40.0						End of Boring at 40 ft								
365	40														
360	45														
355	50														
350	55														
345	60														
340	65														

Date(s) Drilled	to 08/10/2015 12:00 AM	Logged By	Jennifer Allen	Checked By	Stefanie Voss
Drilling Method	Hollow Stem Auger/Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	51.4 ft
Drill Rig Type	CME750	Drilling Contractor	Strata Earth	Surface Elevation	419.05 ft (NAVD88)
Borehole Backfill	Bentonite Grout	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 556835 E 2381983 (ft NAD83)	Groundwater Level(s)	Not Encountered	Not Encountered	

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
419.1	0.0		S-1	4 7 7	67		Very stiff, dry, tan with orange and pale gray, mottling, low plasticity Silty CLAY (CL). [LOESS]					0 2.0			
			S-2	0 1 3	100		Becomes soft					0.5 0.5			
415	5		S-3	2 3 5	89		Becomes medium stiff, brown.	22.0		28	10	1.5 1.5 1.5			
410			S-4	2 2 4	100							1 1 1.5			
409.1	10.0		ST-1	P	100		Medium stiff, moist, pale gray with orange mottling, low to medium plasticity Silty CLAY (CL), some fine rounded gravel. [RESIDUAL]	20.7 19.1 18.4	129.4 130.3 130.7 130.3	40	25			2.2 2.0 2.5	
405	15		S-5	3 4 5	100		Becomes stiff.					3 2.5 2			
400	20		S-6	4 6 8	83							3.5 2.5 2.5			
395	25		ST-2	P			Stiff, moist, pale gray with orange mottling, low plasticity clay, some fine gravel.								
390 / 389.1	30 / 30.0														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B022

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
	30		S-7	12 27 36	100		Hard, moist, gray, high plasticity CLAY (CH). [RESIDUAL]					>4.5			
385															
	35		S-8	12 26 32	100			23.6		58	33	>4.5			
380															
	40		S-9	17 45 50	100		379.1 / 40.0 SHALE: Gray, highly weathered, very weak.								
375															
	45		S-10	18 50/3"	100										
370															
	50		S-11	32 44 50\4"			367.7 / 51.4 End of Boring at 51.4 ft								
365	55														
360	60														
355	65														

Project: Dynegy CCR Rule Assessment of Plants	**Log of Boring BAL-B023**
Project Location: Baldwin, Illinois	Sheet 1 of 2
Project Number: 60428794	

Date(s) Drilled	08/03/2015 9:27 AM to 08/03/2015 12:20 PM	Logged By	Jennifer Allen	Checked By	Stefanie Voss
Drilling Method	4" SSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	55.0 ft
Drill Rig Type	CME75	Drilling Contractor	Strata Earth	Surface Elevation	418.82 ft (NAVD88)
Borehole Backfill	Bentonite Grout	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 557045 E 2381798 (ft NAD83)	Groundwater Level(s)	Not Encountered		Not Encountered

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
418.8	0					418.8 / 0.0								
418.5	0.3	S-1	9 3 2	22		GRAVEL 4".					1.5			
						Medium stiff, moist, orangish brown with gray, mottling, medium plasticity CLAY (CL), trace organics 1 to 1.5'. [FILL/FLY ASH]								
415		S-2	2 1 5	17							2.0			
	5	S-3	2 4 6	67			18.6		37	23	0.5 1.5 2.0			
410		S-4	3 4 8	67		Becomes brown, trace gray, mottling.					2.0 2.0			
														Switched to mud rotary at 9'
408.8	10	ST-1	P	100		408.8 / 10.0 Stiff, moist, brown, high plasticity CLAY (CH). [FILL/FLY ASH]	22.6	127.7 129.0	51	36	2.0		2.1	
405														
403.8	15	S-5	2 2 7	100		403.8 / 15.0 Stiff, moist, brownish gray, low plasticity Silty CLAY (CL). [LOESS]					1.0 1.5 1.5			
400														
	20	S-6	0 0 4	100		Becomes gray.	22.3		34	16	0 05 05			
395														
	25	ST-2	P	73		Some orange staining.	17.9 16.2	132.2 133.4 132.8	36	22	2.0		2.6 2.5	
390														
388.8	30					388.8 / 30.0								

AECOM

Depth (feet)	Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	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
30		S-7	6 8 3	78		Stiff, moist, brownish gray, high plasticity CLAY (CH). [RESIDUAL]		26.7		59	29	>4.5			
35		S-8	25 40 50	100		Becomes hard, gray, partially laminated.						>4.5			
40		S-9	53 82	100		Becomes interbedded with limestone.						>4.5			
45		S-10	87/6"	100											
50		S-11	19 75/6"	100	368.8	SHALE: Dark gray, highly weathered, laminated, very weak.	50.0								
					366.8	LIMESTONE.	52.0								
55					363.8	End of Boring at 55 ft	55.0								

Elevation scale (feet): 385, 380, 375, 370, 365, 360, 355
Depth scale (feet): 30, 35, 40, 45, 50, 55, 60, 65

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B024

Date(s) Drilled	08/03/2015 12:30 PM to 08/03/2015 12:00 AM	Logged By	Jennifer Allen	Checked By	Stefanie Voss
Drilling Method	4" SSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	55.0 ft
Drill Rig Type	CME 75	Drilling Contractor	Strata Earth	Surface Elevation	419.37 ft (NAVD88)
Borehole Backfill	Bentonite Grout	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 557191 E 2381759 (ft NAD83)	Groundwater Level(s)	7.0 ft on 8/3/2015	Not Encountered	

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
419.4	0.0													
419.0	0.3					0.0' - 0.33': Gravel.								
		Split spoon	1	8 5 5	33	Stiff, moist, brown with orange mottling, low plasticity CLAY (CL). [FILL/FLY ASH]					3.0			S-1: Gravel not included in sample.
		Split spoon	2	5 3 4	22	Becomes medium stiff.					4.0			
415	5	Split spoon	3	1 4 8	44	5.0' - 7.0': Some black mottling.					3.5			
	7.0 (groundwater ▽)													7.0': Groundwater encountered.
		Split spoon	4	6 8 9		Becomes very stiff.								
410														9.0': Switch to mud rotary.
409.4	10.0	Split spoon	5	2 3 4	100	Medium stiff, moist, low plasticity CLAY (CL). [LOESS]					2.0			
405	15	Split spoon	6	2 3 4	100	Becomes orangish brown.	24.1		41	22	2.0			
399.4	20.0	Shelby tube	1	P	100	Stiff, moist, light gray, medium plasticity CLAY (CL). [RESIDUAL]	19.4 20.5 19.4	130.0 129.6 128.6 128.0	49	36	2.5		2.8 2.8 2.3	
395	25	Split spoon	7	3 6 6	100	25.0' - 26.5': Trace clayey sand nodules black organics.					3.0			
390	30													

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
	30		8	3 6 9	50		Becomes very stiff, moist, light gray.					3.0			
385															34.0': Driller noted hard lithology.
	35		9	51 18 36	50		384.4 / 35.0; 383.9 LIMESTONE 35.5; Hard, moist, gray, low plasticity SILT (ML), partially laminated. [RESIDUAL]					>4.5			S-9: Limestone fragments not included in sample. 35.0'-50.0': Driller noted interbedded limestone.
380															
	40		10	47 50/4"	80		379.4 / 40.0; SHALE: Gray, moderately to slightly weathered, very weak.	14.5		45	22	>4.5			
375															
	45		11	100/2"			374.4 / 45.0; 373.9 LIMESTONE, with clay. 45.5; SHALE: Gray, moderately to slightly weathered, very weak.								
370															
	50		12	22 22 42	72		Becoming Shale.					>4.5			
							366.4 / 53.0; LIMESTONE.								53.0': Driller noted solid rock. 53.0'-55.0': Logged cuttings.
365	55						364.4 / 55.0; End of Boring at 55 ft								
360	60														
355	65														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B025

Date(s) Drilled	08/05/2015 9:00 AM to 08/05/2015 1:30 PM	Logged By	Betty Tesfu	Checked By	Stefanie Voss
Drilling Method	4" SSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	58.5 ft
Drill Rig Type	D-120 ATV	Drilling Contractor	Strata Earth	Surface Elevation	457.13 ft (NAVD88)
Borehole Backfill	Tremie Grout	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 556742 E 2385368 (ft NAD83)	Groundwater Level(s)	Not Encountered	Not Encountered	

Elevation (feet)	Depth (feet)	Samples: Type	Samples: 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
457.1	0.0	Split spoon	1	2 3 4	61		Loose, moist, dark brown, Silty SAND (SM). [FILL/FLY ASH]								
455		Split spoon	2	4 3 3	72		Becomes with black bottom ash and fine coal, trace silt.								
	5	Split spoon	3	1 1 1	83		Becomes very loose, wet, gray with pockets of fine coal and bottom ash.								5.5': Groundwater encountered.
450		Shelby tube	1	P	100		No coal and bottom ash.	22.0	112.5			4.0 4.25			SA(- #200)=74.3%
	10	Split spoon	4	0 0 1	79							0.0 0.0			
445															12.0': Switch to mud rotary.
	15	Split spoon	5	1 1 WH	78		Becomes silty with pockets of fine coal and bottom ash.								
440															
	20	Split spoon	6	2 2 1	100		With pockets of coal and bottom ash								
435															
432.1	25.0	Split spoon	7	WH 1 2	89		Soft, moist to wet, gray and greenish brown, Lean CLAY (CL), some silt. [TILL]	26.5	0.5 0.5 0.5	40	20				
430															
	30														

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		2	P	17		Becomes medium stiff, gray, Silty Lean CLAY (CL).								
425												3.0			
	35		8	4 5 8	100		Becomes very stiff, with iron staining, trace gravel.					3.0 2.75 3.25			
420															
	40		9a 9b	3 2 3	100		417.1 / 40.0 Very loose, wet, brown, fine SAND (SP). 415.9 / 41.2 Medium stiff, wet, gray, Lean CLAY (CL), with silt and iron staining. [RESIDUAL]	19.3		32	16				
415															
	45		10	9 11 15	100		Becomes very stiff, brown and gray, trace gravel and silt.					3.75 3.75 >4.5			
410															
	50		11	9 9 14	78							4.0 4.0 3.75			
405							404.6 / 52.5 SHALE: Gray, highly weathered, very weak.								
	55		12	17 50/4"	100			16.7		43	22				
400							398.6 / 58.5 End of Boring at 58.5 ft								*58.5': Auger refusal.*
	60														
395															
	65														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B026

Date(s) Drilled	08/08/2015 8:40 AM to 08/08/2015 3:30 PM	Logged By	Betty Tesfu	Checked By	Stefanie Voss
Drilling Method	4" SSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	75.0 ft
Drill Rig Type	D-120 ATV	Drilling Contractor	Strata Earth	Surface Elevation	458.02 ft (NAVD88)
Borehole Backfill	Piezometer	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 556773 E 2385293 (ft NAD83)	Groundwater Level(s)	Not Encountered		Not Encountered

Elevation (feet)	Depth (feet)	Samples: Type	Samples: Number	Samples: Sampling Resist. OR Core RQD (%)	Samples: Recovery (%)	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
458.0	0.0	Split Spoon	1	7 7 7	89	Medium dense, moist, brown, fine to medium, Silty SAND (SM), with gravel, trace silt and coal [FILL/FLY ASH].								
455		Split Spoon	2	3 4 3	50	Becomes loose.								
	5	Split Spoon	3	3 4 8	83	Becomes medium dense.								
450		Split Spoon	4	6 6 7	100									
	10	Split Spoon	5A 5B	5 5 4	78	Becomes loose. 10.25' - 10.5': Dark gray pocket with coal.								*10.5': Inserted casing and started mud rotary.*
445														
443.0	15.0	Split Spoon	6	4 4 3	50	Loose, wet, dark gray and brown, fine poorly graded, fine SAND (SP-SM), with silt, with coal [FILL/FLY ASH].								*17.0': Driller noted change to clay.*
440	20													
437.0	21.0	Shelby Tube	1	P	100	Stiff, wet, gray and brown, Silty CLAY (CL), iron staining, trace gravel and fine sand [FILL/FLY ASH].	20.1	128.0			2.25 2.25 2.75		2.0	*SA (-#200) =97.5%.*
435														
432.8	25.3	Split Spoon	7	7 6 7	61	Medium dense, wet, dark gray, fine to medium Sandy GRAVEL (GP), with bottom ash, trace silt and coal [FILL/FLY ASH].								
430	30													

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
	30		8	WR WR WR	67		Very soft, wet, gray, SILT (ML), with clay, trace fine sand, trace gravel, fine sand seam. [LOESS]					0.0 0.0 0.25			
425															
	35		2	P	100		423.0 / 35.0 Stiff, wet, gray, high plasticity CLAY (CH). [LOESS]	23.6 24.0 23.5 22.9	125.4 125.9 124.3 126.4 126.3	61	47	2.25 2.5 1.5		2.0 2.1 1.9	
420															
	40		9	4 5 6	100		418.0 / 40.0 Stiff, wet, gray with spots of reddish brown, mottled, Silty CLAY (CL), trace fine gravel and sand, iron staining. [TILL]	17.8		48	35	2.5 3.0 2.75			*40.0': Drilling activity stopped due to repairs on hydraulics.*
415															
	45		10	5 6 8	89		Becomes gray and orangish brown, trace shale fragments.					3.5 4.0 3.5			
410															
	50		11	8 12 16	100		Becomes very stiff, gray and yellowish brown, with fine sand.	23.5		49	30				
405															
	55		12	14 28 50/3"	100		403.0 / 55.0 SHALE: Brown, completely to highly weathered, with hard silt, very weak.	16.6		43	26				
400															*57.0': Strata change.*
	60		13	50 33 61	100										*S-13A: Grinded pieces of rock/shale. S-13B: Gray, soft silt/completely weathered shale.*
395															
	65														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B026

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
			14	20 30 42			SHALE: Gray, highly weathered, very weak.								
390															
	70		15	23 31 65	100										
385															
383.0	75.0		16	50/1"			End of Boring at 75 ft								
380	80														
375	85														
370	90														
365	95														
360	100														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B027

Sheet 1 of 3

Date(s) Drilled	08/07/2015 9:50 AM to 08/11/2015 12:40 PM	Logged By	Betty Tesfu	Checked By	Stefanie Voss
Drilling Method	4" SSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	65.5 ft
Drill Rig Type	D-120 ATV	Drilling Contractor	Strata Earth	Surface Elevation	457.46 ft (NAVD88)
Borehole Backfill	Piezometer	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 556872 E 2385255 (ft NAD83)	Groundwater Level(s)	6.5 ft on 8/7/2015		Not Encountered

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
457.5	0.0	Split spoon	1	3 4 7	94		Medium dense, moist, brown, gravelly fine to medium SAND (SP), trace silt, bottom ash, and coal. [FILL/FLY ASH]								SA (- #200) = 5.3%
455		Split spoon	2	5 3 1	44		Becomes loose.								
	5	Split spoon	3	4 4 5	78		Becomes moist to wet. ∇								6.5': Groundwater encountered.
450		Split spoon	4	2 2 3	72		Becomes wet, pocket of fine sand and silt.								
447.5	10.0	Split spoon	5	1 2 3	33		Loose, brown, wet, sandy, fine GRAVEL (GP), trace coal and bottom ash. [FILL/FLY ASH]								
445															
440	15	Split spoon	6	2 2 2	33		Becomes sand size coal fragments, with bottom ash, trace sand and silt.								
435	20	Split spoon	7	3 4 3	56		20.0': Fine sand seam.								SA (- #200) = 0.2%
433.5	24.0						Stiff, moist to wet, gray, Lean CLAY (CL), with silt and fine sand, trace gravel, iron staining. [TILL]								24.0': Strata changed to clay.
430	25	Shelby tube	1	350 psi	100			21.4 21.2	124.6 128.5 127.7	47	31	2.0 2.75 2.5		3.3	
	30														

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
	30		8	4 5 7	100		Becomes stiff, wet, reddish brown and gray, mottled.					3.0 3.25 3.25			
425															
	35		2	500 psi	96		Becomes, stiff, wet, yellowish brown and gray, mottled.	20.3	130.0	47	32			1.6	
420															*ST-2: Bottom 3" of sample not recovered, no pocket pen. 37.5': Started to be stiffer.*
	40		9	7 12 16	100		Becomes very stiff, reddish brown and gray, mottled.					4.0 4.25 4.25			
415															
	45		10	9 12 14	78		Becomes gray and yellowish brown.					4.0 4.5 >4.5			
410															
409.5	48.0						LIMESTONE: Gray, fine grained, moderately weathered, weak.								*48.0': Strata changed. 48.0'-53.0': Hard strata (Limestone).*
	50		11	50/0.5"	100										
405															
404.5	53.0						SHALE: Dark gray, completely weathered, very weak.								
	55		12	18 28 43	100			17.4		47	26				*S-12: Soil easily disintegrated to fine particles.*
400															
	60		13	28 38 51	100		Becomes completely to highly weathered.								
395															
	65														*64.5': Strata changed.*

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B027

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
			14	50/0.5"			392.0 / 65.5								
							End of Boring at 65.5 ft								

Elevation scale: 390, 385, 380, 375, 370, 365, 360

Depth scale: 70, 75, 80, 85, 90, 95, 100

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B028

Date(s) Drilled	08/18/2015 1:10 PM to 08/18/2015 5:15 PM	Logged By	Betty Tesfu	Checked By	Stefanie Voss
Drilling Method	4" SSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	86.0 ft
Drill Rig Type	D-120 ATV	Drilling Contractor	Strata Earth	Surface Elevation	455.89 ft (NAVD88)
Borehole Backfill	Piezometer P005	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 554602 E 2383703 (ft NAD83)	Groundwater Level(s)	1.0 ft on 8/18/2015 ft on 9/1/2015	Not Encountered	

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
455.9	0.0														
455	0	Split spoon	1	3 5 3	100		Loose, moist to wet, gray, SILT (ML), with sand, gravel and bottom ash. [FILL/FLY ASH] ▽								1.0': Groundwater encountered.
		Split spoon	2	3 4 3	100		Becomes gray and brown, wet, sandy.								
450.9	5.0						Soft, wet, dark brown to light brown, trace gravel, no bottom ash.								
450	5	Shelby tube	1	P	100		Soft, wet, gray and brown, SILT (ML), with clayey silt. [FILL/FLY ASH]	90.9	90.7	47	NP				SA (- #200) = 81.4%
		Split spoon	3	1 1 1	100										
445	10	Shelby tube	2	P	67		Becomes gray, trace coal and sand.	65.0	101.8	47	NP				SA (- #200) = 62.9% *10.0': Switch to mud rotary.*
440	15	Split spoon	4	0 1 1	23		Becomes very soft, dark gray, with fly ash and bottom ash, with fine to coarse sand, trace gravel.								
435	20	Split spoon	5	0 0 1	100		Becomes fly ash with silt.								
430	25	Split spoon	6A 6B	WH 1 1	100		Becomes yellowish brown and dark gray, varved silt and fly ash, with top 6" silt.								*S-6A: Top 6" yellowish brown silt* *S-6B: Dark brown and yellowish brown, varved silt and silty ash.*
425.9	30 / 30.0														

Elevation (feet)	Depth (feet)	Samples: Type	Samples: 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
425	30		7	3 5 7	100		Stiff, wet, gray and orangish brown, Silty CLAY (CL), iron staining, trace gravel. [LOESS]					2.5 1.0 1.5			
420	35		8	3 5 7	100			20.3		40	22	2.0 2.75 2.5			
415	40		9	4 5 7	100							4.5 3.75 3.5			
410	45		10	19 14 18	100		410.9 / 45.0 Hard, wet, gray, Silty CLAY (CL), with fine sand. [RESIDUAL]					4.0 >4.5 4.5			
405	50		11	4 7 11	100		Becomes very stiff.					3.75 3.5 3.25			
400	55		12	9 10 16	100							4.0 2.75 2.5			
395	60		13	47 36 17	100		395.9 / 60.0 SHALE: Gray to greenish gray, completely weathered, very weak.	16.7							
	65														

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
390			14	20 45 41	100		SHALE: Gray, completely to highly weathered, very weak.	18.9		39	14				
385	70		15	24 33 44	100		Becomes gray.								
380	75		16	18 29 36	100										
375	80		17	35 50 64	100										
370	85		18	29 55/6"			Becomes slightly weathered, weak.								
369.9	86.0						End of Boring at 86 ft								
365	90														
360	95														
	100														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B029

Date(s) Drilled	09/01/2015 2:45 PM to 09/01/2015 5:15 PM	Logged By	Betty Tesfu	Checked By	Stefanie Voss
Drilling Method	4" SSA and 4" Mud Rotary	Drill Bit Size/Type	3 7/8" Tricone	Borehole Depth	51.5 ft
Drill Rig Type	D-120 ATV	Drilling Contractor	Strata Earth	Surface Elevation	453.65 ft (NAVD88)
Borehole Backfill	Piezometer P005	Sampling Method(s)	18" Split Spoon 2" ID, 30" Shelby Tube 3" ID	Hammer Data	Auto-Hammer, 90% efficiency
Boring Location	N 554831 E 2385299 (ft NAD83)	Groundwater Level(s)	2.5. ft on 9/1/2015	Not Encountered	

Elevation (feet)	Depth (feet)	Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) 453.7 / Depth (feet) 0.0)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0		S-1	2 4 4	44		Medium stiff, moist, Silty CLAY (CL), trace gravel and grass. [FILL/FLY ASH]	20.6		42	23				*Too disturbed to take PP test*
450			S-2	0 0 1	100		Becomes very loose, wet, dark gray, silty.	31.0				0			*SA (- #200) = 95.7%*
	5		ST-1	P	100		Becomes loose, with fine to medium silty sand, trace coal.								
								31.9							*SA (- #200) = 86.0%*
445			S-3	1 2 3	100		Trace sand and gravel.					0			*9.0': Strated mud rotary*
	10		S-4	0 0 1	100		Becomes very loose.	34.1							*SA (- #200) = 94.5%*
440			ST-2	P	0										
	15		ST-3	P	100		Becomes silty.					1.25 2.25 2.0			
							437.7 / 16.0 — Medium stiff, wet, gray, high plasticity CLAY (CH), trace gravel and sand. [LOESS]								
435															
	20		S-5	3 4 5	100		433.7 / 20.0 — Stiff, wet, gray, Silty CLAY (CL), iron staining, trace gravel. [LOESS]	22.1		32	16	1.5 1.25 1.75			
430															
	25		S-6	4 5 7	100		Becomes reddish brown and gray, trace coal and sand.					2.5 3.0 3.0			
425															
	30														

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-B029

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
	30		S-7	2 3 7	92		Stiff wet, gray and yellowish brown, Silty CLAY (CL), trace gravel and sand. [RESIDUAL]	21.9		47	25	2.5 1.5 1.75			
420	35		S-8	11 17 54	100		Becomes hard, yellowish brown with fine sand, trace gravel.					>4.5 >4.5 >4.5			
415															
413.7	40.0		S-9	9 10 12	100		Very stiff, wet, light greenish gray, high plasticity clay (CH), with shale fragments. [RESIDUAL]	26.3		56	36	3.75 4.25 >4.5			
410															
408.7	45.0		S-10	50/1"	50		SHALE: Light greenish gray, highly to slightly weathered, very weak, possible limestone interbeds.								*45': Chattering. 45'-48.5': Hard strata*
405															*48.5': Strata changed.*
	50		S-11	21 27 55	100		Becomes gray, highly weathered, very weak to weak.								
402.2	51.5						End of Boring at 51.5 ft								

Elevation scale: 420, 415, 410, 405, 400, 395, 390. Depth scale: 30, 35, 40, 45, 50, 55, 60, 65.

Project: Dynegy CCR Rule Assessment of Plants

Project Location: Baldwin, Illinois

Project Number: 60428794

Log of Boring BAL-C039

Sheet 1 of 1

Date(s) Drilled	08/07/2015 12:00 AM to 08/07/2015 12:00 AM	Logged By	Blaine Higbee	Checked By	Stefanie Voss
Drilling Method	Hand Auger	Drill Bit Size/Type	2" Bucket Auger	Borehole Depth	8.5 ft
Drill Rig Type	N/A	Drilling Contractor	N/A	Surface Elevation	~439.00 ft (NAVD88)
Borehole Backfill	Cuttings	Sampling Method(s)	Grab	Hammer Data	N/A
		Groundwater Level(s)	Not Encountered	Not Encountered	

Elevation (feet)	Depth (feet)	SAMPLES Type	SAMPLES Number	SAMPLES Sampling Resist. OR Core RQD (%)	SAMPLES Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation ~439.00 / Depth 0.0)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0		S-1				Black, high plasticity CLAY (CH), with organics, silt (0.5)	34.0		52	26	1.0			
			S-2				Stiff, tan, low to medium plasticity CLAY (CL).	24.5		37	21	1.1			
			S-3				Becoming more plastic.					0.5			
			S-4				Becoming very stiff, light brown.					1.0			
			S-5				Becoming moist.					1.3			
	5		S-6				Becoming wet.					1.5			
			S-7				With increasing gravel.	21.5				2.0			
			S-8				Becoming hard, coarse gravel. (8.5)					2.5			
							End of Boring at 8.5 ft								*Refusal at 8.5' on gravel.*
	10														
	15														
	20														
	25														
	30														

Project: Dynegy CCR RULE ASSESSMENT OF PLANTS

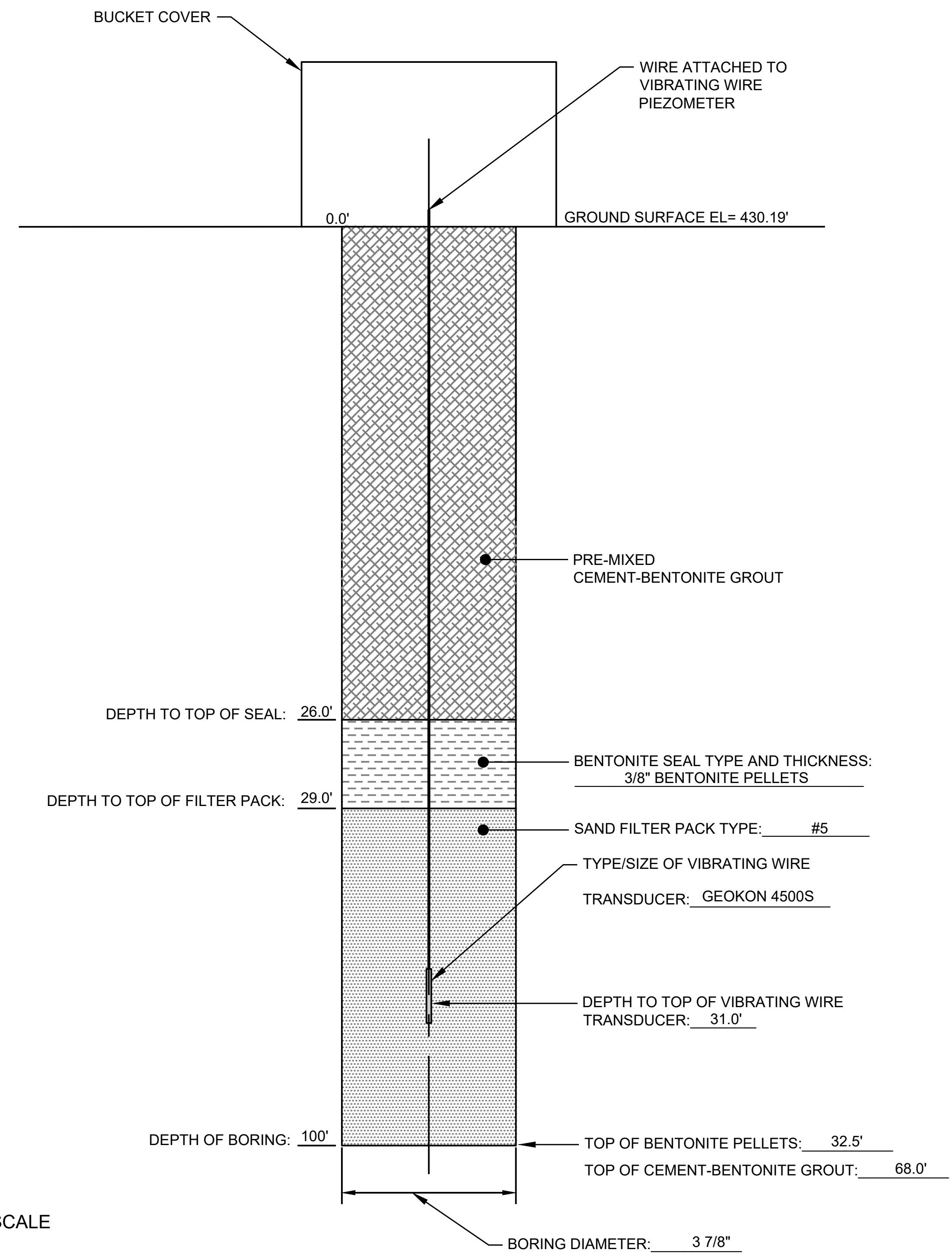
Project Location: BALDWIN, ILLINOIS

Project Number: 60428794

Log of Piezometer
BAL-P001
Sheet 1 of 1

Piezometer Location	BALDWIN BOTTOM ASH POND	Date Installed	08/10/15	Time	08/13/15 - 11:57AM
Installed By	SCOTT KOMEN	Observed By	BETTY TESFU	Total Depth	100.0'
Method of Installation	CME 75 MUD ROTARY	Drilling Contractor	STRATA EARTH SERVICES	Surface Elevation	430.19'
Sand Pack Interval	29.0' - 32.5'	Completion Zone	BUCKET COVER		
Remarks	REFER TO BAL-B020 SOIL LOG FOR SOIL DESCRIPTION	Groundwater Level(s)	0.5'		

SERIAL NO. 1522968



NOT TO SCALE

AECOM

Project: Dynegy CCR RULE ASSESSMENT OF PLANTS

Project Location: BALDWIN, ILLINOIS

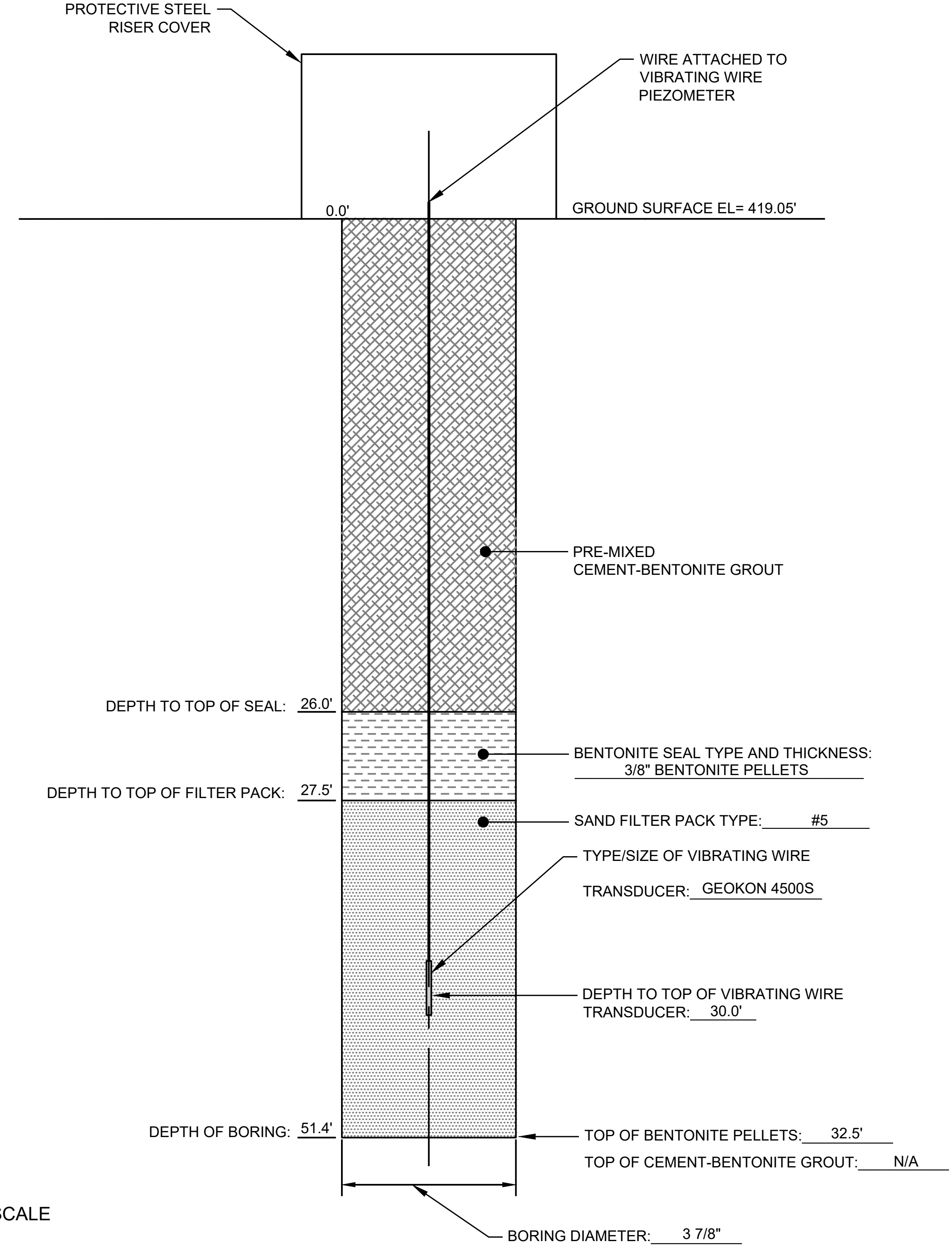
Project Number: 60428794

Log of Piezometer BAL-P002

Sheet 1 of 1

Piezometer Location	BALDWIN BOTTOM ASH POND	Date Installed	08/10/15	Time	2:57PM
Installed By	DAN MALOUF	Observed By	JENNIFER ALLEN	Total Depth	51.4'
Method of Installation	CME 75 MUD ROTARY	Drilling Contractor	STRATA EARTH SERVICES	Surface Elevation	419.05'
Sand Pack Interval	27.5'-32.5'	Completion Zone	PROTECTIVE STEEL RISER COVER		
Remarks	REFER TO BAL-B022 SOIL LOG FOR SOIL DESCRIPTION	Groundwater Level(s)	GROUNDWATER NOT OBSERVED DURING DRILLING		

SERIAL NO. 1522969



NOT TO SCALE

AECOM

DEGUIRE, DAVID, 12/14/2015 4:15 PM

Project: Dynegy CCR RULE ASSESSMENT OF PLANTS

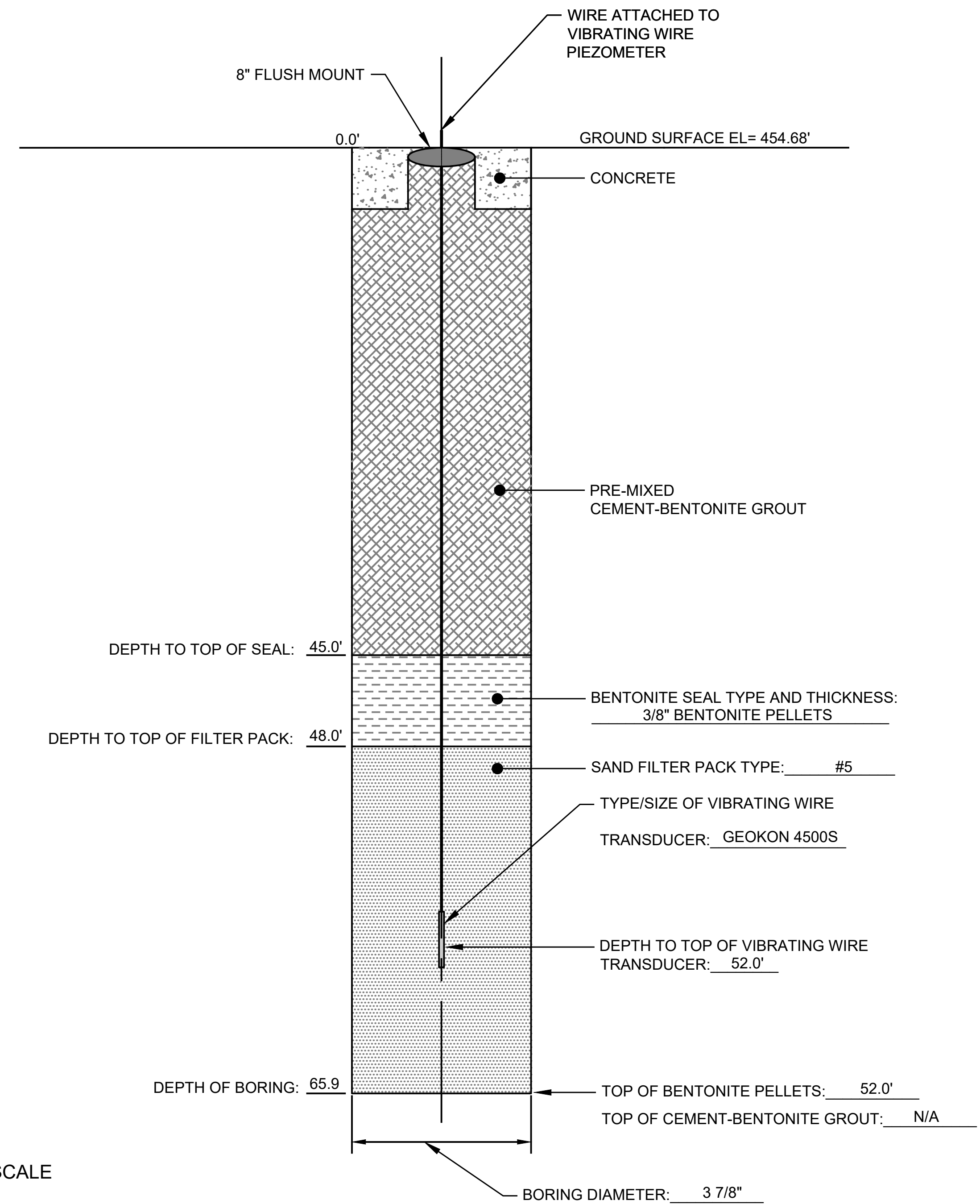
Project Location: BALDWIN, ILLINOIS

Project Number: 60428794

Log of Piezometer BAL-P003

Piezometer Location	BALDWIN EAST FLY ASH POND	Date Installed	08/12/15	Time	2:10PM
Installed By	DAN MALOUF	Observed By	JENNIFER ALLEN	Total Depth	65.9'
Method of Installation	CME 75 MUD ROTARY	Drilling Contractor	STRATA EARTH SERVICES	Surface Elevation	454.68'
Sand Pack Interval	48.0' - 52.0'	Completion Zone	FLUSH MOUNT		
Remarks	REFER TO BAL-B022 SOIL LOG FOR SOIL DESCRIPTION	Groundwater Level(s)	GROUNDWATER NOT OBSERVED DURING DRILLING		

SERIAL NO. 1522965



NOT TO SCALE

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AECOM

DEGUIRE, DAVID, 12/14/2015 4:17 PM

Project: Dynegy

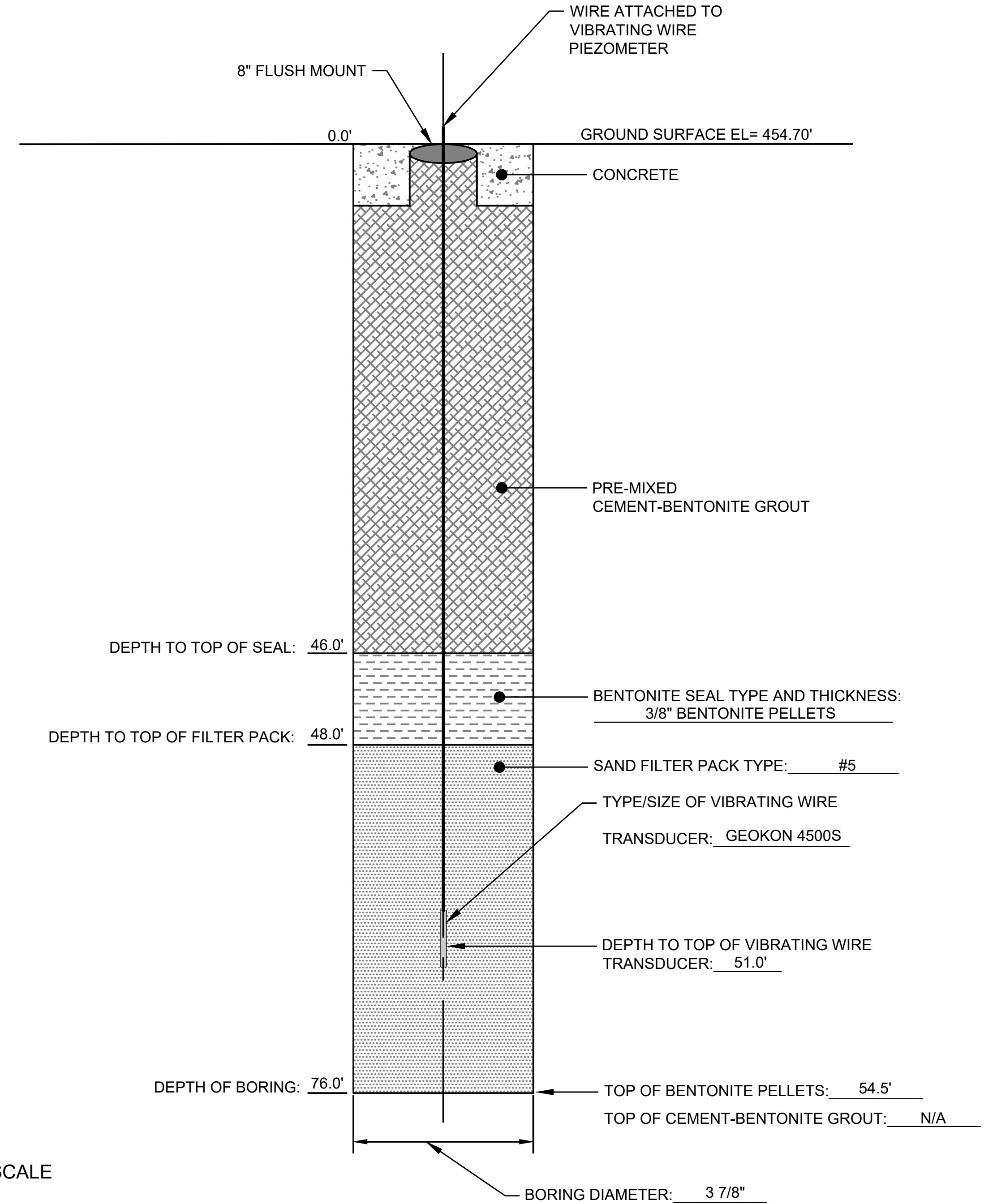
Project Location: BALDWIN, ILLINOIS

Project Number: 60428794

Log of Piezometer
BAL-P004
Sheet 1 of 1

Piezometer Location	BALDWIN EAST FLY ASH POND	Date Installed	08/08/15	Time	2:25 PM
Installed By	DAN MALOUF	Observed By	JENNIFER ALLEN	Total Depth	76.0'
Method of Installation	CME 75 MUD ROTARY	Drilling Contractor	STRATA EARTH SERVICES	Surface Elevation	454.70'
Sand Pack Interval	48.0'-54.5'	Completion Zone	FLUSH MOUNT		
Remarks	REFER TO BAL-B002 SOIL LOG FOR SOIL DESCRIPTION	Groundwater Level(s)	25.0'		

SERIAL NO. 1522970



NOT TO SCALE

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Project: Dynegy CCR RULE ASSESSMENT OF PLANTS

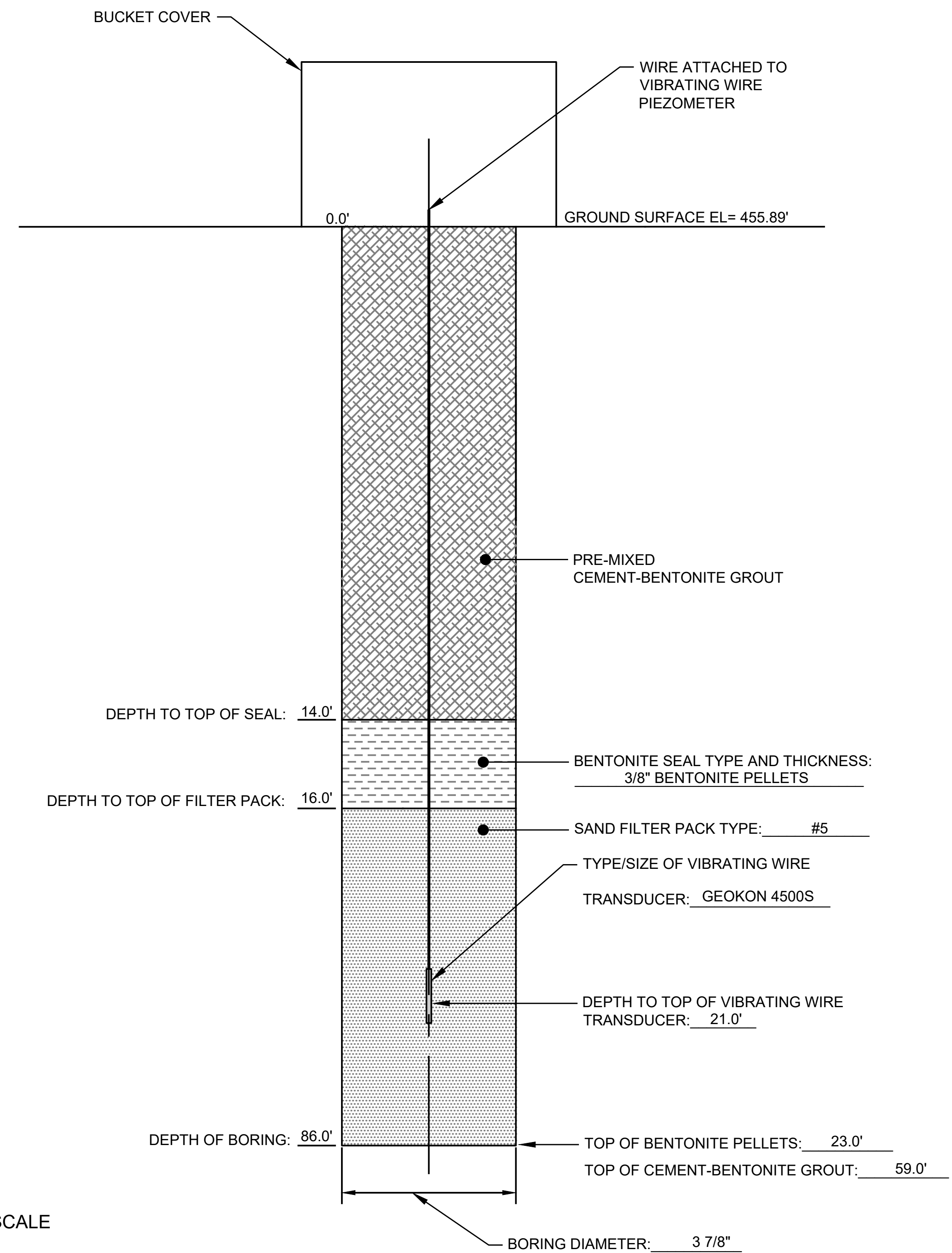
Project Location: BALDWIN, ILLINOIS

Project Number: 60428794

Log of Piezometer
BAL-P005
Sheet 1 of 1

Piezometer Location	BALDWIN EAST FLY ASH POND	Date Installed	08/19/15	Time	11:00AM
Installed By	SCOTT KOMEN	Observed By	BETTY TESFU	Total Depth	86.0'
Method of Installation	CME 75 MUD ROTARY	Drilling Contractor	STRATA EARTH SERVICES	Surface Elevation	455.89'
Sand Pack Interval	16.0' - 23.0'	Completion Zone	BUCKET COVER		
Remarks	REFER TO BAL-B028 SOIL LOG FOR SOIL DESCRIPTION	Groundwater Level(s)	1.0'		

SERIAL NO. 1523287



NOT TO SCALE

AECOM

Project: Dynegy

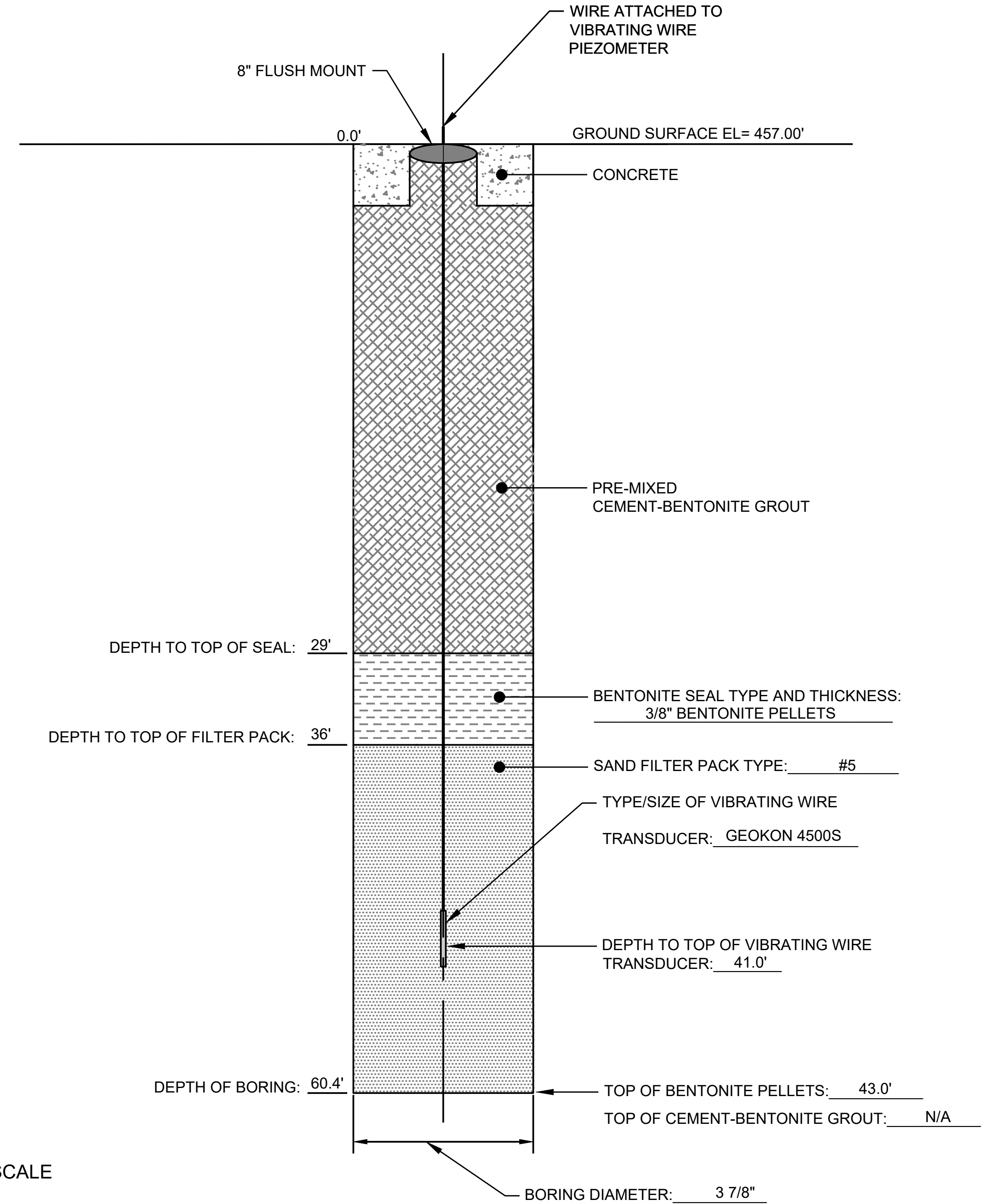
Project Location: BALDWIN, ILLINOIS

Project Number: 60428794

Log of Piezometer
BAL-P006
Sheet 1 of 1

Piezometer Location	BALDWIN OLD EAST FLY ASH POND	Date Installed	08/20/15	Time	08/20/15 - 9:15 AM
Installed By	SCOTT KOMEN	Observed By	BETTY TESFU	Total Depth	60.4'
Method of Installation	CME 75 MUD ROTARY	Drilling Contractor	STRATA EARTH SERVICES	Surface Elevation	457.00'
Sand Pack Interval	36.0' - 43.0'	Completion Zone	FLUSH MOUNT		
Remarks	REFER TO BAL-B005 SOIL LOG FOR SOIL DESCRIPTION	Groundwater Level(s)	11.0'		

SERIAL NO. 1523288



NOT TO SCALE

AECOM

Project: Dynegy

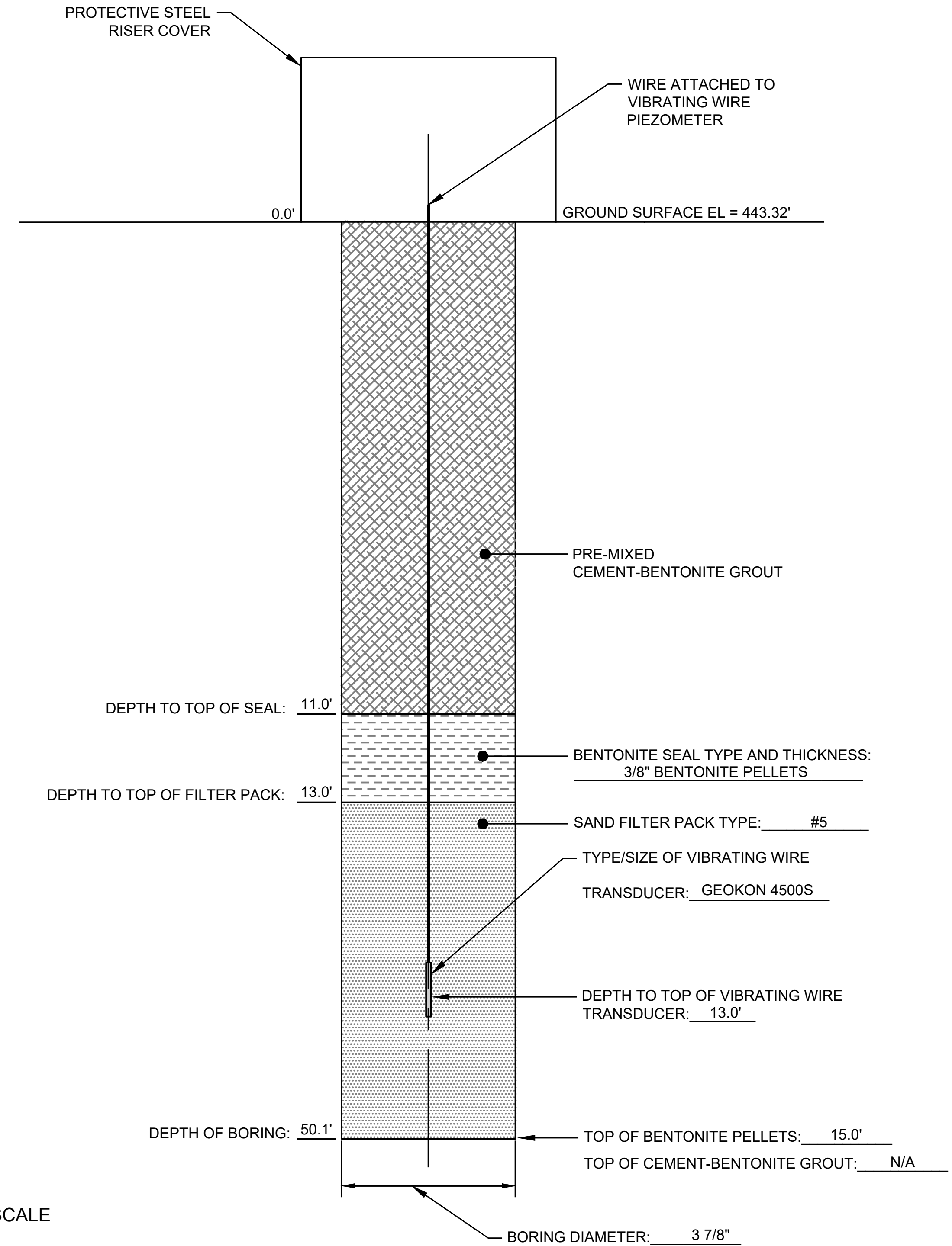
Project Location: BALDWIN, ILLINOIS

Project Number: 60428794

Log of Piezometer
BAL-P007

Piezometer Location	BALDWIN BOTTOM ASH POND	Date Installed	09/01/15	Time	8:50 AM
Installed By	SCOTT KOMEN	Observed By	BETTY TESFU	Total Depth	50.1'
Method of Installation	CME 75 MUD ROTARY	Drilling Contractor	STRATA EARTH SERVICES	Surface Elevation	443.32'
Sand Pack Interval	13.0' - 15.0'	Completion Zone	PROTECTIVE STEEL RISER COVER		
Remarks	REFER TO BAL-B006 SOIL LOG FOR SOIL DESCRIPTION	Groundwater Level(s)	2.5'		

SERIAL NO. 1522963



NOT TO SCALE

AECOM

Project: Dynegy

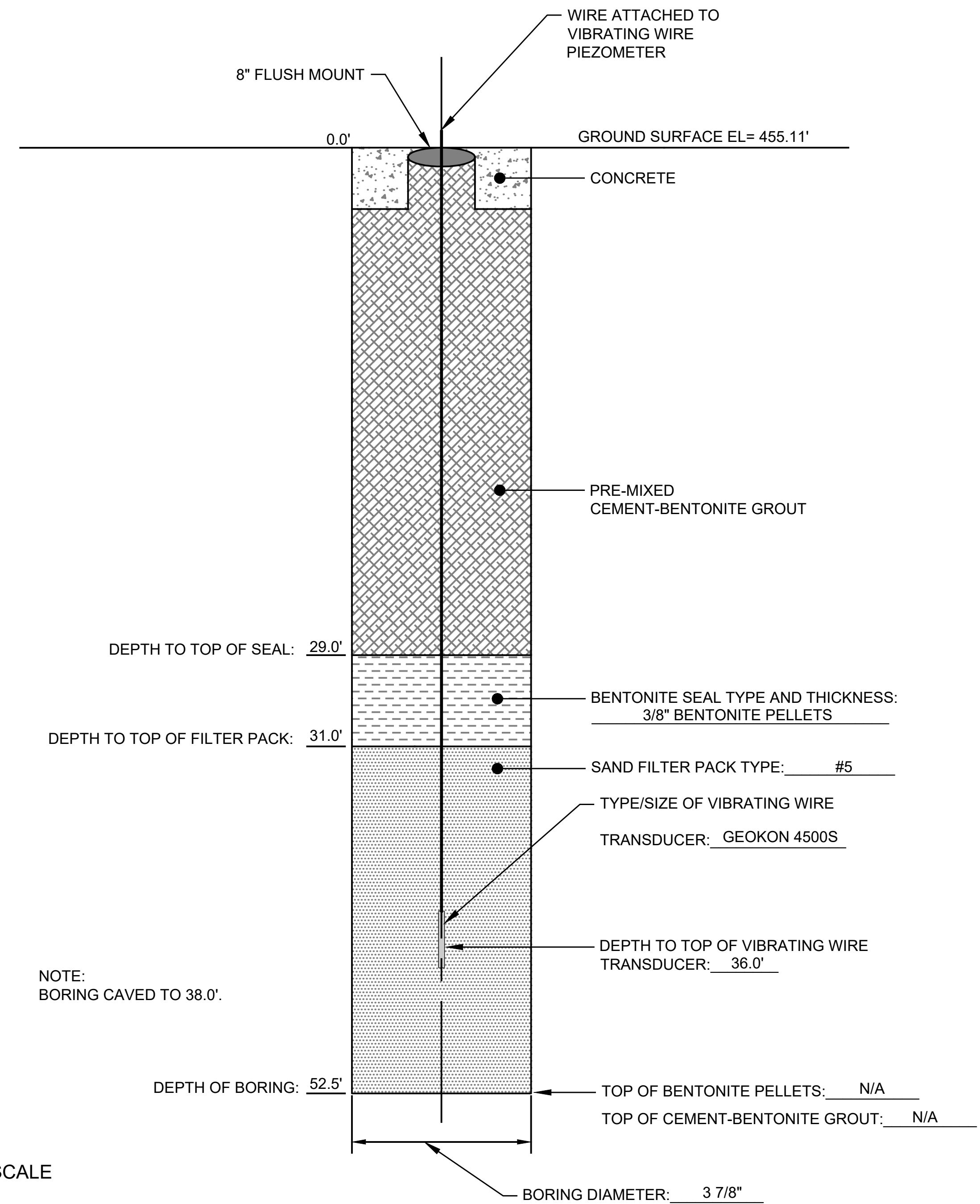
Project Location: BALDWIN, ILLINOIS

Project Number: 60428794

Log of Piezometer
BAL-P008

Piezometer Location	BALDWIN OLD EAST FLY ASH POND	Date Installed	08/14/15	Time	8:30 PM
Installed By	DAN MALOUF	Observed By	JENNIFER ALLEN	Total Depth	52.5'
Method of Installation	CME 75 MUD ROTARY	Drilling Contractor	STRATA EARTH SERVICES	Surface Elevation	455.11'
Sand Pack Interval	31.0' - 38.0'	Completion Zone	FLUSH MOUNT		
Remarks	REFER TO BAL-B011 SOIL LOG FOR SOIL DESCRIPTION	Groundwater Level(s)	GROUNDWATER NOT APPARENT IN SAMPLE RECOVERY OR DURING DRILLING		

SERIAL NO. 1522961



NOT TO SCALE

Project: Dynegy

Project Location: BALDWIN, ILLINOIS

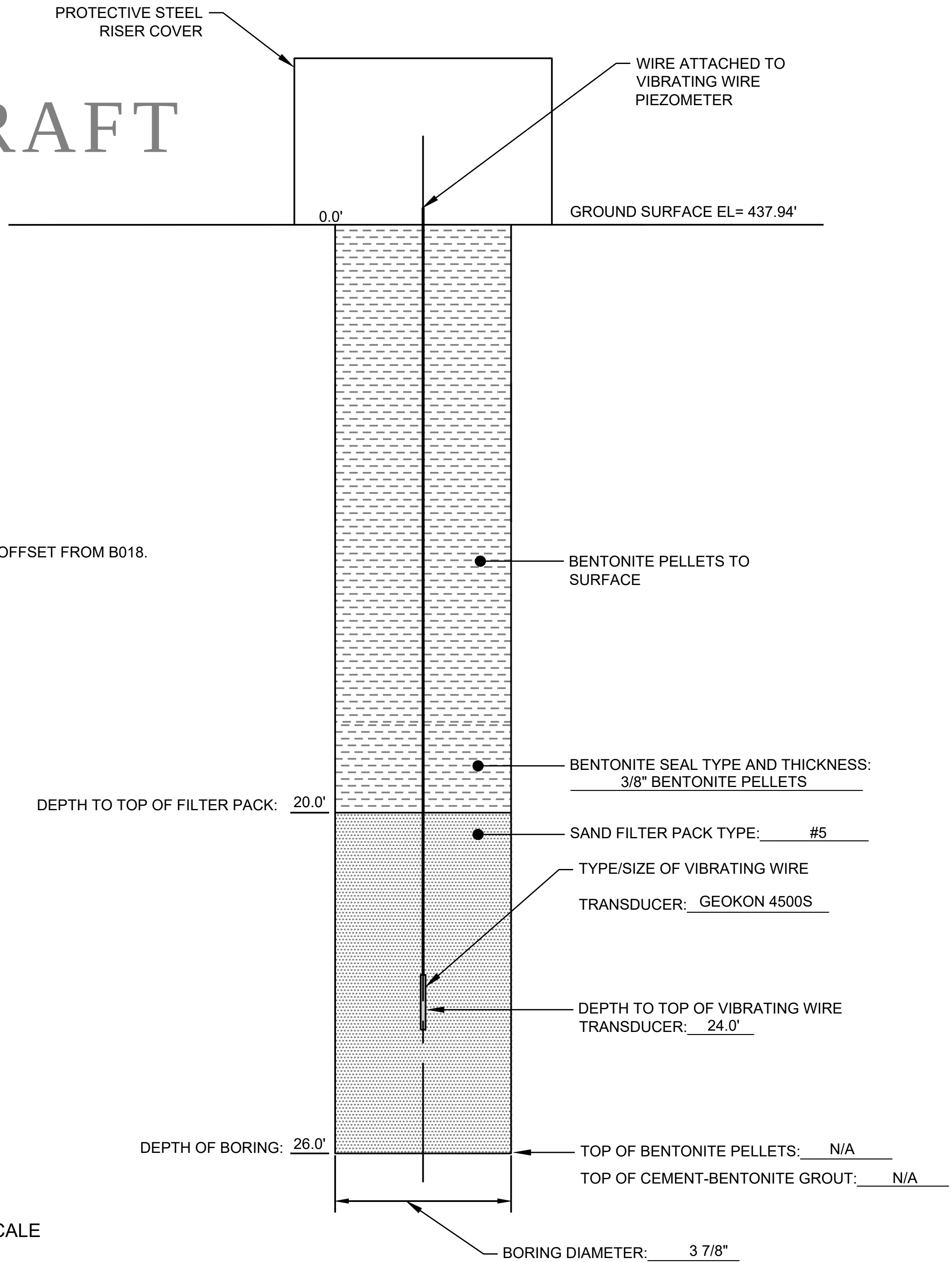
Project Number: 60428794

Log of Piezometer
BAL-P009
Sheet 1 of 1

Piezometer Location	BALDWIN OLD EAST FLY ASH POND	Date Installed	8/11/15	Time	3:20 PM
Installed By	SCOTT KOMEN	Observed By	JENNIFER ALLEN	Total Depth	26.0'
Method of Installation	CME 75 MUD ROTARY	Drilling Contractor	STRATA EARTH SERVICES	Surface Elevation	437.94'
Sand Pack Interval	20.0' - 26.0'	Completion Zone	PROTECTIVE STEEL RISER COVER		
Remarks	REFER TO BAL-B018 SOIL LOG FOR SOIL DESCRIPTION	Groundwater Level(s)	GROUNDWATER NOT APPARENT IN SAMPLE RECOVERY OR DURING DRILLING		

SERIAL NO. 1522964

DRAFT



NOTE:
P009 IS 5' OFFSET FROM B018.

NOT TO SCALE

AECOM

Project: Dynegy CCR RULE ASSESSMENT OF PLANTS

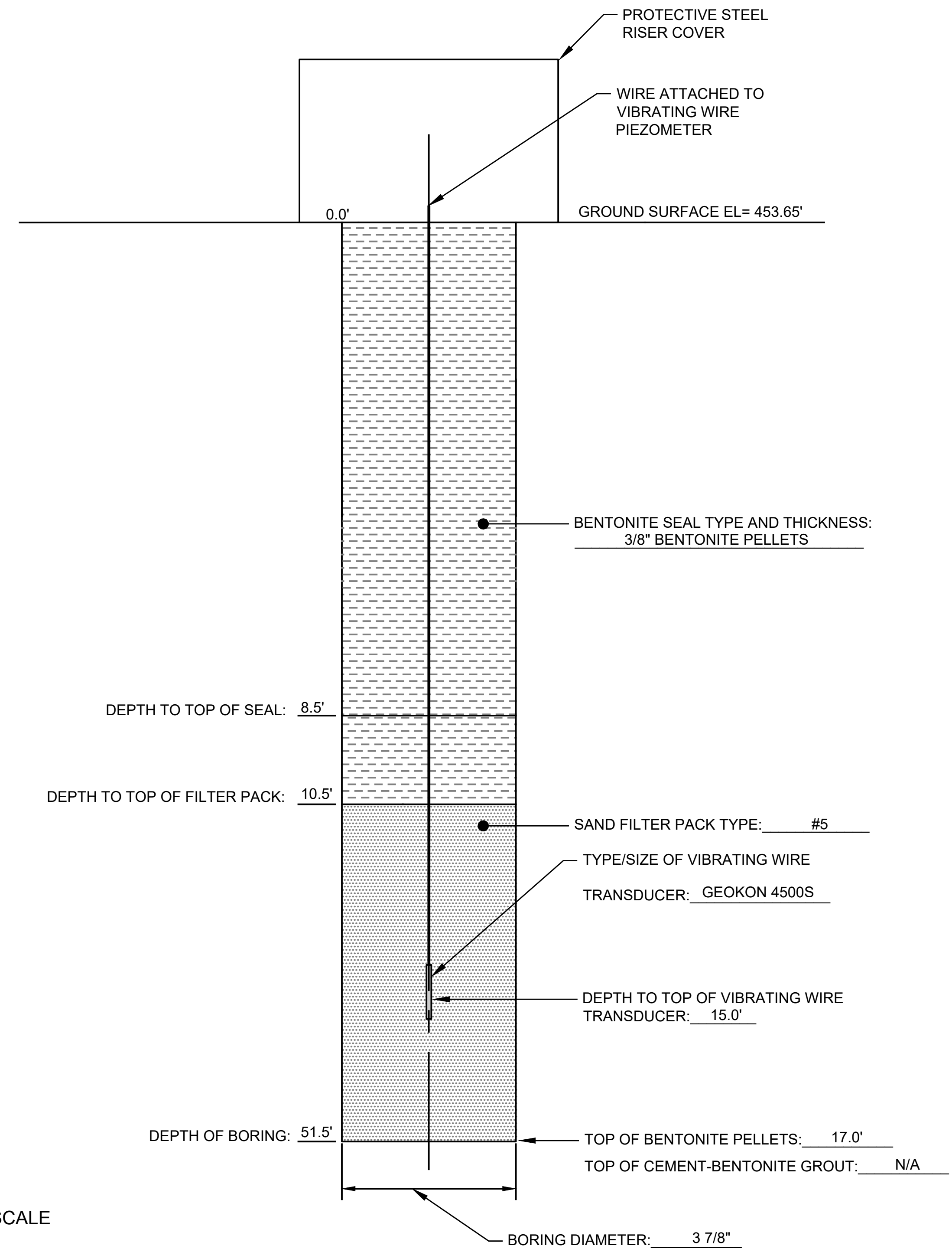
Project Location: BALDWIN, ILLINOIS

Project Number: 60428794

Log of Piezometer BAL-P010

Piezometer Location	BALDWIN OLD EAST FLY ASH POND	Date Installed	09/02/15	Time	10.00AM
Installed By	SCOTT KOMEN	Observed By	BETTY TESFU	Total Depth	51.5'
Method of Installation	CME 75 MUD ROTARY	Drilling Contractor	STRATA EARTH SERVICES	Surface Elevation	453.65'
Sand Pack Interval	10.5' - 17.0'	Completion Zone	PROTECTIVE STEEL RISER COVER		
Remarks	REFER TO BAL-B029 SOIL LOG FOR SOIL DESCRIPTION	Groundwater Level(s)	2.0'		

SERIAL NO. 1522962



NOT TO SCALE

Project: Dynegy CCR RULE ASSESSMENT OF PLANTS

Project Location: BALDWIN, ILLINOIS

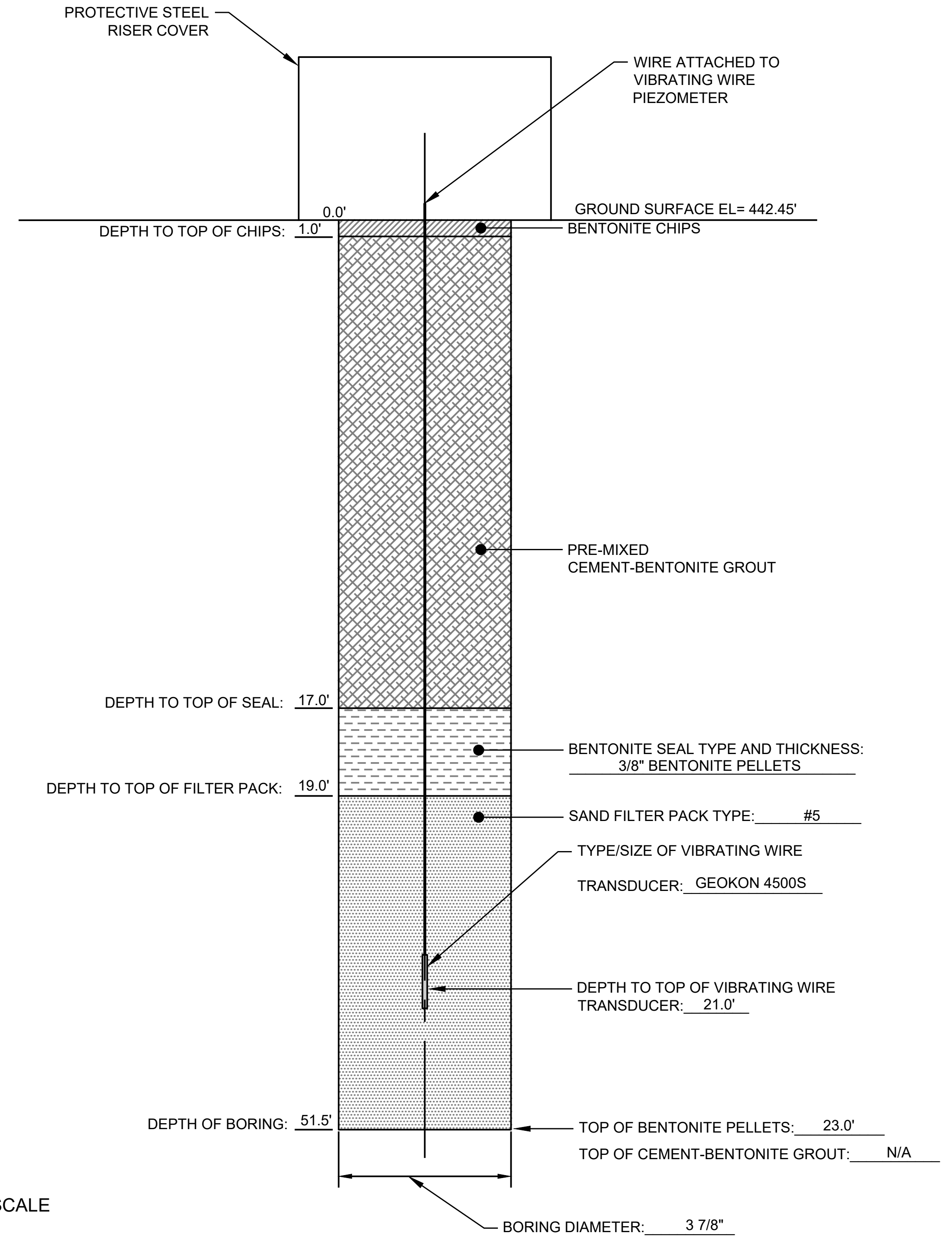
Project Number: 60428794

Log of Piezometer BAL-P011

Sheet 1 of 1

Piezometer Location	BALDWIN OLD EAST FLY ASH POND	Date Installed	08/18/15	Time	11:10AM
Installed By	SCOTT KOMEN	Observed By	BETTY TESFU	Total Depth	51.5'
Method of Installation	CME 75 MUD ROTARY	Drilling Contractor	STRATA EARTH SERVICES	Surface Elevation	442.45'
Sand Pack Interval	19.0' - 23.0'	Completion Zone	PROTECTIVE RISER COVER		
Remarks	REFER TO BAL-B015 SOIL LOG FOR SOIL DESCRIPTION	Groundwater Level(s)	3.0'		

SERIAL NO. 1523286



NOT TO SCALE

AECOM

DEGUIRE, DAVID, 12/15/2015 8:56 PM

Project: Dynegy CCR RULE ASSESSMENT OF PLANTS

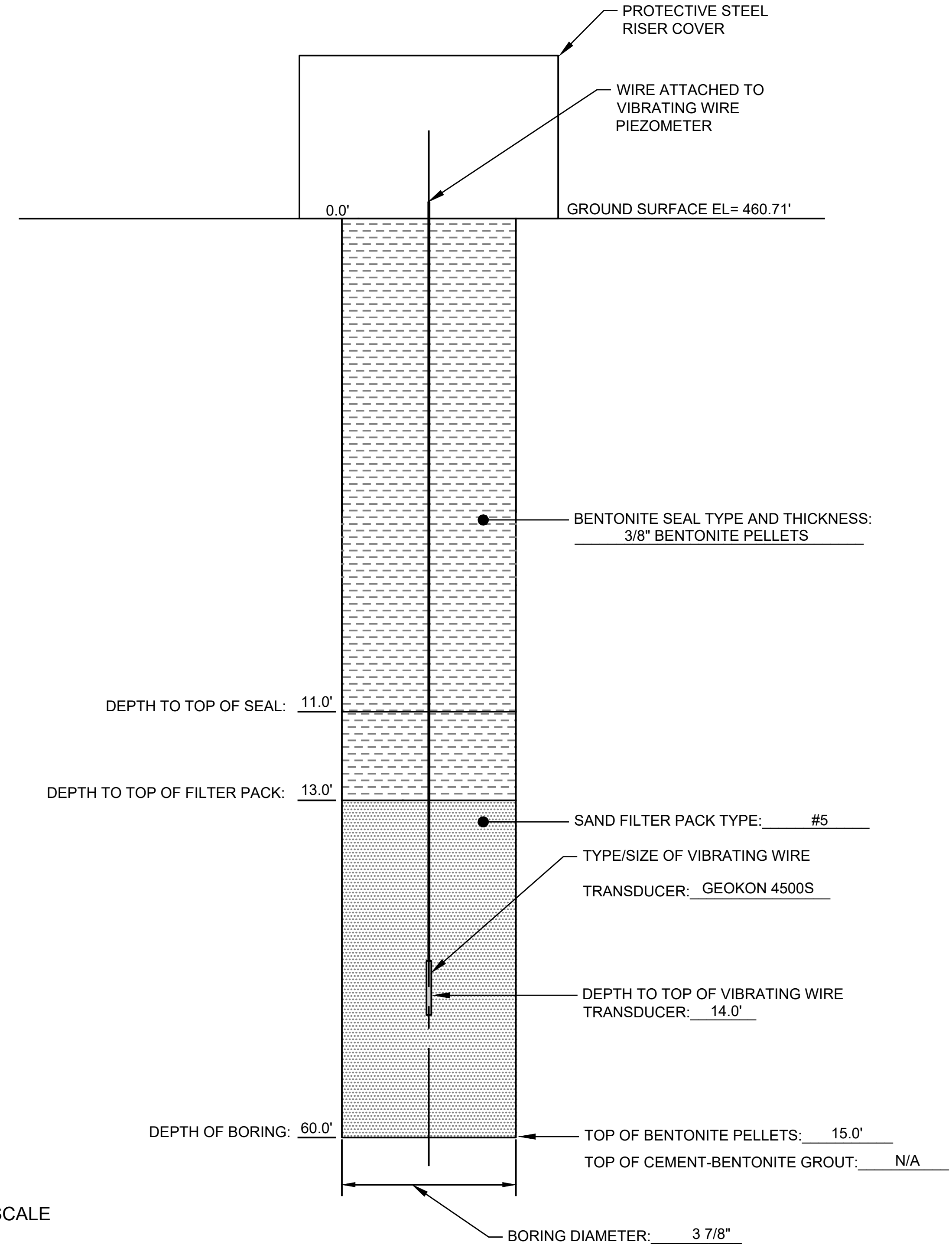
Project Location: BALDWIN, ILLINOIS

Project Number: 60428794

Log of Piezometer
BAL-P012
Sheet 1 of 1

Piezometer Location	BALDWIN OLD EAST FLY ASH POND	Date Installed	09/01/15	Time	2:00PM
Installed By	SCOTT KOMEN	Observed By	BETTY TESFU	Total Depth	60.0'
Method of Installation	CME 75 MUD ROTARY	Drilling Contractor	STRATA EARTH SERVICES	Surface Elevation	460.71'
Sand Pack Interval	13.0' - 15.0'	Completion Zone	PROTECTIVE STEEL RISER COVER		
Remarks	REFER TO BAL-B017 SOIL LOG FOR SOIL DESCRIPTION	Groundwater Level(s)	2.0'		

SERIAL NO. 1522967



NOT TO SCALE

AECOM DRAWING PATH: P:\Projects\Geotech\60428794_DynegyCCR\04Tasks\00 Program Tasks\01_Templates\CADD\DYNEGY CAD STANDARDS\7.05_Working_Files\Piezometer Template\BAL-P012 Log of Piezometer.dwg

Project: Dynegy CCR RULE ASSESSMENT OF PLANTS

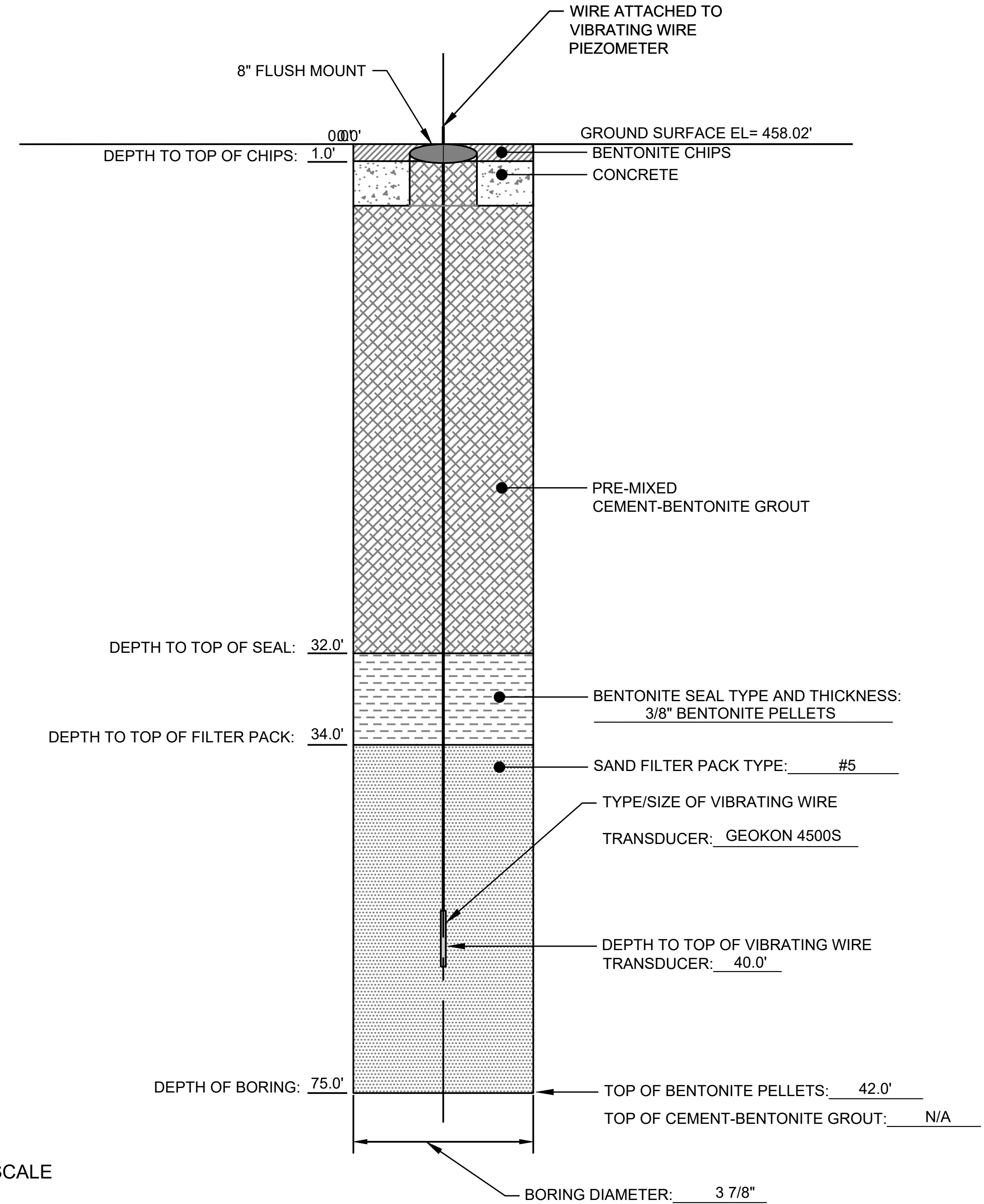
Project Location: BALDWIN, ILLINOIS

Project Number: 60428794

Log of Piezometer
BAL-P013
Sheet 1 of 1

Piezometer Location	BALDWIN OLD EAST FLY ASH POND	Date Installed	08/18/15	Time	9:15AM TO 4:15PM
Installed By	SCOTT KOMEN	Observed By	BETTY TESFU	Total Depth	75.0'
Method of Installation	CME 75 MUD ROTARY	Drilling Contractor	STRATA EARTH SERVICES	Surface Elevation	458.02'
Sand Pack Interval	34.0' - 42.0'	Completion Zone	FLUSH MOUNT		
Remarks	REFER TO BAL-B026 SOIL LOG FOR SOIL DESCRIPTION	Groundwater Level(s)	6.7'		

SERIAL NO. 1522966

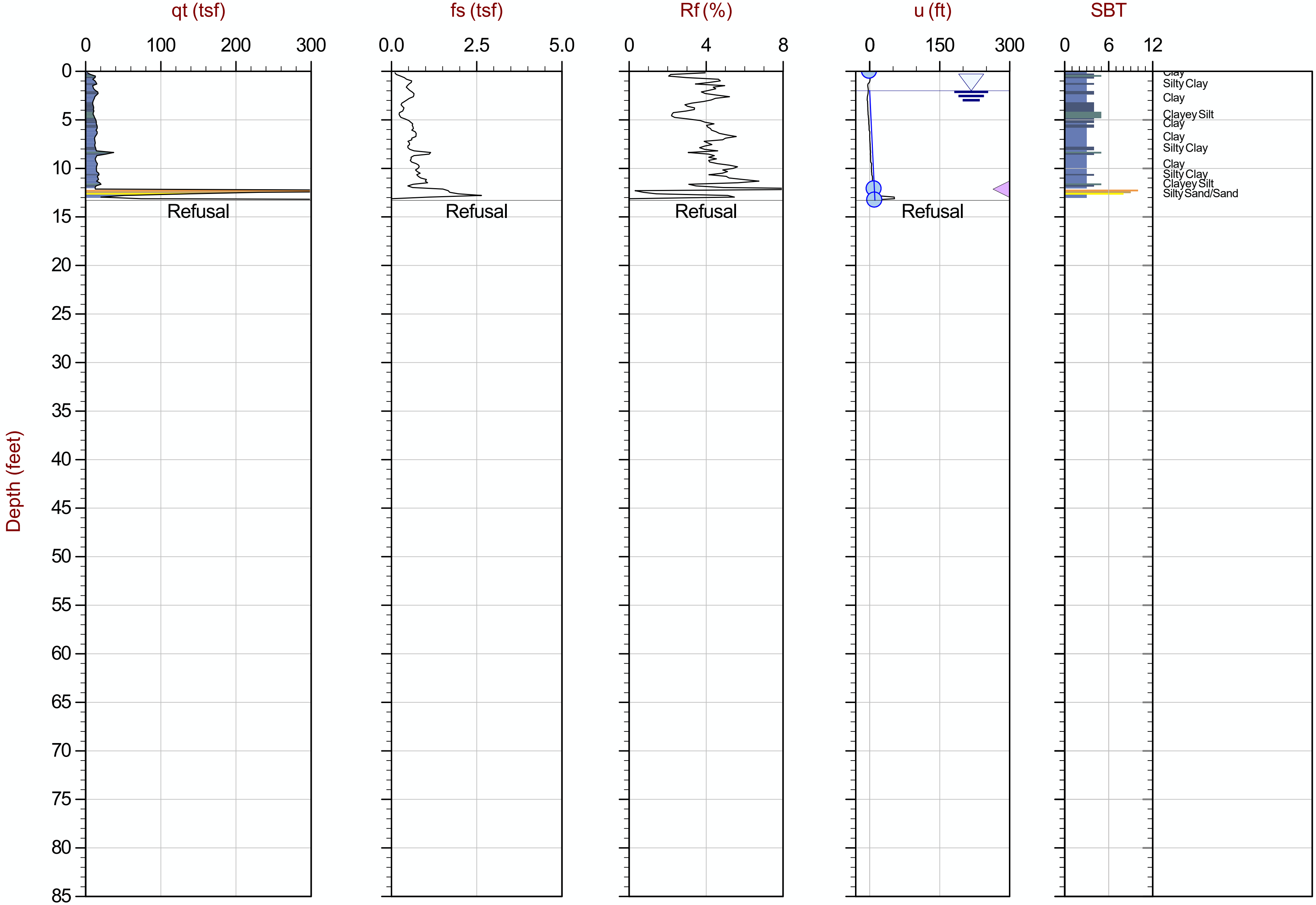


NOT TO SCALE

AECOM

Job No: 15-53062
Date: 08:21:15 08:11
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C001
Cone: 419:T1500F15U500



Max Depth: 4.050 m / 13.29 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC001.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230823m E: 247842m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

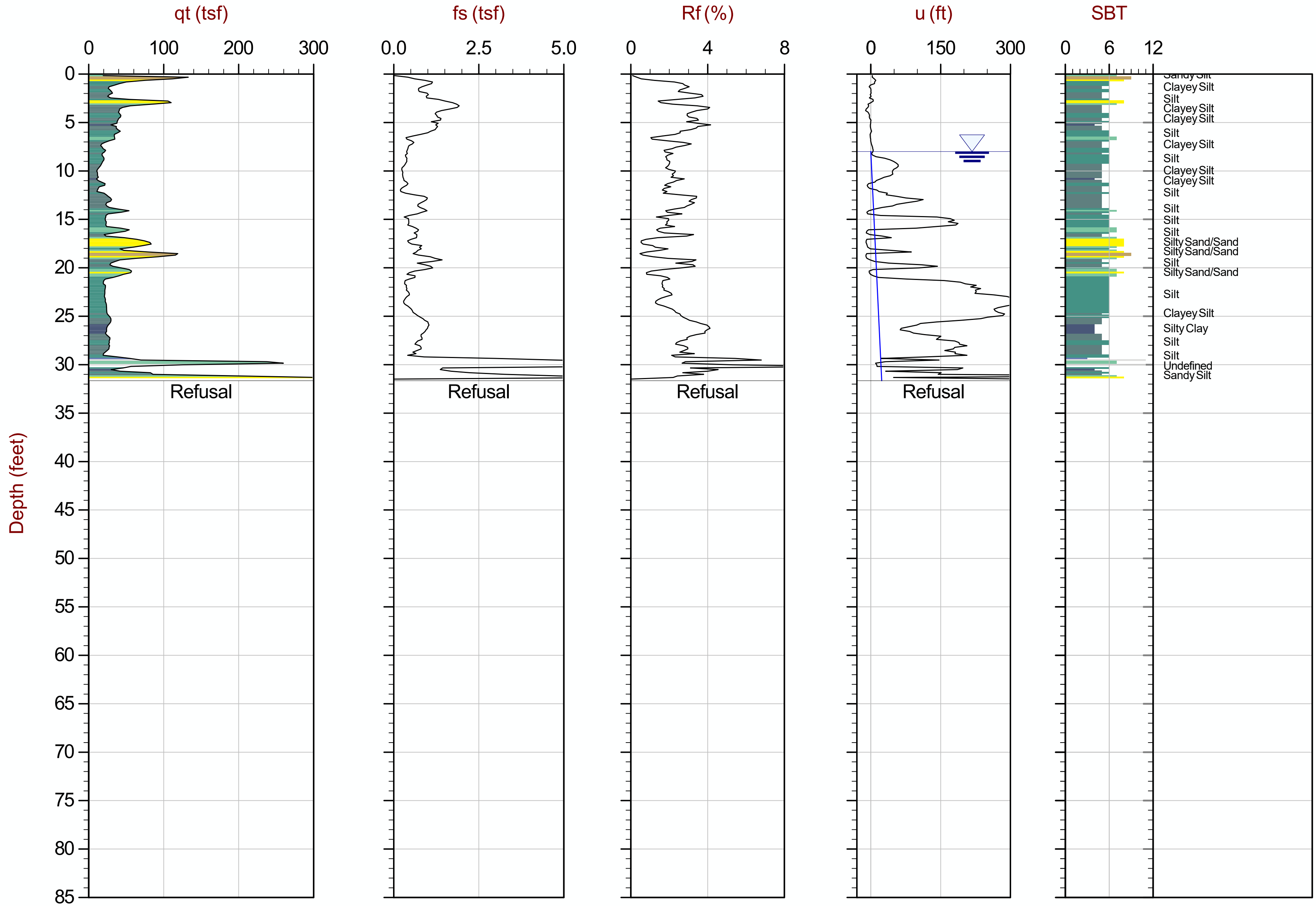
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:14:15 07:56
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C002
Cone: 419:T1500F15U500



Max Depth: 9.650 m / 31.66 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC002.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230952m E: 247856m

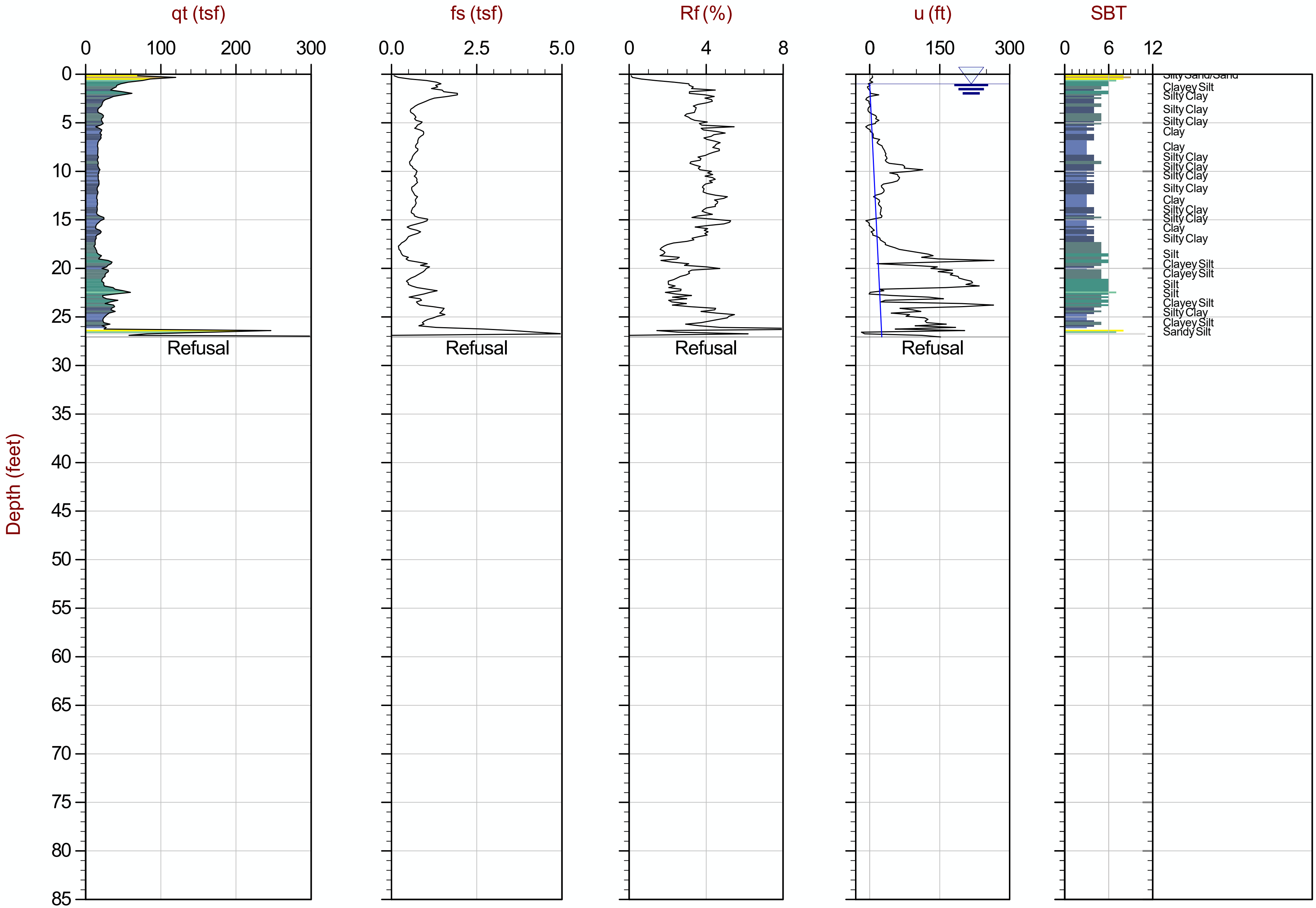
Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

AECOM

Job No: 15-53062
Date: 08:14:15 08:35
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C003
Cone: 419:T1500F15U500



Max Depth: 8.250 m / 27.07 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC003.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230803m E: 247952m

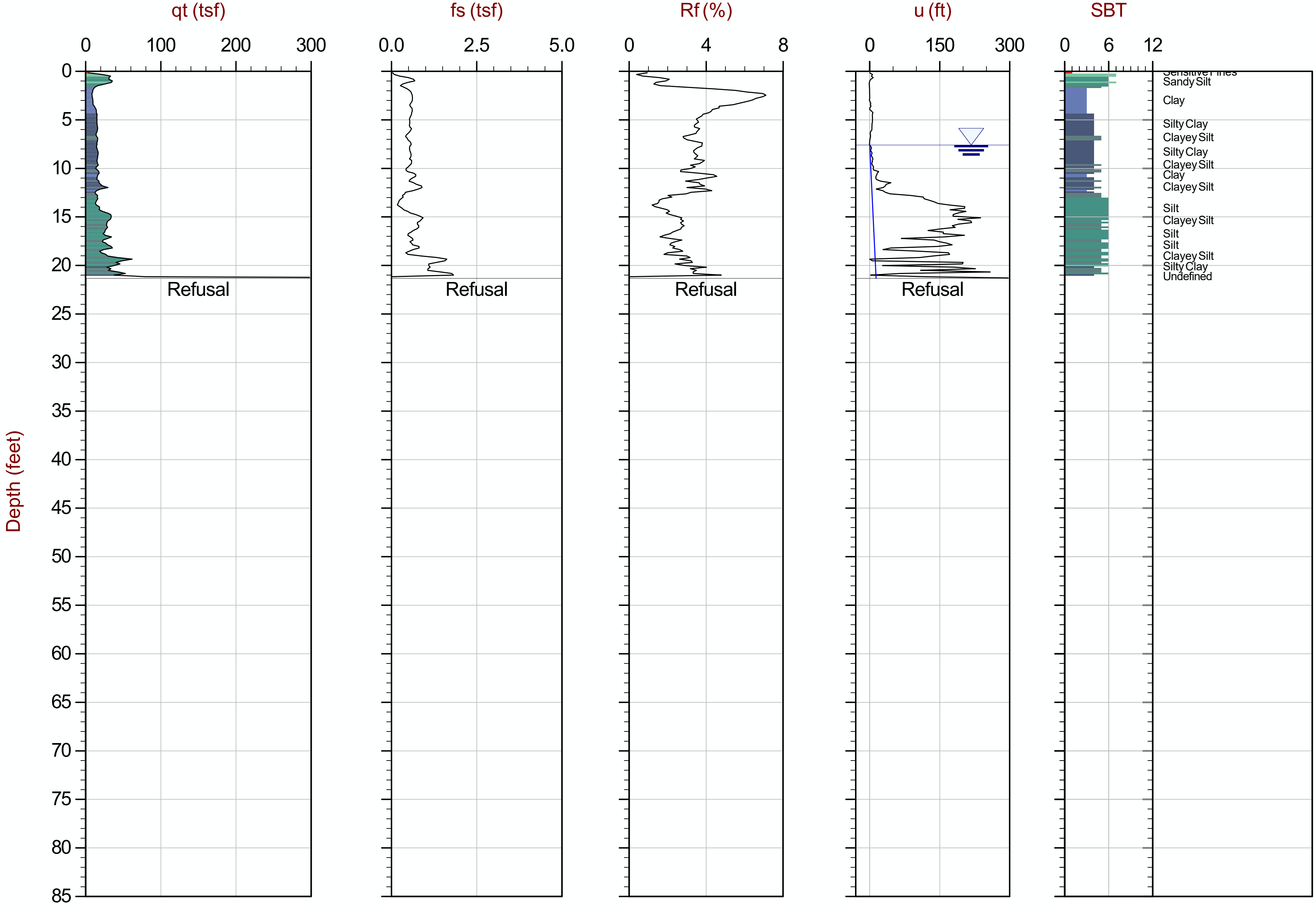
Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

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: 15-53062
Date: 08:14:15 09:15
Site: Baldwin Power Station, Baldwin, IL
Sounding: CPT15-BAL-C004
Cone: 419:T1500F15U500



Max Depth: 6.500 m / 21.33 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC004.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230794m E: 247958m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

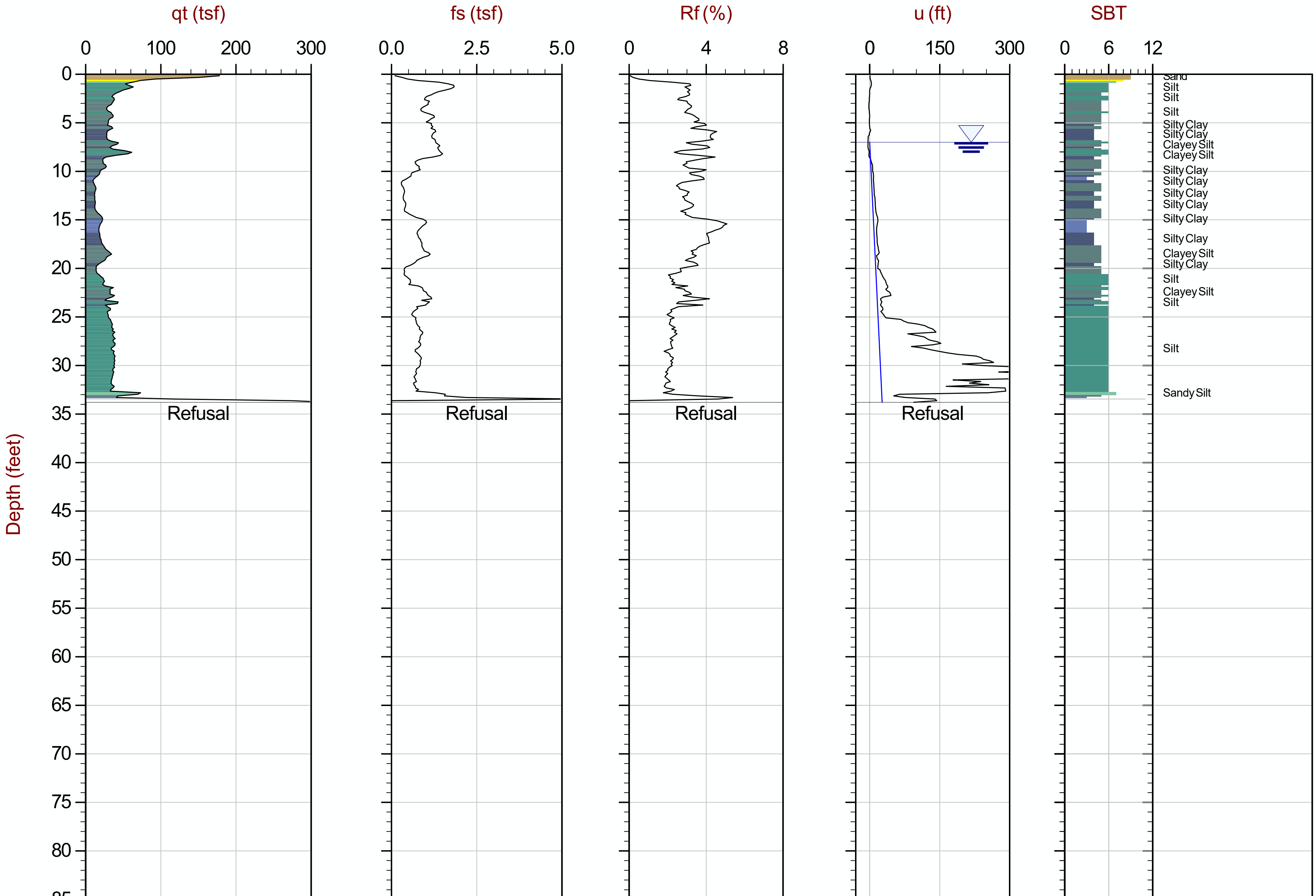
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:14:15 12:03
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C005
Cone: 419:T1500F15U500



Max Depth: 10.300 m / 33.79 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC005.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230808m E: 248049m

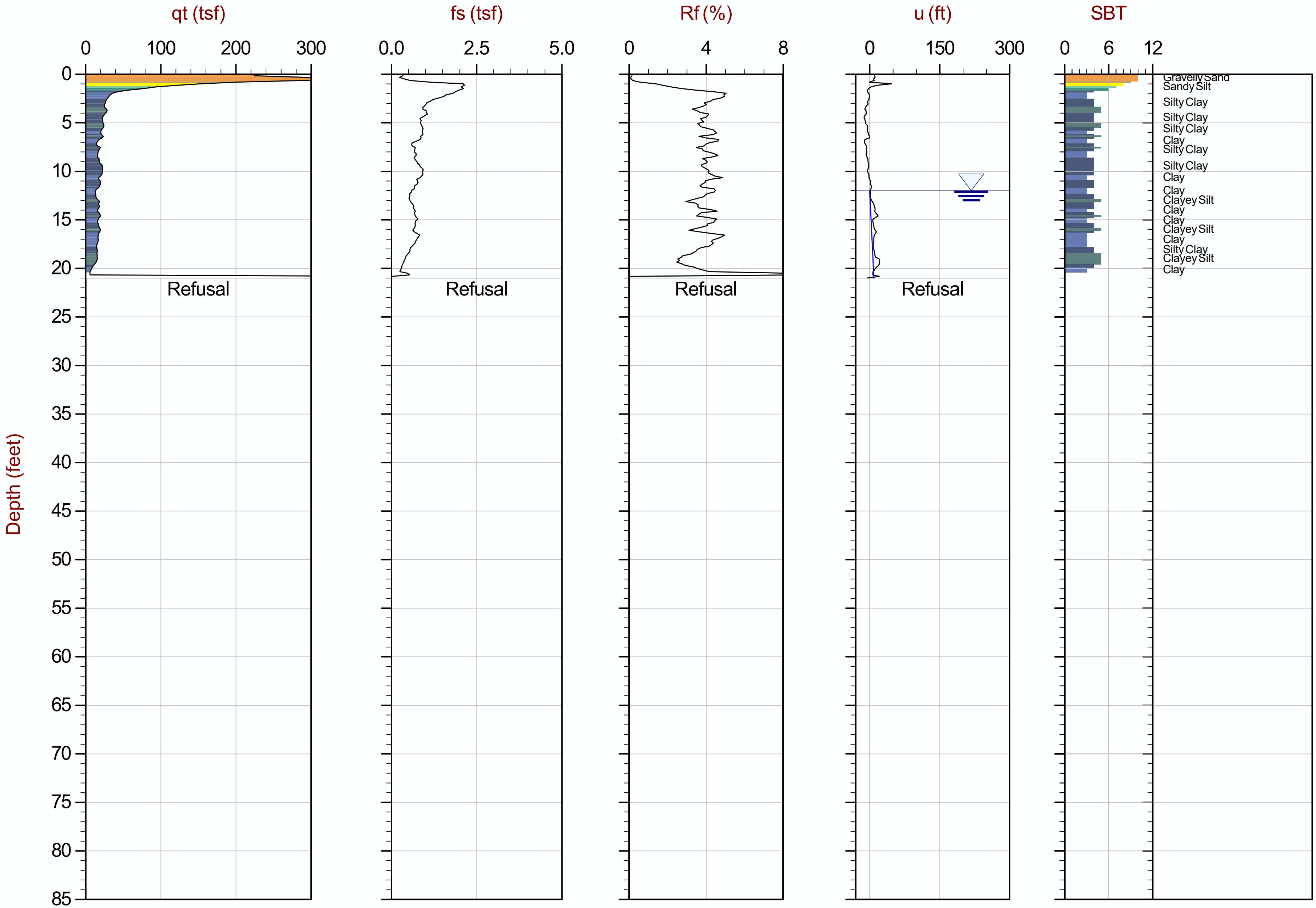
Hydrostatic Line | Ueq | Assumed Ueq | PPD, Ueq achieved | PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

AECOM

Job No: 15-53062
Date: 08:14:15 11:36
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C006
Cone: 419:T1500F15U500



Max Depth: 6.400 m / 21.00 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC006.COR

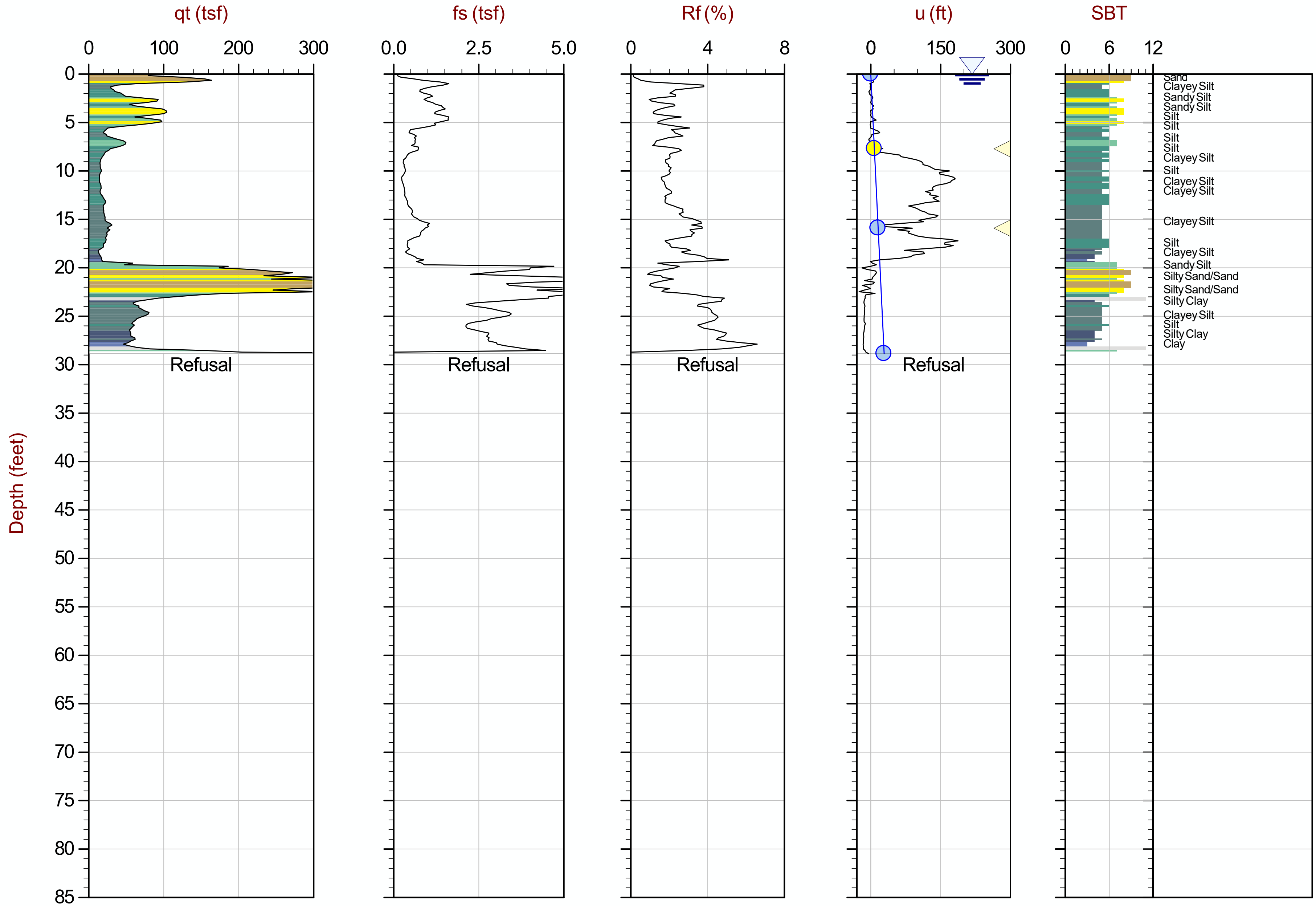
SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230846m E: 248015m

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.

AECOM

Job No: 15-53062
Date: 08:14:15 09:47
Site: Baldwin Power Station, Baldwin, IL
Sounding: CPT15-BAL-C007
Cone: 419:T1500F15U500



Max Depth: 8.800 m / 28.87 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC007.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230952m E: 247926m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

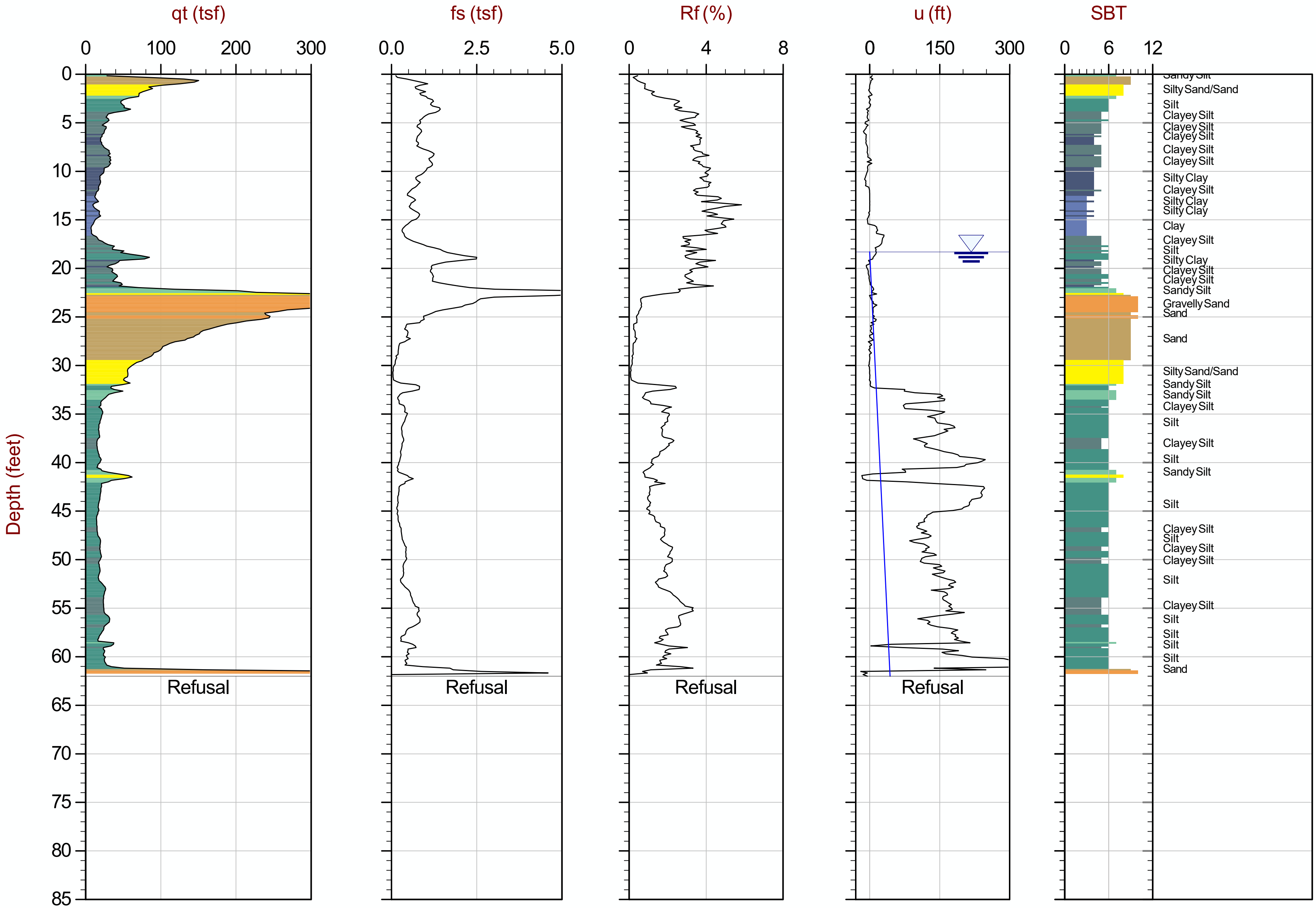
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:05:15 09:56
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C009
Cone: 226:T1500F15U500



Max Depth: 18.900 m / 62.01 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC009.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230741m E: 248292m

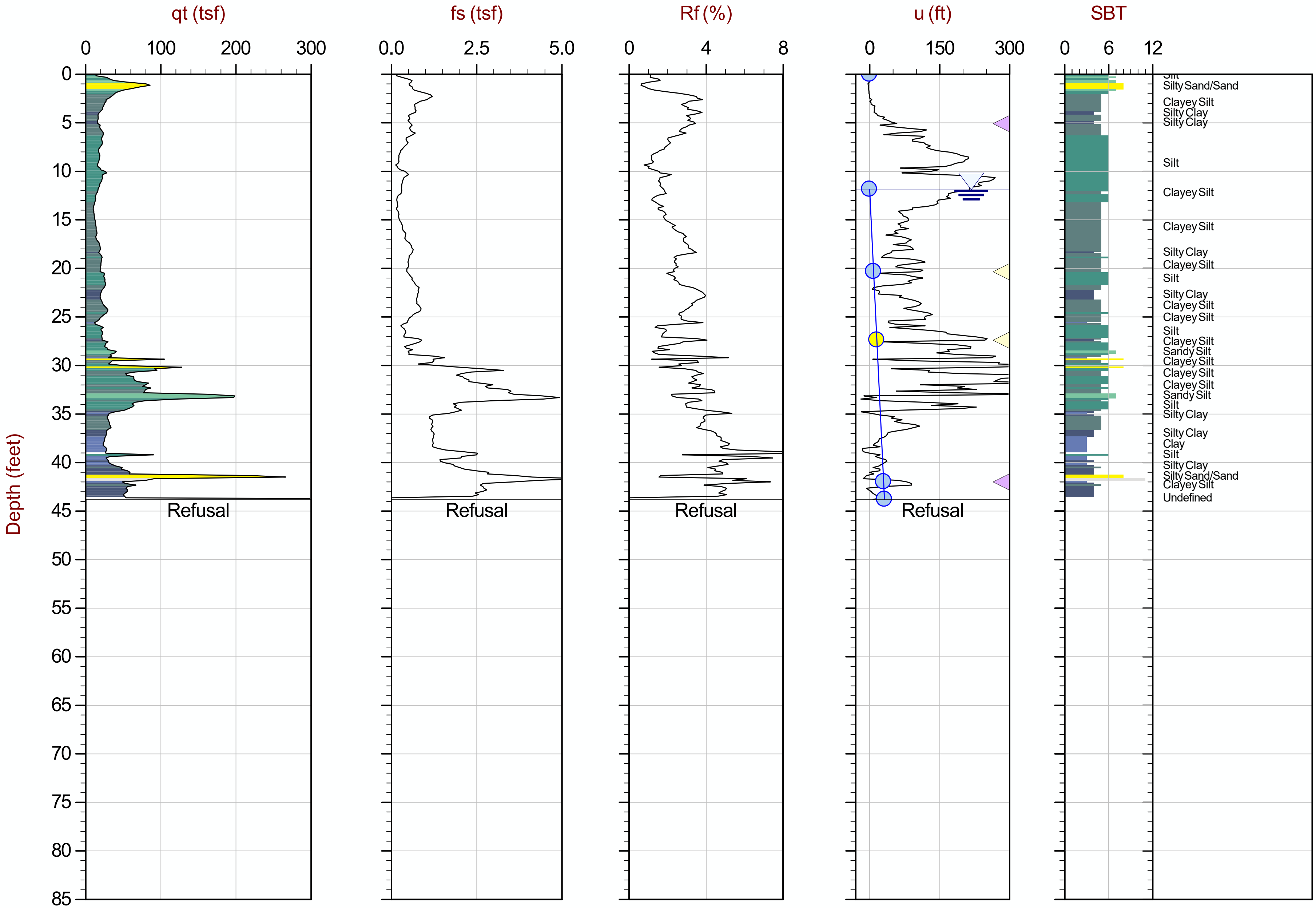
Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

AECOM

Job No: 15-53062
Date: 08:04:15 09:19
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C010
Cone: 226:T1500F15U500



Max Depth: 13.350 m / 43.80 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC010.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230711m E: 248287m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

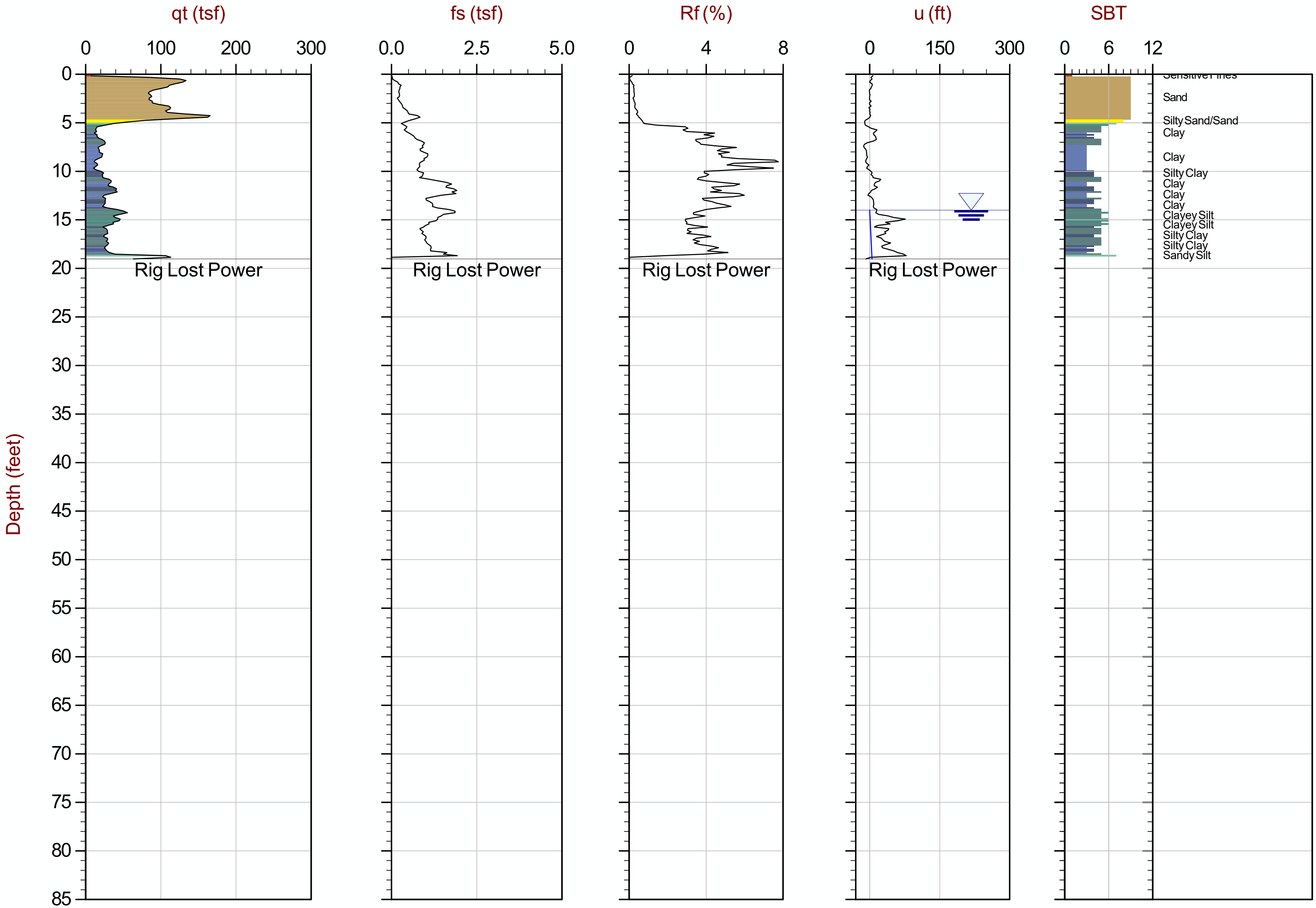
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:05:15 13:39
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C011
Cone: 226:T1500F15U500



Max Depth: 5.800 m / 19.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC011.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231032m E: 248576m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

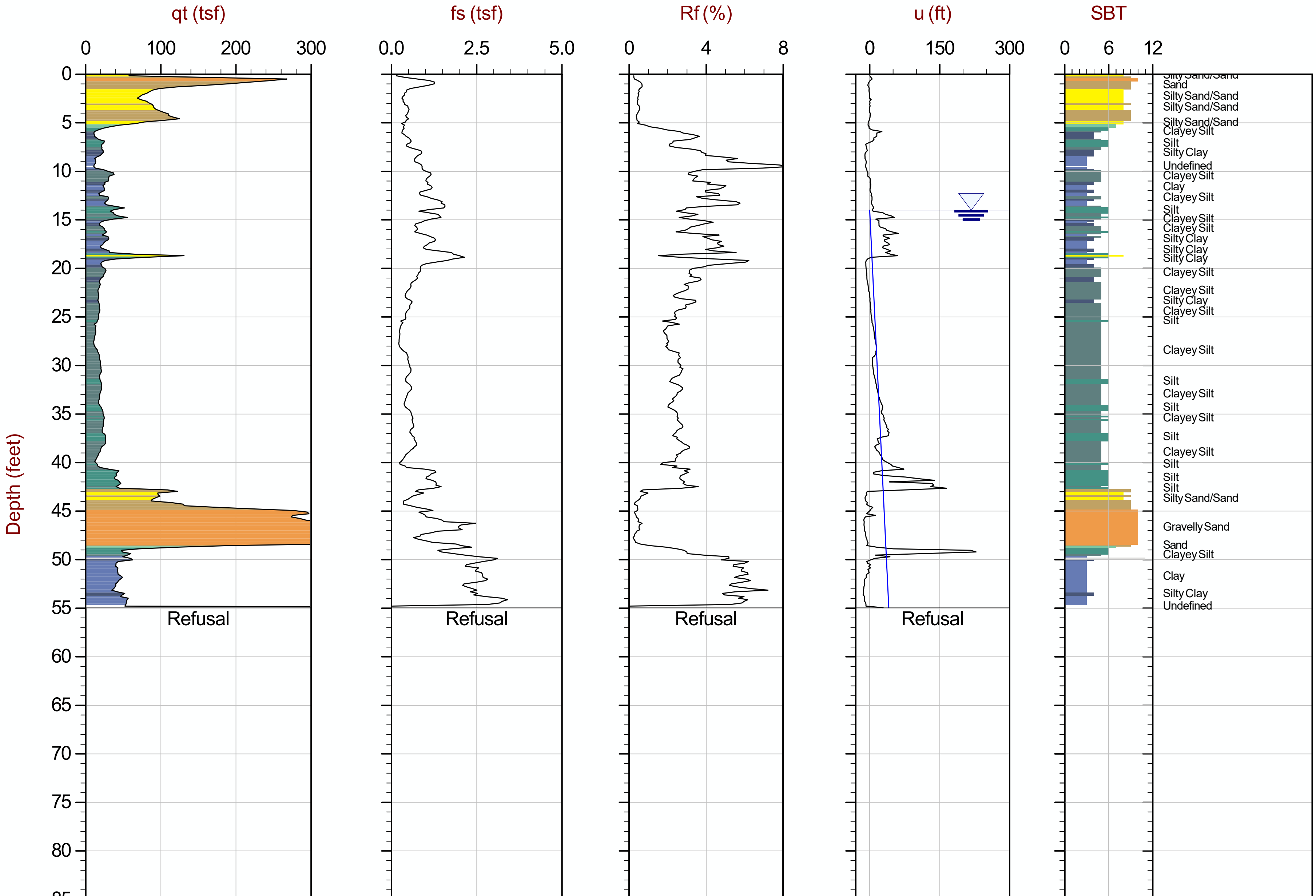
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:10:15 13:04
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C011A
Cone: 436:T1500F15U500



Max Depth: 16.750 m / 54.95 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC011A.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231034m E: 248577m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

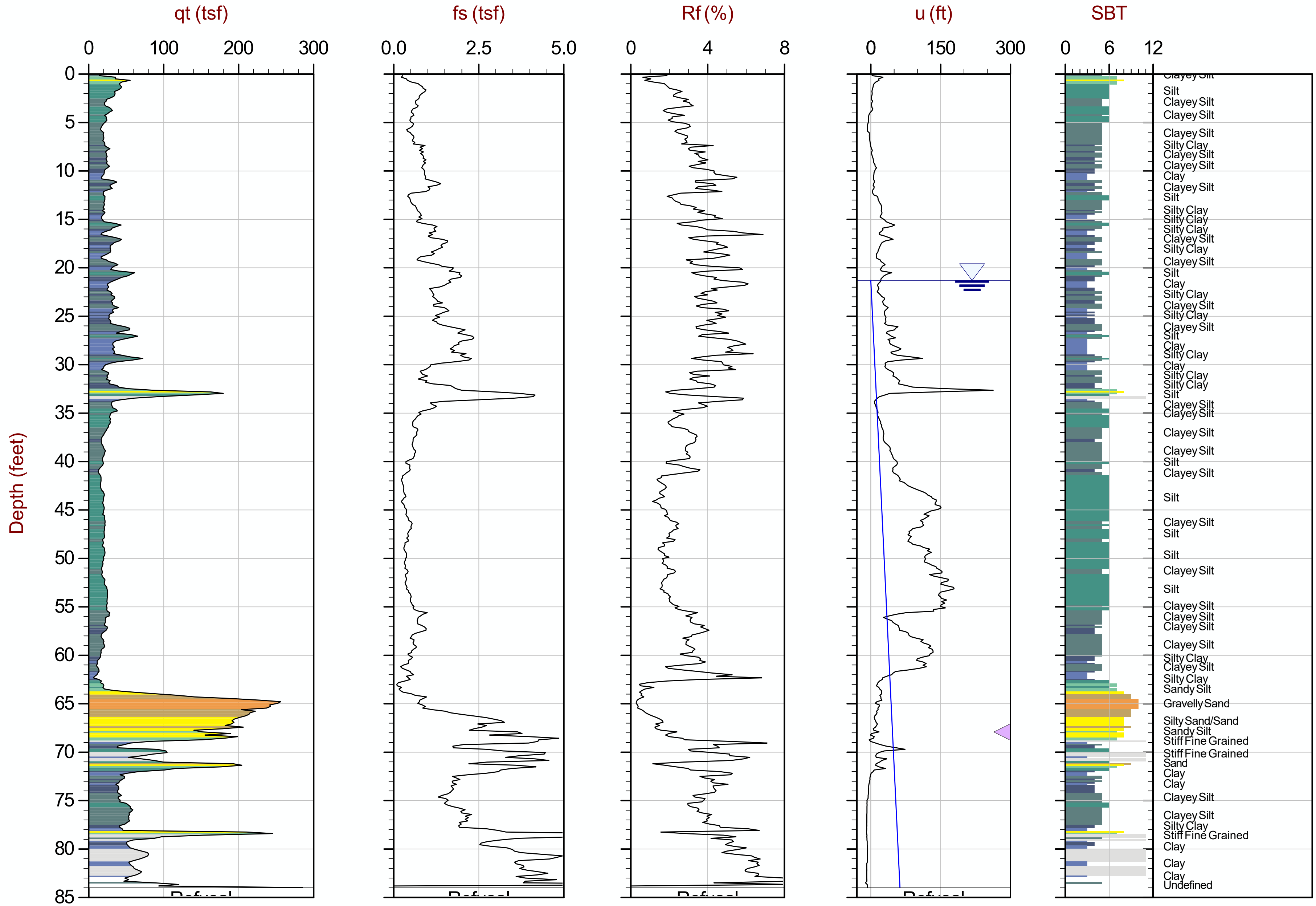
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:04:15 09:54
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C012
Cone: 301:T1500F15U500



Max Depth: 25.600 m / 83.99 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC012.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231049m E: 248570m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

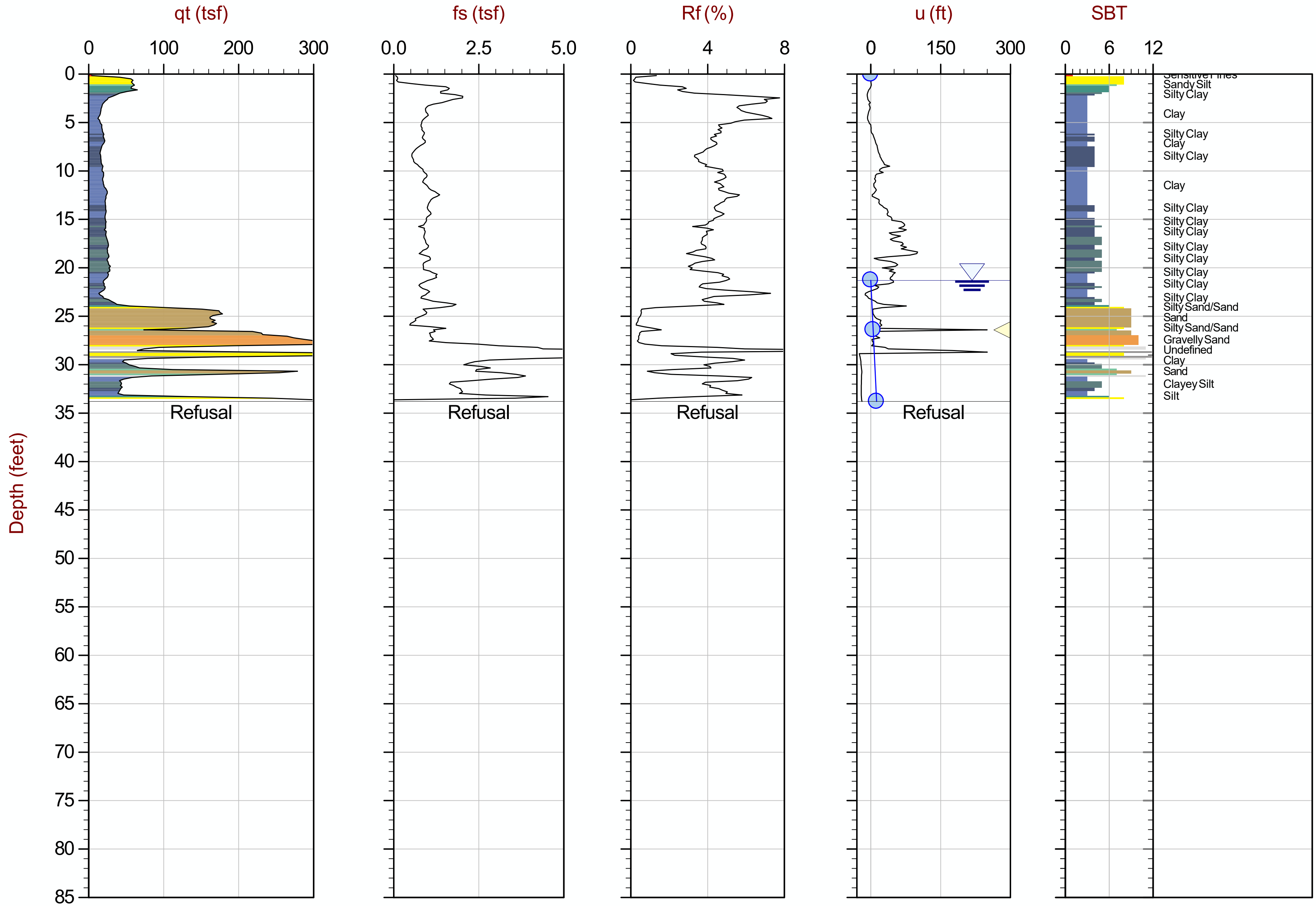
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:03:15 12:51
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C013
Cone: 226:T1500F15U500



Max Depth: 10.300 m / 33.79 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

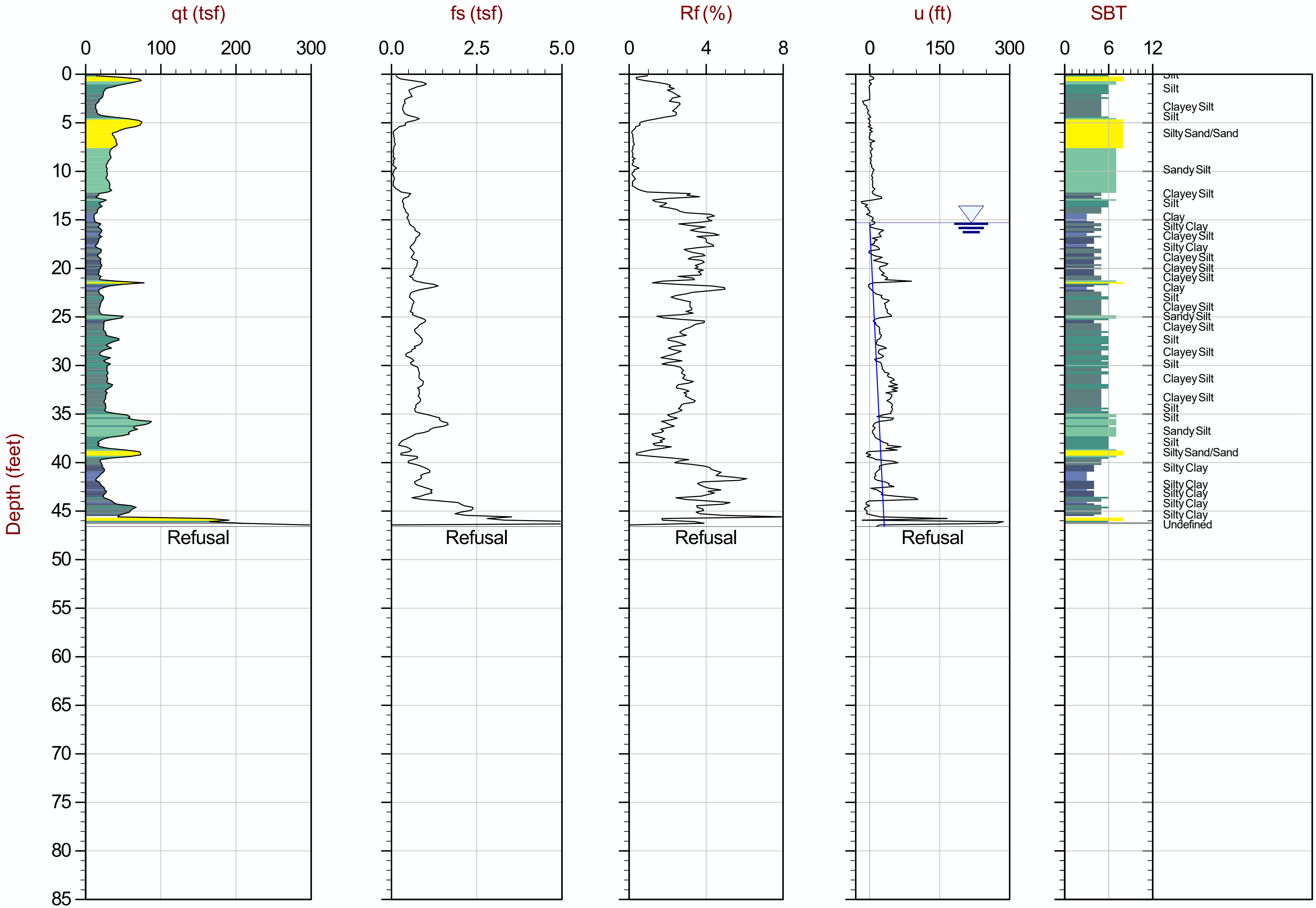
File: 15-53062_SPBALC013.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231082m E: 248558m

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: 15-53062 Date: 08:05:15 09:10 Site: Baldwin Power Station, Baldwin, IL	Sounding: CPT15-BAL-C014 Cone: 226:T1500F15U500



Max Depth: 14.200 m / 46.59 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC014.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230665m E: 248579m

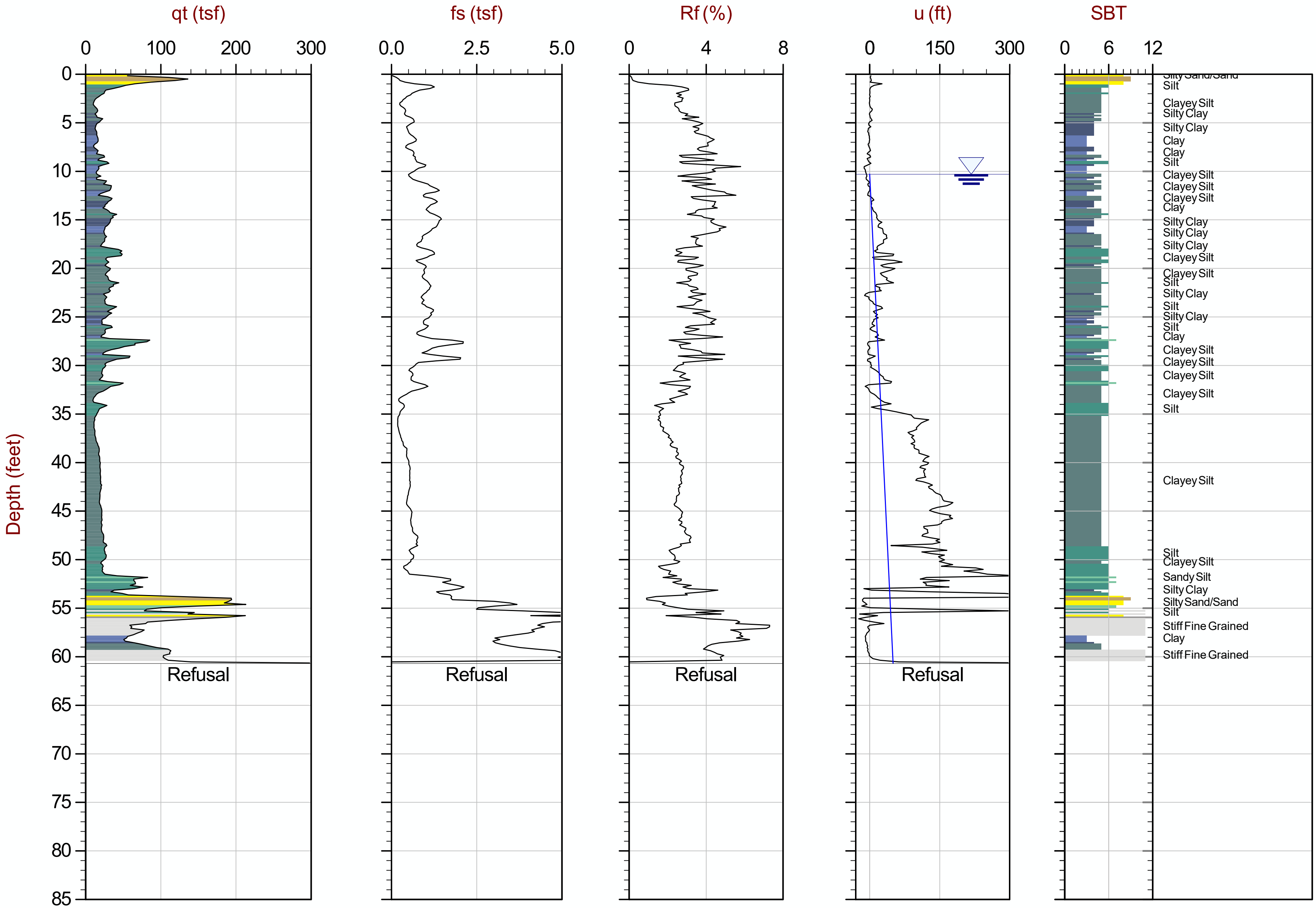
Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

AECOM

Job No: 15-53062
Date: 08:05:15 10:59
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C015
Cone: 226:T1500F15U500



Max Depth: 18.500 m / 60.69 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC015.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230947m E: 248329m

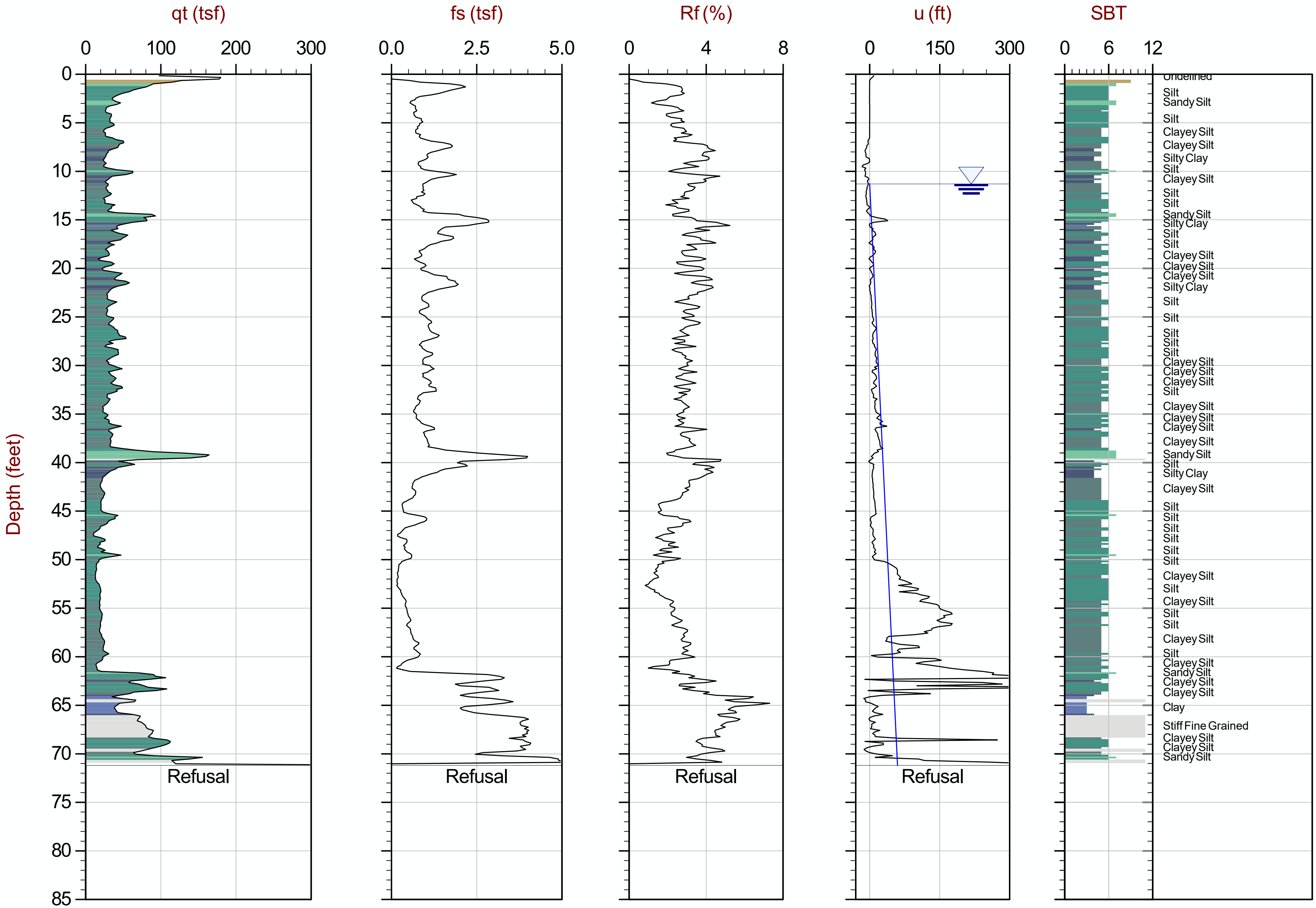
Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

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: 15-53062
Date: 08:05:15 12:17
Site: Baldwin Power Station, Baldwin, IL
Sounding: SCPT15-BAL-C016
Cone: 226:T1500F15U500



Max Depth: 21.700 m / 71.19 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC016A.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230967m E: 248340m

Hydrostatic Line — Ueq — Assumed Ueq — PPD, Ueq achieved — PPD, Ueq not achieved

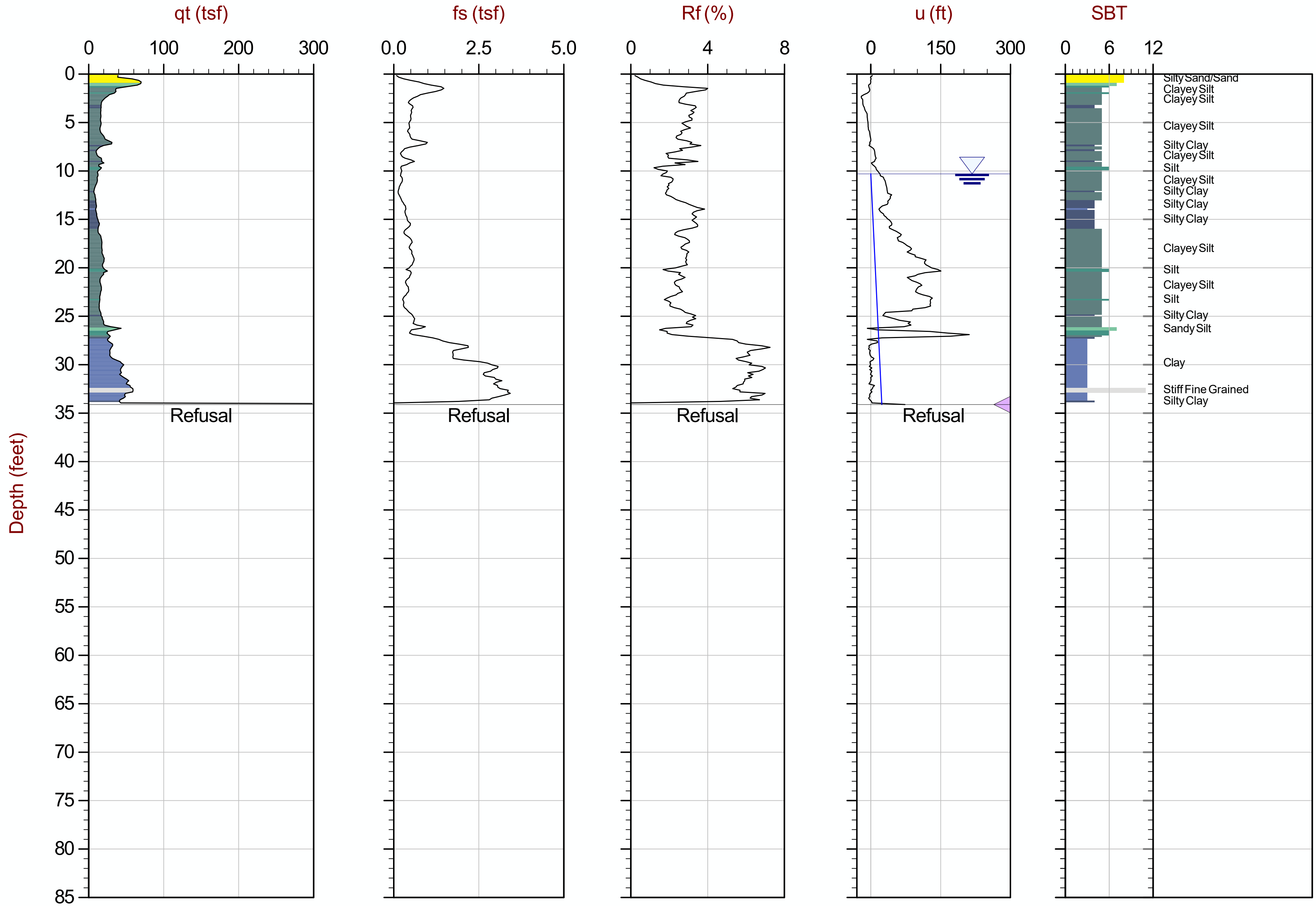
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:04:15 08:14
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C017
Cone: 226:T1500F15U500



Max Depth: 10.400 m / 34.12 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC017.COR

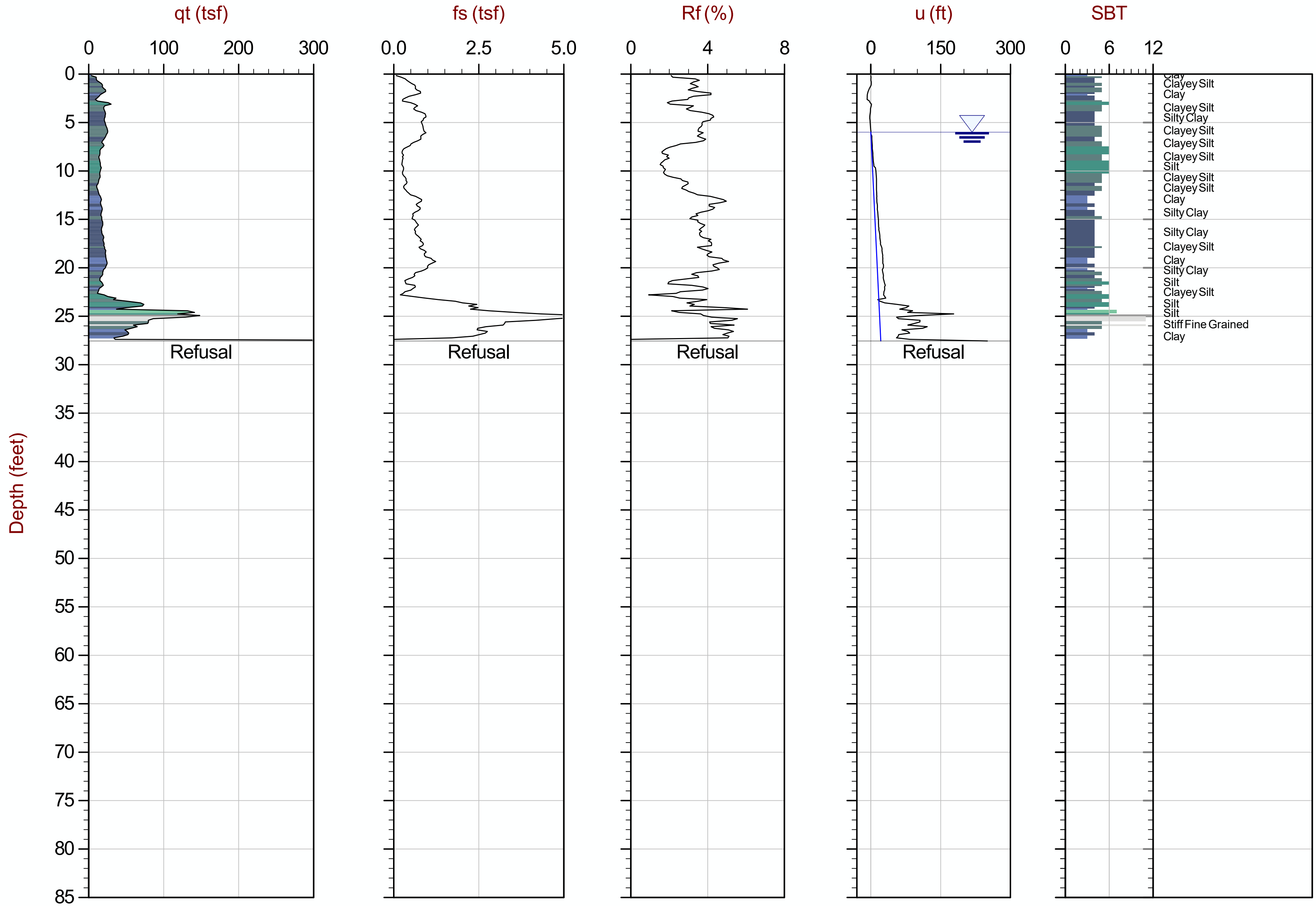
SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231001m E: 248318m

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.

Job No: 15-53062
Date: 08:20:15 16:43
Site: Baldwin Power Station, Baldwin, IL
Sounding: CPT15-BAL-C018
Cone: 419:T1500F15U500

AECOM



Max Depth: 8.400 m / 27.56 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC018.COR

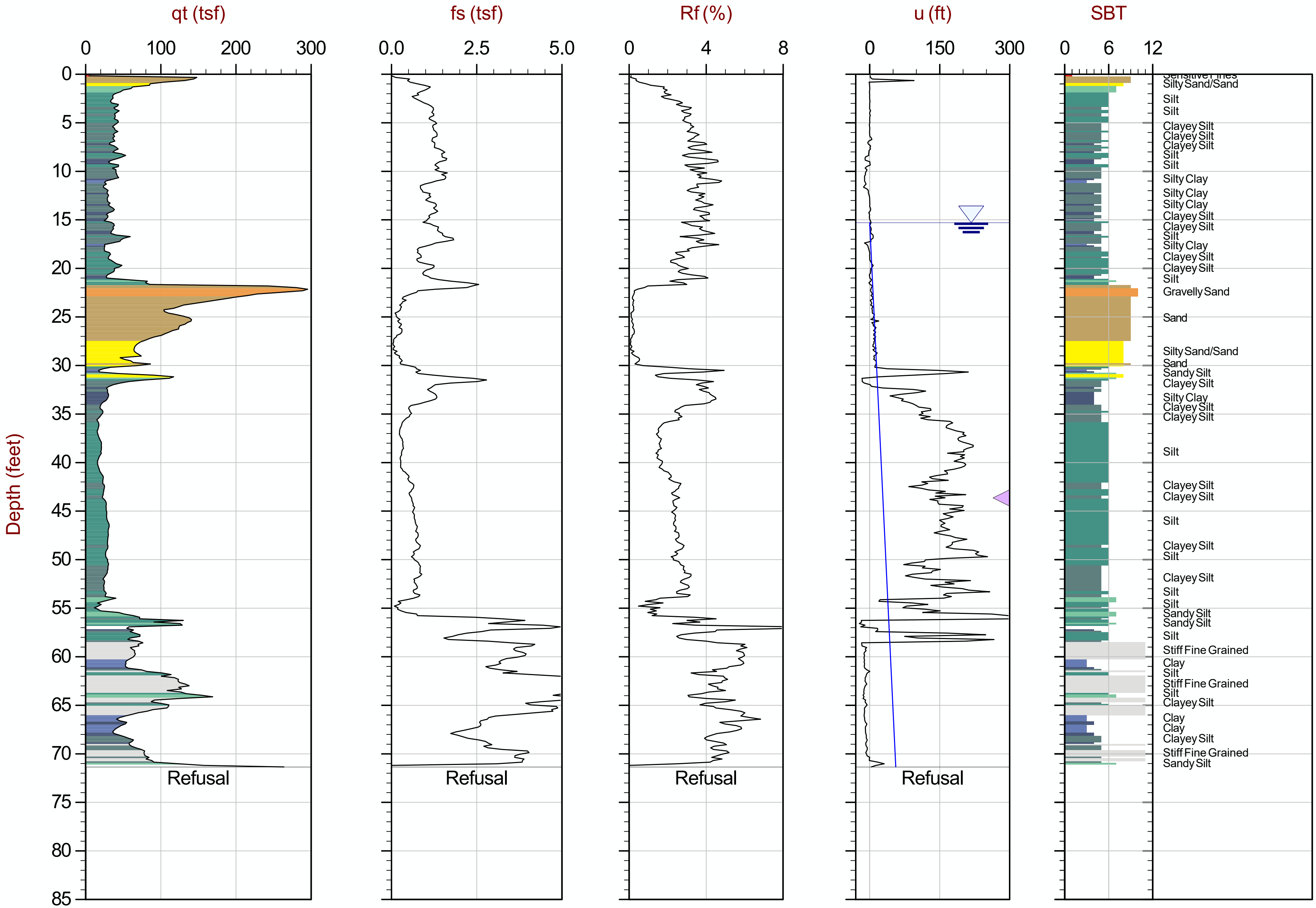
SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230571m E: 248822m

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: 15-53062
Date: 08:04:15 15:25
Site: Baldwin Power Station, Baldwin, IL
Sounding: CPT15-BAL-C019
Cone: 226:T1500F15U500



Max Depth: 21.750 m / 71.36 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC019.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230596m E: 248840m

Hydrostatic Line | Ueq | Assumed Ueq | PPD, Ueq achieved | PPD, Ueq not achieved

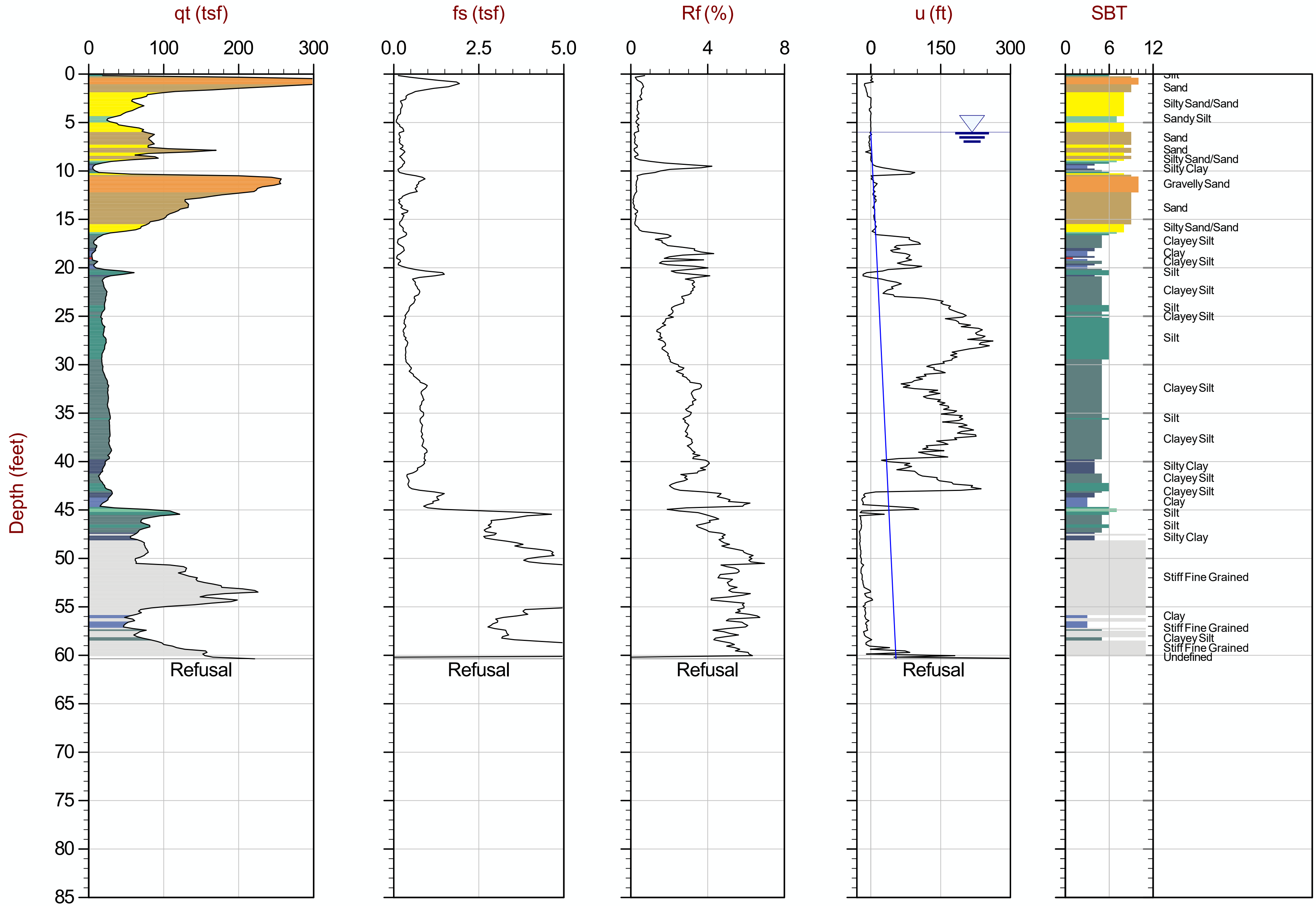
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:05:15 07:53
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C020
Cone: 226:T1500F15U500



Max Depth: 18.400 m / 60.37 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC020.COR

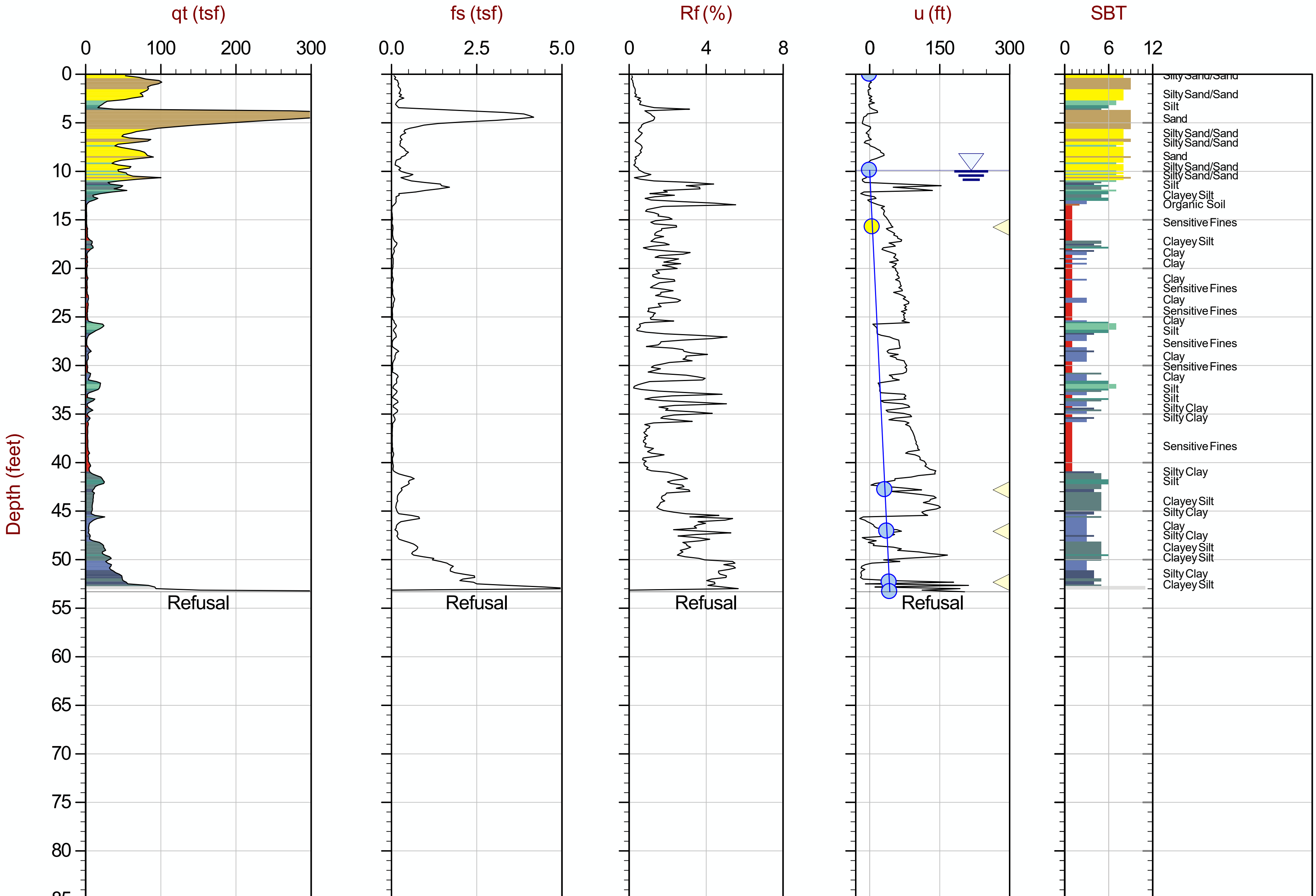
SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230622m E: 248844m

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.

AECOM

Job No: 15-53062
Date: 08:11:15 08:31
Site: Baldwin Power Station, Baldwin, IL
Sounding: CPT15-BAL-C021
Cone: 436:T1500F15U500



Max Depth: 16.250 m / 53.31 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC021.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230737m E: 248697m

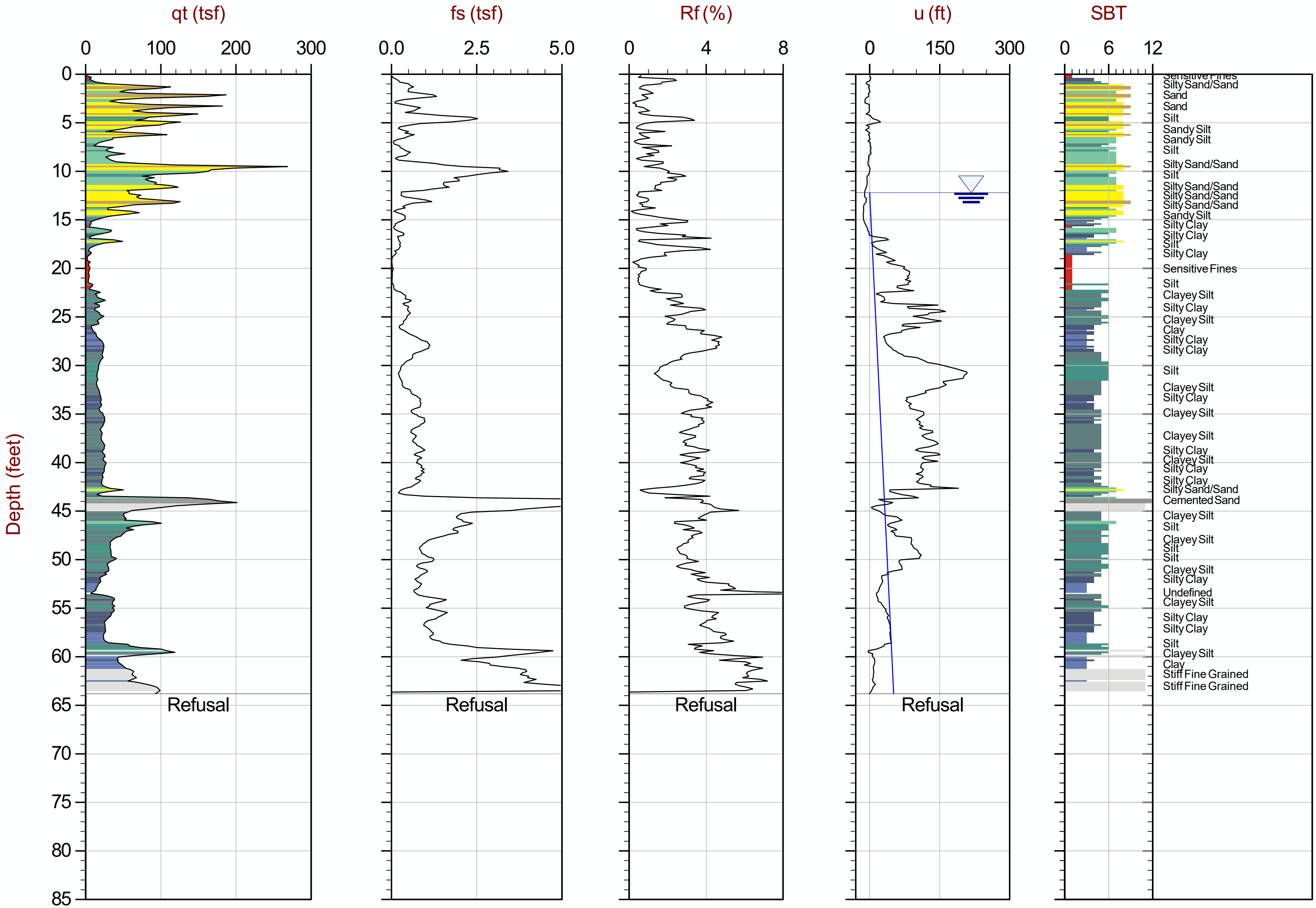
Hydrostatic Line ● Ueq ● Assumed Ueq ◁ PPD, Ueq achieved ◁ PPD, Ueq not achieved

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: 15-53062
Date: 08:22:15 14:19
Site: Baldwin Power Station, Baldwin, IL
Sounding: CPT15-BAL-C022
Cone: 419:T1500F15U500



Max Depth: 19.450 m / 63.81 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

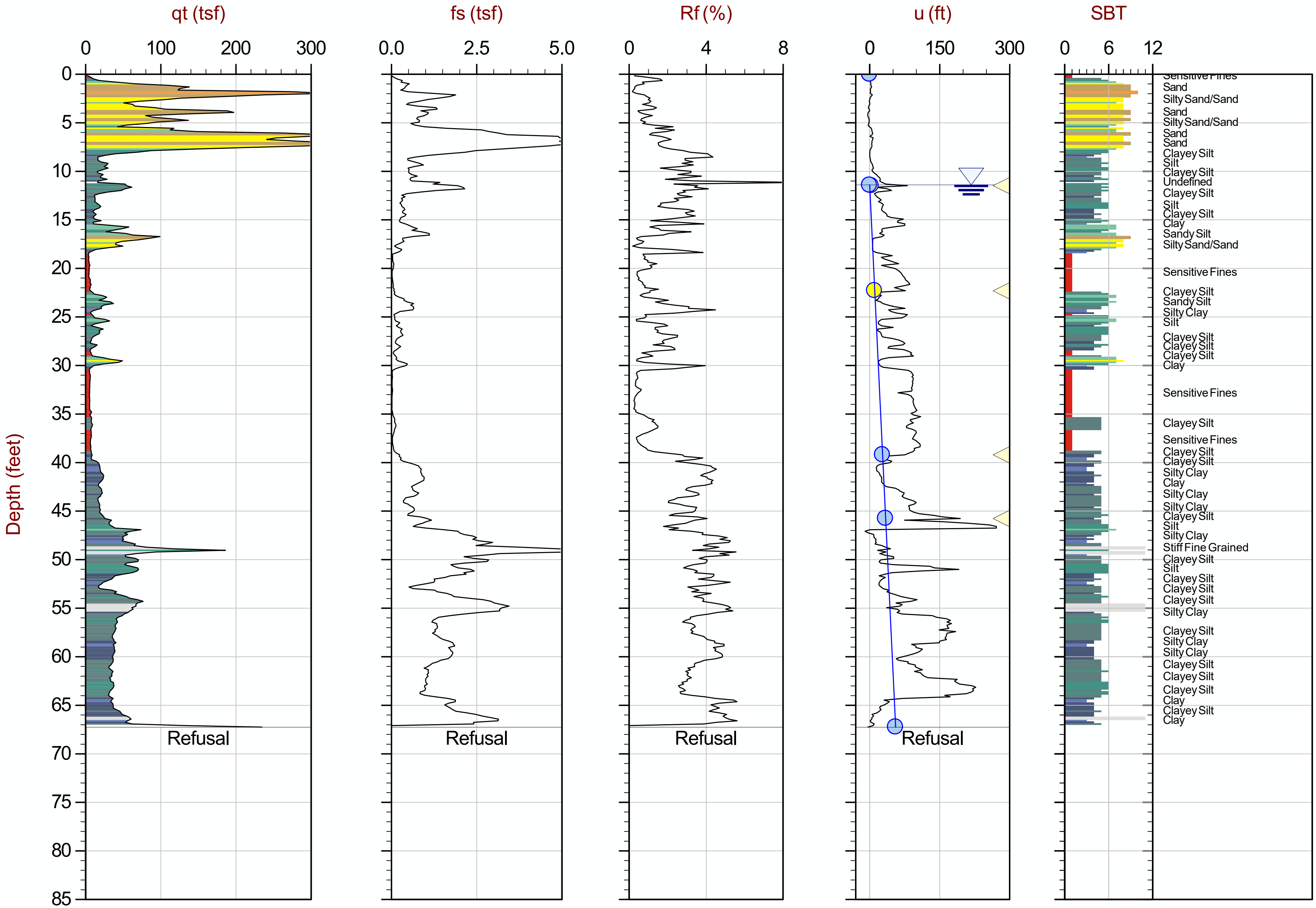
File: 15-53062_CPBALC022.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230716m E: 249210m

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.

AECOM	Job No: 15-53062	Sounding: CPT15-BAL-C023
	Date: 08:22:15 12:25	Cone: 419:T1500F15U500
	Site: Baldwin Power Station, Baldwin, IL	



Max Depth: 20.500 m / 67.26 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC023.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230666m E: 249079m

Hydrostatic Line · Ueq · Assumed Ueq · PPD, Ueq achieved · PPD, Ueq not achieved

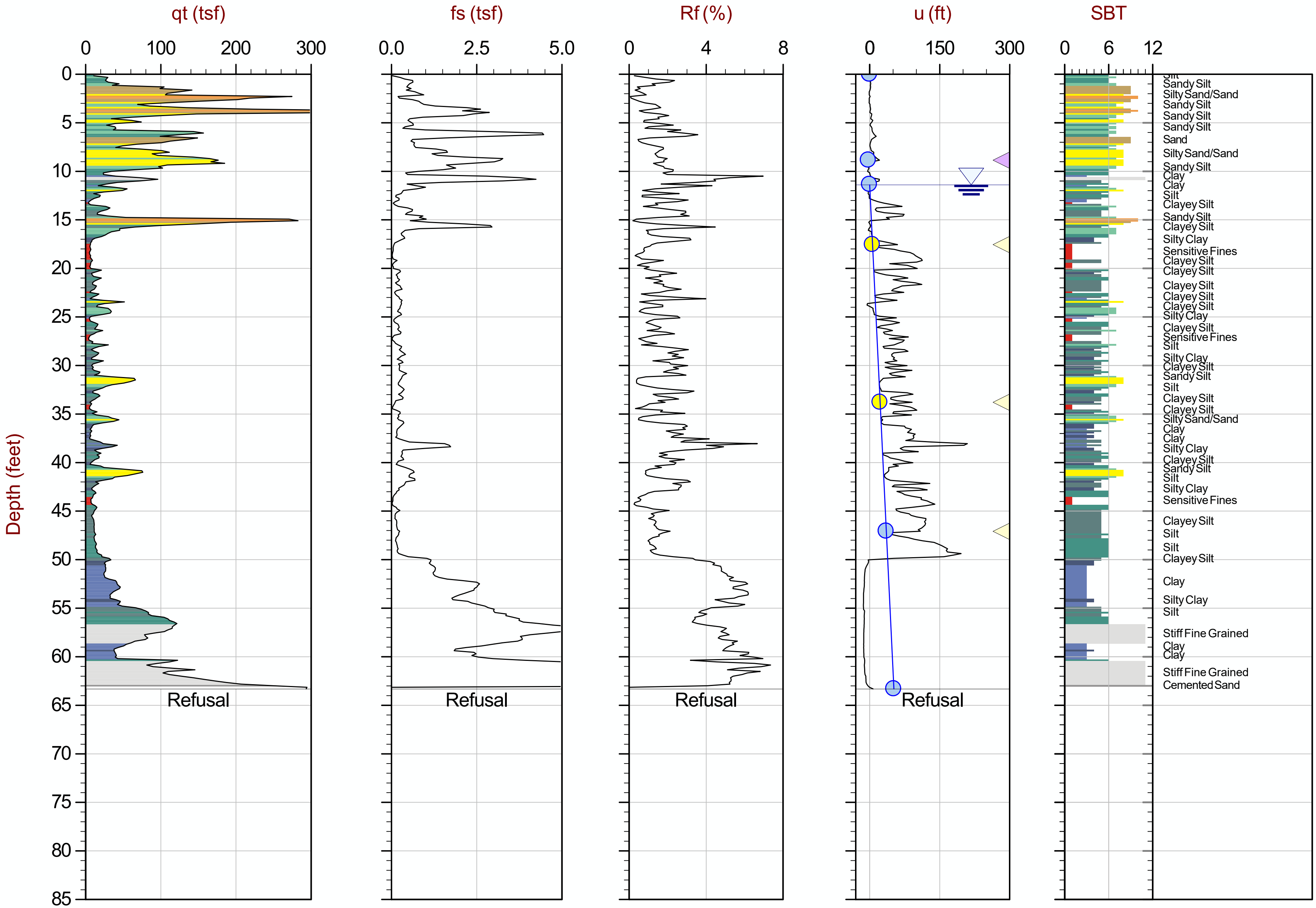
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:22:15 10:48
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C024
Cone: 419:T1500F15U500



Max Depth: 19.300 m / 63.32 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC024.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230928m E: 249001m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

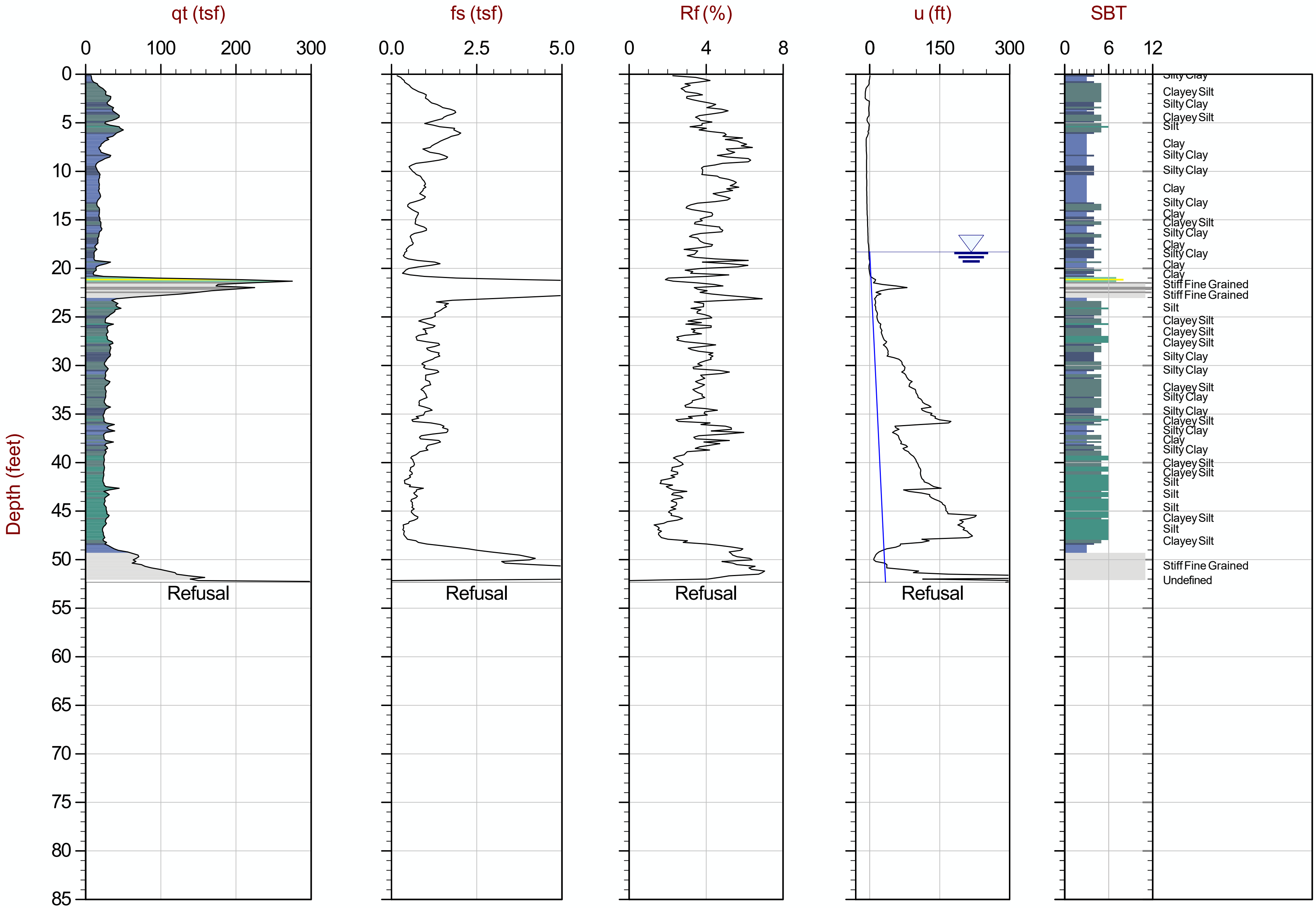
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:20:15 17:17
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C025
Cone: 419:T1500F15U500



Max Depth: 15.950 m / 52.33 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC025.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230495m E: 249097m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

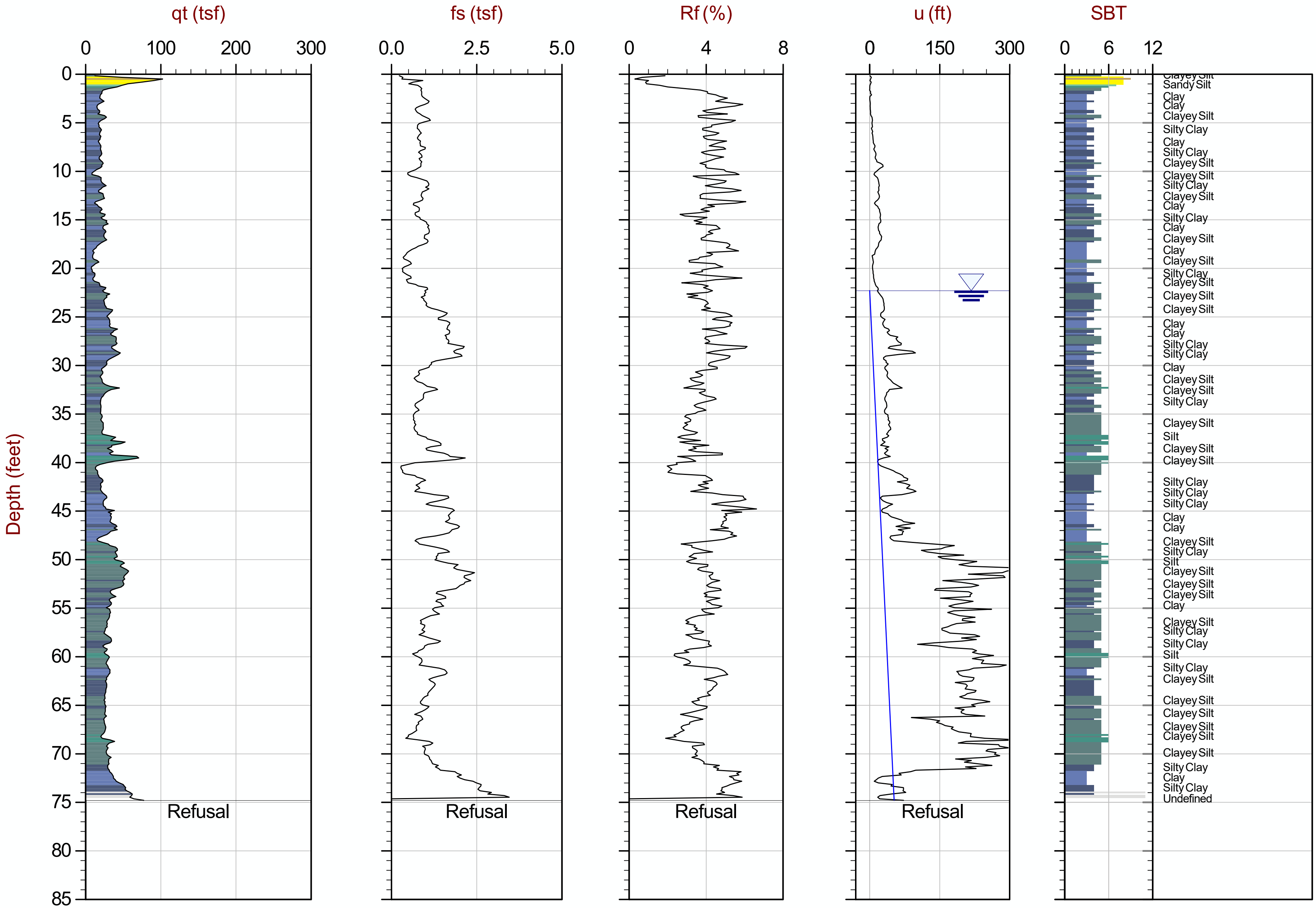
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:09:15 10:53
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C026
Cone: 335:T1500F15U500



Max Depth: 22.800 m / 74.80 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC026.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230515m E: 249112m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

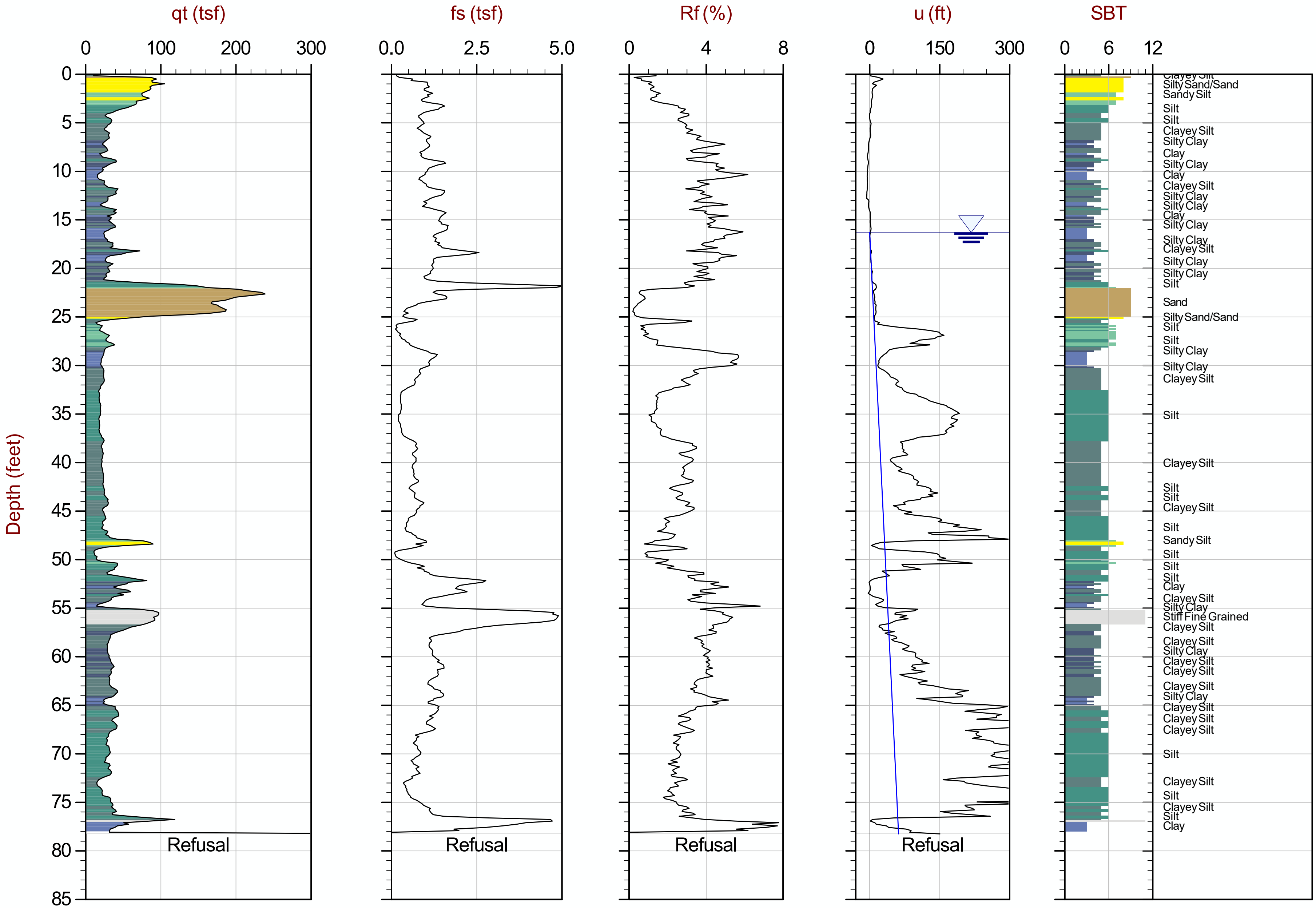
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:09:15 09:46
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C027
Cone: 335:T1500F15U500



Max Depth: 23.850 m / 78.25 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC027.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230558m E: 248991m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

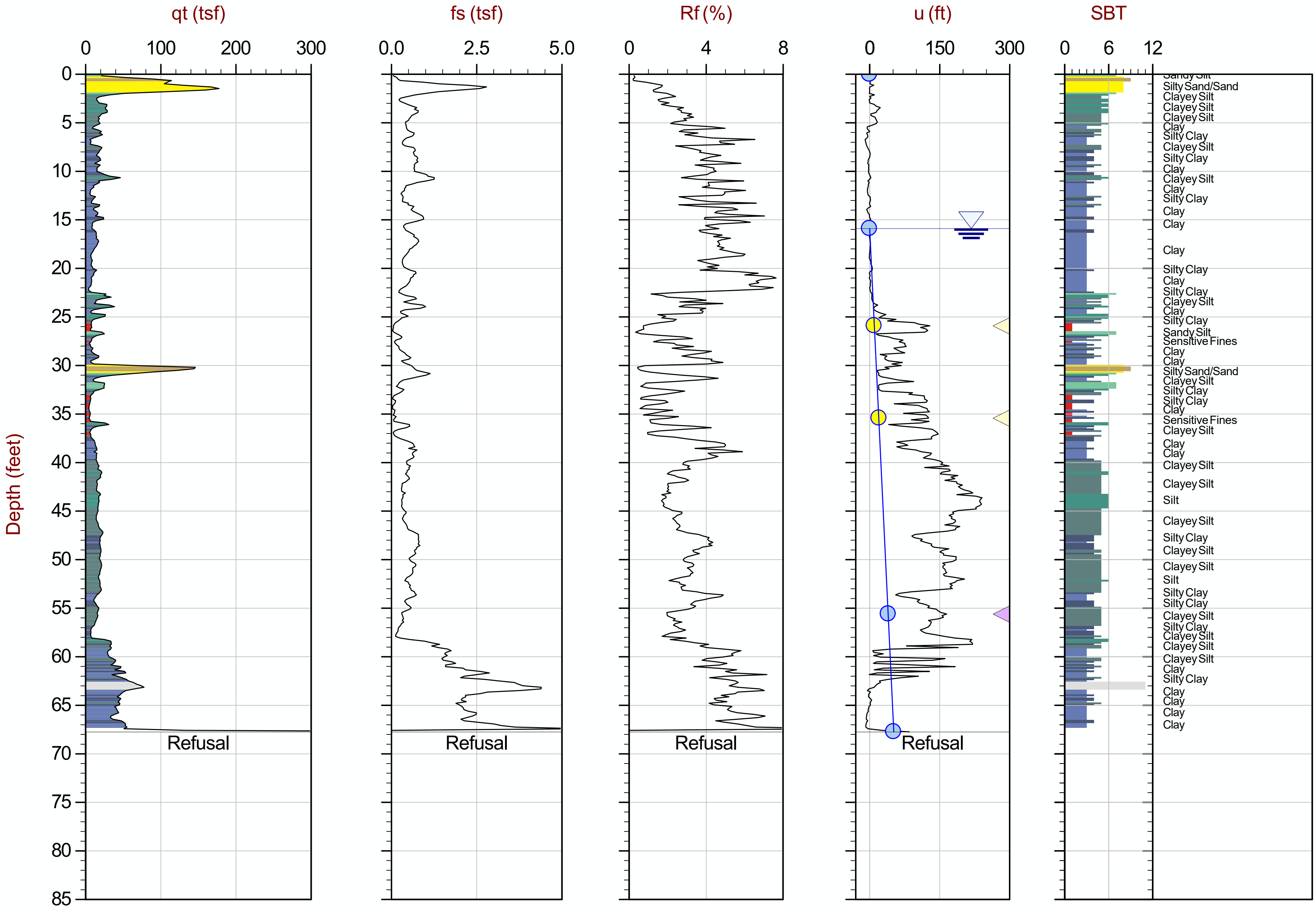
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:09:15 07:22
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C028
Cone: 335:T1500F15U500



Max Depth: 20.650 m / 67.75 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC028.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230941m E: 248810m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

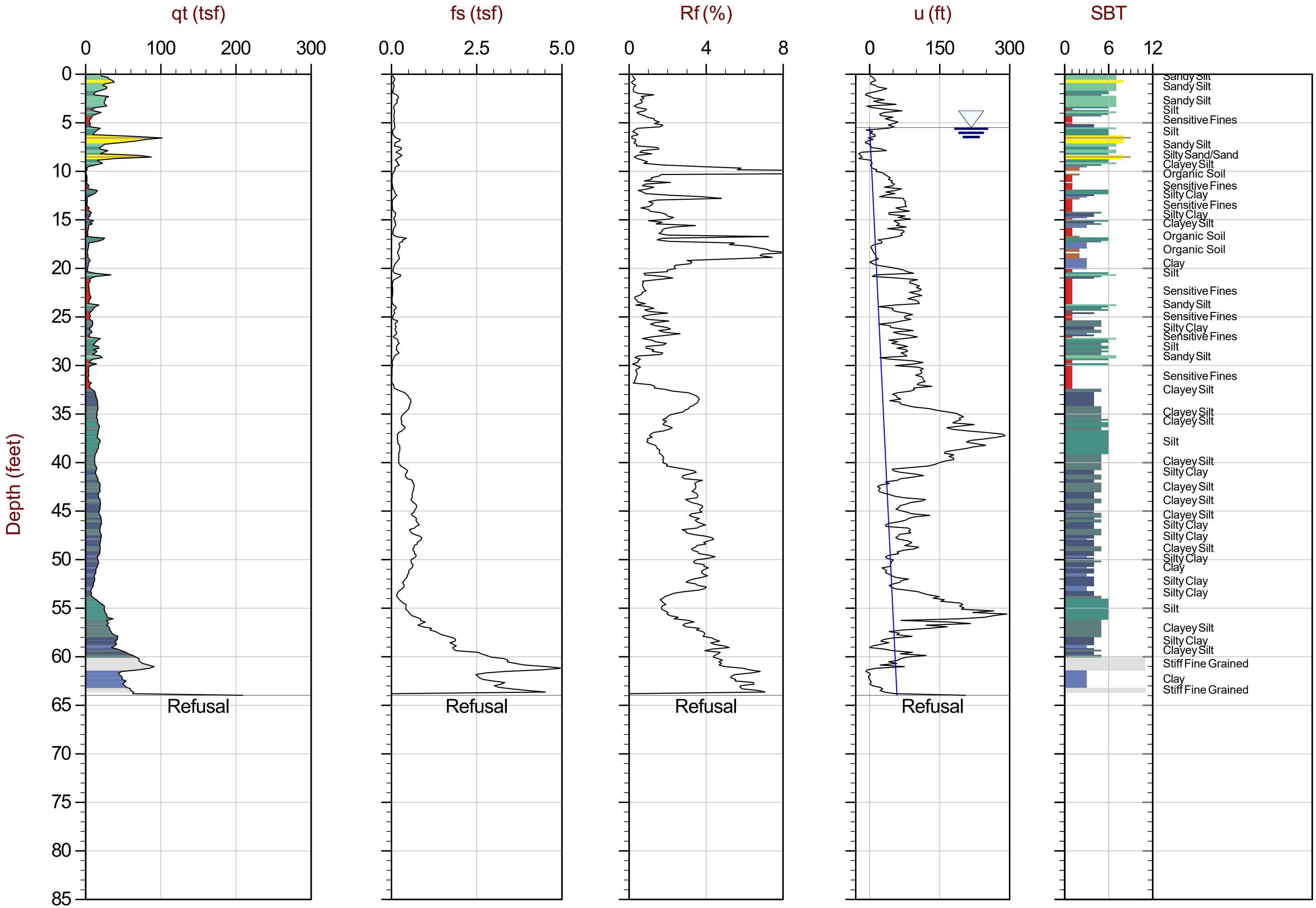
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:10:15 14:55
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C029
Cone: 436:T1500F15U500



Max Depth: 19.500 m / 63.98 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC029.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230947m E: 248820m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

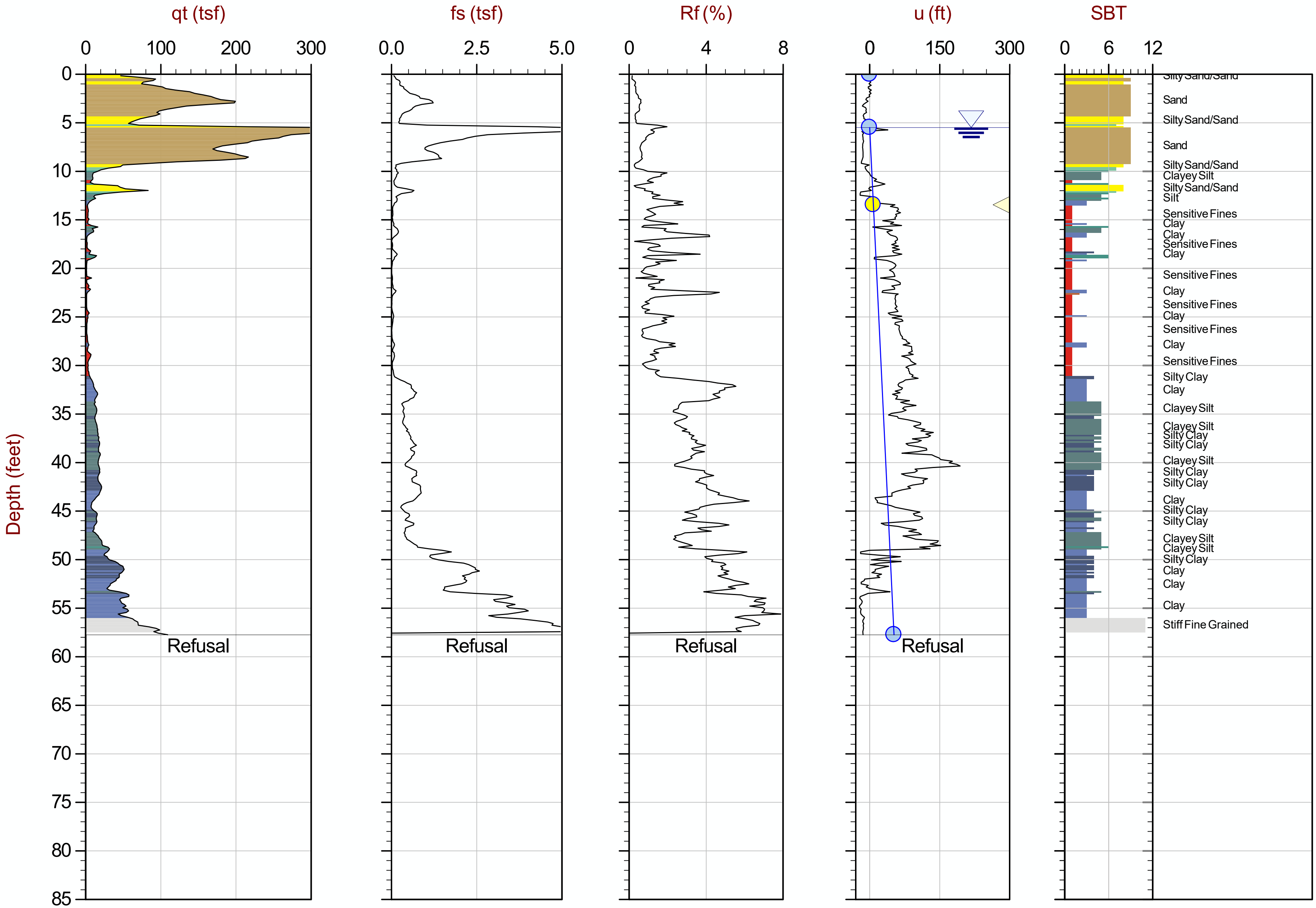
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:10:15 13:55
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C030
Cone: 436:T1500F15U500



Max Depth: 17.600 m / 57.74 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC030.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230928m E: 248774m

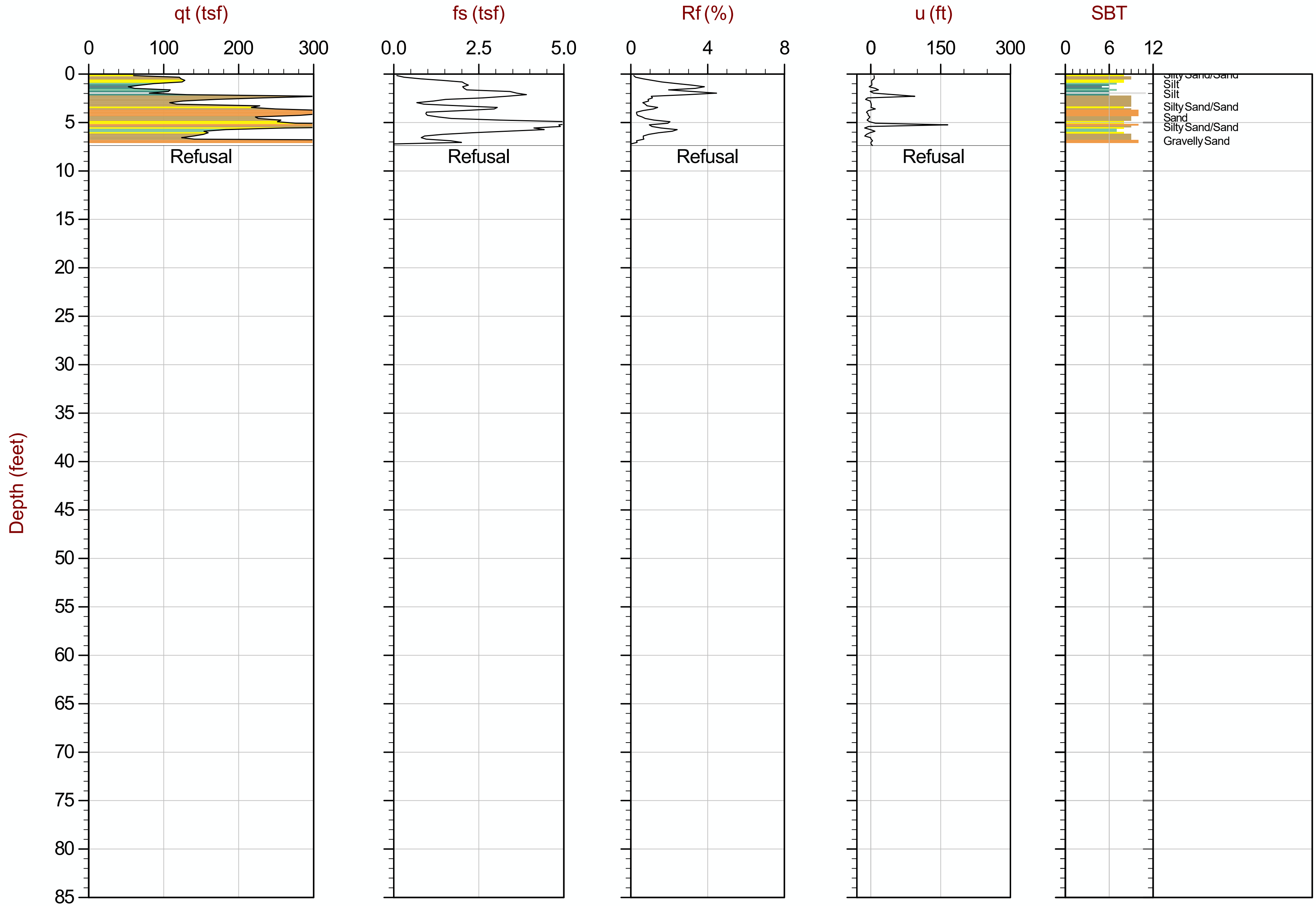
Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

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: 15-53062
Date: 08:18:15 07:57
Site: Baldwin Power Station, Baldwin, IL
Sounding: CPT15-BAL-C031
Cone: 419:T1500F15U500



Max Depth: 2.250 m / 7.38 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC031.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230875m E: 249399m

Hydrostatic Line ○ Ueq ● Assumed Ueq ◁ PPD, Ueq achieved ◁ PPD, Ueq not achieved

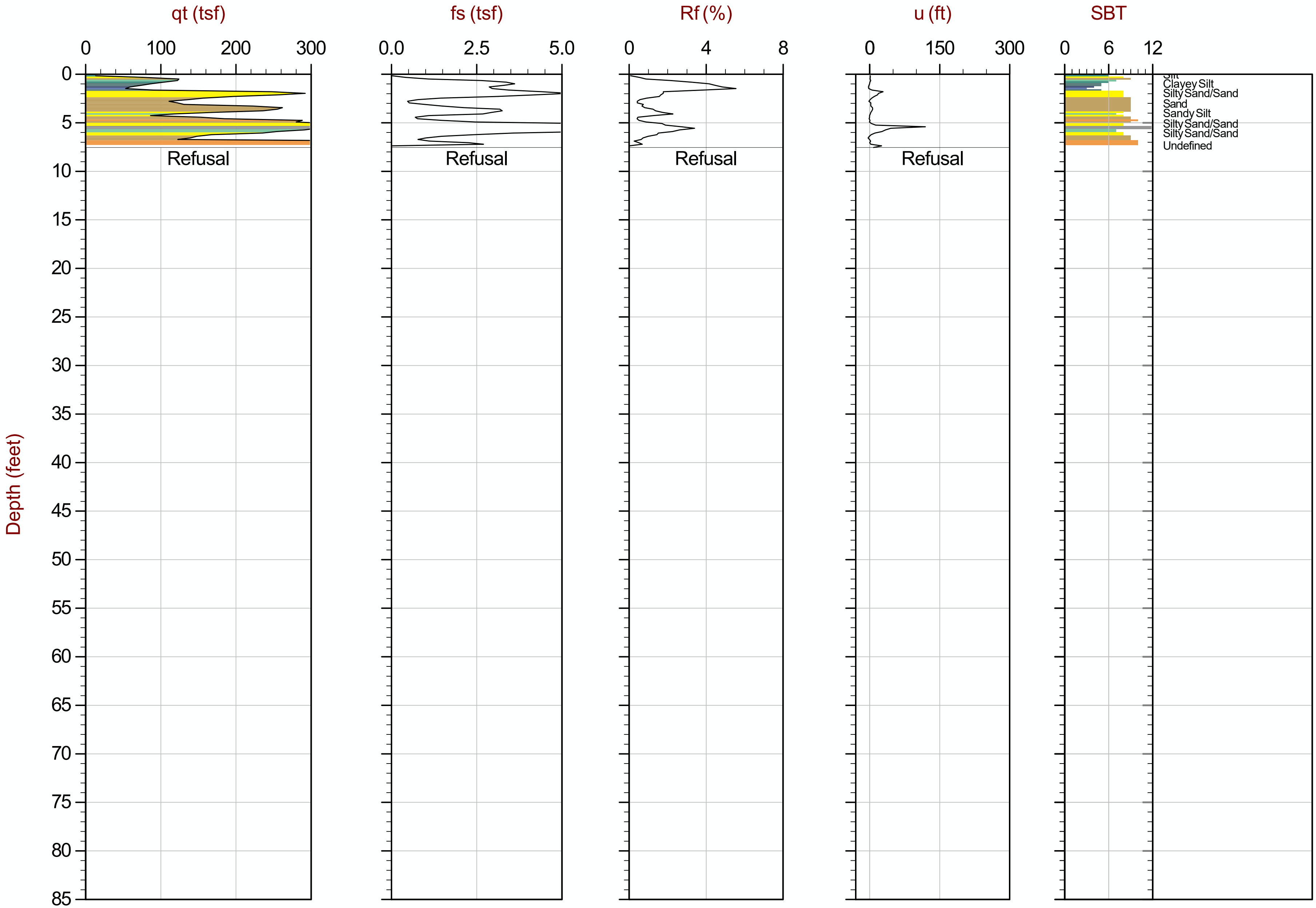
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:18:15 08:09
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C031A
Cone: 419:T1500F15U500



Max Depth: 2.300 m / 7.55 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC031A.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230875m E: 249399m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

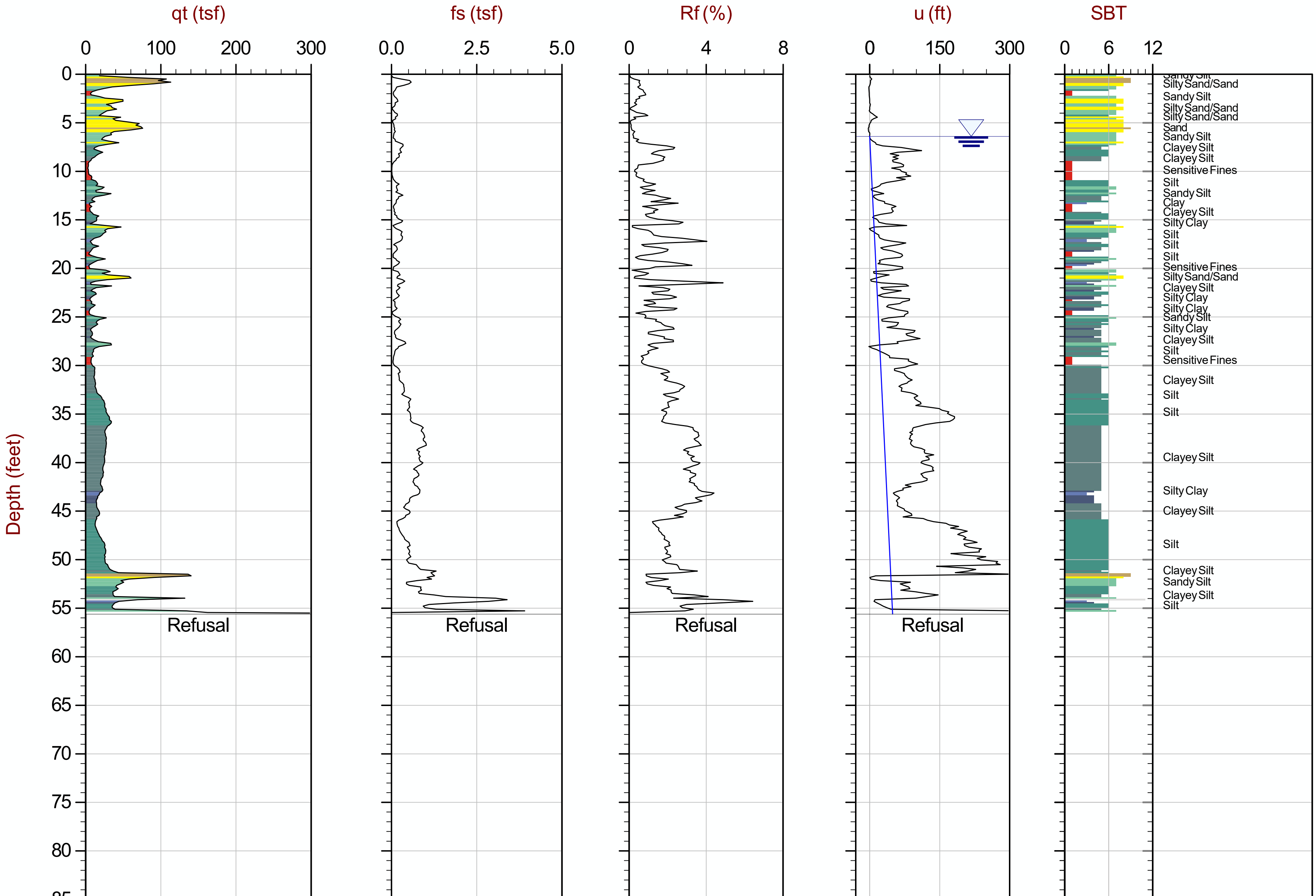
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:21:15 11:18
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C032
Cone: 419:T1500F15U500



Max Depth: 16.950 m / 55.61 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC032.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230993m E: 249296m

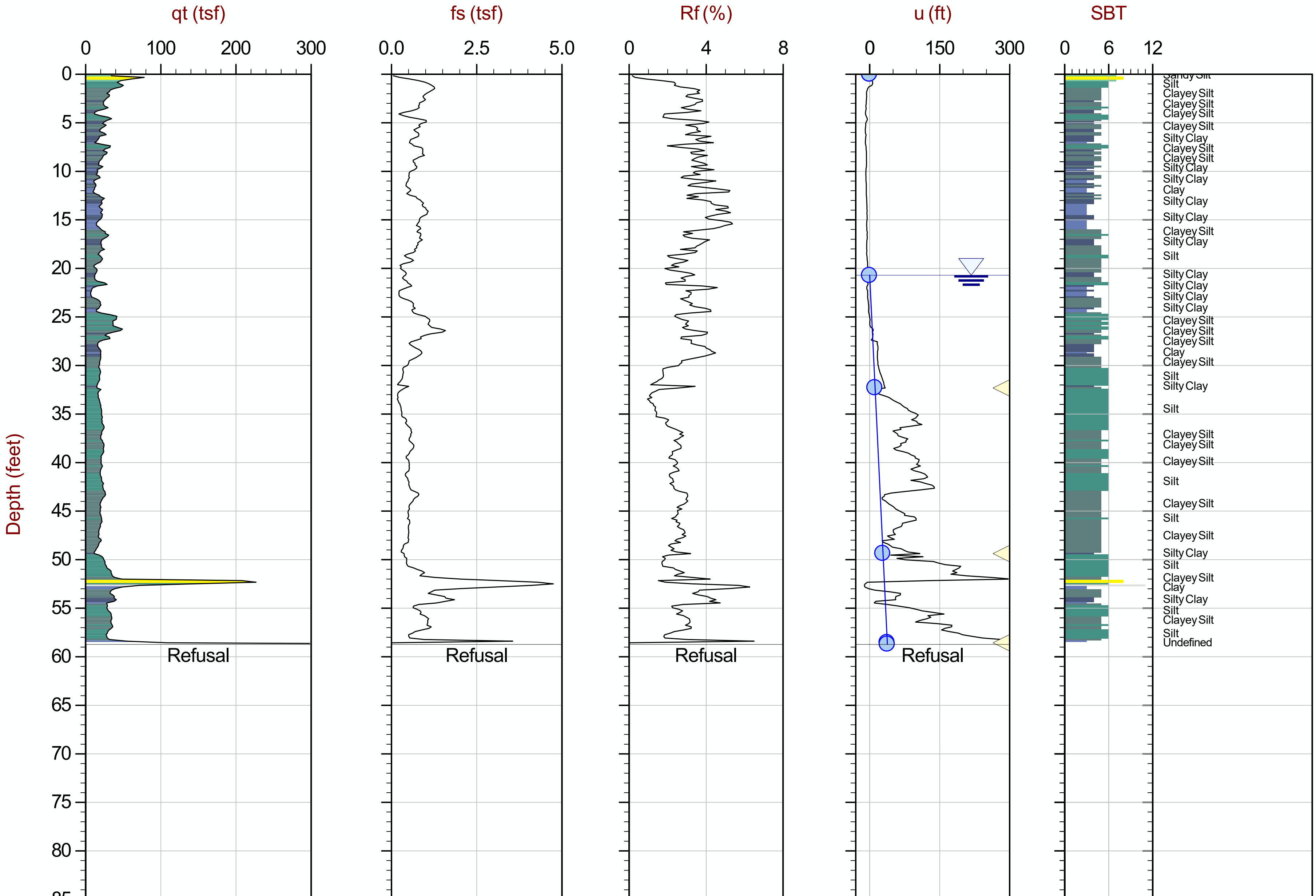
Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

AECOM

Job No: 15-53062
Date: 08:09:15 12:25
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C033
Cone: 335:T1500F15U500



Max Depth: 17.900 m / 58.73 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC033.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231022m E: 249305m

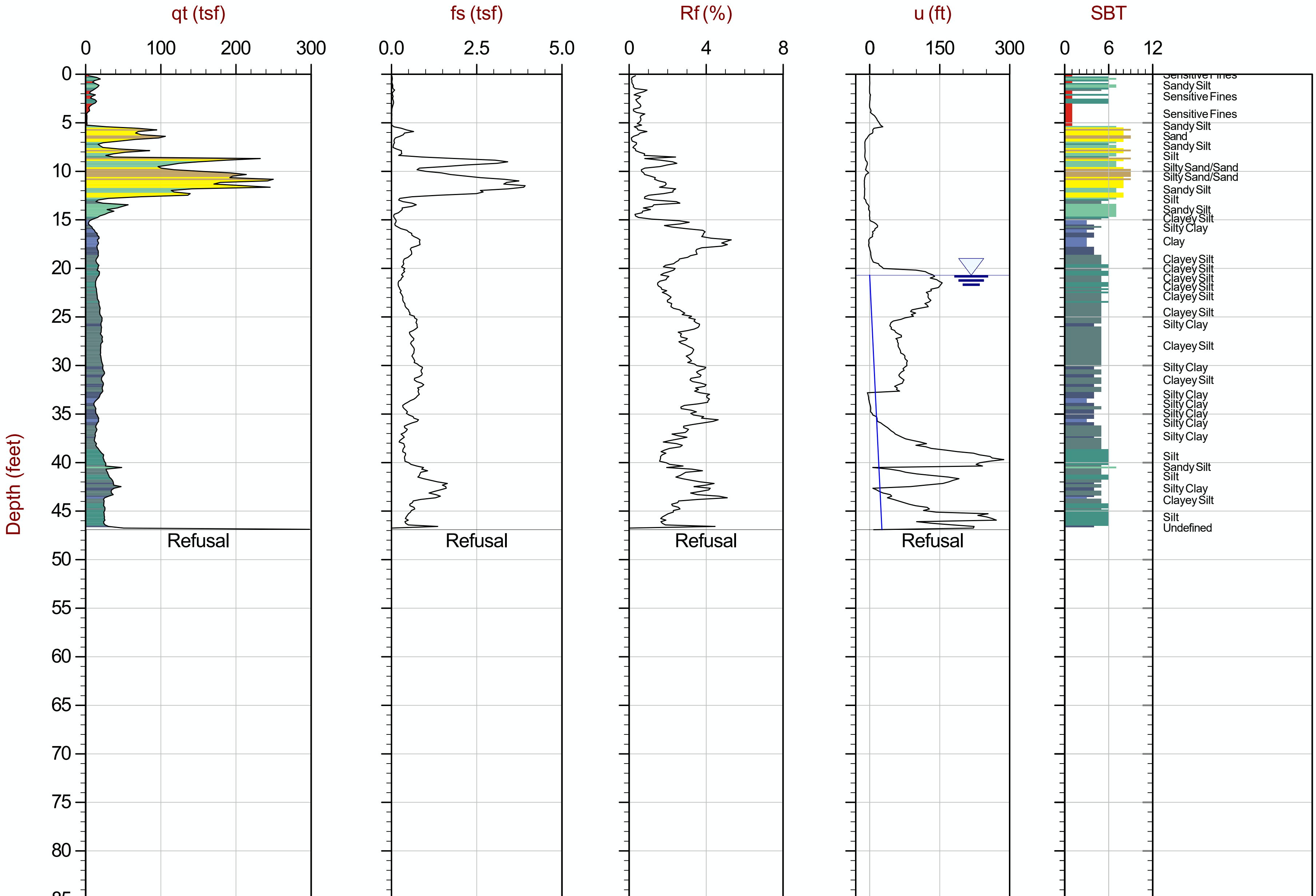
Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

AECOM

Job No: 15-53062
Date: 08:21:15 15:43
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C034
Cone: 419:T1500F15U500



Max Depth: 14.300 m / 46.92 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC034.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231046m E: 249316m

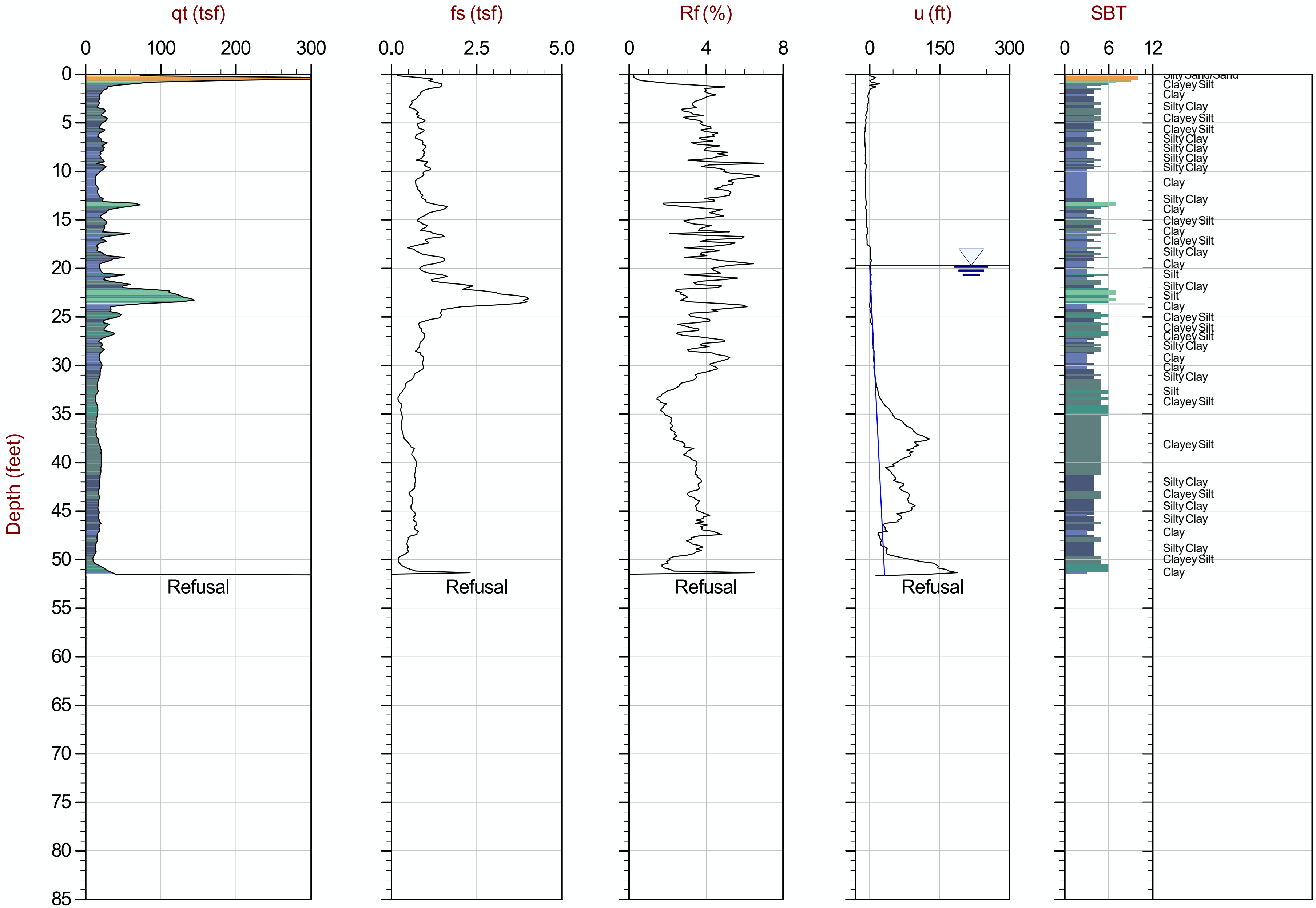
Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

AECOM

Job No: 15-53062
Date: 08:09:15 14:31
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C035
Cone: 335:T1500F15U500



Max Depth: 15.750 m / 51.67 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC035.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231074m E: 249183m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

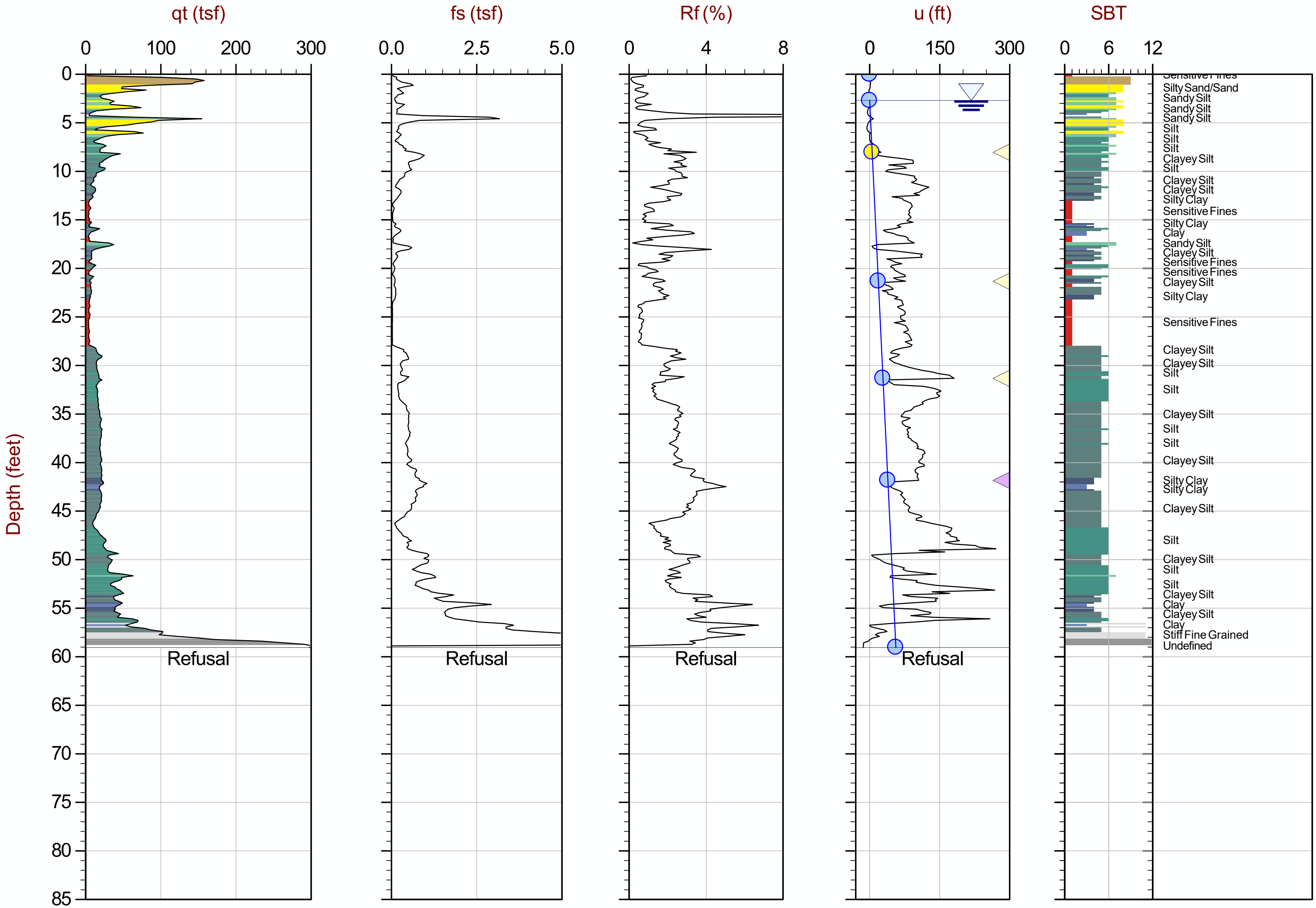
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:21:15 12:35
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C036
Cone: 419:T1500F15U500



Max Depth: 18.000 m / 59.05 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC036.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231081m E: 248798m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

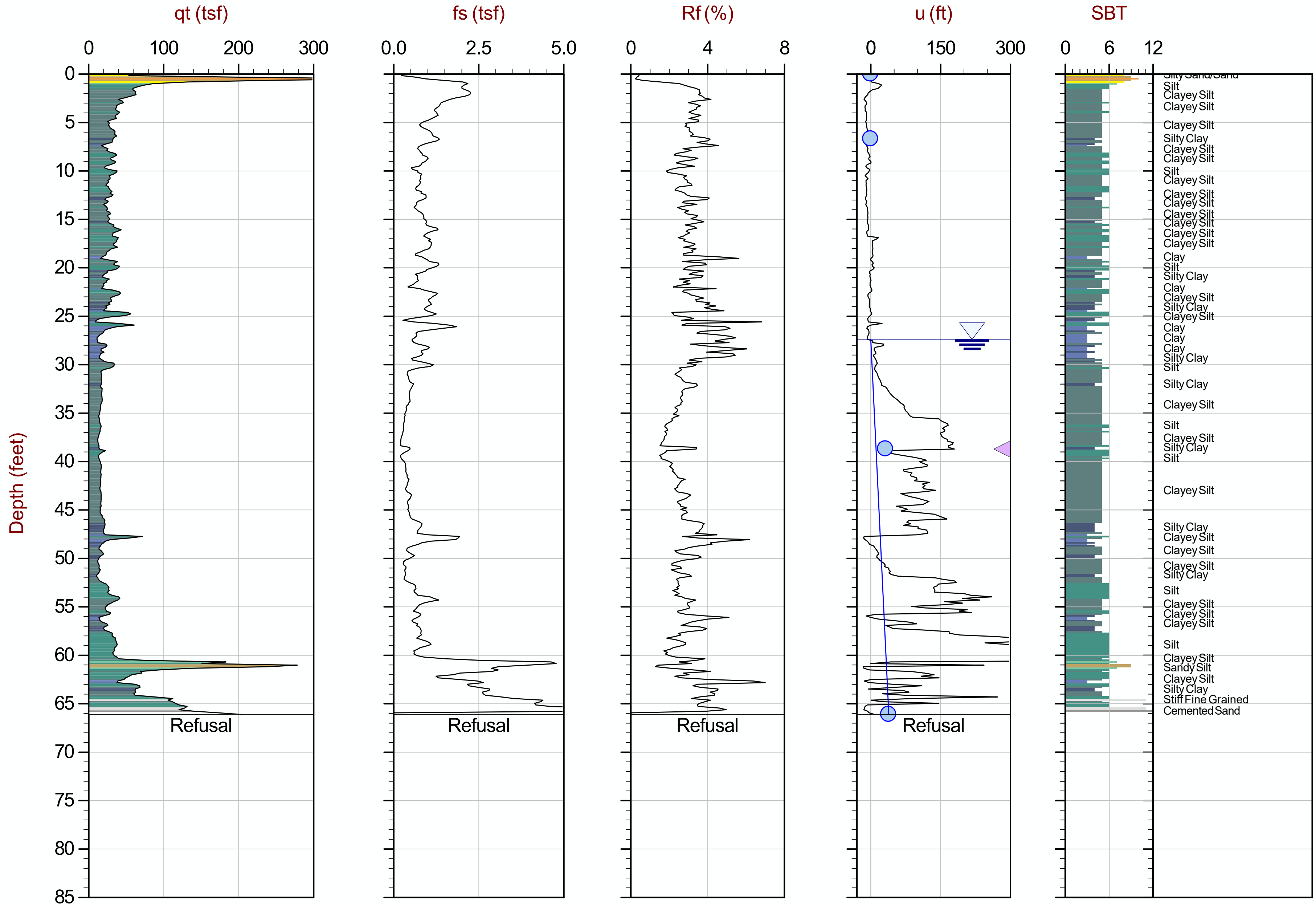
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:11:15 10:48
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C037
Cone: 436:T1500F15U500



Max Depth: 20.150 m / 66.11 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC037.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231125m E: 248785m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

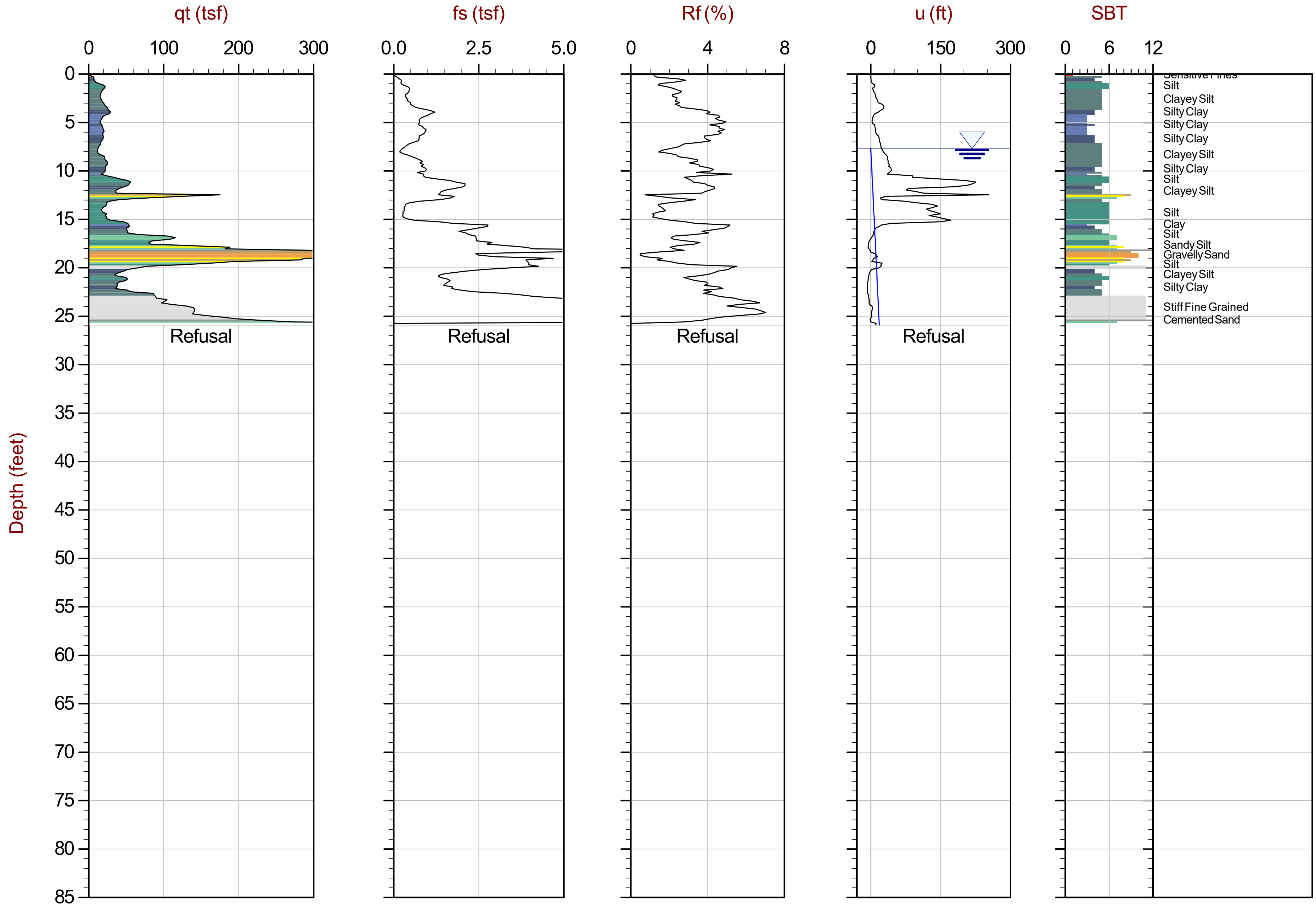
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:21:15 09:55
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C038
Cone: 419:T1500F15U500



Max Depth: 7.900 m / 25.92 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC038.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231202m E: 248764m

Hydrostatic Line · Ueq · Assumed Ueq · PPD, Ueq achieved · PPD, Ueq not achieved

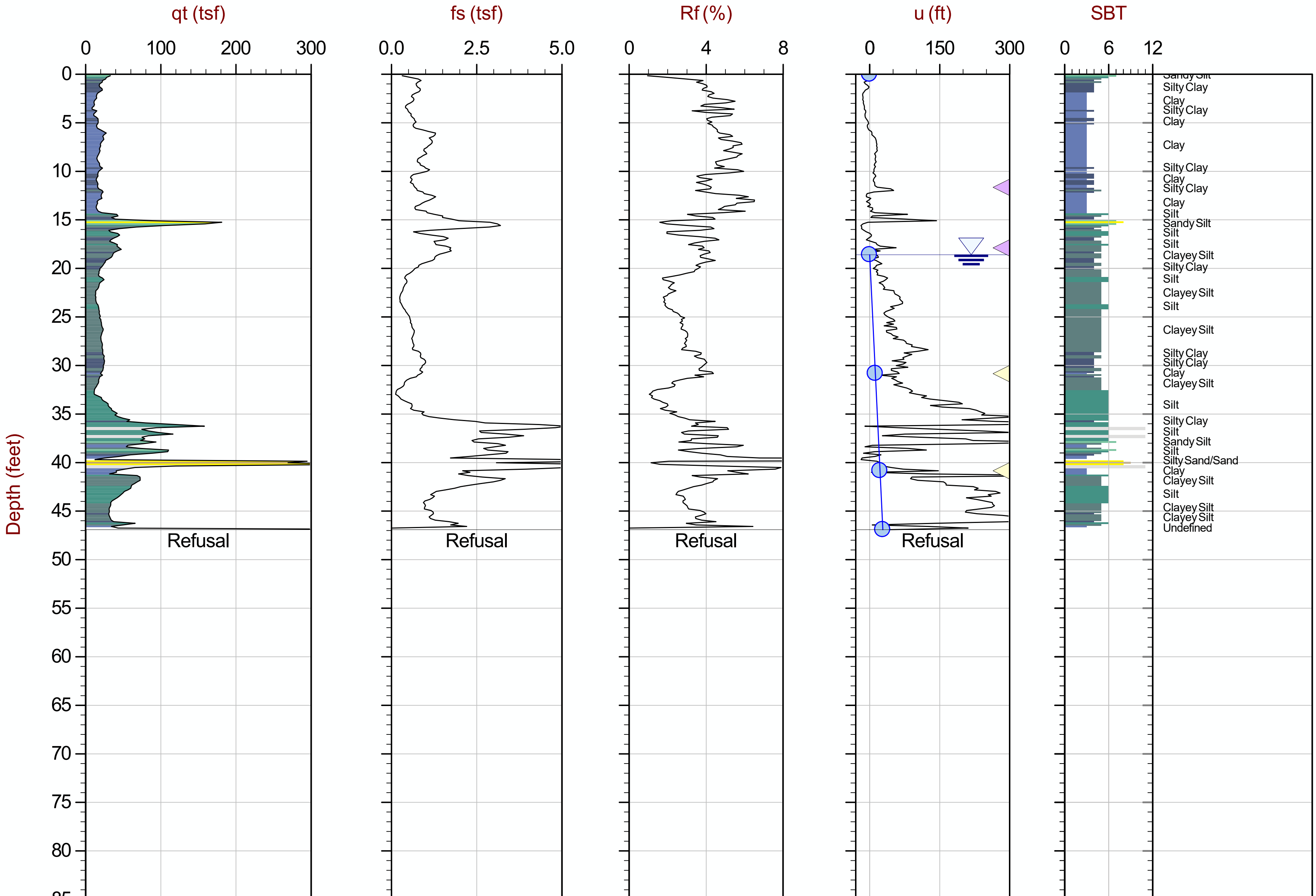
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:13:15 09:39
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C040
Cone: 419:T1500F15U500



Max Depth: 14.300 m / 46.92 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC040.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230452m E: 249379m

Hydrostatic Line ○ Ueq ● Assumed Ueq ◁ PPD, Ueq achieved ◁ PPD, Ueq not achieved

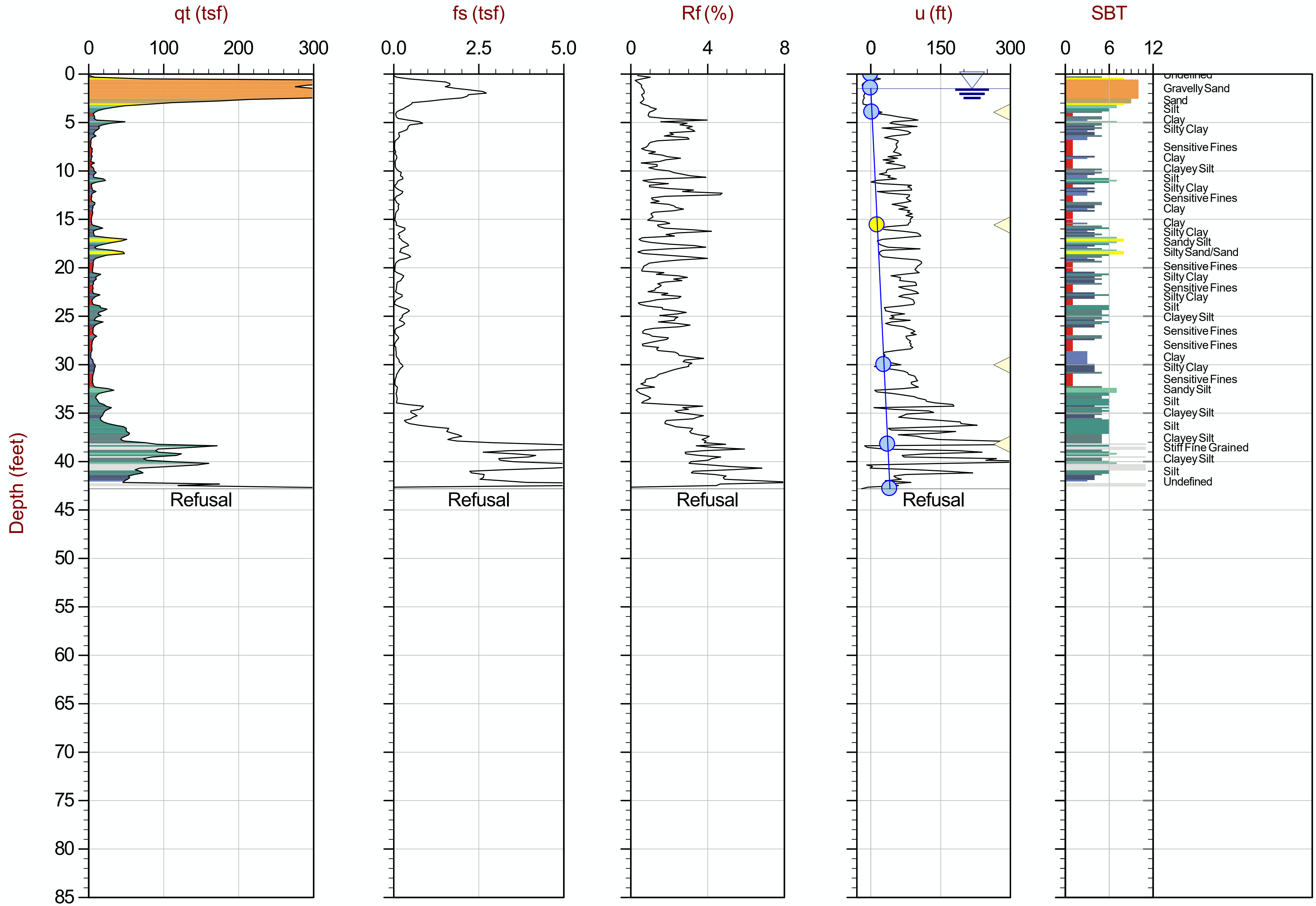
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:23:15 07:45
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C041
Cone: 419:T1500F15U500



Max Depth: 13.050 m / 42.81 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

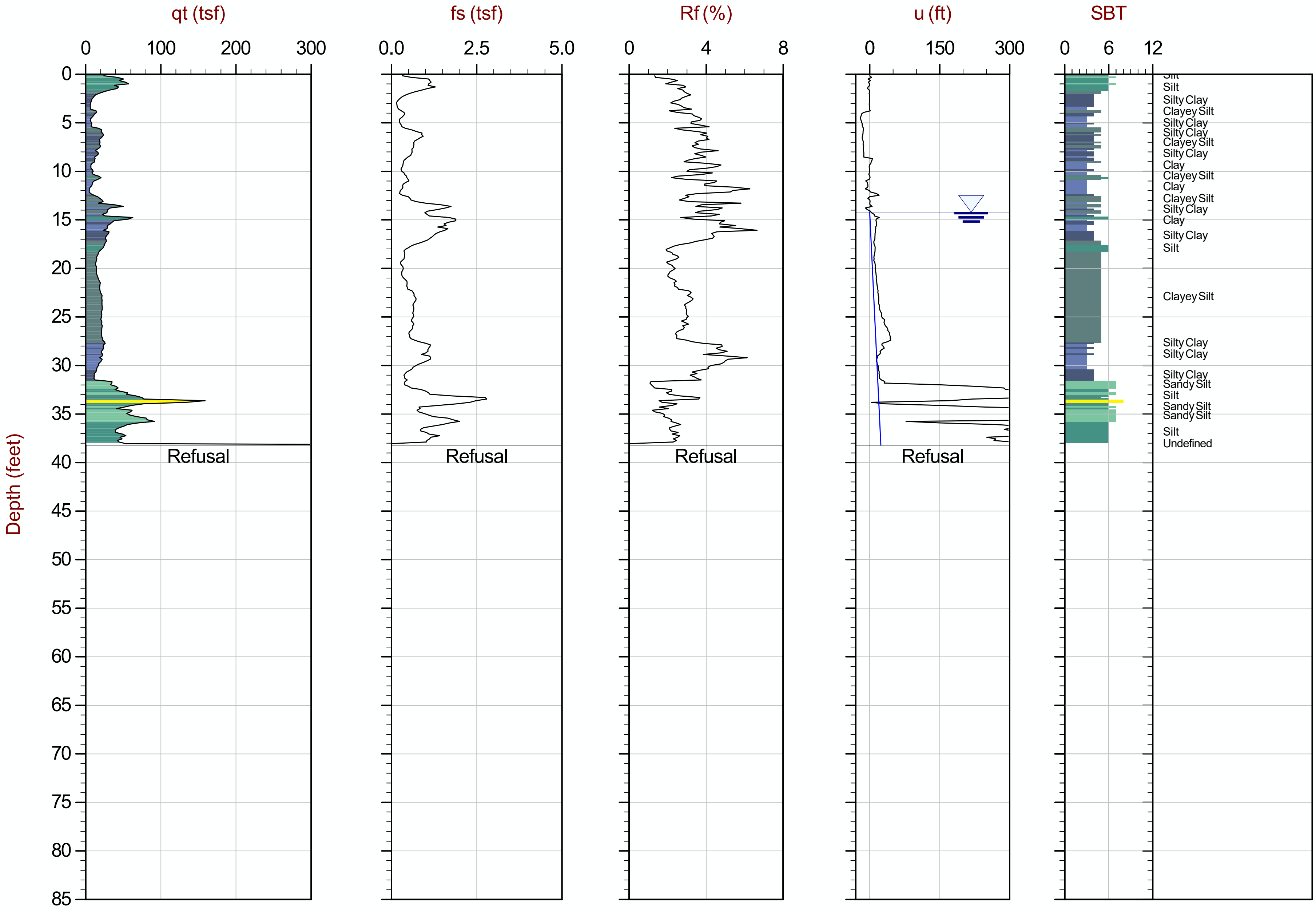
File: 15-53062_CPBALC041.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230605m E: 249505m

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.

AECOM	Job No: 15-53062	Sounding: CPT15-BAL-C042
	Date: 08:12:15 15:15	Cone: 226:T1500F15U500
	Site: Baldwin Power Station, Baldwin, IL	



Max Depth: 11.650 m / 38.22 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC042.COR

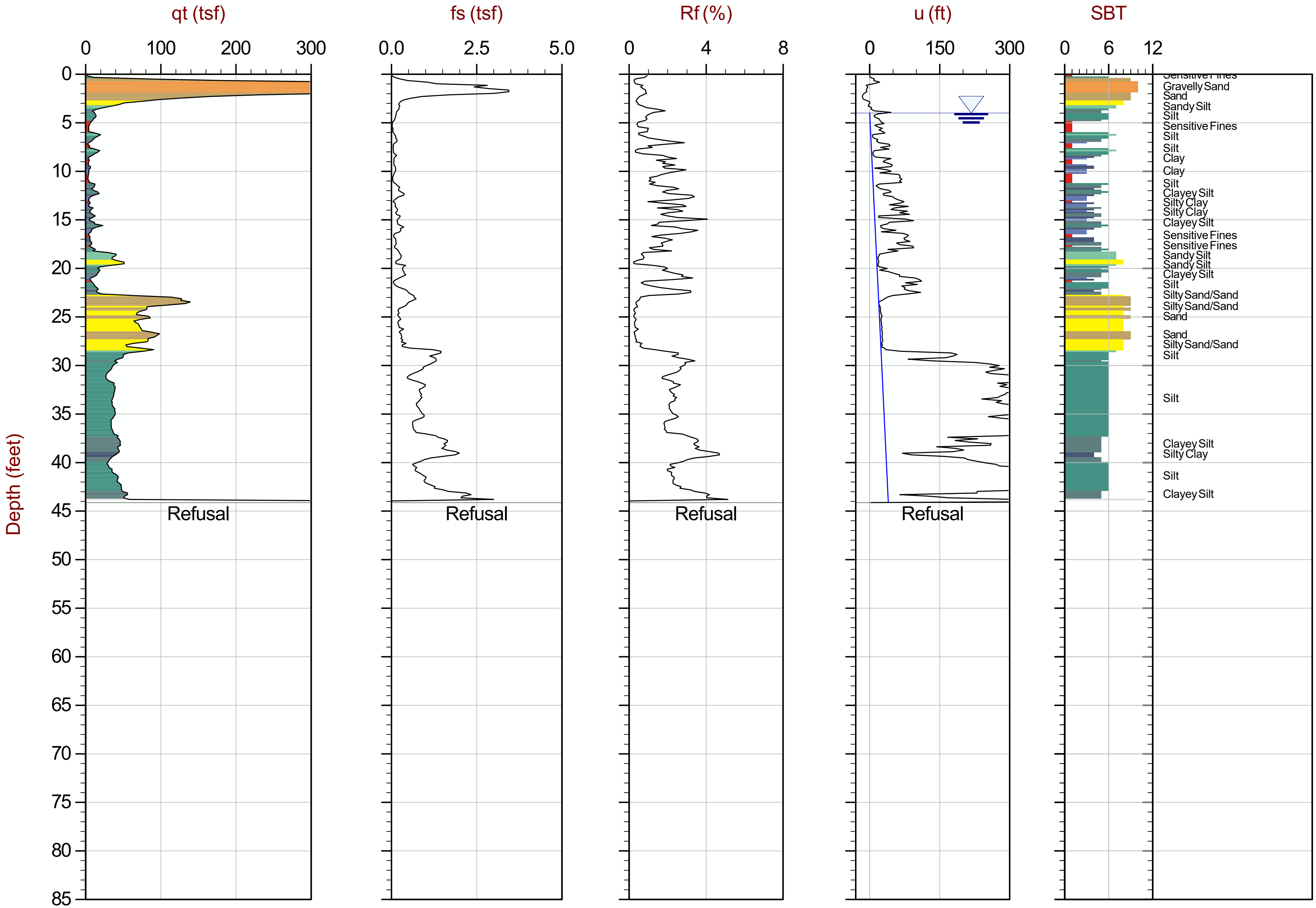
SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230453m E: 249687m

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.

AECOM

Job No: 15-53062
Date: 08:25:15 08:27
Site: Baldwin Power Station, Baldwin, IL
Sounding: SCPT15-BAL-C043
Cone: 419:T1500F15U500



Max Depth: 13.450 m / 44.13 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC043.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230562m E: 249708m

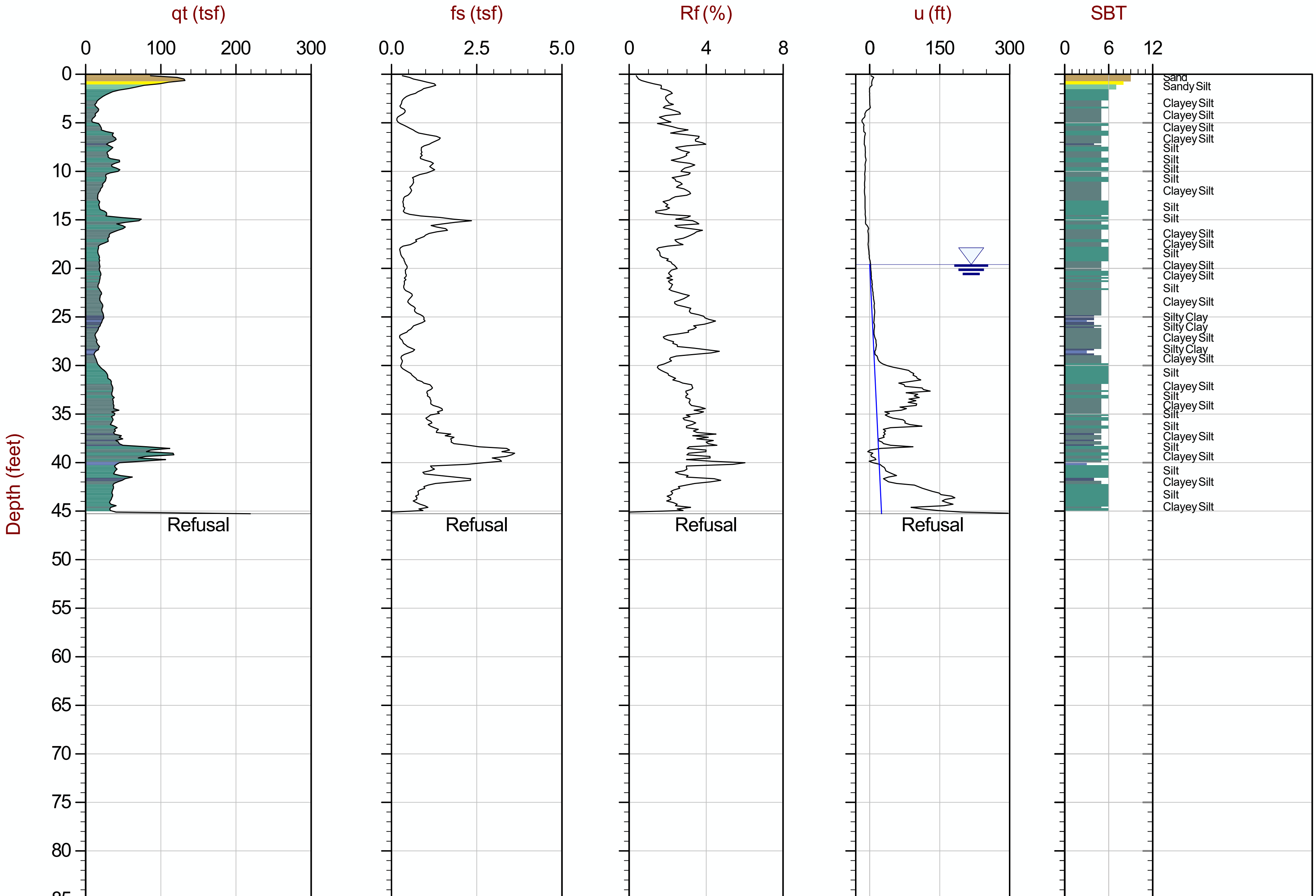
Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

AECOM

Job No: 15-53062
Date: 08:13:15 08:51
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C044
Cone: 419:T1500F15U500



Max Depth: 13.800 m / 45.28 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC044.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230539m E: 249785m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

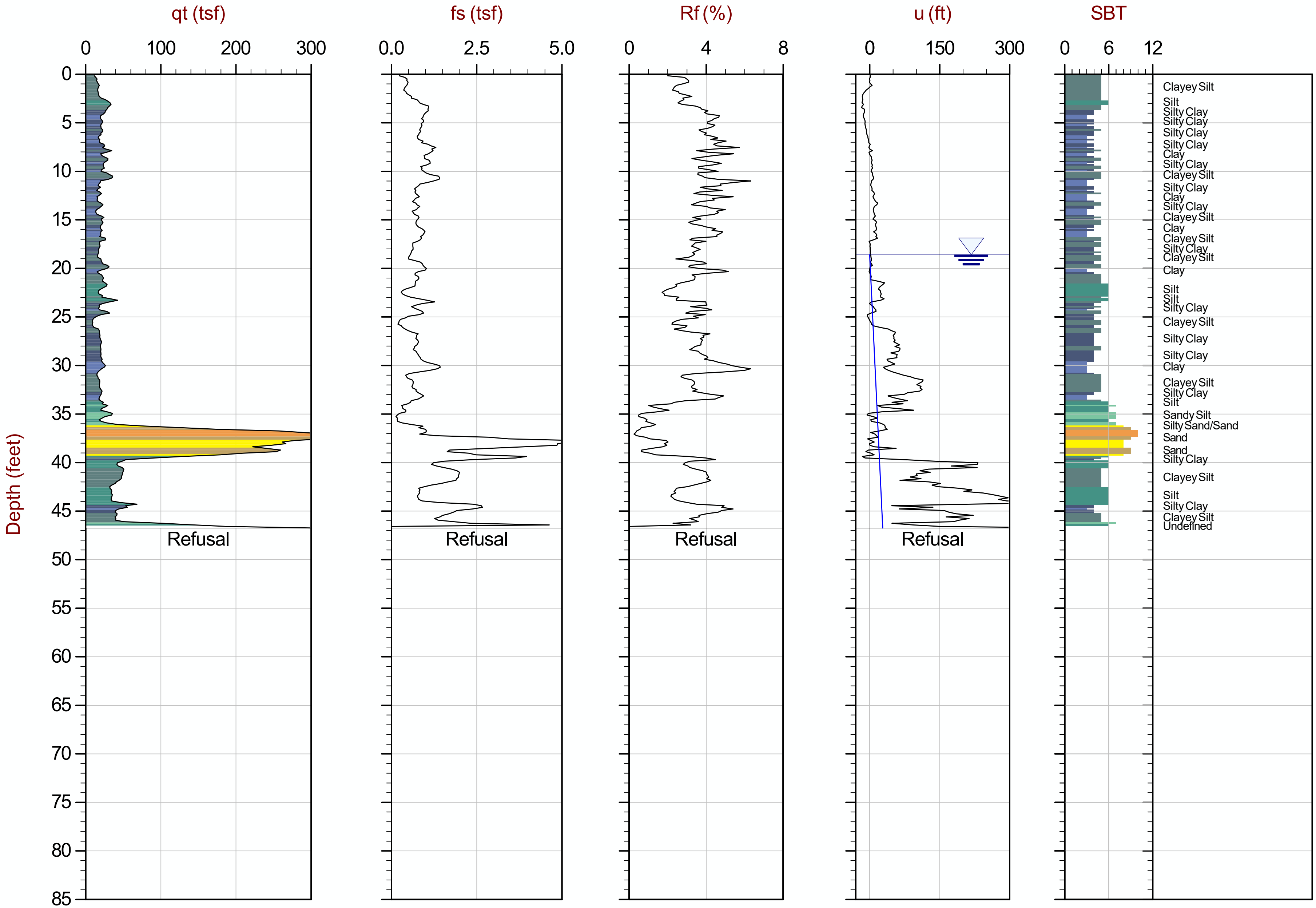
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:25:15 09:48
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C045
Cone: 419:T1500F15U500



Max Depth: 14.250 m / 46.75 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC045.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230596m E: 249804m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

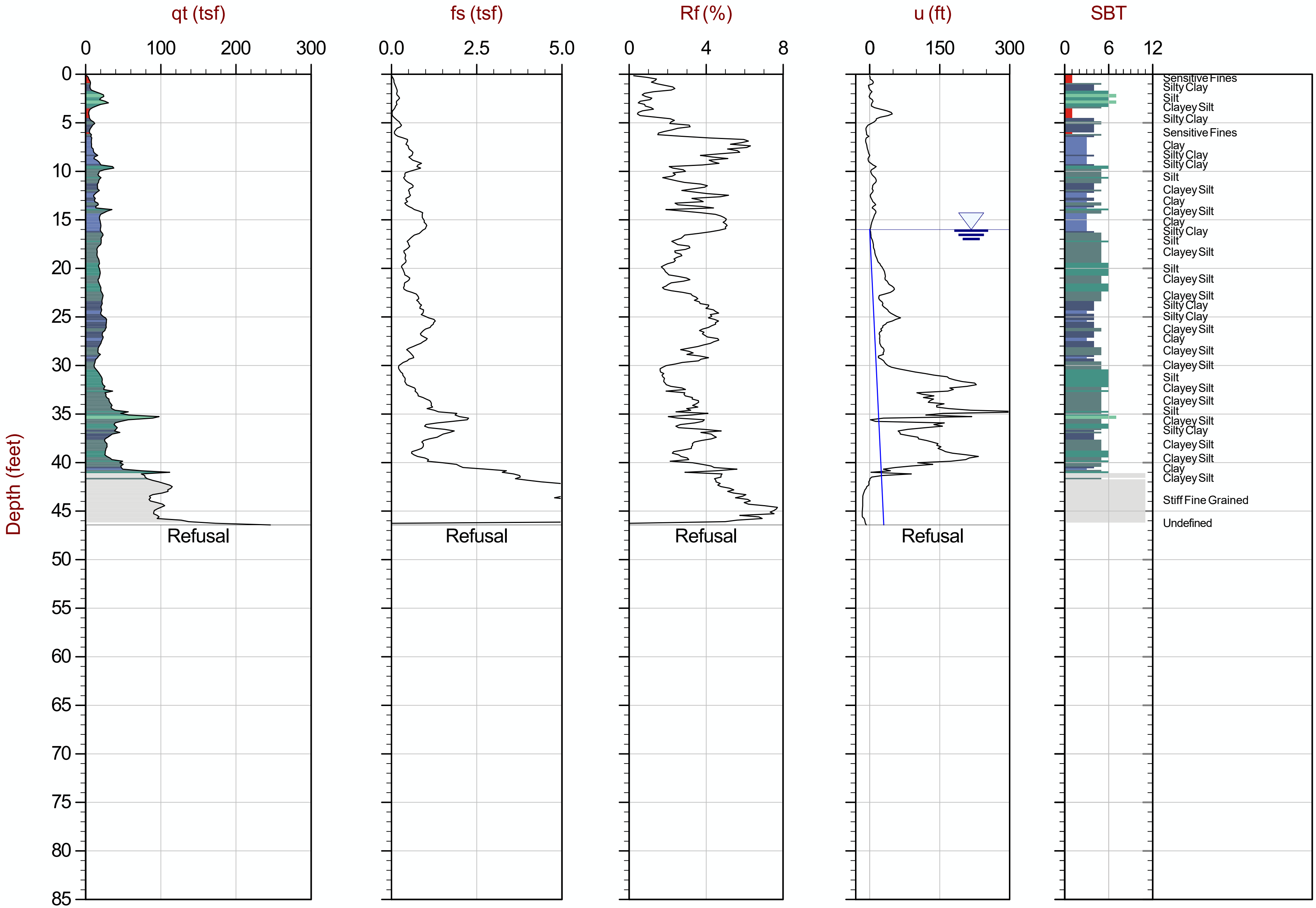
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:23:15 12:43
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C046
Cone: 419:T1500F15U500



Max Depth: 14.150 m / 46.42 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC046.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230730m E: 249820m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

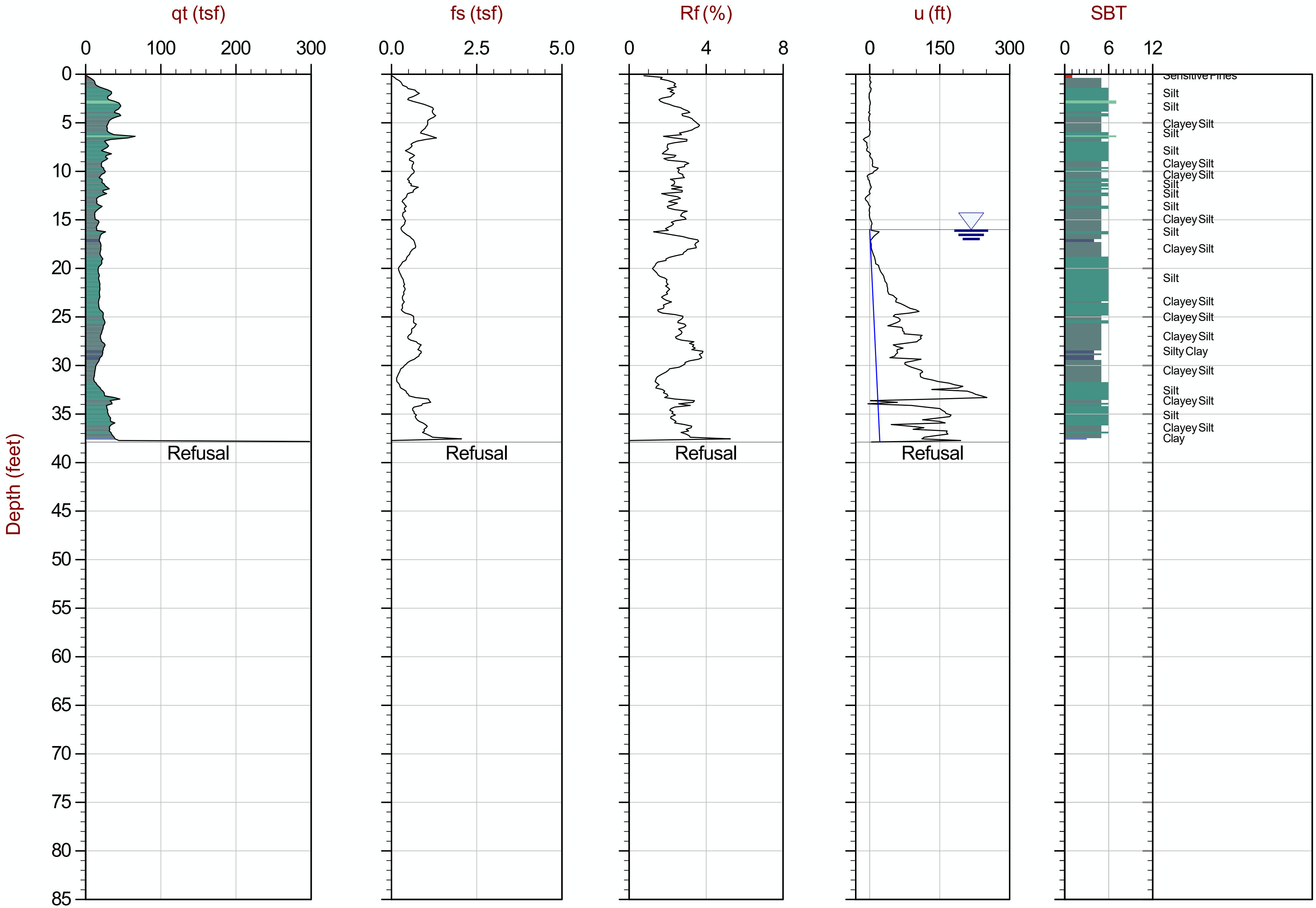
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:23:15 13:54
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C047
Cone: 419:T1500F15U500



Max Depth: 11.550 m / 37.89 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC047.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230728m E: 249825m

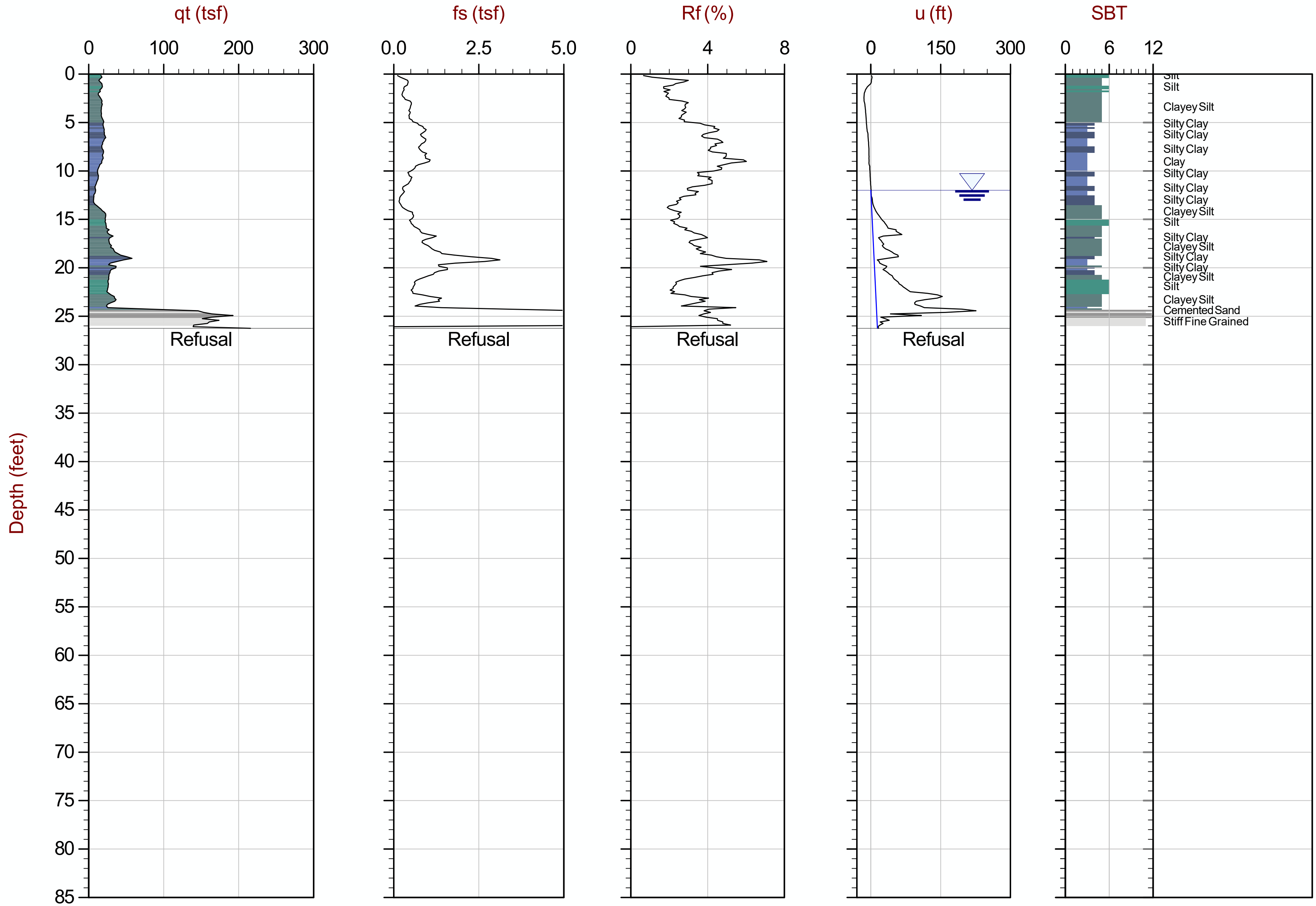
Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

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: 15-53062
Date: 08:17:15 14:47
Site: Baldwin Power Station, Baldwin, IL
Sounding: CPT15-BAL-C048
Cone: 419:T1500F15U500



Max Depth: 8.000 m / 26.25 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC048.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230715m E: 249849m

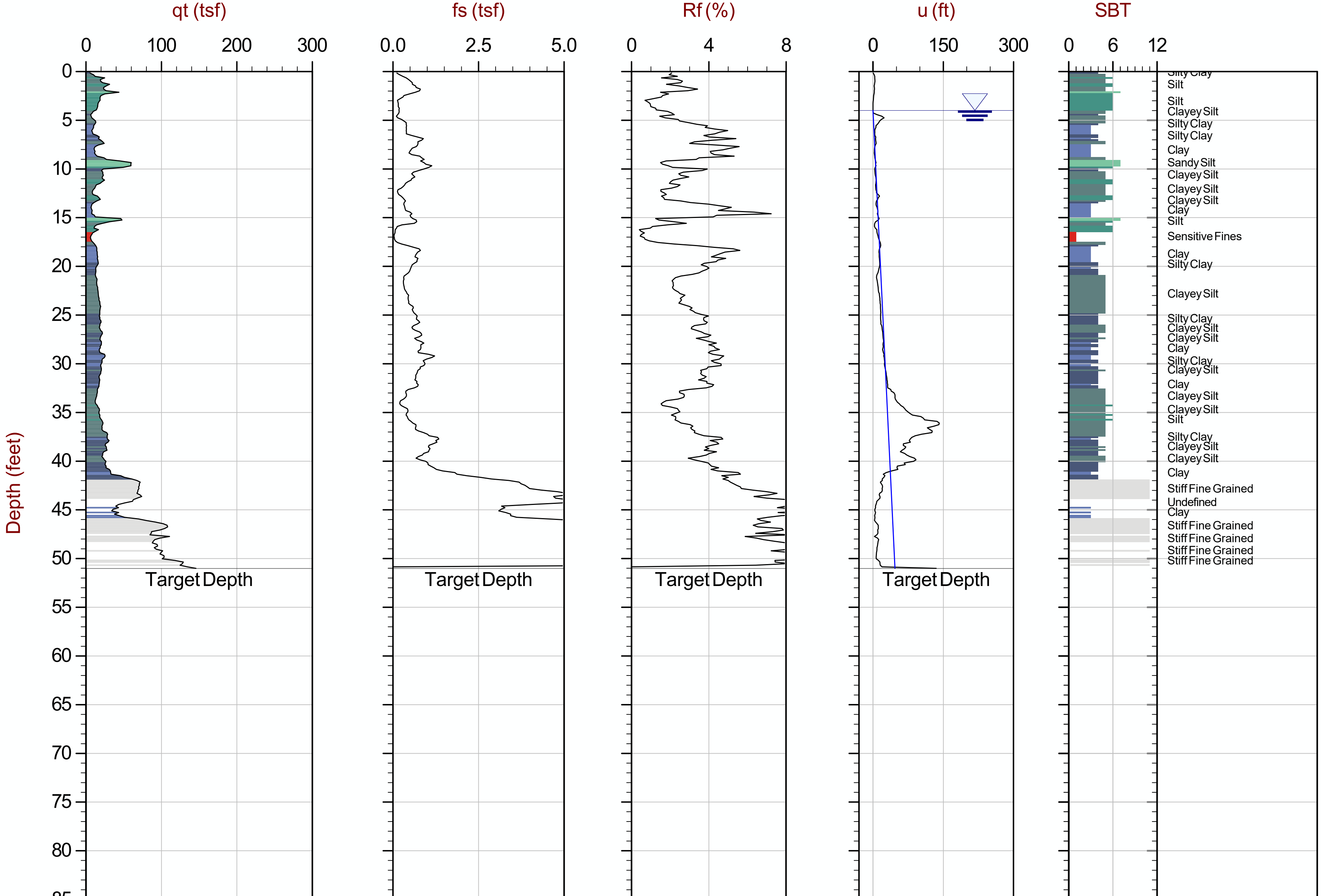
Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

AECOM

Job No: 15-53062
Date: 08:23:15 15:07
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C049
Cone: 419:T1500F15U500



Max Depth: 15.550 m / 51.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC049.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230896m E: 249850m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

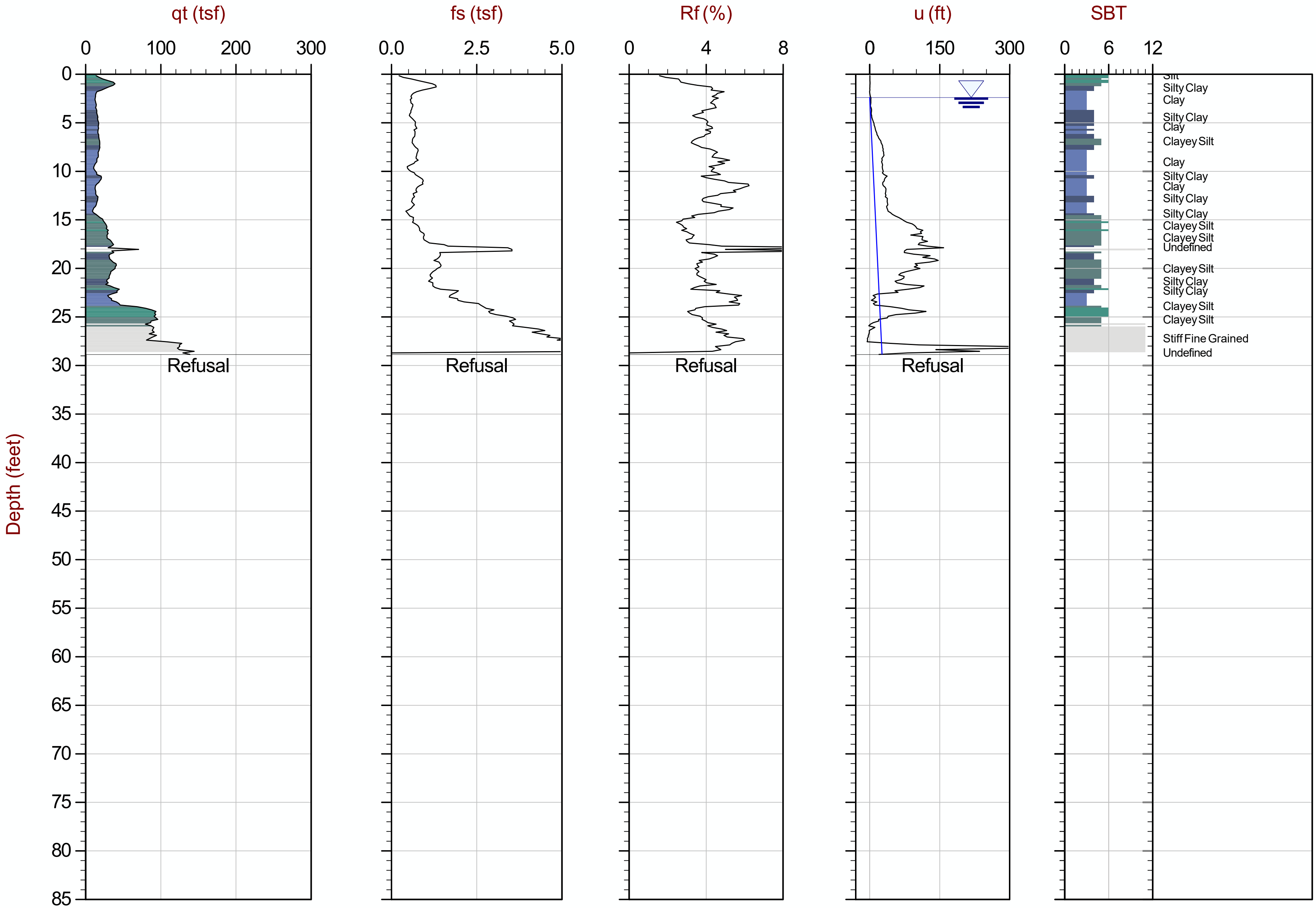
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:12:15 14:19
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C050
Cone: 301:T1500F15U500



Max Depth: 8.800 m / 28.87 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC050.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230880m E: 249885m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

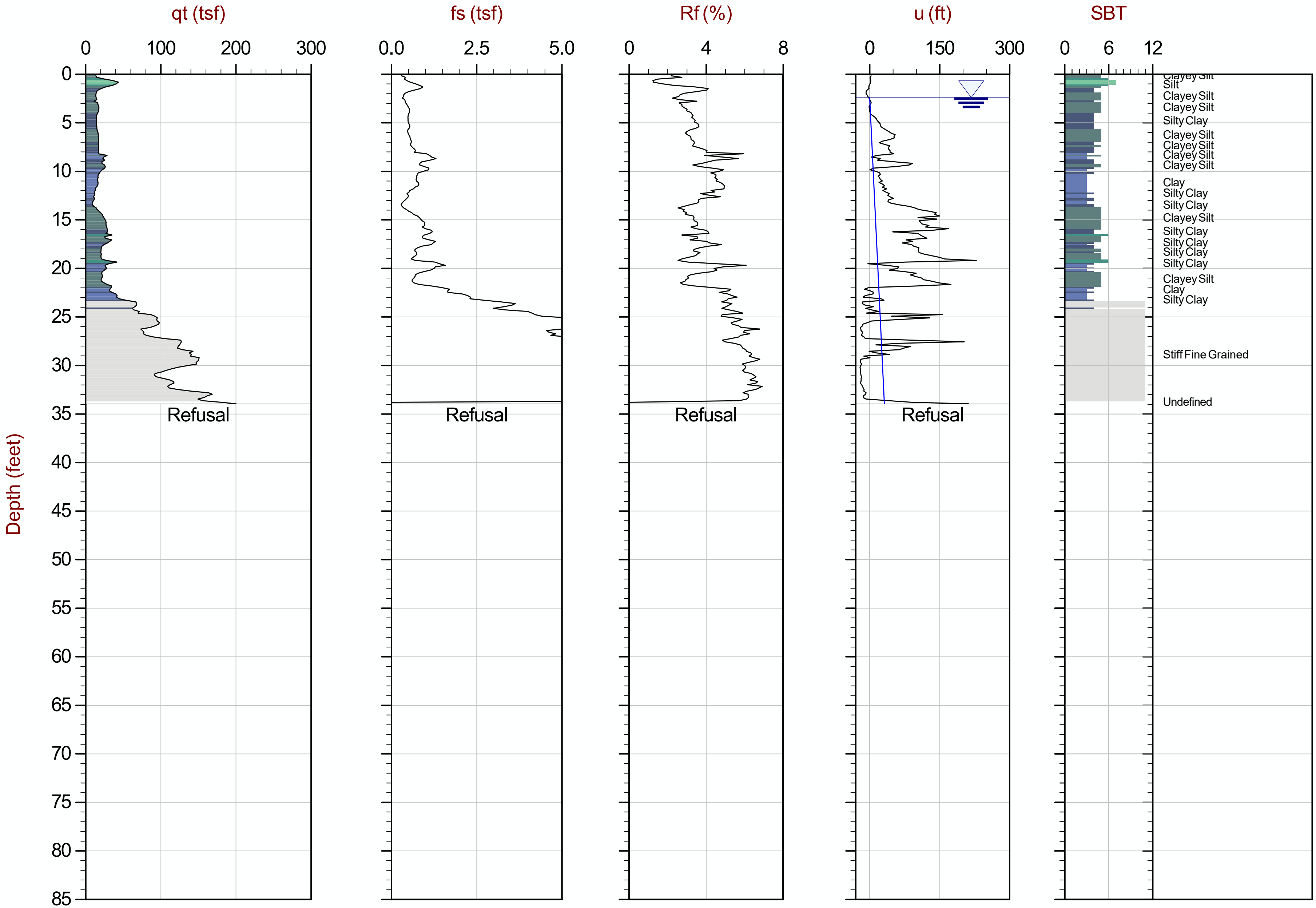
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:12:15 14:46
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C050A
Cone: 226:T1500F15U500



Max Depth: 10.350 m / 33.96 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC050A.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230878m E: 249885m

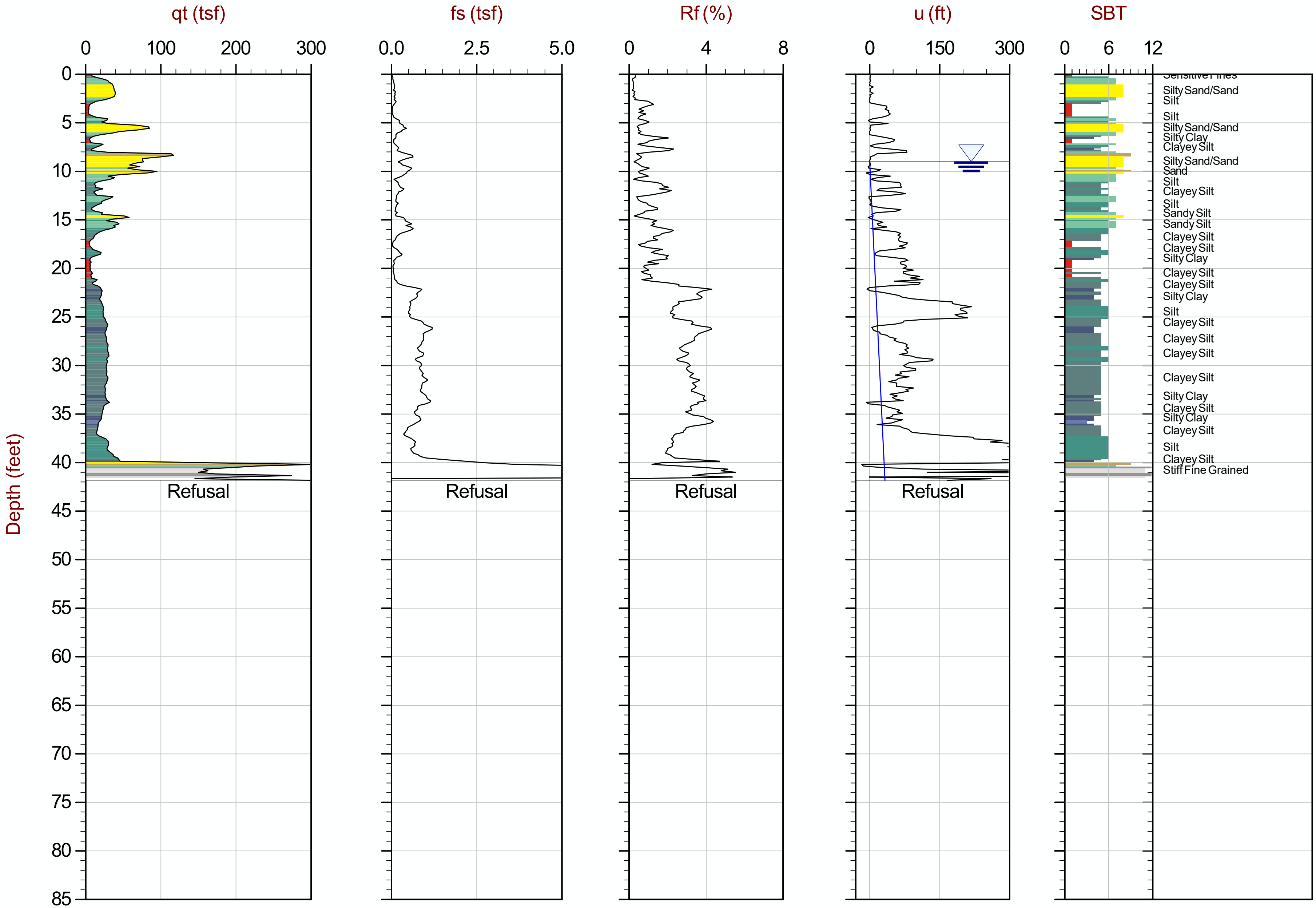
Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

AECOM

Job No: 15-53062
Date: 08:24:15 10:02
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C051
Cone: 419:T1500F15U500



Max Depth: 12.750 m / 41.83 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC051.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231379m E: 249928m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

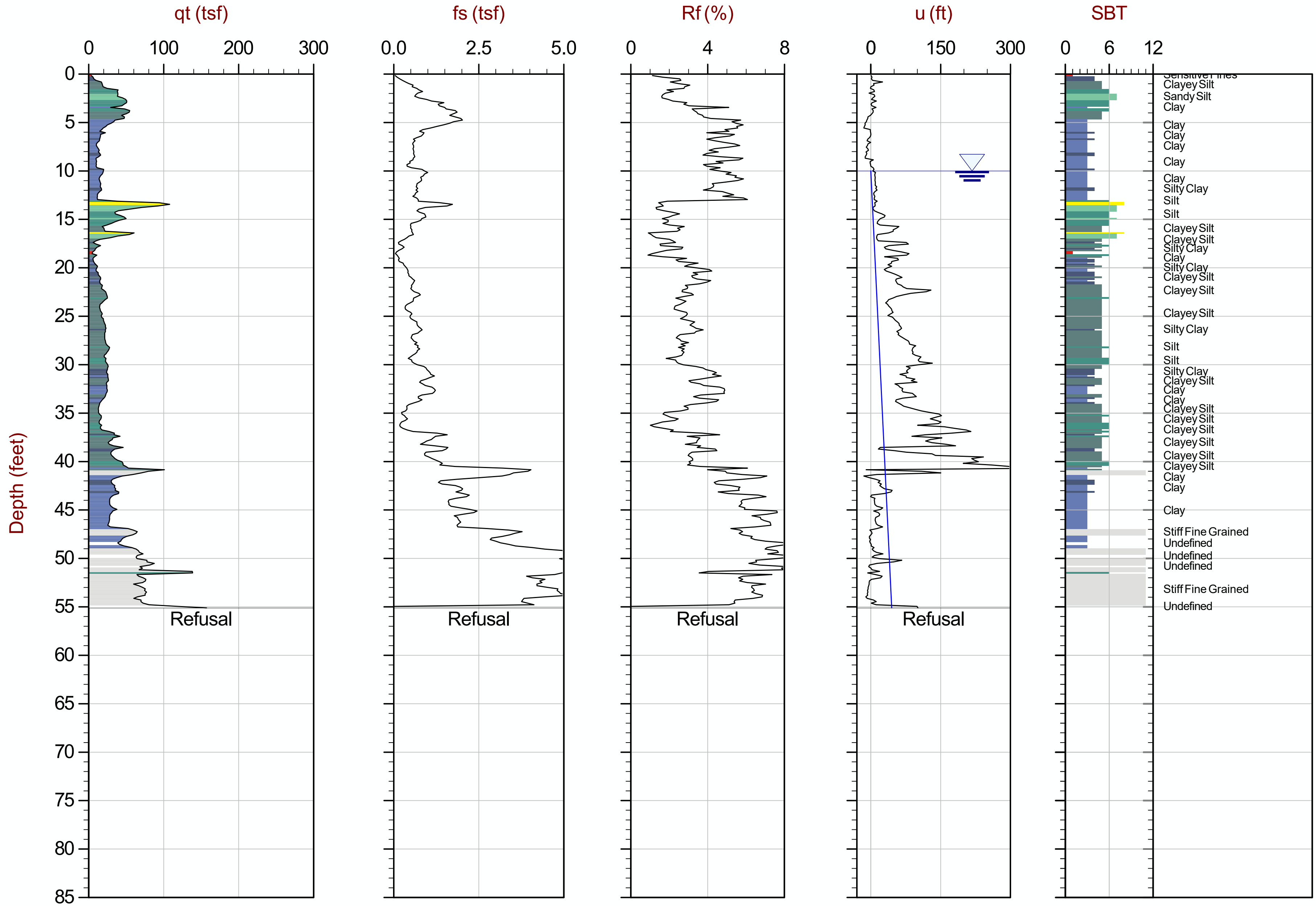
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:24:15 10:45
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C052
Cone: 419:T1500F15U500



Max Depth: 16.800 m / 55.12 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC052.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231373m E: 249939m

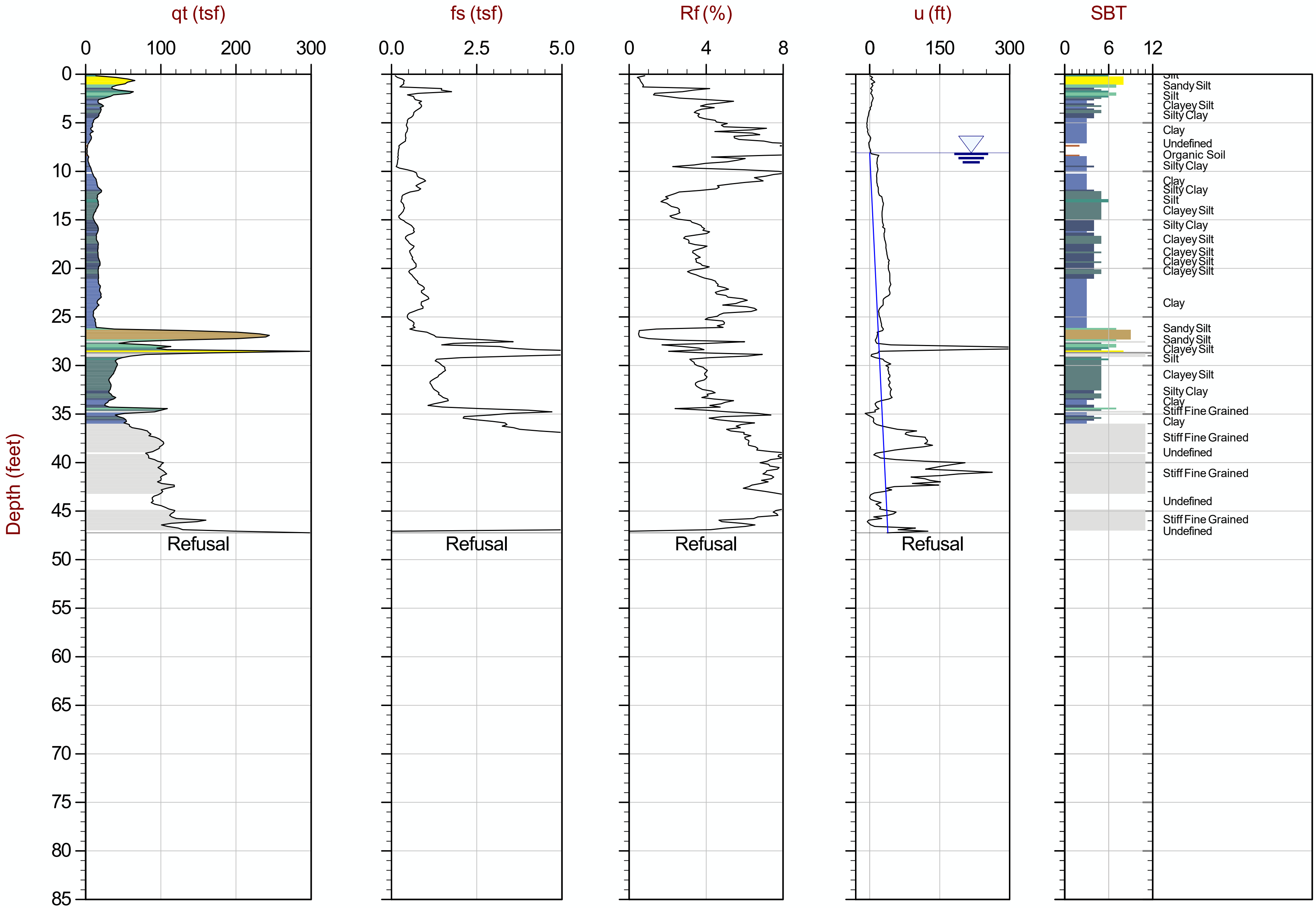
Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

AECOM

Job No: 15-53062
Date: 08:12:15 13:08
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C053
Cone: 436:T1500F15U500



Max Depth: 14.400 m / 47.24 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC053.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231348m E: 250015m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

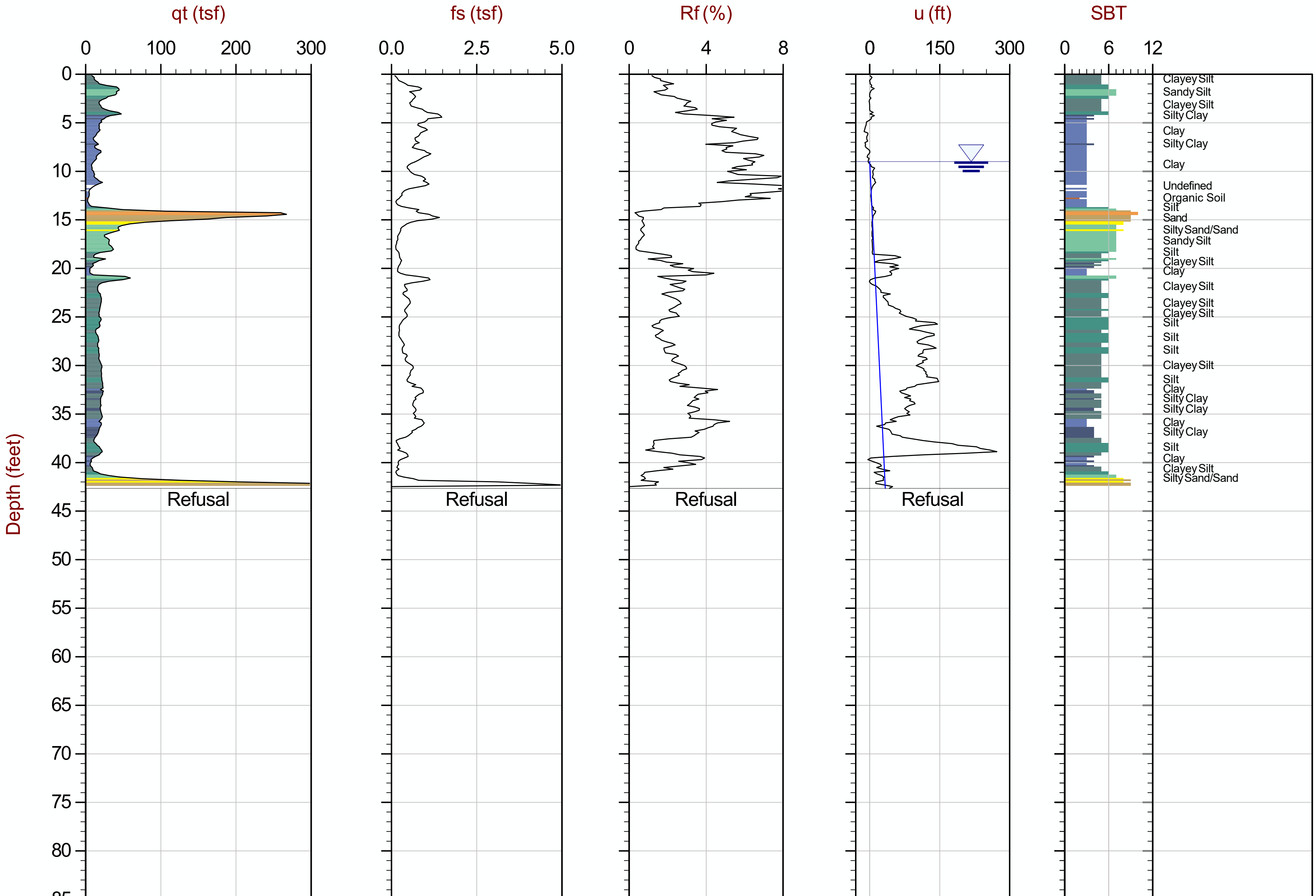
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:24:15 12:25
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C054
Cone: 419:T1500F15U500



Max Depth: 13.000 m / 42.65 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC054.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231485m E: 249960m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

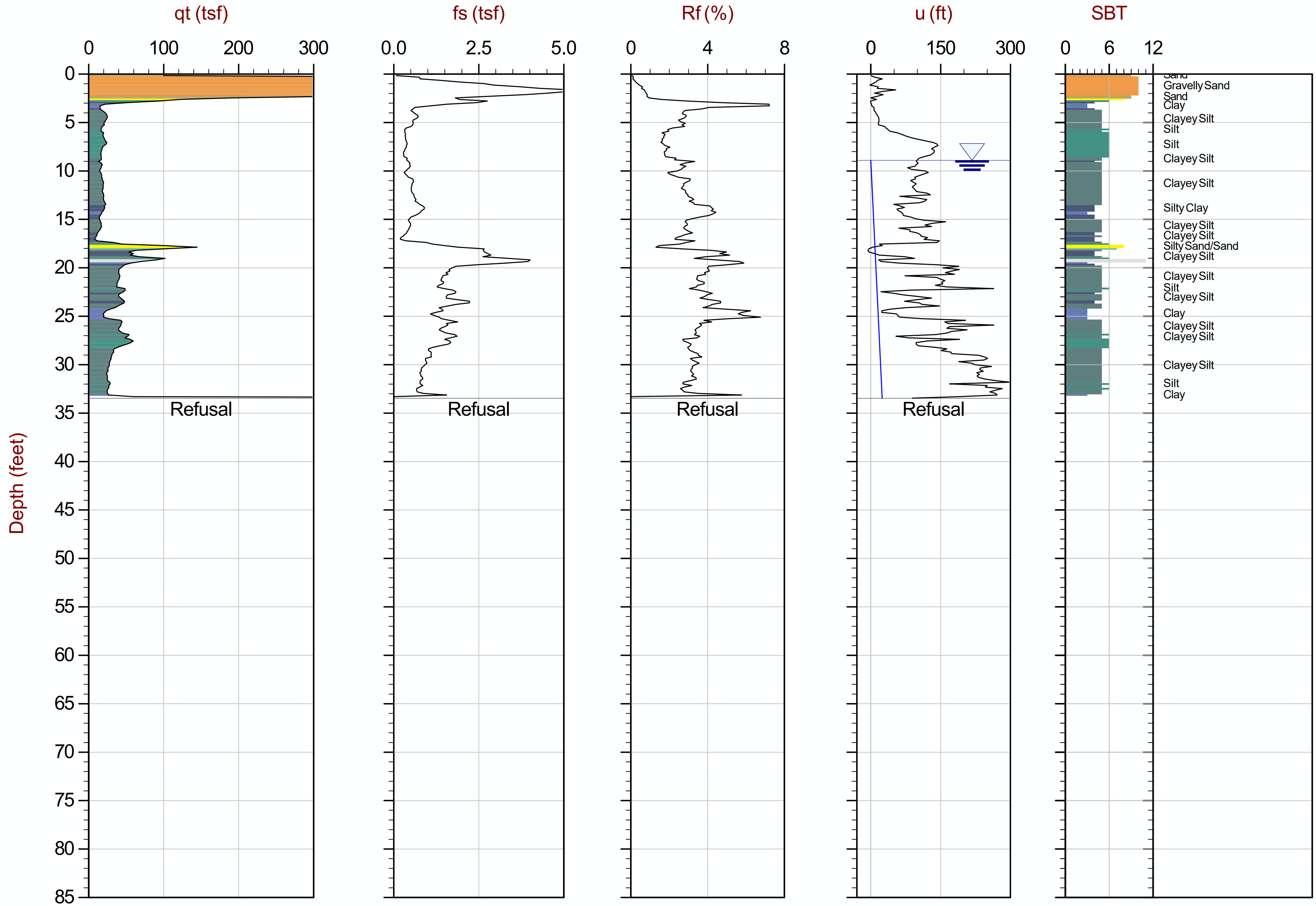
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:12:15 12:09
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C055
Cone: 436:T1500F15U500



Max Depth: 10.200 m / 33.46 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC055.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231753m E: 249923m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

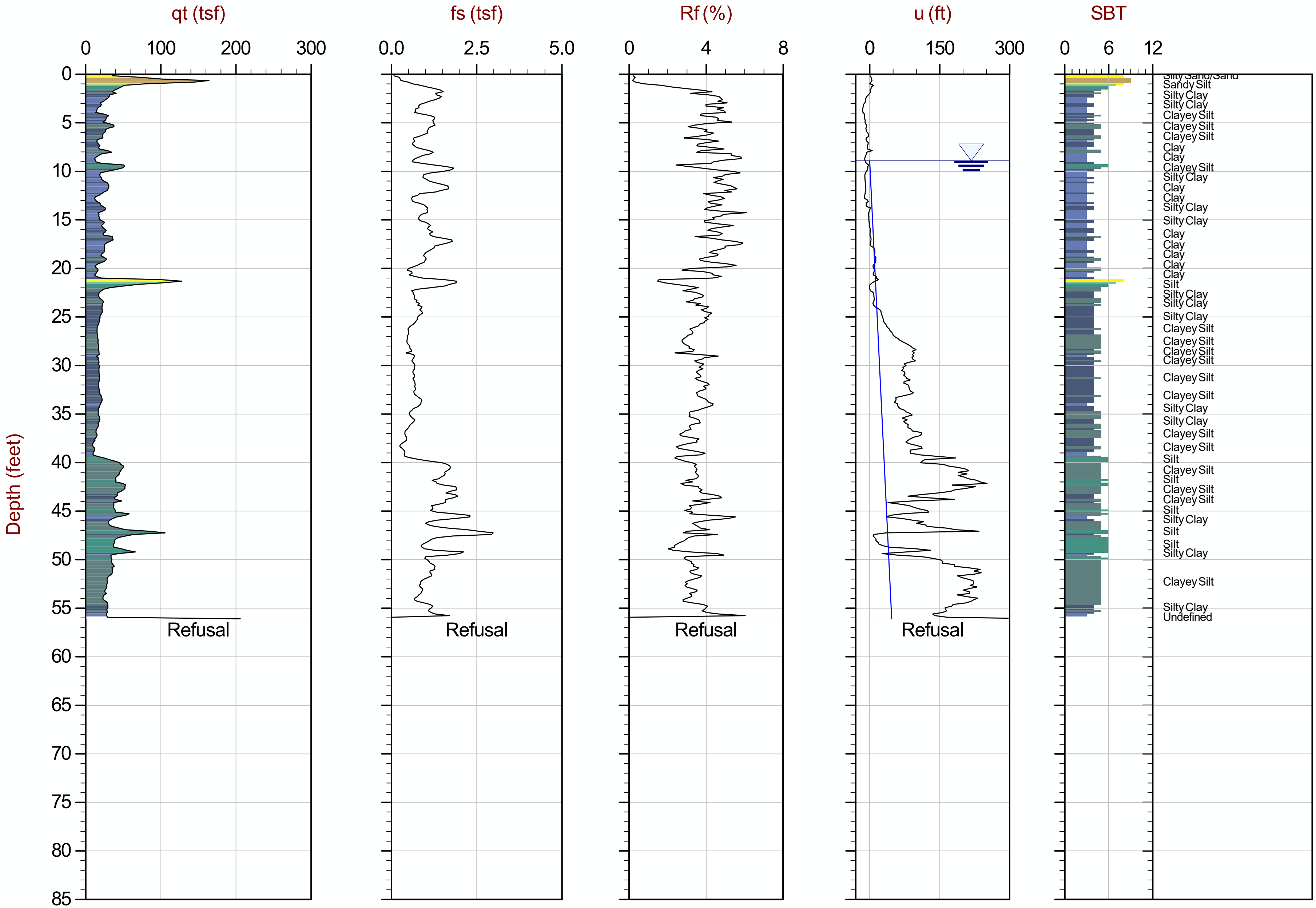
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:13:15 08:11
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C056
Cone: 419:T1500F15U500



Max Depth: 17.100 m / 56.10 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC056.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231737m E: 249918m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

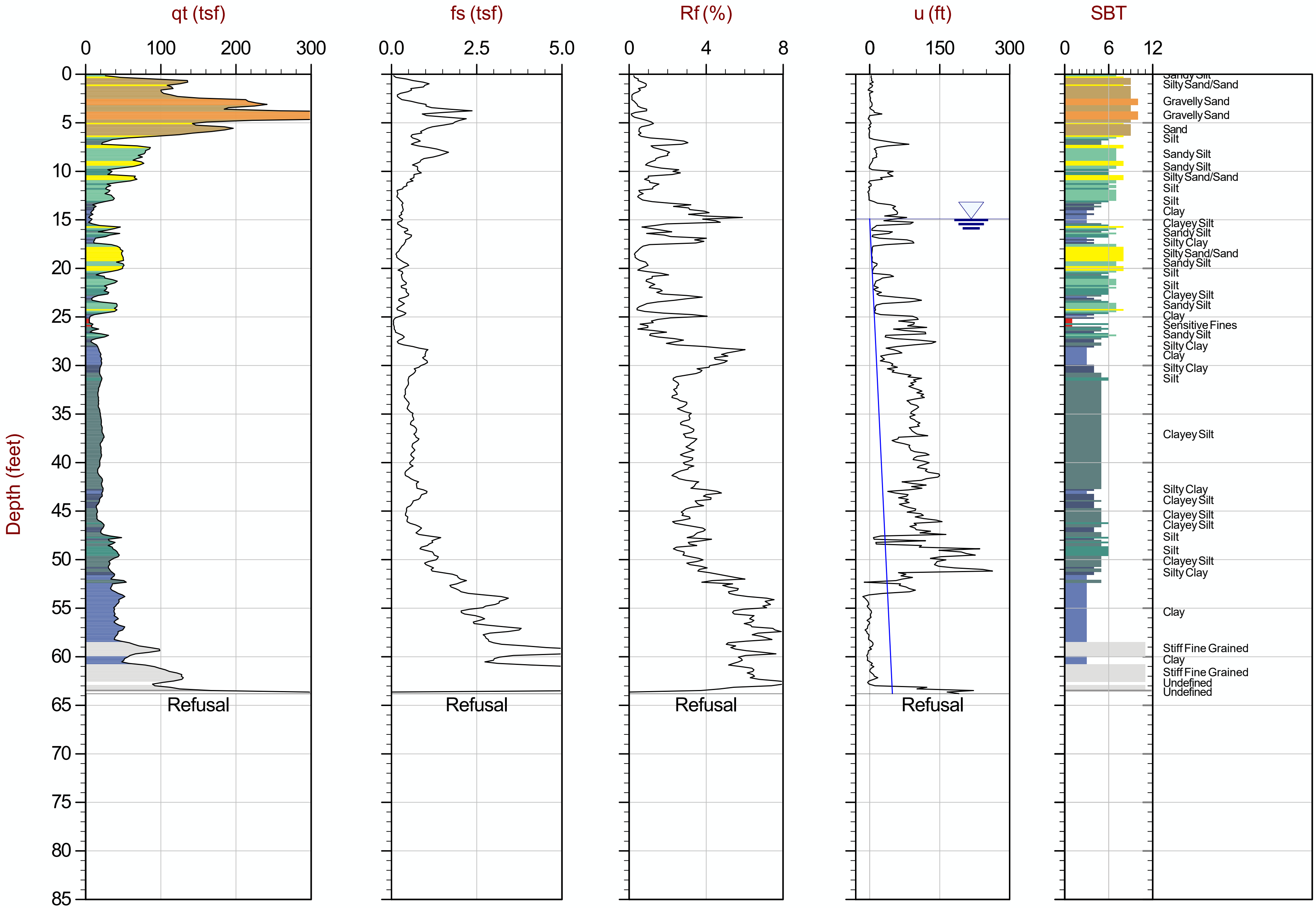
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:17:15 13:36
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C057
Cone: 419:T1500F15U500



Max Depth: 19.450 m / 63.81 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC057.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231566m E: 249853m

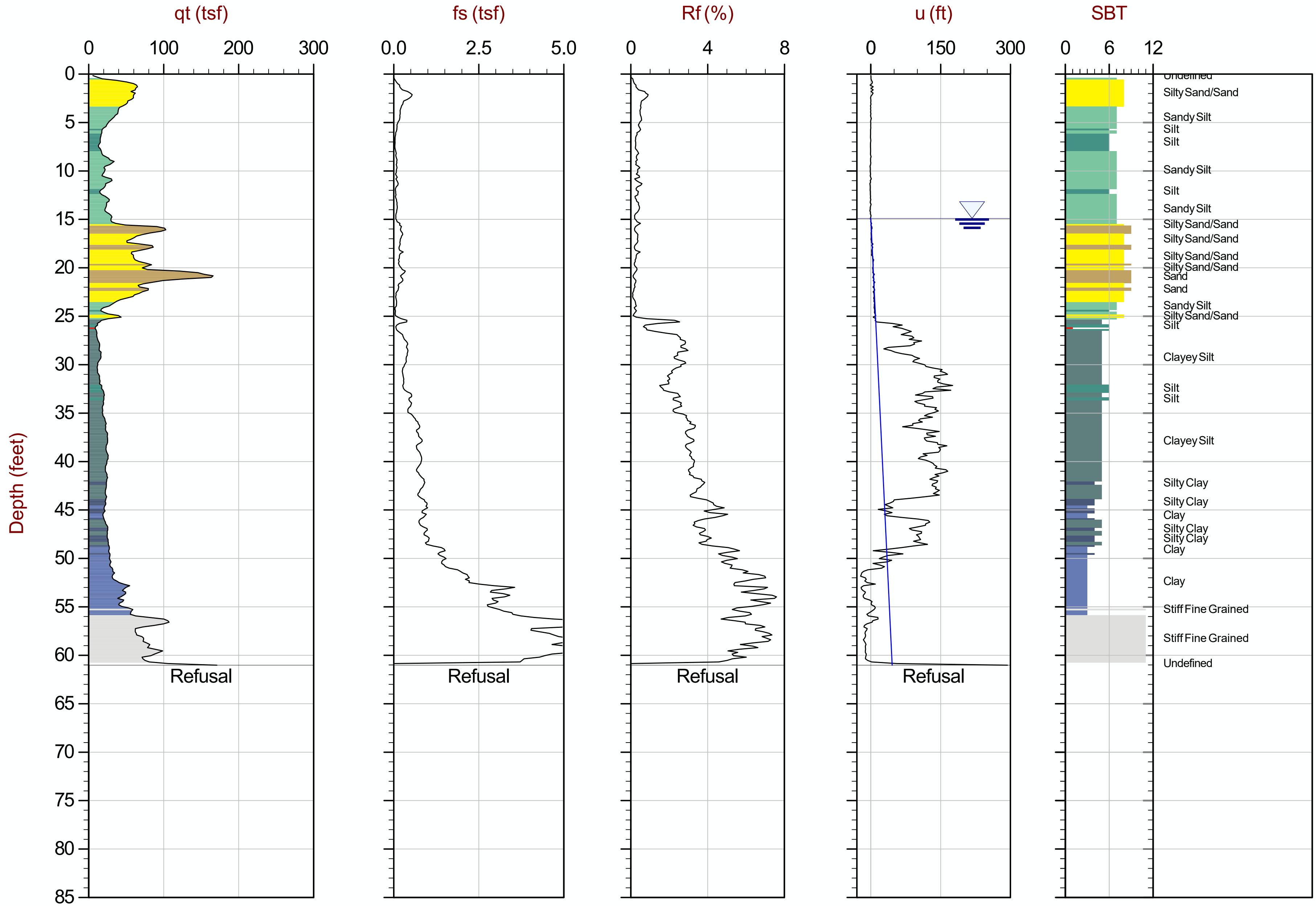
Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

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: 15-53062
Date: 08:24:15 14:32
Site: Baldwin Power Station, Baldwin, IL
Sounding: CPT15-BAL-C058
Cone: 419:T1500F15U500



Max Depth: 18.600 m / 61.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC058.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231513m E: 249771m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

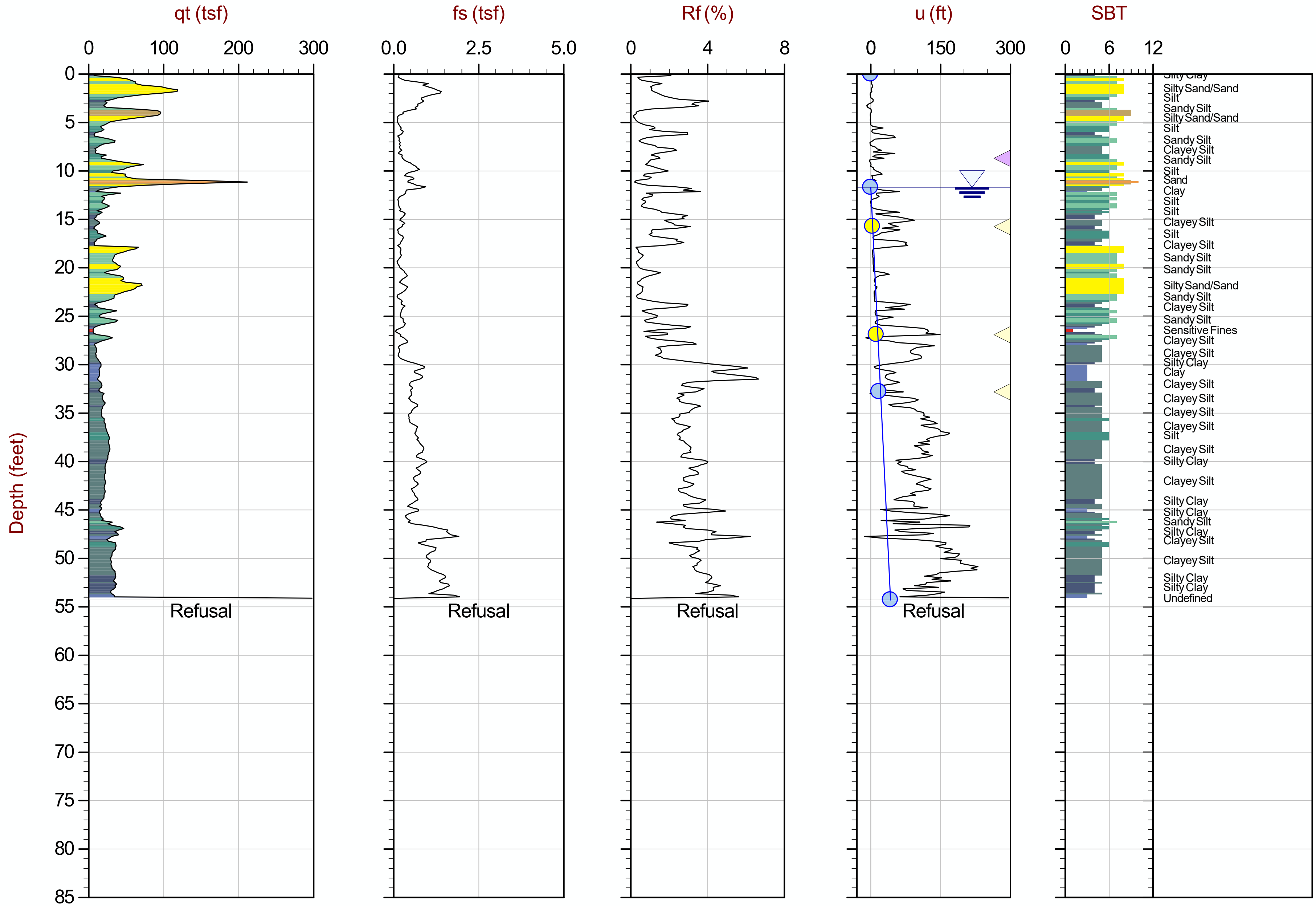
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:17:15 12:12
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C059
Cone: 419:T1500F15U500



Max Depth: 16.550 m / 54.30 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC059.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231567m E: 249907m

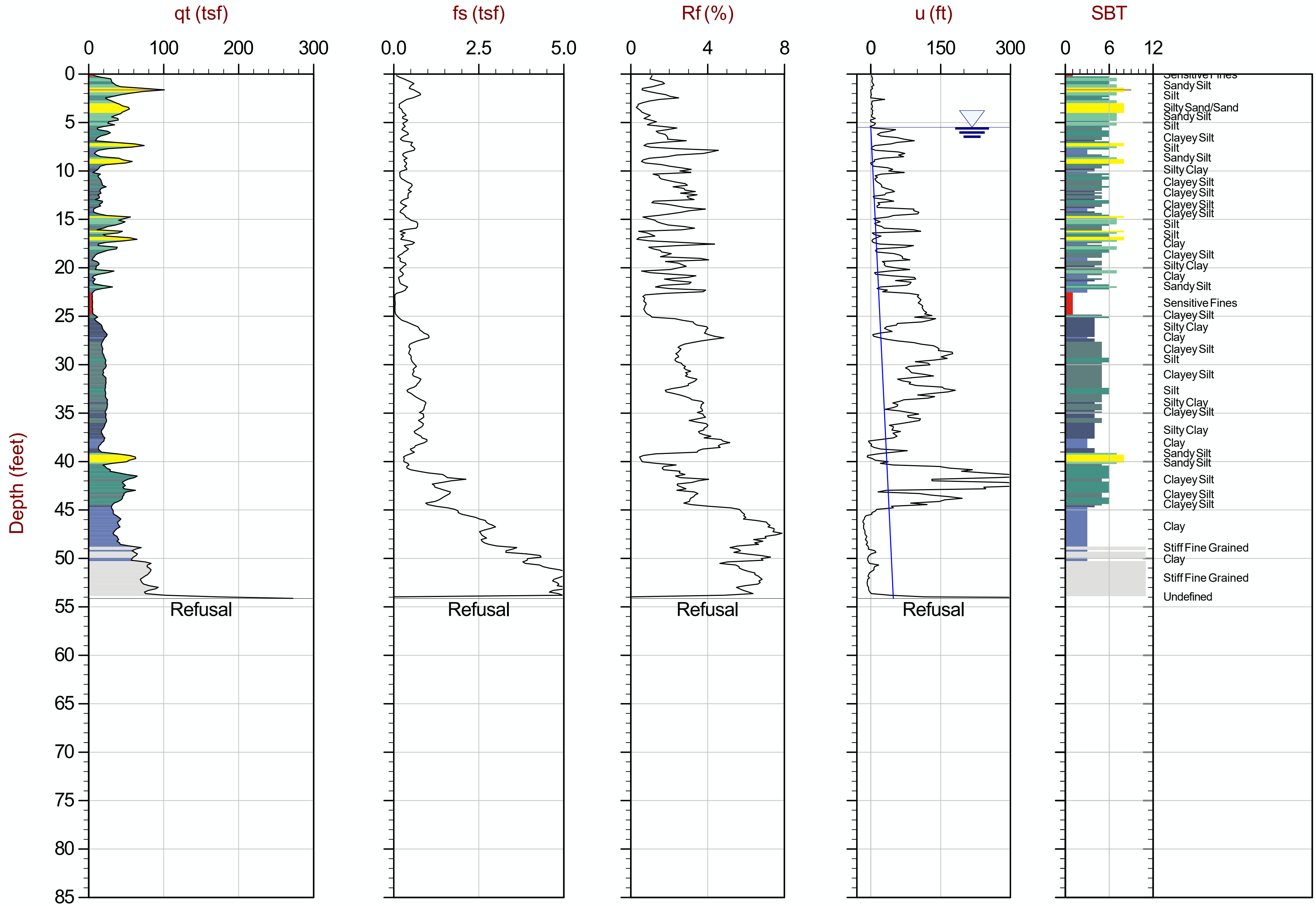
Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

AECOM

Job No: 15-53062
Date: 08:24:15 08:39
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C060
Cone: 419:T1500F15U500



Max Depth: 16.500 m / 54.13 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC060.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231318m E: 249808m

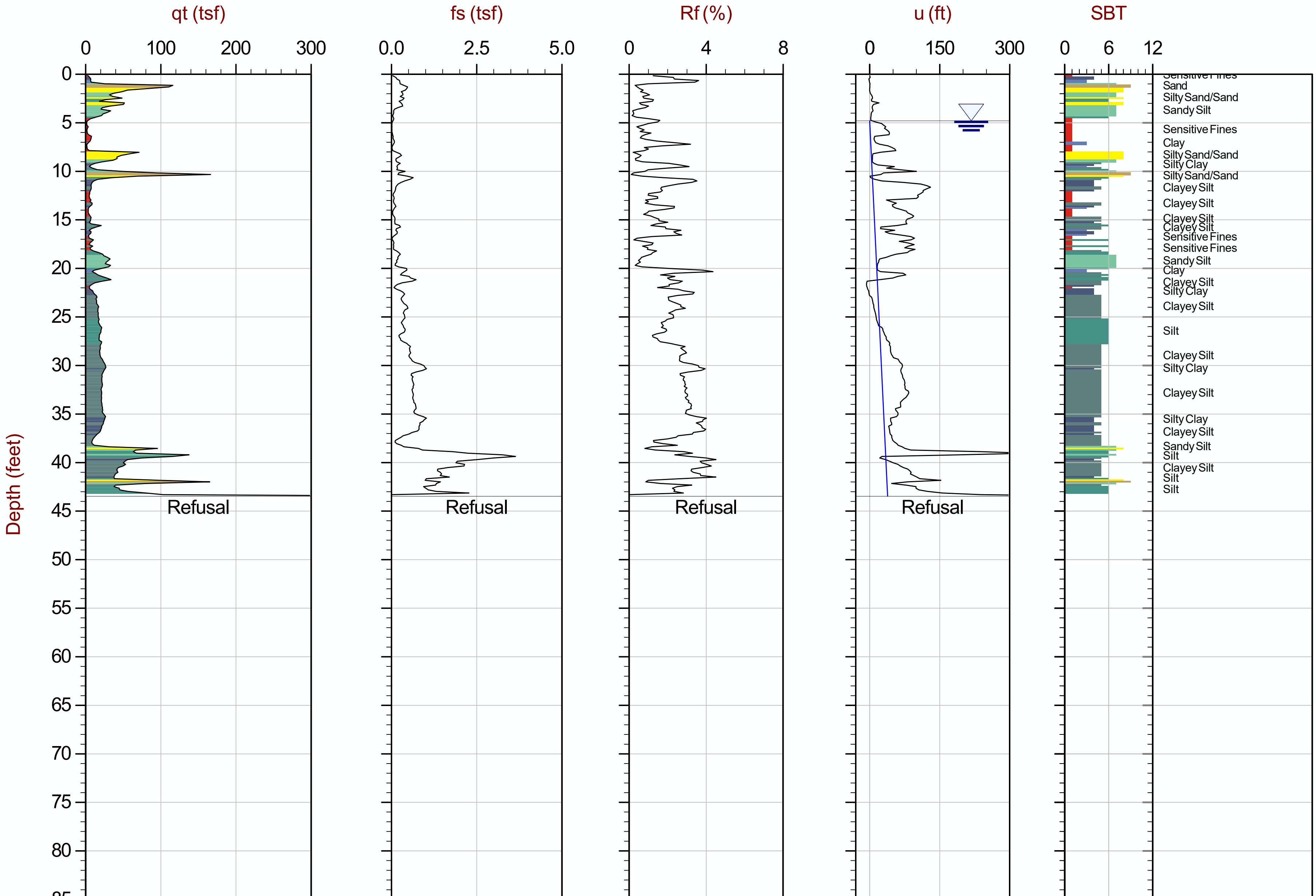
Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

AECOM

Job No: 15-53062
Date: 08:23:15 16:03
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C061
Cone: 419:T1500F15U500



Max Depth: 13.250 m / 43.47 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC061.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230972m E: 249663m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

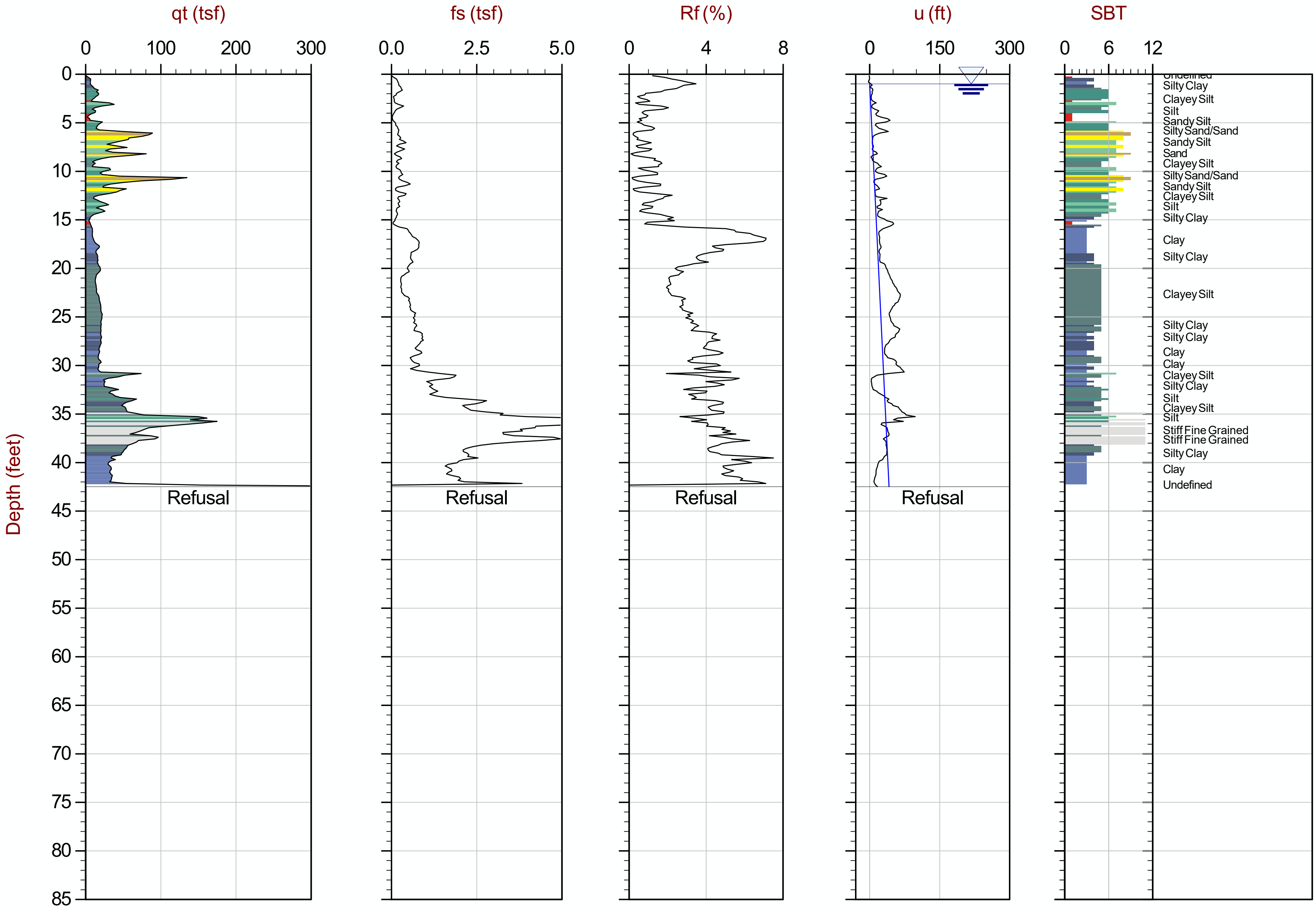
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:23:15 11:54
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C062
Cone: 419:T1500F15U500



Max Depth: 12.950 m / 42.49 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC062.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230766m E: 249701m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

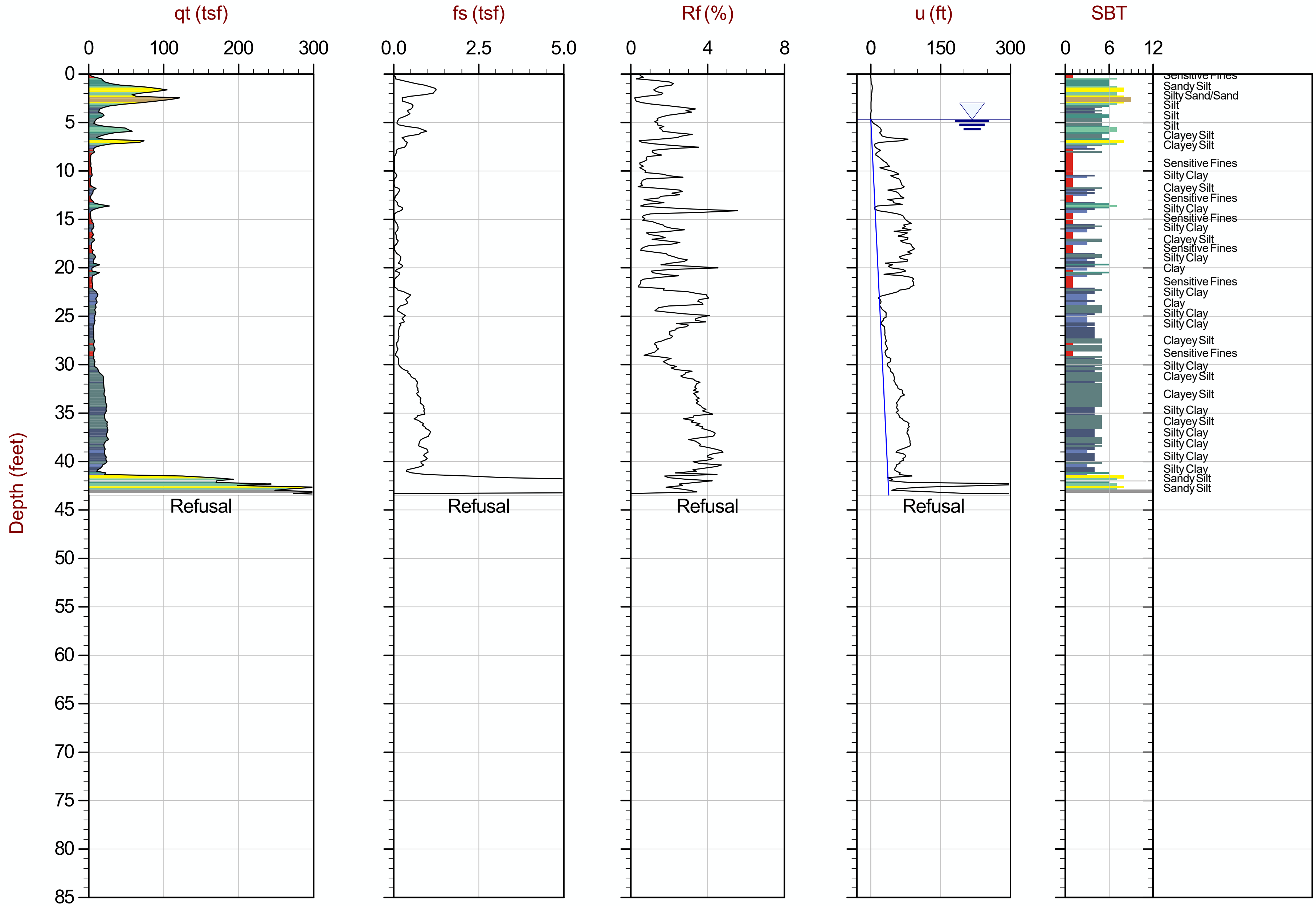
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:23:15 09:46
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C063
Cone: 419:T1500F15U500



Max Depth: 13.250 m / 43.47 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC063.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230808m E: 249422m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

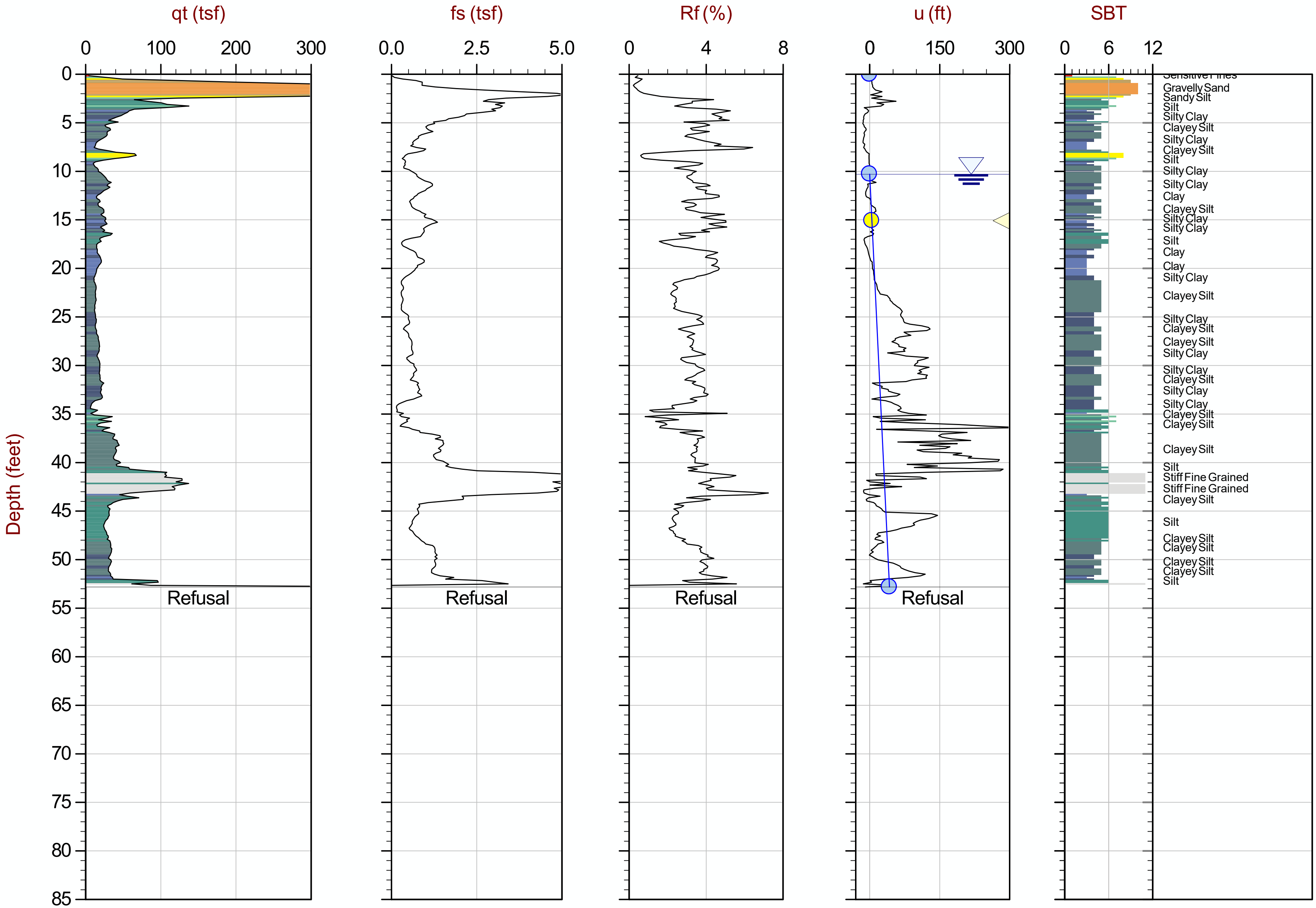
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:12:15 09:52
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C064
Cone: 436:T1500F15U500



Max Depth: 16.100 m / 52.82 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC064.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231751m E: 249640m

Hydrostatic Line · Ueq · Assumed Ueq · PPD, Ueq achieved · PPD, Ueq not achieved

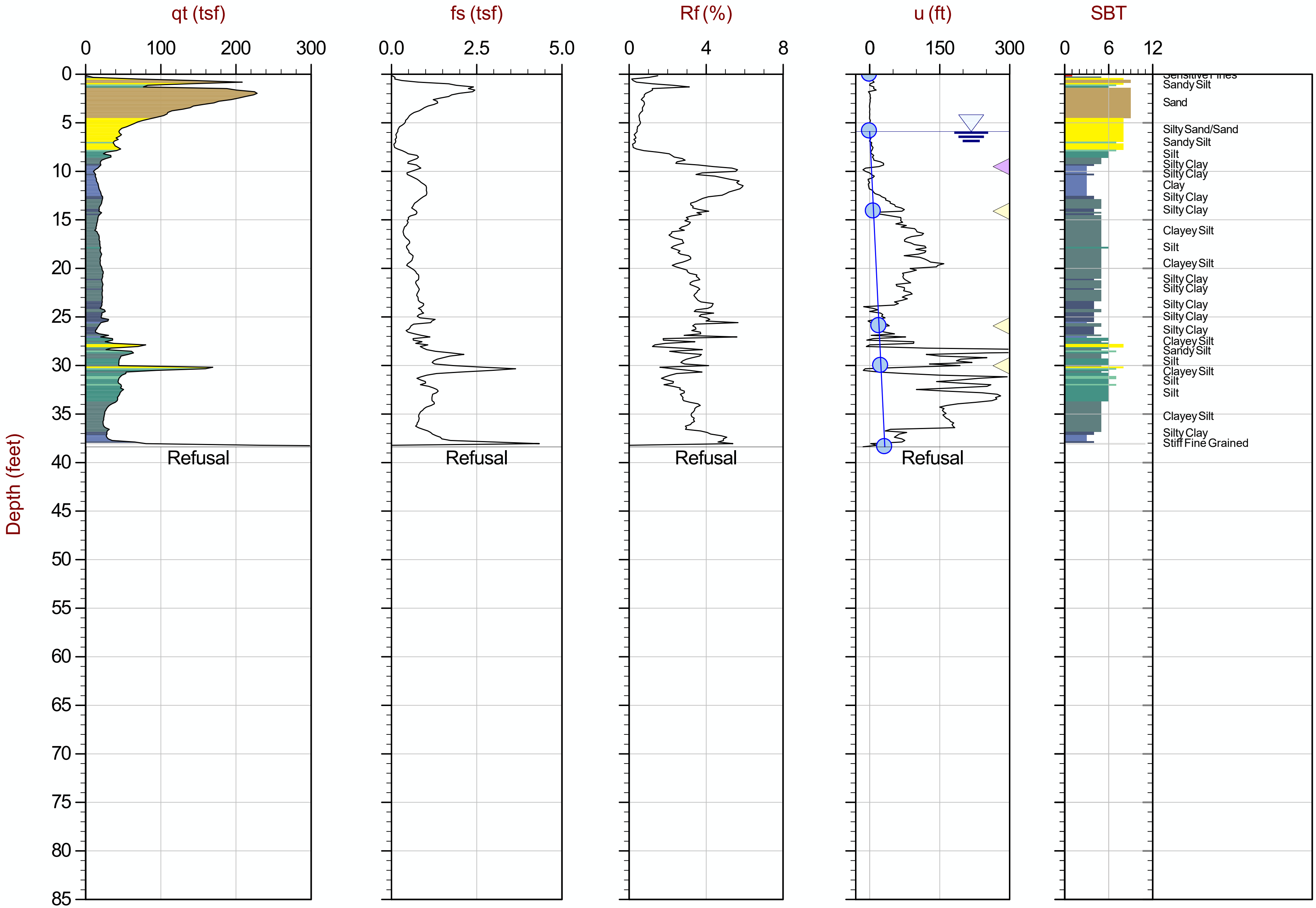
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:17:15 08:25
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C065
Cone: 419:T1500F15U500



Max Depth: 11.700 m / 38.39 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC065.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231729m E: 249439m

Hydrostatic Line ○ Ueq ● Assumed Ueq ◁ PPD, Ueq achieved ◁ PPD, Ueq not achieved

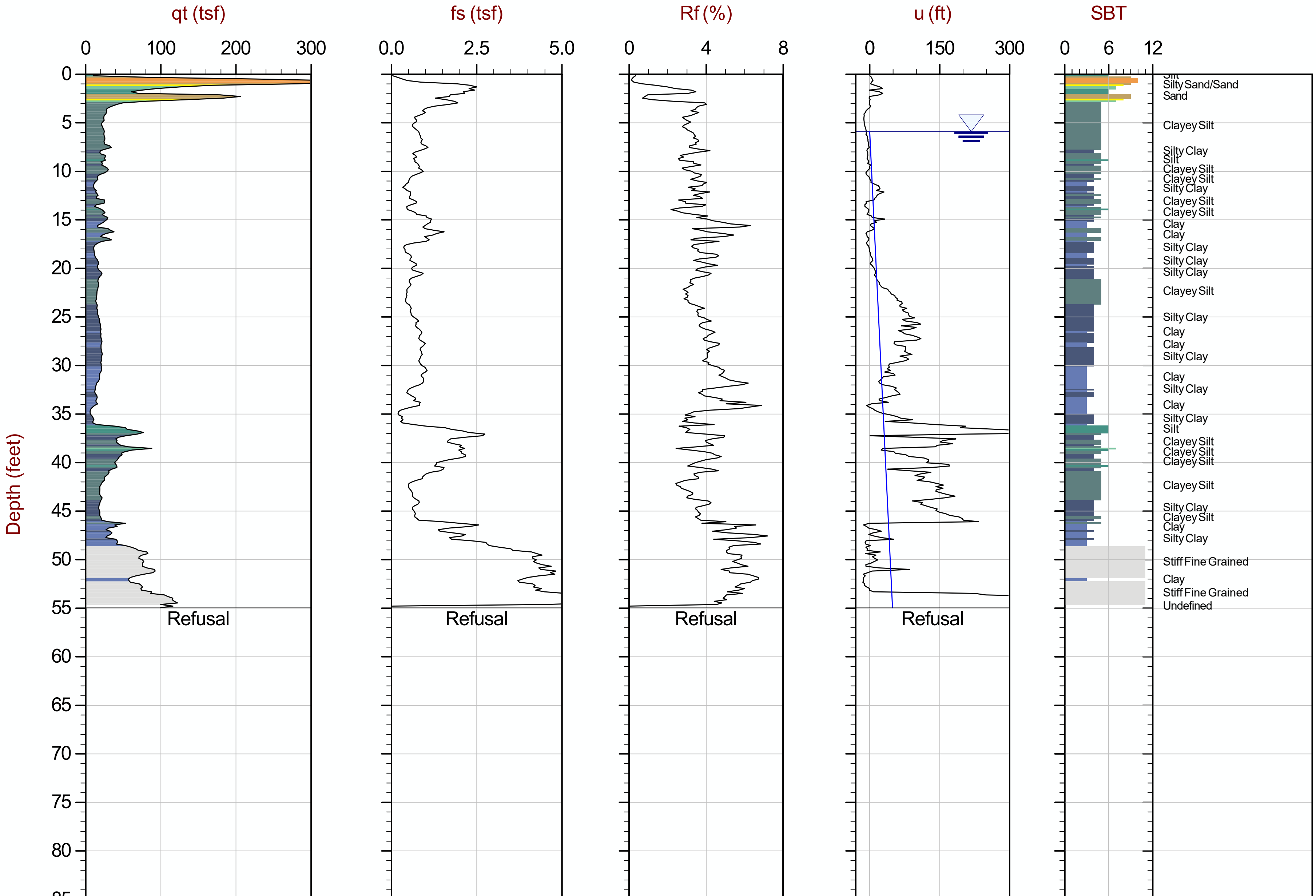
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:12:15 10:41
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C066
Cone: 436:T1500F15U500



Max Depth: 16.750 m / 54.95 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC066.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231762m E: 249440m

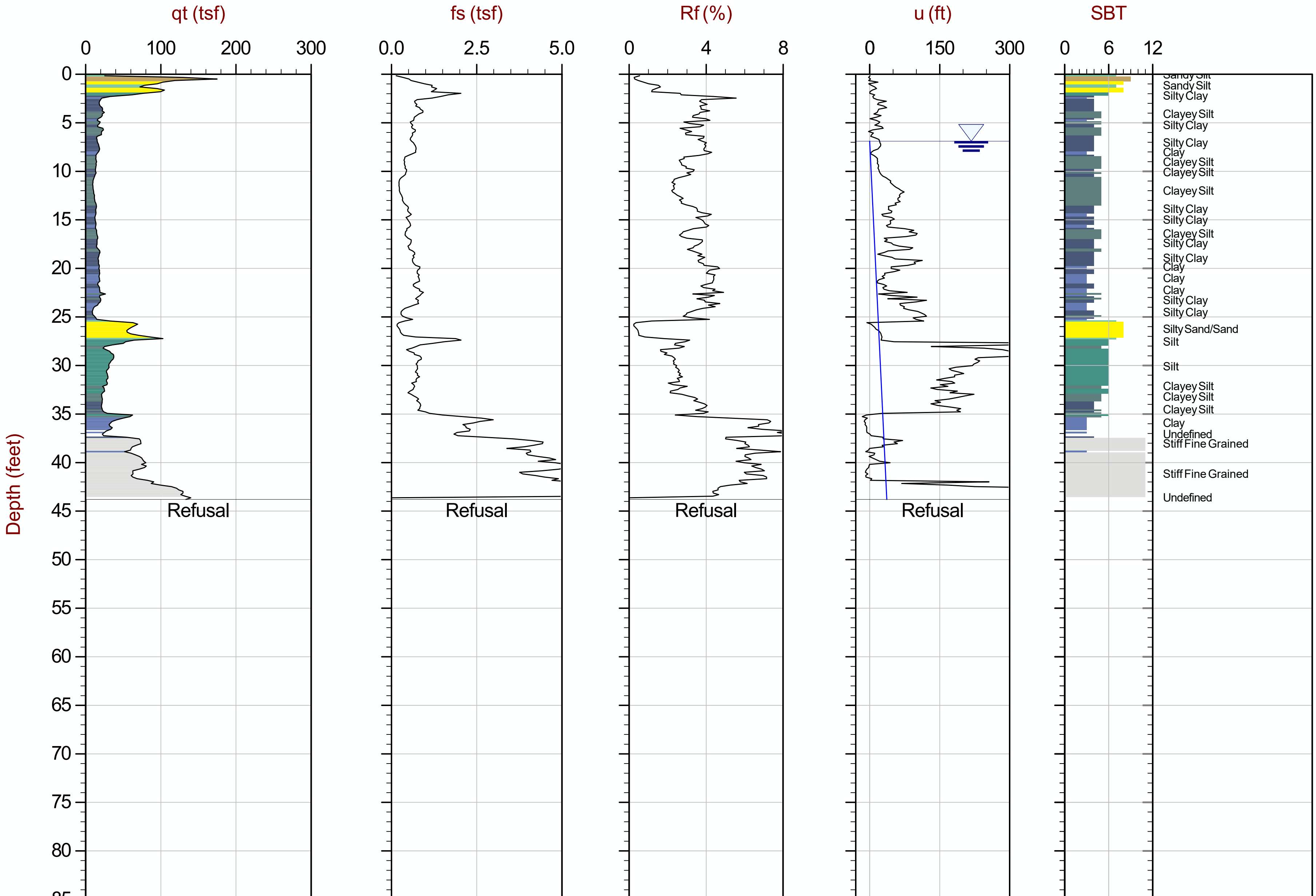
Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

AECOM

Job No: 15-53062
Date: 08:12:15 09:00
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C067
Cone: 436:T1500F15U500



Max Depth: 13.350 m / 43.80 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC067.COR

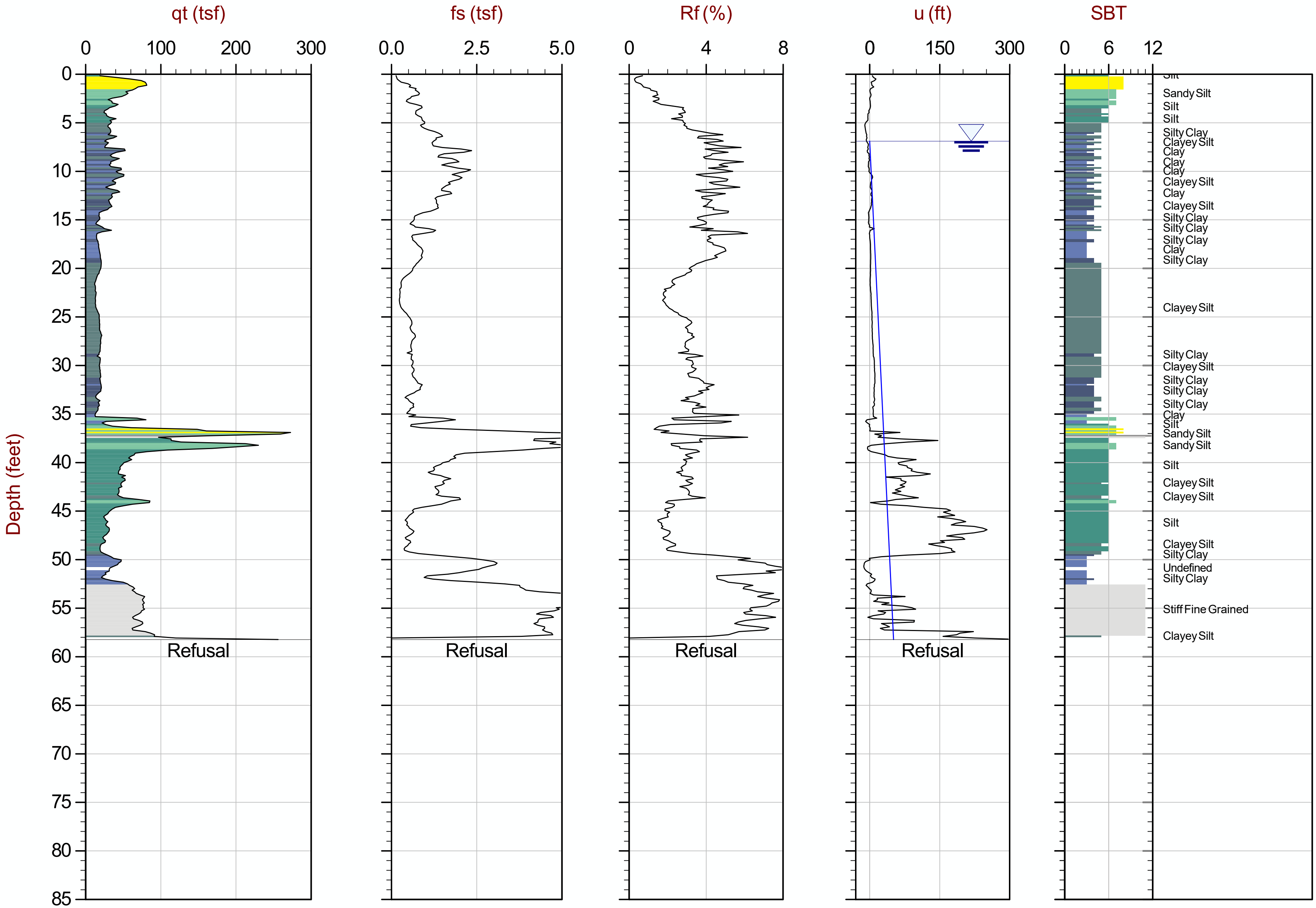
SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231779m E: 249441m

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.

AECOM

Job No: 15-53062
Date: 08:12:15 11:23
Site: Baldwin Power Station, Baldwin, IL
Sounding: CPT15-BAL-C068
Cone: 436:T1500F15U500



Max Depth: 17.750 m / 58.23 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC068.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231771m E: 249287m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

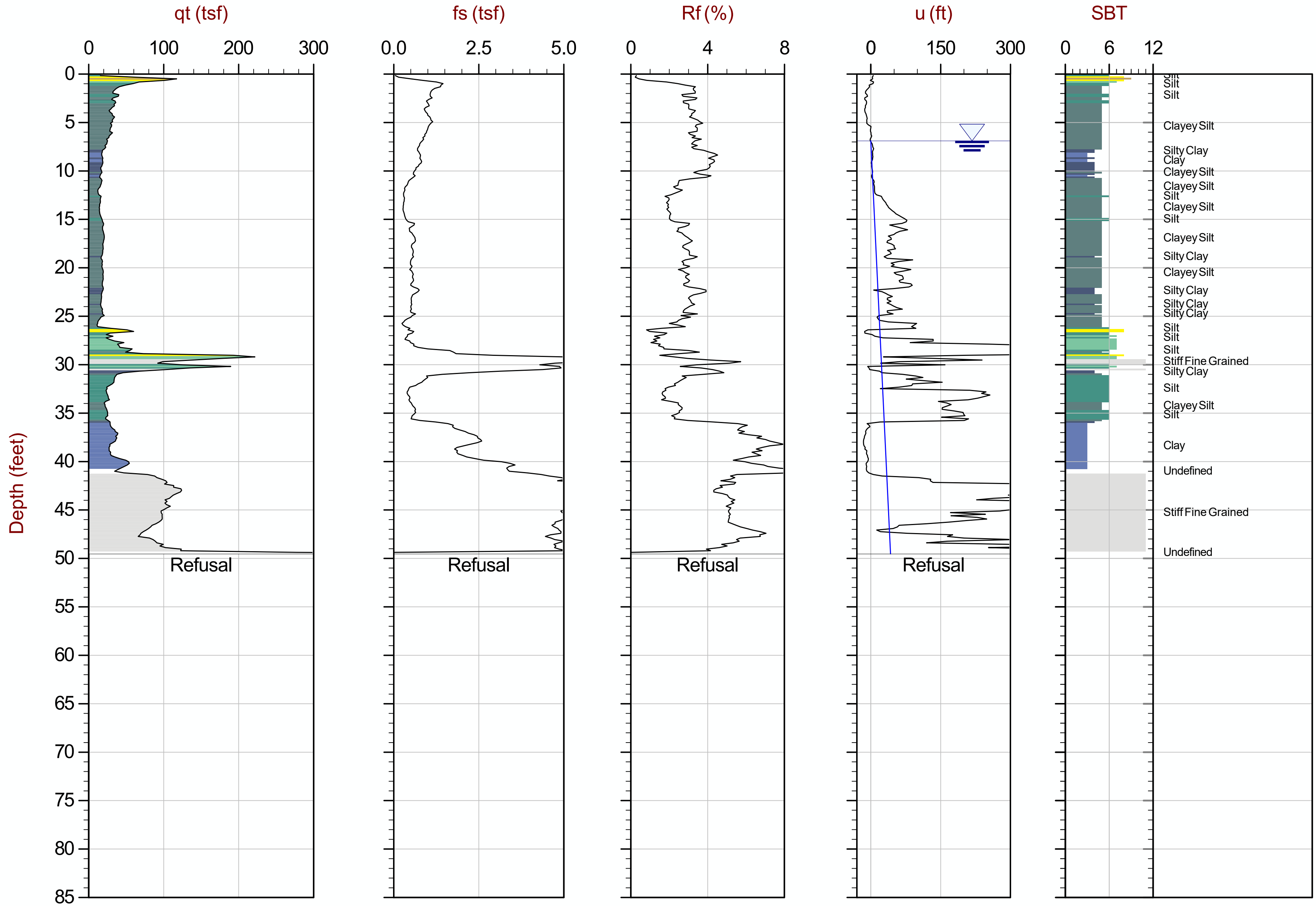
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:12:15 08:01
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C069
Cone: 436:T1500F15U500



Max Depth: 15.100 m / 49.54 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC069.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231786m E: 249287m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

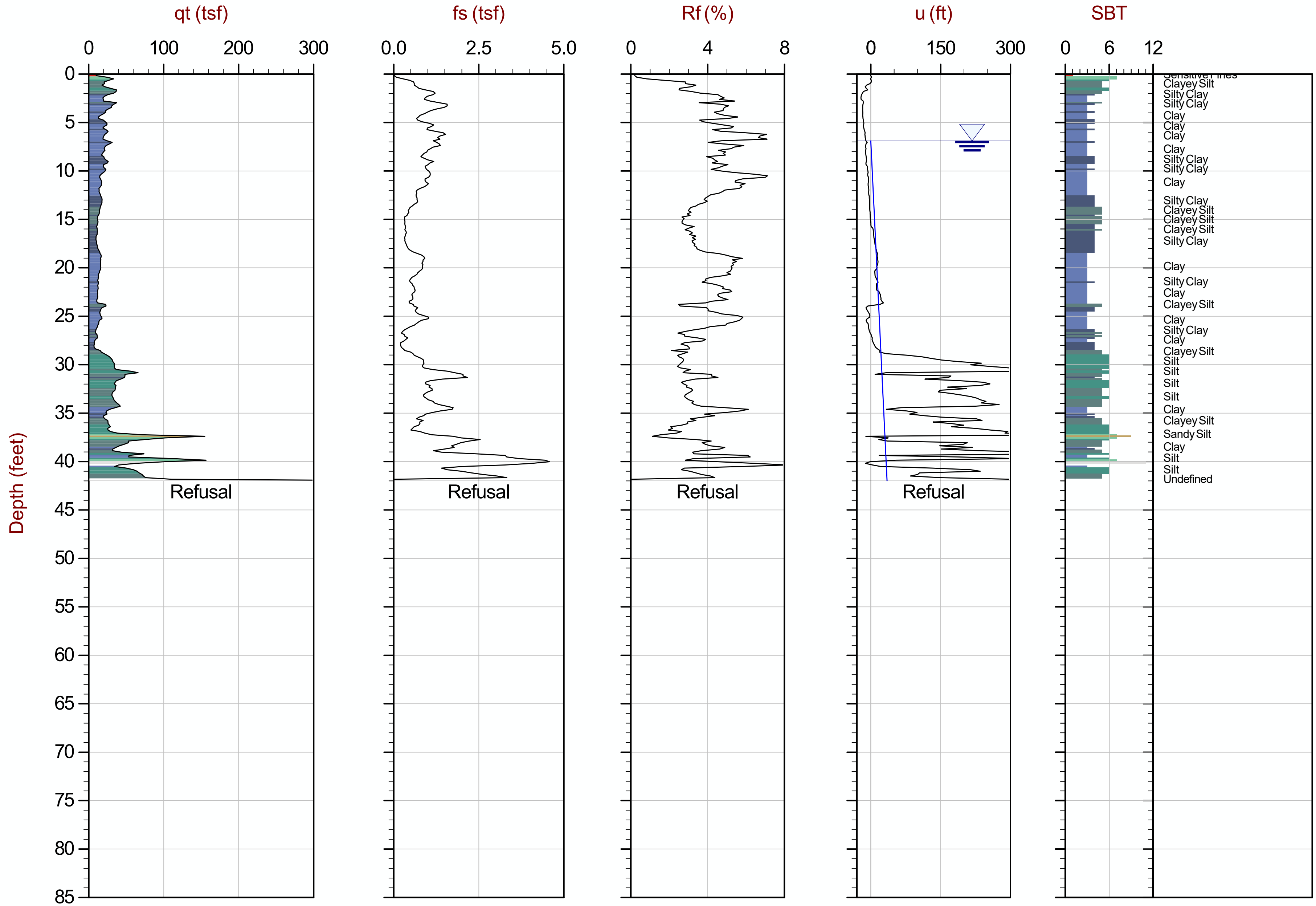
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:11:15 15:08
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C070
Cone: 436:T1500F15U500



Max Depth: 12.800 m / 41.99 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC070.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231793m E: 249048m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

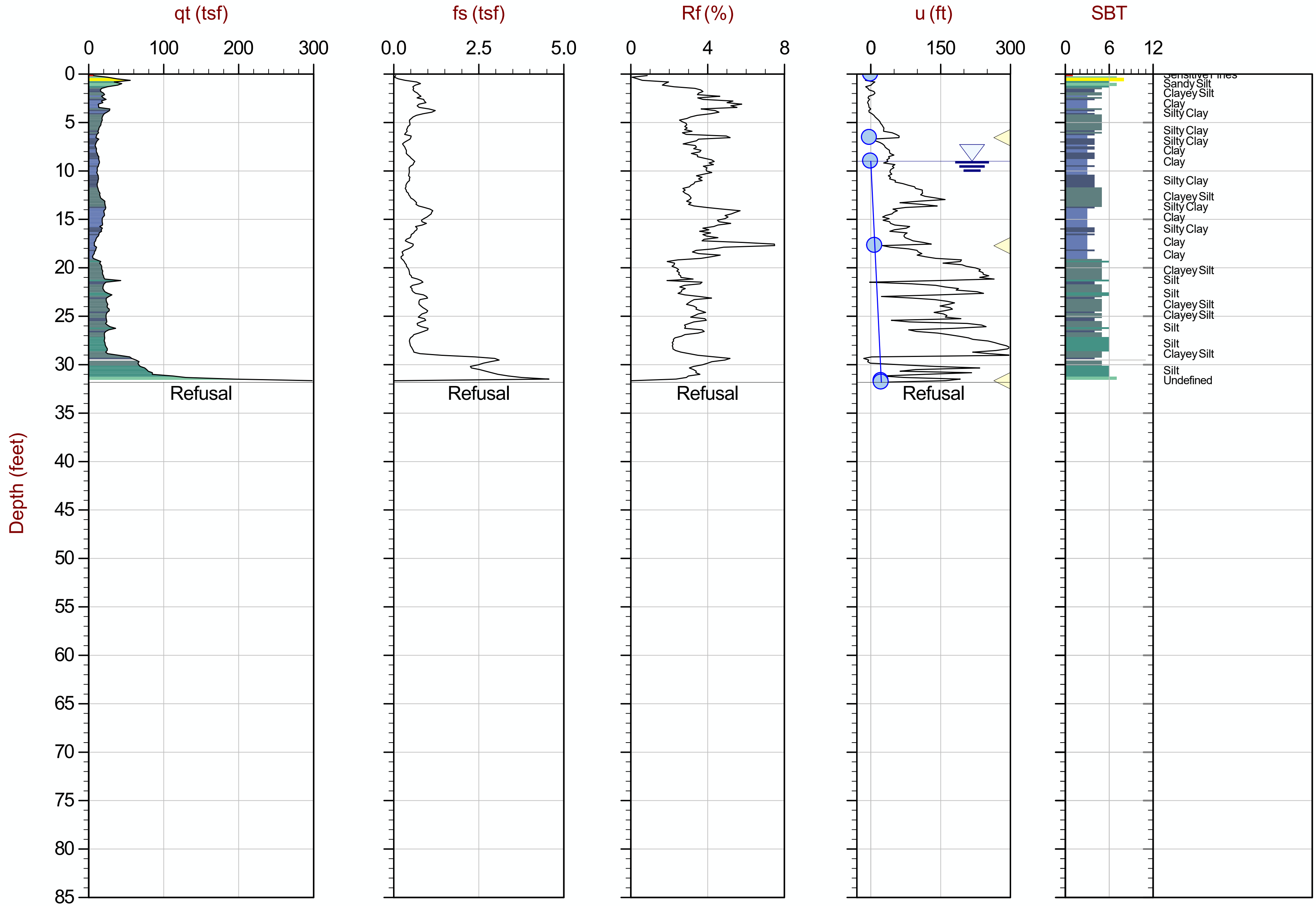
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:11:15 11:49
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C071
Cone: 436:T1500F15U500



Max Depth: 9.700 m / 31.82 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC071.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231415m E: 248710m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

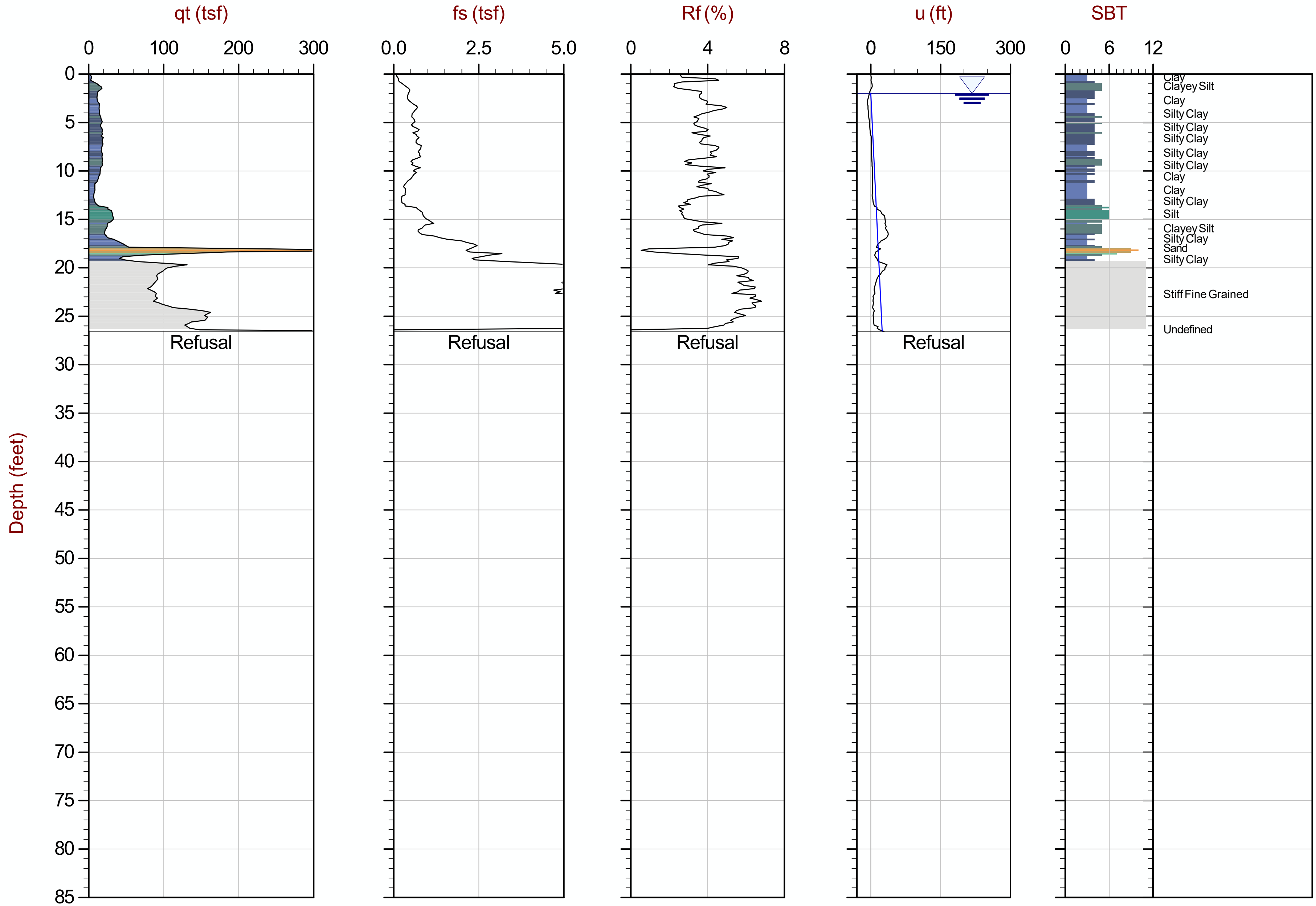
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:20:15 15:31
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C072
Cone: 419:T1500F15U500



Max Depth: 8.100 m / 26.57 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

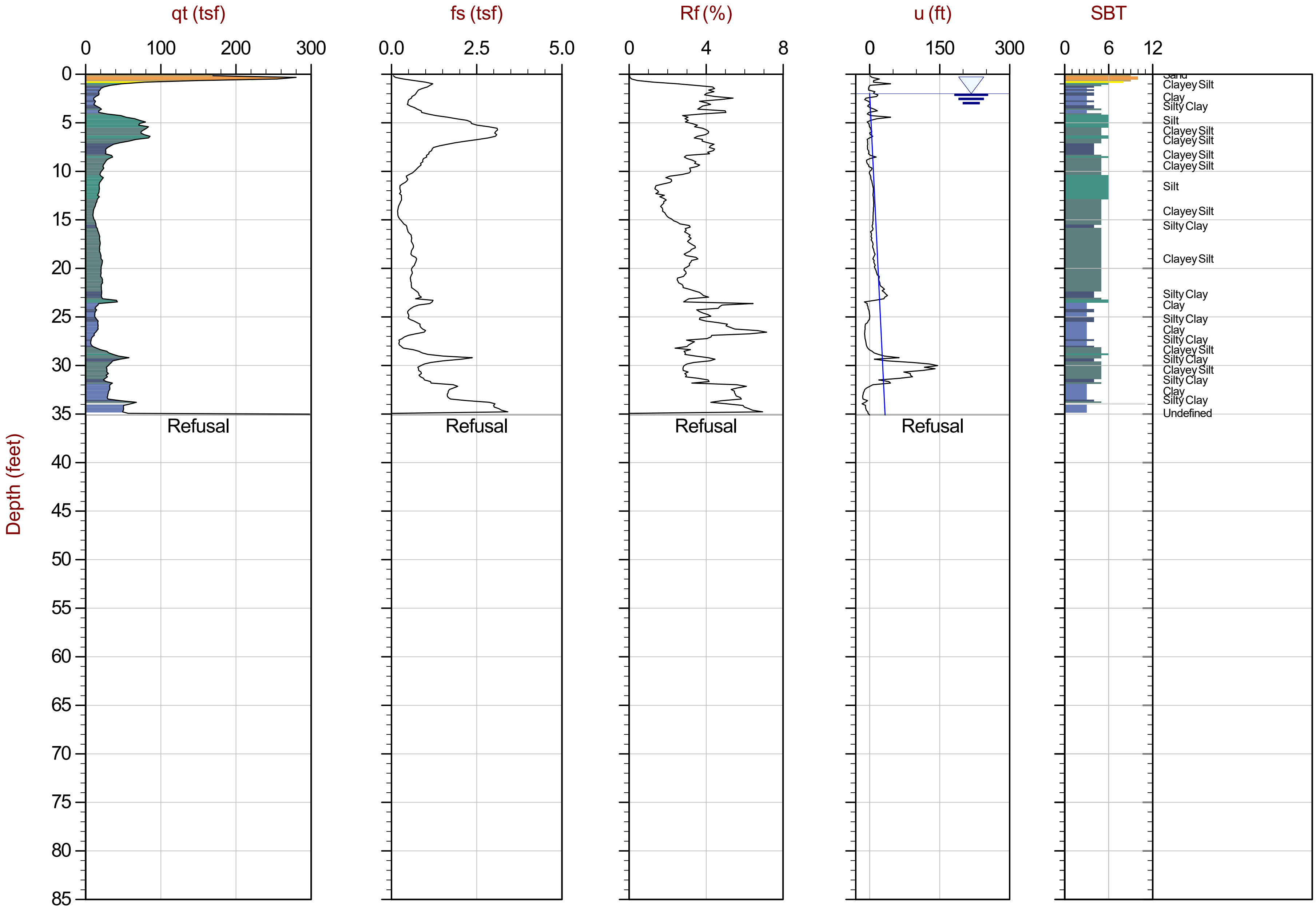
File: 15-53062_CPBALC072.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231515m E: 248633m

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.

Job No: 15-53062
Date: 08:11:15 14:37
Site: Baldwin Power Station, Baldwin, IL
Sounding: CPT15-BAL-C073
Cone: 436:T1500F15U500



Max Depth: 10.700 m / 35.10 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC073.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231524m E: 248649m

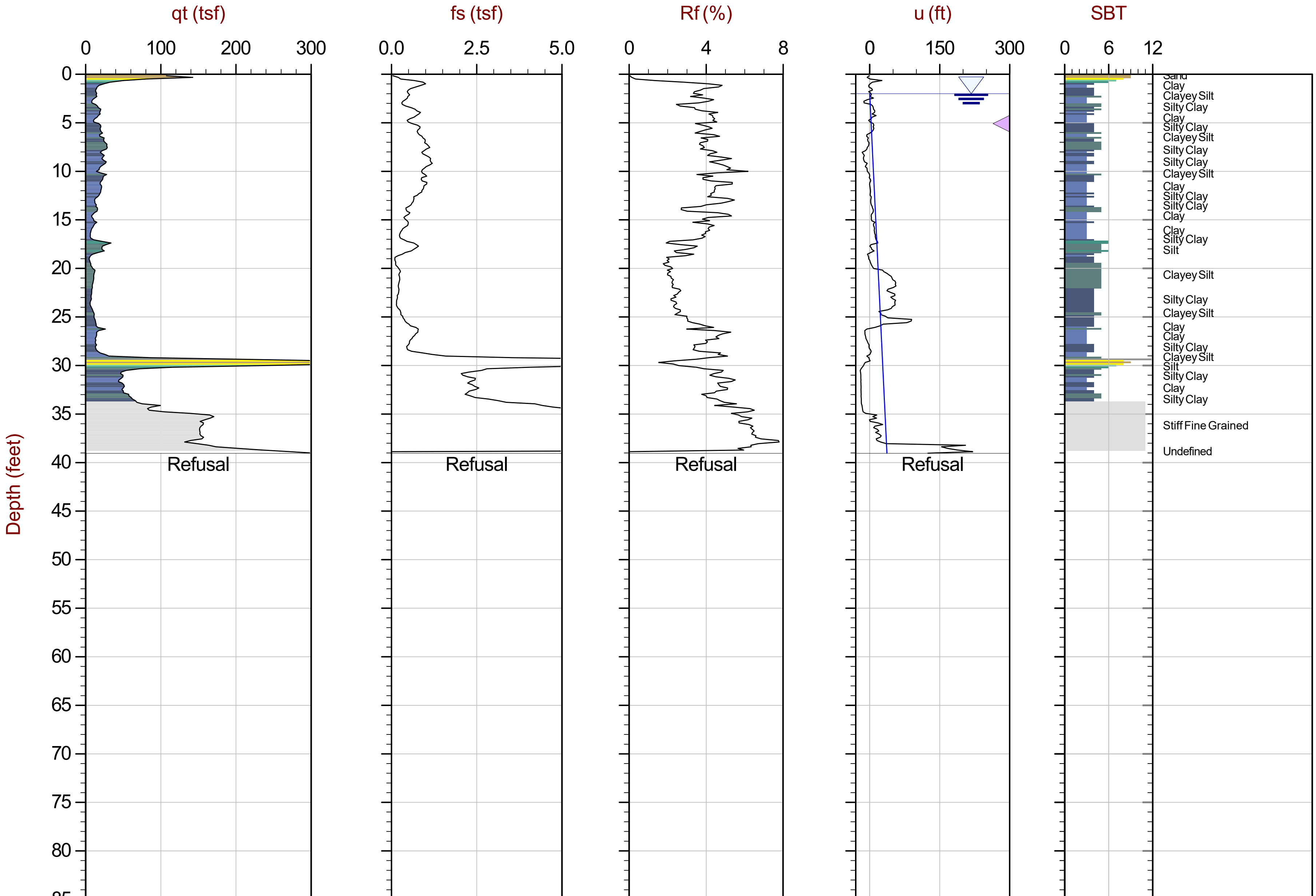
Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

AECOM

Job No: 15-53062
Date: 08:11:15 13:53
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C074
Cone: 436:T1500F15U500



Max Depth: 11.900 m / 39.04 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC074.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231481m E: 248660m

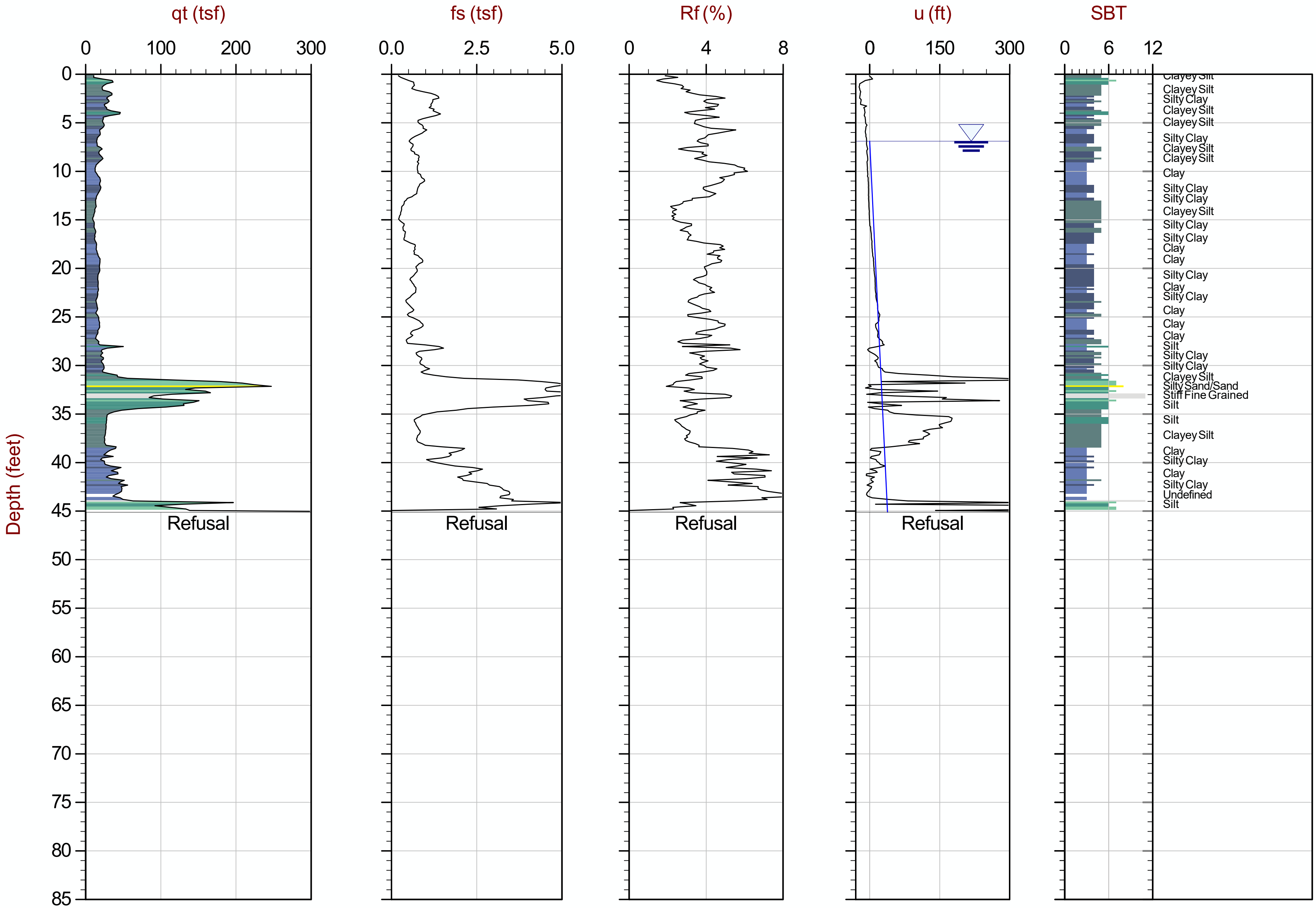
Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

AECOM

Job No: 15-53062
Date: 08:11:15 15:35
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C075
Cone: 436:T1500F15U500



Max Depth: 13.750 m / 45.11 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC075.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231792m E: 249130m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

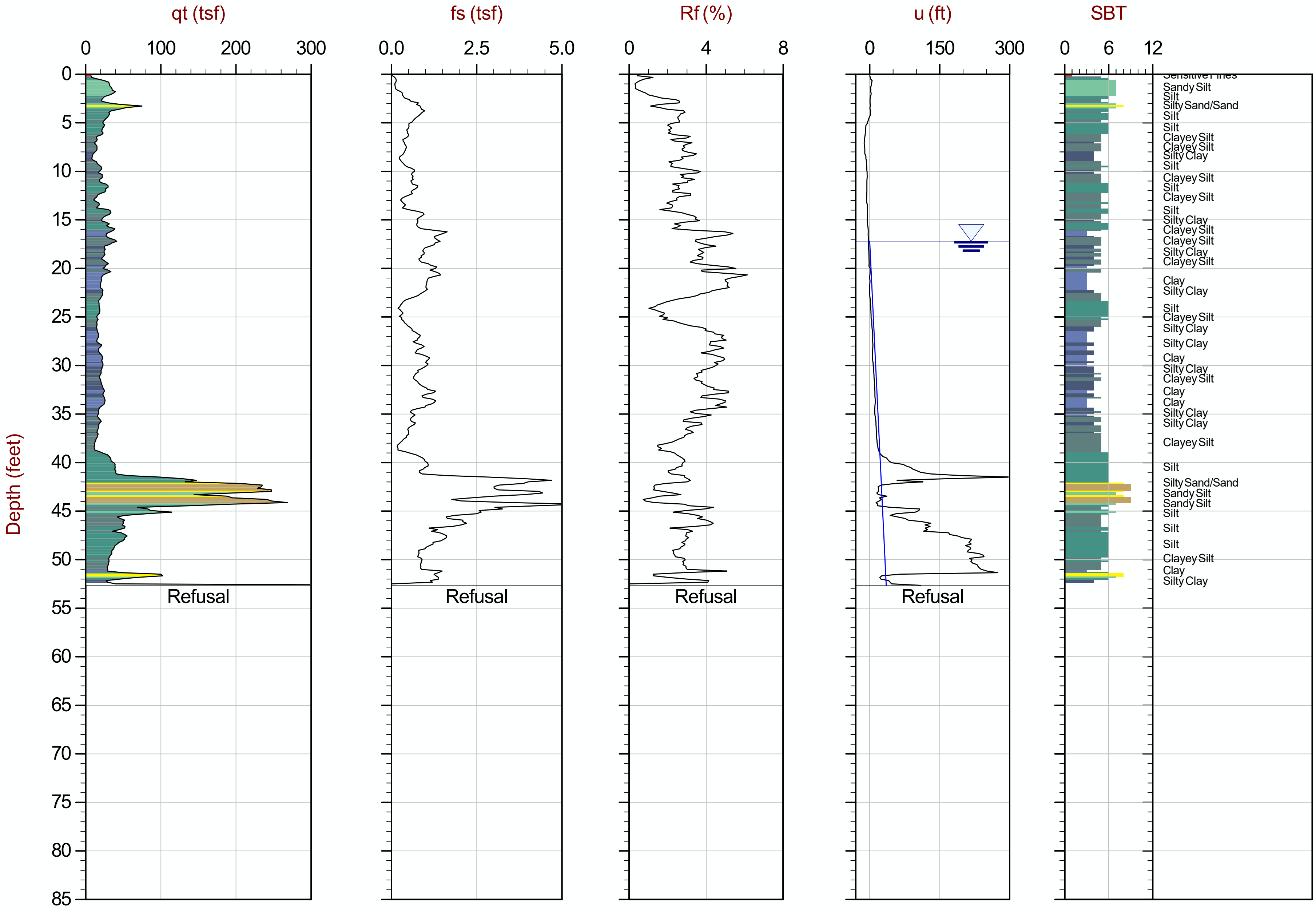
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:23:15 10:36
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C076
Cone: 419:T1500F15U500



Max Depth: 16.050 m / 52.66 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC076.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230639m E: 249356m

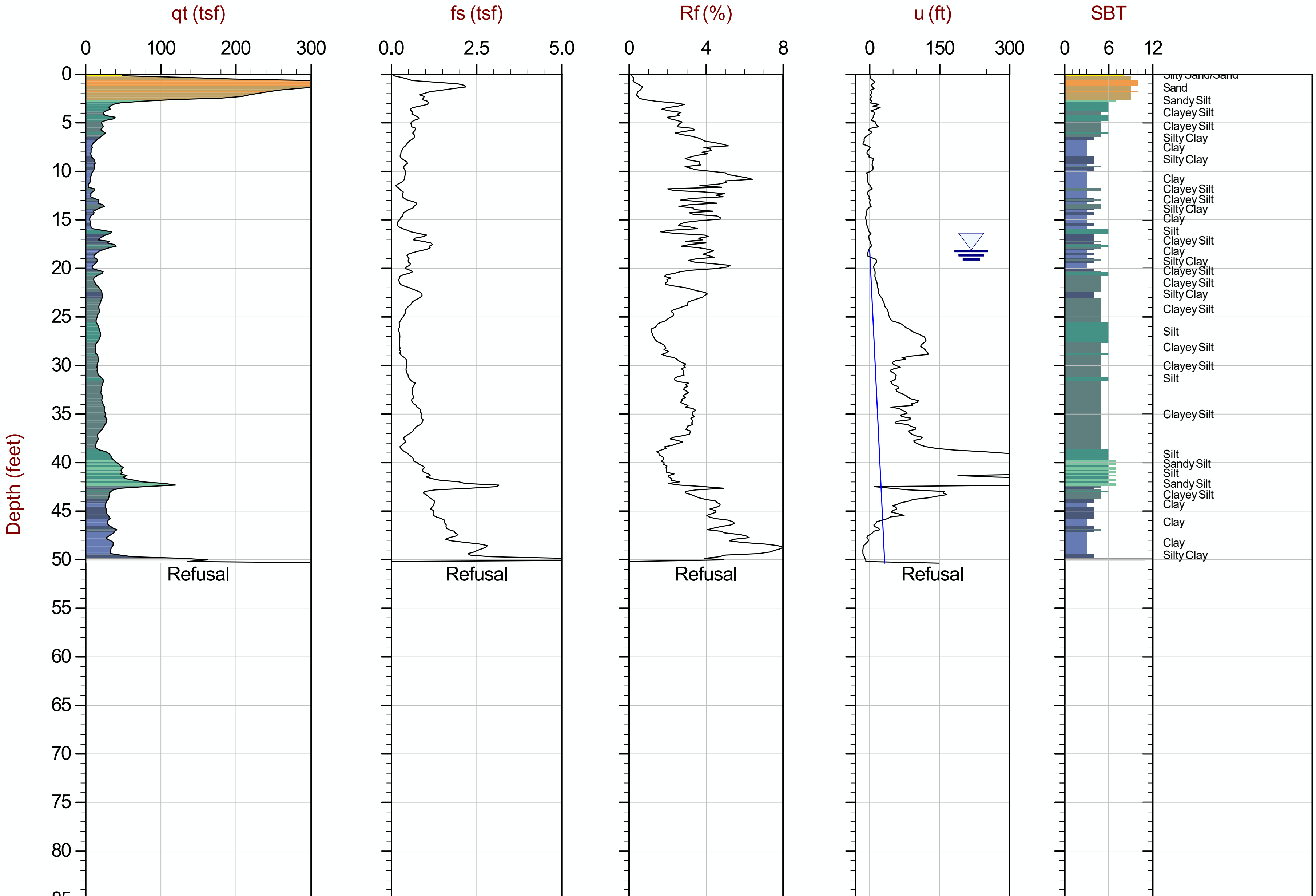
Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

AECOM

Job No: 15-53062
Date: 08:13:15 13:49
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C077
Cone: 419:T1500F15U500



Max Depth: 15.350 m / 50.36 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC077.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231162m E: 249633m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

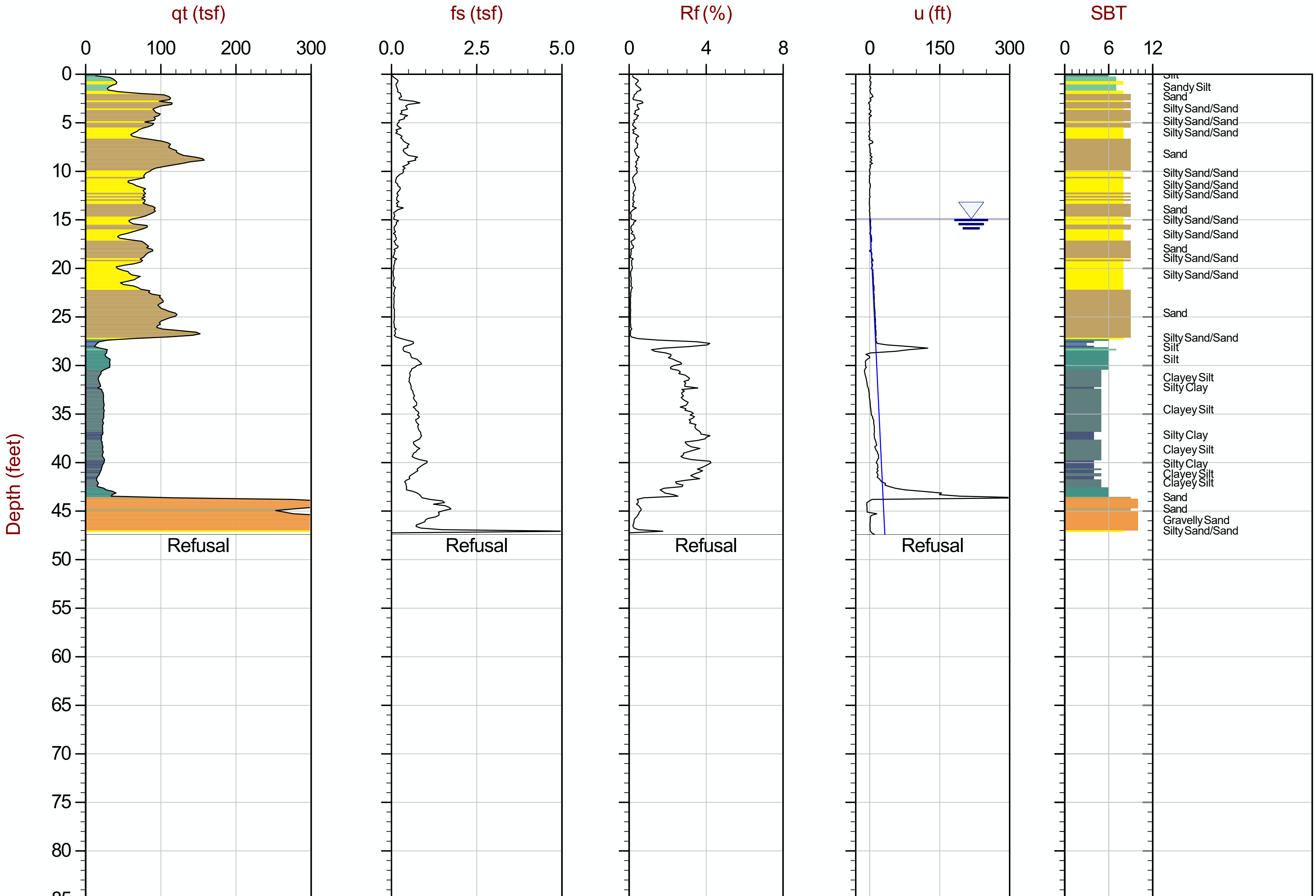
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:13:15 14:25
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C078
Cone: 419:T1500F15U500



Max Depth: 14.450 m / 47.41 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC078.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231456m E: 249765m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

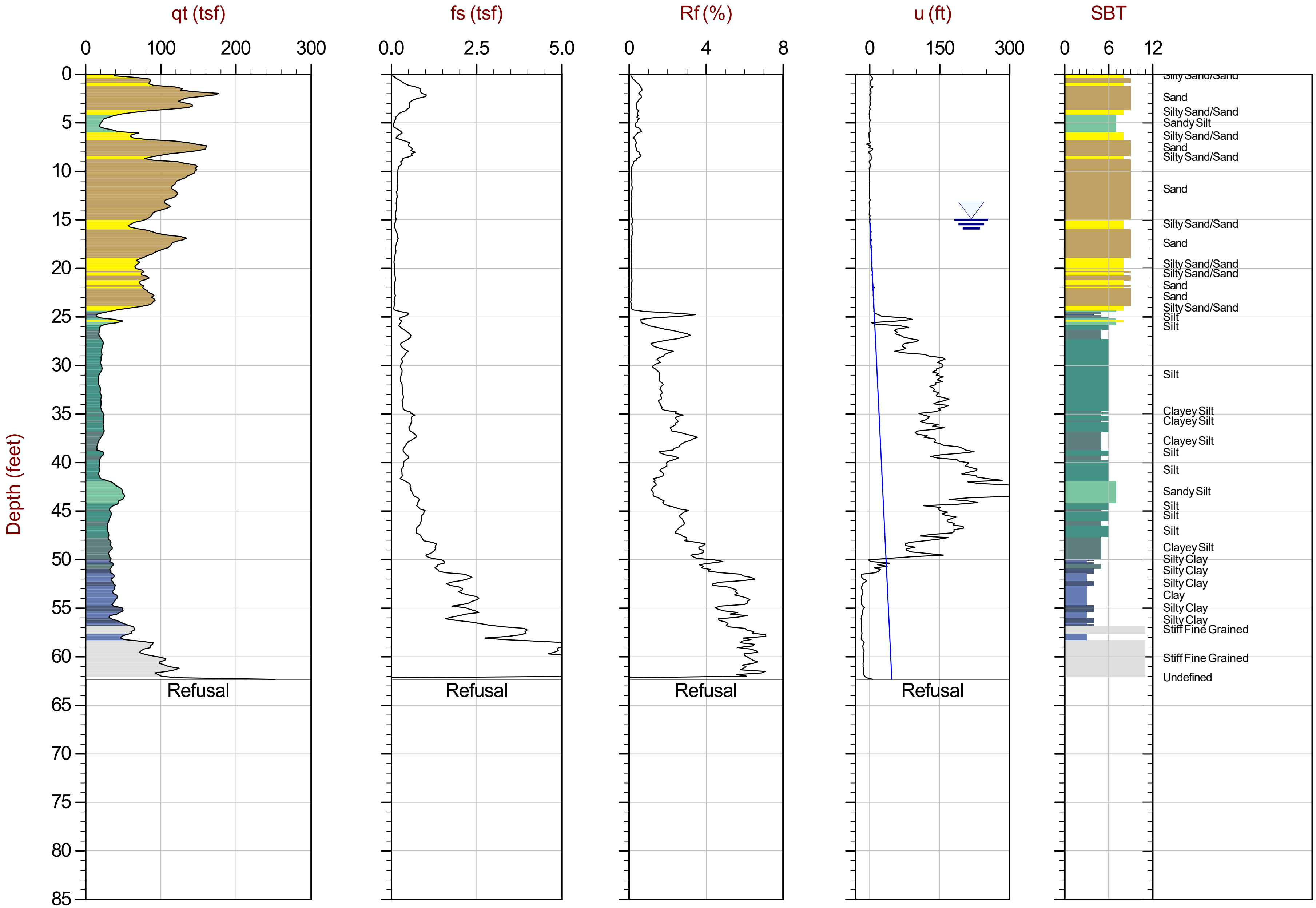
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:13:15 15:10
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C079
Cone: 419:T1500F15U500



Max Depth: 19.000 m / 62.34 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC079.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231582m E: 249819m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

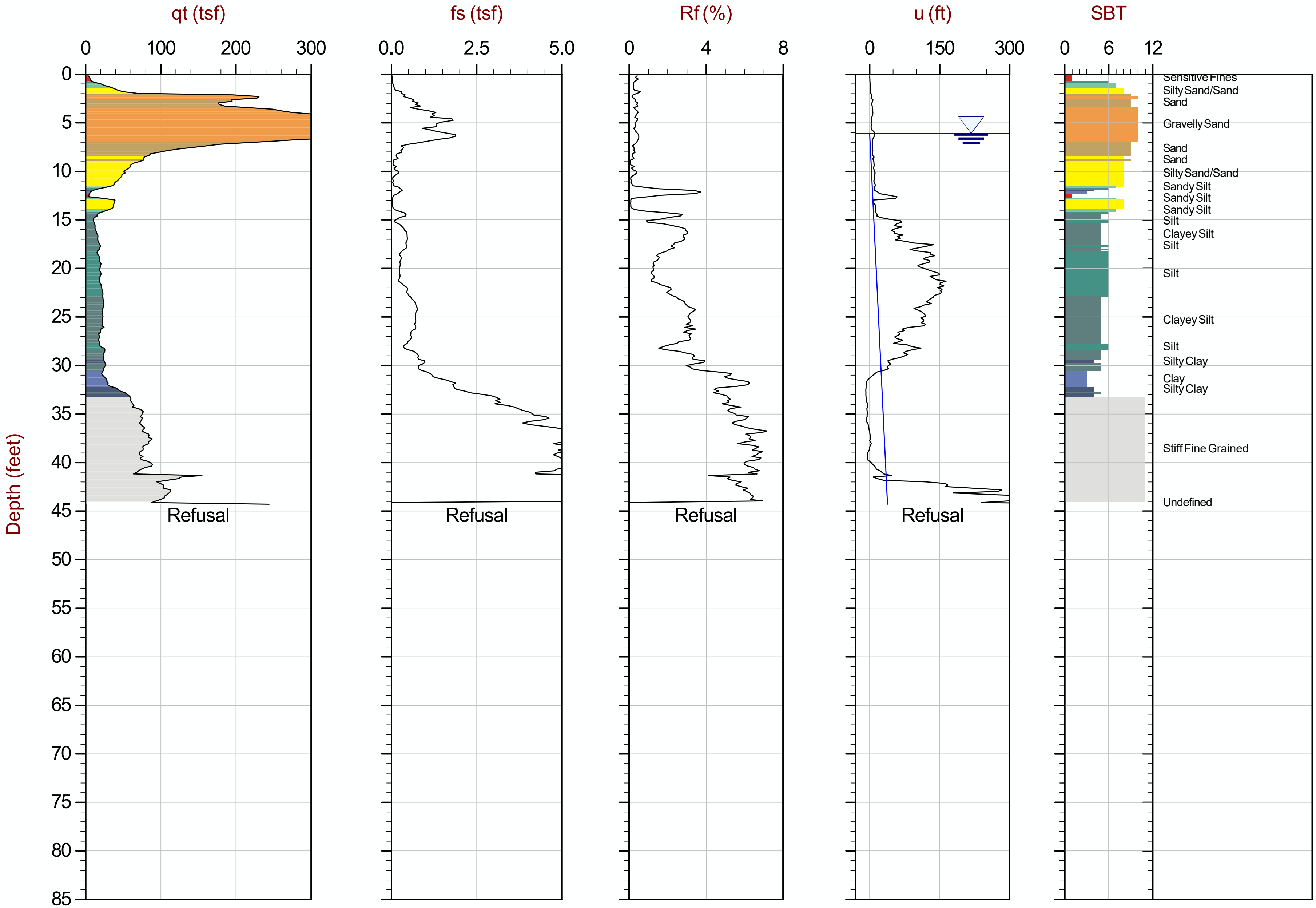
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:22:15 08:16
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C081
Cone: 419:T1500F15U500



Max Depth: 13.500 m / 44.29 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC081.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231470m E: 249440m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

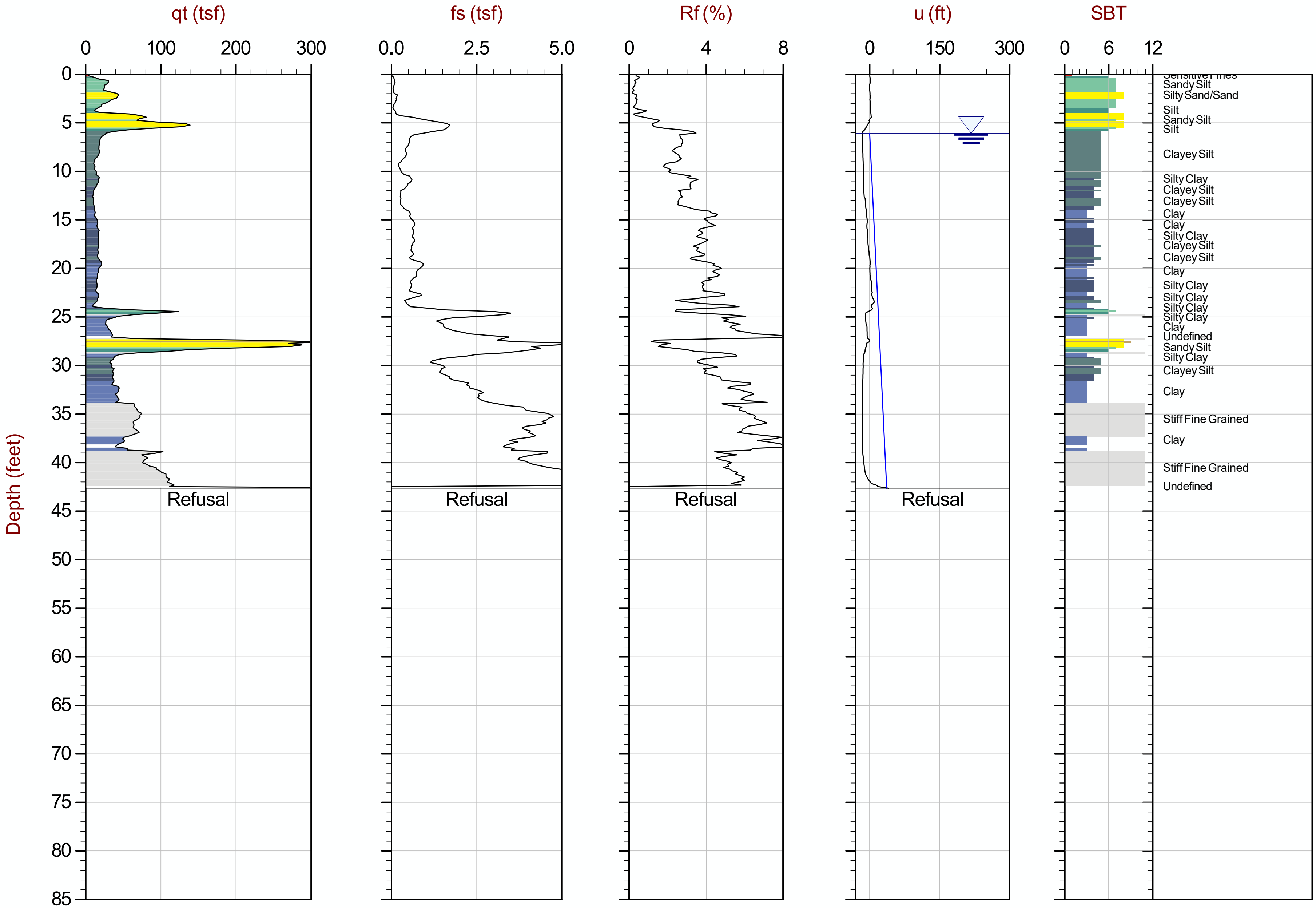
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:22:15 09:02
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C082
Cone: 419:T1500F15U500



Max Depth: 13.000 m / 42.65 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC082.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231419m E: 249345m

Hydrostatic Line | Ueq | Assumed Ueq | PPD, Ueq achieved | PPD, Ueq not achieved

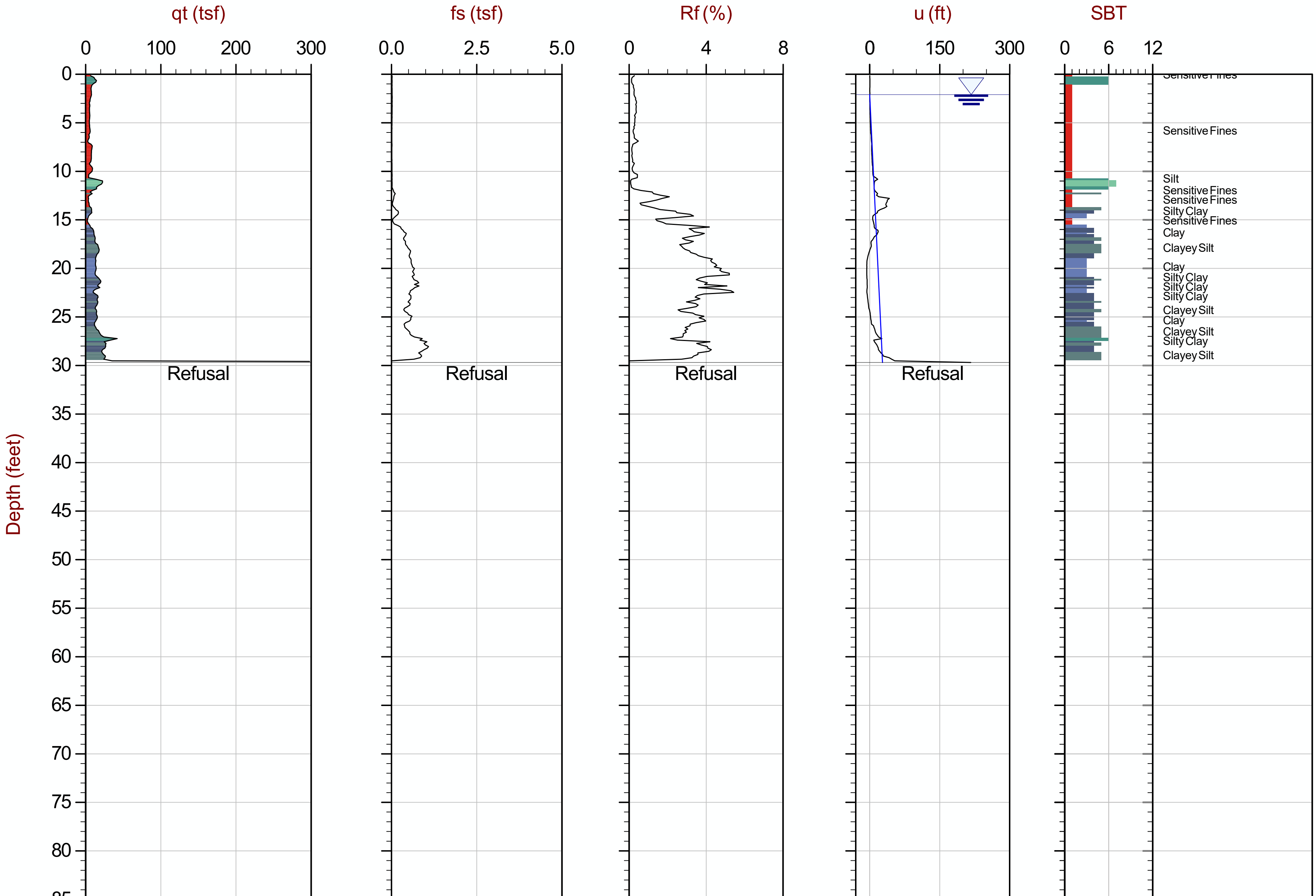
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:22:15 09:43
Site: Baldwin Power Station, Baldwin, IL

Sounding: CPT15-BAL-C083
Cone: 419:T1500F15U500



Max Depth: 9.050 m / 29.69 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_CPBALC083.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231320m E: 249191m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

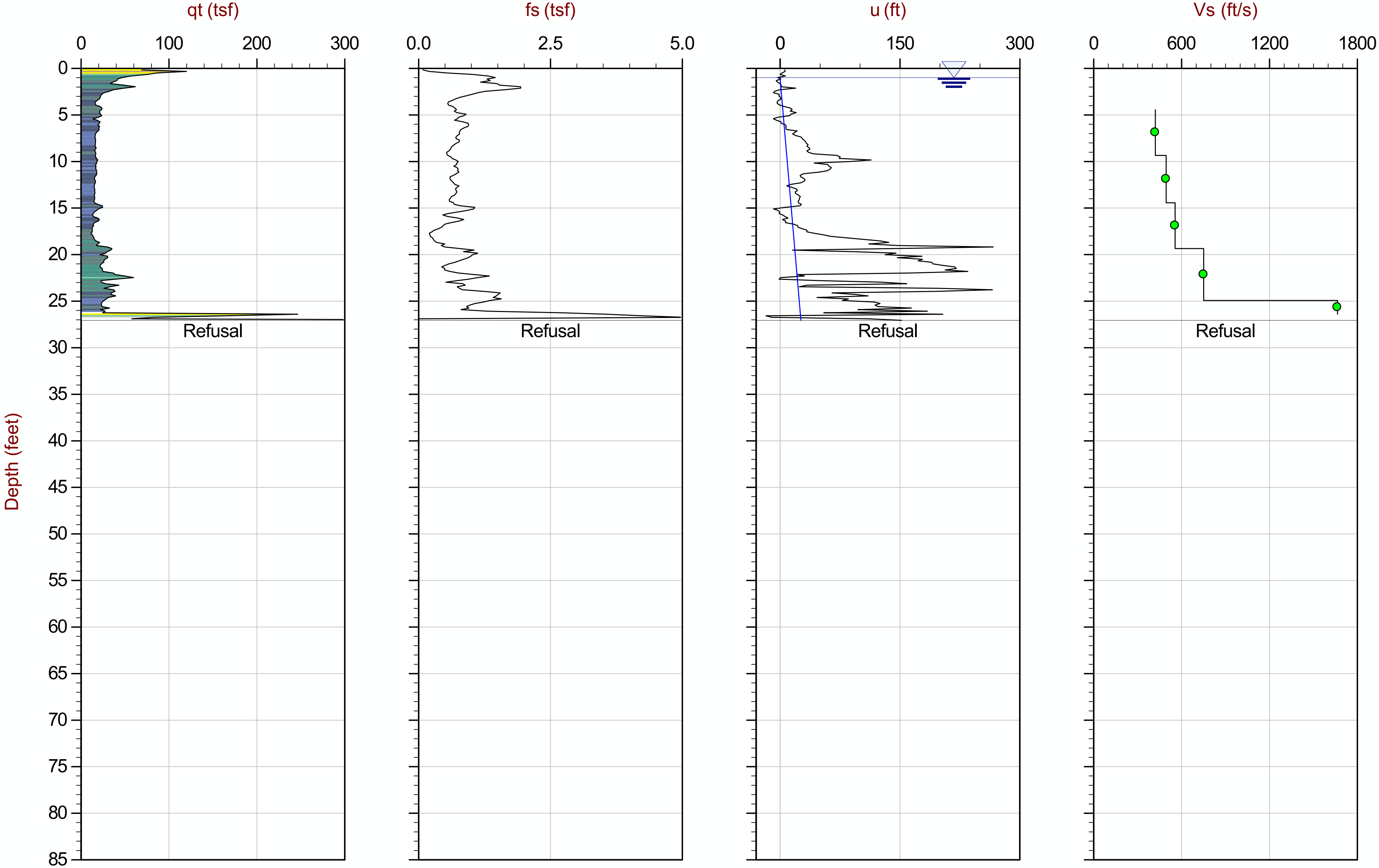
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:14:15 08:35
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C003
Cone: 419:T1500F15U500



Max Depth: 8.250 m / 27.07 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC003.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230803m E: 247952m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

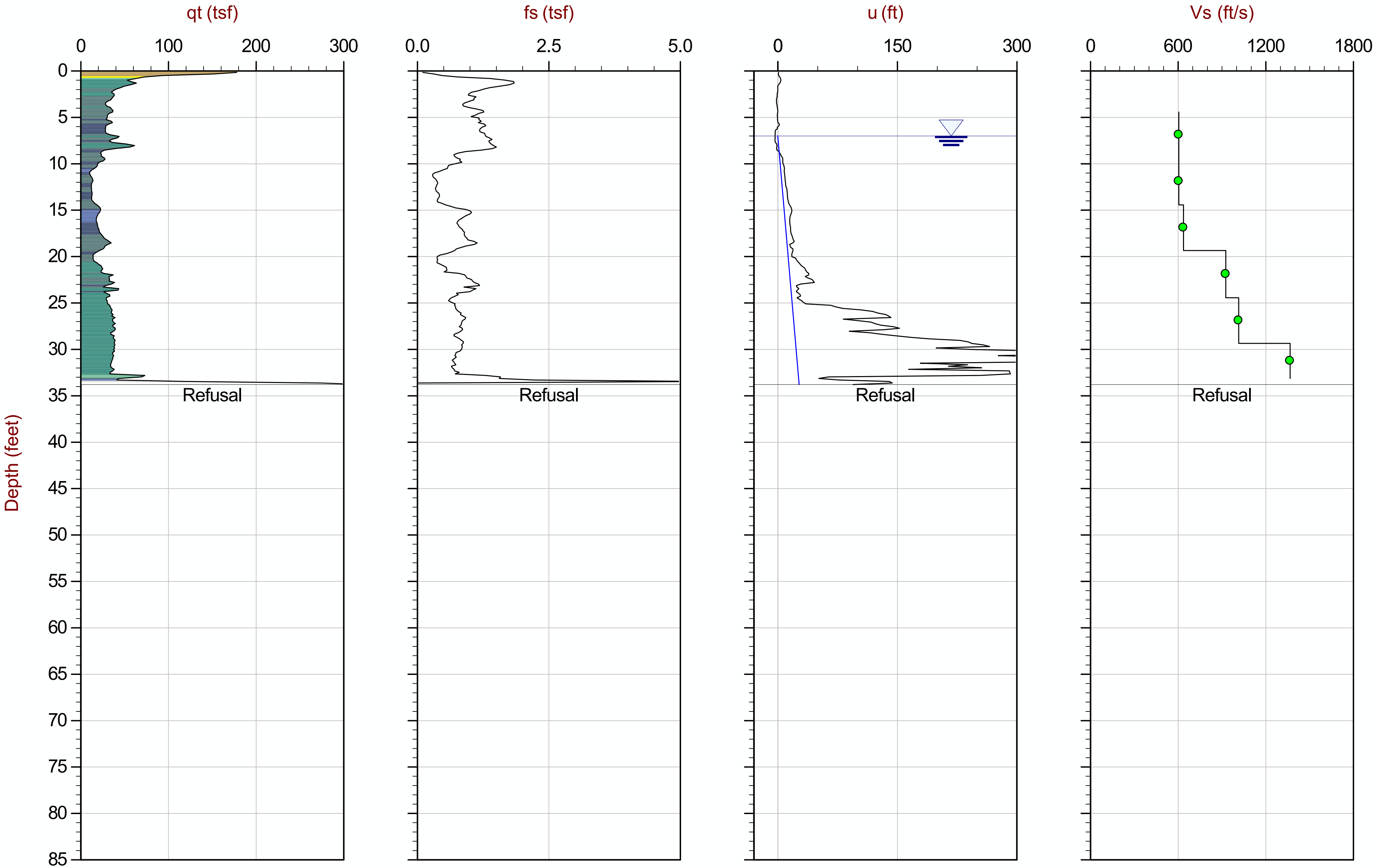
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:14:15 12:03
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C005
Cone: 419:T1500F15U500



Max Depth: 10.300 m / 33.79 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC005.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230808m E: 248049m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

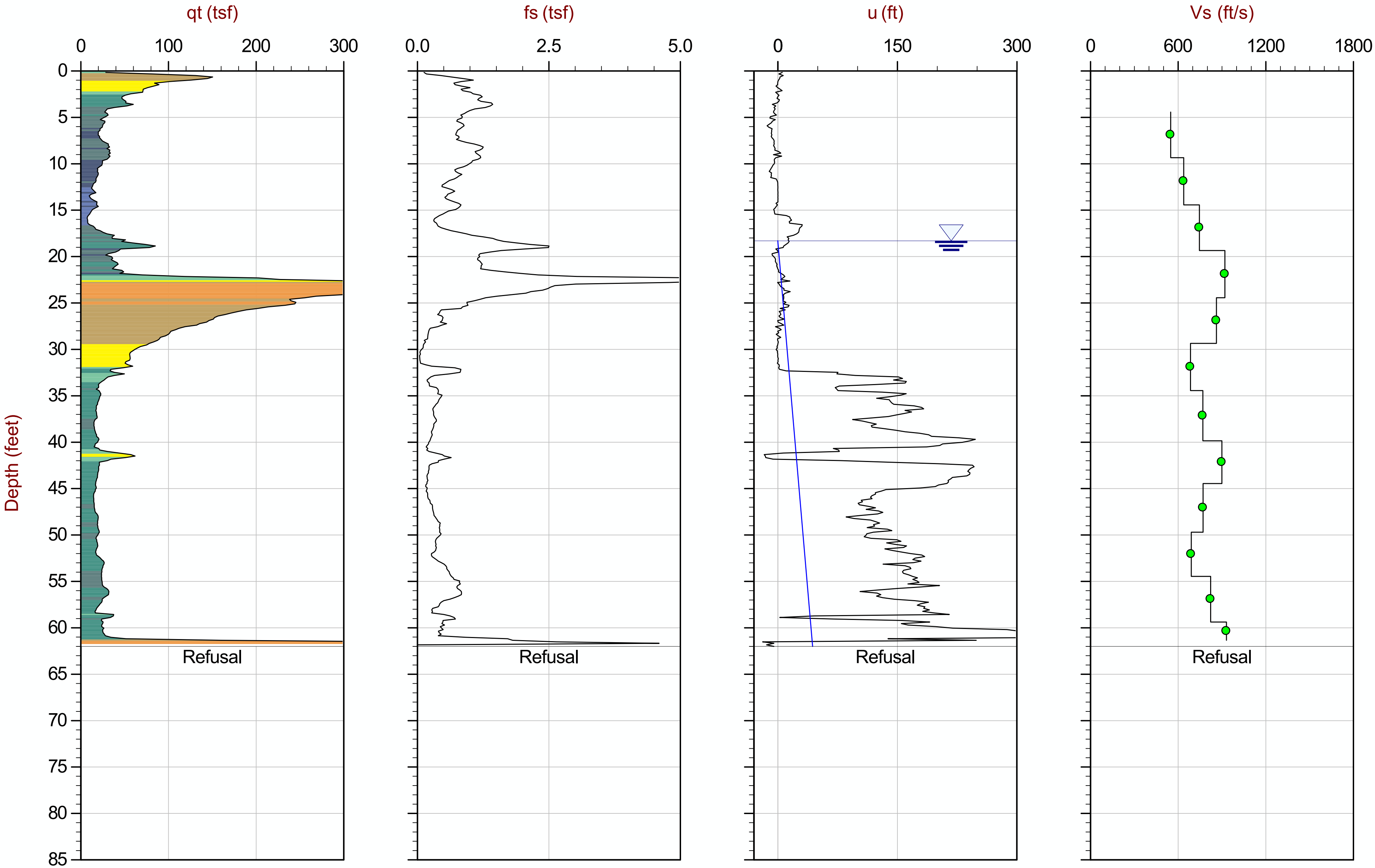
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:05:15 09:56
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C009
Cone: 226:T1500F15U500



Max Depth: 18.900 m / 62.01 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC009.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230741m E: 248292m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

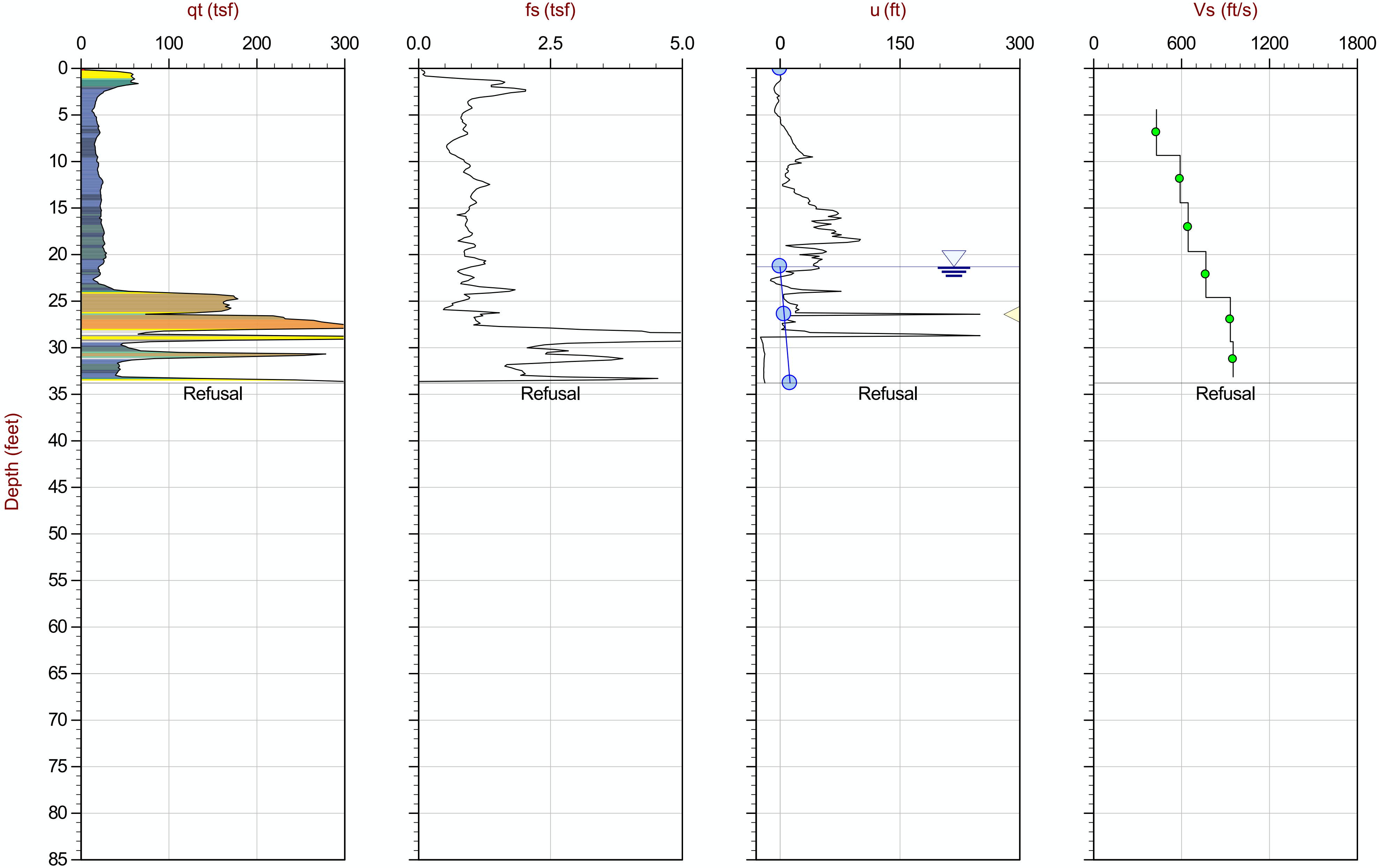
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:03:15 12:51
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C013
Cone: 226:T1500F15U500



Max Depth: 10.300 m / 33.79 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC013.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231082m E: 248558m

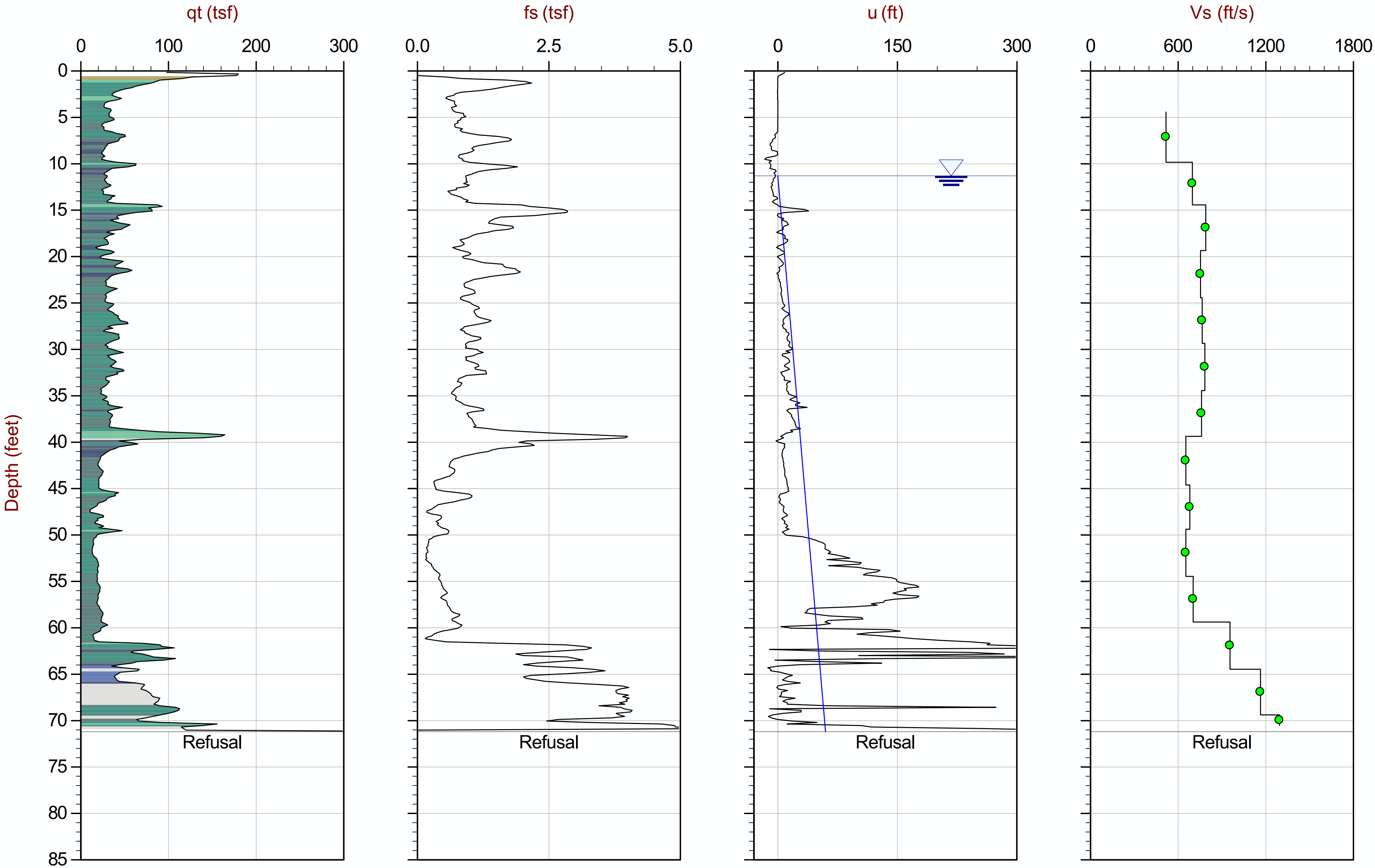
Hydrostatic Line · Ueq · Assumed Ueq · PPD, Ueq achieved · PPD, Ueq not achieved

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: 15-53062
Date: 08:05:15 12:17
Site: Baldwin Power Station, Baldwin, IL
Sounding: SCPT15-BAL-C016
Cone: 226:T1500F15U500



Max Depth: 21.700 m / 71.19 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC016A.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230967m E: 248340m

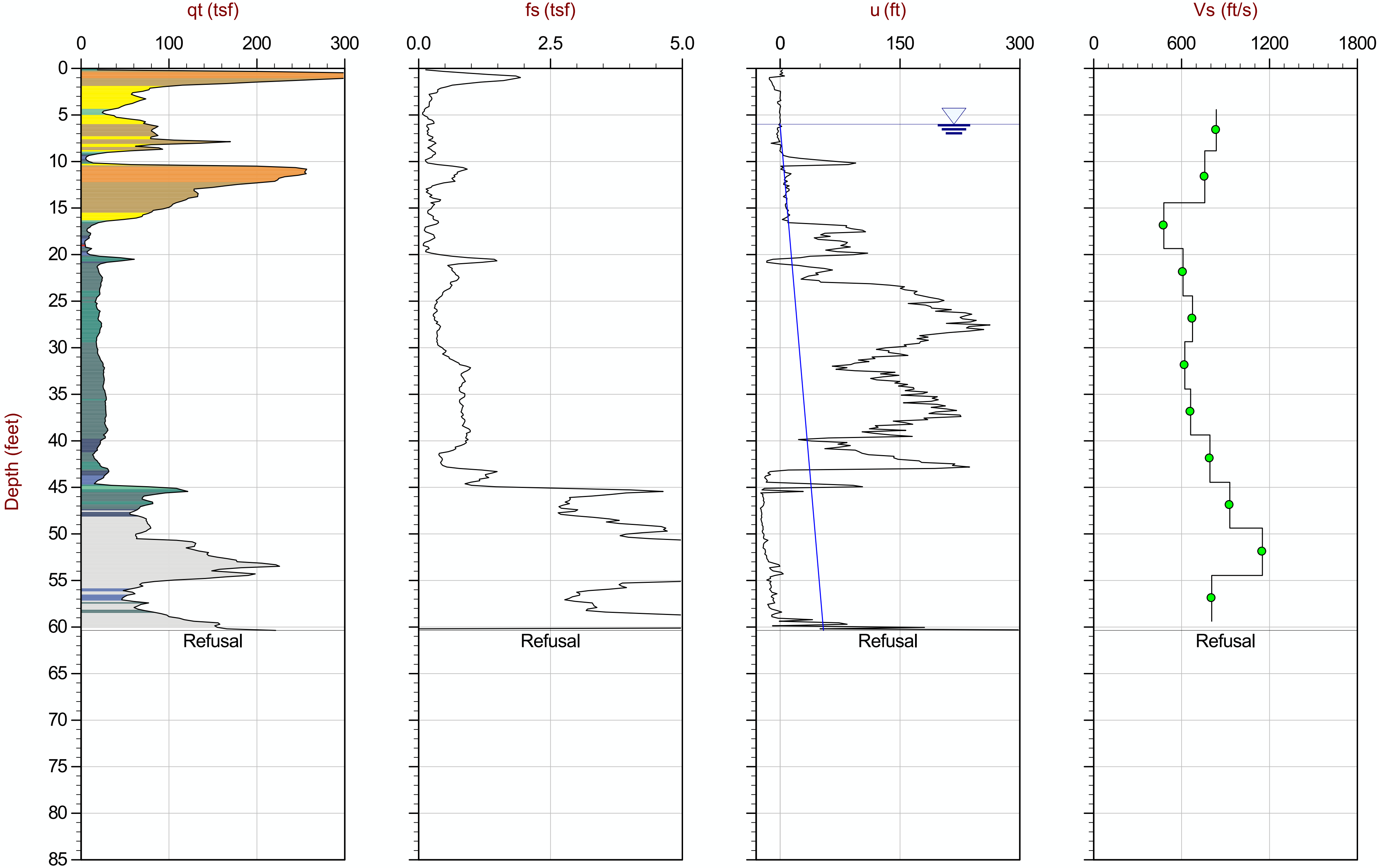
Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

AECOM

Job No: 15-53062
Date: 08:05:15 07:53
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C020
Cone: 226:T1500F15U500



Max Depth: 18.400 m / 60.37 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC020.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230622m E: 248844m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

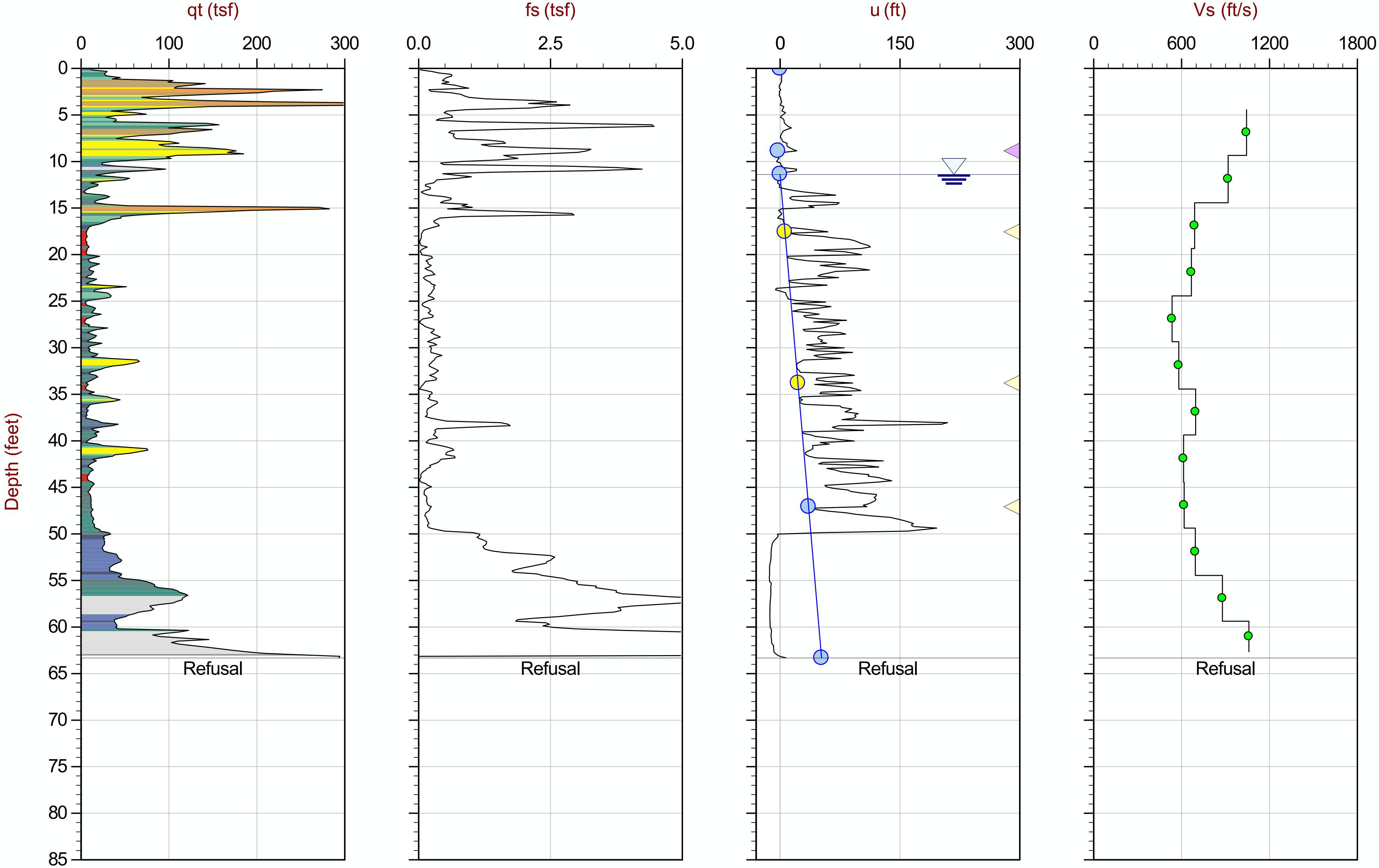
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:22:15 10:48
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C024
Cone: 419:T1500F15U500



Max Depth: 19.300 m / 63.32 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC024.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230928m E: 249001m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

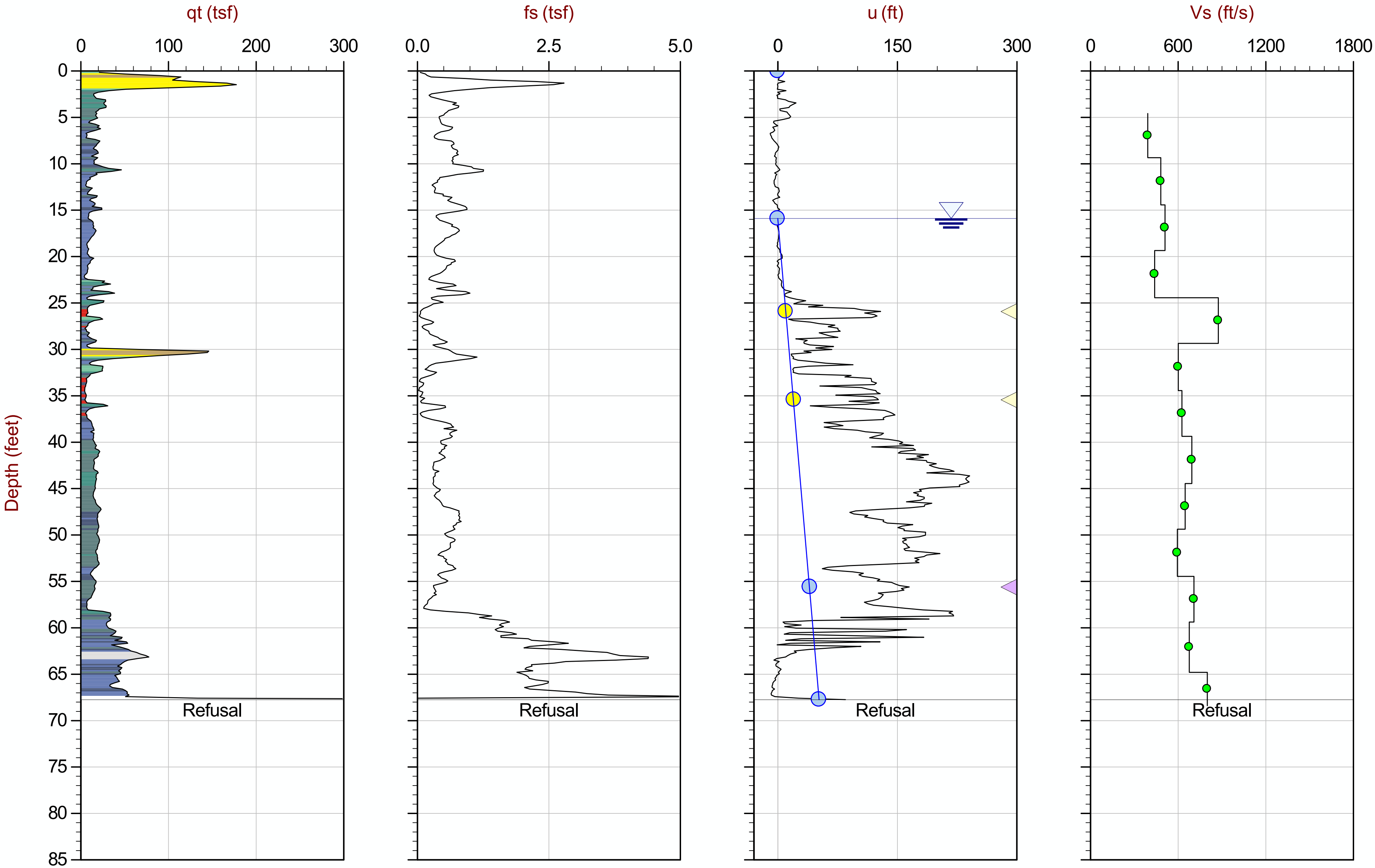
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:09:15 07:22
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C028
Cone: 335:T1500F15U500



Max Depth: 20.650 m / 67.75 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC028.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230941m E: 248810m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

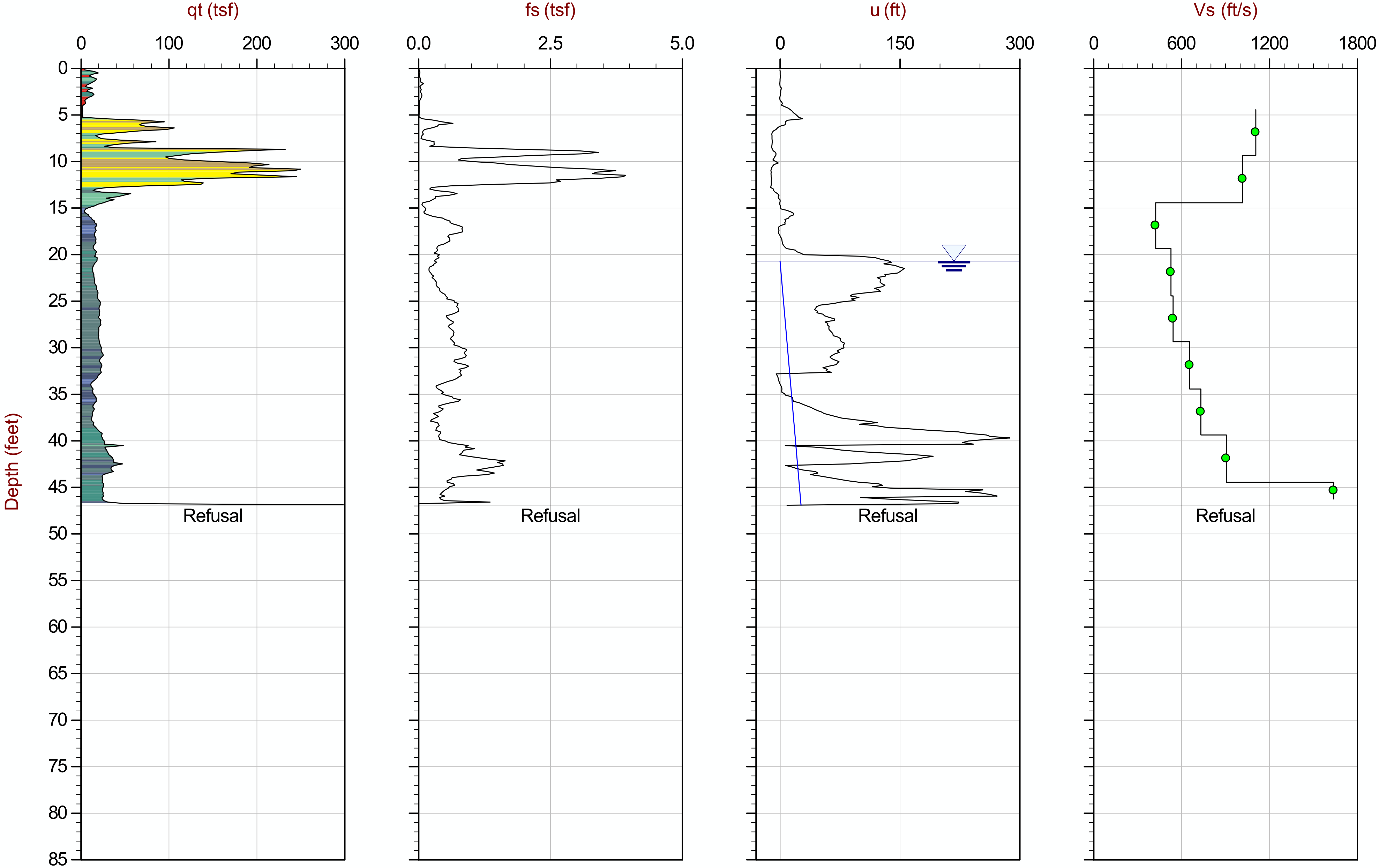
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:21:15 15:43
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C034
Cone: 419:T1500F15U500



Max Depth: 14.300 m / 46.92 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC034.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231046m E: 249316m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

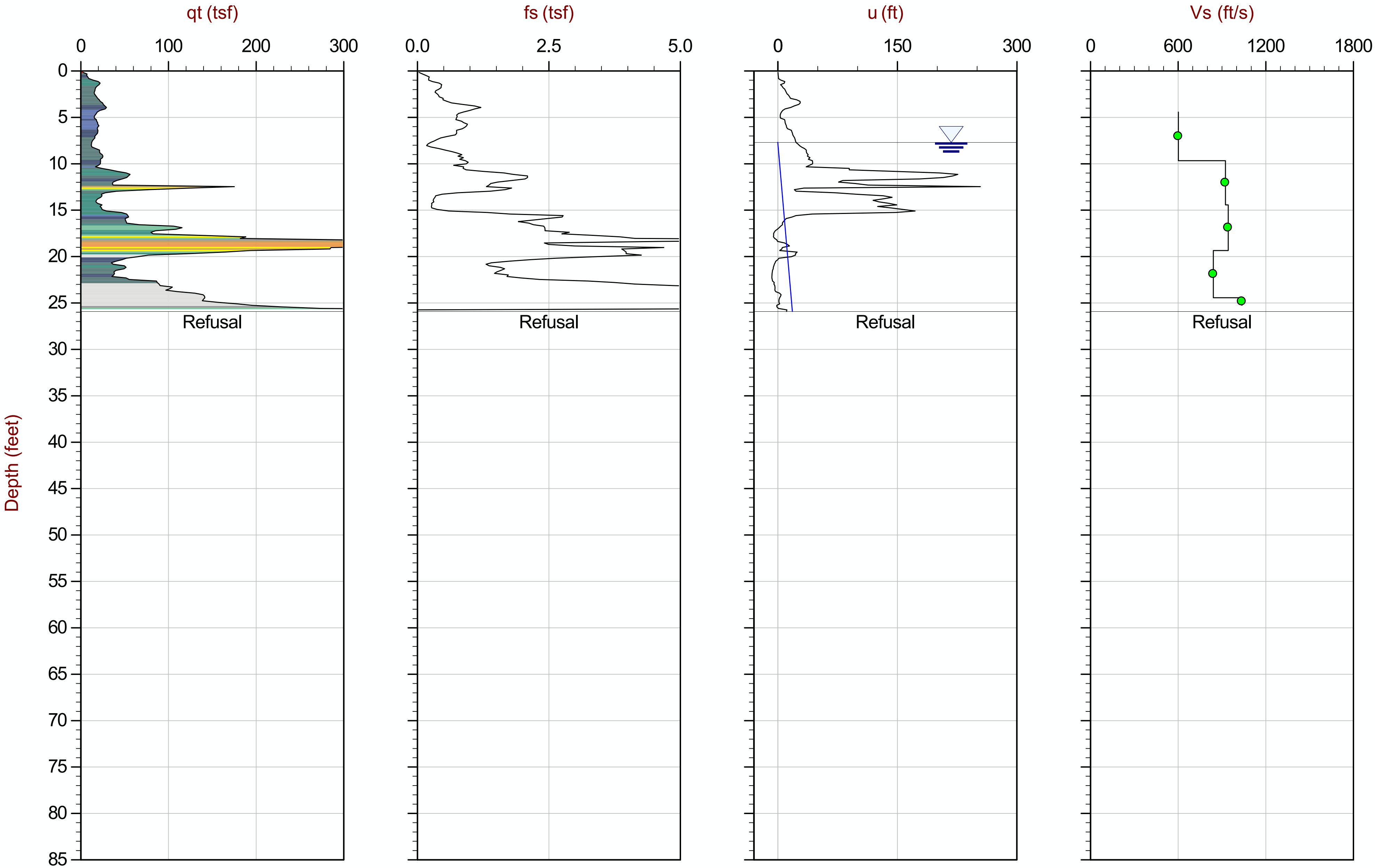
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:21:15 09:55
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C038
Cone: 419:T1500F15U500



Max Depth: 7.900 m / 25.92 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC038.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231202m E: 248764m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

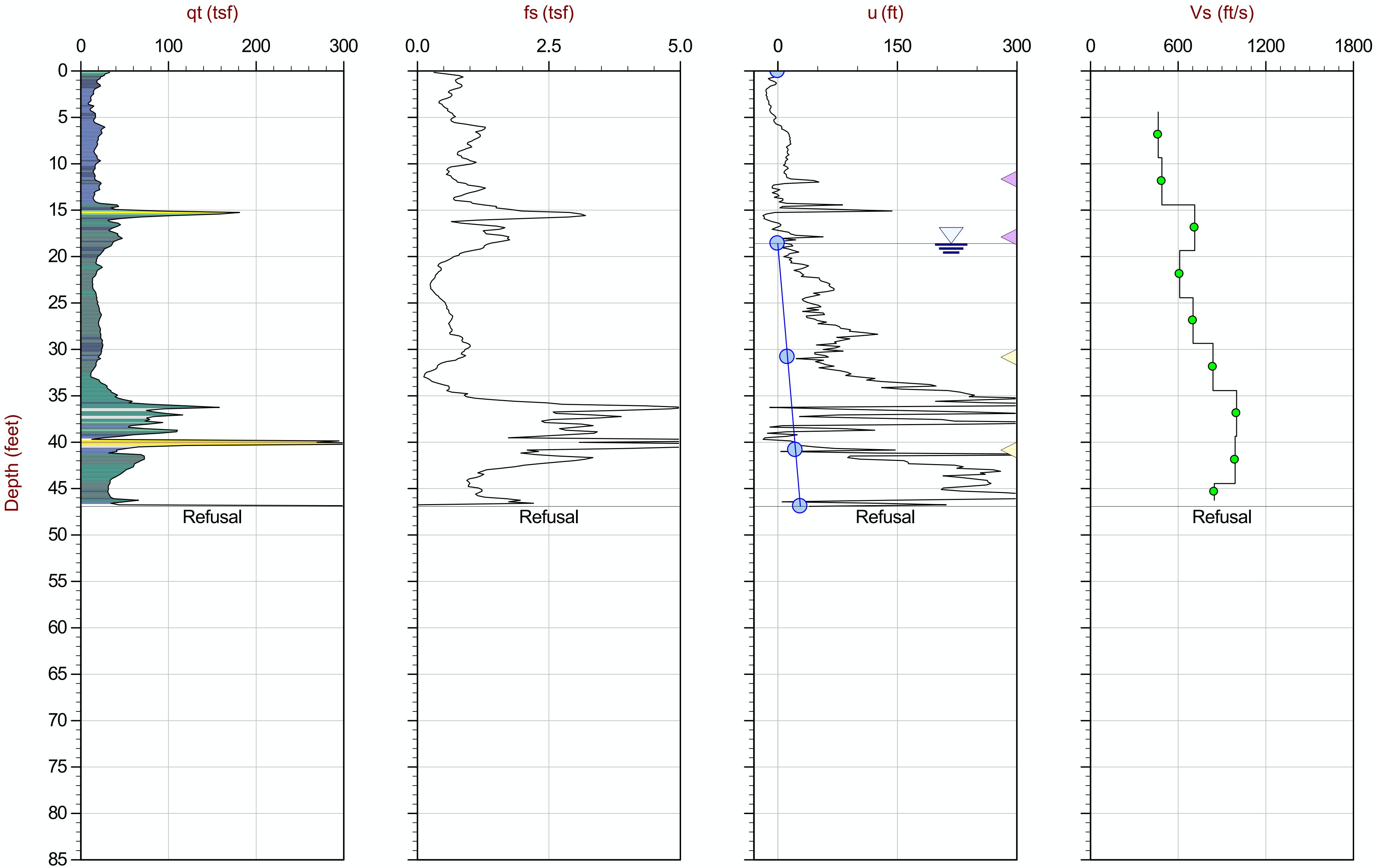
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:13:15 09:39
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C040
Cone: 419:T1500F15U500



Max Depth: 14.300 m / 46.92 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC040.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230452m E: 249379m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

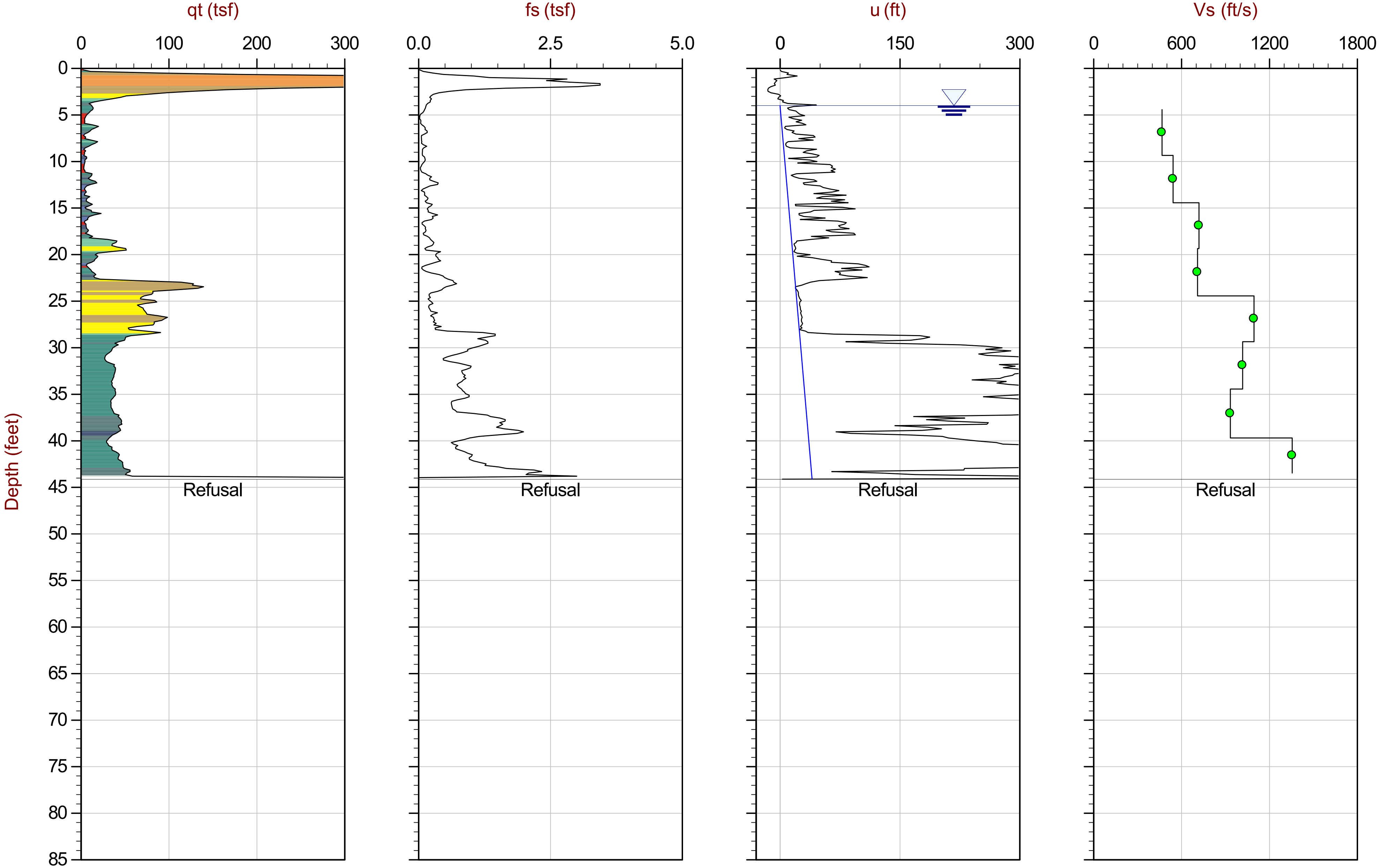
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53062
Date: 08:25:15 08:27
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C043
Cone: 419:T1500F15U500



Max Depth: 13.450 m / 44.13 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC043.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230562m E: 249708m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

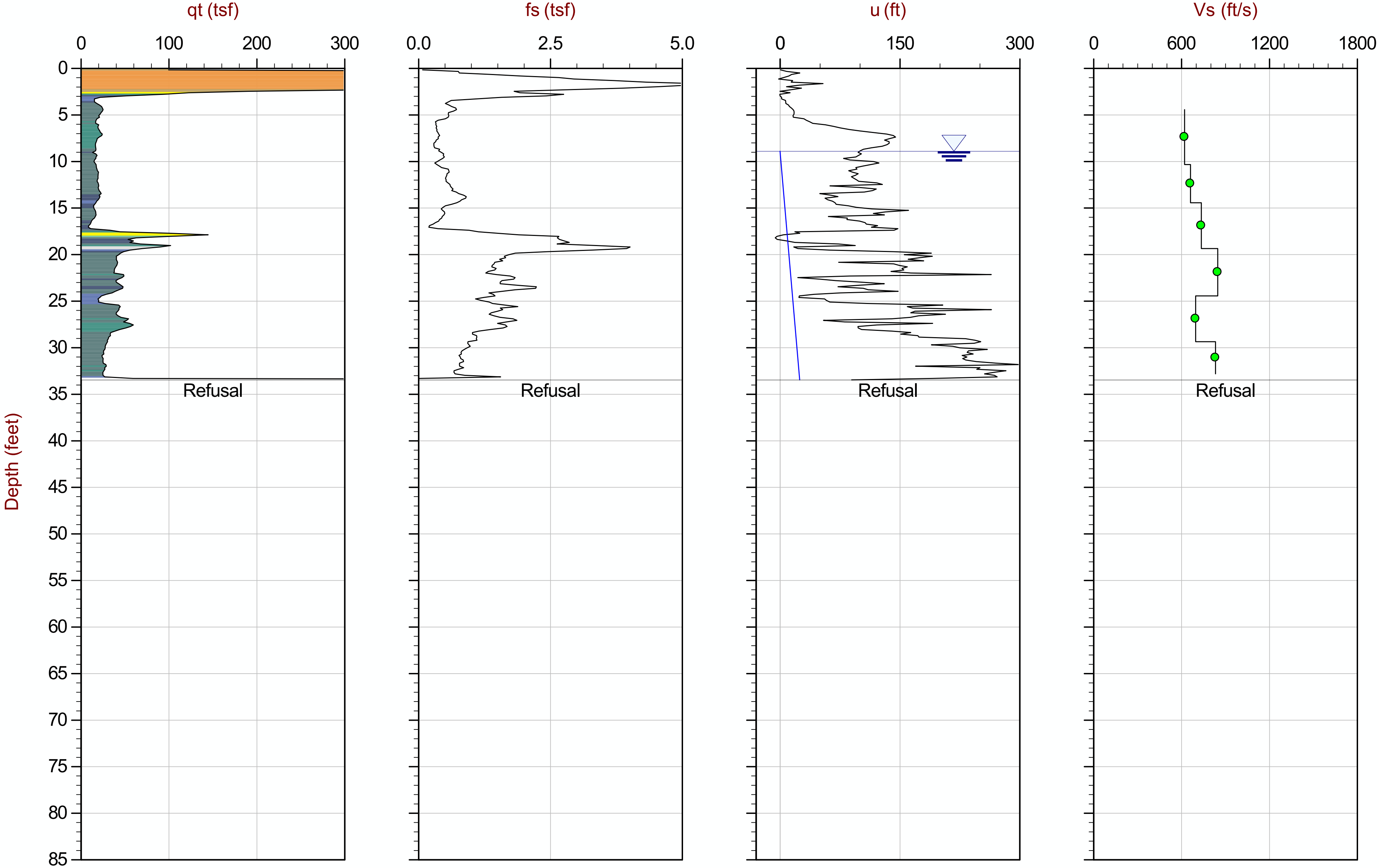
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:12:15 12:09
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C055
Cone: 436:T1500F15U500



Max Depth: 10.200 m / 33.46 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC055.COR

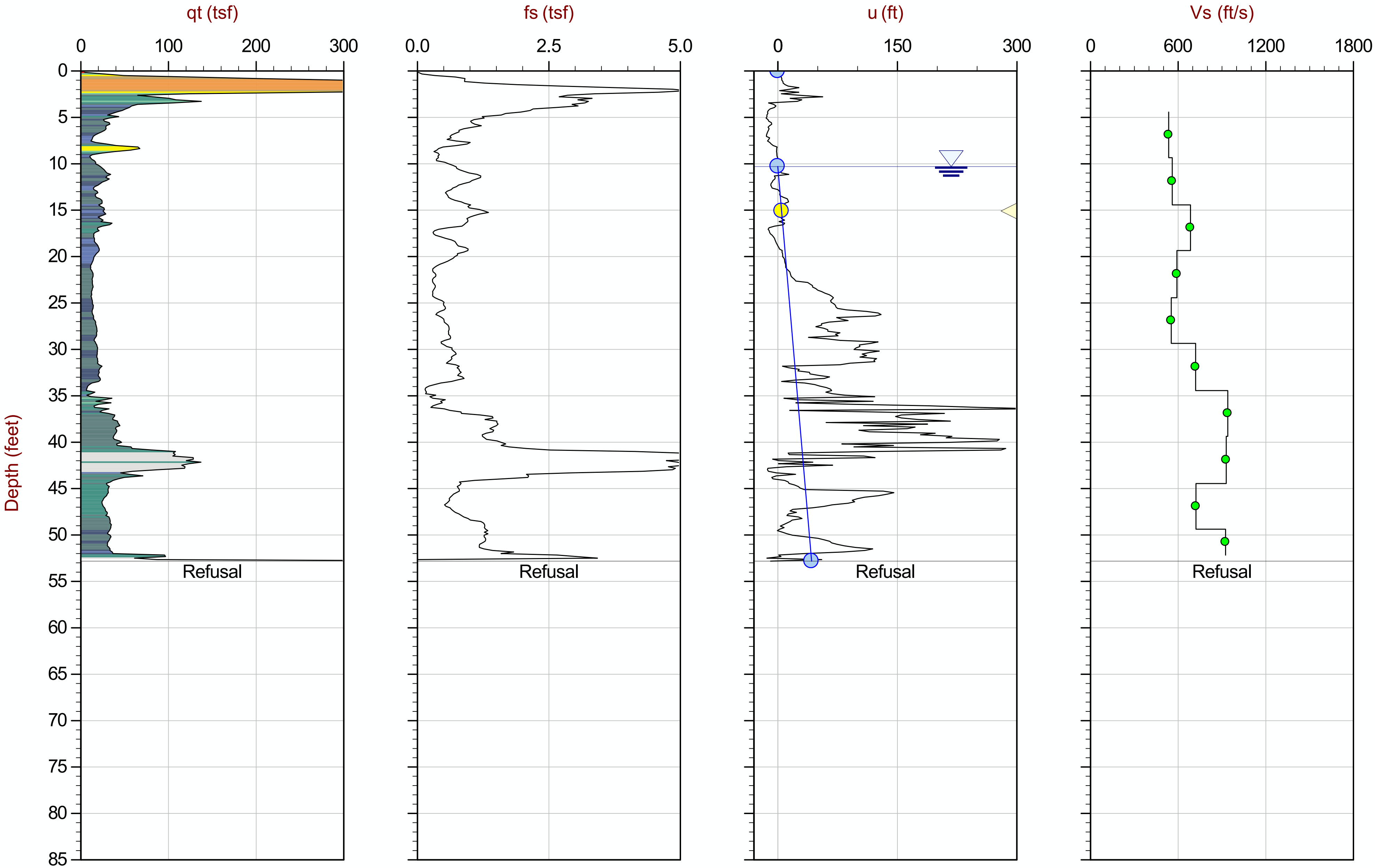
SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231753m E: 249923m

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: 15-53062
Date: 08:12:15 09:52
Site: Baldwin Power Station, Baldwin, IL
Sounding: SCPT15-BAL-C064
Cone: 436:T1500F15U500



Max Depth: 16.100 m / 52.82 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC064.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231751m E: 249640m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

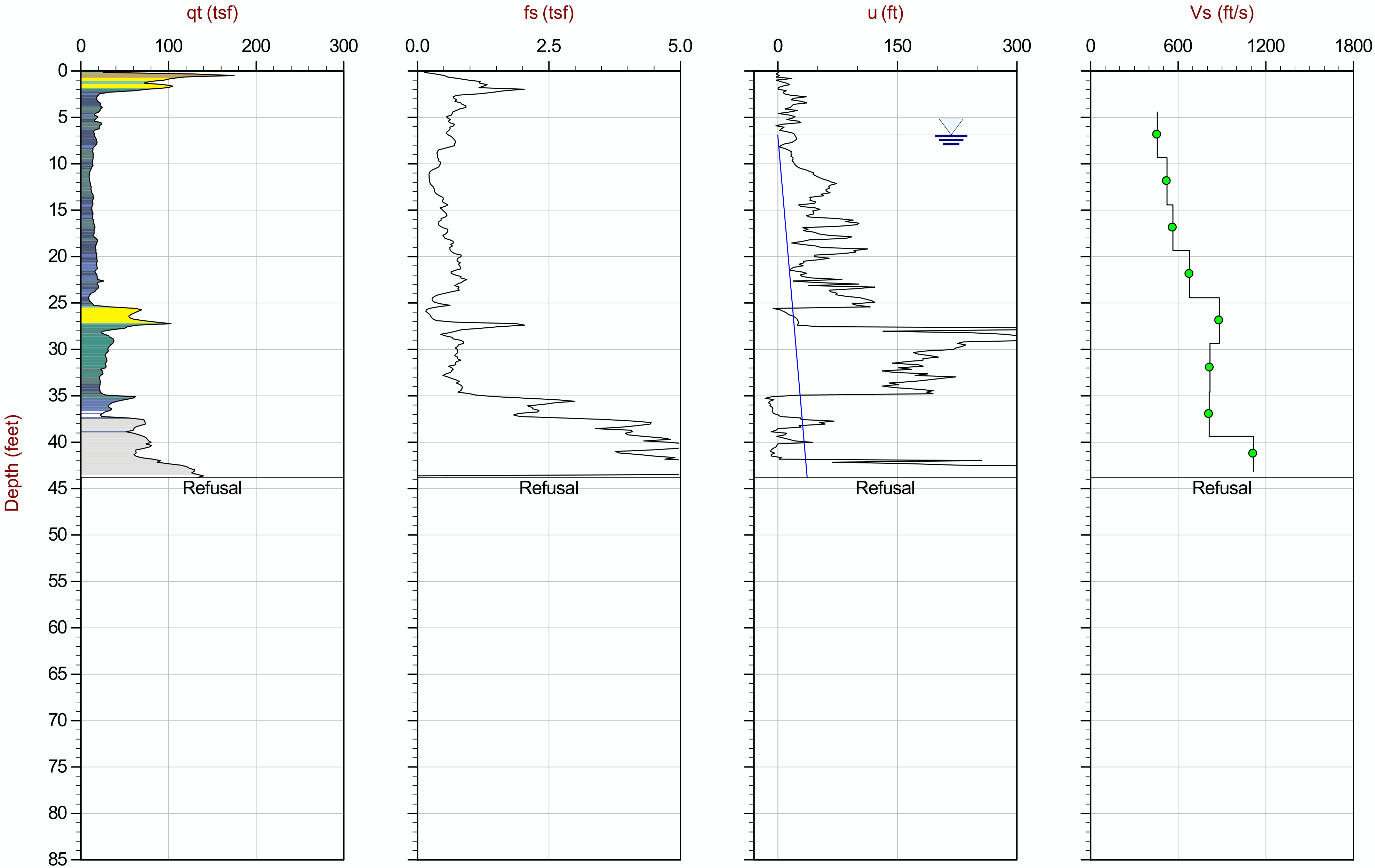
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:12:15 09:00
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C067
Cone: 436:T1500F15U500



Max Depth: 13.350 m / 43.80 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC067.COR

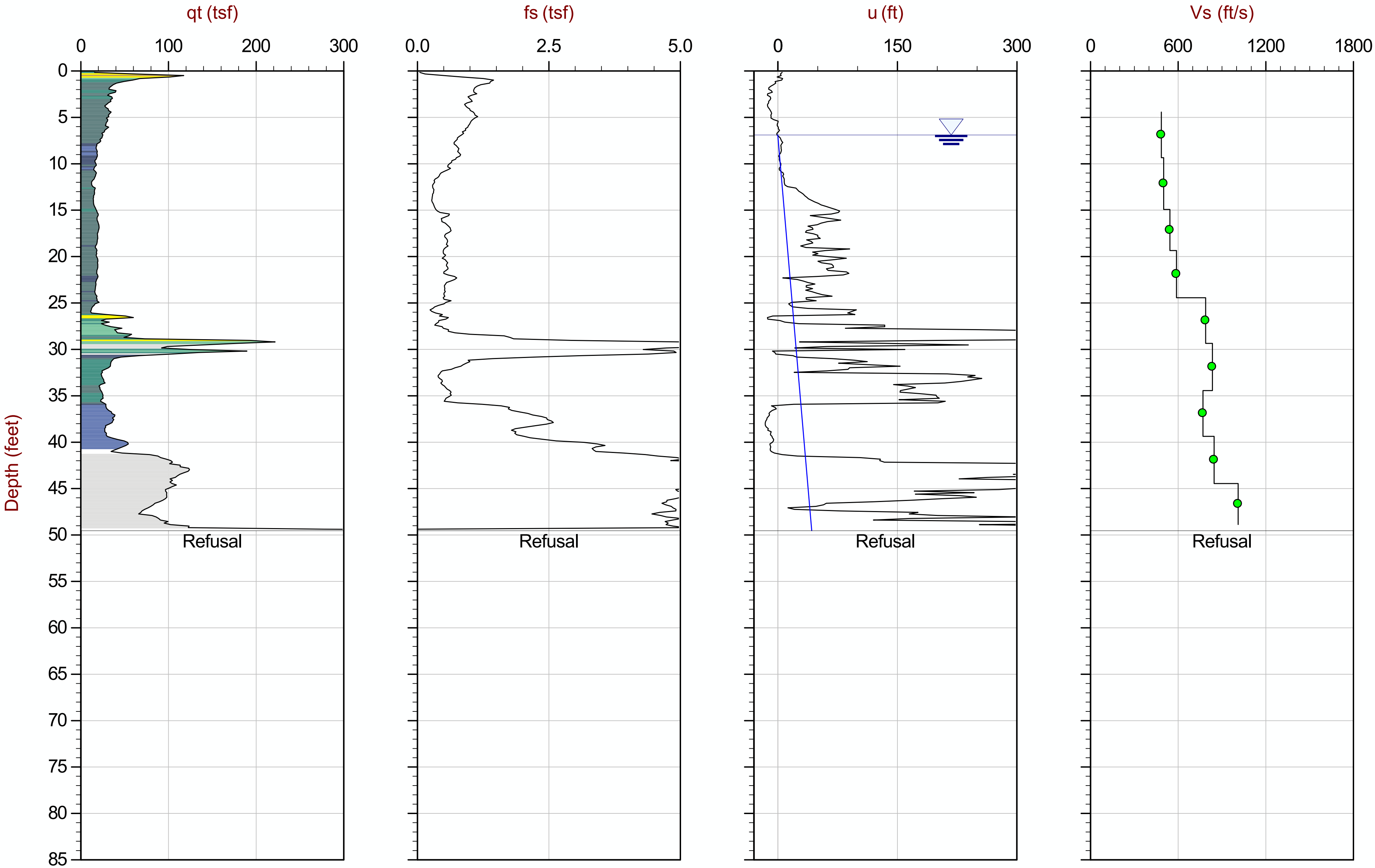
SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231779m E: 249441m

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.

AECOM

Job No: 15-53062
Date: 08:12:15 08:01
Site: Baldwin Power Station, Baldwin, IL
Sounding: SCPT15-BAL-C069
Cone: 436:T1500F15U500



Max Depth: 15.100 m / 49.54 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC069.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231786m E: 249287m

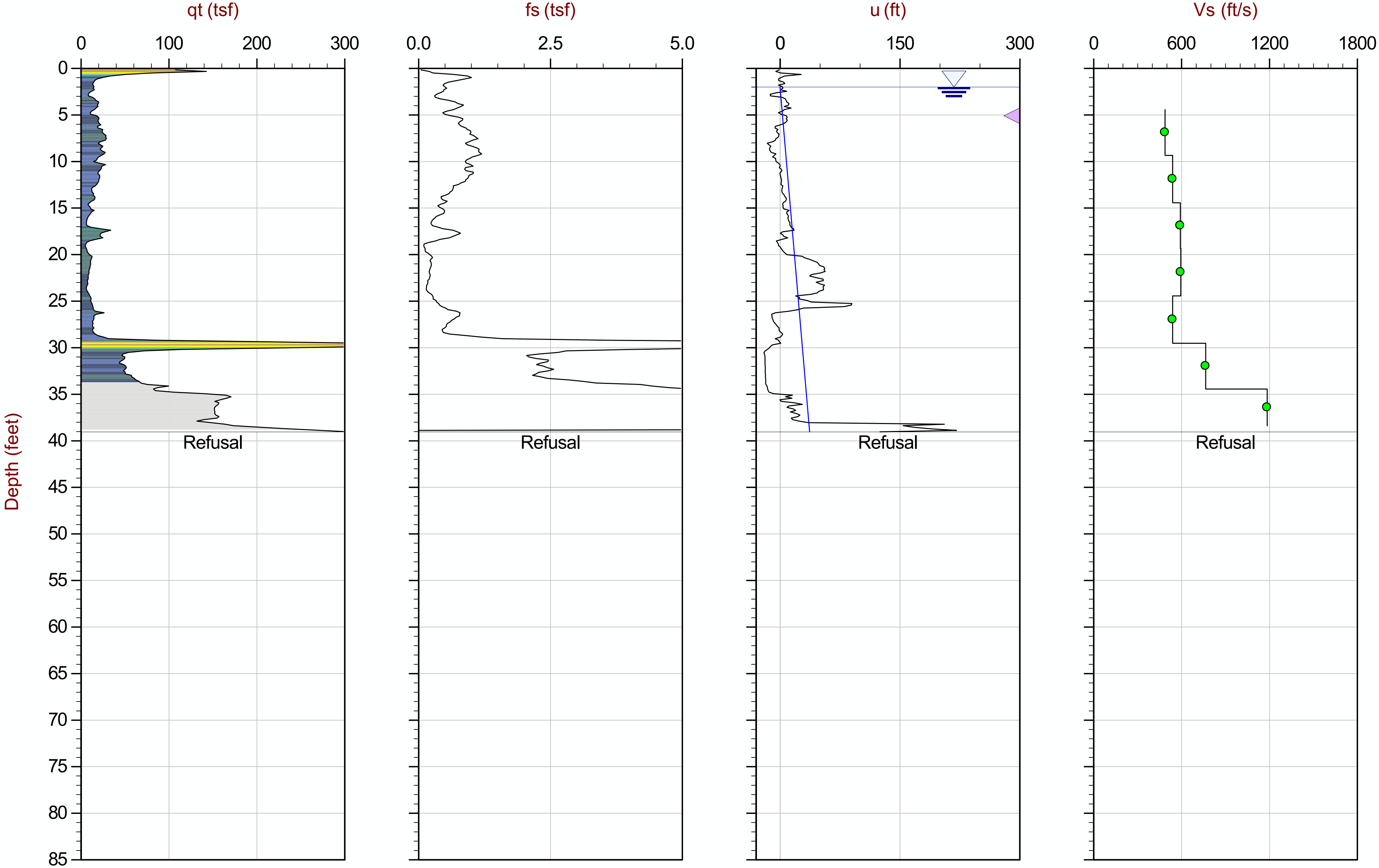
Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

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: 15-53062
Date: 08:11:15 13:53
Site: Baldwin Power Station, Baldwin, IL
Sounding: SCPT15-BAL-C074
Cone: 436:T1500F15U500



Max Depth: 11.900 m / 39.04 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC074.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231481m E: 248660m

Hydrostatic Line   Ueq   Assumed Ueq   PPD, Ueq achieved   PPD, Ueq not achieved

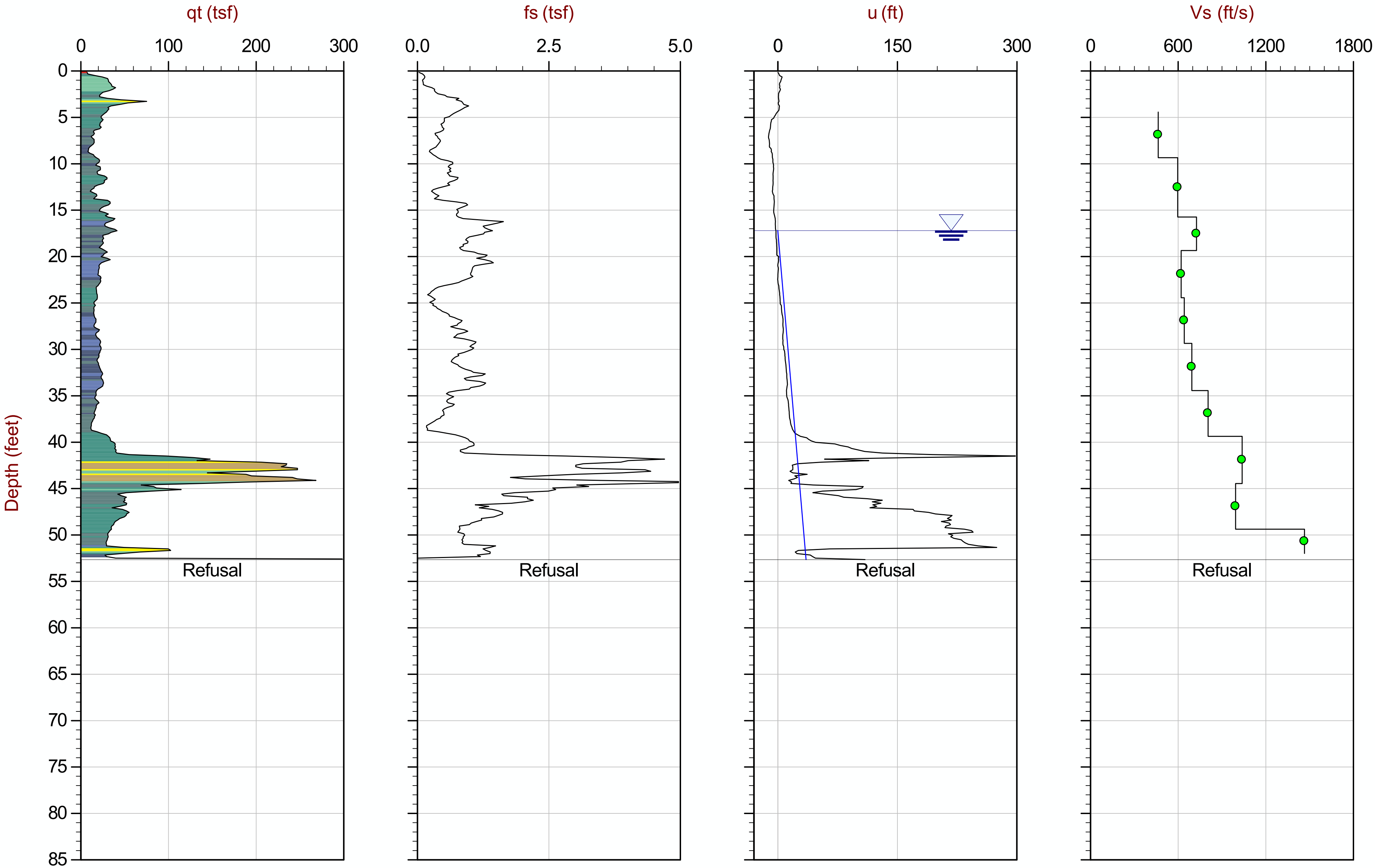
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

ConeTec

AECOM

Job No: 15-53062
Date: 08:23:15 10:36
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C076
Cone: 419:T1500F15U500



Max Depth: 16.050 m / 52.66 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC076.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4230639m E: 249356m

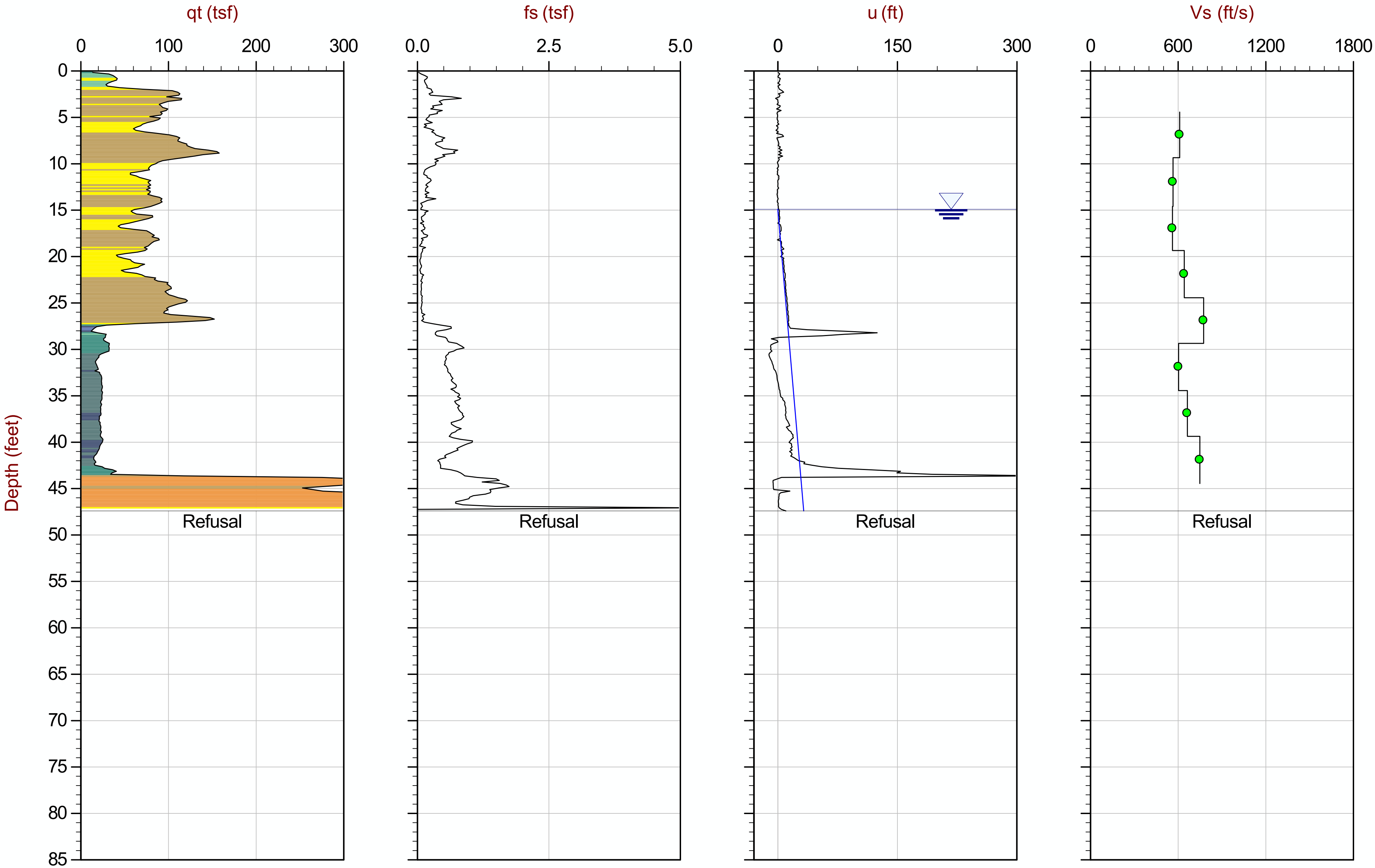
Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

AECOM

Job No: 15-53062
Date: 08:13:15 14:25
Site: Baldwin Power Station, Baldwin, IL

Sounding: SCPT15-BAL-C078
Cone: 419:T1500F15U500



Max Depth: 14.450 m / 47.41 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53062_SPBALC078.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4231456m E: 249765m

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.

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS										PERMEA-BILITY (cm/sec)	STRENGTH			CONSOLIDATION INITIAL CONDITIONS		REMARKS/ TEST ID
				WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)		Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	VOID RATIO (-)	SATUR-ATION (%)	
BAL-B001	S-4	7.5-9		66.9				SM	31.5	5										
BAL-B001	S-6	15-18		37.9				CL	93.9	6										
BAL-B001	ST-2	35-37									125.6									
BAL-B001	ST-2	35.35		23.1																
BAL-B001	ST-2A	35.6		23.8	63	15	48	CH			126.6	102.3		1.30E-08						P10576
BAL-B001	ST-2	35.9		23.2																
BAL-B001	ST-2	36.15		22.4				CH			128.4	104.9			UU@6.2	1.6	10.9			UU245g
BAL-B001	S-10	45.0-46.5	Brown silty CLAY, trace gravel	16.6																
BAL-B001	S-11	50.0-51.5	Brown silty, CLAY with gravel	12.4																
BAL-B001	S-14	65.0-66.5	Gray brown silty CLAY with fine gravel	19.0																
BAL-B001	S-16	75.0-75.5	Gray brown silty CLAY with fine gravel	12.5																
BAL-B002	S-1	0.0-1.5	Brown silty CLAY, trace sand and gravel	19.5																
BAL-B002	S-2	2.5-4.0	Brown silty CLAY, trace sand and gravel	16.5																
BAL-B002	S-3	5.0-6.5	Brown silty CLAY, trace sand and gravel	19.1	36	19														
BAL-B002	ST-1	8-10									120.5									
BAL-B002	ST-1A	8.25		19.1				CH	91.8	29										dispersion
BAL-B002	ST-1B	8.8		25.9	54	16	38	CH			120.1	95.4			UU@1.1	1	15			UU257i
BAL-B002	S-4	10.0-11.5	Brown silty CLAY, trace sand and gravel	21.0																
BAL-B002	ST-2	15-17									130.3									
BAL-B002	ST-2A	15.45		21.8	46	14	32	CL			123.3	101.2			UU@1.9	0.7	15			UU257j
BAL-B002	S-5	20.0-21.5	Brown silty CLAY, trace sand and gravel	21.7																
BAL-B002	S-6	25.0-26.5	Brown sandy silty CLAY	40.3																
BAL-B002	ST-3	27.5-30									113.5									
BAL-B002	ST-3A	27.75		34.8				ML			111.5	82.7			CIU@3.4	1.3	16.5			T3850
BAL-B002	ST-3B	28.1		26.4				ML			118.5	93.8						0.69	97	C15141
BAL-B002	ST-3C	28.45		32.1	21	21	NP	ML			114.9	87	2.491		CIU@3.5	2.9	19.6			T3851
BAL-B002	ST-3D	28.9		25.5				ML			122	97.2			CIU@3.6	10.1	24.8			T3852
BAL-B002	S-7	30.0-31.5	Brown sandy silty CLAY with gravel	47.9																
BAL-B002	S-8	35.0-36.5	Brown sandy silty CLAY with gravel	36.8																
BAL-B002	S-9	40-41.5		38.6				CL	94.3	5										
BAL-B002	S-10	45.0-46.5	Dark brown silty CLAY, trace sand	32.6																
BAL-B002	S-11	50.0-51.5	Dark brown silty CLAY, trace sand	25.0																
BAL-B002	S-12	55.0-56.5	Brown silty CLAY, trace sand	24.0	42	23														
BAL-B002	S-13	60.0-61.5	Dark brown silty CLAY with gravel, trace organics	33.3																
BAL-B002	S-14	70.0-71.5	Gray silty CLAY, trace sand	16.5																
BAL-B002	S-15	75.0-76.0	Gray silty CLAY, trace sand	17.4	45	24														
BAL-B003	S-4	10.0-11.5	Brown CLAY with fine gravel	22.3	39	17														
BAL-B003	ST-2	15-17									125.3									
BAL-B003	ST-2	15.35		25.4																
BAL-B003	ST-2A	15.6																		
BAL-B003	ST-2	15.95		23.4																
BAL-B003	ST-2B	16.2		24.7	58	15	43	CH			124.8	100.1			UU@1.9	0.8	15			UU230d
BAL-B003	S-6	30.0-31.5	Brown CLAY	40.7				CL	97	7										
BAL-B003	S-8	40.0-41.5	Brown sandy silty CLAY	43.6									2.43							
BAL-B003	S-10	50.0-51.5	Brown fat CLAY, trace sand and gravel	19.3	39	17														
BAL-B003	S-12	60.0-61.5	Light brown silty CLAY	26.9																
BAL-B003	S-13	65.0-66.5	Light gray silty CLAY	21.6	57	30														
BAL-B003	S-14	70.0-75.4	Light gray silty CLAY	18.7																
BAL-B004	S-2	2.5-4		10.3				SW-SM	5.4	0										
BAL-B004	ST-2	25-27									118.1									
BAL-B004	ST-2A	25.35		37.1				PT			115.8	84.5			CIU@3.0	1.4	12.1			T3892
BAL-B004	ST-2B	25.85		23.6	47	14	33	CL			127	102.7			CIU@3.1	1.4	12.3			T3893
BAL-B004	ST-2C	26.35		29.9				CL			119.2	91.8			CIU@3.2	1.8	19			T3894
BAL-B004	S-8	30-31.5		31.4	37	18	19	CL												
BAL-B004	S-9	35.0-36.5	Light gray silty CLAY, trace sand	19.4	38	15														
BAL-B004	S-11	45.0-46.5	Light brown silty CLAY with gravel	20.3																
BAL-B005	S-1	0.0-1.5	Dark brown silty coarse SAND with gravel	9.8																
BAL-B005	S-2	2.5-4.0	Brown silty CLAY	25.7																
BAL-B005	ST-1	5.0-7.0									108.7									
BAL-B005	ST-1	5.75		24.3																UU275A

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS: WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	PERMEA-BILITY (cm/sec)	STRENGTH: Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	CONSOLIDATION INITIAL CONDITIONS: VOID RATIO (-)	SATUR-ATION (%)	REMARKS/ TEST ID
BAL-B005	ST-1B	6		22	60	17	43	CH			126.5	103.7			UU@0.7	1.9	15			
BAL-B005	S-3	7.5-9.0	Brown silty CLAY	26.2																
BAL-B005	ST-2	10.0-12.0									115.1									
BAL-B005	ST-2A	10.3		25.8				CH			121.4	96.5			CIU@0.8	0.7	19.8			T3910
BAL-B005	ST-2B	10.85		24.8	60	16	44	CH			123.7	99.1			CIU@1.2	1.4	19.6			T3911
BAL-B005	S-4	15.0-16.5	Brown silty CLAY, trace sand	25.1																
BAL-B005	S-5	20.0-21.5	Brown gray silty CLAY	27.5																
BAL-B005	S-6	25.0-26.5	Brown silty CLAY	24.1																
BAL-B005	S-7	30.0-31.5	Brown silty CLAY	21.2	36	18														
BAL-B005	S-8	35.0-36.5	Brown silty CLAY	21.9																
BAL-B005	S-9	40.0-41.5	Brown silty CLAY	16.7																
BAL-B005	S-10	45.0-46.5	Gray silty CLAY	16.6																
BAL-B005	S-11	50.0-51.5	Gray silty CLAY	22.0																
BAL-B005	S-12	55.0-56.5	Gray silty CLAY, trace sand	16.6	44	25														
BAL-B005	S-13	60.0-60.4	Gray brown silty CLAY	18.8																
BAL-B006	S-1	0.0-1.5		11.6				SC	20.9	2										
BAL-B006	S-2	2.5-4.0		67.9				SC	44.4	4										
BAL-B006	S-3	5.0-6.5		31.6				SM	18.5	1										
BAL-B006	S-4	7.5-9.0		24.9				SC	12.8	0										
BAL-B006	S-5	10.0-11.5		19.9				CL	53.4	6										
BAL-B006	S-6	12.5-15	Gray brown silty CLAY, trace sand and fine gravel	21.2																
BAL-B006	ST-1	15.0-17.0									129									
BAL-B006	ST-1	15.15		25.2																
BAL-B006	ST-1	15.7		23.5																
BAL-B006	ST-1B	15.95		17.9				CL			135	114.5			UU@1.4	1.7	15			UU275G
BAL-B006	ST-1	16.25		15.9																
BAL-B006	S-7	20.0-21.5	Gray brown silty CLAY, trace sand and fine gravel	20.8																
BAL-B006	S-8	25.0-26.5	Light brown silty CLAY, trace sand and fine gravel	20	32	14														
BAL-B006	ST-2	30.0-32									139.5									
BAL-B006	ST-2A	30.25		13.4	29	15	14	CL			138.3	122			CIU@2.0	6.1	17.4			T3886
BAL-B006	ST-2B	30.6		13				CL			135.3	119.7	2.682					0.398	87	C15157
BAL-B006	ST-2C	31		13.3				CL			134.8	119			CIU@2.2	7.2	21.8			T3887
BAL-B006	ST-2D	31.5		14				CL			137	120.1			CIU@2.4	5	18.5			T3888
BAL-B006	S-9	35.0-36.5	Light brown silty CLAY, trace sand and fine gravel	29.6																
BAL-B006	S-10	40.0-41.5	Gray silty CLAY, trace sand	22.4																
BAL-B006	S-11	45.0-46.5	Gray CLAY, trace sand	19.1	56	23														
BAL-B006	S-12	50-51.5	Gray silty GRAVEL	9.1																
BAL-B007	S-3	5.5-7.0		65.4	NP	NP														
BAL-B007	ST-1	30-32									123									
BAL-B007	ST-1A	30.4		25				CL			125.8	100.6			CIU@3.6	2.2	15.2			T3857
BAL-B007	ST-1B	30.95		25.8	48	17	31	CL			126.6	100.6	2.609		CIU@3.7	2.9	14.7			T3859
BAL-B007	ST-1C	31.35		22.8				CL			123	100.1						0.661	92	C15142
BAL-B007	ST-1D	31.8		26				CL			125.8	99.8			CIU@3.8	2.5	16.7			T3858
BAL-B008	S-1	0.0-1.5	Brown silty CLAY, trace sand	15.4																
BAL-B008	S-2	2.5-4.0	Brown silty, CLAY, trace sand	21.8																
BAL-B008	S-3	5.0-6.5	Brown silty CLAY, trace sand and fine gravel	21.6	48	21														
BAL-B008	S-4	10.0-11.5	Brown silty CLAY, trace sand and fine gravel	19.6																
BAL-B008	ST-1	10-12																		
BAL-B008	ST-1A	10.35		25.7				CH	84.2	25										dispersion
BAL-B008	ST-1B	10.8		23.1	65	17	48	CH			127.5	103.6		5.50E-09						P10595
BAL-B008	S-5	20.0-21.5	Brown silty CLAY, trace sand and fine gravel	22.5																
BAL-B008	ST-2	20-22									119.5									
BAL-B008	ST-2	20.05		43.5																
BAL-B008	ST-2A	20.3		23.4	58	18	40	CH			125.7	101.9			UU@2.5	0.4	15			UU278e
BAL-B008	S-6	25.0-26.5	Brown silty CLAY, trace sand and fine gravel	20.8																
BAL-B008	S-7	30.0-31.5	Brown silty CLAY, trace sand and fine gravel	26.2	38	17														
BAL-B008	S-8	35.0-36.5	Brown silty CLAY, trace sand and fine gravel	22.9																
BAL-B008	S-9	40.0-41.5	Brown silty CLAY, trace sand and fine gravel	20.8																
BAL-B008	S-10	45.0-46.5	Brown silty CLAY, trace sand and fine gravel	22.1																
BAL-B008	S-11	50.0-51.5	Brown silty CLAY, trace sand and fine gravel	18.0																
BAL-B008	S-12	55.0-56.5	Light brown SILTY SAND	19.2				SM	16											

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS										PERMEA-BILITY (cm/sec)	STRENGTH			CONSOLIDATION INITIAL CONDITIONS		REMARKS/ TEST ID
				WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)		Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	VOID RATIO (-)	SATUR-ATION (%)	
BAL-B008	S-13	60.0-61.5	Gray silty CLAY, trace sand	17.8	42	25														
BAL-B008	S-14	65.0-66.5	Gray silty CLAY, trace sand	14.0																
BAL-B009	S-1	0-1.5		85.3				MH	78.3	10										
BAL-B009	ST-2	10.5-12.5									122.5									
BAL-B009	ST-2A	10.65		4.3				CL												
BAL-B009	ST-2	10.9		24.9																
BAL-B009	ST-2B	11.15		25.2				CL			124.9	99.8			CIU@1.3	1.8	16.9			T3863
BAL-B009	ST-2	11.45		28																
BAL-B009	ST-2C	11.7		26.3				CL			124.1	98.3			CIU@1.4	1.6	14.6			T3889
BAL-B009	ST-2	12		24.1																
BAL-B009	ST-2D	12.25		26.3	40	19	21	CL	95.2	20	123.6	97.8			CIU@1.5	2.1	14.2			dispersion T3864
BAL-B009	ST-3	25-27									113.6									
BAL-B009	ST-3	25.25		22.1	49	14	35	CL			125.9	103.1			UU@3.1	0.7	15			UU278g
BAL-B009	ST-3	25.85		19.5																
BAL-B009	S-7	30.0-31.5	Brown POORLY GRADED GRAVEL	14.5				GP	3											
BAL-B009	S-8	35.0-36.5	Gray silty CLAY, trace sand	23.2	49	25														
BAL-B009	S-9	40.0-41.5	Gray silty CLAY, trace sand	21.2																
BAL-B010	S-2	2.5-4		50.2				SC	28.4	4										
BAL-B010	S-5	15-16.5		42.5				CL	98.3	7										
BAL-B010	ST-2	20-22									123.9									
BAL-B010	ST-2	20.5		24.7																
BAL-B010	ST-2	21.05		22.1																
BAL-B010	ST-2B	21.3		22.2	42	18	24	CL			124.2	101.7		2.40E-06						P10578
BAL-B010	ST-2	21.6		21.9																
BAL-B010	ST-2C	21.85		20.9				CL			124.9	103.3			UU@2.5	2	3.8			UU246d
BAL-B010	S-8	30.0-31.5	Light brown silty CLAY with sand and gravel	18.6	30	14														
BAL-B010	S-9	35.0-36.5	Brown silty CLAY with sand and gravel	15.0	22	14														
BAL-B010	S-11	45.0-46.5	Light brown silty CLAY with sand and gravel	21.7																
BAL-B010	S-12	50.0-51.5	Brown silty CLAY, trace sand	18.2																
BAL-B011	S-1	0.0-1.5	Brown silty CLAY, trace sand	13.0																
BAL-B011	S-2	2.5-4		23.0				CL	95.2	27										
BAL-B011	S-4	7.5-9.0	Brown silty CLAY, trace sand	18.8																
BAL-B011	S-5	10.0-11.5	Gray brown silty CLAY, trace sand	19.9																
BAL-B011	ST-1	15-17									122.8									
BAL-B011	ST-1A	15.2		25.8							123.3	98		1.80E-09						P10594
BAL-B011	ST-1B	15.7		24.8				CL			125.1	100.2			CIU@1.8	2.5	12.1			T3903
BAL-B011	ST-1C	16.2		24.9				CL			122.3	98			CIU@1.9	2.8	20.1			T3904
BAL-B011	ST-1	16.55		25.4																
BAL-B011	ST-1D	16.8		25.6	46	18	28	CL			121.3	96.6			CIU@2.0	1.7	19.2			T3905
BAL-B011	S-6	20.0-21.5	Gray brown silty CLAY, trace sand	21.7																
BAL-B011	S-7	30.0-31.5	Brown silty CLAY, trace sand	17.8																
BAL-B011	S-8	35.0-36.5	Brown silty sandy CLAY with gravel	8.8	19	11														
BAL-B011	S-9	42.5-44.0	Light brown silty CLAY, trace sand	18.2	49	24														
BAL-B011	S-10	47.5-49.0	Gray silty CLAY, trace sand	19.8																
BAL-B012	S-3	2.0-3.0	Brown silty CLAY, trace sand	22.0	54	24														
BAL-B012	S-7	6.0-7.0	Light brown silty CLAY	20.7	34	18														
BAL-B012	S-10	9.0-10.0	Light brown silty CLAY	21.3																
BAL-B015	S-1	0.0-1.5	Light brown sandy silty CLAY with find gravel and organics	12.5																
BAL-B015	S-2	2.5-4.0	Light brown sandy silty CLAY	21.5																
BAL-B015	ST-1	5.0-7.0									124.7									
BAL-B015	ST-1	5.6		24.8																
BAL-B015	ST-1	6.15		43																
BAL-B015	ST-1C	6.4		21.3	44	17	27	CL			129.1	106.4			UU@0.7	2.3	15			UU275D
BAL-B015	S-3	7.5-9.0	Light brown sandy silty CLAY	22.8																
BAL-B015	S-4	10.0-11.5	Light brown sandy silty CLAY, trace gravel	21.0																
BAL-B015	ST-2	11.5-13.5									128.6									
BAL-B015	ST-2	11.8		19.5																
BAL-B015	ST-2A	12.05		20.8				CH			129.5	107.2			CIU@1.0	1.8	18.7			T3912
BAL-B015	ST-2	12.35		20.8																
BAL-B015	ST-2B	12.6		20.1				CH			129.9	108.2			CIU@1.2	1.8	20.4			T3913
BAL-B015	ST-2	12.9		20.7																

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS: WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	PERMEA-BILITY (cm/sec)	STRENGTH: Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	CONSOLIDATION INITIAL CONDITIONS: VOID RATIO (-)	SATUR-ATION (%)	REMARKS/ TEST ID
BAL-B015	ST-2C	13.15		21.1	53	14	39	CH			128.8	106.4			CIU@1.4	1.9	20.1			T3914
BAL-B015	S-5	15.0-16.5	Light brown sandy silty CLAY, trace gravel	23.0																
BAL-B015	S-6	20.0-21.5	Light brown sandy silty CLAY with gravel	18.8																
BAL-B015	S-7	25.0-26.5	Light brown gray silty CLAY, trace sand and gravel	17.1	37	15														
BAL-B015	S-8	30.0-31.5	Light brown silty CLAY, with sand and gravel	23.7																
BAL-B015	S-9	35.0-36.5	Brown silty CLAY, trace sand	23.5																
BAL-B015	S-10	40.0-41.5	Gray brown silty CLAY	20.1																
BAL-B015	S-11	45.0-46.5	Light brown sandy silty CLAY with medium gravel	25.9																
BAL-B015	S-12	50.0-51.5	Gray fat CLAY	21.7	87	33														
BAL-B016	ST-1	4.0-6.0									114.6									
BAL-B016	ST-1	4.15		15.7																
BAL-B016	ST-1A	4.4		15				ML			128	111.3			CIU@0.5	0.8	21.2			T3825
BAL-B016	ST-1	4.7		19.8																
BAL-B016	ST-1B	4.95		27.6				ML			115.4	90.5			CIU@0.6	2.1	18			T3826
BAL-B016	ST-1	5.25		33.3																
BAL-B016	ST-1C	5.5		31.8	24	22	2	ML			107.7	81.7			CIU@0.7	1.9	11.1			T3827
BAL-B016	S-3B	7.5-9.0	Brown SILT	41.3				ML	96	6										
BAL-B016	ST-2	10.0-12.0									103.4									
BAL-B016	ST-2	10.15		44.3																
BAL-B016	ST-2	10.65		49.8																
BAL-B016	ST-2	11.15		54.9																
BAL-B016	ST-2B	10.9		62.1	-	29	NP	ML			96.8	59.7						1.562	97	C15119
BAL-B016	S-4	15.0-16.5		31.3																
BAL-B016	S-5	20.0-21.5	Dark brown SILT	29				ML	90	4										
BAL-B016	S-8	35.0-36.5		22.6																
BAL-B016	S-10	45.0-46.5		17.9																
BAL-B016	S-11	50.0-51.5		14.5	30	15														
BAL-B016	S-12	55.0-56.5		10.3	34	14														
BAL-B016	S-14	65.0-66.5		18.2																
BAL-B017	S-1	0.0-1.5		11.5				ML												
BAL-B017	S-2	2.5-4.0		14.7				ML	73.5	9										
BAL-B017	S-3	5.0-6.5		21.4				ML	67	4										
BAL-B017	S-4	7.5-9.0		28.9				ML	94.2	6										
BAL-B017	ST-1	10.0-12.0									108.5									
BAL-B017	ST-1	11.3		28.4																
BAL-B017	ST-1C	11.55		35	23	25	NP	ML	95.4	7	112.2	83.1			UU@0.8	0.4	15			UU278H
BAL-B017	S-5	15.0-16.5	Brown silty CLAY	30.5																
BAL-B017	S-6	20.0-21.5	Brown silty CLAY with fine gravel	21.4	33	15														
BAL-B017	ST-2	25.5-27.5									122.1									
BAL-B017	ST-2	25.9		30.3																
BAL-B017	ST-2A	26.15		22.6				CL			125.4	102.3			CIU@2.2	6.7	20.1			T3921
BAL-B017	ST-2	26.45		21.9																
BAL-B017	ST-2B	26.7		23.5	44	15	29	CL			124.5	100.8		1.70E-08	CIU@2.4	2	19.7			T3922
BAL-B017	ST-2	27		25																
BAL-B017	ST-2C	27.25		25.4				CL			124.4	99.2			CIU@2.6	1.8	12.9			T3923
BAL-B017	S-7	30.0-31.5	Brown silty CLAY with fine gravel	30.5																
BAL-B017	S-8	35.0-36.5	Brown silty CLAY with fine gravel	21.2	43	11														
BAL-B017	S-9	40.0-41.5	Gray brown sandy silty CLAY with fine gravel	18.1																
BAL-B017	S-10	45.0-45.1	Gray brown sandy silty CLAY with fine gravel	15.6																
BAL-B017	S-11	50.0-51.5	Gray brown sandy silty CLAY with fine gravel	22.6																
BAL-B017	S-12	55.0-56.5	Brown sandy silty CLAY with fine gravel	10.3	28	9														
BAL-B018	S-2	5.0-6.5	Light brown silty CLAY	30.0	37	20														
BAL-B018	ST-2	25-27									126.1									
BAL-B018	ST-2B	25.95		27.4				CH			123.3	96.8			CIU@3.0	0.9	22.7			T3890
BAL-B018	ST-2C	26.55		18.1	54	13	41	CH			129.7	109.9			CIU@3.2	2.2	18.2			T3865
BAL-B018	S-7	35.0-36.5	Light brown silty CLAY	23.6																
BAL-B018	S-8	40.0-41.5	Gray silty CLAY, trace sand	17.7	47	25														
BAL-B018	S-9	45.0-46.5	Gray silty CLAY, trace sand	18.4																
BAL-B019	S-1	0.0-1.5		15.3																
BAL-B019	S-3	5.0-6.5		22.4	40	19														
BAL-B019	S-7	15.0-16.5		17.5																

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS										PERMEA-BILITY (cm/sec)	STRENGTH			CONSOLIDATION INITIAL CONDITIONS		REMARKS/ TEST ID
				WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2μm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)		Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	VOID RATIO (-)	SATUR-ATION (%)	
BAL-B019	ST-1	25-27.5									128.1									
BAL-B019	ST-1	25.45		24.3																
BAL-B019	ST-1	26		25.1																
BAL-B019	ST-1	26.55		23.9																
BAL-B019	ST-1C	26.8		24.5	38	17	21	CL			124.8	100.3			UU@3.1	1.5	14.6			UU231a
BAL-B019	ST-2	35-37.5									118.4									
BAL-B019	ST-2	35.35		34.7																
BAL-B019	ST-2	35.9		25.6																
BAL-B019	ST-2	36.5		22.3																
BAL-B019	ST-2C	36.8		22.1	55	15	40	CH			126.8	103.8			UU@4.1	2	8.8			UU231b
BAL-B019	S-11	45.0-46.5		16.7	33	16														
BAL-B019	S-13	55.0-56.5		18.6	40	18														
BAL-B019	S-14	60.0-61.5		21.9	43	26														
BAL-B019	S-16	70.0-71.0		15.4																
BAL-B019	S-18	80.0-80.8		17.5																
BAL-B020	S-2A	2.5-4		19.5				SP-SM	10.8	1										
BAL-B020	ST-2	9-11									121.1									
BAL-B020	ST-2A	9.4		30.8				CH			120.4	92.1			CIU@1.1	0.9	19			T3901
BAL-B020	ST-2B	9.9		25.6	51	17	34	CH			123.5	98.3			CIU@1.2	1.2	18.8			T3895
BAL-B020	ST-2C	10.4		24.7				CH			125.8	100.9			CIU@1.3	1.3	17.9			T3896
BAL-B020	S-5	20.0-21.5	Brown SANDY LEAN CLAY	22.6	38	16		CL	67											
BAL-B020	S-7B	30.0-31.5	Brown CLAY with SAND	18.7				CL	78											
BAL-B020	S-10	45.0-46.5	Gray silty sandy CLAY with fine gravel	11.2																
BAL-B020	S-13	60.0-61.5	Gray silty CLAY	21.6	73	36														
BAL-B020	S-17	80.0-81.5	Gray silty CLAY	21.3																
BAL-B021	ST-1	2.5-4.5									117.5									
BAL-B021	ST-1A	2.75		20.6				CL			125.8	104.3			CIU@0.3	0.6	18			T3834
BAL-B021	ST-1B	3.25		22.4	49	15	34	CL			124.9	102			CIU@0.54	0.9	20.5			T3835
BAL-B021	S-3	7.5-9.0		20.8	43	17														
BAL-B021	S-5	15.0-16.5		20.7																
BAL-B021	S-6	20.0-21.5		20.5																
BAL-B021	S-9	35.0-36.5		18.6	42	23														
BAL-B022	S-3	5.0-6.5	Brown silty CLAY, trace fine gravel	22.0	28	18														
BAL-B022	ST-1	10-12									130.3									
BAL-B022	ST-1	10.35		21.1																
BAL-B022	ST-1A	10.6		20.7				CL			129.4	107.2			CIU@1.2	2.2	20.1			T3906
BAL-B022	ST-1	10.9		19.9																
BAL-B022	ST-1B	11.15		19.1	40	15	25	CL	80.3	22	130.3	109.4			CIU@1.3	2	15.3			dispersion T3907
BAL-B022	ST-1	11.45		18.7																
BAL-B022	ST-1C	11.7		18.4				CL			130.7	110.4			CIU@1.4	2.5	20.2			T3908
BAL-B022	S-8	35.0-36.5	Gray silty CLAY, trace gravel	23.6	58	25														
BAL-B022	S-10	45.0-45.8	Gray silty CLAY, trace gravel	16.6																
BAL-B023	S-3	5.0-6.5		18.6	37	14														
BAL-B023	ST-1	10.0-12.5									129									
BAL-B023	ST-1	10.3		23.7																
BAL-B023	ST-1A	10.55		22.6	51	15	36	CH			127.7	104.1			UU@1.3	2.1	15			UU230b
BAL-B023	ST-1	10.85		22.3																
BAL-B023	ST-1B	11.1																		
BAL-B023	S-6	20.0-21.5		22.3	34	18														
BAL-B023	ST-2	25-27.5									132.8									
BAL-B023	ST-2B	25.65		17.9				CL			132.2	112.1			CIU@3.0	2.6	21.4			T3828
BAL-B023	ST-2C	26.05		16.2	36	14	22	CL			133.4	114.8			CIU@3.2	2.5	21			T3829
BAL-B023	S-7	30.0-31.5		26.7	59	30														
BAL-B023	S-8	35.0-36.5		17.8																
BAL-B023	S-11	50.0-50.8		16.1																
BAL-B024	S-4	7.5-9.0		18.7																
BAL-B024	S-6	15.0-16.5		24.1	41	19														
BAL-B024	ST-1	20.0-22.5									128									
BAL-B024	ST-1	20.45		28.1																
BAL-B024	ST-1A	20.7		19.4				CL			130	108.9			CIU@2.4	2.8	17.7			T3831
BAL-B024	ST-1	21.05		20.0																

Project: Dynergy CCR-Baldwin **Project No.: 60440739**

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS: WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)	PERMEA-BILITY (cm/sec)	STRENGTH: Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	CONSOLIDATION INITIAL CONDITIONS: VOID RATIO (-)	SATUR-ATION (%)	REMARKS/ TEST ID
BAL-B024	ST-1B	21.3		20.5	49	13	36	CL			129.6	107.6			CIU@2.5	2.8	11			T3832
BAL-B024	ST-1	21.6		20.6																
BAL-B024	ST-1C	21.9		19.4				CL			128.6	107.7			CIU@2.6	2.3	6.2			T3833
BAL-B024	S-7	25.0-26.5		18.1																
BAL-B024	S-10	40.0-41.5		14.5	45	23														
BAL-B024	S-12	50.0-51.5		22.6																
BAL-B025	ST-1	7.5-9.5									112.5									
BAL-B025	ST-1	7.75		22.4																
BAL-B025	ST-1A	8		22.0				CL	74.3	4										
BAL-B025	ST-1	8.3		25.6																
BAL-B025	ST-1	8.85		55.1																
BAL-B025	S-4	10.0-11.5		40.4									2.46							
BAL-B025	S-7	25.0-26.5		26.5	40	20														
BAL-B025	S-9B	40.0-41.5		19.3	32	16														
BAL-B025	S-11	50.0-51.5		24.2																
BAL-B025	S-12	55.0-56.5		16.7	43	21														
BAL-B026	S-4	7.5-9		9.4				SM	14.6											
BAL-B026	S-6	15-16.5		19.4				SW-SM	5.8											
BAL-B026	ST-1	20-22																		
BAL-B026	ST-1	20.45		37.3																
BAL-B026	ST-1	21		27.3																
BAL-B026	ST-1	21.55		23.5																
BAL-B026	ST-1C	21.8		20.1				CL	97.5	28	128	106.5			UU@2.6	2	8.7			UU257k
BAL-B026	S-7A	25-26.5		32.9				CL	78.9											
BAL-B026	ST-2	35-37									126.3									
BAL-B026	ST-2A	35.35		23.6				CH			125.4	101.4			CIU@4.2	2	19			T3860
BAL-B026	ST-2B	35.9		24.0				CH			125.9	101.6			CIU@4.3	2.1	19.2			T3861
BAL-B026	ST-2C	36.25		23.5	61	14	47	CH			124.3	100.6	2.675					0.649	96	C15144
BAL-B026	ST-2D	36.8		22.9				CH			126.4	102.9			CIU@4.4	1.9	15.9			T3862
BAL-B026	S-9	40.0-41.5	Brown silty CLAY, trace gravel	17.8	48	13														
BAL-B026	S-11	50.0-51.5	Brown silty CLAY, trace gravel	23.5	49	19														
BAL-B026	S-12	55.0-56.5	Brown silty CLAY, trace gravel	16.6	43	17														
BAL-B026	S-15	70.0-71.5	Gray silty CLAY, trace sand	16.5																
BAL-B027	S-1	0-1.5		17.7				SW-SM	5.3											
BAL-B027	S-7	20-21.5		16.7				SP	0.2											
BAL-B027	ST-1	25-27									124.6									
BAL-B027	ST-1	25.55		21.1																
BAL-B027	ST-1	26.1		21.8																
BAL-B027	ST-1C	26.35		21.4				CL			128.5	105.9			UU@3.1	3.3	11.9			UU275e
BAL-B027	ST-1	26.65		21.1																
BAL-B027	ST-1D	26.9		21.2	43	16	27	CL			127.7	105.4		5.00E-09						P10596
BAL-B027	ST-2	35-37									127.3									
BAL-B027	ST-2	35.3		19.1																
BAL-B027	ST-2	35.85		19.9																
BAL-B027	ST-2	36.4		19.8																
BAL-B027	ST-2C	36.65		20.3	47	15	32	CL			130	108			UU@4.3	1.6	15			UU275f
BAL-B027	S-10	45.0-46.5	Light brown silty CLAY	24.1																
BAL-B027	S-12	55.0-56.5	Gray silty CLAY, trace sand	17.4	47	21														
BAL-B027	S-13	60.0-61.5	Gray silty CLAY, trace sand	19.4																
BAL-B028	S-1	0-1.5		72.5																
BAL-B028	S-2	2.5-4.0		70.8				ML	67.5	11										
BAL-B028	ST-1	5.0-7.0									89.5									
BAL-B028	ST-1	5.4		104.4																
BAL-B028	ST-1	5.95		76.6																
BAL-B028	ST-1	6.55		114.3																
BAL-B028	ST-1C	6.8		90.7	47	53	NP	ML	81.4		90.7	47.6			CYCTRX@0.7					CTXS488
BAL-B028	S-3	7.5-9.0		103.7				ML	75.6	13										
BAL-B028	ST-2	9.0-11.0									89.5									
BAL-B028	ST-2A	9.3		48.5				ML	67.9		104.4	70.3			CYCTRX@1.0					CTXS487
BAL-B028	ST-2B	9.95		65	47	52	NP	ML			101.8	61.7	2.684					1.716	102	C15154
BAL-B028	S-4	15-17		39.6				ML	64.3	6										

Project: Dynergy CCR-Baldwin **Project No.: 60440739**

Summary of Laboratory Test Results

BORING NO.	SAMPLE NO.	DEPTH (ft)	CLASSIFICATION	IDENTIFICATION TESTS										PERMEA-BILITY (cm/sec)	STRENGTH			CONSOLIDATION INITIAL CONDITIONS		REMARKS/ TEST ID
				WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2µm (%)	TOTAL UNIT WEIGHT (pcf)	DRY UNIT WEIGHT (pcf)	SPECIFIC GRAVITY (-)		Type Test @ STRESS (ksf)	PEAK SHEAR STRESS (ksf)	AXIAL STRAIN @ PEAK STRESS (%)	VOID RATIO (-)	SATUR-ATION (%)	
BAL-B028	S-5	20-22		34.9				ML	97.7	8										
BAL-B028	S-6A&B	25-26.5		50.6				CL	89.4	9										
BAL-B028	S-7	30.0-31.5	Brown silty Clay	26.7																
BAL-B028	S-8	35.0-36.5	Brown silty CLAY with sand and gravel	20.3	40	18														
BAL-B028	S-9	40.0-41.5	Brown silty CLAY with sand and gravel	20.7																
BAL-B028	S-10	45.0-46.5	Brown silty CLAY with sand and gravel	16.5																
BAL-B028	S-11	50.0-51.5	Brown silty CLAY with sand and gravel	20.2																
BAL-B028	S-12	55.0-56.5	Gray silty CLAY, trace sand	21.0																
BAL-B028	S-13	60.0-61.5	Gray silty CLAY with sand and gravel	16.7																
BAL-B028	S-14	65.0-66.5	Gray silty CLAY, trace gravel	18.9	39	25														
BAL-B028	S-15	70.0-71.5	Gray silty CLAY, trace gravel	18.5																
BAL-B028	S-16	75.0-76.5	Gray silty CLAY, trace gravel	20.9																
BAL-B028	S-17	80.0-81.5	Gray silty CLAY, trace gravel	17.8																
BAL-B028	S-18	85.5-86.0	Gray silty CLAY, trace gravel	17.7																
BAL-B029	S-1	0.0-1.5		20.6	42	19	23	CL												
BAL-B029	S-2	2.0-4.0		31				CL	95.7	6										
BAL-B029	S-3	7.5-9.0		31.9				ML	86	7										
BAL-B029	S-4	10.0-11.5		34.1				ML	94.5	8										
BAL-B029	S-5	20.0-21.5	Gray sandy silty CLAY	22.1	32	16														
BAL-B029	S-6	25.0-26.5	Gray brown sandy silty CLAY	19.8																
BAL-B029	S-7	30.0-31.5	Gray brown sandy silty CLAY	21.9	47	22														
BAL-B029	S-8	35.0-56.5	Brown sandy CLAY with gravel	10.9																
BAL-B029	S-9	40.0-41.5	Brown sandy CLAY with gravel	26.3	56	20														
BAL-B029	S-11	50.0-51.5	Brown gray sandy silty CLAY	21.8																
BAL-C039	S-1	0.0-1.0	Brown silty CLAY, trace sand	34.0	52	26														
BAL-C039	S-2	2.0-3.0	Brown silty CLAY with organics	24.5	37	16														
BAL-C039	S-6	5.0-6.0	Brown silty CLAY with organics, trace sand and gravel	21.7																

NOTE: Laboratory tests were performed by AECOM, Conshoshocken, Pennsylvania and Terrasense, Totowa, New Jersey.

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 | BORING: BAL-B001 | Test No.: P10576

Project Name: Dynegy CCR - Baldwin | SAMPLE: ST-2A | DEPTH (ft): 35.6

Specimen - Apparatus set-up - Test Information | Cell No. E | Apparatus No. 1 | Stage No.: 5

Preliminary Length/Area Calculations

Lo =	3.991	in	Lo=	10.137	cm
dLc=	0.091	in	Ao =	41.93	cm^2
Lc=	3.900	in	Vo =	424.99	cm^3
			Lc=	9.905	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	29.07	cm^3
			Vc =	395.92	cm^3
Sc =	0.248	cm^{-1}	Ac=	39.970	cm^2

1) Specimen Tested in :	x	Triaxial Cell or		Compaction Mold or
	x	with stones or		Stones with filter paper or top + bottom
2) Specimen orientation for:	x	Vertical or		Horizontal permeability determination
3) During saturation: Water flushed up sides of specimen to remove air	x	No		Yes
4) During consolidation:	x	Top and bottom drainage or	Top	Bottom only
5) Direction of permeant :	x	Up during or		Down during permeation
6) Permeant: water used	x	Tap		Distilled
or		Demineralized		0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000757 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt   TubeC= 1.3127

Consol Stage-Trial No.	Temp. ° C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	22.5	9/4/15	09	47	00	129.9	100.0	57.00	37.70	0.88	1.40E-08
final	23.1	9/4/15	11	34	00			55.87	38.10		1.30E-08
1	RT = 0.936	dT =	107.00 min			σ'_c =	4.3 ksf	0.085	0.096	io= 24.5	-1%
initial	23.1	9/4/15	11	35	00	129.9	100.0	59.27	37.04	1.00	1.49E-08
final	23.5	9/4/15	13	29	00			57.80	37.50		1.36E-08
2	RT = 0.924	dT =	114.00 min			σ'_c =	4.3 ksf	0.110	0.110	io= 28.2	4%
initial	23.5	9/4/15	13	30	00	129.9	100.0	59.65	36.90	0.97	1.48E-08
final	23.5	9/4/15	15	19	00			58.22	37.36		1.35E-08
3	RT = 0.919	dT =	109.00 min			σ'_c =	4.3 ksf	0.107	0.110	io= 28.9	2%
initial	23.5	9/4/15	15	20	00	129.9	100.0	60.00	36.78	1.02	1.37E-08
final	23.5	9/4/15	17	38	00			58.30	37.30		1.25E-08
4	RT = 0.919	dT =	138.00 min			σ'_c =	4.3 ksf	0.127	0.125	io= 29.5	-5%
initial											
final											
5		dT =				σ'_c =					
initial											
final											
6		dT =				σ'_c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc =	9.905	cm	ε_{axial} =	2.3%
Ac =	40.425	cm^2		
Vc=	400.43	cm^3	ε_{vol} =	5.8%
Sc =	0.245	cm^{-1}	Sc = Lc / Ac , final	

	w (%)	γ_t (pcf)	γ_d (pcf)	S (%)
Initial	23.79	126.6	102.3	94.0
PreTest	21.79	132.2	108.6	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 1-4

ave K @ 20 ºC: **1.31E-08** cm/sec

(i_o)ave = 27.8

Tested By: BB   Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 BORING: BAL-B008 Test No.: P10595
Project Name: Dynegy CCR - Baldwin SAMPLE: ST-1B DEPTH (ft): 10.8

Specimen - Apparatus set-up - Test Information Cell No. C Apparatus No. 2 Stage No.: 2

Preliminary Length/Area Calculations

Lo =	3.985	in	Lo=	10.121	cm
dLc=	0.010	in	Ao =	41.87	cm^2
Lc=	3.975	in	Vo =	423.74	cm^3
			Lc=	10.095	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	3.19	cm^3
			Vc =	420.55	cm^3
Sc =	0.242	cm^{-1}	Ac=	41.657	cm^2

1) Specimen Tested in :	x	Triaxial Cell or		Compaction Mold or	
	x	with stones or		Stones with filter paper or	top + bottom
2) Specimen orientation for:	x	Vertical or		Horizontal permeability determination	
3) During saturation: Water flushed up sides of specimen to remove air	x	No		Yes	
4) During consolidation:	x	Top and bottom drainage or		Top	Bottom only
5) Direction of permeant :	x	Up during or		Down during permeation	
6) Permeant: water used	x	Tap		Distilled	
or		Demineralized		0.005 N calcium sulfate (CaSO4)	

Equations Used

Kt = - 0.0000746 * Sc/dT(min) * ln (ho/hf)
RT = (-0.02452*(ave. temp in C) + 1.495)
K @ 20 ºC = RT * Kt TubeC= 1.3214

Consol Stage-Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	22.3	10/3/15	15	11	00	105.0	100.0	58.00	43.50	1.16	6.53E-09
final	22.0	10/4/15	09	33	00			54.40	44.50		6.21E-09
6	RT = 0.952	dT =	1102.00 min			σ'_c =	0.7 ksf	0.268	0.231	io= 18.1	13%
initial	22.0	10/4/15	09	38	00	105.0	100.0	58.20	43.40	1.07	5.75E-09
final	23.6	10/4/15	14	32	00			57.20	43.70		5.38E-09
7	RT = 0.936	dT =	294.00 min			σ'_c =	0.7 ksf	0.074	0.069	io= 18.4	-2%
initial	23.6	10/4/15	14	36	00	105.0	100.0	58.15	43.50	1.61	5.39E-09
final	24.2	10/4/15	17	11	00			57.65	43.60		4.89E-09
8	RT = 0.909	dT =	155.00 min			σ'_c =	0.7 ksf	0.037	0.023	io= 18.2	-11%
initial	24.2	10/4/15	17	11	00	105.0	100.0	57.65	43.60	0.95	5.89E-09
final	22.6	10/5/15	08	49	00			54.85	44.55		5.43E-09
9	RT = 0.921	dT =	938.00 min			σ'_c =	0.7 ksf	0.208	0.220	io= 17.5	-1%
initial											
final											
10		dT =				σ'_c =					
initial											
final											
11		dT =				σ'_c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc = 10.095 cm ε_{axial} = 0.3%
Ac = 41.674 cm^2
Vc= 420.72 cm^3 ε_{vol} = 0.7%
Sc = 0.242 cm^{-1} Sc = Lc / Ac , final

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	23.07	127.5	103.6	94.9
PreTest	23.87	129.2	104.3	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 6-9
ave K @ 20 ºC: **5.48E-09** cm/sec
(i_o)ave = 18.1

Tested By: BB Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 | BORING: BAL-B010 | Test No.: P10578

Project Name: Dynegy CCR - Baldwin | SAMPLE: ST-2B | DEPTH (ft): 21.3

Specimen - Apparatus set-up - Test Information Cell No. B Apparatus No. 2 Stage No.: 4

Preliminary Length/Area Calculations

Lo =	4.006	in	Lo=	10.174	cm
dLc=	0.057	in	Ao =	42.20	cm^2
Lc=	3.949	in	Vo =	429.34	cm^3
			Lc=	10.029	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	18.33	cm^3
			Vc =	411.01	cm^3
Sc =	0.245	cm^{-1}	Ac=	40.980	cm^2

1) Specimen Tested in :	x	Triaxial Cell or		Compaction Mold or
	x	with stones or		Stones with filter paper or top + bottom
2) Specimen orientation for:	x	Vertical or		Horizontal permeability determination
3) During saturation: Water flushed up sides of specimen to remove air	x	No		Yes
4) During consolidation:	x	Top and bottom drainage or		Top / Bottom only
5) Direction of permeant :	x	Up during or		Down during permeation
6) Permeant: water used	x	Tap		Distilled
or		Demineralized		0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000746 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt TubeC= 1.3214

Consol Stage-Trial No.	Temp. ° C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	23.1	9/8/15	11	02	00	117.6	100.0	56.00	44.13	1.01	2.66E-06
final	23.1	9/8/15	11	15	00			48.37	46.55		2.44E-06
1	RT = 0.929	dT =	13.00 min			σ'c =	2.5 ksf	0.568	0.560	io= 14.9	0%
initial	23.1	9/8/15	11	16	00	117.6	100.0	56.00	44.13	0.99	2.85E-06
final	23.2	9/8/15	11	31	00			47.88	46.77		2.62E-06
2	RT = 0.927	dT =	15.00 min			σ'c =	2.5 ksf	0.604	0.611	io= 14.9	7%
initial	23.2	9/8/15	11	32	00	117.6	100.0	56.00	44.13	1.01	2.76E-06
final	23.2	9/8/15	11	40	00			49.70	46.13		2.53E-06
3	RT = 0.926	dT =	8.00 min			σ'c =	2.5 ksf	0.469	0.463	io= 14.9	4%
initial	23.2	9/8/15	11	41	00	117.6	100.0	56.00	44.13	1.01	2.38E-06
final	23.2	9/8/15	12	02	00			47.60	46.80		2.18E-06
4	RT = 0.926	dT =	21.00 min			σ'c =	2.5 ksf	0.625	0.618	io= 14.9	-11%
initial											
final											
5		dT =				σ'c =					
initial											
final											
6		dT =				σ'c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc =	10.029	cm	ε_{axial} =	1.4%	
Ac =	41.453	cm^2			
Vc=	415.75	cm^3	ε_{vol} =	3.2%	
Sc =	0.242	cm^{-1}	Sc = Lc / Ac , final		

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	22.15	124.2	101.7	88.4
PreTest	23.11	129.2	105.0	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 1-4

ave K @ 20 ºC: **2.44E-06** cm/sec

(i_o)ave = 14.9

Tested By: BB Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 | BORING: BAL-B011 | Test No.: P10594

Project Name: Dynegy CCR - Baldwin | SAMPLE: ST-1A | DEPTH (ft): 15.2

Specimen - Apparatus set-up - Test Information | Cell No. D | Apparatus No. 1 | Stage No.: 3

Preliminary Length/Area Calculations

Lo =	3.998	in	Lo=	10.155	cm
dLc=	0.017	in	Ao =	42.08	cm^2
Lc=	3.981	in	Vo =	427.34	cm^3
			Lc=	10.112	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	5.45	cm^3
			Vc =	421.89	cm^3
Sc =	0.242	cm^{-1}	Ac=	41.722	cm^2

1) Specimen Tested in :	x	Triaxial Cell or		Compaction Mold or
	x	with stones or		Stones with filter paper or top + bottom
2) Specimen orientation for:	x	Vertical or		Horizontal permeability determination
3) During saturation: Water flushed up sides of specimen to remove air	x	No		Yes
4) During consolidation:	x	Top and bottom drainage or	Top	Bottom only
5) Direction of permeant :	x	Up during or		Down during permeation
6) Permeant: water used	x	Tap		Distilled
or		Demineralized		0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000757 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt   TubeC= 1.3127

Consol Stage-Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	23.7	10/1/15	17	22	00	105.0	100.0	56.45	37.90	0.95	2.70E-09
final	21.9	10/2/15	09	04	49			54.62	38.50		2.54E-09
5	RT = 0.936	dT =	942.82 min			σ'_c =	0.7 ksf	0.137	0.144	io= 23.1	39%
initial	22.5	10/2/15	15	34	00	105.0	100.0	57.61	37.55	1.10	2.25E-09
final	22.0	10/3/15	11	47	00			55.50	38.15		2.15E-09
6	RT = 0.949	dT =	1213.00 min			σ'_c =	0.7 ksf	0.158	0.144	io= 24.9	18%
initial	22.0	10/3/15	12	05	00	105.0	100.0	57.00	37.75	1.09	1.43E-09
final	22.0	10/4/15	09	35	00			55.60	38.15		1.37E-09
7	RT = 0.956	dT =	1290.00 min			σ'_c =	0.7 ksf	0.105	0.096	io= 23.9	-25%
initial	22.0	10/4/15	09	40	00	105.0	100.0	56.30	37.95	1.02	1.28E-09
final	22.2	10/5/15	08	54	00			55.00	38.35		1.23E-09
8	RT = 0.953	dT =	1394.00 min			σ'_c =	0.7 ksf	0.097	0.096	io= 22.8	-32%
initial											
final											
9		dT =				σ'_c =					
initial											
final											
10		dT =				σ'_c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc =	10.112	cm	ε_{axial} =	0.4%
Ac =	41.467	cm^2		
Vc=	419.30	cm^3	ε_{vol} =	1.9%
Sc =	0.244	cm^{-1}	Sc = Lc / Ac , final	

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	25.83	123.3	98.0	94.5
PreTest	26.15	126.0	99.9	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 5-8

ave K @ 20 ºC: **1.82E-09** cm/sec

(i_o)ave = 23.7

Tested By: BB   Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE

ASTM D 5084 - Method F

Project No.: T60440739 | Boring: BAL-B017 | Test No.: T3922

Project Name: Dynegy CCR - Baldwin | Sample: ST-2B | Depth: 26.7

Specimen - Apparatus set-up - Test Information | Cell No. H-6 | Apparatus No. 1 | Stage No.: 3

Preliminary Length/Area Calculations

Lo =	5.975	in	Lo=	15.178	cm
dLc=	0.064	in	Ao =	41.79	cm^2
Lc=	5.911	in	Vo =	634.27	cm^3
			Lc=	15.015	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	20.38	cm^3
			Vc =	613.89	cm^3
Sc =	0.367	cm^{-1}	Ac=	40.885	cm^2

1) Specimen Tested in : [x] Triaxial Cell or [ ] Compaction Mold or

[x] with stones or [ ] Stones with filter paper or ______ top + bottom

2) Specimen orientation for: [x] Vertical or [ ] Horizontal permeability determination

3) During saturation: Water flushed up sides of specimen to remove air [x] No [ ] Yes

4) During consolidation: [x] Top and bottom drainage or [ ] Top [ ] Bottom only

5) Direction of permeant : [x] Up during or [ ] Down during permeation

6) Permeant: water used [x] Tap [ ] Distilled

or [ ] [ ] Demineralized [ ] 0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000757 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt TubeC= 1.3127

Consol Stage-Trial No.	Temp. ° C	Date	Time hr	Time min	Time sec	Initial σ_c psi	Initial Ub psi	U-tube Reading Head (cm) (cc)	U-tube Reading Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	22.5	10/13/15	09	21	00	116.7	100.0	61.98	36.20	0.99	2.38E-08
final	22.5	10/13/15	13	38	00			58.10	37.42		2.21E-08
1	RT = 0.943	dT =	257.00 min			σ'_c =	2.4 ksf	0.291	0.292	io= 21.6	30%
initial	22.5	10/13/15	13	40	00	116.7	100.0	61.78	36.30	1.05	2.05E-08
final	22.9	10/13/15	18	03	00			58.35	37.32		1.90E-08
2	RT = 0.939	dT =	263.00 min			σ'_c =	2.4 ksf	0.257	0.244	io= 21.3	11%
initial	22.9	10/13/15	18	12	00	116.7	100.0	61.48	36.35	1.00	1.74E-08
final	22.4	10/14/15	09	00	00			53.30	38.91		1.61E-08
3	RT = 0.940	dT =	888.00 min			σ'_c =	2.4 ksf	0.613	0.613	io= 21.0	-5%
initial	22.4	10/14/15	09	02	00	116.7	100.0	61.55	36.35	0.97	1.74E-08
final	24.0	10/14/15	12	31	00			59.20	37.11		1.58E-08
4	RT = 0.926	dT =	209.00 min			σ'_c =	2.4 ksf	0.176	0.182	io= 21.1	-7%
initial	24.0	10/14/15	12	37	00	116.7	100.0	62.20	36.18	1.07	1.90E-08
final	22.9	10/14/15	15	37	00			59.90	36.85		1.72E-08
5	RT = 0.920	dT =	180.00 min			σ'_c =	2.4 ksf	0.172	0.161	io= 21.8	1%
initial											
final											
6		dT =				σ'_c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc = 15.015 cm ε_{axial} = 1.1%

Ac = 41.570 cm^2

Vc= 624.17 cm^3 ε_{vol} = 1.6%

Sc = 0.361 cm^{-1} Sc = Lc / Ac , final

	w (%)	γ_t (pcf)	γ_d (pcf)	S (%)
Initial	23.51	124.5	100.8	95.4
PreTest	23.66	126.6	102.4	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 2-5

ave K @ 20 ºC: **1.70E-08** cm/sec

(i_o)ave = 21.3

Tested By: BB Reviewed By: GET

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 BORING: BAL-B027 Test No.: P10596

Project Name: Dynegy CCR - Baldwin SAMPLE: ST-1D DEPTH (ft): 26.9

Specimen - Apparatus set-up - Test Information Cell No. B Apparatus No. 3 Stage No.: 4

Preliminary Length/Area Calculations

Lo =	3.986	in	Lo=	10.125	cm
dLc=	0.018	in	Ao =	41.55	cm^2
Lc=	3.968	in	Vo =	420.72	cm^3
			Lc=	10.079	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	5.70	cm^3
			Vc =	415.02	cm^3
Sc =	0.245	cm^{-1}	Ac=	41.176	cm^2

1) Specimen Tested in : [x] Triaxial Cell or [ ] Compaction Mold or
[x] with stones or [ ] Stones with filter paper or top + bottom
2) Specimen orientation for: [x] Vertical or [ ] Horizontal permeability determination
3) During saturation: Water flushed up sides of specimen to remove air [x] No [ ] Yes
4) During consolidation: [x] Top and bottom drainage or [ ] Top [ ] Bottom only
5) Direction of permeant : [x] Up during or [ ] Down during permeation
6) Permeant: water used [x] Tap [ ] Distilled
or [ ] [ ] Demineralized [ ] 0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000755 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt TubeC= 1.3132

Consol Stage- Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	22.9	10/5/15	11	34	00	121.5	100.0	65.60	46.90	1.05	9.40E-09
final	22.7	10/5/15	16	07	27			63.75	47.45		8.86E-09
1	RT = 0.936	dT =	273.45 min			σ'_c =	3.1 ksf	0.138	0.131	io= 23.3	79%
initial	22.7	10/5/15	16	43	00	121.5	100.0	65.65	46.85	0.27	7.28E-09
final	23.5	10/5/15	18	22	26			65.10	47.50		6.81E-09
2	RT = 0.929	dT =	99.43 min			σ'_c =	3.1 ksf	0.041	0.155	io= 23.4	37%
initial	23.5	10/5/15	18	24	00	121.5	100.0	66.40	46.65	1.01	5.93E-09
final	22.2	10/6/15	09	03	00			62.70	47.80		5.59E-09
3	RT = 0.935	dT =	879.00 min			σ'_c =	3.1 ksf	0.277	0.274	io= 24.6	13%
initial	22.2	10/6/15	09	07	00	121.5	100.0	65.85	46.80	1.01	5.07E-09
final	22.5	10/7/15	08	41	12			61.18	48.25		4.84E-09
4	RT = 0.947	dT =	1414.20 min			σ'_c =	3.1 ksf	0.349	0.346	io= 23.8	-2%
initial	22.6	10/7/15	08	57	00	121.5	100.0	65.58	46.85	1.04	5.18E-09
final	22.8	10/7/15	17	04	00			63.76	47.40		4.90E-09
5	RT = 0.938	dT =	487.00 min			σ'_c =	3.1 ksf	0.136	0.131	io= 23.4	-1%
initial	22.8	10/7/15	17	04	00	121.5	100.0	63.76	47.40	0.94	4.76E-09
final	22.8	10/8/15	09	16	00			61.00	48.32		4.49E-09
6	RT = 0.936	dT =	972.00 min			σ'_c =	3.1 ksf	0.206	0.220	io= 20.4	-9%

TEST SUMMARY

Final Specimen and Test Conditions

Lc = 10.079 cm ε_{axial} = 0.5%

Ac = 40.862 cm^2

Vc= 411.86 cm^3 ε_{vol} = 2.1%

Sc = 0.247 cm^{-1} Sc = Lc / Ac , final

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	21.16	127.7	105.4	90.0
PreTest	22.27	131.6	107.7	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 3-6

ave K @ 20 ºC: **4.95E-09** cm/sec

(i_o)ave = 23.0

Tested By: BB Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 BORING: BAL-B001 Test No.: P10576

Project Name: Dynegy CCR - Baldwin SAMPLE: ST-2A DEPTH (ft): 35.6

Specimen - Apparatus set-up - Test Information Cell No. E Apparatus No. 1 Stage No.: 5

Preliminary Length/Area Calculations

Lo =	3.991	in	Lo=	10.137	cm
dLc=	0.091	in	Ao =	41.93	cm^2
Lc=	3.900	in	Vo =	424.99	cm^3
			Lc=	9.905	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	29.07	cm^3
			Vc =	395.92	cm^3
Sc =	0.248	cm^{-1}	Ac=	39.970	cm^2

1) Specimen Tested in :	x	Triaxial Cell or		Compaction Mold or	
	x	with stones or		Stones with filter paper or	top + bottom
2) Specimen orientation for:	x	Vertical or		Horizontal permeability determination	
3) During saturation: Water flushed up sides of specimen to remove air	x	No		Yes	
4) During consolidation:	x	Top and bottom drainage or		Top	Bottom only
5) Direction of permeant :	x	Up during or		Down during permeation	
6) Permeant: water used	x	Tap		Distilled	
or		Demineralized		0.005 N calcium sulfate (CaSO4)	

Equations Used

Kt = - 0.0000757 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt TubeC= 1.3127

Consol Stage-Trial No.	Temp. ° C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	22.5	9/4/15	09	47	00	129.9	100.0	57.00	37.70	0.88	1.40E-08
final	23.1	9/4/15	11	34	00			55.87	38.10		1.30E-08
1	RT = 0.936	dT =	107.00 min			σ'_c =	4.3 ksf	0.085	0.096	io= 24.5	-1%
initial	23.1	9/4/15	11	35	00	129.9	100.0	59.27	37.04	1.00	1.49E-08
final	23.5	9/4/15	13	29	00			57.80	37.50		1.36E-08
2	RT = 0.924	dT =	114.00 min			σ'_c =	4.3 ksf	0.110	0.110	io= 28.2	4%
initial	23.5	9/4/15	13	30	00	129.9	100.0	59.65	36.90	0.97	1.48E-08
final	23.5	9/4/15	15	19	00			58.22	37.36		1.35E-08
3	RT = 0.919	dT =	109.00 min			σ'_c =	4.3 ksf	0.107	0.110	io= 28.9	2%
initial	23.5	9/4/15	15	20	00	129.9	100.0	60.00	36.78	1.02	1.37E-08
final	23.5	9/4/15	17	38	00			58.30	37.30		1.25E-08
4	RT = 0.919	dT =	138.00 min			σ'_c =	4.3 ksf	0.127	0.125	io= 29.5	-5%
initial											
final											
5		dT =				σ'_c =					
initial											
final											
6		dT =				σ'_c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc =	9.905	cm	ε_{axial} =	2.3%	
Ac =	40.425	cm^2			
Vc=	400.43	cm^3	ε_{vol} =	5.8%	
Sc =	0.245	cm^{-1}	Sc = Lc / Ac , final		

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	23.79	126.6	102.3	94.0
PreTest	21.79	132.2	108.6	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 1-4

ave K @ 20 ºC: **1.31E-08** cm/sec

(i_o)ave = 27.8

Tested By: BB Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 | BORING: BAL-B008 | Test No.: P10595

Project Name: Dynegy CCR - Baldwin | SAMPLE: ST-1B | DEPTH (ft): 10.8

Specimen - Apparatus set-up - Test Information | Cell No. C | Apparatus No. 2 | Stage No.: 2

Preliminary Length/Area Calculations

Lo =	3.985	in	Lo=	10.121	cm
dLc=	0.010	in	Ao =	41.87	cm^2
Lc=	3.975	in	Vo =	423.74	cm^3
			Lc=	10.095	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	3.19	cm^3
			Vc =	420.55	cm^3
Sc =	0.242	cm^{-1}	Ac=	41.657	cm^2

1) Specimen Tested in :	x	Triaxial Cell or		Compaction Mold or		
	x	with stones or		Stones with filter paper or		top + bottom
2) Specimen orientation for:	x	Vertical or		Horizontal permeability determination		
3) During saturation: Water flushed up sides of specimen to remove air	x	No		Yes		
4) During consolidation:	x	Top and bottom drainage or		Top		Bottom only
5) Direction of permeant :	x	Up during or		Down during permeation		
6) Permeant: water used	x	Tap		Distilled		
or		Demineralized		0.005 N calcium sulfate (CaSO4)		

Equations Used

Kt = - 0.0000746 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt   TubeC= 1.3214

Consol Stage-Trial No.	Temp. ° C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	22.3	10/3/15	15	11	00	105.0	100.0	58.00	43.50	1.16	6.53E-09
final	22.0	10/4/15	09	33	00			54.40	44.50		6.21E-09
6	RT = 0.952	dT =	1102.00 min			σ'_c =	0.7 ksf	0.268	0.231	io= 18.1	13%
initial	22.0	10/4/15	09	38	00	105.0	100.0	58.20	43.40	1.07	5.75E-09
final	23.6	10/4/15	14	32	00			57.20	43.70		5.38E-09
7	RT = 0.936	dT =	294.00 min			σ'_c =	0.7 ksf	0.074	0.069	io= 18.4	-2%
initial	23.6	10/4/15	14	36	00	105.0	100.0	58.15	43.50	1.61	5.39E-09
final	24.2	10/4/15	17	11	00			57.65	43.60		4.89E-09
8	RT = 0.909	dT =	155.00 min			σ'_c =	0.7 ksf	0.037	0.023	io= 18.2	-11%
initial	24.2	10/4/15	17	11	00	105.0	100.0	57.65	43.60	0.95	5.89E-09
final	22.6	10/5/15	08	49	00			54.85	44.55		5.43E-09
9	RT = 0.921	dT =	938.00 min			σ'_c =	0.7 ksf	0.208	0.220	io= 17.5	-1%
initial											
final											
10		dT =				σ'_c =					
initial											
final											
11		dT =				σ'_c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc =	10.095	cm	ε_{axial} =	0.3%	
Ac =	41.674	cm^2			
Vc=	420.72	cm^3	ε_{vol} =	0.7%	
Sc =	0.242	cm^{-1}	Sc = Lc / Ac , final		

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	23.07	127.5	103.6	94.9
PreTest	23.87	129.2	104.3	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 6-9

ave K @ 20 ºC: **5.48E-09** cm/sec

(i_o)ave = 18.1

Tested By: BB   Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 BORING: BAL-B010 Test No.: P10578
Project Name: Dynegy CCR - Baldwin SAMPLE: ST-2B DEPTH (ft): 21.3

Specimen - Apparatus set-up - Test Information Cell No. B Apparatus No. 2 Stage No.: 4

Preliminary Length/Area Calculations

Lo =	4.006	in	Lo=	10.174	cm
dLc=	0.057	in	Ao =	42.20	cm^2
Lc=	3.949	in	Vo =	429.34	cm^3
			Lc=	10.029	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	18.33	cm^3
			Vc =	411.01	cm^3
Sc =	0.245	cm^{-1}	Ac=	40.980	cm^2

1) Specimen Tested in : [x] Triaxial Cell or [ ] Compaction Mold or
[x] with stones or [ ] Stones with filter paper or ______ top + bottom
2) Specimen orientation for: [x] Vertical or [ ] Horizontal permeability determination
3) During saturation: Water flushed up sides of specimen to remove air [x] No [ ] Yes
4) During consolidation: [x] Top and bottom drainage or [ ] Top [ ] Bottom only
5) Direction of permeant : [x] Up during or [ ] Down during permeation
6) Permeant: water used [x] Tap [ ] Distilled
or [ ] [ ] Demineralized [ ] 0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000746 * Sc/dT(min) * ln (ho/hf)
RT = (-0.02452*(ave. temp in C) + 1.495)
K @ 20 ºC = RT * Kt TubeC= 1.3214

Consol Stage-Trial No.	Temp. º C	Date	Time hr	Time min	Time sec	Initial σ_c psi	Initial Ub psi	U-tube Reading Head (cm) (cc)	U-tube Reading Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	23.1	9/8/15	11	02	00	117.6	100.0	56.00	44.13	1.01	2.66E-06
final	23.1	9/8/15	11	15	00			48.37	46.55		2.44E-06
1	RT = 0.929	dT =	13.00 min			σ'_c =	2.5 ksf	0.568	0.560	io= 14.9	0%
initial	23.1	9/8/15	11	16	00	117.6	100.0	56.00	44.13	0.99	2.85E-06
final	23.2	9/8/15	11	31	00			47.88	46.77		2.62E-06
2	RT = 0.927	dT =	15.00 min			σ'_c =	2.5 ksf	0.604	0.611	io= 14.9	7%
initial	23.2	9/8/15	11	32	00	117.6	100.0	56.00	44.13	1.01	2.76E-06
final	23.2	9/8/15	11	40	00			49.70	46.13		2.53E-06
3	RT = 0.926	dT =	8.00 min			σ'_c =	2.5 ksf	0.469	0.463	io= 14.9	4%
initial	23.2	9/8/15	11	41	00	117.6	100.0	56.00	44.13	1.01	2.38E-06
final	23.2	9/8/15	12	02	00			47.60	46.80		2.18E-06
4	RT = 0.926	dT =	21.00 min			σ'_c =	2.5 ksf	0.625	0.618	io= 14.9	-11%
initial											
final											
5		dT =				σ'_c =					
initial											
final											
6		dT =				σ'_c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc = 10.029 cm ε_{axial} = 1.4%
Ac = 41.453 cm^2
Vc= 415.75 cm^3 ε_{vol} = 3.2%
Sc = 0.242 cm^{-1} Sc = Lc / Ac , final

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	22.15	124.2	101.7	88.4
PreTest	23.11	129.2	105.0	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 1-4
ave K @ 20 ºC: **2.44E-06** cm/sec
(i_o)ave = 14.9

Tested By: BB Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 | BORING: BAL-B011 | Test No.: P10594

Project Name: Dynegy CCR - Baldwin | SAMPLE: ST-1A | DEPTH (ft): 15.2

Specimen - Apparatus set-up - Test Information | Cell No. D | Apparatus No. 1 | Stage No.: 3

Preliminary Length/Area Calculations

Lo =	3.998	in	Lo=	10.155	cm
dLc=	0.017	in	Ao =	42.08	cm^2
Lc=	3.981	in	Vo =	427.34	cm^3
			Lc=	10.112	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	5.45	cm^3
			Vc =	421.89	cm^3
Sc =	0.242	cm^{-1}	Ac=	41.722	cm^2

1) Specimen Tested in : [x] Triaxial Cell or [ ] Compaction Mold or
[x] with stones or [ ] Stones with filter paper or top + bottom

2) Specimen orientation for: [x] Vertical or [ ] Horizontal permeability determination

3) During saturation: Water flushed up sides of specimen to remove air [x] No [ ] Yes

4) During consolidation: [x] Top and bottom drainage or [ ] Top [ ] Bottom only

5) Direction of permeant : [x] Up during or [ ] Down during permeation

6) Permeant: water used [x] Tap [ ] Distilled

or [ ] [ ] Demineralized [ ] 0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000757 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt   TubeC= 1.3127

Consol Stage-Trial No.	Temp. º C	Date	Time hr	Time min	Time sec	Initial σ_c psi	Initial Ub psi	U-tube Reading Head (cm) (cc)	U-tube Reading Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	23.7	10/1/15	17	22	00	105.0	100.0	56.45	37.90	0.95	2.70E-09
final	21.9	10/2/15	09	04	49			54.62	38.50		2.54E-09
5	RT = 0.936	dT =	942.82 min			σ'_c =	0.7 ksf	0.137	0.144	io= 23.1	39%
initial	22.5	10/2/15	15	34	00	105.0	100.0	57.61	37.55	1.10	2.25E-09
final	22.0	10/3/15	11	47	00			55.50	38.15		2.15E-09
6	RT = 0.949	dT =	1213.00 min			σ'_c =	0.7 ksf	0.158	0.144	io= 24.9	18%
initial	22.0	10/3/15	12	05	00	105.0	100.0	57.00	37.75	1.09	1.43E-09
final	22.0	10/4/15	09	35	00			55.60	38.15		1.37E-09
7	RT = 0.956	dT =	1290.00 min			σ'_c =	0.7 ksf	0.105	0.096	io= 23.9	-25%
initial	22.0	10/4/15	09	40	00	105.0	100.0	56.30	37.95	1.02	1.28E-09
final	22.2	10/5/15	08	54	00			55.00	38.35		1.23E-09
8	RT = 0.953	dT =	1394.00 min			σ'_c =	0.7 ksf	0.097	0.096	io= 22.8	-32%
initial											
final											
9		dT =				σ'_c =					
initial											
final											
10		dT =				σ'_c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc =	10.112 cm	ε_{axial} =	0.4%	
Ac =	41.467 cm^2			
Vc=	419.30 cm^3	ε_{vol} =	1.9%	
Sc =	0.244 cm^{-1}	Sc = Lc / Ac , final		

	w (%)	γ_t (pcf)	γ_d (pcf)	S (%)
Initial	25.83	123.3	98.0	94.5
PreTest	26.15	126.0	99.9	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 5-8

ave K @ 20 ºC: **1.82E-09** cm/sec

(i_o)ave = 23.7

Tested By: BB   Reviewed By: G. Thomas

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60440739 | Boring: BAL-B017 | Test No.: T3922

Project Name: Dynegy CCR - Baldwin | Sample: ST-2B | Depth: 26.7

Specimen - Apparatus set-up - Test Information | Cell No. H-6 | Apparatus No. 1 | Stage No.: 3

Preliminary Length/Area Calculations

Lo =	5.975	in	Lo=	15.178	cm
dLc=	0.064	in	Ao =	41.79	cm^2
Lc=	5.911	in	Vo =	634.27	cm^3
			Lc=	15.015	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	20.38	cm^3
			Vc =	613.89	cm^3
Sc =	0.367	cm^{-1}	Ac=	40.885	cm^2

1) Specimen Tested in : [x] Triaxial Cell or [ ] Compaction Mold or
[x] with stones or [ ] Stones with filter paper or top + bottom

2) Specimen orientation for: [x] Vertical or [ ] Horizontal permeability determination

3) During saturation: Water flushed up sides of specimen to remove air [x] No [ ] Yes

4) During consolidation: [x] Top and bottom drainage or [ ] Top [ ] Bottom only

5) Direction of permeant : [x] Up during or [ ] Down during permeation

6) Permeant: water used [x] Tap [ ] Distilled
or [ ] [ ] Demineralized [ ] 0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000757 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt TubeC= 1.3127

Consol Stage-Trial No.	Temp. ° C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	22.5	10/13/15	09	21	00	116.7	100.0	61.98	36.20	0.99	2.38E-08
final	22.5	10/13/15	13	38	00			58.10	37.42		2.21E-08
1	RT = 0.943	dT =	257.00 min			σ'_c =	2.4 ksf	0.291	0.292	io= 21.6	30%
initial	22.5	10/13/15	13	40	00	116.7	100.0	61.78	36.30	1.05	2.05E-08
final	22.9	10/13/15	18	03	00			58.35	37.32		1.90E-08
2	RT = 0.939	dT =	263.00 min			σ'_c =	2.4 ksf	0.257	0.244	io= 21.3	11%
initial	22.9	10/13/15	18	12	00	116.7	100.0	61.48	36.35	1.00	1.74E-08
final	22.4	10/14/15	09	00	00			53.30	38.91		1.61E-08
3	RT = 0.940	dT =	888.00 min			σ'_c =	2.4 ksf	0.613	0.613	io= 21.0	-5%
initial	22.4	10/14/15	09	02	00	116.7	100.0	61.55	36.35	0.97	1.74E-08
final	24.0	10/14/15	12	31	00			59.20	37.11		1.58E-08
4	RT = 0.926	dT =	209.00 min			σ'_c =	2.4 ksf	0.176	0.182	io= 21.1	-7%
initial	24.0	10/14/15	12	37	00	116.7	100.0	62.20	36.18	1.07	1.90E-08
final	22.9	10/14/15	15	37	00			59.90	36.85		1.72E-08
5	RT = 0.920	dT =	180.00 min			σ'_c =	2.4 ksf	0.172	0.161	io= 21.8	1%
initial											
final											
6		dT =				σ'_c =					

TEST SUMMARY

Final Specimen and Test Conditions

Lc = 15.015 cm ε_{axial} = 1.1%

Ac = 41.570 cm^2

Vc= 624.17 cm^3 ε_{vol} = 1.6%

Sc = 0.361 cm^{-1} Sc = Lc / Ac , final

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	23.51	124.5	100.8	95.4
PreTest	23.66	126.6	102.4	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

Averages for trials: 2-5

ave K @ 20 ºC: **1.70E-08** cm/sec

(i_o)ave = 21.3

Tested By: BB Reviewed By: GET

PERMEABILITY TEST: FALLING HEAD - CONSTANT VOLUME U-TUBE
ASTM D 5084 - Method F

Project No.: T60428794 | BORING: BAL-B027 | Test No.: P10596

Project Name: Dynegy CCR - Baldwin | SAMPLE: ST-1D | DEPTH (ft): 26.9

Specimen - Apparatus set-up - Test Information | Cell No. B | Apparatus No. 3 | Stage No.: 4

Preliminary Length/Area Calculations

Lo =	3.986	in	Lo=	10.125	cm
dLc=	0.018	in	Ao =	41.55	cm^2
Lc=	3.968	in	Vo =	420.72	cm^3
			Lc=	10.079	cm
dVc = 3 Vo * (dLc/Lo)			dVc=	5.70	cm^3
			Vc =	415.02	cm^3
Sc =	0.245	cm^{-1}	Ac=	41.176	cm^2

1) Specimen Tested in :	x	Triaxial Cell or		Compaction Mold or
	x	with stones or		Stones with filter paper or top + bottom
2) Specimen orientation for:	x	Vertical or		Horizontal permeability determination
3) During saturation: Water flushed up sides of specimen to remove air	x	No		Yes
4) During consolidation:	x	Top and bottom drainage or		Top / Bottom only
5) Direction of permeant :	x	Up during or		Down during permeation
6) Permeant: water used	x	Tap		Distilled
or		Demineralized		0.005 N calcium sulfate (CaSO4)

Equations Used

Kt = - 0.0000755 * Sc/dT(min) * ln (ho/hf)

RT = (-0.02452*(ave. temp in C) + 1.495)

K @ 20 ºC = RT * Kt   TubeC= 1.3132

Consol Stage- Trial No.	Temp. º C	Date	Time hr	min	sec	Initial σ_c psi	Ub psi	U-tube Reading Head (cm) (cc)	Tail (cm) (cc)	Flow in/out gradient	Permeability Preliminary Final at 20ºC cm/sec Dev. from Ave.
initial	22.9	10/5/15	11	34	00	121.5	100.0	65.60	46.90	1.05	9.40E-09
final	22.7	10/5/15	16	07	27			63.75	47.45		8.86E-09
1	RT = 0.936	dT =	273.45 min			σ'_c =	3.1 ksf	0.138	0.131	io= 23.3	79%
initial	22.7	10/5/15	16	43	00	121.5	100.0	65.65	46.85	0.27	7.28E-09
final	23.5	10/5/15	18	22	26			65.10	47.50		6.81E-09
2	RT = 0.929	dT =	99.43 min			σ'_c =	3.1 ksf	0.041	0.155	io= 23.4	37%
initial	23.5	10/5/15	18	24	00	121.5	100.0	66.40	46.65	1.01	5.93E-09
final	22.2	10/6/15	09	03	00			62.70	47.80		5.59E-09
3	RT = 0.935	dT =	879.00 min			σ'_c =	3.1 ksf	0.277	0.274	io= 24.6	13%
initial	22.2	10/6/15	09	07	00	121.5	100.0	65.85	46.80	1.01	5.07E-09
final	22.5	10/7/15	08	41	12			61.18	48.25		4.84E-09
4	RT = 0.947	dT =	1414.20 min			σ'_c =	3.1 ksf	0.349	0.346	io= 23.8	-2%
initial	22.6	10/7/15	08	57	00	121.5	100.0	65.58	46.85	1.04	5.18E-09
final	22.8	10/7/15	17	04	00			63.76	47.40		4.90E-09
5	RT = 0.938	dT =	487.00 min			σ'_c =	3.1 ksf	0.136	0.131	io= 23.4	-1%
initial	22.8	10/7/15	17	04	00	121.5	100.0	63.76	47.40	0.94	4.76E-09
final	22.8	10/8/15	09	16	00			61.00	48.32		4.49E-09
6	RT = 0.936	dT =	972.00 min			σ'_c =	3.1 ksf	0.206	0.220	io= 20.4	-9%

TEST SUMMARY

Final Specimen and Test Conditions

Lc =	10.079	cm	ε_{axial} =	0.5%
Ac =	40.862	cm^2		
Vc=	411.86	cm^3	ε_{vol} =	2.1%
Sc =	0.247	cm^{-1}	Sc = Lc / Ac , final	

	w (%)	γ_τ (pcf)	γ_d (pcf)	S (%)
Initial	21.16	127.7	105.4	90.0
PreTest	22.27	131.6	107.7	100.0

HYDRAULIC CONDUCTIVITY SUMMARY

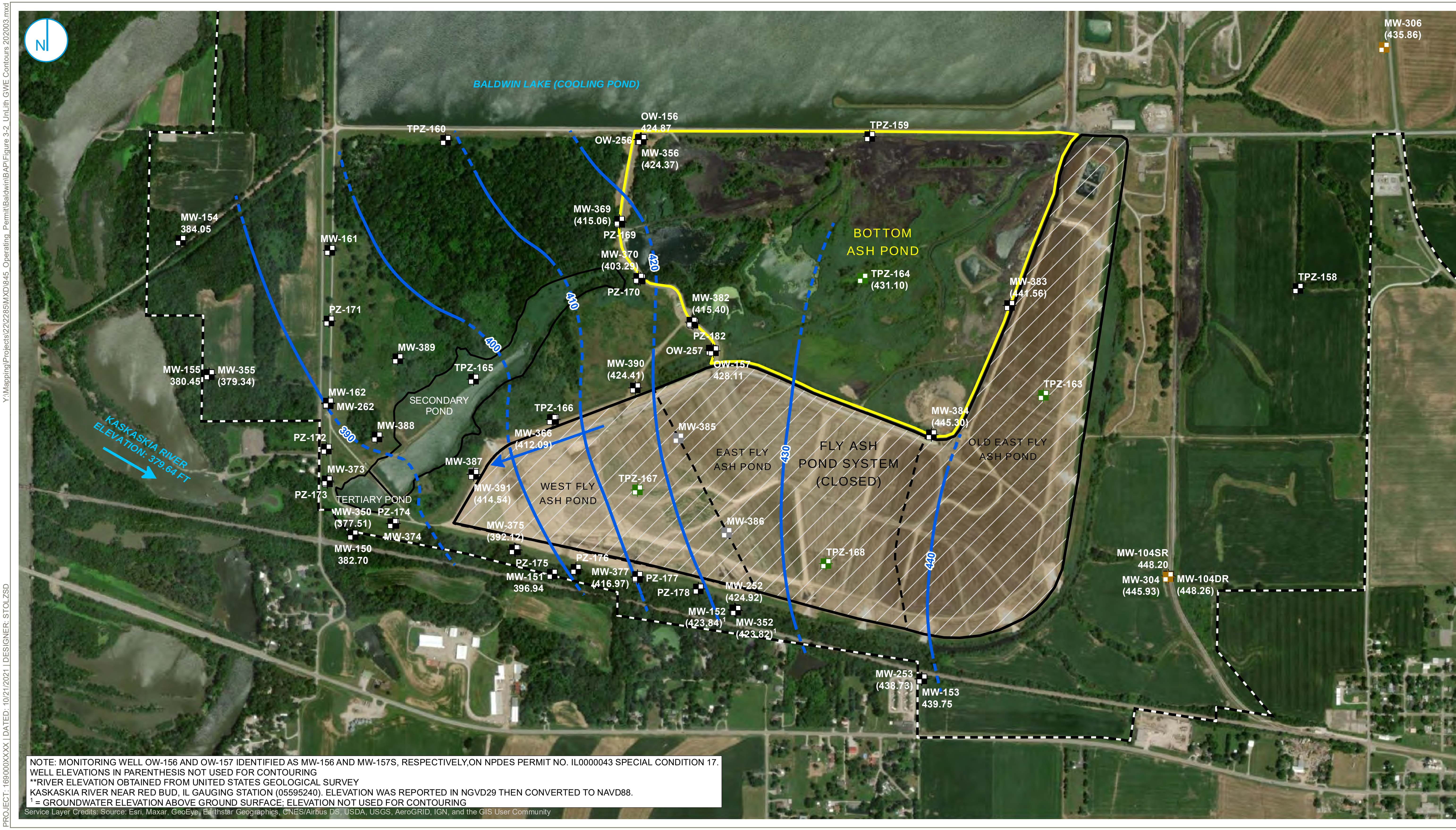
Averages for trials: 3-6

ave K @ 20 ºC: **4.95E-09** cm/sec

(i_o)ave = 23.0

Tested By: BB   Reviewed By: G. Thomas

APPENDIX E
2021 HCR CONTOUR MAPS



BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
ABANDONED MONITORING WELL
GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
PART 845 REGULATED UNIT (SUBJECT UNIT)
FLY ASH POND SYSTEM (CLOSED)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

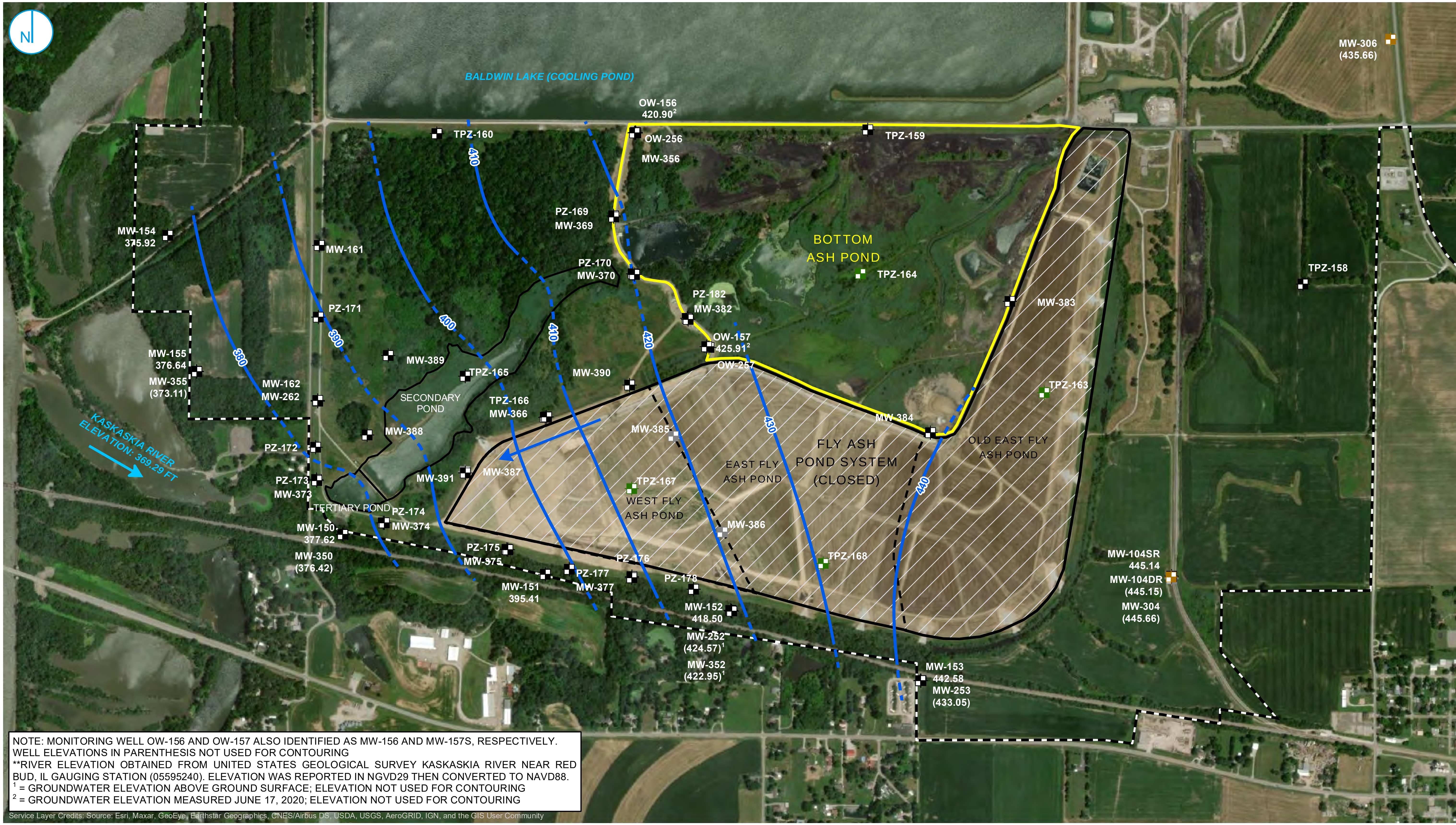
0 400 800 Feet

SHALLOW UNLITHIFIED GROUNDWATER ELEVATION CONTOURS
MARCH 24, 2020

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 3-2

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.



NOTE: MONITORING WELL OW-156 AND OW-157 ALSO IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY.
WELL ELEVATIONS IN PARENTHESIS NOT USED FOR CONTOURING
**RIVER ELEVATION OBTAINED FROM UNITED STATES GEOLOGICAL SURVEY KASKASKIA RIVER NEAR RED BUD, IL GAUGING STATION (05595240). ELEVATION WAS REPORTED IN NGVD29 THEN CONVERTED TO NAVD88.
1 = GROUNDWATER ELEVATION ABOVE GROUND SURFACE; ELEVATION NOT USED FOR CONTOURING
2 = GROUNDWATER ELEVATION MEASURED JUNE 17, 2020; ELEVATION NOT USED FOR CONTOURING

BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
ABANDONED MONITORING WELL

GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION

PART 845 REGULATED UNIT (SUBJECT UNIT)
FLY ASH POND SYSTEM (CLOSED)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

0 400 800 Feet

SHALLOW UNLITHIFIED GROUNDWATER ELEVATION CONTOURS
JUNE 23, 2020

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 3-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
WELL ELEVATIONS IN PARENTHESIS NOT USED FOR CONTOURING
**RIVER ELEVATION OBTAINED FROM UNITED STATES GEOLOGICAL SURVEY
KASKASKIA RIVER NEAR RED BUD, IL GAUGING STATION (05595240). ELEVATION WAS REPORTED IN NGVD29 THEN CONVERTED TO NAVD88.
[1] = GROUNDWATER ELEVATION ABOVE GROUND SURFACE; ELEVATION NOT USED FOR CONTOURING

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\Figure 3-4_UnLith GWE Contours 202009.mxd
PROJECT: 169000XXXX | DATED: 10/21/2021 | DESIGNER: STOLZSD

- BACKGROUND WELL
- MONITORING WELL
- SOURCE SAMPLE LOCATION
- ABANDONED MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD 88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- PART 845 REGULATED UNIT (SUBJECT UNIT)
- SITE FEATURE
- FLY ASH POND SYSTEM (CLOSED)
- LIMITS OF FINAL COVER
- PROPERTY BOUNDARY

0 400 800 Feet

SHALLOW UNLITHIFIED GROUNDWATER ELEVATION CONTOURS
SEPTEMBER 15, 2020

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 3-4

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
WELL ELEVATIONS IN PARENTHESIS NOT USED FOR CONTOURING
**RIVER ELEVATION OBTAINED FROM UNITED STATES GEOLOGICAL SURVEY
KASKASKIA RIVER NEAR RED BUD, IL GAUGING STATION (05595240). ELEVATION WAS REPORTED IN NGVD29 THEN CONVERTED TO NAVD88.
[1] = GROUNDWATER ELEVATION ABOVE GROUND SURFACE; ELEVATION NOT USED FOR CONTOURING

- BACKGROUND WELL
- MONITORING WELL
- SOURCE SAMPLE LOCATION
- ABANDONED MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD 88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- PART 845 REGULATED UNIT (SUBJECT UNIT)
- SITE FEATURE
- FLY ASH POND SYSTEM (CLOSED)
- LIMITS OF FINAL COVER
- PROPERTY BOUNDARY

0 400 800 Feet

SHALLOW UNLITHIFIED GROUNDWATER ELEVATION CONTOURS
DECEMBER 16-17, 2020

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

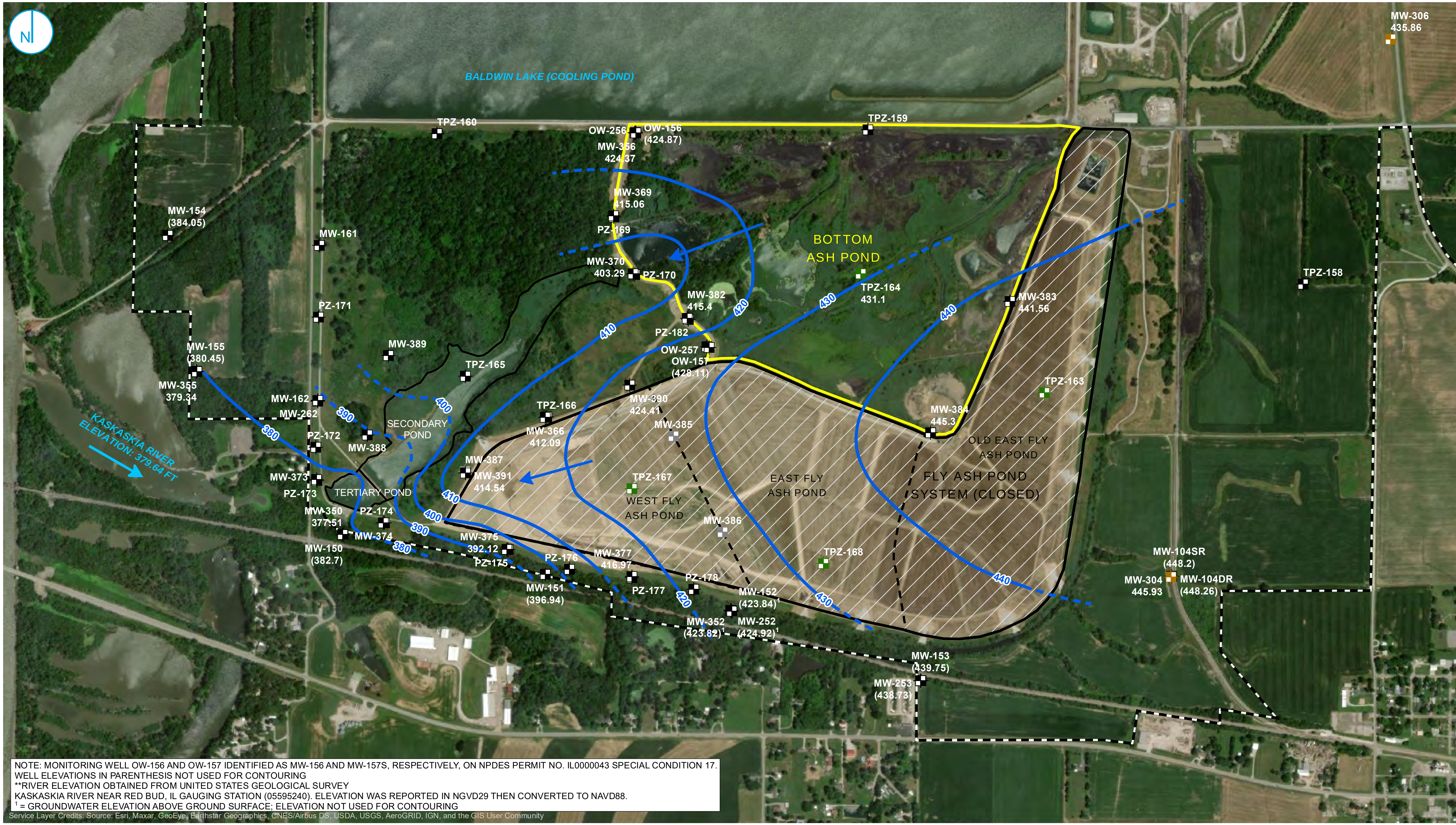
FIGURE 3-5

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\Figure 3-5_UnLith GWE Contours 202012.mxd

PROJECT: 169000XXXX | DATED: 10/21/2021 | DESIGNER: STOLZSD



NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
WELL ELEVATIONS IN PARENTHESIS NOT USED FOR CONTOURING
**RIVER ELEVATION OBTAINED FROM UNITED STATES GEOLOGICAL SURVEY
KASKASKIA RIVER NEAR RED BUD, IL GAUGING STATION (05595240). ELEVATION WAS REPORTED IN NGVD29 THEN CONVERTED TO NAVD88.
[1] = GROUNDWATER ELEVATION ABOVE GROUND SURFACE; ELEVATION NOT USED FOR CONTOURING

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\BaldwinBAP\Figure 3-6_Bedrock GWE Contours 202003.mxd

PROJECT: 169000XXXX | DATED: 10/21/2021 | DESIGNER: STOLZSD

BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
ABANDONED MONITORING WELL

GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION

PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
FLY ASH POND SYSTEM
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

0 400 800 Feet

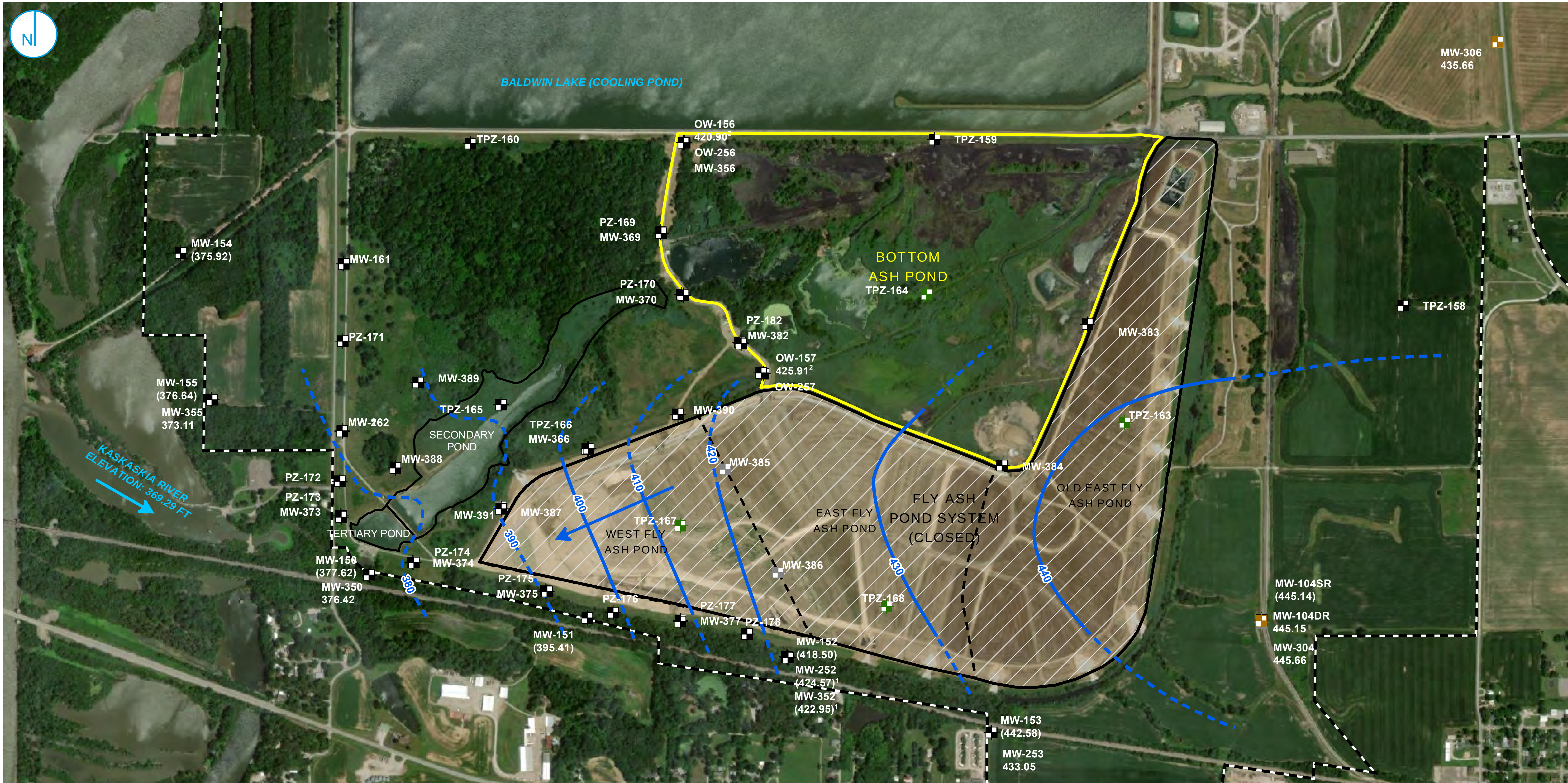
BEDROCK GROUNDWATER ELEVATION CONTOURS
MARCH 24, 2020

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 3-6

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL



NOTE: MONITORING WELL OW-156 AND OW-157 ALSO IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY.
WELL ELEVATIONS IN PARENTHESIS NOT USED FOR CONTOURING
**RIVER ELEVATION OBTAINED FROM UNITED STATES GEOLOGICAL SURVEY KASKASKIA RIVER NEAR RED BUD, IL GAUGING STATION (05595240). ELEVATION WAS REPORTED IN NGVD29 THEN CONVERTED TO NAVD88.
[1] = GROUNDWATER ELEVATION ABOVE GROUND SURFACE; ELEVATION NOT USED FOR CONTOURING
[2] = GROUNDWATER ELEVATION MEASURED JUNE 17, 2020; ELEVATION NOT USED FOR CONTOURING

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\BaldwinBAP\Figure 3-7_Bedrock GWE Contours 202006.mxd

PROJECT: 169000XXXX | DATED: 10/21/2021 | DESIGNER: STOLZSD

BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
ABANDONED MONITORING WELL

GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION

PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
FLY ASH POND SYSTEM
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

0 400 800 Feet

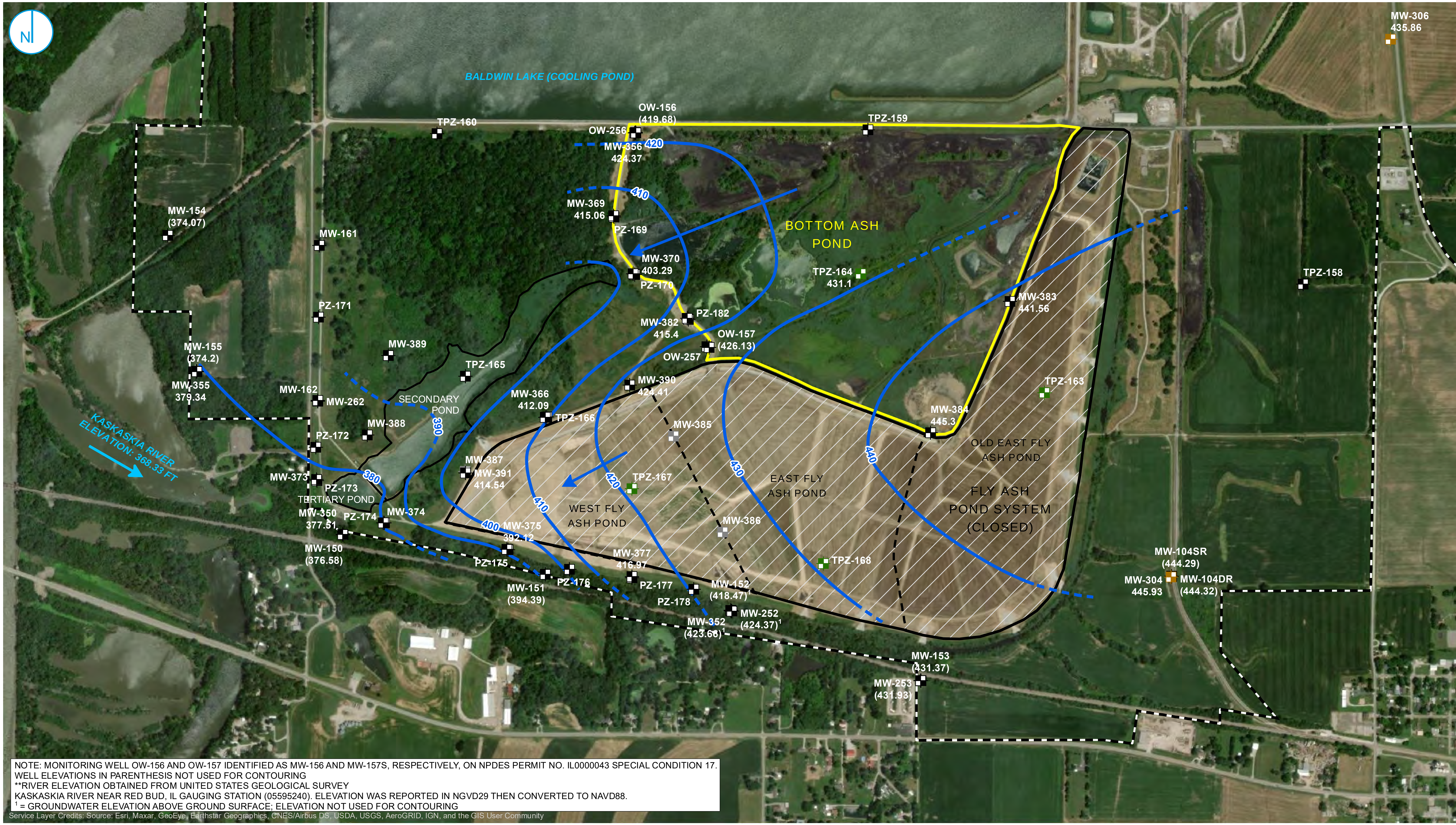
BEDROCK GROUNDWATER ELEVATION CONTOURS
JUNE 23, 2020

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 3-7

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL



NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
WELL ELEVATIONS IN PARENTHESIS NOT USED FOR CONTOURING
**RIVER ELEVATION OBTAINED FROM UNITED STATES GEOLOGICAL SURVEY
KASKASKIA RIVER NEAR RED BUD, IL GAUGING STATION (05595240). ELEVATION WAS REPORTED IN NGVD29 THEN CONVERTED TO NAVD88.
[1] = GROUNDWATER ELEVATION ABOVE GROUND SURFACE; ELEVATION NOT USED FOR CONTOURING

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\BaldwinBAP\Figure 3-8_Bedrock GWE Contours 202009.mxd
PROJECT: 169000XXXX | DATED: 10/21/2021 | DESIGNER: STOLZSD

BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
ABANDONED MONITORING WELL
GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
FLY ASH POND SYSTEM (CLOSED)
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

0 400 800 Feet

BEDROCK GROUNDWATER ELEVATION CONTOURS
SEPTEMBER 15, 2020

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 3-8

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.
WELL ELEVATIONS IN PARENTHESIS NOT USED FOR CONTOURING
**RIVER ELEVATION OBTAINED FROM UNITED STATES GEOLOGICAL SURVEY
KASKASKIA RIVER NEAR RED BUD, IL GAUGING STATION (05595240). ELEVATION WAS REPORTED IN NGVD29 THEN CONVERTED TO NAVD88.
[1] = GROUNDWATER ELEVATION ABOVE GROUND SURFACE; ELEVATION NOT USED FOR CONTOURING

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Baldwin\BAP\Figure 3-9_Bedrock GWE Contours 202012.mxd

PROJECT: 169000XXXX | DATED: 10/21/2021 | DESIGNER: STOLZSD

ABANDONED MONITORING WELL
GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
PART 845 REGULATED UNIT (SUBJECT UNIT)
SITE FEATURE
FLY ASH POND SYSTEM
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

0 400 800 Feet

BEDROCK GROUNDWATER ELEVATION CONTOURS
DECEMBER 16-17, 2020

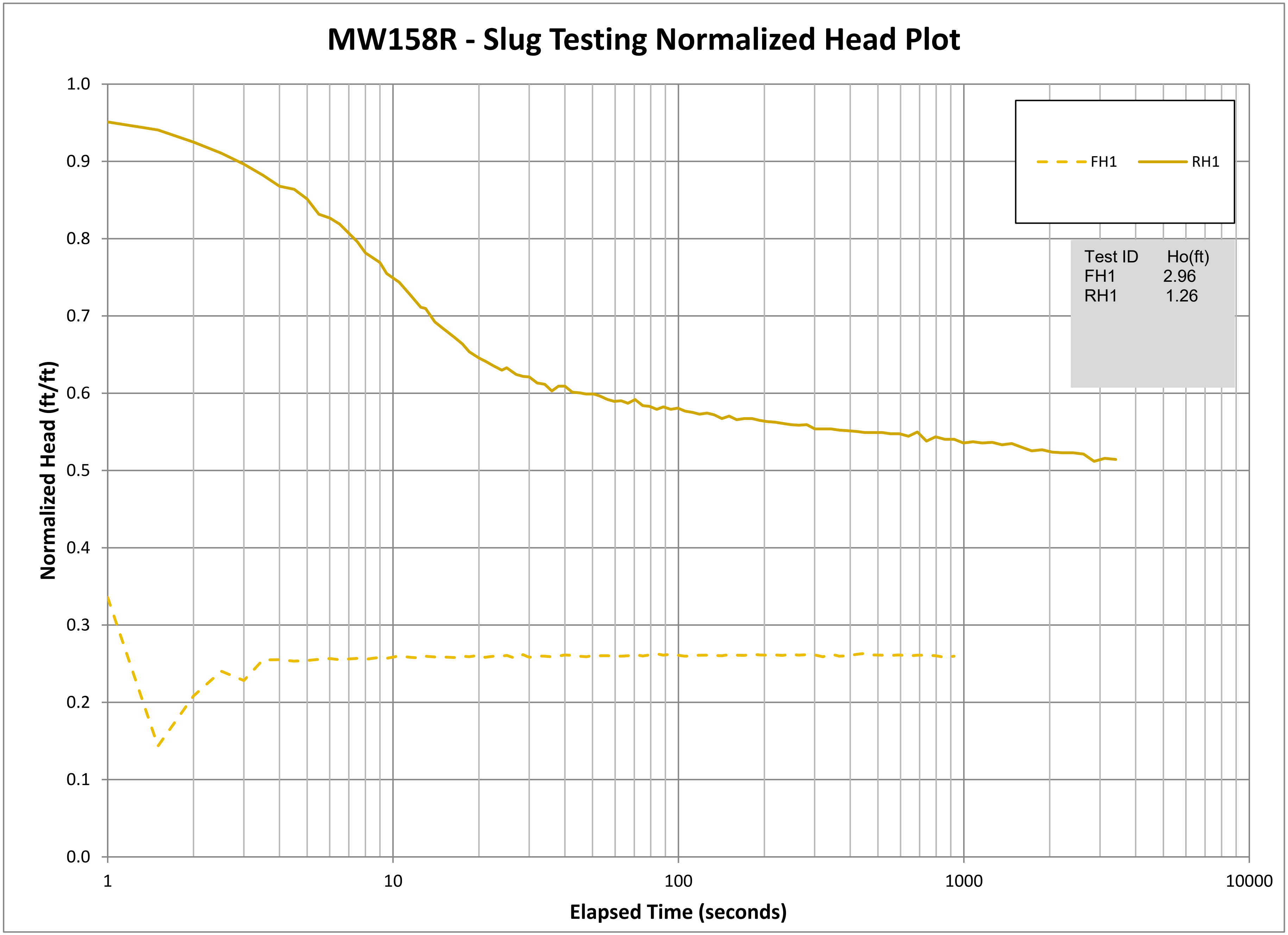
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

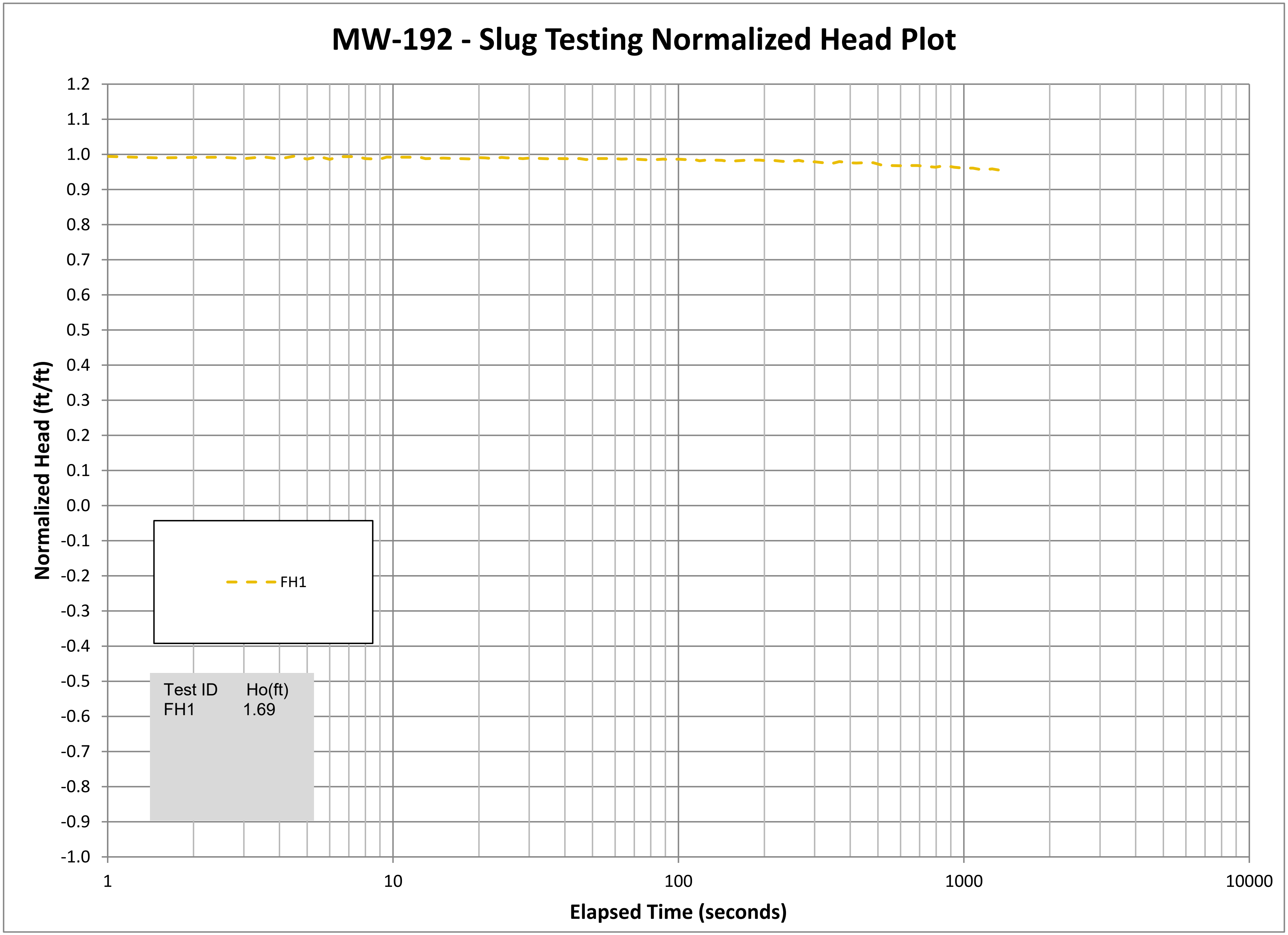
FIGURE 3-9

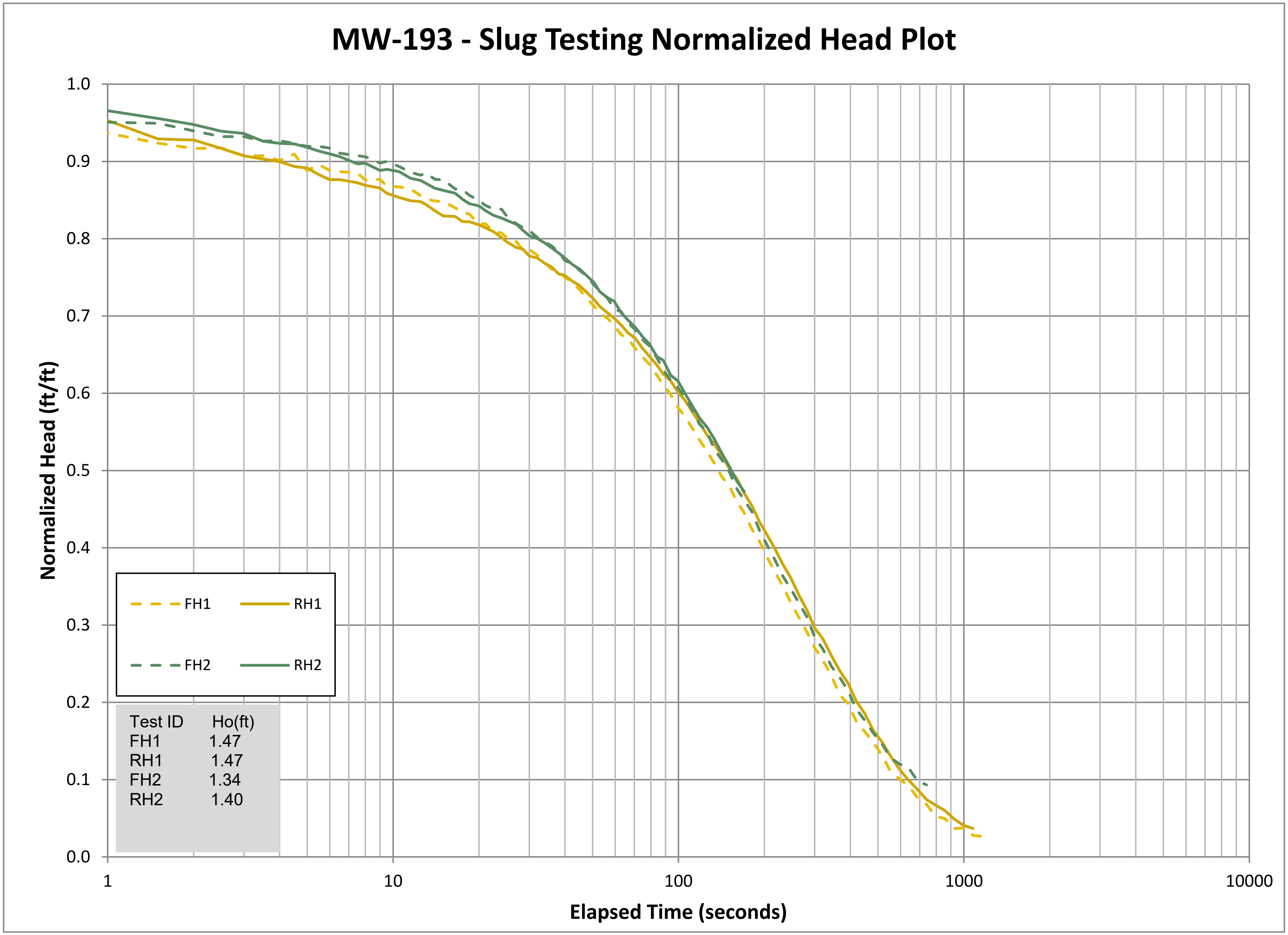
RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

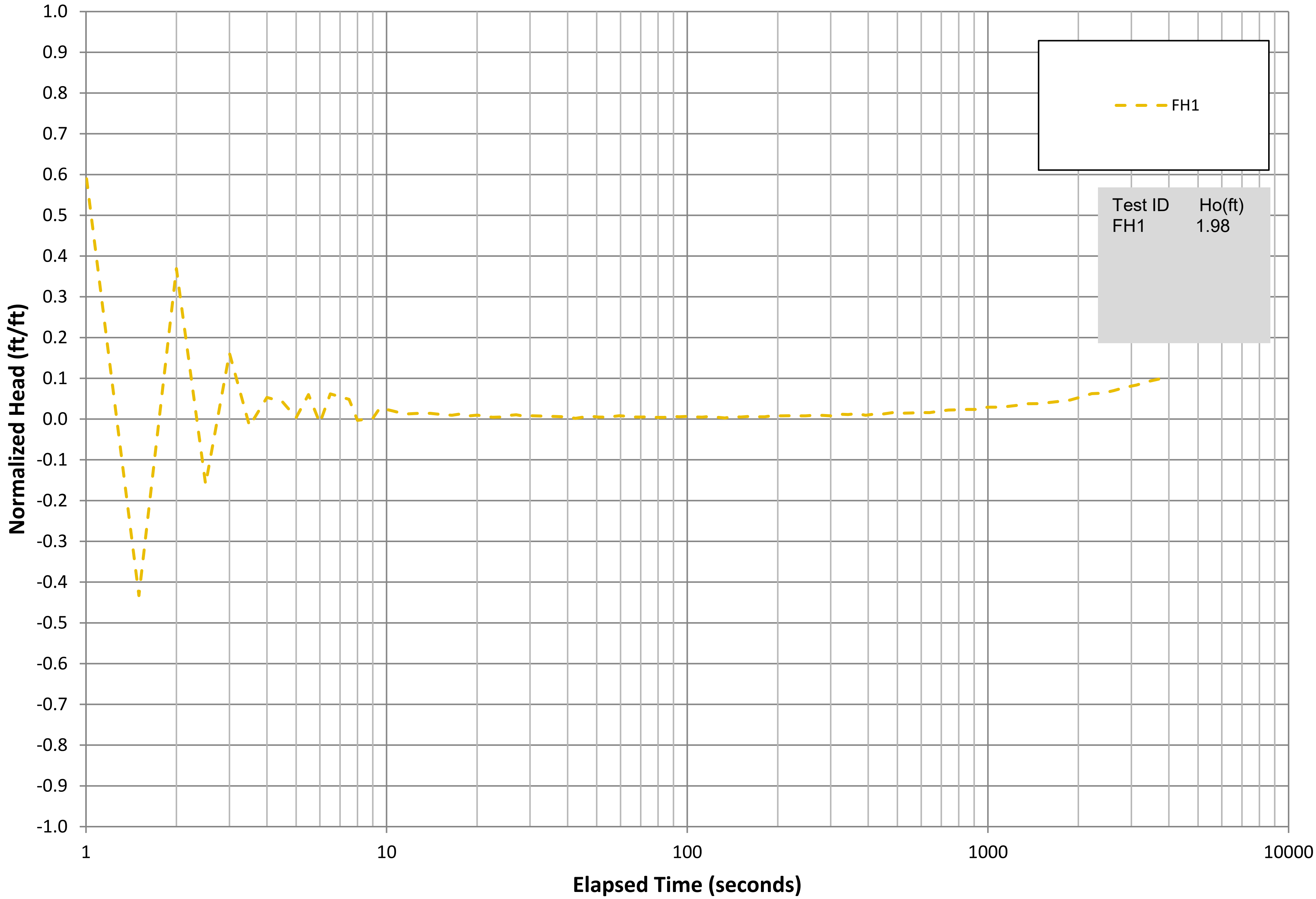
APPENDIX F
AQTESOLV REPORTS

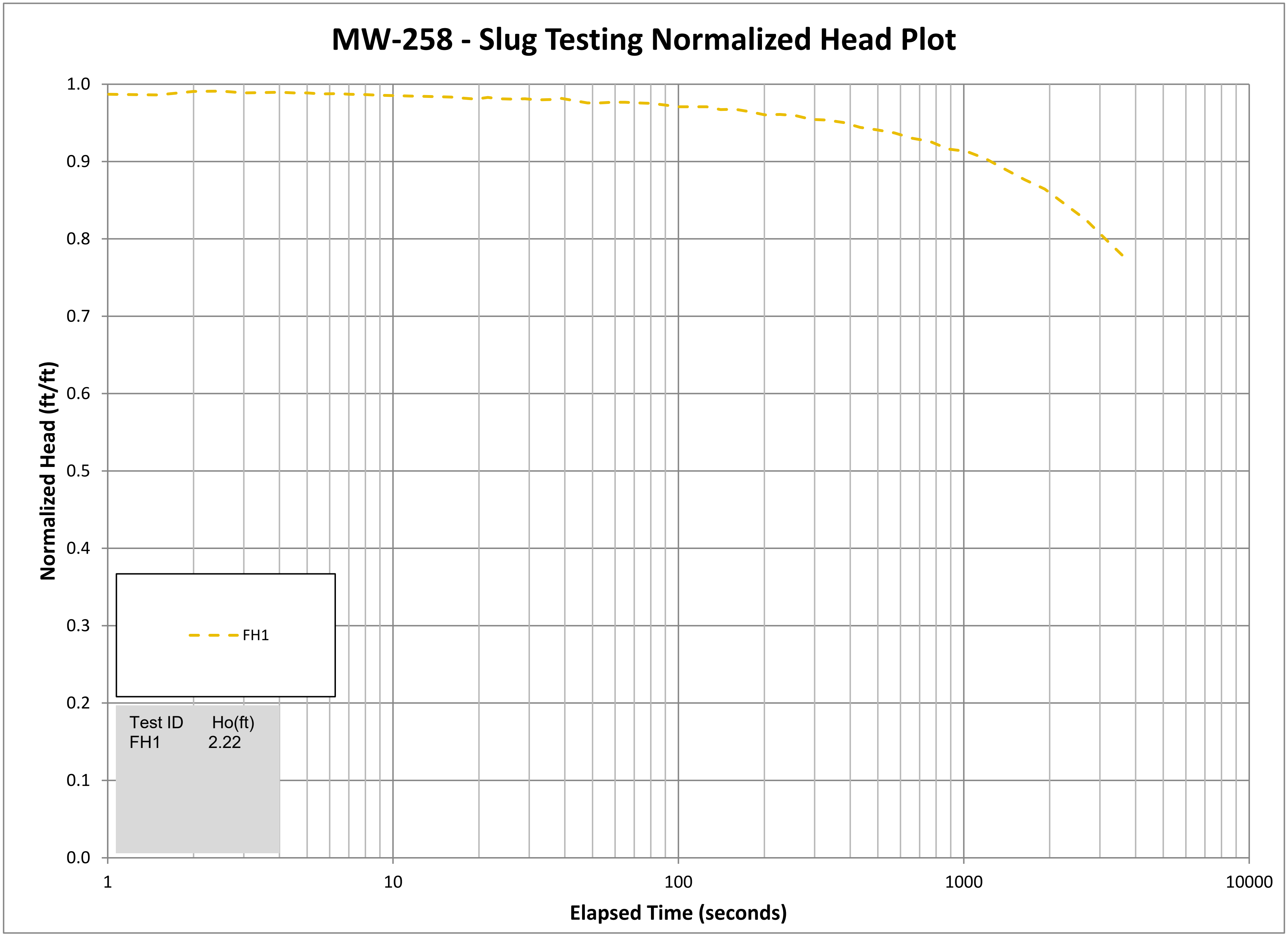

MW158R - Slug Testing Normalized Head Plot
Normalized Head (ft/ft)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
10
100
1000
10000
Elapsed Time (seconds)
FH1
RH1
Test ID Ho(ft)
FH1 2.96
RH1 1.26

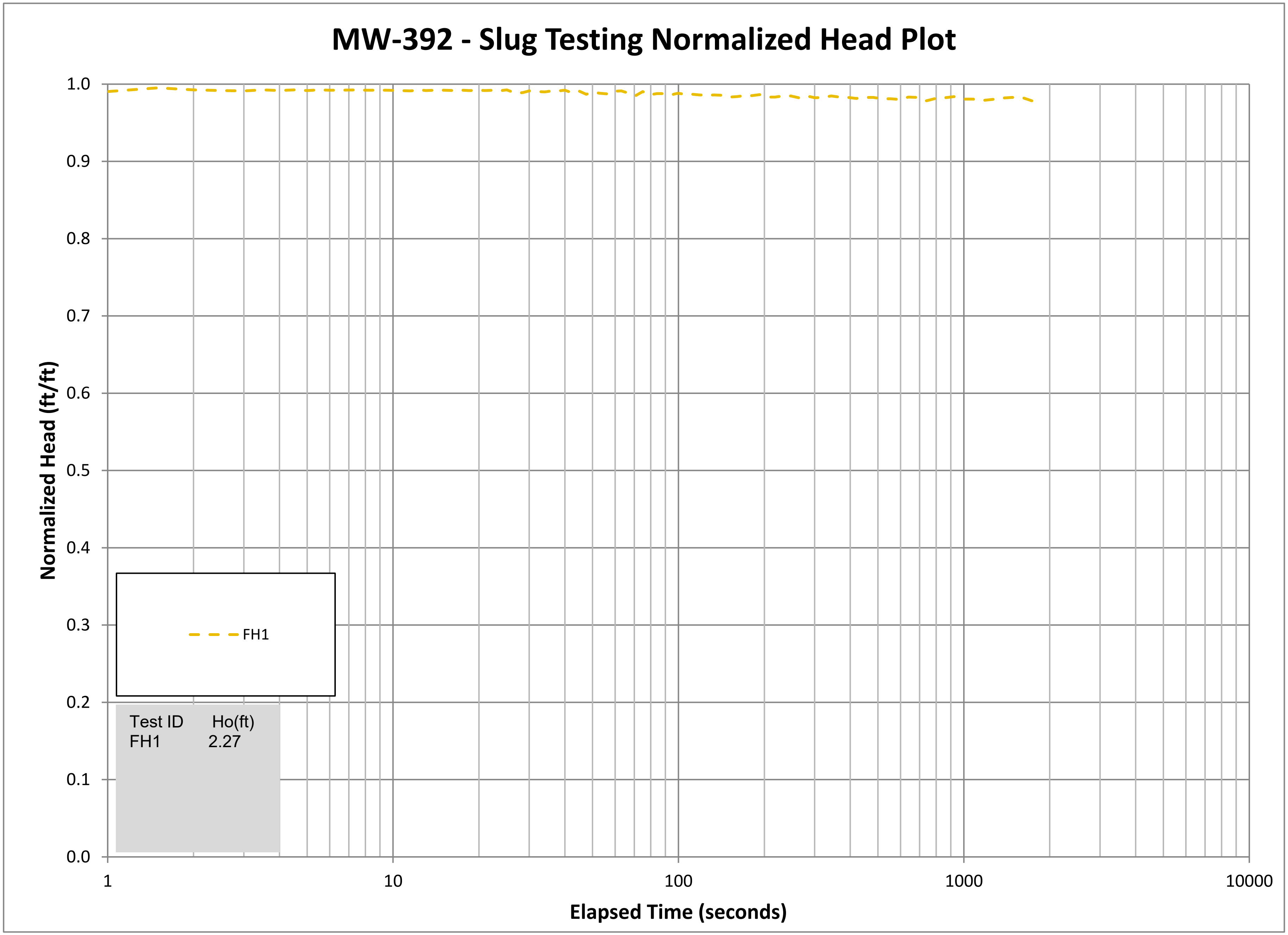

MW-192 - Slug Testing Normalized Head Plot
Normalized Head (ft/ft)
Elapsed Time (seconds)
FH1
Test ID Ho(ft)
FH1 1.69
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1.0
1
10
100
1000
10000

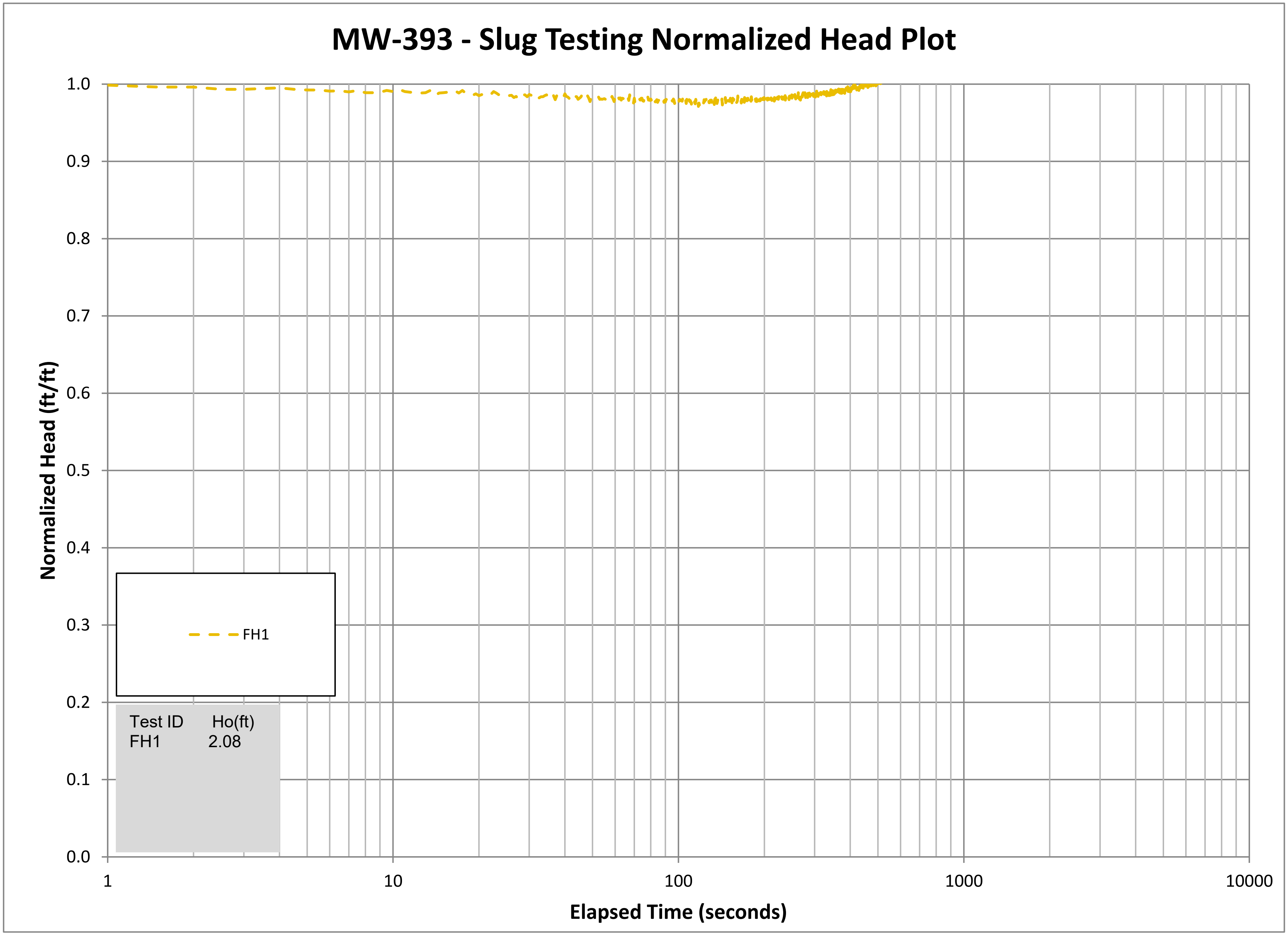

MW-193 - Slug Testing Normalized Head Plot
Normalized Head (ft/ft)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
10
100
1000
10000
Elapsed Time (seconds)
FH1
RH1
FH2
RH2
Test ID Ho(ft)
FH1 1.47
RH1 1.47
FH2 1.34
RH2 1.40

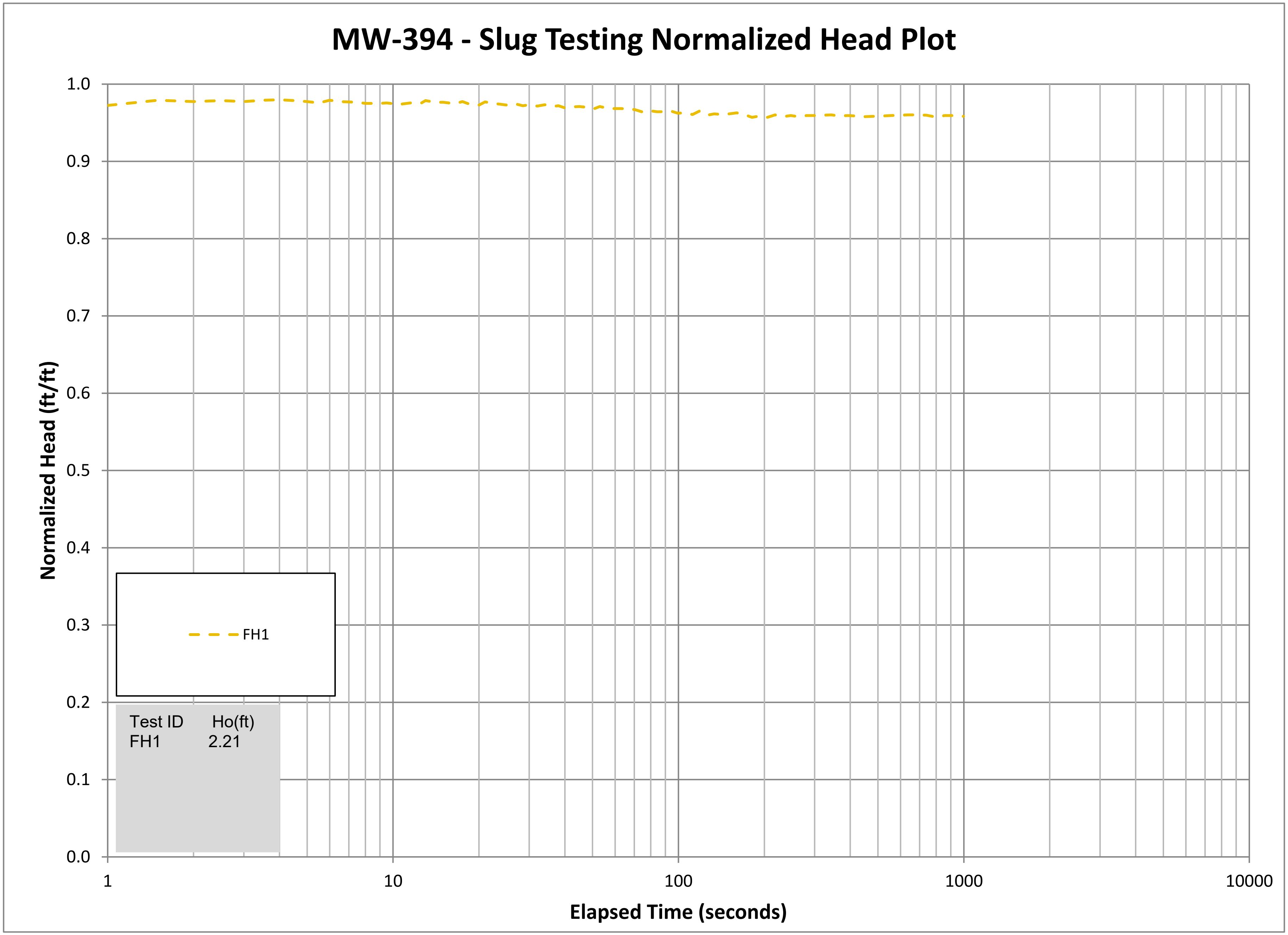
MW-194 - Slug Testing Normalized Head Plot

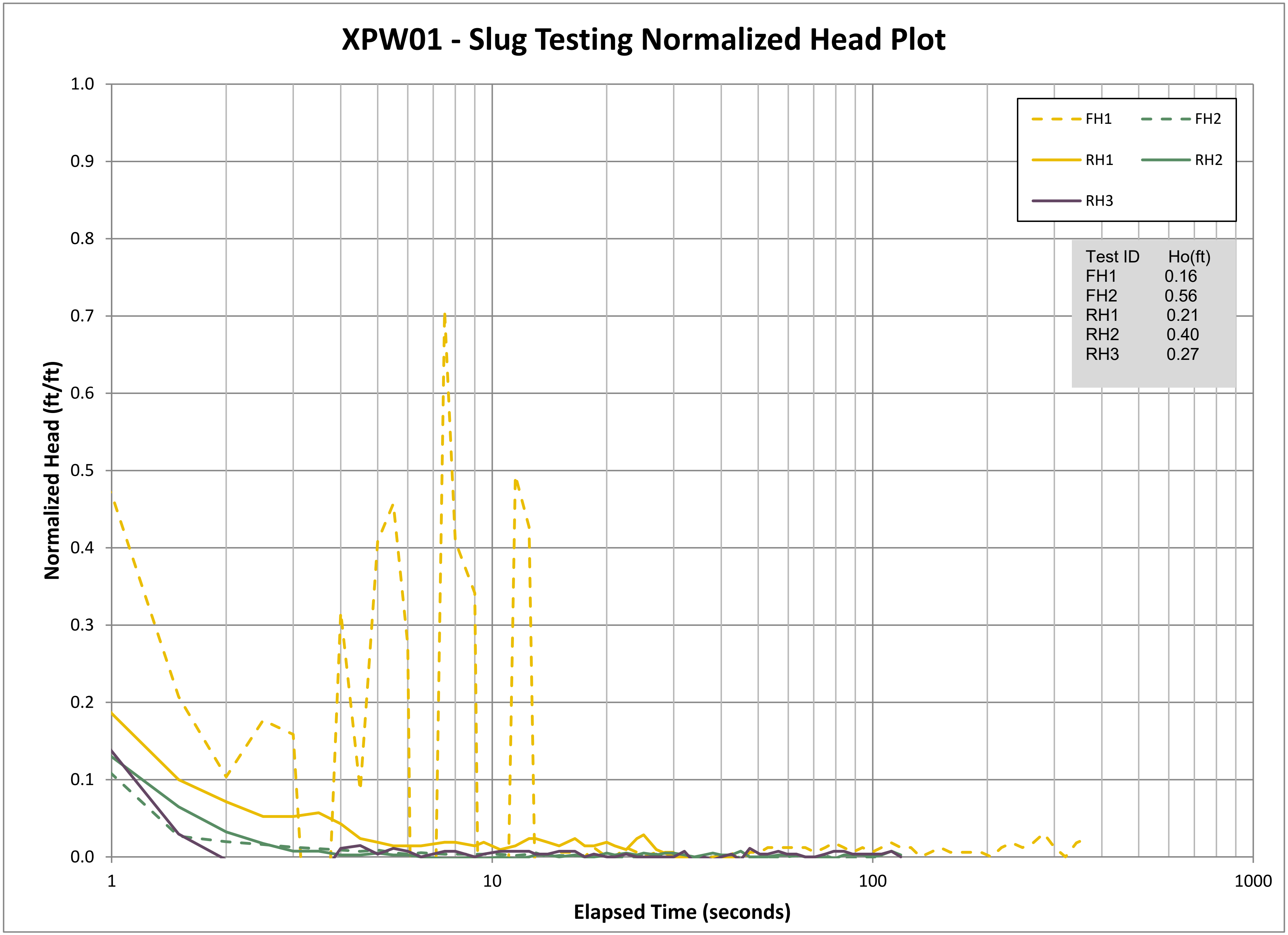


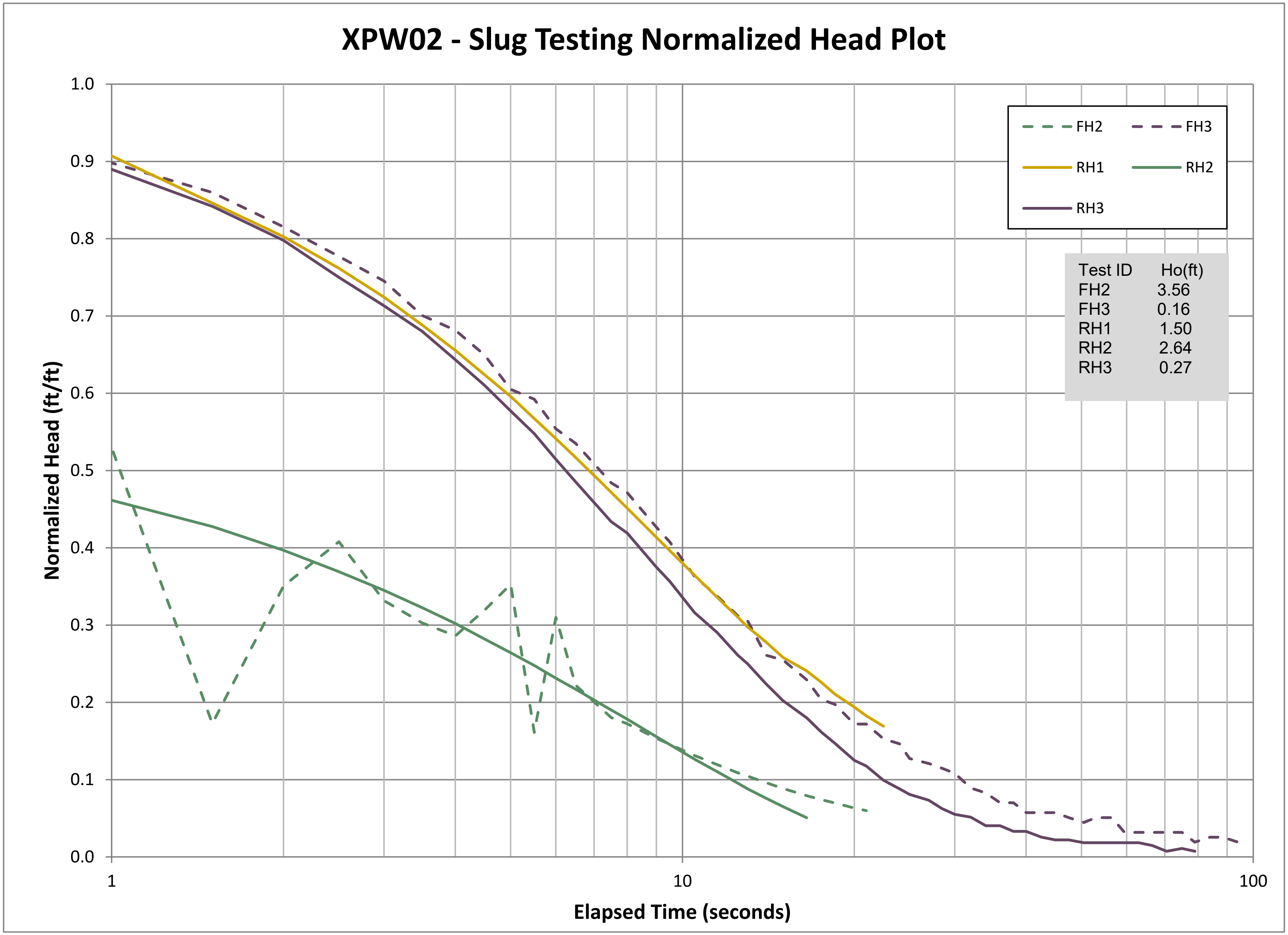

MW-258 - Slug Testing Normalized Head Plot
Normalized Head (ft/ft)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
10
100
1000
10000
Elapsed Time (seconds)
FH1
Test ID Ho(ft)
FH1 2.22


MW-392 - Slug Testing Normalized Head Plot
Normalized Head (ft/ft)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
10
100
1000
10000
Elapsed Time (seconds)
FH1
Test ID Ho(ft)
FH1 2.27

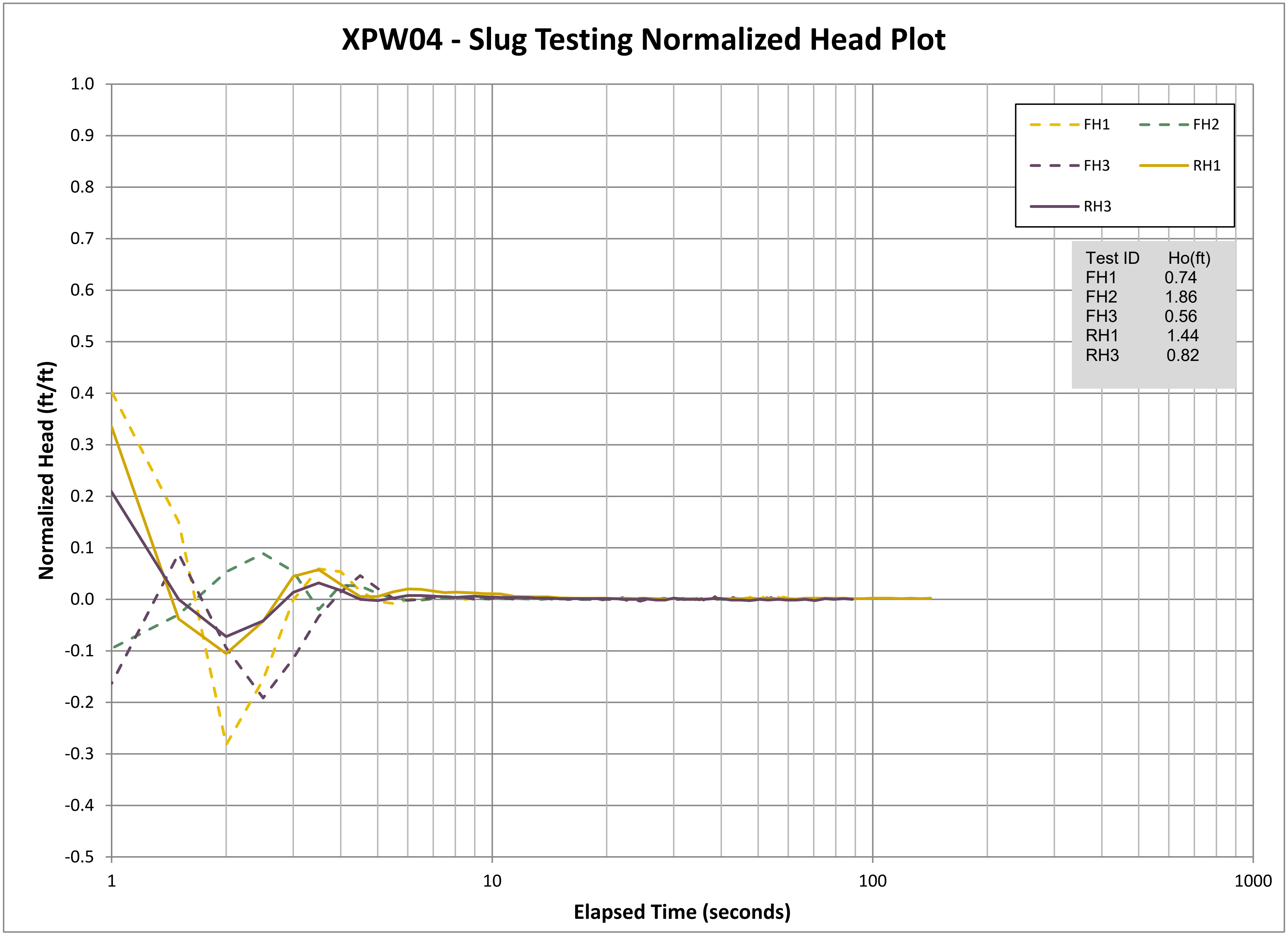

MW-393 - Slug Testing Normalized Head Plot
Normalized Head (ft/ft)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
10
100
1000
10000
Elapsed Time (seconds)
FH1
Test ID Ho(ft)
FH1 2.08


MW-394 - Slug Testing Normalized Head Plot
Normalized Head (ft/ft)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
10
100
1000
10000
Elapsed Time (seconds)
FH1
Test ID Ho(ft)
FH1 2.21

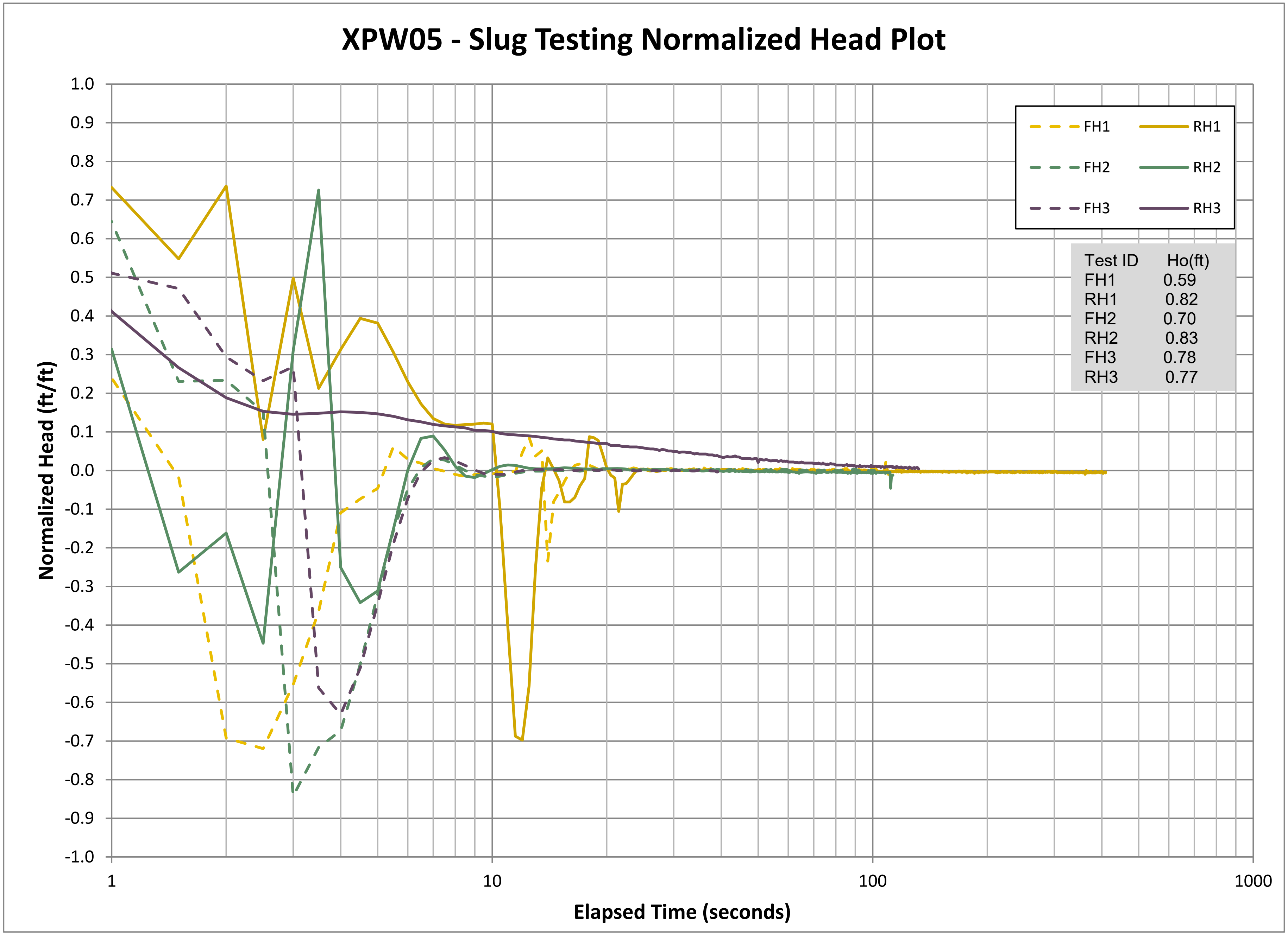

XPW01 - Slug Testing Normalized Head Plot
Normalized Head (ft/ft)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
10
100
1000
Elapsed Time (seconds)
FH1
FH2
RH1
RH2
RH3
Test ID Ho(ft)
FH1 0.16
FH2 0.56
RH1 0.21
RH2 0.40
RH3 0.27

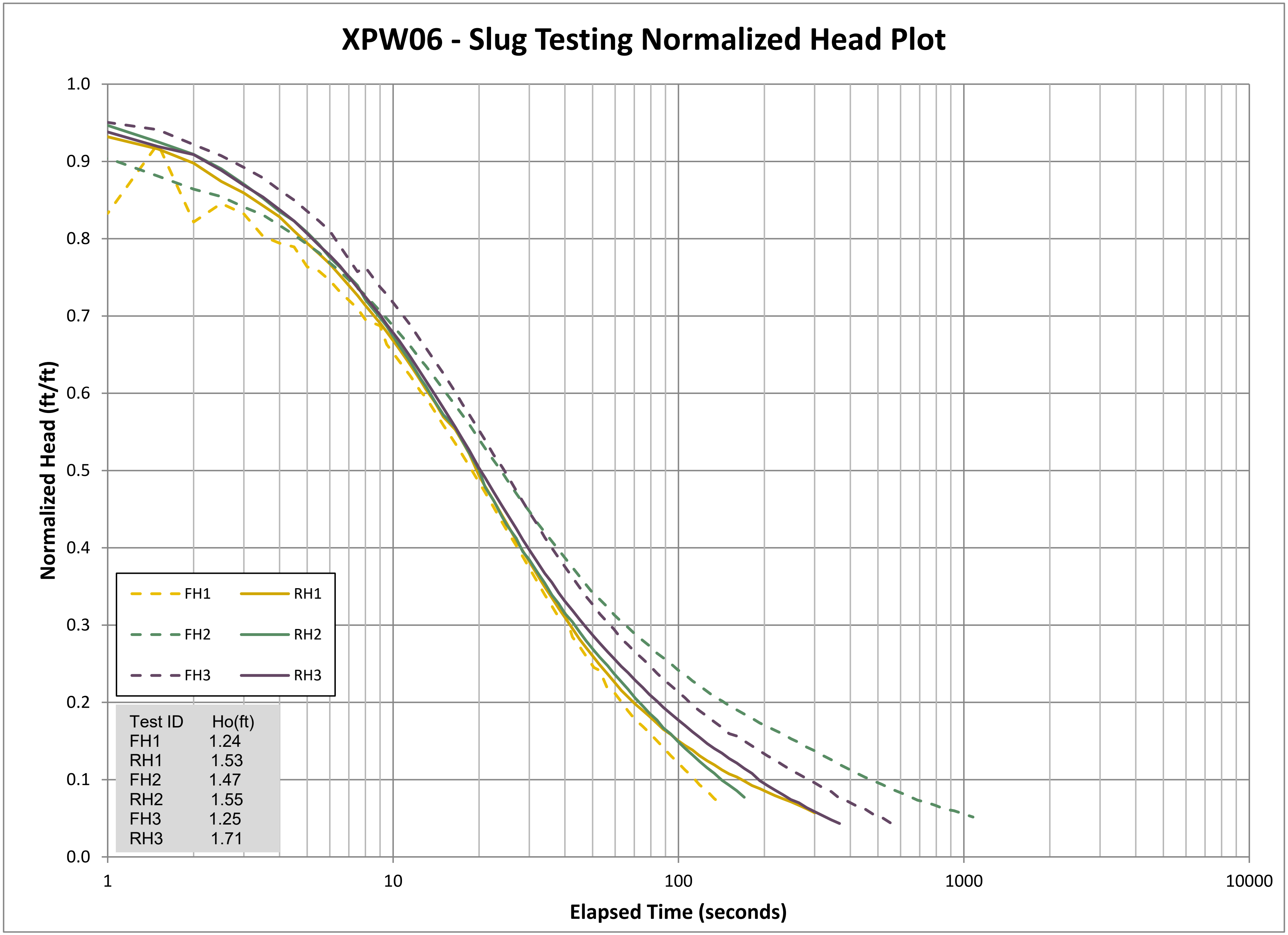


XPW02 - Slug Testing Normalized Head Plot
Normalized Head (ft/ft)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1
10
100
Elapsed Time (seconds)
FH2
FH3
RH1
RH2
RH3
Test ID Ho(ft)
FH2 3.56
FH3 0.16
RH1 1.50
RH2 2.64
RH3 0.27

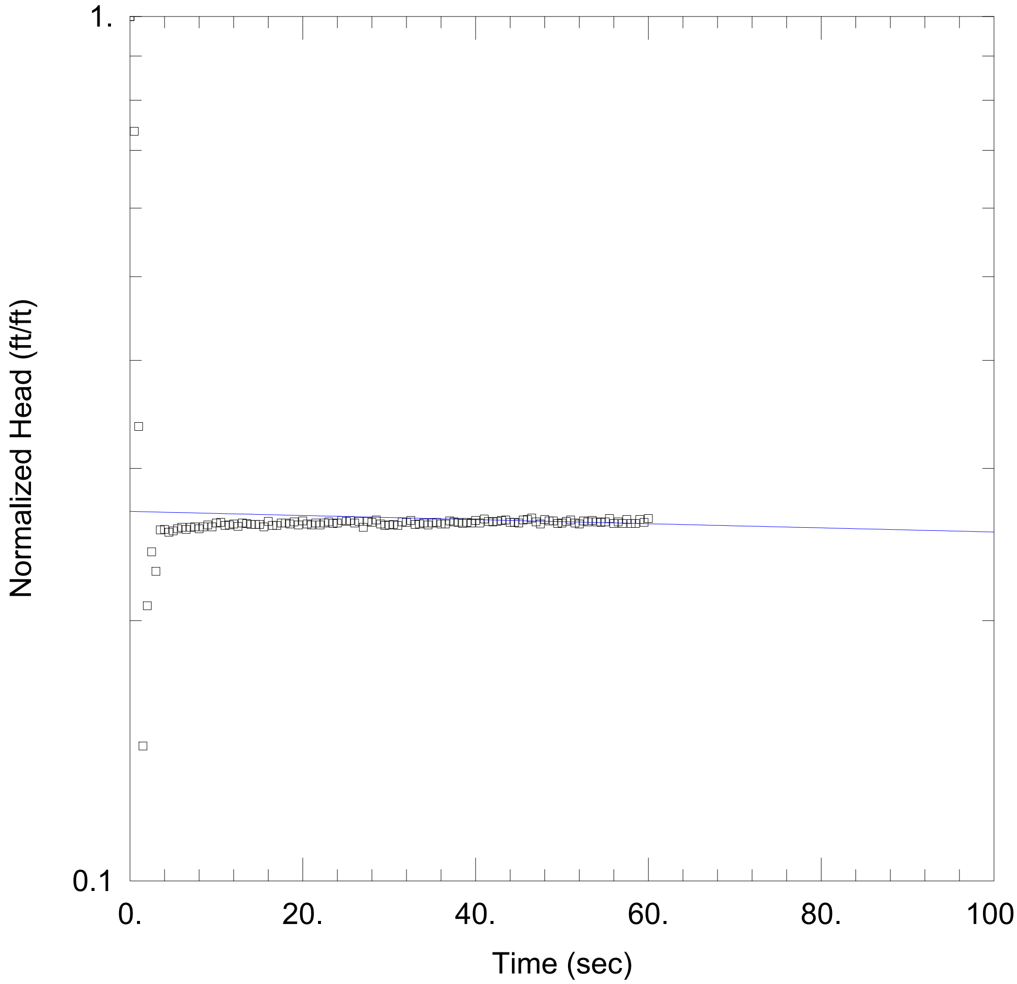


XPW04 - Slug Testing Normalized Head Plot
Normalized Head (ft/ft)
Elapsed Time (seconds)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
1
10
100
1000
FH1
FH2
FH3
RH1
RH3
Test ID Ho(ft)
FH1 0.74
FH2 1.86
FH3 0.56
RH1 1.44
RH3 0.82


XPW05 - Slug Testing Normalized Head Plot
Normalized Head (ft/ft)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1.0
1
10
100
1000
Elapsed Time (seconds)
FH1
RH1
FH2
RH2
FH3
RH3
Test ID Ho(ft)
FH1 0.59
RH1 0.82
FH2 0.70
RH2 0.83
FH3 0.78
RH3 0.77



XPW06 - Slug Testing Normalized Head Plot
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Normalized Head (ft/ft)
1
10
100
1000
10000
Elapsed Time (seconds)
FH1
RH1
FH2
RH2
FH3
RH3
Test ID Ho(ft)
FH1 1.24
RH1 1.53
FH2 1.47
RH2 1.55
FH3 1.25
RH3 1.71



BALDWIN MW158R FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940103649-001
Location: Baldwin Power Plant
Test Well: MW158R
Test Date: 10/20/2022

AQUIFER DATA

Saturated Thickness: 7.1 ft
Anisotropy Ratio (Kz/Kr): 1.

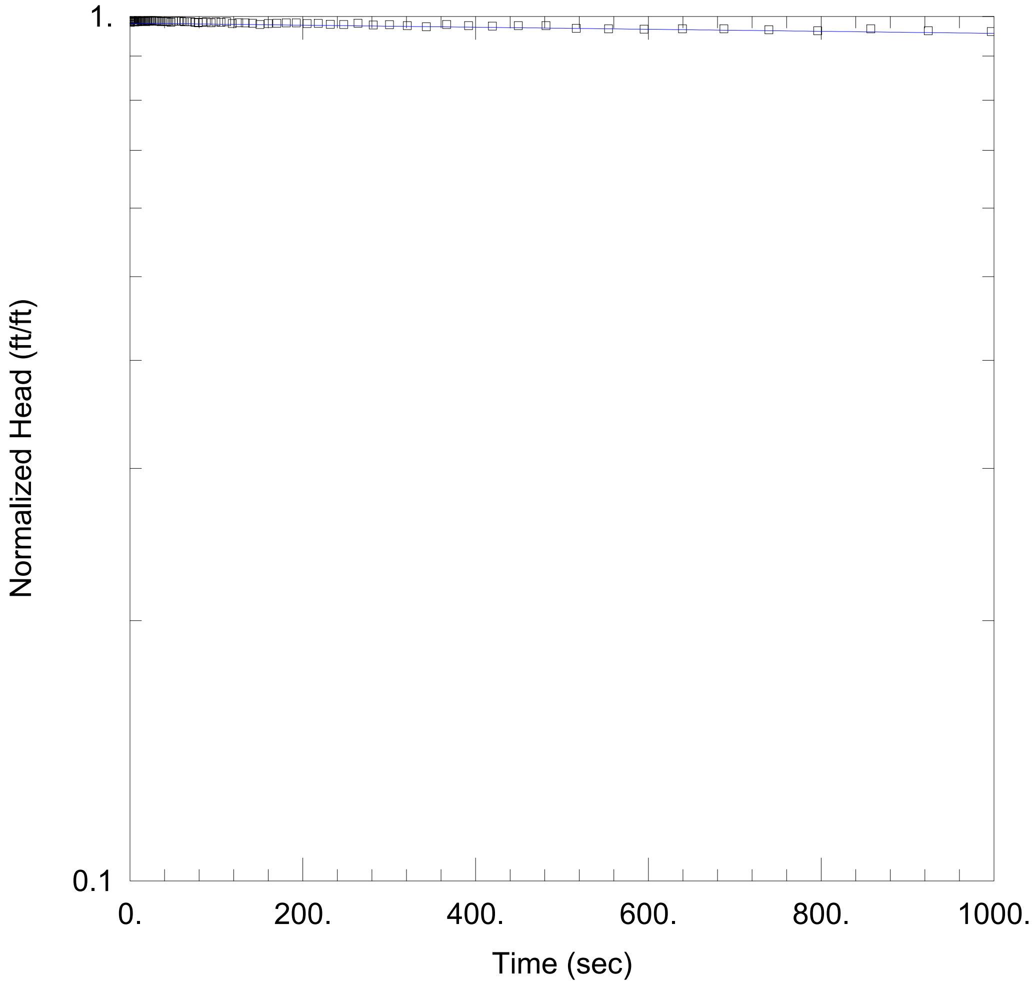
WELL DATA (MW158R)

Initial Displacement: 2.96 ft
Total Well Penetration Depth: 7.1 ft
Casing Radius: 0.086 ft
Static Water Column Height: 7.1 ft
Screen Length: 7.1 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 2.2E-5 cm/sec
y0 = 0.792 ft



BALDWIN MW192 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940103649-001
Location: Baldwin Power Plant
Test Well: MW192
Test Date: 10/19/2022

AQUIFER DATA

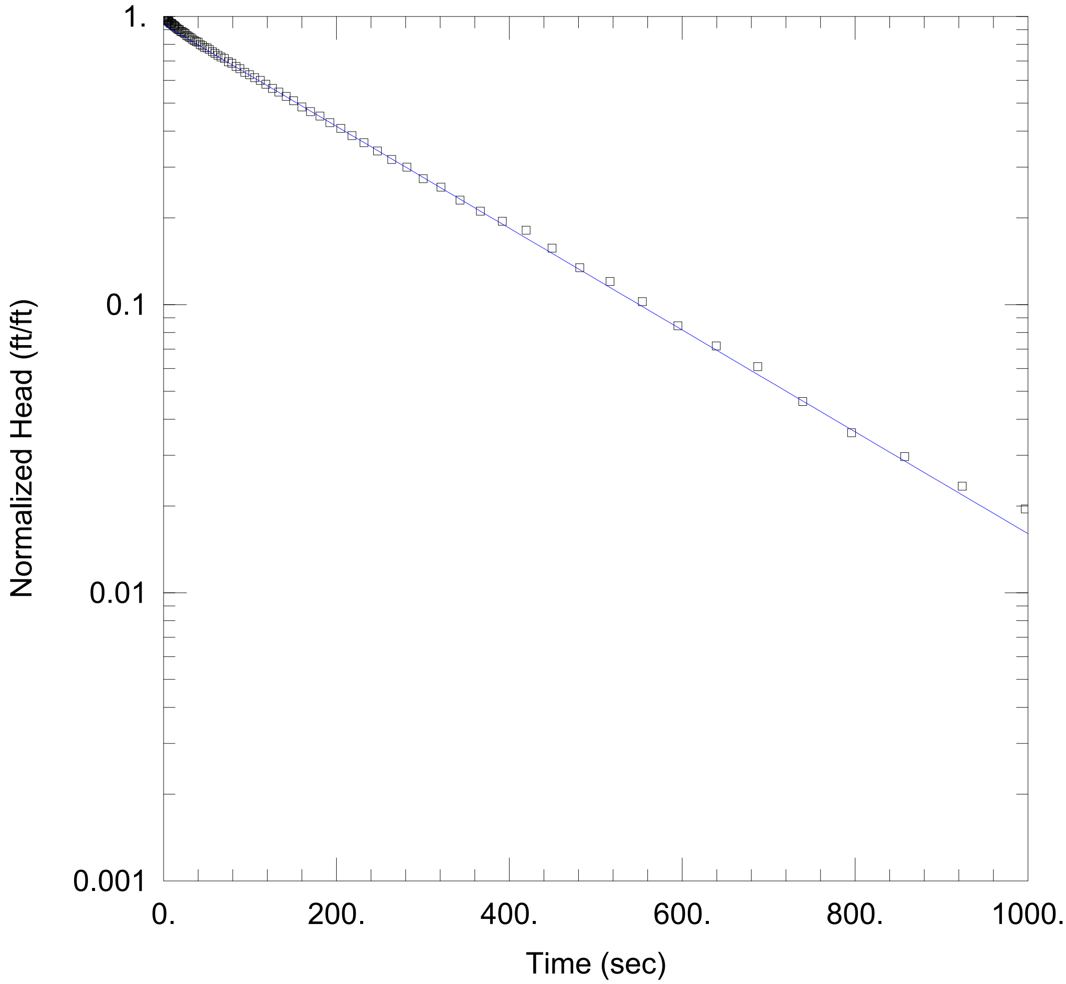
Saturated Thickness: 7.2 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW192)

Initial Displacement: 1.69 ft
Total Well Penetration Depth: 7.2 ft
Casing Radius: 0.086 ft
Static Water Column Height: 24.2 ft
Screen Length: 7.2 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 1.08E-6 cm/sec
y0 = 1.66 ft



BALDWIN MW193 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940103649-001
Location: Baldwin Power Plant
Test Well: MW193
Test Date: 10/19/2022

AQUIFER DATA

Saturated Thickness: 2.2 ft
Anisotropy Ratio (Kz/Kr): 1.

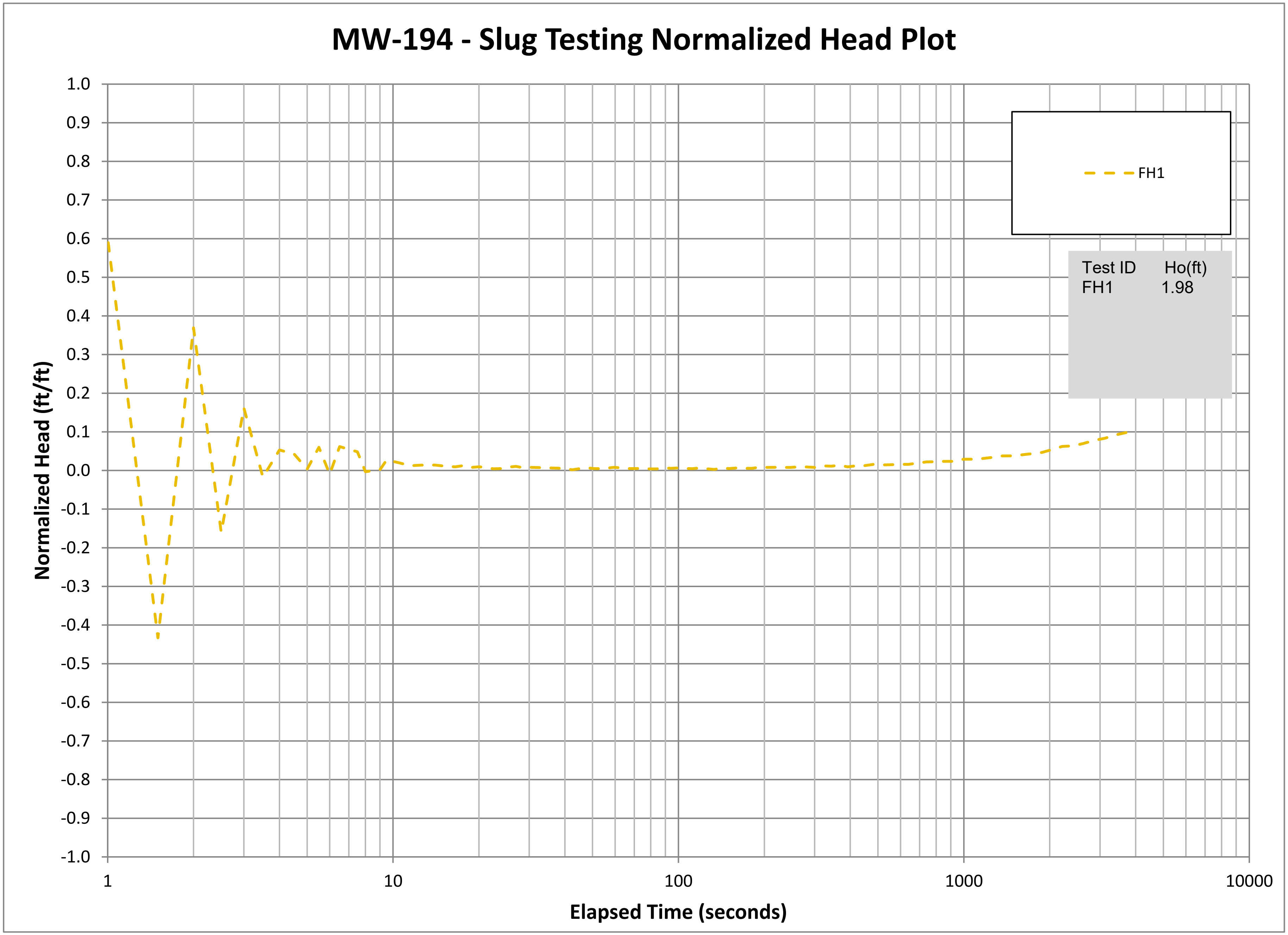
WELL DATA (MW193)

Initial Displacement: 1.28 ft
Total Well Penetration Depth: 2.2 ft
Casing Radius: 0.086 ft
Static Water Column Height: 26.5 ft
Screen Length: 2.2 ft
Well Radius: 0.25 ft

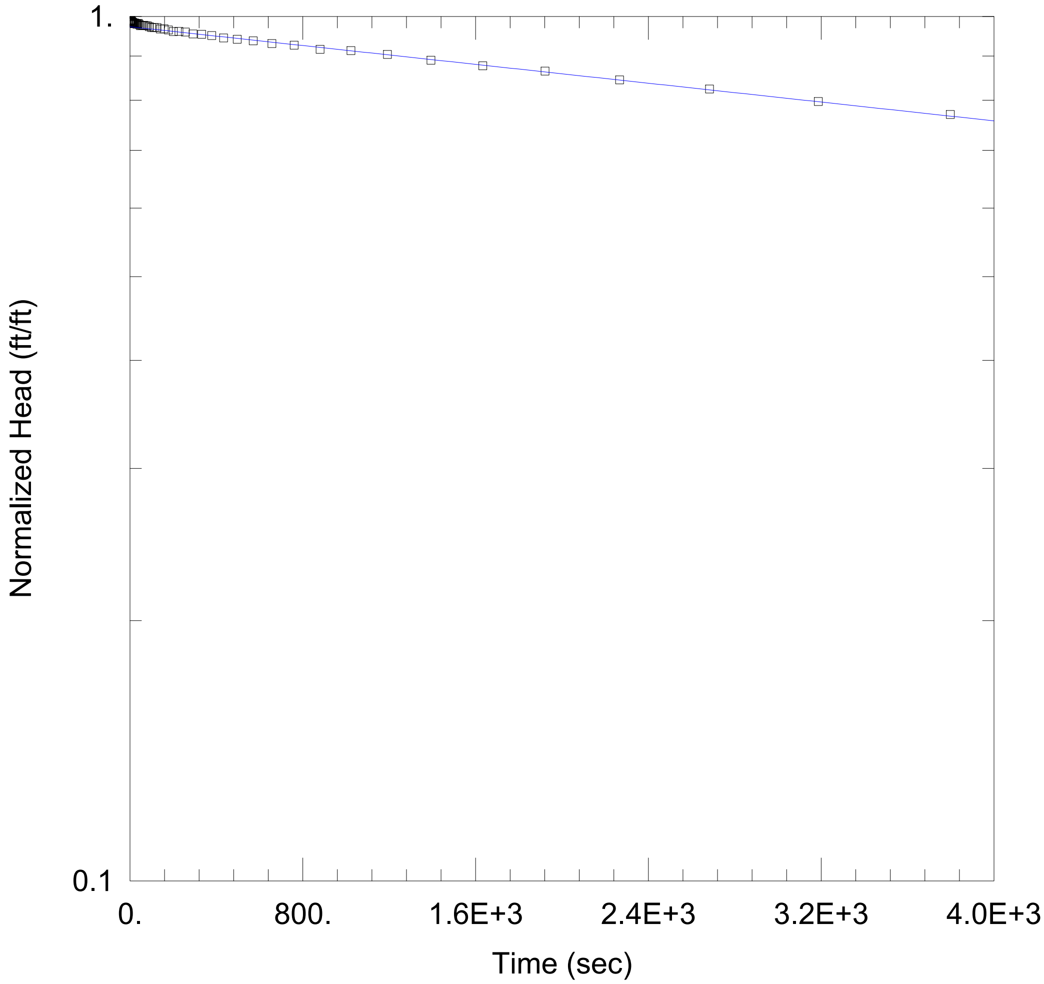
SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.000324 cm/sec
y0 = 1.2 ft



MW-194 - Slug Testing Normalized Head Plot
Normalized Head (ft/ft)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1.0
1
10
100
1000
10000
Elapsed Time (seconds)
FH1
Test ID Ho(ft)
FH1 1.98



BALDWIN MW258 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940103649-001
Location: Baldwin Power Plant
Test Well: MW258
Test Date: 10/20/2022

AQUIFER DATA

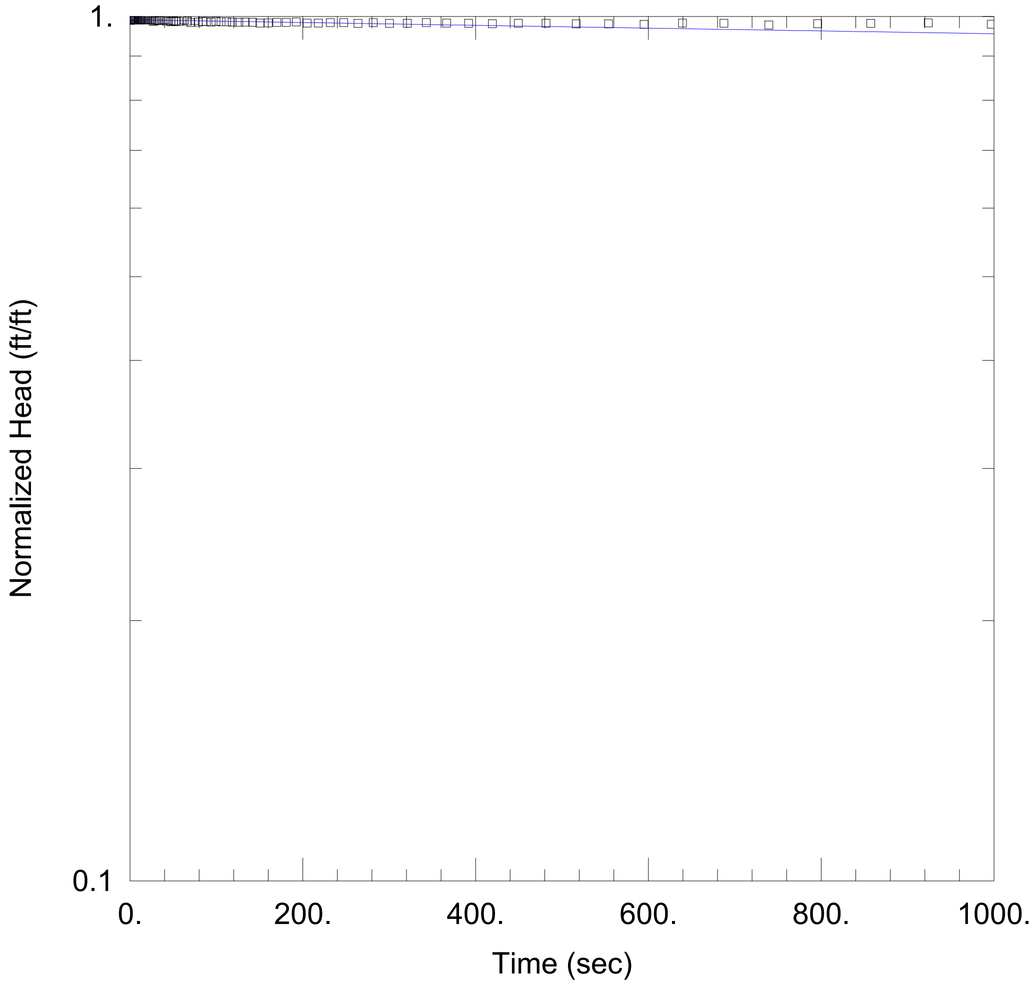
Saturated Thickness: 16.1 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW258)

Initial Displacement: 2.22 ft
Total Well Penetration Depth: 16. ft
Casing Radius: 0.086 ft
Static Water Column Height: 16. ft
Screen Length: 16. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 1.42E-6 cm/sec
y0 = 2.16 ft



BALDWIN MW392 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940103649-001
Location: Baldwin Power Plant
Test Well: MW392
Test Date: 10/19/2022

AQUIFER DATA

Saturated Thickness: 13.1 ft
Anisotropy Ratio (Kz/Kr): 1.

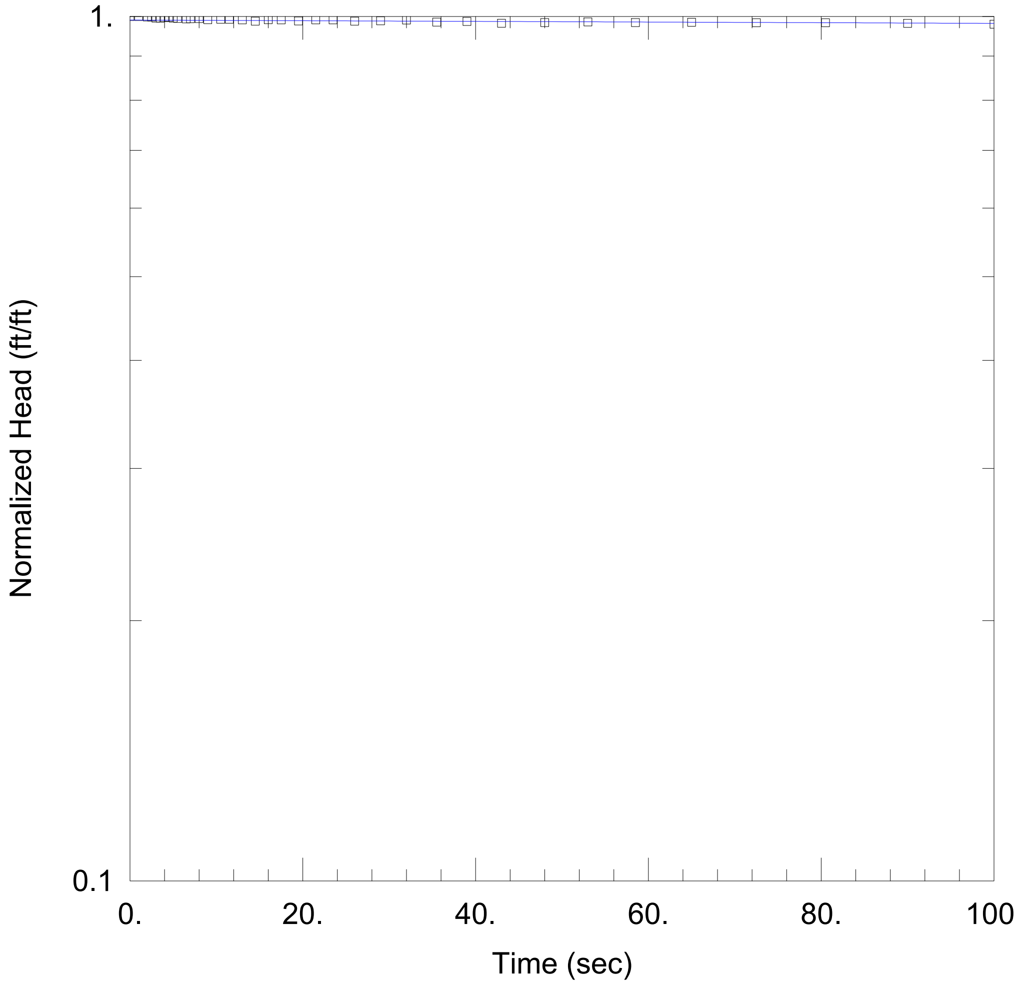
WELL DATA (MW392)

Initial Displacement: 2.27 ft
Total Well Penetration Depth: 13. ft
Casing Radius: 0.086 ft
Static Water Column Height: 13. ft
Screen Length: 13. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 9.8E-7 cm/sec
y0 = 2.25 ft



BALDWIN MW393 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940103649-001
Location: Baldwin Power Plant
Test Well: MW393
Test Date: 10/19/2022

AQUIFER DATA

Saturated Thickness: 14.1 ft
Anisotropy Ratio (Kz/Kr): 1.

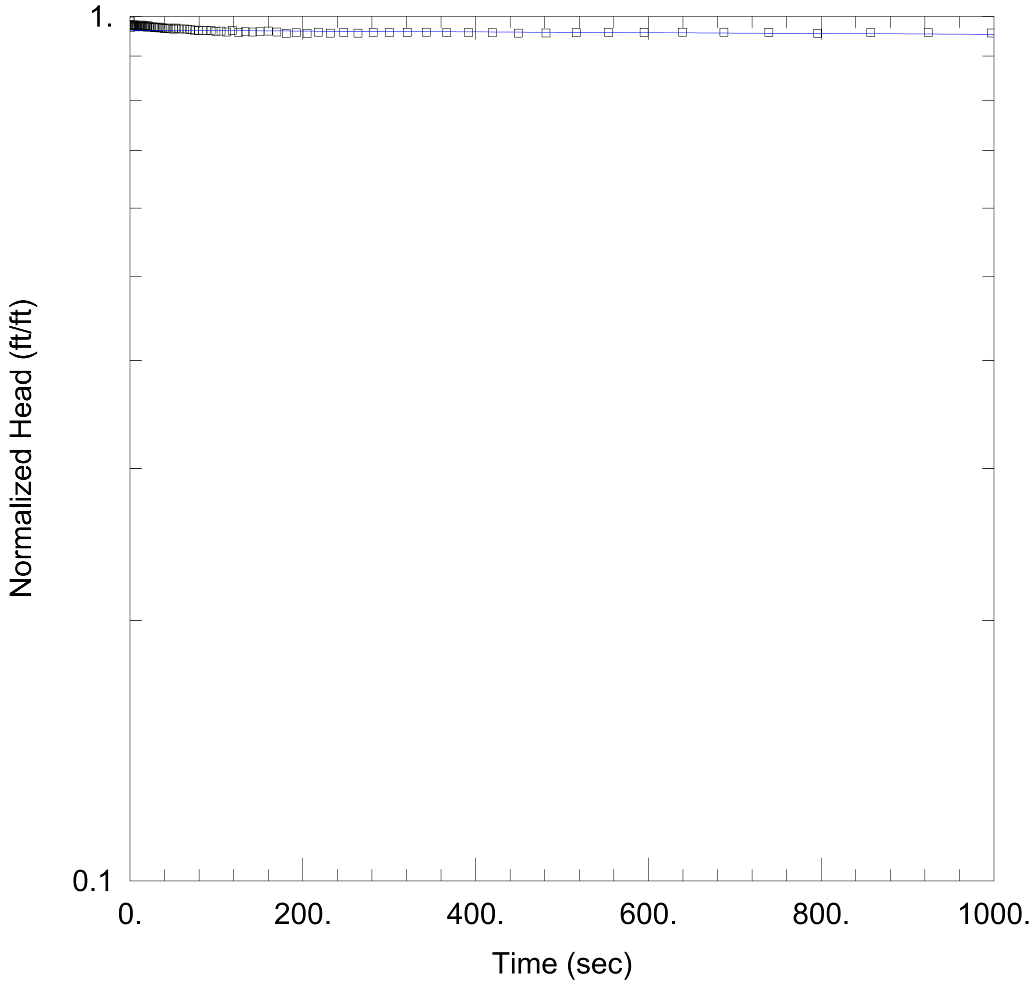
WELL DATA (MW393)

Initial Displacement: 2.07 ft
Total Well Penetration Depth: 14. ft
Casing Radius: 0.086 ft
Static Water Column Height: 14. ft
Screen Length: 14. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 2.18E-6 cm/sec
y0 = 2.05 ft



BALDWIN MW394 FH-1	

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940103649-001
Location: Baldwin Power Plant
Test Well: MW394
Test Date: 10/20/2022

AQUIFER DATA

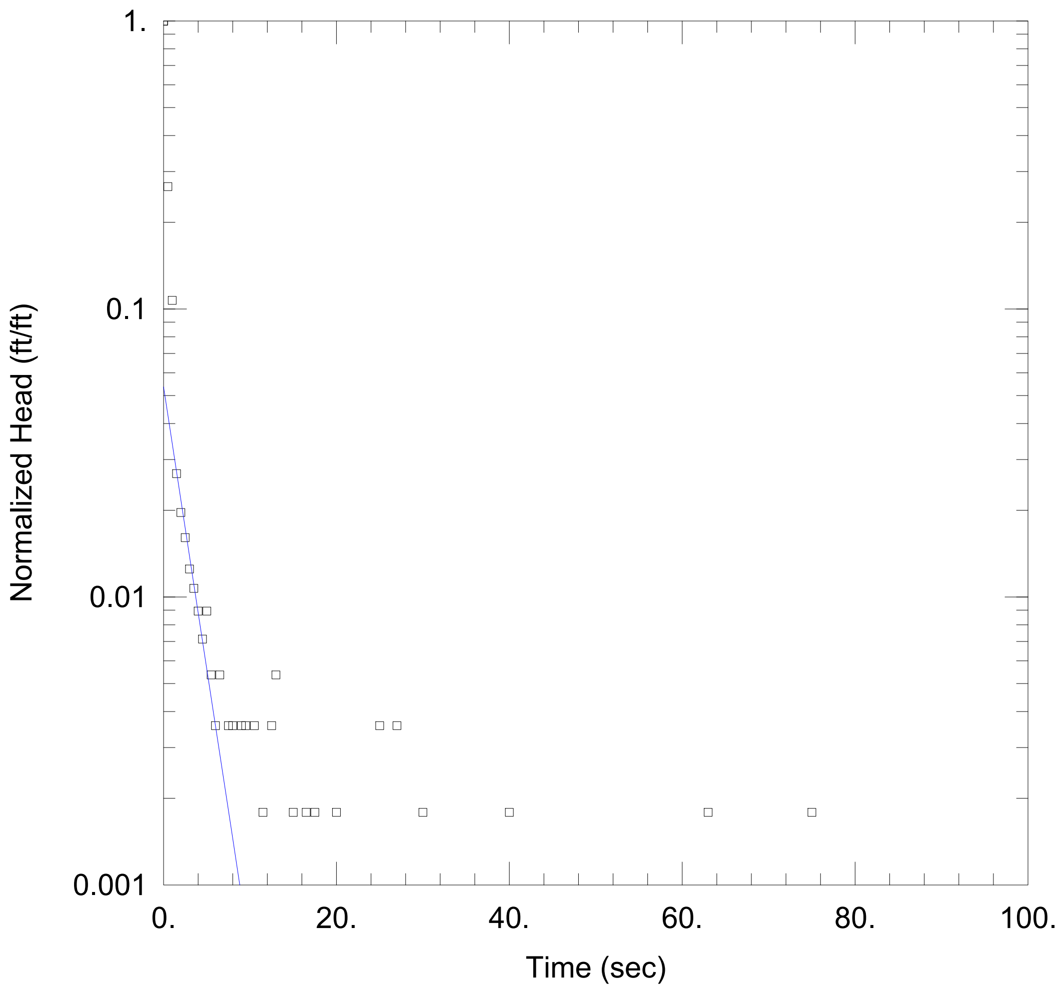
Saturated Thickness: 16.1 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW394)

Initial Displacement: 2.21 ft
Total Well Penetration Depth: 16. ft
Casing Radius: 0.086 ft
Static Water Column Height: 16. ft
Screen Length: 16. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 2.43E-7 cm/sec
y0 = 2.13 ft



BALDWIN XPW01 FH-2

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940103649-001
Location: Baldwin Power Plant
Test Well: XPW01
Test Date: 10/19/2022

AQUIFER DATA

Saturated Thickness: 3. ft
Anisotropy Ratio (Kz/Kr): 1.

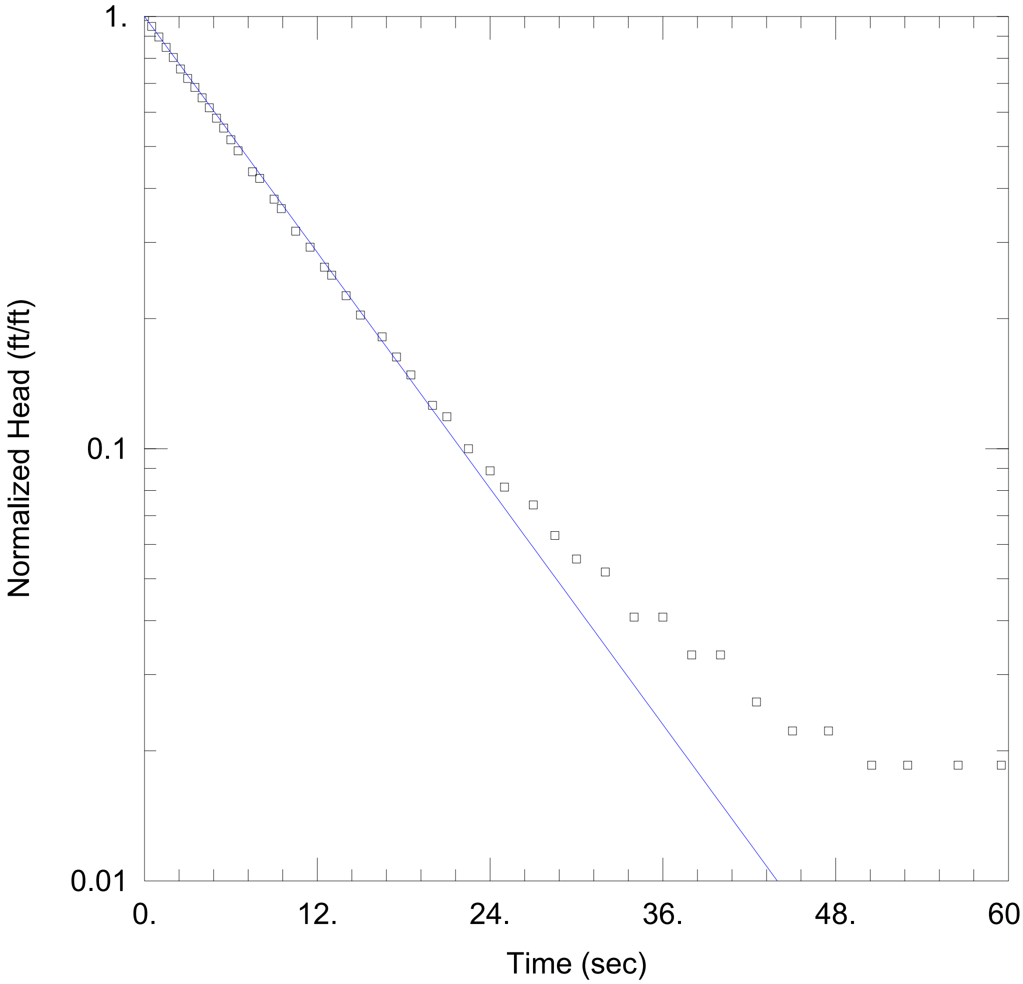
WELL DATA (XPW01)

Initial Displacement: 0.56 ft
Total Well Penetration Depth: 3. ft
Casing Radius: 0.086 ft
Static Water Column Height: 3. ft
Screen Length: 3. ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.25

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.087 cm/sec
y0 = 0.03 ft



BALDWIN XPW02 RH-3

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940103649-001
Location: Baldwin Power Plant
Test Well: XPW02
Test Date: 10/19/2022

AQUIFER DATA

Saturated Thickness: 8.9 ft
Anisotropy Ratio (Kz/Kr): 1.

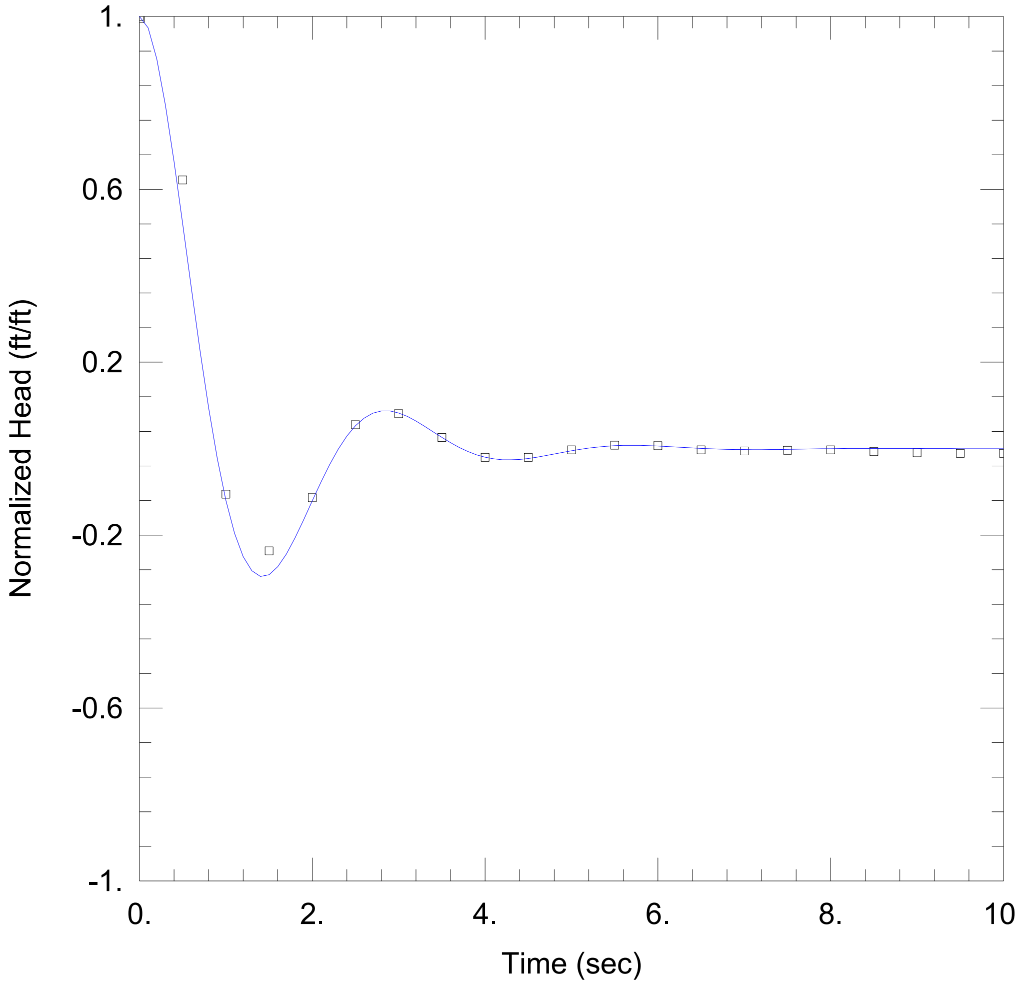
WELL DATA (XPW02)

Initial Displacement: 0.27 ft
Total Well Penetration Depth: 8.95 ft
Casing Radius: 0.086 ft
Static Water Column Height: 8.95 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.00605 cm/sec
y0 = 0.27 ft



BALDWIN XPW04 RH-1

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940103649-001
Location: Baldwin Power Plant
Test Well: XPW04
Test Date: 10/19/2022

AQUIFER DATA

Saturated Thickness: 12.5 ft
Anisotropy Ratio (Kz/Kr): 1.

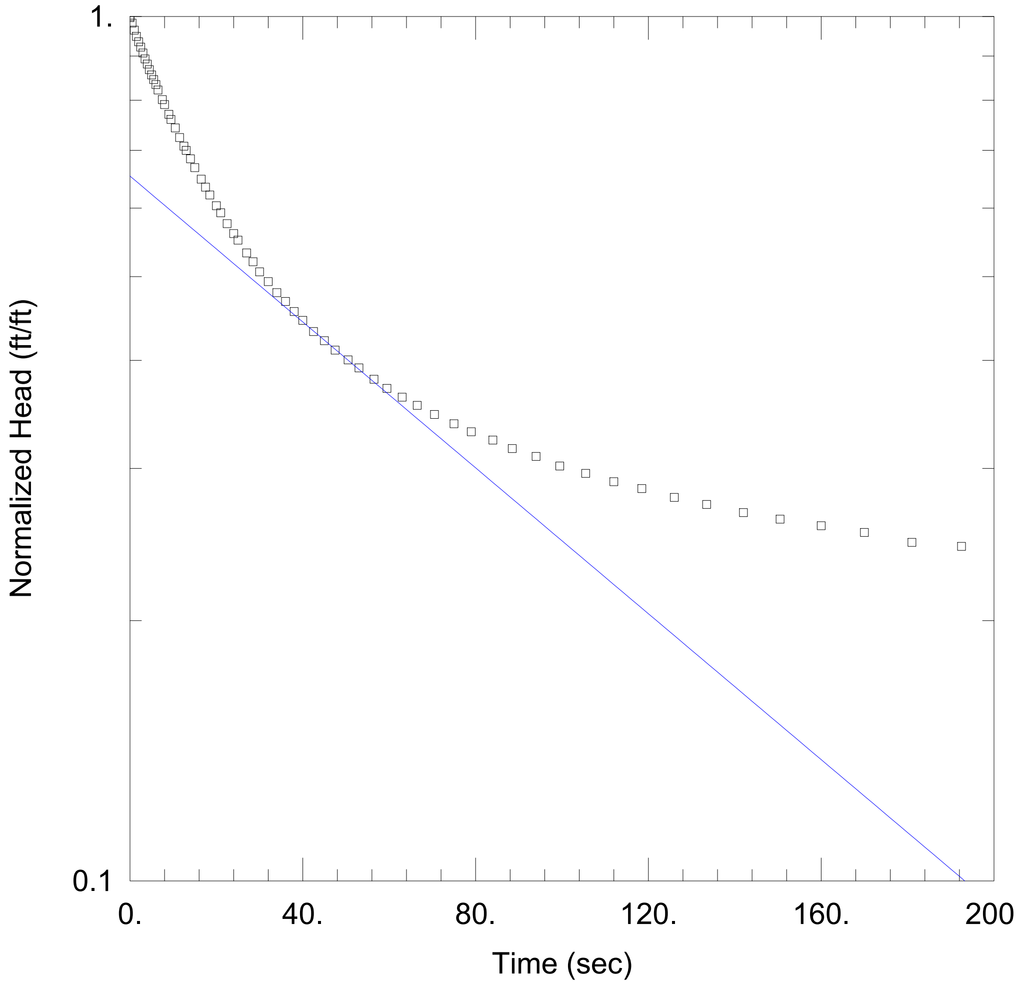
WELL DATA (XPW04)

Initial Displacement: 0.74 ft
Total Well Penetration Depth: 12.5 ft
Casing Radius: 0.086 ft
Static Water Column Height: 12.57 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Springer-Gelhar

K = 0.109 cm/sec
Le = 5.75 ft



BALDWIN XPW06 RH-1

PROJECT INFORMATION

Company: Ramboll
Client: Vistra
Project: 1940103649-001
Location: Baldwin Power Plant
Test Well: XPW06
Test Date: 10/19/2022

AQUIFER DATA

Saturated Thickness: 7.1 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (XPW06)

Initial Displacement: 1.53 ft
Total Well Penetration Depth: 7.1 ft
Casing Radius: 0.086 ft
Static Water Column Height: 7.1 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

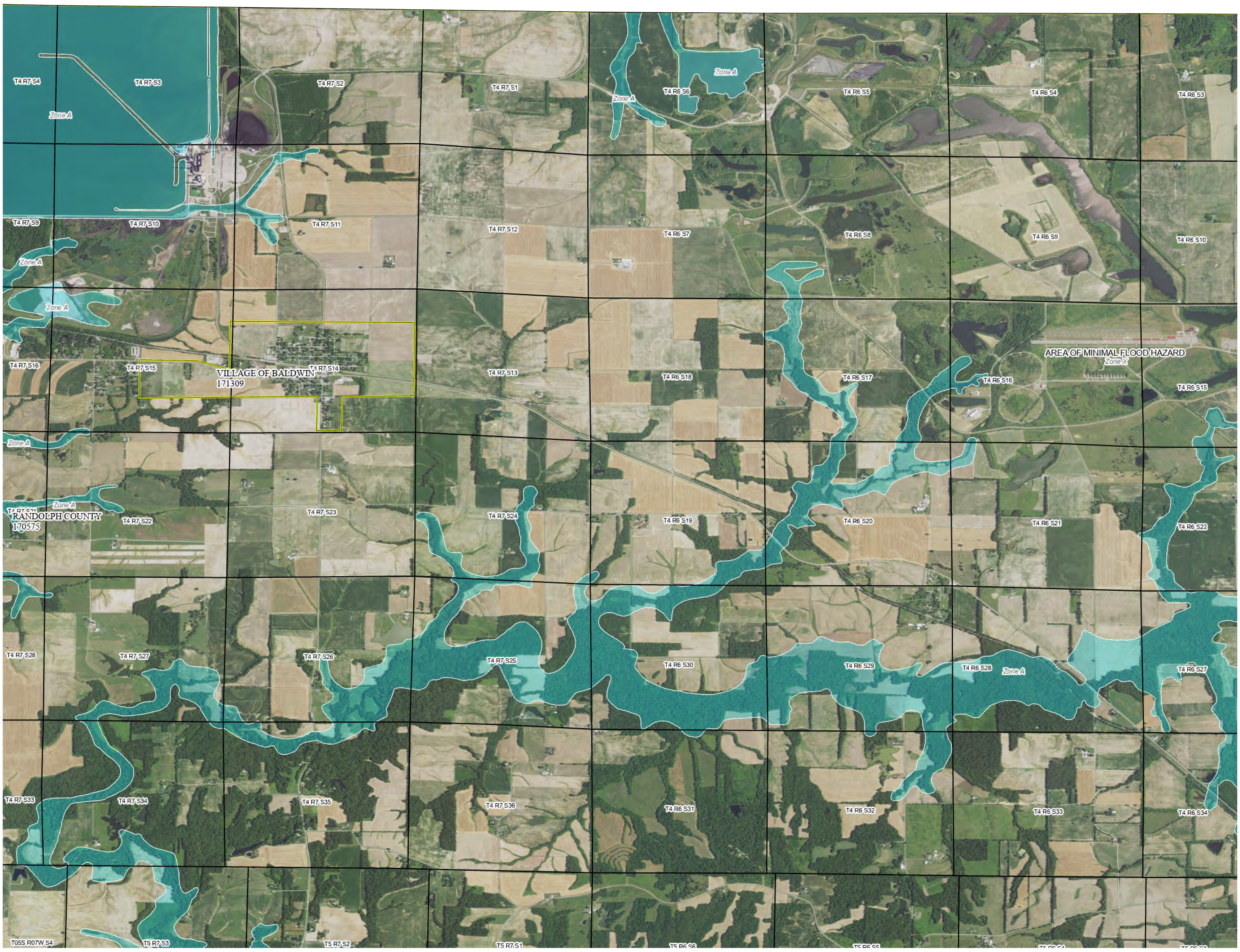
SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev

K = 0.000808 cm/sec
y0 = 1. ft

APPENDIX G
FEMA FLOOD HAZARD MAP

89°52'31.73"W 38°14'33.48"N



89°44'58.31"W 38°6'10.77"N

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR DRAFT FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) *Zone A, V, A99* With BFE or Depth *Zone AE, AO, AH, VE, AR*
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
		Future Conditions 1% Annual Chance Flood Hazard *Zone X*
		Area with Reduced Flood Risk due to Levee See Notes *Zone X*
		Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN	Area of Minimal Flood Hazard *Zone X*
		Effective LOMRs
		Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES	B 20.2 / 17.5	Cross Sections with 1% Annual Chance Water Surface Elevation
	8	Coastal Transect
		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
	513	Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at https://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates, refer to the Flood Insurance Study Report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Basemap information shown on this FIRM was provided in digital format by the United States Geological Survey (USGS). The basemap shown is the USGS National Map: Orthoimagery. Last refreshed October, 2020.

This map was exported from FEMA's National Flood Hazard Layer (NFHL) on **10/14/2021 10:24 AM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet at https://www.fema.gov/media-library/assets/documents/118418

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards. This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date.

SCALE

Map Projection:
GCS, Geodetic Reference System 1980;
Vertical Datum: No elevation features on this FIRM
For information about the specific vertical datum for elevation features, datum conversions, or vertical monuments used to create this map, please see the Flood Insurance Study (FIS) Report for your community at https://msc.fema.gov

N

1 inch = 2,000 feet **1:24,000**

0 1,000 2,000 4,000 6,000 8,000 Feet

0 210 420 840 1,260 1,680 Meters

FEMA
National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

PANEL **75** OF **475**

Panel Contains:

COMMUNITY	NUMBER	PANEL
RANDOLPH COUNTY	170575	0075
VILLAGE OF BALDWIN	171309	0075

MAP NUMBER
17157C0075D
EFFECTIVE DATE
November 05, 2008

APPENDIX H
40.C.F.R. § 257.95(g)(3)(ii): ALTERNATE SOURCE DEMONSTRATION, BALDWIN POWER PLANT, BOTTOM ASH POND, CCR UNIT 601. APRIL 30, 2023.

Intended for

Dynegy Midwest Generation, LLC

Date

April 30, 2023

Project No.

1940102203-001

40 C.F.R. § 257.95(g)(3)(ii): ALTERNATE SOURCE DEMONSTRATION

BALDWIN POWER PLANT

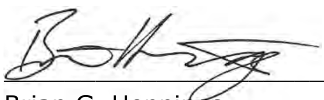
BOTTOM ASH POND

CCR UNIT 601

RAMBOLL Bright ideas. Sustainable change.

CERTIFICATIONS

I, Brian G. Hennings, a professional geologist in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used other than for its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.



Brian G. Hennings
Professional Geologist
196.001482
Illinois
Ramboll Americas Engineering Solutions, Inc.
Date: April 30, 2023

I, Anne Frances Ackerman, a qualified professional engineer in good standing in the State of Illinois, certify that the information in this report is accurate as of the date of my signature below. The content of this report is not to be used other than for its intended purpose and meaning, or for extrapolations beyond the interpretations contained herein.

Anne Frances Ackerman
Qualified Professional Engineer
062-060586
Illinois
Ramboll Americas Engineering Solutions, Inc.
Date: April 30, 2023

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CONTENTS

TABLES (IN TEXT)

FIGURES (IN TEXT)

FIGURES (ATTACHED)

APPENDICES

ACRONYMS AND ABBREVIATIONS

40 C.F.R.	Title 40 of the Code of Federal Regulations
35 I.A.C.	Title 35 of the Illinois Administrative Code
A5D	Assessment Monitoring Sampling Event A5D
ASD	Alternate Source Demonstration
BAP	Bottom Ash Pond
bgs	below ground surface
BPP	Baldwin Power Plant
CCR	coal combustion residuals
cm/s	centimeters per second
FAPS	Fly Ash Pond System
GWPS	groundwater protection standard
IEPA	Illinois Environmental Protection Agency
LOE(s)	line(s) of evidence
mg/L	milligrams per liter
NAVD88	North American Vertical Datum of 1988
NRT	Natural Resource Technology, Inc.
NRT/OBG	Natural Resource Technology, an OBG Company
PMP	potential migration pathways
Ramboll	Ramboll Americas Engineering Solutions, Inc.
SEP	Sequential extraction procedure
SSI	statistically significant increase
SSL	statistically significant level
XRD	X-ray diffraction

1. INTRODUCTION

Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257.95(g)(3)(ii) allows the owner or operator of a coal combustion residuals (CCR) unit 90 days from the date of determination of statistically significant levels (SSLs) over groundwater protection standards (GWPS) of groundwater constituents listed in Appendix IV of 40 C.F.R. § 257 to complete a written demonstration that a source other than the CCR unit being monitored caused the SSL(s) (Alternate Source Demonstration [ASD]), or that the SSL(s) resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

This ASD has been prepared on behalf of Dynegy Midwest Generation, LLC, by Ramboll Americas Engineering Solutions, Inc. (Ramboll), to provide pertinent information pursuant to 40 C.F.R. § 257.95(g)(3)(ii) for the Baldwin Power Plant (BPP) Bottom Ash Pond (BAP) located near Baldwin, Illinois.

The most recent Assessment Monitoring sampling event (A5D) was completed on September 30, 2022, and analytical data was received on November 15, 2022. Additional background and compliance monitoring wells were installed around the BAP in September and October of 2022. Following the well installations, eight monthly rounds of groundwater sampling were initiated per 35 I.A.C. § 845. Analytical data from all monitoring events, from December 2015 through A5D, were evaluated in accordance with the Statistical Analysis Plan (Natural Resource Technology, an OBG Company [NRT/OBG], 2017a) to determine any statistically significant increases (SSIs) of Appendix III parameters over background concentrations or SSLs of Appendix IV parameters over GWPSs. That evaluation identified one SSL at a compliance monitoring well as follows:

- Lithium at well MW-370

Pursuant to 40 C.F.R. § 257.95(g)(3)(ii), the lines of evidence (LOEs) presented in **Section 3** demonstrate that sources other than the BAP were the cause of the lithium SSL listed above. This ASD was completed by April 30, 2023, within 90 days of determination of the SSLs (January 30, 2023), as required by 40 C.F.R. § 257.95(g)(3)(ii).

2. BACKGROUND

2.1 Site Location and Description

The BPP is located in southwest Illinois in Randolph and St. Clair Counties. The Randolph County portion of the BPP is located within Sections 2, 3, 4, 9, 10, 11, 14, 15, and 16 of Township 4 South and Range 7 West. The St. Clair County portion of the property is located within Sections 33, 34, and 35 of Township 3 South and Range 7 West. The BAP is approximately one-half mile west-northwest of the Village of Baldwin.

The BPP property is bordered to the west by the Kaskaskia River; to the east by Baldwin Road, farmland, and strip-mining areas; to the southeast by the Village of Baldwin; to the south by the Illinois Central Gulf railroad tracks, scattered residences, and State Route 154; and to the north by farmland. The St. Clair/Randolph County Line crosses east-west at approximately the midpoint of Baldwin Lake (Cooling Pond). **Figure 1** shows the location of the BAP, as well as the Fly Ash Pond System (FAPS), Secondary Pond, Tertiary Pond, and Baldwin Lake (Cooling Pond). The BAP is adjacent to the FAPS, which was approved for closure by Illinois Environmental Protection Agency (IEPA) on August 16, 2016.

2.2 Groundwater Monitoring

The BAP groundwater monitoring system for compliance with 40 C.F.R. § 257 consists of two background monitoring wells (MW-304 and MW-306) and four compliance monitoring wells (MW-356, MW-369, MW-370, and MW-382). A map showing the groundwater monitoring system, including the CCR unit and all background and compliance monitoring wells, is presented in **Figure 1**. **Figure 1** also shows porewater location TPZ-164, as well as the monitoring wells that were installed in 2022. New monitoring well MW-358 was installed in 2022 upgradient of the BAP and compliance monitoring well MW-370 (compliance monitoring well with identified lithium SSL) with a well screen (363.7 to 373.7 feet North American Vertical Datum of 1988 [NAVD88]) that overlaps with MW-370 well screen elevations (355.6 to 365.6 feet NAVD88).

Groundwater samples are collected and analyzed in accordance with the Sampling and Analysis Plan prepared for the BAP (NRT/OBG, 2017b). Statistical evaluation of analytical data is performed in accordance with the Statistical Analysis Plan (NRT/OBG, 2017a).

2.3 Site Hydrogeology and Stratigraphy

Three hydrostratigraphic units are present at the Site, including CCR, an upper unit, and a bedrock unit. These units are described in detail in the Supplemental Hydrogeologic Site Characterization and Groundwater Monitoring Plan (Natural Resources Technology, Inc. [NRT], 2016) and the Hydrogeologic Site Characterization Report (Ramboll, 2021); and are summarized below.

- **CCR:** CCR, consisting primarily of fly ash, bottom ash, and boiler slag. Also includes earthen fill deposits of predominantly clay and silt materials from on-site excavations that were used to construct berms and roads surrounding the various impoundments across the Site. The 2022 Site Investigation observed up to 28.2 feet of bottom ash towards the center of the BAP (XPW05).
- **Upper Unit:** Predominantly clay with some silt and minor sand, silt layers, and occasional sand lenses. Includes the lithologic layers identified as the Cahokia Alluvium, Peoria Loess,

Equality Formation, and Vandalia Till Member. This unit is composed of unlithified natural geologic materials and extends from the water table to the bedrock. Thin sand seams and the interface (contact) between the Upper Unit and bedrock have been identified as potential migration pathways (PMPs). No continuous sand seams were observed in the Upper Unit within or immediately adjacent to the BAP; however, the sand seams may act as a PMP due to relatively higher hydraulic conductivities (on the order of 10^{-4} centimeters per second [cm/s]) than the surrounding clays (on the order of 10^{-5} cm/s).

- **Bedrock Unit:** Shallow bedrock beneath the BAP yields small amounts of water from interconnected pores, cracks, fractures, crevices, joints, and bedding planes and is the only water-bearing unit that is continuous across the Site; this unit is considered the Uppermost Aquifer (UA) and is composed of Pennsylvanian and Mississippian-aged interbedded shale and limestone bedrock having a regional strike that is generally north to northeast with a dip of 2 to 3 degrees to the east into the Illinois Basin (Breeden et. al, 2018; Bristol and Howard, 1971). The surface elevation varies across the site, generally sloping downward from east to west, and the unlithified Upper Unit thins from east to west. The top of bedrock depth ranges between 12.5 feet below ground surface (bgs) near the Kaskaskia River and 70 feet bgs within the East Fly Ash Pond (part of the FAPS). Limestone layers intercepted at the Site are generally light to dark gray, fine-grained, thin bedded, banded, argillaceous, and competent except where weathered. Weathering of the limestone produces a calcareous clay. The limestone layers are interbedded with thin shale layers and are sometimes fossiliferous or sandy. The shale layers are generally weathered, competent, silty, slightly micaceous, fissile, and dark gray. Where highly weathered shale (*i.e.*, decomposed bedrock) was encountered, the shale was non-fissile and resembled an unlithified stiff clay with medium to high plasticity. Bedrock in the vicinity of

Water quality in the Uppermost Aquifer (*i.e.*, Pennsylvanian and Mississippian-aged bedrock) degrades with increasing depth as water becomes increasingly mineralized. Therefore, water quality at monitoring wells with screens placed in deeper bedrock layers (*e.g.*, MW-358 and MW-370) would be expected to demonstrate more influence from the naturally increased mineralization than wells screened shallower in the bedrock. Groundwater flow in bedrock is toward the northwest in the east and central areas of the BAP, and southwest in the east area of the FAPS. The Secondary and Tertiary ponds were created in a former drainage channel and bedrock groundwater flows toward these ponds as illustrated in **Figure 2**. Groundwater elevations vary seasonally, generally less than 7 feet, although flow directions are generally consistent. Groundwater elevations across the Site range between approximately 370 and 450 feet NAVD88.

3. ALTERNATE SOURCE DEMONSTRATION: LINES OF EVIDENCE

This ASD is based on the following LOEs:

1. The lithium concentration in the BAP porewater is lower than the concentrations observed in compliance monitoring well location MW-370.
2. Compliance monitoring well MW-370 has a similar ionic composition to upgradient monitoring well MW-358.
3. An aquifer solids evaluation identified naturally occurring lithium associated with the shale bedrock as a source for lithium in the Uppermost Aquifer.

These LOEs are described and supported in greater detail below. Monitoring wells and the BAP porewater sample locations are shown in **Figure 1**.

3.1 LOE #1: The lithium concentration in the BAP porewater is lower than the concentrations observed in compliance monitoring well location MW-370.

Table A below provides summary statistics for lithium in background wells, MW-370 and BAP porewater collected from TPZ-164, and the five new porewater wells installed in 2022.

Table A. Summary Statistics for Lithium in MW-370 and BAP Porewater (December 2015 to March 2023).

Sample Location	Lithium (milligrams per liter [mg/L])		
	Minimum	Maximum	Median
Background Groundwater[1]	0.010	0.096	0.055
Exceedance Groundwater (MW-370)	0.098	0.22	0.14
BAP Porewater[2]	<0.005	0.035	0.013

Notes:
[1]Background groundwater was collected at monitoring wells MW-304 and MW-306.
[2]BAP porewater was collected at TPZ-164 (September 2018 through November 2022), XPW01, XPW02, XPW04, XPW05, and XPW06 (October 2022 through January 2023).

The following observations can be made from **Table A** above:

- Concentrations of lithium in background wells ranged from 0.010 to 0.096 mg/L, with a median concentration of 0.055 mg/L.
- Concentrations of lithium in downgradient compliance monitoring well MW-370 ranged from 0.098 to 0.22 mg/L, with a median concentration of 0.14 mg/L.
- Concentrations of lithium in BAP porewater ranged from non-detect (<0.005 mg/L) to 0.035 mg/L, with a median concentration of 0.013 mg/L.
- The median lithium concentration observed in porewater is an order of magnitude lower than the median lithium concentrations observed in compliance monitoring well MW-370.
- The highest observed lithium concentration in porewater is approximately six times lower than the maximum concentration observed in compliance monitoring well MW-370.

If the BAP was the source of lithium in downgradient groundwater, BAP porewater concentrations of lithium would be expected to be higher than the groundwater concentrations. The median lithium concentration observed in porewater is below the median lithium concentrations observed in both background and compliance groundwater monitoring wells, indicating that lithium concentrations are not related to the BAP.

3.2 LOE #2: Compliance monitoring well MW-370 has a similar ionic composition to upgradient monitoring well MW-358.

Stiff diagrams graphically represent ionic composition of aqueous solutions. **Figure A** on the following page shows a series of Stiff diagrams that display the ionic compositions of groundwater from background monitoring wells (brown); compliance monitoring wells (blue); and upgradient monitoring well MW-358 (tan). Polygons with similar shapes on Stiff diagrams indicate solutions with similar ionic compositions, whereas polygons with different shapes indicate solutions with dissimilar ionic compositions. The larger the area of the polygon, the greater the concentration of the various ions. A Stiff diagram was included in **Figure A** for one out-of-network, upgradient, monitoring well, MW-358, due to similarities with MW-370 with respect to ionic composition, well screen elevation, and the composition of the bedrock material.

Compliance monitoring well MW-370 has chloride as the dominant anion and a substantially higher proportion of Na+K, similar to upgradient well MW-358. Upgradient monitoring well MW-358 is screened in a similar shaley bedrock material and at a similar elevation to MW-370 (**Figures 3 and 4**). The similarity in ionic composition in compliance well MW-370 and upgradient well MW-358 suggests that groundwater at these locations and depths is from a similar lithologic material that has undergone a similar amount of naturally occurring dissolution, and supports the conclusion that natural variability of groundwater in the Uppermost Aquifer is responsible for the lithium SSL at MW-370.

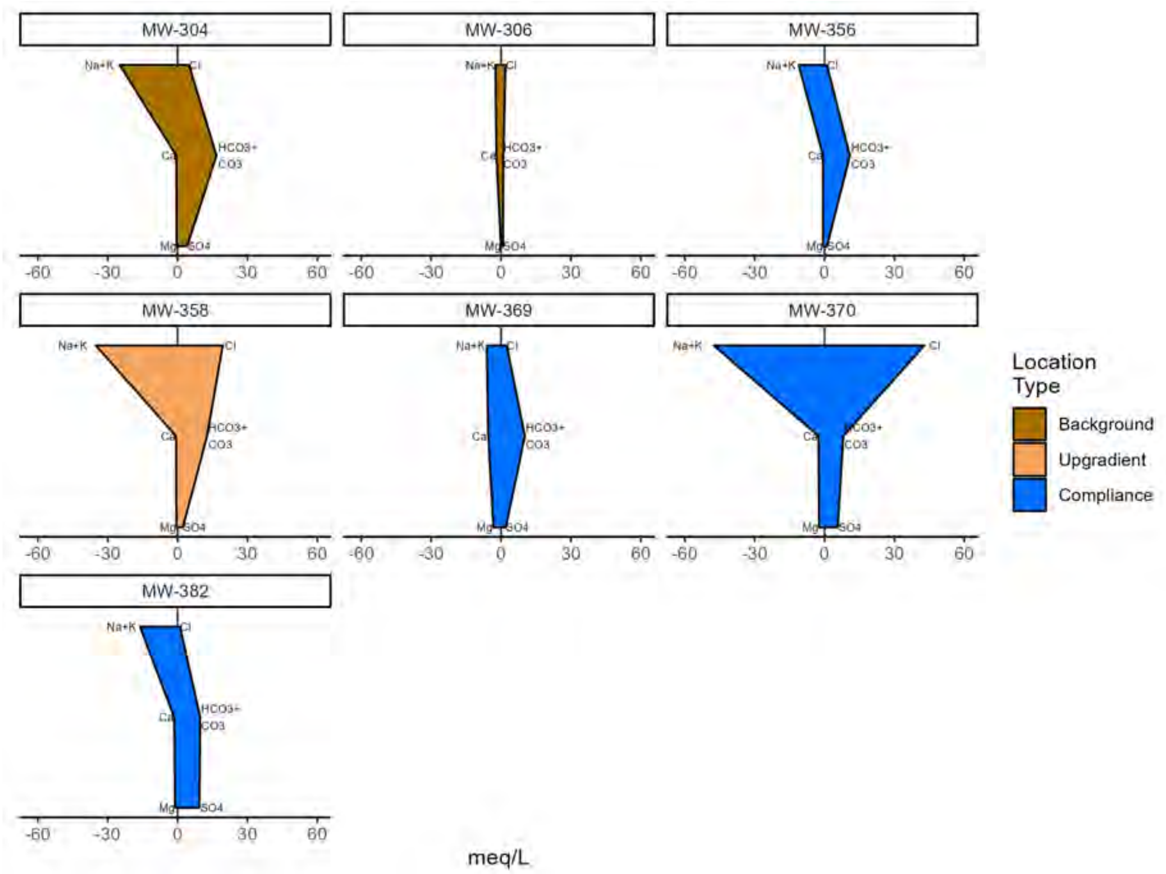

Figure A. Stiff Diagram Showing Ionic Composition of Samples of BAP Background (Brown), Compliance Groundwater (Blue), and Upgradient Groundwater (Tan).

3.3 LOE #3: An aquifer solids evaluation identified naturally occurring lithium associated with the shale bedrock as a source of lithium in the Uppermost Aquifer

Solid phase analyses were completed on samples collected from the Site to support the conclusion that lithium concentrations in groundwater at MW-370 are associated with naturally occurring lithium in the Uppermost Aquifer materials (limestone and shale bedrock formation). A review of the geochemical and site conditions was completed by Geosyntec Consultants, Inc. and is included as **Appendix A**. The following conclusions were made based on the results of the aquifer solids evaluation:

- Lithium host-minerals occur in the UA throughout the Site and constitute natural sources of lithium in BAP soils.
- Lithium is present in both upgradient and downgradient shale samples at the Site, with the largest concentrations observed in upgradient solids samples.
- Natural lithium occurrence in aquifer material from the Site is associated with multiple phases and therefore interacts with groundwater through different mechanisms at different locations and depths.

- Naturally occurring lithium associated with the shale bedrock comprising the UA at the Site was identified as a source of lithium in Site groundwater.

4. CONCLUSIONS

Based on the following three LOEs, it has been demonstrated that the lithium SSL at MW-370 is not due to the BAP:

1. The lithium concentration in the BAP porewater is lower than the concentrations observed in compliance monitoring well location MW-370.
2. Compliance monitoring well MW-370 has a similar ionic composition to upgradient monitoring well MW-358.
3. An aquifer solids evaluation identified naturally occurring lithium associated with the shale bedrock as a source for lithium in the Uppermost Aquifer.

This information serves as the written ASD prepared in accordance with 40 C.F.R. § 257.95(g)(3)(ii) that the SSL observed during the A5D sampling event was not due to the BAP. Therefore, a corrective measures assessment is not required, and the BAP will remain in assessment monitoring. Additional data is being collected to identify the source of the SSLs.

5. REFERENCES

Breeden, J.R., J.A. Devera, W.J. Nelson, and F.B. Denny, 2018. Bedrock Geology of Baldwin Quadrangle, Randolph and St. Clair Counties, Illinois: Illinois State Geological Survey, USGS-STATEMAP contract report, 2 sheets, 1:24,000.

Bristol, H.M., and Howard, R.H., 1971. Paleogeologic map of the Sub- Pennsylvanian Chesterian (Upper Mississippian) surface in the Illinois Basin: Illinois State Geological Survey, Circular 458, plate 1.

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Natural Resource Technology, an OBG Company (NRT/OBG), 2017a. *Statistical Analysis Plan, Baldwin Energy Complex, Havana Power Station, Hennepin Power Station, Wood River Power Station, Dynegy Midwest Generation, LLC*. October 17, 2017.

Natural Resource Technology, an OBG Company (NRT/OBG), 2017b. *Sampling and Analysis Plan, Final, Baldwin Bottom Ash Pond, Baldwin Energy Complex, Baldwin, Illinois, Project No. 2285*. October 17, 2017.

Ramboll Americas Engineering Solutions, Inc. (Ramboll), 2021. *Hydrogeologic Site Characterization Report. Baldwin Bottom Ash Pond. Baldwin Power Plant. Baldwin, Illinois*.

FIGURES

BACKGROUND WELL
COMPLIANCE WELL
MONITORING WELL
PORE WATER WELL

REGULATED UNIT (SUBJECT UNIT)
FLY ASH POND SYSTEM (CLOSED)
SITE FEATURE
CAPPED AREA
PROPERTY BOUNDARY

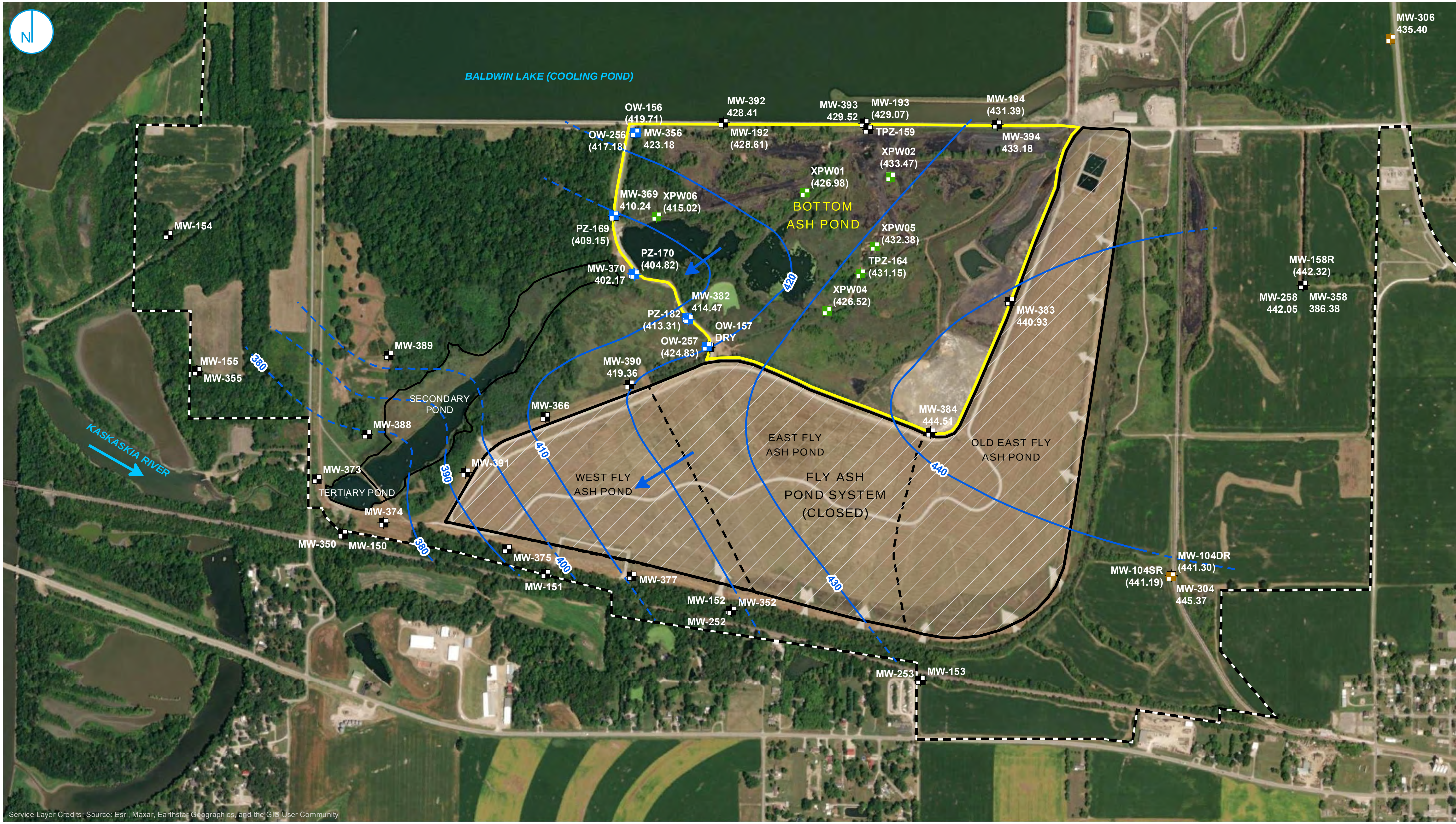
0 400 800 Feet

SAMPLING LOCATION MAP

ALTERNATE SOURCE DEMONSTRATION
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.



Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Baldwin_AP\2023\Figure 2_BAL BAP 601 845 Pot Surface 20221212.mxd

PROJECT: 169000XXXX | DATED: 4/20/2023 | DESIGNER: GALARNMC

- COMPLIANCE WELL
- BACKGROUND WELL
- PORE WATER WELL
- MONITORING WELL
- GROUNDWATER ELEVATION CONTOUR (10-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- PART 845 REGULATED UNIT (SUBJECT UNIT)
- FLY ASH POND SYSTEM (CLOSED)
- SITE FEATURE
- CAPPED AREA
- PROPERTY BOUNDARY

0 400 800 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 DECEMBER 12, 2022

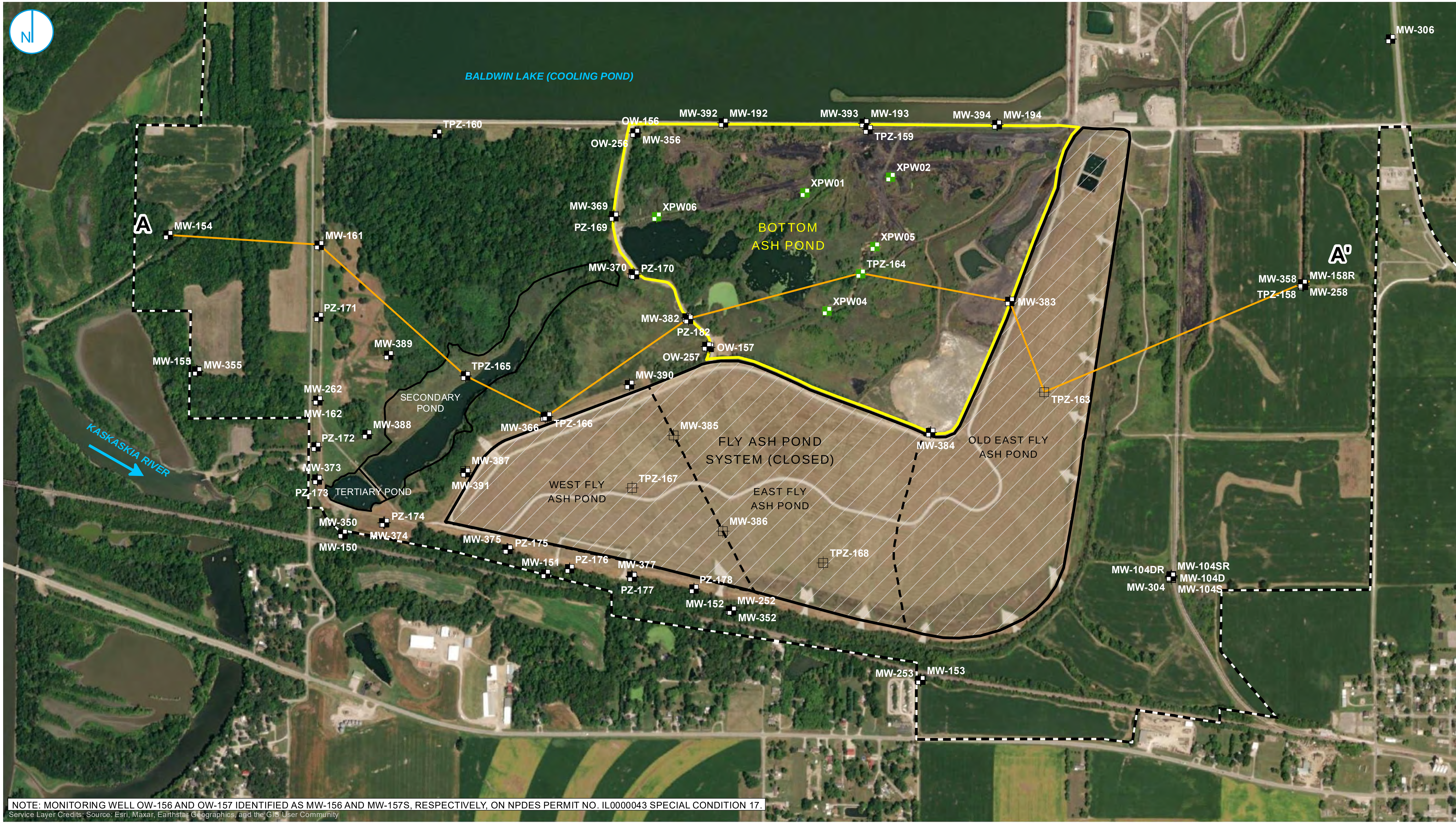
ALTERNATE SOURCE DEMONSTRATION
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 2

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Demo\Baldwin_AP\2023\Figure 3_Cross Section Locations.mxd



NOTE: MONITORING WELL OW-156 AND OW-157 IDENTIFIED AS MW-156 AND MW-157S, RESPECTIVELY, ON NPDES PERMIT NO. IL0000043 SPECIAL CONDITION 17.

Service Layer Credits: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

PROJECT: 169000XXXX | DATED: 4/24/2023 | DESIGNER: GALARNMC

MONITORING WELL AND PIEZOMETER LOCATION
PORE WATER WELL
CLOSED MONITORING WELL
CCR SOURCEWATER SAMPLE

CROSS SECTION TRANSECT

A to A'

REGULATED UNIT (SUBJECT UNIT) FLY ASH
POND SYSTEM (CLOSED)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

0 400 800 Feet

CROSS SECTION LOCATION MAP

ALTERNATE SOURCE DEMONSTRATION
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

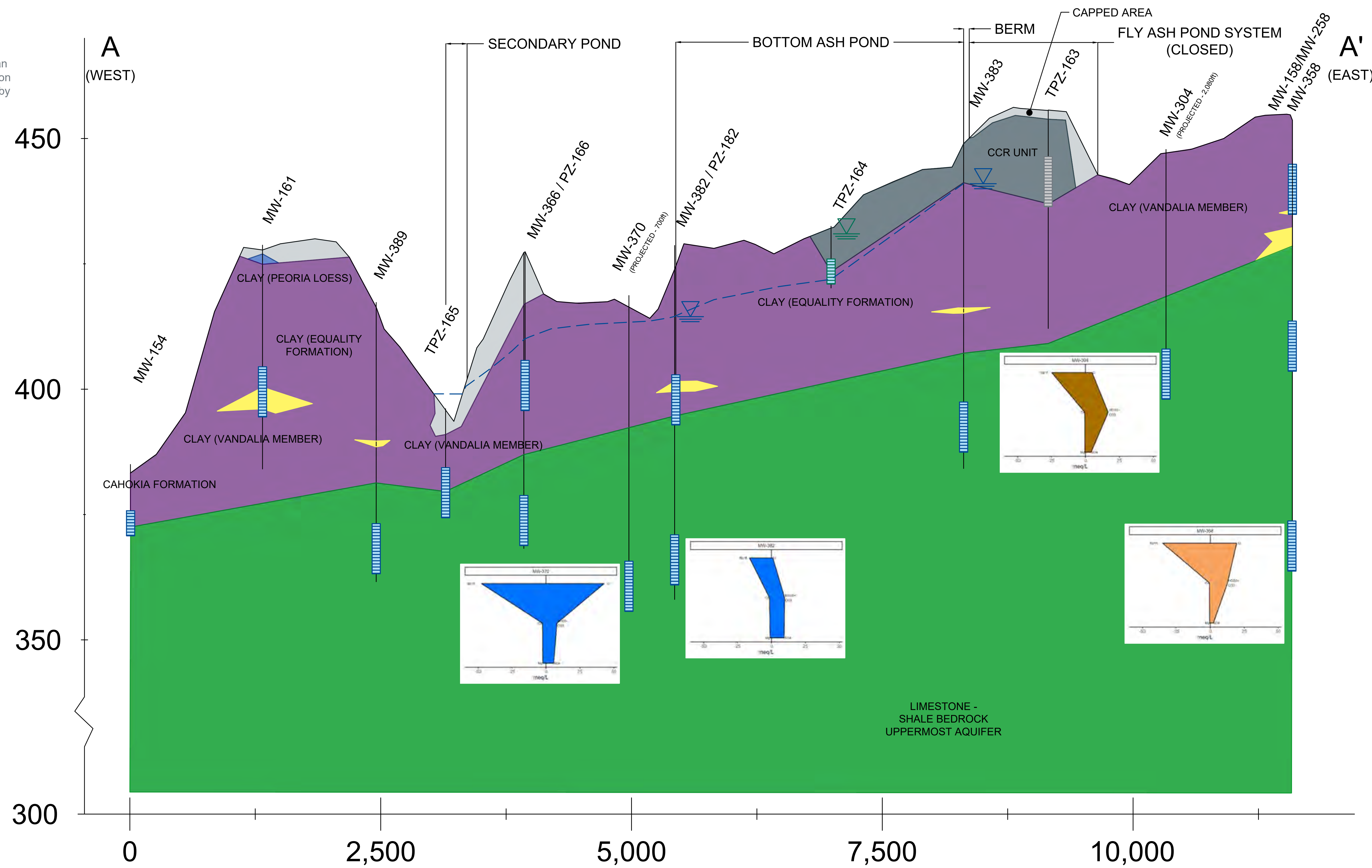
FIGURE 3

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 50X.
4. Groundwater elevations measured on December 12, 2022.



STIFF DIAGRAM LOCATION TYPE:

- BACKGROUND
- UPGRADIENT
- COMPLIANCE

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
- UPPERMOST AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)

20'
0
1,000'

CROSS SECTION A-A'

ALTERNATE SOURCE DEMONSTRATION BOTTOM ASH POND

BALDWIN POWER PLANT
BALDWIN, ILINOIS

FIGURE 4

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

APPENDICES

APPENDIX A
TECHNICAL MEMORANDUM - EVALUATION OF LITHIUM SOURCES WITHIN AQUIFER SOLIDS, BALDWIN POWER STATION - BOTTOM ASH POND (GEOSYNTEC CONSULTANTS, INC., 2023)

Geosyntec consultants

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TECHNICAL MEMORANDUM

Date:	April 24, 2023
To:	Brian Voelker - Vistra
Copies to:	Stu Cravens and Phil Morris - Vistra
From:	Allison Kreinberg and Ryan Fimmen, Ph.D. - Geosyntec Consultants
Subject:	Evaluation of Lithium Sources within Aquifer Solids Baldwin Power Station – Bottom Ash Pond

Geosyntec Consultants, Inc. (Geosyntec) has completed a review of geochemical and site conditions at the Baldwin Power Plant Bottom Ash Pond (BAP; the Site) to evaluate the influence of the bedrock lithology on groundwater composition at downgradient monitoring well MW-370.

Alternate source demonstrations (ASDs) prepared by Ramboll Americas Engineering Solutions, Inc. (Ramboll) concluded that sources other than the BAP were the cause of statistically significant levels (SSL) of lithium at MW-370. This technical review has identified naturally occurring lithium associated with the shale bedrock as a source of elevated lithium in Site groundwater.

SITE CONDITIONS

The groundwater monitoring network for the BAP consists of four downgradient compliance wells (MW-356, MW-369, MW-370, and MW-382) and two upgradient background wells (MW-304 and MW-306). These monitoring locations are shown in the map provided as **Attachment 1**. Site geology consists of glacial drift deposits comprised of clastic material overlying Pennsylvanian and Mississippian-age bedrock (Ramboll, 2021). The geologic units comprising subsurface lithologies at the Site are listed in descending order:

- Equality Formation: predominantly clay and sandy clay, with intermittent sand lenses and some secondary carbonate concretions
- Pearl Formation: predominantly fine-medium grained sand with intermittent gravel
- Vandalia Till: clay and sandy clay diamicton with intermittent silt, sand, and gravel lenses
- Bedrock: Mississippian-age limestone and shale which underlies unconsolidated material beneath the western portion of the Site, and Pennsylvanian-age limestone and shale which underlies unconsolidated material beneath the eastern portion of the Site. The gradual

change from Mississippian bedrock to Pennsylvanian bedrock is believed to occur approximately beneath the central portion of the Site (Willman et al., 1967).

Limestone bedrock at the Site is generally thinly bedded, argillaceous, and competent, with localized areas of increased weathering (Ramboll, 2021). The result of this limestone weathering is a calcareous clay lithology. Layers of limestone bedrock are interbedded with thin shale layers which are sometimes calcareous and sometimes siliciclastic. The shale layers are generally more weathered than the limestone bedrock but are generally still competent. Locations of highly weathered, non-fissile, clay-like shale with medium to high plasticity have been observed.

The Uppermost Aquifer (UA) in the vicinity of the BAP is the shallow limestone/shale bedrock. Although sand lenses are present within the unconsolidated material overlying bedrock, these lenses have not been found to be laterally continuous. Groundwater in the vicinity of the BAP flows through bedrock from east to west primarily through secondary porosity features, predominantly joints and fractures, which are present at variable frequencies within the UA.

Geologic cross-sections of the lithology underlying the BAP are provided as **Attachment 2**. The fracture network within the deeper portions of the UA bedrock is overlain by unconsolidated, predominantly low permeability clay with some silt, resulting in confined to semi-confined groundwater conditions with mostly upward vertical gradients and or flowing artesian conditions observed in the unconsolidated and UA bedrock units across the Site. The observed upward vertical gradients (upwelling) result in deeper groundwater characteristic of older lithologies mixing with shallow formation water in the UA. The flat horizontal groundwater gradient beneath the Site and the mostly upward vertical gradients also suggests the BAP is not an area of significantly increased recharge or infiltration to the UA. Groundwater quality in the UA has observed to decrease with increasing depths as confined formation water is increasingly mineralized (Ramboll, 2021).

GROUNDWATER CONDITIONS

The observed lithium SSL was identified by comparing the reported groundwater concentrations at downgradient monitoring well MW-370 to the site-specific groundwater protection standard (GWPS). The site-specific GWPS for lithium was established at 0.0958 mg/L, as the Site background concentrations were greater than the health-based level of 0.040 mg/L established in 40 CFR § 257.95(h)(2). Groundwater samples collected from recently installed upgradient monitoring well MW-358, which is screened in the Mississippian-age limestone and shale bedrock strata, contained lithium concentrations ranging from 0.0592 to 0.0957 mg/L. These upgradient concentrations, as well as previously observed results from background well MW-304, are elevated with respect to the health-based GWPS. This observation indicates that lithium is present at concentrations across the Site which suggest that a naturally occurring geogenic source of lithium to groundwater is present in these strata.

AQUIFER SOLIDS EVALUATION

Geosyntec reviewed the results of analyses completed on solid phase samples collected from the Site to support the conclusion that the lithium concentrations in groundwater at MW-370 in excess of the site-specific GWPS are associated with the limestone and shale bedrock formation.

Samples were collected from soil borings advanced in September and October 2022 at one location upgradient of the BAP (MW-358) and three locations downgradient of the BAP (MW-392, MW-393, and MW-394). These boring logs, plus the boring log for monitoring well MW-370, are provided as **Attachment 3**. Additional information regarding monitoring well construction and lithology depths of these locations and MW-370 is provided in **Table 1**. Three samples each were collected from various depth intervals/lithologies at MW-358 and MW-392, and one sample each was collected from the unconsolidated overburden at MW-393 and MW-394[1]. The samples were submitted for analysis of mineralogy via X-ray diffraction (XRD), total lithium, and lithium distribution within the aquifer solids using sequential extraction procedure (SEP). SEP uses progressively stronger reagents to solubilize metals from increasingly recalcitrant phases. Although these procedures do not identify the specific metal phases in a soil/aquifer matrix, they do provide a means to evaluate association of constituents with different classes of solids (Tessier et al, 1979).

Results for total and SEP analyses of lithium in these samples are presented in **Table 2** and the analytical laboratory reports are provided as **Attachment 4**. As a first step to evaluate data quality in an SEP analysis, the sum of individual extraction steps from the SEP was compared to the total lithium concentration. The sum of the SEP procedure is not expected to be exactly equal to the total metals analysis but should generally be consistent with the total metals analysis. As can be seen in **Table 2**, the total lithium concentrations ranged from 6.0 micrograms per gram of material (µg/g) to 20 µg/g in the shale samples. The summed concentrations of lithium from the SEP analyses ranged from 7 to 73 µg/g. The results were generally consistent between the total metals analyses and the summed SEP steps, indicating good metals recovery and data quality. One notable exception is the sample collected from 86-88 feet (ft.) below ground surface (bgs) at upgradient location MW-358, which had a total lithium concentration of 20.0 µg/g and a summed SEP total of 73 µg/g. While a difference was observed, both results indicate lithium is present within shale materials upgradient of the Site.

These results indicate that lithium is present in both upgradient and downgradient shale samples at the Site, with the largest concentrations observed in upgradient samples. Most lithium in these samples was found to be associated with the residual metals fraction, which is typically considered to be immobile and not readily soluble. The abundance of lithium within the residual fraction

---

[1] Select samples, including those collected from MW-393 and MW-394, are excluded from subsequent results tables and discussion to emphasize findings associated with the bedrock lithologies.

indicates association with inseparable primary mineral phases such as clay minerals (Tessier et al., 1979). Lithium was also found to be associated with iron/manganese oxides in multiple samples (maximum of 25% associated with iron/manganese oxides in the sample collected from the 47-49 ft. bgs samples from MW-358), and a small component of lithium was found to be associated with organic material in the 86-88 ft. bgs sample collected from MW-358. These results indicate that natural lithium occurrence in aquifer material from the Site is associated with multiple phases and therefore interacts with groundwater through different mechanisms at different locations and depths.

Clay minerals are known to be common geosorbents for naturally occurring lithium (Starkey, 1982). Lithium is known to leach from lithium-hosting igneous rocks and micas through weathering processes. Mineral alteration reactions occurring in micas may result in lithium-rich micas transforming directly to illitic clays, and then to mixed-layer and smectite clays. The lithium within these primary minerals either becomes incorporated directly into the crystal structures of these clay minerals or is transported in solution and later concentrated in brines through evaporation (Ronov et al., 1970). Lithium-enriched brines constitute a common source of lithium in clay minerals, as eroded fine-grained materials deposited in these brines are capable of housing aqueous lithium within vacant sites in octahedral layers comprising their crystal structures (Schultz, 1969). SEP results from **Table 2** support the conclusion that naturally occurring lithium is observed in soils around the BAP, and that the majority of this lithium is associated with the residual solids fraction which consists of primary minerals. Field lithologic descriptions of samples indicate that nearly all of the samples collected and analyzed consist of clay or shale, both of which are comprised primarily of mica and clay minerals which are known to be hosts of natural lithium. Based on SEP results and lithologic observations, the data suggests that lithium in BAP soils is naturally occurring and primarily associated with micas and clays, with a smaller component associated with leachable oxides and organic material.

Mineralogical analyses were completed using X-ray diffraction (XRD) to evaluate whole rock mineralogy and evaluate the abundance of clays and micas within the aquifer solids. Whole rock mineralogy results are provided in **Table 3**. Sample mineralogy consists predominantly of quartz, mica (muscovite), feldspars (albite and microcline), and clay minerals (chlorite, kaolinite) (**Table 3**). Of these minerals, muscovite and clays are known hosts of natural lithium within their crystal structures (Zawidzki, 1976; Starkey, 1982). The combined abundances of muscovite or clay minerals account for between 30 to 49% of samples within the bedrock shale samples, with an average value of 43%. As indicated on **Table 3**, these minerals are present at sizeable abundances both upgradient and downgradient of the BAP, indicating that these lithium-host minerals occur in the UA throughout the Site and constitute natural sources of lithium.

MW-370 is screened from 53-63 ft. bgs within an interval of shaley limestone, with additional shale and clay directly overlying this material, as indicated by the boring log included in **Attachment 3**. It is likely that lithium-hosting micas and clay minerals are present within the screened interval of this monitoring well, the leachable component of which may act as a geogenic source of lithium in groundwater. Additionally, groundwater downgradient of the BAP may be mixing with deeper groundwater in contact with lithium-bearing micas and clay minerals within the deep shale lithologies observed upgradient of the Site due to the observed upward vertical gradient within the bedrock unit.

CONCLUSION

Naturally occurring lithium associated with the shale bedrock comprising the UA at the Site was identified as a source for lithium in Site groundwater. Solid phase samples collected from upgradient and downgradient locations around the BAP contained variable lithium, with the highest total lithium concentration observed in the background deep shale sample. SEP analyses of the solid phase samples determined that the majority of lithium in the solid phase is associated with the residual metals fraction. The residual metals fraction corresponds to primary minerals such as micas and clay minerals, which are known to host natural lithium in their crystal structures, either as a result of mineral formation (micas) or depositional/alteration processes (clays). XRD confirmed the presence of micas and clay minerals in the aquifer solids at an average of 43% of the bedrock total mineralogy, suggesting an abundance of common lithium-hosting minerals which may release lithium to groundwater. This solid phase assessment supports the determination that MW-370 groundwater geochemistry appears to be related to shaley aquifer solid material.

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TABLES

Table 1 - Relevant Monitoring Well Information
Baldwin Power Plant

Monitoring Well	Well Classification	Screened Interval	Depth of Well	Geologic Material Within Screened Interval	Interval of Observed Alluvial Clay	Interval of Observed Bedrock
MW-370	Downgradient	53-63	66	Shaley limestone, Limestone	0-28.5	28.5-66
MW-358	Upgradient	80-90	90	Limestone, Shale	4-21	21-90
MW-392	Downgradient	74-84	84	Shale, Limestone	1-33	52-84
MW-393	Downgradient	75-85	85	Shale	1-27, 31-40	57-85
MW-394	Downgradient	73-83	85	Shale, Limestone	3-20, 22-37	37-85

Notes:
Depths provided in units of feet below ground surface
Observed clay and bedrock intervals are based on the boring logs provided in Attachment 3.

Table 2 - Lithium SEP Results Summary
Baldwin Power Plant

Well ID	**MW-358**		**MW-358**		**MW-392**		**MW-392**	
Depth (ft)	**(47-49)**		**(86-88)**		**(66-68)**		**(80-82)**	
Location	**Upgradient**		**Upgradient**		**Downgradient**		**Downgradient**	
Boring Log Description	**Shallow Shale**		**Deeper Shale Body**		**Shale**		**Shale transitioning to limestone**	
Total Lithium	6.0		20.0		15.0		8.0	
SEP Results								
	Concentration	% of Total	Concentration	% of Total	Concentration	% of Total	Concentration	% of Total
Water Soluble Fraction	<2	--	<2	--	<2	--	<2	--
Exchangeable Metals Fraction	<2	--	<2	--	<2	--	<2	--
Metals Bound to Carbonates Fraction	<2	--	<2	--	<2	--	<2	--
Metals Bound to Fe/Mn Oxides Fraction	3.0	25%	5.0	7%	2.0	10%	<2	--
Bound to Organic Material Fraction	<2	--	3.0	4%	<2	--	<2	--
Residual Metals Fraction	9.0	75%	65.0	89%	19.0	90%	7.0	100%
SEP Total	12.0	100%	73.0	100%	21.0	100%	7.0	100%

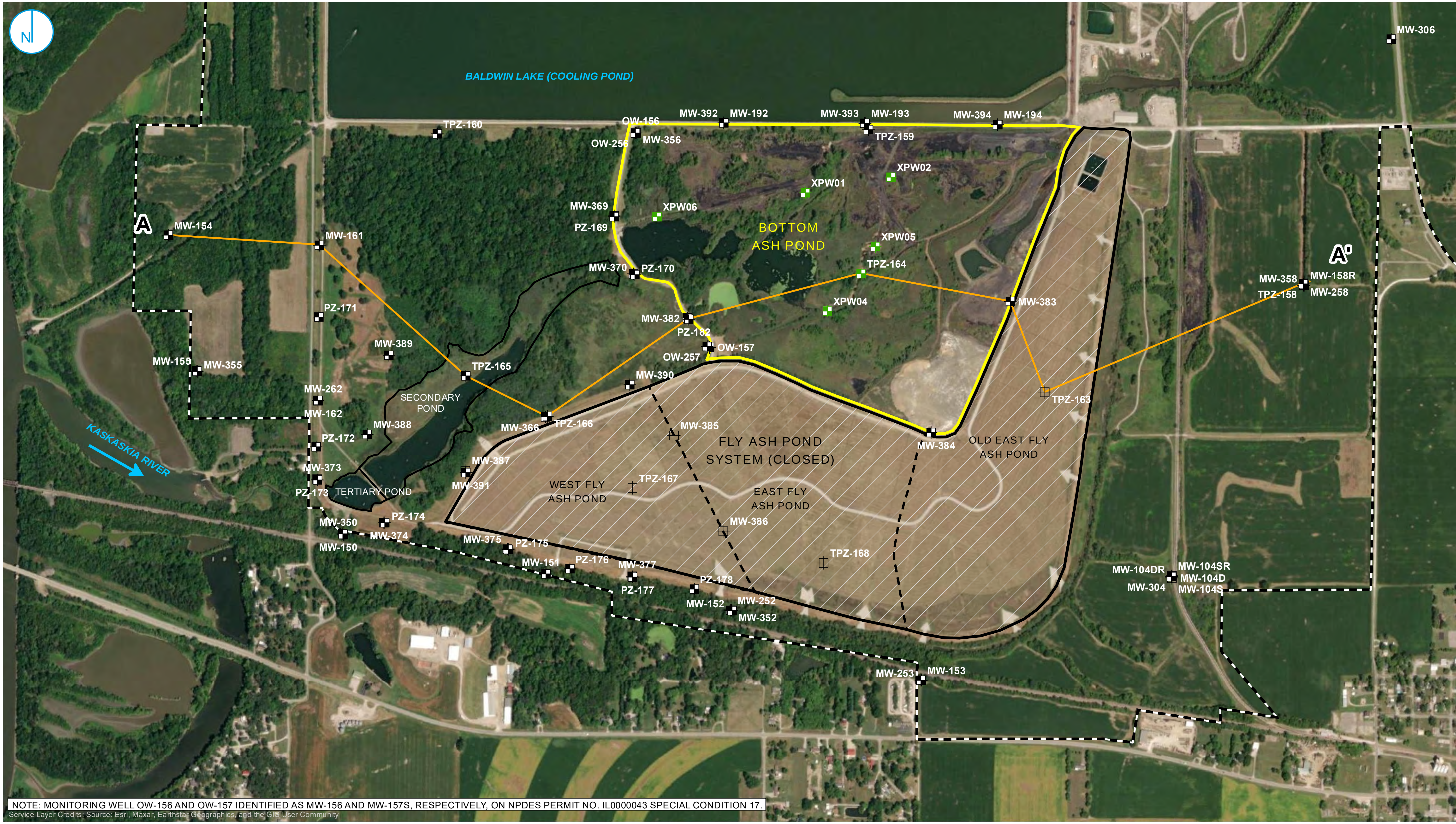
Notes:
SEP - sequential extraction procedure
All results shown in microgram of lithium per gram of soil (µg/g).
Total lithium was analyzed using aqua regia digest, ICP-MS
Non-detect values are shown as less than the detection limit.
The lithium fraction associated with each SEP phase is shown.
% of total lithium is calculated from the sum of the SEP fractions.

Table 3 - Summary of Rietveld Quantitative Analysis
X-Ray Diffraction Results
Baldwin Power Plant

Well ID			MW-358	MW-358	MW-392	MW-392
Depth (ft bgs)			(47-49)	(86-88)	(66-68)	(80-82)
Location			Upgradient	Upgradient	Downgradient	Downgradient
Boring Log Description			Shallow Shale	Deeper Shale Body	Shale	Shale transitioning to limestone
Mineral/Compound	**Formula**	**Mineral Type**	(wt %)	(wt %)	(wt %)	(wt %)
Quartz	SiO_2	Silicate	33.0	34.9	27.2	29.1
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	Mica	37.6	30.5	29.7	14.5
Albite	$NaAlSi_3O_8$	Feldspar	8.2	3.4	4.5	1.0
Microcline	$KAlSi_3O_8$	Feldspar	9.4	8.1	6.9	2.9
Chlorite	$(Fe,(Mg,Mn)_5,Al)(Si_3Al)O_{10}(OH)_8$	Clay	-	-	16.3	6.8
Diaspore	aAlO.OH	Oxyhydroxide	-	-	-	-
Pyrite	FeS_2	Sulfide	1.0	0.8	-	1.2
Kaolinite	$Al_2Si_2O_5(OH)_4$	Clay	9.0	18.4	-	8.2
Calcite	$CaCO_3$	Carbonate	1.8	1.7	14.8	31.5
Anatase	TiO_2	Oxide	-	2.1	0.7	0.4
Leucite	$KAlSi_2O_6$	Zeolite	-	-	-	2.4
Siderite	$FeCO_3$	Carbonate	-	-	-	1.9
Dolomite	$CaMg(CO_3)_2$	Carbonate	-	-	-	-
Gypsum	$CaSO_4·2H_2O$	Sulfate	-	-	-	-
Diopside	$CaMgSi_2O_6$	Pyroxene	-	-	-	-
Clay Minerals Total			9	18	16	15
Clays + Muscovite Total			47	49	46	30

Notes
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.
Sample depths are shown in feet below ground surface (ft bgs).

ATTACHMENT 1
Cross Section Location Map



PROJECT: 169000XXXX | DATED: 4/24/2023 | DESIGNER: GALARNMC

Y:\Mapping\Projects\22\2285\MXD\Alt_Source_Dem\Baldwin_AP\2023\Figure 3_Cross Section Locations.mxd

MONITORING WELL AND PIEZOMETER LOCATION
PORE WATER WELL
CLOSED MONITORING WELL
CCR SOURCEWATER SAMPLE

CROSS SECTION TRANSECT

A to A'

REGULATED UNIT (SUBJECT UNIT) FLY ASH
POND SYSTEM (CLOSED)
SITE FEATURE
LIMITS OF FINAL COVER
PROPERTY BOUNDARY

0 400 800 Feet

CROSS SECTION LOCATION MAP

ALTERNATE SOURCE DEMONSTRATION
BOTTOM ASH POND
BALDWIN POWER PLANT
BALDWIN, ILLINOIS

FIGURE 3

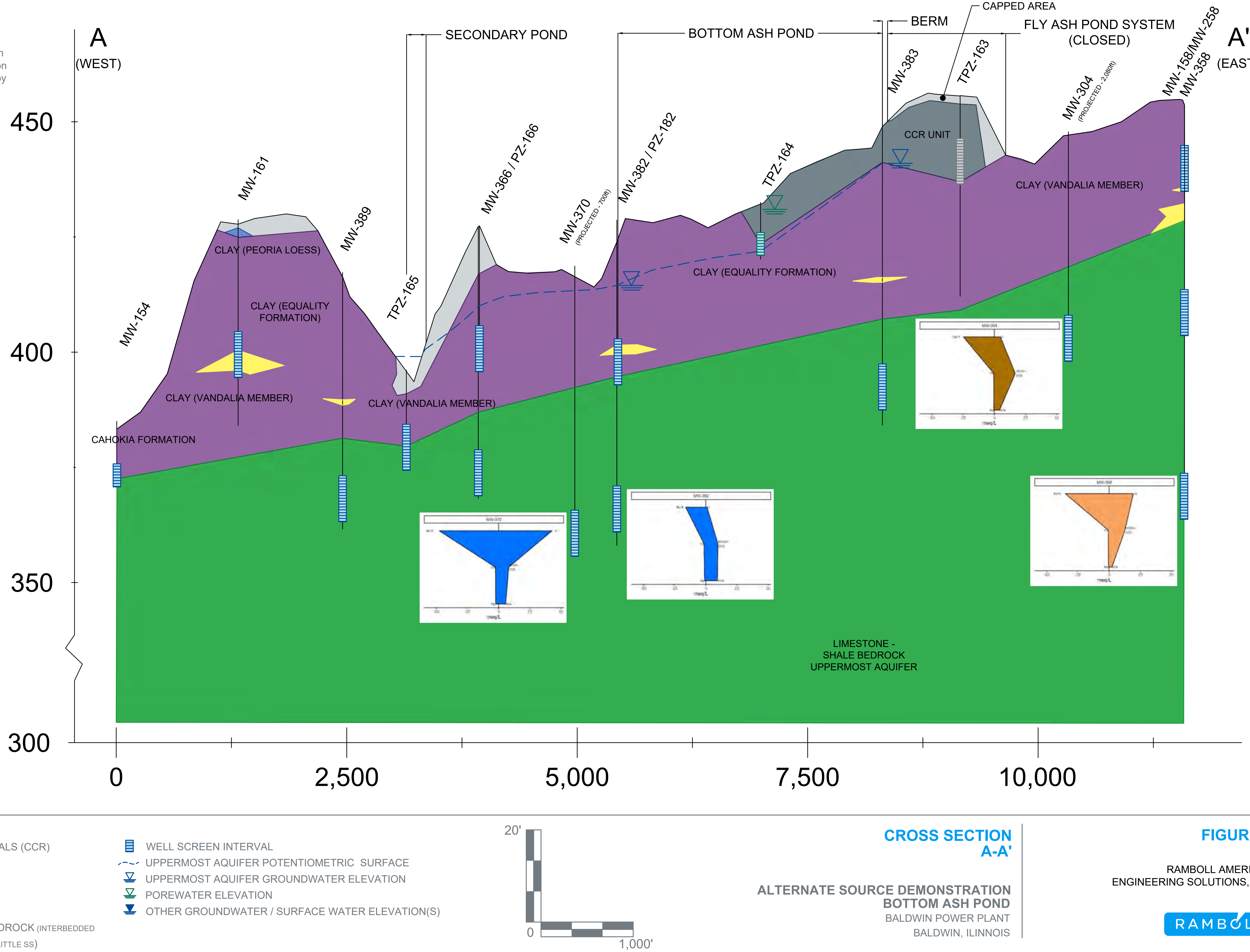
RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

ATTACHMENT 2
Cross Section A-A'

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 50X.
4. Groundwater elevations measured on December 12, 2022.



CROSS SECTION A-A'

ALTERNATE SOURCE DEMONSTRATION BOTTOM ASH POND

BALDWIN POWER PLANT
BALDWIN, ILINOIS

FIGURE 4

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

ATTACHMENT 3
Boring Logs

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Energy Complex		MW-370

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Mark Baetje Bulldog Drilling	11/20/2015	11/24/2015	4 1/4 HSA and rotary

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-370	Feet (NAVD88)	418.67 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,826.50 N, 2,381,936.14 E E/W (W circled)
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 44.1702"
Long -89° 52' 10.8084"
Local Grid Location: Feet ☐ N ☐ S; Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	Illinois	Baldwin

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0-2	0 - 2' **SILTY CLAY** CL/ML.	CL/ML								0-28' Blind Drilled. See log PZ-170 for soil description.
			2-4	2 - 4' Shelby Tube Sample.									
			4-8	4 - 8' **SILTY CLAY** CL/ML.	CL/ML								
			8-10	8 - 10' **SILTY CLAY** to **LEAN CLAY:** CL/ML.	CL/ML								
			10-12	10 - 12' **LEAN CLAY:** CL.	CL								

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

Signature

Firm Natural Resource Technology
234 W. Florida St., Fifth Floor, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-370

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
			12 - 14	12 - 14' Shelby Tube Sample.										
			14 - 24	14 - 24' **SILTY CLAY** CL/ML.	CL/ML									
			24 - 26	24 - 26' Shelby Tube Sample.										
			26 - 28	26 - 28' **SILTY CLAY** CL/ML.	CL/ML									
1 SS	10 10	23 50/4"	28 - 28.4	28 - 28.4' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), trace angular limestone gravel, soft, medium plasticity, moist.	CL									
1 CORE	60 18.5		28.4 - 28.9	28.4 - 28.9' **SHALE:** BDX (SH), gray, highly decomposed, very weak.	BDX (SH)									Core 1, RQD=51%
			28.9 - 38.1	28.9 - 38.1' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (extremely narrow to moderately narrow apertures), medium to thickly bedded, microcrystalline, moderately decomposed, very strong.	BDX (LS/SH)									

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-370

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		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33	28.9 - 38.1' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (extremely narrow to moderately narrow apertures), medium to thickly bedded, microcrystalline, moderately decomposed, very strong. *(continued)*										
2 CORE	51.5 12		34	33.9' - 38.1' gray, greenish gray in fractures, trace fossils, moderately to highly decomposed, slightly to moderately disintegrated, clay in shoe with a hard, reddish brown inclusion.										Core 2, RQD=0%
			35		BDX (LS/SH)									
			36	36' - 37.9' vertical fracture.										
			37											
3 CORE	24 25		38	38.1 - 44' **SHALE:** BDX (SH), bluish gray, intensely fractured (extremely narrow to narrow apertures), highly decomposed, weak.										Core 3, RQD=40%
			39											
4 CORE	24 11		40											Core 4, RQD=0%
5 CORE	36 32		41	40.6' - 40.8 shaley limestone layer, light gray to gray, microcrystalline, moderately decomposed, very strong. 41.1' - 43.2 gray, moderately to highly decomposed.	BDX (SH)									Core 5, RQD=78%
			42											
			43											
6 CORE	12 28		44	44 - 45.7' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (extremely narrow to narrow apertures), thin to medium bedded, microcrystalline, slightly decomposed, clay cement in apertures, very strong.										Core 6, RQD=29%
7 CORE	45 27		45	45' shale layer, bluish gray, moderately fractured (extremely narrow to narrow apertures), highly decomposed, weak.	BDX (LS/SH)									Core 7, RQD=65%
			46	45.7 - 52.2' **SHALE:** BDX (SH), bluish gray, moderately fractured (tight to narrow), highly decomposed, weak.										
			47											
			48											
8 CORE	24 30		49		BDX (SH)									Core 8, RQD=78%
			50											
			51											
9 CORE	24 24		52											Core 9, RQD=0%

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-370

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		Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
				52' clay cement.										
10 CORE	24 36		53 54 55 56 57 58 59 60 61	52.2 - 61.7' **SHALEY LIMESTONE:** BDX (LS/SH), light gray to gray, intensely fractured (very narrow to narrow), thin to medium bedded, microcrystalline, slightly decomposed, cemented clay in apertures, very strong. 52.7' - 53' clayey sand in aperture. 53' - 53.1 shale bed, bluish gray, fossiliferous, moderately fractured (very narrow to narrow), highly decomposed, weak. 53.1' white to bluish gray, gray in the fractures (extremely narrow to moderately narrow apertures), thinly to medium bedded, slightly to moderately disintegrated. 55.7' moderately disintegrated. 58.1' highly decomposed.	BDX (LS/SH)									Core 10, RQD=0%
11 CORE	24 30													Core 11, RQD=18%
12 CORE	30 27													Core 12, RQD=39%
13 CORE	36 53													Core 13, RQD=89%
			62 63 64 65	61.7 - 65.3' **LIMESTONE:** BDX (LS).	BDX (LS)									
			66	65.3 - 66' Overdrilled for Well Installation.										
				66' End of Boring.										Bedrock corehole reamed 6" in diameter to 66' for well installation.

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		MW358

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Blake Weller Cascade Drilling	10/5/2022	10/8/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW358	Feet (NAVD88)	453.59 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 556,726.26 N, 2,387,756.63 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 42.9882"
Long -89° 50' 57.9018"
Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	180 97		0–3.8	0 - 3.8' **SILT:** ML, very dark grayish brown (10YR 3/2), organic material (0-10%), moist to wet. 2.1' dry.	ML									CS= Core Sample Measured Rock Quality Designation (RQD) was modified due to drilling methods, modified RQD equals the sum of recovered core sections greater than 4 inches in length divided by total core recovery.
			3.8–8.9	3.8 - 8.9' **CLAYEY SILT:** ML/CL, light gray (10YR 7/2), very dark grayish brown (10YR 3/2) and yellowish brown (10YR 5/8) mottling (20-30%), dry.	ML/CL									
			8.9–12	8.9 - 13' **SILTY CLAY WITH SAND:** (CL/ML)S, grayish brown (10YR 5/2), strong brown (7.5YR 5/6) and very dark brown (10YR 2/2) mottling (20-30%), organic material (0-10%), low toughness, low to medium plasticity, stiff.	(CL/ML)S									

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

Signature [signature]

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Fax: (414)837-3608

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Boring Number MW358

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	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
					(CL/ML)S							
2 CS	60 60		13–17.8	13 - 17.8' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), strong brown (7.5YR 5/6) and very dark brown (10YR 2/2) mottling (20-30%), low toughness, medium to high plasticity, stiff to very stiff. 16.1' mottling discontinues.	CL/ML							
3 CS	48 36		17.8–21	17.8 - 21' **SILTY CLAY WITH SAND:** (CL/ML)S, brown (10YR 5/3), strong brown (7.5YR 5/6) and gray (10YR 6/1) mottling (20-30%), gravel (5-15%), no dilatancy, high toughness, low to medium plasticity, hard, moist.	(CL/ML)S							
4 CORE	36 32		21–26.5	21 - 26.5' **SHALE:** BDX (SH), dark gray (GLEY 1 4/N), weathered, thin bedding, moderately fractured. 24' -25.2' wet.	BDX (SH)							RUN #4: Modified RQD = (21/32) = 66%
			26.5–27.5	26.5 - 27.5' **LIMESTONE:** BDX (LS), dark gray (5Y 4/1), shaley, fossiliferous, very strong.	BDX (LS)							
5 CORE	36 29		27.5–31.3	27.5 - 31.3' **SHALE:** BDX (SH), grayish black (N2), weathered, highly decomposed to residual soil, wet to moist. 29.3' thinly bedded, moderately decomposed. 30' slightly decomposed to competent, moderately fractured.	BDX (SH)							RUN #5: Modified RQD = (0/29) = 0%
6 CORE	72 60											RUN #6: Modified RQD = (45/60) = 75%
			31.3–32	31.3 - 32' **COAL:** COAL, black (N1).	COAL							

Boring Number MW358

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
			33	32 - 33' **SHALE:** BDX (SH), grayish black (N2), slightly decomposed to competent, moderately fractured, wet to moist.	BDX (SH)									
			34, 35	33 - 36' **SHALEY LIMESTONE:** BDX (LS/SH), medium gray (N5), weathered, shaley, higly decomposed, slightly fractured.	BDX (LS/SH)									
7 CORE	72 71		36, 37, 38, 39, 40	36 - 40.8' **SHALEY LIMESTONE:** to **SHALE:** BDX (LS/SH), interbedded shale.	BDX (LS/SH)									RUN #7: Modified RQD = (67/71) = 94%
			41	40.8 - 42' **LIMESTONE:** BDX (LS), medium light gray (N6), strong to moderately fractured, slightly decomposed, narrow apertures.	BDX (LS)									
8 CORE	96 85		42, 43, 44, 45, 46, 47	42 - 58.9' **SHALE:** BDX (SH), medium gray (N5) to medium dark gray (N4), weathered, weak, thinly bedded, moderately to highly fractured.	BDX (SH)									RUN #8: Modified RQD = (81/85) = 94%
			48, 49	47.5' dark grayish brown (10YR 4/2), pale olive (5Y 6/4) discoloration, more competent.										
9 CORE	60 60		50	50.2' weak to moderate.										RUN #9: Modified RQD = (52/60) = 87%
			51, 52	50.8' olive gray (5Y 5/2).										

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	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			53	42 - 58.9' **SHALE:** BDX (SH), medium gray (N5) to medium dark gray (N4), weathered, weak, thinly bedded, moderately to highly fractured. *(continued)* 52.2' dark grayish green (5GY 4/2).										
			54	54.1' medium dark gray (N4) to medium gray (N5), weak, highly decomposed, no visible bedding, dry.										
10 CORE	60 58		55		BDX (SH)									RUN #10: Modified RQD = (42/58) = 72%
			56	55.7' dark grayish green (5GY 4/2).										
			57	57.2' light brownish gray (10YR 6/2), thinly bedded, laminated.										
			58	58.2' medium dark gray (N4), strong, intensely fractured, thinly bedded.										
			59	58.9 - 64' **LIMESTONE:** BDX (LS), medium gray (N5), very strong, moderately fractured, visible laminations.										
11 CORE	36 31		60											RUN #11: Modified RQD = (8/31) = 26%
			61											
			62		BDX (LS)									
12 CORE	36 36		63											RUN #12: Modified RQD = (31/36) = 86%
			64	64 - 75.3' **SHALE:** BDX (SH), medium dark gray (N4) to medium gray (N5), strong, thinly bedded to laminated, moderately fractured. 64.3' grayish green (5GY 5/2), weathered, weak, decomposed.										
			65											
13 CORE	48 48		66											RUN #13: Modified RQD = (43/48) = 90%
			67											
			68		BDX (SH)									
			69	69.3' medium dark gray (N4), weathered, moderate strength.										
14 CORE	60 58		70											RUN# 14: Modified RQD = (57/58) = 99%
			71											
			72											

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Boring Number MW358

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			73, 74, 75	64 - 75.3' **SHALE:** BDX (SH), medium dark gray (N4) to medium gray (N5), strong, thinly bedded to laminated, moderately fractured. *(continued)*	BDX (SH)									
15 CORE	60 56		76, 77	75.3 - 77.1' **LIMESTONE:** BDX (LS), gray (5Y 6/1), fossiliferous, very strong.	BDX (LS)									RUN #15: Modified RQD = Not Recorded
			78	77.1 - 78.2' **SHALE:** BDX (SH), medium dark gray (N4), weathered, weak to moderate strength, moderately decomposed.	BDX (SH)									
16 CORE	60 51		79, 80, 81, 82, 83, 84	78.2 - 84.8' **LIMESTONE:** BDX (LS), medium dark gray (N4) to medium gray (N5), shaley, fossiliferous, very strong, moderately fractured, laminations (0-5%).	BDX (LS)									RUN #16: Modified RQD = (23/51) = 45%
17 CORE	60 60		85, 86, 87, 88, 89, 90	84.8 - 90' **SHALE:** BDX (SH), dark gray (N3), weathered, weak to moderate strength, moderately decomposed, moderately fractured, thin bedding.	BDX (SH)									RUN #17: Modified RQD = (28/60) = 47%
				90' End of Boring.										

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		MW392

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Blake Weller Cascade Drilling	9/9/2022	9/26/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW392	Feet (NAVD88)	434.07 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 558,140.20 N, 2,382,717.92 E E/Ⓦ
1/4 of 1/4 of Section , T N, R
Lat 38° 11' 57.132"
Long -89° 52' 0.9632"
Local Grid Location ☐ N ☐ S Feet ☐ E ☐ W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	120 46		0–1	0 - 1.2' **FILL, WELL-GRADED GRAVEL WITH CLAY:** GW-GC, pinkish gray (7.5YR 6/2), angular, moist.	(FILL) GW-GC									CS= Core Sample Measured Rock Quality Designation (RQD) was modified due to drilling methods, modified RQD equals the sum of recovered core sections greater than 4 inches in length divided by total core recovery.
			1–10	1.2 - 16' **FILL, LEAN CLAY:** CL, light brown (7.5YR 6/4), sand (0-5%), no dilatancy, low to medium plasticity, moist.	(FILL) CL									
2 CS	120 62		10–12											

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

Signature

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SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW392

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13–16	1.2 - 16' **FILL, LEAN CLAY:** CL, light brown (7.5YR 6/4), sand (0-5%), no dilatancy, low to medium plasticity, moist. *(continued)*	(FILL) CL									
			16–20	16 - 20' **LEAN CLAY:** CL, light brown (7.5YR 6/4), sand (0-5%), no dilatancy, low to medium plasticity, moist.	CL									
3 CS	120 33		20–30	20 - 33' **LEAN CLAY:** CL, pinkish gray (7.5YR 6/2), sand (0-5%), medium to high plasticity, stiff, moist.	CL									
4 CS	120 104		30–32	30' increasing sand and gravel content.										

Boring Number MW392

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
				20 - 33' **LEAN CLAY:** CL, pinkish gray (7.5YR 6/2), sand (0-5%), medium to high plasticity, stiff, moist. *(continued)*	CL									
			33	33 - 35' **WELL-GRADED SAND WITH SILT AND GRAVEL:** (SW-SM)g, fine to medium sand, dry.	(SW-SM)g									
			34											
			35	35 - 36.5' **SANDY SILT WITH GRAVEL:** s(ML)g, light yellowish brown (10YR 6/4), dry.	s(ML)g									
			36											
				36.5 - 39' **CLAYEY SILT:** ML/CL, gray (7.5YR 5/1), sand (5-10%), coal (0-5%), gravel (0-5%), dry.	ML/CL									
			37											
			38											
			39	39 - 40' **SILTY CLAY:** CL/ML, sand (0-5%), low to medium plasticity, stiff.	CL/ML									
5 CS	120 108		40	40 - 48' **SILT WITH SAND:** (ML)s, light brownish gray (10YR 6/2), dry.	(ML)s									
			41											
			42											
			43											
			44	44' increasing clay content.										
			45	45' (2.5Y 6/2).										
			46											
			47											
			48	48 - 52' **SILT:** ML, gray (2.5Y 5/1), sand (0-5%), dry.	ML									
			49											
6 CS	84 81		50											
			51											
			52											

Boring Number MW392

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			52–57	52 - 57' **SHALE:** BDX (SH), dark gray (5Y 4/1), highly weathered, hard, dry. 53' very dark gray (7.5YR 3/1).	BDX (SH)									
7 CORE	60 4		57	57 - 57.5' **LIMESTONE:** BDX (LS), gray (5Y 6/1), slightly fractured.	BDX (LS)									RUN #7: Modified RQD = 0% (No Solid Recovery > 4")
			57.5	57.5 - 70' **SHALE:** BDX (SH), dark gray (5Y 4/1), weathered, soft, moderately fractured to highly fractured limestone beds (0-5%).	BDX (SH)									
8 CORE	96 78		62											RUN #8: Modified RQD = (28/78) = 36%
			66.3	66.3' - 67.2' highly fractured, very soft, wet.										
9 CORE	120 62		70	70 - 74.4' **LIMESTONE:** BDX (LS), gray (5Y 6/1), moderately to intensely fractured, moderately wide apertures.	BDX (LS)									RUN #9: Modified RQD = (28/78) = 36%

Boring Number MW392

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
			73, 74	70 - 74.4' **LIMESTONE:** BDX (LS), gray (5Y 6/1), moderately to intensely fractured, moderately wide apertures. *(continued)*	BDX (LS)									
10 CORE	48 48		75, 76, 77, 78, 79, 80, 81	74.4 - 81.8' **SHALE:** BDX (SH), medium dark gray (N4) to dark gray (N3), slightly weathered, moderately fractured, thinly bedded.	BDX (SH)									RUN #10: Modified RQD = (28/48) = 58%
			82, 83, 84	81.8 - 84' **LIMESTONE:** BDX (LS), medium light gray (N6), shaley, fossiliferous, moderately fractured, thinly bedded. 83.2' medium gray (N5).	BDX (LS)									
				84' End of Boring.										

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		MW393

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Blake Weller Cascade Drilling	9/9/2022	10/4/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW393	Feet (NAVD88)	434.59 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 558,133.57 N, 2,383,944.49 E E/W
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 57.027"
Long -89° 51' 45.5976"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	120 86		0	0 - 1' **FILL, WELL-GRADED GRAVEL:** GW, pinkish gray (7.5YR 6/2), angular, moist.	(FILL) GW									CS= Core Sample
			1	1 - 20' **FILL, LEAN CLAY:** CL, brown (7.5YR 6/4), sand (0-5%), no dilatancy, low to medium plasticity, moist.	(FILL) CL									Measured Rock Quality Designation (RQD) was modified due to drilling methods, modified RQD equals the sum of recovered core sections greater than 4 inches in length divided by total core recovery.
2 CS	120 120		10	10' sand (0-5%), iron concretions (0-5%).										
			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, 5th Floor, Milwaukee, WI 53204
Tel: (414)837-3607
Fax: (414)837-3608

RAMBOLL

Boring Number MW393

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
			13–19	1 - 20' **FILL, LEAN CLAY:** CL, brown (7.5YR 6/4), sand (0-5%), no dilatancy, low to medium plasticity, moist. *(continued)* 18' medium to high plasticity.	(FILL) CL									
3 CS	120 120		20–23	20 - 24' **LEAN CLAY:** CL, light brown (7.5YR 6/4), mottling, sand (0-5%), medium to high plasticity, cohesive, moist.	CL									
			24–26	24 - 27' **CLAYEY SAND:** SC, gray (10YR 6/1), fine to medium sand, wet.	SC									
			27–29	27 - 31' **SILT WITH SAND:** (ML)s, dark gray (7.5YR 4/1), sand (0-5%), moist.	(ML)s									
4 CS	120 105		30	30' coal fragments (0-5%).										
			31–32	31 - 40' **SILTY CLAY:** CL/ML, dark gray (7.5Y 4/1), organic material (0-5%), gravel (0-5%), stiff to very stiff, moist.	CL/ML									

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
			33–39	31 - 40' **SILTY CLAY:** CL/ML, dark gray (7.5Y 4/1), organic material (0-5%), gravel (0-5%), stiff to very stiff, moist. *(continued)*	CL/ML									
5 CS	120 120		40–49	40 - 50' **SILT:** ML, grayish brown (2.5Y 5/2), very stiff to hard, platy, dry.	ML									
6 CS	120 92		50–52	50 - 55' **SILT:** ML, dark gray (7.5YR 4/1), sand (0-5%), very stiff to hard, dry.	ML									

Boring Number MW393

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
			53, 54	50 - 55' **SILT:** ML, dark gray (7.5YR 4/1), sand (0-5%), very stiff to hard, dry. *(continued)*	ML									
			55, 56	55 - 57' **CLAYEY SILT:** ML/CL, gray (10YR 6/1), sand (0-5%), gravel (0-5%), medium plasticity, moist.	ML/CL									
			57, 58, 59	57 - 60' **LIMESTONE:** BDX (LS), gray (10YR 6/1), rock flour and angular chips (<2").	BDX (LS)									
7 CORE	120 60		60, 61, 62, 63, 64, 65, 66, 67, 68, 69	60 - 70' **SHALE:** BDX (SH), medium gray (N5), weathered, very weak, residual soil, soft, slightly fractured.	BDX (SH)									RUN #7: Modified RQD = (31/60) = 52%
8 CORE	42 40		70, 71, 72	70 - 73.5' **LIMESTONE:** BDX (LS), medium dark gray (N4), weathered, shaley, thinly bedded, moderately fractured.	BDX (LS)									RUN #8: Modified RQD = (32/40) = 80%

Boring Number MW393

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
			73	70 - 73.5' **LIMESTONE:** BDX (LS), medium dark gray (N4), weathered, shaley, thinly bedded, moderately fractured. *(continued)* 72' medium gray (N5).	BDX (LS)									
9 CORE	78 40		74, 75, 76, 77, 78, 79	73.5 - 85' **SHALE:** BDX (SH), medium gray (N5), weathered, moderately to slightly fractured, thinly laminated.	BDX (SH)									RUN #9: Modified RQD = (30/40) = 75%
10 CORE	60 45		80, 81, 82, 83, 84	83.5' more competent.										RUN #10: Modified RQD = (34/45) = 76%
			85	85' End of Boring.										

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Baldwin Power Plant		MW394

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Blake Weller Cascade Drilling	9/25/2022	10/5/2022	Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW394	Feet (NAVD88)	435.51 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 558,123.63 N, 2,385,095.76 E E/Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 38° 11' 56.8911"
Long -89° 51' 31.1756"

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

Facility ID	County	State	Civil Town/City/ or Village
	Randolph	IL	Baldwin

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	72 67		0	0 - 2.6' **FILL, WELL-GRADED GRAVEL WITH CLAY:** GW-GC, brown (10YR 4/3), angular, moist.	(FILL) GW-GC									CS= Core Sample Measured Rock Quality Designation (RQD) was modified due to drilling methods, modified RQD equals the sum of recovered core sections greater than 4 inches in length divided by total core recovery.
			2.6	2.6 - 20' **LEAN CLAY:** CL, brown (10YR 5/3), reddish brown bottling (20%), sand (0-5%), low to medium plasticity, very stiff to hard, moist.	CL									
			3						4					
			5						4					
2 CS	120 120		6											
			6.5						2.5					
			7.5						3.5					
			8.5						2					
			9.2	9.2' brown (7.5YR 5/3), medium to high plasticity.										
			9.5						2					
			10.5						3					
			11.5						2.25					

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 MW394

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	2.6 - 20' **LEAN CLAY:** CL, brown (10YR 5/3), reddish brown bottling (20%), sand (0-5%), low to medium plasticity, very stiff to hard, moist. *(continued)*					2.25					
			14	14' low to medium plasticity.										
			15						2.5					
3 CS	120 120		16		CL									
			17	16.5' increasing sand and gravel content, gray (GLEY 1 5/1) iron concretions (50%).										
			18											
			19											
			20	20 - 22.1' **SILTY SAND:** SM, yellowish brown (10YR 5/6), fine sand, clay (0-5%), moist.										
			21		SM									
			22	22.1 - 36.8' **LEAN CLAY:** CL, dark yellowish brown (10YR 4/4), greenish gray (GLEY 1 5/10Y) and yellowish brown (10YR 5/6) mottling, sand (0-5%), medium to high plasticity, hard, moist.										
			23						4.5					
			24						4.5					
			25						4.5					
4 CS	120 112		26						4.5					
			27		CL				4.5					
			28						4.5					
			29						4.5					
			30						4.5					
			31						4.5					
			32											

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	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			33	22.1 - 36.8' **LEAN CLAY:** CL, dark yellowish brown (10YR 4/4), greenish gray (GLEY 1 5/10Y) and yellowish brown (10YR 5/6) mottling, sand (0-5%), medium to high plasticity, hard, moist. *(continued)*					3.75					
			34						4.25					
			35	34.4' olive yellow (5Y 6/6), low to medium plasticity.	CL				4.5					
5 CS	120 113		36											
			37	36.8 - 48' **Weathered SHALE Bedrock:** BDX (SH), pale olive (5Y 6/3), weathered, argillaceous, fissile, moist.										
			38											
			39											
			40	40' olive gray (5Y 5/2).										
			41											
			42											
			43		BDX (SH)									
			44											
			45											
6 CS	96 96		46											
			47											
			48	48 - 58' **LIMESTONE:** to **SHALE:** BDX (LS), olive gray (5Y 4/2), interbedded limestone and shale, fissile.										
			49											
			50	50' - 50.2' limestone, very strong.	BDX (LS)									
			51											
			52											

SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW394

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
			53	48 - 58' **LIMESTONE:** to **SHALE:** BDX (LS), olive gray (5Y 4/2), interbedded limestone and shale, fissile. *(continued)*										
7 CS	48 48		54–57	53.7' - 53.9' limestone, very strong. 54' - 55.6' dark gray (10YR 4/1) to gray (10YR 5/1), more competent. 55.6' gray (10YR 6/1) to dark gray (10YR 4/1), more competent.	BDX (LS)									
8 CORE	18 14		58–59	58 - 59.7' **LIMESTONE:** BDX (LS), medium gray (N5), shaley, laminated, moderately fractured.	BDX (LS)									RUN #8: Modified RQD = (4/14) = 29%
9 CORE	60 60		60–64	59.7 - 68' **SHALE:** BDX (SH), medium dark gray (N4), weathered, very weak to weak, thinly bedded, moderately fractured.	BDX (SH)									RUN #9: Modified RQD = (48/60) = 80%
10 CORE	57 56		65–67	64.5 - 67.2' highly decomposed, weathered, wet.										RUN #10: Modified RQD = Not Recorded
			68	68 - 68.4' **LIMESTONE:** BDX (LS), light olive gray (5Y 6/2) to olive gray (5/2).	BDX (LS)									
11 CORE	68 68		69–70	68.4 - 70.8' **SHALE:** BDX (SH), medium dark gray (N4), weathered, very weak to weak, thinly bedded, moderately fractured.	BDX (SH)									RUN #11: Modified RQD = (42/68) = 62%
			71	70.8 - 71' **LIMESTONE:** BDX (LS), dark gray (N3), shaley.	BDX (LS)									
			72	71 - 77.6' **SHALE:** BDX (SH), dark gray (N3),										

Boring Number MW394

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
12 CORE	60 59		73–77	strong, thinly bedded, moderately fractured. 71 - 77.6' **SHALE:** BDX (SH), dark gray (N3), strong, thinly bedded, moderately fractured. *(continued)*	BDX (SH)									RUN #12: Modified RQD = (44/59) = 75%
			78–79	77.6 - 80' **LIMESTONE:** BDX (LS), medium gray (N5), shaley, weak, moderately fractured.	BDX (LS)									
13 CORE	60 48		80–85	80 - 85' **SHALE:** BDX (SH), medium dark gray (N4), weathered, weak, thinly bedded, moderately fractured, moist to wet.	BDX (SH)									RUN #13: Modified RQD = (40/48) = 83%
			85	85' End of Boring.										

ATTACHMENT 4
Analytical Laboratory Reports

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

28-February-2023

Ramboll Americas Engineering Solutions, Inc.
Attn : Evvan Plank

P.O# Box 4873
Syrascuse, New York
13221-7873, USA

Phone: 315-463-7554
Fax:

Date Rec. : 24 November 2022
LR Report: **CA19218-NOV22**
Reference: Baldwin Power Plant Drilling

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: MW-358 (13-15)	6: MW-358 (47-49)	7: MW-358 (86-88)	8: MW-392 (80-82)
Sample Date & Time					05-Oct-22 14:05	06-Oct-22 15:00	08-Oct-22 18:00	26-Sep-22 16:00
Ag [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.05	< 0.05	< 0.05	< 0.05
Al [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	30	540	380	18
As [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.5	< 0.5	< 0.5	< 0.5
Ba [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	0.4	11	4.2	< 0.1
Be [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.02	0.06	0.05	< 0.02
B [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 1	8	10	3
Bi [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.09	< 0.09	< 0.09	< 0.09
Ca [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	21	300	140	75
Cd [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.05	< 0.05	< 0.05	< 0.05
Co [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.01	0.04	0.86	0.02
Cr [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.5	< 0.5	< 0.5	< 0.5
Cu [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.1	< 0.1	0.1	< 0.1
Fe [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	17	240	190	< 1
K [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	7	250	190	41
Li [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 2	< 2	< 2	< 2
Mg [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	9	210	150	19
Mn [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.5	0.6	0.9	< 0.5
Mo [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.1	< 0.1	< 0.1	< 0.1
Na [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	65	1800	1600	850
Ni [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.5	< 0.5	1.2	< 0.5
P [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 3	6	< 3	< 3
Pb [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.1	< 0.1	0.2	< 0.1
Si [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	100	950	750	59
Sb [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.8	< 0.8	< 0.8	< 0.8
Se [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.7	< 0.7	< 0.7	< 0.7
Sr [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	0.1	13	5.9	1.4
Sn [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.5	< 0.5	< 0.5	< 0.5
Ti [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	1.1	0.6	0.5	0.6
Tl [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.02	< 0.02	< 0.02	< 0.02
U [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.002	0.006	0.029	< 0.002
V [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 3	< 3	< 3	< 3
Zn [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.7	< 0.7	< 0.7	< 0.7

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

LR Report : **CA19218-NOV22**

Analysis	9: MW-392 (32-33.5)	10: MW-393 (24-25.5)	11: MW-394 (20.5-22)	12: MW-392 (66-68)
Sample Date & Time	27-Sep-22 09:00	04-Oct-22 16:00	25-Sep-22 16:00	26-Sep-22 12:00
Ag [µg/g]	< 0.05	< 0.05	< 0.05	< 0.05
Al [µg/g]	33	26	24	59
As [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Ba [µg/g]	0.5	0.3	0.3	0.3
Be [µg/g]	< 0.02	< 0.02	< 0.02	< 0.02
B [µg/g]	< 1	< 1	< 1	5
Bi [µg/g]	< 0.09	< 0.09	< 0.09	< 0.09
Ca [µg/g]	130	28	25	89
Cd [µg/g]	< 0.05	< 0.05	< 0.05	< 0.05
Co [µg/g]	0.02	< 0.01	0.01	0.02
Cr [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Cu [µg/g]	< 0.1	< 0.1	< 0.1	< 0.1
Fe [µg/g]	27	14	20	28
K [µg/g]	16	9	12	92
Li [µg/g]	< 2	< 2	< 2	< 2
Mg [µg/g]	40	12	12	44
Mn [µg/g]	1.4	0.7	0.6	< 0.5
Mo [µg/g]	< 0.1	< 0.1	< 0.1	< 0.1
Na [µg/g]	44	49	43	720
Ni [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
P [µg/g]	< 3	< 3	< 3	< 3
Pb [µg/g]	< 0.1	< 0.1	< 0.1	< 0.1
Si [µg/g]	100	80	91	140
Sb [µg/g]	< 0.8	< 0.8	< 0.8	< 0.8
Se [µg/g]	< 0.7	< 0.7	< 0.7	< 0.7
Sr [µg/g]	0.3	< 0.1	< 0.1	1.8
Sn [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Ti [µg/g]	0.6	0.6	0.9	0.5
Tl [µg/g]	< 0.02	< 0.02	< 0.02	< 0.02
U [µg/g]	< 0.002	< 0.002	< 0.002	< 0.002
V [µg/g]	< 3	< 3	< 3	< 3
Zn [µg/g]	< 0.7	< 0.7	< 0.7	< 0.7

Water Soluble Fraction

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
CATHARINE ARNOLD
CHEMIST

Catharine Arnold

Catharine Arnold, B.Sc., C.Chem
Project Specialist,
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OnLine LIMS

0003245943

SGS

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
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Tessier Leach Fraction 2 - Exchangeable Metals

28-February-2023

Ramboll Americas Engineering Solutions, Inc.
Attn : Evvan Plank

P.O# Box 4873
Syrascuse, New York
13221-7873, USA

Phone: 315-463-7554
Fax:

Date Rec. : 24 November 2022
LR Report: **CA19219-NOV22**
Reference: Baldwin Power Plant Drilling

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: MW-358 (13-15)	6: MW-358 (47-49)	7: MW-358 (86-88)	8: MW-392 (80-82)
Sample Date & Time					05-Oct-22 14:05	06-Oct-22 15:00	08-Oct-22 18:00	26-Sep-22 16:00
Ag [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.05	< 0.05	< 0.05	< 0.05
Al [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	9	17	8	9
As [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.5	< 0.5	< 0.5	< 0.5
Ba [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	48	55	15	3.0
Be [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.02	< 0.02	< 0.02	< 0.02
B [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 1	< 1	1	< 1
Bi [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.09	< 0.09	< 0.09	< 0.09
Ca [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	2000	2500	1300	3500
Cd [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.05	< 0.05	< 0.05	< 0.05
Co [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.01	< 0.01	0.58	0.24
Cr [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.5	< 0.5	< 0.5	< 0.5
Cu [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 0.1	< 0.1	< 0.1	< 0.1
Fe [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	2	21	< 1	12
K [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	37	430	300	160
Li [µg/g]	19-Jan-23	23:42	31-Jan-23	09:43	< 2	< 2	< 2	< 2
Mn [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	6.5	0.7	1.8	3.6
Mo [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 0.1	< 0.1	< 0.1	< 0.1
Na [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	45	3200	2600	420
Ni [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 0.5	< 0.5	< 0.5	0.7
Pb [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 0.1	< 0.1	< 0.1	< 0.1
P [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 3	4	< 3	43
Sb [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 0.8	< 0.8	< 0.8	< 0.8
Se [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 0.7	< 0.7	< 0.7	< 0.7
Sn [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 0.5	< 0.5	< 0.5	< 0.5
Sr [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	11	100	52	76
Ti [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	0.9	0.3	0.2	0.1
Tl [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 0.02	< 0.02	< 0.02	< 0.02
U [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 0.002	0.009	0.006	0.043
V [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 3	< 3	< 3	< 3
Zn [µg/g]	19-Jan-23	23:42	31-Jan-23	09:44	< 0.7	< 0.7	< 0.7	< 0.7

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

LR Report : **CA19219-NOV22**

Analysis	**9: MW-392 (32-33.5)**	**10: MW-393 (24-25.5)**	**11: MW-394 (20.5-22)**	**12: MW-392 (66-68)**
Sample Date & Time	27-Sep-22 09:00	04-Oct-22 16:00	25-Sep-22 16:00	26-Sep-22 12:00
Ag [µg/g]	< 0.05	< 0.05	< 0.05	< 0.05
Al [µg/g]	10	12	12	10
As [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Ba [µg/g]	16	16	10	4.3
Be [µg/g]	< 0.02	< 0.02	< 0.02	< 0.02
B [µg/g]	< 1	< 1	< 1	2
Bi [µg/g]	< 0.09	< 0.09	< 0.09	< 0.09
Ca [µg/g]	2500	1400	2100	3700
Cd [µg/g]	< 0.05	< 0.05	< 0.05	< 0.05
Co [µg/g]	0.02	< 0.01	< 0.01	0.02
Cr [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Cu [µg/g]	< 0.1	< 0.1	< 0.1	< 0.1
Fe [µg/g]	8	9	8	10
K [µg/g]	44	35	60	360
Li [µg/g]	< 2	< 2	< 2	< 2
Mn [µg/g]	3.5	1.7	3.2	2.5
Mo [µg/g]	< 0.1	< 0.1	< 0.1	< 0.1
Na [µg/g]	17	22	30	480
Ni [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Pb [µg/g]	< 0.1	< 0.1	< 0.1	< 0.1
P [µg/g]	< 3	< 3	4	< 3
Sb [µg/g]	< 0.8	< 0.8	< 0.8	< 0.8
Se [µg/g]	< 0.7	< 0.7	< 0.7	< 0.7
Sn [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Sr [µg/g]	6.5	4.3	7.4	75
Ti [µg/g]	0.1	0.6	0.3	< 0.1
Tl [µg/g]	< 0.02	< 0.02	< 0.02	< 0.02
U [µg/g]	< 0.002	< 0.002	< 0.002	0.004
V [µg/g]	< 3	< 3	< 3	< 3
Zn [µg/g]	< 0.7	< 0.7	< 0.7	< 0.7

Fraction 2 Exchangeable Metals

CHARTERED CHEMIST — CATHARINE ARNOLD — ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO

Catharine Arnold, B.Sc., C.Chem
Project Specialist,
Environment, Health & Safety

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Tessier Leach Fraction 3 - Metals Bound to Carbonates

28-February-2023

Ramboll Americas Engineering Solutions, Inc.
Attn : Evvan Plank

P.O# Box 4873
Syrascuse, New York
13221-7873, USA

Phone: 315-463-7554
Fax:

Date Rec. : 24 November 2022
LR Report: **CA19220-NOV22**
Reference: Ramboll Power Plant Drilling

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: MW-358 (13-15)	6: MW-358 (47-49)	7: MW-358 (86-88)	8: MW-392 (80-82)
Sample Date & Time					05-Oct-22 14:05	06-Oct-22 15:00	08-Oct-22 18:00	26-Sep-22 16:00
Ag [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	< 0.05	< 0.05	< 0.05	< 0.05
Al [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	30	55	56	25
As [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	< 0.5	< 0.5	< 0.5	< 0.5
Ba [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	25	23	6.9	2.8
Be [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	0.09	0.10	0.07	0.03
B [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	< 1	2	3	4
Bi [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	< 0.09	< 0.09	< 0.09	< 0.09
Ca [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	110	1300	770	52000
Cd [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	< 0.05	< 0.05	< 0.05	< 0.05
Co [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	0.04	0.02	2.3	1.0
Cr [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	< 0.5	< 0.5	< 0.5	< 0.5
Cu [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	0.6	0.2	0.6	0.2
Fe [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	40	45	42	25
K [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	15	180	120	90
Li [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	< 2	< 2	< 2	< 2
Mn [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	13	7.0	4.3	77
Mo [µg/g]	19-Jan-23	23:42	31-Jan-23	09:45	< 0.1	< 0.1	< 0.1	< 0.1
Ni [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	< 0.5	< 0.5	1.9	2.7
Pb [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	0.2	0.1	0.9	1.9
P [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	< 3	13	< 3	100
Sb [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	< 0.8	< 0.8	< 0.8	< 0.8
Se [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	< 0.7	< 0.7	< 0.7	< 0.7
Si [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	96	160	150	33
Sn [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	< 0.5	< 0.5	< 0.5	< 0.5
Sr [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	0.5	10	7.3	99
Ti [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	0.8	0.6	0.5	1.0
Tl [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	< 0.02	< 0.02	< 0.02	< 0.02
U [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	0.19	0.094	0.13	0.31
V [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	< 3	< 3	< 3	< 3
Zn [µg/g]	19-Jan-23	23:42	31-Jan-23	09:46	< 0.7	< 0.7	< 0.7	3.7

OnLine LIMS

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LR Report : **CA19220-NOV22**

Analysis	**9: MW-392 (32-33.5)**	**10: MW-393 (24-25.5)**	**11: MW-394 (20.5-22)**	**12: MW-392 (66-68)**
Sample Date & Time	27-Sep-22 09:00	04-Oct-22 16:00	25-Sep-22 16:00	26-Sep-22 12:00
Ag [µg/g]	< 0.05	< 0.05	< 0.05	< 0.05
Al [µg/g]	30	28	23	28
As [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Ba [µg/g]	19	15	12	5.0
Be [µg/g]	0.06	0.04	0.04	0.07
B [µg/g]	< 1	< 1	< 1	3
Bi [µg/g]	< 0.09	< 0.09	< 0.09	< 0.09
Ca [µg/g]	1500	56	140	35000
Cd [µg/g]	< 0.05	< 0.05	< 0.05	< 0.05
Co [µg/g]	0.05	0.02	0.03	0.27
Cr [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Cu [µg/g]	0.8	0.2	0.2	0.6
Fe [µg/g]	9	14	10	300
K [µg/g]	16	10	15	130
Li [µg/g]	< 2	< 2	< 2	< 2
Mn [µg/g]	20	4.4	7.0	144
Mo [µg/g]	< 0.1	< 0.1	< 0.1	< 0.1
Ni [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Pb [µg/g]	0.2	0.1	0.1	0.4
P [µg/g]	< 3	< 3	4	< 3
Sb [µg/g]	< 0.8	< 0.8	< 0.8	< 0.8
Se [µg/g]	< 0.7	< 0.7	< 0.7	< 0.7
Si [µg/g]	130	90	99	96
Sn [µg/g]	< 0.5	< 0.5	< 0.5	< 0.5
Sr [µg/g]	1.5	0.3	0.8	59
Ti [µg/g]	0.1	1.9	0.6	< 0.1
Tl [µg/g]	< 0.02	< 0.02	< 0.02	< 0.02
U [µg/g]	0.12	0.14	0.17	0.100
V [µg/g]	< 3	< 3	< 3	< 3
Zn [µg/g]	< 0.7	< 0.7	< 0.7	1.0

Fraction 3 Metals Bound to Carbonates

Catharine Arnold

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Tessier Leach Fraction 4 - Metals Bound to Fe and Mn Oxides

28-February-2023

Ramboll Americas Engineering Solutions, Inc.
Attn : Evvan Plank

P.O# Box 4873
Syrascuse, New York
13221-7873, USA

Phone: 315-463-7554
Fax:

Date Rec. : 24 November 2022
LR Report: **CA19221-NOV22**
Reference: Baldwin Power Plant Drilling

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CERTIFICATE OF ANALYSIS

Final Report

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-358 (13-15)	6: MW-358 (47-49)	7: MW-358 (86-88)	8: MW-392 (80-82)	9: MW-392 (32-33.5)
Sample Date & Time			05-Oct-22 14:05	06-Oct-22 15:00	08-Oct-22 18:00	26-Sep-22 16:00	27-Sep-22 09:00
Ag [µg/g]	31-Jan-23	09:47	< 0.01	< 0.01	< 0.01	< 0.01	0.01
Al [µg/g]	31-Jan-23	09:47	290	310	340	220	220
As [µg/g]	31-Jan-23	09:47	< 0.5	< 0.5	< 0.5	1.3	< 0.5
Ba [µg/g]	31-Jan-23	09:47	16	6.4	1.6	4.1	56
Be [µg/g]	31-Jan-23	09:47	0.26	0.16	0.15	0.15	0.21
B [µg/g]	31-Jan-23	09:47	< 1	5	6	6	< 1
Bi [µg/g]	31-Jan-23	09:47	< 0.09	< 0.09	< 0.09	0.14	< 0.09
Ca [µg/g]	31-Jan-23	09:47	71	320	250	130000	2300
Cd [µg/g]	31-Jan-23	09:47	< 0.05	< 0.05	< 0.05	0.13	0.18
Co [µg/g]	31-Jan-23	09:47	3.8	0.33	3.0	2.3	5.1
Cr [µg/g]	31-Jan-23	09:47	2.3	1.2	1.3	1.0	0.9
Cu [µg/g]	31-Jan-23	09:47	1.6	0.4	0.7	0.1	2.9
Fe [µg/g]	31-Jan-23	09:47	1600	1600	1200	1800	1100
K [µg/g]	31-Jan-23	09:47	16	140	110	43	19
Li [µg/g]	31-Jan-23	09:47	< 2	3	5	< 2	< 2
Mn [µg/g]	31-Jan-23	09:47	240	3.1	2.9	190	500
Mo [µg/g]	31-Jan-23	09:47	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ni [µg/g]	31-Jan-23	09:47	3.1	2.7	4.5	6.5	3.1
Pb [µg/g]	31-Jan-23	09:47	3.3	0.2	1.2	8.4	3.7
P [µg/g]	31-Jan-23	09:47	19	110	77	400	31
Sb [µg/g]	31-Jan-23	09:47	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Se [µg/g]	31-Jan-23	09:47	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Si [µg/g]	31-Jan-23	09:47	920	910	710	270	600
Sn [µg/g]	31-Jan-23	09:47	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Sr [µg/g]	31-Jan-23	09:47	0.4	3.1	2.8	237	1.7
Ti [µg/g]	31-Jan-23	09:47	0.4	0.1	0.3	< 0.1	< 0.1
Tl [µg/g]	31-Jan-23	09:47	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
U [µg/g]	31-Jan-23	09:47	0.26	0.068	0.17	0.62	0.15
V [µg/g]	31-Jan-23	09:47	5	< 3	< 3	< 3	3
Zn [µg/g]	31-Jan-23	09:47	2.9	1.9	1.9	13	3.8

OnLine LIMS

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Tessier Leach Fraction 4 - Metals Bound to Fe and Mn Oxides

LR Report : CA19221-NOV22

Analysis	10: MW-393 (24-25.5)	11: MW-394 (20.5-22)	12: MW-392 (66-68)
Sample Date & Time	04-Oct-22 16:00	25-Sep-22 16:00	26-Sep-22 12:00
Ag [µg/g]	< 0.01	0.02	< 0.01
Al [µg/g]	290	270	490
As [µg/g]	< 0.5	< 0.5	< 0.5
Ba [µg/g]	45	35	1.5
Be [µg/g]	0.16	0.18	0.18
B [µg/g]	< 1	< 1	4
Bi [µg/g]	< 0.09	< 0.09	0.14
Ca [µg/g]	100	350	7600
Cd [µg/g]	0.06	0.14	< 0.05
Co [µg/g]	4.3	3.5	0.62
Cr [µg/g]	1.2	1.2	2.0
Cu [µg/g]	1.5	2.0	0.9
Fe [µg/g]	1500	1200	2700
K [µg/g]	15	22	120
Li [µg/g]	< 2	< 2	2
Mn [µg/g]	380	260	63
Mo [µg/g]	< 0.1	< 0.1	< 0.1
Ni [µg/g]	3.2	3.7	2.5
Pb [µg/g]	3.5	2.1	0.9
P [µg/g]	17	91	110
Sb [µg/g]	< 0.8	< 0.8	< 0.8
Se [µg/g]	< 0.7	< 0.7	< 0.7
Si [µg/g]	660	850	650
Sn [µg/g]	< 0.5	< 0.5	< 0.5
Sr [µg/g]	0.5	1.3	26
Ti [µg/g]	0.3	0.2	0.2
Tl [µg/g]	< 0.02	< 0.02	< 0.02
U [µg/g]	0.12	0.18	0.082
V [µg/g]	< 3	5	< 3
Zn [µg/g]	4.3	7.8	2.8

Fraction 4 Metals Bound to Fe and Mn Oxides

Catharine Arnold

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Tessier Leach Fraction 5 - Bound to Organic Material

28-February-2023

Ramboll Americas Engineering Solutions, Inc.
Attn : Evvan Plank

P.O# Box 4873
Syrascuse, New York
13221-7873, USA

Phone: 315-463-7554
Fax:

Date Rec. : 24 November 2022
LR Report: **CA19222-NOV22**
Reference: Baldwin Power plant Drilling

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-358 (13-15)	6: MW-358 (47-49)	7: MW-358 (86-88)	8: MW-392 (80-82)	9: MW-392 (32-33.5)
Sample Date & Time			05-Oct-22 14:05	06-Oct-22 15:00	08-Oct-22 18:00	26-Sep-22 16:00	27-Sep-22 09:00
Ag [µg/g]	31-Jan-23	09:48	0.14	0.15	0.08	0.07	0.06
Al [µg/g]	31-Jan-23	09:48	980	1300	1100	130	610
As [µg/g]	31-Jan-23	09:48	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Ba [µg/g]	31-Jan-23	09:48	15	11	1.8	3.6	36
Be [µg/g]	31-Jan-23	09:48	0.13	0.32	0.16	0.07	0.12
B [µg/g]	31-Jan-23	09:48	< 1	2	2	2	< 1
Bi [µg/g]	31-Jan-23	09:48	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09
Ca [µg/g]	31-Jan-23	09:48	160	490	220	8600	840
Cd [µg/g]	31-Jan-23	09:48	< 0.05	< 0.05	< 0.05	0.20	< 0.05
Co [µg/g]	31-Jan-23	09:48	1.4	0.45	9.7	3.3	1.3
Cr [µg/g]	31-Jan-23	09:48	2.1	1.0	1.2	< 0.5	1.6
Cu [µg/g]	31-Jan-23	09:48	0.5	1.0	1.8	1.9	0.4
Fe [µg/g]	31-Jan-23	09:48	150	610	1800	220	83
K [µg/g]	31-Jan-23	09:48	15	104	79	25	15
Li [µg/g]	31-Jan-23	09:48	< 2	< 2	3	< 2	< 2
Mg [µg/g]	31-Jan-23	09:48	170	1100	870	200	500
Mn [µg/g]	31-Jan-23	09:48	85	3.6	15	16	92
Mo [µg/g]	31-Jan-23	09:48	< 0.1	< 0.1	< 0.1	0.2	0.4
Na [µg/g]	31-Jan-23	09:48	110	180	150	90	75
Ni [µg/g]	31-Jan-23	09:48	1.9	4.3	13	15	2.1
Pb [µg/g]	31-Jan-23	09:48	1.6	0.1	1.6	3.8	1.3
P [µg/g]	31-Jan-23	09:48	< 3	< 3	< 3	290	5
Sb [µg/g]	31-Jan-23	09:48	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Se [µg/g]	31-Jan-23	09:48	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Si [µg/g]	31-Jan-23	09:48	590	480	420	130	530
Sn [µg/g]	31-Jan-23	09:48	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Sr [µg/g]	31-Jan-23	09:48	0.5	5.1	2.8	48	0.9
Ti [µg/g]	31-Jan-23	09:48	0.7	< 0.1	< 0.1	< 0.1	2.9
Tl [µg/g]	31-Jan-23	09:48	< 0.02	< 0.02	0.02	0.05	< 0.02
U [µg/g]	31-Jan-23	09:48	0.17	0.13	0.19	0.25	0.060
V [µg/g]	31-Jan-23	09:48	< 3	< 3	< 3	< 3	3
Zn [µg/g]	31-Jan-23	09:48	1.4	< 0.7	1.8	41	1.7

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Analysis	**10: MW-393 (24-25.5)**	**11: MW-394 (20.5-22)**	**12: MW-392 (66-68)**
Sample Date & Time	04-Oct-22 16:00	25-Sep-22 16:00	26-Sep-22 12:00
Ag [µg/g]	< 0.05	< 0.05	< 0.05
Al [µg/g]	660	870	820
As [µg/g]	< 0.5	< 0.5	< 0.5
Ba [µg/g]	33	45	1.5
Be [µg/g]	0.08	0.15	0.18
B [µg/g]	< 1	< 1	2
Bi [µg/g]	< 0.09	< 0.09	< 0.09
Ca [µg/g]	88	300	2400
Cd [µg/g]	< 0.05	< 0.05	< 0.05
Co [µg/g]	1.2	2.3	0.68
Cr [µg/g]	1.2	1.5	1.1
Cu [µg/g]	0.3	0.8	1.4
Fe [µg/g]	93	120	680
K [µg/g]	14	21	70
Li [µg/g]	< 2	< 2	< 2
Mg [µg/g]	150	280	730
Mn [µg/g]	100	164	15
Mo [µg/g]	0.1	0.3	< 0.1
Na [µg/g]	48	170	95
Ni [µg/g]	1.6	3.5	2.9
Pb [µg/g]	1.7	1.3	0.9
P [µg/g]	4	8	< 3
Sb [µg/g]	< 0.8	< 0.8	< 0.8
Se [µg/g]	< 0.7	< 0.7	< 0.7
Si [µg/g]	470	650	470
Sn [µg/g]	< 0.5	< 0.5	< 0.5
Sr [µg/g]	0.3	1.2	9.8
Ti [µg/g]	2.1	2.5	< 0.1
Tl [µg/g]	< 0.02	< 0.02	< 0.02
U [µg/g]	0.065	0.16	0.080
V [µg/g]	< 3	4	< 3
Zn [µg/g]	1.6	4.0	0.9

Fraction 5 Bound to Organic Material

Catharine Arnold

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28-February-2023

Ramboll Americas Engineering Solutions, Inc.
Attn : Evvan Plank

P.O# Box 4873
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13221-7873, USA

Phone: 315-463-7554
Fax:

Date Rec. : 24 November 2022
LR Report: **CA19223-NOV22**
Reference: Baldwin Power Plant Drilling

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Completed Date	4: Analysis Completed Time	5: MW-358 (13-15)	6: MW-358 (47-49)	7: MW-358 (86-88)	8: MW-392 (80-82)	9: MW-392 (32-33.5)
Sample Date & Time			05-Oct-22 14:05	06-Oct-22 15:00	08-Oct-22 18:00	26-Sep-22 16:00	27-Sep-22 09:00
Ag [µg/g]	31-Jan-23	09:48	0.09	< 0.05	< 0.05	< 0.05	0.07
Al [µg/g]	31-Jan-23	09:48	44000	63000	71000	27000	45000
As [µg/g]	31-Jan-23	09:48	5.8	2.3	9.8	10	8.6
Ba [µg/g]	31-Jan-23	09:48	390	150	140	56	320
Be [µg/g]	31-Jan-23	09:48	0.65	1.4	1.5	0.68	0.87
B [µg/g]	31-Jan-23	09:48	13	60	62	26	21
Bi [µg/g]	31-Jan-23	09:48	0.25	0.26	0.18	0.14	0.25
Ca [µg/g]	31-Jan-23	09:48	2500	150	120	20000	1400
Cd [µg/g]	31-Jan-23	09:48	0.06	< 0.05	< 0.05	0.11	0.08
Co [µg/g]	31-Jan-23	09:48	3.3	7.2	6.4	2.0	6.4
Cr [µg/g]	31-Jan-23	09:48	34	69	75	37	40
Cu [µg/g]	31-Jan-23	09:48	10	9.9	5.7	7.2	15
Fe [µg/g]	31-Jan-23	09:48	22000	42000	22000	14000	28000
K [µg/g]	31-Jan-23	09:48	11000	18000	16000	5100	13000
Li [µg/g]	31-Jan-23	09:48	18	9	65	7	20
Mg [µg/g]	31-Jan-23	09:48	2700	7800	7600	4100	3300
Mn [µg/g]	31-Jan-23	09:48	110	70	51	50	130
Mo [µg/g]	31-Jan-23	09:48	0.9	0.3	0.1	0.1	0.9
Na [µg/g]	31-Jan-23	09:48	6700	560	830	550	5200
Ni [µg/g]	31-Jan-23	09:48	14	32	29	13	21
Pb [µg/g]	31-Jan-23	09:48	10	8.0	7.0	17	12
P [µg/g]	31-Jan-23	09:48	260	240	160	7200	300
Sb [µg/g]	31-Jan-23	09:48	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Se [µg/g]	31-Jan-23	09:48	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Si [µg/g]	31-Jan-23	09:48	160000	66000	51000	73000	65000
Sn [µg/g]	31-Jan-23	09:48	5.4	5.8	5.8	4.9	5.2
Sr [µg/g]	31-Jan-23	09:48	89	30	25	130	79
Ti [µg/g]	31-Jan-23	09:48	2400	670	570	520	980
Tl [µg/g]	31-Jan-23	09:48	0.47	0.42	0.42	0.17	0.51
U [µg/g]	31-Jan-23	09:48	1.3	0.30	0.99	2.7	1.1
V [µg/g]	31-Jan-23	09:48	54	73	86	95	57
Zn [µg/g]	31-Jan-23	09:48	37	47	32	43	53

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LR Report : **CA19223-NOV22**

Analysis	10: MW-393 (24-25.5)	11: MW-394 (20.5-22)	12: MW-392 (66-68)
Sample Date & Time	04-Oct-22 16:00	25-Sep-22 16:00	26-Sep-22 12:00
Ag [µg/g]	< 0.05	< 0.05	< 0.05
Al [µg/g]	33000	45000	59000
As [µg/g]	10	9.8	0.9
Ba [µg/g]	300	410	93
Be [µg/g]	0.56	0.83	1.2
B [µg/g]	15	16	53
Bi [µg/g]	0.18	0.27	0.20
Ca [µg/g]	1700	3000	170
Cd [µg/g]	< 0.05	0.11	< 0.05
Co [µg/g]	3.2	5.0	6.4
Cr [µg/g]	24	35	71
Cu [µg/g]	9.9	13	12
Fe [µg/g]	19000	27000	43000
K [µg/g]	12000	14000	17000
Li [µg/g]	13	16	19
Mg [µg/g]	2200	3400	9500
Mn [µg/g]	80	140	47
Mo [µg/g]	0.7	2.7	0.2
Na [µg/g]	5100	7700	490
Ni [µg/g]	13	18	31
Pb [µg/g]	9.1	13	4.1
P [µg/g]	230	460	170
Sb [µg/g]	< 0.8	< 0.8	< 0.8
Se [µg/g]	< 0.7	< 0.7	< 0.7
Si [µg/g]	61000	43000	62000
Sn [µg/g]	4.6	5.2	5.6
Sr [µg/g]	70	110	22
Ti [µg/g]	780	1100	560
Tl [µg/g]	0.35	0.50	0.36
U [µg/g]	0.61	1.1	0.097
V [µg/g]	35	57	70
Zn [µg/g]	37	54	48

Fraction 6 Residual metals

Catharine Arnold

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO CHARTERED CATHARINE ARNOLD CHEMIST

Catharine Arnold, B.Sc., C.Chem
Project Specialist,
Environment, Health & Safety

OnLine LIMS

0003246014

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

28-February-2023

Ramboll Americas Engineering Solutions, Inc.
Attn : Evvan Plank

P.O# Box 4873
Syrascuse, New York
13221-7873, USA

Phone: 315-463-7554
Fax:

Date Rec. : 24 November 2022
LR Report: **CA19224-NOV22**
Reference: Baldwon Power Plant Drilling

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	6: MW-358 (47-49)	7: MW-358 (86-88)	8: MW-392 (80-82)	12: MW-392 (66-68)
Sample Date & Time					06-Oct-22 15:00	08-Oct-22 18:00	26-Sep-22 16:00	26-Sep-22 12:00
Hg MS [ug/g]	09-Dec-22	16:29	12-Dec-22	15:05	< 0.05	< 0.05	< 0.05	< 0.05
As [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	2.1	11	17	1.0
B [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	11	16	16	13
Ba [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	140	45	40	21
Be [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	0.85	0.67	0.85	0.70
Cd [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	< 0.02	< 0.02	0.36	0.09
Co [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	4.4	23	12	6.2
Cr [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	9.5	12	17	16
Li [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	6	20	8	15
Mo [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	0.3	0.3	0.3	0.3
Pb [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	5.7	9.6	17	4.9
Se [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	< 0.7	< 0.7	1.4	< 0.7
Tl [µg/g]	09-Dec-22	16:29	12-Dec-22	15:05	0.05	0.06	0.04	0.03

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CHARTERED CATHARINE ARNOLD CHEMIST

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Phone: 705-652-2000 FAX: 705-652-6365

LR Report : **CA19224-NOV22**

Quantitative X-Ray Diffraction by Rietveld Refinement

Report Prepared for:	*Environmental Services*
Project Number/ LIMS No.	*Custom XRD/MI4508-DEC22*
Sample Receipt:	*December 7, 2022*
Sample Analysis:	*December 15, 2022*
Reporting Date:	*December 21, 2022*

Instrument:	BRUKER AXS D8 Advance Diffractometer
Test Conditions:	Co radiation, 35 kV, 40 mA; Detector: LYNXEYE Regular Scanning: Step: 0.02°, Step time: 0.75s, 2θ range: 6-80°
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:

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.

Summary of Rietveld Quantitative Analysis X-Ray Diffraction Results

Mineral/Compound	MW-358 (13-15) DEC4508-01 (wt %)	MW-358 (47-49) DEC4508-02 (wt %)	MW-358 (86-88) DEC4508-03 (wt %)	MW-392 (80-82) DEC4508-04 (wt %)
Quartz	58.9	33.0	34.9	29.1
Muscovite	11.2	37.6	30.5	14.5
Albite	13.3	8.2	3.4	1.0
Microcline	5.3	9.4	8.1	2.9
Chlorite	10.8	-	-	6.8
Diaspore	0.5	-	-	-
Pyrite	-	1.0	0.8	1.2
Kaolinite	-	9.0	18.4	8.2
Calcite	-	1.8	1.7	31.5
Anatase	-	-	2.1	0.4
Leucite	-	-	-	2.4
Siderite	-	-	-	1.9
Dolomite	-	-	-	-
Gypsum	-	-	-	-
Diopside	-	-	-	-
TOTAL	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/Compound	Formula
Quartz	SiO_2
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$
Albite	$NaAlSi_3O_8$
Microcline	$KAlSi_3O_8$
Chlorite	$(Fe,(Mg,Mn)_5,Al)(Si_3Al)O_{10}(OH)_8$
Diaspore	aAlO.OH
Pyrite	FeS_2
Kaolinite	$Al_2Si_2O_5(OH)_4$
Calcite	$CaCO_3$
Anatase	TiO_2
Leucite	$KAlSi_2O_6$
Siderite	$FeCO_3$
Dolomite	$CaMg(CO_3)_2$
Gypsum	$CaSO_4 \cdot 2H_2O$
Diopside	$CaMgSi_2O_6$

Summary of Rietveld Quantitative Analysis X-Ray Diffraction Results

Mineral/Compound	MW-392 (32-33.5) DEC4508-05 (wt %)	MW-393 (24-25.5) DEC4508-06 (wt %)	MW-394 (20.5-22) DEC4508-07 (wt %)	MW-392 (66-68) DEC4508-08 (wt %)
Quartz	53.5	68.2	54.9	27.2
Muscovite	13.1	13.0	11.7	29.7
Albite	8.5	7.4	13.1	4.5
Microcline	6.8	9.5	6.7	6.9
Chlorite	7.0	-	7.0	16.3
Diaspore	-	-	-	-
Pyrite	-	0.3	0.3	-
Kaolinite	7.5	-	5.0	-
Calcite	-	-	-	14.8
Anatase	-	-	-	0.7
Leucite	-	-	-	-
Siderite	-	-	-	-
Dolomite	1.2	-	-	-
Gypsum	0.4	-	-	-
Diopside	1.7	1.6	1.4	-
TOTAL	100	100	100	100

Zero values indicate that the mineral was included in the refinement, but the calculated concentration is below a measurable value.

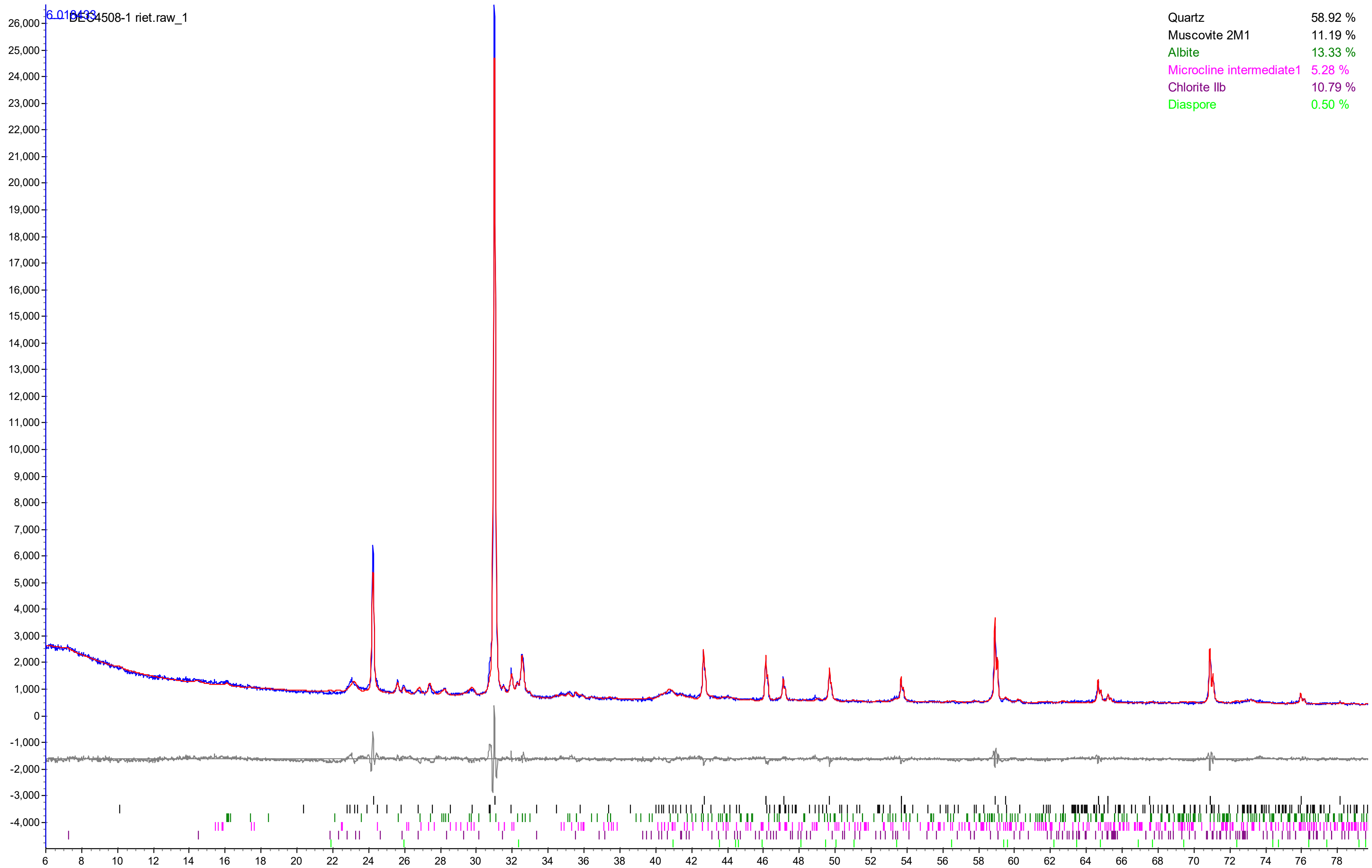
Dashes indicate that the mineral was not identified by the analyst and not included in the refinement calculation for the sample.

The weight percent quantities indicated have been normalized to a sum of 100%. The quantity of amorphous material has not been determined.

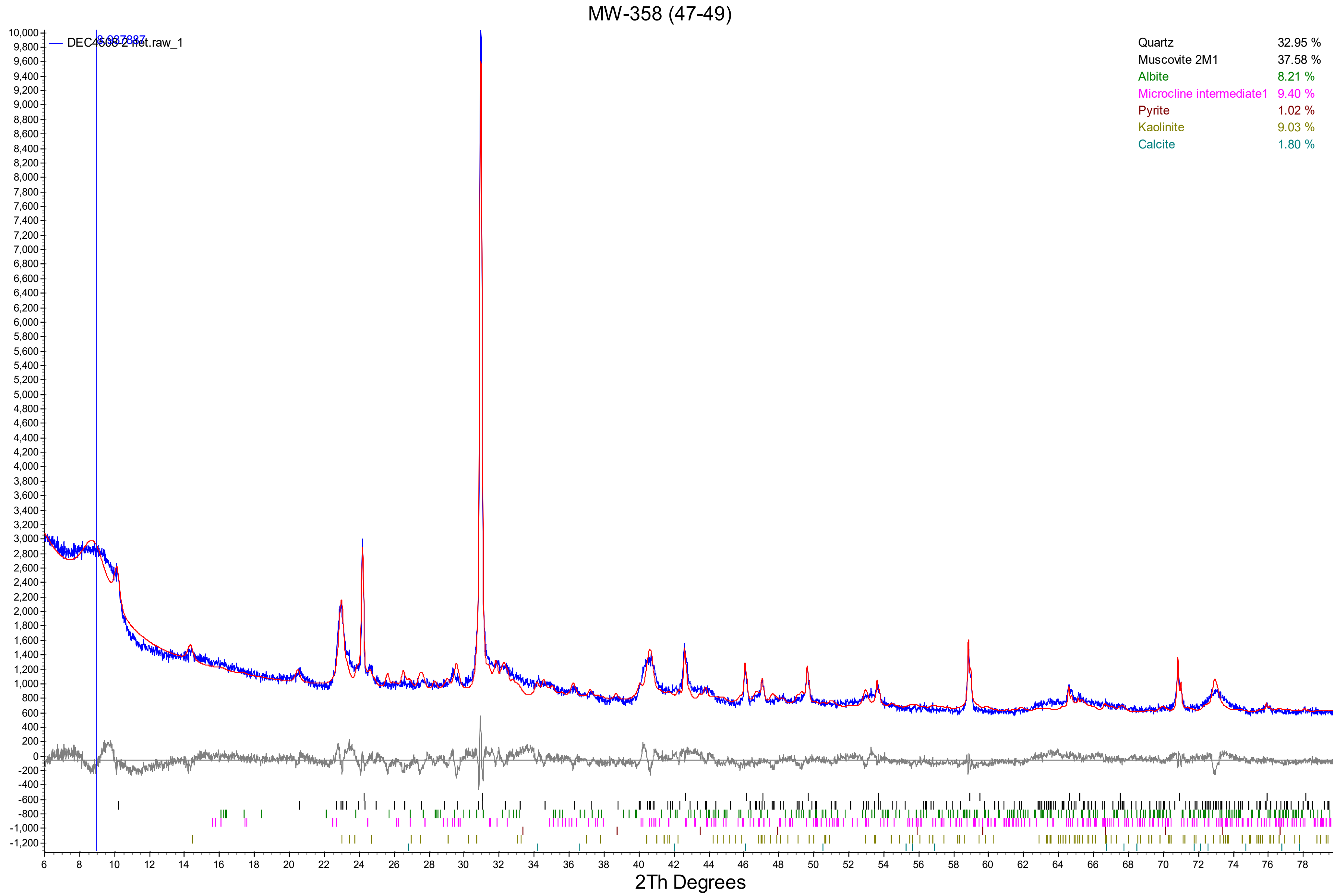
Mineral/Compound	Formula
Quartz	SiO_2
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$
Albite	$NaAlSi_3O_8$
Microcline	$KAlSi_3O_8$
Chlorite	$(Fe,(Mg,Mn)_5,Al)(Si_3Al)O_{10}(OH)_8$
Diaspore	aAlO.OH
Pyrite	FeS_2
Kaolinite	$Al_2Si_2O_5(OH)_4$
Calcite	$CaCO_3$
Anatase	TiO_2
Leucite	$KAlSi_2O_6$
Siderite	$FeCO_3$
Dolomite	$CaMg(CO_3)_2$
Gypsum	$CaSO_4 \cdot 2H_2O$
Diopside	$CaMgSi_2O_6$

Environmental Services
Custom XRD/MI4508-DEC22
21-Dec-22

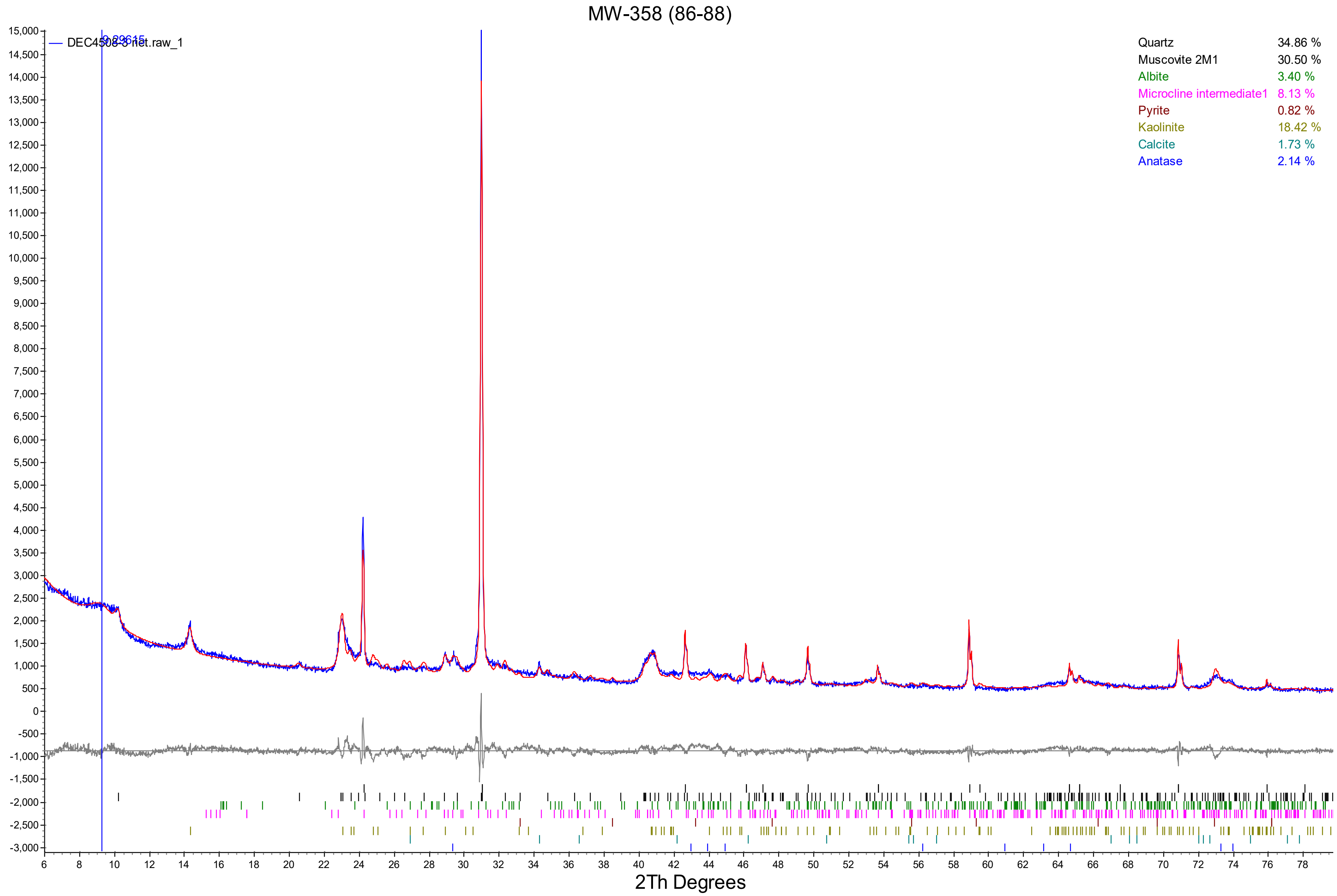
MW-358 (13-15)



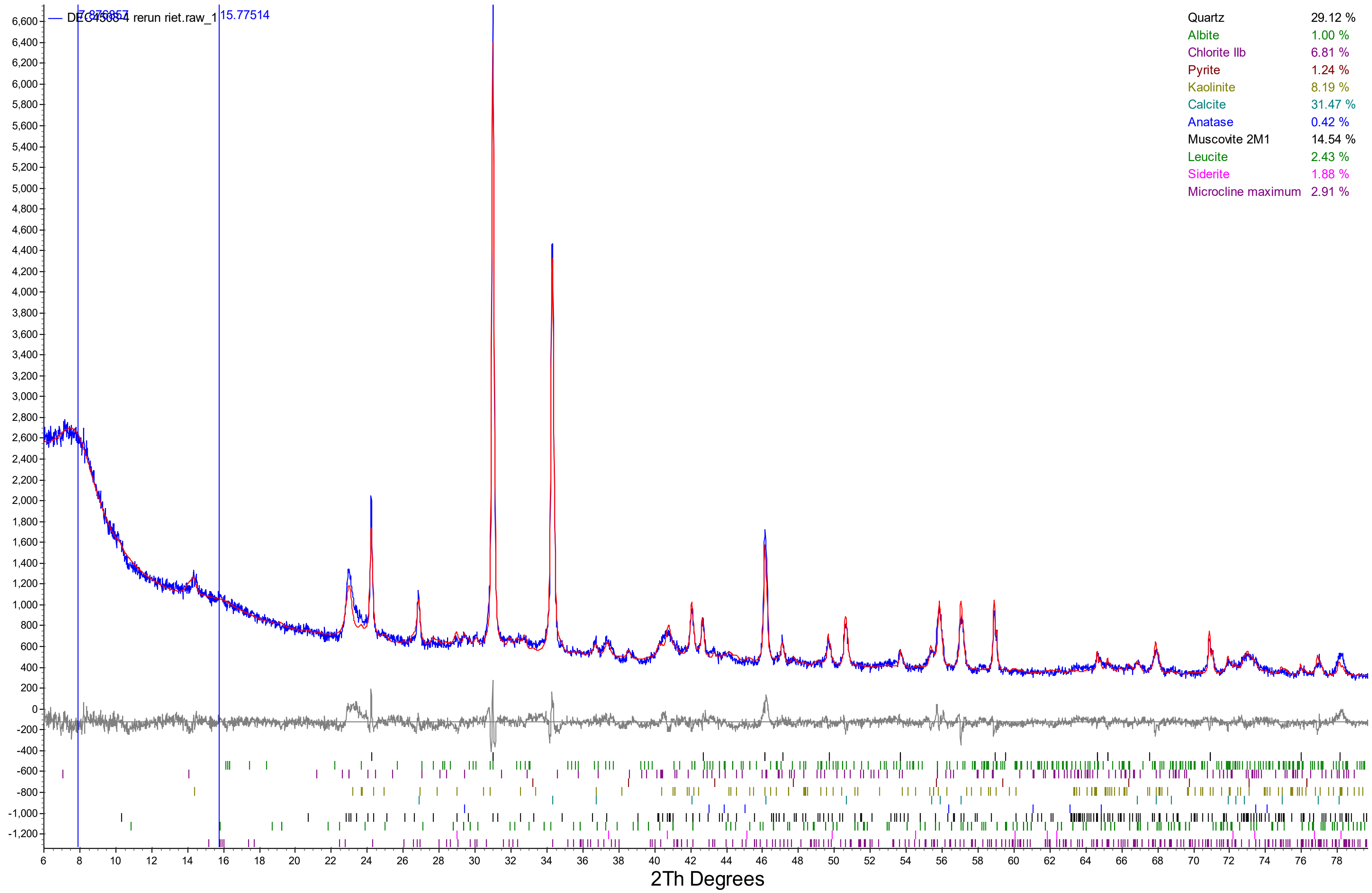
Environmental Services
Custom XRD/MI4508-DEC22
21-Dec-22



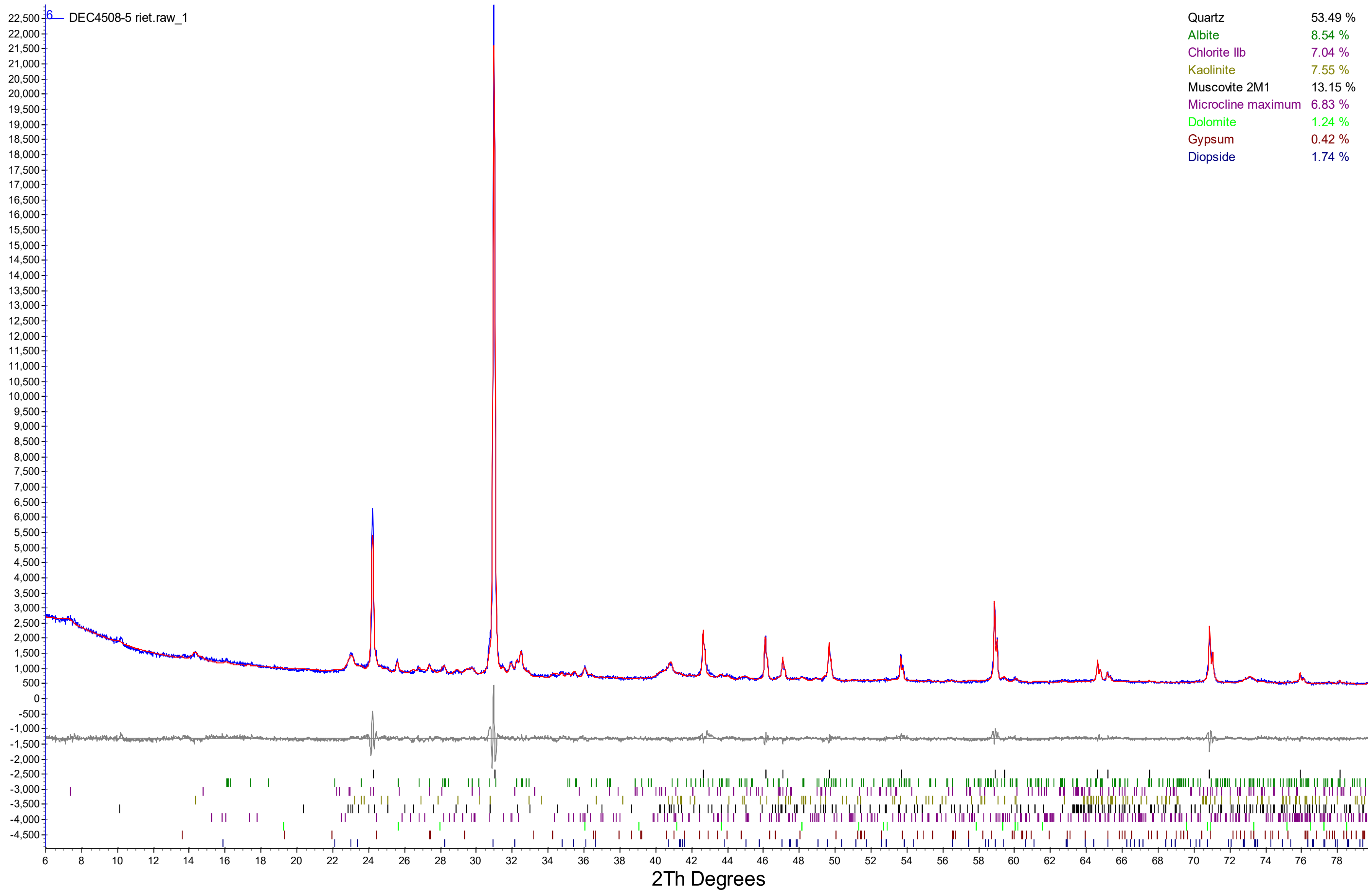
Environmental Services
Custom XRD/MI4508-DEC22
21-Dec-22



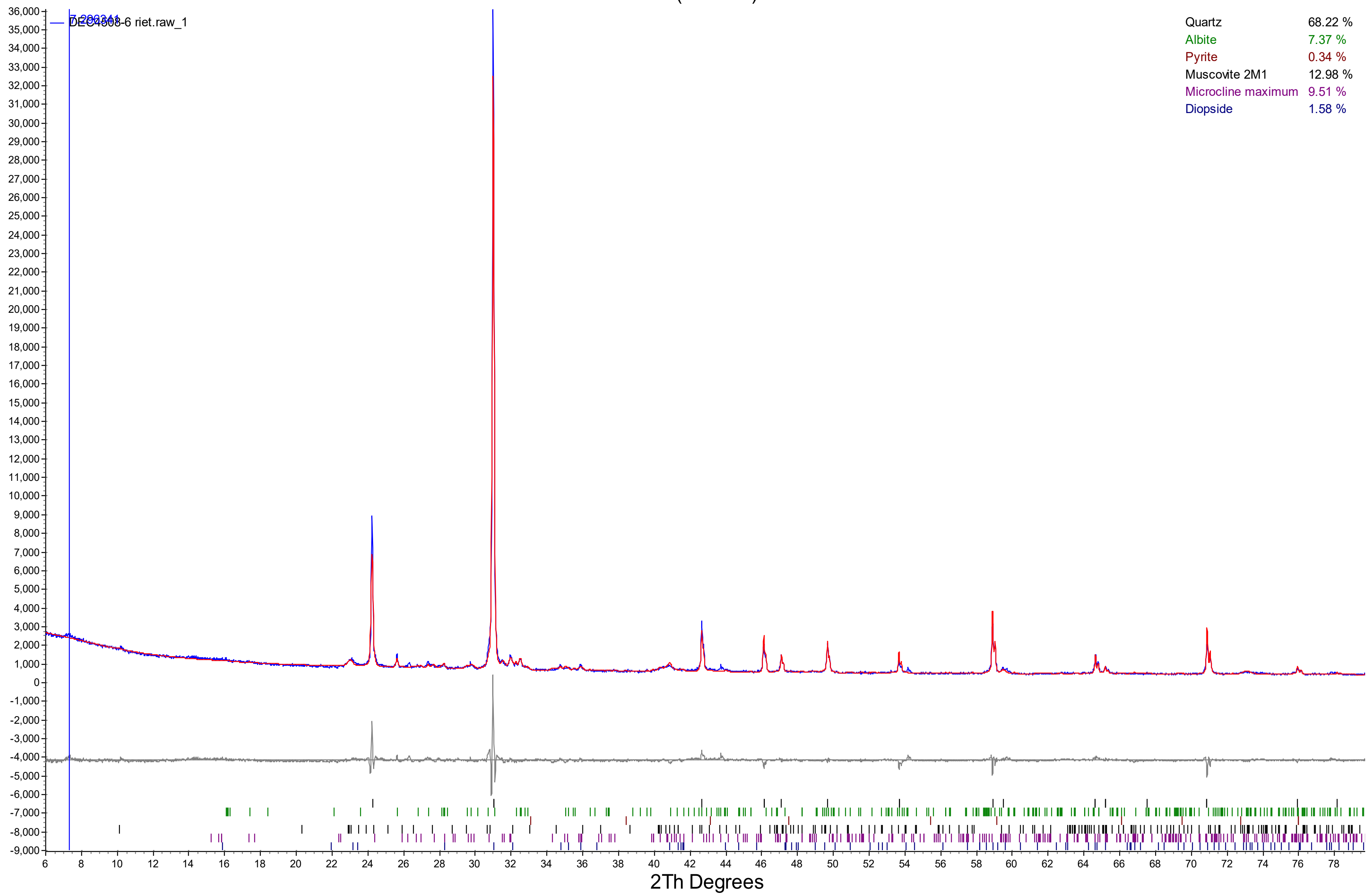
MW-392 (80-82)

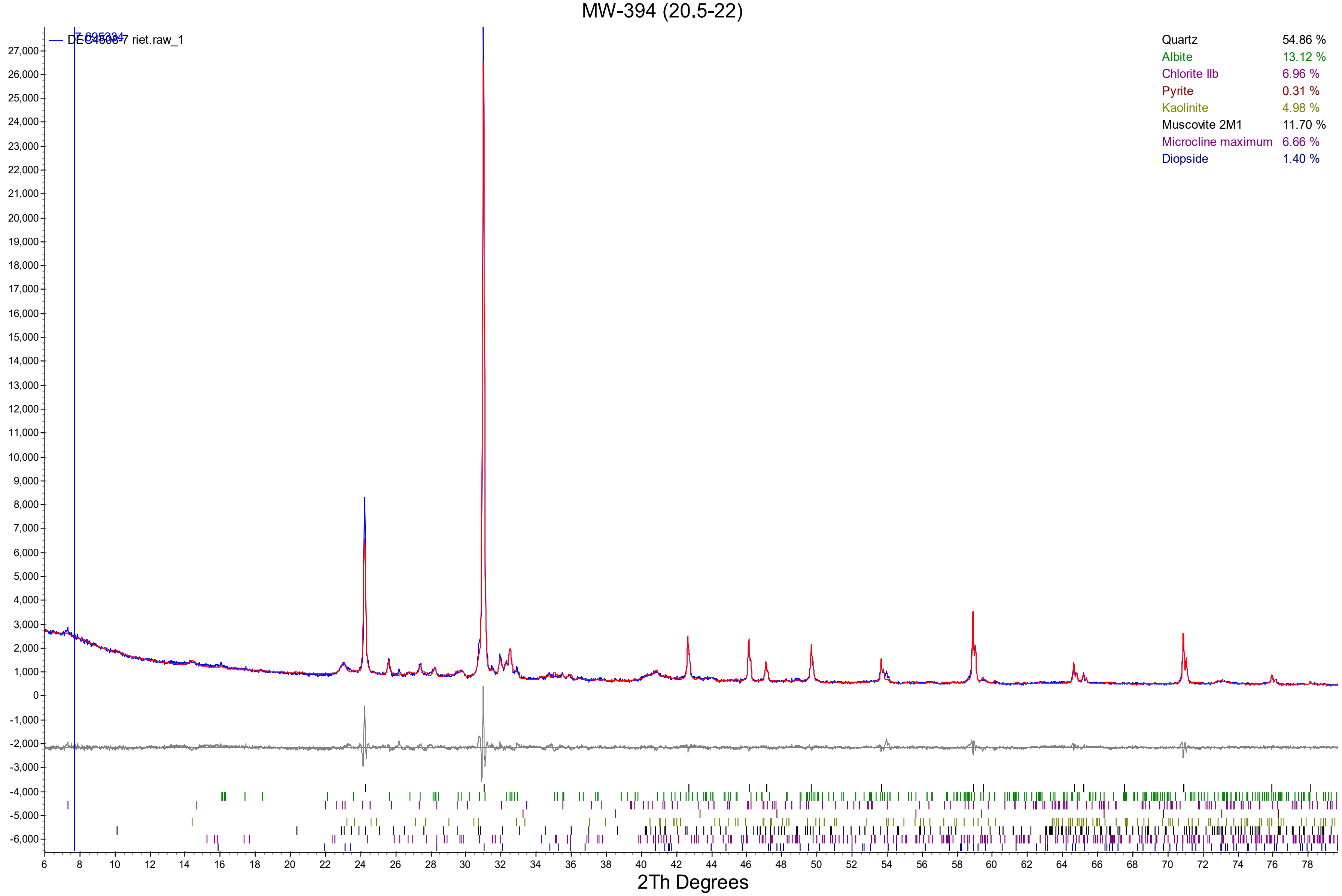

DEC4508-4 rerun riet.raw_1
7.878857
15.77514
2Th Degrees
Quartz 29.12 %
Albite 1.00 %
Chlorite IIb 6.81 %
Pyrite 1.24 %
Kaolinite 8.19 %
Calcite 31.47 %
Anatase 0.42 %
Muscovite 2M1 14.54 %
Leucite 2.43 %
Siderite 1.88 %
Microcline maximum 2.91 %

MW-392 (32-33.5)

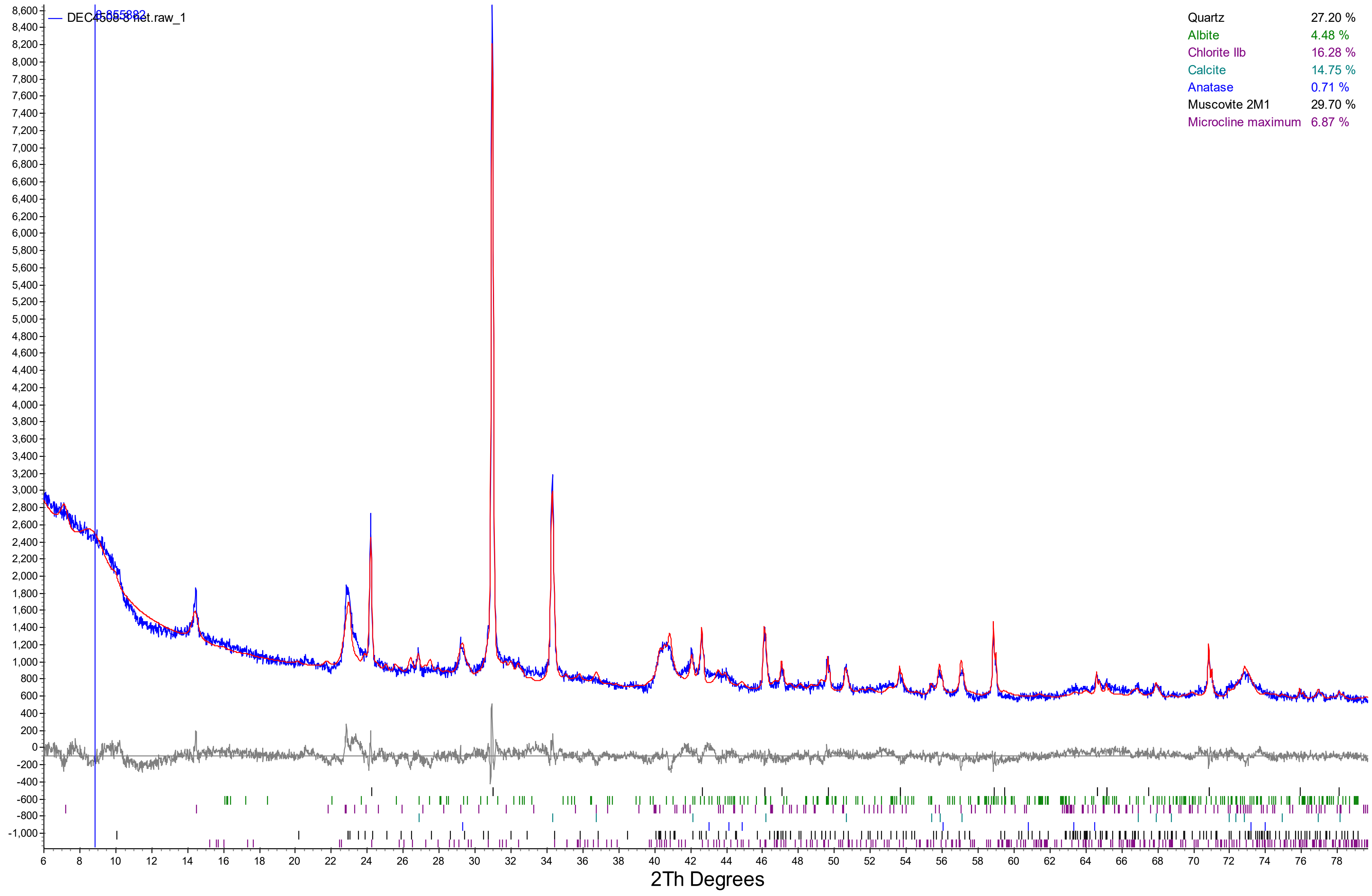

DEC4508-5 riet.raw_1
Quartz 53.49 %
Albite 8.54 %
Chlorite IIb 7.04 %
Kaolinite 7.55 %
Muscovite 2M1 13.15 %
Microcline maximum 6.83 %
Dolomite 1.24 %
Gypsum 0.42 %
Diopside 1.74 %
2Th Degrees

MW-393 (24-25.5)


DEC4508-6 riet.raw_1
Quartz 68.22 %
Albite 7.37 %
Pyrite 0.34 %
Muscovite 2M1 12.98 %
Microcline maximum 9.51 %
Diopside 1.58 %
2Th Degrees


MW-394 (20.5-22)
DEC450087 riet.raw_1
Quartz 54.86 %
Albite 13.12 %
Chlorite IIb 6.96 %
Pyrite 0.31 %
Kaolinite 4.98 %
Muscovite 2M1 11.70 %
Microcline maximum 6.66 %
Diopside 1.40 %
2Th Degrees

MW-392 (66-68)


DEC4508-8 net.raw_1
Quartz 27.20 %
Albite 4.48 %
Chlorite IIb 16.28 %
Calcite 14.75 %
Anatase 0.71 %
Muscovite 2M1 29.70 %
Microcline maximum 6.87 %
2Th Degrees

ATTACHMENT C

History of Construction Report

845.220(a)(1)

July 2023

Attachment C.1

History of Construction Report

July 2023

AECOM

October 2016

Dynegy Midwest Generation, LLC
10901 Baldwin Road
Baldwin, IL 62217

RE: History of Construction
USEPA Final CCR Rule, 40 CFR § 257.73(c)
Baldwin Energy Complex
Baldwin, Illinois

On behalf of Dynegy Midwest Generation, LLC, AECOM has prepared the following history of construction for the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond at the Baldwin Energy Complex 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 site experience. AECOM's document review included construction drawings, geotechnical investigations, observation reports, instrument monitoring reports, construction specifications, operation and maintenance information, etc. for the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond at the Baldwin Energy Complex.

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: Dynegy Midwest Generation, LLC

Address: 1500 Eastport Plaza Drive
Collinsville, IL 62234

CCR Units: Old East Fly Ash Pond
East Fly Ash Pond
West Fly Ash Pond
Bottom Ash Pond

The above named CCR units do 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 locations of the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond have 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 following captures the purpose of each CCR unit:

- The Old East Fly Ash Pond (inactive) was used to store and dispose of fly ash.
- The East Fly Ash Pond (inactive) was used to store and dispose of fly ash.
- The West Fly Ash Pond is being used to store and dispose of dry-stacked fly ash and to clarify CCR contact stormwater prior to discharge in accordance with the station's NPDES permit.
- The Bottom Ash Pond is being used to store and dispose of sluiced bottom ash, with bottom ash mined for beneficial use, to temporarily store spray dry absorption (SDA) waste, and to clarify plant process water, including other non-CCR station process wastewaters, prior to discharge in accordance with the station's NPDES permit.

Notice of intent to close the Old East Fly Ash Pond and East Fly Ash Pond was provided in November, 2015. Notice of intent to close the West Fly Ash Pond was provided in October, 2016.[1]

[1] This history of construction report was prepared on a facility-wide basis for CCR surface impoundments at the Baldwin Energy Complex. The inclusion of the Old East Fly Ash Pond, East Fly Ash Pond, and West Fly Ash Pond in this history of construction report does not concede and should not be construed to concede that the Old

AECOM

§ 257.73(c)(1)(iv): The name and size in acres of the watershed where the CCR unit is located.

The Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond are located at the northern edge of the Baldwin Lake-Kaskaskia River Watershed with a 12-digit Hydrologic Unit Code (HUC) of 071402040908 and a drainage area of 17,034 acres. The Baldwin Lake-Kaskaskia River Watershed is located within the Kaskaskia River Watershed (HUC: 0714020409) (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.

Physical properties of the foundation materials for the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond are described from top to bottom in this paragraph. The area encompassing the ash ponds is immediately to the east of the alluvial plain of the Kaskaskia River. The uppermost material is a 5 to 10-foot-thick layer of loess described as low to medium plastic silty clay. The loess is underlain by a 5 to 20-foot thick zone of glacio-lacustrine and glacial till soils. The upper portion of the zone is typically glacio-lacustrine, a stiff to very stiff, low to medium plastic clay with occasional sand and silt zones. This grades downward to glacial till which is a very stiff to hard, medium plastic clay with varying amounts of sand and gravel. Within the glacial till random pockets of sand and gravel were encountered. The glacial till is underlain by a layer of either moderate to highly weathered limestone or a very stiff to hard, high plastic residual clay (decomposed shale). Bedrock exists below the till or residual clay and consists primarily of weathered clay shale with interbedded limestone.

An alluvium layer of low-strength silt/clay mixture with trace sand and organics (creek deposit) was found at the southern end of the West Fly Ash Pond, which lies on a former creek channel. A layer of sand was found under the northern embankment of the West Fly Ash Pond and East Fly Ash Pond and in the northern portion of the Bottom Ash Pond. An available summary of the engineering properties of the foundation 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 (°)
Alluvium	115	100	28	1,500	0
Loess	120	100	28	1,500	0
Glacio-lacustrine/Till	120	1,000	20	2,000	0
Residual Clay	120	100	28	2,000	0
Shale	125	1,000	28	4000	0

East Fly Ash Pond, East Fly Ash Pond, and West Fly Ash Pond are subject to the Design Criteria or all Operating Criteria in the CCR Rule.

The abutment materials for the Bottom Ash Pond consist of recompacted loess. Physical properties of the loess are described as low to medium plastic silty clay. The Old East Fly Ash Pond, East Fly Ash Pond, and West Fly Ash Pond are enclosed impoundments with dikes and do not have abutments. An available summary of the engineering properties of the abutment materials is presented in **Table 1** above.

§ 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 physical properties of the materials used for initial embankment construction and embankment raise construction (where applicable) of the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond generally consist of low to medium plastic clay and silty clay with zones of high plastic clay (typically recompacted loess). 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 Description	Unit Weight (pcf)	Effective (drained) Shear Strength Parameters		Total (undrained) Shear Strength Parameters	
		c' (psf)	Φ' (°)	c (psf)	Φ (°)
1969 Dike Construction	115	100	28	1,500	0
1989 Dike Construction	115	100	28	2,000	0

Site preparation and construction of the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond were completed in accordance with the applicable construction specification (see §257.73(c)(1)(xi) below for corresponding construction specifications).

The approximate dates of construction of each successive stage of construction of the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond are provided in **Table 3** below.

Table 3. Approximate dates of construction of each successive stage of construction.

Date	Event
1969	Construction of Old East Fly Ash Pond, East Fly Ash Pond, and West Fly Ash Pond external perimeter embankment
1979	Construction of East Fly Ash Pond and West Fly Ash Pond northern embankment
1989	Inboard perimeter raise of the entire East Fly Ash Pond and West Fly Ash Pond
1995	Construction of interior dike between the East Fly Ash Pond and West Fly Ash Pond
1999	Raise of interior dike between the East Fly Ash Pond and West Fly Ash Pond; replacement of outlet pipe from the West Fly Ash Pond to the Secondary Pond
2012	Modification of Bottom Ash Pond embankment (original construction date unknown)

§ 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 Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom 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).

	Old East Fly Ash Pond	East Fly Ash Pond	West Fly Ash Pond	Bottom Ash Pond
Dimensional plan view (all zones)	E-BAL1-B39	E-BAL1-B38, E-BAL1-C119	E-BAL1-B38, E-BAL1-C119	BAL1-C1033
Dimensional cross sections	E-BAL1-B39	E-BAL1-B38, CE-BAL1-B1488	E-BAL1-B38, CE-BAL1-B1488	BAL1-C1035
Foundation Improvements	E-BAL1-B39	E-BAL1-B38	E-BAL1-B38	BAL1-C1035
Drainage Provisions	Not Applicable	Not Applicable	E-BAL1-M1077-1	BAL1-C1033
Spillways and Outlets	Not Applicable	E-BAL1-C120, E-BAL1-C122	E-BAL1-C127	BAL1-C1033, BAL1-C1035, BAL1-C1038
Diversion Ditches	E-BAL1-B39	E-BAL1-B38	E-BAL1-B38	BAL1-C1033, BAL1-C1037
Instrument Locations	Figure 2	Figure 2	Figure 2	Figure 2
Slope Protection	E-BAL1-B39	E-BAL1-B38	E-BAL1-B38	BAL1-C1034, BAL1-C1036
Normal Operating Pool Elevation	Not Available	Not Available	Not Available	BAL1-C1035
Maximum Pool Elevation	Not Available	Not Available	Not Available	BAL1-C1035
Approximate Maximum Depth of CCR in 2016	23 feet	44 feet	21 feet	43 feet

All drawings referenced in **Table 4** above can be found in **Appendix B** and **Appendix C**.

Based on the review of the drawings listed above, no natural or manmade features that could adversely affect operation of these CCR units 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 consists of slope inclinometers and vibrating-wire piezometers installed within the southern embankment of the West Fly Ash Pond near the location of the 1995 slope movement (see § 257.73(c)(1)(xii) below). Additional vibrating-wire piezometers were later installed in 2015 throughout the Old East Fly Ash Pond, East Fly Ash Pond, and

Bottom Ash Pond. The purpose of the slope inclinometers is to measure subsurface movements and deformations. The purpose of the piezometers is to measure the pore water pressures within the embankment. There are two (2) existing slope inclinometers and eighteen (18) existing piezometers within the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond. A location map of the existing instrumentation is presented in **Appendix C**.

§ 257.73(c)(1)(ix): Area-capacity curves for the CCR unit.

The area-capacity curves for the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond are presented in **Figures 1** to **3** below. "Area-capacity curves", as defined by 40 CFR § 257.53, "means graphic curves which readily show the reservoir water surface area, in acres, at different elevations from the bottom of the reservoir to the maximum water surface, and the capacity or volume, in acre-feet, of the water contained in the reservoir at various elevations."

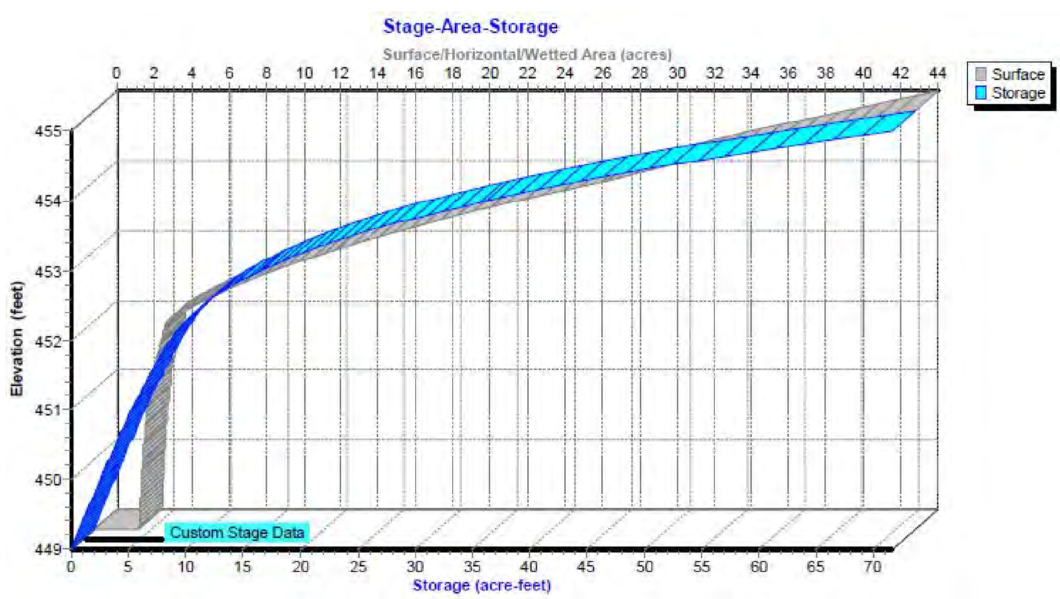


Figure 1. Area-capacity curve for the Old East Fly Ash Pond and East Fly Ash Pond

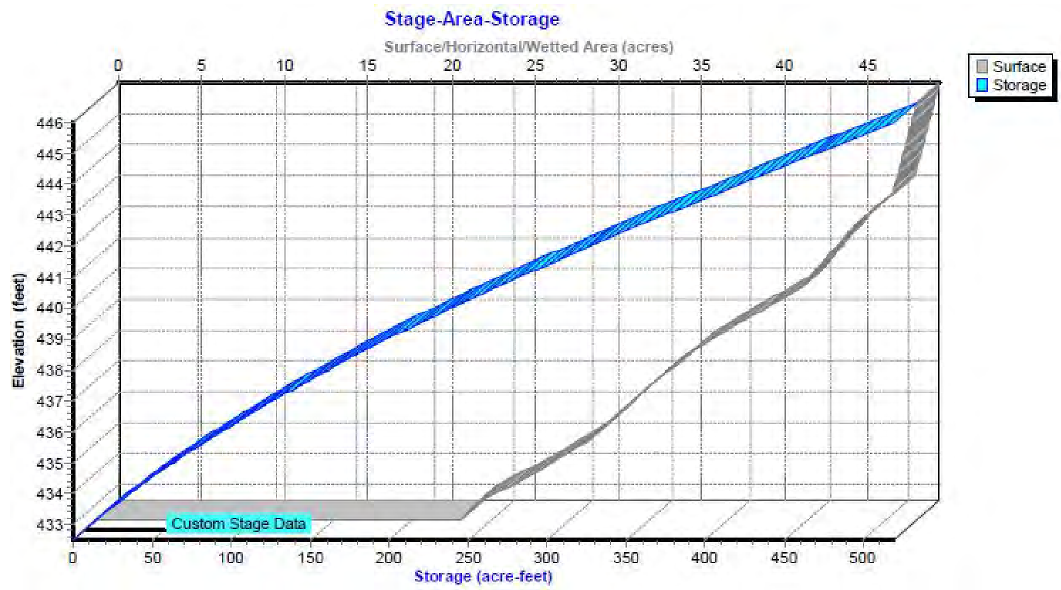


Figure 2. Area-capacity curve for West Fly Ash Pond

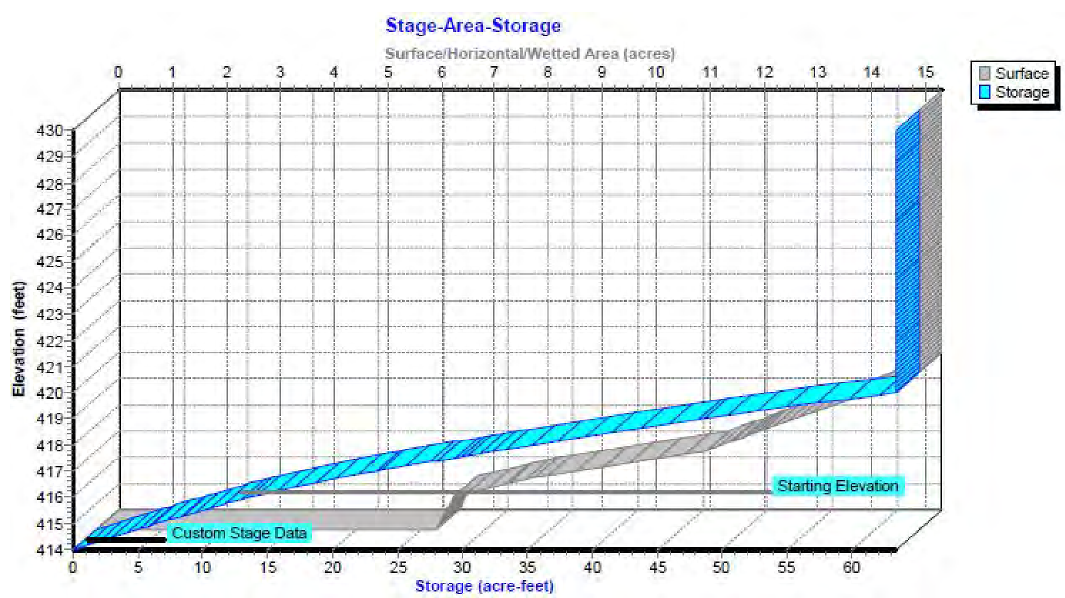


Figure 3. Area-capacity curve for Bottom Ash Pond

The area-capacity curves shown were taken from the pond modeling analysis. Actual pond capacity is limited to the approximate berm elevation listed in **Table 3** below. Any information above berm elevation should be disregarded.

§ 257.73(c)(1)(x): A description of each spillway and diversion design features and capacities and calculations used in their determination.

Stormwater flow from the Old East Fly Ash Pond and East Fly Ash Pond is controlled by a series of five (5) 12-inch diameter (dia.) ductile iron pipe (DIP) risers and is diverted into the

West Fly Ash Pond. The separator dike in between the East Fly Ash Pond and the West Fly Ash Pond also contains an overflow emergency spillway armored with rip rap with an approximate invert at El. 453 feet. Unless otherwise mentioned, all elevations listed in the report are in the NAVD88 datum.

The West Fly Ash Pond contains a 36-inch dia. DIP culvert that discharges into the Secondary Pond. However, the inlet elevation of 432.5 feet is above the normal pool elevation of 424.3 feet; therefore, the pipe acts as an overflow spillway during heavy rain events. During normal operations, water from the West Fly Ash Pond is pumped through a 10-inch dia. high-density polyethylene (HDPE) pipe into the Bottom Ash Pond.

The Bottom Ash Pond contains a drop inlet spillway that discharges to the Secondary Pond via a 30-inch dia. HDPE pipe. The Bottom Ash Pond also contains a pumping station that discharges into the Cooling Pond via two 18-inch dia. HDPE pipes during heavy rain events. The pumping station consists of four pumps, two of which turn on at El. 417.4 feet and two which turn on at El. 417.6 feet. The pumps turn off again when the water level in the impoundment drops to El. 417.2 feet. In 2016 the discharge capacity of the Bottom Ash Pond was evaluated using HydroCAD 10 software modeling a 1,000-year, 24-hour rainfall event. The model results indicates that the Bottom Ash Pond emergency spillway will activate during the 1,000-year, 24-hour storm event. The results of the HydroCAD 10 analysis are presented below in **Table 5**.

Table 5. Results of HydroCAD 10 analysis

	Bottom Ash Pond
Approximate Minimum Berm Elevation[1] (ft)	419.0
Approximate Emergency Spillway Elevation[1] (ft)	417.7
Starting Pool Elevation[1] (ft)	415.8
Peak Elevation[1] (ft)	418.7
Time to Peak (hr)	16.8
Surface Area (ac)	13.7
Storage[2] (ac-ft)	32.7

Note: 1. Elevations are based on NAVD88 datum
2. Storage given is from Starting Pool Elevation to Peak Elevation.

AECOM

§ 257.73(c)(1)(xi): The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.

The construction specification for the Old East Fly Ash Pond, East Fly Ash Pond, and West Fly Ash Pond are located in the document titled *Specification T-2226* (presented in **Appendix D**). As indicated on the construction drawings, the construction specification for the Bottom Ash Pond is located in the document titled *Specification H-3026*, but that document is not reasonably and readily available.

The provisions for surveillance, maintenance, and repair of the East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond are available in *Baldwin Ash Pond; IDNR Dam Safety Operating and Maintenance Plan* (2013) (presented in **Appendix E**).

The operations and maintenance plans for the Old East Fly Ash Pond, East Fly Ash Pond, West Fly Ash Pond, and Bottom Ash Pond are currently being revised by Dynegy Midwest Generation, LLC. This section will be updated when the new operations and maintenance plans are available.

§ 257.73(c)(1)(xii): Any record or knowledge of structural instability of the CCR unit.

In February 1995, a slide occurred on the southern embankment of the West Fly Ash Pond. The slide was first observed as a 10-inch wide scarp which progressively grew larger. After discovering the slide, an investigation was performed by Woodward-Clyde Consultants, Inc. and the pond elevation was lowered. As a further preventive measure, approximately 600 linear feet of the southern embankment crest was removed to reduce the driving forces acting within the slide area. A separator dike was constructed in between the East Fly Ash Pond and West Fly Ash Pond to allow for normal operations of the East Fly Ash Pond and a lowered normal pool level in the West Fly Ash Pond. Following the remedial actions, slope inclinometer readings showed that subsurface movement was insignificant and it was concluded that the remedial actions were successful. The slope movement did not result in any known release of CCR material. The *Final Report of Geotechnical Investigation* by Woodward-Clyde Consultants, Inc. (1995) is presented in **Appendix F**.

A separate surficial slope movement occurred in 2011 on the northwest embankment of the West Fly Ash Pond. The soil movement was investigated by URS and was believed to be caused by recent heavy rains. The entire slide mass was removed and replacement material was compacted and graded to match the adjacent embankment slopes. Information about this event can be found in the 2011 letter by URS presented in **Appendix G**. A similar movement of surficial soil occurred in 2015 further east from the 2011 location and was repaired in the same fashion. Photos from the 2015 surficial movement are provided in **Appendix H**.

There is no record or knowledge of structural instability of the Old East Fly Ash Pond, East Fly Ash Pond, and Bottom Ash Pond at the Baldwin Energy Complex.

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.

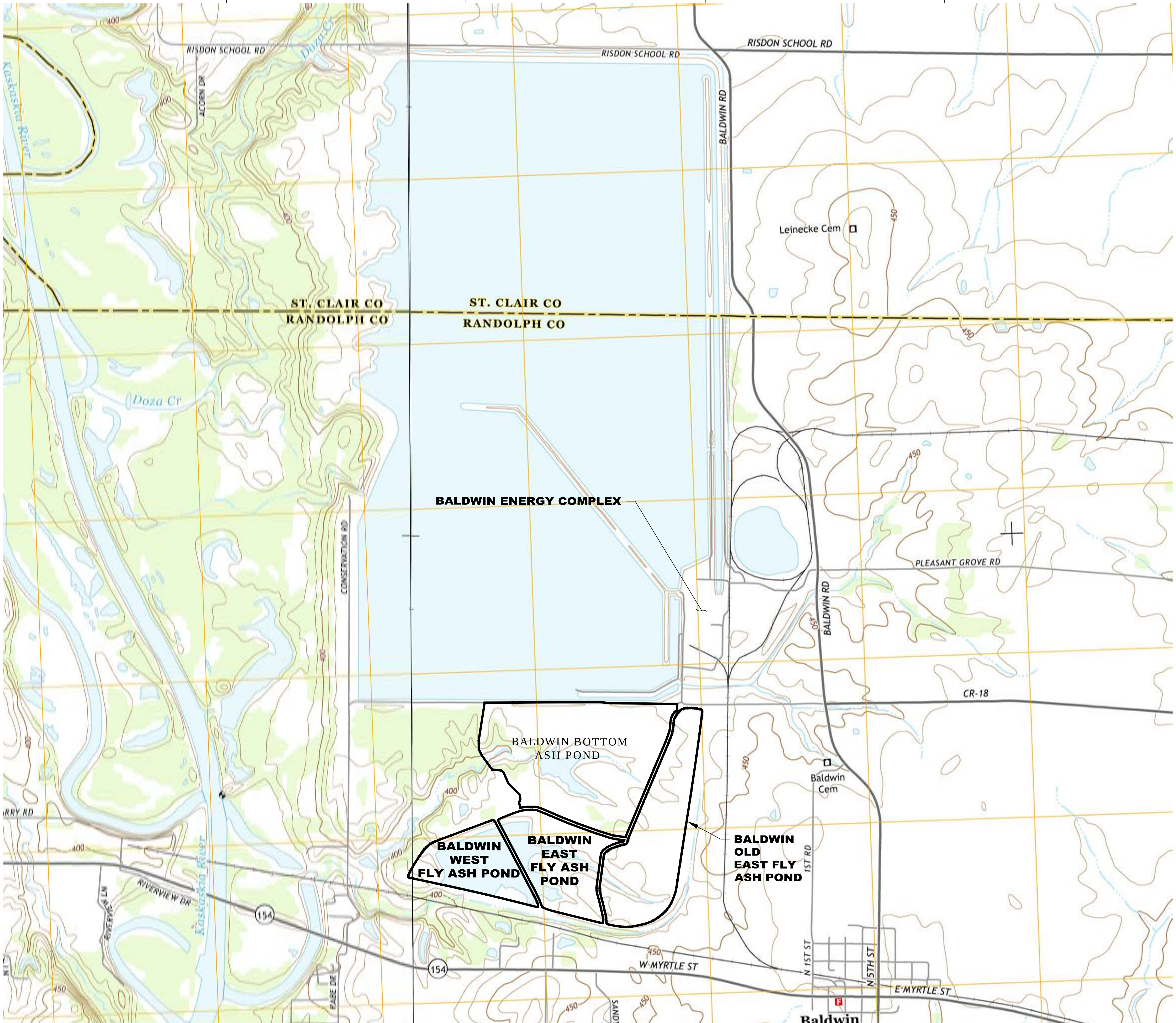
United States Geological Survey (USGS). (2016). The National Map Viewer. http://viewer.nationalmap.gov/viewer/. USGS data first accessed in March of 2016.

APPENDICES

Appendix A: History of Construction Vicinity Map
Appendix B: Baldwin Energy Complex Drawings
Appendix C: Baldwin Energy Complex Piezometer and Inclinometer Locations
Appendix D: Specification T-2226
Appendix E: Baldwin Ash Pond; IDNR Dam Safety Operating and Maintenance Plan (2013)
Appendix F: Final Report of Geotechnical Investigation, Baldwin Power Station, Fly Ash Pond South Dike, Baldwin, Illinois, Woodward-Clyde Consultants, Inc. (1995)
Appendix G: Observation of Slope Movement at Fly Ash Pond, Baldwin Energy Complex, Baldwin, Illinois, URS (2011)
Appendix H: Photos from the 2015 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 RED BUD, ILLINOIS AND BALDWIN, ILLINOIS, REVISED 2015.

QUADRANGLE LOCATION

N

0 1000 2000 3000

SCALE IN FEET

AECOM
1001 Highlands Plaza Drive, Suite 300
St. Louis, Mo. 63110
314 429-0100 (phone)
314-429-0462 (fax)

Dynegy Midwest Generation, LLC
10901 Baldwin Road
Baldwin, IL 62217

HISTORY OF CONSTRUCTION

BALDWIN ENERGY COMPLEX
BALDWIN, 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

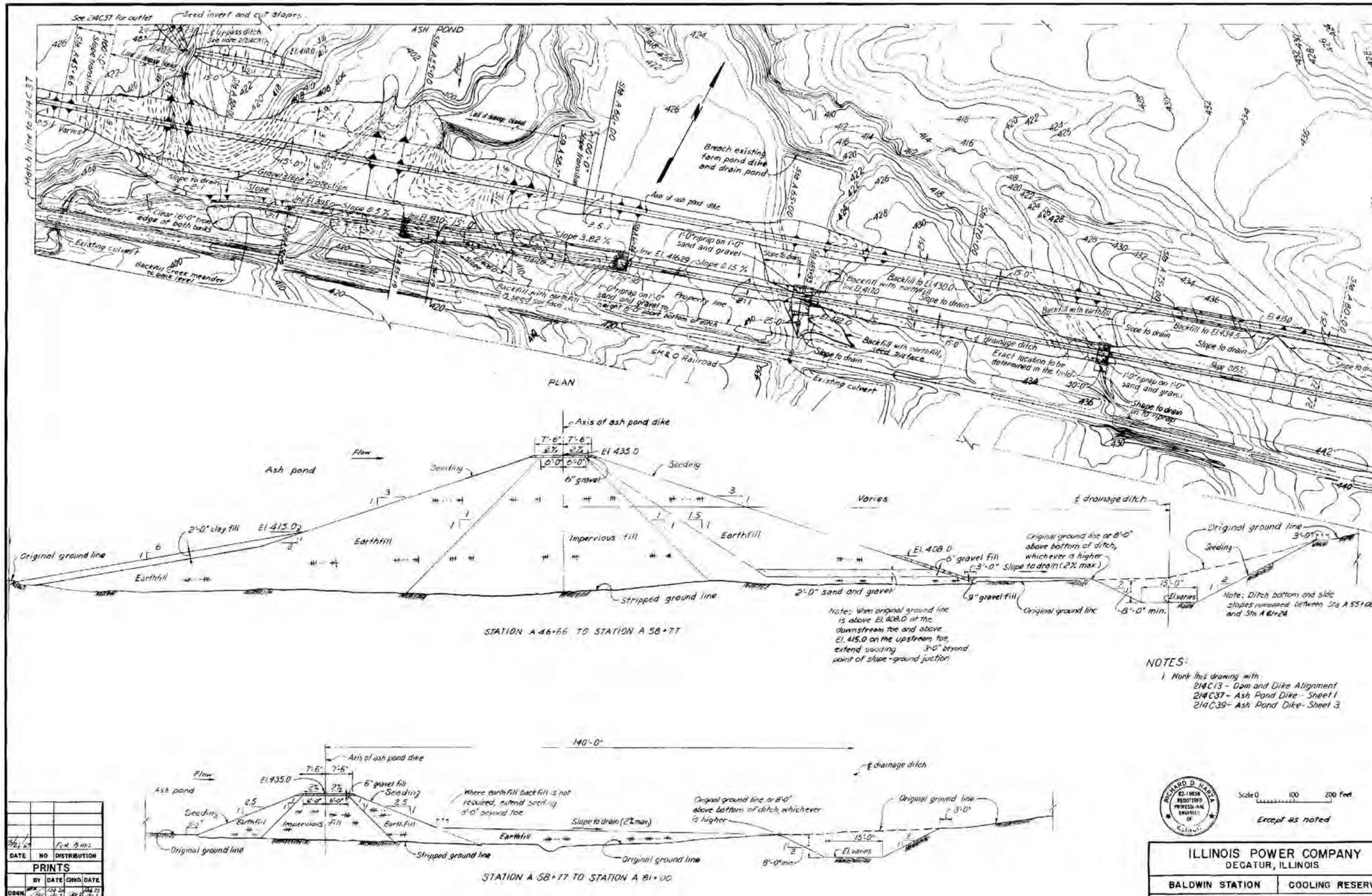
01

AECOM DRAWING PATH: P:\Projects\Geotech\60428794_DynegyCCR\13_Construction History\04 Technical Production\1_Baldwin\References\Vicinity Location Map References\Figures\C-01 History of Construction Vicinity Map (Baldwin)_without non-CCR Units.dwg NANAK, MATT, 8/22/2016 11:37 AM

AECOM

Appendix B: Baldwin Energy Complex Drawings

1. “Ash Pond Dike Sheet 2”, Drawing No. E-BAL1-B38, Revision A, 18 November, 1969, Sargent & Lundy Engineers.
2. “Ash Pond Dike Sheet 3”, Drawing No. E-BAL1-B39, Revision A, 18 November, 1969, Sargent & Lundy Engineers.
3. “Primary Ash Pond Site Plan, Vertical Extension of Intermediate Embankment”, Drawing No. E-BAL1-C119, Revision 3, 27 January, 2000, Illinois Power Company.
4. “Plan and Profile, Vertical Extension of Intermediate Embankment”, Drawing No. E-BAL1-C120, Revision 1, 27 January, 2000, Illinois Power Company.
5. “Miscellaneous Details of Intermediate Embankment, Vertical Extension of Intermediate Embankment”, Drawing No. E-BAL1-C122, Revision 3, 27 January, 2000, Illinois Power Company.
6. “Bottom Ash Pond Dike Improvements, Grading and Drainage Plan”, Drawing No. C1033, Revision 0, 28 November, 2012, Sargent & Lundy, LLC.
7. “Bottom Ash Pond Dike Improvements, Surfacing Plan”, Drawing No. C1034, Revision 0, 28 November, 2012, Sargent & Lundy, LLC.
8. “Bottom Ash Pond Dike Improvements, Grading Sections”, Drawing No. C1035, Revision 0, 28 November, 2012, Sargent & Lundy, LLC.
9. “Bottom Ash Pond Dike Improvements, Grading and Surfacing Details”, Drawing No. C1036, Revision 0, 28, November, 2012, Sargent & Lundy, LLC.
10. “Bottom Ash Pond Dike Improvements, Storm and Erosion Control Details Sheet 1”, Drawing No. C1037, Revision 0, 28 November, 2012, Sargent & Lundy, LLC.
11. “Bottom Ash Pond Dike Improvements, Storm and Erosion Control Details Sheet 2”, Drawing No. C1038, Revision 0, 28 November, 2012, Sargent & Lundy, LLC.
12. “Final Outlet Pipe Replacement, Primary Ash Pond”, Drawing No. E-BAL1-C127, Revision 2, 27 January, 2000, Illinois Power Company.
13. “Partial Plot Plan, Pond Ash Piping”, Drawing No. E-BAL1-M1077-1, Revision 0, 28 June, 2000, Illinois Power Company.



ILLINOIS POWER COMPANY
DECATUR, ILLINOIS

BALDWIN STATION | COOLING RESERVOIR

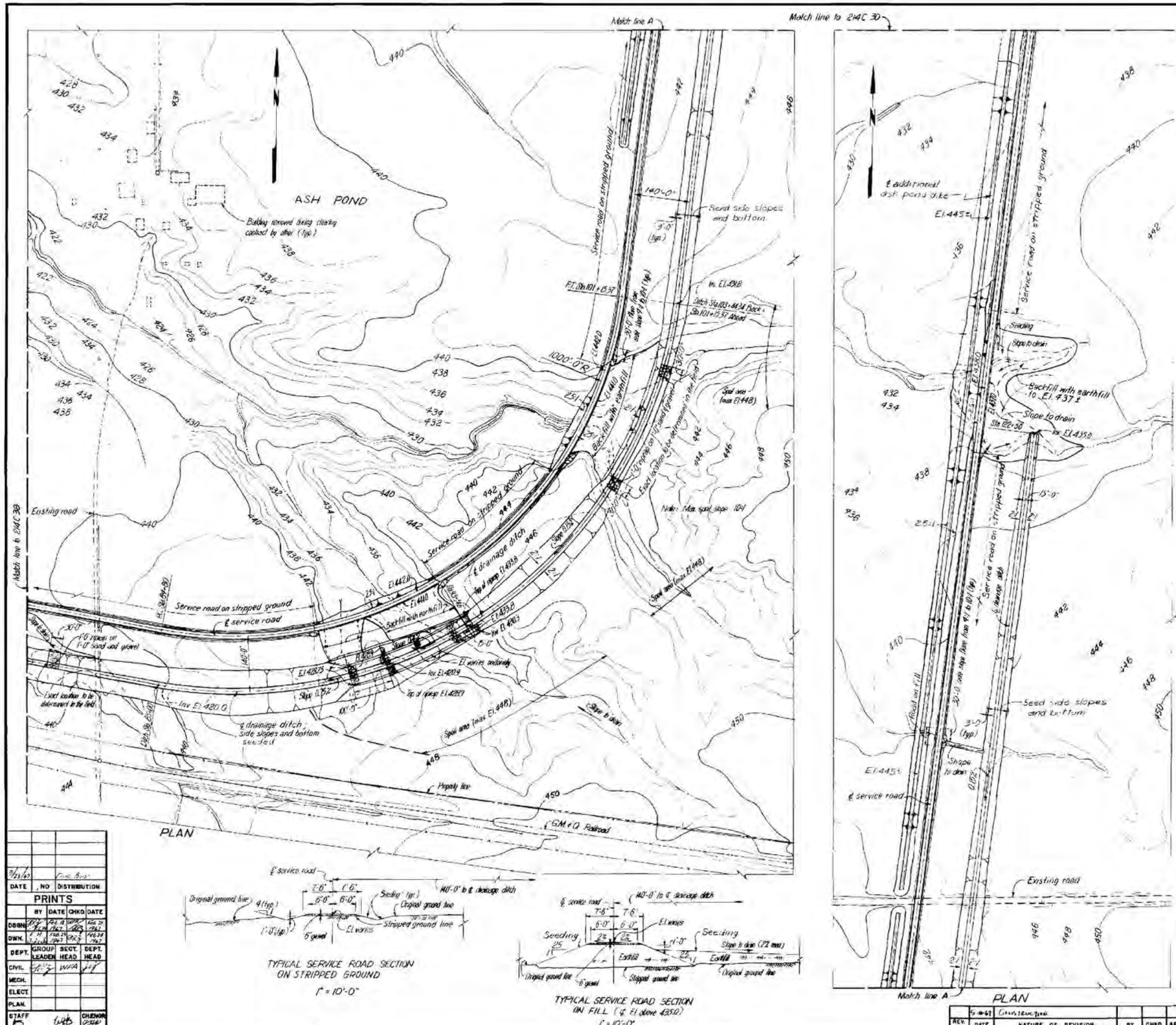
ASH POND DIKE
SHEET 2

SARGENT & LUNDY ENGINEERS
CHICAGO, ILLINOIS

HARZA ENGINEERING COMPANY
APPROVED
DATE MAR 16, 1967
DWG. NO.

REV. NO.	DATE	NATURE OF REVISION	BY	CHKD.	APPD.
A		AS BUILT			
	5/16/67	CONSTRUCTION			

S&L B-38 | HEC 214C38



NOTES:

1. Work this drawing with:
   214C 13 Dam and Dike Alignment
   214C 30 Intake
   214C 38 Ash Pond Dike - Sheet 2

Scale 0 100 200 Feet
Except as noted

DATE	NO	DISTRIBUTION	
PRINTS			
	BY	DATE	CHKD / DATE
DEPT.	GROUP LEADER	SECT. HEAD	DEPT. HEAD
CIVIL		WPA	
MECH.			
ELECT.			
PLAN.			

REV. NO.	DATE	NATURE OF REVISION	BY	CHKD.	APPD.
		Construction			
A		AS BUILT			

ILLINOIS POWER COMPANY
DECATUR, ILLINOIS

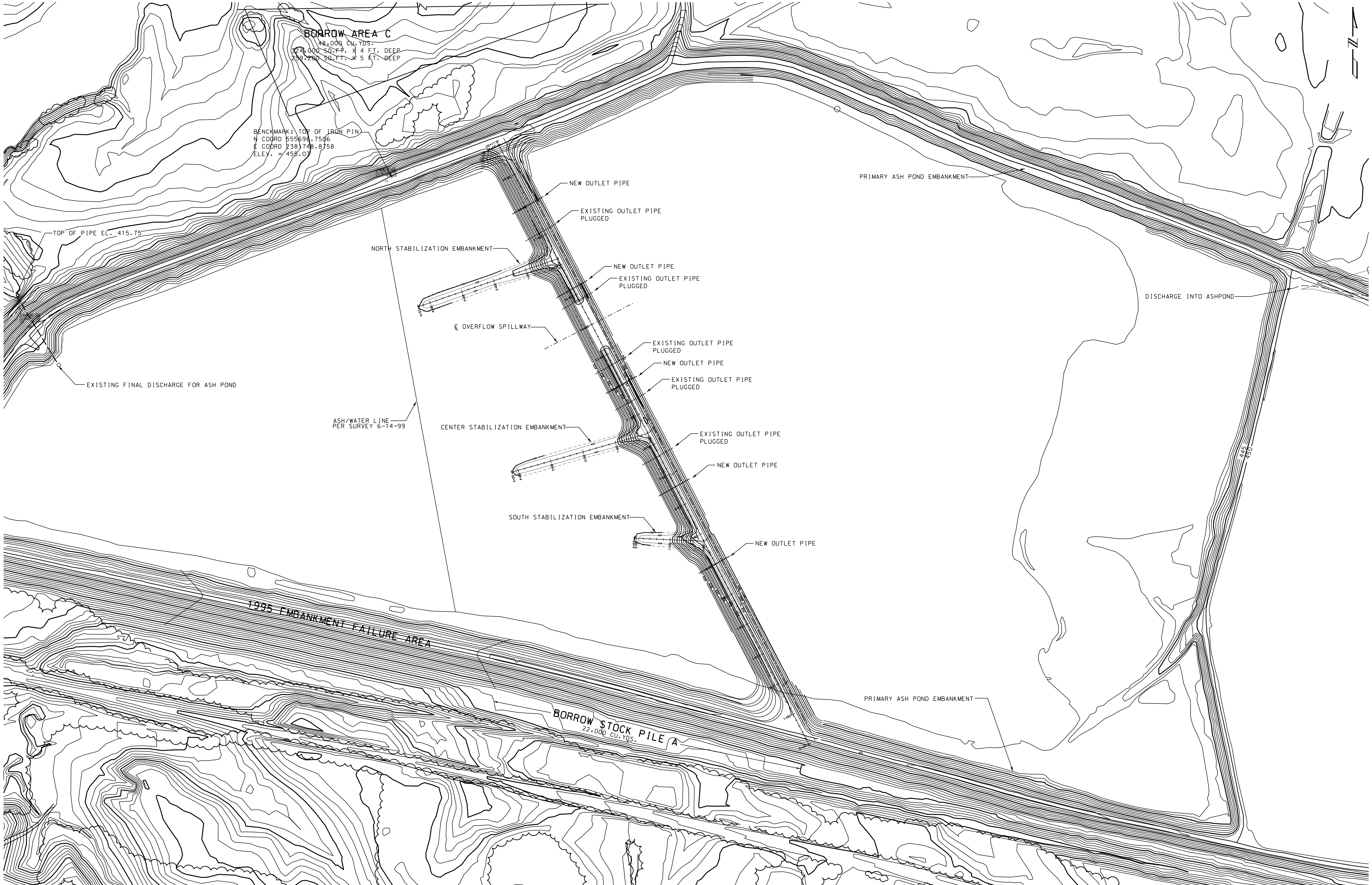
BALDWIN STATION — COOLING RESERVOIR

ASH POND DIKE
SHEET 3

SARGENT & LUNDY ENGINEERS, CHICAGO, ILLINOIS

HARZA ENGINEERING COMPANY
APPROVED Richard D. Harza
DATE MAR 16, 1967
DWG. NO.

S&L B-39 — HFC 214C39



E-BAL1-C119

REVISION STATUS: □-CONSTRUCTION ○-RECORD

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②	10-5-99	GBD	ADDED BORROW AREA INFORMATION	RCW	RCW	RCW							
③	01-27-00	MEC	AS-BUILT - INTERMEDIATE EMBANKMENT. VERTICAL. EXTENTION 1999	RCW	RCW	RCW							

NOTES

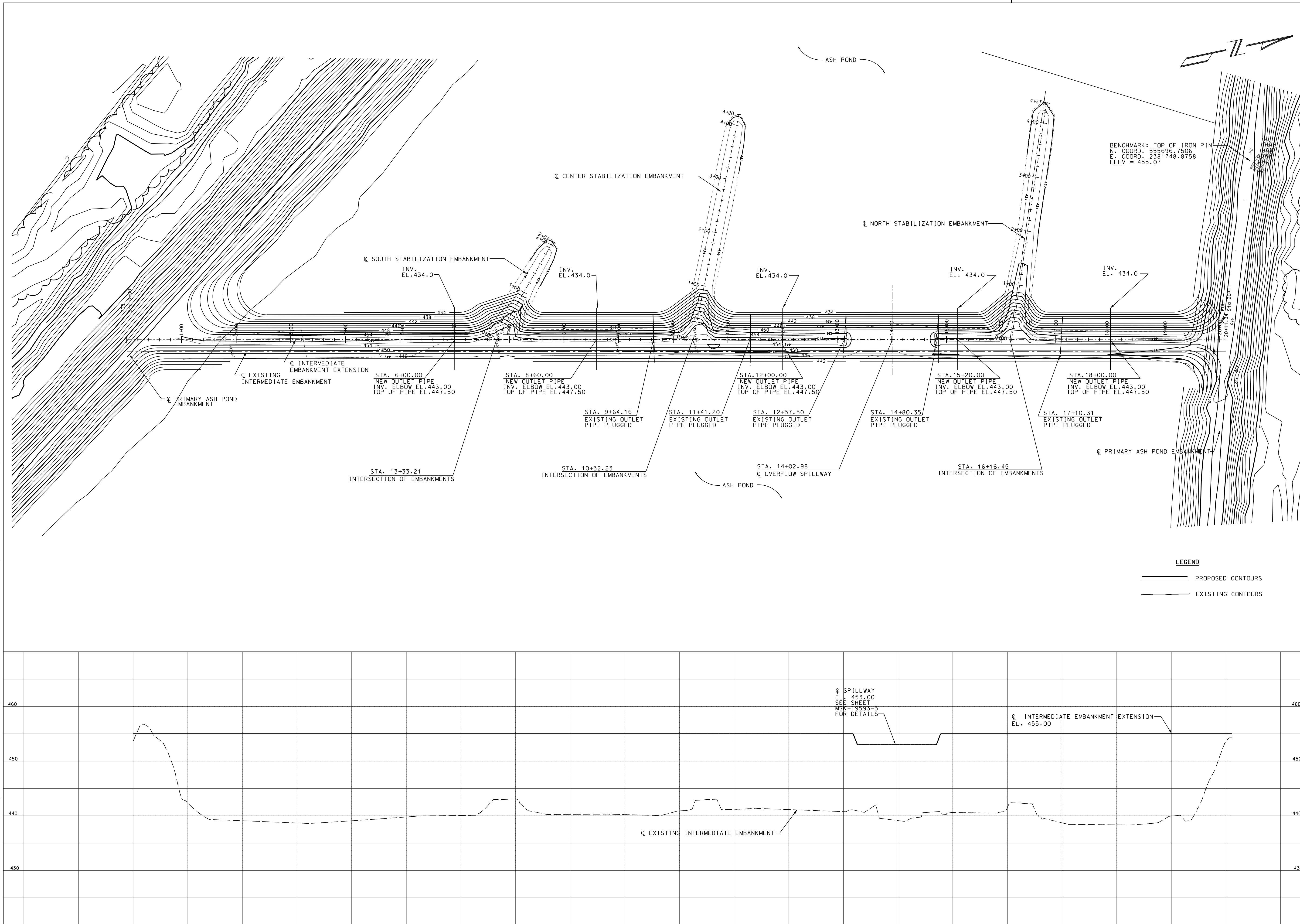
REFERENCES

ILLINOIS POWER COMPANY
DECATUR

PRIMARY ASH POND SITE PLAN
VERTICAL EXTENSION OF INTERMEDIATE EMBANKMENT
BALDWIN POWER STATION

DR RKF	CAD RKF	DATE 7-20-99
OK RCW	CKD	SCALE 1"=100'
APP	PLOTTED 2-14-2000	E-BAL1-C119
APP		

COMPUTER DWG. - DO NOT REVISE MANUALLY



SAG TEMPLATE NO'S.

NO	DATE	REVISIONS DESCRIPTION	BY	APP
1	01-27-00	AS-BUILT - INTERMED. EMBNK. VERTICAL. EXTENTION. 1999	MEC	RCW

Scanned by Illinois Power Company-1995

REVISION STATUS: ☐-CONSTRUCTION ☐-RECORD

ILLINOIS POWER COMPANY
DECATUR

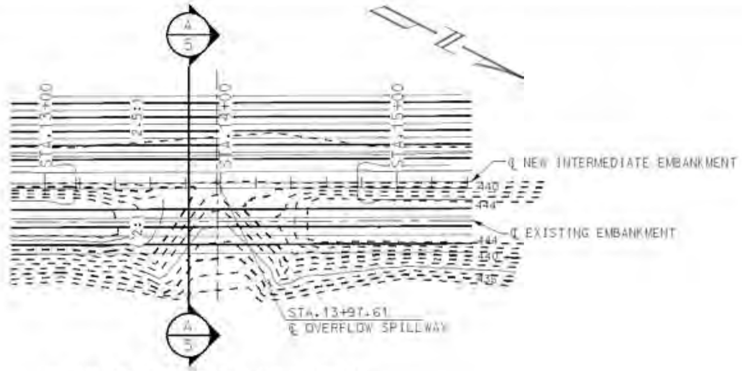
INTERMEDIATE EMBANKMENT
BALDWIN POWER STATION

PLOTTED 2-14-2000

PLAN AND PROFILE
VERTICAL EXTENSION OF INTERMEDIATE EMBANKMENT
BALDWIN POWER STATION

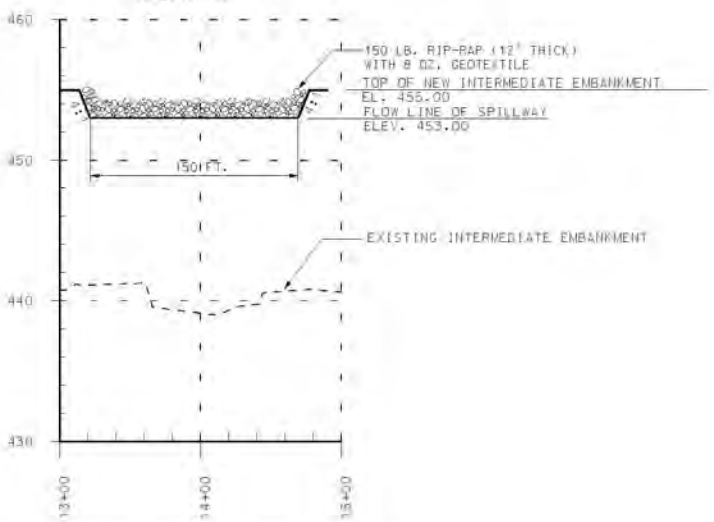
REV. NO. 1

DRAWING NUMBER E-BAL1-C120



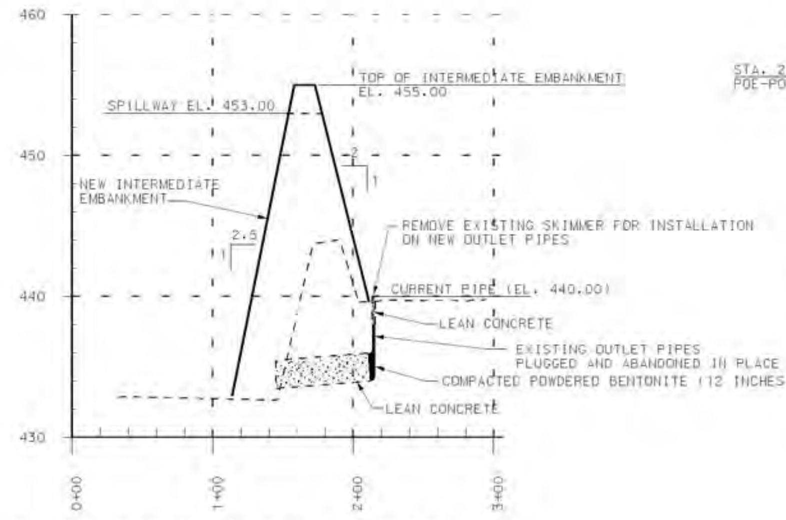
PLAN OF OVERFLOW SPILLWAY

SCALE:1"=40'



PROFILE OF OVERFLOW SPILLWAY

SCALE:1"=50' HORZ
1"=5' VERT



SECTION THRU EXISTING OUTLET PIPES (TYP.)

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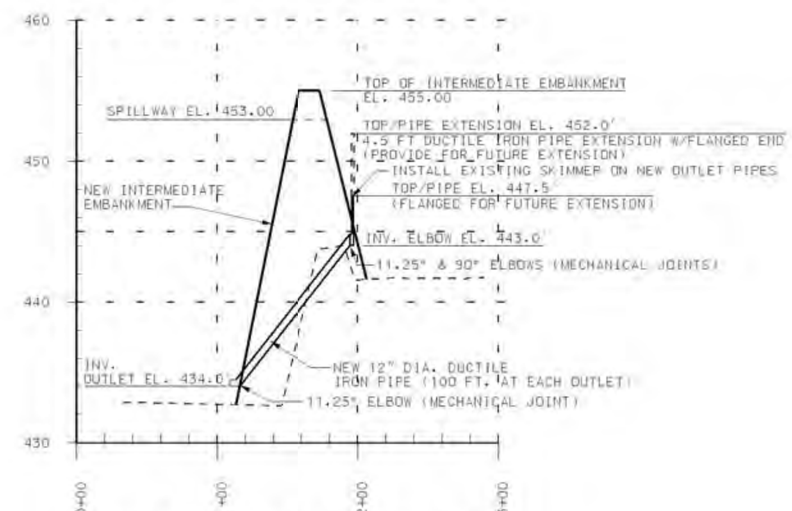
1"=5' VERT



SECTION THRU NEW OUTLET PIPES (TYP.)

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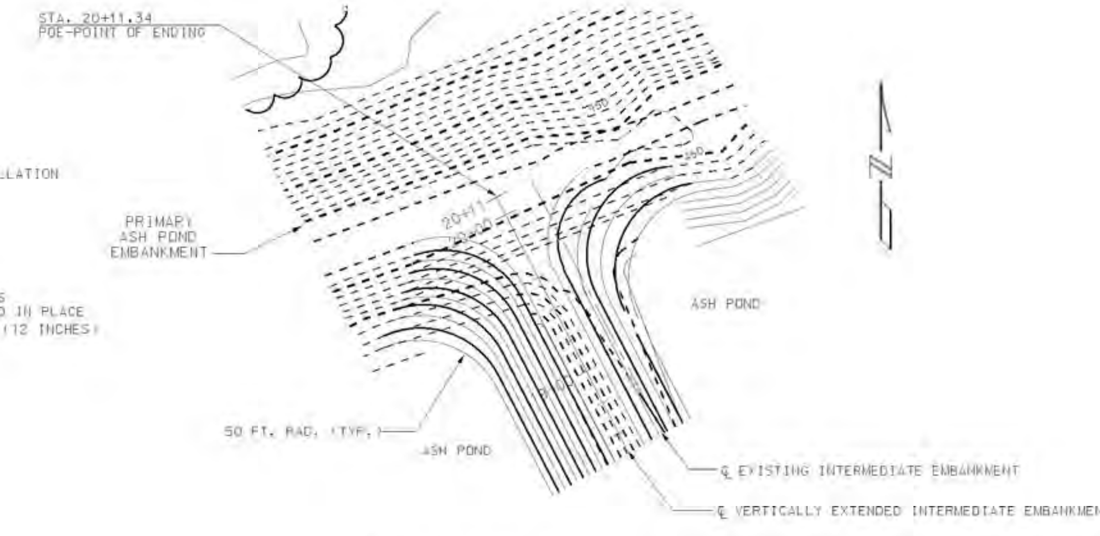
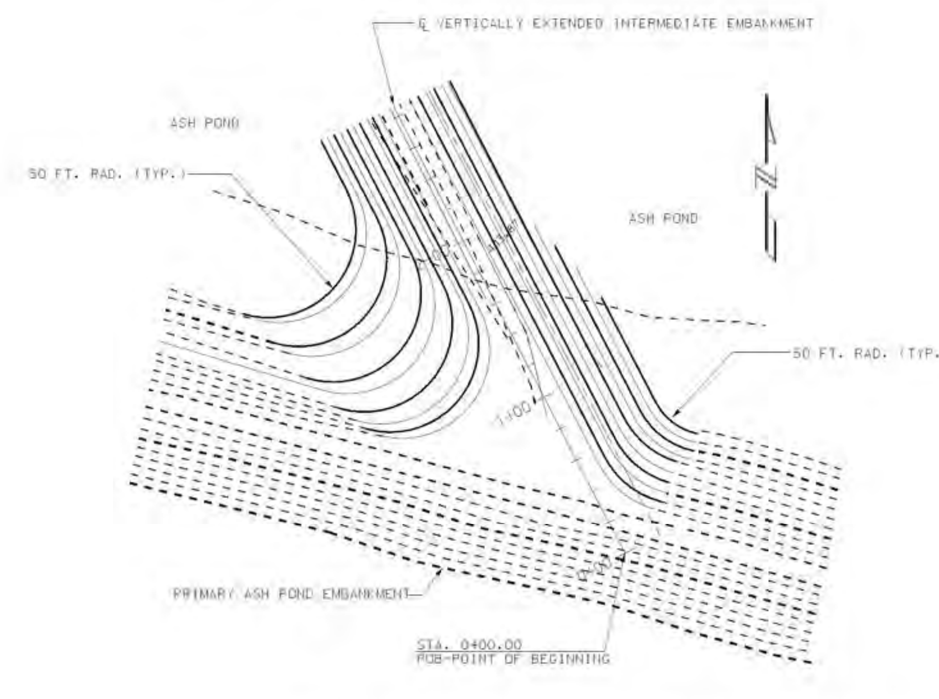
1"=5' VERT



DETAIL OF NORTH END OF INTERMEDIATE EMBANKMENT



DETAIL OF SOUTH END OF INTERMEDIATE EMBANKMENT

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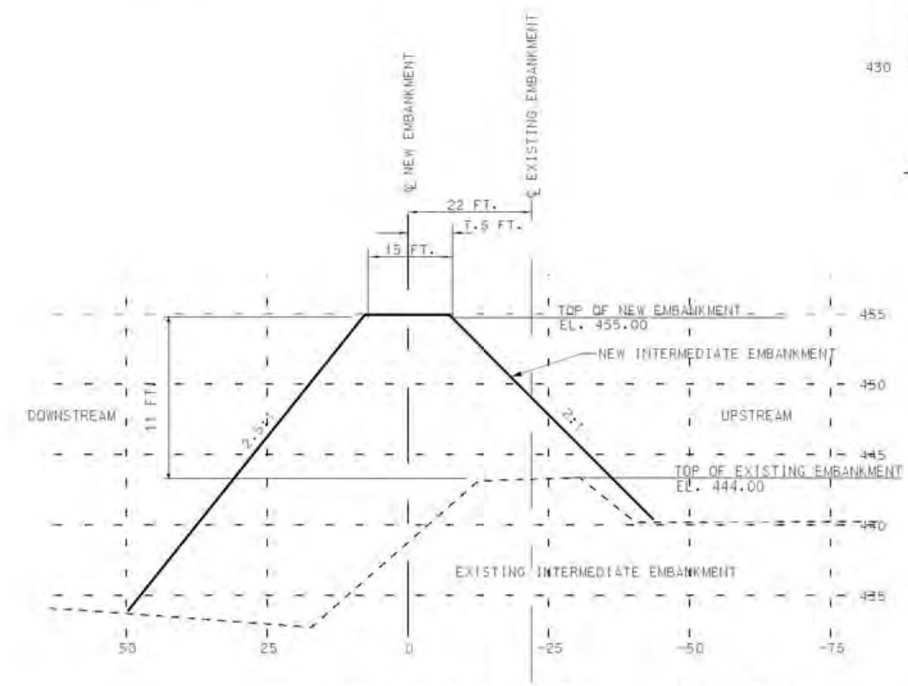

TYPICAL SECTION THRU INTERMEDIATE EMBANKMENT

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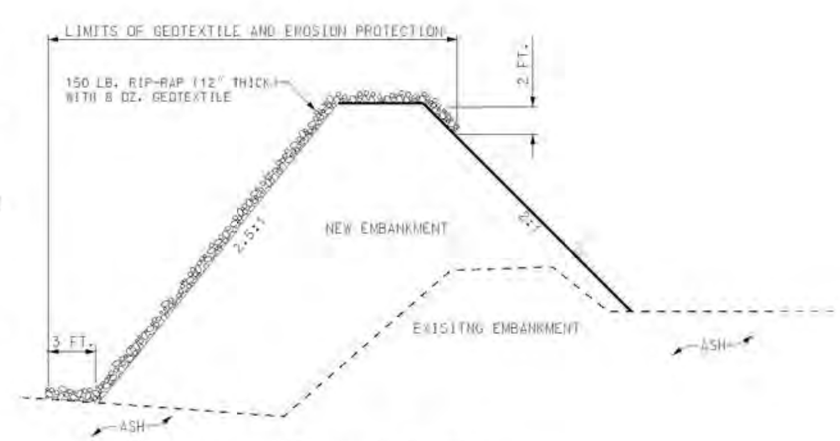

SECTION A-A

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1"=5' VERT

REVISION STATUS: ☐-CONSTRUCTION ○-RECORD

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2	10-5-99	GBD	CHANGED PIPE EXTENSION INFORMATION	RCW	RCW	RCW
3	01-27-00	MEC	AS-BUILT - INTERMEDIATE EMBANKMENT. VERTICAL. EXTENTION 1999	RCW	RCW	RCW

NOTES

REFERENCES

ILLINOIS POWER COMPANY
DECATUR

MISCELLANEOUS DETAILS OF INTERMEDIATE EMBANKMENT
VERTICAL EXTENSION OF INTERMEDIATE EMBANKMENT
BALDWIN POWER STATION

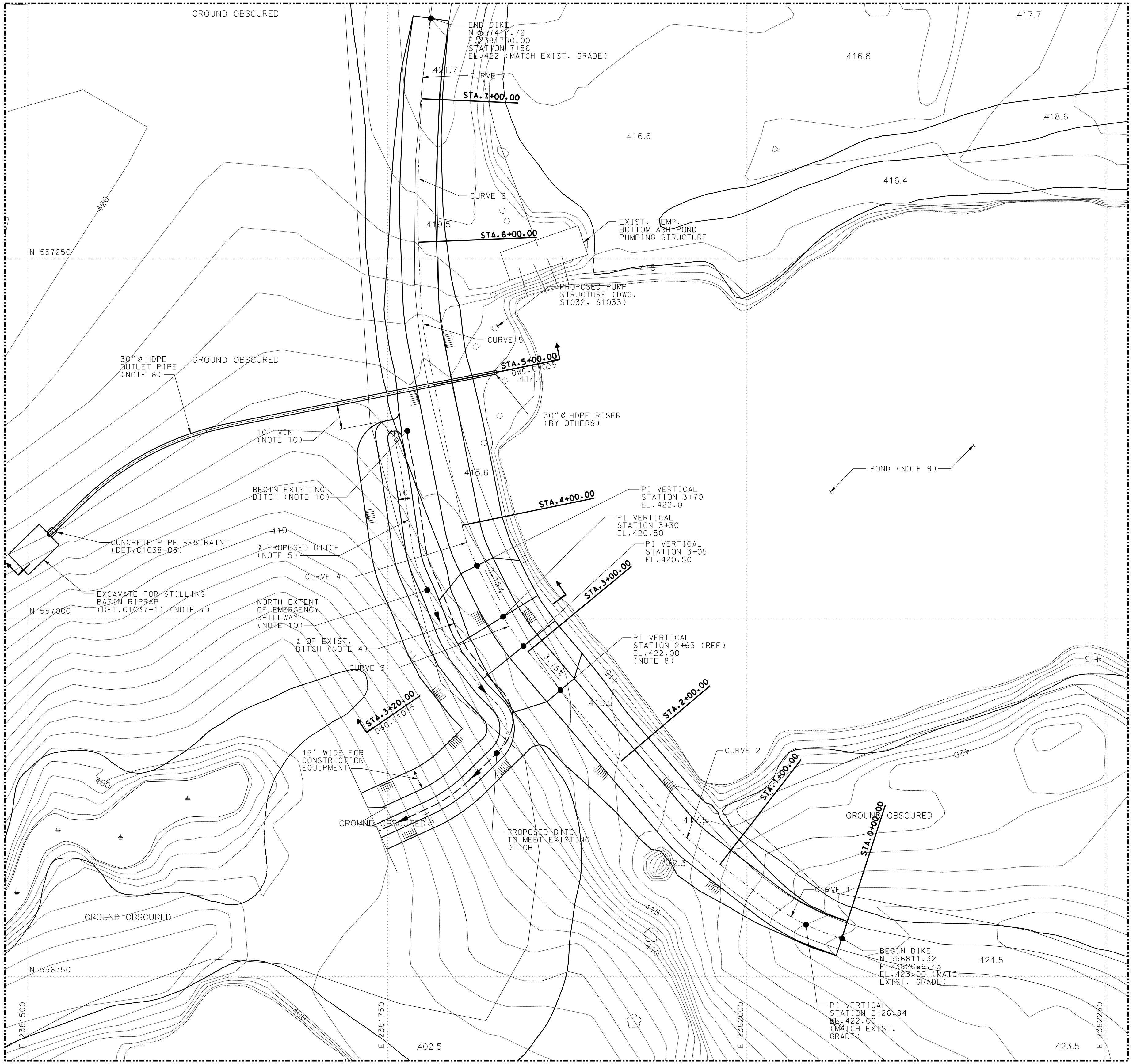
DR RKF	CAD RKF/MEC	DATE 7-22-99
CK RCW	CKD	SCALE
APP	PLOTTED 2-14-2000	E-BAL1-C122
APP		

E-BAL1-C122

BERM HORIZONTAL ALIGNMENT SCHEDULE

CURVE NO.	POINT OF CURVATURE (STATION)	POINT OF TANGENT (STATION)	RADIUS OF CURVE (FT)
CURVE 1	0+00.0	0+59.7	158
CURVE 2	1+19.0	1+39.9	100
CURVE 3	2+97.5	3+46.9	200
CURVE 4	3+74.6	4+00.8	100
CURVE 5	5+29.7	5+60.7	200
CURVE 6	6+05.6	6+47.6	500
CURVE 7	7+05.1	7+24.9	200

(ADJUST FOR CURRENT IN-FIELD CONDITIONS)



NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED IN ACCORDANCE WITH SPECIFICATION H-3026. WHERE NOTES ON THIS DRAWING CONFLICT WITH THE NOTES IN SPECIFICATION H-3026, THE NOTES ON THIS DRAWING SHALL GOVERN.
2. THE LOWEST ELEVATION OF THE DIKE AND THE WATER ELEVATION PER THE AERIAL SURVEY (REFERENCED HEREIN) IS 415.5FT AND 412.6FT RESPECTIVELY, OR 2.9 FEET DIFFERENCE. THE PUMP STRUCTURE FLOOR, WHICH HAS ALREADY BEEN INSTALLED ON THE SITE IS AT ELEVATION 423.0FT (REFER TO "S" SERIES DRAWINGS ATTACHED HEREIN) THE ELEVATION DIFFERENCE BETWEEN THE PROPOSED PUMP STRUCTURE FLOOR ELEVATION AND THE LOWEST ELEVATION OF THE DIKE WAS SHOT (SURVEYED) IN THE FIELD AND DETERMINED TO BE 5.31FT (REFER TO CALC BA-APS-C-1). ALL PROPOSED ELEVATIONS AND EXISTING ELEVATIONS INDICATED ON THESE "C" DRAWINGS ARE BASED ON THE TOP OF THE PROPOSED PUMP STRUCTURE FLOOR ELEVATION OF 423.0FT AND A 5.31FT ELEVATION DIFFERENCE BETWEEN THE PROPOSED PUMP STRUCTURE AND TOP OF EXISTING DIKE ELEVATION. CONTACT THE OWNER FOR BENCHMARK INFORMATION.
3. BASED ON FIELD OBSERVATIONS AND AS NOTED IN TOPOGRAPHIC SURVEY, DUE TO FOLIAGE OBSCURING THE GROUND ON THE REFERENCED AIR SURVEY, THE CONTOURS IN HEAVILY VEGETATED AREAS ARE ESTIMATED. THE DIKE LAYOUT ON THIS DRAWING IS BASED ON THE CONTOURS PROVIDED. THE ELEVATIONS ARE BASED ON A FIELD SURVEY (REFER TO NOTE 2). FIELD ADJUSTMENTS MAY BE REQUIRED DURING CONSTRUCTION BASED ON ACTUAL CONTOUR ELEVATIONS. ALL ADJUSTMENTS MUST BE REVIEWED BY THE OWNER PRIOR TO INSTALLATION.
4. EXISTING DITCH LOCATION IS ESTIMATED BASED ON FIELD OBSERVATIONS (REFER TO NOTES 2 AND 3).
5. PROPOSED DITCH SHALL BE INSTALLED AT THE BASE OF THE TOE OF FILL SLOPE. THE DITCH SHALL HAVE A CONSISTENT WIDTH AND DEPTH AS INDICATED ON PLAN AND DETAILS AND SLOPED AT 0.5% MINIMUM TO THE DOWNSTREAM POND APPROXIMATELY 1000' AWAY. THE PROPOSED DITCH INVERT ELEVATION SHALL MATCH THE EXISTING FLOW LINE OF THE EXISTING DITCH.
6. INSTALL 30 INCH DIAMETER HDPE OUTLET PIPE IN SAME LOCATION AND INVERT ELEVATIONS OF EXISTING 36 INCH DIAMETER CMP PIPE. THE GROUND SURFACE UNDER THE PIPE SHALL BE LEVEL LATERALLY AND SLOPED UNIFORMLY IN THE LONGITUDINAL DIRECTION FROM THE PIPE/DIKE DAY LIGHT POINT TO THE END OF THE PIPE AT THE DOWNSTREAM PIPE DISCHARGE POINT. THE ROUTE SHALL BE FREE OF SHARP ROCKS OR OTHER HARD OBJECTS. REFER TO DETAIL C-1037-03 FOR CULVERT BEDDING AND BACKFILL REQUIREMENTS.
7. PIPE TERMINATION POINT TO BE DETERMINED BY OWNER. MAINTAIN A 2% MINIMUM SLOPE IN OUTLET PIPE.
8. EMERGENCY SPILLWAY SHALL BE LOCATED IN THE FIELD SUCH THAT THE ENTIRE SPILLWAY IS PLACED WITHIN THE LIMITS OF THE DITCH.
9. THE WATER ELEVATION DURING NORMAL OPERATING CONDITIONS SHALL BE MAINTAINED AT MAXIMUM WATER SURFACE ELEVATION 417.6 FT.
10. PROPOSED DITCH SHALL BEGIN AT THE NORTH EXTENT OF THE EMERGENCY SPILLWAY OR THE EXISTING UPSTREAM DITCH LOACTION, WHICHEVER RESULTS IN THE LONGEST DITCH. DITCH INVERT SHALL MATCH EXISTING DITCH INVERT ELEVATION.

REFERENCE DRAWINGS

S1032	ASH POND STRUCTURE PLANS, SECTIONS AND DETAILS
S1033	ASH POND STRUCTURE SECTIONS AND DETAILS
C1035	BOTTOM ASH POND DIKE IMPROVEMENTS GRADING SECTIONS
C1036	BOTTOM ASH POND DIKE IMPROVEMENTS GRADING AND SURFACING DETAILS
C1037	BOTTOM ASH POND DIKE IMPROVEMENTS STORM AND EROSION CONTROL DETAILS SHEET 1
C1038	BOTTOM ASH POND DIKE IMPROVEMENTS STORM AND EROSION CONTROL DETAILS SHEET 2
040212	AERIAL SURVEY BY HENDERSON AERIAL SURVEYS, INC. ON 04-02-12

UNDERGROUND OR EMBEDDED UTILITIES MAY BE LOCATED WITHIN OR ADJACENT TO THE AREA IN WHICH EXCAVATION, DEMOLITION, FOUNDATION, OR MODIFICATION WORK IS TO BE PERFORMED.

REFERENCES RELATING TO THE UNDERGROUND OR EMBEDDED UTILITIES ARE PROVIDED TO ASSIST THE CONTRACTOR/INSTALLER IN THE FIELD LOCATING THOSE UTILITIES AND OTHER POSSIBLE UNDERGROUND OR EMBEDDED INTERFERENCES WITH THE WORK.

THE CONTRACTOR/INSTALLER SHALL EXERCISE DUE CAUTION DURING ALL EXCAVATION/FOUNDATION/DEMOLITION WORK.

CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE, INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUBCONTRACTOR(S)) PERFORMING THE WORK.

Sargent & Lundy LLC

CAD FILE: C1033.DGN

REFERENCE DRAWINGS

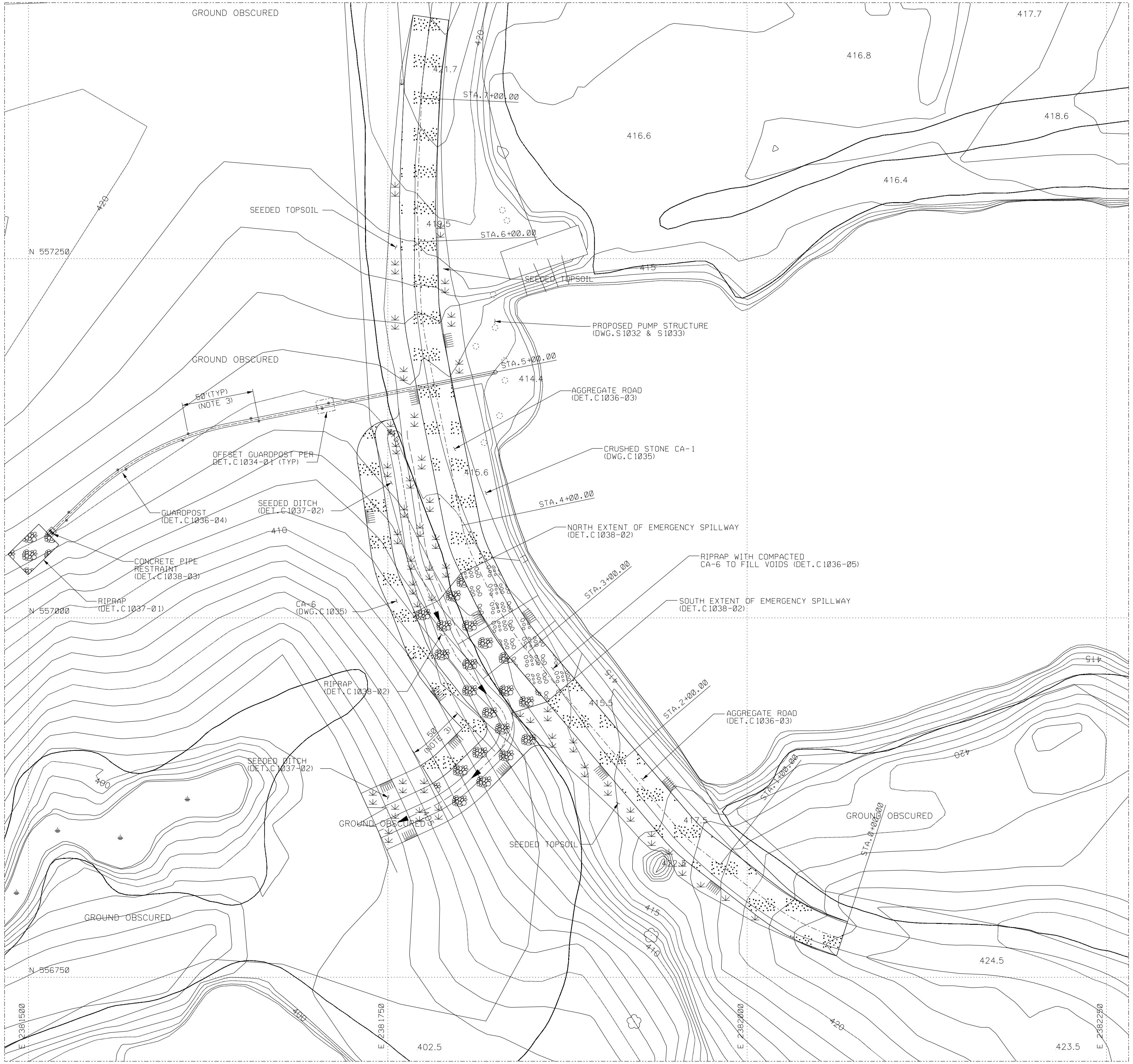
NO.	DATE	REVISION	PREP'D	REV'D	APPR'D
0	11-28-2012	FOR RECORD, P.S.# 49427	C.FLAMINI	T. PITSCH	

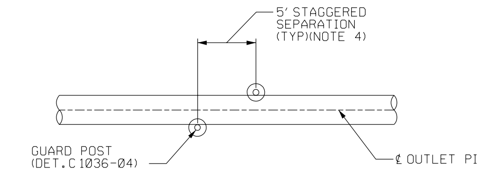
SCALE: 1"=30'-0"	
DWN. ALS	DATE 10-04-2012
CHK. T.M.P.	DATE 10-04-2012
APPV. D.J.D.	DATE 10-04-2012

DYNEGY

BOTTOM ASH POND DIKE IMPROVEMENTS GRADING AND DRAINAGE PLAN BALDWIN ENERGY COMPLEX UNIT 2 DYNEGY MIDWEST GENERATION

PROJECT NO.: 12160-115
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C1033
REV. 0





GUARD POST SEPARATION

DETAIL C1034-01

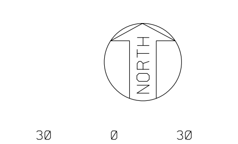
N.T.S.

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED IN ACCORDANCE WITH SPECIFICATION H-3026. WHERE NOTES ON THIS DRAWING CONFLICT WITH THE NOTES IN SPECIFICATION H-3026, THE NOTES ON THIS DRAWING SHALL GOVERN.
2. CONTOUR ELEVATIONS INDICATED ON PLAN ARE APPROXIMATE REFER TO NOTES ON DRAWING C-1033.
3. PLACE RIPRAP SURFACING IN SWALE 50FT BEYOND FLUME EXIT.
4. INSTALL GUARDPOST ON EACH SIDE OF CULVERT AT 50FT SPACINGS, OR AS NECESSARY IN FIELD TO LIMIT THE MOVEMENT BETWEEN TREES. GUARDPOST SHALL BE INSTALLED IN A STAGGERED PATTERN AS INDICATED ON PLAN TO CONTROL THE DIRECTION OF PIPE DEFLECTION DUE TO THERMAL EXPANSION.

REFERENCE DRAWINGS

S1032	ASH POND STRUCTURE PLANS, SECTIONS AND DETAILS
S1033	ASH POND STRUCTURE SECTIONS AND DETAILS
C1035	BOTTOM ASH POND DIKE IMPROVEMENTS GRADING SECTIONS
C1036	BOTTOM ASH POND DIKE IMPROVEMENTS GRADING AND SURFACING DETAILS
C1037	BOTTOM ASH POND DIKE IMPROVEMENTS STORM AND EROSION CONTROL DETAILS SHEET 1
C1038	BOTTOM ASH POND DIKE IMPROVEMENTS STORM AND EROSION CONTROL DETAILS SHEET 2
040212	AERIAL SURVEY BY HENDRESON AERIAL SURVEYS, INC. ON 04-02-12



UNDERGROUND OR EMBEDDED UTILITIES MAY BE LOCATED WITHIN OR ADJACENT TO THE AREA IN WHICH EXCAVATION, DEMOLITION, FOUNDATION, OR MODIFICATION WORK IS TO BE PERFORMED.

REFERENCES RELATING TO THE UNDERGROUND OR EMBEDDED UTILITIES ARE PROVIDED TO ASSIST THE CONTRACTOR/INSTALLER IN THE FIELD LOCATING THOSE UTILITIES AND OTHER POSSIBLE UNDERGROUND OR EMBEDDED INTERFERENCES WITH THE WORK.

THE CONTRACTOR/INSTALLER SHALL EXERCISE DUE CAUTION DURING ALL EXCAVATION/FOUNDATION/DEMOLITION WORK.

CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE, INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUBCONTRACTOR(S)) PERFORMING THE WORK.

Sargent & Lundy LLC

CAD FILE: C1034.DGN

REFERENCE DRAWINGS

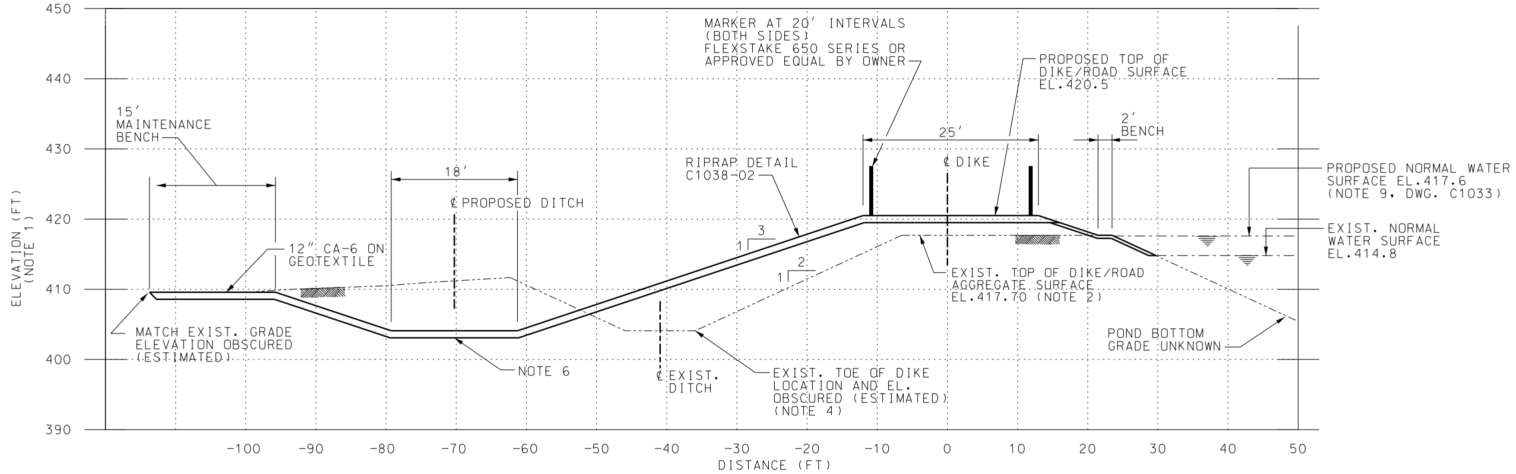
NO.	DATE	REVISION	PREP'D	REV'D	APPR'D
0	11-28-2012	FOR RECORD. P.S.# 49427	C. FLAMINI	T. PITSCH	

SCALE: 1"=30'-0"		
DWN. ALS	DATE 10-04-2012	
CHK. T.M.P.	DATE 10-04-2012	
APPV. D.J.D.	DATE 10-04-2012	

DYNEGY

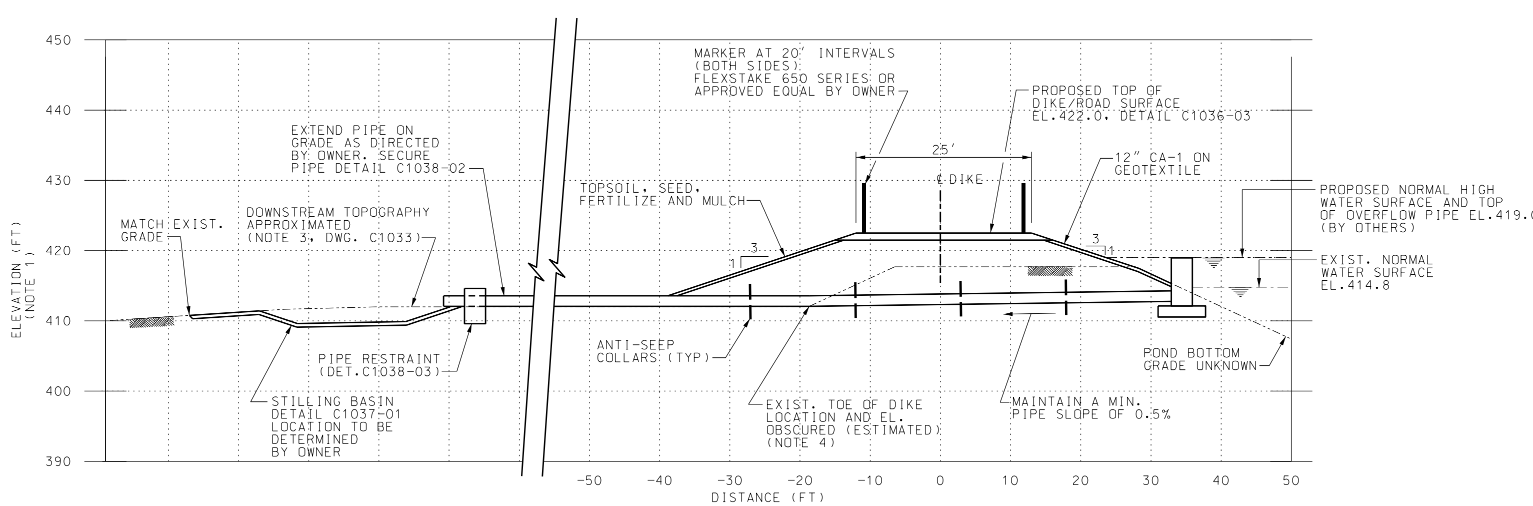
BOTTOM ASH POND DIKE IMPROVEMENTS
SURFACING PLAN
BALDWIN ENERGY COMPLEX UNIT 2
DYNEGY MIDWEST GENERATION

PROJECT NO.: 12160-115
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C1034
REV. 0



SECTION 3+20.00

AT EMERGENCY SPILLWAY



SECTION 5+00.00

AT OVERFLOW PIPE

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED IN ACCORDANCE WITH SPECIFICATION H-3026. WHERE NOTES ON THIS DRAWING CONFLICT WITH THE NOTES IN SPECIFICATION H-3026, THE NOTES ON THIS DRAWING SHALL GOVERN.
2. REFER TO NOTES 2 ON DRAWING C1033 FOR CLARIFICATION ON ELEVATIONS PROVIDED ON THIS DRAWING.
3. REMOVE AND DISPOSE OF EXISTING GRANULAR SURFACING, DELETERIOUS MATERIAL, VEGETATION, ROOTS, AND SOIL NOT MEETING FILL REQUIREMENTS IN SPECIFICATION SECTION 312201 PARAGRAPH 201.2b FROM WATER SURFACE TO DOWNSTREAM TOE OF DIKE AND TO DOWNSTREAM EXTENT OF OVERFLOW DITCH AND MAINTENANCE BENCH, UNTIL CLAY SUBGRADE IS EXPOSED PRIOR TO PLACING FILL (REFER TO DETAIL C1036-01).
4. ELEVATION AND LOCATION OF EXISTING DITCH IS ESTIMATED (SEE NOTE 3 ON DWG. C1033).
5. ELEVATIONS ON SECTIONS BASED ON CONTRACTOR'S DATUM WHERE TOP OF NEW PUMP STRUCTURE IS AT EL.423.0
6. THE PROPOSED DITCH INVERT ELEVATION SHALL MATCH THE INVERT ELEVATION OF THE EXISTING DITCH.

REFERENCE DRAWINGS

C1033	BOTTOM ASH POND DIKE IMPROVEMENTS GRADING AND DRAINAGE PLAN

10 0 10 20
GRAPHIC SCALE HORIZONTAL SCALE

10 0 10 20
GRAPHIC SCALE VERTICAL SCALE

Sargent & Lundy LLC

CAD FILE: C1035.DGN

REFERENCE DRAWINGS

NO.	DATE	REVISION	PREP'D	REV'D	APPR'D
0	11-28-2012	FOR RECORD, P.S.# 49427	C. FLAMINI	T. PITSCH	

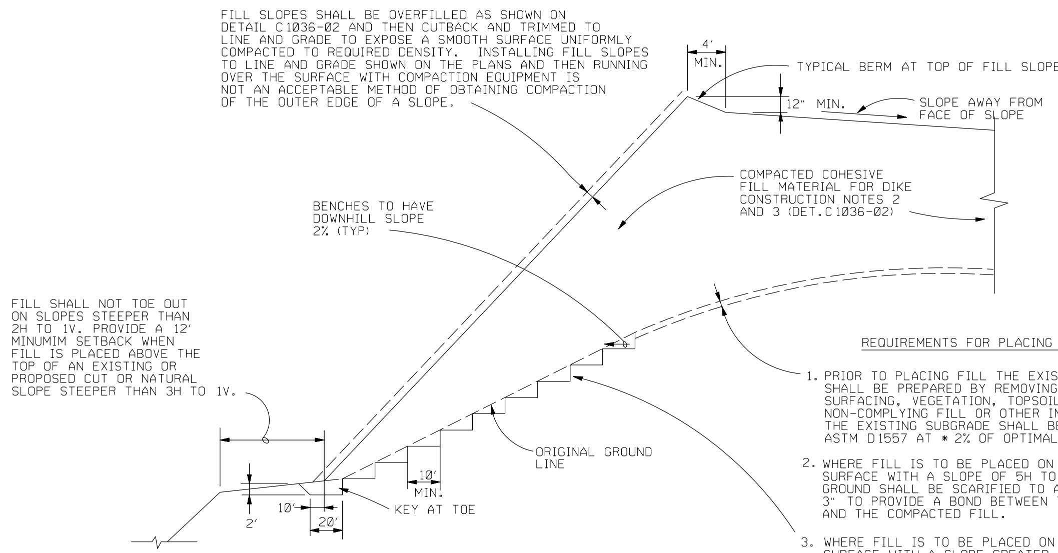
SCALE: AS NOTED

DWN.	ALS	DATE 10-04-2012
CHK.	T.M.P.	DATE 10-04-2012
APPV.	D.J.D.	DATE 10-04-2012

DYNEGY

BOTTOM ASH POND DIKE IMPROVEMENTS
GRADING SECTIONS
BALDWIN ENERGY COMPLEX UNIT 2
DYNEGY MIDWEST GENERATION

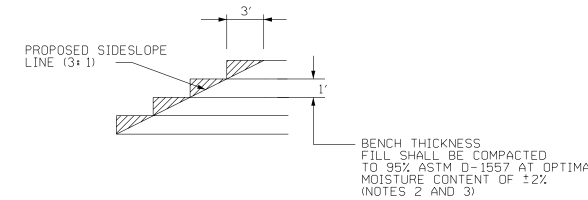
PROJECT NO.: 12160-115
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C1035 REV. 0



REQUIREMENTS FOR PLACING FILL

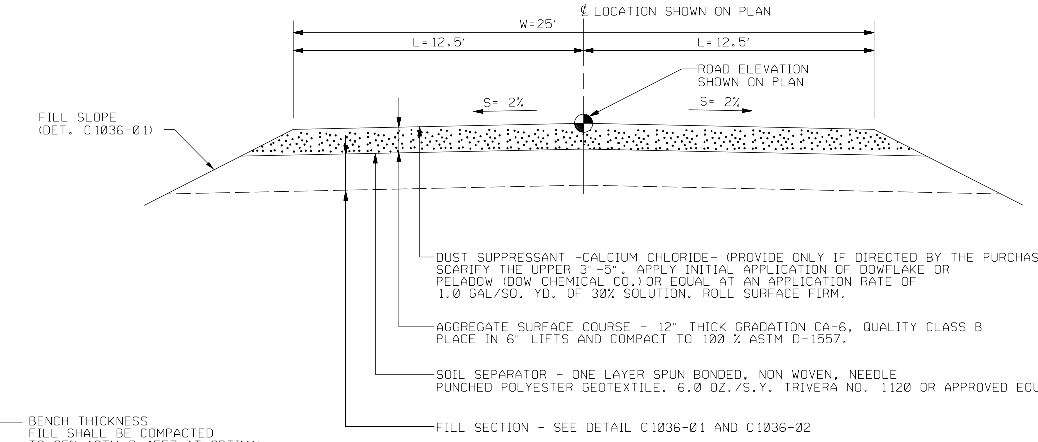
1. PRIOR TO PLACING FILL THE EXISTING GROUND SHALL BE PREPARED BY REMOVING CRUSHED STONE SURFACING, VEGETATION, TOPSOIL AND ANY OTHER NON-COMPLYING FILL OR OTHER INCOMPETENT MATERIAL. THE EXISTING SUBGRADE SHALL BE COMPACTED TO 95% ASTM D1557 AT ± 2% OF OPTIMAL MOISTURE CONTENT.
2. WHERE FILL IS TO BE PLACED ON AN EXISTING GROUND SURFACE WITH A SLOPE OF 5H TO 1V OR LESS, THE GROUND SHALL BE SCARIFIED TO A MINIMUM DEPTH OF 3" TO PROVIDE A BOND BETWEEN THE INSITU MATERIAL AND THE COMPACTED FILL.
3. WHERE FILL IS TO BE PLACED ON AN EXISTING GROUND SURFACE WITH A SLOPE GREATER THAN 5H TO 1V THE FILL SHALL BE KEYED IN AT THE TOE AND CONTINUOSLY BENCHED INTO THE NATURAL SLOPE. BENCHES SHALL SLOPE DOWNHILL 2% IN CROSS-SECTION AND SHALL BE LEVEL LONGITUDINALLY FOLLOWING THE NATURAL CONTOURS. MATERIAL CUT FROM BENCHES SHALL BE MIXED WITH COMPACTED FILL AND RECOMPACTED.

TYPICAL DETAIL
PLACEMENT OF FILL ON A SLOPE
DETAIL C1036-01
N.T.S.

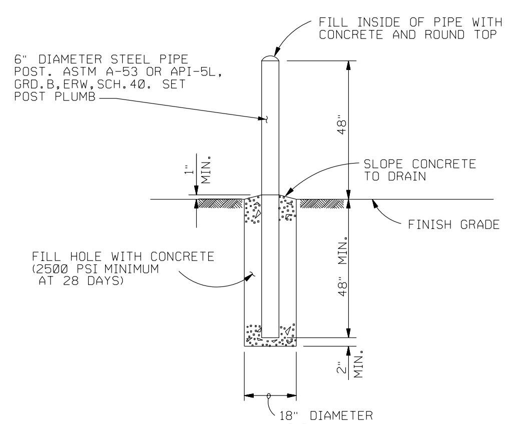


TRIM EXCESS TO ACHIVE PROPER FINISH LINE FOR SIDESLOPE.

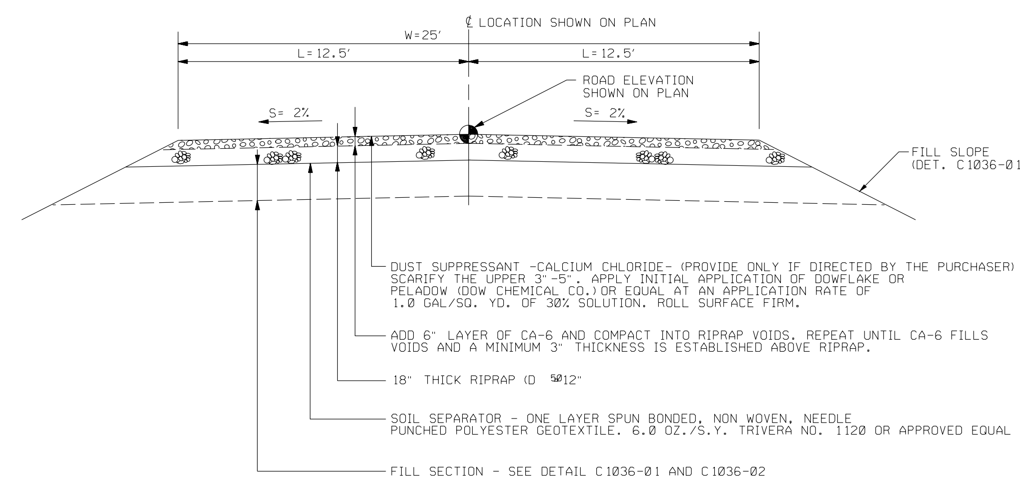
ENLARGED DETAIL A
BENCHES, TRIMMING AND SIDESLOPE COMPACTION
DETAIL C1036-02
N.T.S.



TYPICAL SECTION
AGGREGATE SURFACED PERMANENT ROAD
SECTION C1036-03
N.T.S.



GUARD POST
DETAIL C1036-04
N.T.S.



AGGREGATE SURFACED PERMANENT
ROAD IN EMERGENCY SPILLWAY
SECTION C1036-05
N.T.S.

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED IN ACCORDANCE WITH SPECIFICATION H-3026. WHERE NOTES ON THIS DRAWING CONFLICT WITH THE NOTES IN SPECIFICATION H-3026, THE NOTES ON THIS DRAWING SHALL GOVERN.
2. COHESIVE MATERIAL SHALL CONTAIN NOT MORE THAN 1 PERCENT ORGANIC OR OTHER DELETERIOUS MATERIAL, SHALL HAVE A MAXIMUM PARTICLE SIZE OF 2 INCHES AND SHALL HAVE ATTERBERG LIMITS ABOVE THE "A" LINE WITH A LIQUID LIMIT OF LESS THAN 40 AND A PLASTICITY INDEX LESS THAN 25. ACCEPTABLE SOILS ARE CLASSIFIED AS FINE-GRAINED SOILS IN THE UNITED SOIL CLASSIFICATION SYSTEM ASTM D2487. CLASSIFICATION IS CL.
3. AFTER COMPLETION OF A LIFT IS ACHIEVED, THE SURFACE SHALL BE SUFFICIENTLY ROUGHENED TO CREATE A BOND FOR THE NEXT SUCCEEDING LIFT.

REFERENCE DRAWINGS

C1032	BOTTOM ASH POND DIKE IMPROVEMENTS EROSION CONTROL PLAN

Sargent & Lundy LLC

CAD FILE: C1036.DGN

REFERENCE DRAWINGS

NO.	DATE	REVISION	PREP'D	REV'D	APPR'D	NO.	DATE	REVISION	PREP'D	REV'D	APPR'D
0	11-28-2012	FOR RECORD. P.S.# 49427	C. FLAMINI	T. PITSCH							

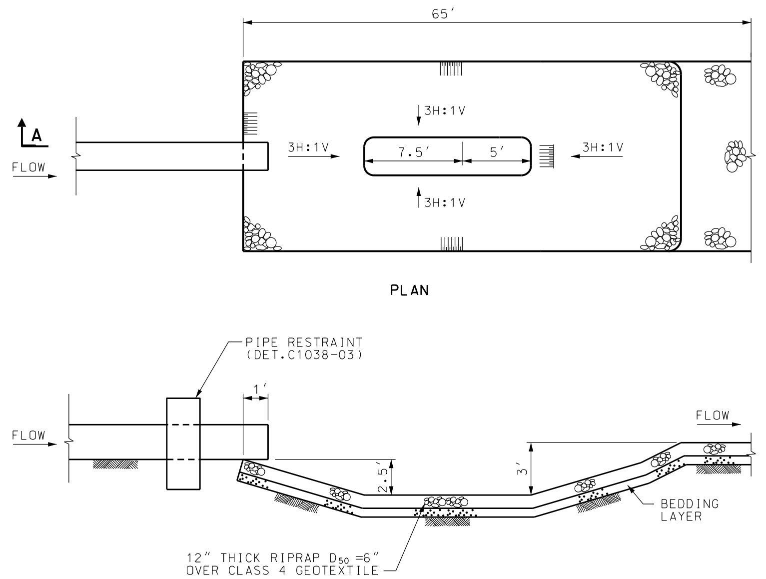
SCALE: NONE
DWN. ALS DATE 10-04-2012
CHK. T.M.P. DATE 10-04-2012
APPV. D.J.D. DATE 10-04-2012

DYNEGY

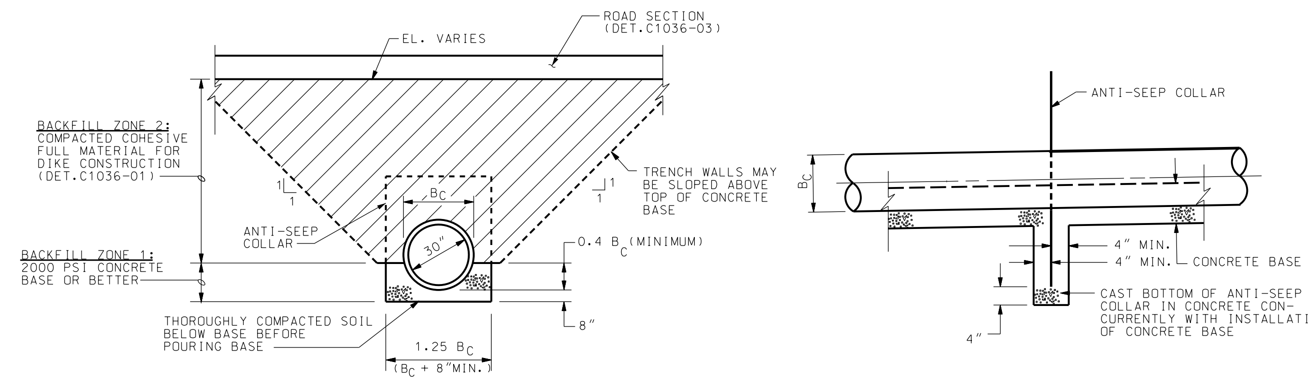
BOTTOM ASH POND DIKE IMPROVEMENTS
GRADING AND SURFACING DETAILS
BALDWIN ENERGY COMPLEX UNIT 2
DYNEGY MIDWEST GENERATION

PROJECT NO.: 12160-115
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C1036
REV. 0

A | B | C | D



PROTECTION AT CULVERT IN AN UNDEFINED CHANNEL STILLING BASIN
DETAIL C1037-01
N.T.S.



SINGLE PIPE BEDDING AND BACKFILL REQUIREMENTS
DETAIL C1037-03
N.T.S.

NOTES PERTAINING TO OUTLET BEDDING AND BACKFILL DETAIL C1037-03

1. BEDDING AND BACKFILL MATERIAL SPECIFICATIONS

   A. SELECT GRANULAR MATERIAL
   "SELECT GRANULAR MATERIAL" SHALL CONSIST OF WELL GRADED SAND, STONE, CRUSHED STONE, PIT RUN GRAVEL, OR CRUSHED GRAVEL WITH A MAXIMUM STONE OF 3/4" Ø, FREE FROM EXCESS OF SOFT AND UNSOUND PARTICLES AND OTHER OBJECTIONABLE MATTER.

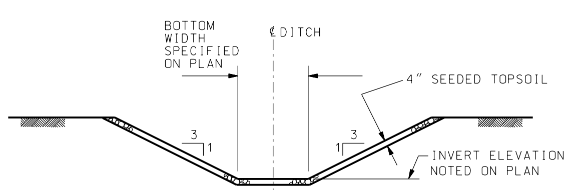
   ACCEPTABLE GRADATIONS ARE:
   ASTM C-33 - FINE CONCRETE AGGREGATE (WELL GRADED SAND)
   ASTM C-33 - GRADATION NO.67 OR GRADATION NO.7 GRADATION SIMILAR TO WELL GRADED FINE ROAD BASE MATERIAL; I.E. ASTM D-1241, GRADATION C AND GRADATION D.

   B. GRANULAR BEDDING MATERIAL
   MATERIAL FOR "GRANULAR BEDDING MATERIAL" SHALL CONSIST OF WELL GRADED STONE SCREENINGS, CRUSHED STONE, PIT RUN GRAVEL, OR WASHED GRAVEL WITH A MAXIMUM STONE SIZE OF 1/2" Ø FOR BEDDING FOR PLASTIC PIPE, OR 3/4" Ø FOR BEDDING OTHER TYPES OF PIPE, FREE FROM EXCESS OF SOFT AND UNSOUND PARTICLES AND OTHER OBJECTIONABLE MATTER. THE FOLLOWING GRADATIONS ARE ACCEPTABLE:

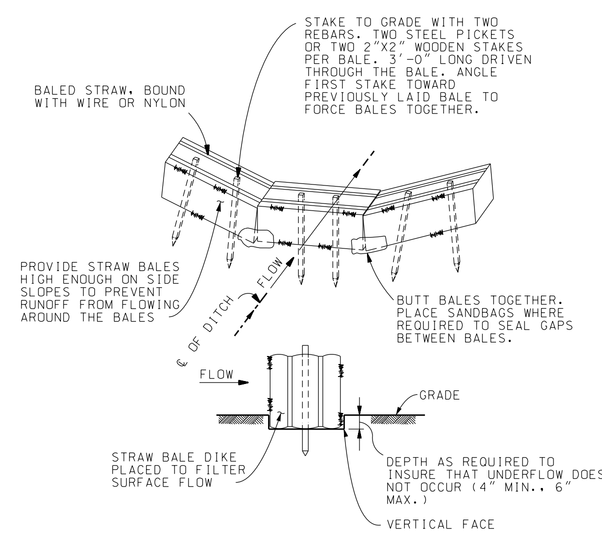
US STANDARD SIEVE SIZE	PERCENT PASSING ASTM C-33 GRADATION NO.67	ASTM C-33 GRADATION 7
1"	100	-
3/4"	90-100	100
1/2"	-	90-100
3/8"	20-55	40-70
NO.4	0-10	0-15
NO.8	0-5	0-5

2. SOFT TRENCH BOTTOM

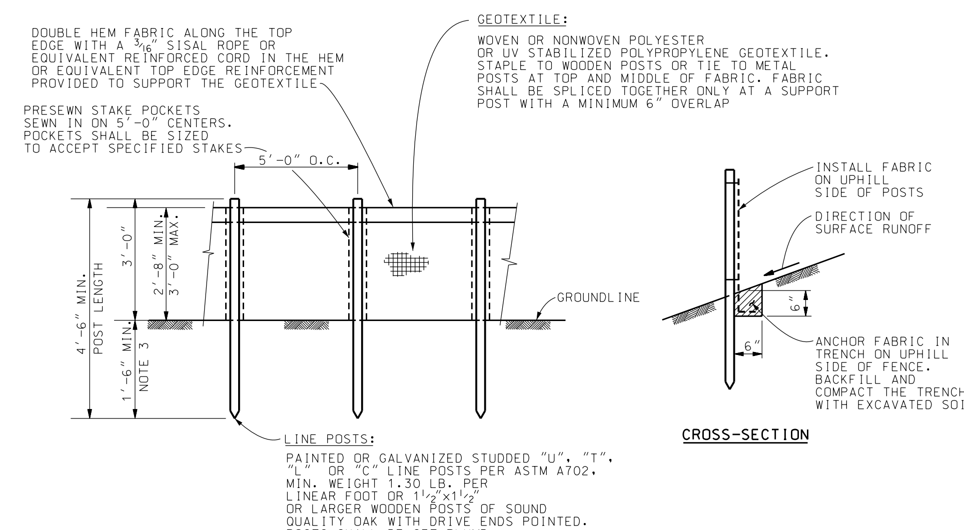
   IF THE BOTTOM OF THE TRENCH IS SOFT, OVER EXCAVATE UP TO 2'-0" MINIMUM, AND REPLACE WITH "GRANULAR BEDDING MATERIAL" COMPACTED TO 90% ASTM D1557.



SEEDED DITCH
DETAIL C1037-02
N.T.S.



STRAW BALE EROSION CHECK FOR TRAPEZOIDAL DITCH (TYPICAL DETAIL)
DETAIL C1037-04
N.T.S.



NOTES:

1. AFTER INSTALLATION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING THE FENCE. THE CONTRACTOR SHALL INSPECT FENCES AFTER EACH RAINFALL AND AT LEAST DAILY DURING PROLONGED RAINFALL. CONTRACTOR IS RESPONSIBLE FOR REMOVING AND REPLACING SILT FENCING NOT FUNCTIONING DUE TO CLOGGING, DAMAGE OR DETERIORATION.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVAL AND DISPOSAL OF FENCING WHEN, AS DETERMINED BY THE OWNER, THE FENCING IS NO LONGER NEEDED.
3. WHERE 18" DEPTH IS IMPOSSIBLE TO ACHIEVE THE POSTS SHALL BE SECURED TO PREVENT OVERTURNING OF THE FENCE DUE TO SEDIMENT LOAD.

SELF-SUPPORTING SILT FENCE (TYPICAL DETAIL)
DETAIL C1037-05
N.T.S.

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED IN ACCORDANCE WITH SPECIFICATION H-3026. WHERE NOTES ON THIS DRAWING CONFLICT WITH THE NOTES IN SPECIFICATION H-3026, THE NOTES ON THIS DRAWING SHALL GOVERN.
2. SEED MIXTURE SHALL BE A TYPE AND MIXTURE MEETING THE REQUIREMENTS OF ILLINOIS DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATION FOR ROAD AND BRIDGE CONSTRICTION SECTION 250.

REFERENCE DRAWINGS

C1032	BOTTOM ASH POND DIKE IMPROVEMENTS EROSION CONTROL PLAN
C1033	BOTTOM ASH POND DIKE IMPROVEMENTS GRADING AND DRAINAGE PLAN

Sargent & Lundy LLC

CAD FILE: C1037.DGN

REFERENCE DRAWINGS

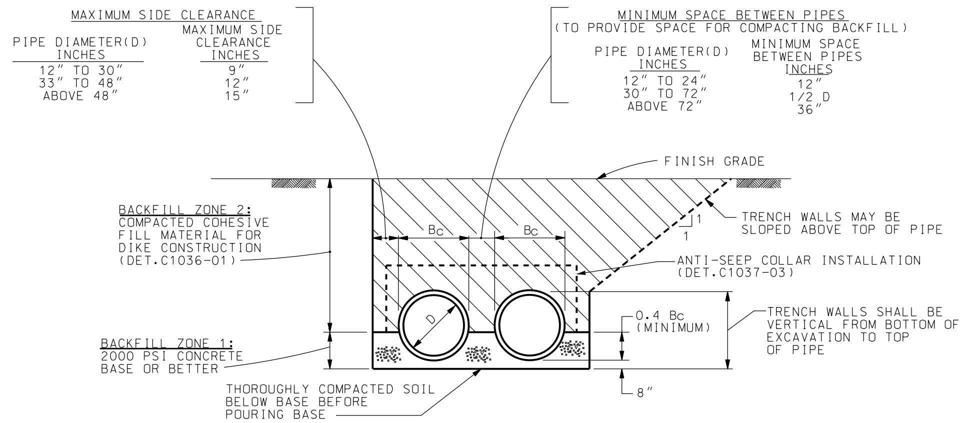
NO.	DATE	REVISION	PREP'D	REV'D	APPR'D	NO.	DATE	REVISION	PREP'D	REV'D	APPR'D
0	11-28-2012	FOR RECORD, P.S.# 49427	C. FLAMINI	T. PITSCH							

SCALE:	NONE
DWN. ALS	DATE 10-04-2012
CHK. T.M.P.	DATE 10-04-2012
APPV. D.J.D.	DATE 10-04-2012

DYNEGY

BOTTOM ASH POND DIKE IMPROVEMENTS
STORM AND EROSION CONTROL DETAILS SHEET 1
BALDWIN ENERGY COMPLEX UNIT 2
DYNEGY MIDWEST GENERATION

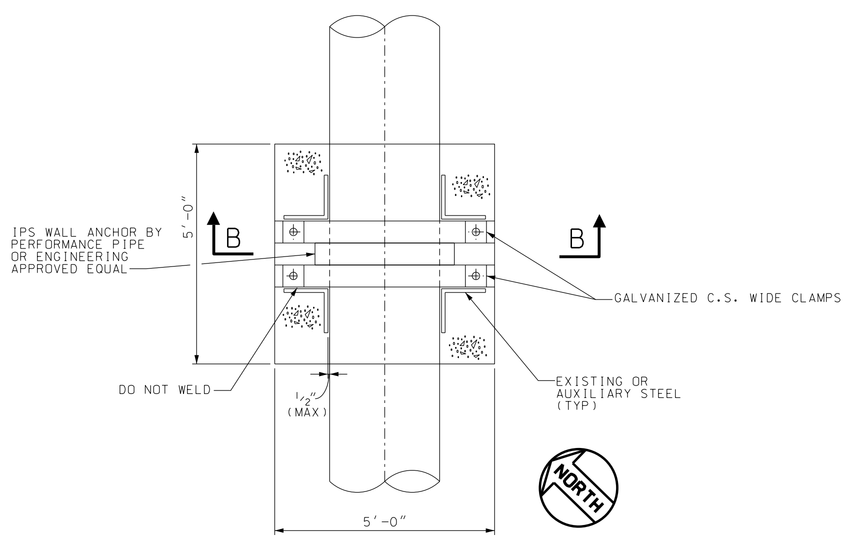
PROJECT NO.: 12160-115
CLIENT: DYNEGY MIDWEST GENERATION
DWG. NO.: C1037
REV. 0



MULTIPLE PIPE BEDDING AND BACKFILL REQUIREMENTS

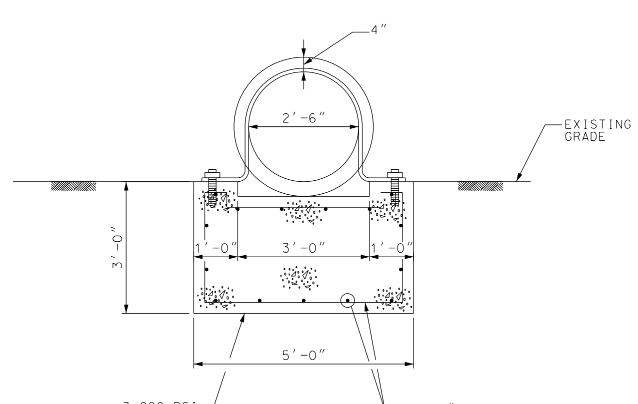
DETAIL C1038-01

N.T.S.



PLAN

N.T.S.

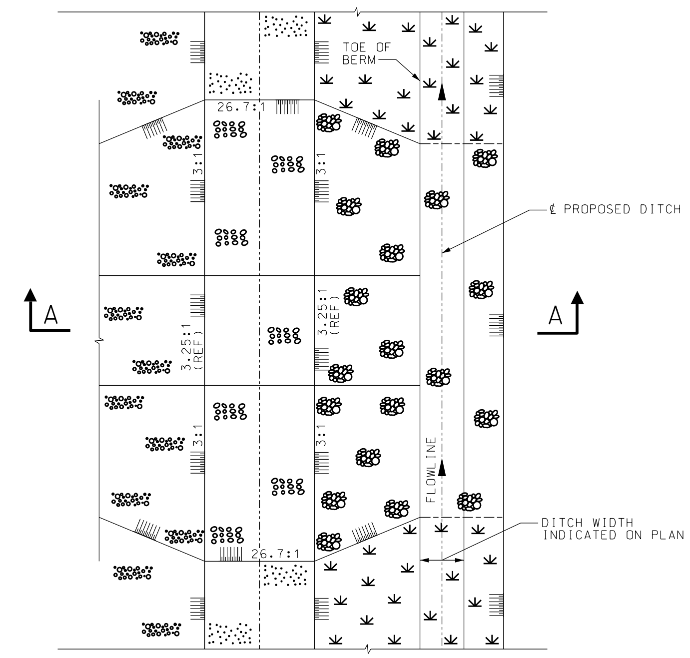


SECTION B

PIPE RESTRAINT

DETAIL C1038-03

N.T.S.



PLAN

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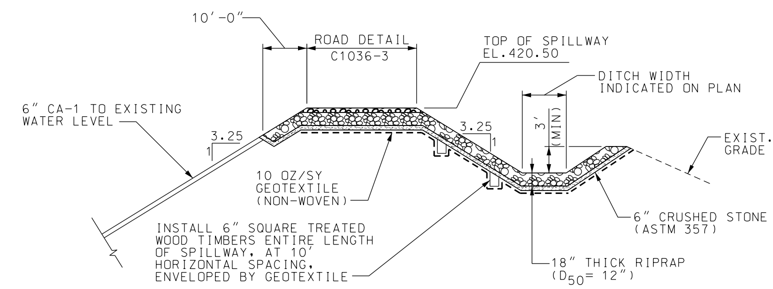
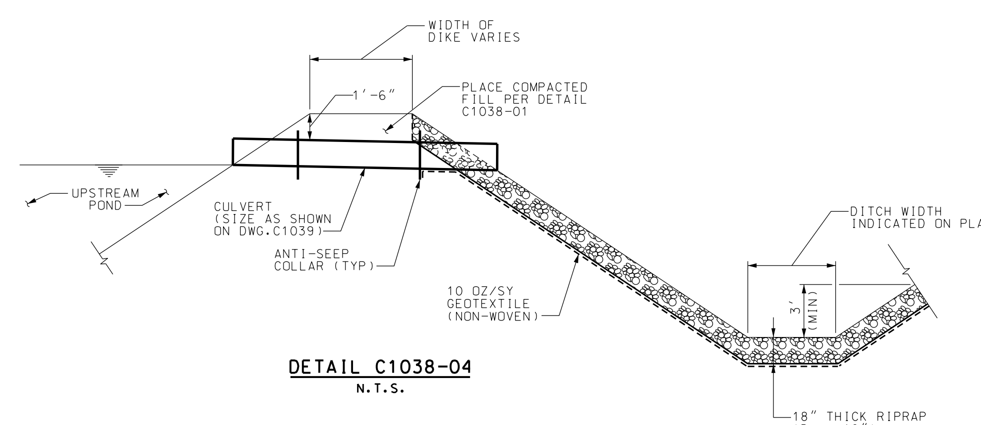


SECTION A

EMERGENCY SPILLWAY AND FLOW SPREADER

DETAIL C1038-02

N.T.S.



DETAIL C1038-04

N.T.S.

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE FURNISHED AND INSTALLED IN ACCORDANCE WITH SPECIFICATION H-3026. WHERE NOTES ON THIS DRAWING CONFLICT WITH THE NOTES IN SPECIFICATION H-3026, THE NOTES ON THIS DRAWING SHALL GOVERN.

REFERENCE DRAWINGS

C1033	BOTTOM ASH POND DIKE EROSION CONTROL PLAN
C1034	BOTTOM ASH POND DIKE IMPROVEMENTS SURFACING PLAN

Sargent & Lundy LLC

CAD FILE: C1038.DGN

REFERENCE DRAWINGS

NO.	DATE	REVISION	PREP'D	REV'D	APPR'D
0	11-28-2012	FOR RECORD, P.S.# 49427	C. FLAMINI	T. PITSCH	

NO.	DATE	REVISION	PREP'D	REV'D	APPR'D

SCALE: NONE		
DWN.	ALS	DATE 10-04-2012
CHK.	T.M.P.	DATE 10-04-2012
APPV.	D.J.D.	DATE 10-04-2012

DYNEGY

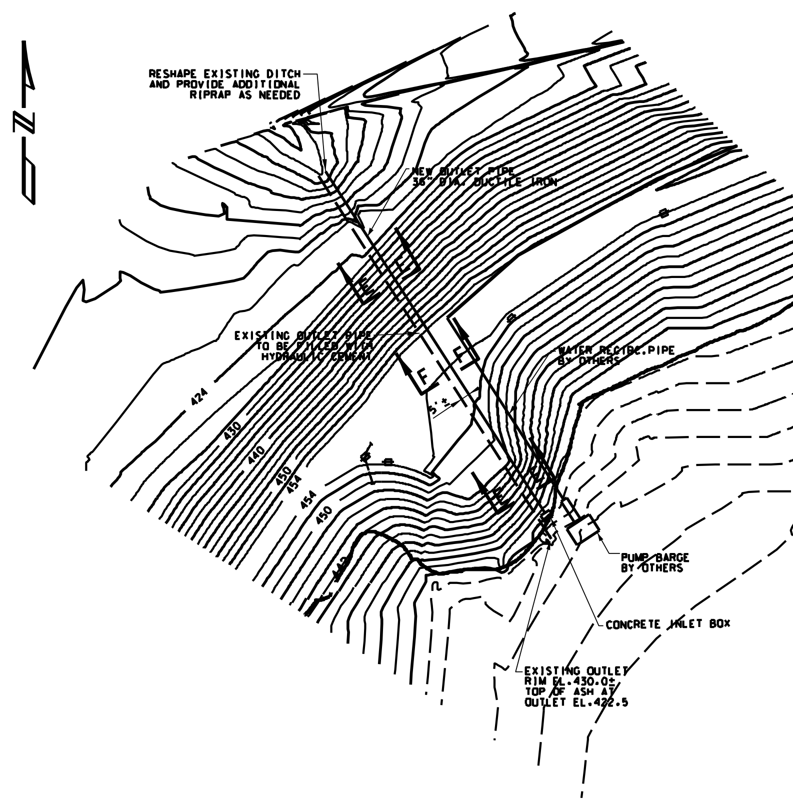
BOTTOM ASH POND DIKE IMPROVEMENTS
STORM AND EROSION CONTROL DETAILS SHEET 2
BALDWIN ENERGY COMPLEX UNIT 2
DYNEGY MIDWEST GENERATION

PROJECT NO.: 12160-115

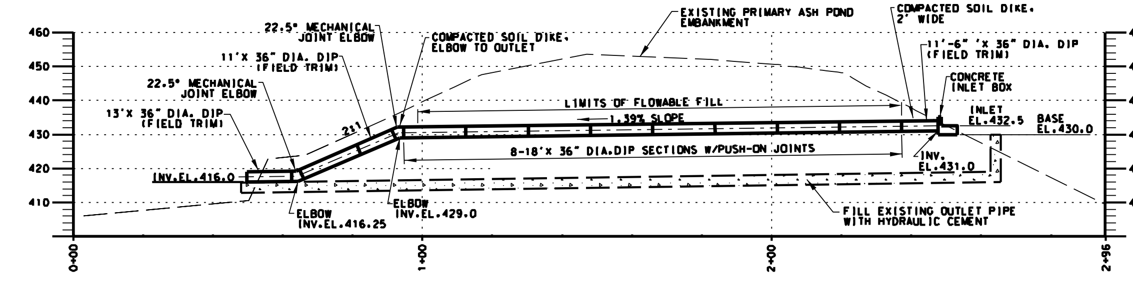
CLIENT: DYNEGY MIDWEST GENERATION

DWG. NO.: C1038

REV. 0

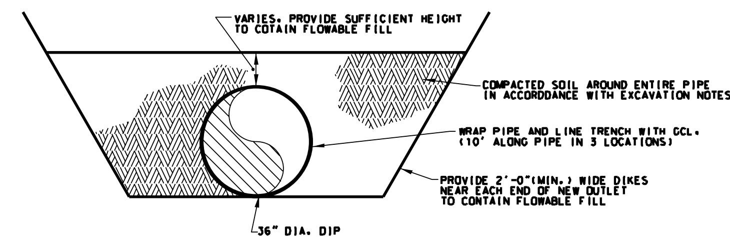


DETAIL OF FINAL DISCHARGE PIPE



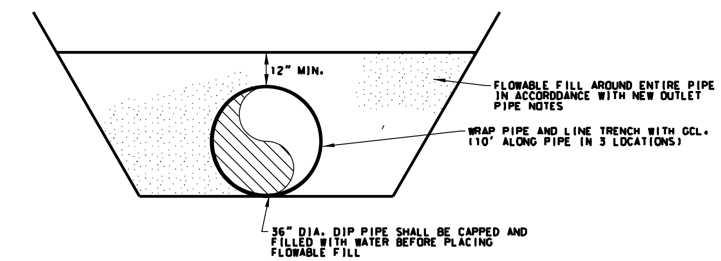
SECTION THRU FINAL DISCHARGE PIPE

SCALE: 1"=20' HORZ : 1"=20' VERT



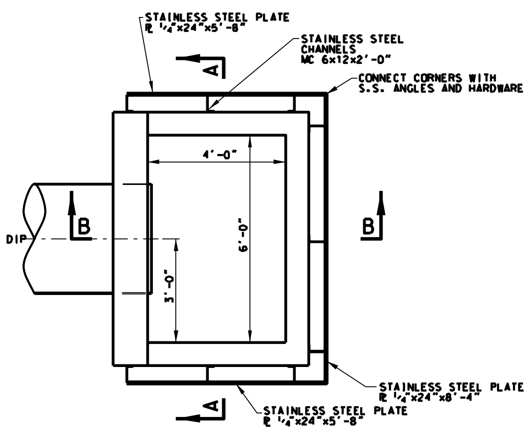
SECTION "E-E"

N.T.S.

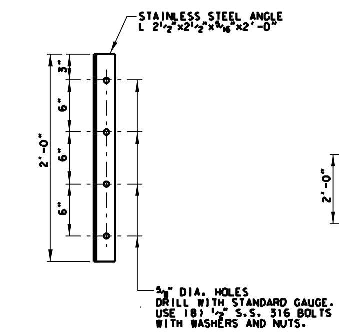


SECTION "F-F"

N.T.S.

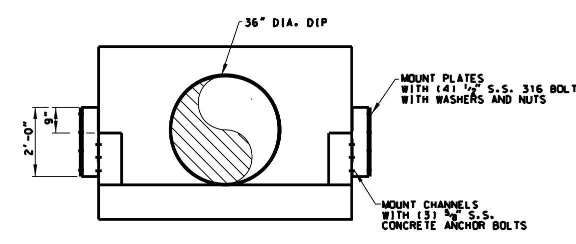


PLAN VIEW

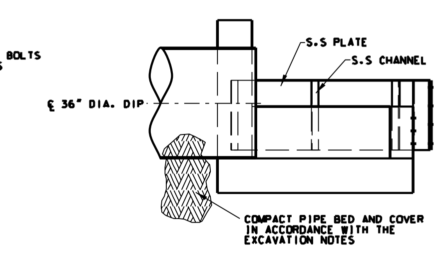


S.S. CORNER ANGLES

SCALE: 1½"= 1'-0"



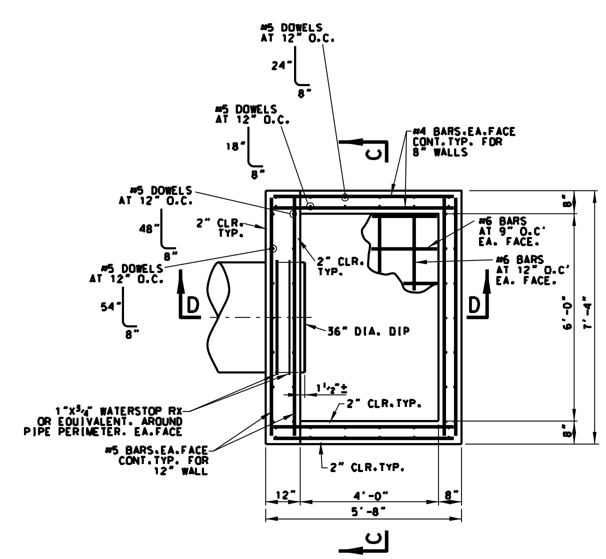
SECTION "A-A"



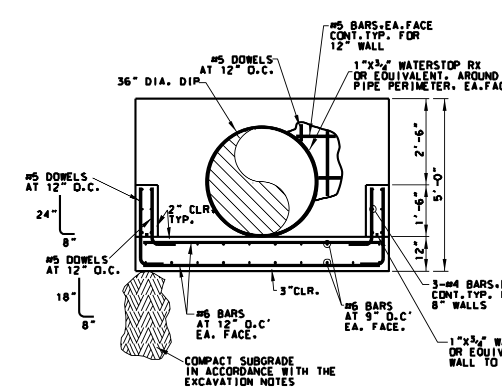
SECTION "B-B"

ASSEMBLY - CONCRETE INLET BOX AND SKIMMER

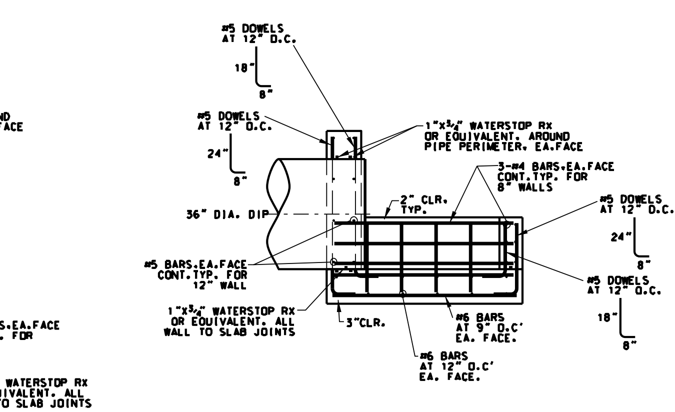
SCALE: ½"= 1'-0"



PLAN VIEW



SECTION "C-C"



SECTION "D-D"

REINFORCING DETAILS - CONCRETE INLET BOX

SCALE: ½"= 1'-0"

CONSTRUCTION NOTES and SPECIFICATIONS

GENERAL

Except as noted otherwise, the Contractor shall furnish all labor, material, tools, and equipment necessary for concrete work shown on the drawings and specified herein.

All work shall be performed in accordance with applicable ACI, OSHA and other applicable guidelines. This work shall also be performed under the personal and constant supervision of a competent Construction Superintendent or Foreman experienced in concrete work, earthwork and general construction activities.

The General Conditions, Safety and Environmental Performance, Earthwork, Riprap, Seeding and Permits sections of the previously provided SPECIFICATION FOR VERTICAL EXTENSION OF EXISTING INTERMEDIATE EMBANKMENT AT PRIMARY ASH POND are applicable to this additional work and shall be considered as part of these Construction Notes and Specifications.

EXCAVATION

All excavated materials shall be stockpiled on-site for re-use. All affected areas shall be returned to its former condition.

Compaction requirements for all phases of the work shall be 95% or greater of the maximum dry density and within ±3% of the optimum moisture content as determined by ASTM D698 (commonly referred to as the Standard Proctor test).

REINFORCING

Reinforcing bars shall conform to ASTM A615, Grade 60 unless otherwise noted on the foundation drawings. All reinforcing shall be free from hard rust, dirt and oil.

All bars shall be bent accurately, placed in position as shown on the drawings, securely tied with #16 gauge black, annealed wire at all intersections, and securely held in place by spacers, chairs, or other approved supports in accordance with ACI 315R. At time of placing concrete, all reinforcing shall be free of loose rust, scale, oil, paint, mud, or other coatings, which will destroy or reduce the concrete bond. Unless otherwise shown on the drawings or specified, the spacing, amount of concrete coverage, splicing, and bending of reinforcing steel shall conform to the requirements of ACI 318. All steel shall have a minimum of 3" concrete cover unless otherwise noted on drawings.

CONCRETE MIXES

Two concrete mixes shall be needed for this project. These are for the concrete inlet box and for the existing outlet pipe plug. The concrete mix designs to be used on the project shall be supplied to the Company by the Contractor 3 days prior to any concrete placement at the job site. All materials incorporated into the concrete mix shall be identified by brand name, gradation, and the supplier.

Type II Portland cement shall be used for the concrete inlet structure. The plug for the existing outlet structure shall consist of hydraulic cement. Type K, M or S Portland cement shall be used in the hydraulic cement plug.

All concrete shall have a minimum compressive strength of 4000 psi at 28 days. Both mixes shall have a maximum water cement ratio of 0.45 (by weight).

All concrete shall have 5 to 7 per cent entrained air.

Concrete for the inlet box shall have a slump of 3 to 4 inches. Concrete for the existing outlet pipe plug shall have a slump of 1 to 2 inches without plasticizer.

Water-reducing admixtures may be used to help meet the above concrete mixture specifications. following admixture manufacturer recommendations.

Ready-Mixed concrete shall be used for all concrete. It shall be mixed and delivered in accordance with the requirements set forth in ASTM C94. The concrete for the outlet pipe plug shall have plasticizer added at the site just prior to final mixing and placement. Final mixing shall be sufficient to fully incorporate plasticizer.

The concrete for the existing outlet pipe plug shall be pumped into the pipe. A tremie tube or hose shall be used to ensure that the concrete fills the entire pipe. Additionally, concrete for the plug shall be placed/pumped continuously until the entire outlet structure is filled. No delays between concrete deliveries shall be allowed.

CONCRETE FINISHES ON EXPOSED SURFACES

Exposed formed surfaces shall be rubbed to the extent of removing small irregularities. Minor voids may be filled with cement mortar. The surface shall not be brush-coated with a cement paste after rubbing.

NEW OUTLET PIPE

Contractor shall install a new outlet pipe through the existing primary ash pond embankment.

Pipe material shall be 36-inch ductile iron pipe, 150-psi pressure class.

The new outlet will consist of approximately 200 feet of straight run pipe and two 22.5° elbows.

Inlet, outlet and elbow invert elevations are shown on the project plans.

Buried, straight run pipe sections shall have push-on joints.

All elbows shall be mechanical joints.

Flowable fill shall be installed as shown on the "Section Thru Final Discharge Pipe".

Flowable fill shall consist of a low strength concrete with a max.compressive strength of 300 psi.

Pipe shall be capped and filled with water before placing flowable fill

Geocomposite Liner (GCL) shall be Claymax 200R, Bentomat ST, or equivalent.

REVISION STATUS: □-CONSTRUCTION ○-RECORD

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
(1)	10-29-99	DEC	ADDED FLOWABLE FILL DETAILS	RCW	RCW	RCW							
(2)	01-27-00	MEC	AS-BUILT - INTERMEDIATE EMBANKMENT. VERTICAL. EXTENTION 1999	RCW	RCW	RCW							

NOTES

REFERENCES

ILLINOIS POWER COMPANY
DECATUR

FINAL OUTLET PIPE REPLACEMENT
PRIMARY ASH POND
BALDWIN POWER STATION

DR RKF	CAD RKF	DATE 7-22-99
CK RCW	CKD	SCALE 1"=40'
APP	PLOTTED 2-14-2000	E-BAL1-C127
APP		

E-BAL1-C127

PLOT SCALE=40

NO	DATE	DRF	DESCRIPTION	E	C	A	NO	DATE	DRF	DESCRIPTION	E	C	A
⓪	06/28/2000	A.T	RECORD REVISION	W.B	R.O	——					W.B	R.O	——

NOTES

1.- ALL DIMENSIONS SHOWN SHALL BE ADJUSTED BY CONTRACTOR TO SUIT INSTALLATION AND FABRICATION TOLERANCES.

REFERENCES

1.- M-2425 FLOW DIAGRAM
2.- M-1077-2 BARGE PUMP PIPING
3.- M-1077-3 WATER PIPING TO MIXING HEAD
4.- (UCC) 510-54671-26 & 27 (SHT. 1 OF 4)

REVISION STATUS
☐ -CONSTRUCTION
○ -RECORD

ILLINOIS POWER COMPANY
DECATUR

PARTIAL PLOT PLAN
POND ASH PIPING
BALDWIN UNIT 1, 2 AND 3

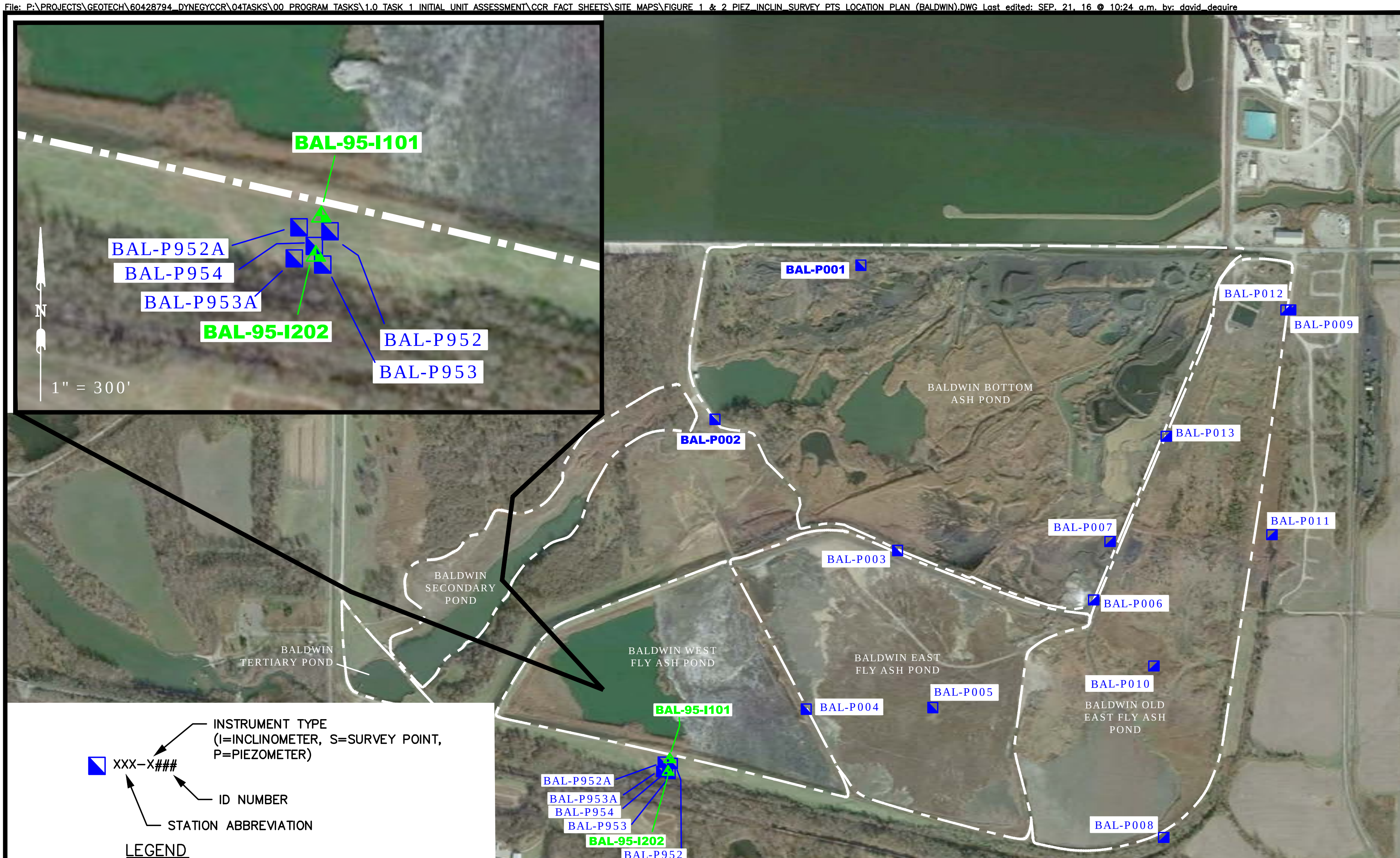
DR	CAD	DATE	11-24-99
OK	CKD	SCALE	1"=300'-0"
APP	PLOTTED	E-BAL 1-M1077-1	
APP			

FILENAME: M1077-1.DGN

COMPUTER DWG. - DO NOT REVISE MANUALLY

Appendix C: Baldwin Energy Complex Piezometer and Inclinometer Locations

File: P:\PROJECTS\GEOTECH\60428794_DYNEGYCCR\04TASKS\00_PROGRAM_TASKS\1.0_TASK_1_INITIAL_UNIT_ASSESSMENT\CCR_FACT_SHEETS\SITE_MAPS\FIGURE_1_&_2_PIEZ_INCLIN_SURVEY_PTS_LOCATION_PLAN_(BALDWIN).DWG Last edited: SEP. 21, 16 @ 10:24 a.m. by: david_dequire



XXX–X### — INSTRUMENT TYPE (I=INCLINOMETER, S=SURVEY POINT, P=PIEZOMETER); ID NUMBER; STATION ABBREVIATION

LEGEND

- INCLINOMETER LOCATION
- PIEZOMETER LOCATION
- CCR UNIT BERM ALIGNMENT

SOURCE:
MAP PROVIDED BY GOOGLE EARTH PRO 2015

0 1000
APPROXIMATE SCALE FEET

N

DYNEGY MIDWEST GENERATION LLC	PROJECT NO. 60440739
AECOM	
DRN. BY:djd November 2015 DSGN. BY:djd CHKD. BY:kmb	**Baldwin Ash Pond Complex Piezometer and Inclinometer Locations** — FIG. NO. 2

Appendix D: Specification T-2226

EXHIBIT "B-1"

May 9, 1967

ADDENDUM NO. 1

TO

SPECIFICATION T-2226

(DATED MARCH 28, 1967)

FOR

COOLING RESERVOIR AND ASH POND WORK

BALDWIN POWER STATION - UNIT 1

ILLINOIS POWER COMPANY

With reference to the above Specification, the following revisions shall apply:

1. Proposal Data Form: The following shall apply:

   A. Page 2, Item A4: Insert the words "liming and" before the work "fertilizing".

   B. Page 4, Item L6: For sub-items b, c and d, revise the figures 1/4", 3/8" and 1/2" deep to 1/2", 3/4" and 1" deep, respectively.

   C. Page 7: This page has been revised May 8, 1967, and extra copies are attached. Revision consists of additions to Item 3, Schedule of Work. Also see Item 4D of this Addendum No. 1.

ALL ADDENDUM ITEMS FOLLOWING COVER REVISIONS TO SPECIFICATION

2. Page 1-1, Article 1-04C, Work Furnished and Installed, or Performed: The following shall apply:

   A. Paragraph C: Revise end of paragraph to read:

      , subdivided as indicated and subject to Base Bid Schedule of Work and Alternate 1 and Alternate 2 Schedules as indicated in Article 1-05:

   B. Subparagraph b, Ash Pond: Revise "culverts" on last line to read "out fall structures".

3. Page 1-2, Paragraph D, Work By Others: Add a new Item c as follows:

   c. Preliminary site work.

4. Starting on Page 1-2, Article 1-05, Schedule of Work: The following shall apply:

   A. Paragraph A, Subparagraph a: In second line, revise "three (3)" to read "two (2)".

   B. Page 1-3, Top of Page: Revise present Item (3), the portion of .... to new Item (2); revise present Item (2), Work on dam and spillways.... to new Subparagraph b; revise present Subparagraphs b and c to new Subparagraphs c and d; and in new Subparagraph d, revise "three (3)" to read "two (2)".

   C. Page 1-3, Paragraph B: Revise entire paragraph to read:

   B. Schedule Dates for Base Bid:

   a. In accordance with foregoing requirements, Contractor shall perform the WORK in accordance with following schedule:

ITEMS	BY DATES BELOW
a. Start WORK at site	May 25, 1967
b. Install observation wells	Before creek at dam site is permanently closed.
e. Complete all WORK, except final seeding (providing that work on dam and spillway is authorized by July 1, 1967, and that Access Pending areas are released for work by October 2, 1967)	December 1, 1967
f. Complete final seeding, subject to conditions indicated in Article 1-05C	May 1, 1968

   D. Page 1-4: Revise Paragraphs C through G to read:

   C. Alternate 1 - Release of Access Pending Areas by ~~May~~ June 1, 1968: Release of Access Pending areas may be delayed beyond October 2, 1967. Contractor shall state, as set forth in Item 3 of the Proposal Data form, the dates by which he would complete work for these two areas, and dates for completing final seeding for these two areas, if these two areas are released by ~~May~~ June 1, 1968.

   D. Alternate 2 - Release of WORK after ~~May~~ June 1, 1968: If any area of WORK is not released to Contractor by ~~May~~ June 1, 1968 and Purchaser does not delete that portion of WORK from the Contract, Contractor will be granted a time extension and an equitable adjustment to the FIRM LUMP SUM PRICE to reflect costs incurred by Contractor due to the delay of portions of WORK beyond ~~May~~ June 1, 1968.

E. Contractor's Schedule of WORK: Within one week after notification of award of Contract, Contractor shall submit, in duplicate, a schedule graphically representing starting and completion dates of each phase of the WORK.

F. Work by Others: Related work by others is scheduled as follows:

ITEMS	BY DATES BELOW
a. Complete initial site clearing	April 15, 1967
b. Earthwork and grading for roadway embankment between river pump house and reservoir area:	
(1) Start WORK	April 15, 1967
(2) Complete WORK	August 1, 1967
c. Preliminary Site Work:	
(1) Start WORK	March 15, 1967
(2) Complete WORK	November 1, 1967

5. Page 1-7, Article 1-09: Revise entire Article to read:

1-09. LINES AND GRADES
As specified in Article 3 of Form 1714. The property lines from which the axes shall be located are indicated on the E. M. Webb Property Line Maps listed in Article 2-03.

6. Page 2-2, under Article 2-02A: Revise title of Drawing B-57 to read:

B-57 Drainage Structure To Doza Creek

7. Page 2-3, Article 2-03, Survey Drawings: In Paragraph B, Item a, revise title to read:

a. Watershed Area NW of Baldwin:

Sheets 1, 2, 2A, 3, 3A, 4, 4A and 5 of 5

8. Page 3-1, Article 3-03B, Initial Clearing Contract: Revise "1'-0" above" to read "at".

9. Page 3-6, under Article 3-06Bd: Revise 3-10 after "Article" in last line to read "5-03".

10. Page 4-1, Article 4-01, Scope: Revise listing for Article 4-03 to read:

    4-03. Liming and Fertilizing:

11. Page 4-1, Article 4-03: Revise heading to read:

    4-03. LIMING AND FERTILIZING

12. Page 5-2, Article 5-03, Portland Cement Concrete Work: The following shall apply:

    A. Paragraph D, Splice Requirements for Reinforcing Bars: In third line, after ACI 318, insert the words ", or those indicated on drawings,".

    B. Paragraph F, Formwork: In third line, delete the words "in curing and".

13. Page 5-4, Paragraph K, Mud Slab: Revise first sentence to read:

    A concrete mud slab, 3 inches thick, shall be placed over foundation of spillway where indicated on drawings.

14. Page 5-6, under Paragraph N, Control Joints: In Subparagraph b, second line, insert "wall" before "control joints".

15. Page 6-2, under Article 6-04: The following shall apply:

    A. Paragraph E, Rubber Sealant Closures: Revise Subparagraph a to read:

       a. Conform to applicable requirements of Form 1755, except depth of sealant in joints shall be equal to width of joint.

    B. Paragraph F, Rubber Control Joint Strips: In second line, insert the word "wall" before "control joints".

16. Page 6-6, under Article 6-09C, Installation: Revise Subparagraph d to read:

    d. Backfill: As specified in Article 7.6 of Form 1714 and as indicated on drawings.

Bidder shall state in his proposal that provisions of this Addendum No. 1 have been covered.

COOLING RESERVOIR AND ASH POND WORK
BALDWIN POWER STATION - UNIT 1
ILLINOIS POWER COMPANY

TABLE OF CONTENTS

TABLE OF CONTENTS, Cont.

Where Specification is revised by Addendum notation in margin indicates Addendum number and Addendum item which pertains.

SPECIFICATION FOR
COOLING RESERVOIR AND ASH POND

SECTION 1 - SPECIAL CONDITIONS

1-01. PURCHASER: ILLINOIS POWER COMPANY.

1-02. NAME OF PROJECT: BALDWIN POWER STATION - UNIT 1.

1-03. LOCATION OF PROJECT
Near Baldwin, Illinois

1-04. SCOPE OF WORK

A. Contractor shall perform the following WORK for and at the above Station site:

COOLING RESERVOIR AND ASH POND WORK, complete as indicated on drawings and as hereinafter specified.

B. Specification Sections: For convenience of reference, this Specification covering the WORK consists of 6 sections, as indicated in the Table of Contents which forms a part hereof.

C. WORK FURNISHED AND INSTALLED, OR PERFORMED: Contractor shall furnish, deliver, and unload materials for, shall store and remove materials from storage for, and shall construct, erect, install and/or perform and finish the following WORK, subdivided as indicated: ADD.1 Item 2

a. Cooling Reservoir: The portion of the WORK for the Cooling Reservoir will include the following major features: Earth dam, concrete spillways, earth dikes around and within the Cooling Reservoir, grading within the Cooling Reservoir, intake, discharge and drainage channels, drainage ditches around the Cooling Reservoir, concrete box culvert in ditch to Doza Creek, and gravel service roads providing access to and along the crest of the Cooling Reservoir dam and dikes.

b. Ash Pond: The portion of the WORK for the Ash Pond will include the following major features: Earth dikes on two sides of the Ash Pond, corrugated metal and timber outfall structures, earth-rock dikes at outfall structures,and gravel service road providing access to dikes and culverts. ADD.1 Item 2

c. The foregoing WORK includes the following:

(1) Completion of clearing and grubbing (including disposal of material) of areas for embankments, spillway, outfall structures, channels, dikes, reservoir gradings, drainage ditches, service road, and borrow areas.

(2) Diversion and care of water, including temporary cofferdams, channels, flumes, drains, sumps, pumps and all other temporary facilities required to perform the WORK in the dry, and including removal of all such temporary facilities.

(3) Excavation for embankments, spillways, outfall structures, channels, ditches, reservoir grading, and excavation from borrow areas.

(4) Compacted fill for dam and dikes, etc., including foundation preparation, impervious fill, earthfill, sand and gravel fill, gravel fill, riprap, topsoil, seeding, etc.

(5) Concrete spillway and other miscellaneous concrete work.

(6) Gravel service road including foundation preparation and gravel for road on crest of dikes and for access roads to dikes.

(7) All other work as indicated on drawings, as herein specified or as required to properly complete the WORK.

D. WORK BY OTHERS: The following related work will be furnished and delivered, or furnished and installed, or performed, by others:

a. Initial site clearing, consisting of the following:

(1) Cutting all trees 1" in diameter or larger level with existing grade elevations, in Reservoir area, Ash Pond area and Plant area.

(2) Knocking over or cutting of all trees 1" in diameter or larger in dike and dam area.

(3) Disposal and/or burning of all cut and/or knocked down trees, bushes, brush and loose vegetation.

b. Earthwork and grading for roadway embankment between river pump house and reservoir area. ADD.1 Item 3

1-05. SCHEDULE OF WORK

A. General Release of Areas for WORK:

a. It will not be possible for Purchaser to immediately release all areas for the WORK to Contractor since three (3) areas within the limits of WORK will not be owned by Purchaser at the time the WORK begins. These areas, identified on the drawings as "Access pending", are as follows: ADD.1 Item 4

(1) The portion of the Cooling Reservoir including dikes, reservoir grading, and borrow area in the southwest corner of the Cooling Reservoir.

(2) Work on dam and spillways cannot start until Purchaser has secured a flood easement for "Access Pending" areas.

(3) The portion of the ash pond, including dikes, in the northwest corner of the Ash Pond. ADD.1 Item 4

b. Until arrangements have been completed by Purchaser to secure these pieces of property, Contractor shall neither trespass nor perform any work on these pieces of property without securing written approval from Purchaser to proceed with work in these areas.

c. Contractor shall include in the FIRM LUMP SUM PRICE AND FIRM UNIT PRICES all costs which may result from delays in completing the WORK in these three (3) areas.

B. Scheduled Dates:

a. In accordance with foregoing requirements, Contractor shall perform the WORK in accordance with following schedule: ADD.1 Item 4

	ITEM	BY DATES BELOW
a.	Start WORK for Cooling Reservoir....	May 1, 1967
b.	Start WORK for Ash Pond............	June 1, 1967
c.	Install observation wells..........	Before creek at dam site is permanently closed
d.	Installation of Closure Dike at southeast corner of Cooling Reservoir........................	Shall be last portion of Cooling Reservoir dike system constructed unless otherwise approved by Purchaser. Do not place any fill for dike before authorization received from Purchaser.
e.	Complete all WORK, except final seeding (providing that areas not owned by Purchaser at time construction is started are released for work by October 1, 1967).......	December 1, 1967
f.	Complete final seeding, subject to conditions indicated in Article 1-05C	May 1, 1968

C. Extension of Scheduled Dates: Should there be any delay in release of areas for WORK that are not owned by Purchaser at time WORK begins, the Scheduled Dates will be extended in accordance with the following provisions providing that the particular areas are released to Contractor for the WORK before May 1, 1968: ADD.1 Item 4

a. If area in southwest corner of Cooling Reservoir has not been released by October 1, 1967, the date for completing WORK in this area will be extended to July 1, 1968.

b. If area in northwest corner of Ash Pond has not been released by November 1, 1967, the date for completing WORK in this area will be extended to June 1, 1968.

D. The date for completing final seeding in areas released after October 1, 1967 will be extended to September 15, 1968 or the end of the first final seeding period following temporary seeding. ADD.1 Item 4

E. Release of WORK after May 1, 1968: If any area of WORK is not released to Contractor by May 1, 1968 and Purchaser does not delete that portion of WORK from the Contract, Contractor will be granted a time extension and an equitable adjustment to the FIRM LUMP SUM PRICE to reflect costs incurred by Contractor due to the delay of portions of WORK beyond May 1, 1968. ADD.1 Item 4

F. Contractor's Schedule of WORK: Within one week after notification of award of Contract, Contractor shall submit, in duplicate, a schedule graphically representing starting and completion dates of each phase of the WORK. ADD.1 Item 4

G. Work by Others: Related work by others is scheduled as follows: ADD.1 Item 4

ITEM	BY DATES BELOW
a. Complete initial site clearing..........	April 15, 1967
b. Earthwork and grading for roadway embankment between river pump house and reservoir area:	
(1) Start Work	April 15, 1967
(2) Complete Work.....................	August 1, 1967

1-06. SPECIFIED PRODUCTS AND SUBSTITUTIONS

The BASE BID shall not contain substitutions for Specified Products; see Standard Requirements Form 1707.

1-07. DEFINITIONS

A. See Standard List, Form 1708.

B. Harza Engineering Company is acting as the subcontractor to Sargent & Lundy for design of the WORK under this Specification T-2226.

C. Wherever the terms "approved", "as approved", "satisfactory", "as requested", or other similar terms are used in this Specification, they shall mean "as approved, etc., by the Consulting Engineers", unless otherwise specifically stated.

D. Contractor is herewith designated as the Reservoir Contractor.

1-08. JOB CONDITIONS

A. Examination of Site:

a. Contractor shall visit site during Bid Period to familiarize himself with conditions under which WORK required to be done.

b. Contractor shall consult with Purchaser's Construction Department as to means of access to site of WORK and methods to be used in unloading and bringing materials and equipment onto site.

c. Contractor's plea of ignorance of existing or foreseeable conditions which will create difficulties or hindrances in execution of WORK not acceptable as excuse for any failure on part of Contractor to fulfill in every detail all requirements of Specification and/or drawings. Furthermore, Contractor's plea of ignorance not acceptable as basis for any claim whatsoever for additional or extra compensation.

B. Railroad Facilities: The Gulf, Mobile and Ohio Railroad passes through Baldwin. At present there is no railroad sidetrack at the site.

C. Highway Access:

a. Illinois State Highway 154 passes through Baldwin, and an approved secondary road runs north from Baldwin near the eastern edge of the site.

b. Access roads into and within the site area, if required, shall be furnished and installed by Contractor at his own expense, and shall be located and shall be of construction as approved or as requested by Purchaser.

D. Utilities: Contractor shall provide all necessary electricity, water and compressed air required for his WORK.

E. Toilet Facilities:

a. Contractor shall provide own temporary sanitary toilet facilities required for own work.

b. Contractor shall maintain all toilet facilities in a clean condition whether or not used by other than own employees, provide all necessary towels, paper, etc., and repair and maintain such facilities if and as requested.

F. Office and Storage:

a. Purchaser will provide, free of charge, suitable space for location of Contractor's office, shops and warehouses and for storage of materials and equipment.

b. Purchaser will designate areas available for such use at time Contractor visits job site during bid period. Contractor shall provide any additional facilities required for own use.

c. Contractor shall provide and maintain temporary buildings and associated electrical work required for own use.

d. Prior to erection of any temporary buildings, Contractor shall submit plans to Purchaser's representative for general approval of materials and appearance.

G. Burning of Debris on Premises: Will be permitted, subject to requirements of Article 4.5.2 of Form 1714.

H. Fire Protection: Provide, as specified in Article 4.5.2.5 of Form 1714.

I. Temporary Barricades: The Contractor shall provide all temporary barricades as required for safety.

J. Temporary Heat:

a. Contractor shall provide and maintain all temporary heating and temporary enclosures as required to insure continuous, efficient and uninterrupted execution of WORK.

b. Temporary enclosures shall be weathertight and shall provide for proper access to all work.

c. Temporary heating equipment, operation and maintenance thereof, shall be such as to cause no fire hazard.

K. Identification and Admittance of Workmen: Purchaser's Gate Officers will not be permitted to admit Contractor's or his subcontractors' employees until they have been identified by Contractor's or his subcontractors' delegated representative on the WORK.

L. Station Rules: Abide by any/all rules Purchaser may have in effect at station site pertaining to handling of men, equipment and materials.

M. Removal of Temporary Facilities: Contractor shall remove temporary facilities provided on premises for own use at termination of their usefulness or termination of WORK, or when requested, and shall leave premises in condition satisfactory to Purchaser's representative in every respect.

1-09. LINES AND GRADES

As specified in Article 3 of Form 1714. ADD.1 Item 3

1-10. PROTECTION

Contractor is responsible for protecting all facilities and work in vicinity from damage from his operations. The following are particularly called to his attention:

A. Numerous cased oil, gas, and water wells; various public utility lines; tracks of the Gulf, Mobile, and Ohio Railroad, State Highway Route 154; etc. are within or immediately adjacent to reservoir area.

B. In addition, all or portions of three farms are in the area of the WORK that will not be made immediately available to Contractor. These farms will probably be maintained in operation during the progress of the WORK.

C. Contractor shall provide all necessary protection, as required, as approved, or as requested, to prevent damage to any portions of cased wells, utilities, farms, railroad tracks or highways, and to prevent any interruption of utility or railway services.

D. Contractor shall exercise extreme care to protect all fences outside of areas released for WORK, and to keep farm fence gates closed so as not to permit escape of farm animals.

E. Contractor shall pay costs of any damages arising from Contractor's acts of omission or commission with respect to these requirements.

1-11. MAINTENANCE OF EXISTING ROADS ON PURCHASER'S PROPERTY

A. Maintain all existing roads at site which are indicated to remain as permanent roads, and which are used by Contractor during course of WORK. Provide maintenance as required, as approved and/or requested, and satisfactory to Purchaser in every respect.

B. Provide temporary bridges, as approved and/or as requested, across all road openings which Contractor cuts for WORK and which interfere with movement of traffic (as determined by Purchaser's representative) at site.

C. Replace portions of existing roads cut by Contractor in accordance with requirements hereinafter specified in Section 3.

1-12. PERMITS

A. Purchaser will obtain all State, County, Township and City permits for the WORK.

B. Contractor shall obtain, at his own expense, all other permits required for the WORK in accordance with Article 11 of Purchaser's General Conditions. Contractor shall arrange with Purchaser for Purchaser's representative to accompany Contractor in securing all such permits.

1-13. PERFORMANCE OF WORK

A. The WORK shall be performed using a normal work week of eight hours per day, five days per week, Monday through Friday. However, Contractor in performing the WORK shall adequately man the job and work such hours per day and days per week as may be necessary to meet the construction schedule, such overtime to be at no additional cost to Purchaser.

B. In the event Contractor determines it necessary to schedule his work force more than eight hours per day for five days per week Monday through Friday, he shall consult in advance with Purchaser's representative to make certain that such a schedule will not conflict with other WORK at the job site. Contractor shall bear all costs that may be incurred in procuring and/or maintaining the necessary labor force on the job, including such items as overtime, bonus or premium time, and transportation and living expenses.

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SECTION 2 - DRAWINGS, SUPPLEMENTS AND STANDARD SPECIFICATIONS

2-01. SCOPE

This section of the Specification includes the following, under the Article numbers indicated, which shall apply to the WORK:

2-02. List of Design Drawings (Consulting Engineers')
2-03. List of Survey Drawings
2-04. List of Supplements and Standard Specifications
2-05. Requirements for Contractor's Shop Drawings
2-06. Requirements for Samples

2-02. DESIGN DRAWINGS (CONSULTING ENGINEERS')

A. The following design drawings by Harza Engineering Company and the Consulting Engineers, dated or revised March 28, 1967, form a part hereof:

C12 Location and Project Plan
C13 Dam & Dike Alignment
C14 Location of Exploration, Borrow, and Grading
C15 Boring Logs - Sheet 1
C16 Boring Logs - Sheet 2
C17 Boring Logs - Sheet 3
C18 Boring Logs - Sheet 4
C19 Boring Logs - Sheet 5
C20 Boring Logs - Sheet 6
C21 Boring Logs - Sheet 7
C22 Test Pits & Trenches - Sheet 1
C23 Test Pits & Trenches - Sheet 2
C24 Laboratory Data - Sheet 1
C25 Laboratory Data - Sheet 2
C26 West Dike - Sheet 1
C27 West Dike - Sheet 2
C28 West Dike - Sheet 3
C29 South Dike
C30 Intake Channel
C31 East Dike - Sheet 1

C32 East Dike - Sheet 2

C33 East Dike - Sheet 3

C34 North Dike

C35 Drainage Ditch to Doza Creek

C36 Baffle Dike

C37 Ash Pond Dike - Sheet 1

C38 Ash Pond Dike - Sheet 2

C39 Ash Pond Dike - Sheet 3

C40 Ash Pond Dike - Sheet 4

C41 Dam - Plan

C42 Dam - Sections & Details

C43 Dam & Spillway Excavation

C44 Spillway - Plan & Sections

C45 Spillway - Sections

C46 Spillway - Details

C47 Spillway - Reinforcement - Sheet 1

C48 Spillway - Reinforcement - Sheet 2

B-57 Drainage Structure - Plan and Sections

B-60 Ash Pond Outfall Structures ADD. 1 Item 6

B. The following design drawings by the Consulting Engineers form a part hereof for reference only:

a. General:

B-1 Plan of Test Boring and Initial Site Clearing - Sh 1

B-2 Plan of Test Boring and Initial Site Clearing - Sh 2

B-3 Logs of Test Borings - Sh 1

B-4 Logs of Test Borings - Sh 2

B-5 Logs of Test Borings - Sh 3

B-6 Logs of Test Borings - Sh 4

B-8 Location Plan - Sheet 1

B-9 Location Plan - Sheet 2

b. Preliminary Work Contract:

B-53 Initial Site Development Plan - Plant Area - Sheet 1 - Unit 1

B-54 Initial Site Development Plant Area - Sheet 2 - Unit 1

c. River Pump House Contract:

B-69 River Pump House - Roadway and Grading - Plan

B-70 River Pump House - Roadway and Grading - Sections

2-03. SURVEY DRAWINGS

The following survey drawings are available for reference inspection at the offices of the Consulting Engineers, and prints will be issued to Contractor, after award of Contract, if Contractor so requests:

A. Property Line Maps by E. M. Webb:

Sheet 0 through Sheet 9 - Land Survey Plat

B. Aerial Topographic Survey Drawings by Clyde E. Williams & Associates, Inc., compiled by photogrammetric methods:

a. Watershed Area North of Baldwin:
Sheets 1, 2, 2A, 3, 3A, 4, 4A and 5 of 5 ADD.1 Item 7

b. Plant Site and Dike Area North:
Sheets 1 and 2 of 2

c. Baldwin Dam Site and Northwest Dike Area:
Sheet 1 of 1

2-04. SUPPLEMENTS, STANDARD SPECIFICATIONS

A. The following are attached hereto and form a part hereof:

a. Supplements:

(1) Form 303-IPCo. General Conditions (12-23-66).
(2) Purchaser's Contract Insurance Provisions dated 4-18-67. These provisions shall prevail in the event of any conflict with corresponding provisions of the General Conditions (Form 303-IPCo). *
(3) Purchaser's Statement of Policy - Field Labor Contracts (11-15-61).

b. Building Standard Specifications:

(1) Form 1701-E - Standard Specification for Welding in Building Construction.

(2) Form 1707-B - Standard Requirements for Specified Products and List of Approved Manufacturers.

(3) Form 1708 - Standard List of Definitions and Reference Publications.

(4) Form 1714 - Standard Specification for Earthwork.

(5) Form 1715-Q - Standard Specification for Concrete Work.

(6) Form 1737-B - Standard Specification for Anchor Bolts.

(7) Form 1742-E - Standard Specification for Miscellaneous Metalwork, Building Work and Embedded Work.

(8) Form 1743-B - Standard Specifications for Crib House Grills, Stop Logs and Gates.

(9) Form 1746-K - Standard Specification for Plumbing Work (pages 1 through 15 only - no Standard Drawings).

(10) Form 1755 - Standard Specification for Rubber Sealants.

(11) Form 1760 - Standard Specification for Carpentry and Millwork.

(12) Form 1790-E - Standard Specification for Prime Coat Painting.

B. Reference to foregoing Standard Specifications elsewhere in this Job Specification and on drawings do not include letter suffix (which indicates latest revision) after form number.

C. In the event of variation between the foregoing Standard Specifications, and the Job Specification or Design Drawings, the Job Specification and Design Drawings shall govern.

2-05. SHOP DRAWINGS (CONTRACTOR'S)

A. Submit shop drawings for approval as follows:

a. As specified in the respective Standard Specifications.

b. Five (5) sets of shop drawings for all fabricated materials included in the WORK, and for which shop drawings are not specified elsewhere.

B. Submit drawings and receive approval of the Consulting Engineers prior to starting any work relating to said drawings.

C. After final approval of the above required drawings, furnish the Consulting Engineers with seven (7) complete sets of approved shop drawings.

2-06. REQUIREMENTS FOR SAMPLES

A. Submit in accordance with Form 1707.

B. Address samples and containers to following:

a. Samples to Purchaser:

Illinois Power Company
500 South 27th Street
Decatur, Illinois
Attention: Mr. A. Kraakevik, Vice President

b. Samples to Sargent & Lundy:

Sargent & Lundy, Engineers
140 South Dearborn Street
Chicago, Illinois 60603
Attention: Mr. S. Rurka

C. Products for which samples are required are hereinafter listed in the last Article of applicable Sections, and these Sections are identified in the Index by the notation "Samples Required".

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SECTION 3 - CLEARING, DEMOLITION, ALTERATION AND EARTHWORK

3-01. SCOPE

This section of the Specification includes requirements for the following, as indicated on the drawings, as hereinafter specified (under the Article numbers indicated), or as required to properly complete the WORK:

3-02. Physical Data

3-03. Clearing, Grubbing, Demolition and Alteration Work

3-04. Diversion and Care of Water

3-05. Excavation

3-06. Fill

3-07. Laboratory Control for Fill Compaction

3-08. Instrumentation.

3-02. PHYSICAL DATA

Physical data indicated on drawings, including topography, boring logs, and laboratory soil test results are furnished for information only, and it is expressly understood that neither Purchaser nor the Consulting Engineers will be responsible for any interpretation or conclusion therefrom. Driller's logs for all borings made at the site and detailed results of laboratory soil tests are available for inspection at the Chicago office of the Consulting Engineers. In addition to the borings made for this WORK, additional borings were made in the area of the Power Station for purpose of plant foundation design. The location and the logs for these supplemental borings are also available for inspection at the Chicago office of the Consulting Engineers. Contractor will be allowed, at his own expense, to collect his own physical data.

3-03. CLEARING, GRUBBING, DEMOLITION AND ALTERATION WORK

A. Scope: Contractor shall complete clearing, and shall grub areas on which the embankments, spillway, outfall structures, drainage ditches, and service roadways will be built and shall complete clearing of areas behind dikes where fill will be placed to raise natural ground level. These requirements do not pertain to clearing and grubbing of borrow areas and Contractor's work areas.

B. Initial Clearing Contract: Initial clearing operations have been conducted within the cooling reservoir area up to property lines or clearing limits indicated on drawings. Trees have generally been cut off 1'-0" above ground level. The uncleared area in ADD.1 Item 8 southwest corner of cooling reservoir, where access is pending, will be cleared by the Initial Site Clearing Contractor as soon as access can be arranged. Where additional clearing is required to construct the WORK, it shall be performed in accordance with the following paragraph "Additional Clearing."

C. Additional Clearing: Where additional clearing is necessary to construct the WORK, conform to applicable requirements of Article 4 of Form 1714, and to following requirements:

a. No clearing shall be done outside of area necessary to construct the WORK without specific approval.

b. Purchaser reserves right to designate any vegetation to be carefully protected from damage by Contractor's operations.

c. Trees: Remove by either cutting within 6" above ground or by uprooting. If trees are uprooted, backfill holes with compacted earthfill as specified in Article 3-06.

d. Grubbing: As specified in Article 4.4 of Form 1714. Contractor shall grub all areas under structures and as indicated on drawings. Explosives may be used. Holes formed by grubbing operations shall be filled with compacted earthfill as specified in Article 3-06.

e. Disposal: As specified in Article 4.5 of Form 1714, except that buried material shall have 2'-0" of cover.

D. Demolition Work:

a. Purchaser may elect to sell certain existing buildings for removal from site. Contractor shall check with Purchaser's representative during visit to site to determine extent of these operations.

b. Contractor shall remove all other existing buildings and fences down to ground level. Foundations need not be removed, but shall be filled to ground level with compacted earthfill as specified in Article 3-06.

E. Altering of Existing Well Casings:

a. A number of cased gas, oil, and water wells are located on Purchaser's property. As indicated on drawings, some of these are located in areas of required excavation or grading. Precautions shall be taken to prevent hitting these wells with construction equipment during excavation or hauling operations in the vicinity.

b. When adjacent ground has been excavated to grade, well casings shall be cut off to grade upon approval of Purchaser's representative. Although wells are plugged, there is a possibility that gas could escape through the plug and provide a potential source of danger should casing be penetrated with a cutting torch. In this regard, casings of all altered wells shall first be vented by removing the cap and/or by making a vent hole with an electric drill bit soaked with oil or water.

c. The wells will be replugged by others under the direction of the Purchaser. The Contractor shall permit unrestricted access to the wells for this purpose.

3-04. DIVERSION AND CARE OF WATER

A. General: Contractor shall construct and maintain all necessary cofferdams, channels, flumes, drains, and sumps, and shall furnish, install, and operate all pumps needed for diversion and care of water from any source so that all work can be performed in the dry.

B. Approval of Plans: Contractor's plans for diversion and care of water shall be subject to approval by Purchaser.

C. Responsibility: Contractor shall be responsible for all diversion and care of water and shall repair at his own expense any damage to foundation or structures caused by water from any source regardless of previous approval.

D. Responsibility for Restriction of Natural Drainage by Dikes:

a. Contractor shall not place any fill for dikes across routes of natural drainage until provisions are made to drain surface runoff into reservoir or into drainage ditches forming part of the WORK.

b. No surface runoff shall be ponded or restricted to a greater degree than would have occurred naturally either before the beginning of construction or after completion of the WORK, unless approved by Purchaser.

c. Should ponding or restriction of surface runoff result in water being backed up onto property not owned by Purchaser or onto Purchaser's property where work by other contractors is either under way or completed or where materials or equipment are being stored, all damages resulting therefrom shall be responsibility of Contractor.

E. Temporary Slopes: Temporary construction slopes in excavation or in fill used for diversion channels or cofferdams within an area from 200 feet upstream to 200 feet downstream of center line of dam shall not be steeper than 4 horizontal to 1 vertical, except as indicated on drawings or as approved.

F. Unwatering: Unwatering shall be accomplished in a manner that will prevent loss of fines from the foundation, will maintain stability of excavated slopes and bottoms of trenches, and will result in all construction operations to be performed in the dry except in approved sumps.

3-05. EXCAVATION

A. Scope: Contractor shall perform all excavation for embankments, spillway, outfall structures, service roads, intake, discharge, and drainage channel, drainage ditches and culverts. Excavation shall conform to applicable requirements of Article 5 of Form 1714, and to requirements hereinafter specified.

B. Definitions:

a. Stripping is defined as removal of sod, topsoil and rubbish in areas indicated on drawings and in borrow areas.

b. Common excavation is defined as all excavation not otherwise defined as stripping, rock excavation, dental excavation, or borrow excavation.

c. Rock excavation is defined as excavation of all solid rock in place which cannot be removed by hand, power shovel, dragline, ripping, or earth moving equipment without continuous and systematic blasting, barring, or wedging. Removal of boulders or individual loose rock, one cubic yard or more in volume, will be classified as rock excavation.

d. Dental excavation is defined as excavation consisting of removal of rock fragments or decomposed materials from seams, joints and solution channels beyond lines of excavation when such removal requires use of hand tools and hand methods. Extent of dental excavation is expected to be small and shall be as requested by Purchaser's representative.

e. Borrow excavation is defined as all excavation in borrow areas, except stripping.

C. Procedures: Excavation may be accomplished by any method and by use of any excavation and hauling equipment adapted to the work. Blasting may be used, subject to requirements of Article 5.11 of Form 1714. All necessary precautions shall be taken to preserve material below bottom of spillway excavation in undisturbed condition. Any damage to work due to Contractor's operations, including disturbance of material beyond lines of excavation, shall be repaired where requested in a manner as approved, and by and at expense of Contractor. Methods of dental excavation shall be such as to avoid fracturing of rock adjacent to material being removed.

D. Limits: All excavation shall be performed to lines and grades indicated on drawings or as requested. Any over-excavation or excess excavation, not requested by Purchaser, shall be at expense of Contractor.

E. Repair of Over-Excavation: Where required or requested to complete work, over-excavation shall be backfilled with materials furnished and placed at expense of Contractor. Underneath embankments, backfill shall consist of impervious fill placed in accordance with Article 3-06. Underneath the portion of the spillway upstream of the drainage blanket, backfill shall consist of impervious fill, placed at optimum moisture content and compacted to 100% standard Proctor maximum density. Downstream of the spillway control structure but upstream of the portion of the stilling basin on rock, backfill shall consist of sand and gravel compacted to 70% relative density. Where rock beneath the stilling basin is over-excavated, backfill shall consist of concrete.

F. Foundation Protection: Finished excavated surfaces shall be protected against damage by movements of construction equipment or other causes. As far as practicable, excavated surfaces shall be protected against erosion by surface runoff. Finished grade on which concrete structures will be placed shall be covered with a drainage blanket or a 3-inch protective concrete layer (mud slab) where indicated on drawings within 24 hours after excavating. Drainage blanket shall also be covered with a mud slab. No traffic shall be allowed on final excavated surface until protective concrete layer (mud slab) has been placed and properly cured. This procedure may be carried out in sections in order to facilitate work.

G. Excavated Materials: Suitable excavated materials may be used as fill or as topsoil if usable and approved. Material excavated from the dam core trench shall be used only as random fill unless otherwise approved. Material may be placed either immediately or may be stockpiled first. Excess excavated material or unsuitable material shall be disposed of in spoil areas within the reservoir where indicated on drawings, in abandoned portions of borrow areas below elevation 425.0, or as approved. Disposal banks shall be sloped to drain and shall not interfere with natural drainage from surrounding land.

H. Borrow Areas: All fill not available from required excavation shall be taken from borrow areas as indicated on drawings or as otherwise approved. Fill for dam shall come from dam and spillway excavation, from Borrow Area A, and from approved required excavation. Purchaser does not guarantee that all material within designated borrow areas will meet requirements of the Specification. Selective loading and placing might be required to produce required quality and uniformity of fill in embankments. At all times during operations in borrow areas, Contractor shall maintain adequate drainage to nearest natural drainage outlet. Sand, gravel, riprap, and rockfill shall not come from areas within Purchaser's property unless otherwise approved.

3-06. FILL

A. Scope: Contractor shall prepare the foundation, furnish, place and compact all fill, and maintain structures in a satisfactory condition at all times until acceptance of the WORK.

B. Foundation Preparation:

a. No material shall be placed until the foundation therefor has been unwatered and suitably prepared and has been approved.

b. Except for areas of abutment blanketing at dam, the earth foundation shall be prepared by leveling and scarifying to a depth of 2 inches. Surface material shall be compacted with, and as part of, the first layer of fill as herein specified for subsequent layers of fill. All existing cavities in foundation shall be filled with compacted earthfill.

c. Areas of abutment blanketing shall be scarified to a depth of 6 inches and compacted with a tamping roller. Where depressions exist, such as holes left from grubbing operations or narrow erosion gullies, they shall be filled with impervious fill and scarified to a depth of 2 inches.

d. Rock surface on bottom of core trench shall be the top of alternating limestone and shale. Contractor shall remove all loose blocks and fragments by barring, prying, and employment of other hand methods which will not further fracture the rock. Rock surface shall be free of overhangs. Local fractured zones shall be removed by dental excavation methods, and backfilled with dental concrete. Dental concrete shall conform to requirements for Class AA concrete in accordance with Article 3-10. ADD.1 Item 9

e. Subgrade under the portion of gravel service roads placed on stripped ground surface shall be scarified to a depth of 4 inches and compacted with heavy pneumatic tired rollers as specified in Article 3-06 Fa "Moisture Content and Compaction - Impervious Fill and Earthfill". To provide a reasonably firm and smooth foundation for overlying gravel surface, grading or rolling with a smooth cylindrical roller may be required.

C. Materials:

a. Impervious Fill: Impervious fill shall consist of fine grained soil as obtained from required excavation or the borrow areas indicated on drawings. Impervious fill shall contain at least 50% material passing No. 200 U. S. Standard Sieve. It shall not contain cobbles or broken rock larger than 5 inches nor shall it contain more than 1% organic material.

b. Clay Fill: Clay fill, used as slope protection on Baffle Dike, shall consist of cohesive, fine grained soil classified by the United Soil Classification System as CL. It shall contain not more than 1% organic material.

c. Earthfill: Earthfill shall consist of fine and/or coarse grained soil from required excavation and borrow areas indicated on drawings. Earthfill shall not contain cobbles or broken rock larger than 5 inches nor shall it contain more than 1% organic material.

d. Random Fill: Random fill shall consist of any soil from required excavation and borrow areas indicated on drawings providing that it does not contain more than 5% organic material.

e. Sand and Gravel Fill: Sand and gravel fill shall consist of a clean, well graded mixture of sand and gravel, crushed stone or crushed gravel conforming to following gradation limits:

(1) Maximum Size: 3 inches.
(2) Between 65% and 85% shall pass 1½ inch U. S. Standard Sieve.
(3) Between 40% and 60% shall pass No. 4 U. S. Standard Sieve.

(4) Between 20% and 35% shall pass No. 30 U. S. Standard Sieve.

(5) Between 15% and 25% shall pass No. 50 U. S. Standard Sieve.

(6) Less than 15% shall pass No. 100 U. S. Standard Sieve.

(7) Less than 5% shall pass No. 200 U. S. Standard Sieve.

f. Gravel for Service Roads: Gravel for service roads on crest of dam, dikes, and elsewhere shall consist of gravel, crushed gravel or crushed stone meeting requirements of Section 29 (Gravel or Crushed Stone Base Course) of the State of Illinois Division of Highways' Standard Specification for Road and Bridge Construction.

g. Gravel Fill: Shall consist of gravel, crushed stone or crushed gravel, reasonably well graded from No. 4 U. S. Standard Sieve to 3 inches. Not more than 15% shall pass No. 4 sieve and not more than 5% shall pass No. 200 sieve.

h. Gravel Drain: Gravel for gravel drain under spillway shall meet criteria specified in ASTM C337 for coarse concrete aggregate. 3/4 inch to No. 4.

i. Riprap:

(1) Riprap shall consist of quarried stone, or other stone, free from structural defects and of approved quality. Stone containing shale, unsound sandstone or any other material which will readily disintegrate under handling and placing or weathering, shall not be used. Any stone which is free from incipient fractures and seams and has given evidence of ability to withstand weathering after long exposure to the elements shall be considered suitable for this purpose. Upon presentation of satisfactory evidence of ability to withstand weathering, such stone may be used without laboratory testing. In case newly quarried stone or stone of questionable weathering quality is proposed, it shall be subjected to the sodium sulphate soundness test and shall show a loss, after five cycles, of not more than 25%. Materials failing this test may be approved if, when subjected to fifty cycles of freezing and thawing, it has a loss not greater than 25%. Soundness method AASHO T104 (ASTM C88), "Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate" or T103, "Method of Test for Soundness of Aggregates by Freezing and Thawing" shall be used. The moist unit weight of riprap shall not be less than 140 pounds per cubic foot.

(2) Riprap shall be reasonably well graded with a gradation conforming to following weight limits (in pounds) for the particular layer thickness:

	Layer Thickness	At least 50% Larger Than	Maximum Size	Minimum Size
(a)	12 inches	40	150	5
(b)	18 inches	90	350	10
(c)	24 inches	160	650	20

(d) The shortest dimension of any stone shall be not less than 1/3 of the longest dimension.

j. Rockfill: Rockfill shall consist of quarried stone or other stone that meets requirements for a 12 inch layer of riprap as specified foregoing.

k. Topsoil: Topsoil shall be obtained from approved stockpiles of materials from stripping for dam, dikes, spillway, borrow areas, reservoir grading or other required excavation, and from other approved areas within limits of reservoir and ash pond. Material shall contain the most fertile loam available from approved sources. Material shall be free from excessive quantities of grass, roots, weeds, sticks, stones, or other objectionable materials.

l. Temporary Slope Protection: Upstream portion of dam below riprap shall be protected from reservoir wave action during reservoir filling by a 12 inch layer of temporary slope protection. This layer shall consist of either clay fill or gravel fill as specified foregoing or rock from required excavation or quarry operations. If rock is used, it does not have to meet the quality requirements for riprap providing that it will not readily disintegrate under handling and placing or during three years of weathering.

D. Equipment:

a. Compaction Equipment: Equipment to be used for constructing various types of fill may consist of any type normally considered suitable to construct embankments for dams or major highways. Main compaction equipment, including heavy pneumatic tired rollers, tamping rollers, segmented pad rollers, vibratory compactors, shall be subject to approval of Purchaser's representative.

b. In addition to the foregoing equipment, Contractor shall have the following equipment available at the WORK:

(1) Power tampers to be used for compaction of material in areas where it is impractical to use a roller or tractor.

(2) A plain cylindrical roller, weighing not less than 1,000 lbs. per lineal foot for rolling the surface of fill smooth for drainage in case of heavy precipitation.

(3) Discs, harrows, and motor graders for drying and maintaining fill.

E. Placing:

a. General. Fills shall be placed to lines and grades indicated on drawings. No brush, roots, sod, or other perishable or unsuitable materials shall be placed in fills. No material shall be placed when either fill material or foundation is frozen.

b. Placing Impervious Fill, Earthfill, and Random Fill.

(1) Fill materials shall be placed in continuous, approximately horizontal layers with moisture content and thickness as specified in Article 3-06F, "Moisture Control and Compaction." Embankments shall be maintained approximately level but with sufficient slope to assure rapid runoff of rainfall.

(2) Distribution and gradation of materials throughout rolled fill shall be such that fill will be free from lenses, pockets, streaks, or layers of material differing materially in texture or gradation from surrounding material. Combined excavation and placing operations shall be such that materials when compacted in the fill will be blended sufficiently to secure the best practicable degree of compaction, impermeability, and stability. Travel on the fill shall be satisfactorily controlled to prevent tracking or cutting fill.

(3) Successive loads of material shall be dumped so as to produce the best practicable distribution of material, and for this purpose locations in earthfill where individual loads shall be deposited may be designated, to the end that more clayey materials shall be placed in areas adjacent to center of embankments and less clayey materials placed toward outside slopes. If the surface of any layer of rolled fill is too dry or too smooth to bond properly with the layer of material to be placed thereon, or has formed a hard overcompacted crust from traffic, it shall be moistened or both moistened and scarified as required before the succeeding layer of material is placed.

(4) When rain is expected, and at the end of each working day, fill shall be rolled with a plain cylindrical roller to form a smooth surface with sufficient slope to cause rapid runoff of rainwater. Before resuming placement, this surface shall be scarified. If, in the opinion of Purchaser's representative, the rolled surface of any layer of earthfill in place is too wet for proper compaction of fill thereon, it shall be removed, allowed to dry, or shall be worked with a harrow, scarifier or other suitable equipment, to reduce water content to the required amount, and then shall be recompacted before the next succeeding layer of fill is placed.

(5) All openings through embankments required for construction and temporary drainage purposes shall be subject to approval, and such openings, if approved, shall be constructed so that side slopes are not steeper than 4 horizontal to 1 vertical. Approach or construction ramps on Cooling Reservoir or Ash Pond face shall be removed and those on outside face shall be removed and/or trimmed, as requested.

c. Placing Impervious Fill on Rock Surface at Bottom of Core Trench:

(1) Immediately prior to placement of impervious fill, rock surface at bottom of core trench shall be thoroughly cleaned of dirt and debris by streams of high pressure air and/or by brooms. Surface shall then be moistened but shall be free of running or standing water. A ½ inch minimum thickness of slush grout shall be broomed onto the cleaned surface of rock. Slush grout shall consist of a mixture of two parts soil to one part cement with a water-cement ratio of about 0.55 by weight. After slush grout has been applied and while it is still plastic and before it has taken an initial set, impervious fill shall be placed and compacted.

(2) Impervious fill shall be hand placed into depressions in foundation area and on top of slush grout and compacted by power tampers until fill is built up over the area to a depth sufficient for operation of roller equipment. Depth of hand placed layers shall be 4 inches and material shall be compacted to the density required for impervious fill under paragraph 3-06F, "Moisture Control and Compaction."

d. Placing Clay Fill Blanket on Baffle Dike:

(1) The layer of clay fill on each side of Baffle Dike may be placed as the earthfill portion of dike is being constructed or it may be placed on the slope of the completed earthfill embankment.

(2) If the surface of any layer of clay fill is too dry or too smooth to bond properly with the layer of material to be placed thereon, or has formed a hard over-compacted crust from traffic, it shall be moistened or both moistened and scarified before the succeeding layer of material is placed.

(3) When rain is expected, and at the end of each working day, clay fill shall be rolled with a plain cylindrical roller to form a smooth surface to cause rapid runoff of rainwater.

e. Placing Sand and Gravel Fill, Gravel Fill and Gravel Drain:

(1) Drawings indicate thicknesses of sand and gravel fill, gravel fill, and gravel drain to be placed in various portions of the WORK.

(2) Method of placing shall be such as not to disturb the foundation on which sand and gravel or gravel layers are placed to the point that drainage efficiency of layer is impaired. Method of loading, hauling and placing shall be such that a uniform, unsegregated layer is obtained.

(3) All fine grained soil that accumulates on surface of sand and gravel fill during construction operations shall be removed before subsequent layers are placed.

f. Placing Gravel for Service Roads: Gravel service roads shall be 6 inches thick and shall be placed in accordance with requirements of Section 29 (Gravel or Crushed Stone Base Course) of the State of Illinois Division of Highways' Standard Specification for Road and Bridge Construction, with the exceptions indicated in Article 3-06F, "Moisture Control and Compaction".

g. Placing Riprap:

(1) Riprap may be placed by dumping and shall be placed on face of sand and gravel layer to the lines and grades indicated on drawings. Placement operations, including handling, stockpiling and transporting, shall be accomplished in such manner as to produce a reasonably well graded mass of rock with minimum percentage of voids, free from objectionable pockets of small stones and clusters of large stones and having a reasonably regular finished surface.

(2) Riprap shall be placed to its full course thickness in one operation, when placed in a layer, and in such manner as to avoid displacing underlying sand and gravel layer more than 3 inches. In no case, however, shall a bulldozer be used in shaping the riprap slope. Average thickness of any layer shall not be less than the full specified thickness required. A tolerance of plus or minus 2 inches from slope lines and grades indicated on drawings will be allowed in the finished surface for riprap in the layer 12 inches thick. A tolerance of plus or minus 3 inches will be allowed in the finished surface for riprap in the layer 18 inches thick. For either layer thickness, extremes of such tolerance shall not occur within areas of less than 100 square feet. Handplacing to a limited extent may be required but only to the extent necessary to secure results specified foregoing.

h. Placing Rockfill: Rockfill shall be placed by dumping to lines and grades indicated on drawings. Placement operations, including hauling, stockpiling, and transporting shall be accomplished in such manner as to produce a reasonable well graded mass of rock with minimum percentage of voids, free from objectionable pockets of small stones and clusters of large stones.

i. Placing Topsoil: Areas to receive topsoil shall be brought to within 4 inches of prescribed final cross-section at all points and finished smooth and uniform before topsoil is applied. Topsoil shall be evenly placed and spread over graded area and rolled, in accordance with paragraph 110.3 of the State of Illinois Division of Highways' "Standard Specification for Road and Bridge Construction."

j. Placing Temporary Slope Protection: Temporary slope protection shall be placed and compacted as specified above for either clay fill, gravel fill or riprap depending on the particular material used.

F. Moisture Control and Compaction:

a. Impervious Fill and Earthfill: Impervious fill and earthfill shall immediately before compaction, have a water content not less than 2% below nor more than 4% above standard Proctor optimum moisture content. Impervious fill and earthfill shall be compacted using a maximum uncompacted layer thickness of 12 inches with either a tamping roller, a heavy pneumatic tired roller or a segmented pad roller to a density of at least 95% standard Proctor maximum density. The only exception to this is for impervious fill beneath and within 15 ft. of spillway which shall be compacted to a density of at least 100% standard Proctor maximum density. In confined areas which cannot be compacted by rollers, equivalent compaction shall be obtained by using power tampers or other approved methods using a maximum uncompacted layer of 4 inches.

b. Clay Fill: Clay fill shall, immediately before compaction, have a water content not less than standard Proctor optimum moisture content nor more than 4% above standard Proctor optimum moisture content. Clay fill shall be compacted using a maximum uncompacted layer thickness of 12 inches with either a tamping roller, a heavy pneumatic tired roller or a segmented pad roller to an average density of at least 95% standard Proctor maximum density for each 1000 cubic yards placed; however, in no case shall density be less than 90% standard Proctor maximum density. After the final layer of clay fill has been compacted, the surface shall be rolled smooth by use of a plain cylindrical roller.

c. Random Fill: Random fill shall, after placing, but before compacting, have a water content not less than 2% below nor more than 6% above standard Proctor optimum moisture content. Random fill shall be compacted using a maximum uncompacted layer thickness of 12 inches with either a tamping roller, a heavy pneumatic tired roller, a segmented pad roller or crawler type tractor to a density of at least 90% standard Proctor maximum density.

d. Sand and Gravel Fill; Gravel Fill, and Gravel Drains:

(1) Sand and gravel fill for drainage blankets under dam, spillway and a portion of the dike system and the gravel drain shall be placed in layers not to exceed 12 inches in thickness after compaction. Sand and gravel shall be thoroughly wet before placing to insure proper compaction. No sprinkling in place will be allowed.

(2) The portion of sand and gravel fill and the gravel drain used for drainage blankets shall be compacted with either a heavy pneumatic tired roller, a vibratory compactor or hand tampers to a density of at least 70% relative density.

(3) Moisture conditioning and compaction of the portion of sand and gravel used as riprap bedding or as channel slope protection and gravel fill will not be required.

e. Gravel for Service Roads: The gravel, crushed stone or crushed gravel used as gravel roadway material shall be moisture conditioned and compacted as specified under Construction Methods (Type A) in Section 29 (Gravel or Crushed Stone Base Coarse) of the State of Illinois, Division of Highways' Standard Specification for Road and Bridge Construction, with the exceptions that layer thickness after compaction may be 6 inches and that vibratory compactors may be used.

f. Rockfill: Rockfill shall be hosed with water during dumping and just prior to compaction. Compaction shall consist of one pass of a crawler type tractor or vibratory compactor.

G. Blanketing of Abutments of the Dam:

a. Where stripped ground is to be covered with an impervious fill blanket, Contractor shall:

(1) Scarify stripped ground surface to a depth of 4 inches.

(2) Compact scarified ground with four passes of a tamping or segmented pad roller.

(3) Place and compact impervious fill blanket as specified foregoing for impervious fill.

(4) Provide a reasonably smooth, dense surface by compacting surface of the top layer of fill with a rubber tired roller or plain cylindrical roller.

b. Where stripped ground is only to be compacted, Contractor shall:

(1) Scarify stripped ground to a depth of 4 inches.

(2) Compact scarified ground with four passes of a tamping roller.

(3) Provide a reasonably smooth, dense surface by compacting the surface with a rubber tired roller or a plain cylindrical roller.

3-07. LABORATORY CONTROL FOR FILL COMPACTION

Verification tests will be performed by a Testing Laboratory retained by Purchaser to ensure compliance with compaction requirements of these specifications. Contractor shall provide unskilled labor and shall otherwise assist Purchaser's representative in having these verification tests made.

3-08. INSTRUMENTATION

Contractor shall furnish and install 15 surface settlement monuments as indicated on drawings. In addition, Contractor shall install 16 observation wells as indicated on drawings and as specified in Article 6-05.

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SECTION 4 - SEEDING WORK

4-01. SCOPE

This section of the Specification includes requirements for the following, as indicated on the drawings, as hereinafter specified (under the Article numbers indicate), or as required to properly complete the WORK:

4-02. General — ADD.1 Item 10

4-03. Fertilizing

4-04. Seeding and Mulching

4-02. GENERAL

A. Contractor shall furnish all materials and perform all operations for both temporary and final seeding to produce a uniform stand of healthy grass where drawings indicate seeded surfaces and/or seeded topsoil.

B. Temporary Seeding and Final Seeding: Temporary seeding, as used herein, covers all items incident to the sowing of the grain or cover crop. Final seeding as used herein covers all items incident to the sowing of grass-seed mixtures for a permanent turf crop.

C. Lines and Grades: Ground preparation shall conform to requirements of Article 110.3 (b) Standard Specifications for Roads and Bridges Construction of Highways State of Illinois. Contractor shall grade the surface as required to assure a neat finished appearance to the lines and grades indicated on drawings.

4-03. FERTILIZING

A. Liming: Agricultural ground lime, conforming to requirements of paragraph 130.6 (Agricultural Ground Lime stone) of the State of Illinois, Division of Highways' "Standard Specifications for Road and Bridge Construction", shall be thoroughly mixed, at the rate of 2 tons per acre, with surface soil before completion of ground preparations. — ADD.1 Item 11

B. Fertilizer:

a. Fertilizer shall consist of Nitrogen, Phosphate and Potassium nutrients.

b. Fertilizer shall be applied at such rate that each acre will receive the following amounts of available units:

(1) Nitrogen 60 pounds

(2) Phosphate (P_2O_5) 100 pounds

(3) Potassium (K_2O) 100 pounds

c. Fertilizer can be placed during ground preparation or mixed with and placed with seed and mulch during final seeding.

d. Condition of fertilizer prior to placing shall be as approved by Purchaser.

4-04. SEEDING AND MULCHING

A. Seed:

a. All seed used shall conform to requirements of paragraph 130.3 (Seeds) of the State of Illinois, Division of Highways', "Standard Specifications for Road and Bridge Construction".

b. Maximum depth of planting shall be 1/2 inch.

c. Seed for temporary cover shall consist of rye grass applied at the rate of 40 pounds per acre.

d. Final seeding where surface is essentially level shall consist of a mixture of the following seeds in the amounts indicated:

Type of Seed in Mixture	Pounds per Acre
(1) Fescue (Kentucky 31 or Alta)	15
(2) Rye Grass, perennial	15
(3) Red Top, solid	8
(4) Lincoln Brome	15
(5) Clover, Alsike (inoculated)	5

e. Final seeding where slopes exceed 4 horizontal to 1 vertical shall consist of a mixture of the following seeds in the amount indicated:

Type of Seed in Mixture	Pounds per Acre
(1) Fescue (Kentucky 31 or Alta)	20
(2) Rye Grass, perennial (cover crop)	15
(3) Red Top, solid	8
(4) Vetch	15
(5) Lincoln Brome	15
(6) Clover, Alsike (inoculated)	5

B. Mulch:

a. Fine mulch, similar or equal to Silva-Fiber as produced by

Weyerhaeuser Company, Tacoma, Washington, shall be placed on any area seeded at the rate of at least 1200 pounds per acre.

b. A course mulch, similar or equal to Slope Protection Blanket as produced by American Excelsior Company, Chicago, Illinois (not necessarily in blanket form) shall be placed on top of the fine mulch at the rate of at least 3000 pounds per acre on all areas with slopes exceeding 4 horizontal to 1 vertical.

c. Mulch shall be smolder resistant and non-toxic to vegetation. It shall not prevent germination of seeds or be injurious to Personnel applying it.

C. Seeding and Mulching:

a. Temporary seeding:

(1) If final seeding cannot be completed during the specified time, Contractor may apply a temporary cover of Rye Grass to help prevent soil from eroding. Rye Grass seed shall be applied at the rate of 40 pounds per acre and may be applied without fertilizer or mulch.

(2) Rye Grass used for temporary seeding shall be uniformly distributed by use of a farm grass seeder.

b. Final Seeding:

(1) Final seeding shall be performed in accordance with paragraph 110.4 (Final Seeding) of the State of Illinois, Division of Highways' "Standard Specifications for Road and Bridge Construction" except for the first sentence in 110.4 (a) seeding time, and 110.4 (c) Fertilizer and Liming.

(2) Final seeding shall be performed between April 15 to June 15 or between August 15 to September 15.

(3) Inoculant shall be applied to vetch seed at suppliers recommended rate at time of seeding. Inoculant shall be applied at three times suppliers recommended rate if vetch seed is mixed with mulch and applied with hydraulic seeder.

c. Mulching: Fine or coarse mulching shall be uniformly distributed over the area at seeding time, using power mulching equipment. Fine mulch may be mixed with the seed and applied with a hydraulic seeder. If the slope being seeded is steeper than 4.0 horizontal to 1.0 vertical, in which case both fine and coarse mulch are to be placed on the slope, mulches shall be distributed separately with the fine mulch placed first.

d. Except as otherwise specified foregoing, methods of preparation of seed beds, fertilizing, mulching, seeding, sprinkling, maintaining, repair, and reseeding as required, will be at option of Contractor. Work shall be considered completed after a uniform and dense stand of healthy grass, free from bare spots and gullies formed by erosion, has been produced in accordance with these specifications.

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SECTION 5 - CONCRETE WORK

5-01. SCOPE

This section of the Specification includes requirements for the following, as indicated on the drawings, as hereinafter specified (under the Article numbers indicated), or as required to properly complete the WORK:

5-02. Asphaltic Concrete Gutters

5-03. Portland Cement Concrete Work

5-02. ASPHALTIC CONCRETE GUTTERS

A. Scope: Contractor shall prepare the foundation and shall furnish and place asphaltic concrete gutters indicated on drawings.

B. Foundation Preparation: Just prior to placing gutters, Contractor shall shape the natural ground or the fill or excavation surface to be covered by asphaltic concrete gutters as indicated on drawings or as otherwise requested. This shaped surface shall be compacted thoroughly and finished to a smooth, firm surface. All soft and yielding or other unsuitable material shall be removed and earthfill as specified in Article 3-06, "Fill", shall be substituted.

C. Materials:

a. Asphalt cement: Asphalt cement shall conform to ASTM D946 "Specification for Asphalt Cement for Use in Pavement Construction." The penetration grade shall be either 60 to 70 or 85 to 100. The amount of asphalt cement to be used in mixture shall be from 6% to 8% of the weight of dry aggregate.

b. Aggregate: Shall consist of a clean, well graded mixture of fine and course aggregate with a maximum size of 3/4 inch conforming to requirements specified in ASTM C33.

D. Preparing Mixture:

a. Mixing shall be done in an approved pugmill type mixer. Pug mill type mixer may be either batch or continuous type.

b. Unless otherwise approved, the asphalt plant supplying asphaltic concrete shall conform to requirements of ASTM D995 "Specification for Requirements for Mixing Plants for Hot Laid Bituminous Paving Mixtures".

E. Placing Mixture:

a. Mixture shall be placed on prepared bed only when foundation is dry and temperature is above 60° F.

b. Mixture shall be placed in one course, compacted to a uniform thickness. Curbs shall be formed as necessary and placed with adjacent paving to form monolithic construction.

c. The course shall be smoothed by raking or screeding and shall be thoroughly compacted by rolling with a power or hand-operated plain cylindrical roller weighing not less than 300 pounds. Curbs and areas that cannot be reached with rollers may be compacted with hand tampers.

d. After compaction, gutters shall be of thickness and cross section indicated on drawings. They shall be smooth and even and of a dense and uniform texture.

5-03. PORTLAND CEMENT CONCRETE WORK

A. Conform to applicable requirements of Standard Specification Form 1715 and to requirements hereinafter specified.

B. Concrete: Class AA (air-entrained) for all work unless otherwise indicated.

C. Cement: After brand and source of cement have initially been approved, changing of brands or source will not be permitted.

D. Splice Requirements for Reinforcing Bars: In place of splice requirements specified in Item (2), Table 15-29, Page 15-6 of Form 1715, splice requirements of ACI 318 shall govern. Reinforcing shop drawing setting plans for the work shall also clearly indicate length of lap for each bar. ADD.1 Item 12

E. Services of Testing Laboratory: Will be furnished by Purchaser, as specified in Article 9 of Form 1715.

F. Formwork: As specified in Articles 5 and 13 of Form 1715, with additional requirement that forms shall be removed as soon as practicable to avoid delay in curing and in repair of surface irregularities. ADD.1 Item 12

G. Consolidation of Concrete: As specified in Article 10.4.5 of Form 1715 and as follows:

a. Concrete shall be placed with the aid of mechanical vibrating equipment, supplemented by hand spading and tamping.

b. Vibrating equipment shall be of the internal type and shall at all times be adequate in number of units and power of each unit to properly consolidate all concrete. Internal vibrators shall maintain a frequency when submerged in concrete of not less than 7000 impulses per minute. In locations adjacent to formed surfaces, concrete shall be vibrated sufficiently until entrapped air bubbles between concrete and forms have had time to emerge from the concrete. Form or surface vibrators shall not be used unless specifically approved.

c. Duration of vibration shall be limited to that necessary to produce satisfactory consolidation without causing objectionable segregation. In consolidating each layer of concrete, vibrator shall be operated in a near vertical position, and vibrating head shall be allowed to penetrate under the action of its own weight and revibrate the concrete in the upper portion of underlying layer. Additional concrete shall not be placed until concrete previously placed has been vibrated thoroughly as specified or requested.

H. Time between Pours: Time between pours shall be defined as the time elapsing from end of striking off one pour to start of placing next one. Unless otherwise requested or approved, minimum time elapsing between adjacent pours shall be not less than 72 hours. Minimum time elapsing between placing successive lifts shall be 72 hours.

I. Time of Pouring the Ogee Section: To insure that final elevation of crest of spillway ogee section will be at normal reservoir elevation, the ogee section shall not be poured until 30 days after remainder of control structure of spillway has been poured and until 30 days after portions of the dam adjacent to spillway control structure have been placed.

J. Curing: As specified in Article 12 of Form 1715, and as follows:

a. All concrete surfaces on or against which concrete is to be placed shall be moist cured. Curing period shall be at least seven consecutive days, except for adjacent or successive pours as hereinbefore specified. All other surfaces shall be either moist cured for seven days or shall be covered with a curing compound. Before actual placement of each pour begins, Contractor shall have on hand and ready to install all equipment and materials needed for curing.

b. Moist curing shall be accomplished as follows:

(1) A continuous (not intermittent) application of water by a system of perforated pipes, mechanical sprinklers, or porous hose.

(2) Or by covering concrete with a 2-inch layer of saturated sand or other material kept wet continuously.

(3) Water for curing shall be clean and free from any element which might cause objectionable staining or discoloration of the concrete.

c. Membrane Curing: As specified in Article 12.4 of Form 1715, and as follows:

(1) Compound shall be applied by spraying in one coat to provide a continuous, uniform membrane over entire area. Coverage shall not exceed 150 square feet per gallon, and on rough areas coverage shall be decreased as necessary.

(2) When curing compound is used on unformed surfaces, application shall be made immediately after finishing operations. When curing compound is used on formed surfaces, surfaces shall be moistened with a light spray of water immediately after forms are removed, and shall be kept wet until surfaces will not absorb more moisture. As soon as surface film of moisture disappears, but while surface still has a damp appearance, curing compound shall be applied. Special care shall be taken to insure ample coverage at edges, corners, and rough spots.

(3) After curing compound has been applied and surface is dry to touch, any required repair of concrete shall be performed. Each repair, after being finished, shall be moistened and coated as specified herein.

(4) Traffic and other operations by Contractor shall be such as to avoid damage to coatings of wiring compound for a period of not less than 14 days. Where it is impossible, because of construction operations, to avoid traffic over surfaces coated with curing compound, membrane shall be protected by a covering of sand or earth not less than one inch in thickness at all times. Protective cover shall not be placed until curing compound is completely dry. Before final acceptance of work, Contractor shall remove all sand or earth in an approved manner. Any curing membrane that is damaged or that peels from concrete surfaces shall be repaired without delay.

K. Mud Slab: A concrete mud slab, 3 inches thick, shall be placed over entire foundation of spillway. Mud slab shall be placed immediately following final excavation to grade for upper part of spillway, and immediately following placement of sand and gravel fill in lower part of spillway. A polyethylene membrane, not less than 0.006" in thickness, shall be placed on top of the sand and gravel or gravel drain, whichever is higher, fill to prevent penetration of concrete paste into the drainage blanket. Concrete mix for mud slab shall be as approved. ADD.1 Item 13

L. Construction Joint Cleaning and Roughening:

a. Cleaning Horizontal Joints: Horizontal construction joints on lifts with relatively open and accessible surfaces may be prepared for receiving next lift by either wet sandblasting or by cutting with an air-water jet, as specified following:

(1) Air-water cutting. Air-water cutting of a construction joint shall be performed after initial set has taken place but before concrete has obtained its final set. Surface shall be cut with a high-pressure air-water jet to remove all laitance and to expose clean, sound aggregate, but not so as to undercut edges of larger particles of aggregate. After cutting, surface shall be washed and rinsed as long as there is any trace of cloudiness of wash water.

(2) Wet sandblasting. When employed in preparation of construction joints, wet sandblasting shall be performed immediately before placing following lift. Operation shall be continued until all unsatisfactory concrete, and all laitance, coating, stains, debris, and other foreign materials are removed. Surface of concrete shall then be washed thoroughly to remove all loose material.

(3) If surface of a lift is congested with reinforcing steel, is relatively inaccessible, or if for any other reason Purchaser's representative considers it undesirable to disturb surface of a lift before final set has taken place, surface cutting by means of air-water jets will not be permitted and use of wet sandblasting or light bush hammering will be required.

b. Cleaning Vertical Construction Joints. Vertical construction joints shall be cleaned by wet sandblasting, as hereinbefore specified, or by light bush hammering.

M. Contraction and Expansion Joints: Contraction and expansion joints shall be located respectively in floor and wall of spillway, as indicated on drawings. Direction of keys in floor slab only may be reversed upon approval. Waterstops (see Article 6-04) shall be center dumbbell type. Pre-molded filler (see Article 6-04) shall be placed as indicated on drawings. All faces of joint not covered with a pre-molded filler shall be coated generously to break bond. Curing compound may be used to break bond. Rubber sealant (see Article 6-04) shall be applied in all permanently exposed expansion joints.

N. Control Joints:

a. Control joints shall be constructed as indicated on drawings.

One-half of all reinforcement shall be cut at each control joint. Corrugated metal strips (see Article 6-04) shall be securely fastened to reinforcement and shall be coated on one side to break bond. Flat dumbbell waterstops (See Article 6-04) shall be installed as indicated on drawings. It will be at option of Contractor whether to place concrete continuously through joint or whether to interrupt placing and to form a construction control joint.

b. Rubber control joint strips (see Article 6-04) shall be used at exposed faces of all control joints. ADD.1 Item 14

O. Finishes and Finishing:

a. General: Types of finishes to be given various surfaces shall be as specified herein or as indicated on drawings. Surface irregularities are classified as "abrupt" or "gradual". Offsets caused by displaced or misplaced form sheathing or lining or form sections, or by loose knots in forms or otherwise defective form lumber, will be considered as abrupt irregularities, and will be tested by direct measurement. All other irregularities will be considered as gradual irregularities and will be tested by template. Length of template will be 5 feet for testing of formed surfaces and 10 feet for testing of unformed surfaces. Honeycomb is not considered an irregularity and shall be repaired without cost to Purchaser, wherever it occurs. Contractor shall clean all exposed surfaces of unsightly encrustations and stains.

b. Formed Surfaces Other Than Water Passages:

(1) Surfaces Backfilled: Surfaces upon or against which backfill or concrete is to be placed will require no treatment after form removal except repair of honeycomb and other defective concrete, and specified curing. Corrections or surface irregularities will be required for depressions only, and only for those which impair structural properties of work.

(2) Exposed Surfaces: Exposed surfaces will require no treatment other than that needed for repair of honeycomb and other defective concrete, and specified curing. Surface irregularities shall not exceed 1/4 inch for abrupt irregularities and 1/2 inch for gradual irregularities.

c. Formed Water Passages: Formed surfaces of water passages need no surface treatment other than that needed for repair of honeycomb and other defective concrete, and specified curing. Abrupt irregularities shall not exceed 1/8 inch.

Gradual irregularities shall not exceed 1/4 inch. As an exception to the foregoing, abrupt irregularities normal to direction of flow (with low side upstream of high side) shall be ground smooth.

d. Unformed Surfaces: Types of finish for unformed concrete surfaces are indicated as screed and float. Finishing of unformed concrete surfaces shall be performed by skilled workmen. Surfaces shall be sloped for drainage where indicated on drawings or as requested. Surfaces which will be exposed to weather and which would normally be level, shall be sloped for drainage. Unless use of other slopes or level surfaces is indicated on drawings or otherwise directed, narrow surfaces such as tops of walls and curbs, shall be sloped approximately 3%. Types of finish shall apply as follows:

(1) Screed Finish: Screed finish shall be applied to unformed surfaces that will be covered by backfill. Screed finish shall also be used as first stage of float finishes. Finishing operations shall consist of sufficient leveling to required grade and screeding to produce even, uniform surfaces. Gradual surface irregularities shall be such as not to impair structural properties of work.

(2) Float Finish: Float finish shall be applied to unformed surfaces not permanently concealed by backfill or concrete. Floating may be performed by use of hand or power driven equipment. Floating shall be started as soon as screeded surface has stiffened sufficiently, and shall be minimum necessary to produce a surface free from screed marks and uniform in texture. Gradual surface irregularities shall not exceed 1/4 inch. Joints and edges shall be tooled where indicated on drawings or where requested. Abrupt irregularities normal to direction of flow shall be ground smooth in spillway crest and ogee and apron or where requested.

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SECTION 6 - MISCELLANEOUS METALWORK, EMBEDDED WORK AND MISCELLANEOUS WORK

6-01. SCOPE

This section of the Specification includes requirements for the following, as indicated on the drawings, as hereinafter specified (under the Article numbers indicate), or as required to properly complete the WORK:

6-02. Services of Testing Laboratory
6-03. Welding
6-04. Miscellaneous Metalwork and Embedded Work
6-05. Observation Wells
6-06. Spillway Stop Log Assembly and Bridge Guard Railing
6-07. Spillway Anchor Bars
6-08. Cast Iron Pipe Drains
6-09. Corrugated Metal Pipe Culverts
6-10. Ash Pond Outfall Structures
6-11. Galvanizing
6-12. Cleaning and Painting
6-13. Samples Required

6-02. SERVICES OF TESTING LABORATORY

Will be furnished by Purchaser for inspection of welding, as specified in Article 10 of Form 1701, where deemed necessary by Purchaser and/or the Consulting Engineers.

6-03. WELDING

As specified in Article 8.5 of Form 1742.

6-04. MISCELLANEOUS METALWORK AND EMBEDDED WORK

A. Conform to applicable requirements following Standard Specifications, and to requirements hereinafter specified:

a. Form 1701.

b. Form 1737.

c. Form 1742.

d. Form 1743.

B. Include all applicable work included under Article 4 of Form 1742. Galvanize all ferrous metal, except cast iron and unless otherwise indicated, as specified in Article 6-06.

C. Waterstops:

a. Type and Size: As specified in Article 10.1 of Form 1742.

b. Continuous strips without field splices are preferred, although field splicing in accordance with manufacturer's recommendations, using special fittings and rubber cement, will be allowed. Bends shall have a radius of not less than 6 inches.

D. Premolded Joint Fillers for Expansion Joints:

a. Type: Sponge rubber, as specified in Article 18.1 of Form 1742.

b. Fillers shall be cut and installed as indicated on drawings, with removable strips to provide for rubber sealant closures in joints on all exposed faces.

E. Rubber Sealant Closures:

a. Conform to applicable requirements of Form 1755. ADD.1 Item 15

b. Provide Type A, Thiokol base, for all uses.

c. Color: To match color of adjacent surfaces as closely as possible, unless otherwise indicated.

d. Bond Breaker: Before priming surfaces to receive rubber sealant, cover top of premolded surfaces with plain kraft paper (do not use any adhesive type material) to serve as a bond breaker between rubber sealant and pre-molded joint fillers.

F. Rubber Control Joint Strips: A rubber control joint strip shall be used at exposed faces of all control joints. This filler shall be as indicated on drawings and as manufactured by Williams Form Engineering Corporation. Installation nails shall be clipped flush with outside surface of filler after stripping of form work. ADD.1 Item 15

G. Corrugated Sheet Metal: Corrugated sheet metal installed at all control joints as indicated on drawings shall consist of galvanized 22 gauge steel sheets with a depth of 3/4 inch. Galvanizing shall conform to ASTM A93, using a coating class of 1.25 ounce per square foot. Sheets shall be cut to required widths with no lateral lapping permitted.

6-05. OBSERVATION WELLS

A. Scope: Contractor shall furnish, fabricate and install observation wells as indicated on drawings.

B. Materials:

a. Well Screens: Type 304 Stainless Steel and of the wire wrapped type similar to the drive point as manufactured by Edward E. Johnson, Inc., St. Paul, Minnesota. Length of screen shall be 24 inches. Slot openings shall be 0.010 inch. Outside diameter of drive point shall not exceed 2 inches.

b. Riser Pipe: Standard 1¼ inch galvanized steel pipe. Couplings shall be galvanized. Pipe shall be fitted with a standard galvanized pipe cap with 1/16 inch air hole.

c. Sand Pack: The sand pack around well screen shall be clean, well-graded, fine to coarse sand with a gradation conforming to ASTM C33 for fine concrete aggregate. Sand with a finer gradation, as approved, may be used, providing that less than 85% passes No. 30 U. S. Standard Sieve.

d. Clay Seal: Shall consist of material conforming to requirements for clay fill in Article 3-06, "Fill" or a mixture of sand and bentonite.

C. Installation: Observation wells shall be installed in drill holes as specified following and as indicated on drawings:

a. Drilling: Holes for observation wells shall be drilled to depths indicated on drawings by any rotary drilling method using equipment approved by Purchaser's representative, which will insure proper placement of well screen, riser pipe, and sand pack. Hole diameter shall be determined by Contractor but shall not be less than 4 inches. Drilling muds shall not be used. When drilling below ground water table, Contractor shall keep water level in drill hole above ground water level at all times. Where necessary to keep drill hole open, steel casing with a minimum inside diameter of 4 inches shall be used and casing raised as installation progresses. During drilling for installation of observation wells, Contractor shall take representative jar samples of overburden at 5 foot intervals or closer where there is a distinct change in strata. Holes shall be logged by Contractor and logs shall be submitted to Purchaser's representative.

b. Placement of Well Screen, Riser Pipe and Sand Pack: Prior to placing well screen and riser pipe, sand pack material shall be placed at bottom of well as indicated on drawings. Assembled riser pipe and screen shall then be placed in hole as indicated on drawings so as to avoid jarring impacts and to assure that assembly is not damaged or displaced. Top of riser pipe shall be held at designated elevation during placement of sand pack. The sand pack material shall be added to level indicated on drawings, withdrawing any casing as necessary.

c. Placement of Clay Seal: Clay fill shall be placed to form a clay seal as indicated on drawings, with sufficient hand tamping to assure an impervious seal.

d. Alignment: Each completed well shall be reasonably straight and plumb, with screen and riser pipe centered in drilled hole.

e. Washing: After well has been backfilled, well shall be washed with water or water and air for at least five minutes.

6-06. SPILLWAY STOP LOG ASSEMBLY AND BRIDGE GUARD RAILING
Conform to applicable requirements of Articles 6-02 through 6-04, and to following

A. Galvanized Pipe: ASTM A120 "Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses".

B. Treated Select Structural Grade Timber, Rough Sawn: Section 125 (Timber and Preservative Treatment) of State of Illinois, Division of Highways' "Standard Specifications for Road and Bridge Construction".

C. Cable: The cable fastened to stop logs shall be nylon coated, galvanized aircraft cable as indicated in Catalog No. 72 of McMaster-Carr Supply Co., Chicago, Illinois.

D. Handwheel: The handwheel shall be fabricated entirely from metal. It may be either purchased or fabricated by Contractor, and shall include a secure means of locking the wheel in any position.

E. Flexible Beam Guardrail: As specified in Article 20.9 of Form 1742, and as follows:

a. Metal Thickness: 12 gauge

b. Railing Terminals: Provide standard terminal sections.

6-07. SPILLWAY ANCHOR BARS

A. Scope: Contractor shall drill holes and furnish and install reinforcing bars for spillway anchor bars.

B. Installation: After drilling, anchor bar holes shall be washed and blown out with an air jet until no water or dirt remains in holes. If anchor bars are not to be grouted in place immediately, holes shall be tightly plugged and again washed and cleaned immediately prior to placing and grouting of bars. At time of placing, the hole shall be partially filled with a thoroughly mixed, thick sand-cement grout, having a water-cement ratio of less than 0.9 by volume (0.6 by weight) and a sand-cement ratio of 3 (by weight). The reinforcing bar used as the anchor bar shall be forced into place while being vibrated by a concrete vibrating machine after which any remaining void shall be filled with grout. The entire grouting procedure shall be subject to approval. Grouting of bars shall be done not less than six days in advance of their embedment in concrete. Any bars which are found to be loose after grout has set up shall be removed and reset at no additional cost to Purchaser. Holes into which water is seeping or running shall be grouted upward from the bottom by means of a tremie pipe to prevent dilution of grout.

6-08. CAST IRON PIPE DRAINS

Conform to applicable requirements of Form 1746 and to following:

A. Pipe and Fittings: Cast iron bell and spigot, as specified in Article 4J of Form 1746. Pipe and fittings shall be Class A.

B. Installation:

a. Underneath upstream end of stilling basin floor slab, within gravel drain material, pipe shall be laid with open joints. Ends shall be centered in bell ends of Tee sections, leaving sufficient room for free passage of water but preventing gravel from entering pipe. Outer ends of pipe shall be closed by cast iron plugs or gratings retaining gravel fill.

b. Where located in concrete, joints shall be packed and caulked thoroughly and pipe shall be firmly supported to prevent movement during concrete placing operations.

c. Care shall be taken to avoid clogging of pipe during progress of work. Wooden plugs shall be provided and placed in any temporary openings and in permanent drain outlets. Wood plugs shall be removed after spillway has been completed and all debris has been cleaned out. If any drain should become plugged, it shall be cleaned out in an approved manner, or shall be replaced by and at the expense of Contractor.

6-09. CORRUGATED METAL PIPE CULVERTS

A. Scope: Contractor shall furnish and install all corrugated metal pipe (CMP) culverts and shall place all crushed rock, riprap, and concrete at entrances and exits of culverts as shown on the drawings. Conform to applicable requirements of Form 1746 and to requirements hereinafter specified.

B. Pipe: Double bituminous coated corrugated metal pipe as specified in Article 9 of Form 1746, with addition that pipe also be bituminous paved.

C. Installation: As specified in Article 9 of Form 1746, and as follows:

a. Camber Pipe 1% of height of future overlying fill, unless otherwise indicated.

b. Install piping in trenches excavated through partially completed embankments. Depth of trenches shall be at least 1½ times pipe diameter, and width of trenches shall be about 2 feet wider than pipe diameter.

c. Bed piping to 20 or 25% of its circumference in base foundation.

d. Backfill: As specified in Article 7.6 of Form 1714 and Article 9 of Form 1746. ADD.1 Item 16

6-10. ASH POND OUTFALL STRUCTURES

A. Scope: Contractor shall furnish and install all material comprising the ash pond outfall structures as indicated on drawings. This includes timber access bridge and inlet support frame, concrete work, and corrugated metal pipe for each of the two outfall structures under ash pond dikes.

B. Materials and Installation:

a. Lumber: Preservative Treated Douglas Fir or Yellow Pine as specified in Form 1760.

b. Anchor Bolts, Angles, Nails, Fasteners, and other Materials: Anchor bolts shall conform to applicable requirements of Form 1737. All angles, nails, fasteners, and other metal work shall be hot dipped galvanized.

c. Concrete Work: As specified in Section 5.

d. Corrugated Metal Pipe: As specified in Article 6-09.

6-11. GALVANIZING

As specified in Article 24 of Form 1742.

6-12. CLEANING AND PAINTING

A. Shop Work: As specified in Article 25 of Form 1742.

B. Field Work: Provide as specified in Articles 11, 12, 13, 14 and 17 of Form 1790, as applicable.

6-13. SAMPLES REQUIRED

Submit samples for following materials specified in this Section 6:

A. Waterstops: Standard sample.

B. Expansion Joint Filler: Standard sample.

AECOM

Appendix E: Baldwin Ash Pond; IDNR Dam Safety Operating and Maintenance Plan

DYNEGY MIDWEST GENERATION, LLC

BALDWIN ENERGY COMPLEX

Baldwin, Illinois

Randolph County

BALDWIN ASH POND

IDNR DAM SAFETY

OPERATING AND MAINTENANCE PLAN

IDNR Dam Identification No. N/A
IDNR Permit No. N/A

October 2013

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1.0 OPERATING PLAN

1.1 Emergency Telephone Numbers

The function of the Baldwin ash pond is for ash disposal for the station. This station is staffed with a full operation crew 24 hours/day, 365 days per year. The first notice of any type emergency to the dam or any portion of the embankments shall be made to the Shift Supervisor on duty (618-785-2294). It shall be the responsibility of the Shift Supervisor on duty to notify:

- Bob Kipp; Managing Director (618-785-3212; Bob.Kipp@dynegy.com);
- Tom Buelter; BEC Production Director, (618-785-3259; Tom.Buelter@dynegy.com);
- Don Crone, Manager Environment & Chemistry (618-785-3244; Donald.Crone@dynegy.com); and
- Nathan Rietz, Manager - Fueling (618-785-2611; Nathan.Reitz@dynegy.com).

One of the above designated personnel shall notify the following state government officials of an emergency condition as well as the following county personnel:

- Illinois Department of Natural Resources; Office of Water Resources; Division of Water Resources Management, Dam Safety Section, Dam Safety Engineers (217-782-3863)
- Illinois Emergency Management Agency, 24-hour service (217-782-7860)
- Randolph County Local Emergency Services & Disaster Agency (ESDA); (618-826-5000, ext. 227; 618-853-2656)
- St. Clair County Local Emergency Services & Disaster Agency (ESDA); (618-277-3012)

The following Dynegy Midwest Generation, LLC and Dynegy Operating Company personnel should then be notified:

- Dan Thompson, Vice President – DMG LLC (618-343-7822; Daniel.P.Thompson@dynegy.com)

- Jeff Biethman, Director Project Engineering (618-343-7742; Jeff.Biethman@dynegy.com)

- Rick Diericx; Senior Director – DOC Environmental Compliance (618-343-7761, 217-519-4034; Rick.Diericx@dynegy.com)

1.2 Responsible Party

The Managing Director and his staff shall be responsible for the operations and maintenance of the Baldwin ash pond. They shall be assisted in areas of inspection, maintenance, and operation, as required, through a contract with an appropriate qualified engineering firm.

1.3 General Description

The ash pond system consists of multiple structures, adjacent to each other. The bottom ash disposal is located on the northeast part of the system. The inactive fly ash pond is located at the southeast end of the system. The active fly ash pond contains a splitter dike and is located to the west. The eastern portion of the active fly ash pond, referred to as the the active primary fly ash pond, is essentially full. The western part of the active fly ash pond is currently in use and is referred to as the active secondary fly ash pond.

The original embankment was constructed in 1969. An inboard embankment raise of the secondary fly ash pond was constructed in 1989. The dikes were constructed mainly using clay from a nearby borrow source. Bottom ash was used to support the 1989 embankment raise on the sluiced fly ash, within the pond interior.

The ground surface varies, with embankment heights ranging from 20 to 60 feet. The elevation of the embankment crests appear to be El. 456 feet, except along the south embankment where the 1995 slide occurred.

Along this section of the 1995 slide, the embankment crest has been lowered to approximately El. 434 feet. A blanket drain was installed at the downstream toe, during the repair phase of the 1995 slide. Also, as a result of the 1995 slide, the water level was lowered to El. 430; and, soil was excavated from the top of the slide. One functional inclinometer and five piezometers, installed in 1995 in the slide area, are periodically monitored.

Water from the ash ponds is directed to a series of settling ponds, at the southwest corner of the site. Drop inlets and pipes also are used to convey water from the eastern part of the active secondary pond to the western side.

Spillways are not installed. However, one seepage berm is located at the final pond.

A pumping station is installed between the bottom ash pond and the secondary pond and is used to pump the bottom slag and bottom ash pond to the cooling pond, when the bottom slag and bottom ash pond reach a certain elevation.

1.4 Ash Pond Monitoring

Weekly Surveillance and Inspection

Inspections shall be made of the dams and outfall structure by BEC personnel.

Quarterly Inspection

Inspections shall be made quarterly by BEC personnel to determine the general condition of the dam and embankments. During these inspections, embankment erosion, tree growth, and embankment seepage shall be monitored. Seepage shall be observed for change in quantity and coloration.

Annual Inspection and Surveillance

The annual inspection of the dam and embankments shall be made in the fall of each year by a licensed professional engineer, experienced in performing such inspections. This inspection shall be followed by a verbal and written list of recommendations. Based on the findings and recommendations of the inspection, corrective action shall be taken by the BEC staff, as required, to assure safe and continued operation of the cooling pond.

Procedures and the methods of correction shall be performed in accordance with the recommendations of the professional engineer and as outlined in the maintenance portion of this report. Copies of this engineer's report, along with a listing of the corrective action taken, shall be forwarded to the Environmental Compliance Group office in Collinsville, Illinois. Because the berm is unpermitted, the reports will not be submitted to the Illinois Department of Natural Resources, Office of Water Resources, Division of Water Resources Management in Springfield, IL.

2.0 EMERGENCY ACTION PLAN

A separate Emergency Action Plan (EAP) is currently being prepared. The separate EAP shall be used for emergency response at this facility.

3.0 MAINTENANCE

3.1 General

Regular inspections and repairs as required of the dam, outfall structure, and embankments. These inspections, along with the review and recommendations made by the licensed professional engineer, shall be the basis for all maintenance activities.

3.2 Vegetation

In order to protect and retain vegetation on the slopes of the dam and embankments, fertilizing and reseeding shall take place in damaged or barren areas. This shall be conducted as soon as appropriate after being discovered. Trees and shrubs observed during the inspections shall be cut and removed from the dam, embankments, and spillway.

Routine mowing shall be conducted as needed on the crest of the embankments to facilitate inspections.

3.3 Earth Embankment Seeding

Barren or damaged areas shall be seeded as soon as possible after discovery. Damaged areas shall be filled with topsoil, limed, fertilized, and seeded with tall fescue (18-24") or smooth brome.

3.4 Method to Ensure Adequate Visual Inspection of the Ash Pond Embankments

The embankments shall be burned if needed to facilitate visual inspection. Utilize a team to walk the embankment to inspect for animal burrows, sloughing, cracks, woody vegetation, and other factors that may threaten the integrity of the cooling pond embankment.

3.5 Animal Damage and Repairs

Animal burrows and holes discovered during inspections shall be backfilled with clay and compacted. Special attention shall be given to animal burrows in the embankments and dam.

3.6 Restriction of Unauthorized Vehicles

The embankments and dam approaches shall be fenced, and signs shall be posted to prevent unauthorized travel on the roadways and slopes.

3.7 Instrumentation

One functional inclinometer and five piezometers, installed in 1995 in the slide area, are periodically monitored - on a semi-annual basis and with formal report submittals - to monitor for any evidence of significant berm movement or settlement.

4.0 Inspection Checklists

The following Inspection checklists should be used during the weekly and quarterly inspections. Beginning in July 2013, formal documentation using these forms will be required.

Baldwin Energy Complex
Ash Pond
***Weekly* Inspection Form**

Dam Location: Baldwin Energy Complex; Randolph County

Owner: Dynegy Midwest Generation, LLC

Permit No.: Unpermitted **Class of Dam:** N/A

Type of Dam: Earthen embankment

Type of Spillway: Drop inlet

Date Inspected: ____________________

Weather Conditions: ____________________

Pool Elevation: ____________________

Inspection Personnel:

____________________ ____________________

Name / Title **Signature**

Inspection Item	Conditions	Location of Problem and Recommended Remedial Measures and Implementation Schedule
Vertical and Horizontal Alignment of Crest		
Unusual Movement or Cracking at or Beyond Toe		
Seepage		
Vegetative Cover		
Embankment Erosion		
Structural Cracking		
Outfall Structures		
Other		

Condition Codes:

NE	-	No evidence of a problem.
GC	-	Good condition
MM	-	Item needing minor maintenance and/or repairs within the year, the safety or integrity of the item is not yet imperiled.
IM	-	Item needing immediate maintenance to restore or ensure its safety or integrity. Remediation should be completed within one month.
EC	-	Emergency condition which if not immediately repaired or other appropriate measures taken could lead to failure of the dam. Emergency measures to be implemented as instructed by engineering; such as pool draw down or stoppage of downstream road and rail traffic.
OB	-	Condition requires regular observation to ensure that the condition does not become worse.
NA	-	Not applicable to this dam.
NI	-	Not inspected – (list the reason for non-inspection)

Baldwin Energy Complex
Ash Pond
***Quarterly* Inspection Form**

Dam Location: Baldwin Energy Complex; Randolph County
Owner: Dynegy Midwest Generation, LLC
Permit No.: Unpermitted **Class of Dam:** N/A
Type of Dam: Earthen embankment
Type of Spillway: **Drop inlet**

Date Inspected: ______________________
Weather Conditions: ____

Pool Elevation: ______________________
Inspection Personnel:

______________________________ ______________________________
Name / Title **Signature**

Inspection Item	Conditions	Location of Problem and Recommended Remedial Measures and Implementation Schedule
Vertical and Horizontal Alignment of Crest		
Downstream Fill Slopes		
Upstream Fill Slopes		
Unusual Movement or Cracking at or Beyond Toe		
Seepage (Condition/Color)		
Vegetative Cover (Tree growth)		
Animal Damage		
Embankment Erosion		
Water Passages		
Structural Cracking		
Outfall Structures		
Other		

Condition Codes:

NE	-	No evidence of a problem.
GC	-	Good condition
MM	-	Item needing minor maintenance and/or repairs within the year, the safety or integrity of the item is not yet imperiled.
IM	-	Item needing immediate maintenance to restore or ensure its safety or integrity. Remediation should be completed within one month.
EC	-	Emergency condition which if not immediately repaired or other appropriate measures taken could lead to failure of the dam. Emergency measures to be implemented as instructed by engineering; such as pool draw down or stoppage of downstream road and rail traffic.
OB	-	Condition requires regular observation to ensure that the condition does not become worse.
NA	-	Not applicable to this dam.
NI	-	Not inspected – (list the reason for non-inspection)

Appendix F: Final Report of Geotechnical Investigation, Baldwin Power Station, Fly Ash Pond South Dike, Baldwin, Illinois, Woodward-Clyde Consultants, Inc. (1995)

Woodward-Clyde
Engineering & sciences applied to the earth & its environment

September 7, 1995
5E08560

Mr. Jeffrey E. Lamb
Senior Project Manager
Illinois Power Company
500 South 27th Street
Decatur, IL 62525

Subject: **Final Report of Geotechnical Investigation**
Baldwin Power Station
Fly Ash Pond South Dike
Baldwin, Illinois
Illinois Power Purchase Order P0900881

Dear Jeff:

This letter transmits our final report for the investigation of the ash pond dike slope failure at the Baldwin Power Station. The report provides our evaluation of the cause of the failure and recommends repair measures. This report supersedes the draft report of June 23, 1995.

We appreciate the opportunity to work with you on this challenging project and will call you to discuss the report within a few days.

Very truly yours,

Thomas L. Cooling, P.E.
Senior Associate

Melvin I. Esrig/mlr

Melvin I. Esrig, P.E., Ph.D.
Senior Consultant

TLC/MIE:mlr

Attachment

Woodward-Clyde Consultants, Inc.
2318 Millpark Drive • Maryland Heights, Missouri 63043
314-429-0100 • Fax 314-429-0462

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EXECUTIVE SUMMARY

The slide occurred in February 1995 on the ash pond south dike over a distance of about 500 lineal feet at a location where the dike is the tallest (55 ft) and crossed a former creek. The dike was constructed in two phases; a 35 ft high compacted clay dike built in 1969, and a 20 ft high "raise" constructed in 1989 on the upstream slope of the older dike. The 1989 raise consists of two materials: 1) bottom ash placed underwater extending to the crest of the older dike, and 2) compacted clay above the bottom ash extending to the current crest. A former haul road consisting of lime treated bottom ash and gravel exists at the crest of the old dike and is hydraulically connected to the bottom ash fill. Both clay dikes were well compacted; the bottom ash is very loose due to underwater placement.

Foundation Materials

The dike rests on a foundation of stiff clayey soils about 20 ft to 30 ft thick overlying weathered shale and limestone bedrock. Over time the surface of the shale has weathered to high plastic clay containing fissures and zones of weakness (slickensides) along which movement has occurred in the past (perhaps ancient landslides). A thin stratum of locally water-washed decomposed limestone and/or glacial till overlies this high plastic clay.

Cause of Slide

The overall slide consists of two portions: shallow and deep. The shallow portion occurred at the contact of the upper clay dike and bottom ash and caused significant damage to the 1989 raise.

The deep slide was not visually apparent at first, but was detected by deep instrumentation. The deep failure plane is located about 70 ft below the existing crest elevation at about the top of the fissured high plastic clay noted above. Prior to raising the pond level in October 1994, the dike was probably close to failure due to the low strength of the clay on the deep failure plane. When the pond level was raised, the deep failure was believed to be initiated by water pressure in the pervious water-washed zone directly above the high plastic clay. It is hypothesized that movement of the dike on the deep failure plane then formed a crack that extended through the clay dikes and bottom ash. As the crack widened, it created a void that was filled by soil and bottom ash migrating into it. This resulted in the upper dike settling. Concurrently the bottom ash and granular haul road permitted hydrostatic pressure equal to the pond head to develop beneath the toe of the upper clay dike. This water pressure lifted the toe allowing the upper clay dike to move laterally. Finally, rainwater in the tension cracks of the failed upper dike aggravated further movement. Lowering of the pond by 6 ft reduced the rate of movement significantly.

Earthquake Considerations

Baldwin is in an area of moderate seismicity. Due to its loose condition, the bottom ash could lose significant strength during earthquake shaking. Such a strength loss, termed liquefaction, could result in post earthquake settlement cracking of the upper dike, failure of the upstream slope of the 1989 raise and probable breaching of the dike where the raise is underlain by significant amounts of bottom ash.

Stability of the Remainder of the South Dike at Full Pond Head

Potential for deep failure (similar to the current failure) exists where the dike is higher than about 35 feet. In addition, the potential for shallow failure exists where bottom ash extends near the downstream slope of the dike. In both areas, the potential exists for earthquake induced liquefaction of the bottom ash.

Interim Repairs

To stabilize the slide area until the permanent repairs can be made, 20+ feet of soil was removed at the crest of the dike for about 600 lineal to reduce the driving forces of the slide. The excavated soil was stockpiled away from the slide area along the downstream toe of the dike for future reuse. This work, completed in July 1995, arrested the slide which had been moving at a rate of about 1/4 inch per day.

Repair Options

Analysis indicates that the most cost-effective method to stabilize the slide is to reduce the water pressure on the failure plane by draining the water-washed zone. Three primary remedial options were developed, two of which focused on drainage. The third option involved rebuilding the dike about 150 ft downstream of its present location. Key details of the three options are summarized below:

OPTION	KEY ELEMENTS	ESTIMATED COST (millions)	REMARKS
Parallel Wall	Cutoff wall, two drain walls pumps in drain walls	$4.3	Lowers groundwater level by pumping from drain walls. Preferred option by IP
Translated Dike	New dike 150 ft downstream of existing dike	$6.1[1]	Passive system (no pumps). May need right of way
HDPE wall	Impermeable cutoff wall of HDPE in center of dike	$5.7	Passive system, lowers groundwater level by very impermeable cutoff wall

[1] Does not include cost of additional right-of-way.

Parallel Wall - the Preferred Option

The Parallel Wall option is preferred by Illinois Power primarily due to cost and because the dike can be maintained along its current alignment with its current shape. Key elements of the Parallel Wall option for areas of potential deep and shallow failure are as follows:

Areas of potential deep failure (1,200 lineal feet)

- A soil-bentonite cutoff wall parallel to the dike constructed near the upstream toe of the dike to cutoff flow through the bottom ash.

- A "drain wall" consisting of drainage backfill such as coarse sand constructed by slurry trench methods using a biodegradable slurry to form a continuous drain. The drain wall will be located downstream of the cutoff wall to intercept seepage along the water-washed layer and seepage that penetrates the cutoff wall. The drain wall will extend about 60 feet deep and will include three pumps that will remove seepage collected by the drain wall. The pumps will operate continuously, but the amount of water to be pumped should be small (a few hundred gallons per minute) because the upstream cutoff wall should significantly retard seepage. During pond closure, a gravity system can be installed to replace the pumps. Pumping is also expected to mitigate the potential for liquefaction of the bottom ash.

- A shallow (25 ft deep) drain wall near the toe of the dike to collect and remove seepage that recharges from the stream. Pumps will be installed in this drain wall, but again the amount of water to be pumped should be small.

- Clay fill to restore the dike to its shape before failure. The clay can be placed when the water pressure at the failure plane has sufficiently drained based on field piezometers measurements.

Areas of Potential Shallow Failure (1,200 lineal feet)

- A soil-bentonite cutoff wall located upstream of the toe of the dike and extending through the bottom ash. This wall will be a continuation of the cutoff wall located in the area of potential deep failure.

- A series of three wells within the bottom ash located immediately downstream of the cutoff wall. The wells will be pumped to drain the bottom ash in order to control the head below the upper clay dike and mitigate the potential for shallow failure as the pond level is raised. Pumping should also mitigate the potential for liquefaction of the bottom ash. Again, the amount of water to be pumped should be small due to the cutoff wall.

Construction Schedule

A tentative construction schedule is to install the cutoff wall, drain walls, and pumps during the Spring and Summer of 1996. The clay fill to restore the dike to its original shape could be done the following Summer or Fall. This would allow about one year for drainage to occur.

Instrumentation

After the repairs are made, instrumentation should be installed within the dike to monitor its performance, especially as the pond level is raised.

Risk

Due to the uncertainties involved, stabilization of landslides involves a greater degree of risk than conventional design. Consequently, the preferred repair involves some risk of poor performance. This risk could be reduced by more conservative design which would involve greater design and construction cost.

FINAL REPORT OF GEOTECHNICAL INVESTIGATION
BALDWIN POWER STATION
FLY ASH POND SOUTH DIKE
BALDWIN, ILLINOIS

1.0
INTRODUCTION

1.1 SCOPE

This report presents results of the geotechnical investigation of the slope failure of the south ash pond dike at Illinois Power's Baldwin Power Station near Baldwin, Illinois (Figure 1). Woodward-Clyde Consultants (WCC) performed this work in general compliance with our proposal of March 29, 1995 and change order request of April 28, 1995. The study was performed under Illinois Power Company Purchase Order number P0900881 dated May 5, 1995. The purpose of the investigation was to address the following key issues:

1. The cause of slope failure.

2. Stability of the remainder of the south dike at the full pond elevation.

3. Recommendations to repair the dike to permit its operation at the full pond elevation.

A draft report was issued June 23, 1995. Subsequently, a meeting of WCC senior-level engineering and construction personnel was held July 21, 1995, at the plant site in an effort to develop other, more cost-effective, repair options than those recommended in the draft report. Two additional repair options, including the 'Parallel Wall" option currently favored by Illinois Power, were developed at the meeting and are discussed and described herein. This report supersedes the June 23, 1995, draft version.

1.2 BACKGROUND

We understand that the original dike forming the 60-acre ash pond was built in the late 1960's. At that time, the dike was built to a crest elevation of about 435±, resulting in maximum height of about 40± ft. The highest portion of the dike, which is in the area of failure, was situated in a former north-south trending stream channel. The dike was raised in 1989 by constructing an addition on the upstream (north) side. Construction was performed and costs reduced by the placement of bottom ash from pond bottom (el. 400±) up to the crest of the existing dike at about el. 435. Clay was placed above the ash from el. 435± to the current crest elevation of 456± as shown in Figure 2. Thus, a lower, original dike and an upper, new dike was formed. In the area of the slope failure, the pond has accumulated only a small quantity of fly ash. The normal pool elevation has been maintained during recent years at about el. 432. In October 1994, the pool was raised 6 ft to about el. 438 and maintained there until it was dropped in March 1995.

The following is a chronology of key events relating to the slide:

- February 22, 1995 - 150 ft long crack and a vertical drop in crest elevation (scarp) was found at the crest near Station 2+00[1] and noted by IP personnel. Vertical displacement at the crack, 10 inches.

- March 4 - Vertical displacement at crest scarp, 18 inches.

- March 7 - Vertical displacement at crest scarp, 3 ft. Large crack also noted 60 ft downslope from the crest on the downstream face parallel to the crest. Heavy rains evening of March 6 and morning of March 7.

---

[1] Refers to dike stationing established for this study.

*All elevations are in feet and are in NGVD datum.

- March 8 - First visit by WCC. Length of slide is 300 ft, vertical displacement of crest scarp is 3 ft. Crack 60 ft downslope (mid-slope scarp) is about 180 ft long with 1.5 to 2 ft vertical displacement.

- March 13 - Illinois Power begins lowering pond level at a rate of 0.5 inch per hour.

- March 14 - Second WCC visit. 150 ft long crack has formed west of crest scarp. Vertical displacement at crest scarp is 4 ft. Vertical displacement at mid-slope scarp is 3 ft; water visible in mid-slope scarp.

- March 20 - Water level has now been dropped by 6 ft to about el. 436. Movement of slide appears negligible. Heavy rains in late March and April cause some small additional movement.

- April 21 - Inclinometers show that a deep slide is occurring below the dike on a failure plane near el. 385, about 15 ft below the level of the ground surface at the toe of the dike.

- May and June - Crack propagates slowly westward at crest. Failed area about 500 ft long by June 9. Inclinometers indicate the slide is moving laterally at about 1/4 in. per day.

- June and July - Approximately 22 ft of soil was removed from the slide area as an interim repair. Movement along the failure plane during August has been negligible.

2.0
RECORDS REVIEW

As part of our investigation, WCC reviewed design drawings and construction records provided by IP which addressed the original dike construction and the subsequent raise.

A summary list of the records received and reviewed include:

- As-built drawings for the original embankment construction dated November 18, 1969
- Plan and Section Drawings of the proposed south dike embankment addition dated 1-6-81. (However, these design drawings for the proposed south dike addition do not match the 1988 construction drawings and records. The 1981 drawings show the raise made of clay and on the downstream face of the 1969 dike. The 1988 drawings show the raise consisting of clay and bottom ash and situated on the upstream face of the 1969 dike).
- A plan of the South Dike Addition dated May 14, 1986
- Earthwork cut/fill cross-sections dated April 15, 1988
- Specifications for South Dike Addition (W.O. 24579) dated May 1988
- Soil boring and soils testing letter report prepared by Professional Services Industries (PSI) dated August 19, 1988
- Partial soils test data (moisture-density relationship tests) performed by PSI dated August 1988.

2.1 ORIGINAL DIKE DESIGN AND CONSTRUCTION

The original dike was constructed during November 1969 using "earthfill" and "impervious fill" material as shown in the drawings. We presume both types of material were actually low plastic clay fill obtained on-site within the present pond area. The original embankment section had a 15-ft wide crest and 3H:1V side slopes between Station 46+66 and 58+77. (Dike stationing refers to stationing for the original dike construction as shown on construction drawings. The failure area is between Station 50+00 and 57+00.) The crest elevation was el. 435±.

Between Stations 46+66 and 58+77, a 6-inch thick gravel erosion protection layer was placed on the downstream slope surface of the dike between el. 408 ft and 400 ft. A 2-ft thick horizontal sand and gravel blanket drain was placed at the embankment toe and extended approximately 50 ft upstream beneath the embankment. A flat-bottomed drainage ditch was built about 40 ft downstream of the embankment toe. From the embankment toe, the ground surface was sloped at approximately 2 percent towards the drainage ditch. Upstream of the upstream toe at el. 415, the embankment slope transitions at a 6H:1V slope.

Between Station 58+77 and Station 81+00, the side slope changes to 2.5H:1V and the blanket drain was eliminated.

The top of the dike had a 6-inch thick layer of bottom ash surfacing along its entire length.

No construction records were provided documenting placement and compaction of 1969 embankment fill, although tests in this study show that it appears to be well compacted.

2.2 1989 DIKE RAISE DESIGN AND CONSTRUCTION

In 1989, the raise was constructed by first end-dumping bottom ash into the pond against the upstream slope of the embankment and over the fly ash deposited on the pond bottom. The bottom ash created a working platform above the water (Figure 3). The maximum total thickness of this bottom ash material is estimated to be approximately 35 ft. A haul road was built along the top of the original embankment to facilitate construction of the bottom ash working platform. It was constructed by placing a driving surface of bottom ash along the crest of the dike and stabilizing the ash with lime and fly ash. A pozzolonic reaction occurred between the bottom ash and the lime/fly ash, creating a surface resembling a weak concrete. The surface of the bottom ash working platform was placed against the upstream face to el. 436 ft, or approximately 1 ft above the roadway crest. The design indicated that the ash was to be placed to el. 434 ft, or approximately 1 ft below the top of the roadway (Figure 2). The fact that the bottom ash was placed to a level above the crest of the lower dike, plus the presence of the stabilized bottom ash roadway, are important factors in the failure, as noted later.

Within the water-inundated area, between approximately Stations 46+50 and Station 75+00, clay fill was placed directly on the surface of the bottom ash working platform to the crest of the present upper dike (el. 456), a height 20± ft above the original embankment crest.

The downstream slope of the addition was placed as an uninterrupted extension of the original 3H:1V downstream embankment face. (Survey data show that the actual slope is somewhat steeper, about 2.77H:1V) This resulted in the centerline of the upper dike being set back in the upstream direction approximately 60 ft from the original dike centerline. The remainder of the embankment section consisted of a 16 ft wide crest and an upstream face with a 2.5H:1V slope to the top of the bottom ash working platform.

To the east of Station 75+00, the height of the original dike was relatively small and resulted in the toe of the dike being setback relative to the toe of the higher portion of the dike further to the west. Between Station 65+00 and Station 74+00, a transition section was constructed where the dike centerline moved from the setback position to a position to coincide with the original dike centerline (Figure 4). The added height of the addition over the original embankment centerline results in an absence of a setback in the toe of the eastern portion of the embankment relative to the western portion. The cross-sectional template of the eastern portion of the dike matched that of the western portion. Compacted fill within the transition section and that further to the east consisted of clay and was placed directly on the existing ground surface.

Construction records indicate that the bottom ash (type "B" fill) on the upstream side of the lower dike was not compacted except for the top 12 inches, which was compacted to 90 percent of its maximum dry density according to ASTM D698.

The fill for the 1989 raise was borrowed from an area north of the ash pond north dike. It was generally silty clay, although some clayey silt was also used. It was reportedly compacted in lifts to 95 percent of its maximum dry density according to ASTM D698. Field density tests by PSI indicate that the specified level of compaction was achieved for all materials tested, although the actual test locations are difficult to verify.

3.0
SITE GEOLOGY

The site is geologically located upon the western flank of the Illinois Basin as shown in Figure 5. This structure defines both the structural geology and stratigraphy of the region. The Illinois Basin developed as a gradual down-warping of the earth's crust beginning in Cambrian time and continuing through the Pennsylvanian time period. Sediments accumulated within this trough from the advance and regression of ancient seas. The uppermost, Pennsylvanian-aged, sedimentary materials consist of interbedded limestones, claystones, shales, sandstones, and coals. These materials comprise the near-surface bedrock of the Spoon Formation that unconformably underlies the overburden materials at this site. Units of the Spoon Formation within the stratigraphic column encountered at the site include the following members: Vergennes Sandstone Member, Stonefort Limestone Member, Wise Ridge Coal Member, Creal Springs Limestone Member, Granger Sandstone Member, Cheltenham Clay Member, Curlew Limestone Member, Seville Limestone Member, and Assumption Coal Member. These units are typically thin, generally less than 2 feet in individual thickness, and are discontinuous in lateral extent. The Cheltenham Clay Member is of particular interest. It is comprised of the thinning out and merging of several underclay units where the coals, which typically overlie the underclays, are absent. These underclays are composed of high percentages of highly plastic clay minerals that are typically highly expansive and exhibit low shear strength as a result of water softening. All the sedimentary units encountered at the site are moderately to completely weathered due to water softening.

The deep-seated failure in the dike foundation occurred in a shale bed at the top of the sedimentary units. Water softening and weathering of the shale over geologic time reduced the shale strength and thereby contributed to the failure.

The surface topography and morphology of the site is controlled by surface deposits of glacio-fluvial and glacio-lacustrine origin. The Illinoisan aged, Vandalia till of the Glasford Formation was deposited unconformably as an end moraine on the Pennsylvanian-aged bedrock by the retreat of the glacier. The till is comprised of undifferentiated sand, silt, and clay materials. Near the end of the Wisconsinian period, the area adjacent to the Kaskaskia River became temporarily choked with excess sediment load creating a glacial lake. Mapping by the Illinois State Geological Survey indicates the glacial lake was located adjacent to the Kaskaskia River with the blockage occurring at a location within the immediate vicinity of the Baldwin Reservoir. Fine-grained sediments, light gray silts and clays of the Equality formation, were deposited within this slackwater area. Stream flows eventually cut through the sediment blockage and permitted the draining of the lake bed. The inundation of large areas by the glacial lake permitted deep-seated water softening of the clay based materials of the Pennsylvanian shales. Wind-blown, silty clay (loess) deposits 5 to 10 ft in thickness cover sediments of both the Glasford and Equality Formations. These wind-blown materials are classified as the Peoria Loess and Roxana Silt Formations. They form the present day, native surface soils.

3.1 REGIONAL SEISMIC SETTING

The geologic framework of southern Illinois is dominated by the Illinois basin to the east, the Ozark Uplift in southeastern Missouri, and the Mississippi embayment to the south along the Arkansas-Tennessee border. Within the Mississippi embayment to the south of the Illinois basin lies an ancient rift complex, which did not develop sufficiently to separate the continent, but caused the crust of the earth in that region to be greatly fractured and weakened. This rift complex is located in the region called New Madrid, where Missouri, Illinois, Kentucky, Tennessee, and Arkansas converge.

The New Madrid region has been the most seismically active region of central and eastern North America during historical times. In the winter of 1811-1812, three of the largest earthquakes known to occur in the interior of a tectonic plate shook the New Madrid region. These events were felt as far away as New England, a distance of over 1,000 miles. Although instrumental data are not available, a study of damage and felt effects by Nuttli (1973)[2] indicates that the events of December 16, 1811, January 23, 1812, and February 7, 1812 had surface-wave magnitudes (M_s) of about 8.6, 8.4, and 8.7, respectively. Current monitoring indicates that earthquakes of smaller magnitudes continually shake Southern Illinois.

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[2] Nuttli, O.W. (1973). "The Mississippi Valley earthquakes of 1811 and 1812: Intensities, ground motion and magnitudes," Bulletin of the Seismological Society of America, Vol. 63, No. 1, pp. 227-248.

A regional map indicating the epicentral locations of earthquakes having surface wave magnitudes (M_s) of 5 or more from 1811 to 1993 is shown in Figure 6. Superimposed on this figure are the acceleration contours having a 90 percent probability of not being exceeded in 50 years based on USGS data (NEHRP, 1988). This map is also used by Illinois DOT for design of bridges. The acceleration contours correspond to a return period of about 475 years and indicate bedrock acceleration at the site of about of 0.12g. For a larger return period such as 2500 years (considered the "maximum credible" level of shaking by the Uniform Building Code), the estimated bedrock acceleration according to NEHRP is 0.25g. For purposes of this study, we have used an acceleration of 0.12g. IDOT Division of Water Resources considers the site to be in Seismic Zone 2 corresponding to a "moderate probability of damage."

4.0
FIELD INVESTIGATION

The field investigation was conducted in two phases. The first phase was completed between March 17 and April 14, 1995, during which a total of 15 conventional test borings, 23 piezocone penetrometer soundings (CPTU) and 8 exploratory test pits were made. After completion of four of the borings, inclinometer casings were installed to measure lateral movement at depth. In addition, one conventional standpipe piezometer and 4 vibrating wire piezometers were installed to measure pore water pressures.

The exploration was concentrated in the slide area. Exploratory locations were selected along the crest of the existing dike and along the downstream slope, as shown in Figure 7. Borings and CPTU soundings were generally conducted to refusal and varied in depth from approximately 15 to 80 ft. A total of 8 test pits were excavated on the downstream slope of the dike, both in and outside the failure area, to visually assess conditions within the dike. Test pits were generally located at the elevation of the mid slope scarp because soils in that area were originally suspected of being the cause of the failure.

Outside the failure area, borings and CPTU soundings were performed only along the center line of the dike in alternating fashion at horizontal spacings of approximately 250 ft, as shown in Figure 4. Generalized subsurface profiles along the centerline of the dike and normal to the dike through the failed area are given in Figures 4 and 8, respectively.

After completion of the borings in mid-April, inclinometer readings indicated that a deep failure was occurring at approximately el. 385, i.e., approximately 70 ft below the crest of the dike. To further investigate this area, a second phase of explorations was performed from May 3 to May 19, 1995. Two additional borings (B-101 and B-102) with inclinometers and five additional vibrating wire piezometers (P-2A, P-3A, P-4, P-5A, and P-7) were installed. The vibrating wire piezometers were installed at the elevation of the suspected failure plane both within the failed area and outside the failed area to compare pore pressures in those two general locations. Borings B-101 and B-102 were advanced into bedrock by NX coring or a Pitcher Sampler to evaluate quality of bedrock.

Details of the field investigation are given in Appendix A along with the detailed boring logs, CPTU logs, and test pit logs. Inclinometer and vibrating wire piezometer data are given in Appendix C.

5.0
LABORATORY TESTING

Laboratory tests were performed to evaluate the index and engineering properties of subsurface materials. Initially, we suspected that the upper fill materials may have been improperly compacted. Consequently, a significant number of density tests and liquid and plastic limit tests were performed on the dike fill materials, principally the new (1989) dike. Laboratory compaction tests were also performed; two on soil from the new dike and two on soil from the old dike. Gradation and specific gravity tests were performed on the ash material. Finally, consolidated-undrained triaxial tests with pore pressure measurements were made to estimate the undrained and drained strength of the dike materials and certain foundation materials. Direct shear tests were performed on soil samples near the deep failure plane. Testing was concentrated on samples from the failure area; more limited tests were performed outside the failure area. Results of the laboratory tests are given in Appendix B.

6.0
SITE AND SUBSURFACE CONDITIONS

6.1 SURFACE OBSERVATIONS

Initial observations of the slide made in mid-March 1995 indicated significant movement and failure in the new portion of the dike, i.e., the portion above el. 435±, which was constructed in 1989. The ground surface of the failed area appeared to have settled and rotated downward and outward. As noted previously, the main scarp with the largest offset (4 ft in mid-March) was located in the crest of the dike approximately between Stations 1+00 and 3+00. (See photograph 1 in Appendix A.) A crack at the crest was also visible between approximately Stations 0-50 to 1+00 with minimal vertical offset. By June, however, about 1 ft of vertical offset had developed along this crack and it had extended westward to near Station -1+00. At the east end of the slide, the main scarp at the crest turned downstream and extended to nearly the toe. A crack about 50 ft long developed at the southeast corner of the slide and joined the scarp extending down the slope (Figure 7). On the westside, the crest scarp stopped on the downstream slope only a few feet below the roadway at the crest.

Another major feature of the slide was the mid-slope scarp, which developed parallel to the crest at the crest elevation of the original dike, i.e., el. 435±. Soil on the downslope side of the midslope scarp was lifted vertically 2 to 3 ft. It appeared that the upper portion of the dike moved downward and rotated such that it slid slightly beneath the surficial soil at the face of the original dike below el. 435 (see photograph No. 2 and Appendix A). Test pits confirmed this mode of movement.

Except for the crack noted at the southeast corner of the failure, there were no obvious signs of movement below the midslope scarp in March. This crack was judged to be a secondary crack related to the movement of the soil above. No other signs of movement on the lower portion of the dike such as bulging at the toe, significant cracking or movement of trees were noticed in early March.

Inclinometer readings on April 21 indicated that a deep slide was occurring about 70 ft beneath the crest of the dike (el. 385±). Surface observations were made on April 22 to visually check for signs of movement of the old dike. We suspected that the dike was moving laterally into the creek south of the dike, however, no signs of movements were apparent. Later observations in May suggested that the movement was into the creek and that the creek was eroding the toe of the dike and washing it downstream. Heavy rains during April and May aggravated the movements and caused cracks at the crest and elsewhere to widen.

6.2 TEST PIT OBSERVATIONS

Test Pits TP-1 and 2 were hand excavated about 1 ft deep north of the north toe of the upper dike to obtain samples of bottom ash for testing. Test Pits TP-3, 4, and 5 were machine excavated in the failed area across the midslope scarp. Test Pits TP-6 and 7 were excavated outside the failure area at a comparable elevation to TP-3 through 5 to compare conditions outside the failed area to those in the failed area. TP-8 was excavated across the crack at the southeast portion of the failure area. Test pit locations are shown in plan on Figures 4 and 7. Test pit logs and photographs are given in Appendix A.

6.2.1 Test Pits Through Failed Area (TP-3, 4, and 5)

Test pits confirmed that a 1± ft thick granular zone near el. 435 separated the upper and lower portions of the dike and extended to near the downstream face. This zone was presumably the old haul road and consisted chiefly of bottom ash and gravel, with some fly ash and clay. It was apparently lime treated in some areas, making it difficult to excavate (see test pit logs TP-3, 4, and 5 in Appendix A and photos 4, 5, and 6 in Appendix A). This zone was sheared vertically at the midslope scarp and the downslope portion was lifted upward a foot or more with respect to the upslope portion. Water was seen observed from the granular zone indicating that it was relatively permeable with respect to the clays above and below (Photo 7 in Appendix A). In some trenches, the midslope scarp was traced vertically to the bottom of the trench. It was 2 to 3 inches wide and filled with soft clay.

The test pits also verified that the older and newer portions of the dike consist generally of compacted low to medium plastic clay in a stiff to very stiff condition.

Test Pit TP-8 at the southeast portion of the failure area indicates stiff to very stiff low plastic clay fill. The crack at the ground surface extended vertically downward to the bottom of the test pit. It was one to two inches wide and contained very soft clay.

6.2.2 Test Pits Outside the Failed Area

Test Pits TP-6 and 7 were located west and east of the failed area, respectively. Both test pits encountered the old haul road material at the contact between the upper and lower portions of the dike (Photos 8 and 9). No seepage, however, was noted from this zone as it was in the trenches of the failed area. This zone in the non-failed area appeared to be stronger, perhaps treated with more lime than in other areas, causing it also to be less permeable. The granular layer in Test Pits TP-6 and 7 was also nearly level, since it had not been displaced by the slide as in the failed area. The clay fill of the upper and lower dikes was similar in the non-failed areas. At Test Pit TP-6, it appeared that the upper 3 ft of soil was poorly compacted. We suspect this soil was spread over the surface of the slope to regrade and smooth the transition between the old and new dikes.

6.3 SOIL CONDITIONS

Explorations revealed nine key materials comprising the dike and its foundation, as described below and shown graphically in Figures 4 and 8. Key geotechnical data are given in Table 1.

6.3.1 Dike Materials

New Dike

The new dike is composed of generally to medium plastic clays and silty clays with occasional zones of high plastic clay. The undrained shear strength of these materials is generally greater than 1.0 tsf. Two laboratory compaction tests (ASTM D-698) indicate an average maximum dry density of 106.1 pcf and optimum water content of 20 percent. Dry densities determined from

Shelby tube samples were compared with the maximum dry density from the compaction test to determine the percent compaction of the embankment. In general, compaction met or exceeded the 95 percent design criterion, as shown in Figure 9.

Old Dike

Materials of the old dike are similar to the new and consist generally of low and medium plastic clays. The undrained shear strength is typically about 1.0 tsf. The laboratory maximum dry density is 102.4 pcf and the average optimum water content is 22 percent. Based on dry density data from the borings, the lower dike was also generally compacted in excess of 95 percent, as indicated in Figure 9.

Bottom Ash

The bottom ash beneath the new dike has the gradation of medium to coarse sand with traces of fine gravel and contains less than 5 percent silt-size or finer material. The upper two to three feet has generally been well compacted and/or lime treated, causing it to be very strong. In some cases, cone penetration equipment met refusal on top of the bottom ash. Below the upper two to three feet, however, the bottom ash is loose to very loose with Standard Penetration test N-values of about 5. This is consistent with loose placement under water.

6.3.2 Foundation Materials

The native soils forming the dike foundation consist of alluvium, loess, glacio-lacustrine and glacial till deposits, residual high plastic clay (decomposed shale), and interbedded shale and limestone bedrock.

Alluvium (Creek Deposit)

As noted, the failure area occupies a former stream channel. Consequently, the soils directly below that area are alluvium approximately 5 ft thick which can be characterized as a gray clayey silt and silty clay with traces of silty sand and black organics. The alluvium generally has a stiff to very stiff consistency with an undrained shear strength of about of 1.0 tsf.

Loess

Outside of the area occupied by the stream channel, the dike is directly underlain by 5 to 10 ft of loess, a wind deposited silt which has weathered in place to a low to medium plastic silty clay. It is typically brown in color and has a firm to stiff consistency. The existing dam materials are constructed primarily of compacted loess since this was the most probable material exposed at shallow depth in the borrow area. The loess was not found in the borings drilled within the old stream channel.

Glacio-Lacustrine Soils and Glacial Till

The loess and alluvium is underlain by a 5 to 20 ft thick zone of glacio-lacustrine and glacial till soils. The upper portion of the zone is typically glacio-lacustrine, a stiff to very stiff low to medium plastic clay with occasional sand and silty zones. This grades downward to glacial till which is a very stiff to hard medium plastic clay with varying amounts of sand and gravel. Within the glacial till, random pockets of sand and gravel were encountered.

Residual Clay

The glacial till rests upon either a thin moderate to highly weathered limestone stratum or a very stiff to hard high plastic residual clay (decomposed shale) which has formed in-place from weathering of the underlying shale. Inclinometer data indicate that the deep failure is occurring at the contact between the till and the underlying soil or rock. Direct shear tests on samples of the residual clay indicated a residual (large displacement) friction angle of 12^{o}. In Piezometer P-4, a thin zone of gravel that appeared to have had the fine matrix surrounding it washed away by flowing water was encountered at the suspected depth of the failure plane. Borings generally encountered a mixture of silt, clay, and gravel at this contact which may be decomposed limestone bedrock or glacial till that has been sheared by this or past slides.

Limestone and Shale Bedrock

Bedrock exists below the till or residual clay and consists primarily of weathered clay shale with interbedded limestone. Limestone beds are thin, usually less than 1 ft, and slightly to moderately weathered. The upper portion of the shale is clayey, high plastic, highly weathered with low strength, especially along the bedding planes. Slickensides (shiny surfaces of earlier movements) are visible in some samples. Weathering decreases somewhat with depth.

6.4 GROUNDWATER

A total of ten piezometers were installed to measure pore pressure at various depths within and below the dike. With the exception of Piezometer P-1, all were vibrating wire piezometers so the response time would be short in the clayey soils of the embankment and foundation. Piezometer P-1 was a standpipe piezometer installed in the bottom ash to measure pond level. Piezometer P-6 was then installed adjacent to P-1 to a depth of several feet above the bottom ash. Piezometers P-2 and P-3 were installed prior to detection of the deep failure and were installed above the failure zone in either the old dike or the underlying creek deposit. Later, Piezometers P-2A, P-4, and P-3A were installed in the failed area at about the depth of the failure plane. P-5 was located outside the failure area at a comparable depth as P-2 installed within the failure zone. Later, after the deep failure plane was recognized, Piezometers P-5A and P-7 were installed outside the failure area to an equivalent elevation as the failure plane.

The shallow and deep piezometers show different pore pressures, suggesting two groundwater regimes; one in the embankment related to flow through the bottom ash and another in the foundation at depth (Figure 10). At the toe and within the failed area, the pore pressures near the failure plane are higher than those in the embankment, probably because of the presence of the blanket drain.

Outside the failure area, the deep piezometers show water levels similar to those of the deep piezometers in the failed area. The shallow piezometers, however, show a lower head in the unfailed area than in the failed area. This suggests that the ash may be less pervious, perhaps due to lime treatment, producing significant head loss to begin further from the downstream face in the unfailed area than in the failed area. Piezometer data are summarized in Table 2.

6.5 INCLINOMETER AND CRACK SETTLEMENT GAUGE DATA

Inclinometer data are plotted on Figure 11 and indicate that movement near the crest of the dike is occurring at the contact of upper dike and the ash. Further downstream failure is occurring near el. 385, at about the contact between the till and high plastic clay. Inclinometers B-11A and B-12, indicate that movement appears to be occurring in a very thin zone. In the inclinometers in Borings B-101 and B-102, movement occurred over a greater depth. The latter two inclinometers were installed about a month after B-11A and B-12.

Illinois Power installed several crack gauges across the main scarp and mid-slope scarp. The first group were installed in early March when movement was first noted, and a second group was installed after April 21, when the deep slide was noted. Results of these data are presented in Appendix C and on Figure 17. They indicate an average daily settlement of approximately 2.7 inches per day in early March 1995 prior to lowering the pond level 6 ft. The rate of movement dropped to 0.3 inch per day during late April and May. This was comparable to the rate of horizontal movement observed in the inclinometers for that time period. Therefore, lowering the water level 6 ft resulted in about a tenfold reduction in the rate of movement. Movement after the interim repair was negligible as shown in Figure 17.

7.0

DISCUSSION

7.1 CAUSE OF THE FAILURE

Data indicate that initially two slides occurred, one in the upper dike at its contact with the bottom ash, the second in the foundation on the residual clay. Slide movement is very sensitive to water pressures; therefore, lowering the pond 6 ft appeared to reduce the rate of movement by a factor of 10. After lowering the pond, the vertical settlements that were being measured became nearly imperceptible without instrumentation..

Our initial premise of the cause of failure was poor compaction of the upper dike. Test data showed, however, that the upper dike was generally well compacted and had relatively high strength. There was some suspicion of a low strength material at the base of the upper dike, however, none was found.

Another premise was that the pervious haul road fill found in the failure area was an avenue for water to travel from the ash to the face of the dike and to produce pond level hydrostatic head near the toe of the upper dike. This pressure certainly reduced the strength at the toe of the upper dike but calculations did not indicate that failure should occur for a 6 ft head difference.

When the deep failure was detected, we backfigured the strength along the failure plane assuming water pressures on the failure surface equal to the pond level at el. 438±, the level when failure first occurred. The backfigured friction angle was 15.5 degrees, assuming no cohesion. This low friction angle is consistent with residual (large displacement) friction angles measured in fissured or slickensided high plastic clays and shale such as found at the Baldwin Plant. Such low residual friction angles can develop over time as movement occurs or can be the result of movements that have occurred in the past, such as by former slides, shrinkage or swelling, or stress relief. The geologic history of the area, the overriding of the area by a glacier followed by inundation by a former glacial lake provided the opportunity for such stress relief and for softening of the residual clay and shale. This may have caused an ancient slide in this area or at least produced significant enough movements to reach the residual strength. Compounding the problem of low strength clay (decomposed shale) was the presence of a thin "washed out" zone immediately above the clay. This relatively pervious zone, that appears to have been created by water-washing, allowed pore pressures from the pond to develop at the failure plane. It is clear from the piezometer readings that pore water pressures nearly equal to pond level were (and are) present on the failure surface.

Based on the information to date, we believe the failure occurred as follows:

1. The original dike was near failure prior to raising the water level in October 1994 due to progressive failure or past movement on the low strength clay on the deep failure plane.

2. After the pond level was raised 6 ft, the water-washed zone directly above the failure plane allowed additional head to develop which initiated the failure along the low strength clay. The time needed for the development of these water pressures is unclear because the continuity and permeability of the water-washed zone is unknown. This may account for the delay from October 1994 to February 1995 for the failure to become apparent.

3. As lateral movement occurred, the dike cracked to the depth at the deep failure surface along a near-vertical failure plane within and below the crest. Soil and bottom ash migrated into the resulting crack which allowed a void to develop below the upper dike.

4. After enough movement and loss of ground had occurred, the upper clay dike slumped down to fill the resulting void caused by continued movement. Concurrently, hydrostatic pressure in the bottom ash lifted the toe of the upper dike, allowing the upper dike to slide horizontally below the failed toe area. This created the mid-slope scarp.

5. Lowering the water table slowed the rate of movement but did not stop it. Continuing lateral movement created void space resulting in loss of ground and continued settlement of the failed area.

During this entire process, the heavy Spring rains filled cracks in the failed dike thereby adding to the movement.

7.2 ESTIMATED PERFORMANCE OF THE REMAINDER OF THE SOUTH DIKE

Two potential modes of failure are possible along the south dike similar to those that occurred in the failed area. These are: 1) deep seated failure on the high plastic clay and 2) shallow failures due to hydrostatic pressure in the bottom ash causing uplift of the upper dike.

7.2.1 Areas of Potential Deep Failure

To evaluate the potential for deep failures, we calculated slope stability factors of safety at various locations along the dike, assuming a weak layer at depth. Our calculations indicate that where the height of dike is less than approximately 35 ft, deep failure is unlikely. Based on this, it appears that the potential for deep failure is greatest between stations -6-50 and 5+50 (approximately 1,200 lineal feet).

7.2.2 Areas of Potential Shallow Failure

Shallow failure at full pond head is possible along those portions of the dike where bottom ash is present and near the downstream face. Test borings encountered bottom ash from the west end of the dike to approximately Station 14+00. Design cross sections show ash extending near the face to about Station 13+00. Based on these data, we estimate that failure of the upper portion of the dike due to hydrostatic pressure in the ash could extend from the west end of the dike to about Station 14+00.

7.3 LIQUEFACTION POTENTIAL

Another concern with the bottom ash is the potential for liquefaction; the temporary loss of strength in saturated granular materials due to earthquake shaking. Liquefaction would cause compaction at the bottom ash, settlement and cracking of the upper dike bearing on the ash and the potential for rain-induced lateral movement. We evaluated liquefaction potential based on a bedrock acceleration of 0.12g and a corresponding earthquake magnitude of 6.5. Based on this level of shaking and the strength of the ash estimated from the Standard Penetration Test and cone penetrometer, it is very likely that liquefaction would occur in the bottom ash. For higher levels of shaking, the probability of liquefaction occurring increases.

The consequences of liquefaction vary depending on the water level and the thickness of fly ash within the pond. As a minimum, liquefaction would cause densification of the bottom ash and settlement and cracking of the upper clay dike. With water at the full pond elevation (el. 454±) and no fly ash as a stabilizing berm, stability analysis indicates that failure of the upstream slope of the pond is probable. This type of failure would extend to the downstream face and likely cause breaching of the dike and loss of water. On the other hand, the potential for failure of the upstream face and breaching of the dike is lower if the fly ash level is near the pond level. To reduce the potential for breaching of the dike due to liquefaction, it is believed necessary to strengthen the ash or closely control the fly ash and water levels. To be conservative, we recommend that the loose bottom ash be strengthened (or drained) to minimize the risk of liquefaction regardless of pond level. Our remedial design assumes that IP wishes to follow such an approach.

8.0
STABILITY AND SEEPAGE ANALYSES

8.1 STABILITY ANALYSIS

Our stability analyses consisted of the following three distinct tasks:

1. During the first task, we attempted to evaluate the material strengths necessary to cause the observed slope failure of the south dike.

2. The second task involved using these strengths in the analysis to determine the recommended repairs to the slide.

3. The third task involved the analysis of liquefaction potential of the upstream slope of the upper dike.

The computer program UTEXAS3, which is based on the Spencer Method, was used to conduct the analyses.

Strength parameters used in the analyses for the dike system and foundation were estimated using laboratory test results, experience, and engineering judgment. The strength parameters are presented in Table 3.

The dikes, alluvium, and loess were assigned the same strength characteristics based on (1) evaluation of triaxial tests conducted on material from the dikes, alluvium, and loess, and (2) the assumption that the dike system was constructed using loess. The remaining materials were assigned strengths based on index property tests, unconfined compression test, CPT data, and judgment.

Task A - Failure Plane Strength

A back-calculation was conducted to estimate the material strength at the failure plane. Complete strength was applied to each soil type while the strength of a thin soil layer at the estimated elevation of the failure plane was varied in order to develop a factor of safety at unity. The analyses estimated that a material with a friction angle of approximately 15.5 degrees and no cohesion could cause a wedge shaped failure of the dike system. The basic geometry assumed during the back-calculation stability analyses is presented on Figure 12. The failure plane predicted by UTEXAS3 is presented on Figure 13.

Task B - Repair Stability

Stability analyses were completed for the slide repair designs in general accordance with procedures outlined in the Illinois Department of Transportation publication Procedural Guidelines for Preparation of Technical Data to be Included in Applications for Permits for Construction and Maintenance of Dams, January 1993. Selected cases including steady state, end of construction, and earthquake loading were evaluated for areas of (1) potential deep sliding, and (2) potential shallow sliding for the three primary repair options. The resulting factors of safety are presented in Appendices D, E, and F, which discuss each primary repair option.

Task C - Liquefaction Potential

Liquefaction potential of the impounded bottom ash is significant considering the nature of the bottom ash and the pond level. A stability analysis was conducted to evaluate the potential for a failure of the upstream slope due to liquefaction of the bottom ash.

Based on published data for clean sands, the liquefied bottom ash was estimated to have a residual strength during liquefaction of approximately 100 pounds per square foot. Considering the strength of the bottom ash and the undrained strength of the remaining materials, the stability results indicate that slope failure is very likely as shown in Figure 14. Such a failure could result in breaching the dike and loss of fly ash and water.

8.2 SEEPAGE ANALYSIS

We conducted seepage analyses for the primary slide repair options using the finite element program SEEP/W (Version 3, 1994) by GEO-SLOPE International, Ltd.

Seepage Model and Analyses

Based on the results of the exploratory investigation and the elements of the slide repair options, the site stratigraphy was separated into 15 different materials which were used in the analyses.

The stratigraphy of the dike system and foundation (exclusive of repair elements) consisted of eight material types. The materials included: (1) 1989 Dike, (2) Bottom Ash, (3) 1969 Dike, (4) Alluvium (creek deposit), (5) Glacial Till, (6) Permeable Residual Clay, (7) Residual Clay, and (8) Weathered Shale. The slide repair elements consisted of the remaining 7 material types. All materials were assumed to be isotropic and homogeneous. The specific material properties are discussed below and summarized in Table 4.

1. The 1989 dike material is classified as a low to medium plastic clay or silty clay with occasional zones of high plastic clay.

2. The bottom ash is classified as a medium to coarse sand with traces of fine gravel and contains less than 5 percent fines.

3. The 1969 dike material consisted of low to medium plastic clays.

4. The alluvial material consisted of a stiff to very stiff gray clayey silt and silty clay with traces of silty sand and organics.

5. The glacial till consisted of a stiff to very stiff medium to high plastic clay with occasional sand and silty zones. This material grades downward to a very stiff to hard medium plastic clay with varying amounts of sand and gravel. The material was assumed to be homogeneous.

6. Based on vibrating wire piezometers screened across the estimated failure plane, a permeable water washed zone of silt, clay, and gravel termed "permeable" residual clay lies between the glacial till and less permeable residual clay. This is the suspected permeable zone that allowed excess head to develop below the downstream toe.

7. The residual clay is characterized as high plastic clay.

8. The weathered shale consisted primarily of clay shale with interbedded limestone. The upper portion of the shale is clayey, high plastic, highly weathered with low strength, especially along the bedding planes. The material was assumed to be homogeneous.

The slide repair elements consisted of various materials that were combined differently for the various repair options. The repair elements included; soil-bentonite wall, drain wall, HDPE wall, cement-bentonite wall, drain wall, lime/fly ash injected bottom ash, and light-weight fill. The properties of these materials assumed for analysis are given in Table 4.

The phreatic surface upstream of the dike system was assumed to be two feet below the dike crest (el. 454$\pm$). At the downstream toe, the phreatic surface was assumed to match the flow line of the creek at el. 395$\pm$ unless it was artificially lowered by pumping.

9.0
COST ESTIMATES

Cost estimates made for the various repair options are based on approximate quantities determined from existing drawings and topographic information plus subsurface information determined from the borings and CPT soundings.

All estimates include a 15 percent allowance for overhead and profit, 15 percent for engineering services (design and construction monitoring), and a 20 percent contingency.

Unit prices were determined based on information from Illinois Power, contractors, material suppliers, Means 1994 Cost Estimating Guide, and judgment. A summary of the key unit prices assumed is given in Table 5.

10.0
REMEDIAL DESIGN

Remedial designs address three potential modes of failure:

1. Deep failure in the foundation
2. Shallow failure in the bottom ash due to excess hydrostatic pressure
3. Liquefaction-induced failure in the bottom ash.

Different repairs are recommended for each potential failure mode as discussed below.

10.1 FAILED AREA AND POTENTIAL DEEP SLIDE AREAS (Station -6-50 to 5+50)

Two general categories of repair techniques exist: 1) those that strengthen soil along the failure plane, and 2) those that reduce the forces causing instability (decrease the driving forces and/or increase the resisting forces).

Methods to increase the strength along the failure plane include drainage to reduce hydrostatic pressure, the removal and replacement of the failure plane materials, or mechanical strengthening of the failure zone. Such strengthening could involve construction of a shear key extending below the failure plane or by use of structural elements, such as drilled piers, stone columns, or tiedback retaining walls. Because of the low frictional resistance along the failure surface and, therefore, the large force needed to restrain the slide, drainage is more economical than the other approaches and is a very common technique. Also, the slide appears very sensitive to changes in water pressure as shown by the significant reduction in the rate of movement that followed the lowering of the pond level 6 ft.

The significant increase in the calculated Factor of Safety that results from lowering the water table below the downstream slope is shown in Figure 15. This figure indicates that lowering the water table about 8 ft is equivalent to constructing a large toe berm and the use of lightweight fill (as discussed with the HDPE option in Appendix F). Due to the significant benefit of lowering the water level below the downstream slope, repair options focused heavily on drainage.

The second repair category, i.e., methods to reduce driving forces, generally involves grading to flatten the slope, the removal of material from the crest, or the placement of material near the toe.

We considered the above techniques either alone or in combination, to develop the remedial options. We selected the target factors of safety similar to those required by the IDOT Division of Water Resources, as follows.

	Condition	Target Slope Stability Factor of Safety
1.	Steady state seepage, full pond head	1.5
2.	End of construction, full pond head	1.4
3.	Earthquake (acceleration 0.12g), full pond head,	1.0
	downstream slope	1.0
	Upstream slope (no liquefaction)	1.0

10.2 REMEDIAL OPTIONS CONSIDERED

Three primary options for repair of the potential deep failure areas were developed along with several secondary options that were briefly considered but not pursued due to obvious deficiencies. The three major options are named as follows:

- Parallel Wall Option (The preferred option)
- Translated Dike Option
- HDPE Wall

The first two options were developed in our meeting of July 21, 1995: the last option, HDPE Wall, was originally proposed as the recommended option in our draft report of June 23, 1995. Each of these three primary options are summarized in the discussion below, but details of each are included in Appendices D, E, and F, respectively. A summary of the options indicating estimated costs, advantages and disadvantages is given in Table 6.

10.2.1 Parallel Wall Option

This is the favored option of Illinois Power and consequently the one developed in most detail. It is preferred because it involves significantly less cost than the others, and will maintain the current alignment and shape of the south dike. A typical cross-section of this repair option is shown on Figure D-1.

The intent is to cut off flow below the dike and lower the water level below the downstream slope to el. 385$\pm$, i.e., the elevation of the failure plane. By controlling the downstream groundwater level, the dike can be reconstructed with conventional earth materials along its current alignment. Key elements of this option are shown graphically in Appendix D and are discussed as follows.

1. A soil bentonite cutoff wall upstream of the existing dike to cutoff the flow through the bottom ash.

2. A "drain wall" installed downstream of the cutoff wall by slurry trench techniques and extending about 5 ft below the failure plane elevation. The drain wall will be backfilled with pervious material and three small wells will be installed within the drain wall to pump water out.

3. A shallow drain wall near the toe of the slope, extending 5 ft $\pm$ below the failure plane elevation. Again three small pumps, will remove water collected by the drain wall.

When the ground water has been lowered sufficiently below the downstream slope (as determined by pore pressure measurements), the compacted clay fill for the dike can be replaced to the configuration prior to slope failure.

The key advantages to this option are cost and the maintenance of the dike along its current alignment, i.e., not shifted up or downstream. The primary disadvantage of this alternate is that pumping will be required throughout the life of the pond until closure, at which time a gravity drain can be constructed. The amount of pumping, however, should be small; a few hundred gallons per minute or less because the soil-bentonite cutoff wall greatly reduces flow through the bottom ash. Another potential disadvantage of this option is that the rate of water table lowering is uncertain due to the variability in permeability and thickness of the water washed zone above the failure plane which this option intends to drain. Therefore there is some risk that additional measures such as a toe berm, or intermediate sand drains may be needed to provide additional stability. We anticipate constructing the cutoff and drain walls in the Spring and Summer of 1996, and replacing the compacted fill approximately one year later in the Summer or Fall of 1997. This would allow approximately one year to lower the ground water level to the desired elevation. During this time, pore pressure measurements will be made. Further details of this option are given in Appendix D.

10.2.2 Translated Dike Option

This option involves building a new dike in the deep failure area approximately 150 ft downstream of the existing dike. This will require the new dike to straddle the creek and necessitate the construction of a large box culvert as shown in Appendix E, Figure E-1. The new dike would be constructed of clay obtained on-site. Foundation drainage would be provided by a drain wall that will flow by artesian pressure, (i.e., no pumps) up into a gravel blanket drain. In addition, a chimney drain is included within the dike to collect seepage through the embankment. The advantage of this option is that it would be passive, i.e., no pumps or significant maintenance would be required after construction. The disadvantages of this option are the significantly higher cost than the parallel wall option, and additional right-of-way may be required for its construction. Details are given in Appendix E.

10.2.3 HDPE Wall

This was the recommended option given in our draft report of June 23, 1995. The objective is to cut off seepage below the downstream slope of the dike with a very low permeability wall along the center line of the dike. Due to potential recharge of water from the stream however, the cutoff is not likely to be fully effective and, therefore, a stabilizing toe berm and use of lightweight fill to rebuild the slope would be required to achieve the desired factor of safety. (See Figure F-1 , Appendix F) In addition, it would be necessary to lime/fly ash inject the bottom ash below the upstream portion of the dike to mitigate liquefaction.

Key elements of this option included the following:

1. HDPE cutoff wall within a cement-bentonite slurry wall
2. Inclined sand filled pressure relief wells
3. A coarse rock toe berm
4. Lightweight fill
5. Lime/fly ash stabilized bottom ash

The advantages of this option are; it is passive, and would maintain the dike along its current alignment. Major disadvantages, however, include cost, use of fly ash backfill that may entail significant environmental constraints, and need for a toe berm. Details are given in Appendix F.

10.2.4 Secondary Options

Several other options were also considered, but after a brief review, were not developed further. These options were; key trench, regrading, and use of drill piers. Key trench and regrading options are shown schematically and approximate cost estimates are given in Appendix G. The drill pier option was not developed far enough to include cost. Each of these options are discussed briefly below.

Key Trench

This involved removing the upper slide material and most of the lower slide and constructing a key trench through the shale. It would also involve a cutoff wall and injection of the fly ash. The disadvantage of this approach was the risk of slope failure during construction and the high cost.

Regrading

This option included regrading to flatten the slope to 5H:1V and moving the crest upstream into the ash pond. This would still require a cutoff wall, but probably eliminate the toe berm. We did not pursue this further due to cost and construction difficulty.

Drilled Piers

We also considered use of drilled piers to key the slide to the underlying material, but preliminary calculations indicated that the cost would be excessive. During the course of the work, it became obvious that due to the low friction angle along the failure plane, control of water pressures was the only practical and economical option to significantly increase stability.

10.3 REMEDIAL DESIGN FOR AREAS OF POTENTIAL SHALLOW SLIDES

Two potential problems exist where the bottom ash is present between the upper and lower dikes and beneath the upper dike, even outside of the area where potential deep failure can occur. The two problems are:

- The potential for shallow slides as the pond level is raised.
- The potential for liquefaction of the bottom ash during earthquake shaking and potential failure of the dike.

These could be eliminated by removal and replacement of the bottom ash with compacted clay fill. This, however, would be expensive since it would require removal and replacement of the existing dike and would produce significant difficulty controlling the pond water level while replacing the bottom ash. Therefore, other measures are needed.

10.3.1 Mitigation of Shallow Slides

To mitigate the potential for slope failure as the pond level is raised, it will be necessary to control the hydrostatic pressure in the bottom ash beneath the downstream slope of the 1989 dike. A practical way to do this is by the installation of a cutoff wall extending through the 1989 dike into the older dike or clay foundation soils. Either soil-bentonite or cement-bentonite is feasible, however, soil-bentonite is less expensive. A cutoff wall is recommended for both the parallel wall and HDPE wall options. In addition to the cutoff wall, a small gravity drain such as a French drain, is needed to collect the small amount of water that passes through the cutoff wall and the clay fill.

10.3.2 Liquefaction Mitigation

We considered two approaches to liquefaction mitigation; 1) Strengthening the bottom ash by lime/fly ash slurry injection, or 2) draining the bottom ash using wells. The first option, lime/fly ash slurry injection, is intended to give the bottom ash cohesion. Specialty contractors quoted a cost of about $3.50 per cubic yard of treated material for lime/fly ash injection. A test section would be needed at the outset of work to determine the actual quantity of lime/fly ash needed to achieve the desired strength. Illinois Power expressed concern about the potential for increasing pH of the pond with a lime/fly ash slurry injection. To preclude changes of pH, it may be possible to inject the lime/fly ash slurry after installation of a cutoff wall. However, careful monitoring of pressures will be needed to prevent damaging the wall. The lime/fly ash injection is a passive system, i.e., no pumping is required. We considered it in conjunction with HDPE wall approach and the other passive approach of the translated dike.

The second option is the installation of wells to drain the bottom ash after construction of the cutoff wall. This is an active approach which would require continuous pumping over the life of the pond. However, with a cutoff wall in place, the quantity of pumping would be small. This approach was included with the parallel wall option, which is also an active approach.

10.4 INSTRUMENTATION

After the slide area is repaired, we recommended that instrumentation be used to monitor the slope performance, especially as the pond level is raised. Instrumentation should include piezometers, surface monuments, and inclinometers. The final number, locations, and details can be determined in final design.

11.0
INTERIM REPAIRS

In late June and July, 1995, interim repairs were done to arrest the movement of the slide which was then moving at a rate of approximately 1/4 inch per day. Interim repairs involved removal of approximately 20 ft of earth fill at the top of the slide as shown in Figure 16. After the interim repairs were completed, two inclinometers were installed on the slide area to monitor further movement. Both inclinometers show that movement to date has been insignificant and within the error of the instruments. Therefore, we conclude that the interim repairs were successful. A plot of the rate of movement of the slide during the spring and summer of 1995 is shown in Figure 17 .

12.0
CONCLUSIONS AND RECOMMENDATIONS

1. At the location of the failure, the dike is about 55 ft high and is located in the former stream channel of a creek which traversed the area prior to dike construction. The dike is composed of three key components; a 35-ft high compacted clay dike constructed in 1969, bottom ash which was placed through water in the pond and brought to the crest elevation of the 1969 dike, and a new clay dike in 1989 placed atop the bottom ash and 1969 dike.

2. In the failure area, an old haul road consisting of bottom ash, fly ash, gravel, and clay extends to the downstream face of the dike and is hydraulically connected to the bottom ash. This haul road allowed water pressure equal to the level in the pond to be felt near the toe of the upper clay dike at the downstream face. Data indicate that the clay fill in both the old and new dike is strong and generally well compacted. The entire dike rests on a foundation of natural soils, generally clay, which overlie weathered shale bedrock interbedded with thin strata of limestone. Over time, the weathered shale surface has softened into a highly plastic clay, with weakened zones possibly due to ancient landslides during geologic time.

3. Data indicate that two slides have occurred; an upper slide occurring near the base of the upper dike and bottom ash, and a deeper slide occurring about 70 ft below the dike crest on a stratum of highly plastic clay. We believe the failure first occurred on the deep slide plane along a zone of weakness, perhaps part of an ancient landslide. The failure was aggravated by excess water pressure along a thin, permeable zone of granular material directly above the high plastic clay layer. Movement of the dike on the deep failure plane opened a crack through the dike below the crest. As lateral movement continued the crack widened creating a void. Migration of bottom ash and soil into the resulting void allowed the upper dike to settle. Uplift pressure developed at the toe of the upper dike due to the bottom ash and old haul road. This lifted the toe allowing the upper portion of the dike to slide laterally below the uplifted toe as it settled.

4. The bottom ash is very loose and susceptible to significant strength loss during earthquake shaking caused by liquefaction. Liquefaction can result in failure of the upstream slope of the upper portion of the dike. This could result in breaching of the dike and loss of water.

5. Our analysis indicates that the potential for failure of the upper portion of the dike exists at full reservoir head due to water pressure in the relatively permeable bottom ash underlying the less permeable clay dike. We believe that such potential failures are possible for approximately 2,400 lineal feet of the dike, if left as is.

6. Analysis indicates that the most effective means to stabilize the deep slide area is to lower the groundwater elevation below the downstream slope of the dike. Three primary options were developed to stabilize the deep slide area; two of the options involve groundwater control, the other involves rebuilding the dike downstream of the present location. These three options are:

OPTION	KEY ELEMENTS	ESTIMATED COST (millions)	REMARKS
Parallel Wall	Cutoff wall, two drain walls pumps in drain walls	$4.3	Lowers groundwater level by pumping from drain walls. Preferred option by IP.
Translated Dike	New dike 150 ft downstream of existing dike	$6.1[1]	Passive system (no pumps). May need more right of way.
HDPE wall	Impermeable cutoff wall of HDPE in center of dike	$5.7	Passive system, lowers groundwater level by very impermeable cutoff wall.

[1] Does not include cost of additional right-of-way.

7. The Parallel Wall option is preferred by Illinois Power due to cost and because the dike can be maintained on its current alignment with its current configuration. The option requires continuous pumping while the pond is in operation, however, the amount of water to be pumped should be small (a few hundred gallons per minute) due to the cutoff wall which restricts flow through the permeable bottom ash. When the water level is lowered sufficiently, as determined by piezometers, the clay fill can be replaced and the pond put back into full operation. A year between installation of the drainage measures and replacement of the clay fill is recommended to allow time for drainage.

8. In areas of potential shallow failure a cutoff wall is recommended through the bottom ash to control hydrostatic pressure below the upper clay dike. Two methods were considered to mitigate liquefaction in areas of potential shallow failure; 1) strengthen the bottom ash by lime/fly ash slurry injection, and 2) drain the ash by small pumps. The later approach (preferred by Illinois Power) is the more economical and is similar to the pumping concept used with the Parallel Wall option in areas of deep failure.

9. Following remedial construction, we recommend that instrumentation including inclinometers, surface monuments, and piezometers be used to monitor performance of the repaired south dike. Monitoring is very important to verify that the drainage measures are effective. If not, additional measures may be needed.

13.0
CONTINUITY OF GEOTECHNICAL ENGINEERING SERVICES

The geotechnical investigation and this report are the first steps in the evaluation of subsurface conditions and remedial design. Because actual subsurface conditions can vary from those inferred from the exploration, it is essential that the geotechnical engineer of record be present on-site during remedial construction to confirm that the subsurface soil and groundwater conditions match the design assumptions. Consequently, we recommend that WCC be retained to document remedial construction. We also recommend that we be involved with the design of the remedial measures and during development of the plans and specifications related to our work to verify that our recommendations have been properly interpreted and incorporated into the final design.

14.0
LIMITATIONS

The evaluation and design of remedial measures to stabilize landslides involve a significant number of uncertainties. While we believe that our exploration program has been detailed enough to identify key subsurface conditions, it is possible that unknown conditions exist between the exploratory locations. Changes in groundwater conditions can also occur over time. These possible unknown conditions could aggravate sliding and adversely affect the mitigation design. Therefore, even with remedial measures installed, there is some risk of future movement and potential dike failure.

SUMMARY OF TYPICAL AND ASSUMED MATERIAL PROPERTIES

Generalized Material Type	TYPICAL MATERIAL VALUES					ASSUMED DESIGN VALUES FOR ANALYSES					
	Atterberg Limits						Drained Strengths		Undrained Strengths		
	LL	PL	Water Content, %	Blow Count (N)	Undrained Shear Strength, tsf	Total Unit Weight, pcf	Cohesion, psf	Friction Angle	Cohesion, psf	Friction Angle	Permeability, cm/sec
DIKE:											
1989 Dike	40 - 50	17 - 22	15 - 25		>1.0	115.0	100	28	2,000	0	5.0E-06
Bottom Ash	NP	NP		5		97.0	0	30	0	30	1.0E-02
1969 Dike	40 - 50	17 - 22	20 - 25		1.0	115.0	100	28	1,500	0	5.0E-06
Lime Treated Ash*	-	-	-	-	-	97.0	0	30	0	30	1.0E-03
Light Weight Fill*	-	-	-	-	-	95.0	0	35	0	35	1.0E-03
FOUNDATION:											
Alluvium	-	-	20 - 30		0.7 - 1.1	115.0	100	28	1,500	0	1.0E-06
Loess	30 - 40	17 - 24	20 - 25	7 - 15	0.5 - 1.5	120.0	100	28	1,500	0	-
Glacio-lacustrine / Till	35 - 45	15 - 20	15 - 30	10 - 22	1.2 - 2.2	120.0	1,000	20	2,000	0	1.0E-07
Failure Plane	50 - 75	30 - 40	-	-	-	120.0	0	14	0	14	-
Residual Clay	45 - 55	25 - 35	18 - 21	11 - 38	1.5 - 2.5	120.0	100	28	2,000	0	1.0E-07
Shale	45 - 55	25 - 35	23	24 - ref.	>2	125.0	1,000	20	2,000	0	1.0E-07

* Materials included as part of the suggested slide repair

Piezometer Data

Illinois Power Levee Landslide
5E08560
Piezometer Data

		Apr-95 Factory Calibration	4/12/95	4/13/95	4/14/95	4/18/95	4/21/95	4/24/95	4/28/95	5/1/95	5/4/95	5/8/95	5/11/94	5/15/95	5/19/95	5/23/95	5/25/95	5/30/95	6/2/95	6/9/95	7/19/95	8/25/95
Standpipe																						
P-1	Depth (ft)	21.4			21.40	21.18	21.23	21.15	21.15	21.08	21.1	21.05	20.9		21.15	20.82	20.6	Piezometer Sheared Off				
Vibrating Wire																						
P-2	Voltage	11697		11645	10744	9870	9956	10008	10067	10127	10177	10269	10387	10540	10604	10582	10580	10600	10614	10650	10838	10916
(25 ft)	Pressure(psi)			0	6.47	12.74	12.13	11.75	11.33	10.90	10.54	9.88	9.03	7.93	7.47	7.63	7.65	7.50	7.40	7.14	5.79	5.23
	Feet of Water			0	14.92	29.40	27.97	27.11	26.13	25.14	24.31	22.79	20.83	18.30	17.24	17.61	17.64	17.31	17.08	16.48	13.37	12.07
	Elevation (ft)			50	65	79	78	77	76	75	74	72	70	68	67	67	67	67	67	66	63	62
P-2A	Voltage	9149												8368	8531	8369	8368	8364	8373	8373	8387	8365
(41.5 ft)	Pressure(psi)													12.61	9.98	12.60	12.61	12.68	12.53	12.53	12.31	12.66
	Feet of Water													29.10	23.03	29.06	29.10	29.25	28.91	28.91	28.39	29.21
	Elevation (ft)													62	56	62	62	62	62	62	61	62
P-3	Voltage	11454		11410	10990	10827	10800	10782	10800	10834	10851	10938	11008	11016	10896	10891	10885	10864	10895	10891	10950	10964
(10 ft)	Pressure(psi)			0	2.93	4.07	4.26	4.38	4.26	4.02	3.90	3.29	2.80	2.75	3.59	3.62	3.66	3.81	3.59	3.62	3.21	3.11
	Feet of Water			0	6.76	9.38	9.82	10.11	9.82	9.27	9.00	7.60	6.47	6.34	8.27	8.35	8.45	8.79	8.29	8.35	7.40	7.18
	Elevation (ft)			41	48	50	51	51	51	50	50	48	47	47	49	49	49	50	49	49	48	48
P-3A	Voltage	9309													8563	8574	8570	8571	8578	8576	8587	8578
(22.2 ft)	Pressure(psi)														11.50	11.33	11.40	11.38	11.27	11.30	11.13	11.27
	Feet of Water														26.54	26.15	26.29	26.25	26.00	26.08	25.68	26.00
	Elevation (ft)														55	55	55	55	55	55	54	55
P-4	Voltage	9225												8569	8572	8570	8570	8566	8572	8570	8578	8566
(30.8 ft)	Pressure(psi)													12.61	12.55	12.59	12.59	12.67	12.55	12.59	12.44	12.67
	Feet of Water													29.09	28.96	29.05	29.05	29.22	28.96	29.05	28.70	29.22
	Elevation (ft)													57	57	57	57	57	57	57	57	57
P-5	Voltage	10093		10051	9224	9136	9118	9100	9114	9153	9160	9170	9185	9128	9098	9115	9099	9092	9112	9111	9140	9091
(25 ft)	Pressure(psi)			0	5.79	6.40	6.53	6.65	6.58	6.28	6.23	6.16	6.06	6.46	6.67	6.55	6.66	6.71	6.57	6.58	6.37	6.72
	Feet of Water			0	13.35	14.77	15.06	15.35	15.12	14.49	14.38	14.22	13.98	14.90	15.38	15.11	15.37	15.48	15.16	15.17	14.70	15.49
	Elevation (ft)			50	63	65	65	65	65	64	64	64	64	65	65	65	65	65	65	65	65	65
P-5A	Voltage	9447												8542	8531	8540	8533	8533	8542	8543	8564	8547
(45 ft)	Pressure(psi)													15.44	15.62	15.47	15.59	15.59	15.44	15.42	15.07	15.35
	Feet of Water													35.62	36.05	35.70	35.97	35.97	35.62	35.58	34.76	35.42
	Elevation (ft)													66	66	66	66	66	66	66	65	65
P-6	Voltage	11256	11261		11420	11342	11345	11329	11336	11350	11365	11376	11387	11388	11386	11392	11434	11459	11365	11320	Eliminated	
(18 ft)	Pressure(psi)		0		-1.13	-0.58	-0.60	-0.49	-0.53	-0.63	-0.74	-0.82	-0.90	-0.89	-0.89	-0.93	-1.23	-1.41	-0.74	-0.42		
	Feet of Water		0		-2.62	-1.33	-1.38	-1.12	-1.23	-1.46	-1.71	-1.89	-2.07	-2.06	-2.06	-2.16	-2.85	-3.26	-1.71	-0.97		
	Elevation (ft)		80		78	79	79	79	79	79	78	78	78	78	78	78	77	77	78	79		
P-7	Voltage	9324													8572	8584	8573	8576	8586	8585	8592	8584
(26.4 ft)	Pressure(psi)														12.75	12.54	12.73	12.68	12.51	12.52	12.40	12.54
	Feet of Water														29.41	28.93	29.37	29.25	28.85	28.89	28.62	28.93
	Elevation (ft)														54	54	54	54	53	53	53	54

NOTE: Negative pressures may not indicate true water elevations.

TABLE 2

TABLE 3
SUMMARY OF ASSUMED MATERIAL PROPERTIES FOR STABILITY ANALYSIS

Generalized Material Type	Total Unit Weight, pcf	Drained Strengths		Undrained Strengths		Source
		Cohesion, psf	Friction Angle	Cohesion, psf	Friction Angle	
DIKE:						
1989 Dike	115.0	100	28	2,000	0	Triaxial Test Results (CIU, UU), judgement
Bottom Ash	97.0	0	30	0	30	Experience, judgement
1969 Dike	115.0	100	28	1,500	0	Triaxial Test Results (CIU, UU), judgement
Gravel Road*	125.0	0	42	-	-	Judgement
Cemented Ash*	125.0	0	42	-	-	Judgement
Lime Treated Ash**	97.0	0	30	0	30	Experience, judgement
Light Weight Fill**	95.0	0	35	0	35	Experience, judgement
FOUNDATION:						
Alluvium	115.0	100	28	1,500	0	Triaxial Test Results (CIU, UU), judgement
Loess***	120.0	100	28	1,500	0	Triaxial Test Results (CIU, UU), judgement
Glacio-lacustrine / Till	120.0	1,000	20	2,000	0	Experience, judgement
Failure Plane	120.0	0	14	0	14	Back-calculation, judgement
Residual Clay	120.0	100	28	2,000	0	Experience, judgement
Shale	125.0	1,000	20	2,000	0	Experience, judgement

* Materials included as features to back-calculation geometry

** Materials included as features to slide repair geometry

*** Material included as a feature to shallow slide area geometry

TABLE 4
SUMMARY OF ASSUMED MATERIAL PROPERTIES
FOR PERMEABILITY ANALYSIS

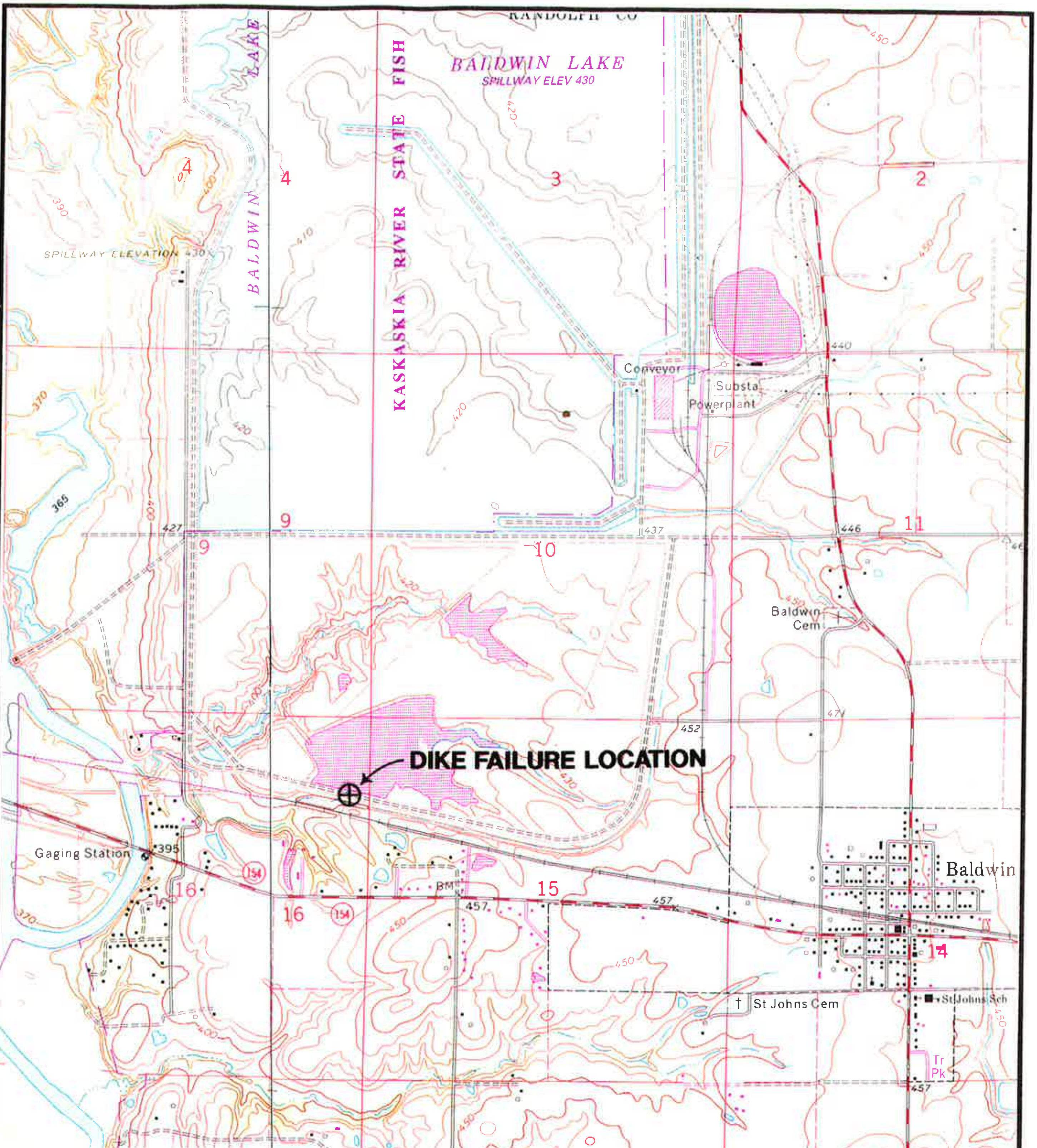
Generalized Material Type	Permeability, cm/sec	Source
DIKE:		
1989 Dike	5.0E-06	Experience, previous test data on similar compacted clays
Bottom Ash	1.0E-02	Experience, judgement
1969 Dike	5.0E-06	Experience, previous test data on similar compacted clays
FOUNDATION:		
Alluvium	1.0E-06	Experience, previous test data on similar compacted clays
Glacio-lacustrine / Till	1.0E-07	Experience, judgement
Permeable Residual Clay	1.0E-05	Judgement, vibrating-tip piezometers
Residual Clay	1.0E-07	Experience, judgement
Shale	1.0E-07	Experience, judgement
REPAIR FEATURES:		
Lime Treated Ash	1.0E-03	Experience, judgement
Light Weight Fill	1.0E-03	Experience, judgement
Geomembrane Wall	1.0E-12	GUNDLE
Inclined Drains	1.0E-03	Experience, judgement
Soil-Bentonite Wall	1.0E-06	Experience, judgement
Drain Wall	1.0E-03	Experience, judgement
Cement-Bentonite Wall	1.0E-06	Experience, judgement

SUMMARY OF KEY UNIT PRICES USED IN COST ESTIMATES

Description	Unit Price ($)	Unit	Source
1. HDPE wall "GundWall" in cement-bentonite slurry wall	10.50	Ft^2	Slurry Walls, Inc. 301/934-1846
2. Cement-bentonite slurry wall	4.25	Ft^2	Slurry Walls, Inc. 301/934-1846
3. Inclined wells	40.00	L.F.	Warren-George Drilling 201/433-9797
4. Lime fly ash injection of bottom ash	3.50	c.y. of treated soil	Woodbine-GKN/Hayward-Baker
5. Excavate soil in slide area and recompact	5.00	c.y.	Illinois Power
6. Excavate soil and stockpile	2.50	c.y.	Judgment
7. Drain rock or shot rock	15.00	c.y.	Rogers Ready Mix 618/282-3844
8. Seed and mulch	0.50	s.y.	Means Guide, 1994
9. Strip topsoil	0.90	c.y.	Means Guide, 1994
10. Lime stabilized fly ash (lightweight fill)	5.00	c.y.	Judgment
11. Soil-bentonite slurry wall	4.00	s.f.	Geo-Con 817/383-1400
12. Drain wall	9.00	s.f.	Geo-Con 817/383-1400
13. 8 by 10 Box culvert	600.00	L.F.	Means Guide, 1994
14. Vertical wells, pumps, warning system	15,000.00	each	Layne-Western 314/343-3700

SUMMARY OF PRIMARY REPAIR OPTIONS

Option	Estimated Cost (millions)	*Design Intent*/Key Elements		Advantages	Disadvantages
		Deep Failure Areas	Shallow Failure Areas		
Parallel Wall	$4.3	*Lower groundwater elevation below downstream slope with drains/pumps.* • Upstream cutoff wall • Upstream drain wall • Downstream drain wall • Pumps within drain walls	*Drain bottom ash by cutoff wall and pumps to mitigate shallow failure and liquefaction.* • Upstream cutoff wall • Pumps in bottom ash	• Lowest cost • Maintain dike alignment • Maintain dike shape	• Continuous pumping (active system)
Translated Dike	$6.1 (w/o additional R.O.W.)	*Build new dike downstream of failure area and without bottom ash fill.* • New clay dike • Drain wall below new dike	*Cutoff flow through bottom ash with cutoff wall. Mitigate liquefaction by lime/fly ash injection to strengthen bottom ash.* • Cutoff wall • Lime/fly ash inject bottom ash • French drain	• Passive system (no pumping)	• High cost • May need additional R.O.W.
HDPE Wall	$5.7	*Lower groundwater level below downstream slope with very impervious wall. Use lightweight fill and toe berm to supplement drainage.* • Centerline HDPE wall • Inclined wells • Lightweight (fly ash) fill • Rock toe berm	*Cutoff flow through bottom ash with cutoff wall. Mitigate liquefaction by lime/fly ash injection to strengthen bottom ash.* • Centerline cutoff wall • Lime/fly ash inject bottom ash • French drain	• Passive system (no pumping) • Maintain dike alignment and shape	• Cost • Complicated construction • Environmental concerns with fly ash fill



Reference Drawing taken from USGS topographic map N38Ø7.5–W8952.5/7.5 & N38Ø7.5–W8945/7.5

N

Ø 1

SCALE MILE

ILLINOIS POWER COMPANY
BALDWIN POWER STATION
ASH POND, SOUTH DIKE

PROJECT NO. 5EØ856Ø

Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment

DRN. BY: bdl 5/22/95
DSGN. BY: gaz
CHKD. BY: KMB 6/23/95

Vicinity Map

FIG. NO. 1

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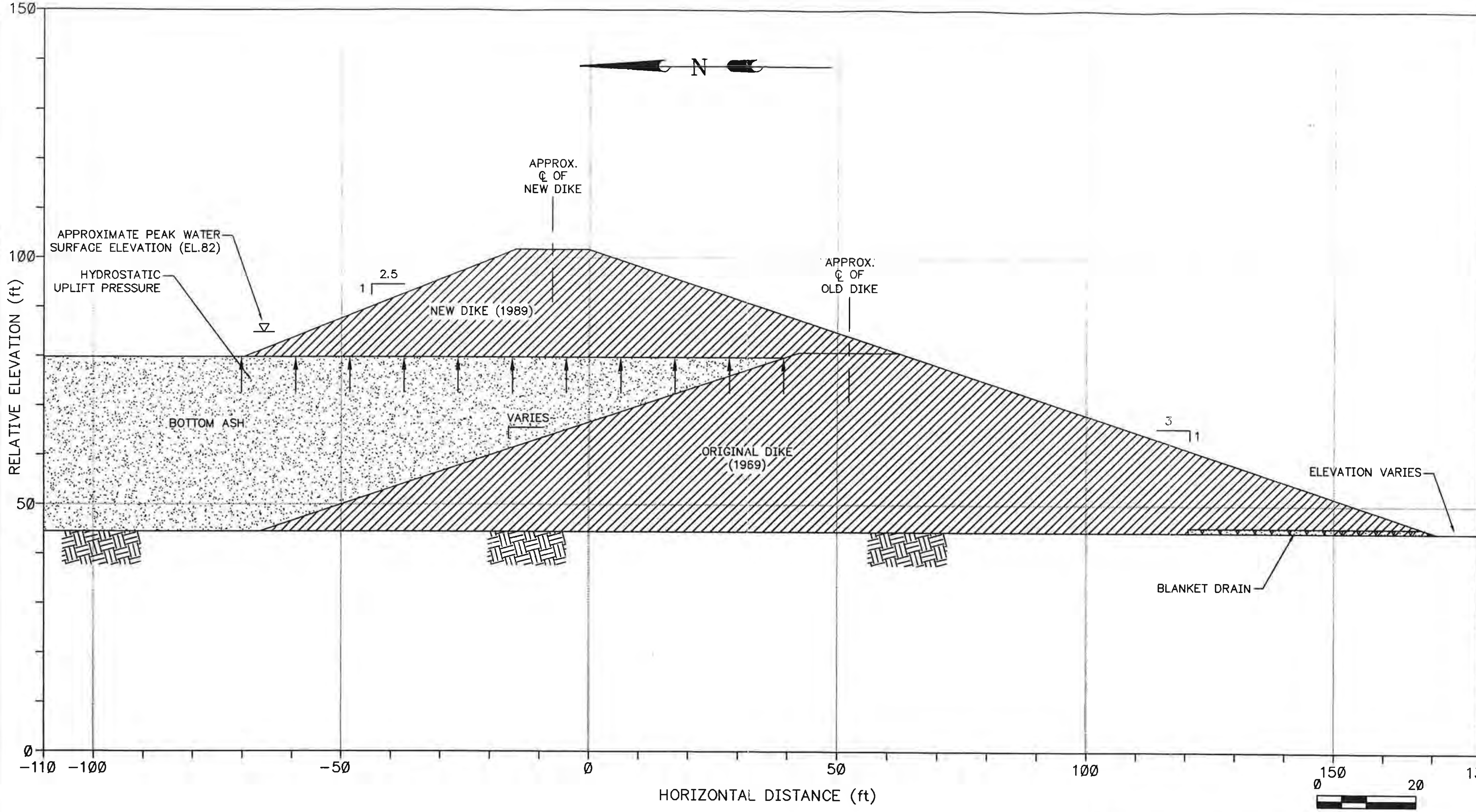
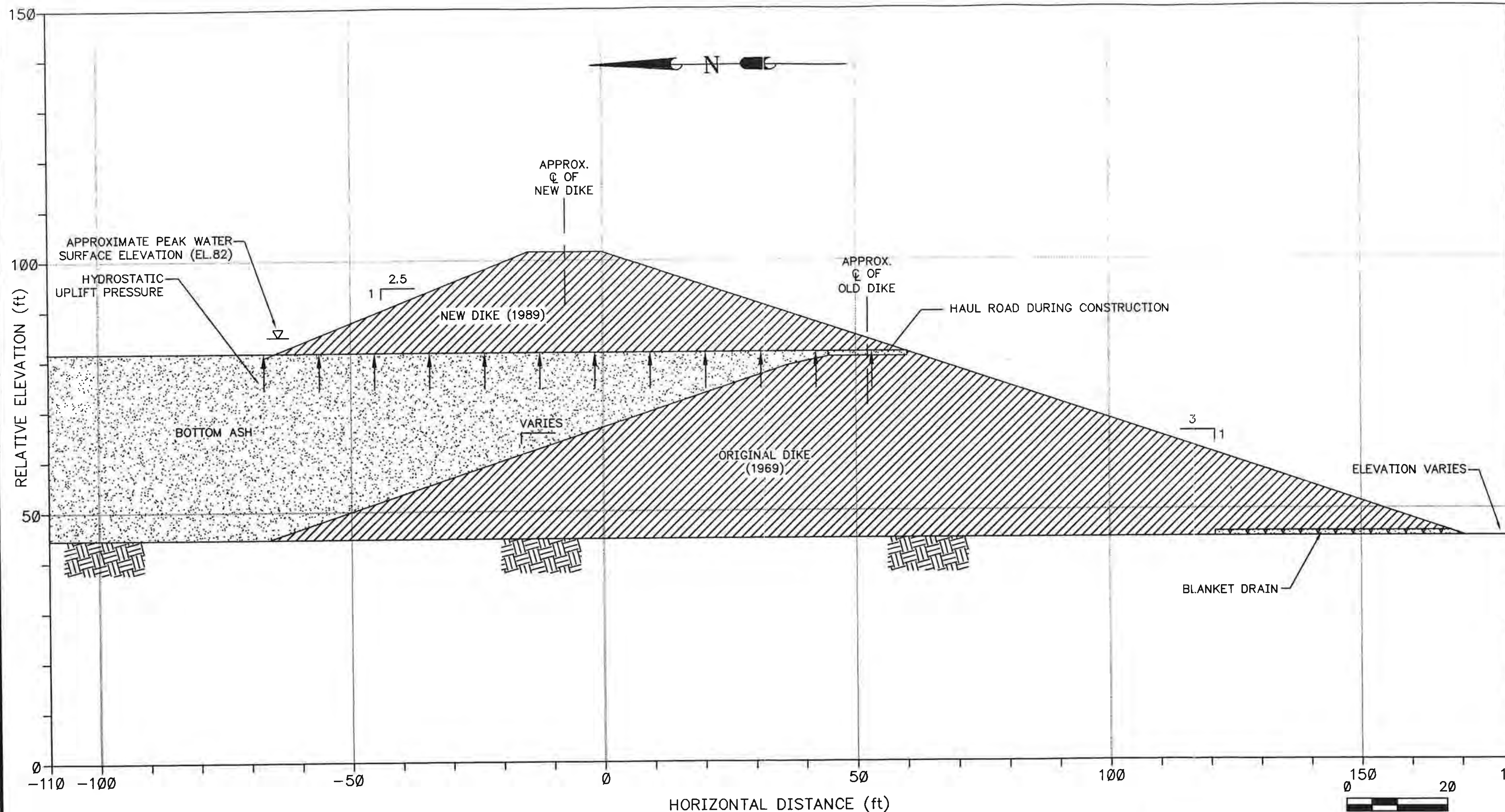


Note: This typical cross section is based on the construction drawings and records provided by Illinois Power.

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND DIKE BALDWIN, IL.	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 5/22/95 DSGN. BY: gaz CHKD. BY: JMB 6/23/95	As Designed Section in Failed Area — FIG. NO. 2

File: F:\5E08560\TASK240\ASDGNSEC.DWG Last edited: 06/22/95 @ 6:15 p.m. @ WCC-ST.LOUIS



Note: This typical cross section is based on the construction drawings and records provided by Illinois Power.

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND DIKE BALDWIN, IL.	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 5/22/95 DSGN. BY: gaz CHKD. BY: KMB 6/23/95	As Built Section in Failed Area — FIG. NO. 3

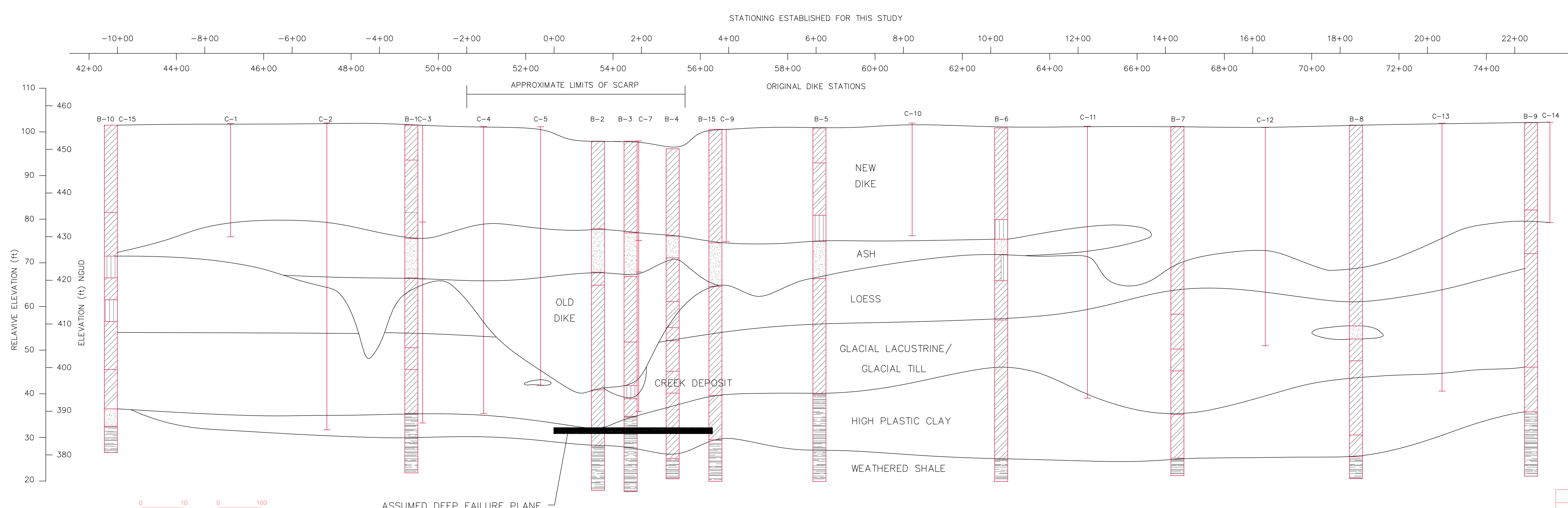
File: F:\5E08560\TASK240\ASBLTSEC.DWG Last edited: 06/22/95 @ 6:28 p.m. @ WCC-ST.LOUIS

NOTE: GROUND SURFACE ELEVATION CONTOURS WERE SCANNED FROM DRAWING HEC 214C38 DATED MARCH 16, 1967 BY HARZA ENGINEERS.

DIKE STATIONING FOR ORIGINAL CONSTRUCTION. STATION 0+00 FOR THIS STUDY=STATION 52+60 FOR ORIGINAL CONSTRUCTION.

A SITE AND EXPLORATIO PLAN AT A SCALE OF 1in EQUALS 50ft IS LOCATED IN FIGURE 7 OF THIS REPORT.

PLAN



GENERALIZED SUBSURFACE PROFILE ALONG CENTERLINE OF NEW DIKE

LEGEND

- CLAY (CL)
- CLAY (CH)
- BOTTOM ASH
- SILT (ML)
- SHALE
- CPTU (CONE PENETRATION TEST)
- BORING
- TEST PIT
- PIEZOMETER
- APPROXIMATE FOOTPRINT OF NEW DIKE
- APPROXIMATE FOOTPRINT OF OLD DIKE

NOTES:
1. THIS DRAWING SHOWS GENERALIZED SUBSURFACE CONDITIONS. SEE ORIGINAL BORING LOGS FOR DETAILS.
2. LINES INDICATING STRATA BETWEEN EXPLORATORY LOCATIONS ARE INFERRED. STRATA SHOWN ARE KNOWN ONLY AT EXPLORATORY LOCATION – NOT BETWEEN.

Revision No.	Description	Date	By	App.

REVISIONS

ILLINOIS POWER COMPANY
BALDWIN POWER STATION

ASH POND, SOUTH DIKE
PLAN AND PROFILE

Date: 4/10/95	Project Number: 5E08560	Figure Number: 4
Drawn by: kdw	Design by: gaz	Checked by:

Woodward–Clyde Consultants
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File: F:\5E08560\TASK2407\PLANPRO.DWG Last edited: 08/25/95 @ 3:34 p.m. @ WCC–ST.LOUIS

Glacial Boundaries

Wisconsinan

- Late Woodfordian
- Middle Woodfordian
- Early Woodfordian
- Altonian

Illinoian

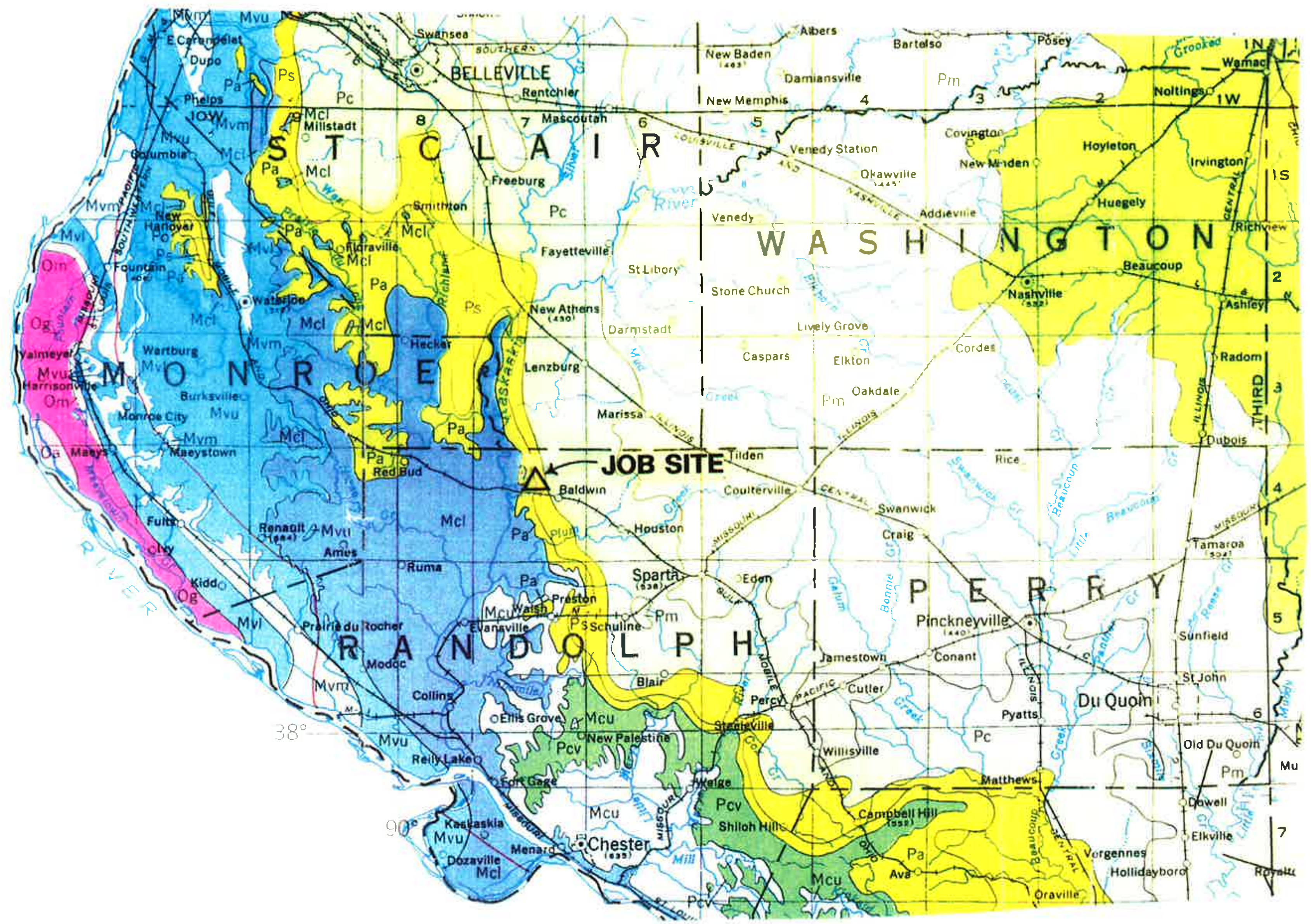
Kansan

PENNSYLVANIAN

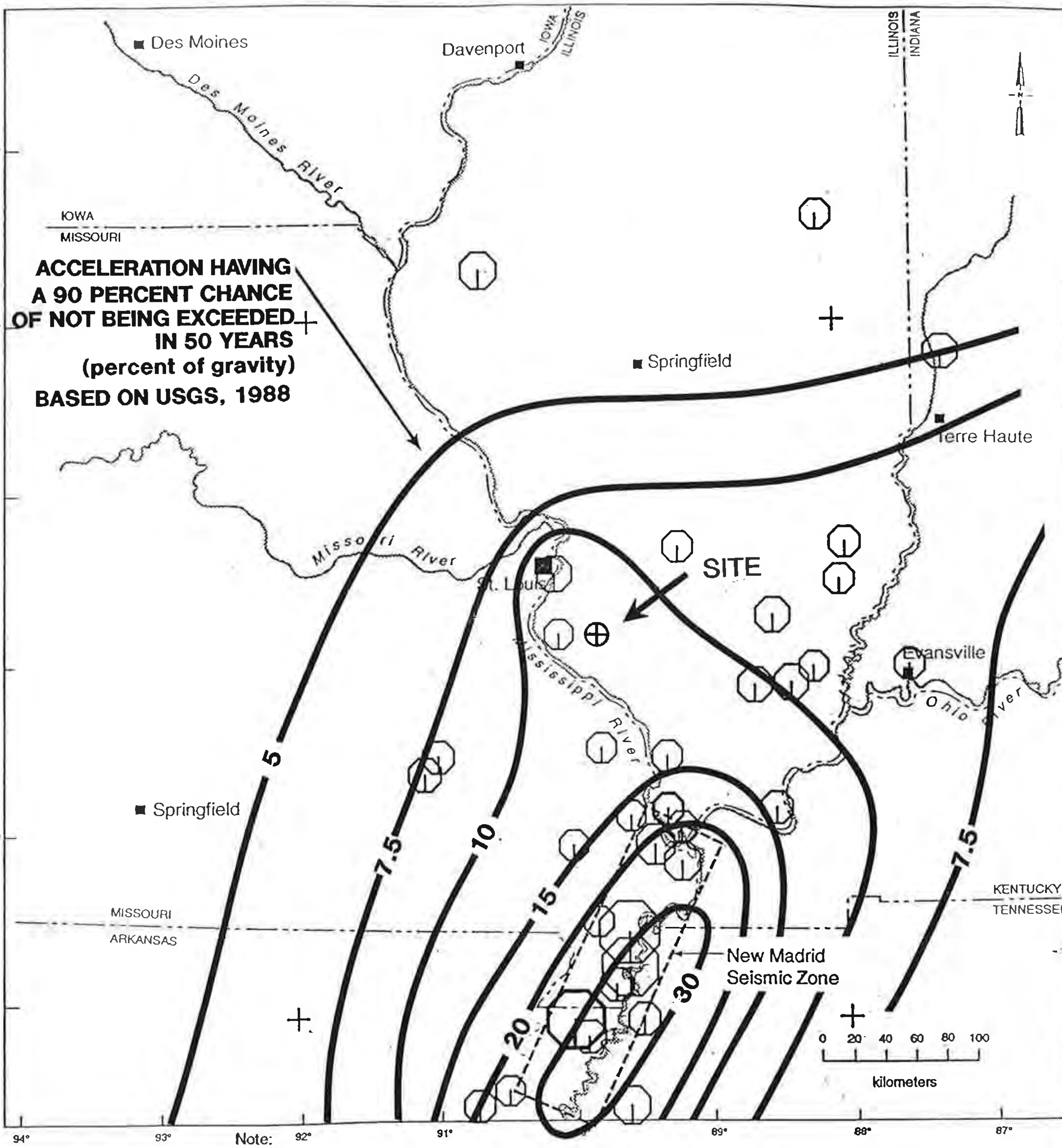
Symbol	Unit
Pc	Carbondale
Ps	Spoon (includes Pa in northeast)
Pa	Abbott
Pcv	Caseyville

MISSISSIPPIAN

Symbol	Unit
Mcu	Upper Chesterian (Grove Church-Tar Springs)
Mcl	Lower Chesterian (Glen Dean-Renault)
Mvu	Upper Valmeyeran (Aux Vases, Ste. Genevieve, St. Louis)



Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment 2318 Millpark Drive Maryland Heights, Missouri 63043	ILLINOIS POWER FLY ASH SEDIMENTATION POND BEDROCK STRATIGRAPHY	PROJECT NO: 5E08560 DATE: 5/25/95	CHK'D BY: TKD FIGURE 5



Note: Epicenter data from National Earthquake Information Center.

Magnitude
5.0
6.0
7.0
8.0

ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE	PROJECT NO. 5E08560

Woodward-Clyde Consultants
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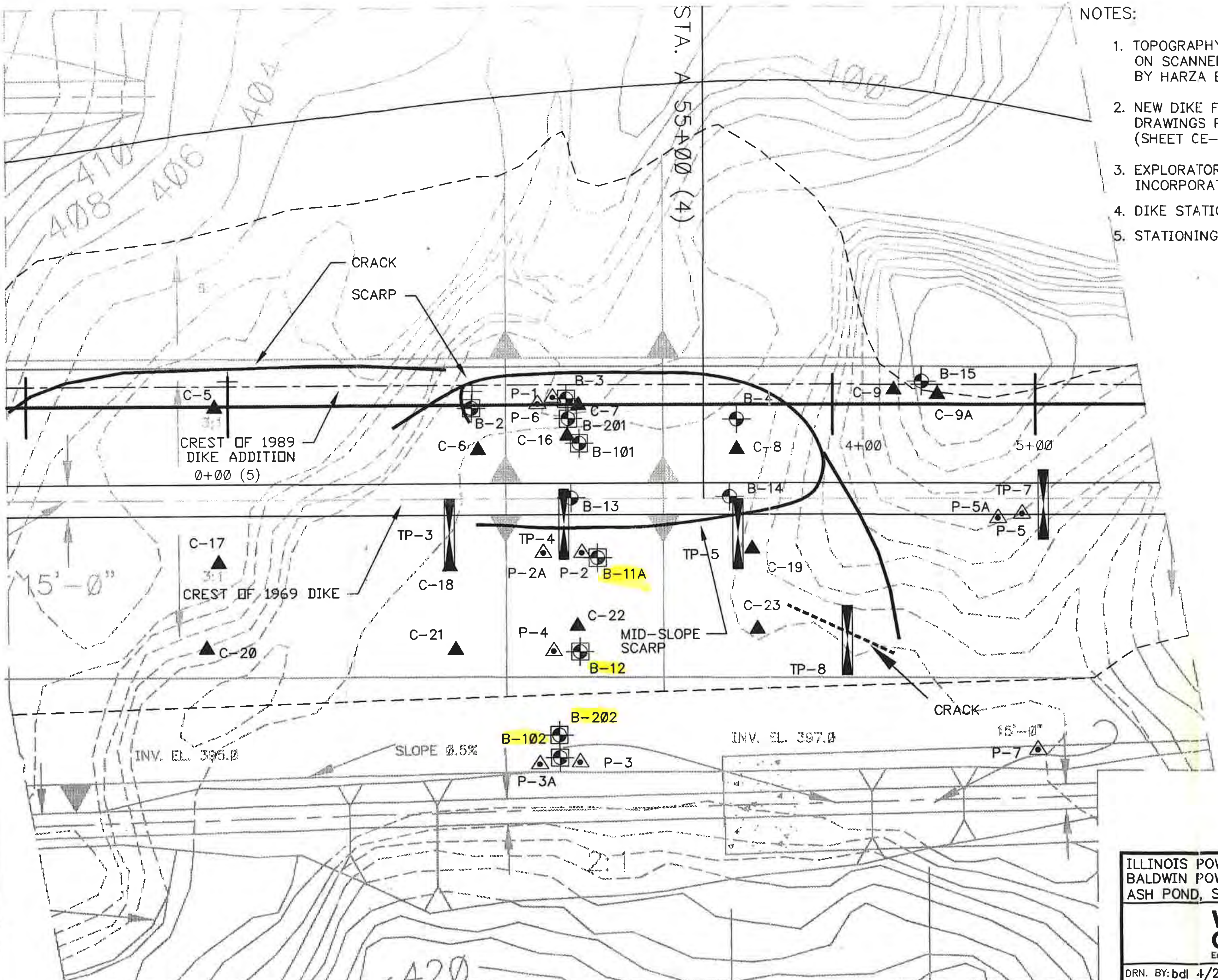
DRN. BY: bdl 5/22/95 DSGN. BY: gaz CHKD. BY:	Estimated Bedrock Acceleration	FIG. NO. 6

File: F:\5E08560\TASK240\ACCONMAP.DWG Last edited: 06/05/95 @ 10:11 a.m. @ WCC-ST.LOUIS



NOTES:

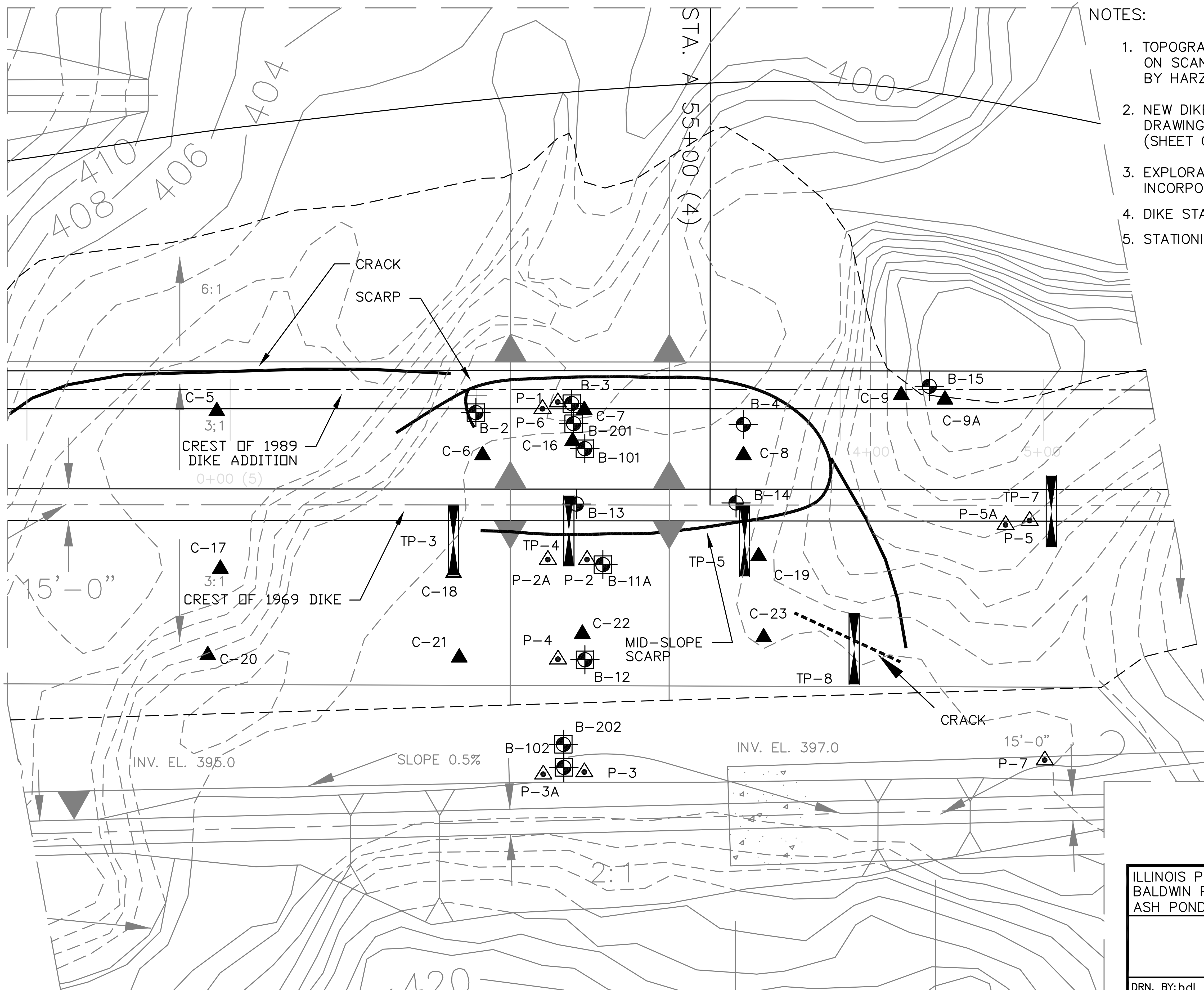
1. TOPOGRAPHY AND OLD DIKE FOOTPRINT BASED ON SCANNED IMAGE FROM CONSTRUCTION DRAWINGS BY HARZA ENGINEERING COMPANY (SHEET 2),(NOV. 18, 1969).
2. NEW DIKE FOOTPRINT BASED ON CONSTRUCTION DRAWINGS PROVIDED BY ILLINOIS POWER COMPANY (SHEET CE-BAL1-B15-Ø3X),(MAY 14, 1986).
3. EXPLORATORY LOCATIONS SURVEYED BY FREESEN INCORPORATED.
4. DIKE STATIONING FOR ORIGINAL CONSTRUTION
5. STATIONING FOR THIS STUDY

LEGEND

- ▲ CPTU
- BORING
- TEST PIT
- PIEZOMETER
- BORING WITH INCLINOMETER

ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE	PROJECT NO. 5EØ856Ø
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 4/27/95 DSGN. BY: gaz CHKD. BY: BMB 8/30/95	SITE AND EXPLORATION PLAN IN FAILED AREA — FIG. NO. 7

File: F:\5E08560\TASK240\SCRPPLAN.DWG Last edited: 08/24/95 @ 4:48 p.m. @ WCC-ST.LOUIS



NOTES:

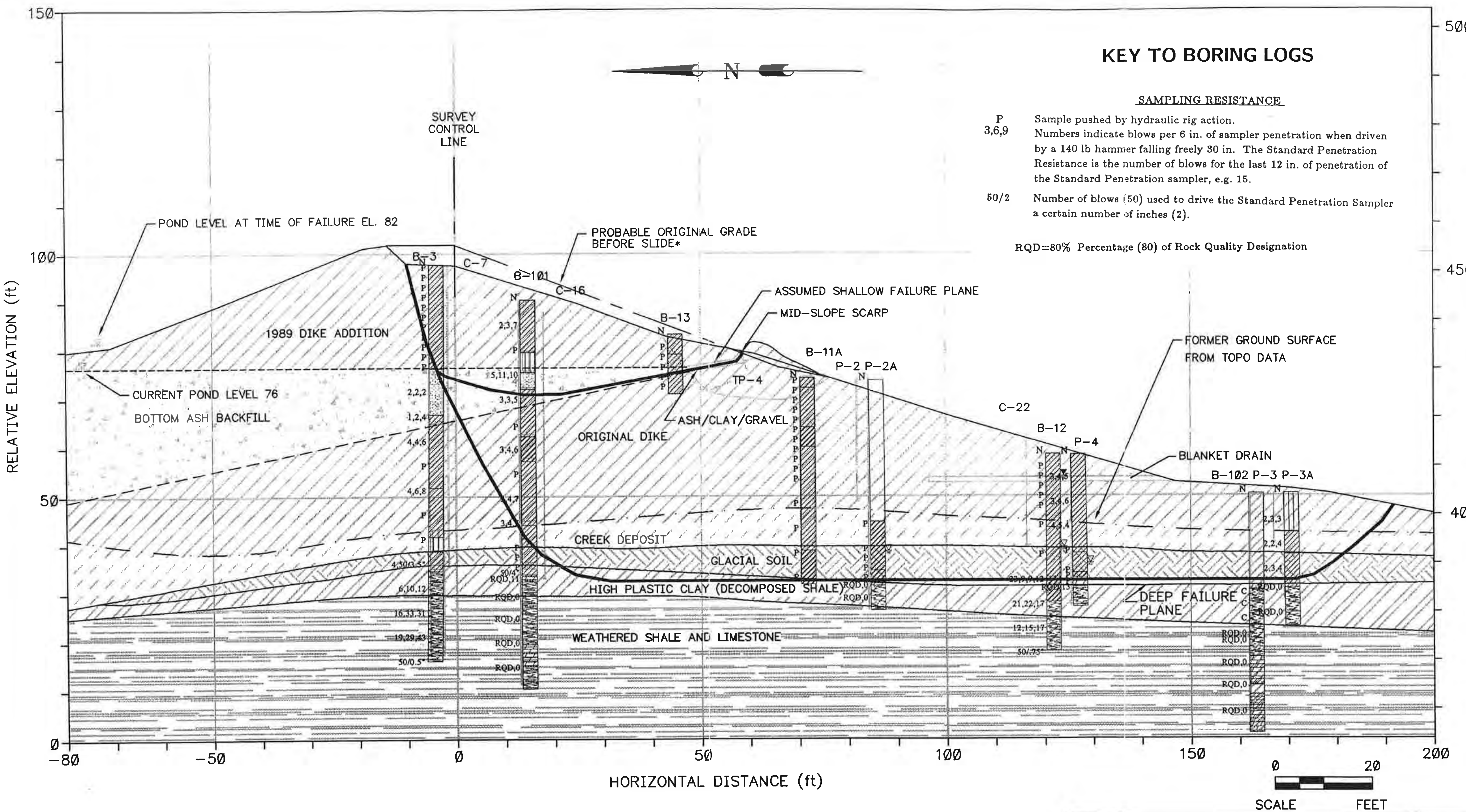
1. TOPOGRAPHY AND OLD DIKE FOOTPRINT BASED ON SCANNED IMAGE FROM CONSTRUCTION DRAWINGS BY HARZA ENGINEERING COMPANY (SHEET 2),(NOV. 18, 1969).
2. NEW DIKE FOOTPRINT BASED ON CONSTRUCTION DRAWINGS PROVIDED BY ILLINOIS POWER COMPANY (SHEET CE-BAL1-B15-03X),(MAY 14, 1986).
3. EXPLORATORY LOCATIONS SURVEYED BY FREESEN INCORPORATED.
4. DIKE STATIONING FOR ORIGINAL CONSTRUTION
5. STATIONING FOR THIS STUDY

LEGEND

- ▲ CPTU
- BORING
- TEST PIT
- PIEZOMETER
- BORING WITH INCLINOMETER

ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 4/27/95 DSGN. BY: gaz CHKD. BY:	SITE AND EXPLORATION PLAN IN FAILED AREA
FIG. NO.	7

File: F:\5E08560\TASK240\SCRPPLAN.DWG Last edited: 08/24/95 @ 4:48 p.m. @ WCC-ST.LOUIS

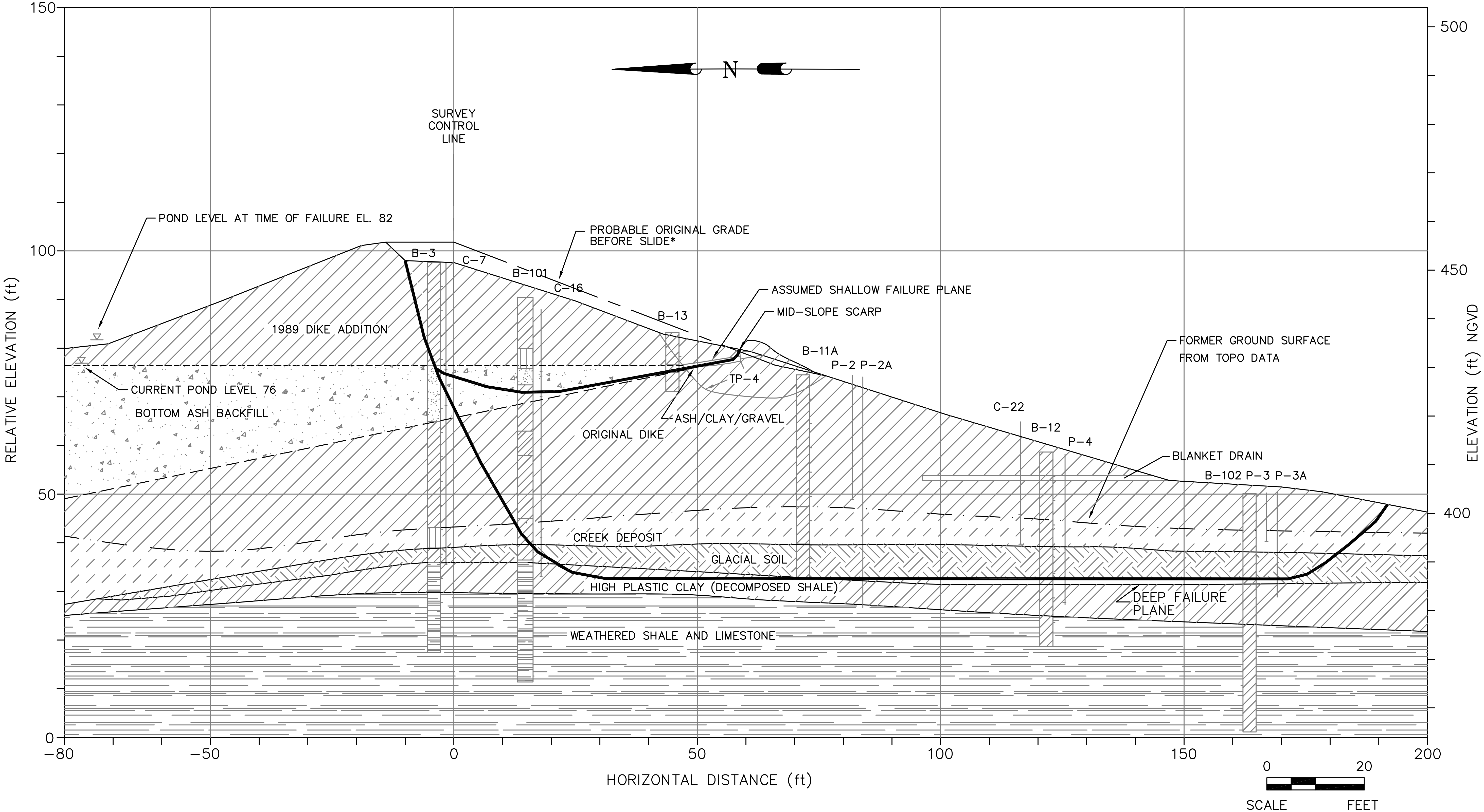


Notes:
1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location – not between.

LEGEND
- CLAY (CL)
- CLAY (CH)
- BOTTOM ASH
- SILT (ML)
- SHALE

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND DIKE BALDWIN, IL.	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 4/20/95 DSGN. BY: gaz CHKD. BY: KMB 10/23/95	Generalized Section Through Center of Failure — FIG. NO. 8

File: F:\5E08560\TASK240\SECTHSLD.DWG Last edited: 06/23/95 @ 1:59 p.m. @ WCC-ST.LOUIS



Notes:
1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location – not between.

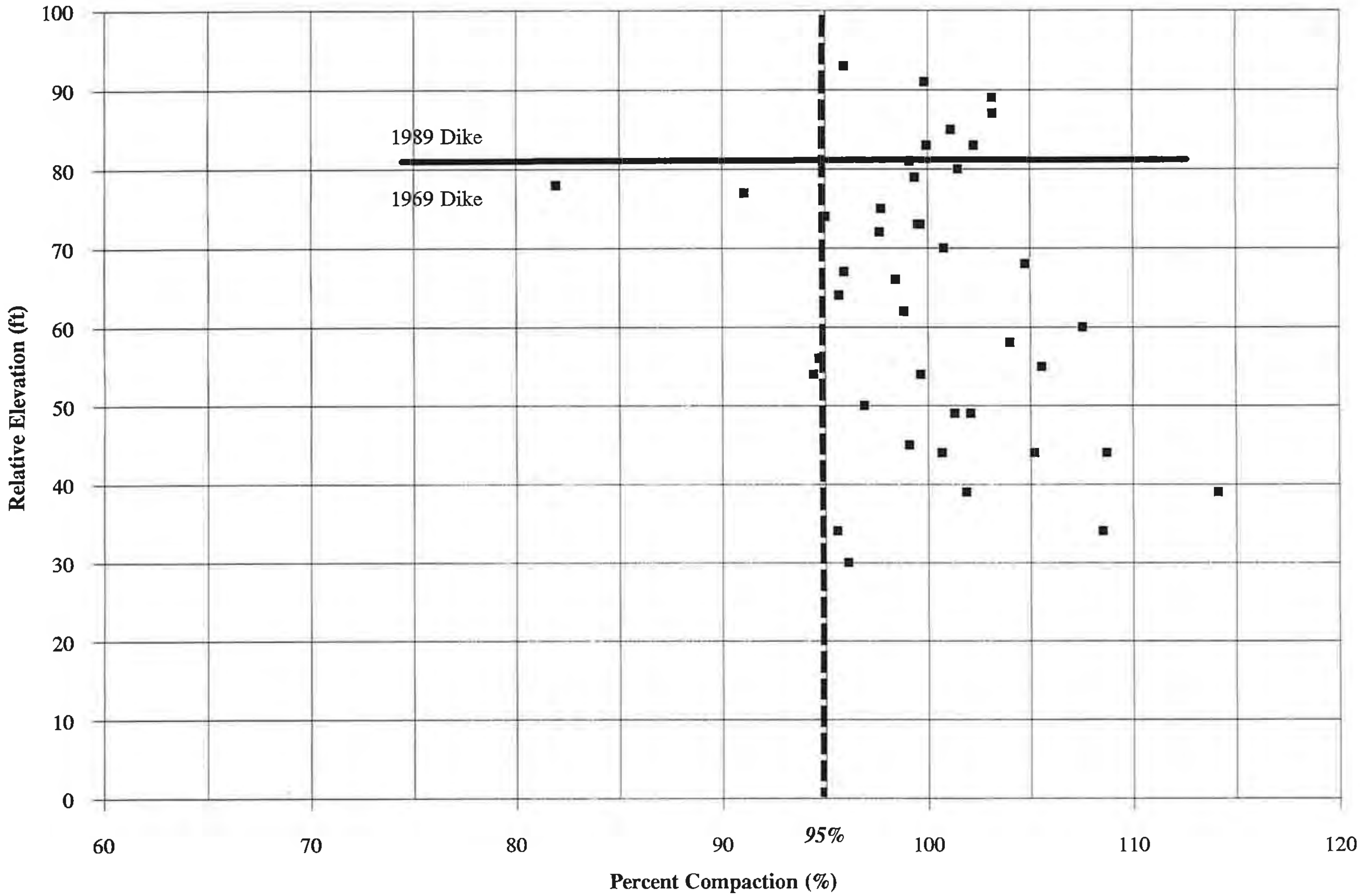
LEGEND

- CLAY (CL)
- CLAY (CH)
- BOTTOM ASH
- SILT (ML)
- SHALE

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND DIKE BALDWIN, IL.	PROJECT NO. 5E08560
Woodward–Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 4/20/95 DSGN. BY: gaz CHKD. BY:	Generalized Section Through Center of Failure — FIG. NO. 8

File: F:\5E08560\TASK240\SECTHSLD.DWG Last edited: 06/23/95 @ 1:59 p.m. @ WCC–ST.LOUIS

RESULTS OF ESTIMATED COMPACTION FOR DIKES

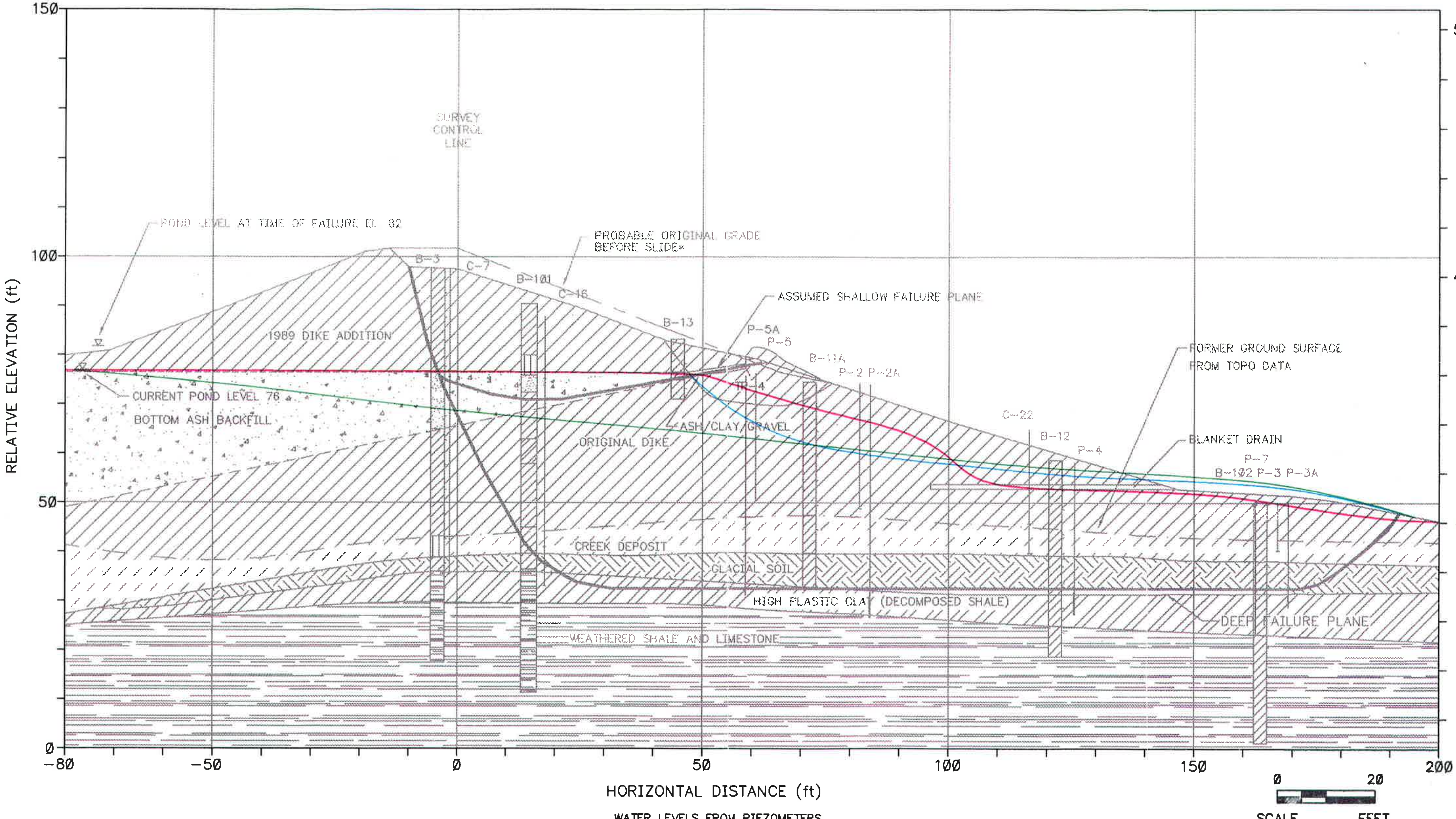


DENSITY.XLS Chart 1

Woodward-Clyde Consultants

FIGURE 9

File: F:\5E08560\TASK240\PIEZHEAD.DWG Last edited: 06/08/95 @ 09:41 a.m. @ WCC-ST.LOUIS



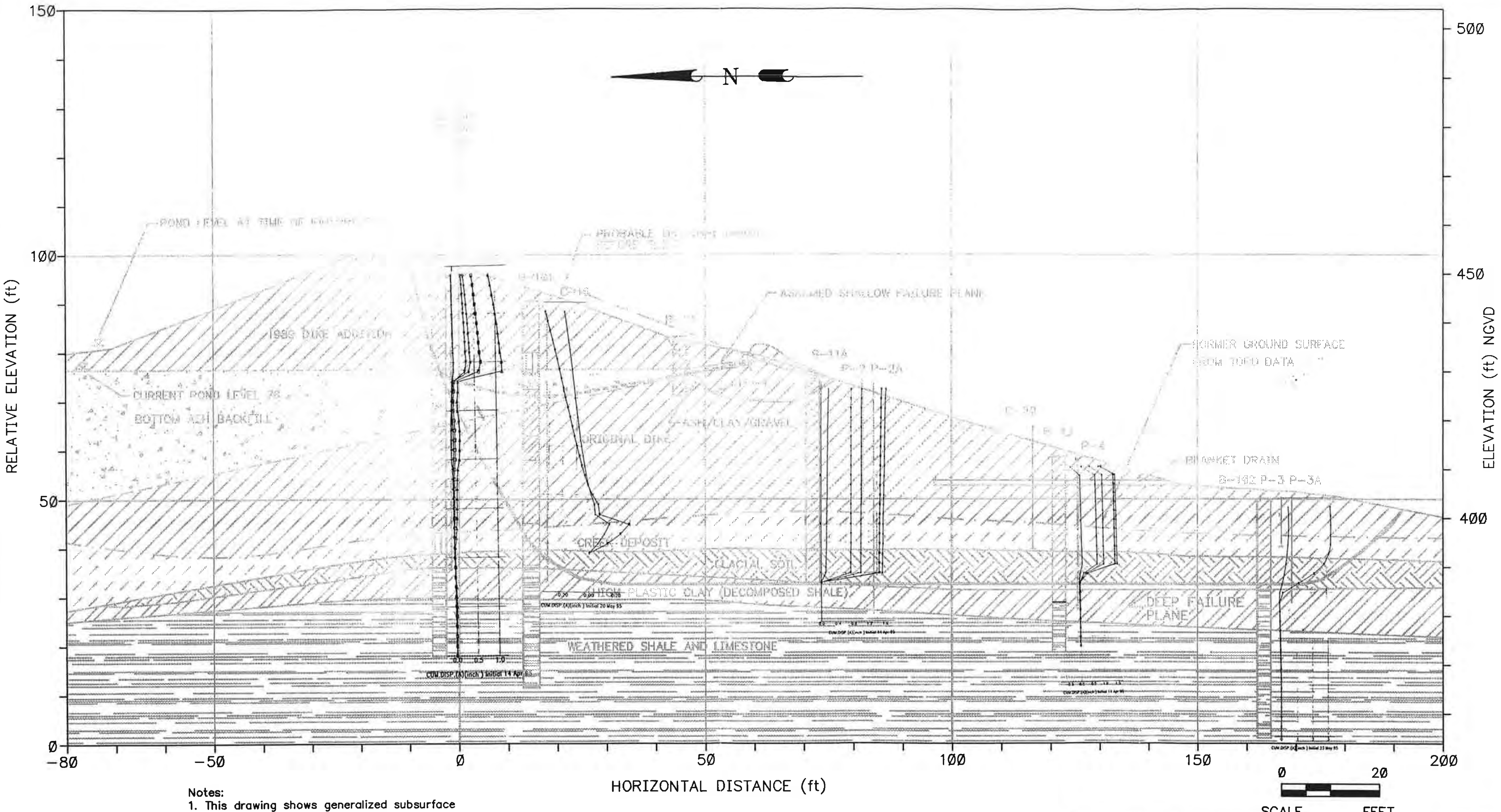
Notes:
1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location – not between.

WATER LEVELS FROM PIEZOMETERS

WITHIN FAILURE ZONE
- SHALLOW PIEZOMETERS
- DEEP PIEZOMETERS (ON FAILURE PLANE)

- OUTSIDE FAILURE (SHALLOW AND DEEP PIEZOMETERS)

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND DIKE BALDWIN, IL.	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 4/20/95 DSGN. BY: gaz CHKD. BY: JMB 6/23/95	Piezometeric Heads in Dam and Foundation — FIG. NO. 10



Notes:
1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location – not between.
3. Inclinometers B–11A and B–12 installed in April 1995; B–1Ø1 and B–1Ø2 install in May 1995.
4. During second reading of B–1Ø1, inclinometer probe would not go past 52ft deep. All future readings referenced to that depth. Bottom of inclinometer was moving laterally.

LEGEND

- CLAY (CL)
- CLAY (CH)
- BOTTOM ASH
- SILT (ML)
- SHALE

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND DIKE BALDWIN, IL.	PROJECT NO. 5EØ856Ø
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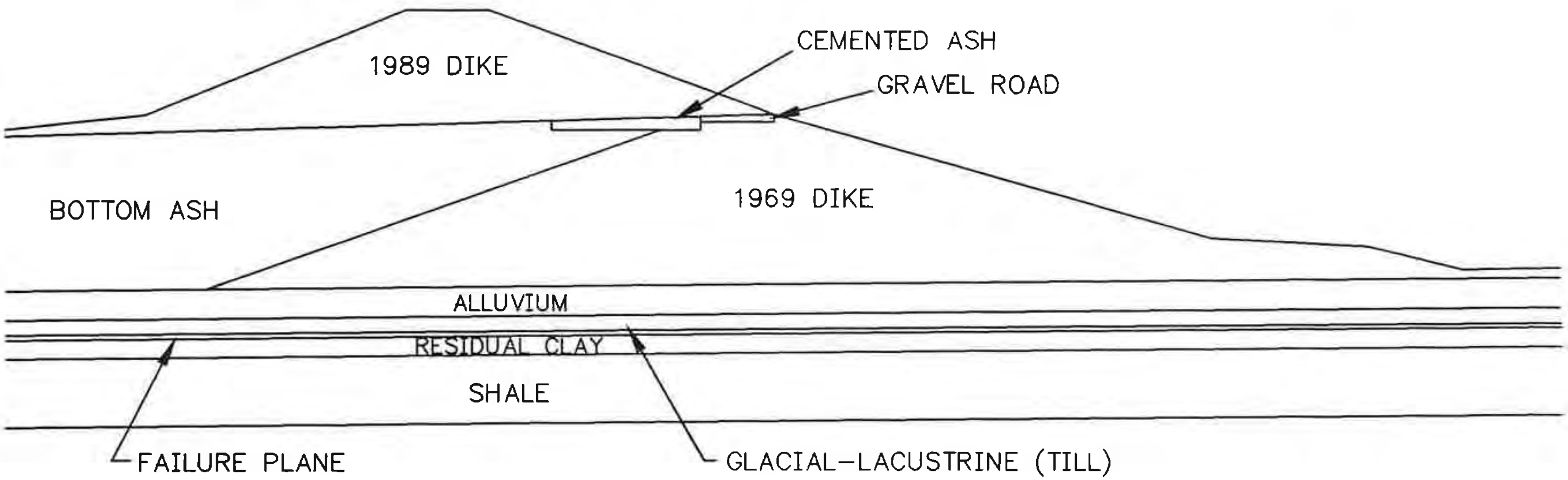
DRN. BY: bdl 4/2Ø/95 DSGN. BY: gaz CHKD. BY: KMB 6/23/95	Inclinometer Data	FIG. NO. 11

File: F:\5E0856Ø\TASK240\INCLDATA.DWG Last edited: 06/23/95 @ 2:08 p.m. @ WCC-ST.LOUIS

BASIC GEOMETERY FOR BACK CALCULATION



ILLINOIS POWER COMPANY
BALDWIN POWER STATION
ASH POND, SOUTH DIKE

PROJECT NO.
5EØ856Ø

Woodward-Clyde Consultants
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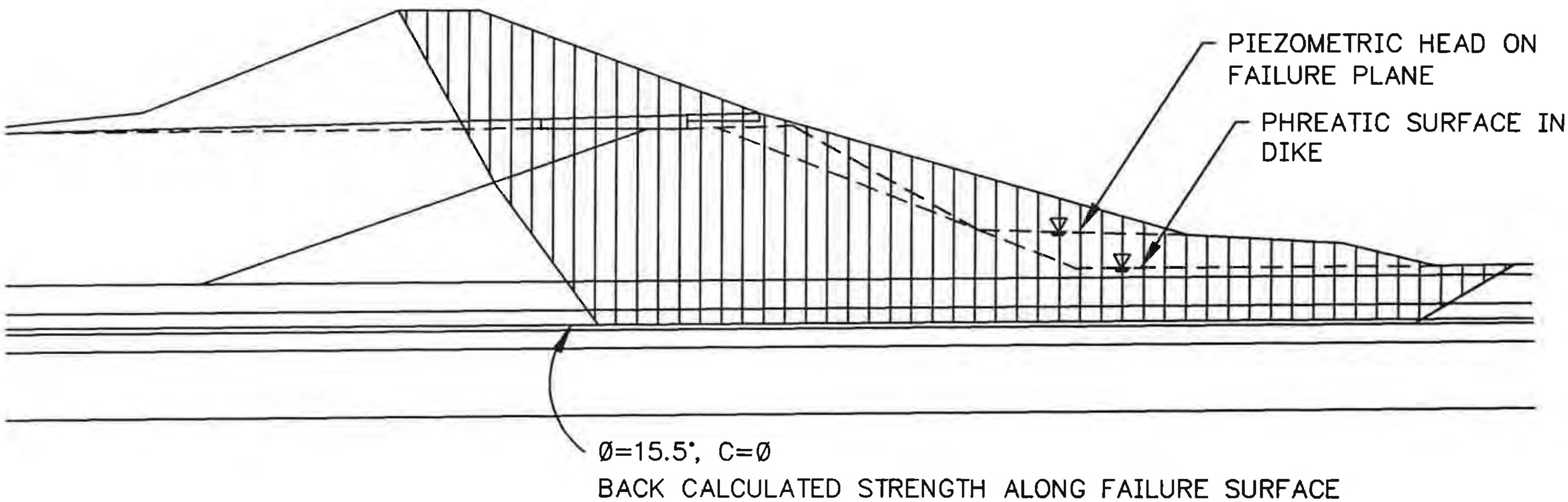
DRN. BY: bdl 8/28/95
DSGN. BY: kmb
CHKD. BY: KMB 8/30/95

Basic Geometry for Back Calculation

FIG. NO. 12

File: F:\5E08560\TASK700\FIG12.DWG Last edited: 08/30/95 @ 11:44 a.m. @ WCC-ST.LOUIS

BACK CALCULATION FAILURE PLANE
STEADY STATE CONDITION



ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE	PROJECT NO. 5EØ856Ø

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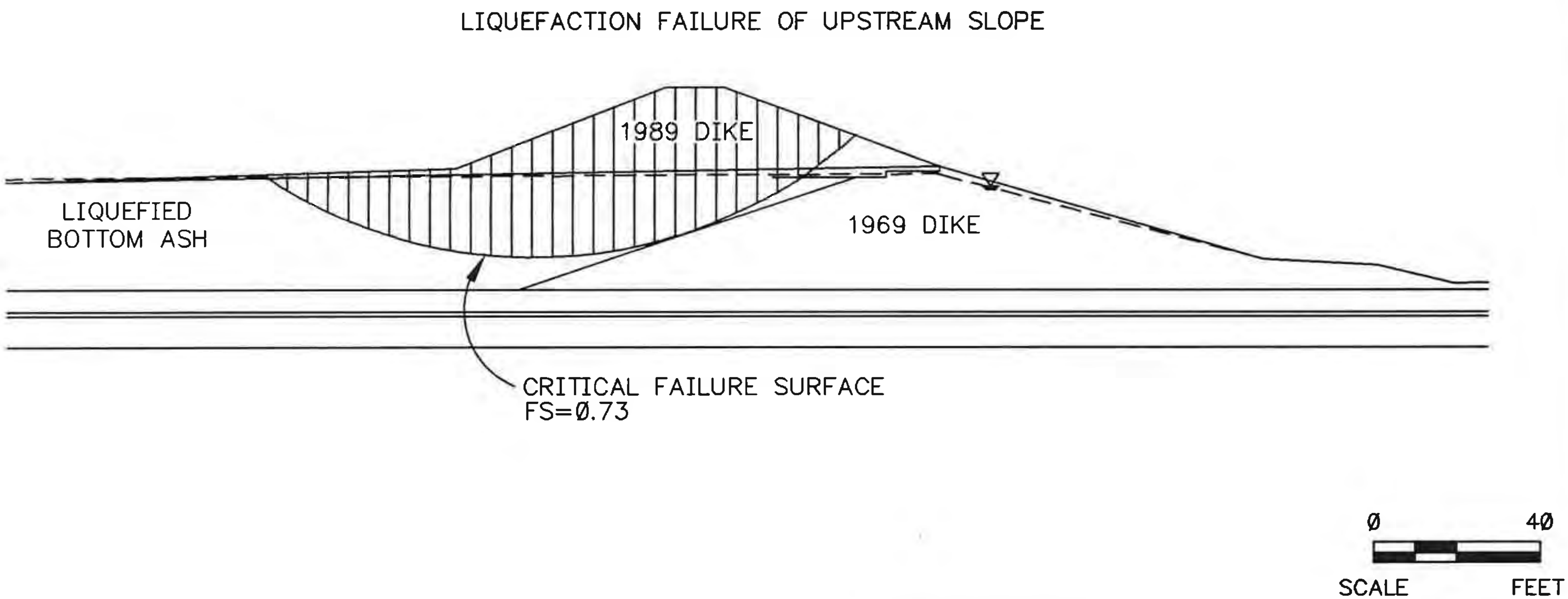
DRN. BY: bdl 8/28/95 DSGN. BY: kmb CHKD. BY: KMB 9-6-95	Back Calculation Failure Plane Steady State Condition	FIG. NO. 13

File: F:\5E08560\TASK700\FIG13.DWG Last edited: 09/06/95 @ 1:31 p.m. @ WCC-ST.LOUIS



ILLINOIS POWER COMPANY
BALDWIN POWER STATION
ASH POND, SOUTH DIKE

PROJECT NO.
5EØ856Ø

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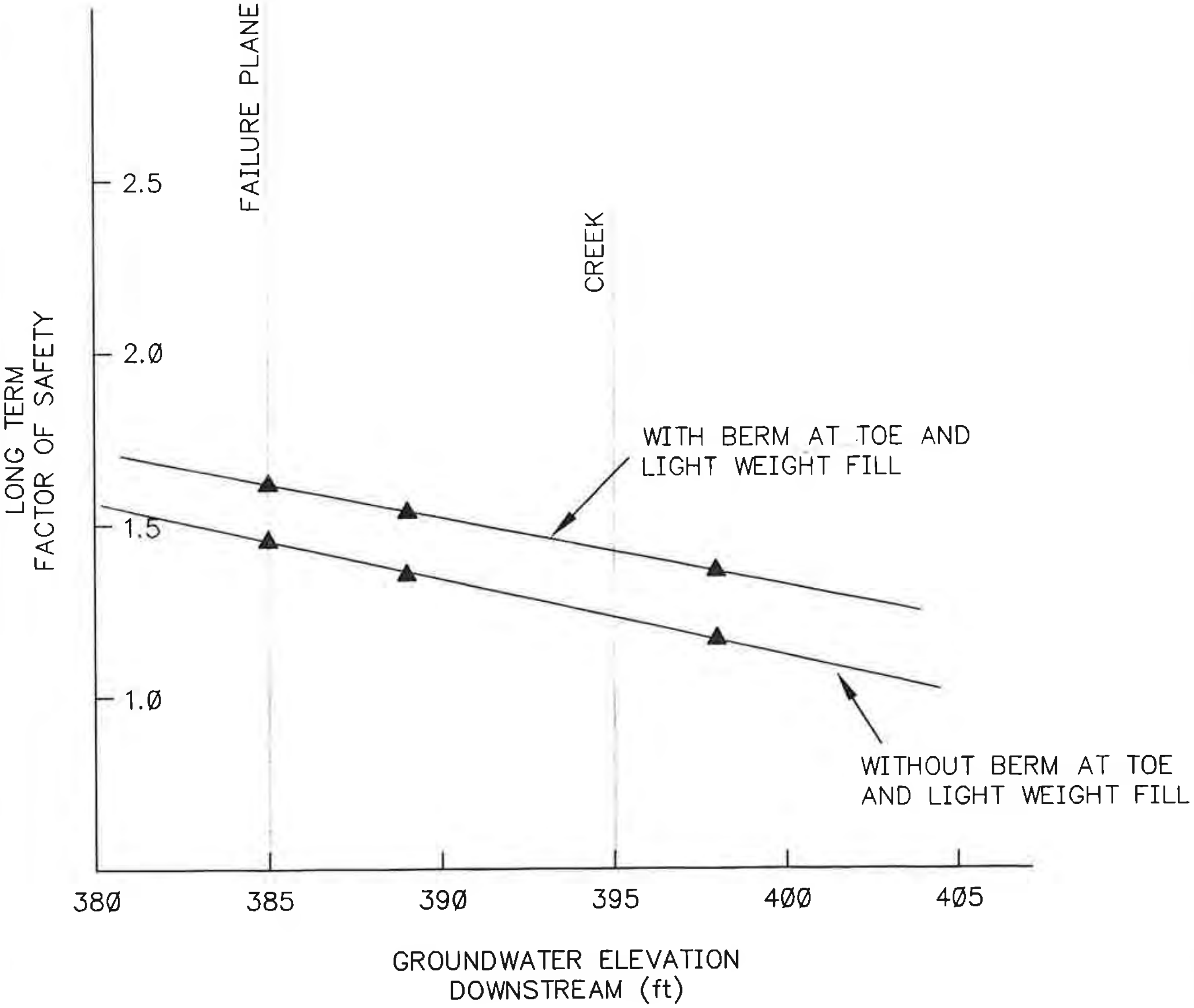
DRN. BY: bdl 8/28/95
DSGN. BY: kmb
CHKD. BY: kmb 9-6-95

Liquefaction of Upstream Slope

FIG. NO.
14



ILLINOIS POWER COMPANY
BALDWIN POWER STATION
ASH POND, SOUTH DIKE

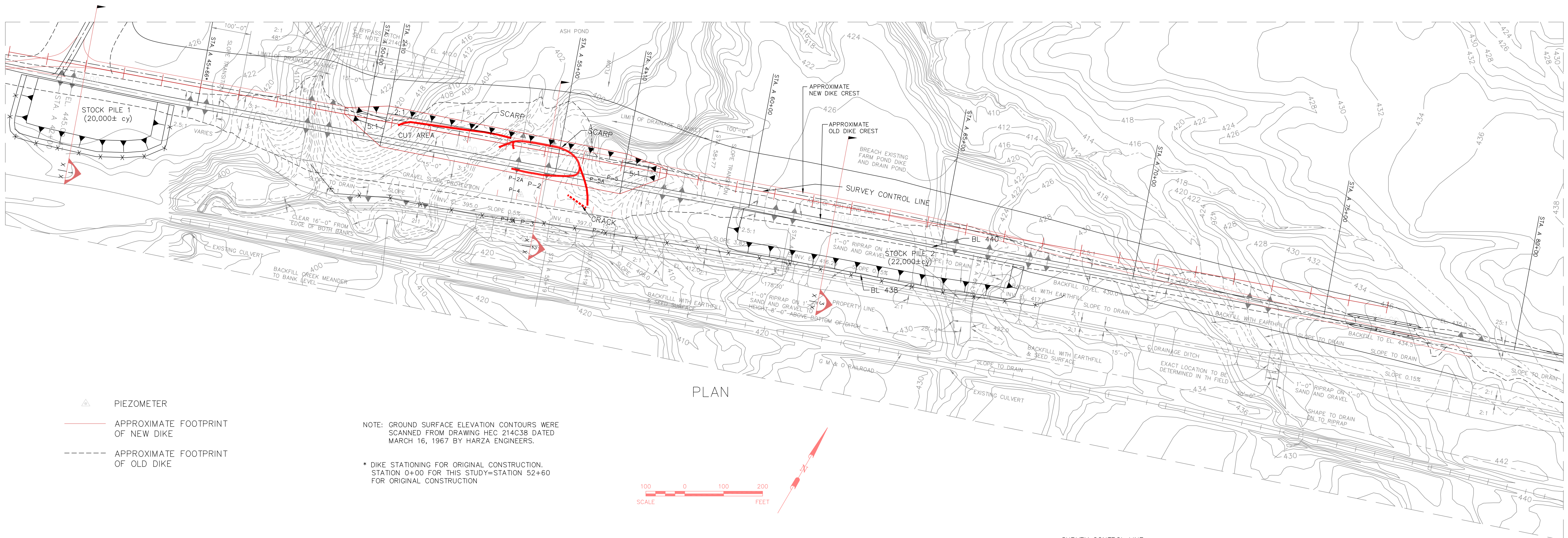
PROJECT NO. 5E08560

Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment

DRN. BY: bdl 8/25/95
DSGN. BY: kmb
CHKD. BY: KMR 8/31/95

Factor of Safety Chart

FIG. NO. 15



PLAN

PIEZOMETER

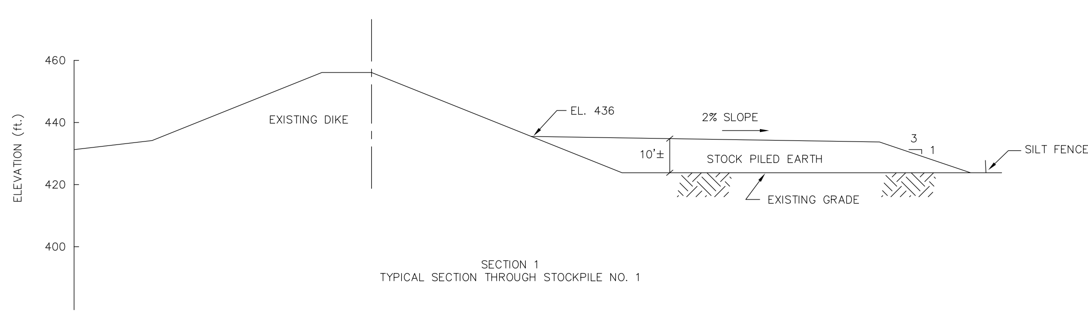
APPROXIMATE FOOTPRINT OF NEW DIKE

APPROXIMATE FOOTPRINT OF OLD DIKE

NOTE: GROUND SURFACE ELEVATION CONTOURS WERE SCANNED FROM DRAWING HEC 214C38 DATED MARCH 16, 1967 BY HARZA ENGINEERS.

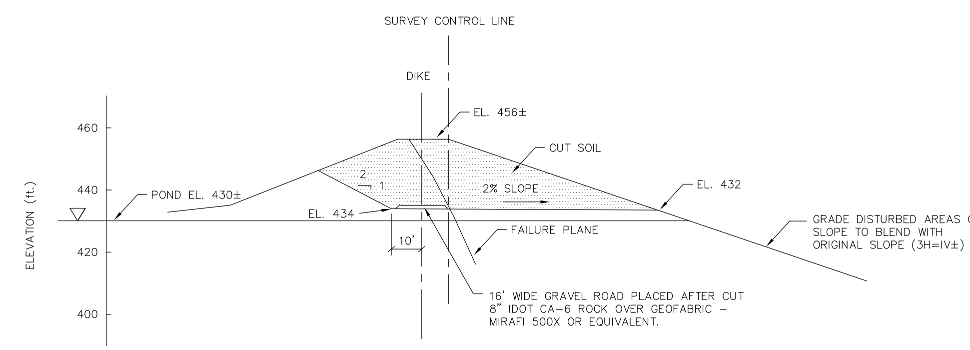
* DIKE STATIONING FOR ORIGINAL CONSTRUCTION. STATION 0+00 FOR THIS STUDY=STATION 52+60 FOR ORIGINAL CONSTRUCTION

100 0 100 200
SCALE FEET



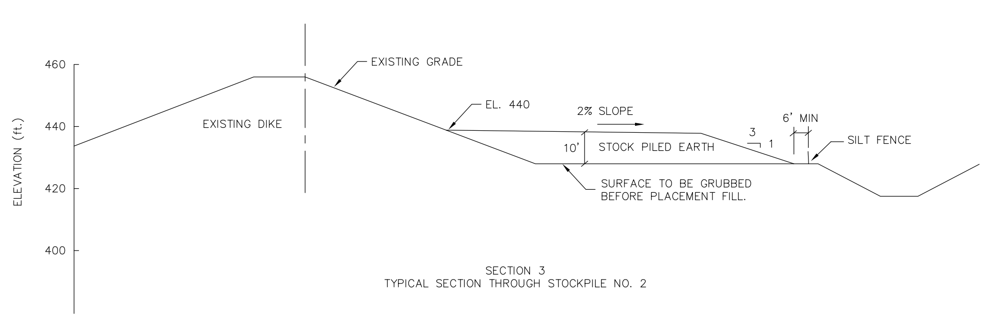
SECTION 1
TYPICAL SECTION THROUGH STOCKPILE NO. 1

0 20
SCALE FEET



SECTION 2
TYPICAL CUT AREA
(STA. 2+00)

0 20
SCALE FEET



SECTION 3
TYPICAL SECTION THROUGH STOCKPILE NO. 2

0 20
SCALE FEET

NOTES:
1. STRIP VEGETATION AND TOP SOIL PRIOR TO FILL PLACEMENT. STOCKPILE TOPSOIL SEPARATELY FROM EARTH.
2. PLACE STOCKPILE IN 12in LIFTS, COMPACT BY TRAFFICKING WITH HAULING AND SPREADING EQUIPMENT.
3. SLOPE FILL AREAS TO DRAIN.
4. SEED STOCKPILE AREAS, CUT AREAS, AND DISTURBED AREAS ON DOWNSTREAM SLOPE WITH CLASS 3 TYPE SEEDING MIXTURE PER SECTION 250, IDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, JULY 1, 1994. PROTECT SEEDED AREAS BY MULCHING PER IDOT STANDARD 251.03, METHOD 2.
5. PLACE AND MAINTAIN SILT FENCE, DOWNSLOPE OF WORK AREAS. SILT FENCES TO BE MIRAFI 100X OR EQUIVALENT.
6. LIMITS OF CUT AREA ARE APPROXIMATE, MAY BE FIELD ADJUSTED.

Revision No.	Description	Date	By	App.

REVISIONS

ILLINOIS POWER COMPANY
BALDWIN POWER STATION

ASH POND, SOUTH DIKE
INTERIM REPAIR

Date: 4/10/95	Project Number: 5E08560	Figure Number: 16
Drawn by: kdw	Design by: gaz	Checked by:

Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment

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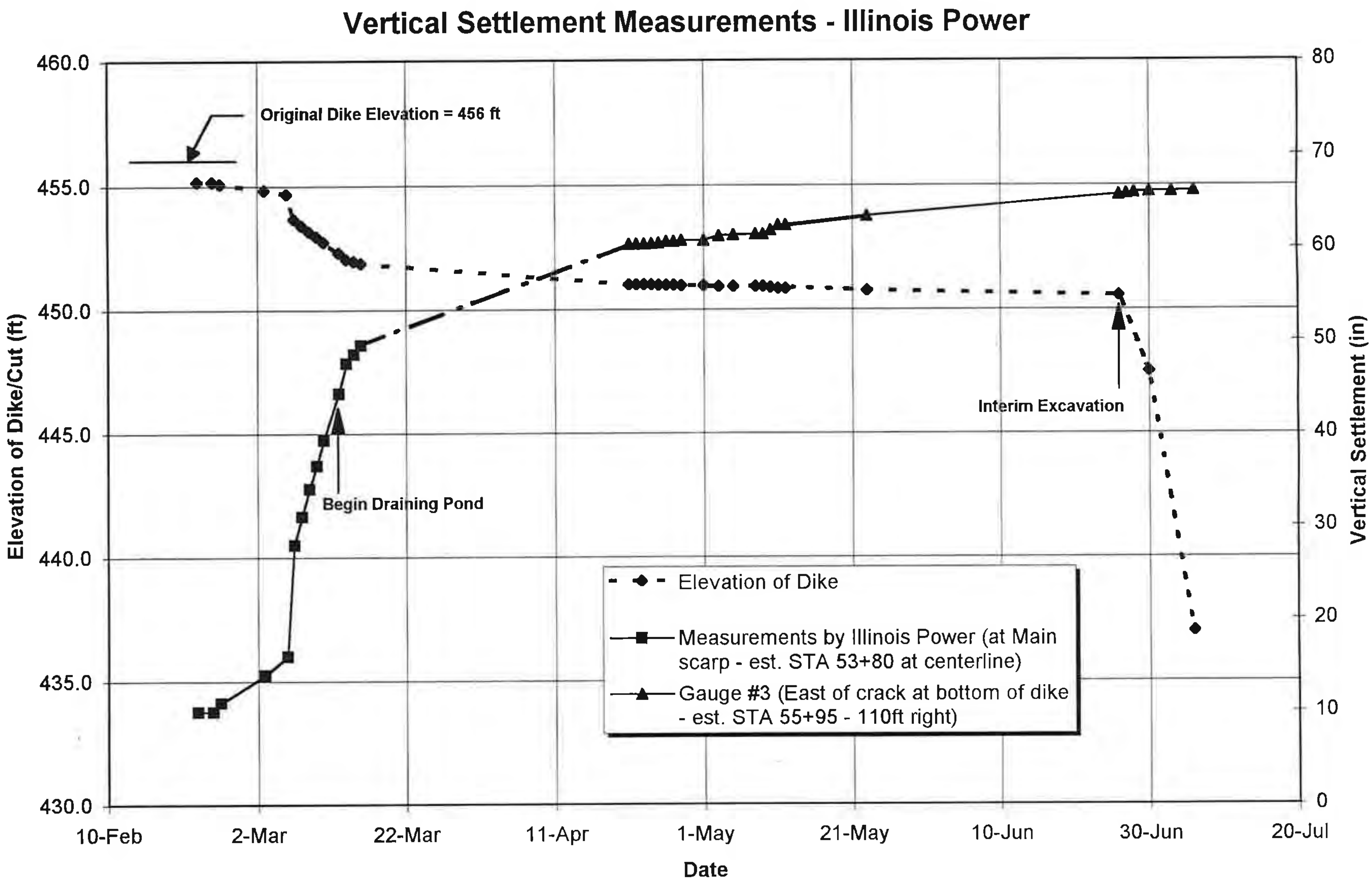


MVMENT.XLS

Figure 17

APPENDIX A

FIELD INVESTIGATION

A-1 PHOTOGRAPHS

A-2 TEST PITS

A-3 BORINGS

A-4 PIEZOCONE SOUNDINGS

APPENDIX A
FIELD INVESTIGATION

APPENDIX A-1 - PHOTOGRAPHS

Woodward-Clyde personnel used photographs to document the site conditions in March and April 1995. The content of the photographs include test pits and the area surrounding the failure scarp. Each photograph contains a description concerning the content of the photograph. The photographs are presented in this appendix as Figures A-1-1 through A-1-10.

PHOTOGRAPHS
Illinois Power Co. - Baldwin Power Station
Ash Pond - South Dike

4/7/95

Looking west over scarp at crest of slide. (21 March 1995). Rig working on Boring B-2.

4/7/95

Looking east over scarp at crest. Piezometer P-1 in foreground. (21 March 1995)

A-1-1

PHOTOGRAPHS
Illinois Power Co. - Baldwin Power Station
Ash Pond - South Dike

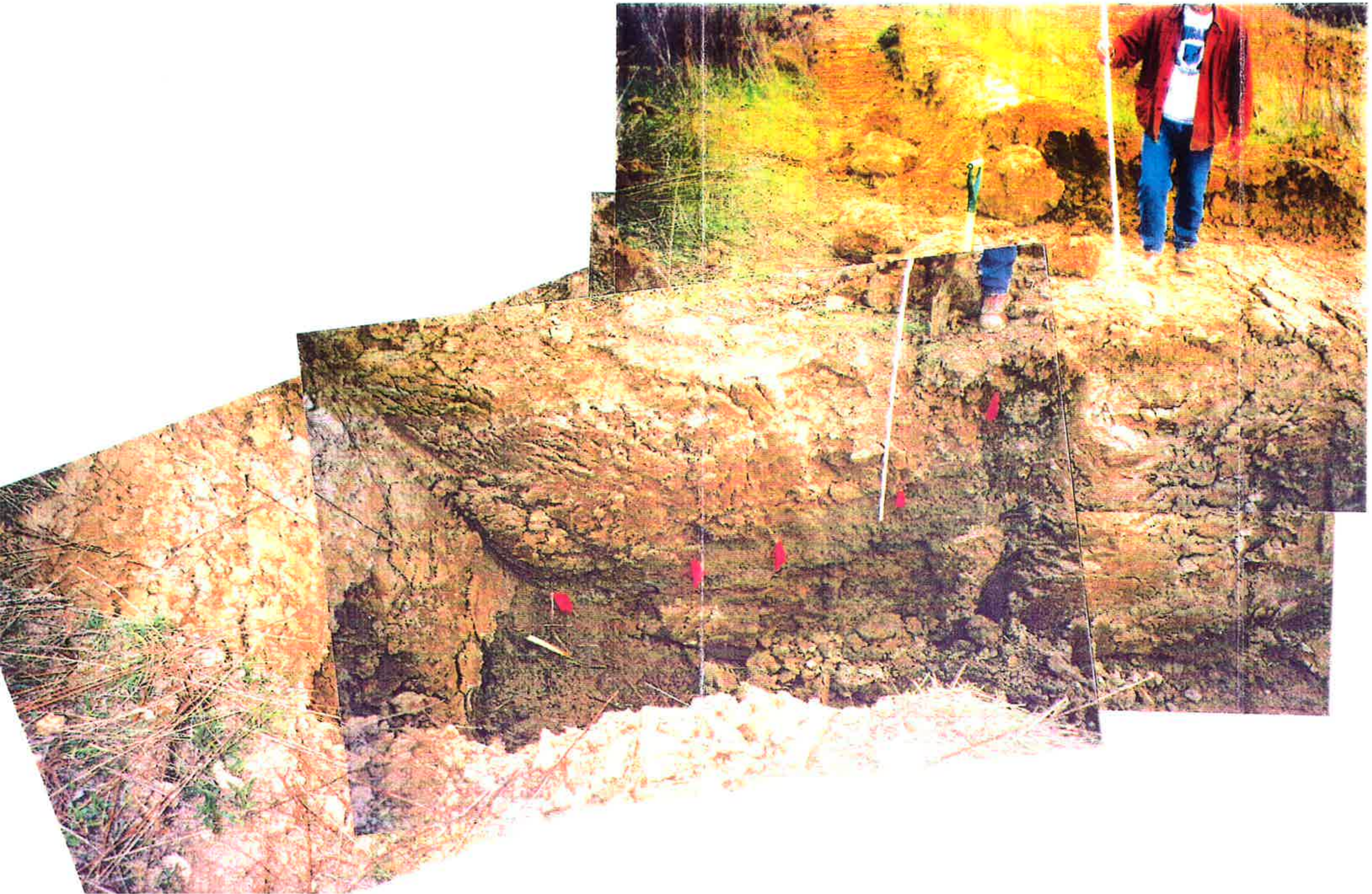
4/7/95	Looking southwest across slide from crest on east edge of slide. Midslope scarp at center. Test pits TP-4 and TP-5 open (21 March 1995)

4/7/95	Looking southeast across slide area from crest at west edge of slide. Note midslope scarp running diagonally across photo. Test pit TP-4 behind man. (21 March 1995)	A-1-2

PHOTOGRAPHS
Illinois Power Co. - Baldwin Power Station
Ash Pond - South Dike

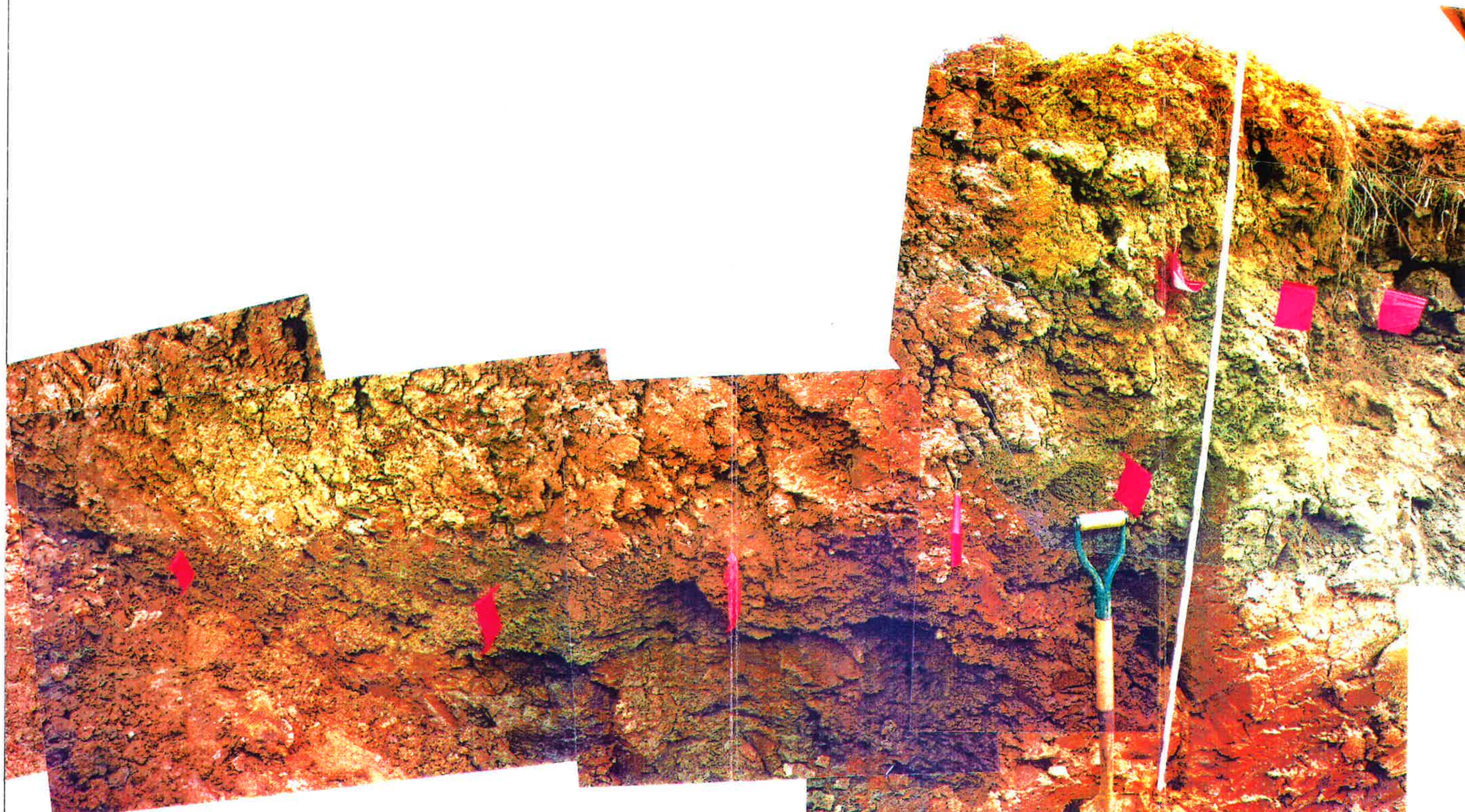
4/7/95	Both photos show scrap at lower east edge of slide; looking east from about midheight of slope. (21 March 1995)	A-1-3

PHOTOGRAPHS
Illinois Power Co. - Baldwin Power Station
Ash Pond - South Dike



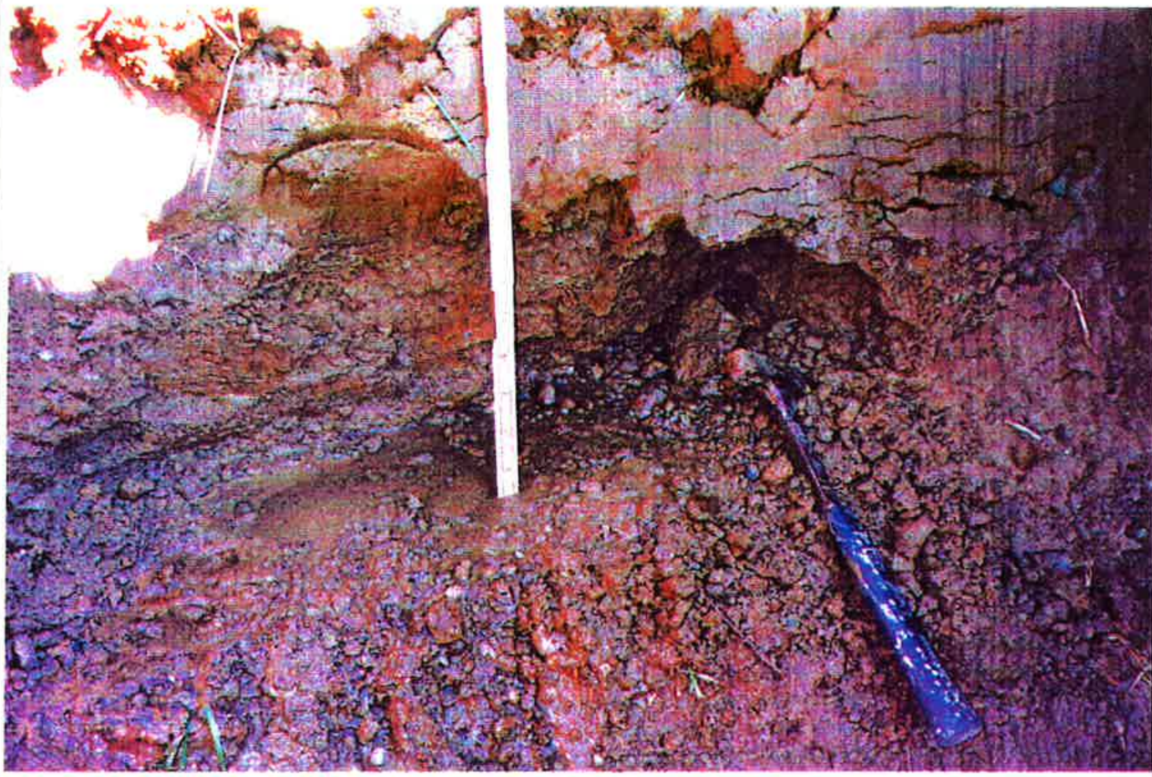
PHOTOGRAPHS
Illinois Power Co. - Baldwin Power Station
Ash Pond - South Dike

4/7/95	Test Pit TP-4: East face. Note zone of fly ash/bottom ash, gravel and clay. Midslope scarp visible in center of photo. Could not trace scarp deeper than about 3 ft. below grade. Seepage at north face in pervious zone when trench opened. (20 March 95)	A-1-5



4/7/95	Test Pit TP-5: Panorama of east face looking from north (left) to east (at location of shovel). Flags are at top of pervious fly ash/bottom ash, gravel and clay zone. Rule is at midslope scarp. Note that a portion of the right zone (downslope) of scarp is lifted above portion on the left (upslope). Scarp extends below the pervious zone at right of rule. Seepage was noted at the north end of the pervious zone when the trench was opened 20 March 1995. (photo taken 22 March 19995).	A-1-6

PHOTOGRAPHS
Illinois Power Co. - Baldwin Power Station
Ash Pond - South Dike

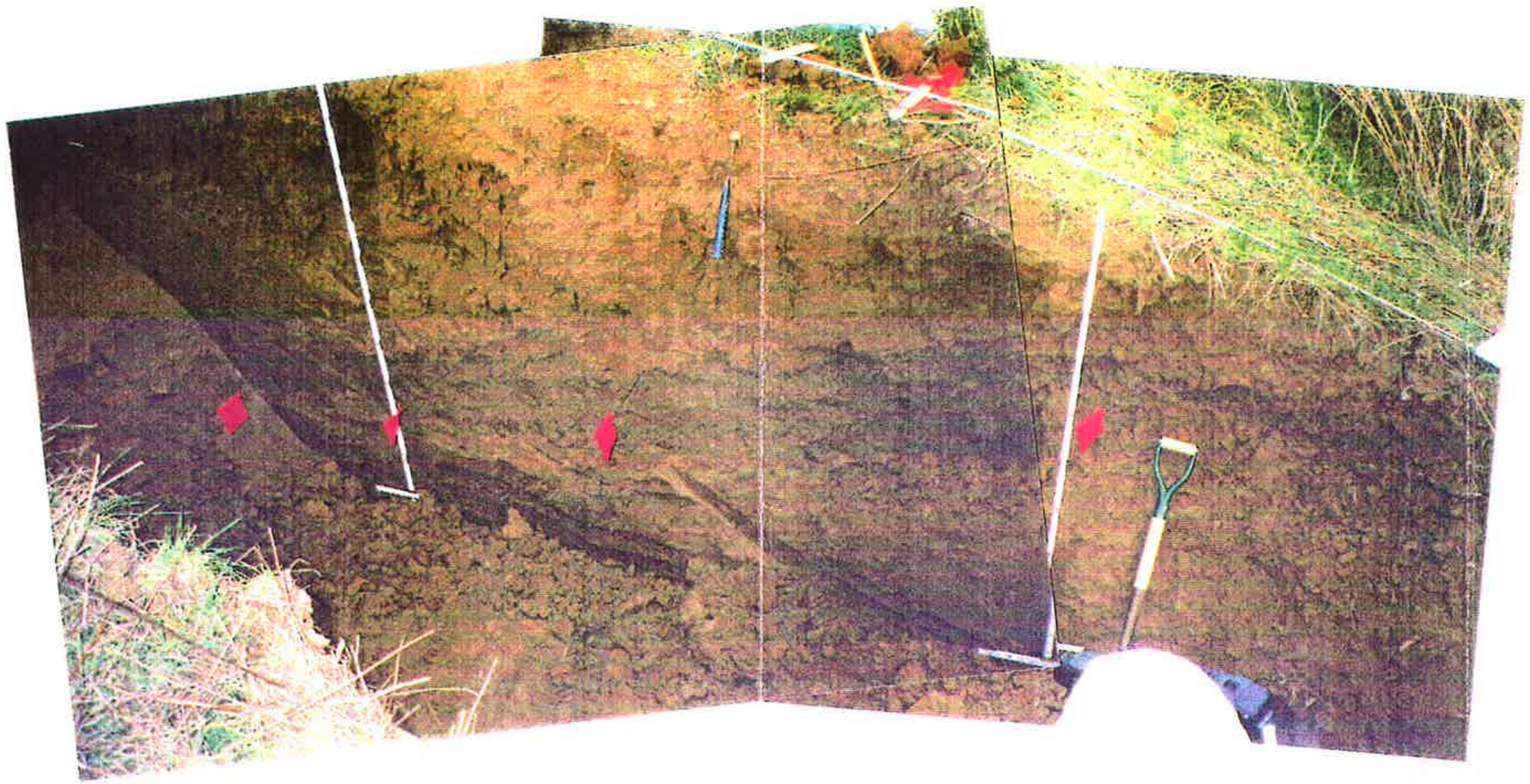


4/7/95	Seepage from the pervious fly ash/bottom ash, gravel and clay zone into the north end of Test Pit TP-5 shortly after excavation. (20 March 1995). Rockpick needed to excavate this zone due to cementation (lime treatment?)	A-1-7

4/7/95

Test Pit TP-6: Looking Northeast. Note zone of fly ash/bottom ash, gravel and clay. North end of this zone is lime treated and hard. No seepage visible. (22 Mar 95)

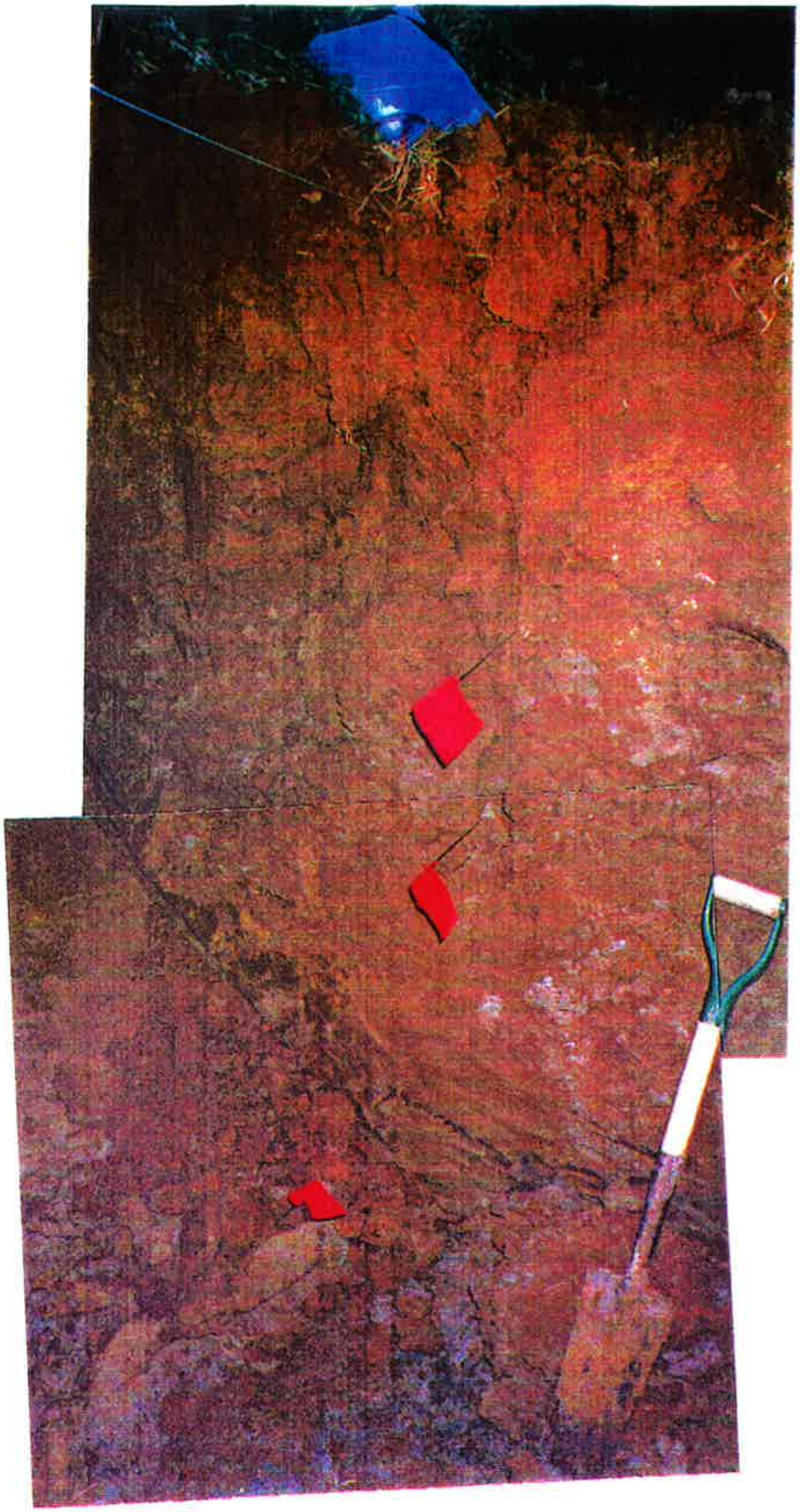
A-1-8



Test Pit TP-7: East face looking northeast. Note zone of fly ash/bottom ash, gravel and clay. Northern portion of this zone is lime treated and hard. No seepage. (22 March 95)

4/7/95

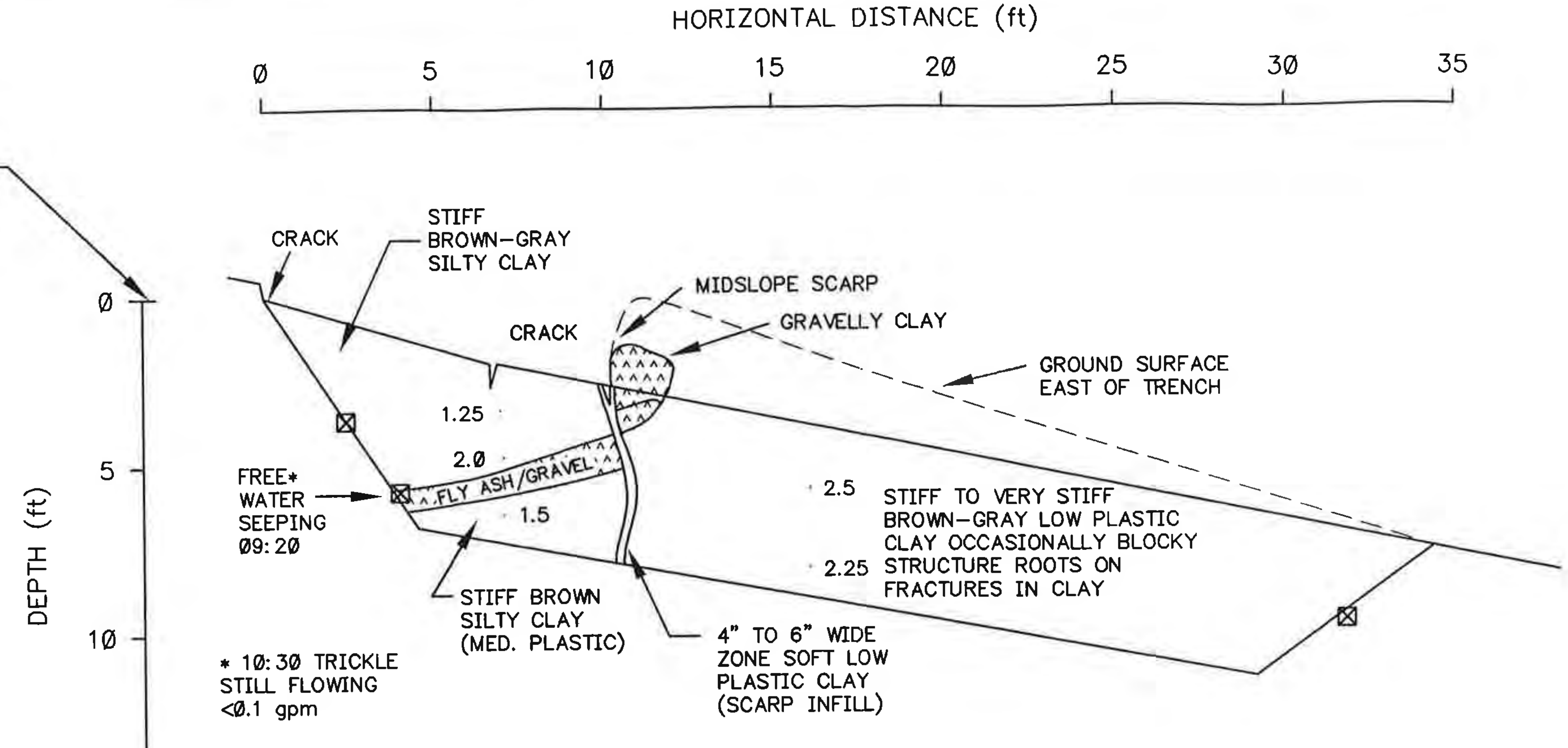
A-1-9



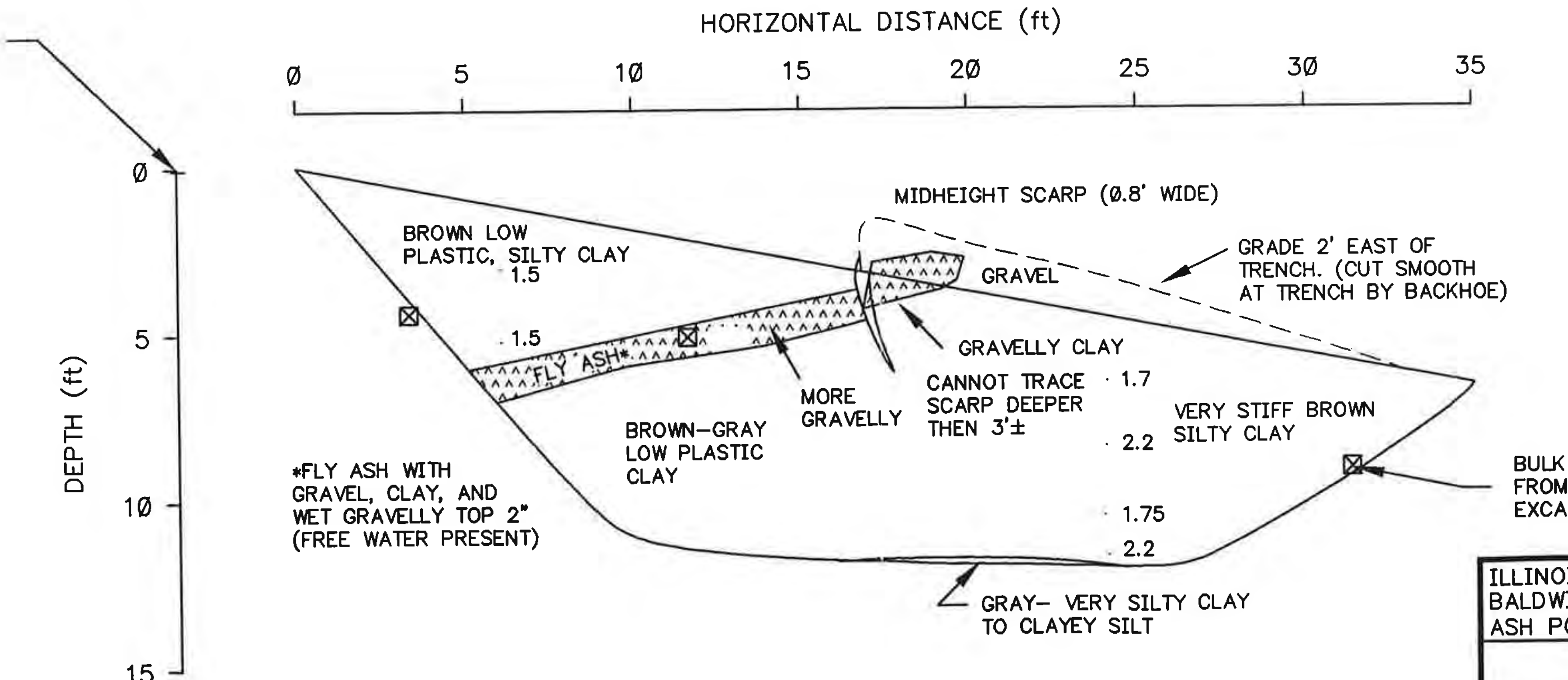
4/7/95	Test Pit TP-8: East face. Flags trace scarp to bottom. Scarp zone consists of very soft clay zone 1 to 2 in. wide. Soil on either side is very stiff clay.	A-1-10

APPENDIX A-2 - TEST PITS

A total of 8 test pits were excavated between March 20, 1995 and March 22, 1995 using a track-mounted Caterpillar backhoe equipped with a 48-inch wide, 2.5 cubic yard bucket. The test pits were positioned to intercept the potential failure surfaces, both within and outside of the observable failure areas. Detailed logs of the test pits are included in Figures A-2-1 through A-2-3.



TEST PIT 3 EAST FACE
(EXCAVATED MARCH 21, 1995)



TEST PIT 4 LOOKING EAST
(EXCAVATED MARCH 20, 1995)

LEGEND

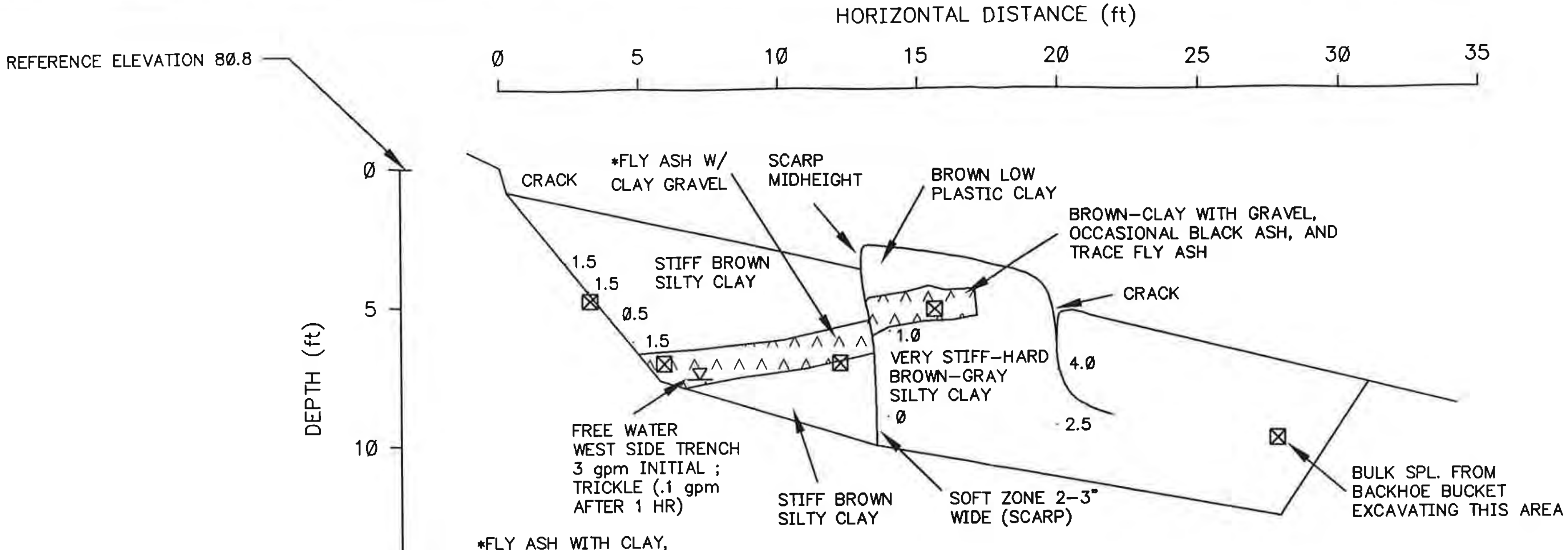
⊠ SOIL SAMPLE

4.0 POCKET PENETROMETER DIRECT READING (UNCONFINED COMPRESSIVE STRENGTH, TSF)

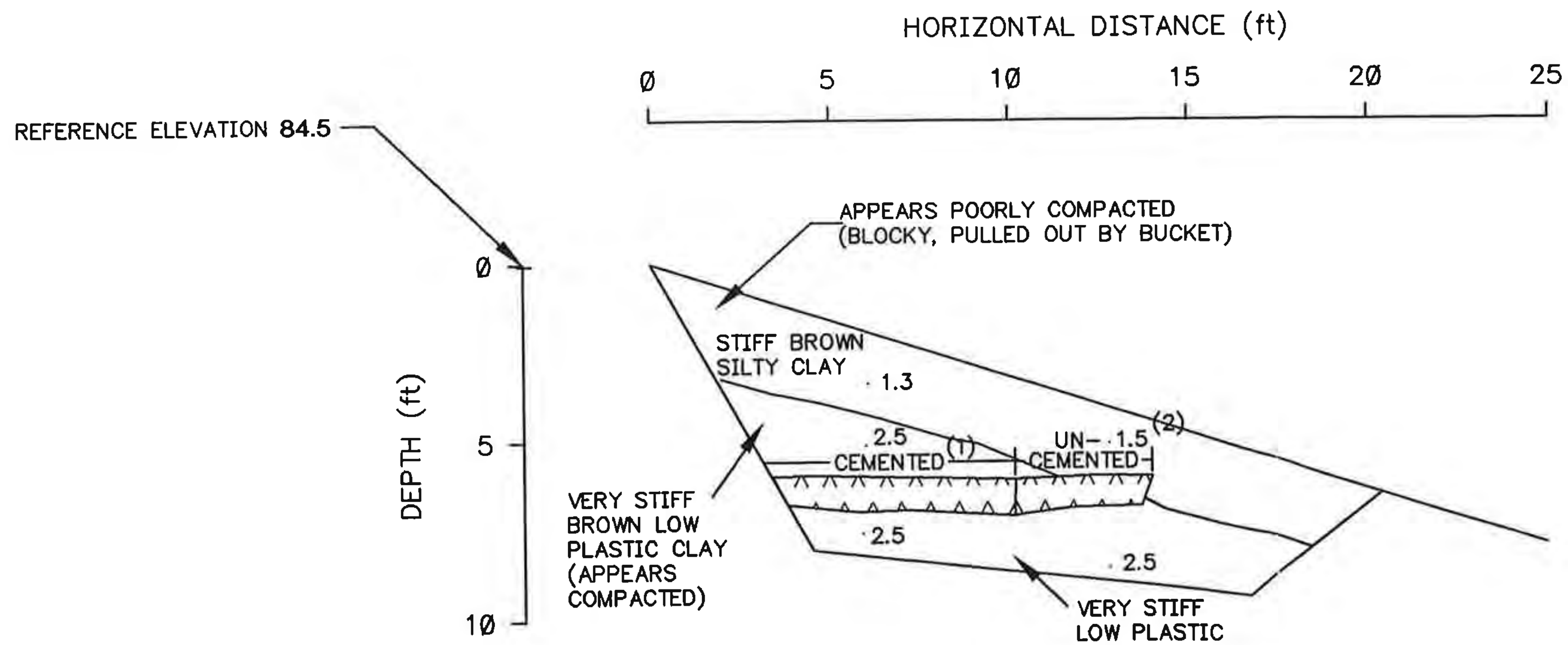
SCALE 0 5 FEET

ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 4/25/95 DSGN. BY: gaz CHKD. BY: KMB 9-6-95 — TEST PIT LOGS TP-3, TP-4	FIG. NO. A-2-1

File: F:\5E08560\TASK240\TESTPIT3.DWG Last edited: 09/06/95 @ 3:53 p.m. @ WCC-ST.LOUIS



TEST PIT 5 EAST FACE
(EXCAVATED MARCH 2Ø, 1995)



(1) FLY ASH 6Ø%, GRAVEL 35%, BOTTOM ASH 5% (CEMENTED)
(2) FLY ASH 5Ø%, GRAVEL 3Ø%, BOTTOM ASH 5%, CLAY 15% (UNCEMENTED)

NO FREE WATER VISIBLE

TEST PIT 6 EAST FACE
(EXCAVATED MARCH 22, 1995)

LEGEND

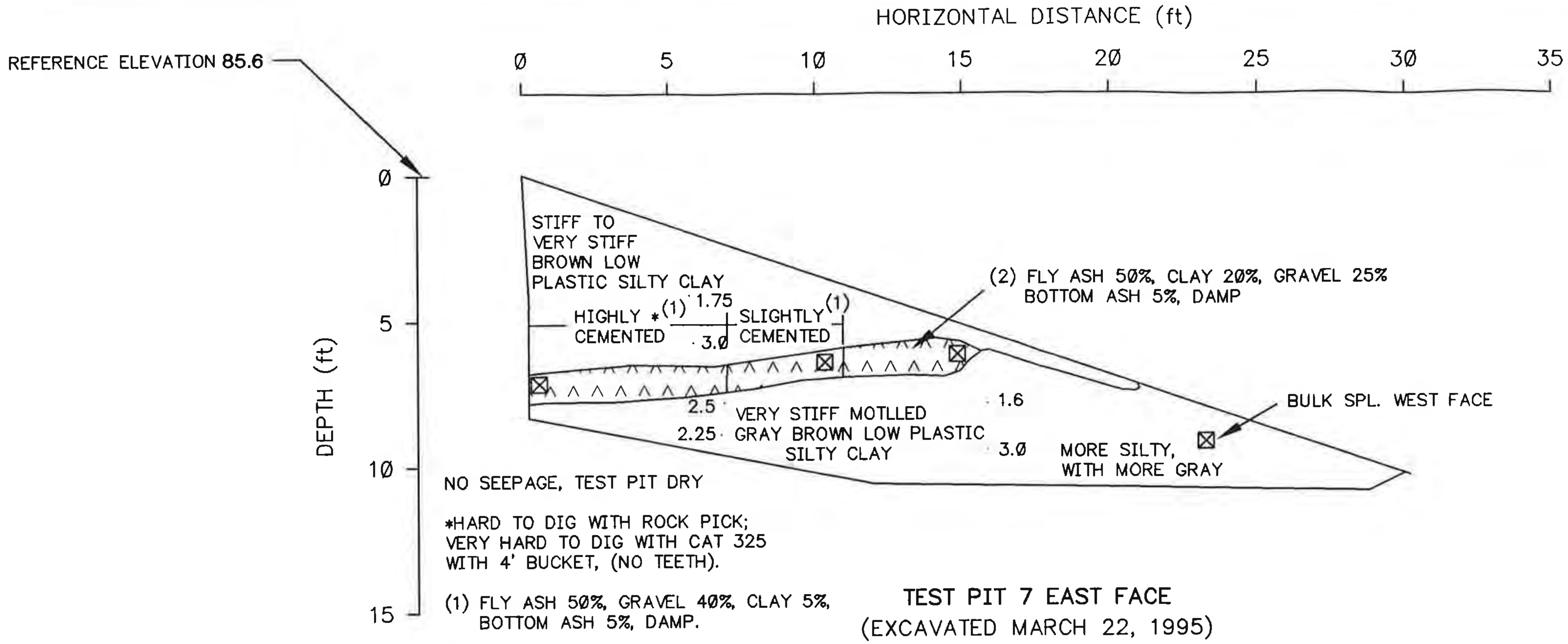
⊠ SOIL SAMPLE

4.Ø POCKET PENETROMETER DIRECT READING (UNCONFINED COMPRESSIVE STRENGTH, TSF)

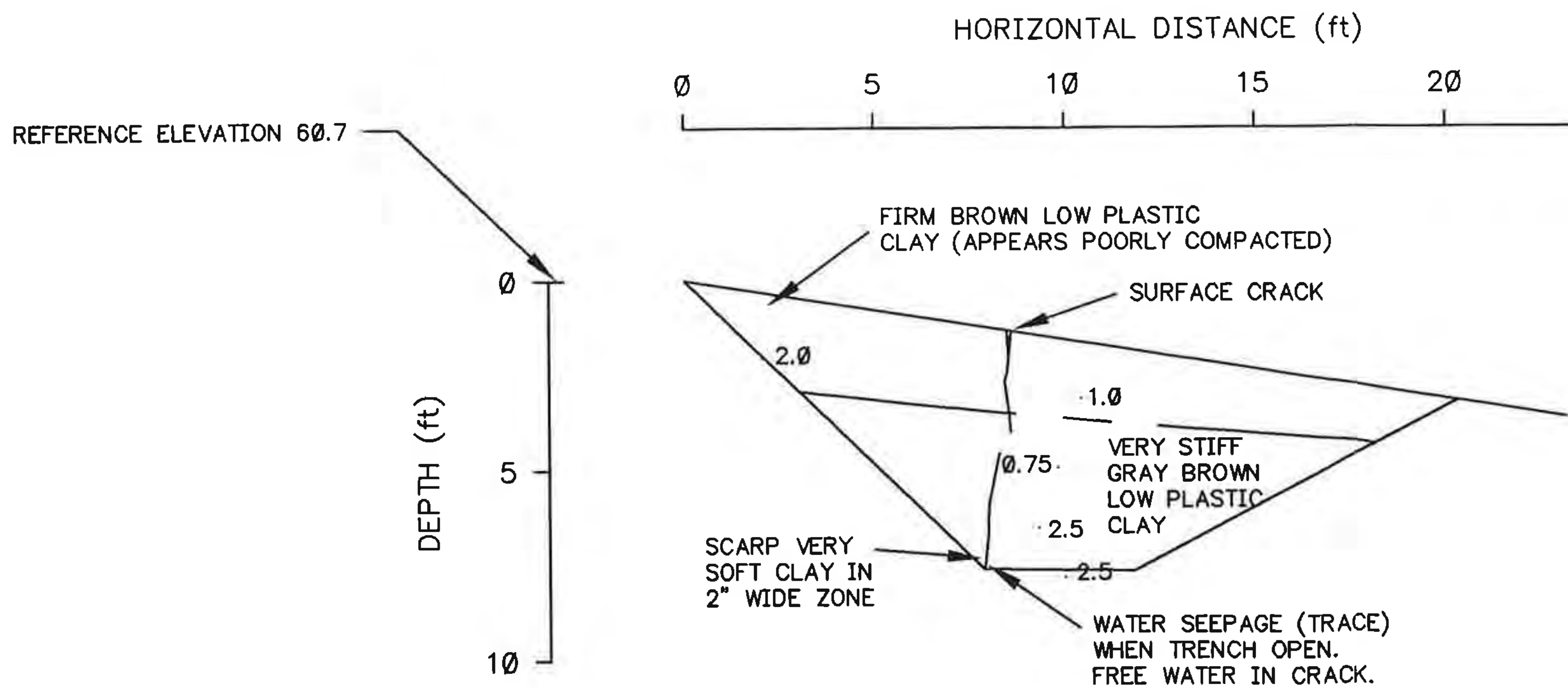
Ø 5
SCALE FEET

ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE	PROJECT NO. 5EØ856Ø
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 4/25/95 DSGN. BY: gaz CHKD. BY: KMA 9-6-95	TEST PIT LOGS TP-5, TP-6 — FIG. NO. A-2-2

File: F:\5EØ856Ø\TASK24Ø\TESTPIT5.DWG Last edited: 09/06/95 @ 3:55 p.m. @ WCC-ST.LOUIS



TEST PIT 7 EAST FACE
(EXCAVATED MARCH 22, 1995)



TEST PIT 8 EAST FACE
(EXCAVATED MARCH 22, 1995)

LEGEND

⊠ SOIL SAMPLE

4.0 POCKET PENETROMETER DIRECT READING (UNCONFINED COMPRESSIVE STRENGTH, TSF)

SCALE 0 5 FEET

ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE	PROJECT NO. 5E08560

Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment

DRN. BY: bdl 4/26/95 DSGN. BY: gaz CHKD. BY: KMB 9-6-95	TEST PIT LOGS TP-7, TP-8	FIG. NO. A-2-3

File: F:\5E08560\TASK240\TESTPIT7.DWG Last edited: 09/06/95 @ 3:58 p.m. @ WCC-ST.LOUIS

APPENDIX A-3 - BORINGS

Seven of the 15 borings (B-1, B-5, B-6, B-7, B-8, B-9, and B-15) were made with a Dietrich 120 drill rig, owned and operated by Midwest Engineering Services, Inc. of Champagne. Two borings (B-101 and B-102) and five piezometers (P-2A, P-3A, P-4, P-5A, and P-7) were made with a CME-750 all terrain drill rig, owned and operated by Roberts Environmental Drilling, Inc. of Millstadt, Illinois. All of the other explorations and instrumentation installations were made by a CME-750 all terrain drill rig, owned and operated by Layne-Western Company, Inc. of St. Louis. Layne-Western had two drill rigs on site for a period of two days, but they removed one rig to take it to another site. The drill rigs were under subcontract to WCC.

The borings were advanced through the soil using either 4-in. O.D. continuous flight auger (CFA), 4.25-in. I.D. hollow stem auger (HSA), 6.25-in. I.D. HSA, or rotary wash with a 5-in diameter tri-cone bit. The depths of the borings ranged from approximately 10 to 80 feet. Surveyed locations (station, offset, and elevation) for the borings of the first phase were provided to WCC by Illinois Power. The locations for the second phase borings was estimated based upon the survey information that was provided.

Samples of subsurface materials were obtained at about 5-ft intervals using three types of samplers: 1) a hydraulically pushed, 2-in. I.D., thick-walled liner-tube sampler (modified California sampler); 2) a 2-in. O.D. split-spoon sampler driven by a 140-lb. hammer in conjunction with a Standard Penetration Test (ASTM D-1586), and 3) hydraulically pushed 3-in. diameter thin-walled Shelby tubes. Some shelby tubes were obtained using a fixed piston sampler.

The borings were logged in the field based upon recovered samples, cuttings, and drilling characteristics. Boring logs were subsequently modified as appropriate based on laboratory test results. Detailed boring logs are included as Figures A-3-1 through A-3-23 of this appendix.

KEY TO BORING LOGS

Group	Graphic Symbol	Description	USC Class.
GRAVEL		GRAVEL with little or no fines	GP or GW
		Silty GRAVEL	GM
		Clayey GRAVEL	GC
SAND		SAND with little or no fines	SP or SW
		Silty SAND	SM
		Clayey SAND	SC
LOW PLASTIC SILTS AND CLAYS		Inorganic low plastic SILT	ML
		Inorganic low plastic CLAY	CL
		Silty	CL
		Sandy	CL
		Gravelly	CL
		Organic low plastic SILT or CLAY	OL
HIGH PLASTIC SILTS AND CLAYS		Inorganic high plastic SILT	MH
		Inorganic high plastic CLAY	CH
		Organic high plastic SILT or CLAY	OH
		Peat and other highly organic soils	PT
ROCKS		LIMESTONE	
		SHALE	
		SANDSTONE	
		SILTSTONE	
SURFACE MATERIALS		Topsoil or pavement	
		FILL	

TERMS DESCRIBING CONSISTENCY OR CONDITION

Coarse grained soils (major portion retained on No. 200 sieve): Includes gravels and sands. Condition is rated according to the Standard Penetration Resistance, as shown below.

Descriptive Term	Blows 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): Includes clays and silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings or by unconfined compression tests.

Descriptive Term	Unconfined Compressive Strength, tons/sq.ft	Hand Test
Very soft	less than 0.25	Extrudes between fingers
Soft	0.25 - 0.50	Molded by slight pressure
Firm	0.50 - 1.00	Molded by strong pressure
Stiff	1.00 - 2.00	Indented by thumb
Very stiff	2.00 - 4.00	Indented by thumbnail
Hard	4.00 and higher	Difficult to indent

LEGEND AND NOMENCLATURE

Symbol	Meaning
	Standard Penetration Sample
	Liner-tube sample, obtained by penetration of thick wall sampler containing 2 in. diameter liner-tubes (California sampler).
	Undisturbed sample, obtained by penetration of minimal 3 in. diameter, thin wall tube or, where indicated, fixed-piston sampling head.
	NX core.
PP,tsf	Unconfined compressive strength in tsf estimated with pocket penetrometer.
TV,tsf	Undrained shear strength in tsf estimated with torvane.
NMC,%	Natural Moisture Content, %
LL	Liquid Limit
PI	Plasticity Index
Qu, ksf	Unconfined Compressive Strength (Laboratory), ksf
RQD=80%	Percentage (80) of Rock Quality Designation
∇	Depth Groundwater enters at time of drilling.
▼	Groundwater Level at some specified time after drilling.

SAMPLING RESISTANCE

Symbol	Meaning
P	Sample pushed by hydraulic rig action.
3 6 9	Numbers indicate blows per 6 in. of sampler penetration when driven by a 140 lb hammer falling freely 30 in. The Standard Penetration Resistance is the number of blows for the last 12 in. of penetration of the Standard Penetration sampler, e.g. 15.
15	Standard Penetration Resistance
50/2	Number of blows (50) used to drive the Standard Penetration Sampler a certain number of inches (2).

ABBREVIATIONS USED UNDER "FIELD NOTES"

HSA = Hollow Stem Auger
CFA = Continuous Flight Auger
ATD = At Time of Drilling
AD = After Drilling
DWL = Drill Water Loss
DWR = Drill Water Return

LOG of BORING No. B-01

DATE 3/30/95 SURFACE ELEVATION, FT 101.6 DATUM TBM=100 STA./OFFSET -3+01/0

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Firm, damp, reddish-brown, low plastic, Silty CLAY (CL)(Fill)									Boring advanced using 4-1/4 inch I.D. HSA 1989 Dike Addition (SPT used automatic hammer)
5		P	100						17			7.8	
				Very stiff, wet to moist, reddish-brown, medium plastic, Silty CLAY (CH)(Fill)	94.1 / 7.5								
10		P	100				3.4	1.3	27	61	40		
15		P	83						15			7.2	
20		P	83	Moist, low plastic, Silty CLAY (CL)(Fill)	81.6 / 20.0				19				Sample appeared to be slough

Completion Depth: 80.2 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Midwest Eng. Service Logged by: K. Berry

LOG of BORING No. B-01

DATE 3/30/95 SURFACE ELEVATION, FT 101.6 DATUM TBM=100 STA./OFFSET -3+01/0

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		1 3 5	67	Loose, wet, black, bottom ash (SP)(Fill)	76.4 25.2								
30		1 2 2	78										
					67.6 34.0								
35		2 5 6	56	Firm, damp to moist, mottled reddish-brown/light brownish-gray, low plastic, Silty CLAY (CL)(Fill)					19				Driller reported a change in material at 34.0 feet Original Dike
40		P	33						25				Sample appeared to be mostly slough
45		P	56				0.8	0.9	23	44	27		
					51.6								

Completion Depth: 80.2 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Midwest Eng. Service

Water Depth: ____ ft., After ____ hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Logged by: K. Berry

LOG of BORING No. B-01

DATE 3/30/95 SURFACE ELEVATION, FT 101.6 DATUM TBM=100 STA./OFFSET -3+01/0

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
50		2 3 3	100	Firm, moist, reddish-brown, low plastic, silty CLAY (CL)	50.0				14				
55		P	100	Soft, moist to wet, light brown, Silty CLAY (CL)	46.6 55.0				26				Approximate top of natural ground Peoria Loess
60		3 5 5	100						30				Equality/Glasford Formation Driller reported stiff material with trace gravel 63.5-64.5 feet
65		4 8 10	100	Stiff to hard, moist, light gray, highly weathered SHALE	36.6 65.0				25				SHALE Spoon Formation
70		14 21 24	100	Grades some purple, highly weathered shale					19				

Completion Depth: 80.2 Ft.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Midwest Eng. Service

Water Depth: ______ ft., After ______ hrs.
______ ft., After ______ hrs.
______ ft., After ______ hrs.
Logged by: K. Berry

Figure No. A-3-1

LOG of BORING No. B-01

DATE 3/30/95 SURFACE ELEVATION, FT 101.6 DATUM TBM=100 STA./OFFSET -3+01/0

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		7 15 21	100	Light brown, highly weathered SHALE	21.6 80.0				23				
80		100/2.2		LIMESTONE Bottom of boring at 80.2 feet	21.4 80.2								
85													
90													
95													

Completion Depth: 80.2 Ft. Water Depth: ______ ft., After ______ hrs.

Project No.: 5E08560 ______ ft., After ______ hrs.

Project Name: Illinois Power/Baldwin Power Station ______ ft., After ______ hrs.

Drilling Contractor: Midwest Eng. Service Logged by: K. Berry

6/13/95 WCCXILPW 58560

Woodward-Clyde Consultants

Figure No. A-3-2

LOG of BORING No. B-02

DATE 3/30/95 SURFACE ELEVATION, FT 97.9 DATUM TBM=100 STA./OFFSET 1+21/2 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Very stiff, moist, reddish-brown, low plastic, Silty CLAY (CL)(Fill)									Boring advanced using 6-1/4 inch I.D. HSA (SPT used automatic hammer) 1989 Dike Addition
5		P	94				2.4	1.6	20	37	20		(sample may be disturbed)
10		P	100	Becomes stiff			1.9	0.9	21	44	26		
15		P	94	Becomes mottled reddish-brown/light brownish-gray			2.8	0.9	22	44	25		
				Becomes high plastic	78.9 / 19.0								
20		P	83				1.5	0.8	26	55	34		
				Very loose, wet, black, bottom ash (SP)(Fill)	76.9 / 21.0								Switched to mud rotary with 4 inch tricone bit (modified to 5 inches)

Completion Depth: 79.7 Ft.
Water Depth: ______ ft., After ______ hrs.
______ ft., After ______ hrs.
______ ft., After ______ hrs.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Layne-Western
Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-02

DATE 3/30/95 SURFACE ELEVATION, FT 97.9 DATUM TBM=100 STA./OFFSET 1+21/2 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		2 2 2	33	SAME: Very loose, wet, black, bottom ash (SP)(Fill)					28				Ash FILL (similar to sand)
30		2 2 2	56	Soft, moist, gray, low plastic SILT and CLAY (CL)(Fill)	68.1 / 29.8				23				Appears to be a transition zone Original dike
				Firm to stiff, moist, brown/mottled brown and brownish-gray, low plastic CLAY (CL)(Fill)	65.4 / 32.5								
35		4 3 6	56						23				Advanced augers to 35 feet due to sloughing problem when trying to sample at 40 feet
40		P	96	Becomes very stiff, reddish-brown			2.1	0.8	32	49	30		Began using fixed piston sampler
45		P	100	Becomes very stiff to hard			2.9	1.6	18	38	20		

Completion Depth: 79.7 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Layne-Western Logged by: K. Berry

LOG of BORING No. B-02

DATE 3/30/95 SURFACE ELEVATION, FT 97.9 DATUM TBM=100 STA./OFFSET 1+21/2 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
50		P	100	SAME: Very stiff, moist, reddish-brown, low plastic CLAY (CL) (Fill)			3.1	1.8	23	51	31		Boring had problems with the clay "squeezing" in at 35 feet Advanced augers to 50 fee
55		P	100				1.9	0.7	21	34	16		
				Small wood fragments, grass and roots	41.3								
				Very stiff, moist, mottled reddish-brown and light gray, low plastic, silty CLAY (CL)	56.6								Approximate top of natural ground Peoria Loess
60		P	100				2.1 1.5	0.9	18	35	20		Continued having problems getting steel to go back down the boring
65		P	100		32.4		>4.5	0.8	25	34	15		
				Hard, moist, light gray, high plastic CLAY (CH); with little sand	65.5								Excess recovery was slough Tube refusal at 65.5 feet Driller reported hard drilling to 66.9 feet Glasford/Equality Formation
70		15 25 18	83	Light brown to gray, highly weathered SHALE; with some silt and sand	28.4 69.5				22				Spoon Formation

Completion Depth: 79.7 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Layne-Western

Water Depth: ____ ft., After ____ hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Logged by: K. Berry

LOG of BORING No. B-02

DATE 3/30/95 SURFACE ELEVATION, FT 97.9 DATUM TBM=100 STA./OFFSET 1+21/2 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		21 42 36	100	SAME: Light brown to gray, highly weathered SHALE; with some silt and sand									
80		50/2.5"	80	Bottom of boring at 79.7 feet	18.2 79.7								SPT was bouncing Inclinometer installed
85													
90													
95													

Completion Depth: 79.7 Ft.
Water Depth: ______ ft., After ______ hrs.
______ ft., After ______ hrs.
______ ft., After ______ hrs.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Layne-Western
Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-03

DATE 4/7/95 SURFACE ELEVATION, FT 98.0 DATUM TBM=100 STA./OFFSET 1+67/3 LT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0		P	71	Stiff to hard, damp to moist, reddish-brown, low plastic, Silty CLAY (CL)(Fill)			2.4	0.7	24				Boring advanced using 4-1/4 inch I.D. HSA Shelby tube samples taken with fixed piston sampler 1989 Dike Addition
		P	71				3.0	0.9	20				
		P	88	Becomes damp			3.2	1.4	18				
5		P	100				4.8	1.8	17				
		P	100				3.6	1.9	18	43	25		
10		P	100				4.8	2.3	18				
		P	96	Trace gravel			2.9	1.2	18	37	19		
		P	100	Becomes brown			3.8	1.0	20	44	26		
15		P	58	Becomes gray with fly ash			2.8	0.9	17	46	25		
		P	100	Becomes brown and gray			1.9	0.8	23	47	27		
20		P	88		77.0		4.4	0.3	18				
				Loose, moist, black, bottom ash (SP)(Fill)	21.0								Mixed mud to fill augers

Completion Depth: 80.5 Ft. Water Depth: ______ ft., After ______ hrs.

Project No.: 5E08560 ______ ft., After ______ hrs.

Project Name: Illinois Power/Baldwin Power Station ______ ft., After ______ hrs.

Drilling Contractor: Layne-Western Logged by: K. Berry

LOG of BORING No. B-03

DATE 4/7/95 SURFACE ELEVATION, FT 98.0 DATUM TBM=100 STA./OFFSET 1+67/3 LT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		2 2 2	50	Very loose, wet, black, bottom ash (SP)(Fill)					18				
30		1 2 4	39	Firm, moist, gray, low plastic, Silty CLAY (CL)(Fill)	67.8 30.2				22				Original dike
35		4 4 6	67	Becomes brown and gray					25				Stopped using mud
40		P	17						20	44	26		Sample in a jar
45		4 6 8	67	Firm to stiff, moist, reddish-brown with trace gray, low plastic, silty CLAY (CL)	53.0 45.0								Approximate Top of Natural Ground Peoria Loess

Completion Depth: 80.5 Ft. Water Depth: ____ ft., After ____ hrs.
Project No.: 5E08560 ____ ft., After ____ hrs.
Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.
Drilling Contractor: Layne-Western Logged by: K. Berry

LOG of BORING No. B-03

DATE 4/7/95 SURFACE ELEVATION, FT 98.0 DATUM TBM=100 STA./OFFSET 1+67/3 LT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
50		P	100	Firm to stiff, moist, gray, low plastic, silty CLAY (CL)	43.0								Peoria Loess
55		P	0	Stiff, wet, light gray, non-plastic, sandy SILT (ML)	55.0 40.0								Pushed a split spoon to get a sample Equality/Glasford Formation
				Stiff to very stiff, moist, brown, low plastic, silty CLAY (CL); with trace gravel	58.0								Driller reported material change at 58.0 feet
60		4 50/3.5"	100	Becomes reddish-brown	36.0								SPT bouncing after 8 inches
				Stiff to hard, damp to moist, light green/light brown/gray, highly weathered SHALE	62.0								Spoon Formation
				9 inches cobble									
65		6 10 12	33										
70		16 33 31	83	Becomes purple then orangish-brown									

Completion Depth: 80.5 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Layne-Western

Water Depth: ______ ft., After ______ hrs.
______ ft., After ______ hrs.
______ ft., After ______ hrs.

Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-03

DATE 4/7/95 SURFACE ELEVATION, FT 98.0 DATUM TBM=100 STA./OFFSET 1+67/3 LT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		19 29 43	100	Damp to moist, green, highly weathered SHALE									
80		50/0.5'	0		17.5								Driller reported hard material Installed inclinometer
				Bottom of boring at 80.5 feet	80.5								
85													
90													
95													

Completion Depth: 80.5 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Layne-Western

Water Depth: ____ ft., After ____ hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Logged by: K. Berry

LOG of BORING No. B-04

DATE 4/11/95 SURFACE ELEVATION, FT 94.0 DATUM TBM=100 STA./OFFSET 2+52/11'RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Firm to stiff, moist, reddish-brown, low plastic, Silty CLAY (CL)(Fill)									Boring advanced using 4-1/4 inch I.D. HSA 1989 Dike Addition
5		P	67						20				
10		P	83						17	43	25		1 inch zone of brown high plastic clay in shoe
15		P	75										Sample slid
				Becomes gray (mixed with fly ash)									
					73.9								
20		P	8	Loose, wet, black, bottom ash (SP)(Fill)	20.1								Placed a plug inside augers
					69.0								
25		1	39	Soft, moist to wet, green, medium plastic	25.0				27	50	31		Brown, silty clay in shoe

Completion Depth: 75.5 Ft.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Layne-Western

Water Depth: ___ ft., After ___ hrs.
___ ft., After ___ hrs.
___ ft., After ___ hrs.
Logged by: K. Berry

6/14/95 WCCXILPW 58560

Woodward-Clyde Consultants

LOG of BORING No. B-04

DATE 4/11/95 SURFACE ELEVATION, FT 94.0 DATUM TBM=100 STA./OFFSET 2+52/11'RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
		2 3		CLAY (CL)(Fill)									Original dike
30		2 4 5	50	Firm, moist, brown, low plastic, silty CLAY (CL)(Fill)					20	42	22		
35		P	100	Becomes stiff, mottled brown and light gray					16	42	22	2.7	
40		P	88		53.7		1.3						
				Stiff, moist, brown, low plastic, silty CLAY (CL)	40.3								Approximate top of natural ground
					51.0								
				Becoming light reddish-brown; with trace roots, oxidation	43.0								Peoria Loess
45		- 5 7	100						23				First 6 inches of SPT - rods fell down boring
					44.0								
50		P	100	Firm, moist, mottled orangish-brown and gray, high plastic CLAY (CH)	50.0								

Completion Depth: 75.5 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Layne-Western Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-04

DATE 4/11/95 SURFACE ELEVATION, FT 94.0 DATUM TBM=100 STA./OFFSET 2+52/11'RT

DEPTH, ft.	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	NMC, %	PP, TSF	TV, TSF	LL	PI	Qu, KSF	FIELD NOTES
55	P	100	Firm, moist, orangish-brown, low plastic, silty CLAY (CL); with trace gravel	39.0 / 55.0	24						Rods slid into boring Glasford Formation Driller reported hard drilling at 57.0 feet
60	14 20 12	83	Very stiff to hard, moist, light brown, severely weathered CLAY-SHALE; with some gravel	34.0 / 60.0	19						Spoon Formation Gray, high plastic clay in shoe
65	25 22 18	89			12						Appeared to be decomposing rock Maroon, high plastic clay in shoe
70	22 25 28	100	Hard, moist, light gray, highly weathered SHALE		19						
75	50/1.5"	50		18.5	27						
			Bottom of boring at 75.5 feet	75.5							Auger refusal at 75.5 feet

Completion Depth: 75.5 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Layne-Western Logged by: K. Berry

LOG of BORING No. B-05

DATE 4/5/95 SURFACE ELEVATION, FT 101.1 DATUM TBM=100 STA./OFFSET 6+05/3 LT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Damp, reddish-brown, Silty CLAY (CL)(Fill)									Boring advanced using 4-1/4inch I.D. HSA without a center plug 1989 Dike Addition
5		P	100										
				Very stiff, damp, reddish-brown, high plastic, Silty CLAY (CH)	93.6 / 7.5								
10		P	50				2.1	1.0	21				
15		P	83	Becomes brown									
20		P	100	Very stiff, damp, light gray, Clayey SILT (ML)	81.1 / 20.0		3.6	1.2	17				

Completion Depth: 81.3 Ft.

Water Depth: 28.0 ft., After ATD hrs.

Project No.: 5E08560

ft., After hrs.

Project Name: Illinois Power/Baldwin Power Station

ft., After hrs.

Drilling Contractor: Midwest Eng.Services

Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-05

DATE 4/5/95 SURFACE ELEVATION, FT 101.1 DATUM TBM=100 STA./OFFSET 6+05/3 LT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		P	67		75.6								
				Loose, wet, black, bottom ash (SP)(Fill) ▽	25.5								
30		1 3 2	67						22				Placed a plug in augers before advancing
					67.1								
				Soft to firm, moist, orangish-brown, medium plastic CLAY (CL); with trace roots (Fill)	34.0								Driller reported material change at 34.0 feet Original Dike
35		4 4 6	83										
					61.1								
40		P	0	Firm, moist, orangish-brown, medium plastic CLAY (CL)	40.0								Approximate top of natural ground Peoria Loess
45		P	8	Becomes light reddish-brown									

Completion Depth: 81.3 Ft.
Water Depth: 28.0 ft., After ATD hrs.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Midwest Eng.Services
Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-05

DATE 4/5/95 SURFACE ELEVATION, FT 101.1 DATUM TBM=100 STA./OFFSET 6+05/3 LT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
50		3 4 6	100	Firm, moist, brown and gray, medium plastic CLAY (CL)					20				Equality/Glasford Formation
55		P	100	Grades trace sand									
60		8 13 15	100	Very stiff to stiff, damp, gray and light green, highly weathered SHALE	41.1 60.0								Spoon Formation
65		5 8 14	100	Becomes stiff, light green 65.7 feet - 1 inch coal layer									
70		3 4 14	100	Becomes light brown 1/2 inch coal layer Becomes light gray					23				6 inches cobble (almost auger refusal) Possible slough/disturbance first 6 inches of SPT

Completion Depth: 81.3 Ft. Water Depth: 28.0 ft., After ATD hrs.

Project No.: 5E08560 ft., After hrs.

Project Name: Illinois Power/Baldwin Power Station ft., After hrs.

Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

Figure No. A-3-5

LOG of BORING No. B-05

DATE 4/5/95 SURFACE ELEVATION, FT 101.1 DATUM TBM=100 STA./OFFSET 6+05/3 LT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		15 35 59	100	Hard, dry, light gray SHALE									
80		11 45 55	100		19.8								
				Bottom of boring at 81.3 feet	81.3								
85													
90													
95													

Completion Depth: 81.3 Ft.
Water Depth: 28.0 ft., After ATD hrs.
Project No.: 5E08560
___ ft., After ___ hrs.
Project Name: Illinois Power/Baldwin Power Station
___ ft., After ___ hrs.
Drilling Contractor: Midwest Eng.Services
Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-06

DATE 4/4/95 SURFACE ELEVATION, FT 101.7 DATUM TBM=100 STA./OFFSET 10+16/7 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Stiff, damp, reddish-brown, Silty CLAY (CL)(Fill)									Boring advanced using 4-1/4 inch I.D. HSA without a center plug 1989 Dike Addition
5		P	8										Sample in a jar
10		P	100						17			5.8	
15		P	75						18	47	29		
20		P	50		81.2		3.6	1.2	17				Shelby tube refusal
				Very stiff, dry, gray SILT (ML)(Fill)	20.5								
													Black fine gravel (ash) in cuttings
					76.7								

Completion Depth: 81.5 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Midwest Eng.Services

Water Depth: ____ ft., After ____ hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.

Logged by: K. Berry

LOG of BORING No. B-06

DATE 4/4/95 SURFACE ELEVATION, FT 101.7 DATUM TBM=100 STA./OFFSET 10+16/7 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		3 3 4	78	Loose, wet, black, bottom ash (SP)(Fill)	25.0				25				A plug was placed in augers
					72.7								
				Stiff, damp to moist, gray, Clayey SILT (CL-ML); with oxidation (Fill)	29.0								Driller stated possible material change at 29.0 feet - Original dike
30		5 7 8	100	Becomes light brown									
					66.7								
35		P	67	Moist, gray, low plastic CLAY (CL)	35.0				21			1.4	(sample was possibly slough)
40		P	100	Becomes light reddish-brown; with oxidation					23				
					58.2								
				Firm, moist, brown and gray, high plastic CLAY (CH)	43.5								Approximate top of natural ground Peoria Loess Repushed 8 inches for recovery of a sample but only recovered a little slough
45		P	0										

Completion Depth: 81.5 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Midwest Eng.Services

Water Depth: ____ ft., After ____ hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Logged by: K. Berry

LOG of BORING No. B-06

DATE 4/4/95 SURFACE ELEVATION, FT 101.7 DATUM TBM=100 STA./OFFSET 10+16/7 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
50		P	67	Becoming light gray; with oxidation					20			3.6	
55		6 10 15	100	Becomes orangish-brown									
60		7 13 25	100	Very stiff to hard, light brown and light gray, high plastic CLAY (CH)	41.7 60.0								Equality/Glasford Formation
65		6 12 18	100	Becomes brown					22				
70		6 15 76	100	With some chert					16				Driller reported a hard zone at 71.0 feet
					26.7								

Completion Depth: 81.5 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Midwest Eng.Services

Water Depth: ____ ft., After ____ hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.

Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-06

DATE 4/4/95 SURFACE ELEVATION, FT 101.7 DATUM TBM=100 STA./OFFSET 10+16/7 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		7 22 33	100	Hard, light brown to light green, highly weathered SHALE	75.0								Spoon Formation Driller reported very hard drilling at 78.5 feet
80		8 15 40	100	Becomes light green and gray	20.2								
				Bottom of boring at 81.5 feet	81.5								
85													
90													
95													

Completion Depth: 81.5 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Midwest Eng.Services

Water Depth: ____ ft., After ____ hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.

Logged by: K. Berry

Figure No. A-3-7

LOG of BORING No. B-07

Sheet 1 of 4

DATE 4/4/95 SURFACE ELEVATION, FT 102.0 DATUM TBM=100 STA./OFFSET 14+26/33 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Firm to stiff, damp, brown, low plastic, Silty CLAY (CL) (Fill)									Boring advanced using 3-1/4 inch I.D. HSA without a center plug 1989 Dike Addition
5		P	100										
10		P	54	Becomes reddish-brown			4.1	1.3	18				
15		P	100										
20		P	83	Trace fly ash					21			8.1	
													Black fine gravel fragments in cuttings

Completion Depth: 80.9 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

6/13/95 WCCXILPW 58560

Woodward-Clyde Consultants

LOG of BORING No. B-07

DATE 4/4/95 SURFACE ELEVATION, FT 102.0 DATUM TBM=100 STA./OFFSET 14+26/33 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		3 6 7	78	SAME: Brown and reddish-brown, Silty CLAY (CL) (Fill)					15				Original dike
30		P	83	Becoming moist					17			7.3	
35		P	65	Becomes gray with oxidation			2.6	0.8	25				
40		P	83						22			4.4	
				Stiff, moist, gray, medium plastic CLAY (CL); trace gravel	59.5 42.5								Top of natural ground Peoria Loess
45		4 5 7	100										
													Driller reported softer drilling
					52.0								

Completion Depth: 80.9 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Midwest Eng.Services

Water Depth: ____ ft., After ____ hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Logged by: K. Berry

LOG of BORING No. B-07

DATE 4/4/95 SURFACE ELEVATION, FT 102.0 DATUM TBM=100 STA./OFFSET 14+26/33 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
50		P	100	Firm, moist, brownish-gray, high plastic CLAY (CH); with trace organics and gravel	50.0				18				
													Sand in shoe
					47.0								Driller reported a cobble at 54 feet
55		5 9 10	100	Very stiff, moist, reddish-brown, low plastic, silty CLAY (CL)	55.0								Sample appeared to be mostly slough? - steel at correct depth
60		10 13 15	6										Sample was slough
					37.0								Driller reports soft drilling
65		6 5 6	97	Stiff, moist, light reddish-brown, high plastic CLAY (CH)	65.0				22				Equality/Glasford Formation
70		P	8										Sample in a jar (sample from shoe)
					27.0								

Completion Depth: 80.9 Ft. Water Depth: ______ ft., After ______ hrs.

Project No.: 5E08560 ______ ft., After ______ hrs.

Project Name: Illinois Power/Baldwin Power Station ______ ft., After ______ hrs.

Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

LOG of BORING No. B-07

DATE 4/4/95 SURFACE ELEVATION, FT 102.0 DATUM TBM=100 STA./OFFSET 14+26/33 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		16 12 12	67	Very stiff to hard, damp, light green, highly weathered SHALE	75.0								Spoon Formation
													Driller reported a cobble at 78 feet
80		44 56/5"	78	Possible weathered limestone	21.1				18				
				Bottom of boring at 80.9 feet	80.9								SPT stiffened up after 3 inches
85													
90													
95													

Completion Depth: 80.9 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Midwest Eng.Services

Water Depth: ____ ft., After ____ hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Logged by: K. Berry

LOG of BORING No. B-08

DATE 4/1/95 SURFACE ELEVATION, FT 102.0 DATUM TBM=100 STA./OFFSET 18+33/55 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Firm to very stiff, moist, brown, low plastic, Silty CLAY (CL)(Fill)									Boring advanced using 4-1/4 inch I.D. HSA 1989 Dike Addition
5		P	100						17			6.1	
10		P	100						18			6.1	
15		P	100	Grades trace ash (black sand)(Fill)					16				
20		P	50				2.4	0.9	25	46	24		

Completion Depth: 81.5 Ft.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Midwest Eng.Services

Water Depth: ____ ft., After ____ hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.
Logged by: K. Berry

LOG of BORING No. B-08

DATE 4/1/95 SURFACE ELEVATION, FT 102.0 DATUM TBM=100 STA./OFFSET 18+33/55 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		4 7 10	100	SAME: Brown, Silty CLAY (CL)(Fill)					15				Original Dike
30		P	100						16			6.8	
35		3 4 6	100	Becoming mottled reddish-brown/light gray					19				
40		P	67						20			3.2	
45		2 4 3	100	Becoming orangish-brown	56.4 / 45.6				31				
				Loose, wet, orangish-brown, medium to fine sand (SP); with trace silt	54.0 / 48.0								
				Stiff, damp to moist, multi-colored reddish-brown, light brown, gray, orangish-brown, med. plastic CLAY(CL)									Approximate top of natural ground

Completion Depth: 81.5 Ft.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Midwest Eng.Services

Water Depth: ____ ft., After ____ hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.
Logged by: K. Berry

LOG of BORING No. B-08

DATE 4/1/95 SURFACE ELEVATION, FT 102.0 DATUM TBM=100 STA./OFFSET 18+33/55 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
50		5 6 9	100	SAME: Firm to stiff, damp to moist, reddish-brown, light brown, gray, medium plastic CLAY (CL)	49.0 53.0				20				Trace coal in shoe
				Firm to stiff, moist, light reddish-brown, low plastic, silty CLAY (CL)									Approximate top of natural ground Peoria Loess
55		P	67						19				Sample was mostly slough
60		4 5 8	100	Becoming light gray, medium plastic					23				Equality/Glasford Formation
65		P	8										Sample was slough
70		4 6 8	100	Firm to stiff, moist, brown, high plastic CLAY (CH) Becomes gray	32.0 70.0				21				Glasford Formation
					27.0								

Completion Depth: 81.5 Ft.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Midwest Eng.Services

Water Depth: ____ ft., After ____ hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.
Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-08

DATE 4/1/95 SURFACE ELEVATION, FT 102.0 DATUM TBM=100 STA./OFFSET 18+33/55 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		11 16 26	100	Very stiff to hard, light gray, highly weathered SHALE	75.0				20				Spoon Formation
80		11 22 31	100						21				
				Becomes gray	20.5								
				Bottom of boring at 81.5 feet	81.5								
85													
90													
95													

Completion Depth: 81.5 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Midwest Eng.Services

Water Depth: ____ ft., After ____ hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Logged by: K. Berry

LOG of BORING No. B-09

DATE 3/31/95 SURFACE ELEVATION, FT 102.7 DATUM TBM=100 STA./OFFSET 22+29/57 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Stiff, moist, brown, low plastic, Silty CLAY (CL)(Fill)									Boring advanced using 4-1/4 inch I.D. HSA 1989 Dike Addition
5		P	100						22				
				Becoming dark brown (possibly mixed with ash)(Fill)									
10		P	75	Becomes mottled brown/brownish-gray (Fill)			4.1	1.5	22	50	30		
15		P	100						18				Sample contained some duct tape Clay appears to be mixed with fly ash at 15.5 feet
20		P	75	Becomes mottled reddish-brown/light gray	82.7 / 20.0								Original Dike
				Becomes gray									

Completion Depth: 80.8 Ft. Water Depth: 45.0 ft., After ATD hrs.

Project No.: 5E08560 ft., After hrs.

Project Name: Illinois Power/Baldwin Power Station ft., After hrs.

Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

6/13/95 WCCXILPW 58560

Woodward-Clyde Consultants

LOG of BORING No. B-09

DATE 3/31/95 SURFACE ELEVATION, FT 102.7 DATUM TBM=100 STA./OFFSET 22+29/57 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		4 4 6	78	Firm to stiff, mottled reddish-brown/light gray, silty CLAY (CL)					24				
30		1 3 4	83	Becoming soft, silty; some organic material	72.7 30.0				20				
35		P	83						20			3.7	Sample had the appearance of slough
40		P	100	Becoming firm to stiff, orangish-brown			1.0	0.5	23	34	16		Tube was pushed approximately 2-3 inches too far
													Trace gravel, coal 2 thin sand layers
45		6 9 12	100	▽									
				Moist, orangish-brown, low plastic, Silty CLAY (CL)	56.7 46.0								Approximate top of natural ground Peoria Loess

Completion Depth: 80.8 Ft.

Water Depth: 45.0 ft., After ATD hrs.

ft., After hrs.

ft., After hrs.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Midwest Eng.Services

Logged by: K. Berry

LOG of BORING No. B-09

DATE 3/31/95 SURFACE ELEVATION, FT 102.7 DATUM TBM=100 STA./OFFSET 22+29/57 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
50		7 10 10	83	Becoming light reddish-brown with little gravel					17				
					47.7								Driller reported a boulder at 54-56 feet
55		11 5 9	100	Firm to stiff, moist, orangish-brown, high plastic CLAY (CH) Becoming stiff to very stiff, light gray	55.0				23				Glasford/Equality Formation Driller reported stiffer drilling
60		6 13 12	0						14				Driller reported top 1/2 of run being hard
65		14 51 50/3.5"	100		37.2								
				Hard, dark gray, weathered SHALE	65.5								Spoon Formation
70		30 43 64	17						25				

Completion Depth: 80.8 Ft. Water Depth: 45.0 ft., After ATD hrs.
Project No.: 5E08560 ft., After hrs.
Project Name: Illinois Power/Baldwin Power Station ft., After hrs.
Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

LOG of BORING No. B-09

DATE 3/31/95 SURFACE ELEVATION, FT 102.7 DATUM TBM=100 STA./OFFSET 22+29/57 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		26 25 30	100	Hard, damp, gray, clayey weathered SHALE					16				
80		38 62/2.5			21.9				11				
				Bottom of boring at 80.8 feet	80.8								
85													
90													
95													

Completion Depth: 80.8 Ft. Water Depth: 45.0 ft., After ATD hrs.

Project No.: 5E08560 ft., After hrs.

Project Name: Illinois Power/Baldwin Power Station ft., After hrs.

Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-10

DATE 3/27/95 SURFACE ELEVATION, FT 101.9 DATUM TBM=100 STA./OFFSET -10+09/0

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Firm, moist, reddish-brown, low plastic, Silty CLAY (CL)(Fill)									Boring advanced using 4-1/4 inch I.D. HSA 1989 Dike Addition
5		P	100						23				
10		P	83	Becoming mottled with light brownish-gray					15				
15		P	100				>4.5	1.7	15	42	24		Shelby refusal
20		26 33 32	89	Becoming hard with some ash (sand); trace gravel					11				
25		5	78	Firm to stiff, moist, light gray, low					24	43	25		

Completion Depth: 75.1 Ft.
Water Depth: ____ ft., After ____ hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Layne-Western
Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-10

DATE 3/27/95 SURFACE ELEVATION, FT 101.9 DATUM TBM=100 STA./OFFSET -10+09/0

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
		5 10		plastic, Silty CLAY (CL); with 1 inch ash zone (Fill)	71.9								
30		P	100	Hard, damp, light brownish-gray, Clayey SILT (ML)	30.0 66.9				19			5.8	Sampler refusal Original Dike
35		2 6 7	100	Firm to stiff, moist, mottled reddish-brown/light brown, low plastic, Silty CLAY (CL)	35.0 61.9				22				
40		P	100	Firm, moist, light brown, Clayey SILT (ML)	40.0 56.9				26	32	8		Approximate top of natural ground Peoria Loess
45		P	100	Stiff, wet, light brown to brown, low plastic, Silty CLAY (CL)	45.0		1.4	0.9	24	32	14		Water at approximately 45.0 feet
50		P	100						25	40	22	1.9	

Completion Depth: 75.1 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Layne-Western Logged by: K. Berry

Woodward-Clyde Consultants

Figure No. A-3-10

LOG of BORING No. B-10

DATE 3/27/95 SURFACE ELEVATION, FT 101.9 DATUM TBM=100 STA./OFFSET -10+09/0

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
					46.9								
55		P	100	Stiff, moist, high plastic CLAY (CH)	55.0				19	57	42	6.3	Glasford/Equality Formation
60		P	17						27				Sample in jar
					37.9								
				Medium dense to dense, wet, brown SAND (SW); with trace silt 1/2 inch clay layer	64.0								Driller reported very soft material at 64.0 feet
65		10 12 20	100						14				Sand flowed into augers. Switched to rotary wash with 3 7/8 inch tricone bit
					33.9								
				Hard, dark brown, highly weathered SHALE	68.0								Approximate top of rock SHALE Spoon Formation
70		17 28 45	67						24	52	24		
					26.8								
75		50/1.5"	0	Bottom of boring at 75.1 feet	75.1								

Completion Depth: 75.1 Ft.
Water Depth: ____ ft., After ____ hrs.
Project No.: 5E08560
____ ft., After ____ hrs.
Project Name: Illinois Power/Baldwin Power Station
____ ft., After ____ hrs.
Drilling Contractor: Layne-Western
Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-11A

DATE 4/5/95 SURFACE ELEVATION, FT 74.5 DATUM TBM=100 STA./OFFSET 1+81/74 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0		P	92	Soft, damp, reddish-brown, Silty CLAY (CL); with organic roots (Fill)			0.3						Original Dike
		P	54	Very stiff to hard, damp, reddish-gray with black specks, Silty CLAY (CL)(Fill)	72.5 / 2.0		2.3						
		P	100				3.6	1.8	20	39	18		
5				Becoming reddish-brown									
		P	54	Becoming moist, reddish-brown			2.6	1.6	21				
		P	63				1.5		25	47	26		Pushed twice Started using Fixed Piston Sampler
10		P	71	Becoming reddish-brown with gray, high plastic CLAY (CH)(Fill)	64.5 / 10.0		3.1	1.7	23	52	29		
		P	79				2.3	1.3	24				
		P	75	Very stiff, moist, reddish-brown-gray, low plastic CLAY (CL); with trace sand (Fill)	60.5 / 14.0		2.3	1.7	20				
15													
		P	75	Becoming gray with reddish-brown; trace sand			2.8	1.7	20				
		P	88				2.0	1.4	20	45	26		
20		P	100				2.3	1.2	21	47	29		

Completion Depth: 42.0 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Layne-Western

Water Depth: ____ ft., After ____ hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Logged by: J. Oldham

LOG of BORING No. B-11A

DATE 4/5/95 SURFACE ELEVATION, FT 74.5 DATUM TBM=100 STA./OFFSET 1+81/74 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		P	79	Stiff, moist, dark gray, low plastic, silty CLAY (CL); with organic roots			1.9	0.9	20	49	28		Approximate top of natural ground
30		P	100	Stiff, moist, gray with reddish-brown sand and organics wood	39.5		1.9	0.9	21	29	12		
35		P	96	Stiff, reddish-brown, high plastic CLAY (CH); with sand and gravel	35.0		1.9	1.0	13				Equality/Glasford Formation
40		P	69	Becomes hard	32.5		1.9	0.9	26				Shelby refusal
				Bottom of boring at 42.0 feet	42.0								2 inch S/S - 75 for 1.5 inches Auger refusal Set Inclinometer at 42.0 feet
45													

Completion Depth: 42.0 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Layne-Western Logged by: J. Oldham

Woodward-Clyde Consultants

Figure No. A-3-12

LOG of BORING No. B-12

Sheet 1 of 2

DATE 4/6/95 SURFACE ELEVATION, FT 58.7 DATUM TBM=100 STA./OFFSET 1+75/123 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Stiff, moist, mottled orangish-brown and gray, low plastic, Silty CLAY (CL)(Fill)									Boring advanced using 4-1/4 inch I.D. HSA Original Dike
		P	75				1.8						
		P	63				1.8	1.0	23				
5				Becoming mottled brown and gray									
		P	96	Trace fine sand at bottom of tube			1.3						
		P	100				1.2	0.7	31	61	39		
10		P	63	Becoming very stiff			2.0						
		P	92		43.7		2.6	0.8	18				
15				Very stiff, moist, mottled brown and gray, low plastic, Silty CLAY (CL); trace organics	15.0								Approximate top of natural ground Peoria Loess
20		P	100				2.5						
				trace fine gravel									
					33.7								

Completion Depth: 40.1 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Layne-Western

Water Depth: 19.0 ft., After ATD hrs.

4.5 ft., After 1.0 hrs.

ft., After hrs.

Logged by: K. Berry

6/13/95 WCCXILPW 58560

Woodward-Clyde Consultants

LOG of BORING No. B-12

DATE 4/6/95 SURFACE ELEVATION, FT 58.7 DATUM TBM=100 STA./OFFSET 1+75/123 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		23 9 9 12	63	Stiff, damp to dry, brown and gray, high plastic CLAY (CH)	25.0 28.7				20	46	23		Shelby tube refusal at 25.0 feet Glasford/Equality Formation
30		21 22 17	72	Hard, moist, light green, severely weathered CLAY-SHALE	30.0				22	47	23		Spoon Formation
35		12 15 17	100	Becoming highly weathered	18.6								
40		50/.75"	0	Bottom of boring at 40.1 feet	40.1								Auger and SPT refusal Inclinometer installed to a depth of 40.0 feet
45													

Completion Depth: 40.1 Ft. Water Depth: 19.0 ft., After ATD hrs.

Project No.: 5E08560 4.5 ft., After 1.0 hrs.

Project Name: Illinois Power/Baldwin Power Station ft., After hrs.

Drilling Contractor: Layne-Western Logged by: K. Berry

LOG of BORING No. B-13

DATE 4/4/95 SURFACE ELEVATION, FT 83.3 DATUM TBM=100 STA./OFFSET 1+69/46 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Stiff, damp, reddish-brown, Silty CLAY (CL)(Fill)									1989 Dike Addition
		P	79				1.8						
					79.3 / 4.0								
		P	100	Very stiff, moist, sandy, Silty CLAY (CL)(Fill)			2.1	0.7	21				
5													Original Dike
		P	83				2.4	0.7	23				
		P	96	Becoming damp, reddish-brown with gray			2.8						Tube refusal
10		P	100				3.3						
					71.3 / 12.0								
				Bottom of boring at 12.0 feet									
15													
20													

Completion Depth: 12.0 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Layne-Western Logged by: J. Oldham

LOG of BORING No. B-14

DATE 4/5/95 SURFACE ELEVATION, FT 80.2 DATUM TBM=100 STA./OFFSET 2+51/49 RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0		P	83	Very stiff, damp, reddish-brown, Silty CLAY (CL); with sand and organics, grass (fill)			2.8						Original Dike
		P	42				3.0						
		P	79	Becoming reddish-brown with gray			1.8	0.6	27				
5													
		P	83				3.4	0.9	24				
		P	63				2.3						
				Becoming gray	70.2								
10				Bottom of boring at 10.0 feet	10.0								
15													
20													

Completion Depth: 10.0 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Layne-Western

Water Depth: ____ ft., After ____ hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Logged by: J. Oldham

LOG of BORING No. B-15

DATE 4/6/95 SURFACE ELEVATION, FT 101.9 DATUM TBM=100 STA./OFFSET 3+42/0

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Stiff, damp to moist, low plastic, Silty CLAY (CL)(Fill)									Boring advanced using 3-1/4 inch I.D. HSA without center plug 1989 Dike Addition
5		P	100						16				
10		3 5 7	100						17				
15		P	65										
20		P	67	Becomes mottled reddish-brown/gray					16			0.0	

Completion Depth: 81.5 Ft. Water Depth: 32.0 ft., After ATD hrs.

Project No.: 5E08560 ft., After hrs.

Project Name: Illinois Power/Baldwin Power Station ft., After hrs.

Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

6/13/95 WCCXILPW 58560

Woodward-Clyde Consultants

Figure No. A-3-15

LOG of BORING No. B-15

DATE 4/6/95 SURFACE ELEVATION, FT 101.9 DATUM TBM=100 STA./OFFSET 3+42/0

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		1 5 7	67	Loose to medium dense, moist to wet, black, bottom ash (SP)	76.4 25.5				20				
30		3 3 3	67						19				
35		2 2 3	67	Firm to stiff, moist, gray, low plastic CLAY (CL); with oxidation	66.4 35.5				24				Original Dike
40		P	100				2.5						
45		P	100	Firm, moist, reddish-brown, medium plastic CLAY (CL); with oxidation	56.9 45.0				24				Approximate top of natural ground Peoria Loess

Completion Depth: 81.5 Ft.

Water Depth: 32.0 ft., After ATD hrs.

ft., After hrs.

ft., After hrs.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Midwest Eng.Services

Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-15

DATE 4/6/95 SURFACE ELEVATION, FT 101.9 DATUM TBM=100 STA./OFFSET 3+42/0

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
50		3 3 4	100	SAME: Firm, moist, reddish brown, medium plastic CLAY (CL); with oxidation					24				Peoria Loess
55		P	100	Becoming more plastic	41.9				22				
60		2 1 3 4	100	Soft to firm, moist, mottled orangish-brown and gray, high plastic CLAY (CH); with trace gravel	60.0				26				Glasford/Equality Formation 6 inches slough
65		P	50		31.9				37				
70		7 12 19	100	Very stiff to hard, light green, highly weathered SHALE	70.0				23				Spoon Formation

Completion Depth: 81.5 Ft. Water Depth: 32.0 ft., After ATD hrs.

Project No.: 5E08560 ft., After hrs.

Project Name: Illinois Power/Baldwin Power Station ft., After hrs.

Drilling Contractor: Midwest Eng.Services Logged by: K. Berry

LOG of BORING No. B-15

DATE 4/6/95 SURFACE ELEVATION, FT 101.9 DATUM TBM=100 STA./OFFSET 3+42/0

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		7 20 33	100	Light green, highly weathered SHALE									
80		1 6 27	100	Becomes brown; weathered SHALE	20.4								6 inches of slough in boring
				Bottom of boring at 81.5	81.5								
85													
90													
95													

Completion Depth: 81.5 Ft.

Water Depth: 32.0 ft., After ATD hrs.

Project No.: 5E08560

ft., After hrs.

Project Name: Illinois Power/Baldwin Power Station

ft., After hrs.

Drilling Contractor: Midwest Eng.Services

Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-101

DATE 5/3/95 SURFACE ELEVATION, FT 88.0 DATUM TBM=100 STA./OFFSET 1+74/19RT

DEPTH, ft.	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0			Stiff, damp, reddish-brown, low plastic, Silty CLAY (CL) (Fill)								Boring advanced using 4-1/4 inch I.D. HSA 1989 Dike Addition
5	2 3 7	97									
10	P	100		77.5							
			Damp, gray, clayey Silt (ML); with trace organics	10.5							
				73.4							
15	5 11 10	72	Medium dense, wet, black ash (medium to coarse sand size) (SP)	14.6							
				70.0							
			Firm to stiff, moist, orangish-brown and gray, low plastic, Silty CLAY (CL); with trace gravel (Fill)	18.0							Original Dike
20	3 3 5	67									Driller reported a material change at 21.0 feet

Completion Depth: 79.0 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Roberts Env.

Water Depth: ____ ft., After ____ hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.

Logged by: K. Berry

6/13/95 WCCXILPW 58560

Woodward-Clyde Consultants

LOG of BORING No. B-101

DATE 5/3/95 SURFACE ELEVATION, FT 88.0 DATUM TBM=100 STA./OFFSET 1+74/19RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		P	0										
				Stiff, moist, light gray and brown, high plastic CLAY (CH)	60.5 / 27.5								
30		3 4 6	67										
				Very stiff, moist, light gray, low plastic CLAY (CL); with oxidation	55.5 / 32.5								
35		P	100				3.0						
40		5 4 7	100	Becomes reddish-brown									Approximate top of natural ground Peoria Loess
45		3 4 5	83										
				Firm, moist, light gray, Silty CLAY (CL); with organics	42.5 / 45.5								Glasford/Equality Formation Alluvium

Completion Depth: 79.0 Ft.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Roberts Env.

Water Depth: ____ ft., After ____ hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.
Logged by: K. Berry

LOG of BORING No. B-101

DATE 5/3/95 SURFACE ELEVATION, FT 88.0 DATUM TBM=100 STA./OFFSET 1+74/19RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
50		P	100	Stiff to very stiff, moist, mottled orangish brown/gray, low to medium plastic CLAY (CL); with trace gravel			1.0						Till
		P	100				4.0						
		P	100				>4.5						Tube refusal at 53.0 feet
55		50/4"	100	Becomes hard, with sand and gravel(highly weathered shale and sandstone)									Spoon Formation Tube refusal at 54.5 feet SPT advanced 4 inches in 2 blows, then bounced
		RQD 11	100		32.0								
				Gray, slightly weathered LIMESTONE	56.0								
				Gray, highly weathered CLAY-SHALE; fissured with calcareous zones	31.4 / 56.6								Switched to coring with NX core barrel Core Run #1 Start: 55.0 feet Stop: 59.5 feet DWR: 90%
					28.8								
60		RQD 0	31	59.2 feet - Orange sand, clay and gravel; decomposed limestone	59.2								Core Run #2 Start: 59.5 feet Stop: 64.0 feet DWR: 95% Driller had problem with silt in casing
					24.5								
65		RQD 0	13	Green, highly weathered, high plastic CLAY-SHALE; with oxidation	63.5								Core Run #3 Start: 64.0 feet Stop: 69.0 feet DWR: 90%
70		RQD 0	100	Damp to moist, highly weathered shale (clayey silt - ML)	18.1 / 69.9								Reamed to 71.7 feet
		RQD	40	Gray, fine grained, thinly bedded, slightly weathered LIMESTONE; strong with shale partings 71.7 feet - Moderately weathered for 0.7 feet	13.6 / 74.4								Core Run #4 Start: 71.7 feet Stop: 74.0 feet DWR: 90% Driller reported clay seams

Completion Depth: 79.0 Ft.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Roberts Env.

Water Depth: ____ ft., After ____ hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.
Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-101

DATE 5/3/95 SURFACE ELEVATION, FT 88.0 DATUM TBM=100 STA./OFFSET 1+74/19RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
75		0		72.0 feet - Hard clay for 0.2 feet 73.6 feet - Moderately fractured with stiff clay for 0.3 feet 74.0 feet - 0.2 feet limestone 74.2 feet - 0.3 feet gray clay and limestone	9.3								Core Run #5 Start: 74.0 Stop: 79.0 DWR: 80% Had to extrude sample with A-rod
				74.5 feet - Dark gray to black, weathered SHALE	78.7								Driller reported that last 2 inches felt like limestone (not recovered)
80				Weathered limestone at 78.7 feet	9.0 79.0								Inclinometer installed
				Bottom of boring at 79.0 feet									
85													
90													
95													

Completion Depth: 79.0 Ft.

Water Depth: ____ ft., After ____ hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Roberts Env.

Logged by: K. Berry

Woodward-Clyde Consultants

LOG of BORING No. B-102

DATE 5/17/95 SURFACE ELEVATION, FT 50.8 DATUM TBM=100 STA./OFFSET 1+67/178RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				(Refer to log of Piezometer P-03A)									Boring advanced using 5-7/8 inch tricone bit with rotary wash
5													
10													
15													
				Bottom Overburden	32.1 / 18.7								
				LIMESTONE	31.1 / 19.7								
20		C	84	Hard, light gray, moderately weathered CLAY-SHALE									Complete tricone at 19.7 feet Begin Pitcher Sampler Run #1 Start: 19.7 feet Stop: 22.2 feet
		C	100	Very stiff to hard, greenish-gray, severely to completely weathered CLAY-SHALE	28.6 / 22.2								Run #2 Start: 22.2 feet Stop: 25.0 feet
25		C	36	Limestone stringer at 25.2 feet									Run #3

Completion Depth: 49.0 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Roberts Env.

Water Depth: ____ ft., After ____ hrs.
____ ft., After ____ hrs.
____ ft., After ____ hrs.

Logged by: T. Deddens

Woodward-Clyde Consultants

Figure No. A-3-17

LOG of BORING No. B-102

DATE 5/17/95 SURFACE ELEVATION, FT 50.8 DATUM TBM=100 STA./OFFSET 1+67/178RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
													Start: 25.2 feet Stop: 28.0 feet
		RQD 0	100										NX Core Barrel Core Run #4 Start: 28.3 feet Stop: 29.6 feet
30		RQD 0	100		17.5 33.3								Core Run #5 Start: 29.6 feet Stop: 34.0 feet
		RQD 0	91	Dark gray, crystalline, moderately weathered LIMESTONE; with numerous horizontal joints	15.9 34.9								Core Run #6 Start: 34.0 feet Stop: 38.5 feet
35				Soft to medium stiff, greenish-gray, severely to completely weathered CLAY-SHALE	15.1 35.7								
				Dark gray, crystalline, severely weathered, highly fractured LIMESTONE; with seam of greenish-gray clay	12.9 37.9								
		RQD 0	55	Soft, greenish-gray, completely weathered CLAY-SHALE; with limestone fragments	11.9 38.9								Core Run #7 Start: 38.5 feet Stop: 44.0 feet
40				Soft to hard, dark gray, moderately to completely weathered CLAY-SHALE	11.7 39.1								
				Absent, wash away	9.9 40.9								
				Soft to hard, dark gray, moderately to completely weathered, fissile CLAY-SHALE	7.5 43.3								
		RQD 0	88	Dark gray, shaley, slightly weathered, thin bedded LIMESTONE	6.8 44.0								Core Run #8 Start: 44.0 feet Stop: 49.0 feet
45				Dark gray, very weathered SHALE	6.2 44.6								
				Dark gray, shaley, moderately weathered LIMESTONE	5.4 45.4								
				Dark gray, moderately to severely weathered, limey CLAY-SHALE	3.9 46.9								
				Dark gray, moderately weathered, thin bedded LIMESTONE; with dark gray shale seam	1.8 49.0								Inclinometer installed
50				Bottom of boring at 49.0 feet									

Completion Depth: 49.0 Ft. Water Depth: ____ ft., After ____ hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Roberts Env. Logged by: T. Deddens

6/13/95 WCCXILPW 58560

Woodward-Clyde Consultants

LOG of BORING No. P-02A

DATE 5/10/95 SURFACE ELEVATION, FT 74.6 DATUM TBM=100 STA./OFFSET 1+56/76RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Boring not sampled 0 - 29.0 feet (See Log of Boring B-11A)									Boring advanced using 4-1/4 inch I.D. HSA
5													
10													
15													
20													

Completion Depth: 47.0 Ft.

Water Depth: 35.0 ft., After ATD hrs.

Project No.: 5E08560

ft., After hrs.

Project Name: Illinois Power/Baldwin Power Station

ft., After hrs.

Drilling Contractor: Roberts Env.

Logged by: K. Berry

Figure No. **A-3-18**

LOG of BORING No. P-02A

Sheet 2 of 2

DATE 5/10/95 SURFACE ELEVATION, FT 74.6 DATUM TBM=100 STA./OFFSET 1+56/76RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25													
		P	21	Stiff to very stiff, moist, orange and gray, high plastic CLAY (CH); with trace gravel	45.6 / 29.0								(No pp - sample slid) Glacial Soils
30													
		P	100				1.5						
35				▽									
		P	100	Becomes very stiff, light brown; with little sand			3.0						
		P	100				>4.5		28	59	33		
				Hard, high plastic CLAY (CH) (highly weathered shale)	35.6 / 39.0								Spoon Formation Driller reported stiff material at 39.5 feet
40		P	0										
		RQD 0	80	Highly weathered LIMESTONE	33.1 / 41.5								Auger refusal at 41.5 feet Switched to rotary wash with NX core (new shale carbide bit)
				Brown and gray, high plastic, highly weathered SHALE; with trace sand and gravel Possible slickenside at 43.0 feet	32.5 / 42.1								Core Run #1 Start: 41.5 feet Stop: 44.0 feet DWR: 95%
		RQD 0	86										Core Run #2 Start: 44.0 feet Stop: 47.0 feet DWR: 95%
45													Driller reported 75% DWR at 46.0 feet
				Bottom of boring at 47.0 feet	27.6 / 47.0								Piezometer installed

Completion Depth: 47.0 Ft. Water Depth: 35.0 ft., After ATD hrs.

Project No.: 5E08560 ft., After ___ hrs.

Project Name: Illinois Power/Baldwin Power Station ft., After ___ hrs.

Drilling Contractor: Roberts Env. Logged by: K. Berry

6/13/95 WCCXILPW 58560

Woodward-Clyde Consultants

LOG of BORING No. P-03

DATE 4/13/95 SURFACE ELEVATION, FT 50.8 DATUM TBM=100 STA./OFFSET 1+57/3LT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Medium stiff, moist, brown, low plastic, silty CLAY (CL) to clayey silt									Boring advanced using 4-inch diameter CFA
	P		92				0.0						
5				Becomes very soft, wet, gray; with some sand									
				▽ (water level)									
	P		100				2.3						
				Becomes stiff, gray and orangish-brown	40.8								
10				Bottom of Boring at 10.0 feet	10.0								Piezometer installed 4 feet west
15													
20													

Completion Depth: 10.0 Ft.
Water Depth: 7.0 ft., After ATD hrs.
Project No.: 5E08560
Project Name: Illinois Power/Baldwin Power Station
Drilling Contractor: Layne-Western
Logged by: K. Berry

LOG of BORING No. P-03A

DATE 5/15/95 SURFACE ELEVATION, FT 50.8 DATUM TBM=100 STA./OFFSET 1+56/178RT

DEPTH, ft.	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0			Firm, moist to wet, medium gray, low plastic, Clayey SILT (ML); trace roots, wet, pocket of medium sand	42.8 / 8.0								Boring advanced using 4-1/4 inch I.D. HSA Fill
5	2 3 3	100										
			Firm, moist to wet, medium gray, medium to high plastic, Silty CLAY (CL); with 6-inch layer of fine grained, silty sand	38.3 / 12.5								Alluvium
10	2 2 4	100										
			Firm, moist, light gray, medium to high plastic, Silty CLAY (CL); with mottles of tan, sandy clay, trace coarse to medium sand	32.1 / 18.7								Glacio-Lacustrine/Till
15	2 3 4	100										
	RQD 0	84	Dark gray, moderately weathered LIMESTONE	31.5 / 19.3								Switched to NX core barrel Core Run #1 Start: 18.8 feet Stop: 23.8 feet Spoon Formation
20			Dark gray, severely weathered SHALE 0.2 feet Limestone at 20.0 feet									
	RQD 0	38	Trace gravel, shale becomes greenish-gray at 23.8 feet									Core Run #2 Start: 23.8 feet

Completion Depth: 27.0 Ft.

Water Depth: ____ ft., After ____ hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Roberts Env.

Logged by: T. Deddens

LOG of BORING No. P-03A

DATE 5/15/95 SURFACE ELEVATION, FT 50.8 DATUM TBM=100 STA./OFFSET 1+56/178RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25													Stop: 27.0 feet
				Becomes maroon	23.8								
				Bottom of boring at 27.0 feet	27.0								Piezometer installed
30													
35													
40													
45													

Completion Depth: 27.0 Ft.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Roberts Env.

Water Depth: ____ ft., After ____ hrs.

____ ft., After ____ hrs.

____ ft., After ____ hrs.

Logged by: T. Deddens

LOG of BORING No. P-04

DATE 5/11/95 SURFACE ELEVATION, FT 58.7 DATUM TBM=100 STA./OFFSET 1+65/122RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Medium stiff, moist, brown, low plastic CLAY (CL) (Fill)									Boring advanced using 4-1/4" I.D. HSA
5		3 4 5	78										
10		3 4 6	72	Becomes gray, more silty									
15		4 5 4	100										
		P	100		38.7		0.8						
20				Stiff to very stiff, moist to wet, brown, medium plastic, Silty CLAY (CL); some fine gravel, coarse sand, trace medium to fine sand ▽	20.0								Glacial Soils
		P	100		34.7		2.5	1.8	16	29	13		Driller reported stiffer material at approximately 24.5 feet
		P	100	Firm to stiff, orange-brown, high plastic,	24.0		0.5	0.7		73	36		

Completion Depth: 30.8 Ft. Water Depth: 22.0 ft., After ATD hrs.

Project No.: 5E08560 ft., After hrs.

Project Name: Illinois Power/Baldwin Power Station ft., After hrs.

Drilling Contractor: Roberts Env. Logged by: K. Berry

LOG of BORING No. P-04

DATE 5/11/95 SURFACE ELEVATION, FT 58.7 DATUM TBM=100 STA./OFFSET 1+65/122RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF
25		P	100	CLAY (CH); trace fine gravel, coarse sand	33.7 / 25.0							
		RQD 13	93	Moist, orange, silty CLAY (CL); with rock fragments	32.9 / 25.8		1.0-3.5					
				25.8 - 26.9: LIMESTONE	31.8 / 26.9							
				26.9 - 27.2: Probable clay (no recovery)	31.5 / 27.2							
				Damp, green, high plastic, highly weathered CLAY-SHALE; with silt and oxidation	28.2 / 30.5							
30				Becomes highly weathered LIMESTONE	27.9 / 30.8							
				Bottom of boring at 30.8 feet								
35												
40												
45												

FIELD NOTES

Driller reported hard material at 25.0 feet
Probable shear zone at 23.9 feet
Appeared to be weathered rock
Driller reported a 4 inch soft zone at 26.8 feet
Core Run #1
Start: 25.8 feet
Stop: 26.3 feet
DWR: 90%
Changed from carbide bit to a surface set bit
Core Run #2
Start: 26.3
Stop: 30.8
DWR: 90%
Piezometer installed

Completion Depth: 30.8 Ft. Water Depth: 22.0 ft., After ATD hrs.

Project No.: 5E08560 ____ ft., After ____ hrs.

Project Name: Illinois Power/Baldwin Power Station ____ ft., After ____ hrs.

Drilling Contractor: Roberts Env. Logged by: K. Berry

Figure No. A-3-22

LOG of BORING No. P-05A

Sheet 1 of 2

DATE 5/11/95 SURFACE ELEVATION, FT 75.0 DATUM TBM=100 STA./OFFSET 3+83/55RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Stiff, moist, low to medium plastic CLAY (CL) (Fill)									Boring advanced using 4-1/4 inch I.D. HSA Original Dike
5		2 4 6	78										
10		3 4 7	83	Becoming stiff, medium plastic CLAY (CL)									
15		3 6 6	100	Stiff, moist, gray, medium plastic CLAY (CL); with trace oxidation	60.3 / 14.7								
				Stiff, moist, brown, medium plastic CLAY (CL); with trace fine roots	57.5 / 17.5								Approximate top of natural ground Peoria Loess
20		4 4 7	100										
		4	100	Firm to stiff, moist, gray, low plastic, Silty CLAY (CL); with little oxidation									Light reddish-brown in shoe

Completion Depth: 45.5 Ft.

Water Depth: 29.0 ft., After ATD hrs.

ft., After hrs.

ft., After hrs.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Roberts Env.

Logged by: K. Berry

6/13/95 WCCXILPW 58560

Woodward-Clyde Consultants

LOG of BORING No. P-05A

DATE 5/11/95 SURFACE ELEVATION, FT 75.0 DATUM TBM=100 STA./OFFSET 3+83/55RT

DEPTH, ft.	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25	4 4			47.5							Glacial Soils
			Soft to medium stiff, moist, orangish-brown, low plastic, silty CLAY (CL); with trace fine sand, pebbles ▽	27.5							
30	3 4 4	100		41.0							
35	4 5 8	100	Stiff, moist, light brown, medium to high plastic CLAY (CL); with trace sand (1/2 inch rounded pebbles)	34.0 37.8							Till Sandstone in shoe (in jar)
			Very stiff to hard, damp, orangish-brown, low plastic CLAY (CL)	37.2							Spoon Formation Driller reported stiff material at 38.5 feet
40	9 18 50/2"	67		33.5							Clay had structure to it Driller reported approximately 6 inches of highly fractured rock at 40.2 feet
			Hard, damp, light green, high plastic CLAY (CH); with trace sand	41.5							Gravel-sized, severely weathered limestone, then shale in shoe (shale on bottom)
45	10 14 19	67		29.5							
			Bottom of boring at 45.5 feet	45.5							Advanced augers to 45.5 for permeability test Piezometer installed

Completion Depth: 45.5 Ft.

Water Depth: 29.0 ft., After ATD hrs.

ft., After hrs.

ft., After hrs.

Project No.: 5E08560

Project Name: Illinois Power/Baldwin Power Station

Drilling Contractor: Roberts Env.

Logged by: K. Berry

6/13/95 WCCXILPW 58560

Woodward-Clyde Consultants

LOG of BORING No. P-07

DATE 5/15/95 SURFACE ELEVATION, FT 51.0 DATUM TBM=100 STA./OFFSET 4+01/172RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
0				Moist, brown, Silty CLAY (CL)	47.0								Boring advanced using 4 1/4 inch I.D. HSA
5		3 4 5	72	Stiff, moist, greenish-gray, medium to high plastic CLAY (CL/CH); with trace organics	4.0 / 44.0								Alluvium
10		3 5 6	100	Medium stiff, moist, mottled orangish brown, low plastic, silty clay and gray, high plastic CLAY (CL/CH); with little sand	7.0 / 39.0								(TILL)
15		4 6 8	100	Stiff, moist, light brown, high plastic CLAY (CH); with little sand, fine pebbles	12.0								(TILL)
20		P	100	Becomes mottled gray and brown	29.0		1.5						
		7	100	Dry to damp, light gray, high plastic CLAY (highly weathered shale)	22.0								21.8 - 22.1 feet: driller reported possible rock Becomes green in shoe

Completion Depth: 27.0 Ft. Water Depth: 14.0 ft., After ATD hrs.
Project No.: 5E08560 ft., After hrs.
Project Name: Illinois Power/Baldwin Power Station ft., After hrs.
Drilling Contractor: Roberts Env. Logged by: K. Berry

LOG of BORING No. P-07

DATE 5/15/95 SURFACE ELEVATION, FT 51.0 DATUM TBM=100 STA./OFFSET 4+01/172RT

DEPTH, ft.	SAMPLES	SAMPLING RESISTANCE	RECOVERY, %	DESCRIPTION	STRATUM EL / DEPTH	SYMBOL	PP, TSF	TV, TSF	NMC, %	LL	PI	Qu, KSF	FIELD NOTES
25		17 16			24.0								
				Bottom of boring at 27.0 feet	27.0								Permeability test at 27.0 feet Installed piezometer
30													
35													
40													
45													

Completion Depth: 27.0 Ft.
Water Depth: 14.0 ft., After ATD hrs.

Project No.: 5E08560
ft., After hrs.

Project Name: Illinois Power/Baldwin Power Station
ft., After hrs.

Drilling Contractor: Roberts Env.
Logged by: K. Berry

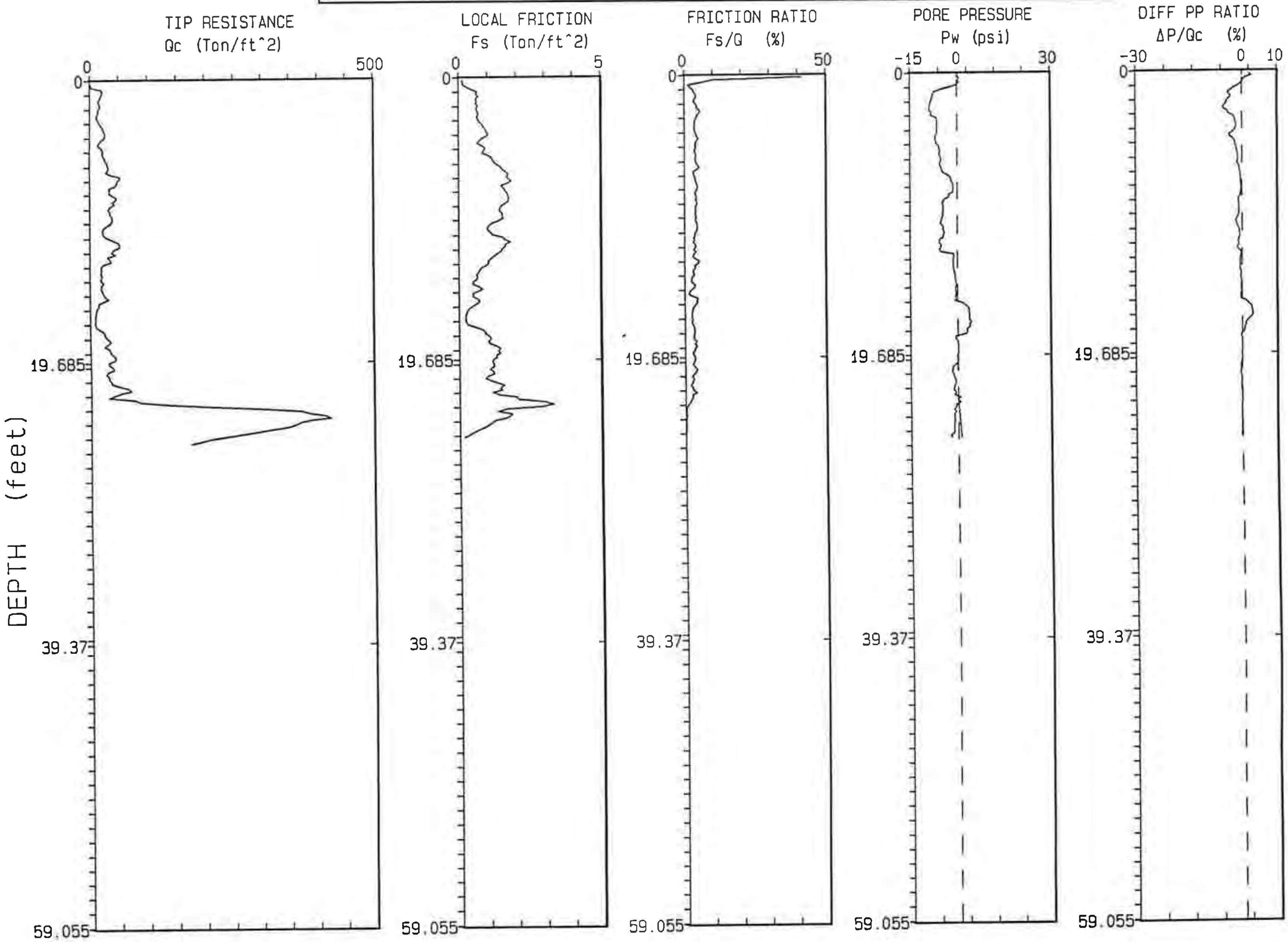
APPENDIX A-4 - PIEZOCONE SOUNDINGS

The 23 cone penetration tests were performed with a 10-ton electronic subtraction cone equipped with a pore pressure transducer. The cones have a tip area of 10 cm^2 and a friction sleeve area of 150 cm^2. The pore pressure transducer is located directly behind the tip. The cone was advanced in the field by hydraulic pushing from a drill rig at a rate of 1 inch per second. Data was collected at a 5 cm vertical interval. The Cone Penetration Test (CPT) was performed in accordance with ASTM D-3441. Plotted results of the CPT tests are included as Figures A-4-1 through A-4-23 of this appendix. Data Tables from the CPT tests are given after each CPT plot.

WOODWARD-CLYDE CONSULTANTS

CPT-1

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 25.43 ft

FIG. A-4-1

WOODWARD-CLYDE CONSULTANTS

CPT-1

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	11.37	0.30	2.68	0.03	silty clay to clay	UNDFND	UNDFD	7	.6
0.60	2	16.80	0.63	3.74	0.09	silty clay to clay	UNDFND	UNDFD	11	.9
0.95	3	14.66	0.67	4.55	0.15	clay	UNDFND	UNDFD	14	.8
1.25	4	24.68	0.93	3.77	0.22	silty clay to clay	UNDFND	UNDFD	16	1.4
1.55	5	18.98	0.79	4.17	0.28	silty clay to clay	UNDFND	UNDFD	12	1.1
1.85	6	28.70	1.13	3.93	0.33	silty clay to clay	UNDFND	UNDFD	18	1.6
2.15	7	41.52	1.64	3.94	0.39	clayey silt to silty clay	UNDFND	UNDFD	20	2.4
2.45	8	39.12	1.65	4.22	0.45	silty clay to clay	UNDFND	UNDFD	25	2.2
2.75	9	40.57	1.66	4.10	0.51	silty clay to clay	UNDFND	UNDFD	26	2.3
3.05	10	37.12	1.47	3.97	0.57	clayey silt to silty clay	UNDFND	UNDFD	18	2.1
3.35	11	25.73	1.09	4.24	0.63	silty clay to clay	UNDFND	UNDFD	16	1.4
3.65	12	45.22	1.62	3.57	0.69	clayey silt to silty clay	UNDFND	UNDFD	22	2.6
3.95	13	32.63	1.19	3.66	0.75	clayey silt to silty clay	UNDFND	UNDFD	16	1.8
4.25	14	19.68	0.73	3.71	0.81	silty clay to clay	UNDFND	UNDFD	13	1.1
4.55	15	21.73	0.64	2.94	0.87	clayey silt to silty clay	UNDFND	UNDFD	10	1.2
4.85	16	21.27	0.58	2.75	0.93	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
5.15	17	9.88	0.28	2.88	0.98	silty clay to clay	UNDFND	UNDFD	6	.5
5.45	18	19.00	0.61	3.19	1.04	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
5.75	19	32.30	1.15	3.57	1.10	clayey silt to silty clay	UNDFND	UNDFD	15	1.8
6.05	20	38.63	1.28	3.32	1.16	clayey silt to silty clay	UNDFND	UNDFD	19	2.2
6.40	21	33.97	1.11	3.26	1.23	clayey silt to silty clay	UNDFND	UNDFD	16	1.9
6.70	22	52.85	1.34	2.54	1.29	sandy silt to clayey silt	UNDFND	UNDFD	20	3.0
7.00	23	140.12	2.43	1.74	1.35	sand to silty sand	70-80	40-42	34	UNDEFINED
7.35	24	387.83	1.50	0.39	1.39	gravelly sand to sand	>90	44-46	>50	UNDEFINED
7.65	25	279.07	0.58	0.21	1.42	gravelly sand to sand	>90	42-44	45	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-1

WOODWARD-CLYDE CONSULTANTS

CPT-2

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

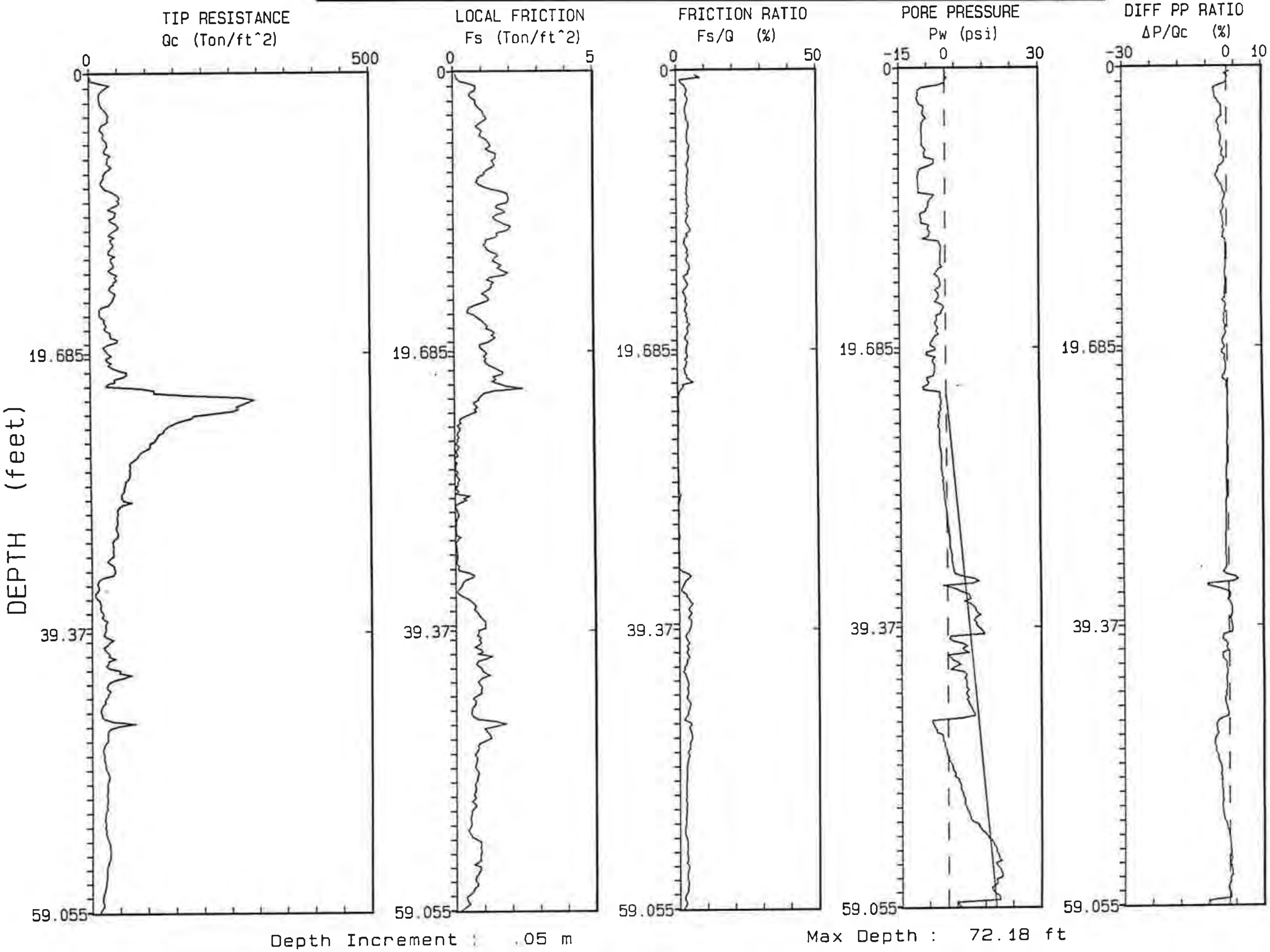
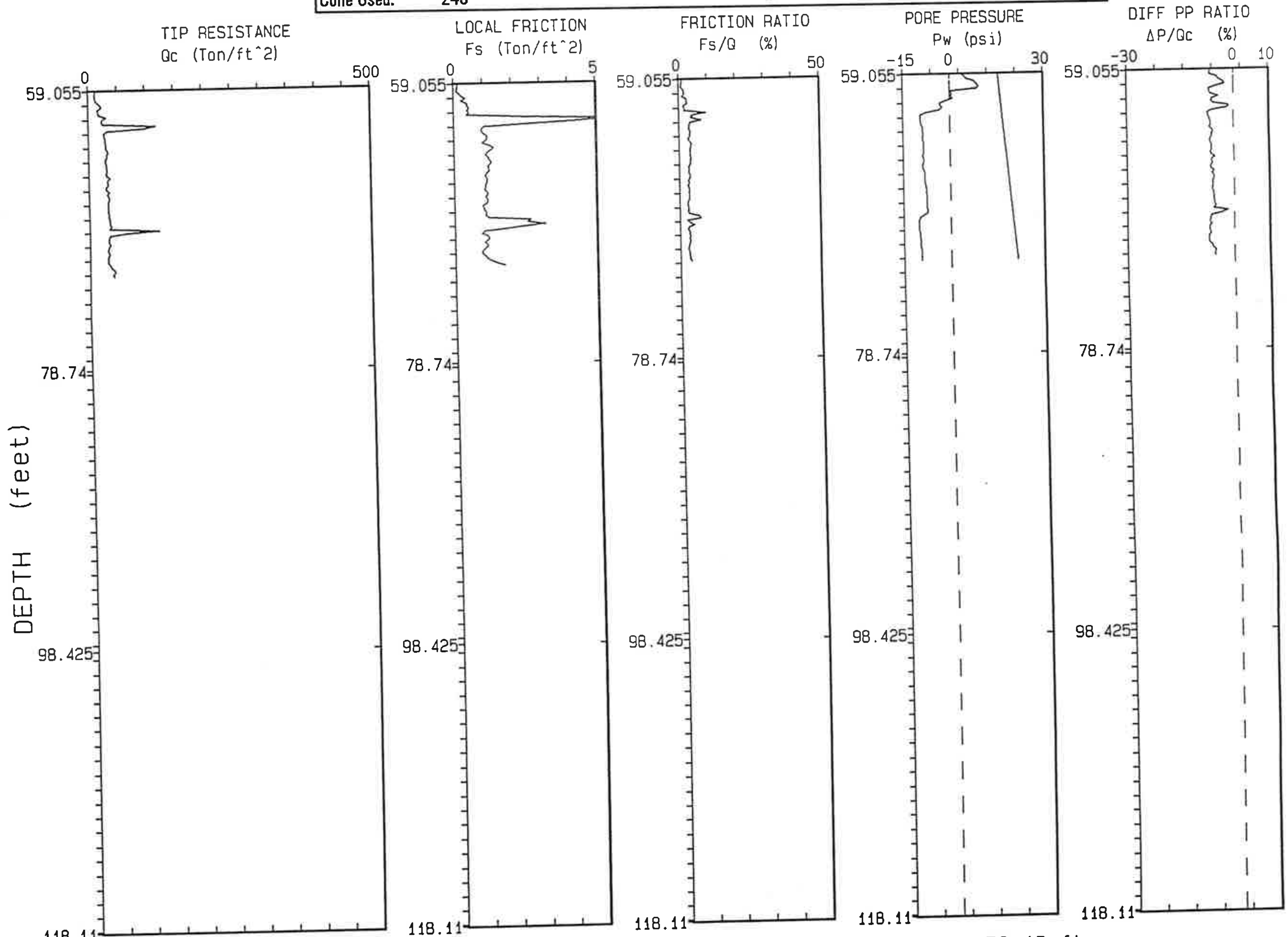


FIG. A-4-2

WOODWARD-CLYDE CONSULTANTS

CPT-2

Operator:	J. Oldham	**CPT Date:**	3/28/95
Page:	2/2	**Location:**	Baldwin
Cone Used:	243	**Job Number:**	5E08560



Depth Increment : .05 m

Max Depth : 72.18 ft

FIG. A-4-2

CPT-2

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

EPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	14.55	0.33	2.29	0.03	clayey silt to silty clay	UNDFND	UNDFD	7	.8
0.60	2	18.98	0.70	3.69	0.09	silty clay to clay	UNDFND	UNDFD	12	1.1
0.95	3	28.16	0.96	3.42	0.15	clayey silt to silty clay	UNDFND	UNDFD	13	1.6
1.25	4	24.57	0.98	3.99	0.22	silty clay to clay	UNDFND	UNDFD	16	1.4
1.55	5	28.02	1.10	3.92	0.28	silty clay to clay	UNDFND	UNDFD	18	1.6
1.85	6	31.35	1.38	4.40	0.33	silty clay to clay	UNDFND	UNDFD	20	1.8
2.15	7	32.65	1.32	4.06	0.39	silty clay to clay	UNDFND	UNDFD	21	1.8
2.45	8	23.52	0.94	4.00	0.45	silty clay to clay	UNDFND	UNDFD	15	1.3
2.75	9	48.83	1.82	3.73	0.51	clayey silt to silty clay	UNDFND	UNDFD	23	2.8
3.05	10	43.05	1.68	3.91	0.57	clayey silt to silty clay	UNDFND	UNDFD	21	2.4
3.35	11	44.15	1.73	3.92	0.63	clayey silt to silty clay	UNDFND	UNDFD	21	2.5
3.65	12	38.48	1.46	3.79	0.69	clayey silt to silty clay	UNDFND	UNDFD	18	2.2
3.95	13	37.63	1.31	3.47	0.75	clayey silt to silty clay	UNDFND	UNDFD	18	2.1
4.25	14	38.48	1.56	4.06	0.81	silty clay to clay	UNDFND	UNDFD	25	2.2
4.55	15	43.65	1.49	3.42	0.87	clayey silt to silty clay	UNDFND	UNDFD	21	2.5
4.85	16	40.38	1.19	2.95	0.93	sandy silt to clayey silt	UNDFND	UNDFD	15	2.3
5.15	17	23.40	0.74	3.17	0.98	clayey silt to silty clay	UNDFND	UNDFD	11	1.3
5.45	18	25.45	0.96	3.76	1.04	silty clay to clay	UNDFND	UNDFD	16	1.4
5.75	19	39.15	1.34	3.43	1.10	clayey silt to silty clay	UNDFND	UNDFD	19	2.2
6.05	20	30.18	1.04	3.45	1.16	clayey silt to silty clay	UNDFND	UNDFD	14	1.7
6.40	21	40.23	1.23	3.06	1.23	clayey silt to silty clay	UNDFND	UNDFD	19	2.2
6.70	22	44.60	1.54	3.44	1.29	clayey silt to silty clay	UNDFND	UNDFD	21	2.5
00	23	174.40	1.42	0.82	1.35	sand	70-80	42-44	33	UNDEFINED
5	24	247.71	0.73	0.29	1.39	gravelly sand to sand	80-90	42-44	40	UNDEFINED
7.65	25	150.20	0.21	0.14	1.42	sand	70-80	40-42	29	UNDEFINED
7.95	26	117.15	0.12	0.10	1.45	sand	60-70	40-42	22	UNDEFINED
8.25	27	92.93	0.08	0.09	1.48	sand	50-60	38-40	18	UNDEFINED
8.55	28	71.08	0.02	0.03	1.51	sand	50-60	36-38	14	UNDEFINED
8.85	29	64.68	0.10	0.15	1.54	sand to silty sand	40-50	36-38	15	UNDEFINED
9.15	30	56.80	0.19	0.33	1.57	sand to silty sand	40-50	36-38	14	UNDEFINED
9.45	31	53.55	0.12	0.23	1.59	sand to silty sand	40-50	34-36	13	UNDEFINED
9.75	32	45.60	0.06	0.13	1.62	sand to silty sand	<40	34-36	11	UNDEFINED
10.05	33	43.78	0.06	0.13	1.65	sand to silty sand	<40	32-34	10	UNDEFINED
10.35	34	38.82	0.04	0.10	1.68	sand to silty sand	<40	32-34	9	UNDEFINED
10.65	35	35.85	0.07	0.20	1.71	sand to silty sand	<40	32-34	9	UNDEFINED
10.95	36	22.08	0.41	1.84	1.74	sandy silt to clayey silt	UNDFND	UNDFD	8	1.1
11.25	37	8.70	0.15	1.68	1.76	clayey silt to silty clay	UNDFND	UNDFD	4	.3
11.55	38	15.45	0.59	3.84	1.79	silty clay to clay	UNDFND	UNDFD	10	.7

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-2

CPT-2

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH		Qc (avg)	Fs (avg)	Rf (avg)	SIGV'	SOIL BEHAVIOUR TYPE	Eq - Dr	PHI	SPT	Su
s)	(feet)	(tsf)	(tsf)	(%)	(tsf)		(%)	deg.	N	tsf
11.85	39	22.70	0.90	3.96	1.82	silty clay to clay	UNDFND	UNDFD	14	1.2
12.15	40	26.57	0.88	3.29	1.85	clayey silt to silty clay	UNDFND	UNDFD	13	1.4
12.45	41	27.13	0.83	3.05	1.88	clayey silt to silty clay	UNDFND	UNDFD	13	1.4
12.80	42	33.99	0.90	2.64	1.91	sandy silt to clayey silt	UNDFND	UNDFD	13	1.8
13.10	43	46.10	0.95	2.06	1.94	sandy silt to clayey silt	UNDFND	UNDFD	18	2.5
13.40	44	28.12	0.85	3.01	1.97	clayey silt to silty clay	UNDFND	UNDFD	13	1.5
13.75	45	18.39	0.61	3.31	2.00	clayey silt to silty clay	UNDFND	UNDFD	9	.9
14.05	46	38.88	1.08	2.78	2.03	sandy silt to clayey silt	UNDFND	UNDFD	15	2.1
14.35	47	27.25	1.11	4.09	2.06	silty clay to clay	UNDFND	UNDFD	17	1.4
14.65	48	20.83	0.74	3.57	2.09	silty clay to clay	UNDFND	UNDFD	13	1.0
14.95	49	23.93	0.70	2.93	2.11	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
15.25	50	28.98	0.74	2.55	2.14	sandy silt to clayey silt	UNDFND	UNDFD	11	1.5
15.55	51	26.50	0.65	2.45	2.17	sandy silt to clayey silt	UNDFND	UNDFD	10	1.3
15.85	52	25.25	0.61	2.40	2.20	sandy silt to clayey silt	UNDFND	UNDFD	10	1.3
16.15	53	22.85	0.52	2.27	2.23	sandy silt to clayey silt	UNDFND	UNDFD	9	1.1
16.45	54	25.93	0.52	2.00	2.26	sandy silt to clayey silt	UNDFND	UNDFD	10	1.3
16.75	55	31.62	0.86	2.72	2.28	sandy silt to clayey silt	UNDFND	UNDFD	12	1.6
17.05	56	28.60	0.80	2.78	2.31	clayey silt to silty clay	UNDFND	UNDFD	14	1.4
17.35	57	25.53	0.74	2.90	2.34	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
17.65	58	21.55	0.63	2.91	2.37	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
17.95	59	18.20	0.38	2.08	2.40	clayey silt to silty clay	UNDFND	UNDFD	9	.8
18.25	60	13.08	0.17	1.28	2.43	sandy silt to clayey silt	UNDFND	UNDFD	5	.5
18.55	61	20.85	0.44	2.09	2.45	sandy silt to clayey silt	UNDFND	UNDFD	8	1.0
.85	62	53.92	2.64	4.91	2.48	silty clay to clay	UNDFND	UNDFD	34	2.9
.20	63	28.20	1.06	3.76	2.51	clayey silt to silty clay	UNDFND	UNDFD	14	1.4
19.50	64	30.68	1.19	3.89	2.54	silty clay to clay	UNDFND	UNDFD	20	1.5
19.80	65	30.52	1.21	3.98	2.57	silty clay to clay	UNDFND	UNDFD	19	1.5
20.15	66	32.63	1.13	3.45	2.60	clayey silt to silty clay	UNDFND	UNDFD	16	1.6
20.45	67	33.40	1.11	3.32	2.63	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
20.75	68	33.62	1.07	3.18	2.66	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
21.05	69	55.33	2.17	3.92	2.69	clayey silt to silty clay	UNDFND	UNDFD	27	3.0
21.35	70	33.47	1.20	3.59	2.72	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
21.65	71	32.18	1.03	3.20	2.75	clayey silt to silty clay	UNDFND	UNDFD	15	1.6
21.95	72	38.10	1.11	2.91	2.77	sandy silt to clayey silt	UNDFND	UNDFD	15	1.9

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-2

CPT-2

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	22.70	0.90	3.96	1.82	silty clay to clay	UNDFND	UNDFD	14	1.2
12.15	40	26.57	0.88	3.29	1.85	clayey silt to silty clay	UNDFND	UNDFD	13	1.4
12.45	41	27.13	0.83	3.05	1.88	clayey silt to silty clay	UNDFND	UNDFD	13	1.4
12.80	42	33.99	0.90	2.64	1.91	sandy silt to clayey silt	UNDFND	UNDFD	13	1.8
13.10	43	46.10	0.95	2.06	1.94	sandy silt to clayey silt	UNDFND	UNDFD	18	2.5
13.40	44	28.12	0.85	3.01	1.97	clayey silt to silty clay	UNDFND	UNDFD	13	1.5
13.75	45	18.39	0.61	3.31	2.00	clayey silt to silty clay	UNDFND	UNDFD	9	.9
14.05	46	38.88	1.08	2.78	2.03	sandy silt to clayey silt	UNDFND	UNDFD	15	2.1
14.35	47	27.25	1.11	4.09	2.06	silty clay to clay	UNDFND	UNDFD	17	1.4
14.65	48	20.83	0.74	3.57	2.09	silty clay to clay	UNDFND	UNDFD	13	1.0
14.95	49	23.93	0.70	2.93	2.11	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
15.25	50	28.98	0.74	2.55	2.14	sandy silt to clayey silt	UNDFND	UNDFD	11	1.5
15.55	51	26.50	0.65	2.45	2.17	sandy silt to clayey silt	UNDFND	UNDFD	10	1.3
15.85	52	25.25	0.61	2.40	2.20	sandy silt to clayey silt	UNDFND	UNDFD	10	1.3
16.15	53	22.85	0.52	2.27	2.23	sandy silt to clayey silt	UNDFND	UNDFD	9	1.1
16.45	54	25.93	0.52	2.00	2.26	sandy silt to clayey silt	UNDFND	UNDFD	10	1.3
16.75	55	31.62	0.86	2.72	2.28	sandy silt to clayey silt	UNDFND	UNDFD	12	1.6
17.05	56	28.60	0.80	2.78	2.31	clayey silt to silty clay	UNDFND	UNDFD	14	1.4
17.35	57	25.53	0.74	2.90	2.34	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
17.65	58	21.55	0.63	2.91	2.37	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
17.95	59	18.20	0.38	2.08	2.40	clayey silt to silty clay	UNDFND	UNDFD	9	.8
18.25	60	13.08	0.17	1.28	2.43	sandy silt to clayey silt	UNDFND	UNDFD	5	.5
18.55	61	20.85	0.44	2.09	2.45	sandy silt to clayey silt	UNDFND	UNDFD	8	1.0
18.85	62	53.92	2.64	4.91	2.48	silty clay to clay	UNDFND	UNDFD	34	2.9
19.20	63	28.20	1.06	3.76	2.51	clayey silt to silty clay	UNDFND	UNDFD	14	1.4
19.50	64	30.68	1.19	3.89	2.54	silty clay to clay	UNDFND	UNDFD	20	1.5
19.80	65	30.52	1.21	3.98	2.57	silty clay to clay	UNDFND	UNDFD	19	1.5
20.15	66	32.63	1.13	3.45	2.60	clayey silt to silty clay	UNDFND	UNDFD	16	1.6
20.45	67	33.40	1.11	3.32	2.63	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
20.75	68	33.62	1.07	3.18	2.66	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
21.05	69	55.33	2.17	3.92	2.69	clayey silt to silty clay	UNDFND	UNDFD	27	3.0
21.35	70	33.47	1.20	3.59	2.72	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
21.65	71	32.18	1.03	3.20	2.75	clayey silt to silty clay	UNDFND	UNDFD	15	1.6
21.95	72	38.10	1.11	2.91	2.77	sandy silt to clayey silt	UNDFND	UNDFD	15	1.9

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

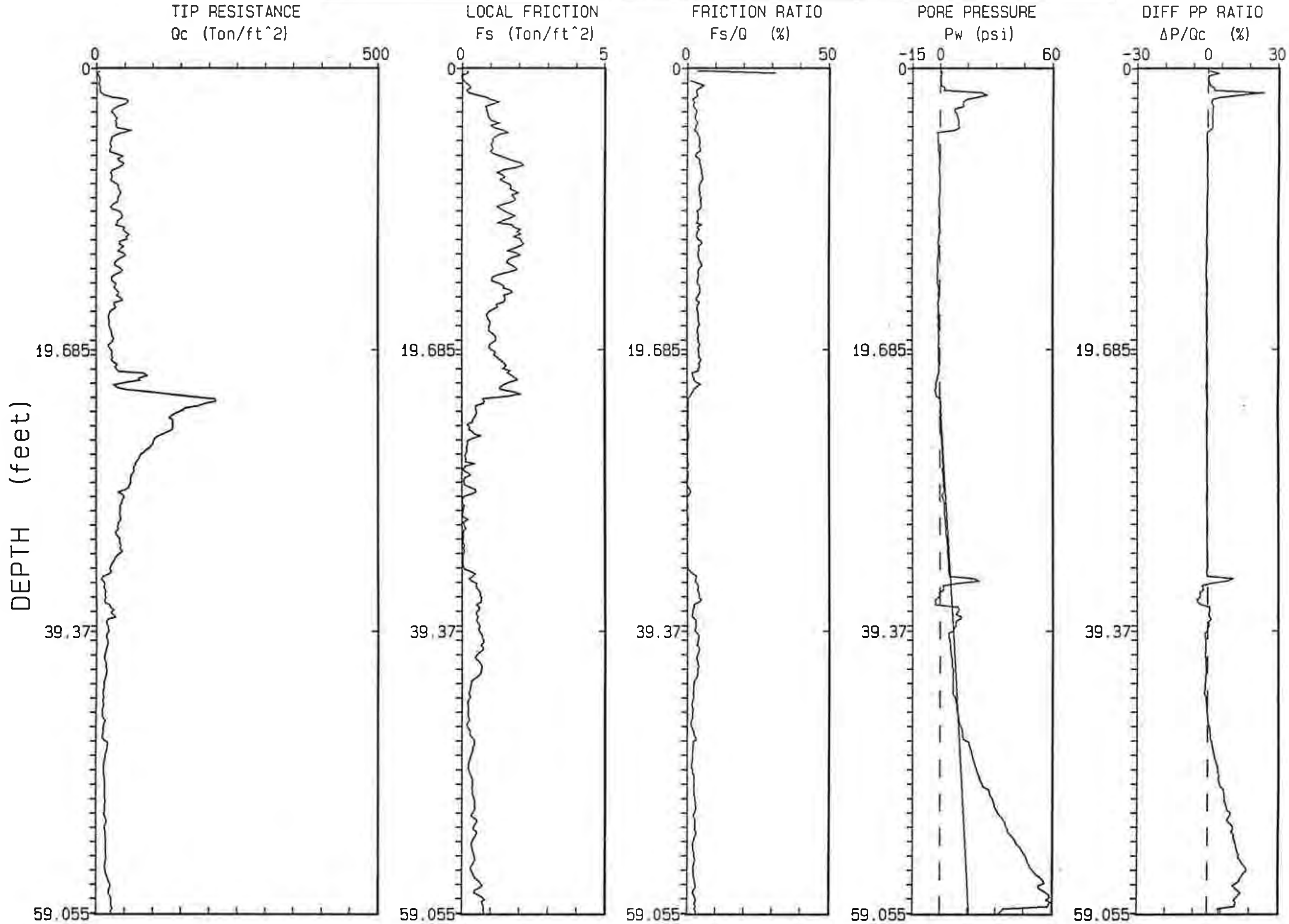
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-2

WOODWARD-CLYDE CONSULTANTS

CPT-3

Operator:	J. Oldham	**CPT Date:**	3/27/95
Page:	1/2	**Location:**	Baldwin
Cone Used:	243	**Job Number:**	5E08560



Depth Increment : .05 m

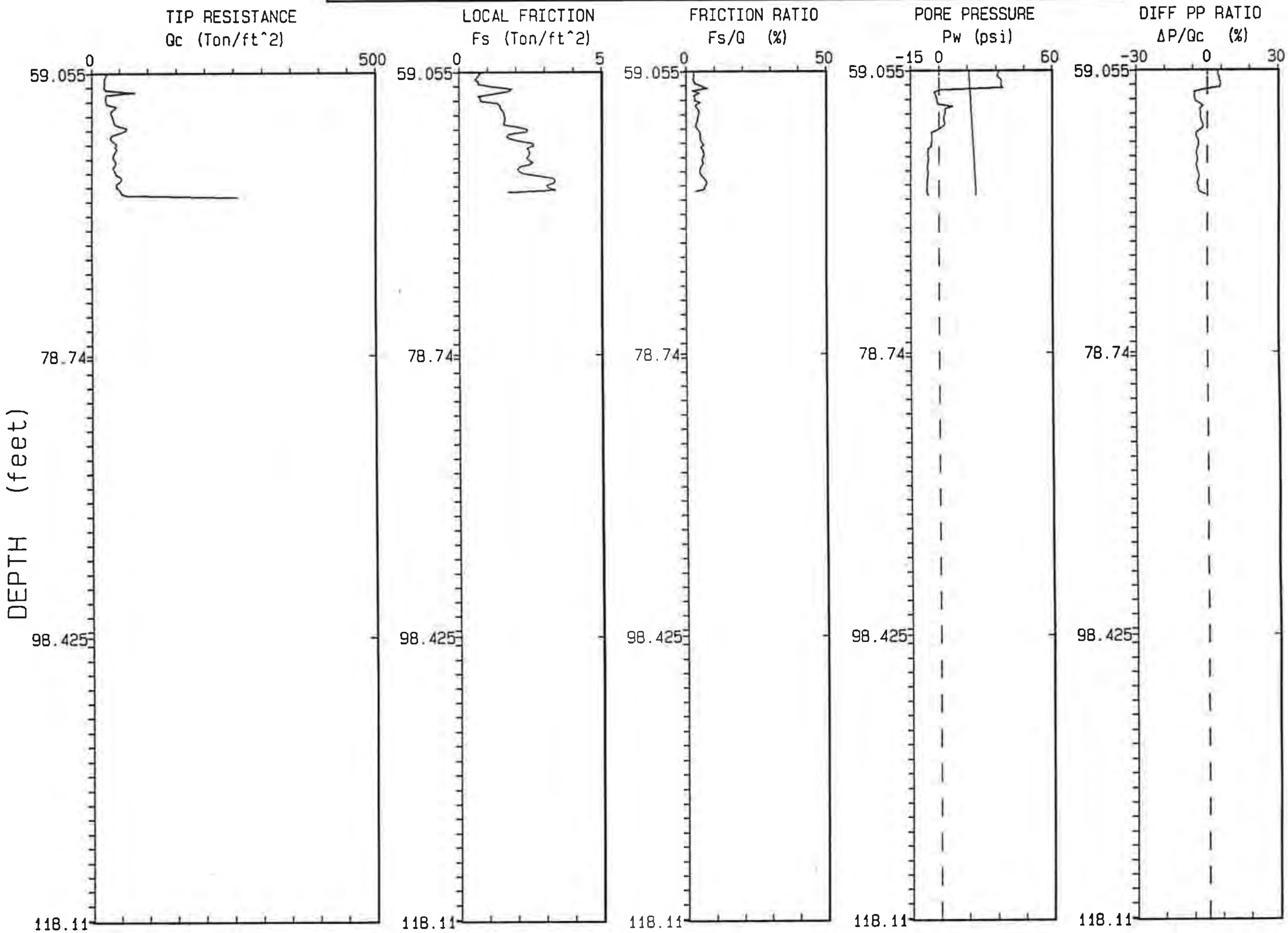
Max Depth : 67.75 ft

FIG. A-4-3

WOODWARD-CLYDE CONSULTANTS

CPT-3

Operator:	J. Oldham	CPT Date:	3/27/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m   Max Depth : 67.75 ft

FIG. A-4-3

WOODWARD-CLYDE CONSULTANTS

CPT-3

Operator: J. Oldham		CPT Date:	3/27/95
Page: 1/2		Location:	Baldwin
Cone Used: 243		Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	3.95	0.09	2.19	0.03	clay	UNDFND	UNDFD	4	.2
0.60	2	10.50	0.37	3.55	0.09	clay	UNDFND	UNDFD	10	.6
0.95	3	39.91	0.96	2.42	0.15	sandy silt to clayey silt	UNDFND	UNDFD	15	2.3
1.25	4	34.28	1.05	3.05	0.22	clayey silt to silty clay	UNDFND	UNDFD	16	2.0
1.55	5	36.38	1.26	3.47	0.28	clayey silt to silty clay	UNDFND	UNDFD	17	2.1
1.85	6	28.98	1.09	3.76	0.33	clayey silt to silty clay	UNDFND	UNDFD	14	1.6
2.15	7	39.25	1.81	4.62	0.39	silty clay to clay	UNDFND	UNDFD	25	2.2
2.45	8	28.33	1.44	5.07	0.45	clay	UNDFND	UNDFD	27	1.6
2.75	9	39.83	1.79	4.50	0.51	silty clay to clay	UNDFND	UNDFD	25	2.3
3.05	10	32.97	1.52	4.61	0.57	silty clay to clay	UNDFND	UNDFD	21	1.9
3.35	11	40.12	1.61	4.01	0.63	clayey silt to silty clay	UNDFND	UNDFD	19	2.3
3.65	12	52.45	1.95	3.72	0.69	clayey silt to silty clay	UNDFND	UNDFD	25	3.0
3.95	13	43.42	1.93	4.46	0.75	silty clay to clay	UNDFND	UNDFD	28	2.5
4.25	14	39.48	1.77	4.47	0.81	silty clay to clay	UNDFND	UNDFD	25	2.2
4.55	15	34.07	1.35	3.97	0.87	silty clay to clay	UNDFND	UNDFD	22	1.9
4.85	16	35.17	1.53	4.36	0.93	silty clay to clay	UNDFND	UNDFD	22	2.0
5.15	17	36.28	1.33	3.68	0.98	clayey silt to silty clay	UNDFND	UNDFD	17	2.0
5.45	18	22.42	0.93	4.14	1.04	silty clay to clay	UNDFND	UNDFD	14	1.2
5.75	19	26.65	1.04	3.91	1.10	silty clay to clay	UNDFND	UNDFD	17	1.5
6.05	20	25.43	1.06	4.18	1.16	silty clay to clay	UNDFND	UNDFD	16	1.4
6.40	21	30.87	1.36	4.40	1.23	silty clay to clay	UNDFND	UNDFD	20	1.7
6.70	22	69.72	1.75	2.51	1.29	sandy silt to clayey silt	UNDFND	UNDFD	27	4.0
7.00	23	86.48	1.60	1.84	1.35	silty sand to sandy silt	50-60	38-40	28	UNDEFINED
7.35	24	178.20	0.60	0.34	1.39	sand	70-80	42-44	34	UNDEFINED
7.65	25	133.95	0.35	0.26	1.42	sand	60-70	40-42	26	UNDEFINED
7.95	26	115.47	0.39	0.34	1.45	sand	60-70	40-42	22	UNDEFINED
8.25	27	89.82	0.16	0.18	1.48	sand	50-60	38-40	17	UNDEFINED
8.55	28	69.77	0.16	0.23	1.51	sand to silty sand	50-60	36-38	17	UNDEFINED
8.85	29	62.20	0.14	0.23	1.54	sand to silty sand	40-50	36-38	15	UNDEFINED
9.15	30	50.35	0.29	0.57	1.57	sand to silty sand	40-50	34-36	12	UNDEFINED
9.45	31	43.67	0.04	0.09	1.59	sand to silty sand	<40	32-34	10	UNDEFINED
9.75	32	41.32	0.07	0.18	1.62	sand to silty sand	<40	32-34	10	UNDEFINED
10.05	33	37.53	0.07	0.18	1.65	sand to silty sand	<40	32-34	9	UNDEFINED
10.35	34	42.67	0.06	0.13	1.68	sand to silty sand	<40	32-34	10	UNDEFINED
10.65	35	30.37	0.04	0.13	1.71	silty sand to sandy silt	<40	30-32	10	UNDEFINED
10.95	36	17.42	0.31	1.77	1.74	sandy silt to clayey silt	UNDFND	UNDFD	7	.8
11.25	37	14.65	0.57	3.88	1.76	silty clay to clay	UNDFND	UNDFD	9	.7
11.55	38	20.52	0.62	3.00	1.79	clayey silt to silty clay	UNDFND	UNDFD	10	1.0

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-3

CPT-3

Operator:	J. Oldham	CPT Date:	3/27/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	23.85	0.54	2.25	1.82	sandy silt to clayey silt	UNDFND	UNDFD	9	1.2
12.15	40	19.32	0.65	3.37	1.85	clayey silt to silty clay	UNDFND	UNDFD	9	.9
12.45	41	17.92	0.70	3.93	1.88	silty clay to clay	UNDFND	UNDFD	11	.9
12.80	42	15.80	0.59	3.74	1.91	silty clay to clay	UNDFND	UNDFD	10	.7
13.10	43	15.35	0.50	3.23	1.94	silty clay to clay	UNDFND	UNDFD	10	.7
13.40	44	12.63	0.28	2.22	1.97	clayey silt to silty clay	UNDFND	UNDFD	6	.5
13.75	45	11.56	0.22	1.88	2.00	clayey silt to silty clay	UNDFND	UNDFD	6	.5
14.05	46	13.08	0.22	1.68	2.03	clayey silt to silty clay	UNDFND	UNDFD	6	.6
14.35	47	13.65	0.34	2.51	2.06	clayey silt to silty clay	UNDFND	UNDFD	7	.6
14.65	48	18.12	0.37	2.05	2.09	clayey silt to silty clay	UNDFND	UNDFD	9	.8
14.95	49	14.12	0.25	1.77	2.11	clayey silt to silty clay	UNDFND	UNDFD	7	.6
15.25	50	14.65	0.34	2.31	2.14	clayey silt to silty clay	UNDFND	UNDFD	7	.6
15.55	51	15.27	0.38	2.49	2.17	clayey silt to silty clay	UNDFND	UNDFD	7	.7
15.85	52	15.17	0.44	2.87	2.20	clayey silt to silty clay	UNDFND	UNDFD	7	.7
16.15	53	16.27	0.43	2.67	2.23	clayey silt to silty clay	UNDFND	UNDFD	8	.7
16.45	54	16.42	0.45	2.72	2.26	clayey silt to silty clay	UNDFND	UNDFD	8	.7
16.75	55	17.07	0.38	2.20	2.28	clayey silt to silty clay	UNDFND	UNDFD	8	.8
17.05	56	16.15	0.38	2.36	2.31	clayey silt to silty clay	UNDFND	UNDFD	8	.7
17.35	57	19.63	0.49	2.48	2.34	clayey silt to silty clay	UNDFND	UNDFD	9	.9
17.65	58	23.40	0.59	2.53	2.37	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
17.95	59	26.37	0.76	2.87	2.40	clayey silt to silty clay	UNDFND	UNDFD	13	1.3
18.25	60	23.67	0.67	2.83	2.43	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
18.55	61	33.03	1.23	3.71	2.45	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
18.85	62	34.13	1.34	3.92	2.48	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
19.20	63	46.39	1.78	3.83	2.51	clayey silt to silty clay	UNDFND	UNDFD	22	2.5
19.50	64	39.83	2.03	5.09	2.54	clay	UNDFND	UNDFD	38	2.1
19.80	65	40.88	2.45	6.00	2.57	clay	UNDFND	UNDFD	39	2.1
20.15	66	41.96	2.29	5.45	2.60	clay	UNDFND	UNDFD	40	2.2
20.45	67	48.98	3.17	6.47	2.63	clay	UNDFND	UNDFD	47	2.6

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-3

WOODWARD-CLYDE CONSULTANTS

CPT-4

Operator:	J. Oldham	CPT Date:	3/27/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

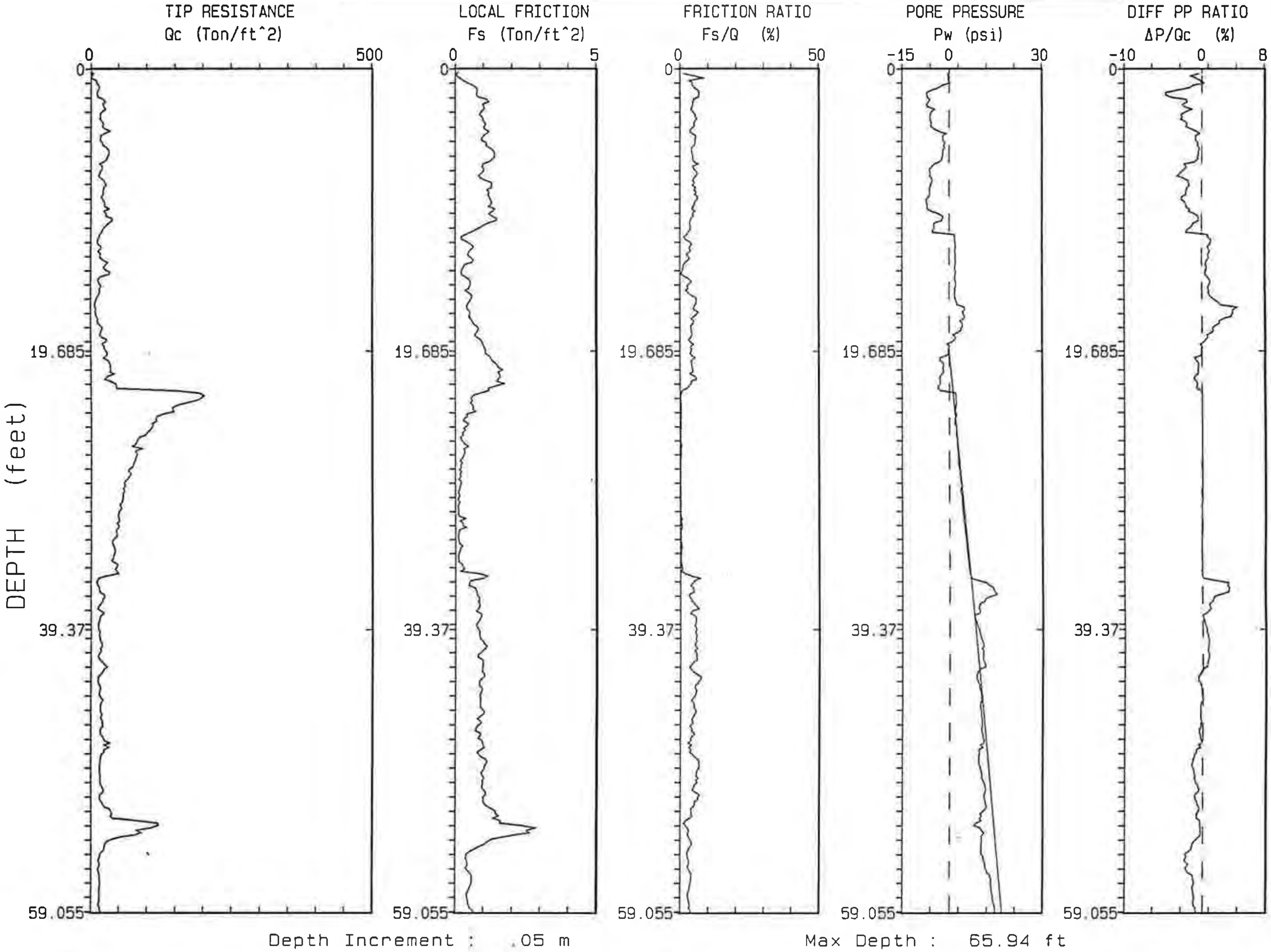
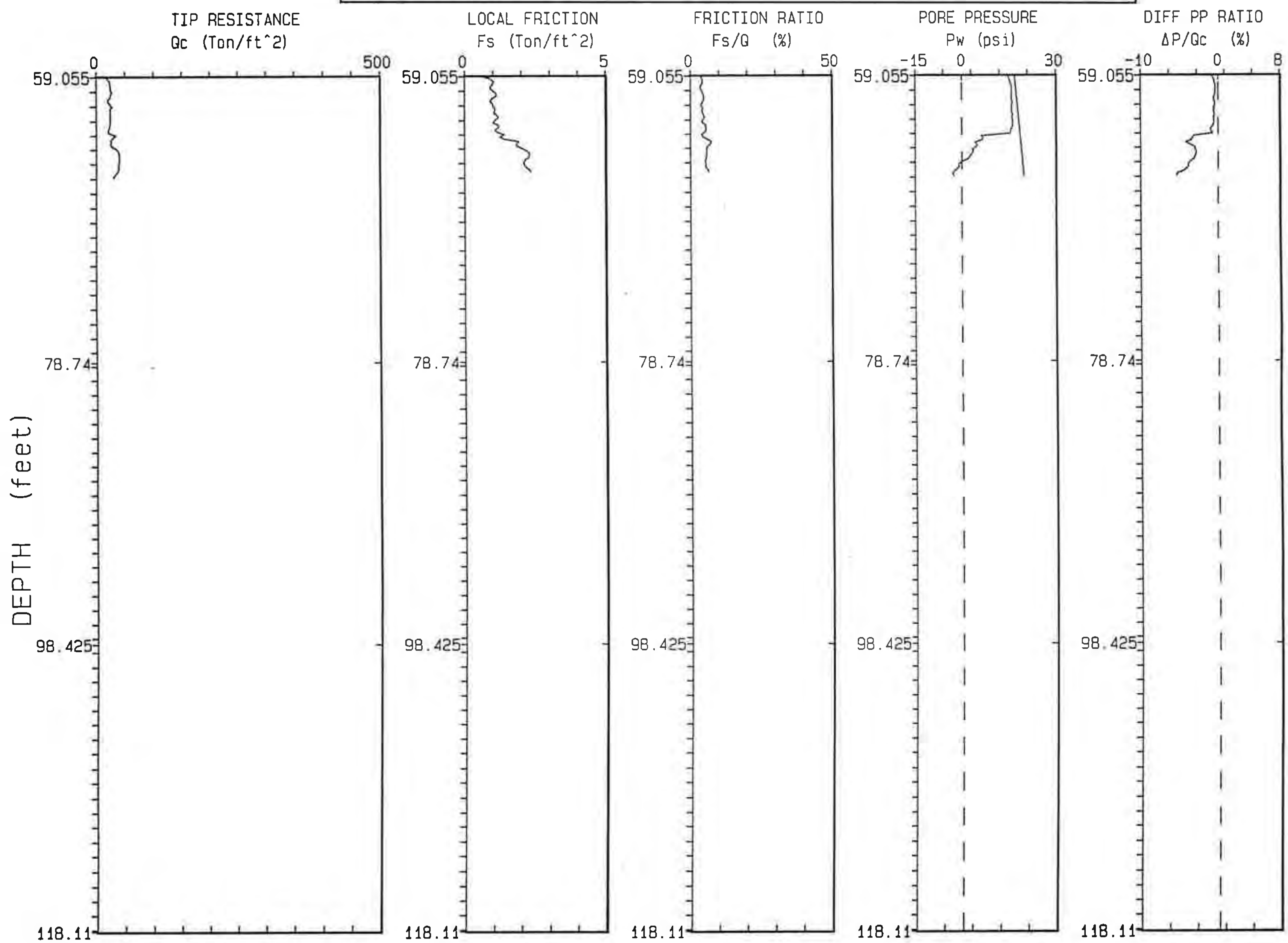


FIG. A-4-4

WOODWARD-CLYDE CONSULTANTS

CPT-4

Operator:	J. Oldham	CPT Date:	3/27/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 65.94 ft

FIG. A-4-4

WOODWARD-CLYDE CONSULTANTS

CPT-4

Operator:	J. Oldham	CPT Date:	3/27/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	4.33	0.18	4.27	0.03	clay	UNDFND	UNDFD	4	.2
0.60	2	12.67	0.76	5.97	0.09	clay	UNDFND	UNDFD	12	.7
0.95	3	22.00	1.02	4.65	0.15	clay	UNDFND	UNDFD	21	1.2
1.25	4	20.00	1.01	5.07	0.22	clay	UNDFND	UNDFD	19	1.1
1.55	5	22.17	1.06	4.77	0.28	clay	UNDFND	UNDFD	21	1.2
1.85	6	28.67	1.29	4.50	0.33	silty clay to clay	UNDFND	UNDFD	18	1.6
2.15	7	20.50	1.08	5.24	0.39	clay	UNDFND	UNDFD	20	1.1
2.45	8	20.50	1.05	5.13	0.45	clay	UNDFND	UNDFD	20	1.1
2.75	9	21.17	1.21	5.69	0.51	clay	UNDFND	UNDFD	20	1.2
3.05	10	26.33	1.28	4.87	0.57	clay	UNDFND	UNDFD	25	1.5
3.35	11	30.67	1.21	3.93	0.63	silty clay to clay	UNDFND	UNDFD	20	1.7
3.65	12	15.50	0.41	2.68	0.69	clayey silt to silty clay	UNDFND	UNDFD	7	.8
3.95	13	16.17	0.53	3.29	0.75	silty clay to clay	UNDFND	UNDFD	10	.9
4.25	14	24.33	0.44	1.80	0.81	sandy silt to clayey silt	UNDFND	UNDFD	9	1.3
4.55	15	21.50	0.39	1.81	0.87	sandy silt to clayey silt	UNDFND	UNDFD	8	1.2
4.85	16	15.17	0.50	3.27	0.93	silty clay to clay	UNDFND	UNDFD	10	.8
5.15	17	8.33	0.47	5.60	0.98	clay	UNDFND	UNDFD	8	.4
5.45	18	12.67	0.59	4.62	1.04	clay	UNDFND	UNDFD	12	.6
5.75	19	20.50	0.78	3.83	1.10	silty clay to clay	UNDFND	UNDFD	13	1.1
6.05	20	25.50	1.03	4.03	1.16	silty clay to clay	UNDFND	UNDFD	16	1.4
6.40	21	31.57	1.41	4.46	1.23	silty clay to clay	UNDFND	UNDFD	20	1.7
6.70	22	34.83	1.57	4.49	1.29	silty clay to clay	UNDFND	UNDFD	22	1.9
7.00	23	139.33	0.98	0.70	1.35	sand	70-80	40-42	27	UNDEFINED
7.35	24	155.00	0.60	0.38	1.39	sand	70-80	40-42	30	UNDEFINED
7.65	25	112.67	0.38	0.33	1.42	sand	60-70	40-42	22	UNDEFINED
7.95	26	91.33	0.26	0.29	1.45	sand	50-60	38-40	17	UNDEFINED
8.25	27	81.33	0.35	0.42	1.48	sand to silty sand	50-60	38-40	19	UNDEFINED
8.55	28	75.33	0.20	0.27	1.51	sand to silty sand	50-60	36-38	18	UNDEFINED
8.85	29	65.33	0.18	0.27	1.54	sand to silty sand	40-50	36-38	16	UNDEFINED
9.15	30	58.50	0.13	0.23	1.57	sand to silty sand	40-50	36-38	14	UNDEFINED
9.45	31	53.50	0.11	0.21	1.59	sand to silty sand	40-50	34-36	13	UNDEFINED
9.75	32	49.33	0.22	0.44	1.62	sand to silty sand	<40	34-36	12	UNDEFINED
10.05	33	45.67	0.16	0.36	1.65	sand to silty sand	<40	34-36	11	UNDEFINED
10.35	34	40.83	0.16	0.40	1.68	silty sand to sandy silt	<40	32-34	13	UNDEFINED
10.65	35	42.33	0.15	0.35	1.71	sand to silty sand	<40	32-34	10	UNDEFINED
10.95	36	32.33	0.67	2.07	1.74	sandy silt to clayey silt	UNDFND	UNDFD	12	1.7
11.25	37	15.67	0.65	4.16	1.76	clay	UNDFND	UNDFD	15	.7
11.55	38	18.17	0.84	4.63	1.79	clay	UNDFND	UNDFD	17	.9

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-4

WOODWARD-CLYDE CONSULTANTS

CPT-4

Operator:	J. Oldham	CPT Date:	3/27/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	17.50	0.85	4.85	1.82	clay	UNDFND	UNDFD	17	.8
12.15	40	14.67	0.82	5.59	1.85	clay	UNDFND	UNDFD	14	.7
12.45	41	18.17	1.01	5.55	1.88	clay	UNDFND	UNDFD	17	.9
12.80	42	19.43	0.92	4.75	1.91	clay	UNDFND	UNDFD	19	.9
13.10	43	17.17	0.97	5.64	1.94	clay	UNDFND	UNDFD	16	.8
13.40	44	16.00	0.89	5.57	1.97	clay	UNDFND	UNDFD	15	.7
13.75	45	18.86	0.92	4.88	2.00	clay	UNDFND	UNDFD	18	.9
14.05	46	20.17	0.87	4.32	2.03	clay	UNDFND	UNDFD	19	1.0
14.35	47	20.17	0.83	4.09	2.06	silty clay to clay	UNDFND	UNDFD	13	1.0
14.65	48	26.33	0.92	3.50	2.09	clayey silt to silty clay	UNDFND	UNDFD	13	1.3
14.95	49	16.50	1.04	6.32	2.11	clay	UNDFND	UNDFD	16	.7
15.25	50	16.33	0.96	5.89	2.14	clay	UNDFND	UNDFD	16	.7
15.55	51	19.00	1.01	5.32	2.17	clay	UNDFND	UNDFD	18	.9
15.85	52	25.00	1.15	4.60	2.20	clay	UNDFND	UNDFD	24	1.2
16.15	53	72.67	1.63	2.24	2.23	silty sand to sandy silt	40-50	34-36	23	UNDEFINED
16.45	54	74.33	2.17	2.92	2.26	sandy silt to clayey silt	UNDFND	UNDFD	28	4.1
16.75	55	22.83	0.78	3.41	2.28	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
17.05	56	14.17	0.41	2.88	2.31	clayey silt to silty clay	UNDFND	UNDFD	7	.6
17.35	57	14.67	0.56	3.81	2.34	silty clay to clay	UNDFND	UNDFD	9	.6
17.65	58	15.17	0.48	3.15	2.37	silty clay to clay	UNDFND	UNDFD	10	.6
17.95	59	15.00	0.50	3.31	2.40	silty clay to clay	UNDFND	UNDFD	10	.6
18.25	60	22.83	0.89	3.92	2.43	silty clay to clay	UNDFND	UNDFD	15	1.1
18.55	61	23.17	1.01	4.38	2.45	clay	UNDFND	UNDFD	22	1.1
18.85	62	25.00	1.08	4.33	2.48	silty clay to clay	UNDFND	UNDFD	16	1.2
19.20	63	24.29	1.16	4.78	2.51	clay	UNDFND	UNDFD	23	1.2
19.50	64	28.00	1.71	6.11	2.54	clay	UNDFND	UNDFD	27	1.4
19.80	65	39.33	2.20	5.60	2.57	clay	UNDFND	UNDFD	38	2.0
0.00	0	30.14	1.27	4.23	1.65	silty clay to clay	UNDFND	UNDFD	19	1.6

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

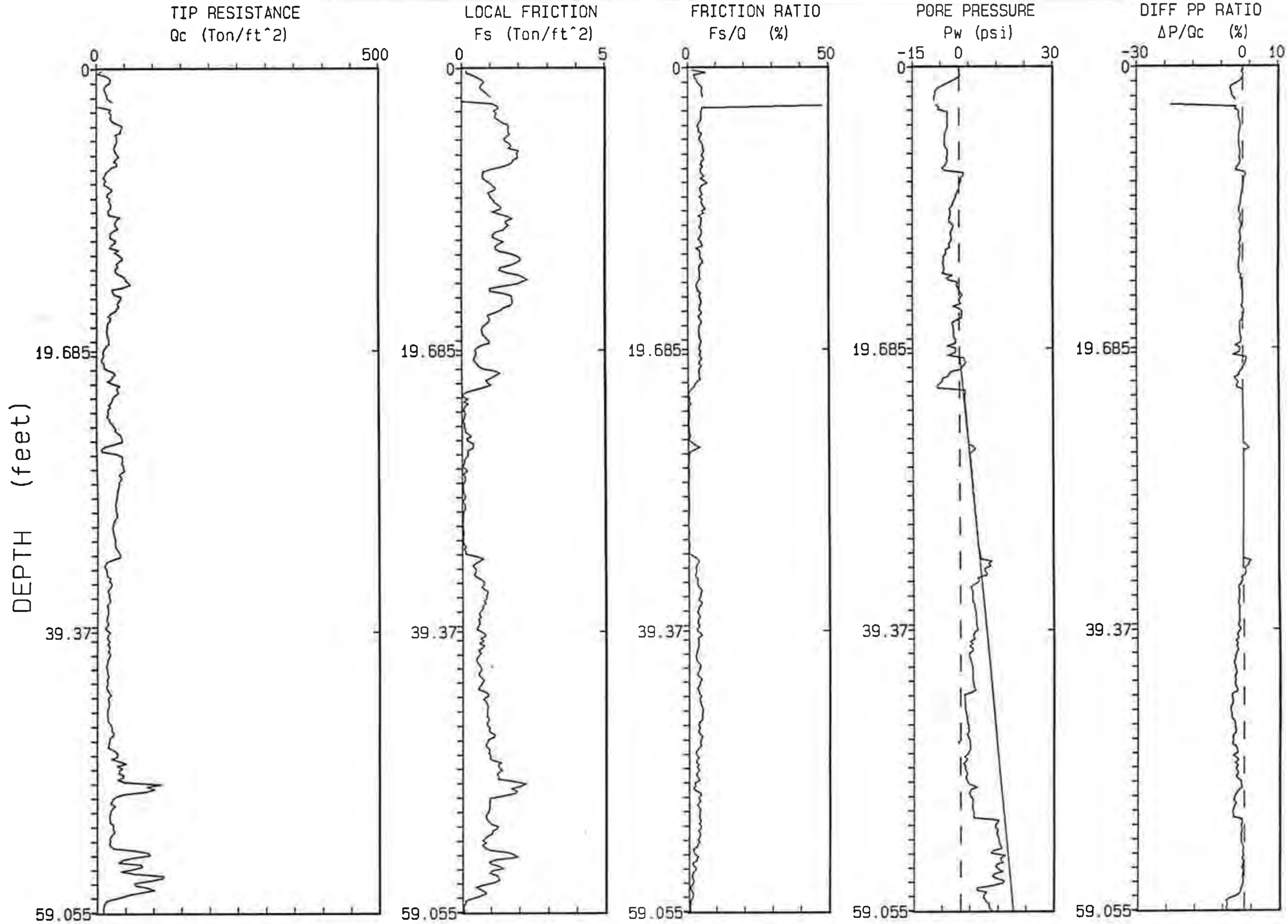
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-4

WOODWARD-CLYDE CONSULTANTS

CPT-5

Operator: J. Oldham		**CPT Date:**	3/24/95
Page: 1/2		**Location:**	Baldwin
Cone Used: 243		**Job Number:**	5E08560



Depth Increment : 05 m

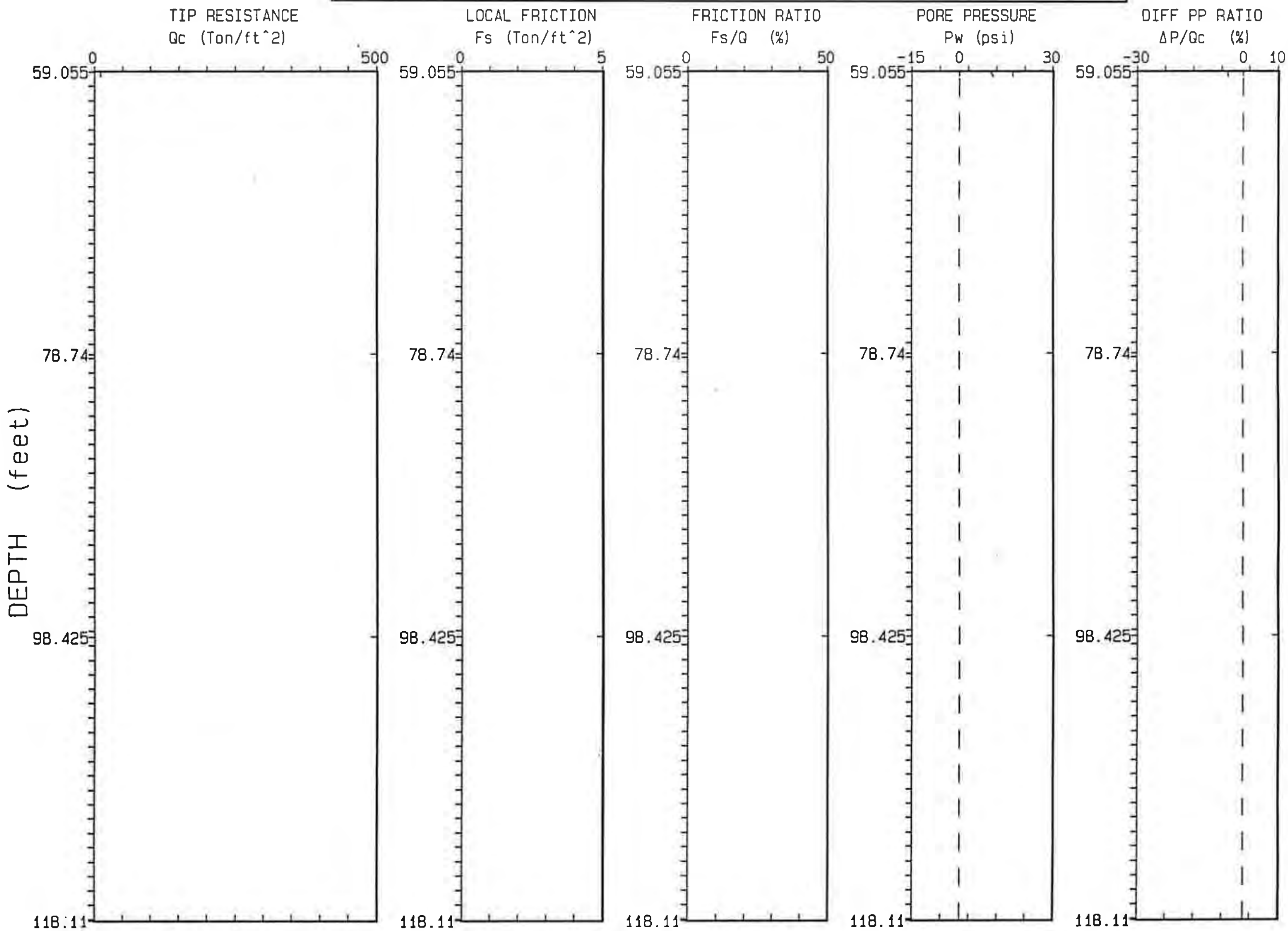
Max Depth : 59.38 ft

FIG. A-4-5

WOODWARD-CLYDE CONSULTANTS

CPT-5

Operator:	J. Oldham	CPT Date:	3/24/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 59.38 ft

FIG. A-4-5

WOODWARD-CLYDE CONSULTANTS

CPT-5

Operator:	J. Oldham	CPT Date:	3/24/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	16.75	0.47	2.82	0.03	clayey silt to silty clay	UNDFND	UNDFD	8	.9
0.60	2	16.10	0.81	5.01	0.09	clay	UNDFND	UNDFD	15	.9
0.95	3	17.81	0.85	4.76	0.15	clay	UNDFND	UNDFD	17	1.0
1.25	4	33.68	1.40	4.15	0.22	silty clay to clay	UNDFND	UNDFD	22	1.9
1.55	5	37.57	1.60	4.26	0.28	silty clay to clay	UNDFND	UNDFD	24	2.1
1.85	6	34.10	1.83	5.36	0.33	clay	UNDFND	UNDFD	33	1.9
2.15	7	30.53	1.59	5.22	0.39	clay	UNDFND	UNDFD	29	1.7
2.45	8	14.78	0.83	5.60	0.45	clay	UNDFND	UNDFD	14	.8
2.75	9	22.62	1.07	4.72	0.51	clay	UNDFND	UNDFD	22	1.3
3.05	10	22.58	1.22	5.41	0.57	clay	UNDFND	UNDFD	22	1.2
3.35	11	32.78	1.58	4.83	0.63	clay	UNDFND	UNDFD	31	1.8
3.65	12	28.40	1.28	4.50	0.69	silty clay to clay	UNDFND	UNDFD	18	1.6
3.95	13	31.03	1.37	4.40	0.75	silty clay to clay	UNDFND	UNDFD	20	1.7
4.25	14	38.97	1.83	4.69	0.81	silty clay to clay	UNDFND	UNDFD	25	2.2
4.55	15	45.75	1.91	4.18	0.87	clayey silt to silty clay	UNDFND	UNDFD	22	2.6
4.85	16	39.52	1.42	3.59	0.93	clayey silt to silty clay	UNDFND	UNDFD	19	2.2
5.15	17	37.10	1.65	4.44	0.98	silty clay to clay	UNDFND	UNDFD	24	2.1
5.45	18	21.50	0.97	4.49	1.01	clay	UNDFND	UNDFD	21	1.2
5.75	19	18.80	0.76	4.02	1.04	silty clay to clay	UNDFND	UNDFD	12	1.0
6.05	20	15.27	0.69	4.49	1.07	clay	UNDFND	UNDFD	15	.8
6.40	21	12.40	0.53	4.30	1.10	clay	UNDFND	UNDFD	12	.6
6.70	22	27.37	1.07	3.92	1.13	silty clay to clay	UNDFND	UNDFD	17	1.5
7.00	23	35.23	0.41	1.17	1.16	silty sand to sandy silt	<40	34-36	11	UNDEFINED
7.35	24	22.71	0.12	0.54	1.19	silty sand to sandy silt	<40	30-32	7	UNDEFINED
7.65	25	25.62	0.07	0.29	1.22	silty sand to sandy silt	<40	32-34	8	UNDEFINED
7.95	26	41.02	0.20	0.49	1.25	silty sand to sandy silt	<40	34-36	13	UNDEFINED
8.25	27	23.37	0.29	1.23	1.28	sandy silt to clayey silt	UNDFND	UNDFD	9	1.2
8.55	28	45.72	0.08	0.18	1.31	sand to silty sand	40-50	34-36	11	UNDEFINED
8.85	29	40.62	0.09	0.23	1.33	sand to silty sand	<40	34-36	10	UNDEFINED
9.15	30	35.10	0.06	0.17	1.36	sand to silty sand	<40	32-34	8	UNDEFINED
9.45	31	31.92	0.07	0.21	1.39	silty sand to sandy silt	<40	32-34	10	UNDEFINED
9.75	32	29.70	0.03	0.10	1.42	silty sand to sandy silt	<40	32-34	9	UNDEFINED
10.05	33	29.03	0.03	0.11	1.45	silty sand to sandy silt	<40	30-32	9	UNDEFINED
10.35	34	34.77	0.09	0.25	1.47	silty sand to sandy silt	<40	32-34	11	UNDEFINED
10.65	35	20.65	0.52	2.51	1.50	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
10.95	36	19.68	0.55	2.79	1.53	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
11.25	37	20.48	0.80	3.88	1.56	silty clay to clay	UNDFND	UNDFD	13	1.0
11.55	38	19.55	0.75	3.86	1.59	silty clay to clay	UNDFND	UNDFD	12	1.0

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-5

CPT-5

Operator:	J. Oldham	CPT Date:	3/24/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	17.57	0.60	3.42	1.62	silty clay to clay	UNDFND	UNDFD	11	.8
12.15	40	17.85	0.64	3.60	1.64	silty clay to clay	UNDFND	UNDFD	11	.9
12.45	41	20.60	0.66	3.22	1.67	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
12.80	42	18.09	0.56	3.10	1.70	clayey silt to silty clay	UNDFND	UNDFD	9	.9
13.10	43	17.87	0.65	3.65	1.73	silty clay to clay	UNDFND	UNDFD	11	.9
13.40	44	19.42	0.72	3.70	1.76	silty clay to clay	UNDFND	UNDFD	12	.9
13.75	45	19.13	0.84	4.38	1.79	clay	UNDFND	UNDFD	18	.9
14.05	46	21.45	0.89	4.14	1.82	silty clay to clay	UNDFND	UNDFD	14	1.1
14.35	47	24.33	0.98	4.01	1.85	silty clay to clay	UNDFND	UNDFD	16	1.2
14.65	48	28.50	0.91	3.18	1.88	clayey silt to silty clay	UNDFND	UNDFD	14	1.5
14.95	49	38.78	1.21	3.12	1.91	clayey silt to silty clay	UNDFND	UNDFD	19	2.1
15.25	50	53.98	1.50	2.77	1.94	sandy silt to clayey silt	UNDFND	UNDFD	21	3.0
15.55	51	63.87	1.64	2.57	1.97	sandy silt to clayey silt	UNDFND	UNDFD	24	3.5
15.85	52	25.35	0.93	3.67	1.99	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
16.15	53	24.28	0.95	3.90	2.02	silty clay to clay	UNDFND	UNDFD	16	1.2
16.45	54	25.42	0.94	3.68	2.05	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
16.75	55	54.72	1.11	2.02	2.08	sandy silt to clayey silt	UNDFND	UNDFD	21	3.0
17.05	56	61.12	1.30	2.12	2.11	sandy silt to clayey silt	UNDFND	UNDFD	23	3.3
17.35	57	83.40	1.14	1.36	2.14	silty sand to sandy silt	50-60	36-38	27	UNDEFINED
17.65	58	73.08	0.67	0.92	2.16	sand to silty sand	40-50	34-36	18	UNDEFINED
17.95	59	14.03	0.10	0.68	2.19	sandy silt to clayey silt	UNDFND	UNDFD	5	.6

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

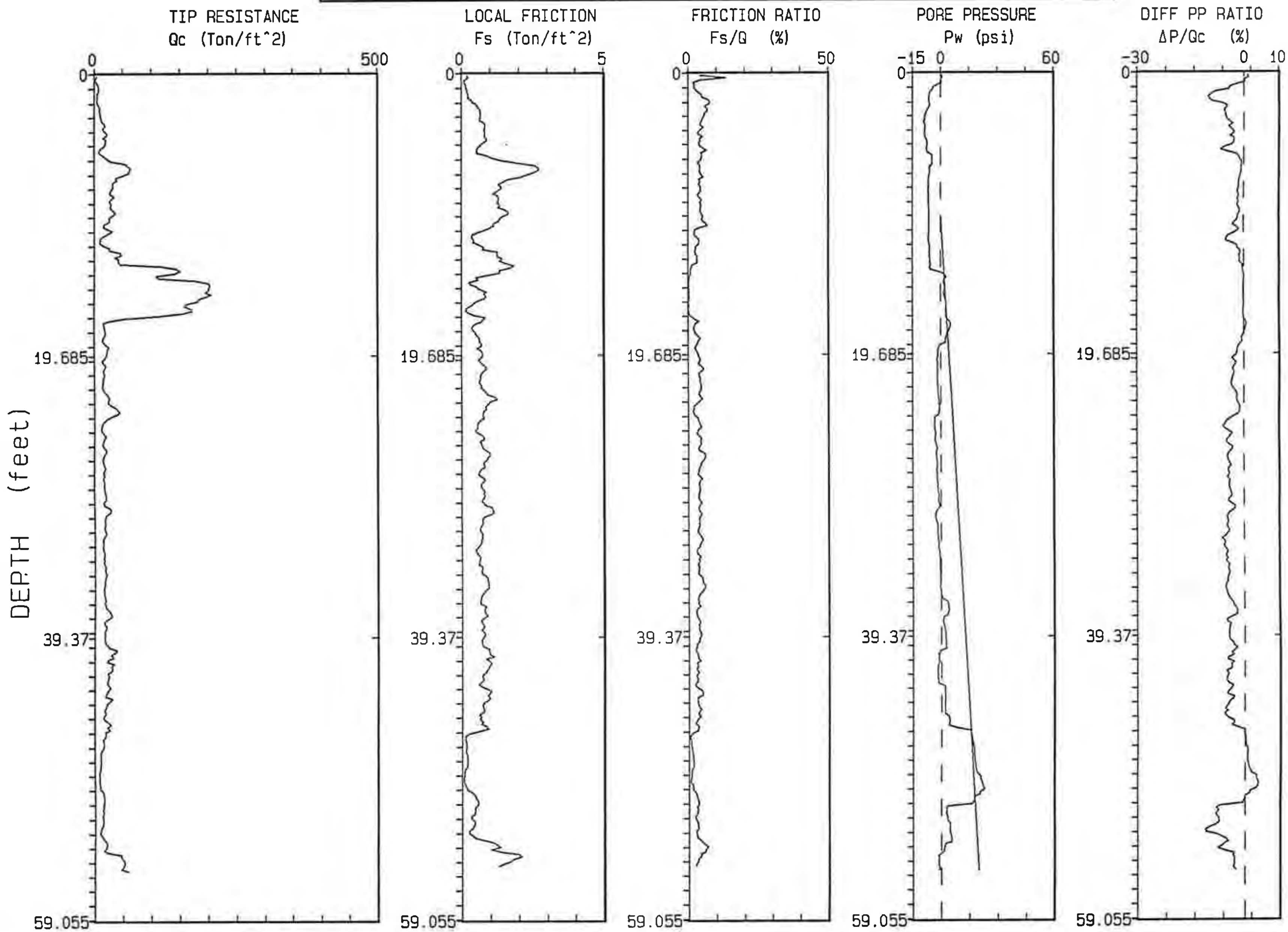
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-5

WOODWARD-CLYDE CONSULTANTS

CPT-6

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 55.61 ft

FIG. A-4-6

WOODWARD-CLYDE CONSULTANTS

CPT-6

Operator:	J. Oldham		CPT Date:	3/28/95
Page:	1/2		Location:	Baldwin
Cone Used:	243		Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	4.68	0.15	3.27	0.03	clay	UNDFND	UNDFD	4	.2
0.60	2	5.33	0.27	5.00	0.09	clay	UNDFND	UNDFD	5	.3
0.95	3	10.07	0.62	6.13	0.15	clay	UNDFND	UNDFD	10	.5
1.25	4	17.42	0.78	4.47	0.22	clay	UNDFND	UNDFD	17	1.0
1.55	5	18.67	0.79	4.21	0.28	clay	UNDFND	UNDFD	18	1.0
1.85	6	16.82	0.83	4.94	0.33	clay	UNDFND	UNDFD	16	.9
2.15	7	59.07	2.46	4.16	0.39	clayey silt to silty clay	UNDFND	UNDFD	28	3.4
2.45	8	34.67	1.53	4.42	0.45	silty clay to clay	UNDFND	UNDFD	22	2.0
2.75	9	29.83	1.24	4.16	0.51	silty clay to clay	UNDFND	UNDFD	19	1.7
3.05	10	31.55	1.46	4.64	0.57	silty clay to clay	UNDFND	UNDFD	20	1.8
3.35	11	23.72	1.09	4.61	0.61	clay	UNDFND	UNDFD	23	1.3
3.65	12	15.12	0.46	3.04	0.64	clayey silt to silty clay	UNDFND	UNDFD	7	.8
3.95	13	38.42	1.12	2.91	0.67	sandy silt to clayey silt	UNDFND	UNDFD	15	2.2
4.25	14	107.78	1.51	1.40	0.69	sand to silty sand	70-80	42-44	26	UNDEFINED
4.55	15	167.65	0.52	0.31	0.72	sand	80-90	44-46	32	UNDEFINED
4.85	16	193.57	0.75	0.39	0.75	sand	80-90	44-46	37	UNDEFINED
5.15	17	154.75	0.29	0.19	0.78	sand	80-90	44-46	30	UNDEFINED
5.45	18	25.63	0.58	2.25	0.81	sandy silt to clayey silt	UNDFND	UNDFD	10	1.4
5.75	19	17.62	0.58	3.27	0.84	clayey silt to silty clay	UNDFND	UNDFD	8	.9
6.05	20	21.95	0.67	3.07	0.86	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
6.40	21	16.86	0.74	4.39	0.89	clay	UNDFND	UNDFD	16	.9
6.70	22	15.27	0.65	4.29	0.93	clay	UNDFND	UNDFD	15	.8
7.00	23	22.88	0.99	4.32	0.95	silty clay to clay	UNDFND	UNDFD	15	1.2
7.35	24	35.09	0.81	2.31	0.98	sandy silt to clayey silt	UNDFND	UNDFD	13	1.9
7.65	25	14.22	0.55	3.89	1.02	silty clay to clay	UNDFND	UNDFD	9	.7
7.95	26	17.02	0.71	4.20	1.04	clay	UNDFND	UNDFD	16	.9
8.25	27	17.72	0.89	5.01	1.07	clay	UNDFND	UNDFD	17	.9
8.55	28	17.45	0.70	4.00	1.10	silty clay to clay	UNDFND	UNDFD	11	.9
8.85	29	17.23	0.72	4.17	1.13	clay	UNDFND	UNDFD	17	.9
9.15	30	18.72	0.76	4.07	1.16	silty clay to clay	UNDFND	UNDFD	12	.9
9.45	31	23.72	0.97	4.11	1.19	silty clay to clay	UNDFND	UNDFD	15	1.2
9.75	32	18.35	0.68	3.73	1.21	silty clay to clay	UNDFND	UNDFD	12	.9
10.05	33	15.97	0.68	4.28	1.24	clay	UNDFND	UNDFD	15	.8
10.35	34	16.00	0.56	3.52	1.27	silty clay to clay	UNDFND	UNDFD	10	.8
10.65	35	18.30	0.67	3.64	1.30	silty clay to clay	UNDFND	UNDFD	12	.9
10.95	36	17.43	0.90	5.18	1.33	clay	UNDFND	UNDFD	17	.9
11.25	37	17.40	0.70	4.01	1.36	silty clay to clay	UNDFND	UNDFD	11	.8
11.55	38	24.77	0.79	3.20	1.38	clayey silt to silty clay	UNDFND	UNDFD	12	1.3

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-6

CPT-6

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	19.40	0.72	3.70	1.41	silty clay to clay	UNDFND	UNDFD	12	1.0
12.15	40	18.97	0.73	3.86	1.44	silty clay to clay	UNDFND	UNDFD	12	.9
12.45	41	31.38	0.93	2.97	1.47	clayey silt to silty clay	UNDFND	UNDFD	15	1.7
12.80	42	27.89	0.89	3.19	1.50	clayey silt to silty clay	UNDFND	UNDFD	13	1.4
13.10	43	24.57	0.71	2.88	1.53	clayey silt to silty clay	UNDFND	UNDFD	12	1.2
13.40	44	23.67	0.92	3.89	1.56	silty clay to clay	UNDFND	UNDFD	15	1.2
13.75	45	18.07	0.68	3.78	1.59	silty clay to clay	UNDFND	UNDFD	12	.9
14.05	46	23.87	0.66	2.76	1.62	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
14.35	47	15.33	0.13	0.84	1.65	sandy silt to clayey silt	UNDFND	UNDFD	6	.7
14.65	48	11.33	0.17	1.49	1.68	clayey silt to silty clay	UNDFND	UNDFD	5	.4
14.95	49	9.10	0.12	1.32	1.70	clayey silt to silty clay	UNDFND	UNDFD	4	.3
15.25	50	9.57	0.12	1.22	1.73	clayey silt to silty clay	UNDFND	UNDFD	5	.3
15.55	51	15.60	0.48	3.10	1.76	clayey silt to silty clay	UNDFND	UNDFD	7	.7
15.85	52	14.35	0.41	2.88	1.79	clayey silt to silty clay	UNDFND	UNDFD	7	.6
16.15	53	11.62	0.36	3.10	1.82	silty clay to clay	UNDFND	UNDFD	7	.4
16.45	54	18.17	0.89	4.88	1.85	clay	UNDFND	UNDFD	17	.8
16.75	55	39.35	1.65	4.21	1.87	silty clay to clay	UNDFND	UNDFD	25	2.1

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

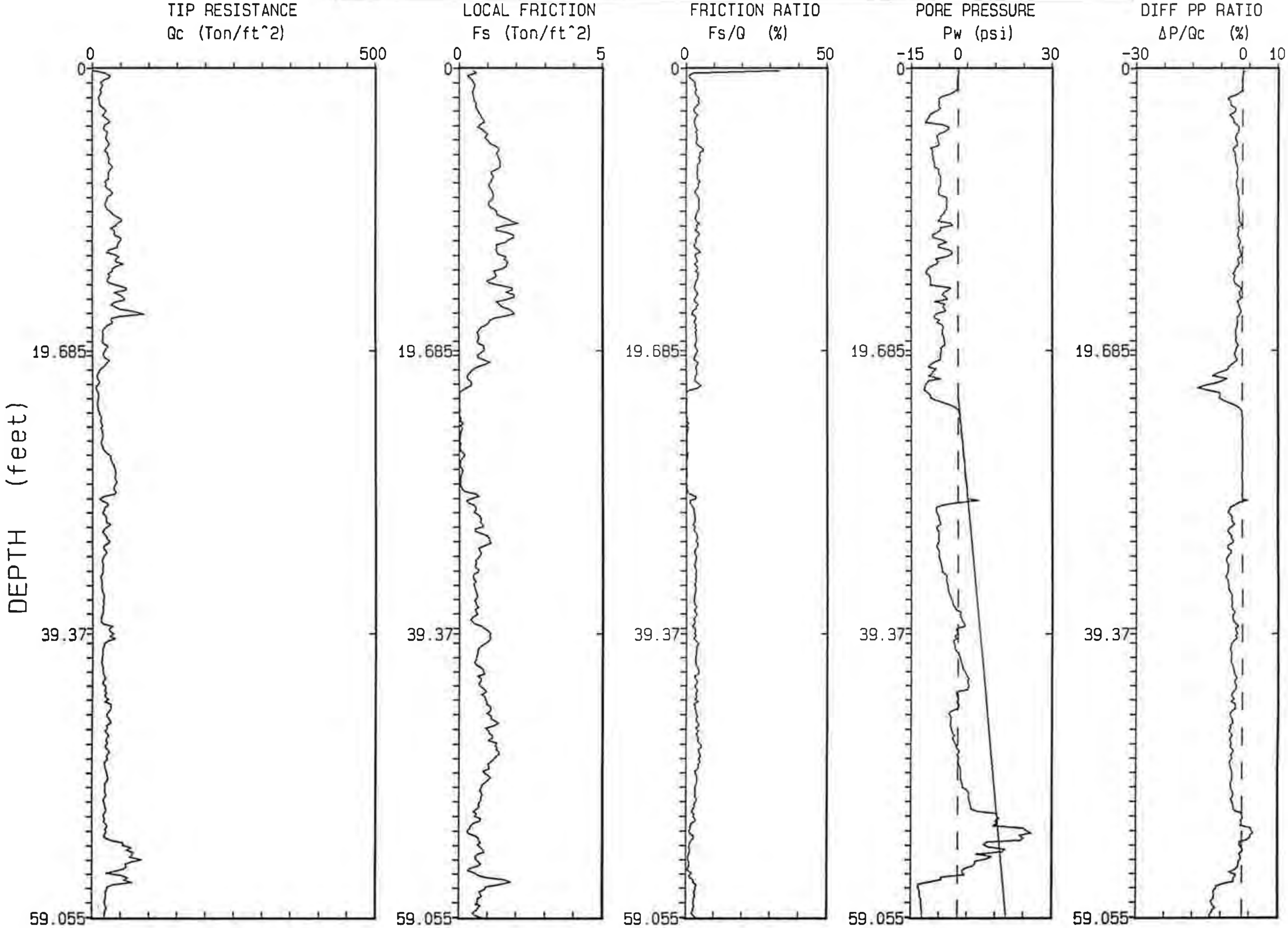
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-6

WOODWARD-CLYDE CONSULTANTS

CPT-7

Operator: J. Oldham		CPT Date:	3/24/95
Page: 2/2		Location:	Baldwin
Cone Used: 243		Job Number:	5E08560



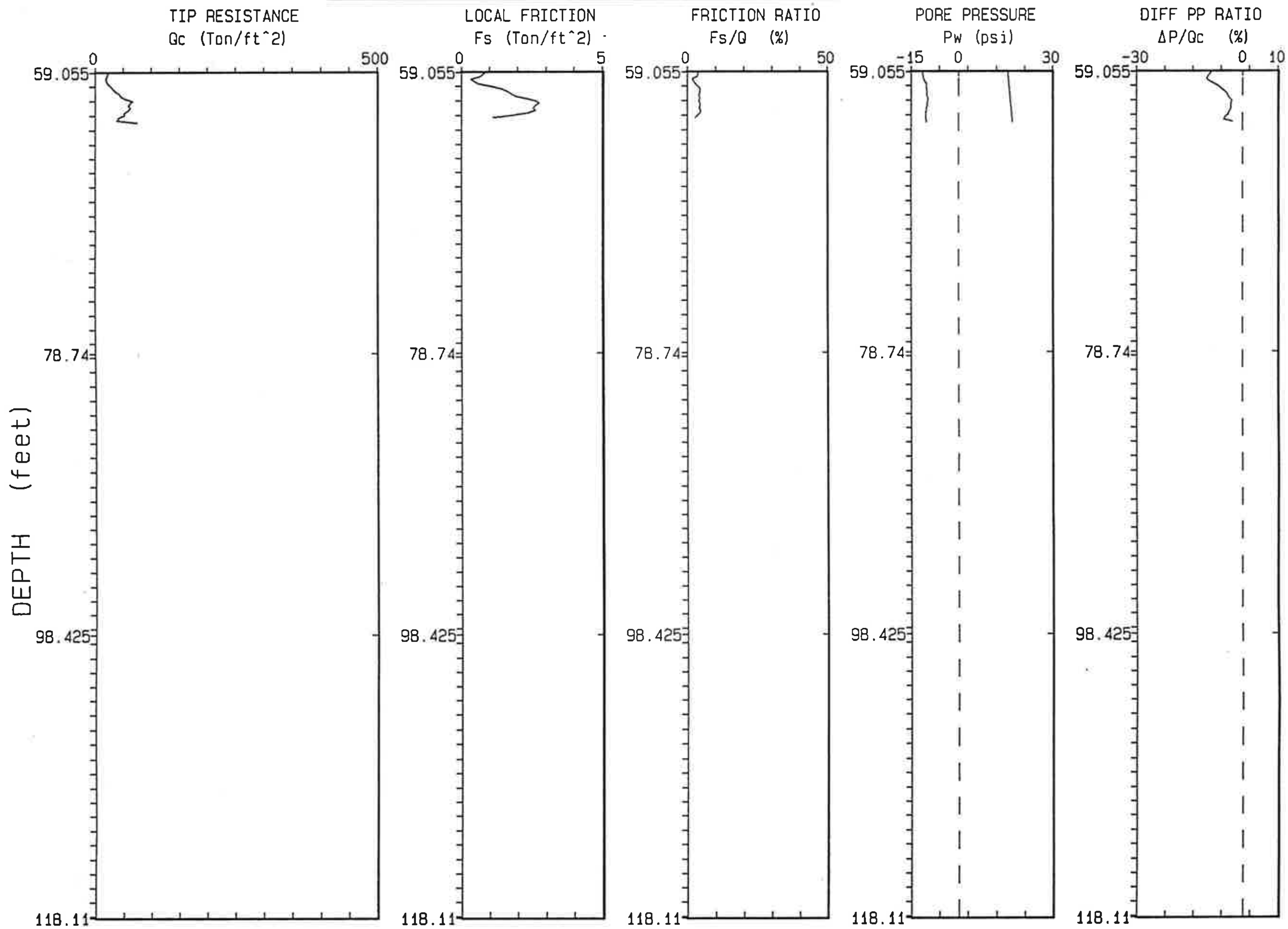
Depth Increment : .05 m   Max Depth : 62.50 ft

FIG. A-4-7

WOODWARD-CLYDE CONSULTANTS

CPT-7

Operator:	J. Oldham	CPT Date:	3/24/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 62.50 ft

FIG. A-4-7

WOODWARD-CLYDE CONSULTANTS

CPT-7

Operator:	J. Oldham	CPT Date:	3/24/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	19.87	0.46	2.29	0.03	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
0.60	2	14.48	0.50	3.43	0.09	silty clay to clay	UNDFND	UNDFD	9	.8
0.95	3	16.86	0.59	3.49	0.15	silty clay to clay	UNDFND	UNDFD	11	.9
1.25	4	24.00	0.77	3.22	0.22	clayey silt to silty clay	UNDFND	UNDFD	11	1.3
1.55	5	24.88	0.92	3.71	0.28	silty clay to clay	UNDFND	UNDFD	16	1.4
1.85	6	26.55	1.30	4.88	0.33	clay	UNDFND	UNDFD	25	1.5
2.15	7	31.48	1.40	4.46	0.39	silty clay to clay	UNDFND	UNDFD	20	1.8
2.45	8	27.08	1.13	4.19	0.45	silty clay to clay	UNDFND	UNDFD	17	1.5
2.75	9	29.62	1.13	3.82	0.51	silty clay to clay	UNDFND	UNDFD	19	1.7
3.05	10	25.87	1.15	4.43	0.57	silty clay to clay	UNDFND	UNDFD	17	1.4
3.35	11	44.28	1.66	3.75	0.63	clayey silt to silty clay	UNDFND	UNDFD	21	2.5
3.65	12	41.62	1.63	3.93	0.69	clayey silt to silty clay	UNDFND	UNDFD	20	2.4
3.95	13	37.67	1.38	3.65	0.75	clayey silt to silty clay	UNDFND	UNDFD	18	2.1
4.25	14	43.83	1.63	3.71	0.81	clayey silt to silty clay	UNDFND	UNDFD	21	2.5
4.55	15	30.05	1.17	3.89	0.87	silty clay to clay	UNDFND	UNDFD	19	1.7
4.85	16	51.15	1.77	3.46	0.93	clayey silt to silty clay	UNDFND	UNDFD	24	2.9
5.15	17	49.08	1.58	3.23	0.98	clayey silt to silty clay	UNDFND	UNDFD	24	2.8
5.45	18	44.93	1.30	2.90	1.04	sandy silt to clayey silt	UNDFND	UNDFD	17	2.5
5.75	19	19.02	0.68	3.59	1.10	silty clay to clay	UNDFND	UNDFD	12	1.0
6.05	20	21.93	0.79	3.58	1.16	silty clay to clay	UNDFND	UNDFD	14	1.2
6.40	21	21.56	0.74	3.44	1.23	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
6.70	22	9.80	0.35	3.59	1.29	clay	UNDFND	UNDFD	9	.5
7.00	23	8.68	0.13	1.48	1.35	clayey silt to silty clay	UNDFND	UNDFD	4	.4
7.35	24	9.96	0.01	0.07	1.39	sensitive fine grained	UNDFND	UNDFD	5	.5
7.65	25	15.15	0.07	0.45	1.42	sandy silt to clayey silt	UNDFND	UNDFD	6	.8
7.95	26	17.25	0.04	0.22	1.45	silty sand to sandy silt	<40	<30	6	UNDEFINED
8.25	27	22.12	0.08	0.38	1.48	silty sand to sandy silt	<40	30-32	7	UNDEFINED
8.55	28	36.07	0.07	0.19	1.51	sand to silty sand	<40	32-34	9	UNDEFINED
8.85	29	40.85	0.06	0.16	1.54	sand to silty sand	<40	32-34	10	UNDEFINED
9.15	30	31.22	0.34	1.09	1.57	silty sand to sandy silt	<40	30-32	10	UNDEFINED
9.45	31	21.87	0.46	2.10	1.59	sandy silt to clayey silt	UNDFND	UNDFD	8	1.1
9.75	32	25.70	0.75	2.93	1.62	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
10.05	33	23.43	0.82	3.51	1.65	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
10.35	34	22.87	0.81	3.54	1.68	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
10.65	35	18.05	0.60	3.32	1.71	clayey silt to silty clay	UNDFND	UNDFD	9	.9
10.95	36	15.85	0.53	3.35	1.74	silty clay to clay	UNDFND	UNDFD	10	.8
11.25	37	18.23	0.58	3.20	1.76	clayey silt to silty clay	UNDFND	UNDFD	9	.9
11.55	38	18.78	0.58	3.11	1.79	clayey silt to silty clay	UNDFND	UNDFD	9	.9

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-7

CPT-7

Operator:	J. Oldham	CPT Date:	3/24/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	19.52	0.55	2.79	1.82	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
12.15	40	32.48	1.03	3.16	1.85	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
12.45	41	18.65	0.71	3.83	1.88	silty clay to clay	UNDFND	UNDFD	12	.9
12.80	42	17.33	0.67	3.85	1.91	silty clay to clay	UNDFND	UNDFD	11	.8
13.10	43	20.53	0.74	3.61	1.94	silty clay to clay	UNDFND	UNDFD	13	1.0
13.40	44	24.32	0.87	3.59	1.97	clayey silt to silty clay	UNDFND	UNDFD	12	1.2
13.75	45	29.00	1.04	3.58	2.00	clayey silt to silty clay	UNDFND	UNDFD	14	1.5
14.05	46	28.35	1.16	4.08	2.03	silty clay to clay	UNDFND	UNDFD	18	1.5
14.35	47	26.25	1.16	4.42	2.06	silty clay to clay	UNDFND	UNDFD	17	1.3
14.65	48	27.08	1.32	4.88	2.09	clay	UNDFND	UNDFD	26	1.4
14.95	49	24.02	1.00	4.15	2.11	silty clay to clay	UNDFND	UNDFD	15	1.2
15.25	50	25.15	0.94	3.75	2.14	silty clay to clay	UNDFND	UNDFD	16	1.3
15.55	51	22.03	0.76	3.47	2.17	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
15.85	52	22.57	0.61	2.71	2.20	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
16.15	53	23.63	0.51	2.15	2.23	sandy silt to clayey silt	UNDFND	UNDFD	9	1.2
16.45	54	35.63	0.62	1.74	2.26	sandy silt to clayey silt	UNDFND	UNDFD	14	1.9
16.75	55	70.77	0.72	1.02	2.28	sand to silty sand	40-50	34-36	17	UNDEFINED
17.05	56	52.55	0.57	1.09	2.31	silty sand to sandy silt	<40	32-34	17	UNDEFINED
17.35	57	51.10	1.24	2.42	2.34	sandy silt to clayey silt	UNDFND	UNDFD	20	2.8
17.65	58	24.20	0.75	3.10	2.37	clayey silt to silty clay	UNDFND	UNDFD	12	1.2
17.95	59	23.33	0.62	2.64	2.40	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
18.25	60	21.05	0.62	2.93	2.43	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
18.55	61	39.82	1.69	4.24	2.45	silty clay to clay	UNDFND	UNDFD	25	2.1
18.85	62	59.52	2.60	4.37	2.48	clayey silt to silty clay	UNDFND	UNDFD	29	3.2

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

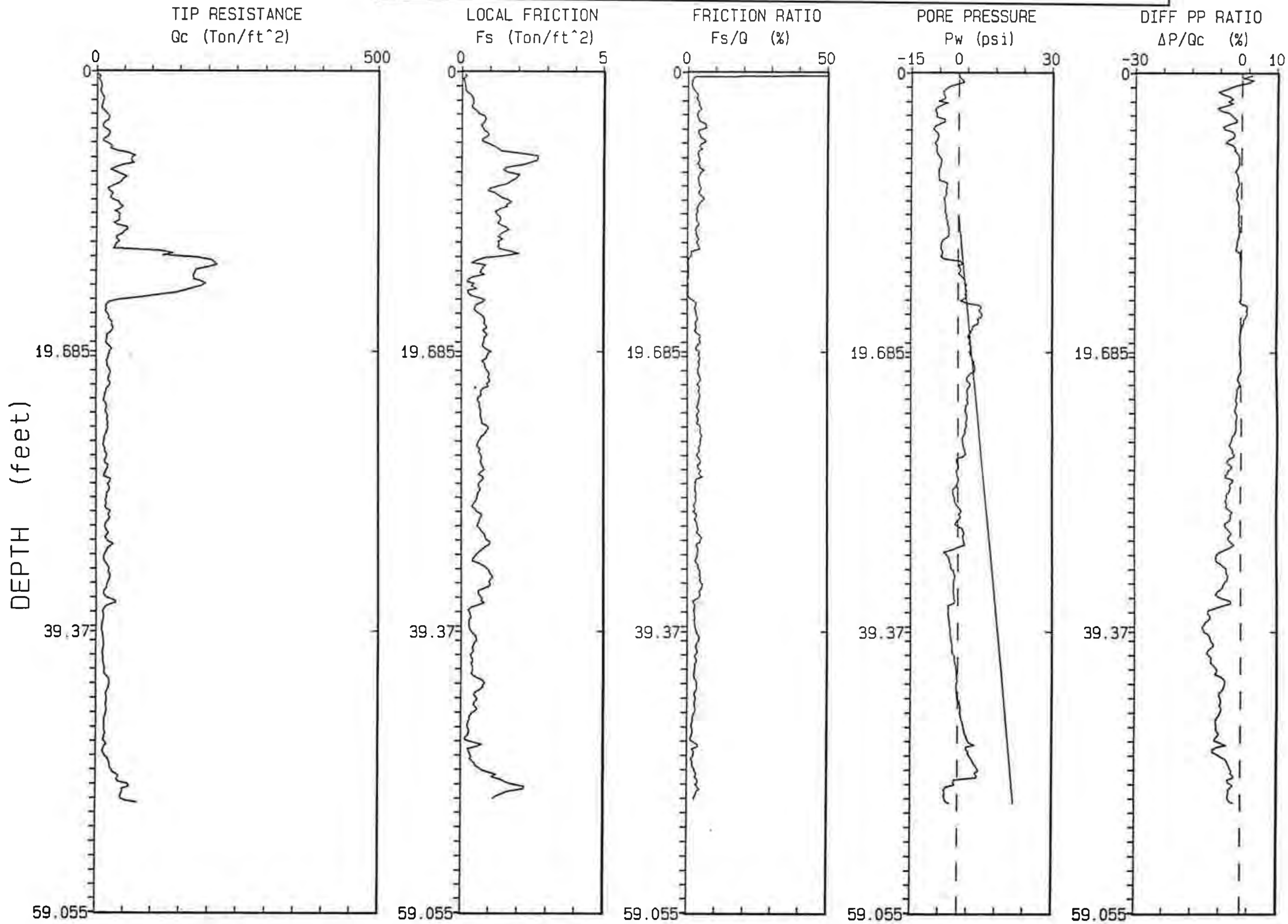
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-7

WOODWARD-CLYDE CONSULTANTS

CPT-8

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : 05 m

Max Depth : 51 35 ft

FIG. A-4-8

WOODWARD-CLYDE CONSULTANTS

CPT-8

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	4.97	0.10	2.01	0.03	silty clay to clay	UNDFND	UNDFD	3	.2
0.60	2	8.73	0.27	3.05	0.09	silty clay to clay	UNDFND	UNDFD	6	.5
0.95	3	12.90	0.50	3.85	0.15	clay	UNDFND	UNDFD	12	.7
1.25	4	16.20	0.78	4.78	0.22	clay	UNDFND	UNDFD	16	.9
1.55	5	18.57	0.87	4.70	0.28	clay	UNDFND	UNDFD	18	1.0
1.85	6	46.72	1.88	4.02	0.33	clayey silt to silty clay	UNDFND	UNDFD	22	2.7
2.15	7	45.98	1.96	4.26	0.39	silty clay to clay	UNDFND	UNDFD	29	2.6
2.45	8	42.95	1.75	4.07	0.45	clayey silt to silty clay	UNDFND	UNDFD	21	2.5
2.75	9	25.48	1.24	4.88	0.51	clay	UNDFND	UNDFD	24	1.4
3.05	10	40.70	1.46	3.60	0.57	clayey silt to silty clay	UNDFND	UNDFD	19	2.3
3.35	11	41.12	1.40	3.40	0.61	clayey silt to silty clay	UNDFND	UNDFD	20	2.3
3.65	12	43.78	1.43	3.27	0.64	clayey silt to silty clay	UNDFND	UNDFD	21	2.5
3.95	13	78.80	1.56	1.97	0.67	silty sand to sandy silt	60-70	40-42	25	UNDEFINED
4.25	14	198.35	0.68	0.34	0.69	sand	>90	44-46	38	UNDEFINED
4.55	15	180.42	0.47	0.26	0.72	sand	80-90	44-46	35	UNDEFINED
4.85	16	141.40	0.38	0.27	0.75	sand	80-90	42-44	27	UNDEFINED
5.15	17	22.33	0.60	2.68	0.78	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
5.45	18	25.12	0.80	3.17	0.81	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
5.75	19	23.58	0.85	3.59	0.84	clayey silt to silty clay	UNDFND	UNDFD	11	1.3
6.05	20	22.97	0.86	3.76	0.86	silty clay to clay	UNDFND	UNDFD	15	1.2
6.40	21	20.80	0.85	4.09	0.89	silty clay to clay	UNDFND	UNDFD	13	1.1
6.70	22	23.52	0.96	4.10	0.93	silty clay to clay	UNDFND	UNDFD	15	1.3
7.00	23	17.22	0.73	4.21	0.95	clay	UNDFND	UNDFD	16	.9
7.35	24	16.79	0.64	3.80	0.98	silty clay to clay	UNDFND	UNDFD	11	.9
7.65	25	20.07	0.78	3.87	1.02	silty clay to clay	UNDFND	UNDFD	13	1.0
7.95	26	15.75	0.75	4.75	1.04	clay	UNDFND	UNDFD	15	.8
8.25	27	15.73	0.63	4.01	1.07	silty clay to clay	UNDFND	UNDFD	10	.8
8.55	28	17.42	0.73	4.20	1.10	clay	UNDFND	UNDFD	17	.9
8.85	29	18.87	0.69	3.64	1.13	silty clay to clay	UNDFND	UNDFD	12	1.0
9.15	30	20.65	0.60	2.90	1.16	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
9.45	31	18.37	0.47	2.53	1.19	clayey silt to silty clay	UNDFND	UNDFD	9	.9
9.75	32	20.55	0.64	3.12	1.21	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
10.05	33	18.80	0.77	4.11	1.24	silty clay to clay	UNDFND	UNDFD	12	.9
10.35	34	22.22	0.82	3.68	1.27	silty clay to clay	UNDFND	UNDFD	14	1.1
10.65	35	16.93	0.59	3.48	1.30	silty clay to clay	UNDFND	UNDFD	11	.8
10.95	36	22.60	1.03	4.57	1.33	clay	UNDFND	UNDFD	22	1.2
11.25	37	15.95	0.77	4.85	1.36	clay	UNDFND	UNDFD	15	.8
11.55	38	22.67	0.58	2.56	1.38	clayey silt to silty clay	UNDFND	UNDFD	11	1.2

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-8

CPT-8

Operator:	J. Oldham	CPT Date:	3/28/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	11.80	0.31	2.59	1.41	silty clay to clay	UNDFND	UNDFD	8	.5
12.15	40	11.35	0.40	3.56	1.44	silty clay to clay	UNDFND	UNDFD	7	.5
12.45	41	12.85	0.44	3.44	1.47	silty clay to clay	UNDFND	UNDFD	8	.6
12.80	42	13.29	0.38	2.89	1.50	silty clay to clay	UNDFND	UNDFD	8	.6
13.10	43	19.72	0.57	2.91	1.53	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
13.40	44	19.97	0.62	3.09	1.56	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
13.75	45	18.09	0.49	2.71	1.59	clayey silt to silty clay	UNDFND	UNDFD	9	.9
14.05	46	14.62	0.26	1.80	1.62	clayey silt to silty clay	UNDFND	UNDFD	7	.6
14.35	47	14.47	0.26	1.76	1.65	clayey silt to silty clay	UNDFND	UNDFD	7	.6
14.65	48	14.88	0.44	2.92	1.68	clayey silt to silty clay	UNDFND	UNDFD	7	.7
14.95	49	24.72	0.52	2.10	1.70	sandy silt to clayey silt	UNDFND	UNDFD	9	1.2
15.25	50	40.57	1.37	3.37	1.73	clayey silt to silty clay	UNDFND	UNDFD	19	2.2
15.55	51	48.25	1.66	3.44	1.76	clayey silt to silty clay	UNDFND	UNDFD	23	2.6

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

WOODWARD-CLYDE CONSULTANTS

CPT-9

Operator:	J. Oldham	CPT Date:	4/3/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

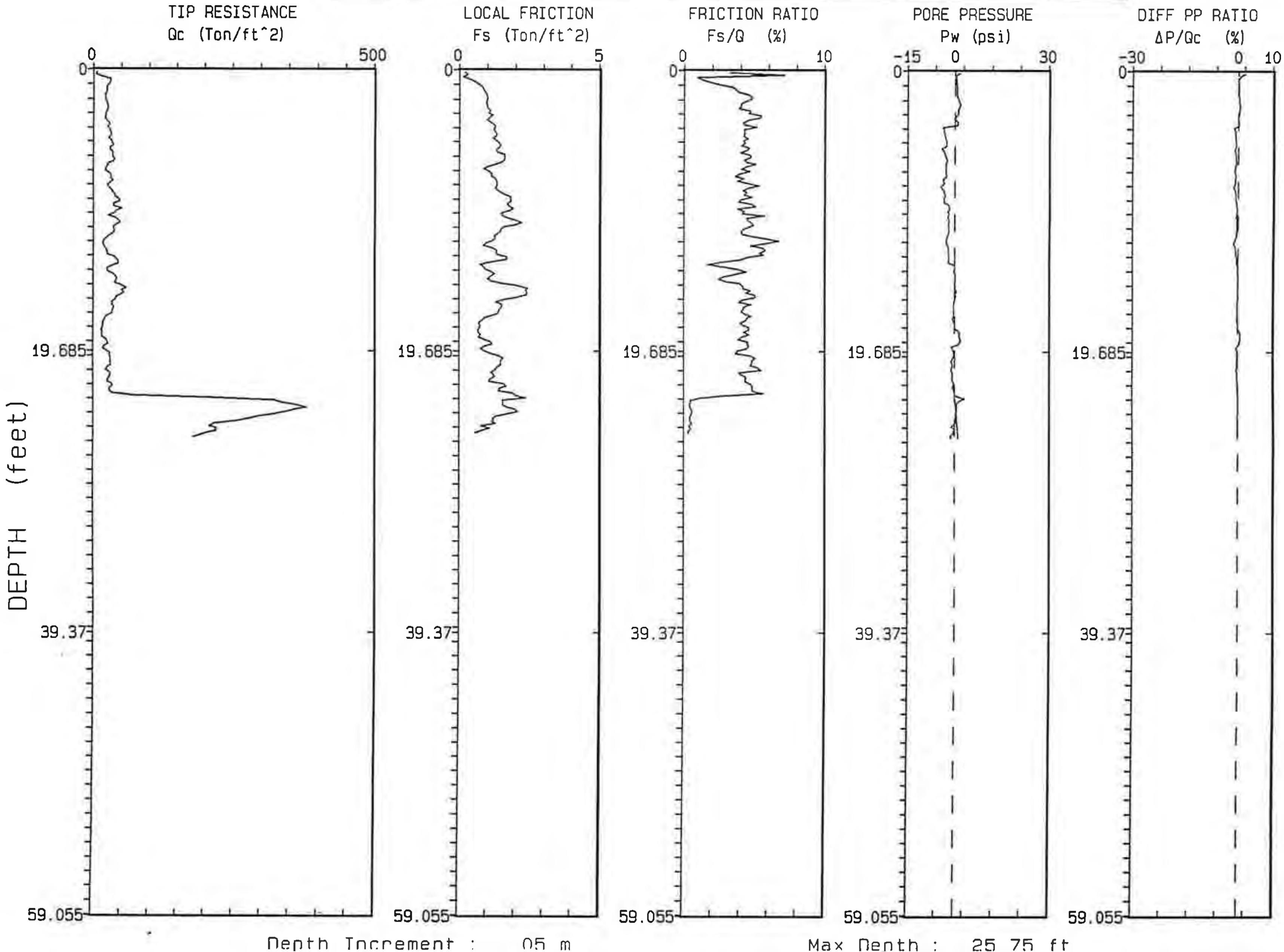


FIG. A-4-9

WOODWARD-CLYDE CONSULTANTS

CPT-9

Operator:	J. Oldham	CPT Date:	4/3/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	18.65	0.38	2.01	0.03	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
0.60	2	22.30	0.92	4.12	0.09	silty clay to clay	UNDFND	UNDFD	14	1.3
0.95	3	23.46	1.03	4.40	0.15	clay	UNDFND	UNDFD	22	1.3
1.25	4	25.03	1.15	4.58	0.22	clay	UNDFND	UNDFD	24	1.4
1.55	5	30.45	1.31	4.30	0.28	silty clay to clay	UNDFND	UNDFD	19	1.7
1.85	6	32.97	1.46	4.42	0.33	silty clay to clay	UNDFND	UNDFD	21	1.9
2.15	7	27.73	1.24	4.48	0.39	silty clay to clay	UNDFND	UNDFD	18	1.6
2.45	8	30.00	1.26	4.20	0.45	silty clay to clay	UNDFND	UNDFD	19	1.7
2.75	9	35.77	1.56	4.37	0.51	silty clay to clay	UNDFND	UNDFD	23	2.0
3.05	10	40.87	1.75	4.27	0.57	silty clay to clay	UNDFND	UNDFD	26	2.3
3.35	11	38.52	1.84	4.78	0.63	silty clay to clay	UNDFND	UNDFD	25	2.2
3.65	12	28.40	1.34	4.70	0.69	clay	UNDFND	UNDFD	27	1.6
3.95	13	21.23	1.17	5.51	0.75	clay	UNDFND	UNDFD	20	1.2
4.25	14	36.90	1.19	3.22	0.81	clayey silt to silty clay	UNDFND	UNDFD	18	2.1
4.55	15	36.18	1.19	3.29	0.87	clayey silt to silty clay	UNDFND	UNDFD	17	2.0
4.85	16	50.07	2.28	4.55	0.93	silty clay to clay	UNDFND	UNDFD	32	2.8
5.15	17	34.60	1.46	4.21	0.98	silty clay to clay	UNDFND	UNDFD	22	1.9
5.45	18	21.42	0.93	4.36	1.04	clay	UNDFND	UNDFD	21	1.1
5.75	19	16.98	0.73	4.29	1.10	clay	UNDFND	UNDFD	16	.9
6.05	20	23.70	1.00	4.20	1.16	silty clay to clay	UNDFND	UNDFD	15	1.3
6.40	21	28.67	1.42	4.95	1.23	clay	UNDFND	UNDFD	27	1.6
6.70	22	28.60	1.23	4.29	1.29	silty clay to clay	UNDFND	UNDFD	18	1.6
7.00	23	68.45	1.80	2.62	1.35	sandy silt to clayey silt	UNDFND	UNDFD	26	3.9
7.35	24	347.31	1.73	0.50	1.39	gravelly sand to sand	>90	44-46	>50	UNDEFINED
7.65	25	244.85	1.14	0.46	1.42	sand	80-90	42-44	47	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

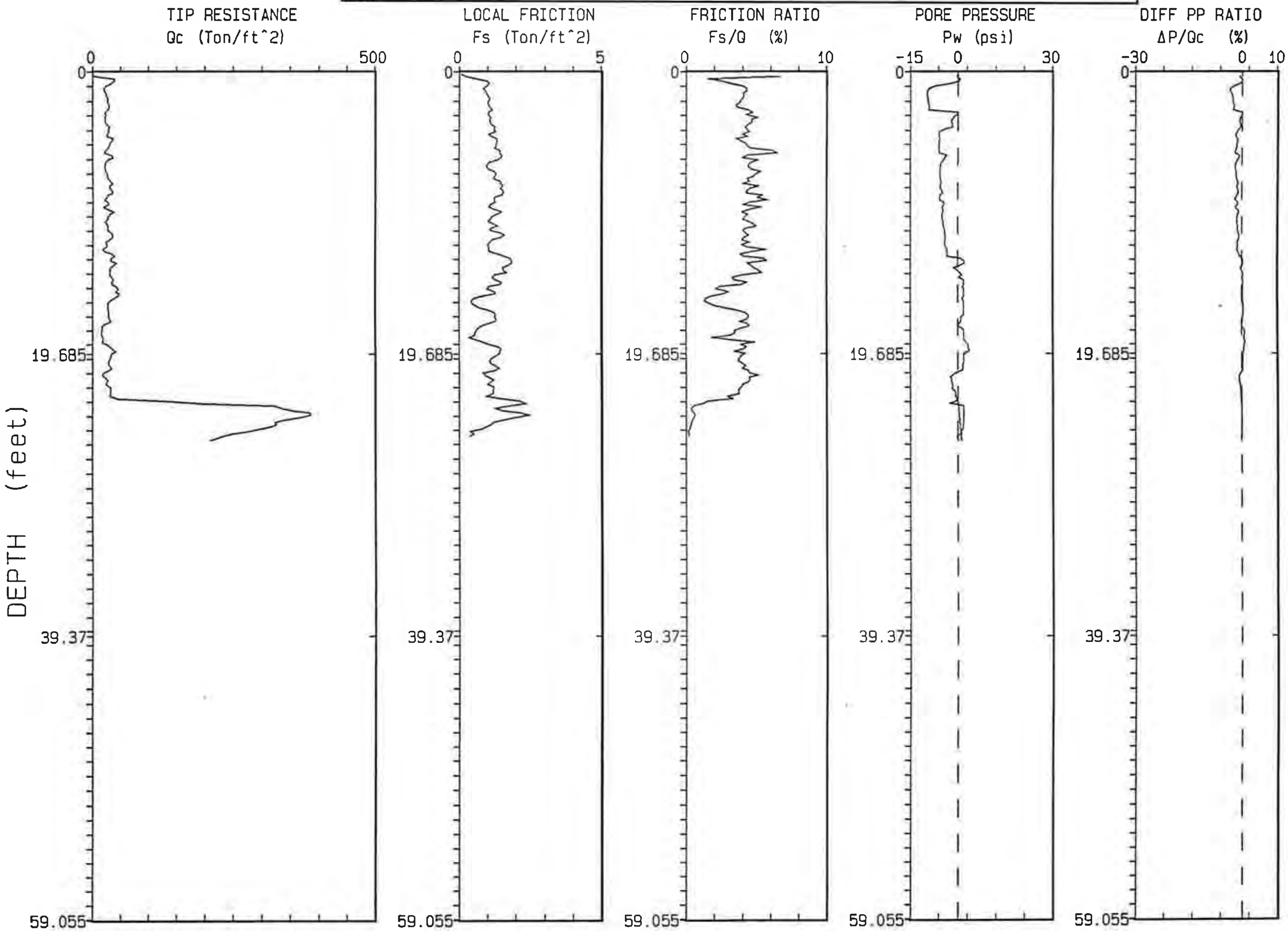
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-9

WOODWARD-CLYDE CONSULTANTS

CPT-9A

Operator:	J. Oldham	CPT Date:	4/3/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 25.75 ft

FIG. A-4-9A

WOODWARD-CLYDE CONSULTANTS

CPT-9A

Operator:	J. Oldham	CPT Date:	4/3/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	23.00	0.66	2.86	0.03	clayey silt to silty clay	UNDFND	UNDFD	11	1.3
0.60	2	23.98	0.98	4.07	0.09	silty clay to clay	UNDFND	UNDFD	15	1.4
0.95	3	25.73	1.07	4.16	0.15	silty clay to clay	UNDFND	UNDFD	16	1.5
1.25	4	26.52	1.18	4.46	0.22	silty clay to clay	UNDFND	UNDFD	17	1.5
1.55	5	30.80	1.24	4.03	0.28	silty clay to clay	UNDFND	UNDFD	20	1.7
1.85	6	28.43	1.40	4.94	0.33	clay	UNDFND	UNDFD	27	1.6
2.15	7	23.23	1.10	4.73	0.39	clay	UNDFND	UNDFD	22	1.3
2.45	8	30.72	1.40	4.54	0.45	silty clay to clay	UNDFND	UNDFD	20	1.7
2.75	9	28.98	1.40	4.81	0.51	clay	UNDFND	UNDFD	28	1.6
3.05	10	28.52	1.23	4.33	0.57	silty clay to clay	UNDFND	UNDFD	18	1.6
3.35	11	26.05	1.15	4.41	0.63	silty clay to clay	UNDFND	UNDFD	17	1.4
3.65	12	30.73	1.29	4.21	0.69	silty clay to clay	UNDFND	UNDFD	20	1.7
3.95	13	28.87	1.33	4.60	0.75	clay	UNDFND	UNDFD	28	1.6
4.25	14	34.35	1.70	4.96	0.81	clay	UNDFND	UNDFD	33	1.9
4.55	15	36.13	1.27	3.51	0.87	clayey silt to silty clay	UNDFND	UNDFD	17	2.0
4.85	16	41.83	0.89	2.12	0.93	sandy silt to clayey silt	UNDFND	UNDFD	16	2.4
5.15	17	28.28	0.88	3.10	0.98	clayey silt to silty clay	UNDFND	UNDFD	14	1.6
5.45	18	25.02	1.05	4.19	1.04	silty clay to clay	UNDFND	UNDFD	16	1.4
5.75	19	17.28	0.57	3.31	1.10	silty clay to clay	UNDFND	UNDFD	11	.9
6.05	20	34.02	1.34	3.94	1.16	silty clay to clay	UNDFND	UNDFD	22	1.9
6.40	21	28.66	1.16	4.05	1.23	silty clay to clay	UNDFND	UNDFD	18	1.6
6.70	22	24.92	1.08	4.34	1.29	silty clay to clay	UNDFND	UNDFD	16	1.3
7.00	23	51.42	1.36	2.65	1.35	sandy silt to clayey silt	UNDFND	UNDFD	20	2.9
7.35	24	334.57	1.93	0.58	1.39	gravelly sand to sand	>90	44-46	>50	UNDEFINED
7.65	25	312.05	1.01	0.32	1.42	gravelly sand to sand	>90	44-46	50	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

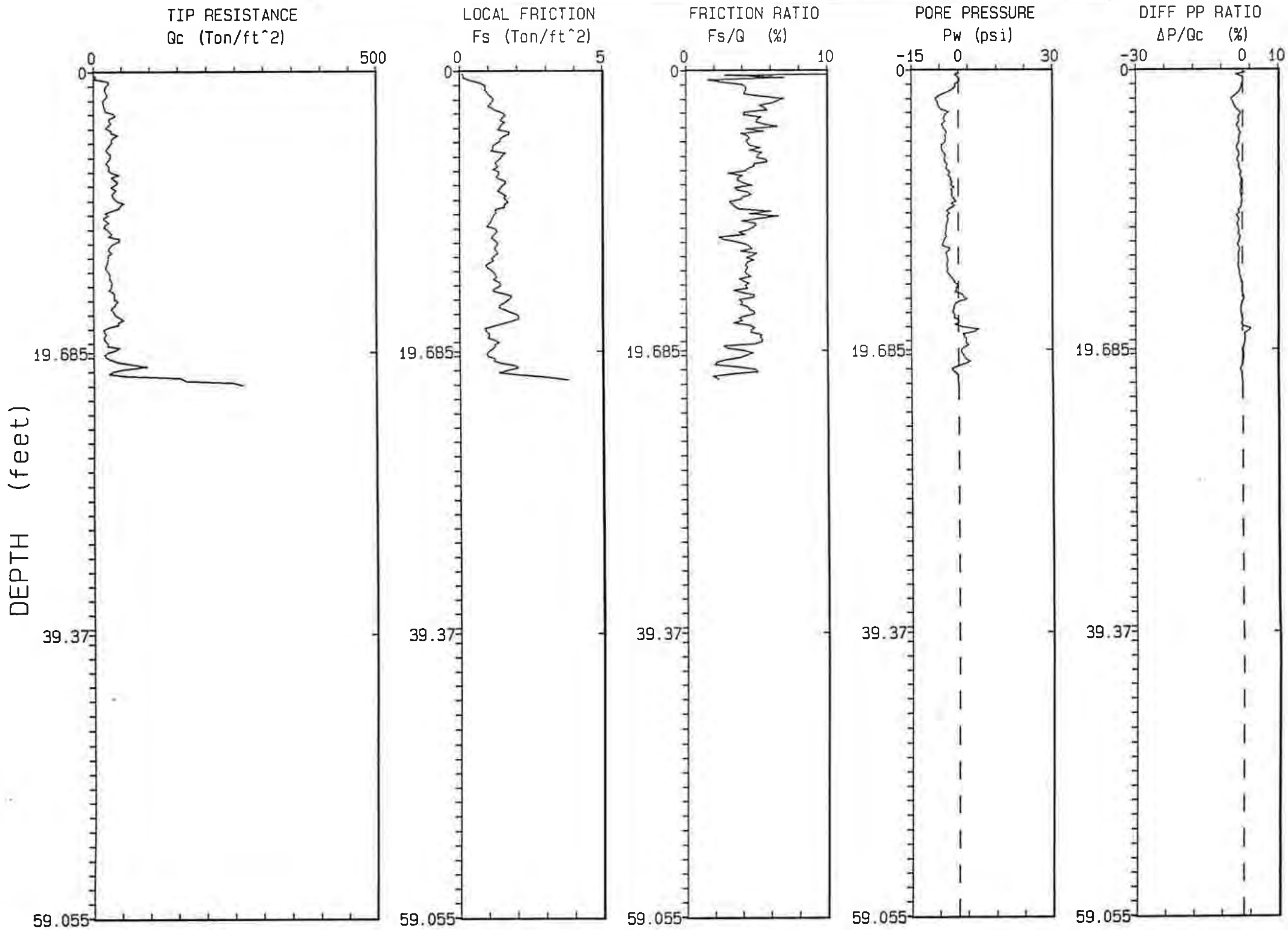
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-9A

WOODWARD-CLYDE CONSULTANTS

CPT-10

Operator:	J. Oldham	CPT Date:	4/3/95
Page:	1/1	Location:	Baldwin
Cone Used:	233	Job Number:	5E08560



Depth Increment : 05 m

Max Depth : 21.98 ft

FIG. A-4-10

WOODWARD-CLYDE CONSULTANTS

CPT-10

Operator:	J. Oldham	CPT Date:	4/3/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	13.50	0.39	2.88	0.03	silty clay to clay	UNDFND	UNDFD	9	.7
0.60	2	21.12	1.01	4.78	0.09	clay	UNDFND	UNDFD	20	1.2
0.95	3	24.70	1.25	5.08	0.15	clay	UNDFND	UNDFD	24	1.4
1.25	4	27.75	1.45	5.22	0.22	clay	UNDFND	UNDFD	27	1.6
1.55	5	33.93	1.52	4.49	0.28	silty clay to clay	UNDFND	UNDFD	22	1.9
1.85	6	26.55	1.33	5.00	0.33	clay	UNDFND	UNDFD	25	1.5
2.15	7	26.47	1.30	4.91	0.39	clay	UNDFND	UNDFD	25	1.5
2.45	8	38.08	1.46	3.82	0.45	clayey silt to silty clay	UNDFND	UNDFD	18	2.2
2.75	9	37.45	1.51	4.02	0.51	silty clay to clay	UNDFND	UNDFD	24	2.1
3.05	10	37.85	1.43	3.78	0.57	clayey silt to silty clay	UNDFND	UNDFD	18	2.1
3.35	11	21.95	1.09	4.98	0.63	clay	UNDFND	UNDFD	21	1.2
3.65	12	36.65	1.23	3.36	0.69	clayey silt to silty clay	UNDFND	UNDFD	18	2.1
3.95	13	28.22	1.27	4.50	0.75	silty clay to clay	UNDFND	UNDFD	18	1.6
4.25	14	24.05	1.06	4.40	0.81	clay	UNDFND	UNDFD	23	1.3
4.55	15	30.22	1.29	4.27	0.87	silty clay to clay	UNDFND	UNDFD	19	1.7
4.85	16	34.28	1.47	4.29	0.93	silty clay to clay	UNDFND	UNDFD	22	1.9
5.15	17	37.22	1.57	4.22	0.98	silty clay to clay	UNDFND	UNDFD	24	2.1
5.45	18	43.20	1.76	4.08	1.04	clayey silt to silty clay	UNDFND	UNDFD	21	2.4
5.75	19	20.03	1.01	5.03	1.10	clay	UNDFND	UNDFD	19	1.1
6.05	20	29.87	1.15	3.84	1.16	silty clay to clay	UNDFND	UNDFD	19	1.6
6.40	21	49.76	1.49	3.00	1.23	sandy silt to clayey silt	UNDFND	UNDFD	19	2.8
6.70	22	151.97	1.68	1.11	1.29	sand to silty sand	70-80	40-42	36	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

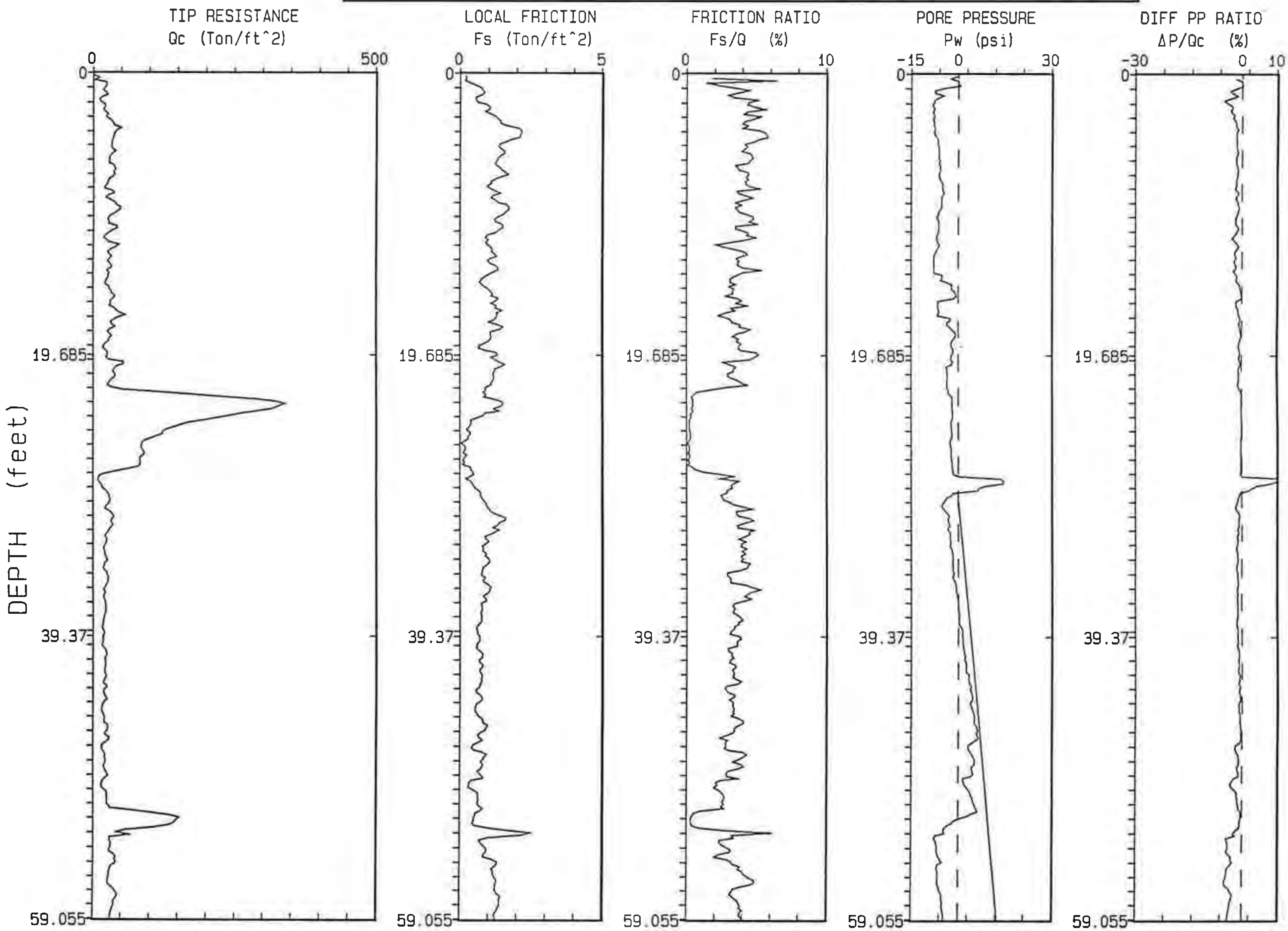
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-10

WOODWARD-CLYDE CONSULTANTS

CPT-11

Operator:	J. Oldham	CPT Date:	4/3/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



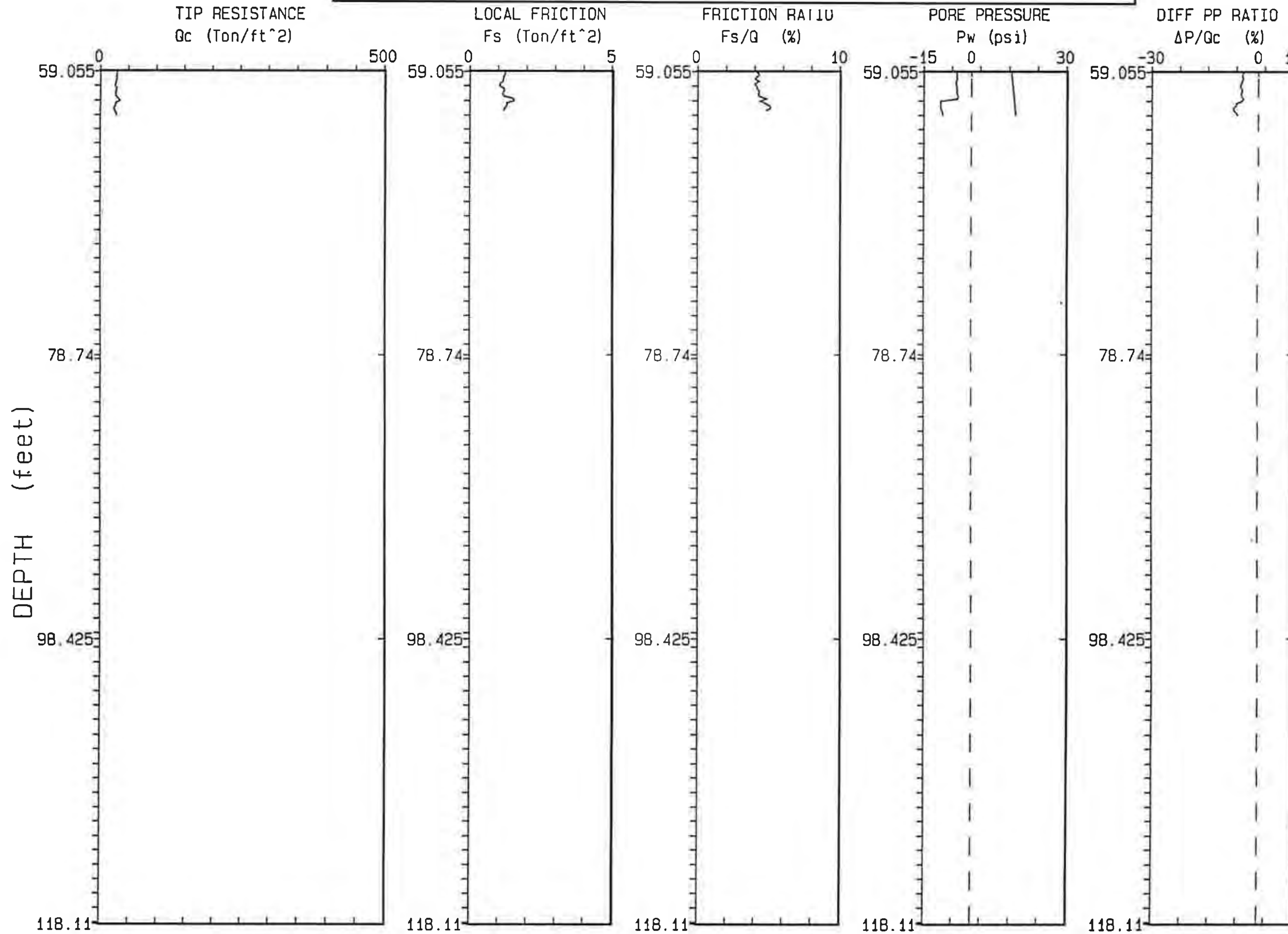
Depth Increment : .05 m   Max Depth : 62.01 ft

FIG. A-4-11

WOODWARD-CLYDE CONSULTANTS

CPT-11

Operator:	J. Oldham	CPT Date:	4/3/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 62.01 ft

FIG. A-4-11

WOODWARD-CLYDE CONSULTANTS

CPT-11

Operator:	J. Oldham	CPT Date:	4/3/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	13.97	0.37	2.63	0.03	clayey silt to silty clay	UNDFND	UNDFD	7	.8
0.60	2	17.87	0.69	3.87	0.09	silty clay to clay	UNDFND	UNDFD	11	1.0
0.95	3	22.44	1.07	4.77	0.15	clay	UNDFND	UNDFD	21	1.3
1.25	4	39.52	1.81	4.57	0.22	silty clay to clay	UNDFND	UNDFD	25	2.3
1.55	5	34.40	1.73	5.03	0.28	clay	UNDFND	UNDFD	33	2.0
1.85	6	32.37	1.43	4.41	0.33	silty clay to clay	UNDFND	UNDFD	21	1.8
2.15	7	35.85	1.44	4.01	0.39	silty clay to clay	UNDFND	UNDFD	23	2.0
2.45	8	25.63	1.14	4.46	0.45	clay	UNDFND	UNDFD	25	1.4
2.75	9	31.70	1.24	3.92	0.51	silty clay to clay	UNDFND	UNDFD	20	1.8
3.05	10	40.28	1.58	3.93	0.57	clayey silt to silty clay	UNDFND	UNDFD	19	2.3
3.35	11	33.30	1.37	4.11	0.63	silty clay to clay	UNDFND	UNDFD	21	1.9
3.65	12	27.72	0.99	3.56	0.69	clayey silt to silty clay	UNDFND	UNDFD	13	1.5
3.95	13	31.67	1.15	3.63	0.75	clayey silt to silty clay	UNDFND	UNDFD	15	1.8
4.25	14	28.82	1.17	4.07	0.81	silty clay to clay	UNDFND	UNDFD	18	1.6
4.55	15	24.85	0.82	3.29	0.87	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
4.85	16	33.87	1.15	3.39	0.93	clayey silt to silty clay	UNDFND	UNDFD	16	1.9
5.15	17	41.03	1.28	3.11	0.98	clayey silt to silty clay	UNDFND	UNDFD	20	2.3
5.45	18	35.78	1.27	3.56	1.04	clayey silt to silty clay	UNDFND	UNDFD	17	2.0
5.75	19	27.72	1.02	3.68	1.10	clayey silt to silty clay	UNDFND	UNDFD	13	1.5
6.05	20	21.93	0.98	4.46	1.16	clay	UNDFND	UNDFD	21	1.2
6.40	21	40.70	1.31	3.22	1.23	clayey silt to silty clay	UNDFND	UNDFD	19	2.3
6.70	22	31.85	1.09	3.43	1.29	clayey silt to silty clay	UNDFND	UNDFD	15	1.7
7.00	23	197.10	1.02	0.52	1.35	sand	80-90	42-44	38	UNDEFINED
7.35	24	285.84	1.11	0.39	1.41	gravelly sand to sand	>90	44-46	46	UNDEFINED
7.65	25	152.78	0.33	0.22	1.48	sand	70-80	40-42	29	UNDEFINED
7.95	26	99.30	0.22	0.22	1.54	sand	60-70	38-40	19	UNDEFINED
8.25	27	86.78	0.16	0.18	1.59	sand	50-60	38-40	17	UNDEFINED
8.55	28	61.58	0.32	0.52	1.65	sand to silty sand	40-50	36-38	15	UNDEFINED
8.85	29	12.35	0.40	3.26	1.71	silty clay to clay	UNDFND	UNDFD	8	.6
9.15	30	27.57	0.76	2.76	1.77	clayey silt to silty clay	UNDFND	UNDFD	13	1.5
9.45	31	28.85	1.10	3.80	1.80	silty clay to clay	UNDFND	UNDFD	18	1.5
9.75	32	32.57	1.40	4.29	1.83	silty clay to clay	UNDFND	UNDFD	21	1.8
10.05	33	23.88	1.00	4.21	1.86	silty clay to clay	UNDFND	UNDFD	15	1.2
10.35	34	21.32	0.87	4.08	1.88	silty clay to clay	UNDFND	UNDFD	14	1.1
10.65	35	22.23	0.88	3.95	1.91	silty clay to clay	UNDFND	UNDFD	14	1.1
10.95	36	25.53	0.89	3.50	1.94	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
11.25	37	20.53	0.93	4.53	1.97	clay	UNDFND	UNDFD	20	1.0
11.55	38	22.20	0.76	3.42	2.00	clayey silt to silty clay	UNDFND	UNDFD	11	1.1

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-11

CPT-11

Operator:	J. Oldham	CPT Date:	4/3/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	18.37	0.68	3.71	2.03	silty clay to clay	UNDFND	UNDFD	12	.9
12.15	40	18.60	0.65	3.52	2.05	silty clay to clay	UNDFND	UNDFD	12	.9
12.45	41	21.75	0.70	3.23	2.08	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
12.80	42	22.00	0.73	3.33	2.11	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
13.10	43	22.02	0.73	3.30	2.14	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
13.40	44	21.58	0.69	3.19	2.17	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
13.75	45	17.74	0.60	3.40	2.20	silty clay to clay	UNDFND	UNDFD	11	.8
14.05	46	23.33	0.85	3.65	2.23	silty clay to clay	UNDFND	UNDFD	15	1.2
14.35	47	22.00	0.60	2.73	2.26	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
14.65	48	20.37	0.77	3.76	2.29	silty clay to clay	UNDFND	UNDFD	13	1.0
14.95	49	22.33	0.74	3.31	2.32	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
15.25	50	17.42	0.44	2.52	2.35	clayey silt to silty clay	UNDFND	UNDFD	8	.8
15.55	51	24.38	0.63	2.60	2.38	clayey silt to silty clay	UNDFND	UNDFD	12	1.2
15.85	52	89.13	0.63	0.70	2.40	sand to silty sand	50-60	36-38	21	UNDEFINED
16.15	53	105.23	1.08	1.03	2.43	sand to silty sand	50-60	36-38	25	UNDEFINED
16.45	54	36.48	1.04	2.86	2.46	sandy silt to clayey silt	UNDFND	UNDFD	14	1.9
16.75	55	35.78	0.98	2.74	2.49	sandy silt to clayey silt	UNDFND	UNDFD	14	1.9
17.05	56	31.07	1.19	3.83	2.52	clayey silt to silty clay	UNDFND	UNDFD	15	1.6
17.35	57	29.63	1.25	4.21	2.55	silty clay to clay	UNDFND	UNDFD	19	1.5
17.65	58	40.28	1.37	3.39	2.57	clayey silt to silty clay	UNDFND	UNDFD	19	2.1
17.95	59	33.37	1.29	3.85	2.60	clayey silt to silty clay	UNDFND	UNDFD	16	1.7
18.25	60	28.25	1.17	4.16	2.63	silty clay to clay	UNDFND	UNDFD	18	1.4
18.55	61	27.88	1.21	4.35	2.66	silty clay to clay	UNDFND	UNDFD	18	1.4
18.85	62	27.30	1.09	4.00	2.69	silty clay to clay	UNDFND	UNDFD	17	1.3

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

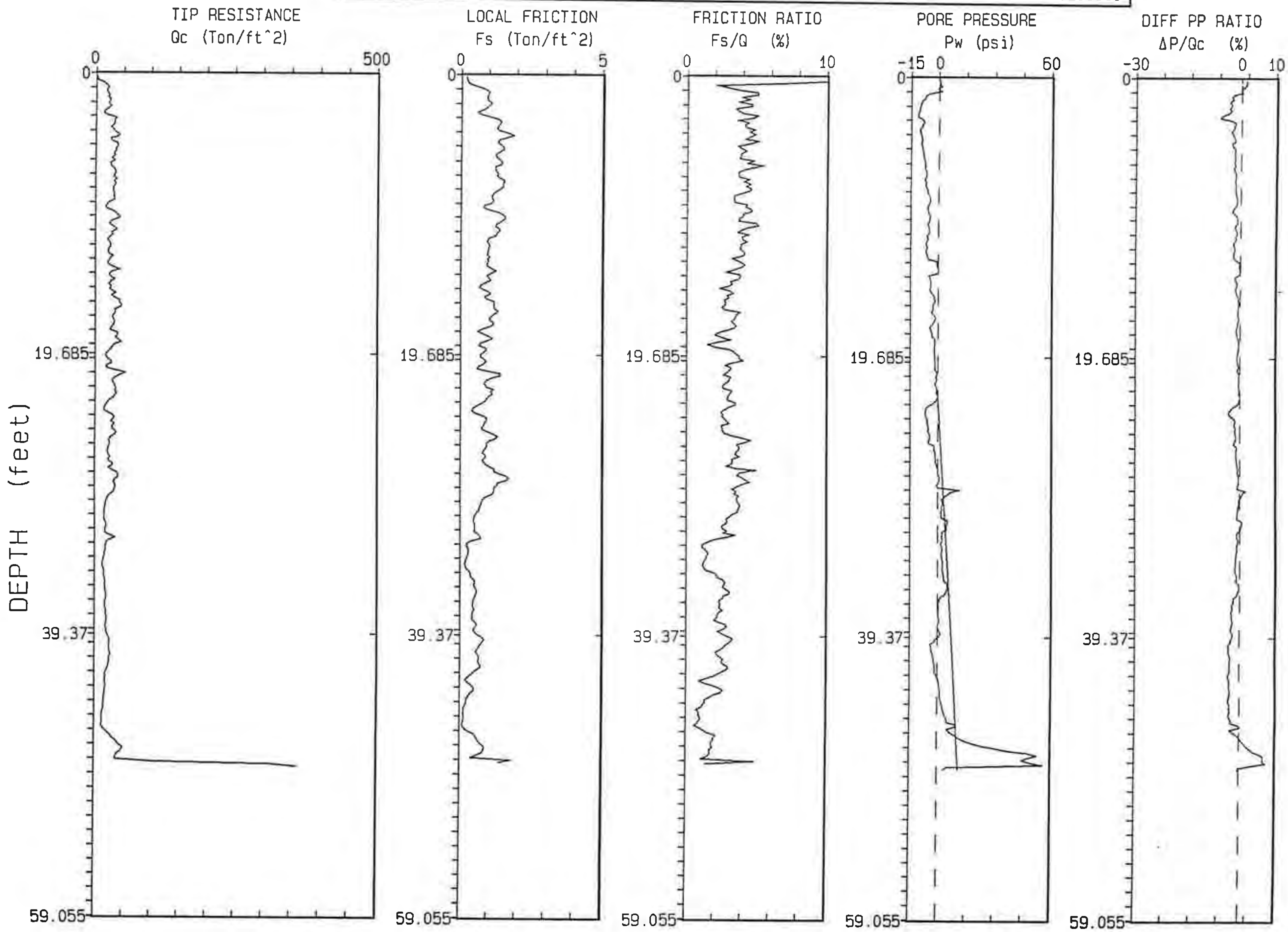
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-11

WOODWARD-CLYDE CONSULTANTS

CPT-12

Operator:	J. Oldham	CPT Date:	4/4/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 48.56 ft

FIG. A-4-12

WOODWARD-CLYDE CONSULTANTS

CPT-12

Operator:	J. Oldham	CPT Date:	4/4/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	9.97	0.37	3.74	0.03	clay	UNDFND	UNDFD	10	.5
0.60	2	22.08	0.97	4.41	0.09	clay	UNDFND	UNDFD	21	1.2
0.95	3	22.60	0.91	4.05	0.15	silty clay to clay	UNDFND	UNDFD	14	1.3
1.25	4	31.50	1.41	4.49	0.22	silty clay to clay	UNDFND	UNDFD	20	1.8
1.55	5	35.72	1.52	4.26	0.28	silty clay to clay	UNDFND	UNDFD	23	2.0
1.85	6	33.33	1.38	4.13	0.33	silty clay to clay	UNDFND	UNDFD	21	1.9
2.15	7	31.27	1.30	4.15	0.39	silty clay to clay	UNDFND	UNDFD	20	1.8
2.45	8	33.38	1.47	4.40	0.45	silty clay to clay	UNDFND	UNDFD	21	1.9
2.75	9	31.68	1.14	3.61	0.51	clayey silt to silty clay	UNDFND	UNDFD	15	1.8
3.05	10	29.00	1.20	4.13	0.57	silty clay to clay	UNDFND	UNDFD	19	1.6
3.35	11	32.95	1.38	4.18	0.63	silty clay to clay	UNDFND	UNDFD	21	1.9
3.65	12	26.70	1.09	4.08	0.69	silty clay to clay	UNDFND	UNDFD	17	1.5
3.95	13	26.12	0.99	3.78	0.75	silty clay to clay	UNDFND	UNDFD	17	1.4
4.25	14	29.52	1.06	3.59	0.81	clayey silt to silty clay	UNDFND	UNDFD	14	1.6
4.55	15	27.78	0.89	3.21	0.87	clayey silt to silty clay	UNDFND	UNDFD	13	1.5
4.85	16	33.20	0.98	2.96	0.93	clayey silt to silty clay	UNDFND	UNDFD	16	1.8
5.15	17	39.48	1.23	3.12	0.98	clayey silt to silty clay	UNDFND	UNDFD	19	2.2
5.45	18	31.38	1.04	3.33	1.04	clayey silt to silty clay	UNDFND	UNDFD	15	1.7
5.75	19	38.73	0.88	2.27	1.10	sandy silt to clayey silt	UNDFND	UNDFD	15	2.2
6.05	20	25.53	0.79	3.11	1.16	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
6.40	21	29.26	0.89	3.05	1.23	clayey silt to silty clay	UNDFND	UNDFD	14	1.6
6.70	22	35.57	1.03	2.89	1.29	sandy silt to clayey silt	UNDFND	UNDFD	14	2.0
7.00	23	33.37	1.04	3.11	1.35	clayey silt to silty clay	UNDFND	UNDFD	16	1.8
7.35	24	22.27	0.63	2.81	1.39	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
7.65	25	31.72	0.86	2.72	1.42	sandy silt to clayey silt	UNDFND	UNDFD	12	1.7
7.95	26	29.02	1.12	3.87	1.45	silty clay to clay	UNDFND	UNDFD	19	1.6
8.25	27	24.10	0.85	3.53	1.48	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
8.55	28	30.58	1.11	3.64	1.51	clayey silt to silty clay	UNDFND	UNDFD	15	1.7
8.85	29	37.48	1.49	3.97	1.54	clayey silt to silty clay	UNDFND	UNDFD	18	2.1
9.15	30	27.77	1.00	3.61	1.57	clayey silt to silty clay	UNDFND	UNDFD	13	1.5
9.45	31	18.12	0.65	3.59	1.59	silty clay to clay	UNDFND	UNDFD	12	.9
9.75	32	18.35	0.51	2.78	1.62	clayey silt to silty clay	UNDFND	UNDFD	9	.9
10.05	33	24.47	0.54	2.19	1.65	sandy silt to clayey silt	UNDFND	UNDFD	9	1.3
10.35	34	18.45	0.26	1.40	1.68	sandy silt to clayey silt	UNDFND	UNDFD	7	.9
10.65	35	14.93	0.21	1.41	1.71	sandy silt to clayey silt	UNDFND	UNDFD	6	.7
10.95	36	17.88	0.46	2.55	1.74	clayey silt to silty clay	UNDFND	UNDFD	9	.9
11.25	37	19.83	0.55	2.76	1.76	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
11.55	38	19.40	0.46	2.38	1.79	clayey silt to silty clay	UNDFND	UNDFD	9	1.0

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-12

CPT-12

Operator:	J. Oldham	CPT Date:	4/4/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	20.43	0.51	2.50	1.82	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
12.15	40	23.32	0.68	2.93	1.85	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
12.45	41	26.52	0.65	2.45	1.88	sandy silt to clayey silt	UNDFND	UNDFD	10	1.4
12.80	42	24.27	0.65	2.69	1.91	clayey silt to silty clay	UNDFND	UNDFD	12	1.2
13.10	43	19.22	0.33	1.71	1.94	sandy silt to clayey silt	UNDFND	UNDFD	7	.9
13.40	44	17.70	0.34	1.94	1.97	clayey silt to silty clay	UNDFND	UNDFD	8	.8
13.75	45	14.76	0.15	0.98	2.00	sandy silt to clayey silt	UNDFND	UNDFD	6	.7
14.05	46	14.88	0.16	1.10	2.03	sandy silt to clayey silt	UNDFND	UNDFD	6	.7
14.35	47	34.83	0.67	1.93	2.06	sandy silt to clayey silt	UNDFND	UNDFD	13	1.8
14.65	48	43.08	0.90	2.08	2.09	sandy silt to clayey silt	UNDFND	UNDFD	17	2.3

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

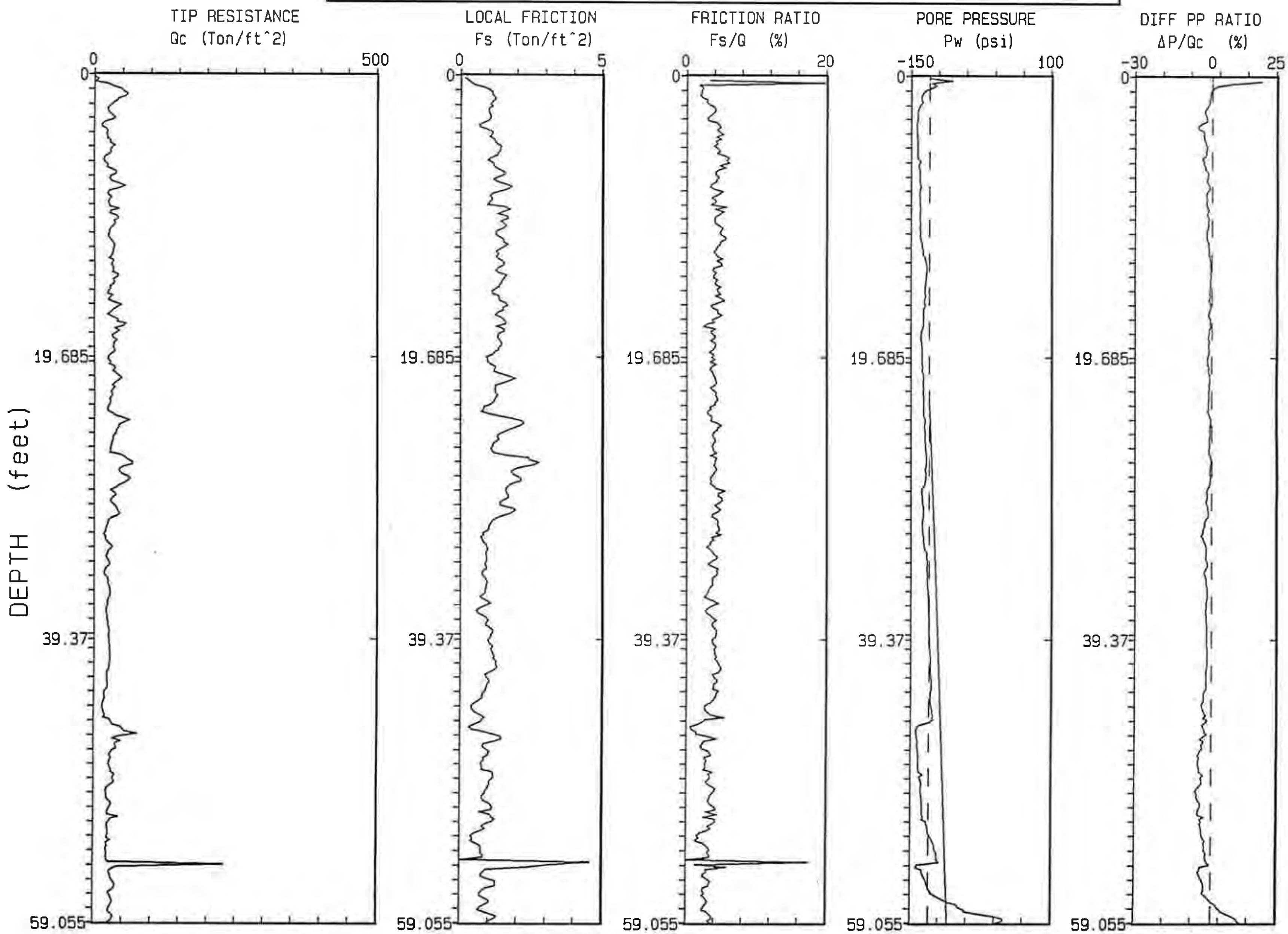
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-12

WOODWARD-CLYDE CONSULTANTS

CPT-13

Operator: J. Oldham		**CPT Date:**	4/4/95
Page: 1/2		**Location:**	Baldwin
Cone Used: 243		**Job Number:**	5E08560



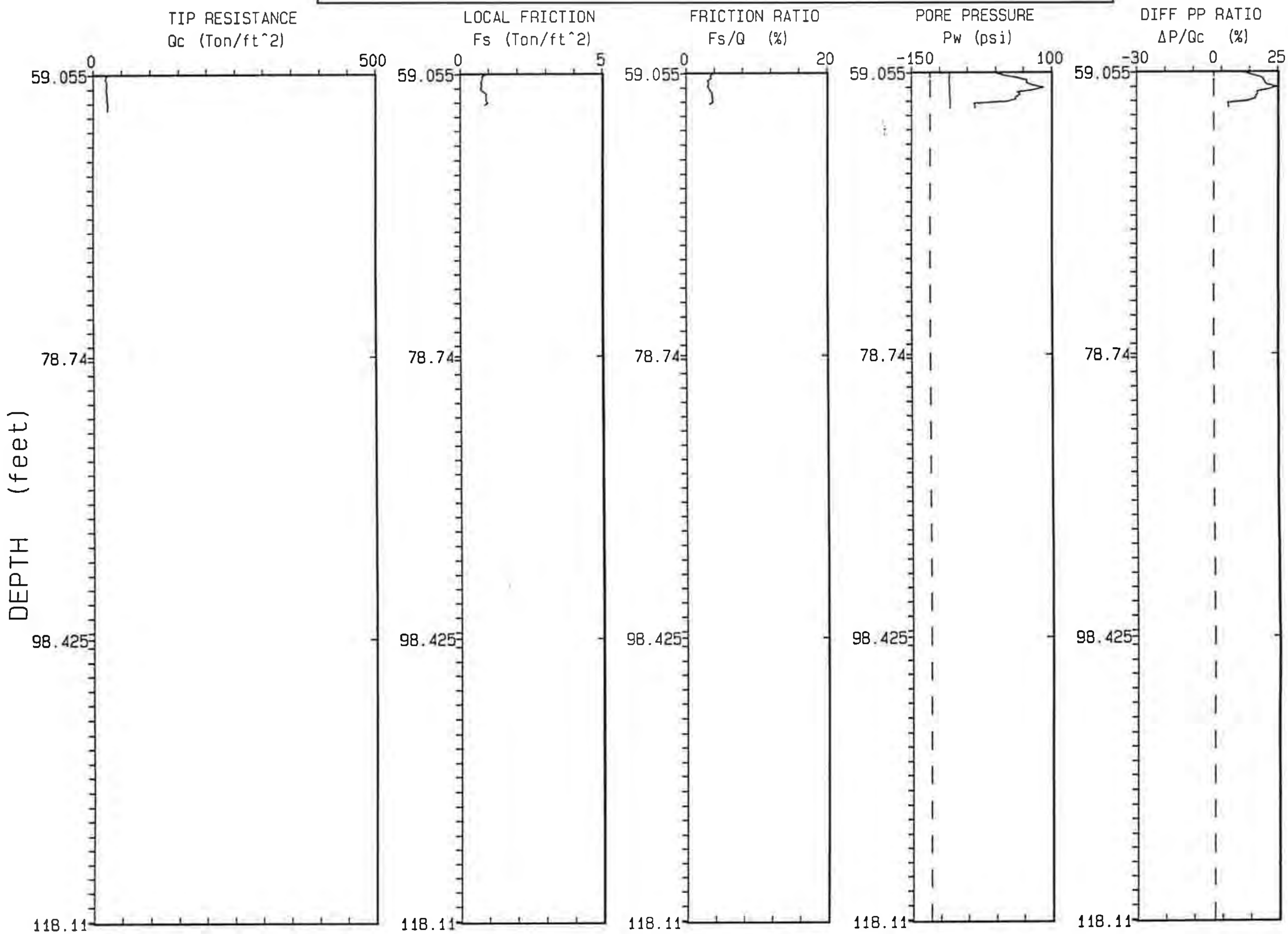
Depth Increment : .05 m Max Depth : 61.52 ft

FIG. A-4-13

WOODWARD-CLYDE CONSULTANTS

CPT-13

Operator:	J. Oldham	CPT Date:	4/4/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : 05 m

Max Depth : 61.52 ft

FIG. A-4-13

WOODWARD-CLYDE CONSULTANTS

CPT-13

Operator:	J. Oldham	CPT Date:	4/4/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	19.20	0.51	2.63	0.03	clayey silt to silty clay	UNDFND	UNDFD	9	1.1
0.60	2	46.05	1.13	2.46	0.09	sandy silt to clayey silt	UNDFND	UNDFD	18	2.7
0.95	3	28.76	1.02	3.55	0.15	clayey silt to silty clay	UNDFND	UNDFD	14	1.6
1.25	4	18.95	0.89	4.71	0.22	clay	UNDFND	UNDFD	18	1.1
1.55	5	28.47	1.24	4.36	0.28	silty clay to clay	UNDFND	UNDFD	18	1.6
1.85	6	22.42	1.19	5.29	0.33	clay	UNDFND	UNDFD	21	1.2
2.15	7	30.02	1.37	4.55	0.39	silty clay to clay	UNDFND	UNDFD	19	1.7
2.45	8	37.40	1.48	3.97	0.45	clayey silt to silty clay	UNDFND	UNDFD	18	2.1
2.75	9	26.12	1.05	4.02	0.51	silty clay to clay	UNDFND	UNDFD	17	1.5
3.05	10	34.80	1.59	4.56	0.57	silty clay to clay	UNDFND	UNDFD	22	2.0
3.35	11	31.25	1.44	4.60	0.63	silty clay to clay	UNDFND	UNDFD	20	1.8
3.65	12	29.72	1.49	5.00	0.69	clay	UNDFND	UNDFD	28	1.7
3.95	13	30.75	1.34	4.36	0.75	silty clay to clay	UNDFND	UNDFD	20	1.7
4.25	14	33.43	1.43	4.27	0.81	silty clay to clay	UNDFND	UNDFD	21	1.9
4.55	15	32.77	1.40	4.27	0.87	silty clay to clay	UNDFND	UNDFD	21	1.8
4.85	16	28.00	1.32	4.72	0.93	clay	UNDFND	UNDFD	27	1.5
5.15	17	34.30	1.44	4.19	0.98	silty clay to clay	UNDFND	UNDFD	22	1.9
5.45	18	44.83	1.51	3.37	1.04	clayey silt to silty clay	UNDFND	UNDFD	21	2.5
5.75	19	35.15	1.38	3.91	1.10	clayey silt to silty clay	UNDFND	UNDFD	17	2.0
6.05	20	30.43	1.14	3.74	1.16	clayey silt to silty clay	UNDFND	UNDFD	15	1.7
6.40	21	33.61	1.24	3.69	1.23	clayey silt to silty clay	UNDFND	UNDFD	16	1.9
6.70	22	37.50	1.49	3.97	1.29	clayey silt to silty clay	UNDFND	UNDFD	18	2.1
7.00	23	28.20	1.19	4.23	1.35	silty clay to clay	UNDFND	UNDFD	18	1.5
7.35	24	36.13	1.23	3.41	1.39	clayey silt to silty clay	UNDFND	UNDFD	17	2.0
7.65	25	41.72	1.80	4.32	1.42	silty clay to clay	UNDFND	UNDFD	27	2.3
7.95	26	31.10	1.21	3.89	1.45	silty clay to clay	UNDFND	UNDFD	20	1.7
8.25	27	47.50	1.91	4.03	1.48	clayey silt to silty clay	UNDFND	UNDFD	23	2.7
8.55	28	52.32	2.06	3.93	1.51	clayey silt to silty clay	UNDFND	UNDFD	25	2.9
8.85	29	47.60	1.83	3.84	1.54	clayey silt to silty clay	UNDFND	UNDFD	23	2.6
9.15	30	33.20	1.55	4.67	1.57	silty clay to clay	UNDFND	UNDFD	21	1.8
9.45	31	38.80	1.64	4.23	1.59	silty clay to clay	UNDFND	UNDFD	25	2.1
9.75	32	21.67	0.98	4.52	1.62	clay	UNDFND	UNDFD	21	1.1
10.05	33	22.73	0.82	3.59	1.65	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
10.35	34	23.67	0.91	3.86	1.68	silty clay to clay	UNDFND	UNDFD	15	1.2
10.65	35	20.95	0.83	3.97	1.71	silty clay to clay	UNDFND	UNDFD	13	1.1
10.95	36	25.03	0.90	3.58	1.74	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
11.25	37	25.85	0.86	3.31	1.76	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
11.55	38	22.15	0.73	3.31	1.79	clayey silt to silty clay	UNDFND	UNDFD	11	1.1

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-13

CPT-13

Operator:	J. Oldham	CPT Date:	4/4/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	24.65	1.00	4.07	1.82	silty clay to clay	UNDFND	UNDFD	16	1.3
12.15	40	26.02	1.05	4.02	1.85	silty clay to clay	UNDFND	UNDFD	17	1.3
12.45	41	27.68	1.15	4.15	1.88	silty clay to clay	UNDFND	UNDFD	18	1.4
12.80	42	24.70	1.11	4.50	1.91	clay	UNDFND	UNDFD	24	1.3
13.10	43	22.42	0.93	4.16	1.94	silty clay to clay	UNDFND	UNDFD	14	1.1
13.40	44	16.93	0.64	3.79	1.97	silty clay to clay	UNDFND	UNDFD	11	.8
13.75	45	20.26	0.63	3.12	2.00	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
14.05	46	51.07	0.75	1.48	2.03	silty sand to sandy silt	<40	32-34	16	UNDEFINED
14.35	47	37.92	1.03	2.72	2.06	sandy silt to clayey silt	UNDFND	UNDFD	15	2.0
14.65	48	28.20	0.85	3.00	2.09	clayey silt to silty clay	UNDFND	UNDFD	14	1.4
14.95	49	32.20	1.02	3.17	2.11	clayey silt to silty clay	UNDFND	UNDFD	15	1.7
15.25	50	27.53	0.96	3.48	2.14	clayey silt to silty clay	UNDFND	UNDFD	13	1.4
15.55	51	26.58	0.94	3.52	2.17	clayey silt to silty clay	UNDFND	UNDFD	13	1.3
15.85	52	29.10	1.05	3.62	2.20	clayey silt to silty clay	UNDFND	UNDFD	14	1.5
16.15	53	24.73	0.70	2.82	2.23	clayey silt to silty clay	UNDFND	UNDFD	12	1.2
16.45	54	24.55	0.60	2.46	2.26	clayey silt to silty clay	UNDFND	UNDFD	12	1.2
16.75	55	58.37	1.70	2.91	2.28	sandy silt to clayey silt	UNDFND	UNDFD	22	3.2
17.05	56	32.35	1.11	3.42	2.31	clayey silt to silty clay	UNDFND	UNDFD	15	1.7
17.35	57	34.47	1.03	2.98	2.34	clayey silt to silty clay	UNDFND	UNDFD	17	1.8
17.65	58	31.53	0.87	2.76	2.37	sandy silt to clayey silt	UNDFND	UNDFD	12	1.6
17.95	59	30.88	1.02	3.30	2.40	clayey silt to silty clay	UNDFND	UNDFD	15	1.6
18.25	60	23.25	0.78	3.35	2.43	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
18.55	61	23.98	0.86	3.59	2.45	clayey silt to silty clay	UNDFND	UNDFD	11	1.1

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

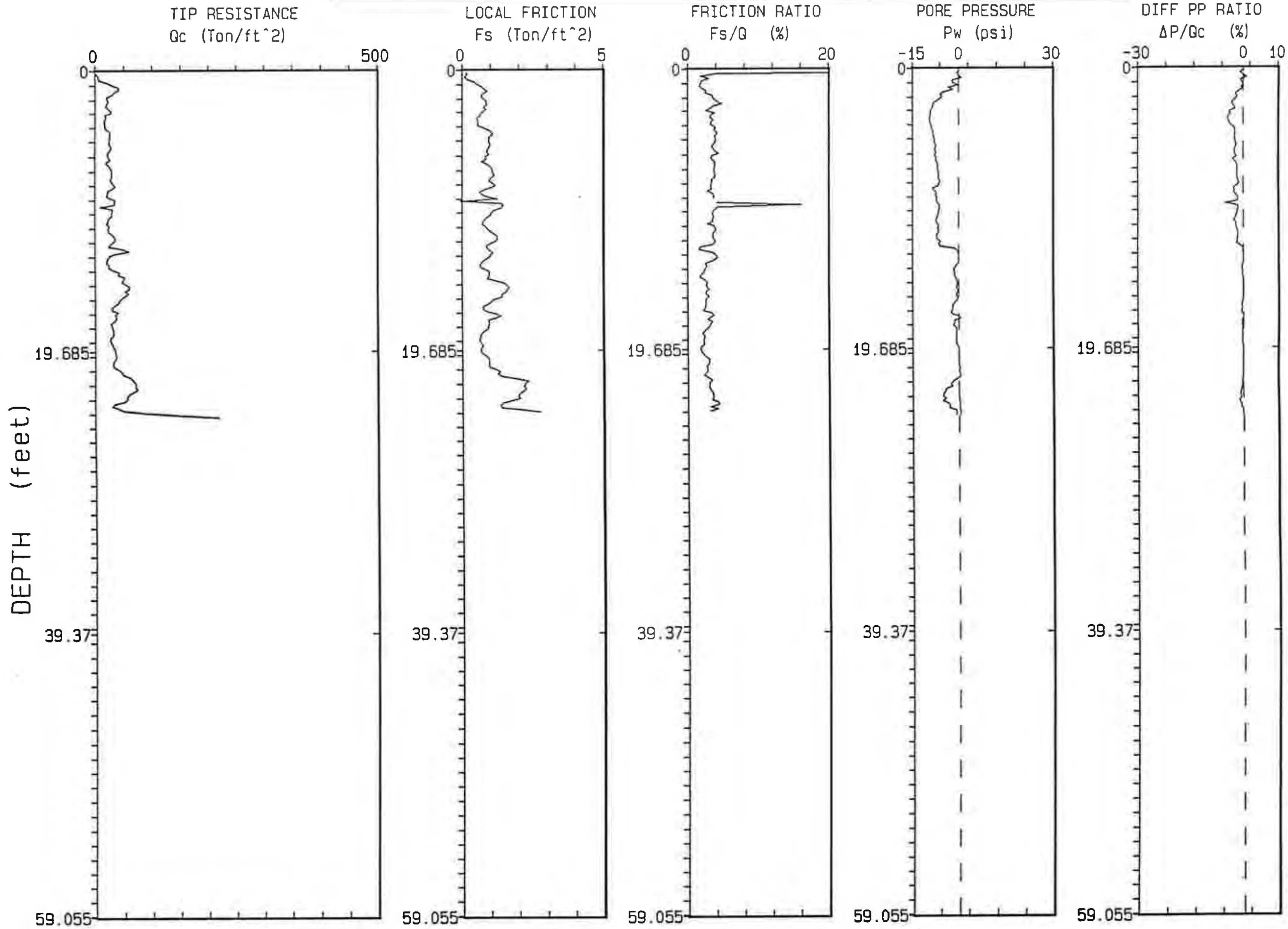
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-13

WOODWARD-CLYDE CONSULTANTS

CPT-14

Operator:	J. Oldham	CPT Date:	4/4/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 24.28 ft

FIG. A-4-14

WOODWARD-CLYDE CONSULTANTS

CPT-14

Operator:	J. Oldham	CPT Date:	4/4/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	11.07	0.26	2.37	0.03	clayey silt to silty clay	UNDFND	UNDFD	5	.6
0.60	2	30.45	0.75	2.46	0.09	sandy silt to clayey silt	UNDFND	UNDFD	12	1.7
0.95	3	21.80	0.79	3.64	0.15	silty clay to clay	UNDFND	UNDFD	14	1.2
1.25	4	17.18	0.59	3.43	0.22	silty clay to clay	UNDFND	UNDFD	11	.9
1.55	5	24.95	0.98	3.94	0.28	silty clay to clay	UNDFND	UNDFD	16	1.4
1.85	6	24.40	0.91	3.71	0.33	silty clay to clay	UNDFND	UNDFD	16	1.4
2.15	7	24.85	0.92	3.70	0.39	silty clay to clay	UNDFND	UNDFD	16	1.4
2.45	8	29.87	1.07	3.59	0.45	clayey silt to silty clay	UNDFND	UNDFD	14	1.7
2.75	9	25.37	0.87	3.41	0.51	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
3.05	10	27.53	1.05	3.81	0.57	silty clay to clay	UNDFND	UNDFD	18	1.5
3.35	11	23.58	0.82	3.47	0.63	clayey silt to silty clay	UNDFND	UNDFD	11	1.3
3.65	12	29.80	1.11	3.74	0.69	clayey silt to silty clay	UNDFND	UNDFD	14	1.7
3.95	13	36.43	0.97	2.67	0.75	sandy silt to clayey silt	UNDFND	UNDFD	14	2.0
4.25	14	23.93	0.76	3.17	0.81	clayey silt to silty clay	UNDFND	UNDFD	11	1.3
4.55	15	46.78	1.07	2.28	0.87	sandy silt to clayey silt	UNDFND	UNDFD	18	2.7
4.85	16	54.43	1.52	2.80	0.93	sandy silt to clayey silt	UNDFND	UNDFD	21	3.1
5.15	17	35.57	0.89	2.51	0.98	sandy silt to clayey silt	UNDFND	UNDFD	14	2.0
5.45	18	32.57	1.10	3.37	1.04	clayey silt to silty clay	UNDFND	UNDFD	16	1.8
5.75	19	29.57	0.75	2.53	1.10	sandy silt to clayey silt	UNDFND	UNDFD	11	1.6
6.05	20	32.17	0.69	2.13	1.16	sandy silt to clayey silt	UNDFND	UNDFD	12	1.8
6.40	21	34.87	0.96	2.76	1.23	sandy silt to clayey silt	UNDFND	UNDFD	13	1.9
6.70	22	60.37	1.75	2.90	1.29	sandy silt to clayey silt	UNDFND	UNDFD	23	3.4
7.00	23	63.65	2.11	3.31	1.35	sandy silt to clayey silt	UNDFND	UNDFD	24	3.6
7.35	24	62.71	1.53	2.44	1.39	sandy silt to clayey silt	UNDFND	UNDFD	24	3.6

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

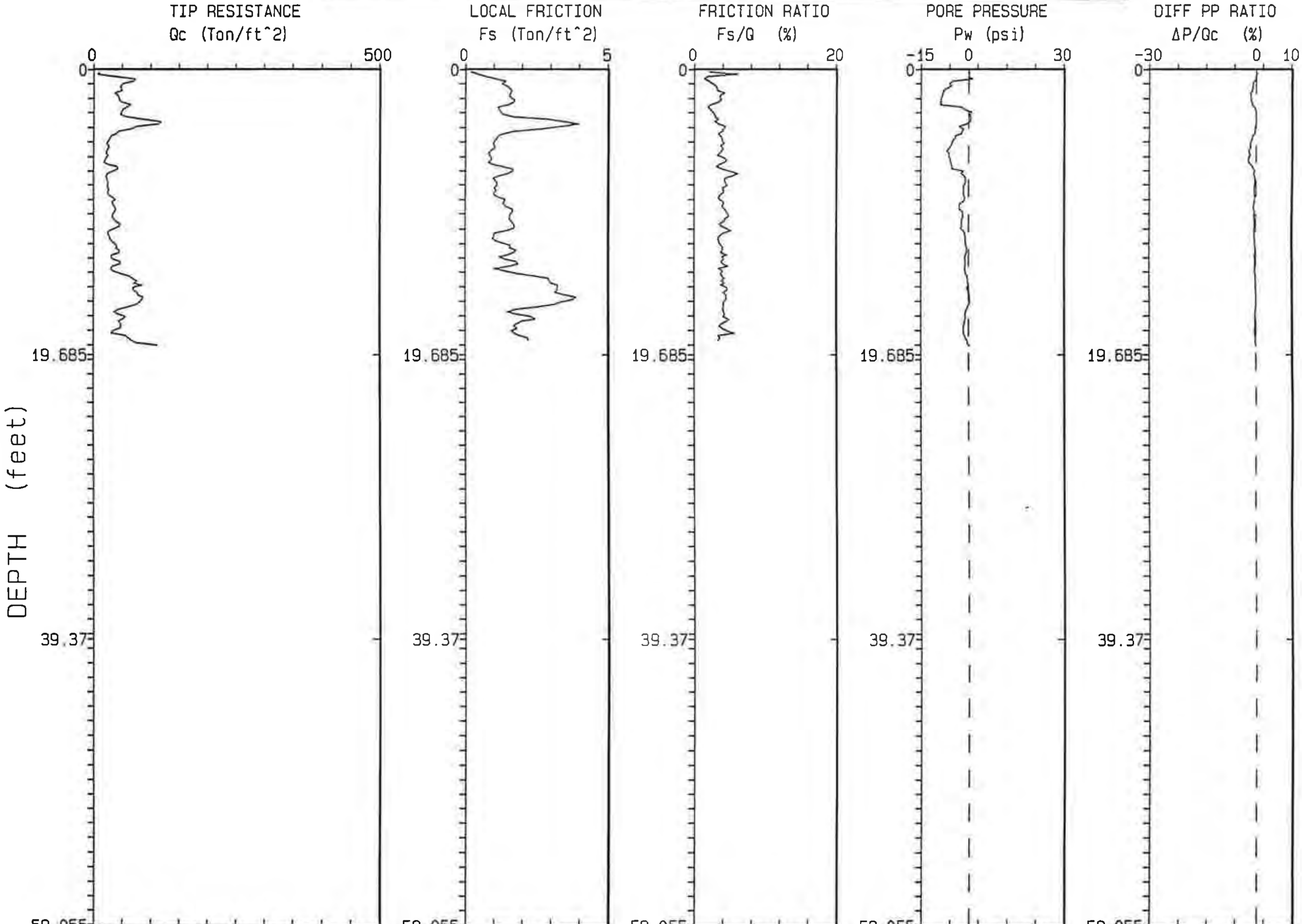
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-14

WOODWARD-CLYDE CONSULTANTS

CPT-15

Operator:	J. Oldham	CPT Date:	3/31/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 19.03 ft

FIG. A-4-15

WOODWARD-CLYDE CONSULTANTS

CPT-15

Operator:	J. Oldham	CPT Date:	3/31/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	41.22	0.85	2.07	0.03	sandy silt to clayey silt	UNDFND	UNDFD	16	2.4
0.60	2	44.60	1.56	3.50	0.09	clayey silt to silty clay	UNDFND	UNDFD	21	2.6
0.95	3	51.91	1.41	2.71	0.15	sandy silt to clayey silt	UNDFND	UNDFD	20	3.0
1.25	4	85.55	3.01	3.52	0.22	sandy silt to clayey silt	UNDFND	UNDFD	33	5.0
1.55	5	31.70	1.21	3.83	0.28	clayey silt to silty clay	UNDFND	UNDFD	15	1.8
1.85	6	24.42	0.92	3.77	0.33	silty clay to clay	UNDFND	UNDFD	16	1.4
2.15	7	30.33	1.22	4.02	0.39	silty clay to clay	UNDFND	UNDFD	19	1.7
2.45	8	23.83	1.16	4.88	0.45	clay	UNDFND	UNDFD	23	1.3
2.75	9	29.25	1.12	3.83	0.51	silty clay to clay	UNDFND	UNDFD	19	1.6
3.05	10	35.07	1.51	4.31	0.57	silty clay to clay	UNDFND	UNDFD	22	2.0
3.35	11	39.23	1.64	4.18	0.63	silty clay to clay	UNDFND	UNDFD	25	2.2
3.65	12	29.32	1.13	3.86	0.69	silty clay to clay	UNDFND	UNDFD	19	1.6
3.95	13	38.77	1.56	4.02	0.75	clayey silt to silty clay	UNDFND	UNDFD	19	2.2
4.25	14	37.22	1.51	4.06	0.81	silty clay to clay	UNDFND	UNDFD	24	2.1
4.55	15	67.98	2.71	3.99	0.87	clayey silt to silty clay	UNDFND	UNDFD	33	3.9
4.85	16	77.35	3.46	4.48	0.93	clayey silt to silty clay	UNDFND	UNDFD	37	4.4
5.15	17	56.75	2.37	4.17	0.98	clayey silt to silty clay	UNDFND	UNDFD	27	3.2
5.45	18	48.88	2.04	4.16	1.04	clayey silt to silty clay	UNDFND	UNDFD	23	2.8
5.75	19	53.88	1.62	3.00	1.10	sandy silt to clayey silt	UNDFND	UNDFD	21	3.1

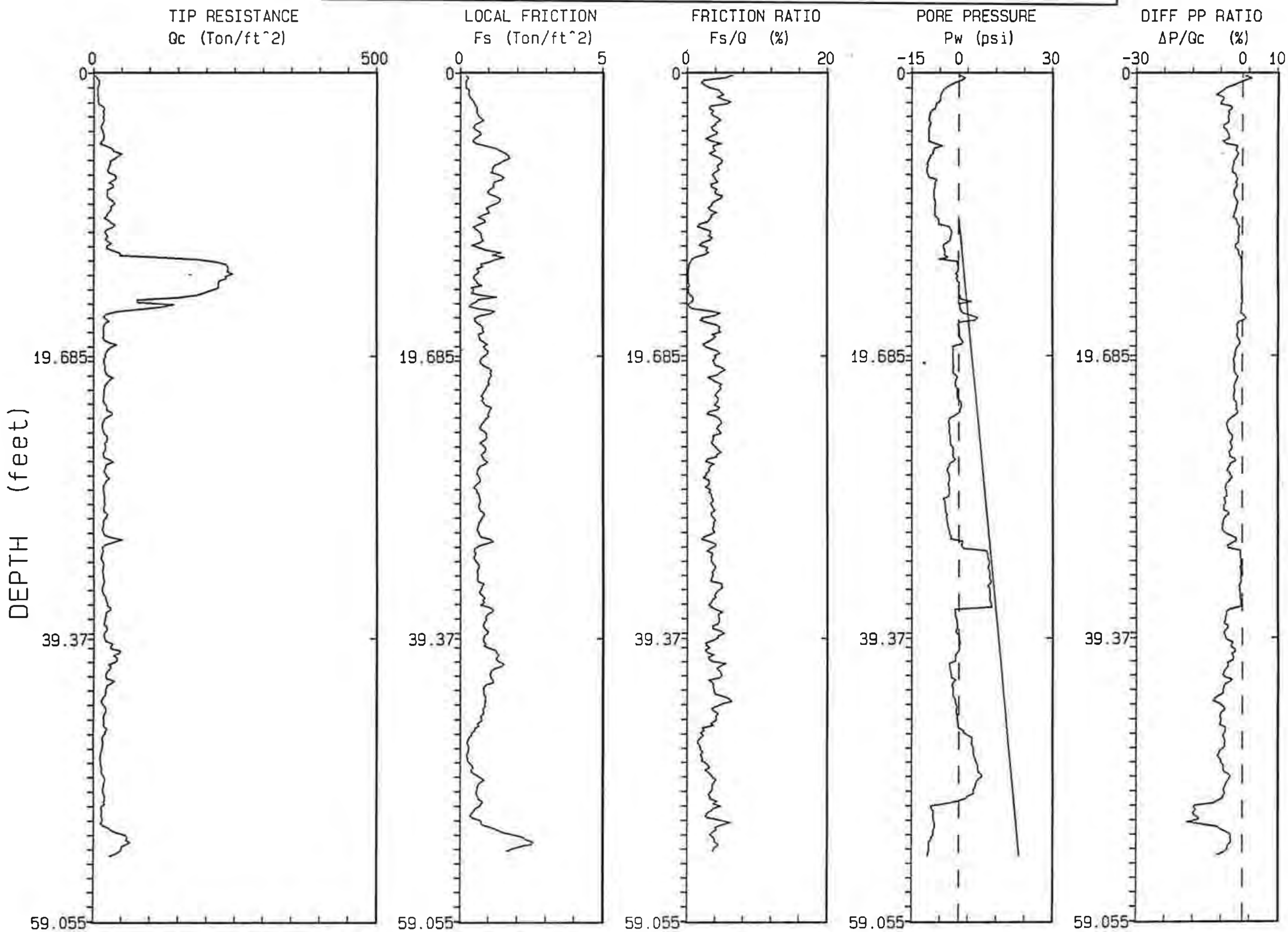
Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

WOODWARD-CLYDE CONSULTANTS

CPT-16

Operator:	J. Oldham	CPT Date:	3/29/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 54.46 ft

FIG. A-4-16

WOODWARD-CLYDE CONSULTANTS

CPT-16

Operator:	J. Oldham	CPT Date:	3/29/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	6.82	0.21	3.15	0.03	clay	UNDFND	UNDFD	7	.3
0.60	2	7.15	0.36	5.03	0.09	clay	UNDFND	UNDFD	7	.4
0.95	3	16.04	0.60	3.76	0.15	silty clay to clay	UNDFND	UNDFD	10	.9
1.25	4	15.15	0.62	4.08	0.22	clay	UNDFND	UNDFD	15	.8
1.55	5	17.32	0.62	3.60	0.28	silty clay to clay	UNDFND	UNDFD	11	1.0
1.85	6	38.12	1.53	4.02	0.33	clayey silt to silty clay	UNDFND	UNDFD	18	2.2
2.15	7	28.85	1.23	4.26	0.39	silty clay to clay	UNDFND	UNDFD	18	1.6
2.45	8	32.72	1.27	3.88	0.45	clayey silt to silty clay	UNDFND	UNDFD	16	1.8
2.75	9	29.08	1.22	4.21	0.51	silty clay to clay	UNDFND	UNDFD	19	1.6
3.05	10	26.22	0.92	3.50	0.57	clayey silt to silty clay	UNDFND	UNDFD	13	1.5
3.35	11	28.72	0.68	2.38	0.61	sandy silt to clayey silt	UNDFND	UNDFD	11	1.6
3.65	12	24.72	0.70	2.81	0.64	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
3.95	13	78.08	1.17	1.50	0.67	silty sand to sandy silt	60-70	40-42	25	UNDEFINED
4.25	14	234.65	0.74	0.32	0.69	sand	>90	46-48	45	UNDEFINED
4.55	15	225.22	0.56	0.25	0.72	gravelly sand to sand	>90	44-46	36	UNDEFINED
4.85	16	148.77	0.68	0.46	0.75	sand	80-90	44-46	28	UNDEFINED
5.15	17	70.82	0.74	1.04	0.78	sand to silty sand	60-70	40-42	17	UNDEFINED
5.45	18	20.58	0.66	3.20	0.81	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
5.75	19	23.00	0.77	3.36	0.84	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
6.05	20	23.38	0.88	3.76	0.86	silty clay to clay	UNDFND	UNDFD	15	1.3
6.40	21	20.79	0.93	4.46	0.89	clay	UNDFND	UNDFD	20	1.1
6.70	22	24.60	0.98	4.00	0.93	silty clay to clay	UNDFND	UNDFD	16	1.3
7.00	23	18.63	0.80	4.29	0.95	clay	UNDFND	UNDFD	18	1.0
7.35	24	26.01	0.99	3.81	0.98	silty clay to clay	UNDFND	UNDFD	17	1.4
7.65	25	17.07	0.79	4.66	1.02	clay	UNDFND	UNDFD	16	.9
7.95	26	22.53	0.85	3.77	1.04	silty clay to clay	UNDFND	UNDFD	14	1.2
8.25	27	23.23	0.85	3.64	1.07	silty clay to clay	UNDFND	UNDFD	15	1.2
8.55	28	21.60	0.68	3.15	1.10	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
8.85	29	21.08	0.61	2.89	1.13	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
9.15	30	19.38	0.67	3.46	1.16	silty clay to clay	UNDFND	UNDFD	12	1.0
9.45	31	20.52	0.75	3.66	1.19	silty clay to clay	UNDFND	UNDFD	13	1.0
9.75	32	17.18	0.66	3.82	1.21	silty clay to clay	UNDFND	UNDFD	11	.8
10.05	33	29.28	0.86	2.94	1.24	clayey silt to silty clay	UNDFND	UNDFD	14	1.6
10.35	34	15.23	0.51	3.35	1.27	silty clay to clay	UNDFND	UNDFD	10	.7
10.65	35	16.67	0.63	3.78	1.30	silty clay to clay	UNDFND	UNDFD	11	.8
10.95	36	16.87	0.70	4.15	1.33	clay	UNDFND	UNDFD	16	.8
11.25	37	20.28	0.79	3.88	1.36	silty clay to clay	UNDFND	UNDFD	13	1.0
11.55	38	24.18	0.98	4.06	1.38	silty clay to clay	UNDFND	UNDFD	15	1.2

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-16

CPT-16

Operator:	J. Oldham	CPT Date:	3/29/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	20.70	0.88	4.23	1.41	silty clay to clay	UNDFND	UNDFD	13	1.0
12.15	40	23.87	0.87	3.63	1.44	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
12.45	41	40.33	1.25	3.09	1.47	clayey silt to silty clay	UNDFND	UNDFD	19	2.2
12.80	42	27.51	1.26	4.59	1.50	clay	UNDFND	UNDFD	26	1.4
13.10	43	26.73	1.00	3.73	1.53	clayey silt to silty clay	UNDFND	UNDFD	13	1.4
13.40	44	17.68	0.88	4.96	1.56	clay	UNDFND	UNDFD	17	.8
13.75	45	19.67	0.80	4.06	1.59	silty clay to clay	UNDFND	UNDFD	13	1.0
14.05	46	19.77	0.52	2.65	1.62	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
14.35	47	16.30	0.28	1.74	1.65	clayey silt to silty clay	UNDFND	UNDFD	8	.7
14.65	48	12.60	0.28	2.21	1.68	clayey silt to silty clay	UNDFND	UNDFD	6	.5
14.95	49	15.80	0.51	3.23	1.70	silty clay to clay	UNDFND	UNDFD	10	.7
15.25	50	18.07	0.67	3.72	1.73	silty clay to clay	UNDFND	UNDFD	12	.8
15.55	51	18.33	0.68	3.70	1.76	silty clay to clay	UNDFND	UNDFD	12	.9
15.85	52	14.38	0.49	3.44	1.79	silty clay to clay	UNDFND	UNDFD	9	.6
16.15	53	31.10	1.23	3.96	1.82	silty clay to clay	UNDFND	UNDFD	20	1.6
16.45	54	56.48	2.27	4.02	1.85	clayey silt to silty clay	UNDFND	UNDFD	27	3.1

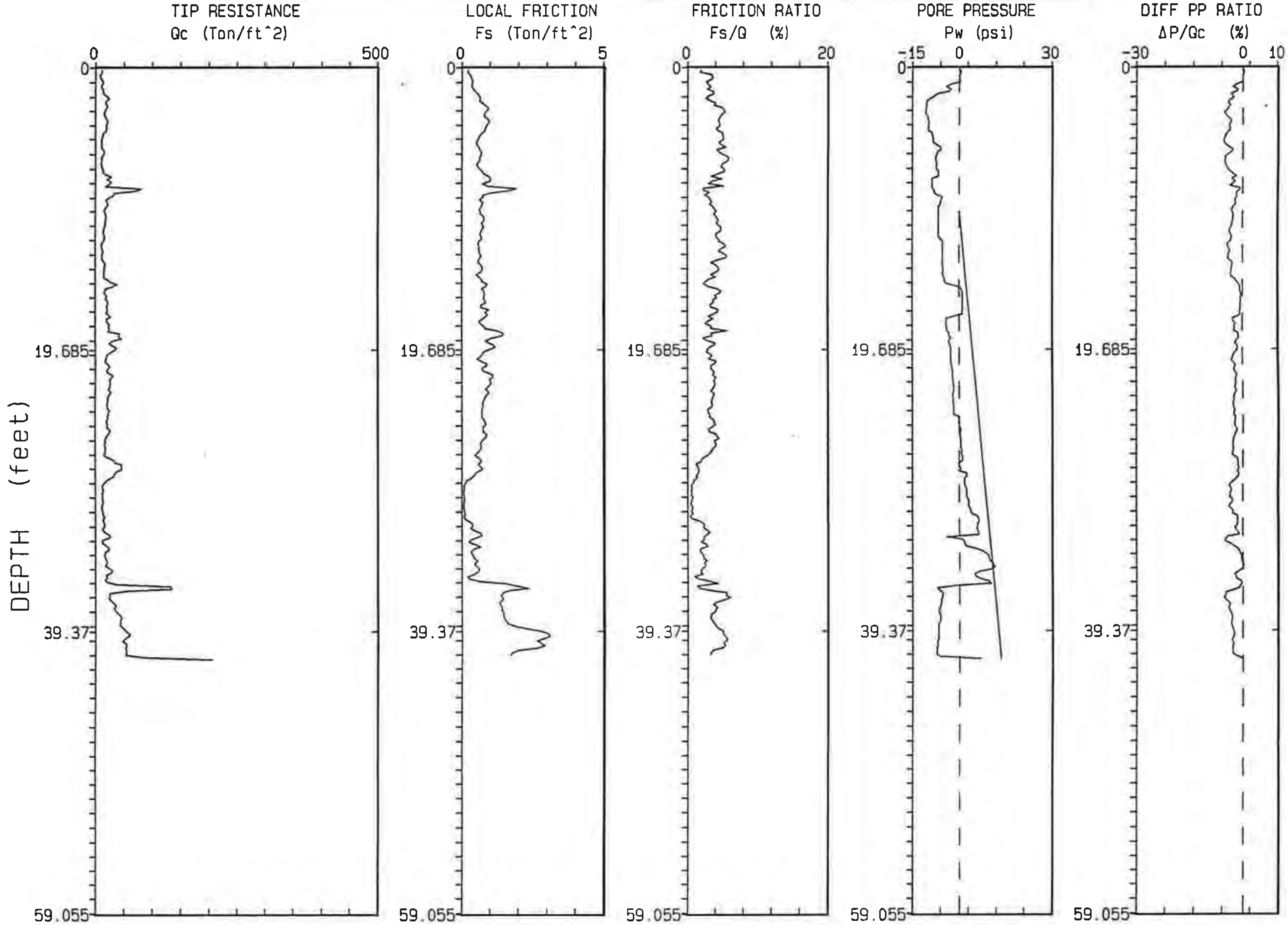
Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

WOODWARD-CLYDE CONSULTANTS

CPT-17

Operator:	J. Oldham	CPT Date:	3/30/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 41.34 ft

FIG. A-4-17

WOODWARD-CLYDE CONSULTANTS

CPT-17

Operator:	J. Oldham	CPT Date:	3/30/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	10.58	0.29	2.75	0.03	silty clay to clay	UNDFND	UNDFD	7	.6
0.60	2	14.35	0.47	3.25	0.09	silty clay to clay	UNDFND	UNDFD	9	.8
0.95	3	19.16	0.78	4.07	0.15	silty clay to clay	UNDFND	UNDFD	12	1.1
1.25	4	18.90	0.87	4.63	0.22	clay	UNDFND	UNDFD	18	1.0
1.55	5	14.60	0.69	4.73	0.28	clay	UNDFND	UNDFD	14	.8
1.85	6	12.67	0.61	4.81	0.33	clay	UNDFND	UNDFD	12	.7
2.15	7	11.10	0.60	5.42	0.39	clay	UNDFND	UNDFD	11	.6
2.45	8	22.05	0.87	3.95	0.45	silty clay to clay	UNDFND	UNDFD	14	1.2
2.75	9	43.12	1.18	2.75	0.51	sandy silt to clayey silt	UNDFND	UNDFD	17	2.5
3.05	10	18.67	0.67	3.60	0.57	silty clay to clay	UNDFND	UNDFD	12	1.0
3.35	11	17.65	0.74	4.19	0.61	clay	UNDFND	UNDFD	17	1.0
3.65	12	15.30	0.69	4.52	0.64	clay	UNDFND	UNDFD	15	.8
3.95	13	12.13	0.60	4.96	0.67	clay	UNDFND	UNDFD	12	.6
4.25	14	14.63	0.65	4.45	0.69	clay	UNDFND	UNDFD	14	.8
4.55	15	18.45	0.65	3.54	0.72	silty clay to clay	UNDFND	UNDFD	12	1.0
4.85	16	22.80	0.81	3.53	0.75	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
5.15	17	20.87	0.79	3.80	0.78	silty clay to clay	UNDFND	UNDFD	13	1.1
5.45	18	22.65	0.76	3.37	0.81	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
5.75	19	33.25	1.15	3.45	0.84	clayey silt to silty clay	UNDFND	UNDFD	16	1.8
6.05	20	30.10	0.98	3.25	0.86	clayey silt to silty clay	UNDFND	UNDFD	14	1.7
6.40	21	20.54	0.72	3.52	0.89	silty clay to clay	UNDFND	UNDFD	13	1.1
6.70	22	25.35	0.97	3.83	0.93	silty clay to clay	UNDFND	UNDFD	16	1.4
7.00	23	24.70	0.92	3.73	0.95	silty clay to clay	UNDFND	UNDFD	16	1.3
7.35	24	22.19	0.74	3.33	0.98	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
7.65	25	21.37	0.77	3.60	1.02	silty clay to clay	UNDFND	UNDFD	14	1.1
7.95	26	21.05	0.79	3.74	1.04	silty clay to clay	UNDFND	UNDFD	13	1.1
8.25	27	16.78	0.60	3.60	1.07	silty clay to clay	UNDFND	UNDFD	11	.8
8.55	28	38.02	0.65	1.71	1.10	sandy silt to clayey silt	UNDFND	UNDFD	15	2.1
8.85	29	26.70	0.35	1.31	1.13	sandy silt to clayey silt	UNDFND	UNDFD	10	1.4
9.15	30	12.62	0.07	0.59	1.16	sandy silt to clayey silt	UNDFND	UNDFD	5	.6
9.45	31	12.80	0.07	0.57	1.19	sandy silt to clayey silt	UNDFND	UNDFD	5	.6
9.75	32	15.02	0.21	1.43	1.21	sandy silt to clayey silt	UNDFND	UNDFD	6	.7
10.05	33	18.38	0.49	2.67	1.24	clayey silt to silty clay	UNDFND	UNDFD	9	.9
10.35	34	18.55	0.42	2.24	1.27	clayey silt to silty clay	UNDFND	UNDFD	9	.9
10.65	35	19.83	0.49	2.49	1.30	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
10.95	36	22.60	0.45	2.00	1.33	sandy silt to clayey silt	UNDFND	UNDFD	9	1.2
11.25	37	68.15	1.74	2.56	1.36	sandy silt to clayey silt	UNDFND	UNDFD	26	3.8
11.55	38	31.18	1.41	4.51	1.38	silty clay to clay	UNDFND	UNDFD	20	1.7

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-17

CPT-17

Operator:	J. Oldham	CPT Date:	3/30/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	42.95	1.54	3.58	1.41	clayey silt to silty clay	UNDFND	UNDFD	21	2.3
12.15	40	53.22	2.67	5.01	1.44	silty clay to clay	UNDFND	UNDFD	34	2.9
12.45	41	52.60	2.47	4.69	1.47	silty clay to clay	UNDFND	UNDFD	34	2.9

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

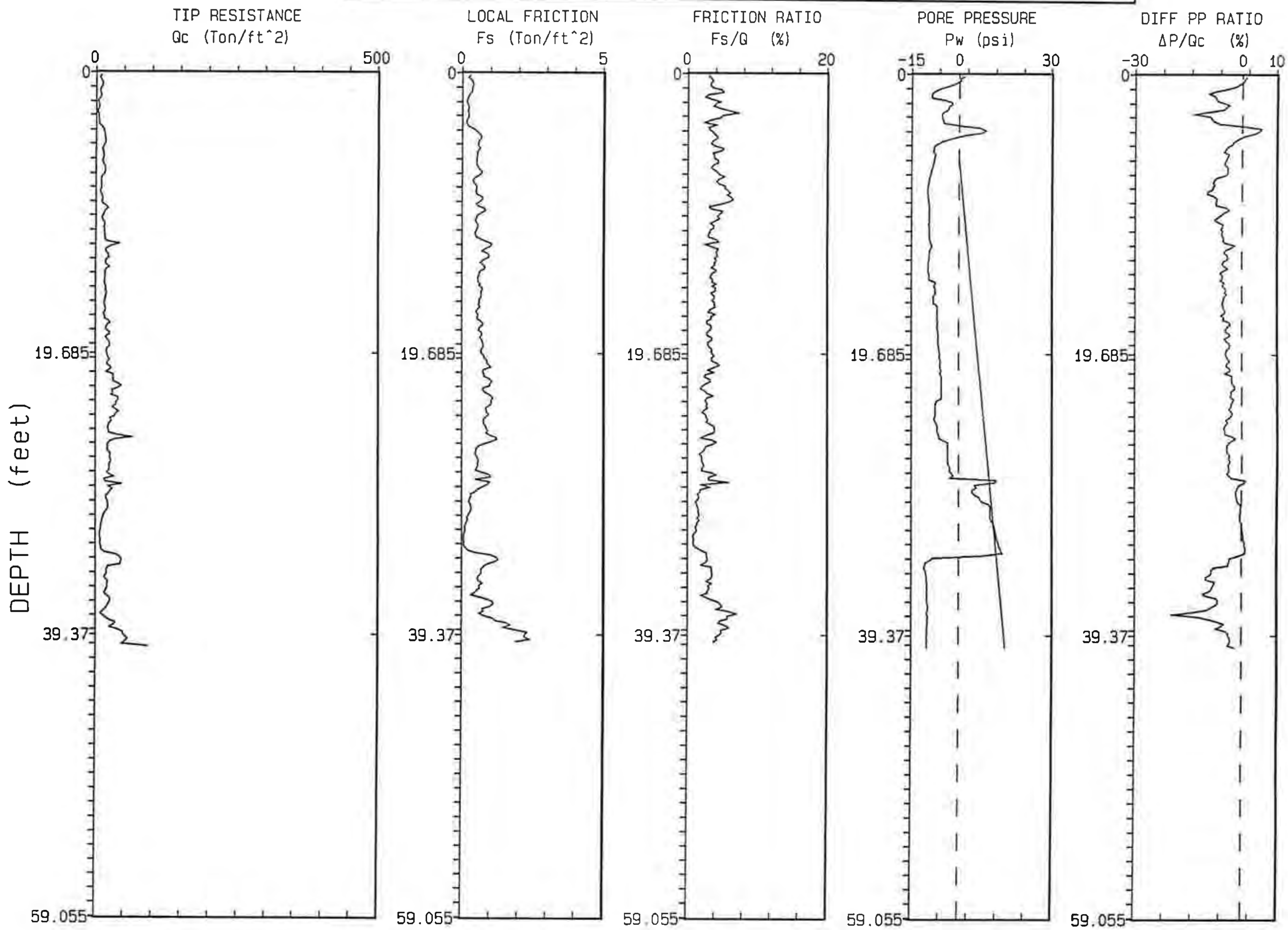
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-17

WOODWARD-CLYDE CONSULTANTS

CPT-18

Operator: J. Oldham		CPT Date:	3/29/95
Page: 1/1		Location:	Baldwin
Cone Used: 243		Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 40.19 ft

FIG. A-4-18

WOODWARD-CLYDE CONSULTANTS

CPT-18

Operator:	J. Oldham	CPT Date:	3/29/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	9.27	0.31	3.34	0.03	clay	UNDFND	UNDFD	9	.5
0.60	2	6.35	0.24	3.78	0.09	clay	UNDFND	UNDFD	6	.3
0.95	3	4.21	0.20	4.77	0.15	clay	UNDFND	UNDFD	4	.2
1.25	4	8.40	0.27	3.24	0.22	clay	UNDFND	UNDFD	8	.4
1.55	5	15.67	0.60	3.85	0.28	silty clay to clay	UNDFND	UNDFD	10	.9
1.85	6	12.75	0.54	4.23	0.33	clay	UNDFND	UNDFD	12	.7
2.15	7	14.83	0.59	3.96	0.39	silty clay to clay	UNDFND	UNDFD	9	.8
2.45	8	9.47	0.46	4.88	0.42	clay	UNDFND	UNDFD	9	.5
2.75	9	9.73	0.59	6.07	0.45	clay	UNDFND	UNDFD	9	.5
3.05	10	15.53	0.64	4.13	0.48	clay	UNDFND	UNDFD	15	.8
3.35	11	13.72	0.51	3.72	0.51	silty clay to clay	UNDFND	UNDFD	9	.7
3.65	12	20.60	0.66	3.20	0.54	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
3.95	13	21.90	0.88	4.02	0.56	silty clay to clay	UNDFND	UNDFD	14	1.2
4.25	14	18.65	0.71	3.83	0.59	silty clay to clay	UNDFND	UNDFD	12	1.0
4.55	15	16.40	0.58	3.56	0.62	silty clay to clay	UNDFND	UNDFD	10	.9
4.85	16	17.72	0.66	3.74	0.65	silty clay to clay	UNDFND	UNDFD	11	.9
5.15	17	15.78	0.57	3.61	0.68	silty clay to clay	UNDFND	UNDFD	10	.8
5.45	18	19.97	0.63	3.15	0.71	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
5.75	19	21.68	0.67	3.08	0.73	clayey silt to silty clay	UNDFND	UNDFD	10	1.2
6.05	20	21.38	0.72	3.37	0.76	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
6.40	21	22.94	0.85	3.70	0.79	silty clay to clay	UNDFND	UNDFD	15	1.2
6.70	22	34.80	0.92	2.65	0.82	sandy silt to clayey silt	UNDFND	UNDFD	13	1.9
7.00	23	34.52	0.91	2.63	0.85	sandy silt to clayey silt	UNDFND	UNDFD	13	1.9
7.35	24	35.40	0.92	2.59	0.88	sandy silt to clayey silt	UNDFND	UNDFD	14	1.9
7.65	25	24.05	0.81	3.38	0.91	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
7.95	26	34.65	1.01	2.91	0.94	clayey silt to silty clay	UNDFND	UNDFD	17	1.9
8.25	27	23.58	0.51	2.16	0.97	sandy silt to clayey silt	UNDFND	UNDFD	9	1.2
8.55	28	24.33	0.57	2.35	1.00	sandy silt to clayey silt	UNDFND	UNDFD	9	1.3
8.85	29	26.50	0.85	3.20	1.03	clayey silt to silty clay	UNDFND	UNDFD	13	1.4
9.15	30	22.62	0.37	1.61	1.05	sandy silt to clayey silt	UNDFND	UNDFD	9	1.2
9.45	31	19.10	0.28	1.48	1.08	sandy silt to clayey silt	UNDFND	UNDFD	7	1.0
9.75	32	10.60	0.15	1.40	1.11	clayey silt to silty clay	UNDFND	UNDFD	5	.5
10.05	33	8.17	0.08	0.92	1.14	clayey silt to silty clay	UNDFND	UNDFD	4	.3
10.35	34	20.77	0.51	2.47	1.17	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
10.65	35	32.37	0.89	2.76	1.20	sandy silt to clayey silt	UNDFND	UNDFD	12	1.7
10.95	36	19.08	0.62	3.24	1.22	clayey silt to silty clay	UNDFND	UNDFD	9	.9
11.25	37	19.92	0.58	2.91	1.25	clayey silt to silty clay	UNDFND	UNDFD	10	1.0
11.55	38	17.67	0.88	4.99	1.28	clay	UNDFND	UNDFD	17	.9

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-18

CPT-18

Operator:	J. Oldham	CPT Date:	3/29/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	24.92	1.30	5.22	1.31	clay	UNDFND	UNDFD	24	1.3
12.15	40	49.58	2.16	4.35	1.34	silty clay to clay	UNDFND	UNDFD	32	2.7

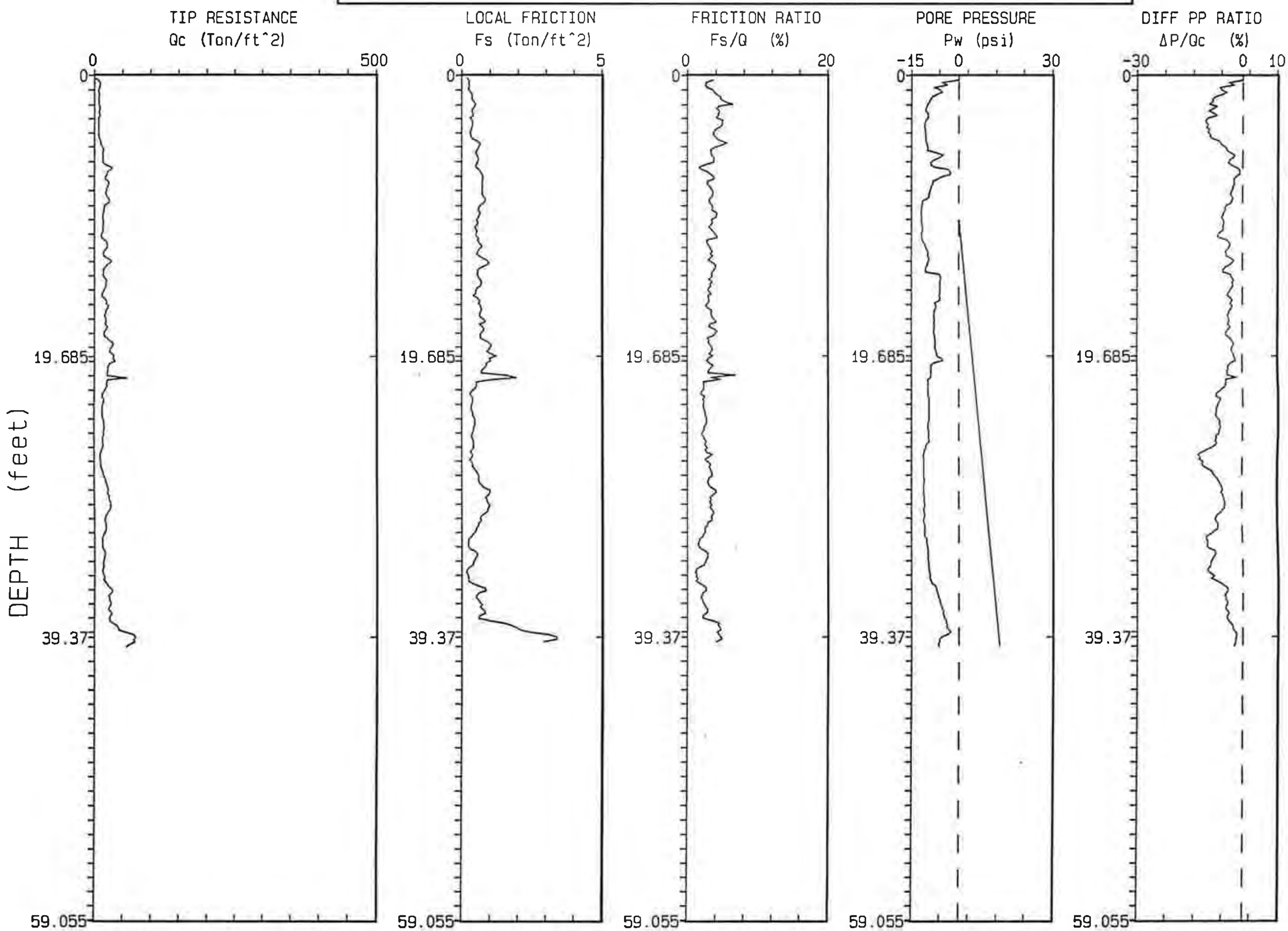
Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

WOODWARD-CLYDE CONSULTANTS

CPT-19

Operator:	J. Oldham	CPT Date:	3/30/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 40.03 ft

FIG. A-4-19

CPT-19

Operator:	J. Oldham	CPT Date:	3/30/95
Page:	1/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	6.97	0.24	3.41	0.03	clay	UNDFND	UNDFD	7	.4
0.60	2	7.88	0.38	4.81	0.09	clay	UNDFND	UNDFD	8	.4
0.95	3	8.44	0.37	4.40	0.15	clay	UNDFND	UNDFD	8	.4
1.25	4	7.80	0.33	4.28	0.22	clay	UNDFND	UNDFD	7	.4
1.55	5	11.30	0.51	4.47	0.28	clay	UNDFND	UNDFD	11	.6
1.85	6	15.28	0.54	3.52	0.33	silty clay to clay	UNDFND	UNDFD	10	.8
2.15	7	24.22	0.62	2.57	0.39	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
2.45	8	22.50	0.73	3.25	0.45	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
2.75	9	22.72	0.76	3.33	0.51	clayey silt to silty clay	UNDFND	UNDFD	11	1.3
3.05	10	15.72	0.59	3.79	0.57	silty clay to clay	UNDFND	UNDFD	10	.8
3.35	11	15.02	0.52	3.47	0.61	silty clay to clay	UNDFND	UNDFD	10	.8
3.65	12	18.67	0.61	3.26	0.64	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
3.95	13	20.52	0.67	3.25	0.67	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
4.25	14	18.97	0.71	3.72	0.69	silty clay to clay	UNDFND	UNDFD	12	1.0
4.55	15	19.37	0.63	3.26	0.72	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
4.85	16	17.38	0.53	3.06	0.75	clayey silt to silty clay	UNDFND	UNDFD	8	.9
5.15	17	20.95	0.67	3.18	0.78	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
5.45	18	20.40	0.75	3.70	0.81	silty clay to clay	UNDFND	UNDFD	13	1.1
5.75	19	25.08	0.81	3.22	0.84	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
6.05	20	30.43	1.01	3.31	0.86	clayey silt to silty clay	UNDFND	UNDFD	15	1.7
6.40	21	25.74	0.93	3.59	0.89	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
6.70	22	27.43	0.83	3.01	0.93	clayey silt to silty clay	UNDFND	UNDFD	13	1.5
7.00	23	15.58	0.34	2.18	0.95	clayey silt to silty clay	UNDFND	UNDFD	7	.8
7.35	24	14.99	0.38	2.54	0.98	clayey silt to silty clay	UNDFND	UNDFD	7	.7
7.65	25	17.38	0.41	2.35	1.02	clayey silt to silty clay	UNDFND	UNDFD	8	.9
7.95	26	15.38	0.39	2.53	1.04	clayey silt to silty clay	UNDFND	UNDFD	7	.8
8.25	27	11.37	0.33	2.87	1.07	silty clay to clay	UNDFND	UNDFD	7	.5
8.55	28	14.43	0.48	3.32	1.10	silty clay to clay	UNDFND	UNDFD	9	.7
8.85	29	22.05	0.71	3.24	1.13	clayey silt to silty clay	UNDFND	UNDFD	11	1.1
9.15	30	26.38	0.91	3.47	1.16	clayey silt to silty clay	UNDFND	UNDFD	13	1.4
9.45	31	23.65	0.82	3.45	1.19	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
9.75	32	19.73	0.55	2.79	1.21	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
10.05	33	14.62	0.27	1.85	1.24	clayey silt to silty clay	UNDFND	UNDFD	7	.7
10.35	34	17.18	0.45	2.61	1.27	clayey silt to silty clay	UNDFND	UNDFD	8	.8
10.65	35	15.32	0.26	1.72	1.30	clayey silt to silty clay	UNDFND	UNDFD	7	.7
10.95	36	21.60	0.41	1.92	1.33	sandy silt to clayey silt	UNDFND	UNDFD	8	1.1
11.25	37	27.83	0.61	2.19	1.36	sandy silt to clayey silt	UNDFND	UNDFD	11	1.5
11.55	38	27.73	0.72	2.59	1.38	sandy silt to clayey silt	UNDFND	UNDFD	11	1.4

Dr - All sands (Jamiolkowski et al. 1985)   PHI - Robertson and Campanella 1983   Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-19

CPT-19

Operator:	J. Oldham	CPT Date:	3/30/95
Page:	2/2	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
11.85	39	35.52	1.46	4.10	1.41	silty clay to clay	UNDFND	UNDFD	23	1.9
12.15	40	66.70	2.52	3.78	1.44	clayey silt to silty clay	UNDFND	UNDFD	32	3.7

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

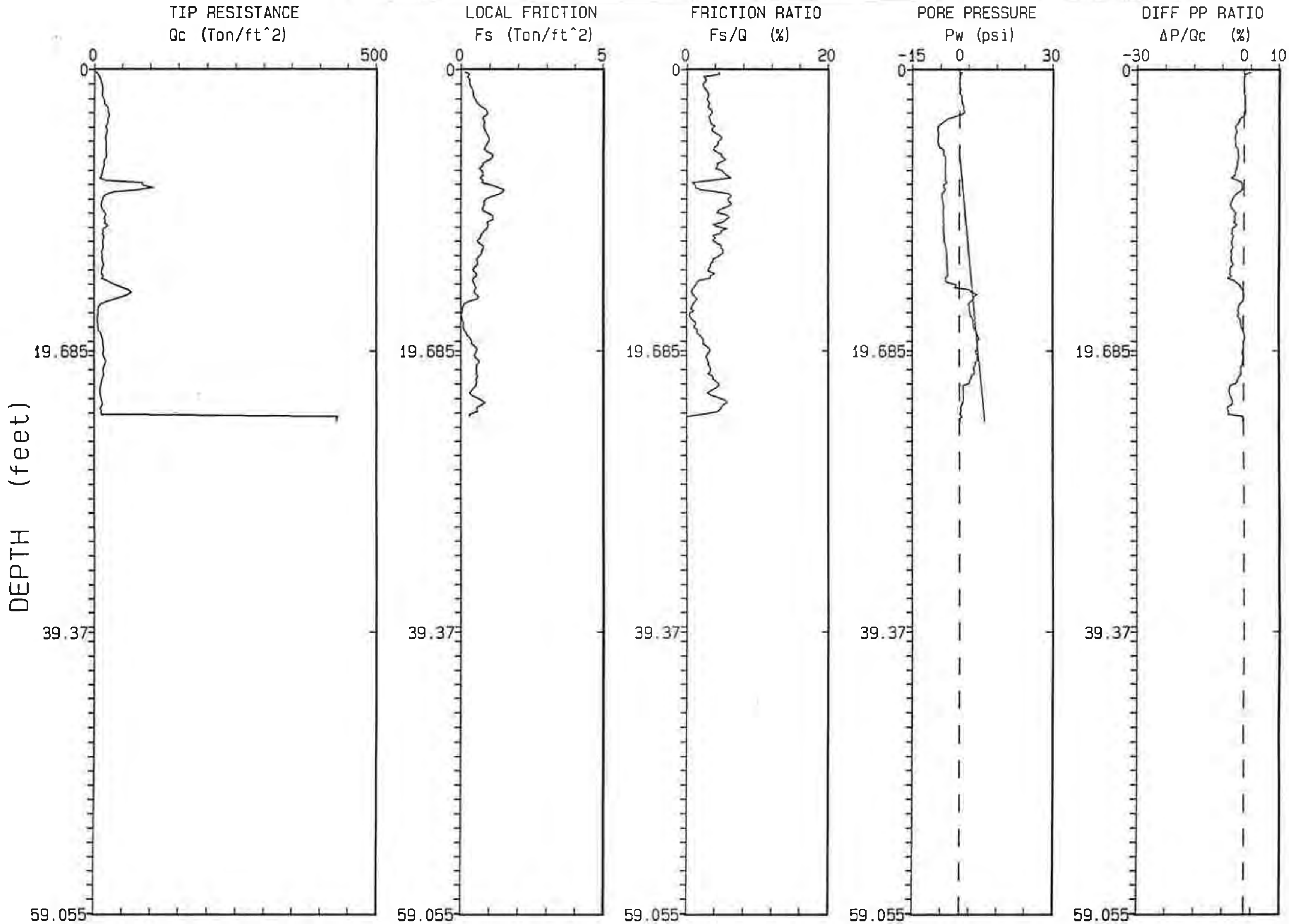
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-19

WOODWARD-CLYDE CONSULTANTS

CPT-20

Operator:	J. Oldham	**CPT Date:**	3/30/95
Page:	1/1	**Location:**	Baldwin
Cone Used:	243	**Job Number:**	5E08560



Depth Increment : .05 m

Max Depth : 24.61 ft

FIG. A-4-20

WOODWARD-CLYDE CONSULTANTS

CPT-20

Operator:	J. Oldham	CPT Date:	3/30/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	8.68	0.25	2.82	0.03	silty clay to clay	UNDFND	UNDFD	6	.5
0.60	2	14.27	0.40	2.81	0.09	clayey silt to silty clay	UNDFND	UNDFD	7	.8
0.95	3	22.29	0.73	3.28	0.15	clayey silt to silty clay	UNDFND	UNDFD	11	1.3
1.25	4	23.03	0.79	3.44	0.22	clayey silt to silty clay	UNDFND	UNDFD	11	1.3
1.55	5	21.10	0.92	4.38	0.28	clay	UNDFND	UNDFD	20	1.2
1.85	6	21.30	0.94	4.41	0.33	clay	UNDFND	UNDFD	20	1.2
2.15	7	16.73	0.79	4.74	0.39	clay	UNDFND	UNDFD	16	.9
2.45	8	38.47	0.79	2.06	0.42	sandy silt to clayey silt	UNDFND	UNDFD	15	2.2
2.75	9	44.78	1.26	2.80	0.45	sandy silt to clayey silt	UNDFND	UNDFD	17	2.6
3.05	10	15.35	0.81	5.26	0.48	clay	UNDFND	UNDFD	15	.8
3.35	11	20.52	1.03	5.00	0.51	clay	UNDFND	UNDFD	20	1.1
3.65	12	16.18	0.72	4.47	0.54	clay	UNDFND	UNDFD	16	.9
3.95	13	14.88	0.72	4.84	0.56	clay	UNDFND	UNDFD	14	.8
4.25	14	14.83	0.54	3.66	0.59	silty clay to clay	UNDFND	UNDFD	9	.8
4.55	15	18.28	0.47	2.55	0.62	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
4.85	16	54.15	0.52	0.96	0.65	silty sand to sandy silt	50-60	40-42	17	UNDEFINED
5.15	17	15.15	0.18	1.20	0.68	sandy silt to clayey silt	UNDFND	UNDFD	6	.8
5.45	18	6.22	0.05	0.79	0.71	sensitive fine grained	UNDFND	UNDFD	3	.3
5.75	19	10.88	0.20	1.80	0.73	clayey silt to silty clay	UNDFND	UNDFD	5	.5
6.05	20	16.12	0.47	2.90	0.76	clayey silt to silty clay	UNDFND	UNDFD	8	.8
6.40	21	17.64	0.55	3.09	0.79	clayey silt to silty clay	UNDFND	UNDFD	8	.9
6.70	22	14.45	0.53	3.70	0.82	silty clay to clay	UNDFND	UNDFD	9	.7
7.00	23	10.83	0.43	3.94	0.85	clay	UNDFND	UNDFD	10	.5
7.35	24	12.87	0.61	4.70	0.88	clay	UNDFND	UNDFD	12	.6

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

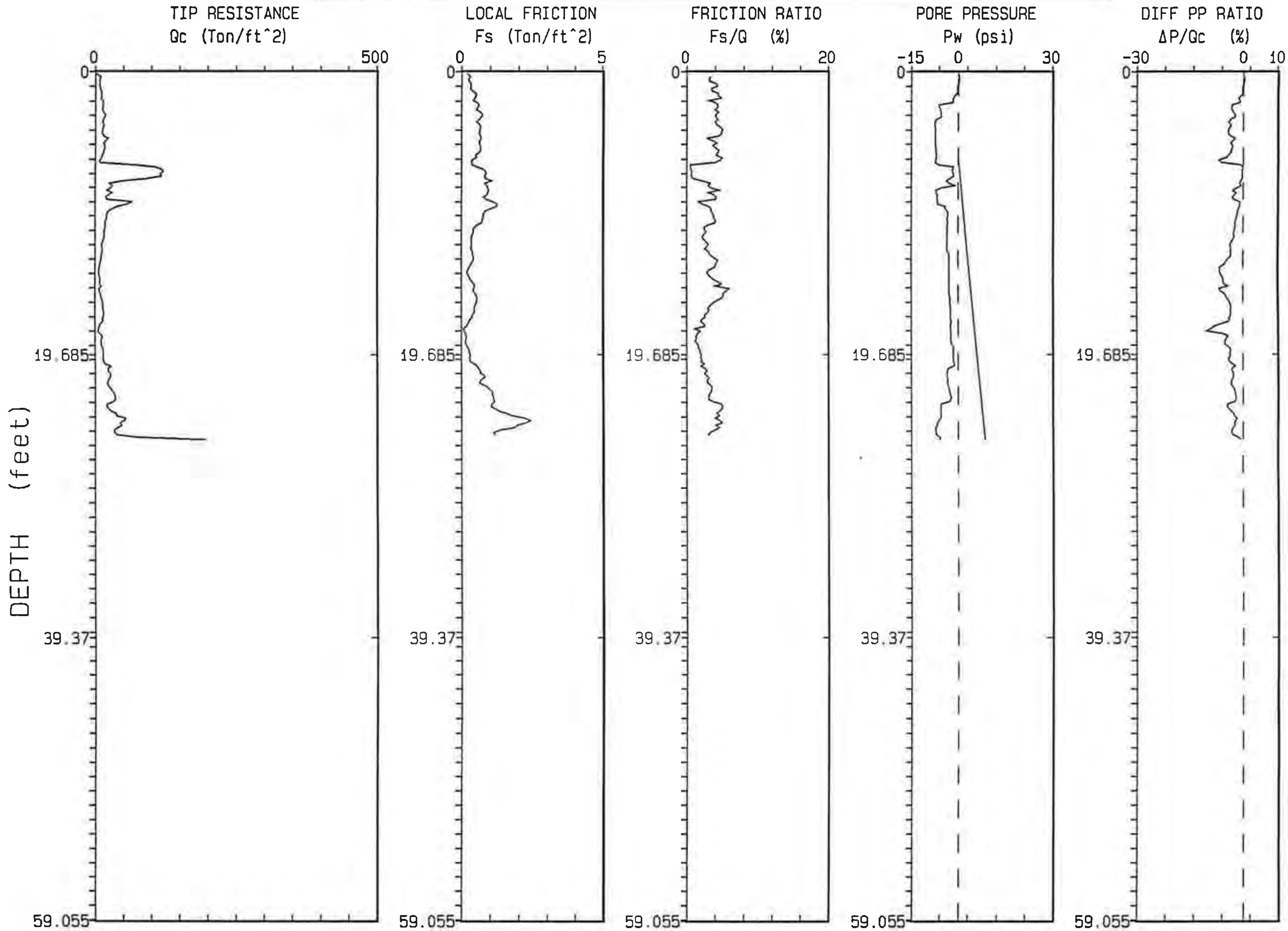
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-20

WOODWARD-CLYDE CONSULTANTS

CPT-21

Operator:	J. Oldham	CPT Date:	3/30/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 25.59 ft

FIG. A-4-21

WOODWARD-CLYDE CONSULTANTS

CPT-21

Operator:	J. Oldham	CPT Date:	3/30/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	6.72	0.28	4.13	0.03	clay	UNDFND	UNDFD	6	.3
0.60	2	10.83	0.43	3.93	0.09	clay	UNDFND	UNDFD	10	.6
0.95	3	14.66	0.61	4.18	0.15	clay	UNDFND	UNDFD	14	.8
1.25	4	13.63	0.62	4.53	0.22	clay	UNDFND	UNDFD	13	.7
1.55	5	16.78	0.65	3.84	0.28	silty clay to clay	UNDFND	UNDFD	11	.9
1.85	6	12.48	0.55	4.41	0.33	clay	UNDFND	UNDFD	12	.7
2.15	7	90.07	0.62	0.69	0.39	sand to silty sand	70-80	44-46	22	UNDEFINED
2.45	8	56.38	0.89	1.57	0.42	silty sand to sandy silt	60-70	42-44	18	UNDEFINED
2.75	9	30.02	0.91	3.04	0.45	clayey silt to silty clay	UNDFND	UNDFD	14	1.7
3.05	10	31.53	0.97	3.07	0.48	clayey silt to silty clay	UNDFND	UNDFD	15	1.8
3.35	11	17.72	0.59	3.30	0.51	clayey silt to silty clay	UNDFND	UNDFD	8	1.0
3.65	12	14.55	0.37	2.56	0.54	clayey silt to silty clay	UNDFND	UNDFD	7	.8
3.95	13	11.88	0.38	3.17	0.56	silty clay to clay	UNDFND	UNDFD	8	.6
4.25	14	7.63	0.29	3.80	0.59	clay	UNDFND	UNDFD	7	.4
4.55	15	8.77	0.35	3.96	0.62	clay	UNDFND	UNDFD	8	.4
4.85	16	9.68	0.49	5.06	0.65	clay	UNDFND	UNDFD	9	.5
5.15	17	14.50	0.45	3.12	0.68	silty clay to clay	UNDFND	UNDFD	9	.7
5.45	18	10.22	0.23	2.20	0.71	clayey silt to silty clay	UNDFND	UNDFD	5	.5
5.75	19	10.07	0.14	1.43	0.73	clayey silt to silty clay	UNDFND	UNDFD	5	.5
6.05	20	14.02	0.26	1.83	0.76	clayey silt to silty clay	UNDFND	UNDFD	7	.7
6.40	21	20.79	0.50	2.42	0.79	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
6.70	22	24.25	0.76	3.13	0.82	clayey silt to silty clay	UNDFND	UNDFD	12	1.3
7.00	23	32.77	1.09	3.32	0.85	clayey silt to silty clay	UNDFND	UNDFD	16	1.8
7.35	24	32.07	1.45	4.52	0.88	silty clay to clay	UNDFND	UNDFD	20	1.8
7.65	25	41.78	1.82	4.36	0.91	silty clay to clay	UNDFND	UNDFD	27	2.3

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

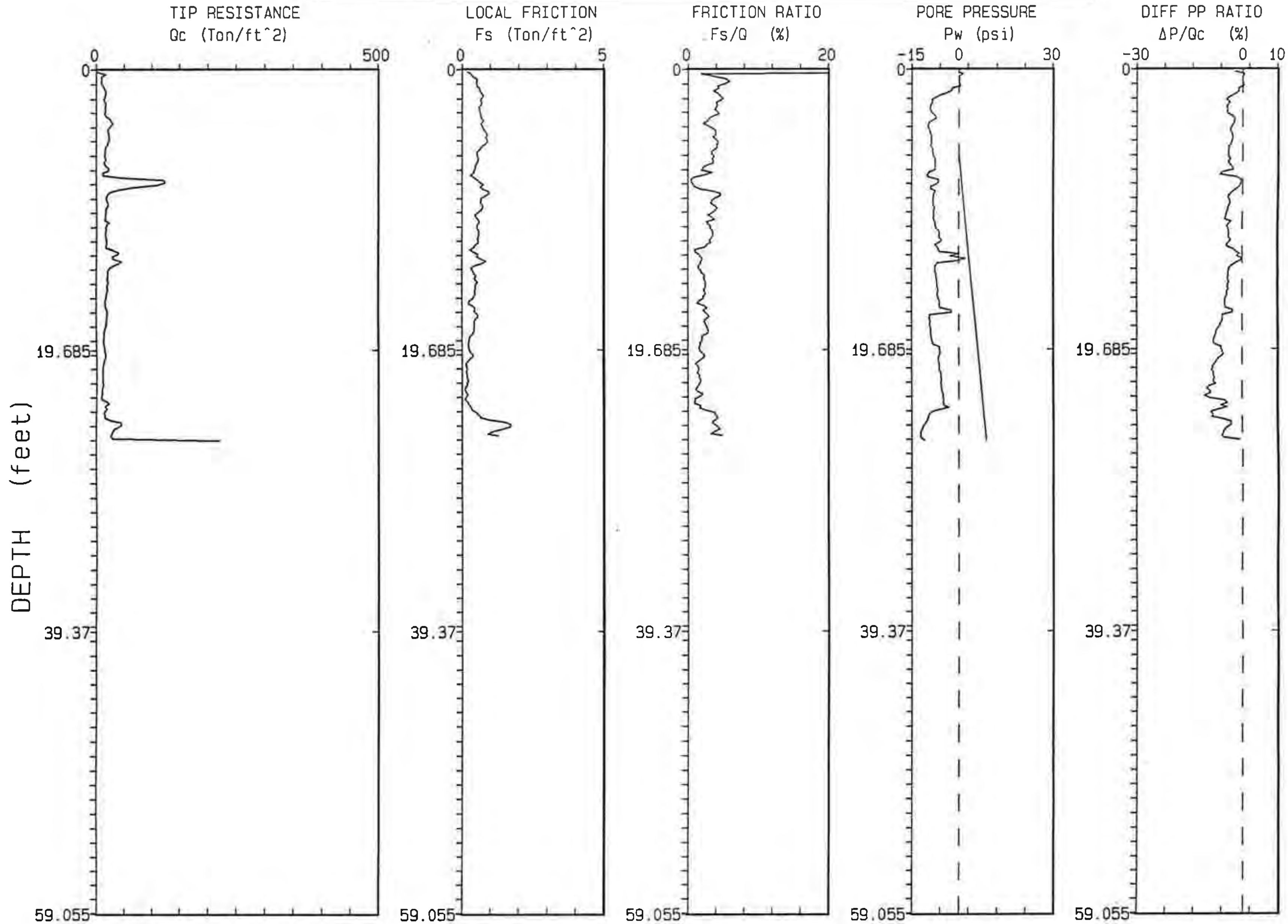
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-21

WOODWARD-CLYDE CONSULTANTS

CPT-22

Operator:	J. Oldham	CPT Date:	3/31/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560



Depth Increment : .05 m

Max Depth : 26.08 ft

FIG. A-4-22

WOODWARD-CLYDE CONSULTANTS

CPT-22

Operator:	J. Oldham	CPT Date:	3/31/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	9.10	0.40	4.43	0.03	clay	UNDFND	UNDFD	9	.5
0.60	2	15.17	0.66	4.33	0.09	clay	UNDFND	UNDFD	15	.8
0.95	3	15.43	0.65	4.19	0.15	clay	UNDFND	UNDFD	15	.8
1.25	4	24.57	0.71	2.90	0.22	clayey silt to silty clay	UNDFND	UNDFD	12	1.4
1.55	5	21.73	0.86	3.96	0.28	silty clay to clay	UNDFND	UNDFD	14	1.2
1.85	6	16.27	0.62	3.83	0.33	silty clay to clay	UNDFND	UNDFD	10	.9
2.15	7	17.92	0.50	2.79	0.39	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
2.45	8	71.20	0.51	0.72	0.42	sand to silty sand	60-70	42-44	17	UNDEFINED
2.75	9	31.97	0.80	2.50	0.45	sandy silt to clayey silt	UNDFND	UNDFD	12	1.8
3.05	10	18.17	0.66	3.66	0.48	silty clay to clay	UNDFND	UNDFD	12	1.0
3.35	11	17.28	0.54	3.14	0.51	clayey silt to silty clay	UNDFND	UNDFD	8	.9
3.65	12	16.95	0.57	3.37	0.54	silty clay to clay	UNDFND	UNDFD	11	.9
3.95	13	26.43	0.46	1.72	0.56	sandy silt to clayey silt	UNDFND	UNDFD	10	1.5
4.25	14	32.40	0.58	1.79	0.59	sandy silt to clayey silt	UNDFND	UNDFD	12	1.8
4.55	15	20.38	0.46	2.24	0.62	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
4.85	16	18.98	0.46	2.40	0.65	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
5.15	17	16.88	0.35	2.09	0.68	clayey silt to silty clay	UNDFND	UNDFD	8	.9
5.45	18	18.38	0.49	2.66	0.71	clayey silt to silty clay	UNDFND	UNDFD	9	1.0
5.75	19	14.37	0.37	2.55	0.73	clayey silt to silty clay	UNDFND	UNDFD	7	.7
6.05	20	13.97	0.25	1.79	0.76	clayey silt to silty clay	UNDFND	UNDFD	7	.7
6.40	21	13.26	0.24	1.84	0.79	clayey silt to silty clay	UNDFND	UNDFD	6	.7
6.70	22	11.20	0.18	1.60	0.82	clayey silt to silty clay	UNDFND	UNDFD	5	.5
7.00	23	10.03	0.16	1.55	0.85	clayey silt to silty clay	UNDFND	UNDFD	5	.5
7.35	24	16.29	0.29	1.77	0.88	clayey silt to silty clay	UNDFND	UNDFD	8	.8
7.65	25	30.65	1.20	3.91	0.91	silty clay to clay	UNDFND	UNDFD	20	1.7
7.95	26	60.65	0.78	1.29	0.94	silty sand to sandy silt	50-60	38-40	19	UNDEFINED

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

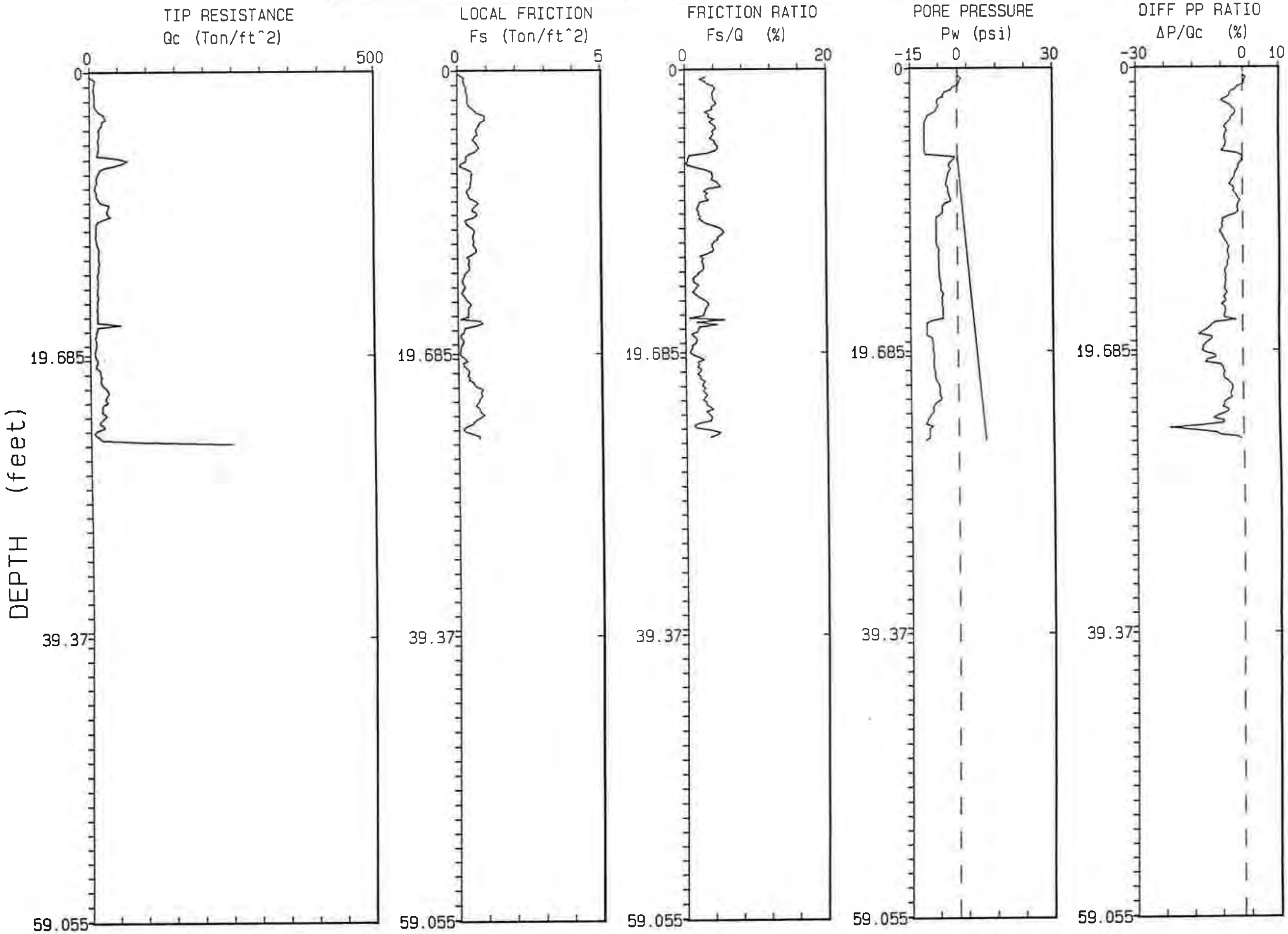
**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-22

WOODWARD-CLYDE CONSULTANTS

CPT-23

Operator:	J. Oldham	**CPT Date:**	3/31/95
Page:	1/1	**Location:**	Baldwin
Cone Used:	243	**Job Number:**	5E08560



Depth Increment : .05 m

Max Depth : 25.92 ft

FIG. A-4-23

WOODWARD-CLYDE CONSULTANTS

CPT-23

Operator:	J. Oldham	CPT Date:	3/31/95
Page:	1/1	Location:	Baldwin
Cone Used:	243	Job Number:	5E08560

DEPTH (meters)	(feet)	Qc (avg) (tsf)	Fs (avg) (tsf)	Rf (avg) (%)	SIGV' (tsf)	SOIL BEHAVIOUR TYPE	Eq - Dr (%)	PHI deg.	SPT N	Su tsf
0.30	1	5.55	0.17	3.14	0.03	clay	UNDFND	UNDFD	5	.3
0.60	2	8.07	0.33	4.05	0.09	clay	UNDFND	UNDFD	8	.4
0.95	3	15.29	0.55	3.61	0.15	silty clay to clay	UNDFND	UNDFD	10	.8
1.25	4	20.70	0.79	3.84	0.22	silty clay to clay	UNDFND	UNDFD	13	1.2
1.55	5	16.08	0.64	3.96	0.28	silty clay to clay	UNDFND	UNDFD	10	.9
1.85	6	29.07	0.51	1.76	0.33	sandy silt to clayey silt	UNDFND	UNDFD	11	1.6
2.15	7	29.58	0.29	0.97	0.39	silty sand to sandy silt	40-50	38-40	9	UNDEFINED
2.45	8	10.93	0.47	4.25	0.42	clay	UNDFND	UNDFD	10	.6
2.75	9	14.08	0.43	3.06	0.45	silty clay to clay	UNDFND	UNDFD	9	.7
3.05	10	33.20	0.63	1.89	0.48	sandy silt to clayey silt	UNDFND	UNDFD	13	1.9
3.35	11	14.17	0.41	2.91	0.51	clayey silt to silty clay	UNDFND	UNDFD	7	.7
3.65	12	11.50	0.56	4.84	0.54	clay	UNDFND	UNDFD	11	.6
3.95	13	15.62	0.54	3.45	0.56	silty clay to clay	UNDFND	UNDFD	10	.8
4.25	14	15.63	0.39	2.49	0.59	clayey silt to silty clay	UNDFND	UNDFD	7	.8
4.55	15	13.92	0.21	1.50	0.62	clayey silt to silty clay	UNDFND	UNDFD	7	.7
4.85	16	13.77	0.22	1.61	0.65	clayey silt to silty clay	UNDFND	UNDFD	7	.7
5.15	17	13.55	0.40	2.92	0.68	silty clay to clay	UNDFND	UNDFD	9	.7
5.45	18	20.27	0.49	2.42	0.71	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
5.75	19	10.68	0.16	1.49	0.73	clayey silt to silty clay	UNDFND	UNDFD	5	.5
6.05	20	9.33	0.09	0.97	0.76	clayey silt to silty clay	UNDFND	UNDFD	4	.4
6.40	21	14.03	0.28	1.98	0.79	clayey silt to silty clay	UNDFND	UNDFD	7	.7
6.70	22	21.33	0.47	2.20	0.82	clayey silt to silty clay	UNDFND	UNDFD	10	1.1
7.00	23	29.63	0.78	2.64	0.85	sandy silt to clayey silt	UNDFND	UNDFD	11	1.6
7.35	24	22.91	0.74	3.21	0.88	clayey silt to silty clay	UNDFND	UNDFD	11	1.2
7.65	25	16.18	0.38	2.32	0.91	clayey silt to silty clay	UNDFND	UNDFD	8	.8

Dr - All sands (Jamiolkowski et al. 1985) PHI - Robertson and Campanella 1983 Su: Nk= 17

**** Note: For interpretation purposes the PLOTTED CPT PROFILE should be used with the TABULATED OUTPUT from CPTINTR1 (v 3.04) ****

FIG. A-4-23

APPENDIX B

LABORATORY TESTING

APPENDIX B
LABORATORY TESTING

Laboratory tests were performed to characterize the index and engineering properties of the subsurface soils. Index tests consisted of visual classification, water content, dry unit weight, and liquid and plastic limits. Engineering property tests consisted of a direct shear test, unconfined compression tests, unconsolidated-undrained (UU) triaxial compression tests, and consolidated-undrained (CIU) triaxial compression tests. The direct shear test was extended to determine the residual strength.

Results of the laboratory tests are summarized and given in Tables B-1 through B-3 in this appendix, and appear on the detailed boring logs. Plots of the grain size distributions are shown in Figures B-1 through B-6. Compaction curves are included as Figures B-7 through B-10. Consolidated drained triaxial test results for drained peak strength are given in Figures B-11 through B-14. Direct shear test results are shown in Figures B-15 and B-16.

TABLE B-1
SUMMARY OF LABORATORY TEST DATA
Illinois Power/Baldwin Power Station 5E08560

BORING NO.	DEPTH (ft)	USC Group Symbol	Water Content (%)	Dry Density (pcf)	LL (%)	PL (%)	Unconf. Strength Qu(ksf)	Strn. (%)	(%) pass 200
B-01	5.0	CL	17				7.8	11.7	
B-01	10.0	CH	27		61	21			
B-01	15.0	CL	15				7.2	11.2	
B-01	20.0	CL	19						
B-01	35.0	CL	19						
B-01	40.0	CL	25						
B-01	45.0	CL	23		44	17			
B-01	50.0	CL	14						
B-01	55.0	CL	26						
B-01	60.0	CL	30						
B-01	65.0	CL	25						
B-01	70.0	CL	19						
B-01	75.0	CL	23						
B-02	5.0	CL	20		37	17			
B-02	10.0	CL	21		44	18			
B-02	15.0	CL	22		44	19			
B-02	20.0	CH	26		55	21			
B-02	24.5	SP	28						
B-02	29.5	CL	23						
B-02	34.5	CL	23						
B-02	39.5	CL	32		49	19			
B-02	44.5	CL	18		38	18			
B-02	49.5	CH	23		51	20			
B-02	54.5	CL	21		34	18			
B-02	59.5	CL	18		35	15			
B-02	64.5	CL	25		34	19			
B-02	69.5	CL	22						
B-03	0.0		24						
B-03	2.0		20						
B-03	4.0		18						
B-03	6.0		17						
B-03	8.0	CL	18		43	18			
B-03	10.0		18						
B-03	12.0	CL	18		37	18			
B-03	14.0	CL	20		44	18			
B-03	16.0	CL	17		46	21			
B-03	18.0	CL	23		47	21			
B-03	20.0	SM	18						
B-03	25.0		18						
B-03	30.0	CL	22						

TABLE B-1
SUMMARY OF LABORATORY TEST DATA
Illinois Power/Baldwin Power Station 5E08560

BORING NO.	DEPTH (ft)	USC Group Symbol	Water Content (%)	Dry Density (pcf)	LL (%)	PL (%)	Unconf. Strength Qu(ksf)	Strn. (%)	(%) pass 200
B-03	35.0	CH	25						
B-03	40.0	CL	20		44	18			
B-03	45.0	CH							
B-03	55.0	ML							
B-03	60.0	CH							
B-03	65.0	CH							
B-03	75.0	CH							
B-04	5.0	CL	20						
B-04	10.0	CL	17		43	18			
B-04	25.0	ML	27		50	20			
B-04	30.0	CL	20		42	20			
B-04	35.0	CL	16	111	42	20	2.7	15.0	
B-04	45.0	CL	23						
B-04	55.0	CH	24						
B-04	60.0		19						
B-04	65.0		12						
B-04	70.0	CH	19						
B-04	75.0	CH	27						
B-05	10.0		21						
B-05	20.0		17						
B-05	30.0		22						
B-05	35.0	CH							
B-05	50.0	CH	20						
B-05	60.0	CH							
B-05	65.0	CH							
B-05	70.0	CH	23						
B-05	75.0	CH							
B-06	5.0	CL							
B-06	10.0	CL	17	116			5.8	15.1	
B-06	15.0	CL	18		47	18			
B-06	20.0		17						
B-06	25.0		25						
B-06	30.0	CL							
B-06	35.0	CL	21	109			1.4	15.0	
B-06	40.0	CL	23						
B-06	50.0	CH	20	111			3.6	11.1	
B-06	55.0	CH							
B-06	60.0	CH							
B-06	65.0	CH	22						
B-06	70.0		16						

TABLE B-1
SUMMARY OF LABORATORY TEST DATA
Illinois Power/Baldwin Power Station 5E08560

BORING NO.	DEPTH (ft)	USC Group Symbol	Water Content (%)	Dry Density (pcf)	LL (%)	PL (%)	Unconf. Strength Qu(ksf)	Strn. (%)	(%) pass 200
B-06	75.0	CH							
B-07	5.0	CL							
B-07	10.0		18						
B-07	15.0	CL							
B-07	20.0	CL	21	116			8.1	13.5	
B-07	25.0	CL	15						
B-07	30.0	CL	17	117			7.3	14.9	
B-07	35.0		25						
B-07	40.0	CL	22	108			4.4	3.9	
B-07	45.0	CL							
B-07	50.0	CL	18						
B-07	55.0	CL							
B-07	65.0	CH	22						
B-07	70.0	CL							
B-07	75.0	CH							
B-07	80.0	CH	18						
B-08	5.0	CL	17				6.1	14.9	
B-08	10.0	CL	18				6.1	14.8	
B-08	15.0	CL	16						
B-08	20.0	CL	25		46	22			
B-08	25.0	CL	15						
B-08	30.0		16	111			6.8	11.1	
B-08	35.0	CL	19						
B-08	40.0		20	106			3.2	6.0	
B-08	45.0	SP	31						
B-08	50.0		20						
B-08	55.0	CL	19						
B-08	60.0	CL	23						
B-08	70.0	CL	21						
B-08	75.0		20						
B-08	80.0	CL	21						
B-09	5.0		22	104					
B-09	10.0	CH	22		50	20			
B-09	15.0		18	79					
B-09	25.0	CL	24						
B-09	30.0	CL	20						
B-09	35.0		20	110			3.7	13.8	
B-09	40.0	CL	23		34	18			
B-09	50.0	CL	17						
B-09	55.0	CL	23						

TABLE B-1
SUMMARY OF LABORATORY TEST DATA
Illinois Power/Baldwin Power Station 5E08560

BORING NO.	DEPTH (ft)	USC Group Symbol	Water Content (%)	Dry Density (pcf)	LL (%)	PL (%)	Unconf. Strength Qu(ksf)	Strn. (%)	(%) pass 200
B-09	60.0	CL	14						
B-09	70.0		25						
B-09	75.0	CL	16						
B-09	80.0	CL	11						
B-10	5.0	CL	23						
B-10	10.0	CL	15	114					
B-10	15.0	CL	15		42	18			
B-10	20.0	CL	11						
B-10	25.0	CL	24		43	18			
B-10	30.0	CL	19	107			5.8	11.6	
B-10	35.0	CL	22						
B-10	40.0	ML	26		32	24			
B-10	45.0	CL	24		32	18			
B-10	50.0	CL	25	97	40	18	1.9	11.3	
B-10	55.0	CH	19	107	57	15	6.3	15.5	
B-10	60.0	CL	27						
B-10	65.0	SM	14						
B-10	70.0	CH	24		52	28			
B-11A	4.0	CL	20		39	21			
B-11A	6.0		21						
B-11A	8.0	CL	25		47	21			
B-11A	10.0	CH	23		52	23			
B-11A	12.0		24						
B-11A	14.0		20						
B-11A	16.0		20						
B-11A	18.0	CL	20		45	19			
B-11A	20.0		21		47	18			
B-11A	25.0	CL	20		49	21			
B-11A	30.0	CL	21		29	17			
B-11A	35.0		13						
B-11A	40.0		26						
B-12	4.0		23						
B-12	8.0	CH	31		61	22			
B-12	14.0		18						
B-12	25.0	CL	20		46	23			
B-12	30.0	CL	22		47	24			
B-13	4.0		21						
B-13	6.0		23						
B-14	4.0		27						
B-14	6.0		24						

TABLE B-1
SUMMARY OF LABORATORY TEST DATA
Illinois Power/Baldwin Power Station 5E08560

BORING NO.	DEPTH (ft)	USC Group Symbol	Water Content (%)	Dry Density (pcf)	LL (%)	PL (%)	Unconf. Strength Qu(ksf)	Strn. (%)	(%) pass 200
B-15	5.0	CH	16						
B-15	10.0	CL	17						
B-15	20.0	CL	16	101			0.0	0.0	
B-15	25.0		20						
B-15	30.0		19						
B-15	35.0	CL	24						
B-15	45.0	CL	24						
B-15	50.0		24						
B-15	55.0		22						
B-15	60.0	CH	26						
B-15	65.0	CH	37						
B-15	70.0	CH	23						
B-15	75.0	CH							
B-15	80.0	CH							
P-02A	38.0	CH	28		59	26			
P-04	23.0	CL	16		29	16			
P-04	24.0	CH			73	37			

TABLE B-2

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING	SAMPLE	DEPTH	IDENTIFICATION TESTS								STRENGTH					REMARKS
NO.	NO.	(ft)	WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 um (%)	TOTAL UNIT WEIGHT (pcf)	TORVANE Su (tsf)	POCKET PENETR q u (tsf)	Type Test	PEAK DEVIATOR STRESS (psi)	AXIAL STRAIN @ PEAK STRESS (%)	
B-1	S-2	10-12								126.2						
B-1	S-2	11.9	26.6	61	21	40	CH				1.3	3.4				
B-1	S-9	45-47								119.8						
B-1	S-9	46.9	22.6	44	17	27	CL				0.8	0.9				
B-2	S-1	5-7								117.0						
B-2	S-1	6.9	19.6	37	17	20	CL				1.6	2.4				
B-2	S-2	10-12								127.9						
B-2	S-2	11.9	20.6	44	18	26	CL	92.9	34		0.9	1.9				
B-2	S-3	15-17								102.1						
B-2	S-3	16.9	21.7	44	19	25	CL				0.9	2.8				
B-2	S-4	20-22								114.7						
B-2	S-4	20.05	17.9								1.6	>4.5				
B-2	S-4	20.2					CH	95.0	34	128.7						
B-2	S-4	20.65	26.3	55	21	34	CH				0.8	1.5				
B-2	S-4	20.8	17.7													Bot. Ash
B-2	S-4	21.0								117.7						Bot. Ash
B-2	S-8	39.5-41.5								128.0						
B-2	S-8	41.4	32.4	49	19	30	CL				0.8	2.1				
B-2	S-9	44.5-46.5								122.4						
B-2	S-9	46.4	18.0	38	18	20	CL				1.6	2.9				
B-2	S-10	49.5-51.5								126.7						
B-2	S-10	51.4	22.9	51	20	31	CH				1.8	3.1				
B-2	S-11	54.5-56.5								126.3						
B-2	S-11	56.4	21.1	34	18	16	CL				0.7	1.9				
B-2	S-12	59.5-61.5								131.0						
B-2	S-12	61.4	17.9	35	15	20	CL				0.9	2.1				
B-2	S-13	64.5-65.5								122.8						
B-2	S-13	64.4	24.8	34	19	15	CL				0.8	>4.5				

Prepared by: CMT Reviewed by: [signature] Date: 6/7/95

TABLE B-2

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS: WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 um (%)	TOTAL UNIT WEIGHT (pcf)	STRENGTH: TORVANE Su (tsf)	POCKET PENETR q u (tsf)	Type Test	PEAK DEVIATOR STRESS (psi)	AXIAL STRAIN @ PEAK STRESS (%)	REMARKS
B-3	S-1	0-2								126.2						
B-3	S-1	1.9	24.0								0.7	2.4				
B-3	S-2	2-4								126.9						
B-3	S-2	3.9	19.8								0.9	3.0				
B-3	S-3	4-6								129.0						
B-3	S-3	5.9	17.9								1.4	3.2				
B-3	S-4	6-8								128.5						
B-3	S-4	7.9	17.4								1.8	4.8				
B-3	S-5	8-10								126.7						
B-3	S-5	8.2	18.1								1.5	2.6				
B-3	S-5	8.55	17.3	44	19	25	CL			123.0			CIU'-C @5psi			
B-3	S-5	8.8	16.4								2.5	4.8				
B-3	S-5	9.0	17.8	41	17	24	CL			131.5			CIU'-C @10psi			
B-3	S-5	9.35	18.4								2.3	4.3				
B-3	S-5	9.9	17.7								1.4	2.8				
B-3	S-6	10-12								127.8						
B-3	S-6	10.2	19.5								2.3	>5				
B-3	S-6	10.75	15.9								2.3	4.8				
B-3	S-6	11.1	18.0							128.1			CIU'-C @15psi			
B-3	S-6	11.35	17.9								2.2	4.8				
B-3	S-7	12-14								124.3						
B-3	S-7	13.9	18.2	37	18	19	CL				1.2	2.9				
B-3	S-8	14-16								122.5						
B-3	S-8	14.2	20.4								0.9	4.2				
B-3	S-8	14.35	19.9	44	18	26	CL	96.9	29	129.1			UU @13psi	44.5	13.4	
B-3	S-8	14.75	16.2								0.9	3.3				
B-3	S-8	15.35	19.0								1.2	3.9				
B-3	S-8	15.95	15.9													
B-3	S-9	16-18								109.3						

Prepared by: CMT Reviewed by: [signature] Date: 6/7/95

TABLE B-2

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 um (%)	TOTAL UNIT WEIGHT (pcf)	STRENGTH TORVANE Su (tsf)	POCKET PENETR q u (tsf)	Type Test	PEAK DEVIATOR STRESS (psi)	AXIAL STRAIN @ PEAK STRESS (%)	REMARKS
B-3	S-9	16.25	17.3								1.0	3.1				
B-3	S-9	16.5	18.7	46	21	25	CL			124.0			CIU'-C @10psi			
B-3	S-9	16.8	17.1								0.7	2.6				
B-3	S-10	18-20								121.7			CIU'-C @11.5,20psi			
B-3	S-10	18.15	21.6								0.7	1.8				
B-3	S-10	18.8	22.6								1.0	2.1				
B-3	S-10	19.1	23.4	52	22	30	CH			124.2			CIU'-C @15psi			
B-3	S-10	19.4	24.2								0.8	1.8				
B-3	S-10	19.65	21.4	42	19	23	CL	88.6	21	126.1			CIU'-C @20psi			
B-3	S-11	20-22								119.9						
B-3	S-11	21.9	17.5		np		SM				0.3	4.4				
B-3	S-17	50-52														
B-5	S-2	10-12								128.5						
B-5	S-2	11.9	21.1								1.0	2.1				Bot. Ash
B-6	S-4	20-22								134.9						
B-6	S-4	21.9	17.2								1.2	3.6				
B-7	S-2	10-12								121.9						
B-7	S-2	11.9	17.5								1.3	4.1				
B-7	S-7	35-37								120.3						
B-7	S-7	36.9	24.7								0.8	2.6				
B-8	S-4	20-22								136.0						
B-8	S-4	21.9	24.5	46	22	24	CL				0.9	2.4				
B-9	S-2	10-12								126.5						
B-9	S-2	11.9	22.2	50	20	30	CH				1.5	4.1				
B-9	S-8	40-42								124.3						

Prepared by: CMT Reviewed by: 97 Date: 6/7/95

TABLE B-2

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING	SAMPLE	DEPTH	IDENTIFICATION TESTS									STRENGTH					REMARKS
NO.	NO.	(ft)	WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 um (%)	TOTAL UNIT WEIGHT (pcf)		TORVANE Su (tsf)	POCKET PENETR q u (tsf)	Type Test	PEAK DEVIATOR STRESS (psi)	AXIAL STRAIN @ PEAK STRESS (%)	
B-9	S-8	41.9	22.7	34	18	16	CL					0.5	1.0				
B-10	S-3	15-16.5								127.3							
B-10	S-3	16.4	15.0	42	18	24	CL					1.7	>4.5				
B-10	S-9	45-47								127.6							
B-10	S-9	46.9	24.3	32	18	14	CL					0.9	1.4				
B-11	S-1	1-5															
B-11A	S-1	0-2															
B-11A	S-2	2-4															
B-11A	S-3	4-6								123.3							
B-11A	S-3	5.9	19.5	39	21	18	CL					1.8	3.6				
B-11A	S-4	6-8								129.7							
B-11A	S-4	7.9	20.9									1.6	2.6				
B-11A	S-5	8-10								121.9							
B-11A	S-5	8.5	24.1														
B-11A	S-5	8.65	24.0									0.8	1.8				
B-11A	S-5	8.95	24.7	47	21	26	CL			125.7				UU @8.5psi	20.5	15	
B-11A	S-5	9.9	25.7									1.1	1.9				
B-11A	S-6	10-12								120.4							
B-11A	S-6	11.9	22.9	52	23	29	CH					1.7	3.1				
B-11A	S-7	12-14								125.9							
B-11A	S-7	13.9	24.4									1.3					
B-11A	S-8	14-16								131.8							
B-11A	S-8	15.9	19.7									1.7					
B-11A	S-9	16-18								128.1							
B-11A	S-9	17.9	20.3									1.7					
B-11A	S-10	18-20								118.1							
B-11A	S-10	18.55	23.8														

Prepared by: CMT Reviewed by: JT Date: 6/7/95

Project No.: 5E08560-230 File: INDX1.XLS

TABLE B-2

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS: WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 um (%)	TOTAL UNIT WEIGHT (pcf)	STRENGTH: TORVANE Su (tsf)	POCKET PENETR q u (tsf)	Type Test	PEAK DEVIATOR STRESS (psi)	AXIAL STRAIN @ PEAK STRESS (%)	REMARKS
B-11A	S-10	18.85	19.8								1.4	2.0				
B-11A	S-10	19.15	20.0	45	19	26	CL			129.7			UU @10psi	32.0	15	
B-11A	S-10	19.5	19.9													
B-11A	S-11	20-22								138.4						
B-11A	S-11	20.15	21.1								0.8	1.8				
B-11A	S-11	20.35	19.6	45	18	27	CL			130.4			CIU'-C @10psi			
B-11A	S-11	20.7	16.8								1.2	2.8				
B-11A	S-11	21.25	20.0								1.2	2.5				
B-11A	S-11	21.6	25.2	49	18	31	CL			128.9			CIU'-C @20psi			
B-11A	S-11	21.9														
B-11A	S-12	25-27								124.9						
B-11A	S-12	25.05	23.5								0.8	2.3				
B-11A	S-12	25.36	21.2							128.2			CIU'-C @10psi			
B-11A	S-12	25.6	19.0								1.3	4.2				
B-11A	S-12	25.75	20.1													
B-11A	S-12	26.07	20.7	49	21	28	CL			128.4			CIU'-C @30psi			
B-11A	S-12	26.45	18.8								1.6	4.5				Organics
B-11A	S-12	26.9	19.5								0.9	1.9				
B-11A	S-13	30-32								124.2						Wood frag.
B-11A	S-13	30.7	22.5	36	16	20	CL			127.2			CIU'-C @20psi			
B-11A	S-13	30.45	22.4								0.8	1.8				
B-11A	S-13	31	21.1								0.9	1.9				
B-11A	S-13	31.35	20.7	29	17	12	CL			130.0			UU @26psi	23.4	15	
B-11A	S-13	31.75	20.9													
B-11A	S-14	35-37								132.5						Organics
B-11A	S-14	36.9	13.4								1.0	1.9				
B-11A	S-15	40-42								123.5						
B-11A	S-15	41.9	26.2								0.9	1.9				
B-12	S-1	2-4														

Prepared by: CMT Reviewed by: [illegible] Date: 6/7/95

Project No.: 5E08560-230 File: INDX1.XLS

TABLE B-2

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING	SAMPLE	DEPTH	IDENTIFICATION TESTS								STRENGTH					REMARKS
NO.	NO.	(ft)	WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 um (%)	TOTAL UNIT WEIGHT (pcf)	TORVANE Su (tsf)	POCKET PENETR q u (tsf)	Type Test	PEAK DEVIATOR STRESS (psi)	AXIAL STRAIN @ PEAK STRESS (%)	
B-12	S-2	4-6								125.8						
B-12	S-2	5.9	23.3								1.0	1.8				
B-12	S-3	6-8														
B-12	S-4	8-10								130.0						
B-12	S-4	9.9	31.0	61	22	39	CH				0.7	1.2				
B-12	S-5	10-12														
B-12	S-6	12-14														
B-12	S-7	14-16								131.8						
B-12	S-7	15.9	18.4								0.8	2.6				
B-13	S-1	2-4														
B-13	S-2	4-6								126.2						
B-13	S-2	4.05	24.7								0.6	1.3				
B-13	S-2	4.65	17.7								0.5	1.9				
B-13	S-2	5.25	22.5								0.5	2.0				
B-13	S-2	5.85	17.6								1.1	3.2				
B-13	S-3	6-8								117.8						
B-13	S-3	6.05	22.8								0.7	1.6				
B-13	S-3	6.65	22.1								0.6	3.1				
B-13	S-3	7.22	22.2													
B-13	S-3	7.85	23.4													
B-13	S-4	8-10														
B-13	S-5	10-12														
B-14	S-1	0-2														
B-14	S-2	2-4														
B-14	S-3	4-6								114.3						Organics
B-14	S-3	4.1	26.6								0.6	1.4				
B-14	S-3	4.64	31.0								0.2	0.8				
B-14	S-3	5.3	23.8								0.9	3.2				

Prepared by: CMT Reviewed by: JJ Date: 6/7/95

Project No.: 5E08560-230 File: INDX1.XLS

TABLE B-2

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS								STRENGTH					REMARKS
			WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDROMETER % MINUS 2 um (%)	TOTAL UNIT WEIGHT (pcf)	TORVANE Su (tsf)	POCKET PENETR q u (tsf)	Type Test	PEAK DEVIATOR STRESS (psi)	AXIAL STRAIN @ PEAK STRESS (%)	
B-14	S-4	6-8								123.4						
B-14	S-4	6.05	26.4								0.5	1.2				
B-14	S-4	6.65	27.7								0.9	2.1				
B-14	S-4	7.25	22.9								0.9	3.3				
B-14	S-4	7.9	24.1								0.8	3.2				
B-15	S-3	15-17														
B-15	S-8	40-42														
B-101	S-10	49.5-51.5								133.1						
B-101	S-11	51.5-53.5								130.1						
B-101	S-12	53.5-55.5								128.7						
B-101	S-12	54.25	23.7							125.5			DS			Slickenslides
P-2A	S-4	38-40								124.2						
P-2A	S-4	38.2		31	14	17	CL	73.9	22							
P-2A	S-4	38.4	15.5													
P-2A	S-4	38.5	23.2													@ ext. interface
P-2A	S-4	38.5	27.7	59	26	33	CH									@ int. interface
P-2A	S-4	38.6	39.1													
P-2A	S-4	38.75		65	38	27	MH	97.3	59							
73.9																
P-4	S-5	23-25								126.9						
P-4	S-5	23.7	15.9	29	16	13	CL	70.4	19		1.8	2.5				above shear
P-4	S-5	23.9	22.4					70.5	26							shear zone
P-4	S-5	24.2	44.2	73	37	36	CH	93.9	68		0.7	0.5				below shear

Note: (1) Plasticity of fines for USCS symbol based on visual observation unless Atterberg limits reported.

Prepared by: CMT Reviewed by: JJ Date: 6/7/95

Project No.: 5E08560-230 File: INDX2.XLS

TABLE B-3

LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING	SAMPLE	DEPTH	IDENTIFICATION TESTS							COMPACTION							REMARKS
NO.	NO.	(ft)	WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	SPECIFIC GRAVITY (-4 mat'l)	ASTM STD.	OPT. WATER CONTENT (%)	MAX . DRY UNIT WGT. (pcf)	- 3/8	- 3/4	PREP wet	PREP dry	
TP-1		0-1							2.642								
TP-2		0-1	17.8				SP-SM	5.0									
TP-3	N End	1 of 3	23.0														
TP-3	N End	2 of 3	24.3	40	18	22	CL										
TP-3	N End	3 of 3	24.4														
TP-3	N End	COMP	23.3							D698-91	19.9	105.8	X		X		
TP-3	S End	1 of 3	26.4														
TP-3	S End	2 of 3	24.1														
TP-3	S End	3 of 3	28.4														
TP-3	S End	COMP	24.4	50	20	30	CL			D698-91	22.9	100.8	X		X		
TP-4	11.5'S E Face	3.1	22.9				CL	55.8									
TP-4	N End	1 of 2	22.4	41	18	23	CL										
TP-4	N End	2 of 2	21.9														
TP-4	S End	7'	24.6														
TP-4	S End	2 of 2 7'	23.8														
TP-5	15.5'SE		14.3				CL	63.7									
TP-5	5'S of N End	5'	18.8				CL	66.4									
TP-5	5.8'S	1.5					CL	61.0									
TP-5	E Face	12'S	23.7				CL	67.1									
TP-5	N End	1 of 2 4'	26.0														
TP-5	N End	2 of 2 4'	21.7														
TP-5	N End	COMP 4'	22.3	42	18	24	CL			D698-91	20.0	106.4	X		X		
TP-5	S End	1 of 2	20.0														
TP-5	S End	2 of 2	19.3														
TP-5	S End	COMP	20.4	47	19	28	CL			D698-91	20.7	104.0	X		X		
TP-5	W Wall 12'S	3.5															
TP-7	Bag 1	3.2	21.8				CL	50.2									
TP-7	Bag 2	1.4	12.9				SC	48.6									
TP-7	Bag 3	6	17.4				CL	66.4									
TP-7	New fill	1 of 2	24.7	51	22	29	CH										

Prepared by: CMT Reviewed by: [signature] Date: 6/7/95

Project No.: 5E08560-230 File: INDX2.XLS

TABLE B-3

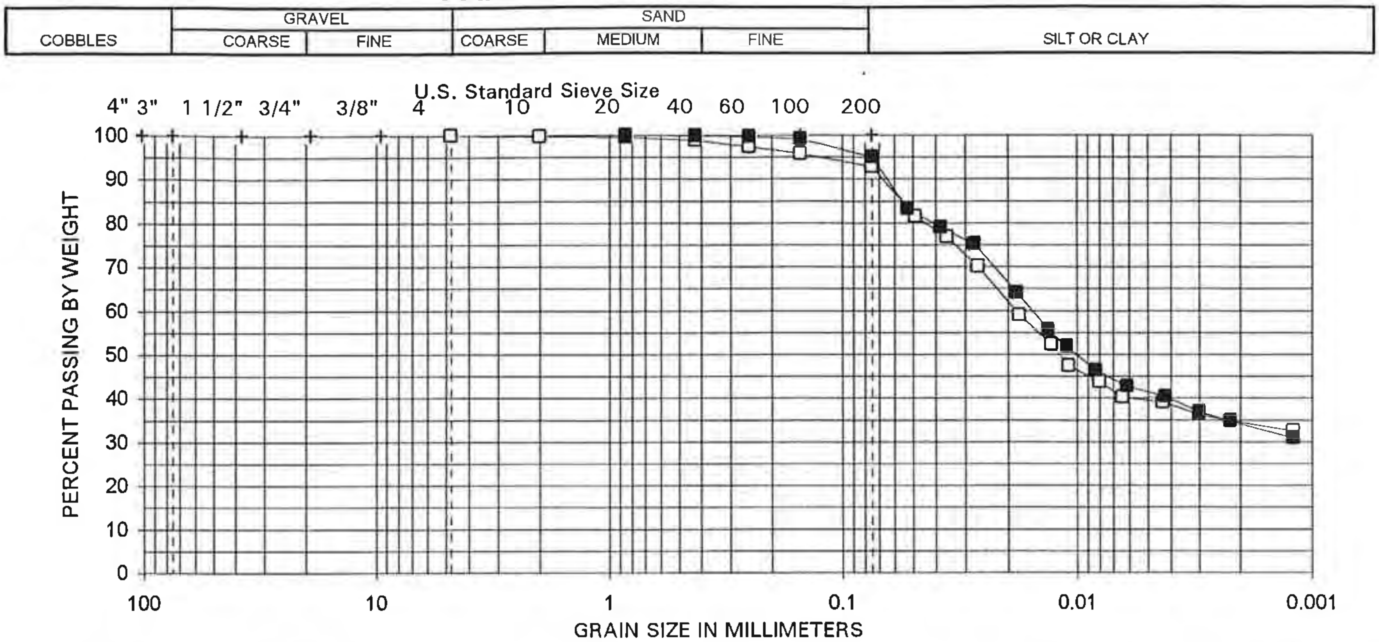
LABORATORY TESTING ASSIGNMENT AND DATA SUMMARY

BORING	SAMPLE	DEPTH	IDENTIFICATION TESTS							COMPACTION							REMARKS
NO.	NO.	(ft)	WATER CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PLAS. IND.	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	SPECIFIC GRAVITY (-4 mat'l)	ASTM STD.	OPT. WATER CONTENT (%)	MAX . DRY UNIT WGT. (pcf)	- 3/8	- 3/4	PREP wet	PREP dry	
TP-7	New fill	2 of 2	23.3														
TP-7	Old fill	1 of 2	21.6														
TP-7	Old fill	2 of 2	22.3	48	21	27	CL										

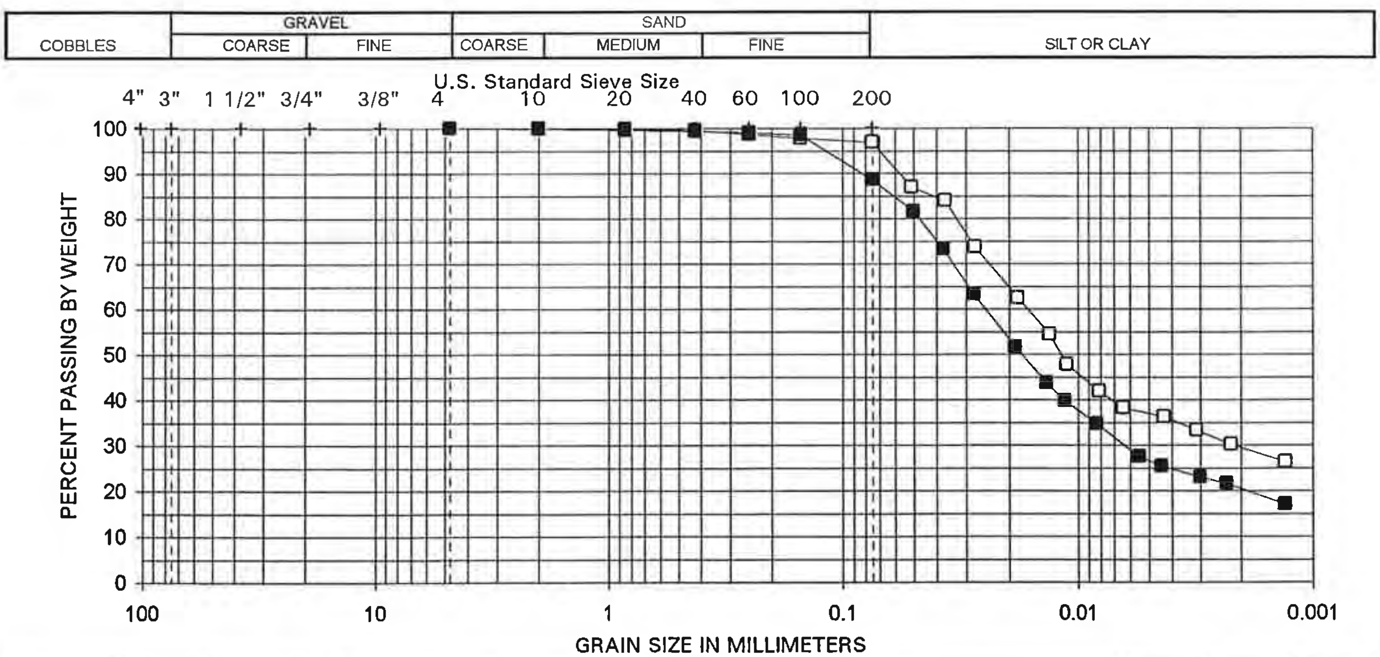
Note: (1) Plasticity of fines for USCS symbol based on visual observation unless Atterberg limits reported.

Prepared by: CMT Reviewed by: [signature] Date: 6/7/95

PARTICLE-SIZE DISTRIBUTION



BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
B-2	S-2	10-12	□	CL, brown plastic silty CLAY, trace m-f sand; mica noted.	20.6	44	18
B-2	S-4	20.2	■	CH, brown plastic silty CLAY, trace f. sand; mica noted.	---	---	---



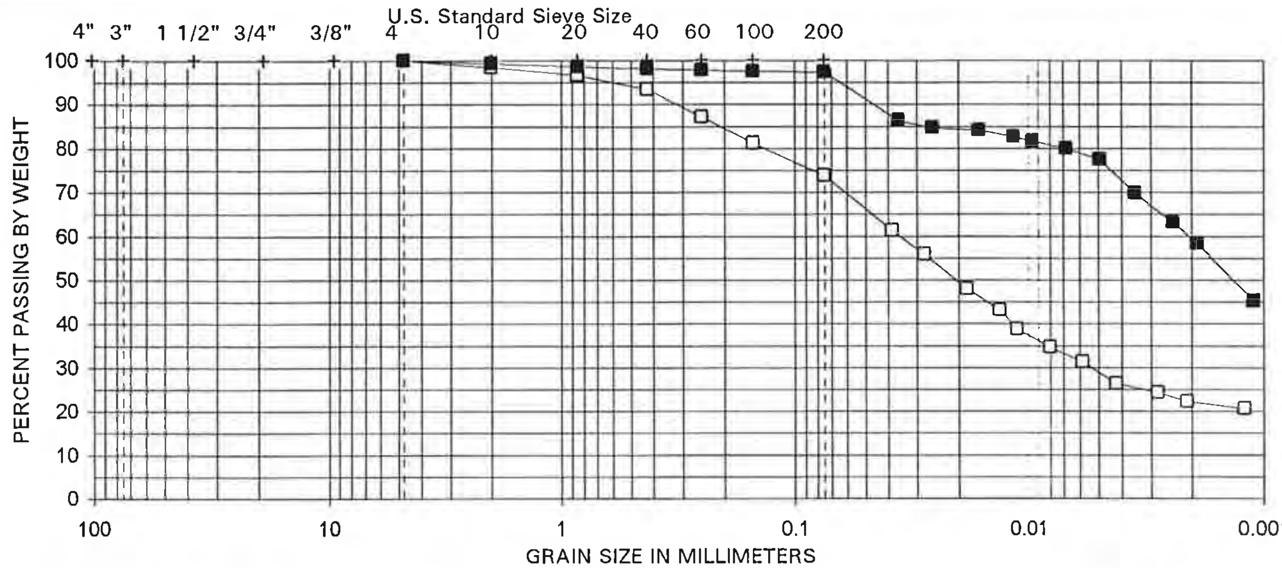
BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
B-3	S-8	14.35	□	CL, brown plastic silty CLAY, trace f. sand; mica noted.	19.9	44	18
B-3	S-10	19.65	■	CL, brown plastic silty CLAY, trace f. sand; mica noted.	21.4	42	19

File: SIEV1A.XLS Project No.: 5E08560-230 Plotted by: CMT Reviewed by: CMT Date: 5/25/95

Figure B-1

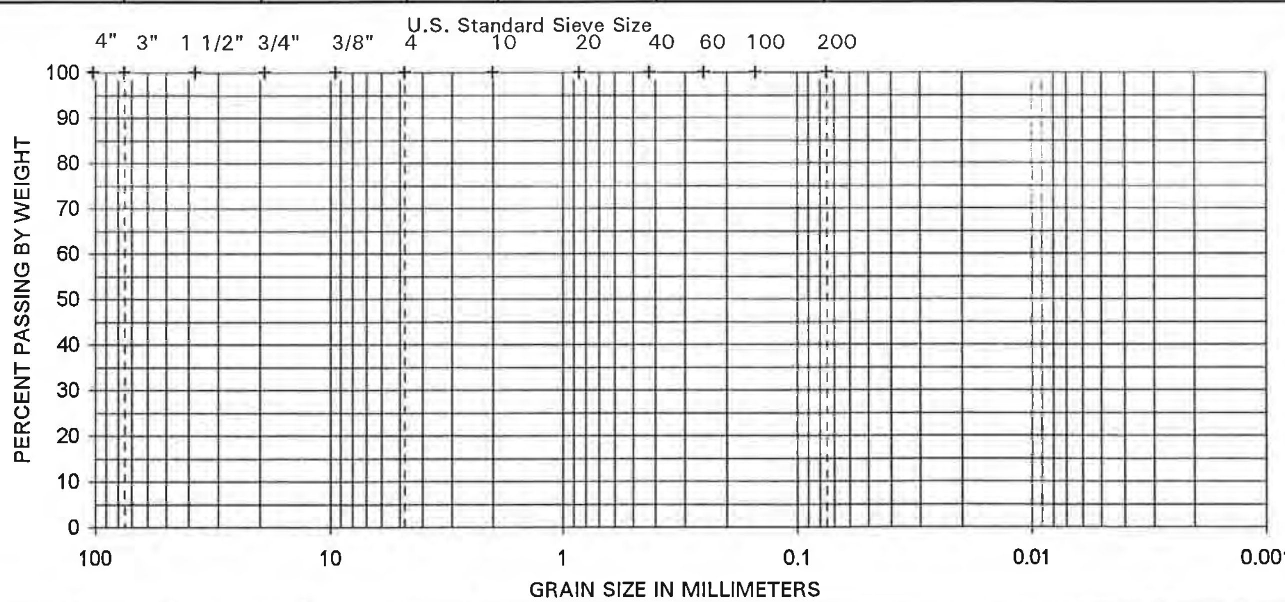
PARTICLE-SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
P-2A	4-A	38.2	□	CL, brown medium plastic silty CLAY, some f. sand, trace	---	31	14
				c-m sand; mica noted.			
P-2A	4-B	38.75	■	MH, mottled green, brown and orange plastic clayey SILT,	---	65	38
				trace m-f sand; mica noted.			

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

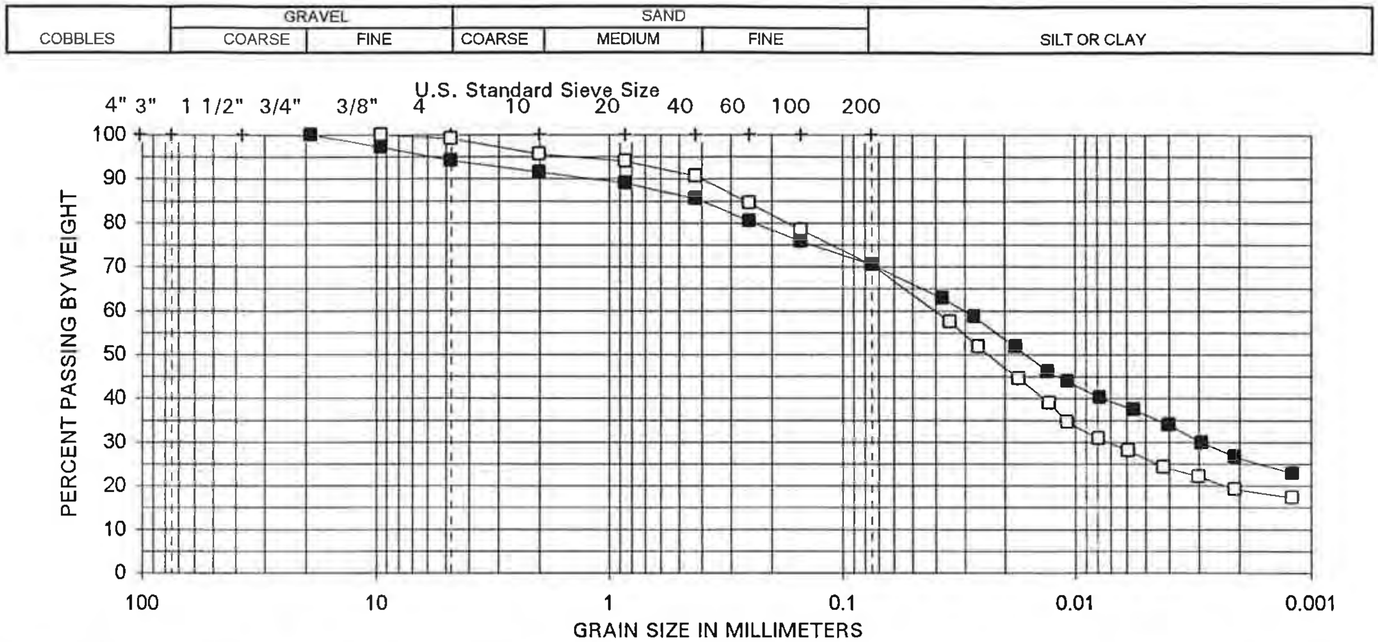


BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
---	---	---	□		---	---	---
---	---	---	■		---	---	---

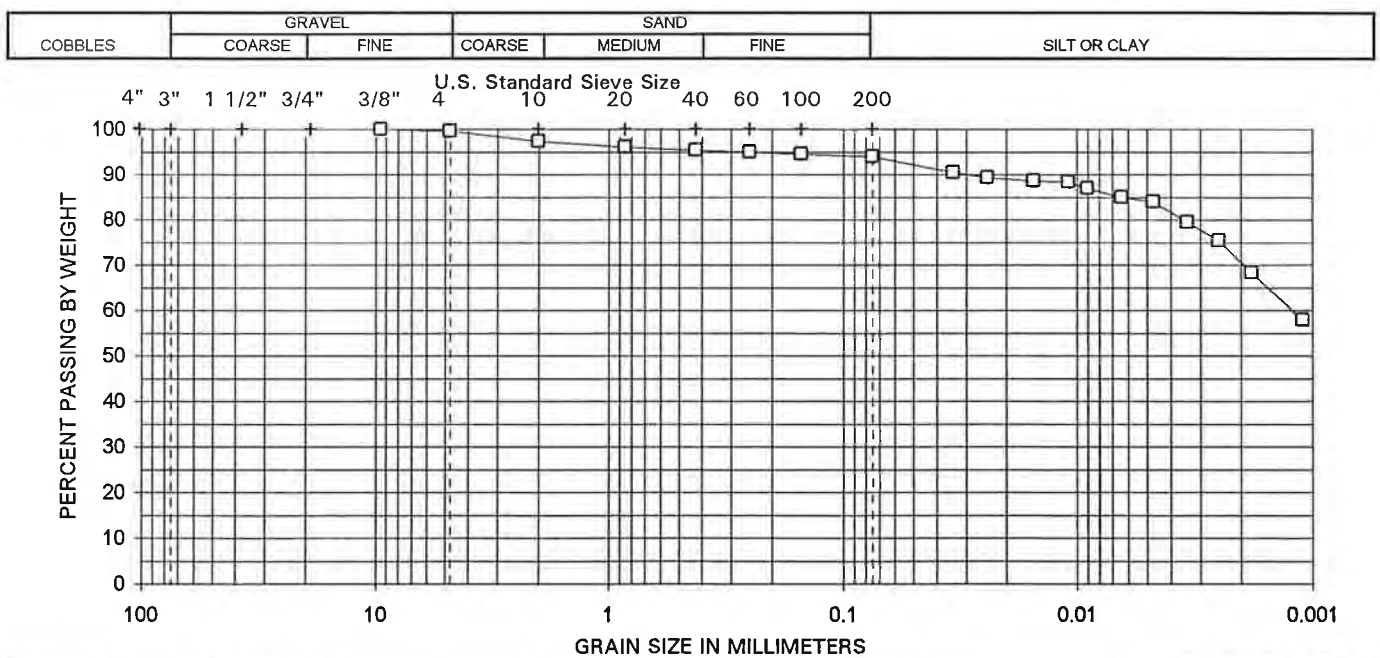
File: SIEV1C.XLS Project No.: 5E08560-230 Plotted by: EK Reviewed by: ________ Date: 6/5/95

Figure B-2

PARTICLE-SIZE DISTRIBUTION



BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
P-4	S-5	---	□	CL, brown medium plastic silty CLAY, some c-f sand; mica	15.9	29	16
Above shear zone				noted.			
P-4	S-5	23.9	■		22.4	---	---
Shear zone							



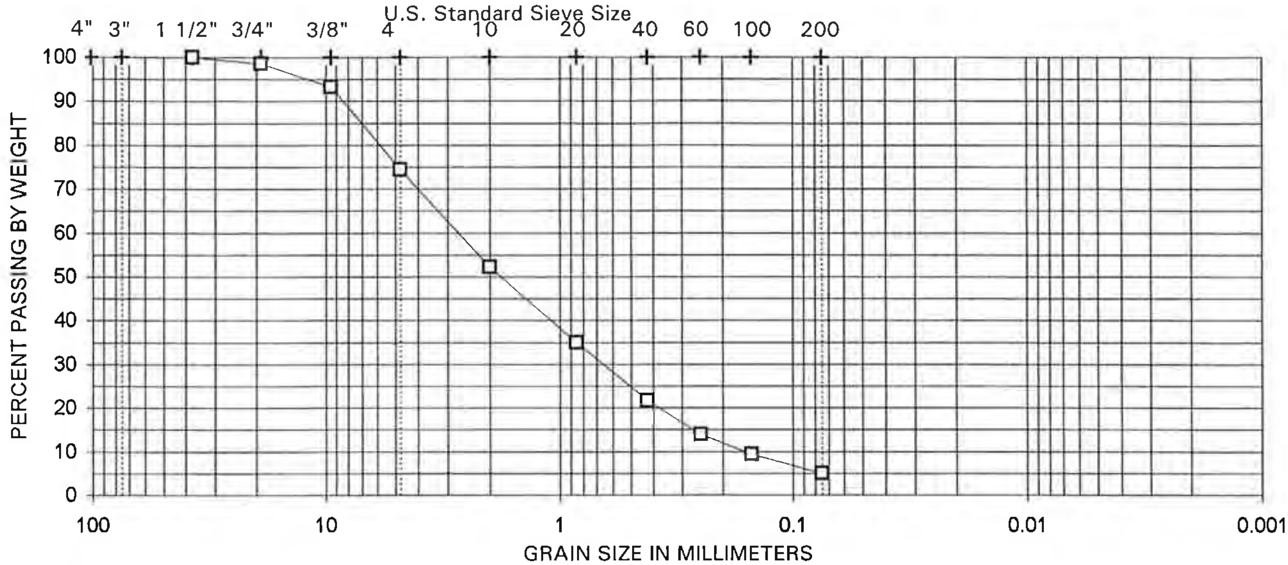
BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
P-4	S-5	---	□	MH, brown plastic clayey SILT, trace c-f sand; mica noted.	44.2	73	37
Below shear zone							
---	---	---	■		---	---	---

File: SIEV1B.XLS Project No.: 5E08560-230 Plotted by: CMT Reviewed by: [signature] Date: 5/30/95

Figure B-3

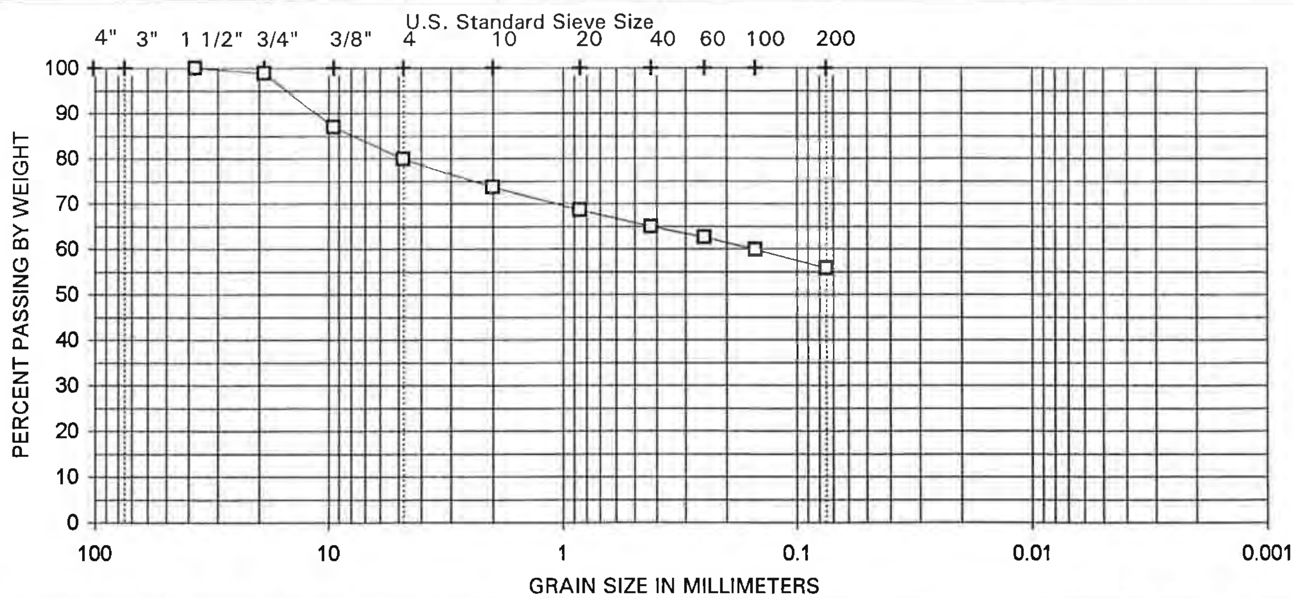
PARTICLE-SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
TP-2	---	0-1	□	SP-SM, brown c-f SAND, some f. gravel, trace c. gravel and	17.8	---	---
				silt; bottom ash material noted.			
---	---	---	■		---	---	---

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



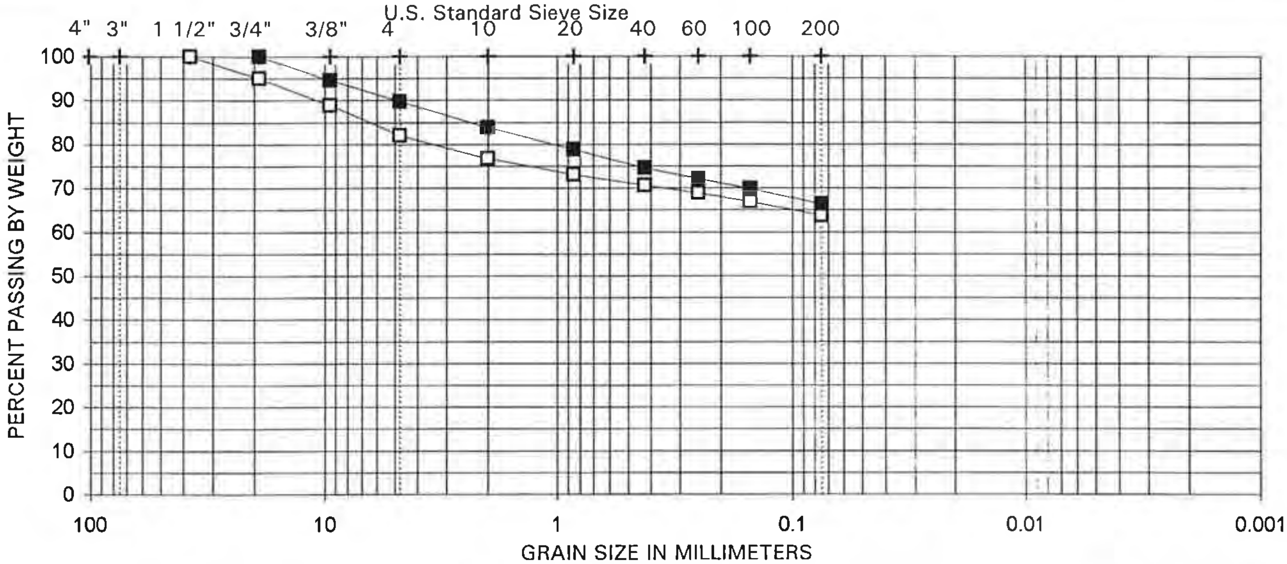
BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
TP-4	11.5' S	3.1	□	CL, brown plastic silty CLAY, some f. gravel and c-f sand,	22.9	---	---
				trace c. gravel; bottom ash material noted.			
---	—	---	■		---	---	---

File: SIEV2A.XLS Project No.: 5E08560-230 Plotted by: CMT Reviewed by: CMT Date: 3/31/95

Figure B-4

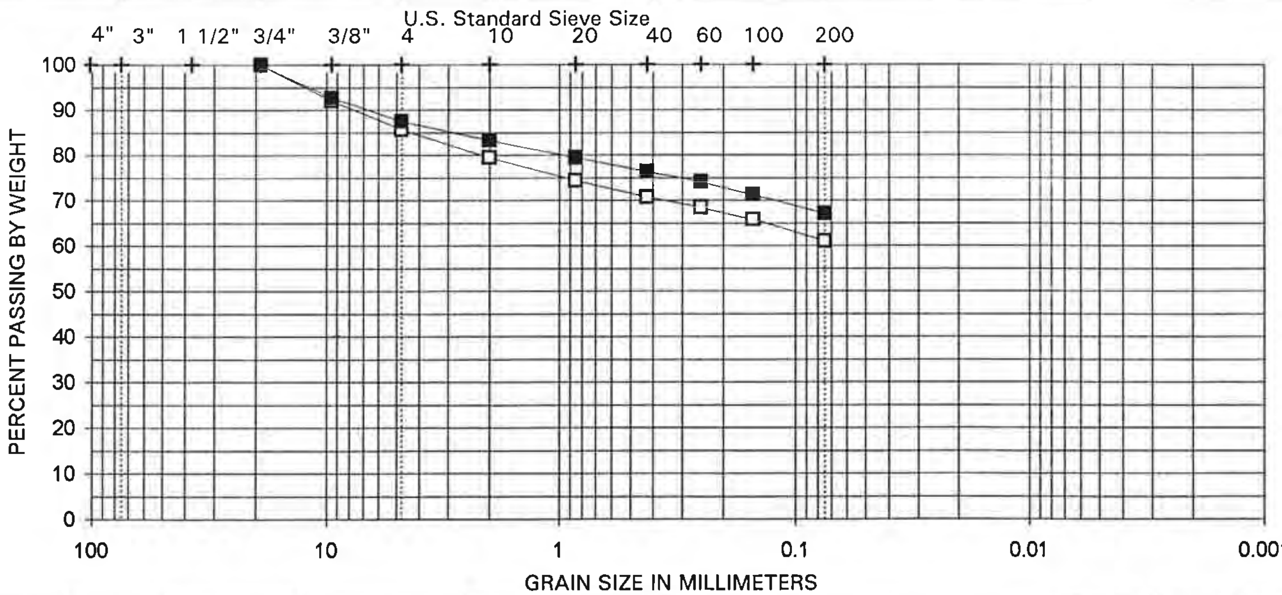
PARTICLE-SIZE DISTRIBUTION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
TP-5	15.5' SE	---	□	CL, brown plastic CLAY, some gravel and c-f sand; bottom	14.3	---	---
				ash material noted.			
TP-5	5' S of N End	5	■	CL, brown plastic CLAY, some c-f sand, trace f. gravel;	18.8	---	---
				bottom ash material noted.			

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

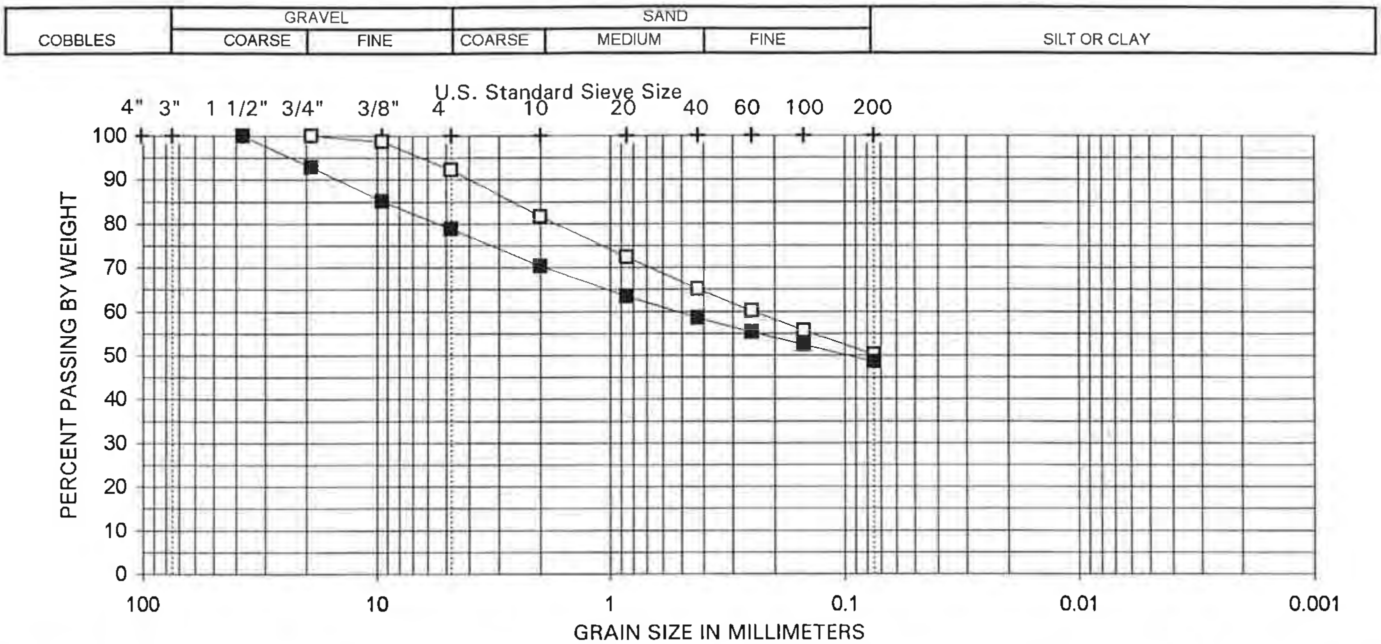


BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
TP-5	5.8' S	1.5	□	CL, brown plastic CLAY, some f. gravel and c-f sand;	---	---	---
				bottom ash material noted.			
TP-5	E Face 12'S		■	CL, brown plastic CLAY, some f. gravel and c-f sand;	23.7	---	---
				bottom ash material noted.			

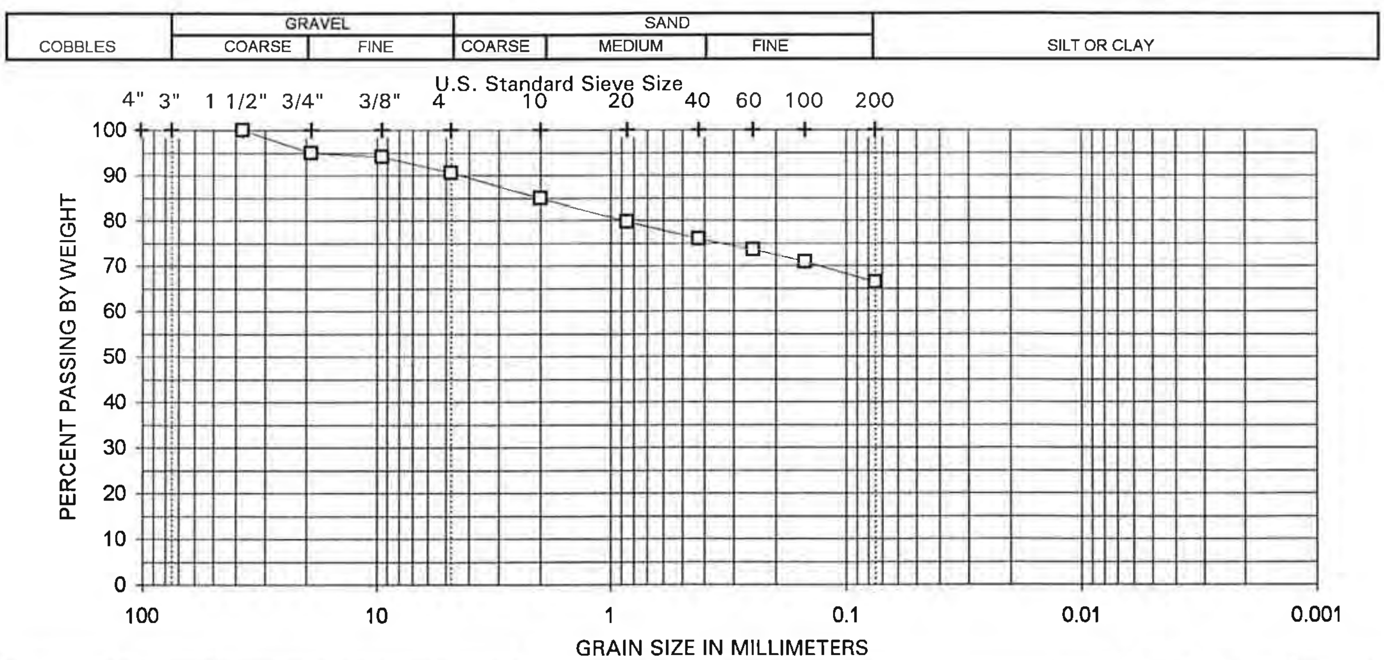
File: SIEV2B.XLS Project No.: 5E08560-230 Plotted by: CMT Reviewed by: CMS Date: 3/31/95

Figure B-5

PARTICLE-SIZE DISTRIBUTION



BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
TP-7	Bag 1	3.2	□	CL, brown plastic c-f sandy CLAY, trace f. gravel; bottom	21.8	---	---
				ash material noted.			
TP-7	Bag 2	1.4	■	SC, brown clayey c-f SAND, some gravel; bottom ash	12.9	---	---
				material noted.			



BORING	SAMPLE	DEPTH (FT)	SYMBOL	DESCRIPTION	w (%)	LL	PL
TP-7	Bag 3	6	□	CL, brown plastic CLAY, some c-f sand, trace gravel; bottom	17.4	---	---
				ash material noted.			
---	---	---	■		---	---	---

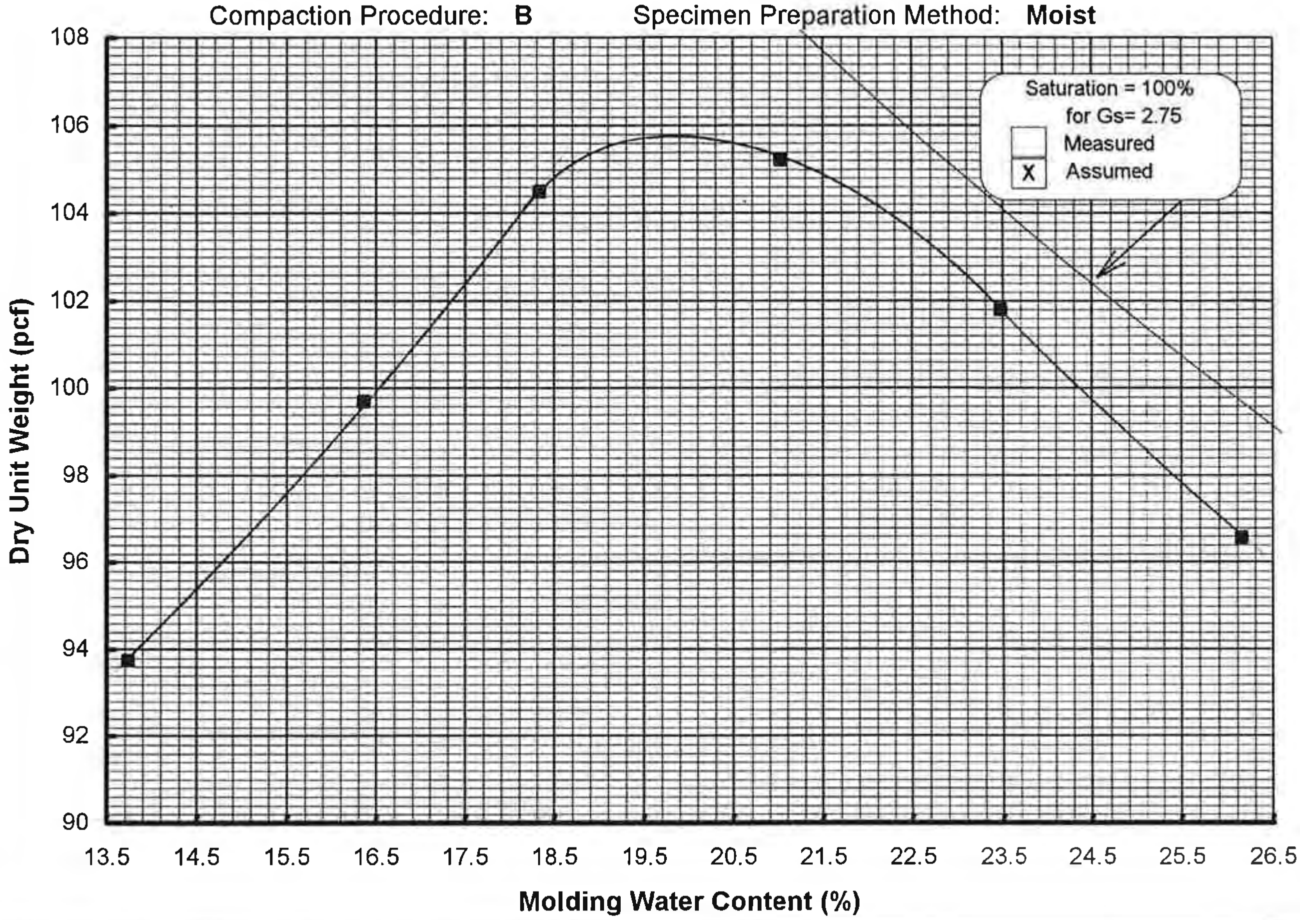
File: SIEV2C.XLS Project No.: 5E08560-230 Plotted by: CMT Reviewed by: CMT Date: 3/31/95

Figure B-6

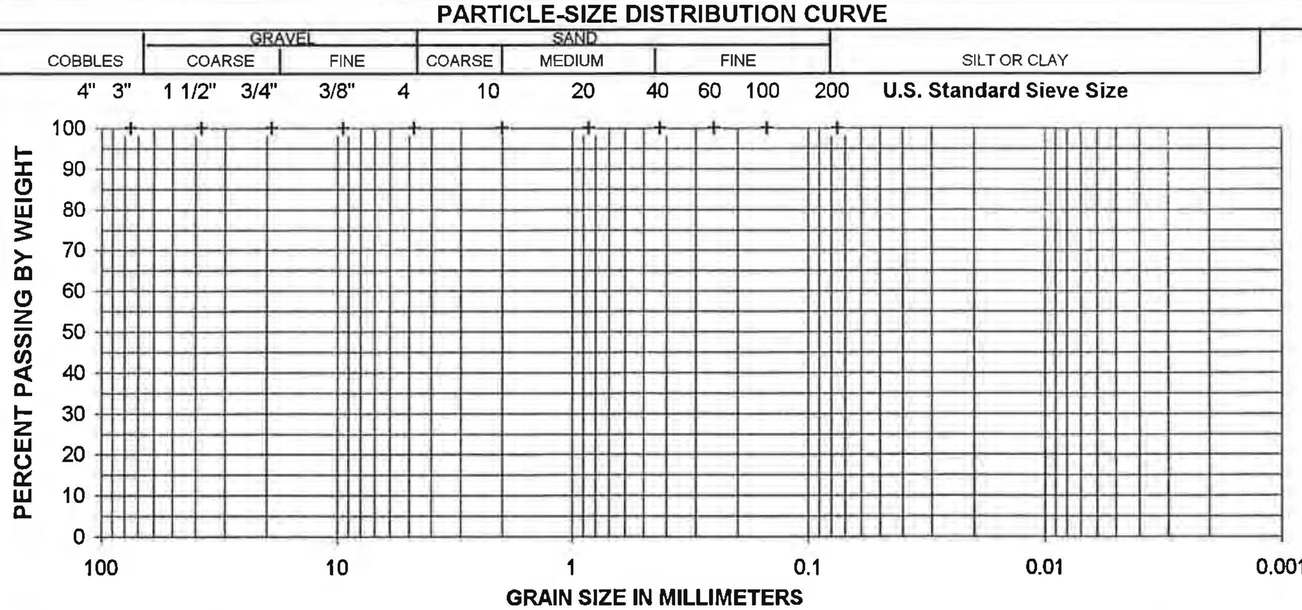
COMPACTION CURVE

Test Method: ● ASTM D 1557-91 ■ ASTM D 698-91 ◆ CA-DWR: S-10 ○ Other Effort

Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE



NOTATION: ○ Representative of entire sample △ Representative of compacted specimen □ Representative of compacted specimen and entire sample

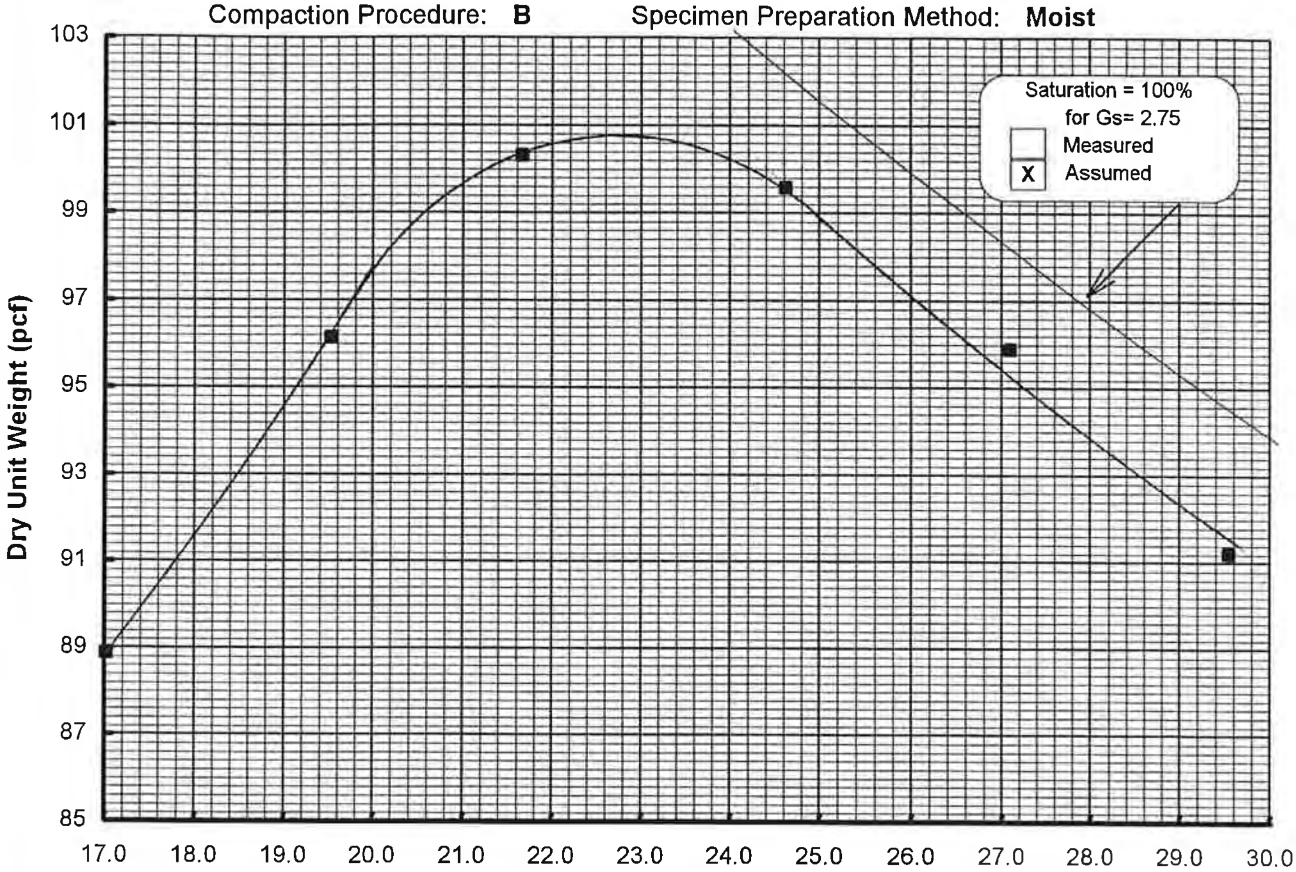
Exploration No.	Sample No.	Depth (ft)	OPT. WC (%)	MAX. DUW (pcf)	LL	PI	Description and/or Classification
TP-3 N End Comp			19.9	105.8			CL, brown plastic silty CLAY, trace f. sand.

PROJECT NAME: **PROJECT NUMBER:** 5E08560-230	**COMPACTION AND INDEX PROPERTY DATA**	**FIGURE No.** B-7

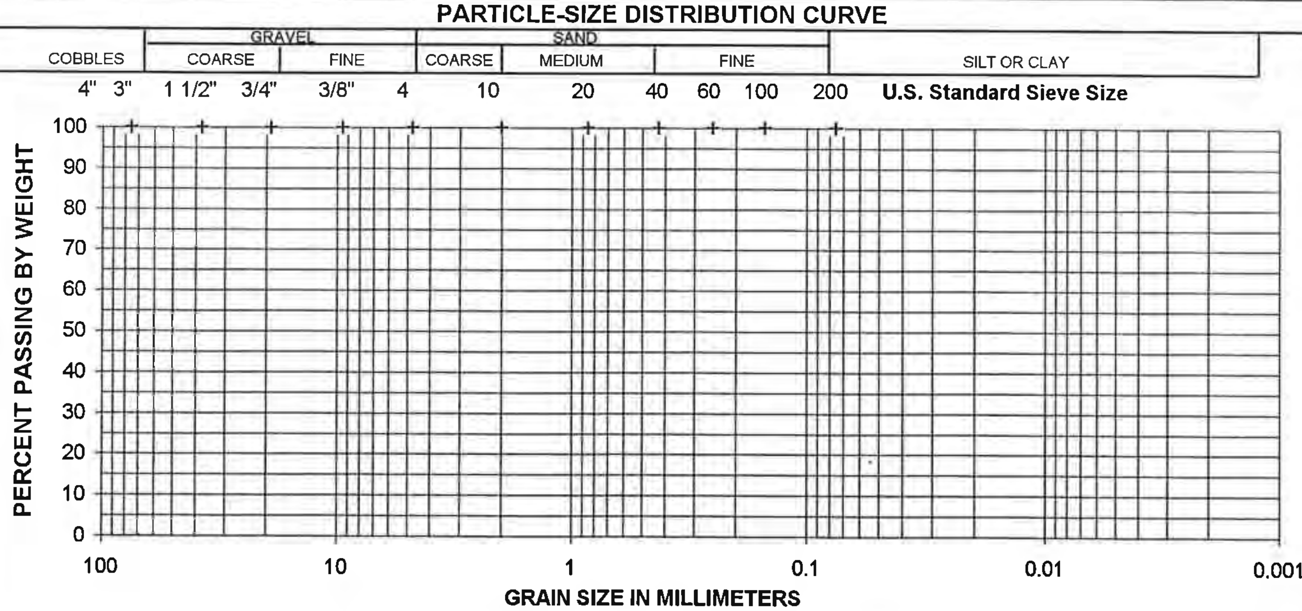
COMPACTION CURVE

Test Method: ● ASTM D 1557-91 ■ ASTM D 698-91 ◆ CA-DWR: S-10 ❍ Other Effort

Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE



NOTATION: ❍ Representative of entire sample Δ Representative of compacted specimen ☐ Representative of compacted specimen and entire sample

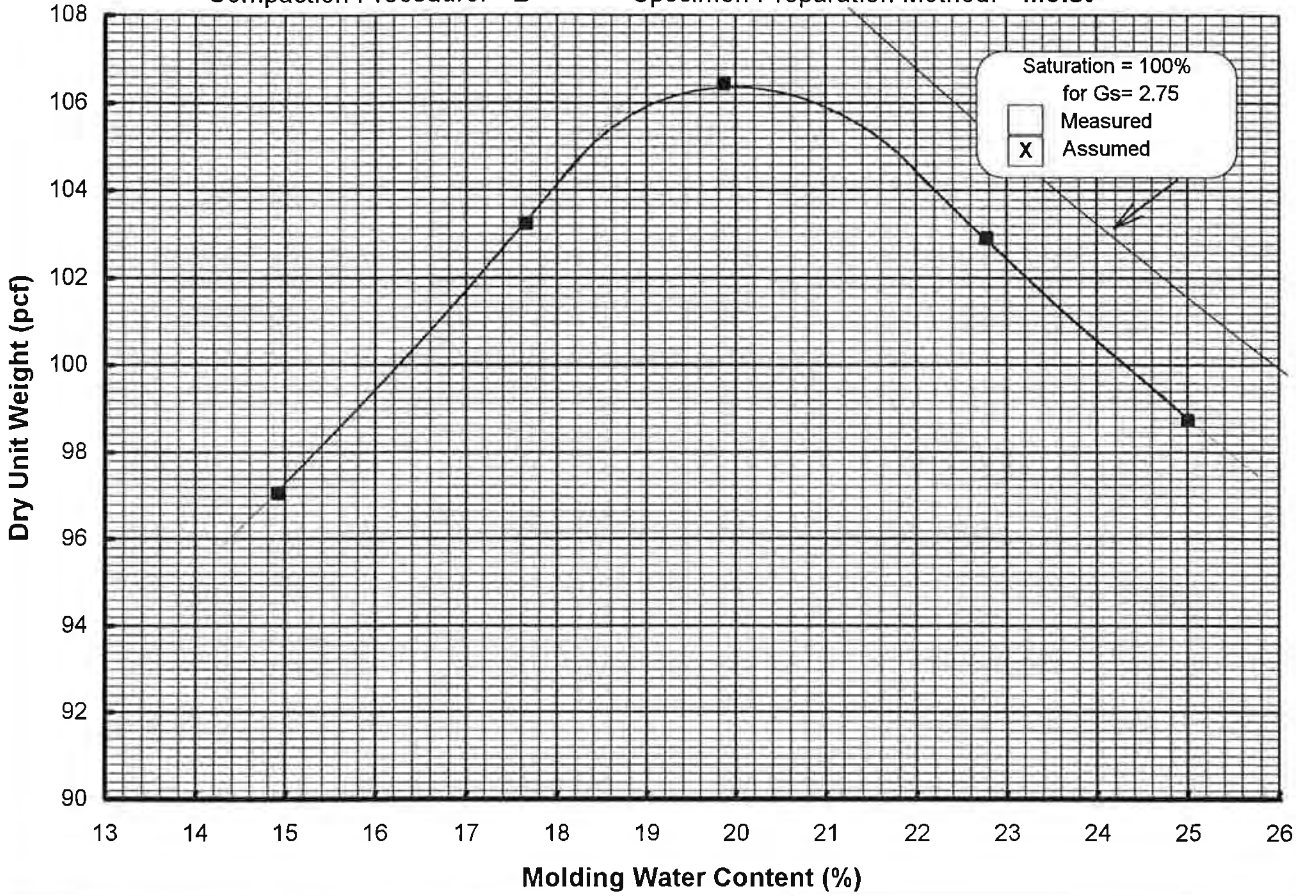
Exploration No.	Sample No.	Depth (ft)	OPT. WC (%)	MAX. DUW (pcf)	LL	PI	Description and/or Classification
TP-3 S End Comp			22.9	100.8	50	30	CL, light brown plastic CLAY, trace f. sand.

PROJECT NAME: **PROJECT NUMBER:** 5E08560-230	**COMPACTION AND INDEX PROPERTY DATA**	**FIGURE No.** B-8

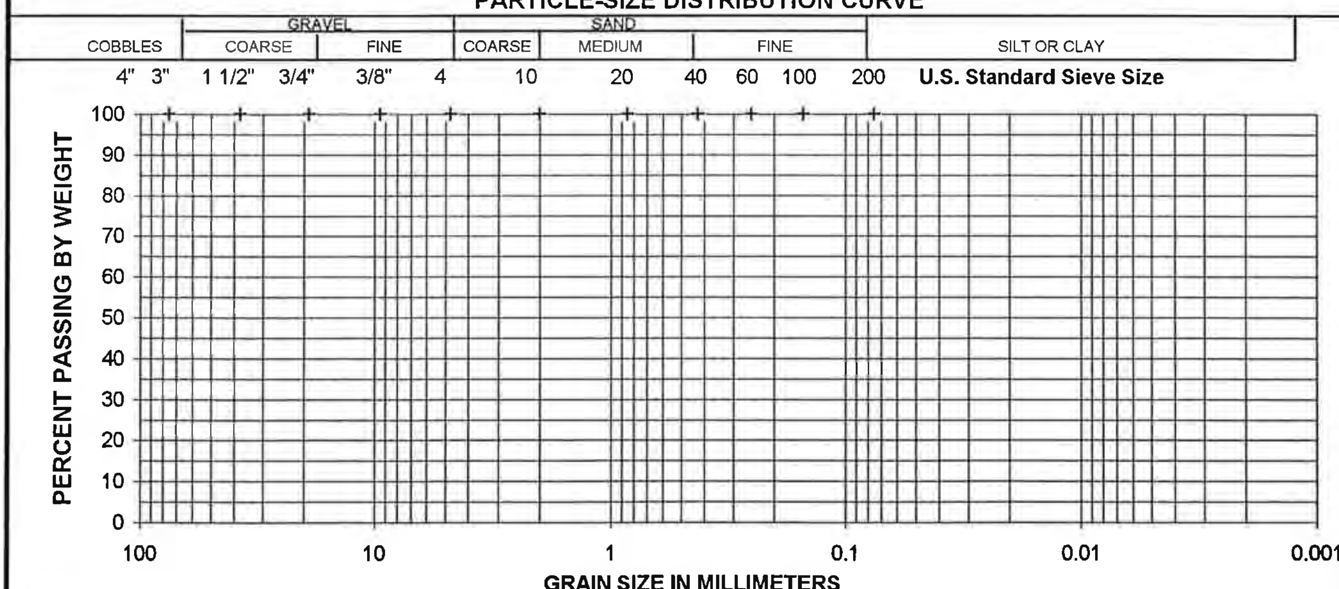
COMPACTION CURVE

Test Method: ● ASTM D 1557-91 ■ ASTM D 698-91 ◆ CA-DWR: S-10 ❍ Other Effort

Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE



NOTATION: ○ Representative of entire sample △ Representative of compacted specimen □ Representative of compacted specimen and entire sample

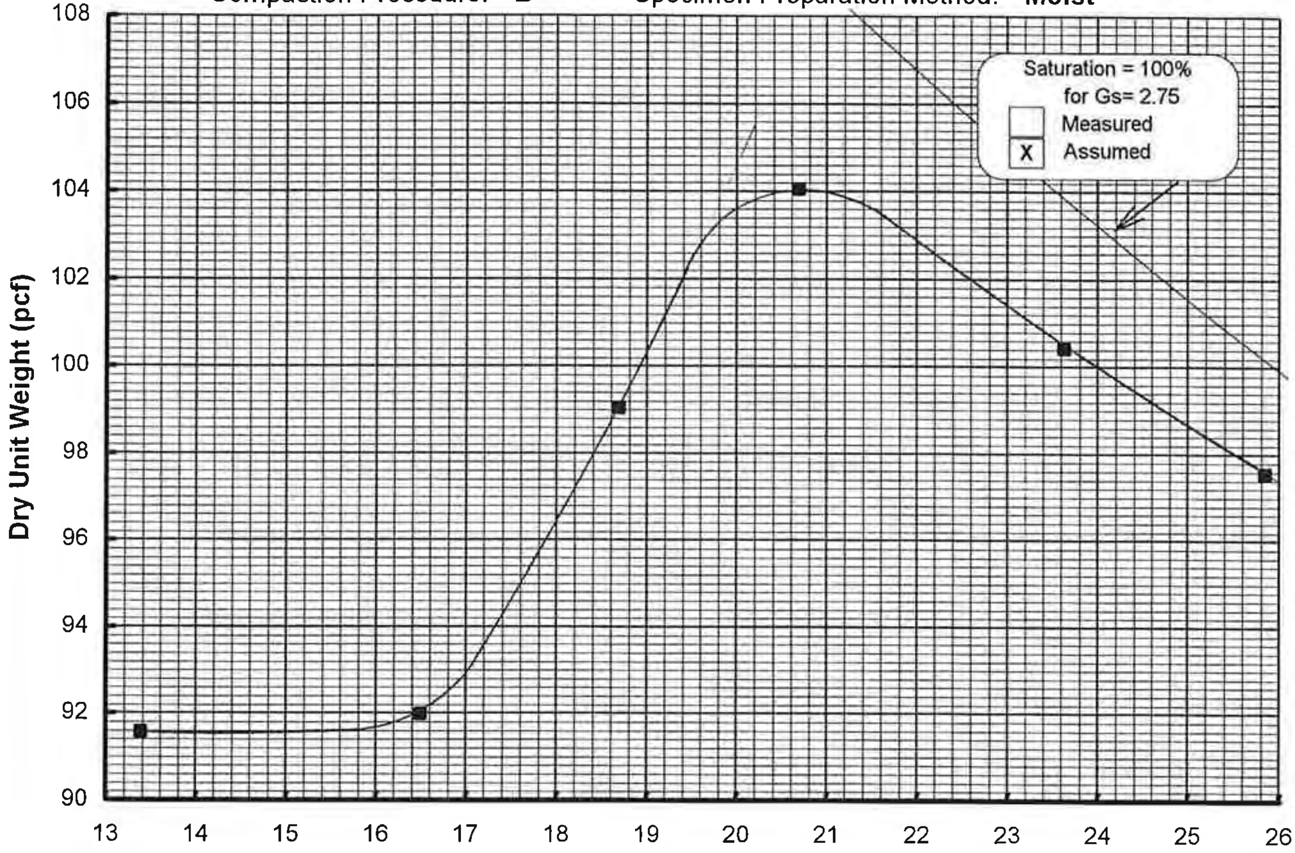
Exploration No.	Sample No.	Depth (ft)	OPT. WC (%)	MAX. DUW (pcf)	LL	PI	Description and/or Classification
TP-5 N End Comp			20.0	106.4	42	24	CL, brown plastic silty CLAY, trace f. sand.

PROJECT NAME: **PROJECT NUMBER:** 5E08560-230	**COMPACTION AND INDEX PROPERTY DATA**	**FIGURE No. B-9**

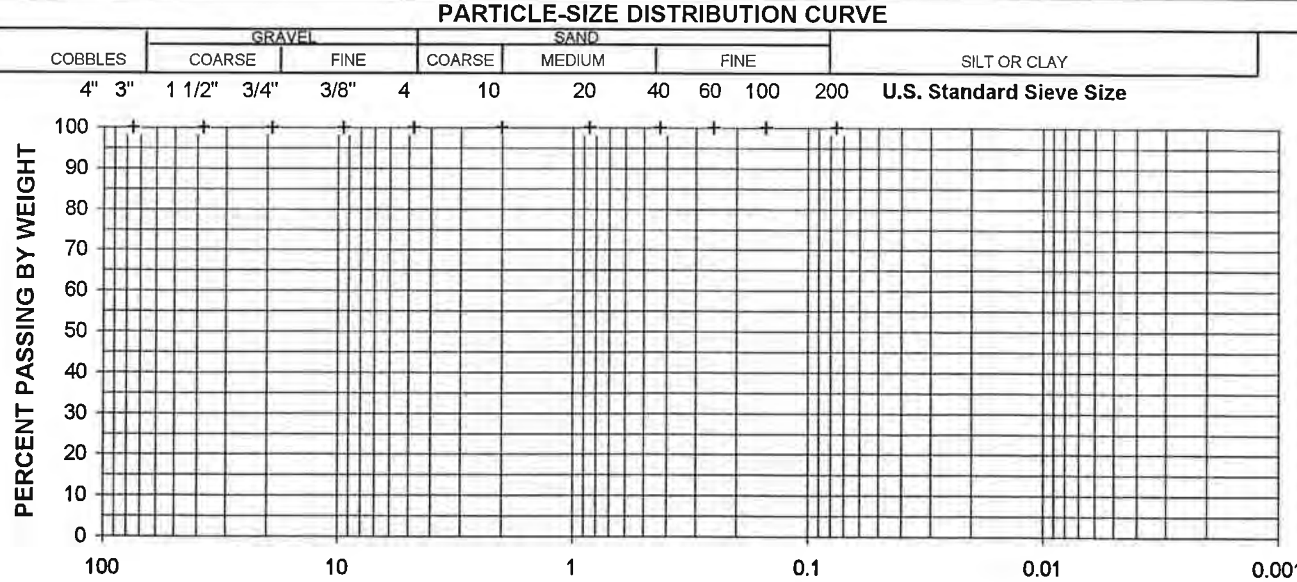
COMPACTION CURVE

Test Method: ● ASTM D 1557-91 ■ ASTM D 698-91 ◆ CA-DWR: S-10 ○ Other Effort

Compaction Procedure: **B** Specimen Preparation Method: **Moist**



PARTICLE-SIZE DISTRIBUTION CURVE



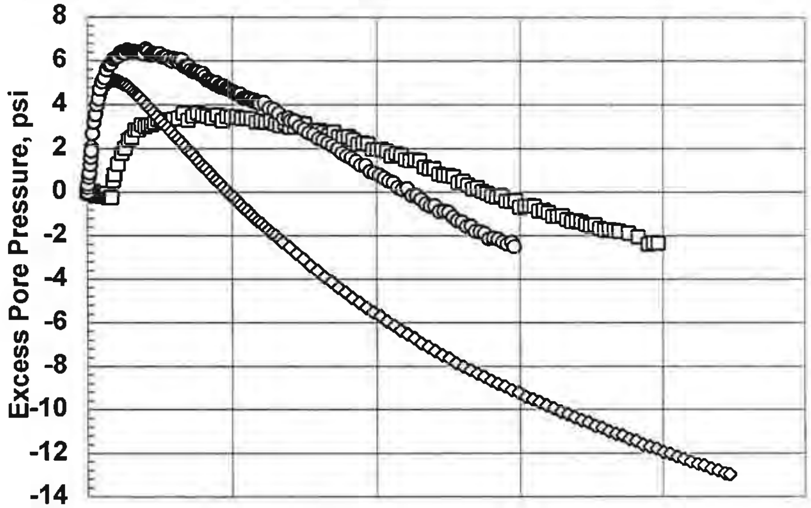
NOTATION: ○ Representative of entire sample Δ Representative of compacted specimen □ Representative of compacted specimen and entire sample

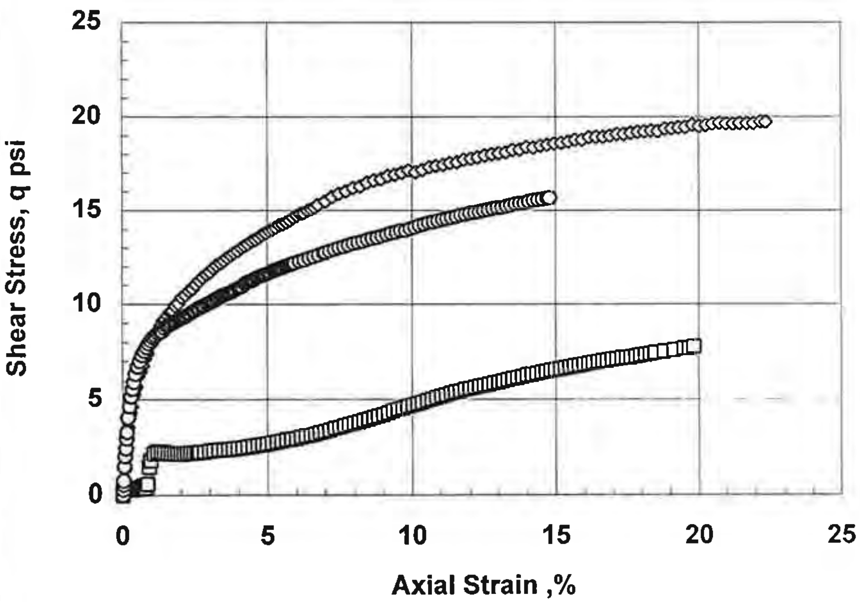
Exploration No.	Sample No.	Depth (ft)	OPT. WC (%)	MAX. DUW (pcf)	LL	PI	Description and/or Classification
TP-5 S End Comp			20.7	104.0	47	28	CL, brown plastic silty CLAY, trace m-f sand.

PROJECT NAME:
PROJECT NUMBER: 5E08560-230

COMPACTION AND INDEX PROPERTY DATA

FIGURE No. B-10



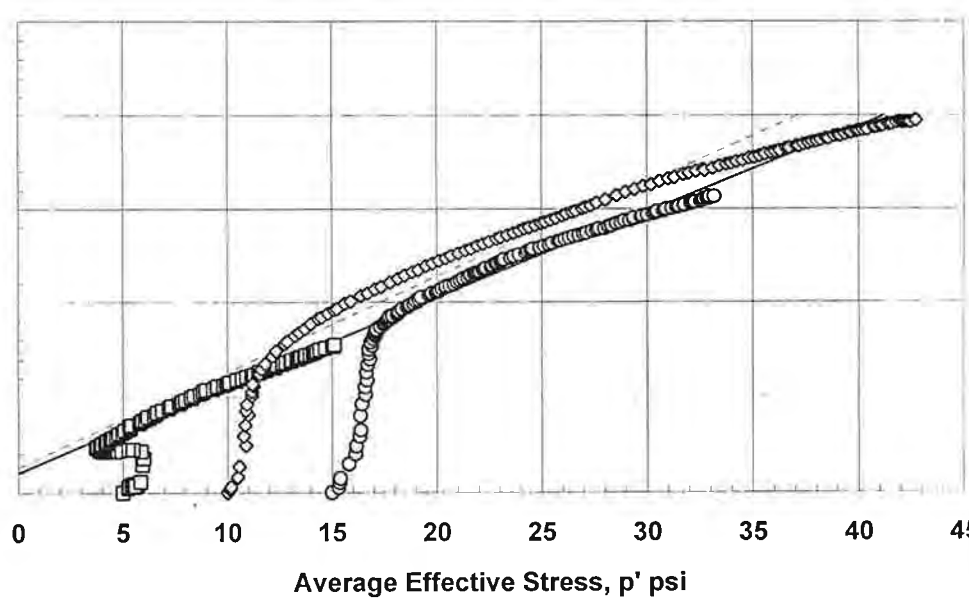


LEGEND AND SUMMARY INFORMATION

Symbol	Test	Boring	Sample	Depth (ft)	w_o (%)	γ_{to} (pcf)	σ'_c	LL	PI
□	T-1191	B-3	S-5	8.55	17.3	123.0	5.0	44	25
◊	T-1194	B-3	S-5	9	17.8	131.5	10.0	41	24
○	T-1192	B-3	S-6	11	18.0	128.1	15.0	---	---

SERIES SUMMARY

Notation	Failure Criteria	c'(psi)	Φ' (degrees)
———	15% strain	1.016	27.4
- - - -	Peak Obliquity	1.295	30.2

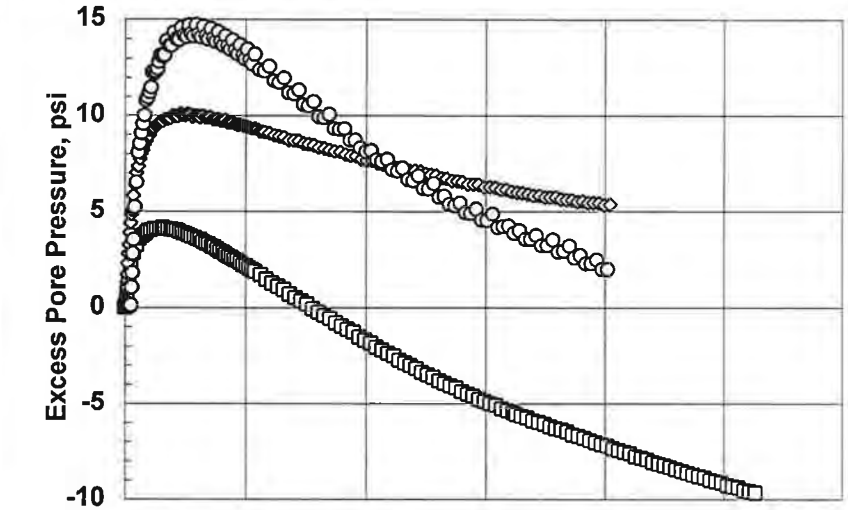


Test by:
Prepared by: CMT
Checked by: GT

		CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements SERIES SUMMARY
Woodward-Clyde Consultants	Project No.: 5E08560	May 1995 Fig. Series 1

6/7/95

Figure B–11

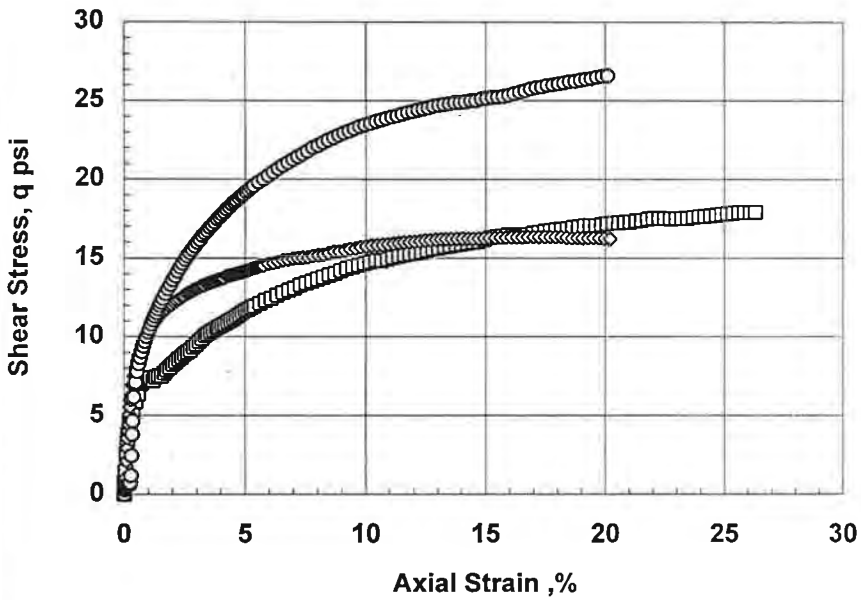


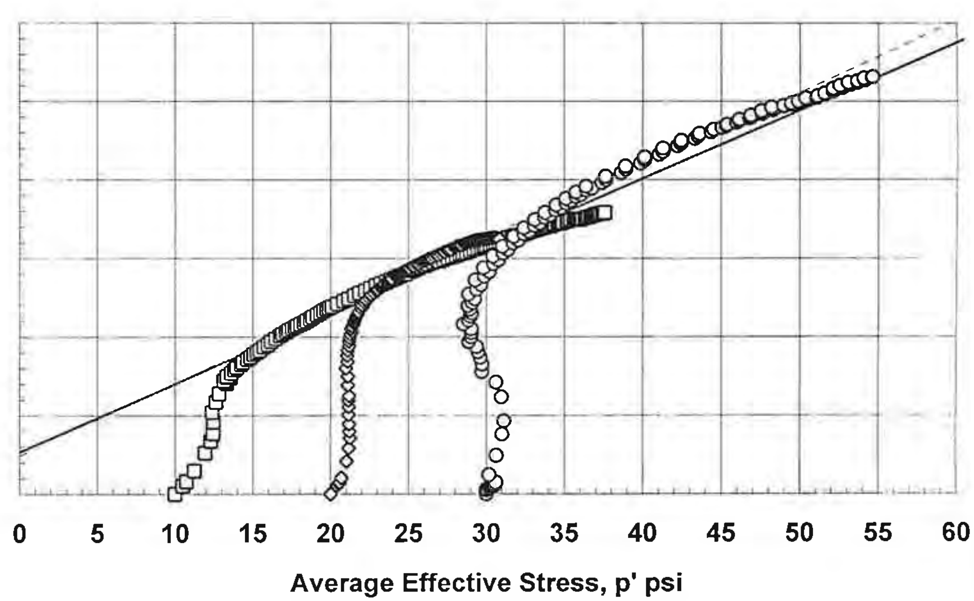
LEGEND AND SUMMARY INFORMATION

Symbol	Test	Boring	Sample	Depth (ft)	w_o (%)	γ_{to} (pcf)	σ'_c	LL	PI
□	T-1199	B-11A	S-12	25	21.2	128.1	10.0	---	---
◊	T-1201	B-11A	S-13	31	22.5	127.2	20.0	36	20
○	T-1200	B-11A	S-12	26	20.7	128.4	30.0	49	28

SERIES SUMMARY

Notation	Failure Criteria	c'(psi)	Φ' (degrees)
———	15% strain	2.66	25.8
- - - -	Peak Obliquity	2.415	27.6





Test by:

Prepared by: CMT

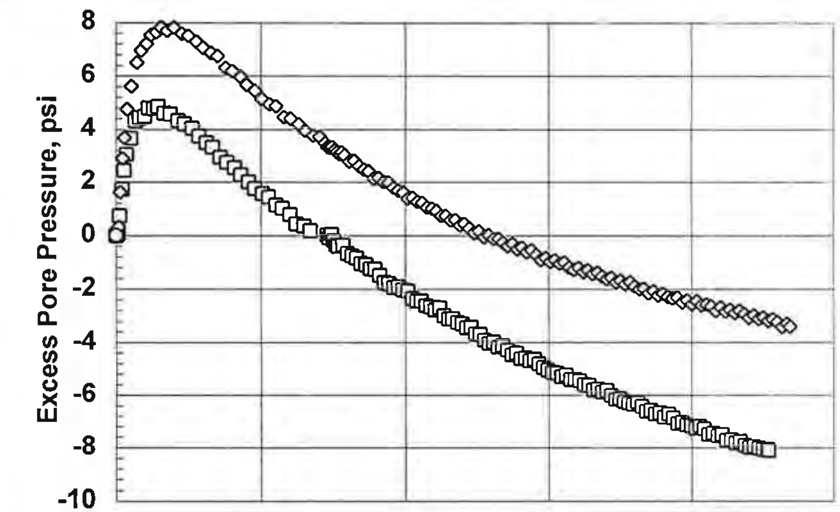
Checked by: GT

Woodward-Clyde Consultants | Project No.: 5E08560 | May 1995 | Fig. Series 4

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION
with Pore Pressure Measurements
SERIES SUMMARY

6/7/95

Figure B-12

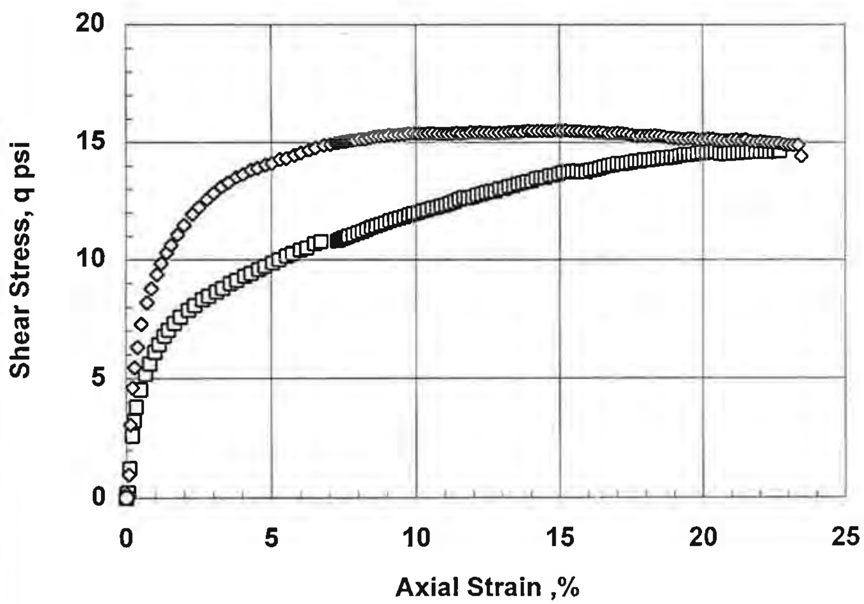


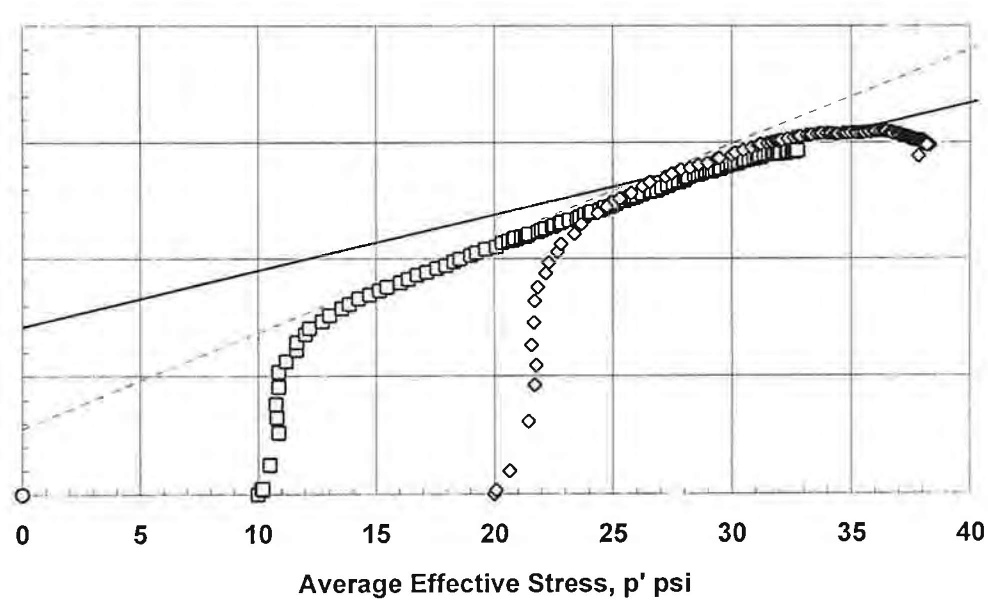
LEGEND AND SUMMARY INFORMATION

Symbol	Test	Boring	Sample	Depth (ft)	w_o (%)	γ_{to} (pcf)	σ'_c	LL	PI
□	T-1203	B-11A	S-11	20	19.6	130.4	10.0	46	21
◊	T-1202	B-11A	S-11	22	25.2	128.8	20.0	52	30
○	---	---	---	---	---	---	---	---	---

SERIES SUMMARY

Notation	Failure Criteria	c'(psi)	Φ' (degrees)
———	15% strain	7.082	13.9
- - - -	Peak Obliquity	2.796	23.9





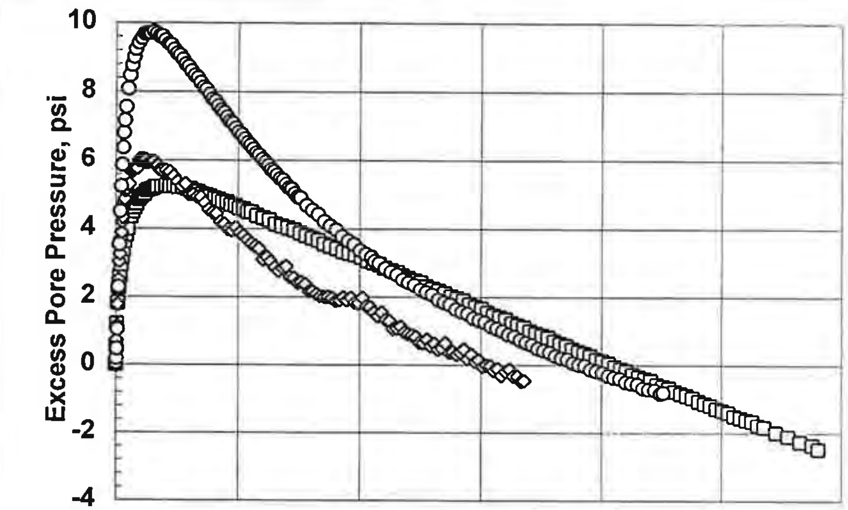
Prepared by: CMT

Checked by: GS

		CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements SERIES SUMMARY
Woodward-Clyde Consultants	Project No.: 5E08560	May 1995 Fig. Series 3

6/7/95

Figure B-13

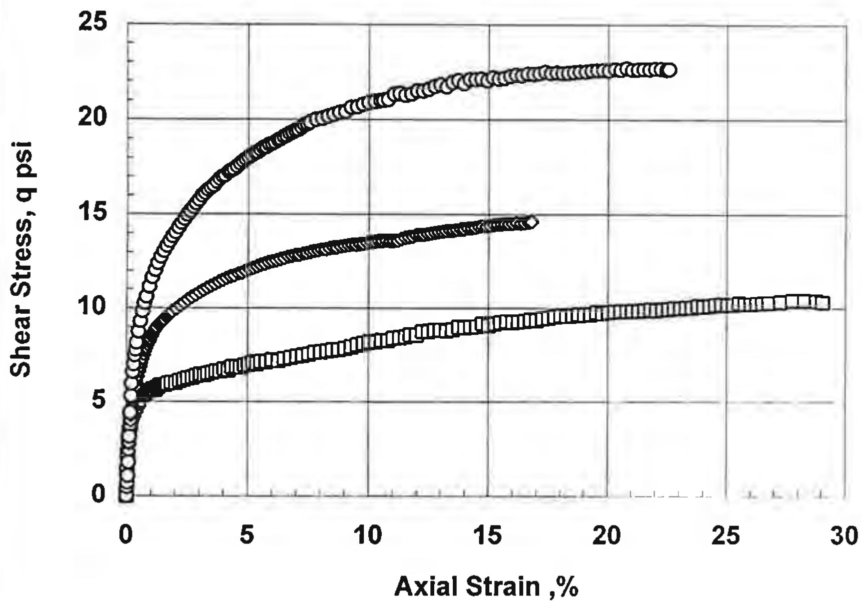


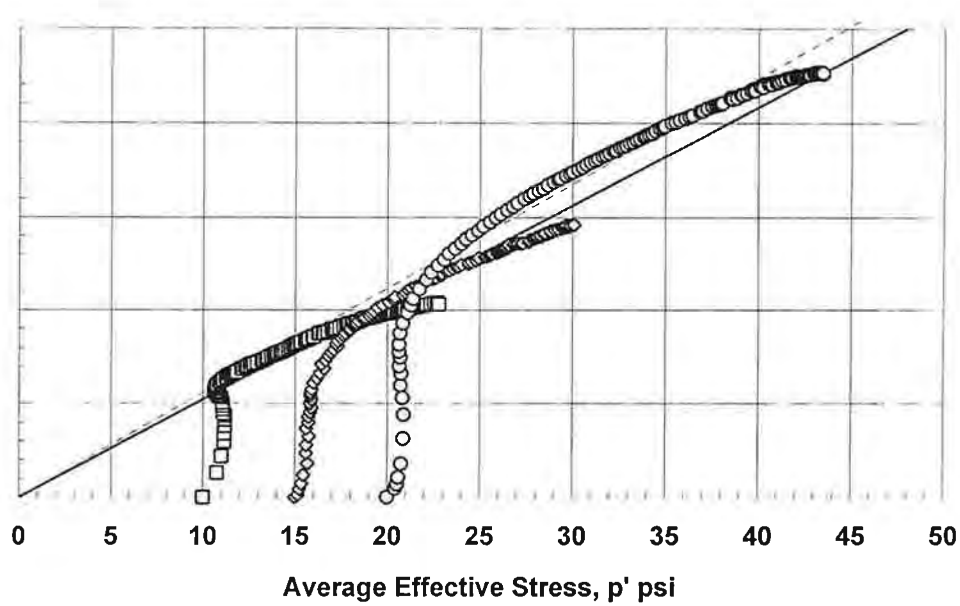
LEGEND AND SUMMARY INFORMATION

Symbol	Test	Boring	Sample	Depth (ft)	w_o (%)	γ_{to} (pcf)	σ'_c	LL	PI
□	T-1190	B-3	S-9	17	18.7	124.0	10.0	46	25
◊	T-1195	B-3	S-10	19	23.4	124.1	15.0	52	30
○	T-1193	B-3	S-10	20	21.4	126.1	20.0	42	23

SERIES SUMMARY

Notation	Failure Criteria	c'(psi)	Φ' (degrees)
— —	15% strain	0	31.4
- - -	Peak Obliquity	0	34





Test by:

Prepared by: CMT

Checked by: GT

		CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION with Pore Pressure Measurements SERIES SUMMARY
Woodward-Clyde Consultants	Project No.: 5E08560	May 1995 Fig. Series 2

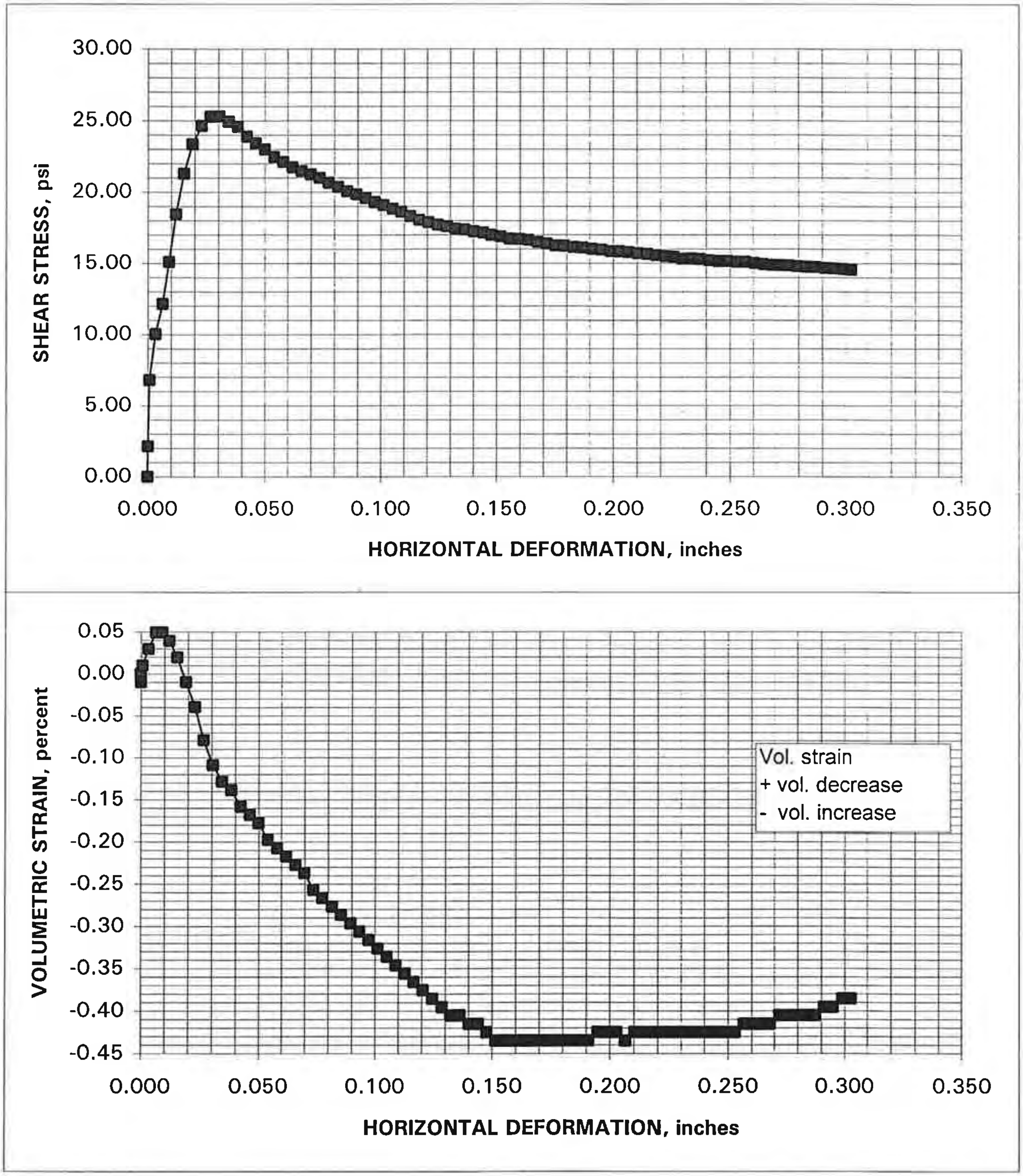
6/7/95

Figure B-14

DIRECT SHEAR TEST

Boring No.:	B-101	Spec. Hgt.:	1.012 in.	Proj. No.:	5E08560
Sample No.:	S-12	Spec. Dia.:	2.500 in.	Test No.:	DS-062
Spec. No.:	NONE	Load Rate:	4.8E-2 in/min		
Depth (ft):	54.25	Output Units:	psi		

Eff. Vert. Conf. Stress: 34.7 psi



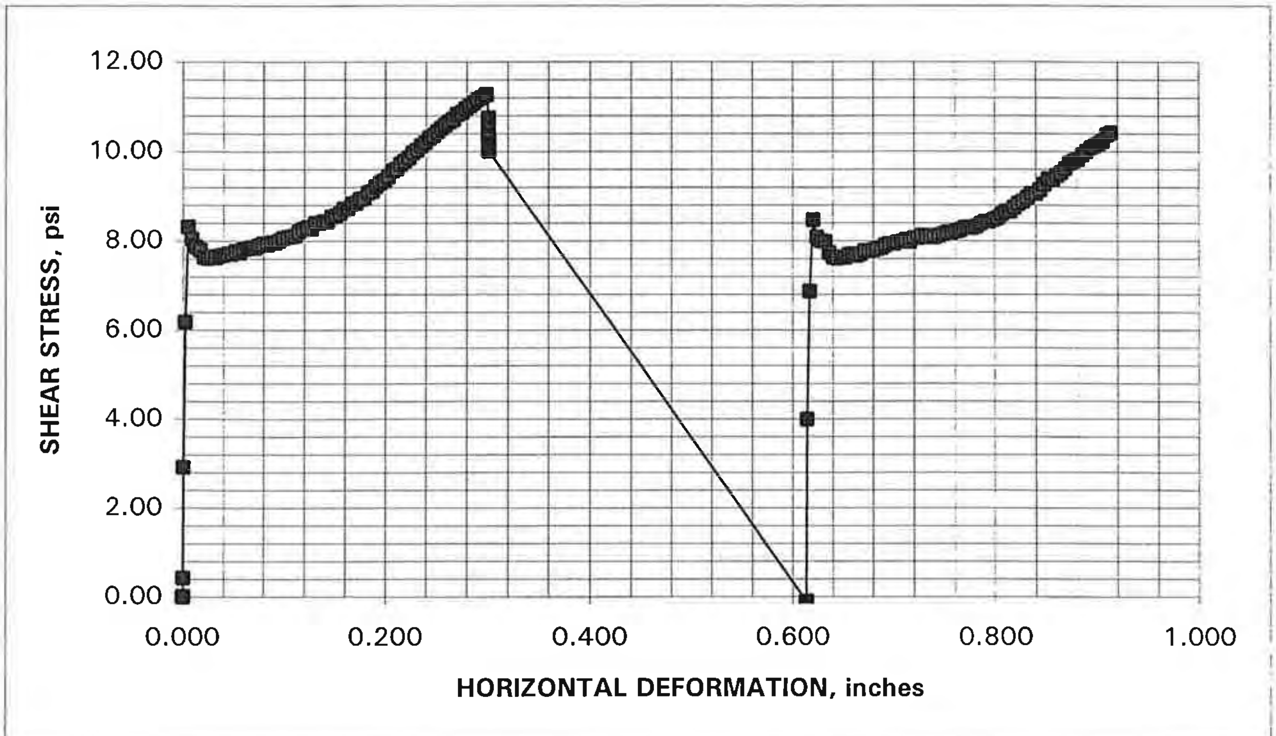
File: DS-062A.XLS Prepared by: CMT Reviewed by: GT Date: 5/16/95

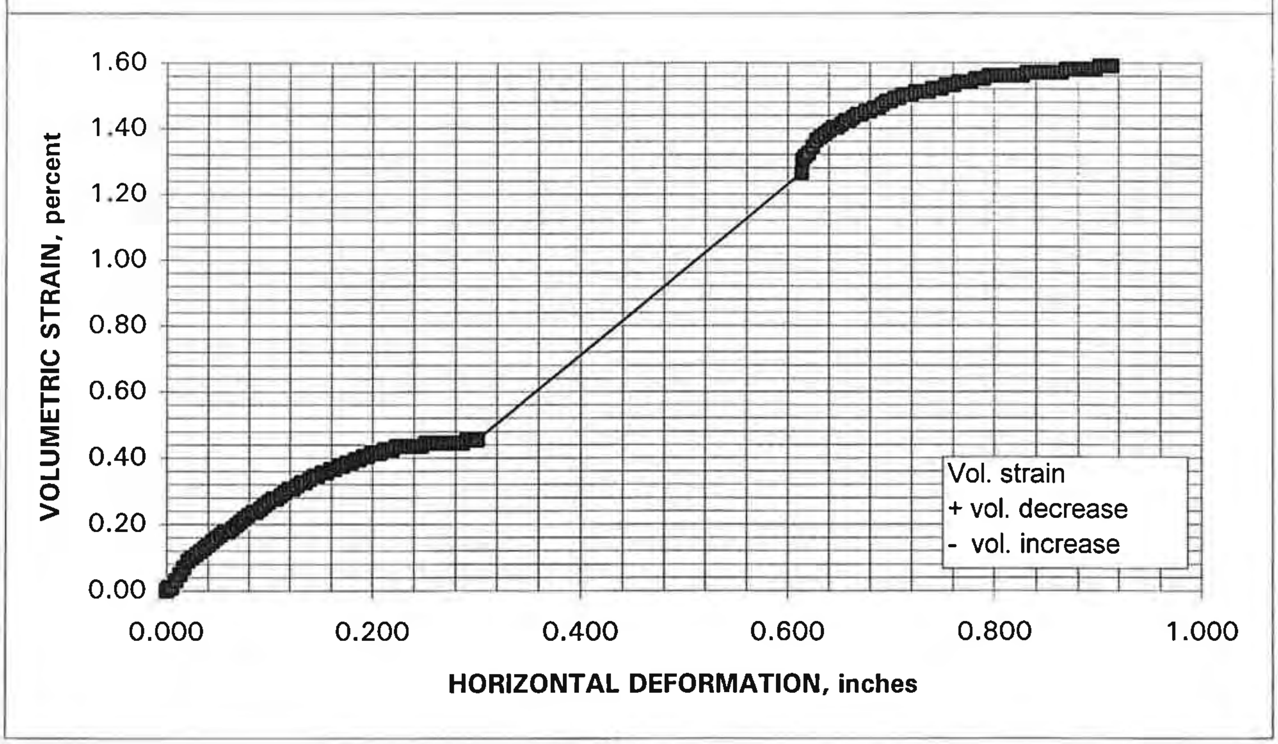
Figure B-15

DIRECT SHEAR TEST

Boring No.:	B-101	Spec. Hgt.:	1.012 in.	Proj. No.:	5E08560
Sample No.:	S-12	Spec. Dia.:	2.500 in.	Test No.:	DS-062
Spec. No.:	NONE	Load Rate:	4.8E-2 in/min		
Depth (ft):	54.25	Output Units:	psi		

Eff. Vert. Conf. Stress: 34.7 psi





File: DS-062B.XLS Prepared by: CMT Reviewed by: ____ Date: 5/16/95 **Figure B-16**

APPENDIX C

INSTRUMENTATION

C-1 INCLINOMETERS

C-2 PEIZOMETER LOGS

C-3 ILLINOIS POWER CRACK GAGES

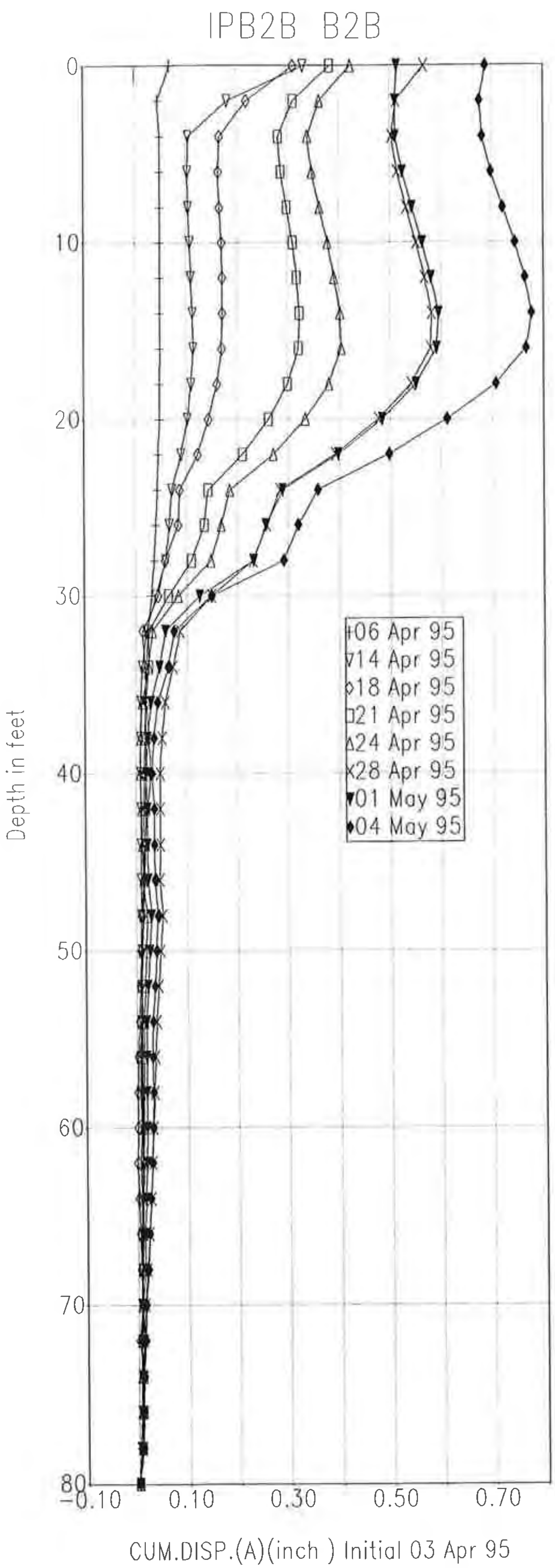
APPENDIX C
INSTRUMENTATION

APPENDIX C-1 - INCLINOMETERS

Six inclinometers were installed in borings within the landslide area. The purpose of the inclinometers was to determine the elevations of the slide planes and the rate of movement. Inclinometers were installed at depths ranging from 40 to 80 ft. Measurements within the inclinometers were made biweekly and summaries of the readings are shown in Figures C-1-1 through C-1-6. The amount of movement of the slides has been so great that all of the inclinometers eventually could not be read beyond the depth of the failure plane. Although new readings are not possible, the inclinometers clearly indicate the depth of the failure planes.

After the removal of soil for the interim repair, two additional inclinometers were installed to monitor possible movement along the failure plane. The readings taken in the month after installation indicate no significant movement and are shown in Figures C-1-7 and C-1-8.

Figure C-1-1


IPB2B B2B
Depth in feet
0
10
20
30
40
50
60
70
80
-0.10
0.10
0.30
0.50
0.70
06 Apr 95
14 Apr 95
18 Apr 95
21 Apr 95
24 Apr 95
28 Apr 95
01 May 95
04 May 95
CUM.DISP.(A)(inch) Initial 03 Apr 95

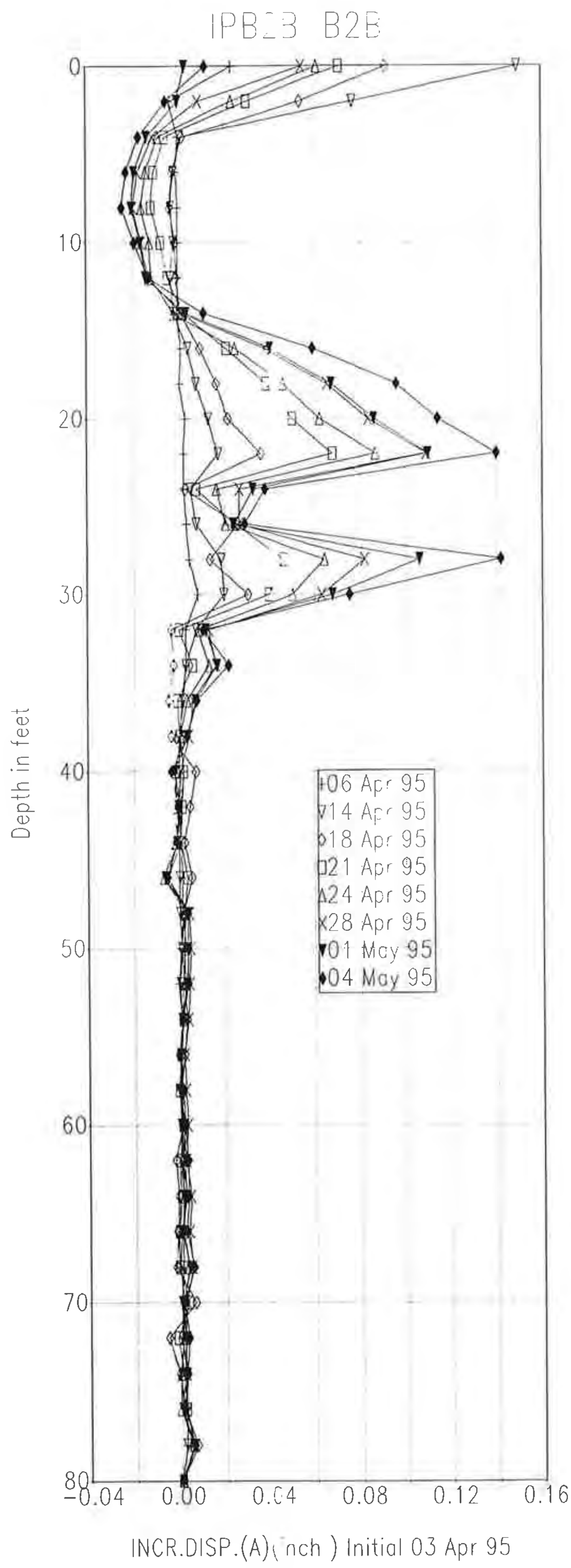
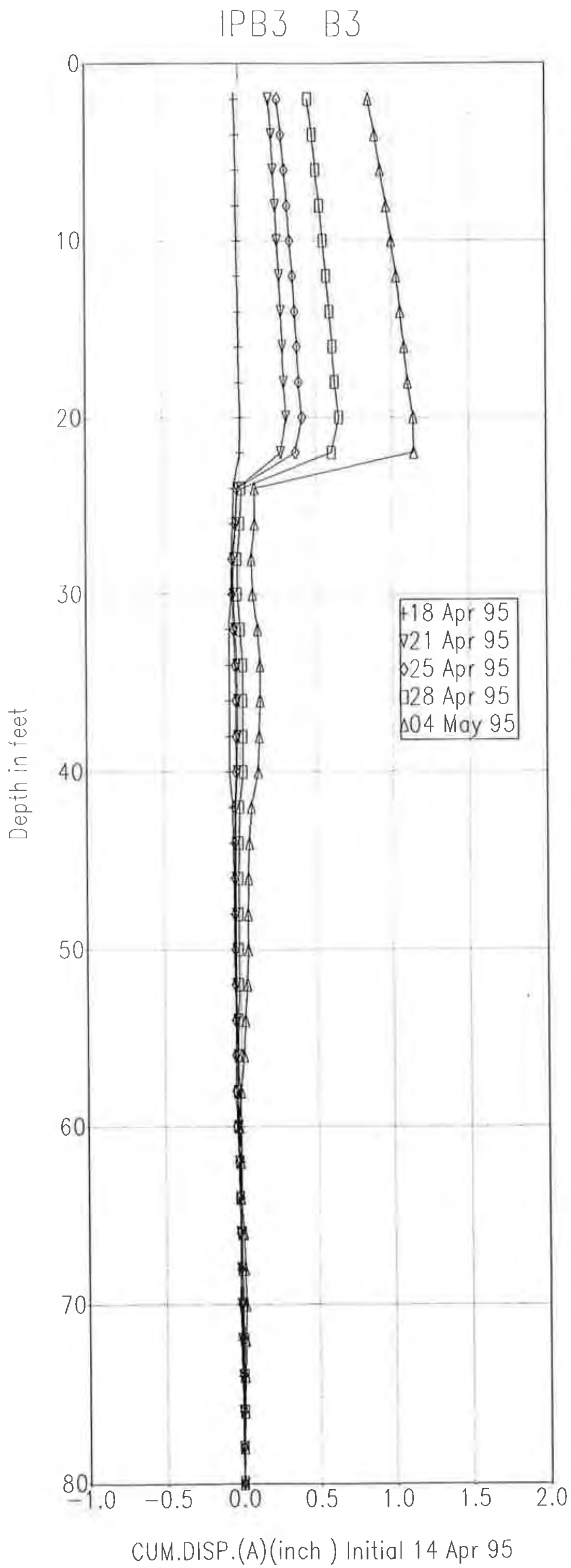

IPB2B B2B
Depth in feet
0
10
20
30
40
50
60
70
80
-0.04
0.00
0.04
0.08
0.12
0.16
06 Apr 95
14 Apr 95
18 Apr 95
21 Apr 95
24 Apr 95
28 Apr 95
01 May 95
04 May 95
INCR.DISP.(A)(inch) Initial 03 Apr 95

Figure C-1-2


IPB3 B3
Depth in feet
0
10
20
30
40
50
60
70
80
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
+18 Apr 95
▽21 Apr 95
◇25 Apr 95
□28 Apr 95
△04 May 95
CUM.DISP.(A)(inch) Initial 14 Apr 95

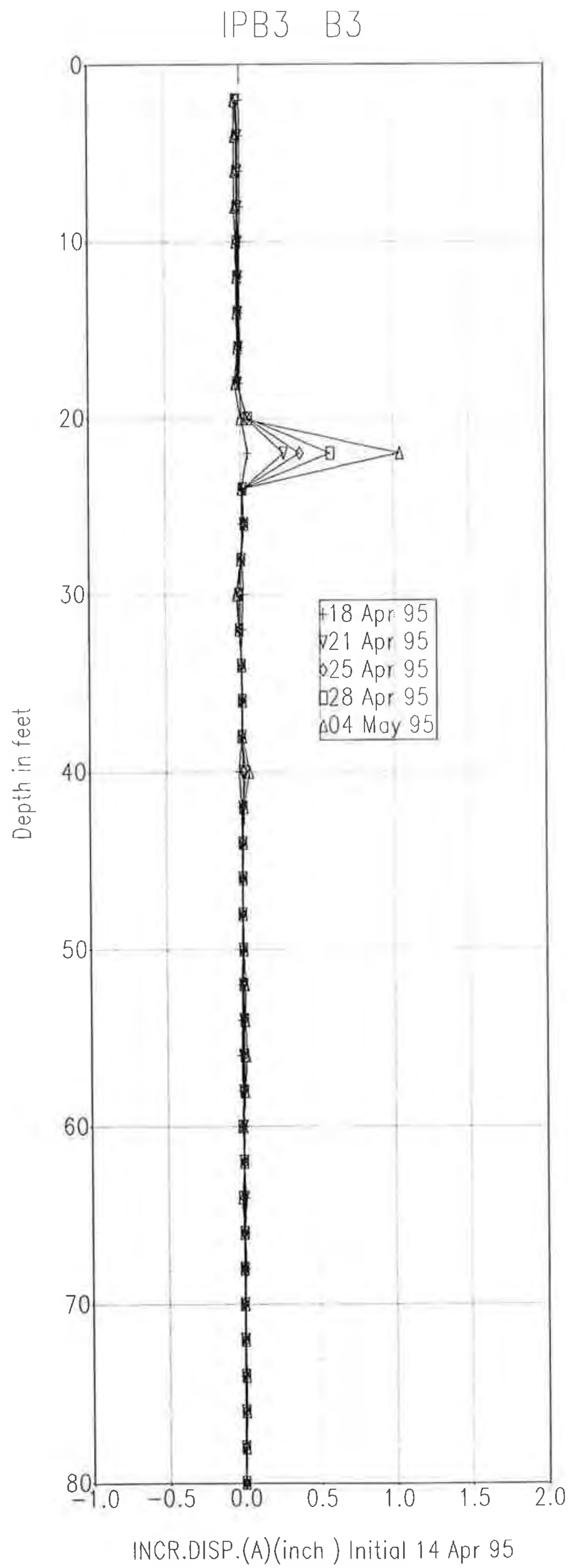
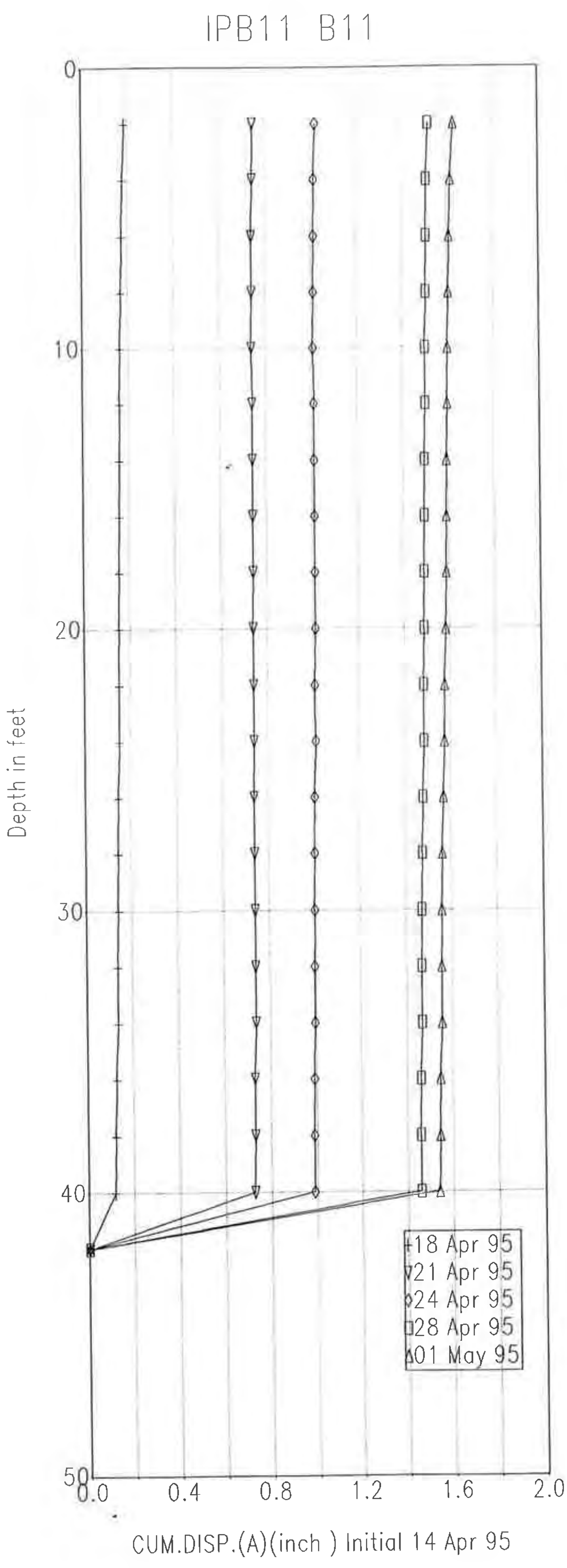
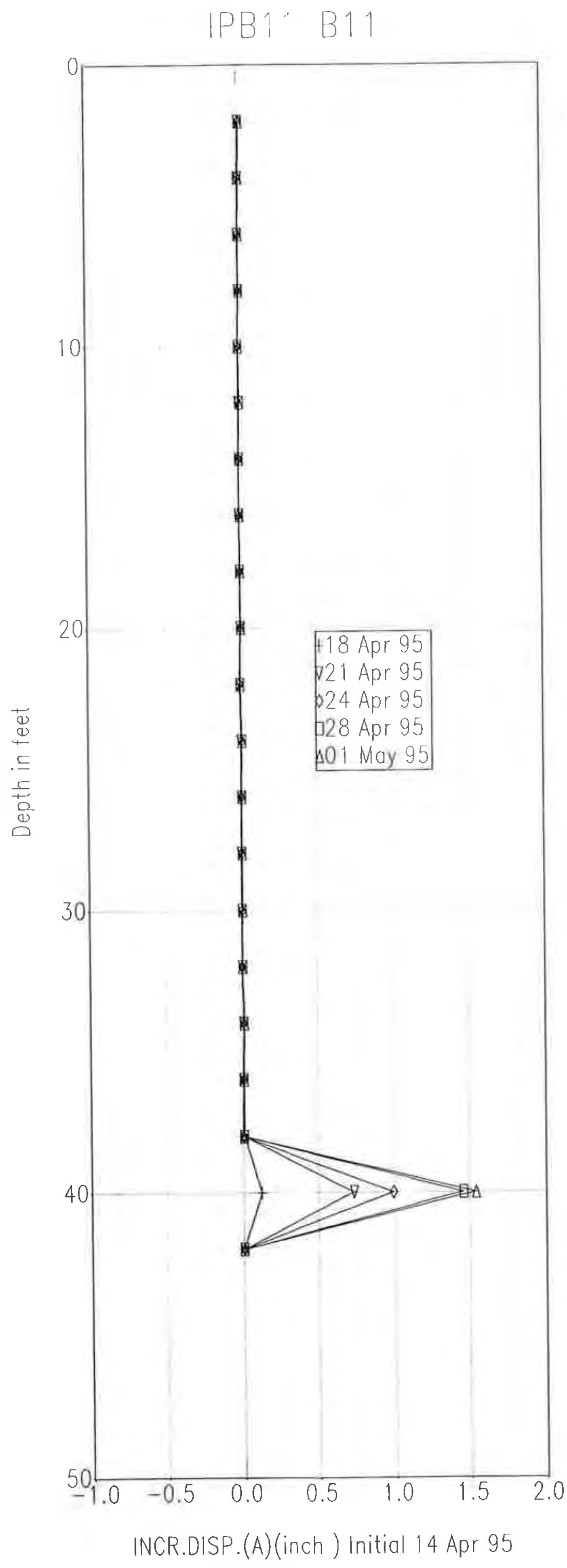

IPB3 B3
Depth in feet
0
10
20
30
40
50
60
70
80
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
+18 Apr 95
▽21 Apr 95
◇25 Apr 95
□28 Apr 95
△04 May 95
INCR.DISP.(A)(inch) Initial 14 Apr 95

Figure C-1-3

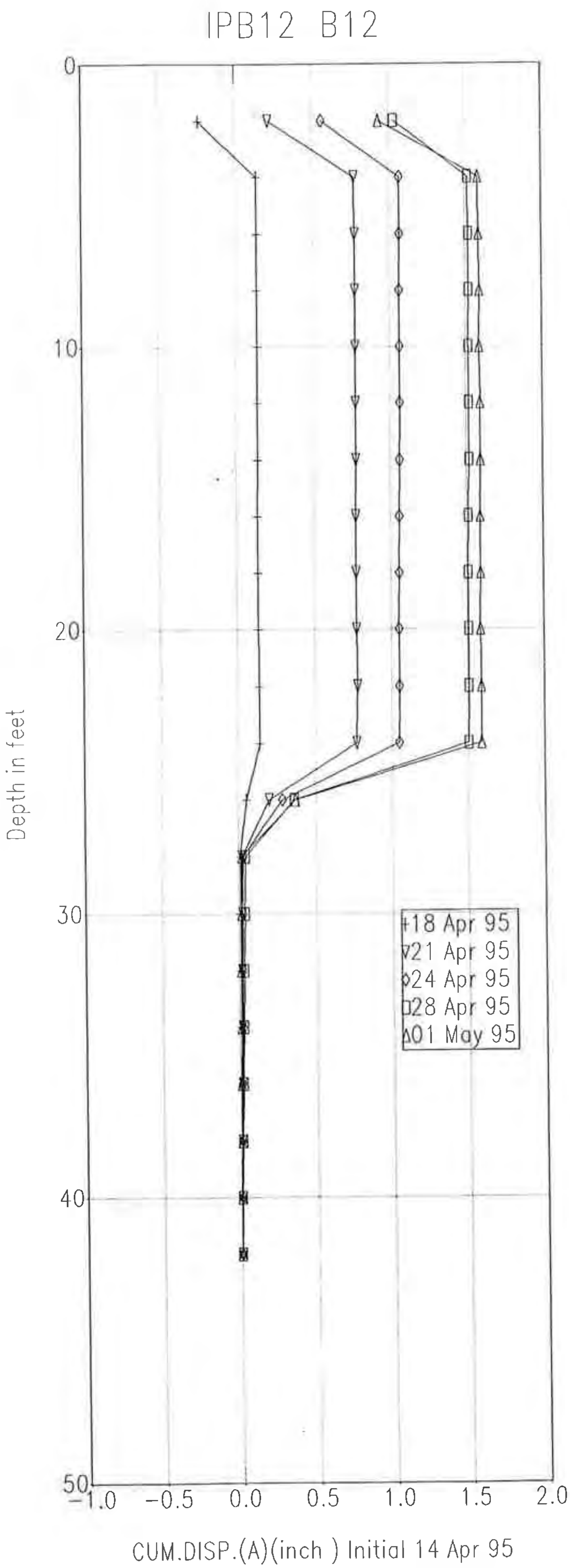


IPB11 B11
Depth in feet
0
10
20
30
40
50
0.0
0.4
0.8
1.2
1.6
2.0
+18 Apr 95
▽21 Apr 95
◇24 Apr 95
□28 Apr 95
△01 May 95
CUM.DISP.(A)(inch) Initial 14 Apr 95



IPB11 B11
Depth in feet
0
10
20
30
40
50
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
+18 Apr 95
▽21 Apr 95
◇24 Apr 95
□28 Apr 95
△01 May 95
INCR.DISP.(A)(inch) Initial 14 Apr 95

Figure C-1-4


IPB12 B12
Depth in feet
0
10
20
30
40
50
-1.0 -0.5 0.0 0.5 1.0 1.5 2.0
CUM.DISP.(A)(inch) Initial 14 Apr 95
+18 Apr 95
▽21 Apr 95
◇24 Apr 95
□28 Apr 95
△01 May 95

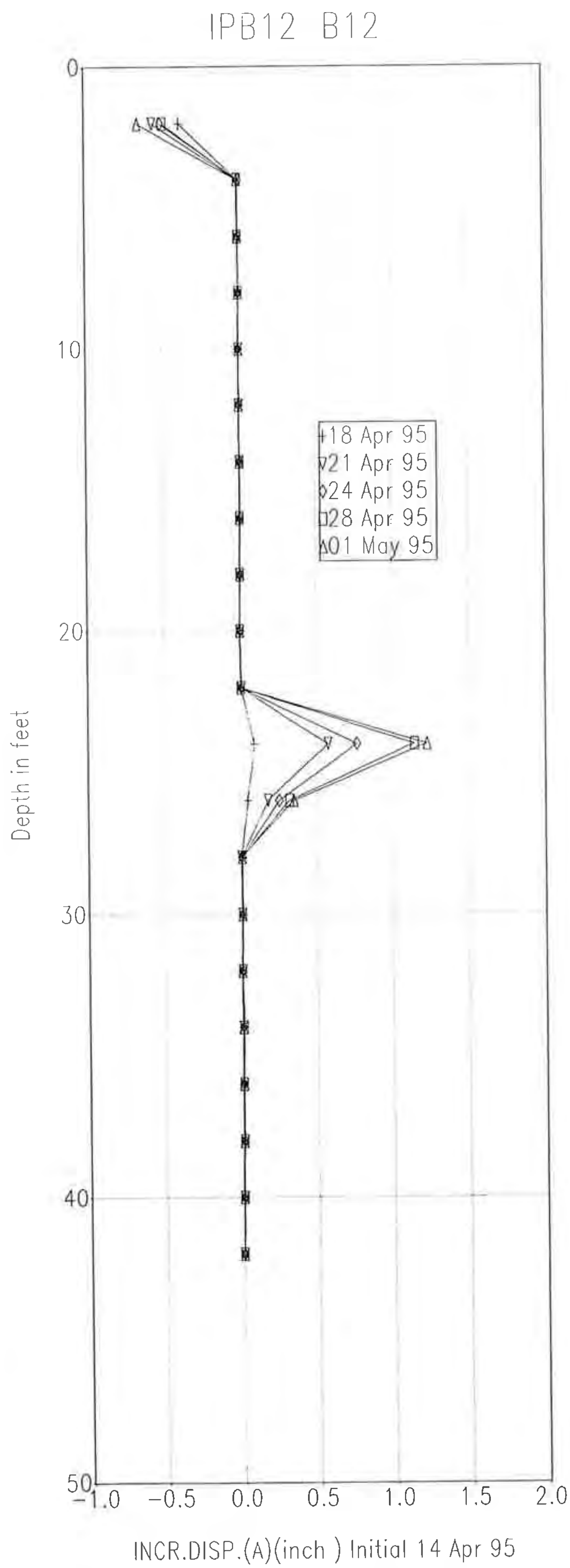
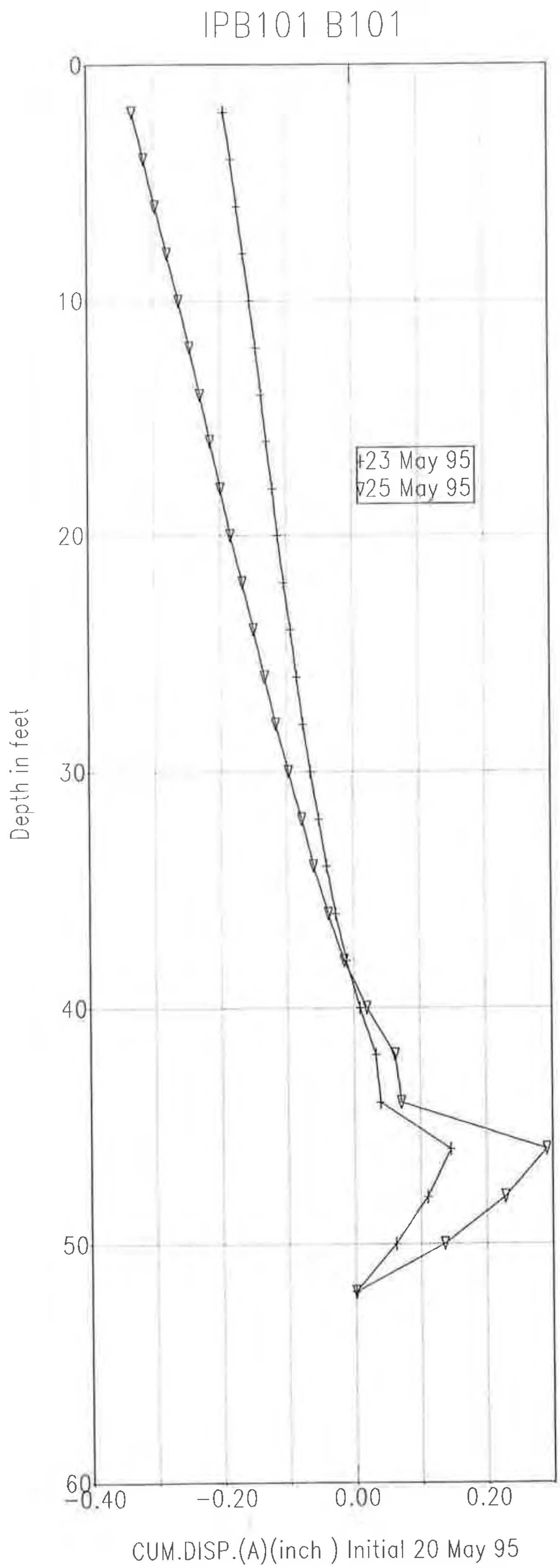

IPB12 B12
Depth in feet
0
10
20
30
40
50
-1.0 -0.5 0.0 0.5 1.0 1.5 2.0
INCR.DISP.(A)(inch) Initial 14 Apr 95
+18 Apr 95
▽21 Apr 95
◇24 Apr 95
□28 Apr 95
△01 May 95

Figure C-1-5


IPB101 B101
+23 May 95
▽25 May 95
Depth in feet
0
10
20
30
40
50
60
-0.40
-0.20
0.00
0.20
CUM.DISP.(A)(inch) Initial 20 May 95

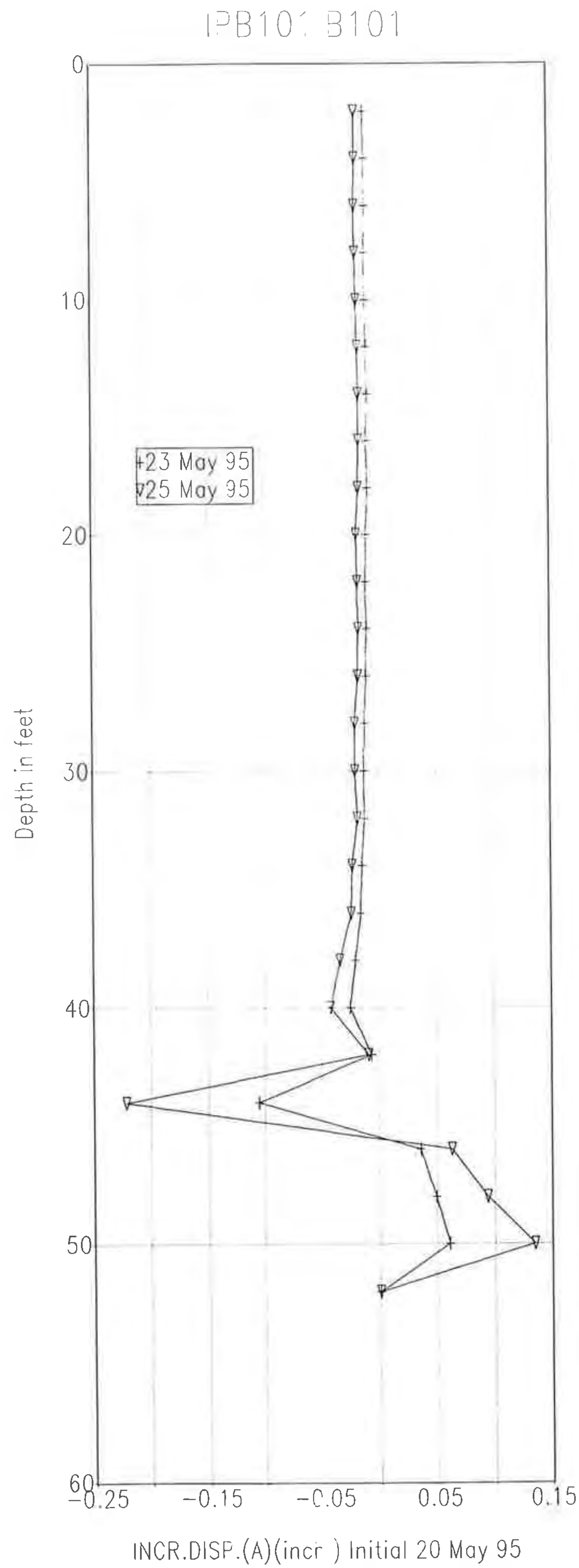
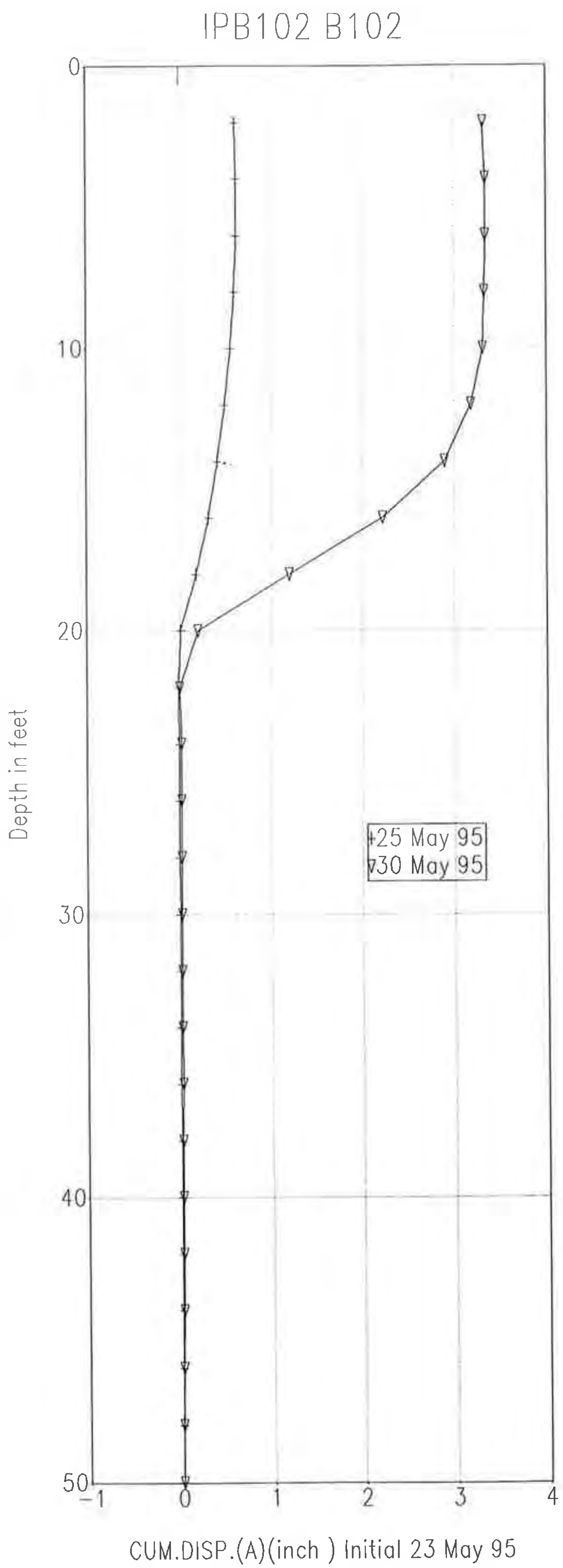

IPB101 B101
+23 May 95
▽25 May 95
Depth in feet
0
10
20
30
40
50
60
-0.25
-0.15
-0.05
0.05
0.15
INCR.DISP.(A)(incr) Initial 20 May 95

Figure C-1-6


IPB102 B102
0
10
20
30
40
50
Depth in feet
+25 May 95
▿30 May 95
-1
0
1
2
3
4
CUM.DISP.(A)(inch) Initial 23 May 95

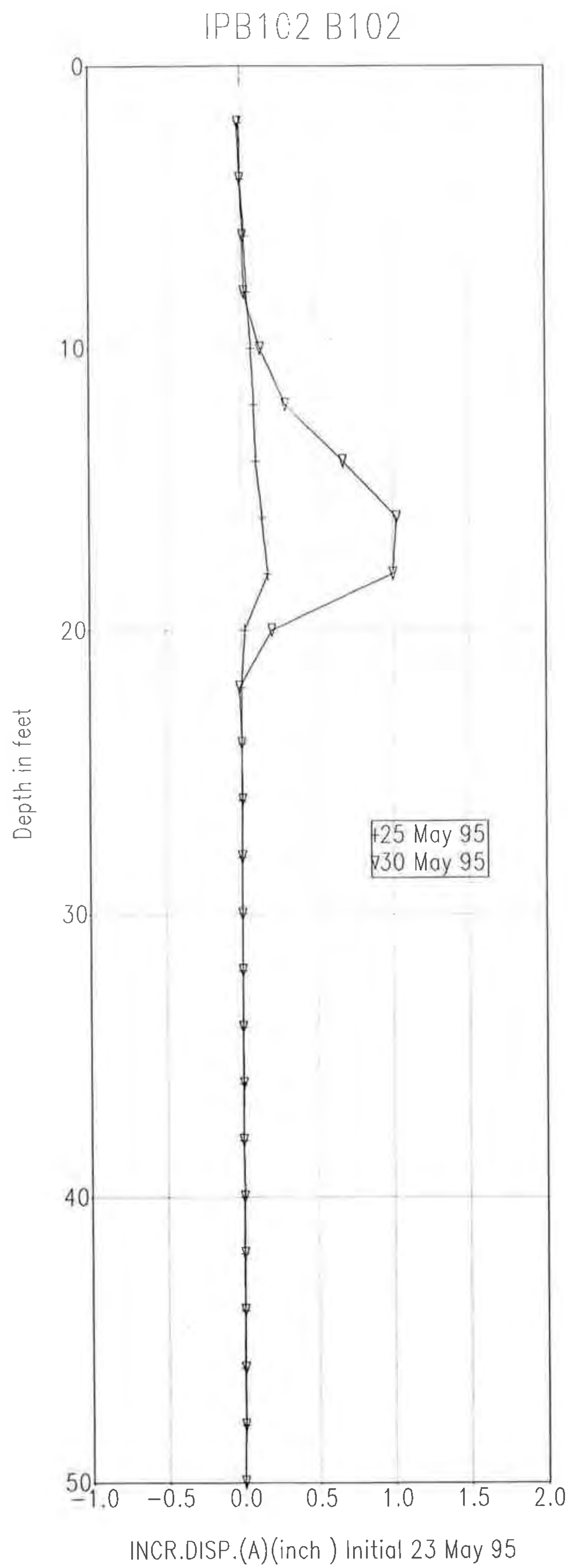
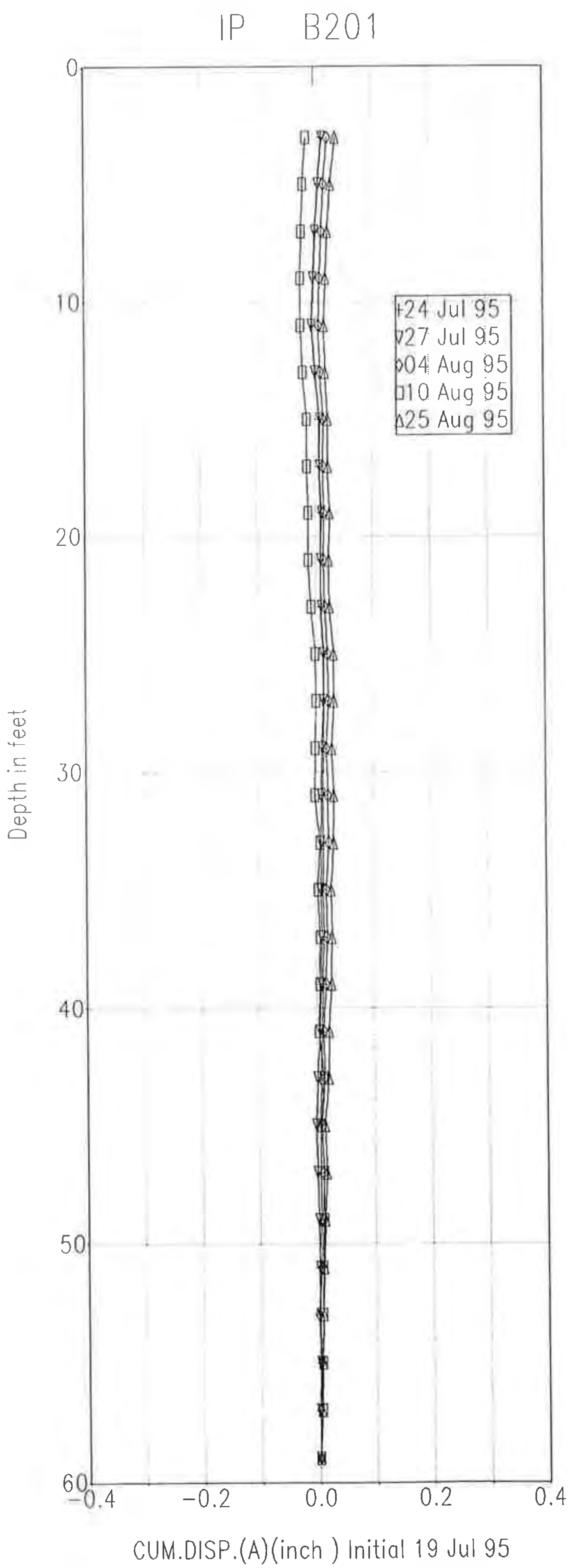

IPB102 B102
0
10
20
30
40
50
Depth in feet
+25 May 95
▿30 May 95
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
INCR.DISP.(A)(inch) Initial 23 May 95

Figure C-1-7


IP B201
+24 Jul 95
▽27 Jul 95
◇04 Aug 95
□10 Aug 95
△25 Aug 95
Depth in feet
0
10
20
30
40
50
60
-0.4
-0.2
0.0
0.2
0.4
CUM.DISP.(A)(inch) Initial 19 Jul 95

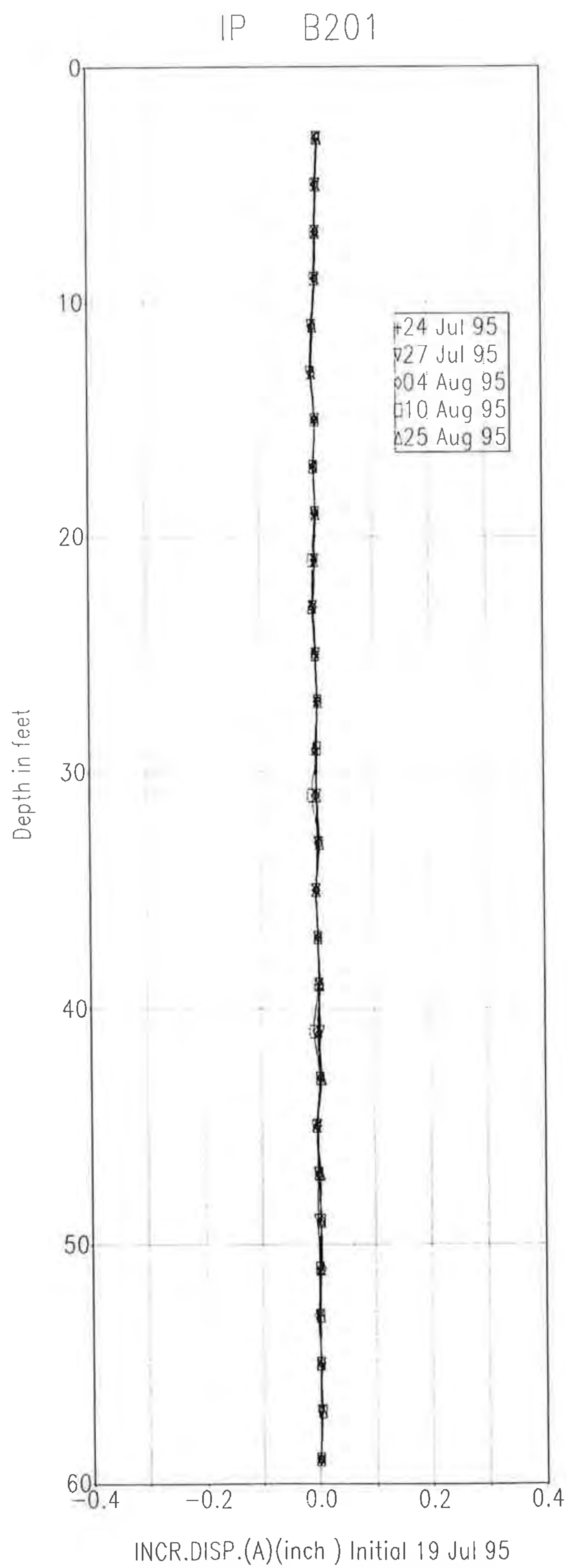
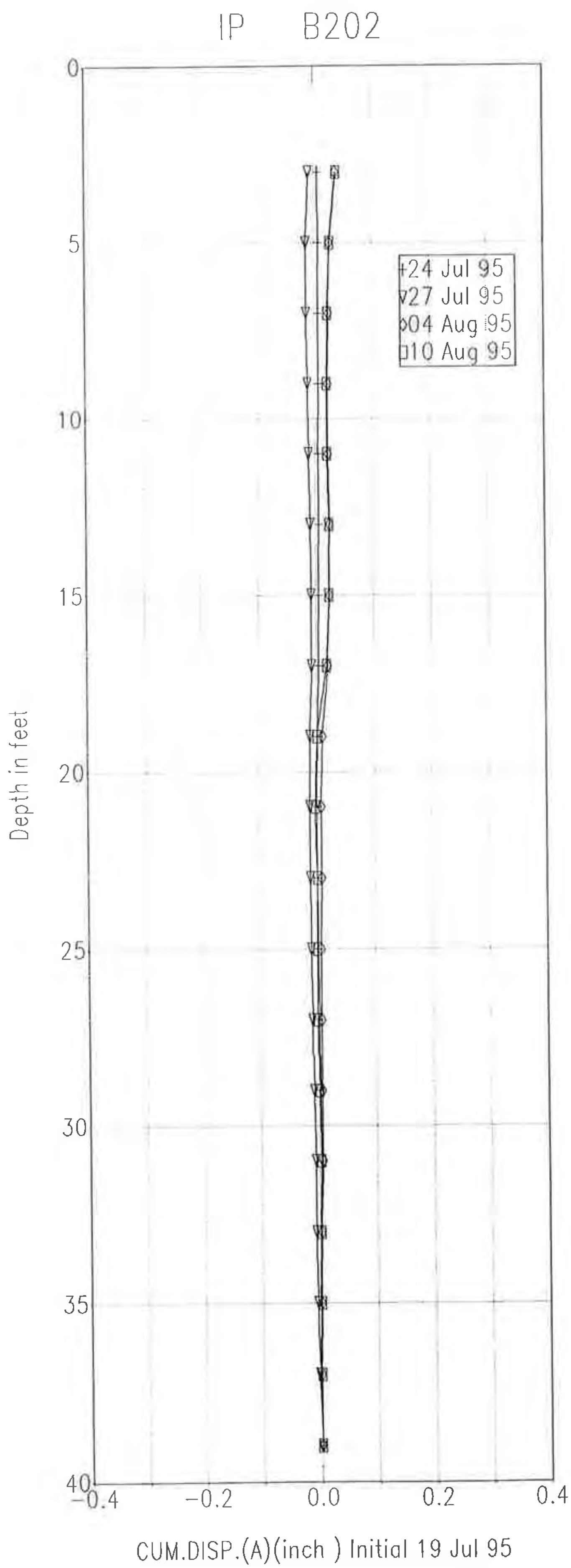
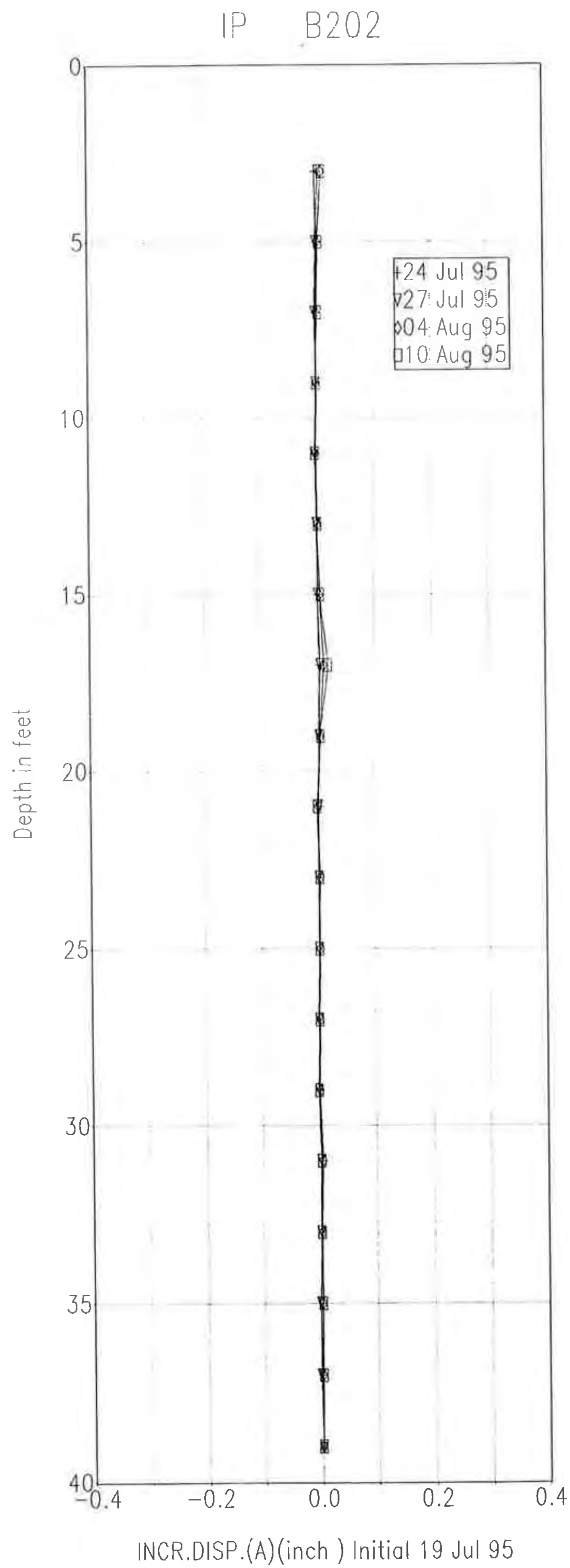

IP B201
+24 Jul 95
▽27 Jul 95
◇04 Aug 95
□10 Aug 95
△25 Aug 95
Depth in feet
0
10
20
30
40
50
60
-0.4
-0.2
0.0
0.2
0.4
INCR.DISP.(A)(inch) Initial 19 Jul 95

Figure C-1-8


IP B202
0
5
10
15
20
25
30
35
40
Depth in feet
+24 Jul 95
▽27 Jul 95
◇04 Aug 95
□10 Aug 95
-0.4
-0.2
0.0
0.2
0.4
CUM.DISP.(A)(inch) Initial 19 Jul 95


IP B202
0
5
10
15
20
25
30
35
40
Depth in feet
+24 Jul 95
▽27 Jul 95
◇04 Aug 95
□10 Aug 95
-0.4
-0.2
0.0
0.2
0.4
INCR.DISP.(A)(inch) Initial 19 Jul 95

APPENDIX C-2 - PIEZOMETER LOGS

A total of 10 piezometers were installed at the site to determine groundwater levels within the area. One stand-pipe piezometer was installed to a depth of 27-ft in P-1. Six vibrating wire piezometers were installed within the landslide, and three were installed east of the landslide. Detailed piezometer installation logs are included as Figures C-2-1 through C-2-10. A summary of the data collected from the piezometers is shown in Table 2. Results are plotted in Figure 10.

MONITORING WELL INSTALLATION REPORT **FIG. C-2-1**

Well No. PZ-01

Project: Illinois Power/Baldwin Power Station — Location: Baldwin, IL

Project No: 5E08560 — Installed By: Layne-Western — Date: 3/20/95 — Time:

Method of Installation:

LOG OF BORING AND WELL

BORING

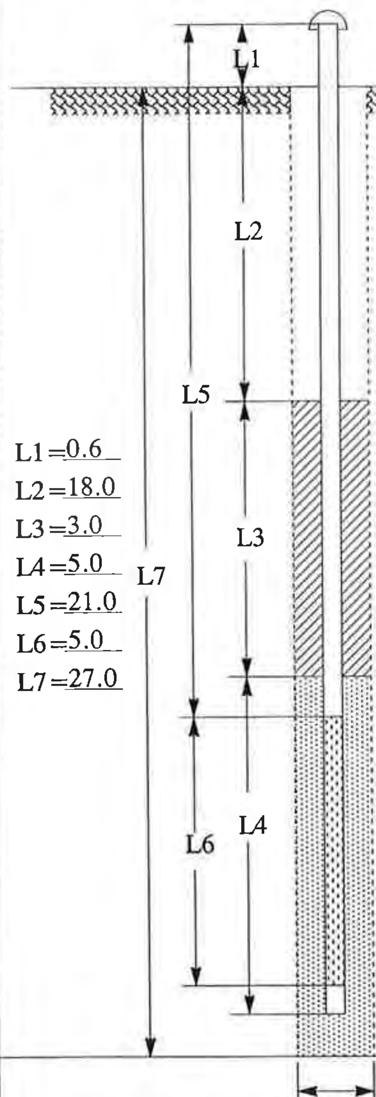
Depth in Ft.	Description	Symbol
0.00	Medium stiff, damp to moist, reddish-brown, low plastic, Silty CLAY (CL)(FILL)	
	Becomes damp	
	Becomes moist	
	Grades trace gravel	
	Becomes damp, brown	
	Becomes gray with fly ash	
	Becomes brown and gray	
21.00	Loose, moist, black, bottom ash (SP)	
	Very loose, wet, black, bottom ash (SP)	

WELL

Type of Well: Piezometer

Ground Elev. 98.0 — Top of Riser Elev. 98.0

L1 = 0.6
L2 = 18.0
L3 = 3.0
L4 = 5.0
L5 = 21.0
L6 = 5.0
L7 = 27.0



Riser Pipe I.D., in. 2

Type of Pipe: Schedule 40 PVC

Backfill Type Around Riser: Grout

Top of Seal Elevation: 80.0

Type of Seal Material: Enviroplug

Top of Filter Elevation: 77.0

Type of Filter Material: Sand and ash sluff

Size of Opening, in. 0.01

Diameter of Well Tip, in. 2.0

Bottom of Screen Elevation: 72.0

Bottom of Riser Elevation: 72.0

Bttm of Boring Elev. 71.0

Diameter of Boring, in. 4.3

Remarks:

Inspected By: K. Berry

WOODWARD-CLYDE CONSULTANTS

MONITORING WELL INSTALLATION REPORT **FIG. C–2–2**

Well No. **PZ-02**

Project **Illinois Power/Baldwin Power Station** Location Baldwin, IL

Project No **5E08560** Installed By Layne-Western Date 4/13/95 Time

Method of Installation Drive point vibrating wire piezometer. Piezometer is pushed for final 5 feet of installation.

LOG OF BORING AND WELL

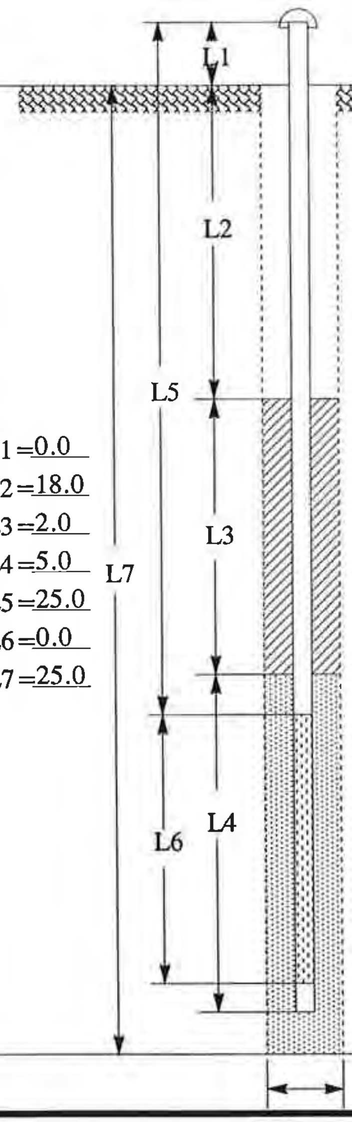
BORING

Depth in Ft.	Description	Symbol
0.00	Soft, damp, reddish-brown, Silty CLAY (CL); with organic roots	
2.00	Medium stiff, damp, reddish-gray with black specks, Silty CLAY (CL) Becoming reddish-brown Damp	
10.00	Becoming reddish-brown with gray, high plastic CLAY (CH)	
14.00	Reddish-brown-gray, low plastic CLAY (CL); with trace sand Becoming gray with reddish-brown; trace sand Gray with reddish brown	

WELL

Type of Well Vibr. Wire Piezo.

Ground Elev. 74.5 Top of Riser Elev. 74.5



L1 = 0.0
L2 = 18.0
L3 = 2.0
L4 = 5.0
L5 = 25.0
L6 = 0.0
L7 = 25.0

Riser Pipe I.D., in. N/A

Type of Pipe Wire

Backfill Type Around Riser Cement grout

Top of Seal Elevation 56.5

Type of Seal Material Bentonite pellets

Top of Filter Elevation 54.5

Type of Filter Material N/A

Size of Opening, in. 0.00

Diameter of Well Tip, in. 1.3

Bottom of Screen Elevation 49.5

Bottom of Riser Elevation 49.5

Bttm of Boring Elev. 54.5

Diameter of Boring, in. 4.0

Remarks

Inspected By K. Berry

WOODWARD-CLYDE CONSULTANTS

MONITORING WELL INSTALLATION REPORT **FIG. C-2-3**

Well No. PZ-02A

Project Illinois Power/Baldwin Power Station — Location Baldwin, IL

Project No 5E08560 — Installed By Roberts Env. — Date 5/10/95 — Time

Method of Installation

LOG OF BORING AND WELL

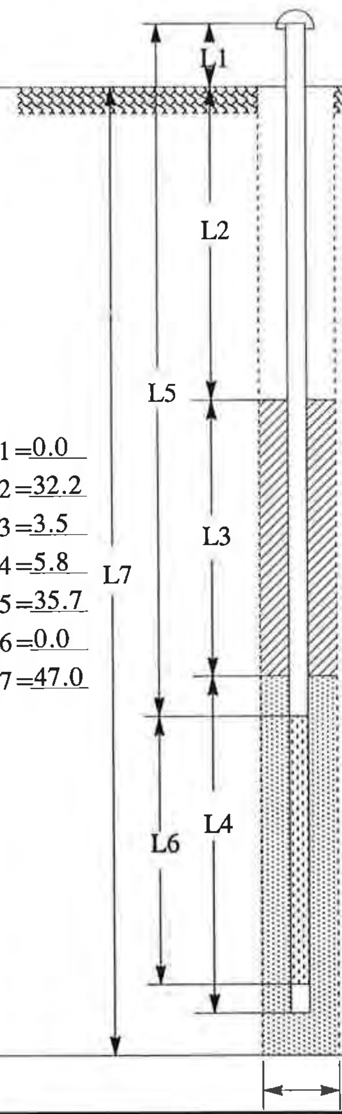
BORING

Depth in Ft.	Description	Symbol
0.00	Boring not sampled 0 - 29.0 feet (See Log of Boring B-11A)	
29.00	Stiff to very stiff, moist, orange and gray, high plastic CLAY (CH); with trace gravel Becomes very stiff, light brown; with little sand	
39.00	Hard, high plastic CLAY (CH) (highly weathered shale)	
41.50	Highly weathered LIMESTONE	
42.10	Brown and gray, high plastic, highly weathered SHALE; with trace sand and gravel Possible slickenside at 43.0 feet	

WELL

Type of Well Vibr. Wire Piezo.

Ground Elev. 74.5 — Top of Riser Elev. 74.5



L1 = 0.0
L2 = 32.2
L3 = 3.5
L4 = 5.8
L5 = 35.7
L6 = 0.0
L7 = 47.0

Riser Pipe I.D., in. N/A

Type of Pipe Wire

Backfill Type Around Riser Grout

Top of Seal Elevation 42.3

Type of Seal Material Bentonite chips

Top of Filter Elevation 38.8

Type of Filter Material Meramec sand

Size of Opening, in. 0.00

Diameter of Well Tip, in. 0.5

Bottom of Screen Elevation 33.0

Bottom of Riser Elevation 33.0

Bttm of Boring Elev. 27.5

Diameter of Boring, in. 8.0

Remarks

Inspected By K. Berry

WOODWARD-CLYDE CONSULTANTS

MONITORING WELL INSTALLATION REPORT **FIG. C-2-4**

Well No. PZ-03

Project Illinois Power/Baldwin Power Station | Location Baldwin, IL

Project No 5E08560 | Installed By Layne-Western | Date 4/13/95 | Time

Method of Installation Drive point vibrating wire piezometer. Piezometer is pushed for final 5 feet of installation.

LOG OF BORING AND WELL

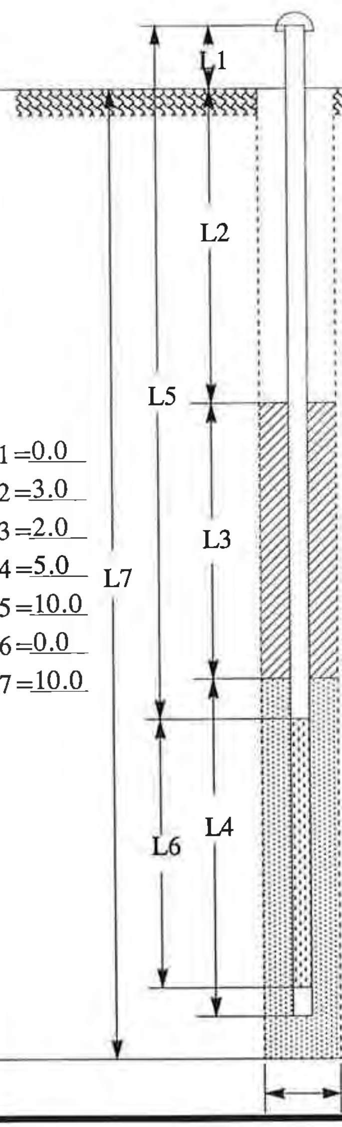
BORING

Depth in Ft.	Description	Symbol
0.00	Medium stiff, moist, brown, low plastic, silty CLAY (CL) to clayey silt	
	Becomes very soft, wet, gray; with some sand	
	Becomes stiff, gray and orangish-brown	
	Bottom of Boring at 10.0 feet	

WELL

Type of Well Vibr. Wire Piezo.

Ground Elev. 50.8 | Top of Riser Elev. 50.8



L1 = 0.0
L2 = 3.0
L3 = 2.0
L4 = 5.0
L5 = 10.0
L6 = 0.0
L7 = 10.0

Riser Pipe I.D., in. N/A

Type of Pipe wire

Backfill Type Around Riser Cement grout

Top of Seal Elevation 47.8

Type of Seal Material Bentonite pellets

Top of Filter Elevation 45.8

Type of Filter Material N/A

Size of Opening, in. 0.00

Diameter of Well Tip, in. 1.3

Bottom of Screen Elevation 40.8

Bottom of Riser Elevation 40.8

Bttm of Boring Elev. 45.8

Diameter of Boring, in. 4.0

Remarks

Inspected By K. Berry

WOODWARD-CLYDE CONSULTANTS

MONITORING WELL INSTALLATION REPORT **FIG. C-2-5**

Well No. PZ-03A

Project Illinois Power/Baldwin Power Station

Location Baldwin, IL

Project No 5E08560 Installed By Roberts Env. Date 5/15/95 Time

Method of Installation

LOG OF BORING AND WELL

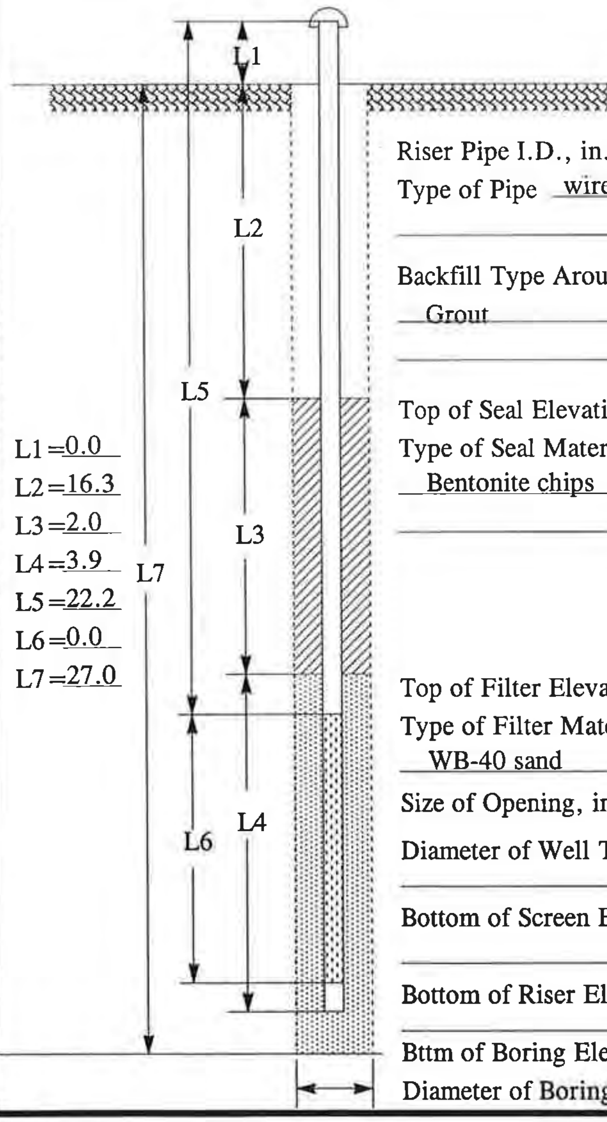
BORING

Depth in Ft.	Description	Symbol
0.00	Firm, moist to wet, medium gray, low plastic, Clayey SILT (ML); trace roots, wet, pocket of medium sand	
8.00	Firm, moist to wet, medium gray, medium to high plastic, Silty CLAY (CL); with 6-inch layer of fine grained, silty sand	
12.50	Firm, moist, light gray, medium to high plastic, Silty CLAY (CL); with mottles of tan, sandy clay, trace coarse to medium sand	
18.70	Dark gray, moderately weathered LIMESTONE	
19.30	Dark gray, severely weathered SHALE 0.2 feet Limestone at 20.0 feet Trace gravel, shale becomes greenish-gray at 23.8 feet Becomes maroon	
	Bottom of boring at 27.0 feet	

WELL

Type of Well Vibr. Wire Piezo.

Ground Elev. 50.8 Top of Riser Elev. 50.8



L1 = 0.0
L2 = 16.3
L3 = 2.0
L4 = 3.9
L5 = 22.2
L6 = 0.0
L7 = 27.0

Riser Pipe I.D., in. N/A

Type of Pipe wire

Backfill Type Around Riser Grout

Top of Seal Elevation 34.5

Type of Seal Material Bentonite chips

Top of Filter Elevation 32.5

Type of Filter Material WB-40 sand

Size of Opening, in. 0.00

Diameter of Well Tip, in. 0.5

Bottom of Screen Elevation 28.6

Bottom of Riser Elevation 28.6

Bttm of Boring Elev. 23.8

Diameter of Boring, in. 2.9

Remarks

Inspected By T. Deddens

WOODWARD-CLYDE CONSULTANTS

MONITORING WELL INSTALLATION REPORT **FIG. C–2–6**

Well No. PZ-04

Project **Illinois Power/Baldwin Power Station** Location Baldwin, IL

Project No **5E08560** Installed By Roberts Env. Date 5/12/95 Time

Method of Installation

LOG OF BORING AND WELL

BORING

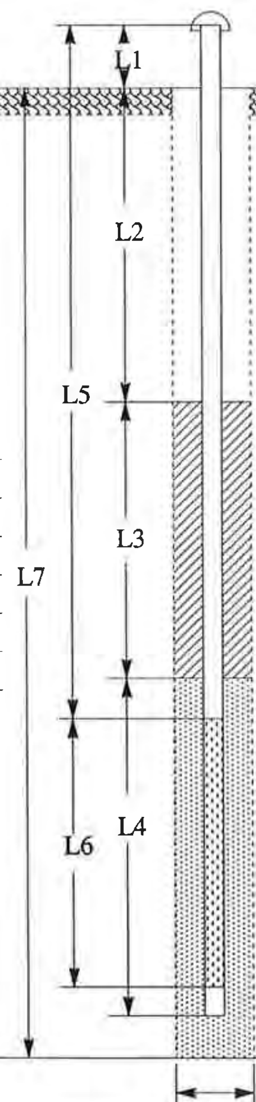
Depth in Ft.	Description	Symbol
0.00	Medium stiff, moist, brown, low plastic CLAY (CL) (Fill)	
	Becomes gray, more silty	
20.00	Stiff to very stiff, moist to wet, brown, medium plastic, Silty CLAY (CL); some fine gravel, coarse sand, trace medium to fine sand	
24.00	Firm to stiff, orange-brown, high plastic CLAY (CH); trace fine gravel, coarse sand	
25.00	Moist, orange, silty CLAY (CL); with rock fragments	
25.80	25.8 - 26.9: LIMESTONE	
26.90	26.9 - 27.2: Probable clay (no recovery)	
27.20	Damp, green, high plastic, highly weathered CLAY-SHALE; with silt and oxidation	
30.50	Becomes highly weathered LIMESTONE	
	Bottom of boring at 30.8 feet	

WELL

Type of Well Vibr. Wire Piezo.

Ground Elev. 58.7 Top of Riser Elev. 58.7

L1 = 0.0
L2 = 17.3
L3 = 2.8
L4 = 10.7
L5 = 30.8
L6 = 0.0
L7 = 30.8



Riser Pipe I.D., in. N/A

Type of Pipe wire

Backfill Type Around Riser
Grout

Top of Seal Elevation 41.4

Type of Seal Material
Bentonite chips

Top of Filter Elevation 38.6

Type of Filter Material
Sand

Size of Opening, in. 0.00

Diameter of Well Tip, in. 0.5

Bottom of Screen Elevation 27.9

Bottom of Riser Elevation 27.9

Bttm of Boring Elev. 27.9

Diameter of Boring, in. 8.0

Remarks

Inspected By K. Berry

WOODWARD-CLYDE CONSULTANTS

MONITORING WELL INSTALLATION REPORT

FIG. C-2-7

Well No. **PZ-05**

Project **Illinois Power/Baldwin Power Station** Location Baldwin, IL

Project No **5E08560** Installed By Layne-Western Date 4/13/95 Time

Method of Installation Drive point vibrating wire piezometer. Piezometer is pushed for final 5 feet of installation.

LOG OF BORING AND WELL

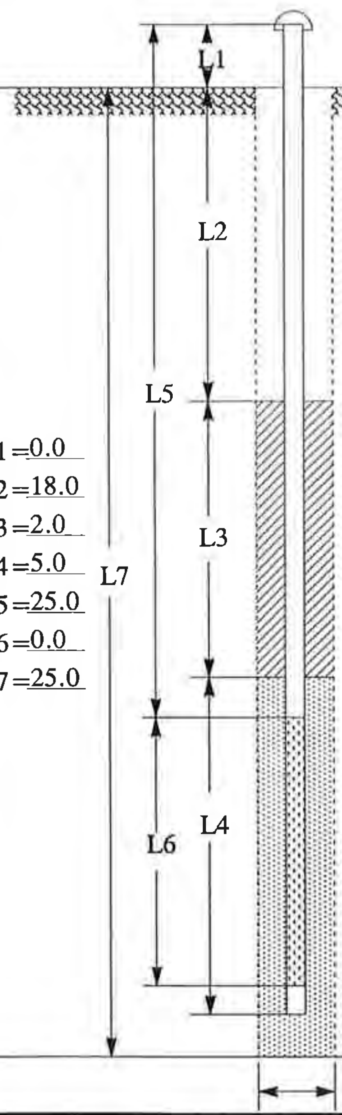
BORING

Depth in Ft.	Description	Symbol
0.00	Medium stiff, brown, low plastic, Silty CLAY (CL)	
6.00	Damp, fly ash/gravel (SP); with clay and bottom ash	
7.50	Very stiff, mottled gray and brown, low plastic, Silty CLAY (CL)	
10.00	Becoming reddish-brown with gray, high plastic CLAY (CH)	
14.00	Reddish-brown-gray, low plastic CLAY (CL); with trace sand Becoming gray with reddish-brown; trace sand Gray with reddish-brown	

WELL

Type of Well Vibr. Wire Piezo.

Ground Elev. 75.0 Top of Riser Elev. 75.0



L1 = 0.0
L2 = 18.0
L3 = 2.0
L4 = 5.0
L5 = 25.0
L6 = 0.0
L7 = 25.0

Riser Pipe I.D., in. N/A

Type of Pipe wire

Backfill Type Around Riser Cement grout

Top of Seal Elevation 57.0

Type of Seal Material Bentonite pellets

Top of Filter Elevation 55.0

Type of Filter Material N/A

Size of Opening, in. 0.00

Diameter of Well Tip, in. 1.3

Bottom of Screen Elevation 50.0

Bottom of Riser Elevation 50.0

Bttm of Boring Elev. 55.0

Diameter of Boring, in. 4.0

Remarks

Inspected By K. Berry

WOODWARD-CLYDE CONSULTANTS

MONITORING WELL INSTALLATION REPORT **FIG. C-2-8**

Well No. PZ-05A

Project Illinois Power/Baldwin Power Station

Location Baldwin, IL

Project No 5E08560 Installed By Roberts Env.

Date 5/11/95 Time

Method of Installation

LOG OF BORING AND WELL

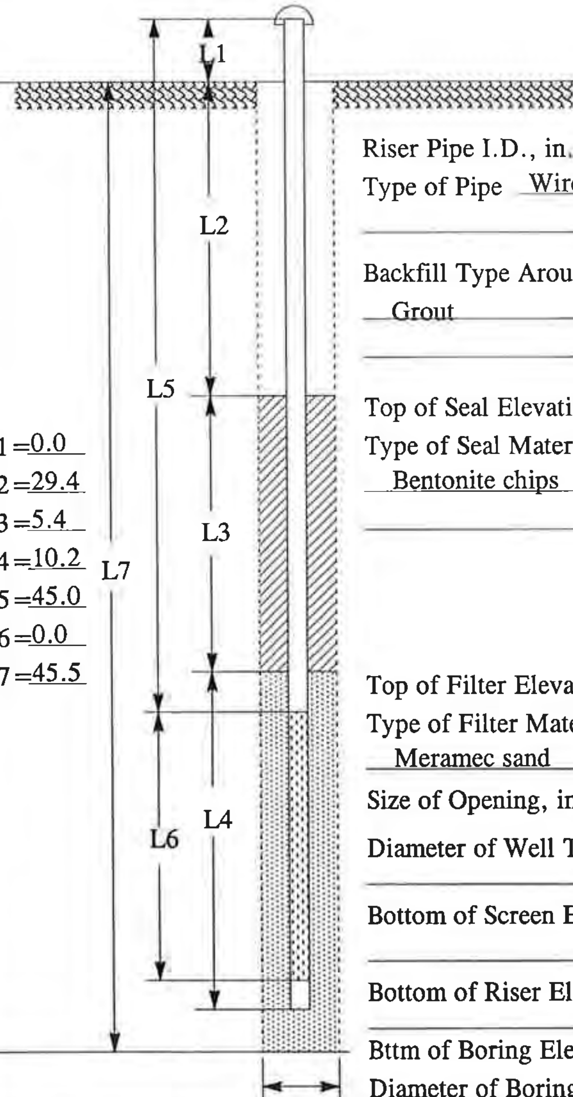
BORING

Depth in Ft.	Description	Symbol
0.00	Stiff, moist, low to medium plastic CLAY (CL) (Fill)	
	Becoming stiff, medium plastic CLAY (CL)	
14.70	Stiff, moist, gray, medium plastic CLAY (CL); with trace oxidation	
17.50	Stiff, moist, brown, medium plastic CLAY (CL); with trace fine roots	
	Firm to stiff, moist, gray, low plastic, Silty CLAY (CL); with little oxidation	
27.50	Soft to medium stiff, moist, orangish-brown, low plastic, silty CLAY (CL); with trace fine sand, pebbles	
34.00	Stiff, moist, light brown, medium to high plastic CLAY (CL); with trace sand (1/2 inch rounded pebbles)	
37.20	Very stiff to hard, damp, orangish-brown, low plastic CLAY (CL)	
41.50	Hard, damp, light green, high plastic CLAY (CH); with trace sand	
	Bottom of boring at 45.5 feet	

WELL

Type of Well Vibr. Wire Piezo.

Ground Elev. 75.0 Top of Riser Elev. 75.0



L1 = 0.0
L2 = 29.4
L3 = 5.4
L4 = 10.2
L5 = 45.0
L6 = 0.0
L7 = 45.5

Riser Pipe I.D., in. N/A

Type of Pipe Wire

Backfill Type Around Riser Grout

Top of Seal Elevation 45.6

Type of Seal Material Bentonite chips

Top of Filter Elevation 40.2

Type of Filter Material Meramec sand

Size of Opening, in. 0.00

Diameter of Well Tip, in. 0.5

Bottom of Screen Elevation 30.0

Bottom of Riser Elevation 30.0

Bttm of Boring Elev. 29.5

Diameter of Boring, in. 8.0

Remarks

Inspected By K. Berry

WOODWARD-CLYDE CONSULTANTS

MONITORING WELL INSTALLATION REPORT **FIG. C–2–9**

Well No. PZ-06

Project **Illinois Power/Baldwin Power Station** Location Baldwin, IL

Project No **5E08560** Installed By Layne-Western Date 4/12/95 Time

Method of Installation Drive point vibrating wire piezometer. Piezometer is pushed for final 5 feet of installation.

LOG OF BORING AND WELL

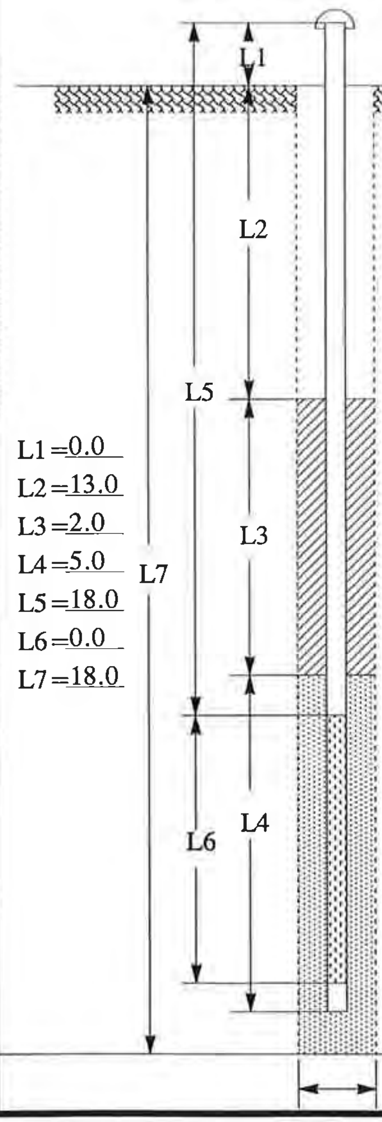
BORING

Depth in Ft.	Description	Symbol
0.00	Medium stiff, damp to moist, reddish-brown, low plastic, Silty CLAY (CL)(FILL) Becomes damp Becomes moist Grades trace gravel Becomes damp, brown Becomes gray with fly ash	

WELL

Type of Well Piezometer

Ground Elev. 97.9 Top of Riser Elev. 97.9



L1 = 0.0
L2 = 13.0
L3 = 2.0
L4 = 5.0
L5 = 18.0
L6 = 0.0
L7 = 18.0

Riser Pipe I.D., in. N/A

Type of Pipe wire

Backfill Type Around Riser Cement grout

Top of Seal Elevation 86.9

Type of Seal Material Bentonite Pellets

Top of Filter Elevation 84.9

Type of Filter Material N/A

Size of Opening, in. 0.00

Diameter of Well Tip, in. 1.3

Bottom of Screen Elevation 79.9

Bottom of Riser Elevation 79.9

Bttm of Boring Elev. 84.9

Diameter of Boring, in. 4.0

Remarks

Inspected By K. Berry

WOODWARD-CLYDE CONSULTANTS

MONITORING WELL INSTALLATION REPORT FIG. C–2–10

Well No. PZ-07

Project Illinois Power/Baldwin Power Station

Location Baldwin, IL

Project No 5E08560

Installed By Roberts Env.

Date 5/15/95

Time

Method of Installation

LOG OF BORING AND WELL

BORING

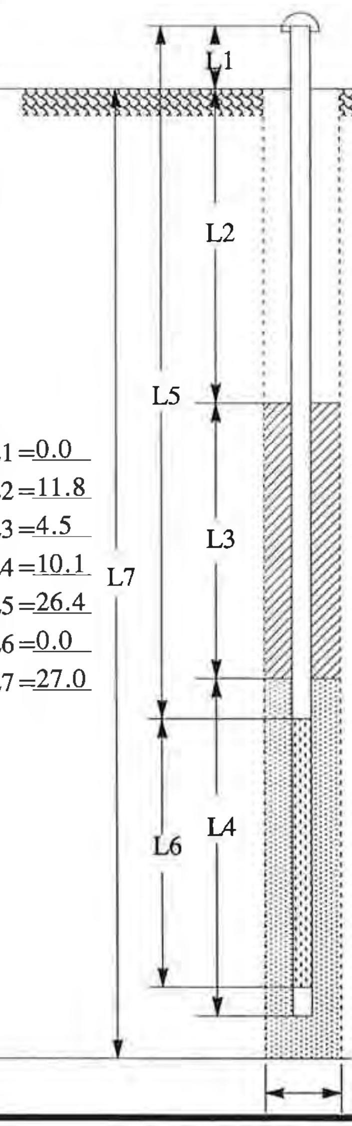
Depth in Ft.	Description	Symbol
0.00	Moist, brown, Silty CLAY (CL)	
4.00	Stiff, moist, greenish-gray, medium to high plastic CLAY (CL/CH); with trace organics	
7.00	Medium stiff, moist, mottled orangish brown, low plastic, silty clay and gray, high plastic CLAY (CL/CH); with little sand	
12.00	Stiff, moist, light brown, high plastic CLAY (CH); with little sand, fine pebbles Becomes mottled gray and brown	
22.00	Dry to damp, light gray, high plastic CLAY (highly weathered shale)	
	Bottom of boring at 27.0 feet	

WELL

Type of Well Vibr. Wire Piezo.

Ground Elev. 51.0

Top of Riser Elev. 51.0



L1 = 0.0
L2 = 11.8
L3 = 4.5
L4 = 10.1
L5 = 26.4
L6 = 0.0
L7 = 27.0

Riser Pipe I.D., in. N/A

Type of Pipe Wire

Backfill Type Around Riser Grout

Top of Seal Elevation 39.2

Type of Seal Material Bentonite chips

Top of Filter Elevation 34.7

Type of Filter Material Sand

Size of Opening, in. 0.00

Diameter of Well Tip, in. 0.5

Bottom of Screen Elevation 24.6

Bottom of Riser Elevation 24.6

Bttm of Boring Elev. 24.0

Diameter of Boring, in. 8.0

Remarks 11:07 - 11:22 temp

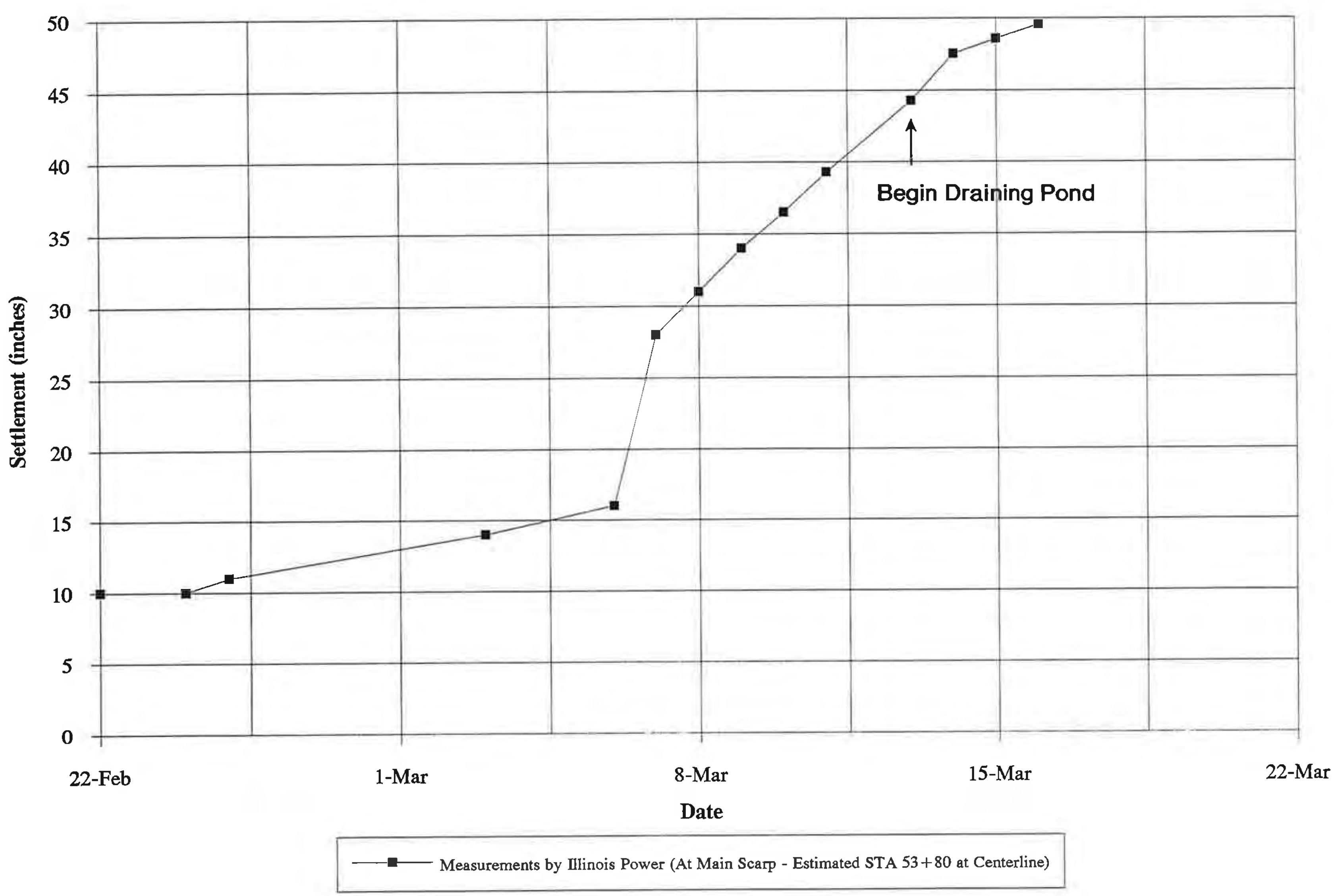
Inspected By K. Berry

WOODWARD-CLYDE CONSULTANTS

APPENDIX C-3 - ILLINOIS POWER CRACK GAUGES

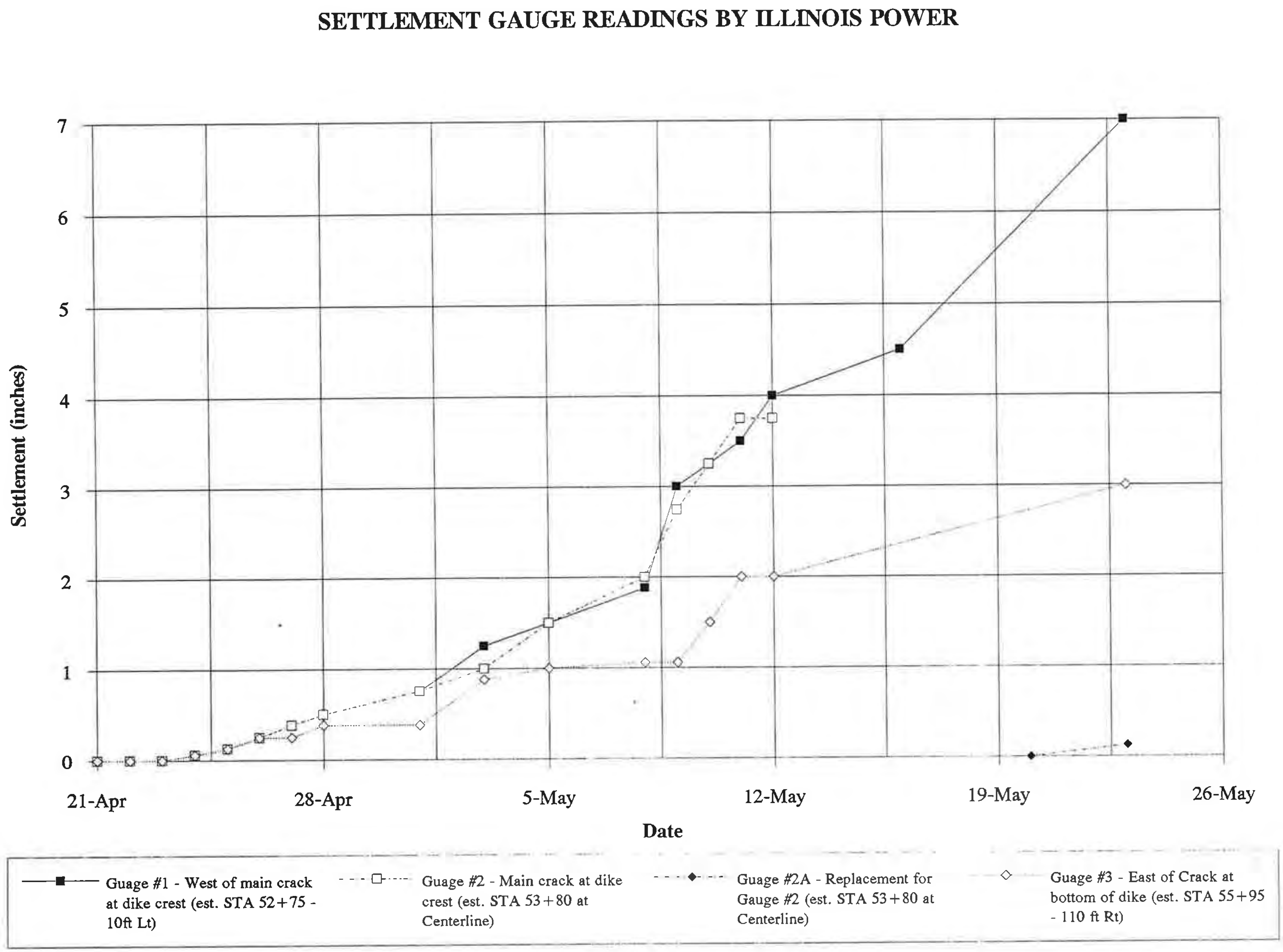
Crack monitoring gauges were installed across the crest and midslope scarps at major cracks by Illinois Power personnel in February and April, 1995. Crack gauges consisted of two reinforcing bars driven into the ground, one on each side of the crack. One was driven vertically, the other horizontally. The relative vertical and sometimes horizontal movement between the two was recorded by a tape measure. The initial crack gauge installed in February had to be removed in March to provide access for drilling activities. Plots of the crack gauges are shown in Figures C-3-1 and C-3-2.

INITIAL SETTLEMENT MEASUREMENTS BY ILLINOIS POWER



SETLMNT.XLS Chart 3

Figure C-3-1



SETLMNT.XLS Chart 2

Figure C-3-2

APPENDIX D

PARALLEL WALL OPTION

APPENDIX D
PARALLEL WALL OPTION

This appendix describes in detail the "Parallel Wall" option which was conceived during our meeting of senior level personnel at the site on July 21, 1995. This option is currently the one favored by Illinois Power, primarily due to cost.

Areas of Potential Deep Failure (Sta. -6-50 to 5+50)

As noted during the July 21 meeting, lowering the groundwater level below the downstream slope of the dike has a significant stabilizing effect. Calculations indicate that a factor of safety of approximately 1.5 during steady state conditions can be achieved without use of a toe berm or lightweight fill by lowering the groundwater level below the downstream slope to within a few feet of the failure plan (el. 385±). This elevation is about 10 feet lower than the flow line of the stream near the downstream toe of the dike. Lowering the groundwater level below the stream will require a deep drainage trench extending a few thousand feet to the west, or the use of a pumped system. It was agreed during our meeting on July 21 that a pumped system would be the more easily implemented and economical solution. We recommend a pumped system using a drain wall located near the upstream toe of the dam, a drain wall near the downstream toe, and a soil-bentonite cutoff wall, as shown in Figure D-1.

To reduce the amount of water pumped, it is necessary to construct a cutoff wall through the bottom ash upstream of the drain wall. A soil-bentonite cutoff wall is recommended. The calculated amount of water to be pumped from the drain wall during full reservoir conditions is approximately 30 gallons per minute for a 2,400-foot long cutoff wall. Due to uncertainties in soil permeability, we recommend designing for approximately 300 gallons per minute. To handle this amount of water and to provide redundancy in case of well failure, we recommend that a minimum of three pumps be used within the upstream drain wall. These can be constructed using conventional well screens during installation of the drain wall.

With only a drain wall near the upstream slope, the phreatic surface beneath portions of the downstream slope would be expected to equal the elevation of the creek near the downstream toe. To maintain the phreatic surface below the entire slope near the failure plane, recharge from the creek needs to be controlled. Therefore, we recommend that a second, shallow drain wall be constructed near the creek to intercept the water and pump it back into the stream as shown in Figure D-1. Again, the inflow should be small. We have assumed three pumps on the downstream drain wall. A cross-section of this option is shown in Figure D-2. We also considered use of a cutoff wall instead of a drain wall at the toe. Seepage analysis, however, showed that a cutoff wall would not be as effective as a drain wall in lowering the head sufficiently.

The production of iron and manganese oxides and the formation of slime by iron bacteria, both of which are known to clog well screens, are issues that remain to be evaluated if pumped wells are to be used. It will be necessary for measurements to be made in the field and laboratory of the pH of the water in the bottom ash beneath the dikes and in the fly ash pond. The formation of iron oxides is most rapid when the pH is about 6 and of manganese oxides when the pH is about 9. The current pH of the water in the pond is between 8 and 9. The dissolved metals and the total metals in the water in the fly ash must also be determined to define the quantities of iron, magnesium, calcium and manganese that are present. For purposes of conceptual design, we have assumed that oxides and iron bacteria will not be a significant problem. Layne-Western has indicated costs of about $2,500 per well to clean the wells, if this becomes necessary. Tests are currently underway to identify if oxide problems are likely.

Another concern with this approach is that during a power outage, water could rise in the drain wall system and jeopardize stability. Because of the low inflow rate and the large volume of soil to resaturate, calculations indicate that several days would be needed for the water level to rise enough to decrease the factor of safety significantly. Emergency power could probably be provided in this time. The need for emergency power should be addressed in the operating and maintenance procedures for the system.

As the water level below the downstream toe is lowered, the stability of the dike is increased. Thus, a point in time will be reached when the clay fill removed during the interim repair can be replaced without jeopardizing stability. The time when the replacement can be made will be determined based on piezometers installed near the failure plane. A chimney drain has also been included within the clay dike to capture seepage from the pond and to drain it into the underlying bottom ash.

Another major benefit of this option is that by draining the bottom ash that is below the upper dike, the possibility of liquefaction in the ash is eliminated. Seismically induced settlements of 3 to 6 inches as a result of densification of the bottom ash would still be likely during the design level shaking, but massive failure due to liquefaction would be unlikely. Drainage of the ash may also produce settlement of the bottom ash of approximately 2 inches. We believe the effects of this amount of settlement to be insignificant.

This option relies on pumps to lower the head downstream to the level of the failure plane. While we believe that this is probable, there is some uncertainty that it can be done. The uncertainty is due to the unknown continuity and permeability of the water washed zone found at about the failure plane, which the pumping system is intended to drain. Therefore, there is some risk that the data obtained from the instrumentation will show that additional stabilization measures may be needed. These may involve things such as sand drains to enhance drainage, or stabilizing berms.

Areas of Potential Shallow Failure (Sta. -10-50 to -6-50 and 5+50 to 14+50)

In the areas identified as having the potential for shallow failure, the head in the bottom ash must be controlled to reduce the risk of failure as the pond level rises, and to reduce the potential for liquefaction. To accomplish this, we agreed at the meeting to construct a soil-bentonite cutoff wall at the upstream toe and to install pumps within the bottom ash to dewater the ash after the wall is in place. This concept is shown in Figure D-3. Flow through the bottom ash should be small once the cutoff wall is in place. We have assumed three wells to provide redundancy.

At the time of the eventual closure of the ash pond, it will be necessary to provide a drainage outlet for the drain walls in lieu of pumping. We understand that a gravity drain will be provided at that time and will extend westward from the toe of the drain wall to a lower area. The requirement for the gravity drain should be included in the operation and maintenance manual.

The plan location of the walls and elevation views are shown in Figure D-1. The estimated cost for the "Parallel Wall" option (for areas of both shallow and deep failure) is $4.3 million as summarized in Table D-1.

Construction

We believe it is most practical to construct the repairs in two phases.

The first phase will involve all work except replacement of the fill removed during the interim repair. It will include installation of the various walls and pumps needed to lower the pore pressures in the ground below the dam. The time for the pore pressures to drain is uncertain but estimated to be 6 to 12 months. Once the pore pressures are lowered (based on piezometer measurements), then the second phase of work (replacement of the fill and final grading) can be completed.

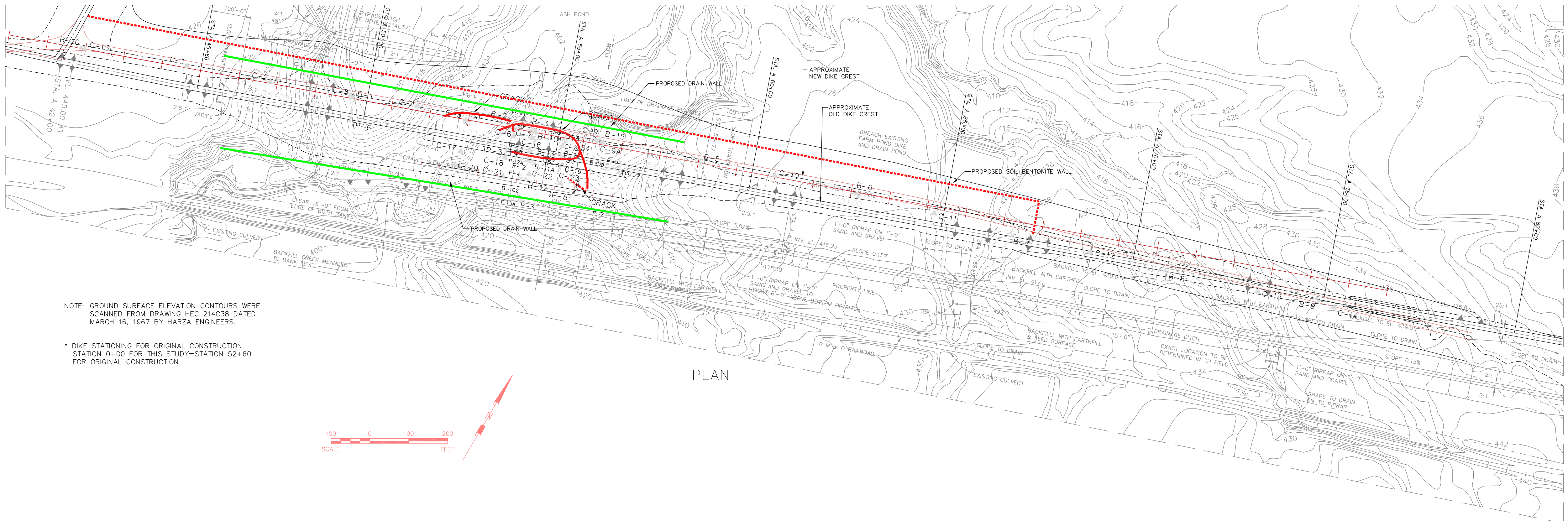
It seems reasonable to expect to construct the first phase in the Spring and Summer of 1996, and the final phase in the Fall of 1997; i.e. allowing about a year for pore pressures to dissipate.

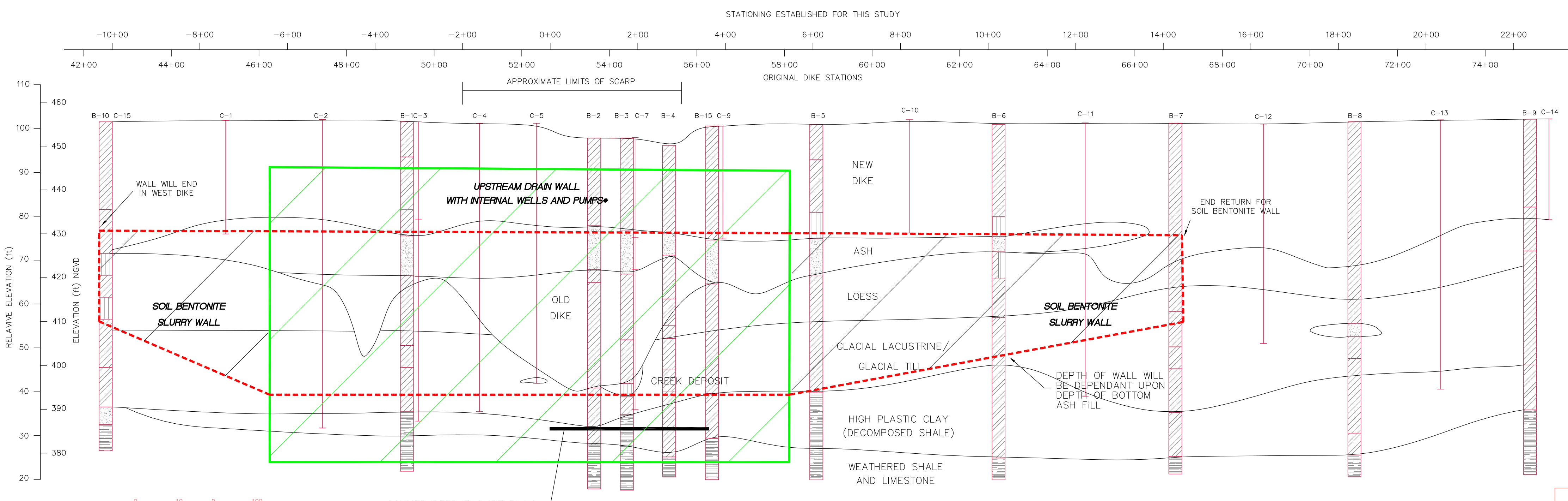
Results of key stability analysis calculated are given in Figures D-4 through D-7.

Additional borings are needed along the cutoff and drain wall alignments to better define subsurface conditions for design and potential bidders. We have provided an allowance for this in the cost estimate. The borings are especially important to help locate rock ledges and estimate the quantity of hard rock removal needed in the drain wall trenches.

TABLE D-1
COST ESTIMATE FOR PARALLEL WALL SYSTEM

ITEM	WORK ITEM	QUANTITY	UNIT RATE	UNIT	TOTAL
	ESTIMATED CONSTRUCTION COST FOR PARALLEL WALL SYSTEM				
1	Mobilization/Demobilization	1	$200,000	ls	$200,000
2	Strip	20,000	$0.90	cy	$18,000
3	Exacavate and stockpile soil	15,400	$2.50	cy	$38,500
4	Borings for information at proposed walls	1	$50,000	allow	$50,000
5	Soil-Bentonite Wall	95,000	$4.00	sf	$380,000
6	Drain Wall	69,600	$9.00	sf	$626,400
7	Wells, Pumps, Warning System	9	$15,000	ea	$135,000
8	Chimney Drain, French Drain	4,000	$15.00	cy	$60,000
9	Working Pads, Clay Cap	20,000	$5.00	cy	$100,000
10	Downstream Drain Wall	29,000	$9.00	sf	$261,000
11	Replacement of fill from Interim Fix	52,400	$5.00	cy	$262,000
12	Roadway on top of dike	2,300	$5.40	sy	$12,420
13	Seed and Mulch	25,000	$0.50	sy	$12,500
14	Instrumentation	1	$25,000	allow	$25,000
15	Provide electrical service	1	$20,000	allow	$20,000
		Subtotal			$2,200,820
		OH and profit @ 15%			$330,123
		Subtotal			$2,530,943
		Engineer'g/Const' Monit'g @ 15%			$379,641
		Subtotal			$2,910,584
16	Maintenance of Pumps (Present Worth Provided by IP)	1	$650,000	allow	$650,000
		Subtotal			$3,560,584
		Contingency @20%			$712,117
		TOTAL			**$4,272,701**





*DOWNSTREAM DRAIN WALL NOT SHOWN FOR CLARITY

GENERALIZED SUBSURFACE PROFILE
ALONG CENTERLINE OF NEW DIKE

LEGEND

- CLAY (CL)
- CLAY (CH)
- BOTTOM ASH
- SILT (ML)
- SHALE
- CPTU
- BORING
- TEST PIT
- PIEZOMETER
- APPROXIMATE FOOTPRINT OF NEW DIKE
- APPROXIMATE FOOTPRINT OF OLD DIKE

NOTES:
1. THIS DRAWING SHOWS GENERALIZED SUBSURFACE CONDITIONS. SEE ORIGINAL BORING LOGS FOR DETAILS.
2. LINES INDICATING STRATA BETWEEN EXPLORATORY LOCATIONS ARE INFERRED. STRATA SHOWN ARE KNOWN ONLY AT EXPLORATORY LOCATION – NOT BETWEEN.
3. NO EXPLORATIONS WERE PERFORMED AT THE LOCATIONS OF THE PROPOSED WALLS. ALL SUBSURFACE CONDITIONS ARE GENERALIZED AND DO NOT REFLECT THE CONDITIONS AT THE PROPOSED WALLS.

Revision No.	Description	Date	By	App.

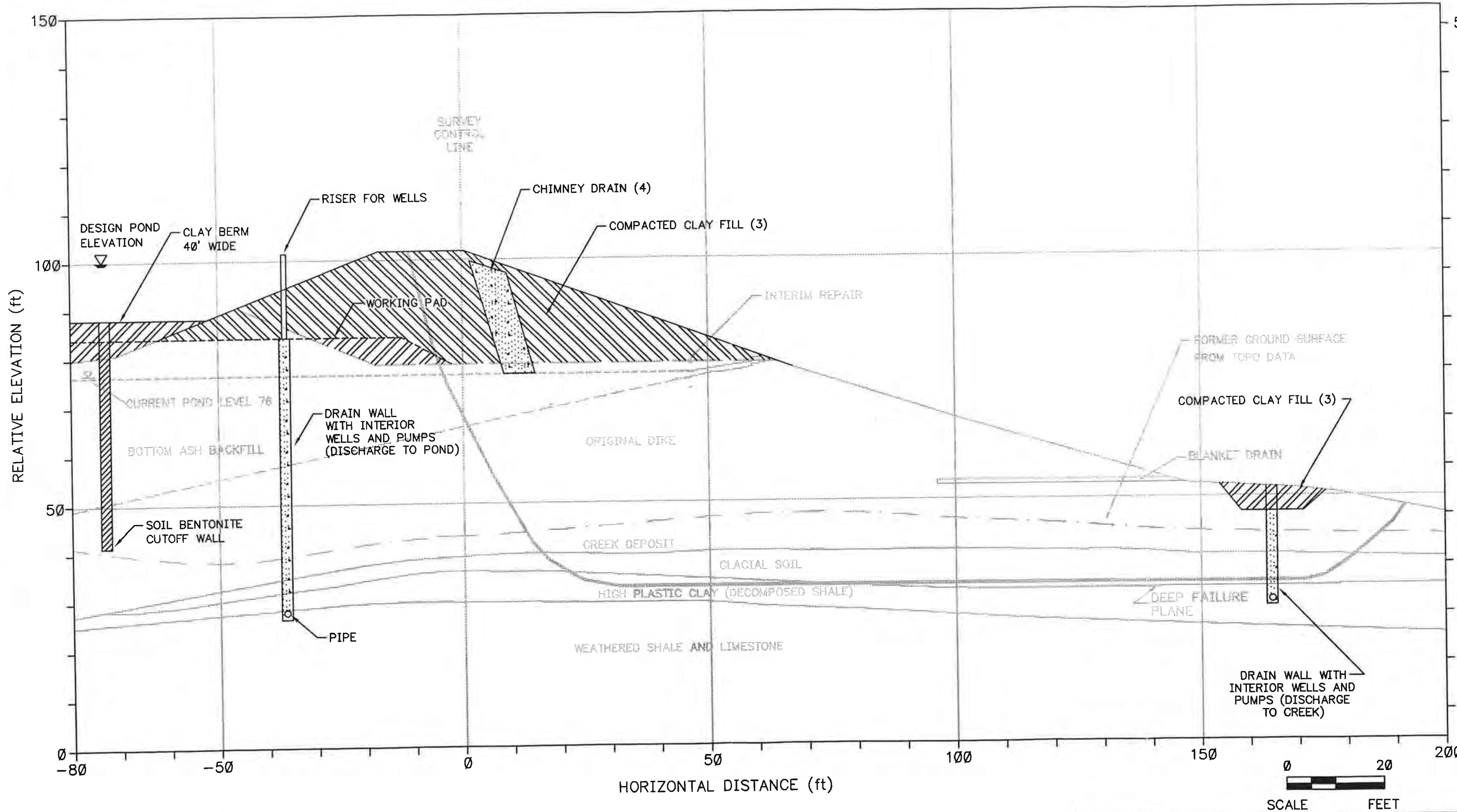
REVISIONS

ILLINOIS POWER COMPANY
BALDWIN POWER STATION

ASH POND, SOUTH DIKE
PLAN AND PROFILE OF REPAIRS
PARALLEL WALL ALTERNATIVE

Date: 7/31/95	Project Number: 5E08560	Figure Number: D-1
Drawn by: wdl	Design by: kmb	Checked by:

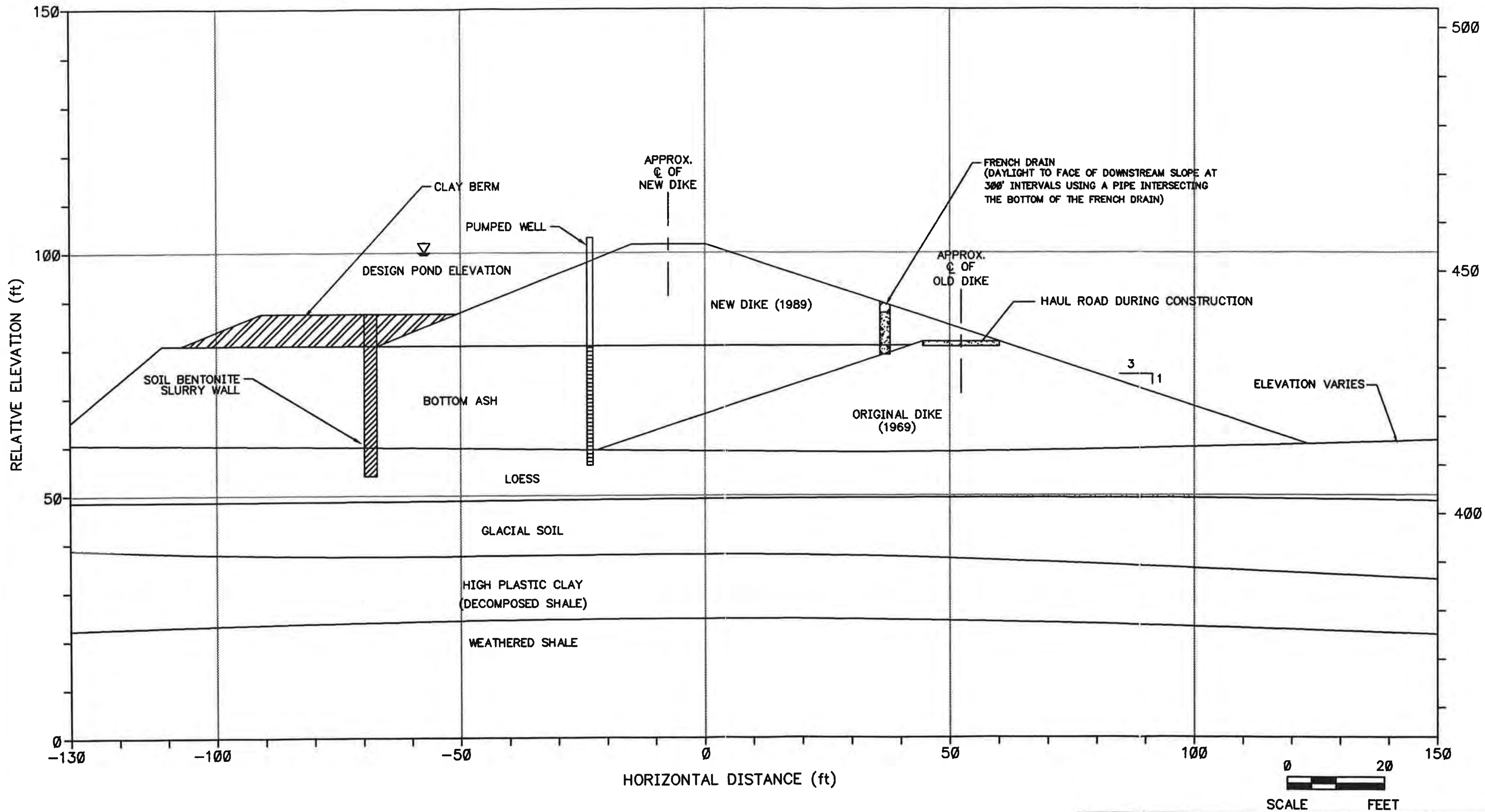
Woodward–Clyde Consultants
Engineering & sciences applied to the earth & its environment



Notes:
1. There are no borings in the location of the proposed walls, therefore the bottom elevations of the walls are approximate.
2. The drain wall will contain a discontinuous pipe at the bottom and will be pumped using installed wells.
3. Place compacted clay fill after pore pressures downstream of drain wall are at el. 390 or below based on piezometer data.
4. Chimney drain will extend over approximately 600 feet of interim repair A french drain will be constructed over the remaining 600 feet of potential deep slide area.

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND DIKE BALDWIN, IL.	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 8/2/95 DSGN. BY: gaz CHKD. BY: KMB 9-5-95 — Repair for Potential Deep Slides Parallel Wall Alternative	FIG. NO. D-2

File: F:\5E08560\TASK240\DULWLSC1.DWG Last edited: 08/31/95 @ 5:00 p.m. @ WCC-ST.LOUIS



Notes:
1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location – not between.

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND DIKE BALDWIN, IL.	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bcl 5/24/95 DSGN. BY: gaz CHKD. BY: KMB 9-6-95	Repair for Potential Shallow Slides Parallel Wall Alternative — FIG. NO. D-3

File: F:\5E08560\TASK240\DWA.DWG Last edited: 09/05/95 @ 4:45 p.m. @ WCC-ST.LOUIS

BASIC GEOMETRY FOR DEEP REPAIR
PARALLEL WALL ALTERNATIVE

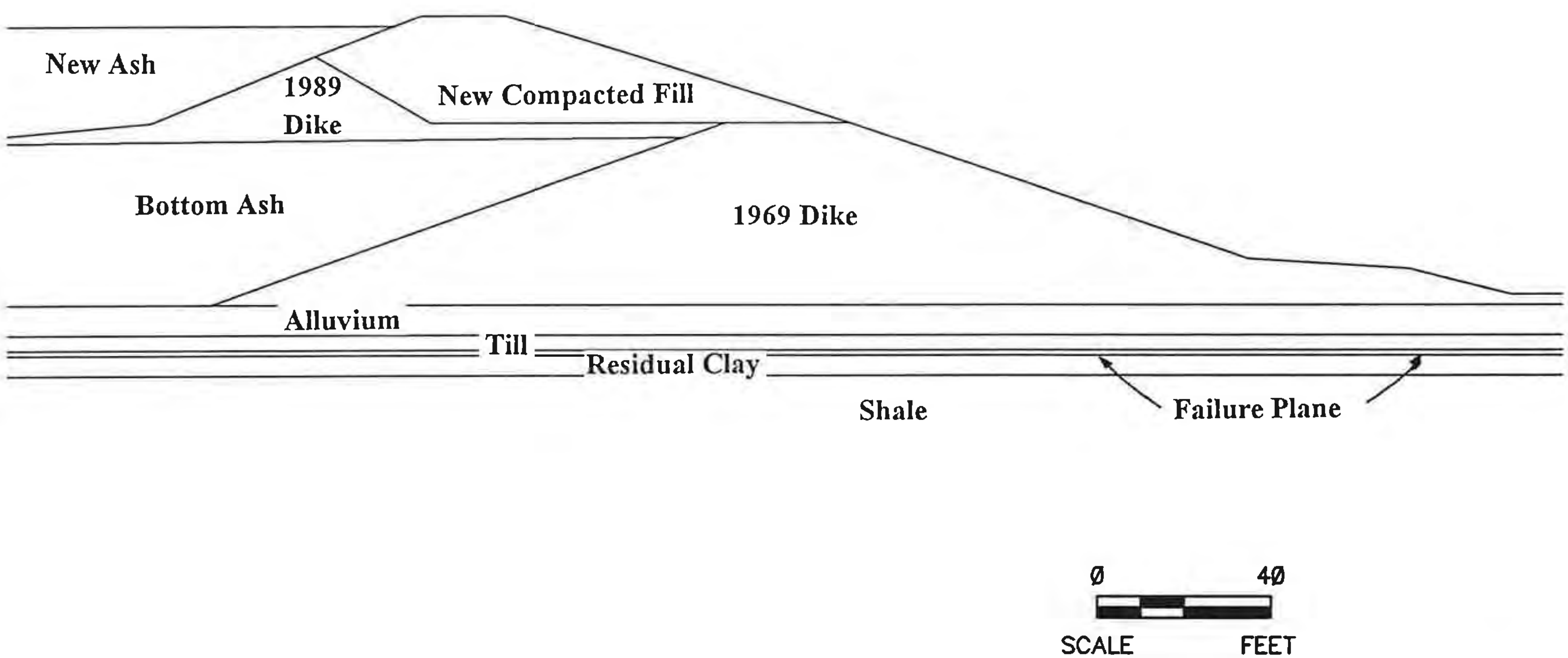
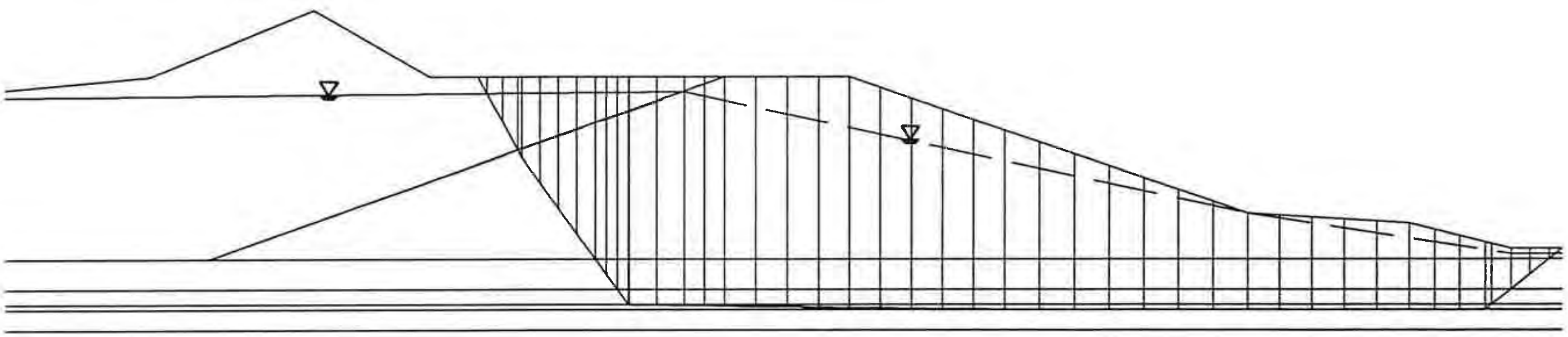


Figure D-4.

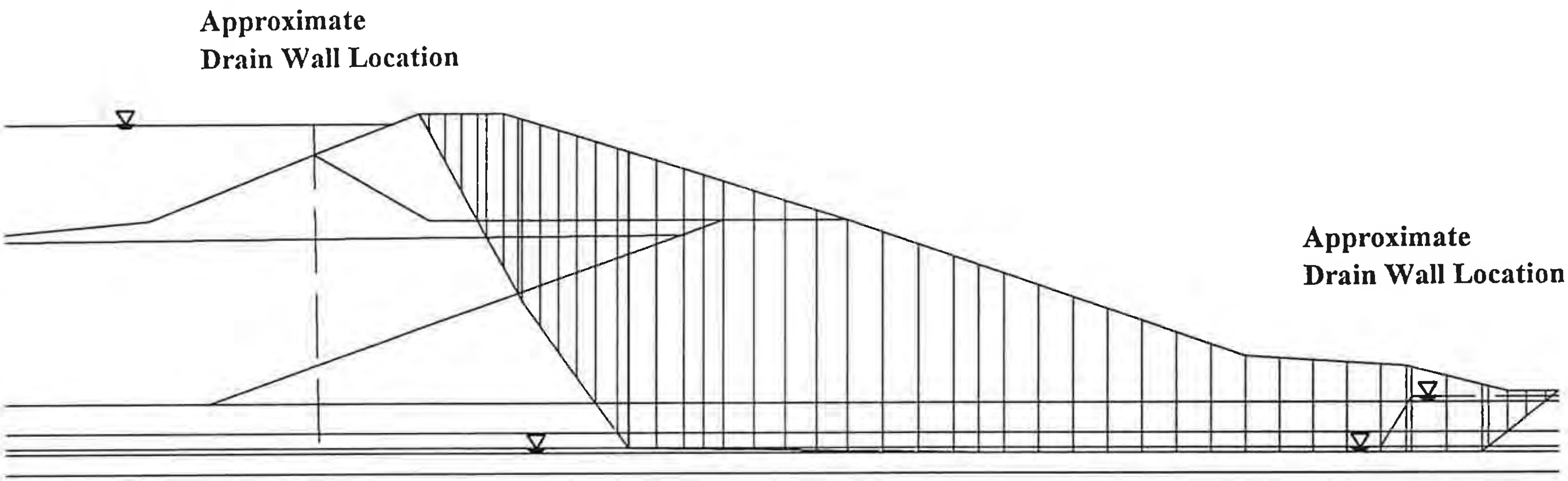
END OF CONSTRUCTION GEOMETERY
(BEFORE REPLACEMENT OF CLAY FILL)
WITH ASSUMED FAILURE
PARALLEL WALL ALTERNATIVE



FS = 1.27

Figure D–5

STEADY STATE CONDITION WITH ASSUMED FAILURE PLANE
PARALLEL WALL ALTERNATIVE



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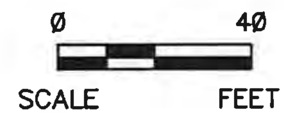
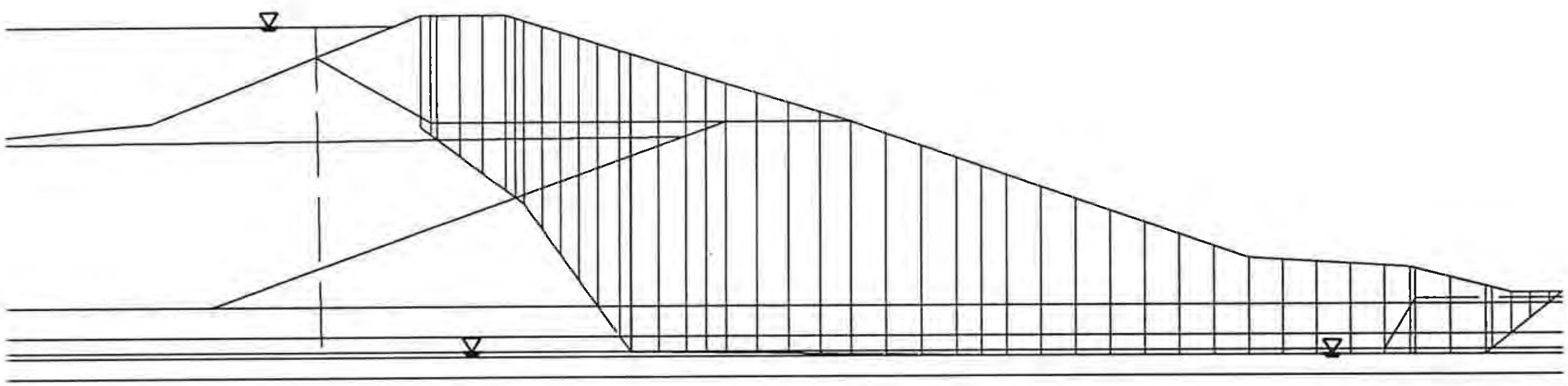


Figure D-6

EARTHQUAKE CONDITION WITH ASSUMED FAILURE PLANE
PARALLEL WALL ALTERNATIVE



FS = 1.02

Figure D-7

APPENDIX E

TRANSLATED DIKE

APPENDIX E
TRANSLATED DIKE

This option was also conceived during the July 21, 1995 meeting.

Areas of Potential Deep Failure

This option involves relocation and reconstruction of the dike further downstream, and the straddling of a portion of the creek as shown in Figure E-1. The primary advantage of this approach is that it is passive; i.e. does not require pumping or significant maintenance after construction. Major disadvantages, however, are cost and probable encroachment on the neighboring right-of-way. At this time, we are uncertain of the current limits of Illinois Power's property.

Calculations indicate that an inclination of 2.5H:1V is satisfactory for both the upstream and downstream slopes. Chimney and blanket drains are included in the dike for internal drainage. To control the head in the foundation soils, we included a drain wall below the dike located near the downstream toe of the existing dike. This drain wall would be expected to fill with water and to flow by artesian pressure into the blanket drain which will eventually drain to the creek by gravity.

Areas of Potential Shallow Failure

In order to use a passive system, the repair considered in these areas was similar to that shown in our draft report, i.e., a cutoff wall and lime slurry injection of the bottom ash fill. The cutoff wall is needed to control head below the 1989 clay fill dike to mitigate failure as the pond level is raised. The lime-fly ash injection is needed to mitigate liquefaction. A cross-section is shown in Figure E-2.

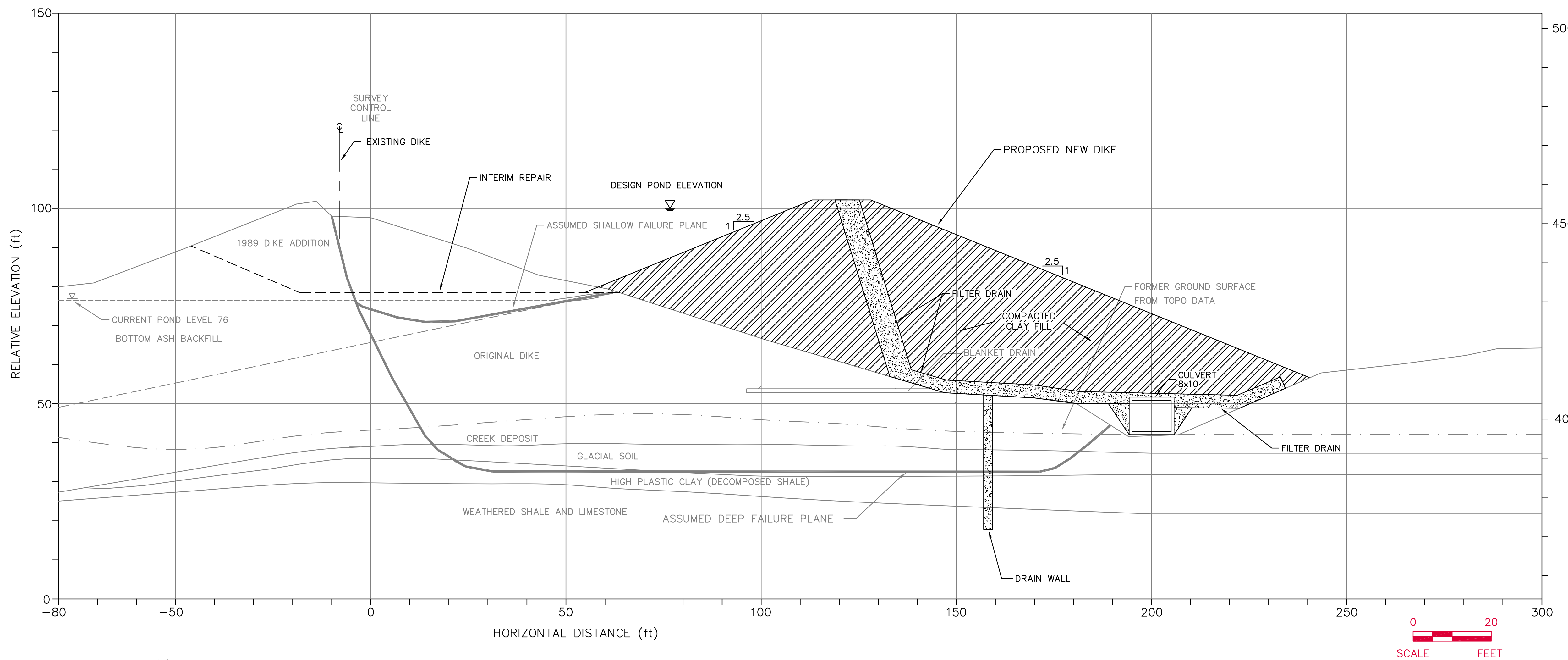
Other Details

A plan view of this option is shown in Figure E-3 and the estimated cost is summarized in Table E-1. The cost of this option, $6.1 million, does not include the cost of additional right-of-way.

Results of stability analysis are given in Figures E-4 through E-7. Detailed seepage calculations were not performed as water levels were assumed based on judgment considering the placement of the drains.

TABLE E-1
COST ESTIMATE FOR TRANSLATED DIKE

ITEM	WORK ITEM	QUANTITY	UNIT RATE	UNIT	TOTAL
	ESTIMATED CONSTRUCTION FOR TRANSLATED DIKE				
1	Mobilization/Demobilization	1	$200,000	ls	$200,000
2	Strip	13,000	$0.90	cy	$11,700
3	Box Culvert	1,200	$600	ft	$720,000
4	Borings at proposed relocation site	1	$100,000	allow	$100,000
5	Drain Wall	42,000	$9.00	sf	$378,000
6	Soil-Bentonite Wall	44,000	$4.00	sf	$176,000
7	Lime Injection	69,000	$3.50	cy	$241,500
8	Filter Drain	30,500	$15.00	cy	$457,500
9	Clay Fill	302,000	$5.00	cy	$1,510,000
10	Clearing and Grubbing	3	$3,000	ac	$9,000
11	Roadway on top of dike	2,300	$5.40	sy	$12,420
12	Seed and Mulch	42,000	$0.50	sy	$21,000
13	Instrumentation	1	$25,000	allow	$25,000
		Subtotal			$3,862,120
		OH and profit @ 15%			$579,318
		Subtotal			$4,441,438
		Engin'g/Constr' Monit'g @ 15%			$666,216
		Subtotal			$5,107,654
		Contingency @20%			$1,021,531
		TOTAL			**$6,129,184**



Notes:
1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location – not between.
3. Strata beyond 180 ft to the right at Survey Control Line have been approximated for this figure.

ILLINOIS POWER
BALDWIN STATION SOUTH ASH POND DIKE
BALDWIN, IL.

PROJECT NO. 5E08560

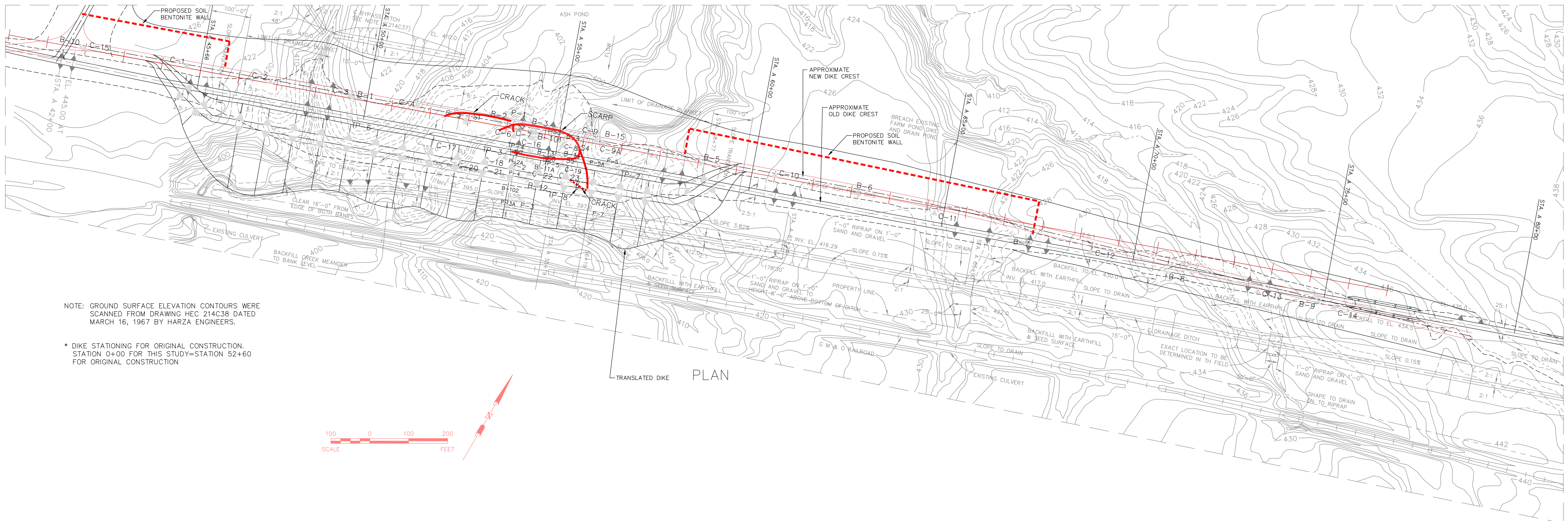
Woodward–Clyde Consultants
Engineering & sciences applied to the earth & its environment

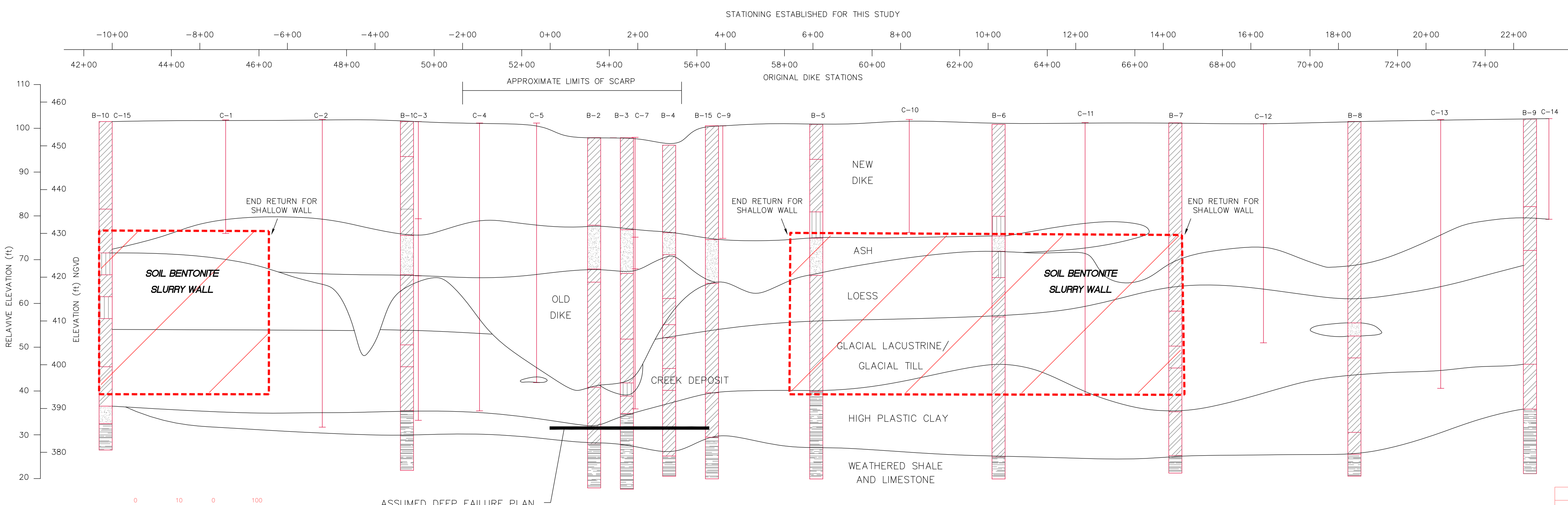
DRN. BY: bdl 8/2/95
DSGN. BY: gaz
CHKD. BY:

Repair for Potential Deep Slides
Translated Dike Alternative

FIG. NO. E–1

File: F:\5E08560\TASK240\RELOCALT.DWG Last edited: 09/05/95 @ 4:16 p.m. @ WCC–ST.LOUIS





GENERALIZED SUBSURFACE PROFILE
ALONG CENTERLINE OF 1989 DIKE

LEGEND

- CLAY (CL)
- CLAY (CH)
- BOTTOM ASH
- SILT (ML)
- SHALE
- CPTU
- BORING
- TEST PIT
- PIEZOMETER
- APPROXIMATE FOOTPRINT OF NEW DIKE
- APPROXIMATE FOOTPRINT OF OLD DIKE

NOTES:
1. THIS DRAWING SHOWS GENERALIZED SUBSURFACE CONDITIONS. SEE ORIGINAL BORING LOGS FOR DETAILS.
2. LINES INDICATING STRATA BETWEEN EXPLORATORY LOCATIONS ARE INFERRED. STRATA SHOWN ARE KNOWN ONLY AT EXPLORATORY LOCATION – NOT BETWEEN.

Revision No.	Description	Date	By	App.

REVISIONS

ILLINOIS POWER COMPANY
BALDWIN POWER STATION

ASH POND, SOUTH DIKE
PLAN AND PROFILE OF REPAIRS
TRANSLATED DIKE ALTERNATIVE

Date: 8/2/95	Project Number: 5E08560	Figure Number: E-2
Drawn by: bdl	Design by: gaz	Checked by:

Woodward-Clyde Consultants
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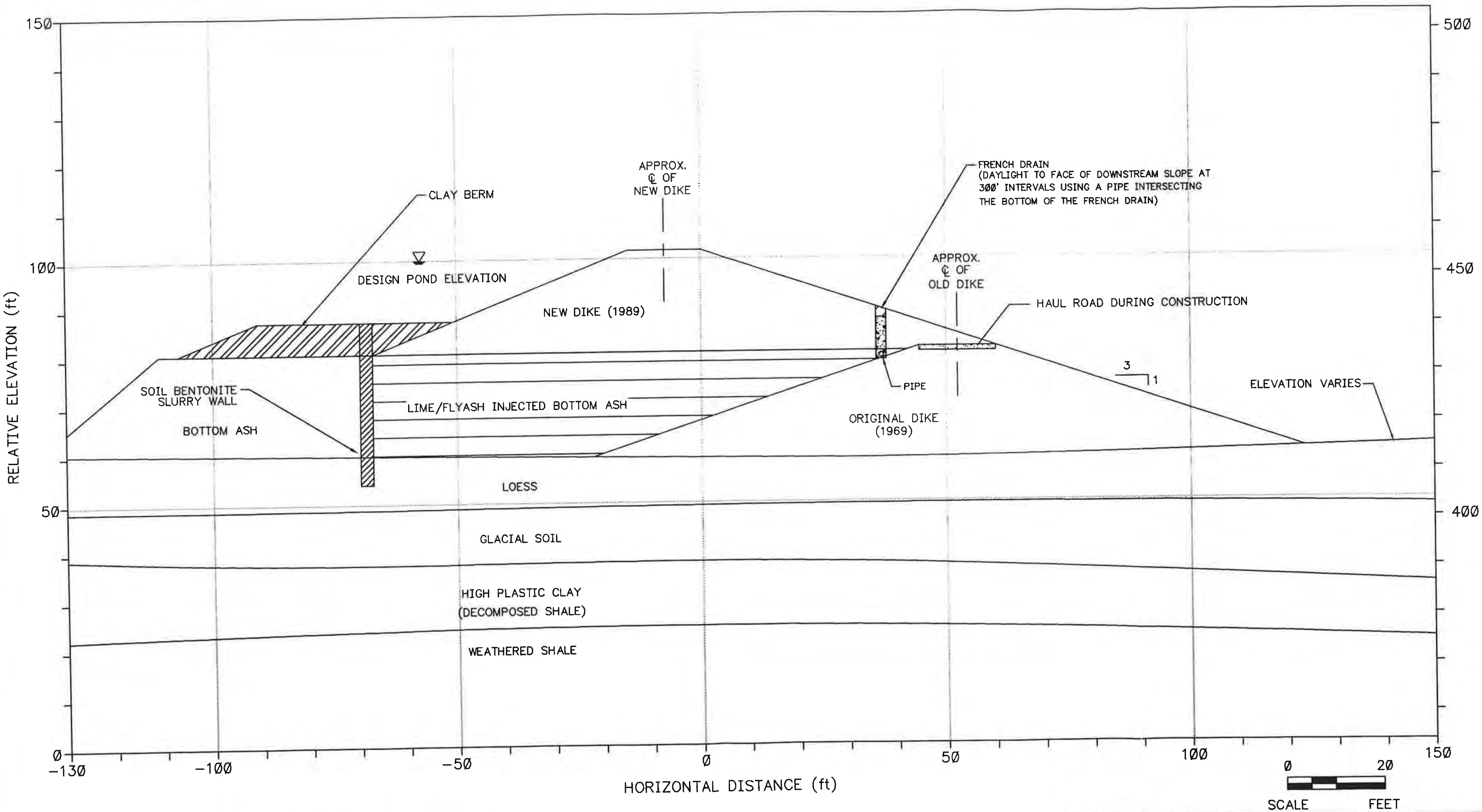

Notes:
1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location – not between.

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND DIKE BALDWIN, IL.	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 5/24/95 DSGN. BY: gaz CHKD. BY: RMB 9-5-95	Repair for Potential Shallow Slides Translated Dike Alternative
FIG. NO.	E-3

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BASIC GEOMETRY FOR DEEP REPAIR
TRANSLATED DIKE ALTERNATIVE

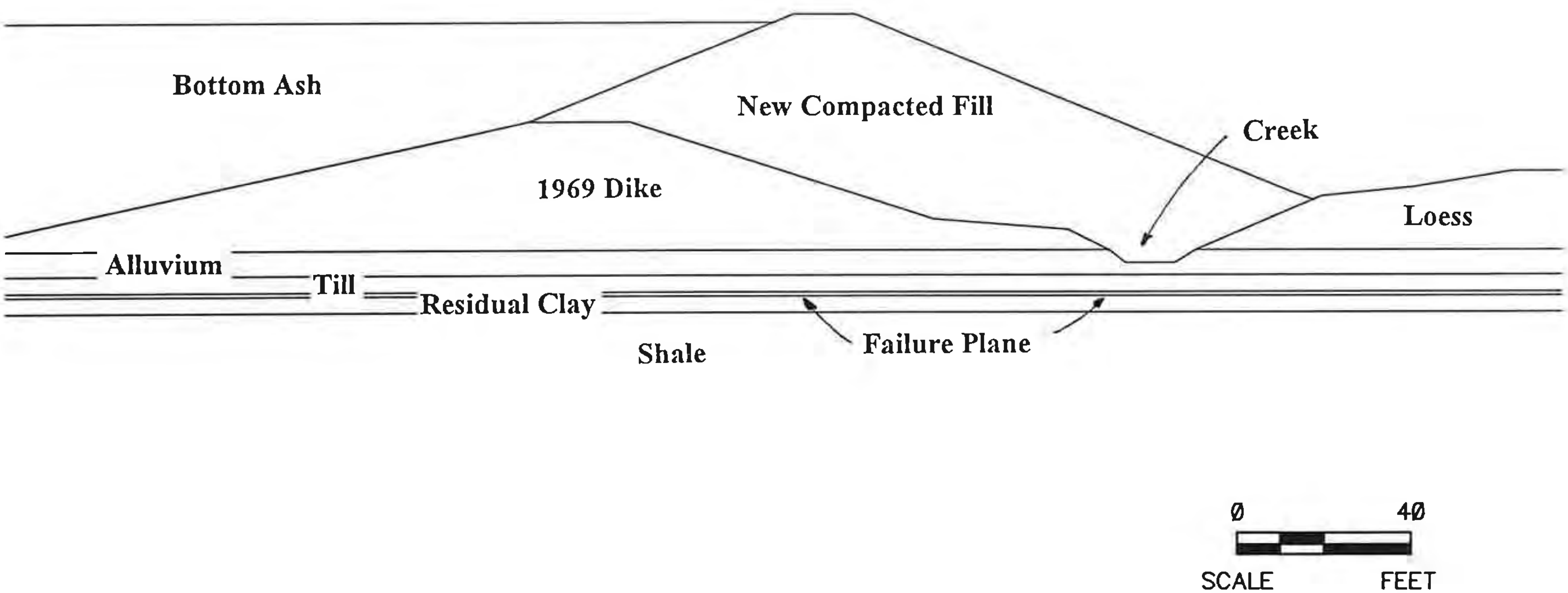
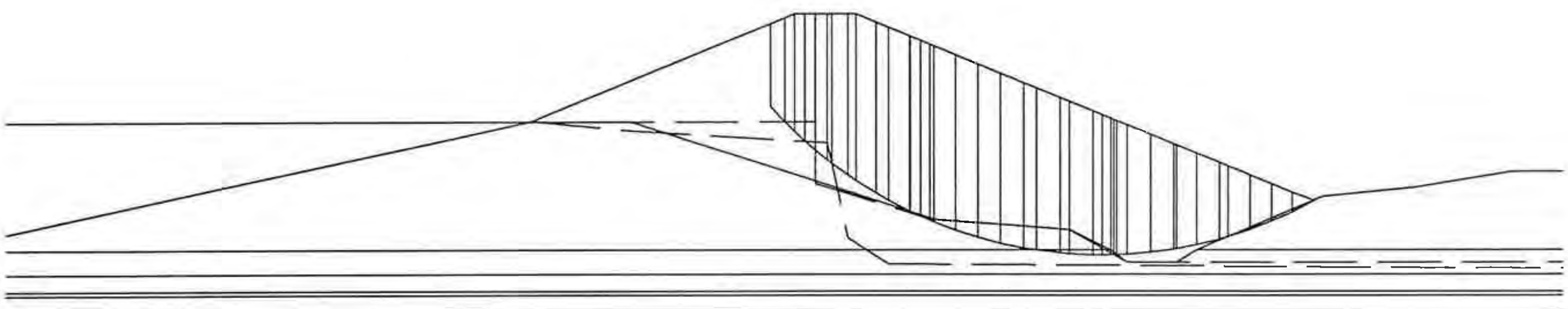


Figure E-4

END OF CONSTRUCTION CONDITION
TRANSLATED DIKE ALTERNATIVE



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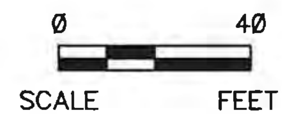
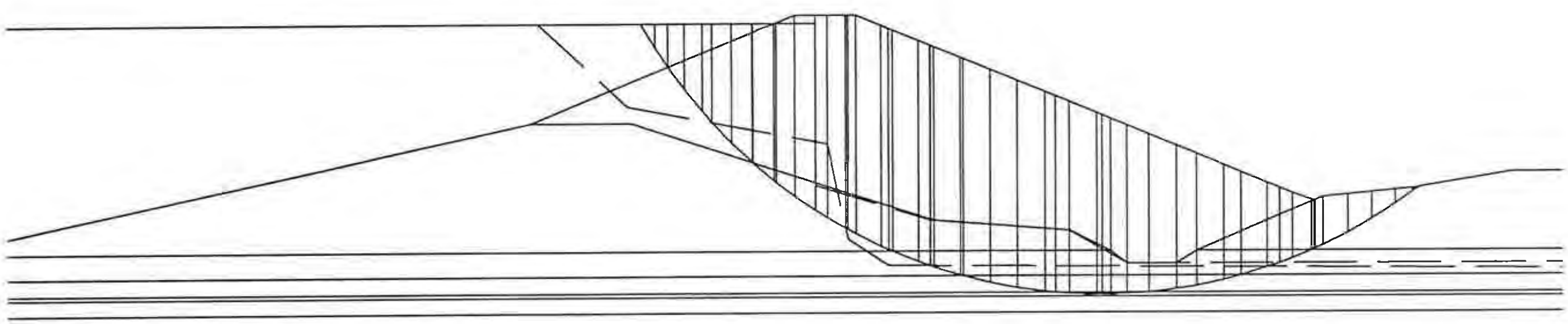


Figure E–5

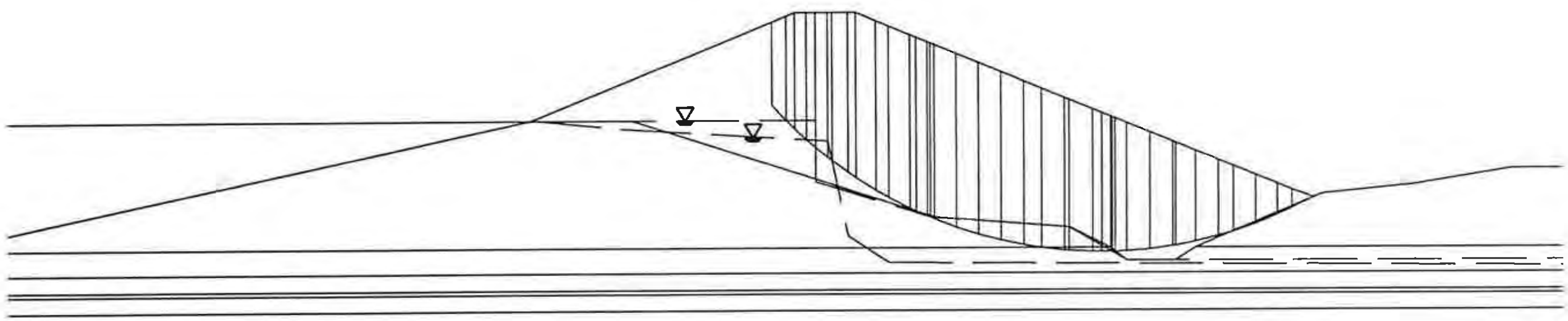
STEADY STATE CONDITION
TRANSLATED DIKE ALTERNATIVE



FS=1.70

Figure E-6

EARTHQUAKE CONDITION
TRANSLATED DIKE ALTERNATIVE



FS = 1.45

Figure E–7

APPENDIX F

HDPE OPTION

APPENDIX F
HPDE WALL OPTION

The HDPE option was the recommended option in the June 23, 1995 draft report. Subsequently developed options are now preferred.

The HDPE option for the deep slide area is shown in cross-section Figure F-1 and involves the following key elements:

1. Removal of the upper dike and replacement with a lightweight fill (compacted fly ash or slag) with a chimney drain and a blanket drain.

2. A centerline cutoff wall consisting of cement bentonite and an HDPE liner extending into the weathered shale constructed by the slurry trench method.

3. Inclined sand-filled drains connected to a drainage blanket at the elevation of the creek to intercept water that seeps beneath or through the cutoff wall.

4. A downstream berm consisting of compacted clay fill and a coarse rock.

5. Lime/fly ash slurry injection of the bottom ash below the upper rebuilt dike.

The aim of this repair is to significantly reduce the hydrostatic pressure on the failure surface. This is to be accomplished by a very low permeability cutoff wall (HDPE, 10^{-10} to 10^{-12} cm per second) and downstream inclined drains to collect seepage that passes either through or below the wall. The combined cutoff and drainage is designed to lower the groundwater level as low as possible (to the creek elevation) without use of pumps. Our calculations indicate however, that lowering the groundwater level to the elevation of the creek only provides a factor of safety for long term conditions of approximately 1.2$\pm$. To increase the factor of safety to the target level, additional measures are needed. Therefore, a toe berm and use of lightweight fill at the crest are recommended. In combination with drainage, these measures increase the factor of safety to the target values.

Other techniques could have been used in lieu of the berm, such as drilled piers or stone columns. However, preliminary calculations indicated the cost of these measures would be significantly greater than the cost of the toe berm. Piers or stone columns would have the advantage, however, of not changing the appearance of the downstream slope. Key elements of the recommended repair are described below.

HDPE Wall

We initially assumed that either a soil bentonite or cement bentonite cutoff wall would be sufficient to control water pressures. However, the permeability of these types of walls is not significantly different from that of the existing dam (except for the bottom ash) and foundation materials and therefore, would not significantly change the groundwater flow. To be effective, a cutoff wall must be significantly less permeable than the surrounding media. With this in mind, we selected an HDPE material developed by Gundle (Tradename: GundWall) that is installed as interlocking sheets similar to steel sheet piling except that a sealant can be used in the interlocks. This HDPE material is installed within a cement bentonite slurry wall approximately 2 ft wide excavated from the top of the existing ash elevation (el. 434±). Construction from this elevation will permit use of relatively economical backhoe excavation equipment to extend to the weathered shale. Above the elevation of the bottom ash, the HDPE will be raised as backfilling proceeds although special care will be required to avoid its damage by the earthwork contractor. Telephone conversations with a contractor (Slurry Walls, Inc.) indicate that this type wall will cost approximately $10.50 per square foot. WCC has previous experience with GundWall on a recent hazardous waste project.

A potential construction difficulty is the removal of limestone boulders and ledges below the failure plane. Borings suggest that these are not continuous and generally less than 1 ft thick. Rock removal techniques such as a chisel will probably be required in some areas to construct the wall. Rock removal is more costly than excavating shale and adds some uncertainty to the cost of installing the wall.

Inclined Drains

Inclined drains will be 10 to 12 in. diameter holes drilled with conventional rigs and backfilled with sand to collect seepage from the less pervious surrounding soil and the pervious zone at the failure plane. Due to the very low permeability of the surrounding soils, we do not believe a well screen is needed within the drains. Inclined wells will be drilled from a gravel working platform at approximately el. 395± (at creek level). The gravel working platform will then act as a gravel drain after the wells are installed. A geofabric is recommended below the gravel drain layer for trafficability.

A major concern with the inclined drains is the low permeability of the surrounding soil and the potential lack of a continuous permeable zone in the foundation that can be "tapped" by the drains. The pervious zone above the failure plane is the target drainage layer for the wells to "tap," however, it may be discontinuous causing drainage wells to be marginally effective. Therefore, monitoring pore pressure after construction will be important to evaluate the effectiveness of the wells. It is possible that additional wells or other measures may be needed to enhance drainage.

Compacted Lightweight Fill

To reduce driving forces, lightweight fill is recommended to rebuild the upper slope. For design purposes, we have assumed that the on-site fly ash treated with lime could be used as lightweight fill and would have a unit weight of approximately 95 pounds per cubic foot. It would be capped at the surface by 3 feet of clay fill to permit growth of vegetation and minimize erosion of fly ash. We have not evaluated the environmental implications of using the fly ash as a construction fill material. This would need to be done prior to construction, as well as testing of the fly ash to determine engineering properties. For design purposes, we have assumed properties based on previous experience with compacted fly ash. In lieu of fly ash, blast furnace slag could be used. We have had success using slag with acceptable chemical properties obtained from Granite City on previous projects.

Lime Fly Ash Injected Bottom Ash

We recommend lime/fly ash injection to strengthen the bottom ash and to reduce potential for liquefaction. This would be done by a specialty contractor such as Hayward-Baker whom we contacted regarding pricing and technical feasibility. They indicated that this procedure has been used to strengthen bottom ash. They also indicated a budget price of $3.50 per cubic yard of treated material. Prior to production injection, a test section on-site approximately 50 ft square will be needed to evaluate the effectiveness of the approach and for the contractor to adjust his mix to achieve the specified strength. Lime injection may be hampered in some areas due to the presence of hard lime treated ash at the surface of the bottom ash layer. This may require localized drilling to penetrate this "crust" of hard ash.

Downstream Berm

The downstream toe berm can be constructed of material removed from the crest of the slide and coarse rock. The rock will provide drainage, allow construction of a steeper slope (1.5H:1V), and provide erosion resistance along the creek. We had also considered a mechanically stabilized wall ("Tensar" wall), but judged the rock fill to be more economical and practical.

Sequence of Construction

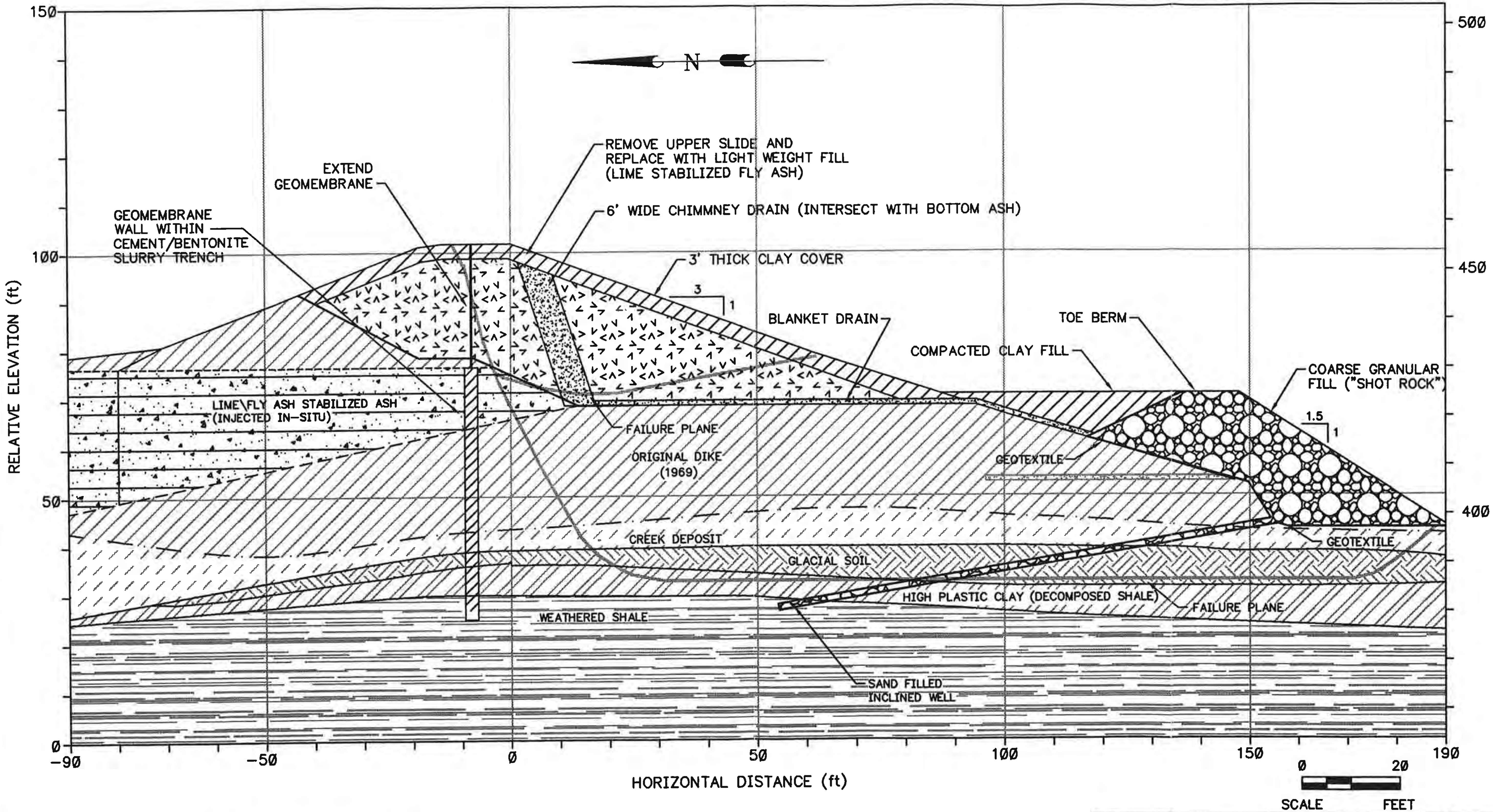
We envision the following sequence of construction, assuming that the upper dike has already been removed to el. 434 within the deep failure area.

1. Remove the upper dike to el. 433± outside the failed area.
2. Inject lime-fly ash into bottom ash.
3. Install HDPE wall.
4. Remove soil in failed area to el. 423± and install blanket drain.
5. Excavate at downstream toe to install gravel drain.
6. Install inclined wells from the downstream toe.
7. After completion of the drains, complete the toe berm.
8. After completion of the cutoff wall, place the lightweight fill at the crest.
9. Install instrumentation to monitor the slide area.

This treatment would be required from approximately Station -6-50 to Station 5+50 as shown in Figure F-2. At each end of the wall, a return would be made toward the downstream portion of the dike, as shown in Figure F-3. Interceptor wells would be installed at each return as shown to intercept seepage coming from either the east or west end of the slide area. A cross-section for areas of potential shallow failure is shown in Figure F-4. The estimated costs for this option is $5.7 million and are summarized in Table F-1. Seepage analyses are shown in Figures F-5 and F-6. The repair elements and Finite Element Mesh are in Figures F-7 and F-8. Results of stability analyses are given in Figure F-9 and F-10. Results of stability analyses for the shallow dikes are shown in Figure F-11.

TABLE F-1
COST ESTIMATE FOR HDPE OPTION REPAIR

ITEM	WORK ITEM	QUANTITY	UNIT RATE	UNIT	TOTAL
ESTIMATED CONSTRUCTION COST FOR HDPE OPTION REPAIR					
1	Mobilization/Demobilization	1	$200,000	ls	$200,000
2	Strip	13,000	$0.90	cy	$11,700
2	Exacavate and stockpile soil	43,900	$2.50	cy	$109,750
3	Deep HDPE slurry wall	99,400	$10.50	sf	$1,043,700
4	Shallow Slurry Wall	52,500	$4.25	sf	$223,125
5	Inclined Sand Drains	5,200	$40.00	ft	$208,000
6	Lime /flyash inject bottom ash	135,000	$3.50	cy	$472,500
7	Excavate for toe berm	10,700	$2.50	cy	$26,750
8	Rock toe berm	36,700	$15.00	cy	$550,500
9	Blanket and chimney drain	13,700	$15.00	cy	$205,500
10	Light weight fill	47,700	$5.00	cy	$238,500
11	Trench drains near toe of upper dike	3,300	$20.00	cy	$66,000
12	Geofabric	13,300	$2.00	sf	$26,600
13	Roadway on top of dike	2,300	$5.40	sy	$12,420
14	Seed and Mulch	25,000	$0.50	sy	$12,500
15	Instrumentation	1	$25,000	allow	$25,000
16	Clay fill at toe berm and cap over lt wt fill	27,500	$5	cy	$137,500
		Subtotal			$3,570,045
		OH and profit @ 15%			$535,507
		Subtotal			$4,105,552
		Engineering @ 15%			$615,833
		Subtotal			$4,721,385
		Contingency @20%			$944,277
		TOTAL			**$5,665,661**



Notes:
1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location — not between.

ILLINOIS POWER BALDWIN STATION SOUTH ASH POND BALDWIN, IL.	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 4/20/95 DSGN. BY: gaz CHKD. BY: KMB 9-6-95	HDPE Repair in Areas of Potential Deep Failure
FIG. NO.	F-1

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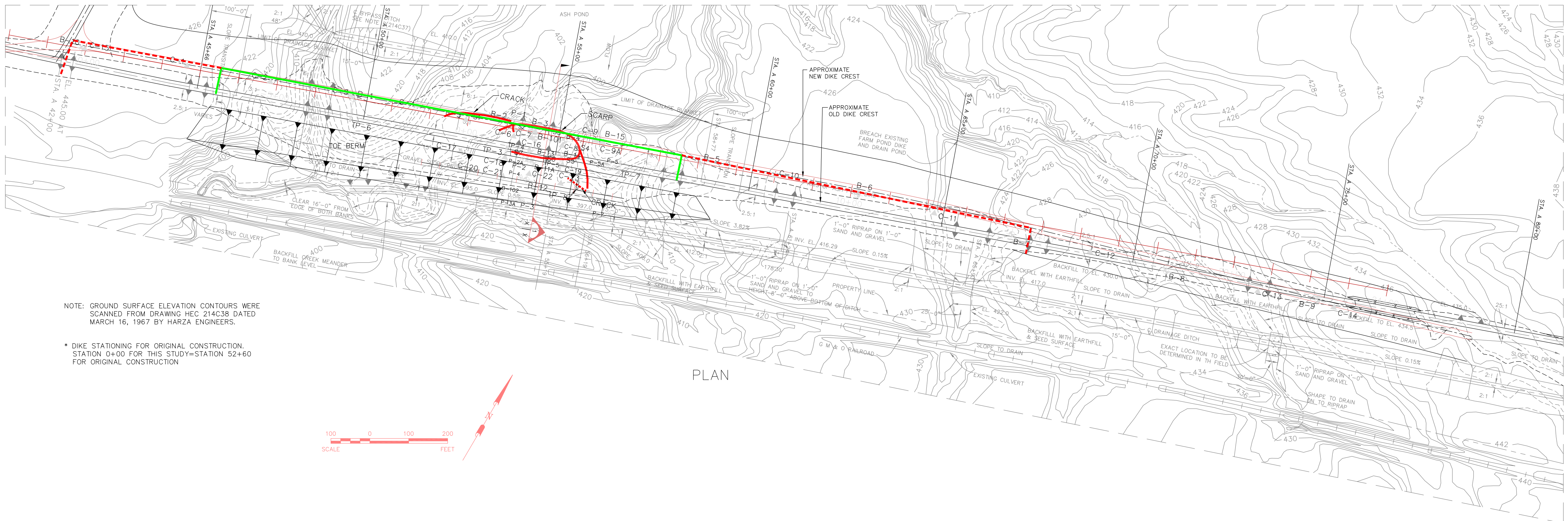
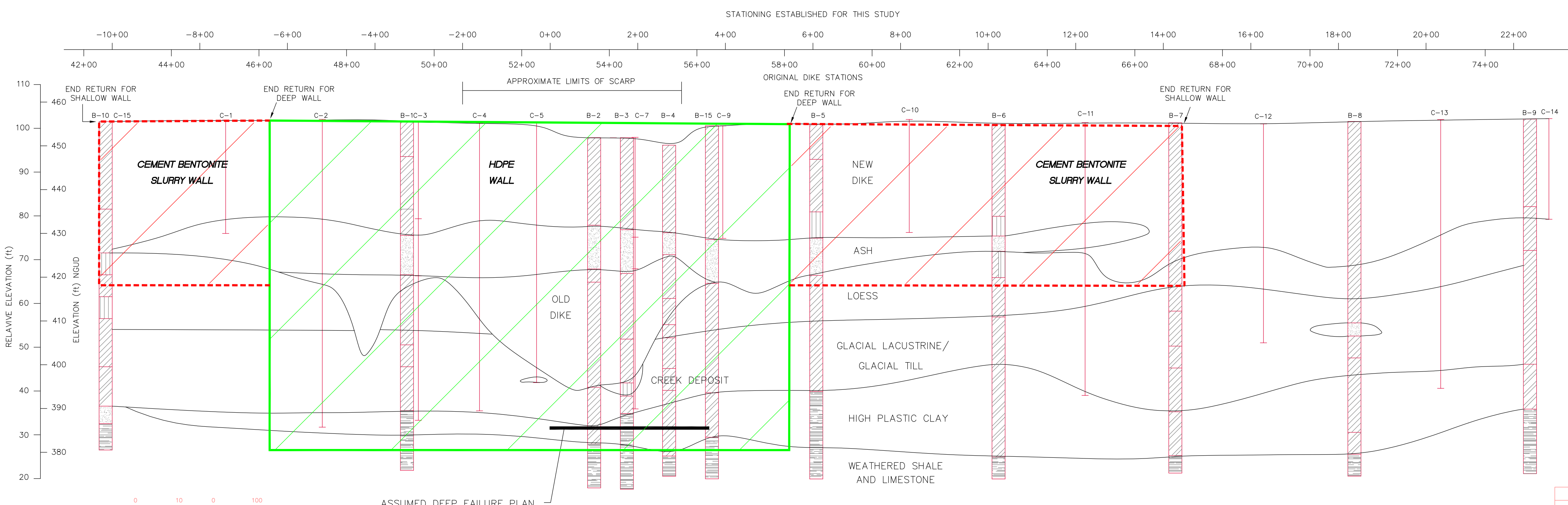


NOTE: GROUND SURFACE ELEVATION CONTOURS WERE SCANNED FROM DRAWING HEC 214C38 DATED MARCH 16, 1967 BY HARZA ENGINEERS.

* DIKE STATIONING FOR ORIGINAL CONSTRUCTION. STATION 0+00 FOR THIS STUDY=STATION 52+60 FOR ORIGINAL CONSTRUCTION

PLAN



GENERALIZED SUBSURFACE PROFILE
ALONG CENTERLINE OF NEW DIKE

LEGEND

- CLAY (CL)
- CLAY (CH)
- BOTTOM ASH
- SILT (ML)
- SHALE
- CPTU
- BORING
- TEST PIT
- PIEZOMETER
- APPROXIMATE FOOTPRINT OF NEW DIKE
- APPROXIMATE FOOTPRINT OF OLD DIKE

NOTES:
1. THIS DRAWING SHOWS GENERALIZED SUBSURFACE CONDITIONS. SEE ORIGINAL BORING LOGS FOR DETAILS.
2. LINES INDICATING STRATA BETWEEN EXPLORATORY LOCATIONS ARE INFERRED. STRATA SHOWN ARE KNOWN ONLY AT EXPLORATORY LOCATION – NOT BETWEEN.

Revision No.	Description	Date	By	App.

REVISIONS

ILLINOIS POWER COMPANY
BALDWIN POWER STATION

ASH POND, SOUTH DIKE
PLAN AND PROFILE OF REPAIRS
HDPE WALL ALTERNATIVE

Date: 4/10/95	Project Number: 5E08560	Figure Number: F-2
Drawn by: kdw	Design by: gaz	Checked by:

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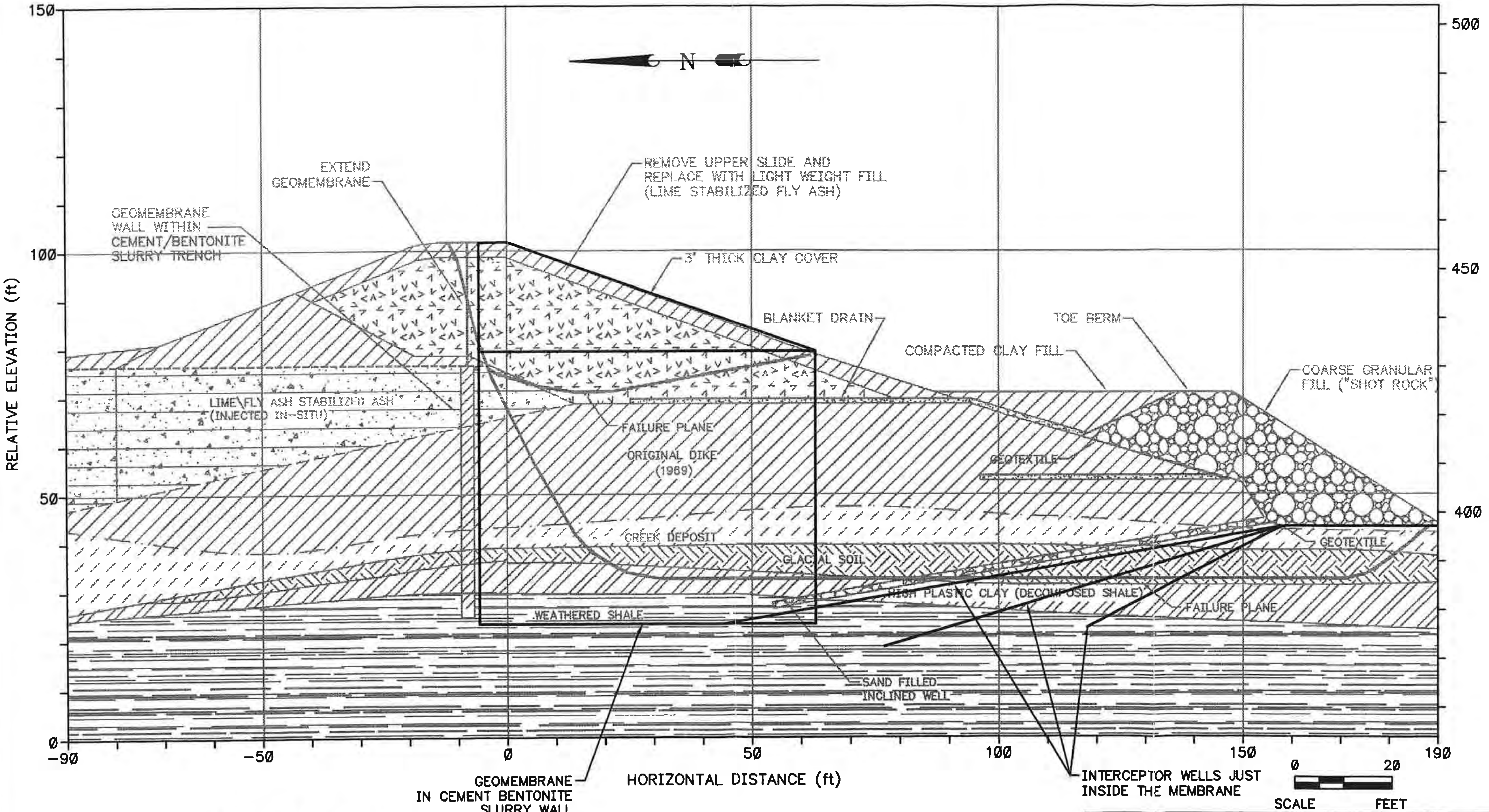

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Notes:
1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location – not between.

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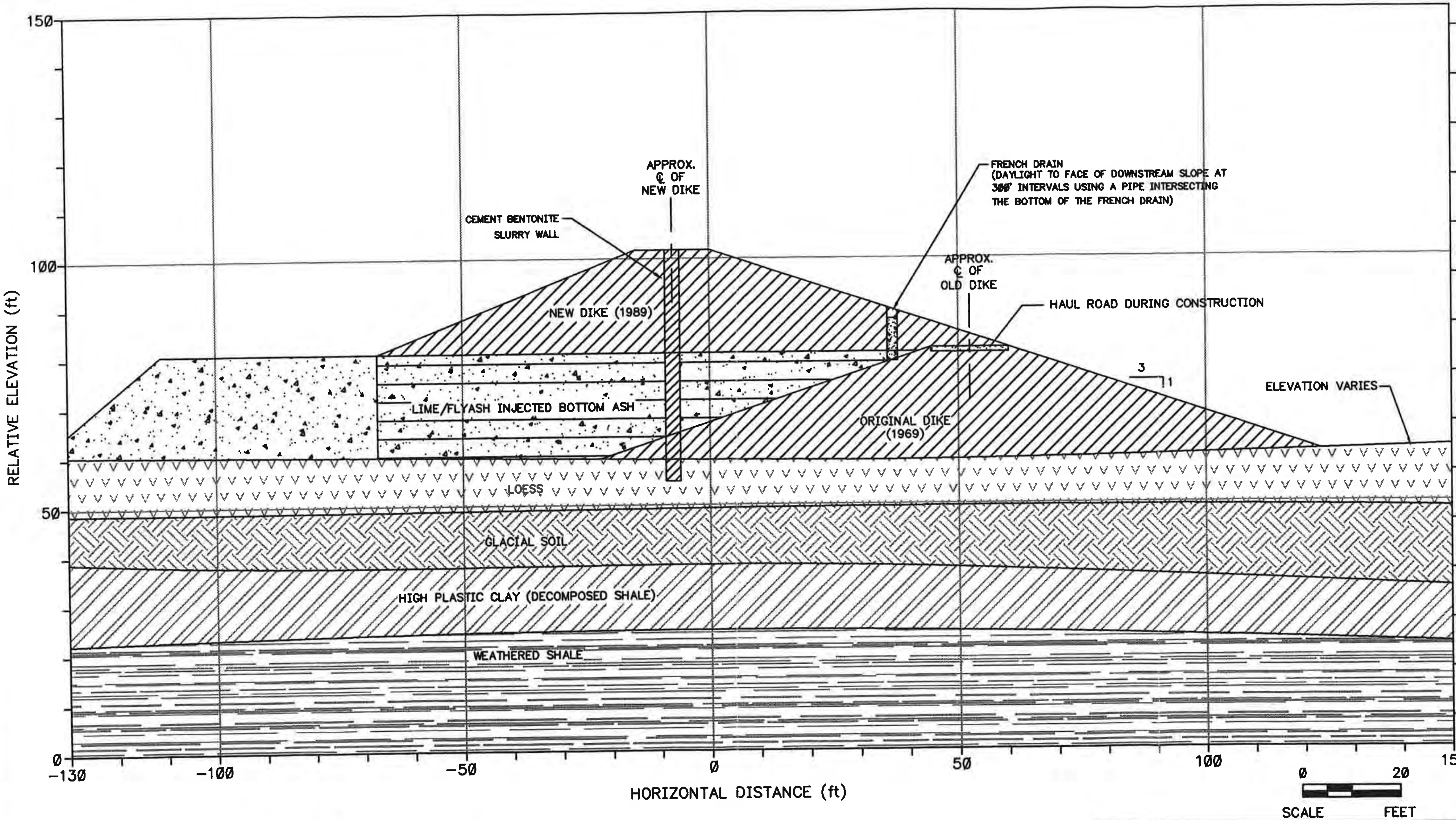
DRN. BY: bdl 4/20/95 DSGN. BY: gaz CHKD. BY: KMB 9-6-95	Detail of End Return for Areas of Potential Deep Failure	FIG. NO. F-3



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Notes:
1. This drawing shows generalized subsurface conditions. See original boring logs for details.
2. Lines indicating strata between exploratory locations are inferred. Strata shown are known only at exploratory location – not between.

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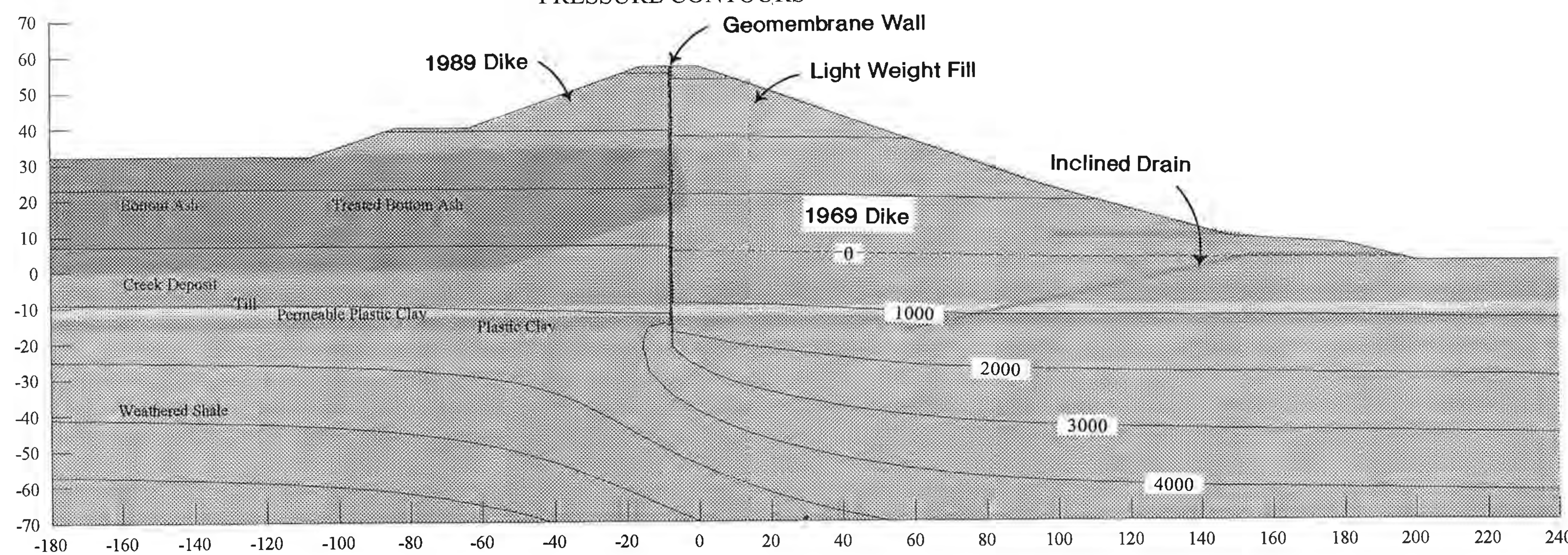
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 5/24/95 DSGN. BY: gaz CHKD. BY: KMB 9-6-95	HDPE Repair for Areas of Potential Shallow Slides
FIG. NO.	F-4

SEEPAGE ANALYSIS FOR RECOMMENDED SLIDE REPAIR
PRESSURE CONTOURS



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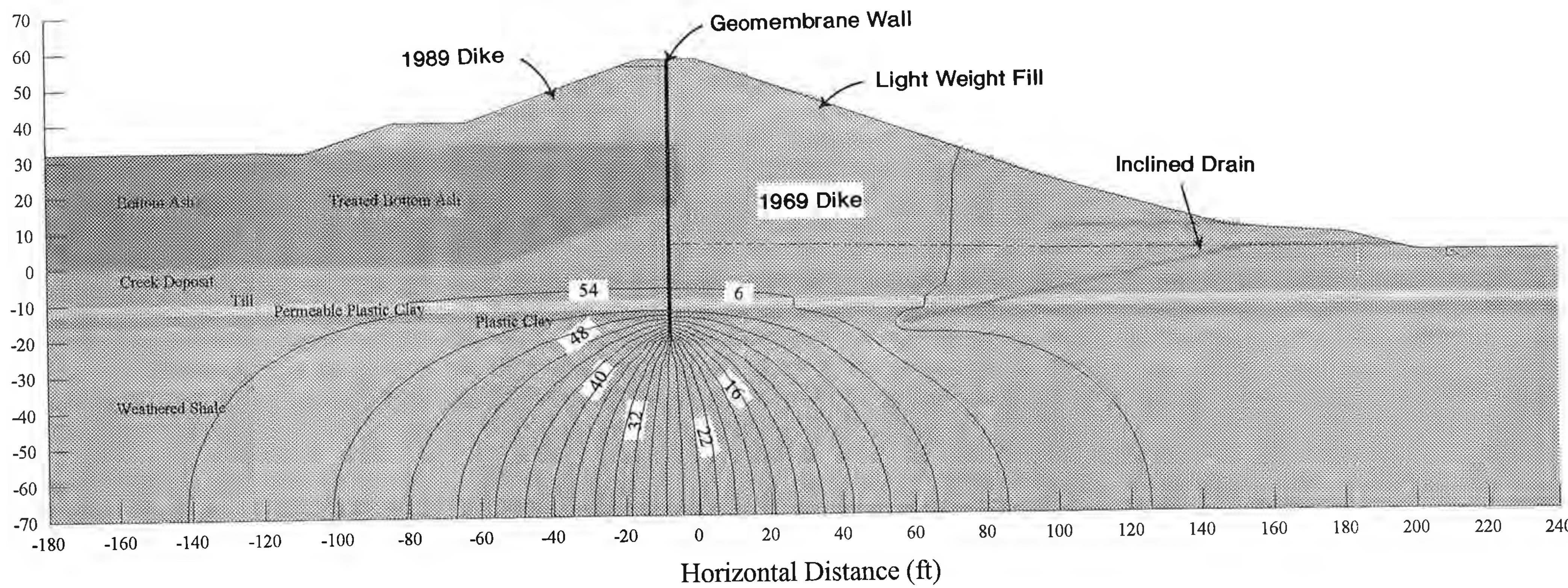
ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE	PROJECT NO. 5E08560
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 6/23/95 DSGN. BY: kmb CHKD. BY: KMB 9-6-95	SEEPAGE ANALYSIS FOR HDPE WALL OPTION WATER PRESSURE CONTOURS
FIG. NO.	F-5

SEEPAGE ANALYSIS FOR RECOMMENDED SLIDE REPAIR
TOTAL HEAD CONTOURS



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Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 6/23/95 DSGN. BY: kmb CHKD. BY: KMB 9-6-95	SEEPAGE ANALYSIS FOR HDPE WALL OPTION TOTAL HEAD CONTOURS
FIG. NO.	F-6

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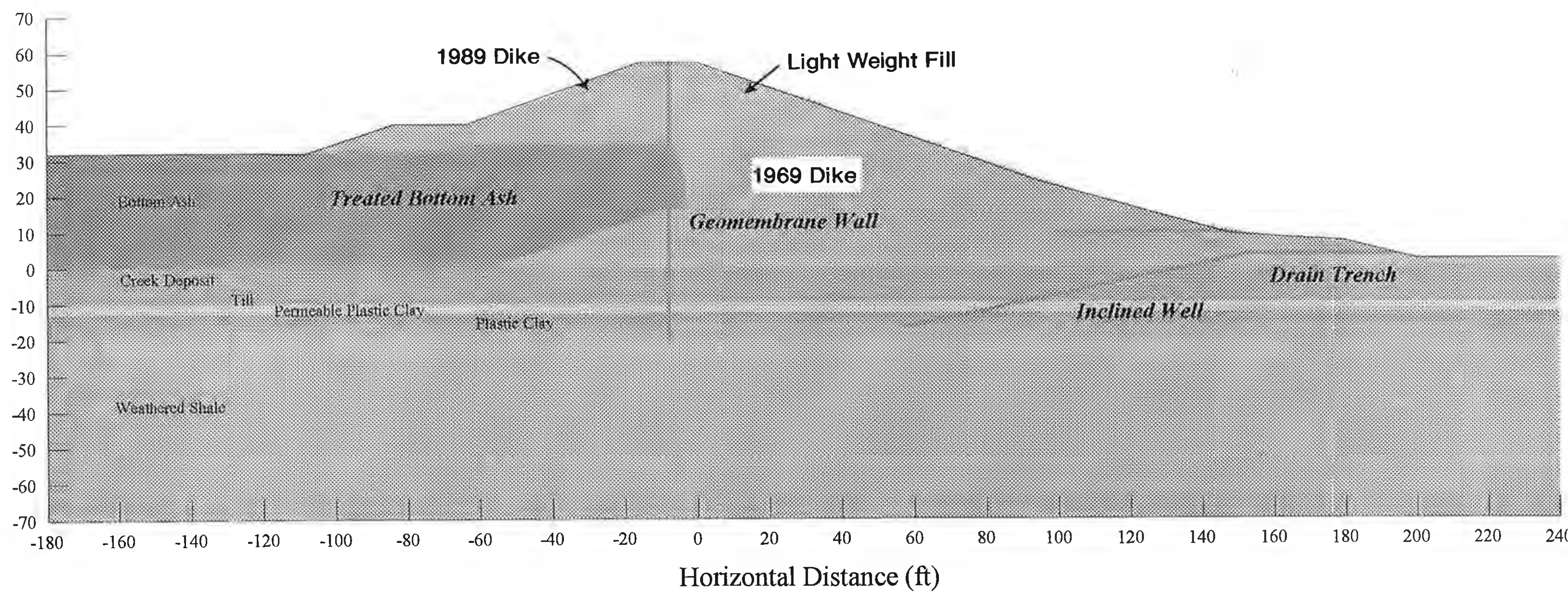
ELEMENTS OF RECOMMENDED SLIDE REPAIR



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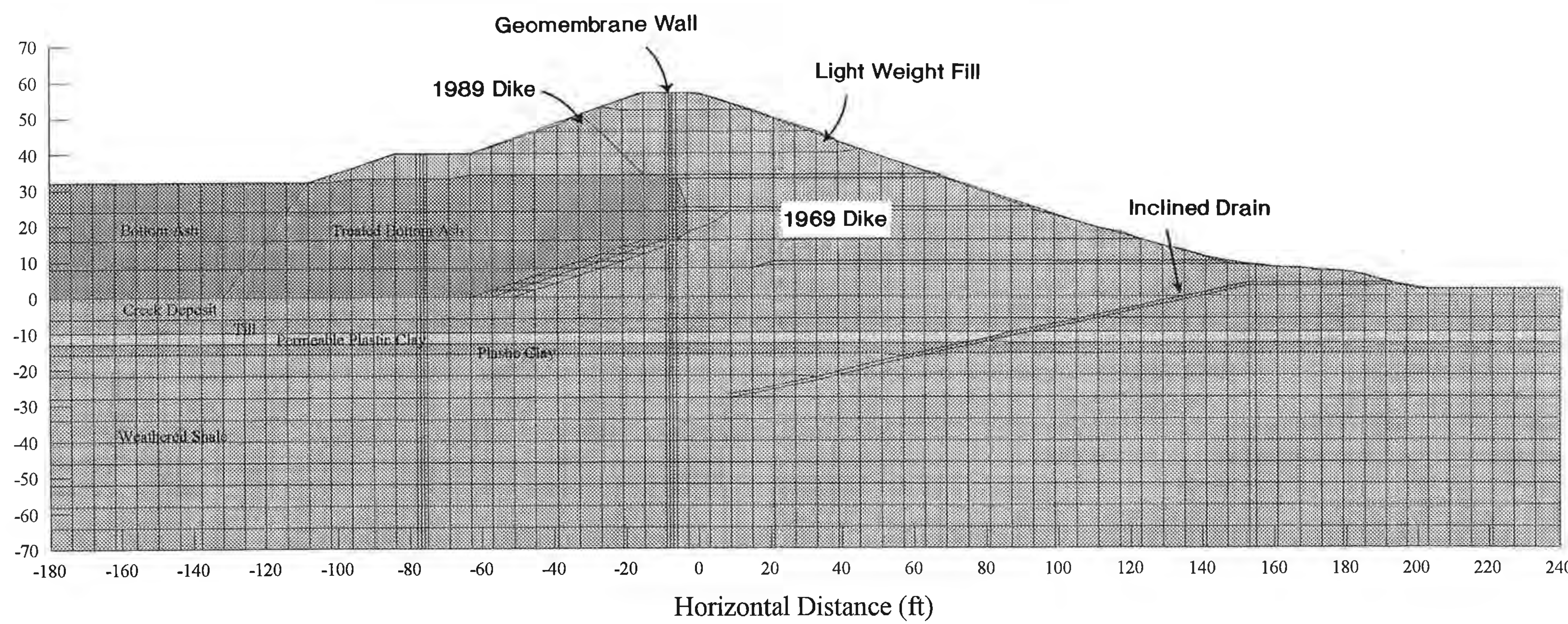
Woodward-Clyde Consultants Engineering & sciences applied to the earth & its environment	
DRN. BY: bdl 6/23/95 DSGN. BY: kmb CHKD. BY: KMB 9-6-95	ELEMENTS OF HDPE WALL OPTION SLIDE REPAIR
	FIG. NO. F-7

FINITE ELEMENT MESH FOR RECOMMENDED SLIDE REPAIR



ILLINOIS POWER COMPANY BALDWIN POWER STATION ASH POND, SOUTH DIKE	PROJECT NO. 5E08560

Woodward-Clyde Consultants
Engineering & sciences applied to the earth & its environment

DRN. BY: bdl 6/23/95 DSGN. BY: kmb CHKD. BY: KMB 9-6-95	FINITE ELEMENT MESH HDPE WALL OPTION SLIDE REPAIR	FIG. NO. F-8

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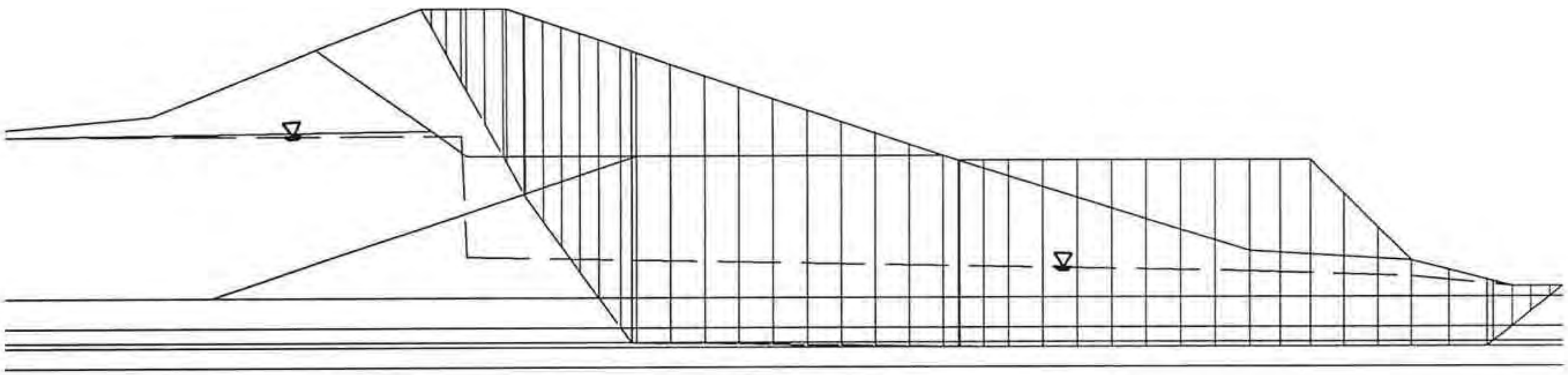
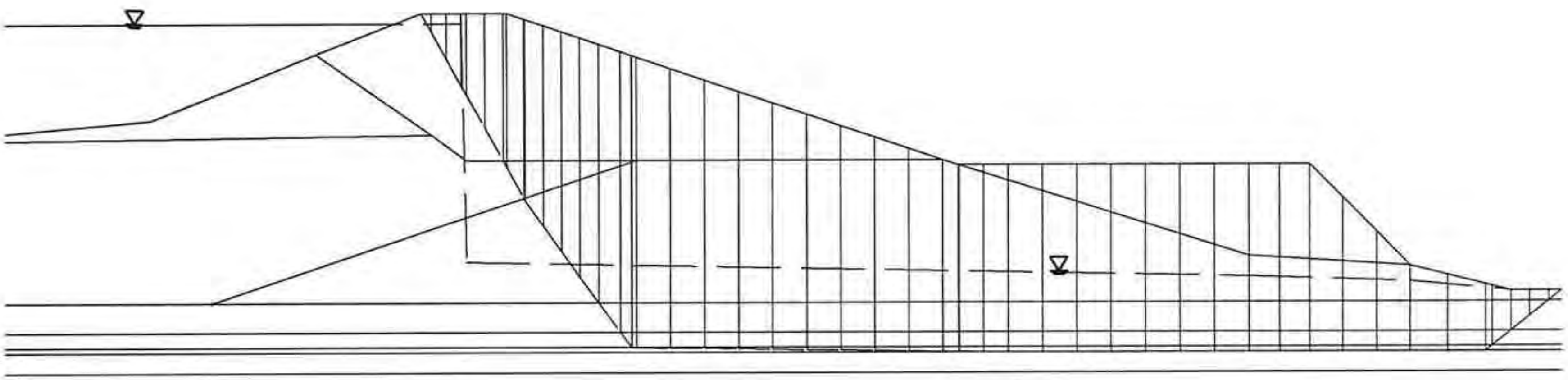
END OF CONSTRUCTION CONDITION
WITH LIGHT-WEIGHT FILL AND TOE BERM
HDPE WALL ALTERNATIVE



FS = 1.43

FIGURE F-9

STEADY STATE SEEPAGE
WITH LIGHT-WEIGHT FILL AND TOE BERM
HDPE WALL ALTERNATIVE



FS = 1.45

(FS = 1.08 Earthquake)

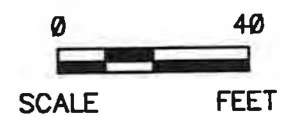
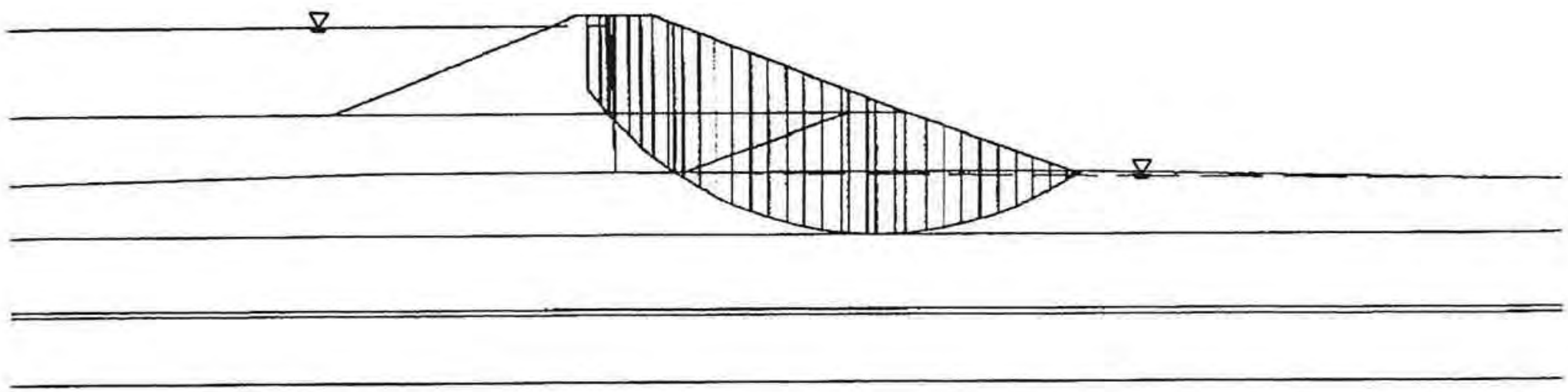


FIGURE F-10

SHALLOW FAILURE
HDPE WALL ALTERNATIVE



FS = 2.8 End of Construction
FS = 1.9 Steady State Seepage
FS = 1.6 Earthquake

Failure planes for each case are similar.

Note: Although these runs were done using the HDPE alternative, results are judjed to be similar for the other primary options since soil and seepage conditions are similar or better than this model.

FIGURE F-11

APPENDIX G

SECONDARY OPTIONS

APPENDIX G
SECONDARY OPTIONS

This appendix includes four options that were considered early on, but not pursued in detail due to cost or other deficiencies. For purposes of discussion they are termed secondary options in this report. They were included in the June 23, 1995 Draft Report and are discussed as follows.

1. Removal and Replacement and Deep Shear Key Trench Option

The intent of this option was to remove the upper slide material and provide a shear key of coarse rock extending below the slide plane to strengthen the slide mass and stabilize it. A sketch of this option is given in Figure G-1 and a cost estimate is given in Table G-1. The shear key option involves the following:

- Excavating to below the depth of the deep failure plane to remove soil in the shallow failure and much of the deep failure area.
- Installing a rock-filled key trench below the failed area extending into the shale.
- Installing an HDPE wall in a cement bentonite slurry trench at the dike centerline (same as the HDPE option).
- Lime/fly ash slurry injection of the bottom ash (same as the HDPE option).
- Installing a cement-bentonite slurry wall and trench drains in areas of potential shallow failure (same as the HDPE option).

The estimated cost of this option is about $8 million and it was not considered further. A major concern with option is stability of the excavation during construction since a major cut (to el. 370) is needed.

2. Regrading Option

Regrading to flatten the slope was also considered as shown in Figure G-2. This approach has been used for tailings dams and maintains the downstream toe location and flattens the slope to about 5H:1V. This geometry moves the crest inside the existing pond where a new dike would be needed. A cutoff wall would still be required as well as stabilizing the bottom ash. Horizontal wells would be drilled from the toe to intercept the bottom ash which would act as a large drain.

The advantage of this system is that a downstream toe berm would probably not be needed. The disadvantage, however is that the dam crest would be moved and require construction inside the ash pond. Rough estimates show the cost to be about the same or somewhat more than the HDPE option. Due to the disadvantages noted, this approach was not considered further.

3. Drain Wall Option

Another option that is similar to the HDPE option is use of a "drain wall" at the center of the rebuilt dike in lieu of the HDPE cutoff wall (Figure G-3). (This is similar to the Parallel Wall option). The drain wall would be constructed by the slurry trench method but use a bio-degradable polymer drilling fluid instead of bentonite. The backfill in the drain wall trench would be free-draining such as concrete sand which would be left in place after the drilling fluid breaks down. The backfill would then act as a chimney drain. To remove the water from the drain wall is problematical. A series of inclined wells drilled from the toe to intersect the wall were considered.

This option has merit because it provides positive drainage. Our concern is difficulty of constructing a relatively deep wall and the inclined wells which would need to intersect the wall. Because of these concerns this option was not pursued further. We judged the cost to be similar to the HDPE repair.

4. Remove And Replace Bottom Ash (Shallow Slide Repair Option)

This option is for repair of potential shallow failures which could occur above the top of the old dike, even in areas without deep failure. The option involves removal and replacement of the bottom ash beneath the upper dike. To accomplish this, it will also be necessary to remove and replace the existing upper dike. This option would eliminate the need for the shallow cement-bentonite slurry wall in areas of potential shallow failure. This concept is shown schematically in Figure G-4. In areas of potential deep failure, the HDPE repair is assumed (i.e. HDPE slurry wall, inclined wells, and a toe berm) except that instead of lime/fly ash slurry injection of the bottom ash, we assume it is removed and replaced with compacted clay. The cost estimate of $8 million is given in Table G-2.

A major problem with this option is dewatering during replacement of the clay fill. To account for this we allowed $100,000 in dewatering costs based on judgment. Also, a temporary excavation or cofferdam would be needed within the pond to allow removal of the bottom ash. In any case, this option is significantly more expensive than the other options and was not considered further.

TABLE G-1
COST ESTIMATE FOR MASS EXCAVATION AND KEY TRENCH

ITEM	WORK ITEM	QUANTITY	UNIT RATE	UNIT	TOTAL
1	Mobilization/Demobilization	1	$200,000	ls	$200,000
2	Strip	22,000	$0.90	cy	$19,800
2	Exacavate and stockpile soil	323,000	$2.50	cy	$807,500
3	Deep HDPE slurry wall	99,400	$10.50	sf	$1,043,700
4	Shallow Slurry Wall	52,500	$4.25	sf	$223,125
5	Inclined Sand Drains	0	$40.00	ft	$0
6	Lime /flyash inject bottom ash	119,000	$3.25	cy	$386,750
7	Excavate for toe berm	0	$2.50	cy	$0
8	Rock key trench	28,000	$15.00	cy	$420,000
9	Blanket drain	19,600	$15.00	cy	$294,000
10	Replace stockpiled fill	275,400	$5.00	cy	$1,377,000
11	Trench drains near toe of upper dike	2,200	$20.00	cy	$44,000
12	Temp sheet pile	24,000	$10.00	sf	$240,000
13	Roadway on top of dike	2,300	$5.40	sy	$12,420
14	Seed and Mulch	50,000	$0.50	sy	$25,000
15	Instrumentation	1	$25,000	allow	$25,000
		Subtotal			$5,118,295
		OH and profit @ 15%			$767,744
		Subtotal			$5,886,039
		Engineering @ 15%			$882,906
		Subtotal			$6,768,945
		Contingency @20%			$1,353,789
		TOTAL			**$8,122,734**

TABLE G-2
COST ESTIMATE FOR REMOVAL AND REPLACEMENT OF BOTTOM ASH

ITEM	WORK ITEM	QUANTITY	UNIT RATE	UNIT	TOTAL
1	Mobilization/Demobilization	1	$75,000	ls	$75,000
2	Strip	28,000	$0.90	cy	$25,200
2	Exacavate and stockpile soil	357,000	$2.50	cy	$892,500
3	Deep HDPE slurry wall	99,400	$10.50	sf	$1,043,700
4	Shallow Slurry Wall	0	$0.00	sf	$0
5	Inclined Sand Drains	5,200	$40.00	ft	$208,000
6	Replace with clay fill	348,000	$5.00	cy	$1,740,000
7	Excavate for toe berm	10,700	$2.50	cy	$26,750
8	Rock toe berm	36,700	$15.00	cy	$550,500
9	Blanket drain	9,100	$15.00	cy	$136,500
10	Dewatering	1	$100,000	allow	$100,000
11	Trench drains near toe of upper dike	2,200	$20.00	cy	$44,000
12	Temp excavate bottom ash at toe	83,000	$4.00	sf	$332,000
13	Roadway on top of dike	2,300	$5.40	sy	$12,420
14	Seed and Mulch	50,000	$0.50	sy	$25,000
15	Instrumentation	1	$25,000	allow	$25,000
		Subtotal			$5,236,570
		OH and profit @ 15%			$785,486
		Subtotal			$6,022,056
		Engineering @ 15%			$903,308
		Subtotal			$6,925,364
		Contingency @20%			$1,385,073
		TOTAL			**$8,310,437**

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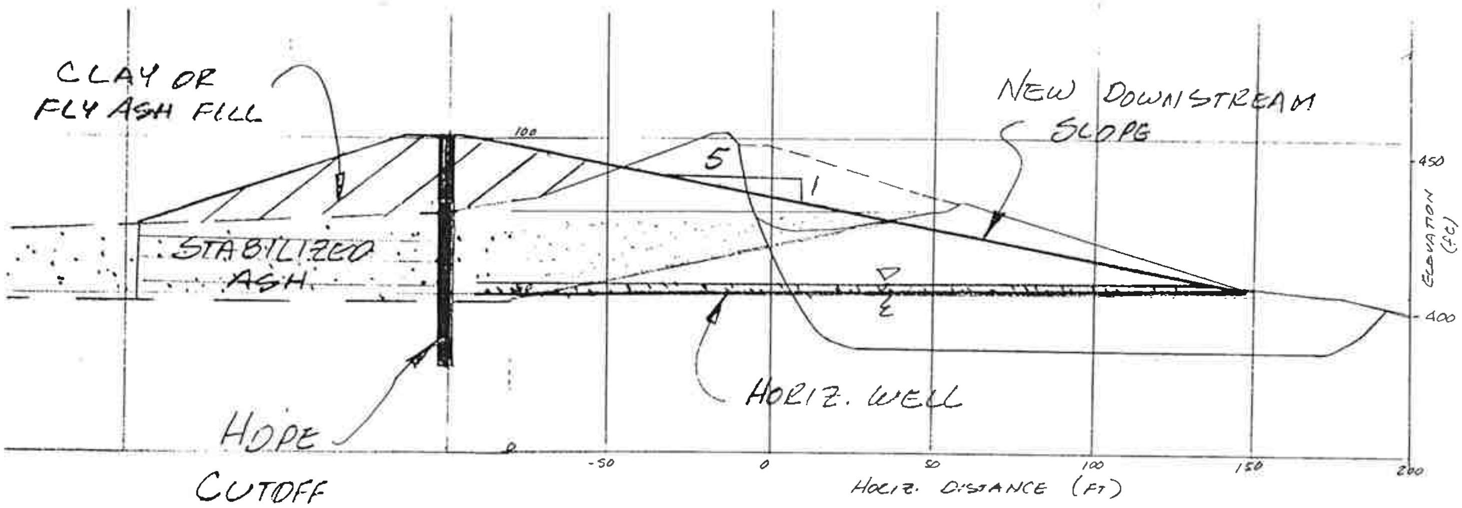

CONCEPTUAL REPAIR
FOR DEEP FAILURE

"RE-GRADE"

FIG. 6-2

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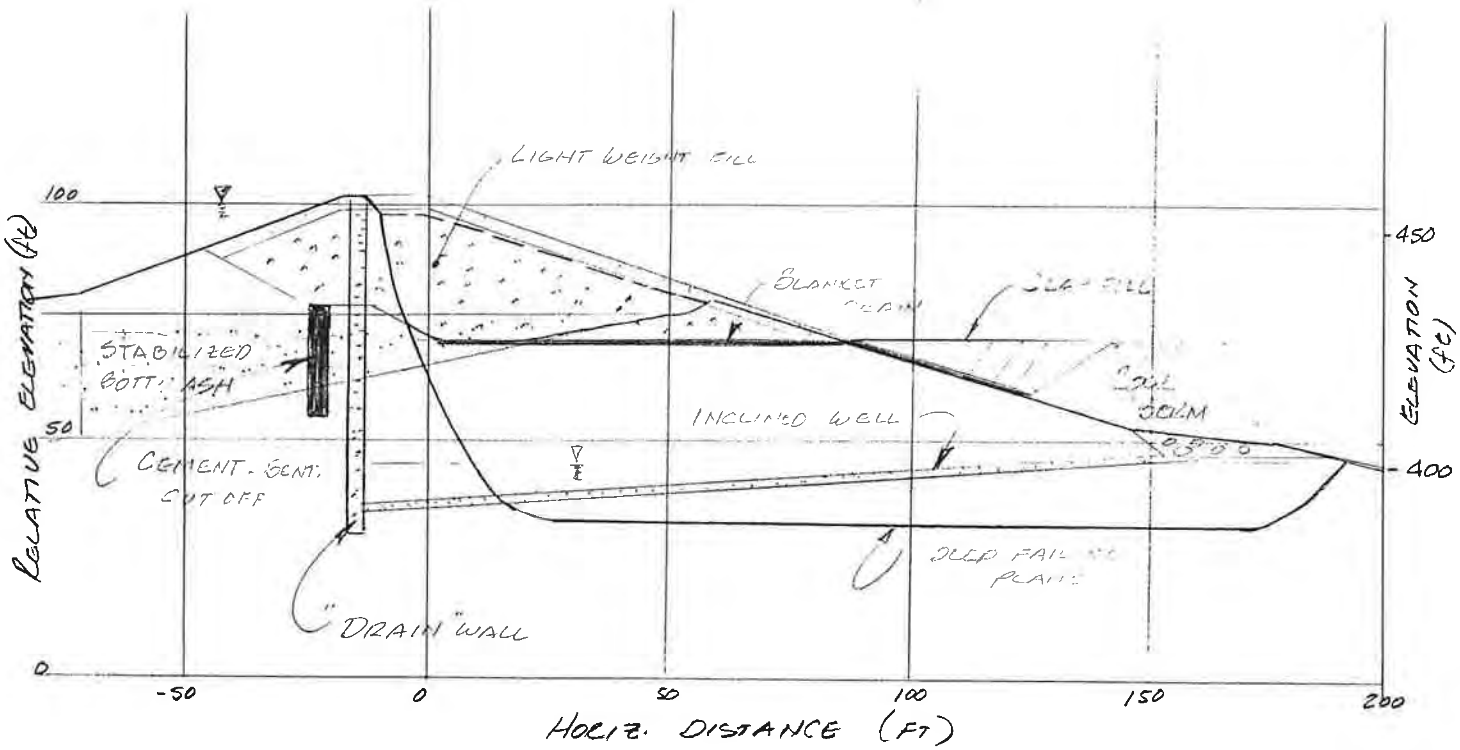
FOR ILL. POWER



DRAIN WALL INSTALLED BY SLURRY TRENCH METHOD
USING BIO-DEGRADABLE POLYMER - SAND BACKFILL

CONCEPTUAL REPAIR FOR
DEEP FAILURE
"DRAIN WALL"

FIG. G-3

Woodward-Clyde Consultants

Sheet No. Of

File ECO8060

Made by TL Date 6-21-95

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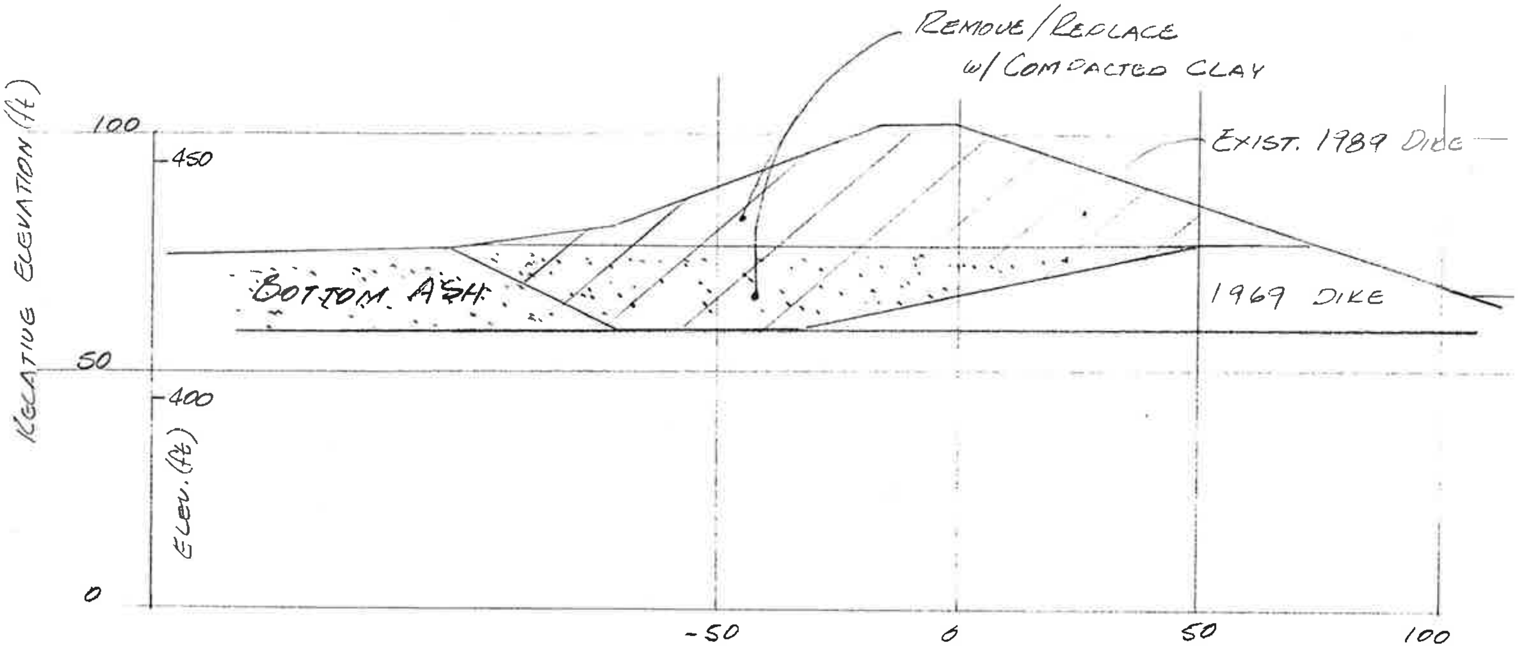
FOR ILL. POWER



CONCEPTUAL REPAIR

SHALLOW FAILURE AREAS

"REMOVE AND REPLACE BOTTOM ASH"

FIG. G-4

Woodward-Clyde Consultants

Sheet No. Of

File 5C08560

Made by TL Date 6-21-95

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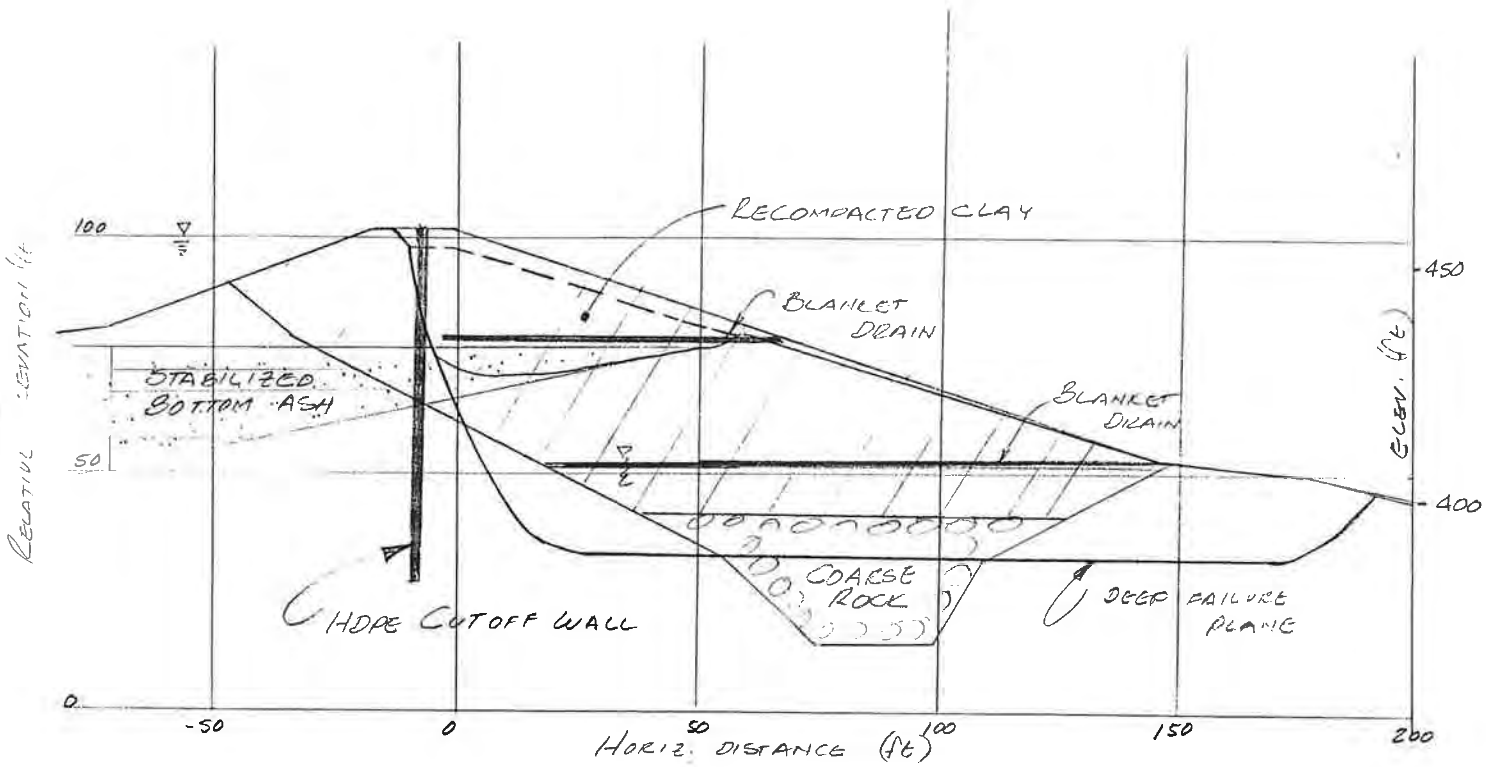
FOR ILL. POWER



CONCEPTUAL REPAIR
FOR DEEP FAILURE

"KEY TRENCH"

FIG. G-1

AECOM

Appendix G: Observation of Slope Movement at Fly Ash Pond, Baldwin Energy Complex, Baldwin, Illinois, URS (2011)

URS

May 10, 2011

Mr. Charles Nerone
Environment and Chemistry Manager
Dynegy Midwest Generation, Inc.
10901 Baldwin Road, P.O. Box 146
Baldwin, IL 62217

SUBJECT: OBSERVATION OF SLOPE MOVEMENT AT FLY ASH POND BALDWIN ENERGY COMPLEX, BALDWIN, ILLINOIS

Dear Chuck:

I appreciated the opportunity to meet with you on May 2nd to view the slope movement at the north west portion of the Fly Ash Pond (Fly Ash West Cell). It is my understanding that Dynegy wanted me to observe the slope and then make comments on Dynegy's proposed remedial measures.

The embankment is exhibiting signs of distress believed to be due to the prolonged heavy rains that the site has been experiencing. There are signs of soil movement on the slope. The area of movement appears to be a stretch of the embankment which is slightly steeper than the rest of the embankment. The site was wet from recent heavy rains. Phil Morris stated that he was on site the previous week when it was drier, and no signs of seepage were observed. The top of the slide is a few feet below the crest of the embankment, and the bottom of the slide appears to be above the toe of the landside of the embankment. See the attached photos for a view of the movement.

Based on topographic data in our files, the approximate elevations of some key features are as follows:

Crest of embankment = El. 453
Landside toe of slope = El. 424
Pond water elevation = El. 426

Without performing any analyses, it is my opinion that the slide was caused by slope saturation due to the heavy precipitation that the site experienced. The area of the slope where movement occurred appears to be slightly steeper than the adjacent embankment. Given the water level of the pond, it is unlikely that pond seepage contributed to the slide. (This is just my opinion and would need numerical modeling to prove or disprove.)

URS Corporation
1001 Highlands Plaza Drive West
Suite 300
St. Louis, MO 63110
Tel: 314.429.0100
Fax: 314.429.0462

URS

I concur with Dynegy's opinion that the area of movement should be remediated in order to prevent a progressive type failure of the slope. It is my understanding that Dynegy intends to perform a removal and replacement of the slide mass. My opinions and comments related to this are as follows:

1) The water level in the pond should remain at its current elevation permanently.

2) This method of slide repair is appropriate as long as the slide mass is relatively shallow (6 feet deep or less). It is unknown how deep the slide extends. The entire slide mass should be removed.

3) After removing the slide mass, the remaining slope will need to be benched to allow a proper connection of the new replacement soil to the remaining slope.

4) The final grade of the slope should be flattened to match the adjacent embankment.

5) The replacement material is anticipated to be clay. The clay fill will need to be thoroughly compacted in lifts at the appropriate moisture content.

We appreciate your consideration of URS for this work.

Sincerely,

Kenneth M Berry

Kenneth M. Berry, P.E.
Sr. Project Manager

Cc: Phil Morris

URS	PHOTOGRAPHIC LOG		
Client Name: Dynegy Midwest Generation	**Site Location:** Baldwin, IL	**Project No.** 21562663	

Photo No. 1	**Date:** 05/02/11

Description:

Northwest slope of Fly Ash Pond – Facing East.

Photo No. 2	**Date:** 05/02/11

Description:

Northwest slope of Fly Ash Pond – Facing West.

Appendix H: Photos from the 2015 surficial movement

Figure I.1. Photo of 2015 surficial movement prior to repairs.

Figure I.2. Photo of 2015 surficial movement area after repairs.

Attachment C.2

Periodic History of Construction Report Update Letter

Geosyntec consultants

1 McBride and Son Center Drive, Suite 202
Chesterfield, MO 63005
PH 636-812-0800
www.geosyntec.com

October 13, 2021

Dynegy Midwest Generation, LLC
10901 Baldwin Rd
Baldwin, Illinois 62217

Subject: Periodic History of Construction Report Update Letter
USEPA Final CCR Rule, 40 CFR §257.73(c)
Baldwin Power Plant
Baldwin, Illinois

At the request of Dynegy Midwest Generation, LLC (DMG), Geosyntec Consultants (Geosyntec) has prepared this Letter to documents updates to the Initial History of Construction (HoC) report for the Baldwin Power Plant (BPP), also known as the Baldwin Energy Complex (BEC). 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 BPP, which included the existing CCR surface impoundment, the Bottom Ash Pond (BAP), was prepared and subsequently posted to DMG'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).

DMG retained Geosyntec to review the Initial HoC report, review reasonably and readily available information for the BAP generated since the Initial HoC report was prepared, and perform a site visit to BPP 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 BAP and BPP, as they pertain the requirements of §257.73(c)(1)(i)-(xii)

UPDATES TO HISTORY OF CONSTRUCTION REPORT

Geosyntec's evaluation for the BPP BAP determined that no known significant changes requiring updates to the information in the Initial HoC report pertaining to §257.73(c)(1)(ii),(iv)-(v), (vii) and §257.73(c)(1)(xi)-(xii) of the CCR Rule had occurred since the Initial HoC report was developed.

However, Geosyntec's evaluation determined that significant changes at the BPP BAP pertaining to §257.73(c)(1)(i), (iii), (vi), (viii)-(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.

Bottom Ash Pond

The BAP operational starting date is readily and reasonable unavailable [1]. The BAP is being used to store and dispose of sluiced bottom ash and to store and dispose of fly ash.

Old East Fly Ash Pond, East Fly Ash Pond and West Fly Ash Pond

The Old East Ash Pond (OEAP), East Ash Pond (EAP), and West Fly Ash Pond (WFAP) were in operation from 1969 to 2020, for a total of approximately 51 years [1]. The OEAP, EAP, and WFAP were used to store and dispose of fly ash [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.

State identification numbers (IDs) for the OEAP, EAP, WFAP, and BAP have been assigned by the Illinois Environmental Protection Agency (IEPA). Each ID is listed in **Table 1**.

Table 1 – IEPA ID Numbers

CCR Surface Impoundment	State ID
Old East Fly Ash Pond (OEAP)	W1578510001-01
East Fly Ash Pond (EAP)	W1578510001-02
West Fly Ash Pond (WFAP)	W1578510001-03
Bottom Ash Pond (BAP)	W1578510001-06

§ 257.73(c)(1)(iii): A statement of the purpose for which the CCR unit is being used.

The OEAP, EAP, and WFAP were closed in 2020, in substantial compliance with the written closure plans posted to DMG's CCR Website ([4], [5], [6]), and as documented by certified Notification of Completion of Closures posted to DMG's CCR Website ([7], [8]). Therefore, the OEAP, EAP, and WFAP are no longer capable of storing additional CCR or free liquids.

§ 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 table summarizing successive stage of construction in the initial HoC is updated to also reflect the dike raise construction for BAP in October 2021:

Table 2 –Updated table for successive stage of constructions at BPP

Year	Event
1969	Construction of Old East Fly Ash Pond, East Fly Ash Pond, and West Fly Ash Pond external perimeter embankment.
1979	Construction of East Fly Ash Pond and West Fly Ash Pond northern embankment

Year	Event
1989	Inboard perimeters raise of the entire East Fly Ash Pond and West Fly Ash Pond
1995	Construction of interior dike between the East Fly Ash Pond and West Fly Ash Pond
1999	Raise of interior dike between the East Fly Ash Pond and West Fly Ash Pond; replacement of outlet pipe from the West Fly Ash Pond to the Secondary Pond
2012	Modification of Bottom Ash Pond embankment (original construction date unknown)
2021	Dike raise in Bottom Ash Pond in October 2021 to a crest elevation of 420 ft (up to 2 ft of material placement).

§ 257.73(c)(1)(viii): A description of the type, purpose, and location of existing instrumentation.

Instrumentation monitoring at the OEAP, EAP, and WFAP is no longer required as these CCR surface impoundments were closed in accordance with §257.102 ([7], [8]), and the instrumentation network was modified at that time. Therefore, the instrumentation locations shown in Appendix C of the Initial HoC report are no longer applicable to the OEAP, EAP, and WFAP. Only piezometers BAL-P001, BAL-P002, and BAL-P007 remain active.

§ 257.73(c)(1)(ix): Area-capacity curves for the CCR unit.

An updated area-capacity curve was prepared for the BAP in 2021. This curve is provided in **Figure 1**.

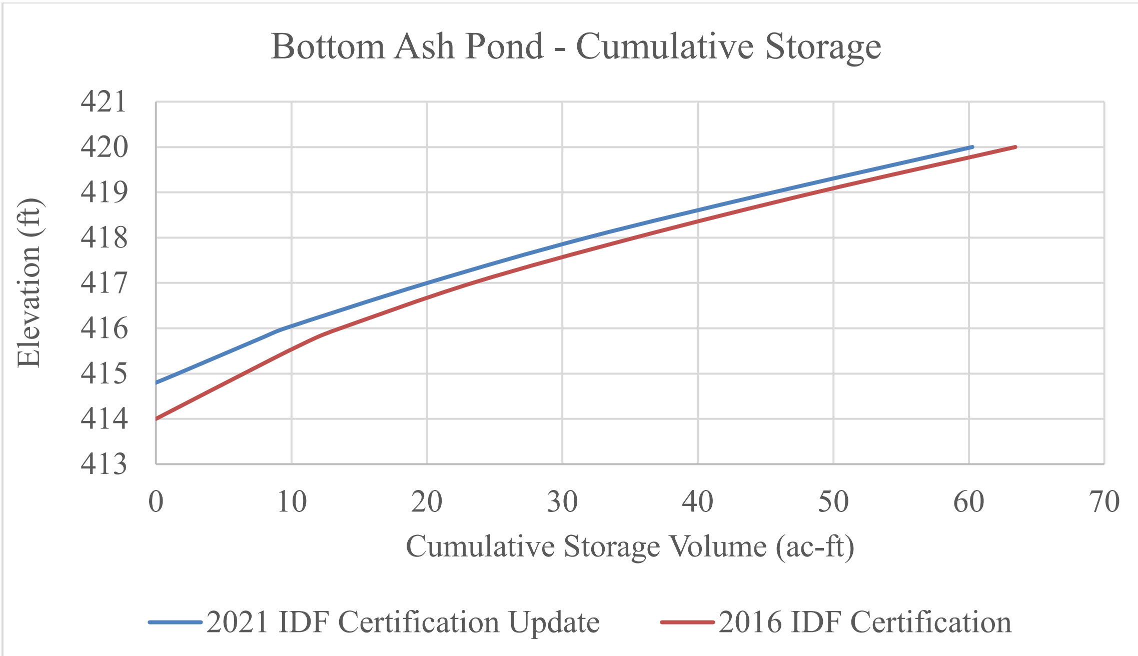


Figure 1 – Area-Capacity Curve for Bottom Ash Pond

§ 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 BAP spillways have sufficient storage capacity and overtopping is not expected during the 1,000-year, 24-hour storm event. The results of these calculations are provided in **Table 3**.

Table 3 – Results of Updated Discharge Capacity Calculations

	Bottom Ash Pond
Approximate Berm Minimum Elevation[1,2], ft	420.0
Approximate Emergency Spillway Elevation[1], ft	417.7
Starting Water Surface Elevation[1] (SWSE), ft	415.2
IDF Peak Water Surface Elevation[1] (PWSE), ft	419.2
Time to Peak, hr	16.9
Surface Area[3], ac	14.1
Storage[4], ac-ft	47.5

Notes:
[1]Elevations are based on the NAVD88 datum
[2]Approximate Berm Minimum Elevation confirmed by DMG
[3]Surface Area is defined as the water surface area at the PWSE
[4]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 BAP at the BPP since the Initial HoC was developed, based on reasonably and readily available information provided by DMG, observed by Geosyntec during the site visit, or generated by Geosyntec as part of subsequent calculations.

Sincerely,

Thomas Ward, P.E.
Senior Engineer

John Seymour, P.E.
Senior Principal

REFERENCES

[1] AECOM, "History of Construction, USEPA 40 CFR § 257.73(c), Baldwin Power Plant, Baldwin, Illinois," 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.

[4] V. Modeer, "Closure Plan for Existing CCR Surface Impoundment, 40 CFR 257.102(b), Baldwin Power Plant, Dynegy Midwest Generation, LLC, Old East Fly Ash Pond," October 17, 2016.

[5] V. Modeer, "Closure Plan for Existing CCR Surface Impoundment, 40 CFR 257.102(b), Baldwin Power Plant, Dynegy Midwest Generation, LLC, East Fly Ash Pond," October 17, 2020.

[6] V. Modeer, "Closure Plan for Existing CCR Surface Impoundment, 40 CFR 257.102(b), Baldwin Power Plant, Dynegy Midwest Generation, LLC, West Fly Ash Pond," October 17, 2016.

[7] Tickner, Diana, "Baldwin Energy Complex; Old East Fly Ash Pond, East Fly Ash Pond, West Ash Pond; Notification of Completion of Closure," Luminant, December 17, 2020.

[8] P. Morris, "Baldwin Power Plant; Old East Fly Ash Pond, East Fly Ash Pond, West Ash Pond, Notification of Completion of Closure," Luminant, December 17, 2020.

ATTACHMENT D

Types of CCR and Chemical Constituents

845.220(a)(2)(A)

Baldwin Power Plant - Bottom Ash Pond's Chemical Constituents

In accordance with 35 I.A.C. 845.230(d)(2)(C), DMG 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, Bottom Ash Pond.

A list of the chemical constituents' analyses contained in the CCR surface impoundment can be found in Appendix A. As determined through antidegradation studies, this list contains chemical constituents found in the surface free liquid and the subsurface free liquids. DMG 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 (IL0001554) in Appendix B.

Appendix A: Chemical Constituents Contained in the Bottom Ash Pond

Pollutant	Units	Surface Free Liquids Average Concentration	Subsurface Free Liquids Average Concentration
Ammonia	mg/L		0.18
Arsenic	mg/L	< 0.025	< 0.025
Barium	mg/L	0.414	0.235
Boron	mg/L	0.861	0.262
Cadmium	mg/L	< 0.001	< 0.001
Chloride	mg/L	62.2	58
Chromium	mg/L	< 0.009	0.0145
Chromium (hexavalent)	mg/L	< 0.006	< 0.005
Copper	mg/L	< 0.014	< 0.005
Cyanide	mg/L	< 0.005	< 0.005
Fluoride	mg/L	0.458	0.27
Iron	mg/L	1.37	0.136
Lead	mg/L	< 0.015	< 0.015
Manganese	mg/L	0.045	0.0032
Mercury	mg/L	0.00003	< 5E-07
Nickel	mg/L	< 0.007	0.0059
Nitrate - Nitrite	mg/L		0.051
Nitrogen, Total Kjeldahl	mg/L		0.5
Oil and Grease	mg/L	< 5.83	3
pH	SU	8.8	8.56
Phenols	mg/L	< 0.005	< 0.005
Phosphorus	mg/L	0.371	0
Selenium	mg/L	< 0.04	< 0.001
Silver	mg/L	< 0.003	< 0.003
Sulfate	mg/L	187	158
TSS	mg/L	13.8	3
Zinc	mg/L	< 0.01	< 0.01

*Used https://calstormcompliance.com/ph-averaging-tool

Appendix B: List of Chemical Additives, Waste Streams and Sorbent Materials

Chemical Additives
Aqua Ammonia
Bulab 6002 (Biocide - Bryozoan control)
Caustic Soda
Chlorine
Citric Acid (50%)
Corrshield NT4201 (Sodium Nitrite)
GE Biomate MBC2881 (Biocide)
GE Hypersperse MDL 150 (Anti-scalant)
GE MDC714 (Antiscalant)
GE KLEEN MCT 103 (Low pH RO Cleaner)
GE KLEEN MCT 405 (High pH RO Cleaner)
Hydrated Lime
Hydrogen Peroxide (30%)
Klairaid IC1173 (Coagulant)
Oxamine: Bulab 6004 (Sodium Hydroxide/Sodium Hypochlorite) and Oxamine 6150 (Ammonium Sulfate)
Sodium Aluminate
Sodium Bisulfite
Sodium Hydroxide (25%)
Sodium Hydroxide (50%)
Sodium Hypochlorite (12.5)
Spectrus NX1100 (Biocide)
Spectrus NX1106 (Biocide)
Spectrus NX1100/NX1103 (2-Bromo-2 Nitropropane-1,3-diol Magnesium Chloride)
Spectrus OX1201 (Sodium Bromide)
Sulfuric Acid (93%)

Waste Streams and Sorbent Materials*
Bottom Ash Transport Water
Unit 1 and 2 Dry Fly Ash
Ash Hopper Systems Waste (Air Heater, Economizer, & SCR)
Demineralizer Regenerate Wastewater
Unit 1 Boiler Sump
Unit 1 Low Point Drains
Water Treatment System Wastewater
O/W Separator (Stack #1)
Dredge Spoils
Air Heater Rinse Water
Units 1, 2, and 3 Spray Dryer (Absorber Slurry Water)
Chemical and Non-Chemical Metal Cleaning Wastes,
Aerated Lagoon Sewage
Low Volume SDA Sump and Other Miscellaneous Floor Drainage
Bottom Ash Transport Water

*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 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]
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
Phosphorus pentoxide (or phosphorus oxide)	1314-56-3	Yes	Yes	Yes	No
Potassium oxide	12136-45-7	No	Yes	No	No
Silica-crystalline (SiO_2), 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:

This SDS has been prepared in accordance with the Hazard Communication Rule 29 CFR 1910.1200. Information herein is based on data considered to be accurate as of date prepared. No warranty or representation, express or implied, is made as to the accuracy or completeness of this data and safety information. No responsibility can be assumed for any damage or injury resulting from abnormal use, failure to adhere to recommended practices, or from any hazards inherent in the nature of the product.

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:

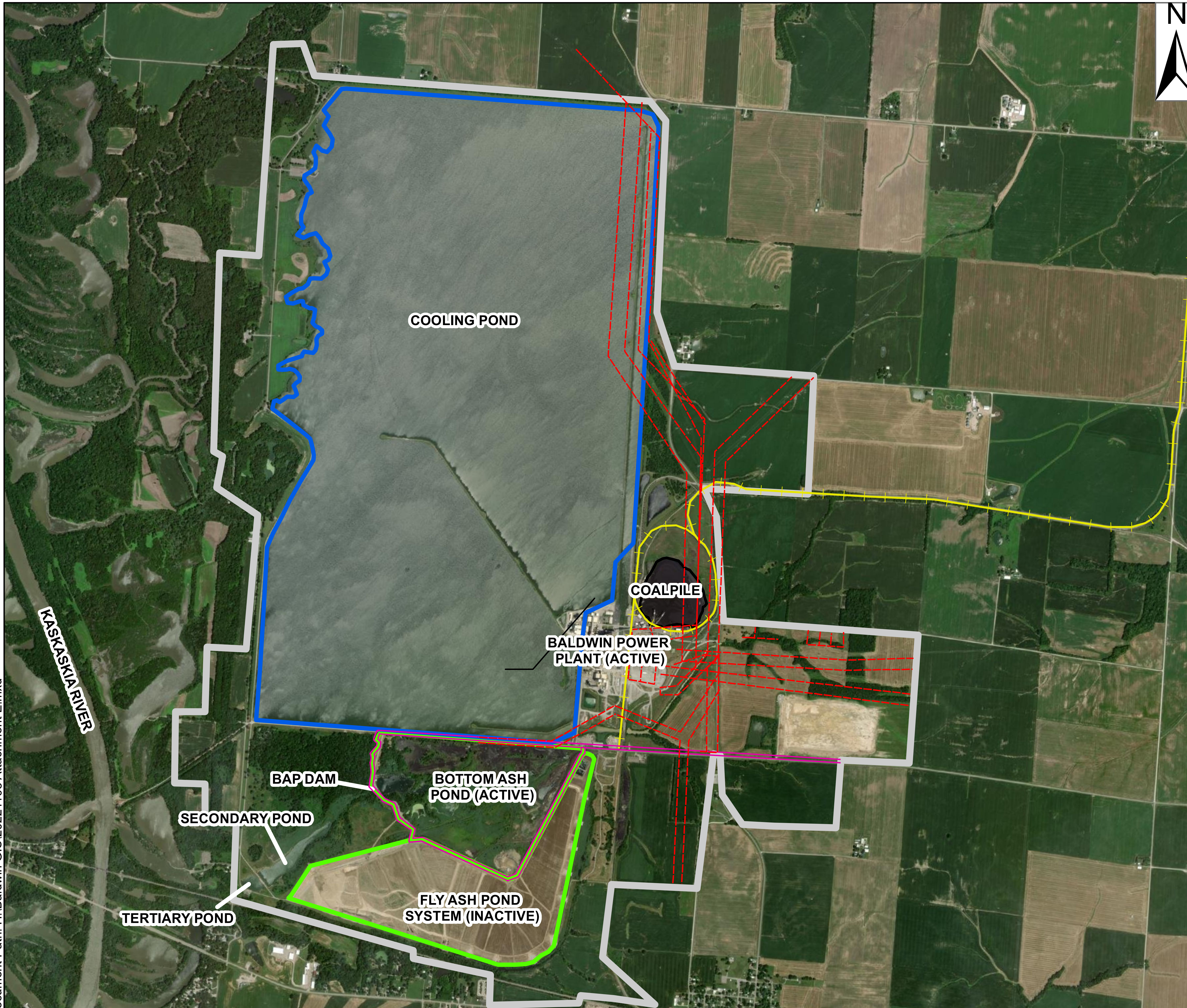
This SDS has been prepared in accordance with the Hazard Communication Rule 29 CFR 1910.1200. Information herein is based on data considered to be accurate as of date prepared. No warranty or representation, express or implied, is made as to the accuracy or completeness of this data and safety information. No responsibility can be assumed for any damage or injury resulting from abnormal use, failure to adhere to recommended practices, or from any hazards inherent in the nature of the product.

ATTACHMENT E

Site Plan Map and On-Site Transportation Plan

845.220(a)(4) and 845.220(a)(2)(E)

PRIVILGED AND CONFIDENTIAL PREPARED AT THE REQUEST OF COUNSEL



Legend

- Baldwin Rail Spur
- High Voltage Overhead Electric Line
- Onsite Transportation Route
- CCR Unit Boundary
- Cooling Pond Boundary
- Approximate Dynegy Midwest Generation Property Lines

NOTES:
The property lines are approximate. All private and public site utilities including, but not limited to, service electric lines, gas lines, hazardous liquid lines, water and sewer lines, telecommunication lines, plant utilities, and/or private utiltities are not shown on this figure and shall be verified in the field prior to any site work.

0 1,000 2,000 4,000 Feet

Baldwin Power Plant

Dynegy Midwest Generation, LLC

Bottom Ash Pond Construction Permit Application

Site Plan Map

GLP8050	**NOVEMBER 2022**

Geosyntec consultants

ATTACHMENT E

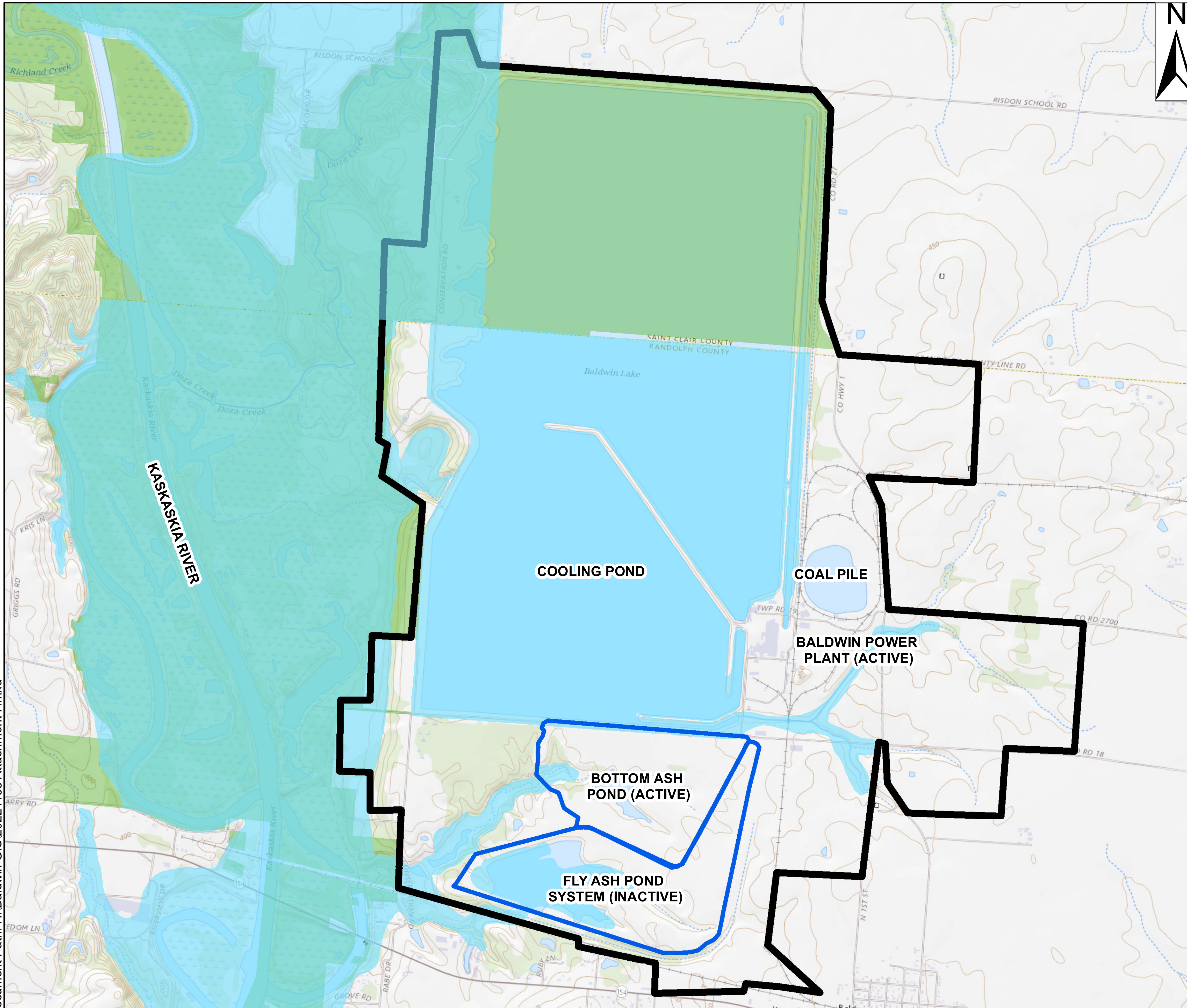
Document Path: H:\Baldwin GIS\20221108 Attachment E.mxd

ATTACHMENT F

Site Location Maps

845.220(a)(3)

PRIVILGED AND CONFIDENTIAL PREPARED AT THE REQUEST OF COUNSEL



Legend

- Approximate Dynegy Midwest Generation Property Lines
- CCR Unit Boundary
- FEMA 100 Year Floodplain
- Protected Natural Lands

NOTES:
Critical habitat was not identified for threatened or endangered species within 1,000 meters of the Site, according to the 2022 US Fish and Wildlife Critical Habitat for Threatened and Endangered Species online mapping application (http://ecos.fws.gov/ecp/report/table/critical-habitat.html)

The Cooling Pond is designated as a State Fish and Wildlife Area and leased to the Illinois Department of Natural Resources. No other Dedicated Illinois Nature Preserves or designated historic and archaeological sites per Illinois National Historic Preservation Act were listed within 1,000 meters of the Site (http://www2.illinois.gov/dnrhistoric/Preserve/Pages/HARGIS.aspx).

The FEMA 100-year Flood Zone boundaries were taken from the FEMA Flood Map Service Center (https://msc.fema.gov/portal/home).

The prevailing wind direction was taken as the highest frequency by direction for the Sparta Community-Hunter Field Airport in Sparta, IL from windhistory.com.

Prevailing Wind

0 1,000 2,000 4,000
Feet

Baldwin Power Plant
Dynegy Midwest Generation, LLC
Bottom Ash Pond Construction Permit Application
Site Location Map

GLP8050	**NOVEMBER 2022**

Geosyntec consultants

ATTACHMENT F

Document Path: H:\Baldwin GIS\20221109 Attachment F.mxd

ATTACHMENT G

Final Closure Plan and Proposed Closure Schedule (including Closure Alternatives Analysis)

845.210, 845.220(a)(5-6), 845.720(b), 845.220(d)(2)

Prepared for

Dynegy Midwest Generation, LLC
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

CCR SURFACE IMPOUNDMENT FINAL CLOSURE PLAN

BALDWIN POWER PLANT BOTTOM ASH POND (IEPA ID W1578510001-06) Baldwin, Illinois

Prepared by

Geosyntec consultants
engineers | scientists | innovators

1 McBride and Son Center Drive
Suite 202
Chesterfield, Missouri 63005

Project Number GLP8050

July 31, 2023

Geosyntec consultants

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TABLES

ATTACHMENTS

1. INTRODUCTION

Dynegy Midwest Generation, LLC (DMG) is the owner of the active coal-fired Baldwin Power Plant (BPP) in Baldwin, Randolph County, Illinois. This closure plan is for the Bottom Ash Pond (BAP). The BAP was present and operational prior to promulgation 35 Ill. Admin. Code 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845). The BAP has an Illinois Environmental Protection Agency (IEPA) identification number of W1578510001-06.

1.1. Selected Closure Method

Section 845.720(b)(3): *The final closure plan must identify the proposed selected closure method and must include the information required in subsection (a)(1) and the closure alternatives analysis specified in Section 845.710.*

Closure with a final cover system has been identified as the most appropriate closure method, also known as Closure-in-Place (CIP, per Section 845.740) based on the Closure Alternatives Analysis (CAA), provided in **Attachment A**. The CAA was prepared by Gradient Corporation (Gradient) to evaluate CIP versus Closure by Removal (CBR, per Section 845.750) and a hybrid closure alternative was selected as the most appropriate closure method for the BAP. All CCR from the western 101-acre portion of the BAP will be removed and placed into the eastern portion of the BAP, which will be closed in accordance with Sections 845.740 and 845.750. Under this hybrid approach, all CCR will be removed from approximately 57% of the current footprint of the impoundment.

The proposed hybrid CIP alternative will control, minimize, or eliminate, as much as feasible "post-closure infiltration of liquids" and releases of CCR, leachate, or contaminated runoff as interpreted by the IEPA in the Part 845 rulemaking.

Information developed by Geosyntec to support the Closure Alternatives Analysis is provided as an attachment to the CAA.

1.2. Organization of Final Closure Plan

This Final Closure Plan is organized in the following manner:

- **Section 1** includes an introduction to the Site and the selected closure method.
- **Section 2** includes the Final Closure Plan, as required by Section 875.720(a)(1).
- **Section 3** includes a summary of amendments of the Closure Plan.

- **Section 4** includes a discussion of how the closure using a final cover system will comply with the performance and design requirements of Sections 845.720 and 845.750, in addition to a Certification from a Qualified Professional Engineer for the final cover system design.

- **Section 5** includes additional information regarding the closure.

- **Section 6** includes a Certification from a Qualified Professional Engineer for this Final Closure Plan.

- **Section 7** includes reference documents used in the development of this Final Closure Plan.

2. FINAL CLOSURE PLAN

<u>Section 845.720(a)(1):</u> *Content of the Preliminary Closure Plan. The owner or operator of a new CCR surface impoundment or an existing CCR surface impoundment not required to close under Section 845.700 must prepare a preliminary written closure plan that describes the steps necessary to close the CCR surface impoundment at any point during the active life of the CCR surface impoundment consistent with recognized and generally accepted engineering practices.*

This section includes the final closure plan for the BAP, as required by Section 845.720(a)(1). Specific requirements of the closure plan and the relevant regulatory citations are included in the following sections.

2.1. Narrative Closure Description

<u>Section 845.720(a)(1)(A):</u> *A narrative description of how the CCR surface impoundment will be closed in accordance with this Part.*

2.1.1. Closure Overview

The BAP will be closed in place and covered with a final cover compliant with 40 C.F.R. §257.102(d)(3) and Section 845.750. Closure of the BAP will include a hybrid method, also called a "consolidate-and-cap" method, where the final footprint of the BAP will be reduced from approximately 177 acres to approximately 76 acres (the closure-in-place area). This will include removing all CCR and some of the underlying subgrade materials, totaling approximately 1.5 million cubic yards (CY), from an approximately 101-acre CBR area. The CIP area is inside the perimeter dikes and east of the CBR area within the current BAP dikes. Figures showing the location of each area of the BAP are provided within the final closure drawings in **Attachment B**.

During the closure process, DMG will continue to assess off-site CCR beneficial use opportunities. CCR consolidation and closure-in-place with a combination of offsite beneficial use may result in a smaller footprint for the ultimate cap design along with a reduced construction schedule.

2.1.1.1. CCR and Soils to be Relocated

Specific areas and volumes that will be removed and placed into the closure-in-place area are described within this section.

- All CCR, and up to an estimated depth of one foot of the underlying subgrade soils, which are approximately 1.5 million CY in volume, will be removed from a 101-acre area inside the BAP (the closure-by-removal area) and placed into the closure-in-place area.
    - The CCR will be closed by removal from the western portions of the BAP.

- The BAP dam will be removed from the closure-by-removal area and will no longer be retaining CCR during post-closure conditions. This will include removing approximately 35,000 CY of dam soils, all CCR, and, where the CCR is present, to an estimated depth of one foot of underlying subgrade soils.

The removal of CCR will be verified via visual observations performed during construction, and excavation depths will be adjusted, as needed to remove all CCR. The removed CCR and native subgrade soils will be placed within the CIP area, over existing impounded CCR that will remain in-place, as compacted fill to achieve final cover system subgrades. Dike soils that are observed as not containing CCR may be utilized as cover soil for the final cover system. Dike soils that contain CCR will be utilized as subgrade fill beneath the final cover system.

2.1.1.2. Final Cover System

A final cover system will be constructed within the CIP area, as described below.

- An approximately 76-acre final cover system will be installed completely over the extents of consolidated CCR in plan. The final cover system will consist of a geomembrane, geotextile cushion, protective cover soil, and vegetated topsoil. The final cover system will be keyed into the perimeter dikes, native foundation soils, or the existing FAPS cover with an anchor trench.

- During consolidation and capping, the BPP will be generating power and CCR materials to be placed into the BAP. An interim slope of 3 horizontal to 1 vertical (3H:1V) with temporary cover will be constructed to act as a protective interface during construction because the BPP will be operating. The temporary slope will be located between the CIP area and the area reserved for process flow and excavation of CCR for beneficial reuse or placement. Once the BPP is no longer generating power, the consolidation and cover system will be completed.

2.1.2. Closure Performance Features

Closing the BAP with a consolidate-and-cap approach with a final cover will result in CCR within the consolidated BAP footprint being:

- Encapsulated on the top and sides by the final cover system.

- Encapsulated on the bottom, by existing native clay foundation soil. The foundation soil is between 8 feet and 35 feet thick beneath the CIP area, with an average of 21 feet thick. The foundation soil has overall (geometric mean) horizontal and vertical hydraulic conductivities that range from 2.9 x 10^{-5} cm/s and 3.5 x 10^{-7} cm/s, respectively.

2.1.3. Closure Construction Narrative Sequencing

Physical construction of the consolidate-and-cap closure of the BAP with a final cover system is expected to include the following tasks:

- The construction limits of disturbance will be established, and perimeter stormwater Best Management Practices (BMPs) will be installed where needed.
- Temporary stormwater best management practices (BMPs), such as erosion control, blankets, straw wattles, and/or check dams, will be used where needed, to reduce erosion during vegetation establishment.
    - After vegetation is established, BMPs will be removed, and closure construction will be considered completed.
- A temporary water management system will be constructed within the BAP, including ditches, sumps, pumps, discharge piping, and/or temporary stormwater detention basin(s), to manage surface water and liquid wastes. Free liquids will be removed from the BAP via unwatering and dewatering and managed in accordance with the National Pollutant Discharge Elimination System (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 as discussed in **Section 4.6**. Free liquids will be routed into the stormwater management system.
    - The stormwater management system will remove liquid waste in the BAP and maintain the BAP in an unwatered state by collecting process water and contact stormwater during closure construction and prior to the installation of the cover system. Liquid waste flows will be pumped to the Cooling Pond for ultimate discharge to the Kaskaskia River at NPDES Outfall 002.
- Existing sluice pipes entering the BAP, and appurtenant structures such as pipe racks, will be demolished and disposed of at least two feet beneath the final cover system of the BAP.
- The existing outflow structures and culverts connecting the BAP to the Secondary Pond and Cooling Pond will be abandoned, to reduce the risk of CCR from migrating through these conduits during post-closure conditions. Abandonment will consist of the following tasks:
    - Drop inlet spillway and 30-inch dia. culvert through the dam.
    - Pumping station and two 18-inch dia. culverts leading to the Cooling Pond.

- All CCR and an estimated depth of one foot of underlying native soils will be removed from the CBR portion of the BAP using mechanical excavation techniques. Excavations will be visually observed for CCR removal to verify that the CCR has been removed, and excavation depths may vary during this process. The material will be placed in the CIP portion of the BAP as compacted fill to provide a subgrade suitable for the construction of a final cover system. Dewatering will be performed as needed to support construction activity and excavation, using the temporary water management system.

- An alternative cover system will be installed over the CCR that remains in the BAP. The cover will minimize vertical infiltration of precipitation into the basin [Part 845.750(a)(1)].

    - The alternate final cover system will be constructed over the entire footprint of the BAP that contains consolidated CCR, and will include, from bottom to top:

        - A 40-mil linear low-density polyethylene (LLDPE) geomembrane, placed on a prepared subgrade with rocks no larger than one inch in diameter; other sharp objects will be removed prior to geomembrane placement.

        - A nonwoven geotextile, to protect the geomembrane from rocks and/or sharp objects in the overlying cover soil.

        - Based on a demonstration included in **Attachment C**, pursuant to Section 845.750(C)(2), the final cover system will include an alternative 1.5-foot thick protective layer (e.g., cover soil) to protect the geomembrane and 0.5 feet of topsoil capable of supporting vegetation, for a total cover soil thickness of 2 feet.

            - The cover soil will be obtained from onsite borrow sources, including portions of the perimeter dikes that are comprised of non-CCR impacted soil fill, and are within the closure-by-removal area.

    - The final cover system will be sloped to direct surface water away from the impoundment. The final cover system grades will be approximately 2% over the majority of the BAP; 25% (4H:1V) grades will be used to tie the final cover system into existing grades. The 4H: 1V slopes will be applied for heights of up to approximately 60 ft. The final cover system will be keyed into the perimeter dikes, native foundation soils, or the existing adjacent FAPS cover, and access roads will be constructed on top of the final cover system. Beyond the final cover system, channels will direct surface water away from the BAP to the dam [Part 845.750(a)(2)].

  - The final cover system will include an anchor trench for the geosynthetic materials along the entire perimeter of the BAP to secure the final cover system into constructed or existing grades.
  - Existing groundwater monitoring wells and standpipe piezometers present within the consolidated footprint will be retained and modified by extending the wells through the final cover system, sealing the penetration with a pipe boot, and constructing a new surface protective casing on top of the final cover. Alternatively, groundwater monitoring wells may be decommissioned and replaced.
  - Some of the existing geotechnical vibrating-wire piezometers (VWPs) that are within the consolidate-and-cap footprint will be retained by extending the readout cable and constructing a new protective readout box on top of the final cover. Some or all VWPs outside of the consolidated footprint will be abandoned by cutting the readout cable off at the ground surface. Because the VWP readout cables are installed and sealed, by grouting, within the VWP casing, the cut off cable will not require grouting.
- A post-closure non-contact stormwater management system will be constructed. The system will consist of:
  - Final Cover System
    - Stormwater diversion berms and letdown channels will be constructed to convey stormwater off the BAP final cover system.
  - Perimeter Ditch
    - A stormwater ditch around the perimeter of the final closure system will convey stormwater to the CBR areas of the BAP that drain towards the dam.
    - Riprap energy dissipation will be placed at the outlet for each letdown to reduce erosion.
- Vegetation will be established across the BAP and other disturbed areas, by:
  - Soils to be seeded will be fertilized, as needed to support vegetation establishment, based on agronomical soil tests.

  - The final cover system in the CIP area and the exterior surface of the new soil containment berm will be seeded with a suitable grass species suitable for the local climate and soil conditions.
  - The CBR area will be seeded with appropriate vegetation, including upland species (e.g., grasses) in most areas. However, appropriate species and/or trees capable of growing in wet areas may be utilized along the estimated flow paths.
  - Temporary stormwater BMPs such as erosion control blankets, straw wattles, detention basins, and/or check dams, will be used, as needed to reduce erosion during vegetation establishment.
- After vegetation is established on the final cover and in closure-by-removal areas, temporary BMPs will be removed, and closure construction will be considered complete.

Engineering drawings and material specifications for the closure are provided in **Attachment B**.

2.2. Decontamination of CCR Surface Impoundment

Section 845.720(a)(1)(B): *If closure of the CCR surface impoundment will be accomplished through removal of CCR from the CCR surface impoundment, a description of the procedures to remove the CCR and decontaminate the CCR surface impoundment in accordance with Section 845.740.*

The portions of the BAP that will be closed-by-removal will be decontaminated as part of closure. Decontamination will occur after all CCR has been removed and will include excavating up to one foot of native underlying subgrade materials (i.e., soils) beneath the CCR, similar to decontamination procedures completed and proposed for other CCR surface impoundments that have been closed-by-removal within Illinois. These excavated subgrade materials will be disposed of beneath the final cover system of the BAP. The inspection of the area to demonstrate complete decontamination will include a visual inspection of the excavated subgrade to verify that all CCR has been removed, and excavation depths will be varied, as needed, until the removal of all CCR has been verified and documented.

The equipment and materials utilized during construction will be decontaminated prior to demobilizing from the site.

2.3. Final Cover System

Section 845.720(a)(1)(C): *If closure of the CCR surface impoundment will be accomplished by leaving CCR in place, a description of the final cover system, designed in accordance with Section*

845.750, and the methods and procedures to be used to install the final cover. The closure plan must also discuss how the final cover system will achieve the performance standards specified in Section 845.750.

A description of the final cover system design, methods and procedures used for installation, and how the final cover system will achieve the Section 845.750 performance standards is provided in **Section 4** of this Closure Plan.

2.4. Maximum CCR Inventory

Section 845.720(a)(1)(D): *An estimate of the maximum inventory of CCR ever on-site over the active life of the CCR surface impoundment.*

The maximum inventory of CCR ever on-site within the BAP is approximately 3.5 million cubic yards.

2.5. Largest Surface Area Estimate

Section 845.720(a)(1)(E): *An estimate of the largest area of the CCR surface impoundment ever requiring a final cover (see Section 845.750), at any time during the CCR surface impoundment's active life.*

The largest surface area of the BAP, in plan, is approximately 177 acres [1]. The surface area in plan will be reduced to approximately 76 acres and the final cover system will extend completely across this consolidated area and beyond the limits of CCR in plan. This will provide a continuous encapsulation system consisting of the final cover on the top of the BAP, the clay perimeter dikes on the sides of the BAP, and the clay foundation soils beneath the BAP. Areas of the BAP that are CBR will not be capped with a final cover system, all CCR will have been removed from these areas after CBR is completed.

2.6. Closure Completion Schedule

Section 845.720(a)(1)(F): *A schedule for completing all activities necessary to satisfy the closure criteria in this Section, including an estimate of the year in which all closure activities for the CCR surface impoundment will be completed. The schedule should provide sufficient information to describe the sequential steps that will be taken to close the CCR surface impoundment, including identification of major milestones such as coordinating with and obtaining necessary approvals and permits from other agencies, the dewatering and stabilization phases of CCR surface impoundment closure, or installation of the final cover system, and the estimated timeframes to complete each step or phase of CCR surface impoundment closure.*

A milestone closure completion schedule has been prepared and is provided in **Table 1**. The table summarizes key sequential phases and sub-tasks. Additional details are provided below:

- Agency Coordinating, Approvals, and Permitting
  - Approval of the closure Construction Permit Application by IEPA.
  - A modification to the existing NPDES permit to allow the disposal of water generated from free liquid removal, unwatering, and dewatering operations to the Kaskaskia River *via* the existing NPDES-permitted Outfall 002 for the Site was obtained.
  - Obtaining a construction permit from the IDNR, Office of Water Resources (OWR), Dam Safety Program (DSP) to allow the dam and spillways of the BAP to be modified as part of closure.
  - A general stormwater permit for construction site activities through IEPA, including construction stormwater controls and other BMPs such as silt fences and other measures.
  - A joint water pollution control construction and operating permit (WPC Permit), as necessary.
- Final Design and Bidding
  - Completion of final design investigations, calculations, design drawings, and specifications.
  - Request for Bids and selection of a closure construction contractor.
- Unwater, Dewater, and Stabilize CCR, CCR Removal, Install Final Cover System
  - Closure contractor mobilization and material procurement.
  - Installing stormwater BMPs around the construction area, per the existing NPDES permit.
  - Clearing brush and trees in the work area.
  - Unwatering the BAP by pumping free surface water to the nearby Cooling Pond, which is a non-CCR surface impoundment at BPP that discharges to the Kaskaskia River via NPDES Outfall No. 002.

  - Abandoning existing structures and culverts in place or by removal. Existing structures, culverts, piping, and equipment in contact with CCR will be decontaminated by power washing.
  - Stabilizing the subgrade through removal of free liquids.
  - Removing all CCR from the closure-by-removal portions of the BAP.
  - Grading CCR to design final cover subgrades.
  - Installing the final cover system geosynthetics and anchor trench.
  - Potentially removing perimeter dikes for use as cover soil.
  - Removing the dam to allow stormwater to flow downstream.
  - Placing final protective layer including topsoil over the geosynthetics.
  - Constructing the post-closure stormwater management system, including diversion berms and channels on the final cover system, and new perimeter stormwater channels.
- Site Restoration
  - Seeding and stabilizing the surface of the final cover system and other disturbed areas and allowing the vegetation to become established.
  - Restoring the CBR areas by establishing vegetation.
  - Removing temporary stormwater BMPs and other temporary stabilization measures, after vegetation is established.
  - Closure contractor demobilization from the site.

The project is expected to be completed by November of 2028. Additional project schedule may be required if delays in permitting or significant weather delays occur.

Table 1 – Closure Completion Milestone Schedule

Milestone	Timeframe (Preliminary Estimates)
Final Closure Plan Submittal	July 2023
Baldwin Power Plant Cessation of Coal Burning	December 31, 2025
Agency Coordination, Approvals, and Permitting • Obtain State permits, as needed, for dewatering and free liquid removal, water discharge, modifications, land disturbance, and dam modifications.	6 to 12 months after Final Closure Plan Approval
Final Design and Bid Process • Complete final design of the closure and select a construction contractor.	12 to 16 months after Agency Coordination, Approvals, and Permitting
Dewater and Stabilize CCR, Relocate CCR and Consolidate, Install Final Cover System • Complete contractor mobilization, installation of stormwater BMPs, and unwatering of the BAP • Abandon outfall structures, stabilize the BAP, and remove free liquids (dewater and stabilize) • Remove all CCR from the closure-by-removal area and areas outside of the BAP embankments. • Construct the new soil containment berm. • Install the final cover system and stormwater downchutes.	27 to 36 months after Final Design and Bid Process
Site Restoration • Seed and stabilize the BAP and closure-by-removal areas. • Complete contractor demobilization.	2 to 8 months after the final cover system is complete
Timeframe to Complete Closure	April 2025 – October 2028 (3 to 6 years)

<u>Section 845.720(a)(1)(F) (Continued):</u> *When preparing the preliminary written closure plan, if the owner or operator of a CCR surface impoundment estimates that the time required to complete closure will exceed the timeframes specified in Section 845.760(a), the preliminary written closure plan must include the site-specific information, factors and considerations that would support any time extension sought under Section 845.760(b).*

Dynegy submitted a site-specific alternative deadline to initiate closure due to the permanent cessation of coal-fired boiler by a certain date to the USEPA in accordance with 40 CFR §257.102(f)(ii) of the CCR Rule [2]. Pursuant to the schedule in that application, construction of closure would begin by April 17, 2025 and cease receipt and placement of CCR and non-CCR wastestreams by no later than December 31, 2025 [3]. Closure will be completed by October 17, 2028 within the 5-year timeframe.

<u>Section 845.760(a):</u> *Except as provided for in subsection (b), the owner or operator must complete closure of existing and new CCR surface impoundments, and any lateral expansion of a CCR surface impoundment, within the timeframe approved by the Agency in the final closure plan, or within five years of obtaining a construction permit for closure, whichever is less.*

The time required to complete closure construction is not expected to exceed the timeframe specified in Section 845.760(a). Therefore, closure extensions for the BAP are not being sought at this time of the IEPA.

3. AMENDMENTS OF FINAL CLOSURE PLAN

<u>Section 845.720(b)(4):</u> *If a final written closure plan revision is necessary after closure activities have started for a CCR surface impoundment, the owner or operator must submit a request to modify the construction permit within 60 days following the triggering event.*

If revisions are required for this Final Closure Plan, the owner will submit a request to modify the construction permit within 60 days following the triggering event.

Table 2. CCR Final Closure Plan Revisions

Revision Number and Date	Pages or Section	Description of Revision	Professional Engineer Certifying Plan

4. CLOSURE WITH FINAL COVER SYSTEM

This section includes a description of the final closure with a final cover that will be completed for the BAP surface impoundment, including principal design and construction features, material specifications, and a discussion of how each feature is in accordance with the requirements of Sections 845.720 and 845.750. Drawings showing each design feature and material specifications are provided in **Attachment B**.

The proposed CIP design will control, minimize, or eliminate as much as feasible "post-closure infiltration of liquids" and releases of CCR, leachate, or contaminated runoff as interpreted by IEPA in the Part 845 rulemaking. Specifically, the Groundwater Modeling Report [4] shows that the CIP design will result in a reduction of total hydraulic flux into and out of the BAP by greater than 90% within 30 days of closure and approximately 96% when simulated post-construction heads in the groundwater monitoring wells are predicted to be stabilized. Due to the reduction in the hydraulic flux out of the BAP, the mass flux out of the BAP will also be controlled or minimized as much as feasible as a result of CIP.

4.1. Minimization of Post-Closure Infiltration and Releases

Section 845.750(a): *The owner or operator of a CCR surface impoundment must ensure that, at a minimum, the CCR surface impoundment is closed in a manner that will:*

Section 845.750(a)(1): *Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere;*

This performance standard will be met through:

- A 40-mil LLDPE geomembrane low-permeability layer will be placed on the prepared subgrade to control and minimize vertical infiltration, to the maximum extend feasible, into the surface impoundment. The geomembrane will be constructed on a subgrade that is free of sharp rocks or other debris and will be protected from damage by installing a nonwoven geotextile cushion and a total of two feet of cover soil and topsoil over the top of the geomembrane.

- Surface stormwater will be routed off the top of the final cover by the construction of a free-draining post-closure stormwater management system including diversion berms, letdown channels, outlet energy dissipators, and a perimeter ditch. The stormwater management system will drain by gravity and preclude water impoundment on top of the final cover system, thereby minimizing post-closure infiltration into the CCR.

- The CCR will be encapsulated on all sides by the cover system tied into native foundation clays, the capped adjacent FAPS, or the existing perimeter berm to the north. The permeability of foundation soils beneath the CCR is 2.9 x 10^{-5} cm/s (horizontal) and 3.5 x 10^{-7} cm/s (vertical). Free liquids will be removed from the CCR as part of closure, and the potential for future accumulation of free liquids within the CCR will be reduced by the installation of a final cover system. These features will control the lateral migration of water into the unit from stormwater and minimize any releases of CCR leachate into ground and surface waters.
    - The final cover system will be tied into native foundation clays, the capped FAPS, or the existing perimeter berm to the north, by constructing a final cover anchor trench. The final cover will therefore provide continuous encapsulation between the CCR and the surrounding environment on the top, bottom, and sides of the CCR.
    - This continuous encapsulation will result in the CCR being physically isolated from the surrounding environment on all sides, including the groundwater, surface water, and atmosphere and therefore minimize the releases of CCR, leachate, or contaminated run-off into the ground, surface waters, and atmosphere.
- Free liquid removal will significantly reduce the amount of leachate within the CCR prior to closure, and the final cover system will minimize infiltration and therefore the amount of leachate that accumulates within the CCR during post-closure.
- All existing culverts that penetrate the BAP dam and dikes will be decontaminated and removed or sealed. Sealing will include cleaning of concrete and HDPE pipe culverts and filling with cement-bentonite grout, thereby removing potential flow paths that could otherwise allow leachate to be released after closure is completed.
- CCR within the consolidated-and-capped footprint of the BAP will not be in contact with the uppermost aquifer during post-closure conditions.
    - All CCR that is currently (e.g., under pre-closure conditions) expected to be in contact with or within close proximity to the uppermost aquifer will be removed and placed under the final cover system within the consolidated-and-capped BAP footprint.

Vertical infiltration will be minimized, and this analysis is ongoing based on the completion of additional sampling events.

4.2. Preclusion of Future Impoundment

<u>Section 845.750(a)(2):</u> *Preclude the probability of future impoundment of water, sediment, or slurry;*

All areas of the final cover system will be sloped to positively drain to the exterior of the BAP and preclude future impoundment of water, sediment, or slurry. This will include installing cross-slopes at approximately 2% grades, although slopes at up to 25% grades at the tie-in between the final cover system and existing grades. Stormwater will be directed into letdown channels via diversion berms; the letdown channels will allow stormwater to flow by gravity off the BAP footprint and into the surrounding area through culverts that will be installed in the perimeter dikes. Hydrologic and hydraulic calculations used to design the stormwater channels and other control features to preclude impoundment are provided in **Attachment D**.

4.3. Provisions for Preventing Instability, Sloughing and Movement

<u>Section 845.750(a)(3):</u> *Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period;*

The perimeter slopes of the final closure with be 25% and constructed of Bottom Ash with a final cover system. The stability of the final closure system has been evaluated by performing global slope stability analyses considering post-closure conditions. The resulting factors of safety exceed regulatory minimum values for static and seismic loading conditions for CCR surface impoundments [2]. Slope stability analyses are provided in **Attachment E**.

Sloughing and movement of the final cover system will be minimized by constructing the final cover system at relatively flat slopes, including 2% over most of the final cover and 25% slopes of up to 60 ft in height at the edges of the final cover, as necessary to tie into existing grades and limit the height of the consolidated BAP. The potential for sloughing and movement of the final cover system, including the 25% slopes, has been evaluated by performing veneer stability analyses for the various interfaces within the final cover system. The resulting factors of safety exceed typical minimum values for static and seismic loading conditions. Veneer stability analyses are provided in **Attachment E**.

4.4. Minimize the Need for Further Maintenance

<u>Section 845.750(a)(4):</u> *Minimize the need for further maintenance of the CCR surface impoundment; and*

Future maintenance needs will be minimized using the following design features:

- The final cover system will be installed at relatively flat 2% slopes over most of the final closure with 25% slopes in limited areas at the extents of the final cover, as needed to tie into existing grades and limit the height of the consolidated BAP.
    - Letdowns and diversion berms will minimize erosion of the final cover soils and thereby minimize maintenance needs.
    - The relatively flat slopes will also facilitate routine mowing of vegetation of the final cover system by allowing tractor-based mowing equipment to operate on the slopes with a reduced risk of equipment flip-over.
- The final cover, outside of stormwater letdown channels and diversion berms, will be stabilized by placing topsoil, fertilizing the topsoil, establishing vegetation using suitable grass species.
    - The vegetation will have a design seed mix suitable for the local climate and need for robustness and longevity, and therefore will minimize erosion of the final cover system by stabilizing the topsoil.
    - Selection of a suitable grass species and the use of fertilizer to establish vegetation will minimize maintenance required to repair areas of poor vegetation establishment.
- Stormwater diversion berms will be stabilized with erosion control blankets and straw wattles. The channels will transition to riprap lined letdowns where they pass down the BAP slope to the perimeter ditch and flow into surrounding areas. Riprap or other types of energy dissipation will be placed at each letdown. The erosion control blankets, non-erodible culverts, and energy dissipation will minimize post-closure erosion and associated maintenance for the stormwater management system.
    - Calculations used to design the stormwater letdown channels and riprap armoring were based on the 100-year, 24-hour storm event. These calculations are provided in **Attachment D**.

4.5. Be Completed in Shortest Amount of Time

<u>Section 845.750(a)(5):</u> *Be completed in the shortest amount of time consistent with recognized and generally accepted engineering practices.*

Closure construction is expected to be completed within an amount of time that is consistent with recognized and generally accepted timeframes required to permit, design, bid, and construct a CCR impoundment final closure system of this size (i.e., approximately 1.5 million CY of CCR excavation and placement), with a consideration of other permits form multiple State and Federal agencies that are also required for the project. An estimated closure construction schedule is provided in **Section 2.6**. It should be noted that this schedule may change based on contractor, equipment, and material availability and actual weather conditions at the time at which closure occurs.

4.6. Drainage and Stabilization

Section 845.750(b): *Drainage and Stabilization of CCR Surface Impoundments. The owner or operator of a CCR surface impoundment or any lateral expansion of a CCR surface impoundment must meet the requirements of this subsection (b) before installing the final cover system required by subsection (c).*

1) Free liquids must be eliminated by removing liquid wastes or solidifying the remaining wastes and waste residues.

2) Remaining wastes must be stabilized sufficiently to support the final cover system.

Prior to installing the final cover system, free liquids will be eliminated by removing the liquid waste from the BAP. Free liquids are defined as "liquids which readily separate from the solid portion of a waste under ambient temperature and pressure" by the United States Environmental Protection Agency (USEPA). Methods for free liquid removal may include, but are not limited to, the methods described below.

- Stopping of Process Flow
    - The BPP will cease producing power on December 31, 2025, and this will cease the process flow.
- Drilled Sumps
    - Drilled sumps typically consist of four to six-foot diameter borings drilled in CCR to depths of at least 10 ft. A perforated pipe is inserted into the boring and the annulus between the CCR and the pipe is backfilled with gravel. Free liquids are then allowed to flow into the pipe and are then removed via pumping.
    - The achieved drawdown will provide data for identifying the required spacing of the sumps.

- Engineered Trenches
  - Excavated and sloped trenches may be used for CCR depths of less than 10 ft.
  - The trenches are sloped for a low point where free liquids are removed via pumping.
- Horizontal Wells
  - Horizontal wells may be directionally-drilled or installed using cut-and-cover techniques in CCR zones of low permeability that do not respond to free liquid removal using trenches drilled sumps or engineered trenches.
  - Liquid waste is removed from the horizontal wells using a submersible pump.

Liquid waste obtained during free liquid removal will be discharged to the site's NPDES-permitted outfall. The removal of free liquids will result in the stabilization of the remaining CCR and will therefore allow the final cover to be placed on a stable subgrade.

4.7. Final Cover System

<u>Section 845.750(c):</u> Final Cover System. If a CCR surface impoundment is closed by leaving CCR in place, the owner or operator must install a final cover system that is designed to minimize infiltration and erosion, and, at a minimum, meets the requirements of this subsection (c) unless the owner or operator demonstrates that another low permeability construction technique or material provides equivalent or superior performance to the requirements of either subsection (c)(1)(A) or (c)(1)(B) and is approved by the Agency. The final cover system must consist of a low permeability layer and a final protective layer. The design of the final cover system must be included in the preliminary and final written closure plans required by Section 845.720 and the construction permit application for closure submitted to the Agency.

An alternate final cover system has been designed consistent with the requirements of Section 845.720(c). The final cover will use a geomembrane as a low-permeability layer. The design of the final cover system is discussed within this section.

4.7.1. Low Permeability Layer - Geomembrane

<u>Section 845.750(c)(1)(B):</u> A geomembrane constructed in accordance with the following standards: i) The geosynthetic membrane must have a minimum thickness of 40 mil (0.04 inches) and, in terms of hydraulic flux, must be equivalent or superior to a three-foot layer of soil with a hydraulic conductivity of 1 x 10^{-7} cm/sec; ii) The geomembrane must have strength to withstand the normal stresses imposed by the waste stabilization process; and (iii) The geomembrane must

be placed over a prepared base free from sharp objects and other materials that may cause damage.

The geomembrane will consist of a 40-mil linear low-density polyethylene (LLDPE) layer. Ramboll completed a Hydrologic Evaluation of Landfill Performance (HELP) [5] model to compare flux through the geomembrane cover to an equivalent cover system with 3 feet of $1x10^{-7}$ cm/sec clay, in order to demonstrate that the geomembrane final cover is superior to a soil-only final cover prescribed in Part 847. The HELP modeling estimated a total infiltration of 0.00011 inches of water per year (in/yr) for the geomembrane final cover system, relative to 0.00083 in/year for the cover system using 3 feet of 1×10^{-7} cm/sec clay. Therefore, the proposed geomembrane final cover system is at least equivalent to the 3-foot, 1×10^{-7} cm/sec clay low-permeability layer, as infiltration is reduced by a factor of approximately 7.5.

The geomembrane will be installed on a prepared subgrade, after the underlying CCR has been stabilized. Therefore, additional normal stresses will not be imparted on the geomembrane due to the waste stabilization process.

The subgrade (e.g., base) for the geomembrane will be visually inspected and sharp objects such as rocks or debris that may damage the geomembrane will be removed, prior to deployment of the geomembrane.

4.7.2. Standards for the Final Protective Layer

An alternative final protective layer is proposed. The alternative final protective layer requirements are as follows:

<u>*Section 845.750(c)(2):*</u> *Standards for the Final Protective Layer. The final protective layer must meet the following requirements, unless the owner or operator demonstrates that another final protective layer construction technique or material provides equivalent or superior performance to the requirements of this subsection (c)(2) and is approved by the Agency.*

A) Cover the entire low permeability layer;

B) Be at least three feet thick, be sufficient to protect the low permeability layer from freezing, and minimize root penetration of the low permeability layer;

C) Consist of soil material capable of supporting vegetation;

D) Be placed as soon as possible after placement of the low permeability layer; and

E) Be covered with vegetation to minimize wind and water erosion.

A final protective layer will be placed over and extend slightly beyond the entire geomembrane low-permeability layer in plan. Based on the demonstration included in **Attachment C**, pursuant to Section 845.750(c)(2), the protective layer will include, from bottom to top, a geotextile cushion, a 1.5-ft thick cover soil layer, and a 0.5-ft thick topsoil layer, for a total thickness of 2 ft.

The nonwoven geotextile cushion and 1.5-ft thick cover soil layer will protect the geomembrane from root penetration. Geomembranes are not susceptible to freeze-thaw damage, as discussed in **Attachment C**. The geotextile and cover soil will be placed as soon as practical after the geomembrane has been deployed and both quality assurance and quality control testing has been performed on the geomembrane seams.

The 0.5-ft thick topsoil layer will be fertilized, as necessary to support appropriate grass species, to vegetate the final protective layer.

Section 845.750(c)(3): The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.

Settling and subsidence has been accounted for in the design of the final cover system as discussed in **Section 4.10**.

4.8. Certification of Final Cover System

<u>Section 845.750(c)(4):</u> *The owner or operator of the CCR surface impoundment must obtain and submit with its construction permit application for closure a written certification from a qualified professional engineer that the design of the final cover system meets the requirements of this Section.*

The undersigned qualified professional engineer registered in Illinois certifies that the design of the final cover system meets the requirements of Section 845.750.

Thomas W. Ward
Printed Name

Signature   Date: 07/31/23

062-069043	IL	November 31, 2023
Registration Number	State	Expiration Date

LICENSED PROFESSIONAL ENGINEER
THOMAS WILLIAM WARD
062-069043
STATE OF ILLINOIS

Affix Seal

4.9. Uses of CCR in Closure

<u>Section 845.750(d):</u> This subsection specifies the allowable uses of CCR in the closure of CCR surface impoundments closing under Section 845.700. Notwithstanding the prohibition on further placement in Section 845.700, CCR may be placed in these surface impoundments, but only for purposes of grading and contouring in the design and construction of the final cover system, if:

1) The CCR placed was generated at the facility and is located at the facility at the time closure was initiated;

2) CCR is placed entirely above the elevation of CCR in the surface impoundment, following dewatering and stabilization (see subsection (b));

3) The CCR is placed entirely within the perimeter berms of the CCR surface impoundment; and

Approximately 500,000 cubic yards of CCR is anticipated to be generated by the BPP from now until December 31, 2025, when closure construction begins. All of the CCR currently being generated by the BPP will be transported to the adjacent BAP to be beneficially used as compacted subgrade fill below the final cover system. This will support achieving design final cover system grades and maintaining final cover system slopes that promote positive stormwater drainage and preclude the impoundment of stormwater.

4.10. Final Cover System Slopes

<u>Section 845.750(d)(4):</u> The final cover system is constructed with either:

A) A slope not steeper than 5% grade after allowance for settlement; or

B) At a steeper grade, if the Agency determines that the steeper slope is necessary, based on conditions at the site, to facilitate run-off and minimize erosion, and that side slopes are evaluated for erosion potential based on a stability analysis to evaluate possible erosion potential. The stability analysis, at a minimum, must evaluate the site geology; characterize soil shear strength; construct a slope stability model; establish groundwater and seepage conditions, if any; select loading conditions; locate critical failure surface; and iterate until minimum factor of safety is achieved.

Final cover slopes will typically consist of 2% cross-slopes on the top of the BAP. However, slopes of up to 25% final cover slopes will be used near the perimeter of the final cover, as needed to tie the final cover into the existing grades, as shown in the drawing package provided in **Attachment B**.

The stability of the 25% final cover slopes has been evaluated both for the final cover system itself (e.g., veneer stability) and the global stability of the slope. These calculations included characterizing soil shear strength based on site geology, constructing slope stability models, establishing groundwater seepage conditions, selecting loading conditions, locating the critical failure surface, and iterating until minimum factors of safety were calculated. These calculations are provided in **Attachment E**. Resulting factors of safety exceed typical minimum factors of safety for both global and veneer stability.

Settlement analyses to evaluate the effects of compression of the underlying native foundation clay soil units on the final cover system have indicated that settlements up to 14 inches are expected. These settlements are not expected to adversely impact final cover system drainage as 80 percent of the settlement will occur during construction with the final 3 inches occurring after construction. Therefore, grades can be adjusted for settlement up to the time the final cover is constructed.

Subsidence is not expected to be a concern for the BAP as previous Unstable Area location restrictions reports, prepared in accordance with §257.64(a) of the USEPA CCR Rule [2] , concluded that *"...karst topography or physiographic features such as sinkholes, vertical shafts, sinking streams, caves, large springs, or blind valleys do not exist at the Plant."*

5. ADDITIONAL INFORMATION

Both the lateral migration of groundwater and vertical infiltration of liquids, and releases of CCR, and leachate, and contaminated run-off into and out of the BAP will be controlled, minimized or eliminated, to the maximum extent feasible, under post-closure conditions. A description of how this will be performed is provided below.

- Free liquids will be removed from the BAP during closure, thereby reducing the amount of leachate and potential for contaminated runoff. Additionally, a final cover system will be installed to reduce the potential for future accumulation of free liquids within the CCR, as discussed in **Section 4.1**.

- The consolidated-and-capped BAP footprint will overly a native alluvial clay thickness (the upper confining unit) of 8 to 35 feet that is approximately 21 feet thick on average beneath the CCR.

  - The alluvial clay has a hydraulic conductivity of 2.9×10^{-5} cm/sec to 3.5×10^{-7} cm/sec [6].

- Closure of the BAP will include constructing a final cover system that ties into native foundation clays, the capped FAPS, or the existing perimeter berm to the north, as discussed in **Section 4.1.**

- CCR within the BAP will not be in contact with the uppermost aquifer during post-closure conditions.

Geosyntec
consultants

6. CERTIFICATION FROM A QUALIFIED PROFESSIONAL ENGINEER

<u>Section 845.720(b)(5):</u> The owner or operator of the CCR surface impoundment must obtain and submit with its construction permit application for closure a written certification from a qualified professional engineer that the final written closure plan meets the requirements of this Part.

I, Thomas W. Ward, 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 and the requirements of Title 35, Subtitle G, Chapter I, Subchapter j, Section 845.720 of the Illinois Administrative Code.

Thomas W. Ward
Printed Name

07/31/23
Signature Date

062-06904 IL November 31, 2023
Registration Number State Expiration Date

Affix Seal

7. REFERENCES

[1] IngenAE, LLC, "CCR Facility Boundary Exhibit, Luminant Baldwin Power Plant," Earth City, MO, September 7, 2021.

[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] Ramboll Americas Engineering Solutions, Inc. , Addendum No. 1 Baldwin Bottom Ash Pond Closure Plan, 2020.

[4] Ramboll, "Groundwater Model Report Revision 1, Bottom Ash Pond, Baldwin Power Plant, Baldwin, Illinois," August 2023.

[5] United States Environmental Protection Agency, "Walkthrough to Install and Operate the Hydrologic Evaluation of Landfill Performance (HELP) Model, Version 3.07," 2017.

[6] Ramboll, "Hydrogeologic Site Characterization Report Revision 1, Bottom Ash Pond, Baldwin Power Plant, Baldwin, Illinois," August 2023.

ATTACHMENT A

Closure Alternatives Analysis (Section 845.720(b)(3))

July 2023

Closure Alternatives Analysis for the Bottom Ash Pond at the Baldwin Power Plant Baldwin, Illinois

July 18, 2023

GRADIENT

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Abbreviations

AACE	Association for the Advancement of Cost Engineering
BAP	Bottom Ash Pond
BMP	Best Management Practice
BPP	Baldwin Power Plant
BU	Bedrock Unit
CAA	Closure Alternatives Analysis
CBR-Offsite	Closure-by-Removal with Off-Site CCR Disposal
CCR	Coal Combustion Residual
CIP	Closure-in-Place
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CY	Cubic Yard
DMG	Dynegy Midwest Generation, LLC
EJ	Environmental Justice
FEMA	Federal Emergency Management Agency
GHG	Greenhouse Gas
GWPS	Groundwater Protection Standard
IAC	Illinois Administrative Code
ID No.	Identification Number
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
LLDPE	Linear Low-Density Polyethylene
N_2O	Nitrous Oxide
NID	National Inventory of Dams
NO_x	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
PM	Particulate Matter
SFWA	State Fish and Wildlife Area
TVA	Tennessee Valley Authority
UGU	Upper Groundwater Unit
US DOT	United States Department of Transportation
VOC	Volatile Organic Compound
WPC Permit	Water Pollution Control Construction and Operating Permit

Summary of Findings

Title 35, Part 845 of the Illinois Administrative Code (IAC; IEPA, 2021) requires the development of a Closure Alternatives Analysis (CAA) prior to undertaking closure activities at certain surface impoundments containing coal combustion residuals (CCRs) in the state of Illinois. Pursuant to requirements under IAC Section 845.710, this report presents a CAA for the Bottom Ash Pond (BAP) located on Dynegy Midwest Generation, LLC's (DMG) Baldwin Power Plant (BPP) property near the village of Baldwin, Illinois. The goal of a CAA is to holistically evaluate potential closure scenarios with respect to a wide range of factors, including the efficiency, reliability, and ease of implementation of the closure scenario; its potential positive and negative short- and long-term impacts on human health and the environment; and its ability to address concerns raised by residents (IAC Part 845; IEPA, 2021). Gradient evaluated two specific closure scenarios for the BAP: Closure-in-Place with consolidation (CIP) and Closure-by-Removal with off-Site CCR disposal (CBR-Offsite). The CIP scenario entails consolidating all CCR into the eastern section of the BAP, and then capping the consolidated CCR with a new cover system consisting of, from bottom to top, a geomembrane layer, a geotextile cushion if needed, and 24 inches of vegetated soil. The CBR-Offsite scenario entails excavating all of the CCR from the BAP and transporting it to an off-Site landfill for disposal. DMG will also continue to evaluate potential opportunities for beneficial use of CCR excavated from the BAP as an alternative to disposal.

IAC Section 845.710(c)(2) requires CAAs to "[i]dentify whether the facility has an onsite landfill with remaining capacity that can legally accept CCR, and, if not, whether constructing an onsite landfill is possible" (IEPA, 2021). There is no existing on-Site landfill at the BPP Site. Additionally, no areas on the property are suitable for the construction of a new on-Site landfill that is capable of receiving all 3.8 million cubic yards (CY) of material to be excavated from the BAP (Appendix B). Geosyntec Consultants evaluated 14 different areas of the Site and found that none of them was suitable for construction of a new on-Site landfill due to various conflicts, including planned utility-scale solar and battery energy storage facility development, potential impacts to the 100-year floodplain, current or former CCR surface impoundments, existing utility corridors and roadways, and planned future uses of the property (Appendix B). For these reasons, construction of a new on-Site landfill is not a viable alternative at this Site.

Table S.1 summarizes the expected impacts of the CIP and CBR-Offsite closure scenarios with regard to each of the factors specified under IAC Section 845.710 (IEPA, 2021). Based on this evaluation and the additional details provided in Section 2 of this report, CIP has been identified as the most appropriate closure scenario for the BAP. Key benefits of the CIP scenario relative to the CBR-Offsite scenario include reduced impacts to workers, community members, and the environment during construction (*e.g.*, fewer constructed-related accidents, lower energy demands, less air pollution and greenhouse gas [GHG] emissions, and less traffic-related impacts). Moreover, the CIP scenario will meet the required closure schedule (*i.e.*, closure completed by October 2028) defined in IAC Section 845.700(d)(2)(C)(ii) (IEPA, 2021), whereas the CBR-Offsite scenario would be unable to meet this required schedule.

Table S.1 Comparison of Proposed Closure Scenarios

Evaluation Factor (Report Section; IAC Part 845 Section)	Closure Scenario	
	CIP	CBR-Offsite
Closure Alternative Descriptions (Section 2.1, IAC Section 845.710(c))	All CCR would be consolidated in the eastern section of the BAP and then capped in place with a new cover system consisting of, from bottom to top, a geomembrane layer, a geotextile cushion if needed, and 24 inches of vegetated soil. During the closure process, we will continue to assess off-Site CCR beneficial use opportunities. Ash consolidation and CIP in combination with off-Site beneficial use may result in a smaller footprint for purposes of our ultimate cap design along with a reduced construction schedule.	All CCR would be excavated from the BAP and transported *via* truck to an off-Site landfill for disposal. Expansion of the off-Site landfill may be necessary in order to accept all of the CCR from the BAP.
Type and Degree of Long-Term Management, Including Monitoring, Operation, and Maintenance (Section 2.2.3, IAC Section 845.710(b)(1)(C))	Monitoring would be performed for 30 years post-closure or until GWPSs are achieved, whichever is longer. Additionally, the final cover system for the BAP would undergo 30 years of annual inspections, mowing, and maintenance.	Monitoring would be performed for 3 years post-closure or until GWPSs are achieved, whichever is longer.
Magnitude of Reduction of Existing Risks (Section 2.2.1, IAC Sections 845.710(b)(1)(A) and 845.710(b)(1)(F))	There are no current unacceptable risks to any human or ecological receptors associated with the BAP. Because there are no current risks, and dissolved constituent concentrations would be expected to decline post-closure, no risks to human or ecological receptors would be expected post-closure.	There are no current unacceptable risks to any human or ecological receptors associated with the BAP. Because there are no current risks, and dissolved constituent concentrations would be expected to decline post-closure, no risks to human or ecological receptors would be expected post-closure.
Likelihood of Future Releases of CCR (Section 2.2.2, IAC Sections 845.710(b)(1)(B) and 845.710(b)(1)(F))	During closure, there would be minimal risk of dike failure occurring at the BAP (due to, *e.g.*, flooding or seismic activity) and minimal risk of dike overtopping during flood conditions. Post-closure, the risks of overtopping and dike failure would be even smaller than they are currently, due to the installation of a protective soil cover and new stormwater control structures. Dikes, final cover, and stormwater control features have been designed to withstand earthquakes and storm events.	During closure, there would be minimal risk of dike failure occurring at the BAP (due to, *e.g.*, flooding or seismic activity) and minimal risk of dike overtopping during flood conditions. Following excavation, there would be no risk of CCR releases due to dike failure. Changing geochemical conditions during an extended excavation can be a mechanism that results in the mobilization and increased transport in groundwater for some constituents.
Worker Risks (Section 2.2.4.1, IAC Sections 845.710(b)(1)(D) and 845.710(b)(1)(F))	An estimated 0.0069 worker fatalities and 0.79 worker injuries would be expected to occur due to on-Site activities under this closure scenario. An additional 0.0093 worker fatalities and 0.58 worker injuries would be expected to occur off-Site due to vehicle accidents during material deliveries and labor and equipment mobilization and demobilization. In total, 0.016 worker fatalities and 1.4 worker injuries would be expected under this closure scenario. Overall, risks to workers would likely be highest under the CBR-Offsite scenario and lowest under the CIP scenario. Simultaneous with closure activities, the Site would be re-developed for use in utility-scale solar generation and battery energy storage. The simultaneous pursuit of two large construction projects may lead to traffic congestion on Site access roads, resulting in greater overall risks to workers than would result from either project alone. The CIP scenario would likely result in less traffic congestion – and, hence, a smaller increase in risks to workers – than the CBR-Offsite scenario.	An estimated 0.011 worker fatalities and 1.3 worker injuries would be expected to occur due to on-Site activities under this closure scenario. An additional 0.053 worker fatalities and 3.1 worker injuries would be expected to occur off-Site due to vehicle accidents during hauling, material deliveries, and labor and equipment mobilization and demobilization. In total, 0.064 worker fatalities and 4.4 worker injuries would be expected under this closure scenario. Overall, risks to workers would likely be highest under the CBR-Offsite scenario and lowest under the CIP scenario. Simultaneous with closure activities, the Site would be re-developed for use in utility-scale solar generation and battery energy storage. The simultaneous pursuit of two large construction projects may lead to traffic congestion on Site access roads, resulting in greater overall risks to workers than would result from either project alone. The CIP scenario would likely result in less traffic congestion – and, hence, a smaller increase in risks to workers – than the CBR-Offsite scenario.
Community Risks (Section 2.2.4.2, IAC Sections 845.710(b)(1)(D) and 845.710(b)(1)(F))		
▪ *Off-Site Impacts on Nearby Residents and EJ Communities*	Off-Site impacts on nearby residents (including accidents, traffic, noise, and air pollution) would be less under this closure scenario than under the CBR-Offsite scenario because it would require less off-Site vehicle and equipment travel miles than the CBR-Offsite scenario. In total, an estimated 0.0056 fatalities and 0.27 injuries would be expected to occur among community members due to off-Site activities under this scenario. With regard to traffic impacts, a haul truck would be likely to pass a location near the Site every 6.4 minutes on average during working hours for approximately 490 working days under this closure scenario. No negative EJ community impacts would be expected under either closure scenario.	Off-Site impacts on nearby residents would be greater under the CBR-Offsite closure scenario than under the CIP scenario because it would require significantly more off-Site vehicle and equipment travel miles. In total, an estimated 0.15 fatalities and 4.1 injuries would be expected to occur among community members due to off-Site activities under this scenario. With regard to traffic impacts, a haul truck would be likely to pass a location near the Site every 2.2 minutes on average during working hours for approximately 1,870 working days under this closure scenario. No negative EJ community impacts would be expected under either closure scenario.

Evaluation Factor (Report Section; IAC Part 845 Section)	Closure Scenario	
	CIP	CBR-Offsite
▪ *Impacts on Scenic, Historical, and Recreational Value*	Due to (*e.g.*) noise and visual disturbances, construction activities may have short-term negative impacts on the recreational use of the Baldwin Power Plant Cooling Lake, which lies within the Kaskaskia River State Fish and Wildlife Area. Residents living near the proposed on-Site borrow soil location and visitors to Baldwin Cemetery may also temporarily be impacted by construction at the proposed borrow soil location, since borrow is required under this scenario. Because the expected duration of construction activities is shorter under this closure scenario compared to the CBR-Offsite scenario, short-term impacts on the scenic, historical, and recreational value of natural areas near the Site would be less under this closure scenario than under the CBR-Offsite scenario.	Due to (*e.g.*) noise and visual disturbances, construction activities may have short-term negative impacts on the recreational use of the Baldwin Power Plant Cooling Lake, which lies within the Kaskaskia River State Fish and Wildlife Area. Because the expected duration of construction activities is longer under the CBR-Offsite scenario than under the CIP scenario, short-term impacts on the scenic, historical, and recreational value of natural areas near the Site would be greater under the CBR-Offsite scenario than under the CIP scenario.
Environmental Risks (Section 2.2.4.3, IAC Sections 845.710(b)(1)(D) and 845.710(b)(1)(F))		
▪ *Impacts on Greenhouse Gas Emissions and Energy Consumption*	Total energy demands and GHG emissions would be smaller under this closure scenario than under the CBR-Offsite scenario, because the total equipment and vehicle mileages required under this closure scenario would be smaller than those required under the CBR-Offsite scenario. The CIP scenario would have an additional, unquantified carbon footprint due to the need to manufacture geomembranes for use in the final cover system. At the grid scale, construction of a solar facility at the Site would put energy back on the grid and reduce reliance on non-renewable energy sources.	Total energy demands and GHG emissions would be greater under the CBR-Offsite closure scenario than under the CIP scenario, because the total equipment and vehicle mileages required under the CBR-Offsite scenario would be greater than those required under the CIP scenario. If expansion of the off-Site landfill became necessary in order to accept all of the CCR from the BAP, then the CBR-Offsite scenario would have an additional, unquantified carbon footprint due to the need to manufacture geomembranes for use in the expanded landfill liner. At the grid scale, construction of a solar facility at the Site would put energy back on the grid and reduce reliance on non-renewable energy sources.
▪ *Impacts on Natural Resources and Habitat*	Construction activities may have short-term negative impacts on species located near the BAP and the on-Site borrow soil location. Short-term impacts on natural resources and habitat would be smaller under the CIP scenario than under the CBR-Offsite scenario, because the overall duration of construction is shorter under the former scenario.	Construction activities may have short-term negative impacts on species located near the BAP and the off-Site landfill. Short-term impacts on natural resources and habitat would be greater under the CBR-Offsite scenario than under the CIP scenario, because the overall duration of construction is longer under the former scenario.
Time Until Groundwater Protection Standards Are Achieved (Section 2.2.5, IAC Sections 845.710(b)(1)(E) and 845.710(d)(2 and 3))	Groundwater modeling was performed to evaluate future groundwater quality in the vicinity of the BAP under each of the proposed closure scenarios. While the groundwater modeling demonstrated that groundwater concentrations will increase at several wells post-closure under both the CIP and CBR-Offsite scenarios, the modeling also suggested that the increasing concentrations are the result of the adjacent Fly Ash Pond System, not the BAP (Ramboll, 2023). Results of groundwater modeling indicate that concentrations of boron, a common indicator parameter used in coal ash fate and transport evaluations, at the proposed BAP compliance wells that are not influenced by the Fly Ash Pond System will remain below the GWPS following implementation of either the CIP or the CBR-Offsite scenarios (Ramboll, 2023).	Groundwater modeling was performed to evaluate future groundwater quality in the vicinity of the BAP under each of the proposed closure scenarios. While the groundwater modeling demonstrated that groundwater concentrations will increase at several wells post-closure under both the CIP and CBR-Offsite scenarios, the modeling also suggested that the increasing concentrations are the result of the adjacent Fly Ash Pond System, not the BAP (Ramboll, 2023). Results of groundwater modeling indicate that concentrations of boron, a common indicator parameter used in coal ash fate and transport evaluations, at the proposed BAP compliance wells that are not influenced by the Fly Ash Pond System will remain below the GWPS following implementation of either the CIP or the CBR-Offsite scenarios (Ramboll, 2023). Additionally, changing geochemical conditions during an extended excavation can be a mechanism that results in the mobilization and increased transport in groundwater for some constituents. This may result in GWPS exceedances.
Long-Term Reliability of the Engineering and Institutional Controls (Section 2.2.7; IAC Section 845.710(b)(1)(G))	CIP would be expected to be a reliable closure alternative over the long term.	CBR-Offsite would be expected to be a reliable closure alternative over the long term.
Potential Need for Future Corrective Action (Section 2.2.8; IAC Section 845.710(b)(1)(H))	Corrective action is expected at the Site. An evaluation of potential corrective measures and corrective actions has not yet been completed, but will be conducted consistent with the requirements in IAC Section 845.660 and IAC Section 845.670.	Corrective action is expected at the Site. An evaluation of potential corrective measures and corrective actions has not yet been completed, but will be conducted consistent with the requirements in IAC Section 845.660 and IAC Section 845.670.
Effectiveness of the Alternative in Controlling Future Releases (Section 2.3; IAC Section 845.710(b)(2)(A and B))	There are no current or future risks to any human or ecological receptors associated with the BAP. During closure, there would be minimal risk of dike failure occurring and minimal risk of dike overtopping during flood conditions. Post-closure, the risks of overtopping and dike failure would be even smaller than they are currently, due to the installation of a protective soil cover and new stormwater control structures. Dikes, final cover, and stormwater control features have been designed to withstand earthquakes and storm events.	There are no current or future risks to any human or ecological receptors associated with the BAP. During closure, there would be minimal risk of dike failure occurring and minimal risk of dike overtopping during flood conditions. Following excavation, there would be no risk of CCR releases due to dike failure.

Evaluation Factor (Report Section; IAC Part 845 Section)	Closure Scenario	
	CIP	**CBR-Offsite**
Ease or Difficulty of Implementing the Alternative (Section 2.4, IAC Section 845.710(b)(3))		
▪ *Degree of Difficulty Associated with Construction*	CIP is a reliable and standard method for managing and closing waste impoundments. Dewatering saturated CCR to construct a stabilized final cover system subgrade may present challenges during closure; however, these challenges are common to most CCR surface impoundment closures and are commonly addressed *via* surface water management and dewatering techniques.	Relative to CIP, CBR-Offsite poses additional implementation difficulties due to larger earthwork volumes, larger dewatering volumes, and longer construction schedules. Hauling to an off-Site landfill would be required under the CBR-Offsite scenario. Off-Site landfilling would additionally require the development of a disposal plan and could raise issues related to the co-disposal of CCR and other non-hazardous wastes. The off-Site landfill may also need to be expanded to receive all of the CCR generated during excavation.
▪ *Expected Operational Reliability*	Operational reliability would be expected under both closure scenarios.	Operational reliability would be expected under both closure scenarios.
▪ *Need for Permits and Approvals*	Permits required under both closure scenarios would include a construction permit from the IDNR Dam Safety Program to allow the embankment and spillways of the BAP to be modified as part of closure; a construction stormwater permit through IEPA; and a joint water pollution control construction and operating permit (WPC permit). A NPDES permit modification has already been obtained through IEPA.	Permits required under both closure scenarios would include a construction permit from the IDNR Dam Safety Program to allow the embankment and spillways of the BAP to be modified as part of closure; a construction stormwater permit through IEPA; and a WPC permit. A NPDES permit modification has already been obtained through IEPA. Additional permits and approvals may be required under this scenario if the off-Site landfill must be expanded to receive all of the CCR from the BAP.
▪ *Availability of Equipment and Specialists*	CIP and CBR-Offsite rely on common construction equipment and materials and typically do not require the use of specialists. However, global supply chains have been disrupted due to the COVID-19 pandemic, resulting in shortages in the availability of construction equipment and parts. There may be delays in construction under both scenarios if supply chain resilience does not improve by the time of construction. Due to smaller earthwork volumes and a lesser need for construction equipment under the CIP scenario than under the CBR-Offsite scenario, shortages may cause fewer challenges under the CIP scenario than under the CBR-Offsite scenario.	CIP and CBR-Offsite rely on common construction equipment and materials and typically do not require the use of specialists. However, global supply chains have been disrupted due to the COVID-19 pandemic, resulting in shortages in the availability of construction equipment and parts. There may be delays in construction under both scenarios if supply chain resilience does not improve by the time of construction. Due to the large volume of CCR to be hauled from the site under the CBR-Offsite scenario, shortages may cause greater challenges under the CBR-Offsite scenario than under the CIP scenario.
▪ *Available Capacity and Location of Treatment, Storage, and Disposal Services*	Under the CIP scenario, all of the CCR currently within the BAP would be stored within the existing footprint of the impoundment. Treatment would consist of unwatering the BAP at the start of construction, performing limited dewatering to stabilize the CCR subgrade, and managing stormwater inflow. Water from unwatering and dewatering of the BAP would be discharged in accordance with the NPDES permit for the facility.	The capacity remaining at the chosen off-Site landfill in Marissa, Illinois (the Cottonwood Hills RDF Landfill), would be sufficient to receive all of the CCR in the BAP. However, due to the relatively short period over which CCR would be received at the landfill, vertical and/or lateral expansions may become necessary. Additionally, the landfill operators may need to develop a disposal plan to account for the increased volume of material that would be received and the unique CCR waste characteristics. If expansion of the chosen off-Site landfill were found to be impractical or infeasible, then an alternative landfill located farther from the Site would need to be identified. A possible alternative to the Cottonwood Hills RDF Landfill is the North Milam Landfill in East Saint Louis, Illinois. Water from unwatering and dewatering of the BAP would be discharged in accordance with the NPDES permit for the facility.
Impact of Alternative on Waters of the State (Section 2.5, IAC Section 845.710(d)(4))	No current or future exceedances of any screening benchmarks for surface water would be expected under either closure scenario.	No current or future exceedances of any screening benchmarks for surface water would be expected under either closure scenario.
Potential Modes of Transportation Associated with CBR-Offsite (Section 2.1; IAC Section 845.710(c)(1)	This factor is not relevant for CIP.	IAC Section 845.710(c)(1) requires CBR-Offsite alternatives to consider multiple methods for transporting CCR off-Site, including rail, barge, and trucks. Geosyntec Consultants evaluated the feasibility of transporting CCR to the off-Site landfill *via* rail or barge and found that neither option is likely to be viable at this Site. Truck transport has been identified as the preferred option for transport of CCR to the off-Site landfill. The local availability and use of natural gas-powered trucks, or other low-polluting trucks, will be evaluated prior to the start of construction.
Concerns of Residents Associated with Alternatives (Section 2.6, IAC Section 845.710(b)(4))	CIP would effectively address residents' concerns regarding potential impacts to groundwater and surface water quality at the Site. Relative to CBR-Offsite, CIP also presents less risks to nearby residents in the form of accidents, traffic, noise, and air pollution. A public meeting was held on June 29, 2023, pursuant to the requirements under IAC Section 845.710(e). Questions raised by the attendees were addressed at the meeting; subsequently, a written summary of the questions and responses was prepared.	The CBR-Offsite scenario has several disadvantages with regard to potential community concerns. Relative to CIP, CBR-Offsite presents greater risks to nearby residents in the form of accidents, traffic, noise, and air pollution. A public meeting was held on June 29, 2023, pursuant to the requirements under IAC Section 845.710(e). Questions raised by the attendees were addressed at the meeting; subsequently, a written summary of the questions and responses was prepared.

Notes:
BAP = Bottom Ash Pond; CBR-Offsite = Closure-by-Removal with Off-Site CCR Disposal; CCR = Coal Combustion Residual; CIP = Closure-in-Place; EJ = Environmental Justice; GHG = Greenhouse Gas; GWPS = Groundwater Protection Standard; IAC = Illinois Administrative Code; IDNR = Illinois Department of Natural Resources; IEPA = Illinois Environmental Protection Agency; NPDES = National Pollutant Discharge Elimination System.

1 Introduction

1.1 Site Description and History

1.1.1 Site Location and History

Dynegy Midwest Generation, LLC's (DMG) Baldwin Power Plant (BPP) is an electric power generating facility with coal-fired units located approximately 1.5 miles north-northwest of the village of Baldwin, Illinois, along the Kaskaskia River. The facility began operating in 1970 (IEPA, 2021; Ramboll, 2021; Appendix B).

1.1.2 CCR Impoundment

The BPP produces and stores coal combustion residuals (CCRs) as a part of its operations. The Bottom Ash Pond (BAP; Vistra identification number [ID No.] CCR Unit 601, Illinois Environmental Protection Agency [IEPA] ID No. W1578510001-06, and National Inventory of Dams [NID] ID No. IL50721) is the subject of this report.

The BAP (Figure 1.1) is a 177-acre unlined surface impoundment used for the management of CCRs, primarily bottom ash, and other non-CCR process wastewaters generated by the BPP (Geosyntec Consultants, 2021; Ramboll, 2021). The construction date of the BAP is unknown (AECOM, 2016a). The footprint of the BAP primarily contains areas of stacked ash and vegetation, though ponding does occur in multiple areas (Geosyntec Consultants, 2021). A portion of the bottom ash stored in the BAP is mined for beneficial use (Ramboll, 2021).

The BAP is bounded by the BPP Cooling Lake to the north and the closed Fly Ash Pond system to the east and south. Under normal operating conditions, the BAP discharges decanted water to the non-CCR Secondary Pond shown in Figure 1.1 *via* a spillway/outfall structure on the western side of the impoundment. The Secondary Pond discharges to the non-CCR Tertiary Pond, which discharges in turn to the Kaskaskia River *via* a National Pollutant Discharge Elimination System (NPDES)-permitted outfall (Geosyntec Consultants, 2021; Ramboll, 2021). During heavy rainfall events, an emergency pumping station pumps decanted water from the BAP into the BPP Cooling Lake. The Cooling Lake discharges to the Kaskaskia River *via* a NPDES-permitted outfall (Geosyntec Consultants, 2021; Ramboll, 2021).

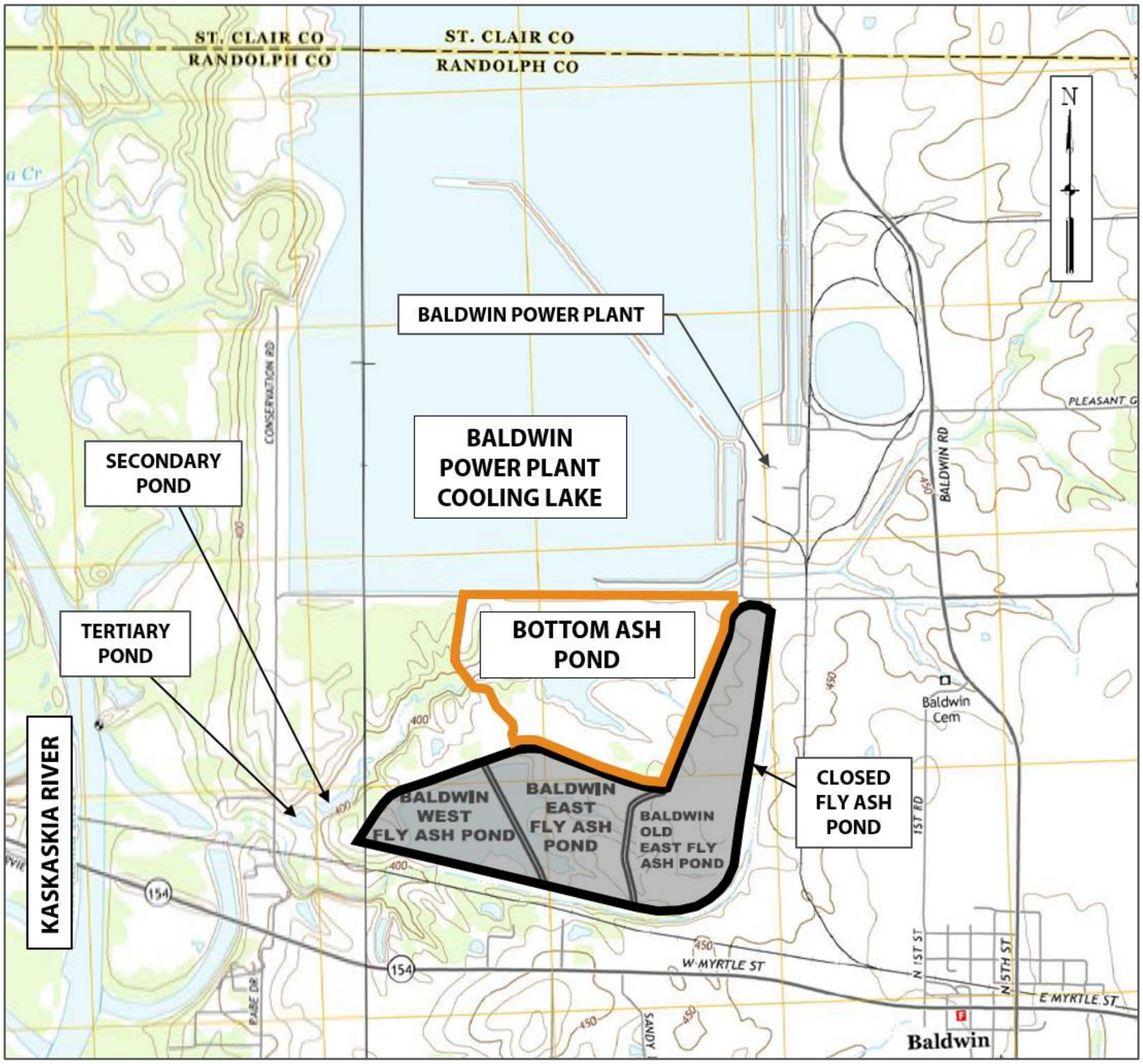

Figure 1.1 Site Location Map. Adapted from AECOM (2016a, Appendix A).

1.1.3 Surface Water Hydrology

There are 28 surface water features within 1,000 meters of the BAP (Ramboll, 2021). One freshwater emergent wetland and one freshwater forested/shrub wetland are also located within this radius (Ramboll, 2021). The most significant surface water features on or near the Site are the Kaskaskia River and the BPP Cooling Lake (Figure 1.1).

The Kaskaskia River is located approximately 1 mile west of the outer perimeter of the BAP within the Kaskaskia River Watershed (AECOM, 2016a). It is a tributary of the Mississippi River, which is located approximately 25 miles west of the Site (Ramboll, 2021). The segment of the Kaskaskia River adjacent to the Site (Section IL_O-97) is included on the 2022 Illinois Section 303(d) List as being impaired for aquatic life due to abnormal flow, degraded habitat, low oxygen, and sediment; fish consumption due to mercury and pesticides; and public and food processing water supply due to pesticides (IEPA, 2022a; US

EPA, 2022). The 2,018-acre BPP Cooling Lake, which borders the BAP to the north, was constructed between 1967 and 1970. The Cooling Lake is filled by pumping water from the Kaskaskia River. As a perched lake, it is partially hydrologically isolated from the natural surface water and groundwater features at the Site (Ramboll, 2021).

Two surface water samples were collected from the same location in the Kaskaskia River adjacent to the Site in November 2016 (Hanson Professional Services Inc., 2017). These data are summarized in Gradient's "Human Health and Ecological Risk Assessment" for the Site, which is provided as Appendix A of this report.

1.1.4 Hydrogeology

The geology underlying the Site in the vicinity of the BAP consists of unlithified materials (alluvium and glacial deposits) underlain by bedrock (Ramboll, 2021). From the surface downwards, the four principal types of unlithified materials present at the Site are the alluvial clay, sandy clay, and clayey sand of the Cahokia Formation (average thickness of 20 feet); the silt and silty clay of the Peoria Loess (average thickness of 10 feet); the clay and sandy clay of the Equality Formation, with occasional sand seams and lenses (average thickness of 13 feet); and the clay and sandy clay diamictons of the Vandalia Till, with intermittent and discontinuous sand lenses (average thickness of 21 feet; Ramboll, 2021). There are two distinct hydrostratigraphic units below the CCR at this Site: (1) the Upper Groundwater Unit (UGU), consisting of the lithologic layers identified as the Cahokia Formation, Peoria Loess, Equality Formation, and Vandalia Till; and (2) the Bedrock Unit (BU). The UGU is composed predominantly of clay with some silt and minor sand, silt layers, and occasional sand lenses. The BU is composed of interbedded shale and limestone bedrock, which is continuous across the entire Site (Ramboll, 2021). The BU has been identified as the uppermost aquifer (Ramboll, 2021). Thin sand lenses in the UGU adjacent to the BAP and the area of contact between the unlithified material and the bedrock have both been identified as potential migration pathways.

The general groundwater flow direction in the vicinity of the Site is west towards the Kaskaskia River, the principal surface drainage for the region (Ramboll, 2021). Based on groundwater hydraulic head measurements, lateral groundwater flow in the UGU and the BU is generally to the west and southwest toward the historic drainage feature at the Site and the bedrock valley underlying the Secondary and Tertiary Ponds. The receiving surface water bodies for groundwater in the UGU are assumed to be the Secondary and Tertiary Ponds (which ultimately drain to the Kaskaskia River). The receiving surface water body for groundwater in the BU (the uppermost aquifer) is the Kaskaskia River (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 Kaskaskia River does not necessarily signify contributions from the BAP.

The "Hydrogeologic Site Characterization Report" prepared by Ramboll as part of the operating permit for the BAP includes an evaluation of groundwater data collected from BAP monitoring wells between 2015 and 2021 (Ramboll, 2021).

1.1.5 Site Vicinity

The BPP Site is bounded by Baldwin Road to the east, Kaskaskia River to the west, and the Illinois Central Gulf railroad and State Route 154 to the south. The area around the Site is predominantly agricultural (Ramboll, 2021). The village of Baldwin, Illinois, lies approximately 1.5 miles south-southeast of the BPP.

The BAP borders the BPP Cooling Lake, which is part of the greater Kaskaskia River State Fish and Wildlife Area (SFWA). The Kaskaskia River SFWA, which spans over 20,000 acres, is popular for fishing and wildlife viewing (IDNR, 2022). A campground is located approximately 2,000 feet south of the southern perimeter of the BAP. The Wood Duck Marina is located approximately 3,500 feet west/southwest of the BAP. The Baldwin Cemetery is located approximately 3,000 feet east of the BAP (Google LLC, 2022). Gradient's "Human Health and Ecological Risk Assessment" for the Site (Appendix A of this report) describes the water wells and domestic water supply intakes in the vicinity of the Site.

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 BAP (Ramboll, 2021).

1.2 IAC Part 845 Regulatory Review and Requirements

Title 35, Part 845 of the Illinois Administrative Code (IAC; IEPA, 2021) requires the development of a Closure Alternatives Analysis (CAA) prior to undertaking closure activities at certain CCR-containing surface impoundments in the state of Illinois. Section 2 of this report presents a CAA for the BAP pursuant to requirements under IAC Section 845.710. The goal of a CAA is to holistically evaluate each potential closure scenario with respect to a wide range of factors, including the efficiency, reliability, and ease of implementation of the closure scenario; its potential positive and negative short- and long-term impacts on human health and the environment; and its ability to address concerns raised by residents (IEPA, 2021). A CAA is a decision-making tool that is designed to aid in the selection of an optimal closure alternative for the impoundments at a site.

2 Closure Alternatives Analysis

2.1 Closure Alternative Descriptions (IAC Section 845.710(c))

This section of the report presents a CAA for the BAP pursuant to requirements under IAC Section 845.710 (IEPA, 2021). The two closure scenarios evaluated in this CAA are Closure-in-Place with consolidation (CIP) and Closure-by-Removal with off-Site CCR disposal (CBR-Offsite). Under the CIP scenario, all CCR would be consolidated into the eastern section of the BAP, and the consolidated CCR would be capped with a new cover system. Under the CBR-Offsite scenario, all of the CCR would be excavated from the impoundment and hauled to an off-Site landfill. DMG will also continue to evaluate potential opportunities for beneficial use of CCR excavated from the BAP as an alternative to disposal.

IAC Section 845.710(c)(2) requires CAAs to, "[i]dentify whether the facility has an onsite landfill with remaining capacity that can legally accept CCR, and, if not, whether constructing an onsite landfill is possible" (IEPA, 2021). There is no existing on-Site landfill at the BPP Site. Additionally, no areas on the property are suitable for the construction of a new on-Site landfill that is capable of receiving all 3.8 million cubic yards (CY) of material to be excavated from the BAP (Appendix B). Geosyntec Consultants evaluated 14 different areas of the Site and found that none of them was suitable for construction of a new on-Site landfill due to various conflicts, including planned utility-scale solar and battery energy storage facility development, potential impacts to the 100-year floodplain, current or former CCR surface impoundments, existing utility corridors and roadways, and planned future uses of the property (Appendix B). For these reasons, construction of a new on-Site landfill is not a viable alternative at this Site.

Sections 2.1.1 and 2.1.2 provide detailed descriptions of the CIP and CBR-Offsite closure scenarios. These scenarios are based on closure documents and analyses provided to Gradient by Geosyntec Consultants, which are attached to this report as Appendix B.

2.1.1 Closure-in-Place

Under the CIP scenario, all of the CCR would be consolidated in the eastern portion of the BAP. The BAP would then be capped in place with a final cover system. This scenario includes the following work elements (Geosyntec Consultants, 2023):

- Unwatering and dewatering of the impoundment *via* pumping and passive dewatering methods. Water would be managed in accordance with the NPDES permit for the facility.
- Consolidation of CCR in the eastern portion of the impoundment, followed by contouring and grading to manage stormwater.
- Construction of an alternative cover system consisting of a 40-mil linear low-density polyethylene (LLDPE) geomembrane layer, a geotextile cushion if needed, and 24 inches of protective soil cover suitable for supporting vegetative growth. The performance of this alternative cover system relative to a default cover is presented in (Geosyntec Consultants, 2023).
- Long-term (post-closure) monitoring and maintenance, including at least 30 years of groundwater monitoring at the impoundment, or until such time as groundwater protection standards (GWPSs)

are achieved. Additionally, 30 years of post-closure care would be undertaken for the final cover system, including annual cap inspections, mowing, and maintenance.

This CIP plan meets all closure requirements of IAC Part 845.750 (IEPA, 2021). Key closure elements that address the Part 845 closure requirements are summarized below. Further details are provided in the Closure Plan (Geosyntec Consultants, 2023).

- An alternative cover system would be installed over the CCR that remains in the BAP. The cover, consisting of a 40-mil LLDPE geomembrane low-permeability layer, a geotextile cushion if needed, and 24 inches of soil, would minimize vertical infiltration of precipitation into the basin [Part 845.750(a)(1)].
- The final cover system would be gently sloped to direct surface water away from the impoundment. Beyond the final cover system, channels would direct surface water away from the BAP to existing site drainages [Part 845.750(a)(2)].
- Impounded water would be removed from the BAP and managed in accordance with the NPDES permit for the facility [845.750(b)(1) and 845.750(b)(2)].
- Free liquids in the CCR would be eliminated by removing liquid wastes or solidifying the remaining wastes. Trenches would facilitate gravity drainage of liquid wastes in the CCR and direct the liquid wastes to sumps. Other engineering measures may be considered to facilitate removal of liquid wastes and stabilization of wastes. Sumps would be used to collect liquid wastes, which would be managed in accordance with the NPDES permit for the Site [845.750(b)(1) and 845.750(b)(2)].
- The proposed CIP design will control, minimize, or eliminate as much as feasible post-closure infiltration of liquids and releases of CCR, leachate, or contaminated runoff as interpreted by IEPA in the Part 845 rulemaking. Specifically, CIP will result in a reduction of infiltration into the BAP by approximately 96% compared to pre-closure conditions (Ramboll, 2023). Additionally, CIP will result in a reduction of hydraulic flux out of the BAP by 96% compared to pre-closure conditions (Ramboll, 2023). Due to the reduction in the hydraulic flux out of the BAP, the mass flux out of the BAP will also be controlled or minimized as much as feasible as a result of CIP.

Furthermore, during the closure process, we will continue to assess off-Site CCR beneficial use opportunities. Ash consolidation and closure in place in combination with off-Site beneficial use may result in a smaller footprint for purposes of our ultimate cap design, along with a reduced construction schedule.

In total, 38,600 CY of material would be required for contouring and grading of the BAP. Construction of the final cover system would also require an additional 343,000 CY of soil to be hauled to the BAP from an on-Site borrow area. Geosyntec Consultants has identified a potential on-Site borrow area located 1 mile east of the BAP. Borrow soil would be hauled from the borrow area to the impoundment using haul trucks with an assumed capacity of 16.5 CY, suitable for access to off-site county roads (Appendix B).

Under the CIP scenario, the overall expected duration of construction activities is approximately 2.4 to 3.9 years (or 29 to 47 months, Appendix B). The CIP scenario will meet the required closure schedule (*i.e.*, closure completed by October 2028) defined in IAC Section 845.700(d)(2)(C)(ii) (IEPA, 2021). Key parameters for the CIP scenario are shown in Table 2.1.

Table 2.1 Key Parameters for the Closure-in-Place Scenario

Parameter	
Surface Area of BAP	177 acres
Required Volume of Borrow Soil	381,000 CY
Distance to the Borrow Site	1 mile
Duration of Construction Activities	2.4-3.9 years
Labor Hours	
Total On-Site Labor	76,000 hours
Total Off-Site Labor	2,750 hours
30% Contingency	23,600 hours
Total Labor Hours:	102,000 hours
Vehicle and Equipment Travel Miles	
Vehicles On-Site	23,200 miles
Equipment On-Site	629,000 miles
On-Site Haul Trucks (Unloaded + Loaded)	50,200 miles
Labor Mobilization	960,000 miles
Equipment Mobilization (Unloaded + Loaded)	58,800 miles
Off-Site Haul Trucks (Unloaded + Loaded)	41,500 miles
Material Deliveries (Unloaded + Loaded)	50,000 miles
Total On-Site Vehicle and Equipment Travel Miles:	703,000 miles
Total Off-Site Vehicle and Equipment Travel Miles:	1,110,000 miles
Total Vehicle and Equipment Travel Miles:	1,810,000 miles

Notes:
CY = Cubic Yards; BAP = Bottom Ash Pond.
Source: Appendix B.

2.1.2 Closure-by-Removal

Under the CBR-Offsite scenario, all CCR would be excavated from the BAP and transported to an off-Site landfill for disposal. Evaluation of landfill capacity and permitted use must be taken into consideration for each landfill considered for off-Site disposal. For example, a municipal landfill is often designed and permitted to accept waste from the local community at a specific rate. The landfill owner relies on this information to determine the remaining life of a landfill and determine when it will be necessary to expand or close the landfill. Due to the lengthy permitting and construction process, a landfill would need to continue accepting current waste streams and ash for a significant period of time to be a viable option, assuming the landfill owner and state approve. Furthermore, given the volume of ash that would need to be transported, it is important to evaluate impacts to communities that will be affected by the increase in truck traffic to and from the landfill. The nearest operating landfill to meet these criteria is the Cottonwood Hills RDF Landfill in Marissa, Illinois (10400 Hillstown Road, Marissa, IL 62257), which is located approximately 10 road miles from the Site (Appendix B). CCR would be hauled to the off-Site landfill using haul trucks with a capacity of 16.5 CY. As is described below in Section 2.4.5, it is possible that the Cottonwood Hills RDF Landfill would have to be expanded in order to accept all of the material excavated from the BAP.

IAC Section 845.710(c)(1) requires CBR-Offsite alternatives to consider multiple methods for transporting CCR off-Site, including rail, barge, and trucks. Geosyntec Consultants evaluated the feasibility of transporting CCR to the off-Site landfill *via* rail or barge and found that neither option is likely to be viable at this Site (Appendix B). Transporting CCR by rail would require the construction of a new spur/terminal and loading facility on-Site and the construction of a new rail spur and unloading terminal near the off-Site landfill. The construction of new spurs and rail terminals would require coordination with the railroad and additional permitting, which could negatively impact the project schedule. Trucks would still be needed to haul CCR to and from the terminals, and additional CCR exposures could occur during the loading and unloading of CCR into trucks and rail cars (Appendix B).

Barge transport would similarly require the construction of a new loading terminal along the Kaskaskia River or modification of the existing Kaskaskia Regional Port District Dock No. 2 (KRPD #2) to allow for multiple barges to be loaded simultaneously and to allow for stockpiling of CCR, which would necessitate additional permitting and could negatively impact the project schedule. Additionally, the closest off-Site landfill with sufficient capacity to receive all of the CCR excavated from the BAP is the Cottonwood Hills RDF Landfill, which is not located near a river and therefore is not accessible by barge. The next closest landfill with sufficient capacity, the North Milam Landfill, is located approximately 6 miles from the Cahokia Marine Terminal in East St. Louis, Illinois. Use of this terminal would require negotiating an agreement with the terminal owner. Additionally, upgrades might be required at this terminal to make it suitable for the unloading of CCR. As with rail terminals, trucks would still be needed to haul CCR to and from the loading and unloading terminals, and additional CCR exposures could occur during the loading and unloading of CCR into trucks and onto barges (Appendix B). Finally, both the North Milam Landfill and the Cahokia Marine Terminal are located within an environmental justice (EJ) community or within the 1-mile buffer zone of an EJ community (IEPA, 2019).

For the reasons listed above, truck transport has been identified as the preferred option for transport of CCR to the off-Site landfill. Transport *via* truck would not require the construction of additional loading or unloading infrastructure and would not result in project delays due to permitting and coordination with other parties. The existing travel routes from the Site to the off-Site landfill are suitable for CCR transport *via* truck, although some upgrades to local roadways would potentially be required to accommodate the expected increase in traffic volumes under the CBR-Offsite scenario (Appendix B). The local availability and use of natural gas-powered trucks, or other low-polluting trucks, will be evaluated prior to the start of construction.

This scenario includes the following work elements (Appendix B):

- Unwatering and dewatering of the impoundment *via* pumping and passive dewatering methods. Stormwater control structures would be constructed to convey runoff away from the impoundment during construction. The ponding area behind the dam would be used as a temporary settling pond for contact stormwater and dewatering flows collected during construction. Unwatering flows would be pumped to the Secondary Pond. Water would be managed in accordance with the NPDES permit for the facility.
- Excavation of CCR from the impoundment, as well as excavation of any CCR observed outside the BAP boundary. Approximately 1 foot of native soils would also be excavated from beneath the excavated CCR.
- Transport of CCR and CCR-impacted native soils to the off-Site landfill using haul trucks.
- Notching of the BAP embankment dam to facilitate the flow of post-closure stormwater from the BAP area into the Secondary Pond. Grading and (if required) backfilling would also be performed to promote surface water drainage towards the notched BAP embankment dam.
- Site restoration, including revegetation of the disturbed area.
- Monitoring for 3 years post-closure or until such time as GWPSs are achieved, whichever is longer.

In total, approximately 4,130,000 CY of CCR would be excavated from the impoundment under this scenario. An on-Site borrow soil location would not need to be established. A capacity of 16.5 CY is assumed for the haul trucks transporting CCRs to the off-Site landfill. Non-CCR material used for backfilling, if required, would be sourced from the existing BAP embankments (Appendix B).

The overall duration of construction activities under this closure scenario is approximately 7.4 to 11 years (or 89 to 132 months Appendix B, Table 2). The CBR-Offsite scenario will not meet the required closure schedule (*i.e.*, closure completed by October 2028) defined in IAC Section 845.700(d)(2)(C)(ii) (IEPA, 2021). Key parameters for the CBR-Offsite scenario are shown in Table 2.2.

Table 2.2 Key Parameters for the Closure-by-Removal Scenario

Parameter	Value
Surface Area of BAP	177 acres
Distance to the Off-Site Landfill	10 miles
Hauled Volume of CCR	4,130,000 CY
Duration of Construction Activities	7.4-11 years
Labor Hours	
Total On-Site Labor	126,000 hours
Total Off-Site Labor	200,000 hours
30% Contingency	98,000 hours
Total Labor Hours:	425,000 hours
Vehicle and Equipment Travel Miles	
Vehicles On-Site	72,000 miles
Equipment On-Site	2,060,000 miles
On-Site Haul Trucks (Unloaded + Loaded)	122,000 miles
Labor Mobilization	2,620,000 miles
Equipment Mobilization (Unloaded + Loaded)	224,000 miles
Off-Site Haul Trucks (Unloaded + Loaded)	10,000,000 miles
Material Deliveries (Unloaded + Loaded)	50,000 miles
Total On-Site Vehicle and Equipment Travel:	2,260,000 miles
Total Off-Site Vehicle and Equipment Travel:	12,900,000 miles
Total Vehicle and Equipment Travel:	15,200,000 miles

Notes:
CCR = Coal Combustion Residual; CY = Cubic Yard; BAP = Bottom Ash Pond.
Source: Appendix B.

2.2 Long- and Short-Term Effectiveness of the Closure Alternative (IAC Section 845.710(b)(1))

2.2.1 Magnitude of Reduction of Existing Risks (IAC Section 845.710(b)(1)(A))

This section of the report addresses the potential risks to human and ecological receptors due to exposure to CCR-associated constituents in groundwater or surface water. Gradient has performed a Human Health and Ecological Risk Assessment for the Site (Appendix A of this report), which provides a detailed evaluation of the magnitude of existing risks to human and ecological receptors associated with the BAP. This report concluded that there are no current unacceptable risks to any human or ecological receptors associated with the BAP. Because there are no current risks to any human or ecological receptors, and dissolved constituent concentrations would be expected to decline post-closure, no post-closure risks would be expected under either closure scenario. Thus, there would be no current risk or future risk under either closure scenario, and the magnitude of reduction of existing risks would be the same under both closure scenarios.

2.2.2 Likelihood of Future Releases of CCR (IAC Section 845.710(b)(1)(B))

This section of the report quantifies the risk of future releases of CCR that may occur during dike failure and storm-related events.

Storm-Related Releases and Dike Failure During Flood Conditions

Based on the effective Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map for the Site, one area in the western portion of the BAP is located within Zone A, meaning this area is potentially located within the 100-year flood zone for the Kaskaskia River; however, no base flood elevation has been established in this area (Figure 2.1; FEMA, 2023; Sacbibit, 2022). Engineering analyses show that the risk of overtopping occurring during flood conditions is minimal under current conditions. Specifically, AECOM and Geosyntec Consultants have evaluated the risk of flood overtopping occurring at the BAP and found that the impoundment can adequately manage flow during peak discharge from a 1,000-year storm event without overtopping of the embankments (AECOM, 2016b; Geosyntec Consultants, 2021). Additionally, engineering analyses show that the BAP dikes are expected to remain stable under static, seismic, and flood conditions (AECOM, 2016c). Prior to closure (*i.e.*, under current conditions), the risk of dike failure occurring during floods or other storm-related events is therefore minimal. Post-closure, the risks of overtopping and dike failure occurring due to floods or other storm-related events would be even smaller than they are currently. Under the CIP scenario, all CCR would be consolidated in the eastern portion of the impoundment, which does not lie within the area designated Zone A on the FEMA Flood Insurance Rate Map (FEMA, 2023; Sacbibit, 2022). Additionally, under the CIP scenario, a new cover system would be installed, which would include 24 inches of soil and a geomembrane liner, as well as new stormwater control structures. Relative to current conditions, this cover system would provide increased protection against berm and surface erosion, groundwater infiltration, and other adverse effects that could potentially trigger a dike slope failure event. Under the CBR-Offsite scenario, all of the CCR in the BAP would be excavated and relocated, eliminating the risk of a CCR release occurring post-closure. In summary, there is minimal current or future risk of sudden CCR releases occurring under either closure scenario either during or following closure.

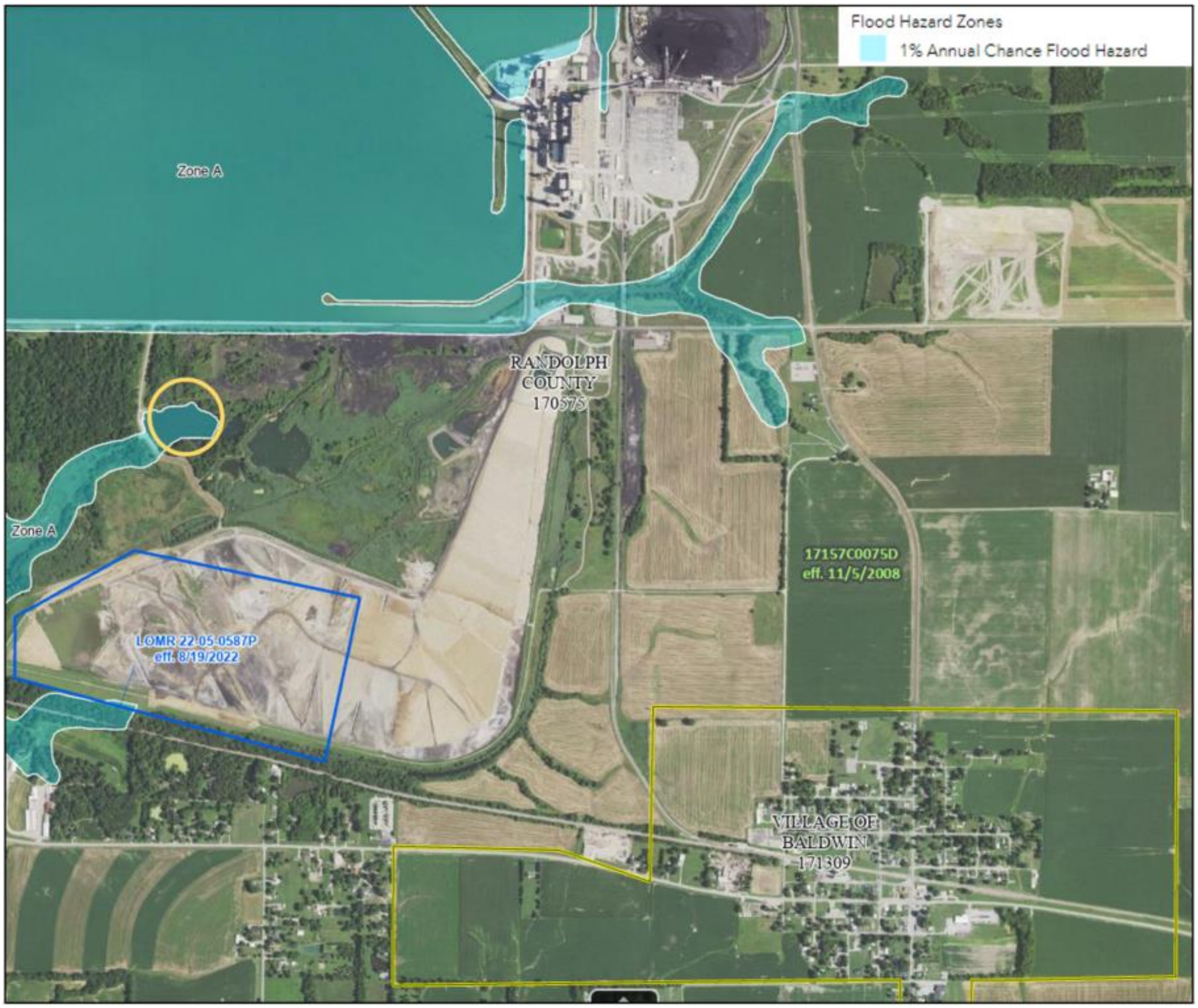

Figure 2.1 Flood Map of Site and Vicinity. The gold circle indicates the portion of the Bottom Ash Basin that lies within Zone A ("Special Flood Hazard Areas Subject to Inundation by the 1% Annual Chance Flood"/"No Base Flood Elevations Determined"). Source: Sacbibit (2022); FEMA (2023).

Dike Failure Due to Seismicity

Sites in Illinois may be subject to seismic risks arising from the Wabash Valley Seismic Zone and the New Madrid Seismic Zone (IEMA, 2020). The BPP property is located within a seismic impact zone. However, the BAP meets the seismic safety requirements of 40 CFR Section 257.63(a) and IAC Section 845.330(a). Thus the overall risk of dike failure due to seismicity is expected to be low (Burns & McDonnell, 2021a). Additionally, the BAP does not lie within 200 feet of an active fault or fault damage zone at which displacement has occurred within the current geological epoch (*i.e.*, within the last ~11,650 years; Burns & McDonnell, 2021b). The nearest known mapped fault is the Cottage Grove Fault System, which is located about 24 miles southeast of the BAP. The time frame of the most recent activity on this fault is unknown (Burns & McDonnell, 2021b). Thus, the risk of dike failure occurring during or following closure activities due to seismic activity is low at the BAP.

2.2.3 Type and Degree of Long-Term Management, Including Monitoring, Operation, and Maintenance (IAC Section 845.710(b)(1)(C))

The long-term operation and management plans for the BAP under each closure scenario are described in Section 2.1 (Closure Alternatives Descriptions). In summary, under the CIP scenario, the BAP would undergo monitoring for 30 years post-closure, or until such time as GWPSs are achieved. Under the CBR-Offsite scenario, the BAP would undergo monitoring for 3 years post-closure, or until such time as GWPSs are achieved. The post-closure care plan for the CIP scenario would additionally include annual inspections, mowing, and maintenance of the final cover system.

2.2.4 Short-Term Risks to the Community or the Environment During Implementation of Closure (IAC Section 845.710(b)(1)(D))

2.2.4.1 Worker Risks

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 the risk of accidents occurring during construction activities, both on- and off-Site. On-Site accidents include injuries and deaths arising from the use of heavy equipment and/or earthmoving operations during construction activities. Off-Site accidents include injuries and deaths due to vehicle accidents during labor and equipment mobilization/demobilization, material deliveries, and the hauling of CCR.

As shown in Tables 2.1 and 2.2, Geosyntec Consultants estimates that the CIP scenario would require 76,000 on-Site labor hours and the CBR-Offsite scenario would require 126,000 on-Site labor hours (Appendix B). 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 US Bureau of Labor Statistics and the on-Site labor hours reported in Appendix B, we estimate that approximately 0.79 worker injuries and 0.0069 worker fatalities would occur on-Site under the CIP scenario, and approximately 1.3 worker injuries and 0.011 worker fatalities would occur on-Site under the CBR-Offsite scenario (Table 2.3). The rate of on-Site worker accidents is therefore expected to be highest under the CBR-Offsite scenario and lowest under the CIP scenario.

Table 2.3 Expected Number of On-Site Worker Accidents Under Each Closure Scenario

Closure Scenario	Injuries	Fatalities
CIP	0.79	0.0069
CBR-Offsite	1.3	0.011

Notes:
CBR-Offsite = Closure-by-Removal with Off-Site CCR Disposal; CCR = Coal Combustion Residual; CIP = Closure-in-Place.

Greater numbers of haul truck miles, labor and equipment mobilization/demobilization miles, and material delivery miles would be required off-Site under the CBR-Offsite scenario than would be required under the CIP scenario (Tables 2.1 and 2.2). Under the CBR-Offsite scenario, 12,900,000 haul truck miles would be required to haul CCR from the Site to an off-Site landfill, and under the CIP scenario, only 1,110,000 haul truck miles would be required (Appendix B). The United States Department of Transportation (US DOT, 2022) provides estimates of the expected number of fatalities and injuries "per vehicle mile driven" for drivers and passengers of large trucks and passenger vehicles. Table 2.4 shows the expected number of off-Site accidents under each closure scenario due to all categories of off-Site vehicle usage. For these calculations, it was assumed that labor mobilization/demobilization would rely on passenger vehicles (cars or light trucks, including pickups, vans, and sport utility vehicles) and that hauling, equipment mobilization/demobilization, and material deliveries would rely on large trucks. Based on US DOT's accident statistics and the mileage estimates in Appendix B, an estimated 0.58 worker injuries and 0.0093 worker fatalities would be expected to occur due to off-Site activities under the CIP scenario; an estimated 3.1 worker injuries and 0.053 worker fatalities would be expected to occur due to off-Site activities under the CBR-Offsite scenario.

Table 2.4 Expected Number of Off-Site Worker Accidents Under Each Closure Scenario

Off-Site Vehicle-Use Category	CIP		CBR-Offsite	
	Injuries	Fatalities	Injuries	Fatalities
Hauling	0.006	1.1×10^{-4}	1.5	0.028
Labor Mobilization/Demobilization	0.56	0.0089	1.5	0.024
Equipment Mobilization/Demobilization	0.0088	1.6×10^{-4}	0.033	6.2×10^{-4}
Material Deliveries	0.0074	1.4×10^{-4}	0.074	1.4×10^{-4}
Total:	0.58	0.0093	3.1	0.053

Notes:
CBR-Offsite = Closure-by-Removal with Off-Site CCR Disposal; CCR = Coal Combustion Residual; CIP = Closure-in-Place.

Overall, taking into account accidents occurring both on- and off-Site, 1.4 worker injuries and 0.016 worker fatalities would be expected under the CIP scenario, and 4.4 worker injuries and 0.064 worker fatalities would be expected under the CBR-Offsite scenario. Thus, overall risks to workers would be highest under the CBR-Offsite scenario and lowest under the CIP scenario.

Concurrently with closure activities, a utility-scale solar and battery energy storage facility would be constructed on the BPP Site. The simultaneous pursuit of closure-related construction and solar facility construction may lead to traffic congestion on Site access roads, resulting in greater overall risks to workers than would result from closure or solar re-development alone. Because the CIP scenario would require less hauling activity (and other forms of ingress and egress to and from the Site) than the CBR-Offsite scenario and would also be completed over a shorter time period, the CIP scenario would be expected to result in less congestion on Site access roads during Site re-development – and, hence, a smaller increase in the risks to workers – than would occur under the CBR-Offsite scenario.

In summary, risks to workers due to accidents would be expected to be greatest under the CBR-Offsite scenario and least under the CIP scenario. Differences in worker risks between the two scenarios would largely be driven by off-Site activities.

2.2.4.2 Community Risks

Accidents

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 (2022) and the off-Site travel mileages reported in Appendix B, off-Site vehicle accidents could result in an estimated 0.27 injuries and 0.0056 fatalities among community members (*i.e.*, people involved in construction-related vehicle accidents, who are neither drivers nor passengers, including pedestrians, drivers of other vehicles, *etc.*) under the CIP scenario (Table 2.5). Under the CBR-Offsite scenario, off-Site vehicle accidents could result in an estimated 4.1 community injuries and 0.15 community fatalities.

Table 2.5 Expected Number of Community Accidents Under Each Closure Scenario

Off-Site Vehicle-Use Category	CIP		CBR-Offsite	
	Injuries	Fatalities	Injuries	Fatalities
Hauling	0.01	6.0×10^{-4}	3.4	0.14
Labor Mobilization/Demobilization	0.22	0.0035	0.6	0.0096
Equipment Mobilization/Demobilization	0.02	8.0×10^{-4}	0.076	0.0031
Material Deliveries	0.017	6.8×10^{-4}	0.017	6.8×10^{-4}
Total:	0.27	0.0056	4.1	0.15

Notes:
CBR-Offsite = Closure-by-Removal with Off-Site CCR Disposal; CCR = Coal Combustion Residual; CIP = Closure-in-Place.

Traffic

Haul routes would be expected to use major arterial roads and highways wherever possible, which would reduce the incidence of traffic. However, the heavy use of local roads for construction operations may result in increased traffic near the Site and the off-Site landfill. Traffic could potentially cause travel delays on local roads and also cause damage to local roadways.

Traffic may increase temporarily around the Site under both closure scenarios 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 or end of each work day (for the arrival/departure of the work force), at the beginning or end of the construction period (for equipment mobilization/demobilization), and at specific times throughout the construction period (for material deliveries). These impacts would therefore likely be less disruptive to community members than the constant and steady movement of haul trucks to and from the Site due to CCR hauling. Under the CBR-Offsite scenario, hauling-related construction activities would be expected to take approximately 1,870 working days and require approximately 250,000 truckloads of CCR (Appendix B). Assuming 10-hour working days, a haul truck would need to pass a given location near the Site once every 2.2 minutes on average under this closure scenario. Off-Site traffic demands due to hauling are expected to be lesser under the CIP scenarios than under the CBR-Offsite scenario because no off-Site hauling of CCR would be required. The CIP scenario requires approximately 23,000 truckloads to transport borrow soil to the Site, which corresponds with a haul truck passing a given location near the Site once every 6.4 minutes on average for the approximately 490 working days duration of hauling-related construction activities (Appendix B).

Noise

Construction generates a great deal of noise, both in the vicinity of the Site and along haul routes. In a closure impact analysis performed by the Tennessee Valley Authority (TVA, 2015), the authors found that "[T]ypical noise levels from construction equipment used for closure are expected to be 85 dBA or less when measured at 50 ft. These types of noise levels would diminish with distance…at a rate of approximately 6 dBA per each doubling of distance and therefore would be expected to attenuate to the recommended EPA noise guideline of 55 dBA at 1,500 ft." There are no residences or businesses within 1,500 feet of the BAP. However, there are a small number of residences within 1,500 feet of the proposed on-Site borrow soil location, which may be required under the CIP scenario. The proposed borrow soil location also lies within 1,500 feet of the Baldwin Cemetery. Recreators and wildlife within the Kaskaskia River SFWA could also be temporarily impacted by construction noise at the BAP under both scenarios, since the Kaskaskia River SFWA includes the BPP Cooling Lake, which lies immediately north of the BAP. The duration of noise impacts in the vicinity of the BAP (both scenarios) and the proposed on-Site borrow soil location (CIP scenario only) would be greater under the CBR-Offsite scenario than under the CIP scenario, because the expected duration of construction is longer (2.4 to 3.9 years under the CIP scenario *vs.* 7.4 to 11 years under the CBR-Offsite scenario).

In addition to impacts in the immediate vicinity of planned construction areas at the Site, local roads near the Site and the off-Site landfill may also experience noise pollution due to high volumes of haul truck traffic under the CBR-Offsite scenario. As described above (Traffic), the construction schedule for the CBR-Offsite scenario requires haul trucks to pass by a given location every 2.2 minutes on average for 10 hours each day for approximately 1,870 working days, and the construction schedule for the CIP scenario requires haul trucks to pass a given location every 6.4 minutes on average for 10 hours each day for approximately 490 working days. Dump trucks generate significant noise pollution, with noise levels of approximately 88 decibels or higher expected within a 50-foot radius of the truck (Exponent, 2018). This noise level is similar to the noise level of a gas-powered lawnmower or leaf blower (CDC, 2019). Decibel levels above 80 can damage hearing after 2 hours of exposure (CDC, 2019).

In addition to haul truck impacts, noise pollution may also arise under both closure scenarios from the daily arrival and departure of the workforce, equipment mobilization/demobilization, and material deliveries. These impacts would be expected to largely occur at the beginning or end of each work day (for the arrival/departure of the work force), at the beginning or end of the construction period (for equipment mobilization/demobilization), and at specific times throughout the construction period (for material deliveries). These impacts would therefore likely be less disruptive to community members than the constant and steady movement of haul trucks to and from the Site under the CBR-Offsite scenario. In summary, noise impacts are likely to be greatest under the CBR-Offsite scenario and least under the CIP scenario.

Air Quality

Construction can adversely impact air quality. Air pollution can occur both on-Site and off-Site (*e.g.*, along haul routes), potentially impacting workers as well as community members. With regard to construction activities, two categories of air pollution are of particular concern: equipment emissions and fugitive dust. The equipment emissions of greatest concern are those found in diesel exhaust. Most construction equipment is diesel-powered, including the dump trucks that would be used to haul material to and from the Site. 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). Fugitive dust, another major air pollutant at construction sites, is generated by earthmoving operations and other soil- and CCR-handling activities. Along haul routes, an additional source of fugitive dust is road dust along unpaved dirt roads. Careful planning and Best Management Practices (BMPs) such as wet suppression are used to minimize and control fugitive dust during construction activities; however, it is not possible to prevent dust generation entirely.

On-Site, emissions would be higher under the CBR-Offsite scenario than under the CIP scenario, due to the greater amount of on-Site vehicle and equipment travel miles required under the CBR-Offsite scenario (703,000 total on-Site travel miles under the CIP scenario *versus* 2,260,000 total on-Site travel miles under the CBR-Offsite scenario; Tables 2.1 and 2.2). Off-Site, emissions would similarly be higher under the CBR-Offsite scenario than under the CIP scenario due to the greater amount of off-Site vehicle and equipment travel miles required under the CBR-Offsite scenario (1,110,000 total off-Site travel miles under the CIP scenario *versus* 12,900,000 total off-Site travel miles under the CBR-Offsite scenario).

Environmental Justice

The state of Illinois defines EJ communities to be those communities with a minority population above twice the state average and/or a total population below twice the state poverty rate (IEPA, 2019). Relative to other communities, EJ communities experience an increased risk of adverse health impacts due to environmental pollution and other factors associated with remediation activities (US EPA, 2016).

As shown in a map of EJ communities throughout the state (IEPA, 2019), the outer perimeter of the 1-mile buffer zone for the nearest EJ community lies approximately 7.5 miles east/southeast of the property boundary for the Site near Sparta, IL (Figure 2.2). As described above (Noise), significant noise impacts due to construction are expected to be limited to potential receptors located within 1,500 feet (0.28 miles) of the Site. Similarly, the air quality impacts of construction are expected to be limited to potential receptors located within 1,000 feet (0.19 miles) of the Site (CARB, 2005; BAAQMD, 2017). Along heavily trafficked roadways, air quality impacts are expected to be limited to potential receptors located within 600 feet of the roadway (0.11 miles; US EPA, 2014). The EJ community near Sparta is therefore unlikely to be directly impacted by on-Site air emissions, noise pollution, or other negative impacts arising at the Site.

EJ communities can potentially be impacted by construction-related activities occurring off-Site, including CCR hauling (CBR-Offsite scenario only), labor and equipment mobilization/demobilization, and material deliveries. Off-Site impacts due to labor and equipment mobilization/demobilization and material deliveries would be expected to be diffuse (*i.e.*, to span a wide range of transport routes originating over a wide area). Additionally, these impacts would be expected to largely occur at the beginning or end of each work day (for the arrival/departure of the work force), at the beginning or end of the construction period (for equipment mobilization/demobilization), and at specific times throughout the construction period (for material deliveries). Hauling, in contrast, would rely on a single transport route used continuously throughout the entire excavation period. Off-Site hauling is therefore more likely to have a significant impact on EJ communities than other types of off-Site vehicle use.

In general, EJ communities located along haul routes or near the preferred off-Site landfill can be negatively impacted throughout excavation by air pollution, noise, traffic, and accidents generated by CCR-hauling activities. In the case of BAP closure at the BPP Site, however, a review of the Illinois map of EJ communities reveals that the preferred off-Site landfill (the Cottonwood Hills RDF Landfill in Marissa, Illinois) is not located within or near any EJ communities. Moreover, haul routes from the Site to the off-Site landfill do not pass through any EJ communities. Thus, no EJ impacts would be expected under either closure scenario.

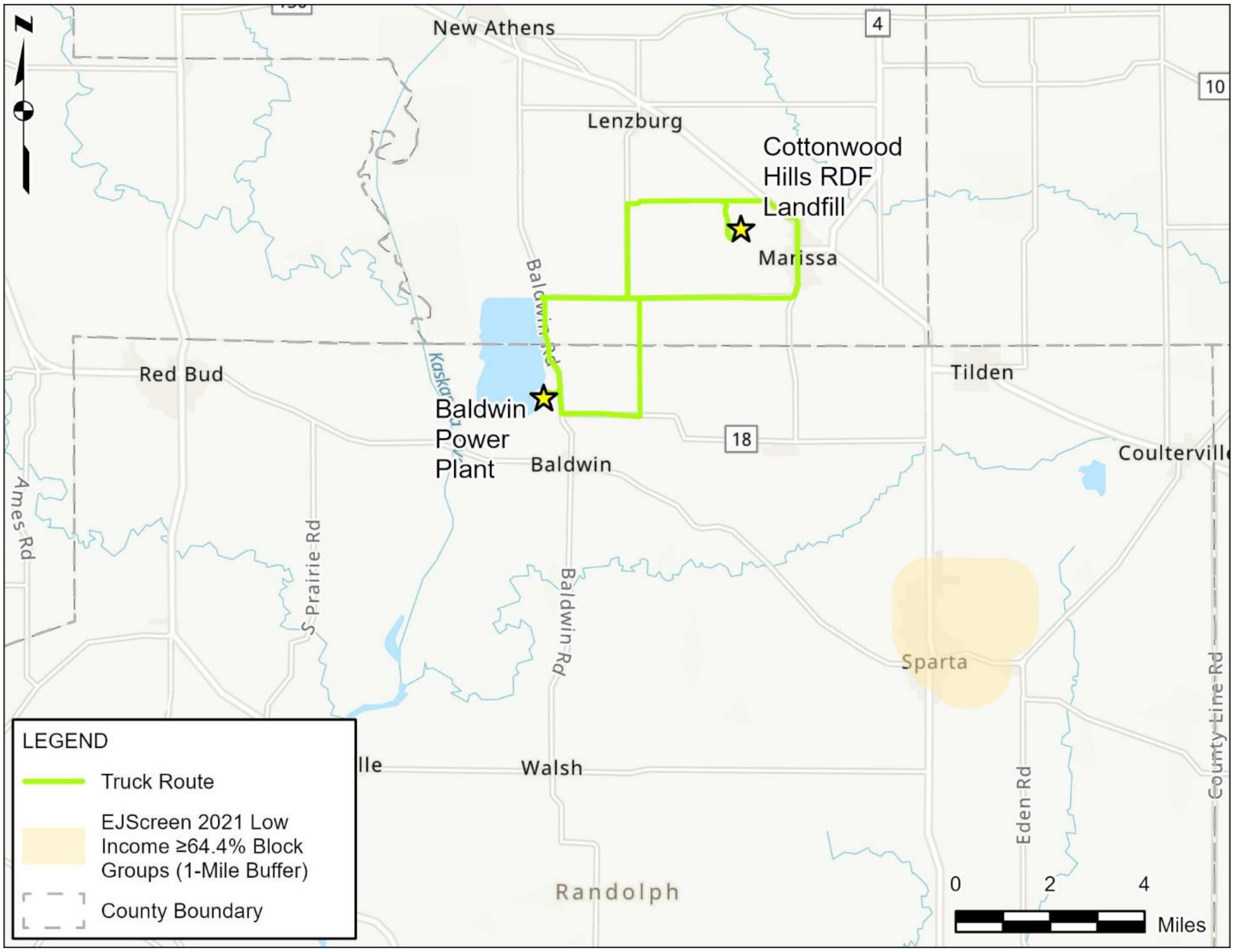

Figure 2.2 Environmental Justice (EJ) Communities in the Vicinity of the Site and the Off-Site Landfill.
Source: IEPA (2019); US EPA (2020); Google LLC (2022).

Scenic, Historical, and Recreational Value

During construction activities, negative impacts on scenic and recreational value may occur within the Kaskaskia River SFWA, which includes the BPP Cooling Lake. The Cooling Lake lies immediately north of the BAP and is a popular spot for fishing year-round (IDNR, 2022). The proposed on-Site borrow soil location, which is required under the CIP scenario, also lies with 1,500 feet of the Baldwin Cemetery and a small number of residences. Noise impacts were described above. In addition, construction activities at the BAP may be visible to recreators using these scenic and recreational areas, potentially interfering with enjoyment of the view. Negative impacts would not be expected to occur within any scenic or recreational areas located further away from the Site, including the campground south of the BAP and the Wood Duck Marina (see Section 1.1.5). The expected duration of construction activities is longer under the CBR-Offsite scenario than under the CIP scenario (2.4 to 3.9 years under the CIP scenario *vs.* 7.4 to 11 years under the CBR-Offsite scenario). It is therefore anticipated that short-term impacts on the scenic and recreational value of natural areas near the Site would be greater under the CBR-Offsite scenario than under the CIP scenario.

Based on a review of the IDNR Historic Preservation Division database and the Illinois State Archaeological Survey database, there are no historic sites located within 1,000 meters of the BAP or the on-Site borrow soil location (Ramboll, 2021).

2.2.4.3 Environmental Risks

Greenhouse Gas Emissions

In addition to the air pollutants listed above in Section 2.2.4.2, construction equipment emits greenhouse gases (GHGs), including carbon dioxide (CO_2) and possibly nitrous oxide (N_2O). The potential impact of each closure scenario on GHG emissions is proportional to the potential impact of each closure scenario on other emissions from construction vehicles and equipment, as described above in Section 2.2.4.2. In summary, GHG emissions from construction equipment and vehicles would be greater under the CBR-Offsite scenario than under the CIP scenario, because the total on-Site and off-Site vehicle and equipment travel miles required under the CBR-Offsite scenario (15,200,000 total vehicle and equipment travel miles) is greater than those required under the CIP scenario (1,810,000 total vehicle and equipment travel miles; Tables 2.1 and 2.2).

We did not quantify the carbon footprint of the approximately 177 acres of 40-mil LLDPE geomembrane liner required for the final BAP cover system under the CIP scenario. The carbon footprint of this geomembrane (*i.e.*, the fossil fuel emissions required to manufacture it) is an additional source of GHG emissions at the Site under the CIP scenario. The potential expansion of the off-Site landfill under the CBR-Offsite scenario would have an additional, unquantified carbon footprint due to the manufacture of geomembranes used in the expanded landfill liner.

Energy Consumption

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 in this analysis include the burning of diesel fuel during construction activities and the carbon footprint of manufacturing geomembrane textiles. Because GHG emission impacts and energy consumption impacts both arise from the same sources at construction sites, the trends discussed above with respect to GHG emissions also apply to the evaluation of energy demands. Specifically, the energy demands of construction equipment and vehicles would be greater under the CBR-Offsite scenario than under the CIP scenario. We did not quantify the energy demands of the geomembranes required for the construction of the final cover system under the CIP scenario or, potentially, the geomembranes required for expansion of the off-Site landfill under the CBR-Offsite scenario.

The BPP Site is slated for re-development as a utility-scale solar power generating facility and battery energy storage facility. The installation of the utility-scale solar power generating facility and a battery energy storage facility will provide additional tax revenue to the local community, jobs, benefit the reliability of the electrical grid, and support Illinois' path toward 100 percent clean energy by 2050.

Natural Resources and Habitat

During closure, major construction activities such as the excavation of the impoundment, the excavation of the borrow area (CIP scenario only), and, potentially, the expansion of the off-Site landfill (CBR-Offsite scenario only) may require the destruction of some existing habitat atop portions of these construction areas, resulting in negative impacts to natural resources and habitat within the footprint of these areas. Construction may also have indirect negative impacts on the natural resources and habitat in the immediate vicinity of these locations by causing alarm and escape behavior in nearby wildlife (*e.g.*, due to noise disturbances). Finally, although erosion prevention and sediment control measures will be undertaken under both closure scenarios, it is possible that limited negative short-term impacts could occur to sensitive aquatic and wetland species in wetlands or surface water bodies located near the BAP (see Section 1.1.3) due to sediment runoff during construction. The duration of time over which various short-term negative habitat impacts might occur due to construction would be longer under the CBR-Offsite scenario than under the CIP scenario, due to the longer expected duration of construction activities under the former scenario 2.4 to 3.9 years for CIP *vs.* 7.4 to 11 years for CBR-Offsite). Thus, negative short-term impacts to natural resources and habitat due to closure activities would likely be greater under the CBR-Offsite scenario than under the CIP scenario.

In addition to the short-term negative habitat impacts caused by construction activities, closure may also result in long-term shifts in the habitat types overlying the major construction locations associated with closure. This assessment does not make any value judgments regarding the relative value of the habitat types currently overlying these locations and the habitat types that could potentially overlie these locations post-closure under the two closure scenarios. For example, we did not attempt to determine whether the conversion of open water to grassland within the footprint of the BAP would constitute a positive or negative long-term change with regard to factors such as biodiversity, ecosystem services, or the preferences of recreators/sightseers.

According to the IDNR Natural Heritage Database, there are 7 state threatened species and 25 state endangered species within Randolph County (Ramboll, 2021). To our knowledge, however, no threatened or endangered species have been identified at the Site. Based on the information that is currently available, we do not expect construction activities to have negative impacts on any threatened or endangered species.

2.2.5 Time Until Groundwater Protection Standards Are Achieved (IAC Sections 845.710(b)(1)(E) and 845.710(d)(2 and 3))

The time horizon over which GWPSs would be exceeded at the Site is immaterial from a risk perspective, because there is no unacceptable risk associated with exceedances of a GWPS at the Site (see Section 2.2.1).

As described above in Section 1.1.4 (Hydrogeology), groundwater (and CCR-related constituents) originating from the BAP may migrate vertically downward through the UGU into the uppermost aquifer, or BU. Groundwater flows laterally to the west and southwest through the UGU and the BU and ultimately discharges to the Kaskaskia River. Identified potential migration pathways at the Site include the thin sand lenses in the UGU adjacent to the BAP and the area of contact between the UGU and the BU. Dissolved constituents in groundwater may partition between river sediments and Kaskaskia River surface water.

While the groundwater modeling demonstrated that groundwater concentrations will increase at several wells post-closure under both the CIP and CBR-Offsite scenarios, the modeling also suggested that the increasing concentrations are the result of the adjacent Fly Ash Pond System, not the BAP (Ramboll, 2023). Results of groundwater modeling indicate that concentrations of boron, a common indicator parameter used in coal ash fate and transport evaluations, at the proposed BAP compliance wells that are not influenced by the Fly Ash Pond System will remain below the GWPS following implementation of either the CIP or the CBR-Offsite scenarios (Ramboll, 2023).

Additionally, changing geochemical conditions during an extended excavation associated with the CBR-Offsite scenario can be a mechanism that results in the mobilization and increased transport in groundwater for some constituents. This may result in GWPS exceedances.

2.2.6 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 845.710(b)(1)(F))

Section 2.2.1 evaluates potential risks to human and ecological receptors arising from the leaching of CCR-associated constituents into groundwater during closure activities and following closure of the BAP. Section 2.2.2 evaluates the potential for CCR releases to occur due to dike failure or overtopping during floods or other storm-related events. In summary, there is no current or future risk to any human or ecological receptors associated with the BAP. Additionally, there is minimal current or future risk of overtopping occurring at the embankments due to flood conditions at the Site. Dike failure due to, *e.g.*, seismic activity and storm-related events is also exceedingly unlikely.

Section 2.2.4 evaluates several potential risks to human health and the environment during closure activities, including risks of accidents occurring among workers; risks to nearby residents related to accidents, traffic, noise, and air pollution; and risks to natural resources and wildlife. The findings from this section of the text are summarized in Table S.1 (Summary of Findings).

2.2.7 Long-Term Reliability of the Engineering and Institutional Controls (IAC Section 845.710(b)(1)(G))

Post-closure, there is minimal risk of engineering or institutional failures leading to sudden releases of CCR from the impoundment under the CIP scenario. There is no post-closure risk of engineering or institutional failures under the CBR-Offsite scenario (see Section 2.2.2 above). Additionally, there are no current or future unacceptable risks to any human or ecological receptors under either closure scenario (see Section 2.2.1 above). Moreover, reliable engineering and institutional controls (*e.g.*, a bottom liner, a leachate management system, and groundwater monitoring) would be implemented at the off-Site landfill under the CBR-Offsite scenario. Both of the evaluated closure scenarios are therefore reliable with respect to long-term engineering and institutional controls.

2.2.8 Potential Need for Future Corrective Action Associated with the Closure (IAC Section 845.710(b)(1)(H))

Corrective action is expected at the Site. An evaluation of potential corrective measures and corrective actions has not yet been completed, but will be conducted consistent with the requirements in IAC Section 845.660 and IAC Section 845.670.

2.3 Effectiveness of the Closure Alternative in Controlling Future Releases (IAC Section 845.710(b)(2))

2.3.1 Extent to Which Containment Practices Will Reduce Further Releases (IAC Section 845.710(b)(2)(A))

The CCR in the BAP currently poses no unacceptable risks to human health or the environment (Section 2.2.1). Because current conditions do not present a risk to human health or the environment, and dissolved constituent concentrations would be expected to decline post-closure, there would also be no unacceptable risks to human health or the environment following closure, regardless of the closure scenario.

Section 2.2.2 discussed the potential for dike failure or overtopping to occur during or following closure activities, resulting in a sudden release of CCR. That analysis showed that there is minimal risk of sudden CCR releases occurring during or following closure under either closure scenario.

2.3.2 Extent to Which Treatment Technologies May Be Used (IAC Section 845.710(b)(2)(B))

Under both closure scenarios, water generated during the dewatering and unwatering of the impoundment would be treated if necessary prior to disposal. Following treatment, water from unwatering and dewatering would be discharged to the Kaskaskia River in accordance with the NPDES permit for the facility.

2.4 Ease or Difficulty of Implementing Closure Alternative (IAC Section 845.710(b)(3))

2.4.1 Degree of Difficulty Associated with Constructing the Closure Alternative

CIP using a final cover system is a reliable and standard method for managing and closing impoundments that relies on common construction activities. Dewatering saturated CCR to construct a stabilized final cover system subgrade can present challenges during closure; however, these challenges are common to most CCR surface impoundment closures and are commonly addressed *via* surface water management and dewatering techniques.

Excavation and landfilling of CCR is also a reliable and standard method for closing impoundments. However, relative to CIP, CBR-Offsite poses additional implementation difficulties due to higher earthwork volumes, higher dewatering volumes, longer construction schedules, and the need to haul CCR over public roads. As described in Section 2.2.4.2 (Community Risks), off-Site hauling may also have detrimental community impacts due to an increased incidence of vehicle accidents, traffic-related impacts, noise, and air pollution.

In addition to off-Site hauling, off-Site landfilling under the CBR-Offsite scenario may pose particular challenges. A disposal plan would need to be developed between DMG and the owner/operator of the third-party landfill in order to outline acceptable waste conditions upon delivery, daily waste production rates, and the expected duration of the project. Off-Site landfilling may additionally raise issues related to the co-disposal of CCR and other non-hazardous wastes. Finally, the construction schedule for excavation may be negatively impacted if, during the course of closure, it is determined that the off-Site landfill must be expanded in order to receive all of the materials excavated from the BAP.

2.4.2 Expected Operational Reliability of the Closure Alternative

There is no post-closure risk of operational failures leading to sudden releases of CCR from the impoundment under the CBR-Offsite scenario. There is minimal post-closure risk of sudden CCR releases occurring under the CIP scenario, because: (i) the final cover system will be constructed and maintained in accordance with all relevant state and federal safety regulations, and (ii) the dikes, final cover, and stormwater control features have all been designed to withstand earthquakes and storm events (see Section 2.2.2 above). Moreover, appropriate operational controls are expected to be implemented at the off-Site landfill under the CBR-Offsite scenario. As such, operational reliability would be expected under both closure scenarios.

2.4.3 Need to Coordinate with and Obtain Necessary Approvals and Permits from Other Agencies

Permits and approvals would be needed under both closure scenarios. Components of both closure scenarios that would be expected to require a permit include:

- A NPDES permit modification has been obtained through IEPA to allow the disposal of water generated from unwatering and dewatering operations to the Kaskaskia River *via* the existing NPDES-permitted outfall for the Site;
- A construction permit from the IDNR, Office of Water Resources, Dam Safety Program to allow the embankment and spillways of the BAP to be modified as part of closure;
- A construction stormwater permit through IEPA, including construction stormwater controls and other BMPs, such as silt fences and other measures; and
- A joint water pollution control construction and operating permit (WPC permit).

As discussed below in Section 2.4.5, it may be necessary to expand the off-Site landfill under the CBR-Offsite scenario in order to accommodate all of the material excavated from the BAP. Additional permitting may be required under this scenario for transport of the CCR and to expand the off-Site landfill. It may also be necessary to modify the operating plan for the off-Site landfill in order to accommodate the increased rate of filling of the landfill and the likely need for additional equipment and personnel to manage the receipt and disposal of the CCR.

2.4.4 Availability of Necessary Equipment and Specialists

CIP and CBR-Offsite are reliable and standard methods for managing waste that rely on common construction equipment and materials and typically do not require the use of specialists, outside of typical construction labor and equipment operators. However, global supply chains have been disrupted due to the COVID-19 pandemic, resulting in shortages in the availability of construction equipment and parts. There may be some shortages in construction equipment under both closure scenarios, if supply chain resilience does not improve by the time of construction. Alternatively, extended downtime may be required for equipment repairs and maintenance. A national shortage of truck drivers has also developed during the COVID-19 pandemic. Due to the large volume of CCR to be hauled from the Site under the CBR-Offsite scenario, shortages in construction equipment may cause greater challenges under the CBR-Offsite scenario than under the CIP scenario. If sufficient trucks and truck drivers are not available, the construction schedule at the impoundment may lengthen based on hauling-related delays.

The availability of critical materials such as metal, wood, and electronic chips has also been impacted by the COVID-19 pandemic. However, soil materials and geomembrane liner materials have generally been available during 2021 and early 2022 for landfill development and closure projects.

2.4.5 Available Capacity and Location of Needed Treatment, Storage, and Disposal Services

Under the CIP scenario, all of the CCR currently within the BAP would be stored within the existing footprint of the BAP. Treatment would consist of unwatering the BAP at the start of construction, performing limited dewatering to stabilize the CCR subgrade, and managing stormwater inflow. Water from unwatering and dewatering of the BAP would be discharged in accordance with the NPDES permit for the facility. Under the CBR-Offsite scenario, water treatment would similarly consist of unwatering and dewatering the BAP at the start of construction and discharging water from unwatering/dewatering in accordance with the NPDES permit for the facility. Due to the need for dewatering prior to CCR hauling, a higher volume of water would be expected to be generated during dewatering under the CBR-Offsite scenario than under the CIP scenario.

For the CBR-Offsite scenario, 4,130,000 CY of CCR would be excavated from the BAP and require disposal. According to the IEPA "Landfill Disposal Capacity Report" for 2022 (IEPA, 2022b), the closest nearby third-party landfill with the ability to receive and dispose of CCR from the Site is the Cottonwood Hills RDF Landfill in Marissa, Illinois. This facility has 27,900,000 CY of remaining capacity in its current permitted footprint. It receives 338,000 CY of waste annually, and is located 10 miles from the Site by road. The Cottonwood Hills RDF Landfill therefore has sufficient capacity to receive CCR from the BAP. However, closure of the BAP would increase the annual waste receipt rate at the off-Site landfill. Due to the short time frame over which CCR would be received at the landfill, vertical and/or lateral expansions may become necessary. Additionally, the landfill operators may need to develop a disposal plan to account for the increased volume of material that would be received and the unique CCR waste characteristics. Elements of this disposal plan might include increasing daily operational capacity and procedures, expediting planned airspace construction, and potentially expediting landfill expansion.

If expansion of the Cottonwood Hills RDF Landfill is impractical or infeasible, then an alternative landfill located farther from the Site would need to be identified. A possible alternative to the Cottonwood Hills RDF Landfill is the North Milam Landfill in East Saint Louis, Illinois. The North Milam Landfill has 10,200,000 CY of remaining capacity in its current permitted footprint, receives 2,380,000 CY of waste annually, and is located 44 road miles from the Site (Appendix B; IEPA, 2022b).

2.5 Impact of Closure Alternative on Waters of the State (IAC Section 845.710(d)(4))

As demonstrated in Gradient's "Human Health and Ecological Risk Assessment" (Appendix A), both modeled and measured surface water concentrations in the Kaskaskia River are all below relevant human health and ecological screening benchmarks. Surface water concentrations of CCR-associated constituents would be expected to decline over time under both closure scenarios. Thus, no current or future exceedances of any human health or ecological screening benchmarks would be anticipated under either closure scenario.

The lined landfill that would receive the CCR excavated from the impoundment under the CBR-Offsite scenario would be managed to ensure that no surface water impacts would occur in the vicinity of the landfill. In summary, no impacts on any waters of the state would be expected under either closure scenario.

2.6 Concerns of Residents Associated with Closure Alternatives (IAC Section 845.710(b)(4))

Nonprofits representing community interests near the Site have raised concerns regarding the potential impacts of the coal ash impoundment at this Site on groundwater and surface water quality, including Earthjustice and the Sierra Club (Earthjustice *et al.*, 2018; Sierra Club and CIHCA, 2014). These parties generally prefer CBR-Offsite to CIP, citing fears that allowing CCR to remain in place "allows the widespread groundwater contamination to continue indefinitely" (Earthjustice *et al*., 2018, p. 24). However, it is not the case that closing the BAP *via* CIP rather than CBR-Offsite would result in undue risks to groundwater and surface water post-closure. As described in Sections 2.2.1 and 2.2.2, no current or future unacceptable risks to human or ecological receptors are associated with the BAP under any scenario. There is also minimal risk of future CCR releases occurring under any scenario. Furthermore, the groundwater model conservatively estimated that concentrations of boron, a common indicator parameter used in coal ash fate and transport evaluations, at the proposed BAP compliance wells that are not influenced by the Fly Ash Pond System will remain below the GWPS following implementation of either the CIP or the CBR-Offsite scenarios (Ramboll, 2023). Both closure scenarios are therefore responsive to residents' concerns regarding impacts to groundwater and surface water quality.

The CIP scenario has several advantages over the CBR-Offsite scenario with regard to likely community concerns. Notably, the CIP scenario presents fewer risks to workers and nearby residents during construction in the form of accidents, traffic-related impacts, noise, and air pollution (Section 2.2.4 above). Closure would also be achieved more rapidly under the CIP scenario than under the CBR-Offsite scenario, due to the shorter duration of construction activities.

A public meeting was held on June 29, 2023, pursuant to the requirements under IAC Section 845.710(e). Questions raised by the attendees were addressed at the meeting; subsequently, a written summary of the questions and responses was prepared.

2.7 Class 4 Estimate (IAC Section 845.710(d)(1))

Analyses in the Final Closure Plan were prepared consistent with Class 4 estimates based on the Association for the Advancement of Cost Engineering (AACE) Classification Standard (or a comparable classification practice as provided in the AACE Classification Standard), as required by IAC Section 845.710 (IEPA, 2021).

2.8 Summary

Table S.1 (Summary of Findings) summarizes the expected impacts of the CIP and CBR-Offsite closure scenarios with regard to each of the factors specified under IAC Section 845.710 (IEPA, 2021). Based on this evaluation and the details provided in Section 2 above, CIP has been identified as the most appropriate closure scenario for the BAP. Key benefits of the CIP scenario relative to the CBR-Offsite scenario include reduced impacts to workers, community members, and the environment due to construction activities (*e.g.*, fewer constructed-related accidents, lower energy demands, less air pollution and GHG emissions, and less traffic-related impacts). Moreover, the CIP scenario will meet the required closure schedule (*i.e.*, closure completed by October 2028) defined in IAC Section 845.700(d)(2)(C)(ii) (IEPA, 2021), whereas the CBR-Offsite scenario would be unable to meet this required schedule.

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Appendix A

Human Health and Ecological Risk Assessment

Human Health and Ecological Risk Assessment
Bottom Ash Pond
Baldwin Power Plant
Baldwin, Illinois

July 18, 2023

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Abbreviations

ADI	Acceptable Daily Intake
BAP	Bottom Ash Pond
BCF	Bioconcentration Factor
BCG	Biota Concentration Guide
BPP	Baldwin Power Plant
BU	Bedrock Unit
CAA	Closure Alternatives Assessment
CCR	Coal Combustion Residuals
CEM	Conceptual Exposure Model
COI	Constituent of Interest
COPC	Constituent of Potential Concern
CSF	Cancer Slope Factor
CSM	Conceptual Site Model
ESV	Ecological Screening Value
FAPS	Fly Ash Pond System
GWPS	Groundwater Protection Standard
GWQS	Groundwater Quality Standard
HTC	Human Threshold Criteria
IAC	Illinois Administrative Code
IEPA	Illinois Environmental Protection Agency
K_d	Equilibrium Partitioning Coefficient
MCL	Maximum Contaminant Level
NRWQC	National Recommended Water Quality Criteria
ORNL RAIS	Oak Ridge National Laboratory's Risk Assessment Information System
pCi/L	PicoCuries per Liter
PRG	Preliminary Remediation Goal
RfD	Reference Dose
RME	Reasonable Maximum Exposure
RSL	Regional Screening Level
SFWA	State Fish and Wildlife Area
SWQS	Surface Water Quality Standard
UA	Uppermost Aquifer
US DOE	United States Department of Energy
US EPA	United States Environmental Protection Agency
UGU	Upper Groundwater Unit

1 Introduction

Dynegy Midwest Generation, LLC operates the Baldwin Power Plant (BPP or "the Site") in Baldwin, Illinois. BPP is an electric power generating facility with coal-fired units that began operation in 1970 (Ramboll, 2021). The BPP has several surface impoundments for storage of coal combustion residuals (CCR): the Bottom Ash Pond (BAP) (Vistra identification [ID] number [No.] 601, Illinois Environmental Protection Agency [IEPA] ID No. W1578510001-06), the Fly Ash Pond System (FAPS, an IEPA closed CCR Unit) (Vistra ID No. 605; IEPA ID Nos. W1578510001-01, W1578510001-02, and W1578510001-03), the Secondary Pond, Tertiary Pond, and Cooling Pond (Ramboll, 2021). The BAP, which is "a 177-acre unlined CCR surface impoundment" (Ramboll, 2021), 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 originating from the BAP. This risk evaluation was performed to support the Closure Alternatives Assessment (CAA) for the BAP in accordance with requirements in Title 35 Part 845 of the Illinois Administrative Code (IAC) (IEPA, 2021). 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 Kaskaskia 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, 2021), or a relevant surface water quality standard (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 in order 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, we 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 or ecological receptors resulting from CCR exposures associated with the BAP 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 boating in the Kaskaskia River to the west of the Site.
- No unacceptable risks were identified for recreators exposed to sediment in the Kaskaskia River to the west of 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 BAP 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 BPP is located in southwest Illinois in Randolph and St. Clair Counties. The BAP is located "approximately one-half mile west-northwest of the Village of Baldwin" (Figure 2.1) (Ramboll, 2021). The BAP (Vistra ID No. 601, IEPA ID No. W1578510001-06, and National Inventory of Dams [NID] No. IL50721), is a Part 845 regulated CCR Unit (Ramboll, 2021). The BAP is north of and adjacent to the FAPS, which was approved for closure by IEPA in August 2016, with the final cover system completed in November 2020 (Ramboll, 2021).

"The BPP property is bordered to the west by the Kaskaskia River; to the east by Baldwin Road, farmland, and strip mining areas; to the southeast by the village of Baldwin; to the south by the Illinois Central Gulf railroad tracks, scattered residences, and State Route 154; and to the north by farmland. The St. Clair/Randolph County Line crosses east-west at approximately the midpoint of Baldwin Lake (Cooling Pond)" (Figure 2.1) (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 BAP consists of unlithified materials (alluvium and glacial deposits) underlain by bedrock (Ramboll, 2021). From the surface downwards, the four principal types of unlithified materials present at the Site are the alluvial clay, sandy clay, and clayey sand of the Cahokia Formation (average thickness of 20 ft); the silt and silty clay of the Peoria Loess (average thickness of 10 ft); the clay and sandy clay of the Equality Formation, with occasional sand seams and lenses (average thickness of 13 ft); and the clay and sandy clay diamictons of the Vandalia Till, with intermittent and discontinuous sand lenses (average thickness of 21 ft; Ramboll, 2021). There are two distinct hydrostratigraphic units below the CCR at this Site: (1) the Upper Groundwater Unit (UGU), consisting of the lithologic layers identified as the Cahokia Formation, Peoria Loess, Equality Formation, and Vandalia Till; and (2) the Bedrock Unit (BU). The UGU is composed predominantly of clay with some silt and minor sand, silt layers, and occasional sand lenses. The BU is composed of interbedded shale and limestone bedrock, which is continuous across the entire Site (Ramboll, 2021). The BU has been identified as the uppermost aquifer (UA) (Ramboll, 2021). Thin sand lenses in the UGU adjacent to the BAP and the area of contact between the unlithified material and the bedrock have both been identified as potential migration pathways. The geometric mean horizontal hydraulic conductivities for the UGU and the BU are 3.2×10^{-5} and 5.0×10^{-6} cm/sec, respectively (Ramboll, 2021).

The general groundwater flow direction in the vicinity of the Site is west towards the Kaskaskia River, the principal surface drainage for the region (Ramboll, 2021). Based on groundwater hydraulic head measurements, lateral groundwater flow in the UGU and the BU is generally to the west and southwest toward the historic drainage feature at the Site and the bedrock valley underlying the Secondary and Tertiary Ponds. The receiving surface water bodies for groundwater in the UGU are assumed to be the Secondary and Tertiary Ponds (which ultimately drain to the Kaskaskia River) and the Kaskaskia River. The receiving surface water body for groundwater in the BU (the UA) is the Kaskaskia River (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 BAP migrates and potentially interacts with surface water and sediment in the adjacent Kaskaskia River. The CSM was developed using available hydrogeologic data specific to the BAP (Ramboll, 2021), including information on groundwater flow and surface water characteristics. Groundwater (and CCR-related constituents) originating from the BAP may migrate vertically downward through the UGU into the UA, or BU. Groundwater flows laterally to the west and southwest through the UGU and the BU and ultimately flows into the Kaskaskia River. Identified potential migration pathways at the Site include the thin sand lenses in the UGU adjacent to the BAP, and the area of contact between the UGU and the BU. Dissolved constituents in groundwater may partition between river sediments and Kaskaskia River surface water.

2.4 Groundwater Monitoring

A total of four wells have been used to monitor the groundwater quality downgradient of the BAP; these include MW-356, MW-369, MW-370, and MW-382 (Figure 2.2). These wells are screened in the upper aquifer (bedrock) (Table 2.1). The analyses presented in this report relied on all available data from the four wells collected between December 2015 and September 2022, 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, 2021),[1] as well as general water quality parameters (chloride, fluoride, sulfate, and total dissolved solids). A summary of the groundwater data used in this risk evaluation is presented in Table 2.2. The use of groundwater data in this risk evaluation does not imply that detected constituents are associated with the BAP or that they have been identified as potential groundwater exceedances.

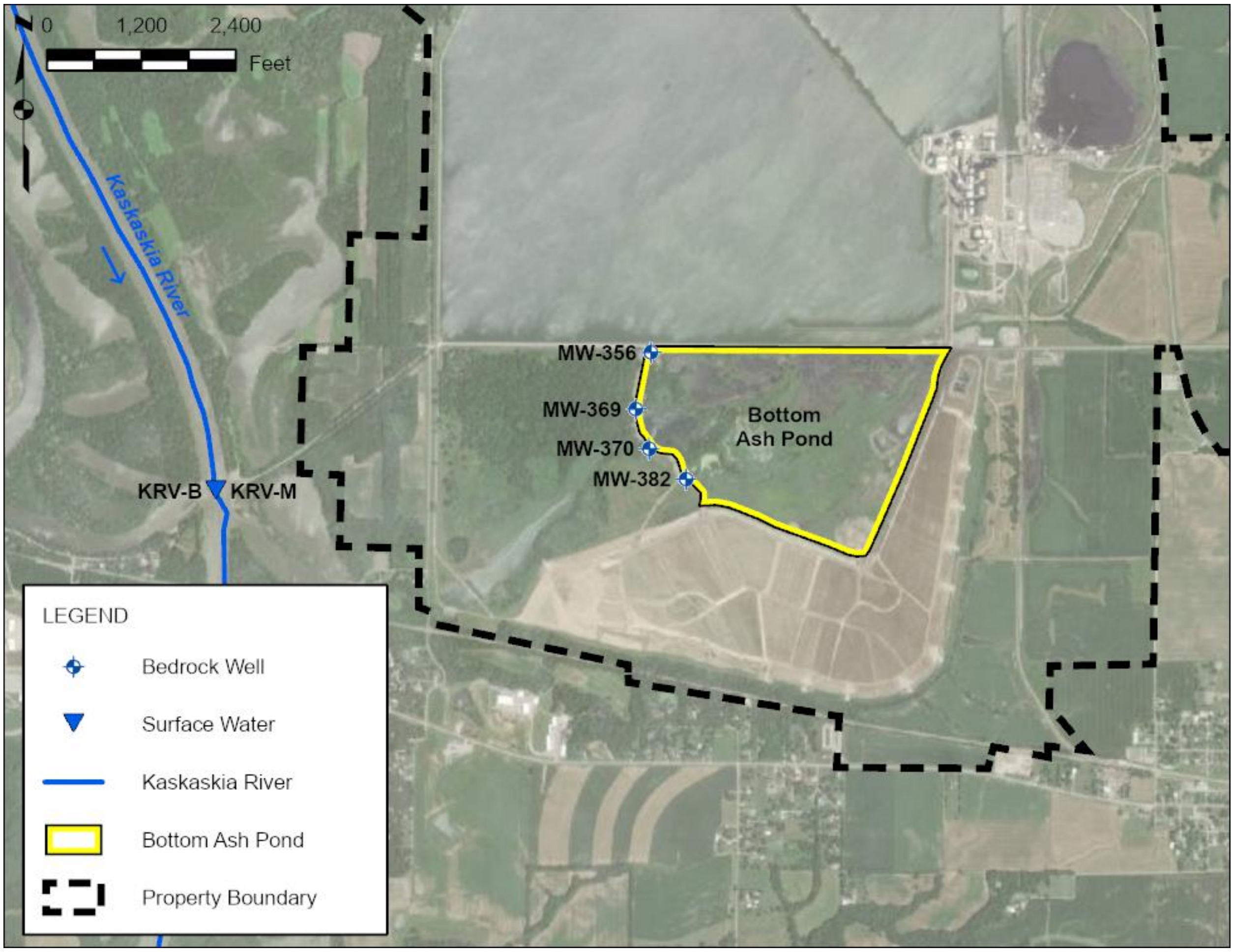

Figure 2.2 Monitoring Well Locations. Source: Ramboll (2021).

[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 Bottom Ash Pond

Well	Hydrogeologic Unit	Date Constructed	Screen Top Depth (ft bgs)	Screen Bottom Depth (ft bgs)	Well Depth (ft bgs)
MW-356	UA	10/1/2015	56.0	66.0	66.0
MW-369	UA	11/19/2015	56.0	66.0	66.0
MW-370	UA	11/25/2015	53.0	63.0	63.0
MW-382	UA	11/23/2015	56.0	66.0	66.0

Notes:
bgs = Below Ground Surface; ft = Feet; UA = Uppermost Aquifer (Bedrock).
Source: Ramboll (2021).

Table 2.2 Groundwater Data Summary

Constituent	Samples with Constituent Detected	Samples Analyzed	Minimum Detected Value	Maximum Detected Value	Maximum Laboratory Detection Limit
Total Metals (mg/L)					
Antimony	10	60	0.0011	0.0038	0.0038
Arsenic	50	72	0.0006	0.014	0.0139
Barium	72	72	0.008	0.12	0.123
Beryllium	0	52			0.0005
Boron	76	76	0.592	2.9	2.92
Cadmium	0	52			0.0005
Calcium	76	76	4.12	110	110
Chromium	18	68	0.001	0.013	0.0131
Cobalt	9	64	0.0003	0.0039	0.0039
Lead	8	64	0.001	0.0049	0.0049
Lithium	72	72	0.0177	0.22	0.223
Mercury	0	52			0.0001
Molybdenum	61	72	0.001	0.076	0.0761
Selenium	8	60	0.001	0.028	0.0275
Thallium	0	52			0.001
Radionuclides (pCi/L)					
Radium 226+228	72	72	0.01	4.8	4.84
Other (mg/L)					
Chloride	76	76	29	1,560	1,560
Fluoride	76	76	0.68	3.8	3.83
Sulfate	76	76	38	509	509
Total Dissolved Solids	76	76	636	3,320	3,320

Notes:
pCi/L = PicoCuries per Liter.
Blank cells indicate constituent was not detected.

2.5 Surface Water Monitoring

Two surface water samples were collected from the same location in the Kaskaskia River in November, 2016 (Hanson Professional Services Inc., 2017). The sample location is shown in Figure 2.2, and the sampling results are summarized in Table 2.3.

Table 2.3 Surface Water Data Summary

Constituent	Samples with Constituent Detected	Samples Analyzed	Minimum Detected Value	Maximum Detected Value	Maximum Laboratory Detection Limit
Total Metals (mg/L)					
Arsenic	0	2			0.013
Barium	2	2	0.073	0.074	0.074
Boron	2	2	0.040	0.042	0.042
Cadmium	0	2			0.0010
Chromium	0	2			0.0025
Chromium (hexavalent)	0	2			0.0050
Copper	0	2			0.0025
Cyanide	0	2			0.0025
Iron	2	2	1.2	1.2	1.2
Lead	0	2			0.0075
Manganese	2	2	0.22	0.23	0.23
Mercury	2	2	2.00E-06	4.00E-06	0.000004
Nickel	0	2			0.0025
Selenium	0	2			0.020
Silver	0	2			0.0025
Zinc	0	2			0.0050
Other (mg/L)					
Chloride	2	2	19	21	21
Fluoride	2	2	0.21	0.22	0.22
Oil and Grease	0	2			3.0
Phenols	0	2			0.0025
Phosphorus	2	2	0.26	0.26	0.26
Sulfate	2	2	23	23	23
Total Suspended Solids (TSS)	2	2	35	49	49
pH	2	2	8.1	8.2	8.2

Note:
Blank cells indicate constituent was not detected.

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 BAP 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.

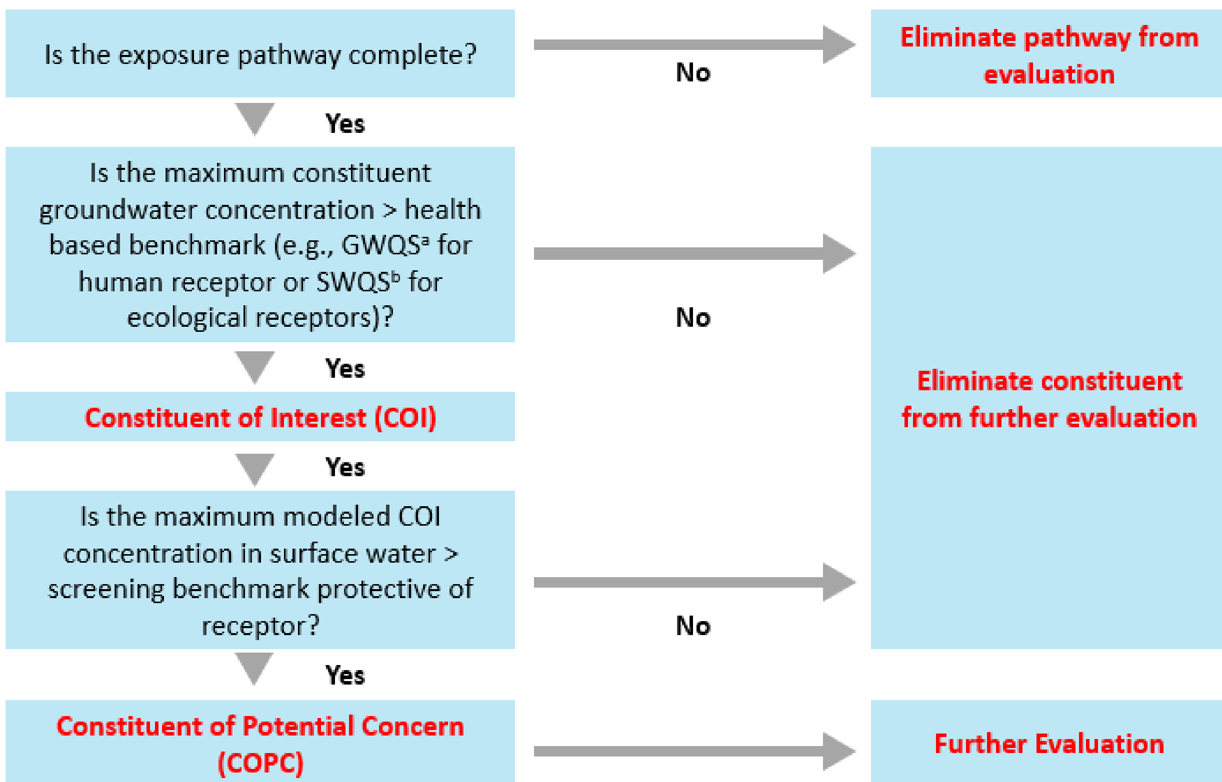

Figure 3.1 Overview of Risk Evaluation Methodology. IEPA = Illinois Environmental Protection Agency; GWQS = IEPA Groundwater Quality Standards; SWQS = IEPA Surface Water Quality Standards. (a) The IEPA Part 845 Groundwater Protection Standards (GWPS) were used to identify COIs. (b) IEPA SWQS protective of chronic exposures to aquatic organisms were used to identify ecological COIs. In the absence of an SWQS, US EPA Region IV Ecological Screening Values (ESVs) 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), some groundwater underlying the BAP has the potential to interact with surface water in the Kaskaskia River. Therefore, potential BAP-related constituents in groundwater may potentially flow toward and into surface water in the Kaskaskia River.

Surface water samples have been collected from Kaskaskia 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 BAP-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, but only 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 BAP 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.

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 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 BAP into groundwater, surface water, sediment, and fish. The following human receptors and exposure pathways were evaluated for inclusion in the Site-specific CEM.

[2] As discussed further in Section 3.3.2, GWQS 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.

- Residents – exposure to groundwater/surface water as drinking water;
- Residents – exposure to groundwater/surface water used for irrigation;
- Recreators in the river adjacent to 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. Section 3.2.1.2 provides additional description of the recreational exposures.

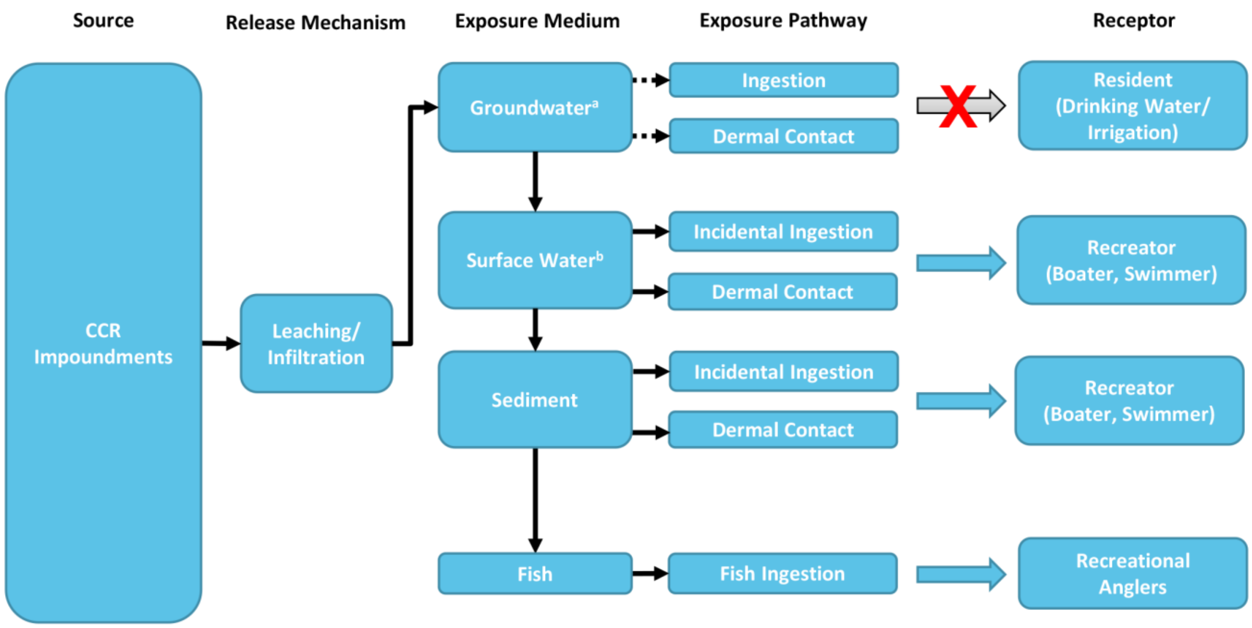

Figure 3.2 Human Conceptual Exposure Model. CCR = Coal Combustion Residuals. Dashed line/Red X = Incomplete or insignificant exposure pathway. (a) Groundwater in the vicinity of the Site is not used as a drinking water or irrigation source. (b) Surface water is not used as a drinking water source.

3.2.1.1 Groundwater or Surface Water as a Drinking Water/Irrigation Source

A receptor survey was conducted in 2021 to identify potential users of groundwater in the vicinity of the BAP (Ramboll, 2021). Specific sources that were used in this survey include the Illinois State Geological Survey (ISGS), Illinois State Water Survey (ISWS), and the IEPA (Ramboll, 2021). A total of 10 wells were identified within 1,000 meters of the BAP, which included six private water wells, four monitoring wells, and one temporary piezometer for Illinois Power (Figure 3.3). The wells are summarized in Table 3.1. The four monitoring wells, owned by Illinois Power, were installed in 1992 and are located north of the BAP but within the BPP. Well 121572596900, owned by Illinois Power, is 27 feet deep and screened in the UGU. Well 121572592700 is a private well 160 feet deep into the BU, but is listed as a dry hole. Both of these wells are shown as being on the BPP property (Figure 3.3), but their coordinates are likely incorrect. Furthermore, because Well 121572592700 is a dry hole, there is no exposure to impacted groundwater that can occur. Four private wells are located south of the BPP (Wells 121570240900, 121572280600, 121572284200, and 121572681800[3]) (Figure 3.3). These wells range in depth from 24 to 37 ft and are screened in the UGU. Groundwater beneath the BAP generally flows to the southwest towards the Kaskaskia River. These four private wells are side-gradient of the BAP and are not expected to be impacted by any CCR constituents in groundwater that originate from the BAP.

Table 3.1 Summary of Water Wells Within 1,000 Meters of the Bottom Ash Pond

API Number	Status	Date Drilled	Latitude	Longitude	Owner	Depth (ft)	Formation
121570240900	Water	4/16/1970	38.18528	-89.8698	Private	32	Sand & gravel
121572280600	Water	6/30/1974	38.18364	-89.8646	Private	24	Red sand & gravel
121572284200	Water	10/1/1974	38.18364	-89.8646	Private	33	Sand & gravel
121572592700	Water	1992	38.19013	-89.8724	Private	160	Lime
121572681800	Water	7/10/2021	38.18639	-89.8736	Private	37	Brown silty clay
121572596900	Water	3/19/1995	38.19013	-89.8724	Illinois Power	27	Silty - clay
121572594000	Monitoring	8/23/1992	38.20553	-89.8573	Illinois Power	23	Silty clay
121572594100	Monitoring	8/25/1992	38.20553	-89.8573	Illinois Power	18	Silty clay, med sand
121572594200	Monitoring	8/25/1992	38.20553	-89.8573	Illinois Power	18	NA
121572594300	Monitoring	8/25/1992	38.20553	-89.8573	Illinois Power	18	NA

Note:
NA = Not Available.

[3] Well 121572681800 was installed on 7/10/21 and is not included in the 2021 Ramboll HCR (Ramboll, 2021).

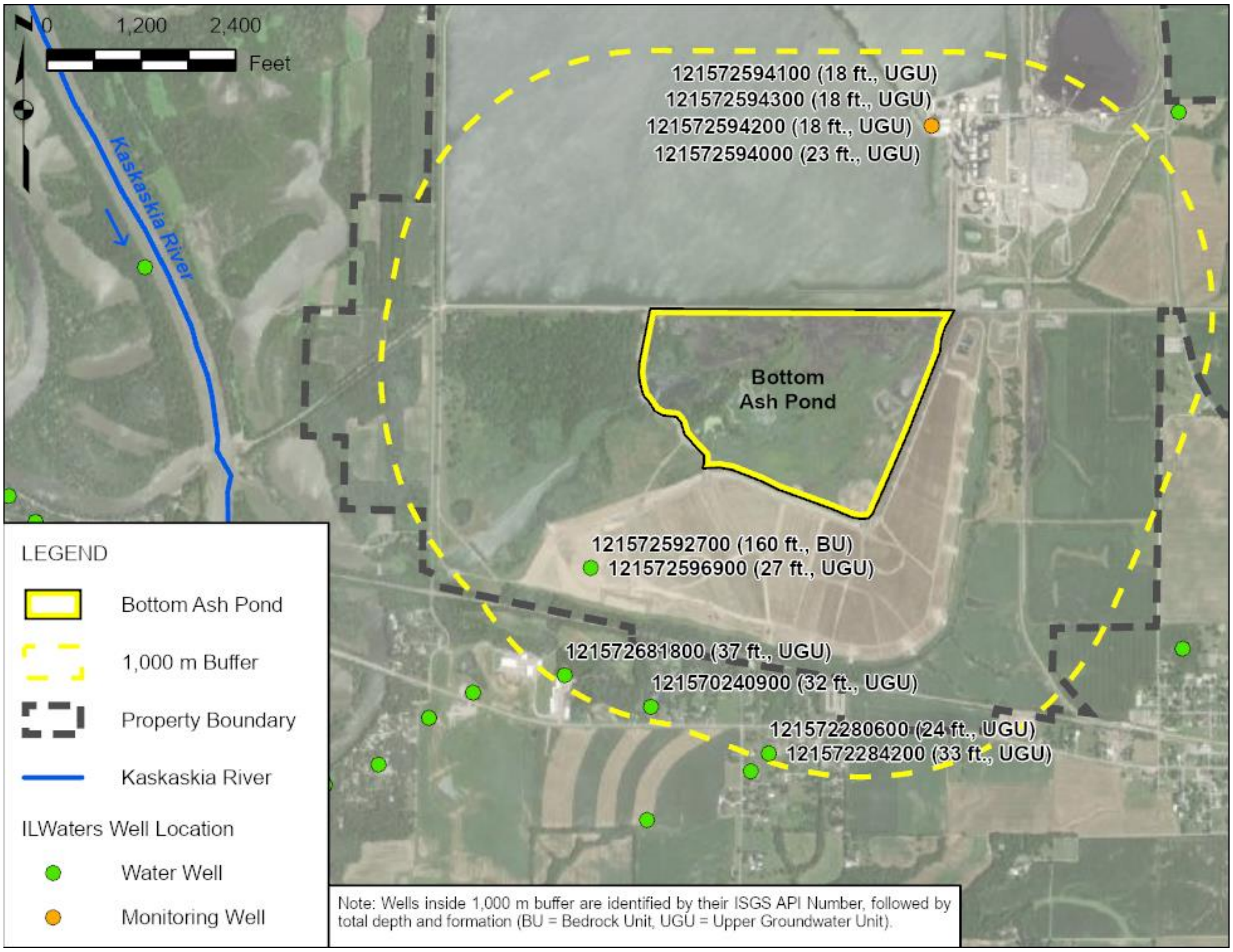

Figure 3.3 Water Wells Within 1,000 Meters of the Bottom Ash Pond. Source: Ramboll (2021).

3.2.1.2 Recreational Exposures

The Kaskaskia River is located to the west of the BPP. The river and its adjacent area to the west of the BPP are part of the Kaskaskia River State Fish and Wildlife Area (SFWA) (Figure 3.4) (Ramboll, 2021). "The Illinois Department of Transportation owns the land along the river and leases most of the land to the Illinois Department of Natural Resources to manage for fish, wildlife and other recreational activities" (IDNR, 2022). The recreational uses of the SFWA include fishing, boating, hunting (IDNR, 2022). Recreational exposure to surface water and sediment may occur during activities such as boating or fishing in the river. Recreational anglers may also consume locally caught fish from the Kaskaskia River.

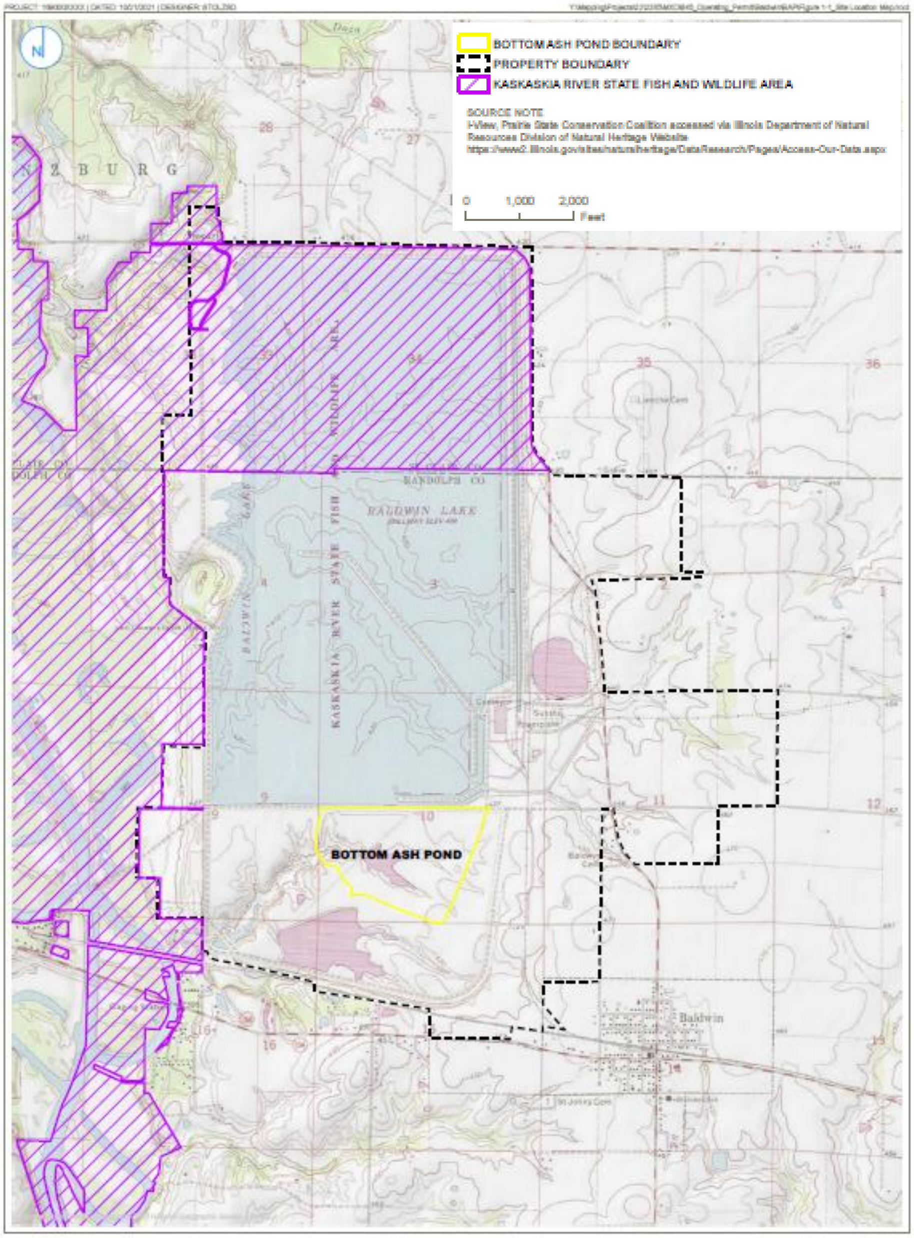

Figure 3.4 Kaskaskia River State Fish and Wildlife Area. Source: Ramboll (2021).

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 3.5 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).

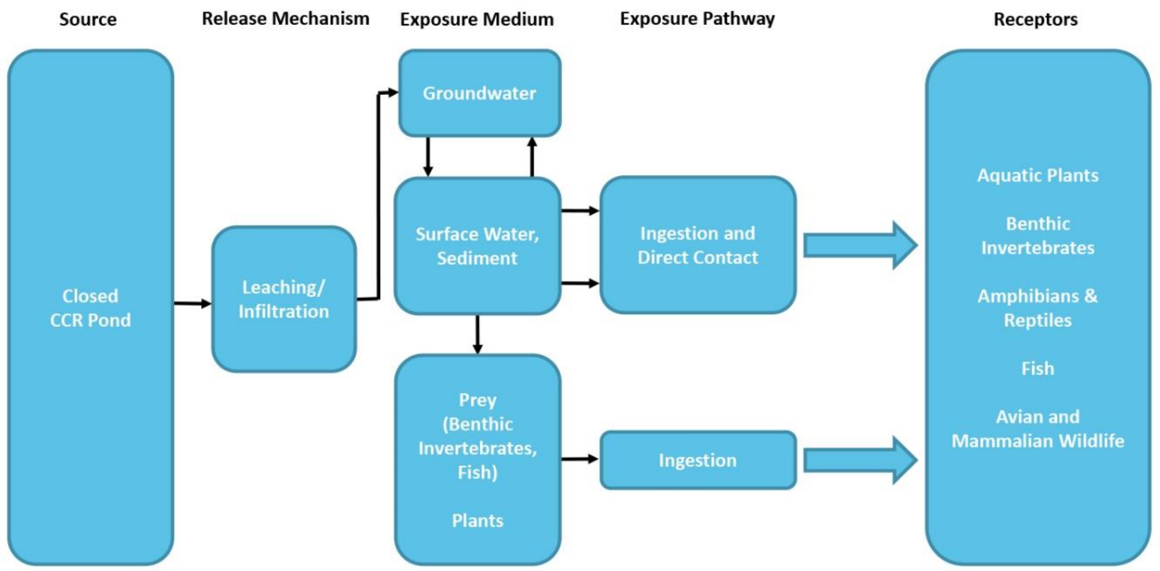

Figure 3.5 Ecological Conceptual Exposure Model. CCR = Coal Combustion Residuals.

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, 2021). Gradient used the maximum detected concentrations from groundwater samples collected from all of the BAP-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 BAP or that they have been identified as potential groundwater exceedances. Using this approach, 3 COIs (arsenic, boron, and lithium) were identified for the human health risk evaluation *via* the surface water pathway (Table 3.2).

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 is based on aesthetic quality and there is an absence of studies regarding toxicity to human health. 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, 2021). The secondary MCL for total dissolved solids (500 mg/L) is based on hardness, deposits, colored water, staining, and salty taste (US EPA, 2021). 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 3.2 Human Health Constituents of Interest

Constituents[a]	Maximum Concentration	GWPS[b]	Human Health COI[c]
Total Metals (mg/L)			
Antimony	0.0038	0.006	No
Arsenic	0.014	0.01	Yes
Barium	0.12	2	No
Beryllium	ND	0.004	No
Boron	2.9	2	Yes
Cadmium	ND	0.005	No
Calcium	110		No
Chromium	0.013	0.1	No
Cobalt	0.0039	0.006	No
Lead	0.0049	0.0075	No
Lithium	0.22	0.04	Yes
Mercury	ND	0.002	No
Molybdenum	0.076	0.1	No
Selenium	0.028	0.05	No
Thallium	ND	0.002	No
Radionuclides (pCi/L)			
Radium 226+228	4.8	5	No
Other (mg/L)			No
Chloride	1,560	200	No[d]
Fluoride	3.8	4	No
Sulfate	509	400	No[d]
Total Dissolved Solids	3,320	1,200	No[e]

Notes:
COI = Constituent of Interest; GWPS = Groundwater Protection Standard; MCL = Maximum Contaminant Level; ND = Not Detected; 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, 2021).
(b) The IL Part 845.600 GWPS (IEPA, 2021) 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, 2022a).[4]
- US EPA Region IV (2018) surface water Ecological Screening Values (ESVs) for hazardous waste sites.

Benchmarks from the United States Department of Energy's (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 BAP-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. The COIs identified for ecological receptors include radium-226+228 and chloride (Table 3.3).

[4] Hardness data are available from the Kaskaskia River at Roots, Illinois (USGS Site No. 595400), 16 miles downstream of the BPP. Based on 130 samples collected from April 1980 to March 1997, the average hardness at this location was 173 mg/L (USGS, 2022a). Due to the age of the samples and the distance from the site, the US EPA (2022a) 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 3.3 Ecological Constituents of Interest

Constituent[a]	Maximum Groundwater Concentration	Ecological Benchmark[b]	Basis	Ecological COI[c]
Total Metals (mg/L)				
Antimony	0.0038	0.19	US EPA R4 ESV	No
Arsenic	0.014	0.19	IEPA SWQC	No
Barium	0.12	5	IEPA SWQC	No
Beryllium		0.064	US EPA R4 ESV	No
Boron	2.9	7.6	IEPA SWQC	No
Cadmium		0.0011	IEPA SWQC	No
Chromium	0.013	0.21	IEPA SWQC	No
Cobalt	0.0039	0.019	US EPA R4 ESV	No
Lead	0.0049	0.02	IEPA SWQC	No
Lithium	0.22	0.44	US EPA R4 ESV	No
Mercury		0.0011	IEPA SWQC	No
Molybdenum	0.076	7.2	US EPA R4 ESV	No
Selenium	0.028	1	IEPA SWQC	No
Thallium		0.006	US EPA R4 ESV	No
Radionuclides (pCi/L)				
Radium-226+228	4.8	3	US DOE	Yes
Other (mg/L)				
Chloride	1,560	500	IEPA SWQC	Yes
Fluoride	3.8	4	IEPA SWQC	No
Sulfate	509	NA	NA	No
Total Dissolved Solids	3,320	NA	NA	No

Notes:
BAP = Bottom Ash Pond; COI = Constituent of Interest; GWPS = Groundwater Protection Standard; IEPA SWQC = Illinois Environmental Protection Agency Surface Water Quality Criteria; NA = Not Available; pCi/L = PicoCuries per Liter; US DOE = United States Department of Energy; US EPA R4 ESV = United States Environmental Protection Agency Region IV Ecological Screening Value.
Shaded = Compound identified as a COI.
(a) The constituents are those listed in the IL Part 845.600 GWPS (IEPA, 2021) that were detected in at least one groundwater sample from the wells related to the BAP.
(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

To estimate the potential contribution to surface water (and sediment) from groundwater specifically associated with the BAP, Gradient modeled concentrations in the Kaskaskia River surface water and sediment from groundwater flowing into the river for the detected human and ecological COIs. This is because the constituents detected in groundwater above an 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 December 2015 to

September 2022 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 into 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 BAP-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 partitioning 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, we 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) at the point where groundwater flows into surface water.

The aquifer properties used to estimate the volume of groundwater flowing into Kaskaskia River and surface water concentrations are presented in Table 3.4 (for the UGU) and Table 3.5 (for the UA or BU). The surface water properties used in the modeling are presented in Table 3.6. The COI concentrations in sediment were modeled using the COI-specific sediment-to-water partitioning coefficients and the sediment properties presented in Table 3.6. In the absence of Site-specific information for the Kaskaskia 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 3.7. These modeled concentrations reflect conservative contributions from groundwater. A description of the modeling and the detailed results are presented in Appendix A.

Table 3.4 Groundwater Properties Used in Modeling of the Upper Groundwater Unit (UGU)

Parameter	Value	Unit	Notes/Source
COI Concentration	Constituent specific	mg/L	Maximum detected concentration in groundwater.
Cross-Sectional Area for the UGU[a]	5,940	m^2	Length of the groundwater discharge zone (1,500 m) multiplied by the estimated thickness of the UGU/PMP intersecting Kaskaskia River (3.96 m) (Ramboll, 2021).
Hydraulic Gradient	0.013	m/m	Average horizontal hydraulic gradient determined for the UGU (Ramboll, 2021).
Hydraulic Conductivity of the UGU	0.000032	cm/s	Average horizontal hydraulic conductivity determined for the upper groundwater unit (Ramboll, 2021).

Notes:
COI = Constituent of Interest; PMP = Potential Migration Pathway; UGU = Upper Groundwater Unit.
(a) The cross-sectional area represents the area through which groundwater flows from the UGU to the Kaskaskia River.

Table 3.5 Groundwater Properties Used in Modeling of the Uppermost Aquifer (UA, or Bedrock Unit)

Parameter	Value	Unit	Notes/Source
COI Concentration	Constituent specific	mg/L	Maximum detected concentration in groundwater.
Cross-Sectional Area for the UA[a]	12,600	m^2	The length of the groundwater discharge zone (1,500 m) multiplied by the estimated thickness of the bedrock aquifer intersecting the Kaskaskia River (8.4 m) (Ramboll, 2021).
Hydraulic Gradient	0.015	m/m	Average horizontal hydraulic gradient determined for the bedrock aquifer (Ramboll, 2021).
Hydraulic Conductivity of the UA	0.000005	cm/s	Average horizontal hydraulic conductivity determined for the bedrock aquifer (Ramboll, 2021).

Notes:
COI = Constituent of Interest; UA = Uppermost Aquifer.
(a) The cross-sectional area represents the area through which groundwater flows from the UA to the Kaskaskia River.

Table 3.6 Surface Water Properties Used in Modeling

Parameter	Value	Unit	Notes/Source
Surface Water Flow Rate	5.4×10^{11}	L/year	Representative low-flow (10th percentile) discharge rate estimated at Kaskaskia River monitoring location USGS05595000 at New Athens, IL (2009-2022) (USGS, 2022b).
Total Suspended Solids (TSS)	84.5	mg/L	Median of suspended solid concentration measured in the Kaskaskia River monitoring location USGS05595000 at New Athens, IL (2015-2022) (USGS, 2022c).
Depth of the Water Column	2.74	m	Average water depth of the Kaskaskia River near BPP (Bist LLC, 2022).
Suspended Sediment to Water Partition Coefficient	Constituent specific	mg/L	Values based on US EPA (2014).

Notes:
BPP = Baldwin Power Plant; UA = Uppermost Aquifer; US EPA = United States Environmental Protection Agency; USGS = United States Geological Survey.

Table 3.7 Sediment Properties Used in Modeling

Parameter	Value	Unit	Notes/Source
Depth of Upper Benthic Layer	0.03	m	Default (US EPA, 2014).
Depth of Water Body	2.77	m	Depth of water column (2.74 m) in the Kaskaskia River (Bist LLC, 2022) plus depth of upper benthic layer (0.03 m) (US EPA, 2014).
Bed Sediment Particle Concentration	1	g/cm^3	Default (US EPA, 2014).
Bed Sediment Porosity	0.6	–	Default (US EPA, 2014).
Total Suspended Solids (TSS) Mass per Unit Area	0.23	kg/m^2	Depth of water column × TSS × conversion factors (10^{-6} kg/mg and 1,000 L/m^3).
Sediment Mass per Unit Area	30	kg/m^2	Depth of upper benthic layer × bed sediment particulate concentration × conversion factors (0.001 kg/g and 10^6 cm^3/m^3).
Sediment to Water Partitioning Coefficients	Constituent specific	mg/L	Values based on US EPA (2014).

Note:
US EPA = United States Environmental Protection Agency.

Table 3.8 Surface Water and Sediment Modeling Results

COI	Groundwater Concentration (mg/L or pCi/L)	Total Water Column Concentration (mg/L or pCi/L)	Concentration Sorbed to Bottom Sediments (mg/kg or pCi/kg)
Arsenic	0.014	2.8E-08	4.3E-06
Boron	2.9	6.0E-06	2.3E-05
Lithium	0.22	4.6E-07	(a)
Radium-226+228	4.84	9.9E-06	4.5E-02
Chloride	1,560	3.2E-03	(a)

Notes:
COI = Constituent of Interest; K_d = Equilibrium Partition Coefficient; pCi/kg = Picocuries per Kilogram; pCi/L = Picocuries per Liter.
(a) Lithium and chloride do not readily sorb to soil or sediment particles; a K_d value of 0 was used for the modeling, therefore, the modeled sediment concentration is 0.

3.4 Human Health Risk Evaluation

The section below presents the results of the human health risk evaluation for recreators (boaters and anglers) in the Kaskaskia 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 boating. In addition, anglers could consume fish caught in the Kaskaskia 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 boating) 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, 2022b) 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:

$$\text{HTC} = \frac{\text{TCR}}{(\text{SF} \times \text{BAF} \times \text{F})}$$

where:

HTC	=	Human health protection criterion in picoCuries per liter (pCi/L)
TCR	=	Target cancer risk (1×10^{-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 3.9). 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 boating. 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 boating and anglers consuming fish caught in the Kaskaskia River.

[5] Although recommended by US EPA (2015b), 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 3.9 Risk Evaluation of 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
Metals (mg/L)							
Arsenic	2.8E-08		0.022	2.0	0.023	No	NA
Boron	6.0E-06	4.2E-02	467	1,400	700	No	No
Lithium	4.6E-07		4.7	14	7.0	No	NA

Notes:
COI = Constituent of Interest; COPC = Constituent of Potential Concern; HTC = Human Threshold Criteria; NA = Not Applicable.
(a) Measured concentrations are listed only for the constituents identified as 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 activity in the Kaskaskia 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, 2022c). 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, 2022c). 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]). 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, 2022c). The sediment screening benchmarks were calculated based on a target hazard quotient of 1, or a target cancer risk of 1×10^{-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 3.10). Therefore, exposure to sediment is not expected to pose an unacceptable risk to recreators while boating.

Table 3.10 Risk Evaluation of Recreators Exposed to Sediment

COI	Modeled Sediment Concentration (mg/kg)	Recreator Sediment Screening Benchmark (mg/kg)	COPC
Total Metals (mg/kg)			
Arsenic	4.3E-06	6.8E+01	No
Boron	2.3E-05	2.7E+05	No
Lithium	(a)	2.7E+03	NA

Notes:

COI = Constituent of Interest; COPC = Constituent of Potential Concern; K_d = Equilibrium Partition Coefficient; NA = Not Applicable.

(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 3.5), ecological receptors could be exposed to surface water and dietary items (*i.e.*, prey and plants) potentially impacted by identified COIs (radium-226+228 and chloride).

3.5.1 Ecological Receptors Exposed to Surface Water

Screening Exposures: The ecological evaluation considered aquatic communities in the Kaskaskia 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, 2022a);[6]
- US EPA Region IV (2018) surface water ESVs for hazardous waste sites; and
- 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 and modeled COI concentrations in surface water were compared to the benchmarks protective of aquatic life (Table 3.11). The measured and modeled surface water concentrations for the COIs were below their respective benchmarks. Thus, none of the COIs evaluated are expected to pose an unacceptable risk to aquatic life in the Kaskaskia River.

[6] Conservatisms associated with using a default hardness value are discussed in Section 3.6.

Table 3.11 Risk Evaluation of Ecological Receptors Exposed to Surface Water

COI	Maximum Surface Water Concentration		Ecological Freshwater Benchmark	Basis	COPC	
	Modeled	Measured			Based on Modeled Concentration	Based on Measured Concentration
Radionuclides (pCi/L)						
Radium-226 + 228	9.9E-06	NA	3.0	US DOE (2019)	No	NA
Other (mg/L)						
Chloride	3.2E-03	19	500	IEPA SWQC (IEPA, 2019)	No	No

Notes:
COI = Constituent of Interest; COPC = Constituent of Potential Concern; IEPA SWQC = Illinois Environmental Protection Agency Surface Water Quality Criteria; NA = Not Applicable; pCi/L = PicoCuries per Liter; US DOE = United States Department of Energy.

3.5.2 Ecological Receptors Exposed to Sediment

Screening Exposures: COIs in impacted groundwater flowing into Kaskaskia 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 originating 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] 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 3.12.

Screening Risk Results: The maximum modeled COI sediment concentrations were below their respective sediment screening benchmarks (Table 3.12). 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 Kaskaskia River adjacent to the Site.

[7] The 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 3.12 Risk Evaluation of Ecological Receptors Exposed to Sediment

COI	Modeled Sediment Concentration	ESV	COPC	% of Benchmark
Radionuclides (pCi/kg)				
Radium 226 + 228	4.5E-02	90,000[a]	No	0.00005%
Other (mg/kg)				
Chloride	(b)	NA	No	-

Notes:
COI = Constituent of Interest; COPC = Constituent of Potential Concern; ESV = Ecological Screening Value; K_d = Equilibrium Partition Coefficient; NA = Not Available; pCi/kg = PicoCuries per Kilogram; US DOE = United States Department of Energy; US EPA = United States Environmental Protection Agency.
(a) ESV from US DOE (2019); value converted from 90 pCi/g to 90,000 pCi/kg.
(b) Chloride does not readily sorb to soil or sediment particles; a K_d value of 0 was used for the modeling, thus the modeled concentration in sediment is zero.

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 SWQS (IEPA, 2019) guidance were used to identify constituents with potential bioaccumulative effects.

Risk Evaluation: The ecological COIs (radium-226+228, chloride) 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, however, mercury was not detected in groundwater.[8]

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 (above GWPS) collected from wells associated with the BAP. However, it is possible that not all of the detected constituents are related specifically to the BAP.
- 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

[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.

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 BAP 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 into 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 BAP-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, 2015c). 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, and Gradient relied on US EPA's default hardness of 100 mg/L. Use of a higher hardness value would increase the cadmium SWQS because benchmarks 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. In addition, the measured surface water data used in this report represent total 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 BPP in Baldwin, Illinois. The CSM developed for the Site indicates that groundwater beneath the BAP flows into the Kaskaskia 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 (boaters) in the Kaskaskia River who are exposed to surface water and sediment, 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 2022 were used to estimate exposures. The available surface water data collected from the Kaskaskia River were 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 or ecological receptors resulting from CCR exposures associated with the BAP 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 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 in the Kaskaskia 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 concentrations are not expected to pose an unacceptable risk to recreators exposed to sediment in the Kaskaskia 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 Kaskaskia 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 BAP 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.

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Appendix A

Surface Water and Sediment Modeling

Gradient modeled concentrations of constituents of interest (COIs) in the Kaskaskia River surface water and sediment based on available groundwater data. First, we estimated the flow rate of COIs discharged to the Kaskaskia 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 Kaskaskia 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 Upper Groundwater Unit (UGU)/Potential Migration Pathway (PMP) and the Bedrock Unit (BU)/Uppermost Aquifer (UA) prior to flowing to the Kaskaskia River. For both layers, the groundwater flow entering the river is the flow going through a cross-sectional area that has a length equal to the length of the river adjacent to the Bottom Ash Pond (BAP) with potential coal combustion residuals (CCR)-related impacts and a height equal to each layer's estimated thickness. It was assumed that all the groundwater flowing through these two layers would ultimately discharge to the Kaskaskia River, thus the total flow into the river is the sum of the flows in the two layers. The length of the groundwater discharge zone was estimated using Google Earth Pro (Google, LLC, 2022).

The groundwater flow to the Kaskaskia 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 COI concentrations at a location downstream of the groundwater discharge point, 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 of each individual COI, in both the UGU and the UA. Further, Gradient ignored adsorption by subsurface soil and assumed that all the groundwater flowing through UGU and UA and intersecting the river bank was discharged into the river.

For each groundwater unit, the groundwater flow rate into the river was derived using Darcy's Law:

$$\mathrm{Q} = \mathrm{K} \times \mathrm{i} \times \mathrm{A}$$

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:

$$\mathrm{m_c} = \mathrm{C_c} \times \mathrm{Q} \times \mathrm{CF}$$

where:

m_c	=	Mass discharge rate of the COI (mg/year)
C_c	=	Maximum groundwater concentration of the COI (mg/L)
Q	=	Groundwater flow rate (m^3/s)
CF	=	Conversion factors: 1,000 L/m^3 and 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 UGU and UA were 5,943 and 12,600 m^2, respectively. The length of the discharge zone was estimated to be approximately 1,500 m. The height of the discharge zone was estimated to be 3.96 m for the UGU and 8.40 m for the UA (Ramboll, 2021). The average horizontal hydraulic gradient was 0.013 m/m for the UGU and 0.015 m/m for the UA (calculated from data in Ramboll, 2021). The average horizontal hydraulic conductivity of the UGU was 0.000032 cm/sec and the UA was 0.000005 cm/sec (calculated from data in Ramboll, 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 Gradient 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," referred to herein as the CCR risk assessment (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 values). 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, we used the K_d values provided in the US EPA CCR risk assessment for all of the COIs (US EPA, 2014, Table J-1). 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 follows (US EPA, 1998):

$$C_{wtot} = \frac{m_c}{V_f \times f_{water}}$$

where:

C_{wtot} = Total water body concentration of the COI (mg/L)
m_c = Mass discharge rate of the COI (mg/year)
V_f = Water body annual flow (L/year)
f_{water} = Fraction of the COI in the water column (unitless)

For the Kaskaskia River annual flow rate, Gradient conservatively used the low-flow (10^{th} percentile) discharge rate of about 606 cubic feet per second (cfs), or 5.4×10^{11} L/year, based on the daily mean discharge rates measured at the United States Geological Survey (USGS) gauging station at New Athens, Illinois (USGS Station 05595000) between 2009 and 2022 (USGS, 2022a). 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). The fraction of COIs in the water column is defined as follows (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 84.5 mg/L based on the median suspended sediment concentration measured at the USGS gauging station at New Athens, Illinois (USGS Station 05595000) between 2015 and 2022 (USGS, 2022b).
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 Kaskaskia River near the Baldwin Power Plant (BPP) (Bist LLC, 2022).
d_b	=	Depth of the upper benthic layer (m). Set equal to 0.03 m (US EPA, 2014).
d_z	=	Depth of the water body (m). Calculated as $d_w + d_b$. Set equal to 2.77 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 follows (US EPA, 2014):

$$f_d = \frac{1}{1 + K_{dsw} \times TSS \times 0.000001}$$

The values for the fraction of COI 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 follows (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 follows (US EPA, 2014):

$$C_{dw} = f_d \times C_{wcTot}$$

The dissolved water column concentration (C_{dw}) 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 COI in the benthic sediments, the model derives the total concentration in benthic sediments (US EPA, 2014):

$$C_{bstot} = f_{benth} \times C_{wtot} \times \frac{d_z}{d_b}$$

where:

C_{bstot} = Total COI concentration in bed sediment (mg/L or g/m^3)
C_{wtot} = Total water body COI concentration (mg/L)
f_{benth} = Fraction of COI in benthic sediments (unitless)
d_b = Depth of the upper benthic layer (m)
d_z = Depth of the water body (m). Calculated as $d_w + d_b$.

This value can be used to calculate dry weight sediment concentration as follows:

$$C_{sed\text{-}dw} = \frac{C_{bstot}}{bsc}$$

where:

$C_{sed\text{-}dw}$ = 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 sum of the COI concentration dissolved in the bed sediment pore water (equal to the concentration dissolved in the water column) and the COI concentration sorbed to benthic sediments (US EPA, 1998).

The COI concentration sorbed to benthic sediments was calculated as follows (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, dry weight sediment concentration, and 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
UGU	A	Cross-Sectional Area	5,940	m^2
UGU	i	Hydraulic Gradient	0.013	m/m
UGU	K	Hydraulic Conductivity	0.000032	cm/s
UA	A	Cross-Sectional Area	12,600	m^2
UA	i	Hydraulic Gradient	0.015	m/m
UA	K	Hydraulic Conductivity	0.000005	cm/s

Notes:
UA = Uppermost Aquifer or Bedrock Unit; UGU = Upper Groundwater Unit or PMP (Potential Migration Pathway).
Source: Hydraulic gradient and hydraulic conductivity values from Ramboll (2021).
Cross-sectional area was estimated from Ramboll (2021).

Table A.2 Partition Coefficients

Constituent	Mean Sediment-Water Partition Coefficient (K_{dbs})		Mean Suspended Sediment-Water Partition Coefficient (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
Boron	0.8	6.31E+00	3.9	7.94E+03
Lithium[a]	–	0	–	0
Radionuclides				
Radium-226+228	–	7.40E+03	–	7.40E+03

Notes:
Source: US EPA (2014).
(a) Lithium does not readily sorb to soils and sediments. Consequently, sediment concentrations were not modeled for this constituent (K_d was assumed to be 0).

Table A.3 Surface Water Parameters

Parameter	Name	Value	Unit
TSS	Total Suspended Solids	84.5	mg/L
V_{fx}	Surface Water Flow Rate	5.4×10^{11}	L/year
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]	0.23	kg/m^2
M_S	Sediment Mass per Unit Area[b]	30	kg/m^2

Notes:
CF = Conversion factor.
Source of default values: US EPA (2014).
(a) M_{TSS} = TSS × d_w × CF1 x CF2.
(b) M_S = d_b × bsc x CF3 x CF4.
CF1 = 1,000 L/m^3; CF2 = 1E-06 kg/kg; CF3 = 1E+06 cm^3/m^3; CF4 = 0.001 kg/g.

Table A.4 Calculated Parameters

COI	Fraction of COI in the Water Column (f_{water})	Fraction of COI in the Benthic Sediments ($f_{benthic}$)	Fraction of COI Dissolved in the Water Column ($f_{dissolved}$)
Metals			
Arsenic	0.38	0.62	0.60
Boron	0.96	0.04	0.60
Lithium	0.99	0.01	0
Radionuclides			
Radium-226+228	0.02	0.98	0.62

Note:
COI = Constituent of Interest.

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)
Metals				
Arsenic	0.014	1.5E+04	2.8E-08	4.3E-06
Boron	2.9	3.2E+06	6.0E-06	2.3E-05
Lithium	0.22	2.4E+05	4.6E-07	(a)
Radionuclides				
Radium-226+228	4.84	5.3E+06	9.9E-06	4.5E-02

Notes:
COI = Constituent of Concern; pCi/kg = Picocuries per Kilogram; pCi/L = Picocuries per Liter.
(a) Lithium does not readily sorb to soils and sediments. Consequently, sediment concentrations were not modeled for this constituent (K_d was assumed to be 0).

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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
Boron	1	(c)	NC	0.20	14	467	1,400	700
Lithium	1	(c)	NC	0.002	0.14	4.7	14	7.0

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; 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.

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	

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
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
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

Notes:

COI = Constituent of Interest; CSF = Cancer Slope Factor; NC = No Criterion Available; 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: c = based on cancer endpoint, nc = based on non-cancer endpoint.

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)

Intake Factor (IF) = $\frac{IR \times EF \times ED \times CF}{BW \times AT}$ =		Non-Cancer		Cancer		Basis
		7.3E-07	6.8E-08	6.3E-08	2.0E-08	
		Child	Adult	Child	Adult	
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, 2022b)
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, 2022b)
AT	Averaging Time (days)	2,190	7,300	25,550	25,550	Default value for Resident (US EPA, 2022b)

Sediment – Dermal Contact (Chemical)

Intake Factor (IF) = $\frac{SA \times AF \times EF \times ED \times CF}{BW \times AT}$ =		Non-Cancer		Cancer		Basis
		2.2E-06	1.2E-06	1.9E-07	3.6E-07	
		Child	Adult	Child	Adult	
SA	Surface Area Exposed to Sediment (cm²/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/cm²)	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, 2022b)
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, 2022b)
AT	Averaging Time (days)	2,190	7,300	25,550	25,550	Default value for Resident (US EPA, 2022b)

Appendix B

Supporting Information for the Closure Alternatives Analysis – Bottom Ash Pond at the Baldwin Power Plant

Prepared for

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CLOSURE ALTERNATIVES ANALYSIS SUPPORTING INFORMATION REPORT

BALDWIN POWER PLANT
BOTTOM ASH POND
(IEPA ID W1578510001-06)
Baldwin, Illinois

Prepared by

Geosyntec consultants
engineers | scientists | innovators

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Project Number GLP8050

July 31, 2023

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1. INTRODUCTION AND BACKGROUND

Dynegy Midwest Generation, LLC (DMG) is the owner of the coal-fired Baldwin Power Plant (BPP) in Baldwin, Illinois. The BPP is currently active. DMG intends to complete closure of the Bottom Ash Pond (BAP) at the BPP (IEPA ID No. W1578510001-06, DMG CCR Unit ID 601, and National Inventory of Dams Number IL50721). Closure of the BAP will be performed under the relevant Illinois Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845) [1] and the United States Environmental Protection Agency (USEPA) CCR Rule [2].

Part 845 requires a Closure Alternatives Analysis (CAA) to be completed, pursuant to the requirements of Section 854.710, to support the Closure Plan prepared pursuant to Section 845.720. The CAA for the BPP BAP will be performed by Gradient Corporation (Gradient). Geosyntec has prepared this Closure Alternatives Analysis Supporting Information Report (Report) to provide information requested by Gradient to support their preparation of the CAA.

1.1. Report Contents

The following information is contained within this report:

- **Section 1** includes the Introduction and Background;
- **Section 2** includes information related to closure-by-removal (CBR) including:
    - A feasibility evaluation of CBR using an onsite landfill (CBR-Onsite);
    - An evaluation of potential offsite landfills to receive the CCR for CBR-Offsite; and
    - A feasibility evaluation of CCR transportation for CBR-Offsite using over-the-road trucks, rail, and barges.
- **Section 3** includes an overview of construction activities that would occur for both CIP and CBR-Offsite;
- **Section 4** includes a project schedule for both CIP and CBR-Offsite; and
- **Section 5** includes estimates for construction material quantities, labor, vehicle miles, and equipment miles, for both CIP and CBR-Offsite.

2. CLOSURE-BY-REMOVAL INFORMATION

Section 845.710(c)(1) requires the evaluation of complete removal of CCR (e.g., CBR), and Section 845.710(c)(2) requires the CAA to identify if the Power Plant has a landfill that can accept the CCR, or if constructing an onsite landfill of sufficient capacity is feasible. Additionally, Section 845.710(c)(1) requires the evaluation of multiple modes of transportation of CCR, including rail, barge, and truck. This section includes evaluation of onsite landfill options, potential offsite landfills, and potential methods for transporting CCR to offsite landfills.

2.1. Evaluation of Onsite Landfill Options

2.1.1. Feasibility of New Onsite Landfill Construction

Areas inside the BPP Site boundaries were evaluated for suitable areas for the construction of a new onsite landfill for disposing of the approximately 3.8 million CY of CCR within the BAP. The Site was divided into multiple areas, Area 1 through Area 14, as shown in **Figure 1**. The potential feasibility of constructing a new landfill in each area is described below. Additionally, utility scale solar and battery energy storage facility are planned at the Site. Areas 1 through 5 are most likely to be impacted.

- Area 1 is approximately 141 acres in size and is located north of the BPP.
  - High voltage overhead electric runs diagonally from the northeast to the southwest corner and along the west side of Area 1.
  - The remaining area is intersected by multiple utility service right-of-ways (ROWs) for three high voltage electric lines leading to the switchyard at the BPP. These electric lines will likely remain in-service after the BPP is closed. Construction of a landfill in this area would likely require relocation of the utilities.
  - Therefore, small areas north to northwest (20 acres) and southeast (30 acres) of the utility service ROWs would not be large enough for construction of a landfill.
- Area 2 is approximately 160 acres in size and is located immediately east of the BPP, extending slightly south.
  - Area 2 contains two utility service ROWs, including high-voltage electric lines leading to the switchyard at the BPP. These utilities are assumed to be active and some are expected to remain active after electricity generation is ceased at BPP. Construction of a landfill in this area would likely require negotiations with the ROW holder and relocation of the utilities.
  - Approximately seven (7) acres of the northwest corner of Area 2 is within the 100-year floodplain of the Kaskaskia River.

- The west end of Area 2 was previously used for borrow soil.
- The southern portion of Area 2 may be used as borrow soil for the project.
- Therefore, there are no feasible locations for constructing a landfill within Area 2, due to borrow source plans and utility conflicts.

- Area 3 is approximately 77 acres in size and is located slightly southeast of the BPP.
    - Area 3 has been designated as borrow material for future construction activities at Baldwin and would need to be reserved for borrow soils for the construction of an onsite landfill.
    - Therefore, there are no feasible locations for constructing a landfill within Area 3, due to potential use as a borrow area.
- Area 4 is approximately 68 acres in size and is located immediately southeast of the BPP, directly south of Area 3.
    - Area 4 contains multiple utility service corridors and ROWs.
    - This area contains active farmland.
    - Therefore, there are no feasible locations for constructing a landfill within Area 4 due to conflicts with existing farmland and utility ROWs.
- Area 5 is approximately 112 acres and is located south of the BPP and immediately east of the BAP.
    - Existing infrastructure is situated in the northwest corner of Area 5.
    - Approximately 11 acres of the northeast corner of Area 5 is within the 100-year floodplain of the Kaskaskia River.
    - This area is intersected by the plant entrance road and other minor access routes.
    - This area is intersected by overhead power lines.
    - Therefore, there are no feasible locations for constructing a landfill within Area 5, due to the existing infrastructure.
- Area 6 is approximately 168 acres in size and is located immediately southwest of the Fly Ash Pond System (FAPS).
    - Area 6 is too narrow to contain the volume of CCR within the BAP.

- This area is intersected by multiple roadways that provide access around the BAP and to storage areas.
- This area is intersected by a railway in the southern portion and a railway along the eastern edge.
- Approximately eight (8) acres of the western portion of Area 6 is within the 100-year floodplain of the Kaskaskia River.
- Therefore, there are no feasible locations to construct a landfill in Area 6 due to size limitations and conflicts with existing infrastructure.

- Area 7 is approximately 230 acres in size and is located immediately south of the BAP.
  - Approximately 62 acres of the western portion of Area 7 is within the 100-year floodplain of the Kaskaskia River.
  - This area contains the closed FAPS and lagoon.
  - Therefore, there are no feasible locations for construction of a landfill within Area 7, due to the existing closure.
- Area 8 is approximately 177 acres in size and is located immediately south of the Cooling Pond.
  - Area 8 consists of the current BAP.
  - Approximately five (5) acres of the western portion of Area 8 is within the 100-year floodplain of the Kaskaskia River.
  - Therefore, there are no feasible locations for construction of a landfill within Area 8, due to the existing active BAP.
- Area 9 is approximately 103 acres in size and is located immediately west of the BAP.
  - Area 9 is being used as a borrow area and has limited capacity for a landfill.
  - Therefore, there are no feasible locations for a landfill within this area due to active and continued use of the area for borrow, as well as infeasible area for a landfill.
- Area 10 is approximately 88 acres in size and is located southwest of the BAP, between Areas 7 and 9.

  - Area 10 consists of the Secondary Pond and Tertiary Pond utilized as stormwater basin and discharge directly to NPDES Outfall 001. These ponds will be needed throughout construction.
  - Approximately 38 acres of Area 10 is within the 100-year floodplain of the Kaskaskia River.
  - Therefore, there are no feasible locations for construction of a landfill within Area 10, due to the floodplain and the existing stormwater basins.
- Area 11 is approximately 371 acres in size and is located immediately west of the Cooling Pond, extending to the north and south.
  - This area is a thin strip of land, running north to south along the west side of the Cooling Pond. It is too narrow to contain the volume of CCR within the BAP.
  - Approximately 104 acres of Area 11 is within the 100-year floodplain of the Kaskaskia River.
  - This area would be infeasible for a landfill, as it has insufficient storage capacity for CCR and part of it is within a floodplain
- Area 12 is approximately 2,052 acres in size and is located immediately north of the BAP.
  - Area 12 consists of the Cooling Pond, which is required to remain untouched. The Cooling Pond is leased to the Illinois Department of Natural Resources (IDNR) for public recreation. It is designated as a State Fish and Wildlife Area.
  - Approximately 1,387 acres of Area 12 are within the 100-year floodplain of the Kaskaskia River.
  - Therefore, there are no feasible locations for a landfill within this area due to the existing Cooling Pond.
- Area 13 is approximately 301 acres in size and is located immediately east of the southeast corner of the Cooling Pond.
  - This area contains the BPP and coal pile.
  - Approximately 44 acres of Area 13 is within the 100-year floodplain of the Kaskaskia River.
  - Remaining areas not occupied by structures, parking lots, or switchyards, are intersected by multiple utilities including no less than six high-voltage electric line

ROWs and one natural gas line ROW. Construction of a landfill would require negotiations with the ROW holders and relocation of the utilities.

  - Therefore, there are no feasible locations for a landfill within Area 13 due to existing infrastructure.

- Area 14 is approximately 42 acres in size and is located east of the Cooling Pond and north of Coal Pile.
  - The northern portion of Area 14 is intersected by high power overhead voltage.
  - Area 14 is too small of an area for CCR within the BAP.
  - Therefore, there are no feasible locations for constructing a landfill within Area 14, due to insufficient size to support a single landfill with adequate capacity to retain the volume of CCR within the BAP.

In summary, there are no feasible locations for constructing a landfill within the existing BPP Site boundary. Several locations have multiple conflicts related to potential 100-year floodplain impacts, current or former CCR surface impoundments, planned utility scale solar and battery energy storage facilities, existing utility corridors and Site roadways, planned future property uses, and/or DMG property boundaries. A landfill may be built on a 100-year floodplain; however, additional measures must be taken to meet flood insurance requirements.

2.2. Potential CBR-Offsite Receiving Landfills

Potential offsite landfills suitable for disposing of the approximately 3.8 million CY of CCR within and outside of the BAP were evaluated for landfills within Illinois and nearby Missouri, and Kentucky. Information on the landfills were obtained from IEPA's online Illinois Disposal Capacity Report [3], the Kentucky Energy and Environment Cabinet Solid Waste Branch's Annual Survey Report [4], and the Missouri Department of Natural Resources' Solid Waste Management Map [5].

Information on all landfills is provided in **Table 1** and the location of each evaluated landfill relative to the BPP is provided in **Figure 2.1 and Figure 2.2**.

2.2.1. Illinois Landfills

There are four landfills in Illinois that are currently accepting outside CCR and have the capacity needed for the closure. The two closest landfills, by road and rail miles, are the Cottonwood Hills Refuse Derived Fuel (RDF) Landfill and the North Milam Landfill, both owned by Waste Management Solutions. The most suitable option for transport by barge, based on proximity to the Site and nearby commercial or public barge terminals is also the North Milam Landfill. Two additional Landfills in Illinois that are currently accepting outside CCR, are the West End Disposal Facility and the Southern Illinois Regional Landfill.

- The Cottonwood Hills RDF Landfill, located in Marissa, Illinois, is located approximately 10 road miles and 13 rail miles from the Site and has 27,914,312 in-place CY of remaining capacity.

- The North Milam Landfill, located in East St. Louis, Illinois is located 44 road miles, 35 rail miles, and 80 river miles from the Site and has 10,167,052 in-place CY of remaining capacity.

- The West End Disposal Facility, located in Thompsonville, Illinois is located 49 road miles from the Site and has 12,059,699 in-place CY of remaining capacity.

- The Southern Illinois Regional Landfill, located in Desoto, Illinois is located 78 road miles from the Site and has 17,963,371 in-place CY of remaining capacity.

Out of the four landfills, the Cottonwood Hills RDF Landfill was selected as the preferred landfill because it is closer to the BPP at 10 one-way road miles versus more than 40 one-way road miles, thereby resulting in reduced hauling mileage. Each landfill is within approximately two miles of existing rail lines; however, none of the locations have an existing rail terminal capable of unloading CCR. These four landfills in Illinois were evaluated for potential use as receiving landfills for CBR-Offsite.

For evaluating the feasibility of barge transport of CCR (discussed in **Section 2.3.2**), landfills near navigable waterways and commercial or public port facilities were also evaluated. The North Milam Landfill in East St. Louis, Illinois was found to be nearest to a navigable river and an existing commercial bulk material handling terminal (Cahokia Marine Terminal), at approximately 6 miles by road from the Mississippi River and 80 miles by the Kaskaskia and Mississippi Rivers from the BPP. The North Milam Landfill has 10,167,052 CY of remaining permitted capacity, which is sufficient to dispose of the 3.8 million CY of CCR from the BAP.

2.2.2. Missouri Landfills

Landfills within Missouri were also evaluated at a cursory level; however, the closest landfill accepting outside CCR is approximately 126 miles from BPP (Lemons Landfill in Dexter, MO), versus 44 to 78 road miles for the evaluated landfills in Illinois. No landfills in Missouri were located near the Mississippi River. Therefore, the Missouri landfills were excluded from additional evaluation.

2.2.3. Kentucky Landfills

The closest landfill identified that accepts outside CCR is the West KY Landfill in Mayfield, Kentucky, which is 150 road miles from the Site. This landfill accepts CCR and has 5,013,470 CY of remaining permitted capacity, which is barely sufficient to accept the 3.8 million CY of CCR contained within and outside of the BAP. It is likely that the landfill will not want to use up their remaining capacity and therefore, the landfill was excluded from additional evaluation.

2.3. Potential CBR-Offsite Transportation Methods

Section 845.710(c)(1) requires CBR to consider multiple methods for transporting removed CCR, including using rail, barge, and trucks. An evaluation of each method is included within this section.

2.3.1. Transportation by Rail

The BPP currently has an established railroad line which borders the BPP, as well as two industrial service tracks branching off from the Site property. For CCR to be transported by rail, the railroad line would have to be modified to construct a spur/terminal and loading facility on the BAP side, which would increase the project schedule due to the need to coordinate with the railroad, complete design, permitting, and construction of the terminal. CCR would still need to be hauled by off-road haul trucks to the new onsite loading terminal and loaded into rail cars.

The Cottonwood Hills Landfill, located in Marissa, Illinois, is the closest landfill to the Site with capacity to accept CCR from the BAP and has nearby railways. However, a rail spur would need to be built for the unloading of CCR at this landfill.

While the Cottonwood Hills Landfill, North Milam Landfill, West End Disposal Facility, and Southern Illinois Regional Landfill are located within approximately five miles of existing rail lines, an existing terminal suitable for the unloading of CCR is not present near any of the landfills. A CCR unloading rail terminal would need to be constructed for the selected landfill which would increase the project schedule due to the need to acquire land for the terminal, coordinate with the railroad, complete design and permitting, and construct the terminal. Additionally, CCR would need to be hauled by truck from the new offsite unloading terminal to the landfill resulting in additional CCR handling and exposure to the surrounding environment near the offsite receiving landfill.

Furthermore, a direct rail route from the BPP to the West End Disposal Facility and the Southern Illinois Regional Landfill does not exist. Hauling CCR to the West End Disposal Facility or Southern Illinois Regional Landfill would involve approximately 84 and 92 miles, respectively, of hauling by rail on tracks owned by three separate rail lines (BNSF, Union Pacific Railroad [UP], and Canadian National Railways [CN]), as shown on **Figure 2.2**. A direct rail route from the BPP to the Cottonwood Hills RDF Landfill exists but would require a rail spur to be installed for unloading of CCR. The ability of CCR to be hauled over multiple lines and transferred from line to line is currently unknown.

Therefore, transporting CCR by rail is unlikely to be a viable option for the BPP BAP, due to the need to design, permit, and construct additional loading and unloading infrastructure, resulting in corresponding project schedule delays, and the distance and number of rail lines which the CCR would need to be transported over.

2.3.2. <u>Transportation by Barge</u>

2.3.2.1. CCR Loading at BPP

The BPP is located along the Kaskaskia River, a tributary of the Mississippi River. However, for CCR to be hauled by barge from the BPP, a new loading terminal would need to be constructed, thereby increasing the project schedule due to the need to complete design, permitting, and construction.

A barge terminal is located at the Kaskaskia Regional Port District Dock No. 2 (KRPD #2), which is located approximately four miles from the BPP. Use of this terminal would require negotiating an agreement with the terminal owner and/or operator. The terminal is currently being utilized to load CCR for another power producer in the vicinity; however, the amount of CCR being loaded onto barges is limited. The terminal will likely need to be modified to increase capacity to allow for multiple barges to be loaded simultaneously and to allow for stockpiling of CCR. This would require the design, permitting, and construction of improvements, thereby increasing the project schedule. CCR would still need to be hauled by truck to the loading terminal and unloaded, resulting in additional potential exposure to the surrounding environment.

Transporting CCR by truck will incur significant amounts of additional truck traffic on the public roads between the Site and the terminal (approximately 4 miles one-way) and would require 250,000 round trip truckloads on public roadways.

2.3.2.2. CCR Unloading Near Receiving Landfills

For evaluating the feasibility of barge transport of CCR, landfills near navigable waterways and commercial or public port facilities were also evaluated. The Cottonwood Hills Landfill, West End Disposal Facility, and Southern Illinois Regional Landfill are not located near a river, thereby making transporting CCR to any of them by barge infeasible. The North Milam Landfill is estimated to be the closest landfill to the Site accessible by river.

The North Milam Landfill is located approximately six (6) miles from an existing commercial bulk material handling terminal on the Mississippi River (Cahokia Marine Terminal) in East St. Louis, Illinois, which is approximately 80 miles by river from the BPP, as shown in **Figure 2.1**. To utilize the Cahokia Marine Terminal, an agreement would need to be negotiated with the terminal owner. It is unknown if this terminal is suitable for the unloading of CCR. If the terminal is not suitable, it would require design, permitting, and construction of improvements to allow CCR to be unloaded. Unloading and trucking of CCR at this location may also result in CCR exposure within an urban environment that is located within a community designated by the Illinois EPA to be an Environmental Justice Area [6]. Therefore, this landfill was not considered a feasible option for disposal of CCR and impacted soils within the BPP BAP.

Transporting CCR by barge would still require that CCR be hauled by truck from the unloading terminal to the landfill and unloaded, resulting in additional CCR handling and exposure to the surrounding environment and communities. Additionally, transporting CCR by truck will incur significant amounts of additional truck traffic on the public roads between the port and the chosen offsite landfill (approximately 6 miles one-way) would require 250,000 round trip truckloads on public roadways.

Therefore, transporting CCR by barge is unlikely to be a viable option for the BPP BAP, due to the need to design, permit, and construct additional loading and unloading infrastructure, resulting in corresponding project schedule delays. Additionally, the total truck loads for transportation to barge facilities would be twice as many, and the total hauling mileage would be the same, compared to transporting all of the CCR by truck to the closer Cottonwood Hills Landfill.

2.3.3. Transportation by Truck

The BPP borders Baldwin Road and intersects IL-18, IL-154, and IL-13, all of which are suitable for accommodating truck hauling traffic. The routes necessary to haul to the evaluated landfills are noted below:

- Cottonwood Hills RDF Landfill - Old Baldwin Road links the BPP to Risdon School Road, which intersects Risdon School Road. Risdon School Road links to Winter Road/State Route 49, which links Hillstown Road to the Cottonwood Hills RDF Landfill.

- West End Disposal Facility - IL-154 links the BPP to IL-148 which links to I-9 and IL-14. IL-14 becomes IL-34 in Benton, Illinois, which links the BPP to the West End Disposal Facility.

- Southern Illinois Regional Landfill - IL-154E links the BPP to State Route 4S which links to the Southern Illinois Regional Landfill.

- North Milam Landfill - Baldwin Road intersects IL-13W which links IL-15W and I-64W to Ohio Avenue. Ohio Avenue links BPP to the North Milam Landfill.

Potential travel routes between the BPP and: Cottonwood Hills RDF Landfill, North Milam Landfill, West End Disposal Facility, and the Southern Illinois Regional Landfill are provided in **Figure 2.1 and Figure 2.2**, respectively.

Transporting CCR by truck will not require the construction of additional loading or unloading infrastructure at either the receiving landfill or the BPP. CCR would be loaded into truck using heavy equipment at the BAP. CCR will then be unloaded at the receiving landfill by the truck directly. However, truck transportation may require upgrades or other infrastructure improvements to local roadways in order to accommodate increased traffic volumes (i.e., site entrances, signals, signage), both near BPP and near the receiving landfill. Because of ability to initiate trucking with installing a limited amount of new loading and unloading infrastructure at BPP and the receiving landfill relative to other options, transporting CCR by truck was considered to be a viable option for disposal of CCR and soils within the BPP BAP and was evaluated further, as discussed in **Section 4** and **Section 5**, below.

Transporting CCR by truck will result in significant amounts of additional truck traffic (250,000 loads) on the public roads between the Site and the offsite landfill (approximately 10 miles one-way). The rate of trucks entering or leaving the Site may be as rapid as approximately one truck every three minutes.

3. CLOSURE DESCRIPTION NARRATIVES

Section 845.720(a)(1)(A) requires narrative description of CCR impoundment closures to be prepared. Narrative descriptions have been prepared for both CIP and CBR-Offsite and are included within this section.

3.1. CIP

A narrative description of how the BAP will be closed in place is provided in **Section 2.1** of the BPP Closure Plan [7].

3.2. CBR-Offsite

A description of how CBR-Offsite alternative will be completed is as follows:

- The BAP will be unwatered by pumping free surface water to the nearby non-CCR secondary pond (non-CCR surface impoundment displayed in **Figure 1**) for ultimate discharge at NPDES Outfall 001.

- A temporary water management system will be constructed within the BAP, including ditches, sumps, and/or temporary stormwater detention basin(s). The system will maintain the BAP in an unwatered state by collecting contact stormwater during closure construction. Unwatering flows will be pumped to the ponding area behind the dam to be used as a settling pond, prior to being pumped to the non-CRR secondary pond for ultimate discharge at NPDES Outfall 001.

- CCR will be removed from the BAP using mass mechanical excavation techniques. Some of the CCR is expected to be saturated or nearly saturated, so mass excavation will include the use of dewatering trenches or other forms of passive dewatering (i.e., rim ditching or windrowing), as and if needed to lower the moisture content of the CCR via free liquid removal prior to handling. Free liquid is to be removed prior to loading onto trucks to facilitate acceptance at the offsite landfill. Dewatering flows will be pumped to the ponding area behind the dam for ultimate discharge at NPDES Outfall 001.

- The BAP bottom and side-slopes will be decontaminated by removing all visible CCR and an estimated depth of one foot of native soils beneath the CCR.

- CCR and excavated CCR-impacted native soils will be loaded into over-the-road dump trucks and hauled to the offsite receiving landfill. If the CCR is excessively dry prior to loading, it may be moisture-conditioned by spraying with water to reduce the potential for fugitive dust emissions at the barge unloading terminal and/or receiving landfill.

- Any observed CCR outside of the BAP boundary will also be excavated. An estimated depth of one foot of CCR-impacted native soils beneath the CCR will be excavated. Both the CCR and native soils will be disposed of in the offsite receiving landfill.

- Non-CCR within the existing BAP embankments will be excavated and used as backfill within the closure-by-removal footprint of the BAP to provide surface water drainage to the Outfall, as and if needed. Remaining portions of the perimeter dikes that are not utilized as borrow material will remain in-place.

- An embankment dam (BAP dam) is located southwest of the BAP. The dam will be notched, and post-closure stormwater flows from the BAP area through the dam will continue to flow to the Secondary Pond.

- Following excavation of the CCR from the consolidated area, the area will be graded to drain surface water. This area will be made to drain towards the notched dam and flow to the Secondary Pond.

- Disturbed areas will be restored by fertilizing and establishing vegetation. Vegetation will include upland species (e.g., grasses) in most areas, although species capable of growing in wet environments, and/or trees, and in the area of the BAP where CCR will be removed.

- Temporary stormwater best management practices (BMPs) such as erosion control blankets, straw wattles, detention basins, and/or check dams, will be used, as needed to reduce erosion during vegetation establishment.

- After vegetation is established, BMPs will be removed, and closure construction will be considered completed.

4. CONSTRUCTION SCHEDULES

Section 845.720(a)(1)(F) requires a schedule including all activities necessary to complete closure to be prepared. Schedules have been prepared for both CIP and CBR-Offsite and are included within this section. Schedules were prepared using estimates of task durations based on Geosyntec's experience, typical weather conditions at the site, likely production rates in CCR excavation and hauling based on site-specific considerations, and expected construction rates relative to estimated construction quantities.

4.1. CIP

The proposed closure completion schedule for CIP is provided in **Section 2.6** of the BPP Closure Plan [7].

4.2. CBR-Offsite

The proposed closure construction schedule for CBR-Offsite is provided in **Table 2**. The same schedule was utilized for transportation using trucks, as the construction duration is primarily based on daily production rates for onsite earthwork.

5. MATERIAL, QUANTITY, LABOR, AND MILEAGE ESTIMATES

Estimates of material quantities, total labor hours, and mileage were prepared for each alternative to support DMG in preparing the CAA. Estimates for CIP and CBR-Offsite using trucks were prepared utilizing the following approach:

- Major construction components and line-items were identified, in accordance with the narrative closure description (**Section 3**).
- Construction quantities were estimated based on volume estimates, area estimates, and proposed construction schedules (**Section 4**).
- For CIP, soil fill was assumed to come from an onsite borrow source located east of the BAP.
- RSMeans Heavy Construction Cost Data [8] (RS Means) was used to estimate the crew size, equipment description, and daily output associated with each line-item.
- For line-items where RSMeans data was not available, the crew size, equipment description, and daily output were estimated based on Geosyntec's experience, information from contractors, and/or information from material suppliers.
- Daily labor mobilization miles were estimated assuming an average one-way commute of 35 miles for each individual working onsite. The number of working days were estimated from the construction schedules (**Section 4**).
- Estimates of haul truck mileage were based on the assumed round-trip haul distance and dump truck size. All dump trucks were assumed to be filled to capacity.
- Estimates of material delivery miles were prepared based on Geosyntec's experience.

The detailed quantity, labor, and mileage estimates for CIP are provided in **Table 3** and **Table 4**, respectively. Similar information for CBR-Offsite with trucks is provided in **Table 5** and **Table 6**.

6. REFERENCES

[1] Illinois Environmental Protection Agency, "35 Ill. Adm. Code Part 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments," Springfield, IL, 2021.

[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, "Illinois Landfill Disposal Capacity Report," July 2022.

[4] Kentucky Energy and Environment Cabinet Solid Waste Branch, "Annual Survey Report," 2021.

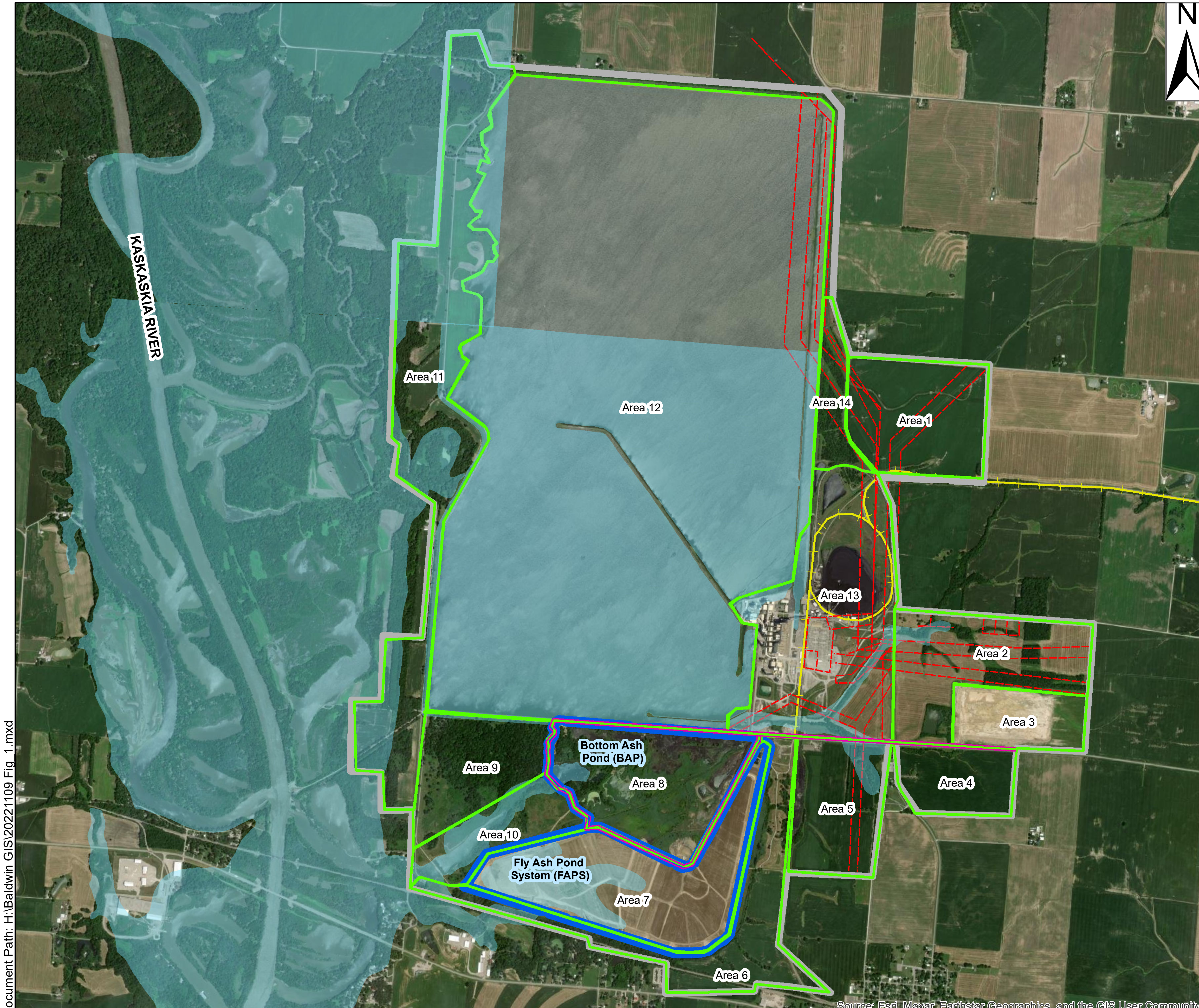
[5] Missouri Department of Natural Resources, "Missouri Solid Waste Management Map," [Online]. Available: https://modnr.maps.arcgis.com/apps/webappviewer/index.html?id=f261c6069e324f48a8cbc6ce74343f41. [Accessed 2022].

[6] Illinois Environmental Protection Agency, "Illinois EPA Environmental Justice Tracker," 2020. [Online]. Available: https://illinois-epa.maps.arcgis.com/apps/webappviewer/index.html?id=f154845da68a4a3f837cd3b880b0233c. [Accessed 2022].

[7] Geosyntec Consultants, "Construction Permit Application, Baldwin Power Plant, Bottom Ash Pond," July 2023.

[8] RSMeans, "Heavy Construction Costs with RSMeans Data," Gordian, 2022.

FIGURES



Legend

- Onsite Transportation Route
- Potential Landfill Areas
- CCR Unit Boundary
- Appoximate Dynegy Midwest Generation Property Lines
- FEMA 100 Year Floodplain
- High Voltage Overhead Electric Line
- Baldwin Rail Spur

NOTES:
1. Property lines are approximate.
2. Private and public site utilities including, but not limited to, service electric lines, gas lines, hazardous liquid lines, water and sewer lines, telecommunication lines, plant utilities, and/or private utilities are not shown on this figure and shall be verified in the field prior to any site work.

The FEMA 100-year Flood Zone boundaries were taken from the FEMA FLood Map Service Center (https://msc.fema/gov/portal/home).

The prevailing wind direction was taken as the highest frequency by direction for the Sparta Community-Hunter Field Airport in Sparta, IL from windhistory.com

Prevailing Wind

0 1,000 2,000 4,000 Feet

Baldwin Power Plant

Dynegy Midwest Generation, LLC

Bottom Ash Pond Construction Permit Application

Site Location Map

GLP8050	**NOVEMBER 2022**

Geosyntec consultants

FIGURE 1

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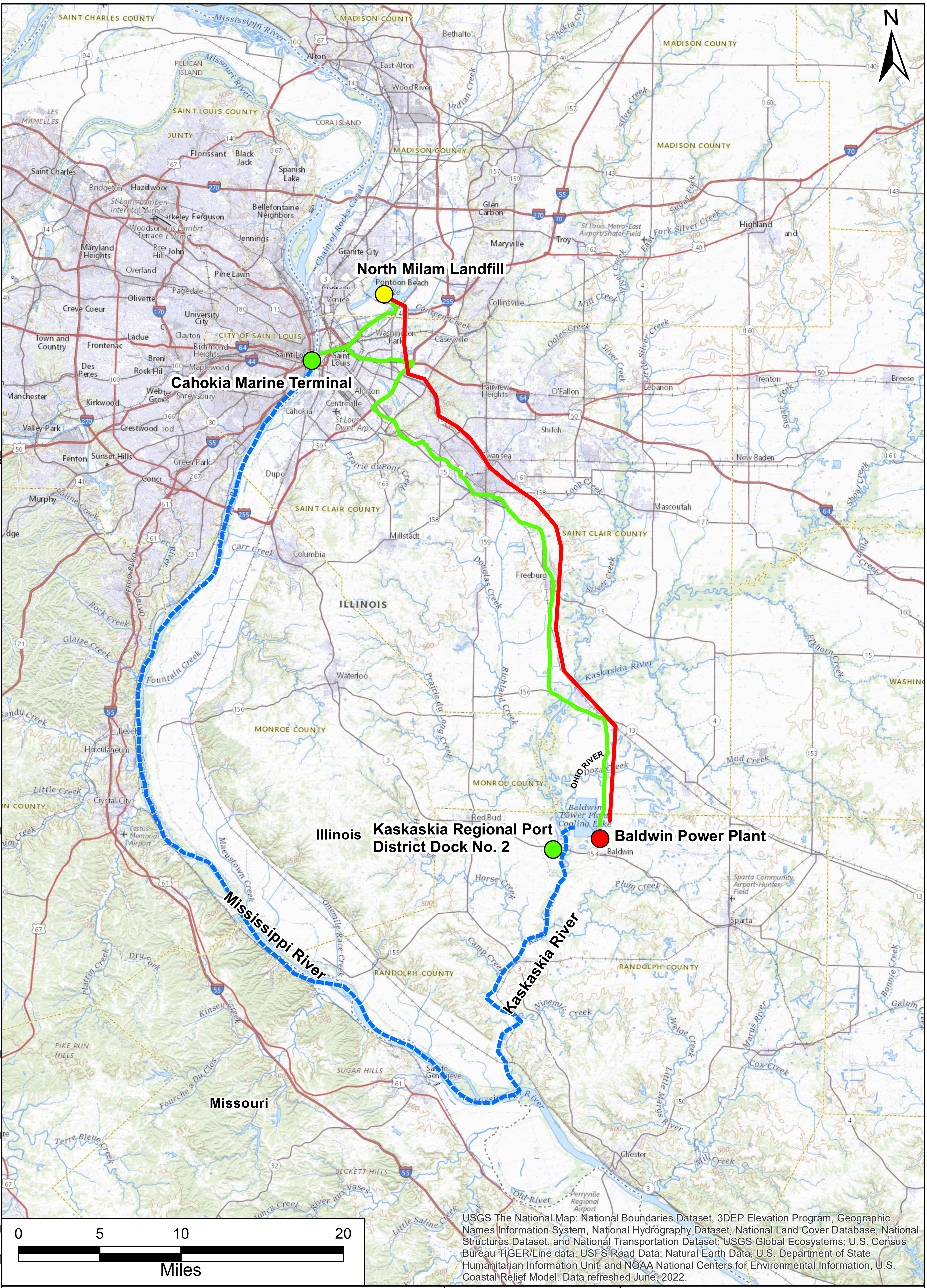

Legend

- Baldwin Power Plant
- Existing Barge Terminal
- Potential Offsite Landfill
- Potential Rail Haul Route
- Potential Truck Haul Route
- Potential Barge Haul Route

NOTES:
Some railroad right-of-ways no longer contain tracks. The potential rail haul route was selected to include right-of-ways with existing tracks, based on an evaluation of Google Earth imagery.

OFFSITE LANDFILL LOCATIONS AND TRANSPORTATION ROUTES

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GLP8050	MAY 2023	FIGURE 2.1

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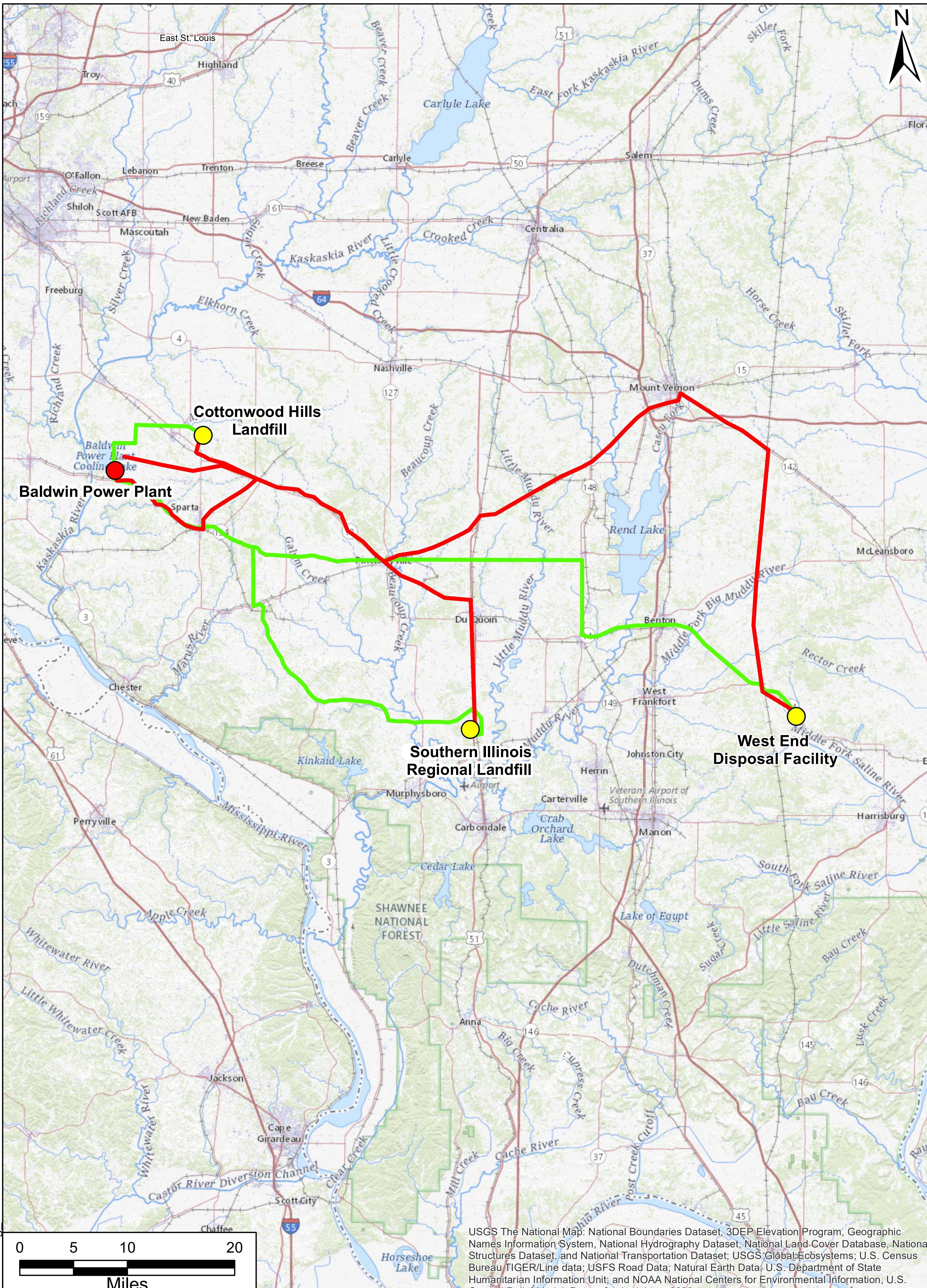

Legend

- Baldwin Power Plant
- Potential Offsite Landfill
- Potential Rail Haul Route
- Potential Truck Haul Route

NOTES:
Some railroad right-of-ways no longer contain tracks. The potential rail haul route was selected to include right-of-ways with existing tracks, based on an evaluation of Google Earth imagery.

OFFSITE LANDFILL LOCATIONS AND TRANSPORTATION ROUTES
SHEET 2 OF 2

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GLP8050 | NOVEMBER 2022

FIGURE 2.2

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TABLES

Table 1: Offsite Landfill Information

Landfill Name	Owner	Location	One-Way Distance from Site (Miles)			Volume (in-place CY)	
			By Road	By Rail	By Barge	2021 Five-Year Average Disposal [3]	Remaining Capacity Reported [3], [4], [5]
Cottonwood Hills RDF	Waste Management Solutions	Marissa, IL	10	13	NE[3]	337,940	27,914,312
North Milam Landfill	Waste Management Solutions	East St. Louis, IL	44	35	80	2,375,868	10,167,052
Southern Illinois Regional Landfill, Inc.	Republic Services	DeSoto, IL	49	NE[4]	NE[3]	436,069	17,693,371
West End Disposal Facility	Waste Connections	Thompsonville, IL	78	NE[4]	NE[3]	139,833	12,059,699
Roxana Landfill LLC	Republic Services	Roxana, IL	54[1]	NE[1]	NE[1]	2,336,906	34,057,468 *(Does not accept outside CCR)*
Sioux Energy Center	AmerenUE	West Alton, MO	70[1]	NE[1]	NE[3]	Not Reported	15,035,276 *(Does not accept outside CCR)*
Lemons Landfill[2]	Republic Services	Dexter, MO	126	NE[4]	NE[3]	Not Reported	4,808,738
Waste Path Sanitary Landfill, LLC	Waste Path Sanitary Landfill, LLC.	Calvert City, KY	143[1]	NE[1]	NE[1]	Not Reported	572,049 *(Does not accept outside CCR)*
West KY Landfill	Jones Sanitation, LLC.	Mayfield, KY	150[2]	NE[2]	NE[2]	Not Reported	5,013,470

Notes:
[1]Not Evaluated due to not accepting outside CCR.
[2]Not Evaluated due to insufficient disposal capacity.
[3]Not Evaluated due to infeasible distance from river.
[4]Not Evaluated due to closer options by rail.

Table 2: Construction Schedule – CBR-Offsite

Milestone	Timeframe (Preliminary Estimates)
Agency Coordination, Approvals, and Permitting • Obtain state permits, as needed, for dewatering, water discharge, land disturbance, wetlands modifications, stream restoration, and dam modifications	6 to 12 months after Final Closure Plan Approval
Final Design and Bid Process • Complete final design of the closure and select a construction contractor.	12 to 16 months after Agency Coordination, Approvals, and Permitting

Dewater and Excavate CCR, Decontaminate CCR Unit
• Complete contractor mobilization, installation of stormwater BMPs, and unwatering of the BAP.
• Complete mass excavation of CCR and decontamination of the BAP.
    • It is assumed that no work will be performed for 17 weeks of each year due to holidays, weather, winter shutdowns, etc.
    • Haul CCR to offsite receiving landfill[1].
	86 to 127 months after necessary permits are issued[1]

Site Restoration • Seed and stabilize the BAP. • Complete contractor demobilization.	3 to 6 months after backfilling is complete
Timeframe to Complete Closure	9 to 13 years

Note: [1]This schedule assumes that CCR hauling to the offsite landfill may occur during weather delays that preclude excavation but do not preclude hauling.

Table 3 - Material Quantity - CIP (1 of 2)

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QUANTITY, LABOR, AND EQUIPMENT HOURS ESTIMATE
DYNEGY MIDWEST GENERATION, LLC - BALDWIN POWER PLANT
CONSOLIDATE AND CAP-IN-PLACE OF BOTTOM ASH POND

ITEM NO.	PRE-CONSTRUCTION	Units	Quantity	Crew	Daily Output	Labor Hours	Equipment Hours	Notes
1	Mobilization and De-Mobilization	LS	1	-	-	-	-	Percentage based on experience
	PRE-CONSTRUCTION ESTIMATED SUBTOTAL							
ITEM NO.	**SITE PREPARATION**	**Units**	**Quantity**	**Crew**	**Daily Output**	**Labor Hours**	**Equipment Hours**	**Notes**
2	Clear Vegetation	Acre	95	-	-	4,369	3,831	Removal of dense vegetation and trees.
	Unit Costs							
	Clear Trees	Acre	24	B7	0.7	1,614	1,076	311110100200: Clear and Grub Site, cut and ship medium trees to 12"diameter. Assume 25% of the clearing area.
	Heavy Vegetation	MSF	3,100	B84	9	2,756	2,756	320190191680: Mowing, mowing brush, tractor with rotary mower, heavy density.
3	Construction Soil Erosion & Sediment Controls	LS	1	-	-	1,218	209	Installation of silt fence, rock check dams, and straw wattles for temporary soil erosion and sediment control during construction.
	Unit Costs							
	Silt Fence	LF	7,000	B62	650	258	86	312514161000: Synthetic erosion control, silt fence, install and remove, 3' high. Quantity assumes approximately 65 percent of the perimeter will require silt fencing.
	Rock Check Dams	EA	20	Sump Install	2	160	80	313713100100: Riprap, riprap and rock lining, random, broken stone, machine placed for slope protection. Crew altered based on experience. Unit rate increased by our experience with similar closure projects in IL. Assume 20 check dams constructed with 2 CY per check dam.
	Straw Wattles	LF	5,300	A2	1000	127	42	312514160705: Compost or Mulch Filter Sock, 9". Quantity assumed 1/acre (based on experience) for entire disturbed area and each being 30 ft long.
	Maintenance	MO - in use	42	2 Clab	1	672	0	Unit rate, Crew, and Daily Output based on experience.
4	Construction Facilities	MO - in use	42	-	-	-	-	Includes monthly costs associated with two office trailers, 5 storage trailers, and 8 portable toilets.
	Unit Costs							
	Office Trailer (x2)	MO - in use	42	-	-	-	-	015213200350: Office trailer, furnished, no hookups, 32' x 8', rent per month.
	Storage Trailers (x5)	MO - in use	42	-	-	-	-	015213201350: Storage boxes, 40' x 8', rent per month.
	Portable Toilet (x8)	MO - in use	42	-	-	-	-	015433406410: Rent toilet, portable chemical.
5	Extend or Lower Piezometers and Monitoring Wells	EA	10	2 Clab	4	40	0	Unit rate, Crew, and Daily Output based on experience.
6	Dust Control	DAY	245	B59	1	1,960	1,960	312323202510: Dust control, heavy; utlizing truck tractor and water tank trailer per RSMeans Crew B59. Quantity is assumed to be half of working days will need dust control. Daily Output assumed to 1, based on experience.
7	Haul Road Maintenance	DAY	98	B86A	1	784	784	312323202600: Haul road maintenance Quantity is assumed to be 1 day/week.
	SITE PREPARATION ESTIMATED SUBTOTAL					**8,370**	**6,780**	
ITEM NO.	**FREE LIQUIDS REMOVAL, UNWATERING, AND STORMWATER MANAGEMENT**	**Units**	**Quantity**	**Crew**	**Daily Output**	**Labor Hours**	**Equipment Hours**	**Notes**
8	Dewatering, Unwatering, and Stormwater Management for the Bottom Ash Pond	DAY	670	B10K	4	2,010	1,340	312319201100: Dewatering, pumping 8 hours, attended 2 hours per day, 6" discharge pump used for 8 hours, includes 20 LF of suction hose and 100 LF of discharge hose. 312319201120: Add per additional pump - 3 additional pumps added. Quantity assumes 6 months of pumping prior to excavation and average of 3 days/week during construction.
	Unit Costs							
	Additional HDPE Piping	LF	4,900	-	-	-	-	221113780098: Pipe, plastic, high density polyethylene (HDPE), single wall, straight, welded, based on 40' length, 10" diameter, DR11, add 1 weld per joint, excludes hangers, trenching, backfill, hoisting, or digging equipment.
9	Dewatering Sumps Installation	EA - in place	42	Sump Install	4	168	84	Unit Rate, Crew, and Daily Output based on experience. Materials include 24" corrugated HDPE pipe with geotextile wrapping, and 1 C.Y. of gravel backfill.
10	Excavate Process Flow Ditch	CY - in place	6,000	-	-	78	73	Assume 4,200 feet ditch excavated to be 3 feet deep, 10 feet wide with 3H:1V side slopes from the process inflow to the bottom ash pond dam.
	Unit Costs							
	Excavation and Loading of Material	CY - as excavated	6,600	B14B	5000	16	11	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 Dumping Onsite of Material for Moisture Conditioning	CY - as excavated	6,600	B34G	850	62	62	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. Unit rate and daily output extrapolated down to 10 min wait.
	DEWATERING, UNWATERING, AND STORMWATER MANAGEMENT ESTIMATED SUBTOTAL					**2,300**	**1,500**	
ITEM NO.	**BOTTOM ASH POND CLOSURE**	**Units**	**Quantity**	**Crew**	**Daily Output**	**Labor Hours**	**Equipment Hours**	**Notes**
11	Demolish and Dispose of Facilities at the Pump Station and Sluice Pipes	LS	1	B14B	0.05	240	160	Unit rate, Crew, and Daily Output based on experience.
12	Excavation and Placement of CCR + 1 ft overdig within Consolidation Area	CY - in place	1,523,000	-	-	34,773	28,417	Quantity based on surface to surface calculation performed in AutoCAD.
	Unit Costs							
	Excavation and Loading of Material	CY - as excavated	1,668,700	B14B	5000	4,005	2,670	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).
	Pushing Material to Excavator	CY - as excavated	834,350	B10B	5000	2,002	1,335	312323170020: Spread dumped material, no compaction, by dozer. Dozer support for excavation. Daily output edited to match excavation based on experience.
	Hauling and Dumping within BAP for Moisture Conditioning	CY - as excavated	1,668,700	B34G	850	15,705	15,705	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. Unit rate and daily output extrapolated down to 10 min wait.
	Spreading/ Drying Moisture Conditioning	CY - as excavated	837,650	B10B	5000	2,010	1,340	312323170020: Spread dumped material, no compaction, by dozer. Daily output edited to match excavation based on experience. Quantity assumes 50% of volume requires moisture conditioning.
	Spreading Lifts	CY - as excavated	1,675,300	B10B	5000	4,021	2,680	312323170020: Spread dumped material, no compaction, by dozer. Daily output edited to match excavation based on experience.
	Compaction of Material	CY - in place	1,523,000	B10F	2600	7,029	4,686	312323235060: Compaction; Riding, vibrating roller, 12" lifts, 2 passes. RSMeans Crew is B10Y; altered to B10F based on experience. RSMeans unit rate halved for 24" lifts.
13	Notch the Dam and Movement of Fill for Regrading/Drainage	CY - in place	35,100	-	-	1,659	1,104	Excavation of dam fill and placement in CBR BAP for positive drainage to the notched dam.
	Unit Costs							
	Excavation and Loading of Material from Onsite Source	CY - as excavated	38,610	B14B	5000	93	62	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 of Material	CY - as excavated	38,610	B34G	714	433	433	312323206180: Hauling; no loading equipment, including hauling, waiting, loading/dumping; 34 C.Y. off-road, 15 min wait/ld/uld., 15 MPH, cycle 2 mile.
	Spreading of Material	CY - as excavated	38,610	B10B	5000	93	62	312323170020: Spread dumped material, no compaction, by dozer. Daily output edited to match excavation based on experience.
	Finish Grading of Material	SY	488,840	B11L	8900	879	439	312216103300: Fine grading, Finish grading slopes, gentle. Crew altered to reflect likely equipment to be used based on experience.
	Compaction of Material	CY - in place	35,100	B10F	2600	162	108	312323235100: Compaction; Riding, vibrating roller, 12" lifts, 4 passes (RSMeans Crew is B10Y; altered to B10F based on experience)
14	Construct Geosynthetic Cover	SF - in place	3,701,000	-	-	5,778	340	Install geomembrane and geotextile cushion.
	Unit Costs							
	Geomembrane	SF - in place	3,701,000	B63B	87120	5,098	340	310519531200: Pond membrane lining systems HDPE, 100,000 S.F. or more, 60 mil thick, per S.F. Unit rate muliplied by 0.4 based on experience and likely use of 40mil geomembrane. Daily output edited based on experience.
	Geocomposite Drainage Layer	SF - in place	1,263,000	2 Clab	87120	232	0	Drainage layer for the perimeter slope areas. Unit rate based on experince with similar projects.
	Geotextile	SF - in place	2,438,000	2 Clab	87120	448	0	313219161550: Geotextile soil stabilization; non-woven 120 lb. tensile strength. Daily output edited based on experience.
15	Install Anchor Trench	LF	8,000	-	-	2,276	460	Install anchor trench for anchoring geosynthetics.
	Unit Costs							
	Excavation of Material	CY - as excavated	2,800	B11C	150	299	149	312316130050: Excavating, Trench or continuous footing, common earth with no sheeting or dewatering included, 1' to 4' deep, 3/8 C.Y. excavator
	Geomembrane	SF - in place	32,000	B63B	2500	1,536	102	310519531200: Pond membrane lining systems HDPE, 100,000 S.F. or more, 60 mil thick, per S.F. Unit rate muliplied by 0.4 based on experience and likely use of 40mil geomembrane. Daily output edited based on experience.
	Geotextile	SF - in place	32,000	2 Clab	2500	205	0	313219161550: Geotextile soil stabilization; non-woven 120 lb. tensile strength.
	Backfilling Material	CY - as excavated	2,800	B10R	400	84	56	312316133020: Backfill trench, F.E. Loader, wheel mtd., 1 C.Y. bucket, minimal haul
	Compacting Material	CY - in place	2,667	A1D	140	152	152	312323237040: Compaction, walk behind, vibrating plate 18" wide, 6" lifts, 4 passes
16	Placement of Onsite Protective Cover Soil	CY - in place	243,000	-	-	4,278	3,850	Place 18 inches of cover soil over geotextile cushion. Material assumed to come from onsite borrow/clean existing dike fill.
	Unit Costs							
	Excavation and Loading of Material from Onsite Source	CY - as excavated	267,300	B14B	5000	642	428	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 of Material	CY - as excavated	267,300	B34G	714	2,995	2,995	312323206180: Hauling; no loading equipment, including hauling, waiting, loading/dumping; 16.5 C.Y. off-road, 15 min wait/ld/uld., 15 MPH, cycle 2 mile.
	Spreading of Material for Regrading /Drainage	CY - as excavated	267,300	B10B	5000	642	428	312323170020: Spread dumped material, no compaction, by dozer. Daily output edited to match excavation based on experience.
17	Placement of Onsite Vegetative Soil	CY - in place	68,500	-	-	1,206	1,085	Place 6 inches of vegetative soil. Material assumed to come from onsite borrow.
	Unit Costs							
	Excavation and Loading of Material	CY - as excavated	75,350	B14B	5000	181	121	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 of Material	CY - as excavated	75,350	B34G	714	844	844	312323206180: Hauling; no loading equipment, including hauling, waiting, loading/dumping; 16.5 C.Y. off-road, 15 min wait/ld/uld., 15 MPH, cycle 2 mile.
	Spreading of Material	CY - as excavated	75,350	B10B	5000	181	121	312323170020: Spread dumped material, no compaction, by dozer. Daily output edited to match excavation based on experience.
	BOTTOM ASH POND CLOSURE ESTIMATED SUBTOTAL					**50,200**	**35,400**	

Table 3 - Material Quantity - CIP (2 of 2)

Geosyntec consultants

ITEM NO.	SITE RESTORATION	Units	Quantity	Crew	Daily Output	Labor Hours	Equipment Hours	Notes
18	Establish Access Roads	LF	5,500	-	-	150	140	Construct gravel access roads on top of the final cover. Assumed to extend around entire cover perimeter.
	Unit Costs							
	Purchasing of Material	TON	2,751	-	-	-	-	Unit Rate provided by local supplier. Quantity assumes material is 125 pcf.
	Hauling of Material	CY	1,630	B34C	116	112	112	312323203070: Hauling; no loading equipment, including hauling, waiting, loading/dumping; 16.5 C.Y.truck, 15 min wait/ld/uld., 35 MPH, cycle 30 miles
	Spreading and Compacting Material	SY	4,890	B32	4200	37	28	321123230400: Base course drainage layers, aggregate base course for roadways and large paved areas, bank run gravel, spread and compacted, 12" deep
19	Install Stormwater Letdowns	SF - in place	153,600	-	-	4,432	2,161	Install rip rap and geotextile in all stormwater letdowns for erosion protection. Each letdown assumed to be 5 ft wide, 2 ft deep with 3H:1V side slopes.
	Unit Costs							
	Purchase of Material	TON	12,672	-	-	-	-	Riprap rate provided by local supplier. Avg unit price for 150-400 lb riprap without hauling used. Quantity assumes material is 110 pcf.
	Hauling of Material	TON	12,672	B34C	116	874	874	Used cost est. provided by Columbia Quarry Company in Waterloo 10.26.22.
	Geotextile Placement	SF - in place	153,600	2 Clab	2500	983	0	313219161550: Geotextile soil stabilization; non-woven 120 lb. tensile strength.
	Rip Rap Placement	CY - in place	8,530	B12S	53	2,575	1,288	313713100200: Rip-rap and rock lining, random, broken stone, 18" minimum thickness, machine placed. Used bare labor estimate (50.51 per SY) and bare equipment estimate (44.79 per SY) for placing rip rap.
20	Install Stormwater Perimeter Ditch	SF - in place	310,000	-	-	4,157	1,968	Install rip rap and geotextile in all stormwater chutes for erosion protection. Each chute assumed to be 100 ft long and 20 ft wide.
	Unit Costs							
	Purchase of Material	TON	25,575	-	-	-	-	Riprap rate provided by local supplier. Avg unit price for 150-400 lb riprap without hauling used. Quantity assumes material is 110 pcf.
	Hauling of Material	TON	25,575	B34C	116	1,764	1,764	Used cost est. provided by Columbia Quarry Company in Waterloo 10.26.22. Previous model used a per CY cost: 312323203070: Hauling; no loading equipment, including hauling, waiting, loading/dumping; 16.5 C.Y.truck, 15 min wait/ld/uld., 35 MPH, cycle 30 miles
	Geotextile Placement	SF - in place	310,000	2 Clab	2500	1,984	0	313219161550: Geotextile soil stabilization; non-woven 120 lb. tensile strength.
	Rip Rap Placement	CY - in place	25,575	B12S	1000	409	205	313713100200: Rip-rap and rock lining, random, broken sotn, 18" minimum thickness, machine placed. Used bare labor estimate (50.51 per SY) and bare equipment estimate (44.79 per SY) for placing rip rap.
21	Placement of Erosion Control Blankets (ECBs)	SF - in place	1,263,000	ECB	22500	1,347	449	Unit rate and Crew based on experience. Daily Output based on 312514160100: Rolled erosion control mats and blankets, plastic netting, stapled, 2" x 1" mesh, 20 mil. Quantity assumed to be 10% of disturbed area and unit rate multiplied by 0.5 based on experience.
22	Seed, Mulch, and Maintain Vegetated Surfaces	AC	177	-	-	1,870	1,870	Includes soil ammendments, upland seeding, and wetland planting for all disturbed areas.
	Unit Costs							
	Lime	MSF	7,700	B66	700	88	88	329113234250: Soil preparation, structural soil mixing, spread soil conditioners, ground limestone, 1#/S.Y., tractor spreader. Unit multiplied by 1.1 to account for soils possibly being void of nutrients.
	Fertilizer	MSF	7,700	B66	700	88	88	329113234150: Soil preparation, tructural soil mixing, spread soil conditioners, fertilizer, 0.2#/S.Y., tractor spreader. Unit multiplied by 1.1 to account for soils possibly being void of nutrients.
	Wetland Mix	MSF	900	B66	26	277	277	Unit rate, daily output, crew based on experience. Quantity assumes 20 acres of disturbed area.
	Grassland Mix	MSF	5,900	B66	52	908	908	329219142300: Seeding athletic fields, seeding fescue, tall, 5.5 lb. per M.S.F., tractor spreader. Quanity all disturbed areas minus wetland area, pollinator area, and 30 acres of ponds in BAP area.
	Pollinator Mix	MSF	900	B66	26	277	277	Unit rate, daily output, crew based on experience. Quantity assumes 20 acres of distubed area.
	Mulch	MSF	7,700	B65	530	232	232	329113160350: Mulching, Hay, 1" deep, power mulcher, large
	SITE RESTORATION ESTIMATED SUBTOTAL					**11,960**	**6,590**	
ITEM NO.	**ENGINEERING AND CONSTRUCTION SUPPORT TASKS**	**Units**	**Quantity**	**Crew**	**Output**	**Labor Hours**	**Equipment Hours**	**Notes**
23	Final Closure Design and Bid Support	LS	1	-	-	-	-	Unit Rate based on experience.
24	Engineering Support and CQA During Construction	LS	1	Eng	60 hrs/week	5,880	1,960	Unit Rate, Crew, and Output based on experience.
	ENGINEERING AND PERMITTING ESTIMATED SUBTOTAL					**5,880**	**1,960**	

NOTES:
1. LS = Lump Sum, AC = Acre, LF = Linear Foot, EA = Each, SY = Square Yard, MO = Month, YR = Year, CY = Cubic Yard, MSF = Thousand Square Feet
2. RS Means refers to the 2022 online edition of RS Means Commercial New Construction. All unit rates refer to standard union labor in Carbondale, IL.
3. See schedule (Table 2) for assumptions regarding schedule for time unit quantities.

Table 4 - Labor, Equipment, and Mileage Estimate - CIP (1 of 2)

Crew	Labor	Daily Labor Hours	Equipment	Daily Equipment Hours	Project Total Labor Hours	Project Total Equipment Hours
B84	Operator x1	8	Rotary Mower/Tractor	8	2,756	2,756
B62	Laborer x2 Operator x 1	24	Loader, Skid Steer, 30 H.P.	8	258	86
B59	Truck Driver x1	8	Truck Tractor, 220 H.P. Water Tank Trailer, 5000 Gal	8	1,960	1,960
B86A	Operator x1	8	Grader, 30,000 lbs	8	784	784
B10K	Operator x1 Laborer x0.5	12	Centr. Water Pump, 6"	8	2,010	1,340
B14B	Operator x1 Laborer x0.5	12	Hyd. Excavator, 6 C.Y.	8	5,176	3,450
B10L	Operator x1 Laborer x0.6	12	Dozer, 80 H.P.	8	Not Used	Not Used
B21	Labor Foreman x 1 Skilled Worker x 1 Laborer x 1 Operator (crane) 0.5	28	S.P. Crane, 4x4, 5 ton	4	Not Used	Not Used
B10B	Operator x1 Laborer x0.5	12	Dozer, 200 H.P.	8	8,949	5,966
B12F	Operator (crane) x 1 Laborer x 1	16	Hyd. Excavator, 0.75 C.Y.	8	Not Used	Not Used
B6	Laborer x 2 Operator (light) x 1	24	Backhoe Loader, 48 H.P.	8	Not Used	Not Used
A1D	Laborer x 1	8	Vibrating Plate, Gas, 18"	8	152	152
B10T	Laborer x 0.5 Operator (med.) x1	12	F.E. Loader W.M. 2.5 C.Y.	8	Not Used	Not Used
B10R	Laborer x 0.5 Operator (med) x 1	12	F.E. Loader W.M., 1 C.Y.	8	84	56
B63B	Labor Foreman x1 Laborer x2 Operator (light) x1 Geosynthetics Laborer x11	120	Loader, Skid Steer, 78 H.P.	8	6,634	442
B32	Laborer x1 Operator (med) x3	32	Grader, 30,000 lbs Tandem Roller, 10 ton Dozer, 200 H.P.	24	37	28
2 Clab	Laborer x2	16	None	0	4,564	0
B12S	Equip. Oper. (crane) x 1 Laborer x 1	16	Hyd. Excavator, 2.5 C.Y.	8	2,984	1,492
A2	Laborer x2 Truck Driver x1	24	Flatbed Truck, Gas, 1.5 ton	8	127	42
B66	Operator (light) x1	8	Loader-Backhoe, 40 H.P.	8	1,638	1,638
B65	Laborer x1 Truck Driver (light) x1	16	Power Mulcher (large) Flatbed Truck, Gas, 1.5 ton	16	232	232
A1F	Laborer x 1	8	Rammer/Tamper, Gas, 8"	8	Not Used	Not Used
B11C	Laborer x1 Operator (med) x1	16	Backhoe Loader, 48 H.P.	8	299	149
B13K	Operators (crane) x 2	16	Hyd. Excavator, .75 C.Y. x 2 Hyd. Hammer, 4000 ft-lb	16	Not Used	Not Used
B34G	Truck Driver x1	8	Dump Truck, Off Hwy., 50 ton	8	20,039	20,039
ECB	Laborer x3	24	Tractor	8	1,347	449
Hopper	Operator x1	8	Hyd. Excavator, 3.5 C.Y.	8	Not Used	Not Used
Sump Install	Laborer x1 Operator x1	16	Hyd. Excavator, 4.5 C.Y.	8	328	164
Trench	Laborer x3 Operator x2	40	Front End Loader, 10 C.Y. Dewind Machine 1000 H.P.	16	Not Used	Not Used
Grout/Concrete	Laborer x2 Truck Driver x1	24	Concrete Truck	8	Not Used	Not Used
Eng	Engineering Staff x1.2	10	Side by Side x1	4	5,880	1,960
B10F	Operator (med) x1 Laborer x0.5	12	Tandem Roller, 10, Ton	8	7,191	4,794
B10I	Operator (med) x1 Laborer x0.5	12	Diaphragm Water Pump, 4"	8	Not Used	Not Used
B34C	Truck Driver (heavy) x 1	8	Truck Tractor, 6x4, 380 H.P. x 1 Dump Trailer, 16.5 CY x 1	8	2,750	2,750
Pipe Liner	Laborer x 4 Operator x 1	40	Hyd. Excavator, 3.5 C.Y. Grouting Pump	16	Not Used	Not Used
B11L	Operator (med.) x 1 Laborer x 1	16	Grader, 30,000 lbs	8	879	439
B10W	Operator (med.) x 1 Laborer x 0.5	12	Dozer, 105 H.P.	8	Not Used	Not Used
B7	Laborer x 5 Operator (med) x 1	48	Brush Chipper, 12", 130 H.P Crawler Loader, 3 C.Y. Chain Saws, Gas, 36" Long x 2	32	1,614	1,076
B45	Operator (med) x1 Truck Driver(heavy) x 1	16	Tanker, 3000 gal Truck Tractor, 6x4, 380 H.P.	8	Not Used	Not Used
Note: Blue crew names were created by Geosyntec based on experience (not pulled from RSMeans).				**Totals**	78,700	52,200

Table 4 - Labor, Equipment, and Mileage Estimate - CIP (2 of 2)

Geosyntec consultants

Item	Quantity	Assumptions
Labor Total Hours	78,700	Per projected subtotal in cost estimate (Does not include contingency)
Duration of Onsite Construction in Days	490	Per Construction Schedule
Average Daily Crew Size	28	10 hour days (5 days per week)
Daily Labor Mobilization Miles	960,400	Average of 70 miles round trip per day
Vehicles Miles Onsite	23,177	1 mile round trip from gate to parking 5 miles per day for 2 CQA techs and Construction Supervisor 10% Contingency for site visitors (client and engineering support)
Equipment Mobilization Miles - Unloaded	29,400	Average of 300 miles one way for equipment hauling Average 1 load of equipment per working week
Equipment Mobilization Miles - Loaded	29,400	Average of 300 miles one way for equipment hauling Average 1 load of equipment per working week
Daily Equipment Miles Onsite	629,160	Average of 21 of 28 crew members running equipment Assume 60 miles per piece of equipment 40 miles per day used for water truck 20 miles per day used for grader
Onsite Haul Truck Miles - Unloaded	25,108	34 CY Off Road Dump Truck 1 mile round trip per load
Onsite Haul Truck Miles - Loaded	25,108	34 CY Off Road Dump Truck 1 mile round trip per load
Offsite Haul Truck Miles - Unloaded	20,767	16.5 CY Dump Truck 2 mi cycle for imported materials
Offsite Haul Truck Miles - Loaded	20,767	16.5 CY Dump Truck 2 mi cycle for imported materials
Material Delivery Miles - Unloaded	25,000	100 extra trips for seed, fertilizer, lime, mulch, ECBs, straw wattles, and concrete - source 250 miles away average
Material Delivery Miles - Loaded	25,000	100 extra trips for seed, fertilizer, lime, mulch, ECBs, straw wattles, and concrete - source 250 miles away average

Table 5 - Material Quantity - CBR-Offsite-Truck Transportation

Geosyntec consultants

QUANTITY, LABOR, AND EQUIPMENT HOURS ESTIMATE
DYNEGY MIDWEST GENERATION, LLC - BALDWIN POWER PLANT
CLOSURE-BY-REMOVAL OF BOTTOM ASH POND

ITEM NO.	PRE-CONSTRUCTION	Units	Quantity	Crew	Daily Output	Labor Hours	Equipment Hours	Notes
1	Mobilization and De-Mobilization	LS	1	-	-	-	-	Percentage based on experience
	PRE-CONSTRUCTION ESTIMATED SUBTOTAL							
ITEM NO.	**SITE PREPARATION**	**Units**	**Quantity**	**Crew**	**Daily Output**	**Labor Hours**	**Equipment Hours**	**Notes**
2	Clear Vegetation	Acre	95	-	-	4,369	3,831	Removal of dense vegetation and trees.
	Unit Costs							
	Clear Trees	Acre	24	B7	0.7	1,614	1,076	311110100200: Clear and Grub Site, cut and ship medium trees to 12"diameter. Assume 25% of the clearing area.
	Heavy Vegetation	MSF	3,100	B84	9	2,756	2,756	320190191680: Mowing, mowing brush, tractor with rotary mower, heavy density.
3	Construction Soil Erosion & Sediment Controls	-	-	-	-	546	209	Installation of silt fence, rock check dams, and straw wattles for temporary soil erosion and sediment control during construction.
	Unit Costs							
	Silt Fence	LF	7,000	B62	650	258	86	312514161000: Synthetic erosion control, silt fence, install and remove, 3' high. Quantity assumes approximately 65 percent of the perimeter will require silt fencing.
	Rock Check Dams	EA	20	Sump Install	2	160	80	313713100100: Riprap, riprap and rock lining, random, broken stone, machine placed for slope protection. Crew altered based on experience. Unit rate increased by our experience with similar closure projects in IL. Assume 20 check dams constructed with 2 CY per check dam.
	Straw Wattles	LF	5,300	A2	1000	127	42	312514160705: Compost or Mulch Filter Sock, 9". Quantity assumed 1/acre (based on experience) for entire disturbed area and each being 30 ft long.
4	Construction Facilities	MO - in use	137	-	-	-	-	Includes monthly costs associated with three office trailers, 10 storage trailers, and 8 portable toilets.
	Unit Costs							
	Office Trailer (x3)	MO - in use	137	-	-	-	-	015213200350: Office trailer, furnished, no hookups, 32' x 8', rent per month.
	Storage Trailers (x10)	MO - in use	137	-	-	-	-	015213201350: Storage boxes, 40' x 8', rent per month.
	Portable Toilet (x8)	MO - in use	137	-	-	-	-	015433406410: Rent toilet, portable chemical.
5	Abandonment of Piezometers and Monitoring Wells	EA	10	Grout/Concrete	4	60	20	Unit rate, Crew, and Daily Output based on experience.
6	Dust Control	DAY	935	B59	1	7,480	7,480	312323202510: Dust control, heavy; utlizing truck tractor and water tank trailer per RSMeans Crew B59. Quantity is assumed to be half of working days will need dust control. Daily Output assumed to 1, based on experience.
7	Haul Road Maintenance	DAY	374	B86A	1	2,992	2,992	312323202600: Haul road maintenance Quantity is assumed to be 1 day/week.
	SITE PREPARATION ESTIMATED SUBTOTAL					**15,450**	**14,530**	
ITEM NO.	**DEWATERING, UNWATERING, AND STORMWATER MANAGEMENT**	**Units**	**Quantity**	**Crew**	**Daily Output**	**Labor Hours**	**Equipment Hours**	**Notes**
8	Dewatering, Unwatering, and Stormwater Management for the Bottom Ash Pond	DAY	1,302	B10K	4	3,906	2,604	312319201100: Dewatering, pumping 8 hours, attended 2 hours per day, 6" discharge pump used for 8 hours, includes 20 LF of suction hose and 100 LF of discharge hose. 312319201120: Add per additional pump - 7 additional pumps added. Quantity assumes 6 months of pumping prior to excavation and average of 3 days/week during construction.
	Unit Costs							
	Additional HDPE Piping	LF	14,600	-	-	-	-	221113780098: Pipe, plastic, high density polyethylene (HDPE), single wall, straight, welded, based on 40' length, 10" diameter, DR11, add 1 weld per joint, excludes hangers, trenching, backfill, hoisting, or digging equipment.
9	Dewatering Sumps Installation	EA - in place	150	Sump Install	4	600	300	Unit Rate, Crew, and Daily Output based on experience. Materials include 24" corrugated HDPE pipe with geotextile wrapping, and 1 C.Y. of gravel backfill.
10	Excavate Process Flow Ditch	CY - as excavated	6,100	-	-	79	74	Assume 4,200 feet ditch excavated to be 3 feet deep, 10 feet wide with 3H:1V side slopes from the process inflow to the bottom ash pond dam.
	Unit Costs							
	Excavation and Loading of Material	CY - as excavated	6,710	B14B	5000	16	11	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 Dumping Onsite of Material for Moisture Conditioning	CY - as excavated	6,710	B34G	850	63	63	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
	DEWATERING, UNWATERING, AND STORMWATER MANAGEMENT ESTIMATED SUBTOTAL					**4,600**	**3,000**	
ITEM NO.	**BOTTOM ASH POND CLOSURE**	**Units**	**Quantity**	**Crew**	**Daily Output**	**Labor Hours**	**Equipment Hours**	**Notes**
11	Demolish and Dispose of Facilities at the Pump Station and Sluice Pipes	LS	1	B14B	0.05	240	160	Unit rate, Crew, and Daily Output based on experience.
12	Excavation of CCR + 1 ft overdig	CY - in place	3,751,844	-	-	277,690	263,878	Quantity based on surface to surface calculation performed in AutoCAD.
	Unit Costs							
	Excavation and Loading of Material	CY - as excavated	4,120,318	B14B	5000	9,889	6,593	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)
	Pushing Material to Excavator	CY - as excavated	4,120,318	B10B	5000	9,889	6,593	312323170020: Spread dumped material, no compaction, by dozer. Dozer support for excavation. Daily output edited to match excavation based on experience.
	Hauling and Dumping Onsite of Material for Moisture Conditioning	CY - as excavated	4,120,318	B34G	850	38,779	38,779	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
	Spreading/ Drying Moisture Conditioning	CY - as excavated	2,063,514	B10B	5000	4,952	3,302	312323170020: Spread dumped material, no compaction, by dozer. Daily output edited to match excavation based on experience.
	Dust Control Moisture Conditioning Prior to Loading	CY - as excavated	619,054	B45	1888	5,246	2,623	312323239000: Water, 3000 gal. truck, 3 mile haul. Assume 30% of volume will need to be wetted.
	Loading of Material	CY - as excavated	4,127,028	B14B	5605	8,836	5,890	312316434420: Excavating, large volume projects; restricted loading trucks, loader, 95% fill factor, 6 C.Y. bucket (assume 10% fluff factor from ground to excavated)
	Hauling of Material Offiste	CY - as excavated	4,127,028	B34C	165	200,098	200,098	312323203080: Hauling; no loading equipment, including hauling, waiting, loading/dumping; 16.5 C.Y.truck, 15 min wait/ld/uld., 40 MPH, cycle 20 miles.
	Landfill Tipping Fee	TON	4,735,765	-	-	-	-	Price based on four local landfills with an average unit weight of 85 pcf.
13	Notch the Dam and Movement of Fill for Regrading/Drainage	CY - in place	35,100	-	-	2,352	1,433	Excavation of dam fill and placement in CBR BAP for positive drainage to the notched dam. 313713100200: Rip-rap and rock lining, random, broken stone, 18" minimum thickness, machine placed. Used bare labor estimate (50.51 per SY) and bare equipment estimate (44.79 per SY) for
	Unit Costs							
	Excavation and Loading of Material	CY - as excavated	38,610	B14B	3230	143	96	312316435400: Excavating, large volume projects; excavation with truck loading; excavator, 4.5 C.Y. bucket, 95% fill factor (assume 10% fluff factor from ground to excavated)
	Hauling of Material	CY - as excavated	38,610	B34G	850	363	363	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
	Spreading of Material	CY - as excavated	38,610	B10B	3230	143	96	312323170020: Spread dumped material, no compaction, by dozer. Daily output edited to match excavation based on experience.
	Finish Grading of Material	SY	856,680	B11L	8900	1,540	770	312216103300: Fine grading, Finish grading slopes, gentle. Crew altered to reflect likely equipment to be used based on experience.
	Compaction of Material	CY - in place	35,100	B10F	2600	162	108	312323235100: Compaction; Riding, vibrating roller, 12" lifts, 4 passes (RSMeans Crew is B10Y; altered to B10F based on experience)
	BOTTOM ASH POND ESTIMATED SUBTOTAL					**280,280**	**265,470**	
ITEM NO.	**SITE RESTORATION**	**Units**	**Quantity**	**Crew**	**Daily Output**	**Labor Hours**	**Equipment Hours**	**Notes**
14	Straw Wattle Ditch Checks	LF - in place	15,900	A2	1000	382	127	312514160705: Sediment Log, Filter Sock, 9". Quantity assumed 3/acre (based on experience) for entire disturbed area and each being 30 ft long.
15	Place Rip Rap and Geotextile Along Dam Notch	SF - in place	50,000	-	-	1,444	704	Placing 18 inches of riprap in the dam notch area to reduce erosion.
	Unit Costs							
	Purchase of Material	TON	4,125	-	-	-	-	Riprap rate provided by local supplier. Avg unit price for 150-400 lb riprap without hauling used. Quantity assumes material is 110 pcf.
	Hauling of Material	TON	4,125	B34C	116	284	284	Used cost est. provided by Columbia Quarry Company in Waterloo 10.26.22. Previous model used a per CY cost: 312323203070: Hauling; no loading equipment, including hauling, waiting, loading/dumping; 16.5 C.Y.truck, 15 min wait/ld/uld., 35 MPH, cycle 30 miles
	Geotextile Placement	SF - in place	50,000	2 Clab	2500	320	0	313219161550: Geotextile soil stabilization; non-woven 120 lb. tensile strength. Assumed rip rap volume placed 2 ft thick to get area.
	Rip Rap Placement	CY - in place	2,780	B12S	53	839	420	313713100200: Rip-rap and rock lining, random, broken stone, 18" minimum thickness, machine placed. Used bare labor estimate (50.51 per SY) and bare equipment estimate (44.79 per SY) for placing rip rap.
16	Seed, Mulch, and Maintain Vegetated Surfaces	AC	177	-	-	1,870	1,870	Includes soil ammendments, upland seeding, and wetland planting for all disturbed areas.
	Unit Costs							
	Lime	MSF	7,700	B66	700	88	88	329113234250: Soil preparation, structural soil mixing, spread soil conditioners, ground limestone, 1#/S.Y., tractor spreader. Unit multiplied by 1.1 to account for soils possibly being void of nutrients.
	Fertilizer	MSF	7,700	B66	700	88	88	329113234150: Soil preparation, tructural soil mixing, spread soil conditioners, fertilizer, 0.2#/S.Y., tractor spreader. Unit multiplied by 1.1 to account for soils possibly being void of nutrients.
	Wetland Mix	MSF	900	B66	26	277	277	Unit rate, daily output, crew based on experience. Quantity assumes 20 acres of disturbed area.
	Grassland Mix	MSF	5,900	B66	52	908	908	329219142300: Seeding athletic fields, seeding fescue, tall, 5.5 lb. per M.S.F., tractor spreader. Quanity all disturbed areas minus wetland area, pollinator area, and 30 acres of ponds in BAP.
	Pollinator Mix	MSF	900	B66	26	277	277	Unit rate, daily output, crew based on experience. Quantity assumes 20 acres of distubed area.
	Mulch	MSF	7,700	B65	530	232	232	329113160350: Mulching, Hay, 1" deep, power mulcher, large
	SITE RESTORATION ESTIMATED SUBTOTAL					**3,700**	**2,700**	
ITEM NO.	**ENGINEERING AND CONSTRUCTION SUPPORT TASKS**	**Units**	**Quantity**	**Crew**	**Output**	**Labor Hours**	**Equipment Hours**	**Notes**
17	Final Closure Design and Bid Support	LS	1	-	-	-	-	Unit Rate based on experience.
18	Engineering Support and CQA During Construction	LS	1	Eng	60 hrs/week	22,440	7,480	Unit Rate, Crew, and Output based on experience.
	ENGINEERING AND PERMITTING ESTIMATED SUBTOTAL					**22,440**	**7,480**	

NOTES:
1. LS = Lump Sum, AC = Acre, LF = Linear Foot, EA = Each, SY = Square Yard, MO = Month, YR = Year, CY = Cubic Yard, MSF = Thousand Sqaure Feet
2. RS Means refers to the 2022 online edition of RS Means Commercial New Construction. All unit rates refer to standard union labor in Carbondale, IL.
3. See schedule (Table 2) for assumptions regarding schedule for time unit quantities.

Table 6 - Labor, Equipment, and Mileage Estimate
CBR-Offsite-Truck Transportation

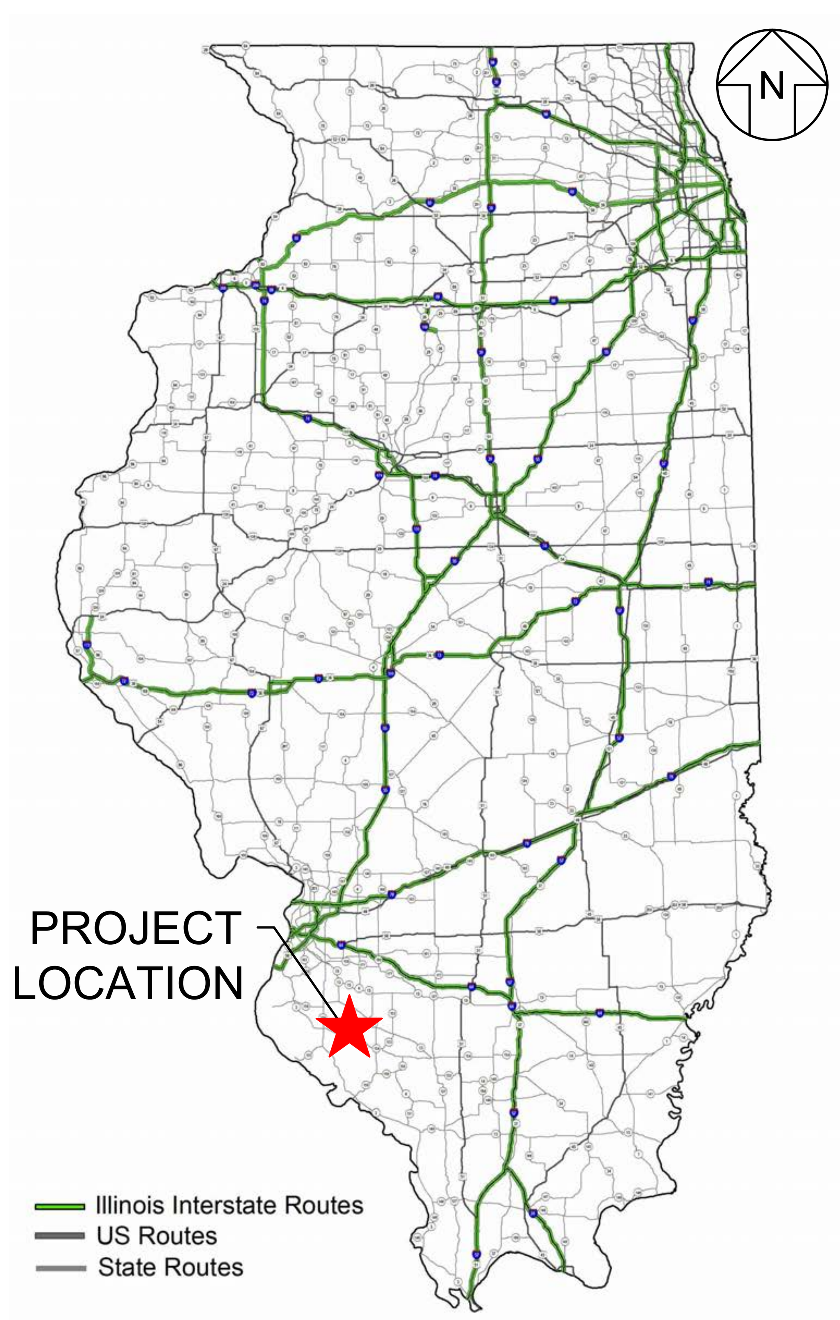
Geosyntec consultants

Crew	Labor	Daily Labor Hours	Equipment	Daily Equipment Hours	Project Total Labor Hours	Project Total Equipment Hours
B84	Operator x1	8	Rotary Mower/Tractor	8	2,756	2,756
B62	Laborer x2 Operator x 1	24	Loader, Skid Steer, 30 H.P.	8	258	86
B59	Truck Driver x1	8	Truck Tractor, 220 H.P. Water Tank Trailer, 5000 Gal	8	7,480	7,480
B86A	Operator x1	8	Grader, 30,000 lbs	8	2,992	2,992
B10K	Operator x1 Laborer x0.5	12	Centr. Water Pump, 6"	8	3,906	2,604
B14B	Operator x1 Laborer x0.5	12	Hyd. Excavator, 6 C.Y.	8	19,124	12,749
1 Clab	Laborer x1	8	None	0	Not Used	Not Used
B34F	Truck Driver x1	8	Dump Truck, Off Hwy., 35 ton	8	Not Used	Not Used
B10B	Operator x1 Laborer x0.5	12	Dozer, 200 H.P.	8	14,985	9,990
B10G	Operator x1 Laborer x0.5	12	Sheepsfoot Roller, 240 H.P.	8	Not Used	Not Used
B34D	Truck Driver (heavy) x 1	8	Truck Tractor, 6x4, 380 H.P. x 1 Dump Trailer, 20 CY x 1	8	Not Used	Not Used
B21C	Labor Foreman x1 Laborer x4 Operator (crane) x1 Operator (oiler) x1	56	Cutting Torches x2 Sets of Gasses x2 Lattice Boom Crane, 90 ton	8	Not Used	Not Used
B69	Labor Foreman x1 Laborer x3 Operator (crane) x1 Operator (oiler) x1	48	Hyd. Crane, 80 ton	8	Not Used	Not Used
C14A	Carpenter Foreman x1 Carpenters x16 Rodmen x4 Laborers x2 Cement Finisher x1 Operator (medium) x1	200	Gas Engine Vibrator Concrete Pump (small)	16	Not Used	Not Used
B63B	Labor Foreman x1 Laborer x2 Operator (light) x1	32	Loader, Skid Steer, 78 H.P.	8	Not Used	Not Used
B32	Laborer x1 Operator (med) x3	32	Grader, 30,000 lbs Tandem Roller, 10 ton Dozer, 200 H.P.	24	Not Used	Not Used
2 Clab	Laborer x2	16	None	0	320	0
B12S	Equip. Oper. (crane) x 1 Laborer x 1	16	Hyd. Excavator, 2.5 C.Y.	8	839	420
A2	Laborer x2 Truck Driver x1	24	Flatbed Truck, Gas, 1.5 ton	8	509	170
B66	Operator (light) x1	8	Loader-Backhoe, 40 H.P.	8	1,638	1,638
B65	Laborer x1 Truck Driver (light) x1	16	Power Mulcher (large) Flatbed Truck, Gas, 1.5 ton	16	232	232
B25B	Laborers x 8 Operators x 4	96	Asphalt Paver x 130 H.P. Tandem Rollers 10 ton x 2 Pneumatic Roller 12 ton	32	Not Used	Not Used
B10M	Laborer x.5 Operator (med) x1	12	Dozer, 300 H.P.	8	Not Used	Not Used
B13K	Operators (crane) x 2	16	Hyd. Excavator, .75 C.Y. x 2 Hyd. Hammer, 4000 ft-lb	16	Not Used	Not Used
B34G	Truck Driver x1	8	Dump Truck, Off Hwy., 50 ton	8	39,206	39,206
ECB	Laborer x3	24	Tractor	8	Not Used	Not Used
Dewater	Laborer x1	8	8" Diesel Pump	2	Not Used	Not Used
Sump Install	Laborer x1 Operator x1	16	Hyd. Excavator, 4.5 C.Y.	8	760	380
Grout/Concrete	Laborer x2 Truck Driver x1	24	Concrete Truck	8	60	20
Eng	Engineering Staff x1.2	10	Side by Side x1	4	22,440	7,480
B10F	Operator (med) x1 Laborer x0.5	12	Tandem Roller, 10, Ton	8	162	108
B14K	Operator (med) x1 Laborer x0.5	12	Front End Loader, 10 C.Y.	8	Not Used	Not Used
B34C	Truck Driver (heavy) x 1	8	Truck Tractor, 6x4, 380 H.P. x 1 Dump Trailer, 16.5 CY x 1	8	200,383	200,383
B14B	Operator (crane) x 1 Laborer x 0.5	12	Hyd. Excavator, 6 C.Y.	8	19,124	12,749
B11L	Operator (med.) x 1 Laborer x 1	16	Grader, 30,000 lbs	8	1,540	770
B10W	Operator (med.) x 1 Laborer x 0.5	12	Dozer, 105 H.P.	8	Not Used	Not Used
B7	Laborer x 5 Operator (med) x 1	48	Brush Chipper, 12", 130 H.P Crawler Loader, 3 C.Y. Chain Saws, Gas, 36" Long x 2	32	1,614	1,076
B45	Operator (med) x1 Truck Driver(heavy) x 1	16	Tanker, 3000 gal Truck Tractor, 6x4, 380 H.P.	8	5,246	2,623
Note: Blue crew names were created by Geosyntec based on experience (not pulled from RSMeans).				**Totals**	345,600	305,900

ATTACHMENT B

Final Closure Plan Drawings and Material Specifications (Section 845.750)

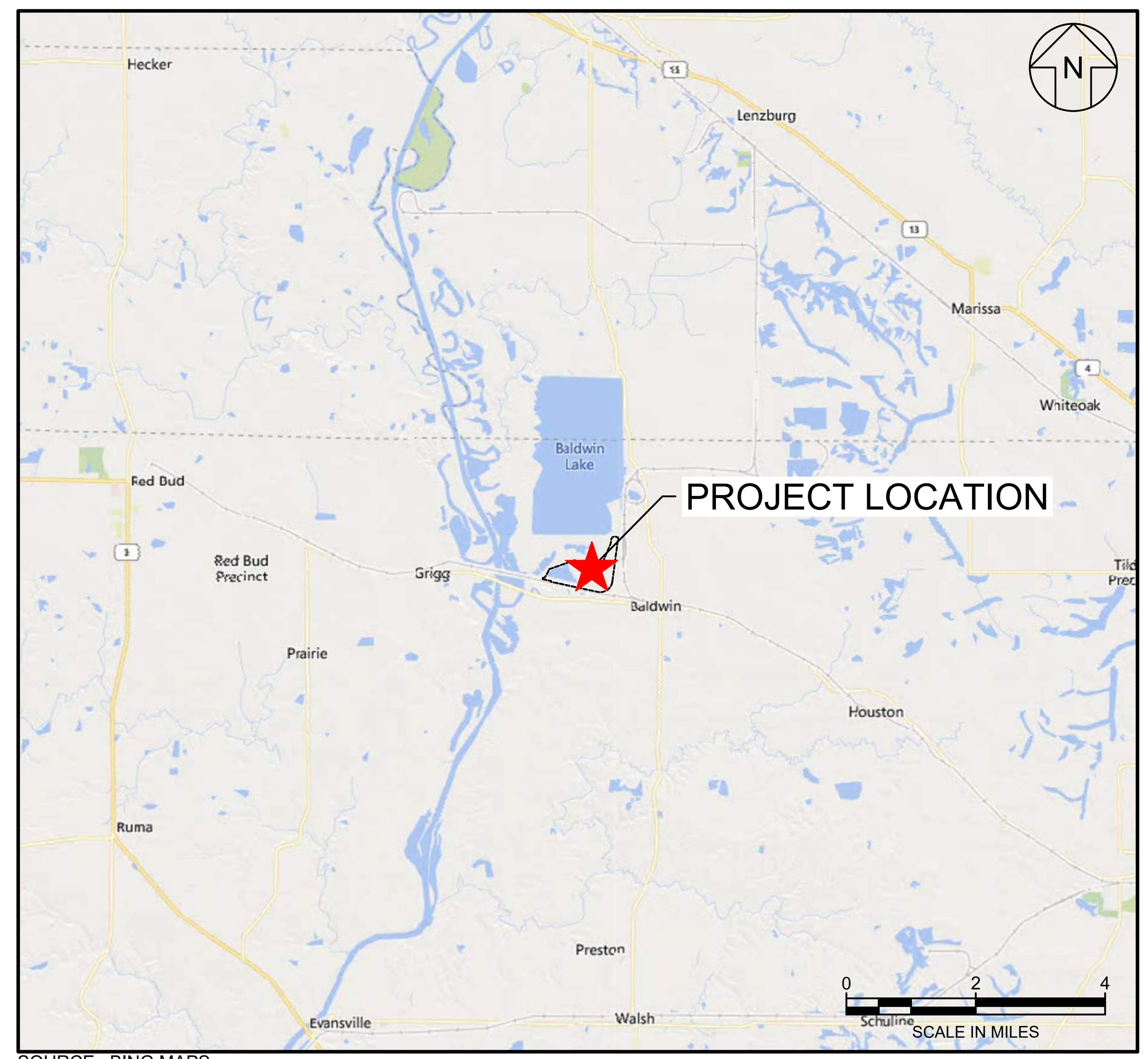
DYNEGY MIDWEST GENERATION, LLC
BALDWIN POWER PLANT
BALDWIN, ILLINOIS
BOTTOM ASH POND CONSTRUCTION PERMIT APPLICATION
CLOSURE DRAWINGS
PROJECT NO. GLP8050
JANUARY 2023



SOURCE: IDOT

STATE MAP

NOT TO SCALE



SOURCE: BING MAPS

LOCATION MAP

SITE MAP

DETAIL NUMBER

4 / C-150

DRAWING ON WHICH ABOVE DETAIL IS PRESENTED

DETAIL NUMBER

4 / C-110 DETAIL TITLE

SCALE:

XREF:

DRAWING ON WHICH ABOVE DETAIL WAS FIRST REFERENCED

EXAMPLE: DETAIL NUMBER 4 PRESENTED ON DRAWING NO. C-400 WAS REFERENCED FOR THE FIRST TIME ON DRAWING NO. C-300.

ABOVE SYSTEM ALSO APPLIES TO SECTION IDENTIFICATIONS.

DETAIL IDENTIFICATION LEGEND

DRAWING LIST

SHEET NO.	SHEET TITLE
G–100	COVER SHEET AND LOCATION MAP
G–110	EXISTING CONDITIONS
C–100	DEMOLITION, RELOCATION, AND ABANDONMENT
C–110	PHASE 1 FINAL GRADING PLAN
C–120	PHASE 2 FINAL GRADING PLAN
C–130	SECTIONS SHEET – 1 OF 2
C–140	SECTIONS SHEET – 2 OF 2
C–150	DETAILS AND MATERIAL SPECIFICATIONS – 1 OF 2
C–160	DETAILS AND MATERIAL SPECIFICATIONS – 2 OF 2
C–170	EROSION AND SEDIMENT CONTROL PLAN

PERMIT APPLICATION
DESIGN DRAWINGS - NOT FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
1 MCBRIDE AND SON CENTER DRIVE, SUITE 202
CHESTERFIELD, MO 63005 USA
TELEPHONE: 636-812-0800

DYNEGY MIDWEST GENERATION, LLC
1500 EASTPORT PLAZA DRIVE
COLLINSVILLE, IL 62234 USA

TITLE: COVER SHEET AND LOCATION MAP

PROJECT: BOTTOM ASH POND CONSTRUCTION PERMIT APPLICATION CLOSURE DRAWINGS

SITE: BALDWIN POWER PLANT
BALDWIN, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

DATE

DESIGN BY:	CLL	DATE:	JANUARY 2023
DRAWN BY:	DCW	PROJECT NO.:	GLP8050
CHECKED BY:	TWW	FILE:	01 - GLP8050 G-100
REVIEWED BY:	JPS	DRAWING NO.:	G-100
APPROVED BY:	TWW		

H:\BALDWIN BAP CP - GLP8050\900 - CAD\DRAWINGS\30PCT PERMIT SET\01 - GLP8050 G-100

PERMIT APPLICATION
DESIGN DRAWINGS - NOT FOR CONSTRUCTION

LEGEND

355	EXISTING GROUND MAJOR CONTOUR (5')
	EXISTING GROUND MINOR CONTOUR (1')
	IMPOUNDMENT BOUNDARY
OE	OVERHEAD ELECTRIC
	LAGOON DISCHARGE PIPE
BAL-B006	BORINGS
BAL-C034	CONE PENETRATION TESTS
BAL-P007	PIEZOMETER
XPW05	MONITORING WELLS

NOTES:

1. COORDINATES AND DIRECTIONS SHOWN IN THESE DRAWINGS WERE BASED ON THE ILLINOIS STATE PLAN COORDINATE SYSTEM (NAD83, IN US FEET). ELEVATIONS WERE BASED ON THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88, IN US FEET).
2. EXISTING CONTOURS, AERIAL IMAGERY, AND WATER SURFACE ELEVATIONS FOR THE BAP AND IMMEDIATE SURROUNDING AREAS WERE TAKEN FROM "LUMINANT, DYNEGY MIDWEST GENERATION, LLC, BALDWIN ENERGY COMPLEX, DECEMBER 2020 TOPOGRAPHY", DATED MAY 20, 2021, BY INGENAE, LLC (2020 INGENAE SURVEY).
3. EXISTING CONTOURS FOR AREAS BEYOND THE LIMITS OF THE 2020 INGENAE SURVEY WERE TAKEN FROM LIDAR DATA PROVIDED BY THE ILLINOIS GEOSPATIAL CLEARINGHOUSE, ILLINOIS HEIGHT MODERNIZATION (ILHMP), ACCESSIBLE AT CLEARINGHOUSE.ISGS.ILLINOIS.EDU. THE IMAGERY WAS OBTAINED FOR RANDOLPH COUNTY AND WAS COLLECTED IN 2012.
4. EXISTING CONTOURS WERE SUPPLEMENTED FROM AERIAL SURVEYS OF THE ACTIVE PACEMENT AREAS FOR FLY ASH, BOTTOM ASH, AND ECONIMIZER ASH PROVIDED BY BORAL (2022).
5. EXISTING AERIAL IMAGERY FOR AREAS BEYOND THE LIMITS OF THE 2021 INGENAE SURVEY WERE OBTAINED FROM GOOGLE EARTH PRO IN 2022, AND THE IMAGERY WAS COLLECTED IN 2020.
6. APPROXIMATE PROPERTY LIMITS WERE TAKEN FROM THE RANDOLPH COUNTY, ILLINOIS ARCGIS HUB(HTTPS://GIS-RANDOLPH-COUNTY.HUB.ARCGIS.COM/) AND REPRESENT THE APPROXIMATE BOUNDARIES OF PARCELS OWNED BY DYNEGY MIDWEST GENERATION, LLC.
7. MONITORING WELL LOCATIONS WERE PROVIDED BY RAMBOLL (2022) AND PIEZOMETER LOCATIONS WERE OBTAINED FROM THE 30 PERCENT DESIGN DRAWINGS FOR THE FLY ASH POND SYSTEM AECOM (2016).
8. ALL OVERHEAD ELECTRIC LINE LOCATIONS ARE APPROXIMATE AND SHOULD NOT BE CONSIDERED COMPREHENSIVE. ADDITIONAL SURVEYS SHOULD BE PERFORMED PRIOR TO CONSTRUCTION TO VERIFY THE LOCATIONS OF ALL OVERHEAD AND BURIED UTILITIES. UTILITY LOCATIONS ARE ONLY SHOWN WITHIN THE PROPERTY LINES.
9. LIMITS FOR THE BAP WERE TAKEN FROM "LUMINANT, BALDWIN POWER PLANT, CCR FACILITY BOUNDARY EXHIBIT", DATED SEPTEMBER 7, 2021, BY INGENAE LLC (2021 INGENAE BOUNDARY SURVEY).
10. LOCATION OF UTILITIES, DISCHARGE PIPING, AND THE LAGOON DISCHARGE TO BE FIELD VERIFIED BY THE CONTRACTOR.

0 200 400
SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP

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DYNEGY MIDWEST GENERATION, LLC
1500 EASTPORT PLAZA DRIVE
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TITLE: EXISTING CONDITIONS

PROJECT: BOTTOM ASH POND CONSTRUCTION PERMIT APPLICATION CLOSURE DRAWINGS

SITE: BALDWIN POWER PLANT BALDWIN, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

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DATE

DESIGN BY:	CL	DATE:	JANUARY 2023
DRAWN BY:	DW	PROJECT NO.:	GLP8050
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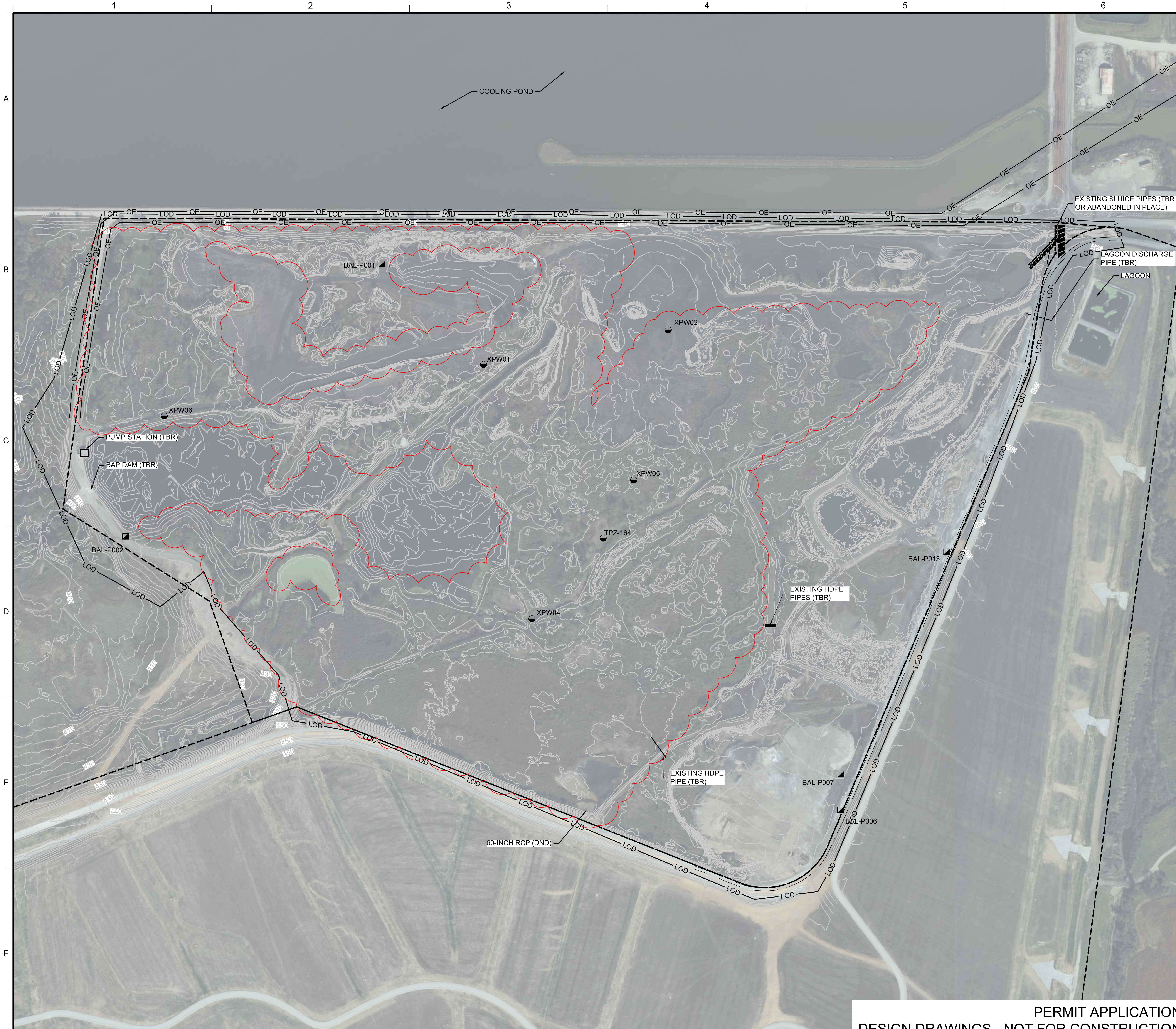
APPROVED BY:	TWW		G-110



LEGEND

- 355 — EXISTING GROUND MAJOR CONTOUR (5')
- EXISTING GROUND MINOR CONTOUR (1')
- IMPOUNDMENT BOUNDARY
- OE — OVERHEAD ELECTRIC
- LAGOON DISCHARGE PIPE
- APPROXIMATE AREA OF CLEARING
- FINAL HAUL ROAD (7 / C-150)
- LOD — LIMITS OF DISTURBANCE (LOD)
- XPW05 — MONITORING WELLS (6 / C-150)
- BAL-P007 — PIEZOMETERS (5 / C-150)

NOTES:

1. ITEMS IDENTIFIED AS TO BE REMOVED (TBR) SHALL BE COMPLETED IN ACCORDANCE WITH LOCAL, STATE, AND FEDERAL GUIDELINES IN APPROVED LANDFILLS. .
2. THE LAGOON DISCHARGE PIPE SHALL NOT BE REMOVED UNTIL THE PLANT HAS STOPPED OPERATION AND OWNER AUTHORIZATION.
3. CLEARING OF EXISTING VEGETATION SHALL BE COMPLETED PRIOR TO EXCAVATION FOR THE CCR MATERIALS.
4. OVERHEAD ELECTRICAL LINES SHALL NOT BE DISTURBED.
5. THE DAM SHALL NOT BE REMOVED UNTIL THE FINAL COVER SYSTEM IS COMPLETE.
6. PUMP STATION SHALL NOT BE REMOVED UNTIL THE FINAL COVER SYSTEM IS COMPLETE.
7. SLUICE LINES SHALL NOT BE REMOVED UNTIL THE BALDWIN POWER PLANT IS NO LONGER GENERATING POWER.

0 200 400
SCALE IN FEET

N

REV	DATE	DESCRIPTION	DRN	APP

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TELEPHONE: 636-812-0800

DYNEGY MIDWEST GENERATION, LLC
1500 EASTPORT PLAZA DRIVE
COLLINSVILLE, IL 62234 USA

TITLE: DEMOLITION, RELOCATION, AND ABANDONMENT

PROJECT: BOTTOM ASH POND CONSTRUCTION PERMIT APPLICATION CLOSURE DRAWINGS

SITE: BALDWIN POWER PLANT
BALDWIN, ILLINOIS

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SIGNATURE

DATE

DESIGN BY:	CLL	DATE:	JANUARY 2023
DRAWN BY:	DCW	PROJECT NO.:	GLP8050
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REVIEWED BY:	JPS	DRAWING NO.:	C-100
APPROVED BY:	TWW		

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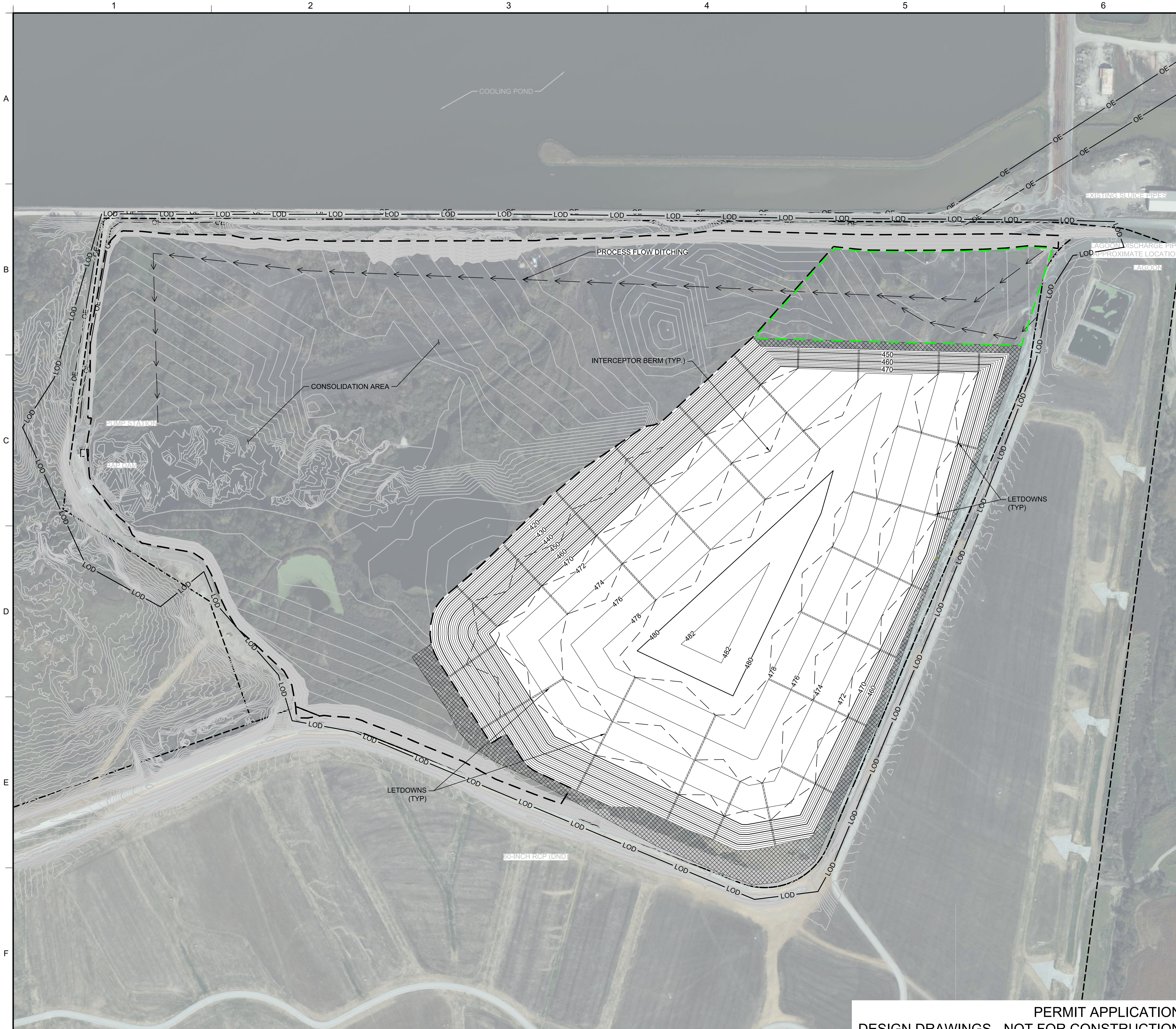

LEGEND

- EXISTING GROUND MAJOR CONTOUR (5')
- EXISTING GROUND MINOR CONTOUR (1')
- IMPOUNDMENT BOUNDARY
- PROPOSED GRADING MAJOR CONTOURS (5')
- PROPOSED GRADING MINOR CONTOURS (1')
- PROCESS FLOW DITCH
- LIMITS OF DISTURBANCE (LOD)
- INTERCEPTOR BERM (12 / C-160)
- PROCESS FLOW AND MATERIAL HANDLING AREA
- EDGE EXISTING GRADE
- LETDOWNS (9 / C-160) (10 / C-160)
- PERIMETER DITCH (8 / C-160)

NOTES:

1. PHASE 1 OF THE CLOSURE SHALL INCLUDE CONSOLIDATION OF CCR INTO THE FINAL COVER FOOTPRINT, CONSTRUCTION OF PERIMETER SLOPES AND FINAL COVER SYSTEM. THE CONTRACTOR SHALL RESERVE THE AREA NOTED FOR PROCESS FLOW AND MATERIAL HANDLING DURING OPERATIONS.
2. CONTRACTOR SHALL COORDINATE WITH THE PLANT AND NOT INTERFERE WITH ONGOING PROCESS FLOW AND PLACEMENT OR EXCAVATION FOR REUSE OF CCR MATERIALS UNTIL THE BPP CEASES POWER GENERATION IN MAY 2027.
3. THE CONTRACTOR SHALL OPERATE WITHIN THE "LOD" TO COMPLETE THE PROPOSED CLOSURE. CONTRACTOR SHALL EVALUATE AND IS SOLELY RESPONSIBLE FOR SAFE AND STABLE ACCESS OF EQUIPMENT ON THE CCR WITHIN THE "LOD".
4. CONTRACTOR SHALL FIELD LOCATE ALL EXISTING UTILITIES.
5. SELECT DEWATERING SHALL BE COMPLETED TO ALLOW FOR EXCAVATION OF THE CCR MATERIALS AND REMOVE FREE LIQUIDS FROM THE AREA TO BE CONSOLIDATED UTILIZING DEWATERING SUMPS AND DITCHES.
6. THE CONTRACTOR IS RESPONSIBLE FOR STORMWATER FLOWS DURING CONSTRUCTION AND SHALL ADHERE TO THE SITE SPECIFIC NPDES PERMIT. CONTACT STORMWATER AND DEWATERING WATER SHALL NOT FLOW OR BE PUMPED OUTSIDE OF THE LIMITS OF THE BAP EXCEPT THROUGH THE NDPES PERMITTED OUTFALL. THE CONTRACTOR SHALL UTILIZE THE EXISTING OUTFALL AT THE BAP DAM TO PUMP TO THE COOLING POND. PERIMETER DITCH ALIGNMENT IS APPROXIMATE AND WILL BE REFINED AT A LATER PHASE OF DESIGN.
7. STORMWATER COLLECTION AND MAINTENANCE OF THE STORMWATER BMPS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
8. CCR SHALL BE REMOVED FROM THE CONSOLIDATION AREAS TO AN ESTIMATED DEPTH OF APPROXIMATELY 1 FOOT BELOW THE ESTIMATED DEPTH OF CCR. VISIBLE CCR SHALL BE REMOVED, FINAL SUBGRADE SHALL BE VISIBLY INSPECTED BY A MEMBER OF THE CONSTRUCTION QUALITY ASSURANCE TEAM AFTER EXCAVATION. THE ACTUAL FINAL GRADES WILL BE DETERMINED IN THE FIELD DURING CCR REMOVAL CONSTRUCTION.
9. THE PROPOSED EXCAVATION GRADE IS BASED ON THE 1967 PRECONSTRUCTION SURVEY AND RECENT EXPLORATION INVESTIGATIONS TO IDENTIFY THE BOTTOM OF CCR.
10. GEOCOMPOSITE DRAINAGE LAYER SHALL BE INCLUDED IN ALL SLOPE AREAS 25% OR MORE STEEP.

0 200 400
SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP

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DYNEGY MIDWEST GENERATION, LLC
1500 EASTPORT PLAZA DRIVE
COLLINSVILLE, IL 62234 USA

TITLE: PHASE 1 FINAL GRADING PLAN

PROJECT: BOTTOM ASH POND CONSTRUCTION PERMIT APPLICATION CLOSURE DRAWINGS

SITE: BALDWIN POWER PLANT BALDWIN, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

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DATE

DESIGN BY:	CLL	DATE:	JANUARY 2023
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REVIEWED BY:	JPS	DRAWING NO.:	C-110
APPROVED BY:	TWW		

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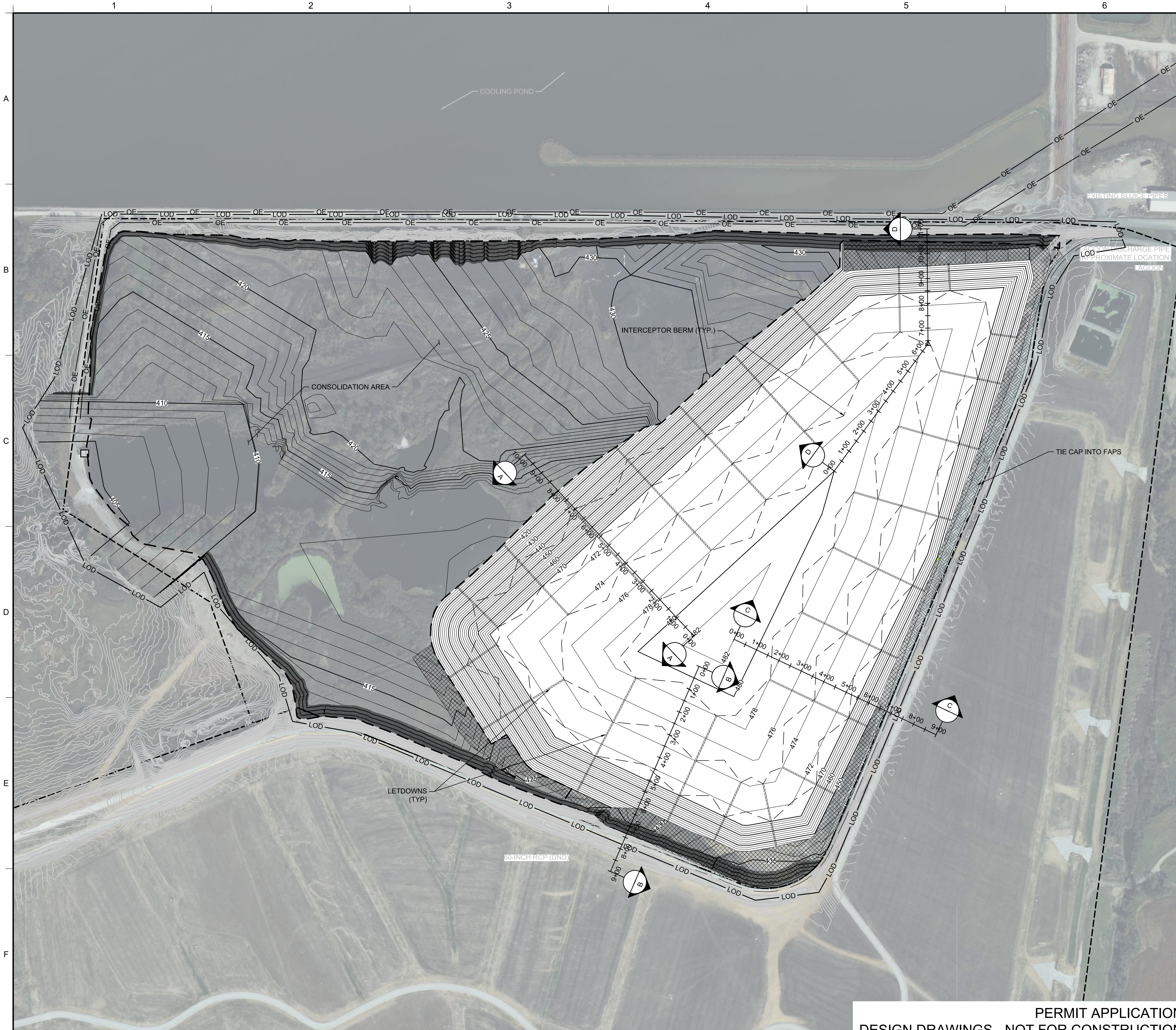

LEGEND

- 420 EXISTING GROUND MAJOR CONTOUR (5')
- EXISTING GROUND MINOR CONTOUR (1')
- IMPOUNDMENT BOUNDARY
- 470 PROPOSED GRADING MAJOR CONTOURS (5')
- 472 PROPOSED GRADING MINOR CONTOURS (1')
- LOD LIMITS OF DISTURBANCE (LOD)
- INTERCEPTOR BERM (12 / C-160)
- FINAL HAUL ROAD (7 / C-150)
- EDGE OF EXISTING GRADE
- LETDOWNS (9 / C-160) (10 / C-160)
- PERIMETER DITCH (8 / C-160)
- CAP TIE-IN TO FAPS

NOTES:

1. PHASE 2 OF THE CLOSURE SHALL INCLUDE FINAL GRADING IN THE CONSOLIDATION AREA AND COMPLETION OF CONSOLIDATION AND COVER SYSTEM IN THE NORTHERN AREA FOLLOWING THE DISCONTINUING OF POWER GENERATION AT THE PLANT.
2. THE CONTRACTOR SHALL OPERATE WITHIN THE "LOD" TO COMPLETE THE PROPOSED CLOSURE. CONTRACTOR SHALL EVALUATE AND IS SOLELY RESPONSIBLE FOR SAFE AND STABLE ACCESS OF EQUIPMENT ON THE CCR WITHIN THE "LOD".
3. SELECT DEWATERING SHALL BE COMPLETED TO ALLOW FOR EXCAVATION OF THE CCR MATERIALS AND REMOVE FREE LIQUIDS FROM THE AREA TO BE CONSOLIDATED UTILIZING DEWATERING SUMPS AND DITCHES.
4. THE CONTRACTOR IS RESPONSIBLE FOR STORMWATER FLOWS DURING CONSTRUCTION AND SHALL ADHERE TO THE SITE SPECIFIC NPDES PERMIT. CONTACT STORMWATER AND DEWATERING WATER,SHALL NOT FLOW OR BE PUMPED OUTSIDE OF THE LIMITS OF THE BAP EXCEPT THROUGH THE NDPES PERMITTED OUTFALL. THE CONTRACTOR SHALL UTILIZE THE EXISTING OUTFALL AT THE BAP DAM TO PUMP TO THE COOLING POND. PERIMETER DITCH ALIGNMENT IS APPROXIMATE AND WILL BE REFINED AT A LATER PHASE OF DESIGN.
5. STORMWATER COLLECTION AND MAINTENANCE OF THE STORMWATER BMPS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
6. CCR SHALL BE REMOVED FROM THE CONSOLIDATION AREAS TO AN ESTIMATED DEPTH OF APPROXIMATELY 1 FOOT BELOW THE ESTIMATED DEPTH OF CCR. VISIBLE CCR SHALL BE REMOVED, FINAL SUBGRADE SHALL BE VISIBLY INSPECTED BY A MEMBER OF THE CONSTRUCTION QUALITY ASSURANCE TEAM AFTER EXCAVATION. THE ACTUAL FINAL GRADES WILL BE DETERMINED IN THE FIELD DURING CCR REMOVAL CONSTRUCTION
7. THE PROPOSED EXCAVATION GRADE IS BASED ON THE 1967 PRECONSTRUCTION SURVEY AND RECENT EXPLORATION INVESTIGATIONS TO IDENTIFY THE BOTTOM OF CCR.
8. THE FINAL CLOSURE CAP WILL EXTEND TO THE LIMITS OF THE FLY ASH POND SYSTEM CAP TO THE EAST OF THE BAP. RESTORE EXISTING HAUL ROAD ON TOP OF FINAL CLOSURE CAP.
9. GEOCOMPOSITE DRAINAGE LAYER SHALL BE INCLUDED IN ALL SLOPE AREAS 25% OR MORE STEEP.

0 200 400
SCALE IN FEET

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DYNEGY MIDWEST GENERATION, LLC
1500 EASTPORT PLAZA DRIVE
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TITLE: PHASE 2 FINAL GRADING PLAN

PROJECT: BOTTOM ASH POND CONSTRUCTION PERMIT APPLICATION CLOSURE DRAWINGS

SITE: BALDWIN POWER PLANT
BALDWIN, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

DATE

DESIGN BY: CLL		DATE:	JANUARY 2023
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APPROVED BY: TWW			

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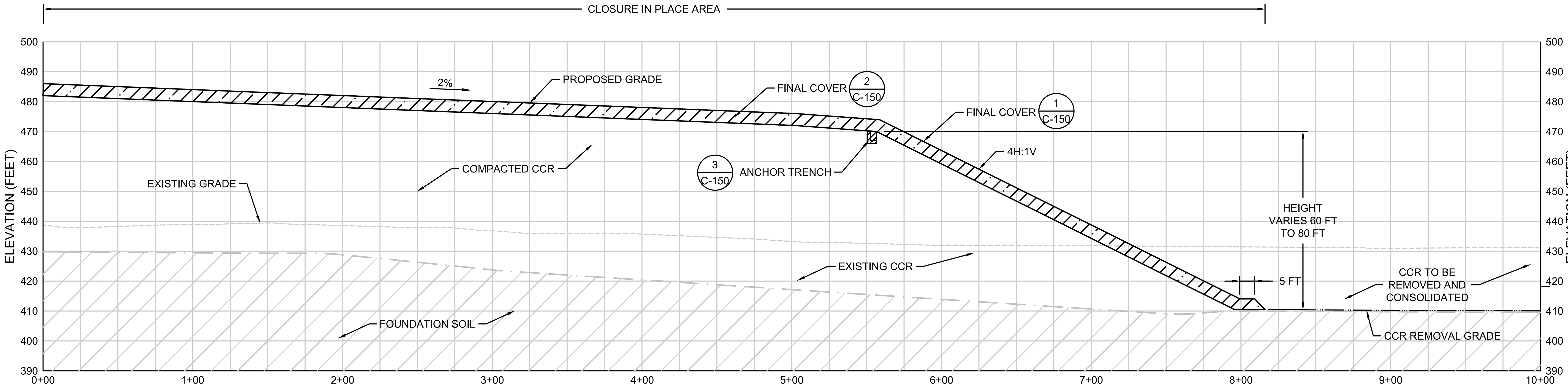
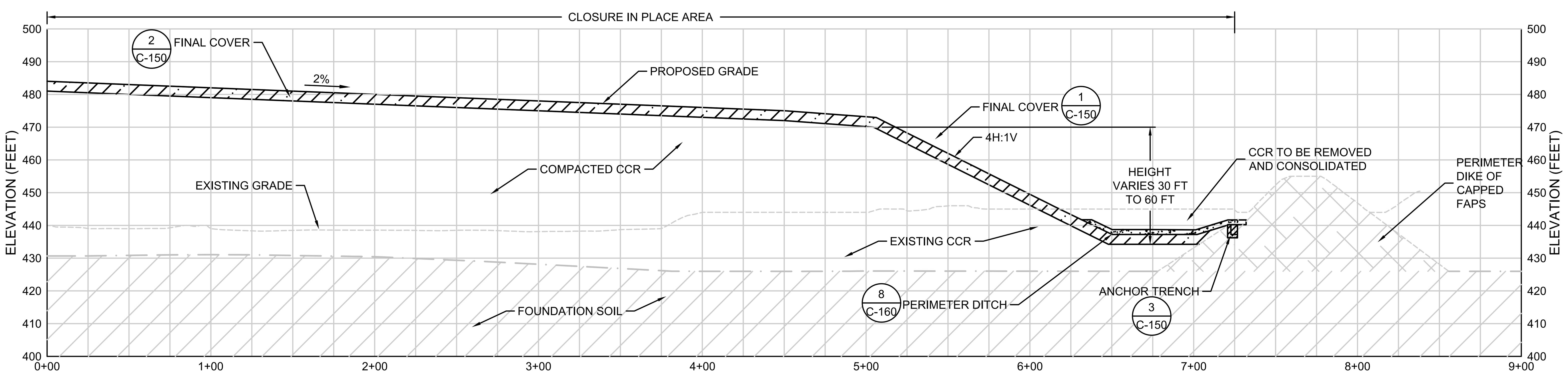
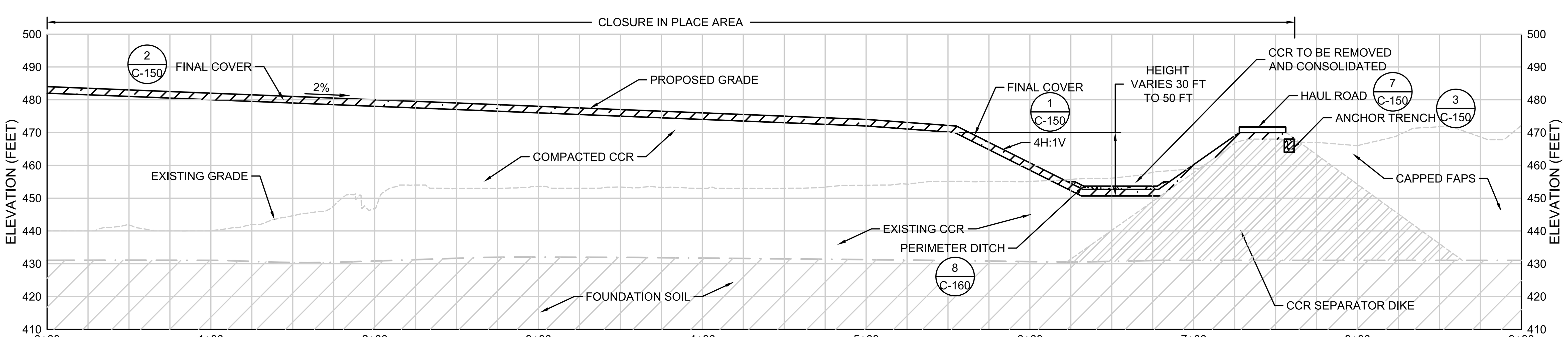


A PROFILE
HORIZONTAL: 1" =50'
VERTICAL: 1" =25'



B PROFILE
HORIZONTAL: 1" =50'
VERTICAL: 1" =25'



C PROFILE
HORIZONTAL: 1" =50'
VERTICAL: 1" =25'

LEGEND

- TOP OF FINAL COVER
- EXISTING GROUND SURFACE
- BOTTOM OF CCR
- PROTECTIVE COVER SOIL
- PERIMETER SOIL DIKE
- FOUNDATION SOIL
- CCR SEPARATOR DIKE

PERMIT APPLICATION
DESIGN DRAWINGS - NOT FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRN	APP

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TITLE: SECTIONS SHEET 1 OF 2

PROJECT: BOTTOM ASH POND CONSTRUCTION PERMIT APPLICATION CLOSURE DRAWINGS

SITE: BALDWIN POWER PLANT, BALDWIN, ILLINOIS

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DATE

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APPROVED BY:	TWW		

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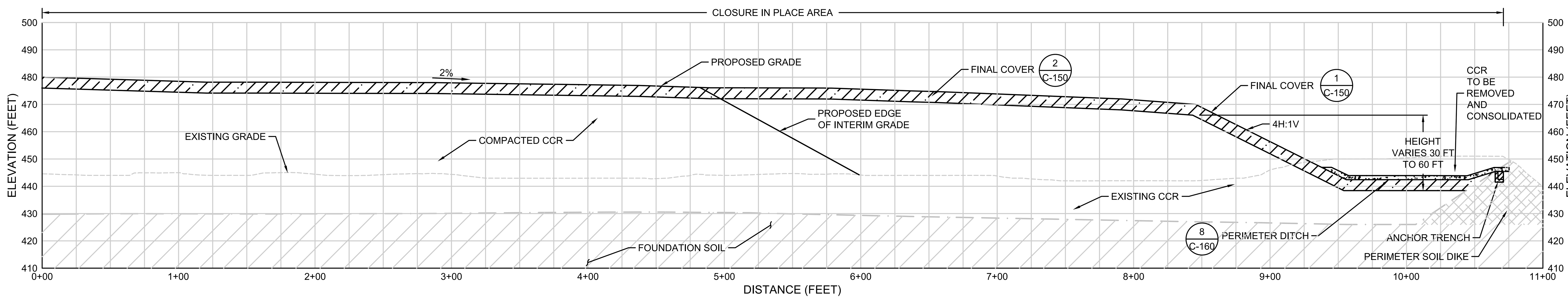

D PROFILE
HORIZONTAL: 1" =50'
VERTICAL: 1" =25'

LEGEND

- TOP OF FINAL COVER
- EXISTING GROUND SURFACE
- BOTTOM OF CCR
- PROTECTIVE COVER SOIL
- PERIMETER SOIL DIKE
- FOUNDATION SOIL

REV	DATE	DESCRIPTION	DRN	APP

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TITLE: SECTIONS SHEET 2 OF 2

PROJECT: BOTTOM ASH POND CONSTRUCTION PERMIT APPLICATION CLOSURE DRAWINGS

SITE: BALDWIN POWER PLANT
BALDWIN, ILLINOIS

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APPROVED BY:	TWW		

PERMIT APPLICATION
DESIGN DRAWINGS - NOT FOR CONSTRUCTION

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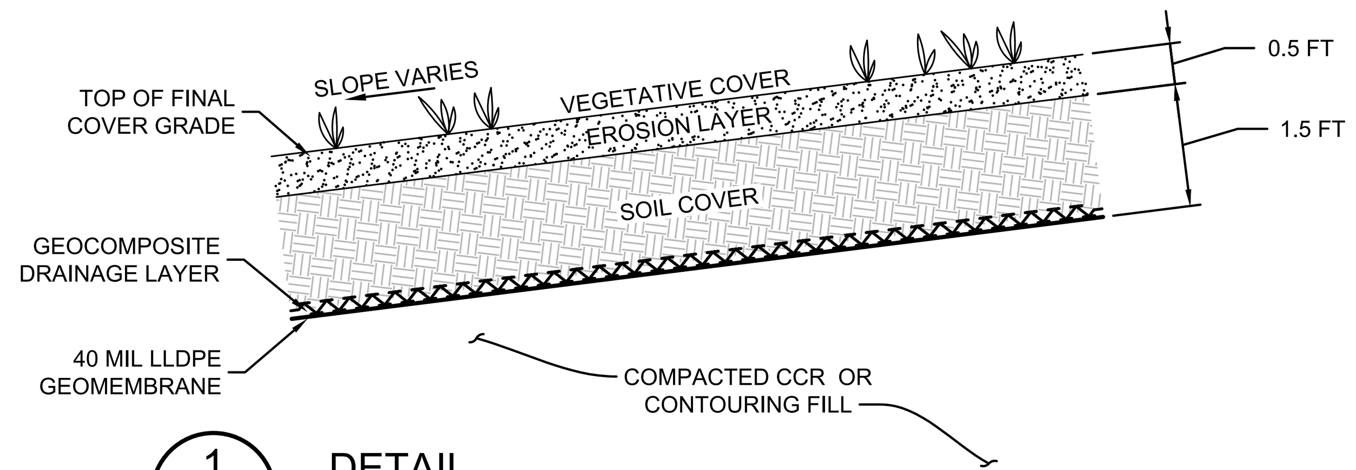
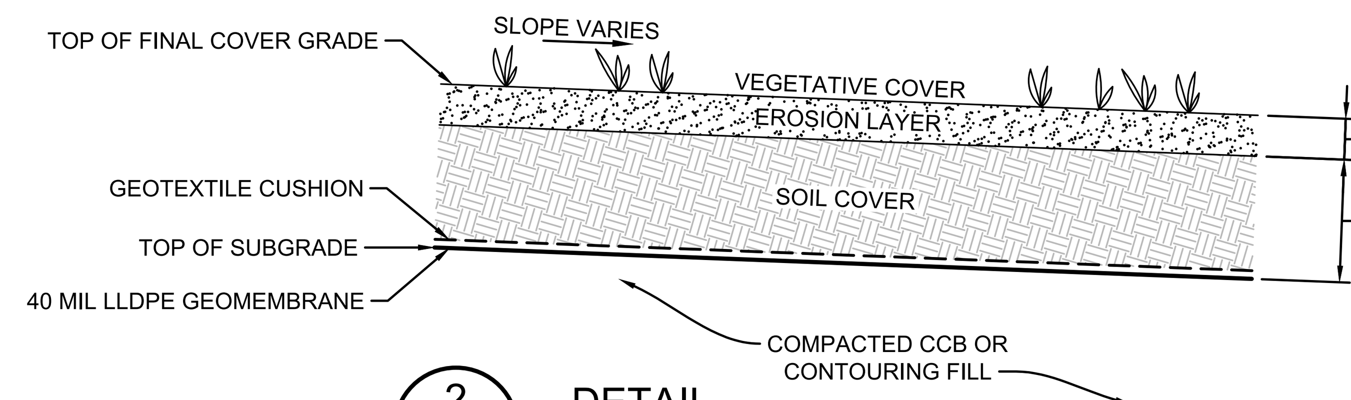
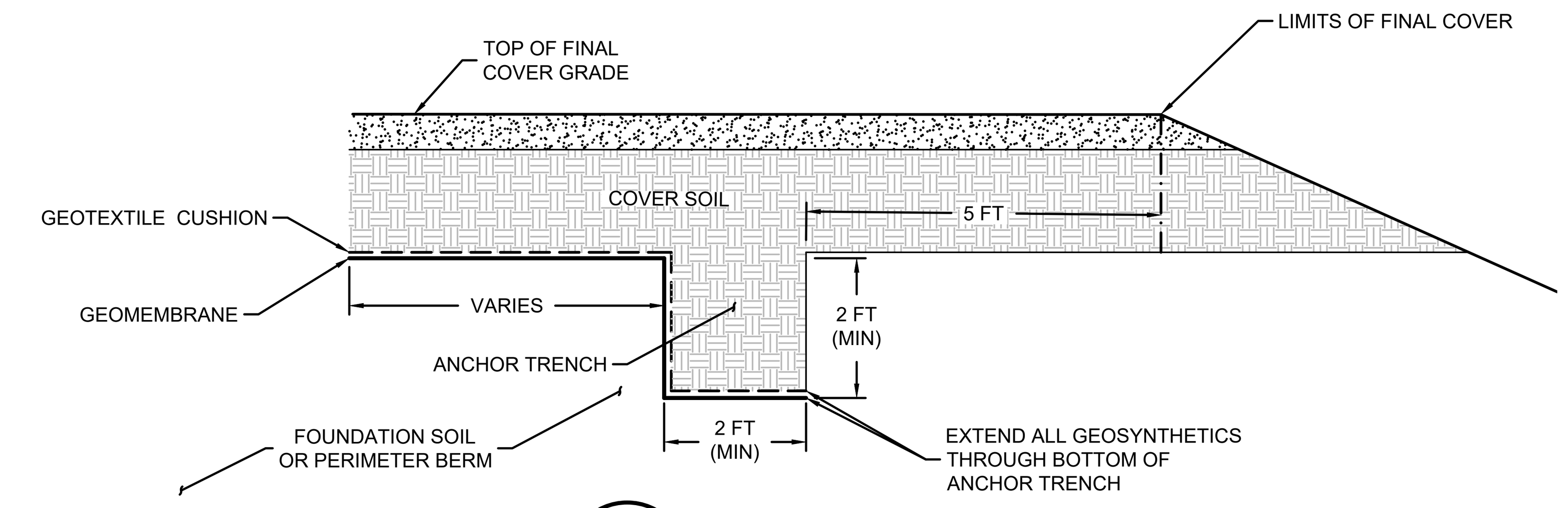


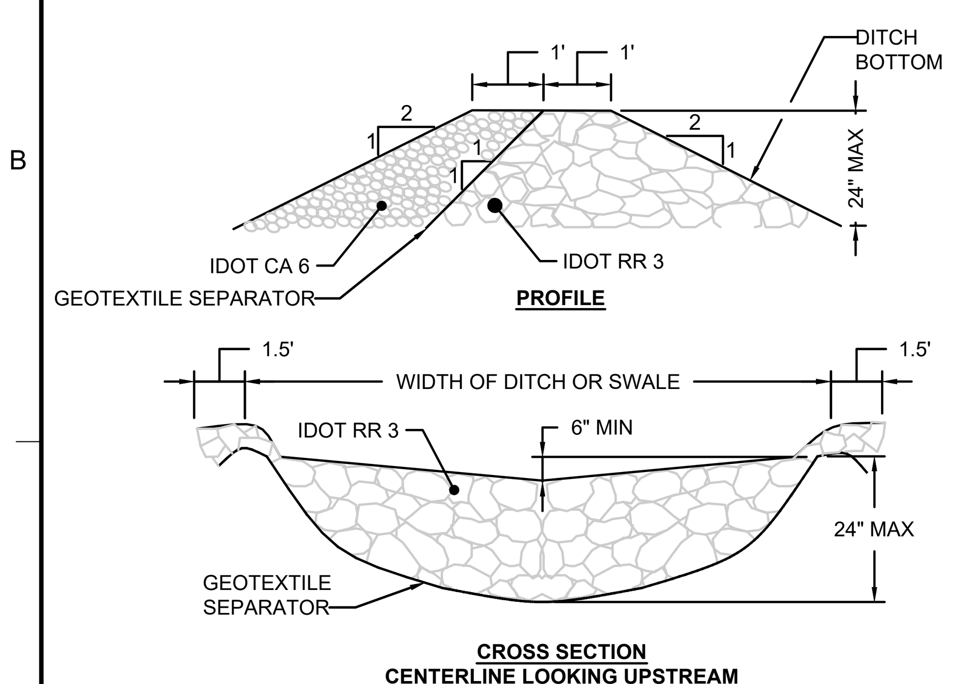
1 C-110 DETAIL
FINAL COVER SYSTEM WITH GEOCOMPOSITE DRAINAGE LAYER (4H:1V SLOPES)
SCALE: N.T.S.



2 C-110 DETAIL
FINAL COVER SYSTEM WITH GEOTEXTILE CUSHION (2% SLOPES)
SCALE: N.T.S.



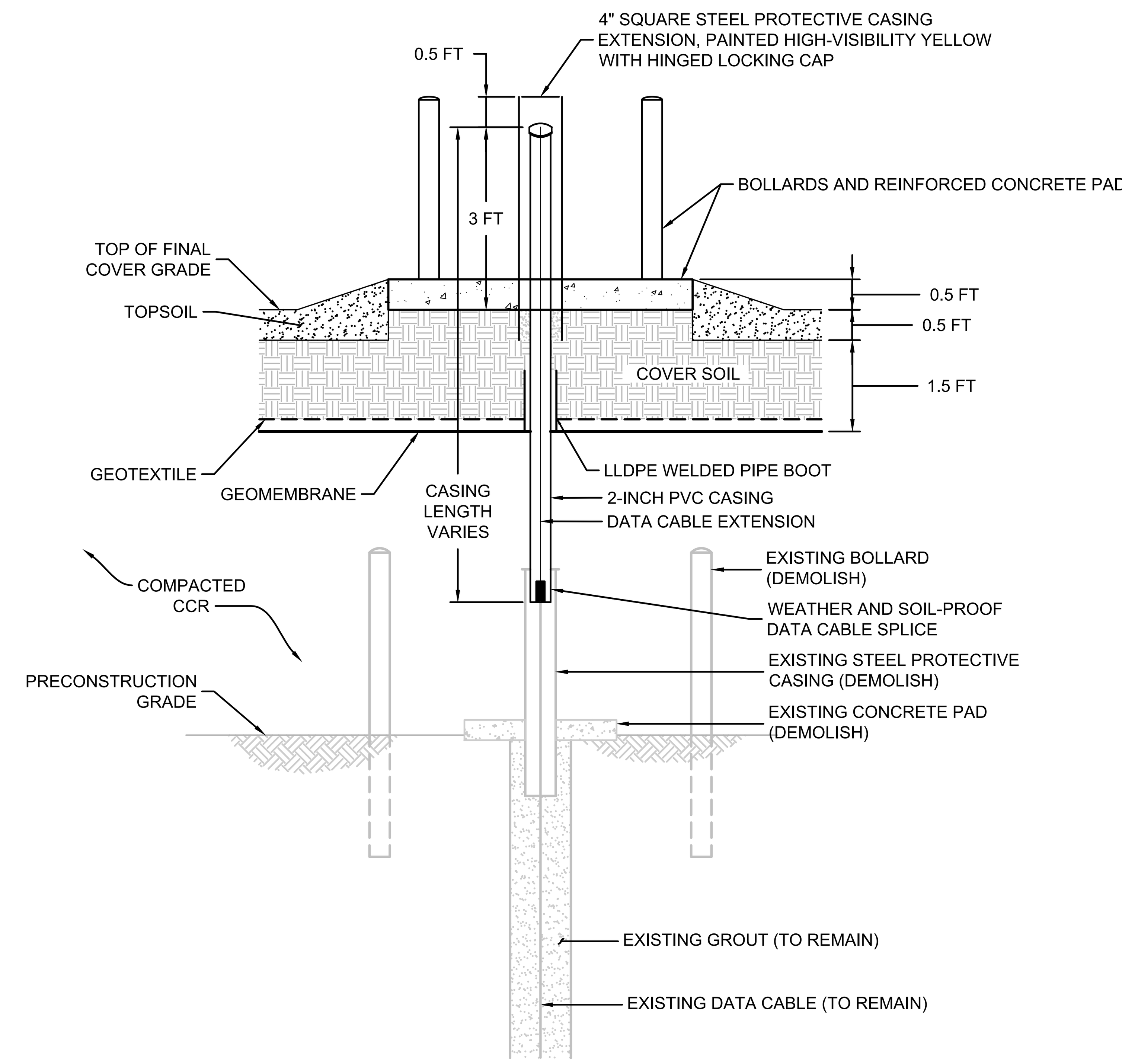
3 C-130 DETAIL
ANCHOR TRENCH
SCALE: N.T.S.



NOTES:

1. GEOTEXTILE SEPARATOR SHALL BE PLACED OVER THE CLEARED AREA PRIOR TO THE PLACING OF ROCK AND SHALL BE TOED IN 6 INCHES AT THE UPSTREAM EDGE.
2. PLACE AGGREGATE MOVING OUTWARD TOWARD CHANNEL EDGE. THE TOP OF THE CHECK DAM AT THE CHANNEL EDGE SHOULD BE AT LEAST 6 INCHES HIGHER THAN THE CENTER, CREATING A PARABOLIC OR TRAPEZOIDAL DOWNSTREAM OVERFLOW PROFILE.
3. FOR ADDED STABILITY, THE BASE OF THE DAM MAY BE KEYED 6 INCHES INTO THE SOIL.
4. SEDIMENT SHALL BE REMOVED WHEN THE SEDIMENT HAS ACCUMULATED TO ONE-HALF THE HEIGHT OF THE STONE BERM

4 C-170 DETAIL
ROCK CHECK DAM
SCALE: N.T.S.



NOTES:

1. THE LLDPE PIPE BOOT AND CLAMPS MAY BE OMITTED FOR PIEZOMETERS LOCATED OUTSIDE OF THE LIMITS OF THE FINAL COVER SYSTEM, AS A GEOMEMBRANE WILL NOT BE PRESENT IN THESE AREAS.
2. FOR PIEZOMETERS LOCATED IN AN ACTIVE SITE ROADWAY,THE ABOVE-GRADE PROTECTIVE CASING, BOLLARDS, AND CONCRETE PAD MAY BE SUBSTITUTED WITH A FLUSH MOUNT CASING AND A CONCRETE PAD AT LEAST 3 FT IN DIAMETER AND 6 INCHES IN THICKNESS. ALL OTHER DETAILS ARE TO REMAIN THE SAME.

5 C-150 DETAIL
VIBRATING WIRE PIEZOMETER EXTENSION
SCALE: N.T.S.

MATERIAL SPECIFICATIONS

1. CRUSHED STONE
CRUSHED STONE IS TO CONSIST OF A SCREENED GRAVEL MATERIAL CONFORMING TO THE IDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 1004 REQUIREMENTS, GRADATION CA 6 UNLESS OTHERWISE NOTED.

2. TOPSOIL
TOPSOIL IS TO CONSIST OF A NATURAL SOIL MATERIAL THAT IS RELATIVELY HOMOGENOUS, FREE OF DEBRIS, FOREIGN OBJECTS, AND LARGE ROCK FRAGMENTS. THE TOPSOIL IS TO:
-BE CLASSIFIED AS SC, CL, ML, OR OL (PER ASTM D2487), AND
-BE FERTILIZED, AS NECESSARY BASED ON AGRONOMIC TESTING, TO SUPPORT VEGETATION GROWTH AT THE SITE.

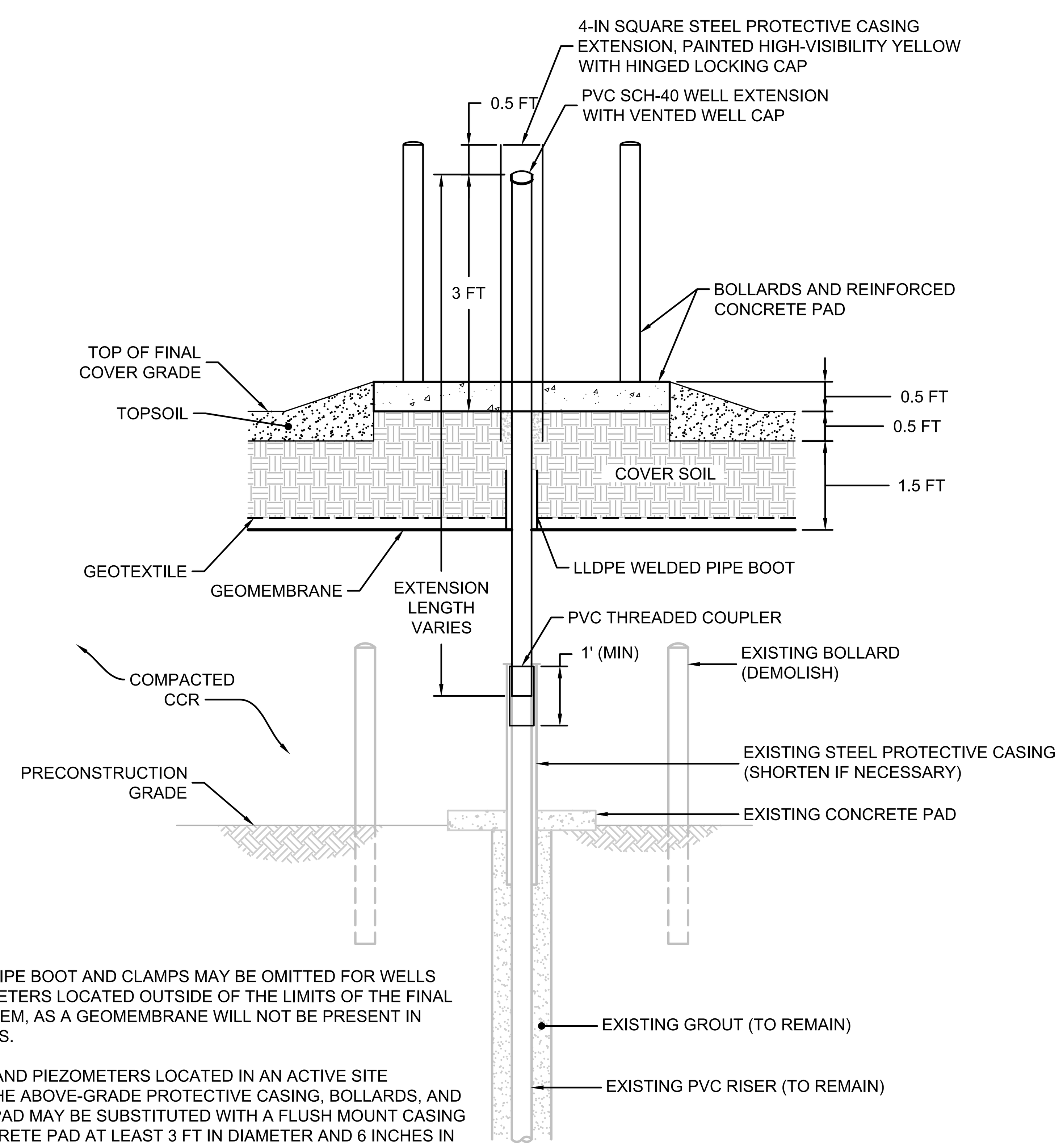
3. COVER SOIL
COVER SOIL IS TO CONSIST OF A NATURAL SOIL MATERIAL THAT IS RELATIVELY HOMOGENOUS, FREE OF DEBRIS, FOREIGN OBJECTS, AND LARGE ROCK FRAGMENTS. THE COVER SOIL IS TO:
-BE CLASSIFIED AS A CL, CH, CL-CH, CL-ML, SC, OR SM (PER ASTH D2487), AND
-HAVE A MAXIMUM PARTICLE SIZE OF 1.5 INCHES (PER ASTM D422 OR D6943) FOR THE INITIAL 6 INCHES AND MAXIMUM PARTICLE SIZE OF 3 INCHES FOR THE REMAINDER.

4. COMPACTED CCR
COMPACTED CCR IS TO CONSIST OF COAL COMBUSTION RESIDUALS, RESIDUAL COAL, AND NATIVE SUBGRADE MATERIALS EXCAVATED FROM WITHIN THE LIMITS OF THE BAP AND SURROUNDING AREA. THE COMPACTED CCR IS TO:
-BE PLACED IN LOOSE LIFTS NOT TO EXCEED 2 FT IN THICKNESS.
-BE COMPACTED WITH AT LEAST 4 PASSES OF SMOOTH DRUM OR SHEEPSFOOT ROLLER, WITH COMPACTION VERIFIED VIA PROOF-ROLLING WITH A LOADED OFF-ROAD DUMP TRUCK UNTIL EXCESSIVE RUTTING GREATER THAN 4 INCHES DOES NOT OCCUR.

5. GEOTEXTILE (CUSHION AND SEPARATOR)
THE GEOTEXTILE IS TO CONSIST OF A NONWOVEN POLYPROPYLENE MATERIAL MANUFACTURED IN ACCORDANCE WITH THE LATEST VERSION OF GEOSYNTHETIC INSTITUTE GRI-GT12(A) STANDARD SPECIFICATION, AND WITH THE FOLLOWING REQUIREMENTS:
-MINIMUM MASS PER UNIT AREA OF 16 OZ/YD^2 (PER ASTM D5261),
-MINIMUM GRAB STRENGTH OF 270 LB (PER ASTM D4632),
-MINIMUM TEAR STRENGTH OF 105 LB (PER ASTM D4533), AND
-MINIMUM PUNCTURE STRENGTH OF 725 LB (PER ASTM D6241).
GEOTEXTILE SEAMS ARE TO OVERLAPPED BY 1 FT DURING PLACEMENT AND EITHER MACHINE-SEWN OR THERMALLY BONDED TO ONE ANOTHER.

6. GEOMEMBRANE
THE GEOMEMBRANE IS TO CONSIST OF A LINEAR, LOW-DENSITY POLYETHYLENE (LLDPE) MATERIAL, TEXTURED ON BOTH SIDES, MANUFACTURED IN ACCORDANCE WITH THE LATEST VERSION OF GEOSYNTHETIC RESEARCH INSTITUTE GM17 STANDARD SPECIFICATION, AND WITH THE FOLLOWING REQUIREMENTS:
-MINIMUM NOMINAL THICKNESS OF 40 MIL (PER ASTM D5994),
-MINIMUM ASPERITY HEIGHT OF 16 MIL (PER ASTM D7466),
-MAXIMUM SPECIFIC GRAVITY OF 0.939 G/ML (PER ASTM D792, OR ASTM D1505),
-MINIMUM TENSILE STRENGTH AT BREAK OF 60 LB/IN (PER ASTM D6693),
-MINIMUM ELONGATION AT BREAK OF 250% (PER ASTM D6693), AND
-MINIMUM PUNCTURE RESISTANCE OF 44 LB (PER ASTM D3895).
GEOMEMBRANE SEAMS ARE TO BE FUSION-WELDED; REPAIRS AND PENETRATIONS FOR PIPE BOOTS ARE TO BE EXTRUSION WELDED.

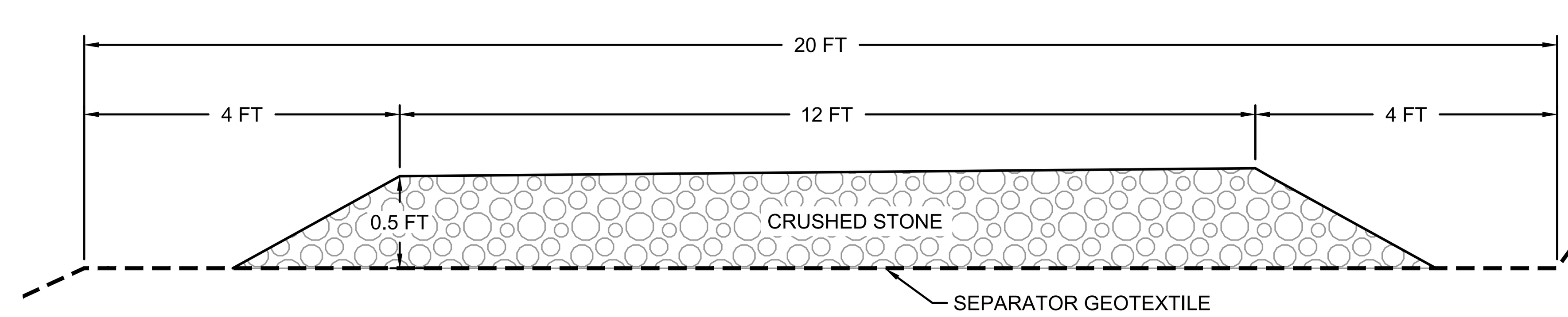
7. GEOCOMPOSITE DRAINAGE LAYER
THE GEOCOMPOSITE DRAINAGE LAYER IS TO CONSIST OF A POLYETHYLENE GEONET CORE WITH A NEEDLE-PUNCHED NONWOVEN GEOTEXTILE HEAT LAMINATED TO BOTH SIDES OF THE GEONET CORE, MANUFACTURED IN ACCORDANCE WITH THE LATEST VERSION OF GEOSYNTHETIC RESEARCH INSTITUTE GM19 STANDARD SPECIFICATION AND WITH THE FOLLOWING REQUIREMENTS:
-MINIMUM POLYMER DENSITY OF 0.93 G/CUBIC CM (PER ASTM D792)
-MINIMUM NOMINAL OF 250 MIL (PER ASTM D5199)
-MINIMUM POLYMER OF 95 POLYESTER OR POLYPROPYLENE
-MAXIMUM APPARENT OPENING SIZE OF 0.15 MM (PER ASTM D4751)
-MINIMUM GRAB STRENGTH OF 260 LB (PER ASTM D4632)
-MINIMUM TEAR STRENGTH OF 100 LB (PER ASTM D4533)
-MINIMUM STATIC PUNCTURE STRENGTH OF 725 (PER ASTM D6241)
-MINIMUM TRANSMISSIVITY OF OF 0.0003 SQ M/SEC (PER ASTM D4716)



NOTES:

1. THE LLDPE PIPE BOOT AND CLAMPS MAY BE OMITTED FOR WELLS AND PIEZOMETERS LOCATED OUTSIDE OF THE LIMITS OF THE FINAL COVER SYSTEM, AS A GEOMEMBRANE WILL NOT BE PRESENT IN THESE AREAS.
2. FOR WELLS AND PIEZOMETERS LOCATED IN AN ACTIVE SITE ROADWAY,THE ABOVE-GRADE PROTECTIVE CASING, BOLLARDS, AND CONCRETE PAD MAY BE SUBSTITUTED WITH A FLUSH MOUNT CASING AND A CONCRETE PAD AT LEAST 3 FT IN DIAMETER AND 6 INCHES IN THICKNESS. ALL OTHER DETAILS ARE TO REMAIN THE SAME.

6 C-150 DETAIL
STANDPIPE PIEZOMETER AND MONITORING WELL EXTENSION
SCALE: N.T.S.



7 C-120 DETAIL
ACCESS ROAD
SCALE: N.T.S.

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REV	DATE	DESCRIPTION	DRN	APP

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DYNEGY MIDWEST GENERATION, LLC
1500 EASTPORT PLAZA DRIVE
COLLINSVILLE, IL 62234 USA

TITLE: DETAILS AND MATERIAL SPECIFICATIONS - 1 OF 2

PROJECT: BOTTOM ASH POND CONSTRUCTION PERMIT APPLICATION CLOSURE DRAWINGS

SITE: BALDWIN POWER PLANT
BALDWIN, ILLINOIS

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SIGNATURE

DATE

DESIGN BY:	CLL	DATE:	JANUARY 2023
DRAWN BY:	DCW	PROJECT NO.:	GLP8050
CHECKED BY:	TWW	FILE:	08 - GLP8050 C-150
REVIEWED BY:	JPS	DRAWING NO.:	
APPROVED BY:	TWW		C-150

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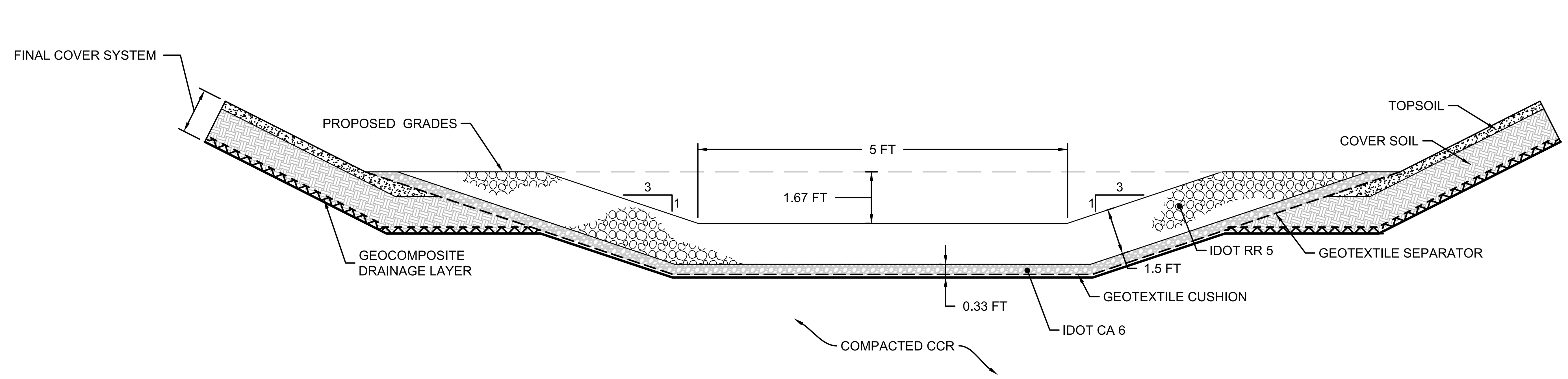
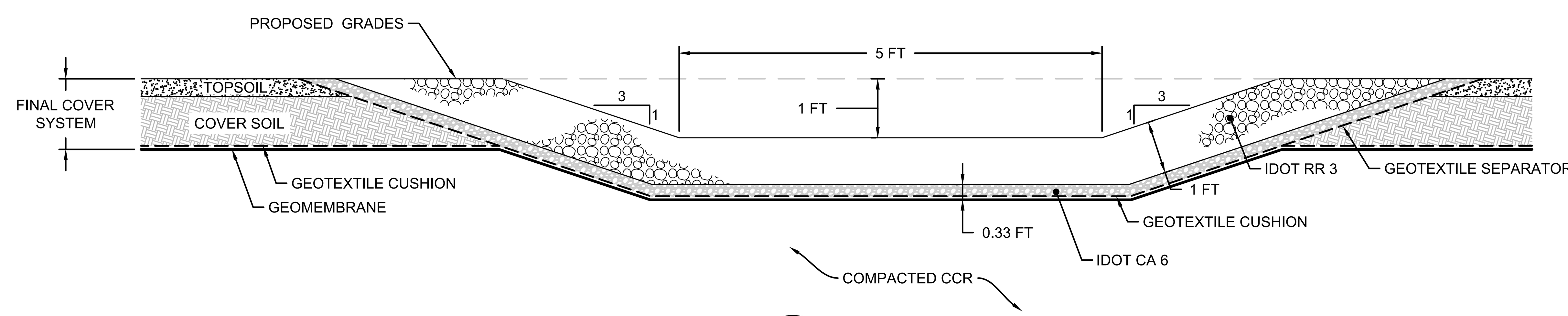
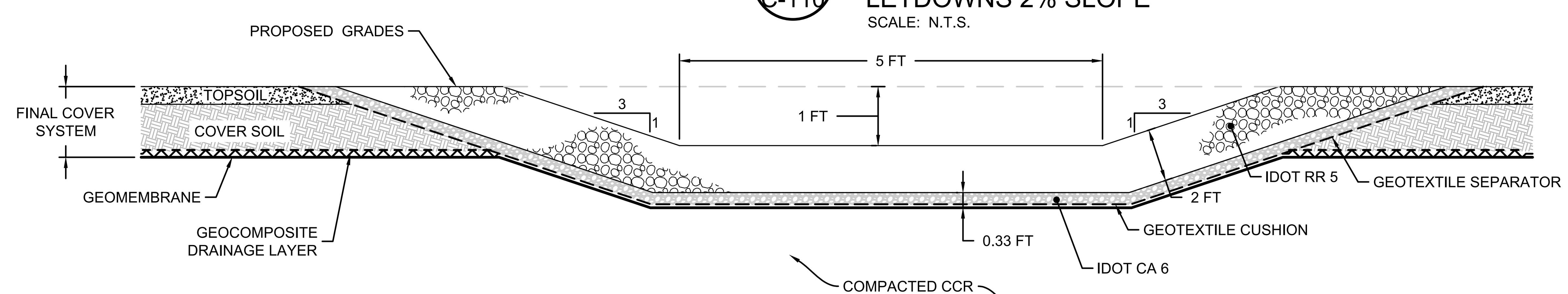


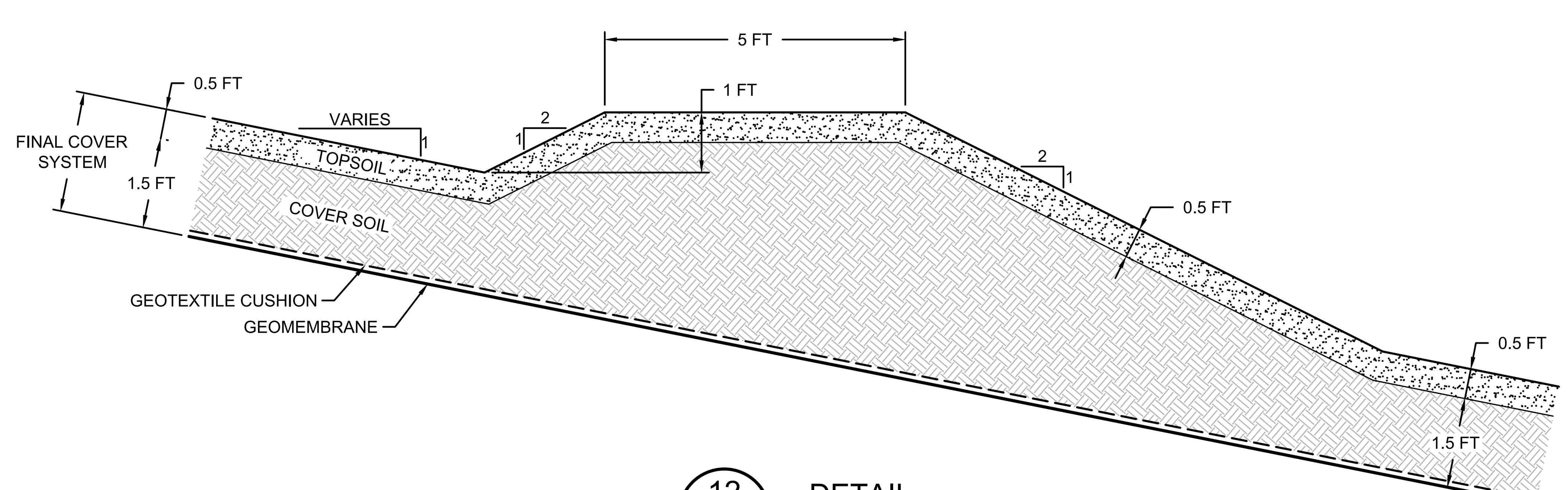
8
C-110
DETAIL
PERIMETER DITCH
SCALE: N.T.S.



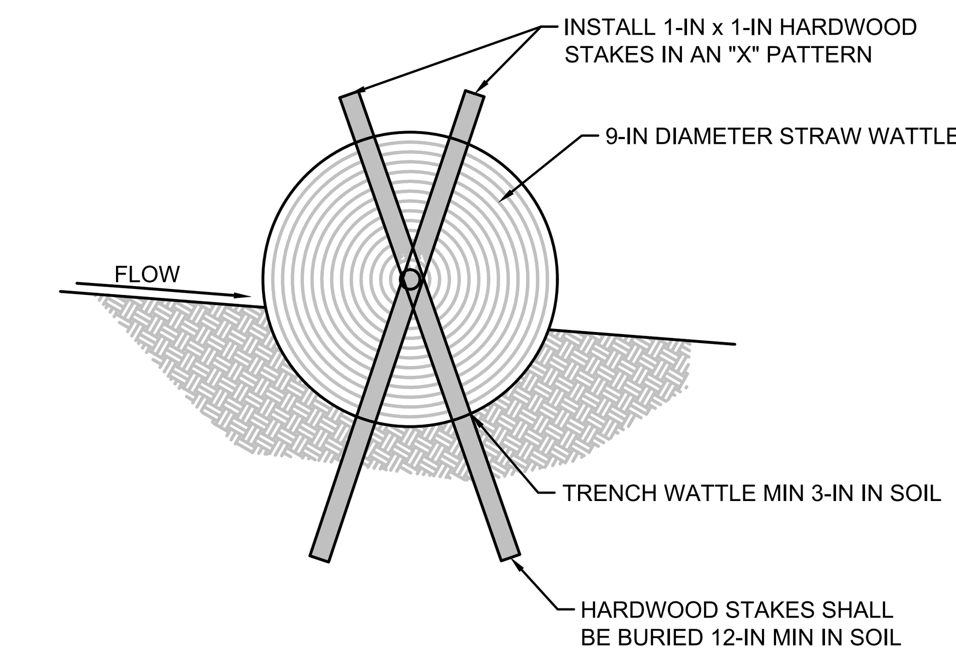
9
C-110
DETAIL
LETDOWNS 2% SLOPE
SCALE: N.T.S.

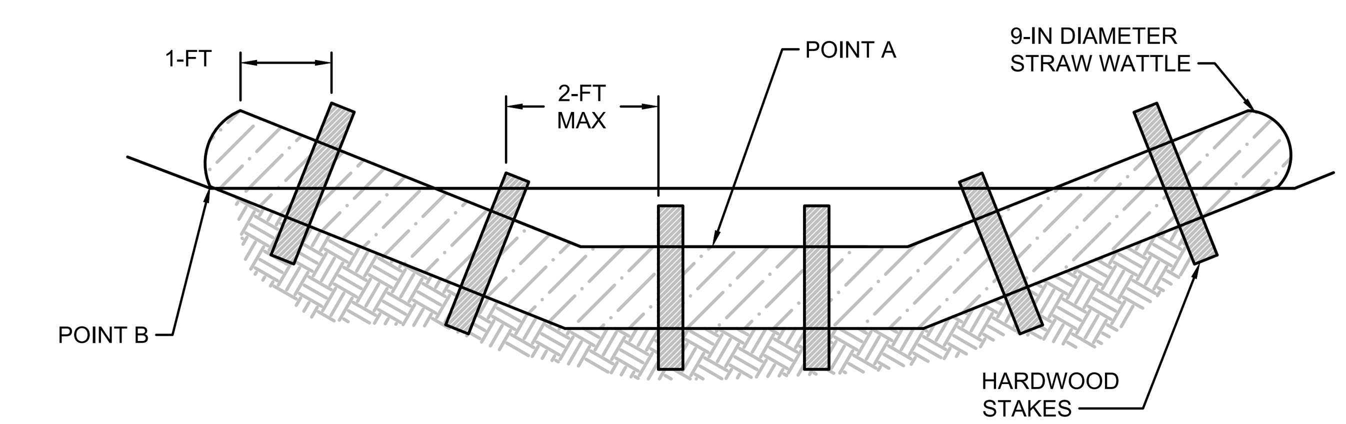


10
C-110
DETAIL
LETDOWNS 25% SLOPE
SCALE: N.T.S.



12
C-110
DETAIL
INTERCEPTOR BERM
SCALE: N.T.S.

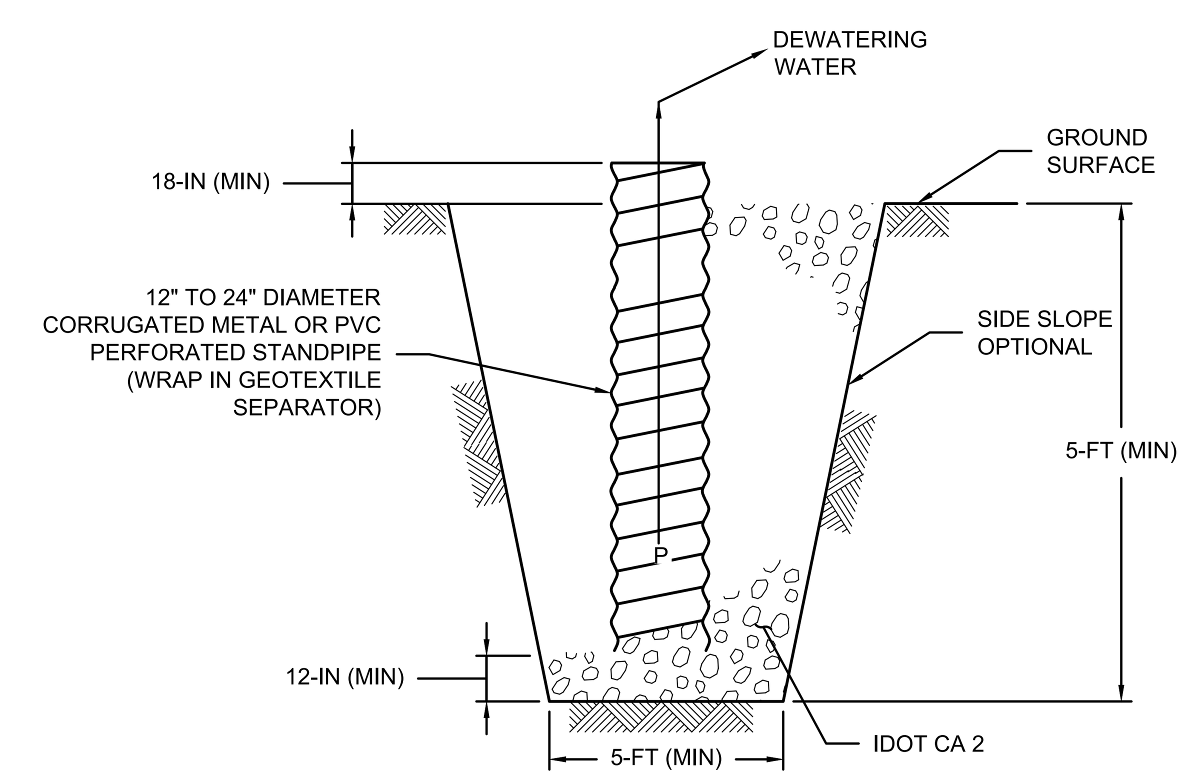




NOTES:

1. CONSTRUCT DITCH CHECK SO THAT "POINT A" IS A MINIMUM OF 3-IN LOWER THAN "POINT B".
2. PLACE DITCH CHECK PERPENDICULAR TO FLOW LINE OF DITCH.
3. CONSTRUCT DITCH CHECK SO THAT WATER DOES NOT FLOW AROUND THE ENDS OF OR UNDER THE DITCH CHECK.
4. REMOVE ACCUMULATED SEDIMENT WHEN SEDIMENT REACHES ONE-HALF THE HEIGHT OF THE DITCH CHECK.

11
C-170
DETAIL
STRAW WATTLE DITCH CHECK
SCALE: N.T.S.



NOTES:

1. A BASE OF IDOT CA 2 SHALL BE PLACED IN THE PIT TO A MINIMUM DEPTH OF 12-IN BELOW THE STANDPIPE.
2. THE STANDPIPE SHALL EXTEND A MINIMUM 18-IN ABOVE THE LIP OF THE PIT; PONDED WATER SHALL NOT OVERTOP THE STANDPIPE BY ADJUSTING THE HEIGHT OF OF THE PIPE ABOVE THE SURFACE OF THE GROUND.
3. THE STANDPIPE SHALL BE WRAPPED IN GEOTEXTILE CUSHION MATERIAL.
4. THE MINIMUM DIMENSIONS OF THE SUMP PIT, IN PLAN, SHALL BE AT LEAST 5-FT DIAMETER.
5. "P" = PUMP

13
C-160
DETAIL
SUMP PIT
SCALE: N.T.S.

MATERIAL SPECIFICATIONS

- RIPRAP
  THE RIPRAP IS TO CONSIST OF A CRUSHED NATURAL LIMESTONE OR DOLOMITE MATERIAL AND CONFORMING TO THE ILLINOIS DEPARTMENT OF TRANSPORTATION (IDOT) STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, SECTION 281 REQUIREMENTS, CLASS A OR CLASS B QUALITY.

PERMIT APPLICATION
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REV	DATE	DESCRIPTION	DRN	APP

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CHESTERFIELD, MO 63005 USA
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COLLINSVILLE, IL 62234 USA

TITLE: DETAILS AND MATERIAL SPECIFICATIONS - 2 OF 2

PROJECT: BOTTOM ASH POND CONSTRUCTION PERMIT APPLICATION CLOSURE DRAWINGS

SITE: BALDWIN POWER PLANT BALDWIN, ILLINOIS

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SIGNATURE

DATE

DESIGN BY:	CLL	DATE:	JANUARY 2023
DRAWN BY:	DCW	PROJECT NO.:	GLP8050
CHECKED BY:	TWW	FILE:	09 - GLP8050 C-160
REVIEWED BY:	JPS	DRAWING NO.:	C-160
APPROVED BY:	TWW		

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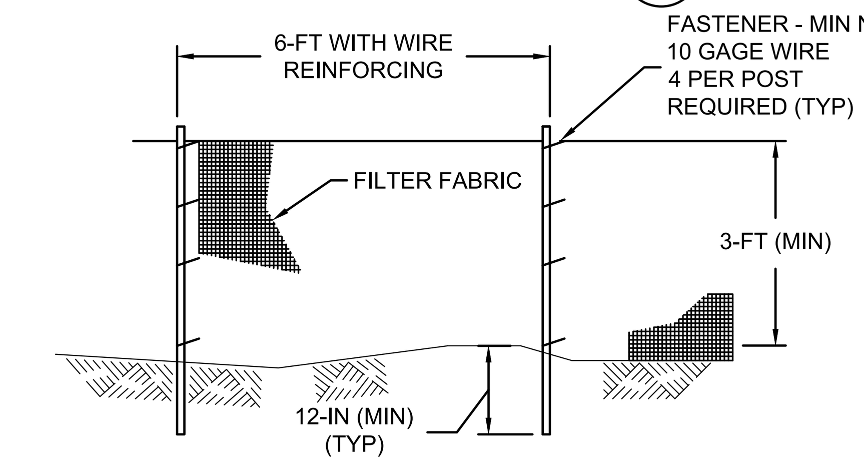
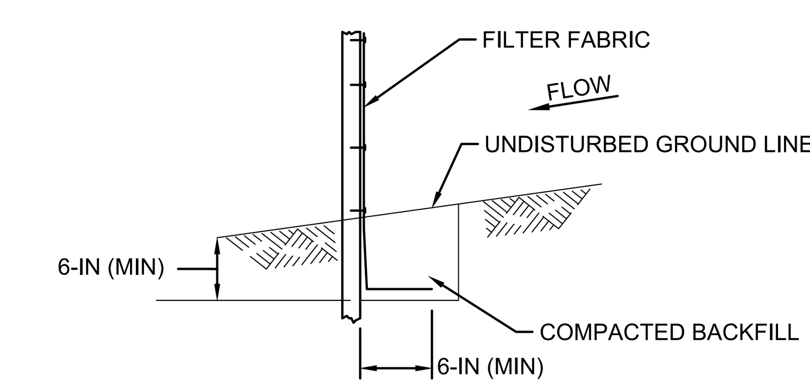
LEGEND

- 420 — EXISTING GROUND MAJOR CONTOUR (5')
- EXISTING GROUND MINOR CONTOUR (1')
- IMPOUNDMENT BOUNDARY
- 470 — PROPOSED GRADING MAJOR CONTOURS (5')
- 472 — PROPOSED GRADING MINOR CONTOURS (1')
- SILT FENCE (14 / C-170)
- STRAW WATTLE (11 / C-160)
- LOD — LIMITS OF DISTURBANCE (LOD)
- INTERCEPTOR BERM (12 / C-160)
- FINAL HAUL ROAD (7 / C-150)
- ROCK CHECK DAM (4 / C-150)



ELEVATION



FABRIC ANCHOR DETAIL

14 / C-170 DETAIL — SILT FENCE
SCALE: NTS

NOTES:

1. INSTALL ADDITIONAL SILT FENCE AND STRAW WATTLES AT ALL ENTRY POINTS FOR STORMWATER COLLECTION.
2. INSTALL ROCK CHECK DAMS IN THE PROCESS FLOW DITCH EVERY 200 FT.
3. INSTALL STRAW WATTLES AT CONCENTRATED FLOW AREAS.

0 200 400
SCALE IN FEET

REV	DATE	DESCRIPTION	DRN	APP

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CHESTERFIELD, MO 63005 USA
TELEPHONE: 636-812-0800

DYNEGY MIDWEST GENERATION, LLC
1500 EASTPORT PLAZA DRIVE
COLLINSVILLE, IL 62234 USA

TITLE: EROSION AND SEDIMENT CONTROL PLAN

PROJECT: BOTTOM ASH POND CONSTRUCTION PERMIT APPLICATION CLOSURE DRAWINGS

SITE: BALDWIN POWER PLANT
BALDWIN, ILLINOIS

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SIGNATURE

DATE

DESIGN BY:	CLL	DATE:	JANUARY 2023
DRAWN BY:	DCW	PROJECT NO.:	GLP8050
CHECKED BY:	TWW	FILE:	10 - GLP8050 C-170
REVIEWED BY:	JPS	DRAWING NO.:	C-170
APPROVED BY:	TWW		

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ATTACHMENT C

Alternative Final Protective Layer Equivalency Demonstration
(Sections 845.720(a)(1)(A) and 750(c)(2))

Geosyntec consultants

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Technical Memorandum

Date: July 31, 2023

To: Victor Modeer, P.E., DGE, Vistra on behalf of Dynegy Midwest Generation, LLC (DMG)

Copies to: Phil Morris, Rhys Fuller, Vistra on behalf of DMG

From: John Seymour, P.E., Geosyntec Consultants (Geosyntec)

Thomas Ward, P.E., Geosyntec

Subject: Proposed Alternative Final Protective Layer Equivalency Demonstration
Bottom Ash Pond, Baldwin Power Plant
Baldwin, Illinois
Geosyntec Project: GLP8050

PROPOSAL

An alternative final protective layer is proposed by Dynegy Midwest Generation, LLC (DMG) for the Bottom Ash Pond (BAP) surface impoundment that will be closed-in-place at the Baldwin Power Plant (BPP). The closure will be in accordance with Illinois Administrative Code (IAC) Part 845 Rule [1] (Part 845). Overall, the proposal will meet the requirements of Section 845.750(c)(2).

This Technical Memorandum presents a demonstration that a 2-foot-thick alternative final protective layer consisting of an 18-inch-thick soil layer and a 6-inch layer of topsoil provide equivalent or superior performance to the default protective layer set forth in Section 845.750(c)(2). The alternative final protective layer works in combination with an underlying low permeability (geomembrane) layer in place of the default three-foot thick, low permeability compacted earth layer required by Section 845.750(c)(1)(A). In addition, a cushion layer consisting of a geotextile or geocomposite drainage layer (25 percent slopes) is placed on top of the geomembrane prior to installation of the final protective layer. The combination of the above materials comprises the final "alternative final cover system".

A discussion of how the closure, including the proposed alternative final cover system discussed herein, meets the performance standards is contained in the Closure Plan [2], which includes the Closure Alternatives Assessment required by Section 845.710.

REQUIREMENTS OF SECTION 845

Section 845.750 provides requirements for both the final protective layer and underlying low permeability layer. They work in tandem to provide protection of groundwater and surface exposure conditions. A principal intention of the low permeability layer is to reduce the infiltration of liquid through the final cover system and into the CCR waste mass during post-closure conditions, in accordance with Section 845.720(a), which states in part:

> *The owner or operator of a CCR surface impoundment must ensure that, at a minimum, the CCR surface impoundment is closed in a manner that will*:
>
> 1) *Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate or contaminated run-off to the ground or surface waters or to the atmosphere;*

Specific default requirements for the final cover system are included in Section 845.750(c), which requires the final cover system to have either: 1) a three-foot thick soil low permeability compacted earth layer overlain by a three-foot-thick final protective layer (final protective layer), or 2) a geomembrane low permeability layer with a three-foot-thick final protective layer.

The specific Section 845.750(c)(2) design requirements for the final protective layer are as follows (emphasis added):

> *Standards for the Final Protective Layer: The final protective layer must meet the following requirements, **unless the owner or operator demonstrates that another final protective layer construction technique or material provides equivalent or superior performance to the requirements of this subsection (c)(2)** and is approved by the Agency.*

Therefore, Section 845.750(c)(2) specifically allows the use of an alternate final protective layer as long as it provides an equivalent or superior performance to the default standards set forth in Section 845.750(c)(2), which are as follows:

> A) *Cover the entire low permeability layer;*
>
> B) *Be at least three feet thick, be sufficient to protect the low permeability layer from freezing, and minimize root penetration of the low permeability layer;*
>
> C) *Consist of soil material capable of supporting vegetation;*
>
> D) *Be placed as soon as possible after placement of the low permeability layer; and*
>
> E) *Be covered with vegetation to minimize wind and water erosion.*

The alternate design is only requesting an alternate to Section 845.740(c)(2)(B) related to the thickness of the of the final protective layer.

PROPOSED FINAL COVER SYSTEM SUMMARY

The proposed final cover systems will include:

- A low permeability layer consisting of a linear low-density polyethylene (LLDPE) geomembrane that is at least 40-mil in thickness, placed on a smooth CCR subgrade;
- A geotextile cushion; and
- A final protective layer consisting of 18 inches of protective cover soil with a 6-inch layer of topsoil capable of supporting vegetation.

The final protective layer will meet all Section 845.750(c)(2) criteria, will not need any supplemental engineering measures, and will be designed by a qualified professional engineer licensed in Illinois.

The concepts of the alternative cover system are illustrated on **Figure 1**.

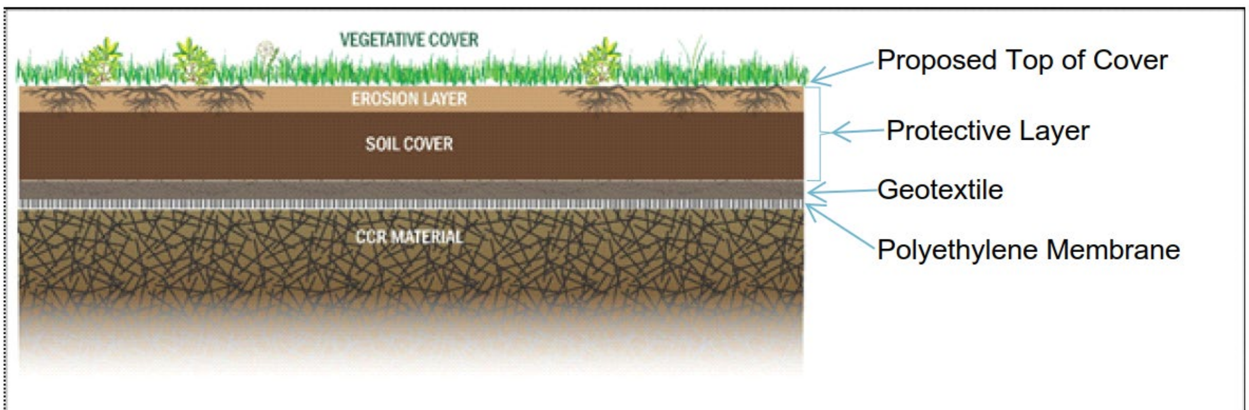

Figure 1: Proposed Alternative Final Cover System

DEMONSTRATION

The proposed alternate final protective layer will address the five requirements of Section 845.750 (c)(2)(A) to (E), as described in this section.

Section 845.750(c)(2)(A) Cover the entire low permeability layer

The final protective layer will horizontally cover the entire low-permeability layer, as indicated in the drawings in Attachment B of the Closure Plan [2]. Therefore, the use of the two-foot-thick final protective layer will meet the minimum requirements of Section 845 750(c)(2)(A) because it will completely cover the low-permeability layer.

Section 845.750(c)(2)(B) Be sufficient to protect the low permeability layer from freezing, and minimize root penetration of the low permeability layer

The existing Part 845, which has the same requirements as Part 814 (closure rule for landfills), requires a three-foot-thick final protective layer to protect the underlying low permeability layer from freeze-thaw effects and root penetration. However, when a geomembrane is used as the low permeability layer it does not need these protections since it is not subject to the same impacts (i.e., causing an increase in hydraulic conductivity) as a compacted earth layer as discussed in more detail below.

A geomembrane low permeability layer will be used for the BPP BAP. Geomembranes have the following characteristics:

- Geomembranes do not have pores that can contain water and are therefore not susceptible to freeze-thaw damage that may reduce their performance as a low permeability layer and/or lead to degradation of the geomembrane.
    - Geomembrane panel strength and stiffness both increase with decreasing temperatures ([3], [4]). In 1996, the United States Bureau of Reclamation [5] (USBR) performed testing of both geomembrane panels and seams subjected to up to 500 freeze-thaw cycles, in both constrained and unconstrained conditions, with temperature cycles as severe as +30º C to -20º C.
    - The testing showed no changes in the strength of the geomembrane panels or seams. The USBR concluded that *"…there is simply "no change" in tensile behavior of geomembrane sheets or their seams after freeze-thaw cycling"*.
    - In 2013, the Geosynthetic Institute, upon reviewing the results of the USBR and other studies, concluded that *"the essential question often raised in this regard, i.e.,*

"will freeze-thaw conditions affect geomembrane sheets or their seam behavior," is answered with a resounding "NO"" [6].

- Geomembranes are not susceptible to grass plant root penetration because the geomembranes do not provide organic nutrients to plant roots and do not have pores or other areas where roots can enter the geomembrane.
  - Consequently, geomembranes are not a hospitable material that would either encourage root penetration or allow root penetration. Additionally, the geomembrane will be covered with a geotextile cushion or geocomposite drainage layer with a geotextile filter on top, which will provide an additional barrier to root penetration.

U.S. EPA research [7] states that *"A typical minimum thickness of the cover soil is 0.45 to 0.6 m…" (18 to 24 inches) thick "… for cover systems with hydraulic barriers"* (low permeability layer). This is particularly appropriate when using a geomembrane with low permeability which is not susceptible to any impact from freezing. U.S. EPA research also states that cover thickness design for root penetration into the low permeability layer is only a concern for compacted clay layers or geosynthetic clay barriers. This is when using an appropriate design of cover vegetation.

Therefore, the use of the two-foot-thick final protective layer will provide equivalent or superior performance to the requirements of Section 845.750 (c) (2) (B) when coupled with a geotextile cushion and a geomembrane low permeability layer, as geomembranes are not susceptible to freeze-thaw damage or root penetration as compared to a low permeability compacted earth layer.

Section 845.750(c)(2)(C) Consist of soil material capable of supporting vegetation.

The uppermost six inches of the final protective layer will consist of topsoil that is capable of supporting vegetation, which is the same requirement as the default (three-foot-thick) final protective layer. This is also consistent with the Federal CCR Rule, which requires a six-inch-thick "erosion" (topsoil) layer. Research [7] and Geosyntec's experience indicate topsoil layers are designed to have shallow-rooted grasses and most shallow-rooted grasses do not typically penetrate more than six inches into the subsurface. Shallow-rooted grasses will be specified based on recommendations from specialists at nurseries in the location of BPP and Illinois Department of Transportation guidelines. The topsoil layer will be fertilized and/or amended, as necessary, on a site-specific basis based on agronomical soil testing, to provide a growing medium for the vegetation that provides the required levels of nutrients and water storage during drought conditions.

Grass species will also be selected on a site-specific basis to minimize long-term vegetation maintenance, based on the climatic conditions at each site and the soil types. Vegetation will be established by applying seed and mulch and watering to establish the vegetation. Temporary erosion control measures will also be used during vegetation establishment to protect the topsoil layer from erosion. These measures may include erosion control blankets (ECBs), silt fences, hydroseeding, and/or other methods. The Post-Closure Care Plan includes the commitment to maintain the vegetation of the surface for the closed BPP BAP within the Construction Permit Application [8].

The 18-inches of the protective layer below the topsoil will consist of a soil type suitable for retaining moisture to provide additional support for vegetation during times of drought, and to support any grass species with roots that exceed six inches. Such soil types may include sandy clay loam, silty loam, silts, silty clays, lean clays, sandy clays, and/or sandy silts.

Therefore, the use of the two-foot-thick protective layer will meet the requirements of Section 845.750(c)(2)(C), as the final protective layer will utilize soil capable of supporting vegetation.

> *Section 845.750(c)(2)(D) Be placed as soon as possible after placement of the low permeability layer*

The BPP BAP Closure Plan (Section 4.7.2 [2]) states that the geotextile and cover soil "…will be placed as soon as practical after the geomembrane has been deployed and both quality assurance and quality control testing has been performed on the geomembrane seams."

The use of a two-foot-thick protective layer will allow the final protective layer to be placed on top of the low permeability layer and vegetation to be established on top of the final protective layer sooner than if a three-foot thick final protective layer is used. This is due to the 33% reduction in earthwork volumes associated with the thinner two-foot-thick final protective layer.

Therefore, the use of the two-foot-thick final protective layer will exceed the minimum requirements of Section 845.750(c)(2)(D), by allowing the protective layer to be installed sooner than when using a three-foot-thick protective layer.

> *Section 845.750(c)(2)(E) Be covered with vegetation to minimize wind and water erosion.*

The protective layer will be covered with vegetation to limit wind and water erosion, as noted in the discussion regarding Section 4.7.2 of the Closure Plan [2]. Additionally, the following design and engineering features, construction techniques, and maintenance procedures will be used to reduce the potential for wind and water erosion under both long-term conditions and during vegetation establishment.

- Design and Engineering Features

    - The final cover system will be gently sloped to direct surface water away from the impoundment. The final cover system grades will be approximately 2% over the majority of the BAP, although 25% (4 horizontal to 1 vertical [4H:1V]) grades will be used for heights of up to approximately 60 ft, to tie the final cover system into existing grades and reduce the overall height of the consolidated BAP. The final cover system will be keyed into the perimeter dikes, native foundation soils, or the existing FAPS cover, and access roads will be constructed on top of the final cover system. Beyond the final cover system, channels will direct surface water away from the BAP to the removed dam [Part 845.750(a)(2)].

    - The final cover system will include an anchor trench for the geosynthetic materials along the entire perimeter of the BAP to secure the final cover system into existing grades.

    - A stormwater management system consisting of armored ditches and letdown structures is included in the drawings within the Closure Plan [2] and will be constructed at percent designed to collect stormwater in a controlled manner and route it off the final cover system that will minimize infiltration into the CCR waste mass. The stormwater management system will minimize the overland flow distance between stormwater channels. Channels will be lined with an appropriate material, based on estimated stormwater velocities, to limit water erosion.

- Construction Techniques

    - The final protective layer is typically the most susceptible to wind and water erosion in the period between the placement of the protective layer and the establishment of vegetation. To reduce the potential for both wind and water erosion during this time, the following approaches will be utilized:

        - Temporary erosion and sediment controls (ESCs) will be installed to reduce the potential for erosion, such as erosion control blankets (ECBs), silt socks (e.g., straw wattles), silt fences, and other methods. These ESCs will be regularly inspected and maintained until vegetation is established.

        - The entire surface of the final protective layer will be stabilized during seeding and until vegetation is established. Coverings may consist of straw, mulch, hydroseeding binder, ECBs, or engineering growing media.

    - The final protective layer will be regularly inspected and maintained during vegetation establishment. Any areas that become eroded by wind and water will be repaired until vegetation is established to a suitable level over the surface of the final cover.

- Maintenance Procedures
  - During the post-closure care period, vegetation established on the final protective cover layer will be regularly maintained using a written and IEPA-approved maintenance program. The program will consist of regular mowing and inspections. Any bare areas or areas of erosion will be repaired by seeding and stabilizing the area, and observing the area until vegetation becomes re-established.
  - The final cover slopes will be approximately 2% over the majority of the BAP and 25% for heights of up to approximately 60 ft. These slopes experience less erosion in general, especially less than typical landfill covers sloped at predominately 25 to 33%. Typically, after three to five years, it is Geosyntec's experience that the cover vegetation becomes fully stabilized and experiences less erosion.

In conclusion, the use of the two-foot-thick final protective layer will exceed the minimum requirements of Section 845 750(c)(2)(E), using a robust program to support the establishment of protective vegetation, prevent and address any erosion that may occur during vegetation establishment, and monitor and maintain the vegetation during post-closure conditions.

ADDITIONAL CONSIDERATIONS

Infiltration Analysis

The use of the proposed two-foot-thick final protective layer, when coupled with a geomembrane low permeability layer, will also meet the criteria contained within Section 845.750 (a) (1). Section 845.750(a)(1) provides the following requirement:

> *Section 845.750(a)(1) Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere;*

Section 845.750(a)(1) is an important overall measure of the effectiveness of the final cover system because it requires control of post-closure infiltration of liquids through the final cover and into the waste and releases of CCR.

An infiltration was conducted by Ramboll, within the BPP BAP Construction Permit Application [8], to estimate post-closure liquid infiltration rates through both the default and the proposed alternate final cover systems at the BPP BAP. The infiltration analysis used the Hydrologic Evaluation of Landfill Performance (HELP) software promulgated by the USEPA [9]. The HELP model estimates the infiltration rates from the top of the cover, through the final protective layer and through the low permeability layer (either a geomembrane or the three-foot thick compacted earth layer). The results are included in **Appendix A**. The resulting estimated infiltration rates are provided in **Table 1**.

Table 1 - BPP BAP Final Cover Systems for Infiltration Analysis

Description	Low Permeability Layer[1]	Final Protective Layer	Infiltration Rate[2,3]
Proposed Alternative Final Cover System	40-mil Linear Low-Density Polyethylene (LLDPE) Geomembrane	2 ft of cover material, including, from bottom to top, a 16 oz nonwoven geotextile, 1.5 ft of silty clay and 0.5 ft of silty clay loam	0.00012 in/yr
Default Cover with Geomembrane Barrier	40-mil LLDPE Geomembrane	3 ft of cover material, including, from bottom to top, a 16 oz nonwoven geotextile, 2.5 ft of silty clay and 0.5 ft of silty clay loam	0.00011 in/yr
Default Cover with Compacted Earth Layer	3-ft thick compacted earth layer (1×10^{-7} cm/sec)	3 ft of cover material, including, from bottom to top, 2.5 ft of silty clay and 0.5 ft of silty clay loam	0.00083 in/yr

The BPP BAP analysis indicated that the performance of the proposed alternative final cover system with a geomembrane and a two-foot-thick final protective cover is equivalent the performance offered by the default final cover system utilizing a geomembrane with the default three-foot-thick protective layer and cushion layer.

Furthermore, the proposed alternative final cover system performance exceeds the performance of a final cover system using a three-foot-thick compacted earthen low permeability layer and a three-foot-thick final protective layer (a total cover thickness of six feet).

Environmental and Societal Benefits

The use of the proposed two-foot-thick final protective layer will provide the following additional environmental and societal benefits, relative to the default three-foot-thick final protective layer:

---

[1] All HELP run versions used a pinhole density of 1 hole per acre, installation defects of 1 hole/acre, and construction quality as "good".
[2] Infiltration is out the bottom of the low permeability layer.
[3] Infiltration rates provided as average percolation through the top and slopes of the cover systems reported in HELP model output files in Appendix A.

- The final cover system earthwork quantities will be reduced by 33%. This will result in a corresponding 33% reduction in the amount of onsite soil fill that needs to be excavated, hauled to the construction location, and placed. This provides multiple benefits, such as:
    - Reduced disruption to onsite areas caused by the excavation of fill materials and corresponding disturbance to the natural environment.
    - Reduced haul truck traffic on site access roadways, thereby reducing, air pollution, and carbon emissions.
    - Reduced earthwork effort during installation of the final cover system, thereby reducing air pollution and carbon emissions.
- Construction of the alternate final cover system can be completed faster than the default final cover, providing multiple benefits, such as:
    - Initiation of the reduction of infiltration at a sooner date than with the default final cover system.
    - Ceasing construction-related impacts to offsite residents (e.g., air pollution, carbon emissions) at a sooner date than otherwise possible.

SUMMARY

The proposed alternate final protective layer will:

- Provide equivalent or superior performance to the requirements of Section 845.750 (c)(2).
- Have a geotextile cushion layer, which is not required by Section 845.750, over the geomembrane that adds physical protection for the geomembrane.
- Have an equivalent infiltration rate with respect to infiltration through the default soil final cover system using a geomembrane barrier with three feet of cover soil, but a lower infiltration rate with respect to infiltration through the default soil final cover system with compacted earth low permeability layer and three feet of cover soil.
- Meet or exceed the same criteria for long term performance and all other requirements of Section 845.750(c)(2).
- Provide other benefits by reducing the amount of final cover earthwork by 33% for the BPP BAP.

REFERENCES

[1] Illinois Environmental Protection Agency, "35 Ill. Adm. Code Part 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments," Springfield, IL, 2021.

[2] Geosyntec Consultants, Inc., "Final Closure Plan for Bottom Ash Pond, Baldwin Power Plant," July 2023.

[3] A. L. Rollin, J. Lafleur, M. Marcotte, O. Dascal and Z. Akber, "Selection Criteria for the Use of Geomembranes in Dams and Dykes in Northern Climate," in *Proceedings of the International Conference on Geomembranes*, Denver, Colorado, 1945.

[4] D. E. Thorton and P. Blackall, "Report EPA-3-76-13: Field Evaluation of Plastic Film Liners for Petroleum Storage Areas in the Mackenzie Delta," Canadian Environmental Protection Service, 1976.

[5] A. I. Comer and Y. G. Hsuan, "Report R-96-03: Freeze-Thaw Cycling and Cold Temperature Effects on Geomembrane Sheets and Seams," U.S. Bureau of Reclamation, 1996.

[6] Y. G. Hsuan, R. M. Koerner and A. I. Comer, "GSI White Paper #28: Cold Temperature and Freeze-Thaw Cycling Behavior of Geomembranes and their Seams," Geosynthetic Institute, Folsom, Pennsylvania, 2013.

[7] United States Environmental Protection Agency, "(Draft) Technical Guidance For RCRA/CERCLA Final Covers," Office of Solid Waste and Emergency Response, Washington D.C., 2004.

[8] Geosyntec Consultants, Inc., "Construction Permit Application for Bottom Ash Pond, Baldwin Power Plant," July 2023.

[9] T. Tolaymat and M. Krause, "Hydrologic Evaluation of Landfill Performance: HELP 4.0 User Manual," United States Environmental Protection Agency, Washington, DC, 2020.

APPENDIX A: HELP MODEL OUTPUT

A-1: BAL BAP- 2-FT FINAL PROTECTIVE COVER SOIL, SLOPES

A-2: BAL BAP-3-FT FINAL PROTECTIVE COVER SOIL, SLOPE

A-3: BAL BAP-3-FT COMPACTED EARTH LAYER, 3-FT FINAL PROTECTIVE COVER SOIL, SLOPES

A-4: BAL BAP- 2-FT FINAL PROTECTIVE COVER SOIL, TOP

A-5: BAL BAP-3-FT FINAL PROTECTIVE COVER SOIL, TOP

A-6: BAL BAP-3-FT COMPACTED EARTH LAYER, 3-FT FINAL PROTECTIVE COVER SOIL, TOP

APPENDIX A-1

BAL BAP- 2-FT FINAL PROTECTIVE COVER

SOIL, SLOPES

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: BAL BAP CIP Cons Slopes **Simulated On:** 1/6/2023 7:23

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
SiCL - Silty Clay Loam (Moderate)
Material Texture Number 26

Thickness	=	6	inches
Porosity	=	0.445	vol/vol
Field Capacity	=	0.393	vol/vol
Wilting Point	=	0.277	vol/vol
Initial Soil Water Content	=	0.3673	vol/vol
Effective Sat. Hyd. Conductivity	=	1.90E-06	cm/sec

Layer 2

Type 1 - Vertical Percolation Layer
SiC - Silty Clay (Moderate)
Material Texture Number 28

Thickness	=	18	inches
Porosity	=	0.452	vol/vol
Field Capacity	=	0.411	vol/vol
Wilting Point	=	0.311	vol/vol
Initial Soil Water Content	=	0.3948	vol/vol
Effective Sat. Hyd. Conductivity	=	1.20E-06	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	=	0.01	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E+01	cm/sec
Slope	=	25	%
Drainage Length	=	150	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)
Electric Plant Coal Bottom Ash
Material Texture Number 83

Thickness	=	231.72	inches
Porosity	=	0.578	vol/vol
Field Capacity	=	0.076	vol/vol
Wilting Point	=	0.025	vol/vol
Initial Soil Water Content	=	0.076	vol/vol
Effective Sat. Hyd. Conductivity	=	5.29E-04	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	=	91.1	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	21.39	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	6.845	inches
Upper Limit of Evaporative Storage	=	8.094	inches
Lower Limit of Evaporative Storage	=	5.394	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	26.923	inches
Total Initial Water	=	26.923	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	38.18	Degrees
Maximum Leaf Area Index	=	4.5	
Start of Growing Season (Julian Date)	=	104	days

End of Growing Season (Julian Date)	=	285	days
Average Wind Speed	=	8	mph
Average 1st Quarter Relative Humidity	=	72	%
Average 2nd Quarter Relative Humidity	=	64	%
Average 3rd Quarter Relative Humidity	=	71	%
Average 4th Quarter Relative Humidity	=	72	%

Note: Evapotranspiration data was obtained for Baldwin, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
2.421014	2.032335	4.330912	4.401604	4.511846	4.068128
4.023992	2.88724	2.952714	2.941943	4.289265	2.800511

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
35	44.8	49.4	61.2	72.7	82.1
84.9	81.7	72.6	59.4	50.1	43.9

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85

Average Annual Totals Summary

Title: BAL BAP CIP Cons Slopes
Simulated on: 1/6/2023 7:24

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	41.66	[4.8]	3,234,836.6	100.00
Runoff	16.562	[3.613]	1,285,952.1	39.75
Evapotranspiration	24.541	[2.705]	1,905,475.7	58.90
Subprofile1				
Lateral drainage collected from Layer 3	0.5339	[0.485]	41,451.4	1.28
Percolation/leakage through Layer 4	0.000007	[0.000006]	0.5720	0.00
Average Head on Top of Layer 4	0.0002	[0.0002]	---	---
Subprofile2				
Percolation/leakage through Layer 5	0.000007	[0.000007]	0.5716	0.00
Water storage				
Change in water storage	0.0252	[0.7492]	1,956.9	0.06

* Note: Average inches are converted to volume based on the user-specified area.

APPENDIX A-2

BAP BAP- 3-FT FINAL PROTECTIVE COVER

SOIL, SLOPES

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title:	BAL BAP CIP Cons Slopes Def 1	**Simulated On:**	1/6/2023 6:43

Layer 1
Type 1 - Vertical Percolation Layer (Cover Soil)
SiCL - Silty Clay Loam (Moderate)
Material Texture Number 26

Thickness	=	6	inches
Porosity	=	0.445	vol/vol
Field Capacity	=	0.393	vol/vol
Wilting Point	=	0.277	vol/vol
Initial Soil Water Content	=	0.3673	vol/vol
Effective Sat. Hyd. Conductivity	=	1.90E-06	cm/sec

Layer 2
Type 1 - Vertical Percolation Layer
SiC - Silty Clay (Moderate)
Material Texture Number 28

Thickness	=	30	inches
Porosity	=	0.452	vol/vol
Field Capacity	=	0.411	vol/vol
Wilting Point	=	0.311	vol/vol
Initial Soil Water Content	=	0.4013	vol/vol
Effective Sat. Hyd. Conductivity	=	1.20E-06	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	=	0.01	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E+01	cm/sec
Slope	=	25	%
Drainage Length	=	150	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)
Electric Plant Coal Bottom Ash
Material Texture Number 83

Thickness	=	231.72	inches
Porosity	=	0.578	vol/vol
Field Capacity	=	0.076	vol/vol
Wilting Point	=	0.025	vol/vol
Initial Soil Water Content	=	0.076	vol/vol
Effective Sat. Hyd. Conductivity	=	5.29E-04	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	=	91.1	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	21.39	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	6.845	inches
Upper Limit of Evaporative Storage	=	8.094	inches
Lower Limit of Evaporative Storage	=	5.394	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	31.855	inches
Total Initial Water	=	31.855	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	38.18	Degrees
Maximum Leaf Area Index	=	4.5	
Start of Growing Season (Julian Date)	=	104	days

End of Growing Season (Julian Date)	=	285	days
Average Wind Speed	=	8	mph
Average 1st Quarter Relative Humidity	=	72	%
Average 2nd Quarter Relative Humidity	=	64	%
Average 3rd Quarter Relative Humidity	=	71	%
Average 4th Quarter Relative Humidity	=	72	%

Note: Evapotranspiration data was obtained for Baldwin, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
2.421014	2.032335	4.330912	4.401604	4.511846	4.068128
4.023992	2.88724	2.952714	2.941943	4.289265	2.800511

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
35	44.8	49.4	61.2	72.7	82.1
84.9	81.7	72.6	59.4	50.1	43.9

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85

Average Annual Totals Summary

Title: BAL BAP CIP Cons Slopes Def 1
Simulated on: 1/6/2023 6:44

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	41.66	[4.8]	3,234,836.6	100.00
Runoff	16.562	[3.613]	1,285,952.1	39.75
Evapotranspiration	24.541	[2.705]	1,905,475.7	58.90
Subprofile1				
Lateral drainage collected from Layer 3	0.5339	[0.4914]	41,451.3	1.28
Percolation/leakage through Layer 4	0.000008	[0.000007]	0.6097	0.00
Average Head on Top of Layer 4	0.0002	[0.0002]	---	---
Subprofile2				
Percolation/leakage through Layer 5	0.000008	[0.000007]	0.6123	0.00
Water storage				
Change in water storage	0.0252	[0.7766]	1,956.9	0.06

* Note: Average inches are converted to volume based on the user-specified area.

APPENDIX A-3

BAL BAP-3-FT COMPACTED EARTH LAYER, 3-FT FINAL PROTECTIVE COVER SOIL, SLOPES

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: BAL BAP CIP Cons Slopes Def 2 **Simulated On:** 1/6/2023 7:01

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
Silty Clay Loam
Material Texture Number 45

Thickness	=	6	inches
Porosity	=	0.445	vol/vol
Field Capacity	=	0.393	vol/vol
Wilting Point	=	0.277	vol/vol
Initial Soil Water Content	=	0.4002	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-07	cm/sec

Layer 2

Type 1 - Vertical Percolation Layer
Silty Clay
Material Texture Number 46

Thickness	=	30	inches
Porosity	=	0.452	vol/vol
Field Capacity	=	0.411	vol/vol
Wilting Point	=	0.311	vol/vol
Initial Soil Water Content	=	0.4184	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-07	cm/sec

Layer 3

Type 1 - Vertical Percolation Layer (Waste)
Electric Plant Coal Bottom Ash
Material Texture Number 83

Thickness	=	231.72	inches
Porosity	=	0.578	vol/vol
Field Capacity	=	0.076	vol/vol
Wilting Point	=	0.025	vol/vol
Initial Soil Water Content	=	0.0761	vol/vol
Effective Sat. Hyd. Conductivity	=	5.29E-04	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	=	91.1	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	21.39	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	7.555	inches
Upper Limit of Evaporative Storage	=	8.094	inches
Lower Limit of Evaporative Storage	=	5.394	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	32.578	inches
Total Initial Water	=	32.578	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	38.18	Degrees
Maximum Leaf Area Index	=	4.5	
Start of Growing Season (Julian Date)	=	104	days
End of Growing Season (Julian Date)	=	285	days
Average Wind Speed	=	8	mph
Average 1st Quarter Relative Humidity	=	72	%
Average 2nd Quarter Relative Humidity	=	64	%
Average 3rd Quarter Relative Humidity	=	71	%
Average 4th Quarter Relative Humidity	=	72	%

Note: Evapotranspiration data was obtained for Baldwin, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
2.421014	2.032335	4.330912	4.401604	4.511846	4.068128
4.023992	2.88724	2.952714	2.941943	4.289265	2.800511

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
35	44.8	49.4	61.2	72.7	82.1
84.9	81.7	72.6	59.4	50.1	43.9

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85

Average Annual Totals Summary

Title: BAL BAP CIP Cons Slopes Def 2
Simulated on: 1/6/2023 7:02

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	41.66	[4.8]	3,234,836.6	100.00
Runoff	13.463	[3.65]	1,045,365.7	32.32
Evapotranspiration	27.904	[3.12]	2,166,632.0	66.98
Subprofile1				
Percolation/leakage through Layer 3	0.000937	[0.000527]	72.7	0.00
Water storage				
Change in water storage	0.2932	[0.6037]	22,766.1	0.70

* Note: Average inches are converted to volume based on the user-specified area.

APPENDIX A-4

BAL BAP- 2-FT FINAL PROTECTIVE COVER SOIL, TOP

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title:	BAL BAP CIP Cons Top	**Simulated On:**	1/6/2023 7:18

Layer 1
Type 1 - Vertical Percolation Layer (Cover Soil)
SiCL - Silty Clay Loam (Moderate)
Material Texture Number 26

Thickness	=	6	inches
Porosity	=	0.445	vol/vol
Field Capacity	=	0.393	vol/vol
Wilting Point	=	0.277	vol/vol
Initial Soil Water Content	=	0.3673	vol/vol
Effective Sat. Hyd. Conductivity	=	1.90E-06	cm/sec

Layer 2
Type 1 - Vertical Percolation Layer
SiC - Silty Clay (Moderate)
Material Texture Number 28

Thickness	=	18	inches
Porosity	=	0.452	vol/vol
Field Capacity	=	0.411	vol/vol
Wilting Point	=	0.311	vol/vol
Initial Soil Water Content	=	0.3951	vol/vol
Effective Sat. Hyd. Conductivity	=	1.20E-06	cm/sec

Layer 3
Type 2 - Lateral Drainage Layer
16 oz Nonwoven Geotextile
Material Texture Number 43

Thickness	=	0.11	inches
Porosity	=	0.85	vol/vol
Field Capacity	=	0.01	vol/vol
Wilting Point	=	0.005	vol/vol
Initial Soil Water Content	=	0.01	vol/vol
Effective Sat. Hyd. Conductivity	=	3.00E-01	cm/sec
Slope	=	2	%
Drainage Length	=	600	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)
Electric Plant Coal Bottom Ash
Material Texture Number 83

Thickness	=	545.28	inches
Porosity	=	0.578	vol/vol
Field Capacity	=	0.076	vol/vol
Wilting Point	=	0.025	vol/vol
Initial Soil Water Content	=	0.076	vol/vol
Effective Sat. Hyd. Conductivity	=	5.29E-04	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	=	89.8	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	53.73	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	6.849	inches
Upper Limit of Evaporative Storage	=	8.094	inches
Lower Limit of Evaporative Storage	=	5.394	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	50.759	inches
Total Initial Water	=	50.759	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	38.18	Degrees
Maximum Leaf Area Index	=	4.5	
Start of Growing Season (Julian Date)	=	104	days

End of Growing Season (Julian Date)	=	285	days
Average Wind Speed	=	8	mph
Average 1st Quarter Relative Humidity	=	72	%
Average 2nd Quarter Relative Humidity	=	64	%
Average 3rd Quarter Relative Humidity	=	71	%
Average 4th Quarter Relative Humidity	=	72	%

Note: Evapotranspiration data was obtained for Baldwin, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
2.421014	2.032335	4.330912	4.401604	4.511846	4.068128
4.023992	2.88724	2.952714	2.941943	4.289265	2.800511

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
35	44.8	49.4	61.2	72.7	82.1
84.9	81.7	72.6	59.4	50.1	43.9

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85

Average Annual Totals Summary

Title: BAL BAP CIP Cons Top
Simulated on: 1/6/2023 7:19

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	41.66	[4.8]	8,125,655.5	100.00
Runoff	16.544	[3.658]	3,226,692.1	39.71
Evapotranspiration	24.605	[2.679]	4,798,963.4	59.06
Subprofile1				
Lateral drainage collected from Layer 3	0.4260	[0.3581]	83,079.3	1.02
Percolation/leakage through Layer 4	0.061216	[0.074113]	11,939.6	0.15
Average Head on Top of Layer 4	0.7474	[0.9614]	---	---
Subprofile2				
Percolation/leakage through Layer 5	0.000239	[0.000259]	46.6	0.00
Water storage				
Change in water storage	0.0865	[0.7368]	16,874.2	0.21

* Note: Average inches are converted to volume based on the user-specified area.

APPENDIX A-5

BAP BAP- 3-FT FINAL PROTECTIVE COVER SOIL, TOP

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: BAP CIP Cons Top Def 1 **Simulated On:** 1/6/2023 6:31

Layer 1
Type 1 - Vertical Percolation Layer (Cover Soil)
SiCL - Silty Clay Loam (Moderate)
Material Texture Number 26

Thickness	=	6	inches
Porosity	=	0.445	vol/vol
Field Capacity	=	0.393	vol/vol
Wilting Point	=	0.277	vol/vol
Initial Soil Water Content	=	0.3673	vol/vol
Effective Sat. Hyd. Conductivity	=	1.90E-06	cm/sec

Layer 2
Type 1 - Vertical Percolation Layer
SiC - Silty Clay (Moderate)
Material Texture Number 28

Thickness	=	30	inches
Porosity	=	0.452	vol/vol
Field Capacity	=	0.411	vol/vol
Wilting Point	=	0.311	vol/vol
Initial Soil Water Content	=	0.4014	vol/vol
Effective Sat. Hyd. Conductivity	=	1.20E-06	cm/sec

Layer 3
Type 2 - Lateral Drainage Layer
16 oz Nonwoven Geotextile
Material Texture Number 43

Thickness	=	0.11	inches
Porosity	=	0.85	vol/vol
Field Capacity	=	0.01	vol/vol
Wilting Point	=	0.005	vol/vol
Initial Soil Water Content	=	0.01	vol/vol
Effective Sat. Hyd. Conductivity	=	3.00E-01	cm/sec
Slope	=	2	%
Drainage Length	=	600	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)
Electric Plant Coal Bottom Ash
Material Texture Number 83

Thickness	=	545.28	inches
Porosity	=	0.578	vol/vol
Field Capacity	=	0.076	vol/vol
Wilting Point	=	0.025	vol/vol
Initial Soil Water Content	=	0.076	vol/vol
Effective Sat. Hyd. Conductivity	=	5.29E-04	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	=	89.8	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	53.73	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	6.849	inches
Upper Limit of Evaporative Storage	=	8.094	inches
Lower Limit of Evaporative Storage	=	5.394	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	55.691	inches
Total Initial Water	=	55.691	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	38.18	Degrees
Maximum Leaf Area Index	=	4.5	
Start of Growing Season (Julian Date)	=	104	days

End of Growing Season (Julian Date)	=	285	days
Average Wind Speed	=	8	mph
Average 1st Quarter Relative Humidity	=	72	%
Average 2nd Quarter Relative Humidity	=	64	%
Average 3rd Quarter Relative Humidity	=	71	%
Average 4th Quarter Relative Humidity	=	72	%

Note: Evapotranspiration data was obtained for Baldwin, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
2.421014	2.032335	4.330912	4.401604	4.511846	4.068128
4.023992	2.88724	2.952714	2.941943	4.289265	2.800511

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
35	44.8	49.4	61.2	72.7	82.1
84.9	81.7	72.6	59.4	50.1	43.9

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85

Average Annual Totals Summary

Title: BAP CIP Cons Top Def 1
Simulated on: 1/6/2023 6:33

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	41.66	[4.8]	8,125,655.5	100.00
Runoff	16.510	[3.611]	3,220,169.2	39.63
Evapotranspiration	24.595	[2.679]	4,797,020.3	59.04
Subprofile1				
Lateral drainage collected from Layer 3	0.4546	[0.4005]	88,667.6	1.09
Percolation/leakage through Layer 4	0.075972	[0.113961]	14,817.6	0.18
Average Head on Top of Layer 4	0.9812	[1.5588]	---	---
Subprofile2				
Percolation/leakage through Layer 5	0.000227	[0.000268]	44.2	0.00
Water storage				
Change in water storage	0.1013	[0.7462]	19,754.1	0.24

* Note: Average inches are converted to volume based on the user-specified area.

APPENDIX A-6

BAL BAP-3-FT COMPACTED EARTH LAYER, 3-FT FINAL PROTECTIVE COVER SOIL, TOP

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: BAL BAP CIP Cons Top Def 2 **Simulated On:** 1/6/2023 7:12

Layer 1
Type 1 - Vertical Percolation Layer (Cover Soil)
Silty Clay Loam
Material Texture Number 45

Thickness	=	6	inches
Porosity	=	0.445	vol/vol
Field Capacity	=	0.393	vol/vol
Wilting Point	=	0.277	vol/vol
Initial Soil Water Content	=	0.3993	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-07	cm/sec

Layer 2
Type 1 - Vertical Percolation Layer
Silty Clay
Material Texture Number 46

Thickness	=	30	inches
Porosity	=	0.452	vol/vol
Field Capacity	=	0.411	vol/vol
Wilting Point	=	0.311	vol/vol
Initial Soil Water Content	=	0.4225	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-07	cm/sec

Layer 3
Type 1 - Vertical Percolation Layer (Waste)
Electric Plant Coal Bottom Ash
Material Texture Number 83

Thickness	=	545.28	inches
Porosity	=	0.578	vol/vol
Field Capacity	=	0.076	vol/vol
Wilting Point	=	0.025	vol/vol
Initial Soil Water Content	=	0.0762	vol/vol
Effective Sat. Hyd. Conductivity	=	5.29E-04	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	=	89.8	
Fraction of Area Allowing Runoff	=	100	%
Area projected on a horizontal plane	=	53.73	acres
Evaporative Zone Depth	=	18	inches
Initial Water in Evaporative Zone	=	7.665	inches
Upper Limit of Evaporative Storage	=	8.094	inches
Lower Limit of Evaporative Storage	=	5.394	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	56.628	inches
Total Initial Water	=	56.628	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	38.18	Degrees
Maximum Leaf Area Index	=	4.5	
Start of Growing Season (Julian Date)	=	104	days
End of Growing Season (Julian Date)	=	285	days
Average Wind Speed	=	8	mph
Average 1st Quarter Relative Humidity	=	72	%
Average 2nd Quarter Relative Humidity	=	64	%
Average 3rd Quarter Relative Humidity	=	71	%
Average 4th Quarter Relative Humidity	=	72	%

Note: Evapotranspiration data was obtained for Baldwin, Illinois

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
2.421014	2.032335	4.330912	4.401604	4.511846	4.068128
4.023992	2.88724	2.952714	2.941943	4.289265	2.800511

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
35	44.8	49.4	61.2	72.7	82.1
84.9	81.7	72.6	59.4	50.1	43.9

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 38.18/-89.85

Average Annual Totals Summary

Title: BAL BAP CIP Cons Top Def 2
Simulated on: 1/6/2023 7:13

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	41.66	[4.8]	8,125,655.5	100.00
Runoff	12.836	[3.593]	2,503,525.7	30.81
Evapotranspiration	28.338	[3.154]	5,527,044.6	68.02
Subprofile1				
Percolation/leakage through Layer 3	0.000716	[0.000461]	139.7	0.00
Water storage				
Change in water storage	0.4868	[0.607]	94,945.6	1.17

* Note: Average inches are converted to volume based on the user-specified area.

ATTACHMENT D

Hydrologic and Hydraulic Design of Stormwater Management System (Sections 845.750(a)(2) and (a)(4))

Geosyntec
consultants

COMPUTATION COVER SHEET

Client:	Dynegy	Project:	Baldwin BAP Closure Plan	Project/ Proposal No.:	GLP8050
				Task No.	02/02

Title of Computations: **Cover System Hydrologic and Hydraulic Analysis Report**

Computations by:	Signature	[signature]	12/07/2022
	Printed Name	Shailendra Singh	Date
	Title	Senior Staff Professional	
Assumptions and Procedures Checked by: (Senior reviewer)	Signature	[signature]	12/8/2022
	Printed Name	Megan Bender, P.E.	Date
	Title	Senior Engineer	
Computations Checked by:	Signature	[signature]	12/07/2022
	Printed Name	Patrick VanDeWiele, P.E.	Date
	Title	Project Engineer	
Computations backchecked by: (Originator)	Signature	[signature]	12/07/2022
	Printed Name	Shailendra Singh	Date
	Title	Senior Staff Professional	
Approved by: (PM or designate)	Signature	[signature]	12/09/2022
	Printed Name	Thomas Ward, P.E.	Date
	Title	Senior Engineer	

Approval notes:

Revisions (number and initial all revisions)

No.	Sheet	Date	By	Checked by	Approval

Geosyntec consultants

Written by:	SS	Date:	07 12 22 (DD MM YY)	Reviewed by:	PV	Date:	07 12 22 (DD MM YY)
Client:	Dynegy	Project:	Baldwin BAP Closure Plan	Project No.:	GLP8050	Task No.:	02/02

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APPENDICES

Written by:	SS	Date:	07 12 2022 (DD MM YY)	Reviewed by:	PV	Date:	07 12 2022 (DD MM YY)
Client:	Dynegy	Project:	Baldwin BAP Closure Plan	Project No.:	GLP8050	Task No.:	02/02

1. Introduction

This report documents the conceptual-level hydrologic and hydraulic analysis to support the 30% design of stormwater features for the Baldwin Fly Ash Pond Closure Plan. The project site is approximately 177 acres located in Baldwin, Illinois with 76 aces being closed in place.

The following sections describe the design approach, methodology, assumptions, results, and findings. Stormwater features analyzed include interceptor berms, rock chutes, and riprap aprons.

2. Design Approach

In accordance with the CCR Rule (USEPA, 2015) and the Illinois Part 845 Rule (IEPA, 2021) the stormwater features are designed to adequately manage a 100-year, 24-hour Soil Conservation Service (SCS) Type II storm event.

The following summarizes tools and methodology used in the hydrologic and hydraulic analysis:

- EPA SWMM 5.1 (US EPA, 2020) is a storm water management model used for planning, analysis, and design stormwater runoff, combined and sanitary sewers, and other drainage system.
- A Manning's flow calculator tool (NEH, 2010) was used to analyze hydraulic performance of interceptor berms.
- The National Resource Conservation Service (NRCS) rock chute design tool (Robinson et al., 1998) was utilized for sizing rock chute grade stabilization structures.

3. Assumptions and Analysis

The following sections present a summary of the performed analyses, along with an overview of the information relied upon and the associated assumptions.

3.1 Project Site Condition

3.1.1 Pre-Closure Topographic Survey

Site topographic surveys of existing (pre-closure) conditions were performed by Others in December 2020 and November 2021 as noted on the drawings.

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Client:	Dynegy	Project:	Baldwin BAP Closure Plan	Project No.:	GLP8050	Task No.:	02/02

3.1.2 Proposed Post-Closure Design

Proposed post-closure design will be permit-level design drawings, Bottom Ash Pond Construction Permit Application Closure Drawings, December 2022.

3.2 Hydrology

A hydrologic analysis was performed for the project site to assess and quantify the peak flow from site under 100-year 24-hr design storm event. The results of the hydrologic analysis were used as part of the hydraulic analysis to design the various stormwater features.

3.2.1 Drainage Areas

The final cover system is approximately 76 acres. The cover system consists of a 25% slope that wraps around the perimeter of the final cover system with 2% slope on top.

The final cover system was delineated into 23 drainage areas ranging from 1.4 acres to a maximum of 6.4 acres. The delineated drainage map is presented in Figure 1 of **Appendix A**.

The largest drainage area on the final cover system was determined to be Drainage Area No. 1 and was utilized as the *critical cover drainage area*. This *critical cover drainage area* of 6.4 acres is the largest and serves as the basis for design of all stormwater features within the cover system. This *critical cover drainage area* was further delineated into two subcatchments as shown in Figure 2 of **Appendix A** to model peak runoff from the area with 2% slope (Subcatchment -1) and 25% slope (Subcatchment -2).

The design of stormwater features that traverse the final closure area were based on cumulative flows from the *critical cover drainage area with 2% slope* and *25% slope*.

3.2.2 Rainfall Depth and Distribution

The National Oceanic Atmospheric Administration (NOAA) Atlas 14 provides precipitation frequency information for the U.S. states and territories. NOAA precipitation frequency estimates serve as standard practice for designing, building, and operating infrastructure to withstand the forces of heavy precipitation and floods.

Rainfall depths used in this analysis were based on NOAA Atlas 14 (NOAA, 2006) Point Precipitation Frequency Estimates, as shown in **Appendix B**.

The rainfall distribution used in this analysis was SCS Type-II distribution, which is considered a conservative temporal distribution for a 24-hour duration storm event due to its peak rainfall intensity. The SCS distribution results in a greater peak flow as compared to other acceptable standardized distributions, such as Huff 3rd Quartile, as published in the Illinois State Water Survey (ISWS) Circular 173 (ISWS, 1990).

The Type II SCS 100-year, 24-hour event of 7.50 inches was used as the *design rainfall event* to size the proposed stormwater features.

3.2.3 Rainfall Runoff – Curve Number

To estimate stormwater runoff from the *design rainfall event*, the SCS curve number method was used in the SWMM model. A curve number (CN) is a numerical representation of the runoff potential of a watershed that is based on soil type, plant cover, imperviousness, interception, and surface storage (USDA, 1986).

The final cover system will include, from bottom to top, a geomembrane, geotextile, 1.5 feet of cover soil, 0.5 feet of topsoil, and a vegetative cover. For this analysis, based on assumed soil conditions, a single CN was determined from TR-55 manual (USDA, 1986) to represent the final cover system as follows:

- Post-closure Areas (CN=80)
  - Cover Type – Meadow
  - Hydrologic Condition – Fair
  - Hydrologic Soil Group – C/D

3.3 Hydraulics

The results of the hydrologic analysis were used as part of the hydraulic analysis to design the various stormwater features, that include interceptor berms, rock chutes and energy dissipation plunge pool. SWMM model generated peak discharges from *critical drainage areas,* and their corresponding sub-catchment, were utilized in this analysis.

3.3.1 Interceptor Berms

Interceptor berms with triangular cross-section will be used to intercept sheet and shallow concentrated flows from the final cover system. *Critical drainage area* described in **Section 3.2.1** were further delineated into subcatchments as part of the design process to determine the location, length, height, and longitudinal slope of the interceptor berms.

According to Manning's n for Channels (Chow, 1959), a Manning's roughness coefficient of 0.030 was used for excavated earthen channels with short grass and few weeds. Hydraulic analyses using the Manning's flow calculator tool (NEH, 2010) were performed to determine maximum intercept berm height required to adequately convey flow from sub-catchments to the corresponding rock chute, without overtopping.

3.3.2 Rock Chutes (Letdowns)

Rock chutes with trapezoidal cross-section will be used to collect flow from interceptor berms and adequately convey the peak discharges down steep slopes on the final cover system. Each Cover Rock Chute will discharge into an inlet depression that feeds into a culvert. Perimeter Slope Rock Chutes were designed to convey cumulative flow from both the contributing cover drainage area and interceptor berms.

The rock chute trapezoidal cross-section design consists of 3H:1V side slopes. Rock chutes were analyzed on longitudinal slopes no greater than 3H:1V. Hydraulic analyses using the NRCS rock chute design tool (Robinson et al., 1998) were performed to determine minimum chute depth to contain the *design storm event* and riprap lining (minimum D_{50} size and riprap layer thickness) to withstand erosive forces from the design storm event.

4. Results and Findings

4.1 Hydrologic Analysis

SWMM model simulated peak runoff from two critical drainage areas (subcatchment 1 with 2% slope and subcatchment-2 with 25% slope) for 100-year storm event is presented in **Table 1**.

Written by:	SS	Date:	07 12 2022 (DD MM YY)	Reviewed by:	PV	Date:	07 12 2022 (DD MM YY)
Client:	Dynegy	Project:	Baldwin BAP Closure Plan	Project No.:	GLP8050	Task No.:	02/02

Table 1. Simulated Peak Runoff for two subcatchments with 2% and 25% slopes

Subcatchment	Peak Runoff (cfs)	Cumulative Peak Runoff (cfs)
Subcatchment -1 (2% Slope)	31.0	31.0
Subcatchment -2 (25% Slope)	15.2	46.2

4.2 Interceptor Berm Design

The peak flow, maximum velocity, and maximum flow depth were evaluated for 2% and 25% slopes and is presented in **Table 2** below. Sub-catchment tributary to the interceptor berm and a schematic representation of the respective interceptor berm are presented in **Appendix C**.

Table 2: Key Parameters for Interceptor Berms

Surface Description	Peak Flow (cubic feet/second)	Max Velocity (feet/second)	Max Flow Depth (feet)
2% Cover Slope	31.3	2.5	0.7
25% Slope	15.3	3.4	1.2

Around the cover system's 2% slope, three set of interceptor berms will be tributary to a cover rock chute and one set of interceptor berms will be tributary to 25% slope rock chute. Since the maximum flow depth was 1.2 feet for the 25% slope, the berm height to adequately convey flow from subcatchments to the rock chute was determined to be set at 1.25-foot, across all slopes, for consistency. Figure 1 of **Appendix A** presents locations of all interceptor berms.

4.3 Rock Chute (Letdowns) Design

The rock chute design key parameters such as peak flow, slope, channel bottom width, and riprap lining D_{50} (minimum D50 size and riprap thickness) are presented in **Table 3** below. The inlet and outlet invert elevations, bottom and top widths, flow depths and riprap layer thicknesses are presented in **Appendix D.**

Table 3: Key Parameters for Rock Chutes

Surface Description	Peak Flow (cubic feet/second)	Channel Bottom Width (feet)	Riprap Lining D_{50} (inches)
On 2% Cover Slope	31.0	5.0	2.1
On 25% Cover Slope	46.2	5.0	11.8

A total of 19 rock chutes with a bottom width of 5 feet and a riprap lining D50 of 2.5 inches will adequately convey 100-year *design storm event* from 2% cover slope that will transition to rock chute with riprap lining D50 of 12 inches on 25% slope to convey the cumulative design storm from 2% and 25% slope areas. A total of 23 rock chutes with a bottom width of 5 feet and a riprap lining D50 of 12 inches will adequately convey cumulative flows from both 2% and 25% slope areas. Figure 1 of **Appendix A** presents locations of all rock chutes.

Written by: **SS** Date: **07 12 2022** (DD MM YY) Reviewed by: **PV** Date: **07 12 2022** (DD MM YY)

Client: **Dynegy** Project: **Baldwin BAP Closure Plan** Project No.: **GLP8050** Task No.: **02/02**

5. References

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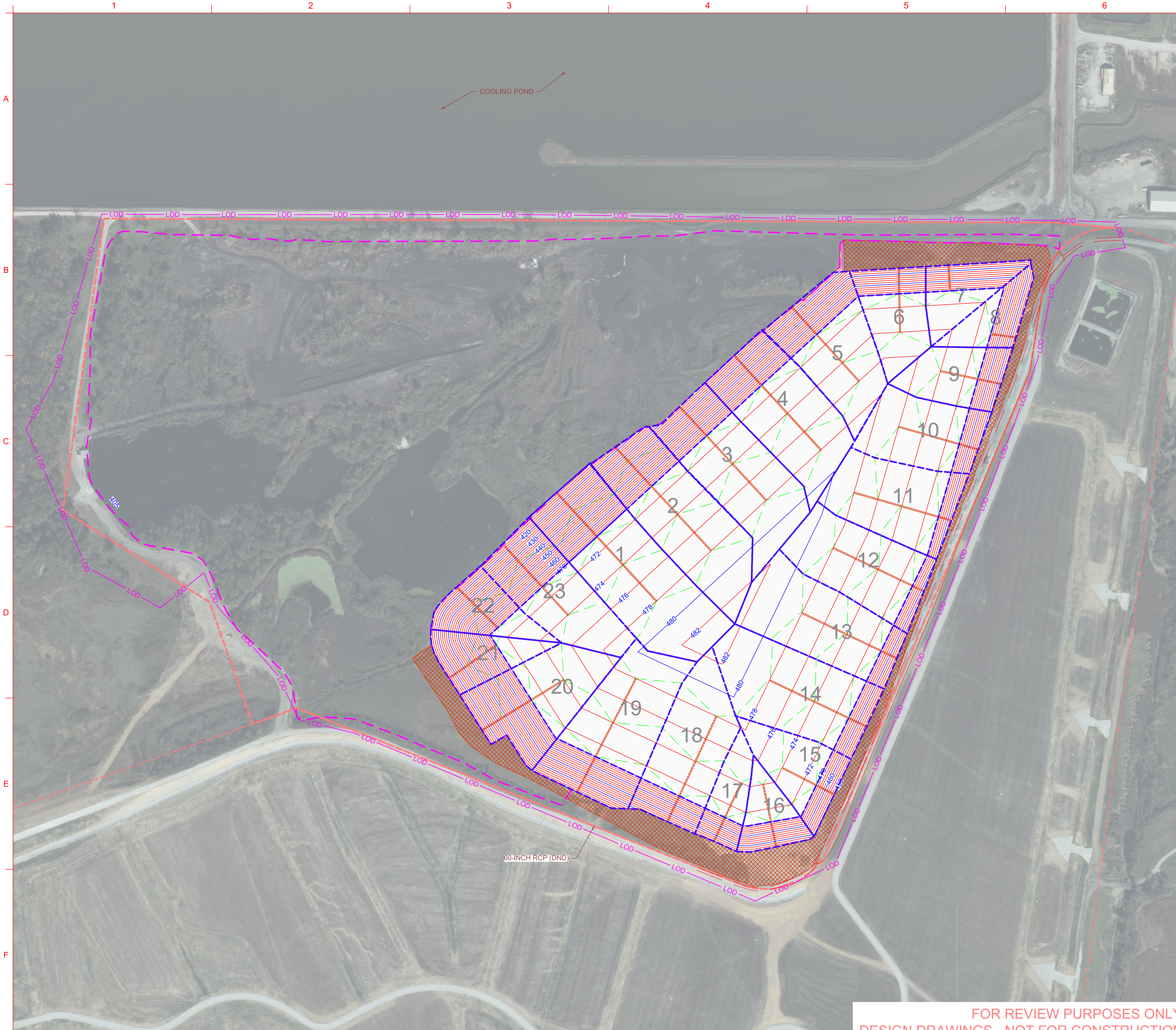
Geosyntec consultants

Appendix A – Drainage Area Maps



LEGEND

- 420 — EXISTING GROUND MAJOR CONTOUR (5')
- EXISTING GROUND MINOR CONTOUR (1')
- IMPOUNDMENT BOUNDARY
- 470 — PROPOSED GRADING MAJOR CONTOURS (5')
- 472 — PROPOSED GRADING MINOR CONTOURS (1')
- LOD — LIMITS OF DISTURBANCE (LOD)
- INTERCEPTOR BERM
- FINAL HAUL ROAD
- EDGE OF EXISTING GRADE
- ROCK CHUTES / LETDOWNS
- PERIMETER DITCH
- CAP TIE-IN TO FAPS
- DELINEATED DRAINAGE AREAS

NOTES:

1. PHASE 2 OF THE CLOSURE SHALL FOLLOWING THE DISCONTINUING OF POWER GENERATION AT THE PLANT.
2. THE CONTRACTOR SHALL OPERATE WITHIN THE "LOD" TO COMPLETE THE PROPOSED CLOSURE. CONTRACTOR SHALL EVALUATE AND IS SOLELY RESPONSIBLE FOR SAFE AND STABLE ACCESS OF EQUIPMENT ON THE CCR WITHIN THE "LOD".
3. SELECT DEWATERING SHALL BE COMPLETED TO ALLOW FOR EXCAVATION OF THE CCR MATERIALS FROM THE AREA TO BE CONSOLIDATED UTILIZING DEWATERING SUMPS AND DITCHES.
4. THE CONTRACTOR IS RESPONSIBLE FOR STORMWATER FLOWS DURING CONSTRUCTION AND SHALL ADHERE TO THE SITE SPECIFIC NPDES PERMIT. CONTACT STORMWATER AND DEWATERING WATER,SHALL NOT FLOW OR BE PUMPED OUTSIDE OF THE LIMITS OF THE BAP EXCEPT THROUGH THE NDPES PERMITTED OUTFALL. THE CONTRACTOR SHALL UTILIZE THE EXISTING OUTFALL AT THE BAP DAM. PERIMETER DITCH ALIGNMENT IS APPROXIMATE AND WILL BE REFINED AT A LATER PHASE OF DESIGN.
5. STORMWATER COLLECTION AND MAINTENANCE OF THE STORMWATER BMPS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
6. CCR SHALL BE REMOVED FROM THE CONSOLIDATION AREAS TO AN ESTIMATED DEPTH OF APPROXIMATELY 1 FOOT BELOW THE ESTIMATED DEPTH OF CCR. VISIBLE CCR SHALL BE REMOVED, FINAL SUBGRADE SHALL BE VISIBLY INSPECTED BY A MEMBER OF THE CONSTRUCTION QUALITY ASSURANCE TEAM AFTER EXCAVATION. THE ACTUAL FINAL GRADES WILL BE DETERMINED IN THE FIELD DURING CCR REMOVAL CONSTRUCTION
7. THE PROPOSED EXCAVATION GRADE IS BASED THE 1967 PRECONSTRUCTION SURVEY AND RECENT EXPLORATION INVESTIGATIONS TO IDENTIFY THE BOTTOM OF ASH.
8. THE FINAL CLOSURE CAP WILL EXTEND TO THE LIMITS OF THE FLY ASH POND SYSTEM CAP TO THE EAST OF THE BAP. RESTORE EXISTING HAUL ROAD ON TOP OF FINAL CLOSURE CAP.
9. GEOCOMPOSITE DRAINAGE LAYER SHALL BE INCLUDED IN ALL SLOPE AREAS 25% OR MORE STEEP.

0 200 400
SCALE IN FEET
N

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
1 MCBRIDE AND SON CENTER DRIVE, SUITE 202
CHESTERFIELD, MO 63005 USA
TELEPHONE: 636-812-0800

DYNEGY MIDWEST GENERATION, LLC
1500 EASTPORT PLAZA DRIVE
COLLINSVILLE, IL 62234 USA

TITLE: DELINEATED DRAINAGE AREAS

PROJECT: BOTTOM ASH POND CONSTRUCTION PERMIT APPLICATION CLOSURE DRAWINGS

SITE: BALDWIN POWER PLANT
BALDWIN, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

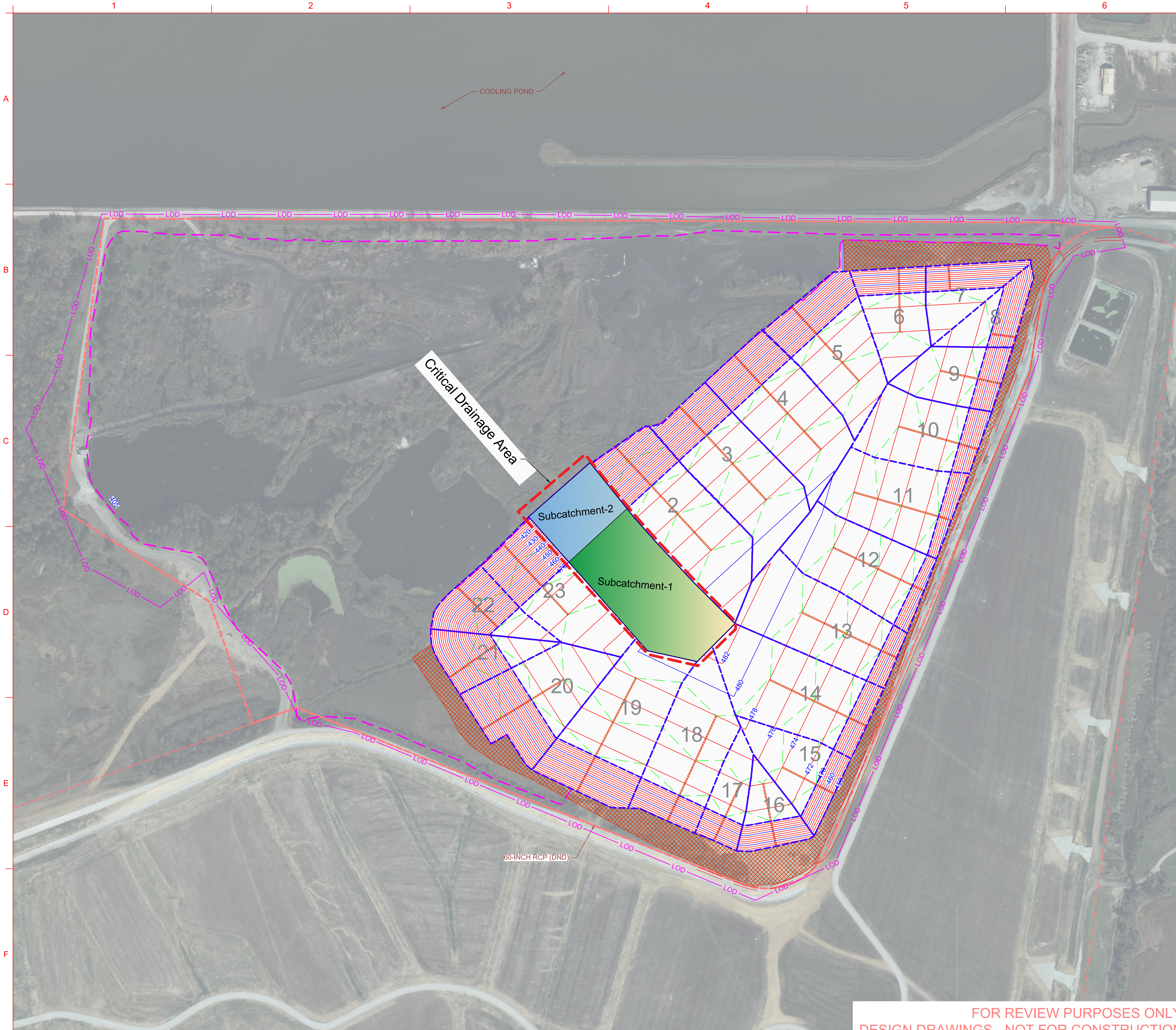
SIGNATURE

DATE

DRAFT

DESIGN BY:	DATE: DECEMBER 2022
DRAWN BY:	PROJECT NO.: GLP8050
CHECKED BY:	FILE: 05 - GLP8050 C-120
REVIEWED BY:	DRAWING NO.: 1
APPROVED BY:	

FOR REVIEW PURPOSES ONLY
DESIGN DRAWINGS - NOT FOR CONSTRUCTION



LEGEND

- 420 — EXISTING GROUND MAJOR CONTOUR (5')
- EXISTING GROUND MINOR CONTOUR (1')
- IMPOUNDMENT BOUNDARY
- 470 — PROPOSED GRADING MAJOR CONTOURS (5')
- 472 — PROPOSED GRADING MINOR CONTOURS (1')
- LOD — LIMITS OF DISTURBANCE (LOD)
- INTERCEPTOR BERM
- FINAL HAUL ROAD
- EDGE OF EXISTING GRADE
- ROCK CHUTES / LETDOWNS
- PERIMETER DITCH
- CAP TIE-IN TO FAPS
- CRITICAL DRAINAGE AREA
- SWMM SUBCATCHMENT 1
- SWMM SUBCATCHMENT 2

NOTES:

1. PHASE 2 OF THE CLOSURE SHALL FOLLOWING THE DISCONTINUING OF POWER GENERATION AT THE PLANT.
2. THE CONTRACTOR SHALL OPERATE WITHIN THE "LOD" TO COMPLETE THE PROPOSED CLOSURE. CONTRACTOR SHALL EVALUATE AND IS SOLELY RESPONSIBLE FOR SAFE AND STABLE ACCESS OF EQUIPMENT ON THE CCR WITHIN THE "LOD".
3. SELECT DEWATERING SHALL BE COMPLETED TO ALLOW FOR EXCAVATION OF THE CCR MATERIALS FROM THE AREA TO BE CONSOLIDATED UTILIZING DEWATERING SUMPS AND DITCHES.
4. THE CONTRACTOR IS RESPONSIBLE FOR STORMWATER FLOWS DURING CONSTRUCTION AND SHALL ADHERE TO THE SITE SPECIFIC NPDES PERMIT. CONTACT STORMWATER AND DEWATERING WATER,SHALL NOT FLOW OR BE PUMPED OUTSIDE OF THE LIMITS OF THE BAP EXCEPT THROUGH THE NDPES PERMITTED OUTFALL. THE CONTRACTOR SHALL UTILIZE THE EXISTING OUTFALL AT THE BAP DAM. PERIMETER DITCH ALIGNMENT IS APPROXIMATE AND WILL BE REFINED AT A LATER PHASE OF DESIGN.
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8. THE FINAL CLOSURE CAP WILL EXTEND TO THE LIMITS OF THE FLY ASH POND SYSTEM CAP TO THE EAST OF THE BAP. RESTORE EXISTING HAUL ROAD ON TOP OF FINAL CLOSURE CAP.
9. GEOCOMPOSITE DRAINAGE LAYER SHALL BE INCLUDED IN ALL SLOPE AREAS 25% OR MORE STEEP.

0 200 400
SCALE IN FEET
N

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
1 MCBRIDE AND SON CENTER DRIVE, SUITE 202
CHESTERFIELD, MO 63005 USA
TELEPHONE: 636-812-0800

DYNEGY MIDWEST GENERATION, LLC
1500 EASTPORT PLAZA DRIVE
COLLINSVILLE, IL 62234 USA

TITLE: CRITICAL DRAINAGE AREA

PROJECT: BOTTOM ASH POND CONSTRUCTION PERMIT APPLICATION CLOSURE DRAWINGS

SITE: BALDWIN POWER PLANT BALDWIN, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

DATE

DRAFT

DESIGN BY:		DATE:	DECEMBER 2022
DRAWN BY:		PROJECT NO.:	GLP8050
CHECKED BY:		FILE:	05 - GLP8050 C-120
REVIEWED BY:		DRAWING NO.:	2
APPROVED BY:			

FOR REVIEW PURPOSES ONLY
DESIGN DRAWINGS - NOT FOR CONSTRUCTION

Appendix B – NOAA Precipitation Frequency Data

Location name: Baldwin, Illinois, USA*
Latitude: 38.2169°, Longitude: -89.8661°
Elevation: 429.54 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.414** (0.375-0.459)	**0.491** (0.446-0.543)	**0.584** (0.530-0.645)	**0.656** (0.594-0.725)	**0.752** (0.678-0.828)	**0.827** (0.743-0.911)	**0.902** (0.806-0.993)	**0.982** (0.873-1.08)	**1.09** (0.964-1.20)	**1.18** (1.03-1.30)
10-min	**0.644** (0.583-0.713)	**0.767** (0.697-0.848)	**0.907** (0.824-1.00)	**1.01** (0.917-1.12)	**1.15** (1.04-1.27)	**1.25** (1.13-1.38)	**1.36** (1.21-1.50)	**1.47** (1.30-1.61)	**1.61** (1.42-1.77)	**1.72** (1.51-1.89)
15-min	**0.789** (0.715-0.873)	**0.938** (0.852-1.04)	**1.11** (1.01-1.23)	**1.25** (1.13-1.38)	**1.42** (1.28-1.57)	**1.55** (1.39-1.71)	**1.69** (1.51-1.86)	**1.82** (1.62-2.00)	**2.01** (1.77-2.21)	**2.15** (1.88-2.37)
30-min	**1.04** (0.946-1.16)	**1.25** (1.14-1.39)	**1.53** (1.39-1.69)	**1.73** (1.57-1.91)	**2.01** (1.81-2.21)	**2.22** (1.99-2.44)	**2.44** (2.18-2.68)	**2.66** (2.37-2.93)	**2.97** (2.62-3.27)	**3.22** (2.82-3.54)
60-min	**1.27** (1.16-1.41)	**1.54** (1.40-1.70)	**1.91** (1.74-2.12)	**2.20** (1.99-2.43)	**2.60** (2.35-2.87)	**2.92** (2.62-3.22)	**3.26** (2.91-3.58)	**3.61** (3.21-3.97)	**4.11** (3.63-4.52)	**4.52** (3.96-4.98)
2-hr	**1.51** (1.36-1.68)	**1.83** (1.65-2.03)	**2.28** (2.06-2.52)	**2.65** (2.38-2.93)	**3.17** (2.84-3.49)	**3.60** (3.21-3.97)	**4.07** (3.62-4.48)	**4.58** (4.04-5.04)	**5.32** (4.66-5.85)	**5.94** (5.18-6.54)
3-hr	**1.63** (1.47-1.81)	**1.97** (1.78-2.18)	**2.46** (2.22-2.73)	**2.86** (2.58-3.17)	**3.45** (3.09-3.81)	**3.94** (3.52-4.35)	**4.47** (3.98-4.93)	**5.06** (4.48-5.57)	**5.94** (5.21-6.53)	**6.68** (5.82-7.35)
6-hr	**1.96** (1.79-2.17)	**2.37** (2.16-2.62)	**2.95** (2.69-3.27)	**3.44** (3.12-3.80)	**4.13** (3.73-4.55)	**4.73** (4.25-5.20)	**5.38** (4.80-5.91)	**6.09** (5.41-6.69)	**7.15** (6.29-7.86)	**8.07** (7.03-8.86)
12-hr	**2.34** (2.12-2.62)	**2.82** (2.55-3.15)	**3.49** (3.16-3.90)	**4.05** (3.66-4.51)	**4.86** (4.36-5.40)	**5.54** (4.94-6.14)	**6.27** (5.57-6.95)	**7.08** (6.25-7.84)	**8.27** (7.23-9.15)	**9.28** (8.06-10.3)
24-hr	**2.76** (2.55-3.02)	**3.32** (3.07-3.64)	**4.12** (3.80-4.51)	**4.79** (4.40-5.25)	**5.76** (5.24-6.33)	**6.59** (5.95-7.27)	**7.50** (6.69-8.31)	**8.51** (7.48-9.49)	**10.0** (8.61-11.3)	**11.3** (9.56-12.9)
2-day	**3.18** (2.93-3.47)	**3.84** (3.54-4.19)	**4.76** (4.39-5.20)	**5.50** (5.05-6.00)	**6.53** (5.95-7.14)	**7.38** (6.67-8.11)	**8.29** (7.41-9.16)	**9.27** (8.20-10.3)	**10.8** (9.40-12.2)	**12.2** (10.4-13.8)
3-day	**3.40** (3.15-3.70)	**4.11** (3.80-4.47)	**5.09** (4.70-5.53)	**5.86** (5.40-6.38)	**6.94** (6.34-7.57)	**7.82** (7.09-8.57)	**8.76** (7.86-9.66)	**9.77** (8.67-10.9)	**11.3** (9.84-12.7)	**12.6** (10.8-14.3)
4-day	**3.63** (3.37-3.93)	**4.38** (4.06-4.75)	**5.42** (5.02-5.87)	**6.22** (5.75-6.75)	**7.35** (6.73-7.99)	**8.26** (7.51-9.03)	**9.23** (8.32-10.2)	**10.3** (9.14-11.4)	**11.8** (10.3-13.2)	**13.0** (11.2-14.8)
7-day	**4.19** (3.89-4.52)	**5.04** (4.69-5.45)	**6.21** (5.77-6.71)	**7.12** (6.59-7.69)	**8.37** (7.69-9.07)	**9.39** (8.56-10.2)	**10.5** (9.44-11.5)	**11.6** (10.3-12.8)	**13.2** (11.6-14.8)	**14.5** (12.6-16.4)
10-day	**4.74** (4.41-5.10)	**5.69** (5.31-6.12)	**6.95** (6.46-7.47)	**7.93** (7.35-8.53)	**9.26** (8.54-9.99)	**10.3** (9.46-11.2)	**11.5** (10.4-12.5)	**12.6** (11.3-13.9)	**14.3** (12.6-15.9)	**15.6** (13.6-17.6)
20-day	**6.46** (6.05-6.90)	**7.71** (7.23-8.25)	**9.25** (8.66-9.89)	**10.4** (9.71-11.1)	**11.9** (11.1-12.8)	**13.1** (12.1-14.1)	**14.3** (13.1-15.4)	**15.4** (14.1-16.8)	**17.1** (15.4-18.8)	**18.3** (16.4-20.3)
30-day	**7.95** (7.46-8.46)	**9.46** (8.90-10.1)	**11.2** (10.5-11.9)	**12.5** (11.7-13.3)	**14.1** (13.2-15.1)	**15.4** (14.3-16.5)	**16.7** (15.4-17.9)	**17.9** (16.4-19.4)	**19.6** (17.8-21.4)	**20.9** (18.8-22.9)
45-day	**9.94** (9.38-10.5)	**11.8** (11.1-12.5)	**13.8** (13.1-14.6)	**15.3** (14.4-16.2)	**17.2** (16.2-18.3)	**18.7** (17.4-19.8)	**20.1** (18.7-21.4)	**21.4** (19.8-23.0)	**23.3** (21.3-25.2)	**24.7** (22.4-26.9)
60-day	**11.6** (11.0-12.3)	**13.8** (13.1-14.6)	**16.1** (15.2-16.9)	**17.8** (16.8-18.7)	**19.9** (18.8-21.1)	**21.6** (20.2-22.9)	**23.2** (21.6-24.7)	**24.8** (22.9-26.5)	**26.9** (24.6-29.0)	**28.5** (25.9-30.9)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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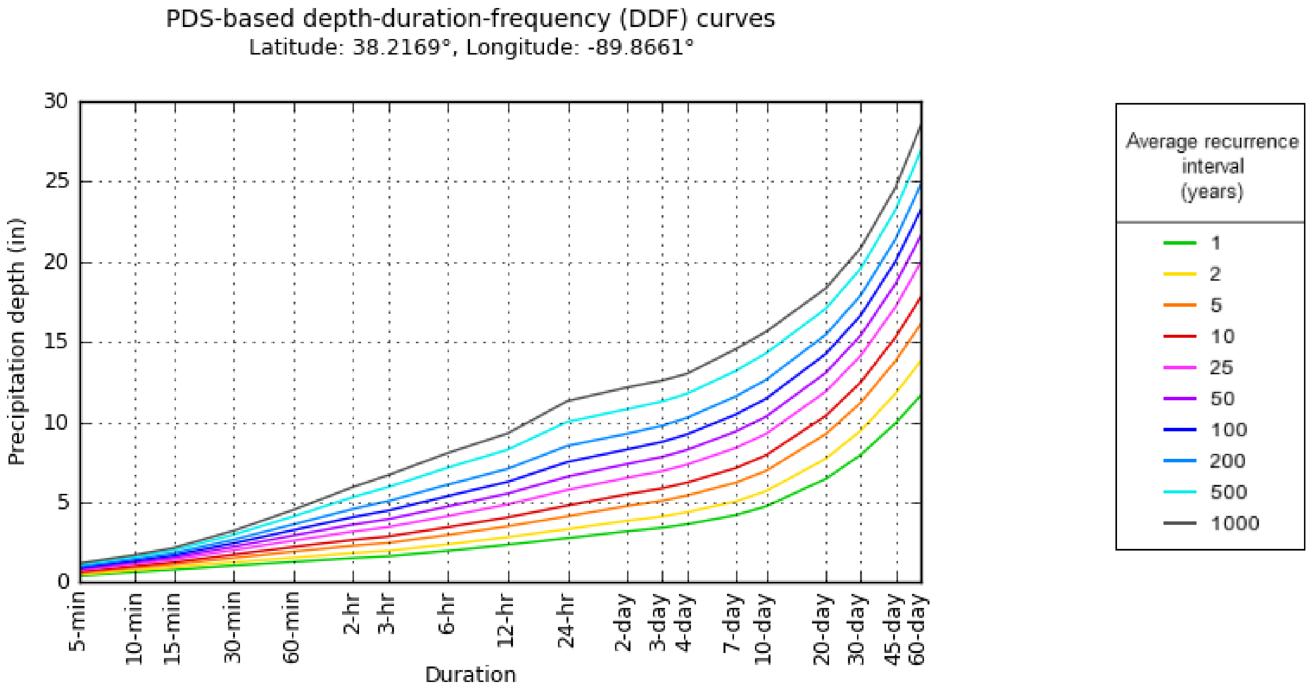
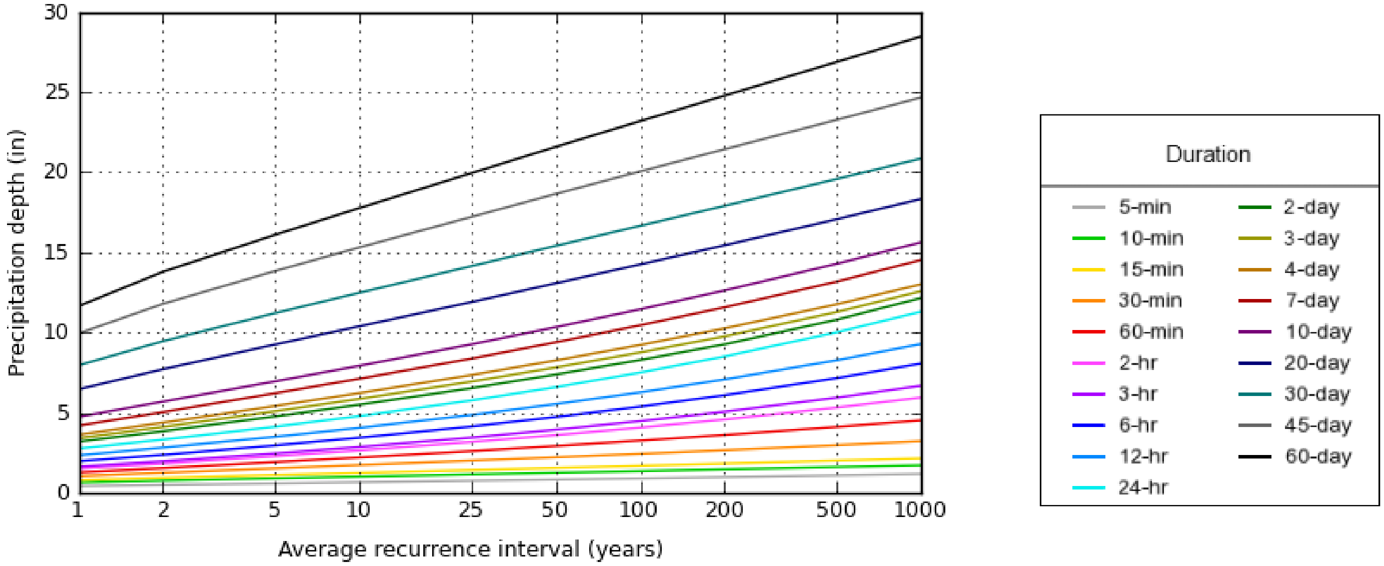
PF graphical





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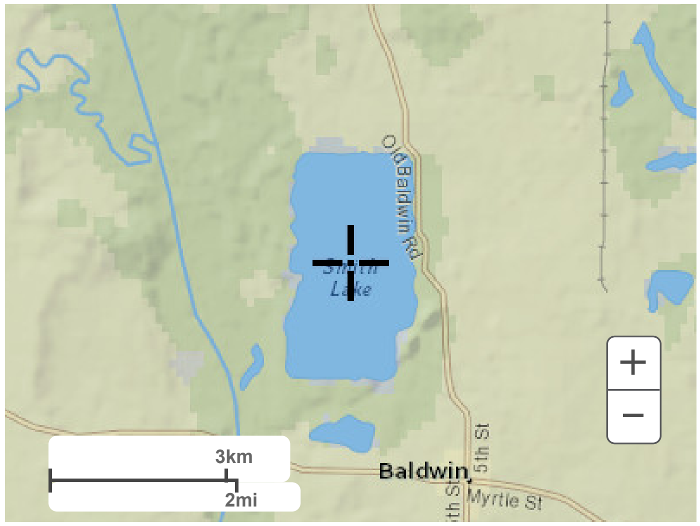
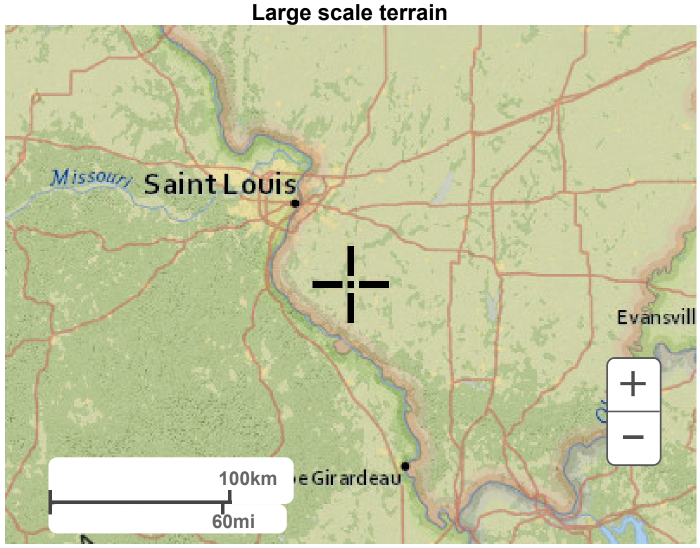
Maps & aerials

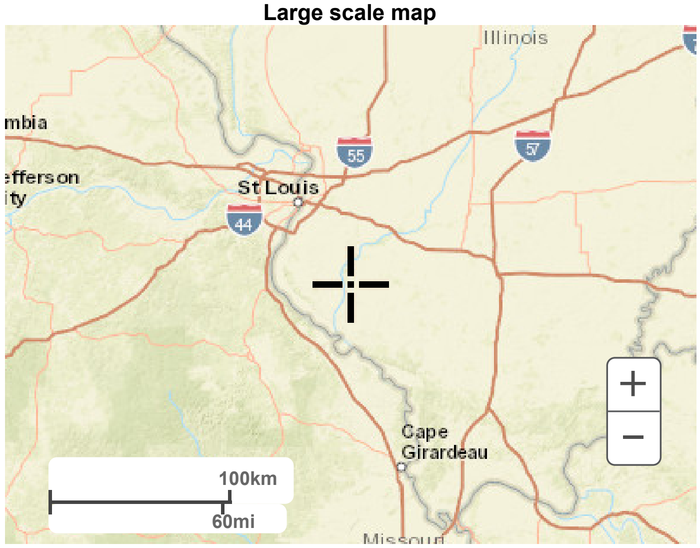
Small scale terrain



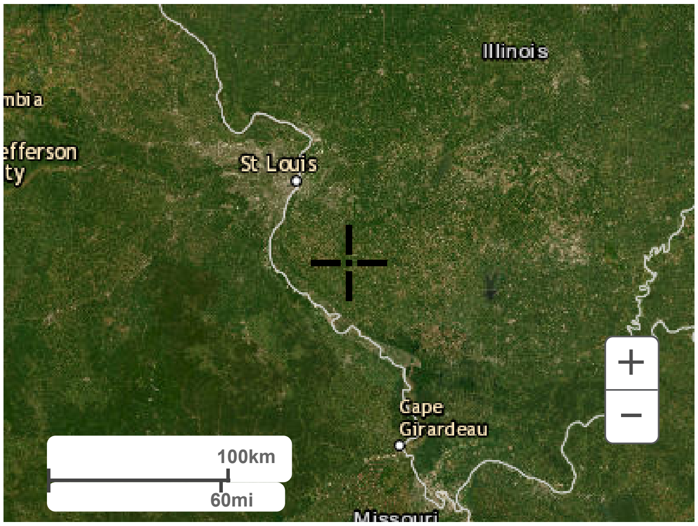
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Appendix C – Interceptor Berm Hydraulic Analysis

Geosyntec consultants
engineers | scientists | innovators

9300 W 110th Street
Overland Park, KS
TELEPHONE (913) 224-1056

JOB	Baldwin BAP CP		
SHEET NO.		OF	
CALCULATED BY	SS	DATE	11/17/2022
CHECKED BY		DATE	
SCALE			
DESCRIPTION	Interceptor Berm Design (on 2% Slope)		
	100-year, 24 hr. SCS Type II		

Drainage Area=	4.65 acres	0.0072656	square miles
Total Peak Discharge Qmax	31 cfs		

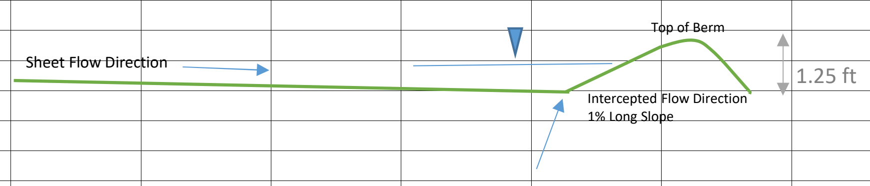
V-Ditch Design Parameters

Bottom Width, B =	0.00	ft	
Left Side Slope, Z1 =	50.00	horizontal :1 vertical	Cover Slope
Right Side Slope, Z2 =	2.00	horizontal :1 vertical	Berm Side Slope
Manning's Roughness Coeff., n =	0.030		
Longitudinal Channel Slope, So =	0.0100	ft/ft	

Depth of Flow	Top Width	Area of Flow	Wetted Perimeter	Hydraulic Radius	Channel Slope	Average Velocity	Discharge (Flow Rate)	Avg. Tractive Stress	Comments
Y	T	A	P	R=A/P		V	Q=AV	to	
ft	ft	ft2	ft	ft	ft/ft	ft/s	ft3/s	lb./ft2	
0.01	0.52	0.00	0.52	0.00	0.010	0.14	0.00	0.00	
0.07	3.51	0.12	3.53	0.03	0.010	0.52	0.06	0.02	
0.13	6.50	0.41	6.53	0.06	0.010	0.78	0.32	0.04	
0.18	9.49	0.87	9.53	0.09	0.010	1.00	0.87	0.06	
0.24	12.48	1.50	12.54	0.12	0.010	1.20	1.80	0.07	
0.30	15.47	2.30	15.54	0.15	0.010	1.39	3.20	0.09	
0.36	18.46	3.28	18.55	0.18	0.010	1.56	5.12	0.11	
0.41	21.45	4.42	21.55	0.21	0.010	1.73	7.64	0.13	
0.47	24.44	5.74	24.56	0.23	0.010	1.88	10.82	0.15	
0.53	27.43	7.23	27.56	0.26	0.010	2.04	14.72	0.16	
0.59	30.42	8.90	30.56	0.29	0.010	2.18	19.40	0.18	
0.64	33.41	10.73	33.57	0.32	0.010	2.32	24.92	0.20	
0.70	36.40	12.74	36.57	0.35	0.010	2.46	31.32	0.22	
0.70	**36.40**	**12.74**	**36.57**	**0.35**	**0.01**	**2.46**	**31.3**	**0.22**	**Design Q (Q100)**

Channel Flow

Velocity (ft/s)	2.46
Flow Length (ft)	200
Tc or Tt (hr)	0.02



Geosyntec consultants
engineers | scientists | innovators

9300 W 110th Street
Overland Park, KS
TELEPHONE (913) 224-1056

JOB	Baldwin BAP CP		
SHEET NO.		OF	
CALCULATED BY	SS	DATE	11/17/2022
CHECKED BY		DATE	
SCALE			
DESCRIPTION	Interceptor Berm Design (on 25% Slope)		
	100-year, 24 hr. SCS Type II		

Drainage Area	1.76000	acres	0.002750	square miles
Total Peak Discharge Qmax	15.20	cfs		

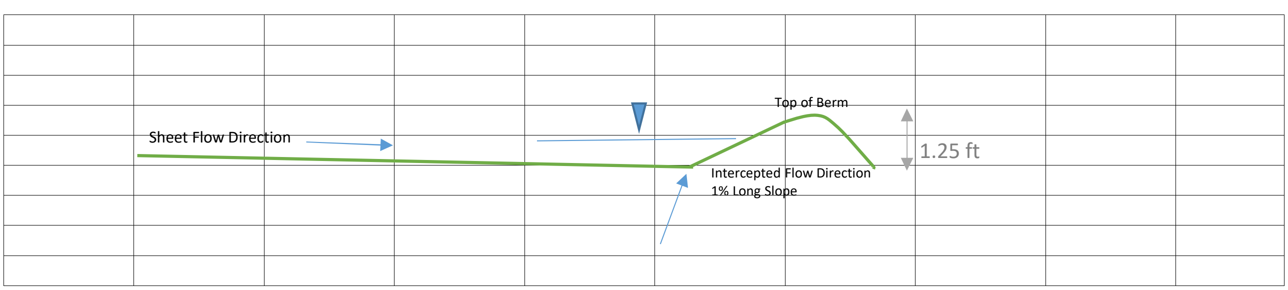
V-Ditch Design Parameters

Bottom Width, b =	0.00	ft	
Left Side Slope, Z1 =	4.00	horizontal :1 vertical	Cover Slope
Right Side Slope, Z2 =	2.00	horizontal :1 vertical	Berm Side Slope
Manning's Roughness Coeff., n =	0.030		
Longitudinal Channel Slope, So =	0.0100	ft/ft	

Depth of Flow	Top Width	Area of Flow	Wetted Perimeter	Hydraulic Radius	Channel Slope	Average Velocity	Discharge (Flow Rate)	Avg. Tractive Stress	Comments
Y	T	A	P	R=A/P		V	Q=AV	to	
ft	ft	ft2	ft	ft	ft/ft	ft/s	ft3/s	lb./ft2	
0.01	0.06	0.00	0.06	0.00	0.010	0.14	0.00	0.00	
0.11	0.67	0.04	0.70	0.05	0.010	0.69	0.03	0.03	
0.21	1.27	0.13	1.35	0.10	0.010	1.07	0.14	0.06	
0.31	1.88	0.29	1.99	0.15	0.010	1.39	0.41	0.09	
0.41	2.48	0.51	2.63	0.19	0.010	1.67	0.86	0.12	
0.51	3.09	0.79	3.27	0.24	0.010	1.93	1.53	0.15	
0.62	3.69	1.13	3.91	0.29	0.010	2.18	2.47	0.18	
0.72	4.30	1.54	4.55	0.34	0.010	2.41	3.70	0.21	
0.82	4.90	2.00	5.19	0.39	0.010	2.63	5.26	0.24	
0.92	5.51	2.53	5.83	0.43	0.010	2.84	7.18	0.27	
1.02	6.11	3.11	6.48	0.48	0.010	3.05	9.48	0.30	
1.12	6.72	3.76	7.12	0.53	0.010	3.24	12.19	0.33	
1.22	7.32	4.47	7.76	0.58	0.010	3.44	15.34	0.36	
1.22	**7.32**	**4.47**	**7.76**	**0.58**	**0.01**	**3.44**	**15.34**	**0.36**	**Design Q (Q100)**

Channel Flow

Velocity (ft/s)	3.44
Flow Length (ft)	200
Tc or Tt (hr)	0.02



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Appendix D – Rock Chute Analysis

Rock Chute Design - Cut/Paste Plan

(Version WI-July-2010, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

Project: Baldwin BAP CP **County:** Randolph, IL
Designer: Shailendra Singh **Checked by:**
Date: 11/16/2022 **Date:**

Design Values

D_{50} dia. = 2.5 in.
$Rock_{chute}$ thickness = 5.0 in.
Inlet apron length = 10 ft.
Outlet apron length = 3 ft.
Radius = 7 ft.
Will bedding be used? No

Rock Gradation Envelope

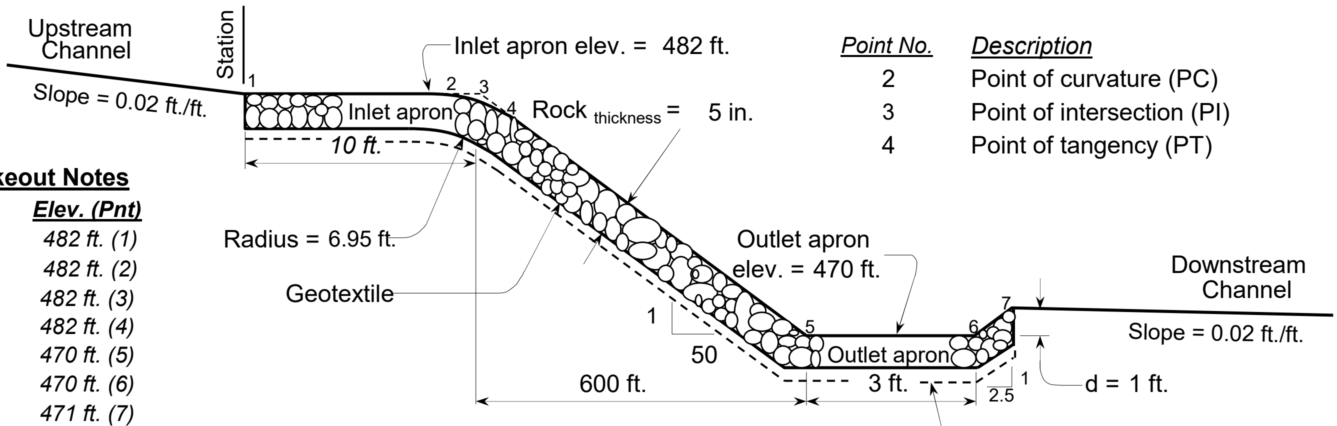
% Passing		*Diameter, in. (weight, lbs.)*
D_{100}	---------	4 - 5 (4 - 9)
D_{85}	---------	3 - 5 (2 - 6)
D_{50}	---------	3 - 4 (1 - 4)
D_{10}	---------	2 - 3 (1 - 2)

Coefficient of Uniformity, $(D_{60})/(D_{10}) < 1.7$

Quantities [a]

Rock = 149 yd^3
Geotextile (WCS-13)[b] = 1165 yd^2
Bedding = 0 yd^3
Excavation = 0 yd^3
Earthfill = 0 yd^3
Seeding = 0.0 acres

***Notes*:** [a] *Rock, bedding, and geotextile quantities are determined from x-section below (neglect radius).*
[b] *Geotextile Class I (Non-woven) shall be overlapped and anchored (18-in. minimum along sides and 24-in. minimum on the ends) --- quantity not included.*

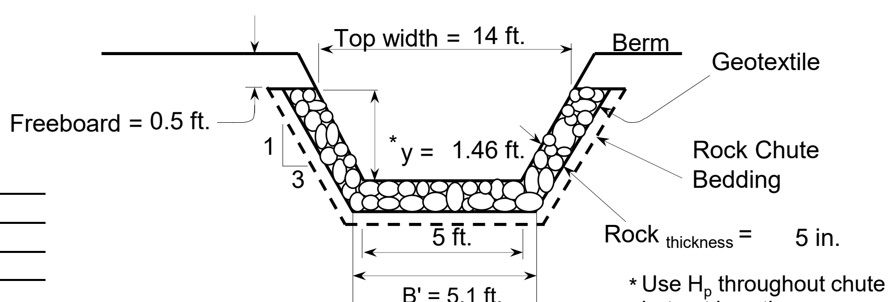


Point No.	*Description*
2	Point of curvature (PC)
3	Point of intersection (PI)
4	Point of tangency (PT)

Stakeout Notes

Sta.	*Elev. (Pnt)*
0+00.0	482 ft. (1)
0+09.9	482 ft. (2)
0+10.0	482 ft. (3)
0+10.1	482 ft. (4)
6+10.0	470 ft. (5)
6+13.0	470 ft. (6)
6+15.5	471 ft. (7)

Profile Along Centerline of Rock Chute



* Use H_p throughout chute but not less than z_2.

Rock Chute Cross Section

Notes:
Rock gradation envelope can be met with
DOT Light riprap Gradation

Profile, Cross Sections, and Quantities

NRCS
Natural Resources Conservation Service
United States Department of Agriculture

Baldwin BAP CP

Randolph, IL County

		Date
Designed	Shailendra Singh	
Drawn		
Checked		
Approved		

File Name
Drawing Name
Sheet __ of __

Rock_Chute.xls
for construction plan

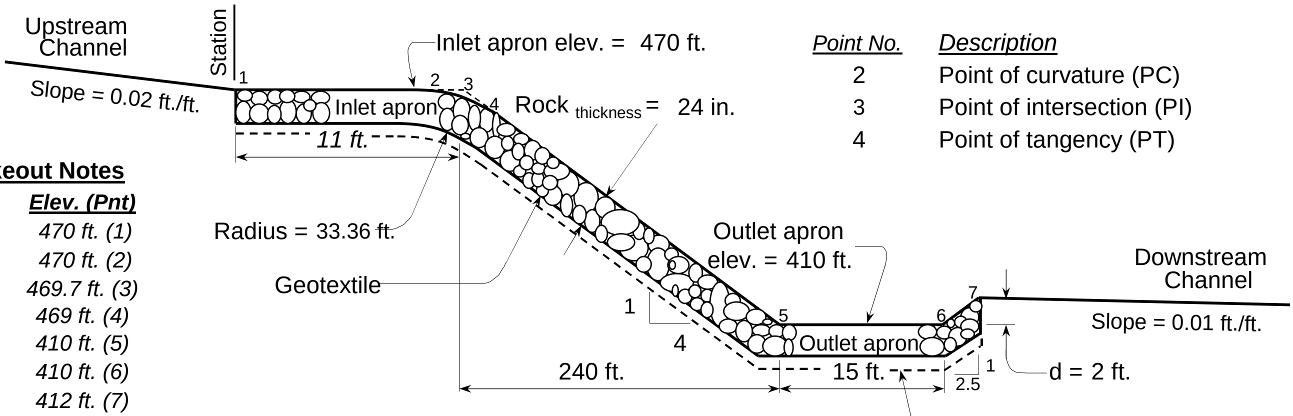
Rock Chute Design - Cut/Paste Plan

(Version WI-July-2010, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

Project: Baldwin BAP CP **County:** Randolph, IL
Designer: Shailendra Singh **Checked by:** ____________
Date: 11/16/2022 **Date:** ____________

Design Values		***Rock Gradation Envelope***		***Quantities*** [a]	
D_{50} dia. =	12.0 in.	*% Passing*	*Diameter, in. (weight, lbs.)*	Rock = 488	yd^3
$Rock_{chute}$ thickness =	24.0 in.	D_{100} ---------	18 - 24 (413 - 978)	Geotextile (WCS-13)[b] = 937	yd^2
Inlet apron length =	11 ft.	D_{85} ---------	16 - 22 (269 - 713)	Bedding = 0	yd^3
Outlet apron length =	15 ft.	D_{50} ---------	12 - 18 (122 - 413)	Excavation = 0	yd^3
Radius =	33 ft.	D_{10} ---------	10 - 16 (63 - 269)	Earthfill = 0	yd^3
Will bedding be used?	No	*Coefficient of Uniformity, $(D_{60})/(D_{10}) < 1.7$*		Seeding = 0.0	acres

Notes: [a] *Rock, bedding, and geotextile quantities are determined from x-section below (neglect radius).*
[b] *Geotextile Class I (Non-woven) shall be overlapped and anchored (18-in. minimum along sides and 24-in. minimum on the ends) --- quantity not included.*

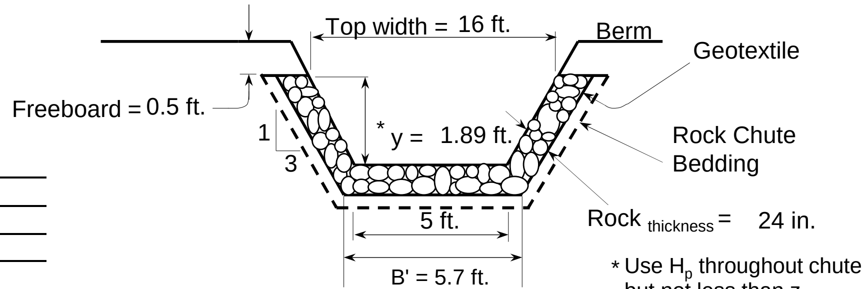


Point No.	*Description*
2	Point of curvature (PC)
3	Point of intersection (PI)
4	Point of tangency (PT)

Stakeout Notes

Sta.	***Elev. (Pnt)***
0+00.0	*470 ft. (1)*
0+06.9	*470 ft. (2)*
0+11.0	*469.7 ft. (3)*
0+15.0	*469 ft. (4)*
2+51.0	*410 ft. (5)*
2+66.0	*410 ft. (6)*
2+71.0	*412 ft. (7)*

Profile Along Centerline of Rock Chute



Rock Chute Cross Section

Notes:
Rock gradation envelope can be met with
DOT Extra Heavy riprap Gradation

Profile, Cross Sections, and Quantities

NRCS
Natural Resources Conservation Service
United States Department of Agriculture

Baldwin BAP CP
Randolph, IL County

		Date
Designed	Shailendra Singh	
Drawn		
Checked		
Approved		

File Name
Drawing Name
Sheet __ of __

ATTACHMENT E

Geotechnical Design of Slopes and Final Cover System (Sections 845.750(a)(3) and (a)(4))

Geosyntec
consultants

COMPUTATION COVER SHEET

Client: **Dynegy**	Project: **Baldwin Power Plant Bottom Ash Pond Construction Permit**	Project No.:	**GLP8050**
		Task No.:	**02/04**

Title of Computations **Geotechnical Calculations for Closure Design**

Computations by:	Signature		01/19/2023	
	Printed Name	Isaiah Vaught, Zachary Fallert, P.E.	Date	
	Title	Staff Professional, Engineer		
Assumptions and Procedures Checked by: (peer reviewer)	Signature		01/20/2023	
	Printed Name	Clinton Carlson,	Date	
	Title	Project Engineer		
Computations Checked by:	Signature		01/23/2023	
	Printed Name	Zachary Fallert, P.E., Isaiah Vaught	Date	
	Title	Engineer, Staff Professional		
Computations backchecked by: (originator)	Signature		01/23/2023	
	Printed Name	Isaiah Vaught, Zachary Fallert, P.E.	Date	
	Title	Staff Professional, Engineer		
Approved by: (PM or designate)	Signature		01/23/2023	
	Printed Name	Thomas Ward, P.E.	Date	
	Title	Senior Engineer		

Approval notes:

Revisions (number and initial all revisions)

No.	Sheet	Date	By	Checked by	Approval
0		12/12/2022	IJV	ZJF, CPC	TWW
1		01/23/2023	IJV	ZJF, CPC	TWW

Geosyntec consultants

TABLE OF CONTENTS

LIST OF ATTACHMENTS

LIST OF TABLES

1. PURPOSE

This calculation package, supporting the Coal Combustion Residual (CCR) Surface Impoundment Final Close Plan [1], presents geotechnical calculations in support of the construction permit application for the closure design of the Bottom Ash Pond (BAP) at the Baldwin Power Plant (BPP) in Baldwin, Illinois. The closure will define the BAP as a Closed CCR Impoundment (Impoundment) which consists of consolidating the former BAP footprint with a cover system. The analyses provided in this calculation package (Package) includes:

(i) A summary of the available data from geotechnical investigations completed at Baldwin by AECOM;

(ii) A summary of subsurface conditions, selected geotechnical design parameters, and seismic inputs developed by Geosyntec;

(iii) Global slope stability analyses considering post-closure conditions for static and seismic conditions;

(iv) Settlement analysis of the proposed Impoundment design; and

(v) Veneer stability analysis for the cover system design.

2. AVAILABLE DATA

In 2015, AECOM presented Dynegy with a 30% Design Data Report [2] and 30% Design Package [3], for the West, East, and Old East Ash Ponds at Baldwin. Relevant data to the BAP, including auger boring logs, CPT soundings, and laboratory testing, performed around the perimeter and interior of the BAP, was selected from the geotechnical exploratory program.

3. SUBSURFACE CONDITIONS AND MATERIAL CHARACTERIZATION

Geosyntec identified the following materials within, beneath, and around the BAP:

(i) Cover Soil,
(ii) Bottom Ash,
(iii) Loess,
(iv) Residual Clay, and
(v) Bedrock.

Each material is discussed below. Material properties used for analysis are summarized in **Table 1**.

Cover Soil

Cover Soil for the proposed Impoundment is assumed to have the same material properties as Residual Clay based on an on-site borrow material likely being used in the construction of the cover system.

Bottom Ash

The contents of the BAP mainly consist of disposed Bottom Ash from the adjacent power plant. The disposed Bottom Ash exists in a very loose to medium dense state. Properties for Bottom Ash are taken from AECOM's 30% Design [3], due to the lack of BAP-specific laboratory testing. The drained shear strength is modeled with an effective cohesion (c') of zero and an effective friction angle (ϕ') of 30 degrees. Unit weight for the Bottom Ash is modeled as 97 pounds per cubic foot (pcf). Bottom Ash is considered to be a freely-draining material; therefore, undrained shear strength properties were not used in modeling the Bottom Ash.

Closure of the BAP will involve a consolidated footprint (i.e. Bottom Ash being stacked within a smaller area). The Bottom Ash will be compacted and likely have an increased shear strength. Because the compaction effort and properties of compacted Bottom Ash are unknown at this time, Bottom Ash used as fill was conservatively assumed to have the same properties as existing Bottom Ash.

Loess

Originating from a wind-deposited silt, Loess has since weathered in place to a low plastic clayey silt or silty clay. The Loess generally has a medium stiff to stiff consistency. Properties for Loess are taken from AECOM's 30% Design [3]. The Loess is not included in the models for the global slope stability analyses, so no strength parameters are included in **Table 1**. Unit weight of Loess is modeled as 120 pcf for consolidation analysis.

Residual Clay

Residual Clay is derived from weathering of the shale bedrock. The clay is typically classified as lean or fat clay with consistency ranging from stiff to hard. Properties for Residual Clay were derived from available consolidated-undrained triaxial compression testing with pore pressure measurements (CIU) performed on samples obtained from the BAP; a total of nine tests were used. These tests were performed as part of a previous investigation by AECOM as presented in the Supplemental Technical Documents Report for the Fly Ash Pond System by Stantec [4]. Failure criteria for individual CIU specimens were defined as the peak obliquity limited to 10% axial strain, to consider the effects of strain incompatibilities, based on Geosyntec's experience. The CIU data reduction calculations and plots are provided in **Attachment A**.

Design friction angles were established by plotting effective stresses normal to the failure plane at failure, σ'_n, versus shear stress on the failure plane at failure, τ_{ff}. The design effective friction angle, ϕ', and effective cohesion, c', was assigned such that at least one-third of the plotted points fell below and two-thirds fell on or above the failure envelope.

Design undrained shear strength functions were established by plotting effective consolidation stress of the sample, σ'_c, versus shear stress on the failure plane at failure, τ_{ff}. The design undrained shear strength function was defined as a strength ratio such that shear strength increases with consolidation stress (e.g., S_u/σ'_{vc} ratio). The selected shear strength envelope corresponds to one-third of the plotted points being below the design envelope and two-thirds of the points above.

The drained strength for the Residual Clay is modeled with an effective cohesion (c') of 200 pounds per square foot (psf) and an effective friction angle (ϕ') of 32 degrees. The undrained strength is modeled with a minimum cohesion of 440 psf and a S_u/σ'_{vc} ratio of 0.50. The design unit weight of 120 pcf for the Residual Clay was taken from AECOM's 30% Design [3] due to the localized laboratory results being less conservative.

Bedrock

The bedrock encountered at the site is generally shale. There are beds of limestone and sandstone within the shale. The shale is considered a soft rock and contains a low plasticity clay. Bedrock is modeled with an infinite strength in the stability analyses.

4. GROUNDWATER CONDITIONS

The BAP is expected to be de-watered prior to or during excavation of Bottom Ash. Because of this, the existing groundwater condition is not used in the stability analysis. An assumed 2 foot groundwater recharge into the bottom of the BAP is modeled for the Long-Term and Pseudostatic Seismic Conditions, based on the January 2023 Groundwater Modeling Report by Ramboll [5]. Because the groundwater recharge is expected as a long-term condition, the groundwater for the Short-Term, End of Construction Condition is assumed at the top of Residual Clay, within the BAP extent. Outside the extent of the BAP, groundwater is assumed at the bottom of excavation, or an elevation of 410 feet.

5. SEISMIC ASSESSMENTS

Site Seismic Hazard Assessment

AECOM previously evaluated seismic hazards at Baldwin by performing a site-specific probabilistic seismic hazard assessment (PSHA) and one-dimensional (1D) dynamic response analysis [5] for the 2% probability of exceedance in 50-years earthquake event (e.g., 2,475-year return period). Within this evaluation, AECOM developed a unified hazard spectrum (UHS) for both the top-of-rock (based on the results of the PSHA) and top-of-ground (based on the results of the 1D dynamic response analysis using the PSHA as an input) for the site. A peak ground acceleration (PGA) of 0.36g (where g is the gravitational acceleration constant) and earthquake magnitude of 7.7 is used to represent the expected earthquake event and loading at the site.

There are different recommendations on selection of seismic coefficient (k_h) in pseudo-static analysis. Richardson [6], recommends using k_h equal to 0.5·PGA/g based on deformation analyses performed by Hynes-Griffin and Franklin [7], and their experience. The Hynes-Griffin and Franklin recommendation to halve the PGA to estimate k_h assumes a seismic deformation of up to three feet is tolerable for the slope. Using this recommendation, k_h of 0.18 was used in the pseudo-static seismic slope stability analysis. Vertical accelerations from seismic events were not considered in the seismic slope stability analysis because they are expected to be minimal compared to the horizontal accelerations.

The Bottom Ash and Residual Clay are assumed to not be susceptible to liquefaction because i) the Bottom Ash will be dewatered before being covered and freely drain any recharging groundwater (i.e. Bottom Ash will not be saturated), and ii) and the Residual Clay is fine grained (fine grained materials are generally not susceptible to liquefaction) and is heavily overconsolidated and exhibits strain hardening at large strains. Pore water raising within the CCR on the order of two feet is anticipated over the long-term based on groundwater modeling. It is anticipated that only two feet will be in contact with pore water. This will be further evaluated during final design phases.

6. GLOBAL SLOPE STABILITY

Global slope stability analyses for the Impoundment were performed using limit-equilibrium SLOPE/W, a two-dimensional (2D) slope stability software developed by GeoStudio [8], to calculate the factor of safety (FoS) of the perimeter dikes against global instability. One critical cross-section (discussed below) was selected to be analyzed utilizing Spencer's limit equilibrium method [9]. Circular slip surfaces defined using the entry-exit method, were evaluated with each critical slip surface being optimized into a non-circular slip surface. Factors of safety were calculated for the following loading conditions:

> Long-Term Static Conditions: This loading condition corresponds to the state of the Impoundment under long-term, normal operating conditions assuming static groundwater levels remain similar to the bottom of excavation elevation. Drained shear strength, representing effective stress conditions, are used for all materials, as this condition corresponds to static conditions without application of loads inducing pore-pressure increases. The minimum acceptable FoS for this loading condition is 1.50, per the USEPA CCR Rule [10] and the Illinois Part 845 Rule [11].
>
> End-of-Construction Conditions: This loading condition evaluates stability immediately following construction of the Impoundment and cover system, which are assumed to be constructed instantaneously. Undrained soil strengths are used in materials expected to behave in an undrained manner (clay-like materials) during construction loading, while drained soil strengths are used in materials expected to behave in a drained manner (freely-draining or sand-like materials) during construction loading. The minimum acceptable FoS for this loading condition is 1.30, per the USEPA CCR Rule [10] and the Illinois Part 845 Rule [11].
>
> Pseudostatic Seismic Conditions: This loading condition corresponds to the stability of the Impoundment under short-term seismic loading conditions. This loading condition assumed peak drained shear strengths in materials above the modeled groundwater table (Cover and Bottom Ash). Reduced undrained shear and drained strengths to eighty percent peak strength are applied to Residual Clay and Bottom Ash beneath the groundwater level as recommended in Hynes-Griffin and Franklin [7]. The seismic loads are modeled using the estimated seismic coefficient, as discussed in Section 5. The minimum acceptable FoS for this loading condition is 1.00, per the USEPA CCR Rule [10] and the Illinois Part 845 Rule [11].

Selected Cross-sections

The North, East, and South slopes of the Impoundment will be buttressed by the existing splitter dike at Baldwin. Cross-section (A-A’) was analyzed because it corresponds to the tallest and steepest slope on the West side of the Impoundment with the toe lying in the BAP. The designed slope height is 44 feet and slope is 4 horizontal to 1 vertical (4H:1V). Loess was minimal in this cross section and therefore the Loess was combined with the Residual Clay. The section location is provided in **Attachment B.**

Results

The results of each of the design scenarios is presented in **Table 2**. Each calculated factor of safety exceeds minimum acceptable values. Graphical outputs from the slope stability analyses are provided in **Attachment B** for each of the design scenarios.

7. VENEER STABILITY

Veneer stability was analyzed to evaluate the potential for a failure along the interface between soil cover, geotextile, geomembrane, and subgrade that are part of the proposed final cover system. Veneer stability was analyzed utilizing spreadsheet calculations based on guidance from Giroud et. al. and Matasovic [12] [13] which are provided in **Attachment C**.

Two separate slopes, displayed on the figure in **Attachment C**, were analyzed including:

- 2% Slope: This analysis represents the top cap of the proposed closure grades of the consolidated BAP. The maximum height of a 2% slope was used, which was 14 ft.
- 4H:1V Slope: This analysis represents the 4H:1V slopes that connect the 2% slope to the surrounding excavated grades. The maximum height of a 4H:1V slope was used, which was 60 ft.

The following loading cases were analyzed for all slopes, except as noted above:

- Static: This case represents normal static conditions and uses the peak shear strength parameters for interface and soil properties. It is assumed that only the geotextile is saturated in this case. The minimum factor of safety was assumed to be 1.50, in accordance with the USEPA CCR Rule [10] and the Illinois Part 845 Rule [11].
- Saturated: This case is the same as the static case; however, it is assumed that the entire two feet of soil cover is saturated following an intense storm event. The minimum factor of safety was assumed to be 1.30, in accordance with the USEPA CCR Rule [10] and the Illinois Part 845 Rule [11].
- Seismic: This case assumes large-strain interface shear strength parameters, peak soil shear strength parameters, that only the geotextile is saturated, and the pseudostatic horizontal seismic coefficient is applied. The minimum factor of safety was assumed to be 1.00, in accordance with the USEPA CCR Rule [10] and the Illinois Part 845 Rule [11].
- Post-EQ: This case is the same as Seismic, except no pseudostatic horizontal seismic coefficient is applied. The minimum factor of safety was assumed to be

1.10, in accordance with the USEPA CCR Rule [8] and the Illinois Part 845 Rule [9].

Results

Interface shear strength parameters (interface adhesion and friction angle) were iterated such that all analyzed cases achieved an adequate factor of safety. Peak parameters were found to be reasonable based on Geosyntec's experience and guidance found in Koerner, et.al [14]. High-strain (i.e. residual) parameters were conservatively assumed to be 60% of peak parameters, also based on guidance in Koerner, et.al [14]. Resulting interface shear strength parameters and calculated veneer stability factors of safety are summarized in **Tables 3 and 4**, respectively.

8. CONSOLIDATION

Geosyntec analyzed three one-dimensional incremental consolidation tests performed on native clay materials at the BPP; one was performed on Residual Clay and two on Loess. These tests were performed as part of a previous investigation by AECOM as presented in the Supplemental Technical Documents Report for the Fly Ash Pond System by Stantec [4]. A summary of the tests results and consolidation parameters are provided in **Table 5**.

Maximum Past Pressure and Over-Consolidation Ratio

Maximum past pressures, or pre-consolidation stress (σ_p') was estimated for each consolidation test using the strain-energy method [15]. Design max past pressure for Loess was assumed to be the minimum obtained from the two tests on Loess.

Over-Consolidation Ratios (*OCR*) for each sample were then calculated by dividing the σ_p' by the estimated in situ stress of the sample. Both Residual Clay and Loess were found to be heavily overconsolidated with OCR ranging from 3 to 31.

Compressibility Ratios

Compression and recompression ratios ($C_{c\varepsilon}$ and $C_{r\varepsilon}$, respectively) for each sample were estimated by reconstructing the consolidation curves using the Schmertmann procedure as outlined by Coduto [16], using maximum past pressures estimated from the strain-energy method [15]. Design compression and recompression ratios for Loess were selected as the maximum values obtained from the two tests on Loess.

Coefficient of Consolidation

Coefficient of Consolidation (C_v) values were provided by the laboratory in the incremental consolidation test data. These values were compiled and plotted versus their respective vertical stresses. This data and plot are provided in **Attachment D** and indicates that c_v does not vary with stress within the clay materials. A design coefficient of consolidation was selected as the two-third percentile of the data, which is typical based on Geosyntec's experience.

Analysis Methodology

Primary consolidation in the native clay layers (Loess and Residual Clay) was estimated as this is expected to be the most significant source of settlement under the weight of the Bottom Ash fill for the closure. Secondary consolidation was not analyzed as it is expected to be negligible compared to the primary consolidation. Settlement of the existing Bottom Ash and proposed Bottom Ash fill was not considered as this consolidation is expected to occur rapidly and not contribute to post-construction settlement.

A conservative soil profile and fill regime was used in analysis utilizing the following:

- Borings around the perimeter of the BAP were considered. The most conservative boring (i.e. thickest loess and/or residual clay) was utilized.
- Some borings indicated glacial till clay, which due to a lack of data, was conservatively categorized as Residual Clay.
- The top of existing bottom ash was conservatively assumed to be the lowest elevation of existing bottom ash along the centerline of the closed Impoundment.
- The top of proposed Fill was assumed to be the highest point of the closed Impoundment (El. 497 ft).

Settlement due to primary consolidation (S_p) was calculated as follows [17]:

$$S_p = \frac{H_0}{1+e_0}\left[C_r \log\left(\frac{\sigma'_p}{\sigma'_{v,0}}\right) + C_c \log\left(\frac{\sigma'_{v,f}}{\sigma'_p}\right)\right] \quad (1)$$

where

H_0	=	initial section height
e_0	=	initial void ratio;
C_c	=	compression index;
C_r	=	recompression index;
$\sigma'_{v,0}$	=	initial vertical effective stress;

$\sigma'_{v,f}$ = final vertical effective stress; and

σ'_p = preconsolidation stress.

Time required to reach an average degree of consolidation was estimated as follows [17]:

$$t = \frac{T_r \times H_d^{\ 2}}{C_v} \tag{2}$$

where

t = time to reach specified degree of consolidation;

T_r = unitless time factor; and

H_d = drainage distance.

The unitless time factor is dependent on the degree of consolidation. The unitless time factor for 80% degree of consolidation is 0.567. During consolidation, Water is not expected to flow into the bedrock during consolidation, so the foundation clays are considered to be singly-drained and the drainage distance is modeled as the total thickness of the Residual Clay and Loess layers.

Results

The total settlement of the foundation clays was estimated to be 14.3 inches; 0.6 inches of settlement is estimated for Residual Clay and 13.7 inches is estimated for Loess. The time required to achieve 80% of consolidation settlement was estimated as 27 months. Remaining settlement after 27 months was estimated to be approximately 2.9 inches. All calculations and results are provided in **Attachment D**.

9. CONCLUSIONS

This Package presents engineering calculations related to the geotechnical analysis in support of the closure design of the Impoundment at Baldwin Power Plant. Global stability was evaluated for the proposed Impoundment closure grades. Veneer stability was evaluated for three different slope grades that represent the expected slopes of the proposed final cover system. Maximum consolidation of foundation materials was estimated along with the estimated time for 80% of consolidation to occur.

All scenarios analyzed resulted in adequate factors of safety being achieved, indicating that the proposed Impoundment is not expected to have slope instabilities (global or veneer). All factors of safety were compared to minimum factors of safety provided by the USEPA CCR Rule [10]. All global stability outputs are provided in **Attachment B** and are summarized in **Table 2**. All veneer stability calculations are provided in **Attachment C** and are summarized in **Table 4**.

Settlement of the foundation clays under the maximum proposed fill is estimated to be approximately 14 inches, with approximately 11 inches of settlement occurring within 27 months of construction of the Impoundment. Settlement results indicate that much of the settlement will occur during construction, leaving an acceptable amount of settlement to occur post-construction.

10. REFERENCES

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[17] K. P. R. a. M. G. Terzaghi, "Soil Mechanics in Engineering Practice," John Wiley and Sons, Inc., New York, 1996.

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Tables

Table 1: Material Properties Summary

Material	Design Unit Weight, γ_T (pcf)	Drained		Static Undrained	
		Cohesion, c' (psf)	Friction Angle, φ' (deg)	Undrained Shear Strength over Effective Consolidation Stress Ratio, S_u/σ'_{vc} (psf/psf)	Minimum Cohesion, c (psf)
Cover[2]	120	200	32	0.50	440
Bottom Ash	97	0	30	-[1]	-[1]
Residual Clay	120	200	32	0.50	440
Bedrock[3]	Infinite Strength				

Notes:
[1]These materials are freely draining and therefore are only modeled with drained strength parameters.
[2]Lab data not available for this material. Parameters assumed to match Residual Clay
[3]Bedrock is assumed to have infinite strength because critical slip surfaces are not expected to intersect the bedrock.

Table 2: Global Slope Stability Results

Scenario	F.S. Requirement	F.S. Result	PASS/FAIL
Drained, Long-Term	1.5	**2.26**	PASS
Undrained, Short-Term	1.3	**2.34**	PASS
Pseudostatic Seismic	1.0	**1.19**	PASS

Table 3: Interface Friction Properties

Design Unit Weight, γ_T (pcf)	Peak Parameters		Large-Strain Parameters (60% of Peak)	
	Cohesion, c' (psf)	Drained Friction Angle, φ' (deg)	Cohesion, c' (psf)	Drained Friction Angle, φ' (deg)
120	90	19	54	11

Table 4: Veneer Stability Results

Loading Condition	Factor of Safety		
	Minimum	2% Slope 14 ft Slope Height	4H:1V Slope 60 ft Slope Height
Unsaturated - Static	1.50	> 5.00	3.11
Saturated - Static	1.30	> 5.00	2.37
Unsaturated - Seismic	1.00	2.12	1.00
Unsaturated - Post Earthquake	1.10	> 5.00	1.92

Table 5: Consolidation Parameters

Boring ID	Sample Depth (ft)	Soil Unit	Recompression Index (C_r)	Virgin Compression Index (C_c)	Recompression Ratio, C_{re}	Compression Ratio, C_{ce}
BAL-B006	30-32	Residual Clay	0.006	0.119	0.004	0.085
BAL-B007	30-32	Loess	0.005	0.194	0.003	0.117
BAL-B026	35-37	Loess	0.035	0.154	0.028	0.121

Boring ID	Sample Depth (ft)	Soil Unit	Initial Void Ratio (eo)	Coefficient of Consolidation, C_v (ft^2/min)	Maximum Past-Pressure (psf)	OCR
BAL-B006	30-32	Residual Clay	0.398	4.3×10^{-4} Evaluated from combined data.	48055	31.3
BAL-B007	30-32	Loess	0.661		10923	8.9
BAL-B026	35-37	Loess	0.273		6144	2.7

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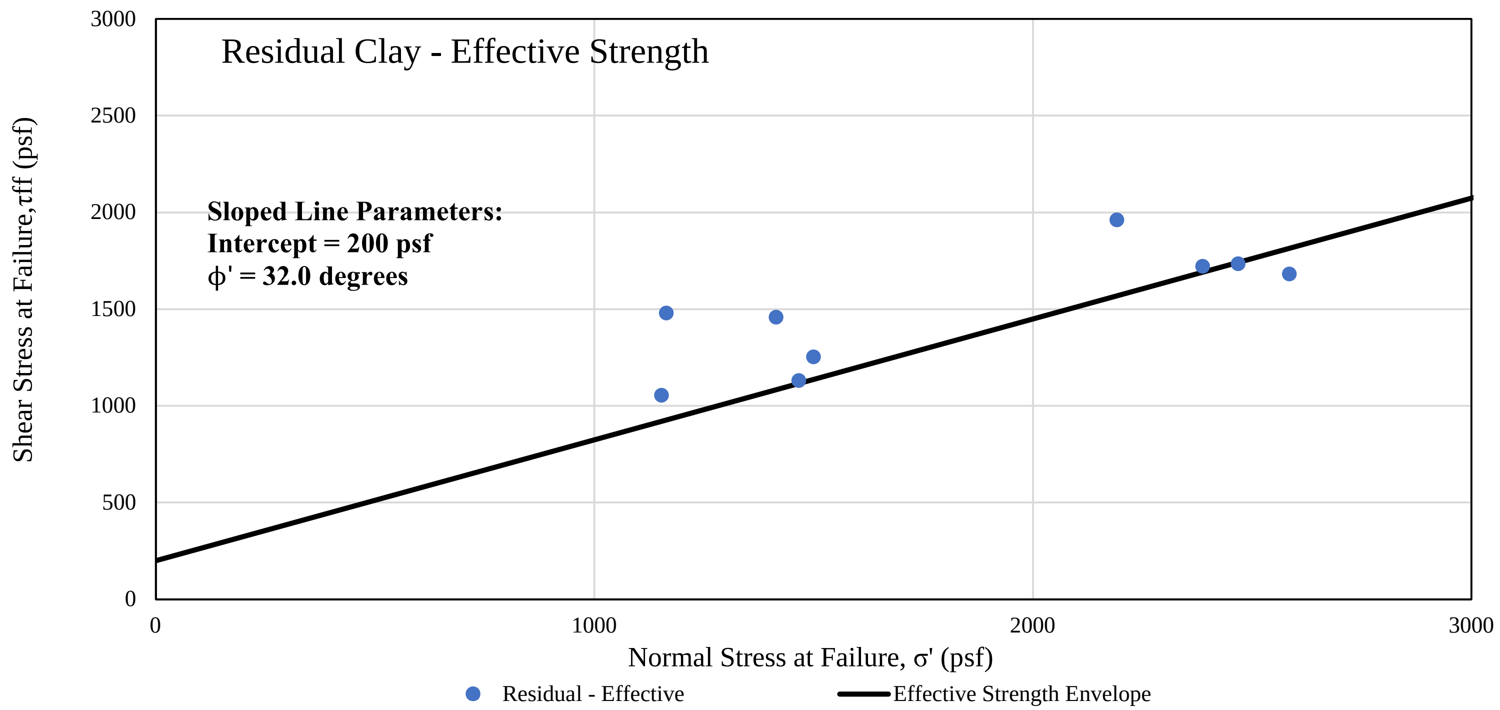
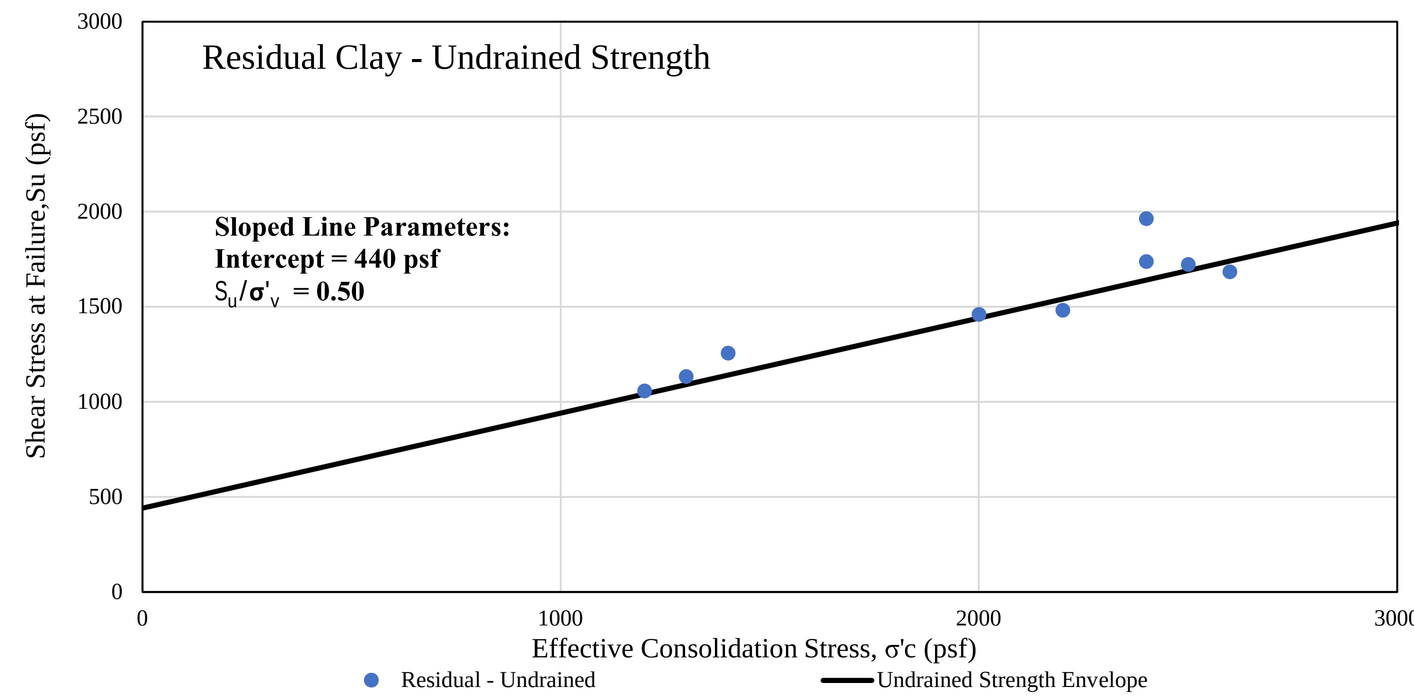
Attachment A

Material Analysis – Residual Clay

Investigation ID	Sample	Mid- Depth	Material	Sample Note	Consolidation Stress, σ'_c	Strain at Failure [2]	Obliquity	σ'_1 At Failure [2]	σ'_3 At Failure [2]	Deviator Stress	Effective Strength [3]			R-Strength [3]		Undrained Strength [1,3]	
											σ'	ϕ'	τ_{ff}	σ'_c	τ_{ff}	σ'_c	S_u
		ft			psi	%	psf/psf	psi	psi	tsf	psf	deg	psf	psf	psf	psf	psf
BAL-B006	ST-2A	30.3	Residual	Shelby	13.89	2.00	6.09	34.83	5.72	2.10	1415	46	1459	2000	1459	2000	1459
BAL-B006	ST-2C	31.0	Residual	Shelby	15.28	2.00	8.36	37.83	4.53	2.40	1164	52	1482	2200	1482	2200	1482
BAL-B006	ST-2D	31.5	Residual	Shelby	16.67	3.10	5.01	45.73	9.13	2.64	2191	42	1963	2400	1963	2400	1963
BAL-B022	ST-1A	10.6	Residual	Shelby	8.33	1.20	5.16	24.66	4.78	1.43	1153	42	1056	1200	1056	1200	1056
BAL-B022	ST-1B	11.2	Residual	Shelby	9.03	2.10	4.14	26.18	6.32	1.43	1467	38	1132	1300	1132	1300	1132
BAL-B022	ST-1C	11.7	Residual	Shelby	9.72	1.10	4.58	29.07	6.35	1.64	1500	40	1255	1400	1255	1400	1255
BAL-B024	ST-1A	20.7	Residual	Shelby	16.67	3.10	3.71	40.37	10.88	2.12	2468	35	1736	2400	1736	2400	1736
BAL-B024	ST-1B	21.3	Residual	Shelby	17.36	1.70	3.82	39.95	10.46	2.12	2387	36	1722	2500	1722	2500	1722
BAL-B024	ST-1C	21.9	Residual	Shelby	18.05	2.80	3.40	39.49	11.62	2.01	2585	33	1682	2600	1682	2600	1682

Notes: [1] Consolidated-Undrained Triaxial Compression Test.
[2] Point of failure is defined as peak obliquity (principal stress ratio) or at the 10% strain, whichever strain is less
[3] Shear strengths are reported based on the σ'-τff plots. Recommended by USACE, the envelope is drawn with approximately two-thirds of the points of tangency above the line and one-third below.

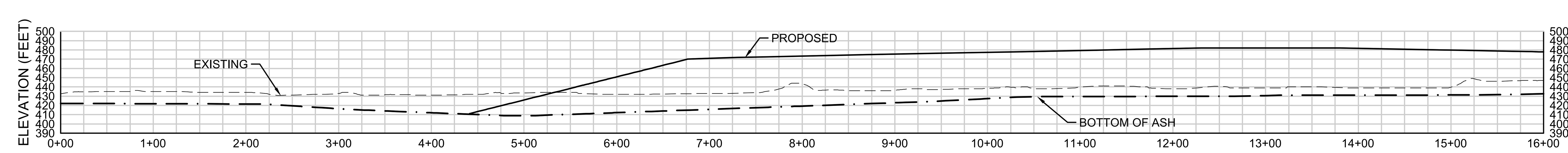




DYNEGY	
BALDWIN POWER PLANT BOTTOM ASH POND	
Triaxial Shear Testing Data Reduction - Undisturbed	Geosyntec consultants
GLP8050	
Created By: Isaiah Vaught	
Checked By: Zachary Fallert	
Date: 12/05/2022	

Geosyntec consultants

Attachment B
Global Slope Stability Location and Results

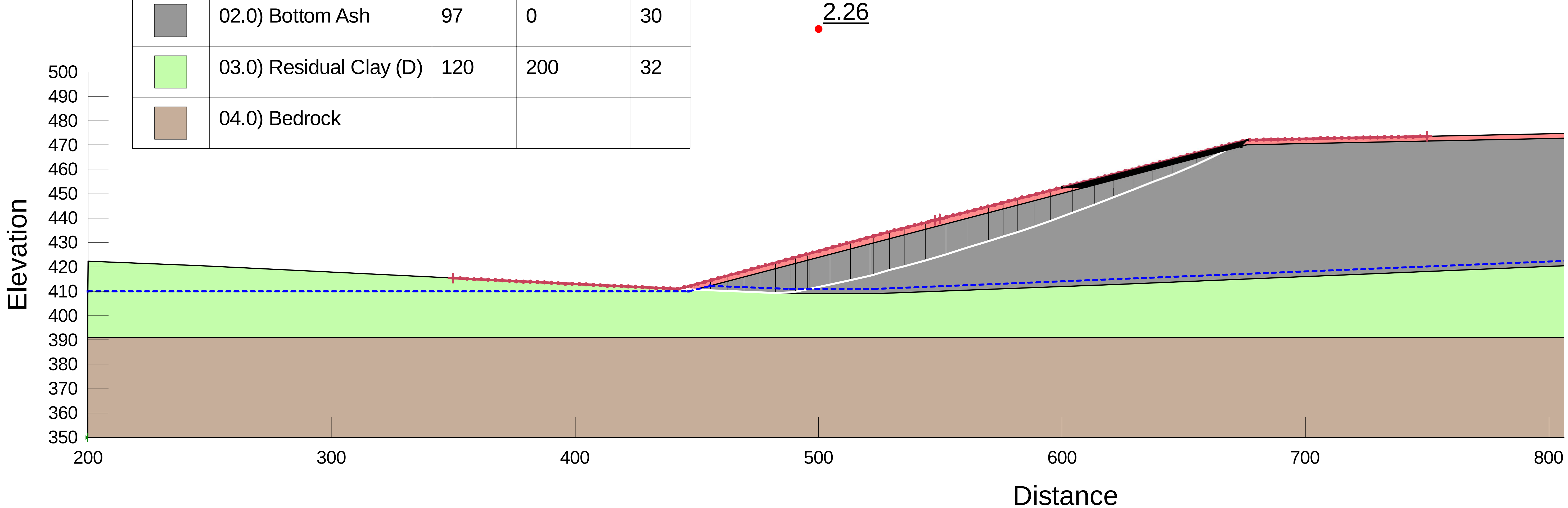


A PROFILE
HORIZONTAL: 1" =100'
VERTICAL: 1" =100'

Geosyntec consultants	Title: Section A-A' - Plan and Profile View	Date: December 2022
	Project: Baldwin Power Plant Bottom Ash Pond Closure	Author: IJV

FIGURE B-1

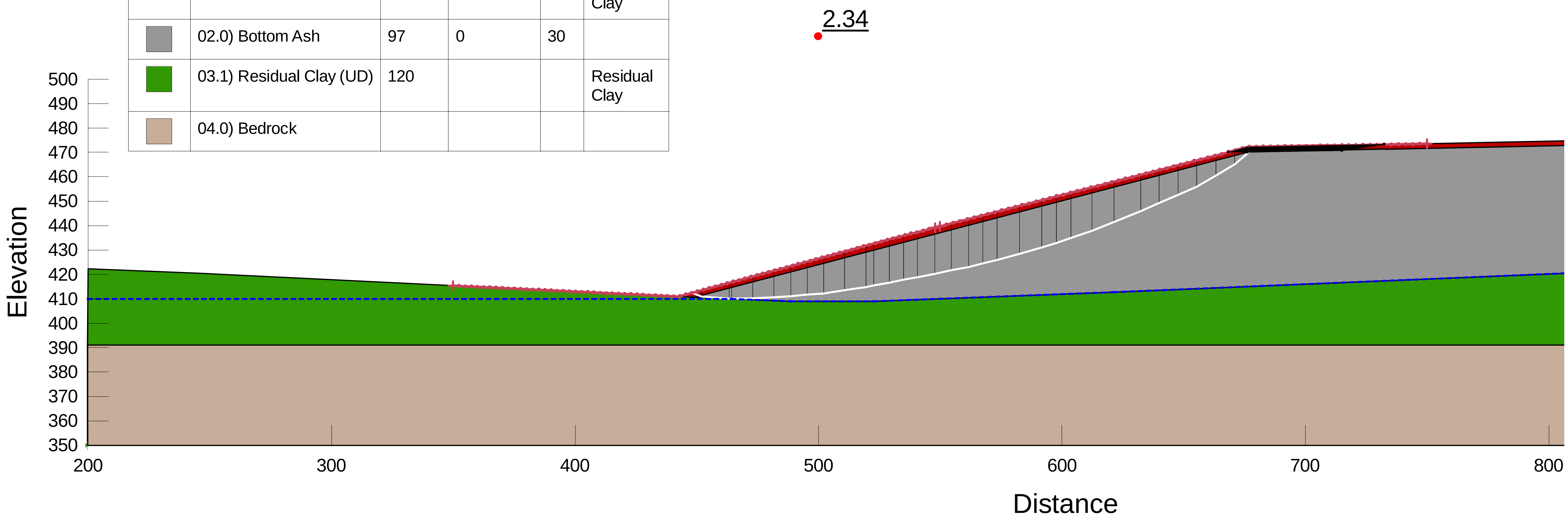
Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	01.0) Cover (D)	120	200	32
	02.0) Bottom Ash	97	0	30
	03.0) Residual Clay (D)	120	200	32
	04.0) Bedrock			



Geosyntec consultants

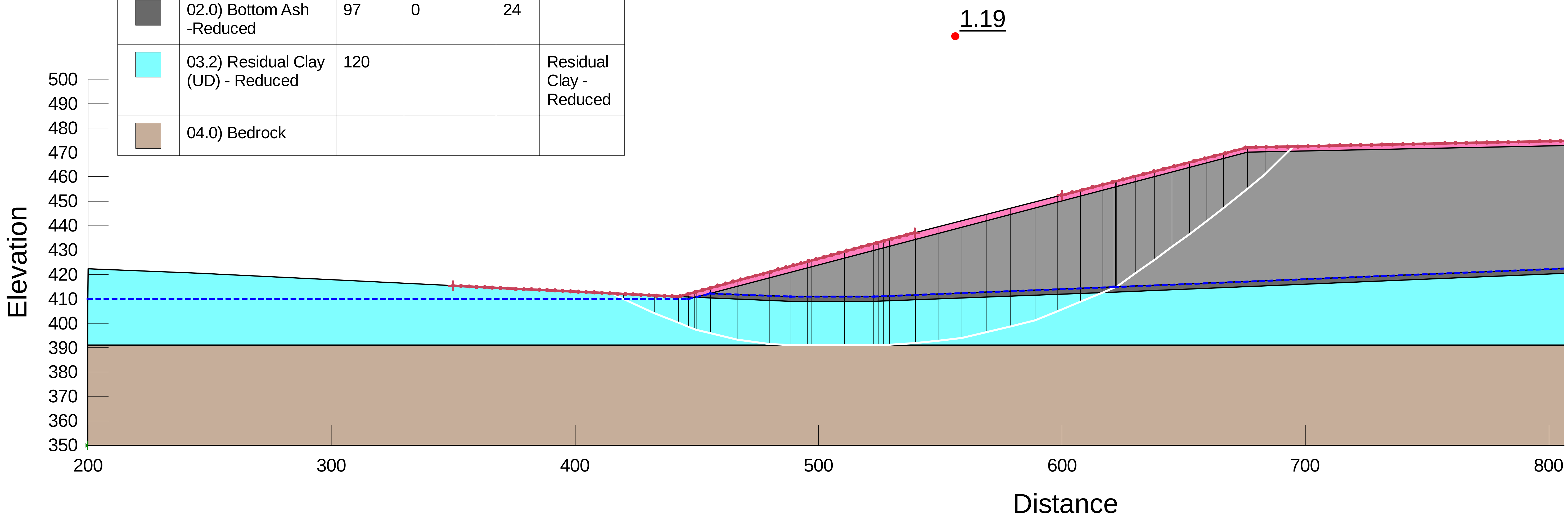
Title: Section A-A' - Long-Term Condition	*Date*: January 2023	**FIGURE B-2**
Project: Baldwin Power Plant Bottom Ash Pond Closure	*Author*: IJV	

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Strength Function
	01.1) Cover (UD)	120			Residual Clay
	02.0) Bottom Ash	97	0	30	
	03.1) Residual Clay (UD)	120			Residual Clay
	04.0) Bedrock				



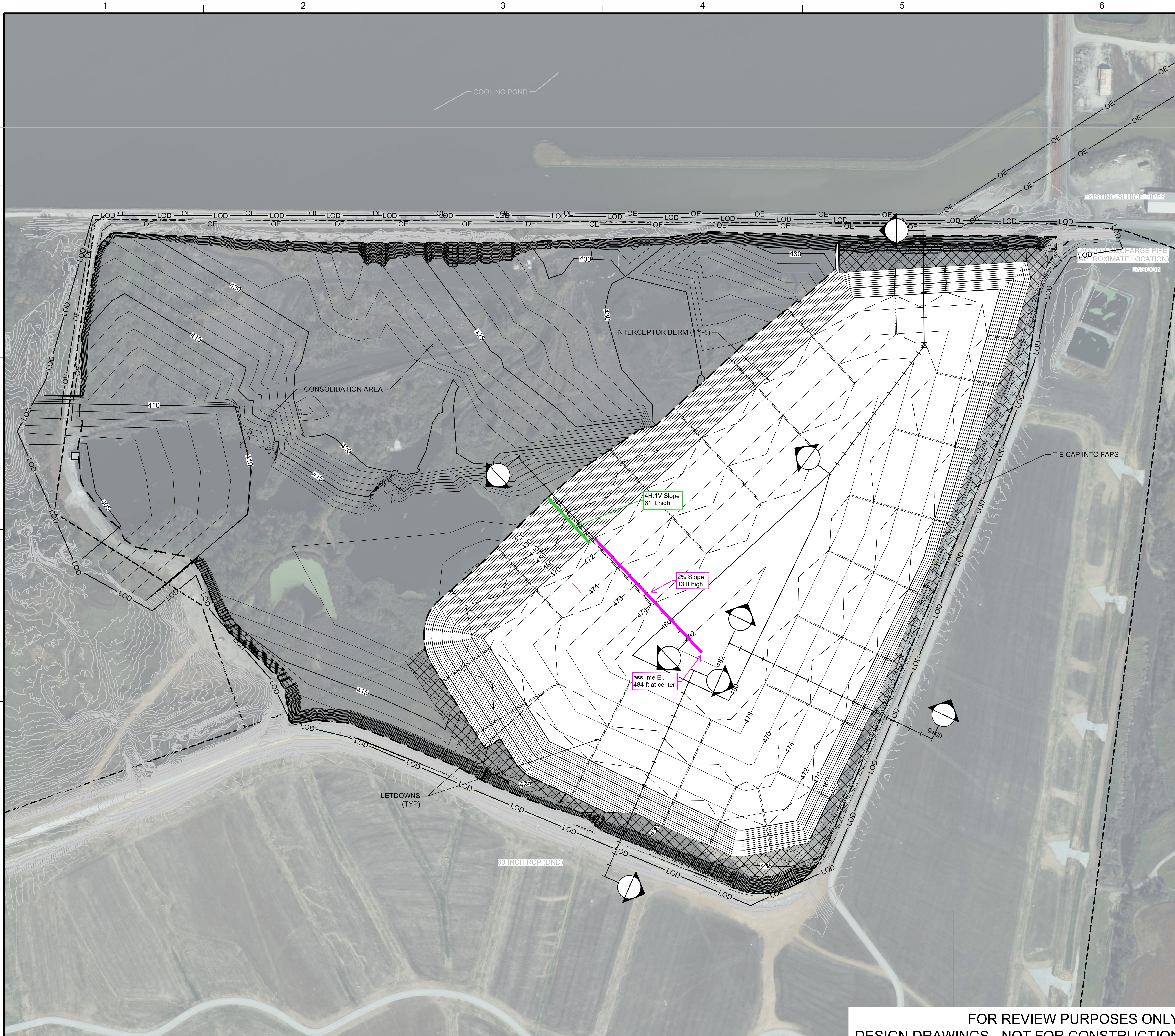
Geosyntec consultants	*Title*: Section A-A' - Short-Term, End of Construction Condition	*Date*: January 2023	**FIGURE B-3**
	Project: Baldwin Power Plant Bottom Ash Pond Closure	*Author*: IJV	

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Strength Function
	01.2) Cover (UD) - Reduced	120			Residual Clay - Reduced
	02.0) Bottom Ash	97	0	30	
	02.0) Bottom Ash -Reduced	97	0	24	
	03.2) Residual Clay (UD) - Reduced	120			Residual Clay - Reduced
	04.0) Bedrock				



Geosyntec consultants	*Title*: Section A-A' - Pseudostatic Seismic Condition	*Date*: January 2023		**FIGURE B-4**
	Project: Baldwin Power Plant Bottom Ash Pond Closure	*Author*: IJV		

Attachment C
Veneer Stability Results



LEGEND

420	EXISTING GROUND MAJOR CONTOUR (5')
	EXISTING GROUND MINOR CONTOUR (1')
	IMPOUNDMENT BOUNDARY
470	PROPOSED GRADING MAJOR CONTOURS (5')
472	PROPOSED GRADING MINOR CONTOURS (1')
LOD	LIMITS OF DISTURBANCE (LOD)
	INTERCEPTOR BERM
	FINAL HAUL ROAD
	EDGE OF EXISTING GRADE
	LETDOWNS
	PERIMETER DITCH
	CAP TIE-IN TO FAPS

PRELIMINARY BOTTOM ASH POND CONSOLIDATED CLOSURE DESIGN

EDITED AND ANNOTATED FOR VENEER STABILITY ANALYSIS

0 200 400
SCALE IN FEET

FOR REVIEW PURPOSES ONLY
DESIGN DRAWINGS - NOT FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRN	APP

Geosyntec consultants
1 MCBRIDE AND SON CENTER DRIVE, SUITE 202
CHESTERFIELD, MO 63005 USA
TELEPHONE: 636-812-0800

DYNEGY MIDWEST GENERATION, LLC
1500 EASTPORT PLAZA DRIVE
COLLINSVILLE, IL 62234 USA

TITLE: PHASE 2 FINAL GRADING PLAN

PROJECT: BOTTOM ASH POND CONSTRUCTION PERMIT APPLICATION CLOSURE DRAWINGS

SITE: BALDWIN POWER PLANT BALDWIN, ILLINOIS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

DATE

DRAFT

DESIGN BY:		DATE:	DECEMBER 2022
DRAWN BY:		PROJECT NO.:	GLP8050
CHECKED BY:		FILE:	05 - GLP8050 C-120
REVIEWED BY:		DRAWING NO.:	
APPROVED BY:			

Inputs in purple.

Analysis of all interfaces (subgrade-to-geomembrane, geomembrane-to-geotextile, geotextile-to-cover soil)
(Conversion of degrees to radians are performed for Excel spread sheet calculations)

Parameter	Value	Unit		
2.0% (50H:1V slope) β =	1.15	degrees =	*0.02*	*radians*
Interface Friction, δ =	**19.0**	**degrees =**	*0.33*	*radians*
Interface Adhesion, a =	**90**	**psf**		
Thickness of soil above geomembrane, t =	**2.00**	**ft**		
Thickness of Saturation (water) t_w =	0.021	ft		
t_w* =	0.021	ft		
Height of slope, h =	13.0	ft		
Total Unit Weight of Soil Above Geomembrane, γ_t =	**120.0**	**pcf**		
Effective Unit Weight, γ_b =	57.60	pcf		
Saturated Unit Weight of Soil Above Geomembrane, γ_{sat} =	120.00	pcf		
Friction Angle of Soil Above Geomembrane, ϕ =	**32.0**	**degrees =**	*0.56*	*radians*
Cohesion of Soil Above Geomembrane, c =	**200**	**psf**		
Seismic Coeffecient, k_s =	0.000	g		

A	*B*	*C*	
$[\gamma_t \times (t-t_w) + \gamma_b \times t_w]$	$[\gamma_t \times (t-t_w) + \gamma_{sat} \times t_w]$	$\tan\delta/\tan\beta$	**[A/B] x C**
238.690	240.000	17.216	17.122

D	
$[a/\sin\beta]$	**D/B**
4500.900	**18.75374963**

E	*F*	*G*	
$\gamma_t \times (t-t_w^*) + \gamma_b \times t_w^*]/B$	$[\tan\phi/(2\sin\beta\cos^2\beta)]/(1-\tan\beta\tan\phi)$	t/h	**E x F x G**
0.995	15.829	0.154	2.422

H	*I*	*J*	
1/B	$[1/(\sin\beta\cos\beta)]/[1-\tan\beta\tan\phi]$	**ct/h**	**H x I x J**
0.004	50.653	30.769	6.494

A'	*B'*	*C'*	*D'*	[A'+B'-C']/D'
$a/[\gamma_t \times t \times \cos^2(\beta)]$	$\tan\phi \times [1-(\gamma_w \times t_w)/(\gamma_t \times t)]$	$n_q \times \tan\beta \times \tan\phi$	$n_q + \tan\beta$	35.880
0.375	0.342	0.000	0.020	

FS (Static)
44.79

Baldwin Bottom Ash Pond Closure Design
Baldwin Power Plant - Baldwin, IL

Geosyntec consultants

Veneer Slope Stability Calculations	
2% Slope - Unsaturated Static	
GLP8050	
Created By: Zachary Fallert	
Checked By: Isaiah Vaught	
Date: 12/12/2022	

Inputs in purple.

Analysis of all interfaces (subgrade-to-geomembrane, geomembrane-to-geotextile, geotextile-to-cover soil)
(Conversion of degrees to radians are performed for Excel spread sheet calculations)

Parameter	Value	Units		
2.0% (50H:1V slope) β =	1.15	degrees =	*0.02*	*radians*
Interface Friction, δ =	**19.0**	**degrees =**	*0.33*	*radians*
Interface Adhesion, a =	**90**	**psf**		
Thickness of soil above geomembrane, t =	**2.00**	**ft**		
Thickness of Saturation (water) t_w =	2.000	ft		
t_w* =	2.000	ft		
Height of slope, h =	13.0	ft		
Total Unit Weight of Soil Above Geomembrane, γ_t =	**120.0**	**pcf**		
Effective Unit Weight, γ_b =	57.60	pcf		
Saturated Unit Weight of Soil Above Geomembrane, γ_{sat} =	120.00	pcf		
Friction Angle of Soil Above Geomembrane, ϕ =	**32.0**	**degrees =**	*0.56*	*radians*
Cohesion of Soil Above Geomembrane, c =	**200**	**psf**		
Seismic Coeffecient, k_s =	0.000	g		

A	*B*	*C*	
[γ_t x (t-t_w) + γ_b x t_w]	**[γ_t x (t-t_w) + γ_{sat} x t_w]**	**tanδ/tanβ**	**[A/B] x C**
115.200	240.000	17.216	8.264

D	
[a/sinβ]	**D/B**
4500.900	**18.75374963**

E	*F*	*G*	
γ_t x (t-t_w*) + γ_b x t_w*]/B	**[tanϕ/(2sinβcos²β)]/(1-tanβtanϕ)**	**t/h**	**E x F x G**
0.480	15.829	0.154	1.169

H	*I*	*J*	
1/B	**[1/(sinβcosβ)]/[1-tanβtanϕ]**	**ct/h**	**H x I x J**
0.004	50.653	30.769	6.494

A'	*B'*	*C'*	*D'*	**[A'+B'-C']/D'**
a/[γ_t x t x cos²(β)]	**tanϕ x [1-(γ_w x t_w)/(γ_t x t)]**	**n_q x tanβ x tanϕ**	**n_q + tanβ**	27.021
0.375	0.165	0.000	0.020	

FS (Static)
34.68

Baldwin Bottom Ash Pond Closure Design
Baldwin Power Plant - Baldwin, IL

Geosyntec consultants

Veneer Slope Stability Calculations
2% Slope - Saturated Static
GLP8050
Created By: Zachary Fallert
Checked By: Isaiah Vaught
Date: 12/12/2022

Inputs in purple.

Analysis of all interfaces (subgrade-to-geomembrane, geomembrane-to-geotextile, geotextile-to-cover soil)

(Conversion of degrees to radians are performed for Excel spread sheet calculations)

Assumed 40% reduction in interface shear strength

2.0% (50H:1V slope) β =	1.15	degrees =	*0.02 radians*
Interface Friction, δ =	**11.4**	**degrees =**	*0.20 radians*
Interface Adhesion, a =	**54.0**	**psf**	
Thickness of soil above geomembrane, t =	**2.00**	**ft**	
Thickness of Saturation (water) t_w =	0.021	ft	
t_w* =	0.021	ft	
Height of slope, h =	13.0	ft	
Total Unit Weight of Soil Above Geomembrane, γ_t =	**120.0**	**pcf**	
Effective Unit Weight, γ_b =	57.60	pcf	
Saturated Unit Weight of Soil Above Geomembrane, γ_{sat} =	120.00	pcf	
Friction Angle of Soil Above Geomembrane, ϕ =	**32.0**	**degrees =**	*0.56 radians*
Cohesion of Soil Above Geomembrane, c =	**200**	**psf**	
Seismic Coeffecient, k_s =	0.180	g	

A	*B*	*C*	
$[\gamma_t \times (t-t_w) + \gamma_b \times t_w]$	$[\gamma_t \times (t-t_w) + \gamma_{sat} \times t_w]$	$\tan\delta/\tan\beta$	**[A/B] x C**
238.690	240.000	10.082	10.027

D	
$[a/\sin\beta]$	**D/B**
2700.540	**11.25224978**

E	*F*	*G*	
$\gamma_t \times (t-t_w^*) + \gamma_b \times t_w^*]/B$	$[\tan\phi/(2\sin\beta\cos^2\beta)]/(1-\tan\beta\tan\phi)$	t/h	**E x F x G**
0.995	15.829	0.154	2.422

H	*I*	*J*	
1/B	$[1/(\sin\beta\cos\beta)]/[1-\tan\beta\tan\phi]$	ct/h	**H x I x J**
0.004	50.653	30.769	6.494

Baldwin Bottom Ash Pond Closure Design

Baldwin Power Plant - Baldwin, IL

Geosyntec consultants

Veneer Slope Stability Calculations

2% Slope - Unsaturated Seismic

GLP8050

Created By: Zachary Fallert

Checked By: Isaiah Vaught

Date: 12/12/2022

A'	*B'*	*C'*	*D'*	**[A'+B'-C']/D'**
$a/[\gamma_t \times t \times \cos^2(\beta)]$	$\tan\phi \times [1-(\gamma_w \times t_w)/(\gamma_t \times t)]$	$n_q \times \tan\beta \times \tan\phi$	$n_q + \tan\beta$	2.124
0.225	0.201	0.001	0.200	

FS (Seismic)
2.12

Inputs in purple.

Analysis of all interfaces (subgrade-to-geomembrane, geomembrane-to-geotextile, geotextile-to-cover soil)

(Conversion of degrees to radians are performed for Excel spread sheet calculations)

Assumed 40% reduction in interface shear strength

Parameter	Value	Unit	Radians
2.0% (50H:1V slope) β =	1.15	degrees =	*0.02 radians*
Interface Friction, δ =	**11.4**	**degrees =**	*0.20 radians*
Interface Adhesion, a =	**54.0**	**psf**	
Thickness of soil above geomembrane, t =	**2.00**	**ft**	
Thickness of Saturation (water) t_w =	0.021	ft	
t_w* =	0.021	ft	
Height of slope, h =	13.0	ft	
Total Unit Weight of Soil Above Geomembrane, γ_t =	**120.0**	**pcf**	
Effective Unit Weight, γ_b =	57.60	pcf	
Saturated Unit Weight of Soil Above Geomembrane, γ_{sat} =	120.00	pcf	
Friction Angle of Soil Above Geomembrane, ϕ =	**32.0**	**degrees =**	*0.56 radians*
Cohesion of Soil Above Geomembrane, c =	**200**	**psf**	
Seismic Coeffecient, k_s =	0.000	g	

A	*B*	*C*	
$[\gamma_t \times (t-t_w) + \gamma_b \times t_w]$	$[\gamma_t \times (t-t_w) + \gamma_{sat} \times t_w]$	$\tan\delta/\tan\beta$	**[A/B] x C**
238.690	240.000	10.082	10.027

D	
$[a/\sin\beta]$	**D/B**
2700.540	**11.25224978**

E	*F*	*G*	
$\gamma_t \times (t-t_w^*) + \gamma_b \times t_w^*]/B$	$[\tan\phi/(2\sin\beta\cos^2\beta)]/(1-\tan\beta\tan\phi)$	t/h	**E x F x G**
0.995	15.829	0.154	2.422

H	*I*	*J*	
1/B	$[1/(\sin\beta\cos\beta)]/[1-\tan\beta\tan\phi]$	ct/h	**H x I x J**
0.004	50.653	30.769	6.494

A'	*B'*	*C'*	*D'*	**[A'+B'-C']/D'**
$a/[\gamma_t \times t \times \cos^2(\beta)]$	$\tan\phi \times [1-(\gamma_w \times t_w)/(\gamma_t \times t)]$	$n_q \times \tan\beta \times \tan\phi$	$n_q + \tan\beta$	21.281
0.225	0.201	0.000	0.020	

FS (Post-EQ)
30.19

Baldwin Bottom Ash Pond Closure Design

Baldwin Power Plant - Baldwin, IL

Geosyntec consultants

Veneer Slope Stability Calculations

2% Slope - Unsaturated Post Earthquake

GLP8050

Created By: Zachary Fallert

Checked By: Isaiah Vaught

Date: 12/12/2022

Inputs in purple.

Analysis of all interfaces (subgrade-to-geomembrane, geomembrane-to-geocomposite, geocomposite-to-cover soil)
(Conversion of degrees to radians are performed for Excel spread sheet calculations)

Parameter	Value	Unit		
4H:1V slope β =	14.04	degrees =	*0.24*	*radians*
Interface Friction, δ =	**19.0**	**degrees =**	*0.33*	*radians*
Interface Adhesion, a =	**90**	**psf**		
Thickness of soil above geomembrane, t =	**2.00**	**ft**		
Thickness of Saturation (water) t_w =	0.021	ft		
t_w* =	0.021	ft		
Height of slope, h =	61.0	ft		
Total Unit Weight of Soil Above Geomembrane, γ_t =	**120.0**	**pcf**		
Effective Unit Weight, γ_b =	57.60	pcf		
Saturated Unit Weight of Soil Above Geomembrane, γ_{sat} =	120.00	pcf		
Friction Angle of Soil Above Geomembrane, ϕ =	**32.0**	**degrees =**	*0.56*	*radians*
Cohesion of Soil Above Geomembrane, c =	**200**	**psf**		
Seismic Coeffecient, k_s =	0.000	g		

A	B	C	
$[\gamma_t \times (t-t_w) + \gamma_b \times t_w]$	$[\gamma_t \times (t-t_w) + \gamma_{sat} \times t_w]$	$\tan\delta/\tan\beta$	[A/B] x C
238.690	240.000	1.377	1.370

D	
$[a/\sin\beta]$	D/B
371.080	**1.54616461**

E	F	G	
$\gamma_t \times (t-t_w^*) + \gamma_b \times t_w^*]/B$	$[\tan\phi/(2\sin\beta\cos^2\beta)]/(1-\tan\beta\tan\phi)$	t/h	E x F x G
0.995	1.622	0.033	0.053

H	I	J	
1/B	$[1/(\sin\beta\cos\beta)]/[1-\tan\beta\tan\phi]$	ct/h	H x I x J
0.004	5.037	6.557	0.138

A'	B'	C'	D'	[A'+B'-C']/D'
$a/[\gamma_t \times t \times \cos^2(\beta)]$	$\tan\phi \times [1-(\gamma_w \times t_w)/(\gamma_t \times t)]$	$n_q \times \tan\beta \times \tan\phi$	$n_q + \tan\beta$	2.964
0.398	0.342	0.000	0.250	

FS (Static)
3.11

Baldwin Bottom Ash Pond Closure Design
Baldwin Power Plant - Baldwin, IL
Geosyntec consultants
Veneer Slope Stability Calculations
4H:1V Slope - Unsaturated Static
GLP8050
Created By: Zachary Fallert
Checked By: Isaiah Vaught
Date: 12/12/2022

Inputs in purple.

Analysis of all interfaces (subgrade-to-geomembrane, geomembrane-to-geocomposite, geocomposite-to-cover soil)
(Conversion of degrees to radians are performed for Excel spread sheet calculations)

Parameter	Value	Unit		
4H:1V slope β =	14.04	degrees =	*0.24*	*radians*
Interface Friction, δ =	**19.0**	**degrees =**	*0.33*	*radians*
Interface Adhesion, a =	**90**	**psf**		
Thickness of soil above geomembrane, t =	**2.00**	**ft**		
Thickness of Saturation (water) t_w =	2.000	ft		
t_w* =	2.000	ft		
Height of slope, h =	61.0	ft		
Total Unit Weight of Soil Above Geomembrane, γ_t =	**120.0**	**pcf**		
Effective Unit Weight, γ_b =	57.60	pcf		
Saturated Unit Weight of Soil Above Geomembrane, γ_{sat} =	120.00	pcf		
Friction Angle of Soil Above Geomembrane, ϕ =	**32.0**	**degrees =**	*0.56*	*radians*
Cohesion of Soil Above Geomembrane, c =	**200**	**psf**		
Seismic Coeffecient, k_s =	0.000	g		

A	*B*	*C*	
$[\gamma_t \times (t-t_w) + \gamma_b \times t_w]$	$[\gamma_t \times (t-t_w) + \gamma_{sat} \times t_w]$	$\tan\delta/\tan\beta$	**[A/B] x C**
115.200	240.000	1.377	0.661

D	
$[a/\sin\beta]$	**D/B**
371.080	**1.54616461**

E	*F*	*G*	
$\gamma_t \times (t-t_w^*) + \gamma_b \times t_w^*]/B$	$[\tan\phi/(2\sin\beta\cos^2\beta)]/(1-\tan\beta\tan\phi)$	t/h	**E x F x G**
0.480	1.622	0.033	0.026

H	*I*	*J*	
1/B	$[1/(\sin\beta\cos\beta)]/[1-\tan\beta\tan\phi]$	ct/h	**H x I x J**
0.004	5.037	6.557	0.138

A'	*B'*	*C'*	*D'*	**[A'+B'-C']/D'**
$a/[\gamma_t \times t \times \cos^2(\beta)]$	$\tan\phi \times [1-(\gamma_w \times t_w)/(\gamma_t \times t)]$	$n_q \times \tan\beta \times \tan\phi$	$n_q + \tan\beta$	2.255
0.398	0.165	0.000	0.250	

FS (Static)
2.37

Baldwin Bottom Ash Pond Closure Design
Baldwin Power Plant - Baldwin, IL

Geosyntec consultants

Veneer Slope Stability Calculations
4H:1V Slope - Saturated Static
GLP8050
Created By: Zachary Fallert
Checked By: Isaiah Vaught
Date: 12/12/2022

Inputs in purple.

Analysis of all interfaces (subgrade-to-geomembrane, geomembrane-to-geocomposite, geocomposite-to-cover soil)

(Conversion of degrees to radians are performed for Excel spread sheet calculations)

Assumed 40% reduction in interface shear strength

Parameter	Value	Unit	Radians	
4H:1V slope β =	14.04	degrees =	*0.24*	*radians*
Interface Friction, δ =	**11.4**	**degrees =**	*0.20*	*radians*
Interface Adhesion, a =	**54.0**	**psf**		
Thickness of soil above geomembrane, t =	**2.00**	**ft**		
Thickness of Saturation (water) t_w =	0.021	ft		
t_w* =	0.021	ft		
Height of slope, h =	61.0	ft		
Total Unit Weight of Soil Above Geomembrane, γ_t =	**120.0**	**pcf**		
Effective Unit Weight, γ_b =	57.60	pcf		
Saturated Unit Weight of Soil Above Geomembrane, γ_{sat} =	120.00	pcf		
Friction Angle of Soil Above Geomembrane, ϕ =	**32.0**	**degrees =**	*0.56*	*radians*
Cohesion of Soil Above Geomembrane, c =	**200**	**psf**		
Seismic Coeffecient, k_s =	0.180	g		

A	B	C	
$[\gamma_t \times (t-t_w) + \gamma_b \times t_w]$	$[\gamma_t \times (t-t_w) + \gamma_{sat} \times t_w]$	$\tan\delta/\tan\beta$	[A/B] x C
238.690	240.000	0.807	0.802

D	
$[a/\sin\beta]$	D/B
222.648	**0.927698766**

E	F	G	
$\gamma_t \times (t-t_w^*) + \gamma_b \times t_w^*]/B$	$[\tan\phi/(2\sin\beta\cos^2\beta)]/(1-\tan\beta\tan\phi)$	t/h	E x F x G
0.995	1.622	0.033	0.053

H	I	J	
1/B	$[1/(\sin\beta\cos\beta)]/[1-\tan\beta\tan\phi]$	ct/h	H x I x J
0.004	5.037	6.557	0.138

A'	B'	C'	D'	[A'+B'-C']/D'
$a/[\gamma_t \times t \times \cos^2(\beta)]$	$\tan\phi \times [1-(\gamma_w \times t_w)/(\gamma_t \times t)]$	$n_q \times \tan\beta \times \tan\phi$	$n_q + \tan\beta$	1.001
0.239	0.201	0.009	0.430	

FS (Seismic)
1.00

Baldwin Bottom Ash Pond Closure Design
Baldwin Power Plant - Baldwin, IL

Geosyntec consultants

Veneer Slope Stability Calculations
4H:1V Slope - Unsaturated Seismic
GLP8050
Created By: Zachary Fallert
Checked By: Isaiah Vaught
Date: 12/12/2022

Inputs in purple.

Analysis of all interfaces (subgrade-to-geomembrane, geomembrane-to-geocomposite, geocomposite-to-cover soil)

(Conversion of degrees to radians are performed for Excel spread sheet calculations)

Assumed 40% reduction in interface shear strength

Parameter	Value	Unit	Radians
4H:1V slope β =	14.04	degrees =	*0.24 radians*
Interface Friction, δ =	**11.4**	**degrees =**	*0.20 radians*
Interface Adhesion, a =	**54.0**	**psf**	
Thickness of soil above geomembrane, t =	**2.00**	**ft**	
Thickness of Saturation (water) t_w =	0.021	ft	
t_w* =	0.021	ft	
Height of slope, h =	61.0	ft	
Total Unit Weight of Soil Above Geomembrane, γ_t =	**120.0**	**pcf**	
Effective Unit Weight, γ_b =	57.60	pcf	
Saturated Unit Weight of Soil Above Geomembrane, γ_{sat} =	120.00	pcf	
Friction Angle of Soil Above Geomembrane, ϕ =	**32.0**	**degrees =**	*0.56 radians*
Cohesion of Soil Above Geomembrane, c =	**200**	**psf**	
Seismic Coeffecient, k_s =	0.000	g	

A	*B*	*C*	
$[\gamma_t \times (t-t_w) + \gamma_b \times t_w]$	$[\gamma_t \times (t-t_w) + \gamma_{sat} \times t_w]$	$\tan\delta/\tan\beta$	[A/B] x C
238.690	240.000	0.807	0.802

D	
$[a/\sin\beta]$	D/B
222.648	**0.927698766**

E	*F*	*G*	
$\gamma_t \times (t-t_w^*) + \gamma_b \times t_w^*]/B$	$[\tan\phi/(2\sin\beta\cos^2\beta)]/(1-\tan\beta\tan\phi)$	t/h	E x F x G
0.995	1.622	0.033	0.053

H	*I*	*J*	
1/B	$[1/(\sin\beta\cos\beta)]/[1-\tan\beta\tan\phi]$	ct/h	H x I x J
0.004	5.037	6.557	0.138

A'	*B'*	*C'*	*D'*	[A'+B'-C']/D'
$a/[\gamma_t \times t \times \cos^2(\beta)]$	$\tan\phi \times [1-(\gamma_w \times t_w)/(\gamma_t \times t)]$	$n_q \times \tan\beta \times \tan\phi$	$n_q + \tan\beta$	1.758
0.239	0.201	0.000	0.250	

FS (Post-EQ)
1.92

Baldwin Bottom Ash Pond Closure Design
Baldwin Power Plant - Baldwin, IL
Geosyntec consultants
Veneer Slope Stability Calculations
4H:1V Slope - Unsaturated Post Earthquake
GLP8050
Created By: Zachary Fallert
Checked By: Isaiah Vaught
Date: 12/12/2022

Geosyntec consultants

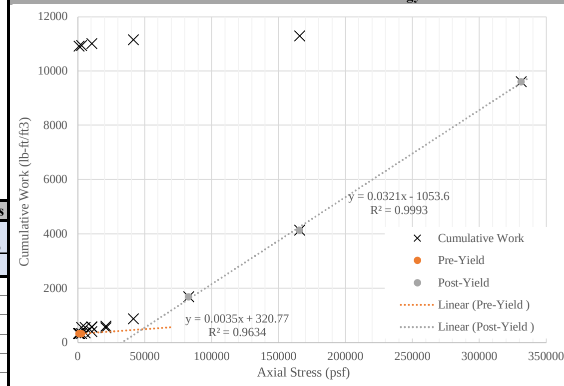
Attachment D
Consolidation Parameters and Results

Boring ID	BAL-B006
Shelby ID	ST-2B
Shelby Depth (ft)	30-32
Soil Unit	Residual Clay

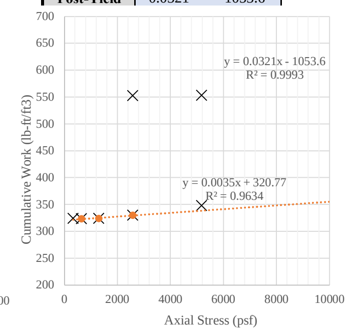
Sample In Situ Effective Stress (psf)	1535

Data Input				Strain-Energy Calculations and Plotting Points					Void Ratio Plotting Points	
Axial Stress	**Axial Stress**	**Axial Strain**	**Void Ratio**	**Delta Work**	**Cumulative Work**	**Pre-Yield**	**Post-Yield**	**Slope**	**Pre-Yield Void Ratio**	**Post-Yield Void Ratio**
psf	**tsf**	**%**	**e**	**lb-ft/ft^3**	**lb-ft/ft^3**	**lb-ft/ft^3**	**lb-ft/ft^3**		**e**	**e**
324	0.162	0.04	0.398	324.00	324.00					
646	0.323	-0.06	0.399	-0.49	323.51	323.51		0.00	0.3990	
1294	0.65	0.04	0.398	0.99	324.50	324.50		0.00	0.3980	
2580	1.3	0.32	0.394	5.46	329.96	329.96		0.00	0.3940	
5180	2.6	0.78	0.387	18.00	347.97			0.01		
10340	5.2	1.49	0.378	54.63	402.60			0.01		
20800	10.4	2.40	0.365	142.31	544.91			0.01		
10340	5.2	2.57	0.362	26.16	571.06			0.00		
2580	1.3	2.28	0.366	-18.48	552.59			0.00		
5180	2.6	2.30	0.366	0.74	553.32			0.00		
10340	5.2	2.44	0.364	10.86	564.19			0.00		
20800	10.4	2.63	0.362	29.27	593.46			0.00		
41400	20.7	3.52	0.349	274.92	868.38			0.01		
82800	41.4	4.83	0.331	814.13	1682.52		1682.52	0.02		0.3310
165600	82.8	6.80	0.303	2451.71	4134.22		4134.22	0.03		0.3030
331200	165.6	9.00	0.272	5472.25	9606.48		9606.48	0.03		0.2720
165600	82.8	9.68	0.263	1684.15	11290.63			-0.01		
41400	20.7	9.54	0.265	-143.86	11146.76			0.00		
10340	5.2	9.00	0.272	-140.47	11006.29			0.00		
2580	1.29	7.91	0.288	-70.61	10935.68			0.01		
646	0.323	6.59	0.306	-21.16	10914.52			0.01		

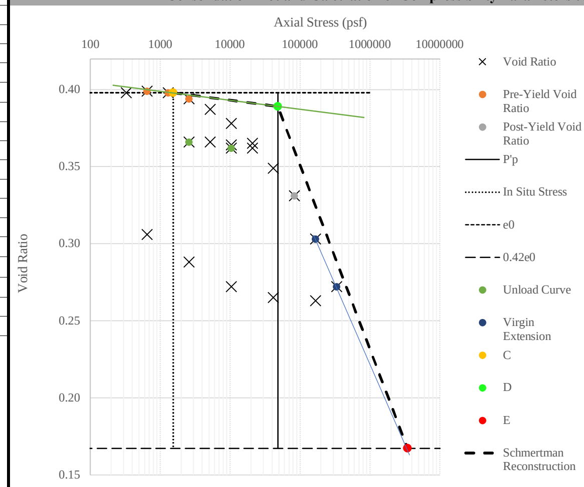
Strain-Energy Plot and Calculation of P'p



Line	Slope	Intercept	P'p (psf)
Pre-Yield	0.0035	320.77	**48054.9**
Post-Yield	0.0321	-1053.6	



Consolidation Plot and Calculation of Compressibility Parameters using Schmertmann's Method



Unload Curve Data Points	
e	**Stress (psf)**
0.3620	10340
0.3660	2580

Schmertman Reconstruction		
Line or Point	**e**	**Stress (psf)**
P'_p	0.3980	48054.9
Vertical Line	0.1672	48054.9
In Situ Stress	0.3980	1535.4
Vertical Line	0.1672	1535.4
e_0	0.3980	1
Horizontal Line	0.3980	1000000
$0.42e_0$	0.1672	1
Horizontal Line	0.1672	10000000
C	0.3980	1535.4
D	0.3890	48054.9
E	0.1672	3460000

Settlement Parameters	
$C_{rε}$	0.004
$C_{cε}$	0.085
P'_p (psf)	48055
OCR	31.3
Consolidation State	Significantly Over-Consolidated

Geosyntec consultants

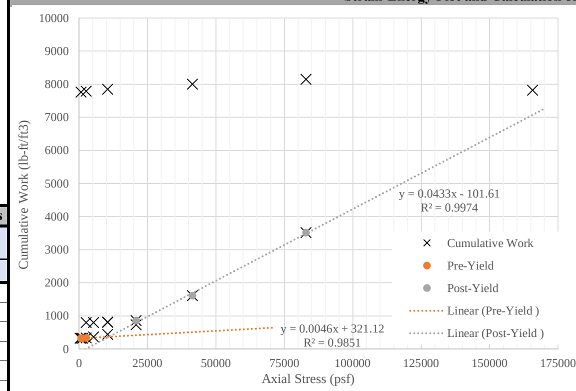
Baldwin Bottom Ash Pond Closure Design			
Baldwin Power Plant - Baldwin, IL			
1-D Consolidation Test Data Processing			
Boring ID: BAL-B006		Authored By:	Zachary Fallert
Sample ID: ST-2B		Checked By:	Isaiah Vaught
Project No. GLP8050		Date:	12/5/2022

Boring ID	BAL-B007
Shelby ID	ST-1C
Shelby Depth (ft)	30-32
Soil Unit	Loess

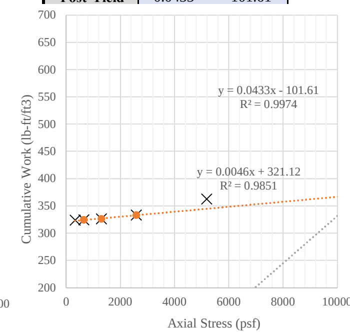
Sample In Situ Effective Stress (psf)	1223

Data Input				Strain-Energy Calculations and Plotting Points					Void Ratio Plotting Points	
Axial Stress	Axial Stress	Axial Strain	Void Ratio	Delta Work	Cumulative Work	Pre-Yield	Post-Yield	Slope	Pre-Yield Void Ratio	Post-Yield Void Ratio
psf	tsf	%	e	lb-ft/ft^3	lb-ft/ft^3	lb-ft/ft^3	lb-ft/ft^3		e	e
324	0.162	0.04	0.661	324.00	324.00					
646	0.323	0.14	0.659	0.49	324.49	324.49		0.00	0.6590	
1294	0.65	0.34	0.656	1.91	326.40	326.40		0.00	0.6560	
2580	1.3	0.68	0.650	6.70	333.10	333.10		0.01	0.6500	
5180	2.6	1.44	0.637	29.53	362.62			0.01		
10340	5.2	2.49	0.620	81.56	444.18			0.02		
20800	10.4	4.32	0.590	284.00	728.18			0.03		
10340	5.2	4.82	0.581	78.63	806.81			-0.01		
2580	1.3	4.67	0.584	-10.08	796.73			0.00		
5180	2.6	4.68	0.584	0.39	797.12			0.00		
10340	5.2	4.82	0.581	11.33	808.45			0.00		
20800	10.4	5.10	0.577	43.91	852.36		852.36	0.00		0.5770
41400	20.7	7.55	0.536	759.77	1612.13		1612.13	0.04		0.5360
82800	41.4	10.61	0.485	1899.02	3511.15		3511.15	0.05		0.4850
165600	82.8	14.07	0.428	4307.26	7818.40			0.05		
82800	41.4	14.34	0.423	331.61	8150.02			0.00		
41400	20.7	14.10	0.427	-147.18	8002.84			0.00		
10340	5.2	13.52	0.437	-151.34	7851.50			0.00		
2580	1.3	12.57	0.453	-61.18	7790.32			0.01		
646	0.32	10.90	0.480	-26.99	7763.34			0.01		

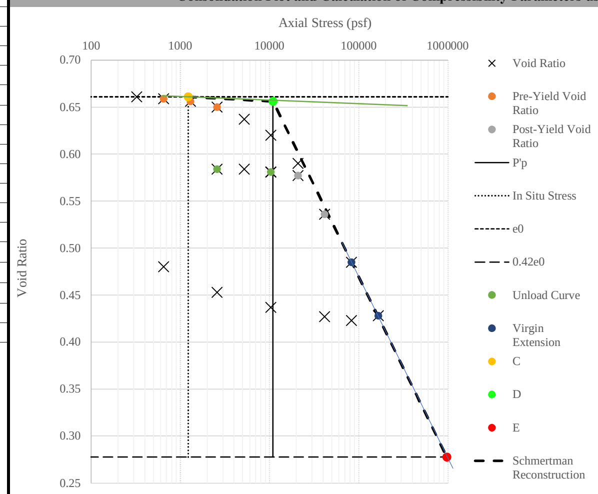
Strain-Energy Plot and Calculation of P'p



Line	Slope	Intercept	P'p (psf)
Pre-Yield	0.0046	321.12	10923.3
Post-Yield	0.0433	-101.61	



Consolidation Plot and Calculation of Compressibility Parameters using Schmertmann's Method



Unload Curve Data Points	
e	Stress (psf)
0.5810	10340
0.5840	2580

Schmertman Reconstruction		
Line or Point	e	Stress (psf)
P'_p	0.6610	10923.3
Vertical Line	0.2776	10923.3
In Situ Stress	0.6610	1222.8
Vertical Line	0.2776	1222.8
e_0	0.6610	1
Horizontal Line	0.6610	1000000
$0.42e_0$	0.2776	1
Horizontal Line	0.2776	10000000
C	0.6610	1222.8
D	0.6560	10923.3
E	0.2776	970000

Settlement Parameters	
$C_{rε}$	0.003
$C_{cε}$	0.117
P'_p (psf)	10923
OCR	8.9
Consolidation State	Significantly Over-Consolidated

Geosyntec consultants

Baldwin Bottom Ash Pond Closure Design			
Baldwin Power Plant - Baldwin, IL			
1-D Consolidation Test Data Processing			
Boring ID:	BAL-B007	Authored By:	Zachary Fallert
Sample ID:	ST-1C	Checked By:	Isaiah Vaught
Project No. GLP8050		Date:	12/5/2022

Boring ID	BAL-B026
Shelby ID	ST-2C
Shelby Depth (ft)	35-37
Soil Unit	Loess

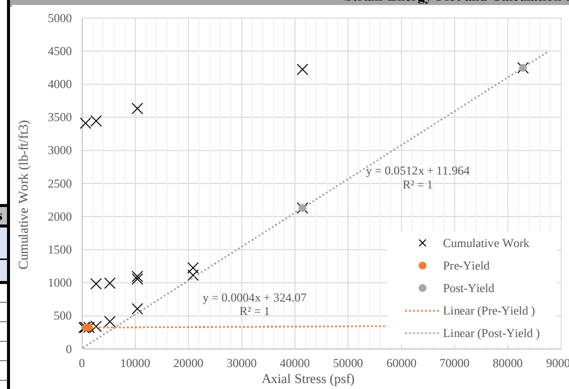
Sample In Situ Effective Stress (psf)	2257

Data Input				Strain-Energy Calculations and Plotting Points					Void Ratio Plotting Points	
Axial Stress	Axial Stress	Axial Strain	Void Ratio	Delta Work	Cumulative Work	Pre-Yield	Post-Yield	Slope	Pre-Yield Void Ratio	Post-Yield Void Ratio
psf	tsf	%	e	lb-ft/ft^3	lb-ft/ft^3	lb-ft/ft^3	lb-ft/ft^3		e	e
324	0.162	-0.06	0.650	324.00	324.00					
646	0.323	0.01	0.648	0.31	324.31	324.31		0.00	0.6480	
1294	0.65	0.03	0.648	0.24	324.55	324.55		0.00	0.6480	
2580	1.3	0.85	0.635	15.73	340.28			0.01		
5180	2.6	2.70	0.604	71.90	412.18			0.03		
10340	5.2	5.23	0.562	196.56	608.74			0.04		
20800	10.4	8.49	0.509	506.65	1115.39			0.05		
10340	5.2	8.35	0.511	-21.18	1094.21			0.00		
2580	1.3	6.63	0.539	-111.18	983.03			0.01		
5180	2.6	6.92	0.534	11.45	994.48			0.00		
10340	5.2	7.72	0.521	61.46	1055.94			0.01		
20800	10.4	8.79	0.504	167.69	1223.63			0.02		
41400	20.7	11.71	0.456	907.19	2130.82		2130.82	0.04		0.4560
82800	41.4	15.12	0.399	2118.85	4249.67		4249.67	0.05		0.3990
41400	20.7	15.08	0.400	-24.84	4224.83			0.00		
10340	5.2	12.80	0.438	-590.09	3634.73			0.02		
2580	1.3	9.90	0.485	-187.60	3447.13			0.02		
646	0.3	7.57	0.524	-37.47	3409.66			0.02		

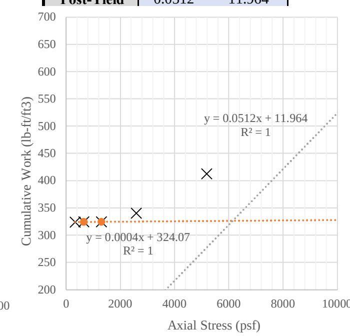
Geosyntec consultants

Baldwin Bottom Ash Pond Closure Design			
Baldwin Power Plant - Baldwin, IL			
1-D Consolidation Test Data Processing			
Boring ID:	BAL-B026	Authored By:	Zachary Fallert
Sample ID:	ST-2C	Checked By:	Isaiah Vaught
Project No. GLP8050		Date:	12/5/2022

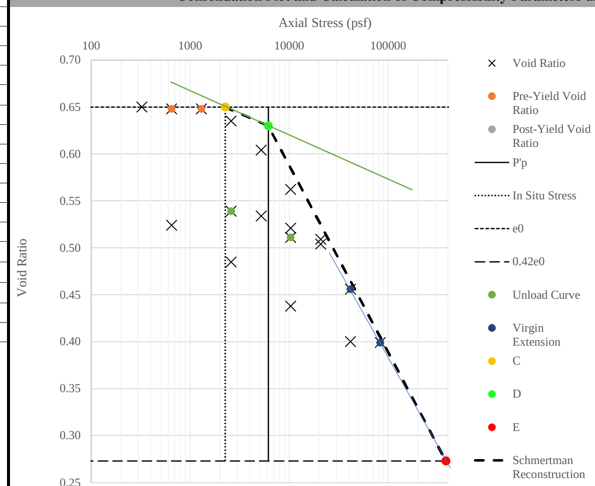
Strain-Energy Plot and Calculation of P'p



Line	Slope	Intercept	P'p (psf)
Pre-Yield	0.0004	324.07	6143.8
Post-Yield	0.0512	11.964	



Consolidation Plot and Calculation of Compressibility Parameters using Schmertmann's Method

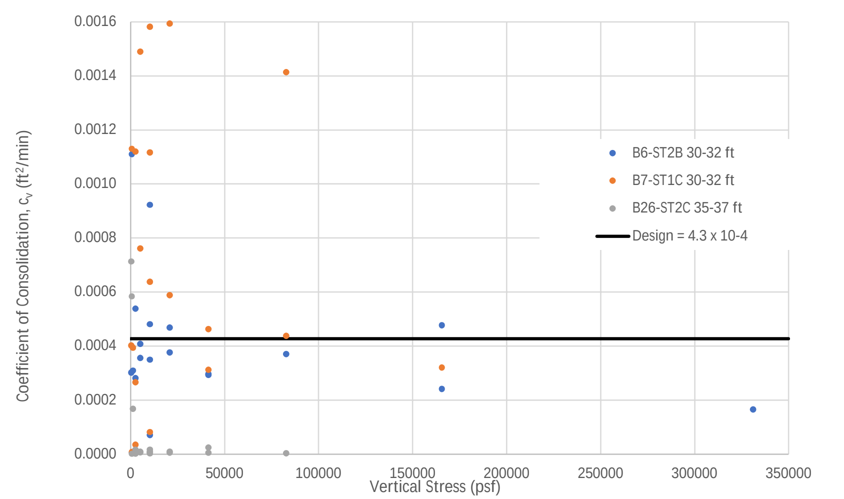


Unload Curve Data Points	
e	Stress (psf)
0.5110	10340
0.5390	2580

Schmertman Reconstruction		
Line or Point	e	Stress (psf)
P'_p	0.6500	6143.8
Vertical Line	0.2730	6143.8
In Situ Stress	0.6500	2257.0
Vertical Line	0.2730	2257.0
e_0	0.6500	1
Horizontal Line	0.6500	1000000
$0.42e_0$	0.2730	1
Horizontal Line	0.2730	10000000
C	0.6500	2257.0
D	0.6300	6143.8
E	0.2730	380000

Settlement Parameters	
$C_{r\varepsilon}$	0.028
$C_{c\varepsilon}$	0.121
P'_p (psf)	6144
OCR	2.7
Consolidation State	Significantly Over-Consolidated

B6-ST2B				B7-ST1C				B26-ST2C			
30-32 ft				30-32 ft				35-37 ft			
B6-ST2B 30-32 ft				B7-ST1C 30-32 ft				B26-ST2C 35-37 ft			
Vertical Stress tsf	**Vertical** Stress psf	Cv ft²/yr	Cv ft²/min	Vertical Stress tsf	**Vertical** Stress psf	Cv ft²/yr	Cv ft²/min	Vertical Stress tsf	**Vertical** Stress psf	Cv ft²/yr	Cv ft²/min
0.162	324	1.59E+02	3.02E-04	0.162	324	2.11E+02	4.02E-04	0.162	324	3.75E+02	7.13E-04
0.323	646	5.83E+02	1.11E-03	0.323	646	5.94E+02	1.13E-03	0.323	646	3.07E+02	5.84E-04
0.647	1294	1.63E+02	3.09E-04	0.647	1294	2.07E+02	3.94E-04	0.647	1294	8.79E+01	1.67E-04
1.29	2580	2.83E+02	5.38E-04	1.29	2580	5.88E+02	1.12E-03	1.29	2580	8.72E+00	1.66E-05
2.59	5180	2.14E+02	4.08E-04	2.59	5180	4.00E+02	7.61E-04	2.59	5180	4.43E+00	8.43E-06
5.17	10340	1.84E+02	3.49E-04	5.17	10340	3.35E+02	6.38E-04	5.17	10340	3.55E+00	6.75E-06
10.4	20800	1.98E+02	3.76E-04	10.4	20800	3.09E+02	5.88E-04	10.4	20800	2.70E+00	5.14E-06
5.17	10340	4.85E+02	9.23E-04	5.17	10340	5.87E+02	1.12E-03	5.17	10340	8.67E+00	1.65E-05
1.29	2580	1.48E+02	2.81E-04	1.29	2580	1.40E+02	2.66E-04	1.29	2580	1.93E+00	3.67E-06
2.59	5180	1.87E+02	3.55E-04	2.59	5180	7.83E+02	1.49E-03	2.59	5180	3.41E+00	6.49E-06
5.17	10340	2.53E+02	4.81E-04	5.17	10340	8.31E+02	1.58E-03	5.17	10340	4.42E+00	8.41E-06
10.4	20800	2.46E+02	4.68E-04	10.4	20800	8.37E+02	1.59E-03	10.4	20800	4.85E+00	9.23E-06
20.7	41400	1.56E+02	2.96E-04	20.7	41400	2.43E+02	4.63E-04	20.7	41400	2.45E+00	4.66E-06
41.4	82800	1.95E+02	3.70E-04	41.4	82800	2.30E+02	4.37E-04	41.4	82800	1.87E+00	3.56E-06
82.8	165600	1.27E+02	2.41E-04	82.8	165600	1.68E+02	3.20E-04	20.7	41400	1.27E+01	2.41E-05
165.6	331200	8.70E+01	1.65E-04	41.4	82800	7.43E+02	1.41E-03	5.17	10340	1.28E+00	2.44E-06
82.8	165600	2.51E+02	4.77E-04	20.7	41400	1.64E+02	3.12E-04	1.29	2580	6.36E-01	1.21E-06
20.7	41400	1.54E+02	2.93E-04	5.17	10340	4.29E+01	8.16E-05	0.323	646	4.42E-01	8.40E-07
5.17	10340	3.69E+01	7.02E-05	1.29	2580	1.81E+01	3.43E-05				
1.29	2580	7.82E+00	1.49E-05	0.323	646	4.16E+00	7.91E-06				
0.323	646	2.44E+00	4.64E-06								



Geosyntec consultants

Baldwin Bottom Ash Pond Closure Design		
Baldwin Power Plant - Baldwin, IL		
1-D Consolidation Test Data Processing		
Boring II -	Authored By:	Zachary Fallert
Sample II -	Checked By:	Isaiah Vaught
Project No. GLP8050	Date:	12/5/2022

Summary of Consolidation Testing Data Processing Results

Boring ID	Sample Depth (ft)	Soil Unit	Initial Void Ratio (eo)	Recompression Index (C_r)	Virgin Compression Index (C_c)	Recompression Ratio, C_{re}	Compression Ratio, C_{ce}	Coefficient of Consolidation, C_v (ft^2/min)	Maximum Past-Pressure (psf)	OCR
BAL-B006	30-32	Residual Clay	0.398	0.006	0.119	0.004	0.085	Evaluated from combined data. Set to upper 2/3 percentile = $4.3x10^{-4}$	48055	31.3
BAL-B007	30-32	Loess	0.661	0.005	0.194	0.003	0.117		10923	8.9
BAL-B026	35-37	Loess	0.273	0.035	0.154	0.028	0.121		6144	2.7
Average			0.444	0.016	0.156	0.012	0.108	4.0E-04	21707	14
Max			0.661	0.035	0.194	0.028	0.121	1.6E-03	48055	31
Min			0.273	0.005	0.119	0.003	0.085	8.4E-07	6144	2.7

Initial Condition	
GWT Elevation	434
Unit	**Elevation (ft)**
	434
Existing Ash	
	425
Loess	
	404
Residual Clay	
	395
Shale	

Final Condition	
GWT Elevation	408
Unit	**Elevation (ft)**
	497
New Fill	
	434
Existing Ash	
	425
Loess	
	404
Residual Clay	
	395
Shale	

Evaluate Critical Soil Profile			
Boring ID	Soil Elevations (ft)		
	Top of Loess	Top of Till/Residual	Bottom of Soils
B005	NA	417.0	402.0
B006	NA	428.3	403.3
B007	423.0	408.0	393.0
B008	424.7	403.7	394.7
B009	NA	407.0	397.0
B026	428.0	418.0	403.0
B027	NA	433.5	409.5

Till assumed to be the same as Residual Clay due to lack of data.
B008 conservatively used for calcualtions (thickest soil and loess).
Lowest existing surface elevation assumed for top of existing ash.
Highest point on closure design assumed for top of fill.

Calculation Soil Units	Soil Properties					
	Re-Compression Ratio	Compression Ratio	Max. Past Pressure (psf)	Unit Weight (pcf)	Calculation Elevation (ft)	Thickness (ft)
New Fill	Assumed Negligible Compression			100	-	63
Existing Ash	Assumed Settlement Will Occur During Construction			97	-	9.32
Loess Top Half	0.028	0.121	6144	120	419.43	10.5
Loess Bottom Half	0.028	0.121	6144	120	408.93	10.5
Residual Clay Top Half	0.004	0.085	48055	120	401.43	4.5
Residual Clay Bottom Half	0.004	0.085	48055	120	396.93	4.5

Calculation Soil Units	Initial Stresses (psf)			Final Stresses (psf)		
	Total	Pore Pressure	Effective	Total	Pore Pressure	Effective
Loess Top Half	1534	909	625	7834	0	7834
Loess Bottom Half	2794	1564	1230	15394	0	15394
Residual Clay Top Half	3694	2032	1662	9994	410	9584
Residual Clay Bottom Half	4234	2313	1921	16834	691	16143

Calculation Soil Units	Settlement (in)		
	Recom-pression	Virgin Com-pression	Total
Loess Top Half	3.5	1.6	5.1
Loess Bottom Half	2.5	6.1	8.5
Residual Clay Top Half	0.3	0.0	0.3
Residual Clay Bottom Half	0.3	0.0	0.3
Total Settlement (in)	6.6	7.7	**14.3**

Time Rate Check	
Degree of Consolidation, U (%)	80
Time Factor, T_v	0.567
Coefficient of Consolidation, C_v (ft^2/min)	4.3E-04
Time for U in Loess (months)	**27**
Estimated Remaining Settlement (in)	**2.9**

Baldwin Bottom Ash Pond Closure Design	
Baldwin Power Plant - Baldwin, IL	
1-D Consolidation and Time Rate Calculations	
Authored By:	Zachary Fallert
Checked By:	Isaiah Vaught
Date:	12/6/2022
Project No. GLP8050	

Geosyntec consultants

ATTACHMENT H

Public Notification and Public Meeting Certification

845.220(a)(9)

Phil Morris
Dynegy Midwest Generation, LLC
1500 Eastport Plaza Drive
Collinsville, IL 62234

July 31, 2023

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, IL 62794-9276

Re: 35 IAC 845.220(a)(9) Certification Statement
Baldwin Power Plant Bottom Ash Pond (IEPA ID #W1578510001-06)

Dear Mr. Darin LeCrone:

For the above-refenced CCR surface impoundment and in accordance with 35 IAC 845.220(a)(9), Dynegy Midwest Generation, LLC certifies that the public notification and public meetings required under 35 IAC 845.240 were completed. Please find enclosed both the public meeting summary and listserv.

Sincerely,
Dynegy Midwest Generation, LLC

Phil Morris
Sr. Director, Environmental

Baldwin Public Meeting Summary, June 29, 2023

On May 29, 2023, Dynegy Midwest Generation, LLC made available to the public its plans to close the Bottom Ash Pond (BAP) located at the Baldwin Power Plant. On Thursday, June 29, 2023, Dynegy Midwest Generation, LLC held in-person public meetings at 3:00 pm and 5:30 pm at Red Bud High School in Red Bud, IL to present its decision-making process. A discussion of the closure alternatives, 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 closure 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 closure action as a result of issues and comments raised by the public. All questions asked during the meeting were addressed. No additional questions were submitted.

Issue/Topic		Summary of Response Provided at Meeting
1.	Ash Management and Monitoring during Closure Activities	The proposed closure alternative, closure in place, would minimize the potential for offsite movement of ash. Once construction activities take place, the ash will be wetted and monitored. During these activities, the ash will be handled and managed appropriately to minimize any offsite migration. If hauling were to take place, haul trucks would be covered per state requirements. Regarding current site conditions, the Fly Ash Pond has been closed and covered per applicable regulations and dust is no longer a concern. Ash within the BAP is currently holding water and unlikely to cause dusting issues. Dynegy Midwest Generation, LLC is required to report any fugitive dust complaints received on a quarterly basis.
2.	Closure-by-Removal with Off-Site Disposal – Traffic Impact	Closure-by-removal with off-site disposal via trucks alternative would result in increased traffic when compared to the closure in place option. Preliminary studies have been done to determine local traffic impacts and further studies may be completed if needed.
3.	Site Activities - 2020	Construction activities at the plant site in 2020 was unrelated to the BAP or the Coal to Solar program activities discussed in this meeting.
4.	Groundwater Impacts and Monitoring	Current groundwater models show a reduction of water flowing through the BAP materials under both the closure by removal and closure in place alternatives. Thus, both alternatives have anticipated groundwater improvements that are similar in magnitude. In the proposed closure alternative, closure in place,

		groundwater will be monitored for a minimum of 30 years to ensure conditions are as anticipated.
5.	Coal to Solar Activities	Coal to Solar activities are independent of the closure activities proposed for the BAP. Additional information about the Coal to Solar program can be found on the website www.renewillinoispower.com/community-scorecard-energy/baldwin/.
6.	Future Use	The Baldwin Power Plant Site is designated for power generation and the site will be preserved for that use. Currently, solar development is currently contemplated for the future use of the property.
7.	Plant Closure Timeline	The Baldwin Power Plant is currently scheduled to cease operations on or before December 30, 2025.
8.	Affiliations	The Baldwin Power Plant owned and operated by Dynegy Midwest Generation, LLC, has no affiliation with Prairie State.
9.	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/ Information and updates regarding the Coal to Solar and Energy Storage Initiative: www.renewillinoispower.com/community-scorecard-energy/baldwin/

In accordance with 845.240(f)(4), a list of people who requested to be added to the IEPA listserv for Baldwin is as follows:

Baldwin construction permit public meetings	
People requesting to be added to IEPA Listserv	
Name	email
Ron Wirth	rhwirth59@gmail.com
Diane Frech	rddflabs@hotmail.com
Scott Ernst	trailcreek1983@gmail.com
Steven Lurk	splurk17@gmail.com

ATTACHMENT I

Closure Prioritization Category Letter

845.220(d)(1)

Luminant

Phil Morris
Dynegy Midwest Generation, LLC
Luminant
1500 Eastport Plaza Drive
Collinsville, IL 62234

May 19, 2021

Mr. Darin LeCrone, P.E.
Manager, Industrial Unit
Bureau of Water, Division of Water Pollution Control, Permits Section
Illinois Environmental Protection Agency
1021 North Grand Avenue, East
Springfield, IL 62794-9276

Re: CCR Surface Impoundment Category Designation and Justification for Dynegy Midwest Generation, LLC

Dear Mr. LeCrone:

Pursuant to 35 I.A.C. 845.700(c), Dynegy Midwest Generation, LLC submits the information necessary to categorize the CCR surface impoundments located at the Baldwin Power Plant and the retired Hennepin and Vermilion Power Plants. The following parameters were used in assessing and justifying each assigned category.

- Category 1 – *Impacts to existing potable water supply well or impacts to groundwater quality within the setback of an existing potable water supply well.*
    - This review includes an assessment of potable water wells within 2,500 feet of CCR surface impoundments to determine whether any potential impacts are occurring within the setback zone of any community water supply well established under the Illinois Groundwater Protection Act.
    - This information was developed during the Part 845 rulemaking and is summarized in Attachment 1, Table 2: Impacts to Potable Water Supply.
- Category 2 – *Imminent threat to human health or the environment or have been designated by IEPA under (g)(5)*
    - The surface impoundments at Baldwin, Hennepin and Vermilion Power Plants do not pose an imminent threat to human health or the environment. There are no known conditions at or around the facility where someone or something may be exposed to contaminant concentrations reasonably expected to cause harm
- Category 3 – *Located in areas of environmental justice ("EJ") concern*
    - EJ areas were evaluated using the EJ mapping link from IEPA's webpage located at https://www2.illinois.gov/epa/topics/environmental-justice. Per the IEPA mapping tool, the EJ Status thresholds were determined as twice the state averages for Minority and Low Income consistent with 35 IAC 845.700(g)(6).
    - An EJ map denoting the facilities with impoundments is located in Attachment 3.

- Category 4-7
    - Category 4 - Inactive CCR surface impoundments that have an exceedance of the groundwater protection standards in Section 845.600
    - Category 5 - Existing CCR surface impoundments that have exceedances of the groundwater protection standards in Section 845.600
    - Category 6 - Inactive CCR surface impoundments that are in compliance with the groundwater protection standards in Section 845.600.
    - Category 7 – Existing CCR surface impoundments that are in compliance with the groundwater protection standards in Section 845.600

Based on the information above, category designations have been assigned. The category designations for each CCR impoundment are shown in Attachment 1, Table 1: Category Designations.

If you have any questions regarding this submittal, please contact Phil Morris at 618-343-7794 or phil.morris@vistracorp.com.

Sincerely,

Phil Morris
Senior Environmental Director

Attachments

Attachment 1

Table 1: Category Designation

Facility	Pond Description	Classifications	Potable Water Supply Impacts (Category 1)	Human Health or Environment Threat (Category 2)	Located within Environmental Justice Areas[1] (Category 3)	Standards Exceedances[2] (Categories 4,5,6,7)	Impoundment Category 845.700(g)
Baldwin	Bottom Ash Pond	Existing	No	No	No	No	7
Hennepin	East New Primary Pond	Inactive	No	No	Yes	NA[3]	3
Vermilion	North Pond Cell 1 & 2	Inactive	No	No	No	Yes	4
	Old East Pond	Inactive	No	No	No	Yes	4
	New East Pond Cell 1 & 2	Inactive	No	No	No	Yes	4

[1] See Attachment 3 Environmental Justice Area Map

[2] Ground water analyses for purposes of categories 4-7, assumptions have been made based on current groundwater data. However, since sampling and analysis is ongoing and subject to IEPA review and approval, IPGC reserves the right to update its category designations for Categories 4-7.

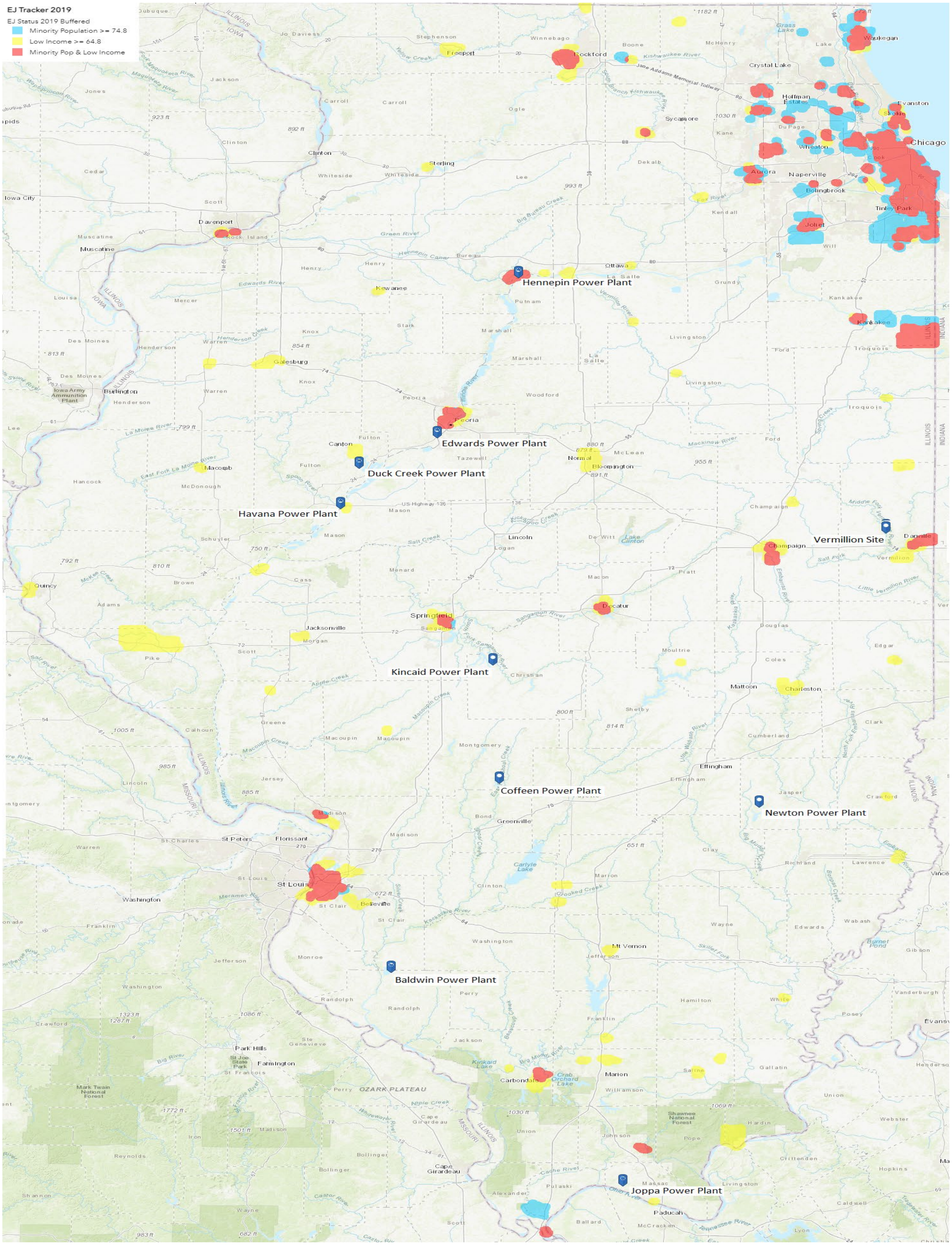
[3] NA for this determination since the CCR surface impoundment was assign a highest priority category

Attachment 2

Table 2: Impacts to Potable Water Supply

Site Name	Private and Semi-Private Wells	Non-Community Water Supply (CWS) Wells	Non-CWS Surface Water Intakes	Community Water Supply Wells	CWS Surface Water Intakes
Baldwin	**Present, but not at risk** Twenty-two (22) water wells were identified and eight (8) are located potentially downgradient of the site. Based on Ramboll's review of groundwater data, these wells are unlikely to be impacted by releases from the site.	Absent	Absent	**Present, but not at risk** Two (2) active CWS wells were identified; however, they are unlikely to be at risk because of their hydrogeologic location relative to the power plant.	**Present, but not at risk** One (1) CWS surface water intake was identified potentially downgradient of the site. Based on Ramboll's review of available information, this CWS surface water intake is unlikely to be impacted by releases from the site.
Hennepin	**Present, but not at risk** Sixteen (16) water wells were identified and one (1) is located potentially downgradient of the site. However, this well is unlikely to be present/in use based on its remote floodplain location and installation date (1884).	**Present, but not at risk** Three (3) non-CWS wells were identified; however, they are unlikely to be at risk because of their relative hydrogeologic position or inactive status.	Absent	Absent	Absent
Vermilion	**Present, but not at risk** Seventy-nine (79) water wells were identified; however, they are unlikely to be at risk because of their hydrogeologic location relative to the power plant, they are abandoned, they do not appear to be used for potable purposes, and/or they are unlikely to be present based on the mapped location. None of the off-site wells are located in a downgradient direction.	**Present, but not at risk** Two CWS wells were identified; however, they are unlikely to be at risk because of their hydrogeologic location relative to the power plant and/or their inactive status.	**Present, but inactive** One non-CWS surface water intake was identified; however, it is unlikely to be at risk because it is listed with inactive status.	Absent	Absent

Attachment 3: EJ Mapping Denoting Facilities with Impoundments



ATTACHMENT J

Post-Closure Care Plan

845.220(d)(5)

July 2023

POST-CLOSURE PLAN FOR EXISTING CCR SURFACE IMPOUNDMENT
40 C.F.R. § 257.104 and 35 I.A.C. 845.780
REV 0 – 10/30/2021

SITE INFORMATION			
Site Name / Address	Baldwin Power Plant / 10901 Baldwin Road, Baldwin, IL 62217		
Owner Name / Address	Dynegy Midwest Generation, LLC / 6555 Sierra Drive Irving, Texas 75039		
CCR Unit	Bottom Ash Pond	Closure Method and Final Cover Type	Close In-Place Clayey Soil Cover with Vegetation

POST-CLOSURE PLAN DESCRIPTION	
40 C.F.R. § 257.104(c)(1) and 35 I.A.C. 845.780(c)(1) – Length of post-closure care period.	Post-closure care will be conducted for a period of 30 years as required by 40 C.F.R. § 257.104(c)(1) and 35 I.A.C. 845.780(c)(1), except as provided by 40 C.F.R. § 257.104(c)(2) and 35 I.A.C. 845.780(c)(2).
40 C.F.R. § 257.104(c)(2) and 35 I.A.C. 845.780(c)(2) – Circumstances extending the post closure care period.	If at the end of the post-closure care period the CCR unit is operating under assessment monitoring in accordance with §257.95, the post-closure care as described in this plan will continue until returning to detection monitoring in accordance with §257.95. Under 35 I.A.C. 845.780(c)(2), the post-closure care period will be extended until groundwater monitoring data demonstrate that concentrations are below the groundwater protection standards in Section 845.600 and are not increasing for those constituents over background, using the statistical procedures and performance standards in Section 845.640(f) and (g), provided that concentrations have been reduced to the maximum extent feasible and concentrations are protective of human health and the environment.
40 C.F.R. § 257.104(d)(1)(i) and 35 I.A.C. 845.780(d)(1)(A) – A description of the monitoring and maintenance activities required in 40 C.F.R. § 257.104(b) and 35 I.A.C. 845.780(b), and the frequency at which these activities will be performed, to maintain the integrity and effectiveness of the final cover system, maintain the groundwater monitoring system and monitor the groundwater.	Pursuant to § 257.104(b)(1) and 35 I.A.C. 845.780(b)(1), throughout the post-closure care period, periodic visual observations of the final cover system and stormwater management system will be performed at least annually for evidence of settlement, subsidence, erosion, or other damage that may adversely affect the integrity and effectiveness of the final cover system. When practical, visual observations of the final cover will be made concurrent with groundwater monitoring activities. Noted evidence of damage, such as rills, surface cracks and settlement, will be repaired to maintain the integrity and effectiveness of the final cover system. Vegetation will be established and maintained on the final cover system, including storm drainage areas, where appropriate, to provide long-term erosion control. Established vegetation and the slope design of the final cover system will prevent potential erosion and damage that may be caused by run-on and run-off. Repair activities may include, but are not limited to, replacing and compacting soil cover, repairing drainage channels that have been

	eroded, filling in depressions with soil, regrading, and reseeding areas of failed vegetation, as necessary. Pursuant to § 257.104(b)(3) and 35 I.A.C. 845.780(b)(3), the groundwater monitoring system will be maintained, and groundwater will be monitored as required by 40 C.F.R. § 257.90 through 40 C.F.R. § 257.98 and 35 I.A.C. 845.600 through 35 I.A.C. 845.680. Monitoring wells will be inspected during each groundwater sampling event. Monitoring wells and associated instrumentation will be maintained so that they perform to the design specifications throughout the life of the monitoring program. Groundwater monitoring frequency will be at least quarterly, except as provided in 40 C.F.R. § 257.94(d), 257.95(c) and 35 I.A.C. 845.650(b)(4).
40 C.F.R. § 257.104(d)(1)(ii) and 35 I.A.C. 845.780(d)(1)(B) – The name, address, telephone number and email address of the person or office to contact about the facility during the post-closure care period.	Dynegy Midwest Generation, LLC 6555 Sierra Drive Irving, Texas 75039 800.633.4704 ccr@dynegy.com
40 C.F.R. § 257.104(d)(1)(iii) and 35 I.A.C. 845.780(d)(1)(C) – A description of the planned uses of the property during the post-closure period.	The CCR unit is located at an operating electric generation facility. Planned uses of the property during the post-closure period are currently unknown, except for post-closure care of the CCR unit. Post-closure use of the property will not disturb the integrity of the final cover system or other components of the containment system, or the function of the monitoring systems unless necessary to comply with the requirements of 40 C.F.R. Part § 257, Subpart D and 35 I.A.C. Part 845. Any other disturbance will be conducted following a demonstration that it will not increase the potential threat to human health or the environment, as required by 40 C.F.R. § 257.104(d)(1)(iii) and 35 I.A.C. 845.780 (d)(1)(C). The demonstration will be certified by a qualified professional engineer and submitted to the Illinois Environmental Protection Agency (IEPA). Per 40 C.F.R. § 257.104(d)(1)(iii) notification shall be provided to the State Director that the demonstration has been placed in the operating record and on the owners or operator's publicly accessible internet site. Following closure of the CCR unit, a notation on the deed to the property, or some other instrument that is normally examined during title search, will be recorded in accordance with 40 C.F.R. § 257.102(i) and 35 I.A.C. 845.760(h). The notation will notify potential purchasers of the property that the land has been used as a CCR unit and its use is restricted under the post-closure care requirements in 40 C.F.R. § 257.104(d)(1)(iii) and 35 I.A.C. 845.780(d)(1)(C) or groundwater monitoring requirements per 35 I.A.C. 845.740(b). Within 30 days of recording the deed notation, a notification stating that the notation has been recorded will be submitted to the IEPA and placed in the facility's operating record per 35 I.A.C. 845.760(h)(3). The notification will be placed on the owner or operator's publicly accessible CCR Web site in accordance with 40 C.F.R. § 257.107(i)(9) and 35 I.A.C. 845.810(e) and placed in the facility's operating record as required by 35 I.A.C. 845.800(d)(26) and §257.105(i)(9).
40 C.F.R. § 257.104(d)(3) and 35 I.A.C. 845.780(d)(3) – Amendments to the initial or subsequent written post-closure plan.	Pursuant to 40 C.F.R. § 257.104(d), the initial post closure care plan for the Baldwin Fly Ash Pond System was prepared on October 17, 2016. That plan is being amended pursuant to 40 C.F.R. § 257.104(d)(3)(i). This plan also serves as the initial post-closure care plan, prepared in accordance with 35 I.A.C. 845.780(d).

	Pursuant to § 257.104(d)(3) and 35 I.A.C. 845.780(d)(3), an operating permit modification application to amend the initial or any subsequent written post-closure care plan developed under 35 I.A.C. 845.780 (d)(1) and § 257.104(d)(1) will be submitted to IEPA. The written post-closure care plan will be amended whenever there is a change in the operation of the CCR surface impoundment that would substantially affect the written post-closure care plan in effect; or unanticipated events necessitate a revision of the written post-closure care plan, after post-closure activities have started. The written post-closure care plan will be amended at least 60 days before a planned change in the operation of the facility or CCR surface impoundment, or within 60 days after an unanticipated event requires the need to revise the existing plan. If the plan is revised after post-closure activities have started, a request to modify the operating permit, including an amended written post-closure care plan, will be submitted to the IEPA within 30 days following the triggering event.
40 C.F.R. § 257.104(d)(4) and 35 I.A.C. 845.780(d)(4) – Qualified professional engineering certification.	Certification by a qualified professional engineer will be appended to this plan and any amendment of this plan.
35 I.A.C. 845.780(e) – Termination of post-closure care	Upon completion of the post-closure period, a request to terminate post-closure care will be submitted to the IEPA. The request will include a certification by a qualified professional engineer verifying that post-closure care has been completed in accordance with the post-closure care plan specified in 35 I.A.C. 845.780(d) and the requirements of 35 I.A.C. 845.780.
40 C.F.R. § 257.104(e) and 35 I.A.C. 845.780(f) – Notification of completion of the post-closure care period.	A notification of completion of post-closure care will be prepared and placed in the facility's operating record within 30 days after IEPA approval of the request to terminate post-closure care. The notification will be placed in the facility's operating record in accordance with 35 I.A.C. 845.800(d)(31) and § 257.105(i)(13). The notification will be placed on the owner or operator's publicly accessible CCR Internet site in accordance with the requirements of § 257.107(i)(13) and 35 I.A.C. 845.810(e). The IEPA will be notified when the notification has been placed in the operating record and on the owner or operator's publicly accessible Internet site in accordance with the requirements of § 257.106(i)(13).

Certification Statement 40 C.F.R. § 257.104(d)(4) and 35 I.A.C. 845.780(d)(4) – Amended/Initial Written Post Closure Plan for a CCR Surface Impoundment

CCR Unit: Dynegy Midwest Generation, LLC; Baldwin Power Plant; Bottom Ash Pond

I, John R. Hesemann, 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 certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the amended/initial written post closure plan, dated October 30, 2021, meets the requirements of 40 C.F.R. § 257.104 and 35 I.A.C. 845.780.

John R. Hesemann

Printed Name

9/27/2021

Date

JOHN ROBERT HESEMANN
062-058523
LICENSED PROFESSIONAL ENGINEER OF ILLINOIS

Exp.: 11/30/2021

ATTACHMENT K

Contractor Training Certification

45 ILCS 5/22.59(b)(4)

Phil Morris
Dynegy Midwest Generation, LLC
1500 Eastport Plaza Drive
Collinsville, IL 62234

July 31, 2023

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
Baldwin Power Plant Bottom Ash Pond (IEPA ID# W1578510001-06)

Dear Mr. Darin LeCrone:

For the above-referenced CCR surface impoundment and in accordance with 415 ILCS 5/22.59(b)(4), Dynegy Midwest Generation, 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,
Dynegy Midwest Generation, LLC

Phil Morris, P.E.
Senior Director, Environmental